PROJECT REPORT
1999-8

sustainable forest management network

réseau sur la gestion durable des forêts

Key Factors in the Maintenance of Biodiversity in the Boreal Forest

A Network of Centres of Excellence
Un réseau de centres d'excellence

Pierre Drapeau, Yves Bergeron and Brian Harvey

For copies of this or other SFM publications contact:

Sustainable Forest Management Network
G208 Biological Sciences Building
University of Alberta
Edmonton, Alberta, T6G 2E9
Ph: (780) 492 6659
Fax: (780) 492 8160
http://www.biology.ualberta.ca/sfm/

ISBN 1-55261-022-5

Key Factors in the Maintenance of Biodiversity in the Boreal Forest

by

Pierre Drapeau[1], Yves Bergeron[1,2] and Brian Harvey[2]

[1]Groupe de recherche en écologie forestière interuniversitaire (GREFi),
Département des sciences biologiques,
Université du Québec à Montréal,
Montréal, C.P. 8888, succ. Centre-Ville, Montréal, Québec, H3C 3P8

[2]Université du Québec en Abitibi-Témiscamingue,
445, boul. de l'Université, Rouyn-Noranda, Québec, J9X 5E4

May 1999

ABSTRACT

In industrial boreal forest landscapes, cutting rates are generally shorter than natural disturbance cycles and more severe in terms of live trees and coarse woody debris left following logging. Loss of mature and old-growth forests and the decrease in availability of key habitat attributes such as coarse woody debris are thus of concern for the issue of biological diversity. This research project evaluates the contribution of critical habitats (mature and old-growth forests) and key habitat attributes (coarse woody debris: standing dead trees and logs) for biodiversity in naturally disturbed and managed boreal forest landscapes of the black spruce forest zone in Quebec. At a local scale (stand level), biodiversity was measured (vascular, non-vascular and carabid beetles) in forest stands that originated from fire events of different ages ranging from recently burned stands (<time since last fire < 5) to old-growth stands (time since last fire > 200 years). At a landscape scale, songbird populations were surveyed in four (4) unmanaged forest mosaics originating from different fire events (< 2 years, < 20 years, 100 years, > 200 years) and two managed forest landscapes, one that was horse-logged some 70 years ago and one that was transformed by conventional industrial logging (< 20 years). Preliminary results of this study are discussed in the context of sustainable forest management guidelines at both site and landscape levels.

INTRODUCTION

It has become recognised around the world that human development cannot take place without first considering sustainability of life support systems. Within this perspective, biodiversity has become a major issue both on the world scene and at the national level. In the Canadian boreal forest ecosystem, timber harvesting is the main human activity that modifies landscapes. Although forest management may show some similarities with natural disturbances (fire and insect outbreaks) to which organisms are adapted, there are important differences between these two types of disturbances. Cutting rates are generally shorter than natural disturbance cycles (Spies et al. 1994; Gauthier et al. 1996; Bergeron and Harvey 1997), and more severe in terms of live trees and coarse woody debris left following logging (Spies et al. 1994). Hence, in industrial forest landscapes, concerns regarding the issue of biodiversity have identified two important aspects: (1) changes in the age structure of forests and (2) whether managed forests successfully hold key environmental attributes (for example, coarse woody debris) for maintaining a biodiversity similar to that in unmanaged forests (Hansen et al. 1991; Franklin 1993; Hejl et al. 1995). Forest industry has yet to demonstrate that biodiversity can be maintained in managed forest landscapes both nation wide and within regions (Forest Management Certification); an important issue in the establishment of sustainable forestry is the maintenance or restoration of biodiversity (Canadian Forest Service 1993; Freedman et al. 1994).

