

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****50 CFR Part 17**

[Docket No. FWS-R6-ES-2016-0106;
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RIN 1018-BB78

Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rule for the North American Wolverine

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule, withdrawal.

SUMMARY: We, the U.S. Fish and Wildlife Service, withdraw the proposed rule to list the distinct population segment (DPS) of the North American wolverine (*Gulo gulo luscus*) occurring in the contiguous United States as a threatened species under the Endangered Species Act of 1973, as amended (Act). This withdrawal is based on our conclusion that the factors affecting the species as identified in the proposed rule are not as significant as believed at the time of the proposed rule. We base this conclusion on our analysis of current and future threat factors. We also find that North American wolverines occurring in the contiguous United States do not qualify as a DPS. Therefore, we are withdrawing our proposal to list the wolverine within the contiguous United States as a threatened species.

DATES: The proposed rule that published February 4, 2013 (78 FR 7864), to list the distinct population segment of the North American wolverine occurring in the contiguous United States as a threatened species is withdrawn on October 13, 2020.

ADDRESSES: The withdrawal of our proposed rule, comments, and supplementary documents are available on the internet at <http://www.regulations.gov> at Docket Nos. FWS-R6-ES-2012-0107 and FWS-R6-ES-2016-0106.

FOR FURTHER INFORMATION CONTACT: Jodi Bush, Field Supervisor, U.S. Fish and Wildlife Service, Montana Ecological Services Office, (see **ADDRESSES**). Persons who use a telecommunications device for the deaf may call the Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, if we determine that a species may be an endangered or threatened species throughout all or a significant

portion of its range, we are required to promptly publish a proposal in the **Federal Register** and make a determination on our proposal within 1 year. To the maximum extent prudent and determinable, we must designate critical habitat for any species that we determine to be an endangered or threatened species under the Act. Listing a species as an endangered or threatened species and designation of critical habitat can only be completed by issuing a rule.

What this document does. We withdraw the proposed rule to list the DPS of the North American wolverine occurring in the contiguous United States as a threatened species under the Act.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of 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 the factors affecting the species as identified in the proposed rule (loss of habitat due to climate change) are not as significant as believed at the time of the proposed rule. We also find that North American wolverines occurring in the contiguous United States do not qualify as a DPS.

Peer review. In accordance with our July 1, 1994, peer review policy (59 FR 34270; July 1, 1994), the Service's August 22, 2016, Director's Memo on the Peer Review Process, and the Office of Management and Budget's December 16, 2004, Final Information Quality Bulletin for Peer Review (revised June 2012), we sought the expert opinions of four appropriate specialists regarding the species status assessment report. We received responses from four specialists, which informed this proposed rule. The purpose of peer review is to ensure that our listing determinations are based on scientifically sound data, assumptions, and analyses. The peer reviewers have expertise in the biology, habitat, and threats to the species. Results of this structured peer review process can be found at <https://www.fws.gov/mountain-prairie/science/peerReview.php>. A draft analysis was also submitted to our Federal, State, and Tribal partners for scientific review. In preparing this withdrawal, we incorporated the results of these reviews in the final SSA report, as appropriate.

During the reopening of the public comment periods for the proposed listing rule, we requested any new information and announced that we initiated a new and comprehensive status review of the North American wolverine to determine whether the species meets the definition of an endangered or threatened species under the Act, or whether the species is not warranted for listing. The wolverine SSA report provides the scientific basis for the decision to withdraw the proposed listing rule for the DPS of wolverine occurring in the contiguous United States. Both new and updated information and analyses presented in the wolverine SSA report, summarized below in support of our listing determination, along with public comment, have also prompted us to reevaluate our previous assessment of the DPS with respect to wolverine in the contiguous United States.

Supporting Documents

A team prepared a Species Status Assessment (SSA) for the North American Wolverine (*Gulo gulo luscus*) (Service, 2018) (hereafter referred to as the wolverine SSA report). The SSA team was composed of U.S. Fish and Wildlife Service biologists, who consulted with other species experts. The wolverine SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the wolverine. The wolverine SSA report underwent independent peer review by scientists with experience with mesocarnivores and their conservation and management, genetics, population modeling, and climate change. The wolverine SSA report and other materials relating to this proposal can be found on the Mountain-Prairie Region website at <https://www.fws.gov/mountain-prairie/> and at <http://www.regulations.gov> under Docket No. FWS-R6-ES-2016-0106.

Previous Federal Actions

Please refer to the proposed listing rule for the wolverine (78 FR 7864; February 4, 2013) for a detailed description of previous Federal actions concerning the wolverine prior to 2013. On February 4, 2013, we published a proposed rule to list the DPS of wolverine occurring in the contiguous United States as threatened, under the Act, with a proposed rule under section 4(d) of the Act that outlines the prohibitions necessary and advisable for the conservation of the wolverine (78 FR

7864). We also published a proposed rule on February 4, 2013, to establish a nonessential experimental population (NEP) area for the North American wolverine in the Southern Rocky Mountains of Colorado, northern New Mexico, and southern Wyoming (78 FR 7890). On October 31, 2013, we reopened the comment period on the proposed listing rule for an additional 30 days (78 FR 65248).

Following publication of the 2013 proposed rules, there was scientific disagreement and debate about the interpretation of the habitat requirements for wolverines and the available climate change information used to determine the extent of threats to the DPS. Based on this substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the proposed listing, on February 5, 2014 (79 FR 6874), we announced a 6-month extension of the final determination of whether to list the wolverine DPS as a threatened species. We also reopened the comment period on the proposed rule to list the contiguous United States DPS of the North American wolverine for 90 days.

On August 13, 2014, we withdrew the proposed rule to list the DPS of the North American wolverine as a threatened species under the Act (79 FR 47522). This withdrawal was based on our conclusion that the factors affecting the DPS as identified in the proposed rule were not as significant as believed at the time of the proposed rule's publication in 2013. As a result, we also withdrew our associated proposed rule under section 4(d) of the Act contained in the proposed listing rule and withdrew the proposed NEP designation under section 10(j) of the Act for the southern Rocky Mountains.

In October 2014, three complaints were filed in the District Court for the District of Montana by Defenders of Wildlife, WildEarth Guardians, Center for Biological Diversity, and other organizations challenging the withdrawal of the proposal to list the North American wolverine DPS. Numerous parties intervened in the litigation. These three cases were consolidated, and on April 4, 2016, the court issued a decision. The court granted plaintiff's motion for summary judgment with respect to the Service's determination regarding (1) the threat posed to the wolverine by the effects of climate change at the reproductive denning scale, (2) the threat posed to the wolverine by small population size and lack of genetic diversity, and (3) the application of the significant portion of its range policy to the wolverine. As a result of the court order, the August 13,

2014, withdrawal (79 FR 47522) was vacated and remanded to the Service for further consideration consistent with the order. As documented in the SSA report, the Service conducted additional analyses and reviewed new literature regarding climate change effects at the denning scale (see pages 73–99 of the SSA report) and included additional life-history information relevant to this potential stressor (see pages 25–39). With regard to population size, we also provide in the SSA report an analysis of information on wolverine population abundance and distribution (to date) and have included a discussion of population structure (genetics, effective population size) in the context of the species' known genetic variability (see pages 44–50). Finally, in this withdrawal, we have provided an updated significant portion of its range analysis (see discussion below).

In effect, the court's action returned the process to the proposed rule stage, and the status of the wolverine under the Act reverted to that of a proposed species for the purposes of consultation under section 7 of the Act. On October 18, 2016, we published a notice (81 FR 71670) reopening the comment period on the February 4, 2013, proposed rule (78 FR 7864) to list the DPS of wolverine occurring in the contiguous United States as threatened, under the Act. We also requested new information and announced that we initiated a new and comprehensive status review of the North American wolverine, to determine whether the species meets the definition of an endangered or threatened species under the Act, or whether the species is not warranted for listing. The wolverine SSA report provides the scientific basis for the decision to withdraw the proposed listing rule for the DPS of wolverine occurring in the contiguous United States. Both new and updated information and analyses presented in the wolverine SSA report, summarized below in support of our listing determination, along with public comment, have prompted us to reevaluate our previous assessment of the DPS (presented in our 2013 proposed listing rule, which in turn relied on the DPS analysis completed in our 2010 12-month finding) with respect to wolverine in the contiguous United States.

Summary of Comments and Recommendations

As stated above in the Previous Federal Actions section, on October 18, 2016 (81 FR 71670), we opened a public comment period on our February 4, 2013, proposed rule (78 FR 7864) to list

the DPS of wolverine occurring in the contiguous United States as threatened. We also contacted appropriate Federal and State agencies, scientific experts and organizations, Tribes, and other interested parties and invited them to comment on the proposed rule. Many of the comments we received from State agencies during our notice for reopening the comment period (81 FR 71670) were similar to those received for the previously proposed rule (78 FR 7864). All substantive information provided during comment periods has either been incorporated directly into this final determination or is addressed below.

Public Comments

(1) Comment: We received several public comments claiming that the North American wolverine faces increasing threats from the effects of climate change, particularly habitat loss due to declining snow pack.

Our Response: As discussed in the wolverine SSA report, we recognize that current climate trends and future (2055 and later) climate model projections indicate warming temperatures for much of western North America and changes to snow pack conditions. Our review of the literature found that, overall, higher elevation areas (*e.g.*, Rocky Mountains, Sierra Nevada Mountains) are more resilient to projected changes in temperature and precipitation as compared to lower elevations (Wobus *et al.* 2017, p. 12). In general, models indicate higher elevations, where documented historical wolverine denning has occurred, will retain more snow cover than lower elevations, particularly in early spring (April 30/May 1). We present in the wolverine SSA report a summary of new, fine-scale analysis of future snow persistence in two regions of the western United States, Glacier National Park and Rocky Mountain National Park. The two regions studied include a high-latitude area near tree line within Glacier National Park, where tree line occurs at (~1,800 to 2,100 meters (m) (5,906 to 6,890 feet (ft))) that is currently occupied by wolverines; and a lower latitude area within Rocky Mountain National Park (occupied by a single male wolverine from 2009 to at least 2012, but not known to be currently occupied), where tree line occurs at higher elevation (~3,500 m (11,483 ft)) (Ray *et al.* 2017, p. 2). These sites were chosen to bracket the range of latitude and elevation wolverines currently occupy in the contiguous United States (Ray *et al.* 2017, p. 2). This effort built upon previous model projections presented in McKelvey *et al.* (2011), but with significant differences such as finer

spatial resolution, incorporation of slope and aspect, snow depth estimates, additional years of historical data, and wider temporal analyses of snow persistence (April–June). Details of this modeling exercise are presented in Ray *et al.* (2017), and summarized in the SSA report. That analysis indicates significant areas (several hundred square kilometers (km²)/square miles (mi²) for each study area) of future snow (greater than 0.5 m (20 inches (in) in depth) will persist on May 1 at elevations currently used by wolverines for denning. This is true, on average, across the range of climate models used out to approximately year 2055.

(2) *Comment:* We received several public comments during our request for information claiming that low population size (and small effective population size) warrant listing of the North American wolverine as threatened or endangered.

Our Response: Small populations in and of themselves do not constitute a threat such that a species would be endangered or threatened. When evaluating species status, we take into consideration the species' life history, population dynamics, and other impacts to populations and species to determine if small population dynamics increases the species' vulnerability to extinction such that listing as threatened or endangered is warranted. Wolverines are difficult animals to survey, and populations occur in naturally low densities across their North American range due, in large part, to their need for large, exclusive territories. At the present time, there is no reliable estimate of the number of wolverines that currently occupy or previously occupied the contiguous United States, nor are there reliable quantitative estimates of wolverine population trends in the contiguous United States. The often-cited population estimate of 318 wolverines (range: 249–626) in the contiguous United States is derived from a habitat modeling exercise presented in Inman *et al.* (2013). That publication also provided a model estimate of potential wolverine capacity of 644 (range: 249–626). However, both of these estimates did not consider important spatial considerations related to wolverine behavior, such as territoriality, relative to wolverine populations. Despite the paucity of information regarding wolverine populations, the SSA analysis is a thorough examination of all of the available population information.

As discussed in the wolverine SSA report, preliminary field results from a recent (2016–2017) occupancy study in four western States (Idaho, Montana,

Washington, and Wyoming) and from a pilot occupancy study in Wyoming (2015–2016) indicate detections of wolverines in areas where they would be expected to be found, but also no detections in areas where they are known to occur (*e.g.*, areas within Glacier National Park) (see Service 2018, Appendix B for a descriptive map). To date, this study reports a total of 86 photographic detections through camera-trapping and 157 wolverine hair samples collected for genetic analysis. It has not yet been determined from the camera-trap images or hair samples how many of the detections are unique individuals. Preliminary analysis of the study results indicates an average estimated probability of occupancy of 0.42 suggesting that wolverines used nearly half of all sites during the study period (Montana FWP, pers. comm., 2017); however, the study did not encompass all potential wolverine habitat in the western United States (Service 2018, Appendix B). For example, wolverines have also been recently detected in northeastern Oregon (as of 2017) and in parts of Grand Teton National Park (two records during the winter of 2017), which were not included in the surveyed study cells. Our SSA report presents a visual summary of these recent detections (Service 2018, Figure 3). Although the sum of these reports cannot confirm previous estimates of population size or verify population trends, they offer recent evidence that wolverines continue to be observed across a large area of the western United States.

The 2013 proposed rule presented an effective population size estimate from a publication by Schwartz *et al.* (2009), which estimated a summed effective population size of 35, with credible limits from 28 to 52 (Schwartz *et al.* 2009, p. 3,226). As described in the SSA report, the study used wolverine samples from the main part of the Rocky Mountain wolverine populations and did not include subpopulations from two other mountain regions in Montana, and samples were missing from other parts of the wolverine range in Idaho and other areas of Montana. Thus, the analysis missed both wolverine subpopulations and individuals, which would underestimate the results for this type of analysis.

In the wolverine SSA report, we provide a contextual discussion of the effective population size concept, particularly in the context of genetic studies related to the phylogeographic history of the North American wolverine that were not well described in the 2013 proposed rule. In sum, the spatial distribution of genetic variability

currently observed in wolverines in North America appears to be a reflection of a complex history in which population abundance has fluctuated since the time of the last glaciation with insufficient time passing since human persecution since at least the 1700s to allow for full recovery of wolverine densities (Cardinal 2004, pp. 23–24; Zigouris *et al.* 2012, p. 1,554). This history and the fact that wolverines in the contiguous United States occupy the southern periphery of the species' entire North American range are important considerations in estimating and interpreting current wolverine distribution and abundance. The wolverine SSA report also presents information from genetic and observational studies that provide support for wolverine movement across the international border of the contiguous United States and Canada. In the 2013 proposed rule, we stated there is an apparent lack of connectivity between wolverine populations in Canada and the United States based on genetic data (78 FR 7864; February 4, 2013). We now consider wolverines that occupy the contiguous United States to be genetically continuous with wolverines in adjacent Canadian provinces. A small effective population size would be more of a concern if the population was in isolation; however, wolverines in the contiguous United States are not genetically isolated from wolverines in Canada. For more information, see the *Small Total Population Size* and *Effective Population Size* sections under *Distinct Population Segment* below.

(3) *Comment:* We received several public comments during our request for information claiming that North American wolverine face threats from indiscriminant trapping in the contiguous United States, or are threatened by incidental trapping.

Our Response: At the present time, trapping or hunting of wolverine is not allowed in any State within the range of the wolverine (with the exception of Alaska). Legal protections for wolverines are codified in western State laws and regulations and include: Endangered in Colorado, threatened in California and Oregon, candidate species in Washington, non-game species protections in Idaho and Wyoming, a species of concern and a furbearer with a closed season in Montana, and protection from collection, importation, and possession in Utah. Since 2013, there has been a zero quota for trapping or harvest of wolverine in Montana.

Incidental trapping of wolverines has been documented in the contiguous

United States (as recently as December 2017), though not all events have resulted in mortality. In the wolverine SSA report, we provide a summary of the number of wolverines that have been incidentally trapped in Idaho (18 since 1965, including 6 known to be released alive and 7 known mortalities), Montana (4 since 2013, 3 mortalities and 1 released unharmed), and Wyoming (2 since 1996, 1 mortality and 1 released unharmed) (Service 2018, p. 66). Both Idaho and Montana are implementing trapper education programs to minimize nontarget wolverine captures.

As discussed in the SSA report, regulated trapping and hunting of wolverines occurs in parts of Alaska and Canada, and appears to be sustainable based on population and density estimates.

(4) *Comment:* We received several public comments identifying potential threats to wolverines from winter recreation activities, such as snowmobiling and back-country skiing.

Our Response: In the SSA report, we present a summary of winter recreation studies (Heinemeyer *et al.* 2015; Heinemeyer *et al.* 2017), future projections of winter recreation activity in the contiguous United States (White *et al.* 2014), and projections of snowpack relative to changes in the length of the winter recreation season (Wobus *et al.* 2017). We reported results from Heinemeyer (2016, pers. comm.) indicating a behavioral response to recreation activities, but also maintenance of home ranges within some areas of relatively high recreation activity over several years. The study has not yet been able to determine whether resident wolverines are reproductively successful due to the limited monitoring information available for reproducing female wolverines. Nor was the study able to determine if recreational activities had a negative impact on wolverine reproductive success.

We also note here that we received the final report of this multiyear study (Heinemeyer *et al.* 2017) in mid-December 2017 (results of this study were recently published (Heinemeyer *et al.* 2019)), which was after we submitted the draft SSA report for review to four peer reviewers and to our State, Federal, and Tribal partners. Much of the report presents a modeling exercise to evaluate wolverine behavior patterns with winter recreation activities. The study found that wolverines maintained multiyear home ranges, and the authors suggest that wolverines are able to tolerate winter recreation at some scales (Heinemeyer *et al.* 2017, p. iv;

Heinemeyer *et al.* 2019, p. 16). The study described habitat selection as complex for female wolverines and was likely driven by a combination of abiotic (snow, cold) and biotic (predator avoidance, food availability) factors (Heinemeyer *et al.*, 2017, p. 36; Heinemeyer *et al.* 2019, p. 16). This study did not assess demographic effects, fitness effects, or population level effects of winter recreation on wolverines (Heinemeyer *et al.* 2019, p. 17 and 19). As discussed in the wolverine SSA report, management measures being implemented in areas within the wolverine's current extent of occurrence include road closures to minimize disturbance to wildlife on lands managed by the U.S. Forest Service and National Park Service (Service 2018, p. 61 and Appendix F). In addition, management strategies are identified in State Wildlife Action Plans (*e.g.*, Oregon, Montana, Idaho) to address potential impacts from recreation to the wolverine. Although we did not rely on these conservation measures to support our decision, they do provide some level of protection to address potential impacts from disturbance from winter recreation activity and mortality from roads.

(5) *Comment:* We received public comments claiming that wolverines are dependent on deep snow for survival and expressing concern for future changes in snow pack due to the effects of climate change.

Our Response: After reviewing studies not previously considered and the results of new studies/publications made available after the 2013 and 2014 proposed rules (*e.g.*, Aronsson 2017, Aronsson and Persson 2016, Aronsson *et al.* 2017, Magoun *et al.* 2017, Persson *et al.* 2017, Stewart *et al.* 2016, Webb *et al.* 2016, see complete list of citations in the wolverine SSA report), we present in the SSA report a detailed discussion of the North American wolverine's physiology and other life-history characteristics (*e.g.*, reproductive behavior). This summary speaks to several presumed aspects of the relationship of denning behavior and other needs of this species regarding the presence of persistent spring snow. As summarized below, we now know that wolverines can and have denned outside of heavy snowpack, multiple factors play a role in den site selection, females will move dens as young become mobile, and areas of significant snowpack will likely persist in the future in areas where wolverines are known to den at levels that will continue to support wolverines.

Denning habitat for the wolverine varies over its range and is dependent

on local and regional environmental conditions (*e.g.*, topographic and other structural features) and biotic (*e.g.*, availability of prey; protection from predators) factors. Reproductive (natal) dens are not always excavated in deep snow, particularly in boreal forest habitats (Dawson *et al.* 2010; Novikov 1962; Webb *et al.* 2016; Jokinen 2019.), and have been observed in spruce tree root balls, logging slash piles, and beaver dens/dams. In the contiguous United States, dens are found at high elevations, often in talus slopes, which provides conditions for protection and food caching (*e.g.*, restricted access and cold temperatures). Our review of studies of wolverine denning activity found no quantitative data reporting snow depth at the den site when wolverines abandon the den. More importantly, wolverine reproductive success has not been studied relative to a number of abiotic and biotic conditions, including depth and temporal aspect of spring snow cover.

