

**DESIGN AND IMPLEMENTATION  
OF THE  
MANITOBA MODEL FOREST  
BIRD MONITORING PROGRAM**

*Interim Report Year II  
Mature Forest Community Analysis  
Project 94-2-17*

Prepared for:

**Manitoba Model Forest Inc.,  
Manitoba Department of Natural Resources  
Wildlife Branch and Parks Branch,  
Pine Falls Paper Company,  
Manitoba Forestry-Wildlife Management Project,  
and  
Canadian Wildlife Service, Prairie and Northern Region**

By

**Wildlife Resource Consulting Services MB Inc., Winnipeg MB  
and  
Silvitech Consulting, Winnipeg MB**

March 1995

ISBN  
1-896763-00-6

ISBN  
1-896763-00-6

## EXECUTIVE SUMMARY

A breeding bird survey was designed and implemented during 1993 to quantitatively document the abundance, distribution and use of interior forested habitats by birds over time in the Manitoba Model Forest area. Studies in 1994 focused on the relationship between older boreal forest stands and their existing bird communities. The method used for sampling bird abundance was based on the IPA or 'Indice Ponctual D'Abondance'. Vegetation was measured by sampling such variables as horizontal cover, density, species composition, and species dominance among others.

A total of 361 bird listening posts or stations were distributed in cluster patterns throughout interior boreal forest habitats in the study area. Station locations included areas concentrated around Black Lake, Long Lake, Caribou Lake, Bissett, Pine Falls, Grand Beach Provincial Park and Belair Provincial Forest. Stations were located along 30 different transect lines, totaling about 100 kilometers in length. The average distance between each station along a single line was about 270 meters. In 1994, 347 of these bird stations were each sampled twice, by two experienced observers during the breeding bird season (26 May to 5 July). In addition, 72 of the bird plots (approximately 20%) were sampled for habitat by two botanists.

Bird data were subjected to multivariate analysis, including TWINSPAN and Reciprocal Averaging Ordination, while vegetation data were analyzed with Principle Components and Canonical Correlation Analyses. Relative abundances of birds were also graphed ( $\pm$  standard deviation). Community diversity was measured by the Shannon Index for species richness and the Simpson Index for species dominance.

Eight distinct groups of birds were identified at the third TWINSPAN division. The order of these species was important as they represented the primary gradient along which the birds were divided. Habitat divisions ranged from immature, mature and overmature coniferous to deciduous stands. Six habitat subdivisions, delineated by dominant tree species, were used to group and describe bird habitats. These groups included black spruce, jack pine/black spruce, jack pine, jack pine/aspens, aspen mixedwood and aspen.

Observers recorded 93 bird species on stations during the survey period. At least 5162 individuals were observed during all sampling periods combined. Incidental observations in the study area increased the total number of species to 143. The ten most frequently observed breeding species in the Manitoba Model Forest included: ovenbird, Nashville

warbler, red-eyed vireo, white-throated sparrow, Tennessee warbler, yellow-rumped warbler, least flycatcher, chipping sparrow, magnolia warbler and chestnut-sided warbler.

Using a general species scale, the largest diversity of species appeared to be in the aspen mixedwood stands (74 species), followed by jack pine (72 species), aspen (63 species), black spruce (56 species) and jack pine/aspen forest (45 species). The relative abundance of territorial birds per plot was also largest in the mixedwood forest stands (34.96), followed by aspen (29.91), black spruce (25.13), jack pine (25.08), jack pine/aspen (24.83) and jack pine/black spruce (21.67). Approximately 40% of all species were observed at fewer than 10 stations, which made a large proportion of all species relatively uncommon.

The Shannon Index indicated that the richest bird community was the aspen mixedwood, followed by jack pine and jack pine/black spruce communities. However, as all statistics were above a value of 3.0, this suggested that all six communities had relatively rich bird communities. The Simpson index of species dominance suggested that many different species of few individuals, rather than few species with many individuals, tended to be present in each of the habitat types.