Until recently, most knowledge on forest ecosystems biodiversity has come from studies conducted in the Coastal Northwest forest biome (Spies and Cline 1988; Hansen et al. 1991; Lamberson et al. 1992; Franklin 1993). Recommendations and management guidelines for sustainable forestry in this biome are not necessarily applicable in the eastern boreal forest. Moreover, as noticed by Freedman et al. (1994), the status of forest types (by age-class) in eastern Canada and their contribution to landscape-scale biodiversity remains poorly documented. Comprehensive efforts to assess the state of forest types and their contribution to biodiversity in the eastern boreal forest are thus critical. Coincident with these efforts, the question of how well managed forests substitute for natural forests is linked to quantitative field investigations that focus: (1) on whether key differences exist in biodiversity patterns between managed forests and naturally disturbed forests, and (2) on how critical these differences are to the maintenance of regional biodiversity. For instance, the more complex structure and higher density of woody debris (snags and logs) in forests under natural disturbance regimes may provide unique microhabitat conditions to a wide range of organisms at the stand level and over the whole landscape. Standing dead wood and coarse woody debris may be far less abundant in forests that regenerate from logging. To tackle these issues, ecological investigations must incorporate both the traditional stand level and landscape level approaches (Freedman et al. 1994; Hejl et al. 1995; Thompson et al. 1995).

In this report we present preliminary results from an ongoing investigation in Quebec's black spruce forests. First, we characterize biodiversity patterns both at the stand (vascular and non-vascular plants, insects) and landscape-scales (birds) in forest landscapes under natural disturbances that cover the range of variability of forest types both in terms of age class

distribution and stand composition. These patterns are considered as bench marks against which assessment of the state of biodiversity in managed forests will be done. Second, we use songbirds to compare biodiversity patterns in forest landscapes under industrial timber management to those of forest landscapes ruled by a natural disturbance regime to evaluate if these differences are critical to the maintenance of regional biodiversity. Emphasis is put on assessing the contribution of (1) overmature and old-growth forests given their vulnerability to current forest management strategies, and (2) coarse woody debris availability considering their key role as habitat attributes for boreal wildlife. Management implications of these preliminary findings are discussed.

STUDY AREA AND METHODOLOGICAL APPROACH

This work is presently underway in six boreal landscapes (from 50 to 100 km^2) disturbed by recent fire and logging located in the Abitibi region, northwestern Quebec ($49^0$13'N $78^0$38'W) and in northeastern Ontario in the lake Abitibi Model Forest ($49^0$03'N, $80^0$09'W). Within selected landscapes, sampling site location is based on a sampling design (1) that focuses on the age gradient (from mature to old-growth) of remnant forest stands to assess the contribution of these habitats in the maintenance of biodiversity at the stand and landscape scales and (2) that characterises biodiversity in adjacent logged and fire disturbed stands to determine if forestry practices substitute for natural disturbances in providing key environmental features for the maintenance of biodiversity. A fire history map of the study area provided by Bergeron's SFMN team (Gauthier, pers. comm.) allowed to identify the location of potential old-growth forests, unlogged areas where wildfires recently occurred, recently logged areas (< 20 years) and mature forest landscapes that regenerated naturally after wildfires (< 90 years). Sampling sites within these forest landscapes were located with respect to logistic constraints of access roads.

Although biodiversity implies all living organisms of a given ecosystem, a species-by-species approach for measuring biological diversity is impractical. Conversely, focusing on a single taxonomic group (for instance, mammals or birds), which is often the case in many studies on biodiversity, may miss the critical point that organisms habitat requirements vary with scale and, hence the maintenance of biodiversity in boreal forests must be considered at multiple scales. In this project, we use four (4) taxonomic groups: Vascular plants (trees, shrubs and herbs), non-vascular plants (bryophytes, lichens) invertebrates (carabid beetles) and vertebrates (songbirds) (see Appendix for 1999 SFM conference abstracts related to this project). These four taxonomic groups will allow us to document variations of biodiversity on different scales. For small and relatively immobile species such as non-vascular plants and invertebrates, habitat requirements may be fulfilled in environments of a few hectares while vascular plants and vertebrates may occupy much larger areas (from several hundred hectares to several hundred of square kilometres). Furthermore, a particular feature of this project is the simultaneous coverage of plant and animal diversity. Most studies on biodiversity focus on one of these components but rarely document both.