Wolverines begin shifting den locations in late April, when young become more mobile and reliant on solid food brought to them by the mother (Aronsson 2017, p. 46; Aubry *et al.* 2016, p. 24). The bioclimatic model presented in Copeland *et al.* (2010) was used to test wolverine distribution at a broad scale based on climate variables, including spring snow cover, using May 15 conditions. They then tested their hypothesis by comparing and correlating the location of wolverine dens across their circumboreal range, and telemetry locations from wolverine studies in North America and Scandinavia (Copeland *et al.* 2010, p. 234). Since that publication, wolverines and wolverine dens have been observed outside the boundaries defined by the model presented in Copeland *et al.* (2010) (*e.g.*, Webb *et al.* 2016, Webb 2017 pers. comm., Persson 2017, pers. comm.). While these observations are found at higher latitudes in the circumboreal region, they also indicate wolverines and wolverine dens are observed in environments that are not characterized by several feet of spring snow on May 15. In sum, Copeland *et al.* (2010) provided a fairly accurate assessment of where wolverine populations are expected to occur, but it did not evaluate (model) snow persistence at the den site scale based on location and denning period.

In the SSA report, we present an analysis of 34 wolverine den locations (years 2002–2015) from studies in the western contiguous United States relative to “melt out” dates, which represents the first day of an 8-day satellite (Moderate Resolution Imaging

Spectroradiometer (MODIS)) composite of when the den switches from “snow” to “no snow” at a 500-by-500-m (1,640-by-1,640-ft) spatial resolution. For natal den locations, the range of the melt-out dates was from May 25 to June 12, which is considerably later than the May 15 date used in the Copeland *et al.* (2010) analysis. The estimated melt-out dates indicate that snow is persistent at these locations past the time when young wolverines are generally moving out of natal dens (*i.e.*, late April).

The Copeland *et al.* (2010) snow model was then used by McKelvey *et al.* (2011) to model effects of climate change to wolverine habitat in the western United States to develop projections of habitat loss. This modeling exercise used May 1 snow presence as a proxy for May 15 snow disappearance and a spatial resolution of 36.3 km² (14 mi²), which is not relevant at the at the den site scale. As described in our Response to Comment #1, in the SSA report, we presented a finer scale analysis (0.0625 km² (0.24 mi²)) for two study areas (Glacier National Park and Rocky Mountain National Park) that focused directly on May 15, in addition to the presence or absence of snow on May 1 and April 15 in our evaluation of the effects of climate change to snowpack. These dates are more relevant to wolverine life-history needs. We also modeled the depth of “significant” snow (0.5 m (1.64 ft)) on these dates. We found that large areas (several hundred km²/mi² for each study area) of future snow (greater than 0.5 m (20 in) in depth) are projected to persist on May 1 at elevations currently used by wolverines for denning. This is true, on average, across the range of climate models used out to approximately year 2055. We recognize that wolverines are difficult to study and evaluation of denning habitat and behavior is challenging. Additional research is needed to evaluate other potential physical and biotic variables that could be important in defining wolverine distribution and den locations. These additional variables include: prey availability, risk of predation, den-site scale factors such as structure/snow conditions, and temporal use of dens.

(6) *Comment:* We received public comments identifying the need for additional research and recommendations for conservation measures for the North American wolverine, including estimates of population size and further evaluation of life-history characteristics, and recommendations for conservation measures.

Our Response: We appreciate the comments acknowledging the need for additional studies as well as the difficulties in studying wolverines given its occupation of remote habitats in the contiguous United States. In the wolverine SSA report, we provide a summary of the preliminary field and genetic results from the recent Western States Wolverine Conservation Project (WSWCP)—Coordinated Occupancy Study in four western (contiguous United) States, as well as results from several new studies presented in peer-reviewed publications and in other reports from Canada and Scandinavia. As discussed in the SSA report, the Western States Wolverine Working Group is continuing to develop studies to evaluate wolverine population distribution and occupancy, and connectivity across four western States.

(7) *Comment:* We received additional comments from the public including the need for collaboration with local government and community stakeholders and use of best available science in developing the proposed rule.

Our Response: During our preparation of the wolverine SSA report, we coordinated extensively with many wolverine researchers in the United States (including Alaska), Canada, and Scandinavia. Those communications are identified in our References Cited section of the wolverine SSA report. Their expertise, insights, and published or soon-to-be published research papers were invaluable in ensuring that we used the best available science in preparing the new status review. We also communicated with biologists at several State and Federal agencies to ensure that we had incorporated the most recent wolverine detections in the western United States. The wolverine SSA report was sent to four independent peer reviewers, selected by an outside contractor, and those non-attributable comments were incorporated, to the extent possible, in the final document. We also reviewed comments received from the public and previous peer reviewers during our request for comments for our previous proposed rule and considered the information provided (78 FR 7864; February 4, 2013) during the preparation of the wolverine SSA report. As a result, this determination is based upon the best scientific and commercial data available to us, as required by the Act.

(8) *Comment:* We also received public comments recommending that the North American wolverine not be listed as threatened or endangered under the Act. One commenter stated that State wildlife agencies are capable of

managing the species and are able to provide protections that ensure continued population growth towards population objectives established by these agencies and that mandates of various Federal resource management agencies provide a commitment to managing wildlife habitat in a way that benefits all wildlife species, including wolverines and other forest carnivores.

Our Response: We acknowledge that some members of the public support our decision to withdraw our proposed rule to list the North American wolverine as threatened under the Act. In the wolverine SSA report (Service 2018, Appendix G), we provide a summary of the regulatory protections provided by western States and Federal agencies as well as management measures being implemented to conserve the wolverine and its habitat. Legal protections in the contiguous United States include State listing in California and Oregon (threatened), endangered in Colorado, a candidate species in Washington, non-game species protections in Idaho and Wyoming, a species of concern and furbearer with a closed season in Montana, and protection from collection, importation, and possession in Utah. Trapping or hunting of wolverines is currently prohibited in the contiguous United States.

(9) *Comment:* In response to our request for information in our public notice, several members of the public provided specific information related to personal wolverine sightings of the North American wolverine in the contiguous United States (*e.g.*, New Mexico, Wyoming), and information regarding past and ongoing research studies of the species in the western United States and in Canada.

Our Response: We appreciate the personal observations provided and encourage members of the public to document sightings of the North American wolverine with photographs and provide additional details to State wildlife agencies. Information we received regarding results from research studies has been incorporated, as appropriate, in the final wolverine SSA report.

(10) *Comment:* We received comments from several organizations that support the listing of the North American wolverine and designation of critical habitat. Threats cited include concerns related to migration, habitat loss and connectivity related to threats from effects of climate change, nontarget trapping pressures, road mortality and other effects of roads (*e.g.*, noise, pollution, fragmentation of habitat), motorized recreation and traffic in wildlife corridors, timber sales and

associated roads, and effects of snowmobile traffic (habitat fragmentation and pollution, and change in behavior).

Our Response: As discussed in the *Risk Factors for the North American Wolverine* section below, we identified several potential stressors that may be affecting the species and its habitat currently or in the future, including impacts associated with climate change effects. We recognize there is limited information available for the wolverine, including population estimates and abundance trends. Based on the best available information, demographic risks to the species from either known or most likely potential stressors (*i.e.*, disturbance due to winter recreational activities, other human disturbances, effects of wildland fire, disease, predation, overutilization, genetic diversity, small population effects, climate change, and cumulative effects) are low based on our evaluation of the best available information as it applies to current and potential future conditions for the wolverine and in the context of the attributes that affect the needs of the species (Service 2018, p. 103). Thus, we determined that, based on the best available information, the North American wolverine in the contiguous United States does not meet the definition of a threatened species or an endangered species under the Act.

(11) *Comment:* We received public comments stating that protection of North American wolverines in the contiguous United States is needed under the Act in order to provide resources and attention needed for research and monitoring, to better understand threats, and sustain wolverines into the future. The commenter also stated that federally sponsored wolverine reintroduction in Colorado will help increase chances of long-term species survival.

Our Response: We appreciate the recognition of the need for continued resources for research and monitoring. However, we base our listing decisions on a determination of whether the species meets the Act's definitions of a threatened species or an endangered species. Regardless, as summarized in the SSA report, in 2015, State wildlife agencies in Idaho, Montana, Washington, and Wyoming, along with Federal, tribal, and nongovernmental organization partners, developed a collaborative and coordinated monitoring program to be implemented in a coordinated fashion across the species' range in the western United States. In 2015, the State of Wyoming contracted with the Wolverine Initiative to conduct the Wyoming Wolverine

Occupancy Pilot Study to address questions pertaining to the status and distribution of wolverines throughout the Greater Yellowstone Ecosystem and the Bighorn Mountains in the winter of 2015–2016. Expanding on this study, the Western States Wolverine Working Group designed and implemented the WSWCP–Coordinated Occupancy Survey in the winter of 2016–2017, and preliminary results are presented in the SSA report. The Western Association of Fish and Wildlife Agencies (WAFWA) Wildlife Chiefs Wolverine Subcommittee (formally endorsed in 2014) currently provides a forum for western States to work collaboratively with each other and with the Service, Tribes, and other partners, for conserving wolverines across the western United States. To date, approximately \$1.5 million of that funding has been applied towards conservation and management actions, including the WSWCP (McDonald 2017, pers. comm.). This group is also developing a connectivity study project to support conservation planning efforts for the Rocky Mountains and North Cascades regions.

In addition, multiple western States have identified the North American wolverine as a Species of Greatest Conservation Need in their State Wildlife Action Plans, and the North American wolverine is a focal species of conservation strategies for conservation targets in a number of ecoregions (*e.g.*, Cascades, Sierra Nevada) that support forested lowlands, subalpine-high montane conifer forest where wolverines occur. These State designations provide information to assist resource managers with proactive decision making regarding species conservation and data collection priorities. Finally, the Nez Perce Tribe is currently preparing an Integrated Resource Management Plan, a Plant and Wildlife Conservation Strategy, and a Forest Management plan with the wolverine defined as a species of conservation concern in all three draft plans (Miles 2017, pers. comm.).

In total, these funded and volunteer collaborative, landscape-level conservation efforts ensure continued support for the conservation of the North American wolverine. Although we did not rely on these plans to support our decision, we recognize that these plans, when implemented, will likely benefit wolverines and their habitat.

(12) *Comment:* We received comments from several industry groups supporting our August 13, 2014, withdrawal (79 FR 47522) of our February 4, 2013, proposed rule (78 FR

7864) to list the North American wolverine as threatened. In general, their support rests on the following: (1) The DPS determination presented in our previous proposed rules (both 2010 and 2013) was flawed; (2) the North American wolverine does not meet the definition of a threatened species; (3) the obligate relationship with denning and need for snow has not been adequately addressed (and may be a habitat preference); and (4) climate model projections do not support complete loss of snow. They also urged us to reaffirm prior findings that winter recreation (motorized and nonmotorized) is not a threat to wolverines.

Our Response: Given that our updated analysis and new information included in the wolverine SSA report directly relates to our previous DPS determination in the 2013 proposed rule, we reevaluated wolverines in the contiguous United States under our DPS Policy. See the Distinct Population Segment section below for more information. We provide our analysis of the status of wolverines in the contiguous United States below in the Determination of Species Status. The topic of denning behavior is discussed in the wolverine SSA report (see Use of Dens and Denning Behavior discussion in the *Reproduction and Growth* section in the wolverine SSA report (Service 2018, pp. 23–28)). For our analysis of the effects of climate change to wolverines and denning habitat, see *Climate Change and Potential for Cumulative Effects* below.

(13) *Comment:* We received a comment from an industry group stating that our decision to prepare the February 4, 2013, proposed rule (78 FR 7864) to list the North American wolverine as threatened was due to a “misreading” of the Service's obligation under our 2011 Settlement Agreement, and therefore the proposed rule was not developed from “an open-ended scientific inquiry.” We received a comment from an industry group stating that the Service should not “revert back to the 2013 proposed rule” and should conduct a new analysis of potential impacts to the species, revise the proposed listing using newly available information, and reevaluate our previous DPS determination.

Our Response: The Service properly prepared its 2013 proposed rule. On October 18, 2016, we published a document in the **Federal Register** (81 FR 71670) announcing that we would initiate a new status review of the North American wolverine, to determine whether this DPS meets the definition of an endangered or threatened species

under the Act, or whether the species is not warranted for listing. The Service has prepared the wolverine SSA report that includes discussion and analyses of the best available scientific information regarding life history, biology, and consideration of current and future vulnerabilities. This information was used to evaluate the current and future conditions of the species, and to inform our current determination.

Comments From Tribes

(14) *Comment:* We received comments from one consortium of Tribal nations stating that, based on the weight of evidence provided in our previous rules, the North American wolverine meets the definition of endangered or threatened and is therefore warranted for listing. Specific threats mentioned in the comment letter included current population status, winter recreation activities, and effects of climate change. The Tribes also included comments documenting the cultural value of the wolverine and connection to cultural practices and concern for the loss of wolverine populations in the contiguous United States. The Tribes encouraged the Service to use sound and solid science in the listing determination, and noted that additional population monitoring and Tribal climate change modeling efforts are under way to evaluate the status of the wolverine.

Our Response: We appreciate the unique perspective provided by the Tribal nations regarding the contribution of the North American wolverine to the Tribes' culture and spirituality. We also appreciate the commitment of the Tribal nations to continue ongoing studies of wolverines.

As described in the wolverine SSA report, we evaluated new information, as well as information not previously considered, and contacted several wolverine researchers (both within and outside the United States) to provide a more detailed description of the wolverine's life history and ecology, including a detailed discussion of wolverine denning habitat and behavior. We conducted new analyses to develop a current potential extent of occupancy using the most recent verified observations. Current potential extent is the perimeter of the outermost geographic limits based on all (available) occurrence records (that is, the maximum extent of occurrences) of a species minus those areas where we believe the species has been extirpated (Service 2017). Conservation measures and regulatory mechanisms relative to the wolverine were also provided in the wolverine SSA report. This information

was used to evaluate the current (potential stressors) and future conditions of the species, and inform our current determination. We evaluated results from a fine-scale analysis of the potential effects of climate change to future snowpack conditions in two regions of the Rocky Mountains. This analysis found that significant areas (several hundred km²/mi²) will persist on May 1 at elevations used by wolverines for denning. We determined that, based on the best available information, the North American wolverine in the contiguous United States does not warrant listing as threatened or endangered under the Act.

(15) *Comment:* We received comments from one Tribe whose aboriginal territory is occupied by the North American wolverine. The Tribe submitted a comment letter in 2013 supporting our proposed listing. The Tribe stated that the conservation and restoration of the wolverine and other species within this homeland is of great importance to the Tribe's subsistence, culture, religion, and economy. The letter also identified conservation and management plans currently under development and highlighted that the wolverine is designated as a species of concern in these current draft plans. Specific comments were provided relative to threats from climate change (including relative to demographic stochasticity), recreation and urban development, and incidental take. Included in those comments were references to other studies under way (e.g., Adaptation Partners and climate change vulnerability assessments; winter recreation study) to evaluate these potential stressors.

Our Response: We appreciate the perspective provided regarding the importance of the wolverine and other species to the Tribe and its commitment to current and future conservation and management actions. We also appreciate and evaluated the information presented in the citations that were provided in the comment letter. As described in the wolverine SSA report, we evaluated several new scientific publications and information not previously considered in preparing a new status review. This information was used to evaluate the current conditions (i.e., potential stressors, including winter recreation) and future conditions (e.g., effects of climate change) of the species. Based on the best available information, we determined that the North American wolverine in the contiguous United States does not warrant listing as threatened or endangered under the Act.

State Agency Comments

We received extensive comments from several western States, requesting that we consider previously submitted comments in response to our previously proposed listing rule (78 FR 7864; February 4, 2013) as well as additional comments submitted in response to our 2016 notice reopening public comment (81 FR 71670; October 18, 2016). These comments were grouped together and summarized as described below:

(16) *Comment:* We received detailed comments critical of our reliance on "unverified" climate model projections in our 2013 proposed rule, the lack of discussion of assumptions in adopting the model findings, the lack of evaluating alternative hypotheses, and the need to evaluate these effects at the den-site scale. One State agency recommended that, given the disagreements in the scientific community on the interpretation of these results, the Service solicit an independent, scientific review of the proposed rule.

Our Response: This withdrawal was based on the scientific analysis using the structure of the Service's Species Status Assessment (SSA) Framework (https://www.fws.gov/endangered/improving_ESA/ssa.html). An SSA is a focused and rigorous assessment of a species' ability to maintain self-sustaining populations over time. This assessment is based on the best available scientific and commercial information regarding life history, biology, and consideration of current and future vulnerabilities. The result is a single document (SSA report) that delivers foundational science for informing decisions under the Act, including listing determinations, consultations, grant allocations, permitting, and recovery planning.

In preparing the final SSA report for the North American wolverine (available at www.regulations.gov, at Docket No. FWS-R6-ES-2016-0106), we reviewed available reports and peer-reviewed literature, incorporated survey information for the purpose of preparing updated maps of the known species' current and historical occurrences, and contacted species experts to collect additional unpublished information. We evaluated the appropriate analytical tools to address data gaps and uncertainties. In some instances, we used publications and other reports of the Eurasian subspecies (*Gulo gulo gulo*) to fully inform our knowledge of the North American wolverine (*Gulo gulo luscus*).

Before finalizing the SSA report, the draft wolverine SSA report was

submitted for peer review to four independent peer reviewers in accordance with our July 1, 1994, peer review policy (59 FR 34270), the Service's August 22, 2016, Director's Memo on the Peer Review Process, and the Office of Management and Budget's December 16, 2004, Final Information Quality Bulletin for Peer Review (revised June 2012). Results of this structured peer review process can be found at <https://www.fws.gov/mountain-prairie/science/peerReview.php>. This draft was also submitted to our Federal, State, and Tribal partners for scientific review. In preparing this determination to withdraw the proposed rule, we incorporated the results of these reviews in the final wolverine SSA report, as appropriate.

As noted in our previous responses to public comments (see response to *Comments 1* and *5* above), in our wolverine SSA report, we recognize that current climate trends and future (2055 and later) climate model projections indicate warming temperatures for much of western North America, and changes to snow pack conditions. Our review of the literature found that, overall, higher elevation areas (*e.g.*, Rocky Mountains, Sierra Nevada Mountains) are more resilient to projected changes in temperature and precipitation as compared to lower elevations (Wobus *et al.* 2017, p. 12). In general, models indicate higher elevations will retain more snow cover than lower elevations, particularly in early spring (April 30/May 1). We present in the wolverine SSA report a summary of new, fine-scale analysis of future snow persistence in two regions of the western United States, Glacier National Park and Rocky Mountain National Park. Glacier National Park represents a high-latitude and relatively low-elevation area currently occupied by North American wolverines. Rocky Mountain National Park is a lower latitude and high-elevation area within the North American wolverine's historical range, which was occupied by a male wolverine from 2009 to at least 2012.

As described above in *Comment 5*, this new analysis built upon previous model projections presented in McKelvey *et al.* (2011), but with significant differences such as finer spatial resolution, incorporation of slope and aspect, snow depth estimates, additional years of historical data, and wider temporal analyses of snow persistence (April–June). Details of this modeling exercise are presented in Ray *et al.* (2017), and summarized in the wolverine SSA report. That analysis indicates large areas (several hundred

km²/mi² for each study area) of future snow (greater than 0.5 m (20 in) in depth) will persist on May 1 at elevations currently used by wolverines for denning. This is true, on average, across the range of climate models used out to approximately year 2055.

After reviewing studies not previously considered and new studies/publications made available after the 2013 and 2014 proposed rules, we present in the wolverine SSA report, a detailed discussion of the North American wolverine's physiology and other life-history characteristics (*e.g.*, reproductive behavior). The analysis speaks to several presumed aspects of the relationship of denning behavior and other needs of this species regarding the presence of persistent spring snow.

