

Towards a Caribou Habitat Management Strategy for Northwestern Ontario: Running the Gauntlet

Gerald D. Racey¹ & Edward R. Armstrong²

¹ Ontario Ministry of Natural Resources, RR#1 25th Sideroad Thunder Bay, Ont. Canada P7C 4T9.

² Ontario Ministry of Natural Resources, 435 South James Street, Thunder Bay, Ontario, Canada P7E 6E3.

Abstract: A management strategy for woodland caribou (*Rangifer tarandus caribou*) habitat is being developed in northwestern Ontario. This strategy is based upon a set of draft *Timber Management Guidelines for the Provision of Woodland Caribou Habitat*. These guidelines recommend maintaining a sustainable supply of winter habitat within large tracts of old forest, protecting calving areas and minimizing human disturbance. Due to the large temporal and spatial scale of caribou habitat management, an ecosystem-based approach is recommended. Public response to the strategy shows a strong dichotomy between environmental and utilitarian values among all the major stakeholder groups. The major issues raised by the public include security of industrial wood supply, quality of the knowledge base, level of awareness of caribou, economic impacts on remote communities, concern about environmental impacts and silvicultural know-how. The government is responding to these concerns as the strategy evolves. Current emphasis is placed on increasing awareness of the public, training resource managers in caribou biology, management and habitat planning, implementing interim habitat management prescriptions and studying the potential impact on wood supply. The final direction for a northwestern Ontario strategy to conserve woodland caribou habitat has yet to be decided, although a commitment has been made to strive for the conservation of woodland caribou populations and their habitat.

Rangifer, Special Issue No. 9, 159-170

Introduction

Northwestern Ontario is developing a strategy for managing woodland caribou (*Rangifer tarandus caribou*) habitat. This paper describes our progress and approach in developing and implementing this strategy. It represents a case study in caribou habitat management, and builds upon proposals previously documented by Racey *et al.* (1991). As such, it is not so much a scientific paper as a chronicle of activities and responses to those activities in pursuit of a management strategy.

The strategy was required to halt the documented northward recession of woodland caribou range in Ontario. This range recession has resulted from a variety of factors including changes in forest structure, predator-prey balance, disease and hunting (Darby *et al.*, 1989). Changes in forest and wildlife communities as a result of timber harvesting have been identified as major factors (Darby *et al.*, 1989; Racey *et al.*, 1991). Evidence to suggest the connection between caribou decline and timber management activities is summarized by Cumming and Beange (1993). The impetus for trying to manage woodland caribou habitat in the forested regions of northwestern Ontario arose from increased aware-

ness of their presence across the landscape, and the realization that they were a resource that was neither being considered nor conserved by contemporary forest management practices.

Ontario has developed draft *Timber Management Guidelines for the Provision of Woodland Caribou Habitat* (Racey *et al.*, 1991; OMNR, 1993a), to both protect woodland caribou and permit timber management to take place. Whether these guidelines will work is an ongoing debate. However, we know that continuing to manage the forest in the traditional manner will not protect woodland caribou (Racey *et al.*, 1991; Cumming & Beange, 1993). In addition it was apparent it would be impractical to attempt to manage caribou on one Forest Management Unit (FMU) without regard for management on adjacent FMU's. The caribou management strategy is based upon the understanding that caribou couldn't be sustained on a single FMU and need to be considered at a regional scale, using a broader ecosystem-based approach. This is a new concept as all other wildlife and forest resources are managed on Wildlife Management Units (WMUs) or FMUs.

The increased concern for caribou occurred at approximately the same time as a change in the expressed corporate culture of the Ontario Ministry of Natural Resources (OMNR). A corporate shift towards sustainable development and an "ecosystem management" approach was reflected in a number of OMNR documents (Ontario Wildlife Working Group, 1991; Ontario Forest Policy Panel, 1993; OMNR, 1991). The OMNR articulated a new goal based on the concept of sustainable development (OMNR, 1991) partially based on the following policy principles:

"... Human activity that affects one part of the natural world should never be considered in isolation from its effects on others."

"... We must recognize the value of a diversified economy based on the preservation of the diversity of the natural world."

"Our understanding of the way the natural world works - and how our actions affect it - is often incomplete. This means that we exercise caution, and special concern for natural values in the face of such uncertainty, and respect the 'precautionary principle'".

The challenge to northwestern Ontario resource managers was to develop a Caribou Management Strategy with the goal of maintaining caribou populations within their current range. The objective is to provide a long-term supply of caribou habitat while maintaining a viable forest products industry

within significant portions of caribou range. This sets the stage for the gauntlet that must be run.

