DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R5–ES–2011–0024]

[4500030113]

RIN 1018–AY98

Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule, and interim rule with request for comments.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine threatened species status under the Endangered Species Act of 1973 (Act), as amended, for the northern long-eared bat (*Myotis septentrionalis*), a bat species that occurs in 37 States, the District of Columbia, and 13 Canadian Provinces. The effect of this final rule will be to add the northern long-eared bat to

the List of Endangered and Threatened Wildlife.

We are also establishing an interim rule under the authority of section 4(d) of the Act that provides measures that are necessary and advisable to provide for the conservation of the northern long-eared bat. We are seeking public comments on this interim rule, and we will publish either an affirmation of the interim rule or a final rule amending the interim rule after we consider all comments we receive. If you previously submitted comments or information on the proposed 4(d) rule we published on January 16, 2015, please do not resubmit them. We have incorporated them into the public record, and we will fully consider them in our final determination on the 4(d) rule.

DATES: *Effective dates:* The final rule amending 50 CFR 17.11 and the interim rule amending 50 CFR 17.40 are both effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

Comments on the interim rule amending 50 CFR 17.40: We will accept comments on the interim rule amending 50 CFR 17.40 received or postmarked on or before [INSERT DATE 90 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date.

ADDRESSES: *Document availability:* The final listing rule is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R5–ES–2011–0024 and at *http://www.fws.gov/midwest/Endangered*. Comments and materials we received, as well as supporting documentation we used in preparing the final listing rule, are available for public

inspection at *http://www.regulations.gov*, and by appointment, during normal business hours at: U.S. Fish and Wildlife Service, Twin Cities Ecological Services Office, 4101 American Blvd. East, Bloomington, MN 55425; telephone (612) 725–3548, ext. 2201; or facsimile (612) 725–3609.

Comments on the interim rule amending 50 CFR 17.40: You may submit comments on the interim rule amending 50 CFR 17.40 by one of the following methods:

(1) Electronically: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R5–ES–2011–0024, which is the docket number for this rulemaking. Then click on the Search button. Please ensure that you have located the correct document before submitting your comments. You may submit a comment by clicking on "Comment Now!"

(2) By hard copy: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R5–ES–2011–0024; Division of Policy, Performance, and Management Programs; U.S. Fish and Wildlife Service, MS: BPHC; 5275 Leesburg Pike, Falls Church, VA 22041-3803.

We request that you send comments only by one of the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see the **Public Comments Solicited on the Interim 4(d) Rule** section, below, for more information).

FOR FURTHER INFORMATION CONTACT: Lisa Mandell, Deputy Field Supervisor, U.S. Fish and Wildlife Service, Twin Cities Ecological Services Field Office, 4101 American Blvd. East, Bloomington, MN 55425; telephone (612) 725–3548, ext. 2201; or facsimile (612) 725–

3609. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Final Listing Rule

Why we need to publish a rule: Under the Endangered Species Act, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule. This rule will finalize the listing of the northern long-eared bat (*Myotis septentrionalis*) as a threatened species.

The basis for our action: Under the Endangered Species Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that white-nose syndrome is the predominant threat to the species.

Peer review and public comment*:* We sought comments from independent specialists to ensure that our designation is based on scientifically sound data, assumptions, and analyses. We invited

these peer reviewers to comment on our listing proposal. We also considered all comments and information we received during the comment periods.

Interim 4(d) Rule

The need for the regulatory action and how the action will meet that need: Consistent with section 4(d) of the Act, this interim 4(d) rule provides measures that are tailored to our current understanding of the conservation needs of the northern long-eared bat.

Statement of legal authority for the regulatory action: Under section 4(d) of the Act, the Secretary of the Interior has discretion to issue such regulations as she deems necessary and advisable to provide for the conservation of the species. The Secretary also has the discretion to prohibit by regulation with respect to a threatened species, any act prohibited by section 9(a)(1) of the Act.

Summary of the major provisions of the regulatory action: The interim species-specific 4(d) rule prohibits purposeful take of northern long-eared bats throughout the species' range, except in instances of removal of northern long-eared bats from human structures and authorized capture and handling of northern long-eared bat by individuals permitted to conduct these same activities for other bats (for a period of 1 year after the effective date of the interim 4(d) rule).

In areas not yet affected by white nose syndrome (WNS), a disease currently affecting many U.S. bat populations, all incidental take resulting from any otherwise lawful activity will be excepted from prohibition.

In areas currently known to be affected by WNS, all incidental take prohibitions apply, except that take attributable to forest management practices, maintenance and limited expansion of transportation and utility rights-of-way, prairie habitat management, and limited tree removal projects shall be excepted from the take prohibition, provided these activities protect known maternity roosts and hibernacula. Further, removal of hazardous trees for the protection of human life or property shall be excepted from the take prohibition.

Previous Federal Action

Please refer to the proposed listing rule for the northern long-eared bat (78 FR 61046; October 2, 2013) for a detailed description of previous Federal actions concerning this species. On October 2, 2013, we published in the **Federal Register** (78 FR 61046) a proposed rule to list the northern long-eared bat as an endangered species under the Act. The proposed rule had a 60-day comment period, ending on December 2, 2013. On December 2, 2013, we extended this comment period through January 2, 2014 (78 FR 72058). On June 30, 2014, we announced a 6-month extension of the final determination on the proposed listing rule for northern long-eared bat, and we reopened the public comment period on the proposed rule for 60 days, ending August 29, 2014 (79 FR 36698). On November 18, 2014, we again reopened the comment period on the proposed listing for an additional 30 days, ending December 18, 2014 (79 FR 68657). During the comment period we received one request for a public hearing, which was held in Sundance, Wyoming, on December 2, 2014. On January 16, 2015, we published a proposed rule to create a species-specific rule under section 4(d) of the Act (a "4(d) rule") that would provide measures that are necessary and advisable to provide for the conservation of the

northern long-eared bat, if it were to be listed as a threatened species (80 FR 2371). At that time, we also reopened the public comment period on the October 2, 2013, proposed listing rule; we accepted public comments on both proposals for 60 days, ending March 17, 2015.

Background

Taxonomy and Species Description

The northern long-eared bat belongs to the order *Chiroptera*, suborder *Microchiroptera*, family *Vespertilionidae*, subfamily *Vespertilioninae*, genus *Myotis*, and subgenus *Myotis* (Caceres and Barclay 2000, p. 1). The northern long-eared bat was considered a subspecies of Keen's long-eared myotis (*Myotis keenii*) (Fitch and Schump 1979, p. 1), but was recognized as a distinct species by van Zyll de Jong in 1979 (1979, p. 993), based on geographic separation and difference in morphology (as cited in Caceres and Pybus 1997 p. 1; Caceres and Barclay 2000, p. 1; Nagorsen and Brigham 1993, p. 87; Whitaker and Hamilton 1998, p. 99; Whitaker and Mumford 2009, p. 207; Simmons 2005, p. 516). The northern long-eared bat is currently considered a monotypic species, with no subspecies described for this species (Caceres and Barclay 2000, p. 1; Nagorsen and Brigham 1993, p. 90; Whitaker and Mumford 2009, p. 214; van Zyll de Jong 1985, p. 94). Reynolds (2013, pers. comm.) stated that there have been very few genetic studies on this species; however, data collected in Ohio suggest relatively low levels of genetic differentiation across that State (Arnold 2007, p. 157). In addition, Johnson *et al*. (2014, upaginated) assessed nuclear genetic diversity at one site in New York and several sites in West Virginia, and found little evidence of population structure in northern long-eared bats at any scale. This species has been recognized by different common names, such as: Keen's bat (Whitaker and Hamilton 1998, p. 99), northern myotis (Nagorsen and Brigham 1993, p. 87;

Whitaker and Mumford 2009, p. 207), and the northern bat (Foster and Kurta 1999, p. 660). For the purposes of this finding, we refer to this species as the northern long-eared bat, and recognize it as a listable entity under the Act.

A medium-sized bat species, the northern long-eared bat's adult body weight averages 5 to 8 grams (g) (0.2 to 0.3 ounces), with females tending to be slightly larger than males (Caceres and Pybus 1997, p. 3). Average body length ranges from 77 to 95 millimeters (mm) (3.0 to 3.7 inches (in)), tail length between 35 and 42 mm (1.3 to 1.6 in), forearm length between 34 and 38 mm (1.3 to 1.5 in), and wingspread between 228 and 258 mm (8.9 to 10.2 in) (Caceres and Barclay 2000, p. 1; Barbour and Davis 1969, p. 76). Pelage (fur) colors include medium to dark brown on its back; dark brown, but not black, ears and wing membranes; and tawny to pale-brown fur on the ventral side (Nagorsen and Brigham 1993, p. 87; Whitaker and Mumford 2009, p. 207). As indicated by its common name, the northern long-eared bat is distinguished from other *Myotis* species by its relatively long ears (average 17 mm (0.7 in); Whitaker and Mumford 2009, p. 207) that, when laid forward, extend beyond the nose up to 5 mm (0.2 in; Caceres and Barclay 2000, p. 1). The tragus (projection of skin in front of the external ear) is long (average 9 mm (0.4 in); Whitaker and Mumford 2009, p. 207), pointed, and symmetrical (Nagorsen and Brigham 1993, p. 87; Whitaker and Mumford 2009, p. 207). There is an occasional tendency for the northern long-eared bat to exhibit a slight keel on the calcar (spur of cartilage arising from inner side of ankle; Nagorsen and Brigham 1993, p. 87). This can add some uncertainty in distinguishing northern long-eared bats from other sympatric *Myotis* species (Lacki 2013, pers. comm.). Within its range, the northern long-eared bat can be confused with the little brown bat (*Myotis lucifugus*) or the western long-eared myotis (*Myotis evotis*). The northern long-eared bat can be distinguished from the little brown bat by its longer ears, tapered and symmetrical tragus,

slightly longer tail, and less glossy pelage (Caceres and Barclay 2000, p. 1; Kurta 2013, pers. comm.). The northern long-eared bat can be distinguished from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000, p. 1).

Distribution and Relative Abundance

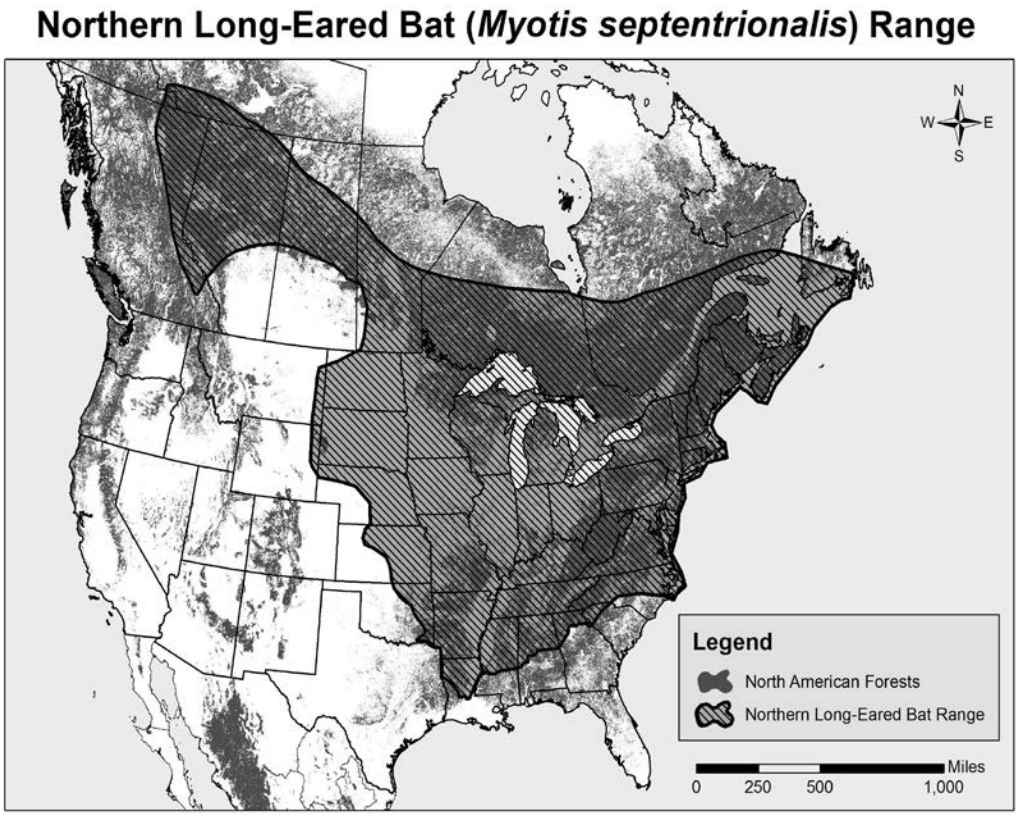
The northern long-eared bat ranges across much of the eastern and north-central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, p. 89; Caceres and Pybus 1997, p. 1; Environment Yukon 2011, p. 10) (see Figure 1, below). In the United States, the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to South Carolina (Whitaker and Hamilton 1998, p. 99; Caceres and Barclay 2000, p. 2; Simmons 2005, p. 516; Amelon and Burhans 2006, pp. 71–72). The species' range includes all or portions of the following 37 States and 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.

The October 2, 2013, proposed listing rule included Florida within the range of the northern long-eared bat; however, since that time we have learned that the species was known from only a single historical winter (1954) record in Jackson County, Florida, and all other historical and recent surveys at this cave and 12 other caves (all in Jackson County) since this record was observed have not found the northern long-eared bat. Further, there are no known

summer records for the State (Florida Fish and Wildlife Conservation Commission 2013, in litt.). 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 periods (Caceres and Barclay 2000, p. 2). Much of the available data on northern long-eared bats are from winter surveys, although they are typically observed in low numbers because of their preference for inconspicuous roosts (Caceres and Pybus 1997, p. 2) (for more information on use of hibernacula, see *Biology*, below). More than 1,100 northern long-eared bat 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, p. 100). Known hibernacula (sites with one or more winter records of northern long-eared bats) 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 (11), 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). Northern long-eared bats 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).

For purposes of organization, the U.S. portion of the northern long-eared bat's range is discussed below in four parts: eastern range, midwest range, southern range, and western range. In these sections, we have identified the species' historical status, in addition to its current status within each State. For those States where white-nose syndrome (WNS) has been detected (see

Table 1), we have assessed the impact the disease has had on the northern long-eared bat's distribution and relative abundance to date. For a discussion on anticipated spread of WNS to currently unaffected States, see "White-nose Syndrome" and "Effects of White-nose Syndrome on the Northern Long-eared Bat" under the *Factor C* discussion.



Eastern Range

For purposes of organization in this rule, the eastern geographic area includes the following States and the District of Columbia: Delaware, Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Vermont, Virginia, West Virginia, New York, and Rhode Island. Historically, the northern long-eared bat was widely distributed in

the eastern part of its range (Caceres and Barclay 2000, p. 2). Prior to documentation of WNS, northern long-eared bats were consistently caught during summer mist-net surveys and detected during acoustic surveys in the eastern United States (Service 2014, unpublished data). Northern long-eared bats continue to be distributed across much of the historical range, but there are many gaps within the range where bats are no longer detected or captured, and in other areas, their occurrence is sparse. Similar to summer distribution, northern long-eared bats were known to occur in many hibernacula throughout the East. Since WNS has been documented, multiple hibernacula now have zero reported northern long-eared bats. Frick *et al*. (2015, p. 6) documented the local extinction of northern long-eared bats from 69 percent of sites included in their analyses (468 sites where WNS has been present for at least 4 years in Vermont, New York, Pennsylvania, Maryland, West Virginia, and Virginia).

In Delaware, the species is rare, but has been found at two hibernacula within the State during winter or fall swarming periods. Summer mist-net surveys have documented 14 individuals all from New Castle County, and there is also a historical record from this county in 1974 (Niederriter 2012, pers. comm.; Delaware Division of Fish and Wildlife 2014, in litt.). WNS was confirmed in the State in the winter of 2009–2010, and WNS was confirmed in Delaware in the two northern long-eared bat hibernacula during the winters of 2011–2012 and 2012–2013 (Delaware Division of Fish and Wildlife 2014, in litt.). Mortality of northern long-eared bats due to WNS has been documented at both of these hibernacula during winter surveys.

In Connecticut, the northern long-eared bat was historically one of the most commonly encountered bats in the State, and was documented Statewide (Dickson 2011, pers. comm.). WNS was first confirmed in Connecticut in the winter of 2008–2009. Prior to WNS detection in Connecticut, northern long-eared bats were found in large numbers (*e.g*., often greater than 400

and up to 1,000 individuals) in hibernacula; however, no northern long-eared bats were found in any of the eight known hibernacula in the State (where the species was found prior to WNS) in 2012 or 2013 surveys (Service 2015, unpublished data).

In Maine, three bat hibernacula are known, and northern long-eared bats have been observed in all of these sites. The species has also been found in the summer in Acadia National Park (DePue 2012, unpublished data), where northern long-eared bats were fairly common in 2009–2010 (242 northern long-eared bats captured, comprising 27 percent of the total captures for the areas surveyed) (National Park Service (NPS) 2010, unpublished data). Recent findings from Acadia National Park show a precipitous decline in the northern long-eared bat population in less than 4 years, based on mist-net surveys conducted 2008–2014 (NPS 2014, in litt.). WNS was first confirmed in the State in the winter of 2010–2011. Prior to WNS, the northern long-eared bat was found in numbers greater than 100 at two of the three regularly surveyed hibernacula; however, in 2013, only one northern long-eared bat was found during surveys conducted at all three of the State's primary hibernacula (Maine Department of Inland Fisheries and Wildlife (MDIFW) 2013, in litt.). In addition, the northern long-eared bat was infrequently found in summer acoustic surveys conducted in the State in 2013, which contrasts with widespread, frequent acoustic detections of *Myotis* species and mist net captures of northern long-eared bats prior to WNS impact (MDIFW 2015, in litt.).

In Maryland, there are eight known hibernacula for the northern long-eared bat, three of which are railroad tunnels (Maryland Department of Natural Resources (MD DNR) 2014, unpublished data). WNS was first confirmed in Maryland in the winter of 2009–2010. In all five of the known caves or mines in the State, the species is thought to be extirpated due to WNS

(MD DNR 2014, unpublished data). It is unknown if the species is extirpated from the known railroad tunnel hibernacula in the State, primarily because the majority of bats in these hibernacula are not visible or accessible during winter hibernacula surveys; however, no northern long-eared bats have been observed in accessible areas in these tunnel hibernacula during recent winter surveys (MD DNR 2014, unpublished data). Acoustic surveys conducted since 2010 (pre- and post-WNS) in the western portion of Maryland have also demonstrated northern long-eared bat declines due to WNS (MD DNR 2014, unpublished data).

In Massachusetts, there are seven known hibernacula. WNS was first confirmed in the State in the winter of 2007–2008. Previous to WNS confirmation in the State, the northern long-eared bat was found in relatively larger numbers for the species in some hibernacula. In 2013 and 2014 winter surveys conducted in Massachusetts hibernacula, either zero or one northern long-eared bat individual were found in all known hibernacula (Service 2015, unpublished data).

In New Hampshire, northern long-eared bats were known to inhabit at least nine mines and two World War II bunkers, and have been found in summer surveys (Brunkhurst 2012, unpublished data). The northern long-eared bat was one of the most common species captured (27 percent of captures) in the White Mountain National Forest in 1993–1994 (Sasse and Pekins 1996, pp. 93–95). WNS was confirmed in the State in the winter of 2008–2009. Data from both hibernacula surveys and summer surveys have shown a dramatic decline (99 percent) in northern long-eared bat numbers compared to pre-WNS numbers (NHFG 2013, in litt.). Results from hibernacula surveys conducted at four of New Hampshire's hibernacula in 2014 found no northern long-eared bats; previous to WNS infection, the species was found in relatively high numbers (*e.g.*, 75–127 individuals) in most of these hibernacula. Furthermore, a researcher conducted mist-net surveys over 7 years pre-and post-WNS (2005–2011) at Surry Mountain

Lake in Cheshire County, New Hampshire, and found a 98 percent decline in capture rate of northern long-eared bats (Moosman *et al*. 2013, p. 554).

In New Jersey, one of the seven known northern long-eared bat hibernacula is a cave, and the rest are mines (Markuson 2011, unpublished data). Northern long-eared bats consisted of 6 to 14 percent of the total number of summer captures at Wallkill River National Wildlife Refuge from 2006–2010 (Kitchell and Wight 2011, in litt.). WNS was first confirmed in the State in the winter of 2008–2009. There have been limited consistent hibernacula and summer surveys conducted in the State to enable analyses of northern long-eared bat population trends pre- and post-WNS. Although small sample sizes precluded statistical comparison, Kitchell and Wight (2011, in litt.) and Bohrman and Fecske (2013, p. 77) documented a slight, overall decline in annual northern long-eared bat mist-net captures at Great Swamp National Wildlife Refuge following the outbreak of WNS. For 3 years prior to the disease's local emergence (2006–2008), northern long-eared bats represented 8–9 percent of total bats captured. Although the northern long-eared bat capture rate rose to 14 percent in 2009, it dropped to 6 percent in 2010, and further to 2 percent in 2012, suggesting a downward trend.

Historically, the northern long-eared bat was found in both summer and winter surveys conducted across Pennsylvania (Pennsylvania Game Commission (PGC) 2014, in litt.). Historically, the species was found in 112 hibernacula in the State. Fall swarm trapping conducted in September and October of 1988–1989, 1990–1991, and 1999–2000 at two hibernacula with large historical numbers of northern long-eared bats had total captures ranging from 6 to 30 bats per hour, which demonstrated that the species was abundant at these hibernacula (PGC 2012, unpublished data). WNS was first confirmed in the State in 2008–2009. Since that time, northern long-eared bat winter survey numbers declined by 99 percent, in

comparison to pre-WNS numbers (PGC 2014, in litt.; PGC 2014, unpublished data). Currently, the northern long-eared bat can still be found in portions of Pennsylvania during the summer; however, the number of summer captures continues to decline. The number of summer captures has declined an additional 15 percent annually, amounting to an overall decline of 76 percent (not including survey information from 2014) from pre-WNS capture rates. The PGC stated that the data support that the decline is attributable to WNS, rather than a lack of habitat or other direct impacts (PGC 2014, in litt.).

In Vermont, the northern long-eared bat was once one of the State's most common bats, but is now its rarest (Vermont Fish and Wildlife Department (VFWD) 2014, in litt.). Prior to 2009, the species was found in 16 hibernacula, totaling an estimated 458 animals, which was thought to be an underestimate due to the species' preference for hibernating in hibernacula cracks and crevices (VFWD 2014, unpublished data). WNS was confirmed in Vermont in the winter of 2007–2008. According to the VFWD, it is believed that all of the State's caves and mines that serve as bat hibernacula are infected with WNS. State-wide hibernacula, summer mist-net, and acoustic and fall swarm data collected in 2010 documented 93–100 percent declines in northern long-eared bat populations post-WNS (VFWD 2014, in litt.). In most recent surveys, few northern long-eared bats were found in three hibernacula in 2012–2013; however no individuals were found in any surveyed hibernacula in 2013–2014 winter surveys. Prior to WNS detection, summer capture data (from 2001–2007) indicated that northern long-eared bats comprised 19 percent of bats captured, and the northern long-eared bat was considered the second most common bat species in the State (Smith 2011, unpublished data). As for fall swarm data, in 2013, capture surveys at Aeolus Cave captured and identified 465 bats, only 3 of which were northern long-eared bats (VFWD 2014, in litt.).

In Virginia, the northern long-eared bat was historically considered “fairly common” during summer mist-net surveys; however, they were considered “uncommon” during winter hibernacula surveys and have been found in eight hibernacula (Reynolds 2012, unpublished data). WNS was first confirmed in Virginia in 2008–2009. Prior to WNS detection in the State (prior to 2011), 1.4 northern long-eared bats were captured per 1,000 units of effort during summer mist-net surveys conducted at sites Statewide. In 2011, there was an increase in captures, with 3.1 bats captured per unit effort. However, in 2013 in the same survey areas, 0.05 northern long-eared bats were captured per 1,000 units of effort, which amounts to a 96 percent decline in the population (Virginia Department of Game and Inland Fisheries (VDGIF) 2014, unpublished data). In 2013, over 85 percent of summer surveys resulted in no northern long-eared bat captures. Fall swarm trends have been similar, with capture rates per hour declining from 3.6 in 2009, to 0.3 in 2012, amounting to a decline of 92 percent (VDGIF 2014, unpublished data).

In West Virginia, northern long-eared bats were historically found regularly in hibernacula surveys, but typically in small numbers (fewer than 20 individuals) in caves (Stihler 2012, unpublished data). The species has also been found in 41 abandoned coal mines during fall swarming surveys conducted from 2002 to 2011, in the New River Gorge National River and Gauley River National Recreation Area, both managed by the NPS; the largest number observed was 157 in one of the NPS mines (NPS 2011, unpublished data). The species has been found in 104 total hibernacula in the State. WNS was first documented in hibernacula in the eastern portion of West Virginia in the winter of 2008–2009. Similar to some other WNS-affected States, northern long-eared bats can still be found across the State (similar pre- and post-WNS distribution); however, it is unclear if northern long-eared bat abundance is greater in West

Virginia than other WNS-affected States and, therefore, whether WNS impacts are less severe to date. Across the State, northern long-eared bat summer captures decreased from 32.5 percent in 2008, and 33.8 percent in 2011, to around 20 percent for all subsequent years (West Virginia Division of Natural Resources 2014, unpublished data). However, percent capture data alone does not indicate whether the northern long-eared bat is declining in the State, especially if all bat captures are declining, as it only indicates their abundance relative to other bat species. Standardized catch per unit effort or other similar data are necessary to make population trend comparisons over time. Francl *et al*. (2012, p. 35) standardized data by captures per net night from 37 counties (31 counties pre-WNS (1997–2008) and 8 counties in 2010) in West Virginia, and had 1.4 captures per net-night pre-WNS and 0.3 captures per net night post-WNS. At one site monitored over time (Monongahela National Forest), average northern long-eared bat calls per mile of acoustic route declined by 31–81 percent (depending on software package used) from 2009–2012 (Johnson *et al*. 2014, unpaginated). Similarly, mist-net capture rates declined by 93 percent from 2006–2008 to 2014 (Johnson *et al.* 2014, unpaginated). Overall, although northern long-eared bats are still captured across West Virginia (*i.e.*, they have a similar distribution as they did pre-WNS), there are marked declines in capture rates.

In New York, the northern long-eared bat was historically one of the most widely distributed hibernating bat species in the State, identified in 90 out of 146 known bat hibernacula (New York State Department of Environmental Conservation (NYSDEC) 2014, in litt.). The species has also been observed in summer mist-net and acoustic surveys. Summer mist-net surveys conducted in New York (primarily for Indiana bat (*Myotis sodalis*) presence-absence surveys) from 2003–2008 resulted in a range of 0.21–0.47 northern long-eared bats per net night, and declined to 0.01 bats per net night in 2011 (Herzog 2012, unpublished data). New York is

considered the epicenter for WNS, and the disease was first found in the State in the winter of 2006–2007. The NYSDEC confirmed that the decline experienced by this species due to WNS is both widespread and severe in the State (NYSDEC 2014, in litt.). Most hibernacula surveys conducted after the onset of WNS (2008 through 2013) found either one or zero northern long-eared bats (Service 2015, unpublished data). There are few long-term data sets for northern long-eared bats across the State, but one such site is the Fort Drum Military Installation, where acoustic surveys and mist-net surveys have monitored summer populations before (2003–2007) and after the onset of WNS (2008–2010). Ford *et al*. (2011, p. 130) reported significant declines (pre- vs. post-WNS) in mean acoustic call rates for northern long-eared bats as a part of this study at Fort Drum. No northern long-eared bats have been captured in mist-nets on Fort Drum since 2011.

There are two known hibernacula for bats in Rhode Island; however, no northern long-eared bats have been observed at either of these. There is also limited summer data available for the State; however, there were six summer records of northern long-eared bats from 2011 mist-net surveys in Washington County (Brown 2012, unpublished data).

We have no information regarding the species in the District of Columbia; however WNS is presumed to be impacting the species because WNS occurs in all neighboring States.

Midwest Range

For purposes of organization in this rule, the midwestern geographic area includes the following States: Missouri, Illinois, Iowa, Indiana, Ohio, Michigan, Wisconsin, and Minnesota. The species is captured during summer mist-net surveys in varying abundance throughout most of the Midwest, and historically was considered one of the more frequently

encountered bat species in the region. However, the species was historically observed infrequently and in small numbers during hibernacula surveys throughout the majority of its range in the Midwest. WNS has since been documented in Illinois, Indiana, Ohio, Michigan, Wisconsin, and Missouri. In Minnesota and Iowa, the presence of the fungus that causes WNS has been confirmed, but the disease itself has not been observed. Overall, clear declines in winter populations of northern long-eared bats have been observed in Ohio and Illinois (Service 2014, unpublished data).

There are no firm population size estimates for the northern long-eared bat rangewide; nor do we have the benefit of a viability analysis; however, a rough estimate of the population size in a portion of the Midwest has been calculated. That estimate shows there may have been more than four million bats in the six-State area that includes the States of Illinois, Indiana, Iowa, Ohio, Michigan, and Missouri (Meinke 2015, pers. comm.). This population size estimate (for the northern long-eared bat) was developed for the Midwest Wind Energy Multi-Species Habitat Conservation Plan (MSHCP) and was calculated by adjusting the 2013 Indiana bat winter population size (within the 6 States) based on the ratio of northern long-eared bats compared to Indiana bats in summer mist-net surveys. This estimate has limitations, however. The principal limitation is that the estimate is based on data that were primarily gathered prior to the onset of WNS in the Midwest; thus declines that have occurred in WNS-affected States are not reflected in the estimated number. Taking into account the documented effects of WNS in the Midwest to date (declines currently limited primarily to Ohio and Illinois), there may still be several million bats within the six-State area. Because post-WNS survey numbers for the species have not been included in this population estimate and WNS continues to spread throughout these 6 States,

there is uncertainty as to the accuracy of this estimate, and it should be considered a rough estimate.

The northern long-eared bat has been documented in 76 of 114 counties in Missouri; its abundance in the summer is variable across the State and is likely related to the presence of suitable forest habitat and fidelity to historical summer areas. There are approximately 269 known northern long-eared bat hibernacula that are concentrated in the karst landscapes (characterized by underground drainage systems with sinkholes and caves) of central, eastern, and southern Missouri (Missouri Department of Conservation 2014, in litt.). Similar to other more predominantly karst areas, the northern long-eared bat is difficult to find in Missouri caves, and thus is rarely found in large numbers. *Pseudogymnoascus destructans* (Pd) was first detected in Missouri in the winter of 2009–2010; however, the majority of sites in the State that have been confirmed with WNS were confirmed more recently, during the winter of 2013–2014. Due to low numbers historically found in hibernacula in the State, it is difficult to determine if changes in count numbers are due to natural fluctuations or to WNS. However, there was one northern long-eared bat mortality observed during the winter of 2013–2014 (WNS Workshop 2014, pers. comm.). Furthermore, Elliott (2015, pers. comm.) noted that surveyors are detecting indicators of decline (changes in bat behavior) as well as actual declines in numbers of northern long-eared bats in hibernacula in the State. As for summer survey data, mist-net and acoustic surveys conducted across Missouri in the summer of 2014 indicate continued distribution throughout the State. However, there were fewer encounters with northern long-eared bats in some parts of the State in 2014, as compared to previous years. Specifically, surveys conducted on the Mark Twain National Forest in 2014 indicate a decline in the overall number of captures of all bat species, including fewer northern long-eared bats than expected (Amelon 2014, pers.

comm.; Harris 2014, pers. comm.). Further, in southwest Missouri, northern long-eared bats have been encountered during mist-net surveys conducted on the Camp Crowder Training Site in 2006, 2013, and 2014. Overall, the number of northern long-eared bat captures has decreased since 2006, relative to the level of survey effort (number of net nights) (Missouri Army National Guard 2014, pp. 2–3; Robbins and Parris 2013, pp. 2–4, Robbins *et al.* 2014, p. 5). Additionally, during a 2-year survey (2013–2014) at a State park in north-central Missouri, 108 northern long-eared bats were captured during the first year, whereas only 32 were captured during the second year, with a similar level of effort between years (Zimmerman 2014, unpublished data).

In Illinois, northern long-eared bats have been found in both winter hibernacula counts and summer mist-net surveys. Northern long-eared bats have been documented in 21 hibernacula in Illinois, most of which are in the southern portion of the State (Davis 2014, p. 5). Counts of more than 100 bats have been documented in some hibernacula, and a high of 640 bats was observed in a southern Illinois hibernaculum in 2005; however, much lower numbers of northern long-eared bats have been observed in most Illinois hibernacula (Service 2015, unpublished data). WNS was first discovered in the State during the winter of 2012–2013. Mortality of northern long-eared bats was observed 1 year later, during the winter of 2013–2014, at two of the State's major hibernacula, which are in the central part of the State. At one hibernaculum, there was a drop-off in numbers of northern long-eared bats observed over the winter, with 371 individuals occupying the hibernaculum in November of 2013, and by March of 2014, there were 10 individuals, which amounts to a 97 percent decline (Davis 2014, pp. 6–18). At the other hibernaculum, in March of 2013, there were 716 northern long-eared bats counted; in November of 2013, there were 171 individuals; and in March of 2014, there were 3 individuals, with a decline of over 99 percent (Davis 2014, pp. 6–18).

During the summer, northern long-eared bats have been observed in landscapes with a variety of forest cover throughout Illinois. Surveys conducted across the State, related to highway projects and research activities, resulted in the capture of northern long-eared bats in moderately forested counties in western and eastern Illinois (*e.g.*, Adams, Brown, and Edgar Counties), as well as in northern counties where forests are highly limited (*e.g.*, Will and Kankakee Counties) (Mengelkoch 2014, unpublished data; Powers 2014, unpublished data). Pre-WNS, northern long-eared bats were regularly caught in mist-net surveys in the Shawnee National Forest in southern Illinois (Kath 2013, pers. comm.). The average number of northern long-eared bats caught during surveys between 1999 and 2011 at Oakwood Bottoms in the Shawnee National Forest was fairly consistent (Carter 2012, pers. comm.). Summer bat surveys in 2007 and 2009 at Scott Air Force Base in St. Clair County resulted in a low numbers of captures (a few individuals) of northern long-eared bats, and, in 2014, no northern long-eared bats were encountered (Department of the Air Force 2007, pp. 10–14; Department of the Air Force 2010, pp. 11–12). Overall, summer surveys from Illinois have not documented a decline due to WNS to date.

In Iowa, there are only summer mist-net records for the northern long-eared bat, and the species has not been documented in hibernacula in the State. Northern long-eared bats have been recorded during many mist-net surveys since the 1970s. Recent records include documented captures in 13 of 99 counties across the central and southeastern portions of the State. In 2011, 8 individuals (including 3 lactating females) were captured in west-central Iowa (Howell 2011, unpublished data). During summer 2014, one nonreproductive female was tracked to a roost in Fremont County in southwest Iowa (Environmental Solutions and Innovations, Inc. 2014, pp. 52–56). In Scott County, southeastern Iowa, four female northern long-eared bats (two pregnant

and two nonreproductive) were captured in June 2014, along the Wapsi River (Chenger and Tyburec 2014, p. 6). WNS has not been detected in Iowa to date; however, the fungus that causes WNS was first found at a hibernaculum in Iowa in the winter of 2011–2012.

Northern long-eared bats have been observed in both winter hibernacula surveys and, more commonly, in summer surveys in Indiana. Indiana has 25 known hibernacula with winter records of one or more northern long-eared bat. However, it is difficult to find large numbers of individuals in caves and mines during hibernation in Indiana (Whitaker and Mumford 2009, p. 208). Therefore, reliable winter population estimates are largely lacking in Indiana. WNS was confirmed in the State in the winter of 2010–2011. Although population trends are difficult to assess because of historically low numbers, mortality of northern long-eared bats due to WNS has been confirmed in the State (WNS Workshop 2014, pers. comm.). Historically, the northern long-eared bat was considered common throughout much of Indiana, and was the fourth or fifth most abundant bat species captured during summer surveys in the State in 2009. The species has been captured in at least 51 of 92 counties, often captured in mist-nets along streams, and was the most common bat taken by trapping at mine entrances (Whitaker and Mumford 2009, pp. 207–208). The abundance of northern long-eared bats appears to vary geographically within Indiana during the summer. For example, during three summers (1990, 1991, and 1992) of mist-netting in the northern half of Indiana, 37 northern long-eared bats were captured at 22 of 127 survey sites, and they only represented 4 percent of all bats captured (King 1993, p. 10). In contrast, northern long-eared bats were the most commonly captured bat species (38 percent of all bats captured) during three summers (2006, 2007, and 2008) of mist-netting on two State forests in south-central Indiana (Sheets *et al*. 2013, p. 193). The differences in abundance in north versus south Indiana are due to there being few hibernacula in northern Indiana;

consequently, migration distances to suitable hibernacula are great, and the species is not as common in summer surveys in the northern as in the southern portion of the State (Kurta 2013, in litt.). Long-term summer mist-netting surveys in Indiana have started to show a potential downward trend in northern long-eared bat numbers (*e.g.*, Indianapolis airport project, Interstate Highway 69 project; Service 2015, unpublished data); however, there was fluctuation in the count numbers from these surveys prior to WNS detection in the State, and it may be too early to confirm a downward trend based on these data. In Indiana, the Hardwood Ecosystem Experiment has collected summer mist-net data from 2006 through 2014 for the northern long-eared bat in Morgan-Monroe and Yellowwood State Forests, and has found consistent numbers of bats captured to date (Service 2015, unpublished data).

In Ohio, there are seven known hibernacula (Norris 2014, unpublished data) used by northern long-eared bat, and the species is regularly collected Statewide as incidental catches in summer mist-net surveys for Indiana bats (Boyer 2012, pers. comm.). WNS was first detected in the State in the winter of 2010–2011. Two hibernacula in Ohio contained approximately 90 percent of the State's overall winter bat population prior to WNS detection. The pre-WNS combined population average (5 years of survey data) for both sites was 282 northern long-eared bats, which declined to 17 northern long-eared bats in winter 2013–2014 (post-WNS). This amounts to a decline of northern long-eared bats from pre-WNS numbers of 90 percent in one of the hibernacula and 100 percent in the other (Norris 2014, pp. 19–20; Ohio Department of Natural Resources (ODNR) 2014, unpublished data). The (ODNR) conducted Statewide summer acoustic surveys along driving transects across the State from 2011 to 2014. Although they have not yet analyzed calls for individual species, such as the northern long-eared bat, initial results indicate a 56 percent decline in recorded *Myotis* bat species' calls over the 3-year period

(ODNR 2014, unpublished data). Capture rates from mist-net surveys, which were primarily conducted to determine Indiana bat presence, were conducted pre-WNS detection in Ohio (2007–2011) and were compared to capture rates post-WNS (2012–2013), and it was found that capture rates of northern long-eared bats declined by 58 percent per mist-net site post-WNS (Service 2015, unpublished data). Several parks in Summit County, Ohio, have been conducting mist-net surveys for northern long-eared bats (among other bat species) since 2004 (Summit Metro Parks 2014, in litt.), with numbers fluctuating. Their data noted a potential slight decline in northern long-eared bat numbers prior to WNS (however, there was a slight increase in 2011), and after WNS was detected in the area, a sharp decline was documented in capture rates. In surveys conducted in 2013 and 2014, no northern long-eared bats were captured at any of the parks surveyed (where the species was previously found; Summit Metro Parks 2014, in litt.).

