

**New Mexico Ridge-nosed Rattlesnake  
(*Crotalus willardi obscurus*)**

**5-Year Review:  
Summary and Evaluation**



**Photo Credit: Bruce L. Christman**

**U.S. Fish and Wildlife Service  
New Mexico Ecological Services Field Office  
Albuquerque, NM  
September 19, 2019**

**5-YEAR REVIEW**  
**New Mexico Ridge-nosed Rattlesnake (*Crotalus willardi obscurus*)**

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

**Lead Regional or Headquarters Office:** N/A

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**Cooperating Regional Office(s):** N/A

**Cooperating Science Center(s) (NMFS only):** N/A

**1.2 Purpose of 5-Year Reviews**

The U.S. Fish and Wildlife Service (Service or USFWS) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing as endangered or threatened is based on the species' status considering the five threat factors described in section 4(a)(1) of the Act. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process including public review and comment.

**1.3 Methodology used to complete the review**

The U.S. Fish and Wildlife Service conducts status reviews for species on the List of Endangered and Threatened Wildlife and Plants List (50 CFR 17.12) as required by section 4(c)(2)(A) of the Act. The Service provides notice of the reviews via the Federal Register (FR) and requests information or input on the status of the species under review. This review was conducted by the New Mexico Ecological Services Field Office staff using limited information from the 1985 *New*

*Mexico Ridgenose Rattlesnake Recovery Plan* (USFWS 1985), peer-reviewed articles, agency reports, and other documents available in the New Mexico Ecological Services Field Office files.

New Mexico Department of Game and Fish (NMDGF ) and Arizona Fish and Game Department (AFGD) were contacted to inquire if they were aware of any data or information that should be included in the 5-year analysis. No new significant information was provided by either state agency, but all responses from the state agencies are included in this 5-year review. The New Mexico Ecological Services Field Office (NMESFO) did not explicitly seek comments from NMDGF and AFGD on a draft version of this 5-year review; however, both state agencies are engaged in discussions with the NMESFO regarding needs for the subspecies. We continue to coordinate with both state agencies.

The information presented here primarily comes from peer-reviewed published literature, agency reports, and graduate theses or dissertations. These sources of information do not report specific data regarding locality or population estimates. We are aware that pertinent, unpublished data that would further inform a 5-year review exist, but we do not possess these data, nor have they been consolidated by any single entity or agency. The majority of these data include approximately 20-years of fieldwork from the late-1980s to late-2000s and are likely contained in approximately 50 to 100 field books from the former, deceased NMDGF state herpetologist. The NMESFO continues to work with NMDGF, AFGD, and researchers that have worked with this subspecies to obtain all data that are located in disparate locations, mostly in hand-written format in field books and notes of multiple individuals. These data are crucial to inform a Species Status Assessment to determine if the recommendations provided in this 5-year review remain valid.

#### **1.4 Background**

The New Mexico ridge-nosed rattlesnake is one of five recognized subspecies of the ridge-nosed rattlesnakes (*Crotalus willardi*) belonging to the viper family (Viperidae). The New Mexico ridge-nosed rattlesnake occurs in the southwestern corner of New Mexico, the southeastern corner of Arizona, and northern Mexico. Specifically, it occurs in the Animas Mountains, New Mexico; in the Peloncillo Mountains of New Mexico and Arizona; and in the Sierra San Luis Mountains in Mexico.

The subspecies was listed as threatened in 1978 and a Recovery Plan for the subspecies was finalized in 1985. The subspecies was listed primarily due to its narrowly restricted range, over collection, and habitat modification. When the Recovery Plan for the New Mexico ridge-nosed rattlesnake was completed, little was known about the natural history of the subspecies, and detection of the subspecies in the Peloncillo Mountains in New Mexico and Arizona had not yet occurred.

**1.4.1 FR Notice citation announcing initiation of this review:**

**83 FR 25034** May 31, 2018

**1.4.2 Listing history**

Original Listing

**FR notice:** 43 FR 34476

**Date listed:** August 4, 1978

**Entity listed:** Subspecies; Reptiles: Rattlesnake, New Mexican Ridge-nosed (*Crotalus willardi obscurus*)

**Classification:** Threatened

**1.4.3 Associated rulemakings:** Critical habitat also designated in 43 FR 34476

**1.4.4 Review History:** No other 5-year reviews have been prepared for this subspecies.

**1.4.5 Species' Recovery Priority Number at start of 5-year review:** 15

According to a July 25, 1990, memo, the New Mexico ridge-nosed rattlesnake was assigned a Recovery Priority Number of 15.

**1.4.6 Recovery Plan or Outline**

**Name of plan or outline:** New Mexico Ridgenose Rattlesnake Recovery Plan

**Date issued:** 1985 (signed March 22, 1985)

**Dates of previous revisions, if applicable:** N/A

**2.0 REVIEW ANALYSIS**

**2.1 Application of the 1996 Distinct Population Segment (DPS) policy**

**2.1.1 Is the species under review a vertebrate?**

  X   *Yes*  
      *No*

**2.1.2 Is the species under review listed as a DPS?**

      *Yes*  
  X   *No*

**2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?**

*Yes*  
 *No*

## 2.2 Recovery Criteria

### 2.2.1 Does the species have a final, approved recovery plan?

*Yes*  
 *No*

#### 2.2.1.1 Does the recovery plan contain objective, measurable criteria?

*Yes*  
 *No*

The 1985 Recovery Plan does not specify recovery criteria. However, a summary paragraph in the 1985 Recovery Plan states that the very restricted range may preclude delisting, but that delisting could be considered when 3 non-specific targets have been met. This summary statement is presented below, as it appears in the Recovery Plan.

#### SUMMARY

Even though the very restricted range of *Crotalus willardi obscurus* as it is presently known may preclude eventual delisting, reclassification to non-threatened status, nonetheless, could be considered when:

- 1) All important areas of *C. w. obscurus* habitat in Mexico and New Mexico are identified;
- 2) *C. w. obscurus* habitat in New Mexico is protected from adverse modification; and
- 3) The continued existence of the taxon in its habitat is assured.

Steps to reach recovery include identification and protection of important habitat and gaining additional information, through research, concerning unknown aspects of the taxon's life history.

