BorNet Canada

WORKSHOP PROCEEDINGS

BorNet Canadian Regional Workshop

November 23 and 24, 2001

Prince George, B.C.

A working meeting hosted by the
Sustainable Forest Management Network

Prepared by Carolyn Whittaker and John Innes
University of British Columbia

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BorNet Canada is part of BorNet, an international network of researchers, forest managers and government representatives developing a synthesis of available information on the conservation of biological diversity and identifying gaps in our understanding in order to further develop coordinated research efforts among boreal countries worldwide.

BorNet Canada
2005 – 2424 Main Mall
University of British Columbia
Vancouver, B.C.
Canada V6T 1Z4

Telephone: (604) 822-3207
Fax: (604) 822-9106
E-mail: cwhittak@interchange.ubc.ca
Internet: www.forestry.ubc.ca/bornet

The Sustainable Forest Management Network is a national partnership in research and training excellence. Its mission is to deliver an internationally recognized, interdisciplinary program that undertakes relevant university-based research. It will develop networks of researchers, industry, government and First Nations partners, and offer innovative approaches to knowledge transfer. The Network will train scientists and advanced practitioners to meet the challenges of modern natural resource management.

The Sustainable Forest Management Network
G208 Biological Sciences Building
University of Alberta
Edmonton, Alberta
Canada T6G 2E9

Telephone: (780) 492-6659
Fax: (780) 492-8160
E-mail: el2@ualberta.ca
Internet: www.ualberta.ca/sfm

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Foreword

AS LARGE-SCALE FORESTRY AND URBAN GROWTH CONTINUES ITS PACE NORTHWARD, CANADA'S boreal forests are increasingly coming under pressure. However, the biodiversity consequences of expansion and extensive forest management are complex and poorly understood. At present, there is little collaboration between the large number of government agencies, universities and non-governmental organizations conducting research on biodiversity in Canada's boreal areas. Nor is there broad collaboration among the host of researchers, resource managers and governments involved in biodiversity management. Furthermore, as 90 per cent of communities in the boreal are aboriginal, there is a large, unmet need to understand distinct cultural relationships to the land and resources in boreal forests across Canada.

As a result of this lack of collaboration and consultation, there is no clear direction or consensus regarding current research and monitoring priorities.

The BorNet regional workshop series were organized to:

- increase the exchange of information and ideas among those researching boreal biodiversity
- seek contributions to the development of a national synthesis, and
- provide direction on future research and monitoring.

To guide discussion, the workshops used as a background reference *Biodiversity Evaluation Tools for European Forests* (Tor-Björn Larsson (ed.) Swedish Environmental Protection Agency. Ecological Bulletin 50: 2001).

A template of three questions, derived during a meeting between Canada and other BorNet countries, was modified by the working groups to suit key regional issues:

- How much forest needs to be devoted to biodiversity maintenance?
- How can management effectively restore/recreate/maintain important features required to conserve biodiversity?
- How can we determine the effectiveness of these biodiversity conservation efforts?

The first question addresses the task of developing targets and benchmarks for biodiversity conservation at the landscape scale. The second question is related to implementation and management tools used to achieve the objectives articulated in Question 1. Finally, the third question explores the effectiveness of management tools and systems, outlined in Question 2, in terms of meeting targets identified in Question 1.

These proceedings were created for the use of workshop participants and others affiliated with BorNet and the Sustainable Forest Management Network. Key issues will be further addressed through an on-line conference in the spring of 2002. Results from the workshops and on-line conference will be integrated into a synthesis document identifying key strengths and gaps in our knowledge. The synthesis will be presented to other boreal countries at the BorNet international conference in Stockholm on May 27-28, 2002 and disseminated as broadly as possible. Documents are posted to the BorNet website (www.bornet.org) as they are made available.

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November 23, 2001	Introduction of participants and keynote speeches
8:00	Breakfast
8:30	Introduction to BorNet *John Innes, University of British Columbia*
9:00	Using natural disturbance benchmarks to improve sustainable forest management practices *Craig DeLong, B.C. Ministry of Forests*
10:00	Break
10:30	Temporal seral stage monitoring and wildlife habitat on Tree Farm License 48 *Don Rosen, Canadian Forest Products Ltd., Peace Region.*
11:15	CanFor's implementation plan *Daryll Hebert, Encompass Strategic Resources Inc.* *and Carl Vandermark, Forest Planner, CanFor*
12:00	Lunch
1:00	Tools for long-term monitoring of biodiversity *Mike Gillingham and Katherine Parker, University of Northern B.C.*
2: 00	Wildlife inventory and habitat assessment: A Gitxsan approach to aboriginal participation in forest management *Russell Collier, Resource Consultant, Smithers, B.C.*
3:00	Break
3:30	Panel discussion
November 24, 2001	Presentations and discussion
8:00	Breakfast
8:30	Some Canadian Forest Service led research projects addressing boreal forest fire disturbance *Brad Hawkes, Natural Resources Canada, Canadian Forest Service*
9:30	Begin plenary and breakout groups around synthesis questions
11: 30	Bat roosting and foraging ecology in disturbed and undisturbed B.C. sub-boreal forests *Jennifer Psyllakis, University of Northern B.C.*
12:00	Lunch
1:00	Plenary discussion continued
2:30	Identification of research gaps
3:40	Break
4:00	Final discussion *John Innes and Carolyn Whittaker, University of British Columbia*

Welcome and objectives

John Innes, University of British Columbia

Introduction to BorNet

- BorNet is an international network on biodiversity research in the boreal forest with participants from Canada, Finland, Norway, Russia, Scotland, Sweden and the United States.
- BorNet researchers, forest managers and government representatives are developing a synthesis of available information on the conservation of biological diversity and identifying gaps in our understanding to further develop coordinated research efforts in the circumpolar boreal.

