

## Developing a woodland caribou habitat mosaic on the Ogoki-Nakina North Forests of northwestern Ontario

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**Abstract:** The Ogoki-North Nakina Forests consist of (10 638 km<sup>2</sup>) unroaded boreal forest approximately 400 km northeast of Thunder Bay, Ontario (lat 50°- 51°31'N, long 86°30'- 89°W). Woodland caribou (*Rangifer tarandus caribou*) inhabit discrete portions within these forests based on minimal current and past historical data. As part of the Forest Management Planning process, for the period 1997-2097, a woodland caribou habitat mosaic has been developed to coordinate present and future forest management activities with the retention and development of current and future woodland caribou habitat. Several criteria including, past fire history, forest structure, age, species composition, proximity to current road access and location of existing and potential caribou habitat, helped identify and delineate 50 mosaic harvest blocks. Each harvest block will be logged in one of five 20 year periods over a 100 year rotation (1997-2097). The harvest blocks have been developed to simulate a pattern of past wildfire history in an area that has not been subjected to past forest management activities, while managing for woodland caribou, a locally featured species.

**Key words:** forest management planning, harvest blocks, Canada.

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### Introduction

The Ogoki-Nakina North Forest (10 638 km<sup>2</sup> of largely unroaded boreal forest) is located 400 km northeast of Thunder Bay in the northwest region of Ontario (Fig. 1). Sustainable Forest Licences (SFL) for both forests have recently been awarded to Long Lake Forest Products Ltd. Mature and over mature coniferous species, primarily black spruce (*Picea mariana* Mill), and jackpine (*Pinus banksiana* Lamb) occupy 87% of the productive forest land base. Both species will supply fibre to a spruce/pine/fir dimensional lumber mill in Longlac and a "Small Wood Maximizer" mill in Nakina Ontario.

The Ogoki Forest was first established in 1974 and was licenced to Kimberly Clark Forest Products Inc. as a Forest Management Unit. The first 20 year management plan (1986-2006) was prepared in accordance with the Timber Management Planning Manual for Crown Lands in Ontario (OMNR, 1985).

The Nakina North Forest was originally part of the Nakina Forest established in 1985 and licenced

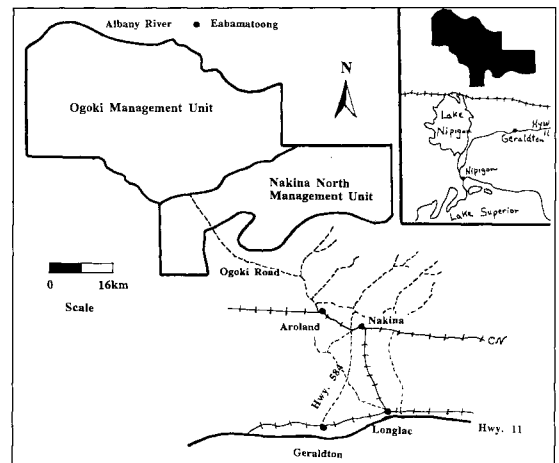


Fig. 1. Location of the Ogoki- Nakina North Forests in northwestern Ontario.

to Kimberly Clark Forest Products Inc. under a Forest Management Agreement (FMA). A SFL was issued to Long Lake Forest Products in March 1996

and the current unit contains 382 132 ha of land and water.

Long Lake Forest Products Ltd. is currently preparing a Forest Management Plan for both the Ogoki and Nakina North Forest in accordance with the new Forest Management Planning Manual for Ontario's Crown Forests (OMNR, 1996). The plan will be rewritten and updated every five years for subsequent 20 year periods. Included under signed terms and conditions is a comprehensive renewal and maintenance program.

Both moose (*Alces alces*) and woodland caribou are commonly found within the area (Whitlaw *et al.*, 1993; Darby *et al.*, 1989). Moose densities are considered low (< 0.10 per km<sup>2</sup>), and woodland caribou densities are estimated at 0.06 per km<sup>2</sup> or lower based on density estimates in the nearby Wabikimi Wilderness Park (Bergerud, 1989). The Ogoki-Nakina North Forests are located in the northern portion of the commercial forest which also includes the southern portion of the present-day continuous caribou distribution.

This paper describes the methods used to develop a caribou habitat mosaic on the Ogoki-Nakina North Forests for the period 1997-2017. The objective is to develop and coordinate present and future forest management activities with the retention and development of current and future woodland caribou habitat.

