Appendix 18.2

Biological Opinion

United States Department of the Interior
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February 5, 2016

Superior National Forest
Brenda Halter
Forest Supervisor
8901 Grand Avenue Place
Duluth, Minnesota 55808-4300

FWS No. 03E19000-2016-B-0001 Proposed NorthMet Project and Land Exchange

Dear Ms. Halter:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion and is based on our review of the Superior National Forest and U.S. Army Corps of Engineers Biological Assessment for PolyMet's Proposed NorthMet Project and Land Exchange, and potential effects to Canada lynx (*Lynx canadensis*), Canada lynx critical habitat, gray wolf (*Canis lupis*), gray wolf critical habitat, and northern long-eared bat (*Myotis septentrionalis*). The April 2015 Biological Assessment (BA) was submitted to the Service on August 24, 2015, along with a request to initiate formal consultation under section 7 of the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. 1531 *et seq.*; we received it on August 27.

This biological opinion is based on the best available scientific and commercial data including meetings, electronic mail correspondence, and telephone calls with the Superior National Forest, U.S. Army Corps of Engineers, and PolyMet personnel, Service files, pertinent scientific literature, discussions with recognized species authorities, and other scientific sources. A complete administrative record is on file at the Twin Cities Ecological Services Field Office.

Please contact the Service if the project changes or new information reveals effects of the proposed action to proposed or listed species or critical habitat to an extent not covered in your

BA. If you have any questions or comments on this biological opinion, please contact Ms. Ann Belleman, Fish and Wildlife Biologist, via email at *ann_belleman@fws.gov*.

Sincerely,

Peter Fasbender
Field Supervisor

Enclosure

cc: Dan Ryan, SNF District Biologist (dryan@fs.fed.us)
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BIOLOGICAL OPINION

Effects to
Canada Lynx, Gray Wolf, and Northern Long-eared Bat
From the Proposed NorthMet Project and Land Exchange

FWS No. 03E19000-2016-B-0001

Prepared by:
U.S. Fish and Wildlife Service
Twin Cities Field Office

February 2016

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INTRODUCTION

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the proposed NorthMet Project and Land Exchange within the Superior National Forest in St. Louis, Lake, and Cook Counties, Minnesota and its effects on Canada lynx (*Lynx canadensis*), Canada lynx critical habitat, gray wolf (*Canis lupis*), gray wolf critical habitat, and northern long-eared bat (*Myotis septentrionalis*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. 1531 *et seq*. The Superior National Forest's August 20, 2015 request for formal consultation was received on August 27, 2015.

This Opinion is based on information provided in the April 2015 Biological Assessment (U.S. Army Corps of Engineers and U.S. Department of Agriculture (USDA) Forest Service 2015), the Final Environmental Impact Statement (Minnesota Department of Natural Resources et al. 2015), and other sources of information. Early communication on this proposed action between the Service and Superior National Forest began in 2005 and continued until the Biological Assessment was submitted. An initial draft Opinion was submitted to the Superior National Forest and U.S. Army Corps of Engineers for review on December 23, 2015 and the revisions from subsequent discussions between the Service, Superior National Forest, U.S. Army Corps of Engineers, and PolyMet are reflected in this final Opinion. A complete administrative record of this consultation is on file at the Service's Twin Cities Field Office.

The Superior National Forest found that the proposed action may affect and is likely to adversely affect Canada lynx, Canada lynx critical habitat, gray wolf, gray wolf critical habitat, and northern long-eared bat.

Consultation History

On August 21, 2013, the Service received a draft Biological Assessment from the U.S. Army Corps of Engineers and USDA Forest Service's Superior National Forest (Forest or SNF) for early coordination and comment. Between December 2013 and April 2015, the Service received updated versions of the draft Biological Assessment from the Forest that were reviewed and subsequently discussed by phone and through electronic mail, in-person meetings, and formal correspondence. The Forest provided the final Biological Assessment for the proposed actions on August 24, 2015, which included a request to initiate formal section 7 consultation under the ESA. (See Appendix 1 for a comprehensive history.)

BIOLOGICAL OPINION

Description of the Proposed Action

We have summarized (verbatim and paraphrased) portions of the proposed PolyMet Mining Inc. NorthMet Project descriptions from the 2015 Biological Assessment (BA) and 2015 Final Environmental Impact Statement (FEIS) as they relate to Canada lynx (lynx), gray wolf (wolf), critical habitats for lynx and wolf, and northern long-eared bat (NLEB) because the description is complex and lengthy. Refer to either document for a more complete description of the proposed activities, both of which we incorporate into this Opinion by reference.

PolyMet Mining Inc. (PolyMet) proposes the NorthMet Project (Project) to open-pit mine and process polymetallic ore that contains copper, nickel gold, platinum, palladium, and cobalt for approximately 20 years, The Project is located in Township 58 North, Range 14 West, Sections 5, 6, 8, 9, 13, 14, 15, 16, 17, 23, and 24; Township 59 North, Range 13 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18; Township 59 North, Range 14 West, Sections 3, 4, 5, 8, 9, 10, 11,13, 14, 15, 16, 17, 20, 23, 24, 29, and 32; and Township 60 North, Range 14 West, Sections 32, 33, and 34 in St. Louis County, on the eastern end of the Mesabi Iron Range and about 60 miles north of Duluth, and 6 miles south Babbitt, Minnesota (Figure 1).

The U.S. Army Corp of Engineers (USACE) and USDA Forest Service (hereafter USFS) have separate proposed actions on which consultation is occurring. The USACE has an application under the Clean Water Act from PolyMet to impact wetlands and other waters of the U.S. associated with the construction and operation of the NorthMet mine. The USFS is considering transferring approximately 6,495 acres of federal lands within the Superior National Forest to PolyMet in exchange for 7,075 acres of non-federal lands offered by PolyMet. The purpose of the land exchange is to eliminate a conflict between PolyMet’s desire to surface mine and the United States’ surface rights, including USFS administration of National Forest System land. Because the NorthMet Project is dependent on the land exchange, it is considered an interrelated activity, and as such, its effects to listed species and critical habitat must be considered in this biological opinion.

Upon completion of the land exchange, the applicant (PolyMet) intends to develop their private lands. Development of the private lands is not a USFS decision, and the USFS will not retain discretion or authority over subsequent development of the private lands once the exchange is completed. The proposed future development is an indirect effect of the proposed land exchange, however, and would not occur but for the land exchange, as is described later in this document. That is, the subsequent mining of the post-exchange private lands is reasonably certain to occur because the land exchange was proposed to facilitate PolyMet’s desire to mine the lands. Off-site Wetland Mitigation Sites are also included in the proposed action.

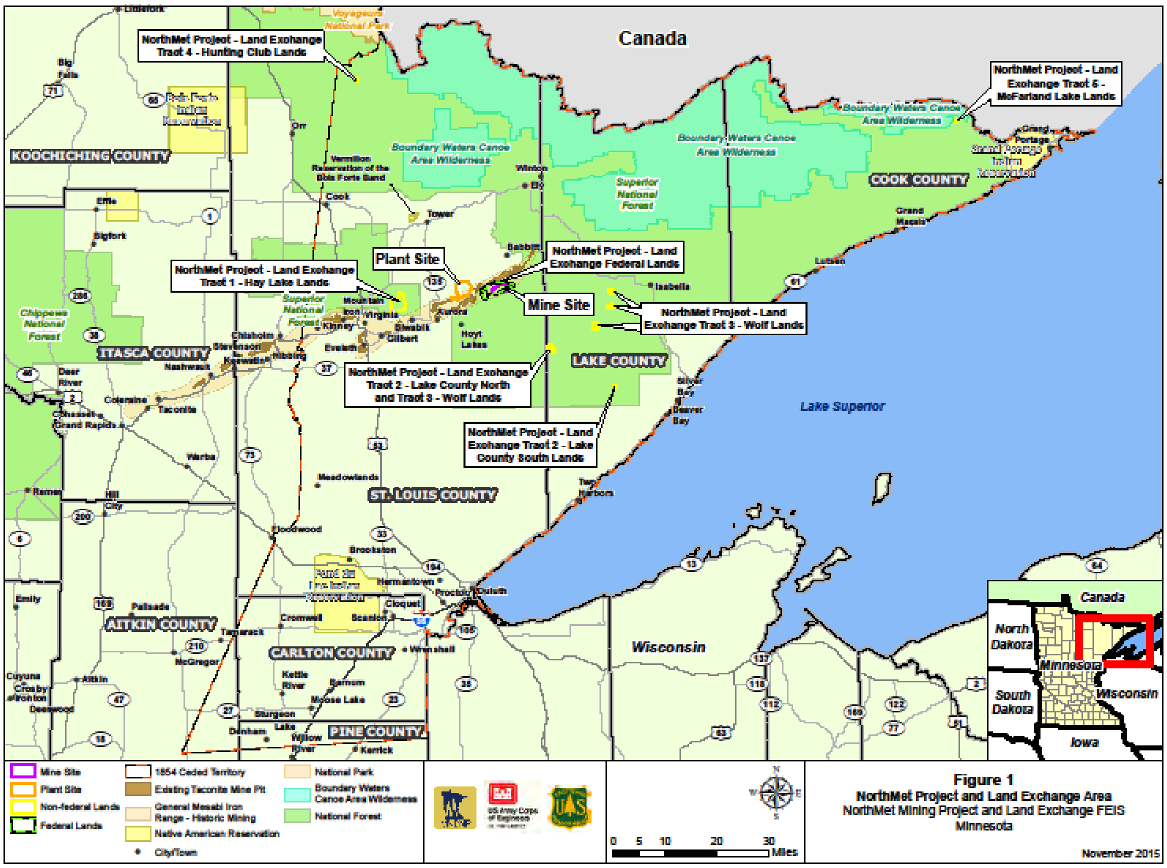

Figure 1. PolyMet NorthMet Project and Land Exchange Area in Northeastern Minnesota (2015 FEIS, Figure 1, p. ES-5).

The proposed mining and processing activities are described through four components and include the Mine Site, Plant Site, Dunka Road and Utility Corridor, and railroad connection corridor (we also combine and discuss the latter two as the Transportation/Utility Corridor) (Figure 2). Under the land exchange, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the USFS will no longer be part of the SNF and as mentioned, will not be subject to USFS management plans and policies. PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the USFS, which include the following areas: Hay Lake lands (4,926 acres), Hunting Club (160 acres), Lake County North and South (382 acres), McFarland Lake lands (31 acres), and Wolf lands 1, 2, 3, and 4 (1,576 acres) (Figure 3).

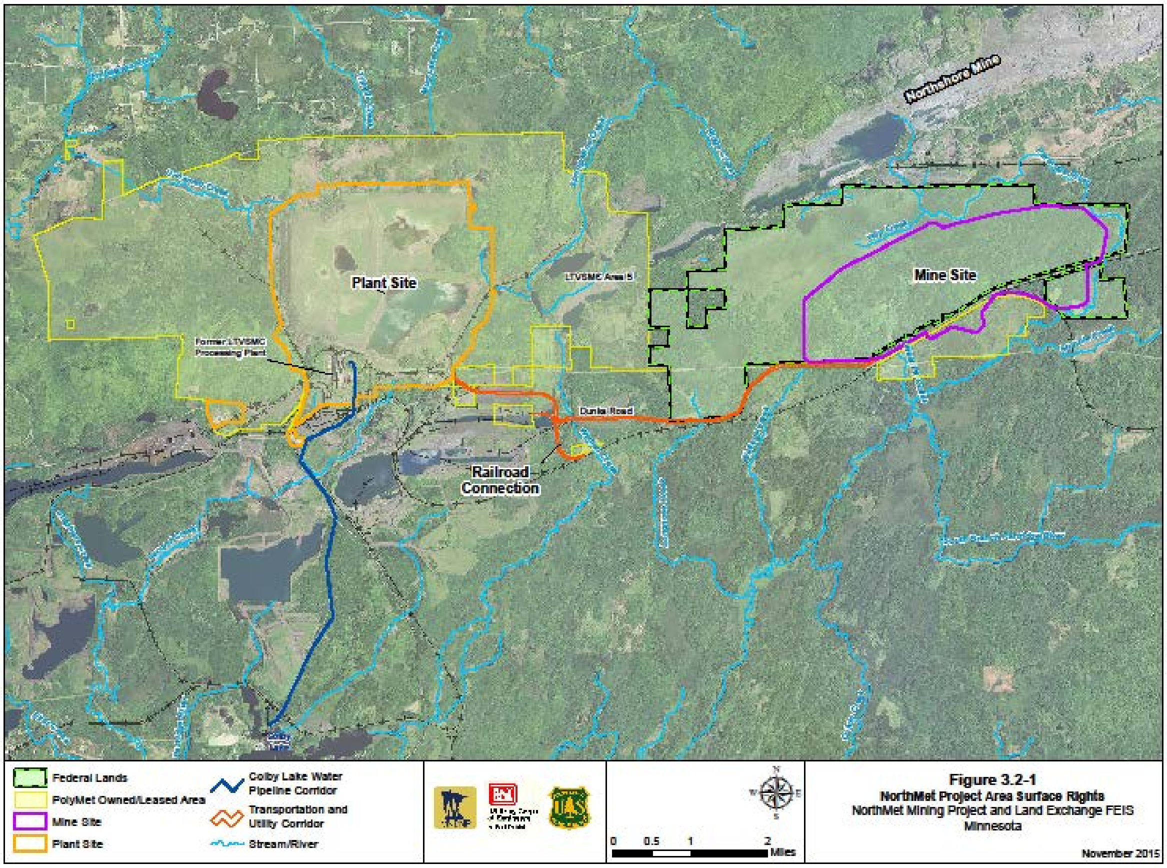

Figure 2. PolyMet Mine and Plant Site Locations (2015 FEIS, Figure 3.2-1, p. 3-9).

There are approximately 3,015 acres of federal lands at the Mine Site, of which approximately 2,719 acres are currently under federal ownership and administered by the USFS, along with 3,776 acres adjacent to the Mine Site. The Plant Site covers 4,515 acres of non-federal lands and the Transportation/Utility Corridor covers 120 acres under mixed ownership. The Project will directly impact approximately 913 acres of wetlands, including 758 acres at the Mine Site, 147 acres at the Plant Site, and 7.5 acres within the Transportation/Utility Corridor. PolyMet is proposing to purchase 2,169 acres as mitigation for wetland impacts from the Project (Wetland Mitigation Sites). The Wetland Mitigation Sites (WMS) include the following: Aitkin WMS in west-central Aitkin County, Hinckley WMS in southwest Pine County, and Zim North and Zim South WMSs in south-central St. Louis County (see BA Figure 13, p. 4-15). On the Wetland Mitigation Sites, 1,603 acres will be restored or converted to wetlands and 197 acres will be used as upland buffer.

The Mine Site includes development of up to 528 acres of open mine pits, up to 794 acres of overburden (material lying over the bedrock) and waste rock stockpiles, and 397 acres of infrastructure, including haul roads, railroad spur and transfer hopper, power distribution system, waste water treatment facility, and water collection systems (see BA Figure 4, p. 3-4). The vegetation will be stripped for these activities and developments. There will be three separate open pits, with mining occurring on the east and west pits during the first 10 years and ending the east pit mining in year 11. The central and west pit mining is planned through year 16, during which time the central and east pits will converge into one.

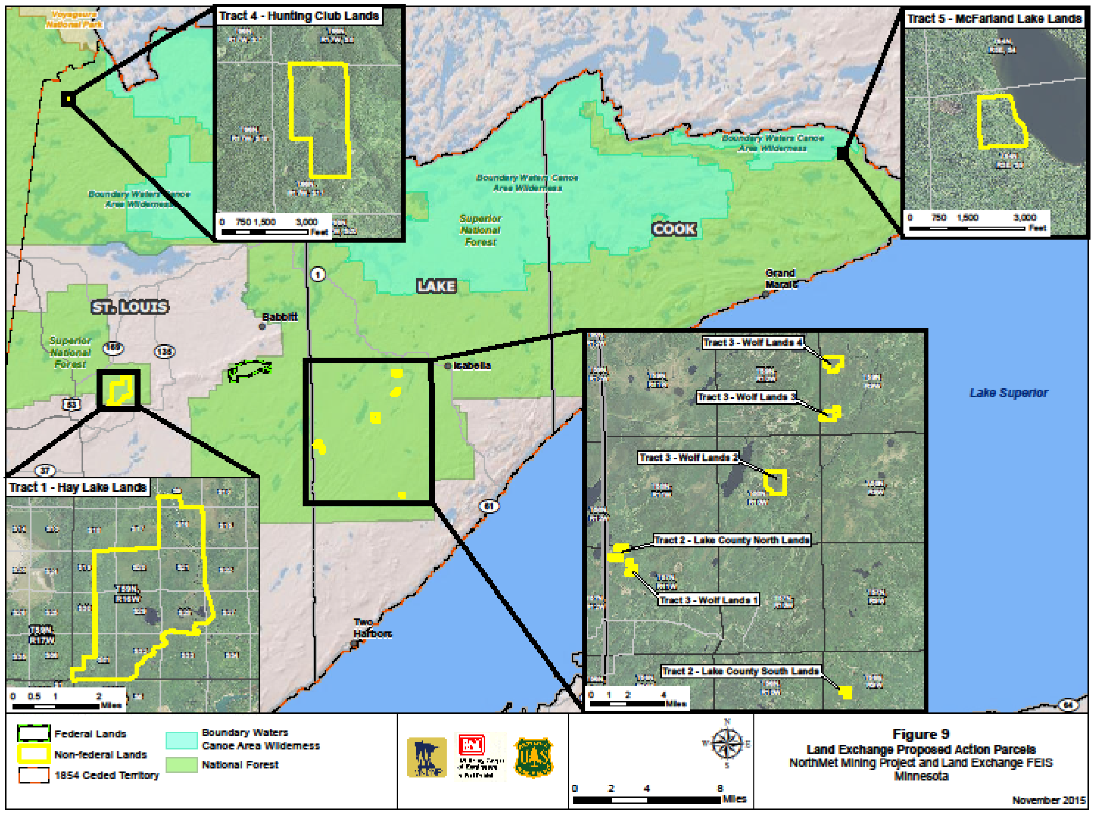

Figure 3. Non-federal Land Exchange Parcel Locations (2015 FEIS Figure 9, p. ES-33).

Ore will be excavated using drilling and blasting methods at the Mine Site, then loaded and hauled by railroad approximately 8 miles west to the Plant Site for processing. Waste rock and overburden will be stockpiled according to geochemical properties, based on percent sulfur content, with Category 1 having the lowest content and Category 4 the highest.

The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet will upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Infrastructure will include various processing buildings and facilities, sewage treatment ponds and a waste water treatment plant, roads, and rail connections. Tailings from ore processing will be placed in a tailings basin built on the existing LTVSMC taconite tailings basin, along with reducing and/or augmenting stream flow in four tributaries.

The Transportation and Utility Corridors connect the Plant and Mine Sites. The Dunka Road will be widened, a water pipeline will be constructed adjacent to the road, and a new railroad spur will be built to connect to existing tracks. In addition to significant vehicle and train traffic to and within the Project area, there will also be transport of goods to off-site locations via rail and existing highways.

Upon completion of mining activities after a minimum of 20 years, much of the infrastructure at the Plant Site will be razed, and most roads and other storage pads will be reclaimed. Disturbed areas will be reclaimed and revegetated. At the Mine Site, buildings and other structures also will be demolished and removed. The Category 1 stockpile will be reclaimed with grasses and forbs but woody vegetation will be removed to prevent damage to the liner system. Category 2/3 and 4 stockpiles will be progressively combined into the east pit. Mine pits will eventually be flooded and pit walls either fenced off or sloped and revegetated. Up to 397 acres of reclamation will occur at the Mine Site, some of it progressively as mining activities allow; approximately half will be suitable for woody vegetation more conducive to future Canada lynx (lynx) , gray wolf (wolf), and northern long-eared bat (NLEB) use.

The Mine Site is used by wildlife, based on surveys, and opportunistic and anecdotal information. There are a variety of habitat types that will be affected by the Project including upland and lowland coniferous, deciduous, and mixed forests and wetlands. About 1,719 acres of the Mine Site will be directly disturbed by mining activities and this disturbance along with other mining-related activities within the Mine and Plant Sites, Transportation/Utility Corridor (collectively, Project area) and adjacent areas are likely to adversely affect lynx, wolf, critical habitats for lynx and wolf, and NLEB. The Transportation and Utility Corridors are mostly disturbed lands and are little used by wildlife. The Plant Site has been operated as an industrial facility for decades and has minimal value to wildlife.

Conservation Measures

In January 2016, PolyMet stated that it would carry out the following conservation measures. The Service's analysis of effects and conclusions below are based on an assumption that these activities will be implemented as described here.

These measures are based, in part, on conservation measures identified by the USFS during its review of the Project, measures in the *Lynx Conservation Assessment and Strategy 3rd edition* (Interagency Lynx Biology Team 2013) that are applicable to lynx populations throughout the contiguous U.S. and therefore apply to lynx in and around the Project area; measures identified in the *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species: 4(d) Rule for the Northern Long-Eared Bat* (USFWS 2016), and measures identified in the *Minnesota Wolf Management Plan* (MDNR 2001) that can benefit wolves in Minnesota.

1. Reclaim Project Area

PolyMet will reclaim about 397 acres to wetland and upland habitat at the Mine Site, including the Waste Rock Stockpiles, the Overburden Storage and Laydown Area, and the Ore Surge Pile. The stockpiles will be revegetated using a mixture of native grasses and forbs. In addition to reclamation efforts mandated by State of Minnesota law, that reclamation will include up to 202 acres identified as feasible for woody vegetation growth and planted with native trees to expedite forest regeneration of lynx, wolf, and NLEB habitat; efforts will include collaboration with the USFS and Minnesota Department of Natural Resources (MDNR) regarding appropriate habitat restoration (e.g., tree species selection, planting density, etc.).Over time, these reclaimed areas may increasingly be used by lynx, wolves, northern long-eared bats, and their prey as coniferous and deciduous forests become established. Lynx tracking surveys at waste rock stockpiles located east of the Project area found that lynx hunt for snowshoe hare that reside in early successional shrubland and forestland habitats that have established on these waste rock stockpiles. As disturbed areas are reclaimed, they would also improve lynx, wolf, and northern long-eared bat habitat connectivity with forestlands in the vicinity of the Project.

During operation of the mine, reclamation will occur as feasible in areas where no additional disturbance is planned. However, the majority of the reclamation work will occur once operation of the mine ends.

2. Maintain Vegetated Buffers

The Project design will include measures to reduce impacts to lynx, northern long-eared bats, and wolves by minimizing the disturbance areas and new road construction, and reclaiming areas when Project activities cease. The perimeter around most of the Project area perimeter has an existing vegetative buffer. The design and operation of the Project will retain the existing vegetative buffer around the perimeter of the Mine Site, Dunka Road and railroad corridors, and Plant Site to reduce light and noise effects on lynx, northern long-eared bat, and wolf. In addition, existing and newly constructed roads (built to access the Project area) will be reclaimed after Project closure.

3. Limit Public Access to Project Area

Public access to the Project area is currently limited, and will continue to be limited during development, operation, and reclamation. PolyMet will continue to maintain an active security patrol to discourage unauthorized access and to escort trespassers off their property.

4. Minimize Road Construction and Reclaim Unused Roads

Modifications to dirt and gravel roads traversing lynx and wolf habitat within the Project area will be minimized. This will include restricting new pavement or other upgrades (e.g., straightening of curves, widening of roadway, etc.) along most of the Project's road network. Roads will be planned and designed in a manner that will discourage significant increases in traffic speeds or increased width of the right of way.

Plowed roads and groomed over-the-snow routes may allow competing carnivores such as coyotes to access lynx and wolf habitat in the winter, increasing competition for prey (Buskirk et al. 2000). However, plowed or created snow roads will be necessary to access the Project areas during construction, operation, and closure. Several studies suggest that lynx may not avoid roads, except at high traffic volumes. Therefore, at this time, there is no compelling evidence to recommend management of road density to conserve lynx. There is evidence, however, that road density can impact wolf use of an area. Therefore, the number of new roads constructed in support of the Project will be minimized and roads will be reclaimed once they are no longer needed for the Project.

5. Educate Employees and Public

Direct mortality from vehicular collisions has affected lynx and wolf in northern Minnesota. In order to reduce the risk of wildlife-vehicle collisions, speed limits will be enforced along Project roads to benefit lynx, wolf, and other wildlife. A maximum 40 mph speed limit will be maintained on the Project's main roads and lower speed limits will be maintained on other roads in the Project area. Observing the posted speed limits will be part of PolyMet's standard rules and regulations required for staff and contractors that access the Project areas.

PolyMet will provide training for employees to: 1) make them aware of the importance of the area to wildlife such as lynx and wolf, 2) report sick, injured, or dying wildlife along roads or railroads to security staff, 3) ensure that wastes or other harmful materials are not dumped off the Project area, and 4) raise awareness of other actions that could be harmful to wildlife or their habitats such as illegal trapping or hunting. If employees report a dead animal along the road PolyMet will move the carcass away from the road edge far enough for scavenging wolves or lynx to be safely away from the line of traffic, and out of sight of traffic. PolyMet will also require that contractors and vendors accessing the site also follow these practices.

PolyMet will continue to restrict access to its property, reducing opportunities for illegal hunting; however, lynx and wolf may be mistakenly trapped or shot by legal predator hunters pursuing bobcats or other furbearers. PolyMet will consult with the USFS, and/or MDNR to obtain USFS and MDNR species identification materials to distribute to employees in order to help reduce or eliminate the incidence of illegal trapping and shooting of lynx and wolf in the region. PolyMet will also use various informational and media resources to inform the public of the possible presence of lynx and wolf within the Project area. PolyMet will consult with MDNR to identify websites and other sources of wildlife information that would be made available through the PolyMet website.