The site-specific habitat characteristics of 28 species were selected from 70 habitat plots and outlined using the interpretation from the PCA scores. Highlights of this information include the primary habitat types selected, general habitat preferences, the mean and standard deviation from the key vegetation variable, the presence of dominant shrubs and herbs in the understory, the maturity of stand, relative abundance ranges, and brief notes of nesting habitat and feeding characteristics of individual species. This information could be particularly useful in developing or validating Habitat Suitability Models for individual species.

This document was written as an interim report only. It is the second in a series of four reports. Caution should be used if results are extrapolated to other studies, or used in management practices.

**TABLE OF CONTENTS**

EXECUTIVE SUMMARY	i
TABLE OF CONTENTS	iii
LIST OF FIGURES	iv
LIST OF TABLES	iv
ACKNOWLEDGMENTS	v
1.0 INTRODUCTION	1
2.0 STUDY AREA DESCRIPTION	4
3.0 GENERAL METHODS	6
3.1 Experimental Design	6
3.2 Estimating Bird Abundance	7
3.3 Habitat Description	8
3.3 Data Analysis	10
4.0 RESULTS AND DISCUSSION	13
3.1 Habitat Characteristics	19
3.2 Community Diversity	48
5.0 CONCLUDING REMARKS	50
6.0 LITERATURE CITED	51
7.0 APPENDIX A - Acronym list of birds sampled on plots in the Manitoba Model Forest (1994).	54
APPENDIX B - Species grouped by TWINSpan analysis.	55
APPENDIX C - Species not grouped by TWINSpan analysis (in alphabetical order).	56

**LIST OF FIGURES**

Figure 1 - Manitoba Model Forest study area.	5
Figure 2 - Histogram of bird species found in the study area.	15
Figure 3 - Species abundance per habitat type.	18
Figure 4 - Reciprocal averaging ordination for birds.	20
Figure 5 - Reciprocal averaging ordination for habitats.	21
Figure 6 - Habitat and bird association groupings by overlaying bird and habitat reciprocal averaging ordinations.	22

**LIST OF TABLES**

Table 1 - Number of sites in each forest category.	6
Table 2 - Observation frequencies of species in the Manitoba Model Forest (1994) sorted alphabetically and by proportion of observations.	16
Table 3 - Summary of the regression models for 28 bird species in the study area.	23
Table 4 - Bird species diversity, Manitoba Model Forest.	49

## ACKNOWLEDGMENTS

This research was supported by numerous people and organizations. Bill Koonz (Manitoba Department of Natural Resources) and Dr. Keith Hobson (Prairie and Northern Region, Canadian Wildlife Service) provided guidance, much of the technical support required for the project, and manuscript editing. Field research was conducted by George Holland, Mark Huebert (ornithology), Jeff Suggitt and Tim Kroeker (Botany). Their expertise and dedication to the project can not be surpassed. Manitoba Department of Natural Resources Regional Staff (Parks and Operational Divisions) at Grand Beach, Bissett, Pine Falls and Black Lake were extremely helpful in providing accommodation and field equipment during the 1993 and 1994 field seasons. Map products, air photos and forest inventory data were supplied as an in-kind contribution by Pine Falls Paper Company, Pine Falls, Manitoba. Volunteers and technicians for data entry, analysis and plot location included Brett Fraser, Erin Bayne, Chris Higgs and Bob Turnock. Their diligence and professionalism greatly assisted in the analysis of bird communities associated with the boreal forest.

Financial support during 1994/95 was provided through Manitoba Model Forest Inc., Pine Falls, Manitoba. Support in-kind was graciously provided by the Manitoba Forestry-Wildlife Management Project.

