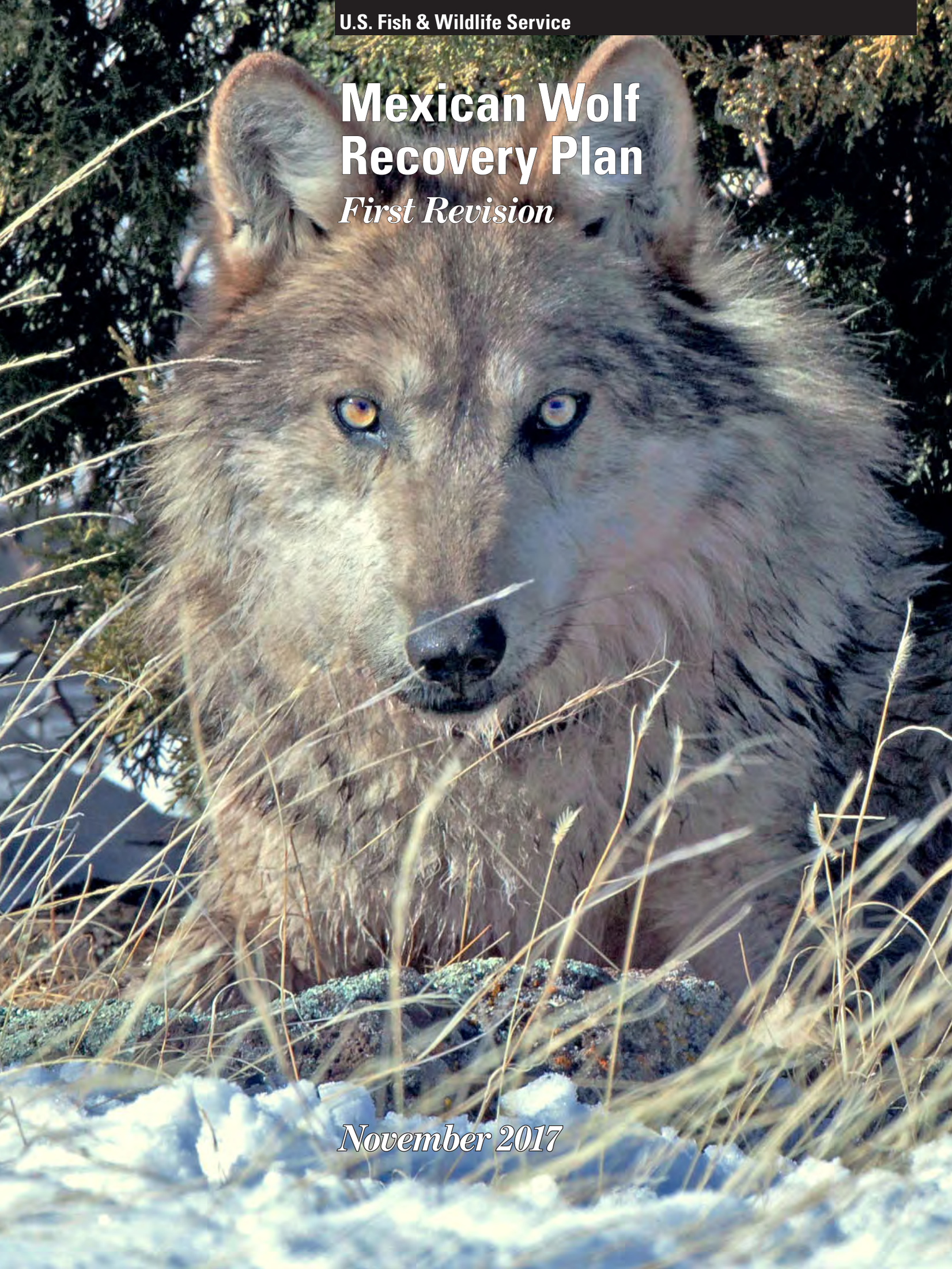
U.S. Fish & Wildlife Service

Mexican Wolf Recovery Plan

First Revision



November 2017

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MEXICAN WOLF RECOVERY PLAN

First Revision

November 2017

Original Plan Approved: 1982

Southwest Region (Region 2)
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

Approved: _____

Regional Director, U.S. Fish and Wildlife Service, Southwest Region

Date: Nov. 28, 2017

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DISCLAIMER

The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.), requires the development of recovery plans for listed species, unless such a plan would not promote the conservation of a particular species. In accordance with section 4(f)(1) of the ESA and to the maximum extent practicable, recovery plans delineate actions which the best available science indicates are required to recover and protect listed species. Plans are published by the U.S. Fish and Wildlife Service (Service), and are sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Recovery teams serve as independent advisors to the Service. Plans are reviewed by the public and submitted to additional peer review before they are adopted by the Service. The purpose of a recovery plan is to provide a scientifically based, logical, and effective roadmap for the recovery of a species. It explains what is needed for species recovery and how to get there. Recovery plans are advisory documents, not regulatory documents. A recovery plan does not commit any entity to implement the recommended strategies or actions contained within it for a particular species, but rather provides guidance for ameliorating threats and implementing proactive conservation measures, as well as providing context for implementation of other sections of the Endangered Species Act, such as section 7(a)(2) consultations on Federal agency activities, development of Habitat Conservation Plans, or the creation of experimental populations under section 10(j). The recovery plan objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than the Service. They represent the official position of the Service once they have been signed by the Regional Director. Approved recovery plans are subject to modification as dictated by new information, changes in species status, and the completion of recovery actions. Please check for updates or revisions at the website below before using.

We developed the Mexican Wolf Recovery Plan, First Revision, using a revised recovery planning process called Recovery Planning and Implementation (RPI), adopted by the Service in 2016. RPI is intended to reduce the time needed to develop recovery plans, increase the relevancy of recovery plans over a longer timeframe, and add flexibility to recovery plans so they can be adjusted to new information or circumstances. Under RPI, a recovery plan includes statutorily required elements (objective, measurable criteria; site-specific management actions; and estimates of time and costs), along with a concise introduction and explanation of our strategy to achieve species recovery. The RPI recovery plan is supported by a separate Species Status Assessment, or in some cases, such as with the Mexican wolf, a species Biological Report, which provides background, life-history, and threat assessment information. The biological report for the Mexican wolf is posted on our website https://www.fws.gov/southwest/es/mexicanwolf/. Additionally under RPI, we develop a separate working document called the Recovery Implementation Strategy (implementation strategy). The implementation strategy steps down from the more general description of actions described in the recovery plan to detail the near-term, specific activities needed to implement the recovery plan. The implementation strategy, which is also posted on our website, will be adaptable by incorporating new information as needed without revising the recovery plan, unless we need to change statutory elements.

ACKNOWLEDGEMENTS

A revision of the 1982 Mexican Wolf Recovery Plan has been a long time in coming, and we are grateful to the many people who have contributed their expertise, perspectives, and dedication to the Mexican wolf recovery effort over the last four decades. In particular, we would like to express our gratitude to our interagency and tribal partners and their staff; previous recovery team members and participants in recent recovery planning workshops; colleagues in Mexico; members of the Mexican Wolf Tribal Working Group; Species Survival Plan institutions, facilities, and staff; Service leaders and staff; the local communities in the Mexican wolf recovery area in the United States; and the general public. We have included a more extensive list of Acknowledgments in the Biological Report.

LITERATURE CITATION AND AVAILABILITY

Literature citation should read as follows:

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New Mexico Ecological Services Field Office
2105 Osuna Drive NE
Albuquerque, New Mexico 87113
Telephone #: 505-346-2525 or 1-800-299-0196

U.S. Fish and Wildlife Service
Southwest Regional Office
P.O. Box 1306
Albuquerque, New Mexico 87103-1306
Telephone #: 505-248-6920

Copies are also available online at:
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EXECUTIVE SUMMARY

The Mexican wolf (*Canis lupus baileyi*) has been protected as an endangered subspecies of gray wolf since 1976 under the Endangered Species Act (ESA) of 1973, as amended (80 FR 2488). Following the near extinction of the Mexican wolf due to predator eradication efforts in the mid to late 1800s to mid-1900s, the U.S. Fish and Wildlife Service (Service, we), Mexico, and partner agencies initiated a binational captive breeding program descended from 7 founder wolves and began efforts to re-establish Mexican wolves in the wild in the United States in 1998 and Mexico in 2011.

Our recovery strategy for the Mexican wolf is to establish and maintain a minimum of two resilient, genetically diverse Mexican wolf populations distributed across ecologically and geographically diverse areas in the subspecies' range in the United States and Mexico. The recovery strategy for the Mexican wolf addresses the threats of human-caused mortality, extinction risk associated with small population size, and loss of gene diversity. Moreover, it ensures that Mexican wolf populations can achieve the *resiliency*, *representation*, and *redundancy* needed to downlist and delist the Mexican wolf, as described in the Rationale for Recovery Criteria. At the time of recovery, we expect Mexican wolf populations to be stable or increasing in abundance, well-distributed geographically within their range, and genetically diverse. The recovery strategy's primary components include expanding the geographic distribution of the Mexican wolf, increasing population abundance, improving gene diversity, monitoring wild populations and implementing adaptive management, and collaborating with partners to address social and economic concerns related to Mexican wolf recovery. We developed this binational Mexican wolf recovery strategy in coordination with federal agencies in Mexico and state, federal, and Tribal agencies in the United States.

Our recovery goal is to conserve and protect the Mexican wolf and its habitat so that its long-term survival is secured, populations are capable of enduring threats, and it can be removed from the list of threatened and endangered species. Recovery objectives for the Mexican wolf are:

1. Increase the size of two Mexican wolf populations;
2. Improve gene diversity and maintain the health of Mexican wolves;
3. Ensure adequate habitat availability to support viable Mexican wolf populations;
4. Maintain the Mexican Wolf Species Survival Plan (SSP) captive breeding program to improve the status of wild populations;
5. Promote Mexican wolf conservation through education and outreach programs; and
6. Ensure recovery success.

Downlisting Recovery Criteria

Option 1:

The Mexican wolf will be considered for downlisting when:

a) The United States population average over a 4-year period is greater than or equal to 320 Mexican wolves; and

b) Gene diversity available from the captive population has been incorporated in the United States population through the scheduled releases of wolves surviving to breeding age as identified in delisting criteria.

-or-

Option 2:

The Mexican wolf will be considered for downlisting when a minimum of two populations (one in the United States and one in Mexico) meet abundance and genetic criteria as follows:

a) Each population average over the same 4-year period is greater than or equal to 150 wolves with an annual positive population growth rate; and

b) Gene diversity available from the captive population has been incorporated into both the United States and Mexico populations through the scheduled releases of wolves surviving to breeding age as identified in delisting criteria.

Delisting Recovery Criteria

The Mexican wolf will be considered for delisting when:

1) A minimum of two populations meet all abundance and genetic criteria as follows:

United States

a) The population average over an 8-year period is greater than or equal to 320 wolves (e.g., annual wolf abundance of 200, 240, 288, 344, 412, 380, 355, and 342 averages 320 wolves);
b) The population must exceed 320 wolves each of the last 3 years of the 8- year period;
c) The annual population growth rate averaged over the 8-year period is stable or increasing (e.g., annual averages of 1.2, 1.2, 1.2, 1.2, 1.2, 0.9, 0.9, and 1.0 averages 1.1); and
d) Gene diversity available from the captive population has been incorporated into the United States population through scheduled releases of a sufficient number of wolves to result in 22 released Mexican wolves surviving to breeding age in the United States population. "Surviving to breeding age" means a pup that lives two years to the age of breeding or an adult or subadult that lives for a year following its release. "Scheduled releases" means captive releases and translocations that achieve genetic representation, as described in Rationale for Recovery Criteria.