6. Lynx Monitoring

Limited research has been conducted on lynx in the contiguous U.S. and in the region. PolyMet will support and collaborate with USFS' on-going lynx occupancy surveys and DNA collection in the action area (as defined in the biological opinion) and elsewhere on the Superior National Forest as part of the on-going larger occupancy study project. Monitoring wildlife travel corridors for lynx and general wildlife use within the action area will be part of this effort and methodologies will incorporate those already being used for lynx and wolves as well as methods appropriate for wildlife in general. Within three months of the completed USFS land exchange and a USACE 404 permit for the NorthMet project, PolyMet will provide $150,000 to the U.S. Forest Service for this monitoring, with precise terms and payment schedule to be determined at the time of the first payment. Monitoring will be accomplished by conducting initial surveys prior to implementation of any Project activities (e.g., vegetation removal) to collect baseline information. PolyMet will coordinate with USFS to schedule the initial survey such that it does not interfere with the overall Project schedule. Subsequent monitoring will occur at least during years 1, 2, 4, 6, 8, and 10 and additionally as identified through on-going collaboration with the USFS. All data will be provided to the USFS at the end of each field season per agreement (and others as appropriate) for use and incorporation into analyses and reporting.

7. Preserve and Protect Habitat

PolyMet has avoided and minimized impacts to lynx, northern long-eared bat, and wolf habitats during design of the Project, to the extent practicable. In order to preserve and protect undisturbed habitat adjacent to the Project areas, PolyMet will manage these areas to provide suitable habitat for use by lynx, northern long-eared bat, wolf, and other wildlife.

This management will include the ongoing periodic harvesting of upland and wetland forestlands in these areas which should provide early successional habitat favored by snowshoe hare, a primary prey species for lynx. In addition, these forestlands would likely be used by lynx and wolf as a travel corridor between lands adjacent to the Project area, and for foraging and roosting habitat by northern long-eared bat.

PolyMet intends to clear trees outside of the bat's pup season, from June 1 through July 31, to the extent practicable, in order to avoid potential indirect take of the northern long-eared bat, per the final 4(d) rule published on January 14, 2016. In the event that trees need to be cleared during the pup season, PolyMet will contact USFWS prior to any tree clearing, to determine whether any known, occupied maternal roost trees are documented within 150 feet of the proposed tree clearing. PolyMet will not remove any known occupied maternal roost trees or other trees within 150 feet of a known occupied roost tree during the pup season.

Northern Long-eared Bat Final 4(d) Rule

The Service published the NLEB Final 4(d) Rule (81FR1900) on January 14, 2016 and it goes into effect on February 16, 2016. It addresses both purposeful take and incidental take of the NLEB, with certain differences distinguished based on the occurrence of the disease white-nose syndrome (WNS). The final 4(d) rule prohibits purposeful take of NLEBs throughout the species' range, except:

- when necessary to protect human health (e.g., public health monitoring for rabies or removal of hazardous trees for the protection of human life and property);
- in instances of removal of NLEBs from human structures; or
- for the authorized capture and handling of NLEBs by individuals permitted to conduct these same activities for other bat species until May 3, 2016.

"Incidental take" is defined at 50 CFR 17.3 as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, an otherwise lawful activity." Incidental take within the context of the final 4(d) rule is regulated relative to the geographic location of the proposed activity and the occurrence of WNS. The WNS zone provides the boundary for implementation of the final rule and is defined as the set of counties with confirmed evidence of the fungus (*Pseudogymnoascus destructans*, or Pd) that causes WNS, plus a 150-mile (241 km) buffer from the Pd-positive county line to account for the spread of the fungus from one year to the next. In instances where the 150-mile (241 km) buffer line bisects a county, the entire intersected county is included in the WNS zone. The final 4(d) rule does not prohibit incidental take resulting from otherwise lawful activities in areas not in the WNS zone. That is, in areas outside the WNS zone, there are no prohibitions on incidental take.

For NLEBs within the WNS zone but outside of hibernacula, the final 4(d) rule establishes separate incidental take prohibitions for activities involving tree removal and those that do not involve tree removal. Incidental take of NLEBs outside of hibernacula that results from activities other than tree removal is not prohibited if they do not result in the incidental take of NLEBs inside hibernacula or otherwise impair essential behavioral patterns at known hibernacula.

For areas of the country impacted by WNS (i.e., areas inside the WNS zone), incidental take is prohibited under the following circumstances:

- if it occurs within a hibernaculum;
- if it results from tree removal activities that are within 0.25 mile (0.4 km) of a known, occupied hibernaculum; or,
- the activity cuts or destroys a known, occupied maternity roost tree or other trees within a 150 foot radius from the maternity roost tree during the pup season from June 1 through July 31.

Known, occupied maternity roost trees are defined as trees that have had female NLEBs or juvenile bats tracked to them or the presence of female or juvenile bats is known as a result of other methods. Known, occupied maternity roost trees are considered known roosts as long as the tree and surrounding habitat remain suitable for the NLEB.

Status of the Species/Critical Habitat

Canada Lynx

An interagency Canada lynx coordination effort was initiated in March 1998 in response to the emerging awareness of the uncertain status of lynx populations and habitat in the contiguous United States and the onset of the listing process. The Service, USFS, Bureau of Land Management, and National Park Service participated in this effort. As a result of those efforts, three products important to the conservation of lynx on federally managed lands were produced: The Scientific Basis for Lynx Conservation (Ruggiero et al. 1999); the Lynx Conservation Assessment and Strategy (LCAS; Ruediger et al. 2000); and Lynx Conservation Agreements (CA) among the Service and various land management agencies.The CA promotes the conservation of lynx and its habitat on federal lands and identifies actions the federal agencies agree to take to reduce or eliminate potential adverse effects or risks to lynx and their habitat. The LCAS was produced in 1999 to provide a consistent and effective approach to conservation of lynx on federal lands and was used as a basis for assessing the effects of Forest Plans on lynx.

The LCAS was revised into a 3rd edition in 2013 based on new information. This information included Kolbe et al. (2007) and Bunnell et al. (2006) who published information on the effects of snowmobiling on lynx, and Squires and Ruggiero (2007) and Squires et al. (2010) who documented the importance of multilayered stands as snowshoe hare (*Lepus americanus*) habitat. Ongoing research in Minnesota and Maine has also contributed to our understanding of lynx and snowshoe hares (e.g., Fuller et al. 2007; Homyack et al. 2007; Hoving et al. 2005; Moen et al. 2008a; Moen et al. 2010).

Species Description

The lynx is a medium-sized cat with long legs, large and well-furred paws, long tufts on the ears, and a short tail whose tip is entirely surrounded by black; the tips of bobcat tails are black only on the upper side (McCord and Cardoza. 1982). The lynx's long legs and large, well-furred paws make it highly adapted for hunting in deep snow. Adult males average 10 kilograms (22 pounds) in weight and 85 centimeters (33.5 inches) in length (head to tail), and females average 8.5 kilograms (19 pounds) and 82 centimeters (32 inches) (Quinn and Parker 1987).

Life History

Lynx evidently require large areas containing boreal forest[1] habitat. In the northeastern U.S., lynx were most likely to occur in areas containing suitable habitat that were greater than 40 square miles (mi^2) (Hoving 2001). The requirement for large areas also is demonstrated by home ranges that encompass many square miles. The size of lynx home ranges varies with sex, age, abundance of prey, season, and the density of lynx populations (Aubry et al. 2000; Hatler 1988; Koehler 1990; Mowat et al. 2000; Poole 1994; Slough and Mowat 1996). Generally, it is believed that larger home ranges, such as have been documented in some areas in the southern extent of the species' range in the west, are a response to lower-density snowshoe hare populations (Apps 2000; Koehler and Aubry 1994; Squires and Laurion 2000).

Long-distance movements (greater than 60 mi; 97 kilometers (km)) are characteristic of lynx (Moen et al. 2010; Mowat et al. 2000). Lynx disperse primarily when snowshoe hare populations decline (Koehler and Aubry 1994; O'Donoghue 1997; Poole 1997; Ward and Krebs 1985). However, subadult lynx also disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges. Lynx also make exploratory movements outside their home ranges (Moen et al. 2010) and are capable of moving extremely long distances (greater than 300 mi, 483 km) (Brainerd 1985; Mech 1977; Mowat et al. 2000; Poole 1997).

Recent studies of Minnesota lynx show that male home ranges varied between 11 and 201 mi^2 (28 and 521 km^2), and female home ranges varied between 2 and 37 mi^2 (5 and 96 km^2) (Burdett 2007). Home ranges varied during the breeding season; males tended to expand the size of their home ranges, presumably to search for females, and females tended to contract their home ranges as the birthing period approached (Burdett 2007). A study of radio-collared lynx in Minnesota documented approximately 40 percent of male and female lynx making long distance movements outside of their home range between Ontario, Canada and Minnesota (Moen et al. 2010). Of those lynx that made long-distance movements, females tended to move 62 to 124 mi (100 to 200 km) and did not return to their original home ranges, while males moved 31 to 49 mi (50 to 80 km) back and forth between Ontario and Minnesota (Moen et al. 2010). While topographic

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[1] The term ''boreal forest'' broadly encompasses most of the vegetative descriptions of this transitional forest type that makes up lynx habitat in the contiguous U.S. (Agee 2000).

features may influence in mountainous western states, lynx in Minnesota tended to move in nearly straight paths (Moen et al. 2010).

Snow conditions also determine the distribution of lynx (Ruggiero et al. 1999). Lynx are morphologically and physiologically adapted for hunting snowshoe hares and surviving in areas that have cold winters with deep, fluffy snow for extended periods. These adaptations provide lynx with a competitive advantage over potential competitors, such as bobcats (*Lynx rufus*) or coyotes (*Canis latrans*) (Buskirk et al. 2000; McCord and Cardoza. 1982; Ruediger et al. 2000; Ruggiero et al. 1999). Bobcats and coyotes have a higher foot load (more weight per surface area of foot), which causes them to sink into the snow more than lynx. Therefore, bobcats and coyotes cannot efficiently hunt in fluffy or deep snow and are at a competitive disadvantage to lynx. Long-term snow conditions presumably limit the winter distribution of potential lynx competitors such as bobcats (McCord and Cardoza. 1982) or coyotes.

Canada lynx prey primarily on snowshoe hares, especially in the winter when they comprise 35 to 97 percent of the diet (Koehler and Aubry 1994). Lynx may modify hunting behavior and switch to alternate prey when hare densities are low (O'Donoghue et al. 1998a; O'Donoghue et al. 1998b). Other prey species include red squirrel (*Tamiasciurus hudsonicus*), other small rodents, small carnivores, and birds, including ruffed grouse (Moen et al. 2004). Recent research indicates that the red squirrel is not an important prey species for lynx in northeastern Minnesota (Burdett 2007; Hanson and Moen 2008), similar to lynx in Montana (Squires and Ruggiero 2007), where red squirrels comprised only two percent of the winter diet of lynx. In Minnesota, Hanson and Moen (2008) found that snowshoe hare remains were found in 76 percent of the lynx scat in their study, while no evidence of red squirrels remains were detected.

Snowshoe hares have evolved to survive in areas that receive deep snow (Koehler and Aubry 1994) and prefer coniferous habitats with dense shrub understories that provide food, abundant cover to escape predators, and thermal protection during extreme weather (Fuller and Heisey 1986; Hodges and Sinclair 2005; Koehler and Aubry 1994; Monthey 1986; Pietz and Tester 1983; Wirsing et al. 2002; Wolfe et al. 1982). Early successional forest stages generally have greater understory structure than do mature forests and therefore support higher hare densities (Newbury and Simon 2005; Pietz and Tester 1983). It may take more than a few years, however, for conditions to become suitable for hares after disturbances (e.g., clearcuts and fire); such areas may not be optimal until 15- 30 years after the initial disturbance, during what may be described as the sapling/large shrub stage – before the onset of self-thinning (Buskirk et al. 2000; Hoving et al. 2004; Koehler and Brittell 1990; Monthey 1986; Thompson et al. 1989). In central Labrador, for example, hare densities peaked thirty years after clearcuts, with hare densities 37 times higher than in recent clearcuts (Newbury and Simon 2005). Potvin et al. (2005) found that hare densities would likely peak no sooner than 15 years after clearcuts in southwestern Quebec and that optimal conditions took longer to develop in some boreal forest types (e.g., black spruce, *Picea mariana*). Peak densities may develop sooner in more southern forests (Newbury and Simon 2005; Potvin et al. 2005).

In the northeastern U.S., lynx were most likely to occur in areas containing suitable habitat greater than 100 km^2 (39 mi^2) (Hoving 2001). Studies in the southern portion of the species' range have found average home ranges of 151 km^2 and 72 km^2 (58 and 28 mi^2) for males and females, respectively (Aubry et al. 2000). Home range size is likely inversely related to density of snowshoe hare (Apps 2000; Koehler and Aubry 1994; Poole 1994; Squires and Laurion 2000).

Lynx use coarse woody debris, such as downed logs, root wads, and windfalls, to provide denning sites with security and thermal cover for kittens (Koehler 1990; Koehler and Brittell 1990; McCord and Cardoza. 1982; Moen et al. 2008a; Mowat et al. 2000; Squires et al. 2008; Squires and Laurion 2000). Mowat et al. (2000) summarized lynx selection of den sites in northern Canada and Alaska as, "… female lynx appear to select den sites in a number of forest types … do not appear constrained to select specific stand types; rather, the feature that was consistently chosen was the structure at the site itself. Wind-felled trees were the most common form of protection selected by female lynx, although other structures such as roots and dense live vegetation were also used." Downed logs and overhead cover must be available throughout the home range of females with kittens to provide alternative den and nursery sites, and security when lynx kittens are old enough to travel (Bailey 1974).

Den sites found in Minnesota were primarily in low-lying areas with dense vertical and horizontal cover (Moen et al. 2008a). They also found that all den sites studied in Minnesota were associated with a downed tree, with disturbance area varying from 20 square meters (m^2) (215 ft^2) to more than 1 hectare (2.5 acres). Lynx den sites consistently had lower stem density than the surrounding area, with greater than 80 percent of tree stems being coniferous species. Lowland and upland conifer types made up greater than 70 percent of the area within 100m (328 ft) of den sites and the percentage of those cover types decreased with greater distance from the den sites. These findings are consistent with USFS definitions for suitable denning habitat.

Lynx breed in spring and females give birth in late May to early June, with litters of up to five kittens. Hare densities are correlated positively with litter size, and age at first breeding is lower when hare populations are high. During the low phase of the hare cycle, few if any kittens are born (Brand and Keith 1979; Poole 1994; Slough and Mowat 1996). Litter sizes may be smaller in the southern lynx range due to lower peak hare densities (Koehler 1990; Squires and Laurion 2000), although large litter sizes do occur. Kittens wean at about 12 weeks after birth and stay with females during their first winter when they may hunt cooperatively; family units then break up at the onset of breeding, about mid-March (Quinn and Parker 1987).

The most commonly reported causes of lynx mortality include kitten starvation (Koehler 1990; Quinn and Parker 1987) and human-caused mortality (Bailey et al. 1986; Ward and Krebs 1985). Significant lynx mortality due to starvation (up to two-thirds of deaths) has been demonstrated in cyclic populations of the northern taiga during the first two years of hare scarcity (Poole 1994; Slough and Mowat 1996). Where trapping of lynx occurs legally, mortality of adults may be almost entirely human-caused during hare population lows (Poole 1994). Lynx are also killed by vehicles, disease, and other mammal species, although the significance of these factors to lynx populations is uncertain (Bailey et al. 1986; Brand and Keith 1979; Carbyn and Patriquin 1983; Shenk 2009; Ward and Krebs 1985). During a lynx irruption in Minnesota in 1971-1974 when the state allowed take by trappers, 96 percent of 128 mortalities were caused by trapping or shooting, whereas 4 percent were killed by cars (Henderson 1977). Through August 2009, of the 118 lynx that died of known or suspected causes in Colorado since the state began reintroducing the species in 1999, approximately 29.7 percent were human-induced through either collisions with vehicles or shot, 18.6 percent died of starvation or disease/illness, and 37.3 percent were from unknown causes (Shenk 2009).

Linear features such as roads may benefit lynx from an energetic perspective, but may also have negative effects if they increase human exposure and the chance of incidental mortality (Moen et al. 2010). Of the 63 lynx mortalities recorded in Minnesota since 2000, 29 died after being trapped, 16 from unknown causes, 9 from vehicle collisions, 7 from being shot, and 2 died after collisions with trains (U.S. Fish and Wildlife Service, unpubl.data). Although there is no longer a legal harvest in Minnesota, lynx that travel long-distances into Canada are susceptible to legal harvest there (Moen et al. 2010), with 4 of the 29 trapped Minnesota lynx taken as legal harvest in Canada.

Buskirk et al. (2000) suggested that when other snowshoe hare predators, particularly coyotes, can access lynx winter hunting areas via compacted snow, they may compete for prey sufficiently to affect local lynx populations, and some study results support that theory (Bunnell et al. 2006, Burghardt-Dowd 2010). Results from the Kolbe et al. (2007) study had contrasting results, whereby coyotes did not use compacted roads any more than uncompacted roads. Overall, studies of coyote use of compacted roads and trails in winter have yielded variable results and while there may be some low level of competition for prey between lynx and coyotes, it's likely variable both spatially and temporally depending on prey availability and composition (Interagency Lynx Biology Team 2013).

Buskirk et al. (2000) also suggested that direct killing by coyotes, bobcats, and mountain lions (*Puma concolor*) could affect lynx numbers where these competitors' ranges overlap substantially with lynx; in addition, Quinn and Parker (1987) stated that "(G)ray wolves will kill lynx that they catch in the open." Bobcat home ranges often exhibit elevational or latitudinal separation from those of Canada lynx, which are better adapted to deep snow. The paws of lynx support twice as much weight on snow than bobcats (Quinn and Parker 1987). Bobcats are thought to displace Canada lynx where both felids are locally sympatric.
Hybridization of lynx with bobcats has been confirmed in Maine, Minnesota, and New Brunswick with DNA analysis (Homyack et al. 2008; Schwartz et al. 2004). The hybrid animals had external physical characteristics of both species (Homyack et al. 2008).

Status of the Species and Distribution

The Canada lynx range is associated closely with the distribution of North American boreal forest inhabited by snowshoe hares (Agee 2000). It extends from Alaska and across much of Canada with southern extensions into the western U.S., including the Cascades Range and Northern and Southern Rocky Mountains western Great Lakes region, and the northeastern U.S. from Maine to New York ((Interagency Lynx Biology Team 2013).

Within the contiguous United States' transitional boreal forest, there are core areas for Canada lynx in Maine, Minnesota, Montana, Washington and likely Idaho (68 Federal Register 40076-40101, July 3, 2003). Status of Canada lynx in the Minnesota/Great Lakes region is summarized below. Outside of Minnesota in the Great Lakes region, lynx may also occur in Wisconsin and Michigan, but there is no current evidence of reproduction there and suitable habitat is limited and disjunct from occupied habitat in Minnesota and Canada (68 Federal Register 40076-40101, July 3, 2003).

Minnesota/Western Great Lakes Region

In Minnesota, recent and historical lynx records are primarily in the northeastern part of the state, especially in the Northern Superior Uplands Ecological Section. Historically, this area was dominated by red pine (*Pinus resinosa*) and white pine (*P. strobus*) mixed with aspen (*Populus spp.*), paper birch (*Betula papyrifera*), spruce, balsam fir (*Abies balsamifera*) and jack pine (*P. banksiana*) (MDNR 2011). Unlike elsewhere within the Great Lakes and Northeast regions, most lynx habitat in northeastern Minnesota is on public lands, particularly the Superior National Forest. Mixed deciduous-boreal forest suitable for lynx habitat encompasses most of the SNF, which has been mapped into Lynx Analysis Units to promote lynx management under the SNF Land and Resource Management Plan (USDA 2004). The 2000 LCAS provided guidance for developing Lynx Analysis Units (LAUs) on federal lands in the contiguous. They do not depict actual lynx home ranges but approximate the size of a female's home range and contain year-round habitat components. The precise area of lynx occupancy in Minnesota is unknown; however, Moen et al. (2008b) estimated it to be 10,632 mi^2 (6,804,480 ac).

Harvest and bounty records for Minnesota, which are available since 1930, indicate approximate 10-year population cycles, with highs in 1940, 1952, 1962, and 1973 (Henderson 1977; McKevley et al. in Ruggiero et al. 1999). Lynx abundance in Minnesota appears to be directly related to population levels in nearby Canada (Mech 1980) and based on trapping records, lynx abundance in Minnesota appears to lag fluctuations in Manitoba, Ontario, and Saskatchewan by about 3 years (McKelvey et al. in Ruggiero et al. 1999). During a 47-year period (1930–1976) before cessation of legal harvest, the Minnesota lynx harvest ranged from 0 to 400 per year (Henderson 1977) and lynx were captured in the state through periods presumed to represent both population highs and lows.

In the 1990s, there were only five verified records of lynx in Minnesota (M. Don Carlos, MDNR 1994; S. Loch 2006, pers. comm.) but beginning in about 2000, their numbers evidently began to rebound. Through May 2015, genetic analyses of 1,085 samples have identified 299 individual lynx, of which 154 were males and 144 were females. There were 42 samples of lynx/bobcat hybrids, of which 13 were individuals – 8 males and 5 females (SNF 2015, unpubl. data). Lynx have been detected in more than 10 counties; however, the majority of lynx were detected in St. Louis, Lake, and Cook Counties where most of the data collection has been focused (Catton and Loch 2011). This number of lynx represents only a subset of the actual number present in the state since 2000, which is unknown.

In northern Minnesota, structural components of forests such as blowdown and deadfalls appear to be more important than forest cover type in determining lynx denning habitat (Interagency Lynx Biology Team 2013, p. 46). Most den sites in Minnesota are found in blowdown and are associated with small patches of uplands surrounded by low-lying wetland areas (Moen and Burdett 2009, pp.).

Lynx researchers have confirmed at least nine lynx dens in Minnesota by following the activities of radio-collared females in the years 2004-2006 (R. Moen 2006, pers. comm.). Moen et al.

(2008a) located kittens every year in which females were radio-collared, totaling 33 kittens in 10 litters, from 2004 through 2007.

Snowshoe hare harvest in Minnesota (the only available long-term index to hare abundance in the state) shows a very inconsistent pattern from 1941-2000. Hare abundance, as indicated by harvest, peaked in the early 1940s and 1950s along with lynx harvest, but not in the early 1950s or 1960s. In contrast, hare harvest was double any previous year from 1977-1980, yet lynx did not increase. Based on on-going northern Minnesota surveys, snowshoe hare numbers were high through the late 2000s (Erb 2009), with some slight 10-year ups and downs. Spring 2015 survey results suggest the current hare population may have declined, which would be expected with a fluctuating 10-year cycle, but the upcoming winter survey will likely provide more conclusive information (Erb 2015, pers. comm.). Canada lynx may not be legally trapped in Minnesota, where they are a protected species, but in the last 10 years, at least 15 lynx have been captured incidentally by trappers in pursuit of other species – 8 of these lynx died as a result (U.S. Fish and Wildlife Service, Bloomington, Minnesota, unpubl. data).

In previous biological opinions for federal actions that are ongoing in Minnesota, the Service anticipated various levels of take. These anticipated levels of take are described below, along with the actual recorded take that may be ascribed to each action. The Service monitors all known take and mortality of lynx in Minnesota in cooperation with the USFS.

• 2004 - Up to 2 lynx per year, but no more than 20 in total, over the 15 years after the approval of the Revised Land and Resource Management Plans, Chippewa and Superior National Forests. These plans were approved in July 2004. Thus, the Service has anticipated that this take would occur between July 2004 and July 2019. Thus far, only one incidental take has been ascribed to the USFS's implementations of these plans – a lynx was killed by a vehicle in April 2005 on the Superior National Forest.

• 2005 - Trunk Highway 371 North, Federal Highway Administration – 1 lynx over a 30 year period (2005-2035). Thus far, no take may be ascribed to this action. 2005 - Trunk Highway 1, Federal Highway Administration – up to 3 lynx, over a 30 year period (2005-2035). Thus far, no take has been ascribed to this action.

• 2005 - Trunk Highway 53, Federal Highway Administration - 3 lynx over the life of the project, a period of approximately 30 years from the start of project construction. Thus far, no take has been ascribed to this action.

• 2007 – Paving of Forest Road (Denley Road), in St. Louis and Lake Counties, Minnesota, Superior National Forest - 1 lynx killed by a vehicle as frequently as once every 10 years, on the 10.4 miles of FR 424 to be reconstructed. Thus far, no take has been ascribed to this action.

• 2007 - Mittal Steel, Minorca Mine Inc. East Reserve Project, U.S. Army Corps of Engineers - 1 lynx killed by a vehicle once every 16 years in the action area. Thus far, no take has been ascribed to this action.

• 2009 – Mesabi Nugget, U.S. Environmental Protection Agency – 1 lynx killed by a vehicle during the 30 year project period. Thus far, no take has been ascribed to this action.

• 2011 – Continued Implementation of the Revised Superior National Forest Land and Resource Management Plan, USFS –1 lynx per year over the life of the Forest Plan of 10 years. Thus far, no take has been ascribed to the continued implementation of the Superior National Forest Plan.

Collectively, we anticipated the above actions would result in take of an average of 2.42 lynx per year, or 2 to 3 per year within their combined action areas in Minnesota. In general, the amount of incidental take we anticipate in an Opinion is based on the best scientific information available, and we consider both qualitative and quantitative factors to derive an amount of take that is as reasonable and logical as possible. The Service also relies upon professional judgment to ensure the Incidental Take Statement represents the best estimate we are able to produce. During the approximately 15 years during which the Service has collected lynx mortality data in Minnesota, 63 lynx deaths have been recorded, of which 47 were due to human causes (vehicle and rail collisions, trapping (including 4 in Canada), and shooting; only 1 of these resulted from a federal action that had undergone consultation).

