

JAGUAR (5.230.2013 version)

Comment [FWS1]: Acknowledge uncertainties so that conclusion can be changed; because of uncertainty, we cannot get to the point to make the call.....

STATUS OF THE SPECIES

Legal Status

In 1972, the jaguar (*Panthera onca*) was listed as endangered (37 FR 6476; March 30, 1972) in accordance with the Endangered Species Conservation Act of 1969 (ESCA), a precursor to the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*). Under the ESCA, the Service maintained separate listings for foreign species and species native to the United States. At that time, the jaguar was believed to be extinct in the United States; thus, the jaguar was included only on the foreign species list. On July 25, 1979, the Service published a notice (44 FR 43705) stating that, through an oversight in the listing of the jaguar and six other endangered species, the United States populations of these species were not protected by the Act. The notice asserted that it was always the intent of the Service that all populations of these species, including the jaguar, deserved to be listed as endangered, whether they occurred in the United States or in foreign countries. Therefore, the notice stated that the Service intended to take action as quickly as possible to propose the U.S. populations of these species (including the jaguar) for listing. On July 25, 1980, the Service published a proposed rule (45 FR 49844) to list the jaguar and four of the other species referred to above in the United States. The proposal for listing the jaguar and three other species was withdrawn on September 17, 1982 (47 FR 41145) stating that the Act mandated withdrawal of proposed rules to list species which have not been finalized within 2 years of the proposal. On July 22, 1997, the Service published a final rule clarifying that endangered status for the jaguar extended into the United States (62 FR 39147).

Life History

The jaguar, a large member of the cat family (Felidae), is an endangered species that currently occurs from southern Arizona and New Mexico to southern South America. Jaguars are muscular cats with relatively short, massive limbs and a deep-chested body. They are cinnamon-buff in color with many black spots; melanistic (dark coloration) forms are also known, primarily from the southern part of the range.

The life history of the jaguar has been summarized by Seymour (1989, entire) and Brown and López González (2001, entire), among others. Jaguars breed year-round rangewide, but at the southern and northern ends of their range there is evidence for a spring breeding season. Gestation is about 100 days; litters range from one to four cubs (usually two). Cubs remain with their mother for nearly 2 years. Females begin sexual activity at 3 years of age, males at 4. Studies have documented few wild jaguars more than 11 years old, although a wild male jaguar in Arizona was documented to be at least 15 years of age (Johnson *et al.* 2011, p. 12), and in Jalisco, Mexico, two wild females were documented to be at least 12 and 13 (Núñez 2011, pers. comm.). The consensus of jaguar experts is that the average lifespan of the jaguar is 10 years.

Prey

The list of prey taken by jaguars throughout their range includes more than 85 species (Seymour 1989, p. 4). Known prey include, but are not limited to, collared peccaries (javelina (*Pecari tajacu*)), white-lipped peccaries (*Tayassu pecari*), capybaras (*Hydrochoerus* spp.), pacas (*Agouti paca*), agoutis (*Dasyprocta* spp.), armadillos (*Dasypus* spp.), caimans (*Caiman* spp.), turtles (*Podocnemis* spp.), white-tailed deer (*Odocoileus virginianus*), livestock, and various other reptiles, birds, and fish (sources as cited in Seymour 1989, p. 4; Núñez *et al.* 2000, pp. iii–

iv; Rosas-Rosas 2006, p. 17; Rosas-Rosas *et al.* 2008, pp. 557–558). Jaguars are considered opportunistic feeders, especially in rainforests, and their diet varies according to prey density and ease of prey capture (sources as cited in Seymour 1989, p. 4). Jaguars equally use medium- and large-size prey, with a trend toward use of larger prey as distance increases from the equator (López González and Miller 2002, p. 218). Javelina and white-tailed deer are thought to be the mainstays in the diet of jaguars in the United States and Mexico borderlands (Brown and López González 2001, p. 51).

Home Range and Movement

Like most large carnivores, jaguars have relatively large home ranges. According to Brown and López-González (2001), their home ranges are highly variable and depend on sex, topography, available prey, and population dynamics. However, little information is available on this subject outside tropical America, where several studies of jaguar ecology have been conducted. Data compiled from studies in Brazil, Venezuela, and Belize found mean home range areas for males to vary from 12.8 to 140 square kilometers (km^2) (5 to 52 square miles [mi^2]) during the wet season and 28 to 165.8 km^2 (11 to 64 mi^2) during the dry season. For females, the ranges were smaller, with less variation between seasons (Rabinowitz and Nottingham 1986, Crawshaw and Quigley 1991, Brown and López-González 2001, Cavalcanti and Gese 2009). In the tropical deciduous forest of Jalisco, Mexico, mean home range size for two males was 100.3 $\pm$ 15.0 km^2 (38.7 $\pm$ 5.8 mi^2) and four females was 42.5 $\pm$ 16 km^2 (16.4 $\pm$ 6.2 mi^2) (Núñez-Pérez 2006). Only one limited home range study using standard radio-telemetry techniques has been conducted for jaguars in northwestern Mexico. Telemetry data from one adult female tracked for four months during the dry season in the municipality of Sahuaripa, Sonora, indicated a home range size of 100 km^2 (39 mi^2) (López-González 2011, pers. comm.). Additionally, camera trap data indicated that the average male home range in the municipality of Sahuaripa, Sonora, was 84 km^2 (32 mi^2) (López-González 2011, pers. comm.). Also using camera traps, in Nacori Chico, Sonora, Rosas-Rosas and Bender (2012) estimated the home range for one adult male jaguar encompasses about 200 km^2 (77 mi^2). No home range studies have been conducted for jaguars in southwestern U.S. using standard radio-telemetry techniques; though McCain and Childs (2008), based on the use of camera-traps, report one jaguar in southeastern Arizona as having a minimum observed "range" of 1359 km^2 (525 mi^2). Because female jaguar scat was used at some camera traps at various times throughout their research, it is unknown whether or how this could have influenced the observed range of the jaguar in this study. The home ranges of borderland jaguars are presumably as large or larger than the home ranges of tropical jaguars (Brown and López González 2001, p. 60; McCain and Childs 2008, pp. 6–7), as jaguars in this area are at the northern limit of their range and the arid environment contains resources and environmental conditions that are more variable than those in the tropics (Hass 2002, as cited in McCain and Childs 2008, p. 6). Therefore, jaguars require more space in arid areas to obtain essential resources such as food, water, and cover. In coastal Jalisco, jaguars moved up to 20 km (12.4 mi) in one night and one juvenile male dispersed about 70 km (43.5 mi) to the north (Núñez et al. 2002). The mean one-day movement of radio-collared jaguars in the Pantanal region of southwestern Brazil was 2.4 $\pm$ 2.3 km (1.5 $\pm$ 1.4 mi), with that of one male being significantly larger (3.3 $\pm$ 1.8 km [2.0 $\pm$ 1.1 mi]) than that displayed by females (1.8 $\pm$ 2.5 km) (Crawshaw and Quigely 1991). Additionally, the mean distance travelled by all animals during one-day intervals in the dry season (2.7 $\pm$ 2.5 km [1.7 $\pm$ 1.5 mi]) was significantly greater than the mean one-day movement for all other months combined

(1.6 +/- 2.1 km [1.0 +/- 1.3 mi]) (Crawshaw and Quigley 1991). In Brazil, male jaguars have been documented to disperse up to 64 km (Rabinowitz and Zeller 2010).

Habitat

Jaguars are known from a variety of vegetation communities (Seymour 1989). Toward and at middle latitudes, they show a high affinity for lowland wet communities, including swampy savannas or tropical rain forests. Swank and Teer (1989) stated that jaguars prefer a warm, tropical climate, usually associated with water, and are rarely found in extensive arid areas. However, jaguars have been documented in arid areas, including thornscrub, desertscrub, lowland desert, mesquite grassland, Madrean oak woodland, and pine-oak woodland communities of northwestern Mexico and southwestern U.S. (Boydston and López-González 2005, McCain and Childs 2008, López-González and Brown 2002). The more open, dry habitat of southwestern U.S. has been characterized as marginal in terms of water, cover, and prey densities (Rabinowitz 1999). Brown and López-González (2001) report that the major habitat requirement appears to be a closed vegetative structure and that jaguars usually avoid open country like grassland or desertscrub. For this reason, jaguars rarely occur above 2,591 m (8,500 ft) (Brown and López-González 2001).

Conde et al. (2010) found significant differences in habitat use between male and female jaguars in the Mayan Forest of the Yucatan Peninsula by modeling occupancy as a function of land cover type, distance to roads, and sex. Although both male and female jaguars prefer tall forest, short forest was used by females but avoided by males. Whereas females significantly avoided roads, males did not and ventured into low-intensity cattle ranching and agriculture. Females' preference for intact forests and against roads led to a less extensive, more fragmented habitat distribution for females than for males. Conde et al. (2010) suggest that specifying sex differences increases the power of habitat models to predict landscape occupancy by large carnivores, and so greater attention should be paid to these differences in their modeling and conservation.

Other studies have also shown that jaguars selectively use large areas of relatively intact habitat away from certain forms of human influence. Zarza et al. (2007) report that towns and roads had an impact on the spatial distribution of jaguars (jaguars used more frequently than expected by chance areas located more than 6.5 km [4 mi] from human settlements and 4.5 km [2.8 mi] from roads) in the Yucatan peninsula. In the state of Mexico, Monroy-Vichis et al. (2007) report that one male jaguar occurred with greater frequency in areas relatively distant from roads and human populations. In some areas of western Mexico, however, jaguars (both sexes) have frequently been recorded near human settlements and roads (Núñez-Pérez, August 2, 2011, email to FWS.). In Marismas Nacionales, Nayarit, a jaguar den was recently located very close to an agricultural field, apparently 1 km (0.6 mi) from a small town (Núñez-Pérez, August 2, 2011, email to FWS). Jaguar presence is affected in different ways by various human activities; however, direct persecution likely has the most significant impact.

No formal habitat use studies have been conducted (with the exception of Núñez et al.'s [2002] examination of arroyo use) in the northwestern most portion of the jaguar's range. However, results of a study in the municipality of Nácori Chico, Sonora, showed that jaguar kill sites of wild prey (i.e., white-tailed deer and peccary) (Rosas-Rosas, August 6, 2011, email to FWS) and cattle were positively associated with oak forest and semi-tropical thornscrub vegetation types, whereas they were negatively associated with upland mesquite (Rosas-Rosas et al. 2010). Sites of cattle kills were also positively associated with proximity to permanent water

sources and roads (Rosas-Rosas et al. 2010). General jaguar habitat associations have been described in this region by various authors. In western Mexico, including Nayarit and Jalisco, jaguars primarily occur in tropical deciduous forest, although other formerly important habitats are the mangrove forests and swamps of the Agua Bravo and Marismas Nacionales straddling the borders of Nayarit and Sinaloa (Brown and López-González 2001). In Jalisco, oak and pine forest are used by jaguars, some of them located between 2,700 and 2,800 m (8,858 ft and 9,186 ft) in elevation (Núñez-Pérez, August 2, 2011, email to FWS). Although jaguars are not primarily associated with these vegetation communities, it is important to consider oak woodlands and pine forests as potential jaguar corridors (Núñez-Pérez, August 2, 2011, email to FWS).

Several studies have helped refine a general understanding of habitats that have been or might be used by jaguars in Arizona and New Mexico, including studies by the Sierra Institute Field Studies Program (2000), Hatten et al. (2002 and 2005), Menke and Hayes (2003), Boydston and López-González (2005), Robinson et al. (2006), McCain and Childs (2008), and Grigione et al. (2009). As Johnson et al. (2011) explain, however, any conclusions about the conservation importance of the habitat types in which jaguars have occurred or might occur in Arizona and New Mexico are preliminary and can vary widely, depending on what assumptions are factored into the analyses, such as the number and reliability of jaguar occurrence records and the significance of single “point in time” occurrence observations as predictors of habitat use by jaguars.

