

Mexican Wolf Experimental Population Area
Initial Release and Translocation Proposal for 2022

This document was developed by the Mexican Wolf Interagency Field Team (IFT) and outlines management options for initial release(s) and translocation(s) of Mexican wolves into the Mexican Wolf Experimental Population Area (MWEPA) in Arizona and New Mexico in 2022. The initial releases and translocations outlined in this document are consistent with:

- (1) *the 2014 Final Environmental Impact Statement (EIS) for the Proposed Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf (Canis lupus baileyi),*
- (2) *the 2015 Record of Decision for the Proposed Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf (Canis lupus baileyi),*
- (3) *the 2015 Final Rule - Revisions to the Regulations for the Nonessential Experimental Population of the Mexican Wolf.*
- (4) *the 2017 Mexican Wolf Recovery Plan, First Revision.*

The above documents analyzed the potential environmental and socioeconomic impacts of establishing a Mexican wolf population in the MWEPA, including initial releases and translocations. This document is the initial release and translocation planning proposal for 2022; thus, it is not a final agency action but rather an implementation planning document that may be changed during this planning period. From 1998 through September of 2021, the IFT has conducted 55 initial release events (168 wolves) and 83 translocations events (143 wolves). Cross-foster events can be considered translocations (the IFT has cross-fostered 6 wild born pups to other wild dens) or initial releases (the IFT has cross-fostered 72 captive born pups to the wild) and are included in the overall numbers above. Detailed information on cross-foster efforts is presented in this document.

With seven unrelated founders, the Mexican wolf has experienced a genetic bottleneck necessitating management actions to retain, maintain or enhance gene diversity. Specifically, pairing within the captive population is carefully managed by the Species Survival Program (SSP) and cooperating breeding facilities to maintain gene diversity by establishing breeding pairs through a process that considers mean kinship¹ (MK) and avoidance of inbreeding². Conversely, breeding pairs in the wild population are not prescribed, but typically establish through natural dispersal and pack formation. Thus, to manage gene diversity in the wild population, it is important to ensure the population as a whole is genetically diverse, increasing the probability that wolves pairing naturally have a low MK.

¹ Mean kinship (MK) is an individual's degree of relatedness to the population. A wolf with low MK is less genetically represented in the population, and a breeding event by this animal would decrease the overall relatedness of the population. A wolf with higher MK is genetically well represented in the population, and a breeding event by this animal would increase the overall relatedness of the population. Because MK of an individual animal is relative to the current population, it is constantly changing. For example, an individual's MK will increase each time that animal successfully produces and raises offspring in the population.

² Inbreeding is the mating of closely related individuals, which tends to increase the number of individuals in the population that are homozygous for a trait which can reduce adaptive potential.

The Mexican Wolf Species Survival Plan (captive breeding program) monitors several genetic parameters for the captive and wild populations, including: Founder Genome Equivalents (FGE), Gene Diversity (GD), Mean Inbreeding (Mf) and Population Mean Kinship (Pop MK). In the past three years, likely because of cross-fostered pups surviving and becoming incorporated into the population, these monitored genetic parameters have improved for the wild population: FGE increased from 1.96 to 2.1, GD increased from 74.54 to 76.23, Mf declined from 0.2201 to 0.2062, and Pop MK declined from 0.2546 to 0.2377. Release of wolves from the more genetically diverse captive population is necessary to decrease the overall relatedness among wolves in the wild population and to meet the objectives of the 2017 Mexican Wolf Recovery Plan, First Revision. In addition, we will consider preventing production of highly inbred wolves or remove wolves from the wild to reduce MK. The following release and translocation actions are proposed in consideration of the current genetic status of the wild population.

The proposed actions within the MWEPA are to:

- (1) Cross-foster pups from captivity into wild wolf packs throughout the MWEPA. Our goal is to cross-foster as many pups as logistically feasible (up to 12 in the Arizona portion of the MWEPA) throughout the MWEPA during 2022, recognizing the actual number will depend on synchrony of litters among the captive and wild population.
- (2) Temporarily remove any female wolf that is paired with a full sibling during the helicopter capture in January/February, or other times and methods deemed appropriate by the IFT, to prevent a brother/sister mating event. During the temporary period in captivity, the female may be allowed to breed naturally with a captive male. Artificial insemination of the female may be considered pending additional planning and logistics (see below). Following a complete estrous cycle (likely late March), the IFT could translocate the female wolf back into its home range to maintain pack dynamics, and potentially produce pups with increased genetic diversity and lower inbreeding coefficients. Full sibling pairs are not known to exist in the recovery area at this time. However, the IFT will have the option of managing a full sibling pairing(s), if documented, through the methods described above.
- (3) Provide for the translocation of wolves for management purposes as needs arise (primarily wolves that disperse outside of the MWEPA, occupy tribal nations and removal is requested, or if other packs are determined to be brother/sister pairings).

Background

Initial Release and Translocation Restrictions and Land Use:

Initial release and translocation strategies differ throughout the MWEPA to reflect various state, federal, and tribal nation laws, rules, regulations, and land-use patterns (e.g., multiple land-use areas vs. wilderness). To the extent possible, agency direction and land-use patterns are addressed in these initial release and translocation strategies while still promoting the health of the wolf population by addressing critical genetic issues. In March of 2018, the U.S. Fish and Wildlife Service (Service), New Mexico Department of Game and Fish (NMDGF), and the Arizona Game and Fish Department (AZGFD) entered into a Memorandum of Agreement to clarify the commitment of the Service and

States to work cooperatively to determine the timing, location, and circumstances of releases of Mexican wolves into the wild in Arizona and New Mexico under the 2017 Mexican Wolf Recovery Plan, First Revision and the 2015 Final Experimental Population Rule, with the intent of facilitating recovery of the subspecies and eventual transition from federal management to state management. In 2022, the agencies are considering cross-fostering of captive born pups into wild dens and to allow for translocations of wolves on a case-by-case basis. The combinations of strategies within the MWEPA that are outlined in this plan represent an effort to increase gene diversity in the wild population. Gene diversity can continue to be managed through additional juvenile and adult initial releases and cross-fostering efforts in future years. However, it is easier to affect the gene diversity of the wild population when it is small, and it will become more difficult as the population increases.

