Hyperabundant Moose Management Plan

For North Mountain, Cape Breton Highlands National Park

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Parks Canada Parcs Canada

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2 Executive Summary

The Hyperabundant Moose Management Plan for North Mountain establishes the moose population of Cape Breton Highlands National Park (CBHNP) as hyperabundant within Parks Canada and sets out a detailed strategy to address this serious ecosystem issue in the North Mountain region of CBHNP over the next three years. The plan was developed with the involvement of Parks Canada experts, in collaboration with First Nations, and through consultation with key stakeholders and invited experts. This small-scale plan will help inform a future park-wide comprehensive moose hyperabundance management exercise.

Forest health concerns, specifically fragmentation and loss of natural biodiversity in the boreal region, are perhaps CBHNP's most serious ecological integrity issue. The State of the Parks Report 2010 for CBHNP identifies this as a key issue, and the CBHNP Management Plan sets an objective to improve forest health and calls for active management measures to improve habitat and reduce moose densities.

In 2014, CBHNP launched Bring Back the Boreal, a four-year Conservation and Restoration (CoRe) project to begin to restore forest health and engage Mi'kmaq partners, stakeholders and Canadians. The project objective is to test various forest restoration methods including fenced moose exclosures, tree-planting, and removing moose from a small 20 km^2 area of the park that shows high potential for natural forest regeneration under reduced browsing pressure.

Before active management for wildlife can occur, Parks Canada requires the development of a hyperabundant wildlife management plan according to the process and principles set out in the Parks Canada Management Directive 4.4.11: Management of Hyperabundant Wildlife Populations in Canada's National Parks. This plan fully satisfies the requirements of the Directive.

The plan clearly demonstrates that moose in CBHNP meet all of Parks Canada's criteria to be classified as hyperabundant. In recent decades large areas of the park have experienced failed forest regeneration due to severe moose browsing. High moose numbers are attributed to the absence of a significant predator and to the immense food supply following a large spruce budworm infestation in the 1970-80s. Satellite imagery indicates that a third of the CBHNP boreal forest shows lasting impacts, while 11% of the total park area has been converted from forest to grass-dominated savannah. Boreal forest health is not expected to recover without intervention and the current state of degradation has impacts on a wide range of flora and fauna, including several species of special concern.

The plan applies the established Parks Canada process of considering and developing strategies to manage hyperabundant moose on North Mountain over the next 3 years, in the context of the Bring Back the Boreal project. Following this process and stakeholder consultation, CBHNP proposes lethal removal of moose from North Mountain as the most appropriate method to achieve project objectives. The operational target is to remove >90% of the moose present in the 20 km^2 treatment area (2% of CBHNP). Consistent with a 2012 agreement with Parks Canada, representatives of the Mi'kmaq of Nova Scotia have accepted the first opportunity to engage in the harvest. Information will be collected on harvest efficiency and effectiveness in removing moose, and forest regeneration monitoring will take place throughout the project.

An operational protocol is presented for a Mi'kmaq-led harvest in 2015. The protocol demonstrates the harvest will be conducted according to high ethical and safety practices that fully reflect both Parks Canada and Mi'kmaq values and interests. It also reflects an interest in providing opportunities for non-Mi'kmaq communities to support and benefit from the harvest. The protocol will be assessed and adjusted as needed for each subsequent year.

Stakeholder and expert feedback is generally very supportive of the Plan. However, some stakeholders and local public have expressed concerns related to the need to remove moose, the exclusivity of Mi'kmaq harvest access, and the impacts of the proposed harvest on neighbouring land interests. In consideration of these concerns, CBHNP will undertake to enhance engagement with stakeholders and the public on hyperabundant moose management, both during the course of this project and for future park-wide planning. Increased participation opportunities for non-Mi'kmaq will continue to be explored. CBHNP will collaborate with local knowledge holders to monitor moose harvest impacts on neighbouring lands throughout the course of the project.

The Plan outlines a communications and public education strategy that will be implemented to engage communities, stakeholders, partners, visitors and Canadians, particularly those living in urban areas, on CBHNP forest health issues and strategies. Parks Canada will seek to connect Canadians to CBHNP in meaningful ways and foster a sense of stewardship.

The Hyperabundant Moose Management Plan for North Mountain has successfully completed Parks Canada internal reviews, including Animal Care and Environmental Impact Assessment.

3 Introduction

Cape Breton Highlands National Park was established in 1936. It covers approximately 20% of northern Cape Breton, protecting 950 km^2 of the Maritime Acadian Highlands Natural Region (Figure 1). The landscape rises from the Gulf of St. Lawrence on the west and the Atlantic Ocean on the east to the plateau: a flat, elevated area in the centre of the park created by glaciers and divided by deep river canyons. Boreal forest ecosystems of balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*), and spruce (*Picea* spp.) are found on the plateau, and temperate, mixed Acadian forests are found in the river valleys and low-lying coastal areas.

Over the past three decades the Boreal Forest region of CBHNP has undergone dramatic changes. A third of the boreal forest has failed to regenerate after a spruce budworm (*Archips fumiferana*) infestation in the 1970s. These impacts have been well documented through scientific research (Pardy 1998; Smith et al. 2007) and the park Ecological Integrity monitoring program. The most recent State of the Park report issued for CBHNP (Harvey et al. 2010) identified the condition of the forest ecosystem as Fair, with a declining condition trend. This decline in forest health is attributed to very high numbers of moose, with densities greater than 2 moose/km^2, and the subsequent failure of regeneration over large areas of the Boreal land region. The Park Management Plan has also identified poor regeneration as a serious concern and called for the development of strategies to address the loss of forest health (Parks Canada Agency 2010).

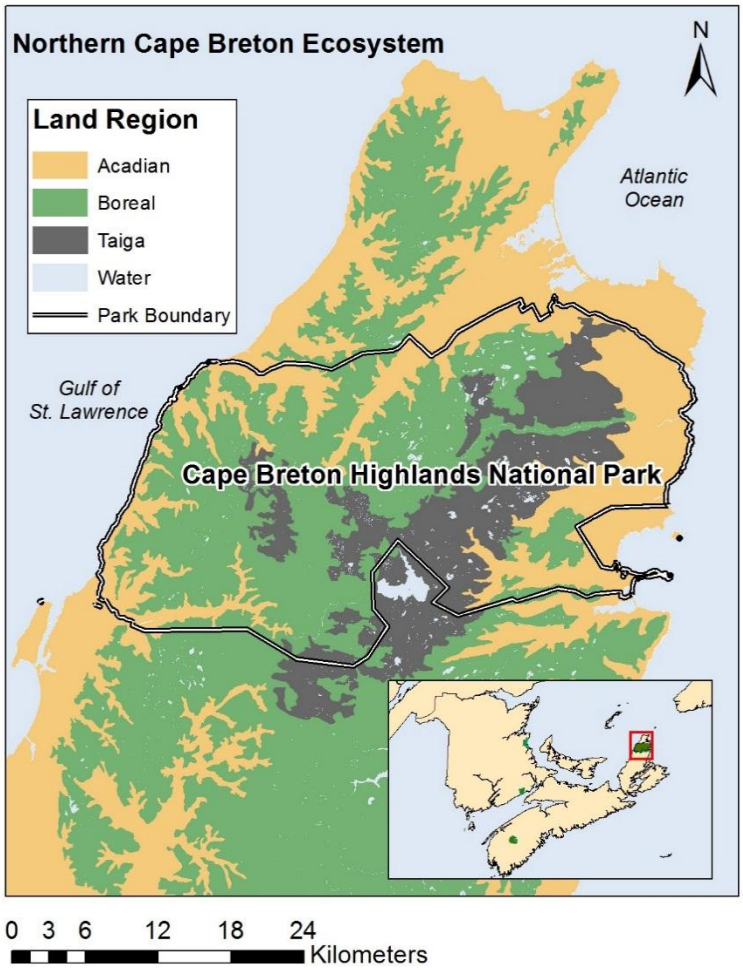

Figure 1: Three major land regions of Cape Breton Highlands National Park: the Acadian forest, Boreal forest, and Taiga.

Moose (*Alces alces americana*) are native to Cape Breton Island but were extirpated by the 1920s after widespread hunting and habitat change. Eighteen individuals of a different moose subspecies (*Alces alces andersoni*) were reintroduced to Cape Breton Highlands National Park from Elk Island, Alberta, by Parks Canada in 1947—48. The reintroduced moose population remained low until the 1970s, when a widespread budworm infestation created an abundance of food. In CBHNP there are no major predators of moose (wolves or hunting) or parasites (e.g. winter tick are not present in Cape Breton). Consequently, moose populations in the park grew unchecked, increasing from 66 animals observed in the 1970s (Bridgland et al. 2007) to more than 2000 in the mid-2000s (CBHNP 2015). Park-wide estimates of moose densities at their peak were greater than 3 moose/km^2, and in some areas densities reached 5-10 moose/km^2. After years of constant browsing, many of the stunted trees died and were replaced by a thick mat of grass and ferns (Smith et al. 2007). The last moose population survey was conducted in 2015 and estimated the density of moose in CBHNP to be 1.9 moose/km^2. Although moose numbers have dropped since the mid-2000s, the impact of moose on regenerating forest has not improved.

There is evidence from permanent sample plots (NS DNR 2006) and moose exclosures (CBHNP 2014c) that the problem in much of the park is getting worse. Satellite imagery from 2013 indicates that 11% of the forested area of the park is now dominated by grass. This represents one-third of the forested portion of the Boreal Region (excluding bogs and wetlands). The loss of forest cover directly impacts those species that need forests for shelter and food. This includes Species at Risk like Bicknell's Thrush (*Catharus bicknelli*), which require dense regenerating forests for nesting (COSEWIC 2009), and provincial species at risk like American marten (*Martes americana*) and Canada lynx (*Lynx canadensis*), which require forest for cover and prey.

In an effort to improve future forest regeneration and forest health, CBHNP submitted a four-year Conservation and Restoration (CoRe) proposal to test various management options including building fences, tree planting, and removing moose from a 20 km^2 area of the park. Construction of the exclosure and tree-planting trials are underway. The removal of moose from North Mountain requires an approved hyperabundant wildlife management plan as per the Parks Canada Management Directive 4.4.11: Management of Hyperabundant Wildlife Populations in Canada's National Parks (hereafter referred to as the Directive).

The Directive specifies the steps needed to implement a plan for reducing populations in the case of hyperabundance. This includes Aboriginal and stakeholder consultation on whether the population meets the definition of hyperabundant, and an evaluation of various management options for reducing populations. Stakeholder and public consultation completed as part of this Hyperabundant Moose Management Plan (HMMP) focused only on the scope of the CoRe project – the 20 km^2 area of North Mountain – and not on park-wide moose management. The CoRe project will help inform any future efforts to create a park-wide initiative, which would also involve greater discussion and input from partners and stakeholders.