Northeast

The boreal forest of the Northeast historically and presently occurs primarily in Maine, where habitat hosts a resident, breeding population of lynx. Maine's lynx population is directly connected to substantive lynx populations and habitat in southeastern Quebec and northern New Brunswick. Lynx numbers in Maine apparently increased since the mid-1980s to early 2000s coinciding with increased habitat from extensive clearcutting in the 1970's and 1980's to address a spruce budworm outbreak (Hoving et al. 2004, Simons-Legaard et al. 2013, Vashon et al. 2012). This habitat is aging and the amount of habitat (Simons 2009) and lynx populations (Vashon et al. 2012) are believed to be declining. Lynx habitat and populations will decline by 50 to 60 percent in the next 15 to 20 years (Simons 2009). Small numbers of breeding lynx were discovered in northern New Hampshire and Vermont in 2007 that persisted through about 2013 (Interagency Lynx Biology Team 2013, p. 40). However, forested habitats are very limited and highly fragmented in those states and New York. Lynx occurring in New York since 1900 have been dispersers.

Northern Rocky Mountains/Cascades

In this region, the majority of lynx occurrences are associated at a broad scale with the "Rocky Mountain Conifer Forest" and within this type, most occurrences are in moist Douglas fir (*Pseudotsuga menziesii*) and western spruce/fir forests (McKelvey et al. *in* Ruggiero et al. 2000). Most of the lynx occurrences are in the 4,920 to 6,560 feet (ft) (1,500 to 2,000 m) elevation range in northwestern Montana and at higher elevations in more southerly latitudes (6,500 to 9,800 ft in Wyoming) (McKelvey et al. *in* Ruggiero et al. 2000). In the Cascades, potential lynx habitat occurs generally above 4,000 ft (Interagency Lynx Biology Team 2013, p. 64). These habitats are found in the Rocky Mountains of Montana, Idaho, eastern Washington, and Utah, in the Wallowa Mountains and Blue Mountains of southeast Washington and northeastern Oregon, and the Cascade Mountains in Washington and Oregon. A substantial proportion of the verified lynx occurrences in the U.S. and confirmed breeding are from this region. The boreal forest of Washington, Montana, and Idaho is contiguous with that in adjacent British Columbia and Alberta, Canada.

The Northern Rocky Mountains and Cascade Region support the most viable resident lynx populations in the contiguous U.S., while recognizing that at best, lynx in the contiguous U.S. are naturally rare. Strong evidence exists to support the presence of resident lynx populations throughout much of the forest types considered lynx habitat in Montana and Washington. Resident lynx populations probably exist in contiguous habitats in Idaho and northwestern Wyoming, whereas lynx have probably always occurred intermittently in Oregon and Utah, although the historical or current presence of resident populations in these two states has not been confirmed.

Southern Rocky Mountains

It is unclear whether lynx in this region historically occurred as a resident population or if historic records were of periodic dispersers. If a resident lynx population occurred historically in the Southern Rocky Mountains, then this native population has been lost. Isolation from potential source populations may have led to the extirpation of lynx in this region. Although habitats in the Southern Rockies are far from source populations and more isolated, it is still possible that dispersers could arrive in the Southern Rocky Mountains during highs in the population cycle.

From 1999 through 2006, Colorado Division of Wildlife (CDOW; now Colorado Parks and Wildlife or CPW) reintroduced 218 lynx from Canada and Alaska into southwestern Colorado (Shenk 2009). No lynx were released in 2007, 2008 or 2009 and in 2010, the CDOW determined that the state’s population was apparently viable and self-sustaining. As of August 2009, CDOW had tracked 37 of the released animals and confirmed 118 mortalities (Shenk 2009). Reproduction was first documented in 2003 and a total of 42 dens were found during 2003-2009 surveys. All of the dens have been scattered throughout the high elevation areas of Colorado, except one den was found in southeastern Wyoming in 2004 (Shenk 2006, 2009). Preliminary CPW 2014-2015 monitoring efforts (snow tracking, scat/hair samples, and camera detections) focused in the San Juan Mountain Range resulted in newly documented resident lynx in the LaGarita Mountains north of Creede and near the New Mexico border. Adult females with kittens were detected at cameras documenting at least some reproduction in the San Juan Mountains study area (Colorado Parks and Wildlife 2015).

Lynx Critical Habitat

On September 12, 2014, the Service published a revised designation of critical habitat for the contiguous U.S. Distinct Population Segment (DPS) of Canada lynx (79FR54782). Critical habitat is defined as the physical and biological features and associated primary constituent elements (PCEs) laid out in a specific quantity and spatial arrangement to be essential to the conservation of the species. Lynx critical habitat PCEs are found in boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with coniferous boughs touching the snow surface;

b. Winter snow conditions that are generally deep and fluffy for extended periods of time;

c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and

d. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The Service designated approximately 38,954 mi^2 (100,891 km^2) of critical habitat in five units within portions of Idaho, Maine, Minnesota, Montana, Washington, and Wyoming. Northeastern Minnesota is considered Unit 2 (Figure 4) and is located in portions of Koochiching, St. Louis, Lake, and Cook Counties; Unit 2 consists of 8,069 mi^2 (20,899 km^2) of designated critical habitat and includes the majority of the Superior National Forest. Approximately 73,976 acres of Superior National Forest lands are outside of Lynx Analysis Units (LAU)[2] but within designated critical habitat (USDA 2011). These areas were not included in the LAU development, primarily because of the mixed ownership patterns. The Unit 2 area was occupied at the time of listing and it contains the physical and biological features essential to the conservation of lynx. This area is essential because it is the only area in the Great Lakes Region for which there is evidence of recent lynx reproduction. It likely acts as a source for, or provides connectivity to, more peripheral portions of the lynx's range in the region. The Superior National Forest has designated critical habitat but the Chippewa National Forest does not.

[2] LAUs are used to facilitate analyses and monitoring of effects from management actions on lynx habitat. They approximate the size of a female's home range and contain year-round habitat components.

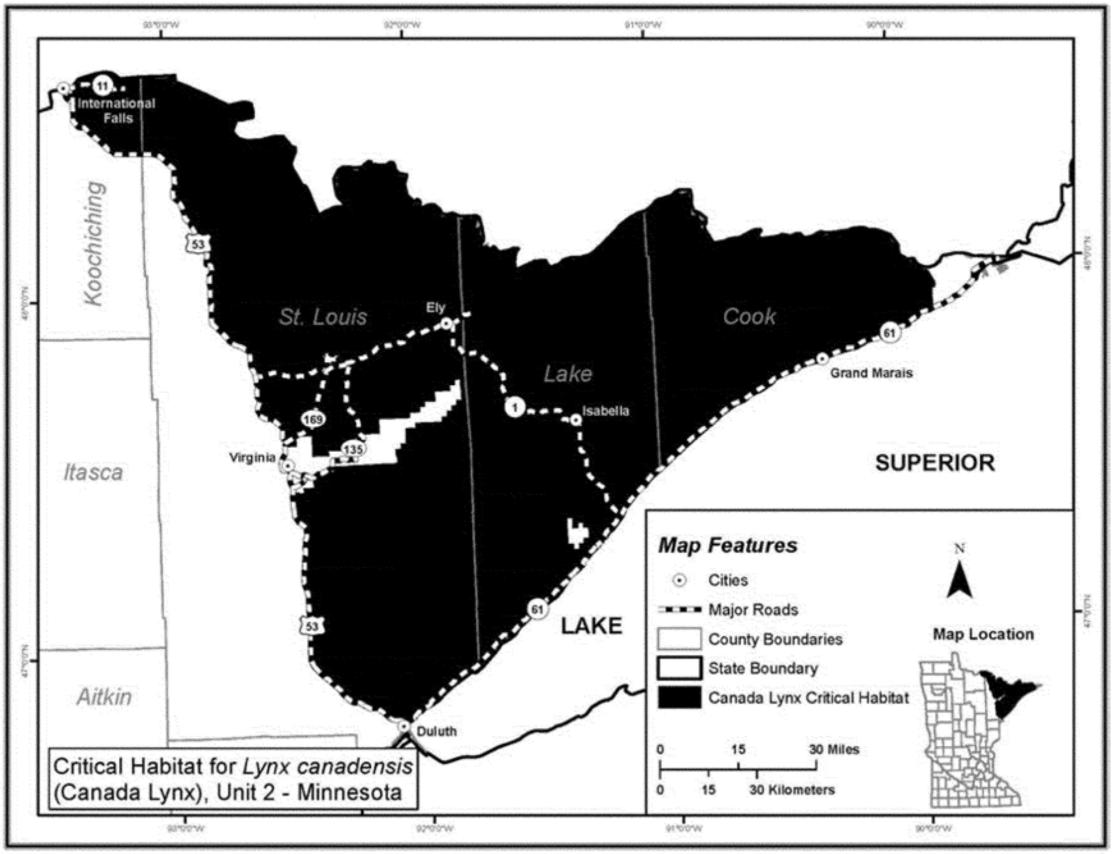

Figure 4. Unit 2 - Designated Critical Habitat for Lynx in Minnesota.

Gray Wolf

Species Description

Gray wolves are the largest wild members of the Canidae, or dog family, with adults ranging from 18 to 80 kilograms (kg) (40 to 175 pounds (lb)) depending upon sex and subspecies (Mech 1974). The average weight of male wolves in Wisconsin is 35 kg (77 pounds (lb)) and ranges from 26 to 46 kg (57 to 102 lb), while females average 28 kg (62 lb) and range from 21 to 34 kg (46 to 75 lb) (Wisconsin Department of Natural Resources 1999). Wolf fur color is frequently a grizzled gray, but it can vary from pure white to coal black. Wolves may appear similar to coyotes and some domestic dog breeds (such as the German shepherd or Siberian husky) (*Canis lupus familiaris*). Wolves' longer legs, larger feet, wider head and snout, and straight tail distinguish them from both coyotes and dogs.

The taxonomic status of wolves in the western Great Lakes region has long been debated. Most recently, they have been considered as a mixed population of *C. lupus, C. lycaon* (eastern wolf), and their intercrosses (e.g., Fain et al. 2010; Wheeldon et al. 2010). These varying interpretations of the taxonomic status of western Great Lakes wolves are summarized in the 2011 published proposed rule to delist the Western Great Lakes DPS of the gray wolf (50 CFR Part 17 Vol. 76 No. 87 May 5, 2011).

Life History

Wolves are primarily predators of medium and large mammals. Wild prey species in Minnesota include white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), beaver (*Castor canadensis*), and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken (Mech 1974; Stebler 1944; Wisconsin Department of Natural Resources 1999). Wolves are habitat generalists that do not depend on the type, age, or structure of vegetation; instead, they are indirectly influenced by vegetative condition through the distribution of their primary prey species. In the Western Great Lakes, during the last 25 years, wolves have also killed domestic animals including horses (*Equus caballus*), cattle (*Bos taurus*), sheep (*Ovis aries*), goats (*Capra hircus*), llamas (*Lama glama*), pigs (*Sus scrofa*), geese (*Anser sp.*), ducks (*Anas sp.*), turkeys (*Meleagris gallopavo*), chickens (*Gallus sp.*), guinea fowl (*Numida meleagris*), pheasants (*Phasianus colchicus*), dogs, cats (*Felis catus*), and captive white-tailed deer (USDA APHIS - Wildlife Services 2008, 2009; Wydeven 1998; Wydeven et al. 2001; Wydeven and Wiedenhoeft 1999, 2000, 2001, 2005).

Wolves are social animals, normally living in packs of 2 to 12 individuals. In Minnesota, the average pack size ranges between 4.9 and 5.6, according to surveys conducted between 1988 and 2008 (Erb 2008b; Erb and Benson 2004). Packs are primarily family groups consisting of a breeding pair, their pups from the current year, offspring from one or two previous years, and occasionally an unrelated wolf. Packs typically occupy, and defend from other packs and individual wolves, a territory of 20 to 214 mi^2 (50 to 550 km^2). Midwest wolf packs tend to occupy territories on the lower end of this size range. Minnesota territory size, for example, averaged 39 to 40 mi^2 (102 km^2) (Erb 2008a; Erb and Benson 2004).

Wolves are sexually mature at 22 months but generally only the alpha pair breed (Mech 1974). The alpha pair normally inhibits sexual contact between other mature members. Breeding takes place from January through March, and gestation is 60-63 days. Litters are born from early April into May; they range from 1 to 11 pups, but generally include 4 to 6 pups (Michigan Department of Natural Resources 1997, 2008; U.S. Fish and Wildlife Service 1992). Normally a pack has a single litter annually, but the production of two or three litters in one year has been documented in Yellowstone National Park (Smith et al. 2009; Smith et al. 2005). Pups remain at the den site for 6 to 8 weeks. Throughout the summer, wolves use two to three rendezvous sites (Fuller et al. 2003). In September, when the pups are large enough to travel with the pack, rendezvous sites are abandoned and the pack moves as a single unit.

Yearling wolves frequently disperse from their natal packs, although some remain with them. Adult wolves and pups older than 5 months also may disperse but at much lower frequencies (Fuller 1989). Dispersers may range over large areas as lone animals after leaving their natal pack, or they may locate suitable unoccupied habitat and a member of the opposite sex and begin their own pack. These dispersal movements allow a wolf population to quickly expand and colonize areas of suitable habitat that are nearby, or even those that are isolated by a broad expanse of unsuitable habitat.

Wolves are susceptible to disease, predation, human persecution, starvation, and accidents. Survival of pups in summer is difficult to estimate but has ranged from 0.48 to 0.89. Survival of pups is likely related to prey biomass (Fuller 1989). Survival of yearlings and adults in the Great Lakes region has varied from 0.61 to 0.82 (Fuller 1989; Gogan et al. 2004; Wydeven et al. 1995).

Potential and favorable wolf habitat is defined by several elements such as low human population density, sufficient prey density, road density, vegetation cover, and special landscape patterns (Mladenoff et al. 1997; Mladenoff et al. 1995). Gray wolves are generalists that can live in most any habitat that supports ungulate prey. Wolf densities are directly related to the densities of their primary ungulate prey (Fuller 1989); thus forested areas occupied by white-tailed deer and moose are critical. Additionally, the habitat should be suitable for smaller prey such as beaver and snowshoe hare, which may be seasonally important (Mech 1970). Moose, deer, and snowshoe hare tend to forage in areas of regenerating upland forest, and conifer forest is an important component of thermal cover for all. Riparian aspen forest is important for beavers. Patch structure is only important in that it may alter prey densities or include areas of high road and human densities, thereby indirectly altering wolf distribution (Fuller 1997).

In Wisconsin, Mladenoff et al. (1995) and Mladenoff et al. (1999) indicated that re-colonizing wolf packs selected territories that contained no urban land, very little farmland, and were 93 percent forested. Road density was the best predictor of suitable habitat for breeding packs (Mech et al. 1988a; Mladenoff et al. 1995; Thiel 1985). While wolves will use roads and readily cross them, generally, areas with road densities of less than 1 mi/mi^2 are best for wolf survival (Wydeven et al. 2001; Wydeven & Wiedenhoeft 2001; Fuller 1997).

Status of the Species and Distribution

Most of the gray wolf populations in the United States are currently protected under the ESA pursuant to the February 2015 reinstatement of final rules; however, gray wolves in Montana, Idaho, the eastern third of Washington and Oregon, and north-central Utah retain their delisted status. Gray wolves are considered threatened in Minnesota, nonessential experimental in Wyoming, and endangered in the remaining conterminous states and Mexico (50 CFR 17.11(h)). Within this broad area, there are separate regulations establishing non-essential experimental populations in the Northern Rocky Mountains and for the Mexican wolf (*C. lupus baileyi*) in Arizona and New Mexico (50 CFR 17.84(i), (k), and (n)). Since 2003, the status of the gray wolf under the ESA has been subject to several regulatory changes and resulting litigation in numerous Federal Courts, including rules to delist and reinstate protections.

The estimated population of wolves covering Canada and occupied portions of the U.S. is at least 60,000 (International Wolf Center 2016; USFWS 2016). In the contiguous U.S., they occur in Minnesota, Wisconsin, Michigan, portions of the northern Rocky Mountains, central Idaho, and Arizona/New Mexico, and more recently, in Washington and Oregon, with an estimated population size of over 5,500 in 2015.

Numbers of wolves in the Western Great Lakes DPS core range (Figure 5) remain above the levels that would be cause for significant concern to the Service. After federal de-listing in 2012, wolf harvest seasons were established in Minnesota and population surveys were conducted annually. In the first two winters post-harvest, wolf population estimates varied from approximately 2,200 to 2,400 (MN DNR 2015). In December 2014, following the third consecutive wolf harvest season, wolves in Minnesota were returned to the list of federally threatened species as a result of a court ruling. The 2014-15 mid-winter estimated wolf population was 2,221, or 1.2 wolves per 100 mi^2 (3.2 wolves per 100 km^2) of occupied range, with a 90 percent confidence interval ranging from 1,789 to 2,719 wolves. There has been no statistically significant change in the population size over the past 3 years. Wolves have an estimated occupied range of 27,251 mi^2 (70,579 km^2) in Minnesota (Erb et al. 2015).

As of April 2015, the Wisconsin statewide minimum wolf population was estimated to be 746 to 771, an increase of 12.5 percent from the previous year. The range of contiguous wolf packs covers approximately 23,750 mi^2 in the northern and central forested regions of the state, with three isolated packs occurring in the southwestern and western parts of the state. Wolves have been observed in most counties in the state (WI DNR 2016). Michigan wolf numbers changed from 687 in 2010-2011 to 636 in 2013-2014 (Bump 2014, pers. comm.; USFWS 2016). This represents an approximate 7 percent decrease in wolf numbers; however, wolves were hunted during the period of wolf delisting (until December 2014). These population estimates individually and combined (1,382 at a minimum) are well above the numbers that might cause concern at the individual state level (100) or combined (200).

Figure 5. Gray Wolf Range in the Western Great Lakes DPS (76 FR 81671).

Gray Wolf Critical Habitat

Critical habitat for gray wolf was designated in northeastern Minnesota and Michigan's Isle Royale National Park in March 1978. In Minnesota, five regulatory zones were created state-wide, of which Zones 1, 2, and 3 are considered critical habitat and cover 9,845 mi^2 (Figure 6). Zone 1 fully protects wolves whereas Zones 2-5 allow for regulated take of depredating wolves, with most take likely occurring in Zone 4.

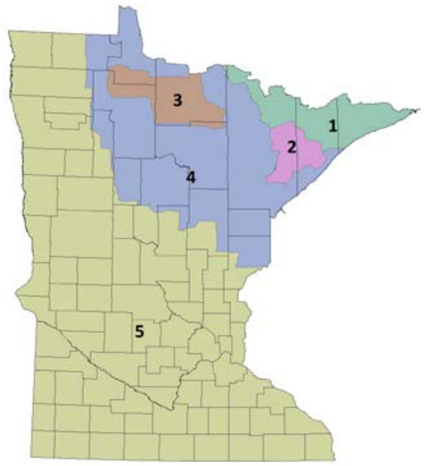

Figure 6: Gray Wolf Management Zones in Minnesota (*Note*: Zones 1, 2, and 3 are also considered critical habitat).

Northern Long-eared Bat

The Service published its decision to list the northern long-eared bat (NLEB) as a threatened species on April 2, 2015 (80 FR 17974-18033) and the effective date of this final rule was May 4, 2015. The final rule determined that critical habitat designation for the NLEB was not determinable at the time. The following information on NLEB life history and biology, threats, distribution, and overall status is summarized from that rule.

Life History and Biology

The NLEB is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and spends summers in wooded areas. The key stages in its annual cycle are: hibernation, spring staging and migration, pregnancy, lactation, volancy/weaning, fall migration and swarming. NLEB generally hibernate from mid-fall through mid-spring each year. Spring migration period likely runs from mid-March to mid-May each year, with timing varying depending on the portion of the range. Females depart shortly after emerging from hibernation and are pregnant when they reach their summer area. Parturition (birth) occurs in late May or early June (Caire et al. 1979, p. 406; Easterla 1968, p. 770; Whitaker and Mumford 2009, p. 213) but may occur as late as July (Whitaker and Mumford 2009, p. 213), with nursing continuing until weaning, which is shortly after young become volant (able to fly) in mid- to late-July. Fall migration likely occurs between mid-August and mid-October.

Summer habitat and ecology

Suitable summer habitat[3] for NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields, and pastures. This includes forests and woodlots containing potential roosts, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure.

Many species of bats, including the NLEB, consistently avoid foraging in or crossing large open areas, choosing instead to use tree-lined pathways or small openings (Patriquin and Barclay 2003, Yates and Muzika 2006). Further, wing morphology of the species suggests that they are adapted to moving in cluttered habitats. Thus, isolated patches of forest may not be suitable for foraging or roosting unless the patches are connected by a wooded corridor.

Upon emergence from the hibernacula in the spring, females seek suitable habitat for maternity colonies (typically consisting of females and young). NLEB actively form colonies in the summer (Foster and Kurta 1999) and exhibit fission-fusion behavior (Garroway and Broders 2007), where members frequently coalesce to form a group (fusion), but composition of the group is in flux, with individuals frequently departing to be solitary or to form smaller groups (fission) before returning to the main unit (Barclay and Kurta 2007). As part of this behavior, NLEBs switch tree roosts often (Sasse and Pekins 1996), typically every 2 to 3 days (Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Timpone et al. 2010). NLEB maternity colonies range widely in size, although a maximum of 30-60 individuals may be most common early in the season, with the colony size decreasing post-lactation of young (Service 2014). NLEB show some degree of interannual fidelity to single roost trees and/or maternity areas. Male NLEB are routinely found with females and young in maternity colonies. NLEB use networks of roost trees often centered around one or more central-node roost trees (Johnson et al. 2012). NLEB roost networks also include multiple alternate roost trees and male and non-reproductive female NLEB may also roost in cooler places, like caves and mines (Barbour and Davis 1969, Amelon and Burhans 2006).

NLEB roost in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags [typically greater than or equal to 3 inches diameter at breast height (dbh)]. NLEB are known to use a wide variety of roost types, using tree species based on presence of cavities or crevices or presence of peeling bark. Occasionally, NLEB have also been found roosting in structures like barns and sheds, particularly when suitable tree roosts are unavailable.

Females give birth to a single offspring, typically in late-May or early June (Caire et al. 1979, p. 406; Easterla 1968, p. 770; Whitaker and Mumford 2009, p. 213). Lactation then lasts 3 to 5 weeks with pups typically becoming volant between early July and early August.

Migration

Males and non-reproductive females may summer near hibernacula, or migrate to summer habitat further from their hibernaculum. The NLEB is not considered to be a long distance migrant and typically migrates 40-50 mi from hibernacula. Migration is an energetically demanding behavior for the NLEB, particularly in the spring when their fat reserves and food supplies are low and females are pregnant.

Winter habitat and ecology

Suitable winter habitat (hibernacula) includes underground caves and cave-like structures (e.g. abandoned or active mines and railroad tunnels. Other landscape features that may also be used by NLEBs during the winter have yet to be documented. Generally, NLEBs remain at hibernacula from October to April, depending on local climate. In southern portions of the species' range, they may be at hibernacula only from November to December; in some northern areas they may leave hibernacula for summer habitat between March and mid-May.

Hibernacula for NLEBs typically have significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius); high humidity; and, minimal air currents. Specific areas where they hibernate have very high humidity and droplets of water are often visible on their fur. Surveyors may find them in small crevices or cracks, often with only the nose and ears visible.

NLEBs tend to roost singly or in small groups, with hibernating population sizes ranging from a few individuals to around 1,000 (U.S. Fish and Wildlife Service 2014 and unpublished data). The northern long-eared bat exhibits more winter activity than other cave species; individuals often move between hibernacula throughout the winter (Griffin 1940, Whitaker and Rissler 1992, Caceres and Barclay 2000). NLEB have shown a high degree of philopatry to hibernacula used, returning to the same ones every year.

Spring Staging and Fall Swarming habitat and ecology

Upon arrival at hibernacula in mid-August to mid-November, NLEB "swarm," a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in caves during the day. Swarming continues for several weeks and mating occurs during the latter part of the period. After mating, females begin hibernation, with most bats of both sexes hibernating by the end of November (by mid-October in northern areas).

After hibernation ends in late March or early April (as late as May in some northern areas), most NLEB migrate to summer roosts. Females emerge from hibernation before males. Reproductively active females store sperm from autumn copulations through winter and ovulation takes place after the bats emerge from hibernation in spring. The period after hibernation and just before spring migration is typically referred to as "staging," a time when bats forage and a limited amount of mating occurs. This period can be as short as a day for an individual, but not all bats emerge on the same day.

In general, NLEB use roosts in the spring and fall similar to those selected during the summer. Suitable spring staging and fall swarming habitat is typically within 5 miles of a hibernaculum and consists of forested habitats similar to where they may roost, forage, and travel. This includes forested patches and linear features such as fencerows, riparian forests and other wooded corridors. These wooded areas may be comprised of dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1,000 ft from the next nearest suitable roost tree, woodlot, or wooded fencerow.

Threats

No other threat is as severe and immediate for the NLEB as the disease white-nose syndrome (WNS). It is unlikely that NLEB populations would be declining so dramatically without the impact of WNS. Since the disease was first observed in New York in 2007 (later biologists found evidence from 2006 photographs), WNS has spread rapidly in bat populations from the Northeast to the Midwest and the Southeast. Population numbers of NLEB have declined by 99 percent in the Northeast, which along with Canada, has been considered the core of the species' range. Although there is uncertainty about how quickly WNS will spread through the remaining portions of this species' range, it is expected to spread throughout. In general, the Service believes that WNS has significantly reduced the redundancy and resiliency of the NLEB.

