Capacity of Ontario's Parks to Sustain Large Carnivores

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Abstract

*We examined whether Ontario's parks, in the event they became isolated areas, might sustain populations of wolves (*Canis lupus*) and black bears (*Ursus americanus*). Minimum critical areas for viable populations of both species (based on a series of life history parameters) were compared to the sizes of 167 provincial parks categorised as nature reserves, wilderness parks, and natural environment parks. One hundred and sixty provincial parks appeared unable to sustain either species. Of the remaining 7 parks, 6 might be large enough to sustain both species in best-case (optimistic) scenarios; only the largest park might be able to sustain both species in worst-case scenarios. Only 1 national park (Pukaskwa National Park) and the Chapleau Game Preserve were large enough to sustain both species under best-case scenarios. To maintain the ecological integrity of these parks by providing for the habitat needs of these large carnivores, remaining wilderness areas outside the parks need to be preserved or managed in ways that allow it to function as ecological adjuncts. New provincial policies and legislation are required to promote co-operative management of federal, provincial, and private lands adjacent to parks, and especially among neighboring jurisdictions.*

Introduction

Many parks have been created in Ontario during the past century. These parks vary in both size and purpose, ranging from small recreational areas surrounded by urban and rural development, to large areas of wilderness surrounded by undeveloped Crown lands (Ontario Parks, 2001) (Table 1). These parks serve a variety of functions, including the conservation of the Province's flora and fauna.

Ontario's parks are distributed throughout the province, but they do not exist as a network of protected areas with recognised corridors connecting adjacent park lands into an ecologically-intact landscape (Campbell, 2000). To date, there are no ecological networks implemented in the province, but the Greater Georgian Bay Islands Ecosystem Cores and Corridors Project (Tegler *et al.* 1999; Wiersma 1996, *in press*; Zorn and Quirouette 1999) and the proposed Algonquin to Adirondack Corridor (Quinby *et al.* 2000) are in the process of being developed. Three other corridors have been identified, including the Superior-Temagami Corridor, the Temagami-Algonquin Corridor, and the Niagara Escarpment Corridor (Ancient Forest Exploration and Research, 2001), but these are all in initial stages.

Landry *et al.* (2001) analyzed the capacity of Canada's national parks to sustain populations of large mammalian predators in the event the parks became completely insularized. They concluded that few national parks were sufficiently large to sustain grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*) and wolves (*Canis lupus*), and the presence of theses species in some southern national parks is attributed to the presence of large tracts of adjacent wilderness (Wiersma, pers. comm). Ontario's Crown lands are experiencing continued exploitation from forestry, mining, road building and human encroachment, so the risk that Ontario's parks may become isolates is real.

We repeated Landry *et al*'s. (2001) methods to determine the capacity of Ontario's parks to sustain populations of wolves and black bears if the parks were insularized by human development. If provincial parks are large enough to sustain viable populations of wolves and black bears, then management of these species can occur within park boundaries. However, if the parks are deemed too small even to support minimally viable populations (MVPs) of wolves and black bears, then other land use strategies must be considered in order to conserve these species.

Methods

A classification system exists for Ontario's provincial parks, with each category containing different criteria for use (Ontario Parks, 2001). Provincial parks classified, as of 2001, as nature reserves, wilderness parks, and natural environment parks were used in this study. These categories were selected because parks with these designations are composed mainly of preservation and wilderness areas (Categories 1 and 2 in IUCN terminology; Table 1, see appendix). Parks classified in category 1 or 2 allow only for minimal human interference, and therefore, are more likely to be used by large carnivores. There are five national parks in Ontario and they were included in this study as a comparison with the provincial parks system. The Chapleau Game Preserve, although not a provincial park, also was included in the study because of its size and its location adjacent to Lake Superior Provincial Park.

Values for minimum viable populations (MVP), minimum viable population densities (MVPD), and minimum critical areas (MCA) for wolves and black bears were obtained directly from Landry et al. (2001) (Table 2). These estimates were applied by Landry *et al.* (2001) to all of Canada's national parks, but this range of MVP sizes can also be applied to provincial parks in Ontario because the original study included life history parameters derived from Ontario's black bears and wolves.

The MVP refers to a population size that is large enough to permit long-term (centuries) persistence despite uncertainty related to genetic, demographic, and environmental changes (Shaffer, 1981; Fritts and Carbyn, 1995). Minimum critical area (MCA) refers to the smallest area needed for a viable population to survive (Nudds et al. 1998). The MCA for a species is calculated as MCA = MVP/MVPD,

Table 2. Different minimum viable population (MVP) sizes, minimum viable population densities (MVPD), and minimum critical areas (MCA) for wolves (Canis lupus), and black bears (Ursus americanus) using the model developed by Reed et al. (1986) with different parameters. L, is age at first breeding; l, survival rate to age at first breeding, and b, probability of breeding.