## 1.0 INTRODUCTION

Birds are important components of Canada's forest landscapes. They perform important ecological roles by helping maintain ecosystem stability. However, recent evidence suggests that migratory bird populations in North America are declining. Almost without exception, the birds that have been decreasing as breeders throughout interior forest habitats are primarily neotropical migrants; species that migrate long distances each autumn to spend the winter in the tropical forests of Central America, South America, and the Caribbean Islands. Species that are holding their own or increasing are those species that either don't migrate at all or move short distances each fall such as to the southern US. Several explanations have been suggested as to why neotropical migrants have been decreasing in numbers: (1) habitat loss, and increasing habitat fragmentation, on the breeding range due to increasing human impact, especially agricultural land use, and urbanization (Terborgh 1989); (2) increased nest predation (Andren et al. 1985, Wilcove 1985, Andren and Angelstam 1988, Yahner and Scott 1988) and nest parasitism by cowbirds (Brittingham and Temple 1983, Temple and Cary 1988), which may be exacerbated by forest fragmentation; (3) deforestation on the wintering grounds (Terborgh 1989, 1992, Robbins et al. 1989a,b); and (4) complexes of factors that have predisposed some taxonomic groups to decrease in response to several kinds of human-caused environmental change. All of these factors could have an influence, and it has been difficult to estimate their relative importance (Bohning-Gaese et al. 1993).

Numerous studies have been conducted on the effects of altering forest habitat on bird communities in North America (Noon et al. 1979, 1980, Szaro and Balda 1979, Scott and Gottfried 1983, Niemi and Hanowski 1984, Kuhnke 1993, Webb et al. 1977). Most studies focused on the effects of various forest logging operations on bird species diversity and composition. More recently, greater research activity has focused on the effects of forest habitat fragmentation on regional avifauna (Blake and Karr 1984, 1987, Lynch and Whigham 1984, Small and Hunter 1988, Saunders et al. 1991, Hagan and Johnston 1992). The consensus of these authors suggest that forest clearing operations set succession back to an old field stage. The severity of such factors as clearing, soil productivity, site moisture conditions, climate and proximity to a seed source will determine the rate of recovery through the plant successional process. Avifaunal species composition will be drastically altered as forest-dependent foraging guilds such as the insectivorous bark drillers and gleaners, canopy foliage gleaners, salliers and hole-nesters are replaced with seed-eating ground gleaners. Species groups most severely affected are forest-interior species and rare foraging guilds both of which tend to be eliminated from

disturbed habitats. As succession progresses from an old-field stage, the loss of grasses and forbs decreases the opportunity for seed and plant-eating birds, while the addition of shrubs and trees provides new niches for primarily insectivorous species. Avian communities will become more diverse as habitat complexity increases through the addition of midstory and overstory strata. Avian communities should theoretically take on a similar species composition to the pre-disturbance forest as succession finally resembles the original forest structure. This assumes that sufficient reservoirs of forest interior and rare foraging guilds have been maintained regionally so that new forest habitats can be recolonized.

It is apparent that the effects of habitat disturbance on birds should be addressed within a regional avifaunal perspective wherein the goal is to maintain thriving populations of the total forest bird community. Using this perspective, one can envision various situations where forestry practices would either positively or negatively affect the regional forest bird community. As discussed, it is primarily forest-dependent migratory species which are lost from cut-overs for some length of time. Any increases in avian diversity on the landscape, previously considered a positive effect, can be attributed to opportunistic resident species characteristic of unstable field and forest edge habitats. Thus, in regions where forests have largely been cleared, or fragmented, the effects of additional forestry operations through any of the remaining forest tracts would serve to: (1) increase the available habitat and population levels of an already successful, thriving group comprised of resident opportunistic, forest edge and field species; and (2) aggravate the decline of forest-dependent migratory species (Hagan and Johnson 1992, Kuhnke 1993). The continued or potentially accelerated loss of forest species could be considered a negative impact to the regional avifauna.