To keep the subspecies recovered, it will be necessary to provide adequate protection and management of important habitat. This must include entering into land management agreements with private landowners and monitoring *C. w. obscurus* populations to assure continued survival of viable populations.

In August 2018, the Service completed a supplemental finding to the 1985 Recovery Plan finding that it remains not practicable to develop delisting objectives and criteria at this time. We determined that the development of delisting objectives and criteria was not practicable for the following reasons:

1. Some of the major threats affecting the subspecies now and in the foreseeable future cannot be measured, monitored, or abated (illegal collection, continuous habitat alteration and loss);
2. We lack the necessary information regarding impacts to the subspecies for some potential threats (prey availability, hybridization, disease); and
3. We lack population-level information and cannot develop population-level criteria.

The threats that cannot be measured, monitored, or not practically abated include illegal collection and continuous habitat alteration and loss due to climate change and altered fire regimes. We currently lack data as it pertains to some threats such as prey availability, hybridization, disease, population connectivity, and small population size and related genetic impacts. Some threats, such as small population size or impacts from prescribed fire could potentially be abated and increased law enforcement in the Peloncillo Mountains could reduce potential illegal collections. We therefore recommend that in these cases, conservation actions should be developed and included in a future update to the Recovery Plan.

### **2.3 Updated Information and Current Species Status**

The New Mexico ridge-nosed rattlesnake was listed as threatened with critical habitat in 1978 and its Recovery Plan was finalized in 1985. The New Mexico ridge-nosed rattlesnake is one of five recognized subspecies of ridge-nosed rattlesnakes (*Crotalus willardi*) belonging to the viper family (Viperidae). Ridge-nosed rattlesnakes are considered to be adapted to the montane pine-oak woodlands of the Sierra Madre Occidental (McCranie and Wilson 1987 *In* Holycross et al. 2002). There are currently 3 known isolated populations of the New Mexico ridge-nosed rattlesnake subspecies: Animas Mountains (NM), Peloncillo Mountains (NM and AZ), and the Sierra San Luis Mountains (Mexico). These 3 isolated populations are restricted to 3 of the approximately 57 sky-islands in the region. The Madrean Sky Islands (also known as the Madrean Archipelago) is a world diversity hotspot in northwestern Mexico and the southwestern United States (Arizona and New Mexico), characterized by pine and oak forested mountains surrounded by low elevation desert and grassland “seas” (Sky Island Alliance website accessed February 2019). Principles of island biogeography are often applicable to Sky Islands.

At the time of listing in 1978 and when the Recovery Plan for the New Mexico ridge-nosed rattlesnake was completed in 1985, little was known about the natural history of the subspecies, and detection of the subspecies in the Peloncillo Mountains in New Mexico and Arizona had not yet occurred. The New Mexico ridge-nosed rattlesnake was first observed in the Peloncillo Mountains in 1987, in Cochise County, Arizona (Barker 2016).

The Animas Mountains population is well-studied and occurs entirely on private land on the Gray Ranch, in southwestern New Mexico. The Peloncillo Mountains population occurs with extremely low numbers, and it is not well understood why the subspecies appears to be extremely rare in this area. Some studies have occurred in the Sierra San Luis population; based on catch per unit effort (CPUE), it has been postulated that this population is the most robust of the three populations (Holycross and Douglas 2007). However, using mark-recapture data and a

population viability analysis, Davis (2008) considered the Animas Mountains population to be the largest in terms of numbers of individuals of all three populations. Davis (2008) noted that additional data were available for Population Viability Analysis estimates that were not used or available to inform the Holycross and Douglas (2007) estimates.

Since the time of listing and the Final Recovery Plan, numerous studies have resulted in a variety of reports, theses, dissertations, and peer-reviewed publications contributing to our understanding of the life history and biology of the subspecies. While these documents provide information regarding our understanding of some key attributes of the subspecies, we still lack specific locality or capture data for most of these studies, and our understanding relies upon analyses and information as presented in available literature. Designated critical habitat for the subspecies occurs only in the Animas Mountains (NM) because that was its known distribution in the United States at the time of listing in 1978.

We presently possess only a handful of specific locality data for the subspecies. These data are not sufficient to create distribution maps or models and we present the best available information regarding the distribution of the subspecies, primarily as excerpted maps from reports and publications. Figure 1 represents an older general distribution for all subspecies of *Crotalus willardi* excerpted from Barker 1992 (p. 90), with the 3 populations that comprise the entire range of the New Mexico ridge-nosed rattlesnake represented in polygons 1, 2, and 3 (the Peloncillo Mountains of southwestern New Mexico and southeastern Arizona, the Animas Mountains in the southwestern corner of New Mexico, and the Sierra San Luis Mountains in northern Mexico.). Figure 2 (excerpted from Holycross and Douglas 2007, p. 144) represents projected habitat type and the areas sampled for an assessment of connectivity among the three populations of the New Mexico ridge-nosed rattlesnake. In a Biological Opinion issued in 2008 (USFWS 2008), we reported that we were aware of the documentation of 27 individual snakes within 13 general areas running from upper Miller Canyon at the southern end of the range to south Skeleton Canyon at the northern end from 1987 to 2008; however, at this time, we have not identified the exact locality information for these individuals. Figure 3 is a coarse scale map of possible habitat for the New Mexico ridge-nosed rattlesnake based solely on the known elevational range of the subspecies in each mountain area where the subspecies occurs.

In the 1985 Recovery Plan, we identified four areas of known occurrence of the subspecies in the Animas Mountains: West Fork Canyon, Indian Creek Canyon, Bear Canyon, and Little Bear Canyon. It is our understanding that nearly all work and surveys for the subspecies in the Animas Mountains has occurred in West Fork Canyon and Indian Creek Canyon; however, because we do not have specific locality data, there is uncertainty regarding location of studies, samples, and data. Holycross et al. (2016) reported that population monitoring in the Animas Mountains sporadically occurred since 1990 resulting in the marking of 870 individual snakes of all species encountered. Holycross (2000) reported that surveys from 1994-1999 resulted in the marking of 160 individual New Mexico ridge-nosed rattlesnakes in the Animas Mountains (from 1994-1999 with 5,779 person-hours of searching or 36 person-hours/snake); 17 individuals in the Peloncillo Mountains (from 1995-1998 with 4,753 person-hours of searching or 280 person-hours/snake), and 29 individuals from the Sierra San Luis in Mexico (from 1998 with 307 person-hours of searching or 11 person-hours/snake).