Species	Parameters	MVP	MVPD	MCA (km^2)
Wolves	Largest L; sex*, breeding 1:1	530	0.69 km^2	768[a]
	Smallest L; sex 1:1, breeding 1:3	1,178		1,707[b]
Black Bears	Largest L, l, b; sex, breeding 1:1	462	0.27 km^2	1,717[a]
	Smallest L, l, b; sex, breeding 1:1	4,296		15,970[b]
	Averages; sex, breeding 1:1	982		3,651
	Averages; sex 1:1, breeding 1:3	1,336		4,967

* Sex ratio and breeding ratio M : F

Data sources:

1.Carbyn (1981), Soper (1973), Burt and Grossenheider (1976),Carbyn et al. (1993), Haber (1977), Mech (1977).

2.van Tighem (1997), Burt and Grossenheider (1976), Soper (1973), Yodzis and Kolenosky (1986), Schwartz and Franzmann (1991), Keay (1995), Kasbohm et al. (1996), Elowe and Wendell (1989).

a) Best-case (optimistic) scenario. b) Worst-case (pessimistic) scenario

where MVPD is derived from allometric regressions of minimum population densities on body mass (see Landry *et al.* 2001). Best-and worst-case scenarios for MVPs and the associated MCAs were derived for black bears and wolves using different values for life history parameters. The best–case (optimistic) scenario determined the smallest viable population size, and the worst-case scenario (pessimistic) determined the largest viable population size. The MCAs for both species were compared to the size of each provincial park.

Results

Mean sizes of provincial parks selected for this study varied considerably, ranging from 10.01 km^2 to 6 028.65 km^2. However, few provincial parks in Ontario are large enough to sustain viable populations of wolves and black bears (Table 3). Of the 167 Ontario provincial parks studied, 157 are less than 400 km^2, and 151 of those are smaller than 100 km^2 (Figure 1). Virtually all of the parks are unlikely to be able to sustain either of the species studied, even in the most optimistic scenarios. Only Polar Bear Provincial Park is larger than 15, 970 km^2 and therefore might sustain both species under a worst-case scenario. Seven provincial parks may be large enough to sustain wolves in best-case scenarios and 6 appear able to sustain wolves in a worst-case scenario (Figure 1). Six provincial parks may be large enough to sustain black bears in best-case scenarios and only 1 could sustain them in a worst-case scenario (Figure 1).

Pukaskwa National Park, which is 1, 878 km^2, is the only national park in Ontario that is large enough to sustain both species in best-case scenarios, but it appears

Table 3. Number of provincial parks, national parks, and game preserves in Ontario that can sustain populations of wolves (Canis lupus) and black bears (Ursus americanus) under best-and worst-case scenarios.

Scenarios		Black Bears	Wolves
Best-Case	Provincial Parks	6[a]	7[b]
	National Parks	1[c]	1[c]
	Game Preserves	1[d]	1[d]
Worst-Case	Provincial Parks	1[e]	6[a]
	National Parks	0	0
	Game Preserves	0	1[d]

a. Woodland Caribou, Opasquia, Quetico, Algonquin, Polar Bear, Wabakkimi
b. Woodland Caribou, Opasquia, Quetico, Algonquin, Polar Bear, Wabakkimi, Lake Superior
c. Pukaskwa
d. Chapleau Game Preserve
e. Polar Bear

