Moose Mountain Provincial Park

ECOSYSTEM-BASED MANAGEMENT PLAN

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Prepared for:

Saskatchewan Ministry of Parks, Culture and Sport
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FORSITE
Forest Management Specialists

Approval Form

The Ecosystem-based Management Plan for Moose Mountain Provincial Park (2021) is hereby approved for use by the Ministry of Parks, Culture and Sport in the management of the ecosystem and landscape of Moose Mountain Park.

November 5, 2021

Darryl Sande, RPF, Plan Author — Date

FORSITE Inc.

Recommended for approval by:

Thuan Chu, Senior Park Landscape Ecologist — Date
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EXECUTIVE SUMMARY

Moose Mountain Provincial Park (MMPP) is a 400 square kilometre Natural Environment Park (*The Parks Act*) within the southeastern corner of Saskatchewan. The park encompasses unique geological features and elevation in contrast to the surrounding area. The area primarily contains Aspen Parkland forest elements as well as Prairie grassland elements. The area is surrounded by agricultural, First Nation, and pasture lands.

The park is made up of a mix of natural deciduous forests, wetlands, and grasslands, which is classified into six ecosites. Upland ecosites include grasslands with or without shrub cover and trembling aspen on fresh silty clay. Mesic sites include balsam poplar, trembling aspen, and green ash on very moist silty clay loam. The mesic to hydric ecosites are rich fens with varying amounts of shrub, graminoid or tree cover on very moist clay.

The park supports a rich amount of biodiversity with many species endemic or rare to the area. Biodiversity includes 314 vascular plants, 181 breeding birds, 61 mammals, eight amphibians, and five reptiles. Habitat for the diversity of animal species depends on the diversity of vegetation types and age classes. The park landscape is shaped by both natural and anthropogenic disturbances. Historically, the natural disturbance regime was dominated by wildfire, however fire suppression has limited this disturbance and there have been minimal large fires since the last landscape-level wildfire of 1897. Today, 68 percent of the forests of MMPP are classified as mature, old, or very old.

The human history includes First Nation use and European settlement. The area is also of historical and cultural significance with the fur trade and for Indigenous populations. Recreation became the dominant land use with the creation of the park in 1931. The footprint of development in MMPP is eight percent of the total area, but largely concentrated within the core area. The core area boasts a variety of recreational activities while the remainder of the park is relatively primitive and un-developed, except for oil and gas developments. The park contains over 420 campsites, over 453 cottages, private businesses, and over 410 kilometres of roads and trails. The park is also used for hunting, ATV and snowmobile riding, sport fishing, and livestock grazing.

This ecosystem-based management plan provides strategic directions for the maintenance, protection and restoration of natural landscape, ecosystem, and species diversity of MMPP. This, in turn, enhances visitor experience as well as public appreciation and understanding. Within the plan, areas of concern are given context, management goals and objectives are identified, and corresponding recommendations are provided. The management plan is designed to provide a long term and comprehensive framework to guide both park operations and park services in using natural resources in a sustainable manner. The plan identified two main ecosystem-based management goals:

- Goal 1 - Maintain a safe outdoor environment while enhancing aesthetic, educational, recreational, and interpretive opportunities within the park
- Goal 2 - Restore natural disturbances while maintaining the natural landscape, ecosystem, and species diversity of MMPP

High priority recommendations include:

- Conduct inventory and reclaim abandoned oil and gas developments and associated access roads
- Manage active well sites, pipelines, and surrounding areas for invasive plants, topsoil properties, erosion control, and environmental concerns
- Annual survey and control of invasive plant species, and ensure the inclusion of recreational trails and non-core areas in exotic plant inventory, treatment, and management
- Develop a vegetation management plan for the core park areas and continue to manage risk trees in the core park areas

- Allow natural succession of forests with multiple cohorts of trembling aspen, green ash, and balsam poplar in the park while increasing the area of young forest by 15 percent in the non-core areas through renewing patches of old to very old forests where there is low natural regeneration, shrubby cover, and stem breakdown
- Develop effective evacuation plan in the event of an urban-wildland fire
- Implement fuel treatments for wildfire threat reduction (e.g., fuel modifications, mechanical thinning, prescribed fire, or other FireSmart treatments)
- Treat non-invasive insects and diseases as part of natural disturbance regime while timely monitoring and implementing treatments for invasive insects and diseases (e.g., emerald ash borer)
- Maintain range and grazed land health assessment every five to 10 years
- Develop grazing management plan and manage gazing in alignment with the plan recommendations
- Conduct inventories and maintain accurate information on rare and endangered species occurrences within the park
- Conduct more research and monitor hydrological processes, beaver-hydrology relationships, and beaver control activities within the park
- Enter or maintain current relationships with First Nations and Métis communities, NGOs, stakeholders, industry, or other government agencies to conduct projects related to the park's ecosystems

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1 PURPOSE, APPROACH, AND PROCESS

1.1 PURPOSE OF PLAN

The purpose of this plan is to provide a foundation for ecosystem-based management of Moose Mountain Provincial Park (MMPP), in accordance with current standards and policies and the guideline of ecosystem-based management plans provided by Parks Division. This plan is intended to address issues related to management of the park's terrestrial ecosystems. The emphasis of the plan is on the general directions for ecosystem management, rather than on day-to-day operational issues. It is expected that the ecosystem-based management plan will provide a building block for revision of the overall Park Management Strategy.

The rationale for developing ecosystem-based management of MMPP is as follows:

- Ecosystems are the natural units for management in MMPP (e.g., forest stand, grassland patch, wetland, streams, lake zone, etc.). Ecosystem-based management approach will analyze and consider the full array of interactions within and among ecosystems, including human., rather than looking at single issues, species, or an ecosystem service in isolation.
- Threats posed by human activities are many: alterations to fire regimes, introduction of non-native or invasive plants, insects, and diseases, climate change, linear features, oil and gas exploration, mechanical disturbance in the core area, ATV use, grazing, etc.
- Management actions are needed to mitigate/relieve these threats and to maintain natural landscape, vegetation biodiversity, and ecological processes. These actions include forest harvesting, prescribed burns, grazing in grasslands, reclamation of abandoned oil and gas features, management of non-native or invasive plants, risk tree management and tree regeneration in the core area and treatment areas, etc.
- Planning is required to give context to threats to the park ecosystems, and our responses to those threats. Contexts to be addressed include social, economic, ecological, and landscape.

1.2 PLANNING APPROACH

Ecosystem-based management has become the dominant paradigm for protected areas in North America. Saskatchewan Environment summarized this paradigm in a set of principles for their operations (Government of Saskatchewan, 1999):

- Focus on the large spatial and long temporal scales.
- Concentrate on ecosystem health and integrity.
- Make decisions based on science-based and traditional knowledge and human values.
- Involve those who will be affected by decisions, or who have an interest in the outcome.
- Use adaptive management by learning from experience.
- Look at the big picture.
- Base planning units on natural boundaries when appropriate.
- Design with nature.

Ecosystem-based management differs from traditional resource management in several ways. It is based on the ecosystem concept, in which ecosystems are viewed as open, evolving, complex systems with dynamic interactions between system components – including human, ecosystem features and ecological processes. An integral part of

ecosystem-based management is that the human system is viewed as part of the ecosystem. Land managers are expected to consider the whole interconnected system, not just individual species, resources, or issues. They must take the long-term view (recognize that ecosystems are constantly changing) and the landscape view (recognize that ecosystems interact with their surroundings).

In addition to the shift in understanding, there is a shift in values. One of the ecosystem-based management plan goals is maintaining ecosystem integrity. This includes conserving the biodiversity of the area under consideration, including genetic diversity, species diversity, and ecosystem/landscape diversity. These comprise the "natural capital" of the area, which is valued alongside the human-created capital such as campsites and roads. Uses and management must meet the test of sustainability, meaning that they cannot reduce the opportunities of future generations. Development which leads to a permanent reduction in natural capital (e.g., eliminating some components of biodiversity, or degrading soil and water systems) would fail this test. Ecosystem-based management is knowledge-intensive, integrated, and holistic science. Ecological inventory and research should be conducted to provide more understanding of the ecosystems being managed and thus propose appropriate management recommendations. . Plans are subject to revision as understanding improves.

1.3 PLANNING PROCESS

This plan was based mainly on a review and analysis of existing information. The project team initially met with Parks Operations staff and Parks Landscape Protection Unit staff at MMPP to discuss issues and information sources. Parks Operations provided records from previous work on vegetation management and other issues at MMPP. The project team worked through the available information, bringing in scientific literature as appropriate, and consulting with Parks Division staff on specific issues. Public consultation, in the form of a survey aided in gathering relevant concerns from stakeholders. Duty to Consult (DTC) and public engagement processes will also be implemented to achieve comments and feedback before the approval of the plan.

2 KEY ISSUES AND PRIORITIES

2.1 KEY BIODIVERSITY ISSUES

2.1.1 RESTORATION OF A MORE NATURAL DISTURBANCE REGIME TO PARK ECOSYSTEMS

To support a wide range of biodiversity within MMPP, significant areas of forest in various age classes, as well as wetlands must be maintained. Historical natural disturbances and the current stand age distribution show that most of the park's forests are at the mature to over-mature stage (see Section 3.5.4). Minimal renewal has occurred since the last major natural disturbance of a landscape-level fire in 1897. This is the result of forest fire suppression and an absence of forest harvesting. The renewal of some of the mature forest within the park through harvesting is preferred, while the renewal of grasslands through managed grazing or prescribed fire is preferred to best replicate grassland natural disturbances. The retention and protection of limited mature forest areas is also important as they contain critical biodiversity value. This value is further described in Section 3.6.1.

2.1.2 MAINTAINING THE DIVERSITY OF NATURAL LANDSCAPES, ECOSYSTEMS, AND SPECIES

The natural capital of the Moose Mountain Provincial Park arises from the unique landforms and the natural mixture of deciduous forest, grasslands, and wetlands within a predominately prairie landscape. The park would not exist without this natural capital.

The diversity of the terrestrial ecosystems found within MMPP are defined by the provincial classification system of ecosites by McLaughlan, Wright, and Jiricka (2010) and identified in the forest inventory update by Timberline Forest Inventory Consultants (2021). Ecosite mapping shows that at least five ecosites are important in the park and incorporate elements from Aspen Parkland and Moist Mixed Grassland ecoregions. These ecosites differ in floral species composition, tree and shrub cover, understory vegetation, moisture regimes, and soil properties. The park is dominated by one ecosite type, trembling aspen, which has limited variability in its age class distribution. To ensure and maintain the natural capital of MMPP a range of age classes will need to be established. To accomplish this, forest areas will need to be maintained and managed.

Additionally, it is important to identify long-term management challenges. Climate change and fire suppression activities are expected to cause vegetation changes within the coming century. Fire suppression activities have resulted in a shrub dominated understory in mature trembling aspen stands. Subsequently the dense shrub cover impedes aspen regeneration, causing changes in stand composition. Climate change is expected to negatively impact trembling aspen stands as they have a low tolerance for drought conditions. The long-term maintenance of current ecosystems in the face of climate change is not feasible. Conservation and management practices should recognize this transition and allow it to occur while minimizing ecological degradation.

The invasion of non-native plant species is one of the most serious threats to the ecological integrity and natural capital of parks. The presence and abundance of non-native species will be a key factor in the level of ecological degradation resulting from climate change. The park is host to many rare plant species and communities. Non-native species introduction and expansion can be the result of: adjacent agricultural lands, presence of cattle grazing within the park, fragmentation by trails and roads, abandoned oil and gas facilities, and increased recreational activities and developments. Managing the threat of invasive species is an important issue in maintaining the natural capital of MMPP.

2.1.3 CONSERVATION OF UNIQUE ECOSYSTEMS AND RARE SPECIES

Many of the floral and faunal species found within MMPP are not found elsewhere within Saskatchewan. The deciduous forests of MMPP contain unique ecosystems. The balsam poplar, trembling aspen, green ash, and Manitoba maple forests of the upland provide forest biodiversity compared to that of primarily grassland dominated area of the province. However, as climate change impacts the area it is expected to cause a shift to a warmer, drier climate over the coming century, the aspen forests are expected to convert to a grassland or shrub dominated landscape type. During this conversion it is expected that the current aspen forests within the park will be overtaken by neighboring, primarily modified grassland expansion (see Section 3.2.1).

A large number of rare plants and animals are documented to occur within MMPP (see Section 3.5.3.2 and Section 3.6.2). Ensuring the diversity and health of the park ecosystems in management decisions, as mentioned above (see Section 2.1.2), will provide the habitats needed by these rare species.

2.1.4 CONSERVING ANIMAL POPULATIONS AND SPECIES ACROSS MMPP

The flora of MMPP support a wide range of animal species, including forest, shrubland, grassland, and wetland avian species (see Section 3.6.1.1), ungulates (see Section 3.6.1.2), and furbearers (see Section 3.6.1.3). The diverse habitat requirements of the park's fauna highlights the need to maintain a varied range of ecosites and age classes within management plans as well as protect those habitats from sources of degradation such as fragmentation (see Section 2.2.1) or invasive species (see Section 3.5.3.1).

In addition to maintaining habitat for the animal species of MMPP conserving population numbers is crucial. Currently, Ministry of Environment manages big game, upland bird, and migratory bird hunting which is permitted as a draw, regular season, and/or Aboriginal subsistence. The park also allows hunting (see Section 3.5.1.5), trapping (see Section 3.6.1.3), and fishing (see Section 3.5.1.6). The pressures of hunting and trapping within the park have created conservation concerns among stakeholders within the park as well as concerns with adjacent landowners regarding farmland depredation by ungulates. The movements of ungulates in response to habitat availability and hunting pressures as well as recommended mitigation efforts are discussed in Section 3.5.1.5.

2.2 LANDSCAPE AND ECOSYSTEM MANAGEMENT ISSUES

2.2.1 HYDROLOGY AND BEAVER MANAGEMENT

The landscape of MMPP, which is defined by hummocky moraines, supports a large number of small lakes and wetlands. Input sources of freshwater within MMPP are limited to precipitation from snow and rain. The absence of other water sources (e.g., river) within the park creates water management challenges. In addition, high beaver populations within the park create water flow impediments and alter drainages. In response to these challenges, several management plans have been produced. The hydrology of MMPP is discussed in detail in Section 3.2.3.

In 2013 an Ecosystem-based Surface Water Management addressed the water management challenges of the area with the goal to restore or maintain the natural hydrological function of the park for ecological function and recreational opportunities. Declining lake levels threatened recreational uses within the park and stakeholders brought forwards their concerns.

The Ecosystem-based Surface Water Management (2013) found that a variety of factors have contributed to the decline of lake water levels within the park including climate change, anthropogenic water consumption and water flow impediments, and beaver activity. Climate change is expected to have an impact on MMPP with both mean

annual temperatures and precipitation increasing, when compared to baseline conditions. Increased temperatures will intensify evapotranspiration rates and subsequently negate the increased precipitation, leading to a drier, hotter climate. Climate modelling and the impacts of climate change on MMPP is further discussed in Section 3.2.1 .

Anthropogenic water consumption and water flow impediments have implications for water management. Obstructions to water movements can be caused by roadways, dams, and ineffective or inadequate water crossings. The removal or replacement of these obstructions, where possible, will aid in restoring the natural hydrological function of the area. Water use for recreational and domestic purposes puts a strain on finite local water resources. In addition to impediments, a substantial amount of water is taken from the Kenosee Lake watershed for recreational and domestic uses. The hydrology of the area is further discussed in Section 3.2.3 .

Hydrological management is further complicated by beaver activity within the park. The area maintains a large population of American beaver. The population is thought to be greater than a naturally occurring population would be due to habitat suitability coupled with minimal predators and other mortality factors, such as fire. Due to limited research, it is difficult to understand the complexity and interconnectedness of beaver with the hydrology and ecology of MMPP, and therefore difficult to make management decisions. The beaver population and management challenges are discussed in Section 3.2.3 and Section 3.6.1.3.

A lack of formal research and data hampers informed management decisions. The areas lack detailed hydrological information on surface and subsurface flows, current beaver population assessments, and local weather data collection.

2.2.2 FRAGMENTATION

Habitat fragmentation is a threat to the park's natural ecosystems. Sources of anthropogenic habitat fragmentation within MMPP include roads, trails, utility corridors, fence lines, oil and gas exploration, pipelines, and recreational developments. A summary of all fragmentation sources and their associated densities are discussed in detail in Section 3.5.1.1 and Section 3.5.1.2. Fragmentation degrades both the quality and quantity of natural areas. Fragmentation can introduce invasive species into natural areas, impede wildlife movements, as well as reduce the quantity of interior undisturbed habitat. The natural capital of MMPP depends on the area of natural ecosystems as well as their spatial distribution. From the perspective of habitat value, large, un-fragmented areas hold more ecological value when compared to smaller habitat areas or large areas with high amounts of fragmentation.

The Park maintains obligations to provide visitors with recreational facilities. In the interest of increasing visitor numbers there is an interest in developing more recreational facilities. However, it is important to evaluate the benefit of additional developments to the environmental cost to the natural capital. Increasing the number of developments will reduce the quantity and value of the park's natural setting, scenery, and biodiversity, which are the primary attractants of park visitors.

MMPP maintains a developmental footprint of approximately eight percent of park land. As mentioned in Present-day Resource Use Activities (see Section 3.5.1), the core area contains a wide array of recreational developments. Most developments of the park are located within the core area. To minimize further fragmentation in the future, new developments should be planned with a minimal ecological footprint or limited entirely. Proper restoration and reclamation of disturbed or decommissioned areas, including all abandoned oil and gas developments, will also aid in reducing fragmentation within the park.

Minimizing forest fragmentation and ensuring adequate and continuous habitat patch sizes is necessary for ensuring the conservation of animal populations and species within MMPP. Species diversity in forest ecosystems

is closely tied to habitat patch size and structural diversity, both of which may be influenced positively or negatively by anthropogenic activities such as intensive forest management or linear features. Strong species to area relationships have been observed in many ecological systems, with larger habitat patches containing a richer diversity of species as well as population numbers (Fischer, Fletcher, Willis, & Brigham, 2004; Jones, et al., 2015; Myung-Bok & Carroll, 2018; Keinath, et al., 2017).

2.2.3 CORE AREA VEGETATION MANAGEMENT

Recreational developments within the core area of Moose Mountain Provincial Park play an important role in accommodating visitors. Natural and introduced vegetation within these core areas present management concerns. Visitor safety is the primary concern regarding core area vegetation management. Trees that pose a risk to visitor safety (i.e., snags, dead standing) require immediate detection and mitigation. Long-term vegetation management issues involve the forest as a whole.

The forests within MMPP are considered mature or over-mature. In the absence of disturbances such as fire and harvesting they will succumb to mortality factors (i.e., insects, disease, and wind throw) and become risk-trees or increase forest fuel loads. The core areas within the park contain a density of white and blue spruce that are not representative of the surrounding Aspen Parkland ecoregion. Additionally, the density of white birch and white spruce within the core area increases fire risks. The vegetation found within the core area of MMPP is further discussed in Section 3.5.6. Other issues in the core area relate to physical damage, especially along the shorelines and high use areas due to recreational activities.

Parks Division operates a core risk tree program to address risk trees across the provincial parks, which is managed by the Landscape Protection Unit. Core area vegetation management plans are also conducted across our provincial parks and help manage the forests within the core area. A new core area silviculture program has been developed by Parks Division and is being implemented within priority core areas in various provincial parks.

2.2.4 PARK EXPANSION, RE-DESIGNATION, VEGETATION MANAGEMENT, AND CONSERVATION

Recreational developments within MMPP began prior to the area becoming a Provincial Park in 1931. The park is comprised of a continuous forested upland area and is surrounded by private agricultural and reserve land. At the time of this report, no park expansion plans beyond the current boundary are being considered as no potential adjacent lands are available. Currently, the back country areas of MMPP remain relatively undeveloped except for oil and gas developments scattered throughout the park. The backcountry provides remote trail and exploration experiences for visitors. The core area of the park is well developed for front-country camping experiences. Expansion within the core area includes plans for a storage facility. To date, the location for the storage area (i.e. Lot 8 SW-15-10-03-2) has been determined and a commercial lease was awarded for the construction and operation of a storage compound along with the rental of boat slip. Another possible future expansion includes back country camping.

Vegetation management and conservation within MMPP include small forest harvests and core area vegetation management. Forest harvests have been implemented within the park for firewood and stand renewal purposes, aiding in re-balancing the forest age-class distributions. Forest harvests and vegetation management within the park are further discussed in Section 3.5.1.8 and Section 3.5.5.

2.2.5 ASSESSING THE ECOSYSTEM EFFECTS OF RESOURCE EXTRACTION ACTIVITIES

Moose Mountain Provincial Park is impacted by resource extraction and resource use activities. The most notable resource extraction activity is the exploration and extraction of oil and gas within the park. Oil and gas developments began in the 1960s and continue today with a total of 112 well sites and nine pipelines found within the park. Oil and gas developments within the park have led to habitat fragmentation and degradation. The effects of oil and gas developments are further discussed in Section 3.5.1.7.

Vegetation resource extraction include forest harvesting and grazing permits. Small volumes of forest harvesting occur within the park primarily for stand regeneration and firewood purposes. In the absence of natural disturbances, such as forest fire, grazing, and mechanical harvesting, is a viable option for stand renewal within the deciduous forests of MMPP (see Section 3.3.1 and Section 3.5.1.8). The permittance of cattle within the park for grazing is another resource extraction activity. Cattle have been used to promote and renew the grassland areas in the absence of native grazers (e.g., bison) and fire. Cattle grazing can have impacts on vegetation structure and riparian soils, non-native species transportation, and aesthetics of the natural area (see Section 3.5.1.9).

The use of ATVs and snowmobiles within the park is permitted. The effects of ATV and snowmobile use are further detailed in Section 3.5.1.2. The use of ATVs within parkland can lead to loss of vegetation, soil compaction, rutting and/or erosion, as well as the spread of non-native invasive plant species. Unauthorized trail use, use beyond permitted trails, and signs of willful damage to the ecosystem have also been noted.

Lastly, the park allows a variety of animal harvest opportunities including: hunting (see Section 3.5.1.5), furbearer trapping (see Section 3.6.1.3), and fishing (see Section 3.5.1.6). Additionally, the presence of beaver and absence of management efforts within the park impact the ecosystems. The management of beaver is further discussed in Section 3.2.3 and Section 3.6.1.3.

2.3 INTERPRETATION AND INFORMATION MANAGEMENT ISSUES

2.3.1 INTERPRETATION OF NATURAL VEGETATION AND LANDSCAPES, SPECIES AT RISK, AND MANAGEMENT ACTIONS

Several themes can be communicated to the public through an Ecosystem-based Management Plan, including:

- The diversity of ecosystems in MMPP through Saskatchewan ecosite classifications.
- The importance and role of diversity within ecosystems including age-class variety within forest stand and how that diversity provides habitat for a wide range of fauna.
- The role of fire as a natural disturbance including the successional stages that follow fire in an area; and the use of mechanical harvesting to emulate natural disturbance in a controlled manner.
- The expected effects of climate change on the park's ecosystems.
- The importance of the unique vegetation communities (i.e., rough fescue, green ash, and Manitoba maple forests) including rare and endemic species (e.g. redheaded woodpecker, Sprague's Pipit).
- The threat from introduced invasive species and their effects on the park's ecosystems.
- The threats from habitat fragmentations and the effects on animal habitats and invasive species expansion.

2.3.2 THE MANAGEMENT AND USE OF NATURAL RESOURCE DATA

The success and effectiveness of an Ecosystem-based Management Plan requires consistent monitoring and revisions. The management and storage of collected data in an organized fashion is critical for utilizing the data in a valuable manner. The Landscape Protection Unit of Parks Division had a full forest inventory completed in 2020 – completed to Saskatchewan Forest Vegetation Inventory (SFVI) standards, which provides critical baseline data for forest vegetation throughout MMPP. The LPU is also working on the development of a park ecosystem database (PED) in which project documents and ecological indicators and attributes will be managed through a GIS based platform. A Park Ecosystem Health Index will be used to monitor and report on ecological conditions that helps in prioritizing management actions and optimizing allocations of personnel and financial resources in ecosystem management. Data currently available or future collections from MMPP should be entered into the PED which will be the geospatial dataset to manage ecological and biological information into the future.

3 LANDSCAPE AND ECOLOGY OF THE PARK

3.1 REGIONAL LANDSCAPE AND ADMINISTRATIVE CONTEXT

Moose Mountain Provincial Park (MMPP) is located within the Prairie Ecozone and the Aspen Parkland Ecoregion (***Figure 1***) and is adjacent to the Moist Mixed Grassland Ecoregion. The Aspen Parkland Ecoregion occupies 17,518,400 hectares within in the Prairie Ecozone and spans Alberta, Saskatchewan, and Manitoba (Nature Conservancy of Canada, 2019). The Aspen Parkland covers approximately 8,157,000 hectares within Saskatchewan, roughly 13 percent of the province (Saskatchewan Conservation Data Centre, 2014). The Aspen Parkland is the transition zone between the boreal forest to the North and the prairies to the South. The region contains 41 ecodistricts (Government of Canada, 2017) with 22 found within Saskatchewan (Saskatchewan Conservation Data Centre, 2014). The Moose Mountain area is comprised of five ecodistricts: Kipling Plain (H17), Moose Mountain Upland (H18), Moose Mountain (H19), Gainsborough Plain (H20), and Moose Mountain Creek Plain (H21). Moose Mountain (H19) makes up most of the park area with the remaining ecodistricts extending in various directions from H19 (Acton, Padbury, & Stushnoff, 1998).

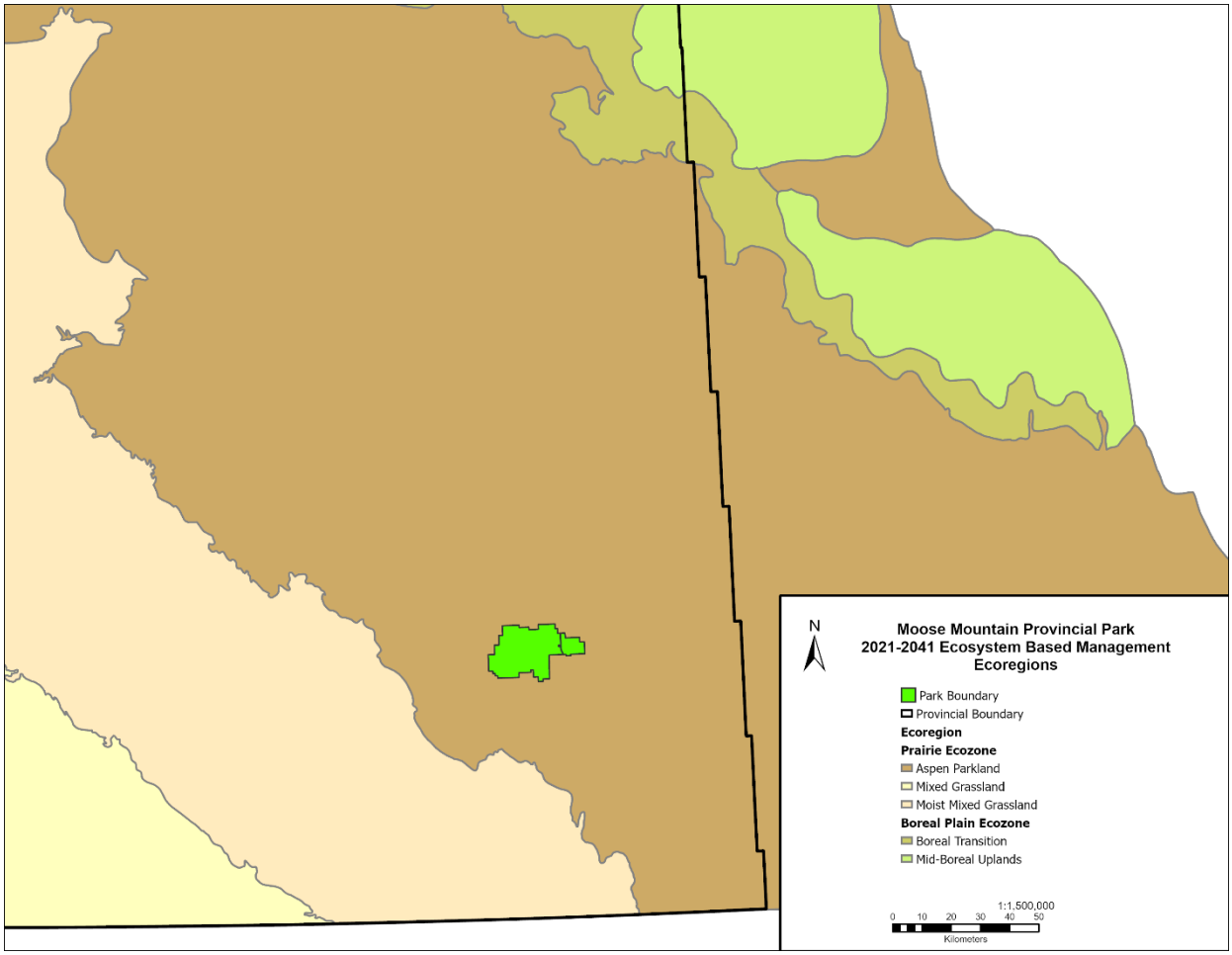

Figure 1 *Location of Moose Mountain Provincial Park in relation to ecoregions of Saskatchewan.*

Moose Mountain rises to form a plateau ranging from 730 to 800 metres in elevation and over 100 metres above the surrounding Aspen Parkland. The area is comprised of a single distinct block (Acton, Padbury, & Stushnoff, 1998) and occupies approximately 33 kilometres east to west and 20 kilometres north to south or about 400 square kilometres.

MMPP was established in 1931. The park is one of Saskatchewan's original six provincial parks established in 1931 after the Natural Resource Transfer Agreement. MMPP is one of 36 provincial parks and is designated as a natural environment park.

The extent of the park encompasses 40,059 hectares and is presented in ***Figure 2***. The area surrounding the park contains different types of land administrations and are presented in ***Figure 3***. The park is mostly surrounded by private land which is used for cropland, rangeland or pastureland. As well, the perimeter includes areas designated as First Nation reserve land. There are three First Nation reserves located near the park. White Bear First Nation No. 70 is located to the southeast of the park, Pheasant Rump First Nation No.68 is located to the west and south of the park, and Flying Dust First Nation No. 105 is located to the east of the park. The nearest settlement is the Town of Carlyle (population 1,508 in 2016 census), located approximately 24 kilometres south of the park. The nearest major city within Saskatchewan is Estevan (population 13,615 in 2016 census), located approximately 126 kilometres west from the park.

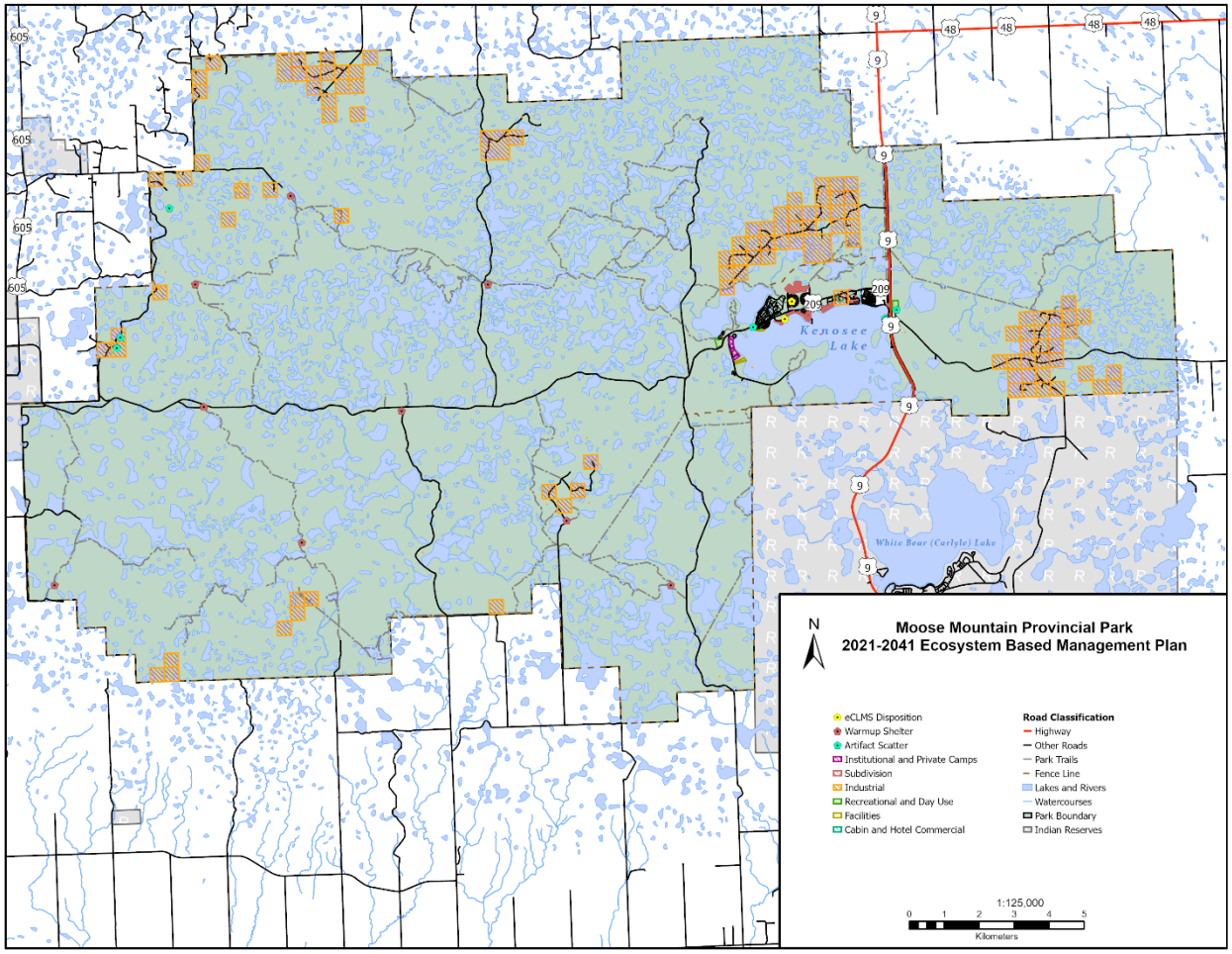

Figure 2 *General map of Moose Mountain Provincial Park (MMPP).*

A closer examination of adjacent land use within a radius of five kilometres outside of the park boundary is presented in ***Figure 4***. Main land use types include cropland, forest, managed grasslands, and water or wetlands. Within a five-kilometer radius of the park boundary the area is primarily cropland (approximately 42 percent). Other land use types surrounding the park include forest (32 percent), managed grasslands (12 percent), water and wetlands (11 percent), and urban or developed (approximately two percent) and are presented in ***Table 1***. Transitions between the forested areas of the hills and the shrubland, grassland, and agricultural lands below tend to be gradual (***Figure 5*** and ***Figure 6***).

Table 1 *Land use within five kilometers buffer outside of the boundary of MMPP.*

Land Use	Area (ha)	Relative Area
Cropland	24,624	42 %
Forest and treed areas	19,664	32 %
Managed Grassland	7,464	12 %
Water and wetlands	6,709	11 %
Roads	1,152	2 %
Settlements	270	< 1 %
Other	2	< 1 %
Total	**61,024**	**100 %**

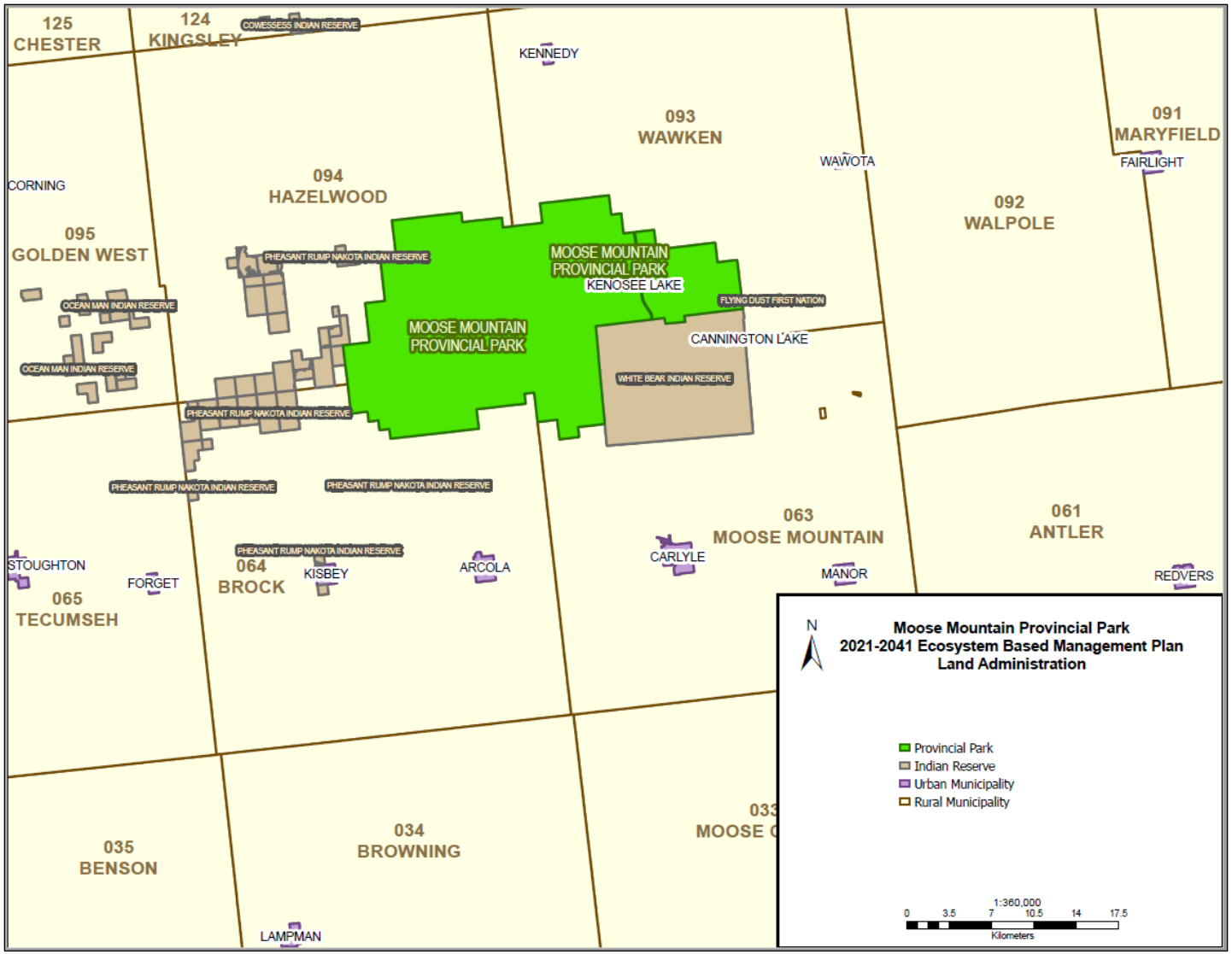

Figure 3 *Land administration in the region of MMPP.*

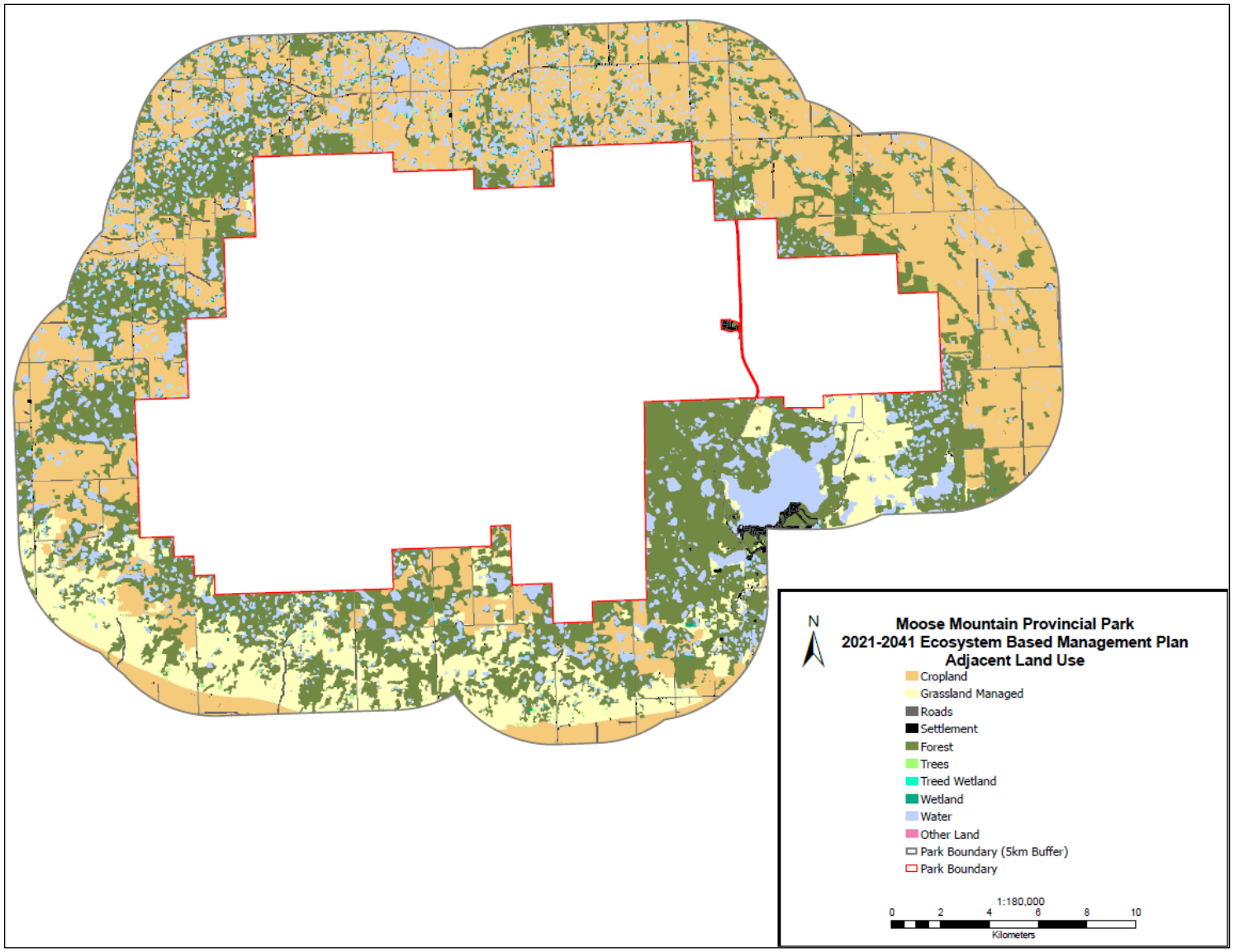

Figure 4 *Land use management adjacent to MMPP within a radius of five kilometres.*

Figure 5 *Land cover types of hardwood forest and shrubland within transitioning to crop or grazing land with wetlands. Photo source: Google (2018).*

Figure 6 *Adjacent land cover types of hardwood forest and shrubland. Photo Source: Google (2018).*

3.2 PHYSICAL SETTING

3.2.1 CLIMATE

The climate of Moose Mountain Provincial Park is reflective of the climate of the Aspen Parkland Ecoregion. However, the elevation difference of the Moose Mountain plateau provides slightly cooler temperatures and higher volumes of precipitation when compared to the average of the Aspen Parkland (Acton, Padbury, & Stushnoff, 1998). The area is also cooler and wetter than the southern and western grassland ecoregions. Meteorological data for the Moose Mountain area was determined by averaging weather stations within a 60 kilometre radius surrounding the park and is presented in ***Table 2***. Stations include Handsworth (32.2 kilometres west), Willmar (46.5 kilometres south), Kipling (46.8 kilometres northwest), Redvers (56.5 kilometres southeast), and Whitewood (58.6 kilometres north).

Handsworth is located approximately 32 kilometres west of MMPP and has the closest available weather data source. The elevation difference between Handsworth and the park is approximately 130 metres. Mean annual temperature within Moose Mountain area averaged 2.8° Celsius, with a range of 2.5 to 3.0° Celsius. Mean temperatures in July and January were 18.6° and -14.7° Celsius, respectively. Average frost-free days for Handsworth and Whitewood were 108 days (Government of Canada, 2021) and a total of 1,584 growing degree days[1] (Acton, Padbury, & Stushnoff, 1998).

Historical and recent mean minimum temperature values for Regina, which is located approximately 200 kilometres to the northwest of the park and can be seen in ***Figure 7***. The weather station at the Regina International Airport was used as it maintains weather data from over 120 years. The local temperature of the Regina International Airport would be comparable to that of MMPP, given the latitude of Regina being nearly one-degree greater north as well as MMPP having an elevation of approximately 200 meters greater than Regina. The data presented shows an increasing mean minimum temperature.

Table 2 *Mean monthly temperature (°C) based on the 1981-2010 Climate Normals for a 60 km radius from Moose Mountain Provincial Park (Government of Canada, 2021).*

	J	F	M	A	M	J	J	A	S	O	N	D	Mean
Handsworth, SK (642m)	-14.3	-11.6	-4.7	4.7	11.1	15.8	18.9	18.1	11.8	4.3	-5.2	-12.4	3.0
Kipling, SK (653m)	-14.7	-12.0	-5.4	3.8	10.6	15.5	18.3	17.1	11.2	3.8	-5.4	-12.5	2.5
Redvers, SK (588m)	-14.8	-11.9	-5.4	4.4	11.1	16.2	18.7	18.0	12.5	4.5	-4.9	-12.0	3.0
Whitewood, SK (604m)	-15.0	-12.0	-5.6	3.9	10.7	15.6	18.3	17.4	11.5	4.2	-5.4	-12.6	2.6

[1] The sum of growing degree-days is a measure of the length and warmth of the growing season, and is calculated by summing the daily deviations above a base temperature of 5 degrees Celsius over the whole year.

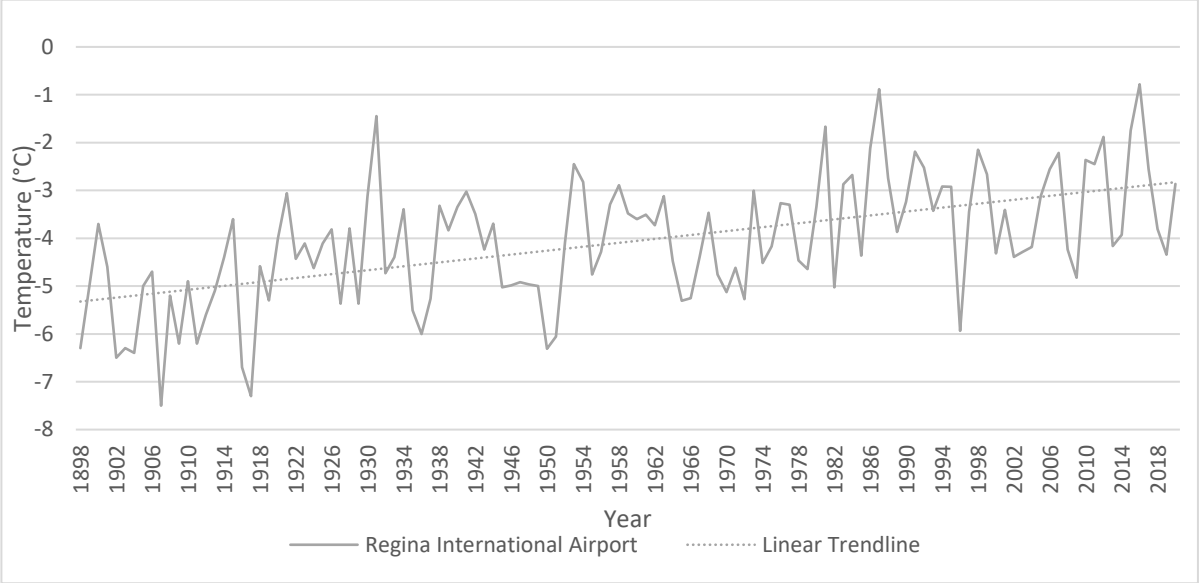

Figure 7 *Historical and recent annual minimum mean temperatures at Regina International Airport 1898 - 2020 (Government of Canada, 2021; Weather Underground, 2021).*

Average precipitation for the area surrounding MMPP can be seen in ***Table 3***. The average annual precipitation for the area is approximately 467.7 millimetres with a range of 443.6 to 506.5 millimetres. Snowfall averages from 1981 to 2010 within the Moose Mountain Area were 120.8 centimetres with an average of 39.9 of snowfall days (Government of Canada, 2021).

Table 3 *Mean Monthly Precipitation (mm) Based on the 1981-2010 Climate Normals for 60 km radius from Moose Mountain Provincial Park (Government of Canada, 2021).*

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Handsworth, SK (642m)	18.1	14.5	19.4	28.0	59.4	81.1	67.4	59.4	35.4	23.8	16.6	20.8	443.8
Willmar, SK (593m)	21.1	15.3	25.8	24.6	58.4	85.7	78.8	56.1	40.1	30.7	18.8	22.8	478.2
Kipling, SK (653m)	18.9	15.1	26.0	27.1	58.2	90.2	64.9	60	37.3	26.8	19.3	23.0	466.6
Redvers, SK (588m)	20.0	11.5	19.2	22.8	60.0	95.2	65.5	46.6	32.7	27.0	20.0	23.3	443.6
Whitewood, SK (604m)	25.1	18.7	28.9	27.6	58.3	91.4	69.7	63.8	40.8	29.5	24.3	28.2	506.5

The climatic moisture index closely relates to the distribution of forests versus grasslands. Index values are calculated as annual precipitation minus annual potential evapotranspiration[2]. The Moose Mountain area falls into the aspen parkland region and is surrounded by the moist mixed grassland transition zone of the climatic moisture

[2] Potential evapotranspiration is an estimate of the amount of evaporation that would occur if there is always an ample supply of soil moisture and depends mostly on temperature.

index. This is due to the elevation of the uplands, as increased elevation increases moisture. Grassland values are generally negative while forest values are generally positive, indicating that forested regions have excess of precipitation over potential evapotranspiration. In the aspen parkland, this ranges from -225 to 0 mm, in drier and in the moist mixed grassland and transition zone this is -175 to -125 and -225 to -175 respectively. Historical climate moisture index for the Moose Mountain area can be seen in ***Figure 8***.

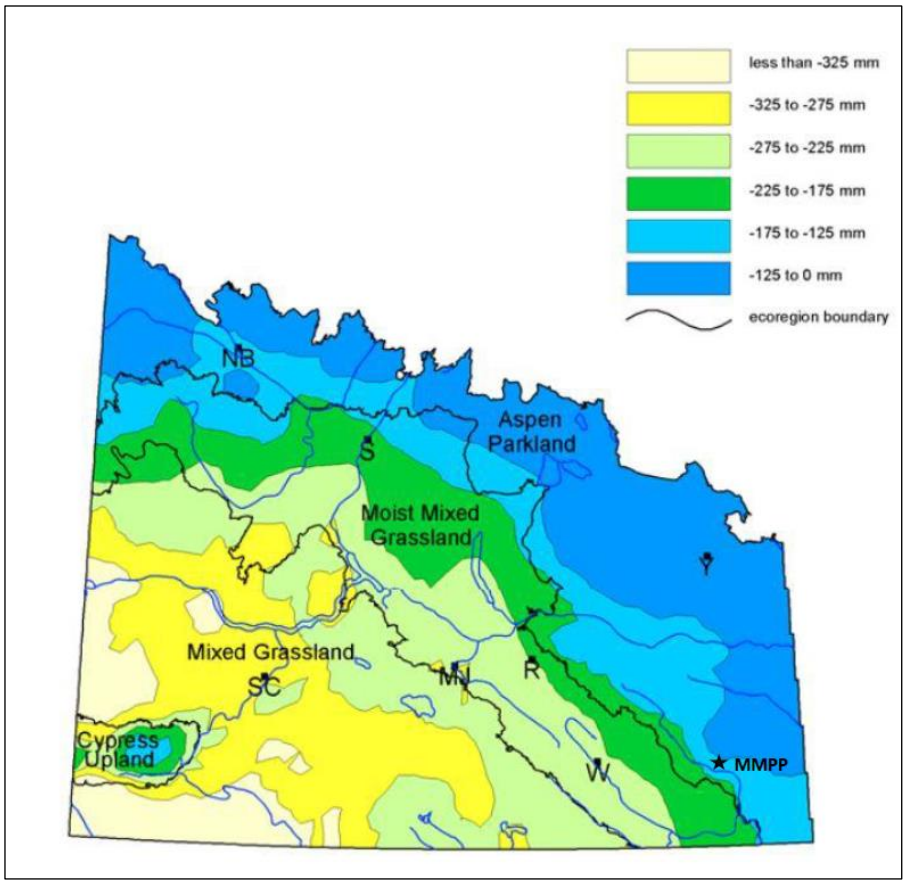

Figure 8 *Historical Climatic Moisture Index for the 1961-1990 Period in the Prairie Ecozone including Moose Mountain (Thorpe J. , 2011).*

Although there is little weather data for the park itself, there is longer term climate data for the area surrounding the park. Climate change is expected to have a major impact within the Prairie Ecozone. Overall, temperatures in the grasslands will increase along with increasing precipitation (Godwin, Wittrock, & Thorpe, 2013; Barrow, 2009). Regina for example, has experienced a 1.5°C increase in temperature over the last 110 years. Estevan (about 90km southwest of MMPP) has seen an increase of 0.5 degrees Celsius over the 66 years of recorded weather data (Godwin, Wittrock, & Thorpe, 2013). In years of warmer weather, evapotranspiration will increase potentially restricting available water even in years of average precipitation.