The 2017 Mexican Wolf Recovery Plan, First Revision recognizes the importance of managing gene diversity and specifically identifies delisting criteria based on gene diversity. The criteria read, “Gene diversity available from the captive populations 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.” The 2017 Mexican Wolf Recovery Plan, First Revision did not require a released or translocated wolf to produce offspring in the population as the basis for recovery criteria, but rather used a metric (i.e., number of animals that survived to breeding age) that coupled model performance with performance of the wild population (i.e., the model takes into consideration that not all released wolves surviving to breeding age will contribute offspring in the population).

Initial Release and Translocation Strategies:

Translocations: Involve moving a wolf for management purposes from one location (within or outside the MWEPA) to a location within the MWEPA. Mexican wolves that travel outside of the MWEPA or require translocation for management purposes will be considered for translocation onto federal land within Zones 1 and 2 of the MWEPA in accordance with the guidance of Phase 1 (see 2015 10(j) Rule). Decisions for translocations on tribal nations within the MWEPA will be at the discretion of the individual tribal nation and is not specifically covered in this document. In some instances, a wolf or wolves’ greatest potential to contribute to recovery may be to translocate the animal(s) to Mexico. In any case, the IFT will assess: (a) the specific reasons for a translocation, (b) previous behavior of the wolf or wolves, (c) the potential effects of the management action, (d) wolf distribution and breeding vacancies, and (e) the wolf or wolves’ potential genetic contribution to the overall recovery program prior to recommending a translocation.

Most translocations will be single animals and can occur anywhere within Zone 1 or 2 as a hard release (i.e., a release from a transport crate). The IFT may recommend that translocations be conducted at a previously established release site. If a previously established release site will be considered, the IFT will recommend the best available site based on site ranking. Translocated wolves may spend a period in captivity (note: time spent in captivity did not significantly impact success or removal probability for animals that had at least six months of wild experience [$n = 24$, $df = 4$, $\chi^2 = 6.0$, $p = 0.19$]) prior to being translocated in a new location in the wild.

In 2021, the IFT translocated 9 wolves in 2 separate events. Female 1728 and M1693 (a cross-fostered wolf from 2018) bred in the wild and were captured and placed in captivity temporarily for management purposes. The pair whelped 6 pups (mp2666, mp2667, mp2668, mp2669, fp2670, fp2671) while in captivity (these pups are considered wild born translocations because they were conceived in the wild). The pair and their pups were named the Seco Creek pack and were translocated back to the wild in July. The second translocation in 2021 occurred in August when m2520 traveled outside the MWEPA boundary and was translocated back within the recovery area.

In 2022, the IFT is recommending the following management action as an option to prevent reproduction by full sibling pairs. If a full sibling pair is documented, the preferred management action will be to remove the female wolf from the pair to potentially be impregnated in captivity by a captive male wolf, or through artificial insemination (pending additional coordination and logistics), and then returned to the same area in the wild as the removal as soon as the female has completed an estrus cycle. However, other management actions (i.e., removal and translocation of the male) may be necessary depending on the ability to catch the female and the availability of male wolves in captivity and personnel to perform AI.

The preferred action would be considered a translocation. Other wolves may be translocated for management purposes as needs arise in 2022. Options will be evaluated to determine if, where, and how a translocation should proceed based on SOP 6.1 (Wolf Translocations) and a full evaluation by the IFT.

Initial Releases: Involve the release of wolves from captivity without wild experience and include cross-foster pups from captivity. No initial release of adults or packs are proposed during 2022. The IFT will focus on cross-fostering (considered an initial release) in 2022 because initial efforts (2014-2021) have been successful (see below) and present an opportunity to accomplish genetic goals of the 2017 Mexican Wolf Recovery Plan, First Revision, while eliminating nuisance behavior that could be observed during initial release of adult wolves. Originally, initial releases were necessary to establish a wild population and subsequently augment population growth. Now, initial cross-fostering releases are a management option to reduce MK of the wild population (Figure 1).

Cross-fostering (a specific technique of initial releases): Involves placing captive-born pups (<14 days old) into wild dens with similarly aged pups and is another method to increase gene diversity in the wild population. Cross-fostering opportunities require synchronicity between captive and wild born litters produced during a short time window (within days of one another) and can be logistically challenging as these litters are often a considerable distance apart (e.g., we have previously cross-fostered from captive facilities as far away as New York, Missouri, and Illinois). Cross-fostering has been used since 2014 in the Mexican Wolf Recovery Program. Successes within the Mexican Wolf Recovery Program and the experience of the red wolf program in North Carolina show that cross-fostering is an effective genetic management tool. These expectations are grounded by data from the wild population suggesting that from birth to one year of age, approximately 50% of pups survive, and average survival for yearlings is 0.673. Thus, we would predict that 0.34 ($0.5 * 0.673$) of cross-fostered pups would survive to breeding age (two years old) should cross-fostered animals perform similarly to other wild-born pups. This survival rate would likely be considered a minimum estimate because packs that receive cross-fostered pups are also provided a supplemental food cache to increase pup

survival. Thus, we expect a minimum of 24 pups ($0.34 * 72$) to survive to breeding age from the captive cross-fostering ($n = 72$) efforts conducted through 2021.