A gauntlet is two rows of people facing each other armed with clubs or other weapons with which they strike at an individual who is made to run between them. Like any emotionally charged and polarized issue, those trying to manage the issue are often caught in the middle (Fig. 1). In the case of woodland caribou in northwestern Ontario, the apparent solution to management problems may appear counter-intuitive; a paradox that confuses the stakeholders and frustrates managers. The apparent immediate solution, protection of existing habitat, does not recognize the spatial and temporal complexity of forested landscapes. Long term maintenance of habitat may require scheduled and large-scale habitat disturbance. Provision for long term wood supply and access may require initial investment in road construction and regulation of forest age class. Maintenance of diversity at the Provincial level may mean conservation of local areas of low habitat or wildlife diversity. Differing perceptions and demands among stakeholders, even when certain principles are agreed to, are the weapons that befall the management strategy as it is developed, as it matures, and as it is implemented.

Methods

A team of foresters, biologists and resource management specialists was empowered to develop a regional caribou strategy to guide habitat management and to undertake public consultation pertaining to wood-



Fig. 1. The caribou gauntlet. To almost every proposed solution to the problem of managing woodland caribou there is a strongly bipolar response based upon an environmental or utilitarian perspective. There is either too much information too fast, or not enough information; concern over amount of wood available for harvest, but concern that the cuts are too big; desire to protect caribou, but not at the expense of moose.

land caribou in northwestern Ontario. This process involved the collection of background information, development of a habitat mosaic methodology based upon the draft guidelines, application of the guidelines to current Timber Management Plans, and consultation on all components of the strategy.

Background information on inventory and biology was collected to clarify the status of caribou in northwestern Ontario. Emphasis was placed on identifying caribou wintering areas (Timmermann, 1993a), and determining caribou presence in areas where inventory information was scarce or absent. The public was enlisted to report sightings of woodland caribou, particularly summer habitat. A special emphasis was placed on the remote tourism industry because of their access to, and use of, potential calving lakes. In addition, calving site surveys were conducted according to a set methodology (Timmermann, 1993b) on potential calving areas near locations of proposed timber harvest allocations. Past observations of caribou were compiled to augment contemporary inventory efforts.

A regional map of current caribou distribution and range was constructed based upon these data. This map formed the basis for discussions on the area which could be managed for woodland caribou and to identify the zone of continuous distribution.

A habitat mosaic development process was created using as its basis, the draft *Timber Management Guidelines for the Provision of Woodland Caribou Habitat* (Racey *et al.*, 1991; OMNR, 1993a). Mosaic development was based on the concept of identifying and documenting areas of present and future winter habitat. This was done by developing a schedule of allocation and harvest of the forest so a sustainable supply of large areas of mature winter habitat is provided. This approach recognizes the dual role of winter habitat in providing opportunities for caribou to space themselves from predators while still providing winter food resources (Racey *et al.*, 1991).

Caribou sightings and basic interpretive information on soils, landform, forest cover and contemporary forest ecology knowledge were used to identify and evaluate, current and future winter habitat. These current and future winter habitat blocks provided the framework around which the sustainable mosaic was developed. In areas with relatively few options for conserving winter habitat, emphasis was placed on protection of existing winter habitat. In areas where most of the forest was old, emphasis was placed on renewing large areas of future winter habitat while protecting large areas of existing winter habitat. Maintenance of a sustainable supply of large tracts of old forest containing suitable winter habitat required planned cutting of large areas (100

km² or greater) to provide for future habitat. This does not require clearcutting the entire allocation, but of operating in an area for a period of 5–20 years, regenerating the forest to winter habitat where ecologically feasible, abandoning all secondary and tertiary roads, and then leaving the area largely untouched until the next commercial rotation. Primary roads must avoid existing or future winter habitat blocks. Silviculture strategies would encourage management of non-winter habitat areas to restore the basic landscape structure and composition that was previously there, but not to enhance diversity beyond the level previously existing. This is quite different from the strategy for managing moose (*Alces alces*) that encourages the deliberate production and maintenance of a high proportion of forest edge habitat.

There were several objectives of the consultation and communication program. A communication strategy was developed to upgrade biological knowledge of resource management staff and to increase the awareness of the public of woodland caribou in northwestern Ontario. Materials to support the public education and consultation strategy were developed. This information included written and audio-visual products and a detailed communication plan to address the key issues that were anticipated to arise. Input was solicited from the public and timber industry on the proposed caribou strategy and the potential impacts of managing for woodland caribou.

Early in the process, communication took place with the forest industry to discuss potential issues and identify areas of significance to woodland caribou. Specific resource management planning teams were in place for the preparation of five year Timber Management Plans on the Trout Forest, and Brightsand Forest, and for a two year contingency plan for the East Caribou Forest (Fig. 2). Aspects of the caribou strategy were presented to the public during development of these plans, as well as during consultation relating specifically to the caribou strategy.