BorNet objectives

- Objective 1 – National Synthesis: Develop a national synthesis linking management tools with biodiversity requirements within the context of current assessment systems at a range of spatial scales in Canada.
- Objective 2 – International Conference: Compare national reports from Canada, Norway, Sweden, Finland, Russia, the U.K. and the U.S.; develop extension tools; develop an international research program addressing gaps identified in the international comparison.

May conference outputs

- Production of a proceedings volume in a refereed publication.
- Planning of extension activities associated with this publication.
- Development of new international research partnerships and submission of proposal(s) to relevant national and international funding agencies (EU, NSERC, SFMN).

Where are we now

- Phase 1: National synthesis
    - Regional workshops have also taken place in Sault Ste. Marie, Ontario (October 13 and 14) and Edmonton, Alberta (November 17 and 18).
    - National synthesis draft will be prepared by early spring.
- Phase 2: International program
    - International conference: May 27-28, 2002.
- Phase 3: International implementation
    - Extension following conference will consist of industry feedback, project dissemination, and new research opportunities.

Workshop format

- The workshop will be semi-structured, addressing three key questions.
- Initial speakers are asked to put forward ideas that can picked up in the discussions.

Workshop questions

- How much forest needs to be devoted to biodiversity maintenance?
- How can management restore/recreate/maintain important features required to conserve biodiversity?
- How can we determine the effectiveness of these biodiversity conservation efforts?

Key workshop objectives

- The strengths and limitations of knowledge should be identified and classified.
- Ranking.
- Other objectives may be specified by participants.

Desirable deliverables

- Identification of the key issues and priorities for the boreal (validated in follow-up work from December 2001 to May 2002).
- Recommendations for prioritizing research and funding resources (for SFMN, NSERC, ARC).
- Improved networking amongst boreal biodiversity researchers and managers (including boreal research database via NRIN and GFIS).
- Recommendations for developing practical tools for operational managers.

Using natural disturbance benchmarks to improve sustainable forest management practices

Craig DeLong, B.C. Ministry of Forests

ABSTRACT: A common theme in current forest management policy is that forest harvesting should be designed to achieve the landscape patterns and habitat conditions maintained by natural disturbance regimes. Natural disturbance benchmarks are increasingly being used to set targets for disturbance patch size, patch shape, amount and arrangement of retained trees, etc. I provide numerous examples from northern British Columbia where knowledge of natural disturbance patterns and stand dynamics is providing useful information to develop more ecologically, and often economically, sustainable forest practices. In the past, forest managers have attempted to reduce variability in harvest block sizes, target stand density and structure, and organic matter removal. Research has demonstrated that patch size, stand density and structure, and disturbance intensity varies considerably within and among natural disturbances and this variability is important to maintain habitat for certain organisms. Utilizing natural disturbance benchmarks to set targets relating to forest management activities should result in more sustainable forest management activities.

This presentation is available on the Internet at www.bornet.org/newsevents/Delong_Bornet.zip

Questions and comments

- We are reducing natural forests more quickly than natural disturbance did. We need to differentiate the rate of cut and the distribution of cut in our discussions as they are separate issues.
- There is concern regarding the comparability of trees left behind after fire and after harvesting. The big difference between natural disturbance and harvesting is that we remove trees whereas nature does not, and fires burn both young and old stands. That is why CWD (course woody debris) is so variable.
- There is no advantage to medium-sized cut-blocks.

Temporal seral stage monitoring and wildlife habitat on B.C. Tree Farm License 48

Don Rosen, Canadian Forest Products Ltd., Peace Region

ABSTRACT: The conservation of biological diversity in managed forest habitats will require suitable inventories to monitor habitat changes over time. Since 1995 CanFor has undertaken a comprehensive inventory program to build appropriate baseline inventories for terrain and vegetation resources for Tree Farm Licence 48 (TFL 48) near Chetwynd, British Columbia (Lat 55 42/Long 121 37). Wildlife habitat models for four species of ungulates, four species of furbearers and four species of birds were developed in concert with baseline inventories. TFL 48 is approximately 650,000 hectares in size and spans five biogeoclimatic zones: Alpine Tundra, Englemann Spruce-Subalpine Fir, Subboreal Spruce, Boreal White, and Black Spruce. We used vegetation resources inventory to model seral and structural stages for the years 1960-2000-2020, and to project wildlife habitat models. From 1960 to 2020 we project that old growth on TFL 48 will increase from 5.2 per cent to 18.4 per cent with associated changes in wildlife habitat values. For example, we forecast a reduction in high quality grizzly bear fall forage habitat, but an increase in high quality goshawk nesting habitat. In 1960 early forest patch size had a bimodal distribution of small (< 40 ha) and large patches (> 1,000 ha) with relatively few patches found in the 40 to 250 ha range. If we maintain current timber harvesting practices we forecast that by 2020 there will be no large early forest patches and mid-size patches will be over-represented.