In Michigan, the northern long-eared bat is known from 36 (physical detections in 33 counties and acoustic detections from 3 additional counties) of 83 counties and is commonly encountered in parts of the northern Lower Peninsula and portions of the Upper Peninsula (Kurta 1982, p. 301; Kurta 2013, pers. comm.; Bohrman 2015, pers. comm.). WNS was first confirmed in Michigan in the winter of 2014–2015. Cave bat mortality was documented in 2014–2015, although mortality was not specifically confirmed for northern long-eared bats. The majority of hibernacula in Michigan are in the northern and western Upper Peninsula; therefore, there are very few cave-hibernating bats in general in the southern half of the Lower Peninsula during the summer because the distance to hibernacula is too great (Kurta 1982, pp. 301–302). It is thought that the few bats that do spend the summer in the southern half of the Lower Peninsula may hibernate in caves or mines in neighboring States (Kurta 1982, pp. 301–302).

In Wisconsin, the northern long-eared bat was historically reported as one of the least abundant bats, based on hibernacula surveys, acoustic surveys, and summer mist-netting efforts (Amelon and Burhans 2006, pp. 71–72; Redell 2011, pers. comm.). However, summer surveys conducted in 2014 revealed a more widespread distribution than previously thought (Wisconsin Department of Natural Resources (WDNR) 2014, unpublished data). In the summer of 2014, WDNR radio-tracked 12 female northern long-eared bats in four regions in the State and collected information on selected roost tree species and characteristics (WNDR 2014, unpublished data). In addition, acoustic and mist-net data was collected by a pipeline project proponent in 2014, which resulted in new records for the species in many surveyed areas along a corridor from the northwest part through the southeast part of the State (WDNR 2014, unpublished data). The northern long-eared bat has been observed in 67 hibernacula in the State. WNS was confirmed in Wisconsin in the winter of 2013–2014. A recent population viability analysis in Wisconsin found that "there are no known natural refugia or highly resistant sites on the landscape, which will likely lead to statewide extinction of the species once WNS infects the major hibernacula" (Peery *et al.* 2013, unpublished data; WDNR 2014, in litt.).

The northern long-eared bat is known from 11 hibernacula in Minnesota. WNS has not been detected in Minnesota; however, the fungus that causes WNS was detected in 2011–2012. Prior to 2014, there was little information on northern long-eared bat 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 northern long-eared bats at each of 13 sites sampled, accounting for approximately 14 percent of all recorded bat calls (Smith *et al*. 2014, pp. 3–4). Mist-net surveys in 2014 at seven sites on Camp Ripley Training Center, Morrison County, resulted in capture of 4 northern long-eared bats (5 percent of total captures), and at five sites on

the Superior National Forest, Lake and St. Louis Counties, resulted in capture of 24 northern long-eared bats (55 percent of total captures) (Catton 2014, pp. 2–3). Acoustic and mist-net data were collected by a pipeline project proponent in 2014, which surveyed a 300-mile (mi) (483-kilometer (km)) corridor through the northern third of the State. Positive detections were recorded for Hubbard, Cass, Crow Wing, Aitkin, and Carlton Counties, and northern long-eared bats were the most common species captured by mist-net (Merjent 2014, unpublished data). Mist-net surveys were conducted the previous year (2013) on the Kawishiwi District of the Superior National Forest, and resulted in capture of 13 northern long-eared bats (38 percent of total captures) over nine nights of netting at eight sites (Grandmaison *et al*. 2013, pp. 7–8).

Southern Range

For purposes of organization in this rule, southern geographic area includes: Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, and Tennessee. In the South, the northern long-eared bat is considered more common in States such as Kentucky and Tennessee, and less common in the southern extremes of its range (*e.g*., Alabama, Georgia, and South Carolina). The absence of widespread survey efforts in several States is likely limiting the known range of the species, as well as information on its relative abundance (Armstrong 2015, pers. comm.). In the southern part of the species' range, Kentucky is the only State with Statewide survey data prior to 2010, primarily as a result of survey efforts for other listed bats species, such as the Indiana bat. WNS has been documented at many northern long-eared bat hibernacula in this region, with mortality confirmed at many sites.

Northern long-eared bats were historically observed in the majority of hibernacula in Kentucky and have been a commonly captured species during summer surveys (Lacki and Hutchinson 1999, p. 11; Hemberger 2015, pers. comm.). The northern long-eared bat has been documented throughout the majority of Kentucky, with historical records in 91 of its 120 counties. Eighty-five counties have summer records, and 68 of those include reproductive records (*i.e*., captures of juveniles or pregnant, lactating, or post-lactating adult females) (Hemberger 2015, pers. comm.). WNS was first observed in Kentucky in 2011. Currently there are more than 60 known WNS-infected northern long-eared bat hibernacula in the State (Kentucky Department of Fish and Wildlife Resources (KDFWR) 2014, unpublished data). Bat mortality at infected sites was first documented in 2013, and increased in 2014 (KDFWR 2014, unpublished report). However, population trends are difficult to assess as northern long-eared bat numbers in these hibernacula have historically been variable. Summer survey data for Kentucky lack a standardized unit of effort and, therefore, cannot be used to assess population trends. However, Silvis *et al*. (2015, p. 6) documented significant summer population declines within four maternity colonies on Fort Knox Military Installation during their 3-year study (from 2012–2014), presumably due to WNS.

In Tennessee, northern long-eared bats have been observed in both summer mist-net surveys and winter hibernacula counts. Summer mist-net surveys from 2002 through 2013 resulted in the capture of more than 1,000 individuals, including males and juveniles or pregnant, lactating, or post-lactating adult females (Flock 2014, unpublished data). During the winter of 2009–2010, the Tennessee Wildlife Resource Agency (TWRA) began tracking northern long-eared bat populations and has since documented northern long-eared bats in 58 hibernacula, with individual hibernaculum populations ranging from 1 to 136 individuals (TWRA 2014,

unpublished data). According to TWRA, Tennessee has over 9,000 caves and less than 2 percent of those have been surveyed, which led them to suggest that there could be additional unknown northern long-eared bat hibernacula in the State (TWRA 2013, in litt.). WNS was first documented in Tennessee in the winter of 2009–2010. WNS-related mortality was documented (including northern long-eared bat mortality) in 2014 (WNS Workshop 2014, pers. comm.); however, there is no pre-WNS data from these sites, and we cannot draw any conclusions regarding population trends based on hibernacula surveys. TWRA (2013, in litt.) indicates that summer mist-netting data for the eastern portion of the State showed a pre-WNS (2000–2008) capture frequency of 33 percent and post-WNS (2010–2012) capture frequency of 3l percent. These data do not have a standardized unit of effort, and, therefore, they cannot be used to assess population trends. Conversely, Lamb (2014, pers. comm.) observed declines in summer capture trends of several species of bats, including the northern long-eared bat, at Arnold Air Force Base in south-central Tennessee from 1998 to 2014. In the Great Smoky Mountains National Park, 2014 capture rates of northern long-eared bats in comparison to 2009–2012 declined by 71 to 94percent (across all sites) based on unit of effort comparisons (NPS 2014, in litt.; Indiana State University 2015, in litt.).

In 2000, during sampling of bat populations in the Kisatchie National Forest, Louisiana, three northern long-eared bats, including two males and one lactating female, were collected. These were the first official records of the species from Louisiana, and the presence of a reproductive female likely represents a resident summer colony (Crnkovic 2003, p. 715). Northern long-eared bats have not been documented using caves in Louisiana, including the five known caves that occur within 54 miles (87 km) of the collection site (Crnkovic 2003, p. 715). Neither WNS nor the fungus that cause WNS has been detected in Louisiana to date.

In Georgia, northern long-eared bat winter records are rare (Georgia Department of Natural Resources (GA DNR) 2014, in litt.). However, this species is commonly captured during summer mist-net surveys (GA DNR 2014, in litt.). Twenty-four summer records were documented between 2007 and 2011. Mist-net surveys were conducted in the Chattahoochee National Forest in 2001–2002 and 2006–2007, with 51 total individual records for the species (Morris 2012, unpublished data). WNS was first detected in the State in the winter of 2012–2013. With historically small numbers of northern long-eared bats found in hibernacula surveys in Georgia, we cannot draw conclusions regarding population trends based on hibernacula surveys. WNS-related mortality has been documented in cave bats in the State; however, northern long-eared bat mortality has not been documented to date.

Northern long-eared bats have been documented in 22 hibernacula in North Carolina. All known hibernacula are caves or mines located in the western part of the State (North Carolina Wildlife Resources Commission 2014, unpublished data), although summer records for the species exist for both the eastern and western parts of the State. In the summer of 2007, six northern long-eared bats were captured in Washington County, North Carolina (Morris *et al.* 2009, p. 356). Both adults and juveniles were captured, suggesting that there is a reproducing resident population (Morris *et al*. 2009, p. 359). Reproductive females and adult males have recently been documented in the northeastern part of the State. Mist-netting and acoustic data indicate that the northern long-eared bat may be active almost year-round in eastern portions of the State, likely due to mild winter temperatures and insect availability in coastal counties (North Carolina Department of Transportation 2014, in litt.). In North Carolina, WNS was first documented in the winter of 2008–2009. Northern long-eared bats have declined by 95 percent in hibernacula where WNS has been present for 2 or more years, with smaller declines

documented in hibernacula infected for less than 2 years (Weeks and Graeter 2014, pers. comm.).

Northern long-eared bats are known from the mountain region of three counties in northwestern South Carolina: Oconee, Pickens, and Greenville. There are two known northern long-eared bat hibernacula in the State: one is a cave that had 26 northern long-eared bats present in 1995, but has not been surveyed since, and the other is a tunnel where only one bat was found in 2011 (Bunch 2011, unpublished data). In South Carolina, WNS was first documented in the winter of 2012–2013. Bat mortality due to WNS has not been documented to date. Winter northern long-eared bat records are infrequent in the State. When present in hibernacula counts, their numbers range from 24 (1995 survey of a Pickens County hibernaculum) to single records in Oconee County (South Carolina Department of Natural Resources 2015, in litt.). Thus, population trends cannot be determined based on hibernacula surveys, due to historically low numbers of northern long-eared bats found.

Northern long-eared bats are known from 41 hibernacula in Arkansas, although there are typically few individuals (*e.g.*, fewer than 10 individuals) observed (Sasse 2012, unpublished data). Saugey *et al*. (1993, p. 104) reported the northern long-eared bat to be rather common during fall swarming at abandoned mines in the Ouachita Mountains. Additionally, Heath *et al*. (1986, p. 35) found 57 pregnant females roosting in a mine in the spring of 1985. Summer surveys in the Ouachita Mountains of central Arkansas from 2000–2005 tracked 17 males and 23 females to 43 and 49 day-roosts, respectively (Perry and Thill 2007, pp. 221–222). In 2013 summer surveys in the Ozark St. Francis National Forest, the northern long-eared bat was the most common species captured (Service 2014, unpublished data). Pd was first detected in the State in the winter of 2011-2012; however, WNS was confirmed at different sites (than where Pd

was first confirmed) in 2013–2014. Northern long-eared bat mortality was documented (five individuals) from one of the sites where WNS was first confirmed in 2013-2014 (WNS Workshop 2014, pers. comm.). Mortality of northern long-eared bats from WNS was observed in the State's largest hibernacula in 2015; 2015 surveys found 120 northern long-eared bats in that hibernacula, where counts in recent years often numbered 200 to 300 (Bitting 2015, pers. comm.).

Northern long-eared bats are known from two hibernacula in Alabama, where typically few individuals (*e.g.*, fewer than 20) are observed (Sharp 2014, unpublished data). Surveys conducted during the Southeast Bat Diversity Network bat blitz in 2008 reported the northern long-eared bat to be rather common in late summer/early fall swarm at known bat caves in Alabama (Sharp 2014, unpublished data). Summer surveys, mostly conducted between 2001 and 2008, in Alabama have documented 71 individual captures, including both males and reproductively active females (Sharp 2014, unpublished data). WNS was first documented in Alabama in the winter of 2011–2012.

The northern long-eared bat is known to occur in seven counties along the eastern edge of Oklahoma (Stevenson 1986, p. 41). The species is known from nine hibernacula, where typically they are observed in low numbers (*e.g.*, 1 to 20 individuals). However, a larger colony uses a cave on the Ouachita National Forest in southeastern Oklahoma (LeFlore County) during the winter (9 to 96 individuals) and during the fall (9 to 463 individuals) (Perry 2014, pers. comm.). Northern long-eared bats have been recorded from 21 caves (7 of which occur on the Ozark Plateau National Wildlife Refuge) during the summer. The species has regularly been captured in summer mist-net surveys at cave entrances in Adair, Cherokee, Sequoyah, Delaware, and LeFlore Counties, and are often one of the most common bats captured during mist-net

surveys at cave entrances in the Ozarks of northeastern Oklahoma (Stark 2013, pers. comm.; Clark and Clark 1997, p. 4). Small numbers of northern long-eared bats (typical range of 1 to 17 individuals) also have been captured during mist-net surveys along creeks and riparian zones in eastern Oklahoma (Stark 2013, pers. comm.; Clark and Clark 1997, pp. 4, 9–13). Neither WNS nor Pd has been detected in Oklahoma to date.

Although the northern long-eared bat was not considered abundant in Kentucky and Tennessee historically (Harvey *et al*. 1991, p. 192), research conducted from 1990-2012 found the species abundant in summer mist-net surveys (Hemberger 2012, pers. comm.; Pelren 2011, pers. comm.; Lacki and Hutchinson 1999, p. 11). With the exception of Kentucky and possibly portions of Tennessee, western North Carolina, and northwestern Arkansas, where the species appears broadly distributed, there simply was not historically adequate effort expended to determine how abundant the species was in States such as South Carolina, Georgia, Alabama, Mississippi, and Louisiana. Due to this lack of surveys, historical variability of winter populations, or lack of standardized data, it is difficult to draw conclusions about winter population trends pre- and post- WNS introduction in this region. Similarly, summer population trends are also difficult to summarize at this time due to a lack of surveys or standardized data.

Western Range

For purposes of organization in this rule, this region includes the following States: South Dakota, North Dakota, Nebraska, Wyoming, Montana, and Kansas. The northern long-eared bat is historically less common in the western portion of its range than in the northern portion of the range (Amelon and Burhans 2006, p. 71), and is considered common in only small portions of

the western part of its range (*e.g*., Black Hills of South Dakota) and uncommon or rare in the western extremes of the range (*e.g*., Wyoming, Kansas, Nebraska) (Caceres and Barclay 2000, p. 2); however, there has been limited survey effort throughout much of this part of the species' range. To date, WNS has not been found in any of these States.

The northern long-eared bat has been observed hibernating and residing during the summer in the Black Hills National Forest in South Dakota and is considered abundant in the region. Capture and banding data for survey efforts in the Black Hills of South Dakota and Wyoming showed northern long-eared bats to be the second most common bat banded (159 of 878 total bats) during 3 years of survey effort (Tigner and Aney 1994, p. 4). South Dakota contains 21 known hibernacula, all within the Black Hills, 9 of which are abandoned mines (Bessken 2015, pers. comm.). The largest number of northern long-eared bats was observed in a hibernaculum near Hill City, South Dakota; 40 northern long-eared bats were observed in this mine in the winter of 2002–2003 (Tigner and Stukel 2003, pp. 27–28). A summer population was found in the Dakota Prairie National Grassland and Custer National Forest in 2005 (Lausen undated, unpublished data). Using mist-nets and echolocation detectors, northern long-eared bats have also been observed in small numbers in the Buffalo Gap National Grasslands (Tigner 2004, pp. 13–30; Tigner 2005, pp. 7–18). Additionally, northern long-eared bats, including some pregnant females, have been captured during the summer along the Missouri River in South Dakota (Swier 2006, p. 5; Kiesow and Kiesow 2010, pp. 65–66). Swier (2003, p. 25) found that of 52 bats collected in a survey along the Missouri River, 42 percent were northern long-eared bats. Acoustic data recorded by bat monitoring stations operated by the South Dakota Department of Game, Fish, and Parks (SDDGFP) also detected the northern long-eared bat sporadically throughout the State (across 16 counties) in 2011 and 2012 (SDDGFP 2014, in litt.)

Summer surveys in North Dakota (2009–2011) documented the species in the Turtle Mountains, the Missouri River Valley, and the Badlands (Gillam and Barnhart 2011, pp. 10–12). No northern long-eared bat hibernacula are known within North Dakota. During the winters of 2010–2013, Barnhart (2014, unpublished; Western Area Power Administration 2015, in litt.) documented 3 bat hibernacula and 18 potential hibernacula in Theodore Roosevelt National Park; however, no northern long-eared bat were found. .

Northern long-eared bats have been observed at two quarries located in east-central Nebraska (Geluso 2011, unpublished data). However, the species is known to summer in the northwestern parts of Nebraska, specifically Pine Ridge in Sheridan County, and a small maternity colony has been recently documented (Geluso *et al*. 2014, p. 2). A reproducing population has also been documented north of Valentine in Cherry County (Benedict *et al*. 2000, pp. 60–61). During an acoustic survey conducted during the summer of 2012, the species was present in Cass County (east-central Nebraska). Similarly, acoustic surveys in Holt County, on the Grand Prairie Wind Farm, observed the northern long-eared bat at five of seven sites (Mattson *et al*. 2014, pp. 2–3). Limestone quarries in Cass County are used as hibernacula by this species and others (White *et al*. 2012, p. 3). White *et al*. (2012, p. 2) state that the bat is uncommon or absent from extreme southeastern Nebraska; however, surveys in Otoe County found two northern long-eared bats, a female and a male, and telemetry surveys identified roosts in the county (Brack and Brack 2014, pp. 52–53).

During acoustic and mist-net surveys conducted throughout Wyoming in the summers of 2008–2011, 32 separate observations of northern long-eared bats were made in the northeast part of the State, and breeding was confirmed (U.S. Forest Service (USFS) 2006, unpublished data; Wyoming Game and Fish Department (WGFD) 2012, unpublished data). Northern long-eared

bats have also been observed at Devils Tower National Monument in Wyoming during the summer months, and primarily used forested areas of the monument (NPS 2014, in litt.). To date, there are no known hibernacula in Wyoming, and it is unclear if there are existing hibernacula used by northern long-eared bats, although the majority of potential hibernacula (abandoned mines) within the State occur outside of the northern long-eared bat's range (Tigner and Stukel 2003, p. 27; WGFD 2012, unpublished data).

Montana has only one known record of a northern long-eared bat in the State, a male collected in an abandoned coal mine in 1978 in Richland County (Montana Fish, Wildlife, and Parks (MFWP) 2012, unpublished data). The species has not been reported in eastern Montana since the 1978 record, despite mist-net and acoustic surveys conducted in the eastern portion of the State through 2014 (Montana Natural Heritage Program 2015, in litt.). The specimen of this single bat collected in the State is currently undergoing genetic testing to determine whether the record is indeed a northern long-eared bat (Montana Natural Heritage Program 2015, in litt.; MFWP 2015, in litt.).

In Kansas, the northern long-eared bat was first documented in 1951, when individual bats were documented hibernating in the gypsum mines of Marshall County (Schmidt *et al*. 2015, unpaginated). The status of the gypsum mines as hibernaculum in Kansas is widely unknown. Northern long-eared bats were thought to only migrate through central Kansas until pregnant females were discovered in north-central Kansas in 1994 and 1995 (Sparks and Choate 1995, p. 190). Since then, northern long-eared bats have been considered relatively common in riparian woodlands in Phillips, Rooks, Graham, Osborne, Ellis, and Russel Counties (Schmidt *et al.* 2015, unpaginated).

Canadian Range

The northern long-eared bat occurs throughout the majority of the forested regions of Canada, although it is found in higher abundance in eastern Canada than in western Canada, similar to in the United States (Caceres and Pybus 1997, p. 6). However, the scarcity of records in the western parts of Canada may be due to more limited survey efforts. It has been estimated that approximately 40 percent of the northern long-eared bat's global range is in Canada (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2012, p. 9). The population size for the northern long-eared bat in Canada is unknown, but likely numbered over a million prior to the 2010 arrival of WNS in Canada (COSEWIC 2013, p. xv1). The range of the northern long-eared bat in Canada includes Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Northwest Territories, Nova Scotia, Prince Edward Island, Ontario, Quebec, Saskatchewan, and Yukon (COSEWIC 2012, p. 4). There are no records of the species overwintering in Yukon and Northwest Territories (COSEWIC 2012, p. 9).

Habitat

Winter Habitat

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bats vary in size from large, with large passages and entrances (Raesly and Gates 1987, p. 20), to much smaller hibernacula (Kurta 2013, in litt.). These hibernacula have relatively constant, cooler temperatures (0 to 9 degrees Celsius (°C) (32 to 48 degrees Fahrenheit (°F))) (Raesly and Gates 1987, p. 18; Caceres and Pybus 1997, p. 2; Brack 2007, p. 744), with high humidity and no air currents (Fitch and Shump

1979, p. 2; van Zyll de Jong 1985, p. 94; Raesly and Gates 1987, p. 118; Caceres and Pybus 1997, p. 2). The sites favored by northern long-eared bats are often in very high humidity areas, to such a large degree that droplets of water are often observed on their fur (Hitchcock 1949, p. 52; Barbour and Davis 1969, p. 77). Northern long-eared bats, like eastern small-footed bats (*Myotis leibii*) and big brown bats (*Eptesicus fuscus*), typically prefer cooler and more humid conditions than little brown bats, but are less tolerant of drier conditions than eastern small-footed bats and big brown bats (Hitchcock 1949, pp. 52–53; Barbour and Davis 1969, p. 77; Caceres and Pybus 1997, p. 2). Northern long-eared bats are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, sometimes with only the nose and ears visible, and thus are easily overlooked during surveys (Griffin 1940a, pp. 181–182; Barbour and Davis 1969, p. 77; Caire *et al*. 1979, p. 405; van Zyll de Jong 1985, p. 9; Caceres and Pybus 1997, p. 2; Whitaker and Mumford 2009, pp. 209–210). Caire *et al*. (1979, p. 405) and Whitaker and Mumford (2009, p. 208) commonly observed individuals exiting caves with mud and clay on their fur, also suggesting the bats were roosting in tighter recesses of hibernacula. Additionally, northern long-eared bats have been found hanging in the open, although not as frequently as in cracks and crevices (Barbour and Davis 1969, p. 77; Whitaker and Mumford 2009, pp. 209–210). In 1968, Whitaker and Mumford (2009, pp. 209–210) observed three northern long-eared bats roosting in the hollow core of stalactites in a small cave in Jennings County, Indiana.

To a lesser extent, northern long-eared bats have also been observed overwintering in other types of habitat that resemble cave or mine hibernacula, including abandoned railroad tunnels, (Service 2015, unpublished data). Also, in 1952, three northern long-eared bats were found hibernating near the entrance of a storm sewer in central Minnesota (Goehring 1954, p. 435). Kurta *et al.* (1997, p. 478) found northern long-eared bats hibernating in a hydroelectric

dam facility in Michigan. In Massachusetts, northern long-eared bats have been found hibernating in the Sudbury Aqueduct (Massachusetts Department of Fish and Game 2012, unpublished data). Griffin (1945, p. 22) found northern long-eared bats in December in Massachusetts in a dry well, and commented that these bats may regularly hibernate in "unsuspected retreats" in areas where caves or mines are not present. Although confamilial (belonging to the same taxonomic family) bat species (*e.g.*, big brown bats) have been found using non-cave or mine hibernacula, including attics and hollow trees (Neubaum *et al*. 2006, p. 473; Whitaker and Gummer 1992, pp. 313–316), northern long-eared bats have only been observed over-wintering in suitable caves, mines, or habitat with the same types of conditions found in suitable caves or mines to date.

Summer Habitat

I. Summer Roost Characteristics

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags (Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 662; Owen *et al*. 2002, p. 2; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 222; Timpone *et al.* 2010, p. 119). Males' and nonreproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969, p. 77; Amelon and Burhans 2006, p. 72). Northern long-eared bats have also been observed roosting in colonies in human-made structures, such as in buildings, in barns, on utility poles, behind window shutters, and in bat houses (Mumford and Cope 1964, p. 72; Barbour and Davis 1969, p. 77; Cope and Humphrey 1972, p. 9; Burke 1999, pp. 77–78; Sparks *et al*. 2004, p.

94; Amelon and Burhans 2006, p. 72; Whitaker and Mumford 2009, p. 209; Timpone *et al*. 2010, p. 119; Bohrman and Fecske 2013, pp. 37, 74; Joe Kath 2013, pers. comm.).

The northern long-eared bat appears to be somewhat flexible in tree roost selection, selecting varying roost tree species and types of roosts throughout its range. Northern long-eared bats have been documented in roost in many species of trees, including: black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), silver maple (*Acer saccharinum*), black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), sourwood (*Oxydendrum arboreum*), and shortleaf pine (*Pinus echinata*) (*e.g*., Mumford and Cope 1964, p. 72; Clark *et al*. 1987, p. 89; Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 662; Lacki and Schwierjohann 2001, p. 484; Owen *et al*. 2002, p. 2; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 224; Timpone *et al*. 2010, p. 119). Northern long-eared bats most likely are not dependent on certain species of trees for roosts throughout their range; rather, many tree species that form suitable cavities or retain bark will be used by the bats opportunistically (Foster and Kurta 1999, p. 668). Carter and Feldhamer (2005, p. 265) hypothesized that structural complexity of habitat or available roosting resources are more important factors than the actual tree species.

In the majority of northern long-eared bat telemetry studies, roost trees consist predominantly of hardwoods (*e.g*., Foster and Kurta 1999, p. 662; Lacki and Schwierjohann 2001, p. 484; Broders and Forbes 2004, p. 606). Broders and Forbes (2004, p. 605) reported that female northern long-eared bat roosts in New Brunswick were 24 times more likely to be shade-tolerant, deciduous trees than conifers. Of the few northern long-eared bat telemetry studies in which conifers represented a large proportion of roosts, most were reported as snags (*e.g*., Cryan *et al*. 2001, p. 45; Jung *et al*. 2004, p. 329). Overall, these data suggest that hardwood trees most

often provide the structural and microclimate conditions preferred by maternity colonies and groups of females, which have more specific roosting needs than solitary males (Lacki and Schwierjohann 2001, p. 484), although softwood snags may offer more suitable roosting habitat for both genders than hardwoods (Perry and Thill 2007, p. 222; Cryan *et al*. 2001, p. 45). One reason deciduous snags may be preferred over conifer snags is increased resistance to decay, and consequently roost longevity, of the former (USFS 1998).

Many studies have documented the northern long-eared bat's selection of both live trees and snags, with a range of 10 to 53 percent selection of live roosts found (Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 668; Lacki and Schwierjohann 2001, p. 484; Menzel *et al*. 2002, p. 107; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 224; Timpone *et al*. 2010, p. 118). Foster and Kurta (1999, p. 663) found 53 percent of roosts in Michigan were in living trees, whereas in New Hampshire, 66 percent of roosts were in live trees (Sasse and Pekins 1996, p. 95). The use of live trees versus snags may reflect the availability of such structures in study areas (Perry and Thill 2007, p. 224) and the flexibility in roost selection when there is a sympatric bat species present (*e.g*., Indiana bat) (Timpone *et al*. 2010, p. 120). Most telemetry studies describe a greater number of dead than live roosts (*e.g*., Cryan *et al*. 2001, p. 45; Lacki and Schwierjohann 2001, p. 486; Timpone *et al*. 2010, p. 120; Silvis *et al*. 2012, p. 3). A significant preference for dead or dying trees was reported for northern long-eared bats in Kentucky (Silvis *et al*. 2012, p. 3), Illinois, and Indiana; in South Dakota (Cryan *et al*. 2001, p. 45) and West Virginia, northern long-eared bat roost plots contained a higher than expected proportion of snags (Owen *et al*. 2002, p. 4). Moreover, most studies reporting a higher proportion of live roosts included trees that had visible signs of decline, such as broken crowns or dead branches (*e.g*., Foster and Kurta 1999, pp. 662,663; Ford *et al*. 2006, p. 20). Thus, the

tendency for northern long-eared bats (particularly large maternity colonies) to use healthy live trees appears to be fairly low.

In tree roosts, northern long-eared bats are typically found beneath loose bark or within cavities and have been found to use both exfoliating bark and crevices to a similar degree for summer roosting habitat (Foster and Kurta 1999, p. 662; Lacki and Schwierjohann 2001, p. 484; Menzel *et al*. 2002, p. 110; Owen *et al*. 2002, p. 2; Perry and Thill 2007, p. 222; Timpone *et al*. 2010, p. 119).

Canopy coverage at northern long-eared bat roosts has ranged from 56 percent in Missouri (Timpone *et al*. 2010, p. 118), to 66 percent in Arkansas (Perry and Thill 2007, p. 223), to greater than 75 percent in New Hampshire (Sasse and Pekins 1996, p. 95), to greater than 84 percent in Kentucky (Lacki and Schwierjohann 2001, p. 487). Studies in New Hampshire and British Columbia have found that canopy coverage around roosts is lower than in available stands (Sasse and Pekins 1996, p. 95). Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids pup development (Perry and Thill 2007, p. 224). Fewer trees surrounding maternity roosts may also benefit juvenile bats that are starting to learn to fly (Perry and Thill 2007, p. 224). However, in southern Illinois, northern long-eared bats were observed roosting in areas with greater canopy cover than in random plots (Carter and Feldhamer 2005, p. 263). Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999, p. 669; Menzel *et al*. 2002, p. 112).

Results from studies have found the diameters of roost trees selected by northern long-eared bats vary greatly. Some studies have found that the diameter-at-breast height (dbh) of

northern long-eared bat roost trees was greater than random trees (Lacki and Schwierjohann 2001, p. 485), and others have found both dbh and height of selected roost trees to be greater than random trees (Sasse and Pekins 1996, p. 97; Owen *et al*. 2002 p. 2). However, other studies have found that roost tree mean dbh and height did not differ from random trees (Menzel *et al*. 2002, p. 111; Carter and Feldhamer 2005, p. 266). Based on a consolidation of data from across the northern long-eared bat range (Sasse and Pekins 1996, pp. 95–96; Schultes 2002, pp. 49, 51; Perry 2014, pers. comm.; Lereculeur 2013, pp. 52–54; Carter and Feldhamer 2005, p. 263; Foster and Kurta 1999, p. 663; Lacki and Schwierjohann 2001, pp. 484–485; Owens *et al*. 2002, p. 3; Timpone *et al.* 2010, p. 118; Lowe 2012, p. 61; Perry and Thill 2007, p. 223; Lacki *et al*. 2009, p. 1,171), roost tree dbh most commonly used (close to 80 percent of over 400 documented maternity tree roosts) by northern long-eared bat maternity colonies range from 10 to 25 centimeters (cm) (4 to 10 inches).

As for elevation of northern long-eared bat roosts, Lacki and Schwierjohann (2001, p. 486) have found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations, possibly due to increased solar heating. Silvis *et al*. (2012, p. 4), found that selection of mid- and upper-slope roost areas may also be a function of the landscape position, whereby forest stands are most subjected to disturbance (*e.g.*, wind, more intense fire, more drought stress, higher incidence of insect attack) that in turn creates suitable roost conditions among multiple snags and trees within the stand.

Some studies have found tree roost selection to differ slightly between male and female northern long-eared bats. Some studies have found male northern long-eared bats more readily using smaller diameter trees for roosting than females, suggesting males are more flexible in roost selection than females (Lacki and Schwierjohann 2001, p. 487; Broders and Forbes 2004,

p. 606; Perry and Thill 2007, p. 224). In the Ouachita Mountains of Arkansas, both sexes primarily roosted in pine snags, although females roosted in snags surrounded by fewer midstory trees than did males (Perry and Thill 2007, p. 224). In New Brunswick, Canada, Broders and Forbes (2004, pp. 606–607) found that there was spatial segregation between male and female roosts, with female maternity colonies typically occupying more mature, shade-tolerant deciduous tree stands and males occupying more conifer-dominated stands. Data from West Virginia at the Fernow Experimental Forest and the former Westvaco Ecosystem Research Forest (both of which contain both relatively unmanaged, older, mature stands; early successional/mid-age stands; and fire-modified stands) suggest that females choose smaller diameter, suppressed understory trees, whereas males often chose larger, sometimes canopy-dominant trees for roosts, perhaps in contrast to other tree-roosting myotids such as Indiana bats (Menzel *et al*. 2002, p. 112; Ford *et al*. 2006, p. 16; Johnson *et al*. 2009a, p. 239). A study in northeastern Kentucky found that males did not use colony roosting sites and were typically found occupying cavities in live hardwood trees, while females formed colonies more often in both hardwood and softwood snags (Lacki and Schwierjohann 2001, p. 486). However, males and nonreproductively active females are found roosting within home ranges of known maternity colonies the majority of the time (1,712 of 1,825 capture records or 94 percent) within Kentucky (Service 2014, unpublished data), suggesting little segregation between reproductive females and other individuals in summer.

II. Summer Roosting Behavior

Northern long-eared bats actively form colonies in the summer (Foster and Kurta 1999, p. 667) and exhibit fission-fusion behavior (Garroway and Broders 2007, p. 961), 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, p. 44). As part of this behavior, northern long-eared bats switch tree roosts often (Sasse and Pekins 1996, p. 95), typically every 2 to 3 days (Foster and Kurta 1999, p. 665; Owen *et al*. 2002, p. 2; Carter and Feldhamer 2005, p. 261; Timpone *et al*. 2010, p. 119). In Missouri, the longest time spent roosting in one tree was 3 nights; however, up to 11 nights spent roosting in a human-made structure has been documented (Timpone *et al*. 2010, p. 118). Bats switch roosts for a variety of reasons, including temperature, precipitation, predation, parasitism, sociality, and ephemeral roost sites (Carter and Feldhamer 2005, p. 264). Ephemeral roost sites, with the need to proactively investigate new potential roost trees prior to their current roost tree becoming uninhabitable (*e.g*., tree falls over), may be the most likely scenario (Kurta *et al*. 2002, p. 127; Carter and Feldhamer 2005, p. 264; Timpone *et al*. 2010, p. 119).

Fission-fusion dynamics also drives maternal roosting behaviors and relatedness within social groups of northern long-eared bats. Patriquin *et al*. (2013, p. 952) found that the average relatedness of social group members (northern long-eared bat individuals in nearby colonies that may occasionally share roosts) was low; however, familiar pairs of females (females that frequently roosted together) were more closely related than expected by chance. Consistent with these genetic findings, Garroway and Broders (2007, p. 960), Patriquin *et al.* (2010, p. 904), and Johnson *et al.* (2011, p. 227) observed nonrandom roosting behaviors, with some female northern long-eared bats roosting more frequently together than with other females.

Roosts trees used by northern long-eared bats are often in fairly close proximity to each other within the species' summer home range. For example, in Missouri, Timpone *et al*. (2010,

p. 118) radio-tracked 13 northern long-eared bats to 39 roosts and found the mean distance traveled between roost trees was 0.67 km (0.42 mi) (range 0.05–3.9 km (0.03–2.4 mi)). In Michigan, the longest distance moved by the same bat between roosts was 2 km (1.2 mi), and the shortest was 6 meters (m) (20 feet (ft)) (Foster and Kurta 1999, p. 665). In the Ouachita Mountains of Arkansas, Perry and Thill (2007, p. 22) found that individuals moved among snags that were within less than 2 hectares (ha) (5 acres). Johnson *et al.* (2011, p. 227) found that northern long-eared bats form social groups in networks of roost trees often centered on a central-node roost. Central-node roost trees may be similar to Indiana bat primary roost trees (locations for information exchange, thermal buffering), but they were identified by the degree of connectivity with other roost trees rather than by the number of individuals using the tree (Johnson *et al.* 2011, p. 228).

Spring Staging

Spring staging for the northern long-eared bat is the time period between winter hibernation and spring migration to summer habitat (Whitaker and Hamilton 1998, p. 80). During this time, bats begin to gradually emerge from hibernation, exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (state of mental or physical inactivity) (Whitaker and Hamilton 1998, p. 80). The staging period for the northern long-eared bat is likely short in duration (Whitaker and Hamilton 1998, p. 80; Caire *et al*. 1979, p. 405). In Missouri, Caire *et al*. (1979, p. 405) found that northern long-eared bats moved into the staging period in mid-March through early May. In Michigan, Kurta *et al*. (1997, p. 478) determined that by early May, two-thirds of the *Myotis* species, including the northern long-eared bat, had dispersed to summer habitat. Variation in timing (onset and duration) of staging

for Indiana bats was based on latitude and weather (Service 2007, pp. 39–40, 42); similarly, timing of staging for northern long-eared bats is likely based on these same factors.

Fall Swarming

The swarming season fills the time between the summer and winter seasons (Lowe 2012, p. 50) and the purpose of swarming behavior may include: introduction of juveniles to potential hibernacula, copulation, and stopping over sites on migratory pathways between summer and winter regions (Kurta *et al.* 1997, p. 479; Parsons *et al*. 2003, p. 64; Lowe 2012, p. 51; Randall and Broders 2014, pp. 109–110). The swarming season for some species of the genus *Myotis* begins shortly after females and young depart maternity colonies (Fenton 1969, p. 601). During this time, both male and female northern long-eared bats are present at swarming sites (often with other species of bats). During this period, heightened activity and congregation of transient bats around caves and mines is observed, followed later by increased sexual activity and bouts of torpor prior to winter hibernation (Fenton 1969, p. 601; Parsons *et al*. 2003, pp. 63–64; Davis and Hitchcock 1965, pp. 304–306). For the northern long-eared bat, the swarming period may occur between July and early October, depending on latitude within the species' range (Fenton 1969, p. 598; Kurta *et al*. 1997, p. 479; Lowe 2012, p. 86; Hall and Brenner 1968, p. 780; Caire *et al*. 1979, p. 405). The northern long-eared bat may investigate several cave or mine openings during the transient portion of the swarming period, and some individuals may use these areas as temporary daytime roosts or may roost in forest habitat adjacent these sites (Kurta *et al.* 1997, pp. 479, 483; Lowe 2012, p. 51). Many of the caves and mines associated with swarming are also used as hibernacula for several species of bats, including the northern long-eared bat

(Fenton 1969, p. 599; Glover and Altringham 2008, p. 1498; Randall and Broders 2014, p. 109; Kurta *et al*. 1997, p. 484; Whitaker and Rissler 1992a, p. 132).

Little is known about northern long-eared bat roost selection outside of caves and mines during the swarming period (Lowe 2012, p. 6). Lowe (2012, pp. 32, 58, 63) documented northern long-eared bats in the Northeast roosting in both coniferous and deciduous trees or stumps as far away as 3 miles (7 km) from the swarming site. Although Lowe (2012, pp. 61, 64) hypothesized that tree roosts used during the fall swarming season would be similar to summer roosts, there was a difference found between summer and fall in the variation in distances bats traveled from the capture site to roost, roost orientation, and greater variation of roost types (*e.g*., roost species, size, decay class) in the fall. Greater variation among roosts during the swarming season may be a result of the variation in energy demands that individual northern long-eared bats exhibit during this time (Lowe 2012, p. 64; Barclay and Kurta 2007, pp. 31–32).

Biology

Hibernation

Northern long-eared bats hibernate during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. To increase energy savings, individuals enter a state of torpor, when internal body temperatures approach ambient temperature, metabolic rates are significantly lowered, and immune function declines (Thomas *et al.* 1990, p. 475; Thomas and Geiser 1997, p. 585; Bouma *et al.* 2010, p. 623). Periodic arousal from torpor naturally occurs in all hibernating mammals (Lyman *et al.* 1982, p. 92), although arousals remain among the least understood of hibernation phenomena (Thomas and Geiser

1997, p. 585). Numerous factors (*e.g.*, reduction of metabolic waste, body temperature, and water balance) have been proposed to account for the occurrence and frequency of arousals (Thomas and Geiser 1997, p. 585). Each time a bat arouses from torpor, it uses a significant amount of energy to warm its body and increase its metabolic rate. The cost and number of arousals are the two key factors that determine energy expenditures of hibernating bats in winter (Thomas *et al.* 1990, p. 475). For example, little brown bats used as much fat during a typical arousal from hibernation as would be used during 68 days of torpor, and arousals and subsequent activity may constitute 84 percent of the total energy used by hibernating bats during the winter (Thomas *et al.* 1990, pp. 477–478).

