APPENDIX 6.3B

Wildlife Habitat Models

October 2017
Project No. 1535751

Table of Contents

TABLES

FIGURES

LIST OF ACRONYMS

CSM	Core Security Model
FRI	Forest Resources Inventory
HSI	Habitat Suitability Index
LIO	Land Information Ontario
MNRF	Ontario Ministry of Natural Resources and Forestry
RSA	regional study area
ZOI	zones of influence

LIST OF UNITS

cm	centimetre
ha	hectare
km	kilometre
km^2	square kilometre
m	metre
<	Less than
%	percent

6.3B1.0 INTRODUCTION

Habitat suitability modeling is an approach and tool that can be used to predict the availability and distribution of habitat for a particular wildlife species or suite of species, and that can help to identify areas of higher quality habitat in a given landscape. This approach has been used extensively to document areas of important wildlife habitat and to predict the potential effects of habitat alteration on wildlife populations (Brooks 1997, Marzluff et al. 2002). Model results and mapping outputs are tools in the evaluation of land management because they help to quantify and display the distribution of habitat "quality" across a landscape. Using habitat suitability modeling is an accepted method of identifying habitat value and specific geographic locations as the basis of impact assessment and wildlife management.

Habitat suitability modeling was used to quantify habitat changes between the Project Case and Base Case, and between the Reasonable Foreseeable Development Case and Base Case for the nine wildlife criteria selected for the Wataynikaneyap Power L.P. Phase 1 New Transmission Line to Pickle Lake Project (Table 6.3B-1). Selected wildlife criteria are provincially and/or federally listed and/or of social/cultural importance, as well as being representative of the habitat requirements of other species (i.e., they limit the amount of assessment and ecological redundancy by capturing the habitat needs of a suite of species or represent reliance on a particular landscape feature of ecological significance, such as a wetland ecosystem). Wildlife criteria selected for habitat suitability modeling are, therefore, representative species that allow for a focused examination of the ways a project may result in changes to the environment in terms of issues of importance to the species and the habitats they use.

Table 6.3B-1: Wildlife Criteria Habitat Suitability Models

Species	Season	Habitat Type
Woodland caribou	All seasons	Category 1 – nursery, winter use and travel corridors[(a)] Category 2 – seasonal ranges Category 3 – other areas in the range
Moose	All seasons	Food, winter, and cover habitats
Wolverine	All seasons	Core security habitat
Little brown myotis	All seasons	Summer maternity roosts, winter hibernacula
Bald eagle	Breeding	Nesting habitat
Canada warbler	Breeding	Nesting habitat
Common nighthawk	Breeding	Nesting habitat
Eastern whip-poor-will	Breeding	Nesting habitat
Olive-sided flycatcher	Breeding	Nesting habitat

Note:

a) Nursery and travel corridors were not mapped but were described qualitatively.

6.3B1.1 Woodland Caribou

Habitat categorization for caribou followed that provided in the *General Habitat Description for the Forest-dwelling Woodland Caribou (Rangifer tarandus caribou)* (MNRF 2013b). The Ontario Ministry of Natural Resources and Forestry (MNRF 2013b) classified habitat into three categories:

- **Category 1:** features or areas that have the lowest tolerance to alteration before their function or usefulness is compromised;
- **Category 2:** features or areas that have moderate tolerance to alteration before their function or usefulness is compromised; and
- **Category 3:** features or areas with the highest tolerance to alteration before their function or usefulness is compromised.

Category 1

Nursery Areas

Nursery areas are defined as generalized features that an individual or a group of adult female caribou select during late parturition, to give birth and raise their calves during spring, summer, and early fall (MNRF 2013b). According to the MNRF (2013b) nursery habitat features typically comprise “lakes and wetland complexes dominated by bog and fens, particularly those interspersed with upland islands and peninsulas (Carr et al. 2011).” Nursery areas delineated by the MNRF include female caribou observations between May 1 and September 15. This date range presumably excludes animal observations associated with large individual movements of adult females made prior to calving and those that occur in fall or early winter (MNRF 2013b). Nursery areas were identified by MNRF biologists and polygons were provided to Wataynikaneyap. Additional areas important for calving/nursery function were identified through a literature review and are discussed qualitatively.

Winter Use Areas

As described in MNRF (2013b), winter use areas typically provide an abundance of ground lichen for winter forage and have lower than average snow depth, which can facilitate easier movement than in surrounding areas. Lichen-rich habitats tend to contain lower amounts of deciduous browse and therefore tend to support lower densities of alternate prey species and predators (MNRF 2013b). Winter use areas may provide refuge from predators. Areas of lower snow depth (e.g., wind-swept areas or dense forest) may be selected more frequently in late winter, depending on the annual snow depth conditions. Individual fidelity to specific winter use areas is typically lower than for nursery areas (Cumming et al. 1996, Ferguson and Elkie 2004, Hazell and Taylor 2011).

Winter use areas were identified by MNRF biologists and polygons were provided to Wataynikaneyap.

Travel Corridors

Travel corridors are the habitat features used by caribou to move between nursery areas and winter use areas in spring and fall (MNRF 2013b). The habitat features of travel corridors are variable and less distinct than other Category 1 habitats. They are typically delineated using caribou movement data (i.e., telemetry data from collared individuals) observed during migration (in April and November). Potential travel corridors were identified through a literature review and a visual examination of other mapped caribou habitat categories and caribou location data. Travel corridors are discussed qualitatively.

Category 2

Seasonal Ranges

The MNRF (2013b) defines seasonal ranges as "large sub-range habitat features that encompass the majority of current caribou distribution during all seasons within the range." These areas tend to be large tracks of mature conifer dominated forests interspersed with lakes and wetlands. Seasonal ranges are relatively undisturbed and unfragmented, typically do not support high densities of moose, and therefore provide refuge from predators such as wolves and black bears (MNRF 2013b).

Seasonal ranges were estimated and mapped using resource selection probability function developed by the MNRF. Polygons delineating seasonal ranges were provided to Wataynikaneyap by the MNRF.

Category 3

Remaining Areas in the Range

Areas in the regional study area (RSA) not identified as Category 1 or 2 habitat were considered Category 3 habitat. These areas generally have the biophysical features and forest composition consistent with seasonal ranges but are currently young or disturbed (MNRF 2013b). Disturbance types considered as Category 3 habitat include natural disturbances (i.e., fires and blowdown areas) and temporary anthropogenic disturbances (e.g., cutblocks <40 years). All other disturbances are considered permanent disturbances and therefore do not consist of caribou habitat. Category 3 habitat polygons were estimated and mapped using the resource selection probability function developed by the MNRF. Polygons delineating Category 3 habitat were provided to Wataynikaneyap by the MNRF.