Climate scenarios for MMPP have been determined through Climate Scenarios for Saskatchewan by Barrow (2009). Historical climate data of the annual moisture index (AMI) for years 1961 to 1990 is utilized as base-line data. Climatic change scenarios based on global climate models and emissions were then determined relative to the base data. Emissions scenarios within the climate models include B1 and A1B. Both emissions scenarios represent a business-as-usual attitude with slight variations. The B1 scenario incorporates clean technologies and a dematerialization outlook for the world. The A1B scenario represents a world with rapid economic growth but with

a mix of continued fossil fuel use with clean technology advancements. These scenarios are then classified into small, median, and large changes in predicted mean temperatures and annual precipitation across Saskatchewan. These two scenarios, applied globally, show a mean global surface warming of 2.8 and 1.8 degrees Celsius for A1B and B1, respectively.

Figure 9 depicts scenarios for annual mean temperature at the seven grassland sites: North Battleford, Saskatoon, Yorkton, Swift Current, Moose Jaw, Regina, and Weyburn. Weyburn is the closest in proximity, at approximately 100 kilometres to the west-southwest, from Moose Mountain Provincial Park. Weyburn has a baseline temperature of two to four degrees Celsius. Mean annual temperature modeling for the smallest change and least change scenario shows the mean annual temperature increasing from baseline up to four to six degrees Celsius, while median change scenario shows the mean annual temperature increasing to four to six degrees Celsius. The projected annual mean temperature into the 2080s is at least double that of baseline conditions.

Figure 10 depicts scenarios for annual precipitation at the seven grassland sites listed above. Weyburn has a baseline precipitation of 400 to 450 millimetres. Mean annual precipitation modeling for all three scenarios show increases in precipitation when compared to baseline conditions. The annual moisture index is projected to increase as well, indicating more arid conditions throughout all grassland sites.

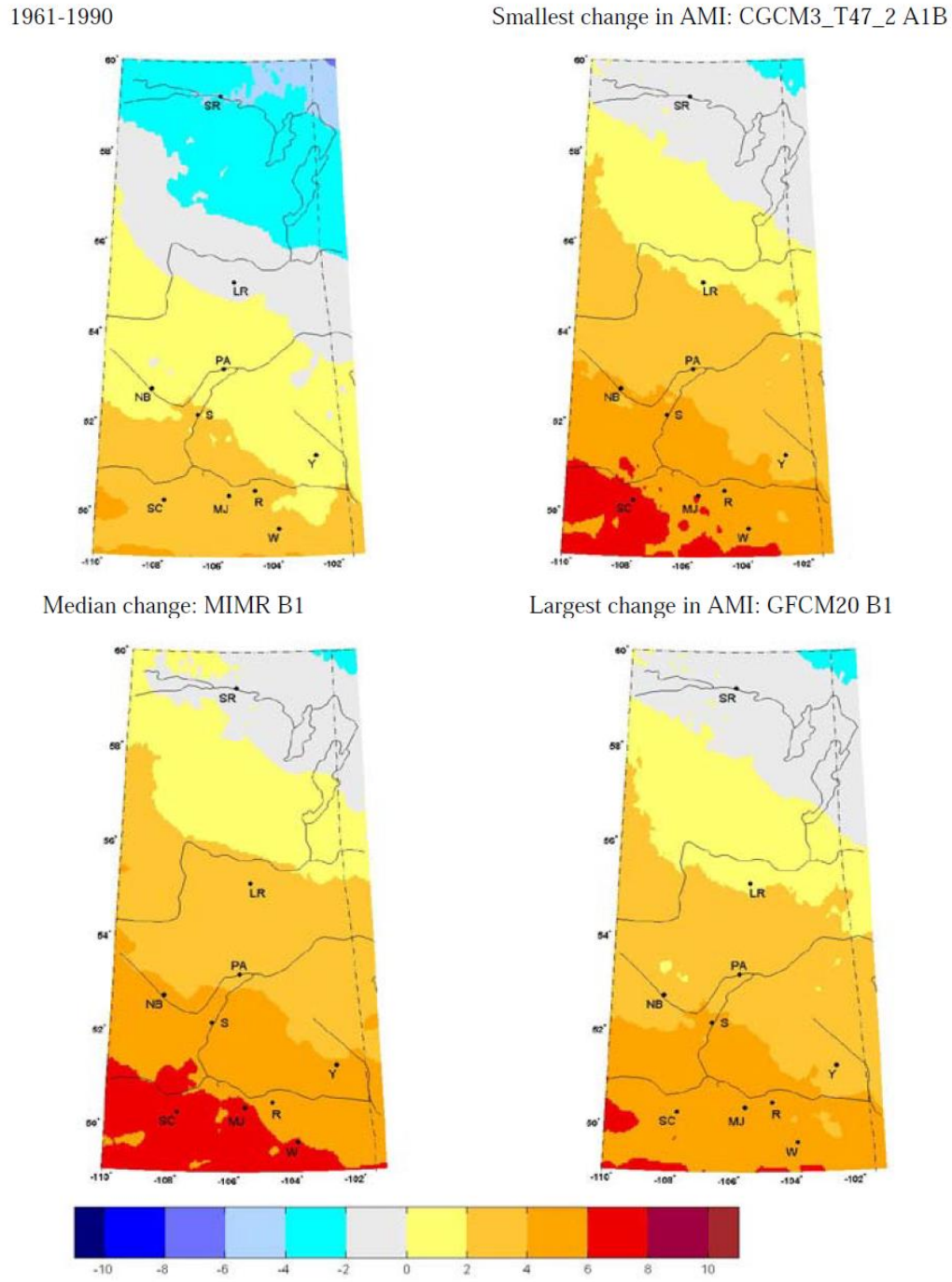

Figure 9 *Annual mean temperature (°C) for the grassland region of Saskatchewan based on AMI Climate Model for the 2050s (Barrow, 2009).*

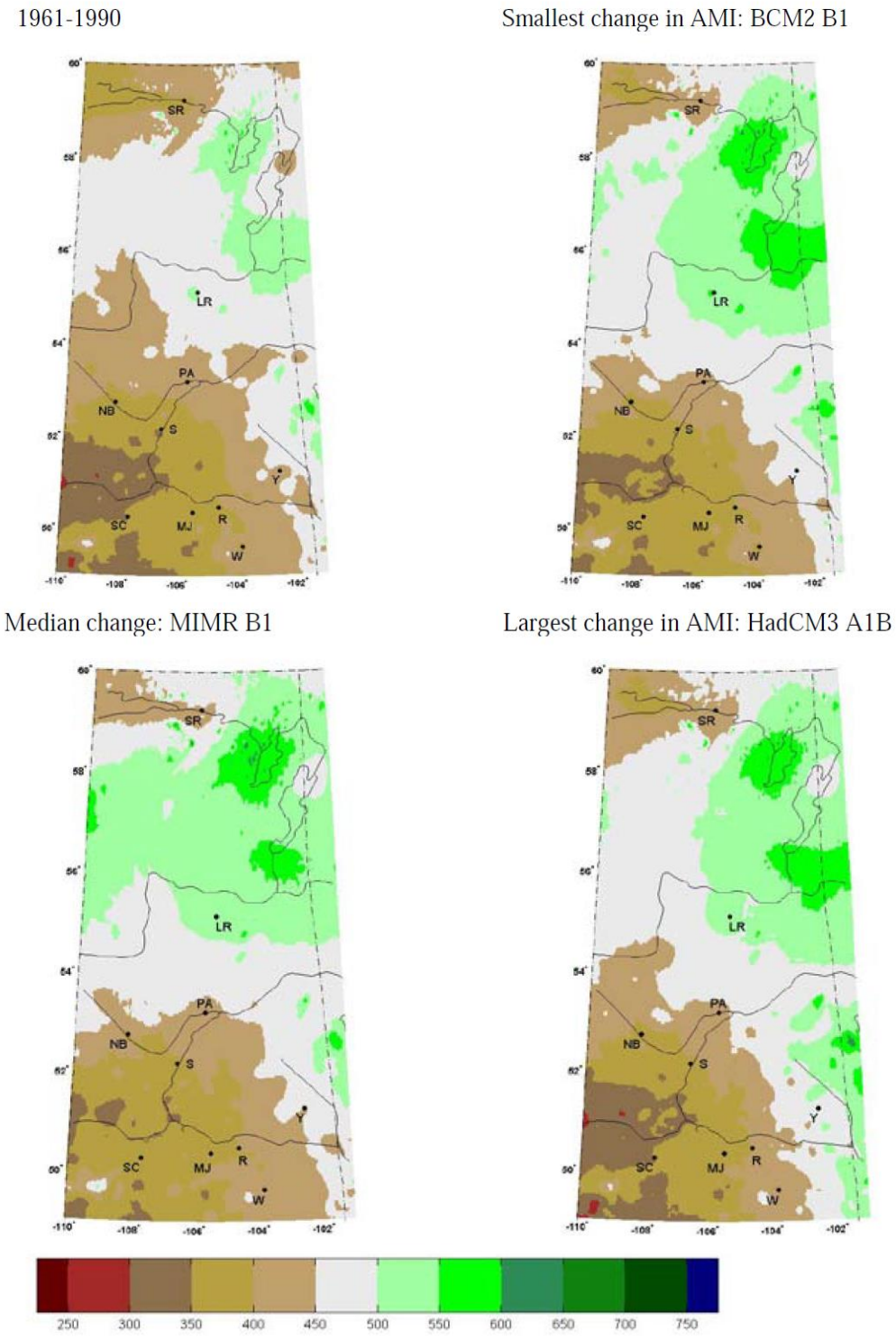

Figure 10 *Annual precipitation (millimetres) for the grassland region of Saskatchewan based on AMI Climate Model for the 2050s (Barrow, 2009).*

Projected changes in temperature and precipitation can alter ecoregion distribution in which there is a potential of converting the Moose Mountain upland from the aspen parkland to moist mixed grassland (Godwin, Wittrock, &

Thorpe, 2013; Michaelian, Hogg, Hall, & Arsenault, 2011). Shifting ecoregions on MMPP will decrease moisture availability leading to stress on vegetation communities. The aspen parkland is drought intolerant and would respond quickly to changing moisture levels leading to a rapid transition from woodland to grassland (Michaelian, Hogg, Hall, & Arsenault, 2011; Allen & Breshears, 1998).

Aspen parkland is primarily composed of trembling aspen stands with shrubland and grasslands interspersed (Thorpe J. , 2011). Trembling aspens are poor at regulating water when it is scarce, impacting the tree's ability to conserve resources for growth (Hanna & Kulakowski, 2012). Warm temperatures combined with low moisture over short term periods can lead to growth impediments, while long periods can lead to decline and mortality of aspen (Hanna & Kulakowski, 2012; Hogg, Brandt , & Michaelian, 2008).

A study completed by Michaelian et al. (2011) found that prairie-like areas with trembling aspen stands exhibited a morality of up to 35 percent during period of severe drought. Increased mortality increased biomass and fuel loading which increased risk of wildfire. As the additional biomass decomposes the forest becomes a source of carbon rather than a sink for carbon sequestration. Trees that are not killed from drought-related stress are more susceptible other mortality factors including forest insects and diseases (Hogg, Brandt , & Michaelian, 2008)

3.2.2 GEOLOGY, LANDFORMS, AND SOILS

The Moose Mountain upland is comprised of an isolated plateau on top of marine sedimentary bedrock. The upland was formed during retreat of the last glacial period and is surrounded by plains. The upland formation rises over 100 metres above the surrounding plains. The elevation of the plateau ranges from 730 to 800 metres above sea level. The plateaus transition into the plains below through abrupt slopes of hummocky moraines with knobs and kettles (Acton, Padbury, & Stushnoff, 1998).

The geology of the area is comprised of a Precambrian basement of hard crystalline rocks. Younger Phanerozoic eon sedimentary rocks lay on top of the basement and are part of the Western Canadian Sedimentary Basin. The lower sedimentary layers, formed during the Cambrian to Jurassic periods contain basal clastics, Platform carbonates and evaporates, including potash deposits (Macdonald, n.d.). Following the Jurassic period, the Cretaceous Period (approximately 145 to 65.5 million years ago) formed another layer of bedrock comprised primarily of marine sedimentary rocks. This sedimentary layer is known as the Pierre Shale Formation or the Riding Mountain Formation (Acton, Padbury, & Stushnoff, 1998). The Pierre Shale Formation ranges from 250 to 600 metres thick (Encyclopedia Britannica, 2011). The sediments found in the formation typically consist of silty clays and shales with deposits of bentonite. Within the subsurface marine sediment’s deposits of petroleum, potash, and other salts exist.

All of Saskatchewan, except for Cypress Hills and Wood Mountain, has experienced glacial advancement and retreat. At least eight periods of glaciation have been recorded (Macdonald, n.d.). The topographic highs of the Moose Mountain area resulted the area to be the first deglaciation during the recession of the last glacial period about 12,500 years ago (Lang, 1974). The resulting glacial landforms mainly consist of ground moraine, dead ice moraine (hummocky, knob and kettle), major end-moraines, fluting, and eskers. Other landforms include minor end-moraines, crevasse fillings, and kames (Christiansen, E A; Government of Saskatchewan: Department of Mineral Resources, 1956).

Generalized landforms in MMPP are shown in Figure 11. A morainal hummocky landform makes up approximately 98 percent of the park area. Approximately two percent of the park is of morainal ridged and less than one percent is of a glaciolacustrine plain.

Ground moraine is an area of low relief consisting of predominately till, frequently referred to as till plain. However small amounts of silt and sand are present. The area is characterized by gentle rolling to undulating relief not

exceeding 5 metres difference. Numerous depressions are found within the landscape in a lobe-like pattern. The hummocky, knob and kettle formations resulting from the melting of large masses of stagnant glacial ice also known as “dead ice”. The dead ice moraines lack a definitive pattern with the knobs and kettles being formed from random accumulations of morainic material and are irregularly spaced. Composition is mainly till with small amounts of stratified drift. The rims of the kettles are low ranging from 0.6 to 1.2 metres in height. Kettle width ranges from six to over 120 metres. This is the dominant landform in the Moose Mountain Provincial Park area.

End-moraines are accumulation of drift in a ridge-like form along the margin of the glacial ice sheet. There are three distinct major end-moraines found within the Moose Mountain area. These are located near south of the town of Oxbow, north of the town of Kisbey, and the Stoughton Moraine east of the town of Stoughton. The Oxbow end-moraine is approximately 18 kilometres long, averages 1600 metres wide, and is composed of stratified drift and intercalated till. The Kisbey end-moraine averages 300 metres wide, is composed of stratified sand, and at its highest point rises approximately 25 metres above the surrounding moraine. The Stoughton Moraine is the largest, extending discontinuously from the northwest to the southeast of the Moose Mountain area. The moraine is moderate to gentle rolling, is composed of till with stratified drift, and at its highest point rises approximately 12 metres above the surrounding moraine.

Fluting describes the parallel arrangement of numerous linear ridges and grooves. The features are low, ranging from 0.6 metres to 1.5 metres in height and span an area approximately 60 metres wide and extending, at most, to 1600 metres in length. The composition of fluting is primarily till with a thin top of lag concentrate.

Eskers are found within the Moose Mountain area. Eskers are described as long narrow sinuous ridges which can be discontinuous and are made up of poor-sorted stratified sands and gravels with a thin top layer of ablation till. Eskers are created from the deposition of material from glacial melt water streams through channels or tunnels in the glacier near the margins. Within the area eskers extend up to 3.2 kilometres long, with a width ranging from 45 to 76 metres, and heights ranging from 1.8 to 4.5 metres. Eskers are found parallel to the direction of ice movement.

Other landforms include minor end-moraines, crevasse fillings, and kames. Minor end-moraines are characterized by wash-board-like deposition of material from annual retreat of the ice margin. Minor end-moraines are found throughout the ground moraine. Crevasse fillings is used to describe material ridges created from meltwater fissures in the stagnant ice near the margins. Kames are used to describe a mound of gravel or sand (with or without small amounts of till) that are of glacial origin (Christiansen, E A; Government of Saskatchewan: Department of Mineral Resources, 1956).

The landforms of the area, along with topography, influence water accumulation, infiltration, soil development, and the spatial distribution of soils (Guo & Lin, 2018). Three main soil types were determined to be within Moose Mountain Provincial Park: Luvisol, gleysol, and chernozemic. Luvisolic soils are found under aspen (*Populus spp.*) stands, gleysolic soils are found under the wetlands and areas with prolonged periods of water saturation, and chernozemic soils are found under grassland and shrubby areas within the periphery of the park (McLaughlan, Wright, & Jiricka, 2010; Terrestrial & Aquatic Environmental Managers Ltd, 1992).

Luvisolic soils are a dominant soil group of the forests within Saskatchewan. They are abundant in elements such as calcium and magnesium. They typically have a grayish, sandy, or silty Ae horizon overlying a B horizon that has higher clay content than either the Ae or the C horizon. The C horizon of the Luvisolics usually contains calcium carbonate (lime). When scarified the surface Ae horizon is exposed and the soils often have a grayish appearance and hence this region is known as the gray soil zone in Saskatchewan. Luvisolic soils typically develop under forested areas and present a thin organic surface horizon (A1 horizon) atop a light-coloured horizon (A2 horizon)

where clays have leached from followed by a clay-rich third horizon. Gray luvisols are the dominate soil types within the park.

Chernozemic soils typically develop under grasslands due to fine root decay and present an organic surface horizon (A1 horizon) with a dark colour. The distinctions between Black, Dark Brown, and Brown groups are based on colour which is associated with the relative dryness of the soil. Brown soils are associated with more arid conditions while Black soils are associated with less arid conditions. Chernozemic soils occur on all soil textures ranging from clays to sands. Black chernozemic and dark grey chernozemic soils are found within the park.

Gleysolic soils are associated with prolonged water saturation. This is mostly commonly found in low points such as those within rolling or hummocky topography. Water saturation leads to the depletion of oxygen within the soil causing anaerobic conditions. The anaerobic condition presents as blue grey colouring or reddish zones (mottles) interspersed in the soil mass, collectively called gley features. Gleysolic soils present these gley features within the upper 50 centimetres of the soil. Luvic and humic gleysols are found within Moose Mountain.

Water-saturated conditions found within Moose Mountain forested regions of Saskatchewan commonly lead to the formation of layers of organic matter. The organic soils of Saskatchewan are classified as peatlands formed by either fens or bogs. The fens of Moose Mountain are dominated by sedges and brown mosses and are classified as humic gleysols. Water within these fens is high in dissolved base ions such as calcium and magnesium. Humisols present as a more advanced stage of decomposition. Fibrosity of the material is not present.

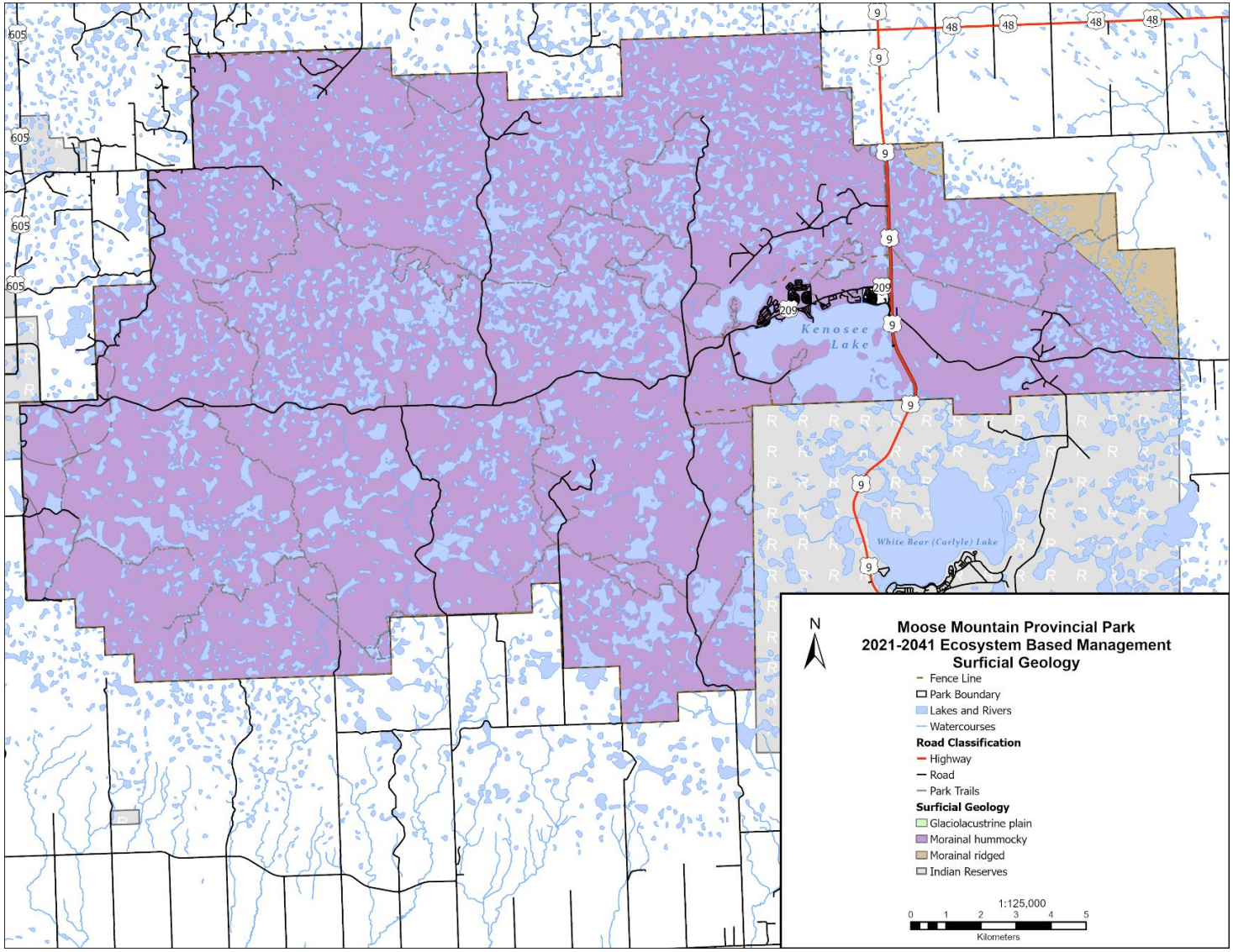

Figure 11 Generalized landforms within the Moose Mountain area.

3.2.3 HYDROLOGY

The Moose Mountain area serves as an essential regional water source. Due to the elevation and subsequent climate variation, the area tends to be more responsive to annual precipitation when compared to the more arid grassland and agricultural land surrounding it (Godwin, Wittrock, & Thorpe, 2013). This allows the area to aid in replenishing ground water sources and maintaining various waterbodies and tributaries. Moose Mountain is contained within the continental Hudson Bay drainage basin and locally, within the Souris River drainage basin. The main watersheds of Moose Mountain are presented in ***Figure 12***. The hydrology of Moose Mountain is comprised of permanent, intermittent, and ephemeral streams, as well as numerous waterbodies. The water features of Moose Mountain are presented in ***Figure 13***.

The glacial history of Moose Mountain has the greatest influence on the hydrology of the park. During the last glacial retreat, as mentioned in Section 3.2.2, till, glacial drift, and dead ice formed the knob and kettle topography along with the deep linear ridges in the ground moraine (Christiansen, E A; Government of Saskatchewan: Department of Mineral Resources, 1956). This created the hundreds of water features throughout the park. The water features are typically located within a parent material of glacial till consisting of layers of gravel, sand, and silt. These layers are permeable and allow water to flow under the surface between lakes and waterbodies. There are also areas where glacial lakes left behind fine clays and areas of loamy and mixed texture sands (Rözkowski, 1969). Kenosee Lake has been the subject of paleolimnological research. The research has indicated that the lake has exhibited wide-ranging depths and salt concentrations over the past 4,000 years. Lake level monitoring has occurred since the early 1900s. Water levels within the lake have been shown to be trending downwards with fluctuations related to wet or dry cycles (Godwin, Wittrock, & Thorpe, 2013).

The main fresh waterbodies within the park include Kenosee Lake, Little Kenosee Lake, and White Bear Lake. The largest of the lakes is Kenosee Lake. The lake is located east of the main park entrance. Kenosee Lake covers an area of 1554 hectares and contains several small islands. The maximum depth is approximately 10 metres, depending on annual water levels. The drainage basin for Kenosee Lake is approximately 14,000 hectares in size. The lake plays a major role in recreation in the park. Data from last hundred years show that the water level is decreasing with periods of fluctuation. A tributary of Kenosee Lake is Little Kenosee Lake. Little Kenosee Lake is the smallest of the three main lakes. The maximum depth is approximately five metres. Water flows from Little Kenosee Lake to Kenosee Lake via a creek on the southeast. Kenosee Lake is a tributary of the third main lake within the area, White Bear Lake (Running 2013). White Bear Lake is a similarly sized to Kenosee Lake. Maximum depth of those lakes is 15 metres.

In addition to the main lentic waterbodies, the area contains several thousand permanent and temporary water features. These water features include sloughs, marshes, wetlands, and swamps. Most are less than 500 hectares in size and reach a maximum depth of three metres (Rözkowski 1969). Typically, these water features are found on more permeable parent material and therefore do not maintain their water levels to the same degree that the main lakes within the area are able to.

The topography of Moose Mountain restricts input of water from sources outside of the upland. Subsurface flows and groundwater recharge help water to move between lakes and water bodies throughout the park. Some small lakes are connected to others by creeks. Others are within closed basins and rely on water percolating through the ground (Godwin, Wittrock, & Thorpe, 2013; Christiansen, E A; Government of Saskatchewan: Department of Mineral Resources, 1956; Henderson, Hogg, Barrow, & Dolter, 2002) .

The uplands of Moose Mountain support numerous outlets found within several drainage basins including Pipestone Creek, Moosomin Lake, Antler River, Moose Mountain Creek Kisbey, Moose Mountain Creek

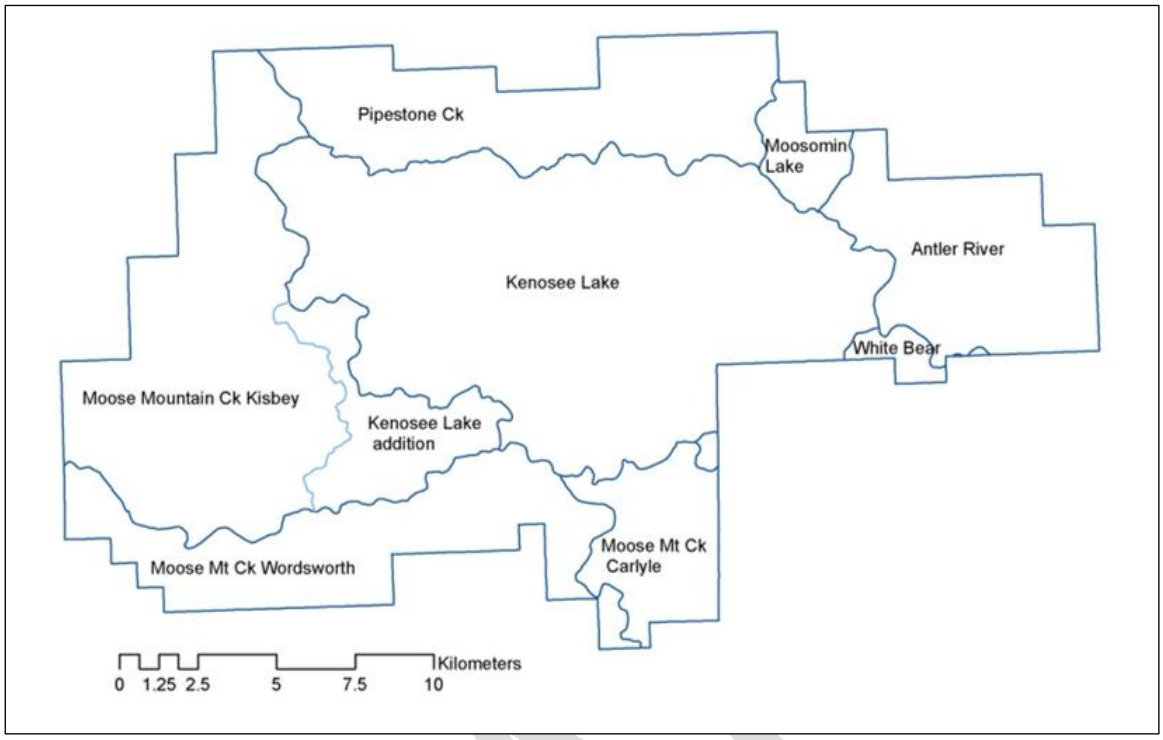

***Figure 12** Detailed watersheds within MMPP **(Godwin, Wittrock, & Thorpe, 2013)**.*

Wordsworth, Moose Mountain Creek Carlyle, and White Bear and are presented in ***Table 4***.

***Table 4** Summary of watersheds within MMPP **(Godwin, Wittrock, & Thorpe, 2013)**.*

Watershed Name		Area (ha)	Percent of Park Area
Moosomin Lake		785	1.9
Pipestone Creek		5,016	12.4
Moose Mountain Creek Wordsworth		4,649	11.5
Moose Mountain Creek Carlyle		2,021	5.0
White Bear		428	1.1
Kenosee Lake		13,725	38.9
Antler River		3,974	9.8
Moose Mountain Creek Kisbey		9,776	19.3
	Total	**40,374**	**100.0**

The main moving fresh waterbodies within Moose Mountain are Antler Creek/River, Moose Mountain Creek and Little Pipestone Creek. The Antler River is a large permanent water system that flows into Souris River to the Assiniboine River and eventually to Hudson Bay. The source of the river is the eastern slopes of the Moose Mountain uplands. The Little Pipestone Creek, a tributary of Pipestone Creek, also begins within the Moose Mountain upland and flows into the Souris River. Drainage from the east and southern slopes enters the Moose Mountain Creek drainage which also flows into the Souris River. Other smaller named tributaries of the Souris River Watershed within the Moose Mountain area include Gooseberry Lake, Wolf Creek, James Creek, Crooked Creek, Cowper Creek, Shepherd Creek, Montgomery Creek, and Weatherald Creek.

Water levels within the area are recharged through spring snow melt as well as annual precipitation. Water depletion occurs from drainage, anthropogenic uses and impediments, climate, precipitation, and evapotranspiration (Running, 2013; Rözkowski, 1969). Anthropogenic feature such as roads, culverts, and pipelines can prevent water surface water drainage and block the natural flow of streams. Additionally, increased water uses by the visitors and permanent residents, due to increased visitor activity and population growth, has potentially contributed to low water levels within Kenosee Lake. Water consumption to maintain the golf course exceeds the total water use by the park and town site at an estimated 60,000 cubic metres per year or approximately 60 million litres (Godwin, Wittrock, & Thorpe, 2013).

Additionally, beaver activity within the area has contributed to altered water movement. Traditionally the American beaver (*Castor canadensis*) existed within the Moose Mountain area, but populations were severely depleted during the fur trade. When the Provincial Government began overseeing the area in 1923 beavers were reintroduced to the park (Stelfox, 1980). Currently, the beaver population within the park creates management challenges. It is estimated that the beaver population is higher than it would naturally be due to a lack of predators, lack of natural disturbances (i.e., fire), and most recently, a decline in trapping efforts (Phillips, 2014; Running, 2013). Dams created by beavers can impede water movement leading to large fluctuations in water levels.

Low water levels negatively impact park recreation activities such as swimming, boating, and canoeing are degraded, this in turn negatively affects parks visitation rates (Godwin, Wittrock, & Thorpe, 2013). Additionally, fluctuations of water levels affect growing conditions for vegetation. Suitable habitats can grow or shrink depending on water levels. In drier years, small lakes will shrink, and sloughs may dry up quicker revealing damp meadows that may be suitable for trembling aspen and balsam poplar (Henderson, 2002).

The hydrology of Moose Mountain plays an important role and creates challenges for ecosystem-based management plans. As mentioned previously, the water features of Moose Mountain contribute to the ecological, economic, and recreational value within the area in addition to being a vital water source for the surrounding area. Therefore, the management of the water features within the park will help maintain the park's biodiversity and visitor experience (see Section 3.5.1 and Section 3.6.1).

The Ecosystem Based Surface Water Quantity Management Plan for Moose Mountain Provincial Park (2013) and the Beaver Management Plan (2014) outlines beaver and water management recommendations including:

- Create variable age classes within the forest and increase regeneration through harvesting as water yield is greater from younger forests.
- Utilizing prescribed fires, where and when it is safe to do so, to emulate natural disturbances and decrease beaver populations.
- Implementing practices to reduce the beaver population to an appropriate level that would be representative of its natural population controls existed within the park (i.e., wolf predation, fire).
- Control of beaver dam and/or beaver would have to be an ongoing process to maintain the benefits but should be only completed once the regional hydrology is better understood.
- Removal of man-made water flow impediments (e.g., old roads, damaged culverts), replacing or improving water crossings, installing flow devices, and an inventory of watercourse crossings as well as an assessment of their impacts on water flow.
- Education and encouragement of park visitors and businesses to utilize water conservatively.
- Eliminate water transfers or channeling between water features.

Incorporate monitoring programs for general resource uses, weather within the park, hydrology, water quality, and beaver control.

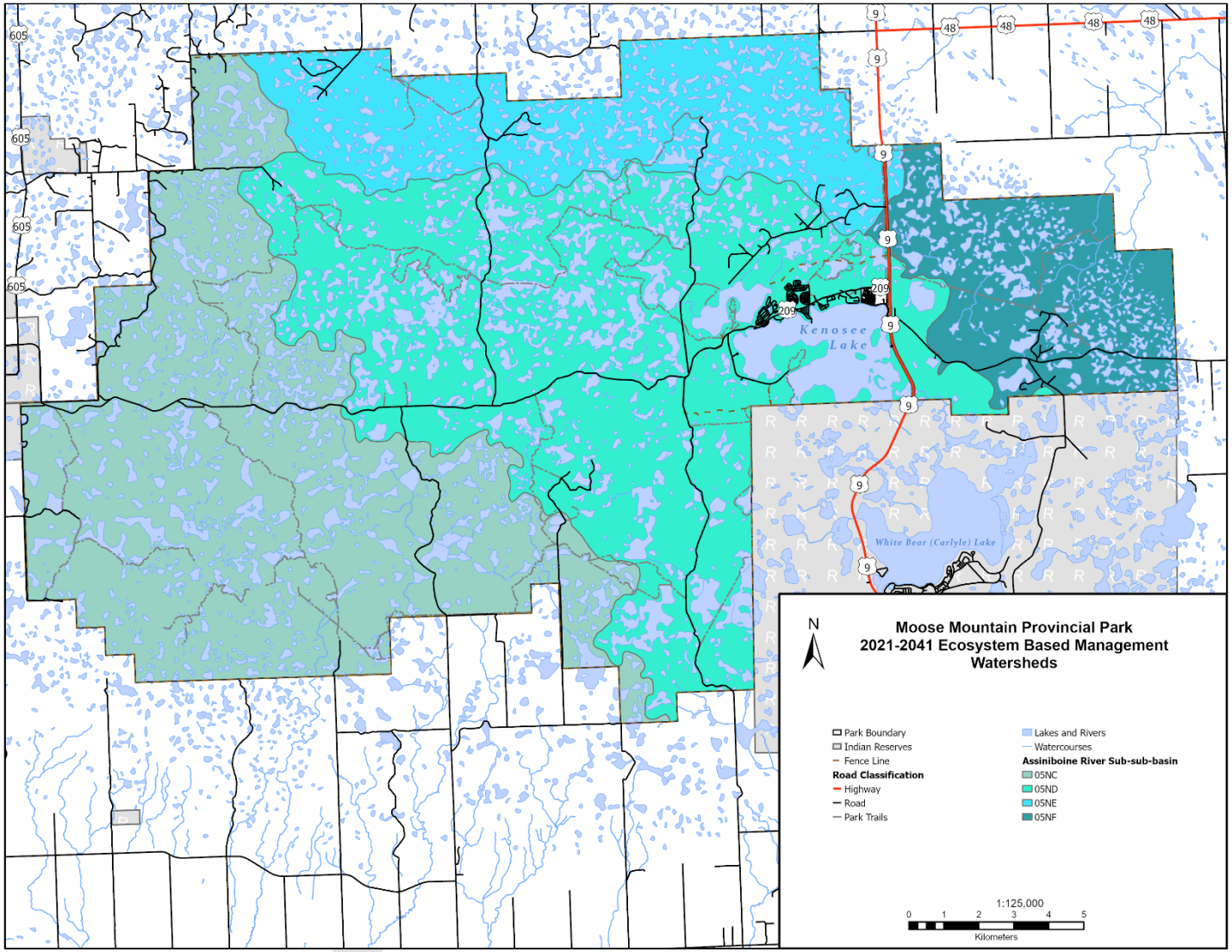

Figure 13 *Major hydrological features of Moose Mountain Provincial Park.*

3.3 NATURAL DISTURBANCE REGIMES

3.3.1 WILDFIRE

Prior to European settlement, low intensity surface fires played a significant role in the natural ecology of MMPP and the surrounding grasslands (Sommers, Coloff, & Conard, 2011). Fire inhibits forest cover growth in grasslands, thus maintaining grassland ecosystems. Fire was also ecologically beneficial to the deciduous forest uplands of the park. Fires reset seral stages of forests from mature, old, or very old back to young and immature. Fire allows aspen, the dominant tree species within MMPP, to reproduce asexually from surviving roots after a fire (Godwin, Wittrock, & Thorpe, 2013).

Historical, fire frequency is estimated to be high. The fire cycle, the number years required for the entire landscape to burn over entirely, for the area was low. Limited information is available for the area specific to Moose Mountain; however, inferences can be made from fire history studies conducted at nearby locations with similar ecosystem types. Weir *et al.* (2000) found that the grassland to boreal transition found within the southern edge of Prince Albert National Park, which is similar to the uplands of Moose Mountains, had a fire cycle of approximately 25 years with a range of 15 to 40 years. These numbers reflect fire cycles prior to European settlement (1760 through 1895) of the area.

Fire was also used by indigenous peoples for landscape management and warfare purposes, including altering vegetation to increase hunting success by attracting wildlife, especially bison (Roos et al., 2018). The use of fire beyond its natural cycle would have had impacts on forests and vegetation as it reset areas back to early seral stages more frequently than natural cycles (Sommers, Coloff, & Conard, 2011; Terrestrial & Aquatic Environmental Managers Ltd, 1992). Higher fire frequency persisted into the early settlement period. Once European's settled the area fire frequency declined and fire suppression activities increased. Cultivation, roads, and other anthropogenic activities caused forest fragmentation, which in turn reduced the ability of surface fires to spread. The post-settlement (after 1945) fire cycle is calculated to be approximately 645 years. This is the number of years needed for the entire landscape to be burnt, given the recent number, size, and frequency of fire events (Godwin, Wittrock, & Thorpe, 2013).

In recent history, only one major fire is noted to have occurred. The fire burned through the area in 1897 following almost a decade long period of drought in the 1890's. Most of the forest within the uplands burned, causing a landscape level regeneration of the forests. Two islands of forest were notably spared in this fire event: Hog Island and Maple Island (Terrestrial & Aquatic Environmental Managers Ltd, 1992; Godwin, Wittrock, & Thorpe, 2013). Recent fires, between the years 1980 and 2008, within the park are presented in ***Table 5***. Total area burned within the park is equal to 232.14 hectares or the equivalent of less than one percent of park area.

Of the 26 fires recorded for the park only two were caused by lightning accounting for 0.01 hectares in 1984 and 2.0 hectares in 1987. The remaining 24 fires that occurred within the park were from anthropogenic sources, their locations are presented ***Figure 14***. Anthropogenic sources account for most recent fires within the park (approximately 92 percent). Sources of anthropogenic fires include automobile, recreational, incendiary, other, and undetermined sources.

Recent fire suppression activities have created ecological and safety issues. Fire is considered a natural disturbance and aids in resetting ecological succession, nutrient cycling, insect, disease and fungal control, understory species control, and soil development of the prairies.

The prolonged absence of fire has caused over mature/old forest stands to become dominated stands within the park (see Section 3.5.4). As trees within the mature stands die, the dead wood accumulates on the forest floor

causing an increase coarse fuel loading. The flammability of the aspen forests can be altered depending on the abundance of ground fuels (e.g., slash, dead and down), stand composition (i.e., higher white birch densities), and annual environmental conditions (i.e., rainfall, temperatures, days with cross-over conditions) (Peterson & Peterson, 1992).

It is common in some Saskatchewan provincial parks (e.g., Duck Mountain Provincial Park and Meadow Lake Provincial Park) that over mature/old forest stands break down and are replaced by a dense layer of shade-tolerant shrubs within the canopy (e.g., beaked hazelnut). However, based on our field observation and the assessment of the 2020 SFVI data, natural regeneration with multiple cohorts of trembling aspen, green ash and balsam poplar is doing well in many forests stands in MMPP. This requires continuous monitoring to ensure that the park forest is on its natural successional pathway. Forest renewal activities using either prescribed fire or mechanical harvesting may need to be implemented on those old/very old stands with single cohort and/or shrubby areas (see Section 3.5.1.8, 3.5.4 and Appendix 6).

Table 5 *Recent fires (1980-2008) within MMPP including size and source of ignition.*

Year	Source	Size (ha)
1981	Human	2.40
1981	Human	34.40
1984	Human	1.00
1984	Human	0.01
1984	Human	0.09
1984	Human	3.20
1984	Lightning	0.01
1984	Human	0.20
1986	Human	0.09
1987	Human	0.20
1987	Lightning	2.00
1988	Human	70.86
1988	Human	0.40
1988	Human	0.10
1988	Human	1.10
1989	Human	11.00
1991	Human	0.01
1992	Human	0.05
1993	Human	2.00
1993	Human	0.01
1995	Human	0.01
1998	Human	65.00
2002	Human	1.00
2003	Human	6.00
2008	Human	25.00
2008	Human	6.00
	Total	232.14

Wildfire plays an important role and creates challenges for ecosystem-based management plans. As mentioned prior, fire plays an important role in the deciduous-dominated forests of Moose Mountain. Emulating the natural disturbance of fire through harvesting or reducing fire suppression activities in within the park will help to maintain the park's natural succession and biodiversity (see Section 3.5.4).

Challenges with fire as a natural disturbance management tool include planning (pre-fire), fire suppression activities, and treatments post-fire. The Saskatchewan Parks Division's "Provincial Park Resource Management and Recreational Activities Guidelines" (2003) outlines that:

- A wildfire management plan should be prepared for each park identifying areas in terms of their fire protection priority.
- "FireSmart" techniques are recommended for developed areas (e.g., harvesting/thinning to reduce continuity of fuels).
- Areas with low priority to the protection of human values and a fire is considered to provide ecological benefits, fires should be allowed to burn naturally.
- Low-impact fire control methods should be preferred and used whenever possible; fires should be contained using natural barriers such as water or roads; fireguards and roads should be kept to the minimum extent consistent with safety; minimal use of foam and fire retardant near water; fireguards and roads should avoid environmentally sensitive areas; these disturbances should be reclaimed to their original condition after the fire is out; windrows of knocked over trees should be reduced and broken up.
- Salvage logging of burned timber is not allowed unless recommended for vegetation management purposes.

Areas containing values at risk have been determined to benefit from wildfire and fuel management treatments. These areas are presented in Appendix 9. Wildfire and fuel management treatments as outlined by FireSmart include:

- Remove interconnected crowns and increase spacing to three metres between higher risk trees (i.e. white spruce)
- Prune tree branches within the first two metres of the height of the tree
- Create a non-combustible zone within 1.5 metres from building (i.e., remove firewood storage, clean gutters, clean roofs, eliminate fuel sources)
- Utilize fire resistant materials in design, construction, and landscaping
- Ensure chimneys are clean and spark arrestors are working properly
- Utilize approved fire pits
- Utilize native tree and shrub species that are naturally resistant to fire (e.g., trembling aspen, balsam poplar, Manitoba maple, green ash, cherry, alder)

Additionally, the Saskatchewan Park's has a "Prescribed Fire Policy" (2009). This policy describes how prescribed fire can be applied on park lands such as:

- Maintaining and improving ecosystem health and biodiversity
- Promoting nutrient recycling and energy flows
- Returning park lands closer to their historical fire regimes
- Managing insects and disease infestations
- Managing the control and spread of invasive alien plant species
- Renewal of native grasslands/forestlands
- Reduction of fuel loading – reducing wildfire hazards
- Restoration and maintenance of rangelands

Implementing prescribed fires into a park setting requires planning detailing the goals, responsibilities, procedures, and monitoring of fire operations. The use of fire for landscape level forest regeneration within the Moose Mountain area was determined to be unacceptable for several reasons such as including cost and concerns from the public safety (Godwin, Wittrock, & Thorpe, 2013). However, to stimulate natural large-scale disturbance, forest harvesting of aspen could replace fire as disturbance mechanism. However, it is worth noting that, small, prescribed fires can be a useful management tool especially in grassland ecosystems, such as the upland grasslands, ecosite type PR12 (see Section 3.5.2.2) of the Moose Mountain area. Prescribed grassland fires can reduce woody encroachment within grassland areas, reduce litter accumulation, and limit the spread of invasive species (Godwin, Wittrock, & Thorpe, 2013; Widenmaier & Strong, 2010), and when integrated with grazing and browsing, can create a shifting mosaic of successional stages shown to be important for plant and animal biodiversity and wildlife habitat (Fuhlendorf and Engle, 2001). Potential areas for prescribed burning within the park are presented in Appendix 10.

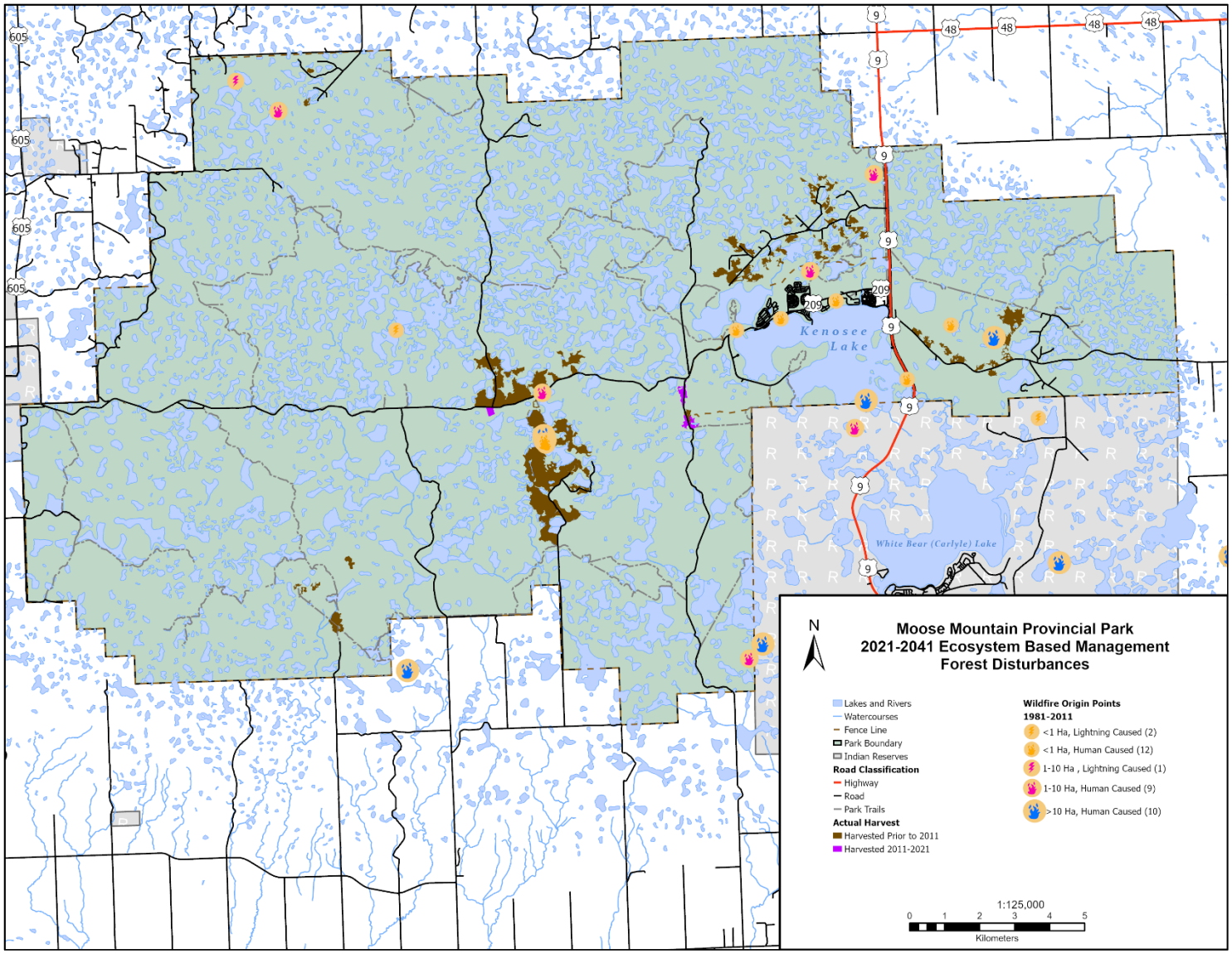

Figure 14 *Map of recent fire occurrences within MMPP.*

3.3.2 INSECTS AND DISEASE

At a provincial level the surveillance, monitoring, and management of forest insects and disease are completed by the Saskatchewan Ministry of Environment (MOE). Information on most of the key pests found in Saskatchewan forests is available on the MOE website (Government of Saskatchewan, 2021). Several insects and diseases are found to affect trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*) forests, which are the dominate stand type within MMPP. The area contains other tree species such as green ash (*Fraxinus pennsylvanica*) and Manitoba maple (*Acer negundo*) which are also susceptible to insects and disease.

Within parklands, insect infestations and disease can negatively impact ecological function, park aesthetics, and visitor safety. While insects such as the forest tent caterpillar (*Malacosoma disstria*) and large aspen tortrix (*Choristoneura conflictana*) serve as natural agents of change in the forests, non-native insects and disease pose a serious threat to the ecological function of Saskatchewan's forests and parklands. Public safety becomes a concern when trees in high use areas, such as the core, become infested with insects or disease. Visitor safety with regard to vegetation management is further mentioned in Section 3.5.6.

Insect and disease mitigation for public safety should include the assessment, monitoring, and removal of suspect trees, especially within core areas. Additionally, the Park's forests should be managed to represent a variety of age classes. Younger forest stands tend to be more resilient to insects and disease as well as generally healthier in comparison to older forests which are more prone to insect and disease infestations (Government of Saskatchewan, 2012). The susceptibility of over mature forests to disease and insect infestations is further supported by the findings of Sutherland and Neil (2001) within the forests of Moose Mountain Provincial Park.

At the time of preparing this plan, no main concerns for MMPP regarding insects and disease were notable, except for a recent forest tent caterpillar outbreak in 2017 (Poniatowski & McIntosh, 2021). Insects and diseases of concern to MMPP include the emerald ash borer, forest tent caterpillar, poplar borer, bronze birch borer, hypoxylon canker and leaf and twig blights of aspen and general agents of decay.

3.3.2.1 EMERALD ASH BORER

The threat of the emerald ash borer (*Agrilus planipennis*) entering the park has been noted within the Annual Park Planning for 2020 (Government of Saskatchewan). The emerald ash borer is an introduced pest from Asia. The borer will infect all species of ash trees (*Fraxinus spp.*). The beetles were introduced in the Detroit/Windsor area and 2002 and quickly spread to Quebec and west to Winnipeg by 2017. If emerald ash borer beetles spread to Saskatchewan, there could be devastating impacts on urban trees as well as natural green ash trees found within MMPP.

Adult emerald ash borers emerge to feed on foliage in May to early June. Adults do not leave any major apparent damage but cause irregular notches on leaves that can be an early sign of infestation. Throughout June and July, the adults lay eggs within the bark during which hatch approximately two weeks later. The larvae tunnel through the bark into the cambium and then into the sapwood and phloem the next spring. Typically, this cycle takes only one year to complete. The galleries left by feeding larvae are the most damaging and can cause significant crown dieback in the first year. Trees often are girdled in the two or three years after becoming infested. Early signs of infestation are hard to detect. Early signs include woodpecker activity, D-shaped holes (***Figure 15***)., notches on leaves, vertical bark cracks that split and slough off, yellowing foliage, and a sparse crown followed by epicormic shoots.

Emerald ash borers spread through infested wood products. Preventative measures would include banning the movement of wood. A core area tree inventory could also be used to monitor the risk of emerald ash borer in the

park and plan for short- and long-term response. Surveying using pheromone traps and branch sampling can be useful to support decision making and reduce costs in the future.