Results from the Mexican Wolf Recovery Program demonstrate that cross-fostering is successful in releasing captive wolves that survive to breeding age. The IFT has conducted cross-fostering on 33 occasions, totaling 82 pups with 72 of these being moved from captive litters into wild dens.

In 2014, the IFT cross-fostered two pups from one wild litter (note: this litter was the result of a captive female breeding with a wild male and subsequent release in the spring; the male and female separated prior to the production of pups) to another wild litter. Both pups (AF1346 and AM1347) survived to breeding age, paired, and produced pups with other wolves in the wild. AF1346 formed the Leopold pack and first bred in 2016 and produced 3 pups; in 2017, 2019 and 2020 the pack denned but pups were not documented due to the pack's wilderness location. In 2021, AF1346 became fate unknown. In 2016, AM1347 formed the Baldy pack and produced at least one pup in 2017, pups were not been documented in 2018 to 2020. AM1347 is still a breeding member of the Baldy pack and produced pups in 2021. These two surviving crossfosters are not counted towards recovery goals because the model scenario used to determine targets in the 2017 Mexican Wolf Recovery Plan incorporated genetics present in the wild population in December 2015 in the first step of the model.

In 2016, the IFT cross-fostered six pups from three captive litters into three wild litters (two pups into each wild litter) and documented that a minimum of two survived (mp1471 and an uncollared pup from Panther Creek pack) to the end of the year. Male (m)1471 survived to breeding age, recruited five pups in 2018, recruited another five pups in 2019, recruited 2 pups in 2020 and is currently raising a fourth litter of pups in 2021.

In 2017, the IFT cross-fostered four pups from two captive litters into two wild litters (two pups into each wild litter). One cross-fostered pup, F1578, was radio-collared in 2017 dispersed and has established a pair (Leon Pack) that produced 5 pups in 2020. Pups from the other cross-fostered pack did not survive to the end of the year.

In 2018, the IFT cross-fostered eight pups from four captive litters into four wild litters (two pups into each litter) and moved two wild pups from their natal den to a recipient wild litter. A minimum of four of the eight cross-fostered captive born pups survived to breeding age (AM1693, F1692, M1710 and AF1712). M1710 survived to breeding age and counts toward recovery criterion but went fate unknown in April 2021 and was not documented producing pups. F1692 (discovered to be alive in 2021), M1693 and F1712 are currently alive and radio collared into 2021. F1692 is a single wolf and has not produced pups in the wild. AM1693 paired in the wild and was translocated with his mate and 6 pups in 2021 and is now part of the Seco Creek pack. AF1712 first bred in 2020 while she was still a member of her natal pack (Iron Creek). AF1712 did produce pups in 2020; however, it is unknown if any of these pups were recruited at the end of the year. In 2021, she formed the Aldo pack but did not produce pups. In addition, a pup from the wild-to-wild cross foster operation, AM1717 is part of the Point of Rocks pack which produced pups in 2021.

In 2019, 13 pups (12 cross-fostered from captive litters and one from wild-to-wild litters) were cross-fostered into six packs. The IFT captured and radio collared three (2 captive born, m1911 and m1953; 1 wild born m1946) of these pups. Male (m)1911 paired and formed the Bear Canyon pack in 2019,

the pack showed denning behavior in 2020, but the den failed early in the breeding season. In 2020, AM1911 was documented dead prior to producing pups, this wolf did not survive to breeding age. M1953 joined the Blue Canyon pack in 2021 but did not produce pups. M1946 formed the Wagontongue pack in 2021, but did not produce pups.

In 2020, 21 pups were cross-fostered (20 from seven captive litters and one wild-to-wild cross-foster). The IFT has captured and collared eight of the pups from captivity (f1867, f1887, m1888, f1889, f1890, f2503, m2505, m2545). The IFT discovered two pups (fp2531 and mp2528) dead in the fall of 2020. Into 2021, 5 of the 8 collared wolves remain alive with functioning GPS collars (m1888, f1889, f1890, f2503, m2545). Female 1889 was first captured in 2021. Male (m)1888, f1889 and f1890 are still members of their natal pack (Hoodoo). In 2021, f2503 formed a new pack, Cottonwood Canyon late in the year but has not produced pups. Male (m)2545 is still a member of his natal pack (Iron Creek).

In 2021, 22 pups were cross-fostered (all 22 were from 5 captive litters). As of October 3, 2021, the IFT has documented survival of cross-fosters, but has not captured and collared any of the pups from 2021 cross-foster operations. Collaring efforts to document survival of cross-fostered pups in 2021 and 2020 will continue in the fall/winter.

Collectively, these results indicate that:

(1) in all but one of the 33 cross-fostering events, human disturbance at the den site resulted in the adult wolves moving the den a short distance but did not result in abandonment of the pups. In 2021, the IFT cross-fostered into the Leon pack, the den failed within 2 weeks. Consequently, this failure was attributed to human caused disturbance.

(2) a minimum of 20 (4 wild to wild and 16 releases from captivity) of the 56 cross-fostered pups survived to the end of the 2020 (2021 cross-fosters are excluded since final data are unknown),

(3) a minimum of 9 (2 wild to wild and 7 from captivity) of the 35 cross-fostered animals that would be old enough to be considered breeding age (born and cross-fostered prior to 2020) survived to breeding age.

(4) a minimum of 6 (2 wild to wild and 4 from captivity) of the 9 cross-fostered animals have reached breeding age have successfully contributed genetically to the wild population (bred and raised pups).

