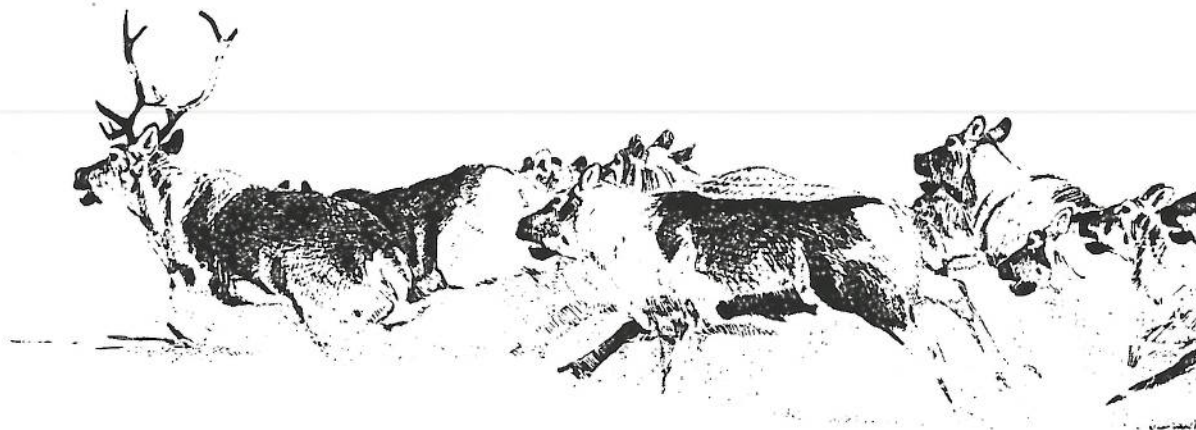


**WOODLAND CARIBOU**  
*(Rangifer tarandus caribou)*  
**CONSERVATION STRATEGY**  
**FOR MANITOBA**



May 2000

Manitoba Conservation

Rebizant, K.J., J.R. Duncan, R. Larche, R. Cameron, G. Collins, D. Cross, C. Elliott, P. Hildebrand, R. Robertson, D. Schindler and K. Whaley. 2000. Woodland caribou (*Rangifer tarandus caribou*) conservation strategy for Manitoba. Unpubl. MS. Report 2000. Wildlife Branch, Manitoba Conservation. Winnipeg, Manitoba. 37pp.

## EXECUTIVE SUMMARY

### Woodland Caribou Conservation Strategy

Woodland caribou were once found throughout the boreal forest regions of Manitoba. The southern portion of their range has been significantly negatively influenced by development. Woodland caribou no longer occur in the Sandilands, Whiteshell, south Interlake or Duck Mountain areas of the province where development and human activity has impacted caribou. Generally, wherever herds of woodland caribou existed and were impacted by development, they decreased in numbers or are no longer present. The current estimated woodland caribou population in Manitoba is 2,000-2,500 animals, though, at one time, there may have been more than 4,000. Because of this and similar reduction in other provinces and territories, the western Canadian population (Alberta, British Columbia, Manitoba, Northwest Territories, Ontario, Saskatchewan) of woodland caribou was declared a vulnerable species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 1984. In May, 2000, their status was uplisted to threatened by COSEWIC.

In September, 1994, the Endangered Species Advisory Committee (ESAC) for Manitoba recommended that woodland caribou be declared an endangered species. In November, 1996, ESAC restated their recommendation for endangered status to ensure that critical habitats, especially old growth forests, are protected for each herd in current and future agreements with forestry companies. This strategy will set the groundwork for woodland caribou conservation in Manitoba and will be integral to adopting the recommendations of ESAC.

Presently, there are 14 woodland caribou ranges identified in Manitoba's boreal lowlands and boreal shield. Many areas, where woodland caribou continue to exist, are unlikely to be impacted by human activity in the immediate future. In these areas, caribou are expected to continue to occur in balance with their natural environment and to experience population and distribution changes in response to naturally occurring habitat changes. Seven areas have been identified as low risk ranges. Three medium risk ranges have been identified where human activities in these areas are at low levels, but could increase. Four ranges have been identified as being at high risk of being negatively impacted from human disturbance. In these four ranges, caribou are being negatively affected and strategies are required to mitigate these impacts, otherwise their numbers may decline. The four high risk ranges in the province are: Kississing-Naosap lakes, Wabowden, Atikaki-Berens, and Owl-Flintstone lakes.

The goal of this strategy is to maintain present woodland caribou numbers and distribution in the province. This will be accomplished by developing integrated management action plans for the four high risk ranges and monitoring populations and habitat of medium and low risk ranges. A process of information gathering and planning, necessary to achieve integrated caribou management with development, is outlined. This planning process has already been completed for the Owl-Flintstone lakes range and has been initiated on the Atikaki-Berens, Kississing-

Naosap lakes and Wabowden ranges. Adaptive management plans for all high risk ranges will be completed within four years. These plans will prioritize woodland caribou conservation activities to be undertaken and will be developed in consultation with stakeholders. For the remaining ranges, where risk to caribou populations is lower, factors affecting ranges will be monitored. If these factors change, range status will be re-evaluated and new management action plans will be developed. This strategy will be reviewed and updated every 2 years.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	i
TABLE OF CONTENTS .....	iii
LIST OF TABLES AND FIGURES .....	v
SECTION I: BACKGROUND .....	1
1. Introduction.....	1
2. Concerns Regarding Future Woodland Caribou Viability .....	3
2.1 Forest Disturbance .....	3
2.2 Wildfire .....	3
2.3 Access .....	4
2.4 Hydroelectric Development .....	4
2.5 Hunting.....	4
2.6 Predation .....	5
2.7 Parasites.....	5
2.8 Treaty Land Entitlement .....	5
3. Status of Woodland Caribou Ranges .....	6
3.1 Nelson-Hayes rivers .....	9
3.2 Wapisu .....	9
3.3 Sisipuk-Kamuchawie .....	9
3.4 Kississing-Naosap lakes .....	10
3.5 Reed-Yawningstone-Clearwater lakes .....	10
3.6 Wabowden .....	10
3.7 Island Lake .....	11
3.8 Gunisao-Hudwin lakes .....	11
3.9 The Bog.....	11
3.10 Swan-Pelican lakes.....	12
3.11 William Lake.....	12
3.12 North Interlake .....	12
3.13 Atikaki-Berens .....	13
3.14 Owl-Flintstone lakes .....	13
4. Current Woodland Caribou Management Actions.....	15
4.1 Introduction.....	15
4.2 Legislation and Hunting .....	15
4.3 Protected Areas .....	15
4.4 Forest Wildlife Guidelines .....	18
4.5 Manitoba's Forest Plan - Towards Ecosystem Management .....	18
4.6 Ecosystem Based Management.....	18
4.7 Canada's Biodiversity Strategy .....	18
4.8 Canada's National Forest Strategy.....	18
4.9 Provincial Woodland Caribou Management Team .....	19
5. Specific Protection for Four High Risk Herds .....	20
5.1 Owl-Flintstone lakes .....	20
5.2 Atikaki-Berens .....	20
5.3 Kississing-Naosap lakes .....	21
5.4 Wabowden .....	21
6. Actions Taken and Future Plans .....	22

6.1 High Risk Ranges.....	22
6.1.1 Kississing-Naosap lakes .....	22
6.1.2 Wabowden.....	23
6.1.3 Atikaki-Berens.....	23
6.1.4 Owl-Flintstone Lakes .....	24
6.2 Medium Risk Ranges .....	25
6.2.1 Reed-Yawningstone-Clearwater lakes .....	25
6.2.2 North Interlake .....	25
6.2.3 Swan-Pelican lakes.....	25
6.3 Low Risk Ranges .....	25
<b>SECTION II: MAINTENANCE STRATEGY .....</b>	<b>26</b>
A. Maintenance Goal .....	26
B. Objectives.....	26
C. Initiatives Required to Complete Objectives.....	27
D. Methodology to Complete Initiatives.....	28
E. Implementation Responsibility.....	32
<b>SECTION III: IMPLEMENTATION SCHEDULE .....</b>	<b>33</b>
<b>SECTION IV: LITERATURE CITED.....</b>	<b>35</b>

## LIST OF TABLES AND FIGURES

Table 1. Conservation Risk Assessment of Woodland Caribou Ranges in Manitoba (May 2000).....	8
Table 2. Implementation Schedule of Maintenance Tasks for High Risk Woodland Caribou Ranges in Manitoba (May 2000).....	34
Figure 1. Woodland Caribou Ranges in Manitoba (May 2000).....	7
Figure 2 Protected Areas and Woodland Caribou Ranges in Manitoba (May 2000).....	17





## SECTION I: BACKGROUND

### 1. Introduction

The woodland caribou (*Rangifer tarandus caribou*) is a threatened cervid species found in the boreal forests of Canada (Gray 1999). In Manitoba, they historically ranged from the Manitoba/Minnesota border in southeastern Manitoba and north to approximately 57 degrees north latitude (Seton 1909, Banfield 1961). Caribou have been extirpated from southeastern Manitoba and no longer occur south of the Winnipeg River (Hristienko 1985). Caribou numbers have likely declined in all parts of the province where timber harvesting, mining or agriculture development have occurred (Darby 1978, 1979, Shoesmith 1986, Shaefer 1988, Shaefer and Pruitt 1991, Crichton 1992). Ontario and the western Canadian provinces have experienced similar range reductions and population declines. In 1984, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)<sup>1</sup> classified woodland caribou as a vulnerable species in western Canada (Kelsall 1984). In May, 2000, their status was uplisted to threatened by COSEWIC.

In September, 1994, the Endangered Species Advisory Committee (ESAC) for Manitoba recommended that woodland caribou be declared an endangered species in the province because of concern for the long term viability of certain herds. In November, 1996, ESAC restated their recommendation of endangered classification to ensure that critical habitats, especially old growth forests, are protected for each herd in current and future agreements with forestry companies. The recommendations by ESAC have yet to be adopted by the government of Manitoba. This strategy will set the groundwork for woodland caribou conservation in Manitoba and will be integral in implementing the recommendations of ESAC.

In 1993, the Manitoba Wildlife Branch prepared a report on the woodland caribou which outlined an action plan to conserve the species in Manitoba (Johnson 1993). It recommended the development of a woodland caribou management team, consisting of Regional Wildlife Managers and a Wildlife Branch biologist. This team was struck in 1994 and was charged

---

<sup>1</sup> COSEWIC - species are grouped in the following categories:

- **Extinct:** a species that no longer exists anywhere.
- **Extirpated:** a species no longer existing in the wild in Canada but occurring elsewhere.
- **Endangered:** a species facing imminent extinction or extirpation.
- **Threatened:** a species likely to become endangered in Canada if limiting factors are not reversed.
- **Vulnerable:** a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

with the task of drafting this strategy report. The report sets priorities for the study and management of woodland caribou. The goal is to maintain woodland caribou at contemporary levels of abundance and distribution in Manitoba.