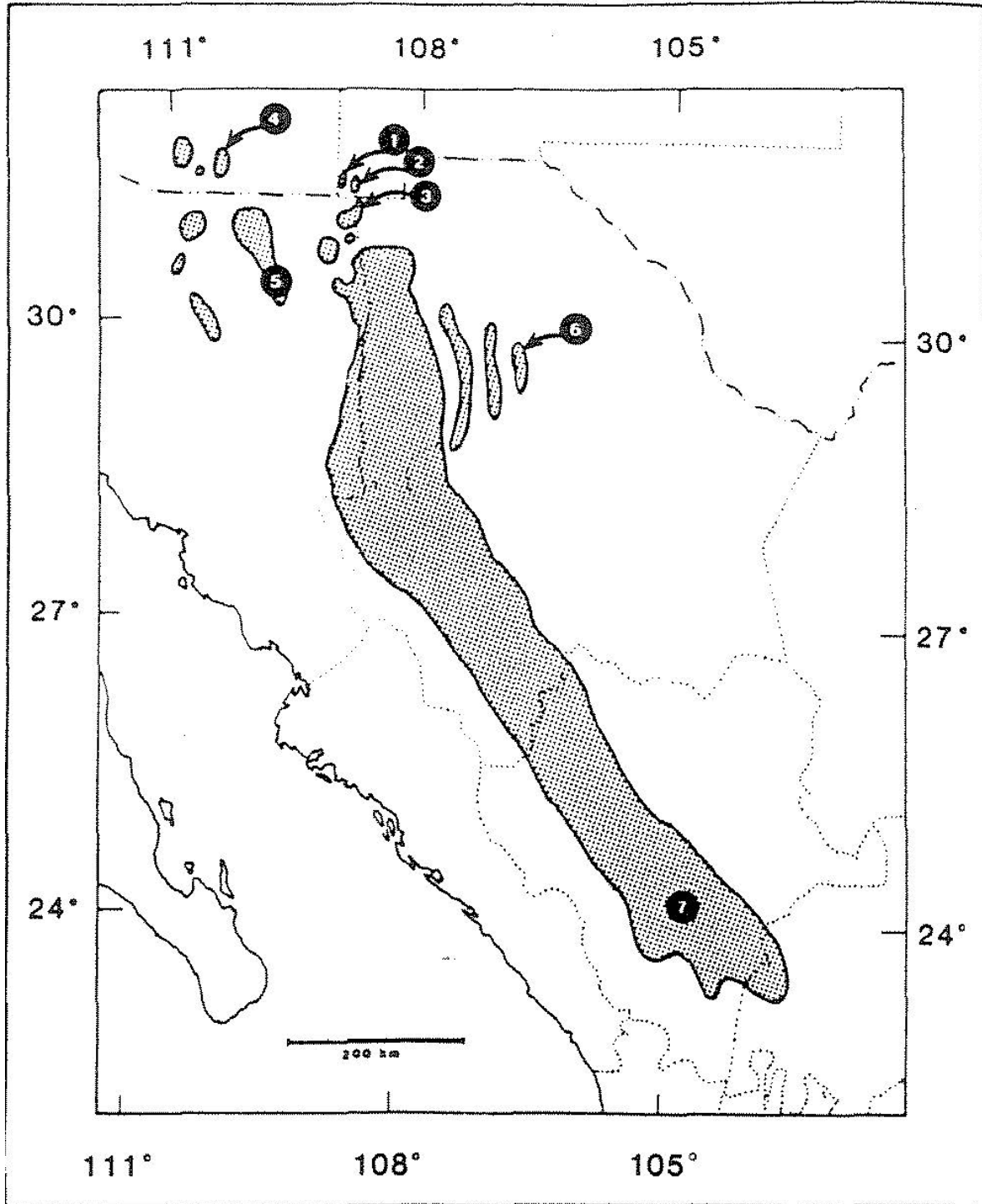


Figure 1. The distribution of *Crotalus willardi* populations sampled to assess intraspecific relationships and biogeography of the ridge-nosed rattlesnakes (excerpted from Barker 1992, p. 90). The New Mexico ridge-nosed rattlesnake is represented by the Peloncillo Mountains, NM (1); the Animas Mountains, NM (2); and the Sierra San Luis, Sonora, Mexico (3). Subsequent to this publication (Barker 1992), the subspecies has also been observed in Arizona just over the New Mexico-Arizona border in the Peloncillo Mountains (1).

