WORKSHOP PROCEEDINGS
2001-8

sustainable forest management network

réseau sur la gestion durable des forêts

Student Workshop
October 18-20, 2001
University of Alberta
Edmonton, Alberta

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Proceedings of the

Sustainable Forest Management Network

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STUDENT WORKSHOP and FIELD TOUR
October 18-20, 2001
DRAFT AGENDA

THURSDAY, OCTOBER 18
Edson, AB

6:30 AM	FIELD TOUR hosted by Weyerhaeuser Company

FRIDAY, OCTOBER 19
CW410 Biological Sciences Building, University of Alberta, Edmonton, AB

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9:15	Landscape Level Influences on Stand Infestation by Pest Insects in Managed Forests *Jane Park, University of Calgary*
9:40	The Impact and Dynamics of Forest Tent Caterpillar Outbreaks in the Aspen-Dominated Forests of Alberta: Implications for SFM *Barry Cooke, University of Alberta*
10:05	Comparing Stand Origin Ages with Forest Inventory Ages on a Boreal Mixedwood Landscape *Rene Martin, University of British Columbia*
10:30 AM	COFFEE BREAK
10:45 AM	Session 2 – Assessing the Impacts of Silvicultural Intensity
10:45	The Reproductive Consequences of Forest Thinning in Bark Beetles *Colleen Simpson, University of Calgary*
11:10	Effects of Intensive Management on Forest Structure, Composition and Understory Biodiversity in the Western Boreal *Cristina Mourelle, University of Alberta*
11:35	Effects of Silvicultural Intensity at the Stand and Landscape Scales on Reproductive Activity of Forest Songbirds *Jean-Sébastien Guénette, Université de Moncton*
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1:00	Derivation of a Remotely-Sensed Index for Predicting the Potential Susceptibility of Surface Water Quality to Disturbances on the Canadian Boreal Plain *Marta Wolniewicz, University of Western Ontario*
1:25	Wetland Characterization at Duck Mountain, Manitoba: Towards a Classification *Dave Locky*

1:50 PM Session 4 – Achieving SFM through Integration and Partnerships

1:50 Towards Sustainable Forestry: A Proposal for Forest Management Linking Ecology, Forestry and Community
Stephen Yamasaki, Université du Québec à Montréal

2:15 Working Towards an Integrated Forest Management Strategy
Pia Wilkinson-Chapman, University of Alberta

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3:00 PM Poster Presentations

Alumni House, University of Alberta, Edmonton, AB
5:00 PM Dinner

SATURDAY, OCTOBER 20
CW410 Biological Sciences Building, University of Alberta, Edmonton, AB

9:00 AM Session 5 – Setting the Baseline Conditions

9:00 Environmental evaluation of land-applied pulp mill biosolids: Monitoring fate of sludge constituents in forest ecosystems and assessing impact using ecologically relevant organisms
Vadim Bostan / Emil Bandelj, Ryerson Polytechnic University

9:25 Estimation of weathering rates of silicate minerals in forest soils of Duschenay Forest Station (Québec): Mineralogy and grain-size distributions
Dieudonne Grodya Dhechuvi, Université du Québec à Montréal

9:50 Characterizing the Alberta landscape via satellite imagery
Mark Kachmar, University of Alberta

10:15 AM COFFEE BREAK

10:30 AM Session 6 – Modeling Tools for SFM

10:30 A Decomposition Approach to Modeling Overlapping Tenures in Alberta: A Case Study
David Nanang, University of Alberta

10:55 Biodiversity Assessment Project within the FMA of Millar Western Forest Products
Ryan Ancelin, Dalhousie University

11:20 A Spatial Assessment of Vertebrate Species Risk in Industrial Forest Management, New Brunswick, Canada
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ORAL PRESENTATIONS

Landscape Level Influences on Stand Infestation by Pest Insects in Managed Forests
Jane Park
Biological Sciences, University of Calgary

Forest landscapes are changing continually due to natural and anthropogenic disturbances. Logging alters the structure of the landscape, and may influence the dispersal and habitat selection of organisms. Potential pest insects such as bark beetles (Coleoptera:Scolytidae) that inhabit dead and dying conifer wood are likely to affected by landscape heterogeneity caused by logging. Although there has been increased interest in the effects of landscape heterogeneity on the dispersal of organisms, many studies capture only a static snapshot of insect abundance, which can be misleading in the continually changing landscape following logging. Research conducted at the EMEND project site in Northern Alberta showed that *Polygraphus rufipennis*, a bark beetle inhabiting freshly dead conifer logs, alters its movement according to the distribution of host trees and habitat patches. Static information on the distribution and abundance of *P. rufipennis* will be used in a spatially explicit incidence function model that will be able to predict patterns of colonization across the landscape. Forest managers can use this model when planning future sites of harvest such that insect infestations can be mitigated.

The Impact and Dynamics of Forest Tent Caterpillar Outbreaks in the Aspen-Dominated Forests of Alberta: Implications for Sustainable Forest Management
Barry J. Cooke
Biological Sciences, University of Alberta

Patterns of defoliation inferred from trembling aspen (*Populus tremuloides* Michx.) ring widths show that outbreaks of forest tent caterpillar (*Malacosoma disstria* [Hbn.]) are a major disturbance affecting primary forest production. Pattern analysis reveals that outbreaks in Alberta are weakly periodic and weakly synchronized, which contrasts sharply with outbreak patterns in Ontario. The breakdown in outbreak synchrony in Alberta occurs over local and regional spatial scales, and is associated with uniquely Albertan patterns of land-use and climate. Such spatiotemporal complexity argues against the use of simplistic disturbance and harvest scheduling models. Forest fragmentation and climate change are expected to alter the dynamics of tent caterpillar outbreaks, thus posing an additional challenge for sustainable forest management. Finally, should protective intervention become economical in the short-term, control programs would still be risky in the long-term because perturbations affecting caterpillar populations should propagate out to the natural enemy community and eventually feed back, thereby influencing the dynamics of forest tent caterpillar populations in complex and unpredictable ways.

Comparing Stand Origin Ages with Forest Inventory Ages on a Boreal Mixedwood Landscape
Rene Martin, Peter Marshall, David Andison and Val LeMay
Forest Resources Management, University of British Columbia

The study of natural disturbance patterns is becoming increasingly common under the auspices of managing for biological values. This strategy should be particularly effective in the boreal forest where fire regimes are thought to be straightforward, and easy to translate into guidelines. Unfortunately, the most common age data available on boreal landscapes to conduct such analyses are from forest inventories, which we know to be inaccurate. We will build and compare a much more accurate "stand-origin" map with the age map from new inventory data for a 30,000 ha area in northwest Saskatchewan. The objective of this study is to determine the exact nature and degree of any spatial inaccuracies and biases associated with inventory age data, towards identifying the most reasonable and efficient solution for those who would like to pursue more detailed fire history or natural range of variation studies. Given the growing importance of natural pattern knowledge, it is necessary to understand the limitations of, and

possible corrections for, using inventory ages rather than more exact stand-origin ages when assessing disturbance patterns (shapes and sizes).