#### *Forest description*

Both forests are located within the arctic watershed and contain approximately 11-12% water. Productive forest land consists of 893 812 ha, while the balance is classified as non-forested land (120 877 ha) and non-productive forest land (123 598 ha). Major waterbodies drain north to James Bay through the Ogoki-Albany river systems and create formidable barriers to road construction and access. Both units are located in the Central Plateau (B8) section of the Boreal Forest Region (Rowe, 1972) within Hill's Site Region 3w and 2w (Hills, 1959). They are considered part of a natural wildfire-driven ecosystem characterized by short, hot summers and long, cold, dry winters. Current forest conditions are believed to be similar to historic forest conditions as minimal fire suppression and logging activities have been carried out in the past. Predominant tree species are black spruce ( $\pm 74\%$ ), jackpine ( $\pm 15\%$ ) and trembling aspen (*Populus tremuloides* Michx) ( $\pm 10\%$ ). White birch (*Betula papyrifera* Marsh), white spruce (*Picea glauca* (Moench)

Voss), balsam fir (*Abies balsamea* (L.) Mill), eastern white cedar (*Thuja occidentalis* L.) and tamarack (*Larix laricina* (Du Roi) K. Koch) are also found intermittently throughout these forests. Forest age composition is predominantly mature (70-120 years) to overmature (120+ years) stands of predominantly coniferous forest originating from large even-age wildfire ranging in size from several hundred to 100 000 hectares.

The growing season generally lasts from 145-155 days with a mean frost-free period of 70-80 days (Chapman & Thomas, 1968). Mean annual precipitation is 737 mm which includes an average annual snowfall of 2660 mm (Environment Canada, 1973).

Geologically, the area lies in the northeast portion of the Precambrian shield with bare and partially bare bedrock exhibiting low to moderate relief (Ontario Geological Survey, 1991). The most common surficial deposit is a ground moraine of variable depth with a discontinuous layer of bouldery silty sand till overlying the bedrock (Cooper, 1983). Local patches of silty sand lacustrine plain deposits and pockets of organic soil are common in low lying areas. Glacial fluvial kame deposits with some outwash deposits form the bulk of both major moraines; the Augutua and Nipigon Moraine (Prest, 1963; Cooper, 1983) located on these forests.

#### *Past and current use - a regional perspective*

Historically the area was settled by the ancestors of local native people who developed through a number of hunting, gathering, fishing and trading cultures (Bray & Epp, 1984). In the late 1700s the Hudsons Bay Company established posts on Wasi and Eabamet lakes based on the fur trade. Trapping for beaver (*Castor canadensis*), mink (*Mustela vison*), marten (*Martes americana*), otter (*Lutra canadensis*), fisher (*Martes pennanti*), lynx (*Lynx canadensis*), weasel (*Mustela* spp.), gray wolf (*Canis lupus*) and red fox (*Vulpes fulva*) is still active in these forests and contributes to the local native economy. In addition a native commercial fishery is based on the Albany River along the northern boarder and on Ara and Met lakes along the forest's southern boundary. Remote tourism activities offer fly-in angling and hunting opportunities. The area currently boasts 119 main base tourism lodges, remote outpost camps and land use permits that contribute to the local economy. In addition several parks including Sedgman Provincial Park, Wabikimi Park and the Albany River Waterways Park provide high quality remote fly-in fishing and canoeing opportunities.

Road access to the the southern boundary of the Ogoki Forest and to portions of the Nakina North Forest is currently restricted to the Ogoki road which terminates at the Ogoki River (Fig. 1).

#### *Woodland caribou habitat mosaic*

Woodland caribou in this area are managed as a locally featured species (OMNR, 1994) for the purposes of Timber Management Planning. The caribou habitat/forest mosaic (Racey *et al.*, 1991) is the basic approach currently suggested for all Forest Management Units within caribou range. Ecosystem management designed to mimic the habitat resulting from large naturally occurring fire is the current habitat management focus. Ontario timber management guidelines for the provision of woodland caribou habitat (OMNR, 1994) assume that logging can replace fire as a means of regenerating winter habitat and re-establish terrestrial lichens (*Cladina* spp.) in boreal forest cutovers (Harris, 1992; Racey *et al.*, 1996). Allocation of harvest areas over a 100 year rotation are to be concentrated within what would become a large disturbance to provide future habitat blocks (+40 years), while cuts will avoid large deferral blocks of currently identified high value seasonal caribou habitats (Timmermann, 1993a; 1993b).

Specific guidelines for management of calving sites, travel corridors and protection of wintering areas are described (OMNR, 1994). Critical/core caribou wintering areas or "virtual refuges" (Cumming, 1996) are to be avoided in Timber Management Plan allocations and road corridors. In addition an uncut buffer should be considered around large or contiguous, clearly defined areas of wintering habitat (Cumming, 1992; Cumming & Beange, 1993). Caribou habitat management prescriptions will minimize edge habitat and develop patterns of cutting that do not favour moose as a means of controlling wolf numbers.