CanFor's implementation plan

Daryll Hebert, Encompass Strategic Resources Inc. and
Carl Vandermark, Planning Superintendent, Canadian Forest Products Ltd.

ABSTRACT: CanFor's forestry principles, unveiled in June of 1999, are a key initiative toward the goal of sustainable forest management. Achievement of SFM is based on the practice of ecosystem management: "the application of ecological, social and economic information, options and constraints to achieve desired social benefits while maintaining ecosystem integrity within a defined geographic area and over a specified period." For CanFor, this has been outlined in 10 forestry principles that provide broad corporate direction to forest management on licensed public lands, and are intended to be the foundation for forest management strategies, policies and operating procedures in all operations. Implementation of the forestry principles is in the very early stages, and many procedural and knowledge gaps remain to be filled. Preliminary sets of indicators have been identified, but objectives and strategies have yet to be established. Timelines and responsibilities have been established such that current knowledge and procedural gaps will be filled, and first approximation objectives and strategies will be in place by the end of 2003. A wide range of studies and projects directed toward development of operational procedures have been outlined. By combining various initiatives, CanFor will perpetuate and enhance a long tradition of forest stewardship through a deliberate shift to sustainable forest management.

The full executive summary of the CanFor Forestry Principles Implementation Plan can be found at www.canfor.ca/resources/4000/FP_Executive_Summary_01_2002.doc

Questions and comments

- What is the contribution of the non-contributing landbase to biodiversity? The NCLB is interactive with natural disturbance; what happens when the NCLB increases the risk to insect or fire disturbances and what does fire protection do to biodiversity in these areas?
- Sustained yield is an old habit and the rate of cut is ingrained in the patch size and distribution. What is the interaction between these two?
- We have to find a balance between the socioeconomic and ecological aspects of these questions.
- Adaptive management is the next step; thresholds need to be set up on the disturbance gradient. We have to decide how to approach adaptive management as it can be very expensive. We need to focus on the important features: biodiversity and effectiveness.
- Biodiversity is the "full variety of life in an area, ranging from the genes to populations"; it includes processes and spatial scales.
- Temporal scale is important in terms of both directional changes and stochastic processes.
- The goal of management is to maintain the conditions and processes that provide long-term biological integrity. Management must ask for whom and for what?

Tools for long-term monitoring of biodiversity

Michael Gillingham, Faculty of Natural Resources and Environmental Studies, UNBC
and Katherine Parker, Faculty of Natural Resources and Environmental Studies, UNBC

ABSTRACT: To ask whether management can effectively restore/recreate/maintain important features required to conserve biodiversity, or to determine the effectiveness of these biodiversity conservation efforts, we need to have a clear understanding of biodiversity. Biodiversity includes genetic, species and community diversity and it includes a component of scale. When discussing "targets" for biodiversity, we must remember that it is the interaction among genes, individuals, populations, communities and ecosystems that give rise to diversity (e.g. predation is a community interaction that affects biodiversity). In addition, there is both a spatial scale (e.g. vertical structure, horizontal diversity and interspersion) and a temporal scale (e.g. population cycles, succession, stochastic changes and natural disturbance) to the determination of biodiversity. So, when we attempt to "manage" for biodiversity, we must maintain conditions and processes that provide the long-term biological integrity for components of the system and recognize that the nature of ecological systems is the result of biological, spatial and temporal scales.

In our work in the Williams Lake area (within Lignum's IFPA) we are examining the importance of both structural and nonstructural (biological) components of the landscape in explaining the presence and absence of vertebrate species. To meet biodiversity objectives through long-term forest stand modelling, landscape planning and adaptive management depend on links between vertebrate distributions and forest inventory. We are evaluating the effectiveness of using lifeforms (sensu Thomas 1979) as a means of linking biodiversity and the forest inventory. This research involves combining species with similar feeding and breeding habitat requirements into "lifeform" groups; once they are developed, key representative species will be selected for each lifeform. Stand structural requirements will then be linked to forest management practices and landscape-level biodiversity objectives

The premise tested by this work is whether structural components by themselves can be used to monitor biodiversity across the landscape. If species within a lifeform are most related to non-structural components, we will reject the hypothesis that lifeforms, and thus biodiversity, can be maintained by monitoring structural components of the system for those species. The basic question we intend to examine with respect to structure and biodiversity is whether the presence or absence of species can be explained by primarily structural (versus non-structural) components of the landscape. From our pilot study we have learned that within our study area relatively small-scale spatial variation is a very dominant feature of the current landscape. This variation is not captured with sufficient accuracy within forest cover maps to be of much use in the evaluation of specific lifeforms or representative species – this variation, however, will have to be captured in the analyses. Although there is considerable material published on most of the vertebrate species occurring within the IFPA, very little appears to be known about the specific structural needs of many species.

This presentation is available at www.bornet.org/newsevents/Gillingham%20Bornet%202001.pdf

Questions and comments

- Representation is the key to grouping species.
- If we lose special habitats like fire skips, we do not know what they contributed.