The Reproductive Consequences of Forest Thinning in Bark Beetles

Colleen M. Simpson
Biological Sciences, University of Calgary

Stand thinning is an intensive forest management practice in which some proportion of trees are removed evenly throughout the stand to enhance the vigour and growth of the remaining trees. Thinning is expected to have two main classes of effects that may influence herbivore life history. First, once a stand is thinned microclimate is immediately changed, affecting temperature and wind speed. The second, more delayed effect of thinning is a change in the growth or vigour of the remaining trees is a stand. I used the pine engraver bark beetle, Ips pini (Say) which breeds in freshly dead lodgepole pine (Pinus contorta) as a model system to investigate the reproductive consequences of forest thinning in an herbivorous insect.

Effects of Intensive Management on Forest Structure, Composition and Understory Biodiversity in the Western Boreal

Cristina Mourelle and S. Ellen Macdonald
Renewable Resources, University of Alberta

Our study examines the effects of one-, four-, and five years following salvage thinning on forest structure, soil nutrients, composition and diversity of understory plants. The thinning treatment consisted of the removal of 1/2 to 1/3 of the live trees comprising 40% of the basal area. The recently thinned stands and the unthinned ones had a lower percentage cover of coarse woody material than the five and four years stands following thinning. For all-understory species and for just shrubs, mean species richness per plot, and turnover among plots and among stands were lowest in the first year after thinning. Five years after thinning stands showed an increase in species turnover, in mean species richness per plot and in total species richness per stand as compared to the unthinned ones. For herbs, thinning reduced species turnover among plots by 50% and the older thinned stands present the lowest values. The thinning treatment and NH4 availability were the best predictors of mean species richness per plot for all-understory species, mean herb species richness per plot, and herb species turnover. PO4 availability and thinning treatment were significantly related to total species richness per stand. Total shrub and herb covers per plot increased with the percentage of deciduous trees and NH4, respectively. We conclude that the manipulation of stand density produces significant changes in species richness, species cover and species turnover in the understory plant community at the plot and the stand levels.

Effects of Silvicultural Intensity at the Stand and Landscape Scales On Reproductive Activity of Forest Songbirds

Jean-Sébastien Guénette
Biology, Université de Moncton

This project aims to determine whether forest songbirds exhibit a threshold response to silvicultural intensity in their probability of presence and of reproductive activity. In the summers of 2000 and 2001, we used stratified random sampling to select 332 stations representing a gradient in silvicultural intensity. The treatments applied in the study area include conifer plantation, selection cutting and patch cutting. At each station, we performed a 5-min point count census to record the bird species present and their relative abundance. During the next 5 minutes, we played a recording of Black-capped Chickadee mobbing calls to attract birds toward the observer and to detect signs of reproductive activity (bird pairs, adults carrying food, family groups, etc.). Observations were pursued during a third 5-min period, for a total of 15 minutes per visit to each station. This method was developed, calibrated, and successfully used in the same region. We then examined major gradients in stand structure and composition using a principal

components analysis on 13 variables. The first axis separated conifer plantations from other stand types, while the second axis could be interpreted as a gradient in harvesting intensity. For the species responding most frequently to the mobbing calls playbacks, we used logistic regression to build predictive models to examine the relationship between silvicultural intensity and their probability of presence and reproductive activity. Preliminary results suggest significant relationship between harvest intensity and reproductive activity of the Ovenbird, the Boreal Chickadee and the Golden-crowned Kinglet. Moreover, we analyzed landscape structure within 0.25, 0.5, 1 and 1.5-km radii around each station. Results from these analyses will be presented.

Derivation of a Remotely-Sensed Index for Predicting the Potential Susceptibility of Surface Water Quality to Disturbances on the Canadian Boreal Plain

M. Wolniewicz[1], R. Clark[1], I.F. Creed[1,2]
[1]Department of Geography, University of Western Ontario
[2]Department of Plant Sciences, University of Western Ontario

On the Boreal Plain, the boreal mixed-wood forest is characterized by complex drainage basins, with hydrologically organized to disorganized drainage networks. Within these drainage basins, the connectivity of surface saturated areas (SSAs) has been shown to be an important regulator of nutrient loading to lakes. We sought to derive an INDEX of the hydrological connectedness of SSAs to create maps of the potential susceptibility of drainage basins to disturbances. A hydro-climatic analysis was conducted to capture hydrologic dynamics of the Moose Lake, an experimental drainage basin on the Boreal Plain. Based on this analysis, remotely sensed images were selected representing conditions ranging from very dry (Antecedent Moisture Index [AMI]=0-10 mm), dry (11-20 mm), moist (21-30 mm), wet (31-40 mm), to very wet (41-50 mm). For LANDSAT analyses, TM band (5) and hybrid bands (5/2, 2/5) were classified to derive maps of the INDEX and change detection techniques were applied to determine the variability in the INDEX under different AMI conditions. The results were corroborated using reference data including ground-based observations and distributed hydrologic modeling results. Image analyses indicated that during dry periods, SSAs were small and hydrologically disconnected from Moose Lake. As AMI increased, the SSAs expanded, creating a larger area of hydrologically connected SSAs to the lake. The increased SSAs connectedness corresponded to an increase in the water levels and nutrient status of the lake, indicating an increased susceptibility of the drainage basin to disturbance. This research provides a foundation for investigating the hydrological control on the potential for forest growth and yield following disturbances within the drainage basins.

Wetland Characterization at Duck Mountain, Manitoba: Towards a Classification

Dave Locky
Biological Sciences, University of Alberta

Rapid changes are occurring to the Canadian boreal landscape due to industrial activities such as forestry. A large proportion of this landscape is comprised of wetlands, in particular forested and non-forested peatlands. In order to gauge potential impacts of forestry on wetlands, an understanding of the inherent variability of natural wetlands, both the abiotic elements and the associated plant biodiversity, is vital. One of the first steps in this approach is characterization of natural wetlands leading to wetland classification. Ninety-nine wetlands were surveyed at Duck Mountain, Manitoba for floristic diversity, forest mensuration variables, edaphic factors, and water chemistry. Our objectives were to characterize the variability of natural wetlands and eventually develop a classification system. Approximately half of the sites were forested peatlands. Preliminary statistical analyses of all the variables except the floristic component have revealed that sites averaged 1.7 ha in area and average peat depth was 1.3 meters. pH and conductivity varied greatly among sites, ranging between 3.7 8.3 and 15 1104 *m*S, respectively. Statistical analysis by ordination of physical data revealed site differences as gradients best explained by peat depth and soil bulk density. Similar analyses of site water chemistry demonstrated gradients best

explained by total dissolved nitrogen, dissolved organic carbon, calcium, magnesium, and colour. Site size does not appear to influence the variables tested in either forested or unforested sites. Analysis of the floristics data will be the next step leading to a classification.

