# ABSTRACTS

# *RÉSUMÉS*

Fifth International Symposium on

# Environmental Concerns in Rights-of-Way Management

5e symposium international :

# L'environnement et les emprises

September 19-22, 1993
Montréal, Québec, Canada

19 au 22 septembre 1993,
Montréal (Québec) Canada

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# AVANT-PROPOS

Ce document regroupe les résumés des présentations orales et celles des séances d'affichage du 5e Symposium International : l'environnement et les emprises. Les résumés sont classés selon leur ordre de présentation à l'intérieur des différentes sessions thématiques. Un index des auteurs est également inclus à la toute fin du document.

Le 5e Symposium International : l'environnement et les emprises s'inscrit dans une série de symposiums qui ont débuté à la Mississippi State University et se sont successivement tenus à Ann Arbor (Michigan) en 1979, à San Diego (Californie) en 1982 et à Indianapolis (Indiana) en 1987. Cette cinquième édition est parrainée par Hydro-Québec et se tient à Montréal (Canada) du 19 au 22 septembre 1993. Cet événement est réalisé en collaboration avec un comité d'organisation formé de représentants d'industries, d'agences et d'universités vivement intéressés par les activités de recherche et de gestion dans le domaine des emprises — électricité, routes, pipelines et chemins de fer.

Afin d'aider les participants moins familiers avec la langue de présentation, les membres du comité d'organisation ont effectué une traduction libre des résumés. Ces versions traduites n'ont pas été validées par les auteur(e)s et ne doivent pas être utilisées comme élément d'information pour des dossiers argumentaires concernant les enjeux environnementaux associés aux emprises.

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# FOREWORD

This booklet is a compilation of abstracts of paper and poster presentations made at the Fifth International Symposium on Environmental Concerns in Rights-of-way Management. The abstracts are arranged in order of presentation within sessions. An authors index follows the abstracts.

This symposium is part of a series begun at Mississippi State University and subsequently held in Ann Arbor, Michigan (1979) San Diego, California (1982) and Indianapolis, Indiana (1987). Its is hosted by Hydro-Québec and held in Montreal, Canada, from September 19 to 22, 1993. This fifth edition is organized in association with a steering committee representing the industries, and agencies concerned with the management of electric, highway, pipeline and railroad rights-of-way.

Members of the steering committee prepared free translations of the abstracts in order to assist participants with difficulties in the language of presentation. The translated texts were not revised by authors and should not be cited as evidence in support of an argument in relation to right-of-way impact or management issues.

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# COOPERATIVE STRATEGIES FOR RIGHTS-OF-WAY MANAGEMENT

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There is increasing pressure for utility rights-of-way to serve other interests besides those associated with the transmission of energy. Landowners, agencies and the public expect these linear features to provide wildlife habitat, recreational and educational opportunities, and other public and private benefits. In many instances these uses can be compatible with utility corridor management, and can lead to direct benefits to public and private entities, and a more positive public perception of the company and industry that is willing to develop partnerships for rights-of-way management. Transcontinental Gas Pipe Line Corporation (TGPL) has developed several cooperative programs along portions of it's 1,200-mile natural gas pipeline system over the past few years. These include the use of cooperative agreements with landowners for right-of-way maintenance, memoranda of understanding with national conservation groups for vegetative management practices that are beneficial to wildlife, the granting of conservation easements on company-owned property, the dedication of portions of the right-of-way as educational and nature trails, and other examples. These programs have proven to be very positive, cost effective and enjoyable. Recommendations for initiating cooperative projects and managing them for maximum benefit are also included.

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La firme TGPL a développé plusieurs programmes coopératifs de gestion des emprises sur plusieurs sections de ses 1 800 km d'emprise de pipeline. Ces programmes visent une utilisation polyvalente des emprises et comprennent des ententes avec des propriétaires privés ou des groupes de conservation. Ils comprennent également la désignation de tronçons d'emprise à des fins éducatives et des sentiers pédestres en milieu naturel.

# A PREFERRED METHOD FOR INCORPORATING PUBLIC INPUT INTO PIPELINE ROUTE PLANNING IN ONTARIO

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Public participation in the environmental planning process is a widely accepted and fundamental principle. However, the appropriate time in the planning process and the approach used to solicit meaningful public input varies significantly. The objective of this paper is to provide an inventory of when in the planning process, and how, public input is solicited and incorporated into planning decisions for pipeline routes in Ontario. A number of pipeline route-planning studies are reviewed and assessed according to the public participation program used and the success of it. A case study of a successful technique used by Tecumseh Gas Storage Ltd. will be presented. This paper outlines the historical evolution of public concern about pipeline routing in Ontario from the 1960s to 1990. Specific route-planning cases are used to highlight public participation programs that were successful. The historical evolution of public concern highlights the importance of input from landowners who are affected directly, the role of government agencies in the process, and traditional concerns of public interest groups. Public input solicited early in the planning process versus later on, when a preferred route has been selected, results in greater support for routing decisions and expeditious regulatory approval. Tecumseh Gas Storage instituted a participation program that included interviews with every landowner on four alternate routes. Their preferences were identified and a general consensus established for a preferred route. This was followed by a public meeting. Based on landowner preferences and public meeting comments, a preferred route was selected. The combination of early public notification, landowner interviews, a public meeting and follow-up review resulted in expeditious regulatory approval. This process is highly recommended for future, pipeline route-planning studies.

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Cet auteur traite du moment et de la façon d'intégrer la participation du public dans l'exercice de planification des tracés de pipeline en Ontario. Une étude de cas permet d'analyser la technique utilisée avec succès par Tecumseh Gas Storage Ltd. Il s'agit d'entrevues réalisées avec chacun des propriétaires affectés sur les 4 variantes de tracé à l'étude.

# ABORIGINAL INVOLVEMENT IN TRANSMISSION FACILITIES PLANNING: A CASE OF THE ONTARIO-MANITOBA INTERCONNECTION PROJECT

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In the spring of 1990 Ontario Hydro began planning studies for a 500kV transmission line across northern Ontario to interconnect with new facilities in Manitoba. The proposed Ontario-Manitoba Interconnection project covered over 1100 km across the rugged terrain, lakes and rivers and Boreal forest of the Canadian Shield. The area is home to a large Aboriginal population, many of whom pursue traditional economic, lifestyle and cultural activities within their homelands and Treaty Areas. Ontario Hydro has a well established route and site selection and environmental assessment process which includes land use and natural environment, socio-economic, technical and cost components and studies with public consultation. However, given the potential for the project to affect Aboriginal communities, resources and cultural activities, a comprehensive assessment of their unique interests and concerns was required. The involvement and contribution of Aboriginal organizations and communities was integral to designing and implementing the Aboriginal component of the assessment process. The particular role that Aboriginal people wished to play had to be determined. Therefore, a process was initiated to contact Aboriginal organizations to determine if First Nations were interested in participating and if so, in what manner. Programs were subsequently established with three Aboriginal organizations representing more than forty First Nations. The programs and studies that evolved over a two-year period illustrate the contributions that can be made and the need for flexibility, innovation, cooperation and trust in order to effectively involve Aboriginal people in transmission planning. This paper will address three areas :

- Building Working Relationships with Aboriginal People ;
- An Approach to joint Environmental Assessment Studies ; and
- Addressing Issues and Past Grievances.

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Ces auteurs discutent de la participation des autochtones au processus de planification d'un projet d'interconnexion de ligne entre l'Ontario et le Manitoba.

# RECONCILING ABORIGINAL AND INDUSTRIAL INTERESTS IN RIGHT-OF-WAY MANAGEMENT

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In British Columbia, the oil and gas industry continues to develop new rights-of-way and leases throughout the province which, as in the past, are often located on traditional native territory. This paper will focus on the increased involvement of Native bands and Westcoast Energy Inc. (Westcoast) pipeline projects. The Tommy Lakes Natural Gas Pipeline Project (July - August, 1992) laid new groundwork for a Native involvement program. It is imperative that the oil and gas industry in Canada acts to involve the Native people in the initial assessment process, as well as provide for business and employment opportunities when operating within traditional lands. The paper will also discuss how the Native band members have participated in route selection, environmental inspection, timber clearing and salvage, revegetation and reclamation.

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Cette présentation traite de la collaboration entre les autochtones et Westcoast Energy à l'étape de la planification des projets de pipelines en Colombie-Britannique. Elle traite également du rôle des autochtones au moment du choix du tracé, de la surveillance environnementale, du déboisement et de la revégétation.

**Monday, September 20, 1993**
**Afternoon**
**1. Vegetation**
**Room Opus 1**

***Lundi 20 septembre 1993***
***Après-midi***
***1. Végétation***
***Salle Opus 1***

# LE PROGRAMME DE RECHERCHE SUR LA MAÎTRISE BIOLOGIQUE DE LA VÉGÉTATION À HYDRO-QUÉBEC

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À Hydro-Québec, le programme de recherche sur la maîtrise biologique de la végétation dans les emprises favorise la croissance des plantes dont les hauteurs maximales respectent les normes de dégagement des conducteurs; on réduit ainsi la densité des ligneux indésirables et, par conséquent, le volume de phytocides à appliquer. Deux stratégies sont utilisées : la propagation d'arbustes ainsi que l'ensemencement de graminées et de plantes herbacées indigènes. Cinq espèces arbustives sont à l'étude : le saule pétiolé (*Salix petiolaris*), le cornouiller stolonifère (*Cornus stolonifera*), la spirée blanche (*Spiraea alba*), le cornouiller oblique (*Cornus obliqua*) et le sumac vinaigrier (*Rhus typhina*). Quant aux herbacées, on évalue l'efficacité de six espèces à réduire la densité des ligneux : le chiendent (*Agropyron repens*), la vesce jargeau (*Vicia Cracca*), la centaurée noire (*Centaurea nigra*), le millepertuis commun (*Hypericum perforatum*), la verge d'or (*Solidago* sp.) et l'aster (*Aster* sp.). De plus, on met à l'essai trois mélanges commerciaux : le mélange Orégon (80 % de ray-grass [*Lolium perenne*] et 20 % de fétuque rouge traçante [*Festuca rubra genuina*]); le mélange paysagiste (40 % de pâturin du Kentucky [*Poa pratensis*], 40 % de fétuque rouge traçante [*F. r. genuina*] et 20 % de ray-grass annuel [*Lolium italicum*]); et le mélange B : (55 % de fléole des prés [*Phleum pratense*], 30 % de trèfle rouge [*Trifolium pratense*] et 15 % de trèfle aslike [*Trifolium hybridum*]). On procède également à des bioessais en serre afin d'améliorer le choix des espèces à ensemencer dans les emprises. On y évalue l'interférence de six espèces herbacées : *C. nigra, A. repens, H. perforatum, L. perenne, F. rubra* et *V. Cracca* sur trois espèces d'arbres indésirables : l'érable à sucre (*Acer saccharum*), le bouleau jaune (*Betula lutea*) et le bouleau à papier (*Betula papyrifera*).

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The research program at Hydro-Québec on the biological control of vegetation in rights-of-way favours the growth of plants, the maximum heights of which meet the utility's conductor clearance standards. The paper focuses on results of the 1990-1992 studies.

# RESTAURATION VÉGÉTALE DES AIRES PERTURBÉES LORS DES TRAVAUX DE CONSTRUCTION DES EMPRISES DE ROUTE

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Le développement du réseau hydro-électrique implique l'utilisation du sol in situ pour édifier les routes et les barrages. Au cours des travaux de la phase I du complexe La Grande, les aménagements intensifs ont été réalisés à l'aide de plantations d'arbustes et d'ensemencements d'herbacées dans les sites visibles des ouvrages et les zones susceptibles à l'érosion. Une restauration minimale, sous forme de plantation en îlot, a été accomplie dans les sites moins visibles où la régénération naturelle était faible. L'aulne crispé (*Alnus crispa*), le pin gris (*Pinus banksiana*) et le saule (*Salix* sp.) ont été les principales espèces utilisées, des espèces complémentaires ont été ajoutées pour diversifier le couvert végétal et favoriser la faune. Les ensemencements hydrauliques d'herbacées ont été réalisés sur les sols limoneux en bordure des routes pour réduire l'érosion et améliorer l'aspect visuel des sites. Avec le temps, les îlots devaient favoriser l'établissement d'un microclimat en réduisant l'effet de l'érosion éolienne et de ruissellement, et avantager l'implantation de plantules d'espèces indigènes. Nos objectifs sont de vérifier si, après 10 ans, la végétation naturelle se développe progressivement à partir de l'îlot selon un gradient et si elle suit conjointement le processus de restructuration du sol. Notre étude compte aussi vérifier l'apport de l'aulne crispé dans le processus d'enrichissement du sol et identifier les paramètres du milieu susceptibles d'influencer l'étalement de la végétation. Une nouvelle méthode, basée sur le dénombrement des végétaux, permet d'estimer la contribution des îlots dans le processus de régénération et d'identifier les stratégies d'envahissement de la végétation. Nous avons observé que les aulnes crispés se reproduisent par semis à l'intérieur et à proximité des îlots dans tous les types de sols. L'*Elaeagnus commutata* implanté dans le sable se propage sous forme de drageons jusqu'à une distance de 11 mètres. En général, la germination des végétaux semble avantagée par la présence de cailloux ou autres aspérités du sol et des rigoles créées par le ruissellement. Les bryophytes et certaines herbacées s'implantent même dans les milieux très pauvres. Cependant, dans les pentes abruptes, la végétation est quasi inexistante sauf s'il y a présence de particules fines. Le sol à l'intérieur de l'îlot a un contenu en azote légèrement supérieur à celui à l'extérieur. L'ensemble des résultats indique que les plantations favorisent la régénération du couvert végétal naturel et ce, pour tous les types de sol.

This paper presents results of environmental monitoring of plantation of alders, pines and willows along with hydroseeding in roadsides and related disturbed areas in the La Grande region in northern Québec. Data are presented on regeneration and soil types. Bryophytes and herbaceous plants are invading all types of soils.

# LA GESTION EXTENSIVE DE LA VÉGÉTATION DES EMPRISES ROUTIÈRES ET AUTOROUTIÈRES

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Il est d'usage courant en France de revégétaliser les emprises routières par semis ou par jeunes plants dès la fin du chantier. Par ailleurs, le climat tempéré, qui concerne la plus grande surface du pays, favorise la reconquête des emprises par la végétation, puis son développement. Aussi la gestion de la végétation des emprises routières et autoroutières est-elle une activité importante des équipes d'entretien. L'entretien habituel est de type intensif. Les tontes sont fréquentes et concernent une surface importante des emprises, l'usage des produits phyto-sanitaires est encore courant, la taille des arbres et haies parfois radicale. Le résultat est l'aspect très jardiné des emprises, étroitement lié à une notion de propreté dans la perception de bien des usagers mais aussi des gestionnaires. Les moyens utilisés ont bien souvent des effets fort destructeurs sur la faune et la flore des emprises. Aussi le ministère de l'environnement, en partenariat avec le ministère de l'équipement, a-t-il engagé depuis quelques années une réflexion sur la gestion des bords de route. À partir d'expériences, il a été montré que les dépendances vertes ne justifient pas toujours sur la totalité de leur surface une gestion intensive. L'entretien doit être adapté au contexte local : le limiter où il n'est pas indispensable et l'intensifier quand des raisons de sécurité ou paysagères le nécessitent. Cette gestion plus extensive, par opposition à intensive, ou mieux encore gestion «raisonnée» s'appuie sur une bonne connaissance du réseau routier, des emprises mais aussi des milieux avoisinants. Elle peut permettre, dans les régions où les espaces naturels sont très réduits (régions d'agriculture intensive par exemple), de valoriser le potentiel écologique des emprises. Cette démarche se veut pratique. Il ne s'agit pas d'en faire moins mais de faire différemment. Cela demande un important effort d'information tant des gestionnaires que des riverains et des usagers, car cette forme de gestion tout en permettant une meilleure utilisation des moyens humains et matériels, est plus respectueuse de la faune et de la flore qui ont su reconquérir les emprises, mais n'est pas toujours bien comprise.

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Historically, in France, vegetation control on highways has been intensive resulting in manicured-looking ROWs. New information is used to adapt ROW vegetation management to local conditions. More concern is given to fauna and flora in this approach.

# LA BIODIVERSITÉ VÉGÉTALE VERSUS LA MISSION DU MINISTÈRE DES TRANSPORTS DU QUÉBEC

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Le ministère des Transports du Québec réalise de très nombreuses interventions sur tout le territoire québécois. Les risques que ces activités portent atteintes à la biodiversité végétale sont réels. Notre démarche est basée sur une série successive d'évaluation des risques d'impacts négatifs. Ceux-ci aboutissent soit à l'arrêt des considérations, soit à des actions à prendre (mesures d'atténuation ou de compensation) ou encore à une cueillette supplémentaire de données en vue d'une seconde évaluation des risques. La première évaluation du risque se fait sur la base des impacts des travaux sur la végétation en général. La deuxième, sur la base des données supplémentaires provenant des banques de données (MENVIQ) et d'études théoriques (photo-interprétation, dépôt meuble, sol, drainage, climat, etc.). La troisième se fait à partir de l'addition de données provenant d'une inspection visuelle *in situ* et enfin la quatrième, par l'ajout de données provenant d'une campagne d'échantillonnage systématique. Afin d'illustrer cette démarche, nous présenterons le cas du prolongement de la route 138 à l'est de Havre-Saint-Pierre.

This paper presents the method of risk evaluation of negative impacts on plant biodiversity adopted by the Québec Ministry of Transports. The approach is illustrated through a highway case study.

# LES CRITÈRES DE SÉLECTION DES ESPÈCES ARBUSTIVES COMME CONTRÔLE DE LA VÉGÉTATION INDÉSIRABLE DANS LES EMPRISES

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L'objectif de cette recherche est de vérifier le potentiel des espèces arbustives du sud du Québec pouvant contrôler la végétation incompatible des lignes de transport d'électricité. Les données de l'étude proviennent essentiellement de la base de données, existante depuis 1982, du groupe de recherche «Haut-Saint-Laurent : Écologie et aménagement» de l'Université de Montréal. L'étude de l'historique de la ligne de transport d'électricité à 735 kV (nº 7040) sur une longueur de 20 km pour le secteur Cazaville a permis de vérifier l'existence des arbustaies et la faisabilité d'une étude ultérieure de ces dernières. Une seconde étape vise à choisir les espèces arbustives ayant un potentiel de blocage envers les arbres. Le choix des espèces a été établi selon des critères de sélection. Ceux-ci sont, par ordre d'importance, la forme biologique, l'amplitude écologique, la densité maximale de recouvrement de l'espèce (couverture au sol), la capacité de reproduction végétative, le potentiel allélopathique, la croissance annuelle de la tige et la capacité à ralentir la croissance des autres espèces ligneuses. Ces critères ont permis de sélectionner 25 espèces arbustives nommées «espèces cibles de blocage» se définissant comme des plantes qui présentent un potentiel pour ralentir la croissance ou pour empêcher l'implantation d'espèces arborescentes indésirables. L'étape suivante consiste à établir un profil écologique des espèces cibles. Les principales variables qui structurent les espèces arbustives sont, par ordre d'importance, le drainage, les processus géomorphologiques, la topographie et les formes géomorphologiques. Une analyse de classification «TWINSPAN» a permis également de constater les associations entre les différentes espèces arbustives formant ainsi 11 types de communautés végétales arbustives. Dans plusieurs de ces cas, on retrouve des arbustes bas associés avec des arbustes plus hauts.

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Selection criteria of shrub species for powerline ROW vegetation control of undesirable woody species are examined. Criteria are: biological form, ecological range, maximal ground cover, vegetative reproduction, allelopathic potential, annual stem growth and capacity to reduce tree species growth. These criteria enabled to select 25 shrub species with potential to slow or stop tree invasion of ROWs.

# MÉTHODES EXPÉRIMENTALES FAVORISANT LES ESPÈCES ARBUSTIVES COMME CONTRÔLE DE LA VÉGÉTATION INDÉSIRABLE DANS LES EMPRISES DE LIGNES DE TRANSPORT D'ÉLECTRICITÉ

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L'objectif de cette recherche vise à favoriser le développement d'espèces arbustives à haut potentiel de blocage successionnel afin de limiter la croissance d'espèces arborescentes dans les emprises des lignes de transport d'électricité. À cette fin, deux stratégies ont été mises à l'essai. A) Tirer profit des arbustaies déjà en place dans l'emprise en augmentant leur envahissement spatial grâce à deux techniques horticoles. Des arbustaies de *Salix petiolaris*, de *Spiraea alba*, de *Cornus stolonifera* et de *Cornus obliqua*, déjà en place dans l'emprise font l'objet de traitements expérimentaux. Chaque site expérimental est constitué de trois parcelles de 5 m x 5 m qui se décrivent comme suit : i) une parcelle de plants témoins, ii) une parcelle de plants marcottés, iii) une parcelle de plants recépés. Les données suivantes ont été recueillies pour chaque plant mère : diamètre au collet de la plus grosse tige du plant mère, longueur des pousses annuelles, nombre de pousses de l'année, diamètre de la couronne avant le traitement, diamètre du clone après le traitement. Six critères de qualité sont utilisés afin de décrire le taux de succès du marcottage : succès, tige cassée, relevée, pourrie, morte et perdue. B) Implanter des espèces arbustives dans des sites soumis à une forte pression d'ensemencement naturel. Des boutures ligneuses de quatre espèces (*Spiraea alba*, *Cornus stolonifera*, *Salix petiolaris* et *Rhus typhina*) ont été plantées selon un plan expérimental où chaque espèce se retrouve dans 4 sites de plantation de 5 parcelles chacun, chaque parcelle étant constituée d'environ 100 boutures. Le taux de survie des boutures est noté à chaque automne. Les deux expérimentations ont été suivies sur une période de deux ans. L'envahissement spatial des arbustaies devient effectif deux ans après le traitement, le marcottage augmentant de façon significative la couronne des clones arbustifs. Le *Cornus stolonifera* a le plus haut taux de succès du marcottage et possède le plus grand nombre de drageons produits à partir des tiges marcottées. Pour l'ensemble des espèces plantées, il est possible d'obtenir un pourcentage de survie élevé des boutures (> 70 %), le succès de la plantation dépendant surtout des conditions édaphiques des sites.

Two experimental horticultural methods to favour shrub species' growth as biological control for undesirable tree species in Hydro-Québec ROWs are presented. The first one takes advantage of established shrub communities, the other involves the plantation of shrub species in ROWs.

# COMPARAISON ENTRE L'HERBICIDE ROUNDUP® ET CERTAINES MÉTHODES ALTERNATIVES DE CONTRÔLE DE LA VÉGÉTATION

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Depuis un certain nombre d'années, on entend généralement par méthodes alternatives de contrôle de la végétation toute méthode qui n'utilise pas d'herbicide chimique. Ces méthodes sont presque toujours perçues comme étant nécessairement plus sécuritaires et plus acceptables, autant en ce qui concerne la santé des travailleurs impliqués qu'en termes d'impact global sur l'environnement. La comparaison entre les caractéristiques toxicologiques d'un herbicide chimique bien connu et celles reliées à l'utilisation d'outils mécaniques (scie à chaîne et débroussailleuse) démontre que la perception générale et la réalité sont parfois très divergentes. Les quelques caractéristiques toxicologiques connues d'un herbicide dit biologique (bialaphos), à l'essai depuis quelques années en Amérique du Nord, seront également discutées.

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A comparison between the toxicological properties of a well-known chemical herbicide, and those of alternative vegetation control methods such as the use of brush saws and chain saws, does not necessarily support the general perception as to which method would be the more acceptable one. The few known toxicological properties of a biological herbicide (bialaphos) will also be discussed.

# CONTRÔLE BIOLOGIQUE DE LA VÉGÉTATION INCOMPATIBLE DANS LES EMPRISES DE LIGNES DE TRANSPORT D'HYDRO-QUÉBEC. DÉVELOPPEMENT D'UNE MÉTHODOLOGIE ANALYTIQUE POUR L'ÉTUDE DES SUBSTANCES ALLÉLOPATHIQUES

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L'interférence allélopathique est un facteur important dans le contrôle biologique de la végétation. L'identification des substances chimiques en jeu et la connaissance de leur comportement dans l'environnement revêtent une importance particulière pour l'expérimentation optimale de diverses stratégies de contrôle biologique. Hydro-Québec a entrepris en 1989 des études visant le développement d'une méthodologie analytique basée sur l'état de l'art en spectrométrie de masse pour l'identification et le dosage des substances allélopathiques produites par certaines espèces végétales de faible hauteur. Cette étude d'une durée approximative de 4 à 5 ans fut confiée au Centre régional de spectrométrie de masse de l'Université de Montréal. La complexité des échantillons à analyser, la nature chimique des substances allélopathiques recherchées et les faibles concentrations environnementales attendues nous ont orienté vers le développement de techniques basées sur la chromatographie liquide à haute pression (HPLC) sur microcolonnes et la spectrométrie de masse (MS) à ionisation par bombardement d'atomes rapides ou à ionisation chimique. Les études réalisées jusqu'à maintenant nous ont permis : 1) d'évaluer et rendre opérationnels certains systèmes chromatographiques candidats, 2) de définir les propriétés d'ionisation et de fragmentation de 16 substances allélopathiques recherchées, appartenant à diverses familles chimiques (acides carboxyliques, flavonoïdes, substances phénoliques, lactones, alcaloïdes, acides aminés et xanthines), 3) de réaliser un couplage HPLC/MS adéquat, 4) de mettre au point un système de cueillette efficace des exsudats racinaires de trois plantes candidates, 5) ainsi que de mettre au point un système de fractionnement des exsudats recueillis selon diverses familles chimiques. Les études à venir visent, d'une part, à identifier et à quantifier les substances allélopathiques recherchées dans les exsudats racinaires de plusieurs espèces végétales candidates, ainsi que dans d'autres matrices plus complexes (racines, sols, feuilles, etc.), et, d'autre part, à développer une technique de dépistage rapide du potentiel allélopathique des diverses fractions analytiques. La présentation portera sur les principaux résultats obtenus depuis 1989, le potentiel d'application de l'outil analytique développé en laboratoire, ainsi que sur les études additionnelles qui seront réalisées au cours des deux prochaines années.

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Hydro-Québec is presently involved in a multi-year development study of microliquid chromatography-mass spectrometry (HPLC/MS) combination analysis techniques for allelochemicals originating from woody species' root exudates. These root extracts will be used in bioassays in order to confirm the allelopathic potential of the chemical mixtures.

**Monday, September 20, 1993**
**Afternoon**
**2. Pipelines**
**Room Opus 2**

***Lundi 20 septembre 1993***
***Après-midi***
***2. Pipelines***
***Salle Opus 2***

# PIPELINING IN CANADA AND THE U.S. – AN ENVIRONMENTAL COMPARISON

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Environmental regulations have been applied to pipeline projects in both the U.S. and Canada for more than 20 years. However, the approaches which have evolved to regulate environmental matters are substantially different. Based on the authors' practical experience with planning and constructing pipelines across Canada and the western U.S., this paper compares environmental regulations and pipeline practices in the two countries. A major U.S. departure from Canadian practice is that the lead regulatory agency is responsible for preparation of the Environmental Impact Statement (EIS) under cost recovery. Although responsible for funding the EIS, the pipeline company has little control over its cost, timing or content. Federal, state and local governments all have considerable input in the regulatory process but statutes and standards vary greatly and are often inconsistent. Considerable attention is focused on system alternatives, cumulative and growth-inducing impacts and withstanding legal challenges from environmental and landowner opponents. Environmental concerns such as cultural resources, threatened and endangered species and wetlands are studied in minute detail. In spite of an expensive and time-consuming EIS process, American pipelines are built with essentially the same level of environmental protection as Canadian pipelines, and in some cases even less so. For example, topsoil stripping requirements on Canadian pipelines are more stringent than in the United States. Environmental approvals for most pipelines in Canada are streamlined and can be obtained in a few months or less. The applications are prepared by the proponent of the project and are reviewed by government agencies. Most environmental applications for pipelines in Canada are not in the form of an EIS and place more emphasis on the Environmental Protection Plan (EPP) portion of the document. The EPP identifies the protection measures to be implemented during construction to minimize impacts. While Environmental Inspectors have been commonplace in Canada since the 1970s, they have only been employed on American pipelines since the late 1980s. The paper concludes that the level of environmental protection on Canadian pipelines is roughly equivalent to American pipelines but is achieved in a more pragmatic, expeditious and cost-effective fashion. Useful lessons for practitioners working in both countries are identified.

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L'auteur compare, au plan de l'environnement, le contexte réglementaire des États-Unis à celui du Canada en ce qui a trait à la planification des tracés et à la construction de pipelines.

# ADVANTAGES AND POTENTIAL PITFALLS OF DIRECTIONALLY CONTROLLED HORIZONTAL DRILLING FOR PIPELINE CONSTRUCTION: A CASE STUDY OF THE IROQUOIS GAS TRANSMISSION SYSTEM HOUSATONIC RIVER CROSSING

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Directionally controlled horizontal drilling as a method for installing pipeline crossings of streams and rivers is gaining attention from regulatory agencies seeking to minimize potential adverse impacts to water resources resulting from traditional open-cut construction methods. The use of directionally controlled horizontal drilling would, on the surface, appear to provide an environmentally benign stream-crossing method, since disturbance to the streambed is not required. However, there are situations in which geologic conditions beneath the streambed limit the probability of a successful crossing. In addition, there is always the possibility for a loss of drilling mud from the borehole, and more often than not the drilling mud will be discharged to the water course. The Iroquois Gas Transmission System installed a 24-inch diameter natural gas pipeline across the lower Housatonic River. The location of the crossing necessitated an alignment through a freshwater intertidal mudflat, a unique ecosystem which supported several state-listed plant species of concern. The bedrock and surficial geology at the crossing site presented several challenges, and the successful completion of the crossing established the state-of-the-art in directionally controlled horizontal drilling. This paper explores some of the pros and cons of directionally controlled horizontal drilling using Iroquois' Housatonic River crossing as a case study.

