ENVIRONMENTAL AND ECONOMIC ASPECTS OF CONTEMPORANEOUS ELECTRIC TRANSMISSION LINE RIGHT-OF-WAY MANAGEMENT TECHNIQUES

Volume 1

GENERAL METHODS, SPECIAL STUDIES, DISCUSSION OF TRENDS,

JUNE 1977

Empire State Electric Energy Research Corporation (ESEERCO)

General Methods, Special Studies, Discussion Of Trends, Conclusions

VOL. 1

Environmental And Economic Aspects Of Contemporaneous Electric Transmission Line Right-Of-Way Management Techniques

VOLUME 1
GENERAL METHODS, SPECIAL STUDIES, DISCUSSION OF TRENDS, AND CONCLUSIONS

PREPARED FOR THE EMPIRE STATE ELECTRIC ENERGY RESEARCH CORPORATION (ESEERCO)

JUNE 1977

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Mr. William S. E. Greenwald
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Dear Mr. Greenwald:

Asplundh Environmental Services takes pleasure in submitting to the Empire State Electric Energy Research Corporation (ESEERCO), "Study of Environmental and Economic Aspects of Contemporaneous Electric Transmission Line Right-of-Way Management Techniques".

This report represents over two years of intensive field analysis and study of twenty-two sites in all major forests and physiographic regions in the state of New York.

In order to clearly define the magnitude of effort which led to both the synthesis of trends and to conclusions regarding the impact of right-of-way (ROW) management techniques, it is important to note that this case history study reflects not only the professional involvement of a multi-disciplinary team of researchers, but also reflects state, local and county agency experience within each of the areas studied. It also reflects the effort of New York State utilities to provide environmentally and economically acceptable ROW management programs and safe, reliable electric service to its consumers.

This report began with the development of methods and selection of sites which would fulfill the objectives outlined in this study. Collection of all applicable case history data covering each of twenty-two specific locations, required extensive searching for photographic or other documentable material as far back as 1906. A search for information was conducted to provide a complete case history before the ROW was constructed and to include ROW management events following construction. In many cases, this search provided only partial or incomplete information.

We believe the great volume of written, tabular, mapped or photographed information collected will provide the basic information necessary for future studies and research to be conducted in the ESEERCO Right-of-Way Management Research Program. Maps and information have been prepared for maximum flexibility and use for further analysis or field research.

This study is presented so that it may be reviewed by: methodology of site selection and field data collection; individual case studies of sites; special vegetational and soils studies; and discussion of trends.

We believe this organization will provide a clearer understanding of information and maximum flexibility for useful application.

This unique project represents tremendous foresight by ESEERCO to provide this comprehensive and indepth case history study of electric transmission line ROW management techniques. It has indeed been a pleasure to be associated with this project, and we thank you for the opportunity to be of service.

Very truly yours,
ASPLUNDH ENVIRONMENTAL SERVICES

Dennis E. Holewinski
Manager

DEH:tm

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FOREWORD

The Empire State Electric Energy Research Corporation (ESEERCO) is a non-profit corporation whose members are Central Hudson Gas & Electric Corporation, Consolidated Edison Company of New York, Inc., Long Island Lighting Company, New York State Electric & Gas Corporation, Niagara Mohawk Power Corporation, Orange and Rockland Utilities, Inc., the Power Authority of the State of New York, and Rochester Gas and Electric Corporation. ESEERCO supports and directs, on behalf of its members, research and development programs oriented toward improving the safety, reliability, economy and environmental compatibility of the provision, use, and conservation of electric energy in New York State.

Many problems facing the electric systems in New York are common to electric utilities nationally. These are most often adequately addressed by national research organizations such as the Electric Power Research Institute (to which the member systems of ESEERCO also belong), or the federal Energy Research and Development Administration. To complement national efforts, the research and development programs supported and directed by ESEERCO tend to concentrate on those problems common to its member systems which are also somewhat peculiar to, or particularly important in New York and the Northeast, or for other reasons are not adequately treated by national research organizations.

One challenge faced by nearly all electric utilities is how to continue improving the management of transmission rights-of-way (ROW's), especially in terms of economy, reliability, and environmental compatibility. The challenge is as complex and multi-faceted as ROW management itself which begins with certain aspects of selecting the final route location and goes on to encompass:

- Vegetation clearing, including slash disposal
- the layout and design of access roads, stream crossing sites and devices, lay-down sites and cable pulling sites,
- erosion control during and after construction,
- certain aspects of the selection of the location for support structures and of the methods for erecting them, and
- management of vegetation on the ROW over the life of the line.

In 1973, ESEERCO initiated a research program into rights-of-way management. At that time, there was very little formal research in this area sponsored at the nation or company level. Even had there been a more extensive ROW research program at the national level, there was still a role for ESEERCO. For while the problems facing ROW managers nationally may have much in common, their solutions vary significantly from one region

of the nation to another, and also differ to some extent from state to state due to differences in climate, topography, soils, native flora and fauna, land uses, laws, and social values.

The goal of the ESEERCO ROW management research program is to increase the safety, economy, and environmental compatibility of the ROW management programs which are carried out to ensure reliable transmission of electric energy in New York State. The ROW Management Research Program addresses this goal through an open-ended series of research projects. These projects are intended to develop and make available new or improved information, methods, and tools useful to ROW managers in selecting and executing elements of safe, economical, and environmentally compatible ROW management programs.

Due to the complexity of ROW management, and its relative lack of documentation as a specialized field of endeavor, ESEERCO chose to establish the state of knowledge concerning ROW management techniques and their environmental impacts and economics, as the first project in the ROW management research program. The objectives of this first project were to provide ESEERCO with one basis for selecting further experimental research, and to produce a summary report[1] on the current state-of-the-art for use by ROW managers of the ESEERCO member electric systems. The Applied Forestry Research Institute of the State University of New York jointly funded the project with ESEERCO, and carried it out by means of a literature search and interviews with nationally recognized experts in the field.

As a second project in the ROW management research program, ESEERCO engaged Asplundh Environmental Services to study the results of the state-of-the-art as applied in New York by examining the "record in the field". This was done by carefully observing and recording a wide variety of conditions in the field on 22 ROW sites selected to be representative of the various conditions encountered by ROW managers and of the various ROW management techniques employed. The recorded observations were then used with the histories of management events on each site to impute cause-effect relationships between the management techniques used, and observed conditions on the sites. These imputations will serve as another basis for designing further projects in the ROW management research program. They will also serve as interim research results for consideration by ROW managers in selecting and executing elements of safe, economical and environmentally compatible management programs for ROW's in New York State. The results of the second project are presented in this report.

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[1] The Applied Forestry Research Institute of the State University of New York, College of Environmental Science and Forestry has printed this report in two volumes for distribution to the interested public: Vegetation Management on Power Line Rights-of-Way, A State-of-the-Knowledge Report (research report #28), and Vegetation Management on Utility Rights-of-Way, An Annotated Bibliography (research report #27). Both reports are available from the Institute, Syracuse, New York 13210.

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1 Summary and General Conclusions

Case history studies of 22 rights-of-way were carried out in New York State from 1975 through 1976. These rights-of-way, (ROW's) had been managed employing a wide range of commonly accepted methods of clearance and maintenance and were located in all major forest regions of the state.

Vegetation management over the past 25 to 30 years on these ROW's has brought about the development of a complex shrub-herb grass community as a general form of ROW plant cover. There was a general trend towards tree species in the adjacent forest also being present in the herb or shrub layers on the ROW's. Although a protective cover of shrubs, herbs, ferns, and grasses covered the ROW's, trees still invaded in large numbers and would re-establish forest cover if not controlled. Characteristic plant communities developed in relation to habitat and were identified as: Blackberry-Goldenrod or Sumac-Goldenrod on mesic habitat areas; Blueberry-Sweet-fern or Blueberry-Bracken on xeric areas; and Willow-Sensitive Fern, Red Osier Dogwood-Sensitive Fern, or Spirea-Sensitive Fern on hydric areas. Species diversity on all habitat areas was found to be consistently higher on the ROW's than in adjacent forests. Most shrub species of the forests persisted on the ROW's and formed a prominent part of plant cover. Herbaceous species on the ROW's consisted of a complex misture of forest species, conbined with plants more typical of open areas.

Impact of ROW management on soil was negligible over the general ROW. Construction disturbances and other uses, however, have resulted in accelerated erosion where such areas were not fully restored to a complete plant cover. ROW habitats and associated dominant plant communities were closely related to soil types and physiography of the sites studied.

Impact of the ROW's on stream temperatures was also negligible for the cases studied. Sedimentation of streams from the ROW was only evident where access roads crossed streams and where flow from disturbed construction areas carried material overland into a stream or pond.

ROW management has produced improved wildlife food and cover conditions and plant species diversity. All the ROW's studied were freely used by common wildlife species of the areas and prominent among these were numerous song birds and raptors.

Generally, there is little change in land use adjacent to the ROW's from before the ROW was constructed (or near the time of construction) to a variable period of many years after the ROW was constructed. There is a decrease in agricultural use which appears to follow the statewide decrease. There is a general absence of long-term negative visual characteristics resulting from clearing, construction, and maintenance of the ROW's that appear in objectionable visual contrast with the surrounding area. A variety of multiple uses, particularly recreation, were found to exist with hunting predominant in all the regions studied.

Based on the meager and non-comparable historic cost data available for this study, it is not possible to postulate cost effectiveness or other economic conclusions concerning the various clearing, construction, restoration, and management procedures used on the study sites.

The flow of the report is from sites - - -▷ trends for regions - - -▷ state-wide trends - - -▷ general conclusions. As the report proceeds in this fashion, less and less detail is presented so that the general conclusions at the end are simple statements of fact. For supporting data, one must proceed backwards towards the individual sites which can be done in 3 steps: first, to state-wide trends; second, to regional summaries of trends; and third, to the individual sites.

2 Introduction

"The primary purpose of the study is to document, for approximately twenty representative electric transmission right-of-way sites, each of about one to two miles in length:

..the existing condition of the right-of-way site in terms of such characteristics as vegetation, fish and wildlife, erosion and sedimentation, visual aspects, and multiple uses being made of the right-of-way.

..the conditions and events which could be reasonably imputed to have caused or influenced the existing condition of the right-of-way site such as construction and management techniques used on the site (including the economic costs of techniques used): soils; moisture; slope; exposure; multiple uses; and conditions, especially vegetation, prior to specific construction or management events".

"The secondary purpose of the study is to reasonably impute, based on the information documented above, the short and long term impact of various construction and management techniques actually used on each site, upon the condition of that site. It is recognized that these imputations will not constitute proof, according to commonly accepted scientific standards, that certain construction and management techniques produce certain results under certain conditions. Rather, these imputations will be recognized as the opinions of trained and informed persons in the field of rights-of-way management based on documented empirical information. (Empirical information, as it is used here, refers to available, reliable, previously documented material, plus documented observed information). The documented information, and the imputations made by Asplundh, will be used as a guide to rights-of-way managers when making management decisions, and to suggest further work and experimentation to be conducted in the on-going ESEERCO Rights-of-Way Management Study".[1]

The first of 3 volumes of this report is organized to first present the "General Methods" from which the study is based. This section establishes methods for site selection and for field data collection. These methods apply to each of the 22 sites. In addition to special studies, discussion of trends for these sites are also included in Volume I.

The "Individual Case Studies of Sites" follows in Volume II (Sites 1-11) and III (Sites 12-22) with specific detail pertinent to each site, depicting both information obtained from field observations and other sources, and further detail on the field studies conducted at the site according to the "General Methods" section. Tables and figures are presented not only to record data but to more clearly depict relationships as a useful method of analysis for arriving at conclusions. The maps in this report are also available at full scale (1"-200') for future field research studies. Each individual site case study is concluded with an evaluation and summary of results.

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[1] ESEERCO - Asplundh contract governing this work.

3 General Methods

3.1 Site Selection

Proper site selection for an ecological study, was vital in order to satisfy study objectives.

Vegetation is the environmental factor most affected by a transmission ROW. The New York environment exhibits 9 distinct forest regions (Fig. 3.1) and 12 unique physiographic areas (Fig. 3.2). Therefore, to insure proper site distribution, site selection was based on physiographic regions as they correspond to forest regions. These major regions of the state correlate closely with the major soil orders and suborders (Fig. 3.3), and important bedrock areas (Fig. 3.4). Thus, a 4-way check of physiographic, forest type, soil, and bedrock characteristics was made.

To accomplish the prime objective of management technique evaluation, major physiographic areas and forest regions were cross-referenced with ROW management techniques of clearing, construction, restoration, and maintenance (Table 3.1).

It was impossible for each site chosen to exhibit all of the major characteristics described, but as many as possible were included in order that a representative comparison of management techniques with major physiographic/forest regions could be made.

Sites selected also exhibited a good composite of the following essential characteristics:

Major moisture regimes: wet (hydric), moist (mesic), and dry (xeric);

Variation in steepness and aspect of slopes;

Representative water resources, e.g., surface water and/or wetlands;

Length of growing season and climate;

Location: suburban, rural, and remote areas; and

Special sites, where unusual management techniques were employed.

Following the above recommendations and prior to field visitation, members of the New York Power Pool (NYPP) were asked to submit sites representative of their systems and management techniques. Asplundh Environmental Services (AES) suggested a maximum 2-mile study site. By confining site size, time and distance traveled was minimized in plot establishment and overall project work flow without limiting study objectives.

Initially, 35 potential sites were considered. These were reduced to 22 sites, which were visited during early spring, 1975, to inventory general site characteristics. The information obtained was set forth in AES's "Proposed Sites and Studies to Evaluate Environmental and Economic Aspects of Contemporaneous Electric Transmission Line Right-of-Way Management Techniques", June 2, 1975[1]. This provided necessary information to establish

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[1] Revised July 10, 1975.

tentative mapped plots, and proposed detailed methodologies for study of each site to achieve objectives.

Sites on Long Island were inventoried and discussed with the NYPP Land Use Subcommittee. Management techniques utilized there were more in the nature of horticultural practices, and, therefore, of limited value to ROW managers in other areas of the state. Thus, due to the lack of "management techniques" as found within the scope of this study, no sites on Long Island were deemed potential study areas.

Distribution of the 22 sites and their geographic locations with reference to the Principal Forest Regions of New York State (Stout, 1958) is illustrated in Fig. 3.1. A composite Site Selection Data Summary (Table 3.1) provides an overall comparison of each site's characteristics.

3.2 Field Data Collection

3.2.1 General Reconnaissance

A general reconnaissance was made of the study area by traversing the ROW and adjacent areas on each side. The following information observed and collected in this reconnaissance was plotted on a base map showing general habitat conditions. Information obtained and plotted included plant community distribution, soil types, water resources, access road locations, slope, aspect, tower sites, and major soil disturbances. Hydric, mesic, and xeric areas were identified by correlating plant community distribution with soil types. The location of vegetation plots in the 3 moisture regimes was verified by the overlapping of soils and vegetative types.

Characteristic plant communities were identified on hydric, mesic, and xeric habitats. Where these broad communities were found to indicate one such habitat, generally to the exclusion of the other 2, they were used as indicator species and noted on the site habitat conditions (base) map. In general, a shrub-herb designation was utilized, and because of these plants' use as indicators of the various moisture regimes, they did not necessarily form the most abundant components of the ROW community. They were, however, most indicative of the habitat. Trees were not included in this designation as they are generally not considered desirable species on the ROW, and may be considered of temporary importance.

A determination of forest types adjoining the ROW was made largely through the use of Stout's Atlas of Forestry in New York (1958), although reference was also made to the Forest Cover Types of North America (Society of American Foresters, 1973),

Common names were used for purposes of the general reconnaissance in particular, and for the project in general (Appendix 1). Where common names were assigned in Gray's Manual of Botany (1970), those names were generally used. Where common names were not so assigned, often the common names designated by Britton and Brown (1970) were used. The Flora of West Virginia was generally used where common names were not found in the first 2 sources. In all instances the Latin names were obtained from Gray's Manual of Botany (1970). Mosses were generally referred to as in Grout's Mosses with Hand-Lens and Microscope (1972), the better known among which are often designated by common names, and the others designated by Latin names.

3.2.2 Vegetation Analysis

Vegetation Analysis on the ROW ROW vegetation plots were rectangular, 1/5 acre in size, generally at right angles to the ROW centerline, and where possible extended the full width of the cleared ROW. One-tenth acre plots were used only where the small area of a particular site condition dictated a smaller plot size. Vegetation was mapped using a 100-foot tape with chaining pins dropped at 10-foot intervals on each side of the plot. Herbaceous plant communities and woody plants were mapped on graph paper. All plot corners were marked with stakes and tagged for future indentification. These corners were tied in to the nearest tower structure.

Major plant communities were identified and mapped. The names of plant communities were obtained by using plant species names which singly or combined comprised 50% or more of the composition of the community. Where only 1 species appears on the community name, then that species alone predominates.

The location of woody vegetation was designated by letter symbols. Woody plants were usually of seed origin. When these were of stump-sprout or root-sucker origin, this was indicated:

* stump sprout
** root sucker

Height of woody vegetation was also recorded.

Vegetation Analysis of Interior Woods Adjacent to ROW A forest study plot was generally established when a ROW plot was established, with the same habitat conditions as far as was possible. In those few instances where the forests on both sides of the ROW were sufficiently dissimilar in composition, forest plots were established in both forests. All forest study plots were circular in shape and 1/5 acre in size. A central point for each plot was chosen approximately 77-1/2 feet from the ROW edge in the interior woods. This was located as follows:

1. The mid-point at the woods' edge of the ROW vegetation plot was determined;

2. A distance of 25 feet perpendicular to the ROW edge was measured off in the interior woods to eliminate edge vegetation;

3. An additional 52-1/2 feet was then measured to obtain a central point for the off-ROW circular plot;

4. A radius of 52-1/2 feet from the central point was used in estimating a 1/5 acre circular plot. This was obtained by use of a range finder, or 100-foot tape, as site conditions permitted.

Vegetation was recorded as follows, indicating abundance and sociability:

1. Tree layer (greater than 3 inches in diameter breast (d.b.h.) high);

2. Shrub layer
   a. shrubs
   b. trees in shrub layer (less than 3 inches d.b.h.)
3. Herb layer.

The shrub layer includes woody vines listed under shrubs.

The herb layer includes all herb species as well as other components such as ferns and grasses. This was done to simplify recording data.

Comparison of On-ROW With Off-ROW Vegetation An analysis of plant cover on the ROW plots and in the adjacent forest was made by means of a combined estimate of abundance and cover (Braun-Blanquet, 1932 and 1964). Each plant community was described and its layers estimated separately, i.e., by tree layer, shrub layer, and herb layer. In this section, "plant community" refers to a major unit occupying a uniform habitat. The shrub layer includes woody vines; the herb layer includes all herb species as well as other components, such as ferns and grasses, to simplify data recording (Appendixes 2 and 3).

This technique described the floristic and structural characteristics of each plant community in the various habitats studied. In addition to the cover value of each species, its typical grouping was described, i.e., whether it grows singly, in groups or tufts, patches, and so forth. From this data, a comparison of ROW communities of various habitats was made with adjacent forests having the same habitat conditions. A correlation of ROW vegetation with a specific forest type may be attempted.

The scales used to make the estimates are:
For abundance and cover:

++ - occasional
+ - sparsely present, covering less than 1/20 of the plot area
1 - plentiful but of small cover value, covering less than 1/20 of the plot
2 - very numerous, covering at least 1/20 of the plot area
3 - covering 1/4 to 1/2 of the plot area
4 - covering 1/2 to 3/4 of the plot area
5 - covering more than 3/4 of the plot area;

For grouping:

1 - growing one in a place, singly
2 - grouped or tufted
3 - in troops, small patches, or cushions
4 - in small colonies, extensive patches, or forming carpets, more than 1 milacre
5 - in pure populations

The comparison of on-ROW vegetation with off-ROW vegetation is based mostly on the A.S. observations for the on and off-ROW vegetation plots. Where a plant species occurs on the ROW or in the woodland, but not on the study plot; that is indicated by enclosing the combined estimate of abundance and cover in parentheses. The combined estimate is underlined by broken lines where the grouping is invaded by other species.

Included in Appendix 4 are those plant species occurring in New York which are proposed by the U.S. Fish and Wildlife Service for classification as endangered or threatened under the federal Endangered Species Act of 1973.

3.2.3 Special Vegetation Studies

Procedures for special vegetation studies concerning topping, structural openings, and seeding are included in Section 5 of this report.

3.2.4 Soils Analysis

Soil Evaluation In the field inventory for site selection, soils were identified as to soil order and suborder (Buckman and Brady, 1969; Soil Survey Staff, 1975) and soil association (Cline, 1970). Also, bedrock geology was listed for the respective sites according to the general map of important bedrock areas of New York (Cline, 1970).

On ROW segments selected for study, the surficial and bedrock geology was determined through reference to geologic maps of New York State (Broughton et al., 1973). A knowledge of geologic formations in which soils have developed are important to proper understanding and interpretation of existing soil properties. Soils in turn may affect kind, abundance, and quality of natural vegetation (tree, shrub, and ground layer plants), wildlife habitat, engineering activities, and water resources on and adjacent to the ROW.

Soils on and adjacent to the ROW study sites were sampled with a soil auger to determine soil series (verified through reference to County Soil Survey Reports where available), effective depth, internal drainage characteristics, and occurrence of restrictions such as fragipans. This survey was accomplished by traversing the ROW and adjacent areas on each side of the ROW in a systematic manner to provide coverage of the entire study area. Texture and reaction (pH) were determined by standard field procedures for the mineral soil surface layer of each soil series identified. Data was recorded in the format shown in the Field Data Form for Soils Evaluation (Appendix 5).

Soil orders and suborders for New York soil series present on ROW study areas were identified by information obtained through personal communication in 1976 with William Hanna, Soil Conservation Service, (SCS), Syracuse, New York. Additional information was obtained from County Soil Survey Reports where available.

Soil boundaries and mapping symbols (identifying soil series and slope classes) were plotted on aerial photographs in the field survey and transcribed onto base maps at a scale of 1 inch = 200 feet. Soil boundaries also were plotted on the ROW centerline profile to show relationship to relief and extended to a distance of 300 feet into adjacent undisturbed areas on both sides of the ROW. Soil boundaries were related to forest type boundaries and ROW plant communities.

Soil mapping units were correlated with recognized Woodland Suitability Groups established on a state wide basis by the SCS. Woodland Suitability Groups provide relative information on productive capacity of tree species, erosion hazards, and specific use limitation of existing soils. Each Woodland Suitability Group is identified by a 3-part symbol such as 2o1, 3d2, or 4s2. The first part of the symbol, a number, indicates the productivity class from 1 (highest) to 5 (lowest); the second part, a letter, identifies the soil property causing a management problem, namely, stoniness (x), excessive wetness (w), restricted rooting depth (d), sandy soils (s), relief or slope (r), or no limitations (0); and, the third part is a consecutive numbering of groups of soils having similar management problems, similar productivity, and similar suitability for the same kind of trees. This latter part of the symbol was deleted when information for respective soils was unavailable.

In counties where information was available, estimated Site Index was present for indicator species such as sugar-maple, red maple, and white pine. Site Index as a measure of productivity refers to the height, in feet, that dominant trees in relatively pure, even aged, well-stocked stands will achieve in 50 years. A Site Index Guide (Appendix 6) was obtained through personal communication in 1976 with William Hanna, SCS, Syracuse, New York.

A brief description of geology, soil profile characteristics, and soil properties was prepared from published County Soil Survey Reports for the soil series identified on each study area. Where no adequate information was available from a County Soil Survey Report, Soil Survey Interpretations of Soils in New York State (Anon., 1972) was used.

Soil Erosion Observations on erosion were made at the time of the soil survey on the respective study areas. Soil erosion was related to existing soil types and slopes and documented as to location or land use, plant cover, class of erosion, and kind of erosion. Areas exhibiting gully erosion were plotted on the ROW base map and depth of gullies were measured. Data was recorded in the format shown in the Field Data Form for Soil Erosion Classification (Appendix 7). Observations of stream bank and floodplain erosion and sedimentation were included under water studies on streams and wetlands.

In addition to active soil erosion, the respective sites were examined for possible areas of mass land movement, such as landslides, which, if present, were to be measured, plotted on base maps, and probable cause determined. Areas of major soil disturbance were photographed to show visual aspects and to supplement field data.

Humus Study The organic layers (O soil horizons) occur on the surface of mineral soil under forest cover conditions. Depending on forest types, soils, and climatic conditions, 3 distinct organic layers collectively called the forest floor may be present. These organic layers are referred to as litter (undecomposed organic matter), fermentation (partially decomposed organic matter), and humus (well-decomposed organic matter). The presence or absence of the various organic layers, plus organic matter incorporation

in the mineral soil (A1 horizon), serve as a basis for forest humus type classification.

The organic layers of a soil profile are sensitive to changes in the aerial environment and likely will exhibit effects of forest canopy removal and surface disturbance before the underlying mineral soil. Therefore, these layers were identified, measured to determine thickness, and classified by humus type according to the key (Appendix 8) developed by Hoover and Lunt (1952).

Evaluation of organic layers and associated humus types were made at 5 sampling points distributed across the ROW, to include ROW center and edges, along the boundaries of mesic and xeric vegetation plots. Five additional samples were taken in the adjacent woodland with even distribution through the center of the circular woodland analysis plots. Consistent with evaluation on the ROW, humus measurements in the woods were made on the mesic and xeric moisture regimes existing on the study area. Data was recorded according to the format shown in the Field Data Form for Humus Classification (Appendix 9). The humus classification key is not adaptable to areas exhibiting prolonged water saturation in the surface soil; therefore, similar measurements were not made on the hydric sites.

3.2.5 Water Studies

Streams

Office Studies Stream order and directional flow were determined for the study streams from United States Geological Survey (USGS) Quadrangle Maps. Stream aspect was also obtained from USGS Quadrangle Maps, and meteorological data were obtained from the U.S. Weather Bureau sources nearest the area of the ROW.

Field Measurements All water data collected in the field were recorded on standardized field sheets (Appendix 10). Temperature, pH, and dissolved oxygen (DO) measurements were taken at points upstream, downstream, and on the ROW. The specific number of field measurement stations depended upon the particular stream. Stream depth, volume, velocity, and width were noted in the field.

Alterations and bank erosion due to construction/maintenance practices on the ROW were measured and a comparative analysis made upstream from the ROW. Changes in stream bottom characteristics were recorded. As an example, stone and/or gravel to silt areas were noted and compared with upstream conditions. Changes in stream bank vegetation and its impact on overhead shading was assessed and water temperature measured. Obvious elimination of potential fish habitats was also noted. Artificial tributaries created due to either construction/maintenance practices and/or alterations in stream channelization or direction were noted and mapped on the site habitat conditions map where applicable. Floodplain erosion due to vegetation removal was noted, then compared with upstream conditions. Run-off erosion due to hydrological events was noted as to type (sheet, rill, or gully). An attempt to estimate the annual sediment stream yield was made by stake pedestals, graded at increments of 1/4 inch, using "0" as a data basis at time of installation. Obvious key construction/maintenance practices which precipitated current conditions

were noted. Stream uses by man and/or wildlife were noted. The use and attendant classification (Appendix 11), for Designated Waters of New York State were noted. The existence of obvious sediment traps was noted on the ROW at the sampling locations.

Wetlands

Office Studies Directional flow and aspect were determined from USGS Quadrangle Maps. Meteorological data were obtained from the U.S. Weather Bureau sources nearest the area of the ROW.

Field Measurements All water data collected in the field were recorded on standarized field sheets (Appendix 10). Wetlands were classified in accordance with the following classification guide: wet meadows, marshes, and swamps (Appendix 12). Vegetation succession was observed and noted throughout the wetland. ROW wetlands were compared with wetlands in adjacent woods and natural versus man-made areas were identified.

Identification of positive, negative, or neutral effects of ROW construction and/or maintenance practices was made. Measurements of pH, temperature, and DO on the ROW and for those wetlands having portions in adjacent woods were made. Obvious evidence of eutropthication was noted (e.g., algae blooms). Quarterly varitations in ROW wetland areas and depth were noted and compared with adjacent wetlands. ROW construction/maintenance practices were observed, noted, and physical measurements made where possible with regard to sediment contribution.

3.2.6 Wildlife Studies

Actual Wildlife Use Studies for wildlife were determined by the major species present. The 3 major game species for each site were determined by AES in conjunction with the New York State Department of Environmental Conservation (DEC) and are listed on Table 3.2. Wildlife observed directly or indirectly on the 22 sites in New York are listed in Appendix 13.

White-tailed Deer

Pellet Counts This special study was made at site 8, Hancock to Stilesville, which is located in Delaware County. This county in past years has had the highest deer harvest on the State (DEC, 1975) and is endowed with a heavy population as noted in field observations by Mayer in 1975 and 1976. The procedures for this study are included with the actual use section for site 8.

Woody Browse Transect Woody browse transects were established at all permanent vegetation plot locations to determine the amount and location of the woody browse present. Transects were 100 feet long and 2 feet wide. All woody material 6 feet or less in height was tallied. The 50-foot mark on the tape was placed on the edge of the ROW so that equal areas were studied on the ROW, the ROW edge, and in the adjacent woods. This was done on each side of the ROW. The ratio of the number of stems per species, browsed and unbrowsed, was used to obtain a percentage of the actual use for each species present on each transect. This method allowed comparison of available browse and use among the ROW, the ROW edge, and the adjacent woods. These transects were established in the spring of 1976 for each ROW study plot, where white-tailed deer was a major game species.

Woodcock Actual use data for woodcock were obtained during the spring of 1976. Singing ground surveys were performed during the breeding season to determine if the birds were using the ROW for singing grounds (Sheldon, 1971). A section of ROW was walked at approximately 1/2 hour before dusk. Stops were made every 1/4 mile and the observer listened for the call of the male woodcock. Results were then recorded, and approximate locations of the singing grounds on the ROW and adjacent areas were plotted on the site habitat conditions map for each site where the surveys were performed.

Ruffed Grouse A ruffed grouse census of drumming males was made by noting their approximate drumming log locations during the spring of 1976 (Trippensee, 1948). Drumming counts were performed by walking a section of the ROW, stopping at intervals, and listening for a cock bird to drum. The approximate locations of grouse drumming logs were plotted on the site habitat conditions map for those sites where counts were made.

Flushing counts were made at the same time. The observer walking a section of the ROW recorded the number of birds flushed. The cover type from which the birds were flushed was also recorded; this illustrated cover preference.

Cottontail Rabbit or Varying Hare Cottontail rabbit and varying hare data were collected by the complete census (Trippensee, 1948). This method was modified to consist of traversing the study area and recording the number of rabbits and hares flushed, along with location on the ROW and cover type from which species were flushed. This method was employed over the period of this study, spring 1976 through summer 1977.

Birds Bird data were recorded for each study area. Birds seen and heard on the ROW and ROW edge were identified and noted on a separate field check list for each site (Appendix 13). Those birds observed on the 22 sites in New York during the study period are listed in Appendix 15.

Miscellaneous Wildlife Observations All other pertinent wildlife data were recorded. This included direct observations of wildlife with species, activities, and locations on the ROW, ROW edge, or in the adjacent woods. Also included were indirect observations, mainly signs such as pellets and tracks.

Potential Wildlife Use Plants located on the ROW and woods plots were rated for wildlife value for the 3 major species for each site using the existing ratings from Martin et al. (1951). In this rating, stars (asterisks) were used instead of percentage figures to indicate the extent of use of food items. There are 2 reasons for this usage: one is that there is a danger of attributing unwarranted finality or accuracy to the food-habits data as expressed in percentages, when an approximate, tentative picture of the food habits of an animal or the extent of food use of a plant is all that should be attempted or implied; the other point in favor of rating by stars is the fact that this method is easy to grasp. Important items stand out and automatically receive attention (Martin et al., 1951).

The star rankings are, for the most part, based directly on percentages from food-habit tabulations. The system, as used here, has the following

approximate percentage equivalents:

+	= 1/2	to 2%	of diet
*	= 2	to 5%	of diet
**	= 5	to 10%	of diet
***	= 10	to 25%	of diet
****	= 25	to 50%	of diet
*****	= 50%	or more	of diet

All items preceded by 1 or more stars are likely to have some importance for the wildlife species concerned. There are few 5-star items. These are so exceptional that they imply a very unique relationship between a wildlife species and a particular plant group. In these few cases the actual percentage base is also given, as a matter of interest (Martin et al., 1951).

In addition to asterisk ratings from New York, asterisk ratings from other states were included for those plant species present on each study area not rated in the New York evaluation for some wildlife species. Additional information pertaining to potential wildlife use for white-tailed deer in New York is found in Appendix 16. Those plants not included in the potential wildlife use evaluation do provide a certain amount of cover for wildlife species and may also provide seasonal food of value.

3.2.7 Photo Stations

Photo stations were established to illustrate the entire study area from on- and off-ROW points (Appendix 17). These locations were selected to include:

1. General views;
2. Unique and abundant plant communities;
3. Open and eroded areas;
4. Special site conditions;
5. Views from major points of observation.

Photo station locations were appropriately marked, tagged for identification, and tied in by structure number and location.

3.2.8 Land Use and Value

Land uses adjacent to the ROW segments were analyzed to determine those uses which benefit or thrive near the ROW as opposed to those which decline from its presence.

To adequately evaluate these effects, 3 factors were considered, these being:

1. The date of construction of the line;
2. Adjacent land uses prior to the construction of the ROW;
3. Adjacent land uses after the construction of the ROW.

The adjacent land uses were determined through reference to the following data sources: New York State Land Use and Natural Resource (LUNR) Inventory System, designed to supply updated land use across the state; USGS Quadrangle Maps of New York State; aerial photographs prior to construction (when available) and also the most recent aerial photograph; and other pertinent documentable material that was available to aid in the evaluation of land use.

To reasonably evaluate land change, the boundaries of the selected study sites were extended to approximately 2,000 feet from the ROW. This total area, including both the adjacent land and the ROW, was 1,658.40 acres.

From these data, the following procedures were used to determine land use changes:

1. Classification of land uses was in accordance with the Land Use and Natural Resource Classification Manual of New York State (LUNR, 1974), as indicated in Appendix 18.

2. Identification of those land uses that existed prior to construction of the ROW. These data were developed by interpreting aerial photographs flown prior to the construction (when available) or other available sources, and were plotted on 7.5 minute USGS Quadrangle Maps;

3. Identification of those land uses that presently exist after the construction of the ROW. These data were obtained from 2 different sources, namely interpretation of the most recent aerial photograph after the construction, and use of the LUNR area land-use overlays, and were plotted;

4. Verification and updating of existing land use changes since 1974, were done by field check;

5. Determination of the acreage of separate areas prior to and after construction of the ROW. Percentages were computed according to the following equations:

$$a/k \times 100 = P$$

where:

a = area of the land use type
k = total area of the study site (1,658.40 acres)
P = percentage of that area in comparison to the total area.

These percentages were presented in the table comparing land use before and after ROW construction for each study area.

3.3 Definition of Terms

Definitions of the following terms used throughout the report are included here for the reader's reference:

abundance - The plentifulness of a species.

annual - A plant that completes its life cycle within 1 year's time and then dies.

aspect - A position facing a particular direction.

biennial - A plant which completes its life cycle within 2 years and then dies.

browse - Woody plant parts such as twigs, leaves, buds, etc. eaten by wildlife, in particular by white-tailed deer.

codominant - Trees with crowns forming the general level of the crown canopy and receiving full light from above, but comparatively little from the sides; usually with medium-sized crowns more or less crowded on the sides.

constancy - A term used to denote the regularity of occurrence of species in stands of a plant community; also called "presence". Usually indicated by a percent of the total number of stands in which the species occurs.

cover - The area of ground covered by a species, or by a combination of species.

diversity - The number of species in a community, unweighted.

dominant - Trees with crowns extending above the general level of the crown canopy and receiving full sunlight from above and partly from the side; larger than the average trees in the stand, and with well-developed crowns.

duff mull - Humus and fermentation layers are present with an underlying A_1 horizon essentially similar to that of a true mull. Gradual transition from the humus layer to the A_1 horizon and mineral soil beneath.

ecotone - The transition zone between 2 different plant communities, such as between forest and prairie.

edge - A transition zone where 2 or more different vegetational communities meet and integrate (e.g., a zone between a field and a forest).

erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents.
(1) sheet erosion - the removal of a fairly uniform layer of soil from the land surface by run-off water.
(2) rill erosion - an erosion process in which numerous small channels of only several inches in depth are formed; occurs mainly on recently cultivated soils.
(3) gully erosion - the erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depth.

fermentation - Transformation of an organic substance by the action of ferments.

forb - Any herbaceous plant that is neither a grass nor at all like one (e.g., such weeds as geranium and buttercup).

fragipan - Dense and brittle pan or layer in the soil that owe their hardness mainly to extreme density of compactness, rather than high clay content or cementation. Removed fragments are friable, but the material in place is so dense that roots cannot penetrate and water moves through it very slowly.

habitat - The dwelling place of a species or plant community including all of the operative factors such as climate, soil, topographic, and biotic. Moisture regime areas hydric, mesic, and xeric represent different habitat conditions.

humus - A brown or black complex variable material resulting from partial decomposition of plant or animal matter and forming the organic portion of soil.

hydric - Pertaining or adapted to a wet or moist environment, drainage impeded.

intermediate - Trees shorter than those in the dominant and codominant crown classes, but with crowns extending into the crown canopy formed by the tree crowns; receiving a little direct light from above, but none from the sides; usually with small crowns considerably crowded on the sides.

litter - The uppermost, slightly decayed layer of organic matter on the forest floor.

mesic - Pertaining or adapted to an environment having a moderate supply of moisture, i.e. well drained, but moist.

moisture regime - Environments designated as either xeric, mesic, or hydric and pertaining to the supply of water and drainage characteristics (i.e., impeded or excessive).

mor - Humus layer is present. There is pratically no mixing of organic matter with mineral soil. Abrupt transition from surface organic matter to underlying horizon exists.

mull - A soil that exhibits no humus layer. The A_1 horizon consists of an intimate mixture of organic matter and mineral soil, with gradual transition between the A_1 and the horizon beneath. Fermentation layer may or may not be present.

overtopped - Trees with crowns entirely below the general level of the crown cover, receiving no direct light from above or from the sides.

pellet group - A group of small pellets defecated by deer about 13 times each day.

perennial - A plant which continues to grow year after year.

plant community - A combination of species which may be differentiated from other combinations and recognized as a unit of vegetation through use of characteristic species.

plot - A designated section of study area for special intensive study.

pole-stage - Stands made up of trees at least 4 inches d.b.h. and no larger than 12 inches d.b.h.

sapling - A young tree over 3 feet in height, but less than 4 inches d.b.h.

sawtimber - A tree greater than 12 inches d.b.h.

seedling - A woody plant less than 3 feet tall.

site - A segment of a ROW used for a study area.

slope - Ground that forms a natural or artificial incline.

slope aspect - The compass direction faced when looking down a slope in the steepest direction.

sociability - The type of grouping of individuals of a species, i.e. for example, in patches.

soil association - A group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region, comparable to plant associations in many ways.

soil horizon - A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in properties such as color, structure, texture, consistency, biological and chemical characteristics.

soil order - The first breakdown in the nomenclature of soil classification.

species - A group of individuals of the same ancestry of nearly identical structure and behavior, and of relative stability in nature.

Table 3.1. Site Selection Data Summary. (Stout, 1958; Cline 1970; Buckman and Brady, 1969; Mayer 1975)

SITE	Visual Exposure Potential Frequency of View (High or Low)	LOCATION: Urban	LOCATION: Rural-Nonfarm	LOCATION: Rural Farm	SOILS: Order and Sub-order	SOILS: Association	Slope	Aspect	WATER: Stream	WATER: Marsh, Swamp or Wet Meadow	Length of Growing Season	MOISTURE: Hydric	MOISTURE: Mesic	MOISTURE: Xeric	ROW AGE: Less than 5 yrs.	ROW AGE: More than 5 yrs.	REGIONS: Forest Region	REGIONS: Physiographic Region	ROW MANAGEMENT TECHNIQUES[1]: CLEARING: Clear Cut	CLEARING: Selective Cut -by Species	CLEARING: Selective Cut -by Area	CLEARING: Selective Cut -Selective Topping	BRUSH DISPOSAL: Piled & Burned	BRUSH DISPOSAL: Stacked/Wind-Rowed	BRUSH DISPOSAL: Drop-Lopped	BRUSH DISPOSAL: Removed & Sold	CONSTRUCTION: Access Roads	CONSTRUCTION: Stream Crossings (culverts)	RESTORATION: Grading	RESTORATION: Seeding	RESTORATION: Planting	MAINTENANCE: Chemical -Stump or Basal	MAINTENANCE: Chemical -Selective Foliage	MAINTENANCE: Chemical -Broadcast Foliage	MAINTENANCE: Mechanical -Clear Cut	MAINTENANCE: Mechanical -Selective Cut	MAINTENANCE: Mechanical -Mowing
1	H	x			13	16	0-13%	N-S-E			165-180		x			x	H	H-5	x			x	x				x				x	x			x		
2	L		x		13	16 17	0-40%	NE-SW	x		180	x	x	x	x		H	H-5		x		x	x		x	x	x				x				x	
3	H		x		13	18	0-33%	NW	NS x	x	180	x	x	x	x		E	H-5		x		x		x	x		x			x				x	
4	H		x		13	18	0-33%	NW	NS x	x	180	x	x	x		x	H	H-5	x				x				x						x	x			
5	L		x		13	23	0-70%	NW SE	x	x	165	x	x	x		x	G	L-3	x				x			x	x				x				x	x x x
6	H		x		13	4	0-15%	NW SE	x		150	x	x	x		x	G	L-4	x				x				x						x			x	x
7	L		x		13	14	0-35%	Flat to W			150		x			x	F	H-3		x	x x		x			x	x		x	x							
8	L		x		13S	12	0-25%	N,S	x		150	x	x	x		x	F	H-4	x				x	x			x							x			
9	L			x	13	24 15	0-40%	E,W	x		150	x	x			x	E	H-3	x				x	x			x						x	x			
10	H		x		13	13	0-40%	flat E	x		135	x	x	x		x	E	H-3	x					x			x		x				x	x		x	x
11	L			x	A3	7 11	0-30%	N-S	NS x	x	165	x	x			x	D	L-5	x				x				x						x			x	
12	H	x			A3	6	0-5%	E-W	x		165	x	x			x	D	L-5	x				x										x	x		x	x
13	L			x	A3	20	0-5%	Flat	NS x		165	x	x			x	D	L-5	x				x	x		x	x						x				
14	H		x		A3	21	0-8%	Vari-able	NS x	x	165	x	x	x	x		D	L-5		x				x	x		x	x	x								
15	H		x		A3	21	0-10%	Vari-able	NS x	x	165	x	x	x		x	D	L-5	x				x				x						x x	x		x	
16	L		x		S2	9 10	0-35%	E-W	x	x	135	x	x	x		x	A	H-1	x				x				x						x x	x		x	
17	L		x		S2	19 22	0-15%	N	NS x		120	x	x			x	C	H-1	x				x				x						x x				
18	L		x		S2	1 3	0-10%	E-W			135	x	x	x		x	C	L-2	x				x			x	x						x	x			
19	L		x		S2S	2	0-15%	N-S	x	x	135	x	x			x	A	H-1	x				x				x						x	x		x	
20	L			x	S2S	1	0-5%	N-S	NS x		135	x	x			x	A	H-1	x				x											x			
21	L		x		A3	25	0-15%	Flat	x		135	x	x		x		B	H-2		x	x					x	x	x				x x				x
22	L			x	13	8	0-5%	Flat	NS	x	165	x	x			x	D	L-5	x				x				x						x	x			

1 Only major ROW management techniques that were used are summarized here. Detailed information regarding these techniques and others used are discussed within the individual case studies of sites.

2 NS = No Sampling Performed

Key to Site Selection Data Summary, Table 3.1

Forest Regions of New York State

A - Adirondack
B - Tug Hill
C - St. Lawrence-Champlain
D - Lake Plain
E - Appalachian Highlands
F - Catskill
G - Mohawk-Hudson
H - New England Highlands
I - Long Island

Physiographic Regions of New York State

L - Lowland Areas
L1 - Champlain Valley
L2 - St. Lawrence Valley
L3 - Hudson Valley
L4 - Mohawk Valley
L5 - Erie Ontario Plain
L6 - Black River Valley
L7 - Long Island Coastal Plain

H - Highland Areas
H1 - Adirondack Highlands
H2 - Tug Hill Plateau
H3 - Allegheny Plateau
H4 - Catskill Mountains
H5 - New England Uplands

Soils

Soil Association	Order & Sub-order
1. Adams-Colton	A3 Alfisols - Udalfs
2. Adams-Croghan-Saugatuck-Scarboro	13 Inceptisols - Ochrept
3. Adams-Walpole	13S Inceptisols - Ochrept
4. Camroden-Marcy	S2 Spodosols - Orthods
5. Canaan-Rock Outcrop	S2S Spodosols - Orthods
6. Colonie-Elnora-Minoa	
7. Farmington	
8. Fulton-Toledo	
9. Gloucester-Essex-Rockland	
10. Hermon-Becket-Rockland	
11. Honeoye-Lima	
12. Lackawanna-Oquaga-Wellsboro	
13. Lordstown	
14. Lordstown-Mardin	
15. Lordstown-Volusia-Mardin	
16. Rockaway-Chatfield	
17. Rockland	
18. Rockland-Chatfield	
19. Rough Mountain Land	
20. Sodus-Ira	
21. Sodus-Ira-Scriba	
22. Stony Land	
23. Troy-Cossayuna	
24. Volusia-Lordstown	
25. Worth-Empeyville	

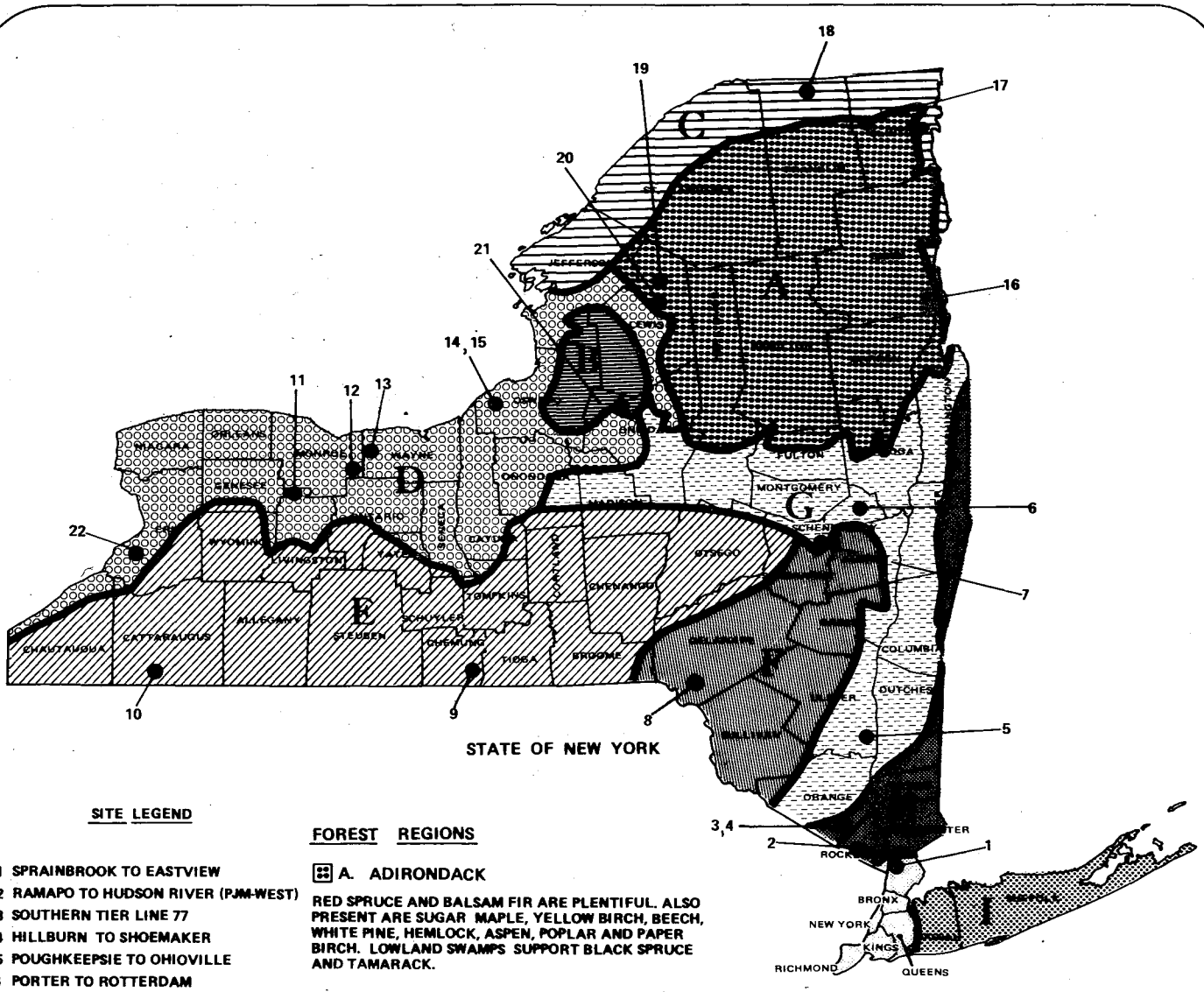
stream aspect - The compass direction of stream flow.

stand - The concrete representative of a plant community in nature.

xeric - Pertaining or adapted to a dry environment, drainage excessive.