Mexico

a) The population average over an 8-year period is greater than or equal to 200 wolves;
b) The population must exceed 200 wolves each of the last three years of the 8- year period;
c) The annual population growth rate averaged over the 8-year period is stable or increasing; and
d) Gene diversity available from the captive population has been incorporated into the Mexico population through scheduled releases of a sufficient number of wolves that

results in 37 released Mexican wolves surviving to breeding age in the Mexico population. "Surviving to breeding age" means a pup that lives 2 years to the age of breeding or an adult or subadult that lives for a year following its release. "Scheduled releases" means captive releases and translocations that achieve genetic representation, as described in Rationale for Recovery Criteria.

-and-

2) States and Tribes will ensure regulatory mechanisms are in place to prohibit or regulate human-caused mortality of Mexican wolves in those areas necessary for recovery such that the Service determines at least 320 Mexican wolves are likely to be maintained in the United States in the absence of Federal ESA protections. In addition, Mexico will ensure regulatory mechanisms are in place to protect Mexican wolves from human-caused mortality, such that the Service determines at least 200 Mexican wolves are likely to be maintained in Mexico.

To ensure we are making expeditious progress toward recovery, we will evaluate our progress at 5 and 10 years after implementation of the recovery plan and subsequently adjust our management as needed. In addition, we will conduct 5-year species status reviews required under the Section 4(c)(2) of the ESA.

We developed recovery actions for the Mexican wolf for each objective, which include: surveying and monitoring Mexican wolf populations in the wild; conducting releases (including cross-fostering) and translocations of Mexican wolves; reducing human-caused mortality of Mexican wolves; reducing Mexican wolf-livestock conflicts; developing and implementing plans for releases, cross-fostering, and translocations; monitoring and managing Mexican wolf health and genetic health; maintaining habitat; maintaining and enhancing connectivity within and between Mexican wolf populations; maintaining and improving the status of native prey populations; managing the Mexican wolf captive breeding population; conducting education and outreach; managing the recovery program; coordinating binational recovery efforts; and developing adequate regulations and management and monitoring plans to maintain viable Mexican wolf populations after delisting.

We expect to recover the Mexican wolf within 25-35 years. The total estimated cost of implementing this plan through year 2043, the estimated recovery date of the Mexican wolf, is $178,439,000. The estimated cost to implement the first 5 years of recovery actions (i.e., intermediate steps toward the goal of recovery) is $38,455,000. This cost includes those borne by governmental agencies and nongovernmental organizations in the United States and Mexico.

I. INTRODUCTION AND BACKGROUND

The Mexican wolf, *Canis lupus baileyi*, has been protected as an endangered subspecies of gray wolf since 1976 under the Endangered Species Act (ESA) of 1973, as amended (80 FR 2488). The Mexican wolf is a top predator native to the southwestern United States and Mexico that lives in packs and requires large amounts of forested terrain with adequate ungulate (deer and elk) populations to support the pack. Predator eradication programs in the mid to late 1800s to mid-1900s resulted in the near extinction of the Mexican wolf. Extinction was averted with the initiation of a binational captive breeding population descended from seven Mexican wolf founders.

The United States Fish and Wildlife Service (Service, we) has been engaged in efforts to conserve and ensure the survival of the Mexican wolf for over three decades. Today, Mexican wolves again inhabit portions of the southwestern United States in Arizona and New Mexico, and the northern Sierra Madre Occidental of Chihuahua and Sonora in Mexico. Mexican wolves are present in these areas due to ongoing reintroduction efforts in both countries, supported by the binational captive breeding program. Additional information about the Mexican wolf reintroduction effort is available in the Biological Report for the Mexican Wolf (USFWS 2017a), and the following documents:

- Final Environmental Impact Statement for the Proposed Revision to the Regulations for the Nonessential Experimental Population of the Mexican wolf (*Canis lupus baileyi*) (USFWS 2014).
- Record of Decision (ROD) for the Proposed Revision to the Regulations for the Nonessential Experimental Population of the Mexican wolf (Canis lupus baileyi) (USFWS 2015).
- Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf (80 FR 2512).
- Endangered and Threatened Wildlife and Plants; Endangered Status for the Mexican Wolf (80 FR 2488).

All documents are available on online: https://www.fws.gov/southwest/es/mexicanwolf/documents.cfm.

Recovery Planning

Three other recovery plans have been finalized for the Mexican wolf in the United States and Mexico:

- Mexican Wolf Recovery Plan, 1982 (USFWS 1982),
- Proyecto de Recuperación del Lobo Mexicano (PREP) (SEMARNAP 2000), and
- Programa de Acción para la Conservación de la Especie: Lobo Gris Mexicano (PACE) (CONANP 2009).

The 1982 Mexican Wolf Recovery Plan was written by a recovery team established by the Service and signed by the Service and the Dirección General de la Fauna Silvestre in Mexico. The latter two plans were written under the guidance of the responsible federal agency in Mexico at the time (Secretaría de Medio Ambiente, Recursos Naturales y Pesca [SEMARNAP] and

Comisión Nacional de Áreas Naturales Protegidas [CONANP]), in collaboration with the National Technical Advisory Subcommittee for the Recovery of the Mexican Wolf in Mexico. All three plans acknowledge the binational historical range of the Mexican wolf in the United States and Mexico, but each plan was written within the context of the federal laws governing its content. The 1982 Mexican Wolf Recovery Plan was written pursuant to the Service's obligation to develop recovery plans for species protected by the ESA, whereas the 2000 Proyecto de Recuperación was written pursuant to Mexico's Ley General del Equilibrio Ecológico y la Protección al Ambiente (or General Law for Ecological Balance and Environmental Protection) and the 2009 Programa de Acción was written pursuant to Mexico's Ley General de Vida Silvestre (or General Wildlife Law).

Mexico: Mexico's Proyecto de Recuperación was not required by law to set a numeric goal for recovery. The plan did, however, establish an objective to reach population levels that would ensure long-term viability by reintroducing Mexican wolves into several areas in Mexico (SEMARNAP 2000). The document explained that Mexico supported reintroduction on both sides of the Mexico-United States border and stated that it would be difficult to find appropriate habitat for reintroduction in Mexico. The Proyecto de Recuperación suggested that the best habitat may exist within the Sierra Madre Occidental and the Sierra Madre Oriental mountain ranges (SEMARNAP 2000).

The responsibilities for Mexico's priority species were transferred to CONANP in 2004, and the Programa de Acción was finalized in 2009 with the participation of the former technical advisory subcommittee. (The rule that established the National Technical Advisory Committee for Priority Species was abolished in March 2009, therefore, the subcommittee ceased to exist formally). This action plan established the necessary steps to begin the reintroduction of the Mexican wolf in Mexico, with five strategic goals: define at least six potential sites for Mexican wolf reintroduction; strengthen law enforcement actions to protect habitat within the historical range of the species; involve a variety of sectors of society in the recovery of the species; support the subcommittee's efforts for the reintroduction of the wolf; and create the conditions to allow the strategies of the subcommittee to contribute to the goals of the PACE (CONANP 2009). The action plan is considered to be outdated and in need of revision, but revision of these actions plans are not mandated on a specific schedule.

United States: The Service's 1982 Mexican Wolf Recovery Plan did not contain all three of the recovery plan elements specified in section 4(f)(1) of the ESA. At the time of writing, the recovery team could not foresee full recovery and eventual delisting of the Mexican wolf due to its dire status in the wild and their assessment of a lack of suitable habitat within historical range due to human activities. Therefore, the recovery team stopped short of providing the objective and measurable recovery criteria required by the ESA and instead laid out a "prime objective":

> "To conserve and ensure the survival of *Canis lupus baileyi* by maintaining a captive breeding program and re-establishing a viable, self-sustaining population of at least 100 Mexican wolves in the middle to high elevations of a 5,000-square-mile area within the Mexican wolf's historic range (USFWS 1982:23)."

The recovery actions and time and cost estimates in the 1982 Recovery Plan focused on information gathering and management recommendations in support of this prime objective. The Service initiated revisions of the 1982 Mexican Wolf Recovery Plan in the mid-1990s and early 2000s, but these revisions were not finalized due to many issues, including litigation related to gray wolf reclassifications (USFWS 2010). These efforts to revise the recovery plan focused on varying recovery areas. The 2003 effort focused on the southwestern distinct population segment (DPS) of the gray wolf (68 FR 15803); this DPS extended from Mexico to Interstate 70 in Colorado and Utah. A court vacated the rule that included the southwestern DPS designation, which halted this recovery planning effort (Defenders of Wildlife; et al., v. Secretary, United States Department of the Interior; et al., 354 F.Supp.2d 1156 (D. Or.2005).

We reinitiated recovery planning for the Mexican wolf again in 2010. This recovery planning effort was put on hold in 2013 while the Service focused on listing the Mexican wolf as an endangered subspecies and on developing revised regulations for the management of the experimental population of Mexican wolves within the Mexican Wolf Experimental Population Area (MWEPA). On June 13, 2013, the Service concurrently proposed a rule in the Federal Register to remove the gray wolf (*Canis lupus*) from the Federal List of Threatened and Endangered Species and list the Mexican wolf (*Canis lupus baileyi*) subspecies as endangered and expand recovery efforts in the Southwest (78 FR 35664). On January 16, 2015, the Service finalized a rule listing Mexican wolves as an endangered species, separate from the gray wolf (80 FR 2488) and revised the regulations for the nonessential experimental population of the Mexican wolf under section 10(j) of the ESA to improve the population's ability to contribute to recovery (80 FR 2512).

With the encouragement of the States and based on our collaborative relationship with Mexico, we reinitiated recovery planning in December 2015, focusing south of Interstate 40 in Arizona and New Mexico and into Mexico, which encompasses the historical range of the Mexican wolf (Parsons 1996). The Service convened six recovery planning workshops to review biological information that would inform the development of the recovery plan. The workshops were attended by staff from the states of Arizona, New Mexico, Colorado, and Utah; the U.S. Forest Service; and the Mexican government. In addition, the Service extended invitations to participate in these workshops to the scientists with experience related to wolf research that were on the Science and Planning Subgroup of the 2010 Mexican Wolf Recovery Team and to scientists who were recommended by the states and Mexico. The IUCN Conservation Planning Species Group facilitated the workshops and developed the Vortex Population Viability Analysis model. We also coordinated with Tribes and Pueblos on the development of this recovery plan through the Mexican Wolf Tribal Working Group. This group developed a Tribal Perspectives on Mexican Wolf Recovery report (Mexican Wolf Tribal Working-Group 2017) that can be found online at https://www.fws.gov/southwest/es/mexicanwolf/MWRP.cfm.

In these workshops, participants reviewed the input parameters in the Vortex model, which helped inform the development of recovery criteria regarding the number of wolves, the number and genetic composition of populations, and connectivity needed to achieve recovery. Participants in the workshop modelled the amount of suitable habitat and prey available from the general vicinity of Interstate 40 south into the Sierra Madre Occidental and Sierra Madre Oriental in Mexico to determine where on the landscape Mexican wolf populations could be

established and sustained. Based on these analyses, the Service and Mexico determined that there was sufficient habitat to *allow for* Mexican wolf recovery. However, due to uncertainty in achieving recovery, we included a periodic review process in the recovery plan to determine the effectiveness of Mexican wolf recovery efforts. If we are not achieving the expected level of recovery, we will revisit the recovery strategy and work with States and others to identify other areas with suitable habitat and adequate prey to achieve recovery; change techniques used to address gene diversity; or implement other substantive changes.