## Methods

The development of the caribou habitat mosaic for the Ogoki- Nakina North Forest was consistent with those outlined in Instructions for Developing Caribou Habitat Mosaics (Young, 1995) and Ontario Timber Management Guidelines For The Provision Of Woodland Caribou Habitat (OMNR, 1994).

The following five steps were used in developing the mosaic:

#### *Data collection*

All available data relating to woodland caribou and their habitat use was compiled. This included caribou seasonal observations (both recent and historical), identification of current and potential future caribou habitat (Timmermann, 1993a), current and suspected calving sites (Timmermann, 1993b) and existing travel corridors or migration routes. These data were collected from recent Ontario Ministry of Natural Resource aerial caribou surveys, current and past reported sightings from tourist operators and their clientele, caribou information collected during past moose aerial surveys, and file reports and plans ( e.g. OMNR, 1983) that made reference to woodland caribou and their location within these forests.

Other sources used to help identify potential areas of caribou habitat were NOEGTS (Northern Ontario Engineering Geology and Terrain Study) maps in combination with NWOFECS (Northwestern Ontario Forest Ecosystem Classification) guide (Ontario Geological Survey, 1991; Sims *et al.*, 1989). All sources were helpful in identifying land forms, soil types, forest age, structure, and composition, and vegetative cover, that are commonly associated with woodland caribou habitat.

#### *Forest disturbance history and patterns*

Recorded wildfire size (1500 to 130 000 ha) and distribution pattern from 1928 to the present was obtained from the Ontario Ministry of Natural Resources Regional Fire Centre in Thunder Bay.

Large areas of even aged forest exist and these areas were used to develop a forest unit eligibility map based on Forest Resource Inventory (FRI). An attempt was made to map these areas on the assumption that their size and pattern would reflect the pre-suppression fire history. Criterion for stand inclusion was that the ages between stands could not vary by more than 20 years. This period was consistent with the Timber Management Guidelines for the Provision of Caribou Habitat (OMNR, 1994) that requires a mosaic block to be harvested within a 20 year time frame. We believe this criterion could potentially create a 20 year variation between age classes within that mosaic block as a result of younger stands within the block being harvested towards the end of the 20 year time frame. Isolated stands of spruce lowland (site class 3) did not have to meet the above criteria to be included in the fire area. This was done to reflect those stands that may have been bypassed during a fire and helped explain the sometimes substantial diffe-

rence in age between these isolated lowland sites and surrounding upland sites. Another approach used to determine fire size and pattern was to identify those features that act as natural fire breaks such as water, wetland ecosites, forest unit types (lowland black spruce), and topographic features. We believe these features assist in establishing mosaic block boundaries that closely emulate natural fire patterns.

#### *Forest eligibility and maturity criteria*

Maturity Class maps were used to identify stands based on forest unit and age class and placed into one of four maturity classes. They are: Juvenile, Maturing, Prime Product, and Declining. This breakdown helps identify forest areas where mature and over-mature wood exists and thus delineates preferred forest development areas within the mosaic. Such a maturity class map is also useful for identifying areas that may be potential preferred winter caribou habitat such as coniferous-dominated V30 sites (Sims *et al.*, 1989). Eligibility maps were created to identify current and future stands that are considered eligible for commercial harvest and each eligibility map was broken down by forest unit at a stand level.

#### *Other forest values*

During mosaic development consideration was also given to other existing forest values. These include areas that could receive some Area Of Concern (AOC) protection that may preclude Forest Management Operations (e.g. remote tourism, parks, and native values). Although these values are not considered a major priority in mosaic development at the landscape level, they do require some consideration in as far as the potential impacts that the mosaic may have on values at the operational level (e.g. mosaic blocks containing many high value tourism lakes).

#### *Other considerations*

Several additional key points were considered such as: whether the mosaic development was consistent with the Forest Management Plan objective for woodland caribou as developed for the Ogoki-Nakina North 1997-2017 Forest Management Plan. The objective for woodland caribou is as follows: "To manage for the maintenance of woodland caribou range and habitat through habitat maintenance and species range conservation" (Armstrong, 1997). To help achieve this objective it was impor-

tant to ensure that the mosaic provided good habitat (preferred & suitable) distribution throughout the forest over time, especially at the southern portion of current caribou range. Here caribou have the opportunity to remain so they can repopulate areas that become eligible as suitable habitat. Distribution of habitat was determined by entering the FRI information from each mosaic block into the Strategic Forest Management Model (OMNR, 1995) and applying the Northwest Region wildlife matrix to determine the type of woodland caribou habitat (preferred/marginal) present, if any and its location within the mosaic.