Using line transects (200 m X 4 m), vascular plants and vegetation structure were sampled in 94 sites covering a range from recently burned (< 2 years) to old-growth forests. For non-vascular plants, 22 sites covering a range of age-class from mature (> 80 years) to old-growth forests (> 200 years) were sampled with an intensive sampling device along line transects of 100 m at each site. Percent cover of individual species of bryophytes and lichens (epiphytic and on the ground) was estimated and specimens were identified in laboratory. Insects, principally Carabid beetles were sampled using a array of sampling devices and techniques (modified malaise traps, pitfall traps, intercept nets in 21 sites that covered a range of age-class from recently burned (< 1 year) to old-growth forests (> 200 years). For Songbirds, six landscapes were selected on the basis of the type and the time of the last disturbance (burned < 2 years, 20 years, 95 years, > 200 years; logged 20 years, horse-logged 80 years). In each landscape songbirds were surveyed in 50 to 65 sampling stations with the point count method. Details of this census technique are outline elsewhere (Drapeau et al. *in press*). Sampling stations were located 300 to 450 m apart along line transects of 1.5 to 3 km long. In the mature (natural and horse-logged) and old-growth forest landscapes sampling stations were located in forest types dominated by black spruce. In recently burned and logged landscapes, remnant forest stands and adjacent stands in the logged and fire disturbed matrix were also be sampled. Even though the overall songbird community was sampled, emphasis was put on cavity-nesting birds that are dependent on the abundance and availability of deadwood for nesting and foraging (Davis et al. 1983; Gutzwiller and Anderson 1987; Lundquist and Mariani 1991; Hutto 1995).

OVERALL IMPORTANCE OF OVER-MATURE AND OLD-GROWTH FORESTS IN THE CLAY BELT REGION

Dendrochronological reconstructions of fire events over the last 300 years in the study area (between 48 and 50 N along the Quebec-Ontario border (Bergeron et al. 1998) indicate that under natural disturbance regimes, old-growth forests in the Clay belt region occupy an important proportion of the landscape (Fig. 1).

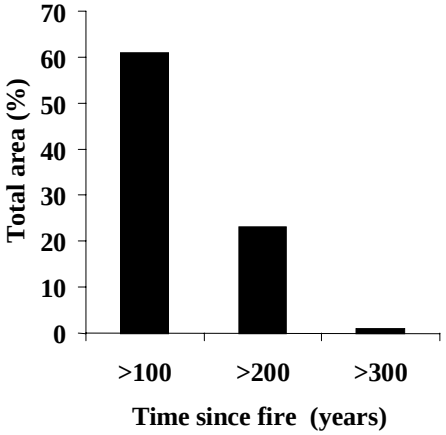

Figure 1. Proportion of the landscape in over-mature and old-growth age-classes in the Quebec-Ontario clay belt region.

CHANGES IN VEGETATION STRUCTURE FROM MATURE TO OLD-GROWTH FORESTS

Changes in mean basal area of black spruce by DBH class in relation with time since fire show that the density of larger trees 15-20 cm and > 20 cm is decreasing as the age of the forest stands exceeds 150 years on clay deposits. In the Quebec and Ontario portions of the Clay belt this results in the opening of the canopy in black spruce old-growth forests (Fig. 2).

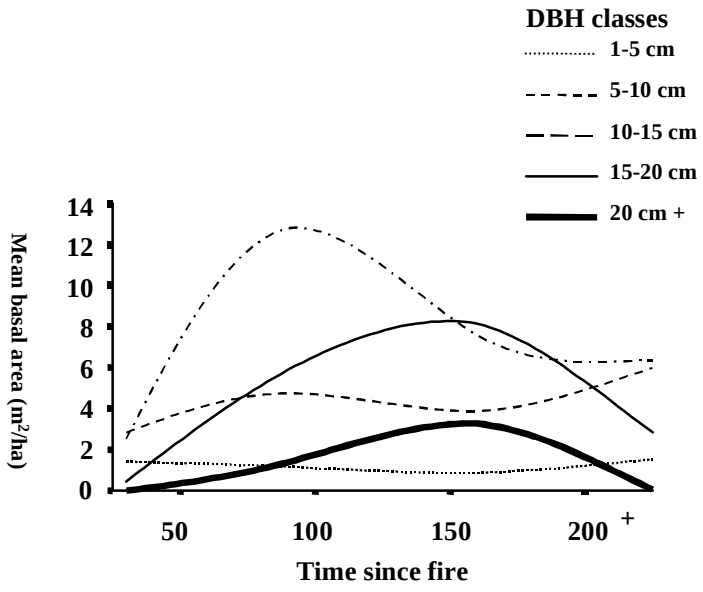

Figure 2. Basal area of black spruce by DBH classes as a function of time since fire from mature to over-mature and old-growth forest types (n = 72) in the Clay belt region.