The proposed target is a 90% reduction of the moose population on North Mountain. An aerial census conducted in December 2014 found 39 moose in the study area. It's estimated that the proposed reduction would remove approximately 30-35 in the first season, with reduced numbers in subsequent years. The last aerial moose population survey covering the greater Highlands ecosystem was conducted in 2015 and estimated 1800 moose in CBHNP (CBHNP 2015). This plan will remove less than 2% of this number, and will take place over 20 km^2 or 2% of the park area. The removal of moose will happen over a three-year period and the response of vegetation in this area will be closely monitored.

Over the past 20 years, CBHNP has worked closely with our partners on moose management in Northern Cape Breton as part of the Moose Working Group including representatives of the Mi'kmaq of Nova Scotia, Nova Scotia Department of Natural Resources, and Nova Scotia Department of the Environment. As part of the National Parks Interim Arrangement between the Mi'kmaq of Nova Scotia and Parks Canada Agency, signed in 2012, the Mi'kmaq of Nova Scotia have first access to harvest hyperabundant wildlife populations inside Cape Breton Highlands National Park. Hence the Mi'kmaq of Nova Scotia, as represented by the Unama'ki Institute of Natural Resources (UINR), and CBHNP will work together to manage the removal of moose from North Mountain, with UINR leading proposed harvest operations.

This is in line with the Directive, which encourages working with Aboriginal stakeholders to find solutions to hyperabundant populations.

At the end of the four-year CoRe project, a Hyperabundant Moose Management Plan for all of Cape Breton Highlands National Park will be completed. More stakeholder and public consultations will take place over the duration of the project and will consider options for park-level moose population control. The results of this restoration project, including fencing, tree-planting, and harvesting, will provide essential information for the development of an HMMP for all of CBHNP.

4 Mi'kmaq Perspective

4.1 Organizational Structure

The Unama'ki Institute of Natural Resources (UINR) is Cape Breton's Mi'kmaq voice on natural resources and the environment. Forestry, marine science research, species management, traditional Mi'kmaq knowledge, water quality monitoring, and environmental partnerships are among the organization's responsibilities.

Representing the five Mi'kmaq communities in Unama'ki (Eskasoni, Membertou, Potlotek, Wagmatcook, and We'koqma'q) on natural resources issues, UINR contributes to an understanding and protection of Unama'ki's ecosystems through research, monitoring, education, and management. By integrating Netukulimk (traditional Mi'kmaq management) with traditional and conventional ways of understanding, known as Two-Eyed-Seeing, UINR takes the lead on best management practices for natural resources in Unama'ki.

The portfolio on moose is managed by UINR on behalf of all 13 Mi'kmaq communities in the province of Nova Scotia, which also includes Patqnke'k, Millbrook, Pictou Landing, Sipekne'katik, Acadia, Annapolis Valley, Glooscap, and Bear River. The portfolio is led by the Moose Working Group, a province-wide initiative that deals with matters of moose and moose management in Unama'ki. The group is made up of members of Mi'kmaq and Provincial and Federal governments, including members from UINR, Kwilmu'kw Maw-klusuaqn (KMK) – Mi'kmaq Rights Initiative, Parks Canada, Nova Scotia Office of Aboriginal Affairs, Nova Scotia Department of Natural Resources, Nova Scotia Department of the Environment, First Nations Conservation Officers, and Guardians.

4.2 Mi'kmaq Perspective

From time immemorial, moose, or Tiam in the Mi'kmaq language, have always been very important to the Mi'kmaq people. From stories of ancient legends to the modern harvesting techniques of today, the concept of Netukulimk stays rooted in the harvesting practices of the Mi'kmaq. The concept of Netukulimk, especially as it pertains to moose, is best expressed in the following legend (UINR 2009):

Tiam's Promise

In the face of an incredible dilemma, a Mi'kmaq family found themselves in a life and death situation. An early and harsh winter lay before them and prospects of surviving loomed unless an adequate supply of

meat was harvested. With this, the protector/provider for the family prayed for sustenance. The very next day, a Moose appeared at the wigwam of the hunters. He told them that if they treated the moose with respect by taking a moose only when in need, by making offerings over the body of the moose, by using all parts of the animal and by treating as sacred even the bones of the moose, he would always return to feed the people. If they disrespected the moose, however, then the moose would leave and never return.

4.2.1 Concept of Netukulimk

(Excerpt from UINR 2014)

The concept and tradition of Netukulimk is the central philosophy of traditional Mi'kmaq management. It is a philosophy of care and respect for the land. Resource management that aligns with Netukulimk honours the integrity, diversity, and productivity of our environment, both for present and future generations.

Netukulimk is a culturally-rooted concept of responsible co-existence and interdependence with Earth's resources and each other. It is best described as the use of the natural bounty provided by the Creator for the self-support and well-being of the individual and the community at large. Netukulimk is about achieving adequate standards of community nutrition and economic well-being without jeopardizing the integrity, diversity, or productivity of the environment.

Harvesting has always been an important part of Mi'kmaq culture and Netukulimk remains at the heart of everything we do. We have been taught how a single animal can provide a wealth of resources (including shelter, clothing, tools, crafts, medicines, and food) and we have an inherent right to access and use the resources in a sustainable way.

Mi'kmaq culture is built on long-term vision, being mindful that decisions made today should have a positive impact on the next seven generations. Conservation and management of resources has been, and continues to be an important part of our culture.

4.2.2 Mi'kmaq World View

(Excerpt from UINR 2014)

The Mi'kmaq are part of Wabanaki, the Algonquin speaking confederacy that includes four other Nations: Maliseet, Passamaquoddy, Penobscot, and Abenaki. Mi'kma'ki (land of the Mi'kmaq) includes the Atlantic Provinces, eastern Quebec, and northern Maine.

Mi'kma'ki was held in communal ownership. Land and its resources were not commodities that could be bought and sold but were considered gifts from the Creator. As Mi'kmaq, we were the caretakers of the seven districts of Mi'kma'ki and we strived to live in harmony. This belief remains strong in our culture today.

We view the world and all that is in it as having spirit. We consider all life equal to our own and treat it with respect. We developed an intimate understanding of the relationships between the living and non-living so that each plant, animal, constellation, full moon, or red sky tells a story that guides our people so they can survive. These beliefs affect the manner in which we treat the natural world for sustenance and

survival. Animals and plants are not taken if they are not needed. When taken, their spirits are acknowledged and respected as relatives and are offered tobacco, prayer, ceremony or a combination. No part of an animal is wasted. All parts that cannot be used are returned to the Creator. This consciousness is described by the Mi'kmaq word, Netukulimk.

The Mi'kmaq right to harvest for food, social, and ceremonial needs, and for a moderate livelihood, is recognized by the Supreme Court of Canada and protected by the Constitution of Canada.

5 Forest Ecology of Cape Breton Highlands National Park

Cape Breton Highlands National Park is home to three major land regions: the Acadian forest, Boreal forest, and Taiga (Figure 1). The Acadian forest makes up nearly one-third of the park and is found in the lowlands and along river canyons. It is a mixed forest characterized by tree species such as sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*). The Boreal forest is found at higher elevations on the plateau, covering approximately one-third of the park. It is dominated by coniferous trees, such as balsam fir and white spruce (*Picea glauca*), and experiences cyclical disturbance by spruce budworm. Lastly, the Taiga, or barrens, covers roughly a quarter of the park and is also found on the plateau. It is characterized by reindeer lichen (*Cladonia* spp.), black spruce (*Picea mariana*) shrub forests, and low Ericaceous species, which are also called heath shrubs and include species such as blueberry (*Vaccinium sp.*), huckleberry (*Gaylussacia baccata*), and lambkill (*Kalmia angustifolia*).

Boreal forests in eastern Canada are cyclically disturbed by spruce budworm (Blais 1983). In the absence of additional disturbance or stressors, forest composition in areas affected by spruce budworm remains similar over the long-term (Baskerville 1975). A study of balsam fir forests in Eastern Quebec indicated they are formed following budworm outbreaks, and that this relationship between balsam fir and spruce budworm is self-regulating (Morin 1994). In the highlands of Cape Breton, boreal forest regeneration follows the succession pattern of mixed regrowth of white birch, balsam fir, and some white spruce, leading to a canopy dominated by balsam fir (MacLean 1988; Pardy 1997; Smith 1998).

5.1 North Mountain Study Area

The study area for this portion of the CoRe: Bring Back the Boreal project (CBHNP 2014e), is the 20 km^2 area on the plateau on North Mountain (Figure 2). It is bounded by the Polletts Cove – Aspy Fault Provincial Wilderness Area to the north, the Grande Anse Valley to the west, and North Aspy Valley to the east. It was selected for this project due to its extensive grasslands caused by severe degradation from moose browsing, high estimated potential for regeneration, and accessibility due to the Cabot Trail running through the northern portion of the study area.