Table 3.2. Three major game species in the vicinity of the 22 project sites locations.

Number and Name of ROW Location	Major Game Species											
	White-tailed Deer	Pheasant	Cottontail Rabbit	Varying Hare	Squirrel	Ruffed Grouse	Woodcock	Muskrat	Beaver	Turkey	Raccoon	Hungarian Partridge
Site 1 Sprainbrook to Eastview		X			X						X	
Site 2 Ramapo to Hudson River (PJM-West)	X				X						X	
Site 3 Southern Tier Line 77	X				X						X	
Site 4 Hillburn to Shoemaker	X				X						X	
Site 5 Poughkeepsie to Ohioville			X			X					X	
Site 6 Porter to Rotterdam			X		X		X					
Site 7 Gilboa to New Scotland	X		X		X							
Site 8 Hancock to Stilesville	X				X						X	
Site 9 Hillside to Oakdale	X		X		X							
Site 10 Falconer to Homer Hill	X									X	X	
Site 11 Station 82 to Station 162	X	X					X					
Site 12 Lockport to Solvay		X	X		X							
Site 13 Station 121-13A		X					X				X	
Site 14 Oswego to Volney	X		X				X					
Site 15 Oswego to Clay #4	X		X				X					
Site 16 National Lead Line						X		X	X			
Site 17 Lyon Mountain to Saranac	X			X		X						
Site 18 Moses to Plattsburg		X		X								X
Site 19 Moses to Adirondack	X			X		X						
Site 20 Adirondack to Porter	X			X		X						
Site 21 Fitzpatrick to Edic	X			X		X						
Site 22 Gardenville to Dunkirk	X				X							



SITE LEGEND

1 SPRAINBROOK TO EASTVIEW
2 RAMAPO TO HUDSON RIVER (PJM-WEST)
3 SOUTHERN TIER LINE 77
4 HILLBURN TO SHOEMAKER
5 POUGHKEEPSIE TO OHIOVILLE
6 PORTER TO ROTTERDAM
7 GILBOA TO NEW SCOTLAND
8 HANCOCK TO STILESVILLE
9 HILLSIDE TO OAKDALE
10 FALCONER TO HOMER HILL
11 STATION 82 TO STATION 162
12 LOCKPORT TO SOLVAY
13 STATION 121 TO STATION 13A
14 OSWEGO TO VOLNEY
15 OSWEGO TO CLAY #4
16 NATIONAL LEAD LINE
17 LYON MOUNTAIN TO SARANAC
18 MOSES TO PLATTSBURG
19 MOSES TO ADIRONDACK
20 ADIRONDACK TO PORTER
21 FITZPATRICK TO EDIC
22 GARDENVILLE TO DUNKIRK

FOREST REGIONS

A. ADIRONDACK

RED SPRUCE AND BALSAM FIR ARE PLENTIFUL. ALSO PRESENT ARE SUGAR MAPLE, YELLOW BIRCH, BEECH, WHITE PINE, HEMLOCK, ASPEN, POPLAR AND PAPER BIRCH. LOWLAND SWAMPS SUPPORT BLACK SPRUCE AND TAMARACK.

B. TUG HILL

THE PRINCIPAL TREES IN CUTOVER WOODLOTS ARE SUGAR MAPLE, YELLOW BIRCH, AND BEECH. COMMON, TOO, ARE ASPEN, RED MAPLE, AND BLACK CHERRY. RED SPRUCE AND BALSAM FIR ARE RESTRICTED TO POORLY DRAINED LAND WHERE HARDWOODS OFFER LITTLE COMPETITION.

C. ST. LAWRENCE - CHAMPLAIN

SUGAR MAPLE AND BEECH ARE FOUND IN ALL SECTIONS. WHITE PINE IS COMMON ON THE CHAMPLAIN VALLEY; ELM, RED MAPLE AND HEMLOCK GROW IN BOTTOMLANDS THROUGHOUT THE AREA. CEDAR IS PLENTIFUL IN NOTHERN FRANKLIN COUNTY AND ON LIMESTONE OUTCROPPINGS IN ALL SECTIONS. GRAY BIRCH AND ASPEN ARE ALSO PRESENT, BUT ARE USUALLY SMALL.

D. LAKE PLAIN

ELM AND RED MAPLE ARE ABUNDANT. ON BETTER DRAINED LANDS, BEECH, BASSWOOD, WHITE ASH, SUGAR MAPLE, HICKORY, HEMLOCK, TULIP POPLAR AND BLACK WALNUT ARE FOUND.

E. APPALACHIAN HIGHLANDS

THE WOODLOTS CONSIST MAINLY OF BEECH, SUGAR MAPLE, BASSWOOD, WHITE ASH, AND BLACK CHERRY, WITH BOTH RED AND WHITE OAK ON THE DRIER SLOPES.

F. CATSKILL

BEECH, SUGAR MAPLE, WHITE ASH, AND BLACK CHERRY PREDOMINATE WITH COMMERCIAL - SIZE YELLOW BIRCH AT THE HIGHER ELEVATIONS. WHITE PINE, HEMLOCK, AND OAK ARE PRESENT IN SCATTERED POCKETS; RED SPRUCE GROWS AT THE HIGHER ELEVATIONS IN ULSTER AND GREEN COUNTIES.

G. MOHAWK - HUDSON

THE WOODLOTS ARE GENERALLY IN POOR CONDITION BECAUSE OF OVERCUTTING. TREES MOST LIKELY TO BE ENCOUNTERED ARE BEECH. YELLOW BIRCH, SUGAR MAPLE, RED MAPLE , WHITE ASH, WHITE PINE, BASSWOOD, PAPER BIRCH, BLACK BIRCH, BLACK CHERRY, HEMLOCK, RED AND WHITE OAK, AND ELM.

H. NEW ENGLAND HIGHLANDS

OAKS ARE PREVALENT; OTHERWISE, THE KINDS OF TREES ARE LARGELY THE SAME AS IN "G". SPRUCE AND BALSAM FIR ARE PRESENT IN THE NORTH.

I. LONG ISLAND

OAK IS THE PREDOMINANT TYPE OF FOREST. PITCH PINE, THE PRINCIPAL CONIFER, GROWS CHIEFLY IN MIXTURE WITH RED AND WHITE OAKS, ALTHOUGH IT IS FOUND IN A FEW PLACES IN PURE STANDS. MUCH OF THE FOREST IS SCRUBBY BECAUSE OF POOR SOILS, LIGHT SUMMER PRECIPITATION, CONSTANT DESICCATING WINDS, AND FREQUENT FIRES.

N

SOURCE:
STOUT, NEIL J. ATLAS OF FORESTRY 1966.

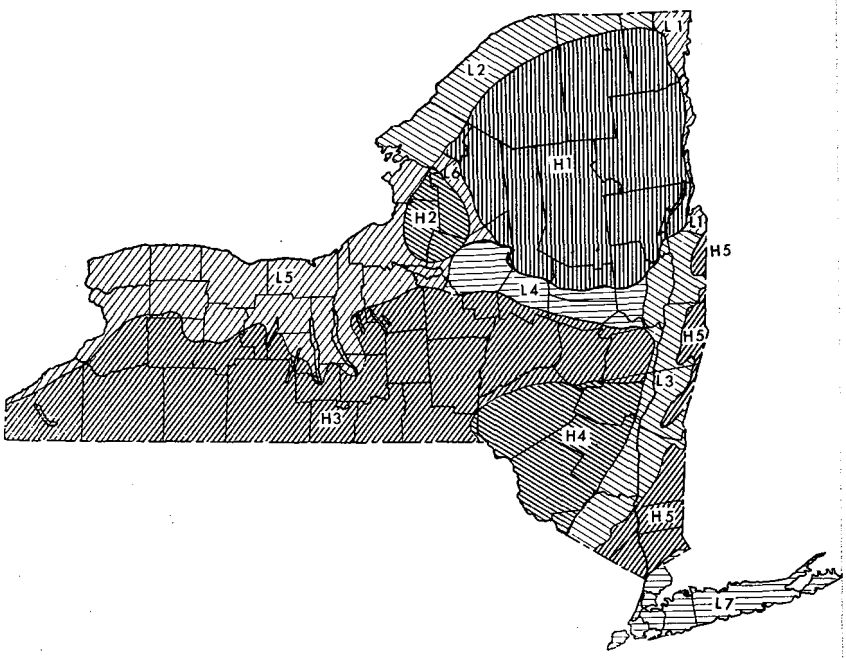
Fig. 3.1 Forest regions of New York State

L - Lowland Areas

- L1- Champlain Valley
- L2 - St. Lawrence Valley
- L3 - Hudson Valley
- L4 - Mohawk Valley
- L5 - Erie - Ontario Plain
- L6 - Black River Valley
- L7 - Long Island Coastal Plain

H - Highland Areas

- H1 - Adirondack Highlands
- H2 - Tug Hill Plateau
- H3 - Allegheny Plateau
- H4 - Catskill Mountains
- H5 - New England Uplands



SOURCE
CLINE, 1970

Fig. 3.2 Physiographic areas of New York State

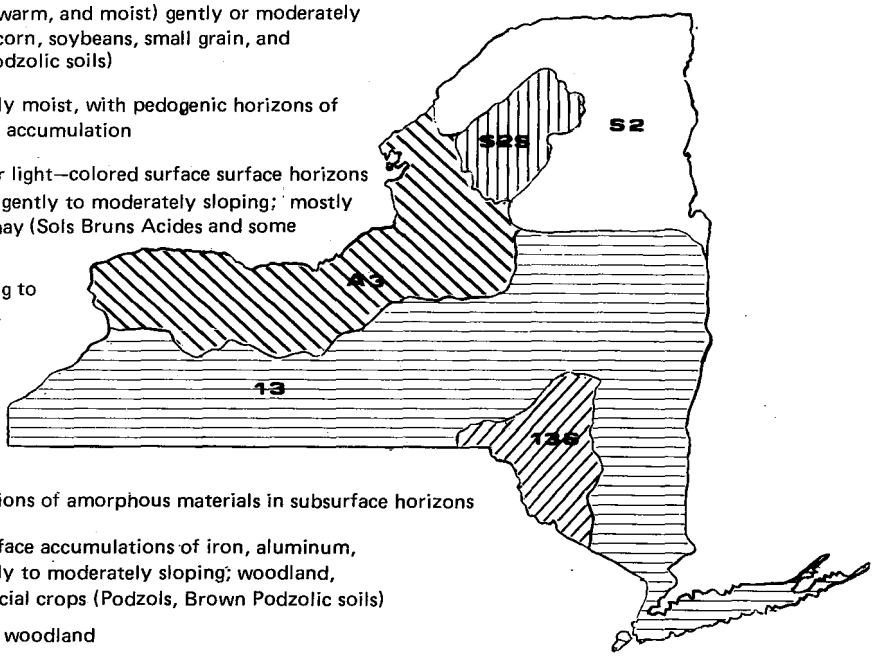
ALFISOLS . . . . Soils with gray to brown surface horizons, medium to high base supply, and subsurface horizons of clay accumulation; usually moist but may be dry during warm season

A3 — UDALFS (temperate or warm, and moist) gently or moderately sloping; mostly farmed, corn, soybeans, small grain, and pasture (Gray—Brown Podzolic soils)

INCEPTISOLS . . . . Soils that are usually moist, with pedogenic horizons of alteration of parent materials but not of accumulation

13 — OCHREPTS (with thin or light—colored surface surface horizons and little organic matter) gently to moderately sloping; mostly pasture, small grain, and hay (Sols Bruns Acides and some Alluvial soils)

13S - OCHREPTS gently sloping to steep; woodland, pasture, small grains



SPODOSOLS . . . Soils with accumulations of amorphous materials in subsurface horizons

S2 — ORTHODS (with subsurface accumulations of iron, aluminum, and organic matter) gently to moderately sloping; woodland, pasture, small grains, special crops (Podzols, Brown Podzolic soils)

S2S — ORTHODS steep; mostly woodland

SOURCE
BUCKMAN AND BRADY, 1969

Fig. 3.3 Major soil orders and suborders of New York State

Ls - Dominantly limestone

Ls & Sh - Alternating limestone and shale formation, mainly calcareous

Sh - Dominantly shale

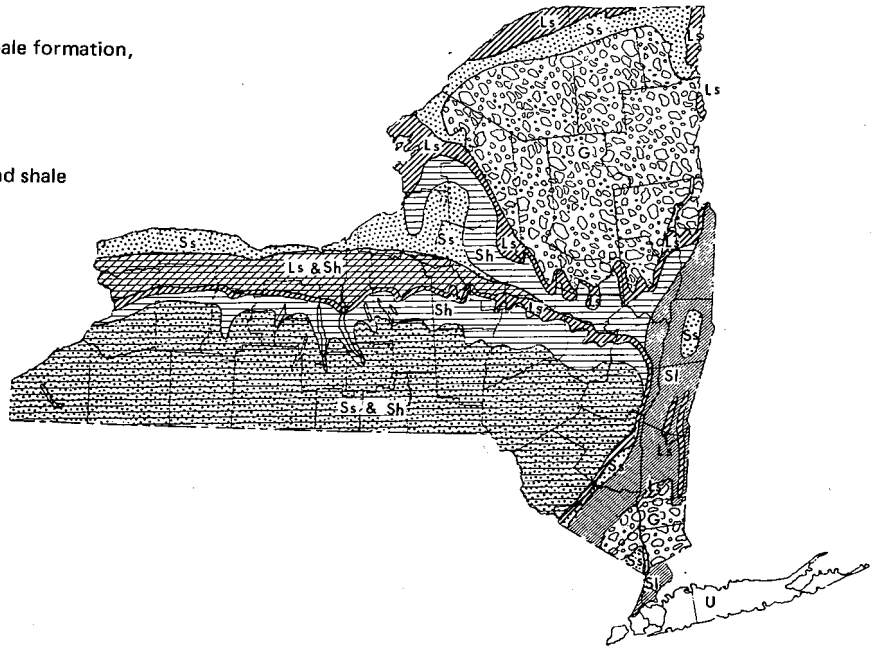
Ss - Dominantly sandstone

Ss & Sh - Interbedded sandstone and shale

Sl - Dominantly slate and schist

G - Dominantly granitic rocks

U - Deep unconsolidated deposits



SOURCE
CLINE, 1970

Fig. 3.4 Important bedrock areas of New York State

4 Individual Case Studies of Sites

The individual case studies of the 22 sites in New York are contained in Volumes 2 and 3 of this report. Listed below according to the volume in which they are located are the site numbers and names of these sites.

VOLUME 2

Site 1 Sprainbrook to Eastview
Site 2 Ramapo to Hudson River (PJM-West)
Site 3 Southern Tier Line 77
Site 4 Hillburn to Shoemaker
Site 5 Poughkeepsie to Ohioville
Site 6 Porter to Rotterdam
Site 7 Gilboa to New Scotland
Site 8 Hancock to Stilesville
Site 9 Hillside to Oakdale
Site 10 Falconer to Homer Hill
Site 11 Station 82 to Station 162

VOLUME 3

Site 12 Lockport to Solvay
Site 13 Station 121 to Station 13A
Site 14 Oswego to Volney
Site 15 Oswego to Clay #4
Site 16 National Lead Line
Site 17 Lyon Mountain to Saranac
Site 18 Moses to Plattsburg
Site 19 Moses to Adirondack
Site 20 Adirondack to Porter
Site 21 Fitzpatrick to Edic
Site 22 Gardenville to Dunkirk

5 Special Studies

5.1 Response of Forest-grown Hemlock to Topping on Selectively-cleared Electric Transmission Line Corridors

During the past decade selective clearing of electric power line corridors has become an increasingly common practice. Partial clearing softens the visual impact of corridor establishment and management. This concept basically entails removal of only those trees, or portions of trees, which interfere now, or will interfere in the future, with safe and uninterrupted electric current transmission, and with erection and inspection of towers and conductors.

In selective clearing many trees are topped rather than completely removed. If the amount of tree crown removed during topping is determined only by the distance from the electric transmission wires rather than by biological considerations of a specific tree's condition or probable reaction to such treatment, then some trees may be topped too severely, even to the point of removing the major photosynthetic area of their crowns.

It should be pointed out that tree topping for transmission line construction is not normally comparable to the trimming so commonly done in urban areas along electric distribution lines. Street shade trees have developed under open conditions, and have large, deep crowns. During each successive trimming of shade trees a relatively small portion of the total crown area is removed. Where transmission line corridors penetrate established forests, however, individual trees are closely spaced, and the entire crown area of each tree is restricted to a small percent of the total tree height. Forest-grown trees usually have less than 40% of their total height in crown; many have a smaller crown ratio[1]. Thus, topping may result in removing a significant percent of the most active photosynthetic surface of a tree. Topped forest-grown trees respond in a number of ways after such treatment. They may die back from the top and expire quickly, remain in a static condition with little immediate change in crown area, or sprout from dormant buds and rapidly restore much of their former crown area.

This study was designed to determine:

1. The response of hemlocks to topping;
2. What percentage of the live crown of hemlock can be removed before vigor is seriously reduced and decline sets in; and
3. Guidelines for topping hemlocks to identify which individuals can be topped with little serious effect on vigor, and when topping results in decline and mortality justifying immediate removal of such trees at the time of corridor establishment.

5.1.1 Location of Study Area

The selectively-cleared and topped ROW area used for this research is along the Ramapo to Hudson River transmission line (site 2) established by Orange and Rockland Utilities, Inc., in 1971. This is a

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[1] Crown ratio is the "length of the tree crown/total tree height" expressed as a percent.

345 kV line. At the time of clearing all vegetation within 18 feet of the electric wires were felled or topped.

The study area occupies a southeast-facing slope. The stand formerly occupying the ROW area consisted of white oak, red oak, and hickory with tulip-poplar, white ash, and sweet birch as associates. Hemlock becomes an increasingly abundant component on the lower-third slope and on the alluvial soils along a stream drainage, approximately 1,000 feet from the Ramapo substation.

During construction of this section of the ROW many trees were completely removed, but 24 hemlocks along an 800-foot length of this corridor were left. Twenty of these had been topped.

After ROW clearing, the increased sunlight had allowed such understory shrubs as sweet-fern, willows, maple-leaved viburnum, and mountain-laurel to gain vigor, and to occupy increasing areas of this corridor. Grasses, sedges, and various herbs have become established between these shrubs. Open and eroding soil is rare on this section of the corridor except on excessively steep grades near tower sites and along the steeper sections of the access road where sheet and gully erosion is active.

The study area on this transmission corridor follows a northwest-southeast course.

5.1.2 Field Procedure

During July, 1975, topped hemlocks on the ROW area were selected for study. Trees that had been subjected to excessive soil disturbance due to corridor construction, or those where fill had been deposited over their root area during road construction, were not included among the sample trees, since it was determined that these activities had had a greater impact on tree vigor than that of topping.

The following measurements were made on topped hemlocks: diameter breast high (4.5 feet), height to lowest live branch, and height to point of topping. In addition, a vigor rating was assigned to each tree: 0, dead; 1, poor; 2, average; and 3, high.

In the immediately adjacent woods at points where the site index was determined to be the same as that on the power line corridor, 20 hemlocks, representing the same range of diameter classes as the line study trees, were selected for controls. These trees were located 30 feet or more from the corridor edge. For these controls the following measurements were made: diameter breast high, total height, height to lowest live branch, relative crown position[2], and vigor rating.

5.1.3 Analysis of Data

Using the control tree data, regression analysis was used to establish the relationship between diameter and total height. Preliminary

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[2] Dominant: Trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the sides. Codominant: Trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little side light. Intermediate: Trees shorter than those in the 2 preceding classes; crowns extend into the cover formed by the codominant and dominant trees, but receive little direct light from above and none from the sides.

plotting of these data indicated this to be a straight-line relationship within the diameter range included in this study. This regression equation, significant at the 5% level, is as follows:

$$Y = 44.580 + 0.532\ D$$

where:

Y = tree height in feet, and
D = diameter breast high in inches.

From this equation an estimate of the original (1971) heights of each of the topped trees was calculated. Using the 1971 height of these trees, and the height to the lowest live branch, the original length of live crown for each of the line study trees was established.

After preliminary plotting of those parameters (independent variables) with present vigor (dependent variable) to determine which variable or variables would best predict the vigor which could be anticipated 4 years after trees of various crown positions had been subjected to crown removals of various intensities, the following regression equations were calculated:

$$(1)\quad Y = 0.934 + 0.070\ \frac{P}{R}$$

$$(2)\quad Y = 0.929 + 0.032\ \frac{P^2}{R}$$

where:

Y = present vigor rating,
P = crown position prior to topping, and
R = portion of crown removed in topping, expressed as a decimal.

Equation 2, significant at the 5% level, gives the closest correlation between crown position, percent crown removal, and present vigor. From this equation Table 5.1 was calculated to indicate expected vigor 4 growing seasons after hemlocks have been topped.

5.1.4 Discussion

In this analysis it became apparent that the relative crown position of a hemlock prior to topping was the most important factor in determining the tree's response to topping. Dominant trees, those with large vigorous crowns, still retained good or average vigor after crown removal of up to 30%. Codominant and intermediate trees withstood lighter topping, 20% of crown removed, without serious loss of vigor. All topping operations, however, where 50% or more of the live crown was removed, resulted in drastic reductions in vigor.

Recent field inspection of successful long-term topping operations on electric corridors managed by Philadelphia Electric Company substantiate the results of this analysis. This Company's policy is to leave 2/3's of the crown when topping vigorous trees. Trees that require more severe topping, to provide safe and uninterrupted electric current transmission, were completely removed, as vigor decline and mortality were certain.

The comparatively high vigor ratings for trees which had 10% of their crown length removed by topping (Table 5.1) may reflect the response of these hemlocks to greater sunlight after the release provided by selective clearing of this corridor. The narrow width of this corridor and the compass direction followed by this line did not provide full sunlight for these hemlocks following selective clearing. However, hemlocks generally respond better to partial release than to sudden exposure to full sunlight.

Field observations on power line corridors in New York State (see Sec. 5.2) indicate that the degree of disturbance around trees left during selective clearing operations is a decisive factor influencing subsequent vigor. Where mechanical skidding operations have disturbed much of the surface soil around "leave trees," these trees generally decline rapidly even when not subjected to topping. Where the original ground level around a tree is raised by deposition of soil, decline and mortality are also common. Much vigor decline and mortality on selectively-cleared corridors can be attributed to destruction of surface roots, soil compaction, and smothering, even where topping practices have been conservative.

In topping trees, the cut should be made immediately above a strong branch. During this study it was observed that when this rule was not followed the tree bole often died back to the closest live branch. Such dead stubs provide a point of entry to heartwood-rotting fungi.

5.1.5 Summary

Hemlocks with dominant crown positions, those with deep full crowns which receive both top light and side light, can withstand heavier topping than trees of lower crown positions (codominants and intermediates). Dominant hemlocks can withstand removal of up to 30% of their crown length without seriously impairing vigor. Codominants and intermediates can withstand lighter topping, with no more than 20% crown removal.

In selective clearing of electric corridors, even where trees are not subjected to topping, great care must be taken not to disturb the soil surface and alter the ground level beneath "leave trees" since this results in breakage and smothering of surface roots, major factors in vigor decline and eventual mortality.

Topping to a strong live branch avoids top die back, and thus reduces the danger of attack by heartwood-rotting fungi.

5.2 Condition and Vigor of Edge Trees Exposed by Clearing: Circular Openings for Tower Construction

5.2.1 Purpose

Forest-grown trees are subjected to radical environmental changes when suddenly exposed to complete sunlight and other site alterations by the construction of ROW corridors. Similar exposure also results on selectively-cleared ROW's when clear-cut openings are created for tower structures. Where electric transmission facilities penetrate forest land, edge trees which have developed in closed stands with the protection of neighboring trees are suddenly exposed to greater sunlight on 1 side of their bole and crown area. They are also subjected to changes

in wind velocity and direction, and lose the protection of neighboring tree crowns which provide support when subject to the weight of heavy snow and glaze.

Clearings for electric corridors result in immediate environmental change, allowing not time for adaption, which might occur when neighboring trees are removed gradually over many years. Dead and dying trees, occasionally encountered along transmission line corridor edges, have often declined from exposure, not from ROW maintenance practices, even though maintenance methods, including herbicide drift, are often blamed for this mortality.

The purposes of this study were to determine:

(1) Those tree species which are most susceptible to decline and mortality following exposure;
(2) The direction of exposure which has the most deleterious effect;
(3) The causes of edge tree decline;
(4) The extent of mechanical damage caused by clearing operations.

5.2.2 Description and History of Study Area

The 3 circular tower-site openings used for this study are located on the Gilboa to New Scotland 345 kV transmission line, which was constructed by the Power Authority of the State of New York. These study areas surround towers 1/6, 1/7, and 1/8 on land adjacent to the Blenheim-Gilboa Pumped Storage Power Project in Schoharie and Greene counties in the Allegheny Plateau (Cline, 1970). These tower openings vary from 0.72 to 1.0 acre in area.

The Hemlock-Northern Hardwoods forest type, comprised of beech, hemlock, sugar-maple, with white ash, yellow birch, red maple,and American hop-hornbeam as associates, is the most widespread forest cover in this locality. The stand in which the tower openings were place is realtively evenaged, with the upper canopy trees approximately 70 years old. Lower-crown-class and understory trees were usually the same age as the overstory, except for scattered younger shade-tolerant trees, such as sugar-maple, beech, and hemlock, that had seeded-in more recently.

The tower openings used for this study were cleared during the fall of 1970 and the spring of 1971. All trees and brush over 3 feet tall, cut from these openings, were removed from the site or burned. There was no evidence of bark scorch from slash fires on any of the edge trees. Brush, trees, and stumps were cut as close to the ground as practicable, and never exceeded 6 inches above ground level. Stumps were treated with a basal spray of low volatile picolinic acid and 2,4,5-T ester in an oil carrier. The open soil was then seeded.

5.2.3 Field Measurement Procedures

For each tower site opening a map was constructed on polar coordinate paper showing the location of each edge tree from the plot center. In plotting the location of each tree from this center a compass bearing was determined and the distance was measured to the nearest foot For each tree the species, diameter breast high (d.b.h., nearest 0.1 inch).

total height (nearest 1 foot), and relative crown position were recorded. In addition, the extent of mechanical damage, sunscald, and root exposure were obtained. General tree vigor was gauged on the basis of crown structure, compactness and density of crown, and presence or absence of dead and dying branches.

Mechanical damage was (Fig. 5.1.1) recorded for that portion of the tree bole facing the opening. This damage included scraping of bark and wood by heavy equipment, and other man-caused damage that would result in an entrance court for fungi or insects. The number of such damages per tree was determined whether or not the wounds were in the process of healing.

Sunscald (Figs. 5.1.2 and 5.1.3) was recorded based on the number of such wounds on the tree trunks. Sunscald was differentiated from mechanical damage by the location on the bole, and the absence of sharp indentations or tears in the bark or wood.

The number of exposed roots (Fig. 5.1.4) was counted for each edge tree. Exposed roots were tallied only if there was evidence of damage and decline to the root as a result of exposure. Where partially exposed roots were live and healthy, and retained their bark, they were not included in the "exposed root" category.

Vigor of edge trees was rated on a scale of 0 through 5. A 0 rating was given to trees that had died since the tower opening had been made; 1 represented poor vigor; 2, below average vigor; 3, average vigor; 4, above average vigor; and 5, high vigor.

5.2.4 Analysis of Results

A total of 255 edge trees were studied along the margins of these 3 openings. In tabulating these data, edge trees from all 3 openings were grouped together.

Sixteen tree species were represented in this tally (Table 5.2.) Hemlock, beech, red maple, sugar-maple, and American hop-hornbeam made up the majority of these trees. Some species occurred only once, including yellow birch, aspen, serviceberry, chestnut, and bitternut hickory. These were included in the tabulations to give a more complete picture of stand composition. The variation in number of edge trees for different locations is due to access roads. These reduced the number of edge trees on the east-southeast, southeast-south, and west-northwest positions.

Table 5.3 gives the number of trees by species which have one or more exposed roots for various locations surrounding the tower site openings. This table also includes the total number of trees in each location by species, for comparison. Table 5.4 presents the average number of exposed roots per edge tree by species and tree location.

Table 5.5 shows the number of edge trees with mechanical damage. This damage was primarily from heavy equipment used at the time the opening was established. Table 5.6 gives average vigor ratings for all tree species based on a scale of 0 to 5.

Percent of trees with sunscald, the most prevalent damage next to mechanical injury, is given in Table 5.7. The 2 most sensitive species, beech and hemlock, have been further separated into diameter distributions in Tables 5.8 and 5.9, respectively.

5.2.5 Discussion

Root Exposure Root exposure of edge trees from loss of the litter layer due to increased solar radiation reaching the ground surface was most severe on the north, through east to south margins of these openings (Tables 5.3 and 5.4). Since this edge of the opening receives the hot afternoon sun, the increased temperature and lower moisture content from rapid evaporation causes the mull humus litter layer, typical of northern forests, to gradually disintegrate, resulting in the exposure of superficial roots.

It was observed that the litter layer on this portion of the clearing had disappeared, or remained only as a dark brown, powder-like cover. This condition on the north through east edge of the tower opening extended several feet back into the forest stand.

Such shallow-rooted species as beech, hemlock, sugar-maple, and red maple (Tables 5.3 and 5.4) were affected by this loss of litter, gradually exposing the upper root surface, resulting in the death of many important surface roots. Invasion of these marginal areas by herbaceous plants, as the litter disappears, takes place slowly, teaberry being conspicuous in this initial invasion. The decaying humus layer evidently is a poor medium for seedling establishment, since plant invasion is delayed for 4 years or longer. This is probably due to the low moisture-holding capacity of this decaying organic layer which makes it difficult for new seedlings to survive unless their roots can penetrate to mineral soil.

This forest stand, prior to the time the clearings were established, contained only a sparse understory of shrubs and herbs due to the heavy shade from the hemlock, beech, and other dense-crowned species. Thus, after the openings were cleared there was only a sparse nucleus of shrubs present along the clearing margin to protect the litter from direct sunlight.

Mechanical Damage Mechanical damage showed no definite trends related to position on ROW clearing, as might be expected (Table 5.5). In general, those species with thin bark are most subject to mechanical damage from contact with heavy equipment. These include beech, red maple, American hop-hornbeam, aspen, and white birch. A high incidence of mechanical damage was noted where access roads entered these tower site openings.

Vigor Ratings Vigor ratings indicate that many trees which sustained root damage and sunscald had not, as yet, started to decline as a result of root and bole damage (Table 5.6). Vigor ratings on the northern and eastern edges were higher than those for other opening positions, even though northern and eastern edges had higher indices of sunscald and root exposure.

Observations on decline from sunscald and root exposure in other parts of the Northeast indicate that these damages result in entrance points for fungi and that decline often follows 10 to 20 years after exposure of edge trees. The higher vigor ratings of the north- and east-edge trees at present can be explained by the increased amount of

direct solar radiation received by these trees, allowing greater photosynthetic activity and retention of lower branches on the face of the trunk towards the opening.

Beech and sugar-maple had particularly high vigor ratings. These species are noted for their shade tolerance and rapid recovery of vigor when exposed to increasing amounts of light. The low vigor ratings for white and sweet birch is due to the lower crown position occupied by these trees prior to the time these openings were made, and their inability to respond to release.

Sunscald Sunscald was most prevalent on the west through north to east margins of these openings, with the highest incidence on the north-northeast section (Table 5.7). Species most heavily affected by sunscald were beech, red maple, red oak, and hemlock. Although the samples of aspen and basswood were small, these species are susceptible to sunscald in other sections of the United States. American hop-hornbeam, white ash, and sugar-maple did not appear subject to sunscald damage.

Sunscald was common on all beech below 12 inches d.b.h., and was particularly prevalent on beech 8 to 12 inches in diameter (Table 5.8). Beech of these diameter classes were lower-crown-class trees in this evenaged stand prior to the time the circular tower openings were made, and thus were not subject to any direct sunlight on their boles and branches until exposed by the tower clearing.

Sunscald seemed equally abundant on hemlocks of all diameter classes, with those in the 6 to 8 inch d.b.h. class most heavily affected (Table 5.9).

5.3 Direct Seeding Study

With the widespread use of direct seeding along highways and for re-vegetating coal strip mines, many plant species have been identified which give quick cover on exposed soil, often under adverse growing conditions. With this increased knowledge of species and seeding mixtures, new techniques and equipment, including hydro-seeders, mulching agents, and fertilizer additives, have been developed. These have all contributed to establishing quick cover, even of compact soil or excessively steep slopes.

Large scale seeding of disturbed soils following electric transmission corridor construction is a relatively new field. ROW managers, of necessity, have had to rely heavily on information, techniques, and experience of state highway department personnel and the Soil Conservation Service for proper seed and slurry mixes and application methods. Although many of the problems encountered by highway departments are similar to those of electric corridors, power line ROW's do present some unique aspects. Among these are extreme soil compaction around tower sites, limited-use access roads which often traverse steep grades, and the relative inaccessibility of remote sections of these corridors, restricting the feasibility of periodic future maintenance (Fig. 5.1.5).

Observations were made on the success of direct seeding for 4 transmission line corridors to determine the success of several direct seeding methods under a variety of environmental conditions; to deter-

mine which plant species give satisfactory survival; and to determine where natural plant invasion might have effectively covered bare soil, thus eliminating the need for costly seeding.

5.3.1 Seeding Methods

A description of the 4 study areas and direct seeding methods employed is as follows:

Site 2 Ramapo to Hudson River (PJM-West) This corridor was cleared during the winter of 1970-71, using selective clearing with topping or complete tree removal, as needed. During the clearing operation sawlogs were stacked at the ROW margin and brush was burned on site. In the fall of 1972, open soil, primarily along construction roads and at tower sites, was seeded using a hydro-seeder.

At 2 of the tower sites included in this study (towers 4 and 5) the following shrub-seed mixture was used:

Perennial rye-grass	40 pounds
Chewings fescue	40
Common rye grass	25
White clover	7
Smooth sumac	1
Staghorn-sumac	1
Scotch broom	1
White pine	1
Sweet-fern	3
Silky dogwood	3
Mountain-laurel	3
	125 pounds per acre

Seeding specifications called for the following additives to the slurry:

Lime - 2 tons ground agricultural limestone or 500 to 700 pounds of high magnesium hot lime;

Fertilizer - 1,000 pounds of 10-10-10
500 pounds of dehydrated manure (2-1-1) or
500 pounds of organic humus builder;

Mulch - 1,500 pounds of wood fiber.

At tower sites 2 and 3 a slightly different seed mixture was employed. This included the following species:

Chewings fescue	40 pounds
Perennial rye-grass	30
Kentucky 31	25
White clover	7
Fragrant sumac	1
Smooth sumac	1
Scotch broom	1
White pine	1
Scotch pine	1
	107 pounds per acre

Seeding specifications called for the following additives to the slurry:

- Lime - ground agricultural limestone, 4,000 pounds;

  Fertilizer - 10-10-10 at 1,000 pounds, dehydrated manure (2-1-1) at 500 pounds or organic humus builder;

  Mulch - Wood cellulose fiber or a suitable substitute, 1,500 pounds

The above were mixed in water in proportionate amounts and the resultant slurry was then sprayed with a hydro-mulcher at a pressure of 300-350 PSI to provide an equally-distributed coverage of all disturbed areas. The total rate of application was 107 pounds of shrub-seed, 400 pounds of lime, 1,000 pounds of fertilizer, 500 pounds of dehydrated manure or humus builder, and 1,500 pounds of mulch per acre.

All direct seeding was done under the supervision of the company forester.

Site 14 Oswego to Volney The section of this line area under study was selectively cleared in 1974. Open areas were seeded in early 1975. Perennial rye-grass, at the rate of 5 pounds per 1,000 square feet, was used on most of the exposed soils around tower sites. Along water bars white clover and perennial rye-grass (40%-60%) was applied. at the same rate.

Site 21 Fitzpatrick to Edic This line corridor was cleared in June-July, 1971. All trees were removed and slash was burned on site or chipped. Around tower and work sites restoration and seeding was done in July and August, 1973, using a hand cyclone seeder. The following mixture was used:

Creeping red fescue	35 pounds
Perennial rye-grass	10
White clover	5
	50 pounds

Site 7 Gilboa to New Scotland Line Three tower sites in the vicinity of the Blenheim-Gilboa Pumped Storage Power Project were used for observing success of direct seeding operations. These tower openings vary from 0.7 to 1.0 acre in area, and were cleared during the winter, 1970, and spring, 1971. Brush, trees, and stumps were cut close to the ground and stumps were treated with a basal spray of Tordon 155 in an oil carrier. During the late spring, 1971, these openings were seeded with 5 pounds of perennial rye-grass seed per 1,000 square feet, covering all open soil.

5.3.2 Observations and Discussion

Site 2 Ramapo to Hudson River Line, Towers 4 and 5 (Tables 5.10 and 5.11) These tower areas are located on a southwest-facing slope, and classify as mesic sites. The ground surface around these towers was drastically altered during corridor construction to provide level areas for the tower footings. On 2 sides of these towers steep slopes are present where cutting was necessary. The large amount of cut and fill required

to construct these tower sites resulted in loss of the original topsoil, and excessive compaction of much of the present surface soil.

Chewings fescue is the major vegetation surviving from the seeding operation. After 4 growing seasons this grass still dominates the vegetation. On level portions of this clearing this fescue forms dense stands. As the slope increases, the density of these grass communities decreases, and on the steepest portions little or no Chewings fescue survives. Common rye grass is no longer present in the tower areas, but probably formed an important cover during the first year, giving way to the more aggressive Chewings fescue during the second growing season. The quick germination of this rye grass was probably beneficial during the first growing season in preventing erosion and in stabilizing the soil, facilitating the invasion and establishment of other species. It is not clear why perennial rye grass has not persisted here, but many strains of this grass, now available, die out after the third or fourth year. This grass is considered an undesirable grass in many states.

Crown-vetch, although not included in the seeding specifications, occurs at scattered points around these towers, and the 1975 and 1976 field observations indicate that this legume is spreading. The seed source for this cover was probably from the seeding mixture, as vetch seed likely occurred in the seeding equipment from previous seeding operations.

Sweet-fern is abundant on both tower sites, and appears to be spreading rapidly. This shrub will become a dominant species within the next decade. Some of these plants may have come from the seeding operation, but this native shrub is locally abundant, and much of the sweet-fern on the study area no doubt came from broken roots in the soil during bulldozing, or from seed from nearby native shrubs.

There is no trace of the sumacs, Scotch broom, Scotch pine, white pine, or mountain-laurel. Some silky dogwood, no doubt of direct seeding origin, occurs around tower 5.

The open bank circling part of tower 4 (where the slope in places exceeds 60%) is still eroding (Fig. 5.1.6), although healing is taking place from the edges and from stabilized centers in the middle of the slope. Invasion along the margins is primarily by root spread. Sweet-fern, whorled loosestrife, and various grasses are extending their root systems into this bare soil. Many of the stabilized centers in the interior of this eroding area have developed where undermined clods of soil and vegetation from the level ground above have broken off, moved down the slope, and then lodged and rooted. Sweet-fern and whorled loosestrife are notable plants in this method of healing.

Site 2 Ramapo to Hudson River Line, Towers 2 and 3 (Tables 5.12 and 5.13) These tower areas are located on a more gentle slope than the 2 areas discussed previously; thus less site modification was needed to prepare the tower areas. Leveling operations exposed several large ledges within the tower area. Small rocks and boulders also protrude through the soil. These outcropings account for the 85 and 90% vegetation density ratings, respectively, assigned to these plots. Actually complete vegetative cover occurs on these tower areas except for rock outcrops. There is also some open soil where tires of maintenance vehicles have compacted the ground on the service road.

Kentucky 31 and Chewings fescue are the dominant plant cover, although several native grasses and herbs are slowly invading. Most conspicuous of these invaders are panic-grass and broom-sedge.

There is no trace of the perennial rye-grass, sumac, Scotch broom, Scotch pine, and white pine from the original seeding mixture. Silky dogwood and white clover are present, scattered through the grass cover, and are no doubt of direct-seeding origin.

The variable density of the Kentucky 31 and Chewings fescue communities throughout the study areas reflects differences in soil compaction and stone content at or immediately beneath the soil surface.

Site 14 Oswego to Volney Line, Tower 56 (Table 5.14) Tower 56 is located on a hydric site. No seeding was done in this area since the level terrain did not require grading, and thus little soil was disturbed during tower construction. After removal of the overhead tree canopy, the area was invaded quickly by a variety of wet-site herbs (Fig. 5.1.6), with sedges and rushes most abundant. These were interspersed with sensitive fern, virgin's-bower, boneset, and Canadian St. John's-wort. No service road passes through this tower area, leaving the herbaceous cover undisturbed. Percent vegetative cover is 100%.

The common elderberry and speckled alder sprouts have persisted from the understory of the previous stand. This area was not seeded after tower construction. The small amount of soil disturbance and the existing shrub and herb cover indicated that natural vegetation would invade quickly.

Site 14 Oswego to Volney Line, Towers 57 and 60 (Tables 5.15 and 5.16) Grading of these areas was necessary during tower construction. This was followed by seeding with perennial rye-grass. Due to the aggressive herbaceous vegetation, no perennial rye perists at present on tower 60. Tower 57, however, is still dominated by this grass. The percent vegetative cover at tower 57 is 80%, and at tower 60 vegetative cover is 100%.

Perennial rye-grass on site 57 dominates all areas except where water flowing in a wide intermittent stream channel had washed the seed away prior to germination. Near the tower base, where the soil was disturbed and compacted, and along a frequently-used access road, rye-grass is also absent.

Site 21 Fitzpatrick to Edic Line, Towers 3, 4 and 5 (Tables 5.17, 5.18, and 5.19) Towers 3 and 4 are located on wet sites and the present plant cover in the vicinity of these structures is 100%. Due to the relatively level terrain where these towers were placed, a minimum of site alteration was necessary to prepare these areas for tower construction.

Creeping red fescue is the dominant plant in the tower area, covering between ¼ and ½ of the area. None of the perrennial rye-grass remains. Other conspicuous plants in this community include sedges, cat-tail, and horsetail.

Although fescue is the most prominent plant on this site, it appears that quick and complete cover would have been obtained even without direct seeding, since the native vegetation on this site prior to line clearing is very aggressive. This and the fact that much of the

surface soil was not disturbed would result in quick and complete vegetative cover.

At tower 5, a mesic site, the percent cover is also 100%. Creeping red fescue is the dominant plant, although woolly panic-grass, sedges, and such perennials as boneset, are conspicuous associates. Some white clover persists where native vegetation is not dense. No perennial rye-grass was observed.

Site 7 Gilboa to New Scotland Line, Towers 6, 7, and 8 (Tables 5.20, 5.21, and 5.22). These 3 tower areas are located on a southwest-facing slope with a grade of approximately 25%. Although it was not necessary to alter the entire ground surface throughout these tower clearings, bulldozing was used to provide access roads and leveling in the vicinity of tower structures. The most extensive ground disturbance is in the vicinity of tower 6.

Spot-seeding with perennial rye-grass was done 5 years prior to this study. It was apparent that seed was sown only where open or compact soil occurred.

Perennial rye-grass is still a conspicuous plant locally on these areas, comprising as little as 5% of the cover at tower 8 where little seeding was needed, to a high of 50-75% of the cover at tower 6. Perennial rye-grass has persisted well where seeded except on one steep road bank at tower 7. Here the excessive slope has resulted in erosion, and the shallow soil to bedrock has created adverse conditions for germination and survival. Hair-cap moss and lichens are presently invading this open soil, but at present the rate of healing is slow, and bare soil will be present for several years more.

Where direct seeding was not done, a complex mixture of grasses, ferns and other herbaceous plants now completely occupies the site. Most of these have become established since the tower clearing was made, and few herbaceous plants from the understory of the former forest stand persist. At towers 6, 7 and 8 the percentage of vegetation cover are 95, 90 and 95%, respectively.

5.3.3 Conclusions

Direct seeding to stabilize disturbed soil around tower sites and along maintenance roads on 4 electric transmission line areas was generally successful in providing quick and attractive cover and preventing erosion. Results of mapping and community analysis on these line areas indicate the following:

1. Kentucky 31 is extremely effective in providing attractive cover and rapid soil stabilization even on compacted soils. On slopes of moderate grade this grass persists in dense stands. On steep slopes, however, the cover is less dense, and where the grade exceeds 30%, establishment is poor.

2. Creeping red fescue and Chewings fescue also provide good cover after direct seeding operations. These grasses persist for many years and facilitate the gradual invasion of native vegetation.

3. Although short-lived, common rye grass germinates quickly, and no doubt plays an important role in stabilizing the soil and facilitating the establishment of other seeded and native plants. Perennial rye-

grass apparently does not persist for more than 3 or 4 years, and where this grass has died out, herbaceous cover may be sparse.

4. After direct seeding, silky dogwood became established in some situations. Seeding of sumacs, Scotch broom, Scotch pine, white pine, and mountain-laurel did not result in establishment. Where sumacs, mountain-laurel, and other woody plants are desired for aesthetic purposes or wildlife food, planting of seedlings would be the best policy.

5. Although some direct seeding of sweet-fern was successful, field observations indicated that many centers of this shrub originated from broken roots of sweet-fern that were left throughout the tower site in the bulldozing operation. Research may show that this shrub can be quickly established by planting short segments of roots at regular intervals, particularly on slopes with excessive grade.

6. When practicle, topsoil from tower sites should be saved and redistributed over the tower area after leveling operations are completed. Much of the surface soil on these study sites had been removed, and the heavy texture of the compacted fill provided extremely adverse growing conditions for both direct seeded species and for quick invasion by native plants. In addition, surface soil contains many native seeds that would facilitate quick ground cover.

7. Crown-vetch shows great promise for successfull direct seeding on critical sites of electric ROW's. This aggressive legume was thriving under adverse growing conditions on the Ramapo to Hudson River Line.

8. White clover, of value for certain wildlife species and as a soil builder, does not compete successfully with taller vegetation, and thus offers little promise on hydric sites where the dense herbaceous mantel often reaches a height of 3 to 5 feet by mid-summer. White clover did persist on seeded road berms and along water bars on the Oswego to Volney Line since the associated species were low and not aggressive.

9. Seeding was less effective on slopes exceeding 30%. On steep slopes much of the seed was washed from the site by surface water before germination.

10. Direct seeding is particularly important where soils have been radically disturbed and compacted during site preparation for tower construction or maintenance roads. Native seed is not present in the fill soil, and the compaction reduces the survival of the native seed that does reach the site.