Although significant NLEB population declines have only been documented due to the spread of WNS, other sources of mortality could further diminish the species' ability to persist as it experiences ongoing dramatic declines. Specifically, declines due to WNS have significantly reduced the number and size of NLEB populations in some areas of its range. This has reduced these populations to the extent that they may be increasingly vulnerable to other stressors that they may have previously had the ability to withstand. These impacts could potentially be seen on two levels. First, individual NLEB sickened or struggling with infection by WNS may be less able to survive other stressors. Second, NLEB populations impacted by WNS, with smaller numbers and reduced fitness among individuals, may be less able to recover making them more prone to extirpation. The status and potential for these impacts will vary across the range of the species.

Bats affected but not killed by WNS during hibernation may be weakened by the effects of the disease and may have extremely reduced fat reserves and damaged wing membranes. These effects may reduce their capability to fly or to survive long-distance migrations to summer roosting or maternity areas.

In areas where WNS is present, there are additional energetic demands for NLEBs. For example, WNS-affected bats have less fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder et al. 2012; Warnecke et al. 2012) and have wing damage (Meteyer et al. 2009; Reichard and Kunz 2009) that makes migration and foraging more challenging. Females that survive the migration to their summer habitat must partition energy resources between foraging, keeping warm, successful pregnancy and pup-rearing, and healing, and may experience reduced reproductive success. In addition, with wing damage, there may be an increased chance of WNS-affected bats being killed or harmed as a result of proposed actions. Again, this is particularly likely if activities such as timber harvest or burns are conducted early in the spring (April – May) when bats have just returned, have damaged wings, and are exposed to colder temperatures when torpor is used more frequently.

Over the long-term, sustainable forestry benefits NLEB by maintaining suitable habitat across a mosaic of forest treatments. However, forest practices can have a variety of impacts on the NLEB depending on the quality, amount, and location of the lost habitat, and the time of year of clearing. Depending on their characteristics and location, forested areas can function as summer maternity habitat, staging and swarming habitat, migration or foraging habitat, or sometimes, combinations of more than one habitat type. Impacts from tree removal to individuals or colonies would be expected to range from indirect impact (e.g., minor amounts of forest removal in areas outside NLEB summer home ranges or away from hibernacula) to minor (e.g., largely forested areas, areas with robust NLEB populations) to significant (e.g., removal of a large percentage of summer home range, highly fragmented landscapes, areas with WNS impacts).

Lastly, there is growing concern that bats, including the NLEB (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Mortality of NLEB has been documented at multiple operating wind turbines/farms. The Service is now working with wind farm operators to avoid and minimize incidental take of bats and assess the magnitude of the threat.

Rangewide Status

The NLEB ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993; Caceres and Pybus 1997; Environment Yukon 2011) (Figure 7). In the United States, the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east through the Gulf States to the Atlantic Coast (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Amelon and Burhans 2006). The species' range includes the following 37 states (plus the District of Columbia): Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Historically, the species has been most frequently observed in the northeastern United States and in the Canadian Provinces of Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the southern and western portion of the range than in the northern portion of the range (Amelon and Burhans 2006).

Although they are typically found in low numbers in inconspicuous roosts, most records of NLEB are from winter hibernacula surveys (Caceres and Pybus 1997). More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals (Whitaker and Hamilton 1998). Known hibernacula (sites with one or more winter records of NLEBs) include: Alabama (2), Arkansas (41), Connecticut (8), Delaware (2), Georgia (3), Illinois (21), Indiana (25), Kentucky (119), Maine (3), Maryland (8), Massachusetts (7), Michigan (103), Minnesota (15), Missouri (more than 269), Nebraska (2), New Hampshire (11), New Jersey (7), New York (90), North Carolina (22), Oklahoma (9), Ohio (7), Pennsylvania (112), South Carolina (2), South Dakota (21), Tennessee (58), Vermont (16), Virginia (8), West Virginia (104), and Wisconsin (67). NLEB are documented in hibernacula in 29 of the 37 states in the species' range. Other states within the species' range have no known hibernacula (due to no suitable hibernacula present, lack of survey effort, or existence of unknown retreats).

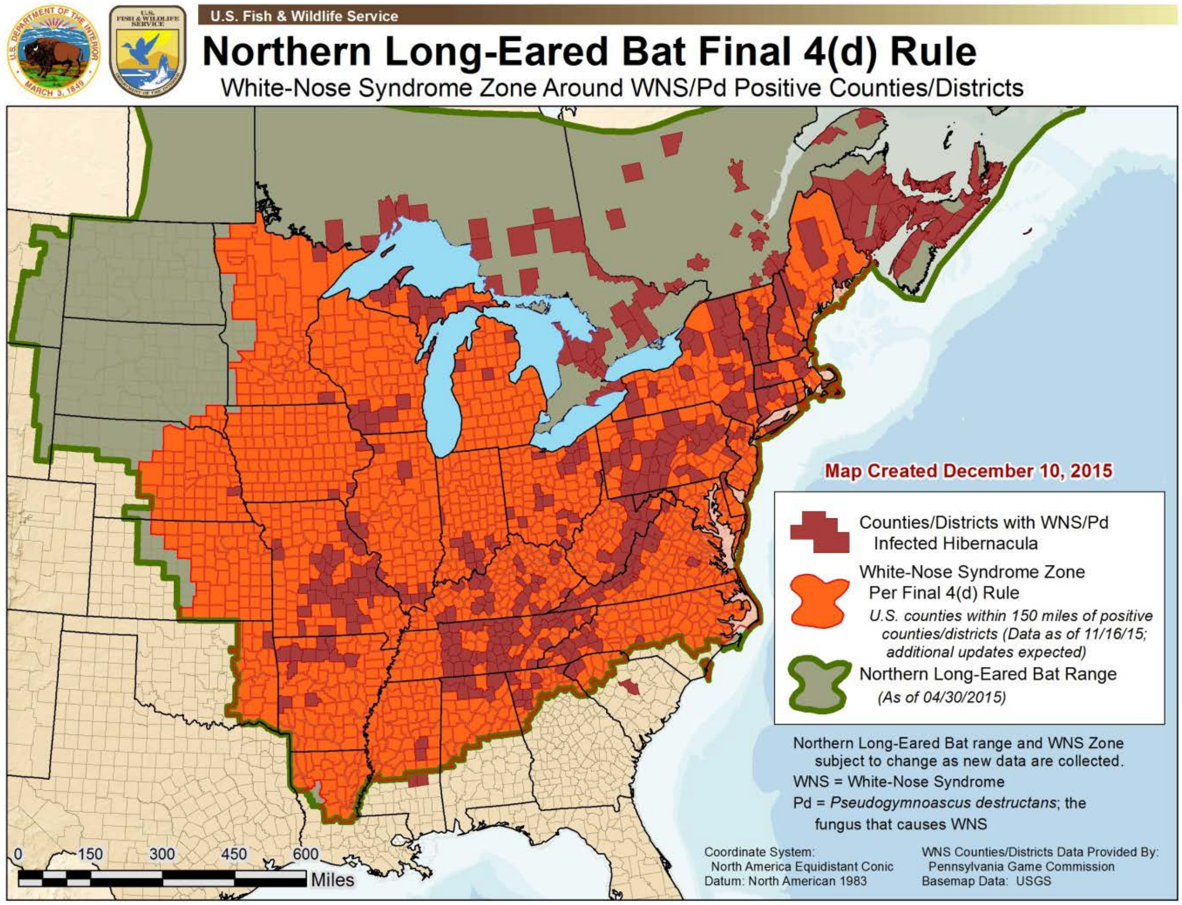

Figure 7. Northern Long-eared Bat Range and Current Zone of White-nose Syndrome.

The current range and distribution of NLEB must be described and understood within the context of the impacts of WNS. Prior to the onset of WNS, the best available information on NLEB came primarily from surveys (mostly focused on Indiana bat or other bat species) and some targeted research projects. In these efforts, NLEB was very frequently encountered and was considered the most common myotid bat in many areas. Overall, the species was considered to be widespread and abundant throughout its historic range (Caceres and Barclay 2000).

WNS has been particularly devastating for NLEB in the northeast, where the species was believed to be the most abundant. There are data supporting substantial declines in NLEB populations in portions of the Midwest due to WNS. In addition, WNS has been documented at more than 100 NLEB hibernacula in the southeast, with apparent population declines at most sites. WNS has not been found in any of the western states to date and the species is considered rarer in the western extremes of its range. We expect further declines as the disease continues to spread across the species' range.

Status of the Northern Long-eared Bat in Minnesota

Prior to 2014, there was little information on NLEB summer populations in the state. In 2014, passive acoustic surveys conducted at a new proposed mining area in central St. Louis County detected the presence of NLEB at each of 13 sites sampled. Calls that were assigned to NLEB accounted for approximately 14 percent of all recorded bat calls (Smith et al. 2014). Also in 2014, acoustic and mist-net data were collected by a pipeline project proponent that surveyed an approximately 125-ft-wide and 300-mile-long corridor through the northern third of the state. Positive detections were recorded in Hubbard, Cass, Crow Wing, Aitkin, and Carlton Counties, and NLEBs were the most common species captured by mist-net (Merjent 2014). In 2015, on-going mist-net surveys at Camp Ripley Training Center, Morrison County, resulted in capture of 7 NLEB (15 percent of total captures). Mist-net surveys on the Superior and Chippewa National Forests resulted in the capture of 45 NLEBs (59 percent of total captures) and 20 NLEBs (34 percent of total captures), respectively (Swingen et al. 2015).

Currently, there are 17,370,394 ac of forest in Minnesota considered potential NLEB summer habitat. Based on a 58.7 percent NLEB occupancy rate (pre-WNS), the Service estimated 10,196,421 ac may be occupied by NLEB (USFWS 2016; Table 2.4, p. 28).

The NLEB is known from 15 hibernacula in Minnesota; however, the status of most is unknown. An estimated 3,000 NLEB are thought to hibernate within the largest known hibernaculum in Minnesota, the Soudan Mine in St. Louis County. WNS has not been detected in Minnesota; however, the fungus that causes WNS was detected in 2011–2012. Currently, only Soudan Mine and Mystery Cave in Minnesota are known to harbor the fungus that causes WNS and to our knowledge, the fungus has not actually caused WNS in bats within the state.

Conservation Needs of the Species

The species' conservation needs define what is needed in terms of reproduction, numbers, and distribution to ensure the species is no longer in danger of extinction. The conservation needs should be defined in the species' recovery outline or plan. Since there is no recovery plan or recovery outline available at this time, we will outline the conservation needs based on our current understanding of the species.

The primary conservation need of the NLEB is to reduce the threat of WNS. This includes minimizing mortality in WNS-affected areas and slowing the rate of spread into currently unaffected areas. In addition, NLEB that continue to exist within WNS-affected areas need to be able to continue to survive and reproduce in order to stabilize and/or increase the populations. This can be done by reducing the other threats to the species, as listed above. Therefore, efforts to protect hibernacula from disturbances need to continue. These should include restricting human access to hibernacula particularly during the hibernation period, constructing/installing suitably designed gates where appropriate and maintaining the gates, and restoring microhabitat conditions in hibernacula that have been altered. Efforts should also be made to protect and restore (in some cases) adequate fall swarming habitat around hibernacula. Known maternity habitat should be maintained, and the removal of known roost trees, particularly when pregnant females and/or young are present should be reduced. Research to identify important hibernacula and summer areas and to delineate the migratory relationship between summering and wintering populations should also be pursued.

Northern Long-eared Bat Critical Habitat

Critical habitat has not been proposed for the NLEB.

Environmental Baseline

The environmental baseline is defined as the impacts from federal, state or private actions and other human or natural activities in the action area, the anticipated impacts from all federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process.

Action Area

Action area, as defined by the ESA's implementing regulations (50 CFR 402.02), is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Action is defined in the regulations as "…all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: (a) actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or (d) actions directly or indirectly causing modifications to the land, water, or air.

For the PolyMet Project, the area where "land, water, or air" is likely to be affected relative to threatened and endangered species and critical habitat includes those lands that are proposed for exchange with the USFS, including the area in and around the sites proposed for mining and processing, and the other non-federal sites. The action area was divided into three distinct parts: (1) the Mine and Plant Sites and associated Transportation and Utility Corridors with roads and related infrastructure (as mentioned, we sometimes refer to these collectively as Project area), plus an approximate 6-mile buffer for the effects analyses; (2) the land exchange parcels; and (3) the Wetland Mitigation Sites. This action area is based on proposed project activities and for (1) above, includes a surrounding area into which Project-related noise and vibrations are expected to emanate beyond the immediate mining activities footprint (see FEIS pp. 4-293 to 4-302 and 5-526 to 5-555 for a detailed description and maps of estimated ranges of noise and vibrations). We also consider several wildlife movement corridors that were identified in the BA and because one of these is outside of the 6-mile buffer, we extend the northeast side of the action area to include wildlife corridor #18, as described later in the Effects of the Action section.

From the information in the FEIS, we considered the maximum noise and air vibration outputs likely to occur during 24 hours of operation and identified a 3- to 6-mile radius as appropriate. The actual radius of this 'buffer' area likely varies due to types of noise and weather-related factors, such as prevailing winds, and other considerations. That is, the effects within the 6-mile buffer actually may be less in some areas; e.g., where noise attenuates and other effects also diminish within a closer distance. Within the action area's northwest, west, and southwest sides, the 6-mile buffer encompasses access roads and highways from nearby communities (e.g., Highways 166 and 135) where additional traffic will occur due to the Project. We recognize that Project-related effects will vary over time; for example, blasting and other extremely loud noises and vibrations will occur primarily at the Mine Site every 2 to 3 days and will decrease as mine pits become deeper, such that noise eventually will be attenuated by pit walls. However, we identified the outermost perimeter for maximum extent of potential wildlife disturbances as the action area.

The activities considered in this BO are located within portions of four Ranger Districts (Laurentian, Kawishiwi, Tofte, and Gunflint) in the SNF and we consider those lands on the Mine and Plant Sites and Transportation/Utility Corridor, within 6 miles of this Project area, and northeast to wildlife corridor #18, and the individual non-federal land parcels and Wetland Mitigation Sites as the action area. However, because much of the lynx, wolf and NLEB information in the BA and associated literature is reported for the entire, or portions of the Forest, rather than for the specific action area, we include information from this broader scale but which can be extrapolated to the action area. The entire Forest boundary encompasses over 3 million acres (includes federal, state, county, and other ownerships), of which 445,000 acres are water, and the proposed project is situated both inside and outside the Forest boundary.

Status of the Species within the Action Area

Canada Lynx

In Minnesota, the deepest snows occur in the northeast corner of the state (Minnesota DNR, http://climate.umn.edu/doc/snowmap.html), which includes the action area. Most lynx habitat in northeastern Minnesota is on public lands, particularly the Superior National Forest, and lynx are present on both the SNF and Chippewa National Forest. Mixed deciduous-boreal forest suitable for lynx habitat encompasses most of the Forests, which have been mapped into LAUs to facilitate lynx management under the 2000 and 2013 LCAS (Figure 8). Currently, the LAUs within the action area have greater than 95 percent habitat in a suitable condition (see Table 1). The 2000 and 2013 LCAS guidance for lynx habitat in any LAU is no more than 30 percent may be in an unsuitable condition (that is, at least 70 percent must be in a suitable condition). The analysis area for direct and indirect effects to lynx includes portions of LAUs 12 (Mine and Plant Sites) and 4, 16, 21, and 22 (land exchange parcels; see Table 1). (*Note*: the Hay Lake land exchange parcel is not within a LAU. It lies within the SNF boundary in an area that is surrounded by private lands and mining activity to the east, south, and west. While the land exchange will consolidate USFS lands into a more contiguous block and some of the upland forest would be considered suitable lynx habitat, this block, in general, is disjunct from other USFS lands, including nearby LAUs, and it was not conducive to including in a LAU.)

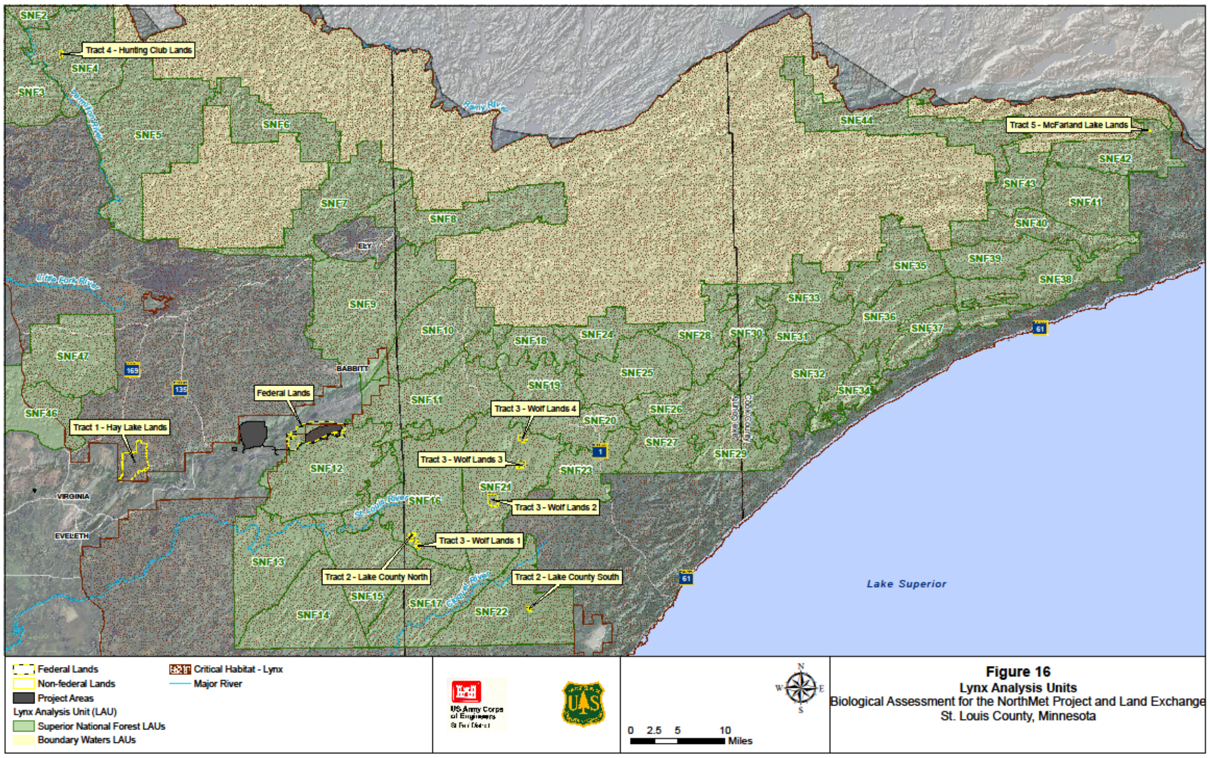

Figure 8. Lynx Analysis Units on the Superior National Forest (from BA Figure 16, p. 6-15).

Table 1. Condition of LAUs on the Superior National Forest before and after land exchange and project (USDA Forest Service 2015; Table adapted from BA Table 5, p. 6-16).

Lynx Analysis Unit	**Land Ownership**	**Suitable Lynx Habitat Before Land Exchange & Project (acres all ownerships/acres USFS lands)**	**Unsuitable Lynx Habitat Before Land Exchange & Project (acres all ownerships/acres USFS lands)**	**Acres Total Suitable Lynx Habitat After Land Exchange & Project**
SNF 12	Federal	69,131/47,908	2,737/31	67,412/41,413
SNF 4	Hunting Club	49,994/28,903	2,470/1,289	49,994/29,054
SNF 16	Lake County North and Wolf Lands 1	70743/29,316	3,127/350	70,743/29,705
SNF 21	Wolf Lands 2, 3, 4	69,632/32,984	2,931/272	69,632/34,434
SNF 22	Lake County South	57,107/40,217	913/344	57,107/40,330
SNF 42	McFarland Lake	27,775/19,609	534/13	27,775/19,640
Not in LAU	Hay Lake	n/a	n/a	4,675*
Net Gain (Loss) to Federal Estate within LAUs (excludes Hay Lake lands)				(4,361)
Net Gain (Loss) to Federal Estate for all exchange lands				314

*Hay Lake lands are not in an LAU but there would be a gain in overall LAU acres by USFS from the land exchange.
Note: All affected LAUs currently have >95 percent suitable habitat. After the land exchange and project, SNF 12 will have 93.7 percent suitable habitat.

Lynx occur within the defined action area. The SNF maintains a database to document the genetically confirmed Canada lynx within Minnesota, which includes samples from the Forest's survey and monitoring program and other studies, as mentioned in the Status of the Species section above. The MDNR summarized all reports of Canada lynx observations in Minnesota reported to them since the species received federal threatened status in March 2000 through November 11, 2006. Over that time, the MDNR received 426 reports, of which 63 reports (15 percent) were verified as lynx.

The BA (p. 5-5) indicated that a lynx survey was conducted for the Birch Lake Project and Maturi Project for Franconia Minerals Corporation, which is about 12 miles northeast of the Mine Site. Several lynx were found during the study, based on DNA analysis of scat samples and track locations. During a winter 2006 survey of seven townships surrounding the Project, tracks and scat of four female lynx were identified; they were concentrated in areas approximately 5 miles east and south of the Mine Site. No lynx or their sign were seen on the federal and non-federal lands during other wildlife surveys in 2000, 2004, 2008, 2009, and 2010; however, SNF biologists observed lynx tracks at the proposed Mine Site during a site visit in February 2010 (BA, pp. 6-17, 6-20).

According to the BA (p. 6-17), the Forest's genetic reference collection has 128 lynx DNA sample collection points that have occurred within 6 miles of the Project since February 2004, as well as within 6 miles of the federal lands and all of the non-federal lands, except Hunting Club and McFarland Lake lands; however, lynx DNA has been found within 10 miles of Hunting Club and McFarland Lake lands and lynx sightings have also occurred near the Hay Lake lands. Lynx DNA also has been collected within 10 miles of the Hinckley Wetland Mitigation Site, but not within 10 miles of the other Wetland Mitigation Sites.

It is difficult to estimate the abundance of highly mobile species that are rare and present at low densities. Assuming that about 25 percent of northeast Minnesota is suitable lynx habitat, coupled with assumptions about residence time and detectability, Moen et al. (2008b) estimated the number of lynx that might be resident in northeastern Minnesota at a given time as between 190 and 250 individuals. Recent research supports the hypothesis that lynx can persist without immigration, based on reproductive rates of females, movement rates, and the distribution of potential denning habitat in northeastern Minnesota (Moen et al. 2008a; Moen et al. 2004; Moen et al. 2008b).

Gray Wolf

National Forests, and the prey species found in their various habitats, are important to wolf conservation and recovery in the western Great Lakes states. The SNF is operated and managed under the current Forest Plan in conformance with standards and guidelines that follow the 1992 Recovery Plan's recommendations for the wolf.

The wolf population is variable but generally stable on the SNF (Berg and Benson 1998; Mech and Karns 1977) and on average, is about 1 wolf per 10 to 15 mi^2 (26 to 39 km^2) (Mech 2004, 2006, 2008). Aerial survey results from radio-collared and non-radio-collared wolf packs in a large area (795 mi^2; 2,060 km^2) of the central Superior National Forest during winter 2003-2004 estimated that about 62 wolves were present, or 7 wolves per 100 mi^2 (259 km^2), or 0.7 wolf per 10 mi^2 (26 km^2) (Mech 2004). Using the same methodology during the winter of 2007-08, aerial survey results identified approximately 82 wolves present in a 795 mi^2 (2,060 km^2) area of the central Superior National Forest, or about 1 wolf per 10 mi^2 (26 km^2) (Mech 2008). This density estimate is the same as estimates from similar winter 2005-2006 surveys (Mech 2006) and was the highest wolf population recorded in the study area since 1971 (Mech 1973, 1986, 2008). Assuming that wolf density was similar to the 2007-2008 density estimates throughout the Forest, which covers approximately 4,688 mi^2 (12,141 km^2), the Service estimated approximately 484 wolves on the Superior National Forest in 2008.

The BA (p. 6-89) indicated that gray wolf tracks, scat, and signs of wolf kills were observed during wildlife surveys on the federal lands, Transportation/Utility Corridor, and Plant Site in 2000, 2004, 2008, and 2009. Tracks were observed on the Dunka Road, mine exploration roads, along railroad grades and utility rights-of-ways, and north of the proposed Mine Site on Northshore Mine roads during all seasons. In addition, several wolves responded to calls from the proposed Mine Site during 2004. Gray wolf tracks and scat were also recorded on the following land exchange parcels: Hay Lake, Wolf Lands 3 and 4, and Lake County North during the surveys. There are no recorded observations of wolves in the township with McFarland Lake lands, although these and other non-federal lands involved in the land exchange and Wetland Mitigation Sites are within the current wolf range.

Northern Long-eared Bat

The SNF initiated annual acoustic monitoring in 2009 and our understanding of NLEB occurrence, distribution, and habitat use on the Forest has improved significantly since then. From 2013 to 2015, mist-netting, radio-telemetry, habitat characterization, and acoustic survey efforts have been completed and while the sample size is still small, available data are providing insights into bat presence and reproductive female NLEB habitat use. Acoustic monitoring data will be used to identify baseline bat activity levels and observe how those levels may change in response to WNS. Only 2 NLEB were detected out of 4,554 bat detections (less than 0.1 percent) over a 6 year period. However, NLEB typically do not forage in larger open areas where most transects were located (USFS Forest Service 2015). In 2013, 34 bats were captured at eight locations, of which 13 were NLEB; in 2014, 44 bats were captured at 5 sites on the SNF, of which 24 were NLEB; and, in 2015, 76 bats were captured at 10 locations, of which 45 were NLEB. Both reproductive adults and non-reproductive juveniles have been captured and 5 reproductive female NLEB in 2013 and 10 reproductive female NLEB in 2014 were equipped with radio-transmitters, which resulted in subsequent detections of multiple maternity roost sites. In 2013, three maternity roosts were identified in live aspen and four additional maternity roosts were in dead aspen and white pine. In 2014, 14 maternity roosts were in aspen (13 live and 1 dead), 2 in live red maple, 1 in live black ash and 1 in an unknown snag. In 2015, 7 transmitters were deployed on adult female bats (6 NLEB) on the Forest, resulting in identification of 21 roost trees, with the most common being quaking aspen (*Populus tremuloides*; 10) and red maple (*Acer rubrum*; 4) (Swingen et al. 2015).