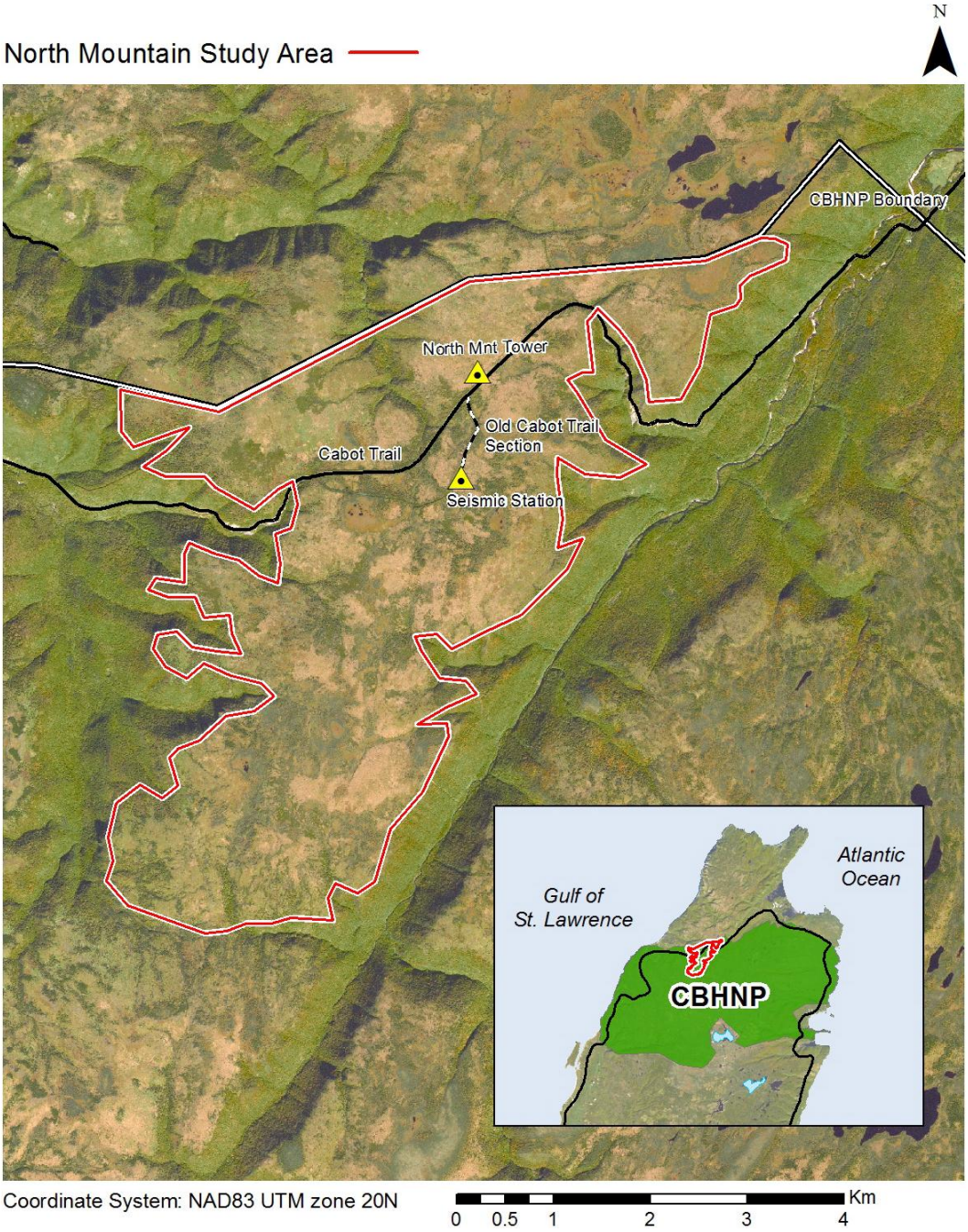

Figure 2: SPOT-5 imagery of the 20 km^2 North Mountain study area.

6 Population dynamics of moose in the Cape Breton Highlands

Moose (*Alces alces americana*) are native to Cape Breton Island and were harvested by the Mi'kmaq before contact with Europeans. Moose were essential to their survival and remain to this day an important source of food for Mi'kmaq communities throughout Cape Breton. The population of moose in Cape Breton was heavily hunted by Europeans starting in the 1700s, with large numbers of moose hunted for provisions for sea-faring ships. By the late 1800s moose were rare on Cape Breton Island and

they were considered by many to be extirpated by the 1920s (Bridgland et al. 2007). Wolves, the major global predator of moose, were also considered extirpated from Cape Breton around 1850 (Cameron 1958). However, the last harvested wolf in Nova Scotia was recorded in 1928 (Novak et al. 1987 in Whitaker 2006), so some remnant individuals may have continued to inhabit the remote highlands of Cape Breton.

Few, if any, moose survived on Cape Breton and in 1947—48, following the establishment of CBHNP, Parks Canada decided to re-establish the population with 18 animals imported from Elk Island National Park in Alberta. These moose were a different subspecies of moose (*Alces alces andersoni*) than those native to Cape Breton and other areas east of Ontario. These moose subspecies are very similar in most respects, with the main difference being cranial shape (Bubenik 1997). The moose were released in Roper's Interval near Ingonish and in the following years moose were observed in various locations across the park. Population estimates in the mid-1970s were around 200 animals (Figure 3).

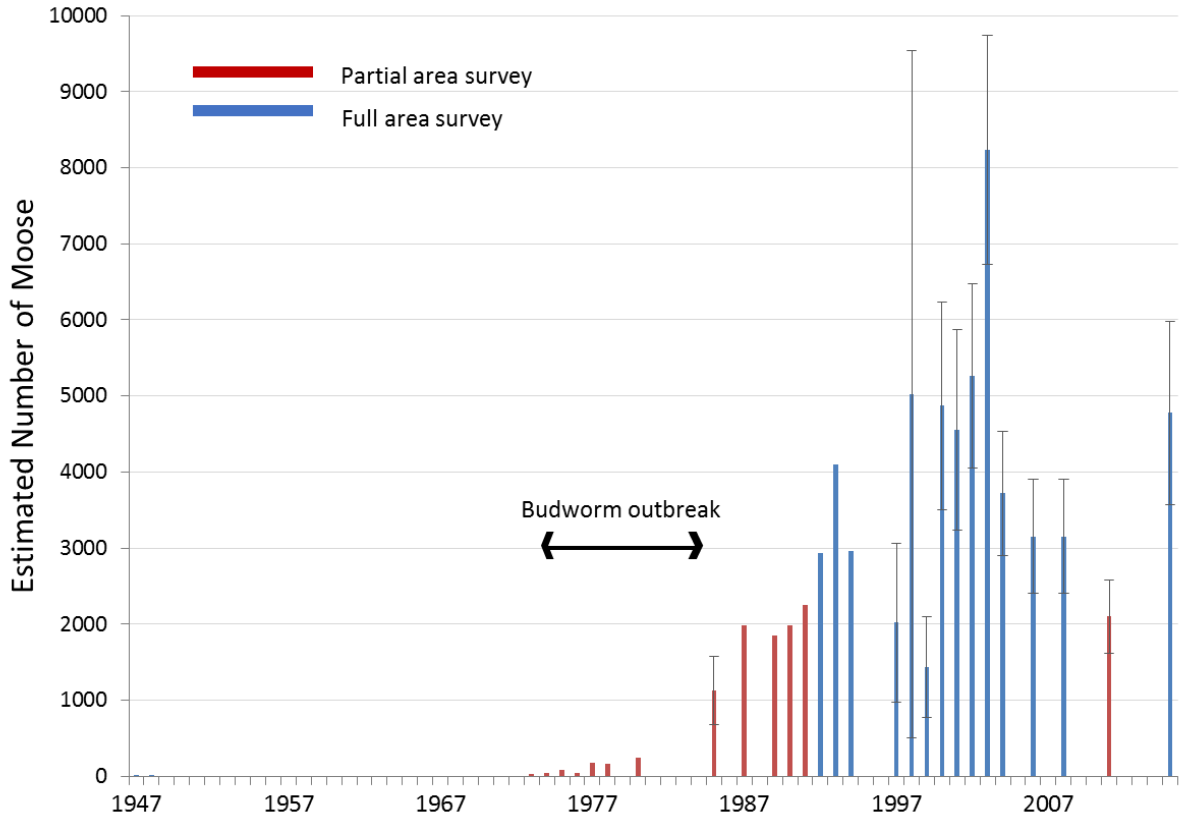

Figure 3: Moose population estimates for northern Cape Breton, 1948-2015. Error bars indicate 90% confidence intervals. Columns without error bars show minimum population (direct count of moose during survey).

Moose numbers were low in Cape Breton until the budworm epidemic of the 1970-80s killed 80-90% of the balsam fir forest (Ostaff and MacLean 1989). Regenerating forests created an abundance of food and moose populations grew from 66 in the 1970s to more than 2000 in the mid-2000s. After more than 30 years of intensive moose browsing, large areas of the budworm-killed forest have not regenerated and

are now being converted to grassland. Recent satellite imagery has shown that 11% of the total park area is now dominated by grass. This represents about one-third of the formerly forested portion of the boreal land region in CBHNP. Similar changes have occurred over large, inaccessible areas of provincial lands north of the park. Moose densities are lower south of the park, in part due to greater accessibility, forest management, and associated significant annual harvesting by Mi'kmaq and non-aboriginal hunters.

Since 2001, moose densities in northern Cape Breton have been estimated via aerial survey (CBHNP 2015). Within CBHNP, moose densities have been consistently estimated above 1 moose/km^2 (

Figure **4**), which is the park threshold identified in the CBHNP Ecological Integrity Monitoring Program where moose densities change from Good to Fair condition, and are frequently greater than 2 moose/km^2, indicating Poor condition (CBHNP 2015, Harvey et al. 2010). Typical moose densities in ecosystems with predation by wolves are less than 0.5 moose/km^2 (Messier 1994). In recent surveys the density of moose for CBHNP has dropped compared to the peak observed in 2004 of 4.2 moose/km^2. This drop in moose density may be due to habitat loss from over-browsing, leading to a reduced carrying capacity.

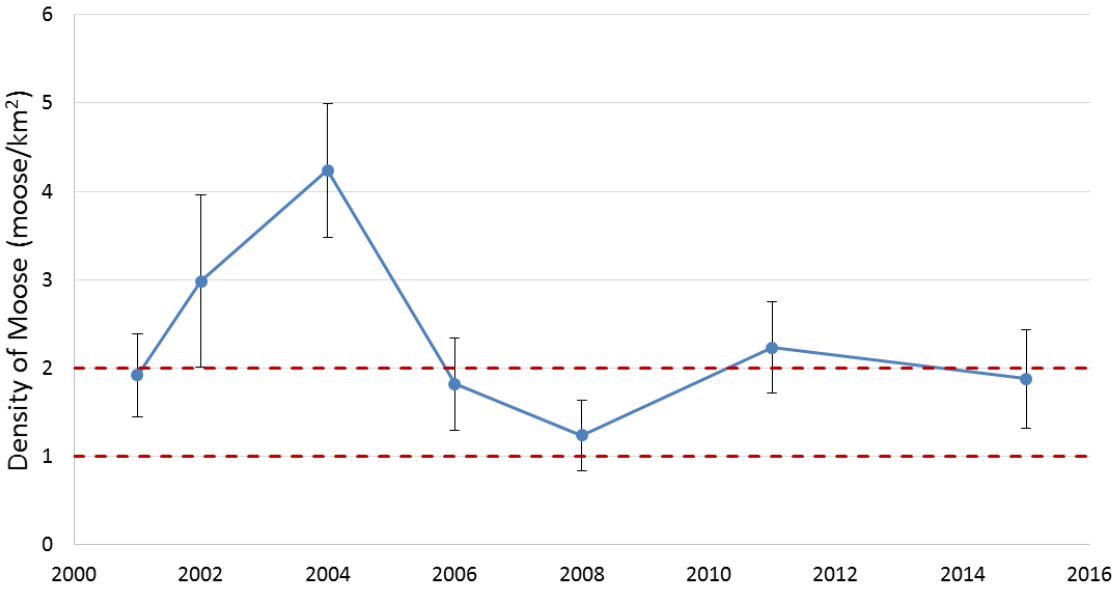

Figure 4: Moose population estimates for Cape Breton Highlands National Park (2001-2015). Error bars indicate 90% confidence intervals. The dashed red lines indicate the condition thresholds between Good (<1 moose/km^2), Fair (1-2 moose/km^2), and Poor (>2 moose/km^2).

7 Impacts of moose on forest ecosystems

7.1 Impacts of moose on forest regeneration

The most recent spruce budworm outbreak in Cape Breton began in 1974. Spruce budworm numbers during the outbreak were extremely high, and 80-90% of balsam fir trees were lost (Ostaff and MacLean 1989). Advance balsam fir regeneration (existing seedlings) and survivorship of regeneration was observed, with approximately 45 000 seedlings per hectare recorded four to six years after the outbreak, predicting a return to balsam-fir dominated stands (MacLean 1984; MacLean 1988). In 1992, average

advanced regeneration of balsam fir at sites previously affected by spruce budworm was 12 400 stems/ha (Pardy 1997). On North Mountain in 2014 we recorded a drastic decrease in regeneration, with 355 stems/ha of balsam fir <4 m in height. There were only 163 stems/ha of balsam fir trees >4 m, indicating that the higher regeneration rates recorded in previous years have not developed into a canopy.