Mean snag density and mean density of suitable snags for wildlife were compared between the 4 natural landscapes. A suitable snag was one dead tree with a large DBH and a small state of decay. It was determined using a logistic regression analysis on 6 655 snags (2 590 used vs 4 065 unused) that were sampled in the recently burned landscape (1 year after fire). The recently burned landscape showed the greatest availability and suitability in snags. There was no significant difference (One-way Anova's, $P < 0.05$) between mature (95 years) and old-growth landscapes (>200 years) in availability and suitability of snags. (Fig. 3).

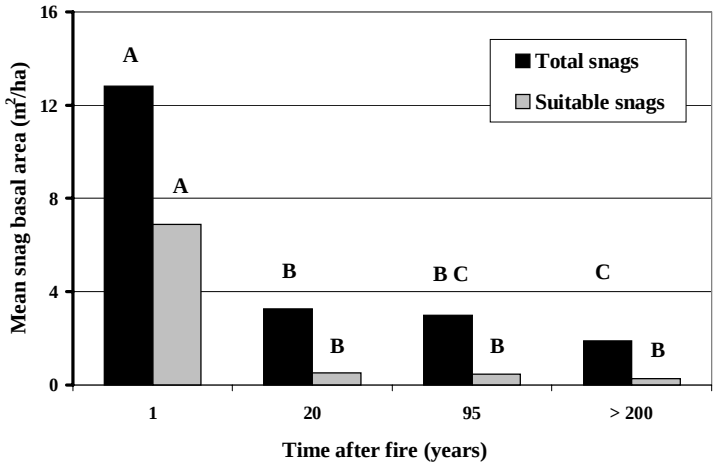

Figure 3. Snag abundance and suitability as a function of time since fire in natural black spruce forest landscapes of Quebec-Ontario clay belt region. Letters denote significant differences between time since fire periods as for availability and suitability of dead trees for wildlife.

BIODIVERSITY PATTERNS IN MATURE, OVERMATURE AND OLD-GROWTH FOREST TYPES

For all taxonomic groups that were sampled (vascular plants, non-vascular, insects and birds) our preliminary results indicate that there are differences in biodiversity (reflected by changes in species composition) between mature and old-growth forests. However, these differences appear to be mainly under the influence of the structure of forest cover that changes from a closed to an open canopy from mature to old-growth forests. Forest continuity (forest stands that have not been disturbed for long time periods) does not seem to be an important factor in the explanation of these patterns. Hence, even though some species show preferences for old-growth forests, across all taxonomic groups under study, these forest types are not refugees for species with restricted range. old-growth habitats at least in the clay belt portion of the boreal forest.

BIODIVERSITY PATTERNS ALONG THE AGE GRADIENT IN POST-FIRE STANDS AND LANDSCAPES

For some groups (insects and birds) we extended the sampling to cover all the chronosequence from early post-fire sites to old-growth sites. Investigations at the landscape scale for birds and at the stand level for insects in recently burned sites and early seral stages indicate that these habitats, particularly recently burned (< 3 years) areas, hold fire dependent species and habitat characteristics (high densities of snags, see Fig.3) that may have an important contribution to the regional biodiversity of the Clay belt black spruce forests (Figure 4).

Moreover, early post-fire landscapes are often subject to salvage cutting. This reduces the suitability of burned–forest habitats for fire-dependent species by removing the most important element – standing fire-killed trees.