Using this same regional perspective, one can also envision forestry cut-overs as having a positive effect on avian communities when located in regions dominated by continuous forest cover. This interpretation would be based on the fact that sufficient area of suitable forest habitat would still exist to ensure thriving populations of forest dependent migrants. Such a large reservoir of suitable forest habitat would offset any local declines of forest migrants caused by the linear habitat disturbance. On the other hand, the creation of new habitat would serve to increase the local abundance and diversity of forest-edge and field species. Since this habitat may be considered limiting, or generally unavailable in extensive forest regions, the net effect could be considered positive to the regional avifauna (Hagan and Johnson 1992, Kuhnke 1993).

This report summarizes research on the habitat requirements of boreal forest birds in southeastern Manitoba. This project contributes to an existing process aimed at integrating timber and non-timber resources within the Manitoba Model Forest area part of which is managed by the Pine Falls Paper Company. A major need however is detailed habitat information for populations that actually occur in the region. This research provides breeding bird data on the relative habitat suitability of the major mature forest cover types, and facilitates the refinement of habitat association groupings for breeding birds.

### ***Objectives***

The goal of this research is to identify and describe the influence of factors affecting the distribution and abundance of breeding birds using mature forests in southeastern Manitoba. Results can be used in the development and verification of bird species habitat suitability index (HSI) models for use in the analysis of habitat supply on the forested landscape. This will allow resource managers to incorporate the habitat needs of forest birds into forest management plans and aid in the maintenance of a diversity of wildlife species and habitats on the forest landscape. Specific objectives of the 1994/95 study are to:

- provide local information on bird status and habitat utilization for those species in the mature boreal forest;
- provide local information to the Manitoba Forestry/Wildlife Management Project which can be used in the development and validation of bird species HSI models and in validating the habitat association matrix used in their species selection process; and
- contribute information to a regional forest bird database being developed by the Canadian Wildlife Service (CWS).

## 2.0 STUDY AREA DESCRIPTION

The forest bird projects are located within the Manitoba Model Forest area (1,000,000 ha). The Model Forest (Figure 1) includes Belair, Brightstone, Nopiming and Grand Beach Provincial Parks. The forest also includes the north end of Agassiz Provincial Forest, part of Atikaki Wilderness Park, First Nation Reserve lands, a Provincial Forest Management Unit, and the Pine Falls Paper Company Forest Management License (Waldram 1992). Some area uses and user-groups include, but are not limited to, the following: outdoor recreational activities such as skiing, hiking, boating, fishing, camping, subsistence harvest, cottages, agriculture, mining, and forestry operations. The area is home to about 15,000 people, who are linked together by an infrastructure of communities, roads, hydro dams, pulp and paper operations etc.

Coniferous to mixed coniferous-deciduous forests occur throughout, with the dominant trees being black spruce (*Picea mariana*), and jack pine (*Pinus banksiana*), with lesser amounts of trembling aspen (*Populus tremuloides*), tamarack (*Larix laricina*), balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), balsam poplar (*Populus balsamifera*), white birch (*Betula papyrifera*), and ash (*Fraxinus* spp). Rock outcrops are primarily covered with jack pine, while many of the low-lying muskeg areas are vegetated by a mixture of black spruce and tamarack stands of varying size classes. Although trembling aspen is somewhat common in the study area, it is generally associated with other tree species such as jack pine or white spruce (Koonz 1979). Additional details of the vegetation communities can be found in Wildlife Resource Consulting and Silvitech Consulting (1994).

Major fire histories of the area have been recorded since 1929. Approximately 71% of the productive forest volume in Forest Management License 01 (FML 01) has been changed by wildfires. Fire losses between 1984 and 1988 were 34,593 ha. The natural forest regions of the FML are strongly influenced by and generally adapted to fire (Rowe 1972). Insects, disease, and wind also influence the structure and composition of the forests. Due to drainage conditions, soils, and topographic features, homogeneous forest communities of over 20 hectares are seldom encountered. The overall result is a "patchy" mixture of forest types and successional stages (Synthen 1991).