Also, see our response to *Comment 5* above for a short summary and our SSA report for more details regarding our analysis of the effects of climate change to denning habitat.

(17) *Comment:* We received comments critical of our previous support for findings by Schwartz *et al.* 2009 regarding effective population size. Relatedly, several States commented on recent dispersal/movements of wolverines into California, Colorado, and Utah as evidence of population expansion.

Our Response: See our response to *Comment 2* above for a discussion of effective population size. Regarding recent occurrences of wolverines in the contiguous United States, wolverines have recently been found in areas where they were once extirpated in the contiguous United States. See the Population Abundance and Density section below for more information.

(18) *Comment:* We received comments from several western States presenting clarifications or updates to incidental trapping events and trapping regulations.

Our Response: In the wolverine SSA report, we include a summary of trapping or hunting of wolverines in the contiguous United States. At the present time, trapping or hunting of wolverines is not allowed in any western State (with the exception of Alaska, which was not included in the DPS in our proposed rule). Legal protections for wolverines are codified in western State laws and regulations concerning hunting and trapping. These protections include: Endangered in Colorado, threatened in California and Oregon, candidate species in Washington, non-game species protections in Idaho and Wyoming, a species of concern and furbearer with a closed season in Montana, and protection from

collection, importation, and possession in Utah. Since 2013, there has been a zero quota for trapping or harvest of wolverine in Montana.

Incidental trapping of wolverines has been documented in the contiguous United States (as recently as December 2017), though not all events have resulted in mortality (see response to *Comment 3* above). Both Idaho and Montana are implementing trapper education programs to minimize nontarget wolverine captures.

(19) *Comment:* Several States provided comments in response to our 2013 proposed rule and to our 2016 reopening of the public comment period indicating their disagreement with our determination of a DPS for the contiguous United States. Specifically, some commenters stated that the criteria of significance should be reevaluated, noting that the proposed rule did not provide any substantive information to support our conclusion that the loss of the wolverine in the contiguous United States would result in a significant gap in the range of the species; that is, our previous use of the loss of latitudinal range does not provide a rational basis for concluding that the loss of the wolverine in the contiguous United States would be significant in relation to the taxon. Another commenter stated that the wolverine population in the contiguous United States is connected geographically and genetically to the Canada/Alaska populations and these northern populations were likely the source of recolonization during the 20th century. Further, this commenter stated there is not a difference in control of exploitation and conservation status between the United States and Canada.

Another commenter noted that, throughout the 2013 proposed rule, the Service acknowledged that, historically, the wolverine population in the contiguous United States was markedly reduced by systematic predator control programs and unregulated trapping. Yet, as the commenter pointed out, areas of suitable habitat in the North Cascades, where trapping has been minimal or nonexistent for decades, and northern Rockies, were recolonized by animals from Canada, where relatively liberal trapping is still allowed. Thus, our characterization in the 2013 proposed rule of "liberal" Canadian regulations as sufficient to "maintain the robust conservation status of the Canadian population," does not comport with our characterization that the very limited trapping in the contiguous United States (Montana only) is insufficient to maintain the rebounding population designated as a DPS.

Our Response: In light of the updated analysis and new information included in the wolverine SSA report, we reevaluated wolverines in the contiguous United States under our DPS Policy. We conclude that the population of wolverines in the contiguous United States is not discrete in relation to the remainder of the species in North America. As a result, the population of wolverines in the contiguous United States is not a listable entity under section 3(16) of the Act. See the Distinct Population Segment section below for more information.

(20) *Comment:* State agencies provided citations or copies of publications and reports relevant to wolverine ecology that were published after the 2013 proposed rule.

Our Response: We appreciate the comprehensive lists of published literature and survey reports provided by the State agencies. We evaluated this information during the preparation of the wolverine SSA report, and have incorporated this information, as appropriate, to ensure that the wolverine SSA report presents the best available information regarding the status of the North American wolverine.

(21) *Comment:* We received information providing background information and preliminary results of ongoing collaborative conservation efforts being implemented through the WSWCP–Coordinated Occupancy Survey.

Our Response: We appreciate the additional information provided by the State agencies participating in the WSWCP–Coordinated Occupancy Study. In the wolverine SSA report, we provide a summary of the preliminary field and genetic results from the recent WSWCP–Coordinated Occupancy Study in four western (contiguous United) States (see wolverine SSA report for additional details). We also incorporated technical comments received from several State agencies during the review of the draft wolverine SSA report into the final report. As discussed in the wolverine SSA report, the Western States Wolverine Working Group is continuing to develop studies to evaluate wolverine population distribution and occupancy, and connectivity across four western States.

(22) *Comment:* Information was provided by State agencies describing the legal protections of wolverines in individual States and conservation measures being implemented.

Our Response: In the wolverine SSA report (Service 2018, Appendix G), we provide a detailed discussion of current State (and Federal) regulatory mechanisms and other conservation

measures that offer protections for the North American wolverine. In addition to the WSWCP–Coordinated Occupancy Study (Service 2018, Appendix B), several western States have identified the North American wolverine as a Species of Greatest Conservation Need in their State Wildlife Action Plans, and the North American wolverine is a focal species of conservation strategies for conservation targets in a number of ecoregions (e.g., Cascades, Sierra Nevada) that support forested lowlands, subalpine–high-montane conifer forest where wolverines occur. These State designations provide information to assist resource managers with proactive decision-making regarding species conservation and data collection priorities, and support the conservation of the North American wolverine and its habitat.

(23) *Comment:* We received a comment from one State agency noting that the State does not recognize the North American wolverine as a native species due to lack of evidence that a population ever existed within New Mexico (i.e., unverified species); thus, the State does not recognize the species in any of its wildlife statutes or regulations.

Our Response: We appreciate the clarification and information provided by the State agency and have considered this in our analysis to define the current potential extent of occurrence for the North American wolverine in the contiguous United States (see Figures 1 and 2 below) and in our assessment of population status in the wolverine SSA report. In their analysis of wolverine distribution records in the contiguous United States, Aubry *et al.* (2001, p. 2,150) identified 1860 as the most recent verifiable documentation of wolverine in northern New Mexico. We received two unverified accounts of wolverine sightings in New Mexico from the general public during the most recent public comment period. We are unaware of any recent verifiable individuals or populations of wolverines in New Mexico.

(24) *Comment:* In response to our request for information in our October 18, 2016, **Federal Register** document (81 FR 71670), we received comments from the U.S. Forest Service submitting verifiable and new records of wolverines from 2000 to 2016. These records include observations from camera surveys by both governmental and nongovernmental organizations, photos from private citizens, and locations from a regional study.

Our Response: We appreciate the information provided and incorporated these observations and detections in our

analysis to define the current potential extent of occurrence for the North American wolverine in the contiguous United States (see Figures 1 and 2 below) and in our assessment of population status in the wolverine SSA report.

Background

A comprehensive review of the life history, population trends, and ecology of the North American wolverine is presented in the wolverine SSA report (Service 2018, pp. 3–44). The Service recognizes the North American wolverine as the subspecies *Gulo gulo luscus* (Service 2018, p. 8). Wolverines are a medium-sized (about 1 m (3.3 ft) in length) carnivore, with a large head, broad forehead, and short neck (Service 2018, p. 4). Wolverines have heavy musculature and relatively short legs, and large feet with strong, curved claws for digging and climbing (Service 2018, p. 4). Their feet are adapted for travel through deep snow and, during the winter, dense, stiff, bristle-type hairs are found between the toes and around the foot pad; this characteristic becomes diminished in the summer (Service 2018, p. 4). The wolverine is the largest terrestrial member of the Mustelidae family (weasels, fisher, mink, marten, and others) and resembles a small bear with a bushy tail (Service 2018, p. 1). Wolverines possess a number of morphological and physiological adaptations that allow them to travel long distances and they maintain large territories in remote areas (Service 2018, p. 1). They have been described as curious, intelligent, and playful, but cautious animals, though their social behavior and social organization has not been well-studied (Service 2018, p. 1). Wolverines have a distribution that includes the northern portions of Europe, Asia, and North America. In North America, they are found in Alaska, much of Canada, and the western-northwestern United States.

During the late 1800s and early 1900s, the wolverine population declined or was extirpated in much of the contiguous United States (lower 48 States), which has been largely attributed to unregulated trapping (Hash 1987, p. 583). Wolverine numbers have recovered to some extent from this decline and, in the United States, wolverines are currently found in parts of Washington, Oregon, Idaho, Montana, Wyoming, California (single male), and Alaska, and as recently as 2010 in Michigan, 2012 in Colorado, and 2016 in Utah. Known reproducing wolverine populations are found in Washington, Idaho, Montana, and Wyoming (Service 2018, p. 1).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an “endangered species” or a “threatened species.” The Act defines an endangered species as a species that is “in danger of extinction throughout all or a significant portion of its range,” and a threatened species as a species that is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” The Act requires that we determine whether any species is an “endangered species” or a “threatened species” because of any of the following 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.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species’ continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term “threat” to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term “threat” includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term “threat” may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an “endangered species” or a “threatened species.” In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an

individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an “endangered species” or a “threatened species” only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term “foreseeable future,” which appears in the statutory definition of “threatened species.” Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term “foreseeable future” extends only so far into the future as the Services can reasonably determine that both the future threats and the species’ responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. “Reliable” does not mean “certain”; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species’ likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species’ biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for the species, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. It does, however, provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act

and its implementing regulations and policies. The following sections provide summaries of the key results and conclusions from the SSA report; the full SSA report can be found on the Mountain-Prairie Region website at <https://www.fws.gov/mountain-prairie/> and at <http://www.regulations.gov> under Docket No. FWS-R6-ES-2016-0106.

To assess wolverine viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species’ ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species’ viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species’ life-history needs. The next stage involved an assessment of the historical and current condition of the species’ demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species’ responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Distinct Population Segment

Pursuant to the Act, we must consider for listing any species, subspecies, or, for vertebrates, any distinct population segment (DPS) of these taxa, if there is sufficient information to indicate that such action may be warranted. To interpret and implement the DPS provision of the Act and Congressional guidance, the Service and the National Marine Fisheries Service published, on February 7, 1996, an interagency Policy

Regarding the Recognition of Distinct Vertebrate Population Segments under the Act (61 FR 4722; February 7, 1996). This policy addresses the recognition of DPSs for potential listing actions. The policy allows for more refined application of the Act that better reflects the biological needs of the taxon being considered, and avoids the inclusion of entities that do not require its protective measures.

Under our DPS policy, three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Act. These are applied similarly for additions to the list of endangered and threatened species, reclassification, and removal from the list. They are: (1) Discreteness of the population segment in relation to the remainder of the taxon; (2) the biological or ecological significance of the population segment to the taxon to which it belongs; and (3) the population segment's conservation status in relation to the Act's standards for listing (*i.e.*, whether the population segment is, when treated as if it were a species or subspecies, an endangered or threatened species). Discreteness refers to the degree of isolation of a population from other members of the species, and we evaluate this factor based on specific criteria. If a population segment is considered discrete, we must consider whether the discrete segment is "significant" to the taxon to which it belongs by using the best available scientific and commercial information. When determining if a potential DPS is significant, our policy directs us to sparingly list DPSs while encouraging the conservation of genetic diversity. If we determine that a population segment is both discrete and significant, we then evaluate it for endangered or threatened species status based on the Act's standards.

Both new and updated information and analyses presented in the wolverine SSA report, summarized below in support of our listing determination, along with public comment, have prompted us to reevaluate our previous assessment of the DPS (presented in our 2013 proposed listing rule, which in turn relied on the DPS analysis completed in our 2010 12-month finding) with respect to wolverine in the contiguous United States. Below we provide our revised evaluation of discreteness under the DPS policy of the segment of the North American wolverine occurring in the contiguous United States.

Distinct Population Segment Analysis for Wolverine in the Contiguous United States

Analysis of Discreteness

Under our DPS Policy, a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphological discontinuity may provide evidence of this separation); or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act (inadequacy of existing regulatory mechanisms).

Discreteness Based on Marked Separation

In our February 4, 2013, proposed listing rule (78 FR 7864), we did not rely on marked separation from other populations to support discreteness of the contiguous United States wolverine population. As supported by information in the SSA report, we maintain that there are no physical, physiological, ecological, or behavioral factors separating wolverines in the contiguous United States from wolverines in Canada. We do not consider wolverines in the contiguous United States to be genetically isolated from wolverines in Canada (McKelvey *et al.* 2014; Pilgrim and Schwartz 2018). Therefore, wolverines in the contiguous United States are not discrete based on marked separation from other populations of the same taxon.

Discreteness Based on the International Border—Legal Status Conveyed by National, State, and Provincial Governments; Differences in Control of Exploitation

Our 2013 proposed rule (78 FR 7864), which incorporated by reference our DPS analysis from our 2010 12-month finding, found there was no significant difference between the legal status of wolverines between Canada and the United States (75 FR 78030; December 14, 2010). In the wolverine SSA report, we provide an updated assessment of legal protections and regulatory mechanisms for wolverine in North America (Service 2018, pp. 70–71, Appendix G). Legal protections in the contiguous United States include State listing in California and Oregon (threatened), endangered in Colorado, a candidate species in Washington, non-

game species protections in Idaho and Wyoming, a species of concern and furbearer with a closed season in Montana, and protected from collection, importation, and possession in Utah. In Canada, provincial designations range from endangered to threatened in eastern provinces, and sensitive/special concern to no ranking in other provinces (definitions provided by the Committee on the Status of Endangered Wildlife in Canada, 2014). As was determined in our 2013 proposed listing rule (78 FR 7864), we again find no significant differences in legal status.

In the 2010 12-month finding (75 FR 78030) and reiterated in our 2013 proposed listing rule (78 FR 7864), we stated that differences in control of exploitation exist, but favor the contiguous United States population. Trapping or hunting of wolverines is currently prohibited in the contiguous United States and regulated as appropriate in Canada (Service 2018, pp. 68–69). In the wolverine SSA report, we included a new analysis of trapping in southern Canada and trapping effort along the U.S.–Canada border, which we found to be limited. Thus, we conclude that the differences in exploitation are not significant in light of section 4(a)(1)(D) of the Act (inadequacy of existing regulatory mechanisms).

Discreteness Based on the International Border—Differences in Management of Habitat

As we outlined in the proposed 4(d) rule (78 FR 7888) management activities (*e.g.*, timber harvest, wildland firefighting, prescribed fire, and silviculture) can modify wolverine habitat, but this generalist species appears to be little affected by changes to the vegetative characteristics of its habitat. In addition, most wolverine habitat occurs at high elevations in rugged terrain that is not conducive to intensive forms of silviculture and timber harvest. Habitat management is not a conservation need for wolverine. Therefore, differences in management of habitat between the United States and Canada are not significant in light of section 4(a)(1)(D) of the Act.

Discreteness Based on the International Border—Differences in Conservation Status

In the December 14, 2010, 12-month finding (75 FR 78030), which is incorporated and discussed in the February 4, 2013, proposed listing rule (78 FR 7864), we found that the wolverine population in the contiguous United States met the second DPS discreteness condition because of

differences in conservation status as delimited by the U.S.–Canada international governmental boundary. We found that those differences were substantial and significant in light of section 4(a)(1)(D) of the Act. We stated that in the remaining current range in Canada and Alaska, wolverines exist in well-distributed, interconnected, large populations. We added that, conversely, wolverine populations in the remaining United States range appear to be at numbers so low that their continued existence could be at risk, especially in light of the threats to the species. In the 2010 finding, we stated that risks come from three main factors: (1) Small total population size; (2) effective population size below that needed to maintain genetic diversity and demographic stability; and (3) the fragmented nature of wolverine habitat in the contiguous United States that results in smaller, isolated sky island patches separated by unsuitable habitat. We stated it was apparent that maintaining wolverines within their native range in the contiguous United States into the future is likely to require regulatory mechanisms that are not currently in place. As a result, we concluded that the contiguous United States population of the wolverine meets the discreteness criterion in our DPS Policy (61 FR 4722, February 7, 1996). Consequently, we used the international border between the United States and Canada to define the northern boundary of the contiguous United States wolverine DPS in our December 14, 2010, 12-month finding (75 FR 78030) and our February 4, 2013, proposed listing rule (78 FR 7864). Below we provide a reevaluation of that determination supported by information presented in the wolverine SSA report.

Small Total Population Size—Wolverine densities vary across North America and have been described as naturally low (van Zyll de Jong 1975, p. 434); wolverine populations are naturally uncommon given the species' large home range, wide-ranging movements, and solitary characteristics (Service 2018, p. 56). There are many fewer wolverines in the contiguous United States than there are in Canada and Alaska (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2014, p. 36; Inman *et al.* 2013, p. 282; Service 2018, p. 71), but this is more a reflection of the amount of suitable habitat available within the contiguous United States (both currently and historically) for a species that needs large exclusive territories, than it is a reflection of poor conservation status. Wolverines in Canada are considered to occur as a single large group as they are

easily able to move between areas of suitable habitat and because wolverine habitat is relatively contiguous (Harrower 2017, pers. comm.). However, wolverines in the contiguous United States are considered to be a metapopulation connected with wolverine populations in Canada (Inman *et al.* 2013, p. 277). Wolverines currently occupy areas in the contiguous United States where they were once extirpated and continue to repopulate the contiguous United States after decades of unregulated trapping, hunting, and poisoning (Service 2018, p. iv). The same holds true for Canada, where wolverines are being detected in areas once extirpated (COSEWIC 2014, p. v).

These movement patterns are supported by recent genetic information that indicates wolverines from Canada have slowly repopulated the contiguous United States over the past century since the era of unregulated persecution (Service 2018, pp. 45–50). This point is discussed in detail below in the *Genetic Diversity* section of this withdrawal. We stated in the December 14, 2010, finding that differences in population sizes between the contiguous United States and Canada were reflective of a difference in conservation status (75 FR 78030). However, based on new information, we now conclude that the contiguous United States wolverines represent a peripheral population at the southern extent of the North American wolverine range. Thus, we now consider the small population size of wolverines in the United States to be a natural result of habitat fragmentation and not reflective of a difference in conservation status (see *Habitat Fragmentation* below for more detail). Therefore, any difference in population size on the contiguous United States side of the international border is not a significant difference in conservation status in light of section 4(a)(1)(D) of the Act as it applies to discreteness.

Effective Population Size—Effective population size (N_e) is defined as “the size of an idealized population that would experience the same amount of genetic drift and inbreeding as the population of interest (Service 2018, Box 2). In popular terms, N_e is the number of individuals in a population that contribute offspring to the next generation” (Hoffman *et al.* 2017, p. 507). Effective population size can be interpreted differently depending on how it's defined and used, and the concept of effective population size (N_e) (see review by Wang *et al.* 2016) and, relatedly, minimum viable population, has been a topic of debate, particularly the 50/500 rule (population size of 50

for short-term, and 500 for long-term genetic health). Importantly, the concept and guidelines for genetically effective population size were developed for a single, isolated population (Laikre *et al.* 2016, p. 280). The term “effective population size” is not a meaningful term unless additional context is provided relative to which concept of population size is being evaluated (Ewens 1990, p. 309). Demographic factors are needed when interpreting actual population size from an effective population size; thus, there is no justification for a fixed, genetically derived minimum viable population size value of ‘500’ as each case is unique and is dependent on such factors as sex ratio, subpopulations, dispersal, and immigration (Ewens 1990, pp. 311–313).

As noted above, we do not consider the wolverine population in the contiguous United States to be genetically isolated from wolverines on the other side of the international border in Canada. In the wolverine SSA report, we provide a contextual discussion of the effective population size concept, particularly in the context of genetic studies related to the phylogeographic history of the North American wolverine (Service 2018, pp. 45–50), which was not well described in the 2013 proposed rule. In sum, the spatial distribution of genetic variability currently observed in wolverines in North America appears to be a reflection of a complex history in which population abundance has fluctuated since the time of the last glaciation with insufficient time passing since human persecution, since at least the 1700s, to allow for full recovery of wolverine densities (Cardinal 2004, pp. 23–24; Zigouris *et al.* 2012, p. 1,554). This history and the fact that wolverines in the contiguous United States occupy the southern periphery of its entire North American range are important considerations. The wolverine SSA report also presents information from genetic and observational studies that provide support for wolverine movement across the international border of the contiguous United States and Canada (Aubry *et al.* 2016, pp. 16, 20; Lucid *et al.* 2016, p. 184; Service 2018, pp. 9–23). Thus, we consider wolverines that occupy the contiguous United States to be genetically continuous with wolverines in adjacent Canadian provinces.