## 2. Concerns Regarding Future Woodland Caribou Viability

Many factors affect woodland caribou populations. Habitat is key to maintaining any viable wildlife population. Woodland caribou require extensive stands (1000's of square kilometres) of mature forest (KPMG 1995). In particular, the areas used for wintering, calving, rutting and seasonal movements are essential to the viability of a herd. A conservation strategy must identify all real and potential impacts and their cumulative effects, and develop a set of clear objectives to avoid or minimize the impacts on critical and sensitive woodland caribou habitats. The possible effects of climatic change on woodland caribou are not discussed in depth in this strategy, though in the long-term global warming may impact range use. Alvo (1998) pointed out that global warming and increased development may affect the frequency and intensity of forest wildfires, which could ultimately change the distribution of the southern discontinuous permafrost limit that may be related to woodland caribou habitat use.

### 2.1 Forest Disturbance

Woodland caribou depend upon mature forests as habitat for most of their seasonal range use and movements (Bergerud 1974, Carbyn 1968, Darby 1978, 1979, Shoesmith and Storey 1977, Stardom 1977). As well, woodland caribou use both arboreal lichens and forest-floor lichens, which occur primarily in mature forests, as a major source of food. Therefore, woodland caribou generally inhabit lichen-rich areas of the boreal forest (Hristienko 1985). The most important disturbances to its habitat are those that affect the lichens: wildfire and clear-cutting (Alvo 1998). Cooperative forest and wildlife management must occur to prevent specific herds from being extirpated from their native ranges. Timber harvesting, mining activities, utility (hydro, telephone) corridors and roads have the potential to be detrimental to and fragment caribou habitat. The role mature forests play as a barrier to the influx of other ungulates and their associated predators into caribou range is as important as overall habitat availability (Bergerud 1974, Bergerud and Mercier 1989, Cringan 1957). As well, habitat changes which favour moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*) may also increase the prevalence of parasites pathological to woodland caribou. Protected or managed areas are needed to safeguard caribou from human disturbance. To ensure that caribou populations are sustainable, forest management plans need to integrate the habitat selection and life history requisites of caribou.

### 2.2 Wildfire

Forest wildfires are a natural part of forest succession and wildfire affects woodland caribou and their habitats. In the long term (>60-100 years), wildfires serve to rejuvenate areas for future caribou use. In the short term (<60-100 years), burned habitats decrease access to winter forage due to the loss of lichens, an increase in snow thickness and hardness, and the accumulation of deadfalls (Shaefer 1988). The length of time of this effect depends on several factors, most importantly on the productivity of soil regime of the area and the length of the growing season. This may eventually lead to caribou displacement. If adjacent, alternative mature forest areas do not exist, then the affected caribou may not persist.

### 2.3 Access

Mining, hydro and forestry developments all require roads and trails to transport people and supplies to and from resource extraction sites. Roads, trails and other linear corridors, including hydro transmission line rights-of-way and mining exploration lines, initially constructed for resource development and extraction, allow easier access to formerly "remote" tracts of caribou habitat. Linear corridor development has the potential to increase mortality from legal or illegal hunting and facilitate movement of predators into caribou range, thereby, increasing predation (James and Stuart-Smith 2000). Road and other linear corridor construction and use can disturb caribou and lead to population and range fragmentation, and partial range abandonment. Linear corridor placement plans must consider the seasonal ranges, travel corridors and seasonal concentration of caribou. In addition, when roads and other linear corridors are no longer needed for their initial purposes, closures will be implemented to reduce the above mentioned impacts.

### 2.4 Hydroelectric Development

Hydroelectric power dams impact woodland caribou by flooding habitat. Transmission lines, to a lesser extent, also cause a reduction in the available habitat for caribou. Human activity associated with large scale construction can cause caribou to abandon traditionally used sites.

### 2.5 Hunting

Most cervid species in Manitoba can normally sustain some human harvest. The sustainable level of harvesting is dependent on the population size, reproductive rate and all mortality factors. Since caribou occur at low densities, have a low reproductive rate, and can experience significant mortality from predation or parasites, uncontrolled hunting can impact a population. Licenced hunting of woodland caribou is no longer permitted in Manitoba except in Game Hunting Area (GHA) 3 (for description of lands encompassed by GHA's see, *Hunting Areas and Zones Regulation*, Manitoba Regulation 220/86 made under *The Wildlife Act*), where woodland caribou range (of a forest/forest ecotype, as defined by Gray (1999)) overlaps with the coastal herd of the Pen Island caribou (a forest/tundra ecotype, as defined by Gray (1999)). The number of woodland caribou harvested in this area is small because of the limited entry hunting season (75 licences). As well, in years with less than average snowfall, most of the harvest that does occur are caribou from the more abundant coastal Pen Island range. Pen Island caribou travel farther west into Manitoba during these years.

First Nations hunting occurs on all ranges except in GHA 26 (Owl-Flintstone lakes range), where a regulation has prohibited the hunting of woodland caribou by anyone since 1991. Current levels of First Nations harvest are not believed to be excessive, but, because of the herding behaviour of caribou, the potential for serious impacts exists where access is available. Harvests levels will be developed and monitored; this is particularly important for ranges at high and medium risk. If hunting is considered the primary cause of caribou

population declines in any area, a regulation restricting hunting will be considered. Opportunities for woodland caribou co-management initiatives with First Nation communities will be encouraged.

Illegal hunting occurs periodically, but based on field reports, it does not appear to be a significant mortality factor.

## **2.6 Predation**

Woodland caribou are a natural prey species for such predators as timber wolves (*Canis lupus*) and black bears (*Ursus americanus*). Predation, when compounded with other mortality factors, can decrease herd numbers. Habitat disturbance can increase the carrying capacity for other ungulates, e.g., moose and white-tailed deer, and result in increased predator numbers and increased predation on caribou. Roads, hydro transmission lines and off-road vehicle routes can enhance access for predators into caribou habitats, resulting in increased predation.

## **2.7 Parasites**

In parts of Manitoba, white-tailed deer are infected with brainworm (*Parelaphostrongylus tenuis*). This parasite has little effect on deer, but caribou are highly susceptible to neurological damage caused by the worm (Anderson 1971, Anderson and Strelive 1968, Behrend and Witter 1968). Prior to 1995, deer were expanding their range northwards due to a series of mild winters and improved habitat conditions resulting from timber harvesting, land clearing and wildfire. This deer and parasite expansion is a threat to caribou on the eastside of Lake Winnipeg. Caribou are particularly susceptible to this impact because the spread of brainworm would likely occur concurrent with increased predation resulting from higher deer numbers. Other pathogens known to infect caribou may have a higher risk of being transmitted to caribou because of increasing white-tailed deer numbers. One such parasite is the giant liver fluke (*Fascioloides magna*) which is prevalent in southeastern Manitoba. The impacts of these diseases will need to be monitored.

## **2.8 Treaty Land Entitlement**

Canada entered into various treaties with First Nation communities in the late 1800s and early 1900s. Under those treaties, Canada agreed to set aside a certain amount of land as reserve lands. To date, not all of those lands have been transferred and a process is now ongoing to transfer those lands to First Nation communities (Manitoba Northern Affairs 1997).

Some of the land considered for transfer is important to caribou. Opportunities to co-manage woodland caribou with First Nations will be essential for their continued presence in affected ranges.

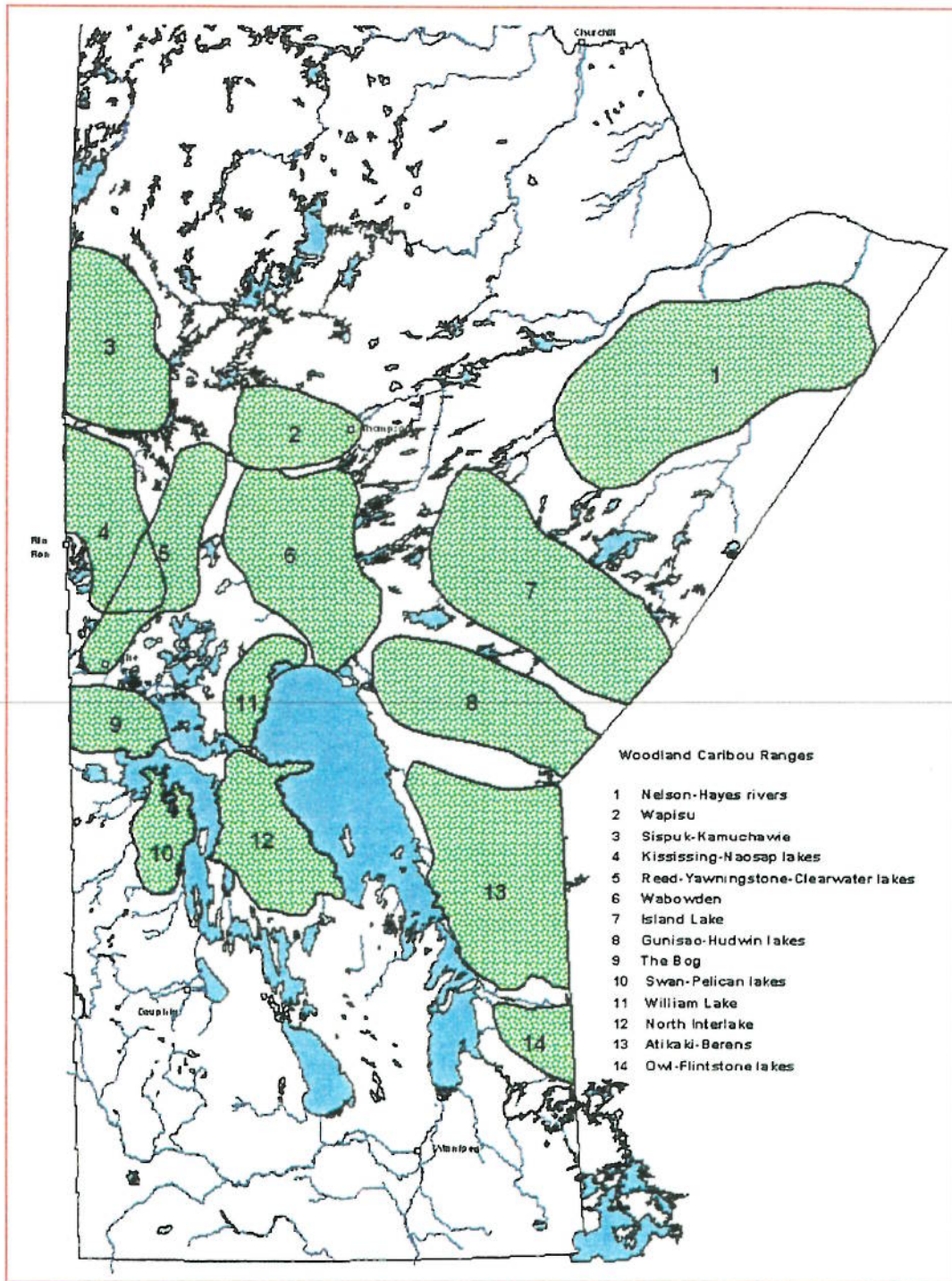
### **3. Status of Woodland Caribou Ranges**

Most literature on the woodland caribou in Manitoba refers to individual caribou herds. For example, Johnson (1993) suggested that there were 27 distinct herds in the province. Subsequent investigations have shown that the population dynamics and dispersal movements of woodland caribou are more complex than previously thought. Combined with the difficulties involved in obtaining reliable data, the concept of managing caribou herds is not practical. A more pragmatic approach is to apply an adaptive conservation strategy using the habitat-based concept of caribou ranges. These are herein defined as areas of contiguous habitat with similar characteristics that support populations of woodland caribou. This report recognizes 14 woodland caribou ranges in Manitoba (Fig. 1).