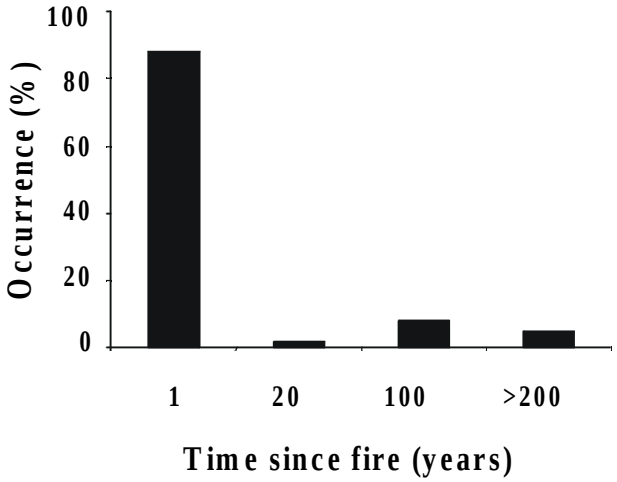

Figure 4. Occurrence of Black-backed Woodpecker (*Picoides arcticus*) in forest mosaics that originated from fire events of different ages ranging from recently burned stands (1 year) to old-growth stands (> 200 years). Sample size by forest mosaic ranged from 50 to 61 sites for a total sampling effort of 370 stations.

SONGBIRD RESPONSE TO FOREST FRAGMENTATION IN NATURAL AND MANAGED FORESTS

Songbirds were sampled in seven landscapes (from 30 to 60 km^2) that covered different levels of fragmentation induced either by fire or timber management. At the landscape scale, preliminary results indicate that many species are tolerant to the opening of the forest canopy. Moreover, some species that have shown sensitivity to changes in the canopy cover at the landscape scale in the boreal mixed-wood forest (Drapeau et al. *in press*) responded differently in the black spruce (Fig. 5). This preliminary result emphasises the importance of using empirical regional studies to assess wildlife sensitivity to changes in habitats rather than relying on literature based habitat suitability indices that can be misleading.

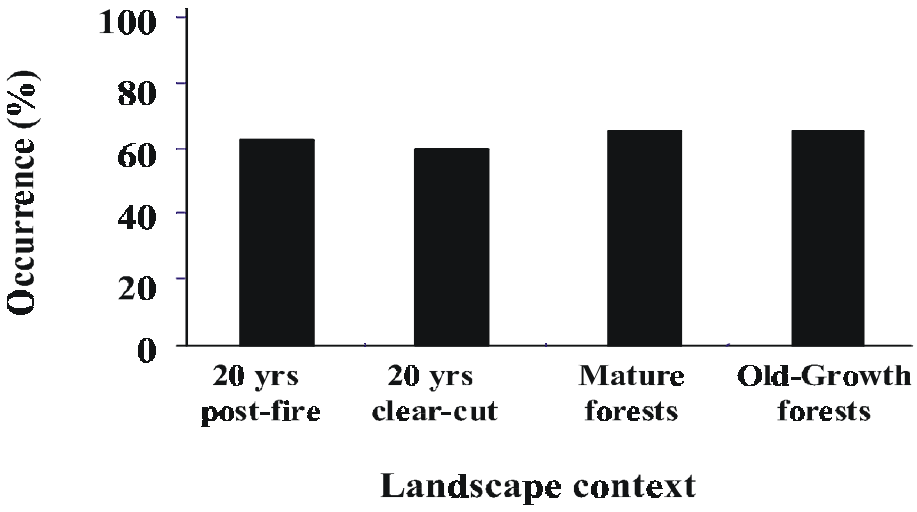

Figure 5. Occurrence of Winter Wren (*Troglodytes troglodytes*) in forest fragments and forest stands in different forest mosaics.

MANAGEMENT IMPLICATIONS

Overall, preliminary results indicate that large areas of old-growth forest are present in Quebec's Clay Belt boreal forest (see Bergeron et al. 1998). This habitat type is not restricted to specific site conditions but is rather part of the forest dynamics, at least in this portion of the eastern boreal forest. Provided such result, the quasi-absence of species restricted to old-growth habitats in the black spruce forest may come as no surprise. This, however, does not preclude the cumulative impacts that changes in the age-class distribution from current forest rotations may have on biodiversity. Over-mature and old-growth forests will necessarily cover a less important proportion of the boreal landscape to the expense of earlier stages. This will have an impact on the regional biological diversity given the actual importance of theses seral stages in forest landscapes of the Clay belt region.