Wolverines travel (disperse) through areas outside high-elevation, forested habitats. For example, tracked movements of a male wolverine, M56, from Wyoming into Colorado and its subsequent discovery in North Dakota, indicate extensive travel outside of

modeled primary wolverine habitat (*i.e.*, Inman *et al.* 2013), including through arid grasslands and shrubland habitats of the Wyoming Basin ecoregion (Packila *et al.* 2017, entire). This animal's movement also supports some level of connectivity (and potential gene flow) between currently occupied habitat (Wyoming) and unoccupied habitat within the wolverine's historical range (Colorado) (Packila *et al.* 2017, p. 404). Similarly wolverines in the North Cascades region have moved from Washington and Idaho into British Columbia, and from Montana to British Columbia and Alberta (Service 2018, p. 45). Based on genetic analyses, the male wolverine currently occupying an area within the Sierra Nevada Mountains of California also represents evidence of connectivity between wolverine populations of the Rocky and Sierra Nevada Mountain Ranges (Moriarty *et al.* 2009, p. 154). Within the Southwestern Crown of the Continent (SWCC) in northwestern Montana, cross-valley movements of wolverines have been detected, which researchers believe is an indication of good connectivity in this region (SWCC Working Group 2016, pers. comm.).

A preliminary mitochondrial DNA analysis was prepared for wolverine samples collected during the winters of 2015–2016 and 2016–2017 as part of the Western States Wolverine Conservation Project—Coordinated Occupancy Survey (Pilgrim and Schwartz 2018, entire). All 45 wolverines identified from samples collected in Idaho, Montana, and Wyoming match haplotype Wilson-A, which is common throughout the Rocky Mountains, Alaska, and Canada, while all 5 wolverines identified from samples collected in Washington match haplotype Wilson-C (Pilgrim and Schwartz 2018, p. 3). Previous analyses of recent or modern (1989–2012) samples from the Cascades Range in northern Washington and southern British Columbia, as presented in McKelvey *et al.* (2014, p. 328), were characterized as haplotype C, and one historical (defined in this study as pre-1930) sample as haplotype A (McKelvey *et al.* 2014, p. 327). Outside of this region, haplotype C has been found only in Alberta, Saskatchewan, and Nunavut provinces (McKelvey *et al.* 2014, p. 330). Based on mitochondrial DNA, McKelvey *et al.* (2014, p. 330) concluded that modern (defined in their study as 1989–2012) wolverine populations in the contiguous United States are the result of recolonization (following persecution during a period of unregulated hunting or trapping and

poisoning) from the north. The additional mitochondrial analysis from samples collected in 2015, 2016, and 2017 provides further support that all contiguous United States historical (pre-1900) and recent wolverine populations are likely descendants of immigrants from Canada.

The 2013 proposed rule presented an effective population size estimate for wolverines in the contiguous United States from a publication by Schwartz *et al.* (2009), which estimated a summed effective population size of 35, with credible limits from 28 to 52 (Schwartz *et al.* 2009, p. 3,226). As described in the wolverine SSA report, the study used wolverine samples from the main part of the Rocky Mountain wolverine populations and did not include subpopulations from two other mountain regions in Montana, and samples were missing from other parts of the wolverine range in Idaho and other areas of Montana. Thus, the analysis missed wolverine subpopulations and individuals, which would underestimate the results for this type of analysis. Furthermore, a small effective population size would be more of a concern if the population was in isolation; however, wolverines in the contiguous United States are not genetically or physically isolated from wolverines in Canada.

To summarize, the currently known spatial distribution of genetic variability in wolverines in North America appears to be a reflection of a complex history where population abundance has fluctuated since the time of the last glaciation and insufficient time has passed since human persecution for a full recovery of wolverine densities (Cardinal 2004, pp. 23–24; Zigouris *et al.* 2012, p. 1,554). Zigouris *et al.* (2012, p. 1,545) noted that the genetic diversity reported in Cegelski *et al.* (2006) and Kyle and Strobeck (2001, 2002) for the southwestern edge of the North American range represented only part of the diversity in the northern populations of wolverines. Zigouris *et al.* (2012, p. 1,545) posit that the irregular distribution of wolverines in the southwestern periphery and the genetic diversity observed in those analyses is a result of population bottlenecks that were caused by range contractions from a panmictic (random mating) northern core population approximately 150 years ago coinciding with human persecution. Recent dispersals of wolverines into Colorado (2009), California (2008), and Utah (2014) provide evidence for connectivity and the potential for gene flow between Northern Rocky Mountain populations and areas where wolverines were

extirpated. As noted above, there is also recent evidence of wolverine movement across the international border.

Furthermore, our analysis of trapping levels in the wolverine SSA report does not support previous assumptions that trapping in Canada near the border acts as a barrier to wolverine movement into the contiguous United States (Service 2018, pp. 68–69). Finally, very few successful migrants are needed per generation to maintain at least 95 percent of the genetic variation in the next 100 generations (approximately 750 years) in the contiguous United States (Cegelski *et al.* 2006, p. 209).

We conclude that this level of migration from the north has already been occurring following the end of intense persecution of this species; wolverines are currently observed in previously occupied areas within the contiguous United States. Given the recent observations of wolverines moving vast distances over varied terrain and across the U.S.–Canada border, our recent assessment of the low levels of trapping mortality in Canada near the border, and further confirmation of Canada as the source of wolverine genetics present in contiguous United States wolverines, we believe that wolverines in the contiguous United States are not separated genetically from the larger population in Canada. Wolverines in the contiguous United States exhibit genetic and phenotypic similarities with wolverines in Canada that implies connectivity with Canada. As such, we conclude that it is not biologically appropriate to consider the low effective population size of wolverines on the contiguous United States side of the border as a difference in conservation status that is significant in light of section 4(a)(1)(D) of the Act as it applies to discreteness. For additional information related to wolverine genetic diversity and effective population size, see *Genetic Diversity* below and the wolverine SSA report (Service 2018, pp. 45–50).

Habitat Fragmentation—In our 2010 12-month finding (incorporated into the 2013 proposed listing rule), we stated that wolverine habitat in the contiguous United States consists of small, isolated islands of high-elevation habitat separated from each other by low valleys of unsuitable habitat. We also described that these ‘habitat islands’ are represented by areas containing spring snow, citing Copeland *et al.* (2010). We concluded that the fragmented nature and distribution of wolverine habitat in the contiguous United States results in a population that is highly vulnerable to extirpation because of lack of

connectivity between subpopulations, and this also makes them more vulnerable to external threats (75 FR 78030; December 14, 2010).

Our previous analysis of wolverine habitat fragmentation relied upon the assumption that wolverines are constricted to habitats that contain deep, persistent spring snow cover and, therefore, are more or less confined to areas that were defined by the Copeland *et al.* (2010) spring snow cover model. However, wolverines are observed in and move through areas without snow cover (*e.g.*, male wolverines dispersing to California and Colorado), and female wolverines have successfully denned in areas outside previously modeled projections of deep, persistent spring snow cover (*e.g.*, Webb *et al.* 2016; Persson 2017, pers. comm.; Jokinen 2018, pers. comm.).

We now conclude that it is not accurate to categorize the occupied habitat of wolverines in the contiguous United States as ‘habitat islands.’ As discussed above, wolverine populations in the contiguous United States represent the southern periphery of a much larger range of the North American wolverine due to naturally occurring landscape features such as high elevation and topographic roughness of mountain regions. Thus, the distribution of persistent spring snow cover in mountainous regions does not represent the only determining habitat feature for wolverines. The availability of prey and avoidance of predators are also important elements of wolverine habitat (Inman *et al.* 2012, p. 785; Scraftord *et al.* 2017, p. 34)). As described in the SSA report, wolverines use a unique and productive ecological niche that allows them to occupy high-elevation regions across the northwestern portion of the contiguous United States (Service 2018, pp. 27, 38). Finally, as noted above, wolverine movement in the contiguous United States is not constrained by high-elevation habitat or snow cover, and wolverines can easily move and disperse long distances in the western United States (*e.g.*, SWCC Working Group 2016, pers. comm.; Packila *et al.* 2017, entire). Therefore, habitat fragmentation in the context of availability of persistent spring snow cover or loss of connectivity in the contiguous United States is not an appropriate difference in conservation status in light of section 4(a)(1)(D) of the Act as it applies to discreteness.

Discreteness Based on the International Border—Differences in Regulatory Mechanisms

Because there aren’t significant differences in control of exploitation, legal conservation status, and management of habitat, nor other threats to the wolverine requiring regulatory mechanisms to address them, we conclude that there are not differences in regulatory mechanisms between the United States and Canada that are significant in light of section 4(a)(1)(D).

Conclusion on Discreteness

Based on our updated analysis described above and supported by information in the wolverine SSA report, the contiguous United States population of wolverine does not meet the discreteness criterion in our DPS Policy (61 FR 4722; February 7, 1996). As a result, the contiguous United States population of wolverines does not qualify as a DPS and is not a listable entity under section 3(16) of the Act. After determining that a vertebrate population is not discrete, we are not required to complete an analysis to determine if the population in question is significant according to our DPS Policy.

DPS Conclusion

Based on the best available information, we conclude that the population of wolverines in the contiguous United States is not discrete in relation to the remainder of the species in North America. As a result, the population of wolverines in the contiguous United States is not a listable entity under section 3(16) of the Act.

The DPS Policy sets forth a three-step process for determining whether a vertebrate population as a separate entity warrants listing: (1) Determine whether the population is discrete; (2) if the population is discrete, determine whether the population is significant to the taxon as a whole; and (3) if the population is both discrete and significant, then evaluate the conservation status of the population to determine whether it is endangered or threatened. Although we have determined that wolverines in the contiguous United States do not qualify as a DPS and, therefore, are not a listable entity, we provide below a status determination of the wolverine population in the contiguous United States. The DPS Policy neither requires nor prohibits completion of a status determination once we have determined that a population does not qualify as a DPS. Nevertheless, in this instance, we

concluded that completing an assessment—and detailing the nature, scope, and likely effect of the threats to the population and the species—would provide us and the public with useful information regarding wolverines occupying the contiguous United States.

Summary of Biological Status and Threats

In preparing the SSA report for the wolverine, we reviewed available reports and peer-reviewed literature, incorporated survey information, and contacted species experts to collect additional unpublished information for the North American subspecies (*Gulo gulo luscus*), including Canada and Alaska. We identified uncertainties and data gaps in our assessment of the current and future status of the species. We also evaluated the appropriate analytical tools to address these gaps and conducted discussions with species experts and prepared updated maps of the known species’ range in North America. In some instances, we used publications and other reports (primarily from Fenno-Scandinavia) of the Eurasian subspecies (*G. g. gulo*) in completing this assessment.

Since the publication of the February 4, 2013, proposed listing rule (78 FR 7864), several new wolverine studies have been published (*e.g.*, Aronsson 2017, Aronsson and Persson 2016, Aronsson *et al.* 2017, Heinemeyer *et al.* 2019, Jokinen *et al.* 2019, Magoun *et al.* 2017, Persson *et al.* 2017, Stewart *et al.* 2016, Webb *et al.* 2016, see additional list of citations in the wolverine SSA report), which have added to our understanding of wolverine biology while also highlighting new insights into identifying key species’ needs and their interactions with both abiotic and biotic factors. This new information is particularly relevant for a difficult-to-study animal like the wolverine.

Using the species, individual, and population needs identified for the wolverine and location results from surveys and studies, we conducted a geospatial analysis to estimate the current potential extent of occurrence for the North American wolverine in North America including the contiguous United States (Figure 1; Service 2018). ‘‘Current potential extent’’ represents the perimeter of the outermost geographic limits based on all (available) occurrence records (that is, the maximum extent of occurrences) of a species minus those areas where we believe the species has been extirpated (Service 2017). We then evaluated this area and previous estimates of potentially suitable habitat in the western-northwestern United States to

assess the species' current conditions within that region. Our future-condition analysis includes the potential conditions that the species or its habitat may face, that is, the most probable

scenario if those conditions are realized in the future. This most probable scenario includes consideration of the sources that have the potential to most likely impact the species at the

population or rangewide scales in the future, including potential cumulative impacts.

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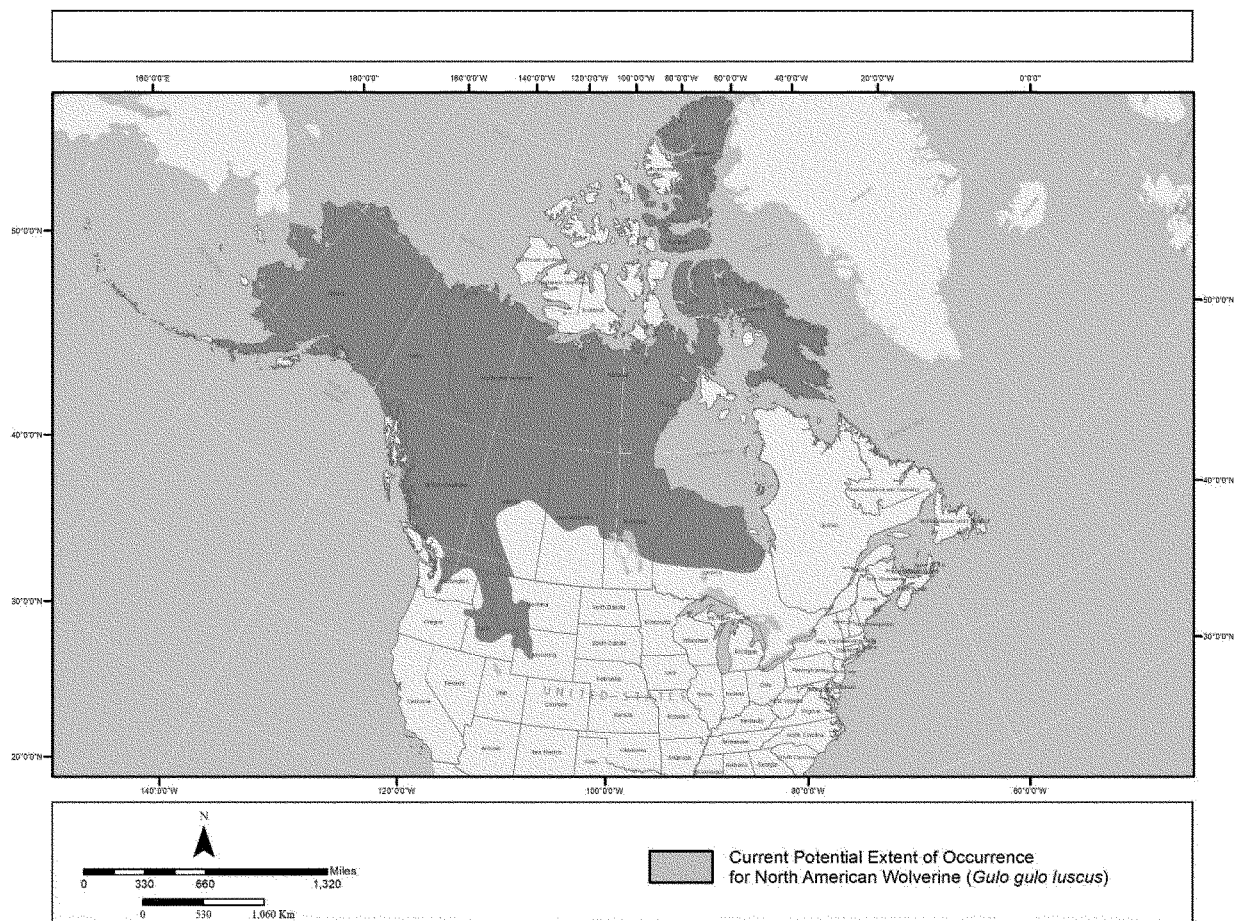


Figure 1—Current potential extent of occurrence for the North American wolverine taxon in North America (Service 2018, p. 16).

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Our analysis of potential future effects to the North American wolverine and its habitat that are associated with climate change (probabilistic estimates for temperature and precipitation) is presented in the SSA report and summarized here. This analysis was based on downscaled (high resolution local climate information derived from global climate models) climate model projections, including a detailed study of two regions in the western United States—Glacier National Park (currently occupied by reproducing wolverines) and Rocky Mountain National Park (occupied by a single male wolverine from 2009 to at least 2012, but not

known to be currently occupied). The two regions studied include a high-latitude area near tree line within Glacier National Park, where tree line occurs at ~ 1,800 to 2,100 m (5,906 to 6,890 ft) that is currently occupied by wolverines; and a lower latitude area within Rocky Mountain National Park, where tree line occurs at higher elevation (~ 3,500 m (11,483 ft)) (Ray *et al.* 2017, p. 2). These sites were selected to bracket the range of latitude and elevation wolverines currently occupy in the contiguous United States (Ray *et al.* 2017, p. 2).

For the purpose of this assessment, we generally define viability as “consisting of self-sustaining

populations that are well distributed throughout the species' range,” and where “[s]elf-sustaining populations are those that are sufficiently abundant and have sufficient genetic diversity to display the array of life history strategies and forms that will provide for their persistence and adaptability in the planning area over time” (Committee of Scientists 1999, p. 38). We use a timeframe of approximately 38 to 50 years for assessing future effects to wolverine viability. This timeframe captures consideration of the projected future conditions related to trapping/harvesting, climate change, or other potential cumulative impacts (Service 2018, p. 73). Beyond this range, climate

modeling uncertainty increases substantially. We believe this is a reasonable timeframe to consider as it includes the potential for observing these effects over several generations of the wolverine.

As discussed above in *Analytical Framework*, we consider what the species needs to maintain viability by characterizing the status of the species in terms of resiliency, redundancy, and representation (Wolf *et al.* 2015, entire). Resiliency is having sufficiently large populations for the species to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health; for example, birth versus death rates and population size. Resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

Redundancy is having a sufficient number of populations for the species to withstand catastrophic events (such as a rare destructive natural event or episode involving many populations). Redundancy is about spreading the risk and can be measured through the duplication and distribution of populations across the range of the species. The greater the number of populations a species has distributed over a larger landscape, the better it can withstand catastrophic events.

Representation is having the breadth of genetic makeup of the species to adapt to changing environmental conditions. Representation can be measured through the genetic diversity within and among populations and the ecological diversity (also called environmental variation or diversity) of populations across the species' range. The more representation, or diversity, a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics within the geographical range.

Life-History Needs

Wolverines are capable of moving and dispersing over great distances over short periods of time. Wolverine populations are characterized by naturally low densities in North America. The species is highly territorial, with very little overlap between same-sex adults. Wolverines occupy a variety of habitats, but generally select habitat in locations away from human settlements. Wolverines consume a variety of food resources, and seasonal switching of prey is commonly observed. As with other Arctic mammals, wolverines have the ability to adapt to both warm and cold ambient temperatures and solar radiation through both physiological and behavioral responses, such as vasodilation, increase in skin temperature, seasonal adjustments in fur insulation, and micro- and macro-habitat selection.

Wolverine reproduction includes the following characteristics: polygamous behavior (*i.e.*, male mates with more than one female each year), delayed implantation (up to 6 months), a short gestation period (30–40 days), denning behavior, and an extended period of maternal care. The reproductive behavior in wolverines is temporally adapted to take advantage of the availability of food resources, limited interspecific competition, and snow cover in the winter.

Since the publication of the Service's 2013 proposed rule to list the distinct population segment of the North American wolverine in the contiguous United States (78 FR 7864; February 4, 2013), several new wolverine studies have been published (*e.g.*, Aronsson 2017, Aronsson and Persson 2016, Aronsson *et al.* 2017, Heinemeyer *et al.* 2019, Jokinen *et al.* 2019, Magoun *et al.* 2017, Persson *et al.* 2017, Stewart *et al.* 2016, Webb *et al.* 2016, see additional list of citations in the wolverine SSA report). These studies have improved our understanding of wolverine biology while also highlighting new insights into identifying key species' needs and their interactions with both abiotic and biotic factors. Of particular importance

relative to life history needs and wolverine reproductive behavior, wolverine populations and wolverine dens have been observed outside previously modeled projections of spring snow cover.