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Les auteurs discutent des avantages et inconvénients d'une méthode de forage horizontal pour installer un pipeline sous un ruisseau, sans toutefois en perturber le lit. La technique est illustrée à l'aide d'une étude de cas.

# THE SEDIMENT MAT: AN ECONOMICAL AND EFFECTIVE DEVICE FOR TRAPPING STREAM SEDIMENTS DISTURBED BY CONSTRUCTION

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A new device for trapping streambed sediment disturbed by construction activities was developed and tested in streams in central and western New York. The Sediment Mat (patented) is a 4' x 10' absorbent mat which is attached to the stream bottom immediately below the reach about to be disturbed by activities such as pipeline installation, access road construction or bridge repair. By linking several mats together, the entire channel width and desired length may be covered. Disturbed sediment transported along the streambed is trapped in the biodegradable mats, which are removed after construction and staked to the streambank to serve as a seedbed and stabilizer for restoration efforts. The mats were tested at pipeline installations in eight streams with substrates suitable for salmonid spawning (less than 20% fines smaller than 3mm in diameter). Before construction, the average percent sediment fines immediately downstream of the work area was 12.2%. After construction, it was 14.7%. At six unprotected sites, the average percent of downstream fines increased from 11.5% to 23.8%. A comparison of the two before/after rates indicates that the mats prevented an average of 80% of the potential downstream sedimentation impact and maintained salmonid spawning substrate quality. Individual mats absorbed up to 1,000 lbs of sediment. The mats were inexpensive and easy to handle, install, and remove. They did not interfere with construction activities and they subsequently performed well at streambank stabilization and revegetation. The Sediment Mat appears to be a practical, inexpensive, and effective tool to minimize or prevent downstream sedimentation impacts from instream construction activities. They are now available through Indian Valley Industries of Johnson City, N.Y.

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Le «Sediment Mat» est une grande bâche que l'on installe dans les ruisseaux, à l'aval des zones qui seront éventuellement perturbées par les activités de construction d'un pipeline, d'un chemin de fer ou par la réparation d'un pont. Cette bâche sert à capter les sédiments remis en circulation lors de la construction et sert ensuite à stabiliser et à revégéter les berges en bordure des cours d'eau.

# EFFECTIVENESS OF HORIZONTAL BORING OPERATIONS FOR STREAM CROSSINGS IN WEST CENTRAL ALBERTA

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NOVA Corporation of Alberta recently constructed the Minnow Lake Lateral pipeline approximately 50 km south of Edson, Alberta. The project involved the installation of 17 km of 150 mm diameter pipeline through forested till, glaciolacustrine and localized glaciofluvial deposits. Clearing for the project commenced during the second week of January 1993 and construction was completed by late February, 1993. Four fish-bearing watercourses were crossed by the project. Active channel widths (i.e., distance between top of high water marks) ranged from approximately 4 m for the smallest stream to 30 m for the largest, and all supported below-ice flows throughout the winter. Because of regulatory concerns over the introduction of high sediment loads into these watercourses during pipe installation, NOVA agreed to attempt to horizontally bore under the stream channels, rather than install the pipe by an open cut procedure. It was felt that such an operation would not only minimize instream impacts but would reduce post-construction restorative requirements as well. This paper presents the results of the attempted boring operations at the four watercourses. It provides a description of boring equipment and techniques used during the operations in addition to an overview of geotechnical conditions and materials encountered during bell hole excavations and boring operations. It discusses problems encountered and special requirements implemented during operations (e.g., bell hole dewatering). The cost effectiveness of such operations (relative to open-cut methods) is discussed in relation to local geotechnical and hydrological conditions.

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La compagnie NOVA a récemment construit un pipeline en Alberta. Une partie se trouvait en milieu forestier et traversait 4 cours d'eau d'une largeur de 4 à 30 m. En raison des préoccupations quant à la sédimentation lors de la mise en place du pipeline, NOVA a opté pour un forage horizontal sous les cours d'eau plutôt que d'installer le pipeline en utilisant des tranchées conventionnelles. La présentation porte sur la technique de forage, les conditions géotechniques et les problèmes rencontrés lors de la construction. Une analyse comparative des coûts est également présentée.

# PRE-CONSTRUCTION PLANNING FOR ENVIRONMENTAL COMPLIANCE OF NATURAL GAS PIPELINE PROJECTS

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Compliance with environmental requirements established during the design and licensing phases of natural gas pipeline projects can be enhanced through effective planning and communication during the period of a project immediately preceding initiation of construction. Our observations during compliance inspections involving 20 pipeline construction projects across the United States indicate that a major cause in the lack of compliance with environmental conditions and requirements during construction relates to two factors: a general lack of awareness by the various construction personnel of the environmental requirements imposed upon or committed to by a pipeline company prior to construction; and a lack of knowledge in how to implement these requirements. Pre-construction planning should include actions on behalf of the pipeline company to communicate, through various techniques, environmental requirements to all company and contractor personnel on a construction spread. From a construction contractor's perspective, it is optimum for the company to include as many of the detailed environmental requirements in the construction bid specifications and construction drawings as possible. Although this requires increased levels of planning by the company's environmental and engineering staffs during the bid development stage, it results in a higher level of awareness by the contractors of these requirements which results in more accurate cost planning and greater compliance. Additionally, development of contractor costing provisions that allow greater flexibility by the contractor to implement mitigation procedures has also been found to increase compliance with environmental requirements. Other techniques found to effectively increase compliance during construction of large, multi-segmented projects include identification and consolidation of mitigation requirements by segment or construction spread, incorporation of preconstruction environmental training programs for both environmental and craft inspectors to enhance implementation of mitigation measures and monitoring requirements, and the development and implementation of a well-conceived, internal compliance reporting program.

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La difficulté pour certaines compagnies de construction de pipeline de respecter les engagements et exigences environnementales sont attribuables à 2 facteurs. Le premier est le manque d'information de la part du personnel de construction quant au contenu de ces exigences. Le deuxième est le manque de connaissances nécessaires pour respecter ces engagements et exigences environnementales. Des techniques pour améliorer cette situation y sont discutées.

# PIPELINES IN PARKS: SPECIAL CONSIDERATIONS

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This paper provides a discussion of environmental protections, planning considerations and special construction techniques used to minimize adverse environmental impacts due to construction of natural gas transmission pipelines in parks and recreational areas. In particular, special planning needs and construction limits for large-diameter pipelines in parks in New York State are reported and assessed. Techniques for minimizing visual, recreational use, aquatic, and wildlife impacts are discussed. Restoration methods and multiple-use considerations for the gas line right-of-way are detailed. Incorporating input from interested public users, including recreational and sportsmen's groups, is addressed. Construction of large diameter pipelines in parks, recreation areas and an historic cemetery warranted special consideration of these special-use areas, and required special design, construction and restoration planning and implementation. Protection of scenic areas through routing considerations, clearing methods, and landscaping of above-ground facilities is discussed. Protections for trout-streams and other wildlife considerations included innovative restoration methods. Recreational uses of the project area were incorporated into construction and restoration requirements. The paper concludes with an assessment of the short-term and long-term impacts due to pipeline construction, and provides recommendations for application of protective measures in other areas.

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Cette présentation porte sur la planification, les techniques de construction et les mesures de protection de l'environnement utilisées pour minimiser les impacts négatifs associés à la construction de pipelines dans les parcs et les zones de récréation de l'État de New York. L'auteur discute également des méthodes de restauration ainsi que de la polyvalence des emprises de pipelines.

# USE OF GIS FOR APPLICATIONS ON GAS PIPELINE RIGHTS-OF-WAY

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Geographic information system (GIS) applications for the siting and monitoring of gas pipeline rights-of-way (ROWs) were developed for areas near Rio Vista, California. The data layers developed for this project represent geographic features, such as landcover, elevation, aspect, slope, soils, hydrography, transportation, endangered species, wetlands, and public line surveys. A GIS was used to develop and store spatial data from several sources; to manipulate spatial data to evaluate environmental and engineering issues associated with the siting, permitting, construction, maintenance, and monitoring of gas pipeline ROWs; and to graphically display analysis results. Examples of these applications include (1) determination of environmentally sensitive areas, such as endangered species habitat, wetlands, and areas of highly erosive soils; (2) evaluation of engineering constraints, including shallow depth to bedrock, major hydrographic features, and shallow water table; (3) classification of satellite imagery for land use/ land cover that will affect ROWs; and (4) identification of alternative ROW corridors that avoid environmentally sensitive areas or areas with severe engineering constraints.

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Cette présentation traite des applications d'un système à référence spatiale pour le choix de tracé et le suivi environmental d'une emprise de pipeline en Californie. Quatre exemples d'application sont discutés : 1) identification des zones sensibles, 2) évaluation des contraintes techniques, 3) classification d'images satellitaires, et 4) identification de corridors alternatifs.

# A PRO-ACTIVE REGULATORY STRATEGY IN SECURING PIPELINE CONSTRUCTION APPROVAL

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Successful development of natural gas reserves often requires consideration of and integration with important environmental resources. As with any complex project, such an approach involves all aspects of right-of-way development: the land agent, engineer and environmental specialist. It is this approach which was successfully used by the Shell Michigan Pipe Line Company to gain approval for a 20-mile, 8-inch natural gas pipeline in Michigan's north-central Lower Peninsula. The purpose of this paper is to present the integrated pre-construction strategy which was developed and implemented in gaining approval from state (Michigan Public Service Commission) and federal (U.S. Forest Service) authorities. This approach emerged as a result of the considerable environmental obstacles which confronted the project, including:

1) multiple agency jurisdiction;
2) federally endangered species;
3) wetlands;
4) a designated natural river; and
5) federally-owned forestland.

The strategy expands on the importance of the route selection phase, in the application of appropriate construction methods, and in the use of the NEPA (National Environmental Policy Act) compliance document as a means of gaining concurrence. Methods to be discussed in the presentation will emphasize the value of open disclosure, proactive response to ecological issues, and willingness to modify traditional construction techniques. The result of this approach was a constructed project acceptable to the resource agencies, local interest groups and the owner.

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Cette présentation traite d'une stratégie développée en vue d'obtenir l'autorisation de construire un pipeline au Michigan. Cette approche tient compte :

1) des juridictions multiples,
2) des espèces menacées,
3) des habitats humides,
4) d'une rivière officiellement désignée naturelle, et
5) de terres forestières appartenant au gouvernement fédéral.

L'application de cette approche a permis la construction d'un projet acceptable par les agences gouvernementales, les groupes d'intérêt et le promoteur.

**Monday, September 20, 1993**
**Afternoon**
**3. Planning and monitoring**
**Room Beethoven**

***Lundi 20 septembre 1993***
***Après-midi***
***3. Planification et suivi environnemental***
***Salle Beethoven***

# ENVIRONMENTAL MANAGEMENT OF POWERLINES IN SPAIN

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One of the main characteristics of the Spanish territory is the extraordinary variety and natural resources that it shows, in terms of its flora, fauna, landscapes and historic-artistic heritage. These elements are the source of two main problems from the point of view of powerline construction. They represent the diversity of potentially affected elements, and the great vulnerability of several of these elements. All of this makes it difficult to conduct Environmental Studies and to select routes of minimum impact. The methodology to conduct these studies is described, as well as the preventive and corrective measures carried out to minimize the environmental impact of a new power transmission line. Special attention is paid to every concern related to the vegetation treatment and the avifauna.

Les auteurs discutent des études environnementales reliées au choix des tracés de lignes de transport d'énergie électrique en Espagne. On présente la méthode d'évaluation des impacts ainsi que les mesures d'atténuation à appliquer, particulièrement en ce qui a trait à la maîtrise de la végétation et à l'avifaune.

# THE ROLE OF DEFENSIBLE VISUALIZATION TECHNOLOGY IN HIGHWAY DESIGN IN THE NINETIES

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The focus of highway development in the decade of the nineties and into the next century will be on renovation and improvement of existing corridors. In major urban centers the need to upgrade the highway system for reasons of safety, increased capacity or simply replacement of deteriorated structures is meeting a great deal of resistance. In many cases the resistance is a function of differences of opinion of how the improvements will impact adjacent properties. These differences of opinion arise because of an inability to clearly communicate the character of the proposed development. The Texas Transportation Institute, Environmental Management Program has been working with Texas Department of Transportation's major urban districts to develop a wide range of defensible visualization technologies to facilitate the communication of design proposals. This work has focused on objectively enhancing existing computer-based graphic tools and adapting them to the unique needs of highway transportation. The presentation will focus on the palette of visualization tools available to highway transportation interests and how they can be applied to a variety of highway communication and design problems. Of particular interest is the progress being made to reduce the time of developing 3-dimensional data sets of very complex highway alignments and current experiments with random access video disk imagery.

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Durant la prochaine décennie, les projets autoroutiers consisteront surtout en des travaux de restauration et d'amélioration des corridors actuels. Dans plusieurs cas, la résistance à ces projets provient des différences d'opinion quant à leur impact sur les propriétés avoisinantes. Comme ces différences d'opinion sont dues à l'incapacité de communiquer clairement la nature des travaux à réaliser, le «Texas Transportation Institute» en collaboration avec le «Texas Department of Transportation» a mis au point plusieurs technologies à caractère visuel pour la présentation des projets auprès des publics.

# THE ARIZONA DEPARTMENT OF TRANSPORTATION'S PLANT INVENTORY AND MANAGEMENT SYSTEM, PIMa

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The use of geographic information system based management tools is a widely discussed topic in all areas of highway transportation. In 1992 the Arizona Department of Transportation completed work on a new generation of landscape management systems called PIMa (Plant Inventory and Management). This system utilizes a unique combination of computer-based technologies to plan and track all landscape and irrigation maintenance activities on the highly landscaped freeway system in the greater Phoenix area. The system is "paperless" in that all work scheduling, field reporting and accounting operations are accomplished in an electronic environment. PIMa utilizes a pen-sensitive screen device to communicate work assignments and for all field information reporting. In addition to the basic information communication, the device also has graphic capabilities which have been utilized to provide maps of the landscape development and irrigation system. This information is all contained in a device about the size of a clipboard. The operational framework of the system is the GIS environment which formats, stores, processes and prepares a variety of management reports. The GIS system allows production of standard reports along with the unique ability to produce output in map form. This allows managers to see problem areas and take remedial actions as needed. This presentation will be of particular interest to roadside managers thinking of adopting a GIS base for roadside activities.

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En 1992, le «Arizona Department of Transportation» a mis en place un système d'information géographique (GIS) pour les travaux d'aménagement paysager. Ce système sert à planifier et à surveiller toutes les activités de paysagement et d'irrigation du réseau routier de la grande région de Phoenix. La présentation est particulièrement intéressante pour les spécialistes qui songent à adopter un système d'information géographique (GIS) pour leurs travaux d'aménagement paysager.

# GIS METHODS FOR ROUTING AND SITING UTILITY PROJECTS

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In order to identify a preferred transmission line corridor and associated sites for interconnection points, switching stations, or substations, interrelated factors of engineering, economic, and environmental studies for alternative routing and siting should be evaluated. From a strictly pragmatic sense, few constraints exist that make placement of a transmission line impossible. However, given a choice of options governed by economic and environmental variables, the selection of a route corridor and sites may be made which represents a responsible assessment of these options. The environmental impacts of the proposed action are considered in a broad sense to include an assessment of both beneficial and adverse effects on the social, economic and natural environments. While many impacts cannot be predicted with certainty, their probability of occurrence is made easier to predict through a systematic assessment process. Geographic Information System (GIS) technologies deal with these in a manner that is quantitative, defensible and understandable. While any number of environmental elements may be considered, not all would be relevant to the identification and evaluation of each alternative. Elements considered relevant are grouped into four general categories: Living Components, Non-living Components, Human Values, and Demographics and Socioeconomics. The probable effects of a proposed action on each of the elements should be weighed against the pre-action condition in selecting and evaluating alternative sites and routes. The preferred alternative selection process generally would proceed as follows:

Identify a study area that is large enough to provide alternatives for study within the parameters of prudent economic, engineering, and environmental constraints.

Establish evaluation criteria of environmental suitability to include: Land Use; Recreation, Visual, Biological, and Cultural Resources; Socioeconomics.

Establish evaluation criteria of economic suitability to include: Construction Difficulty; Rights-of-Way Costs, Capital Costs, and the importance of each of the evaluation criteria.

Prepare an environmental data base of the study area. Develop GIS models for the previously established criteria that will evaluate the study area based on GIS techniques.

Analyze map data and create thematic maps depicting varying degrees of suitability for each of the evaluation criteria. Combine maps and tabular databases with spatial analysis routines to create maps.

Determine the requirement for a right-of-way corridor. Combine the thematic maps using the predetermined "weight of importance formula", which results in an overall suitability map showing varying degrees between "Best and Worst". Assess potential impacts, based upon the resource sensitivity, and resource and economic suitability.

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Cette présentation traite de l'utilisation des systèmes d'information géographique (GIS) pour l'évaluation des impacts environnementaux associés aux lignes de transport d'énergie électrique.

# REDUCING THE EFFECTS OF HEAVY EQUIPMENT COMPACTION THROUGH A PROGRAM OF IN-SITU ARCHAEOLOGICAL SITE PRESERVATION

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Archaeological sites represent a group of nonrenewable cultural resources. Many federal, state and local agencies now require that archaeological resources be protected from adverse impacts caused by construction or other types of development. The primary method of protecting these resources has been through a program of systematic data recovery designed to identify and preserve the site through excavation. However, alternative methods of mitigation are now being examined as a means of site protection. These methods seek to preserve a site in-situ, and include measures for both short and long-term solutions. This paper examines a study using an experimental technique for short-term preservation of in-place archaeological resources. The technique was designed to reduce or eliminate the potential effects of compaction on buried cultural materials, caused by the movement of heavy equipment through a site area during construction. The study was conducted in 1991, during the construction of the Iroquois Gas Pipeline in New York State. Implementation of the study consisted of a combination of data recovery, analysis of soil characteristics, collection of soil compaction data, the placement of a protective overburden over portions of each test site, and a systematic program of regular monitoring of each site. The protective overburden consisted of two feet of crushed stone placed atop a protective layer of geo-textile filter fabric. Archaeological testing consisted of both pre- and post-construction data recovery. Approximately 5% of the materials recovered were analyzed both macroscopically and microscopically for signs of edge damage. In addition, all of the artifacts were visually scanned as they were cataloged. Pre- and post-construction soil samples were collected at each test site and analyzed for pH level, percentage of moisture, and particle size count. In addition cone penetrometer readings (which measure shear strength of the soil expressed in psi) were taken to assess possible compaction effects to the test area soils. The results of the field study have shown that in instances where construction impact will occur over a relatively brief time span the effects of compaction from heavy equipment on buried cultural material may be prevented or reduced by use of a short-term preservation in-place technique utilizing a protective overburden. In addition the results of this study may be used to justify reduction of over-all project time by allowing a site, identified through preliminary archaeological testing, to be buried rather than undergo a lengthy mitigation. This technique would serve to protect the integrity of the site during construction and leave it virtually intact afterwards. Regardless of the length of time that a site is to be preserved, each site should be subject to an archaeological review with sufficient excavation completed to properly evaluate the site prior to any decision on what mitigation measures to implement. In addition, measures must be designed to determine the long-term effects on the site once the protective overburden is removed.

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Ce document examine une technique expérimentale pour assurer la protection des sites archéologiques contre la compaction du sol. La superposition de 65 cm de concassé sur une membrane géotextile semble permettre la circulation à court terme de la machinerie lourde, tout en assurant la protection des éléments archéologiques souterrains.

# THE BENEFITS OF THE ENVIRONMENTAL ASSESSMENT PROCESS IN ELECTRIC TRANSMISSION LINE ROUTE SELECTION, DESIGN, PERMITTING, AND CONSTRUCTION: A CASE STUDY

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The process of developing an Environmental Assessment for an electric transmission line project may require expertise from many disciplines, including: various engineering disciplines, landscape architecture, botany, aquatic ecology, wildlife management, soil science, remote sensing, archaeology and historic preservation, and urban planning. The involvement of many disciplines has proved beneficial to the early identification of site specific issues which must be addressed in the route selection, design, permitting, and construction phases of a project. Indiana Michigan Power Company's Kenzie Creek - Valley 138 kV Transmission Line Project Environmental Assessment process is reviewed in this paper. The Environmental Assessment process involved the documentation of the need for the project, the route selection process and public and agency involvement, in addition to the anticipated impacts and identification of measures to mitigate or reduce adverse effects. The involvement of several disciplines and documentation of numerous decisions made during route selection and design greatly benefited subsequent permitting and construction phases of the project.

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La mise à profit de spécialistes de plusieurs disciplines s'est avérée bénéfique pour l'identification d'enjeux environnementaux associés aux diverses étapes d'un projet de ligne : 1) le choix de tracé, 2) le design, 3) les demandes de permis, et 4) la construction. Ceci est illustré à l'aide d'une étude de cas portant sur une ligne de transport à 138 kV.

# PUBLIC PERCEPTION OF POWERLINE RIGHTS-OF-WAY MANAGEMENT

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Increasing public awareness of environmental concerns coupled with the vast land area traversed by utility rights-of-way (ROW) enjoins ROW managers to plan and take actions with public perception in mind. Potential health hazards of utility service production and property rights issues cause utilities to be under intense scrutiny, placing a premium on knowledge of landowner and general public attitudes toward ROW management. Knowledge of people's attitudes about ROW treatments, herbicide use, wildlife habitat, and vegetation management would provide ROW managers and decision-makers with tools to improve ROW management programs. Such improvements could yield positive results economically, environmentally, and in terms of public perception of ROW, and the responsible utilities. Relatively little or no research has been conducted to investigate public perception of ROW management. This information gap likely hampers improvements in ROW programs. Two methods of researching people's attitudes about electric transmission ROW management practices have been implemented in a study in eastern Tennessee. First, we are analyzing ROW management complaint files from public utility operations. This analysis may reveal particular landowner and public concerns that can be accomodated or mitigated in future program actions. Second, we are using focus groups to investigate public perception of transmission line corridors and their management. Focus groups are widely acknowledged as a means of gaining in-depth, meaningful information about public perceptions and attitudes. With this method, we will assess public attitudes about a range of ROW management-related topics, including aesthetics, wildlife habitat, and vegetation manipulation.

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Très peu d'études ont été réalisées sur la perception du public de la gestion des emprises. Deux méthodes pour déterminer la perception du public vis-à-vis des emprises de lignes électriques ont été utilisées au Tennessee. Une de ces méthodes permet d'analyser la perception en fonction de la végétation, de la faune et des préoccupations d'ordre esthétique.

# IMPACT OF HIGH-TENSION LINES – 50% OF RESIDENTS DO NOT PERCEIVE THE EQUIPMENT

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Surveys carried out by Entre Les Lignes reveal that 50% of the population living in a zone from which at least one high-tension line can be seen, declare that they can not see it. This group of residents divides itself in two: 25% declare that there is no high-tension line in the region and the other 25% assert that they cannot see the equipment from their home. These observations were repeated in three types of areas: urban, resort and agricultural. These results are used in the preparation of a specialized method for the assessment of the social impacts of high-tension lines. We will present models of the phenomena. Three types of factors have been used: visibility of the equipment, distance of the line from the homes and finally social characteristics of the residents. The tools and procedures developed as a result of these surveys could prove useful when analyzing public awareness of other infrastructures.

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Selon cette étude, 50 % des personnes habitant dans un secteur à partir duquel on peut apercevoir une ligne à haute tension déclarent ne pas la voir. Ces observations ont été faites en milieu urbain, agricole et de villégiature. Ces données servent à élaborer une méthode sur l'évaluation des impacts sociaux des lignes à haute tension.

**Tuesday, September 21, 1993**
**Morning**
**4. Vegetation**
**Room Opus 1**

***Mardi 21 septembre 1993***
***Avant-midi***
***4. Végétation***
***Salle Opus 1***

# ECOLOGICAL PERSPECTIVES ON TREE INVASION IN RIGHTS-OF-WAY: NET COMPETITIVE EFFECTS OF INTACT VEGETATION

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Competition between tree seedlings and intact communities of shrubs and herbaceous species along rights-of-way is generally assumed to be a critical component of the resistance of ROW vegetation to invasion by trees. However, there is still substantial debate among ecologists about the nature and significance of competition among plants in both natural and managed vegetation. We have conducted a series of field and greenhouse experiments designed to assess the net competitive effects of a variety of ROW community types in different environments on growth and survival of tree seedlings. In our core field experiment, seedlings of three tree species - red maple, sugar maple and gray birch - were transplanted into paired plots that either contained intact vegetation or had been cleared of all aboveground vegetation. A total of 24 sites were distributed across a wide range of the communities and physical environments present along rights-of-way in the Hudson Valley of New York. Measurements of growth and survival of 2 separate cohorts of seedlings planted in successive years document a clear trade-off between the importance of competition versus physical environmental stress along a gradient of site quality. On sites that are favorable in general for tree growth, seedling growth and survival is strongly reduced by the presence of intact low-growing species. On sites that are physically stressful primarily because of coarse, drought-prone soils - intact vegetation has little, if any negative effect on tree seedling performance. However, physical stress on those sites reduces seedling growth and survival to levels comparable to seedling performance in the most competitive environments. Additional experiments demonstrate that the relative importance of aboveground versus belowground competition (i.e. for light versus water and nutrients) also varies along a site quality gradient. Our greenhouse experiments with a range of species of tree seedlings have shown that seedlings can be limited by both light and soil resources simultaneously; however, the effects of shading predominate except under extremely low levels of soil resources. These results suggest that management plans designed to maximize the benefits of competition between native communities and tree seedlings should be particularly careful to minimize disturbance to ROW vegetation on productive sites.

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Ces auteurs présentent les résultats d'expériences en serre et en milieu naturel sur la compétition dans les communautés végétales naturelles ainsi que dans celles qui sont soumises à une gestion. Ils discutent de l'importance de réduire la perturbation des communautés végétales naturelles dans le but de promouvoir la compétition comme élément de contrôle de la végétation arborescente.

# ECOLOGICAL PERSPECTIVES ON TREE INVASION IN RIGHTS-OF-WAY: EFFECTS OF HERBIVORY BY MAMMALS

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The invasion of rights-of-way by trees can be strongly affected by herbivorous mammals, which may either kill trees (especially seedlings) outright, or reduce their growth via browsing. We performed a series of experiments to determine the conditions under which herbivory was likely to delay or prevent emergence by trees from low-statured plant communities. In Experiment I, we determined rates of herbivory on tree seedlings as a function of landscape type (forested or post-agricultural), vegetation structure (shrub or herbaceous), and time of year. In Experiment II, we determined the effects of simulated browsing on growth of tree seedlings as a function of tree species, light level, and the seasonal timing and intensity of browsing. In Experiment III, we studied the effects of meadow vole population density on seedling mortality as a function of tree species, vegetation cover (intact or cleared), and time of year. Experiment I demonstrated that the intensity of browsing varied substantially in both space and time. Rights-of-way in forested landscapes and seedlings in open sites experienced higher browse rates than did ROWs in post-agricultural areas or seedlings in shrub or herbaceous communities. Results from Experiment II indicated that browsing actually increased carbon storage and growth when browsing was of low intensity and occurred in winter. Even high intensity, summer browsing did not substantially reduce seedling performance under full sun, but did reduce growth and increase mortality under low light conditions. Experiment III revealed that meadow voles were voracious predators on tree seedlings at all seasons, and that seedling mortality rates approached 100% at high vole density. However, even at high vole density, seedlings in small clearings survived well. Taken together, our results suggest that deer browsing is most intense in habitats in which herbivory by small mammals is least intense. Because browsing had a strong negative impact on tree seedlings only under shady conditions in summer, we hypothesize that browsing generally will be a weak regulator of tree invasion in rights-of way. In contrast, because herbivory by voles usually caused a high rate of outright mortality, we hypothesize that meadow voles may function as strong inhibitors of tree invasion.

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Les auteurs présentent 3 expériences dont le but est de déterminer dans quelles conditions les mammifères herbivores retardent ou inhibent l'émergence des arbres dans les emprises.

# ECOLOGICAL PERSPECTIVES ON TREE INVASION IN RIGHTS-OF-WAY : QUANTIFYING VARIATION AMONG COMMUNITIES IN RESISTANCE TO TREE INVASION.

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Successful emergence of trees above the canopy of shrubs and herbaceous species within a right-of-way requires an entire sequence of events, beginning with the dispersal of tree seeds to the site, followed by avoidance of seed predation, successful germination and seedling establishment, avoidance or tolerance of herbivores, successful competition with adjacent vegetation, and tolerance of physical stress at the site. Therefore, quantifying the resistance of a given ROW community to tree invasion requires a demographic approach that documents the net effects of processes such as competition and herbivory acting at a number of different stages in the process of invasion. As part of our intensive study of the dynamics of tree invasion in rights-of-way, we have monitored the natural population dynamics of trees invading a wide range of ROW communities in the Hudson Valley of New York. We have used our results to parameterize a simple demographic model of tree invasion that allows us to compare the abilities of different ROW communities to resist tree invasion. Our results indicate that no single process or life history stage determines variation among communities in resistance to invasion. Overall, communities dominated by shrubs had higher resistance to invasion than communities dominated by herbaceous species. Our experiments on competition suggest that the high resistance to invasion of shrub communities is due simply to the longer duration of shading of tree seedlings by shrubs than lower-statured herb species. Grass-dominated communities on poor soils had intermediate resistance to invasion. In contrast to the shrub communities, our experiments suggest that physical stress, rather than competition, is a significant limitation on tree invasion in these communities. Communities dominated by herbaceous perennials on productive soils (grasses and goldenrods, *Solidago* spp.) had the lowest resistance to invasion. While competition is initially quite intense in these communities, surviving tree seedlings escape competition after only several years of height growth. In contrast, outright predation by small mammals such as meadow voles and browsing by deer may be much more important than competition in inhibiting tree invasion in these communities.