Population estimates are given for each range based on observations of animals during aerial caribou or other resource inventories, ground observations by biologists, hunters, trappers and others and/or aerial track counts (Table 1). These estimates are not based on any statistically valid sampling or census technique but are the best available.

There are many real and potential threats to the continued viability of woodland caribou ranges in Manitoba. Wildfire is a threat to habitat for all of the ranges. Other important threats are summarized for each range in Table 1 and include habitat loss and fragmentation from timber harvesting, hydro development, mining and increased access from linear corridors, excess mortality from First Nations hunting, increased access, parasites and predation.

Figure 1. Woodland Caribou Ranges in Manitoba (May 2000).



Note: Range delineation is based on known core areas, woodland caribou may be found outside these areas.

**Table 1. Conservation Risk Assessment of Woodland Caribou Ranges in Manitoba (May 2000).**

RANGE	RISK LEVEL	POP'N SIZE	THREATS						
			Timber Harvesting	Hydro	Mining	First Nations Hunting	Access	Parasites	Predators
Kississing-Naosap lakes	High	100-200	Yes	Yes	Yes	Yes	Yes	No	Yes
Wabowden	High	150	Yes	Yes	Yes	Yes	Yes	No	Yes
Atikaki-Berens	High	300-500	Yes	No	Yes	Yes	Yes	Yes	Yes
Owl-Flinstone lakes	High	65-75	Yes	No	Yes	No	Yes	Yes	Yes
Reed-Yawningstone-Clearwater lakes	Medium	100-150	Yes	No	Yes	Yes	Yes	No	Yes
Swan-Pelican lakes	Medium	50-75	Yes	No	No	No	No	No	No
North Interlake	Medium	50-75	Yes	Yes	No	No	No	No	Yes
Nelson-Hayes rivers	Low	N/A	No	No	No	No	No	No	No
Wapisu	Low	100	Yes	Yes	No	No	No	No	No
Sisipuk-Kamuchawie	Low	100-200	Yes	No	No	Yes	No	No	No
Island Lake	Low	500-1000	No	No	No	Yes	No	No	No
Gunisao-Hudwin lakes	Low	250-500	No	No	No	No	No	No	No
The Bog	Low	50-75	No	No	No	Yes	No	No	Yes
William Lake	Low	25	Yes	Yes	Yes	Yes	Yes	No	No



### **3.1 Nelson-Hayes rivers**

That part of northeastern Manitoba between the Nelson and Hayes rivers and south of the Cape Tatnam Wildlife Management Area is winter range to migratory coastal caribou (a forest/tundra ecotype) and year round range to woodland caribou. No estimate of woodland caribou numbers is available.

This range is remote and accessible only by plane, boat or off-road vehicle, or by a winter road to Shamattawa. Major factors, which could affect the future of this range, are hydroelectric development, road development and mining. The risk to caribou on this range is considered low.

### **3.2 Wapisu**

The Wapisu range occurs west of Thompson. Caribou occur south of Provincial Road (PR) #391 and north of Setting Lake, as far west as Highrock and Burntwood lakes and east, as far as Provincial Trunk Highway (PTH) #6. The population is estimated to be a minimum of 100 animals.

This range is remote except for one major road, PR #391, which connects Thompson, Nelson House, Leaf Rapids and Lynn Lake. Road development for timber harvesting began in 1997 and timber harvesting in 1999 on the eastern periphery of the range. Wildfires had an impact on much of this range in 1989. Occasional opportunistic hunting of caribou does occur within this range but the harvest is not significant. A power dam is proposed at the outlet of Wuskwatin Lake. In 1999, assessment activities for a generating station, road and power transmission line began.

Major factors that may affect this range in the future include roads, hydroelectric development, mining and timber harvesting. The risk to caribou is currently considered low, but as development proceeds this risk will be elevated.

### **3.3 Sisipuk-Kamuchawie**

The Sisipuk-Kamuchawie range occurs in northwestern Manitoba near the Saskatchewan border and extends from Vandekerckhove Lake on the north to just south of the Churchill River. It is home to 100-200 caribou. This range is intersected by the Hudson Bay Railway (HBR) line to Lynn Lake, PR #396 from Lynn Lake to Fox Mine and PR #394 from Lynn Lake to Kinoosao. However, little impact on this range has occurred. Timber harvesting commenced here in 1995. First Nations harvest of caribou is occurring, however, a co-management agreement is in place for most of this caribou range.

Major factors that may affect this range in the future include timber harvesting, mining and hydroelectric development. The risk to caribou on this range is presently low.

### **3.4 Kississing-Naosap lakes**

This range covers an area of boreal forest within the Canadian Shield from Kississing Lake south to the lowland mixed forest which includes Grass River Provincial Park. The population is estimated to be 100-200 caribou.

The Sherridon rail line, a 230 kV hydro right-of-way, and PTH #10, PTH #39 and the Sherridon road traverse this area. Extensive timber harvesting from the 1970's to present and a major forest wildfire in 1989 have impacted this area. Further timber harvesting is planned in the Naosap-Peterson lakes area that will further impact the range. Timber harvesting began in 1994 on Collins Point on the north shore of Kississing Lake raising additional concerns. Much of the north and northeast shore of Kississing Lake and large islands, such as Moose Island, are also identified for future timber harvesting. Some caribou harvest occurs by First Nations people. First Nations hunters harvest 10-20 caribou annually from this herd, with most of the harvest taking place along the Sherridon road and the winter road between Pukatawagan and PTH #10. Some mortality due to hunting and vehicle collisions also occurs along PTH #39.

The caribou on this range are considered at high risk because Tolko Manitoba Inc. (formerly Repap Manitoba Inc.) has identified the Naosap lake area for timber harvesting over the next 10 years; there is also the potential for increased mortality from predation and hunting.

### **3.5 Reed-Yawningstone-Clearwater lakes**

This range includes an area of mixed wood forests and lowlands from the Yawningstone-Mitchell lakes area northeast to the Canadian Shield around Reed Lake. The caribou population is estimated to be 100-150 animals.

Extensive timber harvesting and forest wildfires during the 1970's and 1980's, in the Yawningstone-Mitchell lakes area, has had some short term negative impact on the southern portion of this range. Timber harvesting has occurred for some years in the Reed Lake area and continues in the Dolomite Lake area. Some mortality occurs from hunting and vehicle collisions along PTH #39 and the Mitchell Lake road. A portion of this range is within Grass River Provincial Park and Cormorant Provincial Forest.

Future threats to this range could include loss of habitat due to ongoing timber harvesting, increased road access, and continued human disturbances on and around Reed Lake, a known caribou calving and summer area. The caribou on this range are considered at medium risk.

### **3.6 Wabowden**

The Wabowden range occurs south of the Wapisu range and extends as far south as the north end of Lake Winnipeg. The number of caribou is estimated at 150 animals.

This range has well-developed access and is traversed by PTH #6, PTH #39 and PR #373. The HBR Churchill line, Bipole I, Bipole II, a 230 kV hydro transmission line and associated right-of-ways also cross this range. Tolko Manitoba Inc. has been and continues to log this range. The area had an operating mine near Clark Lake which was decommissioned in the mid-1980's. However, mining exploration activities occur annually. Some vehicle mortality and opportunistic harvesting by First Nations hunters occurs. Because of timber harvesting and ongoing mining exploration, the risk to caribou on this range is considered high.

### **3.7 Island Lake**

The Island Lake range occurs south and east of Norway House and extends to the Ontario border. There are several scattered caribou groups with an estimated total population of 500-1000 caribou. There has been little industrial disturbance on this range. Wildfires burned some of this range in 1989 and some opportunistic harvesting of caribou occurs. Factors that may affect this range in the future include road development, mining, timber harvesting and hydro transmission lines. Industry has expressed an interest in forest harvesting in this area. Because of the limited immediate development plans the caribou on this range are considered at low risk.

### **3.8 Gunisao-Hudwin lakes**

The Gunisao-Hudwin lakes range occurs east of the north end of Lake Winnipeg and extends eastward to the Ontario border. The number of caribou in this range is estimated at 250-500 animals. Little impact has occurred here in the past. Future development in this range is not expected in the near future, but industry is interested in forest harvesting in this area. The caribou on this range are at low risk.

### **3.9 The Bog**

The Bog range extends from Westray south to Red Deer Lake, and from Cedar Lake to at least the Saskatchewan border. The population in this range is estimated to be 50-75 animals.

Historically, timber harvesting has been limited in most of this range due to the limited volumes of merchantable timber. Cutting has occurred on both sides of PTH #10 and the mature timber has been virtually depleted. Other factors affecting caribou mortality in this range, include hunting by First Nations people along PTH #10 and PTH #60, vehicle mortality and wolf predation.

The Bog range is the least likely to experience dramatic habitat changes and mortality is low. The overall risk to caribou on this range is low.

### 3.10 Swan-Pelican lakes

The Swan-Pelican lakes range extends from Cowan east to Lake Winnipegosis along the west and north shores of Lake Winnipegosis and west to the eastern edge of Swan Lake. Caribou occur in small numbers, principally between Pelican Lake, Pelican Bay and Lake Winnipegosis. The population is estimated to be 50-75 caribou.