Overall, the best available information indicates that within the contiguous United States the wolverine's physical and ecological needs include:

- (1) Large territories in relatively inaccessible landscapes, at high elevation (1,800 to 3,500 m (5,906 to 11,483 ft));
- (2) access to a variety of food resources, which vary with seasons; and
- (3) physical/structural features (*e.g.*, talus slopes, rugged terrain) linked to reproductive behavioral patterns.

Current Condition

Current Potential Extent of Occurrence

As noted above, using the best available information on current distribution and recent occurrences, we created maps to describe an area of "current potential extent of occurrence" (current potential extent) of wolverine for the western-northwestern contiguous United States (Service 2018, pp. 12–13, 15). The current potential extent represents the perimeter of the outermost geographic limits based on all (available) occurrence records (that is, the maximum extent of occurrences) for the wolverine minus those areas where we believe the species has been extirpated (Service 2018, pp. 11–12). The current potential extent area identified in Figure 2 encompasses approximately 280,316 km² (69,267,592 acres (ac)) (Service 2018, p. 12). We also prepared a current potential extent map for all of North America, including Canada and Alaska, for a total estimated current potential extent of 8,114,878 km² (2,005,230,024 ac) (Service 2018, p. 12 and Figure 1 of this document). The current potential extent area in the contiguous United States represents approximately 3.5 percent of the total current potential extent of wolverines in North America (Service 2018, p. 13 and Figure 2 of this document).

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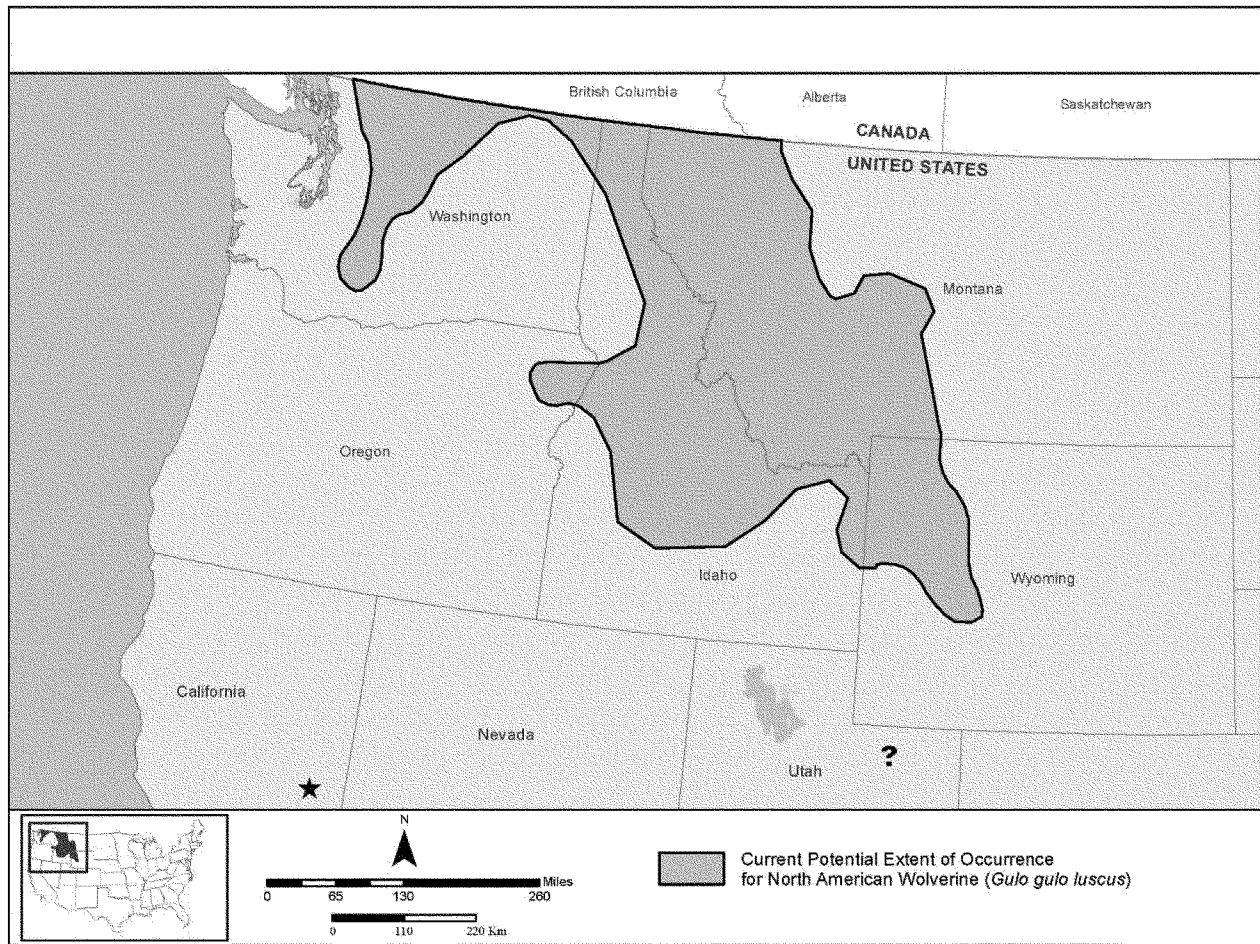


Figure 2—Current potential extent of occurrence for North American wolverine in the western contiguous United States (Service 2018, p. 15). The star symbol represents the single male wolverine who, as of March 2017, continues to occupy the region of California. The ‘?’ represents potential occupancy by individual wolverine(s) in Utah, where sightings of wolverine were reported in 2014, 2015, and 2016.

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Population Abundance and Density

Areas in the western contiguous United States have been previously identified as suitable for wolverine survival (long-term survival; used by resident adults) or primary habitat, reproduction (used by reproductive females), and dispersal (female and male) of wolverines (see methodology in Inman *et al.* 2013, pp. 279–280). From these results, the researchers estimated potential and current distribution and abundance of wolverines in the western contiguous United States. They

estimated current population size of wolverines to be 318 individuals (range 249–626) located within the Northern Continental Divide (Montana) and areas within the following ecoregions: Salmon-Selway (Idaho, portion of eastern Oregon), Central Linkage (primarily Idaho, Montana), Greater Yellowstone (Montana, Idaho, Wyoming), and Northern Cascades (Washington) (Inman *et al.* 2013, p. 282). Potential wolverine population capacity based on habitat modeling was estimated to be 644 individuals (range: 506–1,881) (Inman *et al.* 2013, p. 282);

however, we do not have information indicating wolverine abundance in the contiguous United States.

In the wolverine SSA report, we provide a discussion of recent studies of wolverine detections and observations in the western United States (Service 2018, pp. 51–56); however, no comprehensive surveys have been conducted across the entire area defined as the species’ maximum extent of occurrence (Service 2018, p. 14; Figure 2) or current potential extent of occurrence (Figure 2 above) in the contiguous United States. Below we

provide a summary of recent wolverine observations and detections in the western United States.

A recent study (2007–2015) has demonstrated that the Cascades region of Washington and Canada supports a resident wolverine population (Aubry *et al.* 2016, p. 40). For the first time in recent history, a breeding female wolverine was detected south of I–90 in the south Cascades of Washington, as well as her potential mate, indicating wolverines may be extending their current range in that area (Flatt 2018, p. 1). Wolverines have been detected in the Eagle Cap Wilderness Area in the Wallowa Mountains of northeastern Oregon in 2011–2012, 2016, and 2017 (Magoun *et al.* 2013, p. 17; Magoun 2017, pers. comm.). In California, a single male wolverine occurs in the Truckee area as of March 2017 (Shufelberger 2017, pers. comm.).

Since 2010, survey and monitoring efforts in the Idaho Panhandle and adjoining areas of Washington, Montana, and British Columbia, Canada, have detected five individual male wolverines (Service 2018, p. 52). One male was also detected in British Columbia, north of Canadian Highway 3 (Lucid *et al.* 2016, p. 184), which some consider to be a barrier to wildlife passage (IDFG 2017, pers. comm.). This male was most recently detected in Idaho, on March 6, 2013 (Lucid *et al.* 2016, p. 175). One likely wolverine den was located in the Saint Joe Mountains in Idaho (Lucid *et al.* 2017, p. 12).

Results from a pilot study to evaluate wolverine occupancy in Wyoming indicated at least three individual wolverines (at five stations) with at least one individual in the Gros Ventre and Wind River mountain ranges, and at least two individuals in the Southern Absaroka mountain range (Inman *et al.* 2015, p. 9). Occupancy modeling estimated a probability of occupancy for sampled sites of 62.9 percent (Inman *et al.* 2015, p. 8).

Building on the results of the Wyoming pilot study, the Western Association of Fish and Wildlife Agencies (WAFWA), in coordination with Tribal partners, formed a multi-State, multi-agency working group (Western States Wolverine Working Group) to design and implement the Western States Wolverine Conservation Project (WSWCP)—Coordinated Occupancy Survey. The primary objectives of the WSWCP include: (1) Implement a monitoring program to define a baseline wolverine distribution and genetic characteristics of the metapopulation across Montana, Idaho, Wyoming, and Washington; (2) model and maintain the connectivity of the

wolverine metapopulation in the western United States; and (3) develop policies to address socio-political needs to assist wolverine population expansion as a conservation tool, including translocation of wolverines (IDFG 2016, pers. comm.; Montana FWP 2016, pers. comm.; WGFD 2016, pers. comm.).

The Wyoming Game and Fish Department began implementation of the survey in Wyoming in the Greater Yellowstone Ecosystem region and the Bighorn Mountains in the winter of 2015–2016 (WGFD 2016, pers. comm.). That initial survey detected at least three unique wolverines in the Wind River and southern Absaroka Mountain Ranges (WGFD 2016, pers. comm.).

The monitoring effort was expanded in the winter of 2016–2017 in four States (Washington, Idaho, Montana, and Wyoming), and our review of the results indicate that wolverines were detected in all four States (Service 2018, p. 53). From this study, a total of 43 unique individuals were identified, 20 males and 23 females (Pilgrim *et al.* 2018, no page number).

We also received additional wolverine observations from State and Federal agencies in northwestern Wyoming. A wolverine was detected by camera in northern Grand Teton National Park, and a member of the public reported wolverine tracks in southwestern Grand Teton National Park while skiing, which was confirmed by a Forest Service biologist (Service 2018, p. 53). Both of these observations occurred in March 2017. South of this area in the Wyoming Range (about 4 miles east of Alpine, Wyoming), a wolverine was detected by camera in May 2017 (Service 2018, p. 53).

Wolverine densities vary across North America and have been described as naturally low and wolverine populations as naturally uncommon given the species' large home range, wide-ranging movements, and solitary characteristics (Service 2018, p. 56). In the contiguous United States, density estimates (number of wolverines per 1,000 km² (386 mi²)) ranged from 3.5 for the Greater Yellowstone region (2001–2008) (areas above 2,150 m (7,054 ft) (latitude-adjusted elevation), 4.5 for central Idaho (1992–1995), to 15.4 for northwestern Montana (1972–1977) (Service 2018, p. 57).

We note here that in our 2013 proposed listing rule for the wolverine (78 FR 7864), we discussed the occurrences of two dispersing individuals in California and Colorado (the Colorado wolverine was later killed in North Dakota). We know of one male wolverine in California that has

consistently occupied an area much farther north in the Sierra Nevada Mountains, and we have no evidence of any other wolverines currently in the State. We have no recent records of wolverines in Arizona. Aubry *et al.* (2007, p. 2,150) identified the year 1860 as the most recent verifiable documentation of wolverines in northern New Mexico. We know of no wolverines currently occupying Colorado. As presented in Aubrey *et al.* (2007, p. 2,151; Figure 1), prior to 1900, the most recent verifiable record for wolverine in New Mexico was 1860 and 1887 for Nebraska; no records were found for Arizona, Texas, Oklahoma. This was also true for most midwestern and mid-Atlantic States (Aubrey *et al.*, 2007, p. 2,152, Figure 1). Additionally, historical range maps shown in Seton (1909, p. 947; Map 51), Aubrey *et al.* (2007, p. 2,152; Figure 1), and the assessment and status review for the wolverine in Canada (COSEWIC 2014, p. 12; Figure 3) do not extend the distribution of wolverines into these regions.

Our updated analysis of wolverine occurrence in the contiguous United States is based on a more scientifically robust and spatially explicit assessment of the current areas occupied by wolverines in the contiguous United States, which was prepared based on verifiable wolverine records and comments received by reviewers of a draft of the wolverine SSA report (see the Historical Range and Distribution section of the wolverine SSA report for more on the information used to assess the maximum extent of occurrences ('historical range') and current extent of occurrence (Service 2018, pp. 9–16; Figures 2–4)). Using the current potential extent of occurrence, as presented in Figures 1 and 2 above, provides a more accurate reflection of the areas currently occupied by wolverines in the contiguous United States supported by the best available information.

Alaska and Canada

In the wolverine SSA report, we provide a summary of population abundance in Alaska and Canada where wolverines are more abundant than in the contiguous United States (Service 2018, pp. 57–60). Much of what we know about wolverine occurrences and abundance has been gathered from trapping records (see summary in Service 2018, pp. 53–56).

In Alaska and Yukon, density estimates presented by Inman *et al.* (2012, p. 789) range from 3 to about 14 wolverines per 1,000 km² (386 mi²), using a number of methods. For

example, Royle *et al.* (2011, p. 609) estimated wolverine densities for southeastern Alaska (Tongass National Forest; 2008) from 8.2 to 9.7 per 1,000 km² (386 mi²) (using mark-recapture), where the higher estimate incorporates a positive, trap-specific behavioral response. Density of wolverines were recently reported as an estimated 5–10 wolverines per 1,000 km² (386 mi²) (based on snow tracking) for southcentral Alaska, and approximately 10 per 1,000 km² (386 mi²) (based on DNA mark-recapture methods) for southeastern Alaska (Golden 2017, pers. comm.). A wolverine occupancy study in 2015 within an area of central Alaska reported a density estimate of 9.48 wolverines per 1,000 km² (386 mi²) (Alaska Department of Fish and Game (ADF&G) 2015, p. 7).

Wolverine density estimates for Canada vary across regions, from 5 to 10 per 1,000 km² (386 mi²) in northern mountain and boreal regions to 1 to 4 per 1,000 km² (386 mi²) in southern boreal areas (COSEWIC 2014, p. 27). More recently, Clevenger *et al.* (2017, entire) presented a density estimate (using spatial capture/recapture models) for the Kootenay region of British Columbia of 0.78 wolverines per 1,000 km² (386 mi²), for 3 study years (2014–2016), which they reported as lower than expected (Clevenger *et al.* 2017, p. 6). Researchers in Canada are currently conducting a landscape level analysis to estimate the size and sustainable harvest for wolverine populations within British Columbia (Weir 2017, pers. comm.).

According to the most recent COSEWIC Assessment and Status Report on the Wolverine, *Gulo gulo* in Canada (COSEWIC 2014, entire), Canada's western subpopulation has been estimated at 15,688 to 23,830 adults, which we recognize is an estimate based on several assumptions, such as consistent trapping effort and uniform densities across the species' range (COSEWIC 2014, p. 36). In Alaska, estimates of populations are not available and are best evaluated based on density with recent density estimates ranging from 5 to 10 wolverines per 1,000 km² (386 mi²) for Alaska (Parr 2017, pers. comm.). In Alaska, which, like Canada, allows regulated hunting and trapping of wolverines, an average of 590 wolverines have been taken each year over the past 6 years (Service 2018, p. 68). The consistent harvest levels in these regions suggest relatively stable wolverine populations in Alaska that more likely than not number in the thousands of individuals in order to sustain such level of harvest.

We do not have reliable current population estimates for wolverines in

the contiguous United States. As discussed above, the only estimate available is from 2013, when researchers, using spatial modeling methods, estimated the then-current population size of wolverines to be 318 (range: 249–626) (Inman *et al.* 2013, p. 282). Potential wolverine population capacity in the contiguous United States based on habitat modeling was estimated to be 644 individuals (range: 506–1,881) (Inman *et al.* 2013, p. 282). However, these capacity estimates did not consider spatial characteristics related to behavior, such as territoriality (home range), of wolverine populations. Given all the assumptions, differing methods of estimation, limitations, and uncertainties of the available estimates of North American wolverines (as discussed in the wolverine SSA report (Service 2018, pp. 50–56)), we believe caution should be used relative to comparing the number of wolverines in the contiguous United States to the remainder of the taxon. However, even assuming the high population estimate from 2013 for the contiguous United States (n=626) and the low estimate of wolverines in western Canada from 2014 (15,688 adults), the contiguous United States conservatively contains approximately 4 percent of the total wolverines within these two regions. This estimate does not account for wolverines in Alaska, for which we have no population estimate, but, based on a rough estimate of land area for the State occupied by wolverines and estimated wolverine densities of between 5 to 10 animals per 1000 km² (386 mi²) (Parr 2017, pers. comm.), it is reasonable to assume there are thousands of wolverines in the State. The actual percentage of wolverines in the contiguous United States compared to the overall taxon (Canada and Alaska included) is still significantly less than 4 percent of the overall North American wolverine population. Wolverine densities vary across North America and have been described as being naturally low, due in large part to the species having large home ranges, wide-ranging movements, and solitary characteristics (Service 2018, p. 56). It is important to understand that the amount of suitable habitat in the contiguous United States identified both in historical and current distribution maps (see, for example, 1909, p. 947; Map 51), Aubrey *et al.* (2007, p. 2,152) does not support the larger numbers of wolverines and higher densities found in Canada and Alaska (see Figure 3 in the wolverine SSA report (Service 2018, p. 15)).

Summary of Factors Affecting the North American Wolverine

As mentioned above in *Regulatory Framework*, 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. Potential stressors evaluated for wolverine in the contiguous United States include effects from roads (Factors A and E); disturbance due to winter recreational activity (Factors A and E); other human disturbance (Factors A and E); effects from wildland fire (Factor A); disease (Factor C); predation (Factor C); overutilization (trapping) (Factor B); genetic diversity (Factor E); small-population effects (Factor E); and climate change (Factors A and E). A summary of the potential stressors affecting wolverine in the contiguous United States is presented below; for a full description of our evaluation of the effects of these stressors, refer to the wolverine SSA report (Service 2018, pp. 57–101).

Effects from Roads: Wolverines are associated with habitat found in high-elevation areas, but are known to disperse over great distances. Major highways can present mortality risks to dispersing individuals and affect immigration to open territories, but roads do not represent absolute barriers to wolverine movements. Wolverines den during winter months in locations that are often inaccessible or restricted to motorized vehicles, though secondary roads and trails are used for winter recreational activity. Although we recognize there are likely additional events that have not been reported, we estimated the total number of wolverine mortalities due to roads from 1972 to 2016 (44 years) in North America was 20, at least 11 of which are from Canada (Service 2018, p. 60). In the SSA report, we calculated a low proportion of major highways in both modeled primary habitat and a low mean density of roads at high elevations where wolverines have been observed, with the exception of the southern Rocky Mountains (Service 2018, p. 60). We therefore determine that the effects from roads present a low stressor to wolverines at the individual and population level in

most of its current area of occupancy within the contiguous United States.

Disturbance due to Winter

Recreational Activity: Wolverine behavior patterns, such as denning, rearing of young, movement and dispersal, and foraging/scavenging, may be affected by recreational activities (COSEWIC 2014, p. 42), although several wolverines have been captured for research on or near ski areas (e.g., Teton Mountains) (Montana FWP 2017, pers. comm.). In Norway, one study found, at the home-range scale, a minimal threshold distance of approximately 1.5 km (0.93 mi) for wolverine den sites from private roads and/or recreational cabins (May *et al.* 2012, p. 201). Another study found that in an area of active recreation (Columbia Mountains, Canada), female wolverines were negatively associated with helicopter and backcountry skiing in their winter models (Krebs *et al.* 2007, pp. 2,187–2,188). In summer months, Copeland *et al.* (2007, p. 2,210) reported that wolverines in their study area of central Idaho were not uncommonly found near maintained trails and active campgrounds, which suggests some level of tolerance to human presence/recreational activity.