Towards Sustainable Forestry: A Proposal for Forest Management Linking Ecology, Forestry, and Community

Stephen Yamasaki
Sciences biologiques, Université du Québec a Montréal

Our research group has been developing a framework for sustainable forest management. The work has focused on the integration of fundamental knowledge of the bio-physical and socio-economic impacts of forest management as well as on the development of an understanding of the dynamics among stakeholders. Through collaboration among a multi-disciplinary team of researchers, indicators of biodiversity, water quality, soil fertility, forest productivity, and community sustainability have been developed. A functional prototype landscape-level model has been developed for the Mauricie region, and includes disturbances by wildfire and harvesting. Results thus far indicate that extended rotations are necessary to maintain the age-class structure of the landscape within the bounds of the natural disturbance regime. We will build on these foundations and develop a process for the involvement of public participation in adaptive forest management aided by a refined landscape modeling tool incorporating biophysical and socio-economic indicators of sustainability.

Working Towards an Integrated Forest Management Strategy

Pia Wilkinson-Chapman
Anthropology, University of Alberta

I shall present the findings from my first year of research (2000-2001). The objective of my research is to document and evaluate the socio-cultural and economic aspects of the partnership between Millar Western Forest Products (MWFP) and the Alexis First Nation (AFN). I shall demonstrate the progress in three main areas of the partnership: the traditional land use study, the education program and, economic development.

My research also entails the creation of a long-term, adaptive framework for effective collaboration between MWFP and the AFN that includes mechanisms for resolving conflicts. This is being accomplished through:

1) Identifying the barriers (social, cultural, economic) that impede effective community-industry collaboration;
2) Facilitating communication by identifying areas of conflict;
3) Identifying real and potential production barriers so as to reduce transaction costs.

Environmental Evaluation of Land-Applied Pulp Mill Biosolids: Monitoring Fate of Sludge Constituents in Forest Ecosystems and Assessing Impact using Ecologically-Relevant Organisms

V. Bostan, E. Bandelj, L.H. McCarthy, K. Yambao, and M. Partyka
Chemistry, Biology, and Chemical Engineering, Ryerson Polytechnic University

Land application of pulp mill biosolids has several potential benefits, including an inexpensive alternative to fertilizers for agricultural use. However, critical long-term assessment of these land applications and their impact on terrestrial and receiving-water biota have not been established. Bioassays with distinct endpoints that include an array of relevant organisms in order to assess the possible toxic effects of pulp mill biosolid land application are clearly needed. The current study has incorporated several test organisms that include vertebrate and invertebrate animals, and plant groups found in soil and receiving freshwaters. These include the green algae *Selenastrum capricornutum*, the terrestrial plant *Brassica rapa* and water-borne duckweed *Lemna minor*. The watercolumn invertebrate *Daphnia magna* and the benthic

organism *Hyalella azteca*, along with the mosquitofish *Gambusia affinis* were also utilized. Lastly, the terrestrial invertebrate earthworm *Lumbricus terrestris* was also examined in land application experiments. A laboratory set-up was developed for the collection of water runoff from soil samples treated with and without biosolids. A small-scale mesocosm incorporating many of the aforementioned aquatic species have helped foster an understanding of the potential conditions occurring in receiving waters proximal to biosolid-amended soil at the macro level.

Estimation of Weathering Rates of Silicate Minerals in Forest Soils of Duschenay Forest Station (Quebec): Mineralogy and Grain-Size Distributions

Dieudonne Grodya Dhechuvi
Environmental Sciences, Université du Québec à Montréal

Soil weathering is an important source of nutrient cations for development of forested ecosystems, but the rates of which these nutrients are released are not well known. Weathering rates also influence soil buffering capacities related to acidic deposition in watersheds and control the cycling of many inorganic nutrients which are important in soil fertility and on long term climate change. Soil can be defined as a natural body consisting of generally inconsolidated layers or horizons of mineral and/or organic constituents of variable thickness which differ from parent material in morphological, physical, chemical and mineralogical properties. Jenny (1980) proposed any dependant soil property as a function of a number of independent soil properties such as parent material, topography, age, and organisms. Weathering rates of primary and secondary minerals are strongly influenced by specific soil environments. The rate of release of base cations which are necessary for the plant growth will be governed by the mineralogical composition and the particle-size of grains in each horizon of the soils sequences. We investigate the soils from the Lac Clair Watershed (46 degrees17'N, 71 degrees 40W) located along a climate-vegetation on the Canadian Shield. The vegetation is a typical northern hardwood forest of north-eastern North America. The objectives of this study are to (i) review the development of soil mineralogy and particle-size classes, (ii) discuss certain problems associated with current mineralogy classes and the characterization of soils mineralogy by the mineralogical composition of a selected size fraction, (iii) propose a framework for evaluating the weathering rates based on the mineralogical composition and the mineral evolution in the soils horizons. We assumed that the composition of the parent materials is represented by that of the basal C horizon. Major minerals in the regolith are quartz, feldspaths, micas, argilleous minerals (chlorite, kaolinite, interstratified minerals,...) and iron oxides (goethite, ilmenite, hematite and magnetite,...). The relative abundances of these minerals broadly reflect variations in primary mineralogy related to different lithologies and alteration in different horizons. In process of evaluation, we will learn more about the distribution of soils mineral, how minerals occur in certain environments, their transformations, how they are affected by specific soil management practices and uses, and the ultimate prediction of future soil behavior.

Characterizing the Alberta Landscape via Satellite Imagery

Mark Kachmar
Earth and Atmospheric Sciences, University of Alberta

By classifying satellite imagery through image-processing techniques we can potentially map and detect land-cover features on the ground in an efficient manner. Satellite-based mapping of land-cover is useful, in that it provides repeat coverage over large areas and has wide applications within the earth sciences. For example, by using satellite imagery we can monitor and examine land cover change over time. Satellite classification of land cover can also provide valuable visual “snap-shots” of the landscape permitting researchers and managers, who are not skilled in image interpretation to analyze large areas. Research in satellite based land-cover classification is currently being undertaken in the Earth Observation Systems Laboratory [EOSL] at the University of Alberta. The specific goals of our investigations are to examine the capabilities of employing satellite imagery for large-scale mapping

within Alberta. To date, this project has focused on analyzing land-cover in the northwest portion of the province —extending from Edmonton to Fort Chipewyan. By using medium resolution (28.5 m) Landsat TM 5 satellite data, we are attempting to classify both natural (i.e. forest, wetland) and anthropogenic (i.e. agriculture, cut-blocks) within the study area. We aim to develop a digital database of land cover that will serve as a starting point for land-use cover change (LUCC) studies. The resulting database can then be digitally compared with future land-cover classifications to begin the process of evaluating land cover change over time. This presentation discusses the image classification project and research challenges associated with large-scale image classification.

A decomposition Approach to Modeling Overlapping Tenures in Alberta: A Case Study.