6.3B1.2 Moose

Availability and distribution of moose (*Alces americanus*) habitat was estimated and mapped using Land Cover 2000 and Forest Resource Inventory (FRI) data in a GIS platform. Habitat categorization for moose followed a Habitat Suitability Index (HSI) model approach, and good quality habitats were defined according to a threshold representing the minimum value below which the habitat is not suitable for reproduction and survival (Ackakaya et al. 2004). The standard threshold value is typically 0.5, which was used in this assessment. For clarity, habitats with values greater than or equal to 0.5 were considered moderate to high suitability for moose, habitat values less than 0.5 were considered nil to low suitability.

The moose HSI was similar to that used by the Ontario Landscape Tool for predicting moose densities (Rempel 2008, Elkie et al. 2013). The model considers the following three parameters (Figure 6.3B-1):

- percent of area in young forest cover types;
- percent of area in mature conifer; and
- percent of area in mature mixed forest.

The HSI was applied to FRI data. Where FRI was not available (i.e., areas in the RSA north of the Lac Seul Forest) Ontario Land Cover 2000 data were used instead. Provincial forest fire data were intersected with FRI and Land Cover 2000 data to identify areas associated with burns. Areas intersecting with fires less than 10 years or greater 20 years in age were removed. Table 6.3B-2 describes how the FRI attributes of plan forest units (PLANFU)/secondary forest unit (SFU) and year of origin (AGE), Land Cover 2000 land cover types, and provincial forest fire data were rescaled to apply the HSI.

Table 6.3B-2: Reclassification Land Cover 2000 Land Cover, Forest Resource Inventory, and Provincial Wildfire Data to Apply Moose Habitat Suitability Index

HSI Land Cover	FRI	Land Cover 2000	Provincial Wildfire Data
Young forest	**POLYTYPE** is FOR and **AGE** is <20	Sparse forest, Regenerating depletion	Burn Age is ≥10 to ≤20 years old [since 2016], (i.e., Year of Burn is 2006 to 1996). Over-writes any forest land cover type in FRI data as "young forest". Land Cover 2000 class's dense coniferous forest, treed fen, and treed bog were also reclassified as "young forest".
Mature conifer	**POLYTYPE** is FOR and **PLANFU/SFU** is [Any combination of the following] BF1, BFDOM, BfPur, CE1, CED, CEDAR, COSHA, OCLow,PC1, PJ1, PJC, PjDee, PjSha, PJDOM, PJP, PJPUR, PR1, PrDom, PrwMx, PwDom, PRW, PRWMX, PW1, PWR, SbDee, SbLow, SbMx1, SbSha, UplCe, SBDOM, SBL, SBLOW, SBM, SBP, SPC, SPL, SPU, SPUP and **AGE** is >40	Coniferous forest OR Treed fen OR Treed bog OR Coniferous swamp	Not Applicable
Mature mixed wood	**POLYTYPE** is FOR and **PLANFU/SFU** is [Any combination of the following] , BFM, BfMx1, CMX, CNM, COMX1, COMX2, ConMx, CONMX, MIXED, PjMx1, MC1, PJM, MC2, and **AGE** is >40	Mixed forest	Not Applicable

Note: Land Cover 2000 types of coniferous, treed fen, treed bog, coniferous swamp and mixed forest are assumed to represent mature forest stands.

FRI = Forest Resource Inventory; PLANFU = plan forest units; SFU = secondary forest unit; ≥ = greater than or equal to; ≤ = less than or equal to; > = greater than.

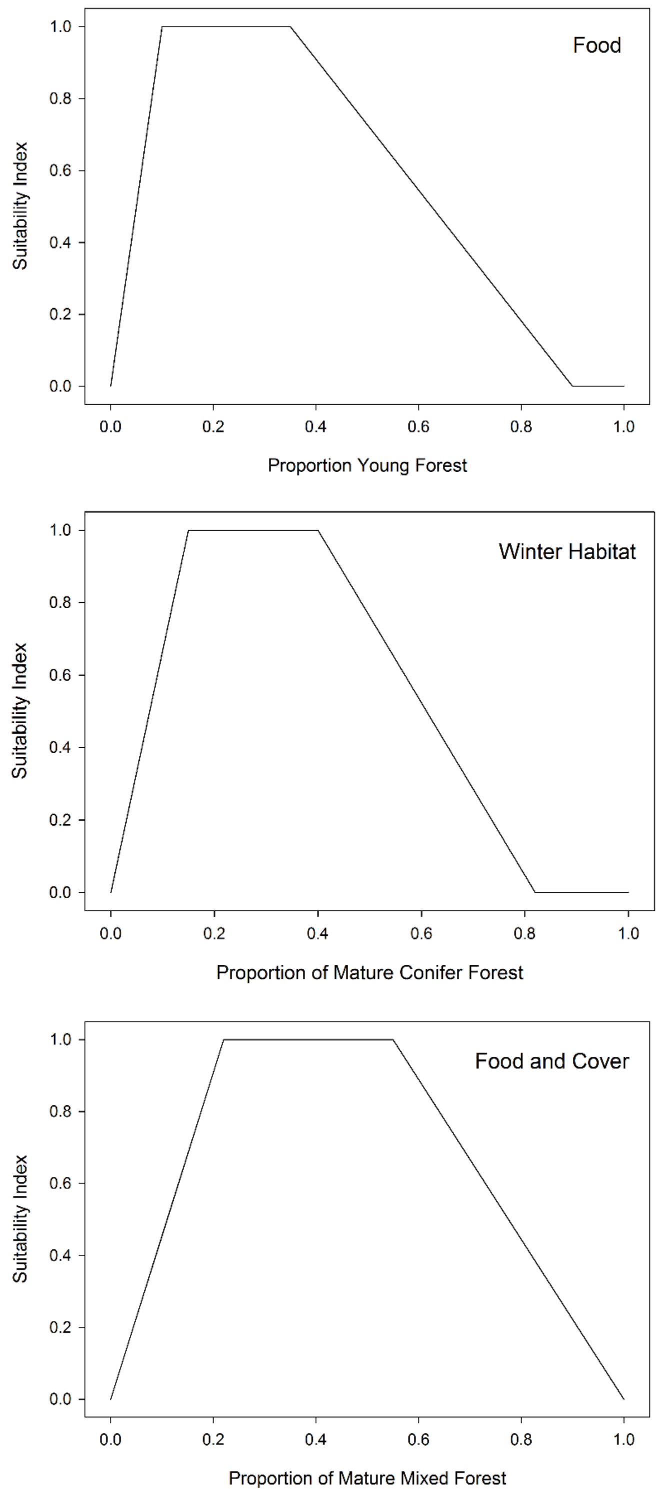

Figure 6.3B-1: Suitability Relationships of Moose for Young Forest, Mature Conifer and Mixed Wood Habitat Interpolated from Rempel (2008)