Recent timber harvesting within this range has been minimal. Some limited caribou harvest by First Nations people may occur.

At present, forest companies have not logged this range. However, if local forest harvest quotas are maintained, this forest will be impacted. Long-term Tolko Manitoba Inc. forest management plans call for extensive timber harvesting and road development in this general area. Given the limited softwood fibre remaining nearby, it is likely that forest harvest will proceed within the next 10 years and the population is at some risk. Due to the potential timber harvesting, caribou on this range are considered to be at medium risk.

### 3.11 William Lake

This range includes a lowland area of mixed forest around William Lake southward to Grand Rapids and east to Lake Winnipeg. Approximately 25 caribou occur in this range.

Forest wildfires in 1961 impacted a significant portion of this range. Only limited timber harvesting has occurred around William Lake to date. Mineral exploration in this area has increased in the last few years.

Little is known about this caribou range, but if timber harvesting continues to expand around William Lake, the risk to caribou on this range will change from low to medium risk.

### 3.12 North Interlake

Suitable range for woodland caribou exists in the northern portion of the Interlake in the area bounded by Dauphin River on the south, Lake Winnipeg on the east, Lake Winnipegosis on the west and Cedar Lake on the north. Observations suggest that 50-75 animals occur on this range.

Although a considerable amount of the range was burnt by a large forest wildfire in 1961, there has been much less impact by wildfire since that time, and older age forests occur in remnant stands throughout the area. Low intensity forest harvesting occurs by winter access only. The only permanent road through the range is PTH #6. Several hydro transmission corridors pass through and provide some access to this range. Mortality caused by hunting and vehicle collision is low. Predation by wolves is probably the most significant source of mortality. The presence of other species including elk (*Cervus elaphus*), white-tailed deer, moose and wood bison (*Bos bison athabasca*) on the caribou range may support a relatively high population of wolves that might prey on caribou in specific seasons.

There is ongoing timber harvesting in the Katimik Lake area and along PTH #6. However, Chitek Lake area has been declared a park reserve and no timber harvesting is allowed. Woodland caribou habitat is at medium risk at this time. However, should timber harvesting operations expand or a major wildfire occurs, the status of caribou on this range could change from medium to high risk.

### **3.13 Atikaki-Berens**

The Atikaki-Berens range includes an area of northern coniferous forest within the Boreal Shield ecozone and the Lac Seul Upland ecoregion. Caribou are restricted on the west by Lake Winnipeg and extend eastward into Ontario. They occur south as far as the Wanipigow River and north of the Poplar River. They are known to calve on islands in various lakes, including, Sasaginnigak, Fishing, Wrong, Carr-Harris and Family lakes and on rock outcrop "islands" between the Berens and Pigeon rivers. Wintering areas include Shallow Lake, Beaver Creek, Atiko Lake, Loon Straits and Berens River area. Fall concentrations have been identified in several areas, including south of Kautunigan Lake. The population is estimated to be between 300-500 animals.

This range is remote except for the Rice River all-weather road and a few winter roads which bisect caribou winter habitat. Some forest harvesting is occurring on the fringe of this range. Present mortality sources are First Nations hunting, wolf and bear predation and vehicle collisions.

The major future habitat threat is timber harvesting. Pine Falls Paper Company will require significant volumes of their wood from this range in the next 10 years due to the development of a thermal mechanical pulping (TMP) process. The TMP process will enable the Pine Falls Paper Company to use much more pine than they presently do. This will increase the demand for harvesting wood in caribou habitat areas. However, timber harvesting is prohibited within Atikaki Wilderness Park. The Bipole III hydro transmission line corridor was destined to traverse through this area and could bisect important wintering areas, resulting in increased access to caribou by First Nations hunters and wolves, as well as, habitat loss. Important habitats may be bisected and First Nations harvest of caribou may increase with the proliferation of winter roads. As well, the construction of a proposed all-weather road on the eastside of Lake Winnipeg, with access roads to aboriginal communities, may also impact important habitats and lead to increased harvest. Loss of habitat due to timber harvesting, and increased mortality due to increased access, places these caribou at a high risk.

### **3.14 Owl-Flintstone lakes**

The Owl-Flintstone lakes range occurs east of Lake Winnipeg and extends into Ontario and from the Wanipigow River south to the Winnipeg River. This range has a population of approximately 65-75 animals.

Presently, the current core winter and summer ranges for this herd are relatively undisturbed from forestry activities and access. However, disturbance in the range around these core areas is extensive and results from forestry activities, road development, recreational development, mining and wild rice harvesting. This may be the primary reason why this range remains occupied by caribou. Timber harvesting and wildfires have diminished the winter range to approximately eight townships. Further loss of winter habitat could be critical to the survival of caribou in this range. Access to the timber harvesting operation at Happy Lake has been controlled to protect the caribou and other resources in the area. Caribou are protected by legislation from harvest, including First Nations hunters, within this range. Mortality occurs through vehicle collisions and by wolf predation. There is a risk of parasites impacting caribou as white-tailed deer emigrate into forest harvested areas used by caribou.

Merchantable timber within the winter range is in demand by the Pine Falls Paper Company, as well demand for pine will increase with the development of TMP. Increased mortality due to brainworm and increased predation are serious threats. Caribou on this range are at high risk.

## **4. Current Woodland Caribou Management Actions**

### **4.1 Introduction**

General and specific management initiatives have been or are occurring that enhance the survival of woodland caribou in Manitoba. Canada's Biodiversity Strategy and Federal Species at Risk initiatives proclaim the importance of ecosystem integrity and sustaining all components of biological systems. Woodland caribou is also a species which has been listed as threatened by COSEWIC. These initiatives have done much to attract the attention of stakeholders with an interest in the boreal forest including the general public, industry and governments. All have a vested interest in conserving this species.

Manitoba Wildlife Legislation provides for regulations which protect woodland caribou and enables a sustainable harvest of them. Manitoba Forest Wildlife Guidelines and Manitoba's Forest Plan provide for general protection and management of caribou habitat in forests which are harvested. Both documents specifically refer to management prescriptions for woodland caribou. Other initiatives such as the Protective Areas Initiative and the Ecosystem Base Management Initiative in Ecoregion 90 recognize woodland caribou as an important forest wildlife species with specific habitat requirements that must be sustained to maintain viable populations.

Site specific management initiatives are occurring in the four areas where caribou are at risk (Table 1). Studies are underway to delineate range use and critical habitats (wintering, calving and calf-rearing) and determine numbers of animals which occupy these ranges. This information is being used to direct and/or restrict development in these areas. Forest industry companies, Manitoba Hydro, First Nations and local people are actively involved in these initiatives.

### **4.2 Legislation and Hunting**

Woodland caribou are classified as big game under *The Wildlife Act*. Licenced hunting seasons for all caribou herds (except GHA 3) have been closed since 1992. Hunting of caribou by First Nations people does occur on most ranges, except on the Owl-Flintstone lakes range, GHA 26 (eastside of Lake Winnipeg), where it has been prohibited since 1991.

### **4.3 Protected Areas**

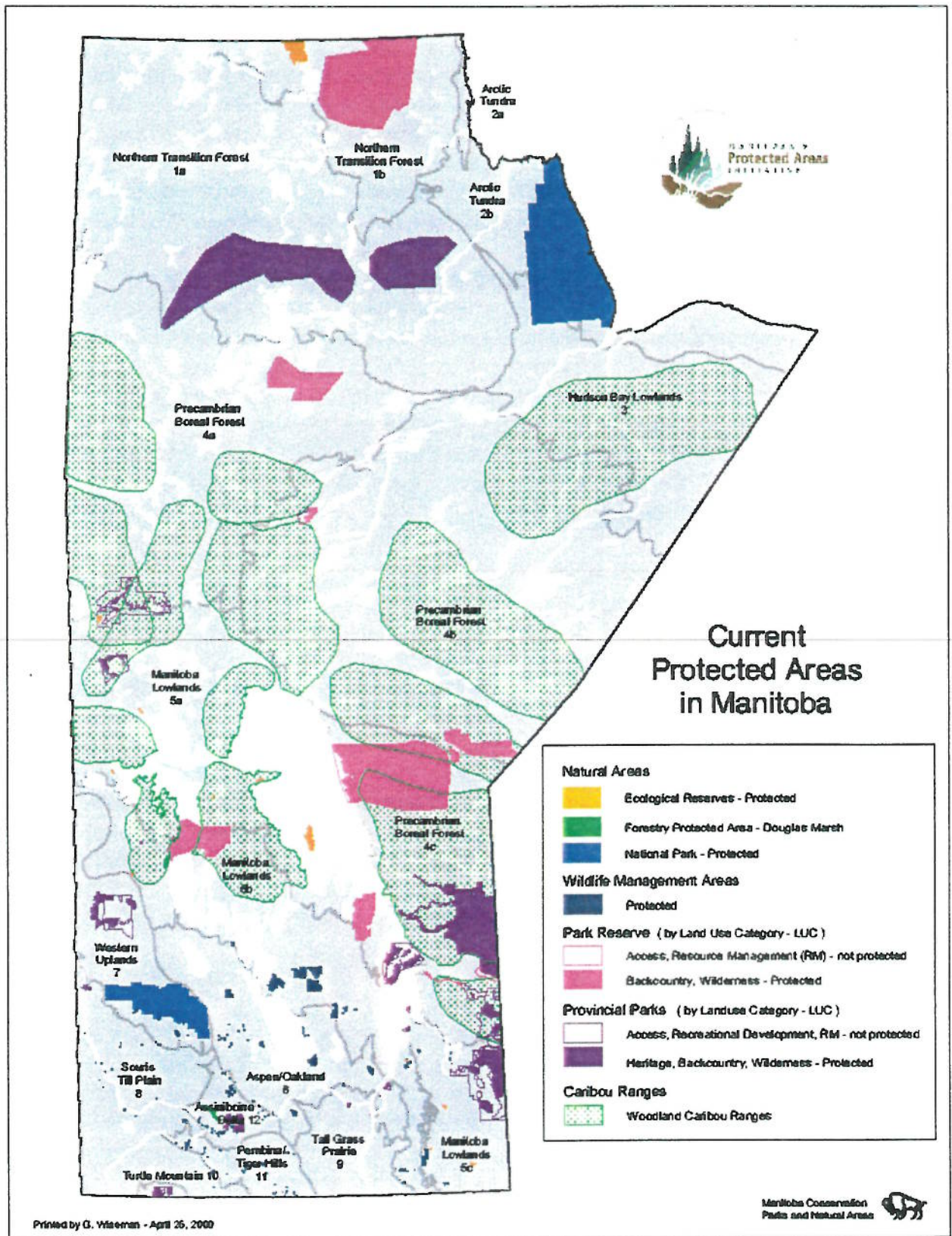
Manitoba has a number of protected areas (Fig. 2, Manitoba Natural Resources 1997b) which overlap with caribou ranges. In protected areas, timber harvesting, mining, hydroelectric development and other activities that negatively impact caribou habitats are prohibited. Protected areas include ecological reserves, national parks, and some, or parts of, provincial parks and wildlife management areas. Within some of these areas, caribou habitat is protected from development. Presently eight of the 14 woodland caribou ranges are partially within protected areas. The land base of several of the protected areas in these ranges is small and not significant.