Collectively, these results are encouraging and support the decision that the Mexican Wolf Recovery Program should continue to utilize cross-fostering as a strategy to manage genetic diversity of Mexican wolves in the wild (note: the numbers reported in this paragraph include two wild to wild cross-fosters (AF1346, AM1347) that occurred prior to 2016 and do not count toward recovery goals). In addition, the results are consistent with expectations based on Mexican wolf pup and yearling survival rates.

Cross-fostering has contributed towards meeting the 2017 Mexican Wolf Recovery Plan, First Revision criteria such that:

(1) Seven wolves released from captivity after December 2015 (AM1471, AF1578, F1692, AM1693, M1710, F1712 and M1953) have survived to breeding age and reduced the number

of released wolves from captivity needed to survive to breeding age for downlisting or delisting from the target (22) to 15 wolves.

- (2) Five additional captive born cross-fostered wolves (m1888, f1889, f1890, f2503, m2545) are currently alive and radio-collared. These wolves would reach breeding age (2 years) in April of 2022 and, therefore, are not yet counted towards achieving the downlisting/delisting target.

A minimum of 10 wolves survived to breeding age (these totals include 3 wild-to-wild cross-fosters) out of 35 cross-fostered pups between 2014 and 2019, therefore cross-foster survival to breeding age is 0.28. This average survival rate is based on a small sample size and year to year survival can vary widely (2014: 1.00, 2015: N/A, 2016: 0.167, 2017: 0.25, 2018: 0.40, 2019: 0.15) and depends on both survival to breeding age and identification and marking of cross-fostered wolves.

This rate of survival is similar to expected survival rate projections for the wild population (0.34).

The interim release target established in the 2017 Mexican Wolf Recovery Plan, First Revision, requires 9 captive born wolves to survive to breeding age by 2022. The IFT has documented 7 captive-born cross-fosters surviving to breeding age thus far. If this level of success is maintained for the 20 captive born pups cross-fostered in 2020, we would expect 5 cross-fostered pups from 2020 to survive to breeding age ($0.28 * 20$). This projection would bring the total number of captive wolves surviving by 2022 to 12. Therefore, it is highly likely that we will meet or exceed the interim release targets through only cross-fostering efforts. However, such projections depend on the survival and identification of cross-fostered pups. We will continue to evaluate the success of cross-fostering and our ability to reach the interim recovery targets.

Cross-fostering does not appreciably change the distribution of wolves on the landscape and depends on coordination of logistics between captive facilities and the wild population (see SOP 31.0) to succeed. Captive-born pups placed into wild Mexican wolf dens will be of a different genetic profile than existing wolf packs in the MWEPA and can increase the gene diversity of the wild wolf population. Cross-fostering will occur in April and/or May and occur within packs that den in Zones 1 and 2 of the MWEPA, in accordance with the guidance of Phase 1 (see 2015 10(j) Rule). Decisions for cross-fostering on tribal land within the MWEPA will be at the discretion of the individual tribe and is not specifically covered in this document.

Adult or Pack Initial Releases: No initial releases of adults or packs are proposed during 2022. The IFT will focus on cross-fostering in 2022 because these initial release efforts (2014-2021) have been effective (see above) and help to accomplish genetic goals of the 2017 Mexican Wolf Recovery Plan, First Revision, while eliminating nuisance behavior observed from adult or pack initial releases.

Captive adult wolves are selected for release based on their genetic value relative to both the captive and wild Mexican wolf populations, as well as other desirable characteristics (e.g., fear of humans). Artificial insemination may also be used to further increase the genetic benefit of release actions.

Both initial releases and translocations of adult wolves are more successful when young pups are present and when they occur in areas with adequate native prey. For instance, from 1998-2015 (note: initial releases or translocations of breeding animals has not occurred since 2015), we have documented that 66% ($n = 9$) of the initial released breeding animals with dependent pups in areas of

adequate native prey have been successful, versus 29% success ($n = 17$) of the initial released breeding-aged animals without dependent pups in similar conditions. The pattern observed for initial released wolves also holds for translocated animals with 77% success ($n = 13$) with pups versus 32% ($n = 38$) without pups under similar conditions. The overall pattern was statistically significant ($n = 77$, $\chi^2 = 11.26$, $df = 1$, $p = 0.00081$)

Success, as the IFT is using this term, means any released wolf that survives and produces pups in the population in the future. Breeding pairs that meet this definition of success tend to persist and produce pups in successional years, continuing to increase gene diversity (note: successful initial released wolves recruit an average of 6.5 pups/wolf). Initial-released adult wolves do not have wild experience, typically exhibit some level of naivety towards humans, and can exhibit nuisance behavior primarily for the first four months following release. Survival of adult Mexican wolves released from captivity has been lower during the first year following a release compared to the average adult survival rate of wild wolves (adult survival rate first year after release of 0.28 [note: this includes adults released without pups] versus an average adult survival rate of 0.8 using data from 2009 through 2015 [note: adult wolves were last initially released in 2015]). Initial release wolves require intensive, sustained management by IFT staff including supplemental feeding, monitoring, and potential hazing from human occupied areas until the pack acclimates to the wild or is removed.

Initial Releases and Translocations

The IFT proposes to conduct the following actions.

Action 1 – Cross-foster Mexican Wolf Pups Produced in Captivity into Wild Mexican Wolf Pack Dens in the MWEPA.

The IFT proposes to cross-foster pups into authorized portions of the MWEPA. Our goal is to cross-foster as many pups as logistically feasible (up to 12 in the Arizona portion of the MWEPA) into the MWEPA in 2022, recognizing that the actual number will depend on the synchrony of litters between captive and wild packs. Cross-fostering will occur within packs that den on federal land within Zones 1 and 2 of the MWEPA, in accordance with the guidance of Phase 1 (see 2015 10(j) Rule).