2017 Mexican Wolf Recovery Plan, First Revision: The 2017 binational Mexican Wolf Recovery Plan, First Revision replaces and supersedes the Service's 1982 Mexican Wolf Recovery Plan, but it does not replace, supersede, or otherwise affect Mexico's Proyecto de Recuperación and Programa de Acción. The Service recognizes that the objectives of the 1982 Mexican Wolf Recovery Plan were largely to halt extinction and explore whether Mexican wolves could be reestablished in the wild. Together with our partners, we have achieved those objectives. The Mexican Wolf Recovery Plan, First Revision provides a strategy, criteria, and actions to fully recover the Mexican wolf pursuant to the ESA and contains the required recovery plan elements specified by the ESA (section 4(f)(1)):

i. a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species;
ii. objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and
iii. estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

We developed this recovery plan using Mexican wolf monitoring data from the wild and captivity, data from other gray wolf populations when relevant, and other relevant scientific information. We also utilized two recent computer modeling analyses to develop the recovery strategy and criteria in this recovery plan. The first model analyzed population viability (referenced herein as population viability analysis or PVA [Miller 2017]). It used subspecies-specific data (e.g., pairing rates, survival rates, and models for number of detectable pups, and probability of producing a litter), some of which were not available for previous model evaluations (Carroll et al. 2014) to predict how a population will perform over time under different scenarios. The second model analyzed habitat suitability (referred to as habitat suitability analysis [Martínez-Meyer et al. 2017]). It used Geographic Information System data layers to identify variations in habitat quality across the landscape. These data and analyses are provided in our Biological Report for the Mexican Wolf (referenced herein as the Biological Report [USFWS 2017a]). We will update the Biological Report as needed to maintain a compendium of the available scientific information upon which to base collaborative recovery efforts for the Mexican wolf (see Disclaimer for additional explanation of the Service's new Recovery Planning and Implementation process).

Recovery Implementation in the United States and Mexico

Recovery efforts for the Mexican wolf have been underway in the United States and Mexico for several decades. Working together, both countries are focused on maintaining the binational

captive population of Mexican wolves and on re-establishing wild populations by releasing captive wolves into reintroduction areas and subsequently promoting natural growth of the populations.

Captive Breeding Program: The Mexican wolf captive breeding program was established in 1977 to 1980 with three effective founder wolves captured from the wild in Mexico. These founding wolves and their offspring were initially referred to as the Certified lineage, later renamed the McBride lineage (Parsons 1996). The captive breeding program has been managed pursuant to breeding protocols and genetic and demographic goals established by the Association of Zoos and Aquariums' Species Survival Plan since 1994 (Hedrick et al. 1997). Two additional lineages of Mexican wolves, the Ghost Ranch lineage, founded by two unrelated wolves, and the Aragon line, founded by two unrelated wolves, were maintained in captivity since the 1960s and 1970s, but were managed apart from the McBride lineage because of uncertainties about their origins. Through genetic analysis, the Ghost Ranch and Aragon lineages were confirmed to be pure Mexican wolves, and in 1995 they were integrated into the captive breeding program due to the limited genetic diversity of the captive population and the potential for inbreeding depression to hinder its success (Parsons 1996, Hedrick et al. 1997). The combination of the three lineages increased the founding base of the captive population from three to seven pure Mexican wolves (Hedrick et al. 1997).

Today, the binational captive breeding program continues to play a vital role in the conservation of the Mexican wolf by providing healthy wolves for release to the wild. However, the small number of founders of the captive population and the resultant low gene diversity available have been a concern since the beginning of the recovery program (Hedrick et al. 1997) and remain a concern today (Siminski and Spevak 2017, and see USFWS 2017a). Long-term viability or adaptive potential depends on the store of genetic variability. It is desirable to retain as much genetic variability as possible, and it is uncertain when loss of genetic variability might manifest in compromised reproductive function or physical and physiological abnormality (Soulé et al. 1986). As of July 2017, the binational captive program houses 281 wolves in 55 institutions, and has retained approximately 83% of the gene diversity of the founders, which is lower than the recommended retention of 90% for most captive breeding programs (Siminski and Spevak 2017, Soulé et al. 1986). It is expected that even with optimal management, the gene diversity in the captive population will continue to decline over time as wolves die or reach reproductive senescence. In its current condition, the population would be expected to retain 75% gene diversity over 67 years and 73% in 100 years (Siminski and Spevak 2017). The gene diversity of the captive population is higher than either wild population in the United States or Mexico. This is expected, as the wild populations are established utilizing animals that are genetically well represented within the captive population (Siminski and Spevak 2017) and because we are able to manage which wolves are paired each year for breeding in captivity, but it is more difficult to do so in the wild.

The United States and Mexico have each undertaken efforts to establish the Mexican wolf in the wild by releasing captive-bred wolves into areas of suitable habitat in each country. The United States and Mexico communicate their reintroduction plans with one another, share equipment, and transfer information and technology through staff visits to each country. Implementation of

reintroductions occurs according to the legal frameworks and management provisions for each country.

United States Reintroductions: We began releasing Mexican wolves back into the wild in Arizona and New Mexico in 1998 in the MWEPA (USFWS 1998, 63 FR 1752). We revised this experimental population area in 2015 (Figure 1; 80 FR 2512). We, with our interagency partners, continue to manage Mexican wolves in this area pursuant to regulations under section 10(j) of the ESA that provide management flexibility and aid in the conservation and recovery of the Mexican wolf.

Figure 1. Mexican Wolf Experimental Population Area in Arizona and New Mexico, United States (80 FR 2512, January 16, 2015).

The Mexican wolf population in the United States has exhibited robust growth since 2009 (Figure 2). As of December 31, 2016, a population of at least 113 wild Mexican wolves inhabits the United States, the largest population size reached to date (USFWS 2017b). In 2016, all Mexican wolves in the United States were wild-born, with the exception of surviving cross-fostered pups from captivity (at least two surviving pups have been documented as of November 2017), demonstrating that population growth is driven by natural reproduction rather than the release of wolves from captivity. We conducted fourteen releases of wolves from captivity, including 10 cross-fostered pups, between 2009 and 2017, during which time the population

grew from a minimum population count of 42 to 113 wolves. We have documented wild-born wolves breeding and raising pups in the wild for 16 consecutive years.

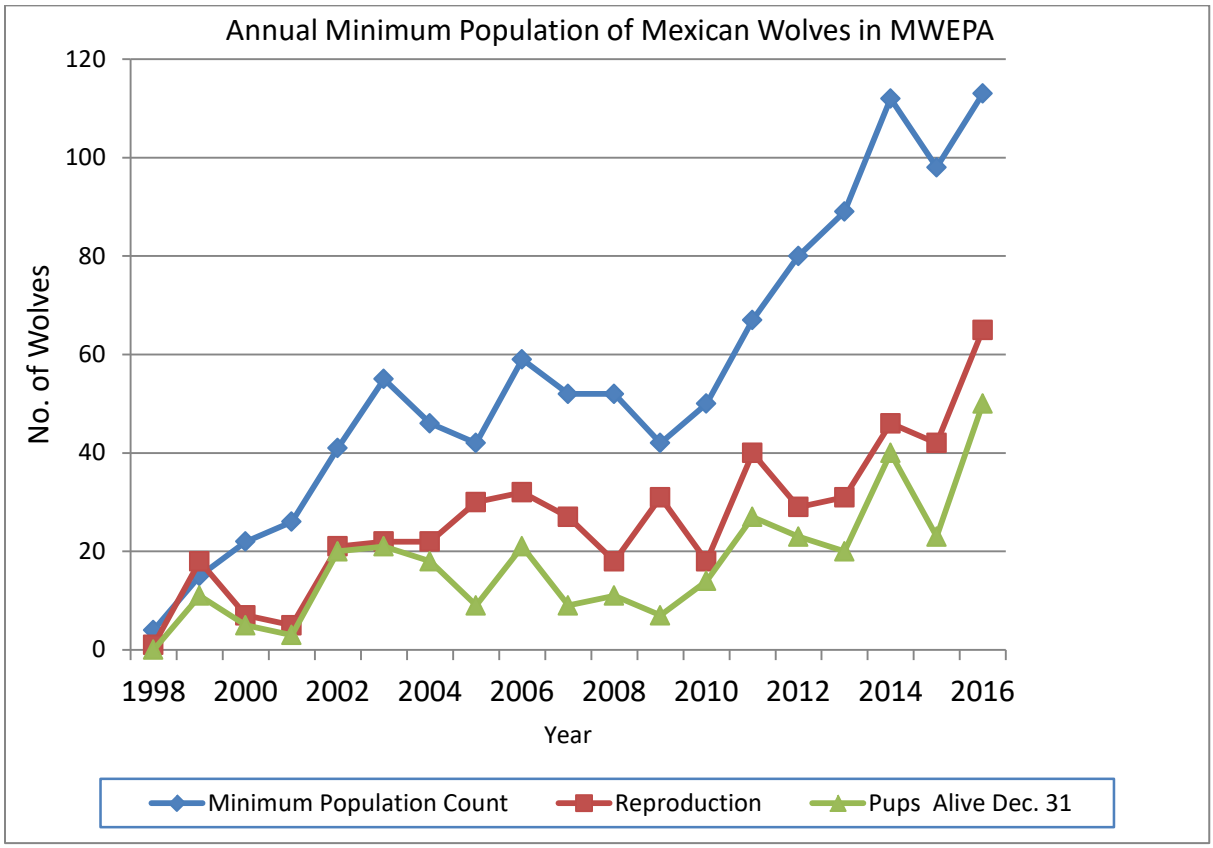

Figure 2. Annual Minimum Population Count of Mexican Wolves in the MWEPA, 1998-2016 (U.S. Fish and Wildlife Service files).

Although the population has been increasing since 2009, we consider Mexican wolves in the United States to be too closely related to one another (referred to as high mean kinship) to ensure the population will be robust over time. Mean kinship for the United States population is 0.2452 (Siminski and Spevak 2017). The high relatedness of wolves to one another and ongoing loss of gene diversity increases concerns over the potential for inbreeding depression to have negative impacts on future population growth in the United States (USFWS 2017a). Due to these concerns, the recovery plan focuses on inserting gene diversity into the United States population through the release of wolves from the captive population. Additionally, genetic diversity is required for populations to adapt to environmental change. We have documented that inbreeding depression is impacting the probability of a breeding pair producing a litter, but not to a degree that is hindering annual population growth in the United States population (USFWS 2017a, Miller 2017). Additional information about the status and trend of the United States population is available in our annual reports (online at https://www.fws.gov/southwest/es/mexicanwolf/documents.cfm) and the Biological Report for the Mexican Wolf, the latter of which also includes a more detailed discussion of the genetic condition of the United States population (USFWS 2017a, Miller 2017).

Mexico Reintroductions: Mexico began reintroducing Mexican wolves to the wild in 2011 and, as of 2017, is still in the establishment phase of their reintroduction effort. Forty-one wolves have been released in the first 5 years of the reintroduction, including both releases from captivity and Mexican wolves translocated from the wild population in the United States to Mexico. As of July 2017, approximately 31 wild Mexican wolves inhabit Chihuahua and Sonora, Mexico, in the northern Sierra Madre Occidental (CONANP 2017, Garcia Chavez et al. 2017). Mexico is continuing to release captive or translocated Mexican wolves to help increase abundance until such time as natural reproduction is sufficient to sustain the population. One wild pair in Mexico has reproduced in three of its four years in the wild (USFWS 2017a), and their pups are successfully establishing wild packs with other released animals.