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Cette présentation fait part d'une étude sur l'invasion des emprises par les essences arborescentes. En général, les communautés végétales dominées par les arbustes présentent une plus forte résistance à l'invasion par les arbres que celles dominées par les espèces herbacées. L'effet des petits rongeurs et des cerfs sur l'invasion des arbres est également discuté.

# A FIELD STUDY OF MOBILITY OF SUPPLEMENTAL WOOD POLE PRESERVATIVES IN ADIRONDACK WETLANDS

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A field study and associated risk assessment was sponsored by the Empire State Electric Energy Research Corporation (ESEERCO) and performed by O'Brien & Gere Engineers, Inc. in order to evaluate the potential ecological and human health impacts related to the application of five supplemental wood preservatives to electric utility transmission poles. The field study consisted of post-application monitoring for chemical residuals and biological impacts related to Osmoplastic, Dursban, Woodfume, Hollow Heart, and Cop-R-Nap Naphthenate. The investigation involved 20 utility wood poles located in wetland sites of the New York State Adirondack Park. Ground water, surface water, and soil around each treated pole were monitored for release of active ingredients and subsequent degradation products of the commercial wood preservatives. The biological monitoring program measured carbon dioxide and methane evolutions, microbial biomass, and soil macro-invertebrates for responses to chemical exposure. Wood preservative residues from treated poles were not found at concentrations above background levels in ground water, surface water, or soil. The absence of detectable residues was related to a combination of physical and chemical factors including the small original mass of applied materials, a high affinity for adsorption to wood surfaces, and an ability of the preservatives to undergo volatilization and biodegradation. Soil microorganism populations were not impacted by supplemental wood pole treatment as evidenced by measurements of carbon dioxide and methane evolution, and microbial biomass. Consistent with the results of soil respiration and microbial biomass indices, no indication of impact was observed among the invertebrate community. Based on the results of the field study and data assessments, it can be concluded that the supplemental utility pole treatments of Osmoplastic, Dursban, Woodfume, Hollow Heart, and Cop-R-Nap do not cause measurable post-application impacts to Adirondack Park wetlands.

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Dans le but d'évaluer les impacts potentiels associés à l'application de 5 agents de préservation du bois sur des poteaux de distribution d'énergie électrique, ESEERCO a réalisé une étude au terrain dans les terres humides des Adirondack ainsi qu'une évaluation de risques.

# RIGHT-OF-WAY SITE FACTORS RESPONSIBLE FOR RESISTANCE OF CERTAIN PLANT COVER TYPES TO TREE INVASION

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A study was conducted on an electric transmission line right-of-way (ROW) in central Pennsylvania in 1992-93 to evaluate site factors that could account for resistance of certain plant cover types to tree invasion. Three predominant species of tree-resistant grass-forb and forb-grass cover types investigated were : poverty grass (*Danthonia spicata*), rough goldenrod (*Solidago rugosa*), and hayscented fern (*Dennstaedtia punctilobula*). Seeds of red maple (*Acer rubrum*), a common ROW tree invader, were sown in seedspots, with and without protection from wildlife, in pure patches of each plant cover species. Four seedbed treatments, each replicated 4 times, used to test germination and seedling growth were: undisturbed vegetation and soil, exposed ROW mineral soil, commercial topsoil covered with plant litter, and commercial topsoil alone. Depredation by small mammals was found to be the most important factor limiting red maple seedling establishment. Plant competition was also highly important. Allelopathy did not appear to be important in inhibiting red maple seed germination or seedling growth during the first growing season.

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Trois types de communautés végétales ont été testées quant à leur potentiel de résistance à l'invasion de l'érable rouge dans une emprise de Pennsylvanie. La présence de petits rongeurs s'est avérée le plus important facteur pour réduire l'invasion des érables. La compétition était importante; par contre, l'allélopathie ne semble pas jouer un grand rôle lors de la première saison de croissance.

# NATIVE PLANT RESTORATION AND VISUAL SCREENING ON A NATURAL GAS PIPELINE CORRIDOR

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From the viewpoint of erosion, aesthetics, topographic variability, and potential habitat for wildlife, an inherent problem encountered in pipeline corridors is with controlling erosion and plant invasion to a vegetative cover that is resistant to weed invasion, drought, and is adapted to the local environment. One way to circumvent this problem is by native plant restoration efforts using regional sources of seed and plant materials. This is a report on our efforts on behalf of Great Lakes Gas Transmission Company (GLGTC) to re-establish approximately 35 miles of disturbed right-of-way (ROW) to pre-construction conditions using native species for restoration. Using a regional contractor (specializing in native species restoration), we were able to coordinate the restoration of 340 acres of ROW with prairie grass and wildflower seeds, and transplantation of 130,000 plugs of beach grass and sedges in a dune swale complex. In addition, 4,000 trees and shrubs were used for visual screening along 13 federally proposed wild and scenic rivers. By using native species for restoration, the growth and development of the selected indigenous vegetation was favored. As well as enhancing the aesthetic character of natural areas crossed by the pipeline ROW, native species provided better erosion control, resistance to weed invasion, wildlife and maintenance benefits, drought tolerance, and adaptation to the local environment. This project was one of the first in the country to integrate this new level of environmental protection into pipeline construction. As levels of environmental concern and protection increase, it is likely that many more pipeline companies will provide increased support for this type of work.

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Cette étude de cas traite de la restauration, à des fins visuelles, de 150 hectares d'emprise de pipeline avec des graines et cartouches d'espèces végétales indigènes, de même que 4 000 arbres et arbustes. L'utilisation d'espèces indigènes a favorisé le contrôle de l'érosion et la résistance à l'invasion de mauvaises herbes, tout en favorisant la faune et en procurant une meilleure protection contre la sécheresse.

# THE EFFECT OF GLYPHOSATE AND PRESCRIBED BURNING ON LEGUMINOUS AND WOODY PLANTS ON RIGHTS-OF-WAY

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This study evaluated two rights-of-way maintenance techniques to determine their effect on upland game bird food plants and undesirable woody vegetation. The maintenance techniques studied were a broadcast application of glyphosate N-(phosphonomethyl) glycine and glyphosate plus a winter prescribed burn. Herbicide-only treatments were effective in significantly reducing undesirable woody plants, i.e., sweetgum (*Liquidambar styraciflua*) and sumac (*Rhus* sp.); however, upland game bird food plants were also substantially reduced. Herbicide treatments followed by burning were found to significantly reduce undesirable woody plants ; however the production of upland game bird food plants was not adversely affected. The cost of the studied techniques compared favorably with other currently used maintenance techniques.

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Cette étude a évalué deux techniques d'entretien de la végétation dans des emprises au Mississippi : l'application non sélective de glyphosate N-(phosphonométhyle) glycine et l'application de glyphosate avec brûlage d'hiver. Cette dernière méthode a réduit la végétation ligneuse indésirable sans toutefois affecter la production d'espèces prisées par l'avifaune.

# REGENERATION OF VEGETATION ON WETLAND CROSSINGS OF GAS PIPELINE RIGHTS-OF-WAY ONE YEAR AFTER CONSTRUCTION

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Four wetland crossings of gas pipeline rights-of-way (ROWs), located in Florida, Michigan, New Jersey, and New York, were surveyed for regeneration of vegetation roughly one year after pipeline construction was completed. Conventional trench-and-fill construction techniques were employed for all four sites. Estimated areal coverage of each species by vegetative layers within transect plots was recorded for plots on the ROW and in immediately adjacent areas undisturbed by construction activities. Relative success of regeneration was measured by percent exposed soil, species diversity, and presence of native vs. introduced species. Variable site factors included separation and replacement of topsoil, final grading of the soil, application of seeding and fertilizing, and human disturbance unrelated to construction. Successful regeneration exhibited greater dependency on the first three factors listed. This work was supported by the Gas Research Institute under contract number 5088-252-1770 with the U.S. Department of Energy.



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Ces auteurs discutent de la régénération de la végétation après la construction d'un pipeline dans les terres humides de la Floride, du Michigan, du New Jersey et de l'État de New York.

**Tuesday, September 21, 1993**
**Morning**
**5. Wildlife**
**Room Opus 2**

***Mardi 21 septembre 1993***
***Avant-midi***
***5. Faune***
***Salle Opus 2***

# HYDRO-QUÉBEC GUIDELINES ON RIGHT-OF-WAY ROUTING AND VEGETATION MANAGEMENT IN RELATION TO WHITE-TAILED DEER WINTER YARDS

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Routing utility rights-of-way (ROW) through white-tailed deer (*Odocoileus virginianus*) winter yards raises serious concerns about the impact on deer habitat in Québec. Since 1974 Hydro-Québec has been collecting data on this issue in the framework of impact assessments, testing of mitigation measures, monitoring and research studies. In 1987, a 6-year intensive research program was initiated with the objective of elaborating corporate guidelines concerning the ROW-deer yard issue. The general hypothesis tested was that strategically routed and managed ROWs could produce abundant browse, which would be used by deer. Methods included browse surveys, aerial surveys and mathematical modeling. Data on winter habitat, deer activity pattern, feeding strategy and mitigation measures were collected in 10 representative deer yards. Results showed that the presence of a ROW did not alter the distribution pattern of yarded deer in the vicinity of the ROW. High browse production and use by deer can be achieved in ROWs 2 years after initial clearing or 3 years after subsequent vegetation treatments. The highest browse count recorded was 600,000 twigs/ha while browsing pressure reached 85% in one ROW. Abundance and browse species available, along with the location of the ROW influenced the browsing intensity. Results from the numerous studies indicated that, within a deer yard management scheme, ROWs routed in order to protect cover and maximize browse production in the proximity of forest cover can improve winter habitat and can be beneficial for deer. To maintain abundant quality browse in a ROW on a long-term basis, appropriate vegetation management approaches and techniques must be implemented. The empirical data available make it relatively easy to elaborate corporate guidelines from a technical standpoint. Techniques available include : smaller scale and more frequent vegetation treatments, half-span or half-width ROW vegetation treatments, removal of undesired species and winter cutting. However, the inclusion of such guidelines by regional managers and administrators in the annual planning and daily work execution represents a greater challenge. Preliminary regional workshops have been held to that end, and to date, the guidelines have been integrated with success in the routing of one ROW and the vegetation management of 3 others.

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De 1987 à 1993, Hydro-Québec a réalisé un programme de recherche visant l'élaboration de principes corporatifs concernant la gestion des emprises dans les ravages du cerf de Virginie. Des inventaires réalisés dans un réseau de 10 ravages représentatifs des habitats et des équipements d'Hydro-Québec ont permis d'obtenir des données indiquant qu'il est possible de développer des directives corporatives au point de vue technique en visant des interventions plus rapprochées et de moindre envergure. Parmi les techniques retenues, on retrouve l'entretien par demi-largeur d'emprise, l'entretien par demi-portée, l'enlèvement des espèces ligneuses non recherchées par le cerf et la coupe d'entretien hivernale.

# THE EFFECT OF MANAGEMENT TREATMENTS ON THE BIOMASS NUTRITIVE QUALITY, AND UTILIZATION OF DEER FORAGES ON UTILITY RIGHTS-OF-WAY

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Powerline rights-of-way (ROW) occupy sizeable portions of forested lands in the southeastern United States. The effect of selected treatments on the biomass and nutritive quality of forages produced on these ROWs and their utilization by white-tailed deer (*Odocoileus virginianus*) pose important management considerations. Six treatments (mow, mow-and-fertilize, burn, burn-and-fertilize, plant-and-fertilize and control), were established on ROWs and sampled seasonally over a 3-year period to compare forage biomass, forage nutrient levels, and utilization of plants by deer. Plant-and-fertilize treatment (cereal rye and legume) was the most effective treatment in terms of increasing plant biomass, improving nutritive quality, and attracting deer. Fertilizing native plants following mowing or burning also significantly increased biomass and quality of forages, particularly forbs and grasses, but significant increases in deer utilization were detected on introduced tall fescue only during the third year of study. Although forage yields reached their highest levels during midsummer and fall, during the same period crude protein, phosphorus, and calcium were at their lowest levels and acid detergent fiber at its highest level.

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Cinq traitements de la végétation dans des emprises de ligne sont comparés à un contrôle quant à la biomasse végétale produite, la qualité nutritive, l'utilisation par le cerf de Virginie et les coûts. Les 5 traitements sont la tonte, la tonte/fertilisation, le brûlage, le brûlage/fertilisation et la plantation. Des résultats sont présentés concernant les divers traitements.

# PRE-, DURING AND POST-CONSTRUCTION EFFECTS OF A 345 kV PROJECT ON WINTERING DEER

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As utility corridors have proliferated in more densely populated parts of the country biologists and analysts have become more concerned about the impacts of construction and clearing on indigenous wildlife. During construction of a 345 kV electric corridor in southeastern New York we studied the physical effect of construction and the resultant 45.7-90.0-meter-wide right-of-way on native populations of white-tailed deer (*Odocoileus virginianus*). Line transects parallel to and across the right-of-way were established in 4 bisected deer winter concentration areas. Tracks, trails and pellet groups were documented at 14.6-meter intervals along each transect through 6 winters (1985-90). Browse use of woody plants was summarized by species for each area at the conclusion of each survey. Track and trail analysis revealed significant differences (.05 level) between on and off right-of-way use in each area. Use as determined by pellet groups on and off right-of-way was not significantly different (.05 level) but most of this use was in early spring when deer were less reluctant to use the open right-of-way. Deer browsing was heaviest on preferred species but woody plants were escaping deer's reach only in the Oneonta area where extensive browse was available off right-of-way. Factors influencing deer movement most were dangerous tree removal and logging which generated browse and snow depth. Use ceased on right-of-way when snow depth exceeded 40 centimeters. Human activity, wild canids, dogs and all-terrain vehicles had little impact on deer in all 4 study areas. We suspected that corridor width is a limiting factor on deer movement but were not able to prove it conclusively. More documentation is needed.

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Les effets d'une emprise de ligne électrique à 345 kV sur le cerf de Virginie ont été étudiés dans l'État de New York. Dans 4 ravages, des dénombrements de pistes et de fèces ont été faits au cours de 6 hivers. L'utilisation du brout a également été mesurée. La pression de broutage était plus importante sur les espèces préférées et dans les ravages où la nourriture à l'extérieur de l'emprise était rare. Les cerfs n'utilisaient pas l'emprise lorsque la profondeur de la neige dépassait 40 cm. Les activités humaines et la présence des canidés ont eu peu d'impact sur les cerfs dans les 4 zones étudiées.

# SHRUB THICKET USE AND DIET OF WILLOW PTARMIGAN NEAR ROADS AND POWERLINE RIGHTS-OF-WAY OF THE LA GRANDE HYDROELECTRIC COMPLEX

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Shrub thicket use by willow ptarmigan (*Lagopus lagopus*) was investigated on the La Grande complex during the winter of 1990. Thickets were examined near access roads and powerlines as well as in control areas located far from the reservoirs. Some individuals were also collected to examine their diet. Willow (*Salix* spp.) and alder (*Alnus* spp.) were the dominant shrub species along roads and powerline rights-of-way and their distribution was similar in these two modified habitats. Willow thickets were by far the most heavily used vegetation type by ptarmigan in all sectors. Thicket use along roads and powerline rights-of-way was similar and was strongly associated with the distribution of willow thickets. Shrub use did not differ between modified habitats (roads, powerlines) and control areas for all types of vegetation. Vegetation species most heavily browsed were willow, wild red cherry (*Prunus pensylvanica*) and glandular birch (*Betula glandulosa*) whereas alder was rarely used by ptarmigans. Diet of willow ptarmigan consisted mainly of willow items. Diet of individuals collected in right-of-way habitats and in control areas was similar. However, gravel was present only in the gizzard of individuals collected near roads and powerlines. Future willow thicket plantation and conservation along roads and powerlines should be beneficial to wintering willow ptarmigan on the La Grande complex territory.

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L'utilisation des arbustaies par le lagopède des saules (*Lagopus lagopus*) a été examinée sur le territoire du complexe La Grande à l'hiver 1990. On a comparé les arbustaies à proximité des chemins d'accès et des emprises de lignes de transport d'énergie à celles de zones témoins situées loin des réservoirs. La diète de quelques individus a également été examinée.

# REDUCING ELECTROCUTIONS ON A 12.5 kV DISTRIBUTION LINE ORIGINALLY DESIGNED TO MINIMIZE ELECTROCUTIONS

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A 12.5 kV distribution line was built and operated by the Western Area Power Administration (Western) in southwestern Colorado to provide power to irrigation pumping systems associated with the Great Cut dam constructed by the U.S. Department of interior, Bureau of Reclamation. The line was designed to minimize electrocutions and then provided with anti-perching devices to prevent bird defecation from fouling the line insulators. In the spring of 1985, Western's line crews working in the area noted and reported dead birds along the facility. Cursory field examinations indicated the birds had died of electrocution. Western, in conjunction with the U.S. Forest Service and the Colorado Division of Wildlife, investigated the line to determine the cause of the electrocutions and develop corrective actions. Field Studies indicated that electrocutions were happening at only certain poles. The species involved included raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*) and golden eagle (*Aquila chrysaetos*). To remediate the problem, the anti-perching devices were removed from approximately seventy-five percent of the line. Perches were provided to those structures where heavy use was apparent, and to other poles considered to have a high potential for use. The perches were placed on the structures to minimize fouling of the insulators.

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Cette présentation traite de l'électrocution d'oiseaux, particulièrement de rapaces, sur une ligne de distribution au Colorado. Une enquête sur le terrain a indiqué que les mortalités n'arrivaient qu'à certains poteaux. Des perchoirs alternatifs furent installés sur ces structures pour éliminer les électrocutions et la salissure des équipements.

# PROTECTION DE L'AVIFAUNE ET RÉSEAUX ÉLECTRIQUES AÉRIENS

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L'Alsace, province de l'est de la France, est connue pour son oiseau symbole : la cigogne blanche (*Ciconia ciconia*). Pendant de nombreuses décennies, plus de 200 nids ont été occupés sur les toits des bâtiments d'Alsace jusque dans les années 60. À partir de cette date, une diminution régulière des effectifs a conduit, en 1974, à une population relictuelle de 9 couples. Des opérations de réintroduction ont été nécessaires pour reconstituer la population, en la sédentarisant, notamment pendant la période juvénile (0 à 3 ans) et durant l'hiver. Il s'est avéré en effet que le facteur principal de mortalité des oiseaux était lié à des accidents et des électrocutions sur des lignes électriques aériennes à moyenne tension : de 70 à 80 % des oiseaux retrouvés morts avaient subi ce sort. Ces observations ont été rendues possibles notamment grâce à un baguage quasi systématique de toute la population de cigognes alsaciennes depuis près de 50 ans. Les opérations de réintroduction de cigognes menées par l'Association pour la Protection et la Réintroduction des Cigognes en Alsace (A.P.R.E.C.I.A.) ont donc été accompagnées de mesures de neutralisation des installations électriques aériennes, en particulier à proximité des enclos de réintroduction et des sites de nidification. Ces équipements ont permis aujourd'hui : 1) de limiter sensiblement les mortalités par électrocution; et 2) de sensibiliser fortement la population, les élus et les responsables d'Électricité de France à la mise en souterrain des réseaux électriques. La protection des cigognes alsaciennes, oiseau fétiche de cette région, aura donc débouché sur un problème important d'aménagement du territoire et d'emprise de réseaux. Cet exemple pourrait être corroboré par des exemples concernant le vautour fauve (*Gyps fulvus*) dans les Cévennes ou l'aigle de Bonelli (*Hieraaetus fasciatus*) dans les Alpilles.

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Banding studies of white storks over the past 50 years indicated that the most important mortality factor was collisions and electrocutions of storks on powerlines. Structures have been improved, particularily at nesting sites. The improved equipment has reduced mortalities and increased public awareness of the issue.

# VULNERABILITY OF REPTILES AND AMPHIBIANS TO TRANSMISSION CORRIDORS

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Reptiles and amphibians, being less mobile than other forms of wildlife, may be more vulnerable to disturbances caused by construction and maintenance of electricity transmission corridors. The ability of each of the 45 species native to Ontario to cope with the incurred disturbances may vary considerably. The purpose of our study was to develop a model to predict the relative sensitivities of these species to the construction and operation of transmission corridors. The model consists of matrices which rate all of Ontario's species according to various sensitivity criteria. Criteria were given numeric ratings, where more sensitive species are given a higher score. These criteria include habitat requirements or life history characteristics which could make populations vulnerable to the environmental changes resulting from transmission corridors. Species' habitat requirements at various life stages are given greater weight than other criteria. Other criteria, such as mobility, age at maturity or number of offspring produced, are also considered as these affect a species' dispersal ability or a population's resilience to recover from a disturbance. The second part of the model deals with the conservation status (i.e., distribution and relative abundance) of the various species. Again criteria were given numeric ratings. The model sums the scores of the various criteria for each species. A final list ranks the relative expected vulnerability of Ontario's amphibian and reptile species to disturbances related to transmission corridors. The model could aid in the route selection process to minimize impact on the most sensitive species and could also be applied to other linear corridors such as roads and pipelines.

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Le but de cette étude était de développer un modèle pour prédire la sensibilité de 45 espèces d'amphibiens de l'Ontario à la construction et à l'exploitation des emprises de lignes électriques. Le modèle tient compte du cycle de vie, des habitats et de la mobilité des espèces. Le modèle traite de la conservation de ces espèces. Une liste finale présente la vulnérabilité relative des espèces aux perturbations associées aux emprises de lignes.

# LA GRENOUILLE ET L'AUTOROUTE

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La législation française a prévu la protection des amphibiens sur le territoire national par un arrêté datant de 1979. Ces animaux jouent, en effet, un rôle important dans l'équilibre écologique du milieu. Certains batraciens se déplacent en masse chaque année sur des kilomètres pour se reproduire. La migration prénuptiale a lieu en fin d'hiver. Les adultes quittent les lieux d'hibernation pour rejoindre les zones de pontes qui les ont vus naître. Après quelques semaines, ces adultes regagnent leur territoire de chasse. Les parcours empruntés respectent diverses conditions écologiques et sont toujours les mêmes. La construction d'une autoroute dans une zone peuplée de batraciens est donc susceptible de couper ces voies de migration. Si des mesures ne sont pas prises, une population entière peut être rapidement décimée. Afin d'assurer la protection des amphibiens, COFIROUTE a mis en oeuvre trois types d'aménagement répondant à différentes problématiques dans la traversée de la SOLOGNE. Les passages sous chaussée : des dispositifs obligent les batraciens à emprunter des passages souterrains constitués de buses d'un diamètre de 400 à 600 mm. Les barrières de protection : elles sont utilisées pour interdire l'accès de la chaussée aux animaux lorsque ceux-ci peuvent trouver sans difficulté un autre lieu de reproduction. La mare de substitution : on recrée ici une zone artificielle de reproduction du même côté que le lieu d'hibernation par rapport à la voie. Diverses conditions écologiques sont à respecter et doivent être aménagées. Des études de suivi ont permis de juger de l'efficacité de ces dispositifs (capture, comptage, marquage des animaux, etc.). Ainsi observe-t-on une bonne utilisation des passages sous chaussée. Cependant, des variations sont sensibles selon les espèces et les années d'étude. Cette présentation sera suivie du film «Pour les beaux yeux du crapaud» .

Film : POUR LES BEAUX YEUX DU CRAPAUD (16 millimètres, 28 minutes). Dès le mois de janvier, au moindre redoux, les batraciens quittent leur retraite hivernale. L'instinct les guide vers la mare de leurs ancêtres, pour se reproduire là où ils sont nés, quelques années plus tôt. Grenouilles, tritons, salamandres, crapauds convergent vers l'eau, par des cheminements souvent hérissés d'obstacles et de pièges. Au printemps, les chants d'amour traduisent la présence des batraciens sur les lieux de ponte. Les jeunes, encore têtards, vivent une étape aquatique jusqu'à leur métamorphose. Puis ils découvrent le milieu terrestre, avec ses pièges. À certains endroits, la route est responsable de la régression des populations. En Sologne, la construction d'une autoroute mettait en péril certaines populations de batraciens. Divers systèmes de protection, simples et peu onéreux, permettent localement de concilier les besoins du trafic routier et les déplacements des batraciens. Une expérience unique en France le long d'une autoroute et un exemple concret de protection de la faune. Réalisé par P. Henry.

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Highway routing and construction in high density amphibian populations can interfere with migration routes. COFIROUTE (France) has developed 3 methods to protect amphibians : underground crossings, protection fences and artificial breeding ponds. This paper will be followed by a 28-minutes film **in French** «Pour les beaux yeux du crapaud» (THE TOADS ARE WATCHING !) : In France, in January, amphibians leave their hibernating habitats and migrate to ponds to breed. Frogs, salamanders and toads converge towards water following routes filled with obstacles. At certain sites, highways are responsible for decrease in amphibian populations. In Sologne, the construction of a highway was threatening some amphibian populations. Various simple protection systems were used locally to conciliate highway traffic needs and amphibian movements without spending great sums of money. The film highlights this unique experience along a superhighway in France to protect amphibians. Dir. P. Henry.

**Tuesday, September 21, 1993**
**Morning**
**6. Planning and monitoring**
**Room Beethoven**

***Mardi 21 septembre 1993***
***Avant-midi***
***6. Planification et suivi environnemental***
***Salle Beethoven***

# A COOPERATIVE PROGRAM FOR THE MANAGEMENT OF UTILITY LINE RIGHTS-OF-WAY IN MISSISSIPPI

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Representatives of the U.S. Soil Conservation Service, U.S. Forest Service, Mississippi Department of Wildlife, Fisheries and Parks, Mississippi State University, and utility companies met and developed a plan for rights-of-way (ROW) development and maintenance. The plan involved the development of vegetative cover which would enhance food and cover for upland game species as well as retard the invasion of objectionable woody plant species. ROWs targeted for immediate consideration were those located on state- and federally-owned lands open to hunting. The state Department of Wildlife, Fisheries, and Parks agreed to furnish seeds, fertilizer, and lime while the agencies owning the land agreed to conduct any soil preparation needed, as well as apply the seed and fertilizer. The Plant Materials Center of the Soil Conservation Service volunteered to help develop seed sources for selected native quail food plants. Utility companies consented to follow the maintenance recommendations made by the technical advisory committee which was made up of experienced ROW ecologists. Within a 2-year span, most utility line ROWs on state and federally-owned lands had maintenance plans. Although a large percentage of ROWs on federal and state-owned lands had maintenance prescriptions written and agreed upon, it was felt the dissemination of ecological information to participants was the most noteworthy aspect of this program.

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Cette présentation porte sur le développement d'un plan de gestion coopératif de la végétation des emprises au Mississippi. Le plan, élaboré par un comité technique, a été adopté dans les terres appartenant au gouvernement fédéral ou à l'État du Mississippi. La dissémination d'informations écologiques aux participants est un aspect très significatif du programme.

# VEGETATION MANAGEMENT WITH ENVIRONMENTAL STEWARDSHIP

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Vegetation management of Delmarva Power's electric transmission and distribution rights-of-way was converted from brushhog mowing to herbicide management during the 1980's. This change was successfully achieved in one of the most environmentally sensitive areas of the United States, and under the watchful eye of Washington's politicians and regulators. The various techniques used for herbicide treatment are demonstrated and compared with those used for mechanical and manual cutting of vegetation. Superior benefits of herbicide management compared to mowing for reasons of safety, aesthetics, wildlife management, environmental protection and economics are discussed. The proper use of herbicides in managing wetlands and endangered species is reviewed. This paper endorses a proactive public relations policy to educate the general public and policy makers as to the positive aspects of judicious herbicide use. It also emphasizes the importance of communication and cooperation with environmental organizations, regulators and politicians. This philosophy has resulted in Delmarva Power becoming a partner with organizations such as The Nature Conservancy, ornithological societies, garden clubs, Greenway commissions, state Heritage Programs and wildlife managers. It concludes by advising managers in all aspects of vegetation management to learn the needs of other interested parties, adjust techniques to accommodate where possible, and promote wise environmental stewardship through proper herbicide use.

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Durant les années 80, la compagnie Delmarva Power a converti son programme de contrôle de la végétation par coupe/tonte dans ses emprises de lignes en un programme favorisant les phytocides. Les techniques de coupes sont comparées à celles utilisant des phytocides. Des bénéfices supérieurs ont été attribués à la gestion de la végétation par phytocides plutôt que mécaniquement en fonction de la sécurité, de l'esthétique, de la faune, de la protection de l'environnement et de l'aspect économique. Cette approche exige la mise en place d'une politique de relations publiques à caractère proactif.

# SPECIAL WILDLIFE AND HABITAT COMPENSATION ISSUES RESULTING FROM HIGHWAY AND ROW DEVELOPMENT IN THE ARID SOUTHWEST, USA: AN ARIZONA PERSPECTIVE

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Pursuant to the wildlife management duties of the Arizona Game & Fish Department and in accordance with federal environmental laws and resource management acts (i.e. NEPA, Clean Water Act), the Department has developed compensation plans for actual and potential losses resulting from land and water projects in Arizona. Habitat compensation plans are predicated upon a 100% level of compensation aimed at eliminating or reducing project-associated impacts (per 'AGFD Operating Manual', Wildlife Habitat Compensation, I2.3) and are based on four Resource Categories established by the Arizona Game and Fish Commission. These Resource Categories will be presented and discussed. This presentation will focus on particular highway projects and ROW's, their potential habitat and wildlife impacts, and mitigation requested by the Arizona Game and Fish Department.