Preserving the original resolution of the Land Cover 2000 data, a 400-m search radius from each default map unit was used to quantify the percent young forest, mature conifer and mixed forest and create one new attribute at a 50-ha unit scale (Elkie et al. 2013). Subsequently each map unit was then classified as “moderate to high suitability” (i.e., unit value of 1) if the following conditions are met:

- 5% to 65% of 50 ha area in young forest; or
- 10% to 60% of 50 ha area in mature conifer; or
- 10% to 75% of 50 ha area in mature mixed forest.
- If conditions are not met, then unit value = 0 (i.e., habitat was low to nil suitability).

6.3B1.3 Wolverine

Wolverines use a wide range of habitat types within their large home ranges, but appear to show a preference for undisturbed areas of coniferous forest (Pasitschniak-Arts and Larivière 1995). Wright (2004) reported wolverines in boreal forests in northwestern Alberta preferred mature stands of black spruce or diverse mixedwood stands with conifers intermixed with dead aspen and poplar for food cache and resting sites. Boles (1977) suggested that wolverines use trees to escape from wolves and so availability of wooded areas may be important for avoiding predation. However, other studies indicate that wolverines do not avoid natural openings and their density may be more closely linked to food accessibility and proximity to humans than to specific habitat attributes (Petersen 1997, Krebs et al. 2007).

Wolverines are highly sensitive to human disturbance and avoid disturbed areas (Banci 1994, Magoun and Copeland 1998, May et al. 2006). Wolverines appear to be most sensitive to disturbance during denning, with reports of adult females moving kits within hours of detecting humans or human disturbance (Magoun and Copeland 1998). Radio-collared wolverines in British Columbia showed avoidance of disturbed areas in occupied habitats (May et al. 2006). Both May et al. (2006) and Krebs et al. (2007) showed that habitat selection by wolverines was negatively influenced by human activity including roads, winter recreation areas, and recently logged landscapes.

As wolverine habitat selection is more closely linked to food accessibility and proximity to humans than to specific habitat attributes, a full HSI model would not be an effective tool for assessing the effects of the Project on this species. Due to the apparent sensitivity of wolverines for human disturbance, a Core Security Model (CSM) was developed to estimate the amount of habitat that may be affected by disturbance zones of influence (ZOIs), as well as the habitat far enough from development that it can be considered core security habitat. Core security habitat refers to areas where the probability of contact with humans, and the associated risk of mortality, is minimized. Areas outside of ZOIs are classified as moderate to high suitability, areas within ZOIs are classified as low suitability, and disturbed areas are assumed to have no value for wolverines.

There is a lack of literature regarding disturbance ZOIs for wolverine. However, for the prairie and northern region Environment Canada recommends minimum setback distances from various levels of disturbance during the winter denning season (Environment Canada 2009; Table 6.3B-3). Existing features not associated with noise disturbance (e.g., inactive quarries) are not buffered, as doing so would underestimate the effects of the Project in the Project Case.

Table 6.3B-3: Zone of Influence Buffers Applied for Various Levels of Disturbance for the Wolverine Core Security Model

Disturbance Type	Feature Type	Zone of Influence Buffer[a] (m)
Rural freeway, 4-lane divided highway	Linear	1,000
Rural arterial undivided highway	Linear	1,000
Rural collector undivided road, ramp	Linear	1,000
Rural local undivided road, street	Linear	500
Rural resource road	Linear	500
Recreation road	Linear	500
Service road	Linear	500
Forestry road	Linear	500
Winter road	Linear	500
Railway	Linear	500
Aggregate site (active)	Polygon	500
Building, cottage, residential site, recreation camp, recreation point	Point[b]	500
Work camp	Point[c]	500
Airport	Polygon	500
Forest processing facility	Point[d]	500
Waste management site	Polygon	500
Dam and barrier	Point[e]	250
Communication/fire towers	Point[f]	250
Trapper cabin	Point[b]	250
Utility site	Point[g]	250
Utility line	Linear	250
Waterpower generation station	Point[h]	250
Tourism establishment area	Polygon	250

Source: Environment Canada (2009)

a) A buffer was applied to point and polygon features and a corridor was applied to linear features.

b) Point feature was buffered by 5 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

c) Point feature was buffered by 100 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

d) Point feature was buffered by 310 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

e) Point feature was buffered by 50 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

f) Point feature was buffered by 21 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

g) Point feature was buffered by 77 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

h) Point feature was buffered by 37 m, as per mean area of this feature inferred from imagery, to estimate a footprint.

6.3B1.4 Little Brown Myotis

6.3B1.4.1 General Habitat Model

The habitat requirements of the little brown myotis (*Myotis lucifugus*), also known as the little brown bat, vary by season (COSEWIC 2013). In winter, little brown myotis hibernate in caves or mines where the open and accessible space extends below the frost line, and above zero temperatures and high humidity are relatively constant throughout the winter. In summer, maternity colonies are formed in trees, rock crevices, buildings, bat houses or under bridges. The trees that this species use are often large, sometimes partly dead (called snags or wildlife trees), features which are generally more abundant in late successional forest (i.e., old growth). Although there is considerable variation in the species of trees in which these bats roost, Lacki et al. (2007) identified little brown myotis most often in large trembling aspen (*Populus tremuloides*), but also in white spruce (*Picea glauca*) and red spruce (*Picea rubra*). Olson and Barclay (2013) found the majority of roosts in trembling aspen or balsam poplar (*Populus balsamifera*).

Myotis species are typically closed-canopy specialists (Kalcounis and Brigham 1995, Jung et al. 1999, Morris et al. 2010), however, little brown myotis is more of a generalist than other *Myotis* species (e.g., northern myotis [*Myotis septentrionalis*]). It is tolerant of anthropogenic disturbance, often favouring man-made structures, and prefers to forage over open areas including ponds, rivers, forest gaps, forest edges or along trails and roads (Segers and Broders 2014).