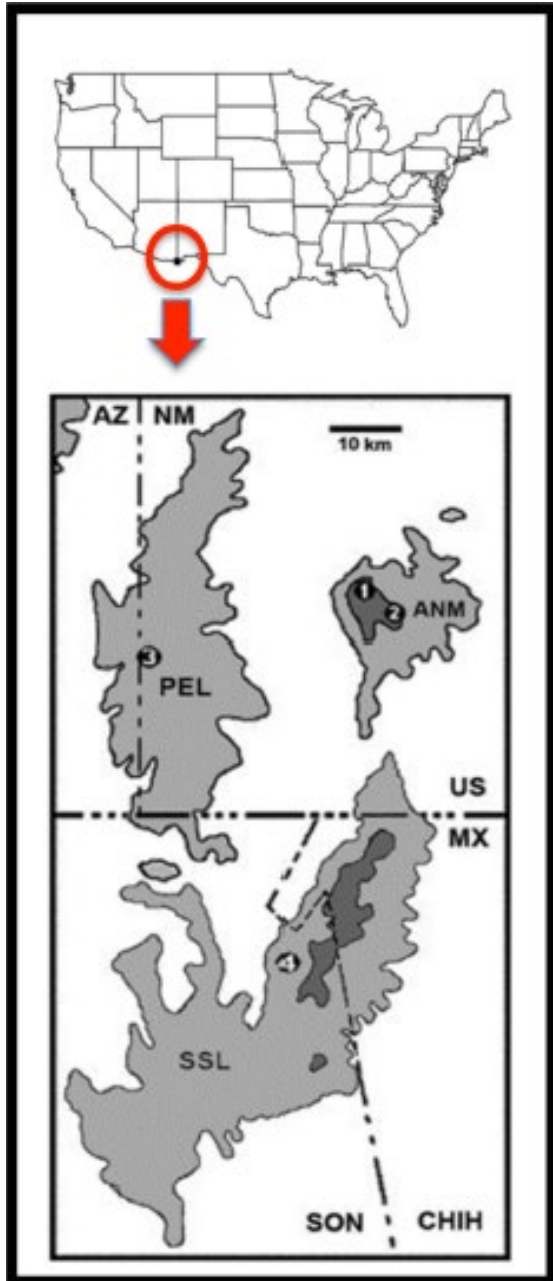


Figure 2. Habitat types and sampling locations of *Crotalus willardi obscurus* populations as presented in Holycross and Douglas 2007 and Davis et al. 2015 (excerpted from Davis et al. 2015, p. 3). The numbers represent sampling locations. The New Mexico ridge-nosed rattlesnake is represented by three populations: the Animas Mountains, NM (represented by two sample sites: 1. West Fork Canyon and 2. Indian Creek Canyon; ANM); the Peloncillo Mountains, NM and AZ (PEL); and the Sierra San Luis, Sonora and Chihuahua, Mexico (SSL). The light gray polygons delineate Madrean Evergreen Woodland vegetation type and the dark gray represents Petran Montane Conifer forest as described in Brown 1994 (Holycross and Douglas 2007, p. 144).

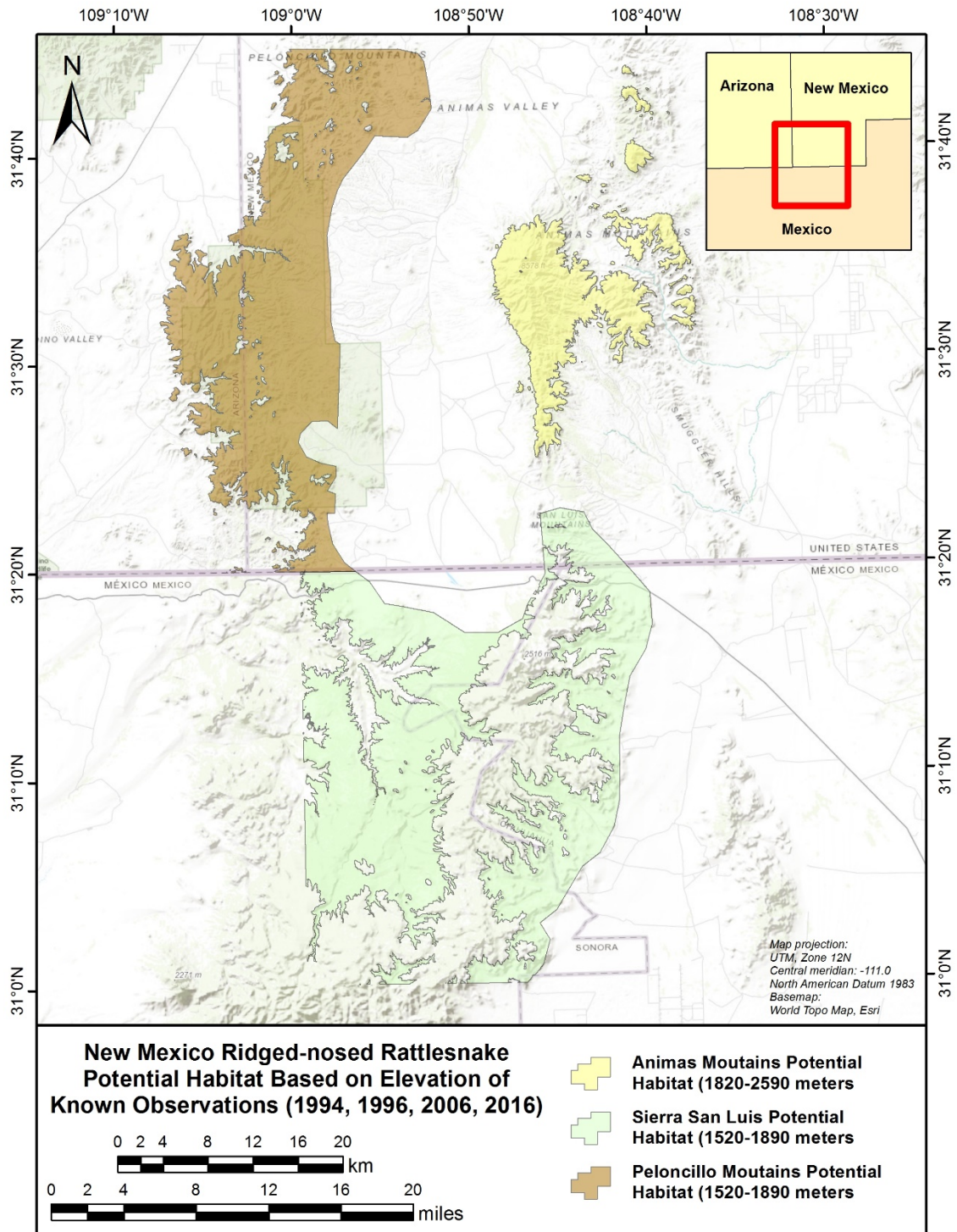


Figure 3. Coarse scale map of possible habitat for the New Mexico ridge-nosed rattlesnake based solely on the known elevational range of the subspecies in each mountain area where the subspecies occurs.

The maps presented in this finding represent the best available information in our possession regarding the distribution of the subspecies at this time; however, based on published literature and reports, we are aware that significantly more information and data exist with respect to locality, distribution, and detection rates over time. The Service is interested in working with partners and stakeholders to compile these data and to develop a distribution map for the subspecies, detection rates over time, and to better assess the status of the subspecies.

### **2.3.1 Biology and Habitat**

#### **2.3.1.1 New information on the species' biology and life history**

The New Mexico ridge-nosed rattlesnake is a montane subspecies that can be found in pine-oak woodlands, on steep, rocky hillsides, in canyon bottoms, and on talus slopes at elevations ranging from approximately 5,971 to 8,500 feet (ft) (1,820 meters (m) to 2,590 m) in the Animas Mountains and 4,987 ft to 6,200 ft (1,520 to 1890 m) in the Peloncillo Mountains (NMDGF 1990; Degenhardt et al. 1996; Fedorko 2017). Holycross (1995) reported habitat use in the Animas Mountains on steep east and southeast facing slopes, dominated by bunchgrass and beargrass, with widely spaced oaks and junipers or on steep east and southeast facing slopes with New Mexico locust and talus. Rocky areas or talus with spaces may be an important habitat component.