In 1990, Manitoba committed to the establishment of a network of protected areas. It plans to protect areas within each natural region of the province. A network of protected lands is being assembled that strives to conserve ecosystems and maintain biodiversity. Several of the protected areas fall within woodland caribou ranges. This species has been considered as an important species when selecting study areas for the protected areas initiative. Therefore, woodland caribou ranges will be receiving greater protection from this initiative. But protected areas are not expected to protect all of the required habitat necessary to sustain woodland caribou populations in Manitoba.

Establishment and management of new protected areas is occurring in consultation with First Nations people. First Nations will assist in identifying areas of cultural, spiritual and ecological significance including traditional ecological knowledge related to woodland caribou.



Figure 2. Protected Areas and Woodland Caribou Ranges in Manitoba (May 2000).



#### **4.4 Forest Wildlife Guidelines**

The Manitoba Forest Wildlife Guidelines are being rewritten. The revised guidelines will incorporate contemporary views of wildlife management, including ecosystem-based management, and will be more proactive in protecting woodland caribou habitat. In the new document, woodland caribou are designated a regional focus species in the Northwest, Northeast and Eastern Manitoba Conservation regions. Therefore, habitat maintenance for woodland caribou species will be one of the main requirements for forest management practices in these regions. This will also benefit other wildlife species which have habitat needs similar to those of woodland caribou as outlined by Kuhnke and Watkins (1999).

#### **4.5 Manitoba's Forest Plan - Towards Ecosystem Management**

This document moves forest management from an economic view of forests to a recognition of the "needs for sustainability, biodiversity, and integration - with forest health and forest integrity as fundamental objectives". In the plan, woodland caribou are identified as an important indicator of forest health and the woodland caribou HSI model is referenced as a tool for monitoring caribou habitat within a managed forest. Forest management practices that accommodate woodland caribou, which require very large blocks of unfragmented mature forest habitat, are outlined in the plan.

#### **4.6 Ecosystem Based Management**

A pilot project on the eastside of Lake Winnipeg will provide future direction to government and industry in the development and application of ecosystem-based management in Manitoba. Woodland caribou are considered a key element in this pilot project.

#### **4.7 Canada's Biodiversity Strategy**

Canada, the provinces and territories signed a commitment in 1995 entitled "Canada's Biodiversity: A commitment to its Conservation and Sustainable Use". Manitoba is a signatory to this document which commits the province to the Canadian Biodiversity Strategy. Manitoba's participation in this strategy is an indication of the province's commitment to global conservation of biodiversity, which includes woodland caribou.

#### **4.8 Canada's National Forest Strategy**

The National Forest Strategy (1998) is meant to guide Canada's efforts in sustainable forest management. The goal of the strategy is to "maintain and enhance the long-term health of our forest ecosystems, for the benefit of all living things both nationally and globally, while providing environmental, economic, social and cultural opportunities for the benefit of present and future generations". Manitoba is a signatory to this document and is committed to the sustainable forest management principles identified in this strategy.

#### **4.9 Provincial Woodland Caribou Management Team**

Manitoba Conservation established a Woodland Caribou Management Team consisting of Regional Wildlife Managers and Wildlife Branch staff. This team sets priorities for the study and management of woodland caribou in the province. The status of each caribou range was reviewed and the degree of threat assessed. Four of the 14 ranges are identified as being at risk due to habitat changes from timber harvesting and other threats (Table 1). These are the Owl-Flintstone lakes, Atikaki-Berens, Kississing-Naosap lakes and Wabowden ranges. Specific programs have been initiated in these ranges to identify the distribution of caribou and critical habitat use. Data will be used to integrate caribou conservation with forest management. Immediate and future action plans for these ranges are identified in this document.

## **5. Specific Protection for Four High Risk Herds**

### **5.1 Owl-Flintstone lakes**

This range is included in the Pine Falls Paper Company Forest Management Licence (FML) and is subject to all existing forestry, wildlife and environmental guidelines.

An Integrated Forestry Woodland Caribou Management Strategy (TAEM 1995) is used to direct timber harvesting on this caribou range. This strategy was developed and is supported by Manitoba Conservation (Policy Coordination, Forestry, Parks and Natural Areas, Wildlife Branch and Operations Division), Pine Falls Paper Company and Time to Respect Earth's Ecosystems (TREE).

Part of this caribou range is in Nopoming Provincial Park. Under park regulations, overnight camping on all islands on both Flintstone and Black lakes (calving and summer rearing areas) is prohibited. Proposed development or possible restrictions in the caribou range within the park is ongoing and subject to review.

Access by the general public to the winter range has been closed by a control structure on the Happy Lake Road. All proposed resource development roads in the area must be approved by Manitoba Conservation.

The Pine Falls Paper Company's Environmental Impact Assessment recognizes caribou as an important species in this area and must consider caribou habitat needs in planning activities and documents. Location of roads, timber harvesting areas and time of harvest have been modified to minimize impacts on caribou.

Manitoba Hydro recognizes that woodland caribou are at risk in this area and have assisted with studies to determine impact of hydro corridors on caribou movements.

The following organizations are funding specific projects and participating on a woodland caribou project advisory committee on caribou management in this area: Manitoba Conservation (Policy Coordination, Forestry, Parks and Natural Areas, Wildlife Branch, Operations Division and Environment Division); Pine Falls Paper Company; Manitoba Model Forest; Manitoba Hydro; Time to Respect Earth's Ecosystems (TREE); Lac du Bonnet Fish and Game; and the University of Manitoba.

### **5.2 Atikaki-Berens**

This range is within areas utilized by the Pine Falls Paper Company. The future expansion of the Pine Falls Paper Company's Forest Management Licence must be approved by Manitoba Conservation and will be subject to all forestry, wildlife and environmental guidelines and regulations.

Part of this range is in the Atikaki Provincial Park. Atikaki Provincial Park is designated as a wilderness park. Proposed development or restrictions in the caribou range within the park will be subject to review. Manitoba Conservation, Manitoba Hydro and Manitoba Model Forest are funding specific projects on caribou management in this area.

### **5.3 Kississing-Naosap lakes**

This range is included in the Tolko Manitoba Inc. FML and is subject to all existing forestry, wildlife and environmental guidelines.

The Tolko Manitoba Inc. Environmental Impact Assessment recognizes woodland caribou as an important species in this area. The company has considered caribou habitat requirements in plan development and has modified cutting plans where conflicts with caribou may occur. Tolko Manitoba Inc. and Manitoba Conservation have developed a woodland caribou mitigation plan for the Naosap operating area encompassing, large leave-areas of habitat, special considerations for woodland caribou travel corridors and vehicle access control. As well, the plan identifies ongoing research to assess the effectiveness of the plan.

Part of this range is in the Grass River Provincial Park. Proposed development in the caribou range within the park will be subject to review.

The following organizations are currently participating in research initiatives aimed at enhancing caribou management by funding projects in this area: Manitoba Conservation (Forestry, Parks and Natural Areas, Wildlife Branch and Operations Division); Tolko Manitoba Inc.; Laurentian University and Manitoba Hydro.

### **5.4 Wabowden**

This area is included in the Tolko Manitoba Inc. FML and is subject to all existing forestry, wildlife and environmental guidelines.

The Tolko Manitoba Inc. Environmental Impact Assessment recognizes caribou as an important species in this area and considers them in plan development and has modified cutting plans in response to concerns.

Tolko Manitoba Inc. and Manitoba Conservation are participating in caribou management activities in this area.

## **6. Actions Taken and Future Plans**

### **6.1 High Risk Ranges**

#### **6.1.1 Kississing-Naosap lakes**

This range is considered to be at high risk because of extensive timber harvesting plans (REPAP 1996). To minimize the effects of these developments, habitat use will be delineated and an integrated forest caribou management plan developed.

Aerial surveys were conducted in March 1991 and during the winters of 1993-94, 1994-95 and 1995-96 to gather information on numbers and distribution of caribou in the area (Cross 1996, Cross and Smith 1995, Cross and Smith, in press).

A spring, summer and fall assessment of caribou habitat use in a portion of the Kississing-Naosap lakes range occurred in 1995 and 1996 (unpublished data, Northwest Region files). In February 1996, five female woodland caribou were fitted with very high frequency (VHF) radio-transmitters. Fifteen more radio-transmitters were deployed on caribou in 1998 and 11 in 1999. These caribou will be monitored on a regular basis and their distribution mapped. This information will provide more precise data on seasonal habitat use and movements of caribou in this area.

Historical data were analyzed to describe habitat use in the Reed-Naosap lakes region (Benoit 1996). Relocation data from recently radio-collared caribou are also being compiled and analyzed by a Laurentian University graduate student as a requirement for a Master of Science (M.Sc.) degree. The focus of this study will be to determine seasonal patterns of habitat use, selection of specific forest community types and disturbance by roads, hydro transmission lines and other linear corridors. These analyses enable Manitoba Conservation to identify and recommend actions to protect caribou habitat in the area.

Habitat availability and distribution will be identified using Forest Resource Inventory (FRI) and the woodland caribou habitat suitability index (HSI) model. Road retirements and hunting prohibitions for First Nations people will also be considered to reduce caribou mortality.

A study of this caribou range, to better determine numbers, distribution, movement patterns, key habitats, mortality, and response to timber harvesting, is underway. This study is continuing. Development of an adaptive management action plan for this range has been initiated. A five-year forest harvesting plan to mitigate impacts to woodland caribou in the Naosap operating area has recently been completed with Tolko Manitoba Inc. The Naosap operating area represents less than 10 percent of the total area of this range but is scheduled for intense forest harvesting operations over the course of the next five years.

### **6.1.2 Wabowden**

Future plans for timber harvesting in this range are significant (REPAP 1996). Because of habitat loss and ongoing mineral exploration, the risk to this range is considered high.