In the short term, removing and destroying affected trees or using a botanical insecticide can help protect high value ash trees. In the long term, beginning public engagement and education can encourage reporting. Ideally this helps to minimize risk while long term options like replanting for species diversity can be undertaken to reduce the impact on existing trees if the emerald ash borer enters or establishes itself in MMPP (Government of Saskatchewan, 2021).

Figure 15 *Signs of emerald ash borer (McKay).*

3.3.2.2 FOREST TENT CATERPILLAR

Forest tent caterpillars (*Malacosoma disstria*) can be found across Canada and will contribute to natural forest disturbances. In 2015, 4.8 million hectares of forest in Canada was defoliated by the larvae feeding. Caterpillars will primarily feed on trembling aspen, but, if in an outbreak or active infestation they will also defoliate other hardwood trees and shrubs. Other tree species found in the park like Manitoba maple, green ash, white birch (*Betula papyrifera*) and balsam poplar are likely to be impacted.

Typically, there is one generation of forest caterpillars per year that will usually finish defoliating trees by mid-June. Every 10 to 12 years the species undergoes an outbreak cycle that can last for three to six years and cause more severe widespread defoliation. In the short term, the risk of disease and large scale die off is minimized by aspen trees re-foliating. Caterpillar defoliation can also result in twig mortality, reduced radial growth, and smaller leaf size. A summer drought or late spring frost will also put additional stress on the tree. Over repeated defoliations this can weaken trees making them are more susceptible to stem cankers, decay, and bark- and wood-boring insects, which is why the end of an outbreak is usually associated with an increase in disease.

If the caterpillars completely defoliate a tree before finishing their development, they will migrate to the understory to feed on shrubs and other vegetation. This can become a nuisance in recreational areas and make for unsightly cocoons on trees that can be removed for aesthetic values. The adult moths may cause issues by gathering around lights (Government of Saskatchewan, 2012; Hiratsuka, Langor, & Crane, 2004; Government of Canada, 2021).

A study within MMPP by Sutherland and Neil (2001) found that approximately 10 percent of suitable host trees were affected by the forest tent caterpillar. However, this percentage would be higher in years of active outbreaks. An outbreak of forest tent caterpillar in 2017 lead to 409 hectares being treated with insecticide to control the insect (Poniatowski & McIntosh, 2021).

3.3.2.3 POPLAR BORER

The poplar borer (*Saperda calcarata*) is a widespread wood-boring beetle that is present wherever there are suitable poplar species (***Figure 16***). The beetles prefer trembling aspen but will also bore into cottonwood (*Populus spp*.), balsam poplar and some species of willow (*Salix spp*.). Unlike many forest pests, poplar borers will affect healthy trees under 30 years old, trees ranging in diameter of seven to ten centimetres, and over mature trees. Trees at the edges of stands in full or partial sun are especially vulnerable.

A study within MMPP by Sutherland and Neil (2001) found that approximately 20 percent of over-mature (80 years old or greater) suitable host trees were affected by the poplar borer while only approximately six percent of immature (30 to 50 years old) and mature (70 to 80 years old) poplar trees were affected.

The life cycle of the poplar borer consists of three to five years of development followed by an adult stage lasting approximately six weeks. Eggs hatch after three weeks and spend time eating the inner bark before hibernating and boring through the sapwood into the heartwood the next spring. Over the rest of their development, the larvae continue the cycle of feeding and hibernating leaving behind crevices and tunnels. Usually this does not cause serious damage but the risk of snapping in the wind, secondary damage by woodpeckers and introduction of rot fungi is increased.

Proactive management of poplar borers is to avoid poor planting sites and plant in groups, so the density keeps stems out of full sun. Sometimes brood trees can occur where one tree is affected and these trees should be removed and disposed of, if possible, to prevent localized infestation (Government of Saskatchewan, 2021; Hiratsuka, Langor, & Crane, 2004).

Figure 16 *Poplar borer affecting a trembling aspen (The City of Grande Prairie, n.d.).*

3.3.2.4 BRONZE BIRCH BORER

A forest pest of all native and introduced birches in Canada is the bronze birch borer (*Agrilus anixus*). The wood-boring beetles target weakened and older trees that may already stressed by drought, wounds, or repeated

defoliation. In MMPP, this pest would likely have the greatest impact on white birch. The bronze birch borer is associated with periods of drought when the shallow-root system of birch trees is vulnerable to attack.

The adult beetles are strong fliers, searching for leaves of birch, poplar, or alder to feed on but do not cause any significant defoliation. Eggs are laid in cracks in the barks. When the eggs hatch, the larvae mine into the cambium and phloem creating a crisscrossing pattern. Later in the season they move into the sapwood where they spend the winter before continuing feeding or pupating in the fall. New adults chew through the bark of the main stem or branches leaving a characteristic D-shaped hole. Depending on climate, this cycle can take one to two years. Populations are not synchronized so there is always one generation each year.

Larval boring within the cambium will eventually girdle the tree, killing it. The effects of this first appear as sparse yellow foliage in the upper crown, followed by branch dieback spreading until the entire crown dies. There may also be signs of swollen ridges where the tree has responded to larvae boring underneath the bark. Spotting an infestation early on may be able to slow the spread. Reducing stressors by watering ornamental birches and keeping the soil cool can help prevent them being targeted.

A study within MMPP by Sutherland and Neil (2001) found that approximately 60 percent of study sites that contained white birch had bronze birch borer.

3.3.2.5 HYPOXYLON CANKER OF ASPEN

Hypoxylon canker (*Hypoxylon mammatum*) is the one of the most damaging diseases of young and intermediate age aspen causing fungal cankers that girdle branches or main stem. It is widespread in Canada potentially also impacting balsam poplar and other poplar hybrids.

Spores initially infect trees through insect or mechanical damage and are moved around by wind during humid and moist weather. The fungus begins growing under the bark and causes death of cambial tissue leading to orange blisters on the bark. The following season, the blisters crack and harden as grey fruiting bodies begin to emerge. The fruiting bodies help to spread the disease when wet and can produce cankers up to a meter long before eventually killing the tree. Often mortality occurs within five years after infection. Trees that are not killed, become more susceptible to wind damage. Environmental stress caused by poor site conditions or poorly stocked forest may increase the seriousness of hypoxylon canker once it enters the stand.

The best way to manage hypoxylon canker is to remove the infected tree and, if possible, dispose of the tree, as the fungus can live saprophytically on dead and down trees within an area. Some forest stands may be more susceptible to the disease if predisposed or if there are susceptible clones. When outbreaks occur in forests frequently used for recreation the infected/damaged trees should be removed to prevent injury or damage to property (Hiratsuka, Langor, & Crane, 2004).

A study within MMPP by Sutherland and Neil (2001) found that approximately 55 percent of immature (30 to 50 years old), 61 percent of mature (70 to 80 years old), and 60 percent of over-mature (80 years old or greater) of aspen were affected by hypoxylon canker.

3.3.2.6 LEAF AND TWIG BLIGHTS OF ASPEN AND POPLAR

Leaf and twig blight of aspen and poplar are two diseases caused by two related fungal pathogens: *Venturia macularis* and *Venturia populina*. Both fungi are widely distributed through the prairies infecting aspen and balsam poplar as well as other *Poplus* species. The fungi utilize dead branches throughout winter for spore production and as a mechanism for spore distribution, as the spores are carried by wind to a new host in the spring. The disease is characterized by blackening and wilting of shoots in young trees, and dark irregular spots on the leaves of older

trees. In young trees, wilting of shoots often causes them to bend backwards causing them to be often called shepherd's crook. Trees can be left severely disfigured with impacted growth if enough shoots are affected.

Sutherland and Neil (2001) found that approximately nine percent of immature (30 to 50 years old), six percent of mature (70 to 80 years old), and 10 percent of over-mature (80 years old or greater) of suitable host trees within MMPP by were affected by blights.

3.3.2.7 DECAY

Several decay organisms that affect broadleaf trees. The decay organisms vary in location, wood affected (i.e., sapwood or heartwood), pattern, and fruiting bodies (***Figure 17***). Common prairie decay organisms include: armillaria root rot (*Armillaria ostoyae*), scorched conk (*Bjerkandera adusta*), tinder conk (*Fomes fomentarius*), artist's conk (*Ganoderma applanatum*), birch polypore (*Piptoporus betulinus*), mossy maze polypore (*Cerrena unicolor*), turkey tail (*Trametes versicolor*), false tinder conk (*Phellinus tremulae*) and scaly shaggycap (*Pholiota squarrosa*). Most produce airborne spores that spread new infection by getting into a stem or branch wounds caused by animals, weather, or mechanical damage. Decay is not exclusive to old or over mature stands. Advanced decay impacts the economic value of the wood if it is not structurally sound or stained inside. Decay is also a threat to public safety in areas of high use (e.g., core areas of provincial parks) as decay reduces the structural integrity of the tree which can lead to blow down and broken tops.

Sutherland and Neil (2001) found that approximately 39 percent of immature (30 to 50 years old), 67percent of mature (70 to 80 years old), and 90 percent of over-mature (80 years old or greater) of suitable host trees within MMPP by were affected by blights.

Figure 17 *Decay of aspen with fruiting body of false tinder conk (Allen).*

Other insects and diseases with potential to affect plants within MMPP include European gypsy moth (*Lymantria dispar*), Armillaria root disease (*Armillaria spp.*), fire blight (*Erwinia amylovora* and *Pseudomonas syringae*), Black knot (*Apiosporina morbosa*), and white trunk rot of aspen (*Phellinus treulae*) (Government of Saskatchewan, 2021).

3.3.3 OTHER DAMAGE

Other damage and mortality factors affecting the forests of MMPP include wind throw, fluctuating water levels leading to drought conditions or a rising water table, which saturate root systems and kill the tree, beaver activity, browsing by herbivores, vandalism, and frost.

An updated forest inventory was completed in August of 2020 by Timberline Forest Inventory Consultants (2021). Findings showed that approximately 68 percent of the park's forests were classified as mature, old or very old. Hardwood species (e.g., trembling aspen, balsam poplar, white birch) are considered to be over mature at ages of 90 years and greater (NCASI, 2005). As mentioned previously, the age of the forest plays a role in its susceptibility or defense to insects and disease. A tree that is infested with insects and or disease can cause it to be further susceptible to other mortality or damage factors. The inventory and age-classes of the forests found in MMPP are further discussed in Section 3.5.4.

Mechanical damage is the damage to vegetation caused by anthropogenic sources and or natural sources. Mechanical damage can cause tree mortality or lead to tree mortality or decline as physical damage and results in stress and or access points for insects or pathogens to enter the tree. Unintentional anthropogenic sources can include regular trail use, ATV use, road and right of way maintenance, improper use of machinery and/or equipment. Intentional anthropogenic sources can include vandalism, off-trail travel, and attaching ropes to trees or bark stripping. Natural sources of mechanical damage include tree rubbing, animal use, damage resulting from the falling of neighboring trees, as well as damage from weather events such as wind, hail, frost, and snowpack.

Weather events such as wind, hail or heavy snow can cause mechanical damage by breaking branches or damaging leaves. Young trees tend to be more affected by hail damage than larger trees. Severe weather events such as plow winds can lead to large areas of wind throw. Wind throw is common disturbance in mature forest stands. In aspen dominated stands, large-scale wind throw events can act as a stand-level rejuvenation mechanism. Blowdown promotes new shoot growth from suckering as well as creates favourable light conditions for new growth (USDA Forest Service, 2015). However, wind throw can create increased risk management concerns especially in the developed core areas. In addition to risks to visitor safety and values, the resulting dead standing or dead and down timber increase ground fuel loading thus increasing the threat of wildfire (Government of Saskatchewan, 2017).

The Moose Mountain area contains many hydrological features (see Section 3.2.3) including wet meadows, wetlands, open muskeg, treed muskeg, and marshes (***Figure 18***). Variability in water levels can lead to drought or water stress. Prolonged stress can lead to foliage discolouration, dieback, and reduced or limited gas exchange in roots, rot, whole tree mortality, and increased insect damage (Government of Saskatchewan, 2020).

Figure 18 *Wetlands within MMPP (Timberline Forest Inventory Consultants, 2021).*

Frost damage is caused when young new foliage freezes in a late spring frost. Trembling aspen will develop secondary leaves to replace damaged leaves, but this can cause stress to the tree, as secondary leaves utilize the plant's resources. Repeated frost damage can cause deformed trees that are more susceptible to wind breakage and have decreased vigor.

The North American beaver (*Castor canadensis*) has caused notable forest damage and disturbance in the areas adjacent to lakes, ponds, and water courses. Trembling aspen is a preferred food source of the beaver, with a single beaver needing about half a hectare of aspen trees per year. A beaver can fell over 200 trees annually (Hinterland Who's Who, 2005). Timberline Forest Inventory Consultants (2021) found that areas of high beaver use exhibited atypical forest regeneration. Aspen regeneration was found to be inhibited due to high density of shrub growth, there are also scattered patches of green ash and white birch, both of which are less preferred food sources for the beaver.

Animals such as mice, squirrels, rabbits, porcupine, and sapsuckers also cause mechanical damage to trees by creating holes and striping off bark; this can cause stress, potential girdling, and opportunities for insects and pathogen to enter (Spengler, 2019). Elk, deer, and moose can also damage trees through feeding, trampling, scenting, scraping, and digging (County of Wetaskiwin, 2021). The park also supports domestic cattle grazing. Together these animals feed on a variety of plant material, including browsing on shrubs, aspen suckers, and young saplings (Thorpe J. , 1994; Bork, Carlyle, Cahill, Haddow, & Hudson, 2013). Grazing has been found to both promote and inhibit woody plant growth (Sankey, 2006).

3.4 HISTORY OF HUMAN USE OF PARK ECOSYSTEMS

The Moose Mountain area has been a site of human and cultural significance both historically and pre-historically. Archeological sites of mounds and medicine wheels can be found dating back at least 1700 years (Baird, 2021) with some sites believed to date back 2650 years (Cyr-Steenkamp). Traditional Aboriginal use of the area prior to European settlement was by the Cree and Assiniboine. The area was used for shelter, water, food sources (especially fish and bison), as well as a navigational landmark, and for ceremonial purposes (Baird, 2021; Yanko).

European exploration of Saskatchewan initiated in the late 1600s, however most exploration did not occur until the late 1700s. Between 1787 and 1821, the Moose Mountain area was primarily used by European fur traders and Indigenous peoples. During this time, the Moose Mountains were named Montagne a la Bosse which translates to "the mountain of the bump or knob". Two known fur trading posts were established by the Hudson Bay Company. The first trading post Moose Mountain I, was established in 1859 and the second, Moose Mountain II, was established in the 1860s/1870s (Cyr-Steenkamp).

Two well-known European explorers, John Palliser, and John Macoun included the Moose Mountain area in their expeditions (Terrestrial & Aquatic Environmental Managers Ltd, 1992). John Palliser was recorded to be in the area between 1857 and 1859 and John Macoun around 1880. By the late 1880s the Northwest Mounted Police had established posts in the Moose Mountain area, specifically Carlyle and Cannington. During this time the number of European settlements and homesteads also increased (Cyr-Steenkamp).

In August of 1871, Treaty 2 was signed between the Crown and the Anishinabe of southern Manitoba and southeastern Saskatchewan. This Treaty included the Moose Mountain area. It was the first federal Treaty within Saskatchewan and subsequently established the reserve lands near Moose Mountain (Baird, 2021).

Near Moose Mountain, Cannington Manor was established in 1882 by Edward Mitchell Pierce. The Manor was set to replicate aristocratic English lifestyle on the prairies. The villagers of Cannington Manor hosted events such as: fox hunts, dramatics societies, poetry clubs, tennis, cricket, and croquet. The village was eventually abandoned in 1900 (Tourism Saskatchewan). The Manor became a provincial historic site in 1965 and then was designated as a provincial historic park under the Parks Act.

The ecological importance of the area was recognized, and the area was protected as a Federal Forest Reserve in 1894. This designation allowed for management and limitations on resource extraction and use. Gradually homesteads were eliminated from within the forest reserve. Permits to allow grazing and haying came into effect in 1914 and 1915, respectively (Sutherland & Niel, 2001).

Before the establishment of MMPP in 1931, and the official naming of Kenosee Lake in 1932, the lake was named "Fish Lake" by European settlers in the late 1800s (Baird, 2021; Running, 2013). The area became a popular resort community in the late 1800s and early 1900s. A local family, the Christopher's, established a resort on the lake in 1897. Around this time other stores, dance halls, cabins, roads, and trails were created. The Fish Lake village was established and by 1906 was home to around 30 people. Additionally, around this time, the first forest ranger position was created for the area (Baird, 2021). Official cottage subdivisions were laid out by the Dominion Forest Branch between 1911 and 1912 (Sutherland & Niel, 2001).

After the Natural Resource Transfer Agreement in 1930 the provincial government designated the Moose Mountain area a Provincial Park in 1931. Shortly after, Fish Lake was renamed to Kenosee Lake, reflective of the Cree word for "fish". A component of the park's establishment was to relieve unemployment rates due to the Great Depression. Approximately 250 unemployed tradespeople were brought in to work on various park projects including a chalet, golf course, gardens, and roads and trails. At the time of its opening in 1933, the golf course was

regarded as one of the best in Canada. Unfortunately, the original chalet was destroyed by fire in 1933. The chalet was rebuilt the following year (Baird, 2021).

Many traditional and modern land uses continued after the designation of the Provincial Park (Sutherland & Niel, 2001). Oil and gas exploration began in the 1960's and continues today. Oil and gas exploration within the park is discussed further in Section 3.5.1.7. Additionally, a correctional camp, Camp 100, was utilized by the government. The camp is no longer in use for its original purpose.

3.5 PRESENT DAY USE AND COMPOSITION OF PARK VEGETATION

3.5.1 PRESENT DAY RESOURCE USE ACTIVITIES

3.5.1.1 RECREATIONAL DEVELOPMENT

Recreational infrastructure has been developed in the years prior to the establishment of the Moose Mountain Provincial Park (1931) and has continued thereafter. Today, the park contains a variety of developments, both public and private. Public facilities include park camping accommodations and recreational opportunities. Private facilities include residentials, accommodations, amenities, and recreational opportunities. A map of all developed features within MMPP is presented in ***Figure 19***.

The Park contains four public campgrounds - two individual and two group camping. Most of the campsites within the park offer amenities such as electrical hookups, water, sewer, washroom and shower facilities, and paved access (***Figure 20***). Together the campgrounds provide over 420 campsites (***Table 6***). Proposed or recommended campground and recreational developments include more full-service campsites, upgrading of amperage in sites from 30 to 50, a public trailer/vehicle storage facility, sewage dump redesign and expansion (Government of Saskatchewan, 2020).

In addition to park camping facilities, the Village of Kenosee Lake within MMPP also contains privately owned accommodations and facilities. The Village of Kenosee Lake has a resident population of approximately 234 (Statistics Canada, 2016). The Kenosee Inn & Cabins provides guests with opportunities to rent hotel rooms or cabins. Additionally, the Inn offers conference rooms and a restaurant. Two private full-service campgrounds also offer accommodations to visitors.

A total of 453 cottages exists within the park. No restrictions are currently in place regarding cottage size or aesthetic. Cottages within the park are trending to a larger developmental footprint and increasing in density (Government of Saskatchewan, 2020).

Other recreational developments within the park include numerous public amenities, privately owned businesses, and non-profit organizations. The park provides swimming and water recreation opportunities in Kenosee Lake through swimming facilities (e.g., changing rooms), beach area, playground, fishing off dock and boat launch. Little Kenosee Lake offers a beach area, fishing off dock and canoe/kayak launch. The Recreation Hall in the core area accommodates large gatherings such as corporate events and weddings.

There are several privately owned businesses within the park such as Masters Mini Golf, Golf Kenosee, Club 19 Restaurant, Kenosee Lake Riding Academy, Allison's (grocery/ice cream store), Laundromat, Kenosee Superslides, Kenosee Inn and Cabins, DSI Enterprises (storage space Rental and Boat Dock Slip Rental). Village of Kenosee is a village located within park boundaries but separate entity. These businesses include The Bar Bar, Mini Mart (fuel station/convenience store/liquor Store), Kenosee Lake Rental Cabins, laundromat, car wash, Moose Mountain Church of Christ, and a volunteer fire department. There is no plumbing and heating services or veterinarian services within the village or park.

Three private children's camps utilize the park and have permanent facilities established. These camps include CANA Camp (Kenosee Lake Bible Camp), Clearview Christian Camp, and Kenosee Boys and Girls Camp (Kish & Carlyle Observer, 2021; Government of Saskatchewan, 2020).

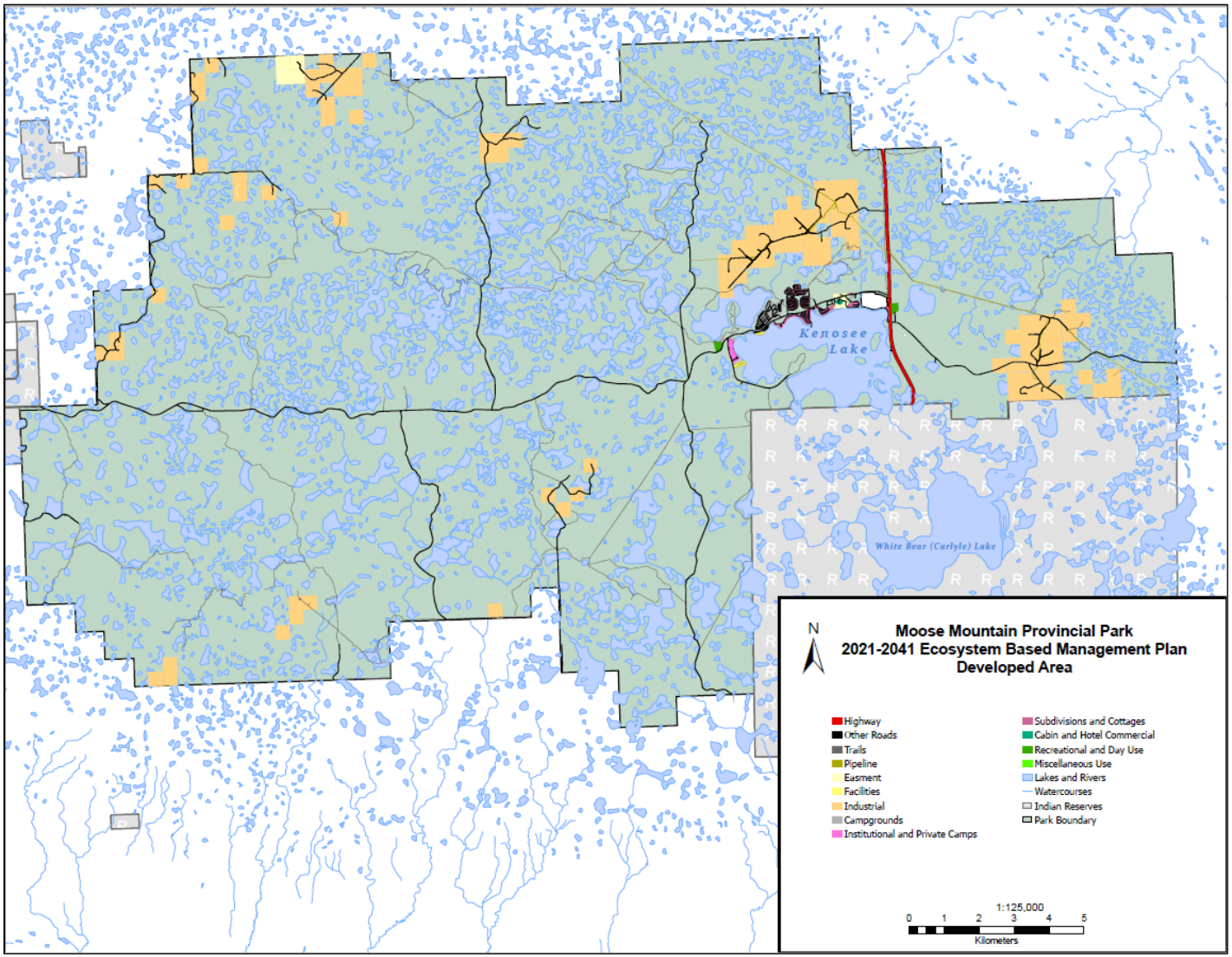

Figure 19 *Map of developed areas within MMPP.*

***Table 6** Recreational developments in MMPP.*

Campgrounds (public, group)			
Name	**Number of Sites**	**Name**	**Number of Sites**
Fish Creek (full-service)	28	Lynwood	30
Fish Creek (electric)	266	Overflow	22
Fish Creek (seasonal, electric)	59	Poplar Lane (group, non-electric)	multiple
Fish Creek (non-electric)	5	Aspen Meadow (group, non-electric)	multiple
		TOTAL	**421**
Cottage Subdivisions (Total: 7)			
Cottages	453		
		TOTAL	**453**
Private Resorts and Campgrounds			
Kenosee Lake Inn & Cabins		Kenosee Cabins and Campground	
Hotel Rooms	30	Cabins	4
Cabins	23	Campsites	14
Kenosee Klassic Campground		Kenosee Mini Mart and Motel	
Campsites	21	Hotel Rooms	N/A
		TOTAL	**92**

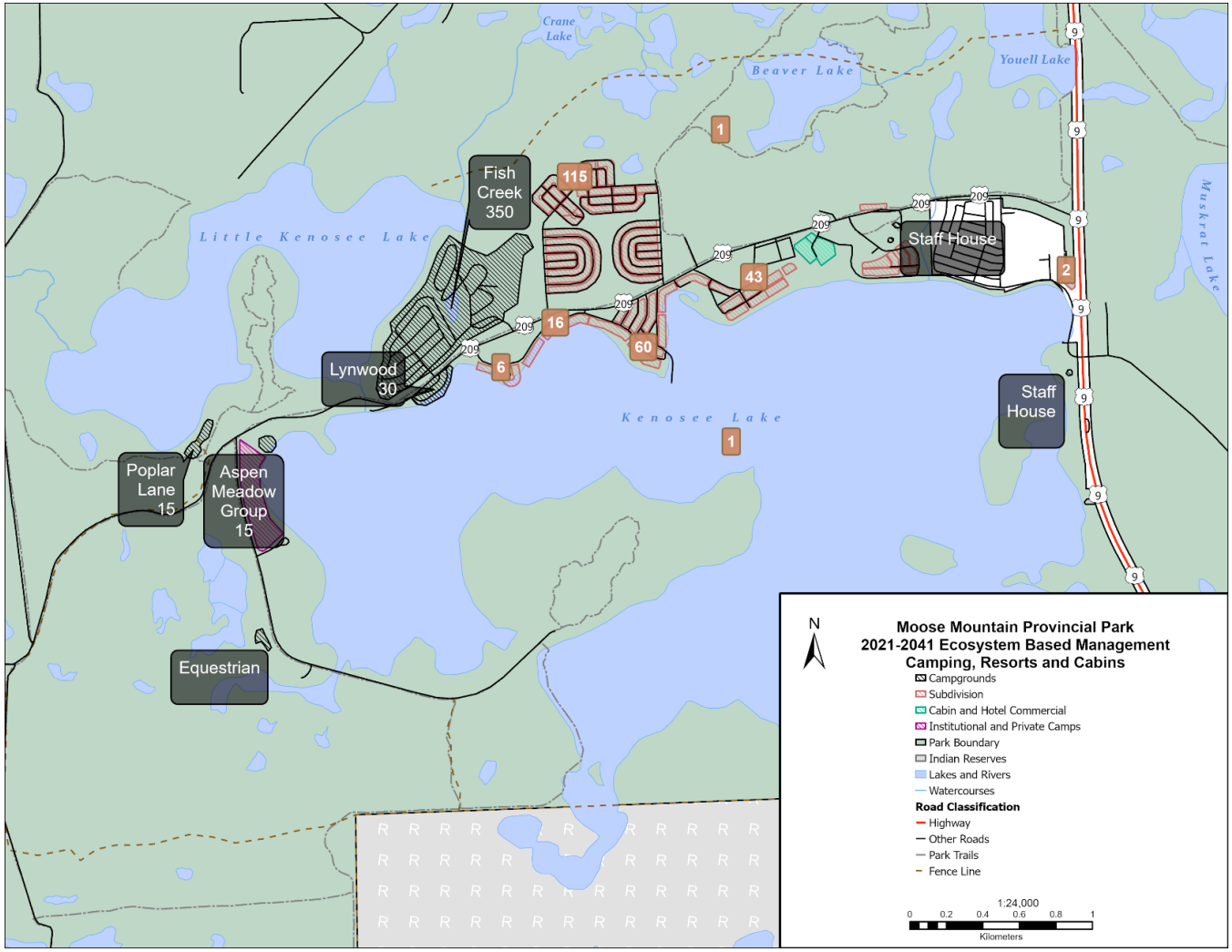

Figure 20 *Map of campgrounds, cabins, and resorts within MMPP.*

3.5.1.2 ROADS AND TRAILS

Roads and trails represent an important form of development within park land. Total length of roads and trails within the park is approximately 410 kilometres. The area of the roads and trails with an assumed right-of-way is approximately 590.5 hectares, which represents approximately 1.5 percent of the total area within the park (***Table 7***). The park is accessed via Saskota Flyway (Highway 9) north from Carlyle. The main access road into the park is paved. Most roads within the Village of Kenosee are paved.

__Table 7__ Developmental footprint summary within MMPP.

Type of Feature	Assumed ROW width (m)	Total Area (ha)
Highways	30	44.7
Other Roads – Paved or Gravel	15	531.5
Trails	5	182.6
Pipelines	5	32.1
	Linear Feature Total Area*	590.5
Cabins, Subdivisions, Commercial, and Private	N/A	54.3
Campgrounds	N/A	21.1
Easements	N/A	74.7
Industrial	N/A	2,221.1
Day Use and Facilities	N/A	10.3
	Non-Linear Feature Total Area*	2,581.8
	Total*	**3172.3**

approx. total land area of park	40,059 ha
percent of land area in roads and trails	~ 1.5 %
percent of land area of other features	~ 6.4 %
Total developed area percent	~ 8 %

*Area was calculated after removing overlapping features

The overall developmental footprint within Moose Mountain Provincial Park is depicted in ***Figure 21***. All types of developments discussed above are included in the analysis. Linear features were combined and calculated to determine linear development density (i.e., length of linear features in kilometers per square kilometer). The overall developmental footprint does not account for the different weight of environmental impacts of the various features (i.e. dirt roads compared to highways) but measures as a whole. The developmental footprint of the park is approximately eight percent of the total park area.

A wide variety of recreational activities (see Section 3.5.1.4) are supported by the roads and trails within the park. The park contains 239 kilometres of trails (***Figure 22***). The network of trails is utilized by hikers, cyclists, birdwatchers, ATV operators, cross-country skiers, snowmobilers, snowshoers, hunters, and equestrian riders. Back country trail use is managed through zoning, trail designations, and seasonal activities.

ATV or snowmobile is permitted within the park in designated areas and trails. The use of ATVs within the park boundary is regulated under *The Parks Regulations* (1991). These regulations ensure ATV operators follow specific

rules to ensure personal safety as well as protect the park ecosystem. In addition to The Parks Regulation 1991, the Recreational ATV Use in Provincial Parks Policy (2012) states that ATV use should only be allowed on designated single-purpose trails and that use should not be allowed in most provincial parks, except for parks large enough to contain an ATV-only trail system created to minimize environmental impact. The Guidelines also state that snowmobiles should only be allowed on designated single-purpose trails.

Despite regulations and guidelines in place, damage from ATV and hunting vehicles has been noted on the trails. Unauthorized trail use and use beyond permitted trails has already been noted within the park. It has also been noted that the park has limited resources to maintain, monitor, and enforce the backcountry trail system (Government of Saskatchewan, 2020).

Limiting or further reducing the use of ATVs and snowmobiles within the park will aid in reducing soil erosion and compaction, vegetation damage, impediments to wildlife movements, roadkill, noise disturbance, air and water pollution, and the introduction of non-native species (Wright & Dodge, 2010). As an example of ATV damage to the provincial park ecosystems, Thorpe and Goodwin (2019) found that the use of ATVs within Meadow Lake Provincial Park caused damage and degradation to the ecosystem. Of the 20 sites surveyed 12 percent showed early stage impacts of occasional ATV use, 31 percent showed loss of vegetation, soil compaction and evidence of multiple years of wear, 27 percent showed severe impacts with soil compaction, rutting and/or erosion and severe loss of vegetation). More concerning is that 19 percent of sites surveys showed signs of willful damage to the ecosystem.

Introduction of exotics along ATV trails through mud and debris attached to machines in conjunction with disturbed soils create ideal establishment opportunities for non-native invasive plants. A variety of practices have been recommended for reducing these ecological impacts, especially limiting use to designated trails which are designed to avoid wet, steep, sandy or beach terrain, and use appropriate creek crossings. As noted previously, observations in Saskatchewan parks show that users often do not stick to designated trails (Wright & Dodge, 2010; Government of Saskatchewan, 2020). Roads have also been found to allow the establishment of non-native/invasive plant species. Smooth brome (*Bromus inermis*) has been found to spread quickly through ditches and rights-of-way. This provides the further invasion opportunities into adjacent native habitats. Belcher and Wilson (1989) found that almost all the leafy spurge (*Euphorbia serpens*) occurrences were centered on roads, trails, or fireguards within their study area of southern Manitoba.

Additionally, linear features such as roads, rights-of-way, and trails are a leading contribution to habitat fragmentation. Large habitat areas that have been fragmented show a reduced core area of ten percent or more, while small habitat areas will have a core area reduction of up to fifty percent. In addition to habitat fragmentation, linear features alter plant composition causing an increase in invasive or non-native species and a decrease in abundance of native species. Physical disturbances also include pollutants (e.g., particulates, dust, and chemicals), alteration of the soil pH, noise, impediments to wildlife movement, and soil compaction. These disturbances extend inward from the linear feature 20 to 30 metres, which in turn contribute to the “edge effect” or degradation of the core habitat. Different classes of roads have higher or lower impacts on the surrounding habitat. Dirt roads have the lowest impact; however, they have a high level of soil compaction and risk of erosion and invasive establishment due to bare ground. Paved roads and their rights-of-way have the highest habitat impact (Gieselman, Hodges, & Vellend, 2013).

The province and Parks Division have previously outlined activities to mitigate or minimize linear feature disturbance. The Provincial Park Resource Management and Recreational Activities Guidelines (2003) state that:

- Vehicle use on roads and trails can lead to environmental damage, increased hunting pressure, and opening of previously inaccessible areas.
- An inventory and assessment of roads and trails should be completed.

- Necessary roads and trails (i.e., resource management use or access routes to park facilities) should be designated.
- Roads and trails that are not necessary should be decommissioned.

The Park and the Village of Kenosee Lake contains a high density of roads and trails (Figure 21).

As described in the Guidelines listed above, a road and trail inventory and assessment should be completed. Unnecessary roads and trails, particularly those access routes to abandoned oil/gas pads, should be decommissioned, and reclaimed to native vegetation, while preventing further access. Roads and trails should also be included in monitoring for invasive plant species. A moratorium on recreational ATV use within park lands would reduce ecological degradation and allow for reclamation activities. ATV use could be limited similar to that of Cypress Hills Interprovincial Park, where its use is for non-recreational purposes (e.g., retrieval of game) or with permits (i.e., for research activities).

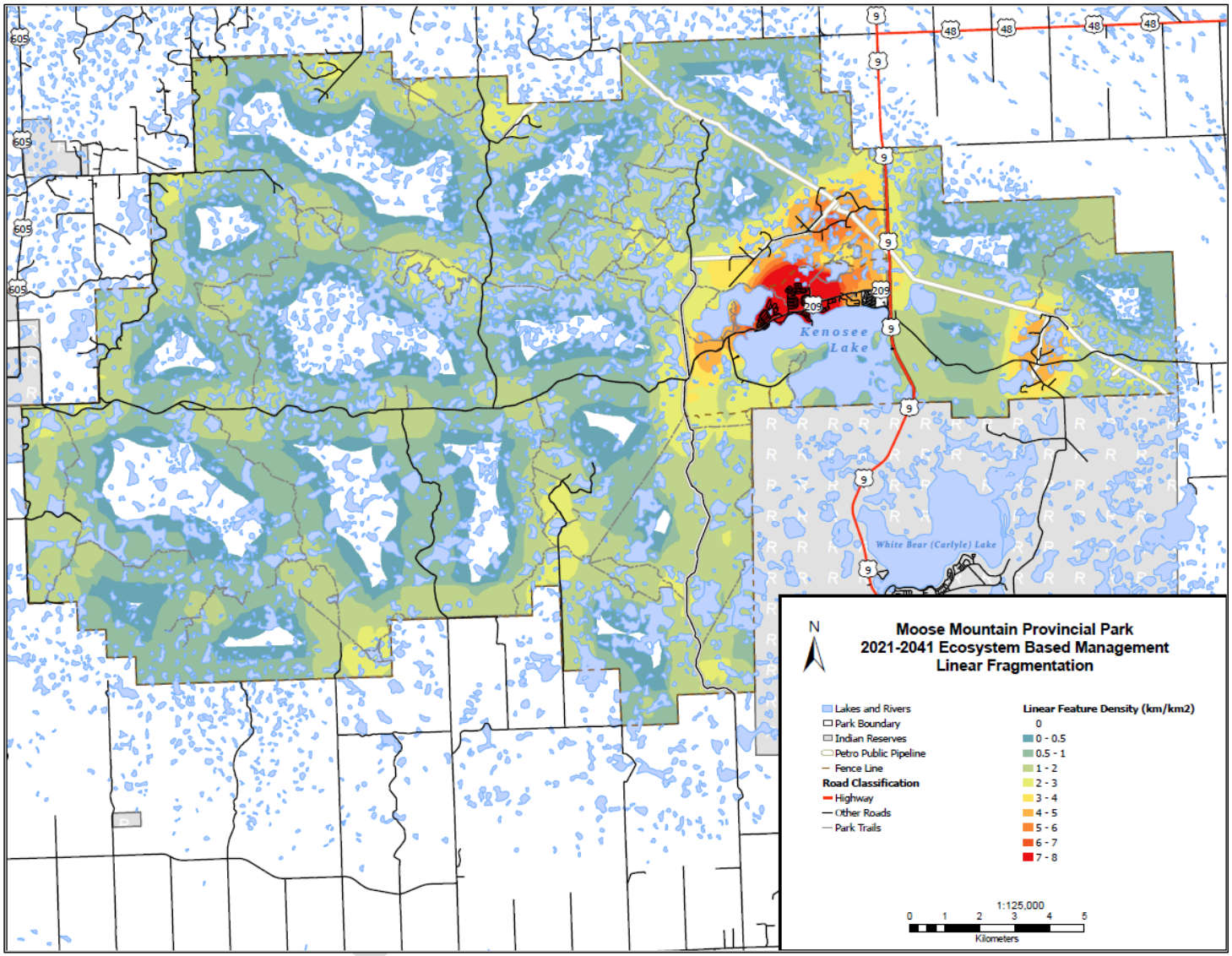

Figure 21 *Overall footprint of linear features and fragmentation within MMPP.*

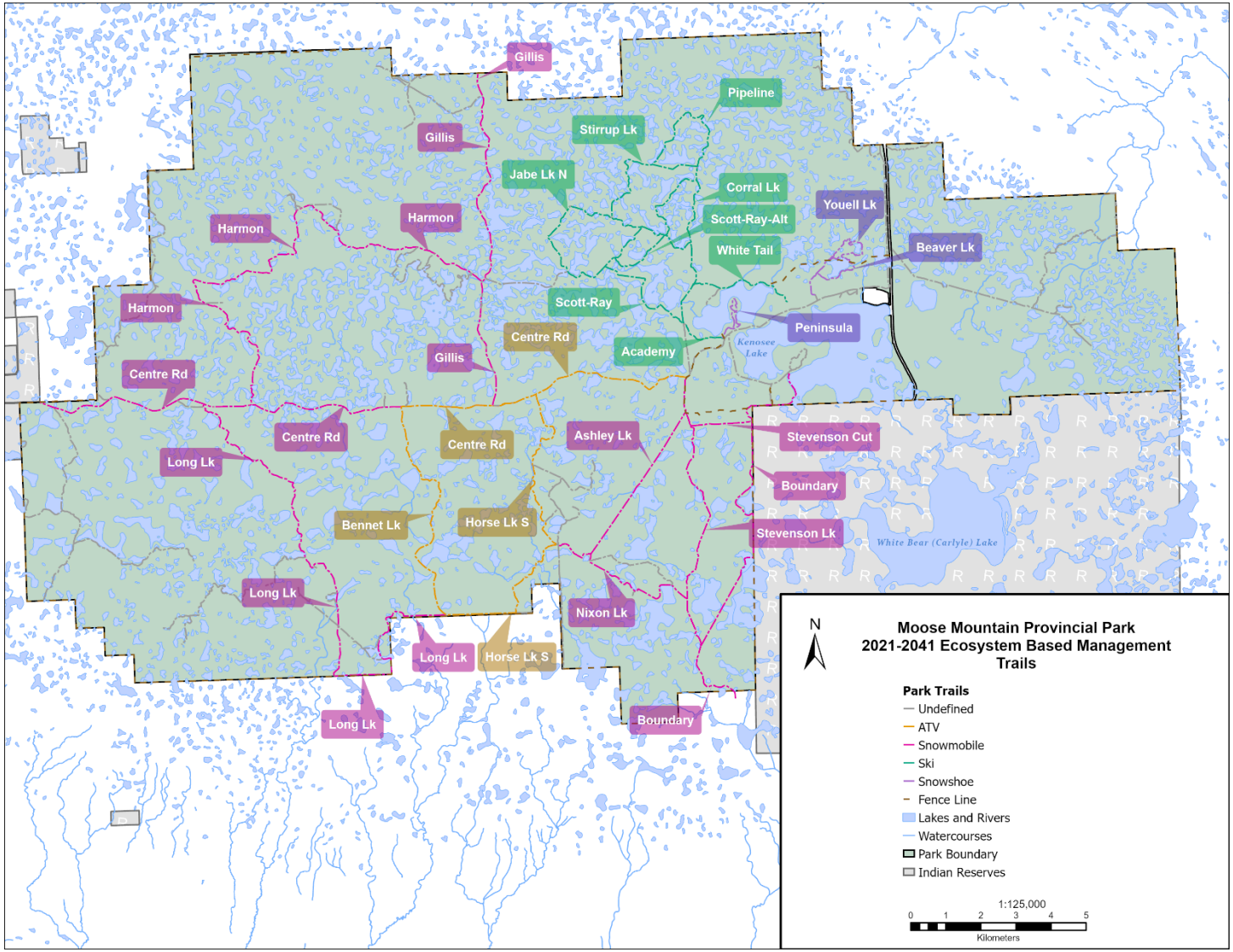

Figure 22 *Trails within MMPP.*

3.5.1.3 GRAVEL PITS

One gravel pit exists within the park. The gravel pit is in the back country area of the park (UTM 0681962, 5520639). The park is the sole user of the pit and intends on maintaining it and continuing to use it. According to Saskatchewan Parks Division's "Policy on sand and gravel and borrow extraction" (2010):

- Gravel extraction is only permitted for park uses or for provincial roads within parks.
- Gravel extraction is only permitted in Resource Extraction and Access zones.
- Pits should be located so park visitors cannot easily see them.
- Topsoil must be stockpiled.
- Invasive plant species must be dealt with immediately.
- Depleted pits must be restored to an appearance that blends in with surrounding landforms.
- Revegetation must be by native species.
- Access roads must be restored.

3.5.1.4 RECREATIONAL ACTIVITIES

Recreational developments within the park have led to a variety of activities for resource users. The Park offers a variety of camping sites, hiking trails, cycling paths, beach, playgrounds, bird and wildlife viewing, angling, kayaking, ATV, and canoeing opportunities. Watersports and equipment rentals are also available. Winter activities within the park include cross-country skiing, ice fishing, snowshoeing, snowmobiling, tobogganing, and skating (Kish & Carlyle Observer, 2021). Snowmobiling is also permitted within the park on designated trails. There are nine snowmobile shelters located throughout the park and area (Saskatchewan Snowmobile Association, 2018). The historic Chalet and gardens within the park offer a picturesque setting for events such as weddings. Located on the shores of Kenosee Lake, the MMPP Artist Colony is an inspiring and peaceful setting for creating, displaying, and selling original works of art. The colony consists of four stone cabins, originally built in 1931 as part of a relief camp. The property is also a representation of the history of early recreation in the province. The cabins along with the Chalet provided tourists with a rustic experience within a natural environment. The Chalet and cabins were designed by Provincial Architect Harold Dawson.

The cabins continued as rustic rental accommodation until the 1980s when their use was changed to providing a public program space. For about the last 20 years the cabins have been used to provide working and exhibit space for artists during the summer months. Today, three cabins in the colony are permanent art studios and display spaces held by long-term artists who utilize their cabins for the entire summer. The other Artisan Cabin is available for studio/display space to qualifying artists for one to two week stays between May long and September long weekend.

The adjacent Cannington Manor Historic Site outside of the park offers tours and historical information (Kish & Carlyle Observer, 2021). Furthermore, the Village of Kenosee Lake and the park offers recreational opportunities of waterslides, shopping, mini-golf, golf, boating and canoeing, tennis courts, basketball courts, golf course, and horseback riding.

The park also offers numerous school programs throughout May and June with interpretive programs offered in July and August. Other visitor experiences include Artisan Cabins and movie nights. Activities for consideration to be added to the park include adult-oriented offerings such as pickle ball, comedy, and barbeque evenings (Government of Saskatchewan, 2020).

3.5.1.5 HUNTING AND OUTFITTING

Moose Mountain provides hunting opportunities for trophy and consumptive users. The park allows hunting in accordance with *The Wildlife Act, 1998* and *The Wildlife Regulations, 1981*. The park is located within Wildlife Management Zone 33 and Game Bird Management Unit 2. Big game hunting seasons are for white-tailed deer, elk, moose, and mule deer. Moose (either sex), elk (either sex), or mule deer (either sex) are a Saskatchewan resident draw species. Whitetail deer (either sex) are a regular season species for Saskatchewan residents and are also available for harvest as Canadian resident draw species (Government of Saskatchewan, 2021). A second antlerless white-tail deer are allowed to be harvested by a Saskatchewan resident within MMPP with the appropriate hunting permit.

The 2020 Hunter Harvest Survey results for Wildlife Management Zone (WMZ) 33 (i.e., extended well beyond MMPP) are presented in ***Table 8*** (Government of Saskatchewan, 2020). Response rates for the hunter harvest survey varied from 40 to 72 percent despite the province making the survey mandatory in 2020. Actual harvest, based on the survey results, is utilized to calculate the estimated the total harvest of the area. Elk are the most harvested species within MMPP with an estimated 93 to 127 elk being harvested in the 2020 season from draw hunters. Mule deer were the second most harvested species with an estimated 41 to 53 animals being harvested. An estimated 18 to 23 moose were harvested within the area. To a lesser extent, antlerless mule deer (estimated five to 11 individuals), youth antlerless mule deer (estimated two to six individuals), and Canadian resident white-tailed deer (estimated two to five individuals) were harvested. It is important to note that the actual number of animals harvested from within MMPP will be higher than this number as regular season first and second white tail are not included nor is subsistence hunting from Treaty and Aboriginal hunters.

In addition to native big game species, wild boar (*Sus scrofa*), an invasive species from Europe, can be hunted without a license within Saskatchewan (Government of Saskatchewan, 2020). Upland game bird seasons are for ring-necked pheasants, sharp-tailed grouse, gray (Hungarian) partridge, and ruffed grouse. Migratory bird seasons include ducks, coots and snipes, dark geese, white geese, and sandhill crane.

As mentioned above, the park is also utilized by Treaty and Aboriginal hunters. The park is contained within Treaty 2. The Treaty extends from the southeast corner of Saskatchewan into much of southern Manitoba. The three Reserves located near Moose Mountain including White Bear First Nation No. 70, Pheasant Rump First Nation No.68, and Flying Dust First Nation No. 105 are signed on to Treaty 2, Treaty 4, and Treaty 6 respectively. Subsistence hunting is allowed within the park where a regular hunting season exists. Hunting pressures from Aboriginal subsistence are difficult to quantify as hunter harvests are not collected or reported to wildlife managers.

Table 8 *Hunter harvest survey results from 2020 for WMZ 33 draw big game species.*

Species	Licenses Sold	Estimated Total Harvest	Estimated Total harvest Range (95% CL)
Elk	221	111	93 – 127
Moose	24	23	18 – 23
Mule deer	64	49	41 – 53
Antlerless mule deer	8	9	5 – 11
Youth antlerless mule deer	4	5	2 – 6
Draw Canadian white-tailed deer	2	5	2 – 5
Total	**332**	**202**	**161 – 225**

For purposes of hunting and recreation, ATV use is allowed within the park. Users must abide by park rules and regulations as well as remain on designated roads or trails. Hunting is not permitted within the core area of the park or within 500 metres of occupied buildings.

Trapping is allowed with permission from the park (Government of Saskatchewan, 2021). General trapping efforts within MMPP are detailed in Section 3.6.1.3 Furbearer Species. Trapping of beaver for management purposes is further detailed in Section 3.2.3 and Section 3.6.1.3.

A survey for stakeholders of the park was completed in the summer of 2021. Results showed that stakeholders have strong concerns regarding the high hunting pressures exhibited within the park (Government of Saskatchewan, 2021). These concerns were also discussed in the Moose Mountain Provincial Park Vegetation Management Plan by TAEM (1992). Suggestions included:

- Designating a minimum of 32 percent[3] of the park land as a wildlife preserve to help protect wildlife from high hunting pressures and increase viewing opportunities for visitors.

Wildlife, specifically ungulates, have been found to alter their movements based on habitat and forage availability as well as pressure from hunting. Animals are known to avoid areas of high hunting pressures such as roads and access points while utilizing more challenging terrain or areas of heavier cover during hunting seasons. Permitting hunting within the park as well as the surrounding area limits the availability of safe zones for animals to utilize (Little, et al., 2014; Kays, et al., 2017; Sergeyev, McMillan, Hersey, & Larsen, 2020). Altering forest age class distributions would attract animals to stay within park boundaries as forage and habitat diversity within would increase (see Section 3.5.4). This in turn would reduce the amount of wildlife on adjacent farmlands, increase wildlife viewing opportunities, and allow the area to become a source for ungulate and other wildlife populations.

3.5.1.6 SPORT FISHING

MMPP provides fishing opportunities for appreciative or consumptive anglers. The park is a popular destination for local anglers. Fishing season opens in the southern zone on May 5th through March 31st.

The Ecosystem Based Surface Water Management Plan for Moose Mountain Provincial Park (2013) states that the only natural waterbodies with potential to support fish are Kenosee Lake, Birch Lake, Little Kenosee Lake, Gillis Lake, and White Bear Lake. Most of the lakes in the park are too shallow to provide protection for adequate over-wintering of fish. In the past, the lakes within the area were known to winterkill that was caused by a depletion of dissolved oxygen and thus resulted in a fish mortality event. Monitoring of winterkill event in the lakes is necessary to ensure the protection of fish population there.

Kenosee Lake has a variety of challenges when it comes to supporting a fish population for sport fishing. In 2021, the lake was considered mesotrophic, meaning it is clear water lake with beds of submerged aquatic plants and medium levels of nutrients. The lake water quality can be classified as “fair” based on its trophic state (Wissel, 2021). This lake water quality has been improved since 2013 when the lake was classified at eutrophic, meaning it had an abundance of nutrients causing increased plant growth and removing oxygen from the water causing fish-kills (Godwin, Wittrock, & Thorpe, 2013)

Kenosee is the only lake within the park that permits recreational motor-boating. The importance of recreation, including angling opportunities, in the core area encouraged stocking efforts. Historically, Kenosee Lake was known to have supported a yellow perch (*Perca flavescens*) population. In 2012 the lake was stocked with catchable sized yellow perch. In 2014 the lake was stocked with 250,000 walleyes, followed by 1,000,000 in 2015 and 750,000 in 2017. No stocking has occurred since 2017. (Government of Saskatchewan, 2011-2020).

[3] It was found that there is strong support in favour of making the entire park a designated wildlife preserve.

In the past, Birch Lake was known to have supported yellow perch. Stocking of Birch Lake has not occurred within the last 10 years. Shortly before the Ecosystem Based Surface Water Management Plan was completed, a trout pond was created South of Kenosee Lake. The pond was created to a depth of 10 metres and is aerated in the winter to reduce chances of winter kill. The pond was created to supplement the poor angling opportunities in the rest of the park. The pond was stocked yearly since 2011 with brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and in one-year tiger trout (*Salmo trutta × Salvelinus fontinalis*). Stocking continued until 2017 with trout of various sizes. No record of fish stocking has occurred since 2017 (Government of Saskatchewan, 2011-2020).

White Bear Lake has also been known to support a fish population. The lake does not flow directly into any other fish bearing lakes within the park. Stocking records from 2016 indicate the lake was stocked with 900,000 walleyes. No further stocking has occurred beyond 2016 (Government of Saskatchewan, 2011-2020).