#### *Reproduction*

Mating and copulation has been reported to occur in the wild from June through October (Holycross and Goldberg 2001). Male New Mexico ridge-nosed rattlesnakes appear to be capable of inseminating females from June through September and females likely have a biennial or longer reproductive cycle. The female reproductive cycle likely includes yolk deposition in one or more reproductive seasons, followed by a season with ovulation, development of young, and parturition. New Mexico ridge-nosed rattlesnakes are live-bearers, and young rattlesnakes are born fully formed from late July through August (Holycross and Goldberg 2001) and may be coincident with occurrence and emergence of certain prey items suitable for baby snakes (see *Diet* below). Litter size is related to the size and age of the female, where small females have smaller litter size and large females have larger litter size. Female size is influenced by the age and health of the individual, as well as available resources. Holycross and Goldberg (2001) report that the average litter size for twelve New Mexico ridge-nosed rattlesnakes was 5.5 and ranged between 4-8; similar litter sizes were reported for the three subspecies of ridge-nosed rattlesnakes (n=25) assessed averaging 5.4 with a range of 2-9. Because the New Mexico ridge-nosed rattlesnake generally has a low reproductive output that is coupled with some loss of neonatal or juvenile snakes, and a single male can sire multiple females, population persistence or recovery may be largely dependent on adult female survivorship.

#### *Diet*

New Mexico ridge-nosed rattlesnakes, like other rattlesnakes, are sit and wait predators. Holycross et al. (2002) report on the foraging ecology of the New Mexico ridge-nosed rattlesnake based on fecal remains and stomach contents from 246 individual snakes, from which

95 prey items were identified. The prey items were independent of population, sex, and season, but were dependent on age. Juvenile rattlesnakes had primarily lizard (57%) and centipede (33%) prey items whereas adult prey items primarily consisted of small mammals (62%) and passerine birds (9%).

Mocino-Deloya et al. (2015) reported on prey items from 92 New Mexico ridge-nosed rattlesnakes from Sierra San Luis and Sierra Pan Duro, which are both situated in the Sierra San Luis mountainous complex where the subspecies occurs in Mexico. Of the 103 prey items examined, nearly two-thirds of prey items were ectotherms (54.4% lizards and 13.6% scolopendromorph centipedes); birds (21.4%) and mammals (10.7%) were also taken. The diet of juvenile snakes ( $n=2$ ) consisted primarily of lizards (62.5%) and centipedes (25.8%), although large juveniles also consumed mammals (6.3%) and passerine birds (6.3%). Adult snakes ( $n=71$ ) fed primarily on lizards (50.7%) and passerine birds (28.2%) but also consumed mammals (12.7%) and centipedes (8.4%). The authors (Mocino-Deloya et al. 2015) further reported that the New Mexico ridge-nosed rattlesnakes examined in the Sierra San Luis and Sierra Pan Duro consumed more birds than has been reported for other subspecies, and they continued to consume centipedes as adults.

### **2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

Davis (2008) analyzed population dynamics of the New Mexico ridge-nosed rattlesnake and found that population survivorship at 76% is consistent with other late maturing, slow reproducing viperids and Crotalines in particular. Davis (2008) reported that on average, adults exhibit a 76% annual survival rate and juveniles had a rate of 53%; males had a greater survival rate at 71% than females at 60%. The slightly lower survivorship of females over males may be from higher rates of predation (as females need to bask more conspicuously for thermoregulation while gravid) and parturition and overwintering mortality may also contribute to reduced survival rates in females. The sex ratio from 193 individuals captured in the Animas Mountains from 1990-2007 was not significantly different from 1:1 (Davis 2008).

Holycross and Douglas (2007) estimated an instantaneous (yearly) abundance that did not exceed 151 ( $\pm 26$ ) individuals at their West Fork Canyon study site in the Animas Mountains. Davis (2008) estimated an instantaneous population of 304.7 ( $\pm 57.6$ ) for the entire Animas Mountains population, and suggest that the Animas Mountains population is the largest of the three extant populations, and represents approximately half of the estimated individuals across the distribution of the New Mexico ridge-nosed rattlesnake.

Holycross and Goldberg (2001) suggested that because the New Mexico ridge-nosed rattlesnake is a long-lived subspecies with relatively low natality and juvenile survivorship, that population growth or persistence would be largely dependent on adult female survivorship. However, Davis (2008) recognized that while this is a reasonable prediction, results from a population viability model concluded that juvenile growth and survival were equally, possibly more, important than adult survival.

### **2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

Holycross and Douglas (2007) used microsatellite and two mitochondrial DNA (mtDNA) genes to assess the genetic diversity within and among three populations of the New Mexico ridge-nosed rattlesnake, to assess the connectivity among those populations, and to look for evidence of population bottlenecks. The molecular data support that both historically and recently New Mexico ridge-nosed rattlesnake populations have been isolated from each other in their distinct mountain habitats (Holycross and Douglas 2007). Historical evidence suggest that one of the three populations (the Animas) has been separated from a low elevation desertification that occurred approximately 4000 years before present (Holycross and Douglass 2007). Recent reduction in size and associated diminished genetic variability was found in all three populations, with the Peloncillo Mountains population being the most severe (Holycross and Douglas 2007). Furthermore, Holycross and Douglas (2007) present anecdotal, but relevant, evidence for inbreeding in the Peloncillo Mountains population where 2 of 21 individuals had congenital rattle abnormalities, and a record of a hybrid of new Mexico ridge-nosed rattlesnake with a banded rock rattlesnake (*Crotalus lepidus*) (Campbell et al. 1989).

Davis et al. (2015) used long-term mark-recapture data and molecular data from the Animas Mountains to model impacts of climate change while considering the geographic restrictions (occurrence on “sky-islands” of the southwest) and impacts from wildfire. While Davis et al. (2015) concluded that survival of the subspecies is significantly influenced by climate change driven wildfire at upper elevations within its habitat, they also concluded that the subspecies is experiencing an “extinction vortex” that is overall being driven by small population dynamics. An extinction vortex is a process in small populations whereby it continues its trajectory towards extinction and is a result of mutually reinforced factors that collectively contribute to the deterioration of that population (Fagan and Holmes 2006).