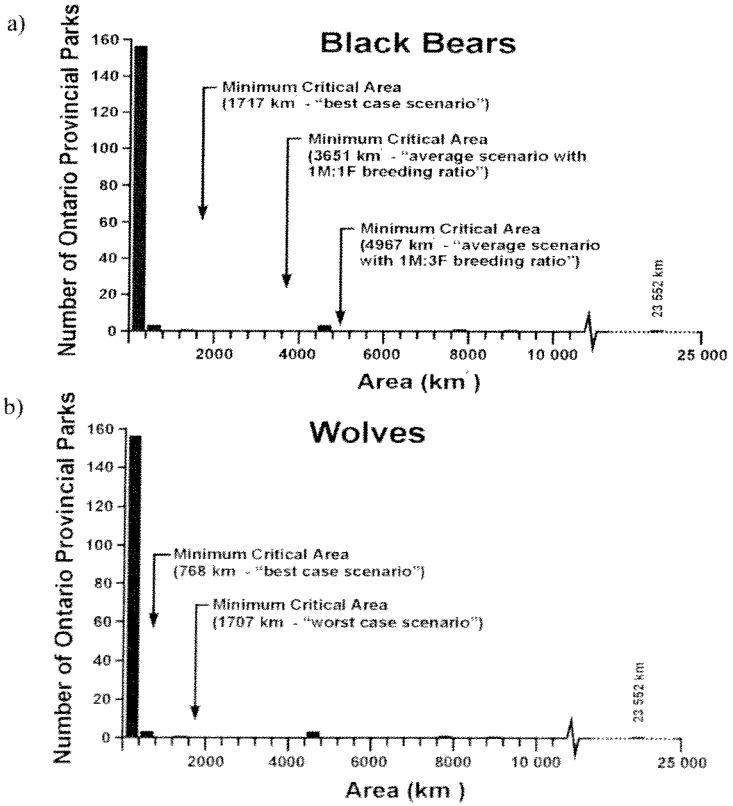

Figure 1. Number of Ontario Provincial Parks able to sustain populations of a) Black Bears, and b) Wolves

unable to sustain black bears in a worst-case scenario (Landry et al. 2001). The Chapleau Game Preserve, which is 7,200 km^2 (Wilderness Island, 2001), is large enough to sustain both species in best-case scenarios, but it also cannot sustain black bears in a worst-case scenario.

Discussion

Most parks in Ontario, in the event they became ecological isolates, would be unable to sustain MVPs of wolves and black bears. Therefore, either additional protected areas should be created that complement the area of existing parks, or intervening lands should also be managed with the goal of conserving ecological integrity. Given that the current provincial parks system is not yet complete, there is opportunity to create new protected areas that complement existing parks (Wildlands League, 2001). Because large distances exist among the parks that have some capacity to sustain both species (Figure 2), land use strategies to increase connectivity among parks should be developed. Parks in northern Ontario are still surrounded by large amounts of wilderness in the form of "Crown lands". Therefore, potential exists to connect parks in this region so those wide-ranging animals such as large carnivores can use lands surrounding parks. This is critical because the ability of large carnivores to use lands adjacent to parks is deemed important for their survival (Newmark, 1995).

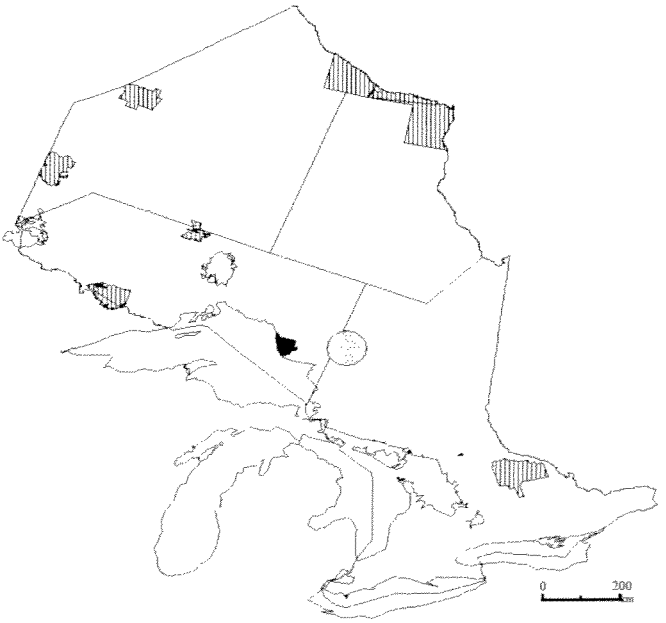

Figure 2. Map of Provincial and National Parks in Ontario, Canada, that contain enough area to sustain wolf and black bear populations

Recently, 378 new protected areas consisting of provincial parks and conservation reserves were created in Ontario through a process known as "Lands for Life" (Wildlands League, 2001). Lands for Life involved setting aside 9% of the province's public lands for protection, with areas selected based on their biological, ecological, and recreational value. The provincial parks established through this process are being integrated into Ontario's provincial parks classification system, but this process is not yet complete. Although the creation of additional protected areas is a positive step, concerns still exist about the conservation of lands outside park boundaries. However, even though these newly-created parks are, individually, not large enough to maintain viable populations of large carnivores, they can complement the functions of existing park habitats by serving as ecological adjuncts.