Two cooperative caribou forest management studies were completed in this range. The first study was initiated in 1995 by Manitoba Conservation with Repap Manitoba Inc. and the University of Saskatchewan. Ten female caribou were fitted with VHF telemetry collars in 1995, with an additional five radio-transmitters deployed in 1996. An ongoing monitoring program is occurring. Movement and distribution data were used to identify important habitats, movement corridors, caribou use of previously harvested areas and extent of the range used. A caribou habitat map is being developed using FRI and monitoring data. Progress to date has been reported (Brown 1998, Brown et al. in press, Elliott 1997, Elliott and Brown 1996). All results will be published in a graduate student's M.Sc. thesis. Once data have been analyzed, an integrated woodland caribou and forestry management plan for this range can be developed in collaboration with Tolko Manitoba Inc.

In 1997, a second study was initiated by Manitoba Conservation with the University of Manitoba, Natural Resource Institute (NRI). The structure of, and fidelity to, calving/calf rearing habitat were measured and described in areas inhabited by cow-calf pairs. The results of this study were published as a NRI practicum (Hirai 1998) and will assist in developing forest management strategies for caribou habitat for this range in conjunction with Tolko Manitoba Inc. This will also form the basis for the development of a caribou summer habitat model for the Manitoba lowlands.

Other management initiatives needed to reduce mortality include road retirements and hunting restrictions. The implementation of these initiatives is ongoing and requires consultation with stakeholders.

### **6.1.3 Atikaki-Berens**

Loss of critical habitat areas through wildfire and timber harvesting, and potential increase in mortality from unregulated hunting and wolf predation as a result of increased access development, place these caribou at high risk.

VHF radio-telemetry studies on these caribou were undertaken in the 1970's and from 1987 to 1992. These studies provided information on important habitats, movement corridors and extent of the range used. The caribou habitat in the area can be further identified by developing a caribou habitat map using FRI and a recently developed HSI model (Palidwor and Schindler 1995). This will occur as part of the integrated woodland caribou/forestry planning process. Once habitat suitability has been mapped, an integrated woodland caribou and forestry management plan can be developed in collaboration with the Pine Falls Paper Company. This management plan will also include input from other stakeholders.

As part of a joint study between Manitoba Conservation, Manitoba Hydro, Pine Fall Paper Company and the Manitoba Model Forest, VHF radio-collars were put on two caribou at Sasaginngak Lake in 1999, and in February, 2000, seven global positioning system (GPS) radio-telemetry collars and two VHF radio-collars were placed on caribou south of the Bloodvein River between Shallow Lake and Atiko Lake. Data collected from these animals will help to determine seasonal range use, important habitats and identify travel corridors on this range. Relocation data will also help to refine and further validate the HSI model for this caribou range.

Other management initiatives needed to reduce mortality include road retirements and hunting restrictions. The implementation of these initiatives will require consultation with stakeholders. Hunting prohibitions for First Nations people may be considered to reduce caribou mortality.

#### **6.1.4 Owl-Flintstone Lakes**

The Owl-Flintstone Lakes range is the most impacted caribou range in Manitoba. Timber harvesting, access development, campgrounds and other recreational activities have all significantly impacted the periphery of this range, while the current core habitat areas are less impacted. Caribou numbers have remained relatively unchanged for the last 30 years, likely because core habitat areas remain somewhat undisturbed. However, continued timber harvesting operations and increases in other activities put this range at high risk.

VHF radio-telemetry studies, in the late 1980s and early 1990s, provided information on wintering areas and limited information on calving and migration routes. This information was used to develop a winter habitat suitability index (Palidwor and Schindler 1994, Palidwor and Schindler 1995). An integrated caribou/forestry management strategy has been developed (TAEM 1995). The strategy addresses various concerns related to forestry and caribou and defines specific habitat objectives and management actions within a caribou management zone. The process of developing this strategy involved the establishment of a project advisory committee consisting of industry, non-government organizations and government representatives. The committee also functions as a catalyst for proactive research and management initiatives with the goal of maintaining woodland caribou numbers and range.

A joint study between Manitoba Hydro, the Manitoba Model Forest and Manitoba Conservation, using GPS radio-collars in 1995/96 and 1996/97 (TAEM 1996, TAEM 1997), has provided an opportunity to further understand winter, summer and migratory habitat use by caribou. As well, Martinez (1998) examined winter habitat use by eight GPS collared caribou on this range. Berger et al. (2000) conducted further analysis of the relocation data from these GPS collared caribou and 3 others. The conclusions of their report were based on the analysis of more than 17,500 relocation records. An experimental forest harvesting program occurred in 1996 and 1997 to specifically monitor the impacts of harvesting on caribou. Nine VHF radio-collared caribou continue to be monitored in this range.



An aerial population survey of this range was conducted in February, 2000. A total of 61 caribou were sighted during the survey flights. This number is consistent with the estimated number of 65-75 caribou which occupy this range.

## **6.2 Medium Risk Ranges**

### **6.2.1 Reed-Yawningstone-Clearwater lakes**

This range is considered at medium risk because no major timber harvesting operations are planned for this range in the foreseeable future.

Several department studies have focused on this range since the 1960s. Information collected, coupled with an HSI model, will assist in identifying important remaining caribou habitats. The HSI model for woodland caribou needs to be validated for this range. This will enable the development of an integrated woodland caribou and forestry management plan for this range and direct development away from sensitive areas should forestry operations be initiated.

### **6.2.2 North Interlake**

This range is considered at medium risk at this time due to limited access and limited forestry operations in the area. However, this status could change if forestry operations or access increases. Information on caribou on this range is limited and a caribou monitoring survey is needed to gather preliminary information on numbers and distribution of animals.

### **6.2.3 Swan-Pelican lakes**

This range is at medium risk since immediate forestry operations are unlikely. Monitoring programs that examine population numbers and habitat use should be developed in this range to assess populations before the commencement of timber harvesting activities. The HSI model for woodland caribou may be used in this range to identify possible sensitive winter habitat areas. The HSI model needs to be validated for this range.

## **6.3 Low Risk Ranges**

The Nelson-Hayes rivers, Wapisu, Sisipuk-Kamuchawie, Island Lake, Gunisao-Hudwin lakes, The Bog and William Lake ranges are low risk ranges and will not be managed other than through opportunistic monitoring. Caribou habitats could be monitored by assessing the impact of wildfires or any changing land use patterns. If land use changes are proposed for these ranges, the impact on caribou numbers and habitats will be assessed. Any decline in caribou numbers or habitat on these ranges will result in reassessment of the risk category. A management strategy would be developed for ranges that become high risk.

## **SECTION II: MAINTENANCE STRATEGY**

### **A. Maintenance Goal**

Although the risk of woodland caribou becoming endangered in the province is not immediate, several challenges need to be addressed to ensure that populations remain at present levels. To achieve this goal, specific objectives must be undertaken. It is recognized that restoring woodland caribou to their original distribution in Manitoba is not feasible.

**GOAL:** To maintain viable woodland caribou populations on existing ranges and at present population levels, thereby, contributing to the maintenance of ecological processes and Manitoba's biological diversity.

### **B. Objectives**

Specific objectives to attain this goal include the following:

1. Monitor ranges to ascertain population dynamics. Identify habitat supply, quality and land use changes. Priority will be given to ranges considered at high risk.
2. Monitor impacts of predators and parasites on woodland caribou and where necessary implement strategies to address impacts.
3. Develop and apply an integrated woodland caribou management strategy for those caribou ranges where forest harvesting or other land use development is occurring or is imminent.
4. Define areas where woodland caribou conservation takes priority over resource use and other wildlife species.
5. Develop public support through education programs, media productions and cooperative management arrangements with First Nations and other stakeholders.
6. Assess effectiveness of applied initiatives in achieving the stated goal.
7. Modify initiatives, as needed, based on new information on caribou biology, forest management and results of management strategies taken.

## **C. Initiatives Required to Complete Objectives**

Objective 1. Monitor existing populations, habitat and land use changes.

1.1 Population ecology.

- 1.1.1 Identify woodland caribou ranges.
- 1.1.2 Identify seasonal distribution and travel corridors.
- 1.1.3 Identify seasonal habitat associations.

1.2 Habitat.

- 1.2.1 Identify and define the habitat used with the aid of FRI and Forest Ecosystem Classification (FEC).
- 1.2.2 Develop and validate winter and summer HSI models.
- 1.2.3 Identify distribution and relative abundance of caribou habitat supply.

1.3 Natural disturbance.

- 1.3.1 Identify habitat changes due to wildfire.

1.4 Land use.

- 1.4.1 Identify timber demands.
- 1.4.2 Identify hydro development.
- 1.4.3 Identify mining and other development.
- 1.4.4 Evaluate significance of linear corridors and access.

---

Objective 2. Assess impacts of predators and parasites on woodland caribou.

- 2.1 Monitor wolf and black bear populations on woodland caribou ranges.
- 2.2 Monitor impacts of parasites on woodland caribou.

Objective 3. Develop range-specific integrated woodland caribou management strategies.

- 3.1 Manage habitat through establishment of protected areas.
- 3.2 Manage habitat through development of integrated forest management plans.
- 3.3 Manage vehicular access through road abandonment, access control or road closure.
- 3.4 Manage predation by habitat or predator management.
- 3.5 Manage parasites by habitat or normal host management.

Objective 4. Define areas where woodland caribou conservation takes priority.

- 4.1 Manage habitat through establishment of woodland caribou conservation areas.
- 4.2 Manage wildlife species within woodland caribou conservation areas.

Objective 5. Develop public support through information and education programming.

5.1 Establish integrated woodland caribou management committees.

5.2 Develop and distribute status reports, public service announcements and brochures on caribou issues relating to tasks identified in this strategy.

Objective 6. Assess the effectiveness of applied strategies.

6.1 Monitor population status and trend.

6.2 Monitor the habitat available for woodland caribou.

Objective 7. Modify strategies in response to effectiveness of previous prescriptions.

#### **D. Methodology to Complete Initiatives**

In the past, woodland caribou have suffered destruction of their habitat, excessive hunting, predation and the introduction of new parasites into their range. As a result, woodland caribou no longer occupy parts of their historic range. Southeastern Manitoba will probably never be reoccupied by caribou because of conflicting land use and due to the introduction of brainworm. However, the current range and numbers of woodland caribou can be maintained if there is a commitment to do so from government, non-government organizations, industries and the public. The following methodology outlines the information and actions needed to support maintenance programs for woodland caribou in Manitoba.

##### **1. Monitoring existing populations, habitat and land use changes.**

###### **1.1 Population ecology.**

###### **1.1.1 Identify woodland caribou ranges.**

Past information, from casual observations and planned or opportunistic aerial surveys, have been used to identify geographical areas important to caribou. More reliable information will be collected by additional surveys and radio-telemetry technologies.