A concurrent planning process was the public review of the boundary for the 155 000 ha Wabakimi Provincial Wilderness Park. The role of parks as refugia in sustaining woodland caribou populations in northwestern Ontario was a major consideration in the boundary review.

Results

The southern limit of continuous caribou range in northwestern Ontario was delineated as a result of the compilation of all recent caribou sightings, inventory efforts and habitat surveys (Fig. 2). The area north of this line represents that portion of the

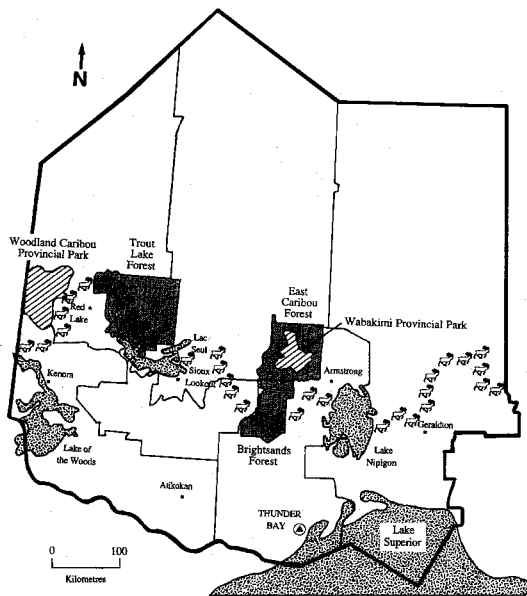


Fig. 2. Locations of the Trout Forest, Brightsands Forest, East Caribou Forest and Wabakimi Provincial Wilderness Park in northwestern Ontario. The best estimated "continuous distribution" line represents the southern-most limits of where we believe we could sustain woodland caribou using a habitat mosaic approach.

landscape most appropriately managed to maintain caribou habitat. The line also defines the zone in which caribou habitat mosaic planning should take place.

Most FMU's north of the line of continuous caribou distribution were involved in the mosaic development process to some degree, and mosaic development was achieved to varying degrees of completeness. Mosaic development was most urgent, and is most complete for those FMU's where timber management planning was currently under way. The process for habitat mosaic planning was customized for specific FMU's by recognizing the contributions of disturbance history, natural landscape features, existing access and refugia such as parks and reserves. Efforts were made to ensure compatibility and continuity of habitat mosaics across administrative boundaries. This regional mosaic is still incomplete, and work is continuing.

Education and communication documents prepared included a technical note on caribou biology and issues (Godwin, 1990), an 11 minute video on woodland caribou and forest management (OMNR, 1992), and three fact sheets pertaining to woodland caribou biology (OMNR, 1993b), the proposed caribou management strategy (OMNR,

1993c) and common questions and answers (OMNR, 1993d).

Twelve key messages which summarize the basis for and content of the strategy were assembled and relayed to the public during the education and consultation process:

1. OMNR is managing for maintenance of caribou and caribou habitat, as part of its ecosystem management approach in the Northwest Region.
2. Caribou are adapted to a fire-disturbed boreal ecosystem. They have different habitat requirements and differ biologically from white-tailed deer and moose.
3. Caribou occur now across much of the northern part of the region. Their range has receded northward over the past century. The primary causes of this recession include loss of habitat and a change in the predator (gray wolf (*Canis lupus*) and prey (moose/caribou) relationships resulting from forest disturbance and increased road access.
4. Current caribou range and the zone of continuous distribution are the basis for future caribou management. The caribou habitat management strategy is intended to stop the northward recession of caribou range in northwestern Ontario.
5. Timber management planning is now occurring within caribou range, and evidence indicates that a continuation of current (traditional) timber management practices will result in further loss of caribou range.
6. The Northwest Region of the OMNR is proposing to manage the forested land base within caribou range using a habitat mosaic approach. Large protected areas of mature forest growth will be balanced with large disturbed areas over the caribou range. Over a period of 50-100 years, this would approach the coarse landscape pattern created by wildfires. The effects of wildfire will also be incorporated into the management strategy.
7. Known critical habitat values will be protected during the planning process.
8. Typical application of the *Timber Management Guidelines for the Provision of Moose Habitat* (OMNR, 1988) generally results in a progressive harvest development pattern. Over time, this creates large disturbance areas associated with the developing road network, but without associated large contiguous undisturbed areas. A caribou habitat mosaic approach will result in a sustainable supply of large, relatively even-aged, older, forest tracts across the landscape, and designed to include winter habitat.

9. In current caribou range, moose numbers are unlikely to decrease. The existing balance of moose, wolves and caribou will be maintained, although there will still likely be an increase in moose numbers for a period of time in the vicinity of cutovers.
10. The OMNR wants public comment on these habitat management proposals.
11. A provincial caribou policy is being developed through public consultation. As part of that process, a regional caribou habitat strategy is being implemented [Subsequent to public consultation, a decision was made to defer policy development].
12. Caribou habitat management at the landscape level will change the pattern of traditional timber harvesting, and there may be measurable impacts on wood supply to the forest industry.