Through analysis of SPOT-5 satellite imagery from 2013, we found that a third of what was previously covered by boreal forest (excluding bogs, wetlands, and other naturally grassy areas) in CBHNP has become grassland, and these disturbed grasslands now cover 11% of the park (Figure 5). On North Mountain this trend is even more severe, with greater than 50% of the study area covered by grasslands, making up two-thirds of what should be boreal forest in the area (Figure **2**).

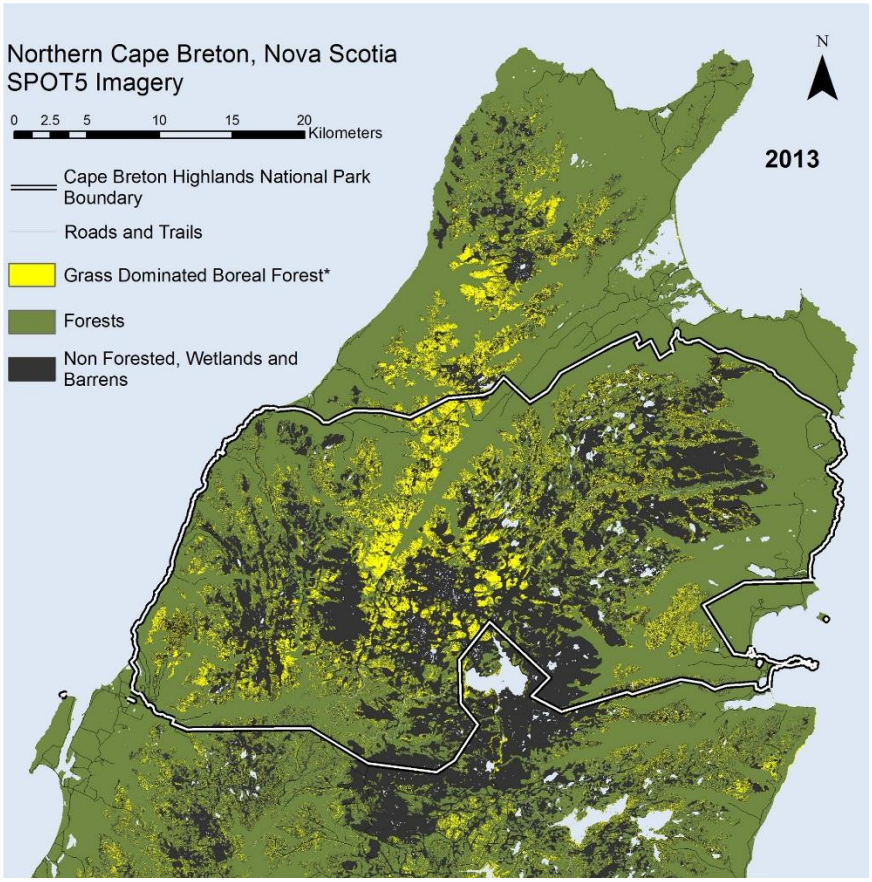

Figure 5: Analysis of 2013 Spot-5 imagery of the park, showing forested areas that have become grasslands following a spruce budworm outbreak and subsequent browsing by moose.

While widespread conversion to grassland is an extreme case, impacts on the boreal forest and associated species are not unique to CBHNP. Damages to forested boreal ecosystems have been attributed to overabundant moose populations around the world, such as in Sweden (Angelstam et al. 2000) and Estonia (Tonisson and Randveer 2003). In Canada, high numbers of moose in Matane Wildlife Reserve in Eastern Québec are not decreasing, despite a decline in forest condition and associated food sources, and active management is suggested (Gingras et al. 2014). Moose have also been identified as the leading

cause of boreal forest regeneration failure on the nearby island of Newfoundland (Connor et al. 2000; Thompson et al. 1992).

Similarly, a 1997 study in CBHNP indicated that moose were having a significant impact on their preferred browse species, such as white birch and balsam fir, but that the long-term impact on successional patterns remained uncertain (Basquill and Thompson 1997). More recent studies have indicated that moose are inhibiting sapling growth, boreal forest succession remains in the sapling stage, and this pattern is likely to persist (Franklin 2013; Smith 2007; Smith et al. 2010).

Figure 6: Failed boreal forest regeneration at monitoring station on the North Mountain plateau, with open grassland and severely browsed and stunted white birch. Photo by Matthew Smith.

Vegetation monitoring conducted by CBHNP staff on North Mountain in 2014 also demonstrates that the degradation of the boreal forest in that area has persisted and substantial changes in forest composition have occurred as a result of over-browsing by moose. Transect surveys originally conducted by Prescott and Roscoe (1978) during the budworm outbreak in 1977 were revisited in the spring of 2014. During these surveys, the number of browsed twigs and the number of twigs available to be browsed were recorded. In 2014 there were less than one-third of the twigs available to be browsed than were present in 1977. Prescott and Roscoe found that, despite higher numbers of white birch and balsam fir twigs, only mountain maple (*Acer spicatum*) was browsed by ungulates, and that these ungulates were likely deer based on pellet count results. In 2014, all browse was by ungulates and was attributed to moose, as local knowledge as well as evidence from aerial surveys (CBHNP 2015, CBHNP 2014a) and pellet surveys (CBHNP 2014d) suggest that deer rarely frequent the area and have limited influence on vegetation at this time. White birch represent 65% of the browsed twigs, followed by balsam fir and maple species.

Annual CBHNP surveys of twig growth and browse levels show that a high proportion of twigs from the previous year's growth are browsed over the winter months (Figure 7). This repeated browsing restricts sapling growth and prevents many stems from growing beyond the reach of moose. Although the habitat is severely degraded, the high degree of browsing on the few remaining stems has likely allowed moose numbers to remain relatively stable in recent years (Section 6).

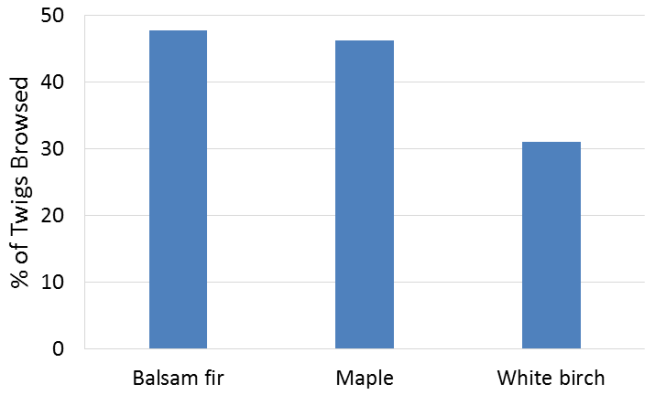

Figure 7: Percent of twigs from previous year's growth browsed over the winter months, for dominant sapling species on North Mountain in 2014. This is a measure of short-term browse, occurring over the previous year. These high proportions of recently-browsed twigs indicate that regenerating stems are currently experiencing severe damage and stunted growth.

Thirty plots covering 400 m^2 each were established in 2014 on North Mountain (CBHNP 2014d), and the number and cumulative browse severity of saplings at moose browsing height (0.5-2 m) were recorded for each plot (Figure 8). Of the living saplings, 83% of balsam fir and 60% of white birch were considered severely browsed, exhibiting stunted and altered growth forms. This is comparable to park-wide results for budworm-affected areas by Smith et al. (2010), although it should be noted that a much higher proportion of dead balsam fir stems in the sapling height class was observed on North Mountain in 2014.

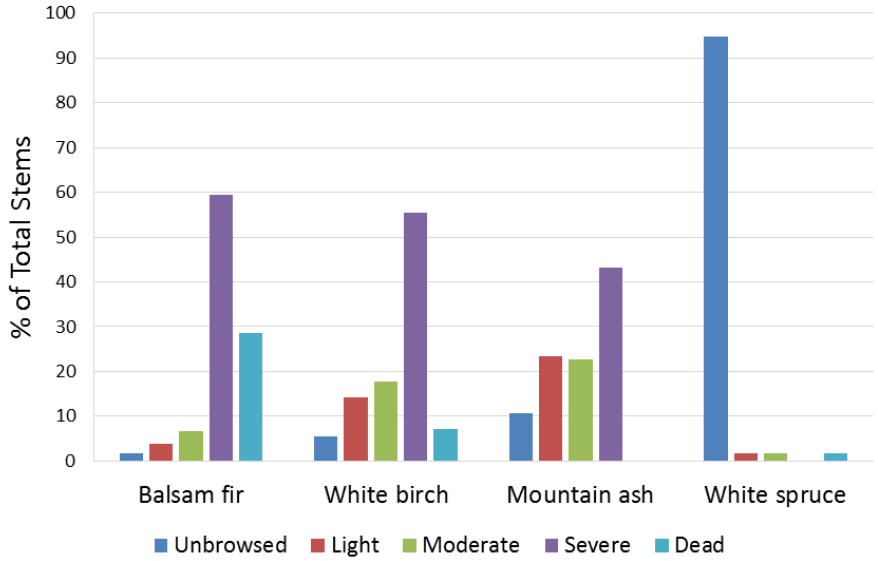

Figure 8: Browse levels of dominant sapling species on North Mountain in 2014. This is a measure of cumulative browse, affecting the long-term growth form of the saplings.

7.2 Impacts of moose on other species

The inhibition of boreal forest regeneration due to over-browsing by moose may have considerable negative impacts on important species in CBHNP. The Bicknell's thrush (*Catharus bicknelli*) was classified as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and was listed as Threatened and a Schedule 1 species under the Species at Risk Act (SARA) in 2012. The population has been estimated at 125 000, with 38% or almost 50 000 individuals in Eastern Canada (Bredin and Whittam 2009; Campbell and Stewart 2012). CBHNP has been identified as one of the most significant protected areas of Bicknell's thrush habitat (COSEWIC 2009). Bicknell's thrush depend on dense stands of balsam fir and spruce, as is found in regenerating boreal forest, and there is a negative correlation between Bicknell's thrush abundance and the amount of thinning or non-treed spaces present in the ecosystem (Chisholm and Leonard 2008). With moose over-browsing boreal vegetation, important habitat for the Bicknell's thrush has been lost. Indeed, Bicknell's thrush abundance is low and shows a decreasing trend in CBHNP (Campbell and Stewart 2012).