David M. Nanang and Grant K. Hauer
Rural Economy, University of Alberta

The purpose of this study was to demonstrate how a decomposition approach to solving large spatially detailed forest management scheduling models could be applied to the problem of overlapping tenures in Alberta. A Model II forest-scheduling model that maximized net present value subject to mill capacity, multiple mill and product demands, regeneration, area, overlapping tenure, and even-flow constraints was specified. The resulting formulation is extremely large with over 5 million decision variables and about 120,000 constraints. The decomposition approach was able to solve this formulation in about 30 minutes on a computer with a Pentium III processor.

This shows that the method used has a potential of being applied in practice to investigate long-term timber supply and demand situations where spatial detail is required. This overlapping tenure application of the model showed that constraints imposed by overlapping tenures can lead to inefficiencies in wood allocation and substantial increases in the marginal costs of production. The results showed that marginal costs of the overlapping tenure constraints were positive and that the marginal cost of wood product increased when overlapping tenure constraints were present in most of the scenarios. The model also provides important shadow price information (marginal cost or marginal value) that is useful for determining how various constraints affect each demand location in the model. Relaxation of the overlapping tenure constraints leads to gains for some mills and losses for others although the overall effect of removing constraints is positive.

Biodiversity Assessment Project within the FMA of Millar Western Forest Products

Ryan Ancelin
School of Resource and Environmental Studies, Dalhousie University

The move by many forestry companies toward implementing a more enhanced timber harvesting strategy will result in silvicultural practices quite different from traditional methods. This might include more salvage thinning of mature stands, pre-commercial thinning in younger stands, increasing seedling densities as well as more control of competition from non-crop trees.

As silvicultural practices become more intensive and extensive monitoring and maintaining biodiversity within forest ecosystems will require adaptive management practices. As other forest values become a more integral part of a forest management system, forestry firms will face greater pressure to include these values in their management plan.

Millar Western has adopted a Biodiversity Assessment Project (BAP) in which specific aspects of the forest environment have been modeled in order to monitor species abundance and habitat over time and during forestry activities. In essence, BAP utilizes three analyses to predict potential impacts of forest management on biodiversity. These include ecosystem biodiversity analysis, landscape configuration and wildlife habitat supply models. Essentially, the aim is to gradually improve management practices by monitoring selected bioindicators within the forest.

My work will focus on the wildlife habitat supply models. I will consider how the abundance and distribution of the Least Flycatcher, a bird species, varies among habitat types in the Millar Western

Forest Management Area. BAP has already created a model to predict the impacts of forestry on this species, as based on other scientific studies. Field work will be completed to collect data to validate or improve the accuracy of the model. The results may then be ! used to improve forest management practices as they pertain to biodiversity protection.

A Spatial Assessment of Vertebrate Species Risk in Industrial Forest Management, New Brunswick, Canada

J.W. Higdon[1], D.A. MacLean[1], J.M. Hagan[2] and J.M. Reed[3]
[1] Faculty of Forestry and Environmental Management, University of New Brunswick
[2] Director, Division of Conservation, Manomet Center, Brunswick, ME
[3] Conservation Biology, Department of Biology, Tufts University, Medford, MA

An important value in ecosystem management is the maintenance of healthy populations of indigenous wildlife species. The species-sorting algorithm (SSA) presents a new method of assessing the potential ability of a landscape to support all terrestrial vertebrate species. This coarse-filter, spatially explicit modeling tool complements a natural disturbance emulation approach to ecosystem management, by allowing an evaluation of alternative landscape management scenarios. This method is currently being used to assess the risk of vertebrate extirpation on J.D. Irving Ltd.'s Black Brook Forest District in northwestern New Brunswick, Canada. This 190,000 ha management district represents some of the most intensively managed forestlands in Canada. A natural disturbance model is being developed as a companion project to this risk assessment (B. Hemens, UNB), which will be used to predict alternative landscape scenarios. These alternate scenarios will then be scored on their biotic integrity using the SSA.

The algorithm is a categorical classification system that places individual species into their respective risk category based on their scores for four different variables. These variables are 1) percent of the landscape that is available to the species (i.e. the amount of suitable habitat); 2) an absolute abundance category, based upon published density/home range data and the availability of suitable habitat; 3) a species-specific connectivity index, based upon the spatial arrangement of suitable habitat patches and the species' dispersal capabilities; and 4) population growth potential, which is based upon litter size and year of first reproduction.

POSTER PRESENTATIONS

Prey Availability, Vulnerability, and Anxiety in Uncut and Regenerating Boreal Forest

Mark Andruskiw
Department of Zoology, University of Guelph

Prey abundance is a common measure of predator habitat suitability despite weaknesses. A species that is better concealed or better able to defend itself may be less available to predators than a less numerous but more vulnerable one. While several studies linking habitat structure (high coarse woody debris coverage) with intense usage by marten have concluded increased vulnerability of voles in structurally complex habitats, the opposite has also been proposed. Mean time to capture of voles by mustelid predators was shorter in structurally simpler habitats. Thus, the existence and direction of an effect of habitat structure on prey vulnerability remains unclear.

This potential effect will be tested in boreal Ontario where the structurally simpler forest which replaces mature conifer stands after clearcut may be suboptimal habitat in which marten have reduced hunting efficiency. In both uncut and regenerating stands, marten hunting success (encounter and kill rate) will be investigated by snow-tracking. Prey vulnerability across habitats will be tested by comparing marten prey selection relative to prey abundances determined from live-trapping. These analyses will be paralleled by the assessment of predation risk perceived by voles, mice, squirrels, hares, and grouse across habitats by comparing differences in foraging behaviour (giving-up densities) in artificial resource patches.

Detailed investigation of marten hunting behavior in uncut and regenerating stands will provide a mechanistic link between habitat variables and marten population dynamics. Through understanding mechanisms influencing marten habitat quality we may be able to amend future silvicultural techniques to improve the quality of younger forest.

The Effect of Disturbance on Boreal Forest Soil Fertility over an Initial Two-year Period

Claudette Bois
Department of Natural Resource Sciences, Macdonald Campus of McGill University

Criteria and Indicators of Sustainable Forest Management contribute to prescriptive measurements of anthropogenic disturbance on a forested ecosystem. When focused on boreal forest soils, wildfire may serve as a reference state upon which soil properties can be measured and compared to properties found in managed forest soils. A better understanding of boreal forest soil dynamics is necessary in order to predict the response of the forest ecosystem to logging methods and ultimately, the long-term effect of human activities. The purpose of this study is to obtain a better understanding of the soil environment by:

1. Characterizing soil properties following wildfire.
2. Characterizing soil properties following implemented harvesting techniques.
3. Describing how soils recover during the first two years following disturbance.
4. Developing site scale soil indicators of the nutritional status of the regenerating forest.