Only 1 national park (Pukaskwa National Park) might be large enough to sustain both species in best-case scenarios. Thus, policy and legislation applied to national parks in Canada can play only a minor role in the conservation of wolves and black bears in Ontario. Therefore, conservation of these species depends a great deal on policy and legislation at the level of the Ontario government. However, initiatives such as the Greater Georgian Bay Islands Cores and Corridors Project (Tegler *et al.* 1999; Wiersma 1996, *in press*; Zorn and Quirouette, 1999) and the proposed Algonquin to Adirondack Corridor (Quinby *et al.* 2000) use land-use strategies that integrate federal, provincial, and private lands in Ontario. Integration of lands under different jurisdictions is important when trying to create a common ground for the protection of ecological integrity.

The sources of error that exist in the determination of the MVP, MVPD, and MCA for both species are summarized in the Landry et al. (2001) paper. We recognise that there is error in the calculated MCAs, but given the small size of a large majority of provincial parks, this does not affect, substantially, the conclusions of this study. We also acknowledge that Polar Bear Provincial Park is located at the extreme northern latitude of black bear range, and that black bears are in only its southern region (Lompart, 1996). It is indicative, however, of the size of park that would be needed to sustain a long-term MVP of black bears under a worst-case scenario.

If we look back through history, parks have been created on an individual basis for a variety of reasons. Now, with the progression of knowledge, conservation of ecological integrity is recognised as being important and managing parks on an individual basis is no longer appropriate. However, the current parks system in Ontario is representative of a collection of isolated areas and not a pre-determined network of protected areas.

The current Ontario Parks Act is inadequate for the conservation of large carnivores because it applies only to areas within provincial parks, and contains no explicit provision for the protection of ecological integrity (Campbell, 2000). It is

outdated and does not reflect current views on biodiversity conservation. Campbell (2000) provides some suggestions for changes to the Act, including clearly defined statements about the purpose, objectives, and principles of provincial parks, and the establishment of mechanisms (such as the inclusion of public involvement) that would increase government accountability and promote ecological protection. Because most provincial parks are small, the Provincial Parks Act should include provisions for connecting parks together into a network of protected areas. This would increase the effective area available for species use, and help alleviate problems associated with insularization. The creation of new enabling legislation and policy at the provincial level will help conserve these large carnivores and the ecological integrity of Ontario's regions.

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Appendix

Table 1. Total area, IUCN category, mean area, and standard deviation (SD) for Ontario provincial parks classified as a) wilderness parks, b) nature reserves, and c) natural environment parks.

Table 1 a) Wilderness Parks

Provincial Park	Total Area km^2	IUCN Category
Kesagami	559.77	2
Killarney	485	2
Lady Evelyn-Smoothwater	724	2
Opasquia	4 730	2
Polar Bear	23 552	2
Quetico	4 757.82	2
Wabakkimi	8 920.61	2 (1550km^2 of total area)
Woodland Caribou	4 500	2
Mean Area	6 028.65 km^2	**S. D.** 7651.79 km^2 n=8

Source: Ontario Parks (2001)

Table 1. b) Nature Reserves (b)

Provincial Park	Total Area km^2	IUCN Category
Adam Creek	0.5	1
Agassiz Peatlands	23.15	1
Albert Lake Mesa	1.3	1
Alliston "Beattie" Pinery	0.68	1
Arrowhead Peninsula	8.15	1
Bayview Escarpment	4.39	1
Bonheur River Kame	8	1
Butler Lake	34	1
Cabot Head	45.14	1
Castle Creek	10.75	1
Cavern Lake	1.89	1
Centennial Lake	5.3	1
Coral Rapids	0.12	1
Craig's Pit	5.3	1
Cranberry Lake	28	1
Devon Road Mesa	0.6	1
Divide Ridge	2.35	1
Dividing Lake	3.5	1
Duclos Point	1.11	1
Ducan Escarpment	1.61	1
East Sister Island	0.53	1