In the spring of 2014, Bird Studies Canada conducted point count surveys for songbirds at 100 locations in the North Mountain study area. They found a high incidence of early successional species that prefer open habitat, such as the white-throated sparrow (*Zonotrichia albicollis*) and mourning warbler (*Geothlypis philadelphia*), respectively found at 99 and 74 of the 100 surveyed sites. Conversely, species that inhabit forested areas, such as black-capped (*Poecile atricapillus*) and boreal chickadees (*P. hudsonicus*), were respectively found at only 5 and 3 percent of sites. This is in line with results from Gros Morne National Park, which indicate that long-term moose over-browsing can result in major changes to forest bird communities (Rae et al. 2014).

Other species that are impacted by moose over-browsing include the American marten (*Martes americana*) and Canada lynx (*Lynx canadensis*), both of which have been classified as Endangered in Nova Scotia. The American marten lives in conifer-dominated boreal forests, particularly balsam fir forests. Loss of this habitat in Cape Breton has been identified as a barrier to marten recovery (Nova Scotia American Marten Recovery Team 2006). Canada lynx prefer regenerating boreal forest and open, mature conifer stands (Hoving et al. 2004). The largest contiguous habitat and the only breeding population of lynx in Nova Scotia is in the highlands of Cape Breton. Loss of this habitat due to moose browse has been identified as a threat to the Cape Breton population (Nova Scotia Lynx Recovery Team 2006).

7.3 Demonstrating the impact of moose through experimental fencing

In 2007, two 30 x 30 m exclosures were constructed on North Mountain and along the Skyline trail. Point-intercept transects are measured each year, and the percent cover of each species calculated (CBHNP 2014c). After seven years the Skyline trail shows no significant difference in percent cover of preferred browse species (Figure **9**), indicating that regeneration potential in the absence of moose is low for that location. Conversely, the North Mountain exclosure saw a doubling in cover of preferred-browse species, while the control plot outside the exclosure has experienced a severe decline in cover as grass becomes more dominant. This suggests that recovery is possible on North Mountain, but management actions should be taken before the habitat is further degraded as seen on the Skyline trail.

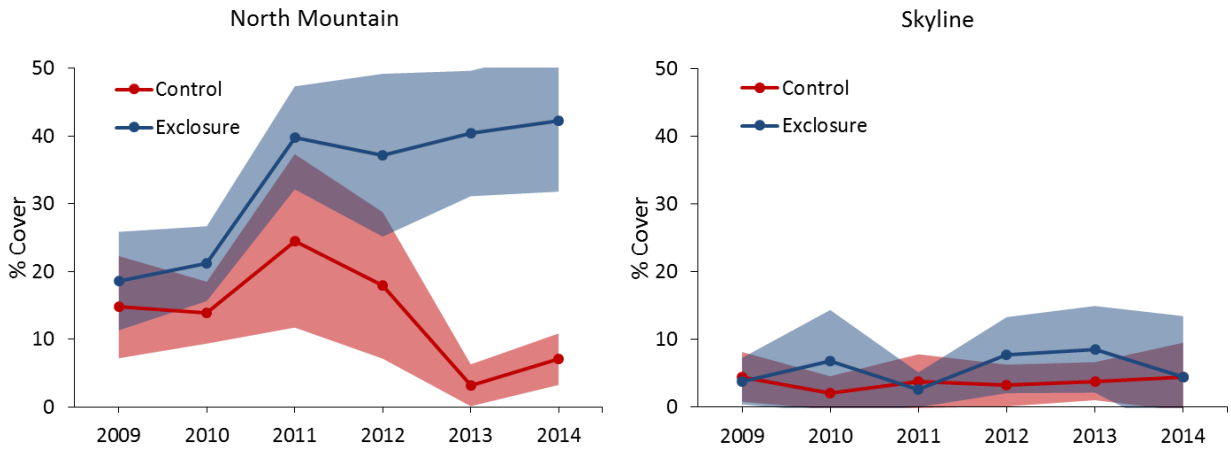

Figure 9: Percent cover in 2014 of plant species preferred by moose (balsam fir, birch, maple, serviceberry, cherry, elderberry, and mountain ash) in exclosure and control plots on North Mountain and the Skyline Trail, CBHNP. Shaded areas show 95% confidence intervals.

In 2014 a 400 m^2 area was sampled inside both the exclosure and control plots of North Mountain (CBHNP 2014d). Thirty-six trees over 2 m in height were recorded inside the North Mountain exclosure, whereas none were found outside in the control plot. Only five of these trees showed evidence of prior browsing, and all were less than 4 m in height and would have developed since the exclosure construction in 2007. There were approximately 16 000 stems/ha of saplings greater than 50 cm in height, while only 3500 stems/ha were present in the control area. This shows strong regeneration potential on North Mountain in the absence of moose (Figure 10).

Figure 10: Researcher Sean Blaney in North Mountain exclosure in 2014, with grassland from control area visible in the background. Photo by Matthew Smith.

8 Active Management of Moose Impacts

8.1 Parks Canada Policy on actively managing hyperabundant species

Moose hyperabundance and the health of the Boreal ecosystem are recognized management concerns for Cape Breton Highlands National Park. In the State of the Park Report 2010 the Boreal Succession and Boreal Connectivity measures (now named Forest Area) were classified as poor and in decline, largely due to moose impeding regeneration, and were identified as a key issue for park management (Harvey et al. 2010). The CBHNP Management Plan 2010 names an improvement in condition or trend of the Boreal Succession Index as a principal target under Key Strategy Number Three: Mosaic Landscape, with the related action to "… employ active moose density reduction measures, such as moose removal and habitat manipulation, as warranted."

Parks Canada has an established history of actively managing hyperabundant ungulate species, including elk (*Cervus canadensis*) in Banff NP and white-tailed deer (*Odocoileus virginianus*) in Point Pelee and Thousand Islands national parks. Most notably, moose have been harvested by volunteers in Gros Morne and Terra Nova national parks since 2011.

The Parks Canada Management Directive 4.4.11 includes direction for classifying wildlife as hyperabundant, evaluating management strategies, and steps to be taken before conducting active management programs. According to the Directive, a wildlife population must meet one of four criteria before being classified as hyperabundant. We find that moose in CBHNP meet all four criteria, as described below:

1. The size of the hyperabundant wildlife population must have exceeded the upper range of natural variability that is characteristic of the ecosystem, and there must be demonstrated impact on ecological integrity. In the case of naturalized species, a population may be regarded as hyperabundant if there is demonstrable evidence that its size is directly responsible for loss of ecological integrity in a park.
    - Moose densities in CBHNP exceed those found in natural predator-regulated ecosystems elsewhere in the boreal forest (Section 6), and are having long-lasting effects on the ecological integrity of the boreal ecosystem (Section 7.1).
2. Hyperabundance is as a result of alteration of the natural population regulation mechanisms.
    - Due to the extirpation of wolves from Nova Scotia by the 1920s, moose have no major natural predators in CBHNP.
3. The survival or condition of one or more native species in the park, in particular species listed under the SARA, are threatened or likely to be threatened by the hyperabundant wildlife population unless mitigation is undertaken.
    - The SARA-listed Bicknell's thrush relies on dense boreal forest regeneration for nesting habitat and is in decline in CBHNP (Section 7.2). Provincially-rare Canadian lynx and American marten also rely on the boreal forest.

4. There is clear evidence that the ecosystem is experiencing impacts outside the historical or modeled range of variation as a result of the presence of hyperabundant wildlife population.
    - The boreal forest is not following typical regeneration patterns and is being transformed into grassland, due to the moose population (Section 7.1).

At a workshop of experts and stakeholders in Baddeck on 24 September 2014 (see Appendix 2 for a list of participants), there was general consensus that moose are hyperabundant on North Mountain following the above definition. While some participants did not consider the number of moose too large, they did agree that they should be classified as hyperabundant due to the severe impact they are having on the boreal forest.

8.2 Management Rationale

As demonstrated above, the health of the boreal forest has been severely impacted and continues to decline. Although moose numbers may be declining due to loss of habitat, lower moose numbers are exerting a strong negative influence on an already-damaged ecosystem and are expected to continue to impede regeneration. Without a natural predator or active management, the boreal forest is unlikely to regenerate and will continue to be converted into grasslands. A third of the boreal forest in CBHNP that was affected by the last spruce budworm outbreak in the 1970-80s has not recovered, and more may be at risk in the event of another disturbance.

Given these factors and considering stakeholder input from workshops and information sessions (Section 8.3), active management via a 90% minimum reduction in North Mountain moose numbers is recommended to promote regeneration and restore a portion of the boreal forest. This target was selected based on results from the North Mountain exclosure, constructed in 2007 (Section 7.3), which shows successful regeneration in the absence of moose browsing pressure. Such a strong reduction is recommended for this trial project as even a few moose can have a severe impact on already degraded and stunted saplings.

8.3 Evaluation of Management Options for excluding moose from North Mountain

CBHNP considered the following list of management options previously laid out in the Hyperabundant Moose Management Plan for Gros Morne and Terra Nova national parks (GMNP 2010, TNNP 2010):

1. Natural regeneration
2. Conversion of forest to species unpalatable to moose
3. Predator (wolf) reintroduction
4. Translocation of moose
5. Confinement or exclusion of moose
6. Moose population reduction by fertility and birth control
7. Lethal reduction (harvest) of moose population
8. Driving or herding moose outside of park boundary

This list was brought to a meeting of key stakeholders and experts on 24 September 2014. Attendees represented a cross-section of varied interests, experiences, viewpoints, and knowledge bases related to moose management in northern Cape Breton (see Section 12: Appendix 2 for a list of participants).

Participants were given a brief introduction to the potential management strategies. They were then asked to select the option they considered to be the most feasible or preferred, as well as two secondary choices (Table 1). It should be noted that biological control, such as the introduction of a pathogen or parasite, was raised as a potential option but was not assessed by participants as it was generally accepted that there is inadequate research on the subject. It was also thought to be inhumane and difficult to control.

Table 1: Ranking of management options by 17 participants in Moose Hyperabundance Workshop held in Baddeck, Nova Scotia, on 24 September 2014.

North Mountain Management Option	Primary Selection	Secondary Selection
Lethal reduction	16	0
Predator (wolf) reintroduction	1	2
Confinement or exclusion	0	10
Conversion of forest to species unpalatable to moose	0	8
Translocation	0	5
Natural regeneration	0	5
Driving or herding	0	1
Fertility and birth control	0	0
Biological control	Not assessed	Not assessed

Sixteen of the seventeen participants rated lethal reduction as the most feasible or preferred option. The participant who selected predator (wolf) reintroduction later indicated that they understood it is not feasible to introduce and contain wolves to North Mountain, but that they had selected it as their preferred option in order to ensure predator reintroduction remains an option in future discussions of hyperabundance for CBHNP or the greater park ecosystem. Opportunity was provided to submit written feedback on all management options; however, due to concentration of interest, workshop discussion groups focused on lethal reduction.