5.3.4 Method of Estimating Abundance, Cover, and Grouping

In evaluating the composition of the direct seeding areas a combined estimate of abundance and cover was made for each study area. In this study no tree layer was present; thus the following tables describe the composition of the herbaceous plants. The presence of tree seedlings and shrubs, however, is also included.

In addition to the cover value of each species, its typical grouping is described, i.e., whether it grows singly, in groups, tufts, patches, etc.

The scales used in these tables is as follows:

For abundance and cover:

++ - occasional
+ - sparsely present, covering less than 1/20 of the plot area
1 - plentiful but of small cover value, covering less than 1/20 of the plot area
2 - very numerous, covering at least 1/20 of the plot area
3 - covering 1/4 to 1/2 of the plot area
4 - covering 1/2 to 3/4 of the plot area
5 - covering more than 3/4 of the plot area;

For grouping:

1 - growing one in a place, singly
2 - grouped or tufted
3 - in troops, small patches, or cushions, less than 1 milacre[3]
4 - in small colonies, extensive patches, or forming carpets, more than 1 milacre[3]
5 - in pure populations (after Braun and Blanquet, 1932).

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3 1 milacre is 1/1000 of an acre or 43.56 sq. feet

Table 5.1. Vigor of hemlocks 4 years after varying degrees of topping based on original relative crown position and percent of crown removed in topping operation.

Percent of Crown Removed	Relative Crown Position		
	Dominant	Codominant	Intermediate
	Vigor Rating[1]		
10	3.6	2.2	1.2
20	2.4	1.6	1.1
30	1.9	1.4	1.0
40	1.6	1.2	1.0
50	1.5	1.2	1.0
60	1.4	1.1	1.0
70	1.3	1.1	1.0
80	1.3	1.1	1.0
90	1.2	1.1	0.9

[1] Based on rating of 1 for poor vigor, 2, average vigor, and 3, high vigor.

Table 5.2. Total number of edge trees examined in this study by species and location on circular opening.

Species	Location on Opening								
	N--NE	NE--E	E--SE	SE--S	S--SW	SW--W	W--NW	NW--N	Total
Hemlock	15	7	8	9	7	11	6	15	78
Beech	12	23	7	2	8	8	5	4	69
American Hop-Hornbeam	3	1	2	1	5	2	0	1	15
Sugar-Maple	2	4	1	2	9	0	1	2	21
Red Maple	4	6	4	2	9	4	1	1	31
Red Oak	1	0	0	0	2	0	2	0	5
White Pine	0	0	0	0	0	1	1	2	4
White Birch	0	0	0	0	1	2	4	1	8
Yellow Birch	0	0	0	0	0	0	0	1	1
Sweet Birch	1	1	1	0	1	1	0	0	5
Aspen	0	0	0	0	0	0	0	1	1
Serviceberry	1	0	0	0	0	0	0	0	1
Chestnut	0	0	0	0	1	0	0	0	1
White Ash	0	0	1	7	1	0	0	2	11
Bitternut Hickory	0	0	0	0	1	0	0	0	1
Basswood	0	0	1	0	2	0	0	0	3
Total	39	42	25	23	47	29	20	30	255

Table 5.3. Number of trees with one or more exposed roots by species and location of tree on tower site opening.

Species	Location on Opening									
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Total	Percent
Hemlock	9-15[1]	5-7	3-8	7-9	4-7	2-11	0-6	5-15	35-78	44.9
Beech	9-12	17-23	7-7	1-2	4-8	5-8	4-5	2-4	49-69	71.0
American Hop-Hornbeam	1-3	1-1	0-2	0-1	1-5	0-2	---	0-1	3-15	20.0
Sugar-Maple	1-2	0-4	1-1	1-2	5-9	---	1-1	0-2	9-21	42.8
Red Maple	1-4	2-4	2-4	1-2	2-9	1-4	0-1	1-1	10-31	32.3
Red Oak	0-1	---	---	---	0-2	---	0-2	---	0-5	0.0
White Pine	---	---	---	---	---	0-1	0-1	0-2	0-4	0.0
White Birch	---	---	---	---	0-1	0-2	1-4	0-1	1-8	12.5
Yellow Birch	---	---	---	---	---	---	---	0-1	0-1	0.0
Sweet Birch	0-1	0-1	1-1	---	0-1	0-1	---	---	1-5	20.0
Aspen	---	---	---	---	---	---	---	---	0-1	0.0
Serviceberry	0-1	---	---	---	---	---	---	---	0-1	0.0
White Ash	---	---	0-1	3-7	0-1	---	---	1-2	4-11	31.4
Basswood	---	---	0-1	---	1-2	---	---	---	1-3	33.3
Chestnut	---	---	---	---	0-1	---	---	---	0-1	0.0
Bitternut Hickory	---	---	---	---	1-1	---	---	---	1-1	100.0
Total	21-39	25-40	14-25	13-23	18-47	8-29	6-20	9-29	114-55	
Percent	53.8	59.5	56.0	56.5	38.3	27.6	30.0	30.0	50.7	44.7

[1] Indicates that 9 of the 15 trees had one or more roots exposed.

Table 5.4. Number of roots exposed per tree, by species and location of trees on tower site opening.

Species	Location in Opening								
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Total
Hemlock	1.2	0.9	1.2	1.9	1.3	0.4	0.0	0.7	1.0
Beech	1.3	1.5	1.7	0.5	1.9	1.3	1.0	1.0	1.3
American Hop-Hornbeam	0.3	3.0	0.0	0.0	0.8	0.0	---	0.0	0.4
Sugar-Maple	1.5	0.0	3.0	0.5	0.8	---	2.0	0.0	0.8
Red Maple	0.9	2.0	0.8	0.5	0.4	0.5	0.0	2.0	0.9
Red Oak	0.0	---	---	---	0.0	---	0.0	---	0.0
White Pine	---	---	---	---	---	0.0	0.0	0.0	0.0
White Birch	---	---	---	---	0.0	0.0	0.5	0.0	0.2
Yellow Birch	---	---	---	---	---	---	---	0.0	0.0
Sweet Birch	0.0	0.0	4.0	---	0.0	0.0	---	---	0.8
Aspen	---	---	---	---	---	---	---	0.0	0.0
Serviceberry	0.0	---	---	---	---	---	---	---	0.0
White Ash	---	---	0.0	0.6	0.0	---	---	0.5	0.5
Basswood	---	---	0.0	---	1.0	---	---	---	0.7
Chestnut	---	---	---	---	0.0	---	---	---	0.0
Bitternut Hickory	---	---	---	---	2.0	---	---	---	2.0
Average	1.0	1.3	1.2	1.1	0.7	0.5	0.4	1.7	

Table 5.5. Mechanical damage to edge trees by species and location on tower site opening.

Species	Location on Opening									
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Total	Percent
Hemlock	3-15	1-7	2-8	1-9	3-7	5-11	5-6	7-15	27-78	34.6
Beech	7-12	10-23	2-7	1-2	3-8	4-8	3-5	2-4	32-69	46.4
American Hop-Hornbeam	1-3	1-1	0-2	0-1	2-5	1-2	---	1-1	6-15	40.0
Sugar Maple	2-2	1-4	0-1	0-2	2-9	---	1-1	1-2	7-21	33.3
Red Maple	1-4	3-6	0-4	1-2	5-9	4-4	1-1	0-1	15-31	48.4
Red Oak	1-1	---	---	---	1-2	---	1-2	---	3-5	60.0
White Pine	---	---	---	---	---	0-1	0-1	0-2	0-4	0.0
White Birch	---	---	---	---	0-1	2-2	2-4	1-1	5-8	62.5
Yellow Birch	---	---	---	---	---	---	---	0-1	0-1	0.0
Sweet Birch	0-1	0-1	0-1	---	1-1	0-1	---	---	1-5	20.0
Aspen	---	---	---	---	---	---	---	1-1	1-1	100.0
Serviceberry	0-1	---	---	---	---	---	---	---	0-1	0.0
Chestnut	---	---	---	---	0-1	---	---	---	0-1	0.0
White Ash	---	---	0-1	1-7	1-1	---	---	0-2	2-11	18-2
Bitternut Hickory	---	---	---	---	1-1	---	---	---	1-1	100.0
Basswood	---	---	0-1	---	1-2	---	---	---	1-3	33.3
Total	15-39	16-42	4-25	4-23	20-47	16-29	13-20	13-30	101-255	
Percent	38.5	38.1	16.0	17.4	42.6	55.2	65.0	43.3	31.4	

Table 5.6. Average vigor rating of all trees by species and location in tower site opening.

Species	Location on Opening								
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Ave.
Hemlock	1.7	2.4	2.9	1.9	1.4	3.0	2.5	2.3	2.2
Beech	2.4	3.4	2.7	4.0	2.1	2.4	1.4	2.0	2.7
American Hop-Hornbeam	1.7	4.0	2.0	2.0	2.2	2.5	---	4.0	2.3
Sugar-Maple	2.5	3.0	1.0	3.0	3.1	---	1.0	1.5	2.7
Red Maple	1.0	2.8	2.0	3.0	2.9	1.5	5.0	3.0	2.3
Red Oak	1.0	---	---	---	1.0	---	4.5	---	2.4
White Pine	---	---	---	---	---	2.0	2.0	3.5	2.8
White Birch	---	---	---	---	1.0	1.5	1.3	0.0	1.0
Yellow Birch	---	---	---	---	---	---	---	4.0	4.0
Sweet Birch	0.0	4.0	1.0	---	1.0	0.0	---	---	1.2
Aspen	---	---	---	---	---	---	---	0.0	0.0
Serviceberry	3.0	---	---	---	---	---	---	---	3.0
White Ash	---	---	1.0	2.1	3.0	---	---	1.0	1.9
Basswood	---	---	3.0	---	4.5	---	---	---	4.0
Bitternut Hickory	---	---	---	---	3.0	---	---	---	3.0
Chestnut	---	---	---	---	1.0	---	---	---	1.0
Average	1.9	3.0	2.4	2.4	2.5	2.3	2.2	3.3	

Table 5.7. Percent of edge trees with sunscald by species and location on tower site opening.

Species	Location on Opening								
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Ave.
Hemlock	20.0	14.3	16.7	11.1	28.7	18.2	16.7	13.3	15.4
Beech	25.0	47.8	0.0	50.0	16.7	0.0	60.0	0.0	27.5
American Hop-Hornbeam	0.0	0.0	0.0	0.0	0.0	0.0	---	0.0	0.0
Sugar-Maple	0.0	25.0	0.0	0.0	0.0	---	0.0	0.0	4.8
Red Maple	25.0	33.3	25.0	0.0	0.0	25.0	0.0	0.0	16.1
Red Oak	0.0	---	---	---	0.0	---	50.0	---	20.0
White Pine	---	---	---	---	---	0.0	0.0	0.0	0.0
White Birch	---	---	---	---	0.0	0.0	0.0	100.0	16.7
Yellow Birch	---	---	---	---	---	---	---	0.0	0.0
Sweet Birch	0.0	0.0	0.0	---	0.0	0.0	---	---	0.0
Aspen	---	---	---	---	---	---	---	100.0	100.0
Serviceberry	0.0	---	---	---	---	---	---	---	0.0
Chestnut	---	---	---	---	0.0	---	---	---	0.0
White Ash	---	---	0.0	0.0	0.0	---	---	0.0	0.0
Bitternut Hickory	---	---	---	---	0.0	---	---	---	0.0
Basswood	---	---	0.0	---	50.0	---	---	---	33.3
Average	18.0	35.7	8.0	8.7	6.4	10.3	25.0	13.3	

Table 5.8. Percent of beech with sunscald by diameter class and location of edge tree on tower site opening.

D.B.H. Class	Location on Opening								
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Ave.
2.0-3.9	40.0	25.0	0.0	---	0.0	0.0	---	0.0	19.0
4.0-5.9	0.0	50.0	0.0	0.0	---	0.0	50.0	---	26.3
6.0-7.9	0.0	50.0	0.0	---	33.3	0.0	---	0.0	12.5
8.0-9.9	100.0	50.0	0.0	---	---	---	100.0	0.0	50.0
10.0-11.9	0.0	100.0	---	---	0.0	0.0	100.0	0.0	44.4
12.0-13.9	---	---	---	---	---	---	---	0.0	0.0
14.0-15.9	---	---	---	---	0.0	---	---	---	0.0
16.0-17.9	---	0.0	---	---	---	---	---	---	0.0
Average	25.0	43.5	0.0	0.0	12.5	0.0	80.0	0.0	

Table 5.9. Percent of hemlock with sunscald by diameter class and location on tower site opening.

D.B.H. Class	Location on Opening								
	N-NE	NE-E	E-SE	SE-S	S-SW	SW-W	W-NW	NW-N	Ave.
2.0-3.9	50.0	33.3	100.0	0.0	20.0	0.0	0.0	0.0	19.0
4.0-5.9	0.0	0.0	0.0	50.0	0.0	---	0.0	25.0	7.1
6.0-7.9	0.0	---	0.0	0.0	0.0	66.7	100.0	0.0	25.0
8.0-9.9	0.0	---	0.0	---	---	0.0	0.0	50.0	7.7
10.0-11.9	25.0	---	0.0	0.0	---	0.0	---	0.0	8.3
12.0-13.9	---	---	---	0.0	---	---	0.0	0.0	0.0
14.0-15.9	100.0	0.0	---	---	---	---	---	---	50.0
16.0-17.9	---	---	---	---	---	---	---	0.0	0.0
Average	20.0	14.3	12.5	11.1	14.3	18.2	16.7	13.3	

Table 5.10. Ramapo to Hudson River Line, Tower Site 4. Composition of plant communities in tower area 4 growing seasons after seeding with perennial rye-grass, Chewings fescue, common rye grass, and various trees and shrubs.

Species	Rating	Species	Rating
	Shrubs		
Blackberry	1.1	Poison Ivy	++.1
Sweet-fern	1.4		
	Herbaceous Plants		
Kentucky 31	5.5	Lace-Grass	+.2
Old-field Cinquefoil	2.3	Crown-Vetch	1.3
Nimble Will Grass	+.2	Whorled Loosestrife	1.4
Cudweed	++.1		

Table 5.11. Ramapo to Hudson River Line, Tower Site 5. Composition of plant communities in tower area 4 growing seasons after seeding with perennial rye-grass, Chewings fescue, common rye grass, and various trees and shrubs.

Species	Rating	Species	Rating
Trees		Shrubs	
Sweet Birch	+.1	Blackberry	+.1
Black Locust	+.1	Blueberry	+.2
Red Maple	++.1	Dewberry	+.1
Red Oak	++.1	Silky Dogwood	+.1
Tulip-Poplar	+.1	Poison Ivy	++.2
		Sweet-fern	2.5
		Willows	++.1
		Witch-Hazel	++.3
	Herbaceous Plants		
Kentucky 31	4.2	Hawkweed (yellow)	++.1
Whorled Loosestrife	2.1	White Clover	+.2
Old-field-Cinquefoil	2.4	Milkweed	++.1
Goldenrods	+.2	Bush-Clover	+.2
Hair-cap Moss	+.3	Sedges	+.2
Panic-Grass	+.3	Violets	+.2

Table 5.12. Ramapo to Hudson River Line, Tower Site 2. Composition of plant communities in tower area 3 years after seeding with Chewings fescue, perennial rye-grass, Kentucky 31, white clover, and various shrubs and trees.

Species	Rating	Species	Rating
Trees		Shrubs	
Quaking Aspen	++.1	Blueberry	1.3
Sweet Birch	+.2	Blackberry	+.1
Black Cherry	++.1	Silky Dogwood	1.1
Red Maple	+.1	Spiraea	+.2
Chestnut-Oak	+.1	Sweet-fern	+.3
	Herbaceous Plants		
Chewings Fescue	3.2	Thistle	1.1
Kentucky 31	3.2	Old-field-Cinquefoil	+.2
Goldenrods	+.2	Common Ragweed	+.2
Deer-tongue Grass	+.3	Orchard-Grass	+.2
Whorled Loosestrife	+.1	Indian Hemp	+.1
Sedges	+.2	Velvet-Grass	+.2
Violets	+.2	Common Plantain	+.2
Bush-Clover	+.1	Broom-sedge	1.2
Common Cinquefoil	+.3	Bird's-foot Trefoil	+.2
Common Mullein	++.1		

Table 5.13. Ramapo to Hudson River Line, Tower Site 3. Composition of plant communities in tower area 3 years after seeding with Chewings fescue, perennial rye-grass, Kentucky 31, white clover, and various shrubs and trees.

Species	Rating	Species	Rating
Trees		Shrubs	
Quaking Aspen	+.1	Blackberry	+.3
Sweet Birch	+.1	Low Blueberry	+.2
Black Cherry	1.1	Silky Dogwood	1.1
Red Maple	+.1	Poison Ivy	+.2
Black Oak	+.1	Spiraea	+.1
Chestnut-Oak	+.1	Sweet-fern	+.3
		Willows	++.1
	Herbaceous Plants		
Chewings Fescue	3.2	Bird's-foot Trefoil	+.2
Kentucky 31	4.2	Velvet-Grass	+.2
Panic-Grass	2.2	Timothy	+.2
Deer-tongue Grass	+.2	Sedges	+.2
Whorled Loosestrife	1.1	White Clover	++.2
Goldenrods	+.1		

Table 5.14. Oswego to Volney Line, Tower Site 56. Composition of plant communities in tower area after 2 growing seasons. Direct seeding was not used on this tower site.

Species	Rating	Species	Rating
Trees		Shrubs and Vines	
		Gray Dogwood	+.2
Slippery Elm	2.1	White Elderberry	2.2
Red Maple	1.1	Choke-Cherry	+.1
		Virgin's-bower	2.2
		Poison Ivy	+.1
		Speckled Alden	1.3
	Herbaceous Plants		
Sedges	3.2	Ox-eye-Daisy	+.3
Rushes	3.2	Lady-Fern	+.3
Rough-leaved Golden-rod	1.3	Lace-Grass	3.3
Avens	1.2	May-apple	1.3
Bellwort sp.	1.1	Common Stitchwort	1.1
Sensitive Fern	1.1	Canadian St. John's-wort	2.3
Buttercup	1.2	Blue-eyed Grass	+.1
Early Meadow-Rue	1.1	Tearthumb	+.2
Yellow Dock	+.1	Speedwell	+.1
Old-field-Cinquefoil	+.1	White Clover	+.2
Jewelweed	+.2	Redtop Clover	+.2
Sheep-Sorrel	+.2	Orchard-Grass	+.3
Bugle-weed	+.3	Boneset	2.2

Table 5.15. Oswego to Volney Line, Tower Site 57. Composition of plant communities in tower site area 2 growing seasons after seeding with perennial rye-grass.

Species	Rating	Species	Rating
Trees		**Shrubs & Vines**	
Large-toothed Aspen	+.1	Staghorn-Sumac	+.1
Red Maple	++.1	Willows	++.1
Black Cherry	++.1	Virgin's bower	++.2
		Shrubby-Cinquefoil	+.1
	Herbaceous Plants		
Perennial Rye-grass	4.4	Lace-Grass	1.3
Nightshade	++.2	Rushes	+.2
Daisy-Fleabane	+.1	Ox-eye-Daisy	1.2
Dwarf Dandelion	+.2	Common Plantain	1.2
Dandelion	+.2	English Plantain	1.2
Strawberry	+.2	Pokeweed	+.1
Upright Yellow Wood-sorrel	1.2	Common Mullein	+.1
Grass-leaved Goldenrod	1.1	Common Ragweed	+.2
Horsetail	1.3	Sensitive Fern	+.2
Chickweed	1.3	Thistle	+.1
Heal-all	+.2	Sedges	1.2
Yellow Dock	1.2	May-apple	++.1
Boneset	1.2	Narrow-leaved Cat Tail	+.2

Table 5.16. Oswego to Volney Line, Tower Site 60. Composition of plant communities in tower area 2 growing seasons after seeding with perennial rye-grass.

Species	Rating	Species	Rating
Trees		Shrubs	
Black Ash	+.1	Arrow-wood	+.1
Large-toothed Aspen	+.1	Poison Ivy	1.3
Black Oak	+.2	Willows	1.1
	Herbaceous Plants		
Sheep-Sorrel	3.2	Black-eyed Susan	++.1
Ox-eye-Daisy	1.2	Boneset	+.1
Yellow Clover	1.3	Daisy-Fleabane	+.1
Red Clover	1.2	Common Ragweed	2.1
Timothy	2.2	White Clover	2.2
Panic-Grass	2.3	Hawkweed (yellow)	+.2
Redtop Grass	+.2	Rushes	+.2
Heal-all	+.2	Orchard-Grass	++.2
Sedges	3.2	Chickweed	2.2
Blue-eyed Grass	2.2	Buttercup	+.2
Dwarf Dandelion	+.2	Strawberry	+.2
Butter-and-eggs	+.2	Common Evening-Primrose	+.1
English Plantain	+.2		
Horsetail	1.3	Queen Anne's-lace	++.1

Table 5.17. Fitzpatrick to Edic Line, Tower Site 3. Composition of plant communities in tower area 3 growing seasons after seeding with creeping red fescue, perennial rye-grass, and white clover.

Species	Rating	Species	Rating
	Shrubs & Vines		
Gray Birch	+.1	Blackberry	+.1
		Virginia Creeper	+.2
		Willows	1.1
	Herbaceous Plants		
Creeping Red Fescue	3.3	Cat-tail	1.3
Kill-cow	1.2	Horsetail	2.4
Rushes	1.2	Blue-eyed Grass	+.1
Boneset	1.1	Bedstraw	1.2
Yellow Dock	++.2	Ox-eye-Daisy	++.3
Spreading Dogbane	++.3	Goldenrods	+.2
Jewelweed	++.2	Asters	+.2
Woolly Panic-grass	+.2	Canadian St. John's-wort	1.2

Table 5.18. Fitzpatrick to Edic Line, Tower Site 4. Composition of plant communities in tower area 3 growing seasons after seeding with creeping red fescue, perennial rye-grass, and white clover.

Species	Rating	Species	Rating
	Shrubs		
Blackberry	+.1	Willows	+.1
White Elderberry	1.2		
	Herbaceous Plants		
Creeping Red Fescue	3.3	Cat-tail	1.2
Sedges	3.2	Boneset	1.2
Rushes	1.2	Bedstraw	+.2
Hawkweed (yellow)	+.2	Sensitive Fern	+.2
Goldenrods	+.3	Northern Lady Fern	+.2
Strawberry	++.2	Tearthumb	++.2
Jewelweed	+.2	Wild Lettuce	+.1
Meadow-Rue	+.1	Ox-eye-Daisy	+.2
Cinnamon-Fern	+.2	Horsetail	2.3
Blue-eyed Grass	+.2	Canadian St. John's-wort	++.2

Table 5.19. Fitzpatrick to Edic Line, Tower Site 5. Composition of plant communities in tower area 3 growing seasons after seeding with creeping red fescue, perennial rye-grass, and white clover.

Species	Rating	Species	Rating
Trees		Shrubs	
Gray Birch	+.1	Blackberry	2.4
Sweet Birch	1.1	Red Elderberry	+.3
Red Maple	+.1		
	Herbaceous Plants		
Creeping Red Fescue	3.4	Sheep-Sorrel	1.2
Woolly Panic-grass	2.2	Boneset	2.1
Goldenrods	+.2	Sedges	1.2
Rushes	+.2	Indian Cucumber-root	+.1
Hay-scented Fern	+.3	Hair-cap Moss	+.3
Ox-eye-Daisy	++.3	Timothy	++.1
Lady-Fern	++.2	Violets	++.2
Black Medick	++.2	White Clover	++.2

Table 5.20. Gilboa to New Scotland Line, Tower Site 6. Composition of plant communities in tower area 5 growing seasons after seeding with perennial rye-grass.

Species	Rating	Species	Rating
Trees		Shrubs and Vines	
White Ash	+.1	Blackberry	+.2
Quaking Aspen	+.1	Grape	++.1
Sweet Birch	+.1	Willows	1.1
Gray Birch	1.1		
Black Locust	++.1		
	Herbaceous Plants		
Blue-eyed Grass	3.2	White Clover	2.3
Ox-eye-Daisy	1.2	Heal-all	+.3
Perennial Rye-grass	4.2	Thistle	2.1
Velvet-Grass	++.2	Wild-pink	++.1
Violets	1.2	Rushes	+.2
Sensitive Fern	1.2	Narrow-leaved Cat-tail	+.3
Sedges	1.2	Panic-Grass	1.2
Everlasting	+.2	Basil	1.2
Chickweed	+.2	Strawberry	2.3
Common Vetch	1.2	Old-field-Cinquefoil	2.4
Horsetail	3.4	Upright Yellow Wood-sorrel	+.2
Grass-leaved Goldenrod	1.2	Boneset	1.1
Water-Pennywort	1.3	Timothy	+.1
Buttercup	1.1	Asters	1.2
Rough-leaved Golden-rod	+.2	Rough Bedstraw	+.2
Spreading Dogbane	++.1	Common St. John's-wort	+.2
Spotted St. John's-wort	+.2		

Table 5.21. Gilboa to Scotland Line, Tower Site 7. Composition of plant communities in tower area 5 growing seasons after seeding with perennial rye-grass.

Species	Rating	Species	Rating
Trees		Shrubs	
Quaking Aspen	+.1	Blackberry	1.3
Gray Birch	2.1	Bush-Honeysuckle	++.2
White Birch	2.1	Willows	+.1
Hemlock	1.1		
Red Maple	1.1		
	Herbaceous Plants		
Perennial Rye-grass	3.2	Pearly Everlasting	1.3
Ox-eye-Daisy	3.2	Spotted St. John's-wort	++.1
White Clover	1.3		
Hawkweed (yellow)	1.2	Violets	+.2
Hawkweed (orange)	++.2	Thistle	+.1
Bird's-foot Trefoil	1.3	Old-field-Cinquefoil	1.4
Panic-Grass	+.2	Fox Sedge	+.2
Sedges	+.2	Strawberry	+.5
Timothy	+.2	Sensitive Fern	+.2
Rushes	+.2	Hay-scented Fern	+.2
Ceratodon purpureus (moss)	+.3	Milkweek	++.1
		Wood-Sorrel	+.2
Speedwell	+.2	Grass-leaved Goldenrod	2.2
Hair-cap Moss	1.3	Black Mustard	++.2
Sheep-Sorrel	+.2	Mouse-ear Hawkweed	++.2
Japanese Clover	+.4	Common Plantain	+.2

Table 5.22. Gilboa to New Scotland Line, Tower Site 8. Composition of plant communities in tower area 5 growing seasons after seeding with perennial rye-grass.

Species	Rating	Species	Rating
Trees		**Shrubs**	
Quaking Aspen	2.1	Blackberry	3.4
Beech	2.2	Spiraea	1.2
White Birch	3.1	Willows	1.2
Hemlock	++.1	Striped Maple	+.1
Red Maple	1.1		
	Herbaceous Plants		
Perennial Rye-grass	1.2	Ox-eye-Daisy	1.3
Rushes	1.2	Hawkweed (yellow)	+.2
Pearly Everlasting	1.2	Hawkweed (orange)	++.2
Speedwell	1.2	Timothy	1.3
Poor-Man's Pepper	+.2	Butter-and-eggs	+.3
Joe-Pye-weed	+.1	Sedges	1.2
Narrow-leaved Cat-tail	+.3	Grass-leaved Goldenrod	1.2
Horsetail	3.4	Common Mullein	+.1
Common Vetch	1.2	Thistle	1.1
Hair-cap Moss	1.4	Strawberry	1.2
Hay-scented Fern	+.2	Old-field-Cinquefoil	1.2
Redtop Grass	1.2	Annual Bluegrass	+.3
Basil	+.3	Dock	++.2
Upright Yellow Wood-sorrel	1.2	Common Stitchwort	+.2
Sheep-Sorrel	+.3		

FIG. 5.1.1 Mechanical damage to hemlock at site 7, in the summer of 1976.

FIG. 5.1.2 Sunscald on red maple at site 7, in the summer of 1976.

FIG. 5.1.3 Sunscald on beech at site 7, in the summer of 1976.

FIG. 5.1.4 Tree with exposed roots on site 7, in the summer of 1976.

FIG. 5.1.5 Seeded area at site 14, in the summer of 1976.

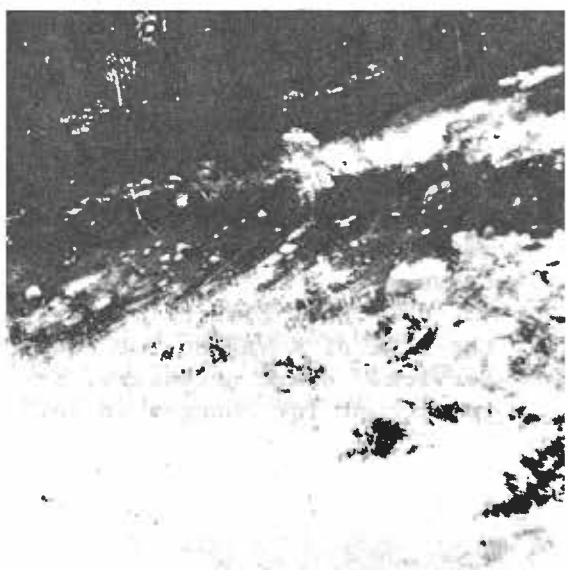

FIG. 5.1.6 Current active erosion at tower 4 at site 2, in the summer of 1976.

FIG. 5.1. Visual characteristics

5.4 Estimation of Soil Erosion Potential on the ROW's and Adjacent Woodlands by the Universal Soil Loss Equation

5.4.1 Introduction

The Universal Soil Loss Equation (Wischmeier, 1965) was initially developed for use on cropland, but recently was modified to permit evaluation of soil loss on woodland, range, and idle lands (Wischmeier, 1971 and 1975) and on construction sites (Wischmeier and Meyer, 1973). In 1974, the Universal Soil Loss Equation was used to obtain quantitative values in an erosion and sediment inventory of New York (Soil Conservation Service, 1974). In this inventory, soil loss was estimated on construction sites, woodland, and open land as well as on crop and pasture land.

In this preliminary investigation, the Soil Loss Equation was applied to existing soil, slope, and plant cover conditions on several study areas to evaluate its potential as a predictor of soil erosion and sediment production on transmission ROW's and adjacent woodlands. The Soil Loss Equation is limited to maximum slope gradients of 20% and slope lengths of 400 feet. Data can be extrapolated beyond these points, but reliability of estimated soil loss is reduced.

The Universal Soil Loss Equation is A = RKLSCP

Where:
- A = soil loss per unit area (tons/acre/year);
- R = the rainfall factor, the number of erosion-index units in a normal year's rain. The erosion index is a measure of the erosive force of specific rainfall;
- K = the soil erodibility factor, the erosion rate per unit of erosion index for specific New York soils;
- L = the slope-length factor, the ratio of soil loss from the study area slope length to that from a 72.6 foot length on the same soil type and gradient;
- S = the slope-gradient factor, the ratio of soil loss from the study area gradient to that from a 9% slope;
- C = the cropping-management factor, the ratio of soil loss from a field with specified cropping and management to that from the fallow condition on which the factor K is evaluated. (This factor is modified to account for canopy cover, surface mulch such as humus, and close-growing vegetation associated with woodland and open lands such as a ROW.);
- P = the erosion control practice factor.

5.4.2 Procedures

The Universal Soil Loss Equation was utilized on 4 study areas: Poughkeepsie to Ohioville (site 5), Hillside to Oakdale (site 9), Oswego to Clay #4 (site 15), and Moses to Adirondack (site 19). These sites were selected to provide erosion predictions on the ROW's for counties and regions of New York with different Rainfall Factors (R) and to include examples with variable soil types.

The Soil Erodibility Factor (K) for each soil series was obtained from the list of K-values for New York soils provided by the Soil Conservation Service. Where necessary, K-values were adjusted according to instructions to account for changes in soil erodibility due to channery, gravelly, or

shaly surface soil conditions. Slope-length and Slope-gradient Factors (LS), for assumed uniform slopes, were calculated from values presented in Table 5.23 (from Wischmeier, 1975) for slopes used in this evaluation. Appropriate C-values were selected from Tables 5.24 and 5.25 (from Wischmeier, 1975) to represent actual or possible plant and mulch cover under ROW and woodland conditions. This involves a modification of the Equation, recommended by Wischmeier (1971 and 1975), for application to these land-use conditions in contrast to conventional use on cropland. The Erosion Control Factor (P) was deleted since it it not applicable in these situations.

Estimated sheet and rill erosion, expressed in tons/acre/year, was calculated for 4 slope-length and 4 slope-steepness categories, assuming uniform slope configurations, with comparisons between the general ROW and undisturbed bordering forest on each study area. These categories were selected to show the effect of increasing slope length up to 400 feet and slope gradient up to 18% on erosion potential when all other factors are held constant. Erosion estimates also were made to compare different vegetal canopies, organic mulch, and surface mineral soil conditions on the ROW's with a constant slope length of 100 feet and 3 slope gradients. These comparisons were made to simulate possible ROW conditions following construction and maintenance activities.

The soil loss predictions presented in this evaluation do not apply to specific segments of each study area, but are based on actual soil, slope, and plant cover conditions present.

5.4.3 Results and Discussion

Site 5 - Poughkeepsie to Ohioville This study area is located in Ulster County (Rainfall Factor = 150) and is included in the New England Highlands and Mohawk-Hudson regions. The Soil Loss Equation was applied to 4 soil types present: Bath gravelly loam, Canandaigua silt loam, Chenango gravelly silt loam, and Erie very stony loam. These included two textural classes, loam and silt loam, with adjustments in the Soil Erodibility Factor (K) for Bath and Chenango series which exhibited high gravel content.

Under existing rainfall, soil, plant cover, and humus type conditions on this study area, it is evident that normal sheet and rill erosion is very low, even on the longest and steepest slopes utilized in this evaluation Table 5.26). Predicted erosion on the 3 and 6 percent slopes was minimal, generally less than 0.3 and 0.6 tons/acre/year for the forest and ROW, respectively, on any soil and slope length category. In this example, erosion is somewhat lower in the undisturbed forest than on the general ROW, areas where woody brush was controlled but with minimal disturbance to the mineral soil, organic mulch, and low plant cover. The highest estimated erosion occurred on the silt loam soil, next highest on the very stony loam, and least on the loam and silt loam where inherent soil erodibility is moderated by the gravelly surface conditions. As expected, potential erosion increases in accordance with increases in slope length and steepness for all soil and cover conditions. This emphasizes the importance of careful management on long, steep gradients, especially on soils such as silt loams that exhibit high erodibility.

Predicted soil erosion rates in tons/acre/year for various land uses in Ulster County by the Soil Conservation Service (1974) for average slope conditions are: woodland, 1.23; open land formerly cropped, 0.27; and pastureland, 0.80. Similar predictions in the Lower Wallkill Watershed near

site 5 are: woodland, 0.66; open land formerly cropped, 0.18; and pasture-land, 0.62. It is evident that estimated erosion on the study area (Table 5.26) is equivalent to, or less than, these rates on lower slope gradients, and slightly higher on steeper slopes up to 18%. In addition, it is interesting to note that erosion estimates by the SCS were slightly higher on woodland than on idle land (open land formerly cropped) that may be somewhat analogous to general ROW conditions.

The comparison in predicted erosion among the ROW cover conditions for the same soil types on 100-foot slopes shows the dramatic impact of partial and/or complete removal of vegetation and organic mulch, and disturbance of the surface mineral soil (Table 5.27). The greatest effect occurs on the erodible Canandaigua silt loam, 18% slope, where estimated erosion was 1.5 tons/acre/year under normal ROW cover conditions, and 256 tons/acre/year estimated soil loss when plant cover and mulch were removed and surface mineral soil exposed and disrupted. These conditions and related soil erosion rates could occur on the ROW tower sites, stringing areas, and access roads that are bare or only partially stabilized by plant cover. Intermediate conditions such as "B" and "C" in Table 5.27 could occur on a ROW following chemical brush control and possible breakdown of litter and humus layers; however, such an effect likely would be of short duration due to invasion and regrowth of plants. Estimated soil losses for disturbed conditions on this site are comparable to average predicted losses by the SCS (1974) on construction sites in Ulster County and the Lower Wallkill Watershed, which are 202.72 and 85.89 tons/acre/year, respectively.

Site 9 - Hillside to Oakdale This study area is located in Chemung County (Rainfall Factor = 100) and is included in the Appalachian Highlands and Catskill regions. The Soil Loss Equation was applied to 3 soil types present: Chenango channery silt loam, Mardin channery silt loam, and Volusia channery silt loam. These silt loam soils occurred on slopes with gradients in the range 0-8% up to 35-50%. Due to inherent soil properties, these soil series had different Soil Erodibility Factors (K), but each was reduced accordingly to account for the less erodible channery phase.

Predicted erosion on the 3 soils was less in the undisturbed forest than on the general ROW, but both were very low, less than 0.5 and 1.0 tons/acre/year on the forest and the ROW, respectively, for all soil types and slopes (Table 5.28). Estimated erosion did not exceed 0.2 tons/acre/year on either the ROW or the forest on slope gradients of 3 and 6%; however, the soil loss was 3 to 5 times greater on slopes of 12 to 18%. This shows the effect of increasing length, up to 400 feet, and steepness, up to 18%, for these assumed uniform slopes. The greatest estimated erosion for all slope categories under both cover types occurred on the Volusia soils, which are somewhat poorly drained and possess a strong fragipan; next highest on the moderately well drained Mardin; and least on the well to excessively drained Chenango series. Although erosion potential should be considered under all ROW conditions, these data reveal that it is especially important on long, steep slopes. Furthermore, it emphasizes the need to be familiar with existing soil types and associated properties such as texture, structure, and permeability that are related to soil erodibility.

Erosion estimates in relation to 4 assumed ROW cover conditions for each of the 3 soil types provides some insight into potential effects of

vegetation manipulation, breakdown, or removal of organic mulch, and disturbance of surface mineral soil (Table 5.29). For the most erodible soil, Volusia channery silt loam, predicted erosion on slopes 100 feet long and with a 6% gradient was 160 times greater when vegetation and organic mulch were removed and mineral soil disturbed (Condition "D") than under normal ROW cover (Condition "A"). The potential impact is even greater on steeper slopes. In this example, predicted erosion on the 18% slope, for the same soil type and slope length, was 84 tons/acre/year on cover condition "D", as compared with less than 1.0 tons/acre/year on cover condition "A". Maximum predicted soil loss on soils with lower inherent erodibilities, Mardin and Chenango, was less than Volusia, but both soils had comparable dramatic increases related to changes in the ROW cover conditions from normal to drastically disturbed.

Reference to the Erosion and Sediment Inventory for New York (Soil Conservation Service, 1974) reveals the following average erosion rates in tons/acre/year for various land uses in Chemung County: woodland, 0.79; open land formerly cropped, 0.92; pastureland, 0.69; and construction sites, 131.78. Erosion rates in watersheds near site 9, Goldsmith Creek and Wyncoop Creek, were similar to county averages except on construction sites. These were: woodland, 0.80; open land formerly cropped, 0.93; pastureland, 0.63; and construction sites, 230.00 tons/acre/year. For the ROW and adjacent forest cover and soil conditions used in soil loss calculations for site 9, it appears that potential erosion is generally less than that predicted on the county or local watershed basis.

Site 15 - Oswego to Clay #4. This study area is located in Oswego County. (Rainfall Factor = 85) and is included in the Lake Plain region. The Soil Loss Equation was applied to 4 soil types present: Alton gravelly fine sandy loam, Minoa very fine sandy loam, Oakville loamy fine sand, and Williamson very fine sandy loam. These are coarse-textured soils that range from excessive to somewhat poorly drained and have different Soil Erodibility Factors (K), except Alton, which was modified to account for high gravel content. These soils occurred mostly on 0-8% slopes on this study area, but may occupy steeper slopes up to 35%, except Minoa, at other locations.

Average erosion estimates for all soils and slopes used in this evaluation were 0.14 and 0.28 tons/acre/year in undisturbed forest and general ROW, respectively. Erosion under these conditions is quite low and reasonably close to overall average erosion predicted by the SCS (Soil Conservation Service, 1974) for somewhat related land uses. SCS predictions for Oswego County and the Lower Oswego River Watershed, which includes site 15, respectively, are: woodland, 0.18 and 0.24; open land formerly cropped, 0.15 and 0.16; and pastureland, 0.68 and 0.70 tons/acre/year.

Erosion varied with slope, as anticipated, with increases related to increases in slope length and steepness (Table 5.30). The greatest change in erosion rate occurred on long, steep slopes, up to 400 feet length and 18% steepness in this example; thus, emphasizing the need for careful management on such sites. Erosion also varied among soils, being highest on Williamson that is moderately well drained with a fragipan; next highest on Minoa that is somewhat poorly drained; and least on Alton and Oakville series which are well to excessively drained. It is likely that erosion would be similar for other soils on site 15, since all have erodibility factors within the range

(K = 0.17 to 0.49) used in this evaluation. However, rates of soil loss and potential sediment production may be higher on steeper slope segments and on all conditions where vegetation and surface soil are disturbed.

Comparison of estimated erosion rates on the ROW for the same soils on 3 slope-gradients and 100-foot slope length, but with different land treatments, shows the effect of vegetation manipulation, removal or deterioration of organic matter, and disturbance of mineral soil (Table 5.31). When compared with general or normal ROW cover conditions (Condition "A"), erosion rates on the most drastic treatment (Condition "D"), which involved complete removal of all vegetation and organic layers plus disruption of the mineral soil, were about 164 times greater on all soil types and slope steepnesses. The highest erosion rates for all the ROW cover conditions and slope gradients evaluated occurred on the Williamson soil, which exhibits the greatest inherent erodibility. Simulated cover conditions used in this model are realistic and do occur on the ROW's following construction activities, particularly access roads, tower sites, and stringing areas, and vegetation maintenance. Some effects, however, are short-term, depending on reestablishment of plant cover and perhaps installation of erosion control structures. Soil erosion on cover condition "D" may be analogous to that on construction sites which was estimated by the SCS (1974) to average 124.10 and 40.89 tons/acre/year for Oswego County and the Lower Oswego River Watershed, respectively.

Site 19 - Moses to Adirondack This study area is located in Lewis County (Rainfall Factor = 125) and is included in the Adirondack, Tug Hill and St. Lawrence-Champlain regions. The Soil Loss Equation was applied to 3 soil types present: Adams loamy fine sand, Croghan loamy fine sand, and Gloucester sandy loam. The somewhat poorly drained Croghan soils normally occupy slopes of less than 15% gradient, while the moderately well to excessively drained Adams and Gloucester soils may occur on slopes up to 35%.

Under existing and assumed conditions on this study area, estimated sheet and rill erosion is less in the bordering forest than on the general ROW (Table 5.32). However, erosion rate is very low under both cover types, averaging 0.14 and 0.27 tons/acre/year in the forest and on the ROW, respectively, for all soil and slope categories combined. Erosion of these coarse-textured soils increased with increasing slope length and steepness, the rate being about 3 times greater on 400-foot than on 50-foot slope lengths and 11 to 12 times greater on 18% than on 3% gradients. This indicates that slope steepness is more critical than slope length in respect to erosion potential on these soil and plant cover conditions. To minimize the erosion hazard, especially when vegetation and surface soils may be disturbed, both slope length and gradient must be considered. Predicted erosion was greatest on the somewhat poorly drained Croghan loamy fine sand than on well-drained Adams loamy fine sand and Gloucester sandy loam, which differ in texture but have similar erodibility factors.

Soil Conservation Service (1974) predictions of average soil loss in tons/acre/year for various land uses in Lewis County are: woodland, 0.14; open land formerly cropped, 0.10; and pastureland, 0.64. Similar soil loss estimates were obtained for 3 nearby watersheds: Tributary at New Breman, Middle Black River, and Beaver River in Lewis County. Predicted soil loss on the Moses to Adirondack ROW and adjacent woodland, therefore, is comparable

to the average losses determined by the SCS for woodland and open land situations in this county.

Although the 3 soils utilized in this evaluation have low erodibility factors (K = 0.17 to 0.20), all are subject to accelerated erosion when protective vegetation, organic layers, and surface soil are disturbed. Comparisons among simulated ROW cover conditions show major increases in estimated soil loss and sediment production when the vegetal canopy and organic mulch are removed and surface mineral soil exposed and graded (Table 5.33). These comparisons, limited to 100-foot slopes, reveal that the most drastic effect of cover manipulation on soil erosion is expressed on the steeper slopes. For the most erodible soil, Croghan loamy fine sand, estimated soil loss on 18% slopes increased from 0.52 tons/acre/year under general ROW conditions (Condition "A") to 87.25 tons/acre/year when the soil is denuded and graded (Condition "D"). A similar ratio of increased soil erosion among cover conditions also occurred on the lower slope gradients, but the magnitude of soil loss was considerably less.

Estimated erosion on all soils for the ROW cover condition "D", which involves disturbance of surface mineral soils, is less than average soil losses of 97 to 133 tons/acre/year predicted by the SCS (1974) on construction sites in Lewis County and nearby watersheds, respectively. However, erosion estimates under disturbed conditions on the ROW are comparable to predicted SCS soil losses on roadbanks of 43.33 to 53.20 tons/acre/year in Lewis County and on local watersheds, respectively.

5.4.4 Summary and Conclusions

The Universal Soil Loss Equation was applied to actual data representing environmental conditions of the ROW's and bordering forests of 4 study areas located in different counties, physiographic regions, and forest types of New York. The objective was to evaluate the applicability of this equation for estimation of soil erosion and sediment production under these nonagricultural land uses. The evaluation was based on overall or average soil and plant cover conditions present on each area and does not apply to conditions on specific segments of the ROW or adjacent forest. The equation is limited to estimates of sheet and rill erosion; therefore, it is not applicable to assessment of soil loss in gully erosion which may occur on the ROW areas such as access roads where runoff-water is channelized and concentrated.

In this preliminary evaluation, soil erosion estimates varied markedly among existing soil types, slope lengths and gradients, plant covers, and organic mulch conditions. Predicted erosion rates were somewhat lower in woodlands than on the general ROW's, but both cover types exhibited low erosion potential. This is apparently due to the protective tree and shrub layers in the forest, dense low plant cover on the general ROW, and nearly complete organic layers on the soil surface of both cover types that are relatively undisturbed. Accelerated soil erosion on long, steep slopes emphasizes the importance of careful management on such critical areas of the ROW. Variation in erosion among soils, within and between study areas, shows the need for an adequate knowledge of soil types and associated properties that may be related to inherent erodibility.

Dramatic increases in estimated soil erosion occurred in a simulation of the ROW cover conditions where the vegetal canopy and organic mulch were partially or completely removed and surface mineral soil disturbed by

grading or bulldozing. The most drastic treatment resulted in soil loss rates 167 times greater than that predicted on normal cover conditions of the general ROW. Although this analysis was based on a simulated model, such conditions do occur on the ROW areas such as access roads, staging-stringing sites, and tower sites where the soil and plant cover is drastically modified. In a like manner, the simulated model can be reversed to show a reduction in soil erosion potential due to partial or complete stabilization of such disturbed areas by natural plant invasion, restoration seeding, or installation of erosion control structures.

Based on this preliminary evaluation, it is evident that the Universal Soil Loss Equation has potential as a management tool on transmission ROW's. In application, it can be used on specific segments of the ROW to evaluate actual existing vegetation, soil, and slope conditions; predict soil losses resulting from construction disturbances; and show potential reduction in erosion due to re-vegetation and installation of control structures on disturbed areas. In essence, it may be useful to show potential consequences of alternative management activities in respect to erosion and sedimentation. In addition, more precise predictions can be made for specified areas with modifications in the equation to account for variable slope configurations, exposed subsoil properties associated with deep excavations, and other local factors. However, additional research is needed to test, modify, and adapt the Soil Loss Equation to conditions encountered on transmission ROW's.