This study takes place in the northeastern two-thirds of the 900,000-hectare Manitoba Model Forest (MBMF). There are several fire regimes in the MBMF and the boundaries of the study area reflect the fire regime that covers the largest proportion of the MBMF. This study is concerned with a comparison between post-harvest and post-fire soil impacts. The study areas involved are Beaver Creek Harvest Trial Area and Bernic Lake Wildfire Area. The primary ecosite types studied are (1) deep dry mineral and (2) moderately deep mineral soils.

The results of this study will extend our understanding of selected silvicultural treatments and wildfire on the cycling of soil nutrients and their availability to plants.

Validation of Wildlife Habitat Models of the Biodiversity Assessment Project (BAP)

Susan Bone
School of Resource and Environmental Studies, Dalhousie University

A research project will be undertaken to determine how accurately Habitat Supply Models (HSM) depict the requirements of a selected indicator species.

Data describing habitat requirements of a specific indicator species will be collected through field investigation. The findings will be used to reduce key uncertainties in the models, thus improving the model's ability to predict relationships accurately between various forest-management strategies and conservation of biodiversity.

Biodiversity conservation is a priority for sustainable forest management (SFM) at all levels. Consequently, forest management companies are encouraged to make use of biodiversity assessment tools, such as HSMs, to aid them in the design of forest-management strategies that will help to conserve biodiversity while harvesting timber.

Effects of Logging and Fire Disturbances on Forest Composition at the Southern Limit of the Boreal Forest in Quebec

Y. Boucher and D. Arseneault
Dép. de Biologie-chimie et Sciences de la santé, Université du Québec à Rimouski

In this study we analyze the impact of past logging activities on forest composition in the Rimouski area (Eastern Quebec). A 2,5 km^2 area was selected in each of the two main forest types of the region: a spruce-poplar-fir forest at a mid elevation site (MACPES site, 130-200 m asl) and a maple-birch-fir forest at a high elevation site (SNR site, 230-260 m asl). At each location, sampling points were systematically located using a 100m X 100 m grid system. At every point, age of individuals and composition of the forest were measured in a 0,04 ha plot. Disk sections of stumps and coarse woody debris were also sampled for species identification and dendrochronological analysis. Preliminary results indicate that the Macpes site was cut in the late 19th century and burned in 1923. *Thuja occidentalis* and *Pinus strobus* had dominated the forest before these two disturbances. These species were homogeneously distributed among sites. In Contrast, the present-day forest is dominated by *Populus balsamea* and *Picea mariana,* such that density of *P. strobus* stems is < 2 stems/ha, compared to > 70 stems/ha before logging. At the SNR site, which is today dominated by *Acer saccharum*, frequent logging during the twentieth century (most likely in 1909, 1938 and 1974) has led to partial or complete exclusion of conifers species like A*bies balsamea*, *Picea glauca and Pinus strobus*. In conclusion, recurrent logging and the interaction of fire and logging disturbances have both reduced the abundance and diversity of coniferous species.

Carbon Dynamics in Boreal Forest Soils Submitted to Various Disturbance Regimes

Bénédicte Cherbuy
Sciences du bois et de la forêt, Université Laval

Boreal forests represent a major pool of organic carbon because they occupy vast surfaces and represent large stored reserves of carbon, particularly in the soil. Sequestration and recycling of organic matter in boreal forest soils can be considered as key processes in the global carbon budget. Because of the increasing demand for fiber, harvest has replaced fire as the main disturbance agent. However, these two types of disturbances have different impacts (especially short term) on the soil. Thus it is important to understand the consequences of each type of disturbance on carbon recycling and to define management options that preserve carbon sequestration processes.

The objectives of this project are :

1. To estimate the impact of a change in disturbance regime on total soil carbon
2. To compare traditional management practices with options that mimic fire disturbance

3. To analyze the influence of major environmental controls of carbon recycling on ecosystem response to disturbance
4. To estimate the impacts of a change in disturbance regime on the partition of soil carbon in labile versus more recalcitrant forms

The study will focus on black spruce forests and on two regions of Quebec (Abitibi and Mauricie). The three first objectives will be approached by analyzing existing data and by modeling, using CENTURY. Different scenarios of fire and harvest will be simulated and compared. The fourth aspect of the study will be based on soil sampling on sites constituting two chronosequences after fire and harvest. The importance of labile carbon will be analyzed by Near Infrared Reflectance Spectroscopy.

The Criteria and Indicators Project (C & I)

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Sciences du bois et de la forêt, Université Laval

Sustainable forest management cannot be realistically implemented without a system of monitoring using pertinent indicators, that ensures adherence to the goal of sustainability. In recent years, there have been numerous efforts made to develop lists of indicators of sustainable forest management that could be used as a basis for certification, however, there has been less effort to validate the underlying science, and to subsequently integrate indicators into forest management plans. In Quebec, as elsewhere in Canada, industries are pursuing certification using different systems, either ISO 14001, Canadian Standards Association, or the Forestry Stewardship Council. It has been evident that there is a need to develop ways of integrating new scientific knowledge, forest data, and public concerns to forest management plans, via the use of indicators. The objectives of this C & I project are 1) to dress a portrait of the past and present forest in the management area 43-02 in the Mauricie region of Quebec and 2) to propose and validate indicators that are relevant to this territory, managed by Abitibi-Consolidated. The C & I project is based on the six criteria defined by the Canadian Council of Forest Ministers : biodiversity, ecosystem productivity, soil conservation, water conservation, multiple benefits, and societal responsibility. Two of those criteria are presented here as examples. Firstly, the project addressing ecosystem productivity aims to study forest dynamics after clearcutting. The objective is to describe the evolution of stand composition over time for different forest types. Also, it addresses the effect of spruce budworm on species proportion. The results could be used to produce more reliable models for calculation of allowable cut. Preliminary analyses suggest that regeneration does not consistently allow the reconstruction of pre-harvest stands. Secondly, the comparison of whole-tree (WTH) and stem-only (SOH) harvest is used to validate the pertinence of vulnerability to WTH as an indicator of soil conservation. WTH can have negative effects on the maintenance of soil fertility caused by the export of nutrients contained in the branches and foliage. The importance of the effect will depend of the stand composition and site richness. This study aims to verify if sites in the Mauricie management unit are vulnerable to productivity loss and to use this information in forest management planning for this territory.

Spatial and Temporal Patterns of Natural Disturbance in Northwestern New Brunswick

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Forest dynamics are shaped by the interaction of natural disturbances and enduring features. The characterization of different disturbances in terms of severity, frequency, and extent for particular regions provides an intuitively attractive means towards defining the temporal, spatial, and structural characteristics of a forest in the absence of human activity. These characteristics can then be used as an aid in the development of ecosystem management guidelines.