In general, northern long-eared bats arrive at hibernacula in August or September, enter hibernation in October and November, and emerge from the hibernacula in March or April (Caire *et al*. 1979, p. 405; Whitaker and Hamilton 1998, p. 100; Amelon and Burhans 2006, p. 72). However, hibernation may begin as early as August (Whitaker and Rissler 1992b, p. 56). In Copperhead Cave (a mine) in west-central Indiana, the majority of bats enter hibernation during October, and spring emergence occurs from about the second week of March to mid-April (Whitaker and Mumford 2009, p. 210). In Indiana, northern long-eared bats become more active and start feeding outside the hibernaculum in mid-March, evidenced by stomach and intestine contents. This species also showed spring activity earlier than little brown bats and tri-colored bats (*Perimyotis subflavus*) (Whitaker and Rissler 1992b, pp. 56–57). In northern latitudes, such as in upper Michigan's copper-mining district, hibernation may begin as early as late August and continue for 8 to 9 months (Stones and Fritz, 1969, p. 81; Fitch and Shump 1979, p. 2). Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum (Pearson 1962, p. 30), although they may not return to the same hibernaculum in

successive seasons (Caceres and Barclay 2000, p. 2).

Typically, northern long-eared bats were not abundant and composed a small proportion of the total number of bats observed hibernating in a hibernaculum (Barbour and Davis 1969, p. 77; Mills 1971, p. 625; Caire *et al*. 1979, p. 405; Caceres and Barclay 2000, pp. 2–3). Although usually observed in small numbers, the species typically inhabits the same hibernacula with large numbers of other bat species, and occasionally are found in clusters with these other bat species. Other species that commonly occupy the same habitat include little brown bat, big brown bat, eastern small-footed bat, tri-colored bat, and Indiana bat (Swanson and Evans 1936, p. 39; Griffin 1940a, p. 181; Hitchcock 1949, pp. 47–58; Stones and Fritz 1969, p. 79). Whitaker and Mumford (2009, pp. 209–210), however, infrequently found northern long-eared bats hibernating beside little brown bats, Indiana bats, or tri-colored bats. Barbour and Davis (1969, p. 77) found that the species was rarely recorded in concentrations of more than 100 in a single hibernaculum.

Northern long-eared bats have been observed moving among hibernacula throughout the winter, which may further decrease population estimates (Griffin 1940a, p. 185; Whitaker and Rissler 1992a, p. 131; Caceres and Barclay 2000, pp. 2–3). Whitaker and Mumford (2009, p. 210) found that this species flies in and out of some mines and caves in southern Indiana throughout the winter. In particular, the bats were active at Copperhead Cave periodically all winter, with northern long-eared bats being more active than other species (such as little brown bats and tri-colored bats) hibernating in the cave. Though northern long-eared bats fly outside of the hibernacula during the winter, they do not feed; hence the function of this behavior is not well understood (Whitaker and Hamilton 1998, p. 101). It has been suggested, however, that bat activity during winter could be due in part to disturbance by researchers (Whitaker and Mumford 2009, pp. 210–211).

Northern long-eared bats exhibit significant weight loss during hibernation. In southern Illinois, Pearson (1962, p. 30) found an average weight loss of 20 percent during hibernation in male northern long-eared bats, with individuals weighing an average of 6.6 g (0.2 ounces) prior to January 10, and those collected after that date weighing an average of 5.3 g (0.2 ounces). Whitaker and Hamilton (1998, p. 101) reported a weight loss of 41–43 percent over the hibernation period for northern long-eared bats in Indiana. In eastern Missouri, male northern long-eared bats lost an average of 3 g (0.1 ounces), or 36 percent, during the hibernation period (late October through March), and females lost an average of 2.7 g (0.1 ounces), or 31 percent (Caire *et al*. 1979, p. 406).

Migration and Homing

While the northern long-eared bat is not considered a long-distance migratory species, short regional migratory movements between seasonal habitats (summer roosts and winter hibernacula) have been documented between 56 km (35 mi) and 89 km (55 mi) (Nagorsen and Brigham 1993 p. 88; Griffin 1940b, pp. 235, 236; Caire *et al*. 1979, p. 404). Griffin (1940b, pp. 235, 236) reported that a banded male northern long-eared bat had traveled from one hibernaculum in Massachusetts to another in Connecticut over the 2-month period of February to April, a distance of 89 km (55 mi). The spring migration period typically runs from mid-March to mid-May (Caire *et al*. 1979, p. 404; Easterla 1968, p. 770; Whitaker and Mumford 2009, p. 207); fall migration typically occurs between mid-August and mid-October.

Northern long-eared bats have shown a high degree of philopatry (tendency to return to the same location) for a hibernaculum (Pearson 1962), although they may not return to the same hibernaculum in successive seasons (Caceres and Barclay 2000). Banding studies in Ohio,

Missouri, and Connecticut show return rates to hibernacula of 5.0 percent (Mills 1971, p. 625), 4.6 percent (Caire *et al*. 1979, p. 404), and 36 percent (Griffin 1940a, p. 185), respectively. An experiment showed an individual bat returned to its home cave up to 32 km (20 mi) away after being removed 3 days prior (Stones and Branick 1969, p. 158).

Reproduction

Mating occurs from late July in northern regions to early October in southern regions and commences when males begin to aggregate around hibernacula and initiate copulation activity (Whitaker and Hamilton 1998, p. 101; Whitaker and Mumford 2009, p. 210; Caceres and Barclay 2000, p. 2; Amelon and Burhans 2006, p. 69). Copulation occasionally occurs again in the spring (Racey 1982, p. 73), and can occur during the winter as well (Kurta 2014, in litt.). Hibernating females store sperm until spring, exhibiting delayed fertilization (Racey 1979, p. 392; Caceres and Pybus 1997, p. 4). Ovulation takes place near the time of emergence from hibernation, followed by fertilization of a single egg, resulting in a single embryo (Cope and Humphrey 1972, p. 9; Caceres and Pybus 1997, p. 4; Caceres and Barclay 2000, p. 2); gestation is approximately 60 days, based on like species (Kurta 1995, p. 71). Males are generally reproductively inactive from April until late July, with testes enlarging in preparation for breeding in most males during August and September (Caire *et al*. 1979, p. 407; Amelon and Burhans 2006, p. 69; Kurta 2013, in litt.).

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3); however, one group of 100 adult females was observed in Vermilion County, Indiana (Whitaker and Mumford 2009, p. 212). In West Virginia, maternity colonies in two

studies had a range of 7 to 88 individuals (Owen *et al*. 2002, p. 2) and 11 to 65 individuals, with a mean size of 31 (Menzel *et al*. 2002, p. 110). Lacki and Schwierjohann (2001, p. 485) found that the number of bats within a given roost declined as the summer progressed. Pregnant females formed the largest aggregations (mean=26) and post-lactating females formed the smallest aggregation (mean=4). The largest overall reported colony size of 65 bats. Other studies have also found that the number of individuals roosting together in a given roost typically decreases from pregnancy to post-lactation (Foster and Kurta 1999, p. 667; Lacki and Schwierjohann 2001, p. 485; Garroway and Broders 2007, p. 962; Perry and Thill 2007, p. 224; Johnson *et al*. 2012, p. 227). Female roost site selection, in terms of canopy cover and tree height, changes depending on reproductive stage; relative to pre- and post-lactation periods, lactating northern long-eared bats have been shown to roost higher in tall trees situated in areas of relatively less canopy cover and lower tree density (Garroway and Broders 2008, p. 91).

Adult females give birth to a single pup (Barbour and Davis 1969, p. 104). Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time (Krochmal and Sparks 2007, p. 654). Parturition (birth) likely 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). Broders *et al*. (2006, p. 1177) estimated a parturition date of July 20 in New Brunswick. Lactating and post-lactating females were observed in mid-June in Missouri (Caire *et al*. 1979, p. 407), July in New Hampshire and Indiana (Sasse and Pekins 1996, p. 95; Whitaker and Mumford 2009, p. 213), and August in Nebraska (Benedict 2004, p. 235). Juvenile volancy (flight) often occurs by 21 days after birth (Krochmal and Sparks 2007, p. 651, Kunz 1971, p. 480) and has been documented as early as 18 days after birth (Krochmal and Sparks 2007, p. 651). Subadults were captured in late June in

Missouri (Caire *et al*. 1979, p. 407), early July in Iowa (Sasse and Pekins 1996, p. 95), and early August in Ohio (Mills 1971, p. 625).

Maximum lifespan for northern long-eared bats is estimated to be up to 18.5 years (Hall *et al.* 1957, p. 407). Most mortality for northern long-eared bats and many other species of bats occurs during the juvenile stage (Caceres and Pybus 1997, p. 4).

Foraging Behavior

Northern long-eared bats are nocturnal foragers and use hawking (catching insects in flight) and gleaning (picking insects from surfaces) behaviors in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, p. 88; Ratcliffe and Dawson 2003, p. 851). Observations of northern long-eared bats foraging on arachnids (spiders) (Feldhamer *et al*. 2009, p. 49), presence of green plant material in their feces (Griffith and Gates 1985, p. 456), and non-flying prey in their stomach contents (Brack and Whitaker 2001, p. 207) suggest considerable gleaning behavior. The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles (Nagorsen and Brigham 1993, p. 88; Brack and Whitaker 2001, p. 207; Griffith and Gates 1985, p. 452), with diet composition differing geographically and seasonally (Brack and Whitaker 2001, p. 208). Feldhamer *et al*. (2009, p. 49) noted close similarities of all *Myotis* diets in southern Illinois, while Griffith and Gates (1985, p. 454) found significant differences between the diets of northern long-eared bats and little brown bats. The most common insects found in the diets of northern long-eared bats are lepidopterans (moths) and coleopterans (beetles) (Brack and Whitaker 2001, p. 207; Lee and McCracken 2004, pp. 595–596; Feldhamer *et al*. 2009, p. 45; Dodd *et al.* 2012, p. 1122), with arachnids also being a common prey item (Feldhamer *et al*. 2009, p. 45). Northern long-eared bats have the highest

frequency call of any bat species in the Great Lakes area (Kurta 1995, p. 71). Gleaning allows this species to gain a foraging advantage for preying on moths because moths are less able to detect these high frequency echolocation calls (Faure *et al*. 1993, p. 185).

Most foraging occurs above the understory, 1 to 3 m (3 to 10 ft) above the ground, but under the canopy (Nagorsen and Brigham 1993, p. 88) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001, p. 207; LaVal *et al*. 1977, p. 594). This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats (Caceres and Pybus 1997, p. 2). Occasional foraging also takes place over small forest clearings and water, and along roads (van Zyll de Jong 1985, p. 94). Foraging patterns indicate a peak activity period within 5 hours after sunset followed by a secondary peak within 8 hours after sunset (Kunz 1973, pp. 18–19). Brack and Whitaker (2001, p. 207) did not find significant differences in the overall diet of northern long-eared bats between morning (3 a.m. to dawn) and evening (dusk to midnight) feedings; however there were some differences in the consumption of particular prey orders between morning and evening feedings. Additionally, no significant differences existed in dietary diversity values between age classes or sex groups (Brack and Whitaker 2001, p. 208).

Home Range

Northern long-eared bats exhibit site fidelity to their summer home range (Perry 2011, pp. 113–114; Johnson *et al*. 2009a, p. 237; Jackson 2004, p. 87; Foster and Kurta 1999, p. 665). During this period, northern long-eared bats roost (Sasse and Pekins 1996, pp. 95–96; Owen *et al*. 2002, p. 1; Perry and Thill 2007, pp. 224–225; Timpone *et al*. 2010, p. 116) and forage (Owen *et al*. 2003, pp. 354–355; Sheets 2010, pp. 3–4, 18; Tichenell *et al*. 2011, p. 985; Dodd *et*

al. 2012, p. 1120) in forests. Their home ranges, which include both the foraging and roosting areas, may vary by sex. Broders *et al*. (2006, p. 1117) found home ranges of females (mean of 8.6 ha (21.3 acres)) to be larger than males (mean of 1.4 ha (3.5 acres)), though Lereculeur (2013, p. 20) found no difference between sexes at a study site in Tennessee. Also, Broders *et al*. (2006, p. 1117) and Henderson and Broders (2008, p. 958) found foraging areas (of either sex) to be six or more times larger than roosting areas. At sites in the Red River Gorge area of the Daniel Boone National Forest, Lacki *et al*. (2009, p. 1169) found female home range size to range from 19 to 172 ha (47 to 425 acres). Owen *et al*. (2003, p. 353) estimated average maternal home range size to be 65 ha (161 acres). Home range size of northern long-eared bats in this study site was small relative to other bat species, but this may be due to the study's timing (during the maternity period) and the small body size of northern long-eared bats (Owen *et al*. 2003, pp. 354–355). The mean distance between roost trees and foraging areas of radio-tagged individuals in New Hampshire was 602 m (1,975 ft) with a range of 60 to 1,719 m (197 to 5,640 ft) (Sasse and Pekins 1996, p. 95). Work on Prince Edward Island by Henderson and Broders (2008, p. 956) found female northern long-eared bats traveling approximately 1,100 m (3,609 ft) between roosting and foraging areas.

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or

curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the northern long-eared bat. There are several factors presented below that affect the northern long-eared bat to a greater or lesser degree; however, we have found that no other threat is as severe and immediate to the northern long-eared bat's persistence as the disease, white-nose syndrome (WNS), discussed below under Factor C. WNS is currently the predominant threat to the species, and if WNS had not emerged or was not affecting the northern long-eared bat populations to the level that it has, we presume the species' would not be experiencing the dramatic declines that it has since WNS emerged. Therefore, although we have included brief discussions of other factors affecting the species, the focus of the discussion below is on WNS.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Hibernation Habitat

Modifications to bat hibernacula, by erecting physical barriers (*e.g.*, doors, gates), to control cave and mine access can affect the microclimate of the subterranean habitat, and thus the ability of the cave or mine to support hibernating bats, including the northern long-eared bat.

These well-documented effects on cave-hibernating bat species were discussed in the Service's Indiana Bat Draft Recovery Plan (Service 2007, pp. 71–74). Anthropogenic modifications to cave and mine entrances, such as the addition of restrictive gates or other structures intended to exclude humans, may not only alter flight characteristics and access (Spanjer and Fenton 2005, p. 1110), but may change airflow and alter internal microclimates of the caves and mines, eliminating their utility as hibernacula (Service 2007, p. 71). For example, Richter *et al.* (1993, p. 409) attributed the decline in the number of Indiana bats at Wyandotte Cave, Indiana (which harbors one of the largest known population of hibernating Indiana bats), to an increase in the cave's temperature resulting from restricted airflow caused by a stone wall erected at the cave's entrance. After the wall was removed, the number of Indiana bats increased markedly over the next 14 years (Richter *et al.* 1993, p. 412; Brack *et al*. 2003, p. 67). Similarly, northern long-eared bats were likely negatively impacted when the entrance to John Friend Cave in Maryland was filled with large rocks in 1981, which closed the only known access to the cave (Gates *et al*. 1984, p. 166). We conclude, based on the need for specific hibernation requirements of any cave-hibernating bat, that alteration of hibernacula could result in adverse impacts to individual northern long-eared bats.

In addition to the direct access modifications to caves discussed above, debris buildup at entrances or on cave gates can also significantly modify the cave or mine site characteristics by restricting airflow and the course of natural water flow. Water flow restriction could lead to flooding, thus drowning hibernating bats (Amelon and Burhans 2006, p. 72). For example, in Minnesota, 5 of the 11 known northern long-eared bat hibernacula are subject to flooding, presenting a threat to hibernating bats (Nordquist 2012, pers. comm.). Flooding has been noted in hibernacula in other States within the range of the northern long-eared bat, but to a lesser

degree. Although modifications to hibernacula can lead to mortality of northern long-eared bats, we do not conclude it has resulted in population-level effects.

Mining operations, mine passage collapse (subsidence), and mine reclamation activities can also affect bats and their hibernacula. Internal and external collapse of abandoned coal mines was identified as one of the primary threats to northern long-eared bat hibernacula at sites located within the New River Gorge National River and Gauley River National Recreation Area in West Virginia (Graham 2011, unpublished data). In States surveyed for effects to northern long-eared bats by hibernacula collapse, responses varied, with the following number of hibernacula in each State reported (not all States surveyed responded) as susceptible to collapse: 1 (of 7) in Maryland, 3 (of 11) in Minnesota, 1 (of 5) in New Hampshire, 4 (of 15) in North Carolina, 1 (of 2) in South Carolina, and 1 (of 13) in Vermont (Service 2011, unpublished data). Previous and current mining operations pose a direct threat to northern long-eared bat from mine collapse in parts of its range.

Before Federal and State cave protection laws were put in place, there were several reported instances where mines were closed while bats were hibernating, thereby entombing entire colonies (Tuttle and Taylor 1998, p. 8). For the northern long-eared bat, loss of potential winter habitat through mine closures has been noted as a concern in Virginia, although visual inspections of openings are typically conducted to determine whether gating is warranted (Reynolds 2011, unpublished data). In Nebraska, closing quarries, and specifically sealing quarries in Cass and Sapry Counties, is considered a potential threat to northern long-eared bats (Geluso 2011, unpublished data).

In general, threats to the integrity of bat hibernacula have decreased since the Indiana bat was listed as endangered in 1967, and since the implementation of Federal and State cave

protection laws and abandoned mine reclamation programs. Increasing awareness about the importance of cave and mine microclimates to hibernating bats and regulation under the Act have helped to alleviate the destruction or modification of hibernation habitat, at least where the Indiana bat and gray bat (*Myotis grisescens*) are present (Service 2007, p. 74). The northern long-eared bat has likely benefited from the protections given to the Indiana bat and the gray bat and their winter habitat, in areas where its range overlaps with those species' ranges.

Disturbance of Hibernating Bats

Human disturbance of hibernating bats has long been considered a threat to cave-hibernating bat species like the northern long-eared bat, and is discussed in detail in the Service's Indiana Bat Draft Recovery Plan (Service 2007, pp. 80–85). The primary forms of human disturbance to hibernating bats results from cave commercialization (cave tours and other commercial uses of caves), recreational caving, vandalism, and research-related activities (Service 2007, p. 80). Arousal during hibernation causes the greatest amount of energy depletion in hibernating bats (Thomas *et al*. 1990, p. 477). Human disturbance at hibernacula, specifically non-tactile disturbance such as changes in light and sound, can cause bats to arouse more frequently, causing premature energy store depletion and starvation, as well as increased tactile disturbance amongst bats (Thomas 1995, p. 944; Speakman *et al*. 1991, p. 1103), leading to marked reductions in bat populations (Tuttle 1979, p. 3). Prior to the outbreak of WNS, Amelon and Burhans (2006, p. 73) indicated that "the widespread recreational use of caves and indirect or direct disturbance by humans during the hibernation period pose the greatest known threat to this species (northern long-eared bat)." Olson *et al*. (2011, p. 228), hypothesized that an increase in the hibernating bat population (including northern long-eared bats) was related to decreased

visits by recreational users and researchers at Cadomin Cave in Alberta, Canada. Bilecki (2003, p. 55) states that the reduction of four species of bats, including the northern long-eared bat, was "directly related to high human use and abuse" of a cave. Disturbance during hibernation could cause movements within or between caves (Beer 1955, p. 244).

Of 14 States that assessed the possibility of human disturbance at bat hibernacula within the range of the northern long-eared bat, 13 identified at least 1 known hibernacula as potentially impacted by human disturbance (Service 2012, unpublished data). Eight of these 14 States (Arkansas, Kentucky, Maine, Minnesota, New Hampshire, North Carolina, South Carolina, and Vermont) indicated the potential for human disturbance at over 50 percent of the known hibernacula in that State. Nearly all States without WNS identified human disturbance as the primary threat to hibernating bats, and all others (including WNS-positive States) noted human disturbance as the next greatest threat after WNS or of significant concern (Service 2012, unpublished data).

The threat of commercial use of caves and mines during the hibernation period has decreased at many sites known to harbor Indiana bats, and we conclude that this also applies to northern long-eared bats. However, effects from recreational caving are more difficult to assess. In addition to unintended effects of commercial and recreational caving, intentional killing of bats in caves by shooting, burning, and clubbing has been documented (Tuttle 1979, pp. 4, 8). Intentional killing of northern long-eared bats has been documented at a small percentage of hibernacula (*e.g.*, one case of shooting disturbance in Maryland and one case of bat torching in Massachusetts where approximately 100 bats (northern long-eared bats and other species) were killed) (Service, unpublished data), but we do not have evidence that this is happening on a large enough scale to have population-level effects.

In summary, while there are isolated incidents of previous disturbance to northern long-eared bats from both intentional disturbance and recreational use of caves and mines, we conclude that there is no evidence suggesting that this threat in itself has led to population-level declines.

Summer Habitat

As discussed in detail in the **Background** (*Biology*, "I. Summer Roost Characteristics") section, above, northern long-eared bats require forest for roosting, raising young, foraging, and commuting between roosting and foraging habitat. Northern long-eared bats will also roost in manmade structures, to a lesser extent. The two common causes of loss or modification of habitat are conversion of forest for other land use and forest modification.

I. Forest Conversion

Forest conversion is the loss of forest to another land cover type (e.g., grassland, cropland, development) and may result in: Loss of suitable roosting or foraging habitat; fragmentation of remaining forest patches, leading to longer flights between suitable roosting and foraging habitat; removal of (fragmenting colonies/networks) travel corridors; and direct injury or mortality (during active season clearing). While forest conversion may occur throughout all States within the species' range, impacts to the northern long-eared bat and their habitat typically occur at a more local-scale *(i.e.*, individuals and potentially colonies).

The USFS (2014, p. 7) summarized U.S. forest trends and found a decline from 1850 to the early 1900s, and a general leveling off since that time; therefore, conversion from forest to other land cover types has been fairly stable with conversion to forest (cropland

reversion/plantings). For example, according to the U.S. Forest Service's Forest Inventory and Analysis, the amount of forested land within the 37 States and the District of Columbia of the northern long-eared bat's range increased from 414,297,531 acres in 2004 and 2005, to 423,585,498 acres in 2013 (Association of Fish and Wildlife Agencies 2014, in litt; Miles 2014, *http://apps.fs.fed.us/Evalidator/evalidator.jsp*). However, between 2001 and 2006, there was a net loss of 1.2 percent of forest across the United States with most losses in the Southeast and West, and a net loss of interior forest (a forest parcel embedded in a 40-acre landscape that has at least 90 percent forest land cover) of 4.3 percent (USFS 2014, p. 18) throughout the continental United States, which increased forest fragmentation and smaller remaining forest patches. There is some evidence that northern long-eared bats have an affinity for less fragmented habitat (interior forest) (Broders *et al*. 2006, p. 1181; Henderson *et al*. 2008, p. 1825). Also, forest ownership varies widely across the species' range in the United States. Private lands may carry with them a higher risk for conversion than do public forests, a factor that must be considered when assessing risk of forest conversion now and in the future. Private land ownership is approximately 81 percent in the East and 30 percent in the West (USFS 2014, p. 15).

Some of the highest rates of development in the conterminous United States are occurring within the range of the northern long-eared bat (Brown *et al.* 2005, p. 1856), and contribute to loss of forest habitat. The 2010 Resources Planning Act (RPA) Assessment (USFS 2012) summarized findings about the status, trends, and projected future of U.S. forests. This assessment was influenced by a set of scenarios with varying assumptions with regard to global and U.S. population, economic growth, climate change, wood energy consumption, and land use change from 2010 to 2060. It projects forest losses of 6.5–13.8 million ha (16–34 million acres or 4–8 percent of 2007 forest area) across the conterminous United States, and forest loss is

expected to be concentrated in the southern United States, with losses of 3.6–8.5 million ha (9–21 million acres) (USFS 2012, p. 12).

Wind energy development continues to increase throughout the northern long-eared bat's range. Iowa, Illinois, Oklahoma, Minnesota, Kansas, and New York are amongst the top 10 States for wind energy capacity (installed projects) in the United States (American Wind Energy Association (AWEA) 2013, unpaginated). If projects are sited in forested habitats, effects from wind energy development may include tree-clearings associated with turbine placement, road construction, turbine lay-down areas, transmission lines, and substations. See *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence* for a discussion on effects to bats from the operation of wind turbines.

Surface coal mining is common in the central Appalachian region, which includes portions of Pennsylvania, West Virginia, Virginia, Kentucky, Ohio, and Tennessee, and is one of the major drivers of land cover change in the region (Sayler 2008, unpaginated). Surface coal mining may also destroy forest habitat in parts of the Illinois Basin in southwest Indiana, western Kentucky, and Illinois (King 2013, pers. comm.).

Natural gas extraction is expanding across the United States, particularly throughout the range of the northern long-eared bat. Natural gas extraction involves fracturing rock formations using highly pressurized water and other various chemicals (Hein 2012, p. 1). Natural gas extraction and transmission, particularly across the Marcellus Shale region, which includes large portions of New York, Pennsylvania, Ohio, and West Virginia, is expected to expand over the coming years. In Pennsylvania, for example, nearly 2,000 Marcellus natural gas wells have already been drilled or permitted, and if development trends continue, as many as 60,000 more could be built by 2030 (Johnson 2010, pp. 8, 13). Habitat necessary for establishing maternity

colonies and foraging may be lost and degraded due to the practice of forest clearing for well pads and associated infrastructures (*e.g.*, roads, pipelines, and water impoundments). These actions could decrease the amount of suitable interior forest habitat available to northern long-eared bats.

There are a variety of reasons forests are being converted (*e.g.*, urban development, energy production, and transmission) within the range of the northern long-eared bat. Impacts to northern long-eared bats from loss of forest vary depending on the timing, location, and extent of the removal. While bats can sometimes flee during tree removal, removal of occupied roosts (during spring through fall) is likely to result in direct injury or mortality to some northern long-eared bats. This is particularly likely during cool spring months (when bats enter torpor) and if flightless pups or inexperienced flying juveniles are also present. Removal of forest outside of northern long-eared bat summer home range, or away from hibernacula, would not likely directly impact the species. However, removal of forest within a summer home range (regardless of when it is removed) may negatively impact the species, depending on the extent of removal and the amount of remaining suitable roosting and foraging habitat.

Some portions of the northern long-eared bat's range are more forested than others. In areas with little forest or highly fragmented forests (*e.g.*, western U.S. edge of the range, central Midwestern states; see Figure 1, above), impact of forest loss would be disproportionately greater than similar-sized losses in heavily forested areas (*e.g.*, Appalachians and northern forests). Also, the impact of habitat loss within a northern long-eared bat's home range is expected to vary depending on the scope of removal. Northern long-eared bats are flexible in which tree species they select as roosts, and roost trees are an ephemeral resource; therefore, the species likely can tolerate some loss of roosts, provided suitable alternative roosts are available.

Silvis *et al*. (2014, pp. 283–290) modeled roost loss of northern long-eared bats, and Silvis *et al*. (2015, pp. 1–17) removed known northern long-eared bat roosts during the winter in the field to determine how this would impact the species. Once removals totaled 20–30 percent of known roosts, a single maternity colony network started showing patterns of break-up. Sociality is hypothesized to increase reproductive success (Silvis *et al*. 2014, p. 283), and smaller colonies would be expected to have reduced reproductive success.

Longer flights to find alternative suitable habitat and colonial disruption may result from removal of roosting or foraging habitat. Northern long-eared bats emerge from hibernation with their lowest annual fat reserves, and return to their summer home ranges. Because northern long-eared bats have summer home range fidelity (Foster and Kurta 1999, p. 665; Patriquin *et al*. 2010, p. 908; Broders *et al*. 2013, p. 1180), loss or alteration of forest habitat may put additional stress on females when returning to summer roost or foraging areas after hibernation. Females (often pregnant) have limited energy reserves available for use if forced to seek out new roosts or foraging areas. Hibernation and reproduction are the most energetically demanding periods for temperate-zone bats, including the northern long-eared bat (Broders *et al*. 2013, p. 1174). Bats may reduce metabolic costs of foraging by concentrating efforts in areas of known high prey profitability, a benefit that could result from the bat's local roosting and home range knowledge and site fidelity (Broders *et al*. 2013, p. 1181). Cool spring temperatures provide an additional energetic demand, as bats need to stay sufficiently warm or enter torpor. Entering torpor comes at a cost of delayed parturition; bats born earlier in the year have a greater chance of surviving their first winter and breeding in their first year of life (Frick *et al*. 2010b, p. 133). Delayed parturition may also be costly because young of the year and adult females would have less time to prepare for hibernation (Broders *et al*. 2013, p. 1180). Female northern long-eared bats

typically roost colonially, with their largest population counts occurring in the spring (Foster and Kurta 1999, p. 667), presumably as one way to reduce thermal costs for individual bats (Foster and Kurta 1999, p. 667). Therefore, similar to other temperate bats, northern long-eared bats have multiple high metabolic demands (particularly in spring), and must have sufficient suitable roosting and foraging habitat available in relatively close proximity to allow for successful reproduction.

In summary, U.S. forest area trends have remained relatively stable with some geographic regions facing more conversion than others in the recent past. In the future, forest conversion is expected to increase, whether from commercial or residential development, energy production, or other pressures on forest lands. While monitoring efforts for impacts to northern long-eared bats from forest conversion did not often occur in the past, we expect that impacts likely occurred, but the species appears to have been resilient to these impacts prior to the emergence of WNS. In areas where WNS is present, there are additional energetic demands for northern long-eared bats. For example, WNS-affected bats have less fat reserves than non-WNS-affected bats when they emerge from hibernation (Reeder *et al*. 2012, p. 8; Warnecke *et al*. 2012, p. 7001) and have wing damage (Meteyer *et al*. 2009, p. 412; Reichard and Kunz 2009, p. 458) 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. Current and future forest conversion may have negative additive impacts where the species has been impacted by WNS. Impacts from forest conversion to individuals or colonies would be expected to range from indirect impact (*e.g*., minor amounts of forest removal in areas outside northern long-eared bat summer home ranges or away from hibernacula) to minor (*e.g*., largely forested areas, areas with robust

northern long-eared bat populations) to significant (*e.g.*, removal of a large percentage of summer home range, highly fragmented landscapes, areas with WNS impacts).

II. Forest Management

Unlike forest conversion, forest management maintains forest habitat on the landscape, and the impacts from management activities are for the most part considered temporary in nature. Forest management includes multiple practices, and this section specifically addresses timber harvest. Timber harvesting includes a wide variety of practices from selected harvest of individual trees to clearcutting. Impacts from forest management would be expected to range from positive (*e.g.*, maintaining or increasing suitable roosting and foraging habitat within northern long-eared bat home ranges) to neutral (*e.g.*, minor amounts forest removal, areas outside northern long-eared bat summer home ranges or away from hibernacula) to negative (*e.g.*, death of adult females or pups or both).

The best available data indicate that the northern long-eared bat shows a varied degree of sensitivity to timber harvesting practices. For example, Menzel *et al*. (2002, p. 112) found northern long-eared bats roosting in intensively managed stands in West Virginia; indicating that there were sufficient suitable roosts (primarily snags) remaining for their use. At the same study site, Owen *et al*. (2002, p. 4) concluded that northern long-eared bats roosted in areas with abundant snags, and that in intensively managed forests in the central Appalachians, roost availability was not a limiting factor. Northern long-eared bats often chose black locust and black cherry as roost trees, which were quite abundant and often regenerate quickly after disturbance (*e.g.*, timber harvest). Similarly, Perry and Thill (2007, p. 222) tracked northern long-eared bats in central Arkansas and found roosts were located in eight forest classes with 89

percent in three classes of mixed pine-hardwood forest. The three classes of mixed pine-hardwood forest that supported the majority of the roosts were partially harvested or thinned, unharvested (50–99 years old), and group selection harvest (Perry and Thill 2007, pp. 223–224).

Certain levels of timber harvest may result in canopy openings, which could result in more rapid development of bat young. In central Arkansas, Perry and Thill (2007, pp. 223–224) found female bat roosts were more often located in areas with partial harvesting than males, with more male roosts (42 percent) in unharvested stands than female roosts (24 percent). They postulated that females roosted in relatively more open forest conditions because they may receive greater solar radiation, which may increase developmental rates of young or permit young bats a greater opportunity to conduct successful initial flights (Perry and Thill 2007, p. 224). Cryan *et al*. (2001, p. 49) found several reproductive and nonreproductive female northern long-eared bat roost areas in recently harvested (less than 5 years) stands in the Black Hills of South Dakota in which snags and small stems (dbh of 2 to 6 inches (5 to 15 cm)) were the only trees left standing; however, the largest colony (n=41) was found in a mature forest stand that had not been harvested in more than 50 years.

Forest size and continuity are also factors that define the quality of habitat for roost sites for northern long-eared bats. Lacki and Schwierjohann (2001, p. 487) stated that silvicultural practices could meet both male and female roosting requirements by maintaining large-diameter snags, while allowing for regeneration of forests. Henderson *et al*. (2008, p. 1825) also found that forest fragmentation effects northern long-eared bats at different scales based on sex; females require a larger unfragmented area with a large number of suitable roost trees to support a colony, whereas males are able to use smaller, more fragmented areas. Henderson and Broders (2008, pp. 959–960) examined how female northern long-eared bats use the forest-agricultural

landscape on Prince Edward Island, Canada, and found that bats were limited in their mobility and activities are constrained when suitable forest is limited. However, they also found that bats in a relatively fragmented area used a building for colony roosting, which suggests an alternative for a colony to persist in an area with fewer available roost trees.

In addition to impacts on roost sites, we consider effects of forest management practices on foraging and traveling behaviors of northern long-eared bats. In southeastern Missouri, the northern long-eared bat showed a preference for contiguous tracts of forest cover (rather than fragmented or wide open landscapes) for foraging or traveling, and different forest types interspersed on the landscape increased likelihood of occupancy (Yates and Muzika 2006, p. 1245). Similarly, in West Virginia, female northern long-eared bats spent most of their time foraging or travelling in intact forest, diameter-limit harvests (70–90 year-old stands with 30–40 percent of basal area removed in the past 10 years), and road corridors, with no use of deferment harvests (similar to clearcutting) (Owen *et al*. 2003, p. 355). When comparing use and availability of habitats, northern long-eared bats preferred diameter-limit harvests and forest roads. In Alberta, Canada, northern long-eared bats avoided the center of clearcuts and foraged more in intact forest than expected (Patriquin and Barclay 2003, p. 654). On Prince Edward Island, Canada, female northern long-eared bats preferred open areas less than forested areas, with foraging areas centered along forest-covered creeks (Henderson and Broders 2008, pp. 956–958). In mature forests in South Carolina, 10 of the 11 stands in which northern long-eared bats were detected were mature stands (Loeb and O'Keefe 2006, p. 1215). Within those mature stands, northern long-eared bats were more likely to be recorded at points with sparse or medium vegetation rather than points with dense vegetation, suggesting that some natural gaps within mature forests can provide good foraging habitat for northern long-eared bats (Loeb and O'Keefe

2006, pp. 1215–1217). However, in southwestern North Carolina, Loeb and O'Keefe (2011, p. 175) found that northern long-eared bats rarely used forest openings, but often used roads. Forest trails and roads may provide small gaps for foraging and cover from predators (Loeb and O'Keefe 2011, p. 175). In general, northern long-eared bats prefer intact mixed-type forests with small gaps (*i.e.*, forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clearcut.

Impacts to northern long-eared bats from forest management would be expected to vary depending on the timing of removal, location (within or outside northern long-eared bat home range), and extent of removal. While bats can flee during tree removal, removal of occupied roosts (during spring through fall) is likely to result in direct injury or mortality to some percentage of northern long-eared bats. This percentage would be expected to be greater if flightless pups or inexperienced flying juveniles were also present. Forest management outside of northern long-eared bat summer home ranges or away from hibernacula would not be expected to result in impacts to this species. However, forest management within a summer home range (regardless of when it is removed) may result in impacts to this species, depending on the extent of removal and amount of remaining suitable roosting and foraging habitat.

Unlike forest conversion, forest management is not usually expected to result in a permanent loss of suitable roosting or foraging habitat for northern long-eared bats. On the contrary, forest management is expected to maintain a forest over the long term for the species. However, localized long-term reductions in suitable roosting and/or foraging habitat can occur from various forest practices (*e.g.*, clearcuts). As stated above, northern long-eared bats have been found in forests that have been managed to varying degrees, and as long as there is

sufficient suitable roosting and foraging habitat within their home range and travel corridors between those areas, we would expect northern long-eared bat colonies to continue to occur in managed landscapes. However, in areas with WNS, we believe northern long-eared bats are likely less resilient to stressors and maternity colonies are smaller. Given the low inherent reproductive potential of northern long-eared bats (max of one pup per female), death of adult females or pups or both during tree felling reduces the long-term viability of those colonies.

Conservation Efforts to Reduce Habitat Destruction, Modification, or Curtailment of Its Range

Although there are various forms of habitat destruction and disturbance that present potential adverse effects to the northern long-eared bat, they are not considered the predominant threat to the species. Even if all habitat-related stressors were eliminated or minimized, the significant effects of WNS on the northern long-eared bat would remain. Therefore, below we present a few examples, but not a comprehensive list, of conservation efforts that have been undertaken to lessen effects from habitat destruction or disturbance to the northern long-eared bat.

Direct protection of caves and mines can be accomplished through installation of bat-friendly gates that allow passage of bats while reducing disturbance from human entry as well as changes to the cave microclimate from air restrictions. One of the threats to bats in Michigan is the closure of unsafe mines in such a way that bats are trapped within or excluded; however, there have been efforts by the Michigan Department of Natural Resources and others to work with landowners who have open mines to encourage them to install bat-friendly gates to close mines to humans, but allow access to bats (Hoving 2011, unpublished data). The NPS has proactively taken steps to minimize effects to underground bat habitat resulting from vandalism,

recreational activities, and abandoned mine closures (Plumb and Budde 2011, unpublished data). In addition, the NPS is properly gating abandoned coal mine entrances, using a "bat-friendly" design, as funding permits (Graham 2011, unpublished data). All known hibernacula within national grasslands and forestlands of the Rocky Mountain Region of the USFS are closed during the winter hibernation period, primarily due to the threat of WNS, although this will reduce disturbance to bats in general inhabiting these hibernacula (USFS 2013, unpaginated). Because of concern over the importance of bat roosts, including hibernacula, the American Society of Mammalogists developed guidelines for protection of roosts, many of which have been adopted by government agencies and special interest groups (Sheffield *et al*. 1992, p. 707).

Many States are also taking a proactive stance to conserve and restore forest and riparian habitats with specific focus on maintaining forest patches and connectivity. For example, Montana is developing best management practices for riparian habitat protection. Other States have established habitat protection buffers around known Indiana bat hibernacula that will also serve to benefit northern long-eared bat by maintaining sufficient quality and quantity of swarming habitat. Some States have also limited tree-clearing activities to the winter, as a measure that would protect maternity colonies and non-volant pups during summer months. Many States are undertaking research and monitoring efforts to gain more information about habitat needs of and use by northern long-eared bat.

Summary of the Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

We have identified several potential threats to the northern long-eared bat due to impacts to their winter and summer habitats. Winter habitat may be impacted by both human and non-

human modification of hibernacula, particularly damaging is the altering or closing of hibernacula entrances. These modifications can lead to a partial or complete loss of utility as hibernacula. Humans can also disturb hibernating bats, either directly or indirectly, potentially resulting in an increase in energy consuming arousal bouts during hibernation (Thomas 1995, pp. 940–945; Johnson *et al*. 1998, pp. 255–260). Human disturbance at hibernacula has been identified by many States as the next greatest threat after WNS.

During the summer, northern long-eared bat habitat loss is primarily due to forest conversion and forest management. Throughout the range of northern long-eared bats, forest conversion is expected to increase due to commercial and urban development, energy production and transmission, and natural changes. Forest conversion can result in a myriad of effects to the species, including direct loss of habitat, fragmentation of remaining habitat, and direct injury or mortality. Forest management activities, unlike forest conversion, typically result in temporary (non-permanent) impacts to northern long-eared bat summer habitat. The impact of management activities may be positive, neutral, or negative to the northern long-eared bat depending on scale, the management practice, and timing. However, these potential impacts can be greatly reduced with the use of measures that avoid or minimize effects to bats and their habitat. Potential benefits to the species from forest management practices include keeping forest on the landscape and creation and management of roosting and foraging habitat (from some forest management practices).