Table 5.23. LS values for uniform slopes of given lengths and steepnesses.[1] (Adapted from Wischmeier, 1975)

Length (ft.)	Steepness (%)							
	3	5	7	9	11	13	15	20
50	0.22	0.38	0.58	0.83	1.12	1.45	1.83	2.95
100	.30	.53	.82	1.17	1.59	2.06	2.59	4.19
150	.37	.65	1.01	1.44	1.94	2.52	3.17	5.14
200	.43	.75	1.16	1.66	2.24	2.91	3.67	5.93
250	.48	.84	1.30	1.86	2.51	3.25	4.10	6.63
300	.53	.92	1.43	2.03	2.75	3.56	4.49	7.26
350	.57	1.00	1.54	2.20	2.97	3.85	4.85	7.85
400	.61	1.07	1.65	2.35	3.17	4.12	5.18	8.39
450	.65	1.13	1.75	2.49	3.36	4.37	5.50	8.90
500	.68	1.19	1.84	2.62	3.54	4.60	5.80	9.38
550	.71	1.25	1.93	2.75	3.72	4.83	6.08	9.84
600	.75	1.31	2.02	2.87	3.88	5.04	6.35	10.27

[1] Derived from standard slope-effect chart (Wischmeier and Smith, 1965), which assumes a length exponent of 0.5. Values for other slopes, not exceeding 20% or 800 feet can be computed by the equation, $LS=0.01\sqrt{L}(0.76+0.53s+0.076s^2)$ where L = slope length in feet and s = percent slope. However, interpolation between values in the table is usually adequate. Where appropriate value of the slope-length exponent is other than 0.5, follow procedure given in Agricultural Handbook 282 (Wischmeier and Smith, 1965).

Table 5.24. "C" values for permanent pasture, rangeland, and idle land.[1] (Adapted from Wischmeier, 1975)

Vegetal Canopy			Cover that Contacts the Surface					
Type and Height[2] of Canopy	% Cover[3]	Type[4]	Percent Ground Cover					
			0	20	40	60	80	95-100
Column No.	2	3	4	5	6	7	8	9
No appreciable canopy		G	.45	.20	.10	.042	.012	.003
		W	.45	.24	.15	.091	.043	.011
Canopy of tall weeds or short brush (0.5 m)	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes (2 m)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees but no appreciable low brush (4 m)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.013	.003
		W	.36	.20	.13	.084	.041	.011

[1] All values shown assume: 1) random distribution of mulch or vegetation, and 2) mulch of substantial depth where credited.

[2] Average fall height of waterdrops from canopy to soil surface. m = meters.

[3] Percentage of total-area surface that would be hidden from view by canopy in a vertical projection.

[4] G: cover at surface is grass or decaying, compacted duff of substantial depth.
W: cover at surface is weeds (plants with little lateral-root network near the surface), or undecayed residue.

Table 5.25. "C" factors for woodland. (Adapted from Wischmeier, 1975)

Stand Condition	Tree Canopy % of Area[1]	Forest Litter % of Area[2]	Undergrowth[3]	"C" Factor
Well stocked	100-75	100-90	Managed[4]	.001
			Unmanaged[4]	.003-.011
Medium stocked	75-40	90-75	Managed	.002-.004
			Unmanaged	.01 -.04
Poorly stocked	40-20	70-40	Managed	.003-.009[5]
			Unmanaged	.02 -.09

[1] When tree canopy is less than 20% the area will be considered as grassland or cropland for estimating soil loss. See Table 5.24.

[2] Forest litter is assumed to be of substantial depth over the percent of the area on which it is credited.

[3] Undergrowth is defined as shrubs, weeds, grasses, vines, etc., on the surface area not protected by forest litter. Usually found under canopy openings.

[4] Managed - grazing and fires are controlled.
Unmanaged - stands that are overgrazed or subjected to repeated burning.

[5] For unmanaged woodland with litter cover of less than 75%, C values should be derived by taking 0.7 of the appropriate values in Table 5.24. The factor of 0.7 adjusts for the much higher soil organic matter on permanent woodland.

Table 5.26. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slopes under forest and ROW conditions on Poughkeepsie to Ohioville Site 5.[1]

Soil Type	Slope Length (ft.)	Location and Slope Steepness Percent							
		Forest				ROW			
		3	6	12	18	3	6	12	18
Bath gravelly loam (K = 0.17)	50	0.02	0.04	0.10	0.19	0.03	0.07	0.20	0.37
	100	.02	.05	.14	.27	.05	.10	.28	.53
	200	.03	.07	.20	.38	.07	.14	.39	.75
	400	.05	.10	.28	.53	.09	.21	.55	1.07
Canandaigua silt loam (K = 0.49)	50	.05	.10	.28	.54	.10	.21	.56	1.08
	100	.07	.15	.40	.80	.13	.30	.80	1.54
	200	.09	.21	.56	1.08	.19	.41	1.12	2.17
	400	.13	.30	.80	1.54	.27	.59	1.59	3.08
Chenango gravelly silt loam (K = 0.17)	50	.02	.04	.10	.19	0.03	.07	.20	.37
	100	.02	.05	.14	.27	.05	.10	.28	.53
	200	.03	.07	.20	.38	.07	.14	.39	.75
	400	.05	.10	.28	.53	.09	.21	.55	1.07
Erie very stony loam (K = 0.32)	50	.03	.07	.18	.35	.06	.14	.37	.71
	100	.04	.10	.26	.50	.09	.19	.52	1.01
	200	.06	.14	.37	.71	.12	.27	.73	1.42
	400	.09	.19	.52	1.01	.18	.39	1.04	2.01

[1] Existing conditions and assumptions:

a. Rainfall factor (R) = 150 for Ulster County, New York.

b. Slope length-steepness factor (LS) from Table 5.23 for uniform slopes.

c. Cover conditions -

Forest: medium stocking; canopy cover 75%; litter cover 85%; undergrowth managed, ungrazed-no recent fires (C = 0.003)

ROW: canopy of tall weeds and short brush; canopy cover 75%; surface cover grass-weeds-duff; surface cover 90%. (C = 0.006)

d. Humus type -

Forest: thin duff mull

ROW: thin duff mull

Table 5.27. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slope steepness of the ROW assuming different cover conditions and constant slope length of 100 feet on the Poughkeepsie to Ohioville Site 5.[1]

Soil Type	ROW Cover Condition[2]	Slope Steepness (%) 6	12	18
		tons/acre/year		
Bath gravelly loam (K = 0.17)	A	0.10	0.28	0.53
	B	0.38	1.02	1.96
	C	7.69	20.77	40.05
	D	17.08	46.15	89.00
Canandaigua silt loam (K = 0.49)	A	0.30	0.80	1.54
	B	1.08	2.93	5.64
	C	22.16	59.87	115.43
	D	49.24	133.03	256.52
Chenango gravelly silt loam (K = 0.17)	A	0.10	0.28	0.53
	B	0.38	1.02	1.96
	C	7.69	20.77	40.05
	D	17.08	46.15	89.00
Erie very stony loam (K = 0.32)	A	0.19	0.52	1.01
	B	0.71	1.91	3.69
	C	14.47	39.10	75.38
	D	32.16	86.88	167.52

[1] See Table 5.26, footnote 1, for existing conditions and assumptions.

[2] ROW cover conditions:

A - Normal grass-herb-shrub cover and organic mulch as in Table 5.26. (C = 0.006)

B - No vegetal canopy except sparse grass and herbs; 90% organic mulch cover; no disturbance of mineral soil. (C = 0.022)

C - No vegetal canopy; no organic mulch; mineral soil exposed, but not disturbed. (C = 0.45)

D - Condition "C" above, plus disturbance of mineral soil by light bulldozing or grading with no erosion control structures. (C = 1.00)

Table 5.28. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slopes under forest and ROW conditions on the Hillside to Oakdale Site 9.[1]

Soil Type	Slope Length (ft.)	Location and Slope Steepness Percent							
		Forest				ROW			
		3	6	12	18	3	6	12	18
		tons/acre/year							
Chenango channery silt loam (K = 0.17)	50	0.01	0.02	0.07	0.12	0.02	0.05	0.13	0.25
	100	.02	.03	.09	.18	.03	.07	.18	.36
	200	.02	.05	.13	.25	.04	.10	.26	.50
	400	.03	.07	.18	.36	.06	.14	.37	.71
Mardin channery silt loam (K = 0.20)	50	.01	.03	.08	.15	.03	.06	.15	.29
	100	.02	.04	.11	.21	.04	.08	.22	.42
	200	.03	.06	.15	.30	.05	.11	.31	.59
	400	.04	.08	.22	.42	.07	.16	.43	.84
Volusia channery silt loam (K = 0.24)	50	.02	.03	.09	.18	.03	.07	.18	.35
	100	.02	.05	.13	.25	.04	.10	.26	.50
	200	.03	.07	.18	.35	.06	.14	.37	.71
	400	.04	.10	.26	.50	.09	.19	.52	1.01

[1] Existing conditions and assumptions:

a. Rainfall factor (R) = 100 for Chemung County, New York.

b. Slope length-steepness factor (LS) from Table 5.23 for uniform slope.

c. Cover conditions -

Forest: medium stocking; canopy cover 75%; litter cover 80%; undergrowth managed, ungrazed-no recent fires. (C = 0.003)

ROW: canopy of tall weeds and short brush; canopy cover 75%; surface cover grass-weeds-duff; surface cover 90%. (C = 0.006)

d. Humus type -

Forest: thin duff mull

ROW: thin duff mull

Table 5.29. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slope steepnesses of the ROW assuming different cover conditions and constant slope length of 100 feet on the Hillside to Oakdale Site 9.[1]

Soil Type	ROW Cover Condition[2]	Slope Steepness (%) 6	12	18
		tons/acre/year		
Chenango channery silt loam (K = 0.17)	A	0.07	0.18	0.36
	B	0.25	0.68	1.31
	C	5.13	13.85	26.70
	D	11.39	30.77	59.33
Mardin channery silt loam (K = 0.20)	A	0.08	0.22	0.42
	B	0.29	0.80	1.54
	C	6.03	16.29	31.41
	D	13.40	36.20	69.80
Volusia channery silt loam (K = 0.24)	A	0.10	0.26	0.50
	B	0.35	0.96	1.84
	C	7.24	19.55	37.69
	D	16.08	43.44	83.76

[1] See Table 5.28, footnote 1, for existing conditions and assumptions.

[2] ROW cover conditions:
- A - Normal grass-herb-shrub cover and organic mulch as in Table 5.28. (C = 0.006)
- B - No vegetal canopy except sparse grass and herbs; 90% organic mulch cover; no disturbance of mineral soil. (C = 0.022)
- C - No vegetal canopy; no organic mulch; mineral soil exposed, but not disturbed. (C = 0.45)
- D - Condition "C" above, plus disturbance of mineral soil by light bulldozing or grading with no erosion control structures. (C = 1.00)

Table 5.30. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slopes under forest and ROW conditions on the Oswego to Clay #4 Site 15.[1]

Soil Type	Slope Length (ft.)	Location and Slope Steepness Percent							
		Forest				ROW			
		3	6	12	18	3	6	12	18
		tons/acre/year							
Alton gravelly fine sandy loam (K = 0.17)	50	0.01	0.02	0.06	0.11	0.02	0.04	0.11	0.21
	100	.01	.03	.08	.15	.03	.06	.16	.30
	200	.02	.04	.11	.21	.04	.08	.22	.43
	400	.03	.06	.16	.30	.05	.12	.31	.61
Minoa very fine sandy loam (K = 0.28)	50	.02	.03	.09	.17	.03	.07	.18	.35
	100	.02	.05	.13	.25	.04	.10	.26	.50
	200	.03	.07	.18	.35	.06	.13	.36	.70
	400	.04	.10	.26	.50	.09	.19	.52	1.00
Oakville loamy fine sand (K = 0.17)	50	.01	.02	.06	.11	.02	.04	.11	.21
	100	.01	.03	.08	.15	.03	.06	.16	.30
	200	.02	.04	.11	.21	.04	.08	.22	.43
	400	.03	.06	.16	.30	.05	.12	.31	.61
Williamson very fine sandy loam (K = 0.49)	50	.03	.06	.16	.31	.05	.12	.32	.61
	100	.04	.08	.23	.44	.07	.17	.45	.87
	200	.05	.12	.32	.61	.11	.23	.64	1.23
	400	.08	.17	.45	.87	.15	.33	.90	1.74

[1] Existing conditions and assumptions:

a. Rainfall factor (R) = 85 for Oswego County, New York.

b. Slope length-steepness factor (LS) from Table 5.23 for uniform slopes.

c. Cover conditions -

Forest: medium stocking; canopy cover 75%; litter cover 75%; undergrowth managed, ungrazed-no recent fires. (C = 0.003)

ROW: canopy of tall weeds and short brush; canopy cover 75%; surface cover grass-weeds-duff; surface cover 90%. (C = 0.006)

d. Humus types -

Forest: mesic sites-thin duff mull; xeric sites-very shallow sand mull.

ROW: mesic sites-thin duff mull; xeric sites-very shallow sand mull.

Table 5.31. Estimation of potential sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slope steepnesses of the ROW assuming different cover conditions and constant slope length of 100 feet on the Oswego to Clay #4 Site 15.[1]

Soil Type	ROW Cover Condition[2]	Slope Steepness (%) 6	12	18
		tons/acre/year		
Alton gravelly fine sandy loam (K = 0.17)	A	0.06	0.16	0.30
	B	0.21	0.58	1.11
	C	4.36	11.77	22.69
	D	9.68	26.15	50.43
Minoa very fine sandy loam (K = 0.28)	A	0.10	0.26	0.50
	B	0.35	0.95	1.83
	C	7.18	19.38	37.38
	D	15.95	43.08	83.06
Oakville loamy fine sand (K = 0.17)	A	0.06	0.16	0.30
	B	0.21	0.58	1.11
	C	4.36	11.77	22.69
	D	9.68	26.15	50.43
Williamson very fine sandy loam (K = 0.49)	A	0.17	0.45	0.87
	B	0.61	1.66	3.20
	C	12.56	33.92	65.41
	D	27.91	75.39	145.36

[1] See Table 5.30 footnote 1, for existing conditions and assumptions.

[2] ROW cover conditions:
- A - Normal grass-weed-shrub cover and organic mulch as in Table 5.30. (C = 0.006)
- B - No vegetal canopy except sparse grass and herbs; 90% organic mulch cover; no disturbance of mineral soil. (C = 0.022)
- C - No vegetal canopy; no organic mulch; mineral soil exposed, but not disturbed. (C = 0.45)
- D - Condition "C" above, plus disturbance of mineral soil by light bulldozing or grading with no erosion control structures. (C = 1.00)

Table 5.32. Estimated sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slopes under forest and ROW conditions on the Moses to Adirondack Site 19.[1]

Soil Type	Slope Length (ft.)	Location and Slope Steepness Percent							
		Forest				ROW			
		3	6	12	18	3	6	12	18
		tons/acre/year							
Adams loamy fine sand (K = 0.17)	50	0.01	0.03	0.08	0.16	0.03	0.06	0.16	0.31
	100	.02	.04	.12	.22	.04	.09	.23	.44
	200	.03	.06	.16	.31	.05	.12	.33	.63
	400	.04	.09	.23	.44	.08	.17	.46	.89
Croghan loamy fine sand (K = 0.20)	50	0.02	0.04	0.10	0.18	0.03	0.07	0.19	0.37
	100	.02	.05	.14	.26	.05	.10	.27	.52
	200	.03	.07	.19	.37	.06	.14	.38	.74
	400	.05	.10	.27	.52	.09	.20	.54	1.05
Gloucester sandy loam (K = 0.17)	50	0.01	0.03	0.08	0.16	0.03	0.06	0.16	0.31
	100	.02	.04	.12	.22	.04	.09	.23	.44
	200	.03	.06	.16	.31	.05	.12	.33	.63
	400	.04	.09	.23	.44	.08	.17	.46	.89

[1] Existing conditions and assumptions:

a. Rainfall factor (R) = 125 for Lewis County, New York.

b. Slope length-steepness factor (LS) from Table 5.23 for uniform slope.

c. Cover conditions -

Forest: medium stocking; canopy cover 75%; litter cover 90%; undergrowth managed, ungrazed-no recent fires. (C = 0.003)

ROW: canopy of tall weeds and short brush; canopy cover 50%; surface cover grass-weeds-duff; surface cover 90%. (C = 0.006)

d. Humus type -

Forest: thin duff mull

ROW: thin duff mull

Table 5.33. Estimated sheet and rill erosion by Universal Soil Loss Equation for selected soil types and slope steepnesses of the ROW assuming different cover conditions and constant slope length of 100 feet on the Moses to Adirondack Site 19.[1]

Soil Type	ROW Cover Condition[2]	Slope Steepness (%) 6	12	18
		tons/acre/year		
Adams loamy fine sand (K = 0.17)	A	0.09	0.23	0.44
	B	0.31	0.85	1.63
	C	6.41	17.31	33.37
	D	14.24	38.46	74.16
Croghan loamy fine sand (K = 0.20)	A	0.10	0.27	0.52
	B	0.37	1.00	1.92
	C	7.50	20.36	39.26
	D	16.75	45.25	87.25
Gloucester sandy loam (K = 0.17)	A	0.09	0.23	0.44
	B	0.31	0.85	1.63
	C	6.41	17.31	33.37
	D	14.24	38.46	74.16

[1] See Table 5.32, footnote 1, for existing conditions and assumptions.

[2] ROW cover conditions:
- A - Normal grass-herb-shrub cover and organic mulch as in Table 5.32. (C = 0.006)
- B - No vegetal canopy except sparse grass and herbs; 90% organic mulch cover; no disturbance of mineral soil. (C = 0.022)
- C - No vegetal canopy; no organic mulch; mineral soil exposed, but not disturbed. (C = 0.45)
- D - Condition "C" above, plus disturbance of mineral soil by light bulldozing or grading with no erosion control structures. (C = 1.00)

6 Synthesis and Discussion of Trends

6.1 Introduction

The trends discussed in this section are based upon documented observations obtained through field data collection and careful analysis of those data. Only obvious trends which are clearly indicated by data collected were considered. For most trends, there was sufficient replication to permit a reasonably sound trend analysis to be made. In a few cases, however, more data is needed to further support trends indicated by a comparatively few sites. For example, while trends have been given for impact of ROW's on stream temperature, and while these are valid for a few cases and conditions, more data is needed on more streams to further clarify the nature of the impact. Also, there are areas from which no trends have been presented in this report as more research is needed to clarify them. For example, trends in effect of selective vs. broadcast herbicide sprays were not presented as there were not sufficient sites with clearly described treatments to do this.

Trends are first described in this report for each of four natural vegetation regions of the state. This was done for two primary reasons: 1) to simplify handling of complex data, and 2) because trends are most apt to be consistent within such regions. Following this, certain trends which appear consistent for all 4 regions are described as statewide trends. Naturally, these were fewer in number than regional trends, but do not reduce the significance of regional trends.

A plant community, as used in this synthesis and discussion of trends, is a combination of species which may be differentiated from other combinations and recognized as a unit of vegetation in the field. A community so defined should have characteristic species (Characterarten) which differentiate it from other communities. For example: Blackberry-Goldenrod may be recognized as different from Blueberry-Sweet-fern.

The possible combinations of plant species are endless and to attribute to every actual combination in nature the value of a community would result in a chaotic splitting up of units of vegetation. Every square meter, or less, of a ROW would form a separate unit, therefore, pieces of vegetation with similar combinations should be united into one abstract type. These types are called communities, the separate pieces being called stands.

6.2 Trends in the New England Highlands and Mohawk-Hudson Regions

6.2.1 Trends in Impact on Vegetation

Relation of plant communities to habitat and forest type Four sites (sites 2,3,4, and 5) located in southeastern New York, where Oak forest types are the characteristic natural vegetation, and 1 site (site 6) in the Mohawk Valley area have shown some very definite trends which correlate the ROW community with habitat and forest type. Site 1 was not used as it is a very special case, difficult to relate to the other sites, owing to the presance of unusual species not found on other sites such as black locust and tartarian honeysuckle. Also, there was a large variation in the mesic habitat which was the only one present. Recent maintenance was also irregular over the entire ROW.

These trends will enable a ROW manager to predict with considerable certainty the general type of ROW shrub-herb-grass community that will be developed over a period of years following ROW clearance and maintenance with commonly used spray maintenance techniques.

Prediction can also be made of the shrubs which may be expected to remain as important species on the ROW's. It is important to note that these are shrubs which usually do well in full sunlight and in competition with other plants of open areas. Shrubs such as blackberry, which, while susceptible to 2,4,5-T damage, reproduce by suckers from underground stems, also have persisted on ROW's and are important to wildlife. Other species such as striped maple and partridge-berry rarely persist in the open away from the shade of woodlands, and are rarely found on the ROW's.

The general trends in vegetation on the ROW's in relation to mesic (moist), xeric (dry), and hydric (wet) habitats and forest type are shown in Table 6.1 and Table 6.2, and may be summarized as follows:

(1) Where the ROW's are adjoined by Oak-Hickory forest types on moist habitat areas, a Blackberry-Goldenrod plant community was dominant. This was true both where only selective sprays were used (sites 2 and 3) and where broadcast sprays followed by selective sprays have been applied (site 4).

Only one site was studied where only broadcast sprays had been used. In this case, a different ROW community had developed on a mesic habitat area which was dominated by grasses and herbs with raspberry and gray dogwood as dominant shrubs (Raspberry-Goldenrod). However, no trends can be safely drawn from this single site (site 6).

(2) Where the ROW's are adjoined by a Chestnut-Oak or Oak-Hickory forest type on dry habitat areas, a Blueberry-Sweet-fern or Huckleberry-sweet fern community had developed (sites 2,4,5, and 6).

This condition held true for all types of spray programs used on these sites: selective, broadcast plus selective, and broadcast maintenance.

(3) On wet habitat areas, it was more difficult to detect a general trend related to forest type. However, a Willow-Sensitive Fern plant community developed on 4 sites with all spray techniques used. On site 3, the Alder community was not disturbed by the ROW management program. A wide variety of moisture-loving shrubs were present on wet habitat areas, plus a number of species of herbs, sedges, and ferns.

Description of ROW Communities

Blackberry-Goldenrod Community (Rubus-Solidago)

This community is typically located on mesic sites on lower and middle slopes which are moderately well drained. The soil pH ranged from pH 4.7 to pH 5.0, with an average pH of 4.9.

Characteristic Species Blackberry and goldenrods are constantly present in all stands and are usually among the dominant species.

Hay-scented fern is often a major plant species growing in large patches, although it is also prominent on xeric sites.

Also characteristic are asters, violets, and cinquefoils which are constantly present.

Companion Species Species of high constancy[1] which are also found on other sites are witch-hazel, spiraea, and blueberry. Also included in this group are hair-cap mosses, whorled loosestrife, poverty-grass, and bracken.

Blueberry-Sweet-fern Community (Vaccinium-Comptonia)

This community is typically located on xeric sites on upper slopes and ridge tops which are excessively drained. The soil pH ranged from pH 4.5 to pH 5.0, with an average pH of 4.8.

Characteristic Species Blueberries are a constantly present species with high abundance and cover values and usually occur in large patches. Sweet-fern is highly characteristic and seldom occurs on other sites.

Hay-scented fern often occurs in large patches, although it is also found on mesic sites as well.

Also characteristic are pearly everlasting and broom-sedge.

Companion Species Species which are constantly present but which are also common on other sites are witch-hazel, spiraea, whorled loosestrife, hair-cap mosses, asters, cinquefoil, and bracken.

Blackberry and goldenrod are constantly present but with lower abundance and cover values than on mesic sites.

Willow-Sensitive Fern Community (Salix-Onoclea)

This community is typically located on hydric sites in stream bottoms and depressions with impeded drainage. The soil pH ranged from pH 5.2 to pH 6.4, with an average pH of 6.0.

Characteristic Species Willows and sensitive fern are constantly present (100%) and usually with high cover values. Spiraea is also of high constancy (80%) and usually has a medium cover value which is higher than on other habitat areas.

Sedges are typically present in all stands (100%) and have high abundance and cover values.

Cat-tail is also typical (80%) where standing water accumulates for long periods and is usually accompanied by sphagnum moss.

Typical herbs of high constancy (60%) are touch-me-not, jack-in-the-pulpit, tearthumb, horsetails, and interrupted fern.

Also typical on wet sites in a few stands (20-40%) are reeds, rush, cinnamon-fern, smartweeds, water-purslane, royal fern, iris, bullhead-lily, eelgrass, duckweed, marsh St. John's-wort, skunk-cabbage, spiked loosestrife, swamp-buttercup, and cowslip.

Typical shrubs of low constancy (20-40%) include elderberry, red osier dogwood, alder, winterberry, wild-raisin, highbush-blueberry, and gray dogwood.

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[1] Constancy is a percentage which equals $\frac{\text{No. of stands in which found}}{\text{Total no. of stands}} \times 100$

Species Diversity In general, species diversity was greater on the ROW's than in adjacent forests in the New England Highlands and Mohawk-Hudson regions in southeastern New York, (Table 6.3). This means, in brief, that the creation and maintenance of the ROW's in this region brings about an increase in the number of plant species present which measurably enhances wildlife habitat in an area affected by a ROW.

The average number of shrubs and herbs was greater on the ROW than in adjacent forests on all habitat areas. While the average number of low-growing trees was equal on the ROW and in the forest on mesic habitats, 3 of 5 sites showed more low-growing trees on the ROW.

Impacts on Shrubs and Low-growing Trees Shrubs are important plants of special interest on the ROW's, as they can be readily managed either to produce a positive, or beneficial, impact or not managed. In general, it appears that the positive impacts of the ROW's on common shrubs outweighed negative impacts so that shrubs formed an important component of sprayed ROW's.

On the ROW's studied in the New England Highlands and Mohawk-Hudson regions of southeastern New York, 26 species of shrubs were present on mesic ROW habitats, 29 species on xeric habitats, and 27 species on hydric habitats. Regardless of the type of management program, they were important contributors to the ROW vegetation.

Some trends which could be gleaned from the data collected on 5 sites are as follows:

1. Shrubs and low-growing trees which were more prominent, or of equal prominence, on the ROW's as compared with the adjacent forest are:

alder	gooseberry	purple-flowering raspberry
arrow-wood	grape	raspberry
blackberry	gray dogwood	red osier dogwood
blueberry	highbush-blueberry	Virginia creeper
buttonbush	mountain-laurel	wild rose
choke-cherry	mountain-maple	
flowering dogwood	pinxter-flower	

2. Shrubs and low-growing trees which occurred only on the ROW's are:

alternate-leaved dogwood	poison sumac	sweet-fern
dewberry	scrub-oak	virgin's-bower
fly-honeysuckle	smooth sumac	wild-raisin
hazelnut	spiraea	winterberry
	staghorn-sumac	

3. Shrubs and low-growing trees which occurred only in the forest are:

bladdernut	poison ivy	spicebush

4. Shrubs and low-growing trees which were more prominent in the forest than on the ROW's are:

barberry	nannyberry	teaberry
buckthorn	partridge-berry	witch-hazel

Impacts on Herbaceous Plants When the ROW's studied were cleared and maintained, long narrow openings were created which differ markedly in habitat conditions from the adjacent forests. A new flora invaded the ROW's and was dominated by plants of open areas. However, many forest-dwelling plants of the region thrived under the new conditions, also, and are now common both on the ROW's as well as in the forests. A few did not thrive under the open ROW conditions and now appear only sparingly, or not at all, on the ROW's.

The most important change in herbaceous cover was caused by the invasion and spreading of plants typical of open areas or old fields. Some 15 plants of this kind were prominent on the ROW's, including species such as wild strawberry and sheep-sorrel, especially valuable for wildlife. Other plants showing floral displays such as goldenrods, asters, daisies, pearly everlasting, Queen Anne's-lace, and hawkweeds have developed on the ROW's. The combinations of old field with forest species make up the present characteristic vegetative cover of the ROW's. Such cover provides excellent protection of the ROW's from active erosion and offers excellent food and cover for wildlife.

Very few forest dwelling plants such as wild sarsaparilla, Solomon's-seal, bluebead-lily, purple trillium, May-apple, bedstraws, and spotted wintergreen were found in the forest adjacent to the ROW's and only sparsely on the ROW's. Many common plants of the forest, including wild lily-of-the-valley, whorled loosestrife, bellworts, twisted-stalk, false Solomon's-seal, and panic-grasses, were common both on the ROW's and in the forest.

Woods inhabiting ferns are of special interest and there was no general adverse impact observed on them. All of the 10 species of ferns encountered in the forest were also found on the ROW's. However, there were some dual impacts observed; of the two flowering ferns present, interrupted fern was found more often on the ROW's and cinnamon-fern was found more often in the forest. Other ferns which were more abundant in the forest include maidenhair-fern, marginal shield-fern, and Christmas-fern. On the other hand, the common bracken, sensitive, and hay-scented ferns were all prominent on the ROW's as well as in the adjacent forest.

Trees on the ROW (Sites 2,3,4,5, and 6)

Xeric Habitat (Table 6.4) The most common tree species on the ROW's were red maple and red oak which ranged from sparse (+) to covering 1/4 to 1/2 of the ROW area (3). Other common species were white ash, chestnut oak, black cherry, white oak, gray birch, and quaking aspen.

The number of species on a ROW ranged from 8 to 14. A total of 26 tree species were recorded as invading the ROW on the plots. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

Mesic Habitat (Table 6.5) The most common species on the ROW were red maple, flowering dogwood, red oak, and white oak which ranged from sparse (+) to covering 1/4 to 1/2 of the ROW area (3). Other common species were sassafras, black cherry, willow, white ash, chestnut oak, sweet birch, and pignut hickory.

The number of species on a ROW ranged from 7 to 13. A total of 23 species was recorded as invading the ROW. While brush control was excellent, there was a reservoir of resurging tree species present under 10 ft. height which can be expected to slowly emerge.

Hydric Habitat (Table 6.6) The most common species on the ROW were willow and red maple which ranged from sparse (+) to covering 1/2 to 3/4 of the ROW area (4). Other common species were American elm and white ash.

The number of species on a ROW ranged from 3 to 13. A total of 20 species was recorded as invading the ROW. While brush control was excellent, there was a reservoir of resurging tree species under 10 ft. height which can be expected to slowly emergy.

6.2.2 Trends in Impact on Soil

Bedrock geology of study areas in the New England Highlands and Mohawk-Hudson regions is composed predominantly of gneiss, marble, quartzite and granite in the New England Highlands (sites 1,2,3, and 4) and shale and sandstone in the Mohawk-Hudson Valley (sites 5 and 6). Soils formed mostly in unstratified glacial till; major orders are Inceptisols and Spodosols, with some inclusions of Alfisols, Entisols and Histosols. Surface mineral soils generally are strongly acid and textures primarily sand loam, silt loam, and loam in the New England Highlands and silt loam and loam in the Mohawk-Hudson Valley.

There was no significant negative impact on soils of the general ROW areas where tree cover had been removed and resurging brush controlled with selective, broadcast, or broadcast followed by selective sprays with minimal disturbance to surface soil. Some differences were observed in thickness of organic layers between ROW and forest and between mesic and xeric habitats; the overall average for all sites and moisture regimes combined being 1.5 inches in the forest and 1.2 inches on the ROW (Table 6.7). Likewise, organic matter accumulation for all sites combined was somewhat greater on xeric than on mesic habitats. Humus types on both the ROW and forest were characteristically duff mulls, except on site 6 where a medium mull occurred on the mesic habitat. Source of organic matter on the ROW was consistently leaves and stems of grasses, herbs, and shrubs in contrast to tree leaves, twigs, and fruit in the forest.

Very little active erosion occurred on the general ROW of all sites which were maintained by chemical sprays with minimal disturbance to the organic mulch and surface mineral soil. However, slight to severe and progressive erosion was evident on access roads, tower sites, and other disturbed areas of all sites where plant cover had been removed and mineral soil exposed. Stabilization of these areas by natural plant invasion and/or restoration seeding was sporadic. Periodic use of access roads on several sites, presumably for ROW inspection and maintenance as well as local recreation, interferes with plant establishment and accelerates erosion. Most erosion sediment collected on lower slopes of the ROW, but some entered swamps on the ROW (site 5) and small amounts moved into flowing streams (sites 2,3, and 6) (Table 6.8).

6.2.3 Trends in Impact on Wildlife

The impact of the ROW's on wildlife use was positive, or beneficial, and a total of 11 common species, plus numerous song birds and raptors, were found to use the ROW's and their edges on the 6 sites studied (sites 1 to 6) (Table 6.9).

Large populations of nongame birds, which included song birds and raptors, were observed using the ROW's and their edges on all sites. The number of species ranged from 20 on site 6 to 28 on site 4. Of particular interest were the Cooper's hawk nests which were observed in the forest near the ROW's on 2 sites, and the osprey observed on site 5.

Of the common game mammals of the region, white-tailed deer made use of the ROW's on 5 sites; no deer were observed on site 1 which was in an urbanized area near a small industrial plant. The important woodchuck burrows were found on 2 sites and woodchuck were observed using 3 sites. Cottontail rabbits, which use the burrows, were using the ROW's on 5 sites. Raccoon used the ROW's on 3 sites. Gray squirrels were observed on 6 sites, 4 on the ROW's.

Of the common game birds of the region, ruffed grouse were observed on the ROW's on 3 sites and in the forest near the ROW on 1 site. Woodcock used the ROW's on 2 sites, one for a singing ground.

An important trend in wildlife use was reflected by deer browse studies carried out in March on 3 sites. While percent browse of woody stems averaged slightly less (57%) on the ROW's than in the forest (59%), the total stems available were greater on the ROW's in all 3 cases.

The following common shrubs of the ROW were heavily browsed by deer: blueberry, huckleberry, maple-leaved viburnum, sweet-fern, willow, witch-hazel, elderberry, and blackberry. This indicates that the ROW's offer essential winter food for deer.

The ROW's under various management programs, both selective spraying and broadcast, did not show any major difference in respect to wildlife use. The commonly used techniques produced excellent game food and cover.

The general trend, therefore, has been for the ROW's to have a favorable effect, or impact, on wildlife use in general. Also, the trend has been for the ROW's to provide for increased deer browsing and to furnish desirable shrubs for important winter food for deer.

6.2.4 Trends in Impact on Water

Of the sites studied in the New England Highlands and Mohawk-Hudson regions, 1 ROW (site 2) crossed a permanent Class B stream. This was a small stream (Torne Brook) which passed through a Hemlock-Yellow Birch forest type on both sides of the ROW.

The Brook was partially shaded on the ROW by yellow birch and hemlock which had been topped. Water temperature sampled once each quarter indicated the ROW had no unfavorable impact on water quality at the times sampled (Table 6.10). There was no sedimentation at the ROW crossing proper which was well protected by border vegetation.

The ROW did cause sedimentation which entered a small feeder stream which joined Torne Brook about 125 yards below the ROW. The feeder carried sediment from an access road on the edge of the ROW.

On the second site (site 5) the ROW crossed a swamp which was well shaded by small trees, shrubs, and herbs on the ROW. The effect of the ROW on water quality was negligible (Table 6.10).

The trend for the ROW's where vegetation has been maintained at stream crossings by good management is not to have a negative impact on water temperature and sedimentation. The same trend is true for the ROW's crossing swamps or wetlands, i.e. where small trees, shrubs, and herbs have been maintained on the ROW, there was no negative impact on water quality. Where access roads have remained open to erosion near streams, however, negative impacts have been observed.

6.2.5 Trends in Impact on Land Use

Changes in Adjacent Land Use The percent change in land use prior to (or near the time of construction) and after construction of the ROW has been compared for 6 sites (sites 1,2,3,4,5, and 6) found within the New England Highlands and Mohawk-Hudson regions (Table 6.11). Percent change by land use type is measured for each site and for all 6 sites as an average percent change. The highest percent change in land use for any single site was a decrease in forest land for site 5 by 8.1%. Zero % change in land use was by far most frequently recorded, both by land use type and by site. As a result, the average percent change by land use are consistently low, with the highest average percent change being a -1.9% decrease for forest land for sites in this region. Other average percent changes included a slight decrease in agriculture (-1.2%), a slight increase in transportation (1.2%), and an increase in water resources (1.0%).

Factors which may influence the impact on adjacent land use include visual characteristics of the ROW's. General reconnaissance of visual characteristics associated with vegetation and other ROW features specific to each site indicates that of the 6 sites, 3 are generally pleasing to view (sites 2,3, and 4), with the remaining 3 (sites 1,5, and 6) neither pleasing nor objectionable within the context of their locations. Visual assets of the sites which are pleasing include opening of vistas, and well vegetated ROW's that are attractive all seasons, with many flowering species. The 3 remaining sites are described as neither pleasing nor objectionable, generally because they lack visual assets or include undesirable characteristics such as erosion. Considering all sites in this region, negative visual characteristics which exist include only erosion, or exposed stumps and brush left after clearing.

A general trend for land use adjacent to the ROW sites within the New England Highlands and Mohawk-Hudson regions is that they have changed very little for the period measured. Slight increases or decreases measured are generally distributed among all 11 land use types. In addition, there is a general absence of long-term negative visual characteristics resulting from clearing, construction or maintenance of the ROW, that would influence adjacent land use changes. It would be difficult to derive other distinct trends because of the few number of sites sampled and the high variability of influences other than the ROW which could affect land use change.

Multiple Uses Multiple uses of the ROW's within these regions include hiking, hunting, horseback riding, agriculture, and other various recreational activities (Table 6.12). Of these, all 6 sites have been used for hunting. It is clear that the ROW's have generally opened the land for a variety of recreational uses.

An important trend in multiple use is shown by the variety of recreational activities which take advantage of the linear character of the ROW's. Hunting is by far the predominant multiple use, indicating that the ROW's are ideally suited for this activity.

Table 6.1. Trends in impact on vegetation in the New England Highlands and Mohawk-Hudson regions.

Site	Region	Habitat	Forest Type	Type of Management	ROW Community
2	New England Highlands	Mesic	Oak-Hickory	Selective Only	Blackberry-Goldenrod
3	New England Highlands	Dry-Mesic	Oak-Hickory	Selective Only	Blueberry-Goldenrod
4	New England Highlands	Mesic	Oak-Hickory	Broadcast & Selective	Blackberry-Goldenrod
5	Mohawk-Hudson	Mesic	Oak-Hickory	Selective Only	Blackberry-Goldenrod
6	Mohawk-Hudson	Mesic	Oak-Hickory	Broadcast Only	Raspberry-Goldenrod
2	New England Highlands	Xeric	Chestnut-Oak	Selective Only	Blueberry-Sweet-fern
3	New England Highlands	Xeric	Chestnut-Oak	Selective Only	Blueberry-Bracken
4	New England Highlands	Xeric	Chestnut-Oak	Broadcast & Selective	Huckleberry-Sweet-fern
5	Mohawk-Hudson	Xeric	Chestnut-Oak	Selective Only	Blueberry-Sweet-fern
6	Mohawk-Hudson	Xeric	Oak-Hickory	Broadcast Only	Blueberry-Sweet-fern
2	New England Highlands	Hydric	Hemlock-Yellow Birch	Selective Only	Willow-Sensitive Fern
3	New England Highlands	Hydric	Alder	Selective Only	Alder
4	New England Highlands	Hydric	Hemlock-Yellow Birch	Broadcast & Selective	Willow-Sensitive Fern
5	Mohawk-Hudson	Hydric	Elm-Red Maple	Selective Only	Willow-Sensitive Fern
6	Mohawk-Hudson	Hydric	Elm-Red Maple	Broadcast Only	Willow-Sensitive Fern

Table 6.2. Trends in plant community development in relation to forest type and habitat of the New England Highlands and Mohawk-Hudson regions. The figures in parenthesis are percent constancy.[1]

Adjacent Forest	ROW Community	
MESIC		
Oak-Hickory ---------->	Blackberry (100) with	- Goldenrod (100)
	Maple-leaved Viburnum (80)	Whorled Loosestrife (80)
	Witch-Hazel (60)	Cinquefoils (100)
	Spiraea (60)	Asters (100)
	Grape (60)	Violets (80)
	Wild Rose (60)	Hay-scented Fern (60)
		Mixed Grass (100)
XERIC		
Chestnut-Oak ---------->	Blueberry (100) with	- Sweet-fern (80)
	Witch-Hazel (100)	Bracken (60)
	Blackberry (100)	Hay-scented Fern (60)
	Spiraea (80)	Pearly Everlasting (60)
	Dewberry (60)	Broom-sedge (60)
		Mixed Grass (100)
HYDRIC		
Elm-Red Maple and Hemlock-Yellow Birch ---------->	Willow (100) with	- Sensitive Fern (80)
	Spiraea (80)	Cat-tail (80)
	Elderberry (60)	Sedges (100)
	Red Osier (20)	Sphagnum (60)
	Alder (20)	Jack-in-the-pulpit (60)
		Touch-me-not (60)
		Tearthumb (60)
		Water-purslane (60)
		Horsetails (60)
		Mixed Grass (100)

[1] Constancy is a percentage which equals $\frac{\text{No. of stands in which found}}{\text{Total no. of stands}} \times 100$

Table 6.3 Comparison of species diversity, based upon number of species, on ROW's with that in adjoining forests in the New England Highlands and Mohawk-Hudson regions.

Site	No. of Species[1]					
	Mesic		Xeric		Hydric	
	Forest	ROW	Forest	ROW	Forest	ROW
			Shrubs			
1	4	10	-	-	-	-
2	1	9	3	8	3	8
3	3	8	4	4	6	6
4	4	6	6	9	3	9
5	7	15	6	16	5	10
6	4	8	3	12	5	6
Average -	3.8	9.3	4.4	9.8	4.4	7.8
			Herbs			
1	8	18	-	-	-	-
2	4	17	2	12	15	27
3	18	11	8	10	12	12
4	6	17	8	11	15	28
5	9	28	12	21	14	19
6	8	20	9	24	9	17
Average -	8.8	18.5	6.2	15.6	13	20.6

[1] If a habitat occurs twice on a site, the total number of respective shrub or herb species for both areas is totaled, then divided by two for an average. This average is then rounded off to the nearest whole number.

Table 6.4 Abundance and cover value of trees on the ROW for the New England Highlands and Mohawk-Hudson regions.
(see Vol. 1, p. 3-3 for value of symbols).

	Xeric Habitat on Sites				
Species on ROW	2	3	4	5	6
Red Maple	2	1	2	2	1
Red Oak	+	1	1	3	1
White Ash	-	-	+	2	2
Chestnut Oak	+	1	-	+	-
Black Cherry	-	+	++	1	-
White Oak	++	+	-	-	+
Gray Birch	-	+	+	1	-
Quaking Aspen	-	++	-	+	+
Sweet Birch	3	1	-	-	-
Hornbeam	-	-	+	++	-
Bitternut Hickory	-	-	++	+	-
Tulip Poplar	+	-	-	++	-
American Elm	-	-	-	1	++
Flowering Dogwood	+	+	-	-	-
Shagbark Hickory	-	-	+	-	-
White Pine	-	-	-	-	3
Sassafras	-	-	-	2	-
Pin Cherry	-	-	-	-	2
Serviceberry	-	-	1	-	-
Red Cedar	-	-	-	-	+
Yellow Birch	-	-	-	+	-
Apple	-	-	-	-	++
Pitch Pine	-	-	-	-	+
Hemlock	++	-	-	-	-
Pignut Hickory	-	-	-	-	+
Large-tooth Aspen	-	-	-	+	-
No. Species (Total = 26)	8	9	9	14	12

Average No. of Species = 10.4

Table 6.5 Abundance and cover value of trees on the ROW for the New England Highlands and Mohawk-Hudson regions.
(see Vol. 1, p. 3-3 for value of symbols).

	Mesic Habitat on Sites				
Species on ROW	2	3	4	5	6
Red Maple	1	2	1	+	1
Flowering Dogwood	+	3	+	++	-
Red Oak	-	+	1	+	1
White Oak	1	1	-	+	+
Sweet Birch	2	1	+	-	-
White Ash	-	1	-	+	1
Sassafras	+	+	-	3	-
Chestnut Oak	+	-	+	+	-
Willow[1]	+	-	-	+	+
Pignut Hickory	+	+	-	-	+
Black Cherry	+	+	-	++	-
Yellow Birch	-	-	3	2	-
Gray Birch	-	-	-	1	1
Quaking Aspen	-	+	-	-	+
Basswood	-	-	++	-	+
White Pine	-	-	-	-	3
Bitternut Hickory		-	-	1	-
Large-tooth Aspen	-	-	-	1	-
Pin Cherry	-	-	-	-	1
Hornbeam	-	+	-	-	-
Shagbark Hickory	-	-	-	-	+
American Elm	-	++	-	-	-
Sugar Maple	++	-	-	-	-
No. Species (Total = 23)	10	12	7	13	12

Average No. of Species = 10.8

[1] Listed under shrub layer in individual site summaries.

Table 6.6 Abundance and cover value of trees on the ROW for the New England Highlands and Mohawk-Hudson regions. (see Vol. 1, p. 3-3 for value of symbols).

	Hydric Habitat on Sites				
Species	2	3	4	5	6
Willow[1]	2	+	+	4	2
Red Maple	1	1	+	2	-
American elm	-	+	-	2	+
White Ash	++	+	-	2	1
Flowering Dogwood	-	+	2	-	-
Red Oak	+	-	-	++	-
Apple	-	-	-	+	+
Shagbark Hickory	++	-	-	++	-
Yellow Birch	2	-	-	-	-
Hemlock	1	-	-	-	-
Sassafras	-	-	-	1	-
Quaking Aspen	-	-	-	1	-
White Pine	-	-	-	-	1
Tulip Poplar	+	-	-	-	-
Red Cedar	-	-	-	++	-
Black Cherry	-	-	-	+	-
Beech	+	-	-	-	-
Sugar Maple	++	-	-	-	-
Gray Birch	-	-	-	++	-
Large-tooth Aspen	-	-	-	++	-
No. Species (Total = 20)	10	5	3	13	5

Average No. of Species = 7.2

[1] Listed under shrub layer in individual site summaries.

Table 6.7. Trends in impact on soil organic layers and humus types in the New England Highlands and Mohawk-Hudson regions.

Site	Moisture Regime	Predominant Humus Type		Organic Layer[1] Thickness (inches)			
				ROW		Forest	
		ROW	Forest	Mesic	Xeric	Mesic	Xeric
1	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ shallow A1	1.0	-	1.1	-
2	Mesic & Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	1.1	1.2	1.8	1.4
3	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	0.6	1.9	1.4	2.1
	Xeric	Thick duff mull w/ very shallow A1	Thick duff mull w/ very shallow A1				
4	Mesic & Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	1.0	2.0	1.5	1.9
5	Mesic & Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	1.5	1.2	1.8	1.0
6	Mesic	Very shallow medium mull	Very shallow medium mull	0.5	0.5	0.8	1.6
	Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ shallow A1				
Average thickness - all sites				1.0	1.4	1.4	1.6
Average thickness - mesic and xeric combined				1.2		1.5	

[1] Includes all layers (litter, fermentation, and humus) where present.

Table 6.8. Trends in impact on erosion in the New England Highlands and Mohawk-Hudson regions.

Site	Active Erosion		Sediment Disposition
	ROW	Forest	
1	None on general ROW; prominent on access roads and tower sites	Slight to moderate on steep slopes	Lower slopes on ROW
2	Slight on general ROW; slight to severe on access roads and tower sites	Moderate on one bare steep slope	Lower slopes on ROW; some in brook
3	Negligible on general ROW; slight to severe on access roads and tower sites	None except one steep slope	Most on lower slopes of ROW; some in streams
4	Negligible on general ROW; slight to severe on access roads and tower sites	Slight on steep slopes	Lower slopes on ROW
5	Slight on general ROW with moss cover; slight on access roads and tower sites	Slight on bare and disturbed areas	Lower slopes on ROW; some in swamp
6	Severe on bare areas of general ROW; severe on access roads, tower sites and excavations	Moderate on one steep slope	Most in streams; some on lower slopes of ROW

Table 6.9. Trends in impact on wildlife use of the ROW's in the New England Highlands and Mohawk-Hudson regions.