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Cette présentation traite de projets de routes dans le sud-ouest des États-Unis, de leurs impacts potentiels sur les habitats fauniques ainsi que des mesures d'atténuation mises en place par le service de la faune et des pêches de l'Arizona.

# EFFECTIVE TRAINING OF ENVIRONMENTAL MONITORS FOR TRANSMISSION LINE AND PIPELINE CONSTRUCTION

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The importance of environmental monitors on construction of electric transmission line or pipeline projects has become increasingly important since failure to comply with environmental conditions attached to Federal and state permits and certificates can result in significant fines or the shutdown of a construction project. Training environmental monitors to effectively implement environmental conditions while still assisting the construction manager in meeting the company's construction schedules becomes a critical endeavor. Environmental monitors may be long-time corporate employees or personnel hired specially to carry out the function of an environmental monitor. In either situation, the corporation must select individuals that demonstrate the personal characteristics to work under adverse administrative and physical conditions. Regardless of the status of the individual, effective training begins with the definition of the responsibilities and authority of the environmental monitor : Who does the environmental monitor report to? Does the environmental monitor have stop-work authority? Under what circumstances can the environmental monitor report directly to regulatory agencies without prior corporate approval? The definition of responsibilities is crucial to the overall development of a training program. The corporate training program must be conducted by a corporate representative who fully understands the range of regulatory requirements for the construction of the project. This includes requirements of the Federal, state, and local regulatory agencies that issued permits and certificates for construction; however, it should also include commitments that have been made during the siting and licensing process to individual landowners and special interest groups, as well as informal commitments to the regulatory agencies. The training program can include both classroom and field components. It is imperative that the individual monitor understands the construction procedures that will be employed and the scheduling aspects between the different construction phases. Failure to do so can result in potentially disastrous confrontations between the environmental monitor and construction contractors. Reporting and communications procedures are critical to the successful functioning of an environmental monitor. Reporting of emergency as well as routine situations must be well defined with established timeframes. As with any function, quality control must be exercised with environmental monitors. The corporation must review the effectiveness of the environmental monitor on a regular basis. Monitors that are not effectively carrying out their role must be identified and corrective action taken. Failure to do so can jeopardize the overall project construction schedule.

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Le rôle du chargé d'environnement sur un site de construction est stratégique; si les directives environnementales ne sont pas respectées, un chantier peut être arrêté. La formation d'un chargé d'environnement doit être encadrée par du personnel qualifié, les responsabilités du chargé doivent être bien définies et le candidat doit connaître les techniques de construction. On doit déterminer à qui le chargé d'environnement doit faire rapport. Un programme de contrôle de la qualité permet de faciliter la tâche du chargé d'environnement.

# THE ROLE OF WETLAND MITIGATION BANKING IN PIPELINE RIGHT-OF-WAY MITIGATION

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Wetland mitigation banks have been proposed as a potential alternative to conventional on-site and off-site mitigation of wetland impacts associated with the impacts of rights-of-way on wetlands. Wetland mitigation banks are areas of wetlands that have been created, restored, enhanced or preserved for the purpose of offsetting unavoidable wetland loss associated with project development. The objective of the research was to characterize the existing and proposed legislation and wetland mitigation banks to determine the role of banks for the oil and gas industries. A second objective was to define an approach to incorporating wetland mitigation banking into pipeline company operations. The information was gathered on wetland mitigation banks with special regard to the areas of regulatory issues, management issues, economic issues and technical issues. Regulatory requirements and positions were gathered from appropriate organizations within individual states. Field reconnaissance was performed on a select number of banks deemed as representative of industry needs. Wetland mitigation banks have proven successful in a variety of cases. The information gathered on the operation of the banks provides a significant data base of lessons learned for incorporation of mitigation banks into the creation and operation of industry rights-of-way and facilities. The potential roles for wetland mitigation within the industry can be defined and guidance for their implementation be prepared.

Pour pallier les inévitables pertes de terres humides associées aux projets de pipeline, une des mesures d'atténuation consiste à créer des banques de terres humides protégées; ce sont des superficies de terres humides qui ont été créées, réaménagées ou conservées. Cette présentation traite des aspects légaux de ces banques ainsi que de leur intégration aux activités d'exploitation des compagnies de pipelines.

# ONTARIO HYDRO - ENVIRONMENTAL MONITORING DURING THE CONSTRUCTION PHASE OF TRANSMISSION LINES

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During the construction of new and refurbishment of existing transmission lines, Ontario Hydro undertakes a comprehensive program of environmental monitoring. The primary purpose of the program is to ensure that all commitments and legislative requirements are met and proposed mitigation measures followed, and that unforseen problems are detected early and dealt with effectively. The secondary purpose is to generate documentation of a thorough, systematic and ongoing process of monitoring field conditions as they pertain to environmental concerns throughout the construction and restoration phase. Ontario Hydro has developed a "user friendly" computerized database using a laptop computer for data inputting, which means that records can be updated in the field. The software can also generate summaries and update reports of various formats for internal and external use. The presentation will also cover the history and evolution of environmental monitoring programs at Ontario Hydro.

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Pour chaque projet de construction ou de réfection de lignes électriques, Ontario Hydro entreprend un progamme de suivi environnemental. Ce dernier permet d'assurer que les engagements de l'entreprise et les exigences législatives sont rencontrés. Le programme de suivi permet de générer des informations concernant l'environnement durant les phases de construction et de restauration. Ontario Hydro a développé une banque de données informatisée qui peut être mise à jour sur le terrain à l'aide d'un ordinateur portatif. Grâce à ce logiciel, des résumés ou des rapports peuvent être mis à jour rapidement pour distribution interne ou externe.

# INSIGHTS GAINED FROM STUDIES OF VARYING AGE GAS PIPELINE RIGHTS-OF-WAY THROUGH WETLANDS

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Impacts of gas pipeline rights-of-way (ROWs) through wetlands depend on type of habitat, construction techniques, final elevations, ROW maintenance practices, soil composition, and local climate. In some instances, factors unrelated to the pipeline have greater impacts on wetland modification than does the presence of the pipeline. This paper will discuss observations from fourteen study sites that are zero to forty years old located in seven eastern states. At one site, the required seeding program inhibited natural wetland plant re-establishment, and another downstream construction resulted in a major disruption to the adjacent wetland habitat. This work was supported by the Gas Research Institute under contract number 5088-252 1770 with the U.S. Department of Energy.



Les impacts des emprises de pipeline traversant des terres humides sont fonction du type d'habitat, des techniques de construction, du niveau du terrain, des méthodes de maintenance, du sol et du climat local. Les auteurs comparent 14 sites d'étude dont l'âge varie de 0 à 40 ans et qui sont situés dans 7 États de l'est des États-Unis.

# PAY ME NOW OR PAY ME LATER: UTILIZING ENVIRONMENTAL DATA BETWEEN TIERED PHASES OF TRANSMISSION LINE AND OTHER LINEAR PROJECTS

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Transmission line projects are typically viewed as having four distinct phases: siting, licensing (permitting), construction, and maintenance. Although each phase has different objectives, data requirements, and methodologies, the efficiency of developing an inherent continuity of environmental data throughout the life of a project should be recognized. Environmental information collected during the siting and permitting phases is often not utilized in later phases. The same, or similar, information is collected again during the construction and maintenance phases. Sometimes the environmental information collected during the siting phase (probably at great effort and expense) is not even used during the permitting phase. This may be due, in part, to a lack of recognition of the usefulness of the data or the realization later in the project of the incompatibility of the data (e.g., mapping at different scales). The collection of similar environmental data at subsequent stages of a project, frequently by different individuals with overlapping goals or objectives, may even be considered a normal project effort and cost. In fact, it is wasteful of resources and can impact project goals, particularly schedules. Computer-assisted geographical information systems (GISs) are commonly used by state and federal regulatory, natural resource, and planning agencies. It is often feasible, cost-effective, and less time-consuming to utilize environmental databases collected by these agencies. The use of agency-derived environmental data throughout the project can greatly enhance the credibility of planning decisions by a utility from the perspective of both the agencies and the public. The in-house GIS specialist can build upon these databases as the project progresses. This "layering" approach involves a progressively higher level of data specificity with each subsequent phase. Prior to starting environmental data collection for a transmission line project (or other linear facility), it is necessary to recognize the hierarchy of data needs such as scale and positional accuracy and the type, form, and availability of the data to be collected. This paper presents an approach to, and guidelines for, the use of environmental data for each phase of a transmission line project using ARC/INFO examples of current projects in Florida.

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Cette présentation traite de l'approche et des directives relatives à l'usage de données environnementales intégrées dans des systèmes d'information géographique (GIS) à chacune des étapes d'un projet de ligne de transport d'énergie. Des exemples de projets de lignes en Floride y sont présentés.

**Tuesday, September 21, 1993**
**Afternoon**
**7. Vegetation**
**Room Opus 1**

***Mardi 21 septembre 1993***
***Après-midi***
***7. Végétation***
***Salle Opus 1***

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# MÉTHODOLOGIE D'ÉVALUATION DU RISQUE : ÉTUDE DE CAS - APPLICATION DE TRICLOPYR DANS UN RAVAGE DE CERFS DE VIRGINIE

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Lors d'une évaluation du risque, une démarche préétablie doit être suivie afin d'obtenir des résultats concluants et scientifiquement acceptables. Hydro-Québec a fait une évaluation de risque relativement aux effets d'un phytocide (le triclopyr) sur la santé d'une population de cerfs de Virginie dans le ravage du lac David. Dans cette étude de cas, Hydro-Québec a utilisé la méthodologie suggérée par l'USEPA. Les différentes étapes de cette méthodologie sont donc présentées ici, avec exemple à l'appui. La première partie a consisté en plusieurs étapes, soit l'identification de l'agresseur, la caractérisation des sources, les propriétés toxicologiques du contaminant ainsi que son cheminement dans l'environnement. Une collecte de ramilles dans la portion d'emprise traitée fut donc effectuée en février 1991. Des quantités résiduelles moyennes de triclopyr acide de 12,8 ppm (érable à sucre), de 21,7 ppm (cerisier de Pennsylvanie) et de 3,5 ppm (érable à épi) furent mesurées. Une évaluation de l'exposition a ensuite été menée à partir des données disponibles. Une caractérisation du risque a été faite en tenant compte des éléments d'incertitude. Suite à cette évaluation du risque, on peut conclure que les concentrations résiduelles de triclopyr retrouvées dans les ramilles présentent un risque négligeable pour la santé des cerfs de Virginie du ravage du lac David. Un suivi des concentrations résiduelles de triclopyr dans les ramilles fut effectué en 1992 et en 1993 afin de pouvoir établir un constat de son devenir environnemental dans la végétation.

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The author uses a case study to conduct a risk analysis on the effect of a herbicide application and white-tailed deer. Data were obtained from twigs collected in a ROW treated with triclopyr.

# SELECTIVE VEGETATION MANAGEMENT ON POWERLINE CORRIDORS IN NEW YORK STATE: TREE DENSITY AND SPECIES COMPOSITION CHANGES FROM 1975 TO 1991

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A selective approach to managing vegetation on powerline corridors has been demonstrated to be effective in controlling tree populations, but only on small, experimental scales. There is little information on the long-term response of tree populations to selective removal at an operational management scale. We hypothesized that the operational selective removal of trees on powerline corridors can lead to relatively stable, low density populations of trees. Tree densities and species composition were compared on powerline corridors in New York State over a 16-year period across a wide range of management schemes, environmental conditions and plant communities. In 1975, 58 permanent vegetation measurement plots, 0.03 to 0.08 ha in size, were established on 21 corridors across New York. In 1991, trees >1m height were re-measured on these plots. Tree densities in 1975 and 1991 were expressed as a function of relative distance across each corridor plot using a quadratic model, and regression equation coefficients compared between these periods using paired t-tests. Species composition was compared between periods using Morisita-Horn similarity coefficients. On corridors where trees were periodically, selectively removed using herbicides, tree populations were observed at constant low density. There was a spatial re-distribution of trees in 1991 compared to 1975, with fewer trees in the corridor centerline and more in the border areas along corridor edges in 1991. An increase in tree density was observed on corridors that did not receive herbicide treatments to control trees, but had only aboveground portions of trees selectively removed using periodic hand cutting. Results of selective tree removal, with or without herbicides, did not vary as a function of site condition or forest region; however, tree densities were lower on hydric and xeric sites as compared with mesic sites, and lower in oak dominated forest areas as compared to northern hardwood forests. Species composition generally did not change over the study period. *Acer*, *Betula*, *Fraxinus*, *Populus*, *Prunus*, and *Quercus* species were commonly present on all sites during 1975 and 1991. Red maple (*Acer rubrum* L.) and white ash (*Fraxinus americana* L.) were ubiquitous. Operational, selective removal of trees on powerline corridors, whereby both the above- and belowground portions of the plants are periodically killed and site disturbance minimized, can lead to the creation of relatively stable, compositionally constant, low density tree populations.

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Les auteurs présentent un programme sélectif de maîtrise de la végétation des emprises de lignes de transport d'énergie de l'État de New York. L'objectif est de réduire la densité des tiges ligneuses et de créer des communautés arborescentes peu denses, relativement stables et constantes quant à leur composition spécifique.

# SYNTHÈSE DES ÉTUDES DE PERSISTANCE DES PHYTOCIDES DANS LES EMPRISES DE LIGNES DE TRANSPORT D'ÉNERGIE ÉLECTRIQUE D'HYDRO-QUÉBEC DE 1987 À 1991

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Cet exposé présente la synthèse des études de suivi des phytocides dans le sol effectués de 1987 à 1991 dans les emprises de lignes de transport d'Hydro-Québec. Quatre modes de traitement, 22 sites et 6 phytocides ont été étudiés sur une période de 5 ans. Le principal facteur étudié est la persistance des phytocides dans le sol. Les concentrations moyennes calculées varient beaucoup selon le site et selon le phytocide utilisé pour le traitement. Les concentrations moyennes maximales observées, pour l'ensemble des sites, sont de 13,8 ppm (µg/g) pour le triclopyr, de 3,9 ppm pour le dicamba, de 1,6 ppm pour le 2,4-D, de 1,1 ppm pour le 2,4-DP et de 0,26 ppm pour le glyphosate. Le temps de demi-vie dans le sol a été calculé à partir d'une dizaine de sites. Le temps de demi-vie est toujours inférieur à 5 mois : de 2 à 5 mois pour le glyphosate; de 1 à 17 semaines pour le triclopyr; de 3 mois pour le 2,4-D et le 2,4-DP; de 3 à 5 mois pour le dicamba. Ces valeurs sont du même ordre de grandeur que celles mentionnées dans la documentation. Un programme de contrôle de qualité a été établi pour s'assurer de la qualité des résultats obtenus. Des corrélations ont été établies entre le temps de demi-vie dans le sol des phytocides et divers facteurs. Les relations suivantes ont été observées : 1) une relation positive entre le pH moyen et le temps de demi-vie (triclopyr); 2) une relation positive entre les précipitations totales et le temps de demi-vie (glyphosate et triclopyr); 3) une relation négative entre la température moyenne et le temps de demi-vie (glyphosate et triclopyr) et 4) une relation négative entre le temps de demi-vie et le taux d'application (arrosage du feuillage et des tiges, triclopyr).

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This report presents a synthesis of herbicide monitoring in the soil in Hydro-Québec powerline ROW network from 1987 to 1991. Data are presented on the persistence of various herbicides used. Relationships are discussed in relation to pH, precipitation, temperature and application rate.

# DETERMINATION OF THE EFFECTIVENESS OF HERBICIDE BUFFER ZONES IN PROTECTING WATER QUALITY

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A study was conducted to test buffer zone effectiveness in protecting stream water quality and to evaluate herbicide toxicity to provide a technical basis for establishing water quality protection goals or standards. The study was conducted between August, 1989, and September, 1990, and consisted of three major parts: (a) effect of buffer zone width and vegetation density on herbicide deposition outside the treated area, (b) field test of effectiveness of specific buffer strategies in protecting water quality during operational use of herbicides, and (c) determination of water quality criteria that will protect aquatic organisms and human health. The first study determined the extent of spray deposition on buffer zones to determine the buffer zone width needed to achieve water protection goals. The study compares the deposition at distances from 0 to 100 feet from the downwind edge of areas treated by either stem-foliar or basal methods. The results show distinct differences in deposition pattern with the method of application, the density of the vegetation, and the distance from the edge of the treatment zone. Where medium to low density vegetation is in the treated area adjacent to the buffer zone, no buffer zone or buffers of only 10 feet were sufficient to meet water quality criteria depending on the herbicide. Larger buffer zones for some herbicides were indicated where high density vegetation was being treated; however, in all cases where there was vegetation in the buffer zone, stream water quality criteria would be achieved if buffers of 25 feet or more are used. The second study was a field test of buffer zone effectiveness in protecting water quality under operational conditions using high-volume stem-foliage and low-volume basal applications. Picloram, triclopyr, 2,4-D or imazapyr were applied operationally to rights-of-ways (ROW) at eight sites. Buffers of 10 to 100 feet were employed. Water samples were collected automatically for two to three months after application until late November, and then for two to three months after spring thaw. Nearly all samples that were positive had concentrations of herbicide of 0.001 to 0.002 mg/liter, very close to the limit of quantitative detection. The highest concentration detected in any sample was 0.006 mg/liter. In no case did the concentration of the herbicide found approach levels, or persist for periods that would be harmful to aquatic organisms or downstream human water users. The third study evaluated published literature and other sources of information on the toxicity of herbicides used in this study and a few others that are used on ROWs in some instances. The study identified concentrations of specific herbicides not harmful to populations of commonly abundant aquatic organisms, or individuals within rare populations of aquatic organisms that might be resident in surface water near ROWs, and to humans that might consume water originating on ROWs. Specific concentrations of individual herbicide, which include margins of safety, were identified as criteria that could be used by ROW managers or regulatory agencies in establishing water quality standards. In aggregate, this study provides a solid basis for evaluation of the effectiveness of various buffer zones in achieving specific water quality protection goals. Application of these water quality protection criteria to the results from this project show the buffer zones tested in this study protected surface water quality with a significant margin of safety. While wider buffer zones could be used, results indicate no substantive gain in safety would be achieved.

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Les auteurs discutent de l'efficacité des zones tampons pour protéger la qualité de l'eau des ruisseaux ainsi que de la toxicité des herbicides. L'efficacité de zones tampons de diverses largeurs est discutée.

# LA MAÎTRISE BIOLOGIQUE DE LA VÉGÉTATION DANS LES CORRIDORS D'EMPRISE DE TRANSPORT D'ÉNERGIE PAR LE CHAMPIGNON *CHONDROSTEREUM PURPUREUM*

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La gestion de la végétation dans les emprises est une opération commune et récurrente d'entretien du réseau de transport d'énergie. Bien que le dégagement manuel soit une pratique couramment utilisée, les feuillus de lumière (principalement *Acer rubrum*, *Prunus pensylvanica*, *Betula papyrifera* et *Populus tremuloïdes*) rejettent abondamment de souches après traitement. La dynamique de résurgence et de croissance de ces rejets est telle que la périodicité des interventions est raccourcie. Une recherche en cours vise à utiliser un champignon saprophyte indigène des régions tempérées du globe (*Chondrostereum purpureum*) comme agent de maîtrise microbien des rejets de souche et ainsi allonger significativement la périodicité des interventions. Les objectifs de cette recherche incluent des études de la virulence du microorganisme et de sa sélectivité envers diverses espèces cibles, la caractérisation génétique pour l'Amérique du Nord et enfin le suivi environnemental. Alors que les travaux sur la virulence et la sélectivité permettront de préciser l'innocuité et l'efficacité d'un premier mycoherbicide en milieu forestier, la caractérisation génétique permettra notamment de préciser les lieux potentiels de traitement et soutenir le suivi environnemental. Ce dernier cherche à préciser l'aire de dissémination de spores de *C. purpureum*, en dehors du lieu de traitement, et la susceptibilité d'espèces non cibles à une présence accrue de spores. Ce suivi environnemental est réalisé suivant deux approches reconnues : 1) par des relevés d'infection d'espèces non cibles en périphérie de l'aire traitée; et 2) par l'utilisation de modèles mathématiques de dispersion aérobiologique décrivant l'émission, la dispersion et l'immission des spores, modèles construits à partir de paramètres micrométéorologiques et de libération de spores mesurés au champ. Cette dernière approche autorise la limitation de zones tampons. Cette communication expose l'état d'avancement des travaux en milieu contrôlé et sur le terrain et fait aussi le point sur la méthodologie de travail retenue et les premiers résultats obtenus.

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A mushroom (*Chondrostereum purpureum*) is studied as a microbial control of stump shoots in ROWs. Specifically, the virulence of the microorganism is tested along with its selectivity for target species. A research update is presented, including methods and preliminary results.

# CROWN, BIOMASS AND TRIM/CHIP TIME REDUCTION FOLLOWING TWO APPLICATION METHODS FOR FLURPRIMIDOL TREE GROWTH REGULATOR

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Two applications of the tree growth regulator flurprimidol were compared to untreated trees three years after treatment. Silver maple in Ohio, willow oak in Virginia, and Norway maple in Pennsylvania, at locations representing five different utilities, were treated with root drench applications at 0.5, 0.75 and 1.0 gai[1] and with implant applications at 0.5 and 0.75 gai in 1989. Trees were revisited three years after application and assessed for growth suppression using three techniques. Measurement of the seven longest shoots in each tree were taken to the nearest inch for the growth occurring 1989 to 1992. All trees were trimmed to utility companies specifications, and the green biomass removed was weighed and chipped. Each tree's green biomass weight and actual trim/chip time was recorded. Means of measurements were interpreted using F-tests for simple analysis of variance statistics.

Significant differences were detected between the untreated trees and the treated trees; however, differences due to application techniques and rates were irregular and seldom significant. Overall, for the four species across all sites, regrowth of the seven longest shoots was 36 percent of the untreated trees' growth. Green biomass was 25 percent when compared to the checks, and trim and chip time overall took 44 percent of the time to trim and chip untreated trees. This corresponds to a 64 percent reduction in shoot elongation, a 75 percent reduction in biomass, and a 56 percent reduction in trim and chip time when tree growth regulators were used on these sites.

[1] grams of active ingredient per inch diameter at breast height (4.5 feet above the ground) of the tree.

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Cette présentation traite de l'effet du régulateur de croissance flurprimidol sur 3 espèces d'arbres en Ohio, en Virginie et en Pennsylvanie. Des résultats sont présentés sur la croissance, la biomasse et le temps de mise en copeaux des érables et des chênes.

# LE TRAITEMENT DES TIGES INDIVIDUELLES : GESTION DE LA VÉGÉTATION À FAIBLE IMPACT

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De nos jours, les responsables de la gestion de la végétation doivent faire face à de nombreux obstacles afin de régulariser ou de maîtriser la croissance de la végétation indésirable. Ils doivent utiliser à cet effet des méthodes à la fois économiques et sûres pour l'environnement, tout en préservant les ressources de la forêt. L'objectif visé par les gestionnaires consiste à diminuer l'envahissement de la végétation non compatible en réduisant son importance et sa couverture, ainsi qu'en modifiant sa composition en vue de favoriser une communauté végétale plus compatible. Grâce au phytocide GARLON*4 de DowElanco, nous sommes maintenant en mesure de maîtriser la croissance de la végétation non compatible par une pulvérisation plus sélective, comme le traitement basal de l'écorce. Ce type de traitement individuel offre l'avantage de ne pas affecter les espèces d'arbres non envahissantes qui peuvent avoir des valeurs fauniques ou esthétiques. Le traitement basal de l'écorce présente également moins de risques de nuire à la végétation non visée par la pulvérisation située à l'extérieur des limites d'épandage, ou de moins nuire, sur les lieux mêmes, à des essences rares ou menacées, ou encore de dériver vers les cours d'eau et les lacs avoisinants. Le traitement, effectué au bon moment, permet également d'éliminer le brunissement. Il peut être effectué toute l'année. Nous pouvons accroître l'efficacité du produit; de plus, le caractère hautement sélectif de la technique offre la possibilité de ne viser que la végétation non désirée et de conserver les essences importantes pour la faune. En conclusion, le traitement basal de l'écorce au moyen du phytocide GARLON 4 constitue un outil utile conçu pour aider les responsables de la gestion de la végétation à effectuer des traitements sur mesure en vue d'atteindre leurs objectifs, tout en préservant les valeurs fauniques et esthétiques.

* Marque de commerce de DowElanco

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The authors discuss how unwanted vegetation can be controlled with Garlon*4 using more selective methods such as basal bark applications. Advantages are: no impact on desirable tree species, less potential for off-site damage to non-target vegetation and for damage to rare or endangered species.

* *Trademark of DowElanco*

# VEGETATION CONTROL METHODS DEMONSTRATED ON TRANSMISSION LINE RIGHTS-OF-WAY

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In practice it is not easy to give someone a clear perspective of exactly how each vegetation control method (mechanical, chemical and fire) impact upon the environment of an electric utility company's powerline right-of-way. At the same time, it is of great importance that company officials, state regulators and private landownwers see for themselves the actual effects of each control method and how the use of herbicides reduces all factors of vegetation control in the long term. To achieve this, a demonstration site was set up and informative field sessions have been held with target individuals or organisms. The 3 types of control methods on display at the demonstration site are :

1. Mechanical methods: chainsaw, mowing, girdling, topping, clearing for grasses;
2. Chemical methods: basal, low volume, high volume, stump treating, allelopathic;
3. Burning methods: planned, unplanned.

This paper presents an overview of the various vegetation control methods in ROWs along with the general concept of a demonstration site to illustrate these methods.

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Au moyen d'un site de démonstration au Vermont, cet auteur présente des méthodes de maîtrise de la végétation dans les emprises de lignes de transport d'énergie.

**Tuesday, September 21, 1993**
**Afternoon**
**8. Soil, Erosion and Agriculture**
**Room Opus 2**

***Mardi 21 septembre 1993***
***Après-midi***
***8. Sol, érosion et agriculture***
***Salle Opus 2***

# BEST MANAGEMENT PRACTICES FOR THE CONSTRUCTION OF INTERSTATE NATURAL GAS PIPELINES ACROSS STREAMS AND WETLANDS[1]

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The construction of interstate natural gas pipelines across streams and wetlands presents unique challenges to both the pipeline engineer and the regulatory agency. From an environmental perspective, construction across these resource areas is a controversial subject due to the potential for adverse ecological impact to occur if proper construction and restoration procedures are not implemented. In addition, greater scrutiny also is being focused on interstate natural gas pipeline projects under the Clean Water Act Section 404(b)(1) Guidelines. To address these concerns, the FERC staff has developed, in conjunction with federal and state resource management agencies, and interstate natural gas pipeline companies, standardized construction guidelines entitled "Wetland and Waterbody Construction and Mitigation Procedures" (Procedures) that are applicable for use throughout the United States. These Procedures address such issues as right-of-way width, location of staging areas, timing considerations, site-specific construction techniques, erosion control, restoration and revegetation methods, and long-term right-of-way maintenance activities. To ensure a minimum level of protection to valuable stream and wetland ecosystems during pipeline construction, the FERC staff requests that pipeline project sponsors incorporate these Procedures into their existing Erosion and Sediment Control Plans, and implement these Procedures during construction. However, in the event that a project sponsor considers a specific procedure to be technically infeasible to implement due to engineering constraints, the FERC staff allows the sponsor to identify the alternative provision(s) it would implement during construction in order to provide an equal or greater level of protection to stream and wetland ecosystems. These Procedures, with any staff-approved deviations, are then made a part of any construction authorization issued by the FERC. The FERC staff developed these Procedures to eliminate or significantly minimize the majority of adverse construction-related impact on stream and wetland ecosystems. The FERC staff believes that proper implementation of these Procedures ensures that the construction of interstate natural gas pipelines across streams and wetlands complies with the Section 404(b)(1) Guidelines and the terms and conditions attached to Nationwide Section 404 Permit Program, as well as ensures that no functional values of these ecosystems are permanently altered or destroyed.

[1]: The views presented in this paper are the opinion of the author and do not necessarily reflect the views, opinions, or policies of the Federal Energy Regulatory Commission, individual Commissioners, the Commission's Office of Pipeline and Producer Regulation, or other members of the Commission staff.

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Cette présentation traite du développement d'une directive intitulée «Procédures concernant la construction et l'atténuation environnementale dans les cours d'eau et les milieux humides». La directive traite de plusieurs sujets, notamment, la largeur de l'emprise, l'échéancier, les techniques de construction, les méthodes de restauration et de revégétation ainsi que les activités d'entretien à long terme.