continued

Edward Island	6	1
Egan Chutes	3.22	1
Fish Point	1.1	1
Fraleigh Lake	8.25	1
Frederick House Lake	0.13	1
Gibson River	1.68	1
Gravel River	7.63	1
Hicks-Oke Bog	58.8	1
Hockley Valley	3.77	1
Holland Landing Prairie	0.34	1
Hope Bay Forest	3.53	1
Ira Lake	0.3	1
John E. Pearce	0.68	1
Johnston Harbour-Pine Tree Point	9.29	1
Kabitotikwia River	19.65	1
Kaiashk	7.8	1
Kama Hill	0.01	1
Le Pate	2.5	1
Lighthouse Point	0.96	1
Limestone Islands	4.5	1
Lion's Head	5.26	1
Little Cove	0.16	1
Little Greenwater Lake	2.44	1
Livingstone Point	18	1
Lola Lake	65.72	1
Manitou Islands	19.25	1
Matawatchan	0.65	1
Matawin River	26.15	1
Maynard Lake	0.3	1
Menzel Centennial	6.27	1
Minnitaki Kames	44.22	1
Misery Bay	7.6	1
Mississagi Delta	23.95	1
Montreal River	0.43	1
Morris Traact	0.59	1
Nagagami Lake	16.5	1
Niosy River	3.78	1
North Driftwood River	0.03	1
Nottawasagaa Lookout	1.3	1
O'Donnell Point	8.75	1
Ojibway Prairie	0.65	1
Ouimet Canyon	7.77	1
Pantagruel Creek	26.85	1
Peter's Woods	0.33	1
Porphyry Island	1.07	1

continued

Potholes	2.47	1
Prairie River Mouth	3.8	1
Puff Island	0.09	1
Pushkin Hills	0.05	1
Red Sucker Point	3.6	1
Round Lake	25.85	1
Sable Islands	20.78	1
Schnreiber Channel	0.13	1
Sedgman Lake	57.1	1
Sextant Rapids	0.04	1
Shallow River	0.02	1
Shesheeb Bay	2.75	1
Smokey Head-White Bluff	3.47	1
Spruce Islands	9.7	1
Stoco Fen	1.01	1
Thackeray	1.16	1
Thompson Island	1.45	1
Tide Lake	0.54	1
Timber Island	0.44	1
Trillium Woods	0.1	1
Trout Lake	71.5	1
Waubaushene Beaches	0.34	1
West Bay	11.2	1
White Lake Peatlands	9.92	1
Williams Island	0.08	1
Windigo Bay	83.78	1
Windigo Point	5.13	1
Mean Area 10.01 km^2	**S.D.** 16.86 km^2	**n**=93

Source: Ontario Parks (2001)

Table 1. c) Natural Environment Parks

Provincial Park	Total Area km^2	IUCN Category
Algonquin	7 723	4
Arrowhead	12.37	2
Aubrey Falls	48.6	2
Awenda	29.15	2
Bell Bay	4.04	2
Bigwind Lake	19.67	2
Black Creek	3.35	2
Blue Jay Creek	2.46	2
Bon Echo	66.44	2
Boyne Valley	4.31	2
Charleston lake	23.34	2
Esker Lakes	32.37	2

continued

Forks of the Credit	2.82	2
Frontenac	52.14	2
Greenwater	53.5	2
Grundy Lake	25.53	2
Halfway Lake	47.3	2
Hardy Lake	7.65	2
Indian Point	9.47	2
Ivanhoe Lake	15.89	2
J. Albert Baauer	1.63	2
Kaakabeka Falls	5	2
Kap-Kig-Iwan	3.28	2
Kashabowie	20.55	2
Kawartha Highlands	18	2
Kenny Foresst	22.04	2
Killbear	17.56	2
La Cloche	74.48	2
Lake Nipigon	13.57	2
Lake Superior	1 556.47	2
Lake of the Woods	128.99	2
Little Abitibi	200	2
MacGregor Point	12.04	2
Michipicoten Island	367.4	2
Mississaagi	49	2
Mono Cliffs	7.32	2
Murphys Point	12.39	2
Nagagamisis	81.31	2
Nakina Moraine	53.19	2
Neys	34.45	2
Obatanga	94.09	2
Ojibway	26.3	2
Pakwash	39.93	2
Presqu'ile	9.37	2
Pigeon River	9.49	2
Pretty River Valley	8.08	2
Restoule	12	2
Rondeau	32.54	2
Samuel de Champlain	25.5	2
Sandbanks	15.09	2
Sandpoint Island	9.14	2
Sandbar Lake	50.83	2
Short Hills	6.6	2
Silent Lake	14.5	2
Silver Falls	32.6	2
Slate Islands	65.7	2
Sleeping Giant	244	2

continued

The Massasauga	131.05	2
The Pinery	25.32	2
The Shoals	106.44	2
Tidewater	9.8	2
Wanapitei	34.13	2
Westmeath	6.1	2
White Lake	17.26	2
Winnange Lake	47.45	2
Wolf Island	2.22	2
Mean Area 180.87 km^2	**S.D.** 962.80 km^2	**n**=66

Source: Ontario Parks (2001)