Wildlife Species	Areas Used by Wildlife Sites 1	2	3	4	5	6
Game mammals						
White-tailed deer	-	ROW & Forest	ROW & Forest	ROW & Forest	ROW	ROW
Cottontail rabbit	ROW & Forest	ROW	-	ROW	ROW & Forest	ROW
Gray squirrel	ROW & Forest	ROW & Forest	ROW & Forest	Forest near ROW	ROW & Forest	Forest near ROW
Woodchuck	ROW-Burrow	-	ROW & Forest	-	Forest	ROW-Burrow
Raccoon	ROW	-	ROW	Forest near ROW	-	ROW & Forest
Game birds						
Ruffed grouse	ROW Edge	Forest near ROW	-	ROW & Edge	ROW & Forest	-
Woodcock	-	-	-	ROW	-	ROW Singing
Black duck	-	-	-	-	ROW & Edge	-
Ringnecked pheasant	Near ROW Edge	-	-	-	-	-
Nongame birds						
Song birds & raptors	ROW & Edges 26 species	ROW & Edges 21 species	ROW & Edges 23 species	ROW & Edges 28 species	ROW & Edges 27 species	ROW & Edges 20 species
Cooper's hawk	ROW & Forest (nest)	ROW & Forest (nest)	ROW & Edges	ROW & Edges	ROW & Edges	-
Small nongame mammals						
Chipmunk	ROW	-	ROW & Forest	ROW & Forest	ROW & Forest	-

Table 6.10. Trends in impact on water in the New England Highlands and Mohawk-Hudson regions

Location in respect to ROW	Border Vegetation	Stream Temp. in Centigrade; Sedimentation			
	Site 5 - Swamp	Oct. 2	Feb. 5	May 12	Aug. 5
		Temperature			
1 - 100 yards south of the ROW (upstream)	Elm-Red Maple Shaded	11.2	0.5	13.0	No water
1A[1]					16.0
2 - mid ROW	Shrubs & Herbs Well shaded	10.5	2.0	13.0	15.0
3 - 100 yards north of the ROW (downstream)	Elm-Red Maple Shaded	11.0	0.0	13.0	16.0
	Site 2 - Torne Brook (Class B)[2]	Sept. 23	Feb. 3	May 11	Aug. 5
		Temperature			
1 - 100 yards upstream from the ROW	Hemlock-Yellow Birch Shaded	12.8	Near freezing	10.2	18.5
2 - mid ROW	Hemlock-Yellow Birch Partial Shade	12.7	Near freezing	10.5	17.0
3 - 50 yards downstream	Hemlock-Yellow Birch Shaded	12.7	Near freezing	11.0	18.0
4 - 200 yards downstream	Hemlock-Yellow Birch Shaded	12.8	Near freezing	11.0	17.0
		Sedimentation			
1 - 100 yards upstream from the ROW		No sediment			
2 - mid ROW		No sediment			
3 - 50 yards downstream		No sediment			
4 - 200 yards downstream		1" sand and gravel			

[1] On August 5, 1976, sampling location 1 was relocated.

[2] Stream was 12-14" deep x 13.5'-19.5' in September; 5-11" deep x 9.5'-16' wide in August. Class B stream - bathing and recreation.

Table 6.11. Percent change of land use prior to (or near the time of construction) and after construction of the ROW for sites within the New England Highlands and Mohawk-Hudson regions.

Land Use		Percent change expressed as increase (+), decrease (-), no change (0), or no recorded land use with no change (NC).[1] Sites						Ave. % Change
		1	2	3	4	5	6	
(A)	Agriculture	0	NC	NC	NC	-4.4	-2.6	-1.2
(C,I)	Commercial & Industrial	0	NC	NC	NC	1.0	0	0.2
(E)	Extractive Industry	NC	0	NC	NC	1.4	-1.3	0
(F)	Forest Land	0	-1.2	0	0	-8.1	-1.8	-1.9
(N)	Non-productive	NC	-0.2	NC	NC	NC	NC	0
(OR)	Outdoor Recreation	0	-.1	NC	NC	0.3	NC	0
(P)	Public & Semi-public	0.7	NC	NC	NC	2.2	0.1	0.5
(R)	Residential	0	NC	NC	NC	1.3	0.3	0.3
(T)	Transportation	0	1.4	NC	NC	0.4	5.2	1.2
(U)	Urban Inactive	-0.7	NC	NC	NC	NC	NC	-0.1
(W)	Water Resources	0	0	0	0	5.9	0.1	1.0

[1] Percentages are derived from each individual case history of the sites and expressed to a 10th of a percent. Percentages were not adjusted to insure cancellation of land use increase or decrease by site.

Table 6.12. Multiple land use of ROW sites within the New England Highlands and Mohawk-Hudson regions.

Multiple Use	Sites						% of Sites with Multiple Use
	1	2	3	4	5	6	
Use of access roads for adjacent logging operations							0
Agriculture					X		17
Extension of residential property							0
Fishing							0
Hiking		X	X	X			50
Horseback riding					X		17
Hunting	X	X	X	X	X	X	100
Industrial uses[1]							0
Other recreational uses[2]	X				X	X	50
Snowmobiling							0

[1] Use by adjacent industry as extension of property, or piling of discarded material associated with that industry.

[2] Other recreational uses include such functions as: Use by children for play; motorcycle trails; use by all-terrain vehicles; and camping activities.

6.3 Trends in the Appalachian Highlands and Catskill Regions

6.3.1 Trends in Impact on Vegetation

Relation of plant communities to habitat and forest type Four sites (sites 7,8,9, and 10) were located in the Appalachian Highlands and Catskill regions of New York where Hemlock-Northern Hardwoods and Oak-Northern Hardwoods are characteristic natural vegetation. Three of these sites (sites 8, 9, and 10) showed definite trends which correlated the ROW community with habitat and forest type. Site 7 was not used for trends as data on plant species were not taken; the site was selected for special studies. A fifth site (site 22) was added from the border of the adjacent region as it fit more nearly in this region.

General trends in vegetation on the ROW's in relation to habitat and forest type are shown in Table 6.13 and Table 6.14 and may be summarized as follows:

(1) On mesic areas where Hemlock-Northern Hardwoods adjoin the ROW's, a Blackberry-Goldenrod plant community developed on the ROW. This held true for all types of management used which included: selective followed by broadcast sprays and broadcast sprays only.

(2) On xeric habitats where Oak-Northern Hardwoods adjoined the ROW's, a Blueberry-Sweet-fern plant community developed on the ROW's. This held true for all types of management used.

(3) On hydric habitats, where the ROW's were adjoined by Hemlock-Northern Hardwoods or Hemlock-Yellow Birch, a Sensitive Fern plant community developed. Where an Elm-Red Maple type bordered a small stream, a Willow-Sensitive Fern plant community developed on the ROW.

Species Diversity The number of species present was greater on the ROW's than in the adjacent forest on all sites and all habitat areas, (Table 6.15). This means that the presence of a ROW greatly enhanced the diversity of species and thus the wildlife habitat of the area.

Impacts on Shrubs and Low-growing Trees As shrubs and low-growing trees are important species on the ROW's, special attention has been paid to them. Some common species may be grouped for comparative purposes as follows:

1. Shrubs and low-growing trees which were more prominent, or of equal prominence, on the ROW's as compared to the adjacent forests are:

American hophornbeam	blueberry	maple-leaved viburnum
American hornbeam	hawthorn	mountain laurel
blackberry	hazelnut	raspberry

2. Shrubs and low-growing trees which occurred only on the ROW's are:

dewberry	spiraea	willow
gooseberry	sweet-fern	

3. Shrubs and low-growing trees which occurred only in the forests are:

   flowering dogwood gray dogwood teaberry

4. Shrubs and low-growing trees present in the forest, and also on the ROW's, but in lesser abundance, are:

   serviceberry striped maple witch-hazel

Impacts on Herbaceous Plants A different herbaceous flora developed on the ROW's in contrast to that in the adjoining forests. This was primarily owing to invasion by plants of open areas on the ROW's which then formed complex mixtures with plants formerly in the forest.

Nine common species were found on the ROW's which were absent or sparse in adjoining forests. These were typical plants of open areas such as goldenrods, sheep-sorrel, pearly everlasting, hay-scented fern, daisy, hawkweeds, Queen Anne's-lace, daisy-fleabane, and pokeweed.

A number of plants typical of the forest were not found on the ROW's, or were very rare. These include: beech-fern, Christmas-fern, marginal shield-fern, star-flower, twisted-stalk, wild sarsaparilla, partridge-berry, trilliums, bluebeard-lily, Solomon's-seal, false Solomon's-seal, and club-mosses.

Many plants, however, were found both on the ROW's and in the forest and include: wild lily-of-the-valley, strawberry, May-apple, trout-lily, New York fern, sedges, Spring-beauty, hair-cap mosses, wood-sorrel, cinquefoil, asters, interrupted fern, foamflower, whorled loosestrife, and bracken.

Trees on the ROW (Sites 8, 9, 10, 22).

Xeric Habitat (Table 6.16) The most common species were red maple and red oak which each covered 1/2 to 1/4 of the ROW (2). Other common species were sweet birch, quaking aspen, yellow birch, and white oak.

The number of species on a ROW ranged from 10 to 11. A total of 15 species where recorded as invading the 2 ROW's. While brush control was excellent on both ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

Mesic Habitat (Table 6.17) The most common species were red maple and red oak which were occasional (++) to sparse (+) to covering up to 1/4 of the ROW area (2). Other common species were quaking aspen, sweet birch, and hawthorn.

The number of species on a ROW ranged from 7 to 18. A total of 25 species was recorded as invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

Hydric Habitat (Table 6.18) The most common species were willow, red oak, and red maple which ranged from numerous to covering up to 1/2 of the ROW area (3). Other common species were white ash, hornbeam, black cherry, American elm, and sweet birch.

The number of species on a ROW ranged from 1 to 9. A total of 15 species were recorded invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

6.3.2 Trends in Impact on Soil

Bedrock geology of the 4 study sites in the Appalachian Highlands and Catskill regions is predominantly shale, sandstone and siltstone. Soils on 3 areas (sites 7,8, and 9) formed mostly in unsorted glacial till, some stratified glacial outwash (site 7) and bottomland alluvium from glacial drift (site 9). One area (site 10) was unglaciated and soils developed in weathered bedrock and alluvium from this material. Soil orders are predominantly Inceptisols with one inclusion of Entisols on recent alluvium. Surface mineral soils are strongly acid, pH 4.0 to pH 5.8, with silt loam textures except for silty clay loam on 1 poorly drained bottomland.

There was some impact of ROW management on surface organic layers, primarily a change in source of litter from tree parts (leaves, twigs, and fruit) in the forest to leaves and stems of shrubs, herbs, and grasses on the ROW's and reduction in total thickness. For all plots combined, average depth of organic matter on the ROW's was 0.9 inches versus 1.3 inches in the forest. This relationship remains about the same when variation for disturbance on mesic of site 7 and different humus type on mesic of site 10 are deleted in comparisons (Table 6.19). There were only slight differences in thickness of organic matter between mesic and xeric habitats. Overall on the general ROW's, however, the major humus type, "thin duff mull with very shallow A1", was the same as that in the forest. The only exception is the "very deep medium mull" on the forest mesic of site 10 which likely resulted from local variation in soil type and properties.

Active erosion on the general ROW's, as with the undisturbed forest, was limited mostly to slight to moderate sheet and rill erosion and some gully erosion on bare steep slopes in silt loam soil. More severe erosion of all kinds occurred primarily on access roads, tower sites and other disturbed areas. Also, slight to moderate erosion occurred along stream banks both in the forest and on the ROW's. The trend, therefore, was for the ROW's in this region to show a negative impact only on disturbed areas and not on the general ROW's which were adequately covered with vegetation and duff mull humus layers (Table 6.20).

6.3.3 Trends in Impact on Wildlife

The trend in impact on wildlife use of the ROW's was positive as shown by the 14 common species found using the ROW's, in addition to numerous song birds and raptors (Table 6.21).

White-tailed deer commonly used both the ROW's and forest on all sites. Cottontail rabbits used the ROW's on 4 of the sites and the forest on 2 sites. Woodchuck were observed on the ROW's on 4 sites, along with their burrows on 2 sites. Fox scats were observed on 3 sites on the ROW's and gray squirrels used the ROW's on 3 sites. Skunk were detected on 1 site.

Of the common game birds, ruffed grouse and wild turkey were observed on the ROW's on 2 sites and woodcock on 1 site on the ROW.

From 10 to 23 species of song birds and raptors were observed using the ROW's on all sites. Two bald eagles were seen on the study area of site 7.

Studies of deer browsing on 3 sites indicated an important trend in wildlife use, namely, that 8 common shrubs on the ROW's and edges were heavily browsed and thus furnished valuable wildlife food for winter use. While percent of stems browsed was higher in the forest (58%) than on the ROW's (44%) on all sites, there were considerably more stems available per unit area on the ROW's (258) than in the forests (119) on all sites.

A pellet group count on 1 site indicated that deer were active during the winter on the ROW, the edges, and in the adjacent forest. There were no significant differences between use in any of these locations.

6.3.4 Trends in Impact on Water

Three streams were sampled on sites in this region: Travis Brook (site 8) and Baldwin Creek (site 9) were Class D streams, agricultural and/or industrial water supply (Table 6.22). The third stream, which was unnamed and unclassified and occurred as a man-made pond and wet meadow on the ROW, was not used for these trends.

Impact of the ROW's on stream temperature was negligible as it varied from only 0.5 to 2.0 C from upstream to 50-100 yards downstream and 16.5 C was the highest temperature measured. The cover on the ROW's consisted of herbs and grasses which furnished only partial shade. The 2 ROW's were 150 and 250 feet wide, respectively.

Active sedimentation from the ROW's was not observed, although Travis Brook did have a measurable deposition in May with no additional by August at mid-ROW and 100 yards downstream. However, little turbidity was observed in Travis Brook in September after heavy rain. Baldwin Creek showed no sediment deposit in May or August.

6.3.5 Trends in Impact on Land Use

Changes in Adjacent Land Use The percent change in land use prior to (or near the time of construction) and after construction of the ROW has been compared for 5 sites (sites 7,8,9,10 and 22). Sites 7 to 10 are found within the Appalachian Highlands and Catskill regions, with site 22 being added from the border of an adjacent region (Lake Plain) because it fits more nearly with this regions vegetative cover. For consistency of analysis with other trend analyses, this grouping is included for the land use section as well. The percent change by land use type is recorded for each site and for all 5 sites as an average percent change (Table 6.23). High percent changes in land use for any single site included a decrease in agriculture for site 22 by 21.5%, and an increase in forest land by 16.4% also for site 22. Zero % change in land use was most frequently measured as a percent change by land use type. The average percent change by land use is generally low, with the highest average percent change being a 5.4% decrease in agriculture for sites in this grouping. Other average percent changes included a slight increase in extractive industry (0.3%); an increase in forest land (3.9%); a slight increase in residential (0.6%); an increase in transportation (1.2%); and a slight decrease in water resources (-0.6%).

Factors which should be considered and may influence the impact (or change) on adjacent land uses include visual characteristics of the ROW's. General reconnaissance of the sites indicates that of the 5 sites, 2 are generally pleasing to view (sites 7 and 8) with the remaining 3 neither pleasing nor objectionable (sites 9,10, and 22). Sites which are pleasing to view either include visual assets of vistas, are well vegetated, or open attractive rugged terrain to view. The remaining 3 sites are described as neither pleasing nor objectionable, generally because they lack visual assets or expose undesirable visual characteristics due to erosion. In this region negative visual characteristics which have been identified are a result of either soil erosion or poor drainage conditions. No effect on adjacent land use change as a result of visual characteristics is apparent.

A general trend for land use adjacent to the ROW's within the Appalachian Highlands and Catskill regions is the lack of change or absence in recorded land uses for 5 land use types: Commercial & Industrial, Non-productive, Outdoor Recreation, Public & Semi-public, and Urban Inactive. This may be a reflection of the rural-farm, or rural non-farm composition of the regions' areas involved. There is a trend towards a consistent decrease in agricultural land. Another trend is the general absence of long-term negative visual characteristics that would be an objectionable contrast with the surrounding land use. Due to the few number of sampled sites, and variability of influences other than the ROW's construction and maintenance which could affect land use change, other distinct trends are not apparent.

Multiple Uses Multiple uses of the ROW's for these sites include agriculture, hunting, horseback riding, and other recreational uses (Table 6.24). All of the 5 sites recorded multiple land uses. Of these 5 sites, the only multiple uses in common are hunting and agriculture.

An important trend is shown by the existance of hunting and agriculture.

Table 6.13. Trends in impact on vegetation in the Appalachian Highlands and Catskill regions.

Site	Region	Habitat	Forest Type	Type of Management	ROW Community
8	Appalachian Highlands	Mesic	Hemlock-Northern Hardwoods	Selective & Broadcast	Blackberry-Goldenrod
9	Appalachian Highlands	Mesic	Hemlock-Northern Hardwoods	Selective & Aerial	Blackberry-Goldenrod
10	Appalachian Highlands	Mesic	Hemlock-Northern Hardwoods	Broadcast	Blackberry-Goldenrod
22	Appalachian Highlands	Mesic	Northern Hard-woods	Broadcast & Selective	Blackberry-Goldenrod
8	Appalachian Highlands	Xeric	Oak-Northern Hardwoods Hardwoods	Selective & Broadcast	Blueberry-Sweet-fern
22	Appalachian Highlands	-	-	-	-
8	Appalachian Highlands	Hydric	Hemlock-Yellow Birch	Selective & Broadcast	Spiraea-Sensitive Fern
9	Appalachian Highlands	Hydric	Alder-Sensitive Fern	Selective & Aerial	Alder-Sensitive Fern
10	Appalachian Highlands	Hydric	Hemlock-Northern Hardwoods	Broadcast	Dewberry-Sensitive Fern
22	Appalachian Highlands	Hydric	Elm-Red Maple	Broadcast & Selective	Willow-Sensitive Fern

Table 6.14. Trends in plant community development in relation to forest type and habitat of the Appalachian Highlands and Catskill regions. The figures in parenthesis are percent constancy.[1]

Adjacent Forest	ROW Community	
MESIC		
Hemlock-Northern Hardwoods---------->	Blackberry (100) with	- Goldenrod (100)
	Witch-Hazel (100)	Sheep-Sorrel (100)
	Hawthorn (100)	Strawberry (100)
	Raspberry (66)	Hair-cap Moss (100)
		Asters (66)
		Hay-scented Fern (66)
		Mixed Grass (100)
XERIC		
Oak-Northern Hardwoods---------->	Blueberry (100) with	- Sweet-fern (100)
	Witch-Hazel (100)	Bracken (100)
		Pearly Everlasting (100)
		Whorled Loosestrife (100)
		Strawberry (100)
		Mixed Grass (100)
		Sedge (100)
		Goldenrod (100)
HYDRIC		
Hemlock-Yellow Birch---------->	Spiraea (66) with	- Sensitive Fern (100)
	Witch-Hazel (66)	Interrupted Fern (66)
	Raspberry (66)	Sedge (66)
		Violet (66)
		Horsetail (66)
		Blue-eyed Grass (66)
		Cinquefoil (66)
		Spring-beauty (66)
		Mixed Grass (66)

[1] Constancy is a percentage which equals $\frac{\text{No. of stands in which found}}{\text{Total no. of stands}} \times 100$

Table 6.15 Comparison of species diversity, based on the number of species, on ROW's with that in the adjoining forests in the Appalachian Highlands and Catskill regions.

Site	No. of Species					
	Mesic		Xeric		Hydric	
	Forest	ROW	Forest	ROW	Forest	ROW
			Shrubs			
7	-	-	-	-	-	-
8	4	7	4	5	2	3
9	2	6	-	-	-	-
10	2	4	6	7	1	4
22	2	6	-	-	4	8
Average -	2.5	5.8	5	6	2.3	5
			Herbs			
7	-	-	-	-	-	-
8	11	15	6	14	10	20
9	11	19	-	-	-	-
10	17	25	10	16	14	18
22	8	13	-	-	9	18
Average -	11.75	18	8	15	11	18.7

Table 6.16. Abundance and cover value of trees on the ROW for the Applachian Highlands and Catskill regions. (see Vol. 1, p. 3-3 for value of symbols).

	Xeric Habitat on Sites			
Species on ROW	8	9	10	22
Red Maple	2	-	2	-
Red Oak	2	-	2	-
Sweet Birch	3	-	+	-
Quaking Aspen	+	-	2	-
Yellow Birch	1	-	+	-
White Oak	1	-	+	-
Beech	1	-	-	-
Gray Birch	1	-	-	-
White Birch	1	-	-	-
Chestnut Oak	1	-	-	-
Large-tooth Aspen	+	-	-	-
White Ash	-	-	+	-
Serviceberry	-	-	+	-
Black Cherry	-	-	+	-
Shagbark Hickory	-	-	+	-
No. Species (Total = 15)	11	-	10	-

Average No. of Species = 10.5

Table 6.17. Abundance and cover value of trees on the ROW for the Applachian Highlands and Catskill regions. (see Vol. 1, p. 3-3 for value of symbols).

	Mesic Habitat on Site			
Species on ROW	8	9	10	22
Red Maple	1	2	1	2
Red Oak	2	+	+	++
Quaking Aspen	1	3	-	2
Sweet Birch	3	1	1	-
Hawthorn[1]	+	+	2	-
Hornbeam	-	3	2	-
White Ash	-	2	-	3
Black Cherry	-	2	1	-
Yellow Birch	1	2	-	-
Pin Cherry	-	+	-	1
Beech	1	+	-	-
Serviceberry	-	1	-	++
Bitternut Hickory	-	-	+	+
Apple	-	2	-	-
Red Pine	-	1	-	-
Willow[1]	-	-	-	1
Chestnut	+	-	-	-
Gray Birch	+	-	-	-
White Birch	+	-	-	-
White Pine	-	++	-	-
Large-tooth Aspen	-	+	-	-
Scotch Pine	-	+	-	-
American Elm	-	++	-	-
White Oak	-	-	-	++
American Hop-Hornbeam	+	-	-	-
No. Species (Total = 25)	11	18	7	9

Average No. of Speices = 11.2

[1] Listed under shrub layer in individual site summaries.

Table 6.18. Abundance and cover value of trees on the ROW for the Appalachian Highlands and Catskill regions. (see Vol. 1, p. 3-3 for value of symbols).

	Hydric Habitat on Sites			
Species on the ROW	8	9	10	22
Willow[1]	-	1	-	3
Red Maple	-	-	1	2
Red Oak	-	-	++	++
White Ash	-	-	-	3
Hornbeam	-	-	2	-
Black Cherry	-	1	-	-
American Elm	-	-	-	1
Sweet Birch	1	-	-	-
Quaking Aspen	-	+	-	-
Serviceberry	-	-	+	-
Shagbark Hickory	-	-	-	+
Pin Cherry	-	-	-	-
Apple	-	-	-	++
Basswood	-	-	-	++
Pignut Hickory	-	-	-	++
No. Species (Total = 15)	1	3	4	9

Average No. of Species = 4.3

[1] Listed under shrub layer in individual site summaries.

Table 6.19. Trends in impact on soil organic layers and humus types in the Appalachian Highlands and Catskill regions.

Site	Moisture Regime	Predominant Humus Type		Organic Layer[1] Thickness (inches)			
				ROW		Forest	
		ROW	Forest	Mesic	Xeric	Mesic	Xeric
7	Mesic	Disturbed tower openings - no humus type	Thin duff mull w/ very shallow A1	0.3	-	1.9	-
8	Mesic & Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	1.0	0.8	2.1	1.5
9	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	1.0	-	1.0	-
10	Mesic	Thin duff mull w/ very shallow A1	Very deep medium mull	1.0	0.6	0.3	1.2
	Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1				
22	Mesic	Thin duff mull w/ shallow A1	Thin duff mull w/ shallow A1	1.7	-	0.9	-
Average thickness - all sites				1.0	0.7	1.2	1.4
Average thickness - mesic and xeric combined				0.9		1.3	

[1] Includes all layers (litter, fermentation, and humus) where present.

Table 6.20. Trends in impact on erosion in the Appalachian Highlands and Catskill regions.

Site	Active Erosion		Sediment Disposition
	ROW	Forest	
7	Slight sheet erosion on general ROW; slight to moderate sheet and rill erosion on tower sites	Moderate sheet and rill erosion in general forest; slight to severe gully erosion in runoff area	Most on lower slopes of ROW; some leaves ROW through gully
8	Moderate sheet erosion on steep slope of general ROW; moderate sheet, rill and gully erosion on access roads, tower sites and equipment cuts	Slight to moderate sheet and rill erosion on steep slopes of general forest	Most on lower slopes of ROW; some moves into intermittent streams
9	Slight to severe sheet and gully erosion on steep bare areas of general ROW; slight to moderate sheet, rill and gully erosion on access roads, intermittent stream bed, stream banks, ditch and equipment cuts	Slight sheet, rill and gully erosion on bare, steep slopes of general forest; severe sheet, rill and gully erosion on stream bed and stream banks	Lower slopes on ROW; some deposited in stream crossing ROW and in pond on ROW edge
10	Moderate sheet erosion in equipment tracks on general ROW; severe gully on tower site; moderate sheet, rill and gully erosion on access road and stream banks	Slight sheet erosion on heavy soil in general forest; slight to moderate sheet and gully erosion on stream banks	Most on lower slopes of ROW; some in stream and ponded area on ROW
22	Slight sheet erosion on general ROW	Slight sheet erosion in general forest; moderate sheet, rill and gully erosion on sanitary land fill adjacent to ROW	All sediment collected on lower slope in depression

Table 6.21. Trends in impact on wildlife use of the ROW's in the Appalachian Highlands and Catskill regions.

Wildlife Species	Areas Used by Wildlife Sites				
	7	8	9	10	22
Game mammals					
White-tailed deer	ROW & Forest	ROW & Forest	ROW & Forest	ROW & Forest	ROW & Fores
Cottontail rabbit	ROW	ROW & Forest	ROW & Forest	ROW	-
Gray squirrel	-	ROW & Forest	ROW	-	ROW
Woodchuck	ROW	ROW	ROW-Burrows	ROW & Forest-Burrows	-
Fox	-	ROW	ROW	-	ROW
Muskrat	-	-	-	ROW-Burrows	-
Game birds					
Woodcock	-	ROW	-	-	-
Wild turkey	-	Forest	-	ROW & Forest	-
Ruffed grouse	-	-	ROW	ROW & Forest	-
Nongame birds					
Song birds & raptors	ROW 10 species	ROW 23 species	ROW 20 species	ROW 21 species	ROW 15 species
Bald eagle	ROW	-	-	-	-
Small nongame mammals					
Chipmunk	-	Forest	-	-	-
Skunk	-	-	ROW & Forest	-	-
Raccoon	-	-	-	-	ROW
Miscellaneous					
Rattlesnake	ROW	ROW	-	-	-
Spring peeper	-	-	-	-	ROW

Table 6.22. Trends in impact on water in the Appalachian Highlands and Catskill regions.

Location in Respect to ROW	Border Vegetation	Stream Temp. in Centigrade			
Site 8 - Travis Brook (Class D)					
		Sept. 25	Jan. 28	May 19	Aug. 5
1 - 100 yards upstream	Hemlock-Northern Hardwoods shaded	9.5	-1.0	6.0	13.0
2 - Upstream edge of ROW	Forest edge partial shade	10.0	0.0	6.6	13.5
3 - Mid ROW	Herbs, grasses partial shade	10.0	-2.0	7.3	14.0
4 - Downstream edge of ROW	Forest edge shaded	10.0	0.0	7.5	14.0
5 - 100 yards downstream	Hemlock-Northern Hardwoods shaded	10.0	0.0	8.0	14.0
Site 9 - Baldwin Creek (Class D)					
		Sept. 27	Feb. 12	May 19	Aug. 3
1 - 100 yards upstream	Forest canopy partial shade	12.0	0.0	7.0	15.5
2 - Mid ROW	Herbs, grasses partial shade	12.0	0.0	7.0	16.0
3 - 50 yards downstream	Forest canopy partial shade	11.3	0.0	7.5	16.5

Table 6.23. Percent change of land use prior to (or near the time of construction) and after construction of the ROW for sites within the Appalachian Highlands and Catskill regions.

Land Use	Percent change expressed as increase (+), decrease (-), no change (0), or no recorded land use with no change (NC).[1] Sites[2]					Ave. % Change
	7	8	9	10	22	
(A) Agriculture	-0.7	-4.3	-0.5	NC	-21.5	-5.4
(C,I) Commercial & Industrial	NC	NC	NC	NC	NC	0
(E) Extractive Industry	0.4	NC	NC	NC	1.2	0.3
(F) Forest Land	-1.5	4.3	0.4	0	16.4	3.9
(N) Non-productive	NC	NC	NC	NC	NC	0
(OR) Outdoor Recreation	NC	NC	NC	0	0	0
(P) Public & Semi-public	NC	0	NC	NC	NC	0
(R) Residential	NC	NC	0.1	NC	2.8	0.6
(T) Transportation	NC	NC	NC	4.7	1.4	1.2
(U) Urban Inactive	NC	NC	NC	NC	NC	0
(W) Water Resources	1.8	NC	0	-4.7	-0.3	-0.6

[1] Percentages are derived from each individual case history of the sites and expressed to a 10th of a percent. Percentages were not adjusted to insure cancellation of land use increase or decrease by site.

[2] Site 22 was added from the border of the adjacent region (Lake Plain) as it fit more nearly with this region.

Table 6.24. Multiple land use of ROW sites within the Appalachian Highlands and Catskill regions.[1]

Multiple Use	Sites					% of Sites with Multiple Use
	7	8	9	10	22	
Use of access roads for adjacent logging operations						0
Agriculture		X	X	X	X	80
Extension of residential property						0
Fishing						0
Hiking						0
Horseback riding		X				20
Hunting	X	X	X	X	X	100
Industrial uses[2]						0
Other recreational uses[3]	X	X				40
Snowmobiling						0

[1] Site 22 was added from the border of the adjacent region (Lake Plain) as it fits more nearly with this region.

[2] Use by adjacent industry as extension of property, or piling of discarded material associated with that industry.

[3] Other recreational uses include such functions as: Use by children for play; motorcycle trails; use by all-terrain vehicles; and camping activities.

6.4. Trends in the Lake Plain Region

6.4.1 Trends in Impact on Vegetation

Relation of plant communities to habitat and forest type Five sites (sites 11,12,13,14, and 15) were studied in the Lake Plain region where Elm-Red Maple and Northern Hardwoods are characteristic natural vegetation (Table 6.25). One site (site 22), which was on the southern border of this region, was put in the Appalachian Highlands and Catskill region owing to its obvious relationship to that region.

General trends in vegetation on the ROW's in relation to habitat and forest type are shown in Table 6.25 and Table 6.26, and may be summarized as follows:

(1) On mesic habitat areas where Northern Hardwoods adjoined the ROW's, a Sumac-Goldenrod plant community developed on the ROW.

It is important to note that on 3 sites with widely different ROW treatments (sites 12,14, and 15), all the ROW's had developed the same plant community, Sumac-Goldenrod. This included site 14 where no herbicides had been used and sites 12 and 15 where broadcast sprays had been used.

(2) Only 2 xeric sites were studied in this region. However, on these a different community, Blueberry-Bracken, had developed which lacked sweet-fern so typical of xeric habitats in the New England Highlands and Mohawk-Hudson regions.

(3) On hydric habitat areas, a Red Osier Dogwood-Sensitive Fern plant community had developed on all sites regardless of the ROW management used. An Elm-Red Maple forest type, or close variant adjoined the ROW's on these habitats.

Description of ROW Communities

Sumac-Goldenrod Community (Rhus-Solidago)

This community is typically located on mesic habitat areas on lower and middle slopes with free drainage. Surface soil pH ranged from pH 5.0 to pH 7.0, with an average pH of 6.2.

Characteristic Species Staghorn-sumac is constantly present (100%), and with high abundance and cover values.

Goldenrods are constantly present (100%), and with high abundance and cover values.

Blackberry is also a constant species (60%) of variable cover value.

Small to large patches of grasses mixed with old field herbs were typical of this community.

Other species of high constancy (80%) are grape, asters, strawberry, yarrow, and sheep-sorrel.

Species with medium constancy (40-60%) and not common to other habitats are prickly ash and climbing bittersweet.

Blueberry-Bracken Community (Vaccinium-Pteridium)

This community is typically located on xeric habitat areas mostly on upland flats and slopes with excessive drainage. The soil pH was 4.8.

Characteristic Species Blueberry occurred on the 2 sites (sites 14 and 15), while sweet-fern was absent.

Bracken fern also occurred on both sites with high abundance and cover values.

Dewberry, flowering dogwood, and arrow-wood all were found on both sites with high cover values.

A number of herbs typical of old fields were found on both sites: goldenrods, asters, hawkweeds, sheep-sorrel, Queen Anne's-lace, strawberry and yarrow.

Small patches and clumps of grasses were typical of this community.

Red Osier Dogwood-Sensitive Fern Community (Cornus stolonifera-Onoclea)

This community is typically located on hydric habitat areas in stream bottoms and depressed areas with impeded drainage. The soil pH ranged from pH 6.5 to pH 7.1, with an average pH of 6.8.

Characteristic Species Red osier dogwood is constantly present (100%) and usually has a high abundance and cover value.

Willow is also a constant species (100%) with low to high cover values.

Sensitive fern is a highly constant species (100%) with very high abundance and cover values.

Elderberry is also a highly constant (80%) species although variable in its abundance.

Sedges and horsetails are highly constant (100%) with very high cover values.

Touch-me-not and boneset are species of high constancy (80%) usually with high abundance and cover values.

Other characteristic species of wet areas with medium constancy values (40 to 60%) are: cowslip, cat-tail, rush, marsh-fern, flag iris, lady-fern, and nightshade.

Mixed grasses occur in clumps and small patches and are constantly present (100%).

Goldenrods and asters are highly constant species (100 and 80%), usually of high cover value.

Species Diversity The average number of species present on the ROW's was considerably greater than in the adjoining forests on all habitat areas for the 5 sites studied (Table 6.27). The only exception was on the hydric habitat of site 11 where there were many more herbs present in the forest than on the ROW. The forest in this case was an open cedar swamp mixed with Elm-Red Maple.

This indicates a general trend towards development of a more diverse vegetation on the ROW's which, in turn, means a greater richness of flora and improved wildlife habitat.

Impacts on Shrubs and Low-Growing Trees Shrubs are important components of the ROW communities which enhance wildlife habitat and add to the attractiveness of scenery. Therefore, special attention has been paid to them and they are grouped below to indicate their development on the ROW's studied.

1. Common shrubs and low-growing trees which were more prominent, or of equal prominence, on the ROW's as compared with adjoining forests are:

alder	buckthorn	hawthorn
arrow-wood	elderberry	northern prickly ash
blackberry	grape	red osier dogwood
blueberry	gray dogwood	rose

2. Common shrubs and low-growing trees which occurred only on the ROW's are:

climbing bittersweet	honeysuckle	staghorn-sumac
dewberry	nannyberry	virgin's-bower
flowering dogwood	spicebush	winterberry

3. Common shrubs and low-growing trees which occurred only in the forests are:

gooseberry	striped maple	teaberry
maple-leaved viburnum		

4. Common shrubs and low-growing trees which occurred both in the forests and on the ROW's, but in lesser abundance on the ROW's are:

choke-cherry	raspberry	witch-hazel
poison ivy	Virginia creeper	

Impact on Herbaceous Plants A different flora developed on the ROW's which contrasted sharply with that of the adjoining forests. This was caused by invasion of the ROW's by plants typical of open areas which then mixed with plants of the forests to produce a complex mixture of shrubs, herbs, ferns, and grasses.

Patches of grass were typical of all habitats and were usually mixed with herbs such as goldenrods, asters, wild strawberry, butterfly-weed, yarrow, and sheep-sorrel. Along with these were such plants of the forest as wild geranium, yellow wood-sorrel, cinquefoils, bracken, sensitive fern, sedges, touch-me-not, boneset, bedstraw, lady-fern, false Solomon's-seal, and May-apple.

Some plants of the forest were either not found on the ROW's, or were extremely rare. These included: twisted-stalk, wild sarsaparilla, partridge-berry, large-leaved aster, Indian cucumber-root, false spikenard, white baneberry, and sweet Cicely. A number of ferns typical of shaded habitats were not found on the ROW's. These included: marginal shield-fern, beech-fern, spinulose wood-fern, and cinnamon-fern. These are mostly plants adapted to growing under the canopy of a forest and do not thrive in open areas of any kind.

Trees on the ROW (Sites 11, 12, 13, 14, 15)

Xeric Habitat (Table 6.28) The most common species on the 2 xeric sites were sassafras, red oak, and white oak which ranged from numerous (1) to covering 1/4 - 1/2 of the ROW area (3). Other common species were flowering dogwood and large-tooth aspen.

The number of species on a ROW ranged from 9 on one ROW to 11 on the other. While brush control was excellent on both ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on both ROW's. These trees can be expected to gradually emerge from the shrub layer.

Mesic Habitat (Table 6.29) The most common species were black cherry, red maple, red oak, white ash, and American elm with a range from very sparse (+) to covering 1/4 - 1/2 of the ROW area (3). Other common species were bitternut hickory, pin cherry, and hawthorn.

The number of species on a ROW ranged from 7 to 17. A total of 25 species was recorded as invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emergy from the shrub layer.

Hydric Habitat (Table 6.30) The most common species were willow, white ash, and American elm which ranged from sparse (+) to covering 1/4 - 1/2 of the ROW area (3). Other common species were black cherry, red maple, and quaking aspen.

The number of species on a ROW ranged from 5 to 9. A total of 15 species were recorded as invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

6.4.2 Trends in Impact on Soil

Bedrock geology of study areas in the Lake Plain region is predominantly shale, sandstone, and limestone with minor inclusions of siltstone, dolostone, and granite. Upland soils formed mostly in glacial till and outwash, and bottomland soils in lake deposits and alluvium from glacial drift. Parent soil materials and associated ground water are generally calcareous. Drumlin formations and wind-blown silt and fine sand deposits are prominent on several sites (sites 12,14, and 15). Major soil orders are Inceptisols, Alfisols, and Entisols. Surface mineral soils vary in texture and reaction apparently due to different parent materials, mostly medium to strongly acid sandy loams and loamy sands on sites 12, 14, and 15, and slightly acid to neutral silt loams and loams on other sites.

Impacts on surface soil organic layers of the general ROW's were very minor in this region (Table 6.31). There was a change in source of annual litter deposits from tree parts under forests to leaves and stems of mixed grass-herb-shrub cover on the ROW's, but overall, organic layers on the ROW's were equivalent to, or slightly thicker than, those in the forests. Humus types were generally similar under ROW and forest conditions, but varied among sites. Medium mulls and sand mulls were prominent on mesic habitats of sites 11, 12, and 13, and sand mulls on the xeric habitat of site 15, while thin duff mulls occurred on mesic areas of all other sites. Another minor effect was the consistent occurrence of thinner A1 horizons on the ROW's than in the forests where mull humus types were present, while no difference occurred on duff mulls. Although not related to ROW management, the mull humus type on site 13 was somewhat modified by past plowing in this area.

Impacts on soil erosion were negligible on the general ROW's, those areas where woody brush was maintained by chemical sprays or mowing but with minimal soil disturbance. Some slight to moderate sheet and rill erosion did occur under these ROW conditions on several sites, but did not exceed normal erosion observed under bordering forest conditions (Table 6.32). More serious sheet, rill and some gully erosion, associated with ROW management activities, occurred on disturbed areas such as access roads, tower sites, staging-stringing areas, and excavations. In addition, other uses not related to ROW management caused further site deterioration leading to erosion on access roads and streambanks of some sites. Small amounts of erosion sediment on 3 sites (sites 12, 14, and 15) entered streams on the ROW, but otherwise accumulated on lower slopes with no apparent adverse effects. The major trend, therefore, was for the ROW's in this region to show negative impacts, primarily soil erosion and some stream sedimentation only on disturbed areas, with none or minimal effects on the general ROW's which were stabilized by low plant cover and organic mulch.

6.4.3 Trends in Impact on Wildlife

Wildlife use on the 5 sites studied was relatively high and 12 common species were observed using the ROW's, or their edges, in addition to numerous song birds and raptors (Table 6.33).

From 11 to 31 species of song birds and raptors were observed using the ROW's on all sites. A Cooper's hawk was observed on one site on the ROW.

White-tailed deer used the ROW's on 4 sites, with one highly urbanized area (site 12) lacking deer. Cottontail rabbits used the ROW's on all 5 sites, along with woodchuck on 2 sites whose burrows are valuable as escape cover. Raccoon used the ROW on 1 site, while gray squirrel on 2 sites used the adjacent forest and crossed the ROW's on 2 sites.

Of the common game birds of the region, woodcock used the ROW's on 4 sites, with singing grounds either on the ROW's or adjacent to it on all sites.

Ringnecked pheasant used the ROW's on 3 sites, Canada goose on 3 sites, and canvasback on 1 site.

Deer browse surveys which were carried out on 2 sites indicated that most browse was available on the ROW's or its edges. An important source of winter food was furnished by the ROW's, as 10 common shrubs were browsed by deer.

6.4.4 Trends in Impact on Water

Water impact was studied on site 11 where the ROW crossed a large swamp located in the Genessee River basin. The swamp was 1.7 miles long by 0.3 miles wide. Flow was negligible and measurements were taken in depressions containing water.

Temperature difference on the ROW compared to 2 adjacent locations varied, but no distinct trend could be detected between the locations to indicate a warming trend on the ROW or other changes in water quality.

6.4.5 Trends in Impact on Land Use

Changes in Adjacent Land Use The percent change in land use prior to (or near the time of construction) and after construction of the ROW has been compared for 5 sites (sites 11,12,13,14, and 15). One site (site 22) which was on the southern border of this region, was put in the Appalachian Highlands and Catskill regions due to its vegetative relationship to that region. For consistency of analysis with other trends sections, this grouping was kept. Percent change by land use type is measured for each site and for all 5 sites as an average percent change (Table 6.34). The highest percent change in land use for any single site was a decrease in agriculture by 58.8% for site 12. Another very high percent change for site 12 was an increase in residential by 43.3%. Sites 14 and 15 also had high percent changes in agriculture (-7.1%), forest land (17.8%), and water resources (-11.0%). As a result, the average percent changes by land use are consistently high for agriculture (-14.8%), forest land (7.0%), residential (8.8%), and water resources (-4.8%).

Because of the high variability in land use changes, special consideration should be given to other factors which may influence the impact on adjacent land uses, including visual characteristics. General reconnaissance of the ROW's indicates that of the 5 sites, 2 are generally pleasing to view (sites 14 and 15), and 3 are neither pleasing nor objectionable (sites 11,12, and 13). Sites which are pleasing to view generally lack undesirable characteristics and include vistas and flowering vegetation pleasing to view. The remaining 3 sites are described as neither pleasing nor objectionable generally because they lack visual assets, although they may visibly blend with adjacent land use and land cover types. Variability associated with the ROW's in the context of their location makes this series of general reconnaissance no less subjective, but does not strongly reflect criteria which would impact adjacent land uses in a negative fashion.

Within this Lake Plain region, one trend is a decrease in agriculture. For sites considered here there is also a general absence of long-term negative visual characteristics that appear in objectionable contrast with the surrounding landscape. The combined effect of high percent changes specifically associated with site 12, and the double counting of changes for parallel sites 14 and 15, make it difficult to derive other distinct trends. The high variability of influences other than the ROW which could affect land use change are apparent within this region, most noticeably with site 12.

Multiple Uses Multiple uses of the ROW's within these regions include agriculture, extension of residential property, hiking, hunting, snowmobiling and other recreational uses (Table 6.35). Of these, 4 sites are used for snowmobiling. It is clear that the ROW's have opened the land for a variety of recreational uses. Extension of residential property for 2 sites (sites 12 and 13), as well as other multiple uses, are positive impacts associated with the ROW's.

An important trend for multiple use for this region is also shown by the variety of recreational activities which take advantage of the linear character of the ROW's. Snowmobiling is a predominant multiple use found on 4 sites and would indicate that the ROW's in this region are ideally suited for this activity.

Table 6.25. Trends in impact on vegetation in the Lake Plain region.

Site	Habitat	Forest Type	Type of Management	ROW Community
11	Mesic	Oak-Northern Hardwoods	Selective Stump	Sumac-Goldenrod
12	Mesic	Northern Hardwoods	Broadcast & Mowed	Sumac-Goldenrod
13	Mesic	Northern Hardwoods	Selective Stump & Mechanical	Sumac-Goldenrod
14	Mesic	Northern Hardwoods	None	Sumac-Goldenrod
15	Mesic	Northern Hardwoods	Broadcast & Selective	Sumac-Goldenrod
14	Xeric	Oak-Northern Hardwoods	None	Blueberry-Bracken
15	Moist-Xeric	Oak-Northern Hardwoods	Broadcast & Selective	Blueberry-Bracken
11	Hydric	Northern White Cedar with Elm-Red Maple	Mechanical	Red Osier Dogwood-Sensitive Fern
12	Hydric	Northern Hardwoods	Broadcast & Selective	Red Osier Dogwood-Sensitive Fern
13	Hydric	Red Maple-Ash	Not given	Red Osier Dogwood-Sensitive Fern
14	Hydric	Elm-Red Maple	None	Red Osier Dogwood-Sensitive Fern
15	Hydric	Elm-Red Maple	Broadcast & Selective	Red Osier Dogwood-Sensitive Fern

Table 6.26. Trends in plant community development in relation to forest type and habitat of the Lake Plain region. The figures in parenthesis are percent constancy.[1]

Adjacent Forest	ROW Community		
MESIC			
Northern Hardwoods ---------->	Sumac (100)	-	Goldenrod (100)
		with	
	Grape (80)		Asters (80)
	Blackberry (60)		Strawberry (80)
	Hawthorn (60)		Yarrow (80)
	Blackberry (60)		Sheep-Sorrel (80)
	Arrow-wood (60)		Mixed Grass (100)
XERIC			
Oak-Northern Hardwoods ---------->	Blueberry (100)	-	Bracken (100)
		with	
	Dewberry (100)		Asters (100)
	Flowering Dogwood (100)		Yarrow (100)
	Arrow-wood (100)		Sheep-Sorrel (100)
			Strawberry (100)
			Hawkweeds (100)
			Queen Anne's-Lace (100)
			Mixed Grass (100)
HYDRIC			
Elm-Red Maple ---------->	Red Osier Dogwood (100)	-	Sensitive Fern (100)
		with	
	Willow (100)		Asters (100)
	Elderberry (80)		Sedge (100)
	Gray Dogwood (60)		Horsetails (100)
	Grape (60)		Goldenrod (100)
	Arrow-wood (60)		Boneset (80)
			Touch-me-not (80)
			Mixed Grass (80)

[1] Constancy is a percentage which equals $\frac{\text{No. of stands in which found}}{\text{Total no. of stands}} \times 100$

Table 6.27 Comparison of species diversity, based on number of species, on ROW's with that in the adjoining forests in the Lake Plain region.

Site	No. of Species[1]					
	Mesic		Xeric		Hydric	
	Forest	ROW	Forest	ROW	Forest	ROW
			Shrubs			
11	5	9	-	-	7	9
12	1	5	-	-	2	6
13	4	8	-	-	6	8
14	3	6	5	6	4	9
15	4	5	5	7	2	7
Average -	3.4	6.6	5.0	6.5	4.2	7.8
			Herbs			
11	11	17	-	-	32	14
12	9	24	-	-	13	31
13	9	12	-	-	7	18
14	14	20	17	20	5	18
15	9	11	15	30	21	25
Average -	10.4	16.8	16.0	25.0	15.6	21.2

[1] If a habitat occurrs twice on a site, the total number of respective shrub or herb species for both areas is totaled, then divided by two for an average. This average is then rounded off to the nearest whole number.

Table 6.28. Abundance and cover value of trees on the ROW for the Lake Plain region.
(see Vol. 1, p. 3-3 for value of symbols).