# STANDARDIZED EROSION CONTROL AND REVEGETATION PLAN FOR THE CONSTRUCTION OF INTERSTATE NATURAL GAS PIPELINES[1]

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The FERC staff has developed a set of standard construction guidelines and procedures entitled "Erosion Control, Revegetation, and Maintenance Plan" (Plan) to deal with the unique challenges to both the pipeline engineer and the regulatory agency in the construction of interstate natural gas pipeline projects. From an environmental perspective, erosion along the pipeline right-of-way is one of the most significant impacts of a project if proper construction and restoration procedures are not implemented. Recently, more scrutiny is being focused on proposed pipeline projects due to the potential impacts of erosion from disturbed areas. The Plan was developed in conjunction with federal and state resource management agencies, and interstate natural gas pipeline companies, and is generally applicable for use throughout the United States. This Plan addresses such issues as : supervision and environmental inspection; preconstruction planning; erosion control techniques during clearing and installation of the pipeline and cleanup; revegetation specifications; off-road vehicle control; and right-of-way maintenance. This Plan is used in conjunction with a set of best-management practices developed for stream and wetland crossings. In order to ensure a minimum level of protection to soil resources during pipeline construction and after installation is completed, the FERC staff requests that pipeline project sponsors incorporate this Plan into their existing Erosion and Sediment Control Plans, and to implement the Plan, as a minimum set of standards, during construction. However, in the event that a project sponsor considers a specific portion of the plan to be technically infeasible to implement due to engineering constraints, the FERC staff allows the sponsor to identify the alternative provision(s) it would implement during construction in order to provide an equal or greater level of protection to soil resources. These guidelines, along with any staff-approved deviations, are then made part of any construction authorizations issued by the FERC. The FERC staff developed this Plan to eliminate or significantly minimize the adverse construction-related impact on soil resources. The FERC staff believes that proper implementation of its Plan ensures that the construction of pipelines would not significantly affect the soil resources of all areas and would lead to proper stabilization of the right-of-way and the minimization of sediment deposition in streams and wetlands. This Plan also forms the basis for state and locally required erosion control plans.

[1]: The views presented in this paper are the opinion of the author and do not necessarily reflect the views, opinions or policies of the Federal Energy Regulatory Commission, individual Commissioners, the Commission's Office of Pipeline and Producer Regulation, or other members ot the Commission staff.

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Cette présentation traite d'un plan de contrôle de l'érosion pour les projets de pipelines. Développé conjointement par les agences gouvernementales américaines et les compagnies de pipelines, ce plan traite de la planification, de l'inspection, des techniques de construction, de la revégétation, du contrôle des véhicules tout-terrain et de l'entretien des emprises.

# TEXAS DEPARTMENT OF TRANSPORTATION / TEXAS TRANSPORTATION INSTITUTE HYDRAULICS AND EROSION CONTROL LABORATORY: FIELD PERFORMANCE OF SOIL RETENTION BLANKETS AND MULCHES

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The objective of the TxDOT/TTI hydraulics and erosion control program is to determine the field performance of rolled erosion control mats and blankets, referred to as soil retention blankets, and to determine the field performance characteristics of hydraulically applied mulches. The soil retention blankets are evaluated for one full growing season on their sediment reduction characteristics and vegetation establishment properties. The mulches are evaluated for one full growing season on their vegetation establishment properties. The methods allow full scale proving of materials under controlled conditions of rainfall rate and intensity and soil properties. The data collected from the research is statistically analysed for significant differences within the sampling group. As a result of the analysis, minimum performance criteria and an approved materials list have been adopted for use by the Texas Department of Transportation. There have been ten soil retention blankets approved for use on slopes of 3:1 or flatter, clay soils; seven products for use on slopes of 2:1 or flatter, clay soils; eight products for use on slopes steeper than 3:1, clay soils; and four products for use on slopes steeper than 3:1, sandy soils. There have been three mulches approved for use on slopes of 3:1 or flatter, both sand and clay. The program and laboratory have been in operation for two full years at the time of the presentation. The presentation will cover the laboratory facilities, evaluation methods and share the cumulative results of the completed research.

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Ce rapport présente les méthodes d'évaluation et les résultats d'une recherche de membranes et de paillis servant à contrôler l'érosion. Les membranes et paillis ont été évalués en fonction de leur capacité à réduire l'érosion et à établir la végétation après un ensemencement hydraulique. Suite à cette étude, certains types de membranes ont été homologués pour les routes du Texas en vue d'une utilisation en fonction du degré de la pente et des types de sol.

# THE ENVIRONMENTAL IMPACT OF LUBRICATING RAILROAD RAILS

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Rail lubricants are commonly used by North American railroads to reduce wheel flange-to-rail friction. Thus reducing wear on rails, and increasing fuel mileage. This grease is carried down the rail by wheel-to-rail contact and some accumulates on the base of the rails and along the road bed on the ballast. The Association of American Railroads (AAR) undertook a study to assess the following questions regarding the environmental impact of stationary rail lubrication : 1) Is the ballast within the visible zone of contamination a Resource Conservation and Recovery Act (RCRA) hazardous waste? 2) What is the potential for contaminants within the visible zone of contamination to migrate when exposed to precipitation? 3) What is the extent of total petroleum hydrocarbon contamination within the visible zone of contamination? Contaminated ballast was collected from lubrication sites of railroads representing each major geographical region of the United States. In addition, samples of unused grease were obtained, and samples of contaminated engineering fabric used as a protective overlayment at rail lubricator sites were collected at several locations. United States Environmental Protection Agency (U.S. EPA) testing procedures were used to evaluate the environmental impact of this practice. The Toxicity Characteristic Leaching Procedure (TCLP) and sulfide reactivity analyses were conducted to determine whether the contaminated ballast was a RCRA characteristic hazardous waste. The Synthetic Precipitation Leaching Procedure (SPLP) analysis was conducted to determine the mobility of contaminants present. Total Petroleum Hydrocarbons (TPH) were analyzed to determine the concentration of petroleum hydrocarbons within the visible zone of contamination. The contaminated ballast materials within the visible zone of contamination are not characteristic hazardous waste; all TCLP and sulfide results were less than the regulatory limits. Further, the potential for the contaminants to migrate, as measured by SPLP testing, was low. As expected, the TPH concentrations associated with visible contamination were high. However, the resistance to leaching by the TCLP and SPLP tests indicates that the visible contamination is relatively immobile. The results indicate that the use of rail lubricants in stationary track lubricators is not likely to have negative impact on the environment. However, when disposing of ballast or fabric, the TPH concentration should be considered and proper management practices should be employed.

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Cette présentation traite des lubrifiants employés en Amérique du Nord, pour réduire la friction sur les rails de chemin de fer. La contamination des empierrements de chemin de fer et la migration des contaminants dans le sol y sont discutées.

# EROSION CONTROL AND RESTORATION OF DISTURBED RIGHTS-OF-WAY

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Restoration of disturbed ROW is an important environmental public issue as well as a biological issue. The concerns of the property owner and the public are the degradation of the environment and economic loss. Wildlife also is threatened by the loss of temporary or permanent habitat or reduction of habitat value. Thus, restoration objectives include minimizing damage to the environment, re-establishing environmental conditions of the site, and re-establishing native and other beneficial vegetation. In addition, minimizing the duration of restoration, maintaining natural diversity and preventing degradation is crucial. The tasks are a challenge in light of the constraints and many obstacles that must be overcome to achieve success. This paper previews one approach in achieving restoration objectives. It also examines specific restoration techniques that have been effective for special situations such as difficult site conditions or special status species or vegetation types. A balance between restoration objectives and economic value must be achieved in the overall restoration process; an integrated approach to planning, implementing, monitoring and concluding regulatory requirements is reviewed. A process is identified which coordinates the various tasks involved in achieving a successful restoration program. The process includes time allocations, participants, resources required and levels of acceptance. Cost estimating and funding are also discussed. Specific techniques that have been developed by Pacific Gas and Electric Company for special restoration situations will be discussed. These include "haybale wattling", "soil grafting", and "native straw seeding". Other techniques developed for woody plant establishment include "planting collar and screen" and pretreatment of woody plant seeds. These techniques when used together allow for the re-establishment of a wide range of native vegetation. The techniques produce effective results, providing for diversity and minimizing delay for the re-establishment of wildlife habitat. Examples of techniques, site conditions, species and results are provided.

Cette présentation traite de la restauration de sites d'emprises perturbées. On y traite des objectifs visés, des techniques utilisées de même que des considérations économiques prises en compte. Des exemples de techniques y sont présentés.

# DÉVELOPPEMENT D'UNE MÉTHODE D'ÉVALUATION DE LA SUSCEPTIBILITÉ DES SOLS AGRICOLES À LA COMPACTION ET D'UNE MESURE RAPIDE D'ÉVALUATION DE LA COMPACITÉ DES SOLS

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À toutes les étapes de l'implantation d'une ligne électrique en milieu agricole, Hydro-Québec doit respecter l'entente conclue avec l'Union des Producteurs Agricoles (UPA) du Québec. Lors des études d'avant-projets, Hydro-Québec doit prévoir les risques de compaction des sols dans l'emprise et les chemins d'accès; elle doit également, pendant et après les travaux, vérifier le degré de compacité et remettre, au besoin, les sols dans un état similaire aux conditions environnantes. Hydro-Québec a confié à la firme Les Consultants BPR le mandat de réaliser une étude de faisabilité et, le cas échéant, de développer une méthode permettant d'atteindre les deux objectifs suivants : 1) évaluer de façon rapide et fiable, au moment des études d'avant-projets, la susceptibilité des sols agricoles à la compaction de manière à prévenir les dommages engendrés par les travaux; 2) mesurer rapidement et rigoureusement, pendant et après les travaux, la compacité des sols agricoles afin d'évaluer les dommages causés et, s'il y a lieu, suggérer une ou des méthodes de restauration. Une enquête, une revue de littérature, un inventaire ainsi qu'une analyse des méthodes disponibles et des principaux instruments de mesure de la teneur en eau du sol et du degré de compaction ont été effectués. Les résultats de l'étude démontrent qu'il existe des appareils relativement fiables qui peuvent être utilisés pour l'évaluation *in situ* de l'humidité du sol et du degré de compaction. Par contre, il n'existe pas de méthodes rapides et efficaces qui puissent être rigoureusement appliquées à chaque terrain agricole sans occasionner des coûts élevés. La méthode proposée repose sur la mise en relation et la modélisation de plusieurs paramètres dont la granulométrie des sols, la teneur en eau du sol, le type de machinerie utilisée, la période des travaux, etc. Cette conférence présente la méthode en développement ainsi que son utilisation prévue à chacune des étapes de l'implantation de lignes électriques en milieu agricole.

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This report presents the development of a method to evaluate the susceptibility of agricultural soil to compaction at the impact analysis stage and to measure soil compaction during and after construction.

# SOIL COMPACTION ALONG TRANSMISSION LINE RIGHTS-OF-WAY AND ITS EFFECT ON AGRONOMIC PRODUCTIVITY OF SELECTED SOILS

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Sites were selected along the recently constructed Bruce Nuclear Generating Station to Longwood Transformer Station and Nanticoke Generating Station to Longwood Transformer Station transmission lines. The sites selected, which represented a variety of soil types, were monitored to determine the degree of soil compaction occurring along the right-of-way and the effectiveness of the remedial measures used. Soil penetration resistance, moisture content and bulk density were measured at benchmark sites prior to construction activity, immediately following transmission line construction, following site remediation work and one year later when the construction access area was returned to agricultural production. Benchmark sites along the construction access were paired with adjacent field benchmark sites which were similar in soil characteristics but undisturbed by construction activities. Crop yields were measured by taking hand samples and the results were analyzed statistically to determine if significant yield differences existed between the disturbed and undisturbed benchmark sites. Soils-related data were used to put forward an explanation for the crop response observed. The results of the data analysis were used as a basis for making generalizations as to the response of broad soil textural groups to construction traffic and site remediation. Based on study results, guidelines were developed for determining compensation levels and for minimizing the impact of transmission line construction on affected agricultural land.

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Au moment de la construction d'une ligne de transport d'énergie électrique, Ontario Hydro a évalué le degré de compaction des sols en milieu agricole ainsi que l'efficacité des mesures correctives. La comparaison des récoltes dans l'emprise à celles des parcelles témoins a permis de relier les grandes classes texturales de sol aux effets des activités de construction et aux mesures correctives.

# DÉVELOPPEMENT D'UNE MÉTHODE D'ÉVALUATION DU RISQUE DE CONTAMINATION DES EAUX SOUTERRAINES

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La sécurité des emprises de lignes de transport, de répartition et de distribution de l'énergie électrique exige un contrôle de la végétation. L'utilisation de phytocides permet un contrôle efficace et peu coûteux mais, sous certaines conditions de terrain, ces produits peuvent affecter la qualité de l'eau souterraine. Hydro-Québec a développé une méthode qui identifie des portions d'emprises pour lesquelles des méthodes alternatives de contrôle de la végétation doivent être utilisées. Cette méthode évalue le risque de contamination des eaux souterraines. Elle utilise des informations disponibles et est simple à appliquer : elle n'exige aucune formation spécifique de l'utilisateur. La méthode repose sur l'établissement d'un indice de vulnérabilité et d'un critère d'évaluation du risque. Nous avons développé un indice de vulnérabilité spécifique, basé sur l'utilisation de quatre paramètres : les matériaux formant le sol, la zone intermédiaire (zone non saturée) et l'aquifère, ainsi que la pente du terrain. Ces paramètres influencent la migration des phytocides vers la nappe d'eau souterraine et sont facilement évaluables. Des cotes, accordées à chacun des paramètres, calculées selon une approche rationnelle, en utilisant des modèles conceptuels connus concernant la migration des phytocides dans le sol et l'eau, permettent de déterminer l'indice de vulnérabilité de la portion d'emprise. La dernière étape consiste à évaluer le risque, c'est-à-dire la valeur de l'indice de vulnérabilité à partir de laquelle l'utilisation d'un phytocide risque de diminuer la qualité de l'eau souterraine. Le critère de risque est déterminé suite à de nombreuses simulations par un modèle analytique de transport. Les résultats présentent l'étendue des concentrations attendues dans l'eau souterraine en fonction de l'indice de vulnérabilité du site, suite à l'épandage d'un phytocide donné. Cela nous permet de fixer le risque pour différents milieux et différents phytocides. La méthode d'évaluation du risque est résumée dans un guide de l'usager qui décrit la procédure à suivre pour calculer l'indice de vulnérabilité et, ensuite, pour déterminer le risque de contamination.

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Hydro-Québec has identified ROW sections presenting a higher risk of ground water contamination by herbicides. This paper presents the risk assesment method. The risk is evaluated by numerous simulations in an analytical transport model. A user's guide is described.

**Tuesday, September 21, 1993**
**Afternoon**
**9. Visual Aesthetics and Greenways**
**Room Beethoven**

***Mardi 21 septembre 1993***
***Après-midi***
***9. Polyvalence et aspects visuels***
***Salle Beethoven***

# LA MÉTHODE D'ÉTUDE DU PAYSAGE POUR LES PROJETS DE LIGNES ET DE POSTES DE TRANSPORT ET DE RÉPARTITION

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Au Québec, les préoccupations d'ordre visuel et esthétique sont intégrées depuis la fin des années 70 au processus d'évaluation environnementale. Hydro-Québec, en conformité avec les exigences gouvernementales, scientifiques et sociales, intègre également l'étude du paysage dans le cadre de son processus global de planification de projets. L'ensemble des recherches et des ateliers de réflexion en matière d'analyse visuelle et de paysage et l'expérience acquise au cours des dernières années ont permis, en 1992, de jeter les bases d'une nouvelle méthode d'étude du paysage applicable dans le cadre des projets de lignes et de postes appartenant aux réseaux de transport et de répartition. Cette méthode spécialisée s'inscrit dans le contexte de la Méthode d'évaluation environnementale de Lignes et de Postes d'Hydro-Québec. Cette méthode d'étude du paysage est adaptée aux types d'équipements particuliers que sont les lignes et les postes électriques et aux milieux susceptibles de les recevoir. Elle a pour lieu d'application les milieux naturel et forestier ou tous les milieux non urbanisés du territoire québécois. La méthode d'étude du paysage propose un cadre pratique d'évaluation qui vise essentiellement l'intégration optimale des équipements dans le milieu. Cette stratégie d'intégration va au-delà d'une approche privilégiant la dissimulation et le camouflage des équipements. Elle favorise, en effet, la prise en compte globale des règles de composition du paysage, de la visibilité potentielle des équipements et de la valeur symbolique que l'on associe au paysage. Cette méthode permet d'assurer la compréhension globale du paysage, l'identification des paysages sensibles et résistants à l'échelle de la zone d'étude et l'identification des corridors et des tracés de lignes ainsi que des aires d'accueil et des emplacements de postes préférables à la lumière des règles d'intégration optimale des équipements dans le paysage. À la phase II, elle veut également préciser le mode d'évaluation définitive des impacts générés sur le paysage et favoriser l'identification des mesures d'atténuation appropriées.

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This paper presents Hydro-Québec's method for landscape studies in powerlines and substations projects. This specialized method is part of Hydro-Québec's overall global environmental impact assessment method for powerlines and substations.

# APPLICATION OF HISTORICAL AND CULTURAL HERITAGES FOR HIGHWAY DEVELOPMENT

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This paper seeks to demonstrate that utilizing historical and cultural heritages of local regions for highway development will help not only with highway aesthetics, but also will contribute to town conservation and tourism development. This study was done by reviewing successful cases in Japan through on-site surveys and interviews as well as probing government reports and the literature. Highway landscapes have long been formed by the everyday life of local people, and reflect local history and culture. However, in the 1960's in Japan, under the pretext of industrial expansion and recreational development, many local highways were abandoned and destroyed. Instead, many modern expressways were laid as convenient and functional means for industrial and recreational development. Furthermore, as recreational and resort development accelerated, motels, restaurants and other resting facilities were erected along highways without any aesthetic consideration, which not only undermined environmental amenity but also dealt a major blow to local landscapes. In the 1980's, as the result of enhancement of nature conservation efforts and awareness of environmental amenity by Japanese people, many local authorities, cooperating with local residents and conservation groups, began to approach such problems, and took initiative to restore and preserve their local landscapes. One of their concerns was the conservation of highway landscapes. Some local authorities made efforts to review and utilize old highways passing along outstanding cultural and historical sites, and others constructed highways utilizing their historical and cultural resources for characterizing their local colors. As a result, highways with cultural and historical interests became the most outstanding scenic and cultural sites for tourism. One good example is the town of Nagiso in Nagano Prefecture. Residents restored the town the way it appeared 200 years ago, when it was a post town on a famous old highway, and revitalized it as a cultural tourist attraction with the Tsumago Post Town Preservation Endowment. Now more than 700,000 tourists per year visit the town. Nowadays Japan is enjoying a travel boom, and the number of participants in ecotourism is growing. People travel not only for the purpose of relieving work-related exhaustion and stress, but for making it an important part of their lives, such as enriching their knowledge. Thus, many local towns and places with cultural and historic interests as well as outstanding natural beauty remain increasingly popular with this new type of tourism. Utilizing historical and cultural resources of local regions for highway development will contribute not only to highway landscape conservation but also town conservation and tourism development.

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Ce rapport tend à démontrer que la considération du patrimoine historique et culturel dans la planification des routes au Japon peut améliorer les aspects esthétiques des routes et développer le tourisme régional. De nouvelles routes et des routes existantes restaurées sont devenues des sites panoramiques et culturels recherchés par les touristes tout en favorisant l'écotourisme.

# VISUAL MITIGATION FOR A PIPELINE RIGHT-OF-WAY IN THE NORTHEAST: A CASE STUDY OF THE IROQUOIS GAS TRANSMISSION SYSTEM

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Construction of the 370-mile, 30 and 24-inch diameter Iroquois Gas Transmission System natural gas pipeline in New York and Connecticut necessitated clearing a new right-of-way corridor along much of its length. The impact of a new right-of-way, as well as associated above-ground facilities (i.e., mainline valves and sales meter stations), on visual resources was a concern of state and federal regulatory agencies and the public in general. This concern was centered on both overall aesthetic values and maintaining the visual integrity of historic structures. To assess potential impacts of the right-of-way on visual resources, Iroquois conducted a viewshed analysis to identify areas from which the new right-of-way could be observed. Iroquois also conducted an inventory of historic structures within 0.25 mile of the pipeline route. Using the viewshed analysis, areas of potential visual sensitivity were analyzed using computer and video simulations to show post-construction views of the right-of-way from visually sensitive areas. In addition, potential mitigation measures (i.e., vegetation screening, route alignments) were simulated. Based on the visual sensitivity analysis, a number of minor routing modifications were made. After the completion of construction, Iroquois developed and implemented vegetation planting plans for approximately 300 locations along the pipeline route to provide visual screening and habitat enhancement.

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Pour évaluer les impacts visuels potentiels d'une emprise de pipeline, des images de l'emprise après la construction ont été simulées sur ordinateur et vidéo. Ces images ont également servi à simuler l'effet des mesures d'atténation et à modifier le tracé en conséquence.

# DES IMPACTS ENVIRONNEMENTAUX VISUELS SUR LES ÊTRES HUMAINS PLUTÔT QUE SUR LES PAYSAGES : UNE MÉTHODE OÙ LES PAYSAGES ONT LE SECOND RÔLE

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L'identification et la mesure des impacts environnementaux visuels est encore un problème non résolu malgré l'abondance des travaux et des études sur la question. Dans le cas des lignes de transport d'énergie électrique, il s'agit d'un impact environnemental majeur soulevé par ce genre de projet. C'est aussi une composante importante des impacts environnementaux d'un projet de route. Les professionnels du groupe Urbatique ont développé une méthode d'identification et de mesure des impacts environnementaux visuels qui, à l'usage, s'est avérée particulièrement efficace. Il s'agit d'une méthode dont l'originalité première est peut-être de faire porter le poids des interrogations sur les être humains plutôt que sur les paysages en tant que tels. La méthode d'identification et d'évaluation des impacts visuels répond aux trois critères énoncés ci-après. La méthode doit être scientifique, les résultats qu'elle donne doivent être susceptibles de faire l'objet de tests (vérifications indépendantes et objectives). La méthode doit être simple d'application ou suffisamment élaborée pour avoir fait l'objet de développement technique qui en rendent l'application facile. Les impacts identifiés par la méthode doivent être significatifs. La méthode doit reposer sur une théorie scientifique des impacts environnementaux. La notion d'impact visuel environnemental doit être signifiante dans le cadre d'une théorie scientifique. Cette méthode a fait l'objet d'applications dans quelques cas particulièrement difficiles d'analyse visuelle, durant les années 1980, en rapport avec des équipements routiers et des équipements de transport d'énergie électrique. Dans chacun des cas, les analyses traditionnelles s'étaient avérées infructueuses. L'approche cognitive constitue le fondement de la méthode. La méthode montre de façon claire et simple comment des interventions de type linéaire peuvent engendrer des impacts positifs ou négatifs, en même temps qu'elle fait ressortir l'ampleur de ces impacts. La méthode permet de dégager sans ambiguïté la signification de ce qui constitue un impact environnemental visuel dans le cas d'une ligne de transport d'énergie électrique. Elle donne un critère rigoureux d'évaluation de l'importance de ce type d'impacts en s'appuyant sur les notions de stabilité structurelle et d'optimisation des objets de la nature. Cette approche permet aussi de cerner les impacts visuels d'ordre esthétique. On y démontre que l'approche cognitive est nécessaire à l'évaluation des impacts d'ordre esthétique et, en fait, en constitue la clé d'interprétation.

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A method to evaluate visual impacts of powerlines and highways is presented. The method identifies and evaluates visual impacts using an original concept which targets the interrogation (analysis) at people rather than at landscapes. The method is based on a cognitive approach and identifies positive and negative impacts.

# UTILISATION POLYVALENTE DES EMPRISES EN MILIEU URBAIN

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Il y a près de 20 ans qu'Hydro-Québec a mis de l'avant le programme de polyvalence de ses installations. Par cette initiative, elle préconise la mise en valeur de ses propriétés à des fins autres que la production et le transport d'électricité. C'est ainsi qu'au cours des années différents projets d'aménagement émanant des collectivités locales ont vu le jour tant en milieu urbain qu'agro-forestier. En milieu urbain, l'utilisation polyvalente des emprises de lignes de transport et de répartition peut prendre des formes diverses. En zone résidentielle, elles constituent des espaces privilégiés pour l'implantation d'équipements à vocation communautaire (tels que parcs linéaires, pistes cyclables et aires de jeux) ou privée (prolongement des cours arrière, jardinage, stationnements, etc.). En zones commerciale et industrielle, elles peuvent être utilisées comme parcs de stationnement et aires d'entreposage. L'utilisation polyvalente des propriétés présente de multiples avantages d'ordre environnemental et socio-économique puisqu'elle favorise une meilleure intégration fonctionnelle et visuelle des équipements. Entre autres, elle contribue à l'optimisation de l'occupation du sol par la mise à la disposition d'espaces faciles d'accès et à potentiel d'utilisation élevé en raison de leur localisation en zones urbaine et péri-urbaine. La description du concept de polyvalence et des avantages environnementaux et sociaux qui lui sont associés sera appuyée par la présentation de quelques types d'aménagement d'emprises conçus pour des usages spécifiques au milieu urbain.

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The description of Hydro-Québec multiple use program of ROWs along with associated environmental and social advantages will be discussed in relation to management approaches designed specifically for urban areas.

# CHARACTERIZATION OF ELECTRIC AND MAGNETIC FIELDS IN TRANSMISSION LINE CORRIDORS

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Power-frequency electric and magnetic fields are generated by high-voltage transmission lines during their normal operation. Electric fields within the rights-of-way have been considered, since the introduction of voltages above 300 kV, as a design factor, mainly from the point of view of induced currents on large vehicles and public safety. Since 1972, however, the possible health effects of electric fields have also entered as a design consideration. Around the year 1980, some studies indicated that there may be a possible link between magnetic fields and some types of cancer. As a result, the magnetic fields in the vicinity of transmission lines are also being considered as a factor affecting line design. There is a need therefore to characterize the electric and magnetic fields generated in the vicinity of transmission lines, including the rights-of-way. Both the theoretical and experimental techniques used to characterize these fields are discussed in this paper. The various factors affecting the spatial distributions as well as the temporal variations of these fields are also discussed. Finally, methods for the evaluation of population exposure to these fields and some proposals for their mitigation are briefly reviewed.

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Les techniques théoriques et expérimentales dont on se sert pour mesurer les champs électrique et magnétique dans les emprises de lignes à haute tension sont présentées. On discute également des facteurs qui influencent la distribution spatiale et la variation temporelle de ces champs, des méthodes d'évaluation de l'exposition des populations à ces champs et des mesures d'atténuation proposées.

# UTILITY CORRIDORS AS GREENWAYS

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Opportunities exist for the use of utility corridors as environmentally productive greenways. The potential benefits from such action are realized not only in the ecological enhancement of the right-of-way but also in the potential for building utility/public partnerships and facilitating the permitting process. While the concept of greenways is somewhat foreign to most utilities, methods exist which can be used to enhance ecological and recreational values of corridors while meeting utility objectives from a safety and maintenance perspective. This paper will address the environmental and recreational need for greenways as well as potential utility concerns which might arise as a result of greenway development in an active right-of-way. It will also include a discussion of concepts for developing utility/interest group partnerships for multiple use and mutual benefits.

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Les bénéfices potentiels de l'utilisation des emprises comme espaces verts linéaires découlent de l'amélioration de la qualité de l'environnement, des partenariats entre organismes publics et compagnies de services publics ainsi que de la facilité à obtenir les permis. Cette présentation traite des méthodes pour améliorer les valeurs écologiques et recréatives des corridors ainsi que des concepts à développer pour favoriser les partenariats entre services publics et groupes d'intérêt.

# COOPERATIVE MANAGEMENT OF UTILITY CORRIDORS IN CANADA

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Despite mitigation programs, utility rights-of-way (ROWs) cause many negative environmental effects, including fragmentation of natural habitats, destruction of biota, disruption of soil horizons and hydrology, and incremental erosion of wilderness areas. Traditional utility corridor maintenance regimens are frequently inflexible and poorly adapted to the local environmental context and social needs, yet utility companies cannot afford the time and labour resources to apply contextually appropriate utility maintenance programs in all areas. Utility corridors may be managed more sustainably if public utility companies enter into ROW co-management agreements with interested local stakeholders (i.e. groups and individuals with a vested interest in ecologically appropriate uses of corridor lands such as the creation of wildlife habitat, greenways, and recreational trails). ROWs may be co-managed in a manner which reduces the impacts of vegetation maintenance, retains ecological congruity with surrounding areas, and improves aesthetic values, frequently making use of volunteer or low-cost labour provided by stakeholder organizations. In August of 1992, Canadian electrical utilities were surveyed about existing ROW land tenure regimens, maintenance techniques, and the degree to which cooperative management programs were being employed. To date, no Canadian utilities have adopted formal cooperative management programs, though existing secondary-use agreements show potential for modification to accommodate co-management strategies. Obstacles to co-management include unclear utility land use policies, entrenched status-quo ROW maintenance procedures, and public liability concerns. New policy structures and procedural tools must be developed cooperatively between utilities and stakeholder groups if co-management of utility corridors is to become a reality.

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Une enquête menée en août 1992 a révélé qu'aucun service public d'électricité au Canada n'avait adopté une approche de gestion coopérative des emprises avec des particuliers ou des groupes intéressés. Cette présentation traite des avantages et des obstacles à une telle approche dans un contexte d'utilisation polyvalente des emprises.

# ACCESS ISSUES IN THE PLANNING OF A NEW RIGHT-OF-WAY FROM SUDBURY TO TORONTO

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The area of Ontario in question has one of the largest and most diverse mixtures of intensive and extensive recreational activities found anywhere in the province. A major issue was how to deal with the diverse views of those who wanted access kept to a minimum (eg. remote rural residents) and those that welcomed the opportunity for increased accessibility (eg. Ontario Federation of Snowmobile Clubs). Also involved was the possible disruption of the livelihood of commercial fly-in outpost camp operators and others who make their living from the undisturbed nature of the area. Sub-issues which were dealt with included social (noise, garbage, vandalism), natural (habitat disruption of flora and fauna), physical (topographic and water constraints), and land tenure (public versus private lands). The paper discusses how Ontario Hydro, together with a variety of publics who had an interest in resolving diverse requirements, were able to detail the problem and develop support to ensure that through the proper location, design and construction of facilities, access problems could be addressed. The techniques recommended emphasize a variety of methods to avoid access problems and techniques to mitigate any residual impacts.