The focal areas for Mexican wolf recovery in the United States and northern Sierra Madre Occidental are approximately 260 miles (mi) (418 kilometers [km]) from each other (when measured from the center of one area to the other), a distance within the natural dispersal capabilities of the Mexican wolf. However, the distance between nearest high-quality habitat patches in both areas is approximately 96 mi (155 km). The proximity of these areas is such that Mexican wolves have the potential to move between populations depending on survival and how they are managed during dispersal events. Since reintroductions began, two Mexican wolves are known to have crossed the border from Mexico into the United States (USFWS, our files). Neither Mexican wolf became established in the United States: one returned to Mexico and one was captured and placed in captivity.

II. THREATS TO THE MEXICAN WOLF

We assess "threats" to a species during our determination of whether a species is threatened or endangered due to any of the five factors in the ESA:

A) the present or threatened destruction, modification, or curtailment of its habitat or range;
B) overutilization for commercial, recreational, scientific, or educational purposes;
C) disease or predation;
D) the inadequacy of existing regulatory mechanisms; and
E) other natural or manmade factors affecting its survival.

In our listing of the Mexican wolf as an endangered species, we conducted a detailed five-factor analysis of threats and determined that the Mexican wolf was in danger of extinction due to illegal shooting, genetic issues (inbreeding, loss of heterozygosity, and loss of adaptive potential), and small population size (80 FR 2488). In the Biological Report (USFWS 2017a), we provide an in-depth description of four "stressors" -- conditions that may influence the current and ongoing recovery potential of the Mexican wolf: 1) adequate habitat availability/suitability; 2) excessive human-caused mortality; 3) demographic stochasticity associated with small population size; and 4) continuing or accelerated loss of genetic diversity in the captive or wild populations. Stressors and threats are highly related concepts, but may not be one and the same for a species. For example, for the Mexican wolf, habitat destruction, modification, or curtailment (Factor A) is not threatening or endangering the Mexican wolf, yet ensuring adequate habitat is available to support recovered Mexican wolf population into the future is central to the recovery effort for the Mexican wolf (e.g., a potential stressor).

Within the context of the recovery plan, we consider the threats to the Mexican wolf to be excessive human-caused mortality (which includes shooting and other sources), demographic stochasticity associated with small population size, and loss of gene diversity. We provide discussion of each of these threats and the stressors noted above in the Biological Report (USFWS 2017a). We further address these threats in our Rationale for Recovery Criteria, and identify recovery actions to alleviate each threat.

III. RECOVERY STRATEGY

For any species, there may be several strategies that provide a valid path to recovery. This is the case for the Mexican wolf – different combinations of the location, number of populations, and number of wolves could alleviate the threats of human-caused mortality, lack of gene diversity, and extinction risk due to small population size. Our recovery strategy, which is based on the current status of the Mexican wolf in the wild and the threats it faces, is to establish and maintain a minimum of two resilient, genetically diverse Mexican wolf populations distributed across ecologically and geographically diverse areas in the subspecies' range in the United States and Mexico. Our recovery strategy addresses the threats of human-caused mortality, extinction risk associated with small population size, and loss of gene diversity (USFWS 2017a, Miller 2017). Moreover, it ensures that Mexican wolf populations can achieve the *resiliency*, *representation*, and *redundancy* needed to downlist and delist the Mexican wolf, as described in the Rationale for Recovery Criteria. At the time of recovery, we expect viable Mexican wolf populations that are stable or increasing in abundance, well-distributed geographically within their range, and genetically diverse.

We developed this binational recovery strategy for the Mexican wolf in coordination with federal agencies in Mexico and state, federal, and Tribal agencies in the United States. Management of listed species in areas outside of the United States is primarily the responsibility of the countries in which the species occur. However, partners in the United States and Mexico will cooperate to conserve and recover the Mexican wolf throughout its range.

The concepts of resiliency, redundancy, and representation are:

> *Resiliency* describes the ability of populations to withstand stochastic events. Measured by the size and growth rate of each population, resiliency is important because it gauges the probability that the populations comprising a species are able to withstand or bounce back from environmental or demographic stochastic events.
>
> *Redundancy* describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution (and connectivity), redundancy is important because it gauges the probability that the species has a margin of safety to withstand or can bounce back from catastrophic events.
>
> *Representation* describes the ability of a species to adapt to changing environmental conditions. Measured by the breadth of genetic or environmental diversity within and among populations, representation is important because it gauges the probability that a species is capable of adapting to environmental changes.

The primary components of our recovery strategy include expanding the geographic distribution of the Mexican wolf, increasing population abundance, improving gene diversity in the wild, monitoring wild populations and implementing adaptive management, and collaborating with partners to address social and economic concerns related to Mexican wolf recovery.

Geographic Distribution

In the United States, we are focusing implementation of the recovery strategy for the Mexican wolf in the area south of Interstate 40 in Arizona and New Mexico. In Mexico, federal agencies are focusing Mexican wolf recovery efforts in the northern Sierra Madre Occidental in Chihuahua and Sonora (Figure 3).

Our strategy is to establish two populations over a large geographical area of the Mexican wolf's range to address the conservation principles of redundancy and representation (both ecological and geographical), as discussed in the Rationale for Recovery Criteria. We are focusing recovery implementation in the United States in the area south of Interstate 40, consistent with the range described by Parsons (1996), which the Service previously adopted when we began reintroducing wolves in 1998 (63 FR 1752). In Mexico, federal agencies are currently focusing Mexican wolf recovery efforts in the northern Sierra Madre Occidental (Figure 3). Recent habitat and population viability modeling (Martínez-Meyer et al. 2017, Miller 2017) support our geographic focus because they predict that each of these areas in the United States and Mexico can support a viable Mexican wolf population.

United States: Recovery in the United States will continue to focus on one large population of Mexican wolves south of Interstate 40 in Arizona and New Mexico. This area contains a large expanse of contiguous high-quality habitat along the Mogollon Rim in central Arizona into west central New Mexico, as well as other patches of high- and low-quality habitat (USFWS 2014; Martínez-Meyer et al. 2017). Management of Mexican wolves in this area is governed by the regulations for the nonessential experimental population of the Mexican wolf (80 FR 2512).

Mexico: In Mexico, there are two large blocks of high-quality habitat in the Sierra Madre Occidental that are connected by areas of lower quality habitat and small interstitial patches of high-quality habitat (Martínez-Meyer et al. 2017); we refer to these two areas as the northern Sierra Madre Occidental and southern Sierra Madre Occidental (Figure 3). Based on recent habitat modeling, we expect that either of these areas will be able to support a population of Mexican wolves (Martínez-Meyer et al. 2017). Current reintroduction efforts are focused in the northern Sierra Madre Occidental due to logistical considerations (e.g., monitoring wolves in a single area rather than spreading resources between the northern and southern areas), and therefore the recovery strategy in Mexico focuses on this area. However, if Mexican wolves disperse to southern Sierra Madre Occidental or federal agencies in Mexico decide to release Mexican wolves into this area as part of their reintroduction effort, the recovery strategy can be adapted to include wolves in either or both areas (Miller 2017). We have not identified large enough blocks of high-quality habitat in the Sierra Madre Oriental region to support a population of sufficient size to contribute to complete recovery under the ESA (Martínez-Meyer et al. 2017), although this does not preclude Mexico from pursuing reintroduction in this area pursuant to their laws and regulations.

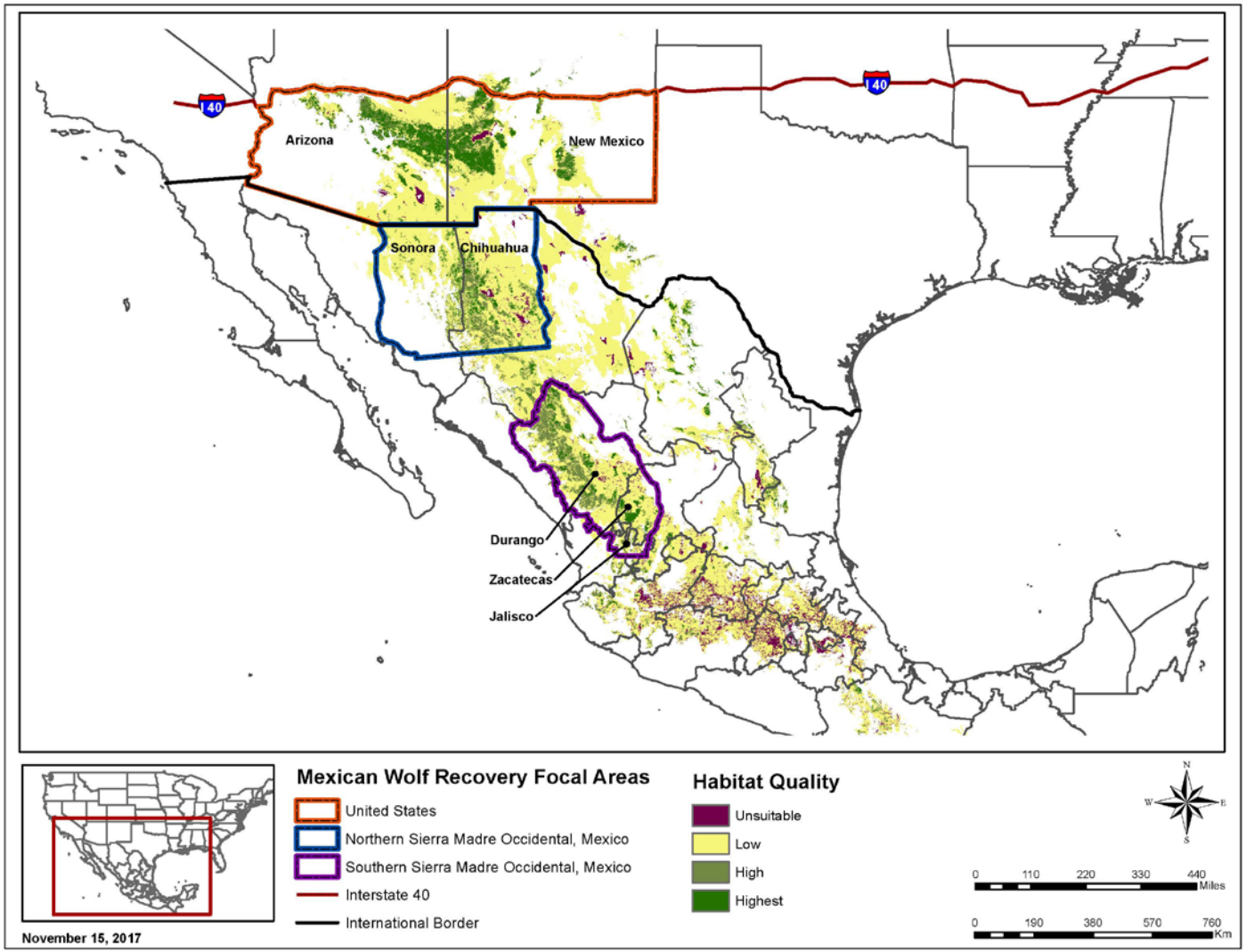

Figure 3. Focal areas for Mexican wolf recovery in the United States and Mexico. (Habitat quality from Martínez-Meyer et al. 2017, titled "Figure 22. Rescaled intermediate habitat suitability scenario for the Mexican wolf based on the combination of climatic suitability, land cover use, human population density, road density, and UBI.")

Population Abundance
We will increase the abundance of Mexican wolf populations in the United States and Mexico from their current size to an abundance that confers a low probability of extinction.