### **2.3.1.4 Taxonomic classification or changes in nomenclature:**

The New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*) is one of five recognized subspecies of ridge-nosed rattlesnakes, and was the entity listed in 1978. The uniqueness of the subspecies was confirmed using morphometric characters and allozyme analysis by Baker (1990) and with mtDNA and microsatellite information by Holycross and Douglas (2007). The Society for the Study of Amphibians and Reptiles’ Committee on Standard English and Scientific Names evaluate peer-reviewed literature and publish accepted common and scientific names for amphibians and reptiles north of Mexico. In the most recent edition (Crother et al. 2017), the New Mexico ridge-nosed rattlesnake continues to be recognized as a valid subspecies. The editors note that Barker 2016 (*In* Shuett et al. 2016 [eds.] Rattlesnakes of Arizona, ECO Publishing) recommended elevating the five subspecies of *C. willardi* to species, but that Crother et al. (2017) do not accept this recommendation until data are available for evaluation. We follow the determination of Crother et al. (2017) that sufficient data have not yet been presented to warrant consideration of elevating any of the five subspecies to species. We therefore continue to recognize the New Mexico ridge-nosed rattlesnake as a valid subspecies and the entity under consideration in this review.

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

As previously noted, since the time of listing and the finalization of the Recovery Plan for the subspecies, the subspecies is now known to occur in the Peloncillo Mountains, in New Mexico and Arizona, and all three populations are considered historically and presently isolated from one another, with no potential for natural demographic or genetic interchange.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

Under a moderate climate change scenario through the year 2080, Davis et al. (2015) concluded that the narrow climate envelope for the New Mexico ridge-nosed rattlesnake would shift to the north approximately 763 km (near Flagstaff, AZ). Their conclusion was that by the year 2080, core habitat for the New Mexico ridge-nosed rattlesnake would no longer be available in the current range of the species. Discussed in further detail in the 5 Factor analysis, large-scale wildfire is impacting the habitat of the New Mexico ridge-nosed rattlesnake, and may be decreasing its suitability by converting vegetation and historical fire regimes (Figure 4).

**2.3.1.7 Other:** None identified.

**2.3.1.8 Conservation Measures:**

The Animas Mountains population occurs on private land. It is our understanding that a conservation easement exists and covers the extent of the Animas population of the New Mexico ridge-nosed rattlesnake; however, we do not have a record of the easement in our files.

Several general conservation measures are incorporated into section 7 consultations with the U.S. Forest Service and the Malpai Borderland Habitat Conservation Plan (documents can be found at <https://www.fws.gov/southwest/es/arizona/Biological.htm>). However, we are not aware of any specific conservation measures that are in place to protect the New Mexico ridge-nosed rattlesnake, its habitat, or its designated critical habitat.

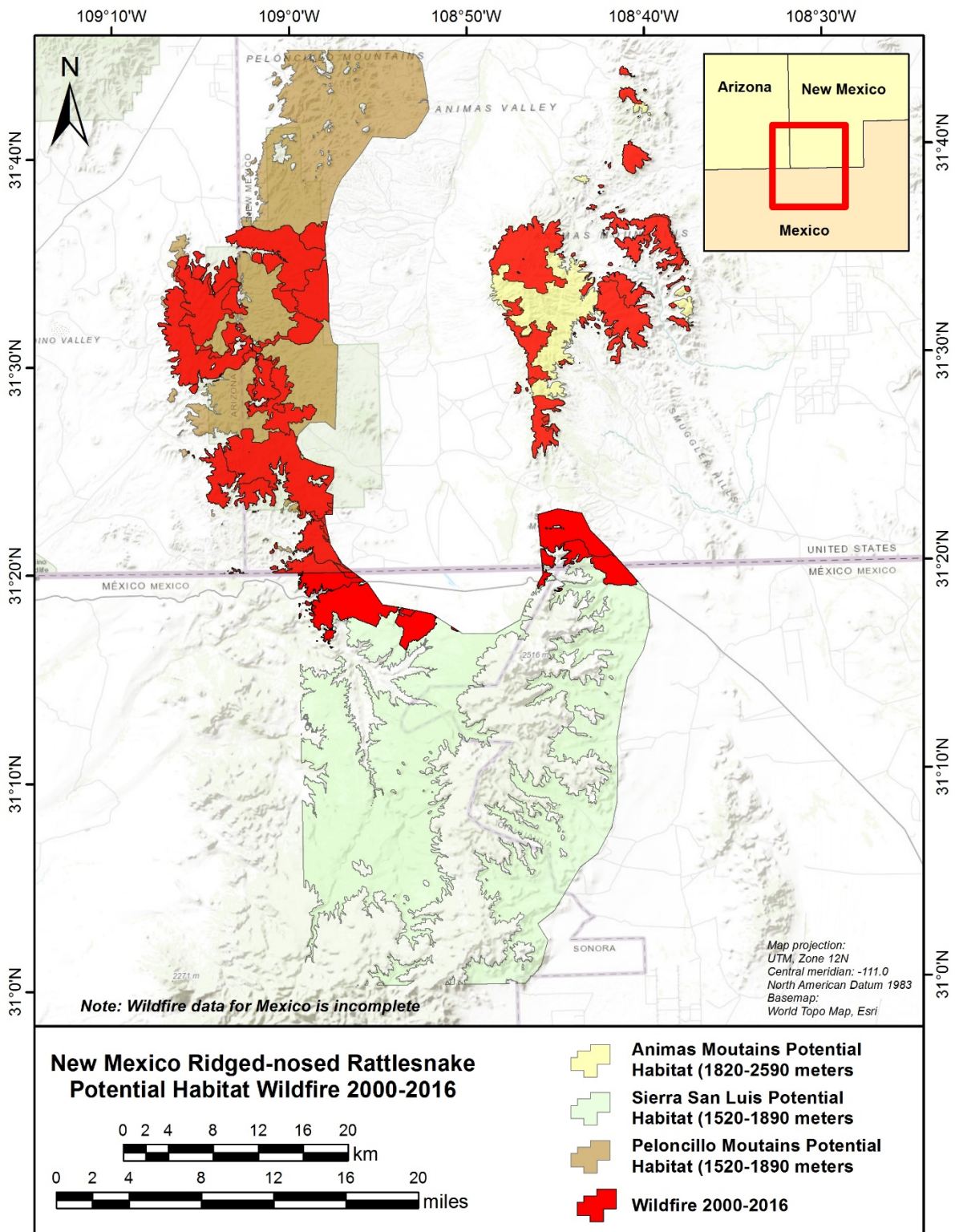


Figure 4. Broad potential habitat (by elevation) affected by wildfire between the years 2000-2016.