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Cette étude de cas analyse comment Ontario Hydro, en coopération avec une variété de publics, n'a réussi à s'assurer que les problèmes d'accès reliés à l'implantation d'une ligne de transport d'électricité en milieu de villégiature soient résolus afin de répondre aux attentes publiques. La participation du public a permis de répondre aux attentes et préoccupations des divers publics en matière d'accès, tant à l'étape de localisation qu'à celle de construction de la ligne.

**Wednesday, September 22, 1993**
**Morning**
**10. Vegetation**
**Room Opus 1**

***Mercredi 22 septembre 1993***
***Avant-midi***
***10. Végétation***
***Salle Opus 1***

# COST EFFECTIVENESS OF HERBICIDE AND NON-HERBICIDE VEGETATION MANAGEMENT METHODS FOR ELECTRIC UTILITY RIGHTS-OF-WAY IN THE NORTHEAST

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A three-phased study was conducted in an effort to assess available information on both herbicide and non-herbicide vegetation management methods for electric utility rights-of-way in the Northeastern United States. Included was an extensive search of the literature, mail and phone survey of utility vegetation managers throughout North America, and on-site visits with several regional utilities. The study had several general goals, including: (1) review existing literature, (2) examine experience of utilities that offer special maintenance agreements to landowners who prefer that non-herbicide methods be employed, and (3) evaluate information from utilities that have experience with long-term no-herbicide-use policies. To achieve these goals, an extensive literature search was performed to locate published data relevant to cost and effectiveness of various herbicide and non-herbicide management methods. The search concentrated on publications from the 1970s to the 1990s and on information pertinent to the Northeast. Cost effectiveness of a variety of herbicide and non-herbicide methods was analyzed based on an examination of published literature, historic production data provided by regional utilities, and by on-site visits. A comprehensive list of the components or both direct and indirect costs and effectiveness was developed to ensure thorough review of all essential aspects. An evaluation of three types of special maintenance agreements offered by utilities in the Northeast and a survey of utilities with 1-15 years of experience with no-herbicide-use policies were conducted as part of the review. The maintenance of vegetation on electric utility rights-of-way is a dynamic process affected by site conditions, public exposure, environmental concerns, and costs. Existing information is insufficient to identify one method or group of methods as optimal in all circumstances. Long-term, cost-effective management of right-of-way vegetation is dependent upon both herbicide and non-herbicide methods. A prescription-based approach, where different methods are selected for different circumstances, is the most rational strategy. To effectively manage this type of program, it is essential that utilities have well-trained professionals and data to make operational prescriptions in the field.

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Cette présentation met à profit la littérature et des questionnaires pour analyser des programmes à long terme d'entretien d'emprises de lignes électriques sans phytocide. Les auteurs concluent que la gestion de la végétation est un processus dynamique et que les méthodes doivent être prescrites par des professionnels, selon les circonstances et à partir de données pertinentes.

# VEGETATION MANAGEMENT ON THE IROQUOIS GAS TRANSMISSION SYSTEM RIGHT-OF-WAY: WHERE LESS IS BETTER

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During the environmental regulatory review of the Iroquois Gas Transmission System's applications for permits and certificates for the construction of a new 370-mile, 30 and 24-inch diameter natural gas pipeline, concern was raised that the creation of a new pipeline right-of-way, particularly in upland forests, wetlands, and riparian habitats, would result in long-term changes to vegetation that could have an adverse impact on resident wildlife populations. In response to these concerns, Iroquois committed to an unprecedented vegetation management program for its right-of-way that would help to minimize the extent and duration of any such impacts. The comprehensive long-term right-of-way management program developed by Iroquois allows essentially unmanaged natural revegetation in all wetlands and riparian corridors, as well as all but 20-30 feet of the permanent right-of-way in upland forests; a longer rotation between maintenance cycles in all other managed upland areas; seasonal restrictions on right-of-way maintenance activities to minimize impacts to nesting birds; and selective clearing of weedy vegetation when necessary to ensure the safe operation of the pipeline system.

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Au moment de la construction d'un nouveau pipeline, la compagnie Iroquois Gas Transmission System a mis sur pied un programme de maîtrise de la végétation pour cette emprise. Ce programme tient compte des secteurs traversant les terres humides et les cours d'eau des zones forestières et des périodes de nidification.

# A COMPARISON OF REVEGETATION OF A GAS PIPELINE RIGHT-OF-WAY IN TWO FORESTED WETLAND CROSSINGS INVOLVING CONVENTIONAL METHODS OF PIPELINE INSTALLATION AND HORIZONTAL DRILLING, NASSAU CO., FLORIDA

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Vegetation was inventoried in the right-of-way (ROW) one year after pipeline installation at two stream floodplain crossings in Nassau County, Florida. Both sites consisted of wetland forests composed of *Acer rubrum*, *Fraxinus caroliniana*, *Liquidamber styraciflua*, *Nyssa ogeche*, *Quercus laurifolia*, *Taxodium distichum*, together with other wetland trees. Pipeline installation across the Brandy Branch floodplain was by conventional ditching and backfill methods. Installation across the Deep Creek floodplain was by horizontal drilling after clearcutting the ROW. This method left the tree stumps, understory vegetation, and soil layers intact except for disruptions caused by logging. Vegetation at the drilled site was more diverse (with nearly twice as many species occurring in sample plots as at the trenched site) and more robust (with no unvegetated exposed soil compared to 15% at the trenched site). This work was supported by the Gas Research Institute under contract number 5088-252-1770 with the U.S. Department of Energy.



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Les auteurs comparent la régénération de 2 emprises de pipelines traversant la plaine de débordement de ruisseaux dans les terres humides en Floride. Dans le premier cas, la méthode conventionnelle de creusage de tranchées et de remplissage a été utilisée tandis que, dans le deuxième cas, on a d'abord déboisé l'emprise avant de procéder au forage horizontal.

# POST-CONSTRUCTION MONITORING OF RIGHT-OF-WAY REVEGETATION

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Post-construction revegetation monitoring of natural gas pipeline rights-of-way is required by the Federal Energy Regulatory Commission and other Federal land management agencies to determine the status of right-of-way restoration and revegetation following installation of new pipelines. Pipeline companies are often responsible to conduct revegetation monitoring but are given little guidance as to how to design or implement these programs. An effective post-construction monitoring program must establish guidelines for when and how the monitoring will be conducted, the qualifications of the monitoring personnel, and how the field observations will be reported. Specific criteria must be established for evaluating and determining thresholds for when corrective action is necessary. Consideration is given to several parameters that could be used to evaluate revegetation, including comparison of the right-of-way to adjacent undisturbed lands with respect to erosion control, and plant density, cover, and vigor.

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Les directives gouvernementales concernant le suivi environnemental des programmes de revégétation des emprises de pipelines sont souvent d'ordre très général. L'auteur discute de l'approche à adopter et des étapes à suivre pour mettre en place un programme de suivi environnemental des activités de restauration et de revégétation d'emprises de pipelines.

# ALTERNATIVE VEGETATION MANAGEMENT ON TRANSMISSION LINE RIGHTS-OF-WAY IN NORTH LOUISIANA

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Vegetation management of transmission line rights-of-way (ROWs) on upland areas in north Louisiana, and other similar areas in the southeastern United States, has relied primarily on repeated mowing cycles to control the height of trees that could interfere with transmission lines. However, regrowth of these trees, especially the hardwood species, is rapid because of vigorous resprouting. Consequently, frequent mowing is required, which results in less than optimum wildlife habitat and an appearance that, from an aesthetics standpoint, is undesirable. Alternative vegetation management techniques that control the unwanted taller tree species, but also allow shrub and low-growing trees to remain, would favor wildlife and would improve the aesthetics of the ROWs. The objectives of this study were to evaluate alternative techniques (mechanical, herbicide and controlled burning) that might be useful in controlling tall tree species, while retaining other vegetation. The specific treatments applied in this study were : (1) wing plowing - a mechanical technique employing the use of a horizontally - oriented plow blade, which undercuts and disrupts the root systems of established tree sprouts with minimum disturbance of the soil surface, (2) selective foliar herbicide application (foam) on sprouts of tall tree species, and (3) controlled burning. The treatments were applied in a factorial design that was replicated on three ROWs in north Louisiana. One year after treatment, individual tree sprouts were identified as to genus and measured for height. This paper reports on the survival and height growth of tree sprouts under the various treatments.

Cette étude porte sur l'évaluation des méthodes alternatives (mécanique, phytocides, brûlage dirigé) qui maîtrisent la croissance des arbres indésirables dans les emprises, tout en conservant les autres strates de végétation. Ces méthodes ont été testées dans les emprises de lignes de transport d'énergie en Louisiane. Des résultats sont présentés quant à la survie et la croissance en hauteur des rejets pour les divers traitements appliqués.

# IOWA COUNTIES STABILIZE ROADSIDES WITH NATIVE PRAIRIE PLANTS

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For decades Roadside Managers attacked weeds as they invaded stands of introduced, cool-season grasses weakened by long hot summers. They waged chemical and mechanical warfare which is viewed more and more as expensive and environmentally unacceptable. Recently, as the same weeds reappeared in the same places each year, they have been forced to admit that the battle was not being won. Meanwhile prairie biologists have long been pointing to the plants of Iowa's once vast prairies as an obvious choice for revegetating roadsides. Adapted to Iowa's climate of extreme temperatures and moistures, prairie plants are able to colonize poor soils, these hardiest of plants and their extensive root systems control weeds and soil erosion better than any other vegetative cover. In response to concerns for groundwater contamination, soil erosion and strained governmental budgets, Iowa's nationally recognized Integrated Roadside Vegetation Management Program employs these native plants and a few simple management techniques in an environmentally sound approach to right-of-way management. Still in its infancy the program works to overcome difficulties such as seeding steep, narrow county roadsides with a tractor and native grass drill, controlling soil erosion until the native species take hold, making native Iowa prairie seed more available, controlling weeds in an entire county with a minimal spot-spray program on a limited budget and making the best use of fire in the brome-to-prairie roadside conversion. With research and development ongoing in the program's 26 active counties, much progress has been made refining the original ideals and principles into a responsible program for creating low maintenance roadsides that are attractive and healthy for humans and wildlife.

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Cette présentation traite de l'utilisation d'espèces végétales de prairie le long des routes en Iowa. Ces espèces possèdent un système radiculaire bien développé et colonisent les sols pauvres. Cette approche vise la création, en bordure des routes, de communautés végétales basses attrayantes pour les humains et la faune. Le programme regroupe présentement 26 des comtés de l'État.

# VASCULAR PLANT SPECIES RICHNESS AND RARITY IN WETLANDS ON ELECTRIC POWER RIGHTS-OF-WAY IN NEW YORK

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Wetlands are receiving increasing regulatory attention throughout North America because so many have already been destroyed, and wetlands have important functions and values, which includes providing habitat for a rich variety of organisms. The objective of our study was to determine the effect of right-of-way (ROW) management and other site characteristics on vascular plant species richness and rarity at six sites in New York. The hydric soils at the study sites ranged from mineral to organic, acidic to slightly alkaline, and low to high fertility. ROW maintenance, begun decades ago, varied from stump and basal spray, selective and broadcast foliar spray, selective cutting and mowing. Complete surveys of the vascular species were made at each site throughout the spring and summer of 1992. Vegetation was also examined in adjacent, untreated areas. Maintenance treatments resulted in some unique communities dominated by early successional species, e.g., the treatment on one ROW site, in combination with site factors, resulted in an ombrotrophic, bog-like community. Species richness was greater in the ROW than adjacent, unmanaged area at all study sites, partly due to an increased abundance of species in the Cyperaceae, Asteraceae, Poaceae, and Rosaceae. Some genera had many species, e.g., there were about 35 species of Carex on the six ROWs (less than 10 in adjacent, non-ROW). Species' richness was generally greater on ROWs managed by more selective, less severe methods of treatment, and at intermediate degrees of minerotrophy. A greater number of state-protected species were encountered within ROWs than in the adjacent unmanaged areas. Some ROWs harbor unusually large populations of, or support a large number of, these species. Protected species occurred more commonly on sites that were more extreme in degree of minerotrophy. This preliminary study suggests that maintaining ROWs within wetlands does not adversely affect one indicator of biodiversity, i.e., vascular plant species richness, nor the opportunity to provide habitat for plant species of state or regional concern.

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Cette présentation traite de l'effet des techniques de maîtrise de végétation dans les emprises de lignes de transport d'énergie sur la diversité et la rareté des plantes vasculaires des terres humides de l'État de New York.

**Wednesday, September 22, 1993**
**Morning**
**11. Wildlife**
**Room Beethoven**

***Mercredi 22 septembre 1993***
***Avant-midi***
***11. Faune***
***Salle Beethoven***

# THE UNEP CONVENTION ON BIODIVERSITY AND ITS IMPLICATIONS FOR RIGHT-OF-WAY SELECTION AND DEVELOPMENT

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With the signing of the United Nations Environmental Program (UNEP) "Convention on Biological Diversity" in 1992, signatory nations indicated a willingness to pursue a range of actions designed to maintain global diversity. Though the convention remains to be ratified, various government agencies are moving forward with the development of national strategies for implementation. It can be expected that through time, specific biodiversity guidelines and regulations will evolve. Given the importance of biodiversity and the crisis we face in this area a pro-active approach in right-of-way planning is warranted. The paper defines biodiversity and its importance, identifies relevant sections of the convention, and reviews current means of biodiversity measurements and conservation. A review of current industry practice suggests that, to a certain extent, the issue of biodiversity is already being addressed. A number of improvements are suggested.

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Dans le cadre de la planification des emprises, cette présentation traite des implications reliées à la signature par le Canada de la Convention sur la Biodiversité biologique - Programme en Environnement des Nations unies. Les nations signataires s'engagent à poursuivre une panoplie d'actions pour maintenir la diversité globale. La présentation identifie les actions pertinentes de la Convention et discute des moyens à prendre pour évaluer et conserver la biodiversité.

# MITIGATING HABITAT FRAGMENTATION IN THE NETHERLANDS

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Nature in the Netherlands is highly fragmented. The main causes are : agricultural activities, urbanisation, road-building, building of railways and waterways and mining. The Road and Hydraulic Engineering Division carries out research and advises on habitat fragmentation caused by highways on the basis of the Second Transport Structure Plan. The objectives of the project on mitigating habitat fragmentation by highways are to give answers to the 3 following questions. What are the effects of highways on species (e. g. fauna) ? Which locations are bottlenecks between nature and road infrastructure ? Which measures can be taken to mitigate the effects ? The results of the project are important for : the choice of species for which measures should be taken or developed, the sequence and way of solving the bottlenecks between nature and road infrastructure and the improvement of the effectivity of measures. One of the objectives, the locating of bottlenecks, was the subject of a study carried out in 1991. The base for the study was the so-called "Ecologische Hoofdstructuur" (ecological maininfrastructure), a network consisting of areas with important existing nature values, areas with a potential for developing nature values and areas that connect the above mentioned areas. In the study an inventory was made of the location and number of intersections between the "Ecologische Hoofdstructuur (EHS)" and the existing and planned network of highways. The ecological functions and species composition of the intersected areas were recorded. The results were stored in a database. The inventory resulted in 245 intersections between the EHS and existing and planned highways. Along with 199 intersections, totaling 530 km of intersected EHS area, concerned existing highways and 46 intersections, in total 60 km, planned highways. These numbers do not give insight into the extent of the ecological effects no more than into the mitigating effects of measures. Therefore additional information about the ecology of the intersected areas is needed. The database can be used to get the desired information. Recently funds have been provided by the Dutch government to carry out measures to mitigate habitat fragmentation caused by existing highways. The results of the above described study will be used for decisions of project priorities to spend the money efficiently. The results could also be useful to determine if the objective of the Dutch policy is achieved. The number of bottlenecks between the EHS and road infrastructure could be an onset for an identifier for habitat fragmentation.

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Cette présentation porte sur les mesures d'atténuation visant à minimiser la fragmentation des habitats fauniques par les autoroutes aux Pays-Bas.

# EFFECTS OF ROW VEGETATION MANAGEMENT ON HABITAT FOR THE ENDANGERED KARNER BLUE BUTTERFLY IN EAST-CENTRAL NEW YORK, USA

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The Karner blue butterfly (*Lycaeides melissa samuelis Nabokov*), recently listed by the U.S. Fish and Wildlife Service as Endangered, depends on the herbaceous perennial, blue lupine (*Lupinus perennis* L.) as a food source, during its larval stages. Both species occur on some transmission-line ROWs in east-central New York. Karner blue butterflies are endangered primarily as a result of habitat loss. Vegetation management along ROWs in these areas appears to have promoted the establishment and maintenance of the early successional blue lupine. Since there were no data relating vegetation management schemes (mode and method) to characteristics of blue lupine populations, our study was designed to determine the relationship between short and long-term vegetation management on the abundance of blue lupine along ROWs. During the 1992 growing season, ROWs with blue lupine populations and extant or extirpated populations of Karner blue butterflies were located. Blue lupine clumps were measured for reproductive and vegetative vigor. Community characteristics of the blue lupine populations included woody plant basal area and density, herbaceous species percent cover, and light intensity. ROW characteristics included short and longer-term management schemes, aspect, orientation, width, and features of off ROW vegetation. Areas within the ROW where blue lupine did not occur were measured similarly. Reductions in the abundance of woody vegetation and increased relative light levels were the primary variables associated with increased blue lupine abundance. Blue lupine population density was most dependent on relative light intensity, and was negatively associated with the number of years since the last management activity and the recent use of herbicides. Percent cover of blue lupine was positively associated with both the recent and longer-term use of herbicides. The relationship between blue lupine abundance and either broadcast or selective management modes was weak. These data suggest that light levels are the most important management concern, and that differences between blue lupine density and percent cover may reflect different effects of ROW management on blue lupine developmental stages.

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L'étude traite de l'effet des activités de maîtrise de la végétation sur l'habitat d'une espèce menacée de papillon (*Lycaeides melissa samuelis*) dans des emprises de lignes de l'État de New York.

# BIODIVERSITY MONITORING USING AN AUTOMATED INTELLIGENT MONITORING SYSTEM (AIMS)

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Ontario Hydro's commitment to preserving the health of our environment is becoming increasingly important. Future studies relating to the terrestrial environment are expected to be more comprehensive and will require greater emphasis on birds and mammals as well as other vertebrate groups such as amphibians. This project involves the development of an intelligent monitoring system for biodiversity monitoring which will allow the collection of consistent data of higher quality, more cost-effective than by present means. The system currently being developed has three components: an intelligent automatic recorder on site, a preprocessing system and an intelligent identification scheme in the laboratory. Data will be presented on results using a multichannel recorder which can collect data without the presence of staff over long time periods. Preliminary results on identification of amphibian species using a pattern recognition system has indicated a success rate of over 98% for "clean" signals. Further research activities are discussed.

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Ce projet de recherche d'Ontario Hydro vise la mise au point d'un système automatisé pour le suivi de la biodiversité animale (oiseaux, mammifères et reptiles). Les premiers résultats sur les amphibiens y sont présentés.

# SEASONAL ABUNDANCE AND COMPOSITION OF FOREST BIRD COMMUNITIES ADJACENT TO A RIGHT-OF-WAY IN NORTHERN FORESTS USA

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We counted birds on line transects in areas adjacent to a right-of-way (ROW) and in areas not associated with a ROW to assess effects of the ROW edge on adjacent forest bird species and communities. Counts were conducted in northern Wisconsin over four years (1986 to 1989) and in two seasons (breeding and fall migration). ROW and reference transects were paired on the basis of habitat structure and floristic composition. No differences were detected in numbers of species or individuals between reference and ROW study areas. We detected no differences in abundance of forest bird species between reference and ROW study areas in any year or season. However, species that have an affinity for edge habitats were more abundant in ROW study areas in three of four years during the breeding season and one of four years during migration. The Chestnut-sided Warbler (*Dendroica pensylvanica*), a shrub associated species, was the only species that was more abundant (over years) in ROW than reference study areas in the breeding season. More individuals that prefer early-successional habitat (two and three of four breeding and migration years respectively) and that nest in shrubs (two and one of four breeding and migration seasons respectively) were observed in ROW than in reference study areas. Cavity nesting birds were more abundant in reference than ROW study areas in one of four breeding and one of four years during migration. We conclude that although abundance of edge species was higher in forest areas adjacent to the ROW, the number of species preferring forests were not concomitantly reduced in these areas as compared with reference sites.

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Des dénombrements d'oiseaux, pendant 4 ans, dans des boisés éloignés (témoins) et adjacents à des emprises de lignes au Wisconsin n'ont révélé aucune différence entre ces habitats quant aux espèces et aux nombres d'oiseaux. Certains relevés annuels ont toutefois indiqué une abondance des espèces recherchant la végétation pionnière dans les boisés associés aux emprises. La présence d'emprises ne semble pas avoir réduit le nombre d'espèces nichant en milieu forestier.

# EFFECT OF A NEW PIPELINE RIGHT-OF-WAY ON WETLAND PLANT AND BIRD COMMUNITIES IN NORTHERN NEW YORK

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The response of vegetation and breeding bird communities to a new pipeline right-of-way is being documented up to 2 years after construction in emergent, shrub, and forested wetlands in St. Lawrence County, New York, on portions of the Iroquois Gas Pipeline right-of-way. Vegetation is being sampled 1 year before and 1 and 2 years after construction on quadrats located on the right-of-way, and on undisturbed control plots located off right-of-way. Quadrat sizes are 100 $m^2$ for overstory trees, 10 $m^2$ for shrubs, and 1 $m^2$ for herbaceous plants. Vegetation height, species composition, density, and percent cover are being determined on each plot. Vegetation parameters for right-of-way plots are being compared with undisturbed and pre-construction right-of-way plots within and between sample years using a number of statistical tests including analysis of variance, and mean separation tests. Bird communities are being censused using the transect method on transects located perpendicular from the right-of-way to the undisturbed wetland interior. Two 200 m to 300 m transects were established within each wetland type. Observers recorded all birds heard or seen and played recordings to elicit responses from secretive species. Species occurence and relative abundance, expressed as number of territorial males, are being determined for each 30 m section of transect. Bird abundance and richness are being compared with distance from the right-of-way using regression analysis. Bird community parameters measured within and adjacent to the right-of-way are being compared with community measurements in the wetland interior. This study will provide information useful to resource professionals involved in the description and the quantification of the impacts of pipelines on ecological communities and in the subsequent design of construction techniques and determination of adequate mitigation measures. Results from surveys conducted prior to and 1, and 2 years after construction will be presented along with observations of 3 years after construction, which is being studied in 1993.

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L'auteur présente les résultats d'une étude sur les effets de la construction d'un pipeline sur les oiseaux et la végétation dans l'État de New York.

# AQUATIC HABITAT ENHANCEMENT AND FISH UTILIZATION OF RECLAIMED PIPELINE STREAM CROSSINGS IN ALBERTA

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This paper examines a number of stabilization and enhancement techniques used to reclaim pipeline crossings of streams in Alberta. Since 1981 NOVA Corporation of Alberta has been using specialized techniques to stabilize streambanks to prevent erosion and to enhance fisheries habitat on streams crossed during pipeline construction. Techniques utilized for streambank stabilization include rock riprap, logwalls, cribwalls, and gabions. Habitat enhancement structures included instream structures such as boulder, V-deflectors, and artificial ledges, while habitat structures associated with streambank enhancement included live logwalls, tree revetments, root wads, and combinations of logwalls and brush layers. The choice as to which structure or combination of structures that is utilized depends upon stream channel characteristics, fish species present and their habitat requirements, and the potential erosion hazards. Each system utilized has certain advantages and disadvantages depending of the objective for its use. The discussion will focus on the value of the system for stabilization and fisheries habitat enhancement, the response of fish populations to enhancement, as well as, the costs and installation limitations. Response of fish populations to reclamation techniques utilized was investigated on the Raven River in west central Alberta. Moderate increases in abundance of young-of-the-year brook trout and one-year-old-and-older brown trout were attributed to the stabilization techniques utilized. Reclamation measures utilized increased the amount of log and stump cover by an average of 146% over pre-reclamation conditions. Overhang cover was increased by 245% as a result of habitat enhancement techniques utilized.

Depuis 1981, Nova Corporation d'Alberta utilise plusieurs techniques de stabilisation des berges des ruisseaux dans le but de prévenir l'érosion et d'améliorer les habitats aquatiques au moment de la construction des pipelines. Cette présentation traitera des avantages et des coûts de ces techniques, de leurs effets sur l'abondance des poissons ainsi que des contraintes à leur utilisation.

# THE IMPACT OF ELECTRIC TRANSMISSION RIGHTS-OF-WAY UPON HEADWATER BROOK TROUT HABITAT AND POPULATIONS IN FORESTED AREAS IN NEW YORK

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Twenty crossings of headwater trout streams by electric transmission rights-of-way (ROWs) in forested areas in New York State were studied to determine the effect of the cleared ROW upon brook trout (*Salvelinus fontinalis*) habitat quality and populations. Brook trout habitat and populations on the ROW were compared to equal-length stream segments off the ROW in the adjacent, upstream forest. A total of 14 habitat variables were measured and compared by paired-t analysis. Fourteen of the streams were electrofished on and off the ROW. The difference in trout and all fish biomass were compared to differences in habitat variables by simple regression analysis. The streams on the ROW became significantly sunnier, with more dense, low streambank vegetation. The streams became deeper and narrower with a greater percent area as pools. Water quality, as measured by pH, temperature, total dissolved solids and dissolved oxygen, was not degraded. Brook trout and all other fish were significantly more abundant on the ROW. The percent of the fish population consisting of brook trout did not change between on and off ROW segments. The coefficient of condition of juvenile and adult brook trout did not change either. The change in mean depth was the most important variable in determining change in brook trout and all other fish biomass. The crossing of headwater trout streams in forested basins by electric transmission ROWs cannot be considered an adverse impact to trout as long as significant stream warming or vehicular damage is avoided.

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Cette étude porte sur l'effet du déboisement des emprises de lignes de transport d'énergie, à la traversée des cours d'eau, sur la qualité de l'habitat et sur les populations d'omble de fontaine (*Salvelinus fontinalis*).

**Wednesday, September 22, 1993**
**Morning**
**12. Corporate Approach :**
**Assessment and Monitoring**
**Room Opus 2**

***Mercredi 22 septembre 1993***
***Avant-midi***
***12. Approche corporative :***
***Évaluation et suivi environnemental***
***Salle Opus 2***

# DEVELOPMENT OF A COMPREHENSIVE PROGRAM TO IMPROVE TRANSMISSION LINE SITING AND CONSTRUCTION PRACTICES - THE DUKE POWER COMPANY EXPERIENCE

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In recent years, the siting of transmission lines and other utility facilities has become increasingly challenging. Projects that historically faced little or no public interest or concern now often encounter a public that demands more justification for a project, why it was sited where, it is, and an opportunity to be involved before final decisions are made. In response to these demands, Duke Power Company engaged EDAW, Inc. to assist them in the development of a process for siting and constructing transmission lines that more effectively integrated environmental considerations and resulted in more defensible siting decisions. A series of internal workshops were held within Duke Power Company to identify roles and responsibilities of various departments involved in the siting process, as well as issues, overlaps and communication problems. In addition, a series of nation-wide workshops were held that involved the participation of representatives from 15 U.S. and Canadian utilities. The workshops were designed to reveal the various approaches used by each utility in facility siting and to share information on problems, trends and successful solutions. Duke Power initiated a reorganization that created a transmission line siting and landscape architecture group and placed greater responsibility for siting decisions with this group. A formal siting methodology was developed and implemented, defining a step-by-step approach to siting decisions with clearly defined organizational responsibilities. New tools were acquired and integrated into the siting process, including GIS and visual simulation. The siting methodology has been successfully implemented on several projects, achieving a high level of acceptance from the North Carolina Utility Commission. Project design and construction practices have been revised, incorporating new approaches to vegetation clearing, tower coloration, and land restoration.

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Cette présentation traite du développement d'un programme global pour améliorer le choix de tracé et les pratiques de construction associées aux emprises de lignes de la compagnie Duke Power. Le programme a été développé dans le cadre d'ateliers à l'interne pour identifier les enjeux et les responsabilités et d'ateliers à l'échelle nationale afin d'identifier les solutions à privilégier. Une approche par étapes a été développée; elle met à profit des méthodes innovatrices telles que des systèmes d'information à références spatiales et des simulations visuelles.

# MITIGATION USED BY DUKE POWER COMPANY TO RESOLVE ENVIRONMENTAL ISSUES ASSOCIATED WITH TRANSMISSION LINES

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An increased public interest in the environmental impacts of the construction of transmission facilities has focused utilities on the development of methods to minimize or eliminate such impacts. Often assurances regarding protection of resources are necessary in order to gain the necessary permits. Concern by agencies, interest groups, the public, and land owners has focused on visual, sedimentation, water quality, rare species, and unique resources issues. To meet these concerns, Duke has improved information gathering efforts to ensure that we are aware of the potential environmental issues that could develop from the selection of a particular line route. The first step, as in an agency mitigation evaluation, is to select a route that avoids impacts; this has been the intent of our siting process. Placement of towers on ridges and spanning ravines is an example of mitigation that has avoided impacts to rare plants which are almost exclusively found in ravines. The second step in our process is to minimize impacts. The careful siting of individual towers, use of darkened steel towers and non-specular conductor, and reduced corridor clearing has successfully minimized the visual impact of lines. Potential impacts resulting from sedimentation have been successfully mitigated by the adherence to best management practices, designating streamside protection zones, performing environmental audits of construction, and limited clearing of the corridor. This has been effective in protecting water quality for some unique brook trout streams and a trout hatchery. Impacts resulting from grading for access roads and tower locations have been rectified by the use of excelsior matting on steep slopes with poor soils; this has provided effective erosion control in areas having excessive rainfall. As part of the project access plan, old logging roads which have not stabilized through time have been regraded, stoned where necessary, seeded, and water bars constructed. These efforts have in most cases resulted in measurable improvement in water quality of area stream by eliminating a historic source of sedimentation to streams. These efforts have more than compensated for any temporary impacts resulting from project construction.