Figures 2 and 3 give a general distribution of existing packs where cross-fostering is likely to occur. As many as 42 packs or pairs (16 in Arizona and 26 in New Mexico) are currently potential breeding pairs for cross-fostering in 2022 (Table 1). We have listed the preferred wild pack candidates for 2022 cross-fostering below, based on their past success with pup production and our expectation that the same experienced breeding females will reproduce in 2022. Other packs (Table 1) will be considered based on a full evaluation when pups from captivity and the wild are born. Depredation history of the pack and the location of the den relative to human nuisance potential will be considered prior to conducting a cross-foster operation with a particular pack. In addition, we will consider the overall benefits to the genetic makeup of the wild population (i.e., packs with overrepresented genetics will be prioritized for cross-foster operations over packs with underrepresented genetics). The preferred pack candidates are listed in chronological order by predicted whelp dates based on previous years:

- Owl Canyon (NM) March 26 – 30
- Noble Mountain (AZ) March 31
- Frieborn (NM) March 31 – April 15
- Eagle Creek (AZ) April 1
- Elk Horn (AZ) April 1 – 25
- Mangas (NM) April 3 – April 12
- Saffel (AZ) April 3 – 30
- Bear Canyon (AZ) April 4 – 6
- Prime Canyon (AZ) April 6 – 23
- Squirrel Springs (NM) April 6 – 21
- Blue Canyon (NM) April 7
- Agua Frio (NM) April 9
- Hoodoo (AZ) April 12 – 22
- Beaver Point (NM) April 16
- SBP (NM) April 16 – May 4
- Whiskey Creek (NM) April 17
- Castle Rock (AZ) April 17 – 28
- Panther Creek (AZ) April 17 – 18
- San Mateo (NM) April 19 – 24
- Cimmaron Mesa (NM) April 19 – 22
- Dark Canyon (NM) April 21 – May 27
- Rocky Prairie (AZ) April 23 – 26
- Whitewater Canyon (NM) April 24
- Sierra Blanca (AZ) April 24
- Leon (NM) April 24 – 27
- Iron Creek (NM) April 24 – May 4
- Point of Rocks (NM) April 26
- Lava (NM) April 26 – May 1
- Buzzard Peak (NM) April 29
- Pitchfork Canyon April 29 – May 8
- Colibri (NM) April 31 – May 6
- Aldo (NM) May 4
- Rose (AZ) May 7

Associated Management Actions

Prior to the 2022 breeding season, the IFT will prepare a cross-fostering priority ranking for all 2022 wild breeding pairs that will be considered for cross-fostering using predicted whelp dates and parameters (e.g. past reproductive successes, locational logistics, availability of GPS collars on breeders) in an effort to increase success and recruitment of wild and cross-fostered pups; a similar analysis is conducted on captive breeding pairs, resulting in a ranking of pups produced and potential genetic contribution to the wild population. These rankings guide the IFT in deciding which wild packs to consider when captive pups become available, and the captive management program in deciding

how many captive pups can be made available for cross-fostering from a specific litter. The IFT will develop specific cross-foster operational plans for the 2022 breeding season after a match between available captive pups and a wild litter is identified. This management option requires the following circumstances and considerations:

- Wild Mexican wolf packs display denning in Zone 1 and Zone 2 of the MWEPA.
- Donor pack(s) in captivity produce available pups based on the demographic and genetic needs of the wild and captive population.
- Wild and donor pups are <14 days old.
- Whelping dates of wild pups and donor pups must be within 10 days of one another (with less age difference preferred).
- Donor litter size needs to be large enough to contribute pups to the wild population. Typically, this is four or more, such that at least two pups can be transported to the recovery area and at least two pups can remain in the captive litter. However, this will be evaluated on a case-by-case basis and will consider the benefits/risks associated with transporting or leaving only one pup, the age and relative genetic value of the breeding pair in captivity, previous rearing success of both donor and recipient litter dams, and pack structure in captivity.
- The IFT will not know the recipient litter size prior to conducting the operation. Thus, a contingency plan will be developed to return wild-born pups to the captive litter in every cross-foster operation if the addition of the captive born pups creates a litter that is too large. In addition, if the captive litter is large enough, the IFT will consider cross-fostering more pups into a wild litter based on our experience of successfully cross-fostering pups from the wild to captivity. Another option to avoid creating too large of a litter size (>10) is to cross-foster wild pups from a large litter to a different predetermined wild den, where pups are of similar age.
- The primary limiting factor in cross-fostering efforts is the synchrony required between wild and captive litters. Experience has shown the last two weeks of April and the first two weeks of May to be the primary period of overlap between wild and captive whelp dates. The Service is exploring options (e.g., induced ovulation and/or artificial insemination) to alter breeding and whelp dates of pups in captivity to coincide within the expected timing of wild wolf whelp dates where possible.

Favorable Attributes of Action 1:

1. Cross-fostering allows for the integration of genetically diverse Mexican wolves into areas already occupied by wolves.
2. Cross-fostering allows captive-born wolf pups to be raised in the wild by experienced wolves and eliminates the potential for nuisance wolf interactions that are often associated with the release of naïve captive adult wolves.
3. Cross-fostering provides for progress towards the genetic criterion of the Mexican Wolf Recovery Plan, First Revision.
4. Cross-fostering has broader acceptance among the impacted public than initial releases of adults or packs of wolves from captivity.