Other results of mist-net surveys conducted in 2013 and 2014 in Minnesota have indicated a range of relative abundance for NLEB. Based on the frequency and proximity to SNF of positive NLEB detections in Minnesota and the prevalence of suitable habitat for the species on the SNF, it is reasonable to assume that the species is widespread in the action area. Because survey data analyses are not yet complete, we cannot estimate roost tree density or the proportion of the SNF that is inhabited by NLEB within a useful level of precision. The SNF is also working with the MDNR, the Chippewa National Forest, and the Service to increase our collective knowledge of NLEB distribution and habitat use in northern Minnesota.

The BA (pp. 5-6) indicated that 2014 survey data (based on passive sonic (Anabat™), direct observation) confirmed NLEB use of the Mine Site, Dunka Road, and Utility Corridor for foraging and travel to and from foraging and roost sites. The Mine Site also may have roost sites but the surveys provided no conclusive evidence of any. Direct observations and survey data suggested that NLEBs used the area around existing Plant Site buildings for foraging and that other infrastructure may have potential for limited roost sites, but evidence is also inconclusive. The BA (p. 6-75) indicated that USFS 2014 bat survey results identified NLEB present and foraging at the Plant Site, the forest/open edge area to the east of the Tailings Basin (within 50 meters of the road) and adjacent to and near the LTV Steel Mining Company process buildings, but not within the Tailings Basin. There was no evidence of NLEB hibernacula, or conditions suitable for hibernacula, on the Mine or Plant Sites or buildings, Dunka Road, and Utility Corridor.

The SNF assumes that forest comprised primarily of trees greater than 9 years old functions as suitable summer habitat for the NLEB. This type of habitat is abundant and well distributed across the SNF on public lands (federal, state and county). SNF suitable summer habitat is distributed among several forest types, but is mostly comprised of hardwood forest, especially aspen/birch (see Table 6 in the BA). The NLEB typically uses summer habitats in northeast Minnesota from early April to late September (Nordquist 2006).

A pilot study initiated by the SNF in 2013 confirmed that NLEB use cracks and crevices in live and dead quaking aspen, live red maple, live black ash (*Fraxinus nigra*) and white pine (Grandmaison et al. 2013). Seven maternity roost trees were located in 2013 and 18 in 2014 on the SNF. Live aspen were the predominant trees used, ranging in size from 9 to 18 inches dbh (Catton 2014). Data from this study should be considered preliminary as the study continues, but thus far has confirmed the following: maternity roost trees were large (greater than 11 inches dbh) with heights ranging from 23.5 to 70.6 ft; canopy closure in the stands around roost trees was high (62 to 98 percent), although maternity roost trees had some level of exposure to sunlight during the day. In 2014, lactating females were found between mid-June and early July (Catton 2014).

There are four known or suspected NLEB hibernacula within 5 miles of the SNF. Section 30 Mine is located on private land just outside of Ely, Minnesota and NLEBs were documented wintering in this site in the 1990s. The mine is not monitored on a regular basis. Soudan Mine, the largest known hibernaculum in the state, is located approximately 5 miles outside the SNF boundary. A third known hibernaculum is located at Tettegouche State Park and is located approximately 4 miles outside of the SNF boundary – but about 9 miles from the nearest USFS lands. This site is also not regularly monitored but was known to house wintering NLEBs in 1990 and 2003. The fourth site is the Jack Lake mine, located within the Boundary Waters Canoe Areas Wilderness on the Tofte Ranger District. This is a suspected hibernaculum and has never been monitored in the winter for bats; however, during a SNF site visit in September 2014, bats were found using it.

The SNF also has a small amount of swarming and staging areas – lands within five miles of hibernacula. A total of 15,150 acres of National Forest lands meet the criteria for swarming or staging areas. Fall swarming dates at the Soudan mine have been documented as early August to mid-October and spring staging activity has been documented from late April to mid-June (Nordquist 2015).

Conservation Needs of NLEB in the Action Area

The conservation needs of the species in the action area are similar to the needs rangewide. The SNF provides habitat for summering, migrating, staging and swarming NLEBs. Therefore, within the action area the conservation needs include: 1) providing suitable habitat conditions for foraging and roosting by the NLEB; 2) reducing the removal of roost trees; 3) searching for previously unidentified areas of maternity and hibernation activity; and, 4) conducting research to understand the migration patterns of the NLEB that use the area during the summer; during spring and fall staging and swarming periods; and, if hibernacula are found in the action area, during winter.

The Forest has initiated NLEB acoustic monitoring routes to identify baseline bat activity levels and observe how those levels change over time, and results of those studies were summarized briefly (see the previous section). The Forest is also working in partnership with the MDNR, the Chippewa National Forest, and the Service to further their knowledge of NLEB distribution and habitat use in northern Minnesota. These measures, in addition to the continued implementation of conservation measures required under the Forest Plan, will contribute to conservation needs of the NLEB in general and within the action area.

Factors Affecting Species and their Habitats within the Action Area

Canada lynx

In the 2000 LCAS, the Lynx Biology Team identified potential risk factors to lynx that are within the authority and jurisdiction of the federal land management agencies. Because effects to lynx are closely tied to habitat, most of the identified risks to lynx are also potential risks to lynx critical habitat. These risk factors include management of timber, wildland or prescribed fire, roads and trails, recreation, grazing, and other human developments such as agriculture. Risk factors that have recently become more pervasive include climate change, oil and gas leasing, and mining exploration and other mining activities. Roads, railroads, utility corridors, land ownership patterns, and developments may affect lynx movements. Risks of direct lynx mortality may come from trapping, shooting, predator control, vehicle collisions, and competition or predation as influenced by human activities. Other large-scale risk factors to lynx and lynx critical habitat are fragmentation and degradation of lynx habitat, for example, from non-native invasive plant species, climate change, or changes in land ownership.

Several of these potential risk factors affecting lynx are proposed in the action area post-land exchange, including mining activities and associated vegetation removal, infrastructure development such as roads, railroads, utility corridors, buildings, and water treatment ponds; associated fragmentation and degradation of habitat; and timber management. Other activities, such as increased recreational use from changes to land use patterns, also may occur. Wildland or prescribed fires are less likely due to full suppression actions in and surrounding the Project area, although they may occur on the other non-federal land exchange parcels. While vegetation will be removed from the Mine and Plant Sites and connecting corridors, timber management may occur on surrounding areas and on non-federal exchange parcels.

Vegetation and Timber

Vegetation management occurs across the range of lynx and can directly affect important habitats and prey. Stand structure, composition, and arrangement are important elements of habitat for snowshoe hares and lynx and as such, alterations to these elements will have varying effects depending on changes (e.g., clearcut versus uneven-aged harvests). The 2013 LCAS (p. 72) indicates that vegetation management promoting high stem density and dense horizontal cover can increase snowshoe hare densities, whereas reducing the density of, for example, sapling-sized conifers in young regenerating forests, reduces the amount and density of horizontal cover, which is needed to sustain snowshoe hares.

Mining

Removal of habitat for the mining operation will result in long-term, and in some areas – permanent, loss of suitable habitat and in turn contribute to habitat fragmentation. In larger mining operations, land exchanges may occur to consolidate private ownership of the surface above a deposit prior to mine development. Depending on lands exchanged, this could retain lynx habitat in public ownership, but could still result in a net loss of habitat. Development of road and railroad access to facilitate development can also directly impact lynx habitat, contribute to fragmentation, facilitate increased competition as a result of snow-compacted routes, and result in direct mortality (LCAS 2013, p. 83).

Roads

Road access to Canada lynx habitat increases the likelihood of human-related adverse effects, simply by increasing the number of humans present in the area. Human-related causes were confirmed for 5 of 11 lynx deaths in Minnesota among radio- and GPS-collared lynx in a recent study (trapping (2), automobile (1), shooting (1) and train (1) (Moen et al. 2008a). Of the remaining six, four died of unknown causes with suspected human involvement (Moen et al. 2008). Six additional lynx deaths have been confirmed in Minnesota due to collisions with vehicles on roads since the species was listed as threatened in 2000 (USFWS, Twin Cities Field Office, Bloomington, MN, unpubl. data).

These deaths have occurred on a wide variety of roads with average daily traffic volume ranging from 19 to 19,400 vehicles per day (USFWS, Twin Cities Field Office, Bloomington, MN, unpubl. data). There have been four documented lynx road mortalities on the Superior National Forest between 2001 and 2015. These mortalities took place on Cook County Highway 12 (Gunflint Trail), Forest Road 172, Lake County Hwy. 2, and MN Trunk Highway 61 (USFWS, Twin Cities Field Office, Bloomington, MN, unpubl. data). No lynx-vehicle collisions have been reported on roads associated with mining projects, even though lynx have been observed using mine roads at the Northshore Mine and former Cliffs Erie mine site near the Project area (ENSR 2006). Twenty-two lynx were struck and killed by vehicles in Maine between 2000 and 2009; 16 of these deaths occurred on logging roads and 6 occurred on state paved highways. Most mortality on logging roads were on 2-lane dirt haul roads that are open to and used frequently by the public (M.McCollough 2009, pers. comm.). In Colorado, nine lynx deaths due to vehicle collisions have been recorded since 1999 and five other lynx from Colorado were killed in adjacent states (K. Broderdorp et al. 2006, Shenk 2008). As in Minnesota, estimated traffic volumes vary widely among roadkill locations, from 480 to 27,600 vehicles per day.

Roads are a factor in human-caused lynx mortality where they provide access to areas where lynx occur, increasing the risk of negative interactions between people and lynx. Throughout the Forest (outside the Boundary Waters Canoe Area Wilderness, or BWCAW), high and low standard roads bisect many areas that provide potential or suitable lynx habitat. Some temporary roads, such as those used in mineral exploration or mining projects may stay open for more years (greater than 20 years) than those used for resource management (less than 10 years). If these roads remain accessible to the public, then human-lynx conflicts may increase. Further, these corridors may increase potential competition with other predators through increased snow compaction. Effective road closures in appropriate circumstances can reduce the potential effects to lynx and lynx critical habitat.

Lynx populations characteristically fluctuate during approximately 10-year cycles in response to changes in numbers of their primary prey, snowshoe hare. As previously mentioned, on-going northern Minnesota surveys indicated snowshoe hare numbers were high through the late 2000s, with some slight 10-year ups and downs (Erb 2009). Spring 2015 survey results suggested the current hare population may have declined, which would be expected with a fluctuating 10-year cycle, but the upcoming 2015-2016 winter survey will likely provide more conclusive information (Erb 2015, pers. comm.). Reduced prey densities and reduced movement of lynx from Canada may reduce their density in the action area but this would likely be followed by a cyclic increase.

The Superior National Forest is currently implementing the 2004 Forest Plan, which contains direction based on the LCAS and Canada Lynx Conservation Agreement between the USFS and the Service (2000). These apply to all activities implemented by the USFS that occur within LAUs. Thus, the aforementioned risk factors are being minimized and managed to promote the conservation of lynx within the Superior National Forest.

Human Presence and Associated Recreational Activities

The 2013 LCAS (p. 80) indicated that our understanding of the effects of outdoor recreation on lynx and their habitat is incomplete. The effects, if any, may depend on the type of activity and the context within which it occurs. Activities that may impact lynx include loss of habitat, reductions in habitat availability due to disturbance, or changes in competition for snowshoe hare prey. Some anecdotal information suggests that lynx are quite tolerant of humans; however, lynx likely exhibit a variety of behavioral responses to human presence (Staples 1995, Mowat et al. 2000). Other anecdotal reports also suggest that lynx are not displaced by human presence, including moderate levels of snowmobile traffic (Mowat et al. 2000).

Lynx that conduct long-distance movements from Minnesota to Ontario are vulnerable to legal harvest in Canada whereas lynx trapping is no longer legal in Minnesota. Lynx may be captured in Minnesota incidental to legal trapping for other mammals. In the last 10 years, at least 15 lynx have been captured incidentally by trappers in pursuit of other species and 8 of them died as a result. Additionally, six lynx have been documented as shot and killed in Minnesota; two of these mortalities were within the SNF proclamation area (U.S. Fish and Wildlife Service, unpubl.data). Some lynx that make movements from Minnesota into Ontario are harvested there, particularly those that go long distances. Four lynx that were radio collared in Minnesota have been legally trapped and killed in Canada since 2000 and two died of unknown causes (U.S. Fish and Wildlife Service, unpubl.data).

Gray wolf

Various land management practices on the Superior National Forest may affect wolves and wolf habitat. These practices include management of timber, wildland or prescribed fire, wildlife habitat management, recreation, construction and maintenance of roads and trails, minerals exploration, and other human developments. Further, developments by other landowners or agencies within the boundaries of the Forests (on other ownerships or by authorization on National Forest System land) such as roads, railroads, utility corridors, and others may affect wolf movements. Risks of direct wolf mortality may come from shooting, trapping, predator control, vehicle collisions, and competition or predation as influenced by human activities. Other large-scale risk factors are disease, fragmentation and degradation of wolf habitat, and climate change. These risk factors are discussed below.

Prey habitat

Wolf density is heavily dependent on prey availability (Fuller et al. 2003), but prey availability is not likely to threaten wolves in Minnesota. Moose (*Alces alces*) and woodland caribou (*Rangifer tarandus caribou*) were the dominant ungulate species in northeast Minnesota before European settlement around the turn of the 20th century. Today white-tailed deer (*Odocoileus virginianus*) have replaced caribou and are the primary prey species in the state; beaver (*Castor canadensis*) are seasonally important prey on the SNF.

Conservation of primary wolf prey in Minnesota is a high priority for the MDNR. They manage ungulates to ensure a harvestable surplus for hunters and non-consumptive users, and to minimize conflicts with humans. To ensure a harvestable surplus for hunters, the MDNR must account for all sources of natural mortality, including loss to wolves, and adjust hunter harvest levels accordingly. In addition to regulating human harvest of deer and moose, the MDNR also monitors and improves habitat for these species. Land management carried out by other public agencies and by private land owners in Minnesota's wolf range, including timber harvest and prescribed fire, incidentally and significantly improves habitat for deer. About one-half of the Minnesota deer harvest is in the Forest Zone, which encompasses most of the occupied wolf range in the state (Cornicelli 2007).

Deer, moose, and beaver are closely associated with forage from young upland forest less than 10 years old. Deer and moose also rely on upland conifer greater than nine years old for thermal and hiding cover. Currently, the Forest provides ample habitat for prey species, and densities of these species (particularly deer) have been high. Prey availability is not likely to threaten wolves on the SNF.

The potential implications of climate change to prey habitat in northern Minnesota are difficult to predict but continue to be studied regionally (e.g., Galatowitsch et al. 2009) and within the SNF (USDA 2011). The effects that climate change may have on prey habitat and availability is uncertain at this time and goes beyond the time frame of this project.

Human access

Human settlement and roads are considered to be major determinants in wolf distribution. These activities have multiple effects, including increased human presence causing an increase in illegal poaching and legal predator control, increased chance of introduced diseases and parasites via pets (e.g., canine parvovirus), and potential deterrence to colonization of otherwise suitable habitat (Gogan et al. 1997; Mech and Goyal 1995).

Road density correlates directly and indirectly with various forms of human-related wolf mortality factors. A rural area with more roads generally has a greater human density, more vehicular traffic, greater access by hunters and trappers, more farms and residences, and more domestic animals. As a result, there is a greater likelihood that wolves in such an area will encounter humans, domestic animals, and various human activities. These encounters may result in wolves being hit by motor vehicles, being controlled by government agents after becoming involved in depredations on domestic animals, being shot intentionally by unauthorized individuals, being trapped or shot accidentally, or contracting diseases from domestic dogs (Mech et al. 1988b; Mech and Goyal 1993; Mladenoff et al. 1995). Based on mortality data from radio-collared Wisconsin wolves from 1979 to 1999, natural causes of death predominated (57 percent of mortalities) in areas with road densities below 1.35 mi per mi^2 (0.84 km per km^2), but human-related factors produced 71 percent of the wolf deaths in areas with higher road densities (Wydeven et al. 2001; Wydeven and Wiedenhoeft 2001).

The Recovery Plan recommends that density of higher standard roads (equivalent to USFS Objective Maintenance Level (OML) 3, 4, and 5) remain below 1 mi/mi^2 in critical habitat to limit the extent of associated effects to wolves. The SNF high standard road density outside the BWCAW is 0.45 $miles/mile^2$. Although the Recovery Plan addresses the impacts from low standard roads (generally equivalent to USFS OML 1 and 2, temporary, and some unclassified roads), it does not recommend a density threshold for them. Low standard roads may have a greater potential for human impact on wolves than high standard roads due to the potential for human access for trapping and shooting. These roads typically are accessed by recreational motor vehicles or on foot.

Radiotelemetry studies are a good way to accurately estimate illegal mortality (Fuller 1989); however, only a few radiotelemetry studies have taken place in Minnesota. Data from north-central Minnesota from 16 diagnosed mortalities of radio-collared wolves over a 12-year period (1994 to 2005) show that human-related causes resulted in 69 percent of the diagnosed mortalities. These data include one wolf accidentally snared, two vehicle collisions, and eight (50 percent of all diagnosed mortalities) that were shot (DelGiudice 2005). Results from a smaller mortality dataset of radio-collared wolves studied between 1987 and 1991 in and adjacent to Voyageurs National Park, showed that all mortality inside the park was due to natural causes (for example, killing by other wolves or starvation), whereas the majority (60 to 80 percent) of mortality outside the park was human-induced (for example, shooting and trapping) (Gogan et al. 2004). Despite the difficulty in measuring the extent of illegal killing of wolves and accidental human-caused mortality, these killings have not been of sufficient magnitude to stop the growth of the wolf numbers in Minnesota.

In addition to illegal mortality, the current Endangered Species sub-permit to USDA Wildlife Services (WS) allows WS and designated WS employees to capture and kill wolves in response to verified depredation of domestic livestock in accordance with regulations 50 CFR 17.40(d)(2)(i)(B)(4). Lethal wolf control is not allowed in federal wolf management Zone 1 in extreme northeastern Minnesota under this sub-permit. Zone 1 stretches from Voyageurs National Park on the west to Taconite Harbor (on Lake Superior) on the east (Figure 6). This area is generally remote with minimal livestock production (USDA APHIS - Wildlife Services 2008). From 1996 to 2009, an average of 146 wolves (95 percent confidence interval of 132 to 159) were taken as a result of depredation control in Minnesota (USDA APHIS - Wildlife Services 2008, 2009).

These deaths have not resulted in a significant decline in wolf numbers in Minnesota, which remain far above recovery goals (U.S. Fish and Wildlife Service 2014). It is important to note that despite the difficulty in measuring the extent of illegal killing of wolves, all sources of wolf mortality, including legal (e.g., depredation control) and illegal human-caused mortality, have not been of sufficient magnitude to stop the continuing growth of the wolf population in Minnesota.

Other factors

Den site disturbance may occur during timber harvest, site preparation, prescribed burning, minerals exploration and other activities; however, wolves at dens and rendezvous sites have been known to tolerate nearby activities. In addition, wolves have large home ranges in Minnesota with available and abundant suitable habitat. The SNF is currently implementing the guidelines set forth in the Recovery Plan for all Forest activities, as directed by the current Forest Plan. Thus, the aforementioned risk factors are being minimized and managed appropriately to promote the conservation of gray wolf.

Northern long-eared bat

No other threat is as severe and immediate for the NLEB as white-nose syndrome and while the fungus that causes WNS is present in the Tower-Soudan mine hibernaculum in northeastern Minnesota, the disease itself is not yet apparent. It is unlikely that NLEB populations would be declining so dramatically without the impact of WNS. However, other factors may affect NLEB, such as habitat loss primarily due to forest conversion, and to a lesser degree, unsustainable forest management, wind energy development, environmental contaminants, and fire.

Forest management activities, unlike forest conversion, typically result in temporary impacts to the habitat of NLEB, but like forest conversion, may also cause direct injury or mortality to individuals. The net effect of forest management may be positive, neutral, or negative, depending on the type, scale, and timing of various practices. The primary potential benefit of forest management to the species is perpetuating forests on the landscape that provide suitable roosting and foraging habitat.

Climate change may also affect this species, as NLEB are particularly sensitive to changes in temperature, humidity, and precipitation. Climate change may indirectly affect the NLEB through changes in food availability and the timing of hibernation and reproductive cycles.

Environmental contaminants, in particular insecticides, other pesticides, and inorganic contaminants, such as mercury and lead, may also have detrimental effects on NLEB. Contaminants may bio-accumulate (become concentrated) in the tissues of bats, potentially leading to a myriad of sub-lethal and lethal effects. There is currently no evidence that the natural or manmade factors mentioned above separately or cumulatively have been contributing to significant range-wide population effects on the NLEB prior to the onset of WNS.

EFFECTS OF THE ACTION

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR §402.02). Direct effects are defined as the direct or immediate effects of the action on the species or its habitat. Direct effects result from the agency action, including the effects of interrelated and interdependent actions. Indirect effects are caused by or result from the agency action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the immediate footprint of the project area, but would occur within the action area as defined.

The following information addresses factors affecting lynx, wolf, and NLEB, with factors specific to the individual species identified where appropriate. The BA (p. 6-1) indicated that the area for direct and indirect effects analyses included those areas within 6 miles of the Project, or approximately 250 mi^2 plus the area that extends to wildlife corridor #18. The 6-mile buffer was originally identified by the Service in 2006 as the minimum area that could be impacted by the Project and we further refined the rationale for the 6-mile radius action area based on information in the BA and FEIS (see Action Area subsection above), as well as the lands specific to the other land exchange parcels and Wetland Mitigation Sites.

In the effects analysis, we reach the following conclusions and explain the rationale behind these conclusions. We conclude that the land exchange, in and of itself, will not result in negative effects to lynx, wolf, and NLEB. However, the land exchange will lead to the subsequent development of the newly private lands, which will be an indirect effect of and caused by the proposed land exchange, thereby resulting in significant adverse effects and potential take of lynx, wolf, and NLEB.

Species habitat effectiveness (including quality and quantity) and use of the Mine and Plant Sites and surrounding area within the exchange parcel will be reduced due to vegetation removal and subsequent habitat fragmentation, increasing human presence, noise, increasing traffic, and other factors as mining activities progress. Permeability within the landscape, including the wildlife travel corridors identified in the BA, also may be reduced due to activities at the Mine and Plant Sites and associated transportation infrastructure and traffic. These activities may create an additional impediment to lynx, wolf, and prey movements. The proposed mine could result in an increase in recreational activities due to the increase in human activity in the area. These effects cannot be described precisely, but may increase the incidence of human-wildlife encounters and could contribute towards the general reduction in the value of the mining area to wildlife, including lynx and wolves. Considering the environmental baseline and the additional effects that may be caused by the PolyMet mine, we believe that loss of habitat, reduced habitat effectiveness and fragmentation, including various types of noise, and transportation impacts within and around the Project area represent an adverse effect to lynx, wolf, and NLEB.

Habitat

The BA (pp. 4-1 to 4-15) provided a description of existing vegetation conditions within the Project-area. We briefly summarize the associated acres below (Table 2) and provide additional contextual information.

Table 2. Summary of acres affected by PolyMet Project.

POLYMET PROJECT	Total Acres	Acres Disturbed by Project	Acres Federal
Total project area	7,650	3,918	6,495
Mine Site	3,015	1,719	2,719
Plant site	4,515	2,189	0
Road/utility & RR corridors	120*	<10	0
Lands adjacent to Mine Site	3,776	0	3,776
Non-federal exchange parcels	7,075	n/a	n/a
Wetland Mitigation Sites	2,169**	n/a	n/a

* Most all acres currently disturbed
** 197 acres are upland

The Mine and Plant Sites provide habitat suitable for all species, although most of it occurs on the 3,015-acre Mine Site and on lands surrounding it. Most of the mature forest habitat is in the central and western portions of the Mine Site, with the largest trees reaching approximately 16 inches dbh. There will be incremental clearing of all vegetation with heavy equipment, totaling 1,719 ac at the Mine Site (550 ac, or 32 percent, during the first 2 years and the remainder by year 11); 914 ac of wetlands also will be removed. Some surrounding habitat within the Mine Site will remain intact, including some forest cover.

The 4,515-ac Plant Site has 2,756 ac (61 percent) of land already disturbed by previous taconite mining; the remaining 1,760 ac include aspen/birch forest (14 percent), grass/shrubland (7 percent), upland coniferous forest (2 percent), and lowland coniferous forest (1 percent). New mining-related activities will result in 2,189 ac of disturbance and when combined with other activities, only 422 ac of forested habitat will remain at the Plant Site. Wetlands cover 245 ac, of which approximately 147 ac will be excavated and/or filled.

Vegetation conditions in the Transportation and Utility Corridors are disturbed (approximately 94 ac out of 120 ac) due to prior use during former taconite operations. There is cropland/grassland and shrubland along these corridors (8 percent and 6 percent, respectively).

The federal lands surrounding the Mine and Plant Sites and connecting corridor area cover 3,776 ac, of which 2,870 ac (76 percent) are wetlands, including part of the One Hundred Mile Swamp, and are comprised mostly of greater than 70 year-old black spruce, northern white cedar, and tamarack forest. These wet areas probably have limited lynx, wolf, and NLEB use except during winter months by lynx and wolf, although lowland conifer cover types in general may have increased lynx use during the denning season (dens often are located near this type; Moen et al. 2008a). The BA (p. 4-3) indicated that the lands not disturbed by mining activities and adjacent to the Mine Site will be managed for timber and wildlife habitat.