The Parks Canada Management Directive 4.4.11 states that methods for managing hyperabundant wildlife should address the following considerations (Parks Canada Agency 2007):

1. Considers the biology and ecology of the species, and the impact on other species
2. Mimics a natural population mortality process for the species
3. Demonstrated to be effective in controlling populations of the same or similar species
4. Minimizes negative impact on Aboriginal peoples' experiences and uses of the park
5. Considers availability of appropriate facilities, expertise, and cost effectiveness
6. Minimizes or mitigates impact on visitor experience and other park users
7. Minimizes risks to the safety of park visitors, staff, and people involved in the hyperabundant wildlife population management program

8. Discussed with Aboriginal communities and stakeholders
9. Ensures humane treatment of individuals of a hyperabundant wildlife population in all operations involving handling of animals

Each of the proposed management options was evaluated with respect to these considerations, and a summary was produced combining literature reviews, stakeholder input, and Mi'kmaq consultation led by UINR (Table 2).

Table 2: Summary of management option assessment, evaluated according to criteria in Parks Canada's Management Directive 4.4.11.

North Mountain management options **Assessment criteria**	Natural regeneration	Conversion of forest to species unpalatable to moose	Predator (wolf) reintroduction	Translocation	Confinement or exclusion	Fertility and birth control	Lethal reduction	Driving or herding
Minimizes impact on other species	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Mimics natural population processes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Demonstrated effective	No	No	Yes	Some[b]	Some[b]	Some[b]	Yes	?
Minimizes impact on Aboriginal people[a]	No	Yes	Yes	No	Yes	No	Yes	No
Cost effective - facilities and expertise available	Yes	Some[b]	Yes	No	No	No	Yes	No
Minimizes impact on visitor experience	Yes	Yes	Yes	Yes	Yes	Yes	Yes[c]	Yes
Minimizes safety risks	Yes	Yes	Yes	Yes	Yes	Yes	Yes[c]	Yes
Supported by Aboriginal communities and stakeholders	No	Some[d]	No	No	Some[d]	No	Yes	No
Ensures humane treatment of animals	Yes	Yes	Yes	Some	Yes	Yes	Yes	Some

[a] As evaluated by representatives from UINR
[b] Fits assessment criterion more appropriately for smaller operations.
[c] Fits assessment criterion under proposed seasonal restrictions (Appendix 11.3)
[d] As identified in selection exercise (Table 1)

8.3.1 Natural regeneration

Following the spruce budworm outbreak of the 1970-80s, the forests were left to regenerate naturally. However, as outlined above, the flush of new growth as the forests regenerated led to an increase in moose numbers, which in turn led to the severe degradation we see today. Although the moose population has declined in recent years, even small numbers of moose will continue to damage the forest and prevent regeneration with the forest already impacted and suitable food becoming increasingly scarce. If regeneration were to begin naturally, it is expected that moose populations would increase again in response to new food sources, as following the budworm outbreak. If additional disturbances (e.g., wind, fire, disease) were to take place, further boreal forest may be converted to grasslands.

8.3.2 Conversion of forests to species unpalatable to moose

Spruce is not a suitable food source for moose, and one management option is to plant large areas with spruce. These trees could form the basis of a new forest or, as they mature, could act as a nurse crop to protect balsam fir seedlings planted in the understory. This was the third most preferred option by stakeholders, listed as a secondary option by almost half of workshop participants. However, it was generally agreed that it is not feasible or cost effective on a large scale, and that its effectiveness has not been proven elsewhere. Plans are currently underway to test the effectiveness of this management option on the Skyline Trail on a small scale, as an additional component of the CoRe: Bring Back the Boreal project.

8.3.3 Predator (wolf) reintroduction

Wolves were extirpated from Cape Breton Island by the early 1900s, leaving the moose with no significant natural predators in CBHNP. Reintroducing wolves is not feasible for the scope of this project, as the wolves would need to be contained to the portion of North Mountain within CBHNP. In North American boreal ecosystems where the diet is predominantly moose, wolf home ranges are at least 100 km^2 (Messier 1985). The area under consideration on North Mountain is only 20 km^2 and therefore too small to sustain a wolf pack. The long-term viability of a population in Cape Breton is also of concern, due to current lack of adjacent wolf populations for genetic transfer (Whitaker 2006). This management strategy was not supported by workshop participants, and would likely result in negative public opinion considering recent fears associated with coyotes in northern Cape Breton. However, this strategy may gain more support if considered from a park-wide or greater park ecosystem perspective.

8.3.4 Translocation of moose

While the North Mountain study area is relatively small at 20 km^2, the rugged terrain renders it inaccessible without further damage to the ecosystem. It is estimated that 30-40 moose are inhabiting North Mountain inside the park. Due to the number of moose involved, the inaccessibility of the terrain, potential stress caused to the animals, and current lack of suitable release site, translocation is not considered feasible at this time. This management option received some support from a few stakeholders, who saw the potential for translocated moose to be harvested elsewhere. However, it was not supported by the majority of stakeholders.

8.3.5 Confinement or exclusion of moose

This management strategy was the second most preferred option by workshop participants. Fence construction is currently underway to exclude five hectares along the Skyline Trail. A similar fence on

North Mountain would not be economically feasible at this time under the CoRe project, as the area under consideration is 400 times this size and would cover uneven terrain. Large snowfalls have caused damage to the current 30 m x 30 m exclosure on North Mountain, and the cost of maintaining a larger fence would be prohibitive. There would also be design issues, as the Cabot Trail passes through the study area.

8.3.6 Moose population reduction by fertility and birth control

Methods to control ungulate fertility include surgical sterilization, immunocontraceptives (vaccines), or oral or injected hormones (Patton et al. 2007). Surgical sterilization is invasive, expensive, and has potential to cause stress to the animal. Many hormonal methods or immunocontraceptives are only effective for short periods of time, and require a regular application schedule which is difficult to achieve in wild populations. The expense of the vaccinations and recapturing of animals would be prohibitive, and there may be negative consequences associated with the introduction of hormones or chemicals into the ecosystem. Most research regarding the effectiveness of ungulate population reduction via fertility control has focused on white-tailed deer. Several models have shown that fertility reduction may be effective, but only on longer timescales than the four-year scope of this project and with high treatment rates (Hobbs et al. 2000; Merrill et al. 2003). Also, models have had upper reduction targets of 60%, whereas the target for the North Mountain area is a 90% population reduction. This option was ranked the lowest by stakeholders, with no participants selecting it as a feasible option.

8.3.7 Lethal reduction (harvest) of moose population

Lethal reduction via harvesting was selected as the most preferred management option by all but one participant, and was the main topic of discussion. A summary of input from workshop participants regarding the lethal reduction option with respect to the nine considerations outlined in the Parks Canada Directive 4.4.11 is as follows:

1. Considers the biology and ecology of the species, and the impact on other species
    - Must use low impact removal methods to minimize damage to ecosystem
    - Use of non-lead ammunition to minimize environmental contamination
2. Mimics a natural population mortality process for the species
    - Harvesters will assume the role of predators
3. Demonstrated to be effective in controlling populations of the same or similar species
    - Regenerating forest inside current North Mountain exclosure shows that removal of moose is effective
    - Forest health is declining outside of the park, where seasonal hunting is permitted; however, a greater proportion of moose will be removed from inside the park
    - Concern regarding viability of maintaining target reductions over the long-term, but assumed effective for four year scope of project
    - Study opportunity to inform on-going stakeholder discussions and long-term management plan for North Mountain and rest of CBHNP
4. Minimizes negative impact on Aboriginal peoples' experiences and uses of the park
    - Positive experience and opportunity for Nova Scotia Mi'kmaq communities

5. Considers availability of appropriate facilities, expertise, and cost effectiveness
    - Cost effective
6. Minimizes or mitigates impact on visitor experience and other park users
    - Harvest should be conducted in the late fall to early winter, when fewer visitors are in the area
7. Minimizes risks to the safety of park visitors, staff, and people involved in the hyperabundant wildlife population management program
    - Appropriate hunter safety protocols should be followed
    - Hunters should be experienced
    - Harvest should be conducted in the winter, to minimize safety risks to visitors
8. Discussed with Aboriginal communities and stakeholders
    - Considered most preferred option by all but one workshop participant
9. Ensures humane treatment of individuals of a hyperabundant wildlife population in all operations involving handling of animals
    - Hunters should be experienced and proficient

The area of greatest concern was the potential impact on surrounding communities, specifically the economic impacts on moose hunting guides who work in the Polletts Cove – Aspy Fault Provincial Wilderness Area, which includes the area outside of the park on North Mountain. It is inevitable that some moose would be harvested from inside the park which have home ranges that include part of the wilderness area outside CBHNP; however, there are also some moose that utilize park habitat which would be outside the park boundary at the time of a harvest.

Stakeholders were concerned that there would be infilling of moose from provincial hunting zones into the unoccupied habitat on North Mountain. While significant numbers of moose are not expected to move from outside areas into the North Mountain treatment area, moose dynamics on North Mountain following the harvest would be monitored (Section 8.4) in order to continuously assess the project and inform future management decisions. It was agreed by all parties that communication channels between Parks Canada and stakeholders must be kept open and ongoing discussion and assessment required as the project unfolds.

8.3.8 Driving or herding moose outside park boundary

This was presented as an additional management strategy in moose management consultations for Gros Morne National Park, where it was raised as a traditional process by Miawpukek First Nation (GMNP 2010). Workshop participants had some ideas regarding how the moose might be deterred from the area, such as the use of dogs or helicopters; however, it was not considered feasible or practical and some options may be considered harassment of wildlife and would not meet animal care expectations.

8.4 Proposed active management option for North Mountain

After considering the above feedback from stakeholders regarding active management options, CBHNP is proposing lethal reduction via harvesting in the 20 km^2 North Mountain area. The intent is to conduct harvest operations so as not to cause unreasonable adverse impacts on adjacent provincial lands. Impacts

to these areas will be monitored and harvest operations assessed and modified as necessary, using a comprehensive approach and involving key stakeholders.

The operational plan for the proposed removal, including seasons, targets, and selection of harvesters, is included in Appendix 1 (Section 11). The removal will be conducted as a harvest by the Mi'kmaq of Nova Scotia, directed by the Unama'ki Institute of Natural Resources. This follows the National Parks Interim Arrangement, which was signed in 2012 and offers the Mi'kmaq of Nova Scotia first access to overabundant wildlife harvesting within national parks in Nova Scotia. This is also in line with the Key Strategy Number Four from the Park Management Plan: Mi'kmaq Collaborative Management – Moose and Beyond (Parks Canada Agency 2010). An environmental assessment will be conducted before approval of this HMMP and initiation of active management activities.

This proposal was presented to the public at meetings in Cape North, Wagmatcook, and Pleasant Bay on 5-7 November 2014. Cape North and Pleasant Bay were selected as they are located adjacent to North Mountain and most of the licensed moose hunting guides operate near these areas. A session for Mi'kmaq communities was held in Wagmatcook.

From these meetings, a strong message was received that residents would like greater access to local moose harvesting and be considered in further plans to reduce the moose population in CBHNP. They would like to see a benefit of the harvest to the local community, whether through involvement in the harvest or distribution of meat, and were concerned regarding the potential negative impacts on the provincial moose hunting zone adjacent to CBHNP on North Mountain.