Differences in biodiversity between mature, over-mature and old-growth forests appear to be mainly under the influence of the structure of vegetation that changes from a closed to an open canopy from mature to old-growth forests. This result is of primary importance to forest management. It indicates that provided some changes in silvicultural practices, structural characteristics of overmature and old-growth forests could be maintained in managed forests. Bergeron et al. (1999), proposed management strategies and forestry practices designed to maintain structural characteristics of the entire range of age-class distribution of forests emphasising that by maintaining forest conditions within their natural range of variation there is a greater chance to preserve all forest values which are historically present in a natural forest and hence biological diversity. At the landscape level, diversifying silvicultural practices should

allow forest managers to plan towards maintaining a proportion of forest types that maintain the structural characteristics of young, mature, over-mature and old-growth types to a level that is close to the proportion found in natural forest mosaics.

REFERENCES

Bergeron, Y., and B. D. Harvey. 1997. Basing silviculture on natural ecosystem dynamics: an approach applied to the southern boreal mixed-wood forest of Québec. Forest Ecology and Management 92: 235-242.

Bergeron, Y., P.J.H. Richard, C. Carcaillet, S. Gauthier, M. Flannigan, and Y.T. Prairie. 1998. Variability in fire frequency and forest composition in Canada's southeastern boreal forest: a challenge for sustainable forest management. Conservation Ecology [online] 2(2): Available from the Internet. URL: http://www.consecol.org/vol2/iss2/art6

Bergeron, Y., B. Harvey, A. Leduc and S. Gauthier. 1999. Forest management guidelines based on natural disturbance dynamics: Stand and forest level considerations. Forestry. Chronicle 75: 1-6.

Canadian Forest Service. 1993. The state of Canada's forests 1993. Natural Resources Canada.

Davis, J.W., G.A. Gregory and R.A. Ockenfels. 1983. Snag habitat management. U.S. For. Serv. Rocky Mt. For. Range Exp. Stn. Tech. Rep. RM-99.

Drapeau, P., A. Leduc, J.-F. Giroux, J.-P. Savard, Y. Bergeron and W. L. Vickery. *In press*. Landscape scale disturbances and changes in bird communities of North American eastern boreal mixed-wood forests. Ecology.

Franklin, J.F. 1993. Preserving biodiversity: species, ecosystems, or landscapes. Ecological applications 3: 202-205.

Freedman, B., S. Woodley and J. Loo. 1994. Forestry practices and biodiversity, with particular reference to the Maritime Provinces of eastern Canada. Environ. Rev. 2: 33-77.

Gauthier, S., A. Leduc, and Y. Bergeron. 1996. Forest dynamics modeling under natural fire cycles: a tool to define natural mosaic diversity for forest management. Environmental Monitoring and Assessment 39: 417-434.

Gutzwiller, K.J. and S.H. Anderson. 1987. Multiscale associations between cavity-nesting birds and features of Wyoming streamside woodlands. Condor 89: 534-538.

Hansen, A.J., T.A. Spies, F.J. Swanson and J.L. Ohmann. 1991. Conserving biodiversity in managed forests, lessons from natural forests. BioScience 41: 382-392.

Hejl, S. J., R. L. Hutto, C. R. Preston, and D. M. Finch. 1995. Effects of silvicultural treatments in the Rocky mountains. Pages. 220-244 *in* T. E. Martin et D. M. Finch, editors.Ecology and Management of Neotropical migratory birds, A Synthesis and Review of Critical Issues. Oxford University Press. New York, New York.

Hutto, R. L. 1995. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (USA) conifer forests. Conservation Biology 9: 1041-1058.

Lamberson, R.H., F. McKelvey, B.R. Noon and C. Voss. 1992. A dynamic analysis of Northern Spotted Owl viability in a fragmented forest landscape. Conservation Biology 6: 505-512.

Lundquist, R.W. and J.M. Mariani. 1991.Nesting habitat and abundance of snag-dependent birds in the southern Washington Cascade Range. *In* Wildlife and vegetation of unmanaged Douglas-fir forests. USDA For. Serv. Gen. Tech. Rep. PNW-285. Pp. 220-240.

Spies, T.A. and S.P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon. *In* >From the forest to the sea: a story of fallen trees. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-229. Pp 5-23.