Public consultation took place in October through December 1993 with a large and diverse audience being reached and a large number of caribou sightings reported by the public (Table 1). The response from the public varied but revealed a dichotomy of perspectives on caribou management and the perceived impact (Table 2). The issues, as identified from public input, fall into the following broad categories where action is required to address the real or perceived problems.

Wood Supply

Wood supply concerns expressed by the forest industry revolved around the loss of merchantable volume in older stands fulfilling the need for caribou habitat, due to being withheld from harvest past their normal prescribed rotation age. There were concerns that wood utilization patterns would result in excess or shortage of veneer, sawlog or pulpwood depending on the size or make-up of the harvest block, and the specific product demands of the company doing the harvesting. There was also concern that the anticipated higher investment in road building due to bypassing accessible wood would result in more expensive wood and reduced competitiveness. The forest industry is concerned that caribou management will constrain flexibility and reduce opportunities for making best economic use of the forest. There were sincere, but unsubstantiated, concerns raised about the potential loss of jobs.

Table 1. Summary of public involvement related directly or indirectly to the caribou strategy. This involvement includes responses to proposals and provision of information.

	Event	No. of Events	No. of People Attending Events
Direct consultation	Open houses	11	441
	Caribou displays	20	464
	Staff training	15	268
	Comments / letters received	99	N/A
	Caribou sightings reported by public	423	N/A
Indirect consultation	Other resource management planning sessions	20	578

Knowledge Base

Knowledge about the caribou population and habitat resource is still limited with little prospect for significant improvement in the near future. The potential socio-economic impacts of de-emphasizing moose management for the sake of caribou and of altering the rules for allocation, harvest and regeneration are largely unknown or undocumented. There is no empirical evidence to suggest the proposed management strategy will be effective at maintaining woodland caribou where they now exist.

Awareness

Awareness of caribou biology, ecology and management principles is still very low among the general public, but increasing among resource managers and special interest groups. Comments from the public suggested many were overwhelmed by the quantity and complexity of information they received while, at the other extreme, some were dismayed by the limited information available on which to base their opinion. Unfamiliarity with the process of public consultation, policy development and current government priorities lead to mistrust and questions as to why the process was happening and how input would be used.

Local Needs

Local needs are perceived as being sacrificed for "city dwellers" far removed from northwestern Ontario, who will never experience the resource first hand. There is the perception that "ecosystem management" is not very tangible and will not provide local economic benefits. The concept of "ecotourism" is still in early stages of development.

Environmental Impacts

Concern over environmental impacts, both known and hypothesized, suggest to some that the Ministry

Table 2. Synthesis of public responses to the caribou strategy by stakeholder group, subdivided by key components of the strategy. Every component of the strategy seems to be perceived in both a positive and negative way by each of the stakeholder groups. Each group has a utilitarian (human-centred) and environmental (environmental ethics) perspective to its position.

Stakeholder Group strategy component	Environmental Perspective	Utilitarian Perspective
<p><i>Forest Industry</i> Size of cut</p>	<p>may create more "natural" landscape pattern; some companies want to be thought of as land stewards</p>	<p>increased cost of regeneration in remote cutovers</p> <p>would force harvesting of immature or unmerchantable products; pulp instead of sawlogs, hardwood instead of softwood etc.</p> <p>may increase access cost, and alter wood supply calculations resulting in reduced annual allowable cut, and potential loss of jobs</p> <p>public may view caribou as an excuse for larger cut size, this perception may have repercussions on the industry</p>
<p>Caribou vs moose</p>	<p>generally in tune to sustain all species, including woodland caribou</p>	<p>possible anti-logging repercussions if cutting patterns are perceived to be anti-moose</p>
<p>Location of "line"</p>	<p>where wood supply and access are not issues, the proposed management line for caribou makes sense and is generally accepted</p>	<p>line may be very inconvenient for certain timber management priorities in specific areas</p> <p>"lots of caribou" north of the line, and socio-economic factors should be primary consideration on where to manage caribou. Feel the line should be moved north in certain circumstances</p>
<p>Mosaic concept</p>	<p>may provide greater flexibility in applying silvicultural practices consistent with the ecology of the site; such as prescribed burning</p> <p>consistent with long range forest management planning principles; forces companies to look at entire forest over entire rotation</p>	<p>difficult to plan for with quality of existing inventory information</p> <p>requirements for 60-80 year projections and links to adjacent Management Units requires a variation from traditional Timber Management Planning Process; administrative limitations to planning and implementation of the mosaic</p> <p>may be situations where the necessary silvicultural prescription is much more expensive than the acceptable prescription that would have been used under the moose guidelines</p>
<p><i>Environmental Groups</i> Size of cut</p>	<p>desirable if it may conserve caribou; have many concerns pertaining to site degradation, nutrient depletion, and impacts on other wildlife species</p>	<p>large clear cuts are ugly and are inconsistent with the general environmental position that small cuts with lots of edge are aesthetically pleasing and beneficial to wildlife</p>
<p>Caribou vs moose</p>	<p>caribou are part of the ecology of this portion of the boreal forest and should be conserved, even at the expense of moose</p> <p>moose will still be present on the landscape</p> <p>woodland caribou should be a priority because the number of caribou in the area would suggest they are "threatened"</p>	<p>some wildlife species that have their habitat conserved through moose habitat management will not be protected when managing for woodland caribou; want all species protected</p>