Hatten et al. (2005) used Geographic Information System (GIS) to characterize potential jaguar habitat in Arizona by overlaying 25 historic jaguar sightings on landscape and habitat features believed important (e.g., vegetation biomes and series, elevation, terrain ruggedness, proximity to perennial or intermittent water sources, human density). The amount of Arizona land area identified as potential jaguar habitat ranged from 21 to 30 percent, depending on the input variables. One hundred percent of jaguar records were observed in four biomes. Of these, 56 percent were observed in scrub grasslands of southeastern Arizona, 20 percent in Madrean evergreen forest, 12 percent in Rocky Mountain montane conifer forest, and 12 percent in Great Basin conifer woodland. At the vegetation series level, jaguars were observed 4.7 times more often in mixed grass-scrub than any other community. Related to water, when springs, rivers, and creeks were combined, 100 percent of the jaguar records were within 10 km (6.2 mi) of a water source. Sixty percent of jaguars were observed between 1,220 and 1,829 m (4,003 and 6,001 ft) in elevation, largely in the scrub grassland biome of southeastern Arizona. The remaining jaguar sightings were between 1,036 and 2,743 m (3,399 and 8,999 ft). With respect to topography, 92 percent of jaguar sightings occurred in intermediately rugged to extremely rugged terrain, with the remainder (8 percent) in nearly level terrain. Hatten et al. (2005) report that apparent preference of jaguars for scrub grasslands may actually reflect the use of travel corridors from the Sierra Madre Occidental of Mexico into southeastern Arizona rather than a preferred vegetation type, or perhaps jaguars were just more visible in open grasslands. They suggest that river valleys might provide travel corridors for jaguars, along with higher prey densities, cooler air, and denser vegetation than surrounding habitats. Furthermore, they suggest that perhaps the most important factor explaining jaguars’ apparent preference for rugged terrain is the abundance of water in mountainous areas of southeastern Arizona. They identified a great deal of potential jaguar habitat along the Mogollon Plateau, but hypothesize that land use practices are limiting jaguar movement into central Arizona. They report that jaguar distribution patterns in the last 40 years suggest that southeastern Arizona is the most likely area for future

jaguar occurrence in the U.S. and conservation efforts should focus on protecting potential jaguar habitat in Santa Cruz, Pima, Cochise, Pinal, and Graham counties.

Distribution, Abundance, Population Trends

The only Neotropical large carnivore with a distribution extending north into the Madrean Archipelago is the jaguar. Historically, the jaguar inhabited 21 countries throughout the Americas, from the United States south into Argentina, but currently the jaguar is found in 19 of those countries (no longer in El Salvador and Uruguay) (Caso et al. 2008). The population trend of jaguars is decreasing (Caso et al. 2008), although the rate of decline is unknown and likely highly variable throughout the jaguar range. To better understand abundance and population trends, research, inventories, and monitoring programs are being implemented in some parts of the jaguar range (Caso et al. 2008, Wildlife Conservation Society 2007, Chávez et al. 2007, Panthera 2011). During a symposium in November 2009 titled "The Jaguar in the XXI Century: The Continental Perspective", experts estimated that there are still probably more than 30,000 jaguars (Medellin 2009) and that Mexico has an estimated 4,100 jaguars (Zarza et al. 2010). Sanderson et al. (2002) found that the jaguar is known to be extant in about 8.75 million km² (3.4 million mi²), which represents 46 percent of its historical global range. Jaguars are known to be extirpated in 37 percent of their historical range, and their status in another 18 percent is unknown (Sanderson et al. 2002). The probability of long-term survival of the jaguar is considered high in 70 percent of the currently occupied range (over 6 million km² or 2.3 million mi²) (Sanderson et al. 2002). Zeller (2007) updated Sanderson et al.'s (2002) work and found that the jaguar is known to be extant in about 11.7 million km², which represents 61% of its historical range, likely reflecting simply a greater representation of knowledge rather than actual range expansion. Within the currently occupied range, 90 Jaguar Conservation Units (JCU) were identified representing a total area of 1.9 million km² (0.7 million mi²) (Zeller 2007). JCUs were defined either as 1) areas with a stable prey community, currently known or believed to contain a population of resident jaguars large enough (at least 50 breeding individuals) to be potentially self-sustaining over the next 100 years, or 2) areas containing fewer jaguars but with adequate habitat and a stable, diverse prey base, such that jaguar populations in the area could increase if threats were alleviated (Sanderson et al. 2002, Zeller 2007).

In northwestern and western Mexico, jaguars occur from the border of Colima and Jalisco north through Nayarit, Sinaloa, southwestern Chihuahua, and Sonora to the border with the U.S. Breeding populations currently occur in Jalisco, Nayarit, Sinaloa, and Sonora. The most northern recently documented breeding population of jaguars occurs in Sonora near the towns of Huasabas and Sahuaripa, about 210 km (130 mi) south of the U.S./Mexico international border (Valdez et al. 2002, Brown and López-González 2001). Since 2009, two jaguars have been documented at Rancho El Aribabi, Sonora, about 48 km (30 mi) southeast of Nogales, and one jaguar has been documented in the Sierra Los Ajos within the Reserva Forestal Nacional y Refugio de Fauna Silvestre Ajos-Bavispe, about 48 km (30 miles) south of the U.S. border near Naco, Mexico. Estimates in the Sonora and Jalisco JCUs were 50-100 and >500, respectively (Zeller 2007). Results of the Mexican National Jaguar Census (Manriquez, July 15, 2011, email to FWS) indicate there are an estimated 271 jaguars in Sonora, 211 in Sinaloa, 92 in Nayarit, and 176 in Jalisco.

In the United States, jaguars historically occurred in California, Arizona, New Mexico, Texas, and possibly Louisiana (62 FR 39147). The last jaguar sightings in California, Texas, and Louisiana were documented in the late 1800s into the early 1900s, with the last confirmed jaguar

killed in Texas in 1948 (Nowak 1975). While jaguars have been documented as far north as the Grand Canyon, Arizona, occurrences in the U.S. since 1963 have been limited to south-central Arizona and extreme southwestern New Mexico. Three records of females with cubs have been documented in the U.S. (all in Arizona), the last in 1910 (Lange 1960, Nowak 1975, Brown 1989), and no females have been confirmed in the U.S. since 1963 (Brown and López-González 2000, Johnson et al. 2011). As a result, jaguars in the U.S. are thought to be part of a population, or populations, that occur largely in Mexico.

From 1996 through 2013, several individual adult jaguars have been documented in the U.S. (i.e., within Arizona and New Mexico). One adult male was observed and photographed on March 7, 1996, in the Peloncillo Mountains in New Mexico near the Arizona border (Glenn 1996, Brown and López-González 2001). The Peloncillo Mountains run north-south to the Mexican border, where they join the foothills of the Sierra San Luis and other mountain ranges connecting to the Sierra Madre Occidental. Another jaguar was photographed in 2004; however, it could not be determined if the animal was a unique individual. Another adult male was observed and photographed on August 31, 1996, in the Baboquivari Mountains of southern Arizona (Childs 1998, Brown and López-González 2001). In February 2006, another adult male jaguar was observed and photographed in the Animas Mountains in Hidalgo County, New Mexico (McCain and Childs 2008). From 2001 to 2009, two jaguars, both adult males, were photographed (one repeatedly) using infra-red camera traps in south-central Arizona, near the Mexico border, one of which, was the male observed and photographed in 1996 in the Baboquivari Mountains. More specifically, these two jaguars were documented in three different mountain range complexes in southeastern Arizona, over an area extending from the U.S./Mexico international border north 66 km (47 mi) and 63 km (39 mi) east to west (McCain and Childs 2008). Furthermore, they were found using areas from rugged mountains at 1,577 m (5,174 ft) to flat lowland desert floor at 877 m (2,877 ft) (McCain and Childs 2008). A male jaguar was seen and photographed by a hunter in the Whetstone Mountains in 2011. Detections of jaguars as recent as March of 2013 have been documented in southern Arizona, within and near the proposed action area (see Environmental Baseline section below).

The rugged and arid conditions at the northern limit of this distribution contrast sharply to lush tropical forests to the south (Boydston and López González 2005). Importantly, populations at the edge of a species' range play a role in maintaining the total genetic diversity of a species (Jaguar Recovery Team 2012a, pp. 19–20); in some cases, these peripheral populations persist the longest as fragmentation and habitat loss impact the total range (Channell and Lomolino 2000, pp. 84–85). The United States and northwestern Mexico represent the northernmost extent of the jaguar's range, with populations persisting in distinct ecological conditions (xeric, or extremely dry, habitat) that occur nowhere else in the species' range (Sanderson *et al.* 2002, entire). Peripheral populations such as these are an important genetic resource in that they may be beneficial to the protection of evolutionary processes and the environmental systems that are likely to generate future evolutionary diversity (Lesica and Allendorf 1995, entire). This may be particularly important considering the potential threats of global climate change. Citing Young and Clarke (2000), Grigione et al. (2009) suggest that conservation of peripheral populations, such as the jaguar in the northernmost portion of its range, plays a role in maintaining the total genetic heterozygosity of a species. The ability for jaguars in the NRU to utilize physical and biological habitat features in the NMU is ecologically important to the recovery of the species; therefore, maintaining connectivity to Mexico is essential to the conservation of the jaguar.

Boydston and López-González (2005) estimated the potential geographic distribution of jaguars in the southwestern U.S. and northwestern Mexico by modeling the jaguar ecological niche from occurrence records (100 male records from Arizona [42], New Mexico [6], Chihuahua [8], and Sonora [39] and 42 female records from Arizona [6] and Sonora [36]). They report that eastern Sonora appeared capable of supporting male and female jaguars with potential range expansion into southeastern Arizona, while New Mexico and Chihuahua contained environmental characteristics primarily limited to the male niche and thus may be areas into which males occasionally disperse. They found significant differences between land cover within the female distribution and the available landscape. The predicted distribution of female jaguars was mainly across areas of shrubland, deciduous broadleaf forest, and grassland, but deciduous broadleaf forest and mixed forest composed more of the female distribution than expected by chance when compared to the available land cover for the study area. Shrubland was a smaller proportion of the female distribution than expected, and grassland and needleleaf forest were present in proportion to their availability. Boydston and López-González's (2005) results indicated that the availability of areas meeting females' environmental requirements may be an important factor limiting the distribution of northern jaguars.

Grigione et al. (2009) conducted a study to construct a blueprint of priority conservation areas for jaguars, as well as ocelots and jaguarundis, in the U.S. – Mexico border region. This was done by (1) compiling reliable (i.e., Class I) sightings for each species from the early 1900s to 2003, (2) conducting field surveys to ascertain species presence, and (3) conducting a GIS based habitat mapping workshop in which 29 scientists and conservationists provided information on the distribution and status of each species. Participants were asked to delineate and describe specific areas in the border region where historical and recent sightings of the three cats have occurred, resulting in a compilation of 84 Class I jaguar sightings from Arizona (20), New Mexico (8), and Sonora (56). They were then asked to identify important habitat areas, dispersal corridors, required or existing underpasses, and to characterize habitat areas and corridors. Finally, each participant was also asked to delineate Cat Conservation Units (units) and Cat Conservation Corridors (corridors) for their area of knowledge onto maps. Units were defined as habitat areas important to the long-term survival of a species, often where populations are currently located or areas likely to support relocated populations. Corridors were defined as strips of habitat connecting otherwise isolated units that had documented Class 1 sightings. Units and corridors were ranked into prioritization categories from very high to moderate conservation importance based on nine different factors. For the jaguar in the western bioregion of the study area (including Arizona, New Mexico, Sonora, Chihuahua, and Sinaloa), four units were identified (two very high priority, one high priority, and one low priority), including two in the U.S. and two in Mexico (totaling 102,530 km² [39,587mi²]). Within these four units, currently 19.8 percent of the area has any form of protection (Grigione et al. 2009). A very high priority corridor was identified between the two Mexican units; otherwise the connections between the units are poorly understood and consequently two corridors needing further study were identified. Two underpasses were identified as being needed in northern Sonora, where jaguars are believed to be crossing roads as they disperse north. The authors conclude that the region to the south of Arizona and New Mexico is especially critical for the recovery of the jaguar in the southwestern U.S. because the source population is likely in central Sonora. Citing Brown and López-González (2001) and List (2007), Grigione et al. (2009) explain that to reach the U.S., jaguars need to travel through Sonora and Chihuahua, where there are many challenges to jaguar survival and movement, including the U.S. –Mexico border fence. In summary, the

Sky Islands Unit was ranked as “very high priority” for a conservation area for jaguars (Grigione et al. 2009:83).