	Xeric Habitat on Sites				
Species on ROW	11	12	13	14	15
Sassafras	-	-	-	3	3
Red Oak	-	-	-	1	2
White Oak	-	-	-	1	1
Flowering Dogwood	-	-	-	1	+
Large-tooth Aspen	-	-	-	3	-
Black Cherry	-	-	-	1	-
White Ash	-	-	-	1	-
Sugar Maple	-	-	-	1	-
Black Oak	-	-	-	1	-
Scotch Pine	-	-	-	-	1
Hawthorn[1]	-	-	-	-	+
Quaking Aspen	-	-	-	-	+
Shagbark Hickory	-	-	-	-	++
Red Maple	-	-	-	-	++
Bitternut Hickory	-	-	-	-	++
White Pine	-	-	-	-	++
No. Species (Total = 16)	-	-	-	9	11

Average No. of Species = 10

[1] Listed under shrub layer in individual site summaries.

Table 6.29. Abundance and cover value of trees on the ROW for the Lake Plain regions.
(see Vol. 1, p. 3-3 for value of symbols).

	Mesic Habitat on Sites				
Species on ROW	11	12	13	14	15
Black Cherry	2	+	+	1	-
White Ash	3	++	++	1	-
American Elm	1	+	+	+	-
Red Maple	3	-	+	3	4
Red Oak	+	1	-	2	+
Bitternut Hickory	++	-	-	+	++
Pin Cherry	-	-	-	3	2
Hawthorn[1]	3	-	-	1	-
Quaking Aspen	-	++	-	3	1
Hornbeam	3	-	-	++	-
Sassafras	-	2	-	3	-
Flowering Dogwood	++	-	-	1	-
Basswood	+	+	-	-	-
Willow[1]	++	-	-	-	1
Apple	-	-	++	-	1
White Birch	++	-	-	-	-
Shagbark Hickory	-	2	-	-	-
Black Ash	2	-	-	-	-
Black Locust	3	-	-	-	-
Large-tooth Aspen	-	-	1	-	-
Cottonwood	-	-	+	-	-
White Oak	-	-	-	+	-
Alternate-leaved Dogwood	++	-	-	-	-
Chestnut Oak	++	-	-	-	-
White Cedar	+	-	-	-	-
No. Species (Total = 25)	17	8	7	13	7

Average No. of Species = 10.4

[1] Listed under shrub layer in individual site summaries.

Table 6.30. Abundance and cover value of trees on the ROW for the Lake Plain region.
(see Vol. 1, p. 3-3 for value of symbols).

	Hydric Habitat on Sites				
Species on ROW	11	12	13	14	15
Willow[1]	1	2	3	1	+
White Ash	-	+	3	1	4
American Elm	2	3	-	+	1
Black Cherry	+	+	++	1	-
Red Maple	+	-	3	-	3
Quaking Aspen	-	+	+	3	-
Apple	-	+	-	-	1
Black Locust	1	-	+	-	-
Black Ash	1	-	-	-	-
White Cedar	1	-	-	-	-
White Oak	+	-	-	-	-
Hawthorn[1]	-	-	-	-	+
Basswood	-	++	-	-	-
Red Oak	-	++	-	-	-
Bitternut Hickory	-	++	-	-	-
No. Species (Total = 15)	8	9	6	5	6

Average No. of Species = 6.8

[1] Listed under shrub layer in individual site summaries.

Table 6.31. Trends in impact on soil organic layers and humus types in the Lake Plain region.

Site	Moisture Regime	Predominant Humus Type		Organic Layer[1] Thickness (inches)			
				ROW		Forest	
		ROW	Forest	Mesic	Xeric	Mesic	Xeric
11	Mesic	Deep medium mull A1=4.0" thick	Deep medium mull A1=4.6" thick	0.3	-	0.3	-
12	Mesic	Deep sand mull A1=4.0" thick	Very deep sand mull A1=5.0" thick	1.1	-	1.1	-
13	Mesic	Deep medium mull-P A1=4.0" thick	Very deep medium mull A1=5.5" thick	0.6	-	0.4	-
14	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	0.6	-	0.7	-
15	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	0.8	-	0.9	-
	Xeric	Very shallow sand mull A1-0.3" thick	Very shallow sand mull A1=0.4" thick	-	0.5	-	0.6
Average thickness - all sites				0.7	0.5	0.7	0.6
Average thickness - mesic and xeric combined				0.6		0.7	

[1] Includes all layers (litter, fermentation, and humus) where present.

Table 6.32. Trends in impact on erosion in the Lake Plain regior

Site	Active Erosion		Sediment Disposition
	ROW	Forest	
11	Moderate sheet and rill erosion on one area of general ROW; moderate sheet and rill erosion on logging road, excavation, and path at spring seep	Moderate sheet erosion on one area of general forest	All sediment deposited on lower slopes of ROW or forests
12	Slight sheet erosion on several bare areas on general ROW; moderate sheet, rill and gully erosion on tower site, stream bank and sand pile	Slight sheet erosion on several areas of bare soil in general forest; moderate to severe sheet and gully erosion on disturbed stream bank and building excavation	Sediment from stream bank erosion enters stream; all other collects on lower slopes
13	Slight sheet erosion on several bare areas of silt loam soil on general ROW and tower site; slight to moderate sheet and gully erosion along drainage ditches	Slight sheet erosion on several bare areas of silt loam soil in general forest	Sediment from ditch banks leave ROW via ditches; other collects on lower slopes
14	No erosion on general ROW; slight to moderate sheet and rill erosion at 6 tower sites and 2 staging-stringing areas; slight erosion of access road water bars; severe erosion at culvert crossing	No erosion under forest conditions	Some from bank erosion at culvert entered streams; most accumulated on lower slopes of ROW
15	No erosion on general ROW; slight to moderate sheet erosion on access road, road water bars and culvert crossing	No erosion under forest conditions	Some from bank erosion at culvert entered stream; most accumulated on lower slopes on ROW

Table 6.33. Trends in impact on wildlife use of the ROW's in the Lake Plain region.

Wildlife Species	Areas Used by Wildlife Sites				
	11	12	13	14	15
Game mammals					
White-tailed deer	ROW & Forest	-	ROW	ROW	ROW
Cottontail rabbit	ROW	ROW & Edges	ROW	ROW	ROW
Raccoon	ROW	-	-	-	-
Woodchuck	ROW 2 burrows	-	-	ROW 1 burrow	-
Gray squirrel	-	-	Adjacent to ROW	-	ROW
Game birds					
Ruffed grouse	-	-	-	ROW	-
Woodcock	ROW	-	ROW	ROW	ROW
Canvasback	-	-	ROW	-	-
Ringnecked pheasant	ROW	ROW	ROW	-	-
Canada goose	-	-	ROW	ROW	ROW
Nongame birds					
Song birds & raptors	ROW 31 species	ROW 11 species	ROW 16 species	ROW 30 species	ROW 24 species
Small nongame mammals					
Oppossum	-	ROW	-	-	-
Mole	-	-	ROW	-	ROW

Table 6.34. Percent change of land use prior to (or near the time of construction) and after construction of the ROW for sites within the Lake Plain region.[1]

Land Use		Percent change expressed as increase (+), decrease (-), no change (0), or no recorded land use with no change (NC).[2] Sites 11	12	13	14	15	Ave. % Change
(A)	Agriculture	-1.0	-58.8	0	-7.1	-7.1	-14.8
(C,I)	Commercial & Industrial	NC	-0.3	NC	0	0	-0.1
(E)	Extractive Industry	NC	NC	0.3	NC	NC	0.1
(F)	Forest Land	1.0	-1.4	-.3	17.8	17.8	7.0
(N)	Non-productive	NC	NC	NC	NC	NC	0
(OR)	Outdoor Recreation	NC	NC	NC	0	0	0
(P)	Public & Semi-public	NC	5.4	NC	NC	NC	1.1
(R)	Residential	0	43.3	0	0.3	0.3	8.8
(T)	Transportation	NC	0	NC	0	0	0
(U)	Urban Inactive	NC	11.8	NC	NC	NC	2.4
(W)	Water Resources	0	0	0	-11.0	-11.0	-4.4

[1] Site 22, which is on the southern border of this region, was put in the Appalachian Highlands and Catskill regions owing to its closer vegetative relationship to that region. For consistency of analysis with trends of vegetation, soils, wildlife and water sections a similar change was made here.

[2] Percentages are derived from each individual case history of the sites and expressed to a 10th of a percent. Percentages were not adjusted to insure cancellation of land use increase or decrease by site.

Table 6.35. Multiple land use of ROW sites within the Lake Plain region.[1]

Multiple Use	Sites					% of Sites with Multiple Use
	11	12	13	14	15	
Use of access roads for adjacent logging operations						0
Agriculture	X					20
Extension of residential property		X	X			40
Fishing						0
Hiking		X				20
Horseback riding						0
Hunting				X	X	40
Industrial Uses[2]						0
Other recreational uses		X				20
Snowmobiling		X	X	X	X	80

[1] Site 22, which is on the southern border of this region, was put in the Appalachian Highlands and Catskill regions owing to its closer vegetative relationship to that region. For consistency of analysis with trends of vegetation, soils, wildlife and water sections, a similar change was made here.

[2] Use by adjacent industry as extension of property, or piling of discarded material associated with that industry.

6.5 Trends in the Adirondack, Tug Hill, and St. Lawrence-Champlain Regions

6.5.1 Trends in Impact on Vegetation

Relation of plant communities to habitat and forest type Six sites were studied in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions where a diversity of northern forest types are characteristic natural vegetation (Table 6.36).

General trends in development of vegetation on the ROW's in relation to habitat and forest type may be summarized from the data collected as follows (Table 6.37):

(1) On mesic habitat areas where northern hardwoods and mixtures of those species with white pine, hemlock, and spruce fir adjoined the ROW's, or where aspen and birch were present as an early successional stage, a Blackberry-Goldenrod ROW community developed. (Table 6.37).

These mesic habitats were characterized by their location on lower to middle slopes with free drainage. The soil pH ranged from pH 4.0 to pH 5.8, with an average pH of 4.7.

(2) On xeric habitat areas where white pine was the dominant tree species, or where aspen and birch were present as an early successional stage, a Blueberry-Bracken ROW community developed (Table 6.37).

These xeric habitats were characterized by their location on upper to middle slopes, or upland areas, with excessive drainage. The soil pH ranged from pH 4.6 to pH 5.4, with an average pH of 4.9.

(3) On hydric habitat areas where elm, red maple, red spruce, and balsam fir were dominant, a Willow-Sensitive Fern, or a Willow-Sphagnum ROW community developed (Table 6.37).

These hydric habitats were characterized by their location in stream bottoms and in depressed areas with impeded drainage. The soil pH ranged from pH 4.7 to pH 6.8, with an average pH of 5.5.

Species Diversity A consistent trend was shown in species diversity on all habitat areas for all sites. The number of species was markedly greater on the ROW's than in the adjoining forests (Table 6.38).

This more diverse flora on the ROW's indicates better wildlife food conditions, as well as an attractive appearance.

Impacts on Shrubs and Low-Growing Trees Shrubs are important components of the ROW communities which enhance wildlife habitat and add to the attractiveness of scenery. Therefore, they received special attention and are grouped below into various categories to indicate their status on the ROW's studied.

1. Common shrubs and low-growing trees which were more prominent, or of equal prominence, on the ROW's as compared with adjoining forests are:

blackberry	blueberry, sour-top	spiraea
blueberry, low	bristly sarsaparilla	Virginia creeper

2. Common shrubs and low-growing trees which occured only on the ROW's are:

hawthorn	mountain-holly	staghorn-sumac
	smooth sumac	

3. Common shrubs and low-growing trees which occurred only in the forests are:

fly-honeysuckle	hobblebush	trailing arbutus
gooseberry	maple-leaved viburnum	

4. Common shrubs and low-growing trees which occurred both in the forests and on the ROW's, but in lesser abundance on the ROW's, are:

alder	dewberry	striped maple
black chokeberry	mountain-maple	teaberry

Impact on Herbaceous Plants Herbaceous vegetation on the ROW's had developed to form a complex mixture which consists of species from the forest mixed with invading species typical of open areas such as old fields. As a result, there were considerably more herbaceous species on the ROW's than in the forests on all sites studied in these regions.

Species of open areas which were found commonly on the ROW's and were either absent, or very sparse, in the forests included: goldenrods, asters, St. John's-wort, yarrow, sheep-sorrel, sedges, wild strawberry, spreading dogbane, and boneset.

Certain important species, however, were common both in the forests and on the ROW's and these included such common plants as bracken, trout-lily, poverty-grass, hair-cap moss, bluebead-lily, sensitive fern, false hellebore, wild lily-of-the-valey, horsetails, touch-me-not, and sphagnum. Also found both on the ROW's and in the forests were: interrupted fern, cinnamon-fern, and royal fern.

Some characteristic forest plants were either absent, or very sparse, on the ROW's. Prominent among these were: partridge-berry, shining club-moss, tree-club-moss, wild sarsaparilla, goldthread, painted trillium, purple trillium, twisted-stalk, and wood-anemone. Forest ferns not found on the ROW's included: marginal shield-fern, lady-fern, and oak-fern.

Trees on the ROW (Sites 16 - 21)

Xeric Habitat (Table 6.39) The most common species on the 2 xeric plots in this region were pin cherry, red maple, white pine, gray birch, and hawthorn which ranged from very sparse (++) to covering 1/4 - 1/2 of the ROW area (3). Other common species were quaking aspen and red oak.

The number of species was 7 on both sites. A total of 9 species was reported as invading the ROW. While brush control was excellent on both ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on both ROW's. These trees can be expected to gradually emerge from the shrub layer.

Mesic Habitat (Table 6.40) The most common species were quaking aspen, pin cherry, red maple, black cherry, gray birch, and yellow birch which ranged from very sparse (++) to covering 1/2 - 3/4 of the ROW (4). Willow was also fairly common on the ROW's.

The number of species on a ROW ranged from 3 to 15. A total of 26 species was reported as invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to gradually emerge from the shrub layer.

Hydric Habitat (Table 6.41) The most common species were red maple and willow which ranged from very sparse (++) to covering 1/4 - 1/2 of the ROW area (3). Other common species were gray birch, quaking aspen, pin cherry, black cherry, and red spruce.

The number of species on a ROW ranged from 5 to 11. A total of 19 species were reported as invading the ROW. While brush control was excellent on all ROW's, with height mostly under 8-10 feet, there was a large reservoir of resurging tree species present on all ROW's. These trees can be expected to emerge from the shrub layer.

6.5.2 Trends in Impact on Soil

Bedrock geology in this region is predominantly granite and granitic gneiss on sites 16, 17, 19, and 20, and sandstone, shale, and some limestone on sites 18 and 21. Soils developed in both unsorted glacial till and stratified glacial outwash deposits on all sites. The 28 soil series mapped on these study areas were classified mostly as Spodosols and Inceptisols. Surface mineral soils are strongly to very strongly acid sandy loams, loamy sands and loams, except for minor inclusions of neutral soil variants on site 18.

There were no major negative effects of ROW management on organic layers of the general ROW's in this region. Minor differences observed, in contrast to forest conditions, included a change in origin of litter from tree-part remains to leaves and stems of grasses, herbs, and shrubs and a slight reduction in average thickness of organic mulch on the ROW's (Table 6.42). Humus types were thin duff mulls on both the ROW's and forests of sites 16, 17A, 19, 20, and 21, and thin mors on site 17B and xeric habitat of site 18. The difference in humus types on the mesic habitat of site 18, thick mor in the forest and thin duff mull-G on the ROW, was likely a result of modification on the ROW due to past grazing activities.

Impacts of ROW management on soil erosion in this region were most severe on disturbed areas such as access roads, tower sites, and excavations where various degrees of sheet, rill, or gully erosion occurred on all sites (Table 6.43). In addition, wind erosion occurred in exposed fine sandy soils on some disturbed areas of sites 18 and 20. Soil erosion on relatively undisturbed general ROW's was minimal; limited to sporadic sheet and rill erosion on 3 of the 6 study areas. Erosion in the bordering forest was practically non-existent, restricted to 1 small area of sheet erosion on site 16. Some sedimentation occurred in streams and water impoundments on the ROW's of sites 16, 17, 20, and 21, and some sediment was carried by wind (sites 18 and 20), but otherwise, they accumulated on lower slopes and did not leave the ROW's. The most obvious trend, therefore, was for the ROW's in this region to show negative impacts only on disturbed segments of the ROW, with minor insignificant effects on the general ROW's where good organic mulch and vegetation cover was maintained.

6.5.3 Trends in Impact on Wildlife

Fifteen common wildlife species, plus numerous song birds and raptors, made active use of the ROW's on the 6 sites studied in the regions (Table 6.44).

From 10 to 27 species of song birds and raptors were using the ROW's. Special notice was paid to the use of the ROW's on 5 of the 6 sites by pileated woodpeckers and on 1 site by a Cooper's hawk.

White-tailed deer used the ROW's on all 6 sites. Woodchuck burrows were observed on 2 ROW's and varying hare on 3 ROW's. Other small mammals using the ROW's included gray squirrel, red squirrel, chipmunk, and raccoon. Various snakes and frogs also made use of habitats on the ROW's which suited their needs.

Deer browse studies on 4 sites yielded data indicating that the ROW's and edges were producing more browse than the adjacent forests. Deer utilized the woody shrubs and low trees in all the ROW areas. These included: blackberry, raspberry, red osier dogwood, mountain-holly, black chokeberry, alder, nannyberry, wild-raisin, elderberry, alternate-leaved dogwood, spiraea, and shrubby willows. This is a valid indication that the ROW's are supplying valuable winter food for deer.

6.5.4 Trends in Impact on Water

Four streams were sampled on sites in these regions (Table 6.45), and 3 of these were officially classified as trout streams.

On site 16, a Class C trout stream and an unnamed tributary were partially shaded on the ROW by shrubs and tall herbs. Water temperature in Putnam Creek on August 4 was 1.0 C higher on and below the ROW than 100 yards above. Sediment was negligible.

On site 19, a small stream in a wet meadow was shaded on the ROW, mostly by shrubs and tall herbs. Water temperature in August was equal downstream of the ROW as compared with above, although the temperature was 1.0 C higher on the ROW. Sediment was composed of debris trapped between rocks and fallen branches.

On site 21, a Class AA trout stream was partially shaded on the ROW by trees, shrubs, and tall herbs. Water temperature in August was 2.0 C higher on and below the ROW than above.

Also on site 21, a Class C trout stream was ponded on the ROW. Water temperature in August was 1.0 C lower below the ROW than above. Sedimentation was high on the ROW where the pond acted as a sediment basin and the access road forded the pond. In September, the pond temperature was 4.0 C higher than above the ROW.

In general, the ROW's had a slight effect on temperature of free-flowing water at the times sampled. The maximum temperature recorded (18 C) was below the toleration limits of trout (24 C to 28 C) and within the good fishing temperatures of 18 C to 20 C often given by New York fly fishermen (Heacox, 74)

6.5.5 Trends in Impact on Land Use

Changes in Adjacent Land Use The percent change in land use prior to (or near the time of construction) and after construction of the ROW has been compared for 7 sites (sites 16,17a,17b,18,19,20, and 21) found within the Adirondack, Tug Hill, and St. Lawrence-Champlain regions (Table 6.47). Percent change by land use type is determined for each site and all 7 sites as an average percent change. The highest percent change in land use for any single site was a decrease in agriculture for site 18 by 21.1%. Zero % change in land use was by far most frequently recorded, both by land use type, and by site. As a result, the average percent changes by land use are consistently low, with the highest average percent change being a 3.3% decrease in agriculture for sites in this region. Other average percent changes recorded are a slight increase in extractive industry (0.2%), and an increase in forest land (3.1%).

Other factors which may influence the impact on adjacent land use include visual characteristics of the ROW's. General reconnaissance of pleasing or objectionable visual characteristics associated with vegetation and other features specific to each site, indicates that of the 7 sites, 3 are generally pleasing to view (sites 16,20, and 21) and 4 are neither pleasing nor objectionable (sites 17a,17b,18, and 19). Visual assets of the sites which are pleasing include: opening of vistas, complement of adjacent woods by on ROW vegetation species, and general harmony with the surrounding landscape. The 4 remaining sites are described as neither pleasing nor objectionable, generally because they lack visual assets or expose undesirable characteristics such as erosion and other less desirable features. Although subjective, reconnaissance of these sites reflects a general absence of long-term negative visual characteristics in objectionable contrast with the surrounding landscape. No effect on adjacent land use change or a specific visual characteristic is apparent.

A general trend for land use adjacent to the ROW sites within the Adirondack, Tug Hill, and St. Lawrence-Champlain regions is that there is very little change in land use for the period measured. Of the changes recorded, agriculture was decreasing, and being replaced by forest land. Another trend is the general absence of long-term negative visual characteristics resulting from clearing, construction, or maintenance of the ROW, that appear in objectionable contrast with the surrounding land use. It would be difficult to derive other distinct trends because of the few number of sites sampled and the high variability of influences other than the ROW which could affect land use change.

Multiple Uses Multiple uses of the ROW's within these regions include: use of access roads for adjacent wood cutting and logging operations; agriculture; extension of residential property; fising; hiking; horseback riding; snowmobiling; hunting; and other recreational uses (Table 6.48). Most noticeable is the large number of different multiple land uses found within this group of sites.

No distinguishable trend can be observed on the ROW's, as a variety of multiple uses are occurring.

Table 6.36. Trends in impact on vegetation in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Site	Region	Habitat	Forest Type	Type of Management	ROW Community
16	Adirondack East	Mesic	White Pine-Northern Hardwoods	Selective & Broadcast	Blackberry-Goldenrod
17	Adirondack East	Mesic	Spruce Fir-Northern Hardwoods	Selective & Broadcast	Blackberry-Goldenrod
18	St. Lawrence-Champlain	Mesic	Northern Hardwoods	Broadcast, Foliar	Blackberry-Goldenrod
19	Adirondack West	Mesic	Northern Hardwoods	Selective & Broadcast	Blackberry-Goldenrod
20	Adirondack West	Mesic	Aspen-Birch	Broadcast	Blackberry-Goldenrod
21	Tug Hill Border	Mesic	Hemlock-Northern Hardwoods	Selective	Blackberry-Goldenrod
16	Adirondack East	Xeric	White Pine	Selective & Broadcast	Blueberry-Bracken
18	St. Lawrence-Champlain	Xeric	Aspen-Birch	Broadcast, Foliar	Blueberry-Bracken
16	Adirondack East	Hydric	Elm-Red Maple	Selective & Broadcast	Willow-Sensitive Fern
17	Adirondack East	Hydric	Northern Hardwoods-Red Maple	Selective & Broadcast	Willow-Sensitive Fern
18	St. Lawrence-Champlain	Hydric	Elm-Red Maple	Broadcast, Foliar	Willow-Sensitive Fern
19	Adirondack West	Hydric	Spruce-Fir	Selective & Broadcast	Willow-Sensitive Fern
20	Adirondack West	Hydric	Spruce-Fir	Broadcast	Willow-Sphagnum
21	Tug Hill Border	Hydric	Elm-Red Maple	Selective	Willow-Sensitive Fern

Table 6.37. Trends in plant community development in relation to forest type and habitat of the Adirondack, Tug Hill, and St. Lawrence-Champlain regions. The figures in parenthesis are percent constancy.[1]

Adjacent Forest	ROW Community	
MESIC		
White Pine-Northern Hardwoods Spruce Fir-Northern Hardwoods Northern Hardwoods Aspen-Birch Hemlock-Northern Hardwoods	Blackberry (100) - with Spiraea (100) Raspberry (50) Choke-cherry (50)	Goldenrod (100) Asters (100) Bracken (100) Sedge (83) Strawberry (83) Hair-cap Moss (83) Mixed Grass (83) Dog's-tooth Violet (66) Wild Lily-of-the-valley (66)
XERIC		
White Pine Aspen-Birch	Blueberry (100) - with Spiraea (100) Hawthorn (100) Blackberry (100)	Bracken (100) Mixed Grass (100) Spreading Dogbane (100) Goldenrod (100) Poverty Grass (100) Hair-cap Moss (100) Reindeer Lichen (100)
HYDRIC		
Elm-Red Maple Spruce-Fir	Willow (100) - with Spiraea (100) Blackberry (83) Wild-raisin (50) Black Choke-berry (100) Common Alder (50)	Sensitive Fern (83) Mixed Grass (83) Strawberry (66) Boneset (50) False Hellebore (50) Dog's-tooth Violet (50) Royal Fern (50)

[1] Constancy is a percentage which equals $\frac{\text{No. of stands in which found}}{\text{Total no. of stands}} \times 100$

Table 6.38. Comparison of species diversity, based on number of species, on ROW's with that in the adjoining forests in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Site	No. of Species[1]					
	Mesic		Xeric		Hydric	
	Forest	ROW	Forest	ROW	Forest	ROW
			Shrubs			
16	2	6	3	5	8	7
17	3	5	-	-	2	5
18	2	6	3	7	6	10
19	7	7	-	-	8	8
20	4	5	-	-	7	7
21	3	5	-	-	1	5
Average -	3.5	5.6	3.0	6.0	5.3	7.0
			Herbs			
16	13	19	9.5	15	12	21
17	8	18	-	-	13	16
18	12	17	8	10	7	18
19	12	12	-	-	15	24
20	17	22	-	-	11	16
21	18	20	-	-	7	17
Average -	13.3	18.0	8.8	12.5	10.8	18.7

[1] If a habitat occurs twice on a site, the total number of species for both areas is totaled, then divided by 2 for an average. This average is then rounded off to the nearest whole number.

Table 6.39. Abundance and cover value of trees on the ROW for the Adirondack, Tug Hill, and St. Lawrence-Champlain regions. (see Vol. 1, p. 3-3 for value of symbols).

	Xeric Habitat on Sites					
Species on ROW	16	17	18	19	20	21
Pin Cherry	3	-	1	-	-	-
Red Maple	++	-	2	-	-	-
White Pine	+	-	1	-	-	-
Gray Birch	++	-	1	-	-	-
Hawthorn[1]	1	-	++	-	-	-
Quaking Aspen	2	-	-	-	-	-
Red Oak	-	-	+	-	-	-
White Ash	++	-	-	-	-	-
Hemlock	-	-	++	-	-	-
No. Species (Total = 9)	7		7			

Average No. of Species = 7

[1] Listed under shrub layer in individual site summaries.

Table 6.40. Abundance and cover value for trees on the ROW for the Adirondack, Tug Hill, and St. Lawrence-Champlain regions. (see Vol. 1, p. 3-3 for value of symbols).

	Mesic Habitat on Sites					
Species on ROW	16	17	18	19	20	21
Quaking Aspen	2	3	2	-	++	1
Pin Cherry	-	1	1	+	3	4
Red Maple	-	3	3	-	+	2
Black Cherry	-	+	-	3	2	3
Gray Birch	++	3	-	-	2	2
Yellow Birch	++	+	+	-	-	3
Willow[1]	2	-	+	-	-	+
Flowering Dogwood	++	+	-	-	-	++
Serviceberry	1	-	-	-	-	+
White Ash	-	1	+	-	-	-
Large-tooth Aspen	1	-	-	-	-	++
White Pine	+	-	+	-	-	-
Hemlock	-	-	+	-	-	++
Scotch Pine	-	-	-	+	-	+
Red Oak	++	-	+	-	-	-
Hornbeam	-	-	++	-	-	+
Basswood	-	+	-	-	-	-
Red Cedar	-	-	-	-	+	-
White Birch	-	-	1	-	-	-
Hawthorn[1]	1	-	-	-	-	-
Sugar Maple	-	-	-	-	-	+
Beech	-	-	-	-	-	+
White Cedar	++	-	-	-	-	-
Red Spruce	++	-	-	-	-	-
Apple	++	-	-	-	-	-
American Elm	-	-	++	-	-	-
No. Species (Total = 26)	13	9	12	3	6	15

Average No. of Species = 9.7

[1] Listed under shrub layer in individual site summaries.

Table 6.41. Abundance and cover value of trees on the ROW for the Adirondack, Tug Hill, and St. Lawrence-Champlain regions. (see Vol. 1, p. 3-3 for value of symbols).

	Hydric Habitat on Sites					
Species on ROW	16	17	18	19	20	21
Red Maple	++	3	3	+	2	1
Willow[1]	-	3	2	1	1	3
Gray Birch	-	2	-	3	3	1
Quaking Aspen	-	+	1	-	1	1
Pin Cherry	-	++	+	-	+	1
Black Cherry	-	+	-	-	+	2
Red Spruce	-	-	-	1	1	-
Serviceberry	1	-	-	-	1	-
White Ash	++	1	-	-	-	-
White Pine	++	-	-	-	++	-
American Elm	-	-	++	-	-	++
Balsam Fir	-	-	-	2	-	-
White Birch	-	-	1	-	-	-
Flowering Dogwood	-	-	-	-	-	1
Black Walnut	+	-	-	-	-	-
Beech	-	+	-	-	-	-
Basswood	-	++	-	-	-	-
Apple	-	++	-	-	-	-
Yellow Birch	-	+	-	-	-	-
No. Species (Total = 19)	5	11	6	5	9	8

Average No. of Species = 7.3

[1] Listed under shrub layer in individual site summaries.

Table 6.42. Trends in impact on soil organic layers and humus types in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Site	Moisture Regime	Predominant Humus Type		Organic Layer[1] Thickness (inches)			
				ROW		Forest	
		ROW	Forest	Mesic	Xeric	Mesic	Xeric
16	Mesic	Thin duff mull w/ shallow A1	Thin duff mull w/ shallow A1	1.8	-	1.1	-
	Xeric	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	-	1.2	-	1.1
17A	Mesic	Thin duff mull w/ very shallow A1	Thick duff mull w/ very shallow A1	1.0	-	1.6	-
17B	Mesic	Thin mor	Thin mor	1.3	-	0.5	-
18	Mesic	Thin duff mull-G w/ very shallow A1	Thick mor	0.6	-	1.2	-
	Xeric	Thin mor	Thin mor	-	0.4	-	0.8
19	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ shallow A1	1.2	-	1.5	-
20	Mesic	Thin duff mull w/ very shallow A1	Thin duff mull w/ very shallow A1	0.5	-	1.1	-
21	Mesic	Thin duff mull w/ very shallow A1	Thick duff mull w/ very shallow A1	0.7	-	1.6	-
Average thickness - all sites				1.0	0.8	1.2	1.0
Average thickness - mesic and xeric combined				1.0		1.2	

[1] Includes all layers (litter, fermentation, and humus) where present.

Table 6.43 Trends in impact on erosion in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Site	Active Erosion		Sediment Disposition
	ROW	Forest	
16	Slight to moderate sheet erosion on soil-slumps around boulders on general ROW; moderate to severe sheet and rill erosion on excavation, equipment cut and area disturbed by animal digging	Moderate sheet erosion on soil-slump around boulders in general forest; moderate sheet and rill erosion in excavated area	Some in pond and stream on ROW; remainder on lower slopes
17	No erosion on the general ROW; slight sheet and rill erosion on access road and bank cut; slight to moderate sheet, rill and gully erosion on an abandoned mining area	No erosion under general forest conditions	Most on lower slopes of ROW; small amounts enter stream at road crossing
18	Slight sheet erosion on general ROW; slight to severe sheet and rill erosion on access road, tower sites and equipment custs. Some wind erosion	No erosion under general forest conditions	Most collected on lower slopes; some carried by wind
19	No erosion on the general ROW; moderate to severe gully erosion on access road; moderate sheet erosion on excavations	No erosion under general forest conditions	Accumulated on lower slopes of ROW
20	Slight to moderate sheet and rill erosion on general ROW; slight to moderate sheet erosion on access road and excavation. Some wind erosion	No erosion under general forest conditions	Some in streams on ROW; some carried by wind
21	No erosion on general ROW; slight to moderate sheet; rill and some gully erosion on access roads and tower sites	No erosion under general forest conditions	Some entered streams and water impoundment on ROW; remainder collected on lower slopes

Table 6.44. Trends in impact on wildlife use of the ROW's in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Wildlife Species	Areas Used by Wildlife Sites					
	16	17	18	19	20	21
Game Mammals						
White-tailed deer	ROW	ROW	ROW	ROW	ROW	ROW
Woodchuck	Adjacent to ROW	-	ROW	ROW	-	-
Varying hare	-	-	ROW	ROW	ROW	ROW
Gray squirrel	-	-	ROW	-	-	-
Game birds						
Ruffed grouse	Adjacent to and on ROW	ROW	-	Adjacent to ROW	ROW & Adjacent	ROW & Edge
Canada goose	-	ROW	ROW	ROW	-	ROW
Shoveler duck	ROW	-	-	-	-	-
Black duck	ROW	-	-	-	-	-
Nongame birds						
Song birds & raptors	22 species on ROW	10 species on ROW	20 species on ROW	27 species on ROW	15 species on ROW	27 species on ROW
Pileated woodpecker	ROW	ROW	ROW	ROW	-	ROW
Small nongame mammals						
Fox	-	-	-	-	-	ROW
Red squirrel	-	-	-	-	-	ROW
Muskrat	Adjacent to ROW	-	-	-	-	-
Chipmunk	-	-	-	ROW	-	-
Beaver	Adjacent to ROW	-	-	-	-	-
Coyote	Adjacent to ROW	-	-	-	-	-
Raccoon	-	-	-	ROW	-	Adjacent to ROW

Table 6.45. Trends in impact on water in the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Location in Respect to ROW	Border Vegetation	Stream Temp. in Centigrade; Sedimentation			
Site 16 - Putnam Creek (Class C Trout)					
		Oct. 1	Feb. 19	May 13	Aug. 4
		Temperature			
1 - 100 yards upstream	Trees - shaded	13.0	0.0	10.0	17.0
2 - North of ROW	Trees - partial shade	13.0	0.0	10.0	17.0
3 - Mid ROW	Shrubs and herbs partial shade	13.5	0.0	10.0	18.0
4 - Tributary 25 yards upstream	Shrubs and herbs shaded	11.6	ice	12.0	16.0
5 - 100 yards downstream	Trees - shaded	13.5	0.0	10.8	18.0
			Sedimentation		
		Stakes set	-	none	none
Site 19 - Small Stream in a Wet Meadow (Nonclassified)					
		Sept. 30	Feb. 18	May 20	Aug. 1
		Temperature			
1 - 100 yards upstream	Trees - shaded	10.5	-1.0	6.0	15.0
2 - Upstream edge	Trees, shrubs and herbs - shaded	10.5	0.0	6.0	15.0
3 - Downstream edge	Trees, shrubs and herbs - shaded	10.0	-0.5	6.0	16.0
4 - 50 yards downstream	Trees - shaded	10.2	0.0	6.0	15.0
			Sedimentation		
		Stakes set	-	Debris at all stakes	1"debris at all stakes

Table 6.45. Continued

Location in Respect to ROW	Border Vegetation	Stream Temp. in Centigrade; Sedimentation			
Site 21 - Florence Creek (Class AA Trout)					
		Sept. 29	Feb. 17	May 20	Aug. 1
			Temperature		
1 - 100 yards upstream	Trees - shaded	8.5	0.0	7.3	15.0
2 - Upstream edge	Trees, shrubs and herbs - partial shade	8.5	0.0	7.0	15.2
3 - Downstream edge	Trees, shrubs and herbs partial shade	10.0	0.0	7.2	17.0
4 - 100 yards downstream	Trees - shaded	10.5	0.0	7.1	17.0
			Sedimentation		
		Stakes set	-	none	2½"gravel at 3
Site 21 - Small Stream (Class C Trout)					
		Sept. 29	Feb. 17	May 20	Aug. 1
			Temperature		
5 - 100 yards upstream	Trees - shaded	11.5	0.0	7.1	16.5
6 - Mid ROW	Man-made pond partial shade	15.5	0.0	7.0	16.0
7 - 100 yards downstream	Trees, herbs in swamp-shaded	14.0	0.0	7.0	15.5
			Sedimentation		
		Stakes set	-	½" at 5 1" at 6	1½"at 5 5" at 6 ½" at 7

Table 6.46. Percent change of land use prior to (or near the time of construction) and after construction of the ROW for sites within the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Land Use		Percent change expressed as increase (+), decrease (-), no change (0), or no recorded land use with no change (NC).[1] Sites							Ave. % Change
		16	17a	17b	18	19	20	21	
(A)	Agriculture	NC	NC	NC	-21.1	0	-0.6	-1.6	-3.3
(C,I)	Commercial & Industrial	NC	0	0	NC	NC	NC	NC	0
(E)	Extractive Industry	NC	NC	NC	0.2	NC	1.1	NC	0.2
(F)	Forest Land	0	0	0	20.7	0	-0.5	1.6	3.1
(N)	Non-productive	NC	NC	NC	0	NC	0	NC	0
(OR)	Outdoor Recreation	NC	0	NC	NC	NC	NC	NC	0
(P)	Public & Semi-public	NC	NC	0	0.2	NC	NC	NC	0
(R)	Residential	NC	0	0	NC	NC	0	NC	0
(T)	Transportation	NC	NC	0	NC	NC	NC	NC	0
(U)	Urban Inactive	NC	NC	NC	NC	NC	NC	NC	0
(W)	Water Resources	0	0	0	0	0	0	0	0

[1] Percentages are derived from each individual case history of the sites and expressed to a 10th of a percent. Percentages were not adjusted to insure cancellation of land use increase or decrease by site.

Table 6.47. Multiple land use of ROW sites within the Adirondack, Tug Hill, and St. Lawrence-Champlain regions.

Multiple Use	Sites							% of Sites with Multiple Use
	16	17a	17b	18	19	20	21	
Use of access roads for adjacent logging operations			X					14
Agriculture				X				14
Extension of residential property				X				14
Fishing	X							14
Hiking		X						14
Horseback riding				X				14
Hunting	X				X			29
Industrial uses[1]								0
Other recreational uses[2]							X	14
Snowmobiling				X	X			29

[1] Use by adjacent industry as extension of property, or piling of discarded material associated with that industry.

[2] Other recreational uses include such functions as: Use by children for play; motorcycle trails; use by all-terrain vehicles; and camping activities.

7 Statewide Trends and General Conclusions

7.1 Introduction

When the important regional trends for each of the 4 major regions of the state were examined critically, certain trends appeared to be statewide in their scope. In other words, some general impacts of ROW management have appeared which are common to all regions of New York. This, in turn, has led to a series of general conclusions which are important to improvement of the ROW management systems.

These statewide trends will be taken up under the various components of natural systems which were studied in the following sections discussing vegetation, soil, wildlife, and water. Discussion of land use and economic costs of clearing, construction, and management procedures follow.

7.2 Trends in Impact on Vegetation

7.2.1 General Impact of the ROW's

In all cases studied (22), the general ROW plant community which has developed under past management was composed of a mixture of growth forms that included low-growing trees, tall shrubs, low shrubs, herbs, grasses, ferns, and mosses. This complex mixture on the ROW's has replaced what is now in the adjacent forest and has produced a diversity of vegetation of high value to wildlife.

7.2.2 Re-establishment of Forest Cover

On all sites there was a general trend towards tree species in the adjacent forests being also present in the herb or shrub layers on ROW's. This means that, although a protective cover of shrubs, herbs, ferns, and grasses covered the ROW's, trees still invaded in large numbers and formed a reservoir of reproduction which would re-establish forest cover if not controlled. Owing to such factors as plant competition with ROW vegetation, animal browsing, microclimate changes, etc. which retard tree growth, many tree seedlings do not emerge from the ground layer, or are slow in doing so. This means further that ROW vegetation may be held as a shrub stage indefinately, as long as the emerging trees are periodically removed as they become a threat to electric power transmission.

Common species While most of the common tree species of the adjoining forests were represented on the ROW's sampled in the 4 major forest regions of New York, there was a definite trend for certain species to occur on nearly all sites and in all regions. For example, red maple was outstanding in that it was prominent on ROW's on all habitat areas in 3 of the 4 regions, while red oak was prominent on both xeric and mesic habitat areas also in 3 regions. White ash was a common species on all habitats in 2 regions, and willow was a common species on hydric habitats in all regions.

Regional differences Some distinct regional differences appeared in common key species which made a regional approach advisable. For example, chestnut oak occurred as a typical species on ROW's only on xeric habitats in the New England Highlands and Mohawk-Hudson region. In the same region, sweet birch was typical of both xeric and mesic habitats while flowering dogwood was typical of mesic and hydric habitats. The common species of the Appalachian Highlands and Catskill regions were similar to those of the preceeding region.

On the other hand, sassafras was the most common species typical of the Lake Plain on xeric habitats, with black cherry most common on mesic habitats and American elm typical of mesic and hydric habitats.

In the northern region (Adironack, et. al.) pin cherry, quaking aspen along with gray birch were typical species on all habitats. White pine was common and typical on xeric habits.

Number of species on ROW's The total number of tree species on all ROW's in a region was about the same in all 4 regions ranging only from 18 in 3 regions to 22 in one region. Number of species on any one ROW, however, varied considerably from a low of one on the site 8 hydric habitat in the Appalachian Highlands to a high of 18 on the site 9 mesic habitat. There was a trend towards more species on mesic habitats than on xeric and hydric habitats.

7.2.3 Mapped Plots on the ROW's

Vegetation has been mapped on permanent plots in each habitat on all the ROW's, except site 7 which was used for special studies.

These plots have produced exact maps of the nature and distribution of plant components of the ROW vegetation as it existed in 1975-76. Their use in future years will permit the process of vegetation development to be followed and serve as an accurate check on impact of current ROW management.

7.2.4 Common Plant Communities Developed on the ROW's

Mesic habitats A definite trend appeared in the common type of plant community developed on mesic (moist) habitat areas. This community was designated as Blackberry or Rasberry-Goldenrod, (Rubus-Solidago) in 3 regions where those species occurred in 100% of the stands, and Staghorn Sumac-Goldenrod in 1 region, where blackberry occurred in only 60% of the stands.

The two characteristic species used to identify the community, blackberry (or rasberry) and goldenrod, were not only high constancy (100%), but also exhibited higher cover and abundance on mesic than on other habitats on which they also occurred.

Other characteristic species were asters, wild strawberry, and hay-scented fern. A typical component of the community was mixed grasses which typically grew in small to large patches and was an important soil cover.

Further research may indicate that this widespread community is a generic type which can be subdivisioned on a regional basis through differential species.

Xeric habitats On xeric (dry) habitat areas in all regions, blueberry was a characteristic species of high constancy (100%) and with high abundance and cover values. On some habitat areas huckleberry replaced blueberry.

Sweet-fern was a highly characteristic species wherever it occurred. Where it was absent, bracken was used. The typical community has been designated, therefore, as either Blueberry-Sweet-fern or Blueberry-Bracken. Mixed grass in patches was also a typical component of these communities and an important soil cover.

Hydric habitats On hydric (wet) habitat areas in all regions, sensitive fern was a characteristic species of high constancy (80-100%). Willows were also characteristic with a 100% constancy in 3 regions, but were replaced in 1 region by spiraea; and in a second region, red osier dogwood was considered more characteristic than willow. The typical plant communities were designated, therefore, as either Willow-Sensitive Fern, Spiraea-Sensitive Fern, or Red Osier Dogwood-Sensitive Fern. Mixed grass in patches was a typical component of these communities and an important soil cover.

7.2.5 Diversity of Plant Species on the ROW's

The presence of a greater number of plant species on the ROW's than in adjacent forests was a consistent statewide trend in all regions. This produced a greater diversity of wildlife food and cover on the ROW's under all types of ROW management.

7.2.6 Impacts on Shrubs and Low-Growing Trees

Great variation occurred impacts on shrubs among regions and among habitats within regions; but, in general, shrubs were always present on the ROW's and usually played a dominant role in plant cover. When all sites were examined for statewide trends, all shrubs of the forest and low-growing tree species were found somewhere on a ROW. However, 1 low-growing tree, stripped maple, was typically absent from the ROW's, or very sparse, and the same was true of a few forest-dwelling shrubs including hobblebush, spicebush, and partridgeberry (a viny herb), i.e., they were absent, or very sparse, on the ROW's.

Of more importance to ROW management is that a number of important shrubs and low trees were found only on the ROW's, or were much more vigorous and abundant on them than in the adjacent forest. These include blackberry, raspberry, spiraea, blueberry, huckleberry, hazelnut, sumac, scrub-oak, sweet-fern, shrubby willows, hawthorn, and red osier dogwood. Favoring these species in management will be most effective in producing good wildlife food and cover.

7.2.7 Impacts on Herbaceous Plant Cover

A complex herbaceous vegetation developed on the ROW's in all regions which was composed of species from former forest types, along with invaders from open field areas and roadsides.

Many of the common and abundant species of the ROW's were absent, or very sparse, in adjacent forests. These were typical plants of open places such as goldenrods, asters, hawkweeds, daisies, pearly everlasting, Queen Anne's-lace, yarrow, wild strawberry, dogbane, boneset, and sheep-sorrel. Patches of mixed grasses were typical of all the ROW communities.

Certain common species of the forest were also common and abundant on the ROW's. These include bracken, hay-scented fern, whorled loosestrife, large-flowered wake-robin, sensitive fern, touch-me-not, wild lily-of-the-valley, cinquefoils, Spring-beauty, and bluebead-lily.

Some characteristic plants of the forests were either absent, or very sparse, on the ROW's. These include wild sarsaparilla, Solomon's-seal, spotted wintergreen, trilliums, twisted-stalk, Indian cucumber-root, shining club-moss, and some woods-inhabiting ferns.

7.3 Trends in Impact on Soil

7.3.1 Impact on Organic Layers

Sources of organic matter on the ROW's differed from adjacent forests in that they were mostly leaves and twigs of shrubs, herbs, and grasses as

contrasted with tree parts in the forest. However, little difference was found in occurrence or depth of organic layers on the ROW's and in the forests in any region. The small differences that were found in organic layer thickness were not of practical significance.

In general, the same humus type was found on the ROW's as in adjacent forests, with some minor exceptions.

7.3.2 Impact on Soil Erosion

Very little active erosion occurred on the general ROW areas as they were covered with adequate protective plant cover and organic mulch. Problem areas on the ROW's, where erosion was significant, were almost entirely places which had been disturbed by construction activities, or other uses not connected with transmission of electric power. These included tower sites, access roads, and excavations that had not been adequately restored to a tight cover by natural plant succession or artificial seeding. It appears important, therefore, that special attention be paid to restoration of disturbed areas on the ROW's even if it must be done some time after the line has been in use.

7.4 Trends in Impact on Wildlife

All the ROW's studied (22) were used by numerous song birds and raptors. The actual number of species observed using a ROW ranged from 11 to 35, with an average of 23 species.

Local game species commonly found using the ROW's included white-tailed deer, ruffed grouse, woodcock, wild turkey, cottontail rabbit, varying hare, woodchuck, gray squirrel, and raccoon.

Deer used the ROW's on all but 2 of the 22 sites, and those not used were in highly urbanized areas. The common shrubs on the ROW's were heavily utilized by deer as woody browse which is important as winter food. More browse was available on the ROW's and their edges than in adjacent forests.

7.5 Trends in Impact on Water

7.5.1 Impact of the ROW's on Water Temperature

The general effect of the ROW's on water temperature of free-flowing streams was negligible. Although some streams were partially shaded by shrubs and herbs as contrasted with forest cover above and below the ROW's, the partial shade, rate of flow, and width of the ROW were sufficient to prevent significant downstream increase in water temperature at the time of sampling at the sites monitored.

Types of water studied included the following diverse situations: 2 swamps, 1 Class B stream, 2 Class D streams, 2 Class C trout streams, 1 Class AA trout stream, and 1 unclassified stream in a wet meadow. Water temperature downstream of the ROW's ranged from 1.8 C less than to 2.5 C greater than that upstream of the ROW's. The maximum temperature recorded below the ROW's was 18.5 C (64.4 F) which was well below the tolerance limit of trout (24.0 C or 75.2 F).

7.5.2 Impact of the ROW's on Sedimentation

Most stream borders on the ROW's were well protected by vegetation and did not contribute materially to sedimentation and cause deterioration of stream quality. Where sedimentation was observed, it was caused by flow

into streams from used access roads, often where they forded the stream, or where erosion from disturbed areas was carried into a stream, or where soil types in the watershed led to erosion along the length of the stream.