Habitat mapping for this criterion considered only summer maternity roosting habitat. Habitat mapping does not fully capture foraging habitat. Foraging habitat is discussed qualitatively as appropriate. Maternity roosting habitat was identified using FRI data to determine mature and late successional seral stage forest within the ecosites described in Table 6.3B-4. The Forest Management Guide for Boreal Landscapes (MNR 2014) was used to determine the onset age of mature development stage for FRI ecosites (Table 6.3B-4). Ecosites were identified as potential maternity roosting habitat following ecosite suggestions provided in a letter from the MNRF on December 13, 2016. The Land Cover 2000 land cover types that were considered to provide moderate to high suitability bat maternity habitat were dense deciduous forest and dense mixed forest.

Table 6.3B-4: Forest Resource Inventory Ecosites Identified as Moderate to High Suitability for Breeding Habitat for Little Brown Myotis in the Regional Study Area

Code[a]	Description	Onset Age of Mature Forest[a] (Years)
NE01	Black Spruce - Jack Pine/White Spruce - White Birch	70
NE03	White Birch - Trembling Aspen - Black Spruce - Coarse Soil	50
NE06	Trembling Aspen - Black Spruce - Jack Pine/Black Spruce - Trembling Aspen - Balsam Fir	60
NE07	Trembling Aspen - White Birch/Trembling Aspen - White Spruce - White Birch	60
NE09	Black Spruce - Larch - Moist Soil/White Spruce - Balsam Fir - White Cedar	70
NE10	Trembling Aspen - Black Spruce - Balsam Poplar - Moist Soil	60
NE15	Red Maple	60
NW15	Red Pine- White Pine: Sandy Soil	80
NW16	Hardwood - Fir - Spruce Mixedwood: Sandy Soil	60
NW18	Red Pine - White Pine: Fresh, Coarse Loamy Soil	80
NW19	Hardwood - Fir - Spruce Mixedwood: Fresh, Sandy - Coarse Loamy Soil	60
NW23	Hardwood - Fir - Spruce - Mixedwood: Moist, Sandy - Coarse Loamy Soil	60
NW24	Red Pine - White Pine: Fresh, Fine Loamy Soil	80
NW28	Hardwood - Fir - Spruce Mixedwood: Fresh, Silty Soil	60
NW29	Hardwood - Fir - Spruce Mixedwood: Fresh, Fine Loamy - Clayey Soil	60
NW30	Black Ash Hardwood: Fresh, Silty - Clayey Soil	60
NW33	Hardwood - Fir - Spruce Mixedwood: Moist, Silty - Clayey Soil	60
NW38	Rich Swamp: Black Ash (Other Hardwood): Organic - Mineral Soil	60
C17	Poplar-White Birch	60
C18	Poplar-White Birch-White Spruce-Balsam Fir	60
C19	Poplar-Jack Pine-White Spruce-Black Spruce	60
C21	White Cedar-White Pine-White Birch-White Spruce	70
C22	White Cedar-Other Conifer	70
C27	Sugar Maple-White Birch-Poplar-White Pine	60
C29	Sugar Maple-Yellow Birch	60
C33	White Cedar-Other Conifer: very moist to wet soils	70

a) Age based on mature age classes in Table 4 and 5 from the Forest Management Guide to Boreal Landscapes (MNR 2014).

6.3B1.4.2 Field Assessment of Suitable Bat Maternity and Wintering Habitat

Suitable little brown myotis maternity roosting habitat and potential hibernacula were identified within an approximate 200 m corridor along the preliminary proposed corridor, corridor alternative around Mishkeegogamang, and corridor alternative through Mishkeegogamang proposed alignments by a bat biologist. A flight over the proposed corridors was completed using a helicopter on May 24 and 25, 2016. The ground was snow-free and trees and other vegetation did not have leaves (i.e., ideal conditions of snow-free and leaf-off). The flight was also recorded using a video camera mounted to the bottom of the helicopter so that the imagery could be reviewed at a later date.

A total of 302.3 km (60.5 km^2) was mapped along the preliminary proposed corridor, 240.2 km (48.0 km^2) was mapped along the corridor alterative around Mishkeegogamang, and 291.6 km (58.3 km^2) was mapped along the corridor alternative through Mishkeegogamang.

A qualitative estimate of suitable bat maternity roosting habitat was determined by identifying live and dead trees with greater than 25 cm diameter at breast height that contained holes (e.g., woodpecker holes). These trees are defined as snags for the bat habitat assessment, even if the trees were not dead. Snag density estimates were determined using the following qualitative approach:

- **None:** Open areas, clearings or treed habitat were no large deciduous snags were noticed, or these were very sparsely distributed.
- **Low:** Infrequent large deciduous snags present which could be suitable for bat maternity roosts.
- **Moderate:** Snags frequently observed.
- **High:** Extensive mature deciduous trees with visible dead trees and in high density above the forest canopy.

Buildings were identified as bat maternity roosting habitat and were identified as point features. Areas of cliffs or bedrock outcrops with little vegetation or lichen cover (i.e., outcrops or cliffs with visible openings that could extend underground) were considered potential hibernacula.

6.3B1.5 Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) in eastern Canada are short distance migrants that breed in eastern Canada in the summer, and may migrate farther south for the winter (Wright 2016). The Project is located in breeding habitat for the bald eagle, and this habitat is the focus of this assessment. Bald eagles are found near major lakes or rivers (Armstrong 2014), often using perches within approximately 500 m of open water when foraging at or near the surface of the water (Buehler 2000). Shallow water and near-shore emergent vegetation increase the likelihood that live fish prey will be available near the surface (Buehler 2000, Armstrong 2014). Foraging area quality may also be higher in areas without human development and disturbance (Buehler 2000). Bald eagle home range sizes vary from 7 km² in Saskatchewan to up to 21.6 km² in Oregon (Buehler 2000); assuming circular home ranges, this corresponds to home range radius of 1.5 to 2.6 km.