Threats

In addition to the numerous anthropogenic threats affecting jaguars, the species has a number of intrinsic biological factors that limit its recovery, including being a K-selected species (i.e., species with large body size, long life expectancy, and the production of fewer offspring, which often require extensive parental care until they mature) and having large spatial requirements. Small and isolated jaguar populations do not appear to be highly persistent (Haag et al. 2010, Rabinowitz and Zeller 2010). However, persistence of relatively small populations appears to increase with connectivity to other populations and reduction of threats within a corridor (Rabinowitz and Zeller 2010). The prospects for the jaguar being self-sustaining in the wild are favorable; however conservation of key jaguar habitats and populations is critical to this sustainability.

Illegal killing of jaguars is one of the two most significant threats to the jaguar (Medellin 2009, Chávez and Ceballos 2006, Medellín et al. 2002, Núñez et al. 2002, Nowell and Jackson 1996) and, to recover jaguars, likely requires the most immediate response (FWS 2012a). Experts from throughout the jaguar range agree that one of the most severe causes of mortality is the direct hunting of jaguars, either because jaguars have caused some conflict by killing livestock or to sell the jaguar as a trophy or its skin or teeth (Medellin 2009). This illegal and indiscriminate killing eliminates hundreds or even thousands of jaguars each year in Latin America and must be controlled to reduce the risk of extinction (Medellin 2009).

Range wide, habitat destruction and modification form ~~the other one~~ of the two most significant threats to the jaguar (Medellin 2009, Chávez and Ceballos 2006, Medellín et al. 2002, Núñez et al. 2002, Nowell and Jackson 1996). To recover jaguars, addressing this threat of habitat loss requires immediate response. The jaguar is classified as “Near Threatened” on the Red List of the International Union for the Conservation (IUCN) due to a number of factors, including habitat loss and fragmentation of populations across portions of the range (Caso et al. 2008). Various factors, particularly habitat loss, have caused a considerable reduction in the historical range of the jaguar (Sanderson et al. 2002, Zeller 2007, Rabinowitz and Zeller 2010). Most loss of occupied range has occurred in the southern U.S., northeastern Mexico, northern Brazil, and southern Argentina (Sanderson et al. 2002). Deforestation rates are high in Latin America and fragmentation of forest habitat isolates jaguar populations so that jaguars are more vulnerable to human persecution (Nowell and Jackson 1996). Medellín et al. (2002) report that loss, fragmentation, and modification of jaguar habitat have contributed to population declines throughout much of the species’ range, including northern Mexico.

Human population growth has both direct and indirect impacts on jaguar survival and mortality. For example, human growth and development tend to fragment habitat and isolate populations of jaguars and other wildlife. For carnivores in general, the impacts of high road density have been well documented and thoroughly reviewed (e.g., Noss et al. 1996, Carroll et al. 2001, as cited by Menke and Hayes 2003). Roads may have direct impacts to carnivores and carnivore habitats, including mortality caused by vehicles, disturbance, habitat fragmentation, changes in prey numbers or distribution, and provision of increased access for legal or illegal harvest (Menke and Hayes 2003, Colchero et al. 2010).

Habitat fragmentation may disrupt original patterns of gene flow and lead to drift induced differentiation among local population units and that top predators, such as the jaguar, may be particularly susceptible to this effect, given their low population densities, leading to small effective sizes in local fragments (Haag et al. 2010). Large-scale habitat removal and fragmentation of once contiguous habitat can cause the reduction of genetic diversity in jaguar populations (Haag et al. 2010). To avoid the negative demographic and genetic consequences of small population size caused by habitat fragmentation, connectivity should be restored to ensure gene flow is maintained (Haag et al. 2010). Citing a number of sources, Rabinowitz and Zeller (2010) explain that reduction or loss of genetic exchange leads to smaller effective population sizes, increased levels of genetic drift and inbreeding, and potential deleterious effects on sperm production, mating ability, female fecundity, and juvenile survival. Furthermore, they state that such effects eventually compromise adaptive potential, reduce fitness, and contribute to extinction risk for a population and, ultimately, for the species. To ensure genetic health and long-term viability of jaguars rangewide, it is critical to maintain gene flow among populations through maintaining and restoring connectivity. Corridors can provide one of the most basic requirements for species persistence—genetic exchange (Rabinowitz and Zeller 2010). Boydston and López-González (2005) suggest that range expansion to the north of eastern Sonora could help prevent genetic isolation and extinction of the northern jaguars and also increase chances for long-term survival of this species in the face of global anthropogenic changes.

Overall, the threat of human encroachment cannot be eliminated, but through conservation planning and implementation efforts, it can be reduced. Conservation of key habitat areas is critical to the recovery of jaguars. There are many opportunities and methods (i.e., creation of new reserves, incentive programs, etc.) to continue to conserve jaguar habitat; however, they will require significant international, national, and local cooperation, as well as financial support.

The jaguar is classified as “Near Threatened” on the Red List of the IUCN in part due to poaching of prey (Caso et al. 2008). According to experts across the jaguar range, hunting of the most important prey, such as peccaries and deer, is one of the primary factors negatively affecting the jaguar (Medellin 2009). An estimated 27 percent of jaguar range has a depleted wild prey base (WCS 2008 as cited by Caso et al. 2008). Illegal hunting of potential jaguar prey species is one of the main threats to long-term conservation of jaguars in northwestern Mexico (Rosas-Rosas 2006). Human population growth can put pressure on game populations that are used for human consumption. These same game populations are often prey for jaguars. Furthermore, overhunting of natural prey may cause an increase in jaguar predation on livestock and consequently increase human-jaguar conflicts, including continued negative attitudes toward jaguars and illegal killing of jaguars.

Jaguar Recovery Planning

The species has a recovery priority number of 5C, meaning that it has a low potential for recovery with a relatively high degree of conflict. Recovery for the jaguar was originally addressed in “Listed Cats of Texas and Arizona Recovery Plan (with Emphasis on the Ocelot)” (U.S. Fish and Wildlife Service 1990), but only general information and recommendations to assess jaguar status in the U.S. and Mexico, and protect and manage occupied and potential habitat in the U.S. were presented. No specific recovery recommendations or objectives for the jaguar were presented. In 2007, the USFWS made a 4(f)(1) determination that development of a formal recovery plan at this time would not promote the conservation of the jaguar. The rationale

for this determination was that for the purposes of formal recovery planning, the jaguar qualifies as an exclusively foreign species. The USFWS was subsequently litigated on this determination and the presiding judge remanded the decision regarding recovery planning back to the USFWS. Subsequently, in 2010, the USFWS made a new determination that development of a recovery plan would contribute to jaguar conservation and that, therefore the USFWS should prepare a recovery plan.

In 2012, a Recovery Outline for the jaguar (FWS 2012b) was finalized by the USFWS. The outline, prepared by the Technical Subgroup of the Jaguar Recovery Team in conjunction with the Implementation Subgroup of the Jaguar Recovery Team and the USFWS, serves as interim guidance for the USFWS to direct recovery efforts, including recovery planning, for the jaguar until a full recovery plan is developed and approved. The Recovery Team is currently developing a draft recovery plan and thus, the Recovery Outline for the Jaguar represents the best available scientific information for this consultation.

The goal for the Recovery Outline is to conserve and protect the jaguar and its habitat so that its long-term survival is secured and it can be considered for removal from the list of threatened and endangered species (delisted). Although the recovery outline does not include Recovery Criteria, the Preliminary Recovery Strategy does include eight Preliminary Recovery Objectives, which collectively describe the specific conditions under which the goals for recovery of the jaguar (i.e., delisting) will be met. These objectives are:

- 1) Assess, protect, and restore sufficient habitat to support viable populations of jaguars in the two recovery units.
- 2) Mediate or mitigate the effects of human population growth and development on jaguar survival and mortality where possible.
- 3) Reduce direct human-caused (i.e., illegal and legal killing) mortality of jaguars.
- 4) Reduce illegal hunting of jaguar prey and improve regulation of legal hunting where appropriate (i.e., in cases where hunting is leading to significant reductions of jaguar prey).
- 5) Maintain or improve genetic fitness, demographic conditions, and health of the jaguar.
- 6) Assure the long-term viability of jaguar conservation through partnerships, the development and application of incentives for landowners, application of existing regulations, and public education and outreach.
- 7) Practice adaptive management in which recovery is monitored and recovery tasks are revised by the USFWS in coordination with the Jaguar Recovery Team as new information becomes available.
- 8) Support international efforts to ascertain the status and conservation needs of the jaguar in the two recovery units.

The 2012 Recovery Outline for the Jaguar describes two recovery units for the jaguar across its range, the Northwestern (see Figure 1 below) and Pan American Recovery Units (FWS 2012a, p. 58). Recovery units are subunits of the listed species' habitat that are geographically or otherwise identifiable and essential to the recovery of the species (FWS 2012a, p. 20). Recovery units for the jaguar are further divided into core, secondary, and peripheral areas (FWS 2012a, pp. 20–23). Core areas have both persistent verified records of jaguar occurrence over time and recent evidence of reproduction. Secondary areas are those that contain jaguar habitat with either or both historical or recent records of jaguar presence with no recent record or very few records of reproduction. The Jaguar Recovery Team hypothesized that secondary areas may contribute to jaguar persistence by providing habitat to support jaguars during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident

jaguars), and as areas for cyclic expansion and contraction of the core areas (FWS 2012a). In peripheral areas, most historical jaguar records are sporadic, and there is no or minimal evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by jaguars.

Northwestern Recovery Unit (NRU)

The NRU is approximately 222,197 km² (85,791 mi²); with (32,081 km² [12,386 mi²] in the U.S. and 190,116 km² [73,404 mi²] in Mexico). The NMU lies within the NRU and is approximately 74,832 km² (28,893 mi²); with (32,081 km² [12,386 mi²] in the U.S. and 42,751 km² [16,506 mi²] in Mexico), see Figure 1. Within the U.S., jaguar habitat in the NRU primarily occurs on tribal (Tohono O'odham Nation) lands and federally and state owned lands, including those managed by the U.S. Forest Service (Coronado National Forest), Bureau of Land Management, National Park Service, USFWS, and Arizona State Land Department. The remaining non-state and non-federal lands within the NRU are privately owned.

Within Mexico, jaguar habitat within the NRU primarily occurs on privately-owned, ejido (communal), and indigenous community (i.e., Yaqui) lands. Although there are natural protected areas (ANP) designated by the Comisión Nacional de Áreas Naturales Protegidas (CONANP [National Commission for Natural Protected Areas]) within the NRU, they overlap privately-owned and communal lands. The protected status of these ANPs does not change the land ownership status but instead imposes use restrictions on the lands. At this time, at least eight Federally recognized protected areas have been established within the NRU in Mexico that provide for jaguar protection (See Conservation Assessment below for more detailed information on protected areas).

As mentioned above, the U.S. lands within the secondary area of the Northwestern Recovery Unit are also located within the Northwestern Management Unit. Management units, as described in the Recovery Outline, are areas within a recovery unit that might require different management, be managed by different entities, or encompass different populations (Jaguar Recovery Team 2012:40). The U.S. lands located within the Northwestern Management Unit simply acknowledge the existence of different species management on either side of the International Border with Mexico. This additional description of the U.S. lands as part of management unit does not mean that the habitat in United States has any less significance within the secondary area of the recovery unit.

Proposed Critical Habitat

Six units are proposed for designation as critical habitat (in the U.S only); these are considered occupied at the time listing and contain the components of the primary constituent elements in the appropriate quantity and spatial arrangement sufficient to support the life-history needs of the species. Two of these units also contain subunits considered unoccupied at the time of listing.. The six units proposed as critical habitat are: (1) Baboquivari Unit divided into subunits (1a) Baboquivari-Coyote Subunit, including the Northern Baboquivari, Saucito, Quinlan, and Coyote Mountains, and (1b) the Southern Baboquivari Subunit; (2) Atascosa Unit, including the Pajarito, Atascosa, and Tumacacori Mountains; (3) Patagonia Unit, including the Patagonia, Santa Rita, and Huachuca Mountains and the Canelo Hills; (4) Whetstone Unit, divided into subunits (4a) Whetstone Subunit, (4b) Whetstone-Santa Rita Subunit, and (4c) Whetstone-Huachuca Subunit; (5) Peloncillo Unit, including the Peloncillo Mountains both in Arizona and New Mexico; and (6) San Luis Unit, including the northern extent of the San Luis

Mountains at the New Mexico-Mexico border.