Mining activities will include construction of various water features. In addition to water-filled pits post-mining, there will be a flotation tailings basin and seepage capture systems, storm water dikes and ditches, drainage swale, and stream reductions and/or augmentations.

Approximately 397 acres lost to mining will be reclaimed after mine closure and will be characterized as grassland/herbaceous (54 percent), wetland and/or grassland/herbaceous (27 percent), and wetland (18 percent); some progressive reclamation may occur within some areas as phases of mining are completed. The west pit will not be reclaimed, but will remain as a 320-acre open pit lake. Only 202 of 397 acres of the reclamation will be suitable for regeneration by shrubs and trees (J. Saran pers. comm. 2016) – the habitat cover conducive to lynx, wolf, and NLEB. In general, reclaimed mine sites often lack diversity that typically occurs prior to mining, and habitat used by these species may take many decades longer to become suitable.

Noise and Vibration

The major sources of noise from the Mine Site will be blasting and drilling, and vehicle/train traffic, including haul trucks and train horns, with noise levels ranging from 89-115 dBA[3].

3 Noise is measured in logarithmic decibels (dB), where change between two values is perceived based on the ratio (e.g., a change from 1 to 2 would be perceived as the same amount of change from 4 to 8); the logarithmic A-weighted decibel (dBA) is a scale emphasizing the range between 1,000 and 8,000 cycles per second, which is the range of sound frequencies most audible to the human ear (see FEIS 4.2.8, p. 4-293).

Ambient noise levels from most of the Mine Site currently range from approximately 35 to 45 dBA. Noise from heavy equipment, such as graders, bull-dozers, and support trucks, will range from 75 to 95 dBA. (A car horn at 3 meters and a nearby thunderclap are equivalent to approximately 120 dBA.) Blasting noises and vibrations within most of the Mine Site will be similar to a loud clap of thunder and are expected to occur once every 2 to 3 days. Typically, rock blasting generates a single event noise level ranging from 111to 115 dBL[4] at 50 ft from the blasting site (BA p. 6-74). Other sources of noise, such as at the Plant Site and the Transportation and Utility Corridors, will likely be similar to the Mine Site heavy equipment levels.

Transportation and Utility Corridors

New roads will be constructed in the Project area and mostly within the Mine Site. They will be well-traveled and there will be noise and activity associated with construction and operations, 24 hours per day and year-round for up to 20 years. The BA indicated that cars and light trucks will travel up to 45 miles per hour (mph) and large trucks will travel up to 40 mph back and forth between the Plant and Mine Sites (approximately 8.5 mi one-way); that has since been lowered to 40 mph (see Conservation Measure #5 above). As mentioned in Conservation Measure #5, PolyMet will post and enforce speed limits on their lands. Ore trains will travel up to 25 mph, with approximately 22 round-trips daily (approximately 9.5 mi one-way) (Saran 2016, pers. comm.).

Additional project-related commuter and service-related traffic will occur on the various roads accessing the Project area from nearby towns, such as Aurora, Hoyt Lakes, Biwabik, and Virginia (approximately 6, 6, 10, and 20 miles, respectively, to the west or south), and will include approximately 150 employee vehicles and 40 service vehicles per day, traveling via the County Road 666 Main gate and North Gate (from Highway 135). Transport of other products from the Plant Site to locations off-site will include approximately 80 round-trips per month on roads, as well as rail travel of a 100-car train once per month, a 30-car train 4 times per month, both year round, and a 100-car train once per week from April to October.

Private Land Exchange Parcels

The Project involves the transfer of approximately 6,495 acres of USFS-administered lands to PolyMet, in exchange for 7,075 acres of privately owned lands. According to the BA (pp. 6-24 to 6-28, 6-39, 6-40), portions of the non-federal lands have been harvested during the past 20 years, with much of the harvest occurring on Lake County Lands North and South, and Wolf Lands 2 and 3. Regenerating forests on these parcels (as well as the other parcels) likely provide habitat for prey species such as snowshoe hares and ungulates, and foraging opportunities at various forest successional stages for lynx, wolf, and NLEB. About 267 acres consist of aquatic habitat, which is unlikely to be used by lynx, wolf, or their prey species, except perhaps during winter. All exchange parcels will come under USFS management. LAUs SNF# 4, 16, 21, 22, and 42 will not actually gain acres because the lands are already encompassed by these LAUs, but they will gain acres under USFS management, and the LAUs will all continue to have at least 95 percent suitable habitat for lynx (see Table 1). Hay Lake lands are not within or near any LAU, so will

4 Air vibration from blasting is measured in linear decibels (dBL), where a change between two values is perceived based on the difference (e.g., a change from 1 to 2 would be perceived as the same amount of change from 4 to 5).

not necessarily be subject to LCAS-related lynx management as described in the Forest Plan; however, these lands do fall within lynx critical habitat, so will be managed according to relevant Forest Plan conservation measures. The Hay Lake lands occur outside of wolf critical habitat but within wolf management Zone 4, so are covered by existing Forest Service wolf management guidelines. Future actions on the Hay Lake lands may also be subject to ESA section 7 review for lynx, wolf, or NLEB.

The BA indicated that the majority of habitat on the non-federal lands consists of immature and mature age classes of upland and lowland coniferous and deciduous forest. After the land exchange, the USFS will have a net gain of 580 ac, most of which provide potential habitat for lynx, wolf, and NLEB. The land exchange will consolidate USFS land ownership and management of these lands will remain relatively unchanged. It is unlikely new roads will be constructed on these lands except those used primarily for timber production and recreation. Therefore, there will be little to no change in existing road densities in these areas. Given that these lands will not be directly or indirectly impacted by the mining project, are not expected to be developed in the near future, and will remain mostly in timber production with limited recreational use, effects to lynx, wolf, and NLEB may be beneficial or adverse in the short-term (e.g., timber harvest) but overall, likely will be neutral. As such, the private land exchange parcels will not be discussed further.

Wetland Mitigation Sites

The BA (pp. 6-26, 6-28, 6-38) indicated that under the proposed action, approximately 2,169 acres of Wetland Mitigation Site lands will be purchased (off-Forest) by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S. These lands are currently used for sod production, but will be restored to native wetland and upland vegetation. Approximately 1,603 acres of wetland and 197 acres of upland will be restored or created at the Wetland Mitigation Sites. These sites could provide habitat for lynx wolves, and NLEB, but there have been no recent records of lynx in or adjacent to the Sites, and wolves are rare on or adjacent to these lands; NLEB presence is unknown.

It is unlikely that new roads will be constructed to improve access to Wetland Mitigation Sites, as these lands are in somewhat remote locations and are little used by the public. There will be little change in impacts from recreational activities to lynx, wolves, and NLEB, or changes affecting lynx and wolf movements. After restoration, the combined total acres of wetlands and uplands will be approximately 1,603 ac and 197 ac, respectively, which could provide a limited amount of wolf and NLEB habitat. However, these acres are unlikely to be used by lynx primarily due to the distant location of contiguous suitable habitat. Also, the open, mostly wetland habitat that will dominate these mitigation sites is generally unsuitable for all three species. Overall effects to lynx, wolf, and NLEB will most likely be neutral; therefore, the Wetland Mitigation Sites will not be discussed further.

Climate Change

Our analyses under the ESA include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on

Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

In 2003, the Service determined that climate change was not a threat to lynx within the contiguous U.S. DPS because the best available science we had at that time (Hoving 2001) was too uncertain in nature (68 FR 40083). Since that time, new information on regional climate changes and potential effects to lynx habitat has been developed (e.g., Danby and Hik 2007; Gonzalez et al. 2007; Knowles et al. 2006), and this new information suggests that climate change may be an issue of concern for the future conservation of lynx because lynx distribution and habitat is likely to shift northward and upward in elevation in areas with significant altitudinal gradation within its currently occupied range as temperatures increase (Gonzalez et al. 2007). This information, combined with the information in Hoving (2001), still needs to be evaluated further to determine how climate change might affect lynx and lynx habitat.

The potential implications of climate change to wolves and wolf prey habitat in northern Minnesota are difficult to predict but have been studied regionally (e.g., Galatowitsch et al. 2009) and within the Superior National Forest (USDA 2011). The effects that climate change may have on prey habitat and availability is uncertain at this time and goes beyond the time frame of this project.

Climate change may also affect NLEB, as they are particularly sensitive to changes in temperature, humidity, and precipitation. Climate change may indirectly affect the NLEB through changes in food availability and the timing of hibernation and reproductive cycles. However, we have no evidence that the proposed Project will appreciably increase greenhouse gases (e.g., due to increased traffic volume) to the degree in which it will affect the climate in the action area. Therefore, climate change will not be addressed further.

Effects from Specific Project Activities

***1. Activity*: After the federal parcel land exchange, there will be mechanical tree and vegetation clearing and complete removal in a large portion of the Mine Site and part of the Plant Site. Some clearing of forested habitat also will occur along existing roads, railroad tracks, and the utility right-of-way.**

Subactivity: Actual disturbance to the 3,015-ac Mine Site area will be 1,719 ac and at the 4,515-ac Plant Site will be 2,189 ac (of which 1,103 ac (50 percent) are already disturbed and have little vegetation from previous mining-related activities; another 25 percent is wetlands).

Transportation/Utility Corridor clearing will be minimal because most of the 120-ac corridor is already developed and disturbed. Heavy equipment will be used to remove all trees, vegetation, soil, and overburden. The clearing at the Mine Site will be incremental, with 550 ac removed during the first 2 years and the remainder removed by year 11; 914 ac of wetlands will also be removed.

Stressor: The change in land ownership will result in subsequent mining development. There will be immediate loss of lynx, wolf, and NLEB habitat and associated prey species that use these same habitats. There will also be noise from heavy equipment involved in vegetation and overburden removal.

Exposure: Lynx, wolves, and NLEB will be exposed to human presence, vegetation removal activities, and associated noise in and around the Mine and Plant Sites and along the connecting Transportation/Utility Corridor through year 11, when this vegetation removal will be completed. The Mine Site and eastern portion of the Transportation and Utility Corridors are within LAU SNF#12 and lynx critical habitat, whereas the western portion of the Corridor and the Plant Site are outside; the entire Project area is outside of wolf critical habitat. The BA identified the Transportation/Utility Corridor as being located adjacent to areas with potential for "moderate and high quality wildlife travel corridors." The immediate loss of habitat will expose lynx and wolves to habitat fragmentation, decreased access to travel corridors, decreased habitat effectiveness, and expose adjacent habitats to increased resource use by lynx, wolves, and prey species. Effects to wildlife travel corridors are addressed under the next mining activity discussion. Individual NLEBs, particularly those associated with maternity roosting areas, also will be exposed to the loss of habitat and fragmentation.

Response - Harm: Adult or young lynx, wolves, their prey, and NLEBs could be injured or killed by tree felling and other vegetation removal activities, including at or near any active den sites or maternity roost sites that may be present. Immediate loss of forested habitat eliminates foraging opportunities and subsequently displaces lynx, wolves, NLEBs, and their prey (snowshoe hare, ungulates, insects, etc.). Habitat loss may result in lynx, wolves, and NLEB having to abandon the area temporarily or permanently, including portions of existing home ranges, territories, or maternity roosting sites, to find suitable habitat with adequate prey or new roost sites. Disturbances forcing NLEBs to flee during daylight hours increase their risk of being preyed upon. Similarly, displaced lynx or wolves may come in contact with other predators, including other wolf packs, resulting in lynx or wolf injury or death. It will further fragment the remaining habitat, particularly on the east side of the action area, and may restrict or prevent access to existing (terrestrial) wildlife travel corridors between habitats to the north and south of the Project area, in turn forcing lynx and wolves to travel farther to find available suitable habitat. All three species also could be forced into areas with less suitable habitat. They may experience decreased fitness from less prey and have to expend energy resources to travel elsewhere in search of resources, potentially decreasing reproductive success.

Response-Harass: Lynx, wolves, and NLEB could be annoyed by the noise of heavy equipment, other motorized vehicles, and human presence during the vegetation removal process to the point that they abandon suitable habitat, portions of home ranges or territories, active den sites, wolf rendezvous sites, or maternity roosting sites, and leave the general area. Because noise and disturbance levels will vary depending on factors such as loudness and duration of noise, habitat type (e.g., forested or open), and current weather conditions such as wind direction, these effects may be either temporary or permanent.

Consequences/Intensity: Effects will vary depending on when vegetation removal activities will occur in the Project area and on quality and quantity of adjacent habitat in the action area. We mostly focus on the Mine Site for this activity because of its inclusion in the land exchange, along with a block of undeveloped, suitable habitat occurring within in it that is contiguous with habitat outside the Mine Site. Effects to habitat at the Mine Site will likely impart greater impacts to these species than from the forested area along the corridor connecting it to the Plant Site, most of which is already disturbed, as is a significant portion of the Plant Site. Death or injury of individuals could occur, not only directly from vegetation removal but from interactions and conflicts with other predators, as lynx, wolves, and NLEB are displaced by vegetation removal disturbances. They may subsequently experience decline of body condition or reduced fitness, especially if it occurs during the energy-demanding denning or pup season. Reproductive efforts could be impaired, leading to failed litters or starvation of kittens and pups. Loss of habitat will further fragment habitat in the area, which already has been significantly diminished by other nearby mining projects.

The Mine Site's 1,719 acres of lynx, wolf and NLEB habitat that will be removed includes 1,333 ac of lynx denning, wolf cover, and NLEB roosting habitat. The loss of 3,918 ac at the Mine and Plant Sites combined in the context of a lynx home range size and density of lynx, which ranges from approximately 1 lynx per 43 mi^2 to 83 mi^2 (27,520 to 53,120 ac) in northeastern Minnesota, equals 14 percent and 7 percent, respectively, of a home range. In the context of a wolf territory and density (density is similar to the size of a territory, although territories in Minnesota typically range from 25 to 150 mi^2), the habitat loss equals approximately 7 percent of an 83 mi^2 territory. Loss of suitable habitat will not only further fragment remaining habitat in the general vicinity but likely will affect adjacent suitable habitats due to increased use, and other factors mentioned above.

LAU SNF #12 encompasses 70,980 ac, of which 47,908 ac are administered by the USFS; the loss of 6,495 ac from the land exchange will equal a 13.6 percent reduction in acreage (to 41,413 ac) administered by the SNF (BA p. 6-14; Table 1 above). The exchange also will result in a loss of 1,719 ac of lynx habitat in LAU SNF# 12 (a decrease of 2 percent suitable habitat within that LAU), most of which will be permanent (a small amount will be reclaimed), However, the remaining portion of LAU SNF #12 will have 93.7 percent suitable habitat after the land exchange, which is well above the 70 percent minimum per the 2000 and 2013 LCAS management guidance and SNF Forest Plan. The BA also indicated that there is suitable habitat available to the east and southeast of the Mine Site. The land exchange of 6,495 ac from the USFS to PolyMet will result in these lands no longer being managed by the USFS for lynx and lynx critical habitat. However, the critical habitat boundary will not change and will continue to include the east-southeast side of the Project area (i.e., Mine Site, part of the Transportation and Utility Corridors, and surrounding lands).

There will be effects to the lynx critical habitat PCEs ((a) presence of snowshoe hares and their preferred habitat conditions; (c) sites for denning that have abundant coarse woody debris; and (d) matrix habitat) for similar reasons discussed above and in the following activities. PCE (b) deep and fluffy winter snow conditions, will likely be affected by changes to snow conditions in areas that are converted from forest cover to openings and mine pits (and later, mine pit lakes). Effects to lynx critical habitat are evaluated at the scale of the entire Unit. Therefore, even if all 6,495 ac included under the land exchange were disturbed in perpetuity, the loss of these critical habitat acres relative to the 8,069 mi^2 (5,164,160 ac) size of Unit 2 equals 0.13 percent. However, the disturbance of 1,719 ac of habitat will be substantially less than this (0.03 percent) relative to Unit 2; both amounts are essentially insignificant at that scale. Also, abundant habitat is available in the vicinity that will be managed for wildlife and other resources, and will continue to provide the physical and biological features and associated PCEs that support lynx critical habitat.

Squires et al. (2013) study results from population-level modeling in the Northern Rockies indicated that changes to vegetation structure can increase landscape resistance to lynx movements; however, there is no evidence that this was causing genetic isolation (Schwartz et al., 2002). Although lynx are capable of crossing hundreds of kilometers of unsuitable habitat, as evidenced by verified locations in prairie ecosystems (McKelvey et al., 2000), lynx in the Northern Rockies are sensitive to changes in forest structure and tend to avoid forest openings (Koehler, 1990; Squires et al., 2010). We anticipate that mining activities will similarly increase landscape resistance to lynx (and wolves) within the Project area at a minimum and both species may avoid much of the disturbed and open spaces due to lack of quality habitat and foraging opportunities, subsequently forcing them to move elsewhere to find suitable habitat, prey, and den sites.

Loss of most of the lynx, wolf, and NLEB habitat will be permanent except for those areas where reclamation of forested habitat will occur. In those areas, it will take at least several decades from when initial mining activities begin until they are reclaimed and regenerate to suitable habitat conditions. However, PolyMet intends to manage for wildlife habitat adjacent to the Project area, some of which already provides suitable habitat for these species and will continue to with appropriate management.

Scale/Extent of Effect on Reproduction, Population: One or more lynx, wolf, or NLEB home ranges or territories could be affected, both temporarily and permanently. Localized impacts to individuals or packs are likely to occur. Although significant at the local scale, effects to rangewide numbers, reproduction, and distribution for the species are unlikely to be substantial. (Maximum habitat loss of 3,918 ac from mining activity at both Mine and Plant Sites would equal less than 0.1 percent of lynx, wolf, or NLEB habitat in Minnesota.) Loss of NLEB habitat due to forest conversion and management has been identified as a threat to NLEB. The final 4(d) rule biological opinion indicated that while NLEB mortalities related to forest management impacts could further diminish the species' ability to persist, NLEB populations would not be declining so dramatically without WNS. There are large tracts of land adjacent to the Mine Site and within the action area, such as the adjacent USFS lands to the northeast, east and southeast, which are managed to provide lynx, wolf, and NLEB habitat, and lynx and wolf critical habitat. Abundant habitat for all three species also occurs outside of Minnesota.

Conservation Measure: PolyMet addressed some of these effects in Conservation Measures #1, 2, and 7 (see Conservation Measures beginning on page 6 of this Opinion). Reclamation of 397 acres will occur, including seeding and/or planting of woody vegetation (trees and shrubs) on up to 202 acres of lands suitable for this type of vegetation (Figure 9). Planting/seeding of woody vegetation rather than with grasses and forbs will expedite forest regeneration on those 202 ac instead of waiting for only natural succession to occur. Depending on the amount and density of seeding and/or planting, and other site conditions, it will still take at least 10 years – and possibly longer – for habitat to become suitable for lynx, wolves, NLEB, and their prey. We anticipate that the slivers of reclaimed habitat along the Mine Site's central pit and haul roads will provide limited value to lynx, wolves, and their prey due to fragmented location, small size, and linear shape of the slivers. These slivers of reclaimed acres cover approximately one-half of the 202 ac, or about 100 ac, which likely will be marginal for lynx and wolf use. NLEBs will forage and roost in interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields, woodlots, and linear features such as fencerows, riparian forests, and other wooded corridors. However, they consistently avoid foraging in or crossing large open areas and instead, use tree-lined pathways or small openings (Patriquin and Barclay 2003, Yates and Muzika 2006). Therefore, the entire 202 ac reclaimed with trees may be more conducive to NLEB use than lynx and wolf.

The reclaimed habitat in the eastern portion of the Mine Site (labeled as Category 2/3 in Figure 9) will be contiguous with adjacent suitable habitat, and more likely to be used by these species and their prey. The surrounding forested lands within the Project area not disturbed by mining operations will be retained and managed as wildlife habitat; however, 2,870 ac (76 percent) are wetlands, comprised mostly of greater than 70 year-old lowland forest. The wet areas probably have limited lynx, wolf, and NLEB use except during winter months by lynx and wolves, but as previously mentioned, Moen (2008a) found that lynx use of the lowland conifer cover type tends to increase during the denning season. PolyMet indicated that they will include timber harvest in its management of these surrounding lands, which will regenerate the forest and perpetuate lynx, wolf, and NLEB habitats. However, these actions also would result in short-term adverse effects during and immediately after timber harvest, depending on timing, size, and type of harvest implemented (e.g., even-aged (clearcut) versus uneven-aged management). Finally, PolyMet intends to clear trees outside of the NLEB's pup season from June 1 through July 31, which will eliminate or reduce disturbance impacts to any potential NLEBs maternity roosting activities.

There are no known lynx or wolf den sites in the area and the likelihood for a den to occur within the Project's area of disturbance is probably low. As previously mentioned, lynx detections from an intensive 3-month winter survey were concentrated approximately 5 miles east and southeast of the Project area. One set of lynx tracks was identified at the Mine Site in February 2010 but none were detected during five other surveys (2000, 2004, 2008, 2009, and 2010). The limited evidence of lynx activity in the action area appears to concentrate toward the outer, eastern and southeastern edges of the action area. Also, the Project area is located adjacent to areas already disturbed by on-going mining activities. There are no records of lynx or wolf dens in the action area and lynx and wolf use in and near the Mine Site appears to be low.

Vegetation removal will include 1,333 ac of potential lynx and wolf denning habitat at the Mine Site. The proportion of this area relative to habitat that supports denning in Minnesota is extremely small. Moen (2008a) indicated that approximately 25 percent (approximately 2.1 million acres) of the landscape in northeastern Minnesota (St. Louis, Lake and Cook Counties -

covering approximately 8.4 million ac) consists of suitable lynx denning habitat. Therefore, removal of 1,333 ac of denning habitat (less than 0.1 percent) would not limit lynx populations in Minnesota. In addition, vegetation removal will occur outside of the period from June 1 to July 31 (per Conservation Measure #7, which is intended to minimize effects to the NLEB). This will further minimize the chances of any direct harm to or death to denning lynx or wolves, including young that could occur as a result of the removal of vegetation. The amount of denning habitat for wolves is likely even greater than that for lynx; therefore, we also expect the removal of 1,333 acres of habitat to no significant effect on the number of wolves in Minnesota.

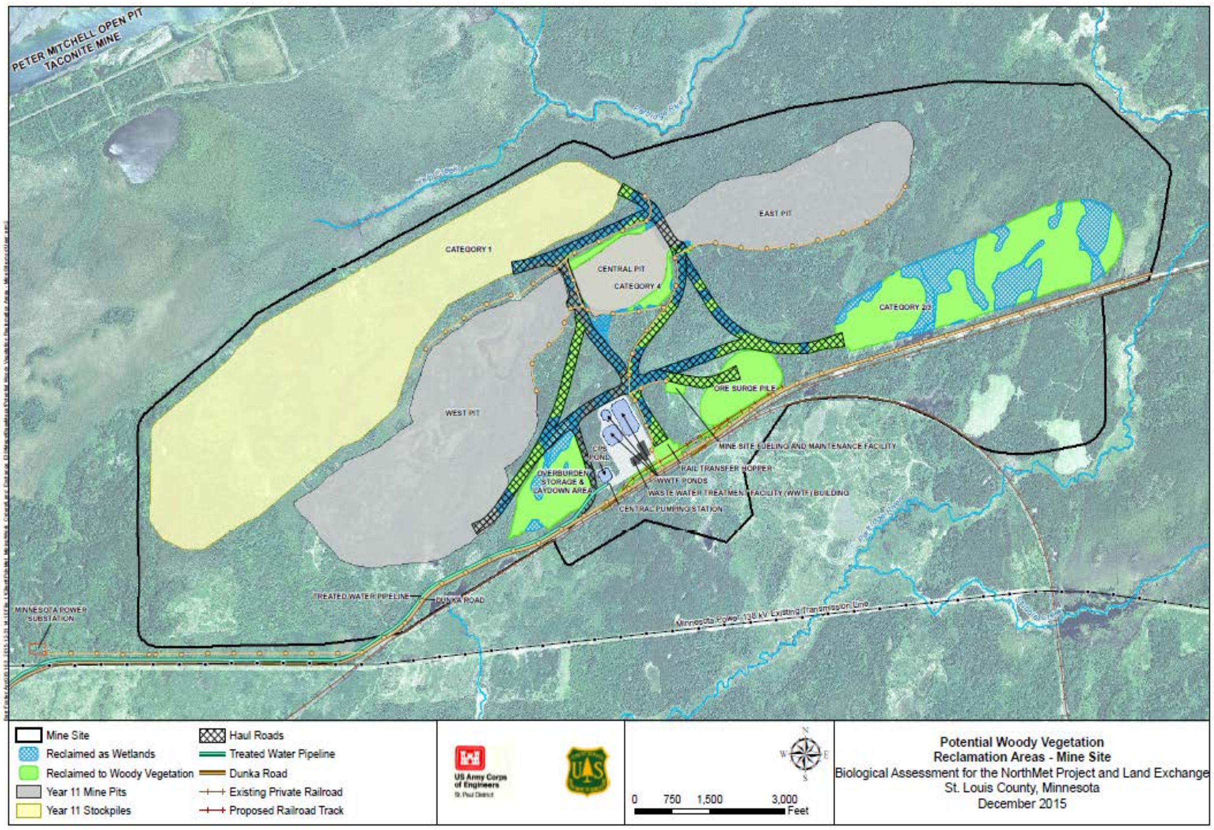

Figure 9. Reclamation areas with potential woody vegetation (PolyMet December 2015).