7.6 Trends in Impact on Land Use

7.6.1 Impact on Adjacent Land Use

There is a general trend for all the regional groups considered of very little change in land use for the period measured. Of all the land uses considered, there is a trend towards a decrease in agricultural uses adjacent to the ROW's. This trend appears to reflect a statewide decline in agriculture. Another general trend is the absence of long-term negative visual characteristics that appear in objectionable visual contrast with the surrounding land use. It was noted that for all regions, a high variability of influences other than the ROW could affect land use changes, based on the limited number of sites (22) for which data was compared.

7.6.2 Multiple Uses of the ROW

A variety of multiple uses, particularly recreational uses which are able to take advantage of linear ROW's, were found to exist. Hunting is the most predominant for all sites considered, indicating the ROW's are well suited for this activity.

7.7 Economic Costs of Clearing, Construction, Restoration, and Management Procedures

Based on the sparseness of historic cost data available as documented under background information for each of the 22 sites, it would be useless and misleading to postulate cost effectiveness or other economic conclusions concerning the various construction and management procedures used on the study sites. This is due to the wide variation in current costs of the various ROW procedures used, which are, in turn, caused by variations in regional labor rates, site conditions, company practices, wide variation of time in years work was performed, and other factors which vary from site to site.

For these reasons, an attempt to assemble even typical costs and ascribing them to the procedures used historically on study sites for purposes of cost-effectiveness analyses was not considered further.

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9 Appendix

LIST OF APPENDIXES

Appendix 1. Tree, Shrub, and Herb Species on the 22 Sites in New York, on the ROW and in the Adjacent Forest.

Common Name	Scientific Name
Trees	
Alternate-leaved Dogwood	Cornus alternifolia
American Elm	Ulmus americana
American Hop-Hornbeam	Ostrya virginiana
American Hornbeam	Carpinus caroliniana
Apple	Pyrus malus
Aspen	Populus spp.
Balsam-Fir	Abies balsamea
Basswood	Tilia americana
Beech	Fagus grandifolia
Bitternut Hickory	Carya cordiformis
Black Ash	Fraxinus nigra
Black Cherry	Prunus serotina
Black Gum	Nyssa sylvatica
Black Locust	Robinia Pseudo-Acacia
Black Oak	Quercus velutina
Black Walnut	Juglans nigra
Butternut	Juglans cinerea
Chestnut	Castanea dentata
Chestnut-Oak	Quercus Prinus
Common Juniper	Juniperis communis
Cottonwood	Populus deltoides
Flowering Dogwood	Cornus florida
Gray Birch	Betula populifolia
Hemlock	Tsuga canadensis
Hickory	Carya spp.
Juniper	Juniperus spp.
Large-toothed Aspen	Populus grandidentata
Mockernut Hickory	Carya tomentosa
Norway Spruce	Picea Abies
Oak	Quercus spp.
Pignut Hickory	Carya glabra
Pin-Cherry	Prunus pensylvanica
Pine	Pinus spp.
Pitch-Pine	Pinus rigida
Quaking Aspen	Populus tremuloides
Red Cedar	Juniperus virginiana
Red Maple	Acer rubrum
Red Oak	Quercus rubra
Red Pine	Pinus resinosa
Red Spruce	Picea rubens
Sassafras	Sassafras spp.
Scotch Pine	Pinus sylvestris
Scrub-Oak	Quercus ilicifolia
Serviceberry	Amelanchier spp.

Appendix 1. Continued

Common Name	Scientific Name
Shagbark-Hickory	Carya ovata
Slippery Elm	Ulmus rubra
Sugar-Maple	Acer saccharum
Sweet Birch	Betula lenta
Sycamore	Platanus occidentalis
Tree-of-heaven	Ailanthus altissima
Tulip-Poplar	Liriodendron Tulipifera
White Ash	Fraxinus americana
White Birch	Betula papyrifera
White Cedar	Chamaecyparis thyoides
White Oak	Quercus alba
White Pine	Pinus Strobus
White Sassafras	Sassafras albidum
Yellow Birch	Betula lutea
Shrubs	
Alder	Alnus spp.
American Bladder-nut	Staphylea trifolia
American Hazelnut	Corylus americana
American Yew	Taxus canadensis
Arrow-wood	Viburnum recognitum
Azalea	Rhododendron spp.
Barberry	Berberis spp.
Bayberry	Myrica pensylvanica
Blackberry	Rubus alleghenienses
Black Chokeberry	Pyrus melanocarpa
Black-haw	Viburnum prunifolium
Blueberry	Vaccinium spp.
Bristly Sarsaparilla	Aralia hispida
Buckthorn	Rhamnus spp.
Bush-Honeysuckle	Diervilla Lonicera
Buttonbush	Cephalanthus occidentalis
Chokeberry	Pyrus spp.
Choke-Cherry	Prunus virginiana
Climbing Bittersweet	Celastrus scandens
Common Alder	Alnus serrulata
Crab-Apple	Pyrus spp.
Dewberry	Rubus spp.
Dogwood	Cornus spp.
Elderberry	Sambucus spp.
Fly-Honeysuckle	Lonicera canadensis
Fragrant Sumac	Rhus aromatica
Gooseberry	Ribes spp.
Grape	Vitis spp.

Appendix 1. Continued

Common Name	Scientific Name
Gray Dogwood	Cornus racemosa
Ground-Juniper	Juniperis communis var. depressa
Hardhack	Spiraea tomentosa
Hawthorn	Crataegus spp.
Hazelnut	Corylus spp.
Highbush-Blueberry	Vaccinium corymbosum
Hobblebush	Viburnum alnifolium
Honeysuckle	Lonicera spp.
Huckleberry	Gaylussacia spp.
Japanese Honeysuckle	Lonicera japonica
Labrador-tea	Ledum groenlandicum
Low Blueberry	Vaccinium vacillans
Low Sweet Blueberry	Vaccinium angustifolium
Maple-leaved Viburnum	Viburnum acerifolium
Meadow-sweet	Spiraea latifolia
Mountain-Ash	Pyrus spp.
Mountain-Holly	Ilex montana
Mountain-Laural	Kalmia latifolia
Mountain-Maple	Acer spicatum
Nannyberry	Viburnum Lentago
New Jersey Tea	Ceanothus americanus
Ninebark	Physocarpus opulifolius
Northern Prickly Ash	Xanthoxylum americanum
Pinxter-flower	Rhododendron nudiflorum
Poison Ivy	Rhus radicans
Poison Sumac	Rhus Vernix
Purple-flowering Raspberry	Rubus odoratus
Pussy-Willow	Salix discolor
Rambler Rose	Rosa multiflora
Raspberry	Rubus idaeus
Red Elderberry	Sambucus pubens
Red Osier Dogwood	Cornus stolonifera
Rhododendron	Rhododendron spp.
Rose	Rosa spp.
Rubus	Rubus spp.
Shrubby Cinquefoil	Potentilla fructicosa
Silky Dogwood	Cornus obliqua
Smooth Sumac	Rhus glabra
Sour-top-Blueberry	Vaccinium myrtilloides
Speckled Alder	Alnus rugosa
Spicebush	Lindera Benzoin
Spiraea	Spiraea spp.
Staghorn-Sumac	Rhus typhina
Striped Maple	Acer pensylvanicum

Appendix 1. Continued

Common Name	Scientific Name
Sumac	*Rhus* spp.
Summer-sweet	*Clethra alnifolia*
Sweet-fern	*Comptonia peregrina*
Tartarian Honeysuckle	*Lonicera tatarica*
Teaberry	*Gaultheria procumbens*
Trailing Arbutus	*Epigaea* spp.
Viburnum	*Viburnum* spp.
Virginia Creeper	*Parthenocissus quinquefolia*
Virgin's-bower	*Clematis virginiana*
White Elderberry	*Sambucus canadensis*
Wild-raisin	*Viburnum cassinoides*
Willow	*Salix* spp.
Winterberry	*Ilex verticillata*
Witch-Hazel	*Hamamelis virginiana*
Herbs	
Algae	*Algae* spp.
American Dog-Violet	*Viola conspersa*
American Marsh-Pennywort	*Hydrocotyle americana*
Angelica	*Angelica* spp.
Annual Bluegrass	*Poa annua*
Arrowhead	*Sagittaria* spp.
Asparagus	*Asparagus officinalis*
Aster	*Aster* spp.
Avens	*Geum* sp.
Barren Strawberry	*Waldsteinia fragariodes*
Basil	*Satureja vulgaris*
Bastard Toad-flax	*Comandra umbellata*
Bedstraw	*Galium* spp.
Beech-Fern	*Dryopteris* spp.
Bellwort	*Uvularia* spp.
Bindweed	*Convolvulus* spp.
Bird's-foot Trefoil	*Lotus corniculatus*
Black Cohosh	*Cimicifuga racemosa*
Black-eyed Susan	*Rudbeckia serotina*
Black Medick	*Medicago lupulina*
Black Mustard	*Brassica nigra*
Black Snake-root	*Sanicula marilandica*
Bloodroot	*Sanguinaria* spp.
Blue Cohosh	*Caulophyllum thalictroides*
Bluets	*Houstonia caerulea*
Bluebead-Lily	*Clintonia borealis*
Blue-eyed Grass	*Sisyrinchium* spp.
Blue-joint Grass	*Calamagrostis canadensis*
Bog Club-moss	*Lycopodium inundatum*

Appendix 1. Continued

Common Name	Scientific Name
Boneset	Eupatorium spp.
Bouncing-Bet	Saponaria officinalis
Bracken	Pteridium aquilinum
Bristly Club-moss	Lycopodium annotinum
Broad Beech-Fern	Dryopteris hexagonoptera
Broom-sedge	Andropogon virginicus
Bugle-weed	Lycopus virginicus
Bullhead-lily	Nuphar variegatum
Burdock	Arctium spp.
Bush-Clover	Lespedeza spp.
Butter-and-eggs	Linaria vulgaris
Buttercup	Ranunculus spp.
Butterfly-weed	Asclepias tuberosa
Campion	Lychnis spp.
Canada Lily	Lilium canadense
Canadian St. John's-wort	Hypericum canadense
Cardinal-flower	Lobelia Cardinalis
Carolina Crane's-bill	Geranium carolinianum
Carolina Spring Beauty	Claytonia caroliniana
Cat-tail	Typha spp.
Ceratodon purpureus	Ceratodon purpureus
Chewings Fesque	Festuca rubra var. commutata
Chickweed	Stellaria sp.
Chinese Mustard	Brassica juncea
Christmas Fern	Polystichum acrostichoides
Cinnamon-Fern	Osmunda cinnamomea
Cinquefoil	Potentilla spp.
Climacium dendroides	Climacium dendroides
Closed Gentian	Gentiana clausa
Coltsfoot	Tussilago Farfara
Columbine	Aquilegia spp.
Common Buttercup	Ranunculus acris
Common Cinquefoil	Potentilla canadensis
Common Evening-Primrose	Oenothera biennis
Common Fern Moss	Thuidium delicatulum
Common Mouse-ear Chickweed	Cerastium vugatum
Common Mullein	Verbascum Thapsus
Common Periwinkle	Vinca minor
Common Plantain	Plantago major
Common Ragweed	Ambrosia artemisiifolia
Common Rye Grass	Elymus sp.
Common St. John's-wort	Hypericum perforatum
Common Speedwell	Veronica officinalis
Common Stitchwort	Stellaria graminea
Common Vetch	Vicia angustifolia

Appendix 1. Continued

Common Name	Scientific Name
Common Wood-Sorrel	Oxalis montana
Cowslip	Caltha palustris
Creeping Red Fesque	Festuca rubra
Crown-Vetch	Coronilla varia
Cudweed	Gnaphalium sp.
Cutgrass	Leersia spp.
Cut-leaved Grape-fern	Botrychium dissectum
Daisy	Chrysanthemum spp.; Matricaria spp.
Daisy-Fleabane	Erigeron annuus
Dame's-Violet	Hesperis matronalis
Dandelion	Taraxacum spp.
Deer-tongue Grass	Panicum clandestinum
Deptford Pink	Dianthus Armeria
Devil's Paint-brush	Hieracium aurantiacum
Dicranum scoparium	Dicranum scoparium
Dock	Rumex spp.
Duckweed	Lemna spp.
Dwarf Cornell	Cornus canadensis
Dwarf Dandelion	Krigia spp.
Dwarf Ginseng	Panax trifolium
Early Meadow-Rue	Thalictrum dioicum
Elecampane	Inula Helenium
English Plantain	Plantago lanceolata
Everlasting	Antennaria spp.
Everlasting Pea	Lathyrus latifolius
False Hellebore	Veratrum spp.
False Spikenard	Smilacina racemosa
Field Cat's-foot	Antennaria neglecta
Fireweed	Epilobium angustifolium
Foamflower	Tiarella cordifolia
Fox Sedge	Carex vulpinoidea
Fringed Loosestrife	Lysimachia ciliata
Fringed Polygala	Polygala paucifolia
Gill-over-the-ground	Glechoma hederacea
Golden Ragwort	Senecio aureus
Goldenrod	Solidago spp.
Goldie's Fern	Dryopteris Goldiana
Goldthread	Coptis groenlandica
Grass-leaved Goldenrod	Solidago graminifolia
Great Lobelia	Lobelia siphilitica
Great-spurred Violet	Viola Selkirkii
Ground-Pine	Lycopodium complanatum
Hair-cap Moss	Polytrichum spp.
Hairy Solomon's Seal	Polygonatum biflorum

Appendix 1. Continued

Common Name	Scientific Name
Hawkweed	Hieracium spp.
Hay-scented Fern	Dennstaedtia punctilobula
Heal-all	Prunella vulgaris
Helleborine	Epipactis Helleborine
Hepatica	Hepatica spp.
Horsetail	Equisetum spp.
Hypnum spp.	Hypnum spp.
Hypnum imponens	Hypnum imponens
Indian Cucumber-root	Medeola virginiana
Indian Hemp	Apocynum cannabinum
Indian-tobacco	Lobelia inflata
Interrupted Fern	Osmunda Claytoniana
Iris	Iris spp.
Jack-in-the-puplit	Arisaema atrorubens
Japanese Clover	Lespedeza striata
Jewelweed	Impatiens spp.
Joe-Pye-weed	Eupatorium spp.
Kentucky 31	Festuca sp.
Kidneyleaf-Buttercup	Ranunculus abortivus
Kill-cow	Eleocharis tenuis
King Devil	Hieracium floribundum
Knotweed	Polygonum spp.
Lace-Grass	Eragrostis capillaris
Lady-Fern	Athyrium Filix-femina
Large-flowered Bellwort	Uvularia grandiflora
Large-flowered Wake-robin	Trillium grandiflorum
Large-leaved Aster	Aster macrophyllus
Large-leaved Mnium	Mnium punctatum var. elatum
Large Yellow Lady's-slipper	Cypripedium Calceolus var. pubescens
Lion's-foot	Prenanthes Serpentaria
Long-spurred Violet	Viola rostrata
Maidenhair-Fern	Adiantum pedatum
Marginal Shield-Fern	Dryopteris marginalis
Marsh-Fern	Dryopteris Thelypteris
Marsh St. John's-wort	Hypericum virginicum
Maryland Golden Aster	Chrysopsis mariana
May-apple	Podophyllum peltatum
Meadow-Rue	Thalictrum spp.
Milkweed	Asclepias spp.
Mint	Mentha spp.
Mixed Grass	Gramineae
Moss	Musci
Moth-Mullein	Verbascum Blattaria
Mouse-ear Hawkweed	Hieracium Pilosella

Appendix 1. Continued

Common Name	Scientific Name
Narrow-leaved Cat-tail	Typha angustifolia
New York Aster	Aster novi-belgii
New York Fern	Dryopteris noveboracensis
Nightshade	Solanum Dulcamara
Nimble Will Grass	Muhlenbergia Schreberi
Nodding Ladies'-tresses	Spiranthes cernua
Northern Lady Fern	Athyrium Filix-femina var. Michanxii
Northern Water Plantain	Alisma triviale
Oak-Fern	Dryopteris disjuncta
Old-field-Cinquefoil	Potentilla simplex
Onion	Allium spp.
Orchard-Grass	Dactylis glomerata
Ostrich-Fern	Pteretis penslyvanica
Ox-eye-Daisy	Chrysanthemum Leucanthemum
Painted Trillium	Trillium undulatum
Pale Corydalis	Corydalis sempervirens
Panic-Grass	Panicum spp.
Papoose-root	Caulophyllum thalictorides
Partridge-berry	Mitchella repens
Partridge-Pea	Cassia fasciculata
Pearly Everlasting	Anaphalis margaritacea
Pennsylvania Bitter-cress	Cardamine pensylvanica
Perennial Rye-grass	Lolium perenne
Perfoliate Bellwort	Uvularia perfoliata
Plantain	Plantago spp.
Pokeweed	Phytolacca spp.
Pondweed	Potamogeton spp.
Poor-Man's Pepper	Lepidium virginicum
Poverty-Grass	Danthonia spicata
Prostate Tick-trefoil	Desmodium rotundifolium
Purple Trillium	Trillium erectum
Queen Anne's-lace	Daucus Carota
Rattlesnake-Fern	Botrychium virginianum
Red Clover	Trifolium pratense
Redtop Grass	Agrostis alba
Reed	Phragmites spp.
Reindeer Lichen	Cladonia rangiferina
Rock-Polypody	Polypodium virginianum
Rose Pogonia	Pogonia ophioglossodies
Rough Bedstraw	Galium asprellum
Rough-fruited Cinquefoil	Potentilla recta
Rough-leaved Golden-rod	Solidago patula
Round-leaved Sundew	Drosera rotundifolia
Roundlobe Hepatica	Hepatica americana
Royal Fern	Osmunda regalis

Appendix 1. Continued

Common Name	Scientific Name
Rue-Anemone	Anemonella thalictroides
Rush	Juncus spp.
St. John's-wort	Hypericum spp.
Schreber's Moss	Calliergon Schreberi
Scotch Broom	Cytisus scoparius
Sedge	Carex spp.
Sensitive Fern	Onoclea sensibilis
Sharp-lobed Hepatica	Hepatica acutiloba
Sheep-Sorrel	Rumex Acetosella
Shining Club-moss	Lycopodium Lucidulum
Shinleaf	Pyrola elliptica
Skullcap	Scutellaria spp.
Skunk-cabbage	Symplocarpus foetidus
Smartweed	Polygonum spp.
Smooth Yellow Violet	Viola pensylvanica
Solomon's-seal	Polygonatum spp.
Speedwell	Veronica spp.
Sphagnum	Sphagnum spp.
Spiked Loosestrife	Lythrum Salicaria
Spinulose Wood-Fern	Dryopteris spinulosa
Spotted Knapweed	Centaurea maculosa
Spotted St. John's-wort	Hypericum punctatum
Spotted Touch-me-not	Impatiens capensis
Spotted Wintergreen	Chimaphila maculata
Spreading Dogbane	Apocynum androsaemifolium
Spring-beauty	Claytonia spp.
Spring-Cress	Cardamine bulbosa
Square-stemmed Monkey-flower	Mimulus ringens
Squirrel-corn	Dicentra canadensis
Star-flower	Trientalis borealis
Star-flowered Solomon's Seal	Smilacina stellata
Stemless Lady's-slipper	Cypripedium acaule
Stonecrop	Sedum spp.
Strawberry	Fragaria spp.
Swamp-Buttercup	Ranunculus septentrionalis
Sweet Cicely	Osmorhiza spp.
Sweet-scented Bedstraw	Galium triflorum
Tall Meadow-Rue	Thalictrum polygamum
Tearthumb	Polygonum spp.
Teasel	Dipsacus spp.
Thistle	Cirsium spp.
Thoroughwort	Eupatorium spp.
Tick-trefoil	Desmodium spp.
Timothy	Phleum spp.
Toothwort	Dentaria spp.

Appendix 1. Continued

Common Name	Scientific Name
Tree Club-moss	Lycopodium obscurum
Trillium	Trillium spp.
Trout-Lily	Erythronium americanum
Twisted-stalk	Streptopus spp.
Upright Yellow Wood-sorrel	Oxalis stricta
Various-leaved Water-Milfoil	Myriophyllum heterophyllum
Velvet-Grass	Holcus lanatus
Violet	Viola spp.
Virginia Knotweed	Tovara virginiana
Water-celery	Vallisneria americana
Water Moss	Fontinalis spp.
Water Parsnip	Sium suave
Water-Pennywort	Hydrocotyle spp.
Water-purslane	Ludwigia palustris
White Baneberry	Actaea pachypoda
White Clover	Trifolium repens
White Moss	Leucobryum glaucum
White Snakeroot	Eupatorium rugosum
Whorled Loosestrife	Lysimachia quadrifolia
Wild Cranesbill	Geranium maculatum
Wild Leek	Allium Ampeloprasum
Wild Lettuce	Lactuca canadensis
Wild Lily-of-the-valley	Maianthemun canadense
Wild Lupine	Lupinus perennis
Wild-oats	Uvularia sessilifolia
Wild-pink	Silene caroliniana var. pensylvanica
Wild Sarsaparilla	Aralia nudicaulis
Wild Yam-root	Dioscorea villosa
Winter-Cress	Barbarea spp.
Wood-Anemone	Anemone quinquefolia
Wood-Fern	Dryopteris spp.
Wood-Lily	Lilium philadelphicum
Wood-Sorrel	Oxalis spp.
Woolly Blue Violet	Viola sororia
Woolly Panic-grass	Panicum lanuginosum
Yarrow	Achillea spp.
Yellow Clover	Trifolium agrarium
Yellow Dock	Rumex crispus
Yellow Loosestrife	Lysimachia terrestris

Appendix 2 Field data form for plant species in adjacent forest.

Area Adjacent to the ROW:

Vegetation Type: _____

Forest Type: _____

Non-forest Type: _____

Tree Layer:

% Cover _____

Height _____

Type Stand _____

Dominant and Characteristic Species:

_____ _____ _____

_____ _____ _____

Shrub Layer:

% Cover _____ Height _____

Herb Layer:

% Cover _____ Height _____

Remarks:

Primary Land Use: _____

_____

General Aesthetics: _____

_____

Other Use: _____

_____

_____

Appendix 3. Field data form for plant species on the ROW.

Data on the ROW

Management History: _____

Clearance: Data: _____ Type: _____

Maintenance: Data: _____

Treatment: _____

Present Vegetation Type: _____

Shrub Layer:

%Cover _____ Height _____

Tree Species:

_____ _____ _____

_____ _____ _____

Shrub Species:

_____ _____ _____

_____ _____ _____

Ground Layer:

% Cover _____ Heigth _____

Herbs and Grasses:

_____ _____ _____

_____ _____ _____

Appendix 4. Plant[1] Species Occurring in New York and Proposed for Designation as Endangered or Threatened Under the Federal Endangered Species Act of 1973.

Scientific Name	Common Name	Proposed Status
Scirpus ancistrochaetus[2]	Bulrush (unnamed)	Endangered
Isotria medeoloides	Pagonia, smalled whorled	Endangered
Plantago cordata	Plantain, heart-leaf	Endangered
Calamagrostis perplexa	Reed Bentgrass (unnamed)	Endangered
Phyllitis Scolopendrium var. americana	Hart's tongue fern, American	Endangered
Aconitum noveboracense	Monkshood, northern wild	Endangered
Trollius laxus	Globeflower, spreading	Endangered
Prenanthes Boottii	A rattlesnake root (unnamed)	Threatened
Helianthemum dumosum	A rockrose (unnamed)	Threatened
Cypripedium arietinum	Ram's head Lady's slipper	Threatened
Cypripedium candidum	Small white lady's slipper	Threatened
Listera auriculata	Auricled twayblade	Threatened
[3]Plantanthera leucophaea	Prarie white fringed orchid	Threatened
[3]Plantanthera peramoena	Purple fringless orchid[4]	Threatened
Calamagrostis Porteri	A reed bentgrass (unnamed)	Threatened
Panicum aculeatum	A panic grass (unnamed)	Threatened
Poa paludigena	A meadow grass (unnamed)	Threatened
Potamogeton Hillii	A pond weed (unnamed)	Threatened
Schizaea pusilla	Curly grass	Threatened
[5]Agalinis acuta	A figwort (unnamed)	Treatened
Micranthemum micranthemoides	A figwort (unnamed)	Threatened

[1] The first seven species listed were proposed for designation as endangered in the Federal Register of Wednesday, June 16, 1976. None of these seven species were identified in conjunction with the individual site studies for the ESEERCO study. The last fourteen species listed were proposed for designation as threatened in the Federal Register of Tuesday, July 1, 1975. Unless otherwise noted, scientific names are as in Gray's Manual of Botany.

[2] This species is not listed in either Gray's Manual of Botany or the New Britain and Brown Illustrated Flora.

[3] This genus (Platanthera) is listed as Habenaria in both Gray's Manual of Botany and the New Britton and Brown Illustrated Flora.

[4] Also known as pride of the peak.

[5] This genus (Micranthemum) is listed as Hemianthus in the New Britton and Brown Illustrated Flora.

Appendix 5. Field data form for soils evaluation.

Site Location and Description

Site Name _____ Data _____ Recorder _____

County _____ Geology _____

Forest Region _____ Surficial _____

Physiographic Region _____ Bedrock _____

Soils

Soil Order and Suborder _____

Soil Association _____

Soil Series	Map Symbol[1]	Effective Depth (in.)	Drainage Class[2]	Surface Mineral Soil pH	Surface Mineral Soil Texture	Woodland Suitability Group

[1] Map Symbol: Soil series and slope class (A=0-8%, B=8-15%, C=25=35%, E=35=50%, F=5-=70%

[2] Drainage Class: VPD=very poorly drained, PD=poorly drained, SPD=somewhat poorly drained, ID=Imperfectively drained, MG=moderately good, G=good, E=excellent (excessive)

[3] Provides information on potential productivity for tree species and hazards and limitations in woodland management.

Appendix 6. Site Index Guide as Received November 15, 1976, from William Hanna, Soil Scientist, Soil Conservation Service, Syracuse, New York.

Tree Species	Productivity[1] Classes for Important Timber Species					
	Excellent	Very Good	Good	Fair	Poor	Very Poor
	1[2]	2	3	4	5	6
Red and White Pine	90+	90-80	80-70	70-60	60-50	50-40
Red Maple		80+	80-70	70-60	60-50	50-
Oaks and Black Cherry	85+	85-75	75-65	65-55	55-45	45-35
W. Spruce, Balsam-Fir	80+	80-70	70-60	60-50	50-40	40-30
Red Spruce	70+	70-60	60-50	50-40	40-30	30-
Sugar-Maple	73+	73-66	66-59	59-52	52-45	45-38

[1] Productivity is based on average site index of an indicator tree species or forest type for each soil. This is the woodland suitability class for the soil. Site index figures refer to the height at 50 years of age for the particular species or forest type.

[2] Woodland Suitability Group is referred to by number.

Appendix 7. Field data form for soil erosion classification.

Site Name _____ Date _____ Recorder _____

Erosion Classification

Soil Type	Average Slope %	Plant Cover	Location[1]	Erosion Class[2] and Kind[3]					
				Woodland			ROW		
				Class	Kind	Depth Gullies (in.)	Class	Kind	Depth Gullies (in.)

[1] Location: A = general ROW, B= access road, C = tower site, D = stringing site, E = forest, F = other (indicate such as horse trail, animal path, bike trail, etc.).

[2] Erosion Class: 0 = none, 1 = slight, 2 - moderate, 3= severe

[3] Erosion Kind: S = sheet, R = rill, G = gully.

Appendix 8. Key for the Classification, Forest Humus Types (1)[1]

Prepared by the Committee on Humus Classification, Forest Soils Section, Soil Science Society of America.[2]

A. No H-layer; the A1-horizon consists of an intimate mixture of organic matter and mineral soil, with gradual transition between the A1 and the horizon beneath. F-layer may or may not be present.
---Mull (2,3,4)

1. The A1 is essentially single grain or massive without aggregates. Organic matter appears to be more or less uniformly distributed throughout.

   (a) Massive and firm with generally less than 5% organic matter by weight.
   ---Firm Mull

   (b) Loose, with low to medium organic matter content (usually less than 10%) and consisting of a mixture of mineral soil and organic matter as single grains. Typically on sandy soils.
   ---Sand Mull

2. The A1-horizon has a granular or crumb structure. The concentration of organic matter and the granular structure are most pronounced in the upper A1 and decrease gradually with depth.

   (a) Coarse granular or crumb structure; many granules 1/8" (2-3mm.) or larger. Usually 5-20% organic matter.
   ---Coarse Mull

   (b) Medium granular or crumb structure; the larger granules about 1/16" (2mm.) or slightly smaller. Wide range of organic matter content usually 5-30%.
   ---Medium Mull

   (c) Fine granular structure; frequently has the appearance of fine black sawdust; organic matter content high, usually over 30%.
   ---Fine Mull

3. Complex mull types. Distinct structural differences between layers within the zone of organic matter incorporation.

   (a) A fine mull underlain by coarse or medium mull.
   ---Twin Mull

B. H and F-layers present with an underlying A1-horizon essentially similar to that of a true mull. Gradual transition from the H to A1 and mineral soil beneath. (This type possesses some of the characteristics of both mulls and mors.)
---Duff Mull (4,5)

1. Combined F and H-layers more than one inch thick.
   ---Thick Duff Mull

2. Combined F and H-layers less than one inch thick.
   ---Thin Duff Mull

---

[1] Numbers in parentheses refer to explanatory material on the following pages.

[2] Hoover, M.D. and H.A. Lunt. 1952. A key for the classification of forest humus types. Soil Sci. Soc. Amer. Proc. 16: 368-370.

C. H-layer present (except in 3 below). Practically no mixing of organic matter with mineral soil. Abrupt transition from surface organic matter to underlying horizon.
---Mor (6)

1. The H-layer more than 1/2 inch thick.
---Thick Mor

(a) The H-layer has a fine granular structure.
---Granular Mor

(b) The H-layer structureless, feels greasy when wet, but hard and brittle when dry.
---Greasy Mor

(c) The H-layer feels and looks felty, due to presence of fungal hyphae and/or plant residues but not living roots.
---Felty Mor

2. The H-layer less than 1/2 inch in thickness.
---Thin Mor

3. The H-layer lacking or present only as a thin film in depressions.
---Imperfect Mor

Explanatory Material

(1) This key does not apply on areas where the upper A-horizon shows evidence of prolonged water saturation. Such as mottling, peat layers, or bog conditions.

(2) Following disturbance of the forest cover a mull may develop on an old podsol. As a result, a remnant of a leached layer may be present in the profile even though the layer above it resembles the A1 of a mull. In such a case, the humus type is typed as a mull on the basis of the characteristics of the A1-horizon.

(3) A complete description of a mull or duff-mull type should furnish the depth of organic matter incorporation in inches. For grouping data and reconnaissance use the following depth classes are suggested: very shallow, less than 1", shallow, 1-2", deep, 2-4", and very deep, more than 4". For example, a sand mull with organic matter incorporated to a depth of 1-1/2" would be a "Shallow Sand Mull."

(4) When it is apparent that plowing or grazing have modified or eliminated the natural humus type, this should be indicated by adding the letter "P" or "G" to the name of the humus type. For example, Firm Mull-P or Firm Mull-G or Firm Mull-PG if both plowing and grazing have caused present contitions. On previously cultivated land, there is frequently an old plow layer which is comparatively homogenous throughout but may usually be re-

cognized by the sharp line of demarcation at the base of the plow layer. The humus type should be based on the characteristics of the H and/or A1-horizon, and not on the properties of the entire plowed horizon. Grazing causes compaction of the organic horizons and may reduce a mull with granular structure to firm mull. Or may mix the H-layer of a mor with mineral soil creating a mull like condition. Again humus type should be based on the H and/or A1-horizon adding the letter "G" to indicate that grazing was responsible.

(5) As stated in explanatory note #3 the depth of organic matter incorporation should be given in description. The adjectives for the depth classes should be used as prefixes in describing the A1 portion of the duff-mull. For example, "Thick Duff Mull with shallow A1" would be used to describe a duff-mull with F and H-layers more than 1" thick and the A1-horizon 1-2" deep.

(6) Because of the high organic matter content in the A1-horizon of fine-mull it may occasionally be difficult to determine in the field whether the layer is the H-layer or granular mor. This is particularly true when the horizon or layer is shallow or thin. In this case, if transition to the mineral soil horizon below is rather abrupt and the organic content so high it cannot be determined in the field whether it is actually fine mull or a granular mor the layer should be classed as an H-layer and typed as mor.

Appendix 9. Field data form for humus classification.

Site Name _____ Date _____ Recorder _____

Classification of Humus Layers

		ROW					Woodland				
		Layer[2] Thickness (in)				Humus	Layer[2] Thickness (in)				Humus
Number	Location[1]	L	F	H	A1	Type	L	F	H	A1	Type

[1] Location: edge, mid (between edge and center), and center of ROW or circular woods plot.

[2] Layers: L = litter, F = fermentation, H = humus, A1 = mixed organic and mineral soil horizon.

Appendix 10. Water survey sheet.

Survey: _____

Date: _____ Time: _____ Field Engineer: _____

City: _____ County: _____ Quadrangle: _____

Weather _____

Water: _____

Velocity: _____ Depth _____ Width: _____

DO: _____ Temp. _____ $\%O_2$ Sat: _____ pH _____

Sediment Traps: _____

Sediment Depth (Stake Marking) _____ Pool-riffle Ratio _____

Stream Vegetation: _____

Potential Fish Habitats: _____

Bank Vegetation _____

Stream Uses _____

Physical Perturbations _____

Floodplain: _____

Erosion: _____ Sheet: _____ Rill: _____ Gully: _____

Wetland: _____

Wet Meadow _____ Marsh _____ Swamp _____

Vegetation: _____

Noticeable Succession: Yes _____ No _____

Soils: Clay_____ Silt_____ Loam_____ Humus_____ Sand_____

Gravel_____ Other_____

Comments:_____

_____

_____

Appendix 11. Recommended Classifications and Assignment of Quality and Purity for Designated Waters of New York State[1,2]

Usages	Class
Domestic water supply (unfiltered)	AA
Domestic water supply (filtered)	A
Bathing and/or recreation	B
Fishing	C
Agriculture and/or industrial water supply	D
Sewage and/or waste disposal and/or transportation	E
Sewage and/or waste disposal	F

In addition, where trout water (T) are involved there is a special dissolved oxygen standard established for the protection of such waters.

[1] Information presented here is derived from Chemung River Drainage Basin Survey Series Report, No. 2, Water Pollution Control Board, New York State Department of Health.

[2] In line with the objectives of the Public Health Law relating to water pollution control, one of the most important items considered is the various present and contemplated future usages of waters within a drainage basin. The usages and attendant classifications for the majority of situations have been established as noted here.

Appendix 12. Wetlands Definitions.

The term "freshwater wetland" shall mean wet meadows, marshes, swamps, or areas where ground water, flowing or standing surface water, or ice provide a significant part of the supporting substrate for emergent or submergent plant communities for at least 5 months of the year.

"Wet meadows" is described where ground water is at the surface for a significant part of the growing season and near the surface throughout the year, and where a significant part of the vegetational community is composed of various grasses, sedges, and rushes. Made up of but not limited to nor necessarily including the following plants or groups of plants: iris (Iris), vervain (Verbena), thoroughwort (Eupatorium), dock (Rumex), false loosestrife (Ludwigia), hydrophillic grasses (Graminae), loosestrife (Lythrum), marsh-fern (Dryopteris thelypteris), rushes (Juncaeae), sedges (Cyperaceae), sensitive fern (Onoclea sensibilis), smartweed (Polygonum).

"Marshes" shall mean areas where a vegetational community exists in standing or flowing water during the growing season and where a significant part of the vegetational community is composed of, but not limited to nor necessarily including all of, the following plants or groups of plants: arums (Araceae), bladderworts (Utricularia), bur-reeds (Sparganiaceae) buttonbush (Cephalanthus occidentalis), cat-tails (Typha), duckweeds (Lemnaceae), eelgrass (Vallisneria), frogs-bits (Hydrocharitaceae), horsetails (Equisetaceae), hydrophilic grasses (Gramineae), lether-leaf (Chamaedaphne calyculatea), pickerelweeds (Pontederiaceae), pipeworts (Eriocaulon) pond weeds (Potamogeton), rushes (Juncaceae), sedges (Cyperaceae), smartweeds (Polygonum), sweet gale (Myrica gale), water-milfoil (Haloragaceae), water-lilies (Nymphaeceae), water-starworts (Callitrichaceae), water-willow (Decodon verticillatus).

"Swamps" shall mean areas where ground water is at or near the surface of the ground for a significant part of the growing season or where runoff water from surface drainage frequently collects above the soils surface, and where a significant part of the vegetational community is made up of, but not limited to nor necessarily include all of, the following plants or groups of plants: alders (Alnus), ashes (Fraxinus), azaleas (Rhododendron canadense and R. viscosum), black alder (Ilex verticillata), black spruce (picea mariana), buttonbush (Cephalanthus occidentalis), American or white elm (Ulmus americana), white Hellebore (Veratrum viride), hemlock (Tsuga canadensis), highbush-blueberry (Vaccinium corymbosum), larch (Larix laricina), cowslip (Caltha palustris), poison sumac (Rhus vernix) red maple (Acer rubrum), Skunk-cabbage (Symplocarpus foetidus), sphagnum mosses (Sphagnum), spicebush (Lindera Benzoin), black gum (Nyssa sylvatica), sweet pepperbush (Clethra alnifolia), white cedar (Chamaecyparis thyoides), willow (Salicaceae).

Appendix 13. Wildlife Observed Directly or Indirectly on the 22 Sites in New York.

Common Name	Scientific Name
American woodcock	Philohela minor
Beaver	Castor canadensis
Black rat snake	Elaphe obsoleta obsoleta
Blanding's turtle	Emydoidea blandingi
Bullfrog	Rana catesbeiana
Carrion beetle	Silpha spp.
Chipmunk	Tamias striatus
Cottontail rabbit	Sylvilagus floridanus
Coyote	Canis latrans
Crayfish	Cambarus spp.
Earthworm	Lumbricus
Eastern box turtle	Terrapene carolina carolina
Fox	Vulpes spp.
Frog	Rana spp.
Garter snake	Thamnophis spp.
Gray squirrel	Sciurus carolinensis
Green snake	Opheodrys spp.
Ground bee	Vespa spp.
Hornet	Vespula maculata
Leopard frog, northern	Rana pipiens pipiens
Lice	Mallophoga spp.
Meadow vole	Microtus pennsylvanicus
Mole	Scalopus aquaticus
Mosquito	Culicidae
Mouse	Peromyscus spp.
Muskrat	Ondatra zibethica
Northern water snake	Natrix sipedon sipedon
Oppossum	Didelphis marsupialis
Praying mantis	Mantidae
Raccoon	Procyon lotor
Red eft (red-spotted newt)	Diemictylus viridescens viridescens
Red squirrel	Tamiasciurus hudsonicus
Ribbon snake	Thamnophis sauritus sauritus
Ring-necked pheasant	Phasianus colchicus
Ruffed grouse	Bonasa umbellus
Shrew	Sorex spp.
Skunk	Mephitis spp.
Spotted salamander	Ambystoma maculatum
Spotted turtle	Clemmys guttata
Spring peeper	Hyla crucifer
Timber rattlesnake	Crotalus horridus horridus
Toad	Bufo spp.

Appendix 13. Continued

Common Name	Scientific Name
Varying hare	*Lepus americanus*
White-tailed deer	*Odocoileus virginianus*
Wild turkey	*Meleagris gallopavo*
Woodchuck	*Marmota monax*

Appendix 14. Field check list for birds seen and/or heard on the ROW and ROW edge.

GAVIIFORMES
Gaviidae - Loons
[ ] Common Loon
[ ] Red-throated Loon
PODICIPEDIFORMES
Podicipedidae - Grebes
[ ] Horned Grebe
[ ] Pied-billed Grebe
PELECANIFORMES
Phalacrocoracidae
[ ] Double-crested Cormorant
CICONIIFORMES
Ardeidae - Herons & Bitterns
[ ] Black-crowned Night Heron
[ ] Great Blue Heron
[ ] Green Heron
[ ] American Bittern
[ ] Least Bittern
[ ] Common Egret
ANSERIFORMES
Anatidae - Swans, Geese & Ducks
sf. Cygninae
[ ] Whistling Swan
sf. Anserinae - Geese
[ ] Blue Goose
[ ] Canada Goose
[ ] Snow Goose

sf. Anatinae - Surface-feeding Ducks
[ ] American Widgeon
[ ] Black Duck
[ ] Blue-winged Teal
[ ] Gadwall
[ ] Green-winged Teal
[ ] Mallard
[ ] Pintail
[ ] Shoveler
[ ] Wood Duck
sf. Aythyinae - Diving Ducks
[ ] Bufflehead
[ ] Canvasback
[ ] Common Goldeneye
[ ] Greater Scaup
[ ] Lesser Scaup
[ ] Oldsquaw
[ ] Redhead
[ ] Ring-necked Duck
[ ] White-winged Scoter
sf. Oxyurinae
[ ] Ruddy Duck
sf. Merginae - Mergansers
[ ] Common Merganser
[ ] Hooded Merganser
[ ] Red-breasted Merganser

FALCONIFORMES
Cathartidae - Vultures
[ ] Black Vulture
[ ] Turkey Vulture

Accipitridae - Hawks (Eagles)
[ ] Broad-winged Hawk
[ ] Cooper's Hawk
[ ] Marsh Hawk
[ ] Red shouldered Hawk
[ ] Red-tailed Hawk
[ ] Rough-legged Hawk
[ ] Sharp-shinned Hawk
[ ] Bald Eagle
[ ] Golden Eagle
Pandionidae
[ ] Osprey
Falconidae - Falcons (Hawks)
[ ] Peregrine Falcon
[ ] Pigeon Hawk
[ ] Sparrow Hawk (American Kestrel
GALLIFORMES
Tetraonidae
[ ] Ruffed Grouse
Phasianidae
[ ] Bobwhite
[ ] Ring-necked Pheasant
Meleagrididae
[ ] Turkey
GRUIFORMES
Rallidae - Rails, Gallinules, & Coots
[ ] King Rail
[ ] Sora (Rail)
[ ] Virginia Rail
[ ] Common Gallinule
[ ] American Coot
CHARADRIIFORMES
Charadriidae - Plovers
[ ] Black-bellied Plover
[ ] Killdeer (plover)
[ ] Semipalmated Plover
Scolopacidae - Woodcock, Snipe, & Sandpipers
[ ] American Woodcock
[ ] Common Snipe
[ ] Greater Yellowlegs (sandpiper)
[ ] Lesser Yellowlegs (sandpiper)
[ ] Upland Plover (sandpiper)
[ ] Dunlin (sandpiper)
[ ] Least Sandpiper
Pectoral Sandpiper
[ ] Semipalmated Sandpiper
[ ] Solitary Sandpiper
[ ] Spotted Sandpiper

Phalaropodidae
[ ] Northern Phalarope
Laridae - Gulls & Terns
[ ] Bonaparte's Gull
[ ] Herring Gull
[ ] Ring billed Gull
[ ] Black Tern
[ ] Caspian Tern
[ ] Common Tern

COLUMBIFORMES
Columbidae - Doves & Pigeons
[ ] Mourning Dove
[ ] Rock Dove (Pigeon)

CUCULIFORMES
Cuculidae Cuckoos
[ ] Black billed Cuckoo
[ ] Yellow-billed Cuckoo

STRIGIFORMES
Tytonidae
[ ] Barn Owl
Strigidae - Typical Owls
[ ] Barred Owl
[ ] Great Horned Owl
[ ] Long-eared Owl
[ ] Saw-whet Owl
[ ] Screech Owl
[ ] Short eared Owl

CARPRIMULGIFORMES
Caprimulgidae - Goatsuckers
[ ] Common Nighthawk
[ ] Whip-poor-will

APODIFORMES
Apodidae
[ ] Chimney Swift
Trochilidae
[ ] Ruby-throated Hummingbird

CORACIIFORMES
Alcedinidae
[ ] Belted Kingfisher

PICIFORMES
Picidae - Woodpeckers
[ ] Downy Woodpecker
[ ] Hairy Woodpecker
[ ] Pileated Woodpecker
[ ] Red bellied Woodpecker
[ ] Red headed Woodpecker
[ ] Yellow-bellied Sapsucker
[ ] Yellow-shafted Flicker

PASSERIFORMES
Tyrannidae - Flycatchers
[ ] Acadian Flycatcher
[ ] Eastern Kingbird
[ ] Eastern Phoebe
[ ] Eastern Wood Pewee
[ ] Great Crested Flycatcher
[ ] Least Flycatcher
[ ] Olive sided Flycatcher
[ ] Traill's Flycatcher
[ ] Yellow bellied Flycatcher
Alaudidae
[ ] Horned Lark
Hirundinidae - Swallows
[ ] Bank Swallow
[ ] Barn Swallow
[ ] Cliff Swallow
[ ] Purple Martin
[ ] Rough winged Swallow
[ ] Tree Swallow
Corvidae
[ ] Blue Jay
[ ] Common Crow
[ ] Common Raven
Paridae
[ ] Black capped Chickadee
[ ] Carolina Chickadee
[ ] Tufted Titmouse
Sittidae
[ ] Red-breasted Nuthatch
[ ] White breasted Nuthatch
Certhiidae
[ ] Brown Creeper

Troglodytidae - Wrens
[ ] Bewick's Wren
[ ] Carolina Wren
[ ] House Wren
[ ] Long-billed Marsh Wren
[ ] Short-billed Marsh Wren
[ ] Winter Wren
Mimidae - Mockingbirds & Thrashers
[ ] Brown-thrasher
[ ] Catbird
[ ] Mockingbird
Turdidae - Thrushes
[ ] Eastern Bluebird
[ ] Gray-cheeked Thrush
[ ] Hermit Thrush
[ ] Robin
[ ] Swainson's Thrush
[ ] Veery
[ ] Wood Thrush

Sylviidae - Gnatcatchers & Kinglets
[ ] Blue-gray Gnatcatcher
[ ] Golden crowned Kinglet
[ ] Ruby crowned Kinglet
Motacillidae
[ ] Water Pipit
Bombycillidae
[ ] Cedar Waxwing
Laniidae
[ ] Loggerhead Shrike
Sturnidae
[ ] Starling
Vireonidae - Vireos
[ ] Philadelphia Vireo
[ ] Red-eyed Vireo
[ ] Solitary Vireo
[ ] Warbling Vireo
[ ] White-eyed Vireo
[ ] Yellow-throated Vireo
Parulidae - Wood Warblers
[ ] American Redstart
[ ] Bay-breasted Warbler
[ ] Black-and-White Warbler
[ ] Blackburnian Warbler
[ ] Blackpoll Warbler
[ ] Black throated Blue Warbler
[ ] Black throated Green
[ ] Blue-winged Warbler
[ ] Canada Warbler
[ ] Cape May Warbler
[ ] Cerulean Warbler
[ ] Chestnut-sided Warbler
[ ] Connecticut Warbler
[ ] Golden-winged Warbler
[ ] Hooded Warbler
[ ] Kentucky Warbler
[ ] Louisiana Waterthrush
[ ] Magnolia Warbler
[ ] Mourning Warbler
[ ] Myrtle Warbler
[ ] Nashville Warbler
[ ] Northern Waterthrush
[ ] Orange-crowned Warbler
[ ] Ovenbird
[ ] Palm Warbler
[ ] Parula Warbler
[ ] Pine Warbler
[ ] Prairie Warbler
[ ] Swainson's Warbler
[ ] Tennessee Warbler
[ ] Wilson's Warbler
[ ] Worm eating Warbler
[ ] Yellow breasted Chat
[ ] Yellow Warbler
[ ] Yellowthroat
[ ] Yellow throated Warbler

Ploceidae - Weaver Finches
[ ] House Sparrow
Icteridae - Blackbirds
[ ] Baltimore Oriole
[ ] Orchard Oriole
[ ] Bobolink
[ ] Brown-headed Cowbird
[ ] Common Grackle
[ ] Eastern Meadowlark
[ ] Red-winged Blackbird
[ ] Rusty Blackbird
Thraupidae
[ ] Scarlet Tanager
[ ] Summer Tanager

Fringillidae - Grosbeaks, Finches, Sparrows & Buntings
sf. Richmondeninae - Cardinals & Allies
[ ] Blue Grosbeak
[ ] Cardinal
[ ] Dickcissel
[ ] Indigo Bunting
[ ] Rose-breasted Grosbeak
sf. Carduelinae - Purple Finches, Goldfinches & Allies
[ ] American Goldfinch
[ ] Common Redpoll
[ ] Evening Grosbeak
[ ] Pine Grosbeak
[ ] Pine Siskin
[ ] Purple Finch
[ ] Red Crossbill
[ ] White-winged Crossbill
sf. Emberizinae - Sparrows & Buntings
[ ] Bachman's Sparrow
[ ] Chipping Sparrow
[ ] Field Sparrow
[ ] Fox Sparrow
[ ] Grasshopper Sparrow
[ ] Henslow's Sparrow
[ ] Lark Sparrow
[ ] Lincoln's Sparrow
[ ] Savannah Sparrow
[ ] Song Sparrow
[ ] Swamp Sparrow
[ ] Tree Sparrow
[ ] White-crowned Sparrow
[ ] White-throated Sparrow
[ ] Vesper Sparrow

[ ] Lapland Longspur
[ ] Rufous-sided Towhee
[ ] Slate-colored Junco
[ ] Snow Bunting

Appendix 15. Birds observed and or/heard on the ROW and on the ROW edge during the study period.