Subunit 1a: Baboquivari-Coyote Subunit

Subunit 1a consists of 35,882 ha (88,667 ac) in the northern Baboquivari, Saucito, Quinlan, and Coyote Mountains in Pima County, Arizona. This subunit is generally bounded by the Baboquivari Valley to the west, State Highway 86 to the north, the Altar Valley to the east, and Three Peaks to the south. Land ownership within the unit includes approximately 4,360 ha (10,775 ac) of Federal lands; 20,036 ha (49,511 ac) of Tohono O’odham Nation lands; 8,483 ha (20,962 ac) of Arizona State lands; and 3,003 ha (7,420 ac) of private lands. The Federal land is administered by the Service and Bureau of Land Management. We consider the Baboquivari-Coyote Subunit occupied at the time of listing (37 FR 6476; March 30, 1972) based on one photo of a jaguar in 1996, and multiple photos of this same jaguar from 2001–2009 (described in “Occupied Area at the Time of Listing,” above), and it may be currently occupied. It contains all elements of the physical or biological feature essential to the conservation of the jaguar, except for connectivity to Mexico.

The primary land uses within Subunit 1a include ranching, grazing, border-related activities, Federal land management activities, and recreational activities throughout the year, including, but not limited to, hiking, birding, horseback riding, and hunting. Special management considerations or protections needed within the unit would need to address increased human disturbances in remote locations through construction of impermeable fences and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Subunit 1b: Southern Baboquivari Subunit

Subunit 1b consists of 20,359 ha (50,308 ac) in the southern Baboquivari Mountains in Pima County, Arizona. This subunit is generally bounded by the Baboquivari Valley to the west, Three Peaks to the north, the Altar Valley to the east, and the U.S.-Mexico border to the south. Land ownership within the unit includes approximately 644 ha (1,591 ac) of Federal lands; 10,853 ha (26,818 ac) of Tohono O’odham Nation lands; 7,005 ha (17,310 ac) of Arizona State lands; and 1,857 ha (4,589 ac) of private lands. The Federal land is administered by the Service and Bureau of Land Management. The Southern Baboquivari Subunit provides connectivity to Mexico and was not occupied at the time of listing. It is essential to the conservation of the jaguar because it contributes to the species’ persistence by providing connectivity to occupied areas that support individuals during dispersal movements during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit.

The primary land uses within Subunit 1b include ranching, grazing, border-related activities, Federal land management activities, and recreational activities throughout the year, including, but not limited to, hiking, birding, horseback riding, and hunting.

Unit 2: Atascosa Unit

Unit 2 consists of 58,104 ha (143,578 ac) in the Pajarito, Atascosa, and Tumacacori Mountains in Pima and Santa Cruz Counties, Arizona. Unit 2 is generally bounded by the San Luis Mountains (Arizona) to the west, Arivaca Road to the north, Interstate 19 to the east, and the U.S.-Mexico border to the south. Land ownership within the unit includes approximately 53,335 ha (131,793 ac) of Federal lands; 2,295 ha (5,670 ac) of Arizona State lands; and 2,475 ha (6,115 ac) of private lands. The Federal land is administered by the Coronado National

Forest. We consider the Pajarito-Tumacacori Unit occupied at the time of listing (37 FR 6476; March 30, 1972) based on multiple photos of two, possibly three, jaguars from 2001–2009 (described in “Occupied Area at the Time of Listing,” above), and it may be currently occupied. It contains all elements of the physical or biological feature essential to the conservation of the jaguar.

The primary land uses within Unit 2 include Federal forest management activities, border-related activities, grazing, and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting. Special management considerations or protections needed within the unit would need to address increased human disturbances into remote locations through construction of impermeable fences and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Unit 3: Patagonia Unit

Unit 3 consists of 138,821 ha (343,033 ac) in the Patagonia, Santa Rita, and Huachuca Mountains, as well as the Canelo Hills, in Pima, Santa Cruz, and Cochise Counties, Arizona. Unit 3 is generally bounded by Interstate 19 to the west; Interstate 10 to the north; Cienega Creek, the Mustang Mountains, and Highways 90 and 92 to the east; and the U.S.-Mexico border to the south. Land ownership within the unit includes approximately 116,080 ha (286,839 ac) of Federal lands; 5,618 ha (13,883 ac) of Arizona State lands; 17,115 ha (42,291 ac) of private lands; and 8 ha (20 ac) of other lands. The Federal land is administered by the Coronado National Forest, Bureau of Land Management, and Fort Huachuca. We consider the Patagonia Unit occupied at the time of listing (37 FR 6476; March 30, 1972) based on the 1965 record from the Patagonia Mountains, and it is currently occupied based on a series of confirmed sightings from 2011 to present. The mountain ranges within this unit contain all elements of the physical or biological feature essential to the conservation of the jaguar.

The primary land uses within Unit 3 include military activities associated with Fort Huachuca, as well as Federal forest management activities, border-related activities, grazing, and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting. Special management considerations or protections needed within the unit would need to address human disturbances through such activities as military ground maneuvers and increased human presence in remote locations through mining and development activities, construction of impermeable fences, and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Subunit 4a: Whetstone Subunit

Subunit 4a consists of 24,012 ha (59,335 ac) in the Whetstone Mountains in Pima, Santa Cruz, and Cochise Counties, Arizona. Subunit 4a is generally bounded by Cienega Creek to the west, Interstate 10 to the north, Highway 90 to the east, and Highway 82 to the south. Land ownership within the subunit includes approximately 16,406 ha (40,541 ac) of Federal lands; 4,684 ha (11,575 ac) of Arizona State lands; and 2,921 ha (7,219 ac) of private lands. The Federal land is administered primarily by the Coronado National Forest. We consider the Whetstone Subunit occupied at the time of listing (37 FR 6476; March 30, 1972) based on photographs taken in 2011 (described in “Occupied Area at the Time of Listing,” above), and it may be currently occupied. The mountain range within this subunit contains all elements of the physical or biological feature essential to the conservation of the jaguar, except for connectivity

to Mexico.

The primary land uses within Subunit 4a include Federal forest management activities, grazing, and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting. Special management considerations or protections needed within the subunit would need to address increased human disturbances through development activities, and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Subunit 4b: Whetstone-Santa Rita Subunit

Subunit 4b consists of 10,686 ha (26,406 ac), including the Empire Mountains, between the Santa Rita Mountains and northern extent of the Whetstone Mountains in Pima County, Arizona. Subunit 4b is generally bounded by the Santa Rita Mountains to the west, Interstate 10 to the north, the Whetstone Mountains to the east, and Wood Canyon to the south. Land ownership within the subunit includes approximately 1,577 ha (3,897 ac) of Federal lands; 6,543 ha (16,168 ac) of Arizona State lands; and 2,566 ha (6,341 ac) of private lands. The Whetstone-Santa Rita Subunit provides connectivity from the Whetstone Mountains to Mexico and was not occupied at the time of listing. It is essential to the conservation of the jaguar because it contributes to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements during cyclical expansion and contraction from the nearest core area and breeding population in the Northwestern Recovery Unit.

The primary land uses within Subunit 4b include grazing and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting.

Subunit 4c: Whetstone-Huachuca Subunit

Subunit 4c consists of 7,995 ha (19,756 ac) between the Huachuca Mountains and southern extent of the Whetstone Mountains in Santa Cruz and Cochise Counties, Arizona. Subunit 4c is generally bounded by Highway 83 to the west, Highway 82 to the north, Highway 90 to the east, and the Huachuca Mountains to the south. Land ownership within the subunit includes approximately 1,575 ha (3,892 ac) of Federal lands; 3,009 ha (7,436 ac) of Arizona State lands; and 3,411 ha (8,428 ac) of private lands. The Federal land is administered by the Coronado National Forest, Bureau of Land Management, and Fort Huachuca. The Whetstone-Huachuca Subunit provides connectivity from the Whetstone Mountains to Mexico and was not occupied at the time of listing. It is essential to the conservation of the jaguar because it contributes to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit.

The primary land uses within Subunit 4c include military activities associated with Fort Huachuca, as well as Federal forest management activities, grazing, and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting.

Unit 5: Peloncillo Unit

Unit 5 consists of 40,290 ha (99,559 ac) in the Peloncillo Mountains in Cochise County, Arizona, and Hidalgo County, New Mexico. Unit 5 is generally bounded by the San Bernardino Valley to the west, the San Simone Valley and northern boundary of the Coronado National

Forest to the north, the Animas Valley to the east, and the U.S.-Mexico border on the south. Land ownership within the unit includes approximately 27,387 ha (67,673 ac) of Federal lands; 7,582 ha (18,736 ac) of Arizona State lands; and 5,321 ha (13,150 ac) of private lands. The Federal land is administered by the Coronado National Forest and Bureau of Land Management. We consider the Peloncillo Unit occupied at the time of listing (37 FR 6476; March 30, 1972) based on a track documented in 1995 and photographs taken in 1996 (described in “Occupied Area at the Time of Listing,” above), and it may be currently occupied. It contains all elements of the physical or biological feature essential to the conservation of the jaguar.

The primary land uses within Unit 5 include Federal forest management activities, border-related activities, grazing, and recreational activities throughout the year, including, but not limited to, hiking, camping, birding, horseback riding, picnicking, sightseeing, and hunting. Special management considerations or protections needed within the unit would need to address increased human disturbances in remote locations through construction of impermeable fences and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Unit 6: San Luis Unit

Unit 6 consists of 3,071 ha (7,590 ac) in the northern extent of the San Luis Mountains in Hidalgo County, New Mexico. Unit 6 is roughly bounded by the Animas Valley to the west, Highway 79 to the north, above approximately 1,600 m (5,249 ft) to the east, and the U.S.-Mexico border to the south. Land ownership within the unit is entirely private land. We consider the San Luis Unit occupied at the time of listing (37 FR 6476; March 30, 1972) based on photographs taken in 2006 (described in “Occupied Area at the Time of Listing,” above), and it may be currently occupied. Unit 6 contains almost all elements (PCEs 2–7) of the physical or biological features essential to the conservation of the jaguar except for PCE 1 (expansive open space). This unit is included because, while by itself it does not provide at least 84 square km (32 square mi) of jaguar habitat in the United States, additional habitat can be found immediately adjacent south of the U.S.-Mexico border, and therefore this area represents a small portion of a much larger area of habitat.

The primary land uses within Unit 6 include border-related activities, grazing, and some recreational activities throughout the year, including, but not limited to, hiking, horseback riding, and hunting. Special management considerations or protections needed within the unit would need to address increased human disturbances into remote locations through construction of impermeable fences and widening or construction of roadways, power lines, or pipelines to ensure all PCEs remain intact.

Models Used for Proposing Critical Habitat

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

The criteria used by the Service to identify critical habitat included reviewing available information and supporting data that pertained to the habitat requirements of the jaguar. Much of this information was compiled in the Recovery Outline for the Jaguar (Jaguar Recovery Team

2012, entire) and Digital Mapping in Support of Recovery Planning for the Northern Jaguar report (Sanderson and Fisher 2011:1–11), which the Service regarded as the best available information for the jaguar and its habitat needs in the northern portion of its range. Additionally, the Service relied on information provided through modeling exercises for Arizona (Hatten *et al.* 2005) and New Mexico (Menke and Hayes 2003; Robinson *et al.* 2006) to further refine the habitat features available in the United States. Other sources of information include, but are not limited to, Boydston and López González 2005, Brown and López González 2000, Brown and López González 2001, Cavalcanti 2008, Channell and Lomolino 2000, Chávez and Ceballos 2006, Colchero *et al.* 2010, Johnson *et al.* 2011, Lesica and Allendorf 1995, López González and Miller 2002, McCain and Childs 2008, Monroy-Vilchis *et al.* 2008, Núñez *et al.* 2000, Núñez *et al.* 2002, Ortega-Huerta and Medley 1999, Quigley and Crawshaw 1992, Rabinowitz 1999, Rosas-Rosas 2006, Rosas-Rosas *et al.* 2008, Rosas-Rosas *et al.* 2010, Rosas-Rosas and Bender 2012, Sanderson *et al.* 2002, Seymour 1989, Swank and Teer 1989, Taber *et al.* 2002, Zarza *et al.* 2007.