2. ***Activity*****: Pre-production and infrastructure construction followed by subsequent mining activities.**

Subactivity: After vegetation clearing, the Dunka Road will be widened between the Plant and Mine Sites and a new railroad spur line and water pipeline will be constructed in the Transportation and Utility Corridors. Development of water management features (ponds, ditches, dikes, etc.), containment systems, storage, fueling, and maintenance areas, and infrastructure at the Plant Site, as well as corridor-related construction will occur first. These will be followed by subsequent mining-related activities, including drilling and blasting of rock; heavy equipment use (such as excavators and bull-dozers); piling, loading, and unloading mined material into stockpiles, haul trucks, and trains; and associated transportation (see transportation below under Activity 3 – Transportation and Utility Corridors).

Stressor: Lights, glare, noise and vibrations from these activities.

Exposure: Along with increased human presence, lynx, wolves, and NLEB could be exposed to lights, glare, noise and vibrations from construction and subsequent mining-related activities for 24 hours per day, year-round, for a minimum of 20 years. The area of exposure will extend beyond the Project area depending on a variety of conditions (type of noise, prevailing wind direction, daytime versus nighttime activities etc.), and is likely to include adjacent areas not being mined that have suitable lynx, wolf, and NLEB habitat, lynx critical habitat, and some of the terrestrial wildlife travel corridors (most likely corridors #15, 16, 17, and 18; Figure 10).

Exposure to lights will be associated mostly with the Mine Site. The loudest noises and vibrations (blasting and drilling) are expected to occur every 2 to 3 days at the Mine Site but other loud noises throughout the project area will be on-going. The air-blasts were estimated to reach 125 dBL at corridor # 17, 115 dBL at #16, and between 105-110 dBL at corridors #15 and 18 (see FEIS Fig. 5.2.8-2, p. 5-537). (*Note*: potential wildlife movement, or travel, corridors were identified through two separate geographic information system spatial analyses by Emmons and Olivier 2006 and Barr 2009. These spatial exercises were based on vegetation cover data, and economic and other information, to identify where in the Iron Range wildlife travel corridors likely still existed that connected adjacent large blocks of habitat to the northwest and southeast of the Iron Range. Subsequent data on wildlife use of these corridors is mostly opportunistic or anecdotal.)

Wildlife travel corridors #16 and 17, particularly access to these areas, would most likely be directly affected by mining-related activities. Corridor #16 is located approximately 1 mile southeast of the existing Plant Site; it is 0.6 mi wide and the FEIS (pp. 5-448 and 6-77) identified it as being important but of moderate quality (the existing LTVSMC Tailings Basin is located within the corridor but provides poor quality habitat, currently obstructs animal movement, and is unlikely to be used much by wildlife). Corridor #17 is located approximately 0.5 mi northwest of the Mine Site, is 0.25 mi wide between two existing open mine pits, and is crossed by roads (Barr 2009); it was identified as important with high quality habitat. However, the north side of this corridor likely will be lost to Northshore Mining's mine pit expansion (Barr 2009). Wildlife travel corridor #15 is approximately 2 miles to the southwest of the Plant Site and is at least 900 ft wide (0.17 mi) at its narrowest point; #18 is approximately 6 miles northeast of the Mine Site and at least 1,100 ft wide (0.2 mi), is crossed by several roads, and follows the course of a river. The approximate distance between wildlife corridors #15 and #16 is 2 miles, #16 and #17 is 3 miles, and #17 and #18 is 9 miles.

Exposure to the various water impoundment features and any potential contaminants released into them, such as mercury, is unlikely to affect lynx or wolves. There is potential to indirectly affect NLEB through ingestion of contaminated insect prey. However, NLEBs primarily forage in, or adjacent to forested areas rather than in openings such as the tailings basin or other ponds within the Project area. The BA (pp. 6-76 to 6-78) indicated that process water collected and stored in ponds, and the substrates within the various ponds will not be conducive to growth and reproduction of algae, macroinvertebrates, and other biota. It further stated that mercury will be sequestered in solids, such as tailings, such that concentrations in the water column should be low – similar to background levels. Management of water levels in some of the impoundments also will limit aquatic insect use, and therefore, NLEB use.

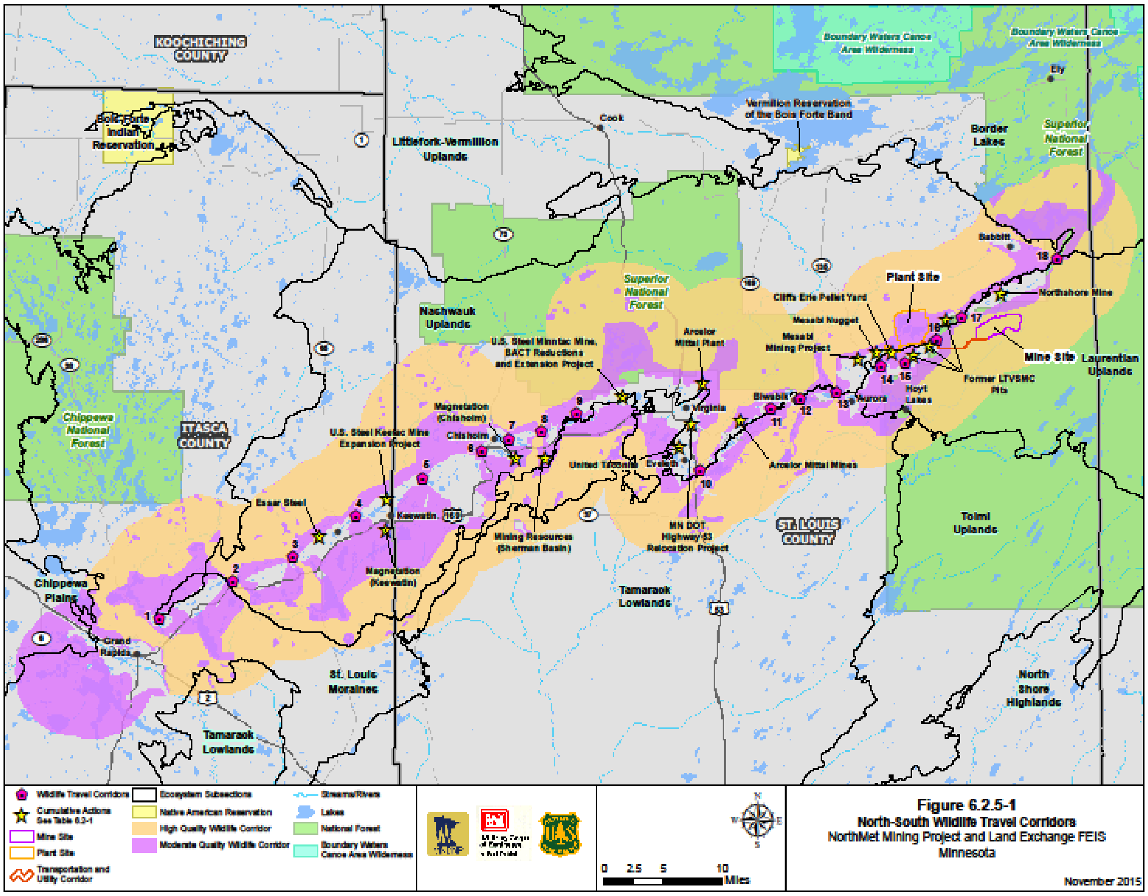

Figure 10. Wildlife travel corridors (from FEIS, Figure 6.2.5-1, p. 6-75).

Response - Harm: Lynx, wolves, and NLEB could be harmed by the loudest decibel levels emanating from blasting and drilling, given that these species have more sensitive hearing than humans. However, these noises and vibrations will occur where habitat has been removed and in conjunction with other on-going activities and noise, and it is unlikely they would be in close enough proximity to suffer harm to their hearing. Noise and other mining-related effects may diminish the habitat quality within the remainder of the Project area and adjacent habitats and travel corridors, contribute to fragmentation effects (from loss of habitat) and force lynx, wolves, and NLEB to travel farther to find available suitable habitat and prey resources.

Response-Harass: Lynx, wolves, and NLEB could be annoyed by the perpetual lights, noises, and vibrations of mining rock material, heavy equipment use, loading and dumping, and transportation sounds to the degree that they may leave the area and/or abandon portions of home ranges or territories, den sites, wolf rendezvous sites, or maternity roost sites either temporarily or permanently.

Consequences/Intensity: The level of effects from lights on individual lynx and wolves is unknown; lights could also act in combination with other activities' effects that annoy individuals. NLEBs foraging in lighted areas may increase their risk of predation (leading to death) or it may deter bats from flying in those areas. Bats that significantly alter their foraging patterns may increase their energy expenditures resulting in reduced reproductive rates, depending on the context (e.g., duration, location, extent, type) of the lighting. However, some studies also show a beneficial effect from concentrating prey.

The extent of the noise and vibration effects will vary considerably depending and many factors, including type and duration of activity producing the sounds, duration and decibel levels of the noises and vibrations, time of day and season (e.g., nighttime versus daytime; summer with abundant foliage that dampens noise versus winter with reduced foliage), weather conditions such as prevailing wind direction and speed, and other factors. The FEIS (section 5.2.8) provided a detailed description of noise and vibration modeling results. The loudest decibels from blasting and drilling will attenuate within varying distances from the Mine and Plant Sites and Transportation/Utility Corridor, again depending on several factors mentioned above. While the loudest noises and vibrations may extend beyond the action area perimeter during some time periods, in general, most other noises and vibrations will likely attenuate closer to the Project area during mining activities.

Similar to effects from habitat loss, lynx, wolves, and NLEB may experience potential decline in body condition or reduced fitness resulting from displacement from or reluctance or inability to access portions of home ranges, territories, roost sites, or adjacent suitable habitats due to noise and vibrations. There could also be reproductive failure (e.g., kitten or pup starvation) from diminished prey and foraging opportunities in affected areas. They also may die or become injured if they interact with other predators while forced into other areas to search for prey or new roost sites.

Consequences also extend to terrestrial wildlife travel corridors and their use by lynx and wolves. Prior to the cumulative development of mine features across the Iron Range, wildlife travel was relatively unrestricted between northwestern and southeastern blocks of habitat. Currently, wildlife movement is restricted because of the extensive landscape changes, including large mine pits, rock stockpiles, mining infrastructure, regional development associated with the Iron Range, and highways (Emmons and Olivier 2006). As mentioned above, travel corridor #16 was identified as important but with moderate quality habitat and per the FEIS (p. 5-448) current use is limited. At Corridor #17, Northshore mining operations to the north may completely eliminate that portion of the corridor, regardless of effects from the proposed PolyMet mine. Proposed PolyMet operations will not physically reduce the corridor size but will likely affect its quality and potentially its use, due to on-going mining noise and activity – particularly near the Mine Site and relative to the large habitat block to the southeast. Effects would likely vary depending on factors such as location, types, duration, and daily or seasonal occurrence of disturbances. Reduced or restricted access to travel corridors #16 and 17 could indirectly affect adjacent corridors due to increased use from displaced lynx, wolves, and their prey. The FEIS (Table 6.2.5-1, p. 6-78) indicated that other reasonably foreseeable projects may affect nearby travel corridors (such as #15, 18, and others), including blocking or encroaching into them, However, the nearest corridors will likely continue to provide at least some habitat for wildlife use. The PolyMet mine impacts could further reduce permeability through these corridors and increase habitat fragmentation.

The net loss of and changes to lynx and wolf habitat, and lynx critical habitat due to development of the mine and associated activities will increase the distance between larger blocks of what the BA indicated as “high quality” habitat to the north and south of the project area (see Figure 9 above). The high quality habitat currently at the proposed Mine Site and between there and the Plant Site covers approximately 7 miles west to east, by 2 miles north to south, and is contiguous with wildlife corridor #17. Some of the high quality habitat to the south of this corridor will be removed and remaining habitat will be affected by noise and other activities. If these disturbances deter lynx and wolves from moving through, then the distance they would be forced to travel to access the next nearest wildlife travel corridors leading to other suitable habitats and prey would increase. The additional distances to access adjacent corridors #15 and 18 are approximately 2 and 9 miles, respectively, depending on where in the Project area wildlife are located.

Scale/Extent of Effect on Reproduction, Population: We cannot precisely ascertain the effects that lights, glare, excessive loud noises and vibrations would have on lynx, wolf, or NLEB reproduction or species numbers in the action area. If there are occupied home ranges, territories, or maternity roost sites in the vicinity, then foraging, denning, or roosting activities could be disrupted to the point of precluding use of portions of home ranges or territories, reproductive failure, or death of individuals. In addition, the continuous band of private lands and development in this eastern portion of the Iron Range that separates adjacent lynx critical habitat, LAUs, and wolf habitat currently extends for more than 30 miles in a southwest to northeast direction and as mentioned, much of it is already developed (other mines, towns, roads, etc.). A mentioned, we cannot predict with certainty how much mining-related impacts within the action area may affect individual lynx, wolf, and NLEB reproduction or numbers, or their use of the action area because there is little baseline information from which to assess these effects.

Cumulative fragmentation and degradation of lynx, wolf, and NLEB habitat in the action area could result in it becoming increasingly impervious, in particular to lynx and wolf use and travel, with energetic and potentially, reproductive costs for all three species. Effects to local use of habitats by these species in the action area will be negative and significant. Likewise, the ability for each species to cross through the Iron Range will be further diminished by the proposed action. Due to the small proportion of each species habitat that will be affected, however, impacts to the rangewide numbers, reproduction, and distribution of the each species will not be great (refer to Figures 1, 4, 5, and 7). The Iron Range occupies a relatively marginal portion of the range of lynx in Minnesota.

Conservation Measure: There are no measures specifically addressing effects from this activity. However, CM #1 and 2 address reclamation of habitat and maintaining vegetated buffers; #6 will incorporate surveys and monitoring of lynx and wolves within the action area, including wildlife travel corridors; and #7 addresses wildlife habitat management in adjacent areas and restricts vegetation removal outside of the NLEB pup season.

***3. Activity*: Transportation and Utility Corridors including infrastructure construction, reconstruction, and/or expansion, on-going maintenance, use via various types of vehicles, trucks, and train cars, and traffic.** *Note*: some of this will occur during pre-production activities with similar effects.

Subactivity: Some clearing of forested habitat will occur along existing roads, railroad tracks, and the utility ROW, and the Dunka Road will be widened between the Plant and Mine Sites. A new railroad spur line and water pipeline in the corridor will also be constructed, and associated maintenance will be on-going. There will be subsequent mining-related vehicle and train travel on roads and railroad tracks between the Mine and Plant Sites and from the Plant Site to off-site destinations.

Stressor: In addition to the effects from pre-production and mining activities covered above, there will be a considerably higher volume of vehicle and train traffic and associated speeds and noise that will occur within potential lynx and wolf home ranges, territories, and/or foraging areas. The higher traffic volumes, road density, and noise may prevent or restrict lynx and wolves from using or crossing roads to access suitable habitat and travel corridors.

Exposure: This activity may affect NLEB for similar reasons (such as habitat loss, noise) already discussed above relative to habitat; therefore, we focus this activity's effects to lynx and wolf. Transportation infrastructure and associated traffic will further fragment habitat in the action area and may restrict lynx and wolf use of the habitat that provides access through travel corridors #16 and 17, and indirectly affect #15 and 18 through increased use if wildlife shift their use to these corridors (addressed above).

Traffic volume resulting from mining and related activities will increase on access and haul roads and highways, and railroad tracks within the action area, particularly on the west side. Increased traffic volume will increase the probability for lynx and wolf mortality by vehicle and train collisions. In addition, vegetation alongside roads and railroad tracks that already attracts prey, particularly deer, and subsequently wolves and lynx, exposes them to the increased traffic levels and mortality risk.

While existing roads will be used, the new access and haul roads and rail spur will increase road density. Current road density in Township 59 North, which includes the Mine Site and federal lands, is 2.2 mi/mi^2, and at just the Mine Site, is 0.5 mi/mi^2. The existing roads in the action area, including the Dunka Road (between the Mine and Plant Sites), State Hwy. 135, and County Hwy. 666, will experience increased traffic volume from the proposed Project. While the Transportation/Utility Corridor is outside the wildlife travel corridors, it runs parallel and perpendicular to them and increased traffic would potentially affect wildlife use of these passages.

Baseline annual average daily traffic volumes in the action area range from approximately 1,850 vehicles on Hwy. 135 to anywhere from 140 to 810 on Hwy. 666 (increases closer to the town of Hoyt Lakes) (Saran 2016, pers. comm.). There will be an increase of approximately 346 vehicle trips per day and 45 train trips per day, totaling 391 per day in the action area above existing traffic levels. The total miles of vehicle and train travel per day in the action area is estimated to be 3,608 mi and 423 mi, respectively, totaling 4,031 mi per day. Vehicle speeds (mostly from light trucks and maintenance vehicles) will range from 30 to 40 mph and trains will travel at speeds ranging from 15 to 25 mph.

Snow compaction of existing and new roads used for mining-related activities could provide access into lynx and wolf habitats not previously used by competing carnivores, such as coyotes. However, lynx research related to snow compaction and competitive interactions is limited and has resulted in somewhat different conclusions based on spatial and temporal factors (see Interagency Lynx Biology Team 2013 p. 82). If such competition were to occur, then both lynx and wolves would be exposed to other predators and associated interactions or conflicts, and increased numbers of competing predators seeking similar prey species – which could result in decreased fitness, which was discussed above.

Response - Harm: The risk of death or injury by vehicle or train collision will increase due to estimated traffic volume and associated speeds for the duration of mine construction and operation.

Response-Harass: The traffic volume and associated noise could also annoy lynx and wolves such that they develop an avoidance or reluctance to cross roads and railroad tracks.

Consequences/Intensity: Current road density at the Mine Site will increase during mining activities, mostly at the Mine Site which, when combined with other on-going activities on roads, could displace lynx and wolves. As mentioned, road density was the best predictor of suitable habitat for breeding packs (Mech et al. 1988a; Mladenoff et al. 1995; Thiel 1985). While wolves will use roads and readily cross them, generally, areas with road densities of less than 1 mile/mi^2 are best for wolf survival (Wydeven et al. 2001; Wydeven and Wiedenhoeft 2001), although wolves may tolerate road densities up to 1.2 mi/mi^2 provided large roadless areas are nearby (such as that provided by the BWCAW). However, because most of the new roads will be within the Mine Site and surrounded by other mining activities, effects from an increase in road density essentially will be overshadowed by other disturbances.

Lynx are known to travel on and readily cross most roads and their use of roads and other linear features is probably based on the energetic efficiency of moving along a road compared to moving through a forest. It is more energetically efficient to walk on or alongside of a road, whether within a home range or while on a long-distance movement (Moen et al 2010). Lynx and wolf use of roads may allow them access to and save energetic costs in finding prey, but may also increase the risk of mortality due to vehicle strikes. In addition, attractive roadside vegetation may be conducive to higher prey densities which, in addition to increased probability for mortality, could disturb lynx and wolf prey foraging because of disruptions from traffic, or presence of humans or other animals.

While PolyMet will reduce the vehicle speed limit from 45 to 40 mph in the portion of the Project area under their ownership, vehicles traveling at or below 40 mph still present a risk for collision, given the mortalities that have occurred on other low-volume, low-speed Forest roads in Minnesota and elsewhere. There could be a reduction in the mortality rate in the future as traffic volumes continue but lynx and wolves increase their avoidance of the Project area and adjacent habitats; however, we have no baseline information from which to assess this. Yet given the amount of future land disturbance and associated mining activities, noise, human presence, traffic, and other perturbations that will occur, it is likely that the transportation corridor will be used less by lynx and wolves during operations. Transportation-related barriers to lynx and wolf, when combined with habitat fragmentation, may further impede habitat use or access to wildlife corridors, and indirectly decrease habitat effectiveness, similar to the effects addressed under the previous two activities.

Scale/Extent of Effect on Reproduction, Population: The extent to which fragmentation from roads and urbanization can impact connectivity of meso-carnivore populations likely depends on the physical design of highway improvements, the surrounding environmental features, the density of increased urbanization, and the increased traffic volume (Clevenger and Waltho, 2005; Grilo et al., 2009). Effects resulting in reduced fitness would be difficult to measure; however, mortalities from collision are measurable. Carnivores are especially vulnerable to highway-caused mortality in areas with dense and high traffic volume roadways (Clevenger et al., 2001). For example, 20 percent of mortalities (13 out of 65) of reintroduced lynx in Colorado were due to vehicle collisions (Devineau et al., 2010), as well as 19 percent (16 out of 83) of reintroduced lynx in the Adirondack Mountains of New York (Aubry et al., 2000). In Germany, 45 percent of the mortalities of subadult Eurasian lynx (*Lynx lynx*) are caused by traffic (Kramer-Schadt et al., 2004). In southeastern British Columbia, lynx avoided crossing highways within their home ranges (Apps, 2000). As previously mentioned, four lynx have been killed by vehicles in northeastern Minnesota – on Cook County Highway 12 (Gunflint Trail), (Superior NF) Forest Road 172, Lake County Hwy. 2, and MN Trunk Highway 61 (USFWS, Twin Cities Field Office, Bloomington, MN, unpubl. data). No lynx-vehicle collisions have been reported on roads associated with mining projects, even though lynx have been observed using mine roads at the Northshore Mine and former Cliffs Erie Mine Site near the Project area (ENSR 2006); two lynx have been killed by trains in Minnesota.

Numerous assumptions have to be made to estimate the numbers of lynx and wolves that would likely be hit by vehicles and trains as a result of increased traffic on roads and railroad tracks. Road-related mortalities of gray wolves have been studied in Wisconsin (Kohn et al. 2000); however for lynx, we do not have a similar study on which to base an estimate of the quantitative impact. The likely frequency of lynx-vehicle collisions may be less than that for wolves due to the lower predicted densities of lynx in northern Minnesota. In addition, lynx populations fluctuate markedly during approximately 10-year cycles, whereas wolf densities will likely be relatively stable. The probability of lynx getting hit by vehicles will likely vary in proportion to lynx density throughout the population cycle. However, because such data are insufficient and interactions are complex, we are unable to differentiate these variables with any confidence or precision. Therefore, we assume that lynx are equally susceptible to being taken by vehicles as are wolves and that the factors considered for wolves will also determine the likely number of lynx taken, See Appendix 2 for the complete description of how we quantified transportation-related mortalities for lynx and wolves that we anticipate may occur.

We do not know if transportation-related effects and associated mortalities would have a measurable effect on lynx or wolf reproduction or species numbers in the action area, although loss of an individual would likely have a short-term localized impact. The likely worst case scenario would be loss of a female lynx or wolf and that year’s litter of kittens or pups. However, these effects are not likely affect to lynx and wolf populations within the range of the species.

Conservation Measures: PolyMet addressed some of these effects in CMs #3, 4, and 5. Because most project-related roads and railroad tracks will be on private property, access will be limited to employees only. They intend to minimize road construction and reclaim unused roads. Some roads will be reclaimed upon completion of mining activities in approximately 20 years, thereby reducing the transportation corridor use and decreasing road density; the roads on the private lands will also remain closed to the public. Finally, adherence to posted speed limits will be part of employee safety training, but depending on whether or not employees adhere to the required safety conservation measures will affect the probability of lynx and wolf mortality. Employee education will also include lynx identification and reporting. All animal carcasses will be moved out of sight along the transportation corridor between the Mine and Plant Sites to prevent attracting predators to roadsides and railroad tracks and associated vehicle- and train-strikes.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

There are numerous mining projects already occurring in or adjacent to the action area and at least one being considered in the Mesabi Iron Range; the latter will require separate consultation, as appropriate, pursuant to section 7 of the ESA. Within the action area, there are four on-going operations (FEIS p. 6-72): Cliffs Erie Pellet Yard, Mesabi Mining, Mesabi Nugget, and Northshore Mine - Northshore Ultimate Pit Progression Project. Only the Northshore project has a proposed expansion that is in its initial stages.

In addition to on-going and future mining activities, other future activities on non-federal lands that are reasonably certain to occur and could affect lynx, wolves, and NLEB and their habitats include timber harvest, prescribed burning, road construction and maintenance, recreation, minerals exploration, and fragmentation through human developments. Large-scale mining operations on non-Forest land could result in irreversible or irretrievable loss of lynx and wolf prey habitat, as well as foraging and roosting habitat for NLEB in an area that already has highly fragmented habitat. State, county, and private land timber harvest, related road construction activities, and fire management are not subject to federal management and would not necessarily provide the same level of protection and conservation for threatened and endangered species and their habitats as occurs on the Forest's administered lands. However, timber harvest that regenerates suitable forest habitat and increases numbers and distribution of snowshoe hare, ungulate prey, and foraging areas for NLEB, could also have beneficial effects on these species.

In addition to loss of suitable habitat for these species, including lynx critical habitat, potential increased pressure on adjacent lynx and wolf habitat from disturbed or displaced individuals, impacts to wildlife movement corridors, and human disturbances could result from these various types of activities. These include additional traffic and an increased potential for collisions with lynx and wolves. Lynx and wolves in this part of their range may also be limited by non-habitat factors such as illegal take by hunters and trappers, and collision with vehicles. Lynx may be further constrained by a low population size, hybridization with bobcats, and competition with other predators. Recreational activities associated with non-federal lands are expected to continue in the action area and are reasonably certain to remain stable or increase in conjunction with human population increases in northern Minnesota.

Conclusion

We have concluded that the proposed land exchange between the Superior National Forest and the Applicant (PolyMet) will result in development of the private lands. The land exchange, in and of itself, will not result in negative effects to lynx, wolf, lynx and wolf critical habitats, and northern long-eared bat, but the exchange will lead to the subsequent development of the private lands, which will result in significant adverse effects to these three species in the action area. The Forest indicated that future development of the subsequent private land is outside of their jurisdiction. We conclude that the mining development is an indirect effect of, and caused by, the proposed land exchange, allowing for the exemption of incidental take to extend to the USFS and the Applicant; this exemption is effective only if the Reasonable and Prudent Measures (RPM, see Incidental Take Statement, below) are implemented.