Wildlife inventory and habitat assessment: A Gitxsan approach to aboriginal participation in forest management

Russell Collier, Resource Consultant, Smithers, B.C.

ABSTRACT: When faced with two seemingly disparate and possibly incompatible choices – participate in provincial planning processes or assert aboriginal rights – the Gitxsan characteristically chose to do both. The result is an interesting project that could serve as a widespread tool to provide inventory information for both general biodiversity and aboriginal rights. The project, Wildlife Inventory and Habitat Assessment, or WIHA, sought to build a GIS-based correlative model by which the distribution and relative abundance of a broad range of terrestrial animals could be predicted with confidence across a range of Biogeoclimatic Ecosystem Classification (BEC) zones. It also sought to demonstrate how selected Gitxsan aboriginal rights could be satisfied through protecting wildlife habitat and populations. As the project was intended as a pilot that would be applied across all Gitxsan territories, the project team used methodologies that were scientifically defensible and culturally appropriate.

The WIHA team consisted of a number of core Gitxsan staff, including GIS and GPS experts and field and cultural experts; key professional specialists, including the regional research head for the Ministry of Forests; an R.P. Bio. (and former Wildlife Branch head); and several wildlife biologists with specialities in rare, threatened and endangered species, herptile species, wildlife capability/suitability and general biodiversity.

The project wildlife habitat polygons, based on Forest Cover and TRIM, were created in a landscape stratification process developed by Anne Hetherington and refined by Allen Banner and Allen Edie. The resulting map base contained 11 distinct wildlife habitat types. These 11 habitat types were used as a guide to sampling: the landscape was sampled in proportion to their occurrence on the mapped study area. The WIHA team used and adapted Dave Hatler's RIC standard methodology (draft 3) to conduct transect sampling of the 11 wildlife habitat types, using straight-line transects that varied from 500 meters to 6 kilometres, depending on terrain.

Points of Commencement and Termination, plus several control points along the transect, were recorded via differentially corrected GPS to positively locate transects in GIS maps. Observations within a 5-metre corridor were located by hip-chain and compass, and recorded in standardised data collection forms in field notebooks. Wildlife observations were collected solely by the RIC methodology, but Gitxsan cultural observations, to capture their patterns across the landscape properly, were necessarily collected as they occurred. For example, a major trail within a hunting/trapping/gathering area would be followed and documented with GPS and field notebook so its relevance to wildlife observations could be more easily understood. All told, some 15,000 data points were collected for the two study areas during the lifetime of the project. Unfortunately, as the spending mandate of FRBC changed over time, funding for this project ended before completion.

However, it is worth mentioning what the WIHA team intended to do with the inventory information. Once wildlife habitat types had been sampled sufficiently in each study area, similar study areas within the same BEC zones would have been picked to test correlative predictions. Like

habitat types should yield roughly the same kinds of wildlife in more or less the same abundance. And once the GIS model could be demonstrated to work reliably for the selected BEC zones, more zones would be sampled and added until the whole Gitxsan territory could be reliably modelled. Predicted populations and distributions could be used as a check on possible negative impacts by large-scale logging, and could inform adaptive management plans. Because the inventories, cultural mapping, predictions and monitoring of impacts would all be done by trained Gitxsans, to provincial RIC standards, the data and management plans could be done with scientific rigour and cultural integrity.

For more information please contact the Gitxsan Treaty Office or e-mail the author at russell.collier@telus.net

Questions and comments

- Is it possible to use cultural information as part of a retrospective study to establish what the impacted areas were like prior to development? There are good descriptions from early explorers and indirect or qualitative measures from historical records (i.e. trapping).
- Social and cultural issues are relevant and they do affect biodiversity. You cannot treat these as purely scientific questions as we need a balance and people are part of the equation.

Some Canadian Forest Service led research projects addressing boreal forest fire disturbance

Brad Hawkes, Ph.D, R.P.F., Natural Resources Canada,
Canadian Forest Service

ABSTRACT: The large fire database (Fires >200 ha, post 1950) provides fire polygons with fire attributes (e.g. fire size, cause, start and end dates, etc.) that will allow the determination of fire regimes in the boreal forest. The database is a cooperative effort among the fire agencies in Canada and the Canadian Forest Service (CFS). In addition to the large fire database, fire weather data from across Canada has been assembled for the same time period on a daily and hourly basis. National fire weather and behaviour seasonal maps are being used in CFS-led climate change research. Key contacts for this effort are Bernie Todd and Dr. Mike Flannigan, CFS, Northern Forestry Centre (NOFC), Edmonton, Alberta and Brian Stocks, CFS, Great Lakes Forestry Centre (GLFC), Sault Ste. Marie, Ontario.

In addition to the large fire database, a fire monitoring, mapping, and modelling system has been developed by Bryan Lee and the fire management systems group at NOFC in cooperation with the Canadian Centre for Remote Sensing in Ottawa. The system produces daily images of hot spots from wildfires, images of smoke plumes, estimates of fire behaviour, integrated GIS products, and fire statistics. System information is available over the Internet through the Fire Research Network web page at NOFC.

An inter-agency research team is developing a fire and insect disturbance database for B.C., funded in its first year by FRBC. The project is led by Steve Taylor, CFS, Pacific Forestry Centre (PFC), Victoria, B.C. Fire polygons >20 ha are being digitized for the period 1920-present and connected to individual fire information including cause and fire weather. The database will form the basis for studying the interaction between fire and insects, especially mountain pine beetle.