Because jaguars are secretive animals and generally tend to avoid highly disturbed areas (Quigley and Crawshaw 1992; Hatten *et al.* 2005:1025), human density was a major factor considered in jaguar habitat modeling exercises for Arizona (Hatten *et al.* 2005, p. 1025), New Mexico (Menke and Hayes 2003:9–13; Robinson *et al.* 2006, pp. 10, 15, 18–20), and the habitat model developed by Sanderson and Fisher (2011:5–11) for the northwestern Mexico and the U.S.-Mexico borderlands area. Hatten *et al.* (2005:1025) excluded areas within city boundaries, higher density rural areas visible on satellite imagery, and agricultural areas from their Arizona habitat model, as recommended by jaguar experts. All of the jaguar locations used in their model fell outside of these areas, indicating jaguars are not found in highly developed or disturbed areas.

The habitat model developed by Sanderson and Fisher (2011:5–11) included a human influence index (HII) criterion developed by the Wildlife Conservation Society (WCS) and Center for International Earth Science Information Network (CIESIN) at the Socioeconomic Data and Applications Center (SEDAC) at Columbia University (SEDAC 2012:1). Using procedures developed by Sanderson (2002, as described in SEDAC 2012:1-2), WCS and CIESIN combined scores for eight input layers (human population density per square km, railroads, major roads, navigable rivers, coastlines, stable nighttime lighting, urban polygons, and land cover) to calculate a composite HII for 1-square-km (0.4-square-mi) grid cells (pixels) worldwide. These values could range from 0 to 64, with 0 representing no human influence and 64 representing the maximum human influence possible using all 8 measures of human presence. Within the region considered for their habitat model, Sanderson and Fisher (2011, pp. 5–11) found that roughly 90 percent of the 333 jaguar records used in their model were located in areas where the HII was less than 30 out of 64. They therefore considered lands with an HII of less than 30 as potential jaguar habitat within their modeling exercise, while lands with an HII equal to or greater than 30 were excluded. Similarly, in our analysis of 130 reports of jaguar locations in the United States, we found that approximately 99 percent occurred in areas where the HII was 20 or less. Therefore, based on this information, the Service identified areas in which the HII calculated over 1-square km (0.4-square mi) is 20 or less as an essential component of the physical or biological feature essential for the conservation of the jaguar in the United States. These areas are characterized by minimal to no human population density, no major roads, or no stable nighttime lighting over any 1-square km (0.4-square mi) area.

Primary Constituent Elements for Jaguar Critical Habitat

The physical or biological feature identified for proposed critical habitat for the jaguar is expansive open spaces in the southwestern United States with adequate connectivity to Mexico that contain a sufficient native prey base and available surface water, have suitable vegetative cover and rugged topography to provide sites for resting, and have minimal human impact (USFWS 2012b). Because habitat in the United States is at the edge of the species' northern range, and is marginal compared to known habitat throughout the range, we have determined that all of the primary constituent elements discussed, below, must be present in each specific area to constitute high-quality jaguar habitat in the United States, including connectivity to Mexico (but that connectivity may be provided either through a direct connection to the border or by other areas essential for the conservation of the species; see "Areas Essential for the Conservation of Jaguars Outside of Occupied Areas," below). Based on our current knowledge of the physical or biological feature and habitat characteristics required to sustain the jaguar's vital life-history functions in the Northwestern Management Unit and the United States, the FWS determined that the primary constituent elements specific to jaguars are: Expansive open spaces in the southwestern United States of at least 84 to 100 square km (32 to 37 square mi) in size which:

- (1) Provide connectivity to Mexico;
- (2) Contain adequate levels of native prey species, including deer and javelina, as well as medium-sized prey such as coatis, skunks, raccoons, or jackrabbits;
- (3) Include surface water sources available within 20 km (12.4 mi) of each other;
- (4) Contain 3 to 40 percent canopy cover within Madrean evergreen woodland, generally recognized by a mixture of oak, juniper, and pine trees on the landscape, or semidesert grassland vegetation communities, usually characterized by *Pleuraphis mutica* (tobosagrass) or *Bouteloua eriopoda* (black grama) along with other grasses;
- (5) Are characterized by intermediately, moderately, or highly rugged terrain;
- (6) Are characterized by minimal to no human population density, no major roads, or no stable nighttime lighting over any 1-square-km (0.4-square-mi) area.

In response to a questionnaire sent to scientists with experience or expertise in jaguar ecology (primarily in the northwestern most portion of the jaguar range) or large cat ecology, participants (which included nine members of the Technical Subgroup of the Jaguar Recovery Team and two other jaguar experts) determined that high-quality habitat for jaguars in the northwestern portion (i.e., southwestern U.S. and northwestern Mexico) of their range includes the following features: (1) high abundance of native prey, particularly large prey like deer and peccary and adequate numbers of medium-sized prey; (2) water available within 10 kilometers (km) (6.2 miles (mi)) year round; (3) dense vegetative cover (to stalk and ambush prey and for denning and resting), particularly including Sinaloan thornscrub; (4) rugged topography, including canyons and ridges, and some rocky hills good for denning and resting; (5) connectivity to allow normal demographic processes to occur and maintain genetic diversity; (6) expansive areas of adequate habitat (i.e., area large enough to support 50 to 100 jaguars) with

low human density; (7) low human activity, development, and infrastructure, including low densities of high-speed roads, mines, and agriculture; and (8) no to low jaguar persecution or poaching by humans (FWS 2012a:15–16). Therefore, the Service based the PCEs within proposed critical habitat for the jaguar (i.e., the PCEs above) in the United States on the above features identified by the questionnaire participants but with modifications more applicable to areas north of the U.S.-Mexico border.

Jaguar Recovery Planning in Relation to Critical Habitat

Jaguar habitat in the U.S. – Mexico borderlands area is part of the secondary area of the Northwestern Management Unit within the Northwestern Recovery Unit for the jaguar (see Figure 1) (FWS 2012a:58). The United States portion of the Northwestern Recovery Unit is considered a secondary area that provides a recovery function benefitting the overall recovery unit (FWS 2012a:40, 42). By Jaguar Recovery Team guidelines (FWS 2012a), a secondary area for jaguars is an area meeting the following conditions: (1) compared to core areas, secondary areas are generally smaller, likely contain fewer jaguars, maintain jaguars at lower densities, and exhibit more sporadic current and historical records of jaguars; some of the secondary areas may not have not been surveyed through the use of defined survey protocols, thus resulting in the unknown current status of jaguars in some secondary areas; (2) there is no or little evidence of recent reproduction (within 10 years); and (3) quality and quantity of jaguar habitat is lower compared to core areas. Jaguar habitat is likely less optimal due to one or more or a combination of these variables important for jaguar presence, including increased human impact, smaller amount of contiguous habitat, different vegetation types, lower prey populations. As stated above, the Jaguar Recovery Team hypothesized that secondary areas may contribute to jaguar persistence by providing habitat to support jaguars during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the core areas (FWS 2012a). Because such a small portion of the jaguar's range occurs in the United States, it is anticipated that recovery of the entire species will rely primarily on actions that occur outside of the United States; activities that may adversely or beneficially affect jaguars in the United States are less likely to affect recovery than activities in core areas of their range (FWS 2012a:38).

However, specific areas within this secondary area that provide the physical and biological features essential to jaguar habitat can contribute to the species' persistence and, therefore, overall conservation by providing areas to support some individuals during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit (about 210 km (130 mi) south of the U.S.-Mexico border in Sonora near the towns of Huasabas, Sahuaripa (Brown and López González 2001:108–109), and Nacori Chico (Rosas-Rosas and Bender 2012, pp. 88–89)). Independent peer review cited in our July 22, 1997, clarifying rule (62 FR 39147, pp. 39153–39154) states that individuals dispersing into the United States are important because they occupy habitat that serves as a buffer to zones of regular reproduction and are potential colonizers of vacant range, and that, as such, areas supporting them are important to maintaining normal demographics, as well as allowing for possible range expansion. As described in the Recovery Outline for the Jaguar, the Northwestern Recovery Unit is essential for the conservation of the species; therefore, consideration of the spatial and biological dynamics that allow this unit to function and that

benefit the overall unit is prudent. Providing connectivity from the United States to Mexico is a key element to maintaining those processes

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions that are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

In the environmental baseline analysis, we discuss the current condition of the critical habitat units in the action area, the factors responsible for that condition, and the conservation roles of the units. In particular, we discuss the relationship of the affected units in the action area to the entire proposed critical habitat with respect to the conservation of the jaguar.

Action Area

The action area is defined as the area within which effects to the listed species and its critical habitat (if any is designated) are likely to occur and is not limited to the actual footprint of the proposed action. The proposed project falls within the northern-most secondary area of the NRU, or the NMU, as defined in the Jaguar Recovery Outline (FWS 2012) and at least one jaguar currently occurs near the project area. Therefore, the action area for the jaguar includes the areas directly impacted by the mine and associated activities (roads, corridors, etc.) and a 43.5 mile radius around the proposed mine (i.e., an area around the project approximately defined by the maximum documented dispersal/movement distance [70 km/43.5 mi] of a jaguar [Núñez et al. 2002]). However, because we lack detailed information encompassing the 43.5 mile radius area, for the purposes of some discussion regarding jaguar, we use the Forest Service Action Area definition (i.e., defined by hydrology).

Terrain, Vegetation Communities, and Climate in the Action Area

See **XXX** for a description of terrain, vegetation communities, and climate in the action area.

Status of the Species within the Action Area

Life History and Habitat

Life history of the jaguar is described above in the Status of the Species. Generally, life history elements are similar throughout their range, although some, such as diet and vegetation community use vary by region (see Status of the Species).

Jaguars have been documented in arid areas of northwestern Mexico and the southwestern United States, including thornscrub, desertscrub, lowland desert, mesquite grassland, Madrean oak woodland, and pine-oak woodland communities (Brown and López González 2001, pp. 43–50; Boydston and López González 2005, p. 54; McCain and Childs 2008, p. 7; Rosas-Rosas and Bender

2012, p. 88). The more open, dry habitat of the southwestern United States has been characterized as marginal habitat for jaguars in terms of water, cover, and prey densities (Rabinowitz 1999, p. 97). However, McCain and Childs (2008, p. 7) documented two male jaguars (and possibly a third) using an extensive area including habitats of the Sonoran lowland desert, Sonoran desert scrub, mesquite grassland, Madrean oak woodland, and pine-oak woodland in mountain ranges in southern Arizona.

Distribution and Abundance

Confirmed jaguar detections have recently occurred within and near the proposed action area. The detections were from trail cameras placed by resident hunters, Arizona Game and Fish Department, and researchers from the University of Arizona – jaguar survey and monitoring project funded by the U.S. Fish and Wildlife Service and Department of Homeland Security. All detections were located on lands administered by the Coronado National Forest within proposed critical habitat, captured by photographs at night, and all are suspected to be of a single male jaguar. The male jaguar photographed by a mountain lion hunter in the Whetstone Mountains (within proposed critical habitat Unit 4 – Whetstone Unit) November 19, 2011 was later detected in the Santa Rita Mountains by the trail cameras. A chronological summary of the confirmed jaguar records in Santa Rita Mountains are as follows:

- September 23, 2012: A trail camera set by a resident hunter photographed a tail of an animal that was later identified as a jaguar. Location of the camera was west of the proposed mine footprint and within proposed critical habitat Unit 3 (Patagonia Unit).
- October 25, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona, as well as by an Arizona Game and Fish remote camera. According to the Forest Service, the male jaguar was detected on seven photographs from two cameras in the vicinity of the September 23, 2012, photograph.
- November 10, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona. Two photos taken the same night in two different locations; one approximately two miles south of the September 23, 2012, photograph, and the second approximately eight miles south of the September 23, 2012 detection according to the Forest Service. Location of the photographs were within proposed critical habitat Unit 3 (Patagonia Unit).
- November 11, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona. Location of the photograph was in the vicinity of the September 23, 2012, photograph.
- December 31, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona, as well as by an Arizona Game and Fish remote camera. Six photographs were taken the same night in two different locations: in the vicinity of the September 23, 2012,

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photograph and approximately two miles south of this location. Location of the photographs were within proposed critical habitat Unit 3 (Patagonia Unit).