The USFS's proposed action (land exchange) will ultimately lead to development of the federal exchange parcel and the remaining private land, which will lead to the subsequent adverse effects to these three species and lynx and wolf critical habitats, including take. Therefore, the USFS would be exempt from any take resulting from the subsequent development of PolyMet's NorthMet mine if the RPMs are implemented. Since development of the subsequent private parcel is beyond the authority of the USFS, their exemption to the take prohibition would not lapse regardless of future activity, or lack thereof, by the Applicant. The Applicant's exemption of incidental take depends upon implementation of the agreed upon Conservation Measures described above and implementation of the RPMs.

After reviewing the current status of Canada lynx, gray wolf, and northern long-eared bat, the environmental baseline for the action area, the effects of the proposed PolyMet mine and land exchange parcels in St. Louis, Lake, and Cook counties, Wetland Mitigation Sites, and the cumulative effects, it is the Service's opinion that the action, as proposed, is not likely to jeopardize the continued existence of Canada lynx, gray wolf, or northern long-eared bat. It is also not likely to adversely modify critical habitat for lynx or wolf.

Based on the assumptions regarding traffic volume, susceptibility to vehicle collisions, traffic speeds, lynx and wolf densities, and current likelihood of vehicle collisions, we estimate that the proposed action will result in approximately one lynx and one wolf taken; take that is likely to occur due to other effects of the project is not likely to be directly detectable and will be expressed in terms of the 3,918 acres of lynx, wolf, and NLEB habitat (less than 0.1 percent in Minnesota) that will be destroyed over the 20-year life of the project. Although destructive locally to the species and their habitats, rangewide effects on numbers, reproduction, and distribution will be minimal for each species. Populations of these three species continue to be wide-ranging across portions of the contiguous United States. Therefore, the estimated proportional impacts to Canada lynx, gray wolves, and northern long-eared bats in the contiguous U.S. would be less than that anticipated for the species in Minnesota alone. This level of impact would not result in an appreciable effect on the survival and recovery of Canada lynx, gray wolf, and northern long-eared bat in the contiguous U.S.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by PolyMet for the exemption in section 7(o)(2) to apply. PolyMet has a continuing duty to regulate the activity covered by the incidental take statement. If PolyMet fails to assume and implement the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, PolyMet must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

In this biological opinion, we described the anticipated incidental take in terms of one lynx and one wolf killed by a vehicle or train every 20 years in the action area. See Appendix 2 for a detailed description of how we quantified these amounts of take. We also described incidental take through a surrogate of acres of habitat for the lynx, wolf, and northern long-eared bat primarily due to vegetation and overburden removal at the Mine and Plant Sites, and along the Transportation and Utility Corridors. Vegetation removal on all these sites/corridors totals no more than 3,918 ac, including 1,719 ac at the Mine Site, less than 10 ac along the Transportation and Utility Corridors, and 2,189 ac at the Plant Site. The loss of 3,918 ac equals 7 to 14 percent of one lynx home range and 7 percent of one wolf territory. While the potential for future forest management actions on lands surrounding the Mine and Plant Sites and Transportation/Utility Corridor was mentioned in the BA, no specific actions, locations, or acreages were provided, so additional acres of lynx, wolf, and northern long-eared bat habitat removal or alteration are unknown. Any incidental take that may occur as a result of those future actions is not the subject of this incidental take statement.

If NLEB are present or use an area proposed for vegetation removal or other mining-related activities, incidental take of NLEB could occur. The Service anticipates incidental take of the NLEB will be difficult to detect for the following reasons: (1) the individuals are small and occupy summer habitats where they are difficult to find; (2) the NLEB forms small, widely dispersed maternity colonies under loose bark or in the cavities of trees and males and non-reproductive females may roost individually, which makes finding the species or occupied habitats difficult; (3) finding dead or injured specimens during or following project implementation is unlikely; (4) the precise distribution and density of the species within its summer habitat in the action area is unknown; and, (5) in many cases incidental take will be non-lethal and undetectable. However, while incidental take may occur, it is not prohibited provided specific actions are implemented (see Terms and Conditions below) under the January 2016 final 4(d) rule for NLEB.

Effect of the Take

In the attached biological opinion, we concluded that the anticipated incidental take would not jeopardize the continued existence of the Contiguous United States Distinct Population Segment of Canada lynx, gray wolf, and northern long-eared bat. Similarly, we concluded that while there may be adverse effects to critical habitat for both lynx and wolf, it will not be adversely modified. The Conservation Measures that PolyMet has committed to will also minimize the potential for take of lynx, wolf and NLEB, as described above.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize take of Canada lynx, gray wolf, and northern long-eared bat.

RPM 1. Implement proposed action Conservation Measures to reduce the likelihood of vehicle collisions with lynx and wolf (see T&C 3 below).

RPM 2. Implement measures to reduce the likelihood of injuring or killing any northern long-eared bats during vegetation removal, other mining-related activities, and forest management.

Terms and Conditions

In order to be exempt from incidental take, PolyMet must comply with the following terms and conditions (T&C), which implement the Reasonable and Prudent Measures described above. These terms and conditions are non-discretionary.

T&C 1. If any hibernacula are found in the Project area, PolyMet will not conduct any activities that disturb or disrupt hibernating individuals when they are present and will not physically alter the hibernaculum's entrance or environment when bats are not present. This includes not conducting any tree removal within 0.25 miles (0.4 km) of any known NLEB hibernacula.

T&C 2. Reporting Requirements:

a. Any vehicle collisions with lynx or wolf must be reported within 72 hours to the U.S. Fish and Wildlife Service, Twin Cities Field Office, Bloomington, Minnesota (952-252-0092). These reports shall include all known information regarding the incident, including the species involved, date of incident, fate of the animal (e.g., dead), location of the carcass and any tissue collected for DNA analysis (see CR1 below), geographic coordinates of the accident location, sex of the animal, and approximate age (i.e., adult, juvenile, yearling). To ensure that any incident will be reported, each employee who will drive on roads or travel by rail associated with the project as described in this biological opinion shall be provided information to enable them to identify, in particular Canada lynx, as discussed above. This information shall be retained in all vehicles and appropriate rail cars that will be driven in association with the proposed PolyMet project. See Appendix 3 for identification information.

   Contact numbers for reporting lynx mortality will be included on the information sheet. The information on the following website could be used for this purpose: http://www.nrri.umn.edu/lynx/information/bobcat.html

b. PolyMet shall make all reasonable efforts to educate personnel to report any sick, injured, and/or dead bats (regardless of species) located in the Project area immediately to the Service's Twin Cities Field Office (TCFO) (952-252-0092) and/or the Minnesota Department of Natural Resources (MDNR; see http://www.dnr.state.mn.us/wns/index.html or call 1-888-345-1730). No one, with the exception of trained staff or researchers contracted to conduct bat monitoring activities, should attempt to handle any live bat, regardless of its condition. If an injured bat is found, if possible, effort should be made by trained staff (with rabies vaccination) to transfer the animal to a wildlife rehabilitator. If needed, TCFO and/or MDNR will assist in species determination for any dead or moribund bats. Any dead bats believed to be NLEB will be transported on ice to the TCFO or MDNR. If an NLEB is identified, TCFO will contact the appropriate Service law enforcement office. Care must be taken in handling dead specimens to preserve biological material in the best possible state. In conjunction with the care of sick and injured fish or wildlife and the preservation of biological materials from dead specimens, the USFS has the responsibility to ensure that information relative to the date, time, and location of NLEB, when found, and possible cause of injury or death of each is recorded and provided to the Service. In the extremely rare event that someone has been bitten by a bat, please keep the bat in a container and contact the local health department.

c. PolyMet shall provide the Service with an annual report summarizing the activities completed per the proposed action Conservation Measures and this biological opinion's Reasonable and Prudent Measures/Terms and Conditions, including the extent of the area (e.g., acres) affected by each. Any wildlife monitoring data submitted to the Superior National Forest that is subsequently analyzed and documented will also be included in annual reports as it becomes available. Mortalities of lynx, wolf, and northern long-eared bat must also be reported and such reports can be consolidated and combined with the other required information.

d. This report shall be provided to the Service no later than January 31 of the following calendar year until all project activities are complete.

The Service concludes that no more than one Canada lynx and one gray wolf will be incidentally taken, and up to 3,918 acres of habitat for lynx, wolf, and NLEB will be removed as a result of the proposed action during the 20-year duration of this biological opinion. (*Note*: We included acres of NLEB habitat here; however, incidental take related to vegetation removal is not prohibited in areas of the country inside the WNS zone provided the measures listed under the final 4(d) rule (and at the top of p. 10 of this Opinion) are implemented. Therefore, we have not addressed them in the RPMs.) The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. PolyMet must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act, directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations (CR) are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop information.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their or their habitats, the Service requests notification of the implementation of any conservation recommendations.

CR 1. Report any sightings of Canada lynx to the Service's Twin Cities Field Office at (952) 252-0092 and provide the date and location (geographic coordinates if available). If feasible, allow access by MDNF and/or USFS personnel to follow up on any lynx sightings and collect DNA as soon as possible after observations, particularly in winter.

CR 2. Remove and reclaim any roads and mining-related areas as soon as they become unnecessary for ongoing activities.

CR3. Consider busing employees to reduce traffic volume – at least through areas where there is suitable habitat on either side of the road or near wildlife travel corridors.

CR 4. Assist with or participate in on-going federal and state investigations on northern long-eared bat within the action area.

CR 5. Manage forests to ensure a continual supply of snags and other suitable northern long-eared bat maternity roost trees, and to maximize snowshoe hare density for lynx.

CR 6. Evaluate the use of outdoor lighting during the active season and seek to minimize light pollution by angling lights downward or via other light minimization measures.

REINITIATION – CLOSING STATEMENT

This concludes formal consultation for the potential effects of the proposed PolyMet NorthMet Project in St. Louis, Lake, and Cook Counties, Minnesota, and associated land exchange and wetland mitigation actions on Canada lynx, gray wolf, critical habitat for lynx and wolf, and northern long-eared bat. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In addition, PolyMet will strictly adhere to the proposed action Conservation Measures stated in the Description of the Proposed Action section. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Appendix 1. Complete consultation history.

4/12/2005. USFWS early coordination letter to MDNR, cc'd to USACE and tribes.

6/3/2005. Environmental Assessment Worksheet released.

6/8/2005. USFWS proves comment letter to USACE on the Polymet Mine Public Notice for proposed 404 wetland impacts.

9/5/2006. ENSR Cooperation released 2006 Canada Lynx Assessment (Final Report) to inform the NEPA process and development of a Biological Assessment.

11/2009. Feasibility Analysis for Threatened, Endangered, and Sensitive Species and Habitat Assessment for the Proposed PolyMet Land Exchange released to inform the NEPA process.

10/2010. Draft EIS released.

1/19/2011. USFWS briefing paper discussing BA needs.

1/26/2010. USFWS submits comments on the Draft EIS.

1/10-3/4/2011. Draft Alternative EIS versions released for comment.

5/3/2011. USFWS meeting with USFS and USACE to discussing BA needs.

9/1/2011. Draft table of contents for the Biological Assessment provided to USFWS.

11/21/2011. USFWS email to USFS discussing BA data needs and formal section 7 process.

12/20/2011. USFWS email to AeCom discussing BA data needs.

3/12/2012. USFWS briefing paper to Congressman Chip Kravaack discussing BA needs.

11/13/2012. Tribal/Gantt chart meetings (occurred regularly).

2/28/2013. Meeting with USFS, USACE, project consultants, and PolyMet staff to discuss BA needs.

8/21/2013. Doug Bruner, USACE submitted the first draft Biological Assessment for Polymet's Proposed NorthMet Project and Land Exchange that included may affect, likely to adversely affect determinations for Canada lynx (*Lynx canadensis*) and its critical habitat and a not likely to jeopardize determination for gray wolf, but if listed and critical habitat reinstated, likely to adversely affect for both.

12/5/2013. MDNR, USFS and USACE released the Supplemental Environmental Impact Statement for public comment.

12/20/2013. Dan Ryan, USFS submitted an updated draft Biological Assessment for the proposed project that included species determination and analysis for impacts to Canada lynx, gray wolf (*Canis lupus*) and their critical habitat, and the northern long-eared bat (*Myotis septentrionalis*). Determinations were as follows: LAA Canada lynx; NLAA Canada lynx CH; no jeopardy under formal conferencing for NLEB, but if listed, NLAA; and no jeopardy for gray wolf, but if relisted, LAA gray wolf and NLAA gray wolf CH.

3/13/2014. USFWS provided comments on the Supplemental EIS under NEPA. A decision was subsequently made by all agencies to postpone further comment on the BA until new analysis was conducted.

5/28/2014. Dan Ryan, USFS informed the Service that they will be taking over the lead in consultation and will wait until all BA comments are classified to determine next steps in the consultation process.

7/9/2014. The Service met with USFS staff to discuss the draft Biological Assessment.

7/14/2014. Biologist Andrew Horton participated in a site visit at the proposed mine with USFS, USACE, project consultants, and PolyMet staff.

10/29/2014. The Service participated in a conference call between USFS, USACE, PolyMet, ERM and Barr consulting to discuss the draft Biological Assessment.

11/18/2014. Dan Ryan, USFS submitted an updated draft Biological Assessment for the proposed project that included the same species determination for Canada lynx, gray wolf and the northern long-eared bat.

12/5/2014. The Service provided formal comments to USFS on the draft BA.

3/4/2015. Dan Ryan, USFS submitted an updated draft Biological Assessment for the proposed project that included the same species determination for Canada lynx, gray wolf and the northern long-eared bat.

3/6/2015. USFWS provided comments by email to USFS on the draft BA.

3/4/2015. Dan Ryan, USFS submitted an updated draft Biological Assessment for the proposed project that included species determinations as follows: LAA Canada lynx; LAA Canada lynx CH; LAA northern long-eared bat; and LAA gray wolf, LAA gray wolf CH.

8/24/2015. Michael Jimenez, USFS submitted by email, the final Biological Assessment for the proposed project that included a request for initiation of formal consultation dated August 20, 2015.

12/10/2015: The Service met with and participated via conference call with PolyMet, SNF, and USACE staff to discuss changes to the BA’s Conservation Measures.

12/21/2016. The Service, SNF, USACE, and PolyMet had a conference call to further revise and clarify the BA’s Conservation Measures.

1/21/2016. The Service, SNF, USACE, and PolyMet had a conference call to finalize BA Conservation Measures.

Appendix 2. PolyMet Project calculation of anticipated lynx and wolf mortalities from vehicle/train collisions.

To estimate the number and frequency of lynx and wolf vehicle collisions as a result of the mine-related traffic on roads, we used the preliminary results of a study of wolves in northwest Wisconsin (Kohn et al. 2000). In that study, 3 wolves were confirmed dead from automobile collisions in a 44-mile (mi) length of U.S. Highway 53 during a seven-year (yr) study period; i.e., approximately 0.01 wolf/mi/yr (3/44 = 0.07 dead per mi, 0.07 per mi/7 yrs = 0.01/mi/yr). However, even intensive studies such as this one may not document all road-related mortality within a study area (Clarke et al. 1998). In the 2000 Kohn et al. study, the likelihood of detecting wolf-automobile collisions during the winter was probably high because a biologist drove the road every day looking for signs of wolves crossing the road, but the likelihood of detecting incidents during summer was probably low (E. Anderson 1996, pers. comm.). To account for this, we extrapolate that Kohn et al. (2000) documented 50 percent of the wolf mortalities due to automobile collisions on Highway (Hwy.) 53 during their study – i.e., actual mortality was double, or 0.02 wolf/mi/yr.

Based on information in the BA (p. 6-31 to -32), at the Project area (Mine and Plant Sites and interconnecting Transportation and Utility Corridors), there will be up to 1,316 mi per day of vehicle traffic. Trains will cover up to 418 mi per day, including groups of 16-20 ore cars, each making 22 round trips per day (or 44 one-way trips). In addition, there will be 151 employee vehicles per day and 40 service vehicles per day entering the project area from off-site locations via existing highways, primarily State Hwy. 135 and St. Louis County Hwy. 666.

In the 2000 Kohn et al. study, traffic volume on Hwy. 53 was 4700 vehicles per day, whereas we estimated Project-related vehicle traffic volume within the entire action area as follows: 1,316 mi per day divided by 8.5 mi (approximate one-way distance on road between Plant and Mine Sites), or 155 vehicle trips per day in the project area; plus 151 employee trips and 40 service vehicle trips (total 191 trips) per day from off-site to the Project area (primarily via State Hwy. 135 and St. Louis County Hwy. 666); then, using 6 mi (action area radius distance around Project area) for each of the two highway segments = 12 mi within action area; 12 X 191 trips off-site = 2,292 mi per day); totaling 346 vehicle trips per day in the action area covering 3,608 mi total. (*Note*: the Project area (defined above) is different than the action area (as defined by the ESA), which we defined as the Project area plus an approximate 6-mile buffer around it that incorporates the two main highway segments, totaling 12 mi. The Opinion includes additional discussion of wildlife travel corridor #18, which is beyond the outer perimeter of our defined action area; however, we have not included it in this calculation because of the minor amount of traffic (e.g., logging roads) that exists between the Project area and this corridor).

Estimated train traffic volume within the project area will be 418 mi per day divided by 9.5 mi (Saran 2016, pers. comm.; the rail line is approximately 1 mile longer than the road segment), or 44 train trips per day. Off-site train trips of a 100-car trip once per month and a 30-car train 4 times per month total 5 trips per month or 0.6 trips/day, covering the 6-mi action area radius distance = 3.6 mi per day. There will also be a 100-car train trip once per week for 31 weeks (April to October), or 31 trips in 214 days which equals 0.15 trips per day (covering 6 mi = 0.9 or 1 mi rounded up). (*Note*: we recognize this latter train trip will not be year-round; however, to simplify the calculation, we include it equally in the overall calculation (the result would not change significantly from a 31-week versus year-round time period). The total train traffic volume in the action area will be 44 + 0.6 + 0.15 = 45 train trips per day in the action area. The total number of miles covered by train per day = 418 + 3.6 + 1 = 423 within the action area.

The total number of vehicle and train trips per day is 346 + 45 = 391 trips (one-way) per day on all sections of road and railroad track in the action area. The total miles of vehicle and train travel per day in the action area = 3,608 mi + 423 mi = 4,031 mi/day.

To estimate the frequency of lynx and wolf deaths due to vehicle/train collisions on the roads and railroad tracks mentioned above, we make the following assumptions:

1. The probability of death due to vehicle and train collisions is likely to be proportional to traffic volume.
2. Total traffic volume within the action area will be 346 vehicles/day and 45 train trips/day, or 391 trips (one-way) per day, covering 4,031 mi.
3. The risk of vehicle strike versus train strike will be the same.
4. Posted speed limits off-site will be similar to those on WI Hwy. 53 and greater than in the Project area, which will be no more than 40 mph.
5. The likelihood of lynx mortality can be expected to be directly proportional to lynx density in the vicinity of the roads, which will approximate that summarized by Moen et al. (2006), approximately 0.01158, or 0.012 lynx/mi^2 (0.3 lynx per km^2). Wolf density in Minnesota is 1.2 per 100 mi^2 or 0.012 per mi^2 (Erb et al. 2015).

Note: There is little available information regarding vehicle/train mortalities for lynx and wolves and the above assumptions do not account for differences in highway/road types and associated traffic volumes and speeds in the action area (e.g., Forest roads with low traffic volumes and speeds versus State highways with high traffic volumes and speeds); habitat characteristics adjacent to the various road segments; seasonal variations in lynx, wolf, and prey use of available habitat, road/rail crossings; and wildlife travel corridors within the action area; lynx and wolf densities in the action area; and other potential factors that are most likely important to fully understanding the vehicle/train-strike risk for lynx and wolves.

Precise lynx and wolf density data are not available for the action area, and density is not evenly distributed for lynx across northeastern Minnesota due to the heterogeneous spatial arrangement of suitable habitat. To estimate lynx density in the project area, we considered both the BA's density estimate of 1 lynx per 83 mi^2 (or 0.012 per mi^2), which was based on a 3-month winter survey in 2006 (2006 was at the end of a 3-year lag period following the Thunder Bay, Ontario peak density), and the information in Moen (2008b), which was based on interpretation of a broad data set of historical records and telemetry, and suggested a maximum population of approximately 250 lynx in a 10,632 mi^2 area (27,537 km^2), or 1 lynx per 43 mi^2 – approximately double the BA's estimate, or 0.023 lynx per 1 mi^2 for purposes of this analysis. We use the Erb et al. (2015) wolf density of 1.2 wolves per 100 mi^2 (3.2 wolves per 100 km^2) in Minnesota, or 0.012 per mi^2.

We recognize that the east half of the action area likely provides more suitable lynx and wolf habitat than the west half due to the existing level of development in the latter – and therefore, lynx and wolf densities likely would be lower in the west half. We also realize that the probability for mortality from collision might be higher in the west half of the action area (but outside of the Project area) due to existing highways and associated traffic volume and speed. However, because lynx and wolf densities in the west half likely are most likely lower, we presume that the probability for collision-related mortality is somewhat diluted. We also recognize that lynx have been killed on low-volume and low-speed Forest roads. Therefore, we consider the various differences in roads and lynx and wolf density as essentially equal for this estimation. Based on our assumptions and the calculations displayed in Table A-1, we anticipate that a mortality level ("take") of one lynx (versus two) and one wolf from vehicle/train collision over the 20-year duration of this project is a reasonable and logical estimate.

Appendix 2 - Table 1: Data for estimated lynx and wolf mortality calculations.

ROAD SEGMENT	Wolf Mortality Rate (WI study)	Density: Lynx (Moen/ENSR) and Wolf	Traff Vol (WI study)	Traff Vol (PolyMet)	Propor-tion Traff Vol	XX	Adj Density: Lynx (Moen/ ENSR) and Wolf	Mortality Rate: Lynx (Moen/ ENSR) and Wolf	Transportation Miles	No. Lynx (Moen/ENSR) and Wolf Per Year	No. Lynx (Moen/ENSR) and Wolf for 20-yr Project (Rounded Up)	Percent of MN Pop: Lynx (max/ min) and Wolf
Project area	0.02	0.023/0.012 0.012	4700	199	23.62	0.001	3.83/2.0 2.0	0.0038/ 0.002 0.002	8.7	0.029/0.0174 0.0174	0.58/0.35 0.35	
6-mile buffer outside project area	0.02	0.023/0.012 0.012	4700	192	24.48	0.001	3.83/2.0 2.0	0.0038/ 0.002 0.002	12	0.0456/0.024 0.024	0.912/0.48 0.48	
TOTAL										0.0813/0.0427 0.0427	1.49/0.83 0.83 (2/1/1)	0.8%/0.8% 0.05%

Field Definitions and Calculations (* Use range of lynx data from two different analyses by Moen and ENSR)

Wolf Mortality Rate (WI study) – wolf mortality rate (wolves/mi/yr)
Density: Lynx (Moen/ENSR)* and Wolf – lynx and wolf density (lynx/mi^2 and wolf/mi^2)
Traff Vol (WI study) – traffic volume in WI wolf study (vehicles per day)
Traff Vol (PolyMet) – traffic volume in proposed PolyMet project (combined vehicles and trains per day)
Proportion Traff Vol – proportional difference in traffic volume (4,700 vehicles per day in WI study / # vehicles and trains per day in project
XX – WI study mortality rate / proportional difference in traffic volume
Adj Density: Lynx (Moen/ENSR) and Wolf – adjusted lynx and wolf density; density of lynx 0.023 (Moen)/0.012 (ENSR) and wolf 0.012 versus density of wolves 0.0006 (WI study)
Mortality Rate: Lynx (Moen/ENSR) and Wolf - mortality rate for lynx equals the adjusted lynx density multiplied by XX
Transportation Miles – number of miles of proposed project road segments (Note: in the Project area, we adjusted this to account for the difference in road versus rail distances (8.5 and 9.5 mi, respectively) between Mine and Plant Sites and the number of associated vehicle and train trips; 155 veh X 8.5 mi = 1,316 mi and 44 train X 9.5 mi = 418 mi; we summed these and divided by 199 total # trips = 8.7 average road and rail miles.)
No. Lynx (Moen/ENSR) and Wolf Per Year – number lynx/lynx/wolf per year = estimated miles of roads X mortality rate
No. Lynx (Moen/ENSR) and Wolf for 20-yr Project – Take for life of the project = 20 years X previous column
Percent of MN Pop: Lynx (max/min) and Wolf – proportion of the MN population of lynx - 250 maximum/130 minimum and wolf - 2,221

Appendix 3. How to identify Canada lynx.

Lynx or Bobcat?

The following information is adapted from the website, http://oden.nrri.umn.edu/lynx/information/bobcat.html.

Canada lynx (*Lynx canadensis*) and bobcats (*Lynx rufus*) are medium-sized cats (2-3 times larger than a large house cat, smaller than a mountain lion) that are similar in appearance. There are several physical characteristics to distinguish between Canada lynx and bobcat:

The black tail, ear tufts, and large feet characteristic of Canada lynx are shown clearly in the photo above.

- Tail: A lynx's tail has a black tip all around, with the appearance of being dipped in a bottle of ink. A bobcat's tail is striped with black bands towards the end and has a black tip.
- Ears: Lynx have longer ear tufts than bobcats.
- Feet: Lynx have much larger feet than bobcats.

While not a physical characteristic, a lynx is more likely to provide humans with a "good" view, often remaining in an area for a period of time while people watch it. Bobcats are more secretive and elusive than lynx.

Contact numbers for reporting lynx mortality (1) FWS Law Enforcement at (651) 778-8360; or cell phone (651) 775-2758; (2) USDA Forest Service Special Agent at (218) 626-4386; (3) MN DNR Conservation Officer Supervisor at (218) 834-1406.