Canadian Forest Service fire researchers are using current global and regional circulation model projections, coupled with fire behaviour and weather prediction systems to determine potential climate change impacts on future fire regimes. These models have shown an increase in the strength and aerial extent of extreme fire danger, and an increase in fire season length. Projections are being improved and validated across Canada. The regional climate model is being further developed to allow lightning predictions to be made. Carbon release from fires is also being determined for Canada. Direct release to the atmosphere averages 27 Tg C/yr (20 per cent of Canada's fossil fuel emissions). The CFS is leading the development of carbon budgets at national, regional and local

scales. The key contacts for this work are Dr. Mike Flannigan, CFS, NOFC and Brian Stocks, CFS, GLFC, Sault Ste. Marie, Ontario.

The international crown fire project is a cooperative project with the CFS, North West Territories, and the U.S. Forest Service playing key roles. The project started in the mid-1990s when an experimental site was developed north of Fort Providence in the North West Territories. Local community involvement has been an important part of the project's success. In addition to the experimental crown fires adding needed information for crown fire modelling, the fires have provided opportunities for the testing of structure ignition, fire resistant clothing and fire shelters. The project has provided an opportunity for testing existing fuel modification procedures for protecting communities and individual homes. There is also ecological research being conducted on the site. A special issue of the *International Journal of Wildland Fire* will feature key results from the project. The key contacts for the project are Dr. Marty Alexander, CFS, NOFC and Brian Stocks, CFS, GLFC.

Integrating fire into sustainable forest management has been a high priority for provincial fire and forest management agencies, especially in the western boreal forest where major fire losses have occurred within forest management agreement areas. A number of studies has been initiated in B.C., Alberta, Saskatchewan, Ontario and Quebec as cooperative efforts among the provinces, forest industry, and CFS. A pilot project is nearing completion in Robson Valley District, B.C. led by Dr. Brad Hawkes, PFC, in cooperation with B.C. Ministry of Forests, Protection Branch and district staff. A wildfire threat analysis is being conducted for the district. The analysis will help fire and forest managers identify what values and locations are most at risk from fire. Additional threat rating projects are being undertaken in Alberta and Saskatchewan. In addition, Kelvin Hirsch CFS, NOFC and Victor Kafka (now with Parks Canada, Ottawa) have completed a project with Millar Western Forest Company in Alberta. The project incorporates fire into the long-range forest management planning process to create landscape-scale fuel breaks to reduce the occurrence of large fires. In addition, a Sustainable Forest Management Network, National Centres of Excellence funded project (CFS, University of Alberta and University of Toronto) is looking further at the incorporation of fire on the landscape, including determining the impact of fire on future timber supply. The key contact for this project is Dr. Dave Martell, University of Toronto, Ontario.

Questions and comments

- Pyrodiverstiy: the Canadian Forest Service has a 51-year-old database of large fires.
- We must take a spatially explicit approach towards certification and examine the trade-offs.

Bat roosting and foraging ecology in disturbed and undisturbed B.C. sub-boreal forests

Jennifer Psyllakis, University of Northern B.C.

ABSTRACT: The overall objective of this project was to improve our understanding of bat roosting and foraging ecology in disturbed habitats. Natural disturbance patterns have recently been adopted as models for timber harvesting practices. Our understanding, however, of how natural disturbances affect populations is in its infancy. To incorporate natural disturbance management "lessons" it is imperative that we understand the effects of, and the differences between, naturally disturbed, harvested and undisturbed landscapes.

To assess the effects of disturbance on the roost-selection behaviour of bats belonging to the genus *Myotis*, I used data from bat capture and radio telemetry. I found that bat capture success and sex ratio were not independent of disturbance history. Fewer bats were captured in disturbed sites (fire and logged) compared to undisturbed sites, and 3:1 females:males were captured in undisturbed sites whereas in logged sites the ratio was 1:3. Roost trees were significantly closer to capture locations in undisturbed habitats compared to logged habitats. This increase in commuting distance between foraging (capture sites) and roosts likely restricted the distribution of females because of the increased energy demands on females during the reproductive season. The 37 day roosts I located were primarily in two species of trees, lodgepole pine and trembling aspen, in mature stands (>120 years). In pine trees, bats roosted under bark, usually alone, whereas aspen were primarily used by maternity colonies. All maternity colonies were in naturally formed vertical crevices and not in primary excavated cavities.

I concluded from these results that: 1) female *Myotis* bats will be most negatively affected by logging activities; 2) management practices that target rotation intervals of <100 years will reduce the habitat available to bats; and 3) in sub-boreal forests management strategies that include bats under the umbrella of primary cavity users will not maintain roosting requirements.

To assess the relative activity of bats in mature residual forest patches, unburned in a successional landscape created by fire, and continuous undisturbed forests of the same age and tree composition, I used remote bat detection equipment to continuously record nightly bat activity. Retaining residual patches of unharvested trees within a clearcut is a current forest management practice meant to approximate natural disturbance and accelerate the succession trajectory of the clearcut. The utility of natural patches to bats and thus the justification of prescribed patches had not been assessed. I found that in natural remnant patches there was a significant positive correlation between bat activity and patch size (range 2 - 21 ha). Overall, however, there was no significant difference between remnant stands and continuous, undisturbed stands. I concluded from my results that remnant patches provide habitat to bats in otherwise inhospitable landscapes (young regenerating forests). The size of the typical prescribed patches in clearcuts (typically <2 ha), however, may limit use in managed forests.