Bald eagle breeding territories tend to be within 2 km of water near lakes greater than 1,000 ha with more than 11 km of shoreline (Armstrong 2014). Bald eagles nest in mature or old growth forest with some edge, in the largest available trees, typically 20 to 60 m in height (Buehler 2000). There are a total of 146 bald eagle nests in the Preliminary Proposed Corridor and corridor alternatives RSAs (MNRF 2017). A tree species is not recorded for 61 of these nests; for the remaining 85 nests, 41% of the nests are in trembling aspen (*Populus tremuloides*), 35% are located in balsam poplar (*Populus balsamifera*), 14% are in white pine (*Pinus strobus*), 3% are in red pine (*Pinus resinosa*), 3% are in jack pine (*Pinus banksiana*), and 2% are in white spruce (*Picea glauca*) (MNRF 2017). Bald eagles prefer nesting in forests with 30% to 50% canopy cover, with large trees suitable for nests and perching (Antony and Isaacs 1989). While bald eagles have clear nest tree preferences, they are also flexible in nest site selection (Grier and Guinn 2003).

Moderate to high suitability bald eagle nesting habitat in the RSA was mapped as the following:

- Land cover 2000 classes of dense deciduous, dense coniferous, and dense mixed forest within 2.6 km of major waterbodies (i.e., greater than 300 ha), and stream order 7 or higher watercourses using the Strahler method in the MNRF waterbody dataset;
- Forest Resource Inventory forest ecosites listed in Table 6.3B-5 below with an age structure greater than 80 years and within 2.6 km of major waterbodies (i.e., greater than 300 ha), and stream order 7 or higher watercourses.
- Cliffs identified from the 2016 MNRF Land Information Ontario (LIO) data were also mapped as moderate to high suitability bald eagle nesting habitat if they were within 2.6 km of major waterbodies or rivers.

Moderate to high suitability bald eagle winter roosting habitat is captured within the 2.6 km buffer of major waterbodies and rivers. In winter, bald eagles will congregate in night roosts that afford them protection from cold weather. These roosts are traditionally used for successive years and are located in mature forest in proximity to foraging habitat (Hall 1998).

Table 6.3B-5: Forest Resource Inventory Ecosites Identified as Moderate to High Suitability for Breeding Habitat for Bald Eagle in the Regional Study Area

Code[(a)]	Description
NE03	White Birch - Trembling Aspen - Black Spruce - Coarse Soil
NE06	Trembling Aspen - Black Spruce - Jack Pine/Black Spruce - Trembling Aspen - Balsam Fir
NE07	Trembling Aspen - White Birch/Trembling Aspen - White Spruce - White Birch
NE10	Trembling Aspen - Black Spruce - Balsam Poplar - Moist Soil
NW16	Hardwood - Fir - Spruce Mixedwood: Sandy Soil
NW18	Red Pine - White Pine: Fresh, Coarse Loamy Soil
NW19	Hardwood - Fir - Spruce Mixedwood: Fresh, Sandy - Coarse Loamy Soil
NW23	Hardwood - Fir - Spruce - Mixedwood: Moist, Sandy - Coarse Loamy Soil
NW24	Red Pine - White Pine: Fresh, Fine Loamy Soil
NW26	Spruce - Pine / Feathermoss: Fresh, Fine Loamy - Clayey Soil
NW27	Fir - Spruce Mixedwood: Fresh, Silty - Fine Loamy Soil
C17	Poplar-White Birch
C18	Poplar-White Birch-White Spruce-Balsam Fir
C19	Poplar-Jack Pine-White Spruce-Black Spruce
C21	White Cedar-White Pine-White Birch-White Spruce
C27	Sugar Maple-White Birch-Poplar-White Pine
NW4	Cliff

a) Ecosite (Racey et al. 1996)

6.3B1.6 Canada Warbler

Throughout their range, Canada warblers (*Cardellina canadensis*) nest in a range of usually wet, forest types, with a well-developed, dense shrub layer (COSEWIC 2008, Environment Canada 2015b). This species is commonly found in shrub marshes, swamps dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*), and riparian woodlands (COSEWIC 2008). In the eastern portion of their range, which includes the RSA, Canada warblers are associated with wet mixedwood forests and early successional forests (6 to 30 years) created by forest harvesting or natural disturbance (Ball and Bayne 2014, Environment Canada 2015b).

The Land Cover 2000 and FRI data were used to determine suitable Canada warbler habitat. The following Land Cover 2000 habitats were determined to be of moderate to high suitability for Canada warbler:

- dense mixed forest;
- treed bog;
- treed fen;
- regenerating depletion forest;
- forest depletion – cuts;
- forest depletion – burns; and
- riparian areas (all land cover types).

The following FRI habitats were determined to be of moderate to high suitability for Canada warbler:

- forest stands 6 to 30 years of age (all ecosites; using year of origin attribute in the FRI dataset calibrated to 2016 calibrated to 2016);
- riparian areas (all ecosites); and
- forest stands greater than 30 years of age (using year of origin attribute in the FRI dataset calibrated to 2016) in the ecosites presented in Table 6.3B-6.

Table 6.3B-6: Forest Resource Inventory Ecosites Identified as Moderate to High Suitablity for Breeding Habitat for Canada Warbler in the Regional Study Area

Code[a]	Description
C18	Poplar-White Birch-White Spruce-Balsam Fir
C19	Poplar-Jack Pine-White Spruce-Black Spruce
C21	White Cedar-White Pine-White Birch-White Spruce
C22	White Cedar-Other Conifer
C31	Black Spruce-Tamarack: very moist mineral and wet organic soils
C32	White Cedar-Black Spruce-Tamarack: very moist mineral and wet organic soils
C33	White Cedar-Other Conifer: very moist to wet soils
NE05	Black Spruce - Fine/Medium Soil
NE06	Black Spruce-Trembling Aspen/Trembling Aspen - Black Spruce - Jack Pine/Trembling Aspen - Black Spruce - Balsam Fir
NE08	Black Spruce - Feathermoss - Sphagnum - Moist Soil
NE09	Black Spruce - Larch/White Spruce - Balsam Fir - White Cedar
NE11	Black Spruce - Labrador Tea - Organic Soil
NE12	Black Spruce - Larch - Labrador Tea - Organic Soil
NE13	Black Spruce - Larch - Speckled Alder/White Cedar - Black Spruce
NE14	Black Spruce - Leatherleaf - Organic Soil
NE15	Red Maple
NW16	Hardwood - Fir - Spruce Mixedwood: Sandy Soil
NW17	White Cedar: Fresh - Moist, Coarse - Fine Loamy Soil
NW19	Hardwood - Fir - Spruce Mixedwood: Fresh, Sandy - Coarse Loamy Soil
NW23	Hardwood - Fir - Spruce - Mixedwood: Moist, Sandy - Coarse Loamy Soil
NW28	Hardwood - Fir - Spruce Mixedwood: Fresh, Silty Soil
NW29	Hardwood - Fir - Spruce Mixedwood: Fresh, Fine Loamy - Clayey Soil
NW30	Black Ash Hardwood: Fresh, Silty - Clayey Soil
NW33	Hardwood - Fir - Spruce Mixedwood: Moist, Silty - Clayey Soil
NW34	Treed Bog: Black Spruce / Sphagnum: Organic Soil
NW35	Poor Swamp: Black Spruce: Organic Soil
NW36	Intermediate Swamp: Black Spruce (Tamarack): Organic Soil
NW37	Rich Swamp: Cedar (Other Conifer): Organic Soil
NW40	Treed Fen: Tamarack - Black Spruce / Sphagnum: Organic Soil
NW44	Thicket Swamp: Organic - Mineral Soil

a) Ecosite (Racey et al. 1996)