Common Name	Scientific Name
Great blue heron	Ardea herodias
Green heron	Butorides virescens
Canada goose	Branta canadensis
Black duck	Anas rubripes
Shoveler	Spatula clypeata
Canvasback	Aythya valisineria
Turkey vulture	Cathartes aura
Cooper's hawk	Accipiter cooperii
Red-shouldered hawk	Buteo lineatus
Red-tailed hawk	Buteo jamaicensis
Sharp-shinned hawk	Accipiter striatus
Bald eagle	Haliaeetus leucocephalus
Osprey	Pandion haliaetus
Sparrow hawk	Falco sparverius
Ruffed grouse	Bonasa umbellus
Ring-necked pheasant	Phasianus colchicus
Turkey	Meleagris gallopavo
Killdeer	Charadrius vociferus
American woodcock	Philohela minor
Solitary sandpiper	Tringa solitaria
Spotted sandpiper	Actitis macularia
Herring gull	Larus argentatus
Ring-billed gull	Larus delawarensis
Mourning dove	Zenaidura macroura
Rock dove (domestic pigeon)	Columba livia
Great horned owl	Bubo virginianus
Whip-poor-will	Caprimulgus vociferus
Ruby-throated hummingbird	Archilochus colubris
Belted kingfisher	Megaceryle alcyon
Downy woodpecker	Dendrocopos pubescens
Hairy woodpecker	Dendrocopos villosus
Pileated woodpecker	Dryocopus pileatus
Yellow-shafted flicker	Colaptes auratus
Eastern kingbird	Tyrannus tyrannus
Eastern phoebe	Sayornis phoebe
Eastern wood pewee	Contopus virens
Great crested flycatcher	Myiarchus crinitus
Olive-sided flycatcher	Nuttallornis borealis
Bank swallow	Riparia riparia
Barn swallow	Hirundo rustica
Purple martin	Progne subis
Rough-winged swallow	Stelgidopteryx ruficollis
Tree swallow	Iridoprocne bicolor
Blue jay	Cyanocitta cristata

Appendix 15. Continued

Common Name	Scientific Name
Common crow	Corvus brachyrhynchos
Black-capped chickadee	Parus atricapillus
Carolina chickadee	Parus carolinensis
Tufted titmouse	Parus bicolor
White-breasted nuthatch	Sitta carolinensis
Brown thrasher	Toxostoma rufum
Catbird	Dumetella carolinensis
Mockingbird	Mimus polyglottos
Robin	Turdus migratorius
Veery	Hylocichla fuscescens
Wood thrush	Hylocichla mustelina
Ruby-crowned kinglet	Regulus calendula
Cedar waxwing	Bombycilla cedrorum
Starling	Sturnus vulgaris
Red-eyed vireo	Vireo olivaceus
American redstart	Setophaga ruticilla
Black-and-white warbler	Mniotilta varia
Black-throated blue warbler	Dendroica caerulescens
Cape May warbler	Dendroica tigrina
Chestnut-sided warbler	Dendroica pensylvanica
Magnolia warbler	Dendroica magnolia
Myrtle warbler	Dendroica coronata
Worn-eating warbler	Helmitheros vermivorus
Yellow-breasted chat	Icteria virens
Yellow warbler	Dendroica petechia
Yellowthroat	Geothlypis trichas
Baltimore oriole	Icterus galbula
Brown-headed cowbird	Molothrus ater
Common grackle	Quiscalus quiscula
Red-winged blackbird	Agelaius phoeniceus
Scarlet tanager	Piranga olivacea
Cardinal	Richmondena cardinalis
Indigo bunting	Passerina cyanea
Rose-breasted grosbeak	Pheucticus ludovicianus
American goldfinch	Spinus tristis
Evening grosbeak	Hesperiphona vespertina
Chipping sparrow	Spizella passerina
Field sparrow	Spizella pusilla
Fox sparrow	Passerella iliaca
Song sparrow	Melospiza melodia
White-throated sparrow	Zonotrichia albicollis
Vesper sparrow	Pooecetes gramineus
Rufous-sided towhee	Pipilo erythrophthalmus
Slate-colored junco	Junco hyemalis

[1]Sequence from American Ornithologists' Union in the main, although alphabetical rearrangements have been made.

Appendix 16. Partial List[1] of Preferred Foods of White-tailed Deer in New York Compiled by the Department of Environmental Conservation.

Preferred or Best Liked	Second Choice	Readily Eaten	Starvation or Poor Food
Cedar, white or arbor-vitae	Elderberry	Greenbrier	Pine, scots**[3]
Yew	Elder, red berried	Ash, white	Pine, pitch**
Apple	Ash, mountain	Maple, sugar	Beech
Sassafras	Cucumber tree	Arrow wood, maple leaved	Sweet fern
Maple, mountain	Cranberry, highbush	Oaks*	Aspen or poplar
Wintergreen	Nannyberry	Grape, wild	Gooseberry and currant*
Maple, striped	Arbutus	Birch, yellow	Buckthorn
Dogwood, alternate leaved	Honeysuckle, fly	Birch, black	Raspberry and blackberry
Dogwood, flowering	Honeysuckle	Chestnut	Steeplebush
Sumac, staghorn	Hemlock	Hickory	Laurel, mountain**
Maple, red	Wild raisin	Cherry, choke	Rhododendron**
Witch hobble	Blueberry, highbush	Cherry, wild black	Pine, white **
Basswood	Dogwood, silky	Witch hazel	Pine, red or Norway**
	Dogwood, red osier	Spice bush	Balsam**
	Dogwood, round-leaved	Elm	Birch, paper
	Willow*[2]	Choke berry, black	Birch, gray
		Arrow wood	Ironwood, or hop hornbeam
		Honeysuckle, bush	Blue beech, or muscle wood
		Walnut, black	Meadowsweet
		Butternut	Cedar, red**
		Hazelnut	Juniper, pasture**
		Juneberry or shadbush	Cherry, fire or pin
		Holly, mountain	Hawthorn
		Holly or winterberry*	Laurel, sheep
		Ash, black	Dogwood, grey-stemmed
		Blueberry, low sweet	Locust, black
		Blueberry, sour top	Huckleberry, black
		Blueberry, low bush	Tamarack
		Leatherwood	Alder
			Spruces

1 This is a partial list of tree and shrub species eaten by deer arranged with the best foods at the beginning, fair foods in middle and starvation foods toward the end. The arrangement is based on thousands of observations in hundreds of wintering areas over many years in all parts of New York.

2 A * indicates there is considerable difference in palatability or preference of the different species of this genus. They vary from this point to very low.

3 A ** indicates this species is often browsed heavily enough to appear to be second choice food in areas where food is inadequate.

Appendix 17. Photo Stations for the 22 Sites in New York

Photo Station	Description and Location
	Site 1
1	General view of the ROW and adjacent forest, looking north. (Taken from 2nd tier of tower 1, north-northwest leg).
2	General view of the ROW and adjacent forest, looking north-northwest. (Taken from 2nd tier at middle of north-northwest side of tower 2).
3	Slight, moderate, and severe gully erosion on access road, looking south-southwest. (Taken 3 feet north-northeast of edge of access road, 103 feet northwest of west leg of tower 3A.)
4	Example of spot-cutting maintenance procedure on the ROW, looking southeast. (Taken 3½ feet from north-northeast edge of ROW, 112 feet northwest of west leg of tower 3A.)
5	Ground water on access road, looking southeast. (Taken on north-northeast edge of access road, 252 feet southeast of east leg of tower 4A.)
6	Open area on mesic plot 2, showing spotty maintenence on the ROW, and tartarian honeysuckle community, looking southeast. (Taken 7 feet southwest of south leg of tower 4, 73 feet southeast.)
7	Access road climbing extreme slope looking northwest toward towers 5 and 5A, with some erosion. (Taken from northeast side of access road, 305 feet northwest of north leg of tower 4A.)
8	General view of the ROW and adjacent forest, looking southeast. (Taken from 2nd tier of tower 5, southwest leg.)
9	Severe gully erosion along edge of access road on the ROW, looking north-northwest. (Taken 40 feet southwest of south leg of tower 6.)
10	Severe gully erosion along edge of access road on the ROW, looking southeast. (Taken 105 feet northwest of north leg of tower 6.)
11	General view of the ROW and adjacent forest, looking southeast. (Taken from 2nd tier of tower 7, south leg.)
12	General view of the ROW and adjacent forest, looking northwest toward railroad track and end of study area, with staghorn-sumac, a root-suckering species, on the ROW. (Taken from 2nd tier of tower 7, west leg.)
13	Interrupted fern, royal fern, and wild cranesbill on the ROW, with cinnamon-fern near the railroad tracks, looking southwest, between towers 7 and 8. (Taken in area of wood chips 75 feet southwest of the ROW's northeast edge, 60 feet southeast of the railroad tracks.)

Appendix 17. Continued

Photo Station	Description and Location
14	General view of the ROW and adjacent forest, looking southeast. (Taken from east leg of tower 8.)
15	Panoramic view of study area, looking southwest, as seen from Rt. 9A. (Taken at light pole at corner of Rt. 9A and Fairview Park Road.)
16	Panoramic view of study area, looking northwest, as seen from Rt. 9A. (Taken at light pole at corner of Rt. 9A and Fairview Park Road.)
17	Panoramic view of study area, well screened by trees where ROW crosses Saw Mill Parkway, looking north. (Taken from median strip of Saw Mill Parkway - South, at exit to Rts. 287/87.)
18	Panoramic view of the site, looking south-southwest from Rt. 100C. (Taken at south edge of Rt. 110C from base of de-energized electrical pole #W1144S.)
19	Panoramic view of site, looking south from Saw Mill Parkway - South. (Taken immediately past entrance ramp from Rt. 100 of road, 84 feet east of "50 mph" sign.)
	Site 2
1	General view of the ROW and adjacent forest, looking south-southwest toward substation. (Taken from west corner of the base of tower 2.)
2	General view of the ROW and adjacent forest, looking south-southeast. (Taken from south corner of the base of tower 2.)
3	Logs piled at the northeast edge of the ROW. (Taken 3 feet north-northeast of north corner of the base of tower 3.)
4	Topped hemlock on the ROW along a stream bank, looking east. (Taken 9 feet south-southeast of middle edge of access road above stream, 11½ feet north-northeast of 2-inch d.b.h. sweet birch).
5	Horsetail community on the ROW, looking northwest. (Taken at corner of access road and ROW, near southeast corner of hydric plot 1.)
6	Severe sheet and rill erosion on bank cut at tower 4, where seeding was apparently unsuccessful, looking north. (Taken 84 feet southeast of tower 4 at a 45^{o} angle.)
7	General view of the ROW and adjacent forest, looking northwest. (Taken 12 feet west of tower 5.)
8	Sweet-fern invading the ROW, looking north. (Taken 16 feet west of tower 5.)
9	General view of the ROW and adjacent forest, looking southeast. (Taken 11 feet south-southwest of tower 5.)

Appendix 17. Continued

Photo Station	Description and Location
10	Seeded area on the ROW at tower 6. (Taken 87 feet southwest of tower 6, at a 45° angle to the tower.)
11	General view of the ROW and adjacent forest, looking southeast toward tower 8, where ROW changes direction. (Taken from east corner of base of tower 7.)
12	Pure sweet-fern community crosses the ROW north of tower 7. (Taken 30 feet south-southwest of tower 7, at a 45° angle from the base of the tower.)
13	General view of the ROW and adjacent forest, looking east. (Taken from middle of base of tower 8.)
14	General view of the ROW and adjacent forest, looking northwest. (Taken from west corner of base of tower 8.)
15	General view of the ROW and adjacent forest, looking east. (Taken from middle of base of tower 10.)
16	General view of the ROW and adjacent forest, looking west. (Taken from southwest corner of base of tower 12.)
17	General view of the ROW and adjacent forest, looking west. (Taken 3 feet west of rock, 65 feet southeast of tower 13 at a 45° angle to the tower.)
18	View of the study area from Rt. 17, looking east. (Taken from Rt. 17 - North, 50 feet from "No Parking" sign with sign beneath it designating 17/8511/1033.)
19	View of the study area from Rt. 202. (Taken from Rt. 202 and Babbling Brook Lane.)
	Site 3
1	General view of the ROW and adjacent forest, looking south. (Taken approximately 381 feet south of the base of tower 61, beside a large rock.)
2	Private gardens on the east side of the ROW. (Taken approximately 381 feet south of the base of tower 61, beside a large rock.)
3	American hornbeam on the ROW, left from selective clearing, looking southwest. (Taken 150 feet beyond photo station 2.)
4	General view of the ROW and adjacent forest showing drop and lop method of slash disposal, looking north. (Taken from the base of tower 60.)

Appendix 17. Continued

Photo Station	Description and Location
5	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 60.)
6	Slight sheet and rill erosion along access road on the ROW near tower 59, with a community of pokeweed which has invaded since line clearing, looking west. (Taken about 90 feet north of tower 59.)
7	General view of the ROW and adjacent forest, looking north. (Taken 63 feet south of tower 59.)
8	Remnants of chestnut on the ROW, on the east side of the ROW. (Taken 63 feet south of tower 59.)
9	General view of the ROW and the adjacent forest, looking south. (Taken from base of tower 58.)
10	Wet area on ROW where culvert is needed at access road. (Taken approximately 300 feet south of tower 58, shooting northeast.)
11	General view of the ROW and adjacent forest, looking north. (Taken 52 feet north of tower 57.)
12	Severe gully erosion on the ROW near tower 57. (Taken 52 feet northwest of tower 57, looking east.)
13	General view of the ROW and adjacent forest, looking south. (Taken approximately 500 feet north of tower 56.)
14	Mullein growing on the ROW, having invaded since line clearing. (Taken 264 feet northwest of tower 54, looking southeast.)
15	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 54.)
16	Noxious weeds, including thistle, invading disturbed areas of the ROW. (Taken approximately 396 feet north of tower 53, looking north.)
17	General view of the ROW and adjacent forest, looking north. (Taken from base of tower 53.)
18	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 53.)
19	Slash in gully on the ROW, looking south-southeast. (Taken from base of tower 53.)
20	General view of the ROW and adjacent forest, looking north from Sterling Lake Road. (Taken from edge of road.)
	Site 4
1	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 107.)

Appendix 17. Continued

Photo Station	Description and Location
2	Hay-scented fern community on the ROW, looking southwest. (Taken about 119 feet south of southwest leg of tower 107.)
3	Gray birch on the ROW, looking south. (Taken approximately 441 feet south of southeast leg of tower 107.)
4	Flowering dogwood on the ROW looking southwest. (Taken approximately 522 feet south of tower 107.)
5	General view of the ROW and adjacent forest, looking north. (Taken approximately 216 feet north of the northeast leg of tower 108, from a large rock.)
6	Open soil under tower 108 exhibiting moderate sheet and rill erosion. (Taken 10 feet east from tower 108.)
7	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 108.)
8	Hay-scented fern community on the ROW, looking northwest. (Taken south of tower 58, at corner of large rock near access road, approximately 651 feet south of tower 109.)
9	General view of the ROW and adjacent forest, looking north. (Taken 62½ feet north of the east leg of tower 110.)
10	Open area under tower, invading with huckleberry, mixed grass, hay-scented fern, and scattered hemlock. Wood-lily is also shown. (Taken 9 feet east of photo station 9.)
11	General view of the ROW and adjacent forest, looking south. (Taken from base of tower 111.)
12	General view of the ROW and adjacent forest, looking north. (Taken from base of tower 114.)
13	General view of the ROW with alder swamp and Sterling Lake Road in the background, looking south. (Taken 100 feet south of base of tower 114.)
14	General view of the ROW with alder swamp, looking north from Sterling Lake Road. (Taken from edge of road.)
	Site 5
1	General view of the ROW and adjacent area from South Street, looking southeast. (Taken 18 feet southwest of telephone pole 152/15 south-east of South Street.)
2	General view of apple orchard on the ROW, looking southeast. (Taken 10 feet southwest of stake at edge of north woods, adjacent to tower 58.)

Appendix 17. Continued

Photo Station	Description and Location
3	Open soil under tower 57 exhibiting slight sheet and rill erosion, looking northeast. (Taken 6 feet southwest of tower 57.)
4	General view of the ROW and adjacent forest, looking southeast toward wet area. (Taken from base of tower 57.)
5	General view of the ROW and adjacent area, looking northwest. (Taken from northwest base of tower 57.)
6	General view of the ROW and adjacent forest, looking southeast. (Taken from base of tower 56.)
7	General view of the ROW and adjacent forest, looking northwest. (Taken 30 feet southwest of structure 54.)
8	Staghorn- and smooth sumacs, typical species on the ROW not found in the adjacent forest, looking south. (Taken from southeast side of access road, 90 feet east of structure 55 at a 45° angle.)
9	Remnants of logs piled on the ROW, probably left from ROW clearing, west of tower 53. (Taken approximately 390 feet east of structure 54, 5 feet north of the logs.)
10	View of the ROW, looking northwest down steep slope at sumac community with sassafras in the background of tower 52. (Taken on steep slope approximately 150 feet southeast of tower 52.)
11	General view of the ROW and adjacent forest, looking northwest. (Taken from 2nd tier of tower 51.)
	Site 6
1	General view of the ROW and adjacent forest, looking northwest. (Taken 3 feet southwest of structure 720.)
2	Partially dead red maple and oak with chemical retention. (Taken 30 feet northwest of structure 718, looking east.)
3	General view of the ROW and adjacent forest, looking southeast. (Taken 25 feet northeast of structure 692, 90 feet northwest.)
4	Open area from grading of access road going through successional stages, invading with mixed grass, herbs, white pine, and gray birch. (Taken 12 feet southwest of structure 692, 66 feet southeast, looking south.)
5	General view of the ROW and adjacent area, looking north. (Taken 30 feet southeast of structure 691.)
6	Ruts on the ROW caused by heavy equipment damage in wet weather, looking west. (Taken 262 feet southwest of pole 691.)

Appendix 17. Continued

Photo Station	Description and Location
7	General view of the ROW and adjacent forest, looking northwest toward Thruway (Rt. 90) where study area ends. (Taken 45 feet northwest of pole 690A.)
8	Dead or partially dead red maples left on the ROW after spraying, looking east. (Taken 4 feet north of pole 691A.)
9	Ground-juniper and white pine invading the ROW, with a sweet-fern community in the background, looking northeast. (Taken 25 feet southwest of tower 12, 52 feet northwest.)
10	Spiraea on the ROW, looking north. (Taken 24 feet southwest of tower 12, 197 feet northwest.)
11	Dead gray dogwood from chemical spray on the ROW, looking southwest. (Taken 13 feet southwest of tower 13, 36 feet southeast.)
12	Open soil under tower 14, exhibiting slight sheet erosion, looking northeast. (Taken 10 feet southwest of tower 14.)
13	Intermittent stream on the ROW, with a cat-tail community in the background, looking west. (Taken 144 feet northeast of milepost 161/7 on the Thruway, 108 feet southeast, on southeast side of stream.)
14	Severe gully erosion on access road, looking north. (Taken 120 feet east of tower 10 at a 45° angle, on south side of access road.)
15	General view of the ROW and adjacent forest, looking southeast from Thruway (Rt. 90). (Taken from southeast side of Thruway, going west, immediately prior to exit 26, at milepost 161/7.)
	Site 7
1	General view of the study area from Rt. 30, looking southeast. (Taken on Rt. 30 North at green sign 30/9502/1056.)
2	General view of PASNY's Blenheim-Gilboa Pumped-Storage building from Rt. 30. (Taken from Rt. 30 North at electric distribution pole M+184, near pole NM 45.)
3	View of substation from Rt. 30. (Taken from Rt. 30 North, electric pole NM 44.)
4	General view of study area, looking southeast from substation. (Taken from northwest corner of fence surrounding substation.)
5	North side of tower GNS-1/1/8 structure opening, looking north-northwest. (Taken 9 feet north of southeast leg of tower GNS-1/1/8, 94 feet east of same.)

Appendix 17. Continued

Photo Station	Description and Location
6	East side of tower 8 structure opening. (Taken 40½ feet north of northeast leg of tower GNS-1/1/8, 31½ feet east of same.)
7	South side of tower 8 structure opening. (Taken 40½ feet north of northeast leg of tower GL 1/8, 143 feet east of same.)
8	West side of tower 8 structure opening. (Taken 2nd tier of tower GL 1/8, southeast leg.)
9	General view of structure opening at tower 8, looking northeast. (Taken 41 feet south of southeast leg of tower G 1/8, 31 feet east.)
10	General view of the ROW and adjacent forest, looking west. (Taken from west side of tower GNS-1121.)
11	General view of the ROW and adjacent forest with feathering obvious, looking west. (Taken from 3rd tier of tower GNS-1/2/2, southwest leg.)
12	General view of the ROW and adjacent forest, looking east. (Taken from northeast leg of tower GNS-1/2/2.)
	Site 8
1	General view of the ROW and adjacent area from Rush Road, looking south. (Taken from south edge of Rush Road.)
2	General view of the ROW and adjacent area, looking basically west toward Rush Road. (Taken 24 feet north of center of structure 34.)
3	General view of the ROW and adjacent forest, looking south. (Taken 80 feet south of structure 34, between 2 easternmost poles.)
4	Whorled loosestrife and hay-scented fern communities on the ROW, with sweet birch and red oak seedlings, and sweet-fern and witch-hazel in the background. (Taken about 10 feet north-northeast of photo station 3, looking north-northeast.)
5	Equipment cut exhibiting moderate sheet erosion on the ROW, looking northeast. (Taken 12 feet southwest of photo station 3.)
6	Deer browse on sweet-fern and sweet birch on the ROW between structures 34 and 33, looking east. (Taken approximately 261 feet north of structure 33, on west edge of access road.)
7	Water running down access road on the ROW, looking south. (Taken 6 feet northeast of photo station 6, on east edge of access road.)
8	Sweet birch invading the ROW, with deer stand in background, looking northeast. (Taken 30 feet northeast of structure 33, on west side of access road.)

Appendix 17. Continued

Photo Station	Description and Location
9	Sweet birch browsed by deer on the ROW. (Taken 75 feet south of mesic plot 3, south of structure 33.)
10	General view of the ROW and adjacent forest, looking west. (Taken 70 feet north of structure 32, easternmost pole.)
11	Access road healed with whorled loosestrife and mixed grass, looking north-northeast. (Taken 20 feet west of structure 31.)
12	Equipment cut exhibiting moderate sheet erosion on the ROW, looking south-southeast. (Taken from east side of access road, 87 feet southeast of structure 32.)
13	Remnants of past line clearing practices, charred logs on the ROW, looking southwest. (Taken from northeast edge of access road, northwest of structure 30.)
14	General view of the ROW and adjacent forest, looking northwest. (Taken from edge of access road, southwest of structure 30.)
15	General view of the ROW and adjacent forest, looking southeast. (Taken from northeast edge of access road, southwest of structure 29.)
16	Xeric plot 5, with deer-browsed yellow birch at end of plot, looking northeast. (Taken 50 feet southwest of photo station 15.)
	Site 9
1	General view of the ROW and adjacent forest, looking east from Breezeport Road. (Taken from Breezeport Road.)
2	General view of the ROW and adjacent forest, looking west from Breezeport Road. (Taken from Breezeport Road.)
3	Stream crossing the ROW, looking north. (Taken from corner of access road on east side of stream.)
4	Depression, result of old equipment damage, and poles left on the ROW, looking northwest. (Taken from northern edge of access road, on west bank of stream.)
5	Grass community on the ROW, with partially dead cherries in background, not completely killed by chemicals, looking southeast. (Taken from base of pole 38B.)
6	Severe gully erosion along wash, apparently an intermittent stream, looking southwest. (Taken from northwest side of wash, 33 feet north of pole 38A.)
7	Severe gully erosion along wash, apparently an intermittent stream, looking southwest into the adjacent forest. (Taken approximately 10 feet south of pole 37C.)

Appendix 17. Continued

Photo Station	Description and Location
8	General view of the ROW and adjacent forest, looking east. (Taken approximately 10 feet south of pole 37C.)
9	Dead aspen off the ROW, which may have been caused by drift, looking southeast. (Taken approximately 8 feet south of pole 37D.)
10	Partially killed red maple, killed by chemicals on ROW. Approximately 28 feet south of pole 37D.
11	Dead and partially dead trees, mainly cherry, looking east. (Taken approximately 125 feet east of pole 37D at south corner of access road.)
12	Past land use practices evidenced, with apple trees seeding in on the ROW from an old orchard south of the ROW, looking north. (Taken approximately 20 feet south of pole 41B.)
13	Dead and partially dead quaking aspen, looking east. (Taken 12 feet south of pole 41B.)
14	Diversion ditch on the ROW, looking northeast. (Taken 227 feet southeast from corner of pole 41B.)
15	General view of the ROW and adjacent forest, looking west, with Breezeport Road in background. (Taken from structure 42.)
16	Slight sheet and rill erosion on the access road on the ROW, looking northwest. (Taken 56 feet east, 140 feet south of structure 32, on the south side of the access road.)
17	Equipment cut on the ROW exhibiting slight sheet and rill erosion, looking south. (Taken 56 feet east of structure 32.)
	Site 10
1	General view of the ROW and adjacent forest, looking west from Rt. 17. (Taken at sign 17/5102/1150 on Rt. 17 West.)
2	General view of the ROW and adjacent forest, looking south from Rt. 17. (Taken at sign 17/5102/1151 on Rt. 17 East.)
3	Witch-hazel, a desirable shrub on the ROW, looking south. (Taken 112 feet south of base of tower 198.)
4	Stream crossing the ROW, looking south. (Taken 35 feet west of pole 59.)
5	General view of the ROW and adjacent forest, showing cultivated area on the ROW, looking west. (Taken from tower 199.)
6	Ponded area on the ROW, looking south-southwest. (Taken 10 feet from base of tower 62.)

Appendix 17. Continued

Photo Station	Description and Location
7	American hornbeam, a desirable species, on the ROW, looking south-southwest. (Taken from base of pole 63.)
8	Cat-tail community on the ROW, looking northwest. (Taken 12 feet west of tower 202.)
9	General view of the ROW and adjacent forest, looking east. (Taken from base of tower 203.)
10	Moderate sheet and rill erosion on the ROW at a bank cut at tower 203, looking southwest. (Taken approximately 50 feet northwest of northwest leg of tower 203.)
11	Willow and quaking aspen at the bottom of a bank cut at tower 203. Taken approximately 50 feet northwest of northwest leg of tower 203.)
12	General view of the ROW and adjacent forest, looking east. (Taken from base of tower 205.)
13	General view of the ROW and adjacent forest, looking west, with xeric plot 3 shown. (Taken from base of tower 203.)
14	General view of the ROW and adjacent forest, looking east. (Taken from base of tower 207.)
	Site 11
1	General view of the stu ' area from Feeley Road, looking west. (Taken from edge of Feeley Roa at pole NM 17/RTC10.)
2	General view of the ROW and adjacent forest, looking east. (Taken from base of structure 145.)
3	General view of the ROW and adjacent forest, looking west. (Taken from base of structure 145.)
4	Northern White-Cedar forest adjacent to the ROW, looking northwest. Taken from base of structure 145.)
5	Scotch pine seedlings on the ROW, with pasture in background, looking southeast. (Taken 60 feet east of pole 145A.)
6	Multiple stems from stump sprout of American hornbeam on the ROW, looking northeast. (Taken 27 feet north of southwest corner of mesic plot 3, at edge of cleared corridor for logging.)
7	General view of the ROW and adjacent forest, looking east. (Taken 47 feet east of base of pole 149A.)
8	General view of the ROW and adjacent forest, looking west. (Taken 40 feet east of base of pole 149A.)

Photo Station	Description and Location
9	Multiple stems of gray dogwood on the ROW, looking northwest. (Taken 27 feet north of southwest corner of mesic plot 3, at edge of cleared corridor for logging.
	Site 12
1	General view of the ROW and adjacent area, looking west from Rt. 250. (Taken from east side of Rt. 250, 15 feet north of "International Rotary" sign.)
2	Open area on the ROW under tower 122 exhibiting moderate sheet erosion, looking southeast. (Taken approximately 4 feet south of southeast leg of tower 122.)
3	General view of the ROW and adjacent forest, looking east toward Rt. 250. (Taken from base of tower 122.)
4	Grape growing up tower 123, looking northwest. (Taken 64 feet east of tower 123, 13 feet north.)
5	Sand pile on the ROW, looking west. (Taken 60 feet west of northwest leg of tower 123.)
6	Tower 122 with grape, poison ivy, sassafras, white ash, quaking aspen, and rose, looking west. (Taken 72 feet east of northeast leg of tower 123.)
7	General view of the ROW and adjacent forest, looking east, showing vegetation at stream crossing the ROW. (Taken 212 feet east of north leg of tower 119.)
8	Sassafras on the ROW, looking west. (Taken 212 feet east of north leg of tower 119.)
	Site 13
1	General view of the ROW and adjacent forest, looking west from County Line Road. (Taken approximately 50 feet north of telephone pole 276, 13 feet east of County Line Road.)
2	General view of the ROW and adjacent area, looking east from County Line Road. (Taken approximately 50 feet north of telephone pole 276, 13 feet east of County Line Road.)
3	Solid community of gray dogwood at the north edge of the ROW. (Taken from base of north pole of structure 135.)
4	Community of staghorn-sumac at the north edge of the ROW, looking northeast. (Taken from base of north pole of structure 135.)

Appendix 17. Continued

Photo Station	Description and Location
5	Gray dogwood community on the ROW, looking west. (Taken 66 feet southeast of south pole of structure 136.)
6	Solid community of gray dogwood on the ROW, looking northwest. (Taken 183 feet east of structure 141, on south side of access road.)
7	On the ROW, gray dogwood gives way to aspen, looking north. (Taken 26 feet west of tower 141 on south side of access road.)
8	Enclosure of access road by gray dogwood, looking northwest. (Taken 82 feet west of structure 141.)
9	Irrigation ditch crossing the ROW with sprouts of red maple on the northwest bank, looking northwest. (Taken 22 feet north of structure 142, 80 feet east along south side of access road.)
10	Large-toothed aspen, an undesirable species on the ROW, looking west. (Taken 9 feet north of structure 136.)
	Site 14
1	General view of the ROW and adjacent forest, looking west. (Taken from base of tower 63.)
2	Topped sugar-maple on the ROW at Rt. 48, looking northwest. (Taken 145 feet east of Rt. 48, on north side of access road, at base of tree-of-heaven.)
3	General view of the ROW and adjacent forest, looking east. (Taken at corner of access road and west edge of Rt. 48.)
4	General view of the ROW and adjacent forest, looking west. (Taken 300 feet west of base of tower 62, on south side of access road.)
5	Stream with culvert under the road on the road, looking north. (Taken 217 feet east of base of tower 61, 26 feet south of access road.)
6	Brush pile on the ROW, looking south. (Taken 128 feet west of tower 60, northern structure.)
7	General view of the ROW and adjacent forest, looking east. (Taken 18 feet south, 121 feet west of tower 58, northern structure.)
8	General view of the ROW and adjacent forest, looking west. (Taken 18 feet south, 121 feet west of tower 58, northern structure.)
9	Open area showing natural succession, looking southeast. (Taken from northeast leg of tower 56, northern structure.)
10	General view of the ROW and adjacent forest, looking west toward County Rt. 8. (Taken from base of tower 55, northern structure.)

Appendix 17. Continued

Photo Station	Description and Location
11	Dead trees in swamp on the ROW, looking northeast. (Taken from northeast leg of tower 54, northern structure.)
12	General view of the ROW and adjacent forest, looking east from Doolittle Road. (Taken from corner of Doolittle Road and access road, at telephone pole 109.)
13	General view of the ROW and adjacent forest, looking west from Doolittle Road. (Taken from corner of Doolittle Road and access road, at telephone pole 109.)
	Site 15
1	General view of the ROW and adjacent forest, looking west. (Taken 7 feet south of pole 84B, 38 feet east.)
2	Slight sheet erosion on the ROW on healed-over access road, looking east. (Taken 125 feet west of pole 84.)
3	General view of the ROW and adjacent forest, looking west from Rt. 48. (Taken 15 feet east of Rt. 48.)
4	View of the ROW, looking west toward a wet area with structure 81 in the background. (Taken 83 feet east of structure 8.)
5	Alder community on the ROW, looking west. (Taken 203 feet west of pole 81.)
6	Cat-tail community on the ROW, looking east. (Taken from middle of culvert at east edge of access road, east of pole 80.)
7	General view of the ROW and adjacent forest, looking east. (Taken 81 feet east of pole 78A.)
8	General view of the ROW and adjacent forest, looking west. (Taken 81 feet east of pole 78A).
9	General view of the ROW and adjacent forest, looking west. (Taken at base of structure 77.)
10	General view of the ROW and adjacent forest, looking west. (Taken 36 feet southeast of pole 75.)
11	Small stream crossing the ROW, well shaded by sedge, spiked loosestrife, elderberry, and alder, looking northwest. (Taken west of culvert, 57 feet east of structure 74, north of access road.)
12	General view of the ROW and adjacent forest, looking west (Taken from base of structure 71.)
13	General view of the ROW and adjacent forest, looking west. (Taken from south side of pole 69.)

Photo Station	Description and Location
	Site 16
1	General view of the ROW and adjacent forest, looking east. (Taken from Crown Point Road.)
2	General view of the ROW and adjacent forest, looking west from Crown Point Road. (Taken from Crown Point Road.)
3	Severe sheet erosion on the ROW caused by equipment cut, looking northeast. (Taken 6 feet south of pole 86, 50 feet west.)
4	Pit on the ROW, made by equipment, looking southeast. (Taken 60 feet east of structure 86.)
5	Wet area on the ROW, looking southeast. (Taken 25 feet northeast of photo station 4.)
6	Ground-juniper, a desirable species, killed on the ROW by aerial application, looking southeast. (Taken 87 feet west of structure 86.)
7	Stream crossing the ROW, looking north. (Taken 7 feet west, 7½ feet north of black cherry with 9½ inch d.b.h. at south ROW edge).
8	Boulder where earth has fallen off naturally, looking southeast. (Taken 258 feet west of pole 85.)
9	Looking southeast off the ROW at apple trees in an old field going through natural succession. (Taken 120 feet east of structure 85.)
10	Excavation on and off the ROW, made by equipment, looking northeast. (Taken 85 feet west of pole 84-1, 5 feet north.)
11	Stream crossing the ROW, looking east. (Taken from base of pole 84-1.)
12	General view of the ROW and adjacent forest, looking east.
13	Ground-juniper on the ROW, looking southwest. (Taken 30 feet west of structure 30.)
14	Mullein on the ROW, looking north. (Taken 20 feet south of pole 87, 125 feet west.)
	Site 17
1	View of the study area, looking west from Chazy Lake Road. (Taken from the lake side of Chazy Lake Road, 3/10 mile south of "Copper Hopper" sign.)
2	General view of the ROW and adjacent forest, looking northwest. (Taken 30 feet west of structure 30.)

Appendix 17. Continued

Photo Station	Description and Location
3	General view of the ROW and adjacent forest, looking southeast, showing pin-cherry and aspen with mixed grass-herb on the ROW, and largely northern hardwood species in the forest. (Taken from base of pole 30A.)
4	General view of the ROW and adjacent forest, looking northwest. (Taken from base of pole 30A.)
5	White ash, typical of height of woody species on east side of Lyon Mountain, looking north. (Taken 24 feet southwest of pole 29B, 54 feet southeast.)
6	General view of the ROW and adjacent forest, looking south. (Taken from base of pole 1D.)
7	General view of study area, looking north toward Rt. 374 and the Lyon Mountain substation. (Taken from base of pole 2B.)
8	Tall white ash on the ROW, looking southeast. (Taken from base of pole 2C.)
9	Moderate sheet and rill erosion occurring on disturbed soil resulting from past mining use on the ROW. (Taken 135 feet southeast of pole 2B, looking south-southeast.)
10	General view of the ROW and adjacent forest, looking northwest. (Taken 4 feet southwest of pole 3A.)
11	General view of the ROW and adjacent forest, looking northwest. (Taken 15 feet southwest of pole 4A, 74 feet northwest.)
	Site 18
1	General view of the ROW and adjacent forest, looking southeast. (Taken 9 feet southwest of northeast pole of structure 1, 147 feet northwest.)
2	Cut and left Scotch pine left from initial ROW clearing, and new Scotch pine seedlings, looking south. (Taken from base of northeast pole of structure 1.)
3	Slight sheet erosion on open sandy soil on the ROW, looking northeast. (Taken 12 feet southwest of southwest pole of structure 1, 162 feet southeast.)
4	General view of the ROW and adjacent area, with pasture and small wet depression in the background, looking northwest. (Taken 8½ feet southeast of northeast pole of structure 2, 43 feet northeast.)
5	Woody species on the ROW, including red maple, quaking aspen, and gray birch, looking southeast. (Taken from base of southwest leg of structure 3.)

Appendix 17. Continued

Photo Station	Description and Location
6	Mountain-holly, a desirable shrub, on the ROW, looking south. (Taken from base of northeast pole of structure 4.)
7	Dry site with moss-lichen community invading with blackberry, birch, and white pine, looking northeast. (Taken 2 feet northeast of southwest pole of structure 4, 200 feet southeast.
8	General view of the ROW and adjacent forest, looking southeast. (Taken from base of northeast pole of structure 5.)
9	General view of the ROW and adjacent area, looking southeast. (Taken from base of northeast pole of structure 6.)
10	General view of the ROW and adjacent forest, looking northwest. (Taken from base of southwest pole of structure 7.)
11	General view of the ROW and adjacent area, looking east. (Taken from base of center pole of structure 8.)
12	General view of the ROW and adjacent area, looking west. (Taken from south pole of structure 29-2.)
	Site 19
1	General view of the ROW and adjacent forest, looking north. (Taken 3 feet west of east pole of structure 2W/75/9, 64 feet north.)
2	Sheet and rill erosion on borrow pit on the ROW. (Taken 17 feet north of east pole of structure 2W/75/9, 40 feet east, looking south.)
3	Blackberry and bracken community on the ROW, with occassional black cherry, looking east. (Taken 49 feet west of west pole of structure 2W/75/8, 34 feet south.)
4	Dead and dying black cherry and hemlock, apparently due to changes in drainage patterns, looking southeast. (Taken 25 feet west of west pole of structure 2W/75/7, 267 feet south.)
5	General view of the ROW and adjacent forest, looking south. (Taken 57 feet south of west pole of structure 1E/75/5, 54 feet west.)
6	General view of the ROW and adjacent forest, looking north. (Taken 57 feet south of west pole of structure 1E/75/5, 54 feet west.
7	Borrow pit excavation on the ROW, looking east. (Taken 33½ feet east of east pole 2B of structure 2W/75/5, 17 feet south.)
8	Stream crossing the access road via a culvert on the ROW. (Taken 14 feet south of east pole of structure 2W/75/4, looking east.)
9	Balsam-fir and black cherry on the ROW, with a cat-tail community in the background. (Taken from base of west pole of structure 1E/75/2, looking northwest.)

Photo Station	Description and Location
10	Severe gully erosion on the access road on the ROW, looking northwest. (Taken 159 feet south of east pole of structure 1E/75/1, 11 feet east.)
11	General view of the ROW and adjacent forest, looking south. (Taken 89 feet north of east pole of structure, 10 feet east; structure is on west side of ROW, beyond structure 2W/75/1.)
	Site 20
1	General view of the ROW and adjacent forest, looking north from Kirch Road. (Taken from south edge of Kirch Road.)
2	Round-leaved sundew on the ROW in area dominated by Sphagnum. (Taken from south edge of Kirch Road.)
3	Quaking aspen on the ROW, looking east. (Taken 57½ feet south of structure CKT11/37, 6½ east, and 6 inches northwest of photo station 2.)
4	Partially dead black cherry off the west side of the ROW, looking northwest. (Taken from base of west pole of structure CKT11/37.)
5	Equipment damage on the ROW, looking northwest. (Taken 45 feet northwest of west pole of structure CKT11/37.)
6	Slight sheet erosion on the ROW, looking west. (Taken 123 feet north of west pole of structure CKT11/37, 14 feet west.)
7	Moderate sheet erosion occurring on the ROW from an excavated area. (Taken 25 feet west of west pole of structure CKT11/36, 215 feet north, looking north.)
8	General view of the ROW and adjacent forest, looking south. (Taken 147 feet west of west pole of structure CKT12/35, 45 feet south from fence.)
9	General view of the ROW and adjacent forest, looking south. (Taken 40½ feet west of west pole of structure CKT11/35.)
10	Red spruce, apparently killed by spray or exposure, off the ROW, looking southeast. (Taken from east pole of structure CKT 12/37.)
11	Juniper, a desirable species, on the ROW, looking west. (Taken 25 feet east of east pole of structure CKT12/38, 60 feet north.)
12	Stump sprouts of black cherry and red maple on the ROW, looking northwest. (Taken 25 feet east of east pole of structure CKT12/38.)
13	General view of the ROW and adjacent forest, looking south. (Taken 33 feet east of east pole of structure CKT12/38, 78 feet south.)

Photo Station	Description and Location
14	Several species of Lycopodium on the east side of the ROW, looking east. (Taken 4 feet east of east pole of structure CKT12/37, 96½ feet south.)
15	Dead hemlock on east side of the ROW. (Taken 4 feet east of west pole of structure CKT11/39, 68 feet noth.)
	Site 21
1	General view of the ROW and adjacent forest, looking northwest from Blake Road. (Taken 25 feet northwest of Blake Road, 30 feet northeast of ROW edge.)
2	General view of the ROW and adjacent forest, looking west. (Taken from base of tower 5.)
3	Florence Creek crossing the ROW, looking south. (Taken 70 feet north of tower 5, 340 feet west, on east bank of creek 60 feet north of access road.)
4	Stump sprouts of red maple on the ROW, looking south. (Taken 60 feet north of tower 5, 340 feet west, on east bank of creek 50 feet north of access road.)
5	Quaking aspen and pin-cherry invading the ROW, looking southeast. (Taken 250 feet east of tower 4, on north side of access road.)
6	Wet area on the ROW, seeded around tower 4, rapidly invading with native vegetation. (Taken 93 feet west of tower 4, looking east.)
7	Equipment cut exhibiting severe sheet and rill erosion on the ROW, looking west. (Taken 75 feet west of tower 4.)
8	Dead Scotch pine along north edge of the ROW. (Taken 118 feet west of tower 4.)
9	General view of the ROW and forest showing live Scotch pine along south edge of the ROW. (Taken 118 feet east of tower 4.)
10	Healthy hemlock along south edge of the ROW, looking southeast. (Taken 93 feet west of tower 4.)
11	Dead hemlock along north edge of the ROW, looking northeast. (Taken 93 feet west of tower 4.)
12	Drainage ditch on the ROW, looking north toward wet area of access road. (Taken 269 feet west of tower 4.)
13	Stone wall on the ROW indicating past agricultural use, looking northwest. (Taken 44 feet south of tower 3, 148 feet west.)

Photo Station	Description and Location
14	Cinnamon-fern, interrupted fern, sensitive fern, and hay-scented fern on the ROW, looking northwest. (Taken 44 feet south of tower 3, 14 feet north.)
15	Wet area on the ROW between towers 1 and 2, with wood chips on the access road, looking west. (Taken from tower 2.)
16	General view of the ROW and adjacent forest, looking east. (Taken approximately midway between towers 1 and 2, on south side of access road.)
17	Ostrich-fern on the ROW. (Taken from west bank of Florence Creek, 30 feet south of access road, looking south-southwest.)
	Site 22
1	General view of the ROW and adjacent area, looking west from Derby Road. (Taken from west side of Derby Road, north base of pole 151½.)
2	Tartarian honeysuckle on the ROW, looking north. (Taken 13 feet north of pole 143A, Line 73, 165 feet east.)
3	Open area on the ROW mechanically or hand cut with dead material from Ammate in the background. (Taken 24 feet northwest of pole 143A, Line 74.)
4	Chemically treated white ash on the ROW with some resurgent growth, looking north-northwest. (Taken 75 feet west of pole 143A, Line 74.)
5	General view of the ROW and adjacent forest, looking west. (Taken from pole 143A, Line 74.)
6	Arrow-wood community on the ROW, with chemically treated white ash near the middle, looking north. (Taken 65 feet northwest of pole 143A, Line 74.)
7	Staghorn-sumac community on the ROW, looking northwest. (Taken from base of pole 144, Line 74.)
8	General view of the ROW and adjacent area, looking east. (Taken 115½ feet west of pole 147B, Line 74.)

Appendix 18. Land use classification for New York State

Agriculture (A)

Active Areas

Ao - Orchards
Av - Vineyards
Ah - Horticulture or floriculture
At - High intensity cropland
Ac - Cropland and cropland pasture
Ap - Pasture
Ay - Specialty farms

Inactive Areas

Ai - Inactive agricultural land
Ui - Urban inactive
Uc - Under construction

Commercial and Industrial Land Uses (C and I)

Commercial Areas

Cu - Central business sections
Cc - Shopping centers
Cr - Resorts
Cs - Commercial strip development

Industrial Areas

Il - Light manufacturing and industrial parks
Ih - Heavy manufacturing

Extractive Industry land Use (E)

Open Mining

Es - Stone quarries
Eg - Sand and gravel pits
Em - Other mining

Underground Mining

Eu - Underground mining

Forest Land (F)

Fc - Forest brushland
Fn - Forest lands
Fp - Plantations

Non-productive Land (N)

Ns - Sand
Nr - Exposed rock cliff, rock slopes and slide areas

Outdoor Recreation Land Use (OR)

Or - Outdoor recreation

Public and Semi-public Land Uses (P)

P - Public and semi-public land use

Residential Land Use (R)

Residential Areas

Rh - High density
Rm - Medium density
Rl - Low density
Rs - Strip development
Rr - Rural hamlet
Rc - Farm labor camp
Re - Rural estate

Cottages and Vacation Homes

Rk - Shoreline development

Transportation Land Uses (T)

Th - Highways
Tr - Railway
Ta - Airport
Tb - Barge Canal

Marine Shipping

Tp - Areas of port or dock facilities
Ts - Areas of shipyards and dry docks
Tl - Areas of locks and water control structures
Tt - Communications and utilities

Water Resources (W)

Lakes and Ponds

Wn - Natural ponds and lakes
Wc - Artificial ponds

Streams and Rivers

Ws - Streams and rivers

Wetlands

Wb - Marshes, shrub wetlands and bogs
Ww - Wooded wetlands
Wk - Marine (salt) wetlands

Marine Lakes, Rivers and Seas

Wm - Areas in embayments and sounds

Hudson River

Wh - Uncontrolled section of the Hudson River from New York City to the mouth of the Mohawk River and the federal dam at Troy