The Wolverine–Winter Recreation Study represents an ongoing project to evaluate the potential effects of backcountry winter recreation (e.g., backcountry skiers, heli-skiers, cat-skiers, snowmobilers) on wolverines in central Idaho and areas in the western Yellowstone region (Island Park area and Teton Mountains) (Heinemeyer 2016, pers. comm.; Heinemeyer 2019, entire; Heinemeyer and Squires 2015, p. 3). Early analysis of the data suggested that wolverines demonstrate a behavioral response to recreation activities, such as increased movement rates and a reduction in resting periods in areas of high-recreation activity, especially high-recreation days (Saturday and Sunday) (Heinemeyer and Squires 2013, pp. 5, 7–8). However, this research also found that wolverines maintained their home ranges within areas with relatively high winter-recreation activity over several years of monitoring, including some areas found to contain the highest recreational activities (Heinemeyer 2016, pers. comm.). The study has not been able to determine whether these resident wolverines are reproductively successful due to the limited monitoring information available for reproductive females (Heinemeyer 2016, pers. comm.).

A final Winter Recreation Study report found that wolverines maintained multi-year home ranges in areas that

support relatively intensive winter recreation, suggesting that wolverines are able to tolerate winter recreation at some scales (Heinemeyer *et al.* 2017, p. iv; Heinemeyer *et al.* 2019, p. 16). Wolverines responded negatively to increasing intensity of winter recreation, with off-road and dispersed recreation having a greater effect than recreation that was concentrated on access routes (Heinemeyer *et al.* 2017, p. 34; Heinemeyer *et al.* 2019, p. 13). Wolverine avoidance of roads and groomed areas used by winter recreationists was found to be less than estimated for dispersed recreation, suggesting that wolverines may be less sensitive to predictable winter-recreational use patterns (Heinemeyer *et al.* 2017, p. 40; Heinemeyer *et al.* 2019, p. 15). Habitat selection in females evaluated in the multi-year study was complex, and likely driven by a combination of abiotic (snow, cold) and biotic factors (predator avoidance, food availability) (Heinemeyer *et al.* 2017, p. 36; Heinemeyer *et al.* 2019, p. 16). This study did not assess demographic effects, fitness effects, or population level effects of winter recreation on wolverines (Heinemeyer *et al.* 2019, p. 17 and 19).

Conservation measures currently being implemented that address the effects of roads in the Teton Mountains include winter closures in certain areas (generally from November 1 through May 1), including road closures in the Bridger-Teton and Caribou-Targhee National Forests and in Grand Teton National Park (Service 2018, p. 67, Appendix F). These closures are being implemented to help minimize disturbance to wildlife (e.g., migration pathways). State Wildlife Action Plans prepared for individual western States identify recreation management strategies within wolverine habitats. For example, in Oregon, the Oregon Department of Fish and Wildlife Conservation Strategy identifies management of winter-recreation use as a conservation action to avoid impacts to wolverines (ODFW 2016). In Montana's State Wildlife Action Plan, conservation actions for the wolverine are identified to address potential impacts from recreation, such as consideration of seasonal closures during denning season (Montana FWP 2015, p. 63). The Idaho Department of Fish and Game Management Plan for the Conservation of Wolverines in Idaho also includes conservation strategies related to developing a better understanding of the relationships between wolverine behavior and winter recreation activities (IDFG 2014, p. 35),

and the State continues to support the Wolverine-Winter Recreation Study. Appendix G in the SSA report provides additional details on individual State conservation strategies. Although we do not rely on these conservation measures to support our decision on listing status, they do provide some protections to address potential impacts to wolverine from disturbance from winter recreational activity and mortality from roads.

Based on the studies summarized above, wolverine behavior (movement) is potentially affected by winter recreational activity. However, wolverines can maintain residency in high winter-recreational use areas (Heinemeyer *et al.* 2017, p. iv; Heinemeyer *et al.* 2019, p. 16). Based on the best available scientific and commercial information, the effect of winter recreational activity represents a low stressor to wolverines in the contiguous United States at the individual and population level.

Other Human Disturbance: Infrastructure, such as pipelines, active logging or clearcuts, seismic lines, and activities associated with mining (e.g., producing mines, mines under development, mineral exploration areas), may also affect individual wolverine behavior (e.g., avoidance) or loss or modification of wolverine habitat. In the SSA report, we summarize a recently published study of habitat selection of wolverines in response to human disturbance in western Canadian forested habitat (Service 2018, p. 62). That study found that wolverines avoided interior areas of some logged areas, but also found that wolverines were attracted to all-season road sections with borrow pits (Scraftford *et al.* 2017, pp. 32–34). The authors concluded that wolverine selection patterns relative to industrial activity and infrastructure in their study area represented a balance between exposure to predators and foraging opportunities (Scraftford *et al.* 2017, p. 32). Based on the best available scientific and commercial information, we find that these human disturbance effects are likely to be small or narrow in scope and scale for wolverines in the contiguous United States.

Effects from Wildland Fire: Wildland fire can produce both direct and indirect effects to wildlife. Direct effects include injury and mortality as well as escape or emigration movement away from fires (Lyon *et al.* 2000, pp. 17–21). We are unaware of any studies evaluating direct effects of wildland fire to wolverines. Wildland fire is likely to temporarily displace wolverines, which could affect home range dynamics. Given that

wolverines can travel long distances in a short period of time, individuals would be expected to move away from fire and smoke (Luensmann 2008, p. 14). In addition, because young wolverines are born in underground or otherwise sheltered dens during winter months and in locations where wildland fire risk is low due to snow cover or increased moisture (Luensmann 2008, p. 14), the potential effects of fire at that critical life stage is very low (Luensmann 2008, p. 14). Indirect effects of wildland fire can include habitat-related effects or effects to prey and competitors/predators; however, we are unaware of empirical studies evaluating these potential effects as they relate to wolverines.

Given the diversity of habitats occupied by wolverines, their opportunistic foraging habitats and seasonal switching of food sources, their occupancy of high elevations, and extensive mobility, wildland fire represents a limited indirect and direct stressor, in scope and scale, to wolverine habitat and its prey in the contiguous United States range (Service 2018, pp. 63–64) such that it would not be expected to have population or species-level impacts.

Disease: We are unaware of comprehensive surveys evaluating the prevalence of diseases in wolverines in the contiguous United States. Other than a parasitic pneumonia mortality event and a single rabies case, we are not aware of any other studies documenting impacts of disease to wolverines in North America (Service 2018, p. 65). At this time, based on the best available scientific and commercial information, we do not find that disease is a population- or species-level stressor to the wolverine in the contiguous United States (Service 2018, pp. 64–65).

Predation: A number of potential natural predators have been identified for wolverines within its North American range, including intraspecific predation (Service 2018, p. 65). However, we have no information that suggests predation represents a significant stressor to the wolverine at the population level. At the individual level, we recognize that wolverines likely avoid areas of potential predation risk from wolves and other potential predators (Service 2018, p. 65). Thus, indirect effects of predators may result in predator avoidance behavior of individual wolverines through habitat selection. However, the best scientific and commercial information available indicates that predation is not a stressor for the wolverine (Service 2018, p. 65).

Overutilization for Commercial, Recreational, Scientific, or Educational

Purposes: During the late 1800s and early 1900s, the wolverine population declined or was extirpated in much of the contiguous United States, which has been attributed in large part to unregulated persecution (Service 2018, p. 1). Similar range reductions and extirpations of some wolverine populations were observed in parts of Canada during this time period (van Zyll de Jong 1975, entire; COSEWIC 2014, p. iv). However, after unregulated harvest of wolverines ceased, the numbers of wolverines in Canada and the contiguous United States began to recover from this decline (e.g., Aubry *et al.*, 2007, p. 2,151; Aubry *et al.*, 2012, entire; Aubry *et al.* 2016, pp. 14–15; Magoun *et al.* 2013, p. 27).

In Montana, wolverines were a legally harvested furbearer up until 2012 (Service 2018, p. 65). There is, however, no evidence to suggest that the harvest of wolverines in Montana at historical rates (about 10 animals per year) was detrimental to wolverine populations (Service 2018, pp. 65–66 and Appendix G). Furthermore, States within the wolverine range in the contiguous United States have adopted protective regulations to prevent unauthorized take and are implementing other measures to limit incidental mortality of wolverines (Service 2018, p. 66). There is currently no allowable trapping or harvesting of wolverines in the contiguous United States, although incidental trapping, shooting, and poisoning mortalities have been documented (Service 2018, pp. 65–69).

In Alaska, wolverine trapping and hunting is controlled by seasons and bag limits, with about 550 animals harvested each year (ADF&G 2017a). This level of harvest has been fairly consistent since 2010 (Service 2018, Table 7).

Trapping and harvesting of wolverines occurs over much of the range in Canada (COSEWIC 2014, pp. 10, 29–35). Specifically, wolverines are harvested in the northern and western territories—Manitoba, Saskatchewan, Alberta, British Columbia, Yukon, Northwest Territories, and Nunavut (COSEWIC 2014, p. 43). The population of wolverines in British Columbia is estimated to be 2,700–4,760 and 1,500–2,000 animals in Alberta (COSEWIC 2014, p. 36). In the wolverine SSA report, we evaluated trapping of wolverines in British Columbia and Alberta regions of southern Canada in an effort to document potential impacts to dispersing wolverines along the U.S.–Canada border (Service 2018, pp. 68–69). This type of analysis was not conducted for the 2013 proposed listing

rule (78 FR 7864; February 4, 2013) or for our 2014 withdrawal (79 FR 47522; August 13, 2014). The results of our spatial analysis for British Columbia indicates a total of 77 wolverines were trapped in wildlife management units within 110 km (68.35 mi) of the U.S.–Canada border in the period 2007–2015, or an average of 8.5 animals per year (Service 2018, pp. 68–69). We used this distance since it is similar to both the average maximum distance per dispersal movement of 102 km (63 mi) for male wolverines in the Greater Yellowstone region of Montana (Inman *et al.* 2012, p. 784), and a reported 100-km (62-mi) dispersal distance for a juvenile male for Ontario, Canada (COSEWIC 2014, p. 24, citing unpublished data from Dawson *et al.* 2013). For Alberta, we identified a total of 15 wolverines harvested by trappers and data presented in other studies within 110 km (68.35 mi) of the U.S.–Canada border in the period 1989–2014 (average of less than 1.0 animal per year) (Service 2018, p. 68).

Based on this new analysis, legal trapping effort along the U.S.–Canada border does not represent a barrier to wolverine movement and dispersal along the international border. As discussed below and in the DPS analysis above, results from genetic analyses provide further evidence of movement and dispersal of wolverines across the international border (see *Genetic Diversity* below).

In summary, overutilization does not currently represent a stressor to the wolverine in the contiguous United States at the individual, population, or species level. Wolverine populations in the contiguous United States are currently protected under several State laws and regulations. Regulated hunting and trapping activities for wolverines are currently suspended or closed entirely for animals that occupy western States of the contiguous United States, though occasional incidental trapping can occur. Current trapping in Alaska and Canada appears to be sustainable and wolverine populations along the Alaska–Canada border are continuous with the Yukon region of Canada, which suggests a rescue effect (animals from a higher population density area moving to areas of lower population density, preventing local extirpation) for Canadian populations along this international boundary (COSEWIC 2014, p. 37). Trapping or harvesting of wolverines along the contiguous U.S.–Canada border does not represent a barrier or stressor to wolverines migrating into the contiguous United States at the individual or population level.

Genetic Diversity: The geographical genetic structure of wolverines is believed to be largely structured around the strong female philopatry characteristic of this species (Rico *et al.* 2015, p. 2) and the species' polygamous behavior. Results from Scandinavia indicate that wolverine population distributions are primarily limited by dispersal of the more philopatric sex (females) (Aronsson 2017, p. 13). The extensive and often asymmetrical movement of male wolverines from core populations to the periphery of their range can result in the addition of nuclear genetic material to these edges (Zigouris *et al.* 2012, p. 1,553). Thus, the dispersal pattern for male wolverines may help explain why allelic richness (*i.e.*, nuclear DNA, which is inherited from both parents) can be similar across regions, but haplotype richness (mitochondrial DNA, which is maternally inherited) is lower at the periphery of the species' range (Zigouris *et al.* 2012, p. 1,553).

Studies evaluating the genetic structure of wolverines, primarily within its core range in North America, were presented in Chappell *et al.* (2004) and Kyle and Strobeck (2001, 2002). Using microsatellite markers, Kyle and Strobeck (2002) and Zigouris *et al.* (2012) found greater genetic structure of wolverines toward the eastern and southern peripheries of their North American distribution, likely due to a west-to-east recolonization during the Holocene (Zigouris *et al.* 2013, p. 9). Similarly, based on an evaluation of mitochondrial DNA, which is used primarily for an evaluation of phylogenetic structure and phylogeography, McKelvey *et al.* (2014, p. 330) concluded that modern wolverine populations in the contiguous United States are the result of recolonization (following persecution during a period of unregulated hunting or trapping and poisoning) from the north.

Genetic diversity and population genetic structure of a larger sample size of wolverines were examined by Cegelski *et al.* (2006, entire) for the southern extent of their North American range using both microsatellite markers and mitochondrial DNA. They concluded that the wolverine populations in the contiguous United States were not sources for dispersing individuals into Canada (Cegelski *et al.* 2006, p. 208). They found that there was significant differentiation between most of the populations in Canada and the United States (Cegelski *et al.* 2006, p. 208). However, they cautioned that their statistical analysis may not have been able to detect "effective migrants" and

that sample size can affect the detection of dispersers (Cegelski *et al.* 2006, p. 208). They concluded that some migration of wolverines was occurring between the Rocky Mountain Front region (northwestern Montana) and Canada as well as among wolverine populations in the United States, with the exception of Idaho (Cegelski *et al.* 2006, p. 208).

This study also conducted model simulations of the number of effective wolverine breeders necessary to maintain genetic variation (heterozygosity) in their sampled population of the contiguous United States in the absence of gene flow (Cegelski *et al.* 2006, p. 201). They indicated that two effective migrants from either Canada or Wyoming into the Rocky Mountain Front population would be needed (per generation, 7.5 years) to maintain the levels of genetic diversity in that population, and one effective migrant was needed to maintain levels of diversity in the Gallatin, Crazybelt, or Idaho populations (Cegelski *et al.* 2006, p. 209). They also found that to maintain at least 95 percent of the genetic variation in the next 100 generations (we estimate this to be approximately 750 years, based on generation time) 200 to 300 wolverine breeding pairs were needed in the Wyoming and Rocky Mountain Front populations, respectively, and 200 breeding pairs were needed in the Gallatin, Crazybelts, and Idaho wolverine populations (Cegelski *et al.*, 2006, pp. 208–209). The authors concluded that migration is essential for maintaining diversity in wolverine populations in the contiguous United States since effective population size may never be reached due to the naturally low population densities of wolverines (Cegelski *et al.* 2006, p. 209).

More recently, an analysis of mitochondrial DNA was prepared for wolverine samples collected during the winters of 2015–2016 and 2016–2017 as part of the Western States Wolverine Conservation Project—Coordinated Occupancy provides further support that all contiguous United States historical (pre-1900) and recent wolverine populations are likely descendants of immigrants from Canada and suggest continued connectivity between the contiguous United States and Canadian wolverine populations (Pilgrim and Schwartz 2018, entire).

Effective population size (N_e) is defined as "the size of an idealized population that would experience the same amount of genetic drift and inbreeding as the population of interest. In popular terms, N_e is the number of individuals in a population that

contribute offspring to the next generation" (Hoffman *et al.* 2017, p. 507; see also Service 2018, Box 2). It represents a metric for quantifying rates of inbreeding and genetic drift and is often used in conservation management to set genetic viability targets (Olsson *et al.* 2017, p. 1). It is not the same as the more commonly used metric, census population size (N), but is often assumed to represent the genetically effective population size.

In his review of the minimum viable population size concept, Ewens (1990, entire) emphasized that the term "effective population size" is not a meaningful term unless additional context is provided relative to which concept of population size is being evaluated (Ewens 1990, p. 309). He introduced the concept of mutation effective population size, defined as the size of population defined by its capacity to maintain genetic variation (Ewens 1990, p. 307), which is different than actual population size (Ewens 1990, p. 309). Demographic factors such as sex ratio, subpopulations, dispersal, and immigration are needed when interpreting actual population size from an effective population size; thus, there is no justification for a fixed, genetically derived minimum viable population size value of '500' as each case is unique (Ewens 1990, p. 310). A review of the minimum viable population concept by Flather *et al.* (2011, entire) also found that any "rule of thumb" used for minimum viable population will likely be a poor estimate for that population (Flather *et al.* 2011, pp. 311, 313). Minimum viable population estimates therefore vary considerably both within and among species and are sensitive to the timeframe in which data are collected (Flather *et al.* 2011, p. 314).

An effective population size analysis for wolverines in the contiguous United States was presented in Schwartz *et al.* (2009, p. 3,225) using wolverine samples from the main part of the Rocky Mountains populations (*e.g.*, central and eastern Idaho, Montana, northwestern Wyoming). Subpopulations in the Crazy and Belt Mountains in Montana were excluded from this analysis based on suggestion by Cegelski *et al.* (2003) that they represented separate groups (Schwartz *et al.* 2009, p. 3,225). The summed effective population size was estimated at 35, with credible limits from 28–52, and the summed values for the three timeframes was reported as follows: N_e 1989–1994 = 33, credible limits 27–43; N_e 1995–2000 = 35, credible limits 28–57; N_e 2001–2006 = 38, credible limits 33–59 (Schwartz *et al.* 2009, p. 3,226). Thus, the two later time-frames evaluated indicate an

(increasing) effective population size with credible limits above 50.

Of direct relevance to potential gene flow and genetic structure at the landscape level, wolverines travel (disperse) through areas outside high-elevation, forested habitats. For example, tracked dispersal movements of a male wolverine, M56, from Wyoming into Colorado and its subsequent discovery in North Dakota, indicate extensive travel outside of modeled primary wolverine habitat (*i.e.*, Inman *et al.* 2013), including through arid grasslands and shrubland habitats of the Wyoming Basin ecoregion (Packila *et al.* 2017, entire). This animal's movement also supports some level of connectivity (and gene flow) between currently occupied habitat (Wyoming) and unoccupied habitat within the wolverine's historic range (Colorado) (Packila *et al.* 2017, p. 404). Similarly, wolverines have recently moved from Washington and Idaho into British Columbia, and earlier from Montana to British Columbia and Alberta (Service 2018, p. 45). Based on genetic analyses, the male wolverine currently occupying an area within the Sierra Nevada Mountains of California also represents evidence of connectivity between wolverine populations of the Rocky and Sierra Nevada Mountain Ranges (Moriarty *et al.* 2009, p. 154). Wolverines have been detected making cross-valley movements in the Southwestern Crown of the Continent (SWCC) in northwestern Montana, which researchers believe is an indication of good connectivity in this region (SWCC Working Group 2016, pers. comm.).

It can be difficult to make inferences about the relationship between population size and point estimates of genetic diversity without continued genetic monitoring and an understanding of the demographic history of a species' population (Hoffman *et al.* 2017, p. 507), including factors that have historically influenced and continue to influence movement patterns and connectivity. Additionally, the extensive dispersal movements of both male and female wolverines can produce gene flow among diverged populations, making it difficult to distinguish, without additional sampling and analysis, between long-distance dispersal and fragmentation based on the patchy distribution of some haplotypes (Zigouris *et al.* 2013, p. 10). Genetic diversity can be a reflection of favorable adaptations (natural selection) and is necessary for species to locally adapt to environmental stressors or to facilitate range shifts (Zigouris *et al.* 2012, p. 1,544). Genetic

distinctiveness in peripheral populations may therefore play a role in both maintaining and generating biological diversity for a species (Zigouris *et al.* 2012, p. 1,544; citing results presented in Channell and Lomolino 2000, p. 84). Relatedly, genetic variation that is adaptive is a better predictor of the long-term success of populations as compared to overall genetic variation (Hoffman *et al.* 2017, p. 510). The challenge is to be able to determine whether genetic variation is adaptive and is a reflection of remnants of high genetic diversity from ancestral populations, or whether that variation is a reflection of accumulated deleterious, nonadaptive genes due to genetic drift in small populations (Hoffman *et al.* 2017, p. 509).