6.3B1.7 Common Nighthawk

Common nighthawks (*Chordeiles minor*) breed in open habitats, such as recently logged and burned areas, open forests, open bogs and fens, and rock barrens (COSEWIC 2007a, Brigham et al. 2011). Nesting areas are chosen in association with large trees for roosting and vegetation for the production of flying insect prey (Brigham et al. 2011). This species avoids areas of dense, intact forest (Brigham et al. 2011).

The Land Cover 2000 and FRI data were used to determine suitable common nighthawk habitat. The following Land Cover 2000 habitats were determined to be of moderate to high suitability for common nighthawk:

- bedrock;
- sparse forest;
- forest depletion – cuts;
- forest depletion – burns;
- forest regenerating depletion; and
- edge areas: 50 m into dense coniferous, dense deciduous, and dense mixed forest landcover classes that border one or more of the following:
  - water;
  - bedrock;
  - sparse forest;
  - forest depletion – cuts;
  - forest depletion – burns; and
  - forest regenerating depletion.

The following FRI habitats were determined to be of moderate to high suitability for common nighthawk:

- Forest stands (polytype FOR) aged 0 to 10 years (pre-sapling stage; using year of origin attribute in the FRI dataset calibrated to 2016);
- Rock barren (NW7);
- Forest stands aged 10 to 31 years of the following types (using year of origin attribute in the FRI dataset calibrated to 2016):
  - hardwood-spruce-fir mixedwood (C18, NW16, NW19, NW28, NW29);
  - hardwood-pine-spruce mixedwood (C19, C20, NE06);
  - hardwood-white pine mixedwood (C27);
  - hardwood (C29);
  - hardwood-spruce mixedwood (NE01, NE03, NE07); and
  - jack pine (NE02, C15, NW13).

- Edge areas: 50 m into upland forested ecosites aged 31 years (immature forest; using year of origin attribute in the FRI dataset calibrated to 2016) and older that border one or more of the following:
  - treed and open wetlands;
  - lakes, ponds, and rivers;
  - burns aged 0 to 10 years; and
  - upland ecosites and polytypes aged 0 to 10 years.

6.3B1.8 Eastern Whip-poor-will

Eastern whip-poor-wills (*Caprimulgus vociferus*) breed in semi-open or patchy forests; wide-open spaces and dense forests are avoided (COSEWIC 2009). Forest structure seems to be more important than forest composition, but whip-poor-wills are found in dry deciduous or mixedwood forests throughout most of the species' range (Cink 2002). Whip-poor-wills are also commonly found in rock or sand barrens with scattered trees, old burns, other disturbed sites with early forest succession, and pine plantations (Cink 2002, COSEWIC 2009). This species prefers even-aged successional habitats and is uncommon in mature forests, although individuals may use openings in mature forest areas (Bushman and Therres 1988, Government of Ontario 2015a). Nests require tree cover, shade, and sparse ground cover, and they need to be in close proximity to open areas used for foraging (MNR 2013). Transmission line ROWs and road corridors may provide suitable foraging habitat for this species (COSEWIC 2009).

The Land Cover 2000 and FRI data were used to determine suitable whip-poor-will habitat. The following Land Cover 2000 habitats were determined to be of moderate to high suitability for whip-poor-will:

- bedrock;
- sparse forest;
- forest depletion – cuts;
- forest depletion – burns; and
- edge areas: 50 m into dense coniferous, dense deciduous, and dense mixed forest landcover classes that border one or more of the following:
  - water;
  - bedrock;
  - sparse forest;
  - forest depletion – cuts; and
  - forest depletion – burns.

The following FRI habitats were determined to be of moderate to high suitability for common nighthawk:

- Forest stands (polytype FOR) aged 0 to 10 years (pre-sapling stage; using year of origin attribute in the FRI dataset calibrated to 2016);
- Rock barren (NW7);
- Forest stands aged 10 to 31 years of the following types (using year of origin attribute in the FRI dataset calibrated to 2016):
  - hardwood-spruce-fir mixedwood (C18, NW16, NW19, NW28, NW29);
  - hardwood-pine-spruce mixedwood (C19, C20, NE06);
  - hardwood-white pine mixedwood (C27);
  - hardwood (C29);
  - hardwood-spruce mixedwood (NE01, NE03, NE07); and
  - jack pine (NE02, C15, NW13).
- Edge areas: 50 m into upland forested ecosites aged 31 years (immature forest; using year of origin attribute in the FRI dataset calibrated to 2016) and older that border one or more of the following:
  - treed and open wetlands;
  - lakes, ponds, and rivers;
  - burns aged 0 to 10 years; and
  - upland ecosites and polytypes aged 0 to 10 years.

6.3B1.9 Olive-sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) breed in forested areas in Canada and parts of the United States and overwinter in central and south America. The Project is located in breeding habitat for this species, which is, therefore, the focus of this assessment. Olive-sided flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which to hunt flying insects. Olive-sided flycatchers nest in forested stands but, because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings such as gaps within old-growth forest stands, as well as meadows, rivers, and wetlands adjacent to forested habitat (COSEWIC 2007, Altman and Sallabanks 2012). As a result, their abundance is correlated with landscapes containing fragmented late-seral forest with high-contrast edges, mature trees and large numbers of dead trees (McGarigal and McComb 1995, Altman and Sallabanks 2012). In Ontario, olive-sided flycatchers commonly nest in conifers such as white and black spruce, jack pine and balsam fir (Government of Ontario 2015b).