## **2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

### **2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

Habitat alteration continues to affect the New Mexico ridge-nosed rattlesnake; however, current habitat alteration and impacts are different than at the time of listing. At the time of listing, invasive (blasting) and destructive (tearing up rock cover) techniques were used to collect the subspecies, and compounded the threat of over-collection. We have no evidence that this type of habitat alteration still occurs. Blasting likely does not occur anywhere since the Animas Mountains population is now privately held with some level of oversight and blasting would not likely be productive as a mechanism to collect New Mexico ridge-nosed rattlesnakes in the Peloncillo Mountains given the low numbers of the subspecies reported there. However, there may be impacts to habitat and rocks used for sheltering from flipping rocks and cover in search of snakes for illegal collection.

Habitat alteration and loss currently affects the subspecies primarily from the interrelated effects of forest type conversions, climate change, and associated wildfire. Forest type conversions are the result from long-term forest management practices over the last century including grazing and fire suppression. Exacerbated by climate change, forest management over the last century has caused shifts in the natural fire regime resulting in large-scale, unplanned wildfires or unnatural prescribed fire regimes, and ultimately vegetation type conversion from suitable woodland habitat to unsuitable chaparral and grassland habitat (Holycross and Smith 2001).

Fire-related habitat changes and impacts coupled with climate change and future climate change projections result in continued declines and loss of available habitat. One study (Smith et al. 2001) assessed the impacts of prescribed fire on radio-telemetered New Mexico ridge-nosed rattlesnakes and found that prescribed fire initiated in the off-season, or conducted without reducing fuel loads prior to burning, may have similar effects to New Mexico ridge-nosed rattlesnake habitat as wildfire, eliminating woodland components as well as directly and indirectly impacting or killing wildlife. However, in areas where fire had previously burned with low-severity and reduced fuel loads, woodland components remained intact.

Davis et al. (2015) used long-term mark-recapture data and molecular data from the Animas Mountains to model impacts of climate change while considering the geographic restrictions of the subspecies and impacts from wildfire. Davis et al. (2015) concluded that survival of the subspecies would be significantly influenced by wildfire at upper elevations and by climate change and vicariant desertification at the lower elevations of its habitat, resulting in a narrowing of available habitat. Davis et al. (2015) further raised concern that, beyond the subspecies-specific concern of the New Mexico ridge-nosed rattlesnake, extends to the trajectory of the collapse of the Madrean Pine-Oak ecosystem to which the subspecies is restricted.

Davis et al. (2015) suggested that the New Mexico ridge-nosed rattlesnake is rapidly moving towards extinction, that some efforts could be put in place to slow the rate, but will not likely prevent extinction unless ecosystem-level conservation strategies and initiatives are developed and implemented.

#### **2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**

Illegal collection was identified as a threat to the subspecies at the time of listing. NMDGF shared records of a case of illegal collection and prosecution for collecting the subspecies without a permit that occurred in 1989. Neither NMDGF nor AFGD reported any additional recent cases of illegal collection or use of the subspecies. However, the range of the subspecies occurs in very remote areas, where the presence of law enforcement is low or very low; thus, the probability of encountering and interdiction of illegal collection is very low. Despite the lack of documented cases of illegal collection, illegal collection of the subspecies likely occurs because of its unique coloration, scale structure, and the overall attractiveness of small, rare rattlesnakes to herpetoculturists around the world - creating a market for illegal trade. Specimens of the New Mexico ridge-nosed rattlesnake likely have a high value on the black market. For example, another subspecies from Mexico, the Western Chihuahuan ridge-nosed rattlesnake (*Crotalus willardi silus*), a non-protected species, was recently available for purchase on the open market and advertised on the internet for \$1,500 (Kingsnake.com classified ad dated July 19, 2018). Generally, the less available and more difficult a species is to collect, the greater the monetary value, and thus the rarity and lack of availability of New Mexico ridge-nosed rattlesnakes likely creates a high demand for the collection of individuals from the wild for sale on the black market. It is not feasible to measure or monitor the threat of illegal collection for the subspecies without intensive study and law enforcement efforts, and impacts to populations are not known. Therefore, while illegal collection may continue to be a significant threat to the New Mexico ridge-nosed rattlesnake, the magnitude and imminence of this threat remain unknown.

#### **2.3.2.3 Disease or predation:**

Disease and parasites were listed as a potential concern in the Recovery Plan, but we are not aware of any new information to know whether disease or parasites affect the subspecies or are a factor of concern for the subspecies. We are also not aware of any new information that would indicate that predation is a factor of concern for the subspecies.

#### **2.3.2.4 Inadequacy of existing regulatory mechanisms:**

New Mexico State law provides some protection to the New Mexico ridge-nosed rattlesnake, as the subspecies is listed as endangered by the State of New Mexico (NMDGF 2018). This designation provides protection under the New Mexico Wildlife Conservation Act of 1974 (i.e., State Endangered Species Act) (19 NMAC 33.6.8), and prohibits direct take of the subspecies, except under issuance of a scientific collecting permit. The New Mexico Wildlife Conservation Act defines “take” or “taking” as harass, hunt, capture, or kill any wildlife or attempt to do so (17 NMAC 17.2.38). New Mexico State status as an endangered species only conveys protection from collection or intentional harm to the animals themselves. New Mexico State statutes do not

address habitat protection, indirect effects, or other threats to these species.