In summary, the currently known spatial distribution of genetic variability in wolverines in North America appears to be a reflection of a complex history where population abundance has fluctuated since the time of the last glaciation and insufficient time has passed since human persecution for a full recovery of wolverine densities (Cardinal 2004, pp. 23–24; Zigouris *et al.* 2012, p. 1,554). Zigouris *et al.* (2012, p. 1,545) noted that the genetic diversity reported in Cegelski *et al.* (2006) and Kyle and Strobeck (2001, 2002) for the southwestern edge of the North American range represented only part of the diversity in the northern populations of wolverines. Zigouris *et al.* (2012, p. 1,545) posit that the irregular distribution of wolverines in the southwestern periphery and the genetic diversity observed in those analyses is a result of population bottlenecks that were caused by range contractions from a panmictic (random mating) northern core population approximately 150 years ago coinciding with human persecution. As described here, recent dispersals of wolverines into Colorado, California, and Utah provide evidence for connectivity and the potential for gene flow between Northern Rocky Mountain populations and areas where wolverines were extirpated.

As noted above in this section (and in the Distinct Population Segment section), there is recent evidence of wolverines traveling across the international border. Furthermore, our analysis of trapping levels in the wolverine SSA report (summarized in *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes* above) does not support previous assumptions that trapping in Canada near the border acts as a barrier to wolverine movement into the contiguous United States. Cegelski *et al.*

(2006, p. 209) determined that very few successful migrants are needed per generation to maintain at least 95 percent of the genetic variation in the next 100 generations (approximately 750 years) in the contiguous United States (Cegelski *et al.* 2006, p. 209). We have no reason to believe that this level of migration from the north has not already been occurring following the end of intense persecution of this species to repopulate previously occupied areas within the contiguous United States. This repopulation has occurred without human-assisted introductions and with unregulated trapping from about the 1930s to 1970 in Montana. Given the recent observations of dispersing wolverines moving vast distances over varied terrain and movement of wolverines across the U.S.–Canada border, our recent assessment of the low levels of trapping mortality in Canada near the border, and further confirmation of Canada as the source of wolverine genetics present in contiguous United States wolverines, we conclude that wolverines in the contiguous United States are not separated genetically from the larger population in Canada. Furthermore, even if they were separated genetically, the multiple generations it would take for genetic isolation to potentially result in significantly lower genetic diversity and for the deleterious effects of decreased genetic diversity to then manifest into negative population-level effects is likely beyond the foreseeable future used for this determination (38 to 50 years, see *Future Condition* section below). As such, we conclude that loss of genetic diversity is not a stressor for wolverines in the contiguous United States now or within the foreseeable future.

Small Population Effects: As described above in Population Abundance and Density, the number of wolverines in the contiguous United States is relatively small compared to the remainder of the range in Canada and Alaska, in large part due to limited suitable habitat and previous persecution and unregulated trapping pressures. As described above in *Genetic Diversity*, we now consider wolverines in the contiguous United States to be genetically connected to wolverines in Canada (McKelvey *et al.* 2014; Pilgrim and Schwartz 2018) and wolverines in the contiguous United States are not separated from the larger North American wolverine population to the North (Canada and Alaska). In previous proposed rules and findings, we have discussed small population

size as a vulnerability that places wolverines in the contiguous United States at risk of extirpation. However, those assertions were predicated on a belief that wolverines in the contiguous United States were effectively isolated regionally within the United States and isolated from Canada, thereby increasing the risk of deleterious genetic effects (countered above in *Genetic Diversity*) and susceptibility to stochastic events and limited rescue effect (migrants) from Canada. With further genetic evidence of the recolonization of once-extirpated areas of the contiguous United States by wolverines from Canada post-unregulated trapping over the last approximately 100 years, history has demonstrated the resiliency of the North American wolverine population to recover from extreme persecution and unprecedented direct mortality. We do not currently foresee any stochastic or catastrophic events that could result in a similar population-level effect on wolverines in the contiguous United States. It is no longer accurate to consider contiguous United States wolverines in isolation from the rest of North American wolverines; rather, it is more accurate to consider the contiguous United States wolverines a portion of a much larger and proven resilient North American wolverine population. We conclude that small population effects are not a stressor for wolverines in the contiguous United States now or within the foreseeable future.

Climate Change: In the SSA report, included in our discussion of future conditions, we provide a summary of current trends related to observed climate change effects, such as increased temperatures and changes in precipitation patterns, in areas that encompass the current potential extent of occurrence for the wolverine. We are not aware of any adverse effects of these observed changes to the wolverine in the contiguous United States. The potential effects of future climate change (projections) are fully considered in our future condition analysis in the wolverine SSA report (Service 2018, pp. 73–99). We summarize the results of that analysis in the Future Condition section of this document below.

Summary of Current Condition

Wolverine populations in much of North America are still recovering from large losses of individuals from intensive hunting and unregulated persecution pressures in the late 1880s into the mid-20th century (Service 2018, p. 104). The distribution of wolverines

within suitable habitat provides a more appropriate method for estimating population status than using abundance of animals, although there is limited rangewide survey information. Based on the best available information, wolverines continue to be detected within suitable habitat within the western-northwestern contiguous United States including Washington, Oregon, Idaho, Montana, and Wyoming (Service 2018, p. 71). Studies are currently under way to provide a better assessment of the species' current distribution and genetic characteristics of these populations. The best available information does not indicate the portion of the North American wolverine population in the contiguous United States is currently negatively impacted by lower genetic diversity, and there is no evidence that wolverine numbers in the contiguous United States are declining.

We prepared a map of the current potential extent of occurrence to illustrate the species' current distribution in the contiguous United States (Figure 2). We estimate this area represents approximately 3.5 percent of the wolverine's current potential extent in North America (Service 2018, p. 71). We determined that 72 percent of our current potential extent of the wolverine in the contiguous United States is found on lands owned or managed by the Federal Government (Service 2018, p. 72 and Appendix D). We also evaluated previously modeled wolverine primary habitat in the contiguous United States (Inman *et al.* 2013, entire) and estimated that 96 percent of this area is owned or managed by Federal agencies and 41 percent of this area is located in designated wilderness areas (Service 2018, p. 72). In our SSA report, we provide a detailed summary of regulatory mechanisms and conservation measures affecting wolverines related to State and Federal land management in the contiguous United States (Service 2018, Appendix G).

We evaluated several potential stressors that may be affecting wolverine populations or its habitat, including effects from roads, disturbance due to winter recreation and other activities, effects from wildland fire, disease and predation, overutilization for (primarily) commercial purposes, genetic diversity, and small-population effects.

We determined that the effects of roads (evaluated by number of miles, density, and location) and disturbance represent low-level stressors to the wolverine in the contiguous United States. Wildland fire was determined to be a short-term stressor to wolverine

habitat and its prey. Disease and predation, genetic diversity, and small population size are not considered stressors to the wolverine.

Trapping or hunting of wolverines is currently prohibited in the contiguous United States. Incidental trapping of wolverines is infrequent in the contiguous United States and, in Idaho and Montana, education programs are being implemented to reduce this stressor. Wolverines are harvested in several Canadian provinces and near the U.S.–Canada border with management and monitoring oversight based on spatial and temporal elements. We evaluated historical trapping information to assess potential impacts to dispersing wolverines into the United States. Based on the best available commercial and scientific information, overutilization does not represent a stressor to the wolverine in the contiguous United States.

We also determined that the wolverines in the contiguous United States are connected to and an extension of the Canadian population that is not genetically isolated nor considered a small population that may be more vulnerable to stressors.

Future Condition

The foreseeable future timeframe evaluated in our SSA analysis is approximately 38 to 50 years, which captures consideration of the projected future conditions related to trapping/harvesting, climate change, or other potential cumulative impacts (Service 2018, p. 73). We use a timeframe of approximately 38 to 50 years because, beyond this range, climate modeling uncertainty increases substantially. We believe this is a reasonable timeframe to consider as it includes the potential for observing these effects over several generations of the wolverine. Evaluations of future conditions for species have an inherent level of uncertainty relative to demographic risks, particularly those related to climate change projections. After considering the current conditions for the wolverine and its habitat, we determine that climate change effects (*i.e.*, significantly elevated temperatures resulting in decline in snowpack) that may modify suitable habitat, including reproductive denning habitat, could also change the scope of the wildland fire stressor and is the most likely future scenario to potentially have an effect on wolverines at the population level in the contiguous United States. Based on our review of the best available information, we determined that there were no other plausible future scenarios that were likely to have population-level impacts

to wolverine in the contiguous United States (Service 2018, p. 73). As described in detail in the wolverine SSA report (Service 2018, pp. 57–72), the effects of disease, predation, overutilization (trapping), genetic diversity, small-population effects, and effects of wildland fire are expected to continue to be at low levels in the future but are not expected to result in population-level effects to wolverine.

Climate Change Effects

In the wolverine SSA report, we considered climate changes that may affect environmental conditions upon which the wolverine relies. As defined by the Intergovernmental Panel on Climate Change (IPCC), the term “climate” refers to the mean and variability of different types of weather conditions over time (IPCC 2013, p. 1,450). Thus, the term “climate change” refers to a change in the mean or the variability of relevant properties, which 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 atmosphere or in land use (IPCC 2013a, p. 1,450).

Multiple lines of evidence, not just projections derived from quantitative models, should be examined when conducting climate vulnerability assessments (Michalak *et al.* 2017, entire). Thus, we evaluated projected effects from climate change in the western United States relative to both abiotic (e.g., temperature, precipitation, snow cover) and biotic (e.g., phenology, behavior) factors. Refer to the wolverine SSA report for a complete discussion of our analysis of the effects of climate change to wolverine in the contiguous United States (Service 2018, pp. 73–99). We summarize the results of that analysis below.

Summary of Future Condition

Abiotic Factors: Observed trends and future climate model projections indicate warming temperatures for much of the western United States, including areas within the current potential extent of the wolverine (Service 2018, pp. 75–81). The degree of future warming varies by region and is dependent upon the future emission scenario used during the modeling process. Future precipitation trends are less certain for many regions, in part, due to naturally high inter-annual variability; some regions are projected to experience greater winter precipitation (Service 2018, p. 81). Wolverines have been found to have a wide range in their physiological critical temperature depending on season and undergo

seasonal changes in fur insulation to adapt to warmer temperatures in summer (Service 2018, p. 81).

Wolverines also exhibit changes in behavior, such as moving to higher elevations in summer months (Service 2018, p. 81). Wolverines continue to occupy areas that have exhibited increases in temperature (e.g., California, parts of Montana and Washington) due to effects of climate change; however, no empirical studies have evaluated these physiological and behavioral adaptations, including sublethal effects, relative to warming temperatures (Service 2018, p. 81).

Biotic Factors: In addition to evaluating changes in abiotic factors, biotic interactions should be considered in evaluating species’ response to climate change (reviewed by Post 2013). Although abiotic changes drive ecological processes, the alterations in biotic interactions (e.g., competition among conspecifics, interactions with competitors, resources, and predators) represent the ecological responses that result from those changes (Post 2013, p. 1). Changes in certain abiotic factors, such as snow and ice cover, should also be considered in an ecological context since they represent habitat for many species (Post 2013, p. 11).

The results presented in the wolverine SSA report indicate biotic effects resulting from climate change, varying from phenological changes to shifts in vegetation and vegetation succession (Service 2018, pp. 81–82). We are unaware of studies that have directly evaluated these types of effects to the North American wolverine or its habitat. Given the relatively large area and varied habitats occupied by wolverines in the contiguous United States, the projected shifts in vegetation are likely to be relatively narrow in scope and scale relative to potential effects to wolverines. Furthermore, we have no information to suggest that wolverines selectively use any specific vegetation type, and some projected changes in vegetation may be advantageous for wolverine prey (Service 2018, p. 82).

Climate Change and Potential for Cumulative Effects

Threats can work in concert with one another to cumulatively create conditions that may impact the wolverine or its habitat beyond the scope of each individual threat (Service 2018, p. 82). Given an expected increase in temperature in the western United States, the best available information indicates that, if there are any cumulative impacts in the future, the most likely population-level effects on

wolverine in the contiguous United States could be: (1) Changes in snowpack from the combination of increased temperature and changes in precipitation patterns, or (2) changes in snowpack and increase in wildland fire potential (Service 2018, p. 83).

Snowpack/Snow Cover: The effects of climate change on snow persistence has been suggested as an important negative impact on wolverine habitat and populations by the mid-21st century and was the primary basis of our 2013 proposed rule to list the North American wolverine in the contiguous United States (78 FR 7864; February 4, 2013). In light of the court decision remanding our consideration of our withdrawal of the 2013 proposed rule relative to climate change effects to wolverine, the Service pursued a refined methodology to provide insights into the potential impacts of climate change on snow persistence (Service 2018, p. 85; Ray *et al.* 2017, entire).

The Service engaged the National Oceanic and Atmospheric Administration and University of Colorado in Boulder, Colorado, to evaluate and model fine-scale persistence of snow in occupied and potential wolverine habitat in the contiguous United States. The primary objective of this study was to refine spatial and temporal scale of snow modeling efforts and improve the scientific understanding of the extent of spring snow retention currently and into the future under a changing climate (Ray *et al.* 2017, p. 9). The objectives of the study included (Ray *et al.* 2017, p. 10):

- Use of fine-scale models to analyze the topographic effects of snow, including slope and aspect (compass direction that slope faces).
- Use of a range of plausible future climate change scenarios to assess snow persistence.
- Analysis of extremes and year-to-year variability by selecting representative wet, dry, and near normal years (using observed conditions) and then modeling changes for those base years under several future climate scenarios.
- Assessment of changes in snow persistence by elevation.

The study was designed to parallel as much as possible and thereby refine the previous assessment of snow cover persistence in the western United States presented in McKelvey *et al.* (2011). However, an exact replication of the McKelvey *et al.* (2011) study was not possible given the time, funding, and computational constraints needed to develop a fine-scale assessment. The current study was limited to two study

areas (approximately 1,500 to 3,000 km² (579 to 1,158 mi²) each) in the northern and southern Rocky Mountains (see Service 2018, Appendix H). These two National Parks bound the Northern and Southern part of the wolverine historic range, and were selected because they encompass the latitudinal and elevational range of wolverines within the contiguous United States. Glacier National Park is representative of a high-latitude and relatively low-elevation area currently occupied by wolverines. The Rocky Mountain National Park region is a lower latitude and higher elevation area within the wolverine's historical range, which was recently occupied by a wolverine from 2009 to at least 2012. See the wolverine SSA report for a summary of the methods used in Ray *et al.* (2017) (Service 2018, pp. 86–87).

Comparison with McKelvey et al. (2011): Although the methods used in this study have similarities with those presented in McKelvey *et al.* (2011), there are several key differences.

- Ray *et al.* (2017) used a finer spatial resolution model than McKelvey *et al.* (2011) (0.0625 km² vs. 37 km²) (see Service 2018, Appendix I for a comparison figure) that also incorporated slope and aspect.

- The grid cells represented in McKelvey *et al.* (2011) were assumed to be flat (*i.e.*, north-facing slopes treated as identical to south-facing slopes).

- McKelvey *et al.* (2011) focused on May 1 snow depth as a proxy for May 15 snow disappearance, while Ray *et al.* (2017) focused directly on May 15 snow disappearance and produced results for the presence or absence of deeper snow (nominally greater than or equal to 0.5 m (20 in) depth) on May 1 and April 15. Ray *et al.* (2017) originally focused on May 15 to compare to the McKelvey *et al.* (2011) study, and June 1 to bracket the snowmelt season. However, the April 15 and April 30 dates were added to the evaluation of snow-covered areas to align with temporal reproductive patterns of the wolverine (see Use of Dens and Denning Behavior discussion in the *Reproduction and Growth* section of the wolverine SSA report (Service 2018, pp. 23–28)).

- Because of the increased resolution of this study, Ray *et al.* (2017) were able to consider whether any areas of snow with depth greater than 0.5 m (20 in) will persist in these areas in the future at time periods encompassing the end of the wolverine denning period.

Additional comparisons are outlined in the wolverine SSA report (Service 2018, p. 88; Table 8) and our rationale supporting the use of snow depth greater than 0.5 m (20 in) is documented

in the wolverine SSA report (Service 2018, p. 87) and in Ray *et al.* (2017; Table 5–2).

Interpretation of results and additional analysis relative to wolverine den site scale: Recent studies of wolverine populations and distribution in Sweden have observed wolverine populations and reproductive den sites outside areas modeled with persistent spring snow cover (Aronsson and Persson 2016, p. 266; Persson 2017, pers. comm.). Another recent study, from Canada, concluded wolverines are adaptable and do not require large areas of deep spring snowpack for successful reproduction, and may select small areas covered with deep snow at a finer scale than can be detected using satellite imagery (Webb *et al.* 2016, p. 1,468). Jokinen *et al.* (2019) reported seven wolverine den sites in hollow mounds (caused by the uplifted root masses from fallen Black Spruce trees) in the boreal forest of Alberta. These areas were largely devoid of spring snow cover (mean distance from dens to nearest spring snow cover was 15.2 km) and the authors stated wolverines appear to be using “locally-available denning structures in the lowland boreal forest, despite a lack of deep snow, persistent spring snow cover, or large boulders documented in other studies.” Regardless as to whether or not wolverines are obligated to den in areas of deep snow, the Service was interested in exploring the question, “If snow cover is required for wolverine denning, will there be a sufficient amount of significant snow cover in the future in areas wolverines have historically used for denning in the contiguous United States?” The Service integrated future Distributed Hydrology Soil Vegetation Model projections (2000–2013 averages) of snow-covered area (greater than 0.5 m (20 in) depth) on May 1 for Glacier National Park and Rocky Mountain National Park with new information obtained from a spatial analysis of documented den sites in the contiguous United States. This analysis indicated 31 of 34 documented den sites in the contiguous United States were located in areas with slopes less than 25 degrees. Avalanche risk increases significantly in areas with slope greater than 25 degrees (Scott 2017, pers. comm.) and thus wolverines maybe avoiding these areas for denning due to this risk (Service 2018, p. 91).

The Service calculated areal estimates for future snow covered area in both study sites and limited these estimates to elevation bands wolverines have used historically for denning and for areas with slopes less than 25 degrees. This approach resulted in providing the most

conservative estimates of future snow covered area in the areas wolverines are most likely to use for denning.

Using the projections prepared by Ray *et al.* (2017), the wolverine SSA report presents the spatial distribution of significant snow-covered area with slopes less than 25 degrees and within the elevation bands expected to be used by wolverines for denning for three future climate scenarios in each study area (Service 2018, pp. 92–98). The three scenarios for Glacier National Park and Rocky Mountain National Park were chosen to span the range of Global Climate Model uncertainty regarding temperature and precipitation, and by extension significant snow-covered area (Service 2018, p. 93). A detailed description of methods describing the process of Global Climate Model selection can be found in Ray *et al.* (2017, pp. 35–38). We found that large portions of the study areas meet all three criteria—greater than 0.5 m (20 in) snow depth on May 1, at elevation 1,514–2,252 m (4,967–7,389 ft) for Glacier National Park or 2,700 to 3,600 m (8,858 to 11,811 ft) for Rocky Mountain National Park, and with slopes less than 25 degrees—across both study sites in the future (See map legends in Figures 10–15 in the SSA report, (Service 2018, pp. 94–98)).

We also determined that large tracts (several hundred km²/mi²) of significant snow (greater than 0.5 m (20 in) in depth) are projected in close proximity to documented historical den sites across all three climate scenarios (Service 2018, pp. 94–95). This analysis is limited to Glacier National Park because this is the only area where new snow-covered area projections and historical den locations were both available. Wolverines would not have to travel far, or at all, relative to either distance or elevation to reach areas with significant snow-covered area for denning in the future (Service 2018, pp. 94–95).

Based on the best available information, we have no reason to believe wolverines are confined to previously modeled spring snow covered areas. Furthermore, there is no quantitative data documenting spring snow patch size or depth to the denning needs of wolverines. Even if wolverines must have spring snow for denning, which we do not believe to be true, the wolverines in the lower 48 will likely have access to areas with significant spring snow cover in the future. Based on the new information presented above and in the wolverine SSA report, we do not believe wolverines need spring snow cover for denning. Nevertheless, new information suggests that spring

snow cover will not be a limiting resource for wolverines in the contiguous United States in the future. Therefore, based on the best available information, we do not consider the effects of changes in snowpack from the combination of increased temperature and changes in precipitation patterns to be a threat to the wolverine.