The 190,000 hectare J.D. Irving Black Brook District is located in northwestern New Brunswick, an area historically subjected to major spruce budworm (*Choristoneura fumiferana* Clem.) and fire disturbances. Available characterizations of the area include an ecological classification based on

enduring features, a cover-type classification interpreted from 1946 air photography, and a current cover-type inventory. Geographic data is also available on the location and extent of budworm defoliation since 1946, and many fire events. The objectives of this project are: 1) to determine natural disturbance regimes and their relationship to vegetation communities; 2) to develop and use natural disturbance modeling tools to simulate stand structures and forest landscape patterns; and 3) to analyze effects of disturbance on forest species composition, patch size, and age class distribution. To achieve this, we will use existing fire spread and spruce budworm disturbance models, modified as appropriate to reflect the interaction of these disturbances. As well, stand-level modeling will be conducted to determine likely stand structures resulting from these disturbances acting in different vegetation types.

Impacts of Post-Fire Salvage Logging on Plant Diversity and Tree Regeneration of the Mixedwood Boreal Forest

Stephanie Kurulok
Renewable Resources, University of Alberta

Over the past decade, salvage logging of fire-damaged, merchantable sized trees has become a common activity immediately following many fires in the western boreal forest. The removal of these fire-damaged trees has potentially important ecological implications for the subsequent stand dynamics, tree regeneration and diversity of plant species of these forests. Salvage logging likely significantly affects the type, availability and microclimatic characteristics of regeneration microsites as well as potentially alters seed availability. This will affect post-disturbance regeneration and subsequently influence successional development and understory plant diversity. Trees removed during salvage logging may also represent a significant loss of carbon and nutrients to the forest site, potentially affecting long-term nutrient dynamics. The objectives of this study are to examine the effects of post-fire salvage logging on the regeneration of dominant tree species and on the diversity and composition of the understory plant communities of the western boreal forest. Tree regeneration, understory plant community composition and above-ground (microclimatic conditions, microsite availability) and below-ground (soil moisture, carbon and nutrients) resources and characteristics will be measured in two replicated disturbance treatments (salvaged burn and burn only) and two successional stages (young stands-2 years post disturbance and mid-succession stands-30 years post disturbance) in upland aspen mixedwood forest stands.

The Response of the Riparian Plant Community to Natural and Anthropogenic Disturbance

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Healthy riparian zone vegetation provides numerous ecosystem services in maintaining water quality and fish habitat of boreal streams. Disturbance that damages or alters the riparian vegetation may have a negative impact on the stream ecosystem. Forest management guidelines require a buffer zone between clear-cuts and the riparian zones to help protect riparian zone vegetation and streams. The effectiveness of buffers in maintaining a healthy riparian plant community is poorly understood. We studied the response of riparian plant communities to natural and anthropogenic disturbances, by comparing sites that experienced natural fire, clear cutting with a riparian buffer, and undisturbed forests in Northwestern Ontario. We found no major differences in the abundance and distribution of riparian plant species between the three disturbance types. A few species seemed to respond to increased light levels at the burned sites. These results indicate that, overall, riparian zones are not strongly affected by a disturbance occurring in the nearby upland vegetation. The current forest management guidelines to maintain a buffer zone along the stream may need to be reevaluated. Sites with narrow riparian zones, however, behave differently where the upland vegetation likely provides many of the essential ecosystem services that are normally provided by the riparian zone. Further research is needed to determine the importance of edge effects and other factors causing changes in the upland buffer zone.

Riparian Disturbance Rates in Natural versus Managed Landscapes of the Boreal Forest

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The goal of riparian (shoreline) management is to protect water quality, fish habitat and biodiversity. The Crown Forest Sustainability Act (CFSA) requires that forest management emulate natural disturbance patterns. However, the Federal Fisheries Act calls for the protection of fish habitat to have priority in areas where forest operations may affect lakes or streams. The resulting policies prescribe 30 to 120m forested shoreline reserves around most lakes. Although these reserves are intended to protect riparian areas they may be creating shoreline forests of unnatural composition and structure that are susceptible to blowdown. What are the effects of logging and wildfire on the rate of shoreline overstory disturbance? Does the rate of disturbance change according to topography, riparian type or ecoregion? Aerial photography and satellite images will be used to obtain new information about natural and artificial riparian disturbance patterns and the associated operational risks. Management and ecological issues will be examined using scale-appropriate remote sensing techniques. As well, performance criteria will be developed to assess data collection and interpretation accuracy. Finally, cost effectiveness analysis will indicate which technologies are most appropriate as management tools.

Influence of the Presence of Aspen on Nutrient Cycling and Productivity of Stands Dominated by Black Spruce in the Boreal Forest of Northwestern Quebec

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Productivity of spruce stands near the 49th parallel is usually less than 1 m3/ha/yr while productivity of mixed stand in the same region vary from 2-3 m3/ha/yr. A number of factors may explain these differences in productivity such as climate, nature of the surficial deposit and influence of vegetation composition on nutrient cycling. Recent studies have demonstrated that climate does not vary between the mixedwood boreal and black spruce boreal regions in Abitibi. However, soil and vegetation dynamics show significant differences. For similar soil conditions, coniferous species tend to 1) promote presence of sphagnum mosses and ericaceous species which can reduce soil temperature, 2)increase depth to water table and 3) produce a poorer litter quality which in term affects soil fertility. Deciduous leaves appear to inhibit growth of mosses and maintain a higher soil quality. The principal aim of this project is to assess how the presence of deciduous trees, in stands dominated by spruce, affect soil temperature, nutrient cycling, understory composition and spruce growth. This information could lead to a determination of threshold level of deciduous species required to increase productivity of spruce.

Effects of Silvicultural Intensity on Pileated Woodpecker Foraging at the Stand and Landscape Scales

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The Pileated Woodpecker (Dryocopus pileatus L.) is often considered to be an indicator of mature forest conditions. This status reflects its restriction to large-diameter trees for nesting, roosting, and foraging. The species is also characterized by a large home range (50 to > 400 ha). Moreover, the cavities it excavates are used, by a wide variety of other species for nesting or roosting. In this study, we surveyed Pileated Woodpeckers using playbacks of calls/drummings and searched for fresh signs of excavations. We sampled, on winter 2000 and summer 2001, 71 stations in the Black Brook District, a 1900 km² area owned by J.D. Irving Ltd in north western New Brunswick. Stations had been selected to cover gradients of intensity silviculture. At each station, we recorded all foraging cavities found along four 100-m transects, their characteristics and the characteristics of excavated trees. Stand structure/composition and

landscape-scale characteristics around all stations (r = 0.5, 1.0 and 1.5-km) were also quantified. Analyses will compare characteristics of stations with 1) bird detection or recent signs of Pileated Woodpecker foraging, 2) no detection and old foraging signs only and, 3) no detection nor foraging signs present. These data will be used to look for evidence of threshold effects of silvicultural intensity at the stand and landscape level. Statistical analysis are currently being completed.