3.5.1.7 OIL AND GAS DEVELOPMENT

Oil and gas development within the park began in the 1960s and continues presently. A total of 112 well sites and nine pipelines exist within the park and are presented in ***Figure 24***. Currently there are 10 different ownership corporations related to the well sites and two ownership corporations related to the pipelines within MMPP.

In the early years of the exploration numerous exploration leases were approved which caused an increase in explorative activity within the park. Historically, three main areas of exploration and extraction were within the park: north of Kenosee Lake, near Skeleton Lakes, and Birch Lake. Since then, extraction has occurred across most of the park.

By 1969 there were 95 wells within the park, 34 of which were extracting oil. In addition to the 95 well site a total of 595 kilometres of seismic lines had been created and 5,120 hectares of land cleared. By 1974 the number of wells within the park was 116 with 69 of them being abandoned or dried up. Between 1974 and 1991 a total of 55 new wells were created in the park and another 58 were deemed to be abandoned. Today 112 wells exist within the park. The most recent license was issued in 2018. The current status of the wells the within the park include active (38), suspended (33), abandoned (29), planned but cancelled (8), abandoned but re-entered (3), and completed (1).

There are nine pipelines within the park dating back to 1960. Of the pipelines eight are for crude oil and one for natural gas. Today, only five of the crude oil pipelines are active and the remaining are considered abandoned. Pipelines within the park total a length of 43.3 kilometres.

Concerns regarding the environmental impacts of oil extraction of the area began in the 1970s. Government regulations were eventually strengthened, and improvements made to the management of oil and gas development. Additionally, exploration was mostly confined to the winter or dry years to minimize negative impacts.

Negative environmental impacts include soil compaction, abandonment, habitat fragmentation and degradation, wildlife avoidance, and the possibility of spills or leaks. Land cleared and regraded to build wells destroys natural habitats as well as can cause erosion, sedimentation into adjacent waterbodies, soil compaction, and allow for invasive weeds to be introduced (Intera Environmental Consultants Ltd., 1978; Terrestrial & Aquatic Environmental Managers Ltd, 1992; Pantel Environmental Consulting Inc., 2020). Range health assessments in to 2020 determined that all meadows associated with oil and gas developments were deemed to be unhealthy, dominated by invasive and introduced plants, soil compaction issues, and a lack of litter or bare soil exposed (Pantel Environmental Consulting Inc., 2020). ***Figure 23*** depicts an inactive well site with bare ground and invasive Canada thistle growing throughout. Historically, there have been several minor spills and oil fires near sites.

A larger containment leak or spill of oil or brine could have destructive impacts on the waterbodies within the park. Toxic gases such as hydrogen sulfide are commonly associated with well sites and pose and environmental and visitor safety risk.

In addition to the environmental impacts of oil and gas exploration, park aesthetic and visitor experience is also negatively impacted. Heavy equipment used in activities is often noisy, unsightly, and conflicts with the values of the park in preserving unique ecosystems (Intera Environmental Consultants Ltd., 1978; Terrestrial & Aquatic Environmental Managers Ltd, 1992).

Reclamation is recommended on all abandoned well sites including roads accessing those well sites. Proposed areas to reclaim, including tree planting and silvicultural treatments, are presented in Appendix 11. Sites where the surrounding habitat is deciduous forest a treatment of planted trembling aspen in high density is recommended. Efforts will need to be focused on preventing grass, invasive, and non-invasive plant growth from inhibiting the aspen until establishment. In sites where the surrounding habitat is non-forested suitable native vegetation will need to be used in reclamation efforts. Erosion control will also need to be utilized until reclaimed site is stabilized with vegetation. To protect the natural capital of the park from invasive species and other negative impacts, it may be necessary to re-evaluate oil and gas activities as permissible within MMPP.

Figure 23 *Inactive well site within MMPP (Hamm, 2019).*

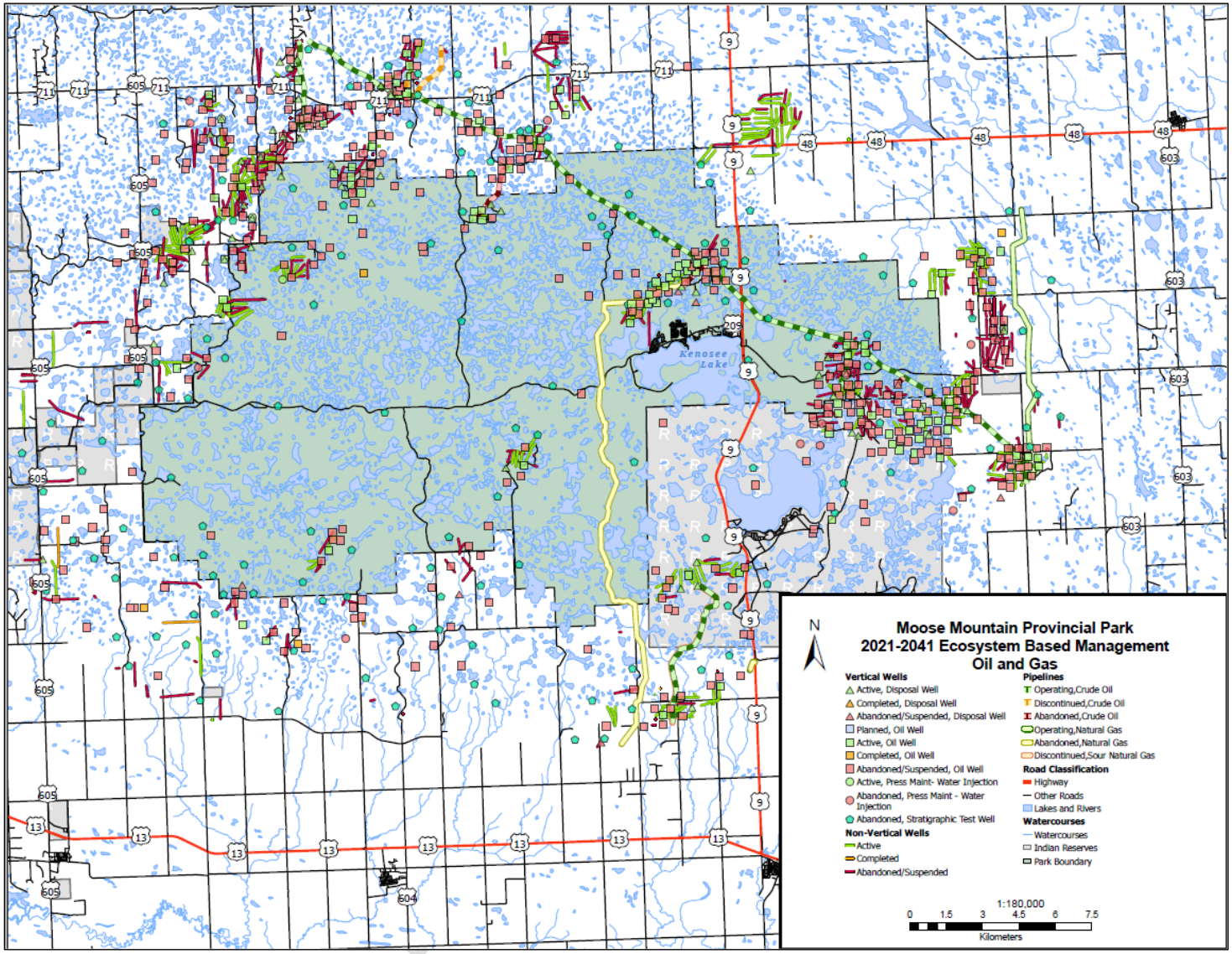

Figure 24 *Oil and gas developments within MMPP.*

3.5.1.8 FOREST HARVESTING

There was limited forest harvesting within MMPP in the last three decades. Recent harvests within the park included approximately 14.8 hectares harvested in the 1990s, 941.4 hectares harvested in the 2000s, and 59.9 hectares harvested in the 2010s. ***Table 9*** and ***Figure 25*** shows recent harvests within the park by year (data provided by Parks Division in 2021). The harvests listed within the table were undertaken primarily for the purpose of stand renewal with some of the smaller harvest volumes being utilized for firewood in the park.

__Table 9__ Moose Mountain harvest volumes since 1990.

Year of Harvest	Area Harvested (ha)	Percent Harvested of Total Forested Land
1990	14.8	0.1
2000	187.9	0.7
2003	749.8	2.9
2007	3.7	< 0.1
2010	36.4	0.1
2015	19.2	0.1
2019	4.3	< 0.1
Total	**1016.2**	**3.9**

Policies within the Parks Service are restrictive to timber harvesting. The Saskatchewan Parks Division's "Provincial Park Resource Management and Recreational Activities Guidelines" (2003) outlines that:

- Harvesting of forests can be used to achieve vegetation management goals such as renewing forest stands, promoting forest age class and species diversity and providing certain types of wildlife habitat.
- Harvesting for strictly commercial purposes will not be allowed, however commercial operations will be allowed to reach vegetation management goals.
- Personal use firewood is only allowed to be harvested if it meets vegetation management goals, and must be accessed via an existing trail, road right-of-way, or utility easement during winter only.
- Gathering of dead/down wood for personal-use firewood will be allowed provided it meets the park's vegetation management objectives, but only at approved locations and using designated trails.
- Burned or wind-thrown timber is not allowed to be salvaged except to ensure public safety or to protect infrastructure; small-scale fuelwood salvaging for use within the park is allowed.

The MMPP Forest Management Strategy (2001) recommended that:

- Active forest management needs to be undertaken within a timely and an intelligent manner to aid in returning a significant portion of the trembling aspen and poplar forests back to early seral stages and creating more distribution of forest age classes.
- The forest management should aim to maintain a viable white birch component within the forest community.
- The management should include restoration and even expansion of the native grassland components within the park.

Our recent field observations and SFVI data assessment showed that natural regeneration of deciduous trees (e.g. trembling aspen, green ash and balsam poplar) occurred significantly and are healthy in many forest stands over the last few decades, resulting in multiple cohorts that can sustain natural successional pathway of the park forest

in coming decades. Therefore, it is recommended that forest renewal activity should only focus on those old and very old forest stands that experienced stem breakdown, low natural regeneration (e.g., single cohort canopy type), and/or shrubby areas. Mechanical harvesting within the park would have to be planned in a manner that maximized ecological benefits while minimizing negative impacts. Such planning could include the exclusion of sensitive areas (i.e., riparian), ensuring slash and coarse woody debris does not impede the regeneration (suckering) of trembling aspen, choosing harvest season with the least soil compaction, displacement or erosion risks, and the retention of dead standing and snags (Janowiak & Webster, 2010). This plan identifies potential and priority areas for forest renewal activities, with long-term forest renewal goals of:

- Converting about 15 percent (~ 1,400 hectares) of the current old to very old upland forest stands into young stands
- Ensure at least of 15 percent of late seral stage (i.e., old, very old) forest remains intact to ensure a diversity of age classes and forest biodiversity

Potential and priority areas for forest renewal activities as well as areas of late seral stage deferrals are presented in Appendix 6 and Appendix 7. Selection of suitable forest renewal approach (e.g., mechanical harvesting and prescribed fire) will depend on forest condition and location that can be determined in operating plans.

Details of current age class distribution of the forests in the park were further discussed in Section 3.5.4.

As with disturbances associated with recreation, grazing, and oil and gas activities, there is a risk of invasive species establishment and spread from forestry activities. A list of beneficial management practices associated with timber harvesting and other activities is provided by Gross (2020). To protect the natural capital of the park from invasive species and other negative impacts it may be necessary to re-evaluate forest harvesting as an acceptable management tool within MMPP.

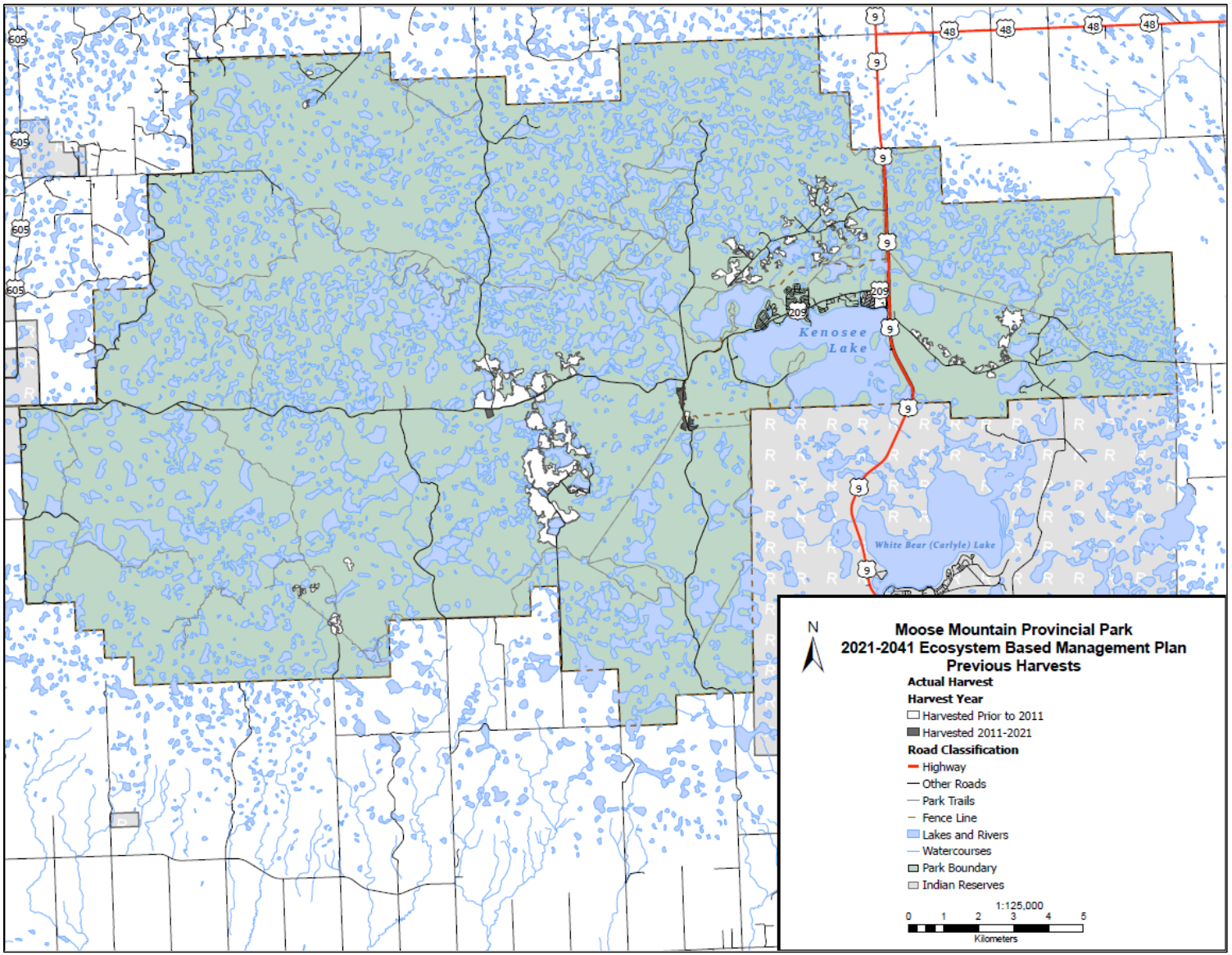

Figure 25 *Map of recent (1990 to present) forest harvests in MMPP.*

3.5.1.9 LIVESTOCK GRAZING AND HAYING

Historically, the area was grazed exclusively by native grazing species (e.g., plains bison). However, as settlement and hunting pressures increased the populations of native grazers declined (Government of Saskatchwan, 2008). European ranchers began settling the area in the late-1800s and introduced livestock grazing into the Moose Mountain area (Pantel Environmental Consulting Inc., 2020). The High View Stock Association was formed in 1919 and managed the grazing within the Forest Reserve (formerly the area of the park). Today, grazing within the park is managed through permits and agreements. The Parks Act permits livestock grazing on park lands with written consent from the minister. Grazing is utilized with the goal to recreate the ecosystem characteristics of pre-settlement bison grazing patterns (Soulodre, 2009).

The park has four grazing and haying areas totaling 33,521 hectares: Highview, Fineview, North Moose Mountain, and Percy Clare. The official grazing season within the park begins between May 15th and July 15th and ends October 15th with a three- or five-month period (Thorpe J. , 1994; Soulodre, 2009; Hamm, 2019). Currently, only Highview and North Moose Mountain are being utilized for grazing. Grazing was ceased in the Fineview pasture in 2010 and Percy Clare pasture in 2011 (Pantel Environmental Consulting Inc., 2020). Grazing and haying areas within the park are presented in ***Figure 30***.

Summary data of grazing and stocking for years 2004-2006 and 2013-2018 within MMPP is presented in ***Table 10***. The grazing carrying capacity of the park is affected by several factors including: annual changes in wetland coverage, the amount of forest grazing, and the volume of hay removed. The total amount of forage available is calculated and represented as Animal Unit Month (AUM), or the amount of forage needed for one animal equaling 1300 pounds (590 kilograms) to be sustained for one month. Stocking rates are determined based on the AUM availability of the area and vary based on ecological factors. The number of AUMs utilized within each grazing area between the years 2004-2006 was proposed in which the Highview area represents the highest grazing potential with 2418 AUMs followed by North Moose Mountain with 2125, Percy Clare with 1533, and Fineview with 753. When all areas were utilized for grazing, before 2010, the number of animal tags allotted to each area reflected the forage AUM availability with Highview and North Moose Mountain allowing 520 tags each, while Percy Clare and Fineview allowed 385 tags and 175 tags, respectively (Thorpe J. , 1994; Soulodre, 2009). In 2021, the park allocated 455 and 520 tags for the grazing associations of Highview and North Moose Mountain, respectively. However, Highview association used 345 tags, and North Moose Mountain only used 138 tags in the 2021 grazing season.

Haying was used in the past within several locations in the park. The last haying permit was issued 15 years ago and then stopped due to the limited availability of suitable grassland for haying within the park. Information on haying for the period from 2002 to 2006 is also presented in ***Table 10***. AUMs worth of grazing removed by haying in the period was also presented assuming that one ton of hay equals 2.8 AUMs. The 5-year average of haying amount that was removed from the park was highest in Highview with 188 tons, followed by Percy Clare, North Moose Mountain, and Fineview with 106, 33, and four tons, respectively (Soulodre, 2009).

The owner of livestock is responsible for the management and containment of the animals in each grazing unit. A minimal amount of infrastructure for cattle exists within the park. These infrastructures include fencing, corrals, and a dugout for water in the North Moose Mountain area. While the livestock owner is primarily responsible for the containment of animals, the park installed and maintained fencing for grazing units, if there is any (Soulodre, 2009).

It is necessary to maintain grazing areas a healthy condition to maintain park ecosystem integrity and provide available forage for cattle.

Table 10 Grazing and haying summary within MMPP (Soulodre, 2009; Hamm, 2019).

Location	Size of Grazing Area (ha)	Number of AUM Grazed in Park [1]	Stocking Rates (cow/calf) [2]	Number of Animal Tags Allotted	Number of AUM Hayed in Park [3]	Average Tonnage in Haying [4]
Fineview	7,132	753	N/A	175	93	4
Highview	8,631	2418	469/383	520	10	188
North Moose Mountain	3,542	2125	150/116	520	526	33
Percy Clare	8,180	1533	N/A	385	297	106
Total	**27,485**	**6829**	**6829**	**1600**	**929**	**332**

[1] Average AUM utilized for years 2004-2006 (Soulodre, 2009).
[2] Average stocking rate of cow/calf for years 2013 – 2018 (Hamm, 2019)
[3] Average AUMs allotted to haying (Soulodre, 2009).
[4] Haying average for years 2002 – 2006 (Soulodre, 2009).

Range health assessments were used by MMPP to provide qualitative and quantitative knowledge on the status of the grazing areas, the effects of grazing practices, as well as aid in management decisions. Pantel Environmental Consulting Inc. (2020) and Hamm (2019) completed range, riparian, and forest health assessments throughout Moose Mountain Provincial Park in 2020 and 2018. During the assessments a total of 76 forest, 41 riparian/wet meadows, and 15 grassland/meadow transects were established and surveyed. The results of these assessments are presented in ***Figure 26***. The results show that 95 percent of forest sites, 73 percent of riparian/wet meadow sites, and none of grassland/meadow sites were determined to be "healthy". Five percent of forest sites, 27 percent of riparian/wet meadow sites and 67 percent of grassland/meadow sites were determined to be "healthy with problems". Thirty three percent of the assessed sites that are located in the grassland/meadow habitats were determined to be "unhealthy". Open areas, including historical oil and gas sites, were included within the grassland/meadow habitats, and thus contributed to the lower health scores of this habitat. The meadows associated with the oil and gas developments were determined to be unhealthy and dominated by invasive plant species (Pantel Environmental Consulting Inc., 2020). Health assessments on grazing areas are recommended to be completed every five to 10 years (Pantel Environmental Consulting Inc., 2020; Hamm, 2019).

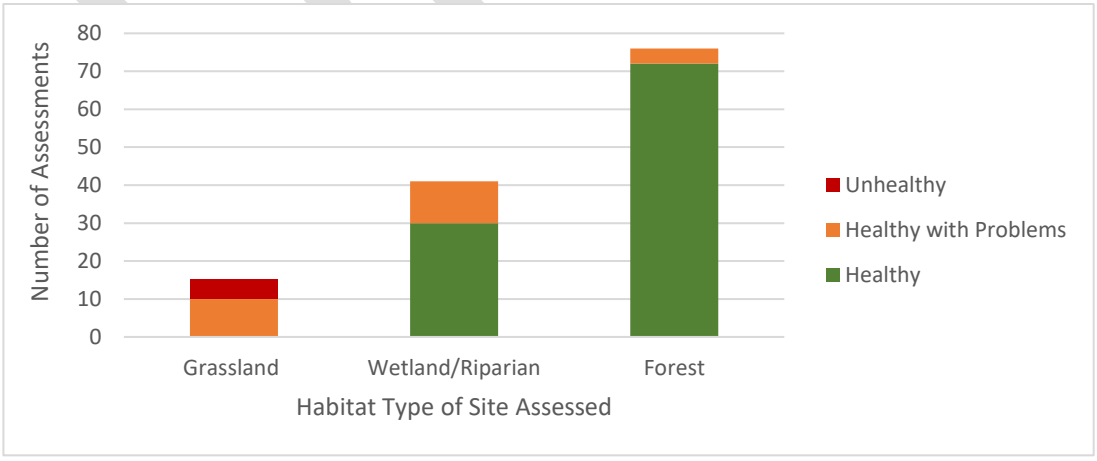

Figure 26 Results of recent range health assessments for MMPP (Pantel Environmental Consulting Inc., 2020; Hamm, 2019).

A key indicator of the health of the grazing areas is the plant community. A healthy site has a diverse population of native plant species, exhibits natural proportions of increaser and decreaser plant species, and is low in invasive plant species. This ensures a broad range of forage opportunities for livestock and wildlife (Pantel Environmental Consulting Inc., 2020). Decreaser species include native plants that are highly productive and are palatable to livestock. These species are called decreaser species because their abundance decreases with heavy grazing pressure. Increaser species include native plants that are lower in productivity and are less palatable or less preferred to livestock. These species are called increaser species because their abundance increases with heavy grazing pressure, and they take the place of the decreaser species. Decreaser species found within Moose Mountain's grazing areas include: fringed brome (*Bromus ciliatus*), Canada wild rye (*Elymus canadensis var. canadensis*), porcupine grass (*Hesperostipa spp*.), inland blue grass (*Poa interior*), fowl blue grass (*Poa palustris*), dotted blazingstar (*Liatris punctata var. punctata*), American purple vetch (*Vicia americana*), wild peavine (*Lathyrus venosus*), pin cherry (*Prunus pensylvanica*), choke cherry (*Prunus virginiana var. virginiana*), Saskatoon (*Amelanchier alnifolia var. alnifolia*).

As mentioned previously, the threat of non-native invasive species is a top concern within the park. The presence of cattle within the park can create opportunities for invasive establishment and spread. Riparian and soil disturbances from high-use cattle areas create establishment opportunities for non-natives. Adjacent agricultural areas and the movement of cattle between them and parks lands can spread seeds of non-native species. Establishment of seeds within grazing units can lead to non-native species invasions that are beyond road, trail, and corridor sites. Notable invasive species found during the health assessments were Canada thistle (*Cirsium arvense*), Kentucky blue grass (*Poa pratensis*) and smooth brome (*Bromus inermis*).

In addition to the overall ecosystem health of the grazing areas, other findings were noted such as influence of water level change and distribution of cattle in the forested areas. Fluctuating water levels affect available grazing opportunities within the park as well as limit, open or alter access routes for cattle movement (Thorpe J. , 1994; Hamm, 2019). Years of low water allow for increase available grazing areas while high water years decrease available grazing areas. Forested areas have been found to have little grazing pressure (Thorpe J. , 1994; Soulodre, 2009; Pantel Environmental Consulting Inc., 2020). It was also found that the forested areas exhibited less use by cattle when compared to the grassland/meadow and riparian/wet meadow areas and can be seen in ***Figure 27***. This was especially apparent in areas of dense aspen (*Populus spp.)* regrowth (Thorpe J. , 1994; Hamm, 2019; Pantel Environmental Consulting Inc., 2020).

Figure 27 *Photos of Grazing Areas within MMPP (Hamm, 2019).*

Unmaintained fence lines which have become overgrown, broken, or dropping (***Figure 28***) can have a negative impact on wildlife causing entanglements, entrapments, or movement impediments (Hamm, 2019). Haying can disrupt, damage, or destroy nest sites of birds (Thorpe J. , 1994). Sensitive areas such as wetlands and riparian sites can suffer from the congregation of livestock leading to hummocking or pugging (Hamm, 2019; Government of British Columbia, 2002). The highest areas of use within the park by livestock was near oil and gas developments. These areas were also found to be in the poorest health condition (Pantel Environmental Consulting Inc., 2020). Additionally, the presence of livestock can lead to avoidance of the area by native ungulates as well as cause increased competition for forage between ungulates and livestock (Thorpe & Godwin, 1994).

Pantel Environmental Consulting Inc. (2020), Hamm (2019), Thorpe (1994) proposed following recommendations to minimize the negative impacts of cattle grazing and haying within MMPP.

- Calculating total grazing potential (AUMs) through available riparian/wet meadow and grassland/meadow sites while excluding or limiting the potential of forest grazing.
- Monitor fluctuating water levels and the resulting changes to available grazing areas and adjust AUM accordingly.
- Manage invasive plant species at livestock entrance points.
- Maintain conservative stocking rates at or below AMU grazing capacity.
- Establish regular range health assessment monitoring.
- Incorporate off-site watering systems to reduce livestock impact to sensitive and wetland areas.
- Develop a plan for the management and protection of known species at risk within MMPP under grazing pressure.

Cattle grazing within parks can provide economic benefits to leaseholders and the park, and grazing at an appropriate regime (i.e., season, duration, intensity) also helps to maintain grassland health through emulating natural disturbance regimes. However, grazing can also cause unwanted ecological damage and negative impacts for recreational users if an area experiences over grazing (***Figure 29***). From an aesthetic perspective, fencing, mineral blocks, manure piles, and the cattle themselves take away from the natural values within the park. When

determining the acceptability of grazing within the park, managers must assess the benefits and impacts of the practice. The presence of cattle within MMPP is not natural, but can be used as a tool to emulate historic patterns of disturbance by native ungulates with suitable stocking rates and managing of negative effects.

Figure 28 *Grazing areas and fence lines within MMPP (Hamm, 2019).*

Additionally, the Saskatchewan Parks Division's "Grazing Management Policy" (2021) states that grazing is allowed where it is recommended in an approved grassland, vegetation, or ecosystem-based management plan to achieve, maintain, or improve the ecological health and integrity of park ecosystems. In MMPP, cattle grazing has been used as a substitute to historical bison and other ungulate grazing and browsing. However, cattle do not provide the same browsing benefits as bison and other ungulates. Cattle are better adapted to a high-cellulose of grass diet (Hanley & Hanley, 1982) compared to that of trees and shrubs. In a deciduous forest dominated ecosystem, such as MMPP, cattle are less adapted for vegetation management. Integrating periodic fire and grazing is another management option to maintain portions of open grassland with the park, especially in areas of declining aspen vigour, and can be used to create a shifting mosaic of plant community types to provide supplemental livestock grazing and improve wildlife habitat.

The unique landscape and the associated vegetation are key components of the natural capital of MMPP. Livestock grazing and the associated habitat degradation and invasion by non-native species pose threats to the natural capital. To protect the natural capital of the park from invasive species it may be necessary to re-evaluate the use cattle grazing as a management tool within high-risk areas of MMPP and consider the use of pyric herbivory to reduce woody plant encroachment into former open grasslands areas.

Figure 29 *Photo of Canada thistle invading riparian habitat within grazing area of MMPP (Hamm, 2019).*

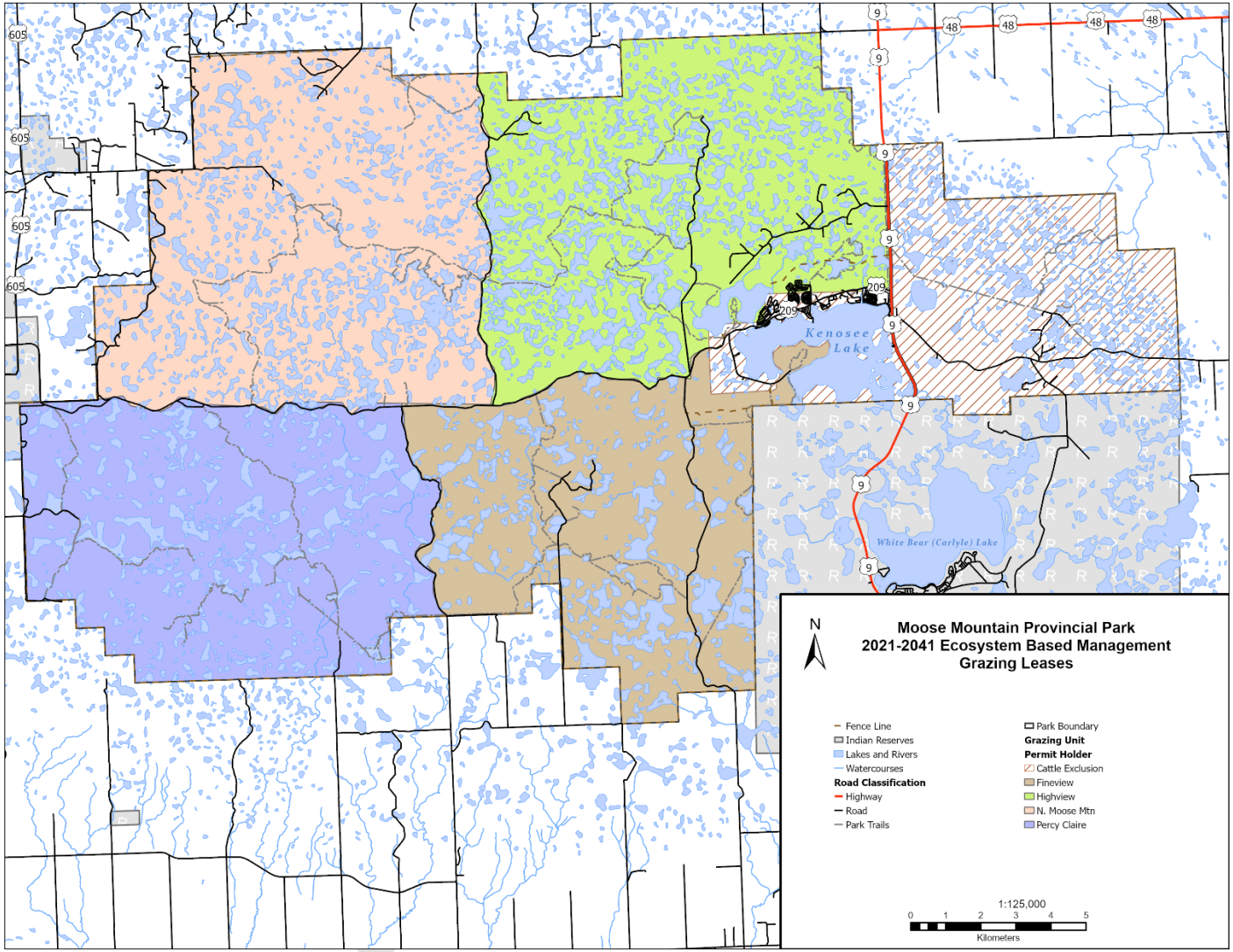

Figure 30 *Grazing Areas within MMPP (currently active: Highview and North Moose Mountain, inactive: Percy Clare and Fineview as of 2021).*

3.5.2 PRESENT DAY VEGETATION

3.5.2.1 VEGETATION CLASSES AND FOREST TYPES

Approximately 26,001 hectares (64.6 percent) of park land supports forest vegetation. The remaining 14,268 hectares (35.4 percent) of the park is composed of lakes, wetlands, poorly drained lowlands, grass or shrublands. In Saskatchewan, the Provincial Forest Inventory delineates areas into two broad types of ecosystems: productive forest land (i.e., the uplands) and non-productive lands (i.e., wetlands, scrubland, grasslands). From a forestry perspective these two types of classifications are sufficient, however; from an ecosystem-based management approach the classification of "non-productive" fails to recognize the ecological benefits of these areas (e.g., flora and fauna biodiversity, rare species habitat, water cycling and storage, nutrient cycling, as well as aesthetics).

The Provincial Forest Types (PFT) found in MMPP are hardwood dominant and can be seen in ***Figure 31***. Trembling aspen dominated hardwood stands (TAB) are found to be the most abundant stand type in MMPP at 25,718 hectares (***Table 11***). The second most common hardwood dominate stand type was found to be any other hardwood dominated not dominated by TAB (AOH) at 230 hectares. The most common softwood dominated stand type was found to be white spruce dominated softwood stands (WSF) at 35 hectares. Spruce dominated mixedwood stands (SMW) and hardwood with spruce mixedwood (HSM) were found in the park with 14 and four hectares, respectively. No pure coniferous stands exist within the park.

In addition to utilizing the Provincial Forest Types classification of MMPP, an ecosystem-based management approach includes details of the site's ecological conditions. Detailed site conditions include ecosite classification, vegetation and forest types, site relationships, as well as site responses to disturbances and time since disturbances. Detailed classifications of ecosites found within MMPP are presented in the Section 3.5.2.2.

Table 11 Area by Provincial Forest Type (PFT) in MMPP.

Provincial Forest Type	Description of PFT	Total Area (ha)
TAB	Trembling aspen or white birch dominated hardwood stands	25,718
AOH	Any other hardwood dominated not dominated by TAB	230
WSF	White spruce or balsam fir dominated softwood stands	35
SMW	Spruce Dominated Mixedwood Stands	14
HSM	Hardwood with Spruce Mixedwood	4
	Total Forested	26,001
	Total Non-Forested	14,269
	Total	40,270

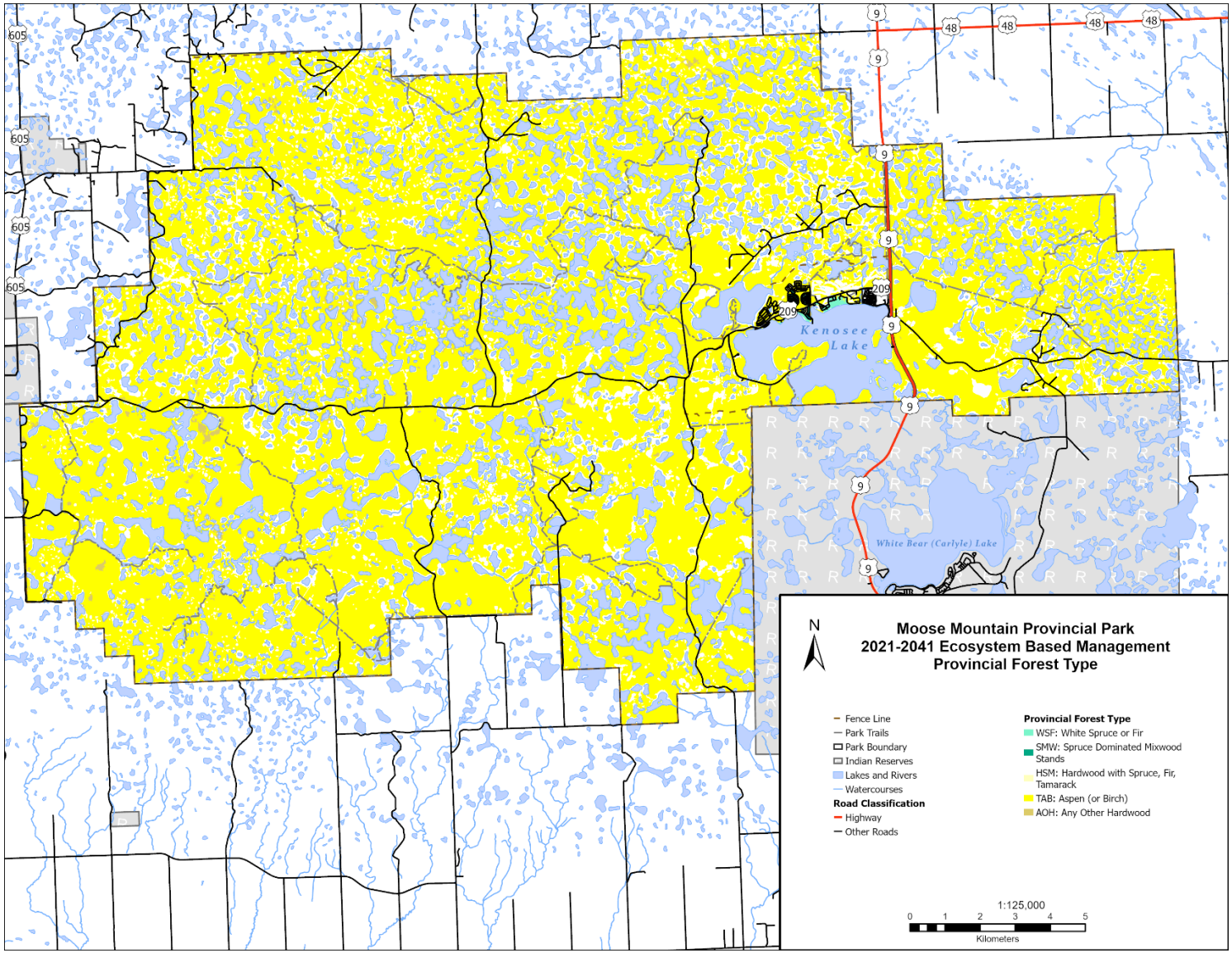

Figure 31 *Provincial Forest Types in MMPP.*

3.5.2.2 ECOSITE CLASSIFICATION

The descriptions of present-day vegetation within MMPP are from pre-constructed Saskatchewan Forest Vegetation Inventory (SFVI) for the park in 2020 by Timberline Forest Inventory Consultants (2021) , that classified the park ecosite based on McLaughlan, Wright, & Jiricka (2010) . A summary of ecosites and their areas within MMPP is presented in ***Table 12***. The ecosites of MMPP and other mapped types can be seen in ***Figure 32***.

Table 12 Summary of MMPP ecosites and other mapped types.

Ecosite		Description in MMPP	Area (ha)
Upland Grassland			
PR 12	A	Upland grassland, moderately dry to mesic, less than 30% shrub cover, sites are usually grazed and includes cleared grasslands	183
	B	Upland grassland, moist, less than 30% shrub cover, sites are usually grazed and includes cleared grasslands	34
	C	Upland grassland, mesic to moderately dry, with greater than 30% shrub cover	15
			231
Hardwood types			
PR 05	A	Trembling aspen with beaked hazelnut or other shrub dominated understory on moderate fresh to very fresh silty clay	17,183
	B	Trembling aspen without beaked hazelnut but other shrub dominate understory on moderate fresh to very fresh silty clay	3773
	C	Trembling aspen with green ash (greater than 40%) on moderate fresh to very fresh silty clay	2702
	D	Beaver disturbed site, no trembling aspen, minimal green ash, and white birch with dominate beaked hazelnut on moderate fresh to very fresh silty clay	3,583
	E	Upland shrub dominated with less than 5% tree cover and greater than 30% shrub cover on moderate fresh to very fresh silty clay	264
			27,505
PR 08	A	Balsam poplar/ green ash or white birch with a shrub understory on very moist silty clay loam	10
	B	Balsam poplar/ green ash without a shrub understory on very moist silty clay loam	8
	C	beaver disturbed site, minimal trees with a dominate shrub layer on moderately moist to very moist silty clay loam	44
			62
Shrubby, herbaceous, graminoid bogs and fens			
PR 09	A	Seasonal marsh with less than 30% shrub cover and little to no water present on very moist clay	1,278
	B	Semi-permanent to permanent marsh with less than 30% shrub cover and water present on very moist clay	229
			1,507
PR 10		Shrubby swamp with greater than 30 percent shrub cover	**17**
PR 11		Treed swamp with greater than 10 percent tree cover	**3**
Other types			
Unclassed			**10,944**
		Total	**40,270**

* "fresh" refers to sites that are intermediate to dry and moist/wet sites – sites of moderate moisture regime.

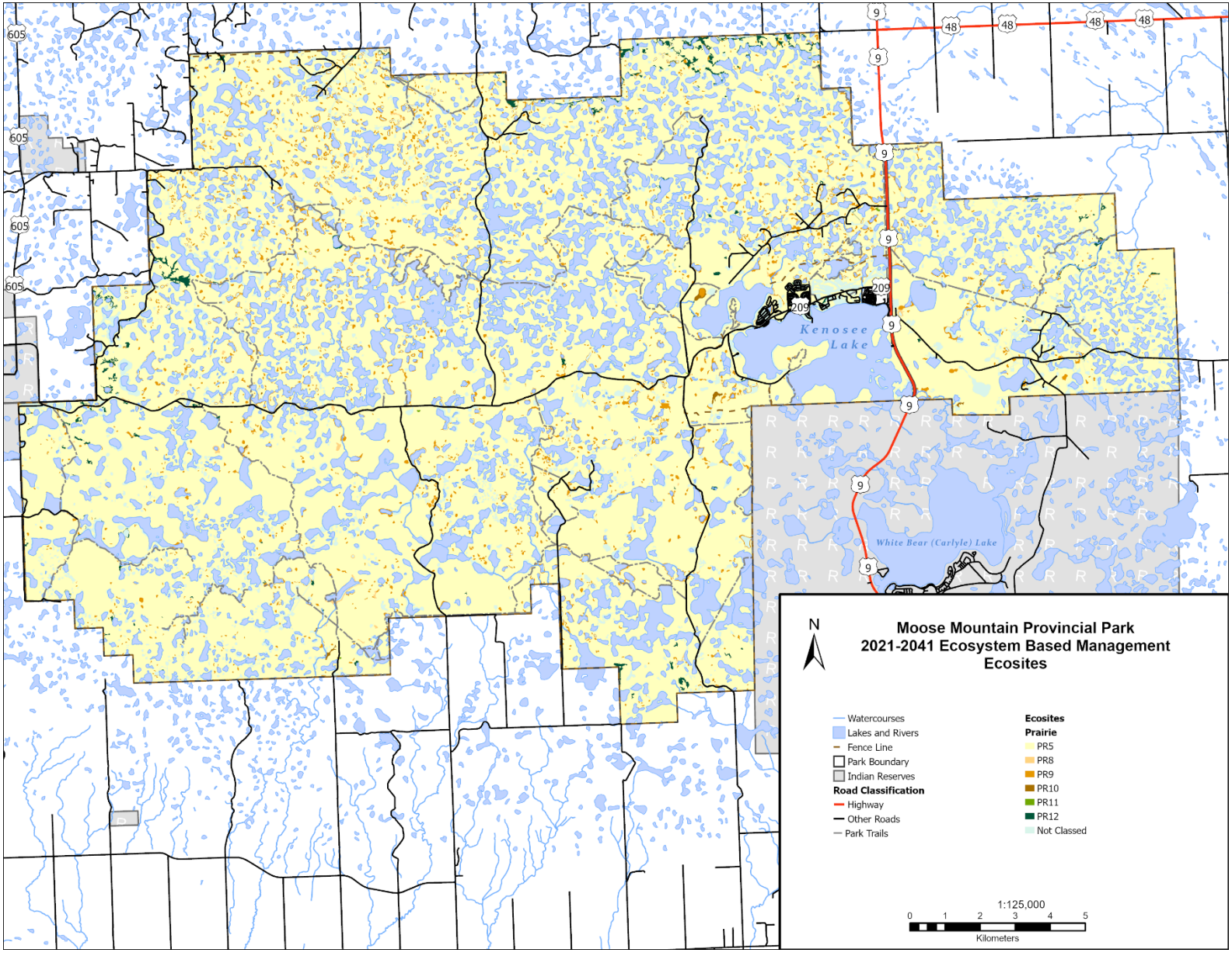

Figure 32 *Ecosites of MMPP.*

PR05 – Trembling aspen and beaked hazelnut on fresh silty clay

The ecosite type PR05 is the primary forest type of MMPP (***Figure 33***) that encompasses approximately 68 percent of the total park land. The ecosite is dominated by trembling aspen with small amounts of green ash or white birch. Varying degrees of a shrub understory include beaked hazelnut, red-osier dogwood, Saskatoon, prickly rose, twinning honeysuckle, and raspberry. Ground cover includes wild sarsaparilla, dew berry, aster species, star-flowered Solomon's seal, and wild lily of the valley[4]. Rare plant species associated with the deciduous dominated forests of MMPP include tall larkspur (*Delphinium glaucum*), black-fruited hawthorn (*Crataegus douglasii*), scarlet paintbrush (*Castilleja coccinea*), downy blue violet (*Viola sororia*), false spikenard (*Maianthemum racemosum ssp. amplexicaule*), striped coralroot (*Corallorhiza striata var. striata*) orchid, and various-glumed wild rye (*Elymus diversiglumis*). A heavy accumulation of leaf litter inhibits the growth of forest floor mosses and lichens within this ecosite.

Historically, sites would succumb to fire leading to a rejuvenation of the forest. Long-term fire suppression has caused the forest age to old and very old in many trembling aspens stands. As these stands begin to collapse, they give way to more shade-tolerant species. Without fire or mechanical disturbances, the forest is predicted to convert to a green ash dominated forest with no white birch. Moisture regime of this ecosite ranges from fresh to very moist. Sites are dominated by Gray Luvisols, Dark Gray Chernozems and Luvic Gleysol soils with the parent materials of lacustrine, morainal, and fluvial (Timberline Forest Inventory Consultants, 2021; McLaughlan, Wright, & Jiricka, 2010).

Figure 33 *Trembling aspen dominated ecosite (PR05) within Moose Mountain (Timberline Forest Inventory Consultants, 2021)*

[4] See APPENDIX 1: Vascular Plants of Moose Mountain

PR08 – Balsam Poplar with trembling aspen and green ash on very moist silty clay loam

The ecosite type PR08 is described specifically as the moist to wet forests of MMPP. This ecosite is a deciduous mix of balsam poplar, trembling aspen, green ash, and the occasional white birch. The canopy is shared between the three species. A dual layer of shrubs includes common snowberry, raspberry, Saskatoon, and prickly rose. The forest floor is dominated by several species including wild sarsaparilla, grasses, snakeroot, dewberry, and wild lily-of-the-valley. Chernozem soils are found in this ecosite suggesting a historical transition from grasslands into a moist deciduous dominated forest. The ecosite encompasses less than 0.2 percent of the total park. Historically, sites would regenerate from fire. Recent fire suppression has caused stands to become over mature. In the absence of stand-regenerating fire or logging this ecosite type is likely to convert to a green ash dominated type. Rare plant species associated with this ecosite include false spikenard, tall blue lettuce (*Lactuca biennis*). Sites are poor to imperfectly drained and moist or very moist. Sites are dominated by Luvic Gleysols and Humic Gleysols soil group orders. Parent material is lacustrine or morainal (McLaughlan, Wright, & Jiricka, 2010; Timberline Forest Inventory Consultants, 2021).

PR09 - Graminoid fen on very moist clay

The ecosite type PR09 is one of three types of graminoid fens found within Moose Mountain. This ecosite type encompasses less than four percent of the total park. The ecosite is dominated by herbaceous cover including sedges, grasses, and bedstraw. Common forbs include cow parsnip, thistle, and wild mint. There is no forest productivity and minimal shrub cover within this ecosite type. Rare plant species associated with this ecosite include: Mingan (common) moonwart (*Botrychium minganense*), narrow-leaved water plantain (*Alisma gramineum*), widgeon-grass (*Ruppia cirrhosa*) and beaked ditch grass (*Ruppia martima*). Sites are very poorly drained, very moist, and anaerobic. This ecosite type is strongly influenced by water levels. Sites are dominated by Humic Gleysol soil developments. Parent material is lacustrine.

The ecosite is further broken down into two sub categories described as a seasonal marsh with less than 30 percent shrub cover and little to no water present on very moist clay or semi-permanent to permanent marsh with less than 30 percent shrub cover and water present on very moist clay (Timberline Forest Inventory Consultants, 2021; McLaughlan, Wright, & Jiricka, 2010).

In addition to those ecosites which were classified using the Field Guide to the Ecosites of Saskatchewan's Provincial Forests (McLaughlan, Wright & Jiricka, 2010), Timberline Forest Inventory Consultants (2021) recommended ecosites PR10, PR11 and PR12 to represent for unique ecosystems of wetland and upland grassland in MMPP.

PR10 - Shrubby swamp with greater than 30 percent shrub cover on very moist clay

The ecosite type PR10 is a wetland dominated type and encompasses approximately 0.4 percent (approximately 17 hectares) of the total park. The wetlands of this ecosite are shrubby with greater than 30 percent shrub cover. Sites are very poorly drained, very moist, and anaerobic. This ecosite type is strongly influenced by water levels. Sites are dominated by Humic Gleysol soil developments. Parent material is lacustrine (Timberline Forest Inventory Consultants, 2021)

PR11- Treed swamp with greater than 10 percent tree cover on very moist clay

This ecosite type encompasses approximately three hectares within of the total park. The wetlands of this ecosite contain sparse trees with less than 10 percent tree cover. Sites are very poorly drained, very moist, and anaerobic. This ecosite type is strongly influenced by water levels. Sites are dominated by Humic Gleysol soil developments. Parent material is lacustrine (Timberline Forest Inventory Consultants, 2021).

PR12 – Upland grasslands

The ecosite type PR12 is an upland grass ecosite comprised of non-fescue natural grassland areas and abandoned anthropogenic clearings. This ecosite type encompasses approximately 0.5 percent of the total park (approximately 232 hectares). The presence of shrubs varies depending on sub-ecosite with hawthorn being a dominate species. Sites are moist to moderately dry.

The upland grass ecosite is further broken down into three subcategories. The first is described as moderately dry to mesic, less than 30 percent shrub cover, sites are usually grazed and includes cleared grasslands and covers approximately 183 hectares within the park. The second is described as moist, less than 30 percent shrub cover, sites are usually grazed and includes cleared grasslands. This subtype covers approximately 34 hectares. Lastly, the third is described as, mesic to moderately dry, with greater than 30 percent shrub cover and covers approximately 15 hectares (Timberline Forest Inventory Consultants, 2021).

Other mapped types in the MMPP updated forest inventory include:

- Water including lakes, sloughs, streams, and beaches.
- Recently burned areas.
- Areas that have been cleared for agriculture at some time in the past.
- Developed areas, including roads, campgrounds, cottage subdivisions, and park administrative areas.

3.5.3 SUMMARY OF OVERALL PARK FLORA

MMPP contains a variety of vascular plant species that represent both the Aspen Parkland and the Boreal Transition ecoregions (Acton, Padbury, & Stushnoff, 1998). The area contains several hardwood species as well as subspecies and variants that are endemic to the area. The regions are characterized by trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera ssp. balsamifera)*, white birch (*Betula papyrifera*), Manitoba maple (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*) with an understory of Saskatoon (*Amelanchier alnifolia var. alnifolia*), chokecherry (*Prunus virginiana var. virginiana*), wild sarsaparilla (*Aralia nudicaulis*), beaked hazelnut (*Corylus cornuta*), and American red raspberry (*Rubus idaeus ssp. strigosus*). The area also contains small regions of plains rough fescue (*Festuca hallii*) grasslands found on southern slopes as well as several species of sedges (*Carex spp.*), rushes (*Juncus spp.*) and common cattail (*Typha latifolia*) found in the numerous lakes, wetlands, marshes, and sloughs of the area (Acton, Padbury, & Stushnoff, 1998; McLaughlan, Wright, & Jiricka, 2010; Terrestrial & Aquatic Environmental Managers Ltd, 1992; Christiansen, E A; Government of Saskatchewan: Department of Mineral Resources, 1956).

A list of vascular plant species within MMPP has been constructed from various sources including Pantel Environmental Consulting Inc. (2020), Intera Environmental Consultants Ltd. (1978), Terrestrial & Aquatic Environmental Managers Ltd. (1992), Vance, Jowsey, & McLean (1993), (Johnson, Kershaw, MacKinnon, & Pojar (1995), Saskatchewan Conservation Data Centre: All Taxa (2021), McLaughlan, Wright, & Jiricka (2010), as well as observations by Saskatchewan Parks staff through SAR and invasive species monitoring and can be found in Appendix 1. The list is comprised of a total of 314 species from 57 families. The most represented families by species counts are the Asters, Grasses, Roses, Legumes, Buttercups, and the Sedges; together these families represent 177 of the 314 total species. Other families are represented to a lesser extent in which many families contain only one or two different species (***Table 13***).