As population abundance increases, the threat of demographic stochasticity decreases and population resiliency increases (Goodman 1987; Pimm et al. 1988; and see discussion in USFWS 2017a; 80 FR 2488; and, USFWS 2010). Currently, both the United States and Mexico populations are at risk of extinction due to their small population size (USFWS 2017a, including Miller 2017). Therefore, both populations will need to increase in abundance sufficient to ameliorate this risk. We consider a population that has at least a 90% probability of persistence over 100 years to contribute to achieving recovery criteria, as described in our Rationale for Recovery Criteria. In the United States, population growth will likely continue to be driven primarily by natural reproduction. In the smaller Mexican wolf population in Mexico, population growth can be stimulated by the continued release of a substantial number of Mexican wolves from captivity to the wild, translocations, and population growth from natural reproduction increasing over time as more wolves become established in the wild.

Our strategy to establish populations of sufficient size to reduce extinction risk addresses the conservation principle of *resiliency*, as discussed further in the Rationale for Recovery Criteria.

Genetic Management
To improve gene diversity of Mexican wolf populations in the wild, we will release and translocate Mexican wolves, as needed.

As of June 2017, the captive population has higher gene diversity than either of the wild populations, and both wild populations are at risk of future genetic issues unless gene diversity can be improved (USFWS 2017a). The release of Mexican wolves from captivity to the wild can result in a substantial amount of the gene diversity available in captivity being represented in the wild. In this Plan, we aim to ensure wild populations represent approximately 90% of the gene diversity retained by the captive population to provide for *representation*. Release strategies from captivity may include the release of individual or paired adult wolves, a pack of wolves, or cross-fostering of pups. (Cross-fostering has been successful in other carnivores, but is a relatively new technique for Mexican wolves. Using this technique, we place captive-born pups into wild dens to be raised with the wild litter. We use this technique to improve the gene diversity of the wild population). Each of these release strategies has benefits and challenges that can be considered, in addition to new strategies that may arise in the future, within the opportunities and limitations of the release event and progress toward recovery. Translocation of wolves between wild populations can also be a source of gene diversity to the recipient population and will be considered as a way to improve the gene diversity of wild populations.

In order to achieve the genetic criteria for downlisting and delisting the Mexican wolf in this Plan, decisions regarding the timing, location and circumstances of Mexican wolf releases will be based on input from the Interagency Field Team, and will be made cooperatively by the Service with the Arizona Game and Fish Department with respect to releases in Arizona, and by the Service with the New Mexico Department of Game and Fish with respect to releases in New Mexico. Additionally, prior to any releases occurring, the Service will comply with state permit

requirements pursuant to (i) 43 C.F.R. pt. 24 and (ii) conditions imposed by any permit issued under section 10(a)(1)(A) of the Endangered Species Act, 16 U.S.C. 1539(a)(1)(A).

Released wolves (including both releases from captivity and translocated wolves) contribute their gene diversity to the recipient population when they breed and produce offspring. We will focus on the number of released wolves that survive to breeding age as our method of tracking progress toward achieving the gene diversity criterion, in concordance with Miller (2017). We estimate that an adult female of breeding age has a 78% likelihood of pairing with a male, and, once paired, has approximately a 68% likelihood of producing a litter, as a function of age and inbreeding (Miller 2017). Currently, many released wolves die within the first year of release, and released Mexican wolves in both wild populations have lower survival during that time than Mexican wolves born in the wild that are not associated with a release event (see Miller 2017 for data on release survival). The low survival of released wolves results in the need to release enough wolves that a sufficient number survive to breeding age. Management to improve the survival of released wolves will decrease the number of releases needed to achieve recovery criteria.

Our strategy to address the conservation principle of (genetic) representation, as discussed further in the Rationale for Recovery Criteria, is to release wolves from captivity to the wild and translocate wolves between populations to ensure wild populations benefit from the gene diversity available in the captive population. Population viability analysis by Miller (2017) has identified several combinations of releases and translocations that will achieve genetic *representation*, and we expect that other combinations are also possible.

The gene diversity of wild Mexican wolf populations can also be influenced through the dispersal of wolves from one wild population to another. We expect the patchy habitat in the border region of Mexico and the United States, as modeled by Martínez-Meyer et al. (2017), has the potential to support a low level of Mexican wolf dispersal between high-quality habitat patches in the United States and the northern Sierra Madre Occidental (about one wolf every 12-16 years; Miller 2017). As of 2017, the international border between the United States and Mexico has segments with no fence and with vehicle fence, both of which are permeable to wolves, as well as segments with pedestrian fence, which is not permeable to wolves (USFWS 2017a). Habitat quality between the northern and southern Sierra Madre Occidental sites in Mexico has the potential to support a higher degree of dispersal compared with the potential between the United States and northern Sierra Madre Occidental site, but it is still predicted to be low (about one wolf every 3-4 years; Miller 2017). While we anticipate habitat between any of the populations can support dispersing wolves and provide some connectivity, we do not expect the level of dispersal predicted between any of the sites (particularly between the United States and northern Sierra Madre Occidental) to provide for adequate gene flow between populations to alleviate genetic threats or ensure *representation* of the captive population's gene diversity in both populations. Therefore, we consider genetic management such as releases from captivity (including cross-fostering pups) and translocations to serve as an effective tool during the recovery process to achieve appropriate *representation* (Miller 2017). Thus, releases and translocations are a form of management that is necessary during portions of the recovery process. We do not expect regular releases from the captive population to be necessary after Mexican wolves have been recovered because a high proportion of the gene diversity from

captivity will have been incorporated into the wild populations and wild populations will be sufficiently abundant such that releases from captivity for population augmentation will not be necessary (Miller 2017). While releases and translocations are necessary for portions of the recovery process, we recognize the benefits of habitat connectivity and will work to maintain and enhance connectivity within and between Mexican wolf populations to improve gene diversity of Mexican wolves. We note, however, that connectivity or successful migrants are not required to achieve recovery (see addendum in Miller 2017).

Monitoring and Adaptive Management
We will conduct ongoing annual monitoring to track Mexican wolf population performance, and we will adjust management techniques and approaches as needed in response to population performance.

Our monitoring will continue to focus on annual population growth, recognizing the relationship between recruitment and mortality (i.e., high recruitment may offset high mortality rates). Wolf mortality, combined with removal of wolves for management purposes (which functions as mortality to the population), will need to stay below threshold levels such that populations can achieve abundance targets. The majority of documented mortalities in the United States are human-caused (USFWS 2017a); therefore, reducing mortalities from human-caused sources such as shooting and vehicle collision may provide our best opportunity to improve population performance and speed the time to recovery. Similarly, management removal of Mexican wolves in response to depredation incidents and conflict with humans has been the biggest source of removal and can impact population performance. Between 2003 and 2009, we observed the negative impact that a high number of removals can have on population performance in the United States, and in response, we reduced our removal rate by focusing on working with landowners and permittees to implement proactive management techniques such as range riders, fladry, non-lethal ammunitions, and diversionary feeding to decrease the likelihood of depredation incidents. Diversionary food caches are road-killed native prey carcasses or carnivore logs (commercially manufactured raw horse meat-based diet especially formulated for carnivores) provided to denning wolves to reduce potential conflicts with livestock in the area.

In the United States, our recovery strategy will entail adaptively managing our removal rate of Mexican wolves in response to documented mortality during the previous year to ensure that mortality is not hindering population growth over multiple years. Therefore, we will employ management actions to work to reduce wolf-livestock and wolf-human conflict through the implementation of pro-active measures to avoid and minimize depredation; facilitate the provision of compensation for the economic impact of wolves on rural ranching communities; and employ a phased management approach in Arizona to minimize or avoid possible adverse impacts to wild ungulate populations (specifically elk). We will also allow take of Mexican wolves under specific circumstances, and continue to work collaboratively with state and local governments, tribes, livestock producers, state game and fish departments, and stakeholder organizations to achieve the social tolerance for wolves in rural communities necessary to achieve Mexican wolf recovery. We expect that Mexico will conduct similar monitoring of Mexican wolves to track population performance and adapt management strategies as needed.

Monitoring of wild Mexican wolf populations will help us annually track our progress in achieving the *resiliency*, *representation*, and *redundancy* necessary for recovery. In addition, we have provided evaluation periods at 5 and 10 years after we begin implementing the recovery plan to evaluate whether the recovery strategy is effective and progress toward recovery is occurring as predicted.

Collaborative Recovery Implementation

We will continue to work with partners to identify and implement effective recovery actions necessary to recover the Mexican wolf and address conflicts related to Mexican wolf recovery in local communities.

The recovery of the Mexican wolf has been a collaborative effort since its earliest days. Effective recovery requires participation by multiple parties within Federal, state, and local governments; nongovernmental organizations; academia; and local communities. We have strong partnerships with the Species Survival Plan captive breeding facilities in the United States and Mexico. We also collaborate with Federal, state, county, and Tribal agencies through a Memorandum of Understanding and the establishment of the Mexican Wolf Interagency Field Team, which conducts the reintroduction, management, and monitoring of Mexican wolves in the United States. We intend to maintain and strengthen the interagency partnerships currently in place for the United States population.

Section 6 (a) of the ESA directs the Service to cooperate to the maximum extent practicable with the states (59 FR 34275), and Secretarial Orders 3175 and 3206 and the Service's Native American Policy (2016) require consultation with tribes in the recovery of listed species. Opportunities for increasing levels of state and tribal management are currently available under the 10(j) rule and will continue to be explored as recovery progresses. When the status of the Mexican wolf has improved sufficiently to downlist it to threatened, we may consider establishing a 4(d) rule under the ESA. The Service uses 4(d) rules to incentivize positive conservation actions and streamline the regulatory process for minor impacts. As part of those goals, the rule is often used to clarify or simplify what forms of take of a threatened species are/are not prohibited wherever the animals may occur. Establishment of a 4(d) rule after the status of the Mexican wolf has improved to "threatened" would provide the state wildlife agencies increased management flexibility. The Service would first publish a proposed rule in the Federal Register and seek public comment and peer review before making a decision on the action.

Addressing wolf-livestock conflicts is one of the most important areas for collaborative management of Mexican wolves. Depredation compensation is currently available through:

- the Farm Bill Livestock Indemnity Program, which is administered by the Farm Services Agency (see https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/livestock-indemnity/index);
- the Arizona Livestock Loss Board (see https://www.azgfd.com/Agency/LivestockBoard/; and
- the Mexican Wolf/Livestock Council (see http://www.coexistencecouncil.org/).

The Mexican Wolf/Livestock Council is an 11-member group of livestock producers, Tribes, county representatives, and environmental groups appointed by the Service. The Service will continue seeking additional funding for these programs to offset Mexican wolves' direct and indirect costs to livestock producers.

Due to the binational range of the Mexican wolf, successful recovery of the species requires close coordination and cooperation with recovery partners in Mexico. The Service has a strong working relationship with the Mexican governmental agencies CONANP and Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT), as well as field staff working to reestablish the Mexican wolf in the wild in Mexico. Section 8 (b) of the ESA encourages foreign countries to provide for the conservation of threatened and endangered species, and the Service to enter into agreements with foreign countries to provide for such conservation. Our relationship with the Mexican government is formalized through a 1996 Memorandum of Understanding establishing the Canada/Mexico/United States Trilateral Committee for Wildlife and Ecosystem Conservation and Management. The Service and our state partners will continue to seek funding to assist Mexico in implementing actions necessary to achieve Mexican wolf recovery. In addition, the Service and our partners will continue to exchange technology and expertise with Mexico to implement recovery actions.

IV. RECOVERY GOAL, OBJECTIVES, AND CRITERIA

Recovery Goal:
The recovery goal is to conserve and protect the Mexican wolf and its habitat so that its long-term survival is secured, populations are capable of enduring threats, and it can be removed from the list of threatened and endangered species.