Spatial Aspects of Boreal Mixedwood Succession and Stand Dynamics

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Mixedwood management is of great interest to the forest community from both an ecological and economic perspective. Substantial resources are used in manipulating tree species mixtures and structures early in stand development, often without full understanding of future implications. This SFM-funded research , which is in its first year, will determine what spatial changes occur between white spruce and aspen during the development of mixedwood stands, both at a fine-scale level (how individual stems are arranged close together) and coarse-scale level (how patches of aspen and spruce are arranged throughout a stand). The relative influence of competition for sunlight and the effect of physical abrasion of aspen branches on spruce growth will be determined.

Detailed stand data is being collected on tree-mapped plots on sites from Alberta to Manitoba (some with a 50-year data record). Hemispherical photos are being taken to measure tree canopy structure and understory light levels. Spatial analysis will include both statistical methods such as point pattern analysis and modelling approaches, using individual tree simulation models such as LITE and SORTIE.

This research will determine the role of competition, mortality, physical interaction (whipping) and the spatial relationships/distribution of aspen and spruce on stand development over time. This will provide guidance as to the best spatial arrangements and species mix to maximize productivity at the stand level, and provide alternatives to current concepts used in tree spacing and patch retention. Results will be applicable to spruce-aspen stands on uplands across the western boreal forest.

Measuring Wetland Disturbances in Western Boreal Mixedwood Ecosystems: Interactions between Roads and Beavers

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Beaver activity plays a major role in structuring boreal landscapes through the creation, abandonment, and decay of dams and through browsing and tree felling. These beaver-created wetlands form a dynamic mosaic of ages, types, and configurations, providing a diversity of habitat types.

Roads and other linear features are expanding rapidly across boreal Alberta. These are conspicuous anthropogenic elements of a landscape with long-term, widespread effects on populations and ecosystem processes. Roads are essentially permanent features and due to their far-reaching ecological effects, they can almost be seen as a “keystone process” in the same way that beaver are a keystone species, altering habitats at a level disproportionate to their abundance or physical dimensions.

Stream crossing structures such as culverts and bridges often create impoundments, acting as a human analog of a beaver dam, altering stream flow and aquatic processes. Due to their permanence and static nature, we can expect that roads, like beavers, produce persistent patterns of aquatic habitat alteration. Further, in contrast to the dynamic nature of beaver-created wetlands, water levels in these impoundments are expected to be static. These differences in flow interruption, between the cyclical changes of beaver dams and activity and the more permanent road crossing, may lead to fundamentally different habitat availability and use in the riparian areas surrounding these wetlands.

In order to understand the long-term consequences of intensifying road construction in boreal mixedwood ecosystems, we need to understand the nature of the effects they produce on broad spatial and temporal scales. The purpose of this project is to study wetland habitats created by road crossings,

compare these to beaver-created wetlands, and examine the long-term, landscape-level implications to wildlife populations of any differences in habitat provision and use.

The Abundance and Use of Edible Wild Fruits in the Gwich'in Settlement Area

Gordon Murray
Rural Economy, University of Alberta

At the northern extreme of the boreal forest, traditional forestry is not possible for many of the communities. In these areas, the development of non-timber forest products may be a viable alternative for income generation. For this study, the non-timber forest product being investigated was edible berry species within the Gwich'in Settlement Area (GSA) in the Northwest Territories. This poster will highlight some research results from the past two years.

During the summer of 2001 and 2002 the amount and variety of the various berries species that grow in the area, were measured in five distinct ecosystems. These ecosystems included white spruce, black spruce, paper birch stands, peat/bog areas, and in the foothills/tundra. During the first part summer (mid June), measurements were taken at 30 sites (6 sites per ecosystem) at 5m intervals to get an estimate of the percent cover of the berry species in each ecosystem. During late summer (late July/early August), each site was revisited to derive an estimate of the actual quantity of berries produced in each ecosystem. These quantities were then used to get an estimate of the potential of berry production in the whole GSA.

Also during these two summers, local people were interviewed and surveyed to ascertain the local use of non-timber forest products within the GSA. Gwich'in from the four communities in the GSA (Inuvik, Fort McPherson, Tsiigethchic, and Akalvik) were contacted for the interviews and surveys. The objectives were to ascertain the type of berries which the Gwich'in people collected, the various ways in which the berries collected were used, and to try and quantify the amount of berries picked. It was found that the first most utilized berries in the GSA were cloudberries, blueberries, and cranberries, and that the uses of the berries included, to clean and serve them fresh, bake with the berries, produce itsu, and make jams and jellies.

Non-Timber Forest Product Use in the Little Red River Cree Nation

Mark Nelson
Anthropology, University of Alberta

This project casts forest sustainability not in terms of continuous flow of timber resources, but in terms of the ability of First Nations to continue to make use of the forest for hunting and gathering purposes. This approach requires that forests be managed so as to provide sufficient habitat for animal and plant species to be harvested, and not exclusively for harvestable timber. The concern here is how cultural sustainability is affected by the availability of non-timber resources. Hunting and gathering for subsistence purposes continues to play a vital cultural and economic role in the Little Red River Cree Nation, and members of the nation wish this continue. To this end, this project was undertaken to assess the frequency and quantity of animal and plant harvesting, to examine future demand based on the large population growth, and to identify sociocultural barriers that may be preventing people from making use of the land in the modern context. This data will used to contribute to a forest management plan for the Special Management Area in which the Little Red River Cree Nation is situated.

The Effects of Forest Thinning on Migrant Songbirds Habitat and use in Fire Regenerated Lodgepole Pine

Bruce Nielsen
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This project will measure the effect of Lodgepole pine thinning treatments on migratory songbird habitat and use. The NCE-SFM presentation will outline the projects design, methods, objectives, and outline the

effort to date. Since no data analysis has taken place, only the projects framework will be illustrated in a poster format.

The study site stands are fire regenerated at densities with inhibited growth resulting in lower yields at rotation age. This shortcoming in projected yield is problematic for the tenure holder who operates with an area based allowable annual cut on a landbase that is already constrained by size and competing land uses. Thinning applications have been prescribed (commercial and salvage thinning) to procure immediate fiber and promote an increase in the stands future yield. There is little known about the effects of this intensive forest management tool in Lodgepole pine on migratory songbird habitat and use.

This project is set up to determine the effects of two types of thinning treatments, commercial and salvage thinning. The project is currently in year two of a four-year program. Songbirds are inventoried in 100m radius point counts; vegetation is inventoried in permanent sample plots. The project will compare pre and post-thinning songbird and vegetation inventories in paired treatment and control stands. The commercial thinning treatment has 18 point counts in 4 treatment units and 22 point counts in 5 control units. The salvage thinning application has 16 point counts in 4 treatment units and 12 point counts in 4 control units.