Table 13 List of vascular plant families and species count (see Appendix 1).

FAMILY	# SPP	FAMILY	# SPP
ASTERACEAE (Aster Family)	63	BORAGINACEAE (Borage Family)	6
POACEAE (Grass Family)	45	CAPRIFOLIACEAE (Honeysuckle Family)	6
ROSACEAE (Rose Family)	24	JUNCACEAE (Rush Family)	6
FABACEAE (Legume Family)	24	POLYGONACEAE (Buckwheat Family)	6
RANUNCULACEAE (Buttercup Family)	11	APIACEAE (Carrot Family)	6
CYPERACEAE (Sedge Family)	10	LILIACEAE (Lily Family)	5
BRASSICACEAE (Mustard Family)	9	CHENOPODIACEAE (Goosefoot Family)	4
ONAGRACEAE (Evening-Primrose Family)	8	ORCHIDACEAE (Orchid Family)	3
SALICACEAE (Willow Family)	7	RUBIACEAE (Madder Family)	3
SCROPHULARIACEAE (Figwort Family)	7	GROSSULARIACEAE (Currant Family)	3

Families with two species:

ACERACEAE (Maple Family), ALISMATACEAE (Water-Plantain Family), BETULACEAE (Birch Family), CORNACEAE (Dogwood Family), ELAEAGNACEAE (Oleaster Family), EQUISETACEAE (Horsetail Family), GERANIACEAE (Geranium Family), POLEMONIACEAE (Phlox Family), PRIMULACEAE (Primrose Family), PYROLACEAE (Wintergreen Family), RUPPIACEAE (Widgeon-weed Family), VIOLACEAE (Violet Family)

Families with one species:

ANACARDIACEAE (Sumac Family), ARALIACEAE (Ginseng Family), BALSAMINACEAE (Touch-Me-Not Family), CALLITRICHACEAE (Water-Starwort Family), CAMPANULACEAE (Bellflower Family), CARYOPHYLLACEAE (Pink Family), CONVOLVULACEAE (Morning-Glory Family), ERICACEAE (Heath Family), EUPHORBIACEAE (Spurge Family), GENTIANACEAE (Gentian Family), IRIDACEAE (Iris Family), LEMNACEAE (Duckweed Family), LENTIBULARIACEAE (Bladderwort Family), LINACEAE (Flax Family), MONOTROPACEAE (Indian-Pipe Family), OLEACEAE (Olive Family), OPHIOGLOSSACEAE (Fern Family), PINACEAE (Pine Family), PLANTAGINACEAE (Plantain Family), SAXIFRAGACEAE (Saxifrage Family),
SMILACACEAE (Greenbrier Family), TYPHACEAE (Cattail Family), URTICACEAE (Nettle Family)

Of the vascular plant species found within MMPP, most are herbaceous forbs and graminoids (***Table 14***). A total of 36 different species of shrubs have been listed. The genera Hawthorn and Salix represent the largest number of shrub species (n=5 and n=5, respectively). Seven different tree species are listed including trembling aspen *(Populus tremuloides)*, balsam poplar (*Populus balsamifera*), two varieties of Manitoba maple (*Acer negundo var. interius* and *Acer negundo var. violaceum*), green ash (*Fraxinus pennsylvanica*), white birch (*Betula papyrifera*), and white spruce *(Picea glauca)* are found within the park.

Table 14 Number of vascular plant species by growth form.

Growth Form	Number of Species
Trees	7
Shrubs	36
Graminoids (grass-like herbs)	63
Forbs (broad-leaved herbs)	208

The vascular plant list created also contains species that are non-native, invasive, or introduced. The designation of non-native/invasive/introduced species was determined through various sources including the Saskatchewan Forage Council: Saskatchewan Invasive Plant Species Identification Guide (2010), Saskatchewan Forage Council: Identification of Common Seeded Plants for Forage and Reclamation in Saskatchewan (2006), and the Saskatchewan Conservation Data Centre: Saskatchewan Vascular Plants: All Taxa (2021), and Taxa List: Non-Native Species (2014).

It is recommended that a vascular plant inventory should be completed within the park to identify species composition, species abundance, and locations of rare or invasive species, key habitat features, as well as general health and condition of the flora in MMPP. Additionally, riparian and wetland health assessments should be completed within the park, as the park encompasses a large area of lowland wetland and water features. Those water features provide key ecological functions that benefit the park (Ambrose, Ehlert, & Spicer-Rawe, 2009). These inventory and assessment will aid in monitoring the long-term changes of park ecosystems.

3.5.3.1 NON-NATIVE PLANT SPECIES

A total of 38 species are listed with an S-rank of "SNA", approximately 12 percent of the total plant species. The designation of "SNA" is defined as: "conservation status is not applicable to the species (e.g., it may have been determined to have been introduced in Saskatchewan)" by Saskatchewan Conservation Data Centre (2021). Of the plants designated as "SNA", all species are confirmed to be non-native, invasive, or introduced. The number species listed as "SNA" and non-native, invasive or introduced can be found organized by family group in ***Table 15***. The vascular plant lists do not include ornamental plantings that may or may not be found in the park core area or lease areas. Noted occurences of invasive species are presented in ***Figure 35***.

The Aster, Legume, Grass, Buckwheat, and Mustard families comprise the largest number of non-natives species. Commonly found non-natives include Canada thistle (*Cirsium arvense*), ox-eye daisy (*Leucanthemum vulgare*), common dandelion (*Taraxacum officinale ssp. officinale*), Russian-thistle (*Salsola spp.*), crested wheat grass (*Agropyron cristatum ssp. pectinatum*), creeping wild rye (*Elymus repens*), dock (*Rumex pseudonatronatus*), smooth brome (*Bromus inermis*), timothy (*Phleum pretense*), common caragana (*Caragana arborescens*), clover (*Trifolium* spp.), and common plantain (*Plantago major*).

The Canadian Biodiversity Strategy: Canada's Response to the Convention on Biological Diversity (Environment Canada, 1995) states that non-native species must be controlled or eliminated to preserve and prevent further destruction of natural ecosystems. Invasion by non-native species decreases diversity of native species. Non-natives are aggressive and competitive; they invade, displace, and out compete native species (Moen, 1998). Additionally, non-native species can introduce diseases, parasites, and cause hybridization. Invasions can result in habitat degradation or destruction as well as the decrease or extinction of native or endemic populations. On a larger scale the introduction of non-native species can lead to the transformation or degradation of whole ecosystems (Environment Canada, 1995).

Table 15 Number of non-native, invasive or introduced vascular plant species by family (see Appendix 1).

Family	Number of Species	
	Non-native/Invasive /Introduced	S-rank "SNA"
ASTERACEAE (Aster Family)	9	9
FABACEAE (Legume Family)	8	8
POACEAE (Grass Family)	7	7
BRASSICACEAE (Mustard Family)	3	3
POLYGONACEAE (Buckwheat Family)	3	3
CHENOPODIACEAE (Goosefoot Family)	2	2
BORAGINACEAE (Borage Family)	1	1
EUPHORBIACEAE (Spurge Family)	1	1
PLANTAGINACEAE (Plantain Family)	1	1
ROSACEAE (Rose Family)	1	1

Most non-native plants are European or Asian in origin. The original establishment of non-natives are from a variety of sources. Many non-natives were intentionally cultivated as forage crops, erosion control, and shelter belts. Additional disturbances from oil and gas exploration, recreational developments, ornamental landscaping, grazing, fire suppression, and fragmentation have aided in the establishment of non-native species. These plants are commonly found in ditches, roadsides, disturbed areas, gravel pits, trails, core areas, and adjacent agriculture fields (Moen, 1998; Environment Canada, 1995; Sampson & Knopf, 1994).

Non-native species threaten the native vegetation as well as the surrounding grasslands of MMPP. Noxious/invasive species that can be found within the park include common burdock (*Arctium minus*), Absinthe (*Artemisia absinthium*), leafy spurge (*Euphorbia esula*), thistle (*Circium spp.* and *Salsola spp.*), and common dandelion (*Taraxacum officinale ssp. officinale*) (Landscape Protection Unit, 2020). Invasive species have been found primarily along roadsides, trails, and in areas of high use such as the park's core area. Those occurrences can be seen in ***Figure 34.***

Invasive species such as smooth brome and caragana are of significant management concerns as they are adapted at forming monodominant stands which inhibit native species. Kentucky bluegrass has been found to be equally significant in abundance and has spread across and largely replaced most of the previously identified fescue prairie. Currently, the park utilizes herbicides for the control and management of priority invasive species found within the park (Chu, 2021).

Recommended practices laid out by the "Provincial Park Resource Management and Recreational Activities Guidelines" (2003) for invasive species management tools include prescribed burns, and utilizing grazing, mowing, or haying. Mechanical management practices must be implemented prior to invasive species reaching seeding. The seasonality of native grasses and the timing of prescribed burning must be considered to ensure appropriate species are being targeted (Saskatchewan Parks, 2003). However, disturbances like fire, grazing, and mowing can also encourage establishment of invasive species because invasive species are generally adapted to colonizing disturbed land when seed sources are available. Therefore, an integrated approach such as a combination of herbicide, biological and mechanical treatments (i.e., prescribed burn, grazing, mowing, or haying) could be very effective to reduce the invasion of non-native species.

Thorpe and Godwin (2019) suggested other practices to limit non-native species establishment opportunities can include:

- Reduce or eliminating livestock grazing.
- Reduce or eliminate ATV use within the park.
- Unnecessary roads and trails (including ATV) should be closed and reclaimed.
- Landscaping, erosion control, and reclamation should be completed using only native species.
- Heavy equipment should be washed to remove seed-bearing mud before entering the park.

An annual survey of known and new invasive or non-native species locations should be maintained, including those used in landscaping within the core areas. The species types as well as the extent and proportion of the invasion within MMPP will be necessary when creating management strategies and to ensure recreational and developmental activities do not further spread these species. Discrete patches of non-native species, where control is likely to be achieved, should be a management focus. These areas include the core area, along roadsides, trails, and ditches, oil and gas developments, forestry activities, and known patches of invasive species. Priority areas for invasive species treatments are presented in Appendix 8.

Figure 34 *Invasive species found along roadsides within MMPP (Hamm, 2019)*

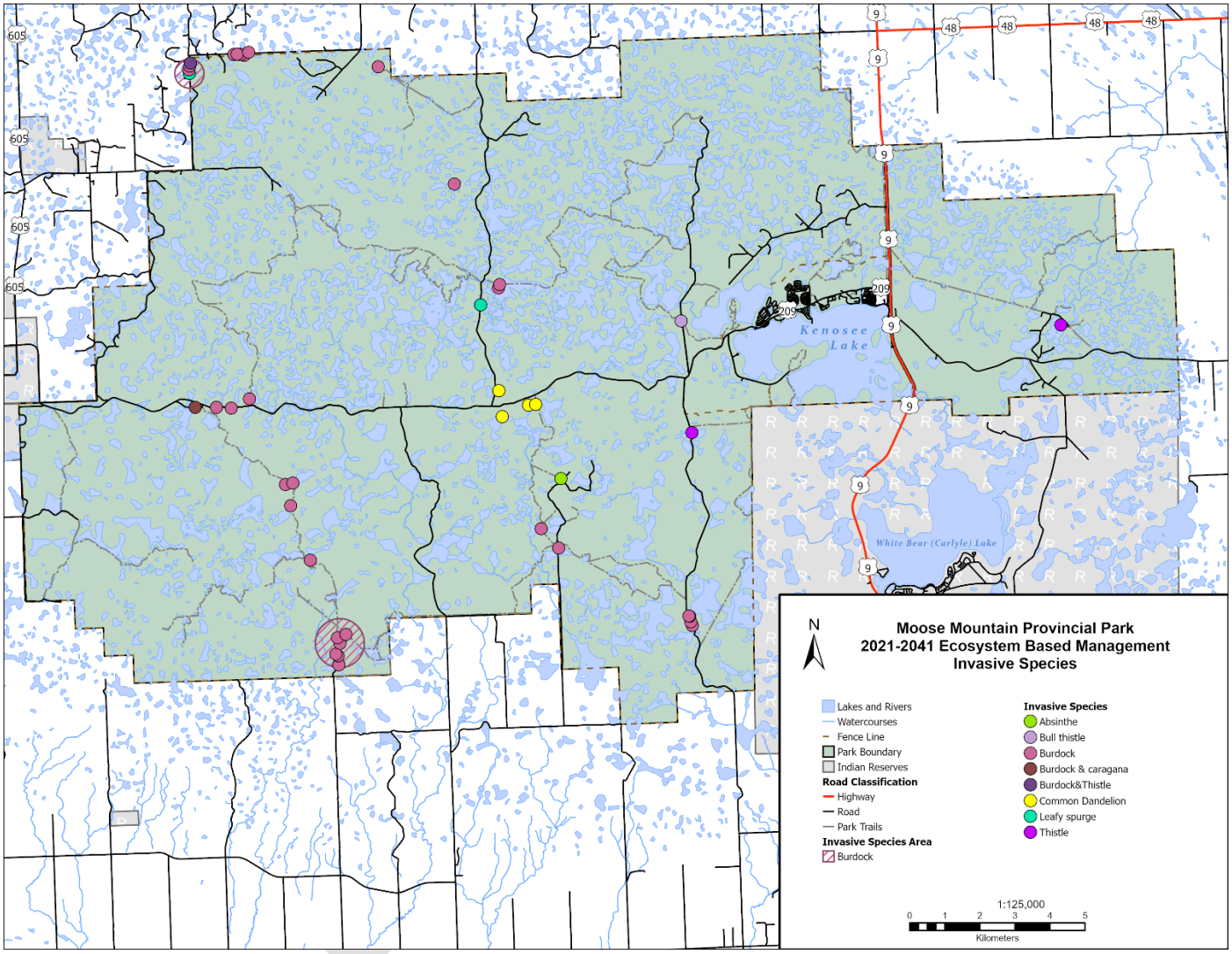

Figure 35 *Known invasive species locations within MMPP (Source: HABISask 2021).*

3.5.3.2 RARE AND UNUSUAL VEGETATION AND PLANT SPECIES

The Moose Mountain area contains several rare vascular plants species and ecological communities. The unique geology of the area allows for a deciduous dominated forest surrounded by grasslands, including small, remnant areas of plains rough fescue grasslands. Additionally, the geographic location of the park allows occurrences of eastern plant species not found elsewhere within the province. Known locations of rare plants can be found in ***Figure 36***.

Eastern ranging plants found within MMPP include the American plum (*Prunus americana*) and the New England American-aster (*Symphyotrichum novae-angliae*). The American plum has a range that extends throughout Manitoba, Ontario, and Québec as well as the eastern United States but is locally rare in Saskatchewan. The New England American aster is a large, showy aster found throughout eastern Canada but is rare in Saskatchewan.

The deciduous forested areas contain many rare species such as tall larkspur (*Delphinium glaucum*), black-fruited hawthorn (*Crataegus douglasii*), scarlet paintbrush (*Castilleja coccinea*), downy blue violet (*Viola sororia*), false spikenard (*Maianthemum racemosum ssp. amplexicaule*), striped coralroot (*Corallorhiza striata var. striata*) orchid, and various-glumed wild rye (*Elymus diversiglumis*). The downy blue violet has only been in one small region of the province and is listed as threatened by Harms (2006) because of this extreme rarity.

Narrow-leaved water plantain (*Alisma gramineum*), tall blue lettuce (*Lactuca biennis*), foxtail sedge (*Carex alopecoidea*), Mingan (common) moonwart (*Botrychium minganense*), widgeon-grass (*Ruppia cirrhosa*) and beaked ditch grass (*Ruppia martima*) can be found within mesic to hydric or wetland/riparian sites of the area. Mingan moonwort has been designated as threatened by Harms (2006) it is limited to two or three general locations in the province and those populations are locally sparse.

Rocky areas, outcrops, cobbles, and gravels or sandy areas provide habitat for the Carolina foxtail (*Alopecurus carolinianus*), upland white goldenrod (*Solidago ptarmicoides*), Foxtail sedge *(Carex alopecoidea),* Carolina wild geranium (*Geranium carolinianum*), small lupine (*Lupinus pusillus ssp. pusillus*), northern yellow point-vetch (*Oxytropis campestris* var. *dispar*) and hairy panic-grass (*Dichanthelium acuminatum var. fasciculatum*). The Carolina foxtail is only found in one region of the province. The Carolina wild geranium, foxtail sedge, and northern yellow point-vetch are limited in occurrences to only a few locations within the province (University of Saskatchewan, n.d.).

The southern slopes of MMPP contain natural fescue and mixed grassland areas, however, have largely been replaced by invasive grasses (e.g., smooth brome and Kentucky blue grass). These grassland patches are the habitat to several rare plant species including tall pussytoes (*Antennaria anaphaloides*), flat-topped pussytoes (*Antennaria corymbosa*), blue-bunch wheatgrass (*Pseudoroegneria spicata*), and Mucronate blue-eyed grass (*Sisyrinchium mucronatum*). Flat-topped pussytoes is listed as endangered by Harms (2006) because of extreme rarity as it is in one subregion of the province, the fescue prairie, and is typically found locally sparse.

Three species of paint brush (*Castilleja* spp.) are found within MMPP that are listed as sub-nationally rare/ uncommon to critically imperiled or extremely rare. The scarlet paintbrush is listed as endangered by Harms (2006) and extremely rare at a subnational level. The scarlet paintbrush is found only within regions of Saskatchewan. Similarly, Raup's Indian paintbrush (*Castilleja raupii)* is listed as threatened Harms (2006) because of extreme rarity is typically regionally restricted to the northern parts of the province. Lastly, the downy paintbrush, the most abundant of the three and listed as rare or uncommon.

Other vascular plants of note found within MMPP include the two species of the family Ruppiaceae or widgeonweeds mentioned above. The widgeonweeds are a family of aquatic plants with only eight known species.

Both *Ruppia cirrhosa* and *Ruppia maritima* can be found within sloughs, ponds, or brackish/alkaline lakes. The plants are rare or uncommon within Saskatchewan.

A full list of rare plants and their associated conservation status designations can be found in ***Table 16***. Various sources were used to comprise the rare plant list as of December 2021 (Government of Canada, 2021; Saskatchewan Conservation Data Centre, 2021; Harms, 2006; Terrestrial & Aquatic Environmental Managers Ltd, 1992).

Apart from the vascular plants noted above, a species of lichen has recently been found within MMPP that is listed in COSEWIC and SARA as of September 1st, 2021. Golden-eye lichen, *Teloschistes chrysophthalmus*, is listed as Special Concern for the prairie-boreal population. The lichen has been found in for the first time in Saskatchewan within MMPP. The lichen was found on planted white spruce and blue spruce within the park. The eastern extent of the prairie/boreal population is near the border of Saskatchewan and Manitoba. Primiary habitat of golden-eye lichen can be most found on twigs and branches of mature white spruce but can also be found on other host trees such as trembling aspen, jack pine, balsam fir, sugar maple, red oak and bur oak (Government of Canada, 2021).

A detailed investigation and re-inventory of rare and species-at-risk flora should be conducted in the park. Current data reflecting the locations and quantity of these species within MMPP will be necessary when creating management strategies and to ensure recreational and developmental activities do not impact these species.

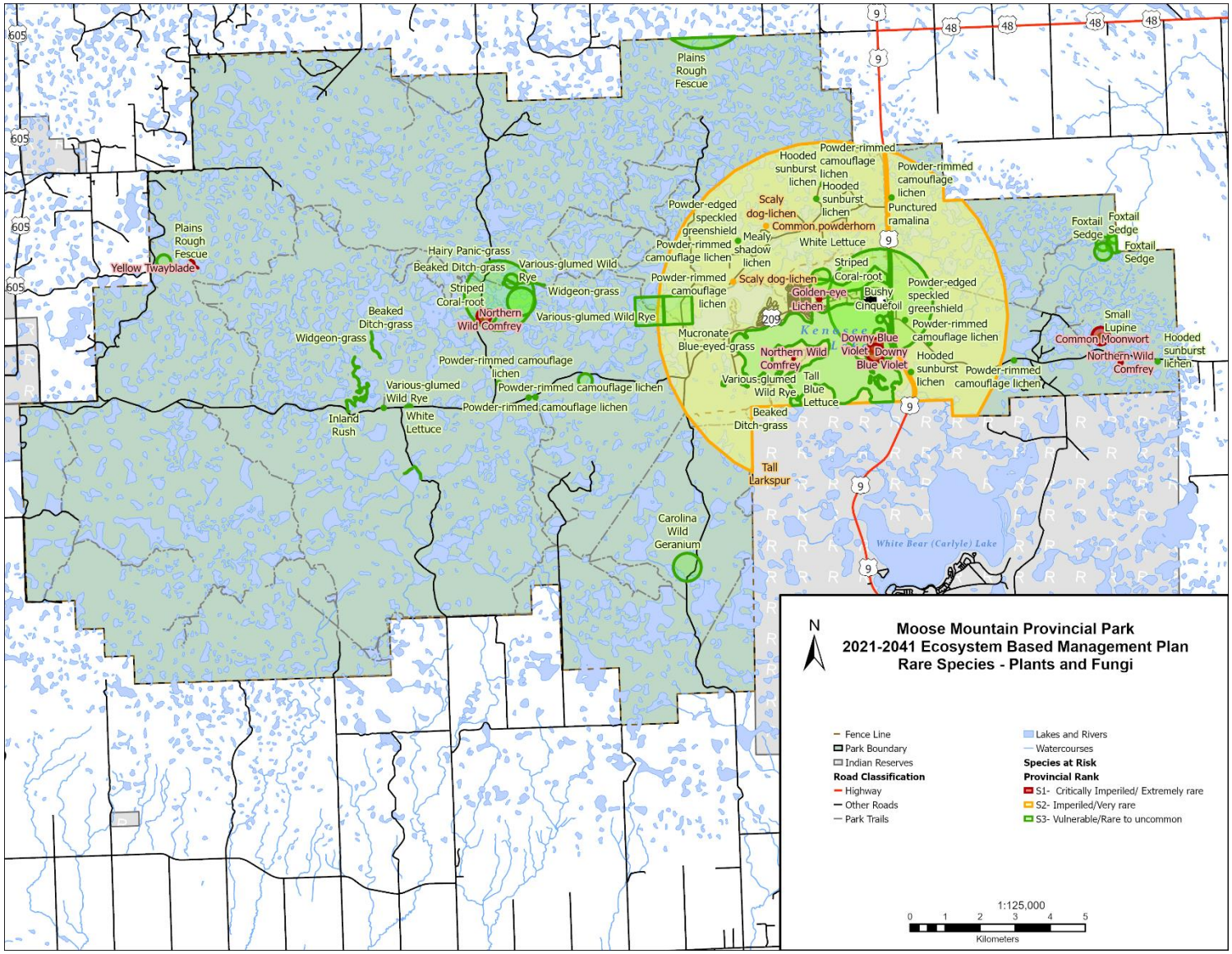

Figure 36 *Know Locations of rare plant and other species occurring within MMPP (Source: HABISask).*

Table 16 Rare vascular plant species within MMPP.

Conservation rankings by the Saskatchewan Conservation Data Centre are shown as Subnational Rank and National Rank. Federal conservation rankings are listed in COSEWIC. Provincial conservation rankings under Saskatchewan Species at Risk are found in SAR. Additionally, Harms (2006) has listed species as endangered, threatened, vulnerable, common, uncommon, fairly common or uncertain. Habitat notes based on references various sources (Johnson, Kershaw, MacKinnon, & Pojar, 1995; Vance, Jowsey, & McLean, 1993; Harms, 2006; University of Saskatchewan, n.d.). Nomenclature has been updated to reflect the Saskatchewan Conservation Data Centre (2021) vascular plant list.

Subnational Rank and National Rank Descriptions:

(1) Secure/ Common | (2) Apparently Secure | (3) Vulnerable/Rare to uncommon | (4) Imperiled/ Very rare | (5) Critically Imperiled/ Extremely rare

Other Description Codes:

(END) Endangered | (THR) Threatened | (VUL) Vulnerable | (-) Not Listed | (U) No Information | (Co) Common | (FC) Fairly Common | (UC) Uncommon | (U?) Uncertain

Scientific Name	Common Name	S-Rank	N-Rank	COSEWIC/ SAR	Harms (2006)	Habitat
ALISMATACEAE (Water-Plantain Family)						
Alisma gramineum	Water Plantain, Narrow-leaved	S3	N4N5	-	UC	Wetlands/marshes submerged or emerged in shallow fresh or brackish water
ASTERACEAE (Aster Family)						
Antennaria anaphaloides	Pussytoes, tall	S1	N4N5	-	THR	Loamy soil in open fescue prairie
Antennaria corymbosa	Pussytoes, flat-topped	S1	N2	-	END	Open woods and prairies in dry to moist soil, fescue prairie, wetlands
Antennaria dimorpha	Low Pussytoes	S3	N5	-	THR	Short-grass prairie in dry sand, silt, gravel or clay
Antennaria umbrinella	Pussytoes, brown-bracted	S2	N5	-	VUL	Dry, open, gravelly slopes
Helianthus tuberosus	Jerusalem Artichoke	S2	N3N4	-	THR	Dry to moist sites along woodlands, thickets, and wasteland

Lactuca biennis	Lettuce, tall blue	S3	N5	-	VUL	Moist woods, thickets, swamps, stream banks in full or part shade
Prenanthes alba	Lettuce, white	S3	N5	-	VUL	Open areas in aspen or poplar forests
Solidago ptarmicoides	Goldenrod, upland white	S3	N5	-	C	Sandy, rocky or dry open prairie or woodlands in part shade or full sun
Symphyotrichum novae-angliae	New England American aster	S1	N5	-	-	Moist, open meadows or wooded areas, disturbed sites, stream backs
BORAGINACEAE (Borage Family)						
Cynoglossum virginianum	Wild Comfrey, northern	S1	NNR	-	END	Dry sites along rich woodlands or slopes in full or part shade
Lappula occidentalis var. cupulata	Sheepbur, flat spine	S1	NNR	-	C	Roadsides, prairies, roadsides, wastelands, or fields with dry, sandy or gravelly soils in part shade or full sun
CYPERACEAE (Sedge Family)						
Carex alopecoidea	Sedge, foxtail	S3	N4N5	-	VUL	Wet meadows, marshes, floodplains, and streambanks in part shade or full sun
Carex saximontana	Sedge, Rocky Mountain	S3	N3	-	VUL	Moist to dry prairies or woodlands in shade or part shade
FABACEAE (Pea Family)						
Lupinus pusillus ssp. pusillus	Lupine, small	S3	N3N4	-	UC	Sandy soil or sand dunes
Oxytropis campestris var. dispar	Point-vetch, northern yellow	S1	NU	-	C	Sandy grasslands and open woods
GERANIACEAE (Geranium Family)						
Geranium carolinianum	Geranium, Carolina wild	S3	N5	-	UC	Dry fields with gravelly to clay soils in part shade

GROSSULARIACEAE (Currant Family)						
Ribes oxyacanthoides var. setosum	Gooseberry, bristly	S2	N2	-	UC/ FC	Streambanks, open forests, woodlands, and thickets
IRIDACEAE (Iris Family)						
Sisyrinchium mucronatum	Blue-eyed grass, Mucronate	S3	N4	-	UC	Moist grasslands
JUNCACEAE (Rush Family)						
Juncus interior	Rush, Inland	S3	N4N5	-	VUL	Ditches, mudflats, low wet or previously wet areas
LAMIACEAE (Mint Family)						
Monarda fistulosa var. mollis	Bergamot, soft wild	S3	NNR	-	C	Dry, rich fields, thickets or clearings
LEMNACEAE (Duckweed Family)						
Lemna minor	Duckweed, Lesser	S1	N5	-	U?	freshwater ponds and slow-moving streams
LILIACEAE (Lily Family)						
Maianthemum racemosum ssp. amplexicaule	Spikenard, false	S1	N5	-	THR	moist woods and thickets
OPHIOGLOSSACEAE (Fern Family)						
Botrychium minganense	Moonwort, Mingan	S1	N5	-	VUL	Drying prairie sloughs, moist meadows, and semi-open woodlands
ORCHIDACEAE (Orchid Family)						
Corallorhiza striata var. striata	Coral-root, striped	S3	N5	-	VUL	Aspen or poplar dominated woodlands
Liparis loeselii	Twayblade, yellow	S3	N4N5	-	VUL	Wet meadow depressions, fens, bogs, sloughs
POACEAE (Grass Family)						
Alopecurus carolinianus	Carolina Foxtail	S3	N3N4	-	END	Low grounds such as dry slough or creek bottoms and mudflats

Dichanthelium acuminatum var. fasciculatum	Panic-grass, hairy	S3	N5	-	VUL	Dry sites such as clearings, exposed rock and sandy open woodlands
Elymus canadensis var. brachystachys	Wild rye, short-spiked Canada	S1	NNR	-	C	Sun or part shade in moist, sandy or gravelly meadows
Elymus diversiglumis	Wild rye, various-glumed	S3	N3	-	THR	Moist, rich deciduous woodlands and thickets
Festuca hallii	Fescue, plains rough	S3	N5	-	C	Moist grasslands
Pseudoroegneria spicata	Wheat grass, bluebunch	S2	N5	-	UC	Prairie grasslands, and aspen dominated forests
RANUNCULACEAE (Buttercup Family)						
Delphinium glaucum	Larkspur, tall	S2	N5	-	THR	Open deciduous woodlands, clearings, meadows, and streambanks
ROSACEAE (Rose Family)						
Crataegus douglasii	Hawthorn, Black-fruited	S2	N4N5	-	VUL	Open *Populus spp.* dominated woodlands or shrub thickets along shorelines
Potentilla supina ssp. paradoxa	Cinquefoil, bushy	S3	N4N5	-	FC	Sandy lakeshores, moist depressions, stream and river banks
Prunus americana var. nigra	Canada Plum	S2	N4	-	VUL	Borders of riparian deciduous woodlands
RUPPIACEAE (Widgeon-weed Family)						
Ruppia cirrhosa	Widgeon-grass	S3	N4N5	-	VUL	Submerged in saline or alkaline lakes, ponds or sloughs
Ruppia martima	Ditch-grass, beaked	S3	N5	-	THR	Submerged in saline or alkaline lakes, ponds or sloughs
SCROPHULARIACEAE (Figwort Family)						

Castilleja coccinea	Paintbrush, scarlet	S1	N5	-	END	Deciduous forests edges, moist meadows, and ditches
Castilleja raupii	Paintbrush, purple	S2	N5	-	THR	Meadows, moist forest edges, and upper lake beach edges
Castilleja sessiliflora	Paintbrush, downy	S3	N3N4	-	FC	Moist to dry prairie
VIOLACEAE (Violet Family)						
Viola sororia	Violet, downy blue	S1	N5	-	THR	moist deciduous or mixed woods

3.5.4 ECOLOGICAL DISTURBANCE AND AGE-SINCE-LAST-DISTURBANCE PROFILES

Currently, most of the forests within MMPP originate from stand-replacing wildfire in 1897. Historically, disturbances from wildfire played an important role in stand regeneration of the Aspen Parkland and the surrounding prairie. Natural disturbances are discussed in detail in Section 3.3. Other than the landscape level fire in 1897, the forests within the park show three major stand origins at approximately 1930-1940, 1960, and 1980 and are depicted in ***Figure 37***.

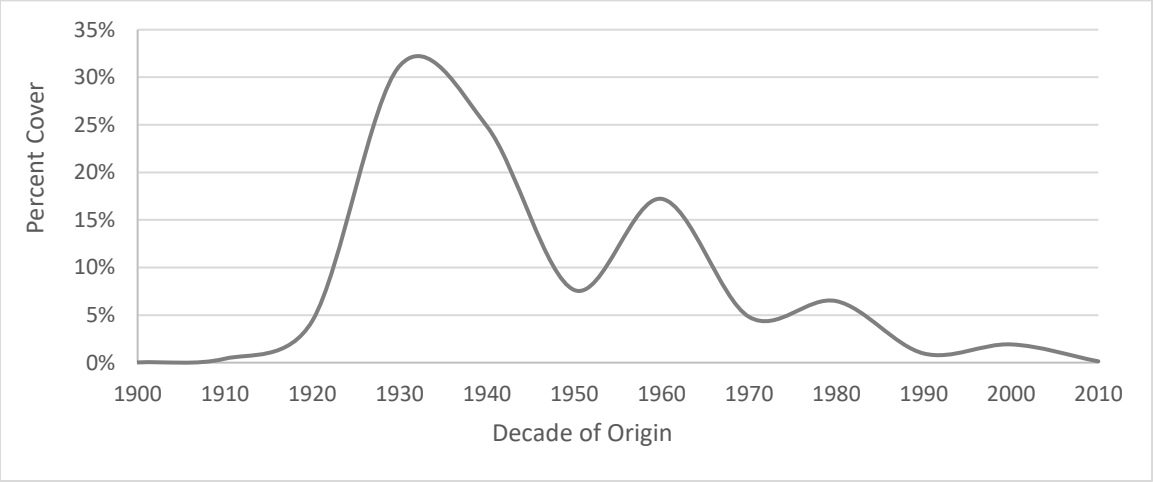

Figure 37 *Decade of origin for forests in MMPP summarized from SFVI database.*

The peak in the 1930s and 1940s coincides with the inception of the park (1931) and subsequent preservation of the forest as well as the reintroduction of beaver to the park area. The cohort from these events represents approximately 56 percent of the forest within the park, of which trembling aspen represent 94 percent followed by white birch at six percent and a negligible amount of green ash (0.3 percent), white spruce (0.1 percent), and balsam poplar (0.02 percent).

Stands originating within the 1960s account for approximately 17 percent of the total stands within the park. Of this cohort, trembling aspen represents approximately 87 percent, white birch represents 11 percent, green ash represents two percent, and white spruce represent less than one percent. It is likely that these stand origins coincide with the additional forest protections as well as increased fire suppression activities in the area.

Stands originating within the 1980s account for approximately six percent of the total stands within the park. Of this cohort, trembling aspen represent approximately 76 percent, white birch represents 23 percent, green ash represents one percent, and white spruce represent less than one percent. These stand origins coincide with some small fires within the park which are discussed in Section 3.3.1. In the years since 1990, stand origins are due primarily to mechanical harvests within the park for stand regeneration purposes. These harvests are discussed in the detail in Section 3.5.1.9.

Main decade of origin for the dominated forest stand types are presented in ***Figure 38***. Trembling aspen stands have main decades of origin of 1930-1940 (58 percent), 1960 (17 percent), and 1980 (seven percent). White birch and green ash stands show main decades of origin between the 1940s and 1960s, totally 77 and 81 percent, respectively. White spruce and blue spruce stands have decades of origin between 1940 and 1950s accounting for a total of 69 percent.

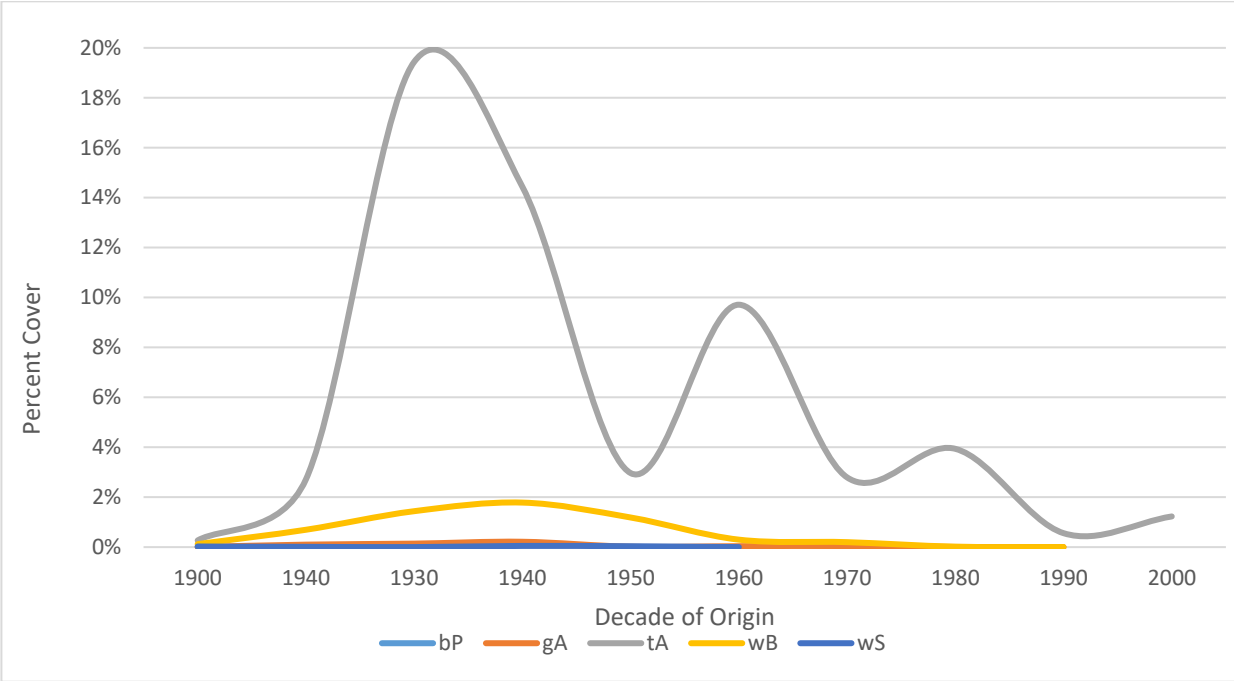

Figure 38 *Decade of origin for main forest stand types in MMPP summarized from SFVI database.*

Currently, approximately 68 percent of the park's forest originate prior to 1950. The resulting stands, 70 years old and greater, are classified as "mature", "old", and "very old", while approximately 30 percent of the forest is classified as "immature" or "young" and are depicted in ***Table 17*** and in ***Figure 39***.

Table 17 *Age class distribution of forests within Moose Mountain Provincial Park (Timberline Forest Inventory Consultants, 2021).*

Seral Stage	Age Range (Years)	Area (ha)	Percent Total
Young	< 20	405.7	1.6 %
Immature	21-70	7847.8	30 %
Mature	71-90	8379.8	32 %
Old	91-120	9352.3	36 %
Very Old	> 120	15.7	< 1%

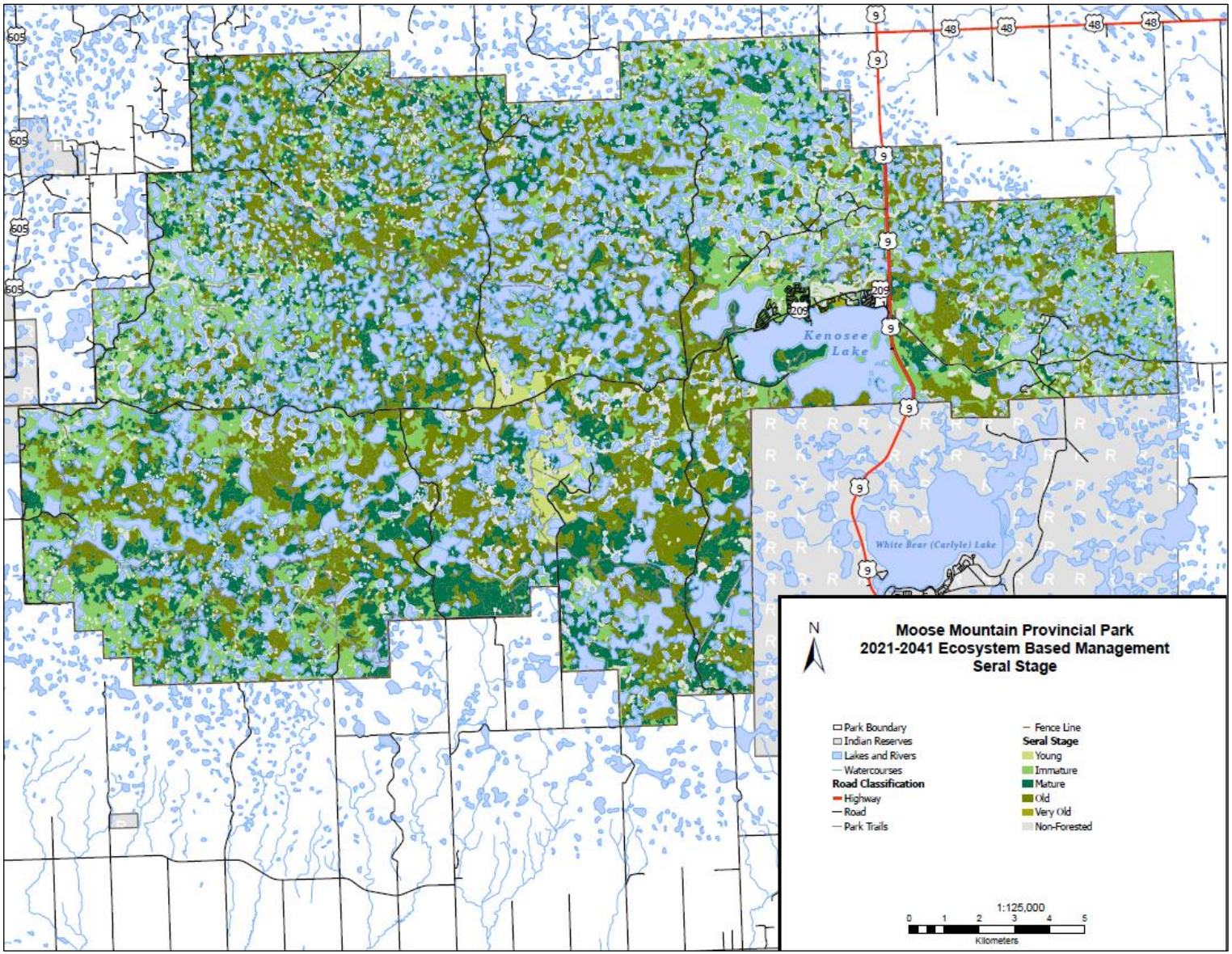

Figure 39 *Seral stage distribution within MMPP.*

3.5.5 CORE AREA VEGETATION

The core area of MMPP has seen a substantial development of facilities including campgrounds, recreational facilities, cottages, and businesses (see Section 3.5.1). These facilities are needed to accommodate and to provide visitor experiences for recreational users. Vegetation management within the core area of the park is required to maintain visitor safety and satisfaction. However, it is important that management practices preserve or mimic the natural aesthetic of the environment and minimize developmental impacts.

Most areas within the core park area are surrounded by natural vegetation. The campgrounds within the park have been created within natural forest stands as seen in ***Figure 40*** (i.e Fish Creek Campground) and ***Figure 41*** (i.e. Lynwood Campground). Forested campgrounds provide the visitor with shade, shelter, and a natural experience. However, as forest stands in the campgrounds are aging, natural forest succession causes these trees to mature, reach their climax community, succumb to mortality factors, and eventually, begin collapsing and renewal. Therefore, it is not acceptable to allow natural forest succession processes to proceed unmanaged in the core area or other high use areas of the park (Thorpe & Godwin, 2019).

Figure 40 *Fish Creek A, site 9, MMPP (Saskatchewan Provincial Parks, no date).*

Core area vegetation management issues include both long-term and short-term concerns. Short-term concerns include dealing with hazardous vegetation that have the potential to cause injury, death, or damage to property. The Saskatchewan Parks (2003) had created a policy for “dealing with hazardous vegetation”. Additionally, the Saskatchewan Parks (2008) has outlined a framework for “Dealing with Risk/Hazardous Vegetation in Core Areas of Provincial Parks and Recreation Sites”. Within this framework, guidelines to deal with risk and hazardous vegetation in core park areas are defined as follows

- There is a duty of the Park Manager to preserve the park's natural environment while ensuring public and employee safety for property and from physical injury.
- Tree maintenance or removal are acceptable when required for human safety, to protect infrastructure, to accommodate approved development, and for managing forest health.
- Trained staff will conduct annual assessments in high use areas such as campsites, picnic sites, day use areas, and parking lots as per the "Core Area Risk Management Field Form" found within the framework of "Dealing with Risk/Hazardous Vegetation in Core Areas of Provincial Parks and Recreation Sites"; and
- Risk assessment should lead to remedial action based on the risk rating including pruning, cabling, and tree removal, removing, or moving at-threat targets, and/or excluding visitors from hazardous sites.

Figure 41 *Lynwood Campground, site 28, MMPP (Saskatchewan Parks).*

The long-term vegetation management issue is overall forest stand renewal. Forest stand renewal can be accomplished through natural processes or prescribed renewal treatments. Stand regeneration through natural disturbances (i.e., fire) are not desirable or feasible in a core area setting. Prescribed treatments may not be aesthetically pleasing, such as tree harvesting within campgrounds, but can be highly effective in regenerating aspen (Thorpe & Godwin, 2019; Godwin, Wittrock, & Thorpe, 2013).

As described in Sections 3.3 and 3.5.4, the forest in the core area cannot live forever. Mature to old trembling aspen and balsam poplar trees are prone to increasing heart-rot, often leading to breakage during windstorms. A particular issue in some core areas is the dieback of aging birch trees. In the absence of renewal treatments, the number of risk trees will increase as the forest ages. Unfortunately, the gradual removal of hardwood risk trees can lead to undesirable regrowth (i.e., shrubs) (Peterson & Peterson, 1992). The shade intolerant aspen require clearcutting to expose the soil to full sunlight and to remove competition. Risks from over-mature trembling aspen and balsam poplar as well as the fire risks from white spruce and white birch within the core area is of concern.

Blue spruce is a commonly planted coniferous species within the core area and can be seen in ***Figure 42*** and ***Figure 43***.

Figure 42 *Core area vegetation of planted blue spruce within MMPP* ***(Google, 2009)****.*

A core area vegetation management plan would begin with an inventory of stands within the core area followed by treatments and siviculture programs that are prioritized based on stand needs. Prioritization would be reflective of stand type, stand age, targeting of non-native species or ornamentals, current forest health (e.g., physical damage, insects, and disease), as well as objectives for visitor accommodations and visitor safety concerns. Harvest and treatment seasons should occur within non-peak seasons (i.e., fall/winter) to minimize visitor impacts.

Invasive species within the park have been discussed within Section 3.5.3. Non-native plant species can be found as ornamentals in landscaping and decoration within privately owned areas, leases, and cottages (***Figure 44)***. Non-native species include blue spruce (*Picea pungens*), mountain ash (*Sorbus americana*), caragana (*Caragana arborescens*), ornamental pines and jack pine (*Pinus spp.*), and junipers (*Juniperus spp.*). Non-natives, when used in an ornamental manner typically do not pose a threat to native vegetation. However, monitoring programs should be established to prevent the introduction of a potentially invasive non-native species. Ideally, ornamentals could be reduced within the core area and an emphasis on utilizing native species within landscaping should be encouraged. This will help affirm the park's commitment in maintaining and conserving natural species communities. A list of preferred native tree and shrub species for suitable planting in the park is provided in Appendix 5.

Reducing or managing the environmental impacts of recreational users within the core area presents additional challenges. Vegetation can become trampled, and growth impeded in areas where visitors create unofficial pathways through forested areas (i.e. shortcuts through campsites/campgrounds, etc.). Diminished vegetation can also contribute to soil instability, compaction, and/or erosion potential. It can be beneficial to create an inventory of these disturbances to identify locations of concern, quantify the number and extent of the disturbances, and prioritize reclamation or remedial efforts.

A provincial Core Area Silviculture Program has been developed by Parks Division and will help address regeneration strategies and silvicultural requirements of various park areas across our provincial parks. In conjunction with the aforementioned program, a detailed inventory of the vegetation within the core area is recommended.

Figure 43 *Core area vegetation of planted blue spruce within Birch Street, MMPP (Google, 2009).*

Figure 44 *Core area vegetation of planted ornamental or non-native plant species MMPP (Google, 2009).*

3.6 PRESENT-DAY USE AND COMPOSITION OF PARK ANIMAL COMMUNITIES

3.6.1 ANIMAL COMMUNITIES AND THEIR RELATIONSHIPS WITH VEGETATION

Vegetation is typically the focus of an ecosystem-based management plan, as it creates the habitats and supports the fauna of the area. MMPP supports approximately 181 breeding or potential to breed bird species, 61 mammals, eight amphibians, and five reptiles. Complete lists of species are given in Appendices 2, 3, and 4.

3.6.1.1 AVIAN

The relationship between animal communities and the vegetation of MMPP was discussed with the focus on bird communities. Birds make up the largest and most diverse community of vertebrates in the park. Bird communities are also easily studied during breeding and non-breeding seasons, thus making them ideal and common study subjects.

A large majority of birds that utilize the ecosites of MMPP are passerines from the Order Passeriformes, or commonly known as perching birds or songbirds. Notable passerines include the yellow-throated vireo (*Vireo flavifrons*), Baird's sparrow (*Centronyx bairdii*), Sprague's pipit (*Anthus spragueii*), Bobolink (*Dolichonyx oryzivorus*), bank swallow (*Riparia riparia*), Chestnut-collared Longspur (*Calcarius ornatus*). MMPP is the only place within Saskatchewan where the yellow throated vireo can be found (Acton, Padbury, & Stushnoff, 1998). The second most common is the Order Anseriformes which is represented by the geese, ducks and grebes that are commonly found in many waterbodies within the park. There are a number of marshes dwelling species that utilize the shallow lakes and seasonal wetlands in addition to the larger waterbodies. These species include the Blue-winged teal, Northern shoveler, lesser scaup and Forster's tern. Historically the area contained a great blue heron colony located in the northwest of Scott, Ray, and McLellan lakes, but have seen to be abandoned in the area (Terrestrial & Aquatic Environmental Managers Ltd, 1992).

Several sources were combined to determine habitat preferences of breeding birds of MMPP. Habitat preferences were then related to ecosites and land covers that are available within the park as well as the surrounding grasslands and agricultural areas. Sources included All About Birds (2021) , Birds Canada (2021), McLaughlan, Wright, & Jiricka (2010), Udvardy (1977), Acton, Padbury, & Stushnoff (1998), Terrestrial & Aquatic Environmental Managers Ltd (1992), Hobson & Bane (2000), Davis (2004), Schieck, Nietfeld, & Stelfox (1995). Common names and scientific names of those birds can be found in Appendix 4.

Analysis of bird communities within the park includes primarily breeding, probably breeding, and year-round species, however; some non-breeding, visitor, and migrant species were also included depending on their conservation status or if they are habitat specialists. Certain species were found to be associated with wetlands or marshes, lakes, deciduous or grassland dominated systems (***Table 18).***

Habitat preferences by ecosites that are available within MMPP for breeding bird species are presented in ***Table 19***. Many of the species listed above are found in more than one ecosite. Several species occur within the park and utilize a wide variety of ecosite types. Notable generalists that utilize four or more of the ecosite types include the northern waterthrush, tree swallow, black-billed magpie, common raven, barn swallow, Nelson's sparrow (Schieck, Nietfeld, & Stelfox, 1995; Birds Canada, 2021).

Table 18 Bird Species Associated with deciduous-dominated, wetland/marsh, lakes, and grassland areas for MMPP.