- January 16, 2013: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona. Location of the camera was approximately 15 miles south of the September 23, 2012, photograph and within proposed critical habitat Unit 3 (Patagonia Unit).
- May 11, 2013: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar survey conducted by University of Arizona. Location of the camera was approximately 13 miles south of the September 23, 2012, photograph and within proposed critical habitat Unit 3 (Patagonia Unit).

Results by jaguar experts of the comparison of rosette patterns of the photographs suggest that the detections listed above are from the same male jaguar. The Forest Service hypothesizes that a single resident male jaguar has established a territory that includes most of the Santa Rita Mountains (which includes the proposed action area) and possibly the Whetstone Mountains as well (from 2/8/2013 supplemental BA). To move between the Whetstone and Santa Rita mountains, the male jaguar would have had to cross a two-lane highway, possibly highway State Route 83, although its exact movement pattern is unknown.

Distribution and Abundance

Confirmed jaguar detections have recently occurred within and near the proposed action area. The detections were from trail cameras placed by resident hunters, Arizona Game and Fish Department, and researchers from the University of Arizona – jaguar and ocelot survey and monitoring project funded by the U.S. Fish and Wildlife Service and Department of Homeland Security. All detections were located on lands administered by the Coronado National Forest, captured by photographs at night, and all are suspected to be of a single male jaguar. The male jaguar photographed by a mountain lion hunter in the Whetstone Mountains (within proposed critical habitat Unit 4 – Whetstone Unit) November 19, 2011 was later detected in the Santa Rita Mountains by the trail cameras. One of the detections was from a trail camera located near the perimeter fence of the proposed mine. A chronological summary of the confirmed jaguar records in Santa Rita Mountains are as follows:

- September 23, 2012: A trail camera set by resident hunter photographed a tail of an animal that was later identified as a jaguar. Location of the camera was immediately west of and adjacent to the proposed mine foot print and within proposed critical habitat Unit 3 (Patagonia Unit).
- October 25, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona as well as by an Arizona Game and Fish remote camera. According to the Forest Service, the male jaguar was detected on seven photographs from two cameras in the vicinity of the September 23, 2012, photograph. Location of the photograph was south of the proposed mine but within proposed critical habitat Unit 3 (Patagonia Unit).

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- November 10, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona. Two photos taken the same night in two different locations; one approximately two miles south of the September 23, 2012, photograph, and the second approximately eight miles south of the September 23, 2012 detection according to the Forest Service. Location of the photographs were south of the proposed mine but within proposed critical habitat Unit 3 (Patagonia Unit).
- November 11, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona. Location of the photograph was south of the proposed mine but within proposed critical habitat Unit 3 (Patagonia Unit).
- December 31, 2012: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona. Six photographs were taken the same night in different locations. Location of the photograph was south of the proposed project but within proposed critical habitat Unit 3 (Patagonia Unit).
- January 16, 2013: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona. Location of the camera was XX miles south of the proposed project area and outside of proposed critical habitat.
- May 11, 2013: Male jaguar photographed by automatic wildlife cameras as part of a U.S. Fish and Wildlife Service/Department of Homeland Security-funded jaguar and ocelot survey conducted by University of Arizona. Location of the camera was south of the proposed mine but within proposed critical habitat Unit 3 (Patagonia Unit).

Results by jaguar experts of the comparison of rosette patterns of the photographs suggest that the detections listed above are from the same male jaguar. The Forest Service hypothesizes that a single resident male jaguar has established a territory that includes most of the Santa Rita Mountains (which includes the proposed action area) and possibly the Whetstone Mountains as well (from 2/8/2013 supplemental BA). To move between the Whetstone and Santa Rita mountains, the male jaguar would have had to cross a two-lane highway, possibly highway State Route 83, although its exact movement pattern is unknown.

Threats

Threats to the jaguar in the action area are generally similar to threats to the species throughout its range as described under “Status of the Species”; however, in the United States, the threat of illegal killing is not currently thought to be a problem (FWS 2012a). Other threats to jaguars in this region are international border issues such as 1) infrastructure along and near the U.S. - Mexico border, including pedestrian and vehicle barriers and towers and their associated roads and lighting; and 2) illegal and U.S. Border Patrol traffic (pedestrian and vehicle). Fences designed to prevent the passage of humans (i.e., pedestrian barriers) also prevent passage of

jaguars. Other infrastructure (e.g., vehicle barriers, towers, roads, and lighting) and human activity may limit jaguar movement across the border, but it is uncertain if and how much this is affecting that movement. Connectivity to Mexico is essential for maintaining jaguars in the NMU in Arizona and New Mexico.

Proposed Critical Habitat within the Action Area as Defined by the Forest Service

Current Condition of Proposed Critical Habitat - The action area as defined by the Forest Service occurs within the Patagonia Unit (Unit 3) which consists of 138,821 ha (343,033 ac) in the Patagonia, Santa Rita, and Huachuca Mountains, as well as the Canelo Hills, in Pima, Santa Cruz, and Cochise Counties, Arizona. The mountain ranges within this unit contain all elements of the physical or biological feature essential to the conservation of the jaguar.

A portion of the project is also located in the Whetstone-Santa Rita Unit (Subunit 4b) which consists of 10,686 ha (26,406 ac) between the Santa Rita Mountains and northern extent of the Whetstone Mountains in Pima County, Arizona. The Whetstone-Santa Rita Subunit provides connectivity from the Whetstone Mountains to Mexico and was not occupied at the time of listing. It is essential to the conservation of the jaguar because it contributes to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements and during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit.

Factors Responsible for the Current Condition of Proposed Critical Habitat -

The Patagonia Unit was proposed as critical habitat because areas such as the Santa Rita Mountains contain the biological and physical feature essential to the conservation of the jaguar (i.e., contains all PCEs). In the jaguar habitat model developed for northwestern Mexico and the U.S.-Mexico borderlands area, Sanderson and Fisher (2011:11) described how low human influence is perhaps the most important feature defining jaguar habitat, as jaguars most often avoid areas with too much human pressure. The Santa Rita Mountains, where the proposed project is located, was identified by the model as having HII values between 14 and 18. As stated above, an HII value of 20 or less was the parameter identified as an essential component of the physical or biological feature essential for the conservation of the jaguar in the United States.

According to the proposed rule, connectivity between areas of habitat for the jaguar in the United States is necessary if viable habitat for the jaguar is to be maintained (FWS 2012b). Currently connectivity exists between the Santa Rita Mountains (i.e., Patagonia Unit 3) and the Whetstone Mountains (Whetstone Unit 4) via subunit 4b (see Figure 2).

Conservation Role of the Proposed Critical Habitat Units - To define the physical and biological feature required for jaguar habitat in the United States, the FWS relied on studies conducted in Mexico as close to the U.S.-Mexico border as available. Many of these studies have been compiled and summarized by the Jaguar Recovery Team in the Recovery Outline for the Jaguar (FWS 2012a) and Digital Mapping in Support of Recovery Planning for the Northern Jaguar report (Sanderson and Fisher 2011:1–11). These documents describe the entire Northwestern Recovery Unit and Northwestern Management Unit of the jaguar including areas of Sonora, Chihuahua, Sinaloa, Nayarit, and Jalisco, Mexico, and south-central and southeastern Arizona and southeastern New Mexico in the United States (FWS 2012a:20–24). When U.S.-specific data became available, the FWS attempted to narrow the focus of our analysis to

information within the United States to determine the physical and biological feature currently present that provide jaguar habitat north of the border.

The FWS considers the Patagonia Unit 3 to have been occupied at the time of listing based on the 1965 record from the Patagonia Mountains. The Patagonia Unit is currently occupied based on the series of recent jaguar sightings in the Whetstone and Santa Rita Mountains (see above). The mountain ranges within this unit contain all elements of the physical and biological feature essential to the conservation of the jaguar. The Whetstone-Santa Rita Subunit 4b provides connectivity from the Whetstone Mountains to Mexico and was not occupied at the time of listing, but is essential to the conservation of the jaguar because it contributes to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit. Connectivity between areas of habitat for the jaguar in the United States was referenced as necessary in the proposed rule if viable habitat for the jaguar is to be maintained. This is particularly true in the mountainous areas of Arizona and New Mexico, where isolated mountain ranges providing the physical and biological feature of jaguar habitat are separated by valley bottoms that may not possess the features described in the proposed rule. Connectivity between the United States and Mexico was also referenced throughout the proposed critical habitat rule as essential for the conservation of jaguars.

Jaguar habitat and the features essential to their conservation are threatened by the direct and indirect effects of increasing human influence into remote, rugged areas, as well as projects and activities that sever connectivity to Mexico. These may include, but are not limited to: significant increases in border-related activities, both legal and illegal; widening or construction of roadways, power lines, or pipelines; construction or expansion of human developments; mineral extraction and mining operations; military activities in remote locations; and human disturbance related to increased activities in or access to remote areas.

Past and Ongoing Federal Actions in the Action Area

See **XXX** for a discussion of past and ongoing Federal actions in the action area. Three projects have undergone formal section 7 consultation for effects to jaguar in southern Arizona. Incidental take of one jaguar has been authorized and no jeopardy opinions have been issued. A summary of these consultations is below:

1) Biological Opinion on Nationwide U.S. Department of Agriculture, Animal and Plant Health Inspection Service-Wildlife Services (USDA, APHIS-WS) Activities on the endangered Jaguar (Consultation Number 000194RO issued on June 22, 1999)

This consultation analyzed the effects of USDA, APHIS-WS' national animal damage control activities on jaguars. Adverse effects to jaguars could occur from certain animal damage control methods, including the use of leg-hold and box traps, snares, M-44s, etc. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and anticipated that, due to animal damage control activities, there would be an undeterminable level of take as a result of harassment and injury, and the take of one jaguar as the result of direct injury or mortality. The anticipated level of take was considered to be exceeded if animal damage control activities are directed at jaguars, or if one jaguar is unintentionally trapped, injured, or killed. To

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minimize incidental take, a number of reasonable and prudent measures were included in the biological opinion. To date, no incidental take has been documented resulting from WS' program.

2) Biological Opinion on the Pedestrian Fence Proposed Along the U.S. and Mexico Border near Sasabe, Naco, and Douglas (Consultation number 22410-2007-F-0416 issued August 29, 2007)

This consultation addressed the effects of DHS's construction of a pedestrian fence (and other associated activities such as road construction and maintenance) along the U.S./Mexico international border near Sasabe, Pima County; Nogales, Santa Cruz County; and near Naco and Douglas, Cochise County. Some pedestrian fence segments that were constructed in these three areas were included in this consultation, while others did not undergo section 7 consultation. Specifically, pedestrian fence segments were constructed in Sasabe (7 mi, all of which were included in this consultation), Nogales (about 6 mi, roughly 2 of which were included in this consultation), Naco (about 25 mi, 15 of which were in this consultation), and Douglas (about 17 mi, 7 of which were included in this consultation). Adverse effects to jaguars were expected to occur from the proposed action by impeding jaguar movement between Mexico and the U.S., disturbing jaguars, and degrading their habitat. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and no incidental take was anticipated. Conservation measures, including funding for the implementation of jaguar recovery actions, were included to offset the effects of the action on jaguars.