Less Favorable Attributes of Action 1:

1. Cross-fostering requires significant disturbance of the targeted wild pack(s) dens, and usually result in packs moving pups to another location. However, data from red wolves and Mexican wolves indicate that den movement has minimal impact on survival of the pups.
2. Cross-fostering requires a series of specific events to occur simultaneously (e.g., packs den in Zones 1 or 2 in the MWEPA, both the donor and wild packs have pups within 10 days of each other, the cross-foster event occurs within the first 14 days of life, wild pack den sites are located within 10 days of whelping, it is logistically feasible to transport the donor pups to and from the wild den). Also, we cannot specify individual recipient or donor packs until the time that key information is available.

Action 2 – Prevent the Mating of Full Siblings

This action provides the option to prevent the production of pups by a full sibling pair of wild wolves; at this time, no full sibling pairs are known to exist in the wild population. If a sibling pair is documented prior to or during the January/February helicopter count and capture operations, the preferred actions are to temporarily remove the female wolf of the pair in January/February and hold the female in captivity with a captive male to breed naturally. Artificial insemination of the female may also be considered should necessary personnel be available and fresh and/or frozen semen obtainable. The female would be released back into the area it was removed from following a completed estrous cycle (~ end of March). The Mexican Wolf Recovery Program has temporarily removed breeding animals during previous helicopter surveys to treat injuries, and subsequently released the wolf back into the territory to maintain the original pairing. Pairs were maintained during this process despite the disturbance. The expectation in this action is that pack dynamics would not change with the temporary removal of the female wolf.

Although the preferred action is outlined above, several options may be used to prevent the breeding of full siblings. For instance, the female may be too difficult to capture with the helicopter. Thus, a male may be removed and translocated to as far away from the established territory as possible (e.g., from one state to another, removed to captivity or transferred to Mexico), either following a stay in captivity or immediately. Should the project fail to prevent a full sibling pair from breeding and producing pups, cross-fostering with removal of all of the wild litter will be attempted.

Favorable Attributes of Action 2:

1. The action would prevent a known mating of full siblings resulting in the production of highly inbred pups in the wild.
2. Similar to cross-fostering, this action would allow for the integration of genetically different Mexican wolves. Pups that survive two years from this action would count towards the genetic criterion in the Mexican Wolf Recovery Plan, First Revision.
3. The action would prevent a potential recommendation to maintain highly inbred wild-born pups in the captive management program.
4. The action should not alter the distribution of wolves.

Less Favorable Attributes of Action 2:

1. There is a chance the male pairs with another female or disperses while the female is being held in captivity. If this occurred, the female could be released and form a new pair with another male prior to whelping in May.
2. There is the potential that the female is released and does not form a pair and whelp pups as an individual animal. The IFT would likely need to provide supplemental feeding to assist the female in raising the pups. In addition, if the timing works, the IFT may cross-foster some of the female's litter into another wild litter. Staff from the IFT will have to be involved in expending resources to manage this scenario.
3. If the sibling pair remains together, a similar action may need to be performed to prevent the sibling mating in 2022.
4. If pups from a sibling mating are left in the wild and survive (only 0.34 are expected to live to breeding age and fewer from a first-time breeder), we can expect a negative impact on MK in the wild populations. Removal of these pups to captivity could create a burden on the captive population (e.g., pups are expected to survive in captivity for a long time but will not be bred).

Action 3 - Translocate Wolves for Management

The IFT will consider translocation onto federal land inside the MWEPA in accordance with the 2015 10(j) Rule of Mexican wolves that travel outside of the MWEPA or that are removed for other management purposes (including removal from tribal lands at a tribe's request). In some instances, the Service may evaluate the wolf or wolves' greatest potential to contribute to recovery and elect to translocate the animal(s) to Mexico, because successful establishment and growth of a second population of Mexican wolves is critical to recovery. If wolves are determined to be released in the MWEPA, the IFT will assess: (a) the specific reasons for a translocation, (b) previous behavior of the wolf or wolves, (c) the potential effects of the management action, (d) wolf distribution and breeding vacancies, and (e) the wolf or wolves potential genetic contribution to the overall recovery program prior to recommending a translocation. Most translocations under these scenarios will be single animals and can occur anywhere within Zone 1 or 2 as a hard release. The IFT will recommend the best available site based on site ranking and current wolf distribution. The IFT will follow SOP 5.1 (Translocations) for communication with permittees and local officials in association with translocation events.

Favorable and Less Favorable Attributes of Action 3:

1. These wolves are maintained inside the MWEPA population as potential breeders.
2. Translocated wolves are radio-collared and could pair with an uncollared wolf.
3. Translocated wolves may travel widely and repeat the behavior causal to the translocation (e.g. leaving the MWEPA).

Table 1. Packs that could produce pups in the wild during 2022. Other packs are likely to pair and produce pups in 2022. These packs will be fully evaluated prior to cross-fostering efforts. N/A indicates a pair that did not show evidence of denning during a particular year and thus did not have pup counts. UK indicates unknown denning date or count, but the pack did show evidence of breeding in a particular year.

Pack	State	Previous whelp dates for breeding female (2021, 2020, 2019, 2018, 2017, etc.)	Minimum no. of pups produced¹ (2021,2020, 2019, 2018, etc.)	Notes
Agua Frio	AZ	4/9/21	UK	New pair in 2021
Aldo	NM	N/A, 5/4/20	N/A, UK	AF1712 had a private trap on her foot while pregnant in 2021. The IFT captured her and removed the trap, but the subsequent den failed. F1712 was with Iron Creek Pack in 2020, pups never confirmed.
Baldy	AZ	*	*	Transboundary pack with FAIR. This pack denned in 2021.
Bear Canyon	AZ ²	4/4/21, 4/6/20	5, UK	Likely had pups in 2020, but they did not survive.
Beaver Point	NM	4/16/21	UK	2021 is the first litter for the female, waiting on pup count.
Blue Canyon	NM	4/7/2021	N/A	Den failed in 2021
Buzzard Peak	NM	4/29/21	1	2021 is the first litter for the female.
Canovas Creek	NM	N/A	N/A	New pair in 2021, did not den in 2021.
Castle Rock	AZ	4/17/21, 4/28/20	7, 5	Cross-fostered in 2021, added 3 pups. One wild pup added to pack in 2020.