Many activities continue to pose a threat to the summer and winter habitats of northern long-eared bats. While, these activities alone were unlikely to have significant, population-level effects, there is now likely a cumulative effect on the species in portions of range that have been impacted by WNS. Also, there have been numerous conservation efforts directed at lessening

the effects of habitat destruction or disturbance on the species, including cross-State and cross-agency collaboration on habitat restoration and hibernacula protection.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There are very few records of the northern long-eared bat being collected specifically for commercial, recreational, scientific, or educational purposes, and thus we do not consider such collection activities to pose a threat to the species. Disturbance of hibernating bats as a result of recreational use and scientific research activities in hibernacula is discussed under Factor A.

Factor C. Disease or Predation

Disease

I. White-nose Syndrome

White-nose syndrome (WNS) is an emerging infectious wildlife disease that poses a considerable threat to hibernating bat species throughout North America (Service 2011, p. 1). WNS is responsible for unprecedented mortality of insectivorous bats in eastern North America (Blehert *et al.* 2009, p. 227; Turner *et al*. 2011, pp. 13, 22). The first evidence of the disease (a photo of bats with fungus) was documented at Howes Cave in Schoharie County, New York, 32 mi (52 km) west of Albany, on February 16, 2006, but WNS was not actually discovered until January 2007, when it was found at four additional caves around Schoharie County (Blehert *et al.* 2009, p. 227). Since that time, WNS has spread rapidly throughout the Northeast, Southeast, Midwest, and eastern Canada. As of February 2015, WNS has been confirmed (meaning one or

more bats in the State have been analyzed and confirmed with the disease) in 25 States (Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin) and 5 Canadian provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). Although WNS has not been confirmed in Rhode Island (2 known hibernacula) or the District of Columbia (no known hibernacula), their size and proximity to heavily impacted WNS-confirmed States make it reasonable to conclude that bat populations are also affected by WNS there. Three additional States (Iowa, Minnesota, and Mississippi) are considered suspect for WNS based on the detection of the causative fungus, Pd (Lorch *et al.* 2011, pp. 376–379; Muller *et al*. 2013, pp. 253–259), on bats within those States, but no mortality or other signs of the disease have been documented at those locations as of December 2014. Evidence suggestive of the presence of Pd on one bat in Oklahoma was recently reassessed, and it was concluded that those initial findings are no longer supported (United States Geologic Survey (USGS) 2014, p. 1). Therefore, Oklahoma is no longer considered a suspect (meaning Pd confirmed) State for WNS. Table 1 (below) provides a summary of the States in which WNS is currently present.

State or District	WNS Present?	First Winter WNS Confirmed	Documented WNS Mortality in Bats
Alabama	Yes	2011-2012	Yes
Arkansas	Yes	2013-2014	Yes
Connecticut	Yes	2007-2008	Yes
District of Columbia	Unknown		
Delaware	Yes	2011-2012	Yes
Georgia	Yes	2012-2013	Yes

Illinois	Yes	2012-2013	Yes
Indiana	Yes	2010-2011	Yes
Iowa	Pd	Pd only (2011-2012)	No
Kansas	No		
Kentucky	Yes	2010-2011	Yes
Louisiana	No		
Maine	Yes	2010-2011	Yes
Maryland	Yes	2009-2010	Yes
Massachusetts	Yes	2007-2008	Yes
Michigan	Yes	2013-2014	Yes
Minnesota	Pd	Pd only (2011-2012)	No
Mississippi	Pd	Pd only (2013-2014)	No
Missouri	Yes	2011-2012	Yes
Montana	No		
Nebraska	No		
New Hampshire	Yes	2008-2009	Yes
New Jersey	Yes	2008-2009	Yes
New York	Yes	2006-2007	Yes
North Carolina	Yes	2010-2011	Yes
North Dakota	No		
Oklahoma	No		
Ohio	Yes	2010-2011	Yes
Pennsylvania	Yes	2008-2009	Yes
Rhode Island	Unknown		
South Carolina	Yes	2012-2013	No
South Dakota	No		
Tennessee	Yes	2009-2010	Yes
Vermont	Yes	2007-2008	Yes
Virginia	Yes	2008-2009	Yes
West Virginia	Yes	2008-2009	Yes
Wisconsin	Yes	2013-2014	Yes
Wyoming	No		

Seven species of North American hibernating bats have been confirmed with WNS to date: big brown bat, gray bat, eastern small-footed bat, little brown bat, northern long-eared bat, Indiana bat, and tricolored bat. The effect of WNS appears to vary greatly by species, with

several species exhibiting high mortality and others showing low or no appreciable population-level effects (Turner *et al.* 2011, p. 13). The fungus that causes WNS has been detected on five additional species, but with no evidence of the infection characteristic of the disease; these include Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), Virginia big-eared bat (*C. townsendii virginianus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), and southeastern bat (*Myotis austroriparius*).

The impacts of WNS on North American bat populations have been substantial. Service and State biologists estimate that at least 5.7 million to 6.7 million bats of several species have died from WNS (Service 2012, p. 1). Dzal *et al.* (2011, p. 393) documented a 78 percent decline in the summer activity of little brown bats in New York State, coinciding with the arrival and spread of WNS, suggesting large-scale population effects. Turner *et al.* (2011, p. 22) reported an 88 percent decline in the number of all hibernating bats at 42 sites across New York, Pennsylvania, Vermont, Virginia, and West Virginia. Furthermore, Frick *et al.* (2010a, p. 681) concluded that the little brown bat, formerly the most common bat in the northeastern United States, is undergoing catastrophic declines in the region due to WNS, and is at risk of regional extirpation in the near future. Similarly, Thogmartin *et al.* (2013, p. 171) predicted that WNS is likely to extirpate the federally endangered Indiana bat over large parts of its range. While recent models by Ingersoll *et al.* (2013, p. 8) have raised some questions about the status of bat populations prior to the arrival of WNS, the empirical evidence from surveys of six species of hibernating bats in New York State, revealed populations that were likely stable or increasing prior to the emergence of WNS (Service 2011, p. 1). Subsequent to the emergence of WNS, decreases in some species of bats at affected hibernacula have ranged from 30 to 100 percent (Frick *et al.* 2010a, p. 680; Turner *et al.* 2011, pp. 16–19, 22).

The pattern of spread of WNS has generally followed predictable trajectories along recognized migratory pathways and overlapping summer ranges of hibernating bat species, with some exception. The range expansion of WNS and Pd has not only been limited to known migratory movements of bats. Kunz and Reichard (2010, p. 12) assert that WNS is spread and transmitted mainly through bat-to-bat contact; however, evidence suggests that fungal spores can be transmitted by humans (USGS National Wildlife Health Center (NWHC), Wildlife Health Bulletin 2011–05, unpaginated), and bats can also become infected by coming into contact with contaminated cave substrate (Darling and Hicks 2012, pers. comm.).

White-nose syndrome is caused by the psychrophilic (cold-loving) fungus Pd, which is likely exotic to North America, and only recently arrived on the continent (Puechmaille *et al.* 2011, p. 8; Foster, pers. comm.; Warnecke *et al.* 2012, p. 7001). The fungus grows on and within exposed soft tissues of hibernating bats (Lorch *et al.* 2011, p. 376; Gargas *et al.* 2009, pp. 147–154), and the resulting mycelium (vegetative part of fungus) is the white filamentous growth visible on the muzzle, ears, or flight membranes (wings and tail) of affected bats that is characteristic of WNS. Epidermal (skin) erosions that are filled with fungal hyphae (branching, filamentous structures of fungi) are the diagnostic standard for WNS (Blehert *et al*. 2009, p. 227; Meteyer 2009, p. 412). Pd grows optimally at temperatures from 5 to 16 °C (41 to 61 °F), the same temperature range at which North American bats typically hibernate (Blehert *et al*. 2009, p. 227; Verant *et al*. 2012, p. 4). The temperature in caves that serve as bat hibernacula ranges from 2 to 14 °C (36 to 57 °F), permitting year-round persistence and growth of the fungus on cave substrates, allowing such hibernacula to serve as a reservoir for maintaining the fungus through summer months in the absence of bats (Blehert *et al*. 2009, p. 227; Reynolds *et al*. 2015, unpaginated). Growth is relatively slow at optimal temperatures (5 to 16 °C (41 to 61 °F)), and

no growth occurs at temperatures above 21.4 °C (75 °F) (Blehert *et al*. 2009, p. 227; Verant *et al*. 2012, pp. 4, 6). Although Pd does not grow above 21.4 °C, it is known to remain viable for extended periods of time above that temperature (Lorch *et al*. 2013, p. 237; Hoyt *et al*. 2014, pp. 2–3). Declines in Indiana bats have been greater under more humid conditions, suggesting that growth of the fungus and either intensity or prevalence of infections are higher in more humid conditions (Langwig *et al*. 2012, p. 1055). However, the effect of humidity on impacts of WNS in bat populations may vary among species. Furthermore, fungal load and prevalence varies among species in WNS-infected sites (Langwig *et al*. 2015, p. 4).

Although Pd has been isolated from numerous bat species in Europe, it is hypothesized that these species have evolved in the presence of the fungus (Wibbelt *et al*. 2010, p. 1241). Pikula *et al*. (2012, p. 210) confirmed that bats found dead in the Czech Republic exhibited lesions consistent with WNS infection; however, the authors also stated that the lesions were not believed to have contributed to the cause of death for those individuals. In all, there are now 12 European bat species, including one Rhinolophid in the sub-order Megachiroptera, that have been confirmed with the WNS disease (Zukal *et al*. 2014, p. 8) (based on the case definitions established in North America (USGS, NWHC 2014, unpaginated)), although no mortality has been documented to date in Europe. This point illustrates the fact that Pd is capable of infecting a wide variety of bat hosts across a large spatial scale.

Bats affected by WNS are characterized by some or all of the following signs: (1) Excessive or unexplained mortality at or near the hibernaculum; (2) visible fungal growth on wing and tail membranes, the muzzle, or the ears of live or recently dead bats; (3) abnormal behaviors including conspicuous daytime activity outside of the hibernaculum, shifts of large numbers to the cold areas near the entrance or elsewhere in the hibernaculum, and decreased

arousal with human disturbance inside hibernaculum (torpid bats responding to noise and vibrations in the cave); (4) moderate to severe wing damage in nontorpid bats; and (5) and depleted fat reserves by mid-winter (USGS, NWHC 2012, p. 1; Service 2011, p. 2). Although the exact process or processes by which WNS leads to death remains unconfirmed, we do know that the fungal infection is responsible, and it is possible that reduced immune function during torpor compromises the ability of hibernating bats to combat the infection (Bouma *et al*. 2010, p. 623; Moore *et al*. 2011, p. 10; Moore *et al*. 2013, pp. 6–7; Reeder *et al*. 2012, p. 8; Johnson *et al*. 2014, unpaginated). It has also been hypothesized that immune reconstitution inflammatory syndrome (IRIS) causes mortality when systemic Pd-infections established during torpor initiate a massive inflammatory response when the infected bat emerges from hibernation (Meteyer *et al*. 2012, pp. 585, 587).

No information was known about Pd and WNS prior to 2007. Early working hypotheses demonstrated that it was not known whether WNS-affected bats before the hibernation season began or if bats arrived at hibernacula sites unaffected and entered hibernation with sufficient fat stores (WNS Science Strategy Group 2008, p. 7). Hibernating bats rely on stored fats to survive winter months, when insect prey is not available. In a related study, 12 of 14 bats (10 little brown bats, 1 big-brown bat, and 1 tri-colored bat) had appreciable degree of fat stores, even though they were infected with WNS and were on the lower end of the normal range of body weight (Courtin *et al*. 2010, p. 214). Further research has lead scientists to suggest that bats are capable of clearing fungal infections during the summer in some areas, and are likely re-infected with Pd when they return to swarming sites or hibernacula in the fall (Langwig *et al*. 2015, p. 6). However, Dobony (2014, pers. comm.) noted the presence of viable Pd in a maternity roost throughout summer months, indicating that in some situations bats can be exposed to the fungus

year-round. Boyles and Willis (2010, pp. 92–98) hypothesized that infection by Pd alters the normal arousal cycles of hibernating bats, particularly by increasing arousal frequency, duration, or both. In fact, Reeder *et al*. (2012, p. 5) and Warnecke *et al*. (2012, p. 2) observed an increase in arousal frequency in laboratory studies of hibernating bats infected with Pd. A disruption of this torpor–arousal cycle could cause bats to metabolize fat reserves too quickly, thereby leading to starvation (Warnecke *et al*. 2012, p. 4). The root cause of these increased arousal bouts remains under investigation, but some have suggested that skin irritation from the fungus might cause bats to arouse and remain out of torpor for longer than normal to groom (Boyles and Willis 2010, p. 93). Routine arousal bouts serve to maintain critical conditions like water balance and immune function; however, arousals are energetically costly, and anything resulting in greater energy expenditure has the potential to cause mortality.

It has also been hypothesized that resulting mortality from infection of Pd is due specifically to fungal infection of bats' wings. Cryan *et al*. (2010, pp. 135–142) suggests that mortality may be caused by catastrophic disruption of wing-dependent physiological functions. The authors also hypothesized that Pd may cause dehydration, trigger thirst-associated arousals, cause significant circulatory and thermoregulatory disturbance, disrupt respiratory gas exchange, and destroy wing structures necessary for flight control (Cryan *et al*. 2010, p. 141). Further, the wings of winter-collected WNS-affected bats often reveal signs of infection, and the degree of damage observed suggests functional impairment (Willis *et al*. 2011, pp. 370–371; Cryan *et al*. 2010, pp. 137–138). In related research, Cryan *et al*. (2013, p. 398) found that electrolytes tended to decrease as wing damage increased in severity; electrolytes are necessary for maintaining physiological homeostasis, and any imbalance could be life-threatening (Cryan *et al*. 2013, p. 398). Again, although the exact proximate mechanism by which WNS affects bats is

still under investigation, the fact that it can result in death for many hibernating bat species is well documented.

Effects of White-nose Syndrome on the Northern Long-eared Bat

The northern long-eared bat is susceptible to WNS, and mortality of northern long-eared bats due to the disease has been confirmed throughout the majority of the WNS-affected range (Ballmann 2013, pers. comm.; Last 2013, pers. comm.). The observed spread of WNS in North America has been rapid, with the fungus that causes the disease (Pd) expanding over 1,000 miles (1,609 km) from the first documented evidence in New York in February 2006, to 28 States and 5 Canadian provinces by February 2015. Pd now affects an estimated 60 percent of the northern long-eared bat's total geographic range, and is expected to continue to spread at a similar rate through the rest of the range (Service 2015, unpublished data). WNS has been confirmed in 25 of the 37 States (does not include the District of Columbia) in the range of northern long-eared bat. Furthermore, although WNS has not been confirmed in Rhode Island or the District of Columbia, those areas are entirely surrounded by WNS.

Although there is some variation in spread dynamics and the impact of WNS on bats when it arrives at a new site, we have no information to suggest that any site within the known range of the northern long-eared bat would be unsusceptible to the arrival of Pd. There is some evidence that microclimate may affect fungal and disease progression and there is a possibility that certain conditions may hinder disease progression in infected bats at some sites, but the degree to which this can be predicted at continental scales remains uncertain. Given the appropriate amount of time for exposure, WNS appears to have had similar levels of impact on northern long-eared bats everywhere the species has been documented with the disease.

Therefore, absent direct evidence to suggest that some northern long-eared bats that encounter Pd do not contract WNS, available information suggests that the species will be impacted by WNS everywhere in its range.

Northern long-eared bats may favor small cracks or crevices in cave ceilings, making locating them more challenging during hibernacula surveys than other species that are typically found in clusters in open areas (*e.g.*, little brown bat, Indiana bat). However, winter surveys represent the best available data for assessing population trends for this species (Ingersoll *et al.* 2013, p. 9; Herzog 2015, pers. comm.). Progression from the detection of a few bats with visible fungus to widespread mortality may take a few weeks to 2 years (Turner *et al.* 2011, pp. 20–21). Although there is variation in when the decline is observed (*e.g.*, a few weeks to 2 years after detection of the disease), there appears to be little or no variation as to whether a decline happens (Service 2014, unpublished data). Microclimate inside the cave, duration and severity of winter, hibernating behavior, body condition of bats, genetic structure of the colony, and other variables may affect the timeline and severity of impacts at the site level. However, there is no evidence to date that any of these variables would greatly delay or reduce mortality in infected colonies.

WNS has been present in the eastern portion of the northern long-eared bat's range the longest; therefore, there is a greater amount of post-WNS hibernacula and summer data available from that region to discuss and examine the impacts of the disease on the species. Turner *et al.* (2011, p. 22) compared the most recent pre-WNS count to the most recent post-WNS count for 6 cave bat species and reported a 98 percent total decline in the number of hibernating northern long-eared bats at 30 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia through 2011. Data analyzed in this study were limited to sites with confirmed WNS

mortality for at least 2 years and sites with comparable survey effort across pre- and post-WNS years.

The Service conducted an analysis of additional survey information at 103 sites across 12 U.S. States and Canadian provinces (New York, Pennsylvania, Vermont, West Virginia, Virginia, New Hampshire, Maryland, Connecticut, Massachusetts, North Carolina, New Jersey, and Quebec) and found comparable declines in winter colony size. All 103 sites analyzed had historical records of northern long-eared bat presence, at least one survey in the 10-year period before WNS was detected, and at least one survey conducted 2 or more years after WNS was detected (Service 2014, unpublished data). In these sites, total northern long-eared bat counts declined by an average of 96 percent after the arrival of WNS; 68 percent of the sites declined to zero northern long-eared bats, and 92 percent of sites declined by more than 50 percent. Similarly, Frick *et al.* (2015, p. 6) documented that northern long-eared bats are now considered extirpated from 69 percent of the hibernacula (in Vermont, New York, Pennsylvania, Maryland, Virginia, and West Virginia) that had colonies of northern long-eared bats prior to WNS. Similar observations have been documented over several years. In a study by Langwig *et al.* (2012, p. 1054), 14 populations of northern long-eared bats in New York, Vermont, and Connecticut became locally extinct within 2 years due to disease, and no population was remaining 5 years post-WNS (Langwig *et al.* 2012, p. 1054). In addition, Langwig (2014, in litt.) stated that, in more than 50 caves and mines surveyed in New York, Vermont, New Hampshire, Virginia, and Illinois, the northern long-eared bat is extirpated from all sites (that had continuous population counts) where WNS has been present for more than 4 years. Hibernacula surveys conducted in Pennsylvania in 2013 revealed a 99 percent decline (637 to 5 bats) at 34 sites where northern long-eared bats were known to hibernate prior to WNS (PGC

2013, unpublished data). In the Northeast, where WNS has been present for 5 or more years, the northern long-eared bat is only rarely encountered on the summer landscape. For example, in Vermont, the species was the second most common bat in the State before WNS, and it is now one of the least likely to be encountered (VFWD 2014, in litt.). Northern long-eared bats were also widespread throughout New York prior to WNS; however, post-WNS captures of this species have declined dramatically (approximately 93 percent) in the eastern part of the State (NYSDEC 2012, unpublished data). The one potential exception in New York is the Long Island population, where the species continues to be found in small numbers during summer surveys. However, these observations are unproven at this point and are the basis for ongoing research. Long-term summer data (including pre- and post-WNS) for the northern long-eared bat, where available, corroborate the population decline observed during hibernacula surveys. For example, summer surveys from 2005–2011 near Surry Mountain Lake in New Hampshire showed a 98 percent decline in capture success of northern long-eared bats post-WNS, which is similar to the hibernacula data for the State (a 95 percent decline) (Moosman *et al.* 2013, p. 554). Likewise, summer monitoring in Virginia from 2009 to present has revealed that declines in northern long-eared bats were not observed by VDGIF until 2 years after the severe declines were observed during winter and fall monitoring efforts in the State (Reynolds 2013, pers. comm.). These trends provide context for the indices of abundance of northern long-eared bats reported in States such as Pennsylvania and West Virginia, where the arrival of Pd at sites has been prolonged over several years (Miller-Butterworth *et al*. 2014). For example, in Pennsylvania, declines of 99 percent of northern long-eared bats counted in winter surveys corresponded with declines of 76 percent in summer capture rates; additionally, the decline in summer captures continues at an average rate of 15 percent annually (PGC 2014, in litt.). The

fact that similar severe declines are documented in both summer and winter estimates demonstrates that northern long-eared bats are succumbing to WNS both at conspicuous hibernacula where they are surveyed and at undocumented hibernacula where they are not monitored directly.

Early reports from WNS-affected States in the Midwest reveal that similar rates of decline in northern long-eared bats are already occurring or are fast approaching. As reported in the *Distribution and Relative Abundance* section, above, in the two Ohio mines where an estimated 90 percent of Ohio's winter bat population hibernates, northern long-eared bat numbers decreased by 94 percent (combined for both hibernacula) from pre-WNS average counts (ODNR 2014, unpublished data). During the summer, ODNR Statewide acoustic surveys show a decline in northern long-eared bats of 56 percent since the pre-WNS years (ODNR 2014, unpublished data). Summer capture rates of northern long-eared bats from mist-net surveys (mostly conducted for Indiana bat presence) have declined by 58 percent per mist-net site post-WNS (Service 2014, unpublished data). Also, at two Illinois' major hibernacula, significant mortality of northern long-eared bats was observed in the first year after WNS was first detected, and the population at one site experienced a 97 percent decline, while the population decline at the second site was over 99 percent (Illinois Department of Natural Resources 2014, unpublished data).

As stated in the *Distribution and Relative Abundance* section, above, in the southern portion of the species' range, it is difficult to draw conclusions about winter population trends pre- and post- WNS introduction (due to a lack of surveys, historical variability of winter populations, or lack of standardized data); however, northern long-eared bat mortality associated with WNS has been observed at sites in Arkansas, Kentucky, North Carolina, and Tennessee.

Also, some declines have been documented via hibernacula surveys in this region. For example, at a hibernaculum in Arkansas, mortality of northern long-eared bats was documented in the first year of known infection with Pd (Sasse 2014, pers. comm.). Over 70 percent of the 185 northern long-eared bats tested for the presence of Pd in Tennessee hibernacula between 2011 and 2014 were found to have Pd (Bernard 2014, in litt.). Also, in the Great Smoky Mountains National Park, 2014 capture rates of northern long-eared bats in comparison to 2009–2012 declined by 71 to 94 percent (across all sites) based on unit of effort comparisons (NPS 2014, in litt.; Indiana State University 2015, in litt.). Summer population trends are also difficult to summarize at this time, due to a lack of surveys or standardized data, although long-term data at localized sites have shown declines in northern long-eared bats.

All models of WNS spread dynamics predict that Pd, and hence the disease, will continue to spread (Maher *et al.* 2012, pp. 5–7; Ihlo 2013, unpublished; Hallam *et al.*, unpublished). These models estimate the disease will cover the entirety of the northern long-eared bat's range (within the models limited geographic limits (the United States)) by sometime between 2 and about 40 years (although estimating WNS arrival dates was not a primary objective of the analysis; Maher *et al*. 2012, pp. 5–7; Ihlo 2013, unpublished; Hallam *et al*., unpublished). However, these models all have significant limitations (e.g., failure to account for: transmission through non-cave hibernacula, spread through Canada, and various biological aspects of disease transmission), and in many instances have either overestimated (predicted WNS would impact later) or underestimated the time at which WNS would arrive in counties that have become infected since the model was published. WNS arrived to surveyed sites 1 to 5 years (mean=2 years) earlier than predicted or when predicted by the Ihlo (2013, unpublished) model. WNS arrived 1 to 4 years later (mean=1 year) than predicted by Maher *et al.* (2012, pp. 1–8) in

approximately 75 counties; 1 to 46 years earlier (mean=5 years) than predicted in approximately 75 counties; and when predicted in approximately 25 counties. For example, Pd was documented in Jasper County, Mississippi, in 2014, 45 years in advance of predictions by Maher *et al.* (2012). Maher (2014, in litt.) also commented that the spread rate of Pd may increase with longer winters, suggesting that spread of Pd in the northern portion of the northern long-eared bat's range with longer winters would be faster than in portions with shorter winters.

As described, there are limitations and uncertainties with relying on these models to predict the rate at which the fungus will spread to currently unaffected areas. Thus, we instead relied on the observed rate of spread to date of Pd to develop a calculation of projected rate of spread through the remaining portion of the northern long-eared bat's range. WNS was first recorded in a cave in New York in 2006. Based on the observed spread of Pd from its point of origin in New York that has occurred to date, the area affected by Pd in North America is expanding at an average rate of roughly 175 miles (280 km) per year. At this average rate of spread, Pd can be expected to occur throughout the range of the northern long-eared bat in an estimated 8 to 9 years from December 2014. The COSEWIC used a similar method to calculate spread in their assessment of 3 bat species; they estimated that the entire range of the northern long-eared bat would be infected within 12 to 15 years (COSEWIC 2013, p. xiv) from November 2013.

Northern long-eared bats exhibit behaviors (*e.g.*, hibernating solitarily or in small clusters, using alternative hibernacula) that have been hypothesized to potentially limit exposure to Pd and reduce the impacts of WNS; however, there currently is no empirical evidence to suggest that these behaviors have mitigated the impacts of WNS, and the northern long-eared bat has been found to be one of the most highly susceptible bat species to WNS (Langwig *et al.*

2015, p. 4). Griffin (1945) reported that northern long-eared bats hibernate in "unsuspected retreats," away from large colonies of other species and where caves and mines are not present, suggesting they may be able to limit exposure to Pd. In the southern extent of their range, northern long-eared bats have been documented sporadically arousing from torpor throughout the winter and moving between hibernacula (Griffin 1940a, p. 185; Whitaker and Rissler 1992a, p. 131; Caceres and Barclay 2000, pp. 2–3). It has been suggested that these periodic arousals provide a hypothetical mechanism by which fungal growth, and resulting infection, may be limited. However, as described in the "Hibernation" section under *Biology*, above, northern long-eared bats prefer to hibernate at temperatures between 0 and 9 °C (Raesly and Gates 1987, p. 18; Caceres and Pybus 1997, p. 2; Brack 2007, p. 744), which falls within the optimal growth limits of Pd, 5 and 16 °C (41 and 61 °F) (Blehert *et al*. 2009, p. 227; Verant *et al*. 2012, p. 4), making them susceptible to WNS infection once exposed to Pd, regardless of hibernaculum type. Northern long-eared bats also roost in areas within hibernacula that have higher humidity. Cryan *et al*. (2010, p. 138) suggested this roosting preference may be due to the northern long-eared bat's high intrinsic rates of evaporative water loss during torpor. Langwig *et al*. (2012, p. 1055) suggested that these more humid conditions could explain why northern long-eared bats actually experience higher rates of infection than other species, such as Indiana bats.

Northern long-eared bats have been reported to enter hibernation in October or November, but sometimes return to hibernacula as early as August, and emerge in March or April (Caire *et al*. 1979, p. 405; Whitaker and Hamilton 1998, p. 100; Amelon and Burhans 2006, p. 72). This extended period of time (in comparison to many other cave bat species that have been less impacted by WNS) may explain observed differences in fungal loads of Pd when compared to less susceptible species because the fungus has more time to infect bats and grow.

Langwig *et al*. (2015, p. 4) determined that nearly 100 percent of northern long-eared bats sampled in 30 hibernacula across 6 States (New York, Vermont, Massachusetts, Virginia, New Hampshire, and Illinois) were infected with Pd early in the hibernation period, and that northern long-eared bats had the highest Pd-load of any other species in these sites. Similar patterns of high prevalence and fungal load in northern long-eared bats were reported by Bernard (2014, pers. comm.; Bernard 2014, in litt.) for bats surveyed outside of hibernacula in Tennessee during the winter. Furthermore, the northern long-eared bat occasionally roosts in clusters or in the same hibernacula as other bat species that are also susceptible to WNS (see the "Hibernation" section under *Biology*, above,) and are susceptible to bat-to-bat transmission of WNS.

Information provided to the Service by a number of State agencies demonstrates that the area currently (as of 2015) affected by WNS likely constitutes the core of the species' range, where densities of northern long-eared bats were highest prior to WNS. Further, it has been suggested that the species was considered less common or rare in the extreme southern, western, and northwestern parts of its range (Caceres and Barclay 2000, p. 2; Harvey 1992, p. 35), areas where WNS has not yet been detected. The northern long-eared bat has been extirpated from hibernacula where WNS, has been present for a significant number of years (*e.g.*, 5 years), and has declined significantly in other hibernacula where WNS has been present for only a few years. A corresponding decline on the summer landscape has also been witnessed. As WNS expands to currently uninfected areas within the range of northern long-eared bat, there is the expectation that the disease, wherever found, will continue to negatively affect the species. WNS is the predominant threat to the northern long-eared bat rangewide, and it is likely to spread to the entirety of the species' range.

II. Other Diseases

Infectious diseases observed in North American bat populations include rabies, histoplasmosis, St. Louis encephalitis, and Venezuelan equine encephalitis (Burek 2001, p. 519; Rupprecht *et al.* 2001, p. 14; Yuill and Seymour 2001, pp. 100, 108). Rabies is the most studied disease of bats, and can lead to mortality, although antibody evidence suggests that some bats may recover from the disease (Messenger *et al.* 2003, p. 645) and retain immunological memory to respond to subsequent exposures (Turmelle *et al*. 2010, p. 2364). Bats are hosts of rabies in North America (Rupprecht *et al.* 2001, p. 14), accounting for 24 percent of all wild animal cases reported during 2009 (Blanton *et al*. 2010, p. 648). Although rabies is detected in up to 25 percent of bats submitted to diagnostic labs for testing, less than 1 percent of bats sampled randomly from wild populations test positive for the virus (Messenger *et al*. 2002, p. 741). Northern long-eared bat is among the species reported positive for rabies virus infection (Constantine 1979, p. 347; Burnett 1989, p. 12; Main 1979, p. 458); however, rabies is not known to have appreciable effects to the species at a population level.

Histoplasmosis has not been associated with the northern long-eared bat and may be limited in this species compared to other bats that form larger aggregations with greater exposure to guano-rich substrate (Hoff and Bigler 1981, p. 192). St. Louis encephalitis antibody and high concentrations of Venezuelan equine encephalitis virus have been observed in big brown bats and little brown bats (Yuill and Seymour 2001, pp. 100, 108), although data are lacking on the prevalence of these viruses in northern long-eared bats. Equine encephalitis has been detected in northern long-eared bats (Main 1979, p. 459), although no known population declines have been found due to presence of the virus. Northern long-eared bats are also known to carry a variety of pests including chiggers, mites, bat bugs, and internal helminthes (Caceres and Barclay 2000, p.

3). However, the level of mortality caused by WNS far exceeds mortality from all other known diseases and pests of the northern long-eared bat.

Predation

Animals such as owls, hawks, raccoons, skunks, and snakes prey upon bats, although a limited number of animals consume bats as a regular part of their diet (Harvey *et al.* 1999, p. 13). Northern long-eared bats are believed to experience a small amount of predation; therefore, predation does not appear to be a population changing cause of mortality (Caceres and Pybus 1997, p. 4; Whitaker and Hamilton 1998, p. 101).

Predation has been observed at a limited number of hibernacula within the range of the northern long-eared bat. Of the State and Federal agency responses received pertaining to northern long-eared bat hibernacula and threat of predation, 1 hibernaculum in Maine, 3 in Maryland (2 of which were due to feral cats), 1 in Minnesota, and 10 in Vermont were reported as being prone to predation. In one instance, domestic cats were observed killing bats at a hibernaculum used by northern long-eared bat in Maryland, although the species of bat killed was not identified (Feller 2011, unpublished data). Turner (1999, personal observation) observed a snake (species unknown) capture an emerging Virginia big-eared bat in West Virginia. Tuttle (1979, p. 11) observed (eastern) screech owls (*Otus asio*) capturing emerging gray bats. Northern long-eared bats are known to be affected to a small degree by predators at summer roosts. Carver and Lereculeur (2013, pp. N6–N7) observed predation of a northern long-eared bat by a gray rat snake during the summer; Sparks *et al.* (2003, pp. 106–107) described attempts by raccoons to prey on both Indiana bats and evening bats. Avian predators, such as owls and magpies, have been known to successfully take individual bats as they roost in

more open sites, although this most likely does not have an effect on the overall population size (Caceres and Pybus 1997, p. 4). In summary, because bats are not a primary prey source for any known natural predators, it is unlikely that predation has substantial effects on the species at this time.

Conservation Efforts to Reduce Disease or Predation

As mentioned above, WNS is responsible for unprecedented mortality in some species of hibernating bats in eastern North America, including the northern long-eared bat, and the disease continues to spread. In 2011, the Service, in partnership with several other State, Federal, and Tribal agencies, finalized a national response plan for WNS (*A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats*; https://www.whitenosesyndrome.org/national-plan/white-nose-syndrome-national-plan) to provide a common framework for the investigation and management of WNS (Service 2011, p. 1). In 2012, a sister plan was finalized for the national response to WNS in Canada (*A National Plan to Manage White Nose Syndrome in Bats in Canada*; http://www2.ccwhc.ca/publications/Canadian%20WNS%20Management%20Plan.pdf), allowing for a broader coordinated response to the disease throughout the two countries. The multi-agency, multi-organization WNS response team, under the U.S. National Plan and in coordination with Canadian partners, has and continues to develop recommendations, tools, and strategies to slow the spread of WNS, minimize disturbance to hibernating bats, and improve conservation strategies for affected bat species. Some of these products include: Decontamination protocols; cave management strategies and best management practices (BMPs); forestry BMPs; nuisance wildlife control operator BMPs; transportation and bridge

BMPs; hibernacula microclimate monitoring recommendations; wildlife rehabilitator BMPs; and a bat species ranking document for conservation actions. These containment and other strategies are intended to slow the spread of WNS and allow time for development of management options. The multi-agency, multi-partner National WNS Decontamination protocol (https://www.whitenosesyndrome.org/topics/decontamination) was developed to provide specific procedures to minimize the risk of transmitting the fungus when conducting work involving close direct contact with bats, their environments, or associated materials. In addition to bat-to-bat transmission of the disease agent, fungal spores can also be transmitted by human actions (USGS NWHC, Wildlife Health Bulletin 2011–05, unpaginated), and decontamination remains one of the only management options available to reduce the risk of human-assisted transmission. Decontamination protocols have been integrated into other protocols and BMPs that involve close direct contact with bats or their environments.

In 2009, the Service also issued a recommendation for a voluntary moratorium on all caving activity in States known to have hibernacula affected by WNS, and all adjoining States, unless conducted as part of an agency-sanctioned research or monitoring project (Service 2009, entire). These recommendations have been reviewed annually and a revised version, including a multi-agency endorsement through the national WNS Steering Committee, is expected to be completed soon. Though not mandatory or required, many State, Federal, and Tribal agencies, along with other organizations and entities, operating within the northern long-eared bat's range have incorporated the recommendations and protocols in the WNS National Plan in their own local response plans. The Western Bat Working Group, for example, has developed a *White-nose Syndrome Action Plan*, a comprehensive strategy to prevent the spread of WNS that covers States currently outside the range of WNS (Western Bat Working Group 2010, pp. 1–11).

The NPS is currently updating their cave management plans (for parks with caves) to include actions to minimize the risk of WNS spreading to uninfected caves. These actions include WNS education, screening visitors for disinfection, and closure of caves if necessary (NPS 2013, *http://www.nature.nps.gov/biology/WNS*). In April 2009, all caves and mines on USFS lands in the Eastern and Southern Regions were closed on an emergency basis in response to the spread of WNS, and closures on other USFS lands have been announced as well. In 2014, the closure order was extended for 5 more years in the USFS's Southern Region. Eight National Forests in the Eastern Region contain caves or mines that are used by bats; caves and mines on seven of these National Forests (Allegheny, Hoosier, Ottawa, Mark Twain, Monongahela, Shawnee, and Wayne) were closed, and no closure is needed for the one mine on the eighth National Forest (Green Mountain) because it is already gated with a bat-friendly structure. Forest supervisors continue to evaluate the most recent information on WNS to inform decisions regarding extending cave and mine closures for the purpose of slowing the spread of WNS and reducing the impacts of disturbance on WNS-affected bat populations (USFS 2013, *http://www.fs.usda.gov/detail/r9/plants-animals/wildlife/?cid=stelprdb5438954*). Caves and mines on USFS lands in the Rocky Mountain Region were closed on an emergency basis in 2010, in response to WNS, but since then have been reopened (USFS 2013, *http://www.fs.usda.gov/detail/r2/home/?cid=stelprdb5319926*). In place of the emergency closures, the Rocky Mountain Region will implement an adaptive management strategy that will require registration to access an open cave, prohibit use of clothing or equipment used in areas where WNS is found, require decontamination procedures prior to entering any and all caves, and require closure of all known hibernacula caves during the winter hibernation period. Although the above-mentioned WNS-related conservation measures may help reduce or slow the

spread of the disease, these efforts are not currently enough to ameliorate the population-level effects to the northern long-eared bat.

Research is also under way to develop control and treatment options for WNS-infected bats and environments. A number of potential treatments are currently being explored and are in various stages of development. Risks to other biota or the environment need to be assessed when considering disease management trials in a field setting. No treatment strategies have been tested on the northern long-eared bat, to date, and there remains no demonstrated safe or effective treatment for WNS. It remains unknown whether treatment of bats may increase survival or allow the northern long-eared bat to survive exposure to the pathogen. Potential treatment of the northern long-eared bat will be further complicated by the dispersed winter roosting habits of the species and difficulty finding the species in hibernacula. Further, no treatment in development has demonstrated any potential to allow a species to adapt to the presence of the pathogen. More research and coordination is needed to address the safety and effectiveness of any treatment proposed for field use and to meet regulatory requirements prior to consideration of widespread application. Therefore, a landscape-scale approach to reduce the impacts of WNS is still at least a few years away.

Summary of Disease and Predation

The northern long-eared bat is highly susceptible to white-nose syndrome and mortality of the species due to the disease has been documented throughout the majority of its range. WNS is caused by the nonnative fungus Pd, which is believed to have originated in Europe. WNS has been found in 25 States and 5 Canadian provinces since first discovered in New York in 2007, and at least seven bat species are confirmed to be susceptible in North America. The

fungus that causes WNS has been documented in an additional three States. WNS infection, characterized by visible fungal growth on the bat, alters the normal arousal cycles of hibernating bats, causes severe wing damage, and depletes fat reserves, and it has resulted in substantial mortality of North American bat populations.

The effect of WNS on northern long-eared bats has been especially severe and has caused mortality in the species throughout the majority of the WNS-affected range. This is currently viewed as the predominant threat to the species, and if WNS had not emerged or was not affecting northern long-eared bat populations to the level that it has, we presume the species would not be declining to the degree observed. A recent study revealed that the northern long-eared bat has experienced a precipitous population decline, estimated at approximately 96 percent (from hibernacula data) in the northeastern portion of its range, due to the emergence of WNS. WNS has spread to approximately 60 percent of the northern long-eared bat's range in the United States, and if the observed average rate of spread of Pd continues, the fungus will be found in hibernacula throughout the entire species' range within 8 to 13 years based on the calculated rate of spread observed to date (by both the Service and COSEWIC). We expect that similar declines as seen in the East and portions of the Midwest will be experienced in the future throughout the rest of the species' range. There has been a sustained and coordinated effort between partners (*e.g.*, Federal, State, Canada, nongovernment) to curtail the spread of WNS, and while these measures may reduce or slow the spread of WNS, these efforts are currently not enough to ameliorate the population-level effects on the northern long-eared bat. Also, research is under way to develop control and treatment options for WNS-infected bats and hibernacula; however, additional research is needed before potential treatments are implemented on a landscape scale.