Summary of group discussion

THE THREE QUESTIONS INTRODUCED AT THE WORKSHOP WERE GIVEN DIFFERENT WEIGHTING. There was a great deal of discussion about the relevance of Question 1 and recognition of the need to rephrase the question. Any one of these questions would be answered differently depending on the scale that was identified.

The second question was framed specifically within a natural disturbance context with limited discussion about other management approaches. The third question was discussed and placed into the context of a framework of different scales and continua.

The workshop approach was adapted and the process of working through the strengths and challenges of knowledge in each area was less relevant. More emphasis was placed on clarifying the approach and context for questions.

Participants generally agreed on the summary below, but did not go through individual strengths and challenges. These points are suggested and not consensus-based. Similarly, we include suggested areas for prioritizing research, but these are not ranked. Thus, the knowledge matrix is a list of suggestions rather than formal consensus-based recommendations.

Question 1: How much forest needs to be devoted to biodiversity maintenance?

We rephrased the question to make it more appropriate to B.C. and the Yukon.

How much area needs to be preserved?

- There is a need to manage the whole landscape as a continuum (mosaic) including protected areas, extensive management, and intensive management. The objectives must balance the ecological with the socioeconomic and remain flexible among provinces. We cannot do everything everywhere; rather, we should do most things in many places. However, our goal is no loss of species richness and ecological function (e.g. natural disturbance) within a defined scale (e.g. ecoregion, defined forest area, or combination of scales). Protected areas are not the only place where biodiversity will be managed and conserved, although we need to examine how much intensive and extensive management there will be. We must balance the social/cultural and economic values with biodiversity values.
- Protected areas in the boreal forests of B.C. are not large enough. We need large reference areas that are unmanaged (left for natural disturbance). We have "postage stamp" parks that are isolated. Representation needs to be balanced with size and variability. Sub-boreal B.C. is represented only by Carp Lake and OGMAs. The LRMP zoning framework provides a context for our discussions.

- What is the significance of the non-contributing landbase? How should we manage it and how should we protect it? We need to explore as an example the NHLB Netdown map with full constraints (partial constraints will be a challenge). Any such study should:
    - Incorporate oil and gas developments
    - Consider risk management, and
    - Include representation and variability.
- What are the opportunities (e.g. road corridors for intensive management, mixed wood for increasing retention)?
- We could use a section map from Alberta where there are 10 to 15 per cent heterogeneous patches and mesic sites that could contribute to protected areas. Are reserves floating or fixed? We will require some fixed reserves, but we should maintain flexibility within the landscape context.
- What is the threshold for how much is enough, and is there a minimum requirement (temporal and spatial)? There is an implicit target for no losses.
- We do not need a full range of natural disturbance across the landscape. Do we really want to emulate large-scale disturbances with associated landslides, erosion and stream damage?
- Land ownership and tenure systems are an impediment to biodiversity management. We need buffers around parks.
- Our target should be to maintain biodiversity as extensively as possible across the landscape. We do not have good data on the CWD; it is patchy, particularly by fire class variables.

Question 2: How can management effectively restore/recreate/maintain important features required to conserve biodiversity?

We recast the question. **If we manage using the natural disturbance template, will we maintain biological diversity?**

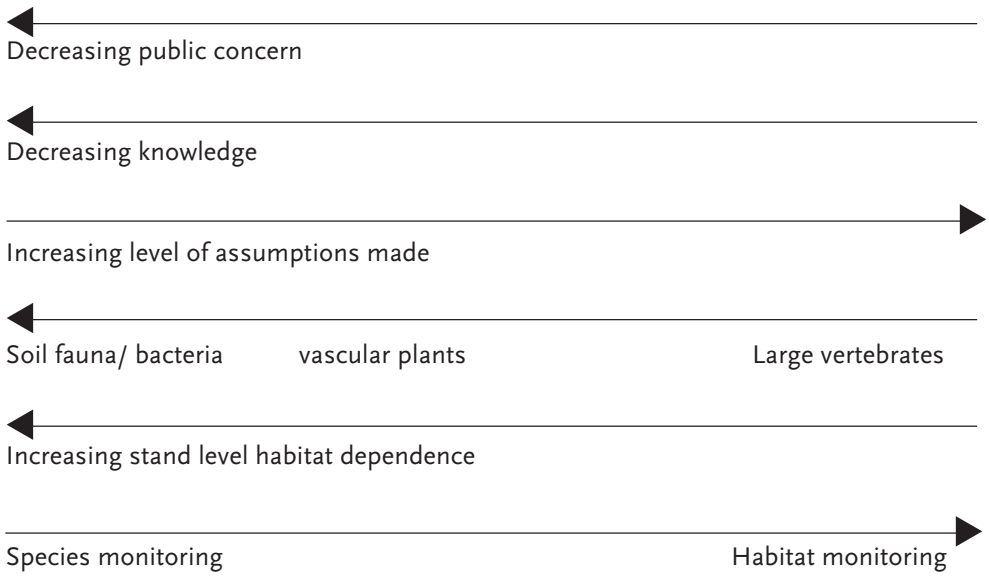
- Maintenance of biological diversity is a priority in the B.C. boreal. Scale determines whether we are looking at maintenance or restoration.
- There is a high probability that we will be very close to maintaining biodiversity if we use a natural disturbance (ND) template. No human management will replicate natural disturbance. We cannot deal with the full range of natural range of variability.
- To answer Question 2, we need targets and natural disturbance baselines (differences between ND and harvesting using the ND template). What do these differences mean in terms of biodiversity, fire obligate species and habitat structure? We need to determine and document differences between ND and managed forests (harvesting impacts will extend beyond natural levels in both rate and extent). Stand level information is limited.
- What strategies can we use to create habitats not created by harvesting?
- What are the management strategies and treatment differences between the timber harvesting landbase and the non-harvesting landbase? How valuable is the NHLB to biodiversity? Do we actively manage it? What is its distribution?
- We need a risk assessment for the salvage policies (targets) and the early successional species.
- Thresholds: if we go outside of the ND template, what are the trade-offs?
- Targets depend on the scale we identify. We do have some targets for structure and pattern, broad provincial goal statements of biodiversity maintenance. Spatial and temporal scales as well as climate changes will need to be considered in the baseline.
- In B.C., the only relevant part of this question is maintenance, as we do not need to look at restoration and recreation.
- Landscape level information is quite good regarding pattern, patch sizes, species distribution, composition, retention and remnant stands. At the stand level we need succession pathways and stand structure differences between managed and natural disturbance, both for the THLB and for the NHLB.