3) Biological Opinion on Secure Border Initiative (SBInet) Tucson West Tower Project, Ajo, Tucson, Casa Grande, Nogales, and Sonoita Stations Area of Operation, U.S. Border Patrol, Tucson Sector, Arizona (Consultation number 22410-2008-F-0373 issued September 4, 2008)

This consultation addressed the effects of the construction, operation, and maintenance of communication and sensor towers, road, and mobile surveillance systems, as well as the deployment of unattended ground sensors. Adverse effects to jaguars were expected to occur from the proposed action by disturbing jaguars and degrading their habitat. We determined that the proposed action was not likely to jeopardize the continued existence of jaguars and no incidental take was anticipated. Conservation measures, including funding for jaguar monitoring, were included to offset the effects of the action on jaguars.

In addition to the aforementioned activities, DHS/CBP has constructed a number of vehicle barriers and pedestrian fences in the action area that have not undergone formal consultation. Furthermore, CBP – Tucson Sector regularly conducts patrol activities within the action area that likely affect jaguar and, with the exception of patrol activities associated with the Tucson West Towers Project, have not undergone formal consultation.

Under section 10 of the ESA, which prescribes permits for scientific purposes or incidental take while carrying out lawful activities, the following has been authorized for specific approved activities of the Arizona Game and Fish Department: 1) incidental take of one jaguar in the form of mortality or harm, and 2) unlimited take in the form of harass.

EFFECTS OF THE ACTION

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR §402.02). Indirect effects occur later in time but are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR §402.02). In the effects of the action analysis, we also characterize the direct and indirect effects of the action and those of interrelated and interdependent actions on the proposed critical habitat. We describe how the primary constituent elements or habitat qualities essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit(s).

Effects of the Action on the Jaguar

The proposed project will result in degradation of jaguar habitat and disturbance to jaguars. Construction and operations of the mine, including the associated roads, will result in removal, destruction, and degradation of jaguar habitat and jaguar prey habitat and is likely to disturb jaguars, causing changes in, among other things, their habitat use and movement patterns. Conservation measures included in the project description may help offset adverse effects to jaguars to some extent.

1) Project Construction

The BA defines the project area as all areas in which any ground disturbance would take place as a result of the proposed project, including the mine pit, waste rock piles, tailings, leach-pad, access roads, utility corridors, and on-site facilities (i.e., the mine “footprint” or area within the security fence plus roads, corridors, and trails). The project area acreage, expected to result in direct impacts owing to project activities, is 5,393 acres (22 km²), which includes areas within the security fence (4,228 acres), the primary access road (226 acres), the utility line corridor (867 acres), the Sycamore connector road (26 acres), decommissioned or new forest roads (28 acres), and the rerouted Arizona National Scenic Trail (19 acres). Vegetation types within this area are Madrean evergreen woodland and semidesert grassland, both important vegetation types for jaguars in the NMU. Therefore, the project will result in the direct removal of about 5,393 acres of jaguar habitat.

Although we do not know the home range size of jaguars in Arizona, considering jaguar home ranges in Sonora range from 84 to 100 km² (20,757 to 24,710 acres), an equivalent of about 0.22 to 0.26 (one quarter) of a jaguar home range may be directly impacted (eliminated) by the project footprint assuming no overlap in home ranges. However, because jaguar home ranges most often overlap (Seymour 1989), the project footprint could impact additional jaguar home ranges. Due to loss of habitat and additional human disturbance near the project area (e.g. lights, noise, etc. - see below for further discussion), the male jaguar detected in the Santa Rita Mountains will most likely adjust its territory south due to habitat lost by the proposed project.

In addition to eliminating jaguar habitat, the project will also result in the direct removal of about 5,393 acres of jaguar prey habitat, leading to a reduced prey base for jaguars. According to AGFD (2012), the proposed project will result in the permanent loss of 14 white-tailed deer and 56 javelina, both key prey species for jaguar. This loss was calculated by

multiplying the average density of these species per square mile by the total square miles directly impacted by the project; it did not take into consideration the potential indirect impacts (future) of the project on prey species.

Outside of the security fence, a perimeter barbed-wire fence will be constructed. The perimeter fence will encompass 7,042 acres of land; however, except where specific features such as the primary or secondary access roads are located, the land between the perimeter fence and the security fence will not be disturbed. Given the influence of human and vehicular activity, noise, and lighting (see discussion below for information on effects of noise, lights, and traffic on jaguars) within the perimeter fence, we anticipate that jaguars will likely avoid most or all areas within the perimeter fence. If this is the case, then the mine will impact about 0.28 to 0.34 (one quarter to one third) of a jaguar home range, possibly more considering home range overlap.

Construction activities associated with all aspects of the project may disturb jaguars and cause them to flee and/or avoid the area. Disturbance to jaguars can result in behavioral changes, increased energetic expenditures, and interference with habitat use, including use of movement corridors. These could lead to decreased dispersal opportunities; decreased home range size; increased inter- and intra-specific competition; increased difficulty meeting energetic needs; etc. Once project construction is complete, jaguars would be excluded from the area as it will be devoid of habitat, as described above. Jaguar avoidance of the project area will force them to shift south and travel longer distances, possibly through less suitable habitat. Extra travel would require jaguars to expend additional energy and increase the potential for encounters with humans, vehicles, potential competitors (i.e., cougars and other jaguars), and other stresses.

2) Lighting

The proposed project lies within an area of community concern relative to the effects of light pollution (Monrad et al. 2012). Because the proposed project will operate around the clock, additional light pollution is of concern to astronomical interests and to the environmental community in general. Neither the existing 2006 Pima County Outdoor Lighting Code (PCOLC) nor the draft 2011 PCOLC have jurisdiction over the proposed project area; however, Rosemont Copper Company will employ an advanced light pollution mitigation plan. The plan includes the use of state of the art lighting equipment and controls to minimize environmental impact to levels below the intent of the PCOLC, including other comparable modern light pollution control standards, while simultaneously complying with the proposed project's operation safety requirements prescribed by the Mine Safety and Health Administration (MSHA). The proposed project is expected to generate approximately 10% to 15% of the amount of environmental light that, under the PCOLC, would normally be allowed by a similar commercial development of the same scale in the same location using conventional lighting systems on a similarly sized parcel (Monrad et al. 2012).

The lumen is the International System of Unit of luminous flux and a measure of the total amount of visible light. The proposed project is expected to produce approximately 5.2 million lumens, which takes into account all lighting sources, including equipment-mounted lighting systems. The sky glow at the mine source will be about as bright as a town the size of Sells or Ajo, Arizona with a population of roughly 2,300 people (i.e., the closest city that would be comparable to lighting from the proposed project) (Westland Resources, Inc 2012:5). Measures were developed that will minimize the amount of light illumination associated with the proposed project (see Monrad 2012). The light intensity will be highest at the mine and attenuate farther

from the mine. Most areas within a 12-mile radius will be blocked from line of sight horizontal light emanating from the project area; however, jaguars are mobile animals that will travel over hills and ridgetops, and therefore would likely see the lighting (horizontal) during regular movement activities or during dispersal. Additionally, sky glow will likely be visible to jaguars in the vicinity of the mine at all times of night. Horizontal light from mine operations extending 12 miles beyond the project was evaluated by Westland Resources (2012). Westland Resources (2012) converted lumen values to lux (lumens/m²) for the 12-mile radius analyses. The lux is the unit of illuminance and luminous emittance, measuring luminous flux per unit area. Results of the simulations showed areas within the perimeter fence north of the open pit were > 0.3 lux, equivalent to brighter than full moon (Westland Resources 2012: Figure 4). The Service calculated a lux value of 0.74 lux using an online calculator and a value of 5.2 million lumens at a 750 meter radius from the pit (see <http://www.rapidtables.com/calc/light/lumen-to-lux-calculator.htm>) which was roughly a similar value to that of the Westland Resource analyses.

Although we considered the Westland Resources (2012) report, we disagree with their statement that the results of the simulations indicate that areas surrounding the proposed project will be largely unaffected by light from lighting sources associated with the proposed project. ~~Specifically, we~~ We are concerned ~~primarily~~ with the length of time (i.e., 20 years ~~plus~~) that the area will be exposed to artificial light, ~~including that~~ -equivalent to “a brighter than full moon.” Artificial illumination will increase light levels at night, which could impact jaguars, resulting in a wide variety of effects, including, but not limited to, changes in behavior, habitat use, and movement patterns; disruption of dispersal movements, corridor use, and biological clocks; and increased deaths in collision on roads (Beir 1995, Longcore and Rich 2004, Beier 2006). According to the DEIS, nocturnal animals may be adversely affected by the light glow in night skies (USDA 2012:5). The effect of human disturbance and artificial night lighting on large felids has been documented by several studies. Beier (1995) for example found dispersing pumas (*Puma concolor*) avoided night-lights in conjunction with open terrain, ~~speculating~~ suggesting that pumas were moving away from ~~the city lights and~~ urban glow and navigating toward the darkest horizon. Ngopresert et al.’s (2007) regression model showed that leopard (*Panthera parus*) habitat use increased with distance from human settlements. Harmsen et al. (2010) found at locations associated with armadillos, jaguar activity declined with brighter illumination perhaps indicating a shift to alternative prey during full moon when armadillos avoided foraging above ground. In addition, a manual on the problem of depredation caused by jaguars and puma on cattle ranches states that the installation of lights in livestock corrals is a useful measure to deter jaguars from killing livestock (Hoogesteijn 2010). Although lighting intensity in a corral may be different than the lighting produced by the proposed action, the above studies document the avoidance of lighted areas by large felids.

Artificial lights will be persistent at night for 20 years of operation plus a period of reclamation and closure. In addition to the ~~possible~~ lighting from the proposed action, the active mine known as ~~Imery’s Imerys~~ Quarry will also contribute to nighttime lighting (see Figures 2 and 3). ~~Imery’s Imerys~~ Quarry was not included in Westland Resource’s (2012) analyses. Although the exact effect of artificial lighting on jaguars is not known, since they are extremely secretive and generally avoid human disturbed areas, we anticipate that the jaguar will avoid areas wherever horizontal light and possibly sky glow from the mine is visible. It is difficult to understand how sky glow may be perceived by jaguars, but because it is not shining down from above, it may not have the same effect as bright moon conditions. Sky glow may increase the

ambient illumination in the area, which we anticipate may adversely affect jaguars to some degree.

In conclusion, while much of the light will be confined to the pit area and thus minimally affect jaguars, the additional escaped lighting and sky glow will likely have an impact on jaguar movements. Jaguars are likely to curtail their movements around the mine due the influence of night time lighting. If they do attempt to go through the narrower corridor between the two mines, movement will be made more difficult due to the existing topography between the proposed mine and the ~~Imery's~~Imerys mine. In areas with rugged terrain, large carnivores' (including jaguars'), travel patterns generally follow canyon bottoms and ridgelines (Beier 1995). Consistent with Beier's findings, Dickson et al. (2005) found that cougars consistently used travel paths that were less rugged than their general surroundings. This suggests that individuals consider the energetic cost of alternative paths; hunting or traveling individuals minimize energetic expense by frequenting landscape features that cost the least. The canyon bottoms and ridgelines in the aforementioned constricted corridor between the proposed mine and ~~Imery's~~Imerys mine generally run north-south, meaning that if a jaguar attempted to move through the corridor it would have to travel perpendicular to its normal travel patterns (i.e., up and down slope faces instead of via canyon bottoms and ridgelines). This travel pattern would result in increased energetic cost to jaguars. Jaguars will not likely attempt to move around the mine to the south, because it contains less suitable habitat.

3) Noise and Vibrations

There will be increased noise associated with the proposed project due to construction noise, intermittent machinery noise, traffic, and blasting. As discussed in the description of the proposed action, blasting would will be required prior to excavation of the ore and waste rock, conducted daily, and limited to daylight hours. Blasting would will typically occur once a day with an ammonium nitrate and fuel oil explosive. All explosives management would will be done in accordance with applicable rules, regulations, and safety standards. Some noise management techniques and operational tools to minimize noise generated during mine operations have been incorporated into the project design.