Under Arizona Game and Fish Department regulations, it is illegal to collect or possess a New Mexico ridge-nosed rattlesnake without specific authorization, as the subspecies is a closed-season species. However, as in New Mexico, this designation only conveys protection from collection or intentional harm to the animals themselves and does not convey habitat protection, indirect effects, or other threats to the subspecies.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence:**

Molecular data suggested that small population sizes, genetic isolation, and current inbreeding and deterioration of genetic variation in all populations may be pushing the New Mexico ridge-nosed rattlesnake into the “extinction vortex” (Holycross and Douglas 2007, Davis et al. 2015; see Section 2.3.1.3). When long-term mark-recapture data were coupled with molecular data, demographic data, and niche modeling, the result was a shallow predicted-time-to-extinction estimate of 17 years (+/- 2 years) (Davis et al. 2015).

### **2.4 Synthesis**

The threats affecting the subspecies, and the magnitude and immediacy in which they are affecting each population, vary by population; some of which we either lack information or the ability to measure to determine the magnitude and immediacy.

The threats currently affecting the subspecies include those that were present at the time of listing (collection; habitat alteration) as well as additional threats not addressed at the time of listing (lack of connectivity among populations; small population sizes; genetic isolation; inbreeding; hybridization; changing climate). Additionally, the habitat alteration impacts are different now than at the time of listing. At the time of listing, invasive (blasting) and destructive (tearing up rock cover) techniques were used to collect the subspecies, and compounded the threat of over-collection. Since listing, blasting of habitat is no longer a significant concern; however, indiscriminate rock-flipping coupled with illegal collection may still be a significant threat to the New Mexico ridge-nosed rattlesnake. Additionally, other forms of habitat alteration and loss significantly affects the subspecies range-wide. Current habitat alteration and loss primarily stems from forest type conversions resulting from effects of climate change coupled with historical forest management practices over the last century (including grazing and fire suppression) that have caused shifts in the natural fire regime resulting in large-scale, unplanned wildfires or shifted prescribed fire regimes, and ultimately vegetation type conversion from suitable woodland habitat to unsuitable chaparral and grassland habitat. Climate change is predicted to push core habitat for the subspecies upwards in elevation until it no longer occurs in the Madrean Archipelago.

### 3.0 RESULTS

#### 3.1 Recommended Classification

- Downlist to Threatened
- Uplist to Endangered
- Delist (*Indicate reasons for delisting per 50 CFR 424.11*):
  - Extinction
  - Recovery
  - Original data for classification in error
- No change is needed\*\*

**\*\* No change is recommended at this time; however, it is strongly recommended that a Species Status Assessment be prioritized and conducted within the next two years. We are aware of multiple gray literature reports and documents that are currently not in our files and that additional data may be available for analyses. The inclusion of all existing information and data using the Species Status Assessment process would contribute to a more rigorous assessment of the status of the species. The information and data presented here indicate that with further analyses, uplisting of the subspecies to Endangered may be warranted. Therefore, we recommend no change in status at this time but that a more in-depth, rigorous assessment be conducted through the process of a Species Status Assessment in the near-term. Conducting a Species Status Assessment is recommended to utilize the process of working with researchers, state and federal partners, and private landowners to obtain reports, literature, and data not currently in our possession, and to garner expert opinions to better analyze the status of the New Mexico ridge-nosed rattlesnake. A Species Status Assessment will also be valuable to update the outdated 1985 Recovery Plan for the New Mexico ridge-nosed rattlesnake.**

#### 3.2 New Recovery Priority Number

6

##### **Brief Rationale:**

We have re-assigned the New Mexico ridge-nosed rattlesnake a Recovery Priority Number of 6 to reflect the high degree of threat and the low recovery potential for this subspecific taxonomic unit.

#### 3.3 Listing and Reclassification Priority Number, if reclassification is recommended (*see Appendix E*)

**Reclassification (from Threatened to Endangered) Priority Number:** \_\_\_\_\_

**Reclassification (from Endangered to Threatened) Priority Number:** \_\_\_\_\_

**Delisting (Removal from list regardless of current classification) Priority Number:**

\_\_\_\_\_

## **Brief Rationale:**

### **4.0 RECOMMENDATIONS FOR FUTURE ACTIONS**

We recommend the following future actions for the New Mexico ridge-nosed rattlesnake:

1. Federal and state agencies, researchers, and other stakeholders should work together to consolidate data and information to analyze, assess, and inform our understanding of the status of the subspecies and to develop future management, conservation, and recovery actions.
2. Use all available information and data to complete a Species Status Assessment.
3. Update the Recovery Plan for the New Mexico ridge-nosed rattlesnake. Recovery strategies should address major threats, including a strategy for conservation and recovery given climate change driven impacts to habitat; illegal collection assessment and strategies; and strategies for managing small, isolated populations.
4. Assess the need for genetic management; if warranted, develop a Genetic Management Plan.
5. Gain an understanding of fire ecology of the area and how altered fire regimes and wildfire may affect the subspecies in the short- and long-term.
6. Work with states, Law Enforcement, and U.S. Customs and Border Protection to provide training on species identification and awareness of potential illegal collection and avoidance of hitting snakes on roads.
7. Develop and fund research in the Peloncillo Mountains to identify the distribution and threats specific to the Peloncillo population.
8. Encourage law enforcement agencies to commit to significantly elevating signage, patrols, vehicle stop and searches, and campsite interviews along the Geronimo Trail and other forest roads in the Peloncillo Mountains to increase the visibility of wildlife law enforcement and discourage the potential for illegal collection of New Mexico ridge-nosed rattlesnake within its only publically-accessible, and most well-known, population.
9. Coordinate with Mexican partners to better understand the status, threats, and conservation of the subspecies in Mexico.

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of New Mexico Ridge-nosed rattlesnake (*Crotalus willardi obscurus*)**

**Current Classification:** Threatened

**Recommendation resulting from the 5-Year Review:**


- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:**

**Review Conducted By:**

**FIELD OFFICE APPROVAL:**

**Lead Field Supervisor, U.S. Fish and Wildlife Service, [Insert Field Office Name]**

Approve  Date 19 September 2019  
*The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.*

**REGIONAL OFFICE APPROVAL:**

*The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.*

**Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2**

Approve N/A Date \_\_\_\_\_

*The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. Written concurrence from other regions is required.*

**Cooperating Regional Director, Fish and Wildlife Service**

Concur  Do Not Concur

Signature N/A Date \_\_\_\_\_