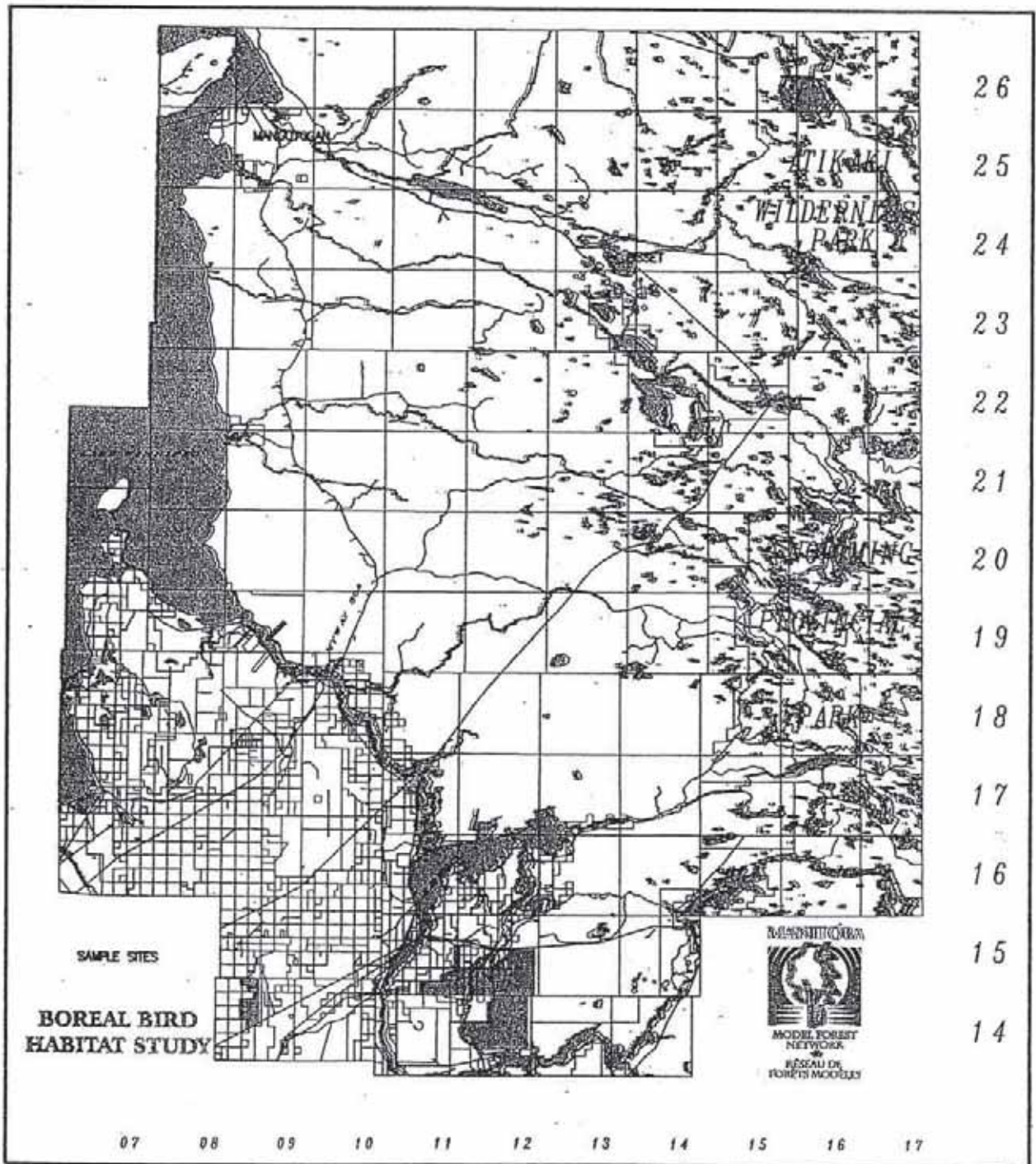


Figure 1 - Manitoba Model Forest study area.