Wildland Fire

The wolverine SSA report includes a discussion of available information on the relationship of predicted future climate conditions on wildland fire projections in the western United States (Service 2018, pp. 99–100). In summary, based on these projections, wildland fire risk is likely to increase in the western United States, with future patterns and trends of wildland fire dependent on several factors (*e.g.*, degree of warming and drought conditions, fuel and soil moisture, wildland fire management practices, elevation) and geographic region (Service 2018, p. 100). However, given the diversity of habitats occupied by wolverines, their occupancy of high elevations, extensive mobility, and the positive effect wildland fire may have on wolverine prey species, wildland fire represents a limited stressor, in scope and scale, to wolverine habitat and its prey in the contiguous United States range (Service 2018, pp. 63–64).

To summarize, based on the best available information, the cumulative effects of wildland fire and climate change (*e.g.*, snowpack) will continue to represent a low impact to the wolverine and its habitat into the mid-21st century, based on climate change projections (Service 2018, p. 100).

Other Cumulative Effects

Finally, we note here that the effects of climate change on snowpack are projected to negatively affect the season lengths for winter recreational activities, such as skiing and snowmobiling, shortening the winter recreation season (Service 2018, pp. 100–101). A shorter winter recreation season would likely decrease the amount of winter recreation related disturbance occurring in wolverine habitat and fewer effects to wolverines. Alternatively, even though winter recreation seasons will be shorter, we could see more winter human activity at higher elevations due to snow loss at lower elevations. However, even at current levels, we do not consider winter recreational activities to be a threat to wolverine in the contiguous United States. For further discussion of winter recreational activities see the wolverine SSA report (Service 2018, pp. 100–101).

Summary of Future Conditions

Climate change model projections for the range of the wolverine within the contiguous United States indicate increases in temperature by the mid-21st century as compared to early to mid-20th century values (Service 2018, p. 101). The degree of future warming varies by region; area specific discussions are included in the SSA report (Service 2018, pp. 73–80). Precipitation patterns into the future are less clear as the climate models show significant disagreement in their many regional projections. Although drought conditions in the western United States are not unusual, drought duration and intensity have the potential to be exacerbated by projected temperature increases. Projected temperature and precipitation changes will affect future snow cover and the persistence of snow on the landscape.

Snow cover is projected to decline in response to warming temperatures and changing precipitation patterns, but this varies by elevation, topography, and by geographic region (Service 2018, p. 101). Simulations of natural snow accumulation at winter recreation locations have found that, overall, higher elevation areas (*e.g.*, Rocky Mountains, Sierra Nevada Mountains) are more resilient to projected changes in temperature and precipitation as compared to lower elevations (Wobus *et al.* 2017, p. 12). In general, models indicate higher elevations will retain more snow cover than lower elevations, particularly in early spring (April 30/ May 1) (Service 2018, p. 101). In the wolverine SSA report, we present results from several recent climate models projecting snowpack declines in the western United States (Service 2018, pp. 83–100). More specifically, we reviewed a new analysis (Ray *et al.* 2017, entire) that modeled future snow persistence for Glacier and Rocky Mountain National Parks (areas that encompass the latitudinal and elevational range of the wolverine in the contiguous United States) at high spatial resolution and at the den-site scale (Service 2018, pp. 85–98). The results indicate large areas (several hundred km²/mi² for each site) of future snow (greater than 0.5 m (20 in) in depth) will persist on May 1 (end of the denning season) at elevations currently used by wolverines for denning (Service 2018, pp. 93–98). This is true, on average, across the range of climate models used out to approximately year 2055.

Within their North American range, wolverines are found in a variety of habitats within primarily high-elevation areas of the western-northwestern

United States, and exhibit wide-ranging movements (Service 2018, p. 102). Wolverines select den sites for differing characteristics depending on location, and natal den locations are generally associated with snow cover; however, many natal dens have been observed outside of the circumpolar boundary of the snow model presented in Copeland *et al.* (2010) (Service 2018, p. 103), particularly in Scandinavia. In addition, reproductive success of wolverines has not been evaluated relative to the depth and persistence of snow cover at the den site scale, or in combination with these or other important key life-history characteristics, including avoidance and/or protection from predators, prey availability, availability of food-caching habitat.

We also considered temperature and precipitation projections from climate change models in conjunction with wildland fire risk. This risk is likely to increase across the western United States, but patterns and trends are dependent on several factors (*e.g.*, degree of warming and drought conditions, fuel and soil moisture) and geographic region (Service 2018, p. 102) and wildland fire represents a limited stressor, in scope and scale, to wolverine habitat and prey as described above in *Effects from Wildland Fire*.

Overall Assessment

The wolverine's current potential extent of occurrence includes the western-northwestern United States (see Figure 2), large areas of Canada, and Alaska (Service 2018, p. 16). The wolverine is found in a variety of habitats in North America, but generally occurs in high-elevation, relatively inaccessible locations (Service 2018, p. 102). In the contiguous United States, potentially suitable habitat (*i.e.*, primary habitat), as determined by the physical and ecological features and the ecological needs of the wolverine, is estimated at 164,125 km² (63,369 mi²) (Inman *et al.* 2013, p. 281). Based on our review of available relevant literature, we identified the physical and ecological needs of the species as follows: large territories in relatively inaccessible landscapes, at high elevation (1,800 to 3,500 m (5,906 to 11,483 ft)) within the contiguous United States; access to a variety of food resources, that varies with seasons; and reproductive behavior linked to both temporal and physical features (Service 2018, p. 104). These needs are currently met for wolverines in the contiguous United States and are expected to be met in the future (*i.e.*, in 38–50 years) (Service 2018, p. 104).

We recognize there is limited information available for the wolverine, including population estimates and abundance trends. In the contiguous United States, the structure of the wolverine population is represented as a metapopulation, although its genetic structure relative to its entire North American range has not been comprehensively evaluated (Service 2018, p. 102). Wolverine populations in Alaska are considered to be continuous with populations in the Yukon and British Columbia provinces of Canada based on genetic studies (COSEWIC 2014, p. 37). Similarly, studies of wolverines in the North Cascades region have documented recent movement of wolverines from Washington into British Columbia (Aubry *et al.* 2016, pp. 16, 20) and from Idaho (Lucid *et al.* 2016, p. 184) to British Columbia, and earlier from Montana to British Columbia and Alberta (*e.g.*, Newby and Wright 1955, p. 252).

We present in our SSA report a detailed discussion of wolverine reproductive behavior. Based on the best available information, wolverines select den sites for different characteristics depending on location. Dens located under snow cover may be related to wolverine distribution based on other life-history traits, including morphological, demographic, and behavioral adaptations that allow them to successfully compete for food resources (Inman 2013, pers. comm.). Structure (*e.g.*, uprooted trees, boulders and talus fields) appears to be an important requirement for natal den sites. However, reproductive success of wolverines has not been evaluated relative to the depth and persistence of snow cover, or in combination with these or other important characteristics, including prey availability and predator avoidance. Recent studies of wolverine populations and distribution in Sweden have observed wolverine populations and reproductive den sites outside areas modeled with persistent spring snow cover (Aronsson and Persson 2016; Persson 2017, pers. comm.). Another recent study concluded that wolverines are adaptable and do not require large areas of deep spring snowpack for successful reproduction, and may select small areas covered with deep snow at a finer scale than can be detected using satellite imagery (Webb *et al.* 2016, p. 1,468). Most recently, wolverine dens have been documented in boreal Alberta, Canada, several kilometers away from spring snow cover, in hollow mounds caused by fallen spruce trees (Jokinen *et al.* 2019). We would not expect fallen trees, and the potentially

suitable denning sites created by them, to be a limiting resource in wolverine habitat.

We identified several potential stressors that may be affecting the species and its habitat currently or in the future, including impacts associated with climate change effects. Based on the best available information, demographic risks to the species from either known or most likely potential stressors (*i.e.*, disturbance due to winter recreational activities, other human disturbances, effects of wildland fire, disease, predation, overutilization, genetic diversity, small-population effects, climate change, and cumulative effects) are low based on our evaluation of the best available information as it applies to current and potential future conditions for the wolverine and in the context of the attributes that affect the needs of the species (Service 2018, p. 103).

Climate change model projections for the range of the wolverine within the contiguous United States indicate increases in temperature by the mid-21st century as compared to early to mid-20th century values (Service 2018, p. 103). Our evaluation of climate change indicates that snow cover is projected to decline in response to warming temperatures and changing precipitation patterns, but this varies by elevation, topography, and by geographic region (Service 2018, p. 103). In general, models indicate higher elevations will retain more snow cover than lower elevations, particularly in early spring (April 30/May 1) (Service 2018, p. 103). Although the persistence of spring snow has not yet been determined to be critical to wolverine survival in North America, our review of projected snow persistence (to approximately 2055) within the Northern and Southern Rocky Mountains, indicates several hundred km²/mi² of deep snow will persist on May 1 at elevations used by the wolverine for denning (Service 2018, p. 103).

Legal protections of the wolverine in the contiguous United States include State listing in California and Oregon (as threatened); Colorado (as endangered); candidate species status in Washington; protected as a non-game species in Idaho and Wyoming; a species of concern and furbearer with a closed season in Montana; and protected from collection, importation, and possession in Utah (Service 2018, p. 107). Trapping or hunting of wolverines is currently prohibited in the contiguous United States. Trapping effort along the U.S.–Canada border does not represent a barrier to wolverine movement and

dispersal along the international border (Service 2018, p. 103).

Management actions for conservation of the wolverine and its habitat are included within State Wildlife Action Plans, the Management Plan for the Conservation of Wolverines in Idaho (IDFG 2014), and USDA Forest Service Land and Resource Management Plans (Service 2018, Appendix G). Various provisions of these plans include, but are not limited to, winter road closures, fire management, and land acquisition or conservation easements. These management measures, currently and in the future, will alleviate effects associated with potential impacts related to stressors. However, we do not rely on the management measures and conservation efforts contained in these plans to support our listing decision. In addition, the WAFWA Wildlife Chiefs Wolverine Subcommittee is providing a forum for western States to work collaboratively with each other and with the Service and other partners for conserving wolverines found in the western-northwestern United States, and, to date, approximately \$1.5 million of funding has been applied towards conservation and management actions for the wolverine (*e.g.*, Western States Wolverine Conservation Project) (McDonald 2017, pers. comm.).

Determination of Species Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of “endangered species” or “threatened species.” The Act defines an “endangered species” as a species that is “in danger of extinction throughout all or a significant portion of its range,” and a “threatened species” as a species that is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” The Act requires that we determine whether a species meets the definition of “endangered species” or “threatened species” because of any of the following 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.

Determination of Status Throughout All of Its Range in the Contiguous United States

Since the publication of the February 4, 2013, proposed rule (78 FR 7864) and reinstatement of that proposed rule on October 18, 2016 (81 FR 71670), we prepared a comprehensive assessment of the current and future status of wolverines in the contiguous United States as presented in the wolverine SSA report (Service 2018, entire). New information from recent surveys and a reevaluation of the species' current range, new genetic information, new studies of wolverine reproductive behavior and denning habitat, and results from detailed modeling of future spring snow persistence are included in the wolverine SSA report and contribute to our current understanding of the species. The wolverine SSA report also provides a comprehensive summary of wolverine life history and ecology, including an assessment of wolverine physiology, and an analysis of new information on wolverine trapping pressure in Canada near the United States-Canada border, as well as analyses of new information relevant to other potential threats to the species. We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to North American wolverines in the contiguous United States including effects from roads (Factors A and E); disturbance due to winter recreational activity (Factors A and E); other human disturbance (Factors A and E); effects from wildland fire (Factor A); disease (Factor C); predation (Factor C); overutilization (trapping) (Factor B); genetic diversity (Factor E); small-population effects (Factor E); and climate change (Factors A and E). We also assessed the adequacy of existing regulatory mechanisms (Factor D).

Consideration of Cumulative Effects—Threats can work in concert with one another to cumulatively create conditions that may impact the wolverine or its habitat beyond the scope of each individual threat. See the *Climate Change and Potential for Cumulative Effects* section above and the wolverine SSA report for an in-depth analysis of cumulative effects (Service 2018, pp. 82–101). We note that by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize

the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors.

Our future-condition analysis in the wolverine SSA report includes the potential conditions that the species or its habitat may face, that is, the most probable scenario if those conditions are realized in the future. This most probable scenario includes consideration of the sources that have the potential to most likely impact the species at the population or rangewide scales in the future, including potential cumulative impacts. Given an expected increase in temperature in the western United States, the best available information indicates that, if there are any cumulative impacts in the future, the most likely to have population-level effects on wolverine in the contiguous United States could be: (1) Changes in snowpack from the combination of increased temperature and changes in precipitation patterns, or (2) changes in snowpack and increase in wildland fire potential (Service 2018, p. 83). The best available information does not indicate that the effects of trapping and mortality from roads will act cumulatively with effects of climate change, and those stressors are expected to remain low-level impacts into the future. We provide a detailed analysis of climate change and the potential for cumulative effects in the wolverine SSA report (Service 2018, pp. 82–102). Based on the best available information, the cumulative effects of wildland fire and climate change (e.g., snowpack) will continue to represent a low impact to the wolverine and its habitat into the mid-21st century, based on climate change projections.

Resilience, Representation, and Redundancy—In order to characterize a species' viability and demographic risks, we consider the concepts of resilience, representation, and redundancy. We also consider known and potential stressors that may negatively impact the physical and biological features that the species needs for survival and reproduction. Stressors are expressed as risks to its demographic features such as abundance, population and spatial structure, and genetic or ecological diversity. We consider the level of impact a stressor may have on a species along with the consideration of

demographic factors (e.g., whether a species has stable, increasing, or decreasing trends in abundance, population growth rates, diversity of populations, and loss or degradation of habitat).

Wolverine populations in much of North America are still recovering from large losses of individuals from unregulated hunting and persecution pressures in the late 1880s into the mid-20th century (Service 2018, p. 104). Surveys conducted in the winter of 2015–2016 and 2016–2017 continue to document its presence within portions of its historical range in the western contiguous United States (representation) (Service 2018, p. 104).

Redundancy, the ability to rebound after stochastic perturbation, can be characterized by the distribution and connectivity of populations. In considering wolverine in the contiguous United States, individuals are found in alpine, boreal, and subalpine habitats, with breeding populations in four western States. Additionally, wolverines in the contiguous United States are connected to wolverine populations in Canada along the U.S.–Canada border, which contributes to current and future redundancy (Service 2018, p. 104).

Resiliency, the ability to withstand stochastic events, can be characterized by numbers of individuals and abundance trends. As indicated above, actual current population size, growth rate, and current population trends are unknown for wolverines in the contiguous United States due to the lack of abundance information. However, according to recent estimates, Canada's western subpopulation (which is connected to wolverines in the contiguous United States) has been estimated at 15,688 to 23,830 adult wolverines, with expansion of wolverines into historically occupied areas in both Canada and the contiguous United States with movement across both international borders (Service 2018, pp. 54, 105). The 2014 Committee on the Status of Endangered Wildlife in Canada report concluded that a climate-driven decline in wolverine populations in North America is not evident at this time in much of its range (COSEWIC 2014, p. 22). Wolverine populations in Canada are considered stable (Service 2018, p. 105). We also note that density estimates indicate no declining trend in wolverine populations in Alaska (Service 2018, p. 105). We recognize that there is limited information on populations (representation) or genetic diversity (resiliency and representation) for the wolverine in the contiguous United States, and no comprehensive studies to indicate what a viable (or

minimal) wolverine population size should be across its North American range. However, the best available information does not indicate either increasing or declining numbers of the wolverine in North America, including the contiguous United States. Further, at this time, the best available information does not indicate that the species' abundance is significantly impacted by the stressors evaluated (singly or cumulatively), and this situation is unlikely to change in the future, supporting current and future resiliency.

As discussed in the wolverine SSA report, both direct and cumulative effects of climate change (e.g., higher temperatures, loss of snow cover, wildland fire) may affect the resiliency of the wolverine in the future by creating an environment that is less favorable to its physiological and ecological needs (Service 2018, p. 105). We are unaware of studies of the wolverine that have formally evaluated the species' responses (e.g., reproductive success or survival) to warming temperatures or other climate change effects.

As described in the wolverine SSA report, the best available information indicates confirmed observations of wolverines denning in areas with patchy snow cover in Alaska, Canada, and Scandinavia (Service 2018, p. 105). Further, using fine-scale snow modeling, we estimated that large areas of spring snow (May 1) will remain within Glacier National Park, where wolverines are known to den (Service 2018, p. 105). Given their high rate of movement, large dispersal distances, including travel through areas not covered with snow, and other life-history traits (e.g., behavioral plasticity) observed in wolverines, we do not predict a significant loss of individual and population resiliency to the species in the future (i.e., 38–50 years) within its North America range, including the contiguous United States (Service 2018, p. 105).

Currently, we are unaware of any documented specific risks for the wolverine related to a substantial change or loss of diversity in life-history traits, population demographics, morphology, behavior, or genetic characteristics that can be used to characterize species representation (the ability to adapt to change). Rates of dispersal or gene flow are not known to have changed, and recent evidence supports continued connectivity with contiguous United States wolverines and wolverines in Canada. Additionally, there is no currently available information to indicate that the current

abundance of the wolverine across its current potential extent in the contiguous United States is at a level that is causing inbreeding depression or that loss of genetic variation is affecting representation or that would affect representation in the future (Service 2018, p. 105). Nor is there any information to indicate that this species is unable to adapt or adjust to changing conditions (e.g., potential reduction in snow cover). We do not expect a reduction in representation of the wolverines in the contiguous United States in the future. We have determined that the needs of the species are provided within the contiguous United States currently and into the future. Thus, after assessing the best available information, we conclude that the North American wolverine in the contiguous United States is not in danger of extinction throughout all of its range (endangered) nor is it likely to become so in the foreseeable future (threatened).

Because we determined that the North American wolverine in the contiguous United States is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we will consider whether there are any significant portions of its range in which it is in danger of extinction or likely to become so in the foreseeable future.

Determination of Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that the wolverine is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and, (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the “significance” question or the “status” question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for the North American wolverine in the contiguous United States, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered or threatened.

For the North American wolverine in the contiguous United States, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: effects from roads, disturbance due to winter recreational activity, other human disturbance, wildland fire, disease, predation, overutilization (trapping), genetic diversity, small-population effects, climate change, and cumulative impacts of these potential threats (Service 2018, entire). All of these potential stressors are relatively evenly distributed geographically throughout the range of the wolverine in the contiguous United States. We found no concentration of threats in any portion of the wolverine's range at a biologically meaningful scale. Therefore, no portion of the species' range can provide a basis for determining that the species is in danger of extinction now or likely to become so in the foreseeable future in a significant portion of its range, and we find the species is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This is consistent with the courts' holdings in *Desert Survivors v. Department of the Interior*, No. 16-cv-01165–JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d, 946, 959 (D. Ariz. 2017).

Determination of Status

We have reviewed the best available scientific and commercial information regarding the past, present, and future threats to the North American wolverine in the contiguous United States and we have determined that, if it were to be a listable entity, it does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Furthermore, we have determined that the population of wolverines in the contiguous United States is not a DPS. As a consequence of these determinations, we are withdrawing our proposed rule to list the distinct population segment of the North American wolverine occurring in the contiguous United States as a threatened species.

References Cited

A complete list of references cited in this document and the wolverine SSA report are available on the internet at <http://www.regulations.gov> at Docket No. FWS-R6-ES-2016-0106 and upon request from the Montana Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

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The primary authors of this document are the staff members of the Montana

Ecological Services Office and the Mountain-Prairie Regional Office.

Signing Authority

The Director, U.S. Fish and Wildlife Service, approved this document and authorized the undersigned to sign and submit the document to the Office of the Federal Register for publication electronically as an official document of the U.S. Fish and Wildlife Service. Aurelia Skipwith, Director, U.S. Fish and Wildlife Service, approved this

document on August 10, 2020, for publication.

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Madonna Baucum,

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