8.5 Monitoring effectiveness

The project will follow an adaptive management approach, with the effectiveness and impacts assessed each year and strategies adapted accordingly. Population surveys will be conducted in late winter of each year, to ensure that the population has been effectively reduced on North Mountain. Deer are not expected to have a significant presence in the area, but will be recorded if present during these surveys to determine if ungulate browsing is indeed attributable to moose. The overall effectiveness will be determined through vegetation monitoring. The transect surveys described above (Section 7.1) and a series of grid points first measured in 2014 (CBHNP 2014a) will be revisited each spring. In both these surveys, the percentage of twigs from the previous year's growth that have been browsed over the winter months is recorded. The harvest will be considered effective if this percentage shows a significant decrease from the 2014 baseline data.

8.6 Monitoring the effects on moose populations outside CBHNP

Ongoing monitoring of the harvest and effects on moose populations outside the park was of utmost importance to stakeholders and community members. Workshop participants identified the need to monitor population dynamics on North Mountain by recording information about the harvested animals, such as sex ratios and health. These data will be collected as part of the regular harvest operations (Section 11.10).

A key topic of concern is depletion of moose from hunted areas adjacent to CBHNP and whether or not moose from these areas will move into the park if the moose population is significantly reduced in the North Mountain area. Typical moose movement behaviour can be expected to result in some moose moving into the treatment area post-harvest. However, a review of the literature and other available information, summarized below, does not suggest this should be a significant issue for the project. A study of moose movements in spruce budworm-affected areas in Quebec indicated that intense harvesting does not affect daily moose movement or home range size (Laurian et al. 2000). Another study of moose movement in relation to regeneration following a large burn in Alaska found that moose whose pre-fire home ranges included the burn area may be more likely to utilize the burn area (Gasaway et al. 1989). However, moose with no pre-fire contact did not use the burn area, despite having home ranges in close proximity, an average of 2.3 km away. It is possible that greater dispersal may occur if the surrounding area has higher moose densities than those in Gasaway's study, but it has been suggested that areas with low moose populations must recover via reproduction rather than immigration, as dispersal has limited effect on adjacent population densities (Hundertmark 1997).

The preliminary results of a four-year radiotelemetry study in the early 2000s conducted inside and outside Cape Breton Highlands National Park (Quann pers. comm.) suggested that the moose ranges appear to be comparable in size to those reported elsewhere in the literature. Also, no evidence was found to suggest a tendency for moose to move or shift their ranges from high to low density areas, which is also compatible with findings elsewhere.

Although the literature described above suggests that infilling of moose to the North Mountain area should be limited, the relatively small study area as well as variability in moose home ranges and dispersal patterns makes moose movements difficult to predict. Some depletion in moose densities in areas adjacent to CBHNP may occur as a result of the proposed lethal reduction. However, this is not expected to be significant or persistent since, as is the case for infilling, increased recruitment may compensate for the loss.

Concerns have been raised regarding potential infilling of moose into the treatment area from the Polletts Cove – Aspy Fault Provincial Wilderness Area, as well as the elimination of an important movement corridor feeding through the treatment area towards the lands north of CBHNP. To address these concerns, a monitoring plan will be developed in conjunction with key stakeholders in order to understand the impact of the harvest on the surrounding area and inform discussions related to future harvest adjustments. The densities of moose inside and outside the park on North Mountain will continue to be monitored via annual aerial survey (CBHNP 2014b), land-based winter surveys will also be developed to document post-harvest moose movement to and from the study area. In addition, this monitoring program will incorporate hunter information reported to Nova Scotia Department of Natural Resources from the nearby provincial hunting zones, as well as any other available and relevant information.

9 Consultation, Communications, and Visitor Experience

9.1 Consultation

A workshop of experts and key stakeholders was held in Baddeck, NS, on 24 September 2014, to discuss the issue of hyperabundance and potential active management options (Section 8). This same group, along with interested members of the public, will be given the opportunity to comment and provide feedback on this HMMP. Public sessions were also held in Cape North and Pleasant Bay on 5 and 7 November 2014, with a session for Mi'kmaq communities in Wagmatcook on 6 November. Feedback from these sessions has helped inform and shape this HMMP and proposed harvest plans.

9.1.1 Aboriginal consultation

Formal Aboriginal Consultation for the larger Bring Back the Boreal project was initiated in December 2013, according to the processes established between Parks Canada and the Mi'kmaq of Nova Scotia. The Mi'kmaq have expressed strong support for the project and an interest to collaborate with Parks Canada on the design and implementation of active management measures. Formal Consultation is ongoing as the project evolves.

As a result of subsequent discussions, an ongoing dialogue and close involvement with the Unama'ki Institute of Natural Resources (UINR) has ensued and continues to be pursued. The development and content of this HMMP and the operational protocol (Appendix A) are a direct result of this consultation and collaboration process.

9.2 Communications and Public Education

A communications and consultation plan has been developed that outlines how Parks Canada will communicate forest health issues to local communities, stakeholders, partners, visitors, and Canadians, particularly those living in large urban areas. The aim is to share the story of restoration and regeneration in order to connect or re-connect Canadians with these special places in a meaningful way, and to foster a culture of stewardship.

9.2.1 Communication goals

Parks Canada will consult and communicate with stakeholders and the public on its Hyperabundant Moose Management Plan for North Mountain by:

- Sharing information with the public about conservation and restoration planning for CBHNP;
- Answering questions the public may have about the Conservation and Restoration (CoRe) Project;
- Gathering feedback and input from the community on the CBHNP CoRe Project;
- Profiling Parks Canada's role in protecting and maintaining the integrity of Canada's heritage resources and how conservation and restoration can be used to protect history;
- Raising conservation and restoration awareness;
- Highlighting Parks Canada's commitment to conservation and restoration;
- Informing the public about conservation and restoration activities and the role and practice of forest health;
- Demonstrating Parks Canada's partnership with the Unama'ki Institute of Natural Resources;

- Promoting opportunities for communities to be involved in the project (e.g. developing monitoring plan, local moose hunting guides assisting with moose transport);
- Creating understanding and support for conservation and restoration as a management tool to restore species and ecosystems and protect cultural resources;
- Providing consistent messaging to the public, stakeholders, and visitors.

9.2.2 Key messages

- As a world leader in natural area protection, conservation, and restoration, Parks Canada has a proven track record of effective ecological management. Population reduction is not a new approach, but is reserved for situations of absolute necessity. It has been successfully implemented in other national parks in Canada.
- The health of the forests in Cape Breton Highlands National Park is failing. Unless we take assertive actions now to address the restoration of forests and hyperabundant moose populations, we could lose the diversity of the forest ecosystem.
- Parks Canada is committed to improving the health of Canada's national parks. The goal of this initiative is to improve forest health. Parks Canada will monitor how well the forests are recovering and make adjustments where appropriate.
- Consultations and information sessions with the public, stakeholders, partners, and the Mi'kmaq of Nova Scotia, are an important part of the conservation and restoration process as Parks Canada begins to restore the natural regeneration of native forests in Cape Breton Highlands National Park.
- Parks Canada is partnering with the Mi'kmaq of Nova Scotia, Unama'ki Institute of Natural Resources, and Nova Scotia Department of Natural Resources to improve forest health in Cape Breton Highlands National Park through the conservation and restoration project.

9.2.3 Considerations

9.2.3.1 Public environment

Moose management is a topic of great interest in nearby communities, where residents deal with moose presence on a daily basis. Many community members are involved in hunting and several earn their livelihoods as guides and outfitters. The Polletts Cove – Aspy Fault Wilderness Area borders the study area on North Mountain. The provincial hunt in this wilderness area became non-motorized in 2012, causing much concern among surrounding communities. Local tensions also exist with regards to the management of the provincial moose hunt in northern Cape Breton, with the perception that the number of moose licenses is too low and the frustration with the lack of licenses allocated to local residents. There are also issues around associated community benefits and direct community impacts. Great local interest and media attention are expected for the duration of this project. Stakeholder engagement sessions and public information sessions are extremely important in developing and gaining support and understanding for the proposed active management method.

9.2.3.2 Moose as a positive presence

Moose are highly valued, whether by visitors to the park whose goal is to spot a moose on their hike or local hunters and guides who rely on them for their livelihoods. In educating about the damage caused by

moose, it is easy to focus on the negative aspects of moose presence. It is important to communicate that moose are a critical component of the greater park ecosystem and that CBHNP is committed to ensuring a healthy and viable moose population.

9.2.3.3 Focus on regeneration

Media and the public often ask about the ideal number of moose. It is easy to focus on a target density and a target reduction of 90% of moose numbers has been set; however, the key target is a regenerating forest, and care should be taken to reflect this in all communication. Even a small number of moose may have an overly damaging effect on forest regeneration. The 90% reduction of moose numbers has been set as a preliminary goal as a means of achieving forest regeneration, and moose density will be measured to determine that any observed change in vegetation health is attributable to the proposed active management. Vegetation will be closely monitored and target densities adjusted as necessary to achieve forest recovery. The anticipated forest regeneration will restore habitat for the SARA-listed Bicknell's thrush and other important species such as Canada lynx and American pine marten.

9.2.3.4 Small-scale experiment vs. long-term moose management

The perception may exist that Parks Canada sees the project's intensive moose removal treatment on North Mountain as desirable on a larger scale and over the long-term. It is important to communicate that this project component should be understood as a small-scale experiment rather than part of a long-term moose management strategy. The experimental treatment target of a 90% reduction in moose numbers on North Mountain was established to achieve a measurable vegetation response over a short period, and resulting moose densities will be much lower than those found in a healthy ecosystem. Although the results from this trial period will inform future management decisions, Parks Canada is not proposing a sustained 90% moose reduction beyond the project treatment area.

9.2.3.5 Harvest benefits

The key anticipated benefit of this initiative is to achieve vegetation regeneration. UINR and other project stakeholders share this objective, and are working with CBHNP to help further this goal through a harvest. While additional benefits may be experienced by project partners and communities, these are considered secondary and the intent remains focused on vegetation response.

9.3 Visitor Experience

The effect on visitor experience was identified as a concern at a meeting of stakeholders and experts (Section 8.3.7). The harvest will take place each year in the late fall or early winter, when park facilities are closed and fewer visitors are in the area. It should be noted that there are no visitor facilities on North Mountain, and no visitor use patterns in the area have been identified, with the exception of the Cabot Trail passing through the study area. Public information bulletins will be posted in neighbouring communities and park facilities to inform local residents and visitors about the issue, including the dates of the harvest and relevant safety precautions.

Visitor experience and public education opportunities will be developed in collaboration with UINR and other partners, incorporating feedback from the public.