###### **1.1.2 Identify seasonal distribution and travel corridors.**

Aerial surveys are useful for providing information on winter distribution of caribou but are of limited value at other seasons of the year, due to reduced visibility under coniferous and deciduous tree cover and lack of visible tracks. Information on seasonal distribution and travel corridors can best be obtained by aerial relocation of radio-collared animals or by ground observations of animals, tracks or other sign.

### 1.1.3 Identify seasonal habitat associations.

When seasonal distributions and travel corridors of animals have been identified, habitat associations will be determined by site evaluations and/or from vegetation maps. FRI data exists for all the critical caribou ranges.

## 1.2 Habitat.

### 1.2.1 Identify and define the habitat used using FRI and Forest Ecosystem Classification (FEC).

All caribou ranges that will be logged have associated FRI data available. This provides an opportunity for effective management planning by identifying known critical caribou habitat associations. These habitat data can be enhanced by using the FEC for Manitoba (Zoladeski et al. 1995).

### 1.2.2 Develop and validate winter and summer habitat suitability index models.

A winter habitat suitability model already exists for use on the eastside of Lake Winnipeg and a preliminary summer model has been developed. However, due to diversity in forest composition and landscapes, models will need to be further validated and modified for use in other locations.

### 1.2.3 Identify distribution and relative abundance of caribou habitat supply.

Using HSI models, the abundance and distribution of caribou habitat will be determined. This information is essential to identify present and potential future caribou distribution.

---

## 1.3 Natural disturbance.

### 1.3.1 Identify habitat changes due to wildfire.

Wildfires are a frequent natural occurrence on caribou ranges. Manitoba Conservation Fire Management maintains a GIS database on wildfires. This database will be used to monitor habitat loss from wildfire for each woodland caribou range.

## 1.4 Land use.

### 1.4.1 Identify timber demands.

Since timber harvesting will have the greatest man-caused impact on the future of caribou ranges, forest cutting plans will be identified to predict future impacts on caribou. Timber harvesting may cause direct loss of habitat, or result in increased access and thereby impacting caribou by increasing predation, hunting and area avoidance.

### 1.4.2 Identify hydro development.

Hydro development is planned on some caribou ranges. The extent of the development and impact on each caribou range will be identified and assessed. It is essential that this process be undertaken in the early stages of development planning so that mitigative measures can be initiated.

#### 1.4.3 Identify mining and other development.

Mining, cottage development, tourism operations and other development will occur on some caribou ranges. The extent of each development, its impact and the cumulative effects of other developments on caribou ranges will be identified and assessed. Identifying these developments, early in their planning process, is essential to ensure that mitigative measures can be undertaken.

#### 1.4.4 Evaluate significance of linear corridors and access.

The impact of linear corridors and increased access is an important negative factor on some caribou ranges. All linear corridors and access routes will be identified and their impact to caribou distribution assessed.

### **2. Assess impacts of predators and parasites on woodland caribou.**

#### 2.1 Monitor wolf and black bear populations on woodland caribou ranges.

Wolf and black bear population trends and distribution will be monitored opportunistically. A systematic method of surveying predators will be conducted for ranges where predators are a significant concern. Mortality due to predation will be estimated using data from radio-collared caribou.

#### 2.2 Monitor impacts of parasites on woodland caribou.

The impact of harmful parasites to woodland caribou (as well as the distribution of their normal hosts) will be monitored opportunistically. A systematic method of monitoring this impact will be developed and used for ranges where parasites are a significant concern.

### **3. Develop range-specific integrated woodland caribou management strategies.**

#### 3.1 Manage habitat through development of integrated forest management plans.

Once caribou and timber company needs are identified, plans will be developed to identify ways and means of accommodating forestry while securing the integrity of each range.

#### 3.2 Manage vehicular access through road abandonment, access control or road closures.

Vehicular access into caribou range can fragment the range and lead to increased mortality from human harvest and vehicle collisions. Access routes and linear corridors also function as travel routes for predators. Once caribou distributions are identified, strategies will be developed to reduce the negative effects of access development.

#### 3.3 Manage predation by habitat or predator management.

Although caribou can maintain their populations with a limited amount of predation, changes in numbers of alternative prey or increased predator access can lead to increased predation resulting in population decline. Operational plans shall be modified to

discourage an increase in alternative prey habitat and predator access. Predator management may be considered on ranges where caribou numbers are at critical levels and predator control will assist in their recovery.

#### **3.4 Manage parasites by habitat or normal host management.**

The introduction of new parasites into caribou ranges by the expansion of their normal host species can lead to increased mortality of caribou. Operational plans shall be modified to discourage an increase in habitat favoured by the normal host species. Hunting seasons can be altered to increase the harvest of the normal host species on woodland caribou ranges.

### **4. Define areas where woodland caribou conservation takes priority.**

#### **4.1 Manage habitat through establishment of woodland caribou conservation areas.**

Habitat considered critical for the continued viability of a woodland caribou range will be protected by legal designation. No development will occur within these protected areas. Calving areas, travel corridors, wintering areas or other habitat may be considered for protection.

#### **4.2 Manage wildlife species within woodland caribou conservation areas.**

Wildlife species within woodland caribou conservation areas will be managed to maintain or enhance caribou survival. This may mean implementing hunting or trapping seasons to increase the harvest of predators or normal host species and habitats preferred by these species.

### **5. Develop public support through information and education programming.**

#### **5.1 Establish integrated woodland caribou management committees.**

Integrated woodland caribou management committees will be established for each of the high risk ranges. These committees will foster information exchange and function as a forum for sharing ideas and concerns about caribou management.

#### **5.2 Develop and distribute status reports, public service announcements and brochures on caribou issues relating to tasks identified in this strategy.**

Information related to caribou and caribou conservation issues will be made available to the public. This information will be provided in appropriate formats to ensure a broad audience. Public and client/stakeholder awareness of caribou management is essential for the success of the strategy.

### **6. Assess the effectiveness of applied strategies.**

The impacts of most management practices (including forestry, access, predator, parasites, etc.) on woodland caribou are poorly understood. As management actions are undertaken, caribou responses to those management actions will be evaluated by changes in distribution or mortality.

#### **6.1 Monitor population status and trend.**

Caribou population trends and distribution will be monitored by surveys and radio-telemetry relocation data.

#### **6.2 Monitor the habitat available for woodland caribou.**

Forest harvesting, wildfires, and other land use changes will occur on caribou ranges and these changes will be mapped to repeatedly assess caribou habitat availability and distribution.

### **7. Modify strategies in response to effectiveness of previous prescriptions.**

As the effectiveness of the strategies are evaluated, those which are effective will be continued while those which are ineffective will be modified or abandoned.

## **E. Implementation Responsibility**

Manitoba Conservation is responsible for the protection and management of woodland caribou in Manitoba. The Wildlife Branch of Manitoba Conservation develops policy and management guidelines, and provides overall provincial direction for woodland caribou protection and management. Operations Division of Manitoba Conservation implements and delivers programs, at the field level, for this species.

Other agencies, industry, First Nations and other stakeholders have an interest, expertise and resources to devote to caribou management. These groups have a role to play in caribou conservation. Industry has a specific responsibility to become actively involved in caribou conservation by partnering in or being the sole proponent of conservation initiatives and research. Industry involvement shall be an integral component of yearly operations and a requirement of doing business on the landscape. This will require a significant commitment of funds and manpower from industry.

The Eastern Region Integrated Woodland Caribou Management Committee reviews caribou management activities and research in the region and provides advice to Manitoba Conservation. This committee has representatives from Manitoba Hydro, Manitoba Model Forest, Manitoba Conservation (Policy Coordination, Forestry and Wildlife branches and Operations Division), Pine Falls Paper Company, TREE, First Nations and local wildlife associations. This integrated approach has worked well in assuring that information is shared with all stakeholders and all concerns are recognized.

It is recommended that integrated management committees be established for all high priority caribou ranges. Membership on each will vary due to the different stakeholders in each geographical area but may include wildlife and forestry staff, industry representatives, First Nations and environmentalists.



### **SECTION III: IMPLEMENTATION SCHEDULE**

The implementation schedule for ranges at high risk (Table 2) outlines maintenance tasks to be undertaken by 2003/2004. It will be used for the scheduling of all activities and as the basis for the distribution of funding between projects. The various tasks follow the outline described in Section II of this document and are grouped together under general categories.

It should be noted that tasks outlined are those which should be undertaken to ensure the continued viability of woodland caribou ranges at high risk. Existing budgets and manpower dedicated for woodland caribou initiatives will have to be increased in order to complete these tasks. These actions will be regularly reviewed, progress updated and future tasks planned at the annual meeting of the Manitoba Conservation Woodland Caribou Management Team.

**Table 2. Implementation Schedule of Maintenance Tasks for High Risk Woodland Caribou Ranges in Manitoba (May 2000).**

ACTION	KISSISSING-NAOSAP		WABOWDEN		ATIKAKI-BERENS		OWL-FLINTSTONE	
	Start	Complete	Start	Complete	Start	Complete	Start	Complete
<b><i>Background Studies</i></b>								
Range	Ongoing	2001/2002	1995/1996	1998/1999	1986/1987	Ongoing	1986/1991	2000/2001
Seasonal Distribution/Travel Corridors	Ongoing	2001/2002	1995/1996	1998/1999	1986/1987	Ongoing	1986/1991	2000/2001
Habitat Association	1996/1997	2001/2002	1997/1998	2000/2001	2001/2002	2002/2003	1986/1991	2000/2001
Habitat Used - FRI & FEC	1996/1997	2001/2002	1997/1998	2000/2001	2001/2002	2002/2003	1994/1995	Done
Habitat Suitability Models	1999/2000	2002/2003	1999/2000	2000/2001	1994/1995	1997/1998	1994/1995	Done
Distribution, Abundance	1996/1997	2001/2002	1995/1996	2000/2001	2001/2002	2002/2003	1994/1995	Done
Natural Disturbance - Wildfire	Ongoing	Ongoing	1950/1951	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Timber Demand	1997/1998	Ongoing	1997/1998	Ongoing	2001/2002	2002/2003	1994/1995	Ongoing
Hydro, Mining & Other Development	Ongoing	Ongoing	1997/1998	Ongoing	2000/2001	Ongoing	1994/1995	Ongoing
Linear Corridors, Access	Ongoing	Ongoing	1995/1996	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Parasites, Predation	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
<b><i>Implementation Action</i></b>								
Integrate Forestry & Habitat	1997/1998	Ongoing	2000/2001	2001/2002	2001/2002	2003/2004	1994/1995	Done
Manage Vehicle Access	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Manage Predation	Ongoing	Ongoing	1997/1998	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Manage Parasites	N/A	N/A	N/A	N/A	2002/2003	Ongoing	2000/2001	Ongoing
Establish Woodland Caribou Conservation Areas	1984/1985	Ongoing	2001/2002	Ongoing	2002/2003	Ongoing	2001/2002	Ongoing
<b><i>Information Action</i></b>								
Establish Stakeholder Committee	1999/2000	Ongoing	1995/1996	Ongoing	1999/2000	Done	1994/1995	Done
Education Information	1998/1999	Ongoing	1996/1997	Ongoing	1999/2000	Ongoing	1994/1995	Ongoing
<b><i>Evaluate Action</i></b>								
Caribou Status	Ongoing	Ongoing	2000/2001	Ongoing	1998/1999	Ongoing	Ongoing	Ongoing
Habitat Status	1997/1998	Ongoing	1997/1998	Ongoing	1999/2000	Ongoing	Ongoing	Ongoing
Modify Plans	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