Pack	State	Previous whelp dates for breeding female (2021, 2020, 2019, 2018, 2017, etc.)	Minimum no. of pups produced ¹ (2021,2020, 2019, 2018, etc.)	Notes
Centerfire	NM ²	UK	UK	It is unknown if this pack denned in 2021
Cimmaron Mesa	NM	4/22/21, 4/19/20	UK, UK	AM1950 died in 2021. First litter in 2020 failed.
Colibri	NM	4/31/21, 5/5/20, 5/6/19	UK, UK, 1	AF2565 died in 2021. Poor candidate for cross-fostering due to denning in the wilderness.
Cottonwood Canyon	NM	N/A	N/A	New pair in 2021 after denning season.
Dark Canyon	NM	5/3/21, 4/27/20, 5/27/19, 5/2/18, 4/21/17	5, 6, 2, 6, UK	Cross-fostered in 2021, added 3 pups. 2020 and 2018 successful cross-foster pack.
Eagle Creek	AZ	UK, N/A, N/A, 4/1/18	UK, N/A, N/A, UK	First-time breeders in 2018. Poor candidate for cross-fostering due to denning in a Primitive Area and lack of documented pup survival.
Elk Horn	AZ ²	4/1/21, 4/5/20, N/A, 4/6/18, 4/16/17, 4/23/16, 4/22-4/25/15	7, 6, N/A, 5, 2, 5, UK	Cross-fostered in 2021, 3 pups added. 2020, 2018, and 2016 successful cross-foster pack
Frieborn	NM	4/8/21, 3/31/20, 4/8/19, 4/7/18, 4/10/17 – 4/17/17	3, 3, 6, 6, UK	2019 successful cross-foster pack and 2018 cross-foster pack.
Hoodoo	AZ	4/12/21, 4/14/20, 4/14/19, 4/13/18, 4/15/17, 4/22/16	7, 6, 6, 3, 5, 6	Cross-foster in 2021, 3 pups added. 2020 and 2019 cross-foster pack.
Iron Creek	NM	5/1/21, 5/4/20, 4/4/28/19, 5/1/18,	UK, 6, 6, 2, 5, 4, 5, 5	2020 and 2018 cross-foster pack

Pack	State	Previous whelp dates for breeding female (2021, 2020, 2019, 2018, 2017, etc.)	Minimum no. of pups produced ¹ (2021,2020, 2019, 2018, etc.)	Notes
		5/1/17, 4/24/16, 5/2/15		
Lava	NM	4/26/2021, 4/26/20, 4/26/19, 5/1/18, 4/28/17	5, 6, 2, 5, 3	Cross-fostered in 2021, 3 pups added, 2 removed. 2018 cross-foster
Leon	NM	4/24/21, 4/27/20, N/A	4, UK, N/A	Cross-fostered in 2021, 3 pups added. 2021 den then failed. First time breeder in 2019.
Luna	NM	N/A, 4/24/20, 4/23/19, 4/20/18, 4/25/17, 4/23/16	N/A, UK, 3, 4, 4, 5	No den in 2021. This pack has had depredations prior to denning in the past. AM1158 may be past breeding age.
Mangas	NM	4/12/21, 4/4/20, 4/11/19, 4/3/18, 4/23/17	5, UK, 6, 1, 4	Similar depredation concerns as Luna
Noble Mountain	AZ	3/31/21, N/A	2, N/A	2021 was first litter for the female. They did not den in 2020.
Owl Canyon	NM ²	3/30/21, 3/26/20	6, UK	Cross-foster in 2021, 3 pups added. Den failed in 2020.
Panther Creek	AZ	4/17/21, 4/18/20, 4/17/19	3, 3, 7	Successful cross-foster pack in 2019
Pitchfork Canyon	NM	4/29/21, 5/8/20	2, 2	This pack has had depredations prior to denning in the past
Point of Rocks	NM	4/26/21, N/A	3, N/A	
Prime Canyon	AZ	4/23/21, 4/9/20, 4/6/19, 4/10/18	5, 6, 7, 6	Cross-foster pack in 2020 and 2019

Pack	State	Previous whelp dates for breeding female (2021, 2020, 2019, 2018, 2017, etc.)	Minimum no. of pups produced ¹ (2021,2020, 2019, 2018, etc.)	Notes
Rocky Prairie	AZ	4/23/21, 4/28/20, 4/26/19	4, 6, 4	Cross-foster pack in 2020.
Rose	AZ	5/7/21, N/A	UK, N/A	New pair formed after the 2020 breeding season
Saffel	AZ	4/3/21, N/A, 4/30/19, 4/17/18, 4/5/17	UK, N/A, 5, 5, 4	Cross-foster pack in 2019.
San Mateo	NM	4/19/21, 4/22/20, 4/22/19, 4/20/18, 4/24/17, 4/20/16	4, 5, 6, 6, 8, 3	Cross-fostered in 2021, 2 pups added. Successful cross-foster pack in 2017, 2019, and 2020.
SBP	NM	4/28/21, 4/28/20, 5/4/19, 4/16/18, 4/26/17	4, 1, 3, 3, 3	
Seco Creek	NM	5/1/21	6	2021 is the first litter for the female. They are on private land, and are not being considered for cross-foster operations in 2021. The AM is a cross-foster.
Sierra Blanca	AZ	N/A, N/A, 4/24/19	N/A, N/A, 4	Thought to be by herself in 2021. 2019 was the first litter for the female.
Squirrel Springs	NM	4/8/2021, 4/6/20, 4/21/19, UK	7, UK, 4, UK	
Tu Dil Hil	AZ	*	*	Dependent on White Mountain Apache Tribe's decisions/discussions.
Tsay-O-Ah	AZ	*	*	Dependent on White Mountain Apache Tribe's decisions/discussions.
Wagontongue	NM	N/A	N/A	New pair in 2021 after denning season