Recovery Objectives:
Recovery objectives identify outcomes that will lead to achieving the goal of recovery and delisting. Recovery objectives for the Mexican wolf are:

1. Increase the size of two Mexican wolf populations;
2. Improve gene diversity and maintain the health of Mexican wolves;
3. Ensure adequate habitat availability to support viable Mexican wolf populations;
4. Maintain the Mexican Wolf Species Survival Plan (SSP) captive breeding program to improve the status of wild populations;
5. Promote Mexican wolf conservation through education and outreach programs; and
6. Ensure recovery success.

Recovery Criteria:
Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the ESA are no longer necessary and the Mexican wolf may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from Endangered to Threatened. The term "endangered species" means any species (species, sub-species, or DPS) which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a signification portion of its range.

All classification decisions consider the following five factors: 1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; 2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; 3) is disease or predation a factor; 4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by the states and other organizations to protect the species or habitat; and 5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment and peer review. Our final decision is announced in the *Federal Register*.

We provide both downlisting and delisting criteria for the Mexican wolf as follows:

Downlisting Recovery Criteria

Option 1:

The Mexican wolf will be considered for downlisting when:

a) The United States population average over a 4-year period is greater than or equal to 320 Mexican wolves; and
b) Gene diversity available from the captive population has been incorporated in the United States population through the scheduled releases of wolves surviving to breeding age as identified in delisting criteria.

-or-

Option 2:

The Mexican wolf will be considered for downlisting when a minimum of two populations (one in the United States and one in Mexico) meet abundance and genetic criteria as follows:

a) Each population average over the same 4-year period is greater than or equal to 150 wolves with an annual positive population growth rate; and
b) Gene diversity available from the captive population has been incorporated into both the United States and Mexico populations through the scheduled releases of wolves surviving to breeding age as identified in delisting criteria.

Delisting Recovery Criteria

The Mexican wolf will be considered for delisting when:

1. A minimum of two populations meet all abundance and genetic criteria as follows:

United States

a) The population average over an 8-year period is greater than or equal to 320 wolves (e.g., annual wolf abundance of 200, 240, 288, 344, 412, 380, 355, and 342 averages 320 wolves);
b) The population must exceed 320 wolves each of the last 3 years of the 8-year period;
c) The annual population growth rate averaged over the 8-year period is stable or increasing (e.g., annual averages of 1.2, 1.2, 1.2, 1.2, 1.2, 0.9, 0.9, and 1.0 averages 1.1); and
d) Gene diversity available from the captive population has been incorporated into the United States population through scheduled releases of a sufficient number of wolves to result in 22 released Mexican wolves surviving to breeding age in the United States population. "Surviving to breeding age" means a pup that lives 2 years to the age of breeding or an adult or subadult that lives for a year following its release. "Scheduled releases" means captive releases and translocations that achieve genetic representation, as described in Rationale for Recovery Criteria.

Mexico

a) The population average over an 8-year period is greater than or equal to 200 wolves;
b) The population must exceed 200 wolves each of the last 3 years of the 8-year period;

c) The annual population growth rate averaged over the 8-year period is stable or increasing; and

d) Gene diversity available from the captive population has been incorporated into the Mexico population through scheduled releases of a sufficient number of wolves that results in 37 released Mexican wolves surviving to breeding age in the Mexico population. "Surviving to breeding age" means a pup that lives 2 years to the age of breeding or an adult or subadult that lives for a year following its release. "Scheduled releases" means captive releases and translocations that achieve genetic representation, as described in Rationale for Recovery Criteria.

-and-

2. States and Tribes will ensure regulatory mechanisms are in place to prohibit or regulate human-caused mortality of Mexican wolves in those areas necessary for recovery such that the Service determines at least 320 Mexican wolves are likely to be maintained in the United States in the absence of Federal ESA protections. In addition, Mexico will ensure regulatory mechanisms are in place to protect Mexican wolves from human-caused mortality, such that the Service determines at least 200 Mexican wolves are likely to be maintained in Mexico.

Rationale for Recovery Criteria

Resiliency

The abundance criteria ensure that populations are *resilient* and the threats of demographic stochasticity and human-caused mortality have been ameliorated. We consider a *resilient* population to be one that is able to maintain at least a 90% likelihood of persistence over a 100-year period. This benchmark falls within the community of practice of recent recovery plans assessed by Doak et al. (2015). In addition, we consider a population to be *resilient* when it has an average annual growth rate that is stable or increasing (i.e., lambda ≥ 1) over the 8-year timeframe and is above its abundance criterion in years 6, 7, and 8. At this level of *resiliency*, the threat of demographic stochasticity has been ameliorated because the population is secure from random population fluctuations, and mortality rates are sufficiently low to allow for stable, long-term persistence of the populations (USFWS 2017a).

Based on population viability modeling, we predict the United States and Mexico populations will achieve *resiliency* when an average population of 320 and 200 Mexican wolves, respectively, can be maintained for 8 years (Miller 2017). Establishing a criterion for an average abundance means that in some years the populations may exceed abundance targets (320 and 200, respectively for the United States and Mexico populations), while in some years they may fall below their target; this is consistent with the annual population fluctuations predicted by population viability modeling results (Miller 2017). Years in which the population grows above 320 are expected and will enable progress toward the abundance criterion for the United States population more quickly than when the population hovers at or near 320.

Mortality rates will need to be sufficiently low to achieve recovery criteria because they are a primary indicator of wolf population trajectory (Fuller et al. 2003). Previous gray wolf studies have primarily pooled mortality rates across age classes for pups older than approximately 6 months, yearlings, and adults (Fuller et al. 2003, Adams et al. 2008). Miller's (2017) results

were based on estimated mortality rates for Mexican wolves in each of the three age classes. Thus, Miller (2017) results are not necessarily directly comparable to other studies. Miller (2017) scenarios with mean adult mortality rates less than 25%, combined with mean sub-adult mortality rates less than 33% and mean pup mortality (for radio-marked pups greater than 4 months old) less than 13% resulted in an increasing population that meet the population abundance recovery criteria, under certain management regimes. In agreement with the results of Carroll et al. (2014), population performance in Miller's results was highly sensitive to relatively small changes in adult mortality rate. Miller's results are consistent with meta-analyses that suggest a wolf population should stabilize with an overall average mortality rate of 34% (Fuller et al. 2003). Miller's results indicate the populations need to perform at mortality rates lower than Fuller et al. (2003) because: (1) the Mexican wolf population needs to exhibit growth (rather than stability) to achieve recovery, (2) the results are based on specific characteristics of the Mexican wolf population rather than wolves in general, and (3) other studies of wolf population growth are significantly influenced by immigration and emigration (Adams et al. 2008), and we do not predict significant natural rates of immigration or emigration between the Mexican wolf populations (Miller 2017). Miller's results are also consistent with growing wolf populations in central Idaho and the Greater Yellowstone area (Smith et al. 2010). The mean mortality rate utilized for Miller's results incorporates human-caused mortality and demonstrates that Mexican wolf populations will still be stable or increasing.

We consider an acceptable mortality rate during the recovery process to be one where the population grows toward or is maintained at the desired population abundance. Thus, the average mortality rates could change over time based on management goals and additional data. We expect to adaptively manage the population to reduce or increase removals based on documented mortality from other causes during the previous year to ensure that the mean mortality rate over several years does not exceed those identified by Miller (2017).

Miller (2017) suggests there is a functional relationship between the inclusion of diversionary feeding and the number of pups produced in that population. Therefore, removal of diversionary feeding can lead to a decrease in the population growth rate for a given level of annual adult mortality. Miller (2017) evaluated the impact of removing diversionary feeding for both the United States and Mexico populations in a select set of PVA scenarios. The results of these analyses indicate that reducing adult mortality is necessary when diversionary feeding is significantly reduced or eliminated (see Addendum in Miller 2017). However, we expect to continue a low level of diversionary feeding to reduce conflicts between livestock and wolf packs rearing pups.

To ensure populations have a high likelihood of maintaining *resiliency*, they must meet the average population abundance targets for 8 consecutive years. Eight years provides an appropriate amount of time to observe the populations' demographic performance for several reasons. First, an 8- year window is equivalent to approximately two wolf generations, grounding the criteria in a biologically relevant timeframe. Observing the population for longer than a single generation will provide assurance that population metrics such as reproduction and mortality rates are fluctuating within expected levels at the target abundance and that populations are performing such that recovered status is likely to be maintained after delisting. Specifically, it allows us to observe population trend, which we expect to be stable or growing as populations

achieve recovery, although we also expect annual fluctuations could include population declines for one or a few years during an 8-year period. We estimate that an 8-year period will include one catastrophe cycle (i.e., an event of extreme pup mortality, as described in Miller 2017), allowing us to ensure that the population is able to rebound following such an event. Downlisting criteria require only a single generation (4 years) because protections under threatened status would remain in place to ensure that populations remain robust through various population cycles. We would not downlist or delist the Mexican wolf if population performance demonstrates that wolf populations are unstable (e.g., populations have not rebounded from a catastrophe cycle).

Based on Miller (2017), we predict that recovery could be reached within 25-35 years (i.e., about 2043 to 2053). This includes the time to reach the abundance and genetics targets in both countries and achieve the population averages indicated in the criteria. However, recovery could be reached sooner if populations grow more rapidly than predicted (e.g., through lower mortality rates, higher recruitment). Also based on Miller (2017), we predict downlisting could be possible within approximately 16-20 years (i.e., about 2034 to 2038) (Miller 2017). Similarly, downlisting could be reached sooner with more rapid population growth. Miller's results are useful for estimating the time frame to recovery assuming the conditions specified in the population viability model are similar (which we expect) to those observed in the wild during recovery implementation.

In the United States, we will focus our management to ensure a population of at least 320 Mexican wolves can be maintained. We recognize that unrestricted Mexican wolf population growth may erode social tolerance in local communities or cause other management concerns, such as unacceptable impacts to wild ungulates (USFWS 2014). We consider it not only possible, but preferable, to achieve recovery while addressing the concerns of local communities and economies. Therefore, we used the Vortex model to explore viability of populations that were not allowed to increase over 380 Mexican wolves in the United States to simulate management response to problem wolves and unacceptable impacts to native ungulate herds (Miller 2017). While 380 Mexican wolves functioned as a population cap in the model, it was not intended as a limit on the number of Mexican wolves in the wild. However, if population growth is causing management concerns, we will consider any and all management options, including allowing mortality rates to increase through permitted take or other mechanisms, provided at least 320 Mexican wolves are likely to be maintained.

Representation

The gene diversity criterion ensures that Mexican wolf populations have genetic *representation* and that genetic threats have been ameliorated, while having Mexican wolves across large portions of their range ensures ecological *representation*. Ensuring gene diversity in the near term will reduce the incidence of inbreeding depression, while over a longer timeframe it will aid the Mexican wolf's ability to respond and adapt to various and changing environmental conditions.

We consider the degree to which wild populations contain the gene diversity (expected heterozygosity) available from the captive population to be an important indication of genetic *representation* for recovery (USFWS 2017a). Ensuring wild populations represent

approximately 90% of the gene diversity retained by the captive population provides for *representation* based on community of practice in the management of captive populations (Siminski and Spevak 2017). Typically when captive populations are established from wild populations, the goal is to retain at least 90% of the gene diversity available from the wild population (Soulé et al. 1986). In the case of the Mexican wolf, we are applying this goal to establish a wild population from a captive population. We consider approximately 90% to be reasonable for recovery because it ensures wild populations contain a high degree of the gene diversity available (Siminski and Spevak 2017), while recognizing that we cannot control breeding events in the wild and need flexibility in our management of wolves (e.g., removal of Mexican wolves from the wild for management purposes may positively or negatively affect the gene diversity of the population). Miller (2017) identifies several release scenarios that are able to achieve 90% gene diversity of the captive population in the wild by model year 20 (2035). It is important to note that in the scenarios presented by Miller (2017), not all released wolves incorporated into the population contribute offspring, and conversely, some released wolves incorporated into the wild population will contribute offspring more than once. We would expect to use one of these release scenarios or a comparable scenario to meet the scheduled releases necessary to achieve the recovery criteria.