Other diseases are known or suspected to infect northern long-eared bats, but none is known to have appreciable effects on the species. Also, it is unlikely that predation is significantly affecting the species at this time.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account "those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species…." In relation to Factor D under the Act, we interpret this language to require the Service to consider relevant Federal, State, and tribal laws, regulations, and other such mechanisms that may reduce any of the threats we describe in threat analyses under the other four factors. We give strongest weight to statutes and their implementing regulations and to management direction that stems from those laws and regulations. An example would be State governmental actions enforced under a State statute or constitution, or Federal action under statute.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the effects from one or more identified threats. In this section, we review existing State, Federal, and local regulatory mechanisms to determine whether they effectively reduce or remove threats to the northern long-eared bat.

No existing regulatory mechanisms have been shown to sufficiently protect the species against WNS, the primary threat to the northern long-eared bat; thus, despite regulatory mechanisms that are currently in place, the species is still at risk. There are, however, some mechanisms in place to provide some protection from other factors that may act cumulatively with WNS. As such, the discussion below provides a few examples of such existing regulatory mechanisms.

Canadian Laws and Regulations

In 2014, the northern long-eared bat was determined, under an emergency assessment, to be endangered under the Canadian Species at Risk Act (SARA) (Species at Risk Public Registry 2014). The SARA makes it an offense to kill, harm, harass, capture, or take an individual of a listed species that is endangered or threatened; possess, collect, buy, sell, or trade an individual of a listed species that is extirpated, endangered, or threatened, or its part or derivative; or to damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction. For most of the species listed under SARA, including the northern long-eared bat, the prohibitions on harm to individuals and destruction of residences are limited to Federal lands.

U.S. Federal Laws and Regulations

Several laws and regulations help Federal agencies protect bats on their lands, such as the Federal Cave Resources Protection Act (16 U.S.C. 4301 *et seq*.) that protects caves on Federal lands and the National Environmental Policy Act (42 U.S.C. 4321 *et seq*.) review, which serves

to mitigate effects to bats due to construction activities on federally owned lands. The NPS has additional laws, policies, and regulations that protect bats on NPS units, including the NPS Organic Act of 1916 (16 U.S.C. 1 *et seq*.), NPS management policies (related to exotic species and protection of native species), and NPS policies related to caves and karst systems (provides guidance on placement of gates on caves not only to address human safety concerns, but also for the preservation of sensitive bat habitat) (Plumb and Budde 2011, unpublished data). Even if a bat species is not listed under the Act, the NPS works to minimize effects to the species. In addition, the NPS Research Permitting and Reporting System tracks research permit applications and investigator annual reports, and NPS management policies require non-NPS studies conducted in parks to conform to NPS policies and guidelines regarding the collection of bat data (Plumb and Budde 2011, unpublished data).

The northern long-eared bat is considered a "sensitive species" throughout the USFS's Eastern Region (USFS 2012, *http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5384459.pdf*). As such, the northern long-eared bat must receive, "special management emphasis to ensure its viability and to preclude trends toward endangerment that would result in the need for Federal listing. There must be no effects to sensitive species without an analysis of the significance of adverse effects on the populations, its habitat, and on the viability of the species as a whole. It is essential to establish population viability objectives when making decisions that would significantly reduce sensitive species numbers" (Forest Service Manual (FSM) 2672.1, *http://www.fs.fed.us/im/directives/fsm/2600/2672-2672.24a.txt*).

State Laws and Regulations

The northern long-eared bat is listed in few of the States within the species' range. The northern long-eared bat is listed as endangered under the Massachusetts endangered species act, under which all listed species are, "protected from killing, collecting, possessing, or sale and from activities that would destroy habitat and thus directly or indirectly cause mortality or disrupt critical behaviors." In addition, listed animals are specifically protected from activities that disrupt nesting, breeding, feeding, or migration (Massachusetts Division of Fisheries and Wildlife 2012, unpublished document). In Wisconsin, all cave bats, including the northern long-eared bat, were listed as threatened in the State in 2011, due to previously existing threats and the impending threat of WNS (Redell 2011, pers. comm.). It is illegal to take, transport, possess, process, or sell any wild animal that is included on the Wisconsin Endangered and Threatened Species List without a valid endangered or threatened species permit. Certain development projects (*e.g.*, wind energy), however, are excluded from regulations that are in place to protect the species in Wisconsin (WDNR, unpublished document, 2011, p. 4). In Vermont, the northern long-eared bat was provided protection by being listed as endangered under the Vermont endangered species law. Except where authorized by separate chapters of the law, the Vermont law states, "a person shall not take, possess or transport wildlife or plants that are members of an endangered or threatened species." The northern long-eared bat is considered as some form of species of concern in 18 States: "Species of Greatest Concern" in Alabama and Rhode Island; "Species of Greatest Conservation Need" in Delaware, Iowa, and Michigan; "Species of Concern" in Ohio and Wyoming; "Rare Species of Concern" in South Carolina; "Imperiled" in Oklahoma; "Critically Imperiled" in Louisiana; "Species of Conservation Concern" in Missouri, and "Species of Special Concern" in Indiana, Maine, Minnesota, New Hampshire, North Carolina, Pennsylvania, and South Carolina. In Kansas, the State has been petitioned to evaluate

the northern long-eared bat as “threatened” in accordance with the Kansas Nongame and Endangered Species Act.

In the following States, there is either no State protection law or the northern long-eared bat is not protected under the existing law: Arkansas, Connecticut, Florida, Georgia, Illinois, Kansas, Kentucky, Maryland, Mississippi, Montana, Nebraska, New Jersey, New York, North Dakota, Tennessee, Virginia, and West Virginia. In Kentucky, although the northern long-eared bat does not have a State listing status, it is considered protected from take under Kentucky State law.

Wind energy development regulation varies by State within the northern long-eared bat’s range. For example, in Virginia, although there are not currently any wind energy developments in the State, new legislation requires operators to “measure the efficacy” of mitigation, with the objective of reducing bat fatalities (Reynolds 2011, unpublished data). In Vermont, all wind energy facilities are required to conduct bat mortality surveys, and at least two of the three currently permitted wind facilities in the State include application of operational adjustments (curtailment) to reduce bat fatalities (Smith 2011, unpublished data). Other States, many of which have expansive wind energy development, have no regulatory program for wind energy projects.

Summary of Inadequacy of Existing Regulatory Mechanisms

No existing regulatory mechanisms have been shown to sufficiently protect the species against WNS, the primary threat to the northern long-eared bat. Therefore, despite regulatory mechanisms that are currently in place for the northern long-eared bat, the species is still at risk, primarily due to WNS, as discussed under *Factor C*.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Wind Energy Development

Significant bat mortality has been witnessed associated with utility-scale (greater than or equal to 0.66 megawatt (MW)) wind turbines along forested ridge tops in the eastern and northeastern United States and in agricultural areas of the Midwest (Johnson 2005, p. 46; Arnett *et al.* 2008, p. 63; Cryan 2011, p. 364; Arnett and Baerwald 2013, p. 441; Hayes 2013, p. 977; Smallwood 2013, p. 26). Recent estimates of bat mortality from wind energy facilities vary considerably depending on the methodology used and species of bat. Arnett and Baerwald (2013 p. 443) estimated that 650,104 to 1,308,378 bats had been killed at wind energy facilities in the United States and Canada as of 2011, and expected another 196,190 to 395,886 would be lost in 2012. Other bat mortality estimates range from "well over 600,000… in 2012" (Hayes 2013, p. 977; [but see Huso and Dalthorp 2014, p. 546–547]) to 888,000 bats per year (Smallwood 2013, p. 26), and mortality can be expected to increase as more turbines are installed on the landscape. The majority of bats killed include migratory foliage-roosting species the hoary bat (*Lasiurus cinereus*) and eastern red bat, and the migratory, tree- and cavity-roosting silver-haired bat (Arnett *et al.* 2008, p. 64; Cryan 2011 p. 364; Arnett and Baerwald 2013, p. 444).

The Service reviewed post-construction mortality monitoring studies at 62 unique operating wind energy facilities in the range of the northern long-eared bat in the United States and Canada. In these studies, 41 northern long-eared bat mortalities were documented, comprising less than 1 percent of all bat mortalities. Northern long-eared bat mortalities were detected throughout the study range, including: Illinois, Indiana, Maryland, Michigan, Missouri,

New York, Pennsylvania, West Virginia, and Ontario. Northern long-eared bat mortalities were detected at 29 percent of the facilities studied. There is a great deal of uncertainty related to extrapolating these numbers to generate an estimate of total northern long-eared bat mortality at wind energy facilities due to variability in post-construction survey effort and methodology (Huso and Dalthorp 2014, pp. 546–547). Bat mortality can vary between years and between sites, and detected carcasses are only a small percentage of total bat mortalities. Despite these limitations, Arnett and Baerwald (2013, p. 444) estimated that wind energy facilities in the United States and Canada killed between 1,175 and 2,433 northern long-eared bats from 2000 to 2011.

The number of bats actually killed at the facilities discussed above is certainly larger than the 41 individuals that were found. Only a portion of carcasses are found during post-construction mortality surveys, most studies only cover a 1- or 2-year period at a single site, and only some facilities conduct monitoring and make the results available to the Service (Cryan 2011, pp. 368–369). Additionally, if mortality occurs at a specific wind facility in a given year, it is reasonable to expect that mortality will occur throughout the operational life of the wind facility (approximately 20 years). Sustained annual mortality of individual northern long-eared bats at a particular wind facility could result in impacts to local populations.

There are three impacts of wind turbines that may explain proximate causes of bat fatalities, which include: (1) Bats collide with turbine towers; (2) bats collide with moving blades; or (3) bats suffer internal injuries (barotrauma) after being exposed to rapid pressure changes near the trailing edges and tips of moving blades (Cryan and Barclay 2009, p. 1331). Researchers have recently indicated that traumatic injury, including bone fractures and soft tissue trauma caused by collision with moving blades, is the major cause of bat mortality at wind

energy facilities (Rollins *et al*. 2012, pp. 365, 368; Grodsky *et al*. 2011, p. 920). Grodsky *et al*. (2011, p. 924) suggested that these injuries can lead to an underestimation of bat mortality at wind energy facilities due to delayed lethal effects. However, the authors also noted that the surface and core pressure drops behind the spinning turbine blades are high enough (equivalent to sound levels that are 10,000 times higher in energy density than the threshold of pain in humans) to cause significant ear damage to bats flying near wind turbines (Grodsky *et al*. 2011, p. 924). Bats suffering from ear damage would have a difficult time navigating and foraging, as both of these functions depend on the bats' ability to echolocate (Grodsky *et al*. 2011, p. 924). While earlier papers indicated that barotrauma may also be responsible for a considerable portion of bat mortality at wind energy facilities (Baerwald *et al*. 2008, pp. 695–696), in a more recent study, researchers found only 6 percent of wind turbine killed bats at one site were possibly killed by barotrauma (Rollins *et al*. 2012, p. 367). In a separate study, Grodsky *et al*. (2011, p. 920 and 922) found that 74 percent of carcasses had bone fractures and more than half had mild to severe hemorrhaging in the middle or inner ears; thus it is difficult to attribute individual fatalities exclusively to either direct collision or barotrauma.

Wind energy development is rapidly increasing throughout the northern long-eared bat's range. Iowa, Illinois, Oklahoma, Minnesota, Kansas, and New York are within the top 10 States for wind energy capacity (installed megawatts) in the United States (AWEA 2013, unpaginated). There is a national movement towards a 20 percent wind energy sector in the U.S. market by 2030 (United States Department of Energy (US DOE)2008, unpaginated). Through 2012, wind energy has achieved its goals in installation towards the targeted 20 percent by 2030 (AWEA 2015, unpaginated). If the target is achieved, it would represent nearly a five-fold increase in wind energy capacity during the next 15 years (Loss *et al*. 2013, pp. 201-209). While locations

of future wind energy projects are largely influenced by ever-changing economic factors and are difficult to predict, sufficient wind regimes exist to support wind power development throughout the range of the northern long-eared bat (US DOE 2015, unpaginated), and wind development can be expected to increase throughout the range in future years. Wind energy facilities have been constructed in areas within a large portion of the range of the northern long-eared bat, thus this species is exposed to the risk of turbine-related mortality. However, northern long-eared bats are rarely detected as mortalities, even in areas where they are known to be common on the landscape.

We conclude that there may be adverse effects posed by wind energy development to northern long-eared bats; however, there is no evidence suggesting effects from wind energy development itself has led to population-level declines in this species. Further, given the low mortality rates experienced and estimated, we believe northern long-eared bats are not as vulnerable to mortality from wind turbines as other species of bats (*e.g.*, hoary bat, silver-haired bat, red bat, big brown bat, little brown bat, and tricolored bat). However, sustained annual mortality of individual northern long-eared bats at a particular wind energy facility could result in negative impacts to local populations.

Climate Change

Our analyses under the Act include consideration of observed or likely environmental effects related to ongoing and projected changes in climate. As defined by the Intergovernmental Panel on Climate Change (IPCC), “climate” refers to average weather, typically measured in terms of the mean and variability of temperature, precipitation, or other relevant properties over time, and “climate change” thus refers to a change in such a measure

that persists for an extended period, typically decades or longer, due to natural conditions (*e.g.*, solar cycles) or human-caused changes in the composition of the atmosphere or in land use (IPCC 2013, p. 1450). Detailed explanations of global climate change and examples of various observed and projected changes and associated effects and risks at the global level are provided in reports issued by the IPCC (2014 and citations therein); information for the United States at national and region levels is summarized in the National Climate Assessment (Melillo *et al*. 2014 entire and citations therein; see Melillo *et al*. 2014, pp. 28–45 for an overview). Because observed and projected changes in climate at regional and local levels vary from global average conditions, rather than using global scale projections we use "downscaled" projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species and the conditions influencing it (see Melillo *et al*. 2014, Appendix 3, pp. 760–763 for a discussion of climate modeling, including downscaling). In our analysis, we use our expert judgment to weigh the best scientific and commercial data available in our consideration of relevant aspects of climate change and related effects.

The unique life-history traits of bats and their susceptibility to local temperature, humidity, and precipitation patterns make them an early warning system for effects of climate change in regional ecosystems (Adams and Hayes 2008, p. 1120). Climate influences food availability, timing of hibernation, frequency and duration of torpor, rate of energy expenditure, reproduction, and rates of juvenile bat development (Sherwin *et al*. 2013, p. 178). Climate change may lead to warmer winters, which could lead to a shorter hibernation period, increased winter activity, and reduced reliance on the relatively stable temperatures of underground hibernation sites (Jones *et al*. 2009, p. 99). An earlier spring would presumably result in a

shorter hibernation period and the earlier appearance of foraging bats (Jones *et al*. 2009, p. 99). An earlier emergence from hibernation may have no detrimental effect on populations if sufficient food is available (Jones *et al*. 2009, p. 99); however, predicting future insect population dynamics and distributions is complex (Bale *et al.* 2002, p. 6). Alterations in precipitation, stream flow, and soil moisture could alter insect populations and, therefore, food availability for bats (Rodenhouse *et al.* 2009, p. 250).

Climate change is expected to alter seasonal ambient temperatures and precipitation patterns across regions (Adams and Hayes 2008, p. 1115), which could lead to shifts in the range of some bat species (Loeb and Winters 2013, p. 107; Razgour *et al*. 2013, p. 1262). Suitable roost temperatures and water availability are directly related to successful reproduction in female insectivorous bats (Adams and Hayes 2008, p. 1116). Adams (2010, p. 2440) reported decreased reproductive success in female insectivorous bats in response to decreased precipitation. In contrast, Burles *et al*. (2009, p. 136) and Lucan *et al*. (2013, p. 154) reported decreased reproductive success in response to increased precipitation in little brown bats and Daubenton's bats (*Myotis daubentonii)*, respectively. Annual precipitation in the northeast United States is projected to either remain stable or increase, although projections are highly variable (Frumhoff *et al.* 2007, p. 8). However, in comparison, Adams and Hayes (2008, p. 1120) predict an overall decline in bat populations in the western United States from reduced regional water storage caused by climate warming.

Warmer winter temperatures may also disrupt bat reproductive physiology. Northern long-eared bats breed in the fall, and spermatozoa are stored in the uterus of hibernating females until spring ovulation. If bats experience warmer hibernating conditions they may arouse prematurely, ovulate, and become pregnant (Jones *et al*. 2009, p. 99). Given this dependence on

external temperatures, climate change is likely to affect the timing of reproductive cycles (Jones *et al*. 2009, p. 99), but making generalizations about the level of risk associated with changes in bat reproduction due to climate change is difficult (Sherwin *et al*. 2013, p. 176). Sherwin *et al*. (2013, p. 176) postulates that warmer climates may benefit female bats by causing earlier birth and weaning of young, allowing more time to mate and store fat reserves in preparation for hibernation. Research by Frick *et al*. (2010b, p. 133) supports this theory, whereby the authors showed giving birth earlier had significant fitness benefits, given that young born in early summer had a higher probability of surviving and breeding in their first year than pups born later in the summer.

The role of climate change in the spread of WNS is largely unknown. A shortened hibernation period and warmer winter temperatures may shorten exposure time and slow the spread of WNS. However, using three standard IPCC scenarios (Special Report: Emissions Scenarios (SRES) B1, least change in climate; A1B, intermediate change; and A2, most change), Maher *et al*. (2012, p. 6) showed accelerated spread of WNS under all scenarios relative to projections based on observed data.

Although we have information that suggests that climate change may affect the northern long-eared bat, we do not have evidence suggesting that climate change in itself has led to population declines; furthermore, the spread of WNS across the species' range is occurring rapidly, so discerning effects from climate change may be difficult.

Contaminants

Effects to bats from contaminant exposure have likely occurred and gone, for the most part, unnoticed in bat populations (Clark and Shore 2001, p. 204). Contaminants of concern to insectivorous bats like northern long-eared bats include organochlorine pesticides,

organophosphate, carbamate and neonicotinoid insecticides, polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs), pyrethroid insecticides, and inorganic contaminants such as mercury (Clark and Shore 2001, pp. 159–214).

Detectable levels of organochlorine pesticides have been reported in northern long-eared bats (Eidels *et al*. 2007, p. 52). Organochlorine pesticides (*e.g.*, dichlorodiphenyltrichloroethane (DDT), chlordane) persist in the environment due to lipophilic (fat-loving) properties, and, therefore, readily accumulate within the fat tissue of bats. Because insectivorous bats have high metabolic rates, associated with flight and small size, their food intake increases the amount of organochlorines available for concentration in the fat (Clark and Shore 2001, p. 166). Because bats are long-lived, the potential for bioaccumulation is great, and effects on reproduction have been documented (Clark and Shore 2001, pp. 181–190). In maternity colonies, young bats appear to be at the greatest risk of mortality. This is because organochlorines become concentrated in the fat of the mother's milk and these chemicals continually and rapidly accumulate in the young as they nurse (Clark 1988, pp. 410–411).

In addition to indirect effects of organochlorine pesticides on bats via prey consumption, documented cases of direct effects involve application of pesticides to bats and their roosts. For example, when a mixture of DDT and chlordane was applied to little brown bats and their roost site, mortality from exposure was observed (Kunz *et al.* 1977, p. 478). Most organochlorine pesticides have been banned in the United States, and time trend analysis indicates that these pesticides have declined significantly over the 30 years since these compounds were restricted (Bayat *et al*. 2014, pp. 46–47).

Organochlorine pesticides have largely been replaced by organophosphate insecticides, which are generally short-lived in the environment and do not accumulate in food chains;

however, risk of exposure is still possible from direct exposure from spraying or ingesting insects that have recently been sprayed but have not died, or both (Clark 1988, p. 411). Organophosphate and carbamate insecticides are acutely toxic to mammals. Some organophosphates may be stored in fat tissue and contribute to "organophosphate-induced delayed neuropathy" in humans (United States Environmental Protection Agency 2013, p. 44). Bats may lose their motor coordination from direct application and are unlikely to survive in the wild in an incapacitated state lasting more than 24 hours (Plumb and Budde 2011, unpublished data). Northern long-eared bats may be exposed to organophosphate and carbamate insecticides in regions where methyl parathion is applied in cotton fields and where malathion is used for mosquito control (Plumb and Budde 2011, unpublished data). The organophosphate, chlorpyrifos, has high fat solubility and is commonly used on crops such as corn and soybeans (van Beelen 2000, p. 34 of Appendix 2; http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2009&map=CHLORPYRIFOS&hilo=L).

Neonicotinoids have been found to cause oxidative stress, neurological damage and possible liver damage in rats, and immune suppression in mice (Kimura-Kuroda *et al*. 2011, p. 381; Duzguner and Erdogan 2012, p. 58; Badgujar *et al.* 2013, p. 408). Due to information indicating that there is a link between neonicotinoids used in agriculture and a decline in bee numbers, the European Union proposed a 2-year ban on the use of the neonicotinoids, thiamethoxam, imidacloprid, and clothianidin on crops attractive to honeybees, beginning in December of 2013 (Bergeson and Campbell PC, *http://www.lawbc.com/regulatory-developments/entry/proposal-for-restriction-of-neonicotinoid-products-in-the-eu/*).

The more recently developed “third generation” of pyrethroids have acute oral toxicities rivaling the toxicity of organophosphate, carbamate and organochlorine pesticides. These pyrethroids include: esfenvalerate, deltamethrin, bifenthrin, tefluthrin, flucythrinate, cyhalothrin, and fenpropathrin (Mueller-Beilschmidt 1990, p. 32). Pyrethroids are increasingly used in the United States, and some of these compounds have very high fat solubility (*e.g.*, bifenthrin, cypermethrin) (van Beelen 2000, p. 34 of Appendix 2).

Like the organochlorine pesticides, PCBs and PBDEs are highly lipophilic and therefore readily accumulate in insectivorous bats. Measured concentrations of PCBs and PBDEs in little brown bats were high, in the parts-per-million range, in both WNS-infected and non-infected bats (Kannan *et al*. 2010, p. 617). High exposures to persistent organic pollutants can potentially be associated with various health effects, including immunosuppression, behavioral anomalies, and contaminant-induced enhancement of metabolic rate in bats (Kannan *et al*. 2010, p. 617). Outside of laboratory experiments, there is no conclusive evidence that bats have been killed by PCBs, although effects on reproduction have been observed (Clark and Shore 2001, pp. 192–194).

Northern long-eared bats forage on emergent insects and can be characterized as occasionally foraging over water (Yates and Evers 2006, p. 5), and, therefore, are at risk of exposure to bioaccumulation of inorganic contaminants (*e.g.*, cadmium, lead, mercury) from contaminated water bodies. Bats tend to accumulate inorganic contaminants due to their diet and slow means of elimination of these compounds (Plumb and Budde 2011, unpublished data). In Virginia, for example, the North Fork Holston River is a water body that was highly contaminated by a waterborne point source of mercury through contamination by a chlor-alkali plant. Based on findings from a pilot study for bats in 2005 (Yates and Evers 2006), there is

sufficient information to conclude that bats from near-downstream areas of the North Fork Holston River have potentially harmful body burdens of mercury, although the effect on bats is unknown. Yates *et al*. (2014, pp. 46-49) collected over 2,000 tissue samples from 10 species of bats in the northeast United States. The highest mercury levels in fur and blood samples were detected in tri-colored, little brown, and northern long-eared bats. Divoll *et al*. (in prep) found that northern long-eared bats showed consistently higher mercury levels than little brown bats or eastern red bats sampled in Maine, which may be correlated with gleaning behavior and the consumption of spiders by northern long-eared bats. Bats recaptured during the study one or 2 years after their original capture maintained similar levels of mercury in fur year-to-year. Biologists suggest that individual bats accumulate body burdens of mercury that cannot be reduced once elevated to a certain threshold.

Exposure to holding ponds containing flow-back and produced water associated with hydraulic fracturing operations may also expose bats to toxins, radioactive material, and other contaminants (Hein 2012, p. 8). Cadmium, mercury, and lead are contaminants reported in hydraulic fracturing operations. Whether bats drink directly from holding ponds or contaminants are introduced from these operations into aquatic ecosystems, bats will presumably accumulate these substances and potentially suffer adverse effects (Hein 2012, p. 9).

A recent review on organic contaminants in bats by Bayat *et al*. (2014, pp. 40–52) "suggests that bats today are exposed generally to lower contaminant concentrations, but that these can manifest in a range of sub-lethal neurological and physiological changes that may impact bat survival. Defining concentration endpoints for sub-lethal impacts, especially for the emerging contaminants, and linking these to effects on bat function, behavior or survival, and long term impacts on populations is limited." In summary, the best available data indicate that

contaminant exposure may cause adverse effects to northern long-eared bats, but if population declines have occurred due to these factors, they have not been discernable.

Prescribed Burning

Eastern forest-dwelling bat species, such as the northern long-eared bat, likely evolved with fire management of mixed-oak ecosystems (Perry 2012, p. 182). A recent review of prescribed fire and its effects on bats (USFS 2012, p. 182) generally found that fire had beneficial effects on bat habitat. Fire may create snags for roosting and creates more open forests conducive to foraging on flying insects (Perry 2012, pp. 177–179), although gleaners such as northern long-eared bats may readily use cluttered understories for foraging (Owen *et al*. 2003, p. 355). Cavity and bark roosting bats, such as the northern long-eared, use previously burned areas for both foraging and roosting (Johnson *et al*. 2009a, p. 239; Johnson *et al*. 2010, p. 118). In Kentucky, the abundance of prey items for northern long-eared bats increased after burning (Lacki *et al*. 2009, p. 1170), and more roosts were found in post-burn areas (Lacki *et al*. 2009, p. 1169). Burning may create more suitable snags for roosting through exfoliation of bark (Johnson *et al*. 2009a, p. 240), mimicking trees in the appropriate decay stage for roosting bats. In contrast, a prescribed burn in Kentucky caused a roost tree used by a radio-tagged female northern long-eared bat to prematurely fall after its base was weakened by smoldering combustion (Dickinson *et al*. 2009, p. 56). Low-intensity burns may not kill taller trees directly but may create snags of smaller trees and larger trees may be injured, resulting in vulnerability (of the tree) to pathogens that cause hollowing of the trunk, which provides roosting habitat (Perry 2012, p. 177). Prescribed burning also opens the tree canopy, providing more canopy light penetration (Boyles and Aubrey 2006, p. 112; Johnson *et al*. 2009a, p. 240), which may facilitate faster development of juvenile bats (Sedgeley 2001, p. 434). Although Johnson *et al*.

(2009a, p. 240) found the amount of roost switching did not differ between burned and unburned areas, the rate of switching in burned areas of every 1.35 days was greater than that found in other studies (every 2 to 3 days) (Foster and Kurta 1999, p. 665; Owen *et al*. 2002, p. 2; Carter and Feldhamer 2005, p. 261; Timpone *et al*. 2010, p. 119).

Direct effects of fire on bats likely differ among species and seasons (Perry 2012, p. 172). Northern long-eared bats have been seen flushing from tree roosts shortly after ignition of prescribed fire during the growing season (Dickinson *et al*. 2009, p. 60). Fires of reduced intensity that proceed slowly allow sufficient time for roosting bats to arouse from sleep or torpor and escape the fire (Dickinson *et al*. 2010, p. 2200), although extra arousals from fire smoke could cause increased energy loss (Dickinson *et al*. 2009, p. 52). During prescribed burns, bats are potentially exposed to heat and gases; the roosting behavior of this species, however, may reduce its vulnerability to toxic gases. When trees are dormant, the bats are roosting in caves or mines (hibernacula can be protected from toxic gases through appropriate burn plans), and during the growing season, northern long-eared bats roost in tree cavities or under bark above the understory, above the area with the highest concentration of gases in a low-intensity prescribed burn (Dickinson *et al*. 2010, pp. 2196, 2200). Carbon monoxide levels did not reach critical thresholds that could harm bats in low-intensity burns at the typical roosting height for the northern long-eared bat (Dickinson *et al*. 2010, p. 2196); thus, heat effects from prescribed fire are of greater concern than gas effects on bats. Direct heat could cause injury to the thin tissue of bat ears and is more likely to occur than exposure to toxic gas levels during prescribed burns (Dickinson *et al*. 2010, p. 2196). In addition, fires of reduced intensity with shorter flame height could lessen the effect of heat to bats roosting higher in trees (Dickinson *et al*. 2010, p. 2196). Winter, early spring, and late fall generally contain less intense fire

conditions than during other seasons and coincide with time periods when bats are less affected by prescribed fire due to low activity in forested areas. Furthermore, no young are present during these times, reducing the likelihood of heat injury to vulnerable young to fire (Dickinson *et al*. 2010, p. 2200). Prescribed fire objectives, such as fires with high intensity and rapid ignition in order to meet vegetation goals, must be balanced with the exposure of bats to the effects of fire (Dickinson *et al*. 2010, p. 2201). Currently, the Service and USFS strongly recommend not burning in the central hardwoods from mid- to late April through summer to avoid periods when bats are active in forests (Dickinson *et al*. 2010, p. 2200).

Bats that occur in forests are likely equipped with evolutionary characteristics that allow them to exist in environments with prescribed fire. Periodic burning can benefit habitat through snag creation and forest canopy gap creation, but frequency and timing need to be considered to avoid direct and indirect adverse effects to bats when using prescribed burns as a management tool. Adverse impacts to individual bats during the active season could be significantly reduced through development of appropriate burn plans that avoid and minimize heat production during prescribed burns. We conclude that there may be adverse effects posed by prescribed burning to individual northern long-eared bats; however, there is no evidence suggesting effects from prescribed burning itself have led to population declines.

Conservation Efforts to Reduce Other Natural or Manmade Factors Affecting Its Continued Existence

In the Midwest, rapid wind energy development is a concern with regard to its effect on bats (Baker 2011, pers. comm.; Kath 2012, pers. comm.). Due to the known impacts from wind energy development, in particular to listed (and species currently being evaluated to determine if

listing is warranted) bird and bat species in the Midwest, the Service, State natural resource agencies, and wind energy industry representatives are developing the MSHCP. The planning area includes the Midwest Region of the Service, which includes all of the following States: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The MSHCP would allow permit holders to proceed with wind energy development, which may result in "incidental" taking of a listed species under section 10 of the Act, through issuance of an incidental take permit (77 FR 52754; August 30, 2012). Currently, the northern long-eared bat is included as a covered species under the MSHCP. The MSHCP will address protection of covered species through avoidance, minimization of take, and mitigation to offset "take" (*e.g.*, habitat preservation, habitat restoration, habitat enhancement) to help ameliorate the effect of wind development (77 FR 52754; August 30, 2012). In some cases, the USFS has agreed to limit or restrict burning in the central hardwoods from mid- to late April through summer to avoid periods when bats are active in forests (Dickinson *et al*. 2010, p. 2200).

Summary of Factor E

Using the best scientific and commercial data available, we have identified a number of natural or manmade factors that may have direct or indirect effects on the continued existence of northern long-eared bats.

Wind energy facilities have been built throughout a large portion of the range of northern long-eared bats, and have been found to cause mortality of northern long-eared bats. While mortality estimates vary between sites and years, sustained mortality at particular sites could result in negative impacts to local populations. Overall, northern long-eared bats are rarely detected as mortalities at wind facilities; however, there is a great amount of uncertainty

associated with extrapolating detected northern long-eared bat mortalities to total bat mortalities. Also, wind energy development within the species' range is projected to continue to increase in future years.

Climate change may also affect this species, as northern long-eared bats are particularly sensitive to changes in temperature, humidity, and precipitation. Impacts from climate change may also indirectly affect the northern long-eared bat due to changes in food availability, timing of hibernation, and reproductive cycles, along with other factors, all of which may contribute to a shift in suitable habitat.

Environmental contaminants, in particular insecticides, pesticides, and inorganic contaminants, such as mercury and lead, may also have detrimental effects on northern long-eared bats. Contaminants may bioaccumulate (become concentrated) in the tissues of bats, potentially leading to a myriad of sublethal and lethal effects.

Northern long-eared bats likely evolved with fire in their habitat, and thus may benefit from fire-created habitat. However, there are potential negative effects from prescribed burning, including direct mortality. Therefore, when using prescribed burning as a management tool, fire frequency, timing, location, and intensity should all be considered in relation to the northern long-eared bat.

There is currently no evidence that these natural or manmade factors would have significant population-level effects on the northern long-eared bat when considered alone. However, these factors may have a cumulative effect on this species when considered in concert with WNS, as this disease has led to dramatic northern long-eared bat population declines (see Factor C discussion, above). While there have been conservation efforts attempting to reduce the potential mortality of northern long-eared bats, particularly involving wind energy development

and prescribed burning, these factors may still affect this species when considered cumulatively with white-nose syndrome (discussed below, in "Cumulative Effects from Factors A through E").

Cumulative Effects from Factors A through E

WNS (Factor C) is the primary factor affecting the northern long-eared bat and has led to dramatic and rapid population-level effects on the species. WNS is the most significant threat to the northern long-eared bat, and the species would likely not be imperiled were it not for this disease. However, although the effects on the northern long-eared bat from Factors A, B, and E, individually or in combination, do not have significant effects on the species, when combined with the significant population reductions due to white-nose syndrome (Factor C), they may have a cumulative effect on this species at a local population scale.

Summary of Changes from the Proposed Listing Rule

Based on our review of the public comments, comments from other Federal and State agencies, peer review comments, issues raised at the public hearing, and new relevant information that has become available since the October 2, 2013, publication of the proposed rule, we have reevaluated our proposed listing rule and made changes as appropriate. Other than minor clarifications and incorporation of additional information on the species' biology and populations, this determination differs from the proposal in the following ways:

(1) Based on our analyses of the potential threats to the species, we have determined that the northern long-eared bat does not meet the definition of an endangered species, contrary to our proposed rule published on October 2, 2013 (78 FR 61046).

(2) Based on our analyses, we have determined that the species meets the definition of a threatened species. Therefore, on the effective date of this final listing rule (see **DATES**, above), the species will be listed as a threatened species in the List of Endangered and Threatened Wildlife at 50 CFR 17.11(h).

(3) We have further refined the estimated timeframe during which Pd (the fungus that causes white-nose syndrome) is expected to spread throughout the range of the northern long-eared bat.

(4) We have expanded the discussion of white-nose syndrome and the effects of white-nose syndrome on the northern long-eared bat under Factor C.

(5) We have included additional (most recent available) survey data for the species in the *Distribution and Relative Abundance* section, above.

Summary of Comments and Recommendations on the Proposed Listing Rule

In the proposed listing rule published on October 2, 2013, we requested that all interested parties submit written comments on the proposal by December 2, 2013. Following that first 60-day comment period, we held four additional public comment periods (see 78 FR 72058, December 2, 2013; 79 FR 36698, June 30, 2014; 79 FR 68657, November 18, 2014; 80 FR 2371, January 16, 2015) totaling an additional 180 days for public comments, with the final comment period closing on March 17, 2015. We also contacted appropriate Federal and State agencies,

scientific experts and organizations, and other interested parties and invited them to comment on the proposed listing. Newspaper notices inviting general public comment were published in multiple newspapers throughout the range of the species. We received a request for a public hearing; we held a public hearing on December 2, 2014, in Sundance, Wyoming. All substantive information provided during comment periods has either been incorporated directly into this final determination or is addressed below. Comments pertaining to the proposed 4(d) rule will be addressed in the final 4(d) rule, and are not included here.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from seven knowledgeable individuals with scientific expertise that included familiarity with the northern long-eared bat and its habitat, biological needs, and threats. We received responses from four of the peer reviewers.

We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the listing of the northern long-eared bat. The peer reviewers generally concurred with our methods and conclusions in the proposed listing rule, and provided additional information, clarifications, and suggestions to improve the final listing rule. Peer reviewer comments are addressed in the following summary and are incorporated into the final rule as appropriate. Specific recommended edits were added under the corresponding section in the final listing rule.

(1) *Comment*: Peer reviewers (and other commenters) concurred with the Service's assessment that factors other than white-nose syndrome are not believed to be contributing to the

current decline of the species rangewide. However, they believed that there could be localized impacts from these other stressors and that cumulative impacts may result from these other factors, in addition to white-nose syndrome, due to a diminished population. Several public commenters further stressed that these additional threats will become proportionately more harmful to the species after the onset of WNS, and protection from these other threats may affect whether the species can stabilize post-WNS.

Our Response: WNS is the most significant threat to the northern long-eared bat, and the species would likely not be imperiled were it not for this disease. Thus, the Service proposed listing the northern long-eared bat due primarily to the impacts of WNS. As stated by commenters, other activities may impact northern long-eared bats as well; however, we conclude that these factors are not believed to be independently impacting the species rangewide. However, although the effects on the northern long-eared bat from Factors A, B, and E, individually or in combination, do not have significant effects on the species, when combined with the significant population reductions due to white-nose syndrome (Factor C), they may have a cumulative effect on this species at a local population scale.

(2) *Comment*: Peer reviewers encouraged the Service to conduct a more extensive literature review. Other commenters also recommended a more extensive literature search and provided citations for relevant literature not included in the proposed listing rule. One reviewer suggested we review literature on the species' habitat requirements, and suggested that the species is more flexible than described in the proposed listing rule. One reviewer recommended, in particular, a more thorough review of literature related to bat community ecology or bat response to forest management where northern long-eared bats are one of many species examined.

Our Response: We have reviewed the literature provided by commenters and incorporated this information into this final listing rule, where appropriate. We also conducted further literature searches to determine if there was additional available literature relevant to the species' biology or the factors affecting its status, and incorporated that information into this final listing rule. In particular, we updated sections with the most recent literature pertaining to the predominant threat to the species, white-nose syndrome, and the resulting impact of the disease on the northern long-eared bat.

(3) *Comment*: One peer reviewer stated that it is critical to point out that these bats day-roost in an ephemeral resource (snags and cavity-trees), and, therefore, they are adapted to handle the dynamic nature of roost longevity and loss of roosts from disturbance in temperate forest systems.

Our Response: Northern long-eared bats are flexible in their tree species roost selection, and roost trees are an ephemeral resource; therefore, the species would be expected to tolerate some loss of roosts provided suitable alternative roosts are available. However, the impact of loss of roosting or foraging habitat within northern long-eared bat home ranges is expected to vary, depending on the scope of removal. See the "Summer Habitat" section under *Factor A*, above, for a more detailed discussion.

(4) *Comment*: One peer reviewer commented that the literature cited that is posted at http://www.regulations.gov was not complete, with several references in the text not appearing in the literature cited section, and many of the unpublished reports that are cited are unobtainable.

Our Response: We corrected this and added these missing references, in addition to any new references used in this final listing rule, to the literature cited list. A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* and

upon request from the Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

The Act and our regulations do not require us to use only peer-reviewed literature, but instead require us to use the best scientific data available in a listing determination. We used information from many different sources, including articles in peer-reviewed journals, scientific status surveys and studies completed by qualified individuals, Master's thesis research that has been reviewed but not published in a journal, other unpublished governmental and nongovernmental reports, reports prepared by industry, personal communication about management or other relevant topics, conservation plans developed by States and counties, biological assessments, other unpublished materials, experts' opinions or personal knowledge, and other sources. You may request a copy of many of these unpublished reports by contacting the Service's Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). Unpublished reports that we have used in making our listing determination include survey information that has been received from State agencies, which the public can request directly from these State agencies.

(5) *Comment*: Peer reviewers agreed that white-nose syndrome likely will spread throughout the range of the northern long-eared bat. One peer reviewer suggested that the rate of spread (through bat-to-bat contact) may slow in western areas, where hibernacula are not as abundant. "Barriers provided by the Great Lakes and isolation from major cave areas in North America are presumably the reasons that the fungus has not yet reached the populations in northern Wisconsin and northern Michigan, and the lower density of hibernacula in the Great Plains may slow the spread in a similar way. However, there is no biological reason to believe that the disease will not spread throughout the entire range of the species."