Wetland/Marsh	Deciduous-dominated	Grassland	Lakes
American Avocet		American Goldfinch	American Black Duck
American Bittern	American Redstart	American Kestrel	American Coot
Black Tern	American Robin	Barn Swallow	American White Pelican
Blue-winged Teal	Bald Eagle	Black-billed Magpie	American Wigeon
Bobolink	Baltimore Oriole	Brewer's Blackbird	Bank Swallow
Forster's Tern	Black-and-white Warbler	Brown Thrasher	Belted Kingfisher
Gadwall	Black-billed Cuckoo	Brown-headed Cowbird	Broad-winged Hawk
Great Blue Heron	Blackburnian Warbler	Chestnut-collared	Bufflehead
Indigo Bunting	Black-capped Chickadee	Longspur	California Gull
Marbled Godwit	Black-headed Grosbeak	Clay-colored Sparrow	Canada Goose
Marsh Wren	Blue Jay	Common Raven	Canvasback
Nelson's Sparrow	Broad-winged Hawk	Dickcissel	Caspian Tern
Northern Harrier	Brown Thrasher	Eastern Bluebird	Chimney Swift
Northern Shoveler	Cedar Waxwing	Eastern Kingbird	Cliff Swallow
Northern Waterthrush	Chestnut-sided Warbler	Ferruginous Hawk	Common Goldeneye
Purple Martin	Common Nighthawk	Golden Eagle	Common Loon
Red-winged Blackbird	Common Raven	Grasshopper Sparrow	Common Tern
Sandhill Crane	Common Yellowthroat	Gray Partridge	Double-crested
Sedge Wren	Cooper's Hawk	Horned Lark	Cormorant
Solitary Sandpiper	Dark-eyed Junco	House Wren	Eared Grebe
Sora	Downy Woodpecker	Killdeer	Forster's Tern
Swamp Sparrow	Eastern Phoebe	Lark Bunting	Franklin's Gull
Tree Swallow	Eastern Screech-Owl	Lark Sparrow	Gadwall
Virginia Rail	Eastern Towhee	Lazuli Bunting	Great Egret
White-faced Ibis	Eastern Wood-pewee	LeConte's Sparrow	Green-winged Teal
Willow Flycatcher	Great Crested Flycatcher	Loggerhead Shrike	Hooded Merganser
Wilson's Snipe	Great Horned Owl	Mourning Warbler	Horned Grebe
Yellow Rail	Hairy Woodpecker	Red Tailed Hawk	Lesser Scaup
Yellow-headed	House Wren	Ring-necked Pheasant	Mallard
Blackbird	Lazuli Bunting	Savannah Sparrow	Merlin
	Least Flycatcher	Say's Phoebe	Northern Pintail
	Nashville Warbler	Sharp-tailed Grouse	Northern Rough-winged
	Northern Flicker	Short-eared Owl	Swallow
	Northern Saw-whet Owl	Spotted Towhee	Northern Shoveler
	Northern Waterthrush	Swainson's Hawk	Osprey
	Orange-crowned Warbler	Turkey Vulture	Pied-billed Grebe
	Orchard Oriole	Upland Sandpiper	Piping Plover
	Ovenbird	Vesper Sparrow	Purple Martin
	Philadelphia Vireo	Western Kingbird	Redhead
	Pileated Woodpecker	Western Meadowlark	Red-necked Grebe
	Pine Siskin	Wild Turkey	Ring-billed Gull
	Purple Finch	Yellow-breasted Chat	Ring-necked Duck
	Red Tailed Hawk		Rock Dove
	Red-breasted Nuthatch		Ruddy Duck
	Red-eyed Vireo		Solitary Sandpiper
	Red-headed woodpecker		Spotted Sandpiper
	Rose-breasted Grosbeak		Tree Swallow
	Ruby-throated Hummingbird		Western Grebe
	Ruffed Grouse		White-faced Ibis

Wetland/Marsh	Deciduous-dominated	Grassland	Lakes
	Sharp-shinned Hawk		Willet
	Song Sparrow		Wilson's Phalarope
	Swainson's Thrush		Wood Duck
	Tennessee Warbler		
	Veery		
	Warbling Vireo		
	Western Wood-pewee		
	White-breasted Nuthatch		
	White-throated Sparrow		
	Yellow Warbler		
	Yellow-bellied Sapsucker		
	Yellow-rumped Warbler		
	Yellow-throated Vireo		

There are several species that occupy the moist treed aspen and poplar forests in the parks (PR05, PR08). These ecosites can have abundant shrub cover and supports a diversity of avian families. These include forest specialists such as the downy woodpecker, black-billed cuckoo, northern flicker, eastern screech-owl, western wood-pewee, yellow-throated vireo, veery, and ovenbird. Species such as ruffed grouse, ruby-throated hummingbird, bald eagle, pileated woodpecker, and blue jays are also known to use forested sites. The endangered red-headed woodpecker utilizes mature deciduous forests, particularly green ash and maple stands. Both Hog Island and Maple Island would contain important habitat features for the red-headed woodpecker (The Cornell Lab of Ornithology, 2021).

Many of these forest species forage for insects in dead trees or leaf litter and require debris and snags for cover or nesting. Species associated with younger forests include the ruffed grouse, rose-breasted grosbeak, common yellow-throat, orange–crowned warbler, cedar waxwing, hermit thrush and tree swallow (Schieck, Nietfeld, & Stelfox, 1995). The Nashville warbler, chestnut-sided warbler, and rose-breasted grosbeak prefer secondary or mature growth deciduous forests.

Grassland species include the Sprague’s pipit, American kestrel, killdeer, sharp-tailed grouse, upland sandpiper, and several species of sparrows as well as other passerines. Sparrows such as the Savannah Sparrow, Clay-coloured Sparrow, Lark Sparrow, LeConte's Sparrow, and Vesper Sparrow all nest in grasses or shrubs. The grasslands are also used by two species of hawk the Swainson’s hawk and Ferruginous hawk as well as the golden eagle and short eared owl. In shorter grasses and less disturbed grazed areas, the endangered Chestnut collared longspur will nest and hunt for insects. The Loggerhead shrike is a unique songbird that utilizes fence posts and other perches around grassland to hunt insects, small mammals, and even other small birds. The loggerhead shrike relies on open areas like grasslands and shrubland. Additionally, certain species are sensitive to habitat patch size. These include Sprague's Pipit, Baird's Sparrow, grasshopper Sparrow, and Chestnut-collared Longspur (Davis, 2004).

Marsh habitats (PR09, PR10, and PR11) are utilized by species such as the American avocet, marsh wren, yellow rail, Wilson’s snipe, marbled godwit, sora, and great blue heron. The wetland ecosites in MMPP are roughly divided into seasonal marshes with little shrub cover and shrubby or tree swamps that may have water. Several species that use these wetlands prefer to be near lakes and grasslands for a variety of food sources and cover types. Gadwalls prefer well vegetated wetlands but will breed in prairie potholes and ponds. Many marsh species like the solitary sandpiper, Virginia rail and the American avocet will eat a mix of plant material, aquatic insects, snails and beetles depending on the time of year or even time of day. Passerines typically like the sedge wren and yellow-headed blackbird use these habitat types for nesting.

Notable visitors to the MMPP wetlands include white-faced Ibis, sandhill crane, and potentially the whopping crane. The white-faced ibis are at the far reaches of their range in Saskatchewan coming to nest in shallow marshes with tall emergent vegetation and forage in wetland and wet agricultural fields. The sandhill crane, a migrant visitor species, will use upland grassy sites to forage for seeds and grains. Sandhill cranes utilize MMPP as a key staging area during migration. Historically, whooping cranes have been sighted in MMPP. The park is on the eastern edge of their primary migration corridor (Johns, 1992).

The abundance of shallow lakes and waterbodies attracts breeding water species such as grebes, ducks, American coot, double-crested cormorant, terns, and gulls. Although the "water" habitat is not distinguished into different types of water bodies, the inhabitants each generally have their own preferences for emergent vegetation and the surrounding area. Horned grebes, redheads, and red-necked grebes build floating nests made from masses of aquatic plants anchored to emergent vegetation, whereas some species that are thought of having strong ties to water like ring-billed gull or common loon build their nests on solid ground. The population and occurrence of piscivorous birds would be subject to lake conditions. If fish populations decline due to low water levels or eutrophication, the predator species that rely upon them will also decline.

Many of the listed species utilize old or mature age class forest. Fire suppression and an absence of harvesting within the park have caused many stands to enter these age-classes (see Section 3.5.4). The use of these stands by bird species highlights the need for maintaining a variety of ecosites within these age classes while management treatments should also be used to renew stands to younger age classes. Special care to the management of the native grasslands should be emphasized, as they support many specialist bird species and those are sensitive to habitat patch sizes. Additionally, management decisions should consider the inclusion of other necessary habitat features (e.g. snags for cavity nesters).

Table 19 Distribution of breeding bird species in relation to ecosites and other areas in MMPP.

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Alder Flycatcher				X				
American Avocet	X	X	X					
American Bittern	X	X		X				
American Black Duck				X		X	X	
American Coot							X	X
American Crow								X
American Goldfinch				X	X	X		
American Kestrel				X				X
American Redstart					X	X		
American Robin					X	X		X
American White Pelican							X	
American Wigeon							X	
Baird's Sparrow				X				
Bald Eagle					X	X		
Baltimore Oriole					X	X		
Bank Swallow							X	X
Barn Swallow				X	X	X		X
Belted Kingfisher							X	
Black Tern	X							
Black-and-white Warbler					X	X		X
Black-billed Cuckoo					X	X		
Black-billed Magpie				X	X	X		X
Blackburnian Warbler					X	X		
Black-capped Chickadee					X	X		
Black-headed Grosbeak					X	X		

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Blue Jay					X	X		X
Blue-winged Teal	X						X	
Bobolink	X			X				
Brewer's Blackbird				X				
Broad-winged Hawk					X	X	X	
Brown Thrasher				X	X	X		
Brown-headed Cowbird				X				
Bufflehead							X	
California Gull							X	
Canada Goose				X			X	X
Canvasback							X	
Caspian Tern							X	
Cedar Waxwing					X	X		
Chestnut-collared Longspur				X				
Chestnut-sided Warbler					X	X		
Chimney Swift				X			X	X
Chipping Sparrow								
Clay-coloured Sparrow				X				
Cliff Swallow				X			X	X
Common Goldeneye							X	
Common Grackle				X				X
Common Loon							X	
Common Nighthawk				X	X	X		
Common Raven				X	X	X		X
Common Tern							X	
Common Yellowthroat				X				
Cooper's Hawk					X	X		X

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Dark-eyed Junco					X	X		
Dickcissel				X				
Double-crested Cormorant							X	
Downy Woodpecker					X	X		
Eared Grebe							X	
Eastern Bluebird				X				
Eastern Kingbird				X				
Eastern Phoebe					X	X		X
Eastern Screech-Owl					X	X		
Eastern Towhee				X	X	X		
Eastern Wood-pewee					X	X		
Eurasian Collared-Dove								X
European Starling								X
Ferruginous Hawk				X				
Forster's Tern	X						X	
Franklin's Gull							X	
Gadwall	X	X					X	
Golden Eagle				X				
Grasshopper Sparrow				X				
Gray Catbird				X				
Gray Partridge				X				
Great Blue Heron	X							
Great Crested Flycatcher			X		X	X		
Great Egret				X			X	
Great Horned Owl		X	X		X	X		
Green-winged Teal	X		X				X	
Hairy Woodpecker					X	X		

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Hooded Merganser	X						X	
Horned Grebe							X	
Horned Lark				X				
House Finch								X
House Sparrow								X
House Wren				X	X	X		
Indigo Bunting		X		X				
Killdeer				X				
Lark Bunting				X				
Lark Sparrow				X				
Lazuli Bunting				X	X	X		
Least Flycatcher					X	X		
LeConte's Sparrow				X				
Lesser Scaup	X			X			X	
Loggerhead Shrike				X				
Mallard							X	
Marbled Godwit	X							
Marsh Wren	X						X	
Merlin					X	X	X	
Mountain Bluebird				X				
Mourning Dove								X
Mourning Warbler				X	X	X		
Nashville Warbler					X	X		
Nelson's Sparrow	X	X	X	X				
Northern Flicker					X	X		
Northern Harrier	X	X		X			X	
Northern Pintail							X	

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Northern Rough-winged Swallow							X	
Northern Saw-whet Owl		X	X		X	X		
Northern Shoveler	X						X	
Northern Waterthrush	X	X	X		X	X		
Orange-crowned Warbler					X	X		
Orchard Oriole					X	X		
Osprey					X	X	X	
Ovenbird					X	X		
Philadelphia Vireo					X	X		
Pied-billed Grebe							X	
Pileated Woodpecker					X	X		
Pine Siskin					X	X		
Piping Plover				X			X	
Purple Finch					X	X		X
Purple Martin	X					X	X	X
Red Tailed Hawk				X	X	X		
Red-breasted Nuthatch					X	X		
Red-eyed Vireo					X	X		
Redhead							X	
Red-headed woodpecker			X		X	X		
Red-necked Grebe							X	
Red-winged Blackbird	X							
Ring-billed Gull							X	
Ring-necked Duck							X	
Ring-necked Pheasant				X				
Rock Dove								X
Rose-breasted Grosbeak		X			X	X		

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Ruby-throated Hummingbird					X	X		
Ruddy Duck	X						X	
Ruffed Grouse					X	X		
Sedge Wren		X	X	X				
Savannah Sparrow				X				
Say's Phoebe				X				
Sedge Wren	X			X				
Sharp-shinned Hawk					X	X		
Sharp-tailed Grouse				X				
Short-eared Owl				X				
Solitary Sandpiper		X	X				X	
Song Sparrow					X	X		
Sora	X	X	X				X	
Spotted Sandpiper							X	
Spotted Towhee				X				
Sprague's Pipit				X				
Swainson's Hawk				X				
Swainson's Thrush					X	X		
Swamp Sparrow	X	X						
Tennessee Warbler					X	X		
Tree Swallow	X	X	X			X	X	
Turkey Vulture				X	X	X		
Upland Sandpiper				X				
Veery					X	X		
Vesper Sparrow				X				
Virginia Rail	X	X	X					
Warbling Vireo					X	X		

	Non-Forested				Forested			
	Wet			Dry	Deciduous		Other	
Species	PR09	PR10	PR11	PR12	PR05	PR08	Water	Developed
Western Grebe							X	
Western Kingbird				X				
Western Meadowlark				X				
Western Wood-pewee					X	X		
White-breasted Nuthatch					X	X		
White-faced Ibis	X						X	
White-throated Sparrow					X	X		X
Wild Turkey				X	X	X		
Willet							X	
Willow Flycatcher	X	X		X				
Wilson's Phalarope							X	
Wilson's Snipe	X							
Wood Duck							X	
Yellow Rail	X			X				
Yellow Warbler					X	X		
Yellow-bellied Sapsucker					X	X		
Yellow-breasted Chat				X				
Yellow-headed Blackbird	X	X	X					
Yellow-rumped Warbler					X	X		
Yellow-throated Vireo					X	X		

3.6.1.2 UNGULATES

The ungulate population within the region of MMPP is diverse. Five species of ungulates can be found within or near the park including elk, moose, mule deer, white-tailed deer, and pronghorn antelope. Descriptions of species, habitat, and ecosite use within MMPP for elk, moose, mule deer, white-tailed deer and pronghorn antelope are found below. Historically, plains bison (*Bos bison bison*), a native bovid, were also found within the park. Bison have been extirpated from the park area since approximately 1882 (Baird, 2021).

It is recommended that detailed, current population assessments for the ungulates of MMPP is needed to make appropriate management decisions. As mentioned in the MMPP Annual Park Planning document (Government of Saskatchewan, 2020) a wildlife-ecosystems or back country specialist within the park would be able to assist in monitoring and addressing wildlife and ecosystem concerns.

3.6.1.2.1 Elk

Elk (*Cervus canadensis*) are an abundant ungulate within MMPP. The range of elk within the province of Saskatchewan extends throughout the southern fringe of the boreal forest, North of Prince Albert, as well as within Cypress Hills, Duck Mountain, and Moose Mountain Provincial Parks. However, exact distribution is largely unknown. Habitat preferences of elk vary but they prefer locations adjacent to protected areas and display high site and range fidelity. Summer habitats include wooded areas and hill sides while open grasslands are preferred for winter habitats. Habitat preferences of elk as determined by Patterson (2014), Edge et al. (1988), McLaughlan et al. (2010), and Nyberg (no date) have interpreted elk to relate to ecosites available within MMPP and are presented in ***Table 20.***

__Table 20__ Elk habitat preferences based on ecosites available within MMPP.

Ecosite	Description in MMPP	Primary Foraging	Secondary foraging	Thermal
Upland Grassland				
PR 12	Upland grassland (moist to mesic)		X	
Hardwood types				
PR 05	Trembling aspen with beaked hazelnut	X		X
PR 08	Balsam poplar, trembling aspen and green ash		X	X
Shrubby, herbaceous, graminoid bogs and fens			X	
PR 09	Graminoid fen		X	
PR 10	Shrubby swamp		X	
PR 11	Treed swamp			
Other types				
burns	recently burned areas		X >10 yrs	
logged	recently harvested areas		X >1-2 yrs	X >2-10 yrs
cleared	cleared for agriculture, usually seeded to tame grass			
developed	developed areas such as roads, subdivisions, and campgrounds			
water	lakes and streams	X		

Elk are both browsers and grazers. Their diverse diet is comprised of woody vegetation including shrubs and tree saplings as well as grasses and sedges. Within woodland habitats they prefer areas with moderate amounts of mixed-wood and deciduous forests including shrub, herbaceous vegetation, and young tree shoots. Population estimates for MMPP in 2016-2017 determined that there were approximately 1,135 individuals with a density of 0.66 animals per kilometre squared. Relative abundance for elk is deemed high for the MMPP area (Government of Saskatchewan, 2017). The elk populations of MMPP are a contentious issue as the elk have been known to

depredate adjacent farmlands (McLaughlan, Wright, & Jiricka, 2010; Government of Saskatchewan, 2017; Patterson, 2014).

Elk are sensitive to anthropogenic disturbances. Avoidances are noted near high road density areas and are observed up to 200-500 metres away (McCorquodale, 2013). Threats to the elk populations include habitat loss and degradation, disturbances, disease, and hunting pressure. Habitat loss and degradation are primarily through agricultural expansion, however; roads, corridors, grazing, and energy/mining exploration also impact elk habitat and therefore population numbers. Disturbances such as forest harvesting, fire, and fire suppression threat elk populations. Hunting and the spread of Chronic Wasting Disease further contribute to population threats.

3.6.1.2.2 Moose

Moose (*Alces americanus*) are Saskatchewan's largest ungulate. Range extends throughout the boreal forest and southern parts of the province. Historically, moose were absent from the mixed-grass ecoregion but have since expanded their range into this area while adapting to the agricultural presence. Preferred habitats are woodlands dominated by spruce, pine, or aspen, forest edges, and agricultural areas such as cropping fields. Important moose habitat includes suitable foraging and diverse thermal cover. Moose require adequate thermal cover for protection from both cold and hot weather, with hot weather being more limiting than cold. Summer thermal habitats include wet sites which facilitate cooling while winter thermal requirements include coniferous cover to limit radiative heat loss (Timmerman & McNicol, 1988; McLaughlan, Wright, & Jiricka, 2010). Habitat preferences of moose as determined by Timmerman & McNicol (1988) have interpreted to relate to ecosites available within MMPP and are presented in ***Table 21***.

Ideal forage habitats are early successional forests up to 20 years old. Moose are generalist herbivore with different summer and winter forage preferences. Winter forage includes twigs from a variety of deciduous shrubs, conifers, and deciduous trees. Summer forage includes leaf material from a variety of deciduous shrubs and trees, aquatic macrophytes, and herbs/forbs (Timmerman & McNicol, Moose Habitat Needs, 1988; Government of Saskatchewan, 2015; Government of Saskatchewan, 2019).

Moose populations determined to be low as per the Moose Mountain Provincial Park Annual Park Planning document (Government of Saskatchewan, 2020). Population estimates for Moose Mountain Provincial Park conducted in 2011-2012 determined there to be approximately 1,202 individuals with a density of 0.70 animals per kilometre squared (Government of Saskatchewan, 2017).

Table 21 *Moose habitat preferences based on ecosites available within MMPP.*

Ecosite	Description in MMPP	Primary Foraging	Secondary foraging	Thermal
Upland Grassland				
PR 12	Upland grassland (moist to mesic)		X	
Hardwood types				
PR 05	Trembling aspen with beaked hazelnut	X<20 yrs		
PR 08	Balsam poplar, trembling aspen and green ash	X		X
Shrubby, herbaceous, graminoid bogs and fens				
PR 09	Graminoid fen	X		
PR 10	Shrubby swamp	X	X	X[1]
PR 11	Treed swamp		X	X[1]
Other types				
burns	recently burned areas	X		
logged	recently harvested areas	X		
cleared	cleared for agriculture, usually seeded to tame grass			
developed	developed areas such as roads, subdivisions, and campgrounds		X	
water	lakes and streams	X	X	X[1]

[1] indicates summer thermal cover

3.6.1.2.3 White-tailed deer

White-tailed deer (*Odocoileus virginianus*) are Saskatchewan's most abundant and widely distributed ungulate. The deer are a sought-after game species, with "trophy" animals being common. Range extends throughout Saskatchewan from the southern parts of the province into the northern boreal forest. Preferred habitats are open woodlands, farmlands, brushy areas, and forest edges bordering grasslands or fields. Important white-tailed deer habitat includes suitable foraging and thermal cover. They require adequate thermal cover for protection during storms, cold weather, and deep snow. The Moose Mountain area is a key wintering habitat for the white-tailed deer in Saskatchewan (Government of Saskatchewan, 2018). Habitat preferences of white-tailed deer as determined by Rothley, K. D. (2001), McLaughlan *et al*. (2010), and Hiller *et al.* (2009) have interpreted to relate to ecosites available within MMPP and are presented in ***Table 22***.

White-tailed deer are both browsers and grazers, selecting the most nutritious plant species available. Their diverse diet consists of woody vegetation and forbs, but has adapted to utilize agricultural crops, particularly alfalfa (Government of Saskatchewan, 2018).

Population estimates for MMPP are not available, but it was determined that the general parkland population is declining or stable since 2016 (Government of Saskatchewan, 2017). The 2008-2009 population for the adjacent Wildlife Management Zone (WMZ) 34 was estimated to be 1,929 (± 19.4 percent) or a density of 1.84 individuals per kilometre squared.

White tailed deer are sensitive to weather events. Threats to the white-tailed deer populations include habitat loss and degradation, severe winter weather, late spring green up, disease, predators, and hunting pressure. The spread of Chronic Wasting Disease further contributes to population threats (Government of Saskatchewan, 2017).

Table 22 *White-tailed deer habitat preferences based on ecosites available within MMPP.*

Ecosite	Description in MMPP	Primary Foraging	Secondary foraging	Thermal
Upland Grassland				
PR 12	Upland grassland (moist to mesic)		X	
Hardwood types				
PR 05	Trembling aspen with beaked hazelnut	X <90 yrs	X	X
PR 08	Balsam poplar, trembling aspen and green ash	X <90 yrs	X	X
Shrubby, herbaceous, graminoid bogs and fens				
PR 09	Graminoid fen		X	
PR 10	Shrubby swamp		X	
PR 11	Treed swamp	X		X
Other types				
burns	recently burned areas	X		
logged	recently harvested areas	X		
cleared	cleared for agriculture, usually seeded to tame grass		X	
developed	developed areas such as roads, subdivisions, and campgrounds		X	
water	lakes and streams			

3.6.1.2.4 Mule deer

Mule deer (*Odocoileus hemionus*) are a sought-after game species and are primarily found in the prairie and parklands of Saskatchewan. Their range extends to the northern forest fringe of the Boreal Forest and west from near Weyburn but there is potential for them to occur in MMPP. Preferred habitats are rolling hills and open terrain, mixed-forest edges, and foothills. Important mule deer habitat includes suitable foraging and thermal

cover. They require adequate thermal cover for protection during storms, cold weather, and deep snow (Government of Saskatchewan, 2017). Many habitat requirements of mule deer are shared with white-tailed deer. Although mule deer occupy larger home ranges and tend to collect in larger and more frequent social groups (Cullingham, et al., 2011). Habitat preferences of mule deer as determined by Loft *et al.* (1991), Collins (1981), and McLaughlan *et al*. (2010) have interpreted to relate to ecosites available within MMPP and are presented ***Table 23***.

Mule deer are primarily browsers of woody vegetation, however; they have adapted to utilize agricultural crops (Government of Saskatchewan, 2018).

Population estimates for MMPP are not available, but it was determined that the general population is increasing in Saskatchewan (Government of Saskatchewan, 2017).

Similar to white-tailed deer, mule deer are sensitive to weather events. Threats to the mule deer populations include habitat loss and degradation, severe winter weather, deep snow, late spring green up, disease, predators, and hunting pressure. The spread of Chronic Wasting Disease further contributes to population threats (Government of Saskatchewan, 2017).

Table 23 *Mule deer habitat preferences based on ecosites available within MMPP.*

Ecosite	Description in MMPP	Primary Foraging	Secondary foraging	Thermal
Upland Grassland				
PR12	Upland grassland (moist to mesic)	X		
Hardwood types				
PR 05	Trembling aspen with beaked hazelnut	X		X
PR 08	Balsam poplar, trembling aspen and green ash	X		X
Shrubby, herbaceous, graminoid bogs and fens				
PR 09	Graminoid fen	X		
PR 10	Shrubby swamp			
PR11	Treed swamp		X	
Other types				
burns	recently burned areas			
logged	recently harvested areas			
cleared	cleared for agriculture, usually seeded to tame grass		X	
developed	developed areas such as roads, subdivisions, and campgrounds	X		
water	lakes and streams	X		

3.6.1.3 FURBEARER SPECIES

A total of 19 species of mammals listed as furbearers in Saskatchewan (Koback, 2021) are found within or in the vicinity of MMPP and are listed in ***Table 24***. The park falls within WMZ 33 but closely borders zone 34 within the northeastern area of the park (***Figure 45***). Trapping within the park boundaries is by written permission of the Park Manager only. However, private land adjacent to the park is available for fur harvesting with right-of-access permission from the landowner. The provincial government maintains harvest records of furbearers along with the area in which they were harvested. These documents provide a rough record of the relative abundance of furbearing animals in the adjacent areas around the park. Summary of fur harvest data between seasons 1999 – 2020 for WMZ 33 are presented in ***Table 25***.

__Table 24__ Furbearers of Moose Mountain Provincial Park (Koback, 2021; Harrison, 2020).

[1] Listed under SARA or COSEWIC [2] Extirpated from area but within historical range

SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME	COMMON NAME
Lepus americanus	Snowshoe Hare	*Canis latrans*	Coyote
Lepus townsendii	White-tailed Jack Rabbit	*Canis lupus occidentalis*[2]	Grey Wolf
Sylvilagus nuttallii	Nuttall's Cottontail	*Vulpes vulpes*	Red Fox
Vison vison	Mink	*Vulpes velox*[1 2]	Swift Fox
Mustela erminea	Short-tailed Weasel	*Mephitis mephitis*	Striped Skunk
Mustela frenata longicauda	Long-tailed Weasel	*Felis concolor*	Cougar
Mustela nivalis	Least Weasel	*Lynx rufus*	Bobcat
Taxidea taxus taxus[1]	Badger	*Castor canadensis*	American Beaver
Procyon lotor	Raccoon	*Ondatra zibethicus*	Muskrat
Ursa americanus	Black Bear	*Tamiasciurus hudsonius*	Red Squirrel

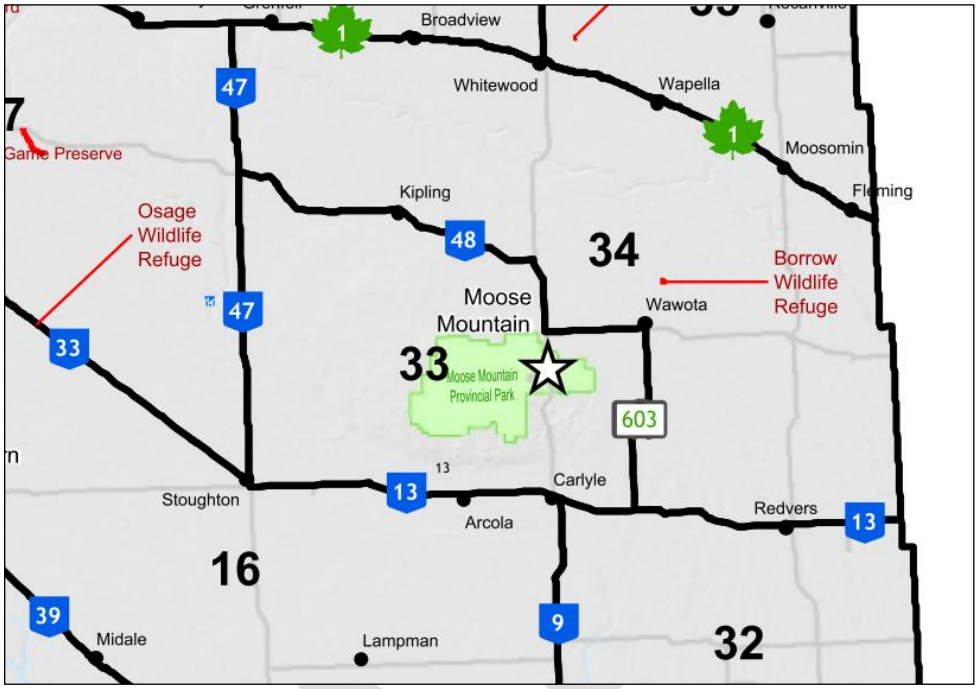

Figure 45 Wildlife Management Zone containing MMPP.

A total of 14 different species have been trapped within WMZ 33. Most commonly trapped species for the last 22 trapping seasons was coyote totaling 8,919 animals for approximately 35 percent of the total harvest. High coyote trapping rates may be due to an open season on the species in the southern fur conservation area as well as that coyote are permitted to be hunted without a fur license (Government of Saskatchewan, 2021). Coyote pelt values have been increasing which can incentivize trappers to target coyote (Koback, 2021). The second most trapped species was the American beaver for a total of 7,871 animals or 31 percent of the total harvest. Muskrat is the third most trapped furbearer species in the zone with a total of 6,787 animals being harvested or approximately 27 percent of the total. Other harvested species included fox (all colour morphs) and raccoon at four and two percent of the total harvest. All other together make up approximately one percent of the total harvest. Incidental or rarely trapped species in MMPP include one bear in 1999-2000, four lynxes in 2006-2007, one marten in 2008-2009, one skunk in 2015-2016, and two wolves in 2001-2002.

Trapping of beavers within the park is for management purposes as well as a fur harvest. Recorded trapping for beavers between the years 1999 and 2020 are presented in ***Figure 46***. Historically beavers were trapped and hunted for their fur. This leads to significant population declines in the late 1800s and early 1900s. In 1923 the provincial government reintroduced beavers to the park (Stelfox, 1980). Today, the beaver population within the park creates management challenges as the animals are believed to cause water level fluctuations due to their dams. It is estimated that the beaver population is higher than it would naturally be due to a lack of predators, lack of natural disturbances (i.e., fire), and most recently, a decline in trapping efforts when compared to historical trapping efforts (Godwin, Wittrock, & Thorpe, 2013).

A Beaver Management Program in Provincial Parks was created through funds from the provincial government to provide an incentive for local trappers to trap beaver within the park. Cooperative efforts between the park and Rural Municipality of Moose Mountain No.63 maintained the program through 2015-2016 with the RM overseeing

the harvest reporting and trapping compensation. Trapping occurred during the legal trapping season of October 1st through May 31st. Trapping outside of the legal trapping season required a special permit (i.e., *nuisance wildlife control* permit) from the Ministry of Environment. In this program, MMPP was allocated to remove 1100 beavers, the highest number of all six parks. (Saskatchewan Association of Rural Municipalities, 2015).

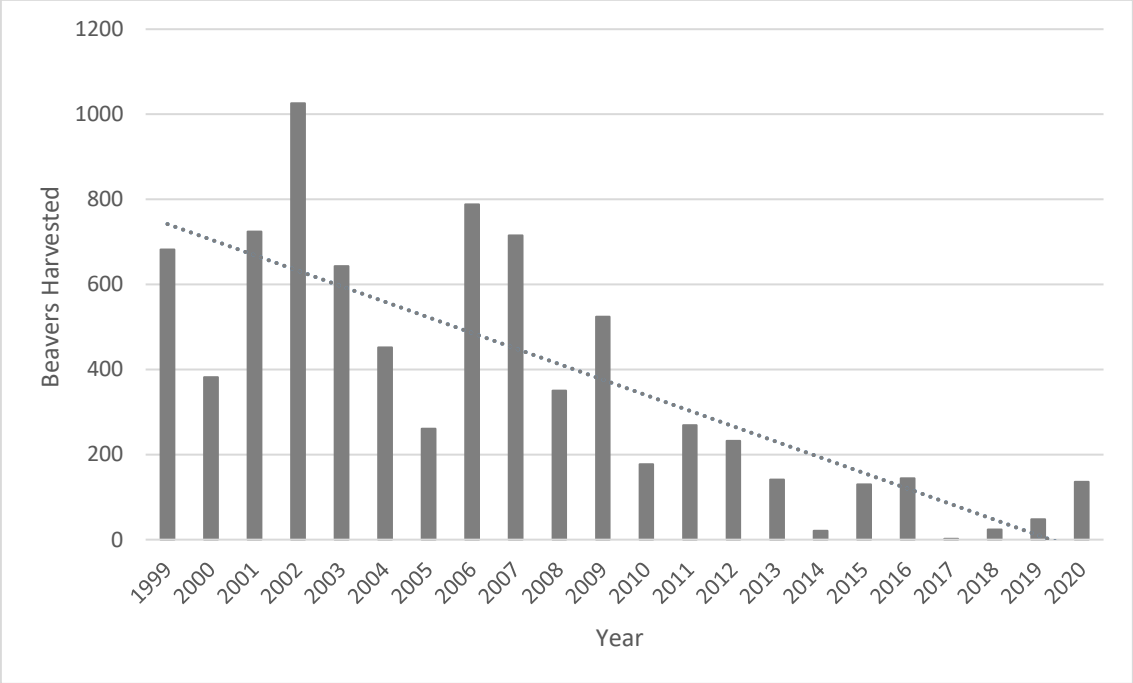

Figure 46 *Beaver harvest within Fur Management Zone WMZ 33 for the period from 1999 to 2021, including a linear trendline (Koback, 2021).*

The use of fur-harvest data to determine or estimate population abundances should be interpreted with caution. Fur-harvest numbers depend not only on animal abundance but on trapping effort and market value.

Habitat and other important information regarding the furbearers within WMZ 33 including MMPP are presented in ***Table 26***.

Table 25 Number of furs harvested by species within Fur Management Zone WMZ 33 for the period from 1999 to 2021 (Koback, 2021).

	Fur Species														
Fur Season	**Badger**	**Bear**	**Beaver**	**Coyote**	**Fox**	**Lynx**	**Marten**	**Mink**	**Muskrat**	**Raccoon**	**Skunk**	**Squirrel**	**Weasel**	**Wolf**	**Totals**
1999-2000	-	1	682	150	43	-	-	7	2208	17	-	6	-	-	3114
2000-2001	3	-	382	440	46	-	-	2	330	50	-	-	3	-	1256
2001-2002	5	-	724	586	68	-	-	5	1027	30	-	1	3	2	2451
2002-2003	8	-	1026	816	151	-	-	31	453	39	-	-	10	-	2534
2003-2004	9	-	643	1276	217	-	-	22	73	101	-	1	3	-	2345
2004-2005	4	-	452	657	98	-	-	4	7	29	-	-	-	-	1251
2005-2006	4	-	261	285	50	-	-	7	90	15	-	-	1	-	713
2006-2007	14	-	788	554	77	4	-	8	178	85	-	-	4	-	1712
2007-2008	7	-	715	1007	80	-	-	3	169	51	-	-	4	-	2036
2008-2009	4	-	350	287	9	-	1	-	22	31	-	-	1	-	705
2009-2010	-	-	524	177	11	-	-	-	44	1	-	-	-	-	757
2010-2011	1	-	177	171	3	-	-	4	519	20	-	-	-	-	895
2011-2012	1	-	269	251	14	-	-	-	898	33	-	-	4	-	1470
2012-2013	5	-	232	268	22	-	-	4	427	1	-	-	-	-	959
2013-2014	-	-	141	323	27	-	-	1	80	23	-	-	2	-	597
2014-2015	1	-	21	304	20	-	-	7	99	3	-	-	3	-	458
2015-2016	2	-	130	154	16	-	-	5	124	-	1	1	3	-	436
2016-2017	-	-	144	321	16	-	-	-	37	-	-	-	-	-	518
2017-2018	-	-	2	241	32	-	-	12	-	3	-	-	-	-	290
2018-2019	1	-	24	208	34	-	-	2	-	-	-	-	-	-	269
2019-2020	1	-	48	254	33	-	-	-	-	39	-	-	2	-	377
2020-2021	-	-	136	189	22	-	-	-	2	1	-	-	-	-	350
Total	70	1	7871	8919	1089	4	1	124	6787	572	1	9	43	2	25493
Average per year	4	1	358	405	50	4	1	8	357	30	1	2	3	2	1159
S.D.	4	-	295	299	51	-	-	8	537	27	-	3	2	-	851

Table 26 Habitat information for furbearers occurring within MMPP or the vicinity of the park (Whitaker, 1996; Koback, 2021).

Species	Prime Habitat	Notes
American Beaver	Streams, rivers, marshes, lakes, and ponds near aspen stands provide the best habitat.	Aspen dominated areas are favoured. Aspens, willow, and birch are preferred food sources.
Muskrat	Marshes, lake edges, or streams with water depths ranging from 1 to 2 metres	Emergent vegetation is the main food source.
Red Squirrel	Prime habitat is pine or spruce dominated forest but will live in deciduous forests.	Coniferous seed are a preferred food source red squirrels, but will also eat mushrooms, nuts, berries, as well as birds and eggs.
Snowshoe Hare	Forested areas with a dense understory for cover and herbaceous vegetation for forage.	Cover can be young trees or tall shrubs which provide protection from predators and a source of food.
White-tailed Jack Rabbit	Prefers open habitats such as grassland, grazed lands, agricultural areas, or barren lands.	Primary forage is grass, clover, and vegetation. Nests are built on the surface ground.
Nuttall's Cottontail	Wooded, rocky or brushy areas with sagebrush present.	Cypress Hills falls within the northern tip of the range. Diet is comprised of sagebrush, grasses, and juniper berries.
Mink	Areas near streams, rivers, marshes, lakes, and ponds provide the best habitat.	Diverse prey includes muskrat, rabbits, mice, amphibians, birds, chipmunks, snakes, and fish.
Marten	Old growth coniferous, mixedwood areas, and riparian areas.	Small rodents, grouse, hare, as well as bird eggs, amphibians, and berries make up the diet of this species.
Short-tailed Weasel	Variable habitats including open forests, forest edges, brushy areas, grasslands, wetlands, and farmlands.	Diet is predominately small mammals such as voles and mice but will also eat young rabbits, frogs, snakes, shrews, insects, birds, and eggs.
Long-tailed Weasel	Variable prairie habitats including grasslands, parklands, open woodlands, and farmland preferably near water.	Diet is predominately small mammals such as voles and mice but will also eat rabbits, chipmunks, shrews, insects, birds, and eggs.
Least Weasel	Open habitats such as grassy and brushy fields, marshes, meadows, and floodplains. Utilizes abandons dens of other mammals such as mice, gopher, and ground squirrel.	Diet is predominately small mammals such as voles and mice but will also eat shrews, insects, birds, and eggs.
Badger	Open plains and prairies, farmlands, and occasionally edges of woodlands	Are a species of concern in Canada and listed at “special concern” under both SARA and COSEWIC

American Black Bear	Heavily wooded areas and dense bushland, preferably mixedwood.	Most abundant areas with low human presence, common where anthropogenic food sources are available.
Coyote	Abundant within plains, prairies, and open or semi-wooded areas. Require denning sites.	The coyote benefits from increased small mammal and ungulate populations associated with logging as well as the extirpation of larger predators.
Grey Wolf	The forested areas that create the most suitable habitat for the large ungulates are the prime habitats for the wolf.	Prey is typically large ungulates but will include smaller prey when available. As moose population expands into southern Saskatchewan wolves have been sighted as farther south.
Red Fox	Forested areas or near forested areas with available denning sites.	Logging and fires create the abundance of small mammals that foxes rely on. The fox is an opportunistic, generalist carnivore taking a wide variety of prey including insects, birds, and berries.
Raccoon	Habitat generalist however, prime habitats include deciduous forests near wet areas, floodplain areas, and farmlands. Prairie habitats include wooded and wetland areas.	Generalist with requirements for food, water, and a protected area for denning being critical.
Striped Skunk	Habitats include open areas of mixed forest and grasslands. Have become accustomed to living in proximity to humans.	More open areas are favoured as they provide the best foraging opportunities. Have an omnivorous diet with a wide variety of foods. Typically utilize abandoned denning sites of other mammals.
Mountain Lion	Forest fragments of foothills, mountains, and interior plateaus with abundant cover.	Found in areas with abundant prey (white-tailed deer and mule deer) and large areas of wilderness. Cover is utilized for stalking prey, establishing den sites, and camouflage.
Bobcat	Southern fragmented forest (deciduous or mixed), farmlands, shrubby areas, or arid lands	Hare and rabbit make up majority of diet but will include other smaller mammals, reptiles, and birds.
Lynx	Old growth boreal forests with a dense understory	Hare and rabbit make up majority of diet but will include other smaller mammals, reptiles, and birds. Populations typically increase after fire or logging in response to increased prey populations.

3.6.2 ANIMAL SPECIES-AT-RISK

Complete lists of birds, mammals, and reptiles/amphibians are given in Appendices 2, 3, and 4. Federally listed animal species-at-risk (i.e., species listed within the *Species at Risk Act* (SARA) or under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) that occur or have potential to occur within MMPP are given in ***Table 27***. Habitat requirements for these species are also given. Known occurrences for rare animal species are presented in ***Figure 47***.

A total of 19 bird species that are listed by SARA or COSEWIC have potential to be found or are confirmed to be breeding within MMPP. The burrowing owl (*Athene cunicularia*), chestnut-collared longspur (*Calcarius ornatus*), piping plover (*Charadrius melodus*), and red-headed woodpecker (*Melanerpes erythrocephalus*) are all considered endangered by COSEWIC, however not all have received the same SARA designation. Additionally, eight bird species are listed by COSEWIC as threatened, and more detailed information about these have been added to the Table 27. Migrants through MMPP include many of the same species that have breeding ranges in the park. Of the 19 bird species that are listed, 15 of them also have migrant populations that move through the park.

The Moose Mountain area provides habitat for three amphibians and one reptile that are considered at-risk. The northern leopard frog (*Lithobates pipiens*), Great Plains Toad (*Anaxyrus cognatus*) and the barred tiger salamander (*Ambystoma mavortium*). All three species are listed as "special concern" by SARA and COSEWIC. The snapping turtle (*Chelydra serpentine*) is listed as "special concern" by COSEWIC and is currently listed as "under consideration" for SARA.

Two mammal species of note are the little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentronalis*). The American badger may be found along the forested edges of the park and is listed as "special concern" under the SARA and the COSEWIC. Both species are listed as endangered by COSEWIC and SARA partly because of the threat of white nose syndrome. In addition, the swift fox (*Vulpes velox*) was reintroduced to southern Saskatchewan and remains threatened across most of its historic range. They prefer short or mixed grass prairie commonly found in southern Saskatchewan and are most at risk from habitat loss and human encounters.

Table 27 *Federally listed animal species-at-risk that occur within MMPP or have the potential to occur in MMPP.*

Federal status according to COSEWIC and SARA from the Government of Canada (2021), and provincial status according to Saskatchewan Conservation Data Center (2021) sub-national ranking (S1=extremely rare; S2=rare; S3=rare-uncommon, S4=common; S5=very common; for migratory species, rating with modifier B applies to the breeding population in SK, modifier N applies to the non-breeding population, and modifier M applies to the transient population).

Common Name	Scientific Name	COSEWIC	SARA	S-Rank	Habitat	Notes
Amphibians						
Great Plains Toad	*Anaxyrus cognatus*	Special Concern	Special Concern	S3	Seasonal wetlands with some emergent vegetation on margins.	Patchy distribution in Canada, leaves the populations vulnerable to habitat loss, degradation and fragmentation. Primarily from cultivation and oil and gas development.
Northern Leopard Frog	*Lithobates pipiens*	Special Concern	Special Concern	S3	Permanent or semi-permanent wetlands 1.5-2.0 m deep, neutral pH and lacking fish, fresh meadow, shallow marsh or un-mowed pasture, streams, creeks, and rivers.	Adversely affected by habitat conversion such as wetland drainage, eutrophication, game fish production, pesticide contamination, habitat fragmentation, collection, and susceptibility to disease.
Western Tiger Salamander	*Ambystoma mavortium*	Special Concern	Special Concern	S4	Grasslands, parkland, and semi-deserts with sandy or friable (crumbly) soils surrounding semi-permanent to permanent water bodies lacking predatory fish.	Threats include habitat loss and fragmentation, fish stocking, and emerging diseases, migration routes disrupted, roadkill mortality.

Reptiles						
Snapping Turtle	*Chelydra serpentina*	Special Concern	Under Consideration	S3	Prefers slow-moving water in ponds or slow streams. Ideally with mud bottom, dense aquatic vegetation and areas on the banks with debris to bask and nest.	Although known to inhabit urbanized ponds, pollution can impact reproductive success. They continue to be threatened by habitat conversion to agriculture and housing development.
Mammals						
American Badger	*Taxidea taxus taxus*	Special Concern	Special Concern	S3	Open plains and prairies, farmlands, and occasionally edges of woodlands.	Population threats from road-kill and habitat loss and degradation resulting from housing development, forest in-growth and encroachment, and agriculture.
Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	S4B, S4N	Hibernacula for over wintering (i.e. caves, buildings or abandoned mines), summer and breeding requiring trees, rock crevices, buildings, bat houses.	Emergency assessment and designation due to White-nose Syndrome (fungal disease) within Canada that has caused a 94% decline in eastern myotis and other bat species populations.
Northern Myotis	*Myotis septentronalis*	Endangered	Endangered	S3	Cold and humid hibernacula for overwintering and in the summer, buildings, or large trees for females to form colonies. Require space to forage over waterways and forest edges.	Threatened by white nose syndrome as well as extermination because of noise or fear of disease. The impact of chemical contamination and insecticides on prey abundance is unknown.

Plains Grizzly Bear	*Ursus arctos*	Special Concern	Special Concern	SX	Little is known about the habitat used by the Plains Grizzly bear. Likely used river valleys and ravines for foraging and denning. Home ranges would have been relative to the availability and predictability of food resources.	Officially the species was listed as extirpated in 1991 as a result of human interaction and habitat loss and re-evaluated as a single western population in 2021. Recovering the prairie population was deemed not currently feasible due to a combination of lack of suitable habitat and likely human interaction. Bison are considered to have been an important food source that no longer exists.
Swift fox	*Vulpes velox*	Threatened	Threatened	S3	Short or mixed grass prairie and arid sites on level terrain or gently rolling hills.	Extirpated from Canada in 1930s, re-introduced to Saskatchewan. Historic range extends into MMPP. Current threats include habitat loss from agriculture, development, roads, predation from coyotes and golden eagles, trapping, vehicle collisions, poisoning.
Birds						
Baird's Sparrow	*Ammodramus bairdii*	Special Concern	Special Concern	S4B	Native mixed-grass and fescue grasslands with sparse shrub cover	Breeding probable within MMPP. Population threats from native prairie habitat loss due to agriculture.

Bank Swallow	*Riparia riparia*	Threatened	Threatened	S4B, S5M	Areas with vertical banks including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stockpiles of soil, foraging in grasslands and open areas.	Breeding population within MMPP. Threats include loss of breeding and foraging habitat, destruction of nests during aggregate excavation, collision with vehicles, widespread pesticide use affecting prey abundance, and reduced survival or reproductive potential due to impacts of climate change.
Barn Swallow	*Hirundo rustica*	Special Concern	Threatened	S4B, S4M	Open forests, shrublands, and grasslands, use of urban, agricultural, and artificial structures (e.g., bridges, buildings).	Breeding population within MMPP. The causes of the recent population decline are not well understood but may be due to declines in insect populations, foraging habitat, or artificial nesting sites.
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	S4B, S4M	Typically found in tall-grass prairie, restored sites, no till crops, wet prairie areas. May also use forage crops but generally not as abundant in short-grass prairie.	Breeding population within MMPP. Threats include incidental mortality from agricultural operations, habitat loss and fragmentation, pesticide exposure and bird control at wintering roosts.
Burrowing Owl	*Athene cunicularia*	Endangered	Endangered	S2B, S2M	Open sparse grasslands with available burrows created by associated species (American badgers, coyotes, foxes, and ground squirrels).	Breeding population potential within MMPP. Population declines due to loss of grassland habitat and suitable burrows compounded by a reduction in prey populations, and concurrent increases in predation, vehicle collisions, expansion of renewable energy, and severe weather events.

Chestnut-collared Longspur	*Calcarius ornatus*	Endangered	Threatened	S3B	Native short- or mixed-grass prairie with an area of at least 40 hectares is generally required for breeding.	Breeding population probable within MMPP. Primary threat is degradation and fragmentation of native grasslands as well as loss of habitat in the core wintering region of northern Mexico.
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	S2B, S2M	Historically lived in hollow trees but now common in house chimneys. Frequently visit water bodies to feed on insects	Breeding population probable within MMPP. Logging, demolition of old buildings and fire regulations (fire screens, mesh to keep animals out of chimneys) has decreased the number of suitable roosting sites. They also face the same threats in their wintering areas in South America).
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened	S4B, S4M	Wide range of open areas with limited vegetation including sparse or harvested forests, scrub, grasslands, rocky outcrops or barrens.	Breeding population probable within MMPP. Reasons for declines are not well known but include reduction in populations of aerial insects due to agricultural and other pesticides, as well as and changes in weather events.
Eastern Wood-pewee	*Contopus virens*	Special Concern	Special Concern	S4B, S4M	Clearings and edges of deciduous and mixed-wood forests that are intermediate age to mature with little understory vegetation.	Breeding population within MMPP. Threatened by changes to prey availability due to pesticide use and habitat loss especially around urban development.

Ferruginous Hawk	*Buteo regalis*	Special Concern	Threatened	S3B	Native grasslands away from urbanization and agriculture.	Breeding population within MMPP. Sensitive to habitat loss and are a grassland species specialist. Fire suppression in native grasslands has allowed for trembling aspen to contract their historical range.
Horned Grebe	*Podiceps auritus*	Special Concern	Special Concern	S5B, S5M	Fresh water or brackish small semi-permanent or permanent ponds, marshes, and shallow bays on lake borders with emergent vegetation	Breeding population potential within MMPP. Threats include degradation of wetland breeding habitat, droughts, increasing populations of nest predators (mostly in the Prairies), and oil spills on their wintering grounds in the Pacific and Atlantic Oceans.
Lark Bunting	*Calamospiza melanocorys*	Threatened	Threatened	S2B, S2M	Grasslands (pastures, mixed-grasses prairie, shortgrass) with a combination of vegetation and bare ground for nesting and hiding from predators.	Breeding population potential within MMPP. Habitat loss and fragmentation from conversion of land to agriculture and urban development is the primary threat to Lark buntings along with the added pressure pesticide use has put on insect availability. They are also known to be sensitive to drought as decreases eggs production and chick survival.
Loggerhead Shrike	*Lanius ludovicianus*	Threatened	Threatened	S2B, S2M	Grassy areas with some shrubs or trees like prairie land or pastures.	Known breeding range within MMPP. Population declines have been attributed to the loss of grassland used in the breeding season as well as road mortality and pesticide use.

Piping plover	*Charadrius melodus*	Endangered	Endangered	S3B, S3M	Nesting just above high-water mark on gravelly shores of lakes or ponds.	Known breeding range within MMPP. Major threats from predation, human disturbance, and declines in habitat extent and quality.
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Endangered	Threatened	S1B, S1M	Open deciduous or deciduous dominant mixed-wood forests but also found in grasslands, riparian, and urban areas with standing dead trees.	Known breeding range within MMPP. Population declines due to reduced quality of breeding habitat, particularly the loss of standing dead trees needed for nesting, fly-catching, and food caching. Other threats include increased competition for nest sites from native and non-native bird species.
Short-eared Owl	*Asio flammeus*	Threatened	Special Concern	S3B, S2N, S3M	Utilizes a variety of open habitats including grasslands, pastures, and occasionally agricultural fields.	Breeding population probable within MMPP. Major threats include habitat loss and degradation on its breeding grounds in southern Canada and poisoning due to pesticide use.
Sprague's Pipit	*Anthus spragueii*	Threatened	Threatened	S3B	Habitat requirements include large tracts of intact native grasslands.	Breeding population within MMPP. Population declines due to habitat loss, degradation (e.g., grazing, haying, agriculture), and/or fragmentation.
Yellow Rail	*Coturnicops noveboracensis*	Special Concern	Special Concern	S3B, S3M	Shallow marshes dominated by sedges and grasses where the ground stays damp.	Breeding population potential within MMPP. Encroachment on wetlands by human development and agriculture has reduced the Yellow Rail wintering range and breeding range.

Western Grebe	*Aechmophorus occidentalis*	Special Concern	Special Concern	S3B, S3M	Lakes and ponds with emergent vegetation, stable water levels and prey fish	Breeding population potential within MMPP. Colonization during breeding increases susceptibility to threats such as oil spills, water level fluctuations, and fisheries bycatch, as well as declines in prey availability.