Spies, T. A., W. J. Ripple, and G. A. Bradshaw. 1994. Dynamics and pattern of a managed coniferous forest landscape in Oregon. Ecological Applications 4: 555-568.

Thompson, F. R., III.,G. R. Probst, and M. G. Raphael. 1995. Impacts of silviculture: overview and management recommendations. Pages 201-219 *in* T. E. Martin and D. M. Finch, editors. Ecology and Management of Neotropical migratory birds, A Synthesis and Review of Critical Issues. Oxford University Press. New York, New York.

Appendix

Science and Practice : Sustaining the Boreal Forest
14 – 17 February, 1999
Shaw Conference Centre, Edmonton, Alberta

DISTRIBUTION PATTERNS OF BIRDS ASSOCIATED WITH SNAGS IN DIFFERENT BOREAL FOREST LANDSCAPES

A. Nappi , P. Drapeau, J.-F. Giroux and A. Leduc

Groupe de Recherche en Écologie Forestière Interuniversitaire,
Université du Québec à Montréal.
C.P. 8888, Succ. Centre-Ville, Montréal, Québec

ABSTRACT

In boreal forests, several bird species use snags for feeding or nesting and depend on them for their survival. Some studies have shown that the availability of snags is greatly influenced by the age of the forest and the type of perturbations (natural vs anthropogenic). Accordingly, cavity nesting birds seem largely affected by these changes in availability of snags. Nevertheless, the dynamics of dead wood and the distribution patterns of birds associated with this habitat feature has never been documented for black spruce forests. The first objective of this study was to document and explain the distribution patterns of birds associated with dead wood in natural forest landscapes that were disturbed by different fire events (< 2 years, 20 years, 95 years and > 200 years). The second objective was to evaluate the impact of forest management on this avian guild by comparing bird patterns and dead wood availability between natural and managed forests landscapes of equivalent ages (20 years, 80-95 years). Point count method was use for bird survey and 348 point counts were distributed in the 6 different forest landscapes. Vegetation plots centered on each point count were used to sample standing dead trees and coarse woody debris. Mature forest mosaic showed a greater species richness and abundance of cavity nesting birds than the other forest mosaics. Results also showed that recently burned forests are especially important for woodpeckers given the greater availability of dead trees in that forest stage compared to other forest stages. Single species models showed species-specific responses to abundance and quality of snags. Black-backed woodpecker was the species that responded the most to the availability of dead wood ; it was mainly restricted to the recently burned forest mosaic. Management implications of these findings for this avian guild are also discussed.

Science and Practice : Sustaining the Boreal Forest
14 – 17 February, 1999
Shaw Conference Centre, Edmonton, Alberta

BRYOPHYTES AND LICHENS COMMUNITIES ALONG A CHRONOSEQUENCE OF THE BOREAL FOREST OF THE ABITIBI REGION

C. Boudreault , Y. Bergeron, S. Gauthier and P. Drapeau

Groupe de Recherche en Écologie Forestière Interuniversitaire,
Université du Québec à Montréal.
C.P. 8888, Succ. Centre-Ville, Montréal, Québec

Several studies have shown that some bryophyte and lichen species are restricted to old-growth forest stands. However, only a few of these studies were conducted in the eastern part of the boreal forest and little is known about the importance of old-growth stands in maintaining biodiversity in this ecosystem. The objectives of our study are 1) to compare bryophyte and lichen communities in the boreal forest of the Abitibi region along a chronosequence, 2) to identify potential indicator species of stand age and 3) to formulate recommandations for sustainable forest management that would respect the integrity of bryophyte and lichen communities.

Twenty-two stands, representing four age classes (80-120, 120-160, 160-200, > 200 years old) were visited. We sampled bryophytes and lichens along a 100 meter transect at each site. Twenty-on quadrats (2500 cm^2) wre placed along the transect. Inside these quadrats, the percent cover of each species was estimated. The epiphytic lichens were collected on two branches from the tree nearest to the quadrats, for a total of 42 branches by stand. The cover of epiphytic lichens was estimated for a portion of 50 cm on the upper surface of the branches. Furthermore, we surveyed all species present within 2 meters of the transect line.