Location of "line"	<p>conserve caribou where they now occur</p> <p>should consider reintroduction and movements into areas previously occupied by caribou</p>	disagree with partitioning of the environment into management zones; inconsistent with notion of managing ecosystems
Mosaic concept	<p>long term planning for habitat is desirable, as is a commitment to try to sustain boreal ecosystems; question the similarity between a caribou habitat mosaic and landscape pattern created by wildfire</p> <p>recognize that no better approach to conserve caribou currently exists other than no timber harvest</p> <p>a natural fire pattern would provide a range of fire sizes</p>	want to create a large fire driven ecosystem wilderness park to act as a control to the management strategy. This also serves their need for wilderness conservation; want park system to provide anchor to habitat mosaic
<i>Outfitters</i> Size of cut	large areas would be regenerating at a relatively consistent rate leaving the appearance of wilderness at an earlier age than if a large number of age classes and reserves were present in a relatively small area	large cutover blocks would destroy the perception of wilderness, particularly for fly-in operations
Caribou vs moose	do not want to see moose decline but would like to sustain caribou if moose hunting opportunities are not limited	<p>want to try to maximize number of moose available to harvest and market</p> <p>no significant economic return from caribou</p>
Location of "line"	conserve caribou where they are	would just as soon manage for moose, or sustain wilderness in all areas where remote tourism exists
Mosaic concept	eco-tourism opportunities for non-consumptive resource use are becoming more abundant; greater protection may be afforded to caribou calving lakes that also have tourist camps than afforded through the moose guidelines	would like to get greater protection around calving lakes and reduced access as offered in the caribou guidelines, but smaller cutovers as offered in the moose guidelines
<i>OMNR Staff</i> Size of cut	<p>large cuts are acceptable if they sustain the species and ecosystem function of the forest</p> <p>concern over social, political and environmental implications of large cuts</p>	<p>may cause problems with wood flow and product availability</p> <p>would require re-examination of how wood supply calculations are made on the management unit level</p>
Caribou vs moose	would generally prefer to conserve caribou in areas where they currently exist; sustain the function of the boreal forest ecosystem	moose targets may not be achieved, the moose program which has traditionally been a flagship of the wildlife management program is seen as threatened in some areas
Location of "line"	based on biological data in accordance with current corporate direction to maintain species where they now exist	concern of increased issues management and undue workload and criticism of OMNR
Mosaic concept	accept notion of the mosaic creating a landscape pattern of age class and patch size similar to that created by wildfire	<p>requires planning beyond the traditional 20 year planning horizon; the administrative mechanisms do not readily allow for this</p> <p>major changes may be required to basic forest management principles; such as oldest first, normalization and estimation of maximum allowable depletion</p>

should err on the side of caution (the precautionary principle). Environmental concerns over the impacts of large harvest areas on nutrient status, regeneration success, successional pathways, aesthetic value and wildlife population fluctuations have been expressed. These concerns appear to arise because of both ideological objections to large cutovers and specific concerns about environmental degradation. These environmental concerns manifest themselves in the perception that the mosaic approach does not mimic fire disturbance and will not be effective at sustaining forest composition and structure.

Silviculture and forestry

Silviculture and forestry practices required to produce forest stands valuable for caribou winter habitat have not yet been fully documented and tested. Questions exist as to how the forest industry will set and achieve targets in woodland caribou range. There is difficulty in extrapolating and envisioning the impact of practices applied at the stand level to responses at the landscape level. This is true particularly in light of the underlying, and often limiting, influence of landform and soil conditions. The interaction of silvicultural practices with lichen (*Cladina* spp.) ecology, successional pathways and hardwood magnification have all been identified as problems, but usually in a general sense and not specific to identified landscape units. Two questions arise repeatedly: can we adequately describe stand conditions and silvicultural objectives in a way meaningful for woodland caribou habitat, and do we have the tools and commitment to achieve these objectives under the current management, institutional and fiscal framework?