Our Response: As stated in this final listing rule, based on past and current rates of spread of the disease, we agree that the disease will likely spread throughout the range of the species. Regarding a slowing rate of spread in western areas due to fewer hibernacula, WNS has been confirmed at numerous hibernacula that are not caves or mines, including culverts, bunkers, forts, tunnels, excavations, quarries, and even houses. Since this peer review was submitted, white-nose syndrome has been documented in Wisconsin and the Upper Peninsula of Michigan. The spread of white-nose syndrome was addressed in more detail in our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above.

(6) *Comment*: Peer reviewers noted that, in the proposed listing rule, we did not stress the importance of the northern long-eared bat's sociality during the summer months, and suggested a further explanation on how social structures be maintained if populations have declined dramatically due to white-nose syndrome is needed. These peer reviewers further questioned if the species will be able to recover, even if white-nose syndrome is curtailed.

Our Response: Similar to other myotid bats (*e.g*., Indiana bat, little brown bat), the northern long-eared bat is considered a highly social species, with females forming maternity colonies during the summer months. Peer reviewers expect that white nose-syndrome will reduce population sizes to a level that these groups may not be able to be maintained. Whether a species is ultimately recoverable is not something we consider when listing species; we are obligated to list species under the Act if they meet the definition of an endangered or a threatened species. We will consider what actions might be necessary to recover the species when we begin recovery planning and implementation. See our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for a more detailed discussion of this topic.

(7) *Comment*: One commenter stated that although the proposed listing rule discusses the regulatory mechanisms that several States have employed to reduce the negative impact of wind development on this species, it fails to discuss potential regulatory efforts that could be controlled at the State level, including the impact of highway construction, forest management, and pest control regulations.

Our Response: In general, we devoted most effort to identifying conservation efforts that have been taken to reduce the impact of the predominant threat to the species: white-nose syndrome. We acknowledge that additional conservation efforts are underway in many arenas and they may address other cumulative threats.

(8) *Comment*: One peer reviewer disagreed with the assessment in the proposed listing rule that the species clusters and, therefore, is at greater risk of bat-to bat transmission of Pd while in hibernation. This reviewer stated, at least in Kentucky caves, that the species is most often seen hibernating alone or in very small groupings.

Our Response: We corrected this in this final listing rule. The northern long-eared bat occasionally can be found in clusters with other bats, but typically is found roosting singly during hibernation. Certain life-history characteristics of the northern long-eared bat (*e.g.*, proclivity to roost in areas with increased humidity of hibernacula, longer hibernation time period) are believed to increase the species' susceptibility to white-nose syndrome in comparison to other cave bat species. Furthermore, of the six species with known mortality from WNS, the northern long-eared bat has demonstrated the greatest declines, based on winter count data. See our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for a more detailed discussion.

(9) *Comment*: One reviewer stated that understanding the extent of the impact to northern long-eared bats remains difficult due to the behavior of the species during the winter, which includes movement between hibernacula, particularly during swarming and staging periods, and the ability of the species to hibernate in cracks and crevices, making it difficult to develop population estimates for winter counts.

Our Response: Despite the difficulties in observing or counting northern long-eared bats, winter hibernacula counts are the recommended method, and the only method with enough history to assess trends over time, for monitoring northern long-eared bats. Hibernacula surveys are considered the best available data for cave-dwelling bats in general. However, in recognition of the limitations of these data, we generally do not use the available hibernacula counts to estimate northern long-eared bat population size. Instead, we use the hibernacula data to understand and estimate population trends for the species. The relative difficulty of observing northern long-eared bats during hibernacula surveys should be consistent from year to year, and these data can be used to estimate relative change in numbers and indicate if the species is increasing or decreasing in number in those hibernacula. Thus, the total data available for known northern long-eared bat hibernacula can yield an individual site and cumulative indication of species population trend; the declines estimated at hibernacula are also corroborated by declines in acoustic records and mist-net captures in summer.

State Agency Comments

(10) *Comment*: State fish and wildlife management agencies (Montana, Louisiana, and Tennessee) commented that the listing of the northern long-eared bat should be limited to the

portions of the range where decline has been documented. Another State (Wyoming) commented that there is insufficient data to warrant listing of the northern long-eared bat at a national level given the absence of white-nose syndrome in much of its range.

Our Response: Decisions under the Act cannot be made on a State-by-State basis, but at the species, subspecies, or distinct population segment (DPS) level. For the northern long-eared bat, we have determined that the species warrants listing as a threatened species throughout its range based on current threats (primarily due to WNS) and how those threats are likely to impact the species into the future. (See our response to Comment 36 for more information.)

White-nose syndrome or Pd have been confirmed in 28 States of the northern long-eared bat's 37-State (plus the District of Columbia) range. The species' range only extends into a small area in some of the States that remain uninfected with white-nose syndrome to date. Information provided to the Service by a number of State agencies and all models concerning the spread of white-nose syndrome demonstrates that white-nose syndrome will continue to spread throughout the range of the northern long-eared bat. Furthermore, based on the average rate of spread to date, Pd can be expected to occur throughout the range of the northern long-eared bat in an estimated 8 to 13 years (see our Factor C discussion in the section titled, "White-nose Syndrome," above). Thus we have determined that the northern long-eared bat is threatened throughout its entire range.

(11) *Comment*: Several State and other commenters stated that the species should be listed as threatened rather than endangered for a variety of reasons: It would provide the Service with a better opportunity to protect the species from white-nose syndrome; we lack understanding of white-nose syndrome in the warmer regions with higher cave temperatures and shorter hibernation periods; a threatened status would allow for potential issuance of a 4(d) rule,

which would allow the Service to implement regulations that are necessary and advisable to conserve the species, due to the large geographic size of the northern long-eared bat's range and the habitat variability within the large range; and a belief that endangered status is premature until more information is available.

Our Response: For the reasons stated in the **Determination** section of this final listing rule, the Service has determined that the northern long-eared bat is a threatened species, rather than an endangered species. Please see our response to other comments, which address the reasons specified by commenters for listing the species as threatened rather than endangered.

(12) *Comment*: One state commenter did not recommend a specific status for the species, but found that the species is not in danger of extinction in the immediate future, but could become so in the future.

Our Response: As explained in the **Determination** section of this final listing rule, although WNS is predicted to spread throughout the range of the species, in the currently uninfected areas we have no evidence that northern long-eared bat numbers have declined, and the present threats to the species in those areas are relatively low. Thus, because the fungus that causes WNS (Pd) may not spread throughout the species' range for another 8 to 13 years, because no significant declines have occurred to date in the portion of the range not yet impacted by the disease, and because some bats persist many years later in some geographic areas impacted by WNS (for unknown reasons), we conclude that the northern long-eared bat is not currently in danger of extinction throughout all of its range. However, because Pd is predicted to continue to spread, we also determine that the northern long-eared bat is likely to be in danger of extinction within the foreseeable future. Therefore, on the basis of the best available scientific

and commercial information, we are listing the northern long-eared bat as a threatened species under the Act.

(13) *Comment*: Several States (Kentucky, Georgia, and Missouri) mentioned that, at the time they submitted their comments, there had not been any decline detected in northern long-eared bat population numbers. Specifically, Kentucky, and Georgia stated that the species is still commonly captured during summer surveys, even following white-nose syndrome confirmation in the State. Kentucky comments stated that the species' population in the State does not seem to be susceptible to white-nose syndrome.

Our Response: No decline has been documented in Georgia, Kentucky, or Missouri to date. However, mortality due to white-nose syndrome has been documented in cave bats in all four States, and mortality in northern long-eared bats has been documented in Kentucky and Missouri. Also, historically, there have been small numbers of northern long-eared bats found in hibernacula in these States; therefore, it is challenging to detect population changes based on hibernacula survey data alone in these States. Summer surveys, where available, often show a lower decline than corresponding hibernacula data in general. These differences likely stem from a combination of different survey techniques, differential influence of white-nose syndrome in the summer versus winter northern long-eared bat populations, and also the likelihood that the summer data do not reflect northern long-eared bat populations as well as the winter data, given the methods and locations from which they were derived. Although there may not be a decline in summer populations observed to date in these States, mortality has been documented, which indicates the species is susceptible to the disease in these States.

(14) *Comment*: Several State commenters (Oklahoma and Midwest Association of Fish and Wildlife Agencies (MAFWA) letter) mentioned that in the proposed listing rule, the Service

described different regions of the northern long-eared bat's range as separate populations and the commenter interpreted that to mean each population was a "subpopulation."

Our Response: We removed "population" from this section of the rule to address any confusion. For the purposes of organization, the northern long-eared bat's range in the United States is discussed in four parts: eastern range, Midwest range, southern range, and western range. Separating the range of the bat is not meant to imply that there are distinct or separate "subpopulations" of the species.

(15) *Comment*: State and public commenters stated that white-nose syndrome research will be impacted if the northern long-eared bat is listed, as treatments cannot be tested on listed species.

Our Response: Under section 4 of the Act, a species shall be listed if it meets the definition of an endangered or threatened species because of any (one or more) of the five factors (threats), considering solely best available scientific and commercial data. Based on our analysis of the five factors, we conclude the northern long-eared bat meets the definition of a threatened species, particularly considering the effects of WNS on the species. Research that is conducted for the purpose of recovery of a species is an activity that can be authorized under section 10 of the Act, normally referred to as a recovery permit, or can be conducted by certain State conservation agencies by virtue of their authority under section 6 of the Act. White-nose syndrome research will be important for recovery of the species, and thus the Service will continue to support such actions.

(16) *Comment*: Both State and public commenters stated that the species is more common in southeast States, Kentucky and Tennessee in particular, than was depicted in the proposed listing rule. The State of Tennessee further questions if the historical core of the species' range

is in the southern Appalachians, rather than the northeast, and commented that "Tennessee has over 9,000 caves and less than 2 percent of those have been surveyed, which could mean that there are many more locations within the [S]tate that have significant numbers of [northern long-eared bats]."

Our Response: The Act requires us to make a determination using the best available scientific and commercial data in our review of the status of the species. In the proposed listing rule, we used the best available data at the time, which did not show the species to be as common, particularly in summer surveys. Based on more thorough data provided since the October 2, 2013, proposed rule (*e.g.*, summer survey data and winter hibernacula counts, peer reviewer comments), we have since learned the species may have been more commonly encountered, historically in Kentucky and Tennessee. We have corrected this in the final listing rule within the "Southern Range" section of the *Distribution and Relative Abundance* discussion, above. With regard to the potential for additional unsurveyed hibernacula in Tennessee, this was noted in the *Distribution and Relative Abundance* discussion, above. Also, there is no reason to believe that white-nose syndrome will not reach bat hibernacula simply because these sites are not monitored. Because we have documented consistently that northern long-eared bat declines are severe once white-nose syndrome is confirmed in a site, it is reasonable to expect that northern long-eared bat declines are similar at sites that are not or cannot be monitored.

(17) *Comment*: Two States (Minnesota and Missouri) and several public commenters requested that, if the species is listed, they be included as stakeholders in designating critical habitat and developing a recovery plan and best management plans.

Our Response: The Service appreciates the interest expressed by these commenters in being involved as stakeholders and welcomes all interested parties to be involved as potential

stakeholders. We will work with stakeholders through recovery planning to identify areas that would aid in recovery of this species, and determine appropriate actions to take. The Service understands the importance of stakeholder participation and support in recovery of the northern long-eared bat and will continue to work with all stakeholders to this end.

(18) *Comment*: Several commenters, through a single letter produced by the Northeast Association of Fish and Wildlife Agencies, stated that known hibernacula containing northern long-eared bats are plentiful in many States, with 89 known in New York and 119 in Pennsylvania alone.

Our Response: Although there are a large number of known hibernacula that were historically used by northern long-eared bats, there are currently few, if any, individuals found during hibernacula surveys (post-WNS) in Pennsylvania and New York. Please refer to the *Distribution and Relative Abundance* section of this final listing rule, which discusses the current status of the species in these two States.

(19) *Comment*: Several States provided information on current and past conservation efforts that may benefit the northern long-eared bat. Also, other public comments noted that State, Federal, and private conservation efforts should be more thoroughly reviewed and included in the final listing rule. Specifically, many commenters mentioned that more weight should have been given to the 2008 white-nose syndrome plan, State white-nose syndrome plans, white-nose syndrome workshops, and State agency efforts in survey and white-nose syndrome research efforts.

Our Response: Information provided to us on additional conservation efforts has been added to the conservation efforts discussion under Factors A and C, above. It should be noted, however, that although recommendations set forth in these documents (*e.g.*, 2008 white-nose

syndrome plan, State white-nose syndrome plans), if followed, may help reduce human-aided spread of white-nose syndrome, the efforts outlined in these plans have not yet identified a method by which WNS can be halted or its impacts reduced. Also, the white-nose syndrome national plan represents guidance that is not strictly enforced by any agency. Thus, although these plans will prepare management agencies to act to stop WNS should a viable option be presented, their ability to halt WNS is not guaranteed.

(20) *Comment*: Many States in the Northeast stated that white-nose syndrome continues to impact the northern long-eared bat in their respective States and have witnessed post-WNS confirmation of mortality and severe declines. Vermont, New Hampshire, and Maine all commented that the species was considered a common species in the State prior to white-nose syndrome confirmation and is now considered rare.

Our Response: Data received during data requests sent to the States corroborate these declines due to white-nose syndrome cited by commenters. This information is presented in *Distribution and Relative Abundance* (in the "Eastern Range" and "Southern Range" sections) within the **Background** section of this final listing rule.

(21) *Comment*: One State questioned what recovery actions would need to be taken to stop the spread of white-nose syndrome throughout the northern long-eared bat's range.

Our Response: Recovery actions will be decided upon during recovery planning, after the species is listed. Recovery planning includes the development of a recovery outline shortly after a species is listed, preparation of a draft and final recovery plan, and revisions to the plan as significant new information becomes available. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. The recovery plan identifies site-specific management actions that will achieve

recovery of the species, measurable criteria that determine when a species may be downlisted or delisted, and methods for monitoring recovery progress.

(22) *Comment*: One State commented that not all white-nose syndrome spread models are in agreement on how the disease will spread. They cited a model presented at the White-nose syndrome Workshop in 2012 (Puechmaille 2012), and indicated that this model suggested that the spread and impacts of the disease presented in the proposed listing rule were significantly overestimated.

Our Response: The Puechmaille model, cited by the commenter, has been presented in evolving forms at the past several annual White-nose syndrome Workshops. The type of model used by Puechmaille may be useful in predicting suitable habitat for WNS, but it is not sufficient to predict unsuitable habitat. Further, this model cannot be used to predict spread of WNS. Given the uncertainties of the Puechmaille model (as identified by the author), we did not consider this model in making inferences about white-nose syndrome (or Pd) spread dynamics or population-level impacts to the northern long-eared bat.

(23) *Comment*: One State commenter agreed with the statement offered in the proposed listing rule that there is no information to indicate that there are areas within the species' range that will not be impacted by white-nose syndrome. Life-history information, as well as what we currently know about the disease, suggests northern long-eared bats exhibit low resiliency due to their extreme susceptibility to the disease and their low reproductive rates.

Our Response: Information provided to the Service by a number of State agencies confirms the likelihood of white-nose syndrome spreading throughout the range of the northern long-eared bat. White-nose syndrome or Pd are now detected in 28 States and 5 Canadian provinces, all of which are in the range of the species. Pd has spread over 1,000 miles (1,609

km) from the primary site of detection in New York to western Missouri, northern Minnesota, and as far south as Alabama, Arkansas, Georgia, and Mississippi. Furthermore, although there is some variation in spread dynamics and the impact of WNS on bats when it arrives at a new site, no information suggests that any site would be unsusceptible to the arrival of Pd. Given the appropriate amount of time for exposure, WNS appears to have had similar levels of impact on northern long-eared bats everywhere the species has been documented with the disease. Therefore, absent direct evidence to suggest that some northern long-eared bats that encounter Pd do not contract WNS, available information suggests that the species will be impacted by WNS everywhere in its range. See our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for more detailed information.

(24) *Comment*: Comments from Oklahoma stated that the northern long-eared bat is commonly captured in the counties where it occurs in the State, and survey results indicate the northern long-eared bat population throughout the southwestern portion of the species' range does not need protection under the Act at this time.

Our Response: We have incorporated information provided on the species' status for the northern long-eared bat in Oklahoma in the *Distribution and Relative Abundance* section of this final listing rule. As stated in response to another comment, decisions under the Act cannot be made on a State-by-State basis, but at the species, subspecies, or DPS level. When a species is listed, we work with all of our partners to develop and implement practical solutions to conserve and protect the species while enabling on-the-ground projects to move forward. The definition of "species" under the Act includes distinct population segments. For a DPS to be identified it must be markedly separated from other populations as a consequence of physical, physiological, ecological, or behavioral factors. It is unlikely, and we have no evidence, that a State boundary

would separate one State's northern long-eared bat population from northern long-eared bats in adjacent States.

(25) *Comment*: One commenter stated that more State-specific data are needed considering the ambiguity and divergence across the range of the northern long-eared bat.

Our Response: The Act requires us to make a determination using the best available scientific and commercial data after conducting a review of the status of the species. In 2014, we requested additional survey data (hibernacula and summer) from all of the States within the range of the species (and the District of Columbia) and received information from the majority of States. We have added this updated information to the *Distribution and Relative Abundance* section of this final listing rule.

(26) *Comment*: Several commenters stated that hibernacula survey data are too unreliable to base the listing decision on for the northern long-eared bat because northern long-eared bats are often overlooked in winter surveys due to their cryptic nature and the fluctuation of winter numbers, and that rather the Service should base its listing decision on summer survey data. Further, some commenters stated that the Service did not compile and review complete summer data sets maintained by State agencies.

Our Response: We agree that northern long-eared bats are often difficult to observe during winter hibernacula surveys due to their tendency to roost deep in cracks and crevices within hibernacula. Despite the difficulties in observing or counting northern long-eared bats, winter hibernacula colony counts are the recommended method, and the only method with enough history to assess trends over time, for monitoring northern long-eared bats, and hibernacula surveys are considered the best available data for cave-dwelling bats in general. However, in recognition of the limitations of these data, we do not use the available hibernacula

counts to estimate northern long-eared bat population size. Instead we use the hibernacula data to understand and estimate population trends for the species. The relative difficulty of observing northern long-eared bats during hibernacula surveys should be consistent from year to year, and these data can be used to estimate relative change in numbers and indicate if the species is increasing or decreasing in number in those hibernacula. Thus, the total data available for known northern long-eared bat hibernacula can yield an individual site and cumulative indication of species population trend; furthermore, declines estimated at hibernacula are corroborated by declines in acoustic records and net captures in summer.

In 2014, we requested all available hibernacula and summer survey data from all State fish and wildlife agencies within the range of the species and received information from the majority of States. We also requested information from States while developing the proposed listing rule. All available information at the time was included in the proposed listing rule. The majority of long-term summer monitoring estimates corroborates the trends observed in hibernating colonies. Although it is important to include all available relevant summer data, summer data likely do not reflect northern long-eared bat populations as well as the winter data, given the variability in methods and locations from which they were derived. Although we acknowledge uncertainties in both summer and winter northern long-eared bat data, we believe that the winter data, at this time, provide a more reliable estimate of population trends. The *Distribution and Relative Abundance* section of this final listing rule includes the most recent data received from States within the species' range.

(27) *Comment*: Commenters stated that the Service is making an assumption that white-nose syndrome will spread throughout the range of the northern long-eared bat. One commenter stated that bat experts do not know with any degree of certainty how WNS affects bats, how it is

transmitted, how quickly or extensively it will spread, or how it might be controlled. These commenters stated that these uncertainties in white-nose syndrome's spread make it impossible to forecast how the disease will spread and impact the species in different areas throughout its range.

Our Response: The question of if and when white-nose syndrome will spread throughout the range of the species has been considered extensively by the Service and its white-nose syndrome coordinators. Information provided to the Service by a number of State agencies demonstrates the likelihood of white-nose syndrome spreading throughout the range of the northern long-eared bat. White-nose syndrome or Pd is now detected in 28 States and 5 Canadian provinces, all of which are in the range of the species. From initial detection of white-nose syndrome in the winter of 2006-2007, Pd has spread over 1,000 miles (1,690 km) from the primary site of detection in the State of New York to western Missouri, northern Minnesota, and as far south as Alabama, Arkansas, Georgia, and Mississippi. All models we have consulted concerning the spread of white-nose syndrome predict the disease or Pd will continue to spread. As mentioned under our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above,, models that provide estimates of the timing of spread predict the disease will cover the entirety of the species' range between 2 and 40 years. However, these models all have significant limitations for predicting timing of spread, and in many instances have overestimated the time white-nose syndrome would arrive in currently uninfected counties by as much as 45 years.

As for how white-nose syndrome affects bats, how it is transmitted, and how it may be controlled, there has been a significant amount of research completed that has provided insight

into these questions. Please see our Factor C discussion in the section titled, "White-nose Syndrome," above, for a more detailed discussion.

(28) *Comment*: Several commenters, through a single letter produced by MAFWA, stated that recent survey data from Pennsylvania, a State amongst the hardest hit by WNS, indicate that hibernacula surveys may be overestimating the decline in northern long-eared bat numbers. A large 2013 sample of summer mist-netting shows that northern long-eared bat captures per unit effort (over 178,000 square-meter mist-net hours in 2001-2007; over 500,000 in 2013) remain at 24 percent of the level observed pre-WNS. In contrast, hibernacula surveys in Pennsylvania during the same time period show a 99 percent decline in northern long-eared bat observations. "These results clearly demonstrate the significant disparity between the prevalence of northern long-eared bats recorded in hibernacula surveys and in summer surveys (Turner 2014, pers. comm.)."

Our Response: Numerous counties in western Pennsylvania were not confirmed with WNS until 2012, possibly attributable to geographic barriers that hinder movements of bats between eastern and western parts of the State (Miller-Butterworth *et al*. 2014). Nevertheless, a 76 percent decline in summer captures of northern long-eared bat (standardized for effort) represents a severe decline in the population over the past 7 years. These summer monitoring estimates corroborate the severe declines observed in hibernating colonies. Furthermore, summer monitoring in Virginia from 2009 to the present revealed that declines in northern long-eared bats were not observed by VDGIF until 2 years after the severe declines were observed during winter and fall monitoring efforts in the State (Reynolds 2012, pers. comm.). Therefore, the assertion that the difference between winter estimates (99 percent decline in count) and summer estimates (76 percent decline in captures) in Pennsylvania represents a significant

disparity in the estimated impact of WNS in the State is premature and inconclusive in the context of the health of northern long-eared bat populations in Pennsylvania. Furthermore, summer monitoring in Pennsylvania reveals that declines in northern long-eared bat captures continued in 2014.

We agree that there are differences between summer and winter data for northern long-eared bat. Specifically, that summer data, where available, often show a lower decline than corresponding hibernacula data. We conclude that these differences likely stem from a combination of different survey techniques, differential influence of WNS in the summer versus winter northern long-eared bat populations, and also the likelihood that the summer data do not reflect northern long-eared bat populations as well as the winter given the methods and locations from which they were derived. Although we acknowledge uncertainties in both summer and winter northern long-eared bat data, we conclude that the winter data, at this time, provide a more reliable estimate of population trends.

(29) *Comment*: Comments from MAFWA stated that only a small proportion of known cave and mine hibernacula across the species' range have been surveyed or monitored for the northern long-eared bat. For example, "Tennessee has over 9,000 caves and less than 2 percent of those have been surveyed, which could mean that there are many more locations within the State that have significant numbers of northern long-eared bat" (TWRA 2014). The commenter stated that this is particularly true for many areas of Canada (COSEWIC 2013) and the central and western States where surveys of bat hibernacula are very limited.

Our Response: These are accurate statements. Additional counties in Tennessee have been confirmed with WNS each year since 2010. There is no reason to believe that WNS will not reach bat hibernacula simply because these sites are not monitored. We have several

examples of hibernacula that were only identified after WNS was transmitted into the area and dead and dying bats were found on the landscape. Because we have seen consistently that northern long-eared bat declines are severe once WNS is confirmed in a site, it is reasonable to expect that northern long-eared bat declines are similar at sites that are not or cannot be monitored. In 103 hibernacula throughout the East, 68 percent now have zero northern long-eared bats observed in winter surveys. An additional 24 percent have declined by more than 50 percent.

(30) *Comment*: MAFWA commented that recent research into slowing the spread of WNS has documented, in a laboratory setting, that Pd spores can be killed by *Rhodococcus rhodochrous* DAP96253 (RRDAP). They suggest that this potential treatment may increase bat survival and allow the northern long-eared bat to adapt to the presence of WNS.

Our Response: As noted by the States in this comment, strategies to slow the spread of WNS are in various early stages of development in the laboratory setting. Promising treatments, including RRDAP and others, are being considered for field trials. However, considerably more research and coordination is needed to address the safety and effectiveness of any treatment proposed for field use and to meet regulatory requirements prior to consideration of widespread application. In short, implementation of WNS treatments on a landscape-scale is likely years away.

Risks associated with application of any compound in a field setting remain largely unknown and undemonstrated when considering the additional harm to bats, other biota, or the environment. Furthermore, the RRDAP compound has not been tested on northern long-eared bats, so it has not yet been demonstrated to be safe or effective for this species. Therefore, the assertion that the treatment of bats with RRDAP or other agents may increase bat survival and

allow northern long-eared bat to survive exposure to the pathogen is unsubstantiated. No treatment in development has demonstrated any potential to allow a species to "adapt to the presence of the pathogen."

Any treatment or application demonstrated to slow the spread and mortality of WNS will be an important tool for potential recovery actions. However, we cannot predict exactly when or if a treatment will be proven safe and effective for large-scale implementation that will affect species at a population level.

(31) *Comment*: Comments from MAWFA stated that there is evidence that little brown bats in Pennsylvania are showing an increasing trend in body mass at time of hibernation (Turner 2014, pers. comm.), and others have suggested that there is evidence that larger body mass increases survival from WNS infection (Jonasson and Willis 2011). The commenters concluded that these trends suggest that *Myotid* species, like the northern long-eared bat, are capable of adapting behavioral strategies for dealing with WNS infection.

Our Response: These observations suggest that there is an increase in body masses of little brown bats at some colonies where WNS has been present for several years. They do not demonstrate an evolutionary shift in behavioral or physiological strategy. Increased body mass may be a result of lesser competition for prey during the fattening period (which may still be potentially beneficial for surviving winter with WNS). Furthermore, this pattern of increasing body masses in pre-hibernating little brown bats has not been documented widely. It is also important to note that these observations have been made in little brown bat only, and not in northern long-eared bat. Jonasson and Willis (2011) studied fat consumption over winter in hibernating little brown bats unaffected by WNS. They hypothesized that fatter bats may be

more likely to survive WNS, but they did not test this hypothesis. Likewise, the observations in Pennsylvania have not been tested for significance or repetition.

Though related, little brown bats and northern long-eared bats are distinctly different species that have exhibited different responses to Pd infection and WNS. Banding studies in the heavily affected northeastern States have confirmed that some little brown bats have survived multiple years of WNS exposure and infection, and little brown bats continue to be observed in some areas. However there is little, if any, data to support the same trend for northern long-eared bats. Efforts to band northern long-eared bat have been initiated; however, extremely low capture rates with only very few individuals banded make it difficult to examine survival trends with this species.

(32) *Comment*: One commenter disagreed that the highest rates of development in the conterminous United States occur within the range of the northern long-eared bat (Brown *et al*. 2005, p. 1856) and contribute to the loss of forest habitat. The commenter stated that forests within the range of the northern long-eared bat continue to recover from unsustainable forestry practices that were employed in the late 19th century.

Our Response: Although the commenter disagreed with the statement in the proposed listing rule with regard to rates of development within the range of the northern long-eared bat, there was no evidence presented to refute this statement. Further, information we have, in the proposed listing rule and in supporting documents, shows that rates of development and forest conversion in general within the species' range is not decreasing. For example, the USFS projected forest losses of 16 to 34 million acres (4 to 8 percent) by 2060 across the continental United States (USFS 2012).

(33) *Comment*: MAFWA stated that recent evidence documents a multitude of species in Europe coexist with the causative agent and do so by getting minimal infection and without documented mortality (Zukal *et al*. 2014). The commenter also stated that data recently presented at the 2014 WNS meeting show the amount of infection on surviving bats in the Northeast has decreased significantly from the period where mass mortality was experienced, and is now closer to the level of European infection.

Our Response: Pd and WNS were not investigated in Europe until after the disease was identified in North America. However, subsequent to the discovery of WNS in North America, European scientists have identified evidence of Pd dating back many decades, leading to the hypothesis that the fungus has been present in Europe for a long time. We cannot know what the impact of Pd has been on different bat species in Europe throughout evolutionary history. The fact that 13 species of European bats have been documented with WNS or Pd without documentation of significant declining populations has led to conclusions that those European species coexist with the disease. However, this observation does not mean WNS did not severely impact or even cause extinction of European bat species at some point in the past.

North American species differ significantly in physiology and ecology to similar species in Europe. We have gained considerable understanding of variability in impact of WNS among North American species, such as that certain species like the big brown bat and Townsend's big-eared bat appear resilient to or unaffected by the disease, while other species like the northern long-eared bat have declined substantially. Therefore, the best available data indicate there are variable response levels to WNS among bat species; northern long-eared bats are among the most susceptible species to WNS.

(34) *Comment*: One commenter stated that the impact of white-nose syndrome may have been overstated by the Service. They commented that the data used in the proposed listing rule only included known winter roost sites surveys and the rule does not state that the species could be employing behavior plasticity and using alternative roosts. This same commenter also questioned carcass testing reports, as presented in the rule, confirming only 50 percent of individuals tested positive for white-nose syndrome.

Our Response: We acknowledge that northern long-eared bats may be using alternate, often unknown or unsurveyed, winter roosts and, as a result, may be unobserved during winter. However, regardless of the type of hibernacula used, northern long-eared bats require roosts with cool, humid conditions, which are also suitable for Pd growth. As for the question of the carcass testing reports, this information was removed in the final listing rule because it was potentially misleading. A small portion of dead bats are tested for the disease, especially in areas where WNS has not been confirmed recently. Therefore, reporting on the small number of bats tested does not give an accurate depiction of the impact of the disease on the species. Principally, the northern long-eared bat is susceptible to WNS, and mortality of northern long-eared bats due to the disease has been confirmed throughout the majority of the WNS-affected range.

Tribal Comments

(35) *Comment*: One Tribe provided information related to the biology, ecology, and threats faced by the northern long-eared bat that reinforced the data and information included in the Background section of this final rule. Additionally, the commenter provided information in response to other public comments that we had received and the letters received from the

Midwest and Southeast Association of Fish and Wildlife Agencies and Regional Forester Groups and the Northeast Association of Fish and Wildlife Agencies. They also expressed their support for listing the species as endangered.

Our Response: We appreciate the input provided and incorporated it into the final rule where appropriate. For the reasons stated in the **Determination** section of this final listing rule, we have determined that the northern long-eared bat should be listed as threatened, rather than endangered. Please refer to that section for a detailed description of that determination.

Tribal Coordination

In October 2013, Tribes and multi-tribal organizations were sent letters inviting them to begin consultation and coordination with the service on the proposal to listing the northern long-eared bat. In August 2014, several Tribes and multi-tribal organizations were sent an additional letter regarding the Service's intent to extend the deadline for making a final listing determination by 6 months. A conference call was also held with Tribes to explain the listing process and discuss any concerns. Following publication of the proposed rule, the Service established 3 interagency teams (biology of the northern long-eared bat, non-WNS threats, and conservation measures) to ensure that States, Tribes, and other Federal agencies were able to provide input into various aspects of the listing rule and potential conservation measures for the species. Invitations for inclusion in these teams were sent to Tribes within the range of the northern long-eared bat. Two additional conference calls (in January and March 2015) were held with Tribes to outline the proposed species-specific 4(d) rule and answer questions. Through this coordination, some Tribal representatives expressed concern about how listing the northern

long-eared bat may impact forestry practices, housing development programs, and other activities on Tribal lands.

Public Comments

(36) *Comment*: One commenter stated that listing should be restricted to the portion of the species' range that has experienced WNS, the current threat to this species. The commenter urged the Service to, instead of listing the species rangewide, consider listing as a DPS, because the species is stable across much of its range and a DPS will "allow the Service to apply appropriate conservation measures in the area of greatest need."

Our Response: When completing a status review in response to a petition to list a species, we conduct that review across the species' range, unless the petition requests that we evaluate a different entity, such as a DPS. The petition to list the northern long-eared bat requested that we consider whether listing is warranted for the species; the petition did not specifically ask us to consider whether any DPSs warrant listing. In conducting status reviews, we generally follow a step-wise process where we begin with a rangewide evaluation. If the species does not warrant listing rangewide, we then consider the status of other listable entities. Furthermore, the Service is to exercise its authority with regard to DPSs "sparingly and only when the biological evidence indicates that such action is warranted" (Senate Report 151, 96th Congress, 1st Session). For the northern long-eared bat, we have determined that the species warrants listing as a threatened species throughout its range based on current threats (primarily due to WNS) and how those threats are likely to impact the species into the future.

(37) *Comment*: A few commenters stated that the Service did not consider the benefit offered to the species from protection of other listed species, such as the Indiana bat. One commenter further stated that because of this overlap in the ranges of the two species, there is no reason to list the northern long-eared bat.

Our Response: There have been conservation efforts that have been undertaken to benefit other federally listed species, such as the Indiana bat, within the range of the northern long-eared bat. More detailed information can be found above, under *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range*. However, prohibitions of the Act are species-specific; thus prohibitions from take would not apply to the northern long-eared bat simply due to another similar species being listed. Further, benefits to the northern long-eared bat that may occur as the result of other similar species that are listed are primarily habitat-related, and do not address the primary threat to the northern long-eared bat, WNS.

(38) *Comment*: Several commenters stated that the peer review of the proposed listing rule should have taken place prior to publication.

Our Response: In accordance with our policy published in the **Federal Register** on July 1, 1994 (59 FR 34270), we are to seek the expert opinions of at least three appropriate and independent specialists regarding proposed listing actions. We are to provide a summary of their review in the final decision, but are not required to conduct this peer review prior to the proposal. The purpose of peer review is to ensure that our final listing determination is based on scientifically sound data, assumptions, and analyses. We solicited expert opinion from seven peer reviewers with scientific expertise, including familiarity with the northern long-eared bat and its habitat, biological needs, and threats. We received responses from four of the peer

reviewers, and have addressed their comments and incorporated relevant information into this final determination.

(39) *Comment*: A few commenters stated that the proposed listing rule was rushed due to judicial settlement.

Our Response: We disagree. The Service received a petition to list the northern long-eared bat and eastern small-footed bat in 2010. We published a substantial 90-day finding on June 29, 2011 (76 FR 38095), indicating that listing these two species may be warranted and initiating a status review. Completion of the status reviews were delayed due to listing resources expended on other higher priority rulemakings. On July 12, 2011, the Service filed a multiyear work plan as part of a settlement agreement with the Center for Biological Diversity and others, in a consolidated case in the U.S. District Court for the District of Columbia. A settlement agreement in Endangered Species Act Section 4 Deadline Litigation, No. 10–377 (EGS), Multi-district Litigation Docket No. 2165 (D.D.C. May 10, 2011) was approved by the court on September 9, 2011. The settlement agreement specified that listing determinations be made for more than 250 candidate species, and specified dates for several petitioned species with delayed findings. For the northern long-eared bat, the specified date for completing a 12-month finding, and a listing proposal if that finding was warranted, was September 30, 2013, 3 years after the receipt of the petition.

(40) *Comment*: Several commenters expressed their concern as to whether unpublished data cited in the proposed listing rule were peer-reviewed.

Our Response: Under the Act, we are obligated to use the best available scientific and commercial information, which in this case included results from surveys, reports by scientists and biological consultants, natural heritage data, and expert opinion from biologists with

experience studying the northern long-eared bat and its habitat, whether published or unpublished. Additionally, we sought comments from independent peer reviewers to ensure that our determinations are based on scientifically sound data, assumptions, and analysis. We solicited information from the general public, nongovernmental conservation organizations, State and Federal agencies that are familiar with the species and its habitat, academic institutions, and groups and individuals that might have information that would contribute to our knowledge of the species, as well as the activities and natural processes that might be contributing to the decline of the species. All told, this information represents the best available scientific and commercial data on which to base this listing determination for the northern long-eared bat.

(41) *Comment*: A few commenters questioned if southern populations of northern long-eared bats are roosting in trees over the winter rather than hibernating in caves and mines and, therefore, might avoid contracting white-nose syndrome.

Our Response: Northern long-eared bats predominantly hibernate in caves and abandoned mines. There are a few documented instances of this species using other types of structures that simulate a cave-like environment that is suitable for hibernation. To date, there have been no documented cases of this species hibernating in trees. The species' physiological demands of hibernation limit selection of winter habitat to areas with relatively stable cool temperatures and humid conditions, which are the same conditions required for the persistence of Pd. See "Hibernation" in the *Biology* section of this final rule for a more complete description of habitat for the species.

(42) *Comment*: We received several comments that questioned how listing the northern long-eared bat will address or reverse the species' decline due to white-nose syndrome. One commenter stated that listing the species as "endangered" will not reverse its decline. Several

stated that habitat loss is not a threat to the species, and white-nose syndrome is the only reason for the species' decline; therefore, placing additional restrictions on activities, such as tree clearing, will have minimal impact on conserving the species and will not halt the spread of white-nose syndrome.

Our Response: No other threat is as severe and immediate for the northern long-eared bat as white-nose syndrome. If this disease had not emerged, it is unlikely the northern long-eared population would be experiencing such a dramatic decline. However, as white-nose syndrome continues to spread and cause mortality, other sources of mortality could further diminish the species' resilience or ability to survive. White-nose syndrome has significantly reduced the numbers of northern long-eared bats throughout much of its range. Small or declining populations may be increasingly vulnerable to other impacts, even impacts to which they were previously resilient. These other impacts may include indirect impact (*e.g.*, clearing important roosting or foraging habitat) or direct impact (*e.g.*, cutting down occupied roost trees while pups are non-volant). We expect that northern long-eared bat populations with smaller numbers and with individuals in poor health will be less able to persist or to rebound.

The Service believes that restrictions alone are neither an effective nor a desirable means for achieving the conservation of listed species. We prefer to work collaboratively with private landowners, and strongly encourage individuals with listed species on their property to work with us to develop incentive-based measures such as safe harbor agreements or habitat conservation plans (HCPs), which have the potential to provide conservation measures that effect positive results for the species and its habitat while providing regulatory relief for landowners. The conservation and recovery of endangered and threatened species, and the ecosystems upon which they depend, is the ultimate objective of the Act, and the Service recognizes the vital

importance of voluntary, nonregulatory conservation measures that provide incentives for landowners in achieving that objective.

(43) *Comment*: Commenters stated that information from New York and Vermont indicates that northern long-eared bat populations are holding steady or increasing.

Our Response: Contrary to information stated by this commenter, information we received from Vermont and New York indicate sharp population declines due to white-nose syndrome based on winter and summer data. Please see the "Eastern Range" section under *Distribution and Relative Abundance*, above, for a more detailed discussion of the information received from these two States. The one potential exception in New York is the Long Island population, where the species continues to be found during summer surveys. This may suggest that there may be scattered locations where this species has not been as severely impacted as other areas of eastern North America. However, these observations are unproven at this point and are the basis for ongoing research to determine the validity of a white-nose syndrome refugia hypothesis.

(44) *Comment*: One commenter stated that the Service should consider that there is a lack of evidence that mass mortality of northern long-eared bats due to white-nose syndrome is occurring outside the northeastern United States even though white-nose syndrome is continuing to spread. There have been no reported mass mortality events outside of the Northeast, and the northern long-eared bat continues to be commonly captured in mist-net surveys in some regions.