Pack	State	Previous whelp dates for breeding female (2021, 2020, 2019, 2018, 2017, etc.)	Minimum no. of pups produced ¹ (2021,2020, 2019, 2018, etc.)	Notes
Whiskey Creek	NM	N/A, 4/17/20	N/A, 4	First time breeder in 2020
Whitewater Canyon	NM	4/24/21, N/A, N/A	2, N/A, N/A	First time breeding female in 2019.

¹Number of pups will likely be refined during the 2021 population count. All data here-in should be considered preliminary. Final numbers will be reflected in the 2019, 2020, and 2021 Annual Reports.

²Boundary pack that occurs in both Arizona and New Mexico, but denned in the state identified in the table in 2021.

*Tribal data are considered proprietary and not displayed.

Figure 1. Mexican wolf home ranges for 2020 in Arizona and New Mexico within the Mexican Wolf Experimental Population Area (MWEPA).

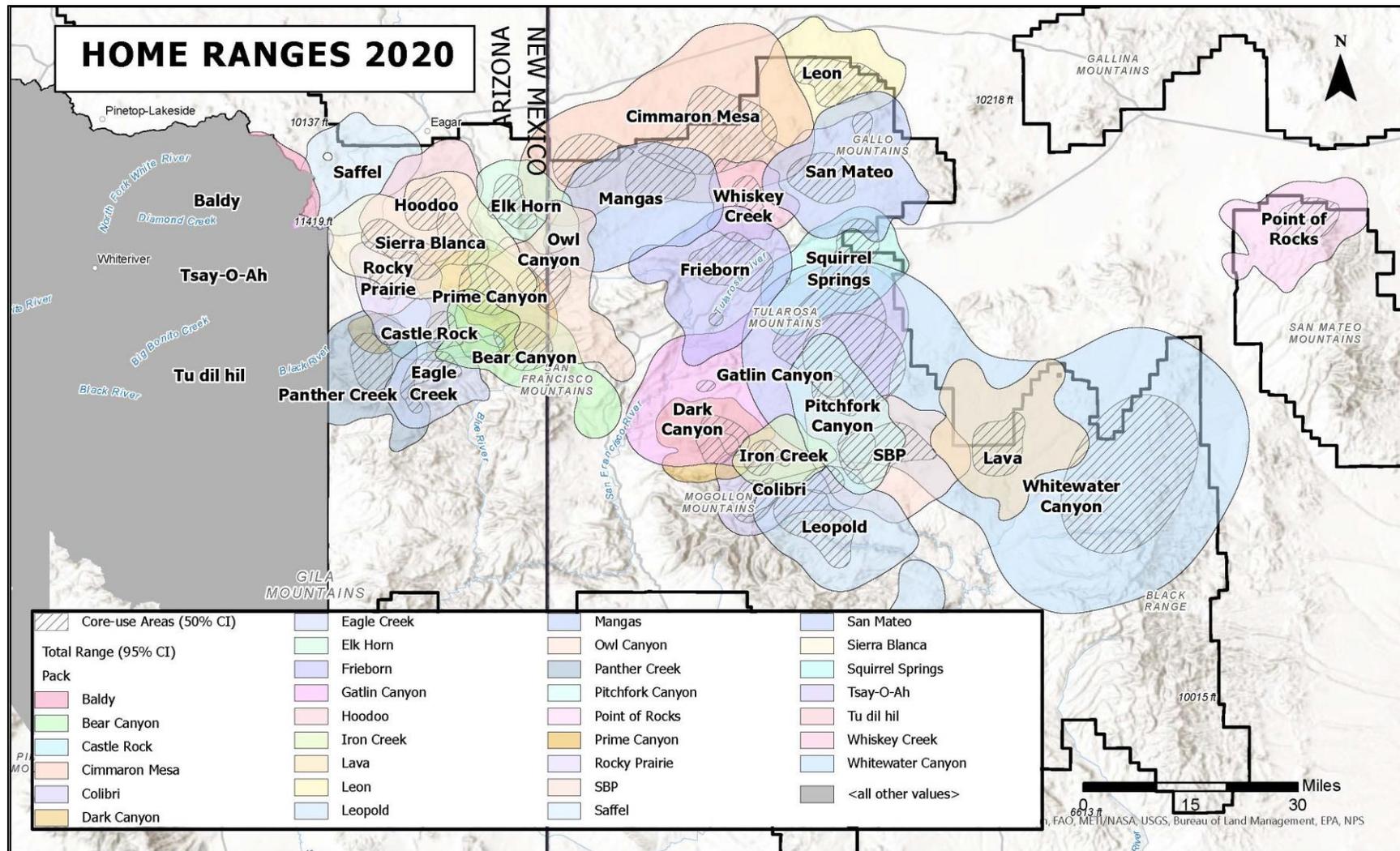


Figure 2. Mexican wolf occupied range in Arizona and New Mexico (2020) within the Mexican Wolf Experimental Population Area (MWEPA). Occupied range is determined based on documented locations of both collared and uncollared wolves, this documentation can include sign search, confirmed public sightings and trail camera work.