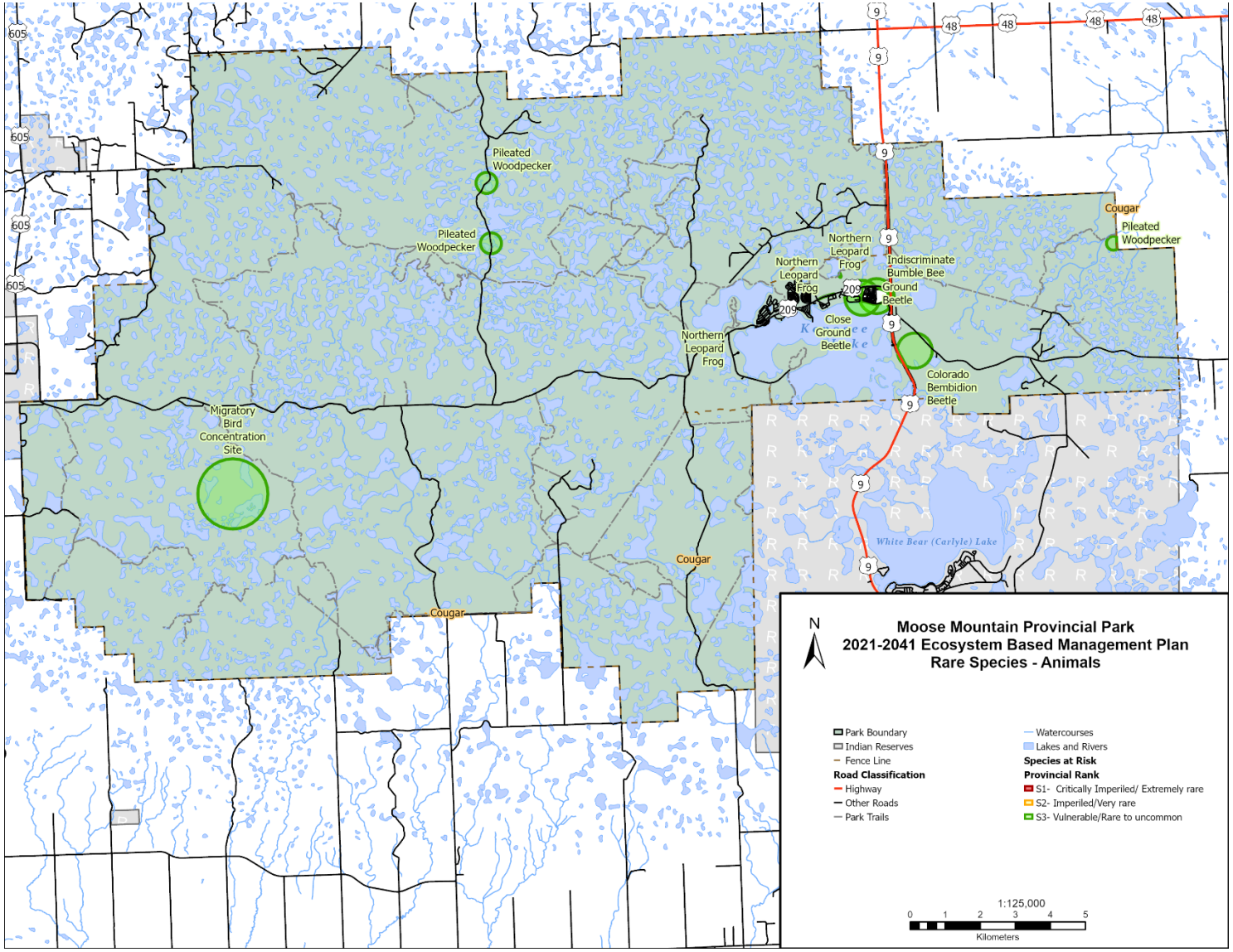

Figure 47 *Rare animal species known locations in MMPP.*

4 ECOSYSTEM-BASED MANAGEMENT GOALS AND OBJECTIVES

4.1 GOAL 1

Maintain a safe outdoor environment while enhancing aesthetic, educational, recreational, and interpretive opportunities within the park.

- Objective 1. Manage overall park vegetation to ensure a safe and natural environment while maintaining the natural aesthetics for park patrons.
- Objective 2. Support enhanced education and interpretation opportunities of park vegetation, known threats (i.e., invasive or non-native species), landscapes, ecosystems, and species.
- Objective 3. Manage high risk vegetation and incorporate forest renewal in core areas and high-use areas by thorough assessments and timely risk mitigation.

4.2 GOAL 2

Restore natural disturbances while maintaining the natural landscape, ecosystem, and species diversity of MMPP.

- Objective 1. Restore natural disturbance regimes and broaden forest age-class distributions to the park ecosystem.
- Objective 2. Create management recommendations based on the impacts of current activities within the park as well as proposed activities or developments.
- Objective 3. Maintain ongoing inventory of the park's biological and ecological resources.
- Objective 4. Build conservation and data-sharing partnerships with stakeholders, First Nation and Métis communities, non-governmental organizations, and other government agencies.
- Objective 5. Monitor the state of the environment within MMPP as well as the outcomes of the management actions implemented from the ecosystem-based management plan.

5 ECOSYSTEM-BASED MANAGEMENT RECOMMENDATIONS AND IMPLEMENTATION

5.1 GOAL 1

Maintain a safe outdoor environment while enhancing aesthetic, educational, recreational, and interpretive opportunities within the park.

5.1.1 OBJECTIVE 1

Manage overall park vegetation to ensure a safe and natural environment while maintaining the natural aesthetics for park patrons.

Recommendations:

- General vegetation management and forest management for non-core areas is addressed under Goal 2, Objective 1
- Reclaim abandoned oil and gas developments and associated access roads as addressed under Goal 2, Objective 2
- Ensure the inclusion of recreational trails and non-core areas in exotic plant inventory, treatment, and management (see Section 3.5.3.1)
- Assess and manage high-risk trees in non-core areas and low-use areas (i.e., trails, day-use areas)
    - Risk assessment should lead to remedial action based on the risk rating including pruning, cabling, and tree removal, removing, or moving at-threat targets, and/or excluding visitors from hazardous sites
- Tree maintenance or removal are acceptable when required for human safety, to protect infrastructure, to accommodate approved development, and for managing forest health
- Incorporate minimal, low-impact management practices on recreational trails and non-core areas (i.e., only the amount of tree removal and mowing needed for visitor use and safety) except in areas where forest renewal activities overlap with recreational trails and use

5.1.2 OBJECTIVE 2

Provide enhanced education and interpretation opportunities of park vegetation, known threats (i.e., invasive, or non-native species), landscapes, ecosystems, and species.

Recommendations:

- Develop interpretive materials on the concepts of ecosystem-based management planning and other management planning, such as:
    - The role of beaver and the unique hydrology of MMPP
    - The importance of water conservation and methods to decrease domestic and commercial water use
    - The importance of forest management activities in the absence or suppression of natural forest disturbances (e.g., fires)
    - The role of cattle grazing to mimic historical bison grazing for range health within MMPP

- Develop and update interpretive materials on specific topics related to conditions and management of the park ecosystems, such as:
    - The diversity of ecosystems and ecosites in MMPP
    - The role of ecosystem and forest age-class diversity in providing habitats for a range of fauna and flora
    - The natural role of fire in forests of the park; successional stages following fire; and treatments such as mechanical harvesting or prescribed/controlled burning to renew ecosystems and landscapes, specifically in the absence of fire
    - Circumstances under which ecologically appropriate forest renewal activities through mechanical harvesting may be used to emulate natural fire disturbances
    - Climate change and its expected effects on park ecosystems including forest structural alternations and hydrological changes
    - Hydrology of MMPP and the conservation and wise use of water resources within the park
    - Wetlands and their role in ecosystems:
        - Providing wildlife habitat and food sources
        - Controlling erosion
        - Conserving and purifying water
        - Preventing flooding
        - Their role in response to climate change
        - Their conservation and management
    - Grassland remnants and their role in ecosystems:
        - Providing wildlife habitat and food sources
        - Improving water filtration and slow run off
        - Controlling erosion
        - Increasing nutrients and organic material in soils
        - Their role in the response to climate change
        - Their conservation and management
    - The threats of non-native and invasive plant species including origins, mechanisms of dispersion, and their effect on natural ecosystems within the park
    - The ecological damage caused by fragmentation, linear features, and development
        - Effects of linear features and fragmentation on animal habitat use and habitat patch size
        - Role of roads and trails in spreading invasive plant species
        - The connection between fragmentation and ATV use, specifically off trail use
        - Benefits of reclamation on abandoned or un-used roads, trails, and developments (i.e. abandoned oil and gas sites)
    - The list of species at risk and biodiversity hotspots found within the park, their general locations or habitat preferences, and their role in natural environment
    - The risk of invasive wild boar within the park

5.1.3 OBJECTIVE 3

Manage high risk vegetation and incorporate forest renewal in core areas and high-use areas by thorough assessments and timely risk mitigation.

Recommendations:

- Develop effective evacuation in the event of an urban-wildland fire and other natural disaster (e.g., windstorm, tornado, etc.)
    - Develop prescriptions for improvements to the routes and treatments adjacent to the routes to improve their robustness and effectiveness as key evacuation routes in the case of wildfire and other natural disasters
- Risk tree management:
    - Continue implementing standard assessment protocols for risk trees within core areas (see Section 3.5.5)
        - Implement remedial action for high-risk trees: pruning, cabling, tree removal; moving the target; or excluding visitors from hazardous sites
    - Develop a vegetation management plan for core-area forests (e.g., campgrounds, high use areas, facilities):
        - Map stand composition and age from the SFVI forest inventory
        - Incorporate field assessments of stand composition and health from the core area inventory (see Section 3.5.5)
        - Prioritize stands for renewal – dependant on age, forest types and health status
        - Prioritize areas for core area silviculture program
        - Rehabilitate areas of physical damage identified by core area inventory (see Section 3.5.5) (e.g., trampled areas in campgrounds and trails)
        - Protect renewed/planted stands until trees are mature enough to withstand recreational traffic and environmental condition
- Implement fuel treatments for reduction of fire threat in core areas (e.g., fuel modifications, mechanical thinning, prescribed fire, or other treatments)
    - Implement fuel treatments around specific areas of high-density infrastructure
        - Remove interconnected crowns and increase spacing to three metres between higher risk trees (i.e., white spruce)
        - Prune tree branches within the first two metres of the height of the tree
    - Work with SaskPower to identify priority line sections for hazard reduction efforts
- Utilizing native plant species as landscaping material and removal of existing exotic ornamentals in core areas and high-use areas with native species (further discussed in Goal 2, Objective 2)
- Incorporate educational opportunities for park patrons, cottage owners, and businesses to learn and implement FireSmart (2018) recommendations:
    - Remove interconnected crowns and increase spacing to three metres between higher risk trees (i.e., conifer trees)
    - Prune tree branches within the first two metres of the height of the tree
    - Create a non-combustible zone within 1.5 metres from building (i.e., remove firewood storage, clean gutters, clean roofs, eliminate fuel sources)

- Utilize fire resistant materials in design, construction, and landscaping
- Ensure chimney are clean and spark arrestors are working properly
- Utilize approved fire pits
- Utilize native tree and shrub species that are naturally resistant to fire (e.g., trembling aspen, balsam poplar, Manitoba maple, green ash, cherry, alder)

5.2 GOAL 2

Restore natural disturbances while maintaining the natural landscape, ecosystem, and species diversity of MMPP.

5.2.1 OBJECTIVE 1

Restore natural disturbance regimes and broaden forest age-class distributions to the park ecosystem.

Recommendations:

- In general, treat non-invasive insects and diseases as part of the natural disturbance regime while timely monitoring and implementing treatments for invasive insects and diseases:
    - There may be a requirement to control insect and disease attacks in core-area stands, where needed for shade, soil protection, or aesthetics
    - A plan to monitor and manage the threat of invasive insects (e.g., emerald ash borer) should be implemented to protect the unique green ash forests within MMPP
    - Continue working with the forest health staff of the Ministry of Environment, Forest Service Branch regarding ongoing detection and management of forest insects and diseases within MMPP
        - Currently both Ministries have an MOU which addresses roles of each agency, whereby the Ministry of Environment undertakes surveillance and the design of forest management prescriptions that may be adopted to control or minimize insects and disease within Park Forest lands
        - Parks Division is responsible for the implementation of control measures
- Increase the area of young forest in MMPP by renewing patches of old to very old forests, mainly using the emulation of natural disturbance throughmechanical harvesting
    - Long term forest renewal activities should aim to convert about 15 percent (~ 1500 hectares) of the current old to very old forest stands into young stands
    - Preferred areas for mechanical harvesting are presented in Appendix 6, general considerations include old to very old forest stands with single cohort, locating suitable access points, continuous patches of desirable forest, topography, and is appropriate for winter harvest
    - Remaining hectares of late seral stage (~7900 hectares) forest should remain intact to ensure a diversity of age classes, also presented in Appendix 7
    - Modified clear cutting (i.e., with retention) while ensuring minimal impediments to sucker regeneration is the preferred approach for trembling aspen mechanical stand renewal
    - Incorporate surveys for species of conservation concern prior to forest renewal activities
    - Mechanical harvesting will be the preferred forest renewal activity within core areas
- While uncontrolled wildfire was the primary historical natural disturbance for forest renewal in the park, a combination of prescribed fire and grazing are acceptable replacement treatments
    - Emulate natural disturbance of fire in trembling aspen dominate stand through prescribed burns

        - Suggested areas suitable for controlled/prescribed burning (i.e., not near values at risk, ease of accessibility, and maintain natural or manmade barriers) are presented in Appendix 10
    - A series of controlled, low intensity, surface fires over a span of 3-4 years would emulate natural disturbance regimes and aid in regenerating trembling aspen while controlling shrub understory growth, the spread of invasive plant species, and beaver populations
    - Whenever possible, fires should be contained using natural barrier such as water or roads
    - No salvage logging after fire, except for the purpose of ecological restoration and maintenance
    - Foam and fire retardant should not be used near water
    - Fireguards and roads should avoid environmentally sensitive areas, and should be closed and reclaimed as soon as after the fire is out
    - Prescribed/controlled fire is the preferred disturbance for non-forested upland grasslands followed by managed grazing to encourage regeneration and inhibit shrub growth
- Allow natural forest progression to continue in the ecosite PR08 – Balsam poplar, trembling aspen, green ash as well as some lowland sites of PR05 where trembling aspen dominate contain a green ash understory:
    - These higher moisture sites are naturally less susceptible to stand replacing wildfire and are expected to naturally convert from a trembling aspen/ balsam poplar dominate forest to a green ash or Manitoba maple dominate forest (natural evidence of this conversion in the absence of disturbance is apparent on Hog Island and Maple Island)
    - Will increase deciduous forest diversity and subsequently add habitat for species such as the redheaded woodpecker

5.2.2 OBJECTIVE 2

Create management recommendations based on the impacts of current activities within the park as well as proposed activities or developments.

Recommendations:

- Oil and gas:
    - An inventory and assessment of all oil and gas developments should be completed with on-going monitoring
    - In-active, decommissioned or abandoned well sites and pipelines:
        - Reclamation of abandoned well sites and roads to as close to the original state as possible:
            - Utilize high density aspen planting or other native species (i.e., grasses, forbs) depending on surrounding habitat
            - Utilize stockpiled topsoil
            - Ensure adequate erosion control measures are in place and working correctly
            - Invasive plants must be dealt with immediately
        - Ensure heavy equipment utilized in reclamation activities is washed to remove seed-bearing mud before entering the park
        - Limit access by grazers and/or recreational users (i.e., ATV/snowmobile) to those sites
        - Access roads to sites must be reclaimed as well

- Active well sites and pipelines:
  - Invasive plants must be dealt with immediately
  - Ensure an adequate stockpile of topsoil remains on site
  - Ensure adequate erosion control measures are in place and working correctly
  - Monitor for environmental concerns (e.g., spills, leaks, H_2S)
  - Limit access by grazers and/or recreational users (i.e., ATV/snowmobile)

- Exotic and invasive plant species:
  - Annual monitoring for the abundance, diversity, and spread of invasive plants within the park and core area
  - Follow a list of recommended tree and shrub species for planting, that can be found in Appendix 5
  - Adopt a general park policy of zero tolerance and the immediate extermination of those prohibited, noxious and nuisance weeds listed under The Weed Control Act that are found as ornamentals within the core area of the park
  - Adopt a general park policy of low to moderate tolerance for non-invasive exotic species that are not mentioned in the recommended trees and shrubs (Appendix 5) and that are found as ornamentals within the park while encouraging the voluntary replacement of these species following the recommended list.
  - Utilize native plant seed when reclaiming disturbed roadside or trail environments within the park
  - Develop control programs for non-native plant invasions identified by exotic plant inventory, priority areas include core areas, trails, and sensitive areas
  - Reduce or eliminating livestock grazing in highly invaded areas to prevent creating disturbed soil and opportunities for invasive species establishment

- Livestock grazing:
  - Develop grazing management plan and manage grazing in alignment with the plan
    - Reduce grazing pressures by adjusting stocking rates in areas of overutilization
    - Prevent grazers from damaging reclamation or silvicultural efforts through fencing or other means of separation
    - Allow Highview pasture a rest period from grazing pressure
    - Continue monitoring range health through assessments every five to ten years, adjust stocking rates to reflect range health as well as cattle movements/areas of high use
    - Annual range health assessments should be considered for areas of highest use and poorest condition (i.e., oil and gas developments and northern portions of grasslands and riparian in Highview and North Moose Mountain)

- Beaver and water management:
  - Utilize LiDAR to create a digital elevation model of the park to properly delineate micro watersheds and better understand the hydrological processes within the park to control water quantity and quality in the park lakes
  - Create variable age classes within the forest and increase regeneration through harvesting as water yield is greater from younger forests

- Implementing practice to manage the beaver population to population level that would be representative of the natural population if natural controls existed within the park (i.e., wolf predation, fire)
    - Beaver dam and/or beaver control would have to be an ongoing process to maintain the benefits but should be only completed once the regional hydrology is better understood
    - Utilizing prescribed fires, where and when it is safe to do so, to emulate natural disturbances and decrease beaver populations
- Inventory of watercourse crossings as well as an assessment of their impacts on water flow
- Remove unnecessary man-made water flow impediments (e.g., old roads, damaged culverts), replacing or improving water crossings, installation of water flow devices
- Eliminate water transfers or channeling between water features
- Incorporate monitoring programs for general resource uses, weather within the park, hydrology, water quality, and beaver control

- Roads and trails:
    - An inventory and assessment of roads and trails should be completed
    - Limit the current developmental footprint - avoid developing any new roads or trails
    - Reduce the length of roads and trails by closing and reclaiming any that are found to be unnecessary based on the road and trail inventory (see Section 3.5.1.2)
    - Necessary roads and trails (i.e., resource management use or access routes to park facilities) should be designated
- ATV and snowmobile use:
    - Acquire better patrol of park trails to ensure people are utilizing the trails safely and appropriatelyRequire washing of ATV or snow machines prior to entering parkland to reduce invasive seed transportation
- Hunting, trapping, and outfitting:
    - Work with ENV to consider changes in hunting policy within the park to protect wildlife from high hunting pressures, increase viewing opportunities for visitors, reduce ungulate depredation outside of the park, and alleviate stakeholder concerns regarding high hunting pressures within the park
    - Develop a monitoring and mitigation plan for wild boar found within the park, consider creating partnership opportunities with local wildlife outfitting vendors to switch from targeting native species to targeting invasive boar

5.2.3 OBJECTIVE 3

Maintain ongoing inventory of the park's biological and ecological resources

Recommendations:

- Conduct inventories and maintain accurate information on rare and endangered species occurrences within the park
    - Implement knowledge of habitat and known threats provided in this document when making management decisions that may affect known SARA plants or animals
- Range and grazing areas:
    - Maintain range and grazed land health assessments

        - Monitor and alter grazing stocking rates and or grazing distribution depending on health assessment condition
- Upland grasslands (i.e., PR12):
    - Identify and assess upland grassland areas, including:
        - Location and size of grasslands
        - Species composition, percent vegetation cover, disturbance induced vegetation growth, invasive species presence, woody vegetation abundance
        - Assess the effects of grazing or use on upland grassland areas (i.e., soil compaction, bare mineral soil, trampling vegetation, erosion potential)
        - Identify areas that would benefit from prescribed/controlled burning or targeted invasive species control
- Implement regular wetland and riparian health assessments within the park, including:
    - Location and size of wetlands
    - Species composition, percent vegetation cover, disturbance induced vegetation growth, invasive species presence, woody vegetation abundance
    - Assess the effects of grazing or use on wetland/riparian areas (i.e., pugs, hummocking, trampling vegetation, sedimentation)
- Forest inventory:
    - Incorporate forest renewal activities (i.e., harvested areas, prescribed/controlled burn, and reclamation) into main SFVI database
    - Monitor forest health and natural forest succession, through permanent or temporary sample plots with reassessments every five years, in unique ecosites and areas (i.e., Hog Island, Maple Island, and PR08) as well as general forest sites to monitor long-term forest changes
    - Monitor forest age class distributions as forest renewal activities are implemented
- Fauna:
    - Conduct general inventories of faunal resources, including:
        - Mammals, birds, amphibians, reptiles, and invertebrates as well as their associated habitats
    - Create research opportunities to study effects of inter-species relationships, specifically the role of beaver with the other fauna of the park
    - Monitor the effects of hunting (regulated and subsistence), trapping, and fishing on wildlife populations within the park over a temporal and spatial scale
    - Develop a monitoring and mitigation plan for invasive wild boar found within the park
- Incorporate all collected data and information into the PED (see Section 2.3.2)

5.2.4 OBJECTIVE 4

Build conservation and data-sharing partnerships with stakeholders, First Nation and Métis communities, non-governmental organizations (NGOs), and other government agencies.

Recommendations:

- Enter or maintain current relationships with NGOs, stakeholders, industry or other government agencies to conduct projects related to the park's ecosystems such as:

- Adjacent universities and colleges with natural resource research-based or cultural/historical programs (e.g., University of Saskatchewan, University of Regina, Saskatchewan Polytechnic)
- Canadian Forest Service
- Canadian Wildlife Federation
- Centre for Indigenous Environmental Resources
- Citizens Environmental Alliance - Saskatchewan (environmental effects of farmland drainage)
- Cottage Owner's Association, Commercial Lessee and Businesses
- CPAWS - Saskatchewan
- Ducks Unlimited
- Grazing Associations
- Indigenous Climate Action
- Ministry of Environment, Forest Service on management of insects and diseases, fire management, etc.
- Ministry of Environment
- Native Plant Society of Saskatchewan
- Nature Conservancy of Canada - Saskatchewan
- Nature Saskatchewan and Nature Canada
- Prairie Regional Adaptation Collaborative
- Royal Saskatchewan Museum
- Saskatchewan Environmental Society
- Saskatchewan Prairie Conservation Action Plan (SK PCAP)
- South of the Divide Conservation Action Program Inc. (SODCAP)
- South Saskatchewan River Watershed Stewards Inc.
- Tourism Saskatchewan
- Town of Carlyle
- Wildlife Conservation Society
- The Wildlife Society - Saskatchewan Chapter

► Incorporate First Nations and Métis communities in projects related to the management of park's ecosystems and visitor experience. Possible topics include:

- Integrated use of traditional knowledge on decision making and management of ecological values and services in the park area
- Collaborate on the protection, conservation, and presentation of historic and cultural sites within the park
- Conduct inventory of interpretive programs and products that reflect First Nation and Métis heritage, culture and perspectives within MMPP
- Develop mechanisms that can improve and broaden partnerships and working relationships among First Nations and Métis groups in the park area

5.2.5 OBJECTIVE 5

Monitor the state of the environment within MMPP as well as the outcomes of the management actions implemented from the ecosystem-based management plan.

Recommendations:

- Monitoring of ecosystem representation and disturbance regime:
  - Utilize the most current forest inventory mapping and incorporate updates
  - Monitor and identify any ecosite changes
  - Monitor hydrological changes
  - Analyze forest age distribution and identify any changes in proportions of young, mature, and old forest from the current distribution
  - Record and report on impacts of natural disturbances (e.g., wildfire, windstorm, insect, and disease) as well as anthropogenic disturbances (e.g., forest harvesting and prescribed fire)
- At regular intervals conduct a survey of plant and wildlife communities, as recommended in Objective 3, to ensure the success of park ecosystem management and apply any adjustment of management activities if necessary
- At regular intervals conduct a survey of land-use change in the park and surrounding area, identifying changes such as recreational developments, roads and trails, land clearing, grazing use, and forest harvesting
- Annual monitoring of non-native or invasive species as well as recording incidental observations on an ongoing basis, as recommended in Objective 2
  - Conduct an inventory of non-native or invasive species incidents to include species, location, extent on invasion, ecosite, and proximity to rare species
  - Inventories should be completed by those specifically trained and experienced in non-native or invasive as well as native plant identification.
  - Inventory should include sample areas of:
    - Roadsides and trails
    - Oil and gas developments
    - Grazing units
    - Campgrounds, beaches, park facilities
    - Cottage subdivisions
    - All other development areas
- Monitor the effects of implementing the Ecosystem Based Surface Water Quantity Management Plan for Moose Mountain Provincial Park (2013), including:
  - Water conservation:
    - Analyze the effectiveness of water conservation initiatives and re-evaluate strategies for improved success
    - Continue to work with municipal and commercial activities to evaluate performance
  - Hydrological monitoring:
    - Maintain current annual hydrology monitoring

- Conduct hydrological trend analysis
- Maintain current annual water quality analysis

- Climatic and weather monitoring:
  - Implement a weather station within the park
  - Monitor annual weather condition
  - Monitor climatic trend annually and analyze its effects on park ecosystem
  - Implement comparison of climatic trends with hydrological trends
- Beavers and effects on hydrology:
  - Conduct more research on hydrological processes, beaver-hydrology relationships, and beaver control activities within the park
  - Utilize the results and insight to modify the beaver control program annually
  - Maintain current database of beaver control activities, including harvest volumes
  - Review the impacts of beaver control, hydrology, and climatic variables within the same temporal scale

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APPENDIX 1: Vascular Plants of Moose Mountain Provincial Park

Sources are: Intera Environmental Consultants Ltd. (1978), Terrestrial & Aquatic Environmental Managers Ltd. (1992), Vance, Jowsey, & McLean (1993), Johnson, Kershaw, MacKinnon, & Pojar (1995), Saskatchewan Conservation Data Centre: All Taxa (2021), McLaughlan, Wright, & Jiricka (2010), and observations by Native Plant Society of Saskatchewan and Saskatchewan Parks through SAR and invasive species monitoring. Nomenclature and S-ranking has been updated following Saskatchewan Conservation Data Centre (2021).

SCIENTIFIC NAME	COMMON NAME	GROWTH-FORM	ORIGIN	S-RANK
ACERACEAE (Maple Family)				
Acer negundo var. interius	Maple, Manitoba	Tree	Native	S5
Acer negundo var. violaceum	Maple, Manitoba	Tree	Non-native	SNA
ALISMATACEAE (Water-Plantain Family)				
Alisma gramineum	Water Plantain, Narrow-leaved	Forb	Native	S3
Alisma triviale	Water-plantain, broad-leaved	Forb	Native	S4
Sagittaria cuneata	Arrowhead, arum-leaved	Forb	Native	S4
ANACARDIACEAE (Sumac Family)				
Toxicodendron rydbergii	Poison ivy	Forb	Native	S4
APIACEAE (Carrot Family)				
Cicuta maculate var. angustifolia	Water-hemlock	Forb	Native	S4
Heracleum maximum	Parsnip, cow	Forb	Native	S4
Osmorhiza longistylis	Sweet-cicely, smooth	Forb	Native	S5
Osmorhiza depauperata	Sweet-cicely, spreading	Forb	Native	S4
Sanicula marilandica	Snakeroot	Forb	Native	S4
Sium suave	Parsnip, water	Forb	Native	S4
ARALIACEAE (Ginseng Family)				
Aralia nudicaulis	Sarsaparilla, wild	Forb	Native	S5
ASTERACEAE (Aster Family)				
Achillea millefolium	Yarrow, Siberian	Forb	Native	S4
Achillea millefolium	Yarrow, common	Forb	Native	S5

Achillea tomentosa	Yarrow, wolley	Forb	Native	Not Listed
Agoseris glauca var. glauca	False Dandelion, glaucous	Forb	Native	S4
Antennaria anaphaloides	Pussytoes, tall	Forb	Native	S1
Antennaria corymbosa	Pussytoes, flat-topped	Forb	Native	S1
Antennaria dimorpha	Low Pussytoes	Forb	Native	S3
Antennaria howellii ssp. canadensis	Pussytoes, canada	Forb	Native	S4
Antennaria howellii ssp. howellii	Pussytoes, small	Forb	Native	S5
Antennaria howellii ssp. neodioica	Pussytoes, tomentose	Forb	Native	S4
Antennaria microphylla	Pussytoes, small-leaved	Forb	Native	S5
Antennaria neglecta	Pussytoes, broad-leaved	Forb	Native	S4
Antennaria parvifolia	Everlasting, small-leaved	Forb	Native	S4
Antennaria pulcherrima ssp. pulcherrima	Everlasting, showy	Forb	Native	S4
Antennaria rosea ssp. arida	Pussytoes, Arid	Forb	Native	S4
Antennaria rosea ssp. pulvinata	Pussytoes, rosy	Forb	Native	S4
Antennaria rosea ssp. rosea	Pussytoes, pink	Forb	Native	S4
Antennaria umbrinella	Pussytoes, brown-bracted	Forb	Native	S2
Arctium minus	Burdock, common	Forb	Non-native	SNA
Arnica fulgens	Arnica, shining-leaved	Forb	Native	S4
Artemisia biennis var. biennis	Sagewort	Forb	Non-native	SNA
Artemisia campestris ssp. caudata	Sagewort, plains	Forb	Native	S4
Artemisia frigida	Sage, pasture	Forb	Native	S5
Artemisia longifolia	Sage, long-leaved	Forb	Native	S4
Cirsium arvense	Thistle, Canada	Forb	Non-native	SNA
Circium vulgare	Thistle, Bull	Forb	Non-native	SNA
Cyclachaena xanthiifolia	Ragweed, false	Forb	Native	S4
Erigeron caespitosus	Fleabane, tufted	Forb	Native	S4
Erigeron philadelphicus var. philadelphicus	Fleabane, Philadelphia	Forb	Native	S4
Euthamia graminifolia var. graminifolia	Goldentop, flat-top	Forb	Native	S4
Gaillardia aristata	Gaillardia, great-flowered	Forb	Native	S4
Grindelia squarrosa	Gumweed	Forb	Native	S5
Gutierrezia sarothrae	Broomweed	Forb	Native	S4
Helenium autumnale	Sneezeweed, common	Forb	Native	S4

Helianthus annuus	Sunflower, common annual	Forb	Native	S4
Helianthus maximiliani	Sunflower, maximillian	Forb	Native	S5
Helianthus nuttallii ssp. nuttallii	Sunflower, common tall	Forb	Native	S4
Helianthus nuttallii ssp. rydbergii	Sunflower, common tall	Forb	Native	S4
Helianthus pauciflorus ssp. subrhomboideus	Sunflower, rhombic-leaved	Forb	Native	S4
Helianthus petiolaris ssp. petiolaris	Sunflower, prairie	Forb	Native	S4
Helianthus tuberosus	Jerusalem Artichoke	Forb	Native	S2
Heterotheca villosa var. villosa	Golden-aster, hairy False	Forb	Native	S5
Lactuca biennis	Lettuce, tall blue	Forb	Native	S3
Leucanthemum vulgare	Daisy, ox-eye	Forb	Non-native	SNA
Liatris punctata var. punctata	Blazingstar, dotted	Forb	Native	S5
Lygodesmia juncea	Skeleton-weed	Forb	Native	S5
Matricaria discoidea	Pineapple-weed	Forb	Non-native	SNA
Petasites frigidus var. palmatus	Coltsfoot, palmate-leaved	Forb	Native	S4
Prenanthes alba	Lettuce, white	Forb	Native	S3
Ratibida columnifera	Coneflower, prairie	Forb	Native	S4
Rudbeckia hirta var. pulcherrima	Susan, black-eyed	Forb	Native	S4
Solidago canadensis var. canadensis	Canada Goldenrod	Forb	Native	S5
Solidago missouriensis	Goldenrod, low	Forb	Native	S5
Solidago ptarmicoides	Goldenrod, upland white	Forb	Native	S3
Solidago rigida ssp. humilis	Goldenrod, stiff	Forb	Native	S4
Sonchus arvensis ssp. uliginosus	Sow-thistle, perennial	Forb	Non-native	SNA
Symphyotrichum ciliolatum	Aster, Lindley's	Forb	Native	S5
Symphyotrichum ericoides var. pansum	Aster, tufted white prairie	Forb	Native	S5
Symphyotrichum novae-angliae	New England American-aster	Forb	Native	S1
Taraxacum officinale ssp. officinale	Dandelion, common	Forb	Non-native	SNA
Tephroseris palustris	Ragwort, marsh	Forb	Native	S4
Tragopogon dubius	Goat’s Beard, yellow	Forb	Non-native	SNA
BALSAMINACEAE (Touch-Me-Not Family)				
Impatiens capensis	Touch-me-not, spotted	Forb	Native	S4

BETULACEAE (Birch Family)				
Betula papyrifera	Birch, paper	Tree	Native	S5
Corylus cornuta	Hazelnut, beaked	Shrub	Native	S5
BORAGINACEAE (Borage Family)				
Cynoglossum virginianum	Wild Comfrey, northern	Forb	Native	S1
Hackelia deflexa var. americana	Stickseed, northern	Forb	Native	S4
Lappula occidentalis var. cupulata	Sheepbur, flat-spine	Forb	Native	S1
Lappula occidentalis var. occidentalis	Sheepbur, flat-spine	Forb	Native	S4
Lappula squarrosa	Blue-bur	Forb	Non-native	SNA
Lithospermum canescens	Puccoon, hoary	Forb	Native	S4
BRASSICACEAE (Mustard Family)				
Boechera retrofracta	Rockcress, reflexed	Forb	Native	S4
Capsella bursa-pastoris	Shepherd's-purse	Forb	Non-native	SNA
Descurainia incana	Tansy-mustard, mountain	Forb	Native	S4
Erysimum asperum	Wallflower, western	Forb	Native	S4
Erysimum inconspicuum	Prairie-rocket, small-flowered	Forb	Native	S4
Lepidium densiflorum	Pepper-grass, common	Forb	Native	S4
Sisymbrium altissimum	Mustard, tumbling	Forb	Non-native	SNA
Thlaspi arvense	Stinkweed	Forb	Non-native	SNA
Turritis glabra	Mustam, tower	Forb	Native	S4
CALLITRICHACEAE (Water-Starwort Family)				
Callitriche hermaphroditica	Water-starwort, northern	Forb	Native	S4
CAMPANULACEAE (Bellflower Family)				
Campanula rotundifolia	Harebell	Forb	Native	S5
CAPRIFOLIACEAE (Honeysuckle Family)				
Linnaea borealis ssp. americana	Twinflower, American	Shrub	Native	S5
Lonicera dioica	Honeysuckle, wild	shrub	Native	S5
Symnphorocarpos albus var. albus	Snow berry	Shrub	Native	S5
Symphorocarpos occidentalis	Snowberry, Western	Shrub	Native	S5

Viburnum edule	Cranberry, low-bush	Shrub	Native	S4
Viburnum opulus var. americanum	Cranberry, high-bush	Shrub	Native	S4
CARYOPHYLLACEAE (Pink Family)				
Stellaria longifolia	Stitchwort, long-leaved	Forb	Native	S4
CHENOPODIACEAE (Goosefoot Family)				
Blitum capitatum ssp. capitatum	Strawberry blight	Forb	Native	S4
Chenopodium glaucum var. salinum	Goosefoot, oak-leaved	Forb	Native	S4
Salsola kali	Russian-thistle	Forb	Non-native	SNA
Salsola tragus	Russian-thistle	Forb	Non-native	SNA
CONVOLVULACEAE (Morning-Glory Family)				
Calystegia sepium ssp. americana	Bindweed, American	Forb	Native	S4
CORNACEAE (Dogwood Family)				
Cornus canadensis	Bunchberry	Shrub	Native	S4
Cornus sercea ssp. sericea	Dogwood, red-osier	Shrub	Native	S5
CYPERACEAE (Sedge Family)				
Bolboschoenus maritimus ssp. paludosus	Bulrush, prairie	Graminoid	Native	S4
Carex alopecoidea	Sedge, foxtail	Graminoid	Native	S3
Carex atherodes	Sedge, awned	Graminoid	Native	S4
Carex pellita	Sedge, woolly	Graminoid	Native	S4
Carex rostrata	Sedge, beaked	Graminoid	Native	S4
Carex saximontana	Sedge, Rocky Mountain	Graminoid	Native	S3
Eleocharis acicularis	Spike-rush, needle	Graminoid	Native	S4
Eleocharis palustris	Spike-rush, creeping	Graminoid	Native	S5
Schoenoplectus pungens	Rush, three-square	Graminoid	Native	S4
Schoenoplectus tabernaemontani	Bulrush, soft stem	Graminoid	Native	S4
ELAEAGNACEAE (Oleaster Family)				
Elaeagnus commutata	Silverberry	Shrub	Native	S4
Shepherdia canadensis	Buffalo-berry, Canada	Shrub	Native	S4
EQUISETACEAE (Horsetail Family)				

Equisetum arvense	Horsetail, common	Forb	Native	S5
Equisteum palustre	Horsetail, marsh	Forb	Native	S4
ERICACEAE (Heath Family)				
Arctostaphylos uva-ursi	Bearberry, common	Shrub	Native	S5
EUPHORBIACEAE (Spurge Family)				
Euphorbia esula	Spurge, leafy	Forb	Non-native	SNA
FABACEAE (Pea Family)				
Astragalus canadensis var. canadensis	Milk vetch, Canadian	Forb	Native	S4
Astragalus flexuosus var. flexuosus	Milk vetch, slender	Forb	Native	S4
Astragalus laxmannii var. robustior	Milk vetch, Laxmann's	Forb	Native	S4
Astragalus pectinatus	Milk vetch, narrow-leaved	Forb	Native	S4
Caragana arborescens	Caragana, common	Shrub	Non-native	SNA
Dalea candida var. candida	Prairie-clover, white	Forb	Native	S4
Dalea purpurea var. purpurea	Prairie-clover, purple	Forb	Native	S4
Glycyrrhiza lepidota	Licorice, wild	Forb	Native	S4
Lathyrus ochroleucus	Cream-colored vetchling	Forb	Native	S5
Lathyrus venosus	Peavine, wild	Forb	Native	S4
Lupinus pusillus ssp. pusillus	Lupine, small	Forb	Native	S3
Medicago lupulina	Medic, black	Forb	Non-native	SNA
Medicago sativa ssp. falcata	Alfalfa, yellow	Forb	Non-native	SNA
Medicago sativa ssp. sativa	Alfalfa	Forb	Non-native	SNA
Melilotus albus	Sweet-clover, white	Forb	Non-native	SNA
Melilotus officinalis	Sweet-clover, yellow	Forb	Non-native	SNA
Oxytropis campestris var. dispar	Point-vetch, northern yellow	Forb	Native	S1
Oxytropis campestris var. spicata	Point-vetch, northern yellow	Forb	Native	S4
Pediomelum argophyllum	Scurf-pea, silvery	Forb	Native	S5
Pediomelum esculentum	Scurf-pea, breadroot	Forb	Native	S4
Trifolium hybridum	Clover, Alsike	Forb	Non-native	SNA
Trifolium repens	Clover, white	Forb	Non-native	SNA
Vicia americana ssp. americana	Vetch, American purple	Forb	Native	S5
Vicia americana ssp. minor	Vetch, American purple	Forb	Native	S5

GENTIANACEAE (Gentian Family)				
Gentianella amarella ssp. acuta	Dwarf-gentian, autumn	Forb	Native	S4
GERANIACEAE (Geranium Family)				
Geranium bicknellii	Geranium, Bicknell's	Forb	Native	S4
Geranium carolinianum	Geranium, Carolina wild	Forb	Native	S3
GROSSULARIACEAE (Currant Family)				
Ribes oxyacanthoides var. oxyacanthoides	Gooseberry, bristly	Shrub	Native	S4
Ribes oxyacanthoides var. setosum	Gooseberry, bristly	Shrub	Native	S2
Ribes triste	Currant, swamp red	Shrub	Native	S4
IRIDACEAE (Iris Family)				
Sisyrinchium mucronatum	Blue-eyed grass, Mucronate	Forb	Native	S3
JUNCACEAE (Rush Family)				
Juncus balticus	Rush, Baltic	Graminoid	Native	S4
Juncus bufonius	Rush, toad	Graminoid	Native	S4
Juncus dudleyi	Rush, Dudley's	Graminoid	Native	S4
Juncus interior	Rush, Inland	Graminoid	Native	S3
Juncus nodosus var. nudosus	Rush, knotted	Graminoid	Native	S4
Juncus torreyi	Rush, Torrey's	Graminoid	Native	S4
LAMIACEAE (Mint Family)				
Agastache foeinculum	Hyssop, giant	Forb	Native	S4
Dracocephalum parviflorum	Dragonhead, American	Forb	Native	S4
Lycopus asper	Water-horehound, western	Forb	Native	S4
Mentha canadensis	Mint, wild	Forb	Native	S4
Monarda fistulosa var. menthifolia	Bergamot, wild	Forb	Native	S4
Monarda fistulosa var. mollis	Bergamot, soft wild	Forb	Native	S3
Physostegia parviflora	Dragonhead, false	Forb	Native	S4
Scutellaria galericulata	Skullcap, marsh	Forb	Native	S4
Stachys pilosa var. pilosa	Hedge-nettle, hairy	Forb	Native	S4

LEMNACEAE (Duckweed Family)				
Lemna minor	Duckweed, Lesser	Forb	Native	S1
LENTIBULARIACEAE (Bladderwort Family)				
Utricularia vulgaris	Bladderwort, common	Forb	Native	S4
LILIACEAE (Lily Family)				
Maianthemum canadense	Solomon's-seal, two-leaved	Forb	Native	S5
Maianthemum racemosum ssp. amplexicaule	Spikenard, false	Forb	Native	S1
Maianthemum stellatum	Solomon's-seal, starflower false	Forb	Native	S4
Maianthemum trifolium	Solomon's-seal, three-leaved	Forb	Native	S4
Prosartes trachycarpa	Fairybells	Forb	Native	S4
LINACEAE (Flax Family)				
Linum lewisii var. lewisii	Flax, wild blue	Forb	Native	S5
MONOTROPACEAE (Indian-Pipe Family)				
Monotropa uniflora	Convulsion Root	Forb	Native	S4
OLEACEAE (Olive Family)				
Fraxinus pennsylvanica	Ash, green	Tree	Native	S4
ONAGRACEAE (Evening Primrose Family)				
Chamerion angustifolium ssp. angustifolium	Fireweed, narrow-leaf	Forb	Native	S4
Chamerion angustifolium ssp. circumvagum	Fireweed, narrow-leaf	Forb	Native	S4
Epilobium ciliatum ssp. ciliatum	Willow-herb, hairy	Forb	Native	S4
Epilobium ciliatum ssp. glandulosum	Willow-herb	Forb	Native	S4
Epilobium leptophyllum	Willow-herb, narrow-leaved	Forb	Native	S4
Gaura coccinea	Scarlet Gaura	Forb	Native	S4
Oenothera biennis	Evening-primrose, yellow	Forb	Native	S4
Oenothera serrulata	Evening-primrose, shrubby	Forb	Native	S5
OPHIOGLOSSACEAE (Adder's Tongue Family)				
Botrychium minganense	Moonwort, Mingan	Forb	Native	S1

ORCHIDACEAE (Orchid Family)				
Corallorhiza striata var. striata	Coral-root, striped	Forb	Native	S3
Liparis loeselii	Twayblade, yellow	Forb	Native	S3
Spiranthes romanzoffiana	Lady's-tresses, hooded	Forb	Native	S4
PINACEAE (Pine Family)				
Picea glauca	Spruce, white	Tree	Native	S5
PLANTAGINACEAE (Plantain Family)				
Plantago major	Plantain, common	Forb	Non-native	SNA
POACEAE (Grass Family)				
Agropyron cristatum ssp. pectinatum	Wheat grass, crested	Graminoid	Non-native	SNA
Agrostis scabra var. scabra	Grass, hair	Graminoid	Native	S4
Agrostis stolonifera var. palustris	Bent, spreading	Graminoid	Non-native	SNA
Alopecurus aequalis var. aequalis	Foxtail, short-awn meadow	Graminoid	Native	S4
Alopecurus carolinianus	Foxtail, Carolina	Graminoid	Native	S3
Avenula hookeri	Oat Grass, Hooker's	Graminoid	Native	S5
Beckmannia syzigachne	Grass, slough	Graminoid	Native	S4
Bouteloua gracilis	Grama, blue	Graminoid	Native	S5
Bromus anomalus	Brome, nodding	Graminoid	Native	Not Listed
Bromus ciliatus	Brome, fringed	Graminoid	Native	S4
Bromus inermis	Brome, smooth	Graminoid	Non-native	SNA
Calamagrostis canadensis var. canadensis	Reed grass, bluejoint	Graminoid	Native	S4
Calamagrostis stricta	Reed grass, northern	Graminoid	Native	S5
Deschampsia cespitosa ssp. cespitosa	Hair grass, tufted	Graminoid	Native	S4
Dichanthelium acuminatum var. fasciculatum	Panic-grass, hairy	Graminoid	Native	S3
Elymus canadensis var. brachystachys	Wild rye, short-spiked Canada	Graminoid	Native	S1
Elymus canadensis var. canadensis	Wild rye, Canada	Graminoid	Native	S4
Elymus diversiglumis	Wild rye, various-glumed	Graminoid	Native	S3
Elymus repens	Rye, creeping wild	Graminoid	Non-native	SNA
Elymus trachycaulus ssp. subsecundus	Wheat grass, slender	Graminoid	Native	S5

Elymus trachycaulus ssp. trachycaulus	Wheat grass, slender	Graminoid	Native	S5
Festuca hallii	Fescue, plains rough	Graminoid	Native	S3
Glyceria grandis var. grandis	Manna grass, American	Graminoid	Native	S4
Hesperostipa comata ssp. comata	Grass, needle and thread	Graminoid	Native	S5
Hesperostipa curtiseta	Grass, porcupine	Graminoid	Native	S5
Hesperostipa spartea	Grass, porcupine	Graminoid	Native	S4
Hordeum jubatum ssp. intermedium	Barley, meadow wild	Graminoid	Native	S5
Hordeum jubatum ssp. jubatum	Barley, foxtail	Graminoid	Native	S5
Koeleria macrantha	Grass, June	Graminoid	Native	S5
Nassella viridula	Needle grass, green	Graminoid	Native	S5
Panicum capillare	Witch grass	Graminoid	Native	S4
Pascopyrum smithii	Wheat grass, western	Graminoid	Native	S5
Phalaris arundinacea	Canary grass, reed	Graminoid	Native	S4
Phragmites australis ssp. americanus	Reed-grass, common	Graminoid	Native	S4
Phleum pratense	Timothy	Graminoid	Non-native	SNA
Poa compressa	Blue grass, Canada	Graminoid	Non-native	SNA
Poa interior	Blue grass, inland	Graminoid	Native	S4
Poa palustris	Blue grass, fowl	Graminoid	Native	S4
Poa pratensis	Blue grass, Kentucky	Graminoid	Non-native	SNA
Poa secunda ssp. juncifolia	Blue grass, big	Graminoid	Native	S5
Poa secunda ssp. secunda	Blue grass, Canby	Graminoid	Native	S5
Pseudoroegneria spicata	Wheat grass, bluebunch	Graminoid	Native	S2
Puccinellia nuttalliana	Salt-meadow grass, Nuttall's	Graminoid	Native	S4
Scolocholoa festucacea	Whitetop	Graminoid	Native	S4
Schizachyrium scoparium var. scoparium	Bluestem, little	Graminoid	Native	S4
POLEMONIACEAE (Phlox Family)				
Collomia linearis	Collomia, narrow-leaved	Forb	Native	S4
Phlox hoodii ssp. hoodii	Phlox, moss	Forb	Native	S5
POLYGONACEAE (Buckwheat Family)				
Fallopia convolvulus	Buckwheat, wild	Forb	Non-native	SNA
Persicaria amphibia var. emersa	Smartweed, water	Forb	Native	S4

Persicaria amphibia var. stipulacea	Smartweed, water	Forb	Native	S4
Polygonum aviculare ssp. rurivagum	Knotweed, narrow-leaf	Forb	Non-native	SNA
Rumex fueginus	Dock, golden	Forb	Native	S5
Rumex pseudonatronatus	Dock, field	Forb	Non-native	SNA
PRIMULACEAE (Primrose Family)				
Androsace septentrionalis	Pygmyflower	Forb	Native	S5
Lysimachia ciliata	Loosestrife, fringed	Forb	Native	S4
PYROLACEAE (Wintergreen Family)				
Orthilia secunda	Wintergreen, one-sided	Forb	Native	S5
Pyrola aserifolia ssp. aserifolia	Wintergreen, common pink	Forb	Native	S5
RANUNCULACEAE (Buttercup Family)				
Actaea pachypoda	Baneberry, white	Forb	Native	Not Listed
Actaea rubra	Baneberry, red	Forb	Native	S4
Anemone canadensis	Anemone, Canada	Forb	Native	S5
Anemone cylindrica	Anemone, long-fruited	Forb	Native	S4
Anemone patens var. multifida	Prairie crocus	Forb	Native	S5
Aquilegia brevistyla	Columbine, small-flowered	Forb	Native	S4
Delphinium glaucum	Larkspur, tall	Forb	Native	S2
Ranunculus cymbalaria	Buttercup, seaside	Forb	Native	S4
Thalictrum dasycarpum	Meadow-rue, tall	Forb	Native	S4
Thalictrum venulosum	Meadow-rue, veiny	Forb	Native	S5
ROSACEAE (Rose Family)				
Agrimonia striata	Agrimony	Forb	Native	S4
Amelanchier alnifolia var. alnifolia	Saskatoon	Shrub	Native	S5
Crataegus castlegarensis	Hawthorn, Castlegar	Shrub	Native	SNR
Crataegus chrysocarpa	Hawthorn, northern	Shrub	Native	S4
Crataegus cupressocollina	Hawthorn, Cypress Hills	Shrub	Native	SNR
Crataegus douglasii	Hawthorn, Black-fruited	Shrub	Native	S2
Crataegus erythropoda	Hawthorn, red	Shrub	Non-native	SNA
Drymocallis arguta	Cinquefoil, white	Forb	Native	S4

Fragaria virginiana ssp. glauca	Strawberry, smooth wild	Forb	Native	S5
Geum aleppicum	Avens, yellow	Forb	Native	S4
Potentilla anserina ssp. anserina	Silverweed	Forb	Native	S4
Potentilla gracilis var. fastigiata	Cinquefoil, Nuttall's	Forb	Native	S4
Potentilla gracilis var. flabelliformis	Cinquefoil, Idaho	Forb	Native	S4
Potentilla rivalis	Cinquefoil, brook	Forb	Native	S4
Potentilla supina ssp. paradoxa	Cinquefoil, bushy	Forb	Native	S3
Prunus pensylvanica	Cherry, pin	Shrub	Native	S5
Prunus virginiana var. virginiana	Cherry, choke	Shrub	Native	S5
Prunus americana var. nigra	Canada Plum	Shrub	Native	S2
Rosa acicularis ssp. sayi	Rose, prickly	Shrub	Native	S5
Rosa arkansana	Rose, low prairie	Shrub	Native	S5
Rosa woodsii	Rose, Wood's	Shrub	Native	S5
Rubus idaeus ssp. strigosus	Raspberry, American red	Shrub	Native	S5
Rubus pubescens	Dewberry	Shrub	Native	S5
Spiraea alba var. alba	Meadow-sweet, narrow-leaved	Shrub	Native	S4
RUBIACEAE (Madder Family)				
Galium boreale	Bedstraw, northern	Forb	Native	S5
Galium trifidum ssp. trifidum	Bedstraw, small	Forb	Native	S4
Galium triflorum	Bedstraw, sweet-scented	Forb	Native	S4
RUPPIACEAE (Widgeon-weed Family)				
Ruppia cirrhosa	Widgeon-grass	Graminoid	Native	S3
Ruppia martima	Ditch-grass, beaked	Graminoid	Native	S3
SALICACEAE (Willow Family)				
Populus balsamifera ssp. balsamifera	Poplar, balsam	Tree	Native	S5
Populus tremuloides	Aspen, trembling	Tree	Native	S5
Salix bebbiana	Willow, long-beaked	Shrub	Native	S4
Salix candida	Willow, hoary	Shrub	Native	S4
Salix discolor	Willow, pussy	Shrub	Native	S4
Salix interior	willow, sandbar	Shrub	Native	S4
Salix petiolaris	willow, basket	Shrub	Native	S4

SAXIFRAGACEAE (Saxifrage Family)				
Parnassia palustris	Grass-of-parnassus, northern	Forb	Native	S4
SCROPHULARIACEAE (Figwort Family)				
Castilleja coccinea	Paintbrush, scarlet	Forb	Native	S1
Castilleja miniata ssp. miniata	Paintbrush, great red	Forb	Native	S4
Castilleja raupii	Paintbrush, purple	Forb	Native	S2
Castilleja sessiliflora	Paintbrush, downy	Forb	Native	S3
Orthocarpus luteus	Owl's-clover	Forb	Native	S4
Penstemon albidus	Beardtongue, white	Forb	Native	S4
Penstemon nitidus var. nitidus	Beardtongue, smooth blue	Forb	Native	S4
SMILACACEAE (Greenbrier Family)				
Smilax lasioneura	Greenbrier, herbaceous	Forb	Native	S4
TYPHACEAE (Cattail Family)				
Typha latifolia	Cattail, common	Forb	Native	S4
URTICACEAE (Nettle Family)				
Urtica dioica ssp. gracilis	Nettle, stinging	Forb	Native	S4
VIOLACEAE (Violet Family)				
Viola canadensis var. rugulosa	Violet, western Canada	Forb	Native	S5
Viola sororia	Violet, downy blue	Forb	Native	S1

APPENDIX 2: Amphibians and Reptiles of Moose Mountain Provincial Park

Sources are: Saskatchewan Conservation Data Centre (2021), Bebler and King (1979), Government of Canada (2021). Nomenclature and S-ranking has been updated following Saskatchewan Conservation Data Centre (2021).