The caribou habitat mosaic developed for the Brightsand Forest centred on the documented calving areas on Seseganaga Lake. This is an irregular, island-filled lake dominating the northeast portion of the Management Unit. Existing wintering areas to the south were identified for protection as well as the timber along a chain of ridges and lakes connecting the two. The past logging history in the Unit left very few options for the protection of woodland caribou or the development of a mosaic other than a large protected area of winter habitat. In the Brightsand Forest caribou management will probably result in a reduction in opportunities for the harvest of timber, but the magnitude and duration are still to be decided.

In the Trout Forest the majority of timber harvest occurs in the southern end of the unit. Caribou wintering areas can largely be avoided in future allocations of timber for harvest at existing allocation levels. Anticipated higher demand for sawlogs

from the unit in the near future may initiate some conflicts in resource use that do not now exist. There are still many options available for managing the Trout Forest for both caribou and timber. The approved 1994-1999 TMP for the Trout Forest implements the principles of caribou habitat management and maintains the options for long term mosaic development.

Management decisions for woodland caribou in the East Caribou Management Unit were heavily influenced by discussions on the role of Wabakimi Provincial Park. One position was that the park should act as a refuge for caribou to mitigate the impacts of forest management in the area around the park. Another argument was that there is no guarantee that the guidelines for caribou will work, and therefore the park should be expanded from 155 000 hectares to 1 250 000 ha. It was proposed that this would permit a natural, fire-driven ecosystem to sustain caribou habitat until we know if the guidelines are effective. Recommendations for park boundary expansion are being developed, with caribou being one of the major values considered. A preliminary mosaic has been developed based upon the existing park boundary. Timber management planning has been deferred, pending the outcome of the park boundary review. In the interim, caribou wintering areas are being protected in a contingency plan.

Discussion

In an ideal scenario, the OMNR would have comprehensive inventories in place before it initiated management programs. In the case of caribou, inventory information was being gathered and assembled at the same time as management issues and conflicts were being identified. As a non-game species in Ontario, there was not a comprehensive caribou data base of either populations or habitat. However, managers were comfortable with the initial level of information obtained from a number of conventional and non-conventional sources, such as observations from the public, searches of archival documents and quickly mobilized inventory efforts. Public reports of caribou sightings were very helpful in delineating caribou range; the public was very supportive and over 400 such reports were received. The Region was able to assemble a good estimate of the southern boundary of continuous caribou range which was significantly revised from that previously reported (Darby *et al.*, 1989).

The amount of inventory and habitat information required to initiate caribou management illustrates the dilemma of trying to manage species using a single-species management approach. We will never have the resources to collect meaningful bio-

logical data on all wildlife species for conservation purposes. It suggests that investment in management and inventory should be focused on a more "ecosystem-based" management strategy. In general, the broad habitat mosaic approach based upon winter habitat blocks (Racey *et al.*, 1991), is an attempt to sustain a landscape pattern at a scale similar to that created by wildfire - a rudimentary ecosystem management concept. Much more knowledge of stand and forest level composition, structure and function and how to manage for these attributes will be required to truly call this process a form of "ecosystem management". This strategy may more appropriately be described as a modification of timber management practices to conform to some basic landscape patterns associated with a natural environment. Expressed in this way, the maintenance of woodland caribou may be interpreted as an indicator that one aspect of ecosystem function, at the landscape level, has been maintained.

The probability (uncertainty) of success in sustaining woodland caribou in the face of timber management activities was questioned by environmental groups. It was fully recognized that our scientific, management and inventory information was incomplete and that the management strategy and projected impacts were based only upon best estimates from the available data.

Uncertainty about the prognosis for success of the proposed management strategy could not be adequately allayed at this point. However, it has been recognized, even by many critics of the strategy that it reflects the only real alternative other than the prohibition of forest management within caribou range or accepting further loss of caribou range. Experience and knowledge we now have suggests we won't know for up to 40 years if attempts to create winter habitat blocks have been successful. The only proof accepted by critics will be empirical evidence of previously harvested forest stands becoming reoccupied by woodland caribou in the winter. In the absence of such empirical evidence, we must always recognize the risk associated with an untried management activity. However, we wouldn't be following the "precautionary principle" if we continued using management practices we know will fail to sustain caribou.

Very difficult management decisions will have to be made. Should caribou be allowed to disappear from the commercial portion of the boreal forest by continuing with current management practices which we know will lead to the demise of caribou (Cumming & Beange, 1993)? Should a huge fire-driven wilderness park be established to conserve caribou in case the proposed management strategy

should fail to achieve its objectives? Should the boreal forest be divided up into a very large controlled experiment?. Adaptive management would have us manage woodland caribou based upon the best information and knowledge available, and be prepared to modify those management practices as more, and better information becomes available. A more active approach would be to design specific, paired treatments on the landscape with a rigorous assessment schedule to monitor effectiveness.