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11 Appendix 1: Operational Protocol for the Mi'kmaq Harvest on North Mountain, Cape Breton Highlands National Park for 2015

This operational protocol has been developed by UINR and Parks Canada, outlining guidelines for the harvest on North Mountain in accordance with established harvesting practices and minimizing risks to public safety. This is a preliminary protocol, pertaining to the CoRe: Bring Back the Boreal project. Detailed operational protocols will be developed before each harvest season, to be considered and approved by project partners.

The harvest, including selection and oversight of harvesters and guides, will be led by UINR. Parks Canada staff will manage logistics, administration, and documentation of the harvest, as well as cover operational expenses. Parks Canada Law Enforcement Branch will be involved in planning and implementing portions of the detailed operational protocol, including enforcement of any area closures and monitoring participant permits and harvest activities.

11.1 Harvesters

All harvesting will be conducted by Mi'kmaq hunters. Harvesters will be carefully selected by UINR, based on skill and demonstration of leadership. They will be role model harvesters, with a strong track record of safety. Harvesters must have taken a Canadian Firearms Safety Course and have a valid Possession and Acquisition License (PAL). They must meet the requirements to hunt moose within Nova Scotia, although they will not be required to carry a Nova Scotia Wildlife Resources Card. They will also not be required to take an Atlantic Provinces Hunter Education course, as all harvesters selected will be proven, experienced hunters.

The harvesters will receive individual authorizations from the CBHNP Superintendent, allowing them to harvest moose in the North Mountain study area (Figure 2) and transport firearms within CBHNP, under Section 15(1) of the National Parks Wildlife Regulations and subject to a series of conditions.

Harvesters will be selected from Unama'ki (Cape Breton) and from Mainland Nova Scotia, with two thirds selected from Unama'ki. The harvesters will be monitored by UINR Moose Management Coordinator Clifford Paul to ensure compliance with operational protocols, terms, and conditions, with additional support by Parks Canada staff.

11.1.1 Participant Conduct

Harvesters must be on best behaviour, and absolutely no alcohol, drugs, or prescription medication (unless prescribed) will be tolerated during the harvest or associated stay in the area.

Participants must not take any photos of the harvest, nor are they permitted to post photos or any information of the same on social media sites.

No garbage or litter will be left behind in the proposed harvest area.

11.2 Animal Care Review and Recommendations

The removal will be carried out using methods that are humane, culturally and socially acceptable, and consistent with appropriate wildlife management practices. The harvest operational plan has been

reviewed by the Parks Canada Animal Care Committee, and the harvest will adhere to the following Animal Care recommendations in order to minimize undue stress and harm to animals:

- Targeting moving animals is strongly discouraged, and only stationary animals should be harvested, either standing or recumbent
- Only rifled shotgun slugs or rifles of .270 calibre or greater will be used
- Rifles must be adequately sighted prior to arrival on-site
- Only animals within 150 m may be harvested if a rifle is used, or within 50 m for shotgun usage, to ensure accurate shot placement
- The thoracic cavity (heart and lungs) will be targeted
    - As only skilled harvesters will be selected to participate, the neck may also be targeted
    - For neck shots, the same 50 m maximum shooting distance for shotgun usage applies, but the maximum distance for rifle usage is lowered to 100 m
- Non-lead ammunition will be used, in order to avoid the introduction of toxic substances into the surrounding environment and the meat

11.3 Season

Harvesting is only permitted between August 15 and December 31 according to Mi'kmaq moose harvesting guidelines (UINR 2009). Harvesting will not take place during the CBHNP visitor season, which is from mid-May to mid-October. In line with these restrictions, harvesting will only occur between the end of the visitor season and December 31, with specific harvest periods identified in a detailed harvest plan to be drafted in each year of harvest operations. Where possible, harvest periods will be scheduled to minimize overlap with the provincial hunt in the neighbouring Polletts Cove – Aspy Fault Provincial Wilderness Area. Harvesting will only occur between one half-hour before sunrise and one-half hour after sunset each day.

11.4 Closure of Park Facilities

No public hiking trails exist in the park on North Mountain and low numbers of visitors are expected to drive along the Cabot Trail through North Mountain. In order to promote safety and an efficient harvest within a small seasonal window, a CBHNP Superintendent's order will be given to prohibit stopping along the roadside, to be enforced by Parks Canada Law Enforcement Officers. An additional order under Section 36 of the National Park General Regulations will be given to close off-road access in the vicinity of the harvest area.

The park roadside emergency shelter located on North Mountain will remain open. The following infrastructure currently exists on North Mountain, and all parties will be informed about the dates and duration of the harvest, so any maintenance schedules can be adjusted:

- Environment Canada weather station
- Bell Aliant and CBHNP radio/cell tower
- Seismic station, operated by the Geological Survey of Canada
- St. Francis Xavier University scientific equipment

11.5 Notification of harvesting operations to staff and public

CBHNP staff and the public will be notified of the duration and extent of harvesting operations via the following means:

- Email to park staff
- Media release to local newspapers and radio stations
- Posters in surrounding communities
- Signage along Cabot Trail outside harvest area
- Posting on CBHNP website and Facebook page

Advance notice of the harvest dates, duration, and regulations will be provided to Nova Scotia Department of Natural Resources (NS DNR), Nova Scotia Department of the Environment, and the RCMP.

11.6 Harvest Targets and Strategy

The goal of the proposed harvest is to remove a minimum of 90% of moose from the study area on North Mountain. This reduction will ideally occur in the first year, with density maintenance in the remaining years of the CoRe project. The first season will focus on the most accessible areas near the Cabot Trail and service road (Figure 2), with the potential for expansion into the more remote southern areas if weather and harvest success permit.

11.7 Field Operations

A schedule of harvesting periods will be established by UINR. Four harvesters will be scheduled at a time. A list of harvesters and the detailed schedule will be provided to Parks Canada, as well as the names of back-up harvesters who may be called in, with notice, should a selected harvester not be available.

Safety is of utmost concern, and no more than 4-5 harvesters will be active within the proposed 20 km^2 area at any given time. For each harvest period, the four harvesters will be divided into two groups of two, to be assigned to coordinating areas on a daily basis. It is anticipated that some harvesters may require transportation to the far reaches of the proposed site in order to cover and define escape routes.

Harvesters will be brought together for a briefing in the weeks leading up to the harvest. Further briefings will be conducted with the arrival of each harvester group and at the beginning of each operational period. Harvesters will be in radio contact with a UINR harvest coordinator and CBHNP representative while in the field. Blaze orange clothing will be worn by harvesters at all times in the field, and all standard safety equipment will be carried by the harvesters, including but not limited to a first aid kit, compass, and whistle.

A temporary base camp will be established near the seismic station along the Old Cabot Trail on North Mountain (Figure 2), providing food, shelter, and a warm, inviting atmosphere. A first aid station will also be present at the base camp, with a first aid kit, wheeled stretcher, etc. Firearms will be transported and stored safely according to Federal regulations, and all applicable Provincial General Regulations will be followed (NS DNR 2015). Firearms will not be discharged within 30 m or across the Cabot Trail. If harvesters are operating within 500 m of the Cabot Trail, designated participants will inform them via radio when a vehicle is passing through the area.

Moose will be harvested in a humane manner, following the Mi'kmaq moose harvesting guidelines (UINR 2009) and Animal Care Recommendations (Section 11.2). The harvest is non-motorized, unless there is sufficient snow cover to allow the use of snowmobiles without damage to the local vegetation. A helicopter may also be required to access more remote areas or to spot remaining moose once densities have been reduced, but would only be used for transportation of participants and meat. No following or herding of moose using snowmobiles or helicopters is permitted. All harvesters are required to use non-lead (copper) ammunition.

Animals wounded but not killed should be retrieved immediately. In the case of a wounded animal, Parks Canada staff must be contacted immediately to help in retrieval and provide additional resources as required.

11.8 Cleaning and transport of harvested animals

Moose will be cleaned at the harvest location. All parts of the moose must be removed from the harvest site, with nothing left behind except the entrails. Tags will be provided to identify the animal harvested and track it during transportation and storage.

The harvesters will be assisted in transporting moose by local guides, selected by UINR representatives. Mi'kmaq harvesters and the selected local guides will work closely together on this project. Both groups are expected to share the best of their capacities to ensure a safe and respectful harvest. All harvesters and guides will be provided with paperwork to show they are permitted to possess and transport moose meat in CBHNP.

Only low-impact methods will be employed for removing moose, and may include:

- Hand cart
- Packs
- Horses
- Sled
- Snowmobile (if sufficient snow cover exists, and with appropriate permit)
- Helicopter (for more remote sites and with appropriate authorization)

Harvested moose will be considered the property of the harvesters, to be distributed according to the guidelines below. Parks Canada employees will not participate in any part of the harvest or transport, and all liability issues regarding meat contamination are the responsibility of the harvesters and transporters.

11.9 Meat Distribution

Harvesters will have the option of taking the meat to a butcher of their choice and distributing the meat to their community. They will also have the option to donate the meat to Feed Nova Scotia, to be distributed to Nova Scotian families in need through the Hunters Helping the Hungry program. The participating butcher in Cape Breton for this program is Bonnar's Meats in North Sydney, who require the moose to be skinned and quartered.

11.10 Data Collection

Harvesters will collect the following information from each harvested animal, to be provided to Parks Canada:

- Date, time, and GPS location of harvest
- Sex and age of harvested animal
- Jawbone, for ageing
- Femur, for body condition analysis
- Hair and blood samples
- Pregnancy (including twin rate) status of adult cows
- Description of pre-existing injuries or parasites in harvested animals
- Effectiveness of harvest (number of shots taken, description of stress to animal)
- Tag identifier number
- Date, time, and method of removal from location

Additional samples may be taken as directed by Parks Canada staff, to be provided to the Atlantic Veterinary College in order to assess the health of the North Mountain moose population.

12 Appendix 2: List of Participants in Workshop on Moose Hyperabundance in Cape Breton Highlands National Park, held in Baddeck, NS on 24 September 2014

Organization	Participant
Registered Guides Operating in Polletts Cove - Aspy Fault Provincial Wilderness Area	Philip Groom
	Hector Hines
	Franklin MacIntosh
	Travis MacIntosh
	Floyd McKinnon
Nova Scotia Department of the Environment (Protected Areas)	David Williams
Nova Scotia Department of Natural Resources (Aboriginal Policy)	Tom Soehl
Nova Scotia Department of Natural Resources (Forestry)	Peter Neily
Nova Scotia Department of Natural Resources (Wildlife)	Don Anderson
	Peter MacDonald
	Emma Vost
Nova Scotia Federation of Anglers and Hunters	Michael Pollard
Unama'ki Institute of Natural Resources	Charlie Dennis
	Annie Johnson
	Ernest Johnston
	Clifford Paul

Regrets:

Canadian Parks and Wilderness Society*	Chris Miller
Ecology Action Centre*	Raymond Plourde
Guides Operating in Polletts Cove - Aspy Fault Provincial Wilderness Area	Mark Timmons
Les Amis du Plein Air	Brian Roach

*Was provided workshop summary and had individual discussion