Question 3: How can we determine the effectiveness of these biodiversity conservation efforts?

We recast the question.

How can we narrow the definition of biodiversity to measure effectiveness?

- Integrated continuums (Innes/Gillingham) require that we make our assumptions explicit. There a re a number of simultaneous trends, shown below.



- What tools do we need to use the continuum? We cannot measure biodiversity so we need to measure pieces of the puzzle below biodiversity to see if management is effective.

The BorNet synthesis report

- It was suggested that BorNet could build a table of indicators and attributes across scales. However, we are looking for indicators of the full range of biodiversity along the continuum. We need to look up the scale from stand to landscape (managing biodiversity at the stand scale does not make sense). BorNet is currently developing an annotated bibliography and synthesis of knowledge as a first step or baseline.

Research priorities

- Establish the relationships between species and structures to build a rationale for monitoring.
- Be cognisant of the influences of public concern vs. range of species or habitat dependence. We must balance attributes such as resident vs. non-resident, size and mobility.
- We need to select things we can measure for effectiveness monitoring.

Extension needs

- There is a lack of awareness and access to ongoing studies and information on biodiversity studies. It would be useful to have a summary of all fire ecology and fire management studies in B.C. (CFS).
- It would be useful to have annual workshops on relevant themes.
- We need habitat models with species accounts and a central clearinghouse for the accounts.
- We need tools for looking at the concept of scale.
- Industry needs definitions for biodiversity and natural disturbance.

Knowledge matrices

Based largely on the surveys (an opportunity for participants and those unable to attend the meeting to contribute written comments on the three synthesis questions), these tables were not developed in the context of the adapted questions used by the B.C. regional workshop. Thus, they reflect the suggested comments from participants and others prior to the group discussions. They should be taken as suggestions rather than as recommendations and do not reflect group discussions or consensus.

Question 1: How much forest needs to be devoted to biodiversity maintenance?

Strengths

- Land ownership (crown land)
- Stand development, succession (single species management)
- Species composition
- CWD (baseline data) thresholds are not available, so information on previous stand history is variable
- Snags?
- Good knowledge of fire disturbance ecology (natural disturbance regimes and patterns), although there are some gaps
- Forest management emulates natural disturbance in SBS
- Caribou/grizzly habitat requirements
- Good ecological classification framework in B.C.

Challenges

- Reduction in the area of old forest
- Best combination of rotating reserves and fixed reserves over time (management strategy) and reserves that allow natural processes
- Targets
- Process for making trade-offs
- Baseline data (synthesizing data)
- Scale (temporal and spatial) i.e. balance spatial metrics natural disturbance and ecosystem function with needs at stand level
- Links between structural features and attributes
- Special habitats
- Poor forest inventory
- Baseline data for historic range of variability for insect disturbance
- Poor knowledge of fire obligates and the associated structural elements
- Distribution and abundance of invertebrates and plants
- Response of non-vertebrate species to disturbance
- Poor understanding of thresholds for habitat management
- Boreal mixed wood stand types (modelling future stand conditions)
- Successional pathways

Question 2: How can management effectively restore/recreate/maintain important features required to conserve biodiversity?