Release strategies from captivity may include the release of individual or paired adult wolves, a pack of wolves, or cross-fostering of pups. The importance of the releases of Mexican wolves from the captive population into the wild is demonstrated graphically in the PVA report (Miller 2017). Based on the current estimates of first year mortality of wolves released from captivity, we estimate the need to release about 70 wolves to the United States population to have 22 of them survive to breeding age. We estimate the need to release about 100 wolves to the wild population in Mexico to have 37 of them survive to breeding age. The number of releases required may increase or decrease if the survival of released wolves changes. We did not require that a released or translocated wolf survive and produce offspring in the population, as the basis for recovery criteria. We instead used a metric (i.e., number of animals that survive to breeding age) that coupled model performance with performance of the wild populations. Including a low level of dispersal/connectivity (approximately 1 wolf every 12 to 16 years), the model predicts that at this level of release and at the predicted first year mortality rate we will achieve gene diversity in the wild population of approximately 90% of that retained in the captive population (Miller 2017).

The extent to which released Mexican wolves are able to influence the gene diversity of a wild population is a function of the number of released wolves that survive and breed in relation to the recipient population abundance (i.e., when releases represent a larger proportion of the recipient population, they result in greater genetic and demographic effect). Therefore, the timing of releases of wolves in relation to population size and whether or not they survive to breeding age are critical factors in the degree to which releases will ensure that approximately 90% of the gene diversity available in captivity is represented in each wild population. For this reason, it will be important for us to establish a schedule of releases that achieves the recovery criteria (Actions 2.1, 2.2, and 2.3 in Table 1).

We consider all releases subsequent to December 2015 to contribute to the genetic criteria for the United States and all releases subsequent to December 2016 to contribute to the genetic criteria

for Mexico. These are appropriate starting dates because Miller's (2017) scenarios were initiated with the pedigree of both populations as of December 2015, but Mexico's 2016 releases were included in the first time step of the model due to the large number of releases that year and the resultant effect on the population's genetic and demographic condition.

We will achieve ecological *representation* by the distribution of Mexican wolves across large portions of their historical range (per Parsons 1996) in the United States and Mexico, namely within Arizona and New Mexico south of Interstate 40 and in the northern Sierra Madre Occidental. Martínez-Meyer et al. (2017) estimate 44,477 km^2 (17,173 mi^2) of high quality habitat in Arizona and New Mexico south of Interstate 40, 21,538 km^2 (8,316 mi^2) in the northern Sierra Madre Occidental, and 34,540 km^2 (13,339 mi^2) in the southern Sierra Madre Occidental under the intermediate scenario with ungulate biomass index. Habitat conditions vary between the United States and Sierra Madre Occidental sites in both terrain and vegetation, as well as the abundance and distribution of prey (USFWS 2017a). These differences will expose the Mexican wolf genome to different environments that may result in different selection pressures. We anticipate more genetically diverse wild populations in the United States and northern Sierra Madre Occidental will be better able to respond to not only the current range of habitat conditions, but also future changing conditions such as shifts in prey availability, drought, or other environmental fluctuations. Variation in environmental conditions (such as drought, fire, and prey fluctuations) and episodic threats, such as disease, are characteristic of wild populations of most species, including Mexican wolves. Mexican wolf populations that are genetically robust will be more likely to recover from episodic threats (USFWS 2010). While we do not consider climate change to be a threat to the Mexican wolf (see our discussion at 80 FR 2488), we recognize that climatic conditions are changing and may consider establishing populations with genetic representation in ecologically/geographically varied habitat to provide Mexican wolves with the potential to withstand these changes.

Redundancy

The establishment of two resilient populations of Mexican wolves with genetic and ecological representation provides for *redundancy* (USFWS 2017a). *Redundancy* provides for security against extinction from catastrophic events that could impact a single population by ensuring that one or more additional resilient, representative populations persist. Our recovery criteria require a minimum of two demographically and environmentally independent populations (e.g., limited dispersal) such that negative events (e.g., disease, severe weather, natural disasters) are unlikely to affect both populations simultaneously (Allendorf and Luikart 2007). In addition, both populations are independently resilient and could be used as a source for reestablishment if severe catastrophes were to occur in a single population. As modeled by Martínez-Meyer et al. (2017), within the historical range of the Mexican wolf (Parsons 1996) there are areas of high-quality habitat in Mexico and the United States of sufficient size to establish *redundant* populations that are resilient.

The Need for Regulatory Protection

Prior to delisting, we will ensure that the state and tribal agencies that will be responsible for maintaining the recovered status of the Mexican wolf have adequate regulations in place to ensure levels of human-caused mortality will enable the population to retain the population abundance specified by the abundance criterion in the United States. We will collaborate with

these agencies during the implementation of the recovery plan as needed to prepare for a change in management from federal to state and tribal regulatory control of the Mexican wolf. Additionally, Mexico will also ensure that regulations are in place to manage levels of human-caused mortality to enable the population to retain the population abundance specified by the abundance criterion in Mexico.

Explanation of Downlisting Criteria

The downlisting criteria are intended to demonstrate that the status of the Mexican wolf has improved such that it is no longer endangered. We provide two options for downlisting the Mexican wolf to threatened status: the United States population achieves abundance and genetic criteria but Mexico does not, or both populations reach a partial level of genetic and demographic stability, but neither population has fully reached its desired population abundance target.

The first option for downlisting is appropriate if the United States population has achieved the abundance criterion for 4 (one wolf generation) of the 8 years, and releases of wolves to provide gene diversity (*representation*) have been conducted. This population will be close to achieving *resiliency* and will have achieved *representation*, but the *redundancy* provided by the second population will not yet be achieved.

The second option (i.e., both populations reach an average population abundance of 150 for 4 years, and releases of wolves to provide gene diversity have been conducted) demonstrates that progress toward *redundancy* is substantial and *representation* has been achieved. In this situation, neither population's abundance is sufficient to achieve *resiliency*, but both would be on track to becoming resilient given their annual positive growth rate. The criterion of 150 Mexican wolves is not intended as a proportion of the population abundance required for delisting, but rather is an indicator of a population abundance that confers a level of genetic and demographic stability (i.e., low extinction risk) under assumed rates of population growth. Given the predicted level of genetic and demographic stability, the Mexican wolf would no longer be in danger of extinction throughout all or a significant portion of its range (i.e., endangered).

As recovery of the Mexican wolf progresses, including but not limited to downlisting to threatened status, we will explore management options with the states and tribes in the United States to increase management flexibility and foster the conservation of the Mexican wolf, as discussed in the Recovery Strategy.

V. EVALUATION OF THE RECOVERY STRATEGY AND PROGRESS TOWARD RECOVERY

Due to the intensive logistical, economic, and socio-political nature of the Mexican wolf recovery effort, it is critical to ensure that progress toward recovery is advancing in a timely manner. Therefore, to determine whether the recovery strategy is proving effective, we will evaluate its efficacy and the progress of the Mexican wolf population toward recovery 5 years and 10 years after implementation of the recovery plan. In addition, we will conduct 5-year species status reviews required under the Section 4(c)(2) of the ESA.

The timing of the 5- and 10-year reviews is based on calendar years following the signing of this recovery plan. The PVA model was initiated using data through December 2015 (Miller 2017). The interim abundance and release and translocation targets to be used in the 5- and 10-year status reviews are derived from Vortex model years 7 and 12. This reflects the 2-year difference between the start of the Vortex model (end of 2015) and the signing of the recovery plan (end of 2017).

5-Year Status Review (based on data through 2022):
In the first 5-year review of the recovery plan, we will assess the status of each population contributing to recovery. The purpose of the assessment will be to identify each population's progress toward recovery criteria, as measured by:

- Interim abundance targets of approximately 145 wolves in the United States and 100 wolves in Mexico;
- Interim release and translocation targets of a sufficient number of wolves to result in approximately 9 released wolves surviving to breeding age in the United States and 25 released and translocated wolves surviving to breeding age in Mexico.

Based on this information, we will identify aspects of population performance needing improvement and will determine what actions are necessary to address identified needs. Our evaluation will include the feasibility of the needed actions, including timelines, cost, and other relevant considerations. To complete the review, we will update the Recovery Implementation Strategy as needed.

10-Year Status Review (based on data through 2027):
In the second 5-year review of the recovery plan, we will assess the status of each population contributing to recovery. The purpose of the assessment will be to identify each population's progress toward recovery criteria and determine whether the recovery strategy is proving effective/feasible. Progress toward recovery will be measured by:

- Interim abundance targets of approximately 210 wolves in the United States and 167 wolves in Mexico;
- Interim release and translocation targets of a sufficient number of wolves to result in approximately 16 released wolves surviving to breeding age in the United States and 37 released and translocated wolves surviving to breeding age in Mexico.

Based on this information, in addition to findings of the 5-year status review, we will make a determination that the recovery strategy is proving effective/feasible or needs to be revised. If we determine the recovery strategy is effective but some elements of recovery implementation need improvement, we will identify what needs to be improved, including actions to address identified needs and the feasibility of conducting such actions such as timelines and costs. If we determine the recovery strategy is not proving effective and the expected recovery level is not achieved, we will identify the reasons for such finding and, if necessary, revisit the recovery strategy and work with States and others to identify other areas with suitable habitat and adequate prey to achieve recovery; change techniques used to address gene diversity; or implement other substantive changes. Any such revised strategy should include revised time/cost estimates necessary to achieve recovery based on necessary actions. We will revise the Recovery Plan or Recovery Implementation Strategy as necessary.

VI. ACTIONS NEEDED

Recovery actions, which were developed for each objective, guide site-specific activities to address threats and achieve the recovery criteria. They are provided in the Recovery Action Table below (Table 1). Implementation of the recovery actions will involve participation from the States, Federal agencies, counties, local communities, Tribes, non-federal landowners, non-governmental organizations, academia, and the public in the United States and Mexico. Recovery actions, organized by recovery objective, are accompanied by estimates of the cost and time required to achieve the plan's goal to recover the Mexican wolf.

The site-specificity of the recovery actions is provided primarily at the geographic scale of the population, e.g., the United States or Mexico. The Plan does not provide more specific locations for actions for which the locations cannot be determined until future conditions are known. For example, the Plan does not identify at which approved release site a future release may occur several years from now because it is unknown whether a specific site will be available (e.g., depending on wolf distribution). Similarly, we do not know when or where events that require law enforcement response will be necessary.

A separate Recovery Implementation Strategy provides additional detailed, site-specific near-term activities needed to implement the actions identified in the recovery plan. We intend to update the implementation strategy as frequently as needed by incorporating new information, including the findings of the 5 and 10-year status reviews. The implementation strategy will provide near-term (e.g., 1-5 years) activities that will be continually updated as recovery implementation progresses. Therefore, we anticipate being able to provide a greater degree of site-specificity in the implementation strategy than the recovery actions in the recovery plan. For example, release locations will be determined based on present-year circumstances. We will only revise the recovery actions in this recovery plan if there are needed changes based upon the findings of our 5 and 10-year status reviews, or subsequent evaluation of progress toward recovery.

As stated in the Disclaimer, recovery plans are advisory documents, not regulatory documents. A recovery plan does not commit any entity to implement the recommended strategies or actions contained within it for a particular species, but rather provides guidance for ameliorating threats and implementing proactive conservation measures, as well as providing context for implementation of other sections of the ESA, such as section 7(a)(2) consultations on Federal agency activities, development of Habitat Conservation Plans, or the creation of experimental populations under section 10(j).