Adaptive management using ecosystem management principles may ultimately force us to challenge the limits (validity) of established forest management practices. There are still institutional and procedural barriers to implementing a caribou habitat management strategy. Our official planning framework is still very much based on featured species management and 20 year planning horizons at the FMU level. Caribou management requires a new look at established forest management planning principles such as the calculation of maximum allowable depletion, the "oldest first" rule, and the definition of a "normal forest". It stimulates managers to synthesize information from stand level concepts and silvicultural effectiveness in order to visualize the results at the landscape level.

Analysis of public input showed that most stakeholders supported the concept of sustaining caribou on the land base. Public reaction to the proposed habitat management strategy was clearly split between two philosophies: environmental and utilitarian. For example, environmental groups expressed strong support for efforts to maintain caribou but strong resistance to the use of large cutovers to achieve that end. A proposed alternative as well as insurance against the uncertainty of the strategy was the use of large protected areas such as parks to protect or "anchor" caribou range in the commercial forest. This alternative would exclude logging within the parks. The forest industry also indicated support for the concept of sustaining caribou, but expressed major concerns about bypassing accessible wood, increased access costs and loss of wood supply. Outfitters and members of the remote tourism industry generally welcome the added protection to calving lakes, and increased access control, but did not like the idea that we might not be trying to maximize moose in these areas or the aesthetic implications of large operating blocks for timber harvest. Representatives of remote communities in the north expressed concern that attempts to conserve caribou may constrain their ability to utilize other resources.

These opposing views have led to polarized positions in the search for solutions. It is generally accepted that caribou could be sustained by halting

timber management and allowing a fire-driven ecosystem to exist. It is also generally accepted that we could continue managing timber according to traditional means if we accepted the recession of caribou range beyond that zone of immediate economic interest. Neither of these highly polar views supports the proposed caribou management strategy which is based upon the best understood science, the concept of sustainable development and which attempts to integrate timber management with the conservation of caribou. These opposing views form the Gauntlet that must be run by the resource managers in considering the full range of environmental, social and economic factors when natural resource management decisions are made. Our management challenge is to reconcile these differences to provide the economic benefits while not compromising our natural resource base.

Increased public awareness of woodland caribou in the boreal forest of northwestern Ontario is evident in the past few years by portrayals in popular magazines (Taylor, 1993; Addison, 1993). Stakeholders involved in TMP advisory teams now routinely discuss the implications of timber and caribou management.

The open houses and information sessions were successful in increasing public awareness of the presence of caribou, caribou biology and habitat requirements. There was also increased awareness of the fact that maintenance of caribou on the landscape would require significant changes to timber management practices. Comments ranged from profound, well-reasoned arguments in support, against or supporting modification of the proposed strategy to comments revealing an emotional reaction to specific, perceived concerns. Comments received from the open houses allowed us to set priorities to respond in three major ways: 1) further efforts in education and awareness, 2) improvements in information and knowledge base, and 3) revisions to the proposed strategy and guidelines. Efforts to implement these responses are now under way.

Caribou habitat mosaic development forces forest managers to look beyond traditional 20 year planning horizons at forest growth and access over the rotation of the forest. It also requires them to consider the impacts of their management of the Forest Management Unit within the greater context of the forest landscape as a whole. This approach is essential to the concept of managing and sustaining ecosystems across the region. It could, in effect, be a first positive step in the direction of "ecosystem management".

Caribou management requires commitments to be made over vast tracts of land over long periods of time. Therefore, it is desirable that we strive toward

the basic ecosystem management principle of sustaining composition, structure and function of the forest at all scales. Caribou management can be delivered within an integrated resource management approach as part of a broader ecosystem management framework. This is the over-riding philosophy that will allow both the sustainability of the resource and the inherent utility of the resource to be managed. However, the concept of sustainable development suggests that the first allocation of the resource is to the resource itself, which is an essential component of the "precautionary principle"

Conclusions

In the case of woodland caribou, the complex interaction of habitat, predators, and populations was very difficult for the general public to understand. As all jurisdictions slowly move toward ecosystem-based management, resource management agencies must find a way to communicate and increase the awareness of these concepts among the public. The public has to be involved and the public has to be informed in order to play its essential role in resource management. The public will always have a valuable role in defining appropriate balance between economics, protection of specific resource values and long term environmental health.

Stakeholders identified wood supply and lack of information on impacts of caribou management as the most significant issues. The first stage of caribou strategy development was necessary just to isolate and focus on these issues. The OMNR now has a clearly defined set of tasks to resolve before further decisions can be made on the caribou strategy. These tasks include a comprehensive analysis of the impact of caribou management on industrial wood supply, bringing together stakeholders to identify and reconcile opposing perspectives, refining the caribou strategy and implementing an interim caribou management approach as a precautionary measure. In addition, the need for better and more comprehensive inventory and habitat information was clearly identified and actions are being taken to meet these needs.