Strengths

- Landscape level information is good
- There is a large body of silviculture knowledge
- Stand-level targets for structure, species composition and CWD, wildlife trees exist
- Thre is information from the EFMPPs on which features to maintain
- Alternative silviculture trials (e.g. MASS, EMEND, Dat Creek) exist
- Patch size distribution, patch shape, residuals and CWD management
- Certification is changing methods and attitudes
- Old growth reserves and wildlife tree patches are required

Challenges

- Natural disturbance as the template for management
- Rate of disturbance
- Patch/shape
- Contribution of the non-harvested landbase
- Interaction of the non-harvested landbase with disturbance and protection of THLB
- Policies regarding salvage and protection
- Adaptive management
- Culture of sustained yield
- Goals of SFM and knowledge gaps
- Determine stand and landscape level objectives
- Impacts of eliminating fire as a disturbance; how well silviculture mimics disturbance, particularly for fire dependent species
- Effects of roads
- Lack of guidance for maintenance of CWD (CWD targets)
- Importance of connectivity of older stands
- Influence of spatial pattern versus amount of habitat
- No good information on partial cutting/variable retention
- Yield and projection modelling (a major limitation is that it is based on single species clearcuts)

Question 3: How can we determine the effectiveness of these biodiversity conservation efforts?

Strengths

- Criteria and indicators have been developed for model forests
- There is a baseline on range of natural range of variability
- Certification schemes detail what is considered to be a good approach
- Establishment of long-term monitoring for trees, snags, CWD, detailed vegetation and site series classification

Challenges

- Suites of indicators
- Field monitoring for validation
- Different scales for different species
- Adaptive management
- The effectiveness of current biodiversity mechanisms is unknown
- Cultural patterns
- Lack of inventory data
- Data quality variable (VRI and forest cover)
- Linkages of structural features and attributes
- Local criteria and indicator development is limited
- There is limited information to compare any resulting stands to a baseline
- There is no effective monitoring program
- We need more easily measurable indicators
- There is little knowledge of communities, as opposed to individual species
- There have been few adaptive management studies on biodiversity (pre and post harvest surveys)
- There is no consistent implementation of monitoring programs

Participants

PARTICIPANTS

BorNet Canadian Regional Workshop

November 23 and 24, 2001 • Prince George, B.C.

Jan Adamckewski
Yukon Fish and Wildlife
Jan.Adamczewski@gov.yk.ca

Herschel H. Boydston, Executive Director
Northern Forest Research & Extension Partnership
hboydston@nfrep.org

Russell Collier, Land and Resource Planner
Strategic Watershed Analysis Team
russell@ecotrustcan.org

Craig Delong, Ecologist
Ministry of Forests, Prince George, B.C.
craig.delong@gems1.gov.bc.ca

Stephanie Dube, Research Silviculturalist
Prince George Forest Region
stephane.dube@gems5.gov.bc.ca

Peter Gilles, Facilitator
Oneworld Facilitation
wag@web.ca

Mike Gillingham, Associate Professor
University of Northern B.C.
michael@unbc.ca

Brad Hawkes, Fire Research Coordinator
Canadian Forest Service
bhawkes@nrcan.gc.ca

Daryll Hebert, Consultant
Encompass Strategic Resources Inc.
jsomerfield@kootenay.com

John Innes, Professor
Forest Resources Management, UBC
innes@interchange.ubc.ca

Mike Jull, Manager
Aleza Lake Research Forest (UNBC/UBC)
jullm@unbc.ca

Kathy Lewis, Associate Professor
University of Northern B.C.
lewis@unbc.ca

Susan Leech, Landscape Ecologist
Southern Interior Forest Research Partnership
sleech@interchange.ubc.ca

Dwayne Martin, Natural Resources Coordinator
Tl'azt'en Nation-Natural Resources
forestry@tlazten.bc.ca

Brian Nyberg, Manager
Wildlife Policy and Adaptive Management
B.C. Forest Service
Brian.Nyberg@gems6.gov.bc.ca

Kathy Parker, Professor
University of Northern B.C.
parker@unbc.ca

Jennifer Psyllakis, Graduate Student
University of Northern B.C.
psyllakj@unbc.ca

Don Rosen, Canadian Forest Products
drosen@mail.canfor.ca

Dale Seip, Wildlife Habitat Ecologist
Ministry of Forests, Prince George, B.C.
Dale.Seip@gems3.gov.bc.ca

Victoria Stevens, Ecological Analyst
Habitat Branch, Ministry of Water, Land and Air Protection
tstevens@gems1.gov.bc.ca

Susan Stevenson, Consultant
Silvi Fauna Research
sksteven@pgweb.com

Steven Thorpe, Planning Coordinator
Canadian Forest Products Ltd.
sthorpe@mail.canfor.ca

Carl Vandermark, Planning Superintendent
Canadian Forest Products Ltd.
cvandermark@mail.canfor.ca

Carolyn Whittaker, BorNet Coordinator
University of British Columbia
cwhittak@interchange.ubc.ca

BORNET PROJECT OVERVIEW

PHASE 1
NATIONAL SYNTHESIS

Canada: Three BorNet regional workshops

Finland: FIBRE program

Sweden: MISTRA program

Funding – Canada: SFMN;
Sweden: MISTRA, Finland: FIBRE

PHASE 2
INTERNATIONAL PROGRAM

International conference May 2002

- Networking
- Development
- Knowledge gap analysis

Funding – Canada: NSERC IOF and SFMN;
Sweden: MISTRA; Finland: BITUMI

PHASE 3
INTERNATIONAL IMPLEMENTATION

Industry feedback

Project dissemination

New research opportunities

Funding to be sought –
Canada: SFMN, private sector