Estimated Cost and Timing of Recovery

We expect the status of the Mexican wolf to improve such that we can achieve downlisting criteria in approximately 16-20 years. We expect to achieve recovery in approximately 25-35 years for a total estimated cost of $178,439,000. This cost includes those borne by governmental agencies and nongovernmental organizations in the United States and Mexico.

While recovery may take an estimated 25-35 years, we anticipate successfully implementing the actions in the Recovery Action Table such that we can achieve recovery in 25 years; therefore,

the total estimated cost to recovery is based on this 25-year timeframe. These timeframes are based on expectation of full funding, implementation as provided for in the recovery plan and implementation strategy, and full cooperation of binational partners.

Annual cost estimates to implement recovery actions for the first 5 years are as follows:

Year 1 = $7,123,000
Year 2 = $7,491,000
Year 3 = $7,771,000
Year 4 = $8,005,000
Year 5 = $8,065,000

The estimated cost to implement the first 5 years of recovery actions (i.e., intermediate steps toward the goal of recovery) is $38,455,000.

The calculation of the total estimated cost to recovery is included in the Recovery Action Table below, whereas, the cost of implementing the first 5 years of recovery is detailed in the Implementation Schedule Table of the Recovery Implementation Strategy.

Acronyms Used In Recovery Action Table

AZGFD	Arizona Game and Fish and Department
AZLLB	Arizona Livestock Loss Board
BLM	Bureau of Land Management
CBP	U.S. Customs and Border Protection
CONAFOR	Comisión Nacional Forestal
CONANP	Comisión Nacional de Áreas Naturales Protegidas
CNOG	Confederación Nacional de Organizaciones Ganaderas
DOT	Department of Transportation
DOW	Defenders of Wildlife
FS	U.S. Forest Service
FSA	U.S. Department of Agriculture Farm Services Agency
FWS	U.S. Fish and Wildlife Service
GM	Grupo México-Unidad de manejo para la conservación de la vida silvestre (UMA) Buenavista del Cobre
GN	Gendarmería Nacional
INECOL	Instituto de Ecología, A.C.-Estación Biológica Piedra Herrada
MFS	Mexican Field Staff
MWF	Mexican Wolf Fund
MWLC	Mexican Wolf/Livestock Council
NMDGF	New Mexico Department of Game and Fish
NPS	National Park Service
NRCS	Natural Resources Conservation Service
OVIS	Organización Vida Silvestre, A.C.-UMA La Mesa
PGR	Procuraduría General de la Republica
PROFEPA	Procuraduría Federal de Protección al Ambiente
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
SCT	La Secretaría de Comunicaciones y Transportes

SEMARNAT	Secretaría del Medio Ambiente y Recursos Naturales
SSP	Species Survival Plan
TESF	Turner Endangered Species Fund
UI	University of Idaho
UNAM-FMVZ	Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México
UNAM-IB	Instituto de Biología, Universidad Nacional Autónoma de México
UNM	University of New Mexico
USDA-WS	U.S. Department of Agriculture - Wildlife Services
WMAT	White Mountain Apache Tribe

Table 1. Recovery Action Table: Estimated Cost, Time, and Priority for Recovery Actions for the Mexican Wolf

SITE-SPECIFIC ACTION[i]		RESPONSIBLE PARTY	ESTIMATED COST in FY18 (US dollars)	TREND of COST over TIME	ESTIMATED TIME (years)	TOTAL COST (US dollars)[ii]	PRIORITY[iii]	ADDRESSES THREAT[iv]
Objective 1: Increase the size of two Mexican wolf populations								
1.1	Survey and monitor Mexican wolves to determine population status in the U.S.	FWS, AZGFD, NMDGF	1,460,000	Stable	25	36,500,000	1	2, 3
1.2	Survey and monitor Mexican wolves to determine population status in Mexico	CONANP, MFS	220,000	Increasing	25	12,120,000	1	2, 3
1.3	Monitor Mexican wolves on Fort Apache Indian Reservation	WMAT, FWS	225,000	Stable	25	5,625,000	1	2, 3
1.4	Monitor Mexican wolves on other Tribal lands	Tribes, FWS	20,000	Increasing	25	3,920,000	2	2, 3
1.5	Conduct Mexican wolf releases to increase population size in Mexico	See Action 2.2	See Action 2.2	See Action 2.2	See Action 2.2	See Action 2.2	2	1, 2
1.6	Reduce human-caused mortality of Mexican wolves in the U.S.	FWS, AZGFD, NMDGF, FS, WMAT	134,000	Increasing	25	6,298,000	2	3
1.7	Reduce human-caused mortality of Mexican wolves in Mexico	CONANP, CNOG, SAGARPA, PROFEPA, MFS, PGR, GN	32,000	Increasing	25	2,672,000	2	3
1.8	Reduce Mexican wolf-livestock conflicts in the U.S.	FWS, AZGFD, NMDGF, DOW, MWF, USDA-WS, MWLC, AZLLB	640,000	Increasing	25	24,100,000	2	3

SITE-SPECIFIC ACTION[i]		RESPONSIBLE PARTY	ESTIMATED COST in FY18 (US dollars)	TREND of COST over TIME	ESTIMATED TIME (years)	TOTAL COST (US dollars)[ii]	PRIORITY[iii]	ADDRESSES THREAT[iv]
1.9	Reduce Mexican wolf-livestock conflicts in the Mexico	SAGARPA, MFS, CNOG, CONANP, CONAFOR	100,000	Increasing	25	4,850,000	2	3
Objective 2: Improve gene diversity and maintain the health of Mexican wolves								
2.1	Develop and implement an annual plan for Mexican wolf releases, cross-fostering, and translocations in the U.S.	FWS, AZGFD, NMDGF, FS, WMAT, TESF	400,000	Stable	16	6,400,000	1	1
2.2	Develop and implement an annual plan for Mexican wolf releases, cross-fostering, and translocations in Mexico	SSP, CONANP, MFS, SEMARNAT, OVIS, GM, INECOL, FWS	70,000	Stable	8	560,000	1	1, 2
2.3	Monitor and manage Mexican wolf genetic health	AZGFD, FWS, NMDGF, MFS, CONANP, UI, UNM	45,000	Stable	25	1,125,000	2	1
2.4	Monitor and manage Mexican wolf health	FWS, AZGFD, NMDGF, MFS, IFT, USDA-WS, UNAM-FMVZ	NA (costs included in 1.1 and 1.2)	NA (costs included in 1.1 and 1.2)	25	NA (costs included in 1.1 and 1.2)	2	3
Objective 3: Ensure adequate habitat availability to support viable Mexican wolf populations								
3.1	Maintain habitat for Mexican wolves in the U.S.	FWS, AZGFD, NMDGF, FS, BLM, NPS, NRCS	NA (costs included in 1.1, 1.2, and 1.6)	NA (costs included in 1.1, 1.2, and 1.6)	25	NA (costs included in 1.1, 1.2, and 1.6)	2	2
3.2	Maintain and protect habitat for Mexican wolves in Mexico	CONANP, MFS, UNAM IB	93,000	Decreasing	25	587,000	2	2

SITE-SPECIFIC ACTION[i]		RESPONSIBLE PARTY	ESTIMATED COST in FY18 (US dollars)	TREND of COST over TIME	ESTIMATED TIME (years)	TOTAL COST (US dollars)[ii]	PRIORITY[iii]	ADDRESSES THREAT[iv]
3.3	Maintain and enhance connectivity within and between Mexican wolf populations	FWS, CONANP, SCT, AZGFD, NMDGF, CBP, Local, State, and Federal DOT	NA (cost included in actions 1.1, 1.2, 6.1)	NA (cost included in actions 1.1, 1.2, 6.1)	25	NA (costs included in actions 1.1, 1.2, 6.1)	2	1
3.4	Maintain or improve the status of native prey populations of Mexican wolves	AZGFD, NMDGF, WMAT, IFT, CONANP, MFS	25,000	Stable	25	625,000	2	3
Objective 4: Maintain the Mexican Wolf SSP captive breeding program to improve the status of wild populations								
4.1	Manage the Mexican Wolf captive breeding population	Various SSP, FWS	2,674,000	Decreasing	25	54,682,000	2	1, 2
Objective 5: Promote Mexican wolf conservation through education and outreach programs								
5.1	Conduct education and outreach on Mexican wolf conservation in the U.S.	FWS, AZGFD, NMDGF, WMAT, FS	450,000	Decreasing	25	9,000,000	3	2, 3
5.2	Conduct education and outreach on Mexican wolf conservation in Mexico	MFS, CONANP	NA (costs included in 1.7)	NA (costs included in 1.7)	25	NA (costs included in 1.7)	3	2, 3
Objective 6: Ensure recovery success								
6.1	Manage the Mexican Wolf Recovery Program in the U.S.	FWS	500,000	Decreasing	25	8,500,000	3	1, 2, 3
6.2	Manage the Mexican Wolf Recovery Program in Mexico	CONANP, MFS, SEMARNAT	35,000	Stable	25	875,000	3	1, 2, 3
6.3	Coordinate binational Mexican wolf recovery efforts	FWS, CONANP	NA (costs included in 6.1 and 6.2)	NA (costs included in 6.1 and 6.2)	25	NA (costs included in 6.1 and 6.2)	3	1, 2, 3

SITE-SPECIFIC ACTION[i]		RESPONSIBLE PARTY	ESTIMATED COST in FY18 (US dollars)	TREND of COST over TIME	ESTIMATED TIME (years)	TOTAL COST (US dollars)[ii]	PRIORITY[iii]	ADDRESSES THREAT[iv]
6.4	Develop adequate regulations and management and monitoring plans to maintain viable Mexican wolf populations after delisting	CONANP, FWS, AZGFD, NMDGF, WMAT	NA (costs included in 6.1 and 6.2)	NA (costs included in 6.1 and 6.2)	5	NA (costs included in 6.1 and 6.2)	3	1, 2, 3
TOTAL COST			7,123,000			178,439,000		

[i] The Recovery Implementation Strategy provides additional detailed, site-specific near-term activities needed to implement the actions identified in this Recovery Action Table.

[ii] Because the estimated costs of some actions may increase or decrease over the duration of the action, the total cost of the action cannot be calculated by multiplying the cost of the action in Fiscal Year 2018 by the estimated time of the action. Whether the trend of the cost is increasing, decreasing, or stable over the total duration of the action is indicated in the "Trend of Cost over Time" column; however, the calculation of the total cost estimate of each action is included in greater detail in the Implementation Schedule Table.

[iii] Recovery actions are assigned numerical priorities to highlight the relative contribution they may make toward species recovery (48 FR 43098). **Priority 1** – An action that must be taken to prevent extinction or to prevent the species from declining irreversibly. **Priority 2** – An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction. **Priority 3** – All other actions necessary to provide for full recovery of the species.

[iv] Threats numbering system: 1) Loss of gene diversity; 2) Extinction risk/demographic stochasticity; 3) Exceeding threshold mortality rate

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U.S. Fish & Wildlife Service
New Mexico Ecological Services Field Office
Mexican Wolf Recovery Program
2105 Osuna Road, NE
Albuquerque, NM 87113
505/346-2525
www.fws.gov/southwest/

www.fws.gov/southwest/es/mexicanwolf/

U.S. Fish and Wildlife Service
Southwest Regional Office
500 Gold Avenue, SW
Albuquerque, NM 87102
505/248-6920
505/248-6788 Fax

Cover: Mexican Wolf

Rear Cover: Mexican Wolf
USDA Forest Service

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