Caribou habitat management requires large-scale, long-term management of the boreal forest, and the opportunities for doing rigorous scientific studies of the effectiveness of the management techniques are very limited. Some form of adaptive management is required. We must use the best management and scientific knowledge currently available to initiate habitat management, but have appropriate active and passive monitoring programs in place to allow managers to respond to new knowledge and adjust their management practices accordingly. Our first attempts will not be perfect.

We must maintain our focus on sustaining caribou populations and habitat within the context of ecosystem-based management, within an environment of constant change and while addressing a gauntlet of public concerns and perceptions. These concerns and perceptions that caribou and caribou managers face are examples of a larger problem: trying to trade off utilitarian and environmental concerns pertaining to resource allocation and conservation. This will be one of our biggest challenges as we practice, implement and refine ecosystem-based management in support of sustainable development.

Acknowledgements

Thanks are extended to all the OMNR staff, forest industry representatives and members of the public who contributed to finding a solution to the woodland caribou problem in northwestern Ontario. Special thanks to all those who contributed thoughts, comments and ideas to the construction of the caribou strategy and to this paper, especially those who reviewed the manuscript and provided helpful comments on revision. We also wish to thank J. Bouchard and L. McMillan for assistance in preparation of the figures.

References

- Addison, W.** 1993. Wabakimi. *Seasons* winter 1993: 20-25.
- Cumming, H.G. & D.B. Beange.** 1993. Survival of woodland caribou in commercial forests of northern Ontario. – *For. Chron.* 69: 579-588.
- Darby, W.R., H.R. Timmermann, J.B. Snider, K.F. Abraham, R.A. Stephanski & C. A. Johnson.** 1989. *Woodland caribou in Ontario; Background to a policy.* Ontario Ministry of Natural Resources, Toronto, Ontario. 38 pp.
- Godwin, L.** 1990. Woodland caribou in northwestern Ontario; why they are different... Ontario Ministry of Natural Resources, *NW Ont. For. Technol. Dev. Unit, Tech. Note.* 7, 7 pp.
- OMNR.** 1988. *Timber management guidelines for the provision of moose habitat.* Ont. Min. Nat. Resour., Wildl. Br., Toronto. 33 pp.
- OMNR.** 1991. *Direction '90s.* Queen's Printer for Ontario, Toronto. 14 pp.
- OMNR.** 1992. *The woodland caribou and timber management in Ontario.* 11 minute VHS video presentation. Ontario Ministry of Natural Resources, Northwest Region Science and Technology section, Thunder Bay, Ontario.
- OMNR.** 1993a. *Timber management guidelines for the provision of woodland caribou habitat.* Ontario Ministry of Natural Resources, Policy and Program Division, Toronto. 6 pp.
- OMNR.** 1993b. *Woodland Caribou.* Ont. Min. Nat. Resour., Resources Report. Northwest Region, Thunder Bay. 3 pp.
- OMNR.** 1993c. *Caribou habitat management in the north-west region - the 5 Wis.* Ont. Min. Nat. Resour. Unpubl. Report. Northwest Region, Thunder Bay. 5 pp.
- OMNR.** 1993d. *Woodland caribou and logging in Ontario: questions and answers.* Ont. Min. Nat. Resour. Unpubl. Report. Northwest Region, Thunder Bay. 5 pp.
- Ontario Forest Policy Panel.** 1993. *Diversity: forests, people, communities - A comprehensive forest policy framework for Ontario.* Queen's Printer for Ontario, Toronto. 147 pp.
- Ontario Wildlife Working Group.** 1991. *Looking ahead: a wild life strategy for Ontario.* Queen's Printer for Ontario, Toronto. 172 pp.
- Racey, G.D., K. Abraham, W.R. Darby, H.R. Timmermann, & Q. Day.** 1991. Can woodland caribou and the forest industry coexist: The Ontario scene. – *Rangifer Spec. Issue No. 7:* 108-115
- Taylor, M.** 1993. Timber plan covets prime caribou habitat. *Seasons*, Summer pp. 9-12.
- Timmermann, H.R.** 1993a. Identification and delineation of woodland caribou winter habitat. In: Ranta, B. W. ed. 1993. *Selected wildlife and habitat features: inventory manual for use in timber management planning DRAFT.* Ontario Ministry of Natural Resources, Draft Report, Toronto, Ontario.
- Timmermann, H.R.** 1993b. Identification of woodland caribou calving sites. In: Ranta, B. W. ed. 1993. *Selected wildlife and habitat features: inventory manual for use in timber management planning DRAFT.* Ontario Ministry of Natural Resources, Draft Report, Toronto, Ontario.