### 3.0 GENERAL METHODS

#### 3.1 *Experimental Design*

Forest stands representative of major forest habitats in the Manitoba Model Forest were selected as study sites. Specific site selections were made by the authors in 1993 which incorporated permanency, access, and representativity. Sites were selected, fixed using global positioning systems, and marked using trail headers and flagging tape in 1993. Several forest categories were defined by a combination of dominant tree and stand age. The goal was to have adequate samples of all major habitat types that forestry operations will be affecting. Most forest stands recognized by the Manitoba Forest Resource Inventory within the Model Forest are representative of forests in the area. They are typically small in size (less than 25 ha). The 1994 field season concentrated on sampling immature to overmature forest stands.

Each forest stand was called a site, and within each site there were 1 to 15 survey points called stations. Stations were located at least 100 m from the edge of the forest type, and if possible, at least 250 m apart. A total of 347 stations was selected for sampling avian abundance in the mature boreal forest. A subset of 72 stations or approximately 20% of the total number of avian sampling stations were selected for detailed habitat analysis. Within each of these 72 stations, 5 sample plots were selected systematically. The center of each plot included the bird listening post. Four other sub-plots are located 50 m from the center of the census point in the cardinal directions. Wildlife Resource Consulting and Silvitech Consulting (1994) should be referenced for additional experimental design details and mapped locations for all sampling plots.

The final sampling arrangement is shown in the table below, with assigned categories based on the dominant or co-dominant overstory of tree species.

Table 1 - Number of sites in each forest category.

	Black Spruce	Jack Pine / Black Spruce	Jack Pine	Jack Pine/ Aspen	Aspen / Mixed	Aspen
# Bird Stations	72	49	59	18	95	54
# Habitat Stations	13	10	15	4	19	11

### 3.2 *Estimating Bird Abundance*

Bird sampling was conducted by two observers during 1994. Although both observers were exceptionally skilled, each participated in a training program to improve their abilities to identify the vocalizations of all bird species likely to be encountered in the study area. Training was done primarily in the field, supplemented by recordings of vocalizations provided by the Canadian Wildlife Service. These efforts to minimize sampling variation between the two observers were supplemented by attempting to ensure that each of the major forest categories was sampled by both observers.

Bird sampling was conducted between 26 May and 5 July, the period with the highest probability of detecting most migratory and resident bird species breeding in this region. Each station was visited twice, a minimum of one week between each visit. The sampling technique was based on the IPA or 'Indice Ponctuel D'Abondance' technique developed by Blondel et al. (1970), and modified from Welsh (1992). It is an unlimited distance point count. The following procedures were used to sample birds at each station.

#### *Procedures*

1) After the station was located, the observer was to wait at least one minute at each station before starting the survey. This gave birds a chance to settle down and give the observer a chance to get his ear 'tuned in.'

2) All birds seen and heard during the 10 minute sample period were counted. To ensure that each individual was counted only once, all records of birds were recorded on the map sheets provided, to keep track of movements. Mapping (marking approximate locations, movements, and behaviors using symbols and abbreviations) was the most appropriate method for reducing duplication. Status symbols were used to record individuals once breeding evidence was determined (e.g., some levels assume a pair, others only a single bird). A range circle on the map was provided to assist in keeping track of bird positions and movements. Wind direction and the orientation of the map sheet were also recorded.

3) The first station of the day was located up to 1/2 hour before sunrise. Counts were conducted early in the morning from dawn until approximately 4 hours after. Observers conducted surveys only in weather that was unlikely to reduce count numbers.

4) All stations for each site were completed on the same day to make them as comparable as possible.

5) Each site was sampled twice during the season by the same observer, once approximately at the end of May to the first week of June (depending on seasonal weather conditions), and once towards the end of June. The first visit was labeled Series 1 and the second, Series 2. The higher value for each species from the two sample series was used as the station estimate.