The nature of anthropogenic noise is multifaceted and even more complex in terms of how it affects wildlife. Noise is typically presented in terms of decibels (dB), and for the majority of noise assessments, including the one completed for the proposed project (Tetra Tech 2008, 2009c), it is quantified in terms of dBA, which is an "A-weighted" sound level scale that more closely describes how a person perceives sound. Thus, the sound level when defined as dBA does not always transfer to wildlife since species groups have different hearing sensitivities and ranges (Pater et al. 2006). Weighting is species specific, and received sound levels depend on many factors (e.g., distance from source to receiver, source emission strength, source directivity, atmospheric attenuation, terrain, ground cover, weather, and frequency energy) (Pater et al. 2009). According to the WestLand Resources, Inc. November 9, 2012, memo, much of the maximal intermittent equipment noise associated with the project will be within the perimeter fenceline, with the exception of low noise contours (30-40 dBA) that extend to the south across Box Canyon Road (Tetra Tech 2009). Need to add USFS response- fence-line is arbitrary boundary for attenuation of maximum noise level. Noise levels (measured in dBA) associated with increased traffic volumes on SR 83 are predicted to increase, but it is not known how these will be perceived by jaguars. Increased noise levels due to traffic on the Sycamore connector road and the primary and secondary access roads, as well as possible increased traffic on Box

Canyon road were not analyzed.

Noise and vibrations from construction and operation of the mine, including blasting and vehicle noise, is anticipated to disturb jaguars, possibly causing, among other things, changes in breeding behaviors, home ranges, and habitat use, activity, and foraging patterns; increased stress response; and possibly damaged hearing if the noise is loud enough (NoiseQuest 2013; Pater et al. 2009). As stated above, jaguars selectively use large areas of relatively intact habitat away from certain forms of human influence (Zarza et al. 2007, Monroy-Vichis et al. 2007), likely to avoid human disturbance, including noise. As with lighting, the magnitude of impacts from vibration and noise are uncertain, but these impacts are expected to decrease as the distance from the mine increases.

In the same or similar manner that noise and vibrations affect jaguars, these anthropogenic disturbances may also adversely affect jaguar prey, leading to a reduced prey base for jaguars. Sawyer et al. (2006) reported mule deer were significantly more likely to select habitat away from noise producing oil and gas developments. Barber et al. (2009) document the costs of chronic noise exposure for terrestrial organisms and state that animal responses probably depend upon the intensity of perceived threats rather than on the intensity of noise. So, while the project will directly impact and result in the permanent loss of 14 white-tailed deer and 56 javelinas, we anticipate the project will result in additional impacts to prey due to noise.

4) Roads and Utility Maintenance Corridor

The detrimental effects of roads have been reported for a wide variety of large carnivores (Noss et al. 1996). Because large carnivores occur at low densities and have low reproductive rates, the effects of human disturbance are often magnified (Kerley et al. 2002). Roads are a serious threat to many large-carnivore populations because they can lead to increased mortality from vehicles strikes, disturbance, habitat fragmentation, access for legal or illegal harvest, and decreased prey numbers or changed prey distribution (Murphy 1983, Beier and Barrett 1993, Caro 1994, Menke and Hayes 2003, Colchero et al. 2010), facilitate human access, decrease prey abundance (Caro 1994), and increase mortality from vehicle strikes (Murphy 1983). The effects of roads can vary among large carnivore species and among sex and age classes within species. Female Florida panthers (*P. c. coryi*) avoid crossing roads while male Florida panthers readily cross roads, resulting in high male mortality rates from vehicle collisions (Maehr 1997). Gray wolves (*Canis lupus*) shift territorial boundaries to avoid heavily traveled roads (Thurber et al. 1994). Cougar movement is significantly constrained, but not prevented, by 2-lane paved roads, (Dickson 2005). Colchero et al. (2010) that jaguars move preferentially to undisturbed forests and that females avoid moving close to roads and to areas with even low levels of human occupation, while males also avoid roads, but to a lesser degree. According to Conde et al. (2010), female jaguars avoided roads while males appeared less likely to avoid them. Monroy-Vichis et al. (2007) report that jaguars occur with greater frequency in areas relatively distant from roads and human populations. Zarza et al. (2007) report that towns and roads have an impact on the spatial distribution of jaguars (jaguars used more frequently than expected by chance areas located more than 6.5 km from human settlements and 4.5 km from roads). Underpasses and other structures can facilitate felid movements across paved roads (Beier 1993, Beier 1995, Foster and Humphrey 1995, Gloyne and Clevenger 2001).

Vehicle strikes are a significant source of mortality for some felid populations (Beier and Barrett 1993, FWS 2010). For example, in the Santa Ana Mountain Range in Southern California, vehicle collisions are the leading cause of mortality of cougars, comprising 32% of all

deaths of radiotagged cougars and their offspring (Beier and Barrett 1993). Less is known about the level of mortality of jaguars caused by vehicle strikes; however, jaguar road kill has been documented (Jaguar road kill was referenced by Colchero et al. (2010:163). According to Conde et al. (2010), female jaguars avoided roads while males appeared less likely to avoid them, and thus are at increased risk of being hit by vehicles.

Pursuant to the Forest Service's first supplemental Biological Assessment, no major paved roads are expected to be built to accommodate the mine, but the nearby major road (State Route 83) will experience an increase in traffic, and problems associated with traffic, such as more cars, more lights, more trucks, closer distance between vehicles, and so on. Mine-related traffic on SR 83 during operations will primarily consist of trucks carrying supplies to the proposed project, trucks carrying concentrate from the proposed project, and employee traffic. A summary of mine-related truck traffic reports that 69 truck trips per day (455 per week) will occur on the SR 83 and the primary access road for the life of the project. This does not include other forms of vehicular access, such as by mine staff entering and leaving the site. Copper and molybdenum concentrate shipments would form the largest number of routine truck shipments, with approximately 50 round trips per day (356 trips per week). The largest concentrated volume of mine traffic during a 24-hour period will occur during workforce shift change which will vary between 6 a.m. to 8 a.m. and 4 p.m. to 6 p.m. In addition, there will be equipment, construction material, and mining material deliveries to the project area. Vehicular use of SR 83 associated with the proposed project is anticipated day and night. Traffic during the pre-mining phase will use SR 83 and existing Forest Road 231 to access the project area until the new primary access road is constructed. This may require an upgrade to Forest Road 231 within the existing easement, in addition to an upgrade of the entrance to SR 83.

At the intersection of SR 83 and the primary access road (see below), SR 83 will be widened and provided with additional lanes. To accommodate such increases in traffic, we anticipate additional portions of SR 83 may need to be widened. If this occurs, SR83 will further fragment jaguar habitat, lead to an increased risk of vehicle collision with jaguars, and may lead to jaguar avoidance of the area and prevent them from crossing the road. Additionally, if travelers attempt to avoid heavier traffic on SR 83, they may use Box Canyon Road as an alternative route. Increased traffic on SR 83 (regardless of widening) and possibly on Box Canyon will lead to an increased risk of jaguars being struck by vehicles. However, because jaguars in Arizona are scarce and no jaguars are known to have been struck by a vehicle in Arizona, it seems unlikely that there is great risk of vehicles striking jaguars on either road. While we are aware that male jaguars will cross roads based on the literature, increased traffic on SR 83 may also lead to increased avoidance of areas near the road and which may prevent them from crossing the road and using habitat on either side (Monroy-Vichis et al. 2007, Zarza et al. 2007, Conde et al. 2010). After mine closure and reclamation/restoration activities end, traffic on SR 83 and Box Canyon Road will likely resume to pre-mine levels. Increased vehicular traffic on these roads will also likely lead to increased collisions with jaguar prey. Rosemont will monitor road-kill weekly on SR 83, adjacent to mine site, from the northern extent of currently proposed critical habitat to Gardner Canyon Road, to assess loss of jaguar, ocelot, or jaguar prey base (white-tailed and mule deer, collared peccary/javelina, and white-nosed coati, in particular). Monitoring will begin at the commencement of mine construction and continue through the second year of mine operation, a total of four years.

The primary access road to the mine will be a newly constructed, two-lane gravel-paved road which will provide access to SR83. The primary access road from SR 83 to the perimeter

fence will be open to the public at all times. During mine operations, the primary access road between the perimeter fence and the mine will be closed to the public; however, after mine closure, it will be open to public use. Segments of the primary access road will be added to the national forest system road inventory. It appears that a portion of this road will be open to the public as a connector to the planned Sycamore Canyon secondary access road north of the perimeter fence (see description below). As stated above, A summary of mine-related truck traffic reports that 69 truck trips per day (45570 per week) will occur on the primary access road and SR 83 for the life of the project. This does not include other forms of vehicular access, such as by mine staff entering and leaving the site. Vehicular use of the primary access road (which will vary from passenger vehicles to haul trucks and heavy equipment) is anticipated day and night. The largest concentrated volume of mine traffic during a 24-hour period will occur during workforce shift change which will vary between 6 a.m. to 8 a.m. and 4 p.m. to 6 p.m. According to Rosemont, heavy vehicular use of the primary access road and SR 83 generally will not occur at night. Although we anticipate that jaguars will generally avoid the project area due to human disturbance associated with the mine, operation of this new road will increase the likelihood of vehicle collisions with jaguars. However, since jaguars in Arizona are scarce and no jaguars are known to have been struck by a vehicle in Arizona, it seems unlikely that there is great risk of vehicles striking jaguars on the primary access road. Vehicles will likely collide with potential jaguar prey; however, we do not anticipate it will have a significant impact on the jaguar prey base. After mine closure and restoration/reclamation activities end (25 plus years), the primary access road will be decommissioned, therefore eliminating the chance of vehicle collisions with jaguars and their prey. The road will fragment suitable habitat between the mine footprint and areas to the north (see Figure 1 of the BA). However, we anticipate jaguars will avoid most or all areas within the perimeter fence given the human influence between the project footprint and perimeter fence.

The utility maintenance road (or secondary access road), located within the utility corridor to serve as access to the power supply line, water supply line, and water booster pump stations, crosses through semidesert grassland northwest of the mine. The road will consist of two discrete segments: one from the processing plant site, over Lopez Pass, to a major wash on private land; and another from the supply wells near Sahuarita to the other side of the major wash, generally following the electrical transmission and water line location. A gravel road would be reconstructed from the processing plant site to Lopez Pass (NFSR 505) to serve as a maintenance road for the utility supply lines. The existing road over Lopez Pass is on NFS land and private land. While NFSR 505 is recognized within the Forest Service's road inventory, it has no public easement across private land. The rocky, hilly portion of the road would be reconstructed, and a new road would be created that will run west across private land. The second segment of the utility maintenance road will begin at the mine water supply wells near Sahuarita and follow the location of the electrical transmission and water lines. This road segment will cross land administered by the ASLD and private lands and will generally parallel Santa Rita Road. Where the water pipeline to the mine travels under Santa Rita Road, the utility maintenance road intersects the public roadway. It will be gated here to prevent unauthorized access. Vehicle traffic on this road is expected to be much lighter in comparison to that on the primary access road. Therefore, we anticipate the chance of vehicles colliding with jaguars is low. The road will be closed to the public during mine construction and operation; however, after the mine is closed, portions of the road may be reopened to the public. This could result in increased public access to jaguar habitat which could lead to somewhat increased 1) disturbance

to jaguars in the area, 2) risk of collision with jaguars, 3) habitat degradation, 4) risk of human-caused fire, and 5) risk of illegal killing of jaguars and their prey. Additionally, the public may illegally use the road during mine operations and thereby increase the risk of the five aforementioned threats to jaguars. The Forest Service has indicated that illegal off-road vehicle use has been a problem for the ~~Imery's~~Imerys mine.

The Sycamore connector road will be a new road constructed from a point on the primary access road outside the north edge of perimeter fence, to connect with NFSR 4050-0.36R-1 (which intersects NFSR 4050 about 0.3 mile farther west) (Figure A). NFSR 4050-0.36R-1 is a road that traverses the aforementioned narrowed corridor between the proposed mine and Imerys mine. The ~~Sycamore connector~~is road is needed because the proposed perimeter fence will cut off legal public access to National Forest System Roads (AFSR) in the Sycamore Canyon area, north of the project area. The Sycamore connector road will be about 12,184 feet long (2.3 miles) and impact about 26 acres. The NFSRs in Sycamore Canyon currently connect to public roads out the bottom (north) end of the canyon. However, the roads cross numerous private ownerships, and a public easement for the road does not exist. Public access from this direction into Sycamore Canyon is thereby controlled by these private