Population Ecology of Marten in the Boreal Forest

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Current forest harvesting plans strive to preserve biodiversity and ecosystem function in an effective and economically viable manner. In Ontario, forest managers strive to conserve boreal forest taxa and function through the preservation of marten habitat and monitoring of population levels. This rationale is based on assumptions that marten act as forest indicators and are an umbrella species for all other taxonomic groups. Unfortunately, these assumptions are not backed by scientific findings, and much of the terminology (i.e. indicator of what?) is ambiguous. The project seeks to either validate current planning regimes or establish better tools for forest management. This goal will be met in two phases. Using a combination of trapping records, mark/recapture, and radio-telemetry studies, phase (I) will illuminate the relationships between forest age/stand structure and marten population demographics, movement, habitat use and juvenile dispersal. Based on these findings, investigators will assess the effectiveness of marten as a putative indicator of old growth forest (>70 yrs). Phase (II) seeks to assess the effectiveness of marten as an umbrella for other taxonomic groups by surveying various vertebrate groups (e.g. anurans, passerines, strigiformes) within the same habitat mosaic. Data from phases one and two will be integrated to assess the effectiveness of current management strategies. If marten are good indicators but poor umbrellas, what taxonomic group might serve as a better umbrella than marten? If marten are poor indicators, but good umbrellas for other species across a range of stand structures, what species might better indicate old growth? Should another species be selected for one or both functions, phase (I) may be re-implemented to assess its validity.

Critical Thresholds in Habitat Cover for Forest Songbirds

Trisha Swift
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Habitat loss is the leading cause of species extinctions and declines worldwide, and is usually associated with habitat fragmentation - the breaking up of formerly contiguous habitat into smaller habitat fragments. The object of the proposed study is to examine the response of forest songbird communities to habitat loss and fragmentation, and to separate the effects of each. Fragmentation exacerbates the effects of habitat loss by changing the quality of remaining habitat and by impeding movement across landscapes. Habitat configuration (fragment size, dispersion, and connectivity) can thus also be important in species persistence. Previous studies indicate that populations may decline linearly with increasing

habitat loss until some critical threshold in habitat amount is reached, below which populations decline precipitously. The proposed study will determine threshold levels of forest cover and examine the impact of fragment configuration, both at the level of individual species (i.e. when are there sharp drops in abundance?) and at the community level (i.e. when are there major shifts in species composition, away from that of an intact forest community?) This will be accomplished by censusing songbirds in a series of landscapes that include a wide range of percent forest covers, from nearly contiguous to severely reduced; for each level of forest cover, fragment configuration will also vary. The results will have potential for guiding conservation and resource management decisions.

Modeling Spatial and Temporal Variation in Boreal Bird Populations

Judith Toms
Biological Sciences, University of Alberta

Many species exhibit large fluctuations in abundance over time and across the landscape, making it extremely difficult to detect treatment effects in experiments. Unfortunately, the factors that cause this variability are usually unknown. I propose to address this issue by developing models that will examine population variability of some boreal bird species and attempt to determine the root causes of some of these fluctuations. As a group, birds are a good choice for developing models of such variation. Many exhibit large differences in abundance over time, and often exhibit concurrent changes in densities across the landscape. They are highly motile and can thus respond quickly to changes in the environment. Furthermore, they have a wide range of life strategies and are sensitive to changes in terrestrial ecosystems.

My models of temporal and spatial patterns of abundance will be developed using data previously collected from northern Alberta. Models will address the following questions:

1. Are some species more variable than others? Do these species share any biological characteristics (e.g. migratory strategy, habitat or foraging specialists)? If so, can we group them for monitoring purposes?
2. Can the context of the site (the characteristics of the surrounding area) explain some of the variation? Are patterns more variable in a fragmented landscape?
3. Do paired sites, chosen because they have superficially similar plant communities, exhibit similar patterns in some or all species?

Crucially, I will then test the models. Developing a model is of little use unless it can be shown to work reasonably well in new situations.

Forest Users' Sense of Place: Implications for Forest Management

Sara Wallace and Adam Dick
Forestry and Environmental Management, University of New Brunswick

The intent of this research is to help us better understand forest users' social-psychological orientations toward forested landscapes and forest communities. Such an understanding has the potential to improve forest management if we are able to discover particular forest or landscape attributes and the experiences that users have with the landscape that are critical in the formation and maintenance of varying forest users' meanings and attachments associated with given locales. Results provide greater clarity regarding just what factors are responsible for forest users being strongly attached to given locales. The information we generate will help forest managers develop planning strategies and public involvement strategies by identifying issues and attributes of forests with which people are most concerned. This poster reviews five main topics related to the research, and covers two of the four research sites in the project. The five topics are; a definition of sense of place, the photo/interview methodology for eliciting sense of place, background on the study areas, and preliminary observations and data relating to community residents' sense of place, a preview of the computer application we intend to build to analyze and display the data.

A New Method for the Estimation of the Site Index of Young Stands Not Requiring the Estimation of Stem Age

Stephen Yamasaki
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Most of the current SI estimation methods require the estimation of stem age, which is difficult and time-consuming to determine with certainty. Small errors in the estimation of stem age can lead to large errors in the estimation of SI and productivity over long time-horizons. Intra-specific and inter-specific competition during early stages of development may also weaken the relationship between age and stem height. The objectives of this study were: 1) to develop a method of SI estimation for young stands that does not rely on the estimation of stem age but on recent annual growth, 2) to test this method by evaluating its precision, accuracy, and sensitivity to measurement error, and 3) to establish specifications for the method that yield the most accurate and precise estimates of SI. The method developed uses traditional yield curves published by the Quebec Ministry of Natural Resources to establish the quantitative link between SI and height growth during the previous 5 years and total height. Simulation for black spruce based on the estimated assymptotic variability and cross-correlation of yield curve coefficients demonstrates that the method leads to erroneous SI classification in fewer 2% of trials for low SI, and between 4 and 16% of trials for high SI. Sensitivity analysis indicates that the method is robust with regards to growth measurement error but is sensitive to errors in the counting of growth intercepts.

Spatial and Temporal Dynamics of Land-Use/Land-Cover Change in Boreal Forests: Elk Island National Park, A Case Study

Jason Young
Earth and Atmospheric Sciences, University of Alberta

The issue of land-use and land-cover change (LUCC) is recognized to have a significant impact on global environmental change. In the boreal ecosystem, increasing forestry, agriculture, and resource exploration are causing fragmentation and isolation of forest patches, which will affect the natural biotic and abiotic patterns. Elk Island Park represents aspen parkland, the southern limit of the boreal forests. Land-use changes in the region due to agriculture are isolating the park. The objectives of this study are to quantify the rate and extent of land-cover change in the aspen parkland region, assess the impact of land development practices near the border of a protected area, and to identify key areas for conservation management. Land-cover changes will be created by post-classification analysis of Landsat satellite images from 1973 to 2000. These images will be classified using a hierarchical method based on spectral characteristics trained by field data. Separation into spectrally similar groups allows for better separation of spectrally similar classes. Initial results show an overall classification accuracy of 86%, with the majority of confusion between spectrally similar classes-closed vs. open deciduous forest and pasture/grassland vs. cropland. Recent field data on canopy closure may improve the classification of closed vs. open forest. The project is in cooperation with Parks Canada, as part of an initiative to promote conservation in the Beaver Hills region of central Alberta.

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