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Cette présentation brosse un tableau général des mesures d'atténuation préconisées par la compagnie Duke Power dans son réseau d'emprises pour résoudre les enjeux environnementaux. Plusieurs aspects y sont discutés, entre autres : le choix du tracé, la localisation des pylônes, la réduction du déboisement, les routes d'accès et la qualité de l'eau.

# ENVIRONMENTAL ASSESSMENTS PERFORMED BY DUKE POWER COMPANY TO ASSIST IN THE SITING AND CONSTRUCTION OF TRANSMISSION LINES

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A series of water chemistry, stream sedimentation, aquatic macroinvertebrate, and fish community sampling programs have become the standard for environmental assessments performed to support transmission line siting and construction for Duke Power Company. Initially, water chemistry, sediment loading, macroinvertebrate indices, and fish inventories are used to characterize streams crossed by proposed routes and determine their sensitivity to potential impacts. These results become part of the data base used to evaluate the potential impact of selected routes and also serve as a baseline to evaluate the impacts of construction. Pre-construction programs are repeated following construction to evaluate the success of the environmental protection measures. Throughout the construction period, an erosion control assessment program focuses on monitoring total suspended solids as a key variable to detect primary instream changes that may be attributable to construction activities. A vertical series of single-stage samplers is set to collect representative samples on the rising stage of storm hydrographs, when erosion and worst-case sedimentation impacts are most likely to occur. This program provides prompt feedback, either confirming the efficacy of erosion control efforts, or alerting construction crews to stabilize indicated problem areas. This type of program has broad application in other nonpoint source assessment studies. Water chemistry, macroinvertebrate, and fish studies are further developed as needed to address site-specific issues. For example, a water quality program was developed to monitor stream pH from excavated and spoiled sulfidic rock. Results indicated that treatment methods were sufficient to protect a downstream hatchery. Water chemistry and bioassessment techniques (macroinvertebrate indices) have been used successfully to monitor sensitive waters, while unique brook trout populations have been monitored through population estimates from electrofishing sampling programs. The important factors in these programs are to have a complete knowledge of the sensitive resources of the proposed line, an effective protection program, and a monitoring program that is sensitive to potential impacts.

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Cette présentation traite de la méthode d'évaluation des impacts environnementaux mise au point par la compagnie Duke Power pour la localisation et la construction de lignes de transport d'énergie. On y traite plus particulièrement des traversées de cours d'eau.

# SUIVI ENVIRONNEMENTAL EN MILIEU AGRICOLE – LIGNE RADISSON-NICOLET-DES CANTONS À ± 450 kV

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Suite à l'implantation d'une ligne ou d'un poste, Hydro-Québec effectue un suivi environnemental afin de mesurer les impacts réels du projet et d'évaluer la performance des mesures d'atténuation. Ce suivi permet de répondre aux préoccupations des agriculteurs. Dans ce contexte, un suivi environnemental en milieu agricole a été réalisé suite à la construction de la ligne Radisson-Nicolet-Des Cantons à ± 450 kV entre 1989 et 1992. Ce suivi a été effectué en 3 phases : avant la restauration des lieux, après la remise en culture et à la troisième année de culture après la construction. Cette étude avait pour objectifs de :
1) vérifier la nature réelle des impacts de l'implantation d'une ligne haute tension en milieu agricole;
2) vérifier l'efficacité des travaux de restauration exécutés par les agriculteurs. Le sol affecté par la circulation des équipements utilisés lors de la construction a été comparé avec le sol non affecté par la circulation de la machinerie. L'étude a été réalisée dans 8 champs représentatifs du territoire étudié dont la texture des sols varie de sable à loam sableux. Globalement, les résultats de l'ensemble des 8 champs échantillonnés en 1992, soit 3 ans après la remise en culture, ne montrent aucune différence de densité du sol entre les sites témoins et les sites touchés. Ces résultats permettent de croire que les sols se sont réhabilités. En effet, en 1989 et en 1990, une densification significative des sites touchés avait été mesurée à certaines profondeurs. Immédiatement après la construction, soit en 1989, ces différences significatives de densité du sol avaient été mesurées à 30, 35 et 40 cm de profondeur. En 1990, un an après la remise en culture, ces différences prévalaient à 20, 25, 30, 35, 50 et 60 cm de profondeur. Les différences de profondeur affectées en 1989 et 1990 pourraient être imputables à la circulation de la machinerie de ferme ou aux dates différentes des relevés d'une année à l'autre. Sur 5 des 8 champs échantillonnés en 1992, aucune compaction due à la construction de 1989 n'a été mesurée. Trois des 8 champs présentaient encore une densité du sol supérieure sur les sites touchés. Sur un de ces champs, l'agriculteur n'a apporté aucune mesure de restauration. Pour le deuxième champ, il est probable que le taux de matière organique supérieur mesuré sur les sites témoins soit à l'origine des différences de densité mesurées. Enfin, sur le troisième champ, on a observé une amélioration graduelle de la densité du sol, mais la compaction persiste; ce sol semble donc en voie d'être réhabilité d'ici peu de temps. Les rendements des cultures mesurés en 1992 étaient statistiquement équivalents, laissant croire que la densité supérieure du sol ne les a pas affectés. Toutefois, les précipitations abondantes de 1992 ont pu masquer les effets de la compaction du sol sur le rendement. En 1990, la construction réalisée un an auparavant avait occasionné des diminutions de rendement sur 5 des 8 champs échantillonnés. Nous sommes d'avis que les mesures de restauration apportées par les agriculteurs étaient dans certains cas efficaces, dans d'autres cas insuffisantes ou inadéquates, car les travaux réalisés correspondent aux pratiques habituelles des agriculteurs. Les résultats doivent cependant être utilisés comme guides et ne peuvent être extrapolés à une région entière.

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In order to assess the effectiveness of mitigation measures and real impacts on agricultural soils, Hydro-Québec carries out environmental monitoring programs. This paper presents the Radisson-Nicolet-Des Cantons ± 450 kV powerline case study. Data are presented for a 4 year period.

# LES GRANDS ENSEIGNEMENTS DU SUIVI ENVIRONNEMENTAL DE LA LIGNE À 450 kV RADISSON-NICOLET-DES CANTONS (RNDC)

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Le suivi environnemental à la Vice-présidence Environnement d'Hydro-Québec est devenu une composante essentielle de tout processus d'évaluation, d'intervention ou de recherche environnementale. La réalisation de la ligne de transport d'énergie Radisson-Nicolet-Des Cantons (RNDC) s'inscrit dans cette démarche dont on peut tirer de grands enseignements pour la conduite des futures évaluations environnementales. Mise en service en 1990, cette ligne à courant continu de 450 kV permet de transporter d'importants blocs d'énergie de la Baie James vers le sud du Québec et la Nouvelle-Angleterre en empruntant un tracé d'une longueur de 1 122 km et une emprise d'une largeur de 60 m dont un tronçon traverse le fleuve Saint-Laurent par voie sous-fluviale. Sa capacité de transport de 2 000 mégawatts correspond à la puissance additionnelle produite par la centrale La Grande-2-A dont la construction a été complétée en 1992. Durant la phase avant-projet, un certain nombre d'enjeux environnementaux ont été identifiés comme devant faire l'objet d'un processus spécifique de suivi à cause de leur caractère critique ou de l'intérêt qu'ils représentent. Entrepris dès 1986, soit avant le début du déboisement, le suivi environnemental de la ligne RNDC s'est poursuivi jusqu'en 1993 et totalise une soixantaine d'études distinctes. Les différentes études de suivi environnemental ont montré que la plupart des impacts identifiés à l'étape de l'avant-projet ne se sont pas matérialisés. C'est le cas des impacts sur le poulamon atlantique (*Microgadus tomcod*), le grand héron (*Ardea herodias*), le cerf de Virginie (*Odocoileus virginianus*), la sauvagine et sur la plupart des autres ressources du milieu naturel qui n'ont montré aucun impact négatif notable à la suite de la mise en place de la ligne et de ses équipements de support. On a observé que des facteurs extérieurs avaient généralement eu plus d'impacts sur les enjeux que la construction de la ligne elle-même. Pour ce qui est des impacts qui affectent directement ou indirectement les populations humaines concernées, les études de suivi sont unanimes à montrer que la perception des impacts est souvent aussi déterminante que leur importance objective. De façon générale, les différentes études de suivi environnemental de la ligne RNDC semblent indiquer qu'il faut éviter de fragmenter les enjeux environnementaux et les mesures d'atténuation et de compensation correspondantes. Au contraire, il faudrait tendre vers une «gestion intégrée des enjeux environnementaux» qui prendrait en compte les valeurs et les priorités des populations d'accueil et où apparaîtraient nécessairement les notions d'impact relatif et comparatif.

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This report presents a critical overview of a 7-year monitoring program implemented to assess a 1,122 km-long 450 kV powerline in Québec. A total of 60 different studies were conducted. Natural resources showed no significant impact. External factors were observed to have more impact on environmental issues than the construction itself.

# CHOIX D'UN TRACÉ OPTIMAL : DÉMARCHE THÉORIQUE ET APPLICATION INFORMATISÉE

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Cette présentation comporte trois volets : d'abord, une description de la *Méthode d'évaluation environnementale lignes et postes* d'Hydro-Québec, suivie de la version informatisée de cette méthode, appelée OPTRAC, avec démonstration à l'ordinateur, et finalement l'avenir de cet outil informatique dans un contexte plus général. Ces trois volets seront présentés à l'aide d'une étude de cas : le projet de ligne à 735 kV Des Cantons-Lévis. Les études d'avant-projet de lignes d'Hydro-Québec visent deux principaux objectifs : la localisation optimale du projet du point de vue environnemental et l'évaluation des impacts du projet sur l'environnement. La localisation optimale du projet consiste à effectuer le tracé de ligne de moindre impact sur l'environnement tout en tenant compte des aspects technoéconomiques. Cette localisation s'effectue par une réduction successive du territoire. La localisation optimale du projet tend à dégager : en phase 1, le corridor de ligne de moindre impact à l'intérieur d'une zone d'étude; en phase 2, le tracé de ligne de moindre impact à l'intérieur du corridor retenu à la phase 1. L'évaluation des impacts sur l'environnement a pour objet d'évaluer et d'atténuer les impacts du projet. D'abord, elle vise l'identification, la localisation et l'évaluation de l'importance des impacts du projet sur le milieu. Elle conduit ensuite à l'identification et à la description des mesures permettant d'atténuer de tels impacts. Enfin, elle établit le bilan des impacts négatifs et positifs qui devraient subsister suite à l'application des mesures d'atténuation. Dans cette démarche d'évaluation environnementale, la modélisation géographique informatisée représente un développement majeur. Il est maintenant possible de soumettre à des procédures d'analyse formelle ce qui, jusqu'à maintenant, relevait de méthodes plus qualitatives, que ce soit de la part d'experts ou de la part du public. Le procédé OPTRAC s'inscrit dans cette évolution. OPTRAC est un processus informatisé de recherche et d'évaluation des tracés d'infrastructures linéaires développé à partir de la *Méthode d'évaluation environnementale lignes et postes.* Il combine l'analyse multicritère et l'algèbre cartographique avec des outils géomatiques pour l'étude et l'optimisation de tracés. L'application d'OPTRAC présente aussi un attrait certain pour les études de planification du réseau d'Hydro-Québec de même que tout autre projet d'infrastructures linéaires.

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This presentation uses a 735 kV powerline case study to describe a method to select a route and to evaluate the environmental impacts. A computer demonstration will highlight the presentation.

**Wednesday, September 22, 1993**
**Afternoon**
**Closing Luncheon (speaker)**
**Room Opus 2**

***Mercredi 22 septembre 1993***
***Après-midi***
***Banquet de clôture (conférence)***
***Salle Opus 2***

# DROIT DE PASSAGE ET LA RESPONSABILITÉ POTENTIELLE DÉCOULANT DE LA CONTAMINATION DES SOLS ET DE LA NAPPE PHRÉATIQUE - PERSPECTIVES QUÉBÉCOISE, AMÉRICAINE ET EUROPÉENNE

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Les coûts reliés à la décontamination et à la restauration des sols et de l'eau souterraine sont souvent importants. Il existe de plus une tendance législative accrue à étendre la responsabilité en matière de contamination des sols et de nappes phréatiques non seulement aux pollueurs actuels, mais aussi aux propriétaires présents et passés ainsi qu'aux occupants des sols contaminés. Nous examinerons en conséquence la responsabilité potentielle et les effets découlant de la contamination des sols et de la nappe phréatique pour un détenteur d'un droit de passage au Québec et aux États-Unis. Une telle responsabilité ainsi que les mesures correctrices qui en découlent peuvent englober des coûts de restauration exigés directement du titulaire d'un droit de passage de même qu'une restriction quant à l'exercice du droit de passage. Nous traiterons également dans ce contexte de la vérification environnementale, outil fréquemment utilisé pour identifier les cas de non conformité et ainsi que des mesures préventives à mettre en place.

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High costs are often related to soil and groundwater decontamination and restoration. Furthermore, legislation tends to broaden such pollution responsibility to actual and past land owners and to present occupants. Potential responsibility and effects of soil and groundwater contamination for rights-of-way permit holders in Québec and in the United States are discussed.

## Poster Session

## *Séance d'affichage*

# MODEL FOR PREDICTION OF PHYTOTOXIC RESPONSE OF CROP SEEDS TOWARDS AQUEOUS LEACHATES OF *PARTHENIUM HYSTEROPHORUS* L.

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Many agronomic and horticultural crops were tested for their susceptibility/resistance towards water soluble allelochemicals of *Parthenium hysterophorus* - a noxious weed. A marked inhibition of physiological parameters like germination, seed vigour and seedling length of crops studied was seen. Forages were found to be relatively resistant and flowering plants as relatively susceptible. The pulses and vegetables showed a mixed response. Not only the seed crops exhibited a differential response towards same kind of allelochemicals, but different parameters like germination, seed vigour and seedling growth were also affected differently. It was observed that in cases where germination percentage remained unchanged, the seed vigour was affected relatively more followed by seedling growth. The ratio of seed coat thickness and seed volume exhibited an exponential relationship of the seed in response to the leachable allelochemicals of Parthenium. Therefore a mathematical expression : $y = y_{max}(1-e^{-x/x_c})$, where y is the physiological parameter; $y_{max}$ the maximum value of the physiological parameter; x the ratio of seed coat thickness and seed volume and $x_c$ the critical or the threshold value of x. The data on seed germination and speed of germination fitted well in the proposed model as an indicator of response. The critical limits below which the seeds show poor response or *vice versa* were calculated to be 0.611, 1.774 and 4.376 for seed germination, seed vigour and seedling length, respectively. The response of the seeds can thus be predicted without putting them to experimentation on the basis of the critical values.

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Cette présentation traite de la susceptibilité/résistance de certaines espèces aux composantes allélopathiques de *P. hysterophorus*. Certains paramètres physiologiques de ces espèces tels que la germination, la vigueur des graines et le longueur des tiges ont été affectés à la baisse.

# THE FORMATION OF STABLE RIGHTS-OF-WAY VEGETATION WITH COVER CROPS - HOW DO YOU CHOOSE WHICH SPECIES TO PLANT?

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Many utilities have implemented vegetation management policies for their rights-of-way that promote the development of a stable vegetation capable of inhibiting tree establishment and growth. The common method of producing this stable community is by removing the undesired trees (with the selective use of chemical, manual or mechanical methods) and then hoping the surrounding vegetation invades the location and inhibits future tree growth. This is a passive method which more often than not fails to produce the desired end-product - a stable tree-free community. An alternative approach is the active planting of species which have a proven ability to inhibit tree growth. This cover crop (smother crop) method has produced stable communities, but a critical question is the decision on what species to plant. We have developed a simple yet effective greenhouse assay which rapidly scans prospective crops for their ability to inhibit tree growth. This involves growing cover crops under controlled greenhouse conditions. A tree seedling is then transplanted into the pots and the crop's inhibitory ability is measured as the reduction in tree height relative to a bare ground control. The crops are ranked and the most inhibitory will then be recommended for field evaluations. The controlled conditions allow for repeatable experiments, such that new species can be evaluated under the same conditions as previous studies. In addition, variables such as soil type, nutrient supply, and soil moisture can be manipulated to provide an estimate of the useful ecological range of the crop. This assay, over a 3-month period, produced results which paralleled those of a 4 year field evaluation of crown vetch (*Coronilla varia*), birdsfoot treefoil (*Lotus corniculatus*), red fescue (*Festuca rubra*) and orchard grass (*Dactylis glomerata*), and has been used by Ontario Hydro to evaluate 36 different plant species.

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Cette présentation traite d'une approche consistant à planter des espèces capables d'arrêter la croissance des arbres dans les emprises, tout en créant des communautés végétales basses. À cette fin, une méthode d'essais en serres a été développée afin de déterminer les espèces à fort potentiel pour réduire la croissance des arbres.

# INFLUENCE DES EMPRISES DE LIGNES DE TRANSPORT D'ÉNERGIE SUR L'HABITAT DU CASTOR

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Cette étude avait pour objectif d'évaluer l'effet des emprises de lignes de transport d'énergie sur l'habitat et l'alimentation du castor (*Castor canadensis*) au Québec. La zone d'étude a été stratifiée, pour des emprises ayant fait l'objet d'un entretien depuis au moins deux ans, en trois zones forestières : la taïga, la forêt boréale et la forêt feuillue. À l'automne 1989 et 1990, l'inventaire du nombre de tiges disponibles et broutées des essences ligneuses a été effectué dans des parcelles de 20 m² situées le long de transects perpendiculaires à la rive des cours d'eau sélectionnés. La qualité et l'utilisation de l'habitat dans l'emprise et la forêt adjacente, qualifiée de témoin, ont été estimées. Des analyses en correspondances multiples, la production de tables de fréquences et des analyses log-linéaires ont permis d'établir des modèles d'utilisation de l'habitat par le castor pour chaque zone forestière. Ces modèles tiennent compte des variables suivantes : les traitements (emprise ou témoin), la distance de la rive, le diamètre des tiges et les espèces broutées. La densité des essences feuillues de faible diamètre (<1,3 cm) est significativement plus élevée dans l'emprise que dans la forêt témoin, pour les trois zones forestières. Les tiges les plus utilisées par le castor sont celles de l'aulne rugueux en taïga, de l'aulne et du saule en forêt boréale, alors que plusieurs essences le sont en forêt feuillue selon leur disponibilité. Dans les trois zones forestières, la densité des essences utilisées par le castor s'avère généralement plus élevée dans l'emprise que dans la forêt limitrophe. L'effet global des emprises sur l'habitat du castor serait constitué d'une alternance d'impacts négatifs (lors du déboisement) et positifs (après quelques saisons de croissance des essences végétales), selon le cycle d'entretien de la végétation. L'impact global demeure toutefois difficile à préciser étant donné le manque de connaissances sur la dynamique de la végétation après coupe et la qualité minimale de l'habitat requis pour le castor.

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This presentation discusses the impact of powerline ROWs on beaver (*Castor canadensis*) in Québec. Data indicate that beavers feed freely in ROWs; the impact could be negative after a cut but favorable toward the end of the vegetation control cycle. Overall effect remains difficult to estimate due to lack of knowledge on plant growth after the cut and minimal habitat quality requirements for beavers in the 3 regions studied.

# ÉTUDE DE LA CONTAMINATION PAR LES PHYTOCIDES DES PETITS FRUITS SAUVAGES ET DE LA VÉGÉTATION DANS LES EMPRISES DE LIGNES DE TRANSPORT

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Dans le cadre du programme quinquennal élaboré par Hydro-Québec dans le but d'évaluer le niveau de contamination de végétaux soumis à des pulvérisations de phytocides, une campagne d'échantillonnage des petits fruits sauvages et de la végétation dans des emprises de la région Manicouagan a été réalisée au cours de l'été 1992. L'objectif principal de cette étude était d'établir des courbes illustrant la persistance des différents ingrédients actifs dans des feuilles de bouleaux à papier (*Betula papyrifera*) et des bleuets (*Vaccinium myrtilloïdes* et *V. angustifolium*) susceptibles d'être consommés par des humains ou des animaux. L'effet du lavage des bleuets a également été examiné afin d'en déterminer l'efficacité. Le lavage d'échantillons de bleuets traités au Tordon 101 depuis une semaine ou moins a réduit de façon hautement significative leur teneur en piclorame, mais n'a pas abaissé significativement leur concentration en 2,4-D. En moyenne, la concentration de piclorame et de 2,4-D de ces échantillons lavés correspondait respectivement à 65 % et 90 % de celle mesurée dans les témoins non lavés. Le lavage, dans les conditions de cet essai, était devenu pratiquement inefficace au terme de la première semaine post-traitement. Les feuilles de bouleaux à papier et les bleuets affichaient, en général, un niveau de contamination décroissant au cours de la période étudiée. Particulièrement rapide dans le cas des feuilles de bouleaux à papier des portées traitées au Tordon 101, ce phénomène était moins accentué dans le cas des feuilles de bouleaux des portées traitées au Dycleer + 2,4-D amine, et des bleuets dans les portées traitées au Tordon 101. Les échantillons qui semblent montrer la plus grande persistance des phytocides sont ceux de bleuets issus de sites traités au Dycleer + 2,4-D amine, quoique dans ces cas l'absence de données pour les 4 premières semaines après l'arrosage rend l'interprétation des résultats fort difficile. Cette étude a également permis d'identifier certaines contraintes inhérentes à l'interprétation des données. Des recommandations sont formulées dans le but de réduire ces contraintes lors de travaux ultérieurs.

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This study presents data on the contamination of wild berries and vegetation in powerline ROWs treated with herbicides in the Manicouagan region in Québec. The persistence curves are presented for different active ingredients and difficulties in data analysis are highlighted.

# UNE TECHNIQUE DE PULVÉRISATION QUI MINIMISE LES QUANTITÉS DE PHYTOCIDE APPLIQUÉ

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La Société d'électrolyse et de chimie Alcan Ltée entretient un réseau de transport d'énergie dans la région du Saguenay-Lac-Saint-Jean. Ses installations s'étendent sur une distance de 500 km et une superficie de 2 330 hectares avec des corridors de diverses largeurs. La végétation incompatible avec l'exploitation du réseau de transport d'énergie est contrôlée par des interventions combinées, mécaniques (coupe manuelle) et chimiques à une récurrence de trois ans. Au fil des années, la végétation herbacée et arbustive s'est développée, contrant l'envahissement par les essences arborescentes. L'utilisation de phytocide a donc diminué considérablement. Les traitements sélectifs sont effectués par voie terrestre. Le phytocide est pulvérisé à l'aide d'une lance fixée à un réservoir monté sur chenillard. Cette technique «A» entraînant de la pulvérisation hors cible et de la dérive en raison de la distance lance-cible qui peut aller jusqu'à 15 mètres, une autre technique d'application fut développée. Deux opérateurs marchant de chaque côté du chenillard pulvérisent, le plus près possible, les espèces-cibles à l'aide de lances portatives reliées au réservoir. Cette technique «B», qui est appliquée sur plus de 60 % des superficies de façon sécuritaire, comporte plusieurs avantages. Elle permet, d'une part, de voir les essences arborescentes qui autrement passeraient inaperçues par l'opérateur sur le chenillard. D'autre part, la réduction de la dérive et la pulvérisation exclusive des espèces cibles ont permis de réduire de 50 % les quantités de phytocide appliqué. Ce raffinement de la technique d'application augmente l'efficacité des traitements chimiques et assure une protection accrue des zones sensibles.

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The combination of mechanical and chemical vegetation control methods resulted in herbaceous and shrub type communities in Alcan's powerline ROWs. Ground selective foliar applications of herbicides by means of a hose and nozzle system by 2 operators walking alongside a muskeg resulted in a 50% decrease in herbicide use.

# DISTRIBUTION OF WOODY ROOTS IN TRANSMISSION LINE ROWS IN NORTH LOUISIANA

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Tree growth on electric transmission ROWs in north Louisiana is typically controlled by frequent mowing. However, resprouting is vigorous because of well-established root systems. ROWs in forested areas not only contain root systems of trees growing in the ROW, but also those extending laterally into the ROW from the adjacent forest. These woody root systems provide the potential for additional root sucker development. The objectives of this study were: (1) to qualify the number of woody roots in typical ROWs of north Louisiana, (2) to estimate the contribution of woody roots from adjacent forests into the ROWs, and (3) to determine the distribution with depth of these roots. At each of three 100-foot (30.5 m)-wide transmission line ROWs selected as study sites, a series of six soil pits were dug with a backhoe in a line perpendicular to the ROWs. Two of the pits were located in the adjacent forest and four were located in the ROW. These pits were evenly spaced from the forest edge to the center of the ROW. In each pit, a 1.5 m x 1.5 m pit face was evaluated for the total number of woody roots (> 3 mm dia.) and for the distribution of these roots with depth (10 cm increments). Mean total woody root numbers decreased with increasing distance from the forest edge, but numbers of woody roots at the center of the ROW were still about 35 % of that in the forest. Some woody roots from the forest extended up to 9 m into the ROW. Woody root concentrations decreased abruptly with increasing depth. The data show that relatively large numbers of woody roots exist near the surface of soils in the ROWs, thus providing a substantial potential for tree sprouting. Efforts to control tree sprouting should be directed toward reducing this reserve.

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Cette étude avait pour objectif de déterminer la quantité de racines d'espèces arborescentes dans une emprise de ligne en Louisiane, d'estimer la contribution des racines provenant des arbres adjacents à l'emprise et de déterminer la distribution des racines en fonction de la profondeur. Des tranchées furent excavées à l'aide d'une rétrocaveuse. Le nombre moyen de racines diminue de la bordure vers le centre de l'emprise. La plupart des racines se trouvent près de la surface du sol, favorisant la croissance des rejets.

# AN EXPERIMENTAL WINTER CUT IN A POWERLINE RIGHT-OF-WAY LOCATED IN A WHITE-TAILED DEER WINTER YARD

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In Québec, approximately 40 white-tailed deer (*Odocoileus virginianus*) yards are crossed by Hydro-Québec powerline rights-of-way (ROWs). To insure the operation of the electrical network, periodical vegetation control in ROWs is necessary. Studies conducted by Hydro-Québec showed that deer often feed in ROWs in winter where browse density is generaly greater than 100 000 twigs/ha. To maximize browse production in powerline ROWs, the woody vegetation was cut in February 1992 at 2 tower sites where double 735 kV lines are bisecting the Hill Head deer yard in the lower Laurentians 40 km north-west of Montréal (Québec). The objectives of this experimental winter cut were : 1) to measure browse availability and use by deer in the 1992 slash, and 2) to monitor browse regeneration in 1993. Stems were cut with chainsaws at snow level; 50 cm above ground. Some of the stems were left about on the ground while others were piled unevenly by the cutters. In May 1992, 20 1m$^2$ sample plots were distributed at each tower sites to determine the number of twigs available and browsed by deer in the slash. Forty 5m$^2$ random sample plots were used in 1993 to evaluate stem and twig densities, and the number of twigs browsed by deer. Ground and aerial observations indicated a heavy use of the slash within 24 hours after the start of the cut. Numerous trails and tracks led directly to the slash at both sites. The 1992 browse survey indicated that 72.5% of all available twigs in the slash at site 1 were used by deer whereas 27.1% were browsed at site 2. Maples, Pin Cherry and Choke Cherry were heavily browsed at both sites. Winter cut stems regenerated rapidly during summer 1992 with observed densities of 66,238 stems/ha (site 1) and 74,239 stems/ha (site 2). These are the highest stem densities ever recorded at these tower sites in 8 years of ROW monitoring. Twig densities greater than 200,000 twigs/ha were already observed at both sites in winter 1993, after one growing season. This study indicates that winter cutting in ROWs can provide food to deer during a high energy demand period. The 2 main advantages of a 50 cm aboveground winter cut are that : 1) out of reach browse is made available to deer in winter, and 2) there is no loss of a growing season as regeneration begins approximately 90 days after the cut.

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Dans un ravage de cerfs de Virginie (*Odocoileus virginianus*) traversé par une emprise de 2 lignes de transport d'énergie électrique à 735 kV, une coupe d'hiver a été effectuée pour favoriser l'alimentation immédiate des cerfs. Les arbustes ont été coupés à 50 cm du sol afin de rendre, dès l'hiver suivant, les repousses accessibles aux cerfs. Cette présentation fait état des résultats de production de brout et de son taux d'utilisation par les cerfs.