#### SECTION IV: LITERATURE CITED

- Alvo, R. 1998. National status evaluation of 20 selected animal species inhabiting Canada's forests. *Gavia Biological Services Report for The Canadian Pulp and Paper Association, The Biodiversity Convention Office & The Canadian Forest Service.* 328 pp.
- Anderson, R.C. 1971. Neurologic disease in reindeer (*Rangifer tarandus tarandus*) introduced into Ontario. *Can. J. Zool.* 49:159-166.
- Anderson, R.C. and U.R. Strelive. 1968. The experimental transmission of *Pneumostrongylus tenuis* to caribou (*Rangifer tarandus terraenovae*). *Can. J. Zool.* 46:503-510.
- Banfield, A.W.F. 1961. A revision of the reindeer and caribou Genus *Rangifer*. *Nat. Mus. Can. Bull.* 177. Bio. Ser. No. 66. 137 pp.
- Benoit, A.D. 1996. A landscape analysis of woodland caribou habitat use in the Reed-Naosap lakes region of Manitoba (1973-1985). MNRM. Thesis, University of Manitoba, Winnipeg, Manitoba.
- Berger, R., I. Martinez-Welgan and M. Wisener. 2000. Analysis of global positioning system (GPS) relocation data (1995-1999) for the Owl Lake woodland caribou. Part A: Synopsis of technical papers. Wildlife Resource Consulting. 88 pp.
- 
- Bergerud, A.T. 1974. Decline of caribou in North America following settlement. *J. Wildl. Manage.* 38:757-770.
- Bergerud, A.T. and W.E. Mercier. 1989. Caribou introductions in eastern North America. *Wildl. Soc. Bull.* 17:111-120.
- Behrend, D.F. and J.F. Witter. 1968. *Pneumostrongylus tenuis* in white-tailed deer in Maine. *J. Wildl. Manage.* 32:936-966.
- Brown, K. 1998. Range distribution and critical habitats of woodland caribou in central Manitoba: implications for forestry practices. Progress Report 1997/98. Manitoba Natural Resources. 15 pp.
- Brown, K., C. Elliott and F. Messier. in press. Woodland caribou population range and distribution in central Manitoba: implications for forestry practices. *in Proceedings of the 8th North American Caribou Workshop, April 20-24, 1998. Whitehorse, Yukon.*
- Carbyn, L.N. 1968. Woodland caribou survey in the Bloodvein River region of eastern Manitoba. Manitoba Dept. of Mines and Natural Resources, Wildlife Branch.

- Crichton, V.F.J. 1992. Woodland caribou management in Manitoba, Canada. *in*: Global trends in wildlife management. B. Bobek, K. Perzanowski, and W. Regelin (eds). Trans. 18<sup>th</sup> IUGB Congress, Krakow 1987. Swiat Press, Krakow-Warszawa. Vol. 2: 193-196.
- Cringan, A. 1957. History, food habits and range requirements of woodland caribou of continental North America. Trans NA Wildlife Conf. 22:485-501.
- Cross, D.W. 1996. Woodland caribou survey in west central Manitoba, March 1991. Manitoba Natural Resources Manuscript Report No. 96-07W 13 pp.
- Cross, D.W. and C.E. Smith. 1995. Woodland caribou winter distribution, habitat use assessment and population estimate Kississing Lake area, Feb. 1993 and Feb. 1994. Unpublished Manuscript. Manitoba Department of Natural Resources.
- Cross, D.W. and C.E. Smith. in press. Woodland caribou winter distribution, habitat use assessment and population estimate Naosap Lake Area. Manitoba Department of Natural Resources.
- Darby, W.R. 1978. The seasonal movements and population ecology of woodland caribou (*Rangifer tarandus caribou* (Gmelin)) in southeastern Manitoba: A final report with discussion and recommendations concerning park development.
- Darby, W.R. 1979. Seasonal movements, habitat utilization and population ecology of woodland caribou (*Rangifer tarandus caribou* Gmelin) in the Wallace-Atkins Lake region of southeastern Manitoba. M.S. Thesis, University of Manitoba, Winnipeg, Manitoba. 187 pp.
- Elliott, C. 1997. Range distribution and critical habitats of woodland caribou in central Manitoba: implications for forestry practices. Progress Report 1996/97. Manitoba Natural Resources. 38 pp.
- Elliott, C. and K. Brown. 1996. Range distribution and critical habitats of woodland caribou in central Manitoba: implications for forestry practices. Progress Report 1995. Unpublished Manuscript. Manitoba Department of Natural Resources.
- Gray, D.R. 1999. Updated Status Report on the Woodland Caribou (caribou des bois) *Rangifer tarandus dawsoni* and *Rangifer tarandus caribou* in Canada. COSEWIC. 37 pp.
- Hirai, T. 1998. An evaluation of woodland caribou (*Rangifer tarandus caribou*) calving habitat in the Wabowden area, Manitoba. MNRM Thesis, University of Manitoba. Winnipeg, Manitoba. 119 pp.

- Hristienko, H. 1985. The impact of logging on woodland caribou (*Rangifer tarandus caribou*): a literature review. Manitoba Natural Resources, Wildlife Branch, Technical Report No. 85-03.
- James, A.R.C. and A.K. Sturat-Smith. 2000. Distribution of caribou and wolves in relation to linear corridors. *J. Wildl. Manage.* 64(1):154-159.
- Johnson, C.S. 1993. Woodland caribou in Manitoba. Manitoba Natural Resources, Wildlife Branch, Technical Report No. 93-02.
- Kelsall J.P. 1984. Status Report on Woodland Caribou *Rangifer tarandus caribou*. COSEWIC. 99 pp.
- KPMG Management Consulting. 1995. Manitoba's Forest Plan Towards Ecosystem Based Management. Report to Manitoba Natural Resources. Vol. 3:83-85.
- Kuhnke, D.H. and W. Watkins. 1999. Selecting wildlife species for integrating habitat supply models into forest management planning in Manitoba. *Nat. Resour. Can., For. Serv., North. For. Cent., Edmonton, Albert. Inf. Rep. NOR-X-357.* 56 pp.
- Manitoba Natural Resources. 1997a. An Action Plan for Manitoba's Network of Protected Areas 1996-1998. 10 pp.
- Manitoba Natural Resources. 1997b. Five Year Report to the Legislature on Wildlife; April 1, 1992 - March 31, 1997. 47 pp.
- Manitoba Northern Affairs. 1997. Manitoba Treaty Land Entitlement Framework Agreement Implementation Handbook. 28 pp.
- Martinez, I.M. 1998. Winter habitat use by woodland caribou (*Rangifer tarandus caribou*) in the Owl Lake region of Manitoba. MNRM Thesis, University of Manitoba. Winnipeg, Manitoba. 105 pp.
- National Forest Strategy 1998-2003: Sustainable Forests A Canadian Commitment. 1998. Prepared for Canadian Council of Forest Ministers. 46 pp.
- Palidwor, K.L. and D.W. Schindler. 1994. Habitat suitability models within Manitoba Model Forest Region: First Approximation Woodland Caribou (*Rangifer tarandus caribou*) March 1994.
- Palidwor, K.L. and D.W. Schindler. 1995. Habitat suitability models within Manitoba Model Forest Region: Woodland Caribou (*Rangifer tarandus caribou*) Version 2.0 February 1995.
- REPAP. 1996. The REPAP Manitoba 1997-2009 Forest Management Plan. 599 pp.

- Seton, E.T. 1909. The woodland caribou or american reindeer. *in* Life-histories of northern animals, an account of the mammals of Manitoba. Vol. I. pp. 187 - 208. Charles Scribner's Sons, New York.
- Shaefer, J.A. 1988. Fire and woodland caribou (*Rangifer tarandus caribou*): An evaluation of range in southeastern Manitoba. M.S. Thesis, University of Manitoba, Winnipeg, Manitoba. 144 pp.
- Shaefer, J.A. and W.O. Pruitt, Jr. 1991. Fire and woodland caribou in southeastern Manitoba. Wildl. Monogr. 116. 39 pp.
- Shoesmith, M.W. 1986. Woodland caribou in Manitoba. Manitoba Dept. of Natural Resources, Wildlife Branch (unpublished report), Winnipeg, Manitoba, January 1986.
- Shoesmith, M.W. and D.R. Storey. 1977. Movements and associated behaviour of woodland caribou in central Manitoba. Proc. Int. Cong. Game Biol. 13. pp. 51-64.
- Stardom, R.R. 1977. Winter ecology of woodland caribou (*Rangifer tarandus caribou*) and some aspects of the winter ecology of moose (*Alces alces andersoni*), and white-tailed deer, (*Odocoileus virginia dacotensis*) (Mammalia: Cervidae) in southeastern Manitoba. M.S. Thesis, University of Manitoba, Winnipeg, Manitoba. 157 pp.
- TAEM Inc. 1995. Report on the Manitoba Model Forest, Integrated Forestry Woodland Caribou Management Strategy, Volume 1 & 2.
- TAEM Inc. 1996. Development and Application of Animal Borne GPS Technology on Woodland Caribou. 1995/96 Progress Report.
- TAEM Inc. 1997. Development and Application of Animal Borne GPS Technology on Woodland Caribou. 1996/97 Progress Report.
- Zoladeski, C.A., G.M. Wickware, R.A. Simms, and I.G.W. Corns. 1995. Forest Ecosystem Classification for Manitoba: field guide. Nat Resour. Can., Can. For. Serv., Northwest Reg., North For. Cent., Edmonton, Alberta. Spec. Rep. 2.