The Land Cover 2000 and FRI data were used to determine suitable olive-sided flycatcher. The following Land Cover 2000 habitats were determined to be of moderate to high suitability for olive-sided flycatcher:

- dense coniferous forest;
- dense mixed forest;
- treed bog;

- treed fen; and
- 50 m into coniferous or mixed forest that is adjacent to the following:
  - water;
  - treed fen;
  - open fen;
  - treed bog;
  - open bog;
  - forest depletion – cuts; and
  - forest depletion – burns.

The following FRI habitats were determined to be of moderate to high suitability for olive-sided flycatcher:

- mature and late successional coniferous or mixedwood forest according to the forest units and onset ages of habitat identified in Table 6.3B-7 below; and
- 50 m into coniferous or mixedwood forest over 39 years of age (i.e., immature or older; using year of origin attribute in the FRI dataset calibrated to 2016) and adjacent to wetlands and waterbodies as identified in FRI data and in the MNRF waterbody dataset, burns less than 25 years old, and cutblocks.

Table 6.3B-7: Forest Units identified as Moderate to High Suitability for Breeding Habitat for Olive-sided Flycatcher in the Regional Study Area

Forest Unit Code	Description	Onset Age of Mature Forest[a,c] (Years)
BF1	Balsam Fir Pure	60
BFDOM	Balsam Fir Dominated	60
BfMx1	Balsam Fir Dominated	60
BfPur	Balsam Fir Pure	60
CMX	Conifer Mix	80
COMX1	Conifer Mix	70
COMX2	Conifer Mix	70
ConMx	Conifer Mix	70
MC1	Conifer Mix	70
MC2	Conifer Mix	70
OC1	Open Conifer	70
OCL	Other Conifer Lowland	70
OCLow	Other Conifer Lowland	70
PJ1	Jack Pine Dominated	70
PjDee	Jack Pine Dominated	70
PJM	Jack Pine Mix	70
PjMx1	Jack Pine Dominated	70

Table 6.3B-7: Forest Units identified as Moderate to High Suitability for Breeding Habitat for Olive-sided Flycatcher in the Regional Study Area

Forest Unit Code	Description	Onset Age of Mature Forest[a,c] (Years)
PJP	Jack Pine Dominated	70
PJPUR	Jack Pine Pure	70
PjSha	Jack Pine Dominated	70
PR1	Red Pine Dominated	80
PrDom	Red Pine Dominated	80
PRW	Red Pine Mix	80
PrwMx	Red Pine Mix	80
PW1	White Pine Dominated	80
PwDom	White Pine Dominated	80
PWR	Red Pine Mix	80
SbDee	Spruce Dominated	70
SBL	Spruce Lowland	70
SbLow	Spruce Lowland	70
SBM	Spruce Mix	70
SbMx1	Spruce Mix	70
SBP	Spruce Dominated	70
SbSha	Spruce Dominated	70
SPL	Spruce Lowland	70
SPU	Spruce Dominated	70
SPUP	Spruce Dominated	70

a) Age based on mature age classes in Table 4 and 5 from the Forest Management Guide to Boreal Landscapes (2014). Age class information was not available for PWR and PW1 so 80 years was assumed as the onset age of mature forest because this was the upper boundary for mixed and conifer forest included in the model.

b) Forest unit codes from individual Forest Management Plans (Dryden, Wabigoon, and Lac Seul Forests) corresponding to Regional Forest Units.

c) Onset age was determined using the ”year of origin” attribute in the FRI dataset, calibrated to 2016.

6.3B2.0 REFERENCES

Ackakaya, H.R., M.A. Burgman, O. Kindvall, C.C. Wood, P. Sjogren-Gulve, J.S. Hatfield, and M.A. McCarthy (editors). 2004. Species conservation and management: case studies. Oxford University Press, New York.

Altman, B. and R. Sallabanks. 2012. *Olive-sided Flycatcher (Contopus cooperi)*. Cornell Lab of Ornithology, Ithaca, NY. Available at: http://bna.birds.cornell.edu/bna/species/502.

Armstrong, T.E.R. 2014. Management Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in Ontario. Ontario Management Plan Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vii + 53 pp. Available online at: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_mp_bldegl_en.pdf. Accessed July 6, 2016.

Ball, J.R. and E.M. Bayne. 2014. Status of Canada warbler (*Cardellina canadensis*) in Alberta. Alberta Wildlife Status Report No. 70. Prepared for Alberta Environment and Sustainable Resource Development (ESRD) and Alberta Conservation Association (ACA).

Brooks, R.P. 1997. Improving Habitat Suitability Index Models. Wildlife Society Bulletin 25:163-167.

Buck, Graham. 2015. Guelph District. Ministry of Natural Resouces. Personal communication with Derek Morningstar (Senior Wildlife Biologist), Golder Associates Ltd.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506. doi:10.2173/bna.506.

Bushman, E.S. and G.D. Therres. 1988. Habitat management guidelines for forest interior breeding birds of coastal Maryland. Maryland Department of Natural Resources, Forest, Park and Wildlife Service. Wildlife Technical Publication 88-1. 54pp.

Carr, N.L., A.R. Rodgers, S.R. Kingston, and D.J. Lowman. 2011. Use of Island and mainland shorelines by woodland caribou during the nursery period in two northern Ontario parks. Rangifer 19:49-62.

Cink, C.L. 2002. Eastern Whip-poor-will (*Antrostomus vociferus*), The Birds of North America (P.G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/whip-p1.

Copeland, T. 2016. Species at Risk Specialist, Ministry of Natural Resources, South Porcupine, ON. Communication regarding caribou habitat categorization. Teleconference communication with Kristine Sare, Wildlife Biologist, Golder Associates. 04--04--2016.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp.

COSEWIC. 2008. COSEWIC assessment and status report on the Canada warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp.

COSEWIC. 2009. COSEWIC assessment and status report on the Whip-poor-will *Caprimulgus vociferus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 28 pp.

COSEWIC. 2013. COSEWIC assessment and status report on the little brown myotis *Myotis lucifugus*, northern myotis *Myotis septentrionalis*, Tri-colored bat *Perimyotis subflavus* in Canada – 2013. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp.

Cumming, H.G., D.B. Beange, and G. Lavoie. 1996. Habitat partitioning between woodland caribou and moose in Ontario: the potential role of shared predation risk. Rangifer 16:81-94.

Elkie P., A. Smiegielski, J. Elliot, R. Kushneriuk and R.S. Rempel. 2013. Ontario's Landscape Tool User's Manual. Version 2013. Ontario Ministry of Natural Resources. Policy Division, Forests Branch, Policy Section, Guides Unit. Sault Ste. Marie Ontario.