SCIENTIFC NAME	COMMON NAME	S-RANK	COSEWIC	SARA
ORDER: ANURA				
BUFONIDAE (Toad Family)				
Anaxyrus cognatus	Great Plains Toad	S3	Special Concern	Special Concern
Anaxyrus hemiopyrus	Canadian Toad	S4	Not At Risk	
RANIDAE (True Frogs Family)				
Lithobates pipiens	Northern Leopard Frog	S3	Special Concern	Special Concern
Lithobates sylvaticus	Wood Frog	S5		
HYLIDAE (New World Tree Frogs Family)				
Dryophytes versicolor	Gray Treefrog	S1		
Pseudacris maculata	Boreal Chorus Frog	S5	Not At Risk	
PELOBATIDAE (Spadefoot Toad Family)				
Spea bombifroms	Plains Spadefoot	S3	Not At Risk	
ORDER: CAUDATA				
AMBYSTOMATIDAE (Mole Salamander Family)				
Ambystoma mavortium	Western Tiger Salamander	S4	Special Concern	Special Concern
ORDER: CHELONIA				
CHELYDRIDAE (Snapping Turtle Family)				
Chelydra serpentina	Snapping Turtle	S3	Special Concern	Special Concern

EMYDIDAE (Box Turtles and Pond Turtles Family)			
Chrysemys picta bellii	Western Painted Turtle	S3	Not At Risk
ORDER: SQUAMATA			
COLUBRIDAE (Colubrid Snake Family)			
Storeria occipitomaculata	Red-bellied Snake	S3	
Thamnophis radix	Plains Gartersnake	S5	
Thamnophis sirtalis parietalis	Red-sided Gartersnake	S5	

APPENDIX 3: Mammals of Moose Mountain Provincial Park

Sources are: Saskatchewan Conservation Data Centre (2021), Whitaker (1996). Nomenclature and S-ranking has been updated following Saskatchewan Conservation Data Centre: All Taxa (Saskatchewan Conservation Data Centre, 2021).

[1] Potential to occur in MMPP [2] Extirpated and re-introduced to area [3] Not native to area [4] Extirpated from area

SCIENTIFC NAME	COMMON NAME	S-RANK	COSEWIC	SARA
ORDER: INSECTIVORA				
SORICIDAE (Shrew Family)				
Blarina brevicauda	Northern Short-tailed Shrew	S4		
Sorex arcticus	Arctic Shrew	S4		
Sorex cinereus	Masked Shrew	S4		
Sorex haydeni	Prairie Shrew	S4		
Sorex hoyi	Eastern Pygmy Shrew	SNR		
Sorex palustris	Water Shrew	S5		
ORDER: CHIROPTERA				
VESPERTILIONIDAE (Evening Bats and Vesper Bats)				
Eptesicus fuscus	Big Brown Bat	S5		
Lasionycteris noctivagans	Silver-haired Bat	S5B		
Lasiurus borealis	Eastern Red Bat	S5B		
Lasiurus cinereus	Hoary Bat	S5B		
Myotis ciliolabrum	Western Small-footed Myotis	S2		
Myotis lucifugus	Little Brown Myotis	S4B,S4N	Endangered	Endangered
Myotis septentrionalis	Northerm Myotis	S3	Endangered	Endangered
ORDER: LAGOMORPHA				
LEPORIDAE (Rabbits and Hares Family)				
Lepus americanus	Snowshoe Hare	S5		
Lepus townsendii	White-tailed Jack Rabbit	S4		

Sylvilagus nuttallii grangeri	Nuttall's Cottontail	S4	Not at Risk
ORDER: RODENTIA			
CASTORIDAE (Beaver Family)			
Castor canadensis	American Beaver	S5	
CRICETIDAE (Mice, Lemmings, and Voles Family)			
Microtus ochrogaster	Prairie Vole	S4	
Microtus pennsylvanicus	Meadow Vole	S4	
Myodes gapperi	Gapper's Red-backed Vole	S5	
Ondatra zibethicus	Muskrat	S5	
Onychomys leucogaster	Northern Grasshopper Mouse	S4	
Peromyscus maniculatus	Deer Mouse	S5	
Phenacomys intermedius	Western Heather Vole	S5	
DIPODIDAE (Jumping Mice Family)			
Zapus princeps	Western Jumping Mouse	S4	
ERETHIZONTIDAE (Porcupine Family)			
Erethizon dorsatum	Porcupine	S4	
GEOMYIDAE (Pocket Gopher Family)			
Thomomys talpoides	Northern Pocket Gopher	S5	
HETEROMYIDAE (Pocket Mice & Kangaroo Rats Family)			
Perognathus fasciatus	Olive-Backed Pocket Mouse	S2	
SCIURIDAE (Squirrels and Allies Family)			
Glaucomys sabrinus	Northern Flying Squirrel	S4	
Ictidomys tridecemlineatus	Thirteen-lined Ground Squirrel	S5	
Marmota minimus	Woodchuck	S4	
Neotamias minimus	Least Chipmunk	S5	
Poliocitellus franklinii	Franklin's Ground Squirrel	S5	
Sciurus carolinensis	Eastern Gray Squirrel	SNA	
Sciurus niger	Fox Squirrel	SNA	Not at Risk

Tamiasciurus hudsonius	Red Squirrel	S5		
Urocitellus richardsonii	Richardson's Ground Squirrel	S5		
MURIDAE (Old World Rats and Mice Family)				
Mus musculus[3]	House Mouse	SNA		
Rattus norvegicus[3]	Norway Rat	SNA		
ORDER: CARNIVORA				
CANIDAE (Wolves, Dogs and Foxes Family)				
Canis latrans	Coyote	S5		
Canis lupus occidentalis[1 4]	Grey Wolf	S4	Not at Risk	
Vulpes vulpes	Red Fox	S5		
Vulpes velox[1 4]	Swift Fox	S3	Threatened	Threatened
PROCYONIDAE (Raccoon Family)				
Procyon lotor	Raccoon	S5		
FELIDAE (Cat Family)				
Felis concolor	Mountain Lion	S2		
Lynx canadensis	Canada Lynx	S4	Not at Risk	
Lynx rufus	Bobcat	S3		
MEPHITIDAE (Skunk Family)				
Mephitis mephitis	Striped Skunk	S5		
MUSTELIDAE (Weasel Family)				
Mustela erminea	Short-tailed Weasel	S5		
Mustela frenata longicauda	Long-tailed Weasel	S5	Not At Risk	
Mustela nivalis	Least Weasel	S5		
Taxidea taxus taxus[1]	Badger	S3	Special Concern	Special Concern
Vison vison	Mink	S5		
URSIDAE (Bear Family)				
Ursus americanus	American Black Bear	S5	Not At Risk	
Ursus arctos[4]	Plains Grizzly Bear	SX	Special Concern	Special Concern

ORDER: ARTIODACTYLA

BOVIDAE (Bovid Family)					
	Bos bison bison[4]	Plains Bison	S2	Threatened	Under Consideration
CERVIDAE (Deer Family)					
	Cervus elaphus	Elk	S4		
	Odocoileus hemionus	Mule Deer	S4		
	Odocoileus virginianus	White-tailed Deer	S4		
	Alces americanus	Moose	S5		
SUIDAE (Pig/Hog Family)					
	Sus scrofa[3]	Eurasian Wild Boar	SNA		

APPENDIX 4: Birds of Moose Mountain Provincial Park

Sources are: Saskatchewan Conservation Data Centre (2021), Birds Canada: Saskatchewan Breeding Bird Atlas (2021), The Cornell Lab of Ornithology (2021), Government of Canada: Species at Risk Search (2021), Udvardy (1977). Nomenclature and S-ranking has been updated following Saskatchewan Conservation Data Centre (2021).

Breeding Codes:

B – Breeding, known breeding within MMPP and area

PRB – Probable breeding area, breeding signs and/or pairs witnessed

POB – Possible breeding, species observed in suitable habitat and/or breeding calls heard

* Not native to area

SCIENTIFC NAME	COMMON NAME	S-RANK	COSEWIC	SARA	BREEDING
ACCIPITRIDAE (Hawks, Kites, and Eagles Family)					
Accipiter cooperii	Cooper's Hawk	S4B,S2M,S2N	Not at Risk		B
Accipiter striatus	Sharp-shinned Hawk	S4B,S2N,S4M	Not at Risk		POB
Aquila chrysaetos	Golden Eagle	S3B,S3N,S4M	Not at Risk		POB
Buteo jamaicensis	Red-tailed Hawk	S5B,S5M,S1N	Not at Risk		B
Buteo platypterus	Broad-winged Hawk	S4B,S3M			B
Buteo regalis	Ferruginous Hawk	S3B	Special Concern	Threatened	B
Buteo swainsoni	Swainson's Hawk	S4B,S4M			B
Circus cyaneus	Northern Harrier	S4B,S4M	Not at Risk		PRB
Haliaeetus leucocephalus	Bald Eagle	S5B,S5N,S4M	Not at Risk		POB
ALAUDIDAE (Lark Family)					
Eremophila alpestris	Horned Lark	S4B,S3N,SUM			B
ALCEDINIDAE (Kingfisher Family)					
Megaceryle alcyon	Belted Kingfisher	S4B,S4M			B
ANATIDAE (Ducks, Geese, and Waterfowl Family)					
Aix sponsa	Wood Duck	S4B,S4M			B
Anas acuta	Northern Pintail	S5B,S5M			B
Anas crecca	Green-winged Teal	S5B,S5M			B
Anas platyrhynchos	Mallard	S5B,S5M			B

Anas rubripes	American Black Duck	S4B,S4M			PRB
Aythya affinis	Lesser Scaup	S5B,S5M			B
Aythya americana	Redhead	S5B,S5M			B
Aythya collaris	Ring-necked Duck	S5B,S5M			B
Aythya valisineria	Canvasback	S5B,S5M			B
Branta canadensis	Canada Goose	S5B,S5M			B
Bucephala albeola	Bufflehead	S5B,S5M			B
Bucephala clangula	Common Goldeneye	S5B,S5M			B
Lophodytes cucullatus	Hooded Merganser	S4B, S3M			B
Mareca americana	American Wigeon	S4B,S3M			B
Mareca strepera	Gadwall	S5B,S5M			B
Oxyura jamaicensis	Ruddy Duck	S5B,S5M			B
Spatula clypeata	Northern Shoveler	S5B,S5M			B
Spatula discors	Blue-winged Teal	S5B,S5M			B
APODIDAE (Swifts Family)					
Chaetura pelagica	Chimney Swift	S2B,S2M	Threatened	Threatened	PRB
ARDEIDAE (Bitterns, Herons, and Egrets Family)					
Ardea alba	Great Egret	SNA			POB
Ardea herodias	Great Blue Heron	S5B,S5M			B
Botaurus lentiginosus	American Bittern	S5B,S5M			PRB
Nycticorax nycticorax	Black-crowned Night-Heron	S4B			PRB
BOMBYCILLIDAE (Waxwings Family)					
Bombycilla cedrorum	Cedar Waxwing	S5B,S5M			B
CALCARIIDAE (Longspurs and Snow Buntings Family)					
Calcarius ornatus	Chestnut-collared Longspur	S3B	Endangered	Threatened	PRB
CAPRIMULGIDAE (Nightjars and allies Family)					
Chordeiles minor	Common Nighthawk	S4B,S4M	Special Concern	Threatened	PRB
CARDINALIDAE (Cardinals and allies Family)					
Passerina amoena	Lazuli Bunting	S4B,S4M			POB

Passerina cyanea	Indigo Bunting	S4B,S4M			POB
Pheucticus ludovicianus	Rose-breasted Grosbeak	S5B,S5M			B
Pheucticus melanocephalus	Black-headed Grosbeak	SUB			PRB
Spiza americana	Dickcissel	SNA			POB
CATHARTIDAE (New World Vultures Family)					
Cathartes aura	Turkey Vulture	S3B,S3M			B
CHARADRIIDAE (Plovers and Lapwings Family)					
Charadrius melodus	Piping plover	S3B,S3M	Endangered	Endangered	B
Charadrius vociferus	Killdeer	S5B,S5M			B
COLUMBIDAE (Pigeons and Doves Family)					
*Columba livia**	Rock Dove	SNA			B
*Streptopelia decaocto**	Eurasian Collared-Dove	SNA			B
Zenaida macroura	Mourning Dove	S5B,S5M			B
CORVIDAE (Jays, Crows, Magpies, and Ravens Family)					
Corvus brachyrhynchos	American Crow	S5B,S4N,S5M			B
Crovus corax	Common Raven	S5			B
Cyanocitta cristata	Blue Jay	S5			POB
Pica hudsonia	Black-billed Magpie	S5			B
CUCULIDAE (Cuckoo Family)					
Coccyzus erythropthalmus	Black-billed Cuckoo	S5B,S5M			POB
FALCONIDAE (Falcon Family)					
Falco columbarius	Merlin	S5B,S5N,S5M	Not at Risk		PRB
Falco sparverius	American Kestrel	S5B,S5M,S1N			B
FRINGILLIDAE (Finches Family)					
Haemorhous mexicanus	House Finch	S5N			B
Haemorhous purpureus	Purple Finch	S5B,S4N,S5M			POB
Spinus pinus	Pine Siskin	S2B,S4N			PRB
Spinus tristis	American Goldfinch	S5B,S5M			B

GAVIIDAE (Loon Family)					
Gavia immer	Common Loon	S5B,SUN,S5M	Not at Risk		PRB
GRUIDAE (Crane Family)					
Grus canadensis	Sandhill Crane	S5B,S5M			POB
HIRUNDINIDAE (Swallows and Martins Family)					
Hirundo rustica	Barn Swallow	S4B,S4M	Special Concern	Threatened	B
Petrochelidon pyrrhonota	Cliff Swallow	S5B,S5M			B
Progne subis	Purple Martin	S5B,S5M			B
Riparia riparia	Bank Swallow	S4B,S5M	Threatened	Threatened	B
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B,S5M			B
Tachycineta bicolor	Tree Swallow	S5B,S5M			B
ICTERIDAE (Orioles, Grackles, Cowbirds Family)					
Agelaius phoeniceus	Red-winged Blackbird	S5B,SUN,S5M			B
Dolichonyx oryzivorus	Bobolink	S4B,S4M	Threatened	Threatened	B
Euphagus cyanocephalus	Brewer's Blackbird	S4B,SUN,S4M			B
Icterus galbula	Baltimore Oriole	S5B,S5M			B
Icterus spurius	Orchard Oriole	S4B			B
Molothrus ater	Brown-headed Cowbird	S5B,SUN,S5M			B
Quiscalus quiscula	Common Grackle	S5B			B
Sturnella neglecta	Western Meadowlark	S4B,S4M			B
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	S5B,S5M			B
ICTERIIDAE (Chat Family)					
Icteria virens	Yellow-breasted Chat	S3B,S3M	Not at Risk		PRB
LANIIDAE (Shrike Family)					
Lanius ludovicianus	Loggerhead Shrike	S2B,S2M	Threatened	Threatened	B
LARIDAE (Gulls, Terns, and Skimmers Family)					
Chlidonias niger	Black Tern	S5B,S5M	Not at Risk		B
Hydroprogne caspia	Caspian Tern	S2B,S2M	Not at Risk		PRB
Larus californicus	California Gull	S4B,S4M			POB

Larus delawarensis	Ring-billed Gull	S5B,S5M			B
Leucophaeus pipixca	Franklin's Gull	S4B,S4M			POB
Sterna forsteri	Forster's Tern	S4B,S4M	Data Deficient		POB
Sterna hirundo	Common Tern	S5B,S5M	Not at Risk		POB
MIMIDAE (Mockingbirds and Thrashers Family)					
Dumetella carolinensis	Gray Catbird	S5B,S5M			B
Toxostoma rufum	Brown Thrasher	S5B,S5M			B
MOTACILLIDAE (Wagtails and Pipits Family)					
Anthus spragueii	Sprague's Pipit	S3B	Threatened	Threatened	B
PANDIONIDAE (Osprey Family)					
Pandion haliaetus	Osprey	S3B,S3M			POB
PARIDAE (Chickadees and Titmice Family)					
Poecile atricapillus	Black-capped Chickadee	S5			B
PARULIDAE (Wood-warbler Family)					
Geothlypis philadelphia	Mourning Warbler	S5B,S5M			B
Geothlypis trichas	Common Yellowthroat	S5B,S5M			B
Leiothlypis celata	Orange-crowned Warbler	S5B			PRB
Leiothlypis peregrina	Tennessee Warbler	S5B,S5M			POB
Leiothlypis ruficapilla	Nashville Warbler	S5B,S5M			POB
Mniotilta varia	Black-and-white Warbler	S5B,S5M			B
Parkesia noveboracensis	Northern Waterthrush	S5B,S5M			POB
Seiurus aurocapilla	Ovenbird	S5B,S5M			PRB
Setophaga coronata	Yellow-rumped Warbler	S5B,S5M			POB
Setophaga fusca	Blackburnian Warbler	S4B,S4M			POB
Setophaga pensylvanica	Chestnut-sided Warbler	S5B,S5M			POB
Setophaga petechia	Yellow Warbler	S5B,S5M			B
Setophaga ruticilla	American Redstart	S5B,S5M			B
PASSERELLIDAE (New World Sparrows Family)					
Ammodramus savannarum	Grasshopper Sparrow	S4B			B

Ammospiza leconteii	LeConte's Sparrow	S5B,S5M			POB
Ammospiza nelsoni	Nelson's Sparrow	S5B,S5M	Not at Risk		POB
Calamospiza melanocorys	Lark Bunting	S2B,S2M	Threatened		POB
Centronyx bairdii	Baird's Sparrow	S4B	Special Concern	Special Concern	PRB
Chondestes grammacus	Lark Sparrow	S5B,SNRM			B
Junco hyemalis	Dark-eyed Junco	S5B,S4N,S5M			POB
Melospiza georgiana	Swamp Sparrow	S5B,S5M			POB
Melospiza melodia	Song Sparrow	S5B,S5M			B
Passerculus sandwichensis	Savannah Sparrow	S5B,S5M			B
Pipilo erythrophthalmus	Eastern Towhee	S4B,S4M			POB
Pipilo maculatus	Spotted Towhee	S5B,S5M			POB
Pooecetes gramineus	Vesper Sparrow	S5B,S5M			B
Spizella pallida	Clay-coloured Sparrow	S5B,S5M			B
Spizella passerina	Chipping Sparrow	S5B,S5M			B
Zonotrichia albicollis	White-throated Sparrow	S5B, S5M			PRB
PASSERIDAE (Old World Sparrows Family)					
*Passer domesticus**	House Sparrow	SNA			B
PELECANIDAE (Pelicans Family)					
Pelecanus erythrorhynchos	American White Pelican	S5B,S5M	Not at Risk		POB
PHALACROCORACIDAE (Cormorants Family)					
Phalacrocorax auritus	Double-crested Cormorant	S5B,S5M	Not at Risk		B
PHASIANIDAE (Pheasants, Grouse, and Allies Family)					
Bonasa umbellus	Ruffed Grouse	S5			PRB
*Meleagris gallopavo**	Wild Turkey	SNA			PRB
*Perdix perdix**	Gray Partridge	SNA			PRB
*Phasianus colchicus**	Ring-necked Pheasant	SNA			B
Tympanuchus phasianellus	Sharp-tailed Grouse	S5			B
PICIDAE (Woodpeckers Family)					
Colaptes auratus	Northern Flicker	S5B,SUN,S5M			B
Dryocopus pileatus	Pileated Woodpecker	S3			B

Melanerpes erythrocephalus	Red-headed Woodpecker	S1B,S1M	Endangered	Endangered	B
Picoides pubescens	Downy Woodpecker	S5			B
Picoides villosus	Hairy Woodpecker	S5			B
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B,S5M			B
PODICIPEDIDAE (Grebes Family)					
Aechmophorus occidentalis	Western Grebe	S3B,S3M	Special Concern	Special Concern	B
Podiceps auritus	Horned Grebe	S5B,S5M	Special Concern	Special Concern	B
Podiceps grisegena	Red-necked Grebe	S5B,S5M	Not at Risk		B
Podiceps nigricollis	Eared Grebe	S5B,S5M			B
Podilymbus podiceps	Pied-billed Grebe	S5B,S5M			B
RALLIDAE (Rails, Gallinules, and Coots Family)					
Coturnicops noveboracensis	Yellow Rail	S3B,S3M	Special Concern	Special Concern	POB
Fulica americana	American Coot	S5B,S5M	Not at Risk		B
Porzana carolina	Sora	S5B,S5M			B
Rallus limicola	Virginia Rail	S4B,S4M			POB
RECURVIROSTRIDAE (Stilts and Avocets Family)					
Recurvirostra americana	American Avocet	S4B,S4M			B
SCOLOPACIDAE (Snipe, Woodcock, Sandpipers, Turnstones, and Allies Family)					
Actitis macularius	Spotted Sandpiper	S5B,S5M			B
Bartramia longicauda	Upland Sandpiper	S5B,S5M			B
Gallinago delicata	Wilson's Snipe	S5B,S5M			PRB
Limosa fedoa	Marbled Godwit	S4B,S4M			PRB
Phalaropus tricolor	Wilson's Phalarope	S5B,S5M			B
Tringa semipalmata	Willet	S4B,S4M			B
Tringa solitaria	Solitary Sandpiper	SUB,SUM			POB
SITTIDAE (Nuthatches Family)					
Sitta canadensis	Red-breasted Nuthatch	S5B,S5N,S5M			POB
Sitta carolinensis	White-breasted Nuthatch	S5			B
STRIGIDAE (Typical Owls Family)					

Aegolius acadicus	Northern Saw-whet Owl	S5B,S4N,S5M			POB
Asio flammeus	Short-eared Owl	S3B,S2N,S3M	Threatened	Special Concern	PRB
Bubo virginianus	Great Horned Owl	S4			B
Megascops asio	Eastern Screech-Owl	S2	Not at Risk		POB
STURNIDAE (Starlings Family)					
*Sturnus vulgaris**	European Starling	SNA			B
THRESKIORNITHIDAE (Ibises and Spoonbills Family)					
Plegadis chihi	White-faced Ibis	S4B,S4M			POB
TROCHILIDAE (Hummingbirds Family)					
Archilochus colubris	Ruby-throated Hummingbird	S5B,S4M			B
TROGLODYTIDAE (Wrens Family)					
Cistothorus palustris	Marsh Wren	S4B,S4M			PRB
Cistothorus platensis	Sedge Wren	S5B,S5M	Not at Risk		B
Troglodytes aedon	House Wren	S5B,S5M			B
TURDIDAE (Thrushes Family)					
Catharus fuscescens	Veery	S4B,S4M			PRB
Catharus ustulatus	Swainson's Thrush	S5B,S5M			POB
Sialia currucoides	Mountain Bluebird	S4B,S4M			B
Sialia sialis	Eastern Bluebird	S3B,S3M	Not at Risk		B
Turdus migratorius	American Robin	S5B,SUN,S5M			B
TYRANNIDAE (Tyrant flycatchers)					
Contopus sordidulus	Western Wood-pewee	S4B,S4M			PRB
Contopus virens	Eastern Wood-pewee	S4B,S4M	Special Concern	Special Concern	B
Empidonax alnorum	Alder Flycatcher	S5B,S5M			B
Empidonax minimus	Least Flycatcher	S5B,S5M			B
Empidonax traillii	Willow Flycatcher	S4B,S4M			PRB
Myiarchus crinitus	Great Crested Flycatcher	S5B,S5M			B
Sayornis phoebe	Eastern Phoebe	S4B,S4M			B
Sayornis saya	Say's Phoebe	S4B,S4M			B

	Tyrannus tyrannus	Eastern Kingbird	S5B,S5M	B
	Tyrannus verticalis	Western Kingbird	S5B,S5M	B
VIREONIDAE (Vireo Family)				
	Vireo flavifrons	Yellow-throated Vireo	S3B,S3M	B
	Vireo gilvus	Warbling Vireo	S5B,S5M	B
	Vireo olivaceus	Red-eyed Vireo	S5B,S5M	B
	Vireo philadelphicus	Philadelphia Vireo	S5B,S5M	POB

APPENDIX 5: Recommended Trees and Shrubs for planting at Moose Mountain Provincial Park

Common Name	Latin Name	Origin	Habitat	Growth Habit	Crown Form	Max Height	Max Spread	Site Type	Exposure	Growth Rate	Application
Beaked Hazelnut	Corylus cornuta	NS	Moist	Shrub - Small	Upright, spreading	2	2	Not Particular	Sun/Shade	Moderate	Eco-Buffer, Naturalizing
Wolf Willow	Elaegnus commutata	NS	Dry	Shrub - Small	Upright, spreading	2	2	Not Particular	Sun/Shade	Moderate	Naturalizing, Reclamation
Western Sandcherry	Prunus besseyi	NS	Dry	Shrub - Small	Globe	2	1	Well Drained	Sun	Fast	Hedging
Prickly rose	Rosa acicularis	NS	Dry	Shrub - Small	Upright	1	1	Not Particular	Sun/Shade	Moderate	Eco-Buffers, Hedging
Woods Rose	Rosa woodsii	NS	Dry	Shrub - Small	Upright	1	1	Not Particular	Sun/Shade	Moderate	Eco-Buffers, Hedging
Hedge Rose	Rosa woodsii x Rosa rugosa	E	Dry	Shrub - Small	Upright	2	2	Not Particular	Sun/Shade	Moderate	Eco-Buffers, Hedging
Western Snowberry	Symphoricarpos occidentalis	NS	Dry	Shrub - Small	Spreading	2	2	Not Particular	Sun	Moderate	Eco-Buffers, Reclamation
Pussy Willow	Salix discolor	NS	Moist	Shrub - Medium	Upright	5	3	Moist	Sun	Moderate	Hedging
Red –Osier Dogwood	Cornus sericea var. stolonifera	NS	Moist	Shrub - Medium	Upright	3	3	Not Particular	Sun/Shade	Moderate	Eco-Buffer, Naturalizing
Roundleaf Hawthorn	Crataegus rotundifolia	NS	Dry	Shrub - Medium	Upright, spreading	3	3	Not Particular	Sun/Shade	Moderate	Eco-Buffer, Naturalizing
Beaked Willow	Salix bebbiana	NS	Wet	Shrub - Medium	Upright	4	3	Moist	Sun	Moderate	Hedging
Sandbar Willow	Salix exigua	NS	Wet	Shrub - Medium	Spreading	4	3	Moist	Sun	Fast	Hedging/Reclamation
Red Elderberry	Sambucus racemosa	NS	Wet	Shrub - Medium	Upright	3	1	Well-Drained	Sun	Very Fast	Eco-Buffers, Hedging
Silver Buffaloberry	Shepherdia argentea	NS	Dry	Shrub - Medium	Upright	5	4	Well-Drained	Sun	Moderate	Eco-Buffers, Hedging
Nannyberry	Viburnum lentago	NS	Moist	Shrub - Medium	Upright	4	3	Not Particular	Sun/Shade	Moderate	Eco-Buffers, Hedging
High Bush Cranberry	Viburnum trilobum	NS	Moist	Shrub - Medium	Upright	3	2	Not Particular	Sun/Shade	Moderate	Eco-Buffers, Hedging
Saskatoon	Amelanchier alnifolia	NS	Moist	Shrub - Tall	Upright	5	4	Not Particular	Sun	Moderate	Eco-Buffer, Naturalizing
Choke Cherry	Prunus virginiana	NS	Moist	Shrub - Tall	Upright, Spreading	4	3	Well-Drained	Sun	Fast	Eco-Buffer, Naturalizing
Speckled Alder	Alnus incana ssp. rugosa	NS	Wet	Tree - Small	Upright	5	3	Not Particular	Sun	Fast	Eco-Buffer, Naturalizing

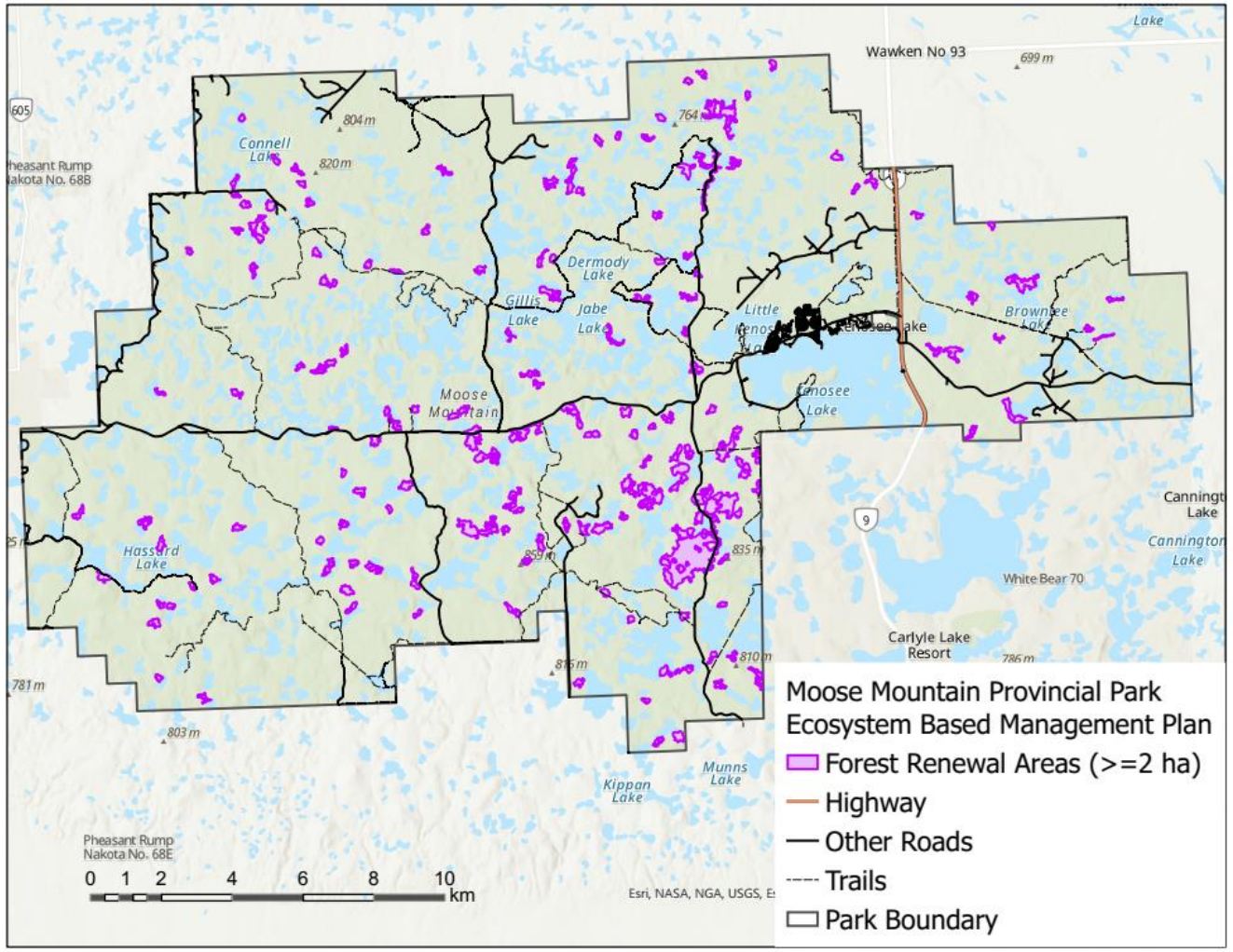
River Birch	Betula occidentalis	NS	Moist	Tree - Small	Upright, open	6	4	Moist, Well Drained	Sun	Moderate	Eco-Buffer, Naturalizing
Rocky Mountain Juniper 'Medora'	Juniperus scopulorum ‘Medora’	E	Dry	Tree - Small	Upright, Pyramidal	5	3	Moist	Sun	Moderate	Specimen
Canada Plum	Prunus nigra	NS	Moist	Tree - Small	Low headed	5	3	Moist	Sun	Moderate	Eco-Buffer, Naturalizing
Pin Cherry	Prunus pensylvanica	NS	Moist	Tree - Small	Low headed, Oval	5	3	Well-Drained	Sun	Fast	Eco-Buffer, Naturalizing
Ussurian Pear	Pyrus ussuriensis	E	Moist	Tree - Small	Low Headed, Oval	7	4	Well-Drained	Sun	Moderate	Specimen, Hedging
Ohio Buckeye	Aesculus glabra	E	Moist	Tree - Medium	Upright round	10	8	Not Particular	Sun/Shade	Moderate	Specimen/Shade
Alder 'Prairie Horizon'	Alnus hirsuta ‘Harbin’	E	Dry	Tree - Medium	Upright	10	8	Not Particular	Sun	Fast	Specimen
Paper Birch	Betula papyrifera	NS	Moist	Tree - Medium	Oval, rounded	12	9	Moist, Well Drained	Sun	Fast	Eco-Buffer, Naturalizing
Paper Birch 'Prairie Dream'	Betula papyrifera ‘Varen’	NS	Wet	Tree - Medium	Oval, rounded	12	9	Moist, Well Drained	Sun	Fast	Specimen
Manitoba Maple 'Baron'	Acer negundo	NS	Moist	Tree - Tall	Upright, Oval	15	12	Not Particular	Sun/Shade	Fast	Specimen/Shade
Manitoba Maple	Acer negundo	NS	Moist	Tree - Tall	Upright, Oval	15	12	Not Particular	Sun/Shade	Fast	Specimen/Shade
Green Ash 'Plains'	Fraxinus pennsylvanica	NS	Dry	Tree - Tall	Upright, Oval	15	8	Not Particular	Sun	Moderate	Specimen/Shade
Siberian Larch	Larix sibirica	E	Moist	Tree - Tall	Upright, Pyramidal	18	6	Well-Drained	Sun	Moderate	Specimen, Hedging
White Spruce	Picea glauca	NS	Moist	Tree - Tall	Pyramidal	18	7	Well Drained	Sun/Shade	Slow	Specimen, Naturalizing
Black Hills Spruce	Picea glauca densata	E	Moist	Tree - Tall	Pyramidal	13	6	Well Drained	Sun/Shade	Slow	Specimen
Colorado Blue Spruce	Picea pungens ‘Glauca’	E	Dry	Tree - Tall	Pyramidal	20	8	Moist	Sun	Moderate	Specimen
Ponderosa Pine	Pinus ponderosa	E	Dry	Tree - Tall	Broad Pyramidal	15	9	Well-Drained	Sun	Slow	Specimen
Scots Pine	Pinus sylvestris	E	Dry	Tree - Tall	Broad Pyramidal	15	8	Well-Drained	Sun	Moderate	Specimen
Balsam poplar	Populus balsamifera	NS	Moist	Tree - Tall	Broad, Oval	15	10	Rich Moist Soils	Sun	Very Fast	Naturalizing
Plains Cottonwood	Populus deloides var. occidentalis	NS	Moist	Tree - Tall	Broad, Oval	25	15	Rich Moist Soils	Sun	Very Fast	Specimen/Shade
Cottonwood Poplar 'Skyfest '	Populus deltoides ‘Jefcot'	E	Moist	Tree - Tall	Broad, Oval	25	10	Rich Moist Soils	Mon	Very Fast	Specimen/Shade
Trembling aspen	Populus tremuloides	NS	Moist	Tree - Tall	Pyramidal rounded	15	9	Not Particular	Sun	Fast	Naturalizing
Hybrid Poplar 'Okanese'	Populus x ‘Okanese’	NS	Moist	Tree - Tall	Pyramidal rounded	20	10	Not Particular	Sun	Fast	Hedging
Hybrid Poplar 'Sundancer'	Populusx”ACWS151’	NS	Moist	Tree - Tall	Narrow Upright	18	3	Not Particular	Sun	Fast	Hedging
Bur Oak	Quercus macrocarpa	NS	Moist	Tree - Tall	Upright, Oval	20	15	Well-Drained	Sun	Moderate	Specimen/Shade
Acute Willow	Salix acutifolia	E	Moist	Tree - Tall	Upright Oval	12	12	Well-Drained	Sun	Fast	Specimen/Hedging

Peach-Leaved Willow	Salix amygdaloides	NS	Moist	Tree - Tall	Upright Oval	8	6	Well-Drained	Sun	Moderate	Specimen/Hedging
Laurel Leaf Willow	Salix pentandra	E	Moist	Tree - Tall	Upright Oval	15	15	Well-Drained	Sun	Fast	Specimen
American Basswood	Tilia americana	E	Moist	Tree - Tall	Upright Oval	15	8	Moist	Sun	Moderate	Specimen/Shade
Brandon American Elm	Ulmus americana	NS	Moist	Tree - Tall	Upright Oval	20	15	Not Particular	Sun	Fast	Specimen/Shade

Origin: NS - Native Saskatchewan, E - Exotic to Saskatchewan

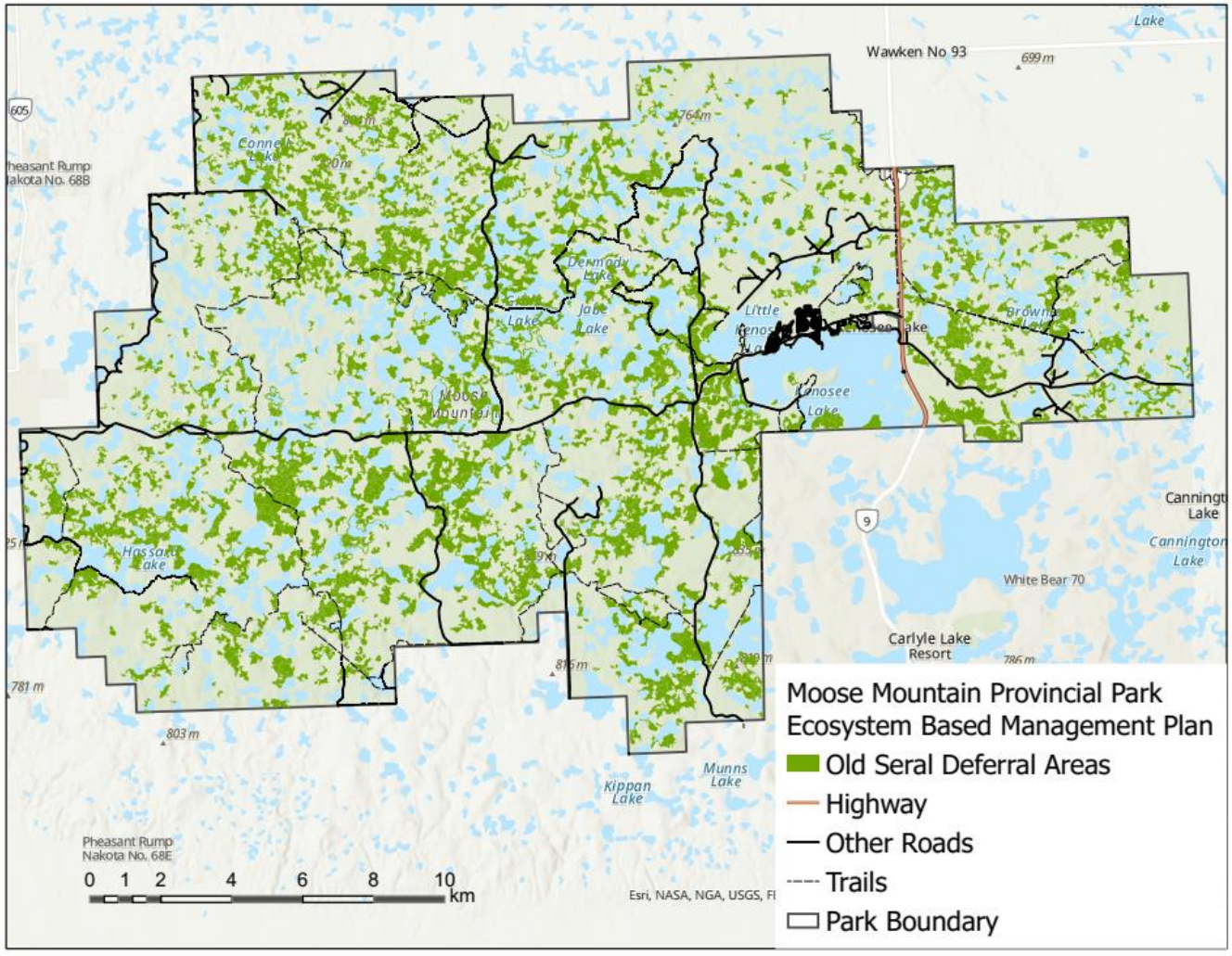
APPENDIX 6: Potential and Priority Areas for Forest Renewal Activities

Potential and priority areas for forest renewal were selected with the goal of converting about 15 percent (~ 1,500 hectares) of the current old to very old stands into young stands while ensuring winter access and logistic feasibility



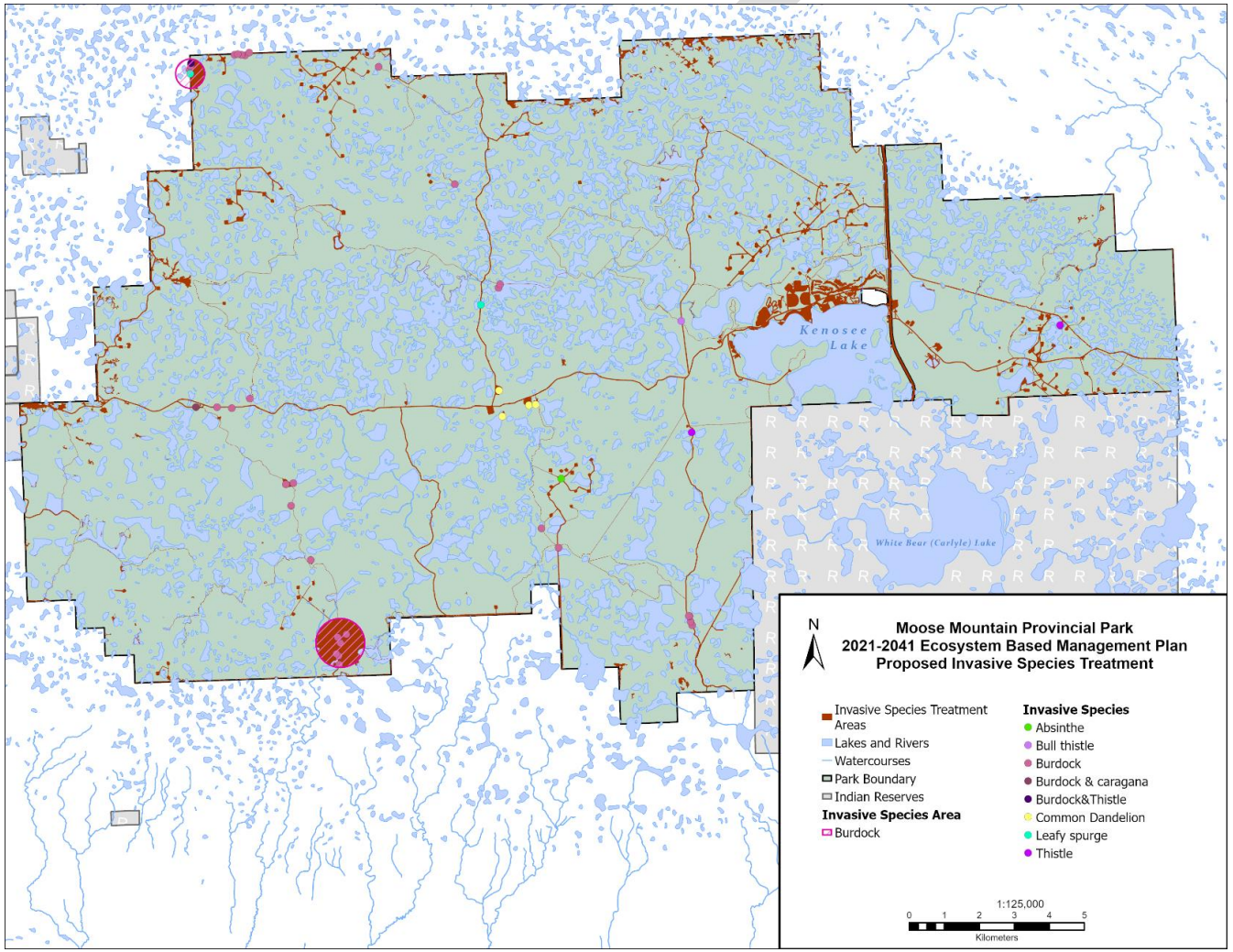
APPENDIX 7: Potential Areas for Natural Forest Succession

Areas for natural forest succession (late seral deferral) were selected to ensure a maximum of 15 percent of late seral stage (i.e. old, very old) forest remains intact to ensure a diversity of age classes.



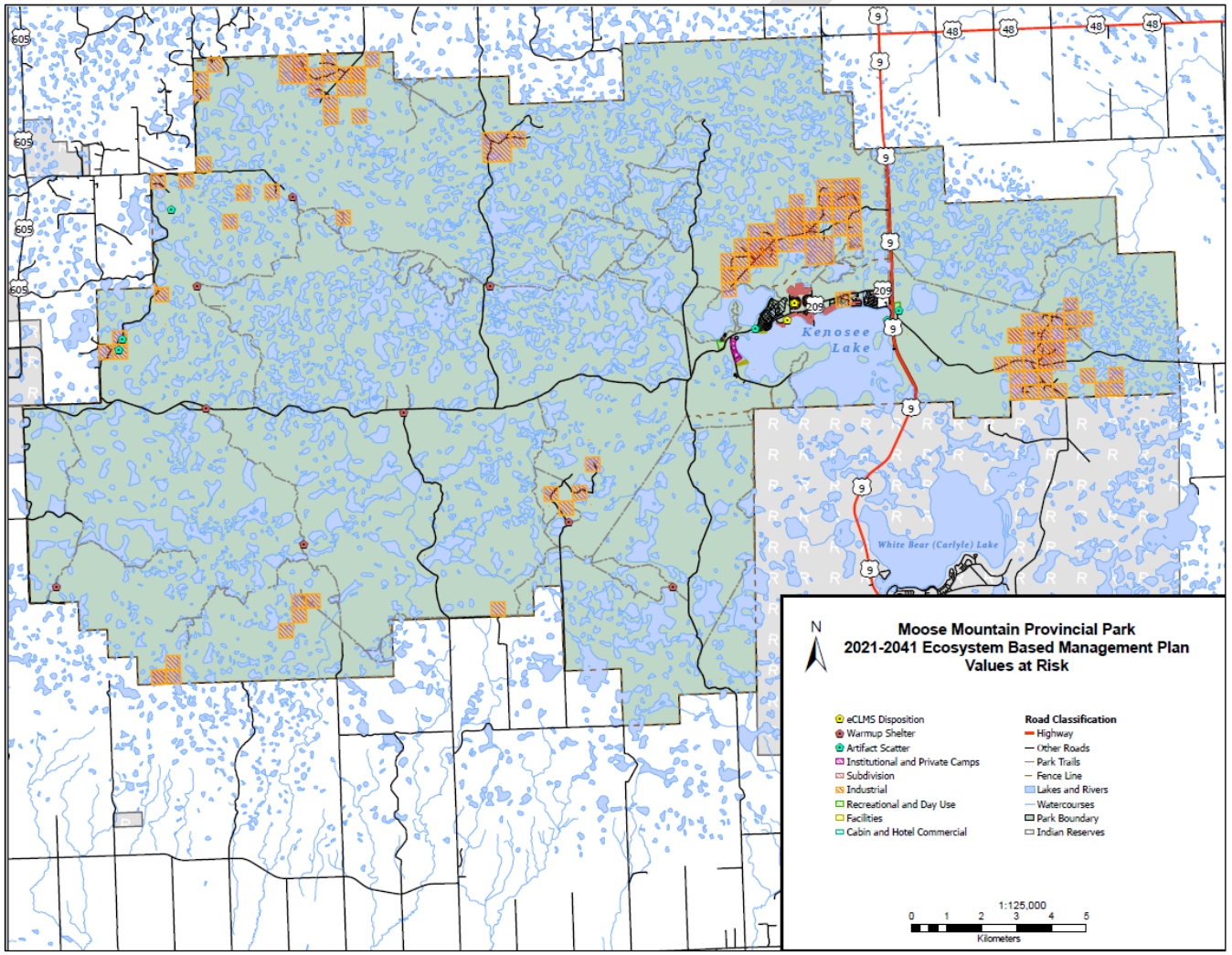
APPENDIX 8: Priority Areas for Invasive Species Treatment

Areas for invasive species treatments were selected based on known patches of invasive species and areas of high use such as: oil and gas developments, core areas, along roadsides, trails, ditches, and all dry grass or upland meadow areas.



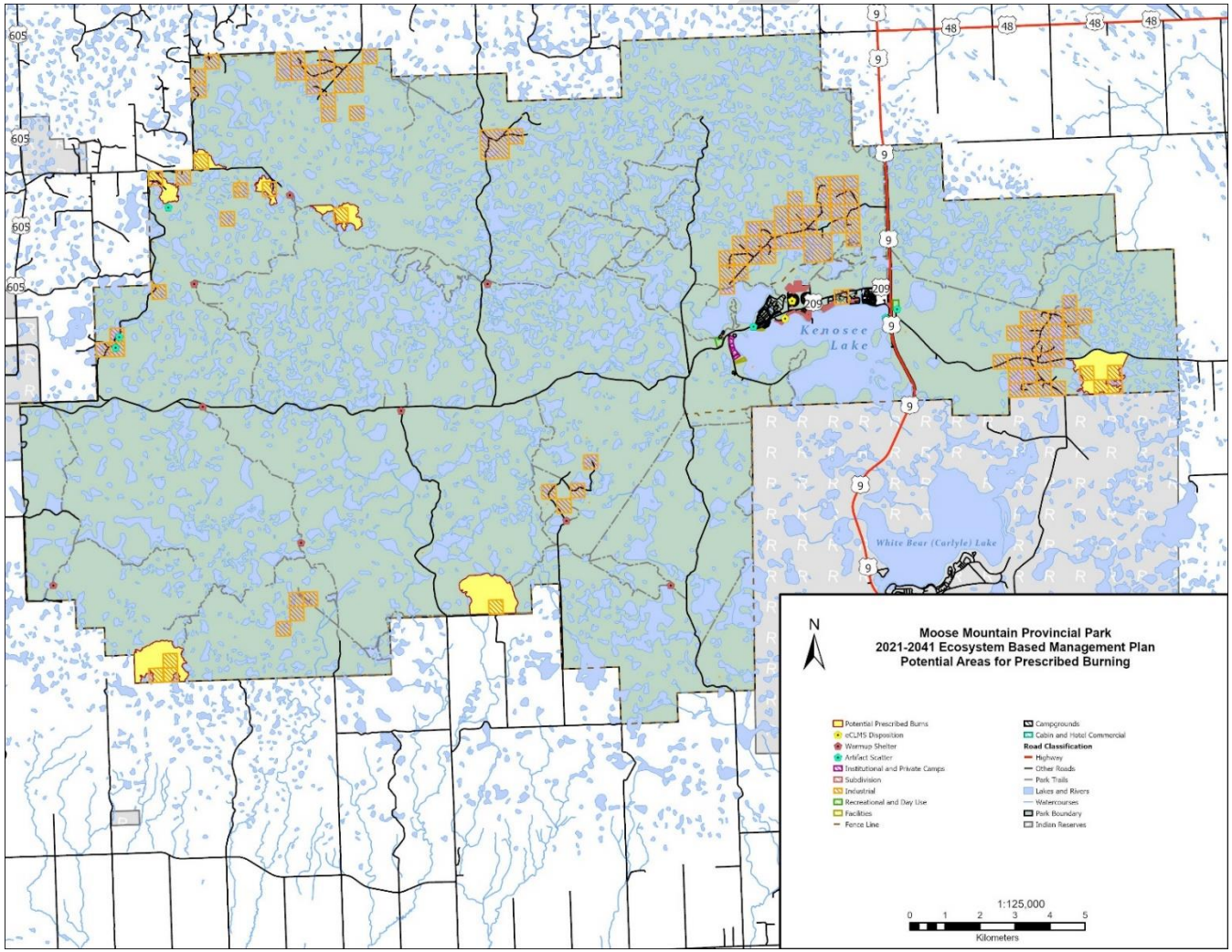
APPENDIX 9: Priority Areas for Wildfire and Fuel Management

Areas for wildlife and fuel management were selected based on values at risk such as: active oil and gas developments, core areas, and all other areas containing infrastructure which could be lost or damaged in the event of a wildfire.



APPENDIX 10: Potential Areas for Prescribed Burning

Potential areas for prescribed burning were selected based on stand age (i.e. mature or over mature), accessibility, availability of natural fire boundaries (i.e. wetlands to be used pinch points, roads, trails), and distance from active oil and gas developments and other values.



APPENDIX 11: Priority Areas for Tree Planting and Silviculture Programs

Areas for planting and silviculture were selected based on high use areas (e.g. core park areas), absence of recent use such as: all abandoned or decommissioned oil and gas developments, including access roads, which are not utilized for access into active oil and gas developments or areas.