Considerations were given towards identifying economic and logistical limitations during mosaic development. It is important to ensure that the access road development program associated with the mosaic is within the economic capabilities of the Company, and that forest units within mosaic blocks allow for a balance of summer and winter operating areas. Although these considerations were not a major priority, they were considered to help achieve an operable mosaic. In addition we examined the pattern of planned harvest blocks after 40 years to evaluate the protection of currently known habitat, remaining habitat and travel corridor linkages between uncut and logged mosaic blocks. The final consideration was to develop a mosaic that complemented caribou mosaics developed on the adjacent forests of Armstrong, Auden, and Nakina FMUs.

## **Results and discussion**

A total of 50 mosaic harvest blocks to be logged in one of five-20 year periods over a 100 year rotation (1997-2097) were delineated (Fig. 2). Watershed boundaries were used to delineate the majority of harvest blocks while the balance used past fire boundaries. The disturbance cut pattern (mean size 20-25 000 ha.) was uniformly distributed, providing a balance of both summer and winter operating areas. Block configuration was southwest to northeast, consistent with prevailing winds and previous fire history. Only several large lakes had more than one block eligible for harvest in a similar time period; thus minimizing disturbance impact. Cut patterns were designed to impact only portions of individual traplines within each 20 year period. The objective being to provide a range of age classes within each trapline to accommodate the habitat requirements of a wide variety of furbearers and other

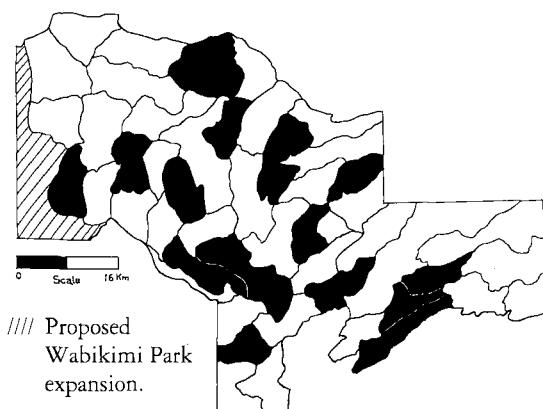


Fig. 2. Location of 50 mosaic harvest blocks within the Ogoki-Nakina North Forests of northwestern Ontario. Shaded blocks represents the pattern of forest logging disturbance after 40 years.

wildlife. Examination of planned forest disturbance suggests a solid pattern of travel corridor linkages remained between seasonal caribou habitats after 40 years. In addition tourism and park values were identified as areas of concern and were withdrawn from harvest eligibility.

The impact of disturbance on wood supply was minimized by strategically locating individual mosaic blocks. Every effort was made, however to identify mature and overmature wood in eligible blocks. In some cases old wood available on a deferred block was left and considered a lost opportunity and in its place younger-aged wood was considered eligible for harvest before reaching maximum yield potential.

The mosaic pattern requires an extensive road network to access the initial 20 year cut blocks. A higher initial road cost is partially compensated by both a short and long-term wood flow pattern from these designated cut blocks. In addition, attempts were made to design road locations that minimize impacts on deferral blocks, allow for long-term extraction use and provide management flexibility. Finally, mosaic block design recognized established mosaic patterns on adjacent southern forests and attempted to reduce disturbance impact along mutual boundaries.

It is believed that the Ogoki-Nakina North Forests are somewhat unique in providing an opportunity to apply a caribou habitat mosaic. The applied methodology allowed flexibility in considering other objectives including a sustainable supply of wood and other socio-economic benefits associated

with tourism and wildlife values. However, this approach may not be directly applicable to other forests where caribou are currently found; hence flexibility, innovation and modifications will likely be needed to meet specific resource-based objectives.

Advantages of the mosaic approach include facilitating a long-term planning and application approach to the entire management unit over a 100 year rotation. This replaces past practices which only included those areas falling under a 20 year allocation and a 5 year cutting cycle. Current known seasonal presence of woodland caribou was largely left undisturbed in the first 40 years of planned logging, while provision was made to create future habitat by mimicking the pattern of large naturally occurring wildfires. The responsibility of harvesting and regenerating 100 years from now is assumed by the sustainable forest licence (SFL) holder. Periodic assessment and incorporation of new information through adaptive management will be required to ensure biological and economic objectives are achieved. We believe this ecosystem based approach will allow for both a long-term sustainable wood supply while providing a continuous supply of woodland caribou habitat.

Some concerns however remain and will need to be addressed. These include reduced flexibility to manage for a sustained yield because the harvest level for each mosaic block is determined by the need to manage caribou in large blocks and not necessarily on forest characteristics. Large cut blocks are a sensitive issue and may produce a negative impact in the marketing of forest products. In addition there is less incentive to practice intensive silviculture because those areas treated intensively will not be available for harvesting when they reach their maximum growth and yield potential (i.e. 60 years of age). This is a direct result of the 100 year cycle or rotation age dictated by the woodland caribou habitat mosaic.

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