Our Response: To date, because impacts from WNS in the far South and West have not yet occurred, it is impossible to conclude that the timeframe and degree of impact will be identical. However, everything that has been observed to date suggests it will be similar. Many sites in the Northeast were infected with WNS prior to development and validation of refined molecular tools to detect Pd. Thus, a hibernaculum in the Northeast was likely confirmed with

white-nose syndrome when there were visible signs of the disease. With genetic tools, it may now be 2 to 3 years from the first detection of a Pd-positive bat at a site and visible signs of the disease in bats. Therefore, there remains some uncertainty in the applicability of the timeline observed in the Northeast to more recent observations in the Midwest and Southeast.

Additionally, there is evidence that microclimate inside the cave, duration and severity of winter, hibernating behavior, body condition of bats, genetic structure of the colony, and other variables may affect the timeline and severity of impacts at the hibernaculum level. However, evidence that any of these variables would greatly delay or reduce mortality in infected colonies has yet to surface. Some have speculated that climatic factors may extend the disease timeline or may result in lower mortality rates among bat populations in the southern United States; however, observations from the winter of 2013-2014 demonstrated the potential for white-nose syndrome-related mortality at sites believed to be in their first or second year of infection as far south as Alabama, Arkansas, and Georgia. Please see our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for more information.

(45) *Comment*: One commenter stated that reported evidence for declines due to white-nose syndrome are based on localized hibernacula surveys, which fail to provide data sufficient to document regional or rangewide abundance or trends. Consistent with this, a recent report by the Committee on the Status of Species of Risk in Ontario (COSSARO) states: Any declines that have taken place can only be inferred from pre- and post-WNS monitoring of known hibernacula. Even then, a lack of baseline population information precludes an evaluation of what proportion of the known population is represented by inferred declines, since not all hibernacula are known, let alone receive regular monitoring attention (COSSARO 2013, p. 4).

Our Response: We received hibernacula data from most States throughout the range of the northern long-eared bat. These data have been included in our analysis of the impact of white-nose syndrome on the species. The information that was included in our analysis included pre- and post- white-nose syndrome data. We agree that we may not be aware of, and thus have not been surveying, all of the northern long-eared bat hibernacula within the species' range. However, it is also extremely likely that if these sites are used by hibernating bats, they exhibit consistently cool, humid conditions suitable for Pd growth. Thus, the bats using them will in all likelihood encounter Pd during activities at swarming and staging sites where they interact with other bats, even if they hibernate in smaller groups elsewhere. We do not use the available hibernacula counts to estimate northern long-eared bat population size; rather we use the hibernacula data to understand and estimate population trends for the species.

(46) *Comment*: One commenter stated that the Service mentioned that some spread models indicate that western and southern populations of the northern long-eared bat may not be impacted by white-nose syndrome; however, in the proposed listing rule we said that this would offer the species little respite since this is on the edge of the species' range. This commenter stated that this does not represent the best scientific and commercial data available. Another commenter similarly stated that Boyles and Brack (2009) and Ehlman *et al*. (2013) describe models that predict the possibility of lower mortality at lower latitudes, due to shorter winters and shorter hibernation in southern States, leading to reduced impact of white-nose syndrome.

Our Response: The model that the commenter referenced is Hallam and McCracken. (2011), which was discussed in the proposed listing rule. Hallam and McCracken (2011) tested temperature-dependence of white-nose syndrome spread, which at the time of the model creation (2011) supported the current distribution of white-nose syndrome. Although the analysis from

this model predicted continued rapid spread throughout the United States, the model also suggested that there may be a temperature-dependent boundary in southern latitudes that may offer refuge to white-nose syndrome-susceptible bats. However, there are limitations in data availability for this model; several States in the Midwest and central regions were not included. In addition, after formation of the model, many counties below Hallam and McCracken's hypothesized temperature-dependent boundary have been confirmed with white-nose syndrome or have had Pd detected. Considering the limitations with this model, we cannot put a high degree of confidence in the conclusions drawn. Boyles and Brack (2009, p. 9) modeled survival rates of little brown bats during hibernation and determined that clustering (with other bats) and disturbances have an overall impact on survival rates during hibernation; however, there was no discussion of white-nose syndrome and its impact on cave bats. Ehlman *et al*. (2013, p. 581) developed a model using evaporative water loss at the stimulus for arousal in both healthy and white-nose syndrome-affected little brown bats. They concluded that populations experiencing shorter southern winters could persist longer than their northern counterparts when faced with white-nose syndrome. However, this is speculative at this time, as the authors acknowledged that there are few data on survival rates for the more southerly regions where white-nose syndrome has more recently spread.

(47) *Comment*: One commenter stated that the Service did not account for the limiting effects that the lower density and occurrence of hibernacula in the central United States will have on the rate of white-nose syndrome spread and its effects on the northern long-eared bat. They referred to peer review comments of A. Kurta (Nov. 12, 2013). The commenter contended that Kurta stated that such lower hibernacula density and occurrence will help protect the species from white-nose syndrome in those areas because the disease is believed to infect the species

primarily through bat-to-bat transmission in hibernacula, where the conditions required for growth of the fungus occur.

Our Response: We have no reason to believe that the northern long-eared bat will be protected from white-nose syndrome in any portion of its range, including the central United States. The statement that white-nose syndrome spread will slow because there are fewer caves or mines serving as hibernacula in the western portion of the northern long-eared bat's range conflicts with the assertion made by other commenters that the northern long-eared bat will use a wide variety of sites as hibernacula (not just caves and mines). White-nose syndrome has been confirmed at numerous hibernacula that are not caves or mines (but with similar habitat conditions), including culverts, bunkers, forts, tunnels, excavations, quarries, and even houses. In addition, all models concerning the spread of white-nose syndrome predict the disease or Pd will continue to spread throughout the range, including the central United States. Models that provide estimates of the timing of spread, predict the disease will cover the entirety of the species' range (within the models limited geographic limits: the United States) by sometime between 2 and about 40 years (see our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for more information). These models all have significant limitations for predicting timing of spread and in many instances have overestimated when WNS would arrive in currently unaffected counties, in one case by as much as 45 years. Limitations include underestimating availability of non-cave hibernacula, lacking relevant biological variables of affected species, excluding spread through Canada or counties with insufficient data, and the fact that Pd is expanding its ecological niche in North America by demonstrating its viability in previously unexposed environments.

(48) *Comment*: One commenter suggested that the Service direct its efforts toward determining the exact original cause of white-nose syndrome, possible treatment strategies for bats, assessing under what conditions the fungus is transmitted and how it spreads, determining what the optimal environmental conditions are that allow the growth and transmission of the fungus, determining what is driving the spread of the fungus, and determining the differences in those colonies affected and unaffected by white-nose syndrome. This commenter stated that only when this critical information is known would the Service be able to determine appropriate listing actions, if necessary.

Our Response: Current knowledge on the cause of the disease, how and under what conditions the fungus is transmitted, how it spreads, and the optimal conditions that allow the growth of the fungus are explained in detail under our Factor C discussion in the section titled, "White-nose Syndrome," above. As for treatment of the disease, the Service leads the national response to white-nose syndrome and supports research and actions identified in the national response plan to contain white-nose syndrome and develop treatments or controls. The Service has granted more than $19.5 million to institutions and Federal and State agencies for research and response actions. Containment strategies are intended to slow the spread of WNS and allow time to develop management options; they are not part of a recovery plan for affected species. There are a number of promising treatments currently in development, and in various stages of the research process. However, considerably more research and coordination is needed to address the safety and effectiveness of any treatment proposed for field use and to meet regulatory requirements prior to consideration of widespread application. In short, implementation of WNS treatments on a landscape-scale is likely years away. The multi-agency and multi-organization white-nose syndrome response team has and continues to develop

recommendations, tools, and strategies to slow the spread of white-nose syndrome, minimize disturbance to hibernating bats, and improve conservation strategies for affected bat species. This collaboration will also prepare management agencies to implement WNS mitigation strategies once the strategies are validated. Information on some of these products developed by the response team can be found in our Factor C discussion in the section titled, "Conservation Efforts to Reduce Disease or Predation," above. If listing is warranted, the Act requires us to list a species regardless of whether listing will ameliorate the threat to the species.

(49) *Comment*: During the second public comment period, one commenter requested a public hearing be held in Crook County, Wyoming. This commenter further stated that they were not given sufficient notice of the first public comment period.

Our Response: In response to the request from Crook County, Wyoming, to hold a public hearing, the Service held a public hearing in Sundance, Wyoming, on December 2, 2014. We consider the comment periods described in the introductory text of this section of the final rule (**Summary of Comments and Recommendations on the Proposed Listing Rule**) to have provided the public a sufficient opportunity for submitting both written and oral public comments. We contend that there has been adequate time for comment, as we accepted public comments on the proposed listing rule for the northern long-eared bat for a total of 240 days.

(50) *Comment*: Commenters stated that there is no information provided in the status review to indicate that the proposed listing or development of a recovery plan would reverse the species' decline.

Our Response: If listing is warranted, the Act requires us to list a species based on one of the five factors, alone or in combination. Disease is one of these factors to be considered. In making a determination as to whether a species meets the Act's definition of an endangered or

threatened species, under section 4(b)(1)(A) of the Act the Secretary is to make that determination based solely on the basis of the best scientific and commercial data available. The question of whether there may be some positive benefit of listing the species is not considered in the decision process, only if the species meets the definition of an endangered or threatened species.

(51) *Comment*: Commenters stated that the listing should not be used as a funding mechanism to conserve the species.

Our Response: Although there are some funding opportunities available to promote recovery of listed species (*e.g.*, grants to the States under section 6 of the Act, funding through the Service's Partner's for Fish and Wildlife Program), we are required to make our determination based on the best scientific and commercial data available at the time of our rulemaking. The potential availability of funding does not enter into this decision of whether listing is warranted for a species. Instead we adhere to the requirements of the Act, to determine whether a species warrants listing based on our assessment of the five-factor threats analysis. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

(52) *Comment*: Several commenters stated that, in the proposed listing rule, the northern long-eared bat was described as "commonly captured" during summer surveys, which contradicts presented winter survey data.

Our Response: The information presented in the "Distribution and Abundance" section of the proposed listing rule described the historical distribution and abundance of the species prior to detection of white-nose syndrome in a given State or portion of a State. This section has been changed to *Distribution and Relative Abundance* in this final listing rule and includes a description of historical and current status to better reflect the current distribution and trend information for the species. The species is often "commonly captured" during summer surveys in areas within its range where it has not been impacted by white-nose syndrome; however, in areas where the disease has been present for a longer period of time (the Northeast in particular), the species is no longer commonly captured even in summer surveys. Please see the *Distribution and Relative Abundance* section, above, for more detailed information.

(53) *Comment*: One commenter stated that we did not provide any evidence to support the notion that other factors are acting in combination with white-nose syndrome to reduce the viability of the species.

Our Response: Although we have not been able to directly observe the impact of these other factors in combination of white-nose syndrome, we contend that it is reasonable to expect that with populations that have been reduced due to white-nose syndrome, any additional stressors have the potential to reduce viability. However, depending on the type of stressor, the scale of impact may differ (rangewide vs. colony-level impact). Peer reviewers of the proposed listing rule concurred with the Service's assessment that cumulative impacts may result from other (other than white-nose syndrome) factors in addition to white-nose syndrome due to a

diminished population. The Act requires us to determine if these other factors affect the northern long-eared bat's ability to persist following the effects of white-nose syndrome. Our continuing analyses are strengthening our understanding of these factors and helping us identify ways to address them.

(54) *Comment*: One commenter stated that the proposed listing rule's discussion of Factor C (disease or predation) includes various hypotheses of the causal connection between WNS and morbidity in the northern long-eared bat, but the Service admits that "the exact process by which WNS leads to death remains undetermined."

Our Response: Although the exact process or processes by which WNS leads to death remains unconfirmed, we do know that the fungal infection is responsible and it is possible that reduced immune function during torpor compromises the ability of hibernating bats to combat the infection. See our Factor C discussion in the section titled, "White-nose Syndrome," above, for a more detailed discussion on white-nose syndrome and mortality in bats.

(55) *Comment*: One commenter stated their concern that potential seasonal forest management restrictions due to the listing will have detrimental impacts to their local forest industry and forest dependent communities, which will outweigh benefits to the species.

Our Response: In making a determination as to whether a species meets the Act's definition of an endangered or threatened species, under section 4(b)(1)(A) of the Act the Secretary is to make that determination based solely on the basis of the best scientific and commercial data available. The Act does not allow us to consider the impacts of listing on economics or humans activities whether over the short term, long term, or cumulatively. The question of whether there may be some positive benefit to the listing cannot by law enter into the determination. The evaluation of economic impacts comes into play only in association with the

designation of critical habitat under section 4(b)(2) of the Act. Therefore, although we did not consider the economic impacts of the proposed listing, as such a consideration is not allowable under the Act, we will consider the potential economic impacts of a critical habitat designation (if prudent), including the potential benefits of such designation.

(56) *Comment*: One commenter stated that the Service should delay listing of the species for a minimum of 3 years while work continues to develop a solution to combat the disease.

Our Response: If listing is warranted, the Act requires us to list a species regardless of if listing will ameliorate the threat to the species. We are required to make our determination based on the best scientific and commercial data available at the time of our rulemaking. The Act requires the Service to publish a final rule within 1 year from the date we propose to list a species unless there is substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination or revision concerned, but only for 6 months and only for purposes of soliciting additional data. Based on the comments received and data evaluated, we determined that an extension was necessary. However, we are able to extend the listing determination by 6 months and cannot extend the determination by 3 years, as recommended. As stated in response to a previous comment, there are a number of promising treatments currently in development, and in various stages of the research process. However, these potential treatments are still being analyzed in a clinical setting, and potential application outside of the laboratory is years away.

(57) *Comment*: Several commenters stated that more time is needed to complete population surveys for the northern long-eared bat before making a listing determination.

Our Response: Our Policy on Information Standards under the Act (published in the Federal Register on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the

Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106-554; H.R. 5658)), and our associated Information Quality Guidelines (http://www.fws.gov/informationquality/), provide criteria and guidance, and establish procedures to ensure that our decisions are based on the best scientific data available at the time of our rulemaking. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to determine if a species warrants listing. Surveys completed after listing will continue to inform actions taken to conserve and recover the species.

(58) *Comment*: One researcher commented that results from his research show that Pd and WNS should be expected to occur in regions consistent with much of the current U.S. range of the northern long-eared bat in a relatively short time period, and demonstrated the potential spread to the majority of the contiguous United States. Further their model (Maher *et al*. 2012) showed that the spread rate increased with longer winters, suggesting that spread of Pd and WNS in the northern range of the species will be faster.

Our Response: We appreciate this comment and have added this information to our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above. This information supports information in this final listing rule regarding the spread of white-nose syndrome within the northern long-eared bat's range.

(59) *Comment*: One commenter notes that information presented in the proposed listing rule stated that summer surveys in the Northeast have confirmed rates of decline observed in northern long-eared bat hibernacula data post-WNS, with rates of decline ranging from 93 to 98 percent; however, the extent of that summer survey data is not given, so it is unclear how

expansive the sample might have been, or how consistent all of the surveys were spatially across time.

Our Response: We have taken this comment into consideration and have further explained where and when declines have been observed within the species' range in the *Distribution and Relative Abundance* section of this final rule.

(60) *Comment*: Commenters stated that population declines of more than 90 percent in the core of the species' range, with more declines predicted due to WNS, constitutes a present danger of extinction throughout all or a significant portion of its range. The population declines do not represent a mere [likelihood] of becoming an endangered species within the foreseeable future, rather endangerment "is not just a possibility on the horizon, endangerment is already here."

Our Response: As explained in the **Determination** section of this final rule, although WNS is predicted to spread throughout the range of the species, in the currently uninfected areas we have no evidence that northern long-eared bat numbers have declined, and the present threats to the species in those areas are relatively low. Thus, because the fungus that causes WNS (Pd) may not spread throughout the species' range for another 8 to 13 years, because no significant declines have occurred to date in the portion of the range not yet impacted by the disease, and because some bats persist many years later in some geographic areas impacted by WNS (for unknown reasons), we conclude that the northern long-eared bat is not currently in danger of extinction throughout all of its range. However, because Pd is predicted to continue to spread, we also determine that the northern long-eared bat is likely to be in danger of extinction within the foreseeable future. Therefore, on the basis of the best available scientific and commercial information, we are listing the northern long-eared bat as a threatened species under the Act.

(61) *Comment*: One commenter stated that the Service did not adequately cultivate its partnership with the States when developing the proposed listing rule and stated that it is imperative that the final decision consider regional differences relative to the status of the species, as specifically identified by the State wildlife agencies.

Our Response: We requested all relevant data and information from States and Federal agencies prior to publishing the proposed rule. Additionally, in 2014, we requested all available hibernacula and summer survey data from all State fish and wildlife agencies within the range of the species to ensure the most up-to-date survey information was included in this final listing rule; we received information from the majority of States. Also, following publication of the proposed listing rule, the Service established three interagency teams to ensure that States, Tribes, and other Federal agencies were able to provide input into various aspects of the listing rule and potential conservation measures for the species. The three teams are: Biology of the Northern long-eared bat, Non-WNS Threats, and Conservation Measures. Invitations for inclusion in these teams were sent to all State agencies within the range of the northern long-eared bat. Further, MAFWA hosted a meeting in Bloomington, Minnesota, in October 2014, and invited biologists and foresters from all State agencies within the species' range to discuss the potential listing of the northern long-eared bat and conservation measures. The information presented in the resulting letters from several regions of the fish and wildlife and forestry associations were considered and included in this final listing determination.

(62) *Comment*: Several commenters addressed the Northern Long-eared Bat Interim Planning and Conference Guidance.

Our Response: The Interim Planning and Conference Guidance was designed for use until the publication of this final rule. While aspects of this guidance may be included in the

recovery plan for northern long-eared bat, the guidance itself does not constitute a recovery plan. We appreciate these comments and will consider them in developing a recovery plan or any potential future consultation guidelines for the species.

(63) *Comment*: One commenter stated that, although no scientific research technique is perfect, (as stated by Ingersoll *et al*. 2013) hibernacula surveys are the most reliable and consistent datasets currently available for long-term, regional studies of North American bats.

Our Response: We agree that hibernacula surveys are the recommended method, and the only method with enough history to assess trends over time, for cave-dwelling bats, including the northern long-eared bat. In this final listing rule, we use the hibernacula data (in addition to summer data) to understand and estimate population trends for northern long-eared bat. The relative difficulty of observing northern long-eared bats during hibernacula surveys should be consistent from year to year, and these data can be used to estimate relative change in numbers and indicate if the species is increasing or decreasing in number in those hibernacula. Thus, the total data available for known northern long-eared bat hibernacula can yield an individual site and cumulative indication of species population trend; declines estimated at hibernacula are corroborated by declines in acoustic records and net captures in summer.

(64) *Comment*: One commenter stated that although the Service finalized its policy regarding interpretation of “significant portion of its range” during the comment period on the proposed listing for the northern long-eared bat, the Service should not rely on this policy in its final determination. The commenter asserted that the information in the proposed listing rule does not support that any portion the bat’s range is "significant.”

Our Response: The Service finalized its policy on the interpretation of the phrase “significant portion of its range” in the Act’s definitions of “endangered species” and “threatened

species" on July 1, 2014 (79 FR 37577). This policy became effective on July 31, 2014, and the Service is now applying that interpretation to its listing determinations as a matter of agency policy. According to that final policy, an analysis of whether a species is endangered or threatened in a significant portion of its range is only undertaken when a species is found to not warrant listing under the Act throughout its range. We have determined that the northern long-eared bat warrants listing as a threatened species throughout its range, and, therefore, we did not conduct an SPR analysis for the species in this final listing determination.

(65) *Comment*: One commenter suggested that northern long-eared bats may have greater potential for survivability because they roost singly rather than clustering in larger groups as do other species during hibernation.

Our Response: The northern long-eared bat occasionally can be found in clusters with other bats, but typically is found roosting singly during hibernation. Although the species does not roost in clusters as much as other cave-bat species during hibernation, there are other life-history factors that are believed to increase the northern long-eared bat's susceptibility to white-nose syndrome in comparison to other cave bat species (*e.g.*, proclivity to roost in areas with increased humidity of hibernacula, longer hibernation time period). See our Factor C discussion in the section titled, "Effects of White-nose Syndrome on the Northern Long-eared Bat," above, for a more detailed discussion.

(66) *Comment*: Several commenters stated that forest practices conducted in Minnesota on County and other managed lands provide habitat for the northern long-eared bat and that properly managed forest has not affected northern long-eared bat populations.

Our Response: We state within the five-factor analysis (**Summary of Factors Affecting the Species)** that other factors (other than white-nose syndrome, including forest management)

are not believed to be contributing the to the current decline species-wide. However, there could be localized impacts from these other stressors, such as forest management. Further, cumulative impacts may result from these other factors in addition to white-nose syndrome due to a diminished population in the future. See our Factor A discussion in the section titled, "Summer Habitat," above, for a more detailed discussion of forest management and its impact on the northern long-eared bat.

(67) *Comment*: One commenter stated that listing the northern long-eared bat would negatively impact the species, because the presumed logging restriction would result in a loss of revenues from reduced logging profits and force the county to sell property, resulting in habitat fragmentation.

Our Response: In making a determination as to whether a species meets the Act's definition of an endangered or threatened species, under section 4(b)(1)(A) of the Act the Secretary is to make that determination based solely on the basis of the best scientific and commercial data available. The question of whether there may be some positive benefit to the listing cannot by law enter into the determination. The evaluation of economic impacts comes into play only in association with the designation of critical habitat under section 4(b)(2) of the Act. Therefore, although we did not consider the economic impacts of the proposed listing, as such a consideration is not allowable under the Act; we will consider the potential economic impacts of the critical habitat designation, including the potential benefits of such designation.

(68) *Comment*: Several commenters cited Ingersoll *et.al*. (2013) as evidence that the northern long-eared bat was in decline prior to the onset of white-nose syndrome.

Our Response: The Service reviewed the Ingersoll *et al*. (2013) paper and was not able to find support for the conclusion that commenters made. Based on a sampling of data from four

States during an 11- to 12-year period, the models utilized in Ingersoll did not treat hibernacula or time periods with and without WNS separately. Thus, there is no way to identify the impact of WNS on the model results, nor to show a pre-WNS model versus a post-WNS model. Moreover, the authors interpret their results to suggest that northern long-eared bat population declines did not increase as a result of WNS. The weight of other available evidence contradicts this interpretation, and still supports the conclusion that the bat was not imperiled prior to WNS.

(69) *Comment*: One commenter stated that "climate change does not pose a threat to the [northern long-eared bat]" and asserted that "the Service should not reevaluate potential climate change impacts on the [northern long-eared bat]" as the species is unlikely affected by climate change because they are roosting generalists, they are unlikely to become water stressed, and they are not limited to a northern latitude range, but rather occupy a large geographic range.

Our Response: Under the Act, we include consideration of observed or likely environmental effects related to ongoing and projected changes in climate. The information presented in the "Climate Change" section under the Factor E discussion of this final listing rule thoroughly addresses the potential effects of a changing climate on the northern long-eared bat using the best available science.

(70) *Comment*: One commenter questioned whether Pd could grow and reproduce on non-bat substrates, and consequently spread to caves with no bats present. The commenter further states that the northern long-eared bat should not be listed to "get ahead" of WNS, as the potential future effects of WNS may or may not occur.

Our Response: Lorch *et al.* (2014) determined that Pd remains viable in cave substrate even in the absence of bats. Additionally, Reynolds *et al.* (2015) concluded that this persistence is sufficient to allow Pd to spread in the absence of bats, and determined that the potential for Pd

to proliferate in the absence of bats greatly increases the possibility of this manner of spread. Regardless of the ability of Pd to grow and reproduce on its own, the best science supports the supposition that white-nose syndrome is the primary and current cause of the decline of the northern long-eared bat. Pd or white-nose syndrome has currently been detected in 28 U.S. States and 5 Canadian provinces in the range of northern long-eared bat. All models consulted on the spread of white-nose syndrome have predicted a continued spread of Pd. We have determined that the northern long-eared bat meets the definition of a threatened species under the Act based on its current status and what we can reasonable predict will occur in the future.

(71) *Comment*: One commenter was concerned that listing the northern long-eared bat "could result in detrimental effects to current and future efforts to recover and provide suitable habitat for other threatened, endangered, and sensitive species" while not addressing the primary threat of WNS. The commenter stated that other species may depend on some forest management for needed travel corridors, forest stand heterogeneity, and other activities.

Our Response: While it is true that WNS is the primary threat to the northern long-eared bat (as discussed in **Summary of Factors Affecting the Species**), forest management and other stressors could have localized impacts, as well as cumulative impacts in conjunction with WNS. For a more detailed discussion of forest management and its impact on the northern long-eared bat, please see our Factor A discussion in the section titled, "Summer Habitat," above.

(72) *Comment*: Several commenters stated that the proposed listing rule overstated the impact from shale gas development. Commenters stated that the statements in the proposed listing rule regarding the number of wells projected and disturbance do not take into account the evolution and shift of technology of horizontal drilling and minimizing disturbance. Also, the

surface disturbance created by the development of shale is temporary and many States require site restoration and reclamation as part of the permit and construction process.

Our Response: As stated previously with regard to threats other than WNS, although shale gas development may impact the species at a local level, it is not believed to be independently impacting the species rangewide.

(73) *Comment*: One commenter stated that the listing proposal does not adequately address the status of the northern long-eared bat in Canada. Currently, one third of its estimated geographic range lies within Canada, yet few data exist from this portion of the range from which a current status assessment or population trend can be drawn. Without comprehensive data from this large portion of the northern long-eared bat's geographic range, we cannot support the concept that this species is in danger of extinction.

Our Response: In 2014, the northern long-eared bat was determined, under an emergency assessment, to be endangered under the Canadian (SARA) (Species at Risk Public Registry 2014). It is estimated that approximately 40 percent of its global range is in Canada (COSEWIC 2012, p. 9; Species at Risk Public Registry 2014). Despite limited survey information on the species in Canada, the decision was made to list the species under SARA because "the imminent threat posed by WNS to these three bat species [northern long-eared bat, little brown bat, and tri-colored bat] were substantiated by verifiable evidence, which included evidence of the declines to these bats in Canada and the United States." WNS has been identified in five Canadian provinces: Ontario, Quebec, Prince Edward Island, Nova Scotia and New Brunswick.

(74) *Comment*: Several commenters stated that the impact from the oil and gas industry on the northern long-eared bat is low because the technology of drilling is changing, thus

minimizing disturbance. These commenters stated that the discussion included in the proposed listing rule did not adequately address this issue.

Our Response: We acknowledge in this final rule that the footprint of oil and gas projects may be lessened by this new technology, and that some impact may be temporary in nature (see our Factor A discussion in the section titled, "Summer Habitat," above). However, gas extraction continues to expand across the range of the northern long-eared bat and is still viewed as a type of forest conversion that may result in direct or indirect impact to the species, comparable to other forms of forest conversion. Although there could be localized impacts to northern long-eared bat populations from forest conversion relating to oil and gas development, factors other than white-nose syndrome are not believed to be contributing to the current decline of the species rangewide.

(75) *Comment:* One commenter presented two recently published models, Alves *et al.* (2014) and Escobar *et al.* (2014), which address WNS spread throughout North America and urged careful consideration of each model in estimating the potential spread of WNS across the range of the northern long-eared bat. This commenter stressed the limitations of these models in predicting the rate of spread; however, they acknowledged that one of the models (Escobar *et al.* (2014) predicted WNS will continue to spread to all suitable areas.

Our Response: We concur with the commenter's concerns regarding the limitations in using these models in predicting the rate of spread of WNS throughout the northern long-eared bat's range. Both Alves *et al*. (2014) and Escobar *et al*. (2014) are maximum entropy models, which are not effective for predicting areas unsuitable for Pd. Although these models may be useful in determining suitable habitat for Pd, they should not be used to predict or identify unsuitable habitat. For example, several sites predicted to be unsuitable for Pd by Alves *et al*.

(September 2014) have already been confirmed with the disease. Due to these limitations, we have not used these models in arriving at the potential rate of spread of WNS across the northern long-eared bat's range.

(76) *Comment*: One organization commented that, since the Service proposed the species as endangered, we cannot decide to change the status to threatened in the final rule without first proposing the species as threatened and providing the public an opportunity to comment on that determination.

Our Response: In a proposed rule, the Service proposes the status it believes is warranted for the species, based on the information it has available at that time. After publishing that proposal, we seek comments on the underlying data and information used in that proposal, including the factors the Service considers in making a listing determination. In our final rulemaking, we analyze additional information and data received in peer review and public comments and testimony. Based on information received, in that final rulemaking we may take one of the following actions: 1) publish a final listing rule as originally proposed, or as revised, because the best available biological data support it; or 2) withdraw the proposal because the biological information does not support listing the species. Thus, any time that we propose a species for listing, regardless of whether we propose to list the species as a threatened species or an endangered species, there are three possible outcomes of the rulemaking process: listing the species as endangered, listing the species as threatened, or withdrawing the proposed rule (and not listing the species). To use the terminology of case law regarding APA rulemaking, any of those three outcomes is necessarily a logical outgrowth of any proposed listing rule. Note also that the commenter did not argue (nor could it) that we must reopen a comment period before we determine to withdraw a proposed rule to list a species as endangered. It stands to reason that we

could also determine to list as threatened, a result that diverges from a proposed endangered listing much lesser degree that a withdrawal, without reopening a comment period.

Furthermore, in this instance, the public was given additional notice that the Service may consider listing the species as threatened instead of endangered when it published a proposed species-specific rule under section 4(d) of the Act. Such 4(d) rules may only be considered for species listed as threatened. With the multiple public comments periods held on the proposal, the public was provided ample opportunity to comment on the listing status determination, and in fact, we received numerous comments on our proposal to list the northern long-eared bat that specifically addressed the status determination.

Determination

Our listing determination is guided by statutory definitions of the terms "endangered" and "threatened." The Act defines an endangered species as any species that is "in danger of extinction throughout all or a significant portion of its range" and a threatened species as any species "that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future." The Service has further determined that the phrase "in danger of extinction" can be most simply expressed as meaning that a species is "on the brink of extinction in the wild." See December 22, 2011, Memorandum from Acting FWS Director Dan Ashe Re: Determination of Threatened Status for Polar Bears [hereinafter the "Polar Bear Memo"]. In at least one type of situation, where a species still has relatively widespread distribution, but has nevertheless suffered ongoing major reductions in numbers, range, or both as a result of factors that have not been abated, the Service acknowledges that no distinct determination exists

between “endangered” and “threatened.” In such cases:

> Whether a species . . . is ultimately an endangered species or a threatened species depends on the specific life history and ecology of the species, the nature of the threats, and population numbers and trends. Even species that have suffered fairly substantial declines in numbers or range are sometimes listed as threatened rather than endangered (Polar Bear Memo, p. 6).

As discussed in more detail below, the northern long-eared bat resides firmly in this category where no distinct determination exists to differentiate between endangered and threatened. Therefore, our determination that this species is threatened is guided by the best available data on the biology of this species, and the threat posed by white-nose syndrome.

In determining whether to list the northern long-eared bat, and if so, whether it should be listed as endangered or as threatened, we are also guided by specific criteria set forth in section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, establishing procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

As discussed in detail below, we find that the northern long-eared bat is appropriately categorized as a threatened species. As discussed in detail under Factor C, in the sections titled

"White-nose Syndrome" and "Effects of White-nose Syndrome on the Northern Long-eared Bat," WNS has impacted the species throughout much of its range, and can be expected to eventually (from 2 to 40 years based upon models of WNS spread dynamics, but more probably within 8 to 13 years) spread and impact the species throughout its entire range. Once WNS becomes established in new areas, we can expect similar, substantial losses of bats beginning in the first few years following infection (Factor C). There is currently no effective means to stop the spread of this disease, or to minimize bat mortalities associated with the disease. The spread of WNS and its expected impact on the northern long-eared bat are reasonably foreseeable, and thus the species is likely to become an endangered species within the foreseeable future.

The Service also concludes, however, that while the species is likely to become an endangered species within the foreseeable future, it is not at the present time in danger of extinction. Stated another way, the species is not currently "on the brink" of extinction. In the time since our 2013 proposal to list the species as endangered, we have received and considered voluminous input on this issue. We have also obtained and carefully considered another 18 months of data and knowledge regarding the continuing effects of WNS on the species, and the prospects for spread of the disease throughout the entire range of the species. Since publication of the proposed rule in 2013, we have also received new population estimates for the species in some parts of its range. Several factors, in the aggregate, support a finding that the species is not currently endangered. For example, WNS has not yet been detected throughout the entire range of the species, and will not likely affect the entire range for some number of years (again, most likely 8 to 13 years). In addition, in the area not yet affected by WNS (about 40 percent of the species' total geographic range), the species has not yet suffered declines and appears stable (see *Distribution and Relative Abundance*, above). Finally, the species still persists in some areas

impacted by WNS, thus creating at least some uncertainty as to the timing of the extinction risk posed by WNS. Even in New York, where WNS was first detected in 2007, small numbers of northern long-eared bats persist (see *Distribution and Relative Abundance*, above) despite the passage of approximately 8 years. Finally, coarse population estimates where they exist for this species indicate a population of potentially several million northern long-eared bats still on the landscape across the range of the species (see *Distribution and Relative Abundance*, above). No one factor alone conclusively establishes whether the species is "on the brink" of extinction. Taken together, however, the data indicate a current condition where the species, while likely to become in danger of extinction at some point in the foreseeable future, is not on the brink of extinction at this time.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the northern long-eared bat. There are several factors that affect the northern long-eared bat; however, no other threat is as severe and immediate to the species persistence as WNS (Factor C). This disease is the prevailing threat to the species, and there is currently no known cure. While we have received some information concerning localized impacts or concerns (unrelated to WNS) regarding the status of the northern long-eared bat, it is likely true that many North American wildlife species have suffered some localized, isolated impacts in the face of human population growth and the continuing development of the continent. Despite this, based upon available evidence, the species as a whole appears to have been doing well prior to WNS.

Since WNS was first discovered in New York in 2007, the northern long-eared bat has experienced a severe and rapid decline in numbers, in the areas affected by the disease. As discussed in detail in Factor C, the available data (winter and summer surveys) indicate

reductions in northern long-eared bat numbers due to WNS. Summer data, although more limited, indicate similar trends to those found in hibernacula surveys. Declines documented in summer surveys are sometimes smaller than the declines shown by winter/hibernacula surveys. For example, in Pennsylvania, pre and post-WNS winter surveys showed a 99 percent decline, with summer surveys showing a 76 percent decline. Unfortunately, summer data tend to show a continuing decline (*e.g.*, by 15 percent annually in Pennsylvania), which is likely to ultimately mirror the higher declines documented during the winter. We do not fully understand the reason for the difference, or "lag" between winter and summer trend data. Nonetheless, both winter and summer data ultimately corroborate one another to demonstrate declines in this species due to WNS; these data support our conclusion that the species is likely to become endangered within the foreseeable future.

Determining whether the northern long-eared bat is "in danger of extinction," and thus either "endangered" or "threatened" under the Act, requires some consideration of the impact of the decline in numbers (as discussed under Factor C and summarized above) on the species' viability. We do not have firm rangewide population size estimates for this species (pre-WNS or post-WNS), nor do we have the benefit of a viability analysis. Nonetheless, principles of conservation biology are instructive in determining the impact of WNS on the viability of this species. Viability can be measured generally by a species' levels of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 301–321). Resiliency means having the ability to withstand natural environmental fluctuations and anthropogenic stressors over time; redundancy means having a sufficient number of populations and distribution to guard against catastrophic events; and representation means having sufficient genetic and ecological diversity to maintain adaptive potential over time.

The presence of surviving northern long-eared bats in areas infected by WNS for up to 8 years creates at least some question as to whether this species is displaying some degree of long-term resiliency. It is unknown whether some populations that have survived the infection are now stabilizing at a lower density or whether the populations are still declining in response to the disease, and whether those populations have been reduced below sustainable levels. In the long term, based upon our best understanding of conservation biology, we believe the declines seen in this species may be unsustainable (see *Biology*, above). Finally, it is also unclear whether the response of bats to Pd in Europe has utility in predicting the long-term viability of bats in North America in response to Pd, as bats in Europe are thought to have evolved with the fungus (Factor C). But we must acknowledge at least some uncertainty as to whether species numbers in the WNS-affected areas in North America represent dramatically reduced, but potentially sustainable, populations. Given that we do not as of yet have a means to stop the spread of WNS and we anticipate the same impact (high mortality) observed to date to occur as WNS spreads across the range, substantial losses in redundancy and representation are likely as well. Thus, we believe it is likely that the northern long-eared bat will decline to the point of being "in danger of extinction."

Having established that the northern long-eared bat is likely to decline to the point of being "in danger of extinction," we next focus on the timing of when the species will reach the point of being "in danger of extinction." In areas currently affected by WNS, there have clearly been significant population effects due to the disease. To date, however, WNS has not yet extended throughout the species' range. In the proposed listing rule, we concluded that the species was "endangered" (i.e., in danger of extinction presently), as we believed that the rate of decline was unsustainable and WNS spread throughout the range was likely. In the listing

proposal we also stated that WNS spread throughout the range would occur in the short term, but did not explicitly determine the timeframe. As explained under Factor C, the WNS spread models are not particularly useful in establishing a specific timeframe; together, these models indicate spread of WNS throughout the range by sometime between 2 and 40 years. Because of the lack of clarity on rate of spread obtained from the models, we believe it is more scientifically relevant to look at the rate of spread that has occurred to date on the landscape as a guide for the timeframe of WNS spread across the species' entire range. Using the data compiled to date, the fungus that causes WNS appears to have spread in all directions in North America, moving southwest at an average of over 175 miles (280 km) per year, but expanding in every direction where bats live. At this rate, the fungus will extend throughout the bat's entire range in about 8 to 9 years (Service 2015, unpublished data). Finally, we note that the Canadian COSEWIC recently estimated that Pd and/or WNS would spread through the entire range of the northern long-eared bat within 12 to 15 years (COSEWIC 2013, p. xiv). Taking into account the passage of time since publication of the COSEWIC estimate, we will place the Canadian estimate of the spread of Pd and/or WNS throughout the full range of the species to be 10 to 13 years. Taken together, we conclude that the best estimate of the spread of Pd throughout the range of the northern long-eared bat is likely between 8 and 13 years , noting that there is typically a delay (up to several years) in the onset of the disease from the first arrival of the fungus..

Although Pd/WNS is predicted to spread throughout the range of the species by 2023–2028, in the currently uninfected areas, northern long-eared bat numbers have not declined, and the present threats to the species in those areas are relatively low. The presence of potentially millions of northern long-eared bats across the species' range (see *Distribution and Relative Abundance*, above), while by no means dispositive in its own right, also indicates a current

condition in which species is not "on the brink" of extinction. Because the fungus/disease may not spread throughout the species' range for another 8 to 13 years, because no significant declines have occurred to date in the portion of the range not yet impacted by the disease, and because some bats persist many years later in some geographic areas impacted by WNS (for unknown reasons), we conclude that the northern long-eared bat is not currently in danger of extinction throughout all of its range. However, because Pd is predicted to continue to spread, we also determine that the northern long-eared bat is likely to be in danger of extinction within the foreseeable future. Therefore, on the basis of the best available scientific and commercial information, we are listing the northern long-eared bat as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. Because we have determined that the northern long-eared bat is threatened throughout all of its range, no portion of its range can be "significant" for purposes of the definitions of "endangered species" and "threatened species." See the Final Policy on Interpretation of the Phrase "Significant Portion of Its Range" in the Endangered Species Act's Definitions of "Endangered Species" and "Threatened Species" (79 FR 37577, July 1, 2014).

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals.