Elkie P., K. Green, G. Racey, M. Gluck, J. Elliott, G. Hooper, R. Kushneriuk and R. Rempel. 2014. Science and Information in support of Policies that address the Conservation of Woodland Caribou in Ontario: Occupancy, Habitat and Disturbance Models, Estimates of Natural Variation and Range Level Summaries. Electronic Document. Version 2014. Ontario Ministry of Natural Resources, Forests Branch.

Environment Canada. 2009. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton Alberta. 64p.

Environment Canada. 2012. Recovery strategy for the woodland caribou (*Rangifer tarandus caribou*), boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

Environment Canada. 2015a. Recovery Strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. ix + 110 pp.

Environment Canada. 2015b. Recovery Strategy for the Canada Warbler (*Cardellina canadensis*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 56 pp.

Ferguson, S.H. and P.C. Elkie. 2004. Seasonal movement patterns of woodland caribou (Rangifer tarandus caribou). Journal of Zoology 262 (2):125–134.

Government of Ontario. 2015a. Eastern whip-poor-will. Available at: https://www.ontario.ca/page/eastern-whip-poor-will. Accessed: September 25, 2016.

Government of Ontario. 2015b. Olive-sided flycatcher. Available at: https://www.ontario.ca/page/olive-sided-flycatcher. Accessed: September 25, 2016.

Grier, J.W., and J.E Guinn. 2003. Bald Eagle habitats and responses to human disturbance in Minnesota. Final Report to Minnesota Department of Natural Resources. North Dakota State University, Fargo ND. 44 pp.

Hall, B.C.E. 1998. Characterization of Bald Eagle Winter Night Roost Habitat Along the Upper Mississippi River. Department of Resource Analysis, Saint Mary's University of Minnesota, Winona, MN 55987 Thesis (M.S.)-.)-Saint Mary's University of Minnesota. http://www.gis.smumn.edu/GradProjects/HallB.pdf

Hazell, M. E. and M.E. Taylor. 2011. Movements of boreal caribou in the James Bay lowlands. Rangifer 31:63-73.

Johnson, A., J. Wiens, B. Milne, and T. Crist. 1992. Animal movements and population dynamics in heterogeneous landscapes. Landscape Ecology. 7:63–75.

Jung, T.S., I.D. Thompson, R.D. Titman, and A.P. Applejohn. 1999. Habitat selection by forest bats in relation to mixedwood stand types and structure in central Ontario. Journal of Wildlife Management 63: 2: 1306-1319.

Kalcounis, M.C. and R.M. Brigham. 1995. Intraspecific variation in wing loading affects habitat use by little brown bats (*Myotis lucifugus*). Canadian Journal of Zoology 73: 89-95.

Lacki, M.J., Hayes, J.P. and A. Kurta. 2007. Bats in Forests: Conservation and Management. Johns Hopkins University Press. 329 pp.

Marzluff, J.M., J.J. Millspaugh, K.R. Cedar, C.D. Oliver, J. Withey, J.B. McCarter, C.L. Mason, and J. Comnick. 2002. *Modelling Changes in Wildlife Habitat and Timber Revenues in Response to Forest Management*. Forest Science 48(2):191-202.

McGarigal, K. and W.C. McComb 1995. *Relationships between landscape structure and breeding birds in the Oregon Coast Range*. Ecological Monographs 65:235-260.

MNR (Ministry of Natural Resources). 2000 Significant Wildlife Habitat Technical Guide. 151p.

MNR. 2009. Forest Information Manual 2009: Forest Resources Inventory Technical Specification Draft for August 2009. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/2837/fim-tech-spec-forest-resources-inventory.pdf.

MNR. 2012. *Science and information in support of Ontario's forest management guides for landscapes: Science Package Series A*. Toronto: Queen's Printer for Ontario.

MNR. 2013. General habitat description for the eastern whip-poor-will (*Caprimulgus vociferus*). Available at: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_whp_pr_wll_en.pdf. Accessed: July 5, 2016. 4 pp.

MNR. 2014. *Forest management guide for boreal landscapes.* Toronto: Queen’s Printer for Ontario.

MNRF (Ministry of Natural Resources and Forestry). 2014a. Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario. Species at Risk Branch, Thunder Bay, Ontario, vii + 95 pp.

MNRF. 2013b. General Habitat Description for the Forest-dwelling Woodland Caribou (*Rangifer tarandus caribou*). Available at: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_car_en.pdf. Accessed June 2016.

MNRF. 2017. Sensitive species data. Received from the MNRF September 2017.

Morris, A.D., D.A. Miller, and M.C. Kalcounis-Rueppell. 2010. Use of forest edges by bats in a managed pine forest landscape. Journal of Wildlife Management 74:26-34.

Olson, C.R. and R.M.R. Barclay. 2013. Concurrent changes in group size and roost use by reproductive female Little Brown Bats (*Myotis lucifugus*). Canadian Journal of Zoology. 91: 149-155

Racey, G.D., A.G. Harris, J.K. Jeglum, R.F. Foster and G.M. Wickware. 1996. Terrestrial and Wetland Ecosites of Northwestern Ontario. NWST Field Guide FG-02. 94pp. +Appendices. Available at: http://www.cfs.nrcan.gc.ca/pubwarehouse/pdfs/9298.pdf.

Rempel, R.S. 2008. A BioClimatic Model for Moose Density in Ontario. Available through hyperlink *in* Elkie, P., R. Rempel, B. Naylor, M. Gluck, J. Elliott, R. Kushneriuk, 2013b. Science and Information in support of Policies that address Landscape Level Moose Requirements: Science Package – Series B, Habitat Definitions, Models and Simulation Results. Ontario Ministry of Natural Resources, Forest Policy Section, Thunder Bay, ON.

Segers, J. and H. Broders. 2014. Interspecific effects of forest fragmentation on bats. Canadian Journal of Zoology 92(8): 665-673.

Vickery, P.D., B. Zuckerberg, A.L. Jones, W.G. Shriver and A.P. Weik. 2005. Influence of fire and other anthropogenic practices on grassland and shrubland birds in New England. Studies in Avian Biology 30: 139.

Wright, K. R. 2016. Count trends for migratory Bald Eagles reveal differences between two populations at a spring site along the Lake Ontario shoreline. PeerJ, 4, e1986. Available online at: https://peerj.com/articles/1986/. Accessed July 6, 2016.

This page intentionally left blank