# LA VÉGÉTATION BASSE : ALTERNATIVE ÉCOLOGIQUE AUX PHYTOCIDES

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En 1991, le Comité de protection de la santé et de l'environnement de Gaspé inc. (CPSEG) a réalisé un projet de recherche et de développement d'alternatives à l'utilisation des phytocides pour l'entretien des emprises du réseau de distribution. Le CPSEG a procédé à des travaux et des essais pratiqués sur des parcelles expérimentales dans trois emprises distinctes dans le district du Grand Gaspé. Ce projet, subventionné par Hydro-Québec et intitulé «La végétation basse : alternative écologique aux phytocides», découlait du moratoire de six ans (1989-1995) sur les pulvérisations de phytocides du réseau de distribution dans la région Matapédia. Les objectifs principaux du CPSEG étaient d'initier de nouvelles recherches sur les alternatives aux phytocides, d'établir des communautés végétales basses pouvant ralentir la succession forestière de façon naturelle, de développer un modèle économiquement harmonieux pour la Gaspésie et de minimiser l'investissement requis pour l'acquisition de plants appropriés. Les méthodes comprenaient l'inventaire systématique des strates herbacée, arbustive et arborescente, ainsi que des espèces à couper. Les espèces compatibles dans 6 emprises autres que celles visées directement par le projet faisaient l'objet d'un inventaire supplémentaire. Le CPSEG a également réalisé l'inventaire des facteurs édaphiques, ainsi qu'un inventaire sommaire de la faune dans les emprises. Le CPSEG a ensuite procédé à une coupe sélective innovatrice en privilégiant l'utilisation de sécateurs. Nous avons déchiqueté et épandu du bois raméal provenant de la coupe, selon notre protocole. Finalement, nous avons procédé à la plantation de végétation basse, selon diverses méthodes de multiplication végétative, en s'approvisionnant localement. Nous avons également suivi les phases lunaires pour la plantation, selon notre protocole. Les résultats furent très encourageants, toutes les étapes étant réussies. On a constaté que la végétation compatible était abondante; que les plantations s'harmonisaient avec la beauté des paysages et les conditions environnementales de la région et qu'elles étaient bénéfiques pour la faune. La population et les institutions de la région ont pu participer en donnant des appuis et il y a eu création d'emplois. En conclusion, le CPSEG demeure fermement convaincu de la faisabilité et de la nécessité d'instaurer l'entretien écologique en permanence pour les réseaux de distribution et de transport.

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This report presents a research and development project on alternate methods to herbicides to control vegetation in powerline ROWs. It describes field experiments in the Gaspé region, Québec. Selective cutting, spreading of wood chips and plantation of shrubs were tested to establish compatible plant communities in ROWs.

# STUDIES OF RIGHTS-OF-WAY AND TRANSMISSION FACILITIES IN THE PACIFIC NORTHWEST

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Over the past 20 years, the Bonneville Power Administration (BPA), headquartered in Portland, Oregon, has conducted research into the effects of transmission lines and rights-of-way on a variety of subjects, including wildlife, domestic animals, agriculture, and social issues. Study findings have subsequently been applied to design better projects, to locate them responsibly, and to improve mitigation techniques. The display illustrates some of those studies conducted on BPA facilities in the States of Oregon, Washington, Idaho, and Montana. Current and proposed research directions are highlighted.

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Cette présentation traite de la recherche que mène Bonneville Power Administration quant aux effets des emprises de lignes sur la faune, les animaux domestiques, l'agriculture et les aspects sociaux.

# ENDOCRINE AND IMMUNE RESPONSES OF EWE LAMBS RAISED ON A 500 kV TRANSMISSION LINE RIGHT-OF-WAY

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Three separate and independent experiments were conducted to evaluate the biological responses of ewe lambs chronically exposed to electric and magnetic fields (EMF) produced from a commercial 500 kV a-c transmission line. Suffolk lambs (7-8 weeks of age) were assigned randomly in equal numbers to a control and treatment (line) group. Mean electric field strength in the line pen was 6.5+/-1.0 kV/m and the mean magnetic field strength was 44.2+/-11 mG. Animals in the control pen were exposed to a mean electric field of <0.01 kV and a mean magnetic field of 0.1 to 0.4 mG. The following biological parameters were monitored in experiments 1 and 2: body weight, wool growth, behavior, and serum concentrations of melatonin, cortisol, and progesterone. Blood samples were collected via jugular vein catheters at 0.5 to 3 hour intervals over eight 48-hour sampling periods (0, 2, 4, 10, 23, 30, 43 weeks of constant EMF exposure plus 1 week post-exposure) and sera analyzed for melatonin and cortisol. Serum progesterone was monitored twice weekly from 19 weeks of age to determine onset of puberty. In experiments 2 and 3 (exp. 3 is currently in progress), production of the immunoregulatory molecule interleukin-1 (IL-1) was quantified as an assessment of immune function. Statistical analysis of the two groups of animals revealed no significant differences in the parameters of growth, reproductive potential, or endocrine function. In contrast, animals exposed to constant EMF showed a marked reduction in IL-1 activity as compared to controls. This reduction was noted in both experiments 2 and 3. Post-exposure (exp. 2) or intermittent exposure (exp. 3) experiments suggest that the reduction in IL-1 activity induced by exposure to constant EMF was reversible. In summary, constant EMF exposure of sheep, while not affecting a variety of growth and endocrine functions, may markedly reduce IL-1 activity. IL-1 is an immunoregulatory molecule critical in development of normal immune responses and therefore additional research is needed to determine whether these results may have implications for effects of EMF on normal immune responses.

Various phases of this research have been supported by Bonneville Power Administration, American Electric Power Service Corp., Hydro Quebec, Western Area Power Administration, Houston Lighting and Power Co., and Salt River Project.

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Les auteurs présentent les résultats de 3 expériences relatives à la réponse d'agneaux aux champs magnétique et électrique. Ces résultats concernent le poids, la croissance de la laine, le comportement et le taux de progestérone dans le sérum.

# ROADSIDE OFFICE HELPS IOWA COUNTIES IMPLEMENT NEW PROGRAM FOR RIGHT-OF-WAY VEGETATION MANAGEMENT

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In 1988 the Iowa legislature responded to concerns over groundwater contamination, soil erosion and ever-increasing maintenance costs in our rights-of-way by creating a program called Integrated Roadside Vegetation Management (IRVM). The program involves greatly reducing herbicide use, working with landowners to reduce sedimentation of ditches, promoting existing prairie vegetation with prescribed burning and seeding bare areas to native prairie plants. Iowa's native prairie grasses and wildflowers are recognized as the vegetation best suited to preventing roadside soil erosion and weed invasion. Starting a county IRVM program entails gaining acceptance for a new philosophy, reorganizing some county services, hiring qualified personnel, learning new management techniques and planning implementation. To help county programs during the phasing-in stage and to provide them with continued support once in the program, the Iowa legislature also created the Office for Integrated Roadside Vegetation Management located in the Biology Department at the University of Northern Iowa. Since its creation 4 years ago, the office, with a staff of one full-time employee and one or two part-time students, has helped 38 counties adopt the program. The office continues to work with these counties serving as a clearinghouse of information, conducting research and demonstration projects and waging an ongoing education campaign to increase public awareness and acceptance. The office is currently working with several counties in varying stages of adopting the program and is organizing a campaign aimed at decision makers in counties where the program has not yet caught on. Even though 100% participation in IRVM is several years away, indications are that even the state's non-IRVM counties are undergoing changes in their roadside vegetation management practices consistant with the principles of IRVM.

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L'État de l'Iowa a instauré un programme intégré pour le contrôle de la végétation le long des routes. Ce programme vise 3 objectifs : 1) réduire l'utilisation des herbicides, 2) travailler conjointement avec les propriétaires privés pour diminuer la sédimentation dans les fossés, et 3) promouvoir l'implantation d'espèces végétales indigènes qui peuvent réduire l'érosion du sol et limiter la présence des mauvaises herbes. Jusqu'à présent, 38 comtés de l'Iowa ont participé au programme.

# COMPARING THE EFFECTS OF CHEMICAL AND MECHANICAL VEGETATION CONTROL METHODS ON A RAILROAD RIGHT-OF-WAY

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The array of vegetation control treatments have a considerably different visual impact on the right-of-way immediately after their application. This research was established to determine plant differences after several years. In 1988, mile-long plots on a railroad right-of-way in south central Indiana were treated as follows: 1) mechanically cut only, 2) a selective herbicide with residual soil activity (Tordon and Garlon), 3) a nonselective herbicide without residual soil activity (Roundup), and 4) a nonselective herbicide with residual soil activity (Arsenal). Twenty sample plots were established per mile for recording percent plant cover by species as well as bare ground. The plots were inventoried annually for three years after treatment. This presentation will discuss the impact of treatments on biodiversity indices as well as woody plant development.

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L'objectif de l'étude est d'évaluer les différences entre les communautés végétales dans une emprise de chemin de fer, quelques années après l'application de 4 méthodes de contrôle de la végétation. Ces méthodes sont : 1) coupe mécanique, 2) herbicide sélectif avec activité résiduelle dans le sol, 3) herbicide non sélectif sans activité résiduelle, et 4) herbicide non sélectif avec activité résiduelle. Les auteurs présentent les impacts de ces méthodes sur la végétation et sur la biodiversité.

# CURRENT DEVELOPMENTS IN TREE GROWTH REGULATORS

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The use and application of tree growth regulators is a continuously evolving arena. This topic will present the results of research being conducted at Purdue University in cooperation with DowElanco. This includes dose responses for physiological activity, infection responses, and basal, soil and implant application.

L'utilisation et l'application de régulateurs de croissance sur les arbres est un domaine de recherche en pleine évolution. Ce rapport présente des résultats sur la réponse des arbres selon le dosage et les modes d'application. Ces travaux de recherche sont menés conjointement par l'université Purdue et la compagnie DowElanco.

# ECOTOURISM POTENTIAL OF ABANDONED AND DESERTED CORRIDORS, HALIFAX COUNTY, NOVA SCOTIA

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The potential for abandoned and deserted corridors to enhance opportunities for ecotourism in Nova Scotia is being investigated through study of the abandoned railway line and deserted utility corridor in the Musquodobolt Harbour area of Halifax County. Baseline environmental and socio-economic data, pertinent to a defined 1 km zone for each corridor under study, are being collected from existing reports, inventories, maps, and key resource people representing municipal, provincial and federal governments, the academic community, local businesses and interest groups. Ecotourism potential will be determined through application of criteria adapted from the Canadian Heritage Rivers System selection process. Interpretive themes and development options will be proposed based on recreational, cultural and ecological attributes of the study corridors which are discerned from the rating exercise. Development and management options will be evaluated in terms of environmental impacts, opportunities for environmental education, and local economic benefits which may be derived from employment and enhanced business opportunities. The results of the study will be used to formulate an approch to identifying, developing and managing the ecotourism potential of abandoned and deserted corridors throughout Nova Scotia.

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Cette présentation traite des opportunités de développement pour l'écotourisme dans des emprises de lignes et de chemins de fer en Nouvelle-Écosse.

# ALLELOPATHIC POTENTIAL OF VOLATILE TERPENES OF EUCALYPTUS

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The undisturbed sites of *Eucalyptus* are virtually devoid of vegetation due to alleged allelopathic effects. Besides the release of allelochemics as water leachates or through microbial action, the role of volatile oils was assessed through various experiments conducted under laboratory and field conditions. There was significant reduction in germination and growth of pulse crops like *Lens esculentum* and *Phaseolus aureus* and forages like *Hordeum vulgare* and *Avena sativa*. In addition the contents of total chlorophyll and water and cell respiration (an index of cellular survival) were also seen to be greatly reduced. The oils, being heavier than air, form a continuous column and get adsorbed on the soil underneath where they adversely affect the vegetation. The amount of volatile oil terpenes varied from species to species as well as seasonally. Seventeen kinds of volatile terpenes were isolated from three Eucalyptus species namely *E. tereticornis*, *E. globulus* and *E. citriodora* employing GLC technique. Seven volatile terpenes namely b-pinene, a-pinene, cineole, linalool, citronellal, a-terpeneol and one unidentified were found common in the three species. Cineole constitutes the major part in *E. globulus* and *E. tereticornis*, while citronellal - in *E. citriodora*. The germination of *P. aureus* seeds maintained in fumatoria containing 20 nl/ml of either of the purified terpenes was greatly reduced. None of the seeds of *P. aureus* could germinate in fumatoria having cineole, citronellal, linalool, and a-terpeneol as volatile component. In fumatoria having a-pinene, b-pinene, p-cymene, citronellol, citral, limonene, geraniol and geranyl acetate vapour, the germination of P. aureus varied from 60-70%. The root and shoot growths were also inhibited significantly.

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La résistance des communautés d'eucalyptus à l'invasion d'autres plantes est possiblement reliée à des effets allélopathiques. Cette présentation traite d'expériences en laboratoire et sur le terrain pour déterminer le potentiel allélopathique des terpènes (huiles volatives) d'eucalyptus.

# GRAPHIC PRESENTATION OF ENVIRONMENTAL RESTRICTIONS : A PLANNING TOOL FOR PIPELINE CONSTRUCTION

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Environmental issues have become increasingly important in the construction of interstate natural gas pipelines. Many environmental concerns involve both spatial and temporal dimensions, i.e. a particular location may be environmentally sensitive for only certain periods during the year. Specific examples of this time-dependent sensitivity include nesting periods for endangered birds or spawning periods for various species of trout. Consequently, when all regulatory time windows are considered, pipeline companies routinely encounter serious problems in developing construction schedules. Comprehensive planning tools are needed for pipeline companies to overcome these problems and proceed with construction projects on a timely basis. In response to this need, the authors developed a simple but extremely effective graphic presentation to display the various time restrictions that occur along the right-of-way of a proposed project. Plotting time on the y-axis and milepost on the x-axis, the charts present a visual representation of the locations and dates when construction can and cannot occur. Depending on the scales selected, a restriction for an eagle nest might appear as a bar with a base of several miles and extending vertically for the period covered by the restriction. By plotting all known time restrictions on the chart, planners can optimize the construction schedule. The chart clearly indicates which restrictions are the most limiting and allows planners to focus their efforts on negotiating with agencies to obtain a variance. The charts have also proven useful as a means of tracking construction progress. By assuming a starting date, milepost, and a daily rate of progress, the construction schedule can be overlain directly on the chart. This appears as a series of colored dashed lines that represent the various phases of construction i.e. clearing, grading, trenching, backfilling and cleanup. During construction the actual progress is plotted as a solid line which allows for effective comparisons between projected and actual progress. Production of the charts is accomplished with presentation graphics software that is commercially available and a printer with color graphics capabilities. The potential exists for the development of a more automated system or the integration of this approach into a GIS system.

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Lorsque toutes les contraintes temporelles sont considérées, les compagnies de pipelines éprouvent souvent des difficultés à établir des calendriers de construction. Les auteurs ont développé une méthode graphique permettant d'illustrer les restrictions temporelles de construction d'un projet. Lorsque la construction débute, l'état d'avancement du projet peut être suivi quotidiennement.

# ÉTUDE DE LA COMPÉTITIVITÉ D'ESPÈCES HERBACÉES POUR LE CONTRÔLE BIOLOGIQUE DE LA VÉGÉTATION INCOMPATIBLE SOUS LES LIGNES DE TRANSPORT D'ÉLECTRICITÉ D'HYDRO-QUÉBEC

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Des essais en serre ont été conduits à l'Université Laval en 1991 et 1992 afin d'évaluer le potentiel de 5 espèces herbacées pour le contrôle de la végétation ligneuse dans les emprises d'Hydro-Québec. Les espèces herbacés interférentes (EHI) étaient : *Centaurea nigra* L. (centaurée noire), *Agropyron repens* (L.) Beauv. (chiendent), *Hypericum perforatum* L. (millepertuis), un mélange 80 % raygrass anglais (*Lolium perenne* L.) + 20 % fétuque rouge (*Festuca rubra* L.) et *Vicia cracca* L. (vesce jargeau). Le potentiel d'interférence de ces espèces a été étudié par rapport à trois espèces ligneuses incompatibles (ELI) : le bouleau jaune (*Betula lutea* Britton), le bouleau à papier (*Betula papyrifera* Marsh.) et l'érable à sucre (*Acer saccharum* Marsh.). La compétitivité des EHI face à chaque ELI a été évaluée par des séries de remplacement avec des proportions de 100 % EHI-0 % ELI, 75 % EHI-25 % ELI, 50 % EHI-50 % ELI, 25 % EHI-75 % ELI, 0 % EHI-100 % ELI. Les espèces ont été établies en pot en juin 1991. Soixante-quinze jours après l'établissement, les recouvrements de chaque espèce ont été évalués visuellement. Cinquante jours plus tard, la biomasse aérienne des EHI a été mesurée, puis les pots ont été placés en hibernation pendant environ 150 jours. Quatre-vingt-cinq jours après l'hibernation (soit en juillet 1992), les mesures de recouvrement ont été répétées et la biomasse aérienne des EHI et ELI a été mesurée. Le recouvrement, la hauteur et la biomasse des EHI étaient peu affectés par les espèces ligneuses et leurs proportions dans le mélange. Avant l'hibernation, le mélange ray-grass + fétuque rouge concurrençait le mieux les ELI, suivi par le chiendent, la centaurée noire, le millepertuis et la vesce jargeau. Après l'hivernage, le chiendent est devenu, de loin, l'espèce herbacée la plus compétitive. La forte mortalité hivernale (environ 50 %) du mélange ray-grass + fétuque rouge a réduit considérablement sa capacité à compétionner les ELI. Cependant, l'effet de sa compétitivité en 1991 était toujours visible en 1992 puisqu'il avait laissé peu de ligneuses s'établir. En 1992, la compétitivité du mélange ray-grass + fétuque rouge se comparait à celle de la centaurée noire. La vesce jargeau a été l'espèce la moins affectée par l'hiver, mais sa faible compétitivité lors de l'année du semis avait permis un bon établissement des ligneuses, et celles-ci ont bien résisté à la compétition en 1992. Le millepertuis est demeuré l'espèce la moins compétitive du groupe, il s'est avéré très sensible à l'hivernage.

This paper deals with competitiveness between 5 herbaceous species and 3 woody species tested in greenhouse for biological control of powerline ROWs vegetation.

# L'UTILISATION D'ESPÈCES ARBUSTIVES COMME CONTRÔLE BIOLOGIQUE DE LA VÉGÉTATION INDÉSIRABLE DANS LES EMPRISES DE LIGNES DE TRANSPORT D'ÉLECTRICITÉ

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L'objectif global de cette recherche est de mettre au point de nouvelles méthodes d'aménagement des emprises en utilisant des espèces arbustives qui peuvent contrôler la présence des espèces indésirables. L'étude a débuté dans la région de Montréal par la sélection de 25 espèces d'arbustes classées selon leur potentiel de blocage successionnel. La deuxième étape de l'étude a permis l'échantillonnage des communautés végétales d'une portion d'environ 20 km d'une emprise. Les données issues de cette campagne d'échantillonnage ont été utilisées pour analyser le comportement successionnel des arbustes à l'aide des vecteurs de succession. Cette analyse a démontré le potentiel de blocage de six espèces arbustives en fonction des dépôts de surface et des classes de drainage. Les espèces retenues sont : cornouiller stolonifère (*Cornus stolonifera*), spirée blanche (*Spiraea alba*), clavalier d'Amérique (*Zanthoxylum americanum*), saule pétiolé (*Salix petiolaris*), sumac vinaigrier (*Rhus typhina*) et cornouiller oblique (*Cornus obliqua*). La suite de cette étude a consisté à développer plusieurs approches favorisant l'étalement horizontal de ces espèces arbustives. Nous avons retenu trois approches distinctes : i) traitements expérimentaux de type horticole sur des arbustaies déjà existantes; ii) plantations d'arbustes; iii) des études sur le développement architectural du port arbustif. Pour les traitements expérimentaux, un marcottage et un recépage ont été effectués sur les espèces suivantes : la spirée blanche, le saule pétiolé et le cornouiller stolonifère ainsi qu'un recépage des tiges de cornouiller oblique. Sauf pour le *Cornus obliqua*, ces mêmes espèces ont été utilisées en plantation expérimentale en plus du *Rhus typhina*. Finalement, l'étude architecturale des arbustes permet de mieux comprendre le mécanisme de densification des tiges selon les caractéristiques de l'espèce. De plus, des essais d'injection de capsules de glyphosate ont été faits sur trois espèces arborescentes afin de les éliminer d'une emprise de lignes de transport d'énergie. Finalement, nous vérifions si le thuya occidental (*Thuya occidentalis*) peut être utilisé comme un arbuste de blocage successionnel ainsi que la capacité des arbustaies à empêcher la présence de semis d'arbres sous leur canopé.

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This research project focuses on shrub communities to control undesirable woody species in powerline ROWs. Three approaches are tested: horticultural techniques on ROW shrub communities; shrub plantations in ROWs and shrub architectural development.

# ANALYSE DE DIFFÉRENTES CAUSES D'ABANDON DE LA HÉRONNIÈRE DE WATOPEKA TRAVERSÉE PAR LA LIGNE À 450 kV RADISSON-NICOLET-DES CANTONS

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La héronnière de Watopeka est une colonie de Grand Héron (*Ardea herodias*) située dans la région de Sherbrooke, Québec. Suite au choix définitif du tracé de la ligne à 450 kV Radisson/Nicolet/des Cantons, il s'est avéré que l'emprise de cette ligne traversait cette héronnière. Connue depuis 1986, cette héronnière a été l'objet d'un suivi environnemental de 1987 à 1992. Cette période couvre les deux saisons ayant précédé le déboisement de l'emprise (1987-1988), le déboisement lui-même, la construction et les deux saisons ayant suivi ces travaux (1991-1992). Au printemps 1992, la colonie fut abandonnée par les hérons. Le présent ouvrage analyse différentes causes ayant pu provoquer l'abandon de cette colonie. Ces causes sont : la présence de la ligne à 450 kV, les activités de suivi en 1991, des dérangements d'origine humaine autres que ceux occasionnés par les travaux d'Hydro-Québec, la présence d'un couple de Grand-duc d'Amérique (*Bubo virginianus*) nichant dans un nid de héron, la coupe forestière dans le voisinage de la colonie, le contexte régional des colonies de hérons, la disponibilité des proies et la qualité des arbres porteurs de nids.

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This presentation discusses causes for the abandonment by Great Blue Heron of the Watopeka rookery. This heronry was located close to a 450 kV poweline in southern Québec, Canada.

# SELECTIVE VEGETATION REMOVAL UNDER A 500 kV LINE IN SHASTA COUNTY, CALIFORNIA

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In 1991, Pacific Gas and Electric Company's Department of Research and Development initiated a 5-year study to evaluate vegetation management techniques for transmission rights-of-way that are cost-effective, environmentally acceptable, and meet operational requirements. We set up study plots in the 500 kV Pacific Intertie ROW in Shasta County, California to test management methods for maintaining low growing vegetation, which is considered desirable because it poses a lower risk of causing fire-related problems, will not interfere with conductors, and may also prevent the establishment of trees and tall shrubs. In a 3-acre, completely randomized block design, we applied two treatments during fall 1991: selective, manual removal of tree species and arborescent shrubs and complete removal of all vegetation by Hydro Axe 711 mower. We tracked all costs. We sampled each plot in late spring and fall of 1992, using three randomly chosen transect lines with five 0.5 m x 0.5 m quadrats where we collected percent cover data. Selective removal costs were about $740 per acre and complete removal costs were about $370 per acre. On the control plots, the dominant species was *Arctostaphylos patula*, an arborescent shrub. On the selective removal plots, the new dominant species was *Ceanothus cordulatus*. Where vegetation was completely removed, *Rhamnus californica* spp. *californica* became dominant. Both shrubs are shorter than *A. patula* and are believed to be less flammable. For both tree and shrub species, about three times more germinated and established in the complete removal plots compared to the selective removal plots. The higher percent cover of R. californica on the complete removal plots is caused by two factors. Because of clumped distributions of shrubs at the site, *R. californica* cover was, by chance, higher on plots assigned complete removal than on those assigned the selective removal treatment. *R. californica* was then better able than *C. cordulatus* to germinate under conditions of complete removal. We expect it to increase in dominance as it continues to be favored by wind and animal dispersal of seeds. We will continue to monitor the sites, tracking vegetation composition, and evaluating the need for herbicides to control resprouting.

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En 1991, Pacific Gas and Electric a débuté une étude d'une durée de 5 ans dans le but d'évaluer les techniques de maîtrise de la végétation dans une emprise de ligne à 500 kV. Ces techniques doivent être économiques, acceptables au plan de l'environnement et réalisables à grande échelle.

# RÉCOLTE D'ORIGNAUX (*ALCES ALCES*) PAR LA CHASSE SPORTIVE À PROXIMITÉ DES EMPRISES DE LIGNES DE TRANSPORT D'ÉNERGIE ÉLECTRIQUE

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Dans le cadre de l'étude des impacts des emprises de lignes de transport d'énergie électrique sur la faune, Hydro-Québec a voulu vérifier l'influence de la présence d'une ligne sur la récolte de l'orignal (*Alces alces*) par la chasse sportive. La récolte d'orignaux à la chasse sportive dans des placettes associées à une emprise a été comparée à celle obtenue dans des placettes sans emprise. Ces placettes étaient situées dans une aire définie par les points suivants : au sud, le fleuve Saint-Laurent; à l'est, Québec; à l'ouest, Montréal et au nord, Chibougamau. Pour l'étude de la récolte à la chasse sportive, 6 placettes d'une longueur de 120 km et d'une largeur de 1 000 m, traversées par une emprise de ligne ont été étudiées entre 1982 et 1990 inclusivement. Six placettes témoins, de mêmes dimensions et situées à proximité des premières, ont aussi été étudiées. Durant les 9 années étudiées (1982-1990), les chasseurs ont récolté au total 178 orignaux dans les placettes associées à une emprise et 148 orignaux dans les placettes témoins. La différence n'est pas significative. Une bonne relation entre la récolte par la chasse et les densités de réseaux de pistes d'orignaux a été notée ($r^2 = 0,83$).

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This paper presents data on moose (*Alces alces*) hunting in relation to the presence of powerline rights-of-way. Data indicate that the number of moose harvested near ROWs and in control areas were not significantly different.

# ALLELOPATHIC INTERACTIONS OF *PARTHENIUM HYSTEROPHORUS* L. AND *AGERATUM CONYZOIDES* L. WEEDS

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*Parthenium hysterophorus* L. and *Ageratum conyzoides*, both exotics are fast spreading in India; the former from south to northwards, while the latter from north southwards. In Chandigarh (30° 7'N, 70° E, 280 m MSL) both weeds are seen to occupy neighbouring localities forming well-defined exclusive territories of their own. Soil samples from both the areas as well as from areas free of vegetation were collected from randomly selected sites, at depths 0-7, 14-21 and 28-35 cm. The seeds of both weeds sown in soil samples showed differential response in respect to germination and subsequent growth. The seeds of *P. hysterophorus* totally failed to germinate in either of the soil samples collected from areas occupied by *P. hysterophorus* itself or the top soil of *A. conyzoides* occupied areas. Nearly 20% seeds of *P. hysterophorus* germinated in middle and bottom layers of *A. conyzoides* occupied area soil compared to 86% in control. The lengths of radicle were reduced significantly while those of plumule remained more or less unchanged. Likewise, the seeds of *A. conyzoides* failed to germinate in top soil of its own territory. In soil of middle layer, nearly 60% seeds germinated. However, no change compared to control could be visualized in bottom layers of *A. conyzoides* occupied areas. The subsequent growth was, nevertheless, significantly reduced. The seeds of *A. conyzoides* showed 30-40% germination with significant growth reductions in top, middle and bottom layers of soil occupied by *P. hysterophorus*. Further, the phytochemics collected from the soil under *P. hysterophorus* were more than that from *A. conyzoides*. In contrast, the soil free from each of these weeds was found to contain negligible content of phytochemics. The soil chemics thus collected exhibited strong bioefficacy against *Chenopodium rubrum*; another weed which is being replaced by *P. hysterophorus* and *A. conyzoides* very fast. The germination percentage, growth, contents of chlorophyll and water and values of cell survival of *C. rubrum* were reduced significantly when given the treatment of different concentrations of chemicals extracted from *A. conyzoides* and *P. hysterophorus* soil. The complete replacement of *C. rubrum* from such areas can be viewed as allelopathic impacts of *A. conyzoides* and *P. hysterophorus*.

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Cette présentation traite des interactions allélopathiques entre 2 herbacées (*Parthenium hysterophorus* L. et *Ageratum conyzoides*) introduites en Inde.

# URBAN WILDLIFE CORRIDORS IN THE UNITED KINGDOM

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The last few years have seen the incorporation of wildlife corridors into the Local Plans and Unitary Development Plans of many cities and towns throughout the United Kingdom. In addition to an ecological function, it is intended that the public should have access along them. A review is presented of the corridors of 18 urban areas, focussing on such aspects as geometry, connectivity, habitat structure and extent of public access leading to a synopsis of those characteristics which urban planners have identified as being essential for a successful wildlife corridor. The results of this review are then compared with three case studies of wildlife corridors. These corridors were assessed and analysed by a team of ecologists from a number of viewpoints. One corridor had been created under transmission lines in the east of London, the second concerned three corridors running into the west of Cambridge, and the third focussed on a motorway verge in the suburbs of Bristol. In all three cases public access was considered to be an important part of corridor function. The comparison generates a series of ecological criteria for establishing wildlife corridors and emphasizes the incongruity which can exist between the incorporation of such corridors into urban planning and the ecological reality. It is concluded that in order to develop the concept of wildlife corridors, broadly acceptable criteria should be used to facilitate design and implementation but more importantly they should be used as a basis of appraisal after the corridor has been established. This is an essential means of determining whether or not corridors serve given ecological criteria and whether or not this function can be achieved in conjunction with public access.

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Ces auteurs discutent de la polyvalence des emprises au Royaume-Uni. En plus de servir d'habitats fauniques en milieu urbain, ces emprises doivent être accessibles au public. Trois études de cas sont comparées : une dans une emprise de ligne d'énergie électrique, une autre dans trois corridors et la troisième sur l'accotement d'une autoroute. Cette comparaison engendre des critères écologiques pour la création d'habitats fauniques dans les emprises et met en évidence l'incongruité qui existe entre l'intégration de ces emprises dans l'exercice de planification urbaine et la réalité écologique

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