The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery

plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (*http://www.fws.gov/endangered*), or from our Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat protection, habitat restoration (*e.g.*, restoration of native vegetation) and management, research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

Following publication of this final listing rule, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the States of 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 would be eligible for Federal funds to implement management actions that promote the protection or recovery of the northern long-eared bat. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Please let us know if you are interested in participating in recovery efforts for the northern long-eared bat. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference or consultation or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the U.S. Fish and Wildlife Service, USFS, NPS, and other Federal agencies; issuance of section 404 Clean Water Act (33 U.S.C. 1251 *et seq*.) permits by the U.S. Army Corps of Engineers; and funding for construction and maintenance of roads or highways by the Federal Highway Administration.

We may issue permits to carry out otherwise prohibited activities involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR

17.32. With regard to threatened wildlife, a permit may be issued for the following purposes: Scientific purposes, or the enhancement of propagation or survival, or economic hardship, or zoological exhibition, or educational purposes, or incidental taking, or special purposes consistent with the purposes of the Act. . There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a listing on proposed and ongoing activities within the range of listed species. At this time, other than those activities that are in compliance with the interim 4(d) rule described below, we are unable to identify specific activities that would not be considered to result in a violation of section 9 of the Act. Because the northern long-eared bat occurs in a variety of habitat conditions across its range, there are many different types of activities that, without site-specific conservation measures, may directly or indirectly affect the species.

Based on the best available information, the following activities may potentially result in a violation of section 9 the Act; this list is not comprehensive: Activities that may affect the northern long-eared bat that do not comport with the interim 4(d) rule (described below); activities that alter a northern long-eared bat hibernacula; activities that may disturb, alter, or destroy occupied maternity colony habitat; and activities that otherwise kill, harm, or harass northern long-eared bat at any time of the year.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT).**

Under section 4(d) of the Act, the Service has discretion to issue regulations that we find necessary and advisable to provide for the conservation of threatened wildlife. We may also prohibit by regulation with respect to threatened wildlife any act prohibited by section 9(a)(1) of the Act for endangered wildlife. For the northern long-eared bat, the Service has developed an interim 4(d) rule, described below, that is tailored to the specific threats and conservation needs of this species.

Provisions of the Interim Species-Specific 4(d) Rule for the Northern Long-eared Bat

Under section 4(d) of the Act, the Secretary may publish a species-specific rule that modifies the standard protections for threatened species with prohibitions and exceptions tailored to the conservation of the species that are determined to be necessary and advisable. Under this interim 4(d) rule, the Service applies all of the prohibitions set forth at 50 CFR 17.31 and 17.32 to the northern long-eared bat, except as noted below. This interim rule under section 4(d) of the Act will not remove, or alter in any way, the consultation requirements under section 7 of the Act.

As discussed in the October 2, 2013, proposed rule (78 FR 61046), the primary factor supporting the proposed determination of endangered species status for the northern long-eared bat is the disease, white-nose syndrome. We further determined that other threat factors (including forest management activities; wind-energy development; habitat modification,

destruction, and disturbance; and other threats) may have cumulative effects to the species in addition to WNS; however, they have not independently caused significant, population-level effects on the northern long-eared bat. Therefore, we are adopting a final rule to list the species as a threatened species, as explained earlier in this document, and in concert with that final rule, we are adopting an interim rule under section 4(d) of the Act to provide exceptions to the prohibitions for some of these activities that cause cumulative effects, as we deem necessary and advisable for the conservation of the species.

We conclude that certain activities described in this section, when conducted in accordance with the conservation measures identified herein, will provide protection for the northern long-eared bat during its most sensitive life stages. These activities are: Forest management activities (subject to certain time restrictions); maintenance and minimal expansion of existing rights-of-way and transmission corridors, also subject to certain restrictions; prairie management; other projects resulting in minimal tree removal; hazard tree removal; removal of bats from and disturbance within human structures; and capture, handling, attachment of radio transmitters, and tracking northern long-eared bats for a 1-year period following the effective date of this interim 4(d) rule (see **DATES**). The Service concludes that incidental take that is caused by these activities implemented on private, State, tribal, and Federal lands will not be prohibited provided those activities abide by the conservation measures in this interim rule and are otherwise legal and conducted in accordance with applicable State, Federal, tribal, and local laws and regulations.

Buffer Zone Around WNS and Pseudogymnoascus destructans *(the fungus that causes WNS) Positive Counties (WNS Buffer Zone)*

Currently, not all of the range of the northern long-eared bat is affected by WNS. Our status determination of the northern long-eared bat as a threatened species is primarily based on the impacts from WNS, and we also determined that the other threats, when acting on the species alone, are not causing the species to be in danger of extinction. Given this information, the Service concludes that while all purposeful take except removal of bats from human dwellings and survey and research efforts conducted within a 1-year period following the effective date of this interim 4(d) rule will be prohibited, all other take incidental to other lawful activities will be allowed in those areas of the northern long-eared bat's range not in proximity to documented occurrence of WNS or Pd, as identified by the Service.

Currently, WNS is mainly detected by surveillance at bat hibernacula. Thus, our direct detection of the disease is limited largely to wintering bat populations in the locations where they hibernate. However, bats are known to leave hibernacula and travel great distances, sometimes hundreds of miles, to summer roosts. Therefore, the impacts of the disease are not limited to the immediate vicinity around bat hibernacula, but have an impact on a landscape scale. For northern long-eared bats, as with all species, this means that the area of influence of WNS is much greater than the counties known to harbor affected hibernacula, resulting in impacts to a much larger section of the species' range. To fully represent the extent of WNS, we must also include these summer areas.

Overall, northern long-eared bats are not considered to be long-distance migrants, typically dispersing 40 to 50 miles (64 to 80 kilometers) from their hibernacula. However, other bat species that disperse much farther distances are also vectors for WNS spread and may transmit the disease to northern long-eared bat populations. It has been suggested that the little brown bat, in particular, be considered a likely source of WNS spread across eastern North

America. Little brown bats tend to migrate greater distances, particularly in the western portions of their range, with distances up to 350 miles (563 km) or more recorded (see Ellison 2008, p. 21; Norquay *et al*. 2013, p. 510). In a recent study, reporting on bat band recoveries of little brown bats over a 21-year period, Norquay *et al*. (2013, pp. 509–510) describe recaptures between hibernacula and summer roosts with a maximum distance of 344 miles (554 km) and a median distance of 288 miles (463 km).

For the purpose of this interim rule, the counties within the northern long-eared bat's range that are considered to be affected by WNS are those within 150 miles (241 km) of the boundary of U.S. counties or Canadian districts where the fungus Pd or WNS has been detected. We acknowledge that 150 miles (241 km) does not capture the full range of potential WNS infection, but represents a compromise distance between the known migration distances of northern long-eared bats and little brown bats that is suitable for our purpose of estimating the extent of WNS infection on the northern long-eared bat. We have chosen to use county boundaries to delineate the boundary because they are clearly recognizable and will minimize confusion. If any portion of a county falls within 150 miles of a county with a WNS detection, the entire county will be considered affected. Anywhere outside of the geographic area defined by these parameters, northern long-eared bat populations will not be considered to be experiencing the impacts of WNS.

The Service defines the term "WNS buffer zone" as the set of counties within the range of the northern long-eared bat within 150 miles of the boundaries of U.S. counties or Canadian districts where the fungus Pd or WNS has been detected.

For purposes of this interim 4(d) rule, coordination with the local Service Ecological Services field office is recommended to determine whether specific locations fall within the

WNS buffer zone. For more information about the current known extent of WNS and the 150-mile (241-km) buffer, please see *http://www.fws.gov/midwest/endangered/mammals/nlba/*.

Conservation Measures

Under this interim 4(d) rule, take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, will not be prohibited (*i.e.*, will be excepted from the prohibitions). For such take to be excepted, the activity must:

- Occur more than 0.25 mile (0.4 kilometer) from a known, occupied hibernacula;
- Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31); and
- Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 mile (0.4 kilometer) of known, occupied roost trees during the pup season (June 1–July 31).

Note that activities that may cause take of northern long-eared bat that do not use these conservation measures may still be done, but only after consultation with the Service. This means that, while the resulting take from such activities is not excepted by this interim rule, the take may be authorized through other means provided in the Act (section 7 consultation or an incidental take permit).

Known roost trees are defined as trees that northern long-eared bats have been documented as using during the active season (approximately April – October). Once documented, a tree will be considered to be a "known roost" as long as the tree and surrounding habitat remain suitable for northern long-eared bat. However, a tree may be considered to be

unoccupied if there is evidence that the roost is no longer in use by northern long-eared bats. Currently, most states and Natural Heritage Programs do not track roosts and many have not tracked any northern long-eared bat occurrences. We anticipate that this will improve over time, as information on the species increases post-listing.

Known, occupied hibernacula are defined as locations where one or more northern long-eared bats have been detected during hibernation or at the entrance during fall swarming or spring emergence. Given the documented challenges of surveying for northern long-eared bats in the winter (use of cracks, crevices), any hibernacula with northern long-eared bats observed at least once, will continue to be considered "known hibernacula" as long as the hibernacula and its surrounding habitat remain suitable for northern long-eared bat. However, a hibernaculum may be considered to be unoccupied if there is evidence (*e.g.*, survey data) that it is no longer in use by northern long-eared bats.

These conservation measures aim to protect the northern long-eared bat during its most sensitive life stages. Hibernacula are an essential habitat and should not be destroyed or modified (any time of year). In addition, there are periods of the year when northern long-eared bats are concentrated at and around their hibernacula (fall, winter, and spring). Northern long-eared bats are susceptible to disruptions near hibernacula in the fall, when they congregate to breed and increase fat stores, which are depleted from migration, before entering hibernation. During hibernation, northern long-eared bat winter colonies are susceptible to direct disturbance. Briefly in spring, northern long-eared bats yet again use the habitat surrounding hibernacula to increase fat stores for migration to their summering grounds. This feeding behavior is particularly important for the females, who must obtain enough fat stores to carry not only themselves, but also their unborn pups, to their summer home range.

Risk of injury or death from being crushed when a roost tree is felled is most likely, but not limited, to nonvolant pups. The likelihood of roost trees containing larger number of northern long-eared bats is greatest during pregnancy and lactation (April-July) with exit counts falling dramatically after this time (Foster and Kurta 1999, p. 667; Sasse and Pekins 1996, pp. 91,92). Once the pups can fly, this risk is reduced because the pups will have the ability to flee their roost if it is being cut or otherwise damaged, potentially avoiding harm, injury, or mortality.

The Service concludes that a 0.25-mile (0.4-km) buffer should be sufficient to protect most known, occupied hibernacula and hibernating colonies. This buffer will provide basic protection for the hibernacula and hibernating bats in winter from direct impacts, such as filling, excavation, blasting, noise, and smoke exposure. This buffer will also protect some roosting and foraging habitat around the hibernacula.

The Service concludes that, in addition to preservation of known maternity roosts, a 0.25-mile (0.4-km) buffer for all clearcutting activities will be sufficient to protect the habitat surrounding known maternity roosts during the pup season. Clearcutting and similar methods is summarized here as the cutting of most or essentially all trees from an area; however, specific definitions are provided within the Society of American Foresters' Dictionary of Forestry. This buffer will prevent the cutting of known occupied roost trees, reduce the cutting of secondary roosts used by maternity colonies during the pup season from clearcutting activities, and protect some habitat for some known maternity colonies at least to some degree. Further, because colonies occupy more than one maternity roost in a forest stand and individual bats frequently change roosts, in some cases a portion of a colony or social network is likely to be protected by multiple 0.25 mile (0.4 km) buffers.

For purposes of this proposed rule and the conservation measures listed above, we recommend contacting the local state agency, State's Natural Heritage database, and local Service Ecological Services field office for information on the best current sources of northern long-eared bat records in your state to determine the specific locations of the "known roosts" and "known hibernacula." These locations will be informed by records in each State's Natural Heritage database, Service records, other databases, or other survey efforts.

Forest Management

Continued forest management and silviculture is vital to the conservation and recovery of the northern long-eared bat. Under this interim rule, incidental take that is caused by forest management and silviculture activities that promote the long-term stability and diversity of forests, when carried out in accordance with the conservation measures, will not be prohibited. Forest management is the practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization and conservation of forests to meet specific goals and objectives (Society of American Foresters (SAF)(a), *http://dictionaryofforestry.org/dict/term/forest_management*). Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis (SAF(b), *http://dictionaryofforestry.org/dict/term/silviculture*). In addition to the conservation measures above, forest management and silviculture activities should also adhere to any applicable State water quality best management practices, where they exist. Further, we

encourage the retention of snags and trees with characteristics (*e.g*., cavities and cracks) favorable for the establishment and maintenance of maternity roosts.

The conversion of mature hardwood, or mixed, forest into intensively managed monoculture pine plantation stands, or non-forested landscape, is not exempted under this interim rule, as typically these types of monoculture pine plantations provide poor-quality bat habitat. Pine plantations are densely planted (*e.g*., typically 675 to 750, or more, trees per acre) and are comprised of single-age or similar age class timber. They are typically managed for timber production with, depending on the product, a uniform, planned endpoint. Maximum stocking rates and short rotations result in the forfeiture of structural diversity in exchange for elevated rates of wood productivity. Plantation productivity may be further enhanced through the use of genetically improved stock, fertilization, extensive site preparation, and reduction of competition. These management actions prohibit variably stocked stands, layers of understory and midstory vegetation, and longer rotations that enhance and maintain habitat traits required by many forest-dependent wildlife species (Allen *et al*. 1996, p. 13).

Though forestry management and silviculture are vital to the long-term survival and recovery of the species, where northern long-eared bats are present when these forest management activities are performed, bats could be exposed to habitat alteration or loss or direct disturbance (i.e., heavy machinery) or removal of maternity roost trees (i.e., harvest). In general, however, the northern long-eared bat is considered to have more flexible habitat requirements than other bat species (Carter and Feldhamer 2005, pp. 265–266; Timpone *et al*. 2010, pp. 120–121), and most types of forest management should provide suitable habitat for the species over the long term (with the exception of conversion to monoculture pine forest, as discussed above). Based upon information obtained during previous comment periods on the proposed listing rule,

approximately 2 percent of forests in States within the range of the northern long-eared bat are impacted by forest management activities annually (Boggess *et al.*, 2014, p. 9). Of this amount, in any given year a smaller fraction of forested habitat is impacted during the active season when pups and female bats are most vulnerable. These impacts are addressed by the above conservation measures adopted in this interim rule.

Therefore, we anticipate that habitat modifications resulting from forest management and silviculture will not significantly affect the conservation of the northern long-eared bat. Further, although activities performed during the species' active season (roughly April through October) may directly kill or injure individuals, implementation of the conservation measures provided for in this interim rule will limit take by protecting currently known populations during their more vulnerable life stages.

Routine Maintenance and Limited Expansion of Existing Rights-of-way and Transmission Corridors

Under this interim rule, incidental take that is caused by activities for the purpose of maintenance and limited expansion of existing rights-of-way and transmission corridors, when carried out in accordance with the conservation measures, will not be prohibited (*i.e.*, will be excepted from the prohibitions). Rights-of-way (ROW) and transmission corridors are in place for activities such as transportation (highways, railways), utility transmission lines, and energy delivery (pipelines), though they are not limited to just these types of corridors. Under this interim rule, take of the northern long-eared bat will not be prohibited provided the take is incidental to activities within the following categories:

(1) Routine maintenance within an existing corridor or ROW, carried out in accordance with the previously described conservation measures.

(2) Expansion of a corridor or ROW by up to 100 feet (30 m) from the edge of an existing cleared corridor or ROW, carried out in accordance with the previously described conservation measures.

General ROW routine maintenance is designed to limit vegetation growth, within an existing footprint, so that operations can continue smoothly. These activities may include tree trimming or removal, mowing, and herbicide spraying. However, depending on the purpose of the corridor or ROW, maintenance may only be performed infrequently, and trees and shrubs may encroach into, or be allowed to grow within, the ROW until such time as maintenance is required. Expansion of these areas requires removal of vegetation along the existing ROW to increase capacity (*e.g.*, road widening).

Northern long-eared bats can occupy various species and sizes of trees when roosting. Because of their wide variety of habitat use when roosting and foraging, it is possible that they may be using trees within or near existing ROWs. Therefore, vegetation removal within or adjacent to an existing ROW may remove maternity roost trees and foraging habitat. Individuals may also temporarily abandon the areas, avoiding the physical disturbance until the work is complete. While ROW corridors can be large in overall distance, due to the relatively small scale of the habitat alteration involved in maintenance of the existing footprint, potential take is limited. No new forest fragmentation is expected as this expands existing open corridors. We also expect that excepting take prohibitions from ROW maintenance and limited expansion will encourage co-location of new linear projects within existing corridors. We conclude that the

overall impact of ROW maintenance and limited expansion activities is not expected to adversely affect conservation and recovery efforts for the species.

Prairie Management

Under this interim rule, incidental take that is caused by activities for the purpose of prairie management, when carried out in accordance with the conservation measures, will not be prohibited (*i.e*., will be excepted from the prohibitions). Prairie management involves management to maintain existing prairies and grasslands or efforts to reestablish grasslands that had previously been converted, usually to cropland. In some areas of the northern long-eared bat's range, tree and shrub species are overtaking prairie areas. Landowners and agencies working to establish or conserve prairies may have to manage trees and brush in order to maintain grasslands. Management activities include cutting, mowing, burning, grazing, or using herbicides on woody vegetation to minimize encroachment into prairies (Grassland Heritage Foundation, accessed December 23, 2014 *http://www.grasslandheritage.org/*). In the absence of fire, some researchers found tree species progressively invade and will eventually dominate tallgrass prairie (Bragg and Hulbert 1976, p. 23; Towne and Owensby 1984, p. 397). In some areas, if prairies are not managed to keep woody vegetation suppressed, they can eventually become shrub or forest lands sometimes in as few as 40 years (Briggs *et al*. 2002, p. 578; Ratajczak *et. al* 2011, p. 3). We conclude that the overall impact of prairie management that removes or manages trees and brush to maintain prairies and grasslands is not expected to adversely affect conservation and recovery efforts for the species.

Projects Resulting in Minimal Tree Removal

Under this interim rule, incidental take that results from projects causing minimal tree removal, when carried out in accordance with the conservation measures, will not be prohibited (*i.e.*, will be excepted from the prohibitions). Throughout the millions of acres of forest habitat in the northern long-eared bat's range, many activities involve cutting or removal of individual or limited numbers of trees, but do not significantly change the overall nature and function of the local forested habitat. As such, activities that remove an acre or less of forested habitat are expected to have little or no impact on the ecological value and function and, therefore, will be considered to be "minimal" as defined by this rule. Examples of activities that might fall within this category are firewood cutting, shelterbelt renovation, removal of diseased trees, culvert replacement, habitat restoration for fish and wildlife conservation, and backyard landscaping. These ongoing activities can occur throughout the northern long-eared bat's range, but we do not believe they materially affect the local forest habitat for this species and in some cases increase habitat availability in the long term.

With respect to the term "minimal," we limit the effect to an impact of one acre or less. Furthermore, the limitation of the impact to an acre or less may be interpreted as follows: one acre of contiguous habitat or one acre in total within a larger tract, whether that larger tract is entirely forested or a mixture of forested and non-forested cover types. Tract may be further defined as the property under the control of the project proponent or ownership. We conclude that the overall impact of projects causing this type of minimal tree removal is not expected to adversely affect conservation and recovery efforts for the species.

Hazardous Tree Removal

Under this interim rule, incidental take that is caused by removal and management of hazardous trees will not be prohibited (*i.e.*, will be excepted from the prohibitions). Removal of hazardous trees completed, as necessary, for human safety or for the protection of human facilities is the intent of this exception. Hazardous trees typically have defects in their roots, trunk, or branches that make them likely to fall, with the likelihood of causing personal injury or property damage. The limited removal of these hazardous trees may be widely dispersed but limited, and should result in very minimal incidental take of northern long-eared bat. We recommend, however, that removal of hazardous trees be done during the winter, wherever possible, when these trees will not be occupied by bats. We conclude that the overall impact of removing hazardous trees is not expected to adversely affect conservation and recovery efforts for the species.

Removal of Bats From and Disturbance Within Human Structures

Under this interim rule, any take that is caused by removal of bats from and disturbance within human structures (*e.g.*, harm from excluding bats from their previous roost site) will not be prohibited (*i.e.*, will be excepted from the prohibitions), provided those actions comply with all applicable State laws. Northern long-eared bats have occasionally been documented roosting in human-made structures, such as houses, barns, pavilions, sheds, cabins, and bat houses (Mumford and Cope 1964, p. 72; Barbour and Davis 1969, p. 77; Cope and Humphrey 1972, p. 9; Amelon and Burhans 2006, p. 72; Whitaker and Mumford 2009, p. 209; Timpone *et al*. 2010,

p. 119; Joe Kath 2013, pers. comm.). We conclude that the overall impact of bat removal from human structures is not expected to adversely affect conservation and recovery efforts for the species. In addition, we provide the following recommendations:

- Minimize use of pesticides (*e.g.*, rodenticides) and avoid use of sticky traps as part of bat evictions/exclusions.
- Conduct exclusions during spring or fall unless there is a perceived public health concern from bats present during summer and/or winter.
- Contact a nuisance wildlife specialist for humane exclusion techniques.

Capture, Handling, and Related Activities for Northern Long-eared Bats for 1 Year

Under this interim rule, for a limited period of 1 year from the effective date of this interim 4(d) rule, purposeful take that is caused by the authorized capture, handling, and related activities (attachment of radio transmitters and tracking) of northern long-eared bats by individuals permitted to conduct these same activities for other bats will be excepted from the prohibitions. After this time period, all such take must be permitted following the Service's standard procedures under 10(a)(1)(A) of the Act. One method of determining presence/probable absence of northern long-eared bats is to conduct mist-netting at summer sites or harp trapping at hibernacula. Gathering of this information is essential to monitor the distribution and status of northern long-eared bats over time. In addition, northern long-eared bats are often captured incidentally to survey and study efforts targeted at other bat species (*e.g.*, Indiana bats). It is necessary and advisable for the conservation of northern long-eared bats to provide an exception for the purposeful take associated with these normal survey activities

conducted by qualified individuals to promote and encourage the gathering of information following standard procedures (including decontamination) as these data will help us conserve and recover this species. To receive an exception, proponents must have an existing research permit under section 10(a)(1)(A) of the Act, or similar State collector's permit, for other bat species. The rationale for this limited time period is that it will be difficult to amend all permits in time for this year.

The Service concludes, for the reasons specified above, that all of the conservation measures, prohibitions, and exceptions identified in this interim rule individually and cumulatively are necessary and advisable for the conservation of the northern long-eared bat and will collectively promote the conservation of the species across its range.

We publish this interim species-specific rule under section 4(d) of the Act in full recognition that WNS is the primary threat to species continued existence. All of the other (non-WNS) threats combined did not lead to imperilment of the species, and elimination of all other non-WNS threats will not likely improve the potential for recovery of this species in any meaningful way unless we find a means to address WNS. We also recognize, however, that in those areas of the country impacted by WNS, some reasonable measures may be taken to protect the species from additive stresses as a result of other factors. By focusing on conservation measures that clearly protect individual bats, we minimize needless and preventable deaths of bats during the species' most sensitive life stages. Although not fully protective of every individual, the conservation measures identified in this interim rule help protect maternity and hibernating colonies, while allowing limited impacts to habitat. We have focused the Act's protections on the landscape scale by protecting known hibernacula, protecting the species from activities that would result in large-scale forest conversion or loss, and encouraging research on

WNS and other aspects of the species' biology by simplifying the permitting process. This interim species-specific rule under section 4(d) of the Act provides the flexibility for certain activities to occur while not significantly impacting habitat for this species and while still promoting conservation of the species across its range.

Of the activities excepted by this interim rule, we project that forest management activities will have the greatest potential impact on the northern long-eared bat. Based upon information obtained during previous comment periods on the proposed listing rule, we expect approximately 2 percent of forests in States within the range of the northern long-eared bat to experience forest management activities this year (Boggess *et al*., 2014, p. 9). Put another way, we would expect 98 percent of potential habitat to be completely unaffected by forest management while this interim rule is in effect. Of the remaining 2 percent, a smaller fraction of this forested habitat will actually be harvested during the northern long-eared bat's active season (April–October), and a smaller portion yet would be harvested during the pup season. For the remaining percentage of bats actually affected by forest management, we expect implementation of the conservation measures to significantly reduce the take of those individual bats where there are known northern long-eared bat roost trees. When occupied roosts are cut outside of the pup season or if undocumented northern long-eared bat roosts are cut while occupied, some portion of these individuals (particularly males) will flee the roost and survive. Thus, we anticipate only a small percentage (less than 1 percent) of northern long-eared bats will be impacted by forestry management activities.

We anticipate that the additional activities covered by this interim species-specific 4(d) rule will only have a minimal impact on northern long-eared bat habitat and individuals. The activities associated with ROW management and expansion, minimal tree removal, prairie

management, and hazard tree removal collectively impact only small percentages of northern long-eared bat habitat; low levels of take of individuals are expected given the limited scope of these activities and the season during which they occur.

We conclude that take of the northern long-eared bat excepted by this interim rule will be small and will not pose a significant impact on the conservation of the species as a whole. However, we recognize that there is some uncertainty regarding the level of take that may result and that there are other approaches and additional conservation measures could improve the overall conservation outcome of this interim species-specific rule under section 4(d) of the Act. We are seeking public comments on this interim rule (see **Public Comments Solicited on the Interim 4(d) Rule**, below), and we will publish either an affirmation of the interim rule or a final rule amending the interim rule after we fully consider all comments we receive. If you previously submitted comments or information on the proposed 4(d) rule we published on January 16, 2015 (80 FR 2371), please do not resubmit them. We have incorporated them into the public record, and we will fully consider them in our final determination on the 4(d) rule.

Table 2 (below) summarizes the details of the interim species-specific 4(d) rule for the northern long-eared bat.

Is the Area Affected by WNS (WNS buffer zone)?	**Take prohibitions at 50 CFR 17.31 and 17.32**	**Take exceptions in interim 4(d) rule**	
		Purposeful	**Incidental**
No	All apply, with the following exceptions listed here	Actions with the intent to remove northern long-eared bats from within human structures and that comply with all applicable State regulations.	Any incidental take of northern long-eared bats resulting from otherwise lawful activities.

		Actions relating to capture and handling of northern long-eared bats by individuals permitted to conduct these same activities for other bats, for a period of 1 year following the effective date of the interim 4(d) rule.	
Yes	All apply, with the following exceptions listed here	Actions with the intent to remove northern long-eared bats from within human structures and that comply with all applicable State regulations.	Implementation of forest management, maintenance and expansion of existing rights-of-way (ROW) and transmission corridors, prairie management, and minimal tree removal projects that: ● Occur more than 0.25 mile (0.4 km) from a known, occupied hibernacula; ● Avoid cutting or destroying known, occupied roost trees during the pup season (June 1 –July 31); and ● Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 mile (0.4 km) of known, occupied roost trees during the pup season (June 1 –July 31).
		Actions relating to capture, and handling of northern long-eared bats by individuals permitted to conduct these same activities for other bats, for a period of 1 year following the effective date of the interim 4(d) rule.	• Routine maintenance within an existing corridor or ROW, carried out in accordance with the previously described conservation measures. • Expansion of a corridor or ROW by up to 100 feet (30 m) from the edge of an existing cleared corridor or ROW, carried out in accordance with the

			previously described conservation measures.
			Removal of hazard trees for the protection of human life and property.

Need for Interim Final Rule

Under 5 U.S.C. 553(b)(3)(B) of the Administrative Procedure Act (APA), we have good cause to find that the delay in adopting a rule, which would be caused by adequately addressing and responding to public comments on the January 16, 2015, proposed rule (80 FR 2371), would be detrimental to the conservation of the northern long-eared bat and, therefore, is contrary to the public interest. If the Secretary went through the standard rulemaking process (granting requested extensions of the public notice-and-comment period and honoring requests for public hearings or meetings), we would be unable to finalize the conservation measures set forth in this interim rule concurrent with the final listing rule. This would result in the default provisions at 50 CFR 17.31 and 17.32 controlling northern long-eared bat management until we complete the standard process to adopt a 4(d) rule. That outcome would be contrary to the public interest in this case because immediate implementation of the interim rule has the advantage of providing a conservation benefit to northern long-eared bat that is unavailable under the general threatened species provisions at 50 CFR 17.31 and 17.32. Under this interim rule, the Service can continue to except the take that will result from the activities addressed within and still address the conservation of bats in individual known roost trees that need protection due to the impacts of WNS. The general threatened species provisions at 50 CFR 17.31 and 17.32 would not allow such protection for northern long-eared bat. In addition, as discussed in detail in the preamble,

applying the default provisions under 50 CFR 17.31 and 17.32, unmodified by a species-specific 4(d) rule, would not provide any significant conservation benefit to the species. Alternatively, another option left to the agency's discretion would be to have no prohibitions for a species determined to be threatened. However, as stated, we think that it is appropriate to provide some protection for this species during its most sensitive life stages so that the northern long-eared bat has the best chance of fighting WNS. We believe this interim species-specific 4(d) rule provides a balance between the default provisions at 50 CFR 17.31 and 17.32 and no take prohibitions by providing the flexibility for certain activities to occur while not significantly impacting habitat for this species and still promoting species conservation across its range.

In general, interim rules are effective immediately upon publication due to the urgency of the actions within those rules. The final rule listing the northern long-eared bat as threatened is published as a part of this document, and is effective in 30 days (see **DATES**). To avoid any confusion arising from varying effective dates, and because we cannot establish a 4(d) rule for a species that is not yet listed, this interim species-specific 4(d) rule will also be effective in 30 days (see **DATES**), to coincide with the effective date of the listing.

Public Comments Solicited on the Interim 4(d) Rule

We request comments or information from other concerned Federal and State agencies, the scientific community, or any other interested party concerning the interim 4(d) rule. We will consider all comments and information we receive during our preparation of an affirmation or final rule under section 4(d) of the Act. With regard to the interim 4(d) rule, we particularly seek comments regarding:

(1) Whether measures outlined in this interim rule under section 4(d) of the Act are necessary and advisable for the conservation and management of the northern long-eared bat.

(2) Whether it may be appropriate to except incidental take as a result of other categories of activities beyond those covered by this interim rule and, if so, under what conditions and with what conservation measures.

(3) Whether the Service should modify the portion of this interim rule under section 4(d) of the Act that defines how the portion of the northern long-eared bat range will be identified as the "WNS buffer zone." We are seeking comments regarding the factors and process we used to delineate where on the ground we believe WNS is likely affecting the northern long-eared bat and whether that delineation should incorporate political boundaries (*e.g.*, county lines) for ease in describing the delineated area to the public.

(4) Additional provisions the Service may wish to consider for a revision to this interim rule under section 4(d) of the Act in order to conserve, recover, and manage the northern long-eared bat.

Please note that comments merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made "solely on the basis of the best scientific and commercial data available." If you previously submitted comments or information on the January 16, 2015, proposed rule, please do not resubmit them. We have incorporated them into the public record, and we will fully consider them in our final

determination on this interim rule. Our final determination on this interim rule will take into consideration all written comments and any additional information we receive. The final decision may differ from this interim final rule, based on our review of all information received during this rulemaking proceeding.

Our intent is to issue an affirmation of this interim rule or a final species-specific rule under section 4(d) of the Act for the northern long-eared bat by the end of the calendar year 2015.

You may submit your comments and materials concerning this interim rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via http://www.regulations.gov, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on http://www.regulations.gov. Please include sufficient information with your comments to allow us to verify any scientific or commercial information you include.

Comments and materials we receive, as well as supporting documentation we used in preparing this interim rule, will be available for public inspection on http://www.regulations.gov, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Critical Habitat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species, and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed

species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of the species. Primary constituent elements are those specific elements of the physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. For example, an area currently occupied by the species but that was not occupied at the time of listing may be essential to the conservation of the species and may be included in the critical

habitat designation. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the recovery plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the

conservation of listed species, both inside and outside the critical habitat designation, continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act, (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species, and (3) section 9 of the Act's prohibitions on taking any individual of the species, including taking caused by actions that affect habitat. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, HCPs, or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Prudency Determination

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

There is currently no imminent threat of take attributed to collection or vandalism for the northern long-eared bat, and identification and mapping of critical habitat is not expected to initiate any such threat. In the absence of finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, then a prudent finding is warranted. In general, the potential benefits of designation may include: (1) Triggering consultation under section 7 of the Act, in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is or has become unoccupied or the occupancy is in question; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to the species. Therefore, because we have determined that the designation of critical habitat will not likely increase the degree of threat to the species and may provide some measure of benefit, we find that designation of critical habitat is prudent for the northern long-eared bat.

Critical Habitat Determinability

Having determined that designation is prudent, under section 4(a)(3) of the Act we must find whether critical habitat for the species is determinable. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist: (i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or (ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

We reviewed the available information pertaining to the biological needs of the species and habitat characteristics where this species is located. As information regarding the biological

needs of the species is not sufficiently well known to permit identification of areas as critical habitat, we conclude that the designation of critical habitat is not determinable for the northern long-eared bat at this time.

There are many uncertainties in designating hibernacula as critical habitat for the northern long-eared bat. We lack sufficient information to define the physical and biological features or primary constituent elements with enough specificity; we are not able to determine how habitats affected by WNS (where populations previously thrived and are now extirpated) may contribute to the recovery of the species or whether those areas may still contain essential physical and biological features. Therefore, we currently lack the information necessary to propose critical habitat for the species.

There are also uncertainties with potential designation of summer habitat, specifically maternity colony habitat. Although research has given us indication of some key summer roost requirements, the northern long-eared bat appears to be somewhat opportunistic in roost selection, selecting varying roost tree species and types of roosts throughout the range. Although research has shown some consistency in female summer roost habitat (*e.g.*, selection of mix of live trees and snags as roosts, roosting in cavities, roosting beneath bark, and roosting in trees associated with closed canopy), the species and diameter of the tree (when tree roost is used) selected by northern long-eared bats for roosts vary widely depending on availability. Thus, it is not clear whether certain summer habitats are essential for the recovery of the species or whether these areas may require special management.

A careful assessment of the designation of hibernacula as critical habitat will require additional time to fully evaluate which features are essential to the conservation of the northern long-eared bat and how those features might change as WNS spreads. In addition, summer

habitat will require a similar assessment and evaluation of the essential physical and biological features and what special management they might require. Additionally, we have not gathered sufficient economic and other data on the impacts of critical habitat designation. These factors must be considered as part of the designation process. Thus, we find that critical habitat is not determinable for the northern long-eared bat at this time.

Required Determinations

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). It is the position of the Service that rules promulgated under section 4(d) of the Act concurrently with listing the species fall under the same rationale as outlined in the October 25, 1983, determination. For this reason, we did not conduct analysis under NEPA for the interim rule under section 4(d) of the Act. However, it is our intent to comply with NEPA standards at the time we publish either an affirmation of the interim 4(d) rule we are adopting in this document or a final rule amending the interim 4(d) rule based on comments we receive.

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination With Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes.

In October 2013, Tribes and multi-tribal organizations were sent letters inviting them to begin consultation and coordination with the service on the proposal to listing the northern long-eared bat. In August 2014, several Tribes and multi-tribal organizations were sent an additional letter regarding the Service's intent to extend the deadline for making a final listing determination by 6 months. A conference call was also held with Tribes to explain the listing process and discuss any concerns. Following publication of the proposed rule, the Service established 3 interagency teams (biology of the northern long-eared bat, non-WNS threats, and conservation measures) to ensure that States, Tribes, and other Federal agencies were able to provide input into various aspects of the listing rule and potential conservation measures for the species. Invitations for inclusion in these teams were sent to Tribes within the range of the northern long-eared bat and a few tribal representatives participated on those teams. Two additional conference calls (in January and March 2015) were held with Tribes to outline the proposed species-specific 4(d) rule and to answer questions. Through this coordination, some

Tribal representatives expressed concern about how listing the northern long-eared bat may impact forestry practices, housing development programs, and other activities on Tribal lands.

Clarity of the Interim 4(d) Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the 4(d) rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, or the sections where you feel lists or tables would be useful.

References Cited

A complete list of references cited in this document is available on the Internet at *http://www.regulations.gov* and upon request from the Twin Cities Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this document are the staff members of the Twin Cities Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361-1407; 1531-1544; and 4201-4245, unless otherwise noted.

2. Amend §17.11(h) by adding an entry for "Bat, northern long-eared" in alphabetical order under MAMMALS to the List of Endangered and Threatened Wildlife to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
MAMMALS							
* * * * * * *							
Bat, northern long-eared	*Myotis septentrionalis*	U.S.A. (AL, AR, CT, DE, DC, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, VT, VA, WV, WI, WY); Canada	Entire	T	857	NA	17.40(n)

(AB, BC,
LB, MB,
NB, NF,
NS, NT,
ON, PE,
QC, SK,
YT)

* * * * * * *

3. Amend § 17.40 by adding paragraph (n) to read as follows:

§ 17.40 Special rules—mammals.

*** * * * ***

(n) Northern long-eared bat (*Myotis septentrionalis*). The provisions of this rule are based upon the occurrence of white-nose syndrome (WNS), a disease affecting many U.S. bat populations. The term "WNS buffer zone" identifies the portion of the range of the northern long-eared bat within 150 miles of the boundaries of U.S. counties or Canadian districts where the fungus Pd or WNS has been detected. For current information regarding the WNS buffer zone, contact your local Service ecological services field office. Field office contact information may be obtained from the Service regional offices, the addresses of which are listed in 50 CFR 2.2.

(1) Outside the WNS buffer zone, the following provisions apply to the northern long-eared bat:

(i) *Prohibitions*. Except as noted in paragraphs (n)(1)(ii)(A) and (B) of this section, all the prohibitions and provisions of §§ 17.31 and 17.32 apply to the northern long-eared bat.

(ii) *Exceptions from prohibitions.*

(A) Purposeful take:

(1) Take resulting from actions taken to remove northern long-eared bats from within human structures, if the actions comply with all applicable State regulations.

(2) Take resulting from actions relating to capture, handling, and related activities for northern long-eared bats by individuals permitted to conduct these same activities for other species of bat until [INSERT DATE 395 DAYS AFTER DATE OF FEDERAL REGISTER PUBLICATION].

(B) Any incidental (non-purposeful) take of northern long-eared bats resulting from otherwise lawful activities.

(2) Inside the WNS buffer zone, the following provisions apply to the northern long-eared bat:

(i) *Prohibitions*. Except as noted in paragraphs (n)(2)(ii)(A) and (B) of this section, all prohibitions and provisions of §§ 17.31 and 17.32 apply to the northern long-eared bat.

(ii) *Exceptions from prohibitions.* Take of northern long-eared bat is not prohibited in the following circumstances:

(A) Purposeful take:

(1) Take resulting from actions taken to remove northern long-eared bats from within human structures, if the actions comply with all applicable State regulations.

(2) Take resulting from actions relating to capture, handling, and related activities for northern long-eared bats by individuals permitted to conduct these same activities for other species of bat until [INSERT DATE 395 DAYS AFTER DATE OF FEDERAL REGISTER PUBLICATION].

(B) Incidental take:

(1) Implementation of forest management, maintenance and expansion of existing rights-of-way and transmission corridors, prairie management, and minimal tree removal projects that:

(*i*) Occur more than 0.25 mile (0.4 kilometer) from a known, occupied hibernacula;

(*ii*) Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31); and

(*iii*) Avoid clearcuts (and similar harvest methods, *e.g.*, seed tree, shelterwood, and coppice) within 0.25 mile (0.4 kilometer) of known, occupied roost trees during the pup season (June 1–July 31).

(2) Routine maintenance within an existing corridor or right-of-way, carried out in accordance with the conservation measures set forth at paragraph (n)(2)(ii)(B)(*1*).

(3) Expansion of a corridor or right-of-way by up to 100 feet (30 meters) from the edge of an existing cleared corridor or right-of-way, carried out in accordance with the conservation measures set forth at paragraph (n)(2)(ii)(B)(*1*).

(4) Removal of hazardous trees for the protection of human life and property.

Dated: March 23, 2015

Signed: Stephen Guertin

Acting Director, U.S. Fish and Wildlife Service

Billing Code 4310–55–P