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Caribou conservation and recovery in Ontario: development and implementation of the Caribou Conservation Plan

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Abstract: The range of Ontario's woodland caribou (*Rangifer tarandus caribou*) (forest-dwelling ecotype) has receded northward substantially over many decades, leading to its current Threatened designation. Ontario released its Caribou Conservation Plan (CCP) in the fall of 2009. This policy responded to public input and recommendations from the Ontario Woodland Caribou Recovery Team and the Caribou Science Review Panel, and outlines conservation and recovery actions to conserve and recover caribou. Within an adaptive management framework, the CCP builds upon a recent history of managing at large landscape scales in Ontario to implement a range management approach as the basis for recovery actions. These commitments and actions include enhanced research and monitoring, improved caribou habitat planning at the landscape scale, an integrated range analysis approach using advanced assessment tools to evaluate thresholds of habitat amount, arrangement and disturbance, the assessment of probability of persistence, consideration of cumulative effects, meeting forest management silvicultural performance requirements, consideration of caribou recovery implications when managing other wildlife, an initial focus on the southern edge of caribou distribution where threats are most significant, improved outreach and stewardship, and consideration of Aboriginal Traditional Knowledge in recovery actions. Implementation of the CCP signifies a long-term provincial commitment to caribou recovery, initially focusing on identified priorities within the CCP.

Key words: woodland caribou; Ontario; conservation; policy; recovery; range management; adaptive management.

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Introduction

The range of Ontario's woodland caribou (forest-dwelling ecotype, boreal population) has receded northward substantially over many decades, dating back to the late 1800s (Harris, 1999). Although interest in caribou recovery and conservation has

increased considerably over recent decades, the concern is not new. deVos (1949) noted that "Of all the game animals in Ontario today, the one most in danger of extinction is the woodland caribou...Only drastic protection measures...can save the species from complete extermination". Based on this long-term,

apparently permanent range recession and the associated population decline, the forest-dwelling ecotype was designated as 'Threatened' in 2004.

There has been increasing emphasis on caribou conservation and management in Ontario since the early 1990s, including a status assessment report (Harris, 1999). A provincial Caribou Recovery Team was established, and produced a provincial Caribou Recovery Strategy (Ontario Woodland Caribou Recovery Team, 2008). Under Ontario's Endangered Species Act, 2007 (ESA), recovery strategies are considered "advice to government", which require a government response statement outlining the actions the government intends to take to recover the species (Government of Ontario, 2007). The Caribou Conservation Plan (CCP) was released by the Ontario Ministry of Natural Resources (OMNR) in 2009 as the Government policy response to recommendations from the Ontario Woodland Caribou Recovery Team and the Ontario Woodland Caribou Science Review Panel (Suffling *et al.*, 2008), and outlines conservation and recovery actions Ontario is taking to recover caribou.

The CCP and some potential limitations were discussed in part in a debate article by Wilkinson (2010). The purpose of this paper is to more fully describe the development of the CCP, clarify and expand on some of the issues raised by Wilkinson (2010), and address initial implementation of the CCP, while recognizing that full implementation of the CCP will be a long-term and ongoing process.

Public consultation and engagement

There was a substantial amount of public input involved in the long-term development of Ontario's caribou conservation and recovery approach. Racey & Armstrong (1996) summarized some of the early consultation efforts that were focused on the development of a caribou habitat management approach for northwestern Ontario. A stakeholder advisory panel provided key advice as part of this process (Greig & Duinker, 1996). A provincial Woodland Caribou Recovery Team was subsequently established to develop a Recovery Strategy, and a Caribou Advisory Committee provided relevant recommendations and advice. The Recovery Strategy was finalized and made available in 2008 (Ontario Woodland Caribou Recovery Team, 2008), considerably changed from and addressing many of the criticism directed at the draft strategy (Wilkinson, 2008).

An external Woodland Caribou Science Review Panel was established to provide independent advice on the content and recommendations of the Recov-

ery Strategy (Suffling *et al.*, 2008). Based on the Recovery Strategy and Science Review Panel report, a discussion paper was developed to solicit public input to support development of the CCP (OMNR, 2008a). Public consultation efforts specific to the CCP included several stakeholder consultation sessions in fall 2008 and winter 2009 (OMNR, 2008b), and invitations to participate through posting on Ontario's Environmental Registry (Government of Ontario, 2009).

A wide range of public comments and interests was submitted, and many people and stakeholders expressed interest in the topic, support for caribou conservation and/or concern about the implications of caribou conservation to northern communities and natural resource management. Public input was considered during the development of both the draft and final CCP. The CCP was released in the fall of 2009 (OMNR, 2009a), at which point the focus shifted to its multi-year implementation.

Ontario's caribou conservation goal

The goal of Ontario's Woodland Caribou Conservation Plan is "To maintain self-sustaining, genetically-connected local populations of woodland caribou (forest-dwelling boreal population) where they currently exist, improve security and connections among isolated mainland local populations, and facilitate the return of caribou to strategic areas near their current extent of occurrence" (OMNR, 2009a). The focus is on maintaining caribou within the area where they are currently distributed, and seeking opportunities to improve their prospects in and adjacent to this area.

Geographic scope of the Caribou Conservation Plan

Caribou occur relatively continuously over much of northern Ontario, where the vast majority of land is under Crown management control. The CCP applies across the entire mapped area of continuous caribou distribution in Ontario (Fig. 1). This reflects both the current distribution of the forest-dwelling ecotype in Ontario and immediately adjacent areas where there is the potential for future caribou re-occupancy. Areas of continuous distribution to the north and along coastal Lake Superior are separated by an area of discontinuous caribou distribution, where caribou live in isolated populations or only on a temporary basis. Some specific elements of the CCP also apply to this area of discontinuous caribou distribution, although the CCP does not broadly apply.

Key elements of the Caribou Conservation Plan

The CCP contains a number of principles to guide its development and implementation. One of the overarching principles was a commitment to the adaptive management process, involving the “ongoing scientific review and evaluation of progress on management actions, and the use of new science and management information to continually review and improve management” (OMNR, 2009a; as adapted from Baker, 2000).

The eight main strategies of the CCP, each with associated actions, are:

1. Enhance caribou science;
2. Adopt a range management approach;
3. Improve planning;
4. Enhance caribou habitat;
5. Manage the wildlife community;
6. Focus on geographic priority areas;
7. Improve outreach and stewardship; and
8. Integrate Aboriginal Traditional Knowledge.

Each of these strategies contain a variable number of specific action items and commitments; more detail on some of the major commitments and actions are outlined in the following sections.

1.0 Enhanced research and monitoring

The CCP recognized both the significant value of existing scientific information to support caribou recovery in Ontario, and the need to address a number of key scientific uncertainties. One of the key commitments of the CCP was met by the initiation of a long-term collaborative caribou research program that has been under development for some time. A number of previous workshops and assessments involving government (federal and provincial, including neighbouring provinces) and non-governmental individuals (university academics, industry representatives, and non-government environmental organizations) had been undertaken to identify key research questions, develop a research approach and experimental design, and to identify candidate research study areas (Rodgers *et al.*, 2007; 2008; 2009). Key identified uncertainties related to the direct and indirect effect of habitat disturbance, principally forest management, on caribou persistence. Based

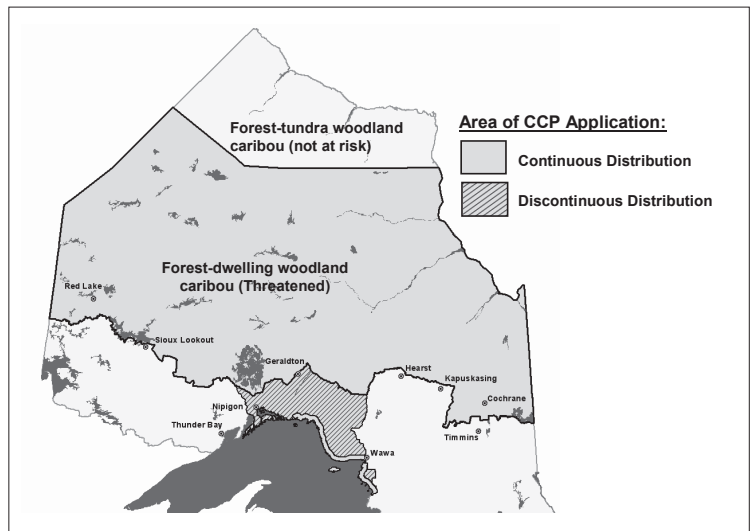


Fig. 1. Area of application of the Caribou Conservation Plan (as revised from OMNR, 2009a).

on a survey of a wide range of resource professionals with interest and/or expertise in caribou, three key research questions of relevance to caribou recovery in Ontario were identified:

1. Evaluation of the effects of landscape disturbances caused by forest management on caribou populations, including impacts on population parameters, habitat selection and changes in the broader wildlife (predator-prey) community;
2. Determination of the mechanisms driving caribou population dynamics in modified landscapes; and
3. Determining thresholds of disturbance for caribou occupancy of disturbed landscapes (Rodgers *et al.*, 2007).

This enhanced research program, involving the Centre for Northern Forest Ecosystem Research (CNFER), the Forest Ecosystem Science Co-op, the University of Guelph, and the Canadian Forest Service was initiated in 2009-10 with the designation of study areas, initiation of silvicultural research, and the radio-collaring of caribou and gray wolves (*Canis lupus*) in three large (22 500 km²) landscapes in northern Ontario with contrasting levels of habitat disturbance, including road densities, predator densities and abundance of alternate prey, mainly moose (*Alces alces*).

One of the major issues raised during public consultation on the CCP was the concern that the Ontario government's habitat management approach

to caribou appeared to be unduly reliant upon the ability to harvest forests within caribou range and subsequently successfully renew them to a condition where they again became suitable as caribou habitat. This was seen by many members of the public, and by the Caribou Science Review Panel, as an untested hypothesis (Suffling *et al.*, 2008). Thus, a significant commitment was also made to a broad science program implemented by CNFER in co-operation with the partners listed above to test this hypothesis and examine the 3 identified key research questions. In areas where caribou appear to have re-occupied logged habitat, researchers will test for differences in habitat conditions between occupied and available stands, and between logged and naturally disturbed habitats across a range of forest ages. Other efforts to further document case studies of demonstrated caribou reoccupancy of logged habitats will also continue (e.g. Racey *et al.*, 1996).

The CCP further committed to an expanded provincial caribou monitoring program that included an annual range monitoring program and a provincial caribou database to maintain all current and historical caribou inventory data. A provincial caribou monitoring plan is currently under development to coordinate monitoring activities consistent with an adaptive management approach, negating Wilkinson's (2010) concern that the lack of a monitoring plan will lead to an inability to determine if the program is achieving its objectives. Population monitoring was initiated for two ranges in 2009-10, and is being continued under the CCP commitment for the monitoring of one to two ranges annually. Additionally, caribou occurrence and population surveys were completed during the winter of 2010-11, the final year of a 4 year endeavour to survey caribou over the entire Far North planning area, which represents the northern 42% of the province. Caribou collaring to support these population monitoring efforts is occurring in the ranges currently being assessed and across the Far North planning area.

A Provincial Caribou Technical Committee was established to provide science expertise and advice on implementation of the CCP. This will build on the successful outcome of the Caribou Science Review Panel, which contributed significantly to the development of the final CCP.

2.0 Adoption of a range management approach

One of the most significant commitments within the CCP was the adoption of a range management approach to caribou recovery. Founded on an adaptive management framework, the CCP builds on a recent history of managing at large landscape scales

in Ontario to implement the range management approach as the primary basis for many recovery actions. This entails the delineation of the area of continuous caribou distribution into smaller units of analysis or conservation based on the local population range concept (see Environment Canada, 2008). These ranges provide the spatial and ecological context for the assessment of the condition of the caribou population and its habitat, and the conservation actions expressed through resource management and land use decisions. This approach is consistent with the range-based concept of critical habitat proposed by Racey & Arsenault (2007), which identified the need for consideration and management of caribou habitat at a range of scales if caribou recovery is to be successful. The extent of Ontario's caribou distribution is believed to be essentially continuous (Racey & Armstrong, 1998; Ontario Woodland Caribou Recovery Team, 2008), an observation supported by both the documentation of occupied range and the results of early studies of radio-collared caribou. There is no indication that Ontario's extent of caribou occurrence can be delimited by geographically explicit and spatially separated "herds" or populations as in some other jurisdictions, with the exception of the Lake Superior islands and mainland.

It was recognized that the ecological and biological information on which to delineate ranges is never fully adequate or complete. However it was also recognized as important to begin to delineate ranges in the area considered most at risk to provide a basis for long-term planning, using criteria identified by Environment Canada (2008). Therefore, preliminary ranges were delineated across the southernmost extent of the continuous distribution. Delineation criteria included:

1. animal movement and occupancy patterns;
2. large spatial extent;
3. geographic features;
4. common ecological expressions of functions and behavioural responses;
5. predominant risk factors; and
6. ecological and administrative boundaries.

Subsequent to release of the CCP, there were adjustments to the number and boundaries of these preliminary ranges based on new information (Fig. 2). It is anticipated that these preliminary ranges may be further adjusted over time as additional information and interpretations become available, consistent with an adaptive approach. Ranges were not initially delineated for the more northern areas within the extent of caribou occurrence (Fig. 2), given that devel-

opment pressures were perceived to be lower and that there was time to await additional information that is forthcoming from current studies of radio-collared caribou. However, rapidly increasing interest in planning and natural resource development in this northern part of the province have accelerated the need for northern range delineation.

Integrated range analyses using advanced assessment tools to evaluate the condition of caribou habitat and populations are an integral component of the range management approach. Each individual range will be periodically assessed (1-2 ranges annually) following a standardized monitoring protocol. Landscape analysis tools, two-stage aerial surveys, and studies of radio-collared caribou are collectively being used to identify habitat condition, landscape disturbance levels, distribution, probability of occurrence, probability of persistence, and population health parameters (e.g. intrinsic rate of increase, population trends, calf survival) (Ontario Woodland Caribou Recovery Team, 2008). This information will support the evaluation of planning alternatives in light of overall range condition. The status of caribou habitat and populations at the range level will guide decisions on resource management proposals, potential mitigation and the need for recovery measures (Fig. 3).

In the context of range management, the CCP recognized the need to work with the adjacent provinces of Manitoba and Quebec, Parks Canada, and Environment Canada, for recovery to be successful. Caribou ranges on the eastern and western bounda-

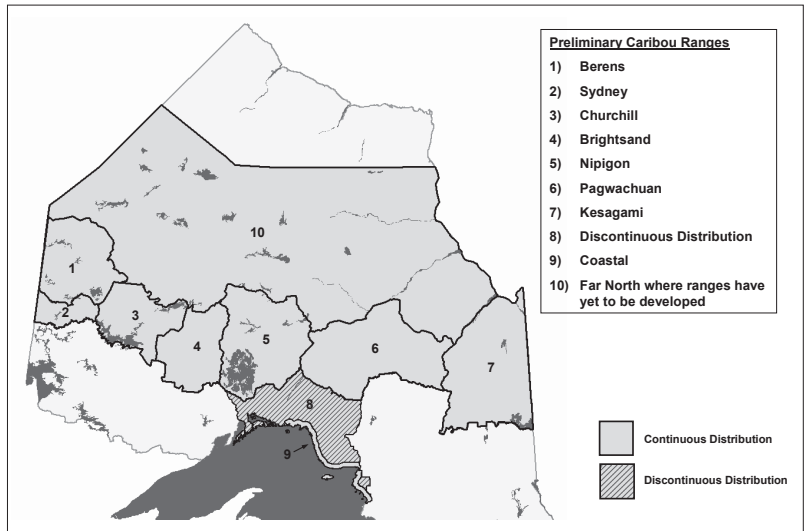


Fig. 2. Preliminary delineation of caribou ranges along the southern edge of the provincial extent of occurrence (as revised from OMNR, 2009a)

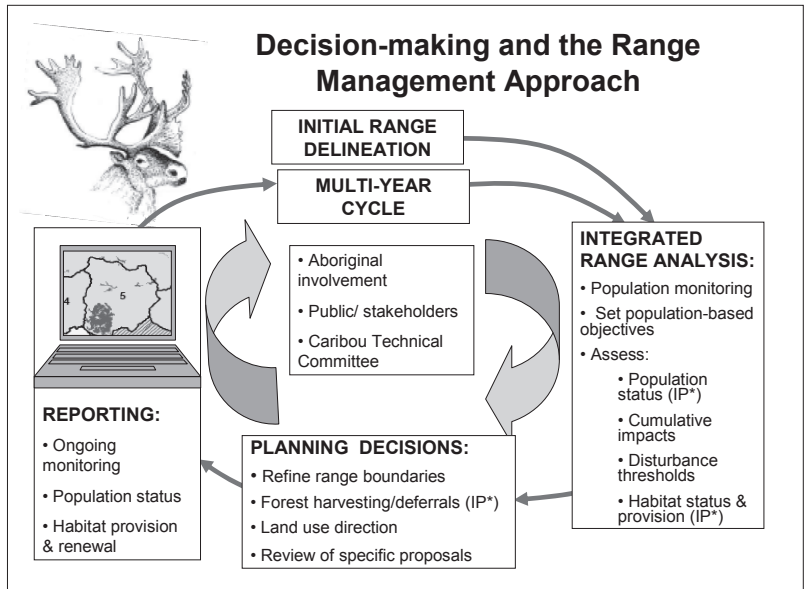


Fig. 3. Relationship between integrated range analysis outcomes and the subsequent CCP decision-making environment (from OMNR, 2009a)

ries of Ontario are contiguous and continuous with ranges in the adjacent jurisdiction (e.g., Manitoba Conservation, 2005), and the CCP commits Ontario to working collaboratively with those jurisdictions to effectively recover caribou.

While the CCP applies to the entire area of continuous caribou distribution, only some elements apply to the zone of discontinuous distribution (see Fig. 1). While this area is not known to support a permanent caribou presence and has limited

opportunity for full recovery as caribou range, it is recognized as having an important role to play in providing potential genetic and landscape connectivity between the isolated Lake Superior coastal range and continuous range to the north. The CCP committed to the development of a strategy for this area that will identify opportunities for enhancing this connectivity to improve the long-term prospects for population security and the probability of persistence of the coastal population.

The range management approach is central to Ontario's caribou recovery program. The CCP identified the need to develop a range management policy to integrate all range-related guidance within a single coordinated policy, and to ensure a consistent and common approach to implementation of the range management approach. Initiation of policy development was an early priority of the CCP.

3.0 Actions to improve planning for caribou at the landscape scale

The greatest number of recovery actions identified in the CCP are those related to the improvement of planning processes, to more comprehensively consider caribou values in the wide range of resource and land use activities that take place on Crown land. The primary focus of these planning tools and processes is reliance on the probability of caribou persistence as a key determinant of appropriate management decisions and actions.

A significant amount of public input from very diverse perspectives was associated with this component. Many respondents felt that it was essential to identify caribou habitat that would be "protected", in the sense that it would be set aside from resource development and exploitation as a protected area. Wilkinson (2010) similarly expressed the concern that there is little direction in the CCP on what and how much habitat will be protected. It was difficult to reconcile this perspective with the view that caribou conservation requires the consideration and management of entire landscapes over large spatial and temporal scales, and that entire ranges represent important habitat (Racey & Arsenault, 2007). Across the broad boreal forest landscape of northern Ontario, parks and protected areas can clearly be important reserves of caribou habitat, although it does not appear that they can ever be sufficiently large and robust to be relied upon solely as isolated islands of habitat in the absence of integrated management with the adjacent connecting landscape; the experience of caribou population and habitat trends in the Prince Albert National Park area appear to support this conclusion (Arlt & Manseau, 2011). This is

particularly important to recognize given that even very large protected areas in the boreal forest can be rendered largely unsuitable for caribou for several decades by wildfire or other natural disturbances. The CCP recognized that parks and protected areas can be important contributors to caribou habitat conservation, but on their own are insufficient to ensure the long-term persistence of caribou; the entire landscape must be managed with caribou habitat considerations in mind. New protected areas were not created as part of the CCP; instead, the focus was on appropriate resource management and land use planning to ensure suitable habitat conditions across the landscape and over time, with an appropriate caribou conservation focus in management plans for protected areas within the extent of caribou occurrence. The CCP committed to significant consideration of caribou conservation values in the designation of new protected areas (at least 225 000 km²) announced for the Far North Planning Area (Office of the Premier, 2008).

The CCP supported amendments to existing land use planning mechanisms to increase commitments to caribou conservation in planning designations and processes. This includes the amendment of the Crown Land Use Policy Atlas, so that designations reference caribou presence and the need to consider caribou values in all land use decisions, and the review of designated Fish and Wildlife Enhanced Management Areas to assess and improve their effectiveness in support of caribou recovery. These are longer term commitments that have not yet been initiated.

Under the Endangered Species Act, 2007 (ESA), habitat can be defined either through a habitat regulation that prescribes the habitat of the species, or more generally as the area on which the species depends, directly or indirectly, to carry on its life processes (Government of Ontario, 2007). As one of the transition provisions of the ESA, general habitat provisions for woodland caribou take effect 5 years after the act is enacted (i.e. 2013) unless a habitat regulation is put into effect sooner. Habitat "protection" is a challenging concept for a landscape species, such as woodland caribou, which requires extensive areas of refuge habitat, and inhabits dynamic boreal forest habitat that will at some point in the successional cycle become unsuitable habitat for several decades after large disturbances such as wildfire. The CCP committed to development of a caribou habitat regulation, within a landscape approach, that will provide sufficient amount and arrangement of habitat over time to sustain caribou populations. The policy direction in the CCP and the legislated habitat protection afforded by the habitat regula-

tion, which is currently under development, will work together to support caribou conservation and recovery.

Much of the southern extent of caribou occurrence in Ontario has been allocated for forest harvesting and management. Enhanced caribou habitat management through forest management planning requires the development of habitat provision plans that will ensure a sufficient amount and spatial arrangement of caribou habitat through time; the CCP requires that all forest management units provide sufficient habitat over time and the renewal of that habitat through the development of “dynamic caribou habitat schedules”, integrated across adjacent management units. These schedules are similar to and build on the former caribou “habitat mosaics” applied in northwestern Ontario (I. Armstrong *et al.*, 1998; T. Armstrong *et al.*, 2000). These dynamic caribou habitat schedules are intended to ensure a long-term habitat supply, and are based on the premise that logged areas that formerly provided suitable habitat can be regenerated through intensive silviculture to again provide future caribou habitat in large tracts of mature coniferous forest.

As noted in the CCP, “Adjustments to forest management practices in northwestern Ontario since the early 1990s appear to have had some initial success at retaining caribou and caribou habitat near the southern edge of range... Although the evidence is not conclusive, short-term caribou well-being and management options for the future are probably greater due to the deferral of large tracts of mature forest at the southern edge of range” (OMNR, 2009a). Although there is some evidence to support this suggestion based on repeated observations of habitat use through time, it is recognized that there are some uncertainties around the effectiveness of silvicultural practices to renew habitat conditions similar to those that follow wildfire and thus support caribou re-occupancy (OMNR, 2008a), sometimes referred to as an “untested hypothesis” (Suffling *et al.*, 2008; Wilkinson, 2010). While this perspective is to some extent valid, it is also clear that past approaches to the management of boreal landscapes in the absence of caribou considerations were decidedly unsuccessful at retaining caribou (Racey & Armstrong, 1998); positive management adjustments based on forest ecology and caribou science are expected to have a much higher likelihood of success at retaining caribou, particularly when enacted within an adaptive management framework.

In part to address this uncertainty, and to ensure that there will be sufficient amount and arrangement of future caribou habitat, a caribou habitat

“insurance policy” is being implemented in areas allocated for forest harvesting. Recognizing that the forest landbase must be planned with caribou habitat needs in mind over the entire rotation of the forest, this “insurance policy” stipulates that deferral areas (areas that are not scheduled for harvest for 20 years or more) will not be harvested in future unless three broad habitat and population criteria are met:

1. there must be sufficient amount and arrangement of both currently suitable habitat and future habitat;
2. harvested areas that do not yet provide habitat must be tracking towards a suitable future habitat condition, based on silvicultural monitoring; and
3. the local caribou population must be stable or increasing at the range level, based on an assessment of caribou presence, population size and population trend.

The development of detailed policy guidance to implement and interpret this “insurance policy” is an early priority of the CCP.

The range management approach provides the key framework for land use planning and resource management decisions, integrating well with the adaptive management framework (Fig. 4). The CCP commits to the development and use of new planning tools, including the evaluation of cumulative effects. The cumulative effects of natural and human disturbance at a landscape scale are being assessed relative to the overall disturbance footprint within a range, comparable to the range disturbance concept applied in Environment Canada (2008). An initial assessment of range condition based upon this approach was completed for each preliminary range as an early CCP priority. A screening tool is being developed to assess the potential implications of proposed development proposals on caribou ranges, and to support planning and mitigation decisions. This tool will evaluate the projected disturbance footprint of the proposed development including existing disturbance levels within the range, proximity to the southern edge of continuous distribution, and adjacency to specific habitat values such as calving and nursery areas. These planning tools and integrated range assessments will define the decision-making environment and support decision-making (Fig. 3). Additional research and policy development on a roads management framework is underway to provide guidance on managing densities of roads and other linear features and the decommissioning of roads to support persistence of caribou.

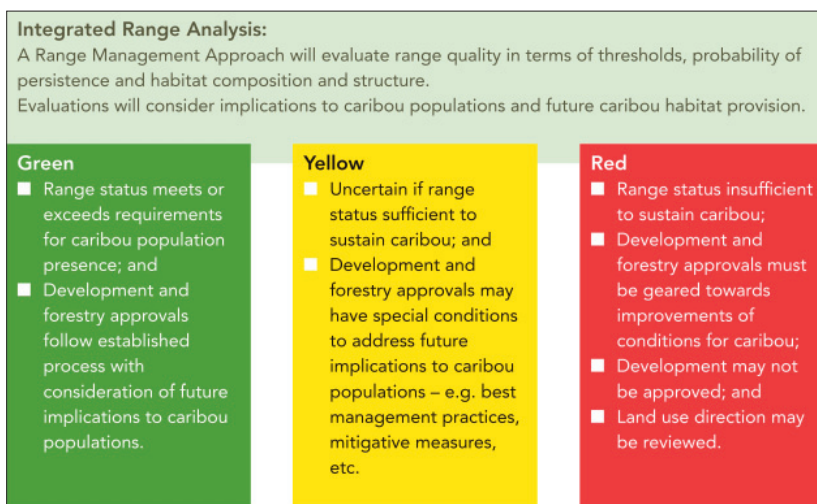


Fig. 4. Application of the CCP range management decision-making framework within the adaptive management context (from OMNR, 2009a).

4.0 Enhanced caribou habitat management

While closely related to enhanced planning approaches (3.0), the CCP contains a specific section on the enhancement of caribou habitat through additional guidance in the application of various natural resource planning processes, and in particular forest management planning. These approaches build on recent advances in forest planning guidance, including the release of guidelines to manage caribou habitat across northwestern Ontario (Racey *et al.*, 1999). Forest management practices will fully consider both current and future caribou habitat needs for all forest management units within the extent of continuous caribou distribution. Tools will include enhanced silviculture, the scheduling of harvest and deferral areas, caribou-specific objectives for forest planning, and the use of science-based models. One such model helps to plan for sufficient amount and spatial arrangement of caribou habitat over time within the range of natural variation, by establishing the desired range of variation in levels of habitat composition and texture over the entire managed forest landbase (Elkie *et al.*, 2010).

There is a particular emphasis on silviculture within the CCP, given the need to ensure that harvested forests within the extent of caribou occurrence are renewed to suitable future caribou habitat. This emphasis on effective silviculture is essential to avoid successional shifts towards more mixedwood or hardwood-dominated forests after harvesting. Forest management silvicultural performance requirements specific to caribou habitat renewal will need to be met. The CCP requires a caribou-based objective for silviculture in every forest management plan,

more rigorous assessment of the effectiveness of silvicultural programs to renew caribou habitat, and monitoring to ensure that regenerating logged areas are tracking towards a suitable future forest condition for caribou habitat, to meet the tests of the “insurance policy”.

An immediate priority of the CCP was the review of all forest management plans to ensure that CCP commitments were met, or schedules developed for revisions and amendments, to address silvicultural

objectives, dynamic caribou habitat schedules, habitat management and roads management. Where not currently in place, dynamic caribou habitat schedules were directed to be developed within the first year of CCP implementation.

5.0 Consideration of caribou recovery implications when managing other wildlife species

A broad ecosystem approach and perspective is important to the successful delivery of a caribou conservation and recovery plan. The CCP recognizes that caribou recovery actions will not be successful in isolation of the consideration and management of other boreal wildlife species. For example, an important consideration within this ecosystem approach is a focus on the management of predators and alternate cervid prey. This is particularly important because of the apparent relationship between habitat disturbance, resulting higher densities of moose and white-tailed deer (*Odocoileus virginianus*), and subsequent higher densities of predator numbers, which in turn may lead to increased and unsustainable predation pressure on caribou (Bergerud, 1974; Bergerud & Ballard, 1988; Schwartz & Franzmann, 1989).

Moose distribution overlaps with that of caribou for most of northern Ontario, and the species have historically co-existed for at least several centuries (Fritz *et al.*, 1993). A number of concurrent wildlife initiatives within OMNR provide convergent direction to strive to maintain natural predator-prey densities within the extent of caribou occurrence, including relatively low moose densities similar to what would occur naturally across much of the con-

fer-dominated boreal forest. The Cervid Ecological Framework provides direction to maintain low moose densities (0-20/100 km²) in the majority of the area of continuous caribou distribution (OMNR, 2009b), and the guidance for establishing moose population objectives similarly recommends that “in areas where caribou are the primary focus of management, moose should be managed to a low density to reduce predation pressure on caribou” (OMNR, 2009c). Based upon Bergerud *et al.* (2007), OMNR (2009c) further suggests that “maintaining or restoring caribou populations may mean managing to ≤10 moose per 100 km²”. The CCP reinforces this direction, recognizing the need to develop objectives for maximum moose densities within the extent of caribou occurrence. There is also the need for a temporal perspective when managing moose densities, as moose typically increase in the short-term after disturbance.

In recent decades white-tailed deer range and populations in northern Ontario have been increasing and expanding northward, raising concern about the potential implications for the predator-prey balance and potential brainworm (*Parelaphostrongylus tenuis*) transmission (Trainer, 1973). Concurrent with finalization of the CCP, new deer hunting seasons were implemented in 2009 in northern wildlife management units that did not yet have a season to help slow the advance of deer range expansion, although it is recognized that any effect on deer numbers will be modest. Efforts are underway to increase monitoring of deer numbers in northern Ontario to track population trends, and to standardize the monitoring and documentation of incidences of brainworm.

Predator numbers are intended to be managed primarily through the management of habitat, with the objective of maintaining naturally occurring low densities of alternate prey and predators (OMNR, 2009a). The CCP commits to a review of the feasibility and effectiveness of directly and indirectly managing predator numbers, and the development of criteria and guidelines. Despite the concerns expressed by Wilkinson (2010) that this is ecologically indefensible and would open the door to the culling of wolves, this will be a comprehensive, ecologically-based review that will consider a range of predator management options including habitat management.

A final important wildlife management action is the commitment to a review of the feasibility of caribou translocations as a recovery tool for unique recovery situations, such as coastal Lake Superior (Bergerud and Mercer, 1989). This review is anticipated to address many of the same considerations as those addressed by Jordan *et al.* (1998), including habitat availability and suitability, and densities of

white-tailed deer, gray wolves, black bears (*Ursus americanus*) and moose. This will be a collaborative review with Parks Canada, who are also evaluating the feasibility of a caribou translocation to augment the Pukaskwa National Park caribou population along the Lake Superior coast (Euler, 2010; Allen *et al.*, 2011).

6.0 An initial recovery focus on geographic priority areas

The CCP places a priority on immediate recovery actions focused on the most at-risk populations along the southern edge of continuous distribution. This includes the area of continuous distribution where preliminary ranges have already been delineated, and the Lake Superior coast population (Fig. 2). An increasing number of pending and potential development proposals further north, including mineral exploration and development, renewable energy projects, utility corridors, and road access development have all emphasized the urgency of completing preliminary range delineation in the far north, and applying all planning tools and actions within the CCP to the entire zone of continuous distribution in the near future.

7.0 Improved outreach and stewardship

Improved public engagement and outreach, and enhanced stewardship of the caribou resource by public and stakeholders, are important objectives of the CCP. Specific communications products are being developed including several natural resource-specific ‘best management practices’ (BMPs) to increase the awareness amongst natural resource users of caribou ecology and conservation practices, and to help mitigate some of the impacts of resource development; these will include BMPs directed towards mineral exploration and development, tourism and outdoor recreation, forestry, and roads and linear feature planning. OMNR will also produce a “State of the Woodland Caribou Resource Report” to coincide with the 5-year review of CCP implementation in 2014. This report will provide results of range assessments (population and habitat condition), research results and progress towards achieving the commitments and targets set in the CCP.

A concern has been raised that the CCP did not make a commitment that any BMPs will be posted on the provincial Environmental Registry for public notification and comment (Wilkinson, 2010). To increase public awareness and support for caribou stewardship, it is essential that these documents be widely circulated and publicly available. Posting on the Environmental Registry will be one means of ensuring that this occurs.

8.0 Consideration of Aboriginal Traditional Knowledge in recovery actions

The CCP contains a commitment to the consideration and incorporation of Aboriginal Traditional Knowledge (ATK), where available, in caribou conservation and recovery. This includes considering ATK in the delineation and refinement of caribou range boundaries, and seeking additional information on caribou populations and habitat to support caribou recovery. The CCP also includes a commitment to work in partnership with Aboriginal people to share information, increase mutual knowledge and awareness of caribou and caribou conservation, and identify opportunities for shared research and recovery actions.

Documented Aboriginal Traditional Knowledge related to caribou is limited, although efforts are underway to increase the awareness and availability of ATK for conservation and recovery planning purposes. O'Flaherty *et al.* (2008) described a positive outcome of an attempt to consider both indigenous and science knowledge in the development of a caribou conservation approach for the Whitefeather Forest in northwestern Ontario. A number of pilot studies, led by First Nations, are being conducted to document traditional knowledge in several areas of both northeastern and northwestern Ontario.

CCP Implementation

The CCP has an initial focus on identified priorities. Not all recovery actions can be initiated simultaneously, requiring the setting of priorities to allocate funds and resources. The CCP contained specific target dates (6 months to 5 years) for some specific actions. Initial CCP implementation is focussed on the one to three year commitments specified within the CCP. Although not all commitments were assigned a specific timeframe, all are expected to be initiated within the first 5 years of implementation. A multi-year implementation plan has been developed to guide implementation, incorporating all commitments within an adaptive management framework (Fig. 3).

Discussion

There has been growing recognition of the decline and 'Threatened' status of woodland caribou in Ontario in recent decades, although concerns about their decline were expressed as early as the mid-20th century (de Vos, 1949; de Vos & Peterson, 1951). Increasing attention began to be directed towards caribou conservation and recovery during the 1980s (Darby *et al.*, 1989). In Ontario, particu-

larly northwestern Ontario, intensive conservation efforts generally began in the early 1990s. Recent efforts have included direction to begin to consider caribou habitat values during the preparation of forest management plans in northwestern Ontario in the early 1990s, the development of forest management guidelines for northwestern Ontario (Racey *et al.*, 1999), a regional caribou conservation strategy for northwestern Ontario (OMNR, 1999), the establishment of some large provincial parks with high caribou conservation value (Cumming, 1987; Duinker *et al.*, 1998), and an enhanced standardized caribou database. A more detailed chronology of some key conservation initiatives in Ontario can be found in OMNR (2008a).

The Caribou Conservation Plan builds upon these earlier conservation efforts to provide a comprehensive and coordinated approach to caribou conservation and recovery. It addresses science and information needs, planning approaches, habitat management, management of the broader wildlife community, public outreach and stewardship, and Aboriginal engagement. This reflects the complexity of the challenge of caribou recovery, and provides the greatest opportunity to conserve caribou, rather than relying on only a few very specific measures such as the designation of protected areas.

Caribou occur relatively continuously across northern Ontario, thus requiring integrated management actions across both protected areas and managed landscapes where resource development activities will occur. Our challenge is to ensure suitable quality, quantity and distribution of intact caribou habitat at a landscape scale, both now and into the future, while also recognizing and integrating recovery actions with other authorized natural resource uses. It is important that the entire northern landscape remain in a condition that is capable of providing suitable habitat over time, so that provincial range is not fragmented or isolated by permanent impairment of habitat quality. The range management approach, applied in an adaptive management context, is an important measure to ensure no further loss of caribou range in Ontario and to strengthen caribou prospects and the probability of caribou persistence. New information on caribou ecology, populations and their habitat, and caribou response to various ecological and anthropogenic factors, is continually and increasingly being gathered. This new information will continue to inform and refine our caribou recovery approaches through the adaptive management approach as it becomes available.

A recurring concern of Wilkinson's (2010) analysis was that the CCP lacks sufficient detail about how

various policies will be implemented, and is thus open-ended and lacks the commitment for follow-through. The CCP is clearly a high-level strategic policy, and given the comprehensive nature of the actions being committed to, it is not feasible to articulate in detail the specific approaches and responsibilities for every policy commitment. Thus there are a number of commitments to further develop more detailed operational policies within the framework of the CCP to address such aspects as road density thresholds, how new protected areas in the Far North will align with caribou conservation values, and the details on implementation of the caribou insurance policy. This is a necessary approach to policy development, but the overall government commitment to achieve every commitment within the CCP is clear.

As a legally required government response under the Endangered Species Act, 2007, the CCP represents a significant long-term commitment to caribou recovery and conservation. The authors view the Caribou Conservation Plan, released in October 2009, as a significant step forward in both a commitment to, and progress towards, caribou recovery and conservation in Ontario. In this regard, we do not agree with the assessment of Wilkinson (2010) that this plan avoids the tough policy choices, fails to take a precautionary approach, holds more uncertainty for stakeholders, and defers many policy decisions to the future. This is a very clear policy commitment, backed by legislation, to establish and implement a number of science, policy, planning and stewardship initiatives that will collectively support caribou conservation and recovery and enhance the long-term probability of caribou persistence in Ontario.

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References

Allen, M., Bruneau, S., Drake, C., Hayes, S., Hutchinson, B., & Parent, L. 2011. Pukaskwa caribou science workshop summary: priority concerns, discussion points, and recommended actions. Unpubl. report, Parks Canada Agency, Marathon, Ontario. 20pp.

Arlt, M.L. & Manseau, M. 2011. Historical changes in caribou distribution and land cover in and around Prince

Albert National Park: land management implications. – *Rangifer* Special Issue No. 19: 17-31.

Armstrong, I., Swant, G., & Timmerman, H.R. 1998. Developing a woodland caribou habitat mosaic on the Ogoki-Nakina North forests of northwestern Ontario. – *Rangifer* Special Issue No. 10: 235-240.

Armstrong, T., Racey, G., & Bookey, N. 2000. Landscape-level considerations in the management of forest-dwelling woodland caribou (*Rangifer tarandus caribou*) in northwestern Ontario. – *Rangifer* Special Issue No. 12: 187-189.

Baker, J.A. 2000. Landscape ecology and adaptive management. – In: Perera, A.H., Euler, D.L., & Thompson, I.D. (eds.). *Ecology of a managed terrestrial landscape: patterns and processes*, pp. 310-322. University of British Columbia Press, Vancouver & Toronto.

Bergerud, A.T. 1974. Decline of caribou in North America following settlement. – *Journal of Wildlife Management* 38: 757-770.

Bergerud, A.T. & Ballard, W.B. 1988. Wolf predation on caribou: the Nelchina herd case history, a different interpretation. – *Journal of Wildlife Management* 52: 344-357.

Bergerud, A.T., Dalton, W.J., Butler, H., Camps, L., & Ferguson, R. 2007. Woodland caribou persistence and extirpation in relic populations on Lake Superior. – *Rangifer* Special Issue No. 17: 57-78.

Berger, A.T. & Mercer, W.E. 1989. Caribou introductions in eastern North America. – *Wildlife Society Bulletin* 17: 111-120.

Cumming, H.G. 1987. Perceived value of woodland caribou in establishing a northwestern Ontario park. – In: Decker, D.J. & Goff, G.R. (eds.). *Valuing Wildlife – Economic and Social Perspectives*, pp. 347-351. Westview Press, Boulder, Colorado.

Darby, W.R., Timmermann, H.R., Snider, J.B., Abraham, K.F., Stefanski, R.A., & Johnson, C.A. 1989. *Woodland caribou in Ontario. Background to a policy*. Ontario Ministry of Natural Resources, Toronto, Ontario. 38pp.

de Vos, A. 1949. Status of the woodland caribou in Ontario. – *Silva* 4: 16-23.

de Vos, A. & Peterson, R.L. 1951. A review of the status of woodland caribou (*Rangifer tarandus*) in Ontario. – *Journal of Mammalogy* 32: 329-337.

Duinker, P.N., Armstrong, T.R., Hyer, B.T., & Petersen, B. 1998. Using caribou knowledge in expanding the Wabakimi protected area. – *Rangifer* Special Issue No. 12: 183-193.

Elkie, P., Gluck, M., Elliott, J., Hooper, G., Kushnieriuk, R., Leith, R., Lucking, G., Rempel, R., & Ride, K. 2010. Science and information in support of the Forest Management Guide for Landscapes and the Caribou Conservation Plan: Package “caribou” habitat definitions, habitat tracts, habitat models and simulation

- results. Ontario Ministry of Natural Resources, Forest Policy Section, Sault Ste. Marie, Ontario.
- Environment Canada.** 2008. Scientific review for the identification of critical habitat for woodland caribou, boreal population (*Rangifer tarandus caribou*) in Canada. August 2008. Environment Canada, Ottawa, Ontario. 72 pp. + 180 pp. appendices.
- Euler, D.** 2010. Can woodland caribou persist in Pukaskwa National Park? Unpubl. report prepared for Parks Canada Agency, Marathon, Ontario. 45pp.
- Fritz, R., Suffling, R., & Younger, T.A.** 1993. Influence of fur trade, famine, and forest fires on moose and woodland caribou populations in northwestern Ontario from 1786 to 1911. – *Environmental Management* 17(4): 477-489.
- Government of Ontario.** 2007. Endangered Species Act, 2007. Legislative Assembly of Ontario, Toronto, Ontario. 51pp.
- Government of Ontario.** 2009. Development of MNR policy to guide woodland caribou conservation and recovery efforts in Ontario. EBR Registry Number 010-4421. Environmental Registry of Ontario, Toronto, Ontario. Available at: <http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTA0MzY4&statusId=MTYxOTU1&language=en>
- Greig, L. & Duinker, P.** 1996. Towards a strategy for caribou habitat management in northwestern Ontario. Final report of the Northwest Region Caribou Advisory Panel. Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 46pp.
- Harris, A.** 1999. Report on the status of woodland caribou in Ontario. Report prepared for the Committee on the Status of Species at Risk in Ontario (COSSARO), Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 34pp.
- Jordan, P.A., Nelson, J.L., & Pastor, J.** 1998. Progress towards the experimental reintroduction of woodland caribou to Minnesota and adjacent Ontario. – *Rangifer* Special Issue No. 10: 169-181.
- Manitoba Conservation.** 2005. Manitoba's conservation and recovery strategy for boreal woodland caribou (*Rangifer tarandus caribou*). Manitoba Conservation, Winnipeg, Manitoba. 20pp.
- Office of the Premier.** 2008. Protecting a northern boreal region one-and-a-half times the size of the Maritimes. Media release on July 14 2008. Office of the Premier, Toronto, Ontario. 3pp.
- O'Flaherty, R. M., Davidson-Hunt, I. J., & Manseau, M.** 2008. Indigenous knowledge and values in planning for sustainable forestry: Pikangikum First Nation and the Whitefeather Forest Initiative. – *Ecology and Society* 13(1): 6. Online. Available at: <http://www.ecologyandsociety.org/vol13/iss1/art6/>
- OMNR.** 1999. A management framework for woodland caribou conservation in northwestern Ontario. MS Report, Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 15pp.
- OMNR.** 2008a. Keeping caribou in Ontario. Discussion paper. Queen's Printer for Ontario, Toronto, Ontario. 41pp.
- OMNR.** 2008b. Keeping caribou in Ontario consultations – 2008. Roll-up report. Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 4pp.
- OMNR.** 2009a. Ontario's woodland caribou conservation plan. Queen's Printer for Ontario, Toronto, Ontario. 24pp.
- OMNR.** 2009b. Cervid ecological framework. Ontario Ministry of Natural Resources, Peterborough, Ontario. 19pp.
- OMNR.** 2009c. Moose population objectives setting guidelines. Ontario Ministry of Natural Resources, Peterborough, Ontario. 13pp.
- Ontario Woodland Caribou Recovery Team.** 2008. Woodland caribou (*Rangifer tarandus caribou*) (forest-dwelling, boreal population) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 93pp
- Racey, G.D. & Armstrong, E.R.** 1996. Towards a caribou habitat management strategy in northwestern Ontario: Running the gauntlet. – *Rangifer* Special Issue No. 9: 159-170.
- Racey, G.D. & Armstrong, E.R.** 1998. Woodland caribou range occupancy in northwestern Ontario: past and present. – *Rangifer* Special Issue No. 12: 173-184.
- Racey, G.D. & Arsenault, A.A..** 2007. In search of a critical habitat concept for woodland caribou, boreal population. – *Rangifer* Special Issue No. 17: 29-37.
- Racey, G.D., Harris, A.G., & Foster, R.F.** 1996. Caribou winter habitat in the new forest: lessons from Lucy Lake. Northwest Science & Technology Technical Report TR-103, Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 9pp.
- Racey, G.D., Harris, A., Gerrish, L., Armstrong, T., McNicol, J., & Baker, J.** 1999. Forest management guidelines for the conservation of woodland caribou: a Landscape approach. Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 69pp.
- Rodgers, A.R., Allison, B.A., Wade, K.D., & Iwachewski, E.P.** 2007. Forest-dwelling woodland caribou in Ontario: Research workshop report. Information Paper CNFER IP-001. Ontario Ministry of Natural Resources, Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario. 27pp.
- Rodgers, A.R., Berglund, N.E, Wade, K.D., Allison, B.A., & Iwachewski, E.P.** 2008. Forest-dwelling woodland caribou in Ontario: Experimental design workshop report. Information Paper CNFER IP-002. Ontario Ministry of Natural Resources, Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario. 19pp.

- Rodgers, A.R., Berglund, N.E, Hagens, J.S., Wade, K.D., Allison, B.A., & Iwachewski, E.P. 2009. Forest-dwelling woodland caribou in Ontario: Candidate study areas report. Information Paper CNFER IP-004. Ontario Ministry of Natural Resources, Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario. 48pp.
- Schwartz, C.C. & Franzmann, A.W. 1989. Bears, wolves, moose, and forest succession, some management considerations on the Kenai Peninsula, Alaska. –*Alces* 25: 1-10.
- Suffling, R., Crichton, V., Ray, J.C., Schaefer, J.A., & Thompson, I.D. 2008. Report of the Ontario Woodland Caribou Science Review Panel: The path forward. Report to Hon. D. Cansfield, Ontario Minister of Natural Resources, Waterloo, Ontario. 19pp.
- Trainer, D.O. 1973. Caribou mortality due to the meningeal worm (*Parelapobstrongylus tenuis*). – *Journal of Wildlife Diseases* 9: 376-378.
- Wilkinson, C.J.A. 2008. An examination of recovery planning for forest-dwelling woodland caribou (*Rangifer tarandus caribou*) in Ontario, Canada. – *Rangifer* 28: 13-32.
- Wilkinson, C.J.A. 2010. An analysis of government actions for the protection and recovery of forest-dwelling woodland caribou (*Rangifer tarandus caribou*) in Ontario, Canada. – *Rangifer* 30(1): 67-77.