Correspondence analysis on the epiphytic data shows that the variable time since fire is the most correlated with the first axis. Variables related to time since fire such as organic matter depth and basal area of *Larix laricina* are positively correlated with the first axis of an ordination on terricolous species. *Dicranum polysetum*, *Polytrichum commune*, *Ptilium crista-castrensis* and *Japewia toroënsis* are indicator species of the youngest stands. Inversely, *Ptilidium ciliare* and Sphagnum fuscum are indicator species of the oldest stands. The results of multiple regression analyses suggest that *Bryoria trichodes*, *Imshaugia aleurites* and *Mycoblastus sanguinaria* prefer the oldest trees whereas *Tuckermanopsis haleii* is more abundant on the youngest trees. Linear regressions show that Sphagnum spp. Richness, abundance and diversity increase while epiphytic lichen richness decreases as the time since fire increases. This study shows that each forest stage of the time sequence possesses distinct bryophyte and lichen community features. This has many implications for sustainable forest management.

Science and Practice : Sustaining the Boreal Forest
14 – 17 February, 1999
Shaw Conference Centre, Edmonton, Alberta

CARABID BEETLE COMMUNITIES (COLEOPTERA : CARABIDAE) AND THEIR POTENTIAL AS BIOINDICATORS FOR BOREAL FOREST MATURATION

Pierre Paquin, Nadine Dupéré and Pierre-Paul Harper

Université de Montréal, Département de Sciences biologiques, C.P. 6128, succursale Centre-ville, Montréal, Québec, H3C 3J7.
Part of Drapeau-Bergeron-Harvey "Key factors in the maintenance of biodiversity in the boreal forest. Groupe de recherche en écologie forestière interuniversitaire (GREFi), Université du Québec à Montréal.

ABSTRACT

We are studying the Carabid beetle communities to understand the evolution of diversity with forest maturation. Twenty-one black spruce stands that cover an age gradient from 0 (recently burned) to more than 340 years-old were sampled for 18 consecutive weeks with pitfall traps, flight-interception traps and soil samples. Age of forest has an effect on species richness ($R^2 = 0.69$; $P < 0.0001$). The relationship between the number of species and the age of forest is suggesting a new model with an increase of richness in older stages. The forest maturation also has an effect on species composition. Chronological clustering shows a structure with four different groups of species: 1) burned, 2) open, 3) mature, and 4) old-growth. These groups are reflecting the main steps of the ecological succession in the black spruce forest. Finally, abundance patterns shows that some species have strong affinities with particular stages of the forest maturation.

Science and Practice : Sustaining the Boreal Forest
14 – 17 February, 1999
Shaw Conference Centre, Edmonton, Alberta

CYLINDROSELLA N.SP. (PTILLIDAE; NANOSELLINAE) AND ITS HOST FOMES PINICOLA (POLYPORACAE) : AFFINITIES FOR MATURE AND OLD-GROWTH FORESTS

Pierre Paquin, Nadine Dupéré and Pierre-Paul Harper

Université de Montréal, Département de Sciences biologiques, C.P. 6128, succursale Centre-ville, Montréal, Québec, H3C 3J7.
Part of Drapeau-Bergeron-Harvey "Key factors in the maintenance of biodiversity in the boreal forest. Groupe de recherche en écologie forestière interuniversitaire (GREFi), Université du Québec à Montréal.

ABSTRACT

Cylindrosella n.sp. lives in the spores tubes of the polypore *Fomes pinicola* (Fr.) Cke, a bracket-fungus associated with dead conifers. The occurrence of that beetle is closely associated with the presence of the fungus-host, itself dependent on forest maturation. In black spruce forests, maturation has a direct effect on the canopy structure as well as on the amount of dead wood, two factors interacting to create a favourable environment for the polypore. The interaction of these factors increase when the forest is getting older ($R^2 = 0.811$) and explains the polypore abundance distribution in the age gradient ($R^2 = 0.765$). The particular distribution of the polypore within the forest succession confers to Fomes pinicola and its associated Ptiliid Beetle *Cylindrosella* n.sp., the status of specialist of mature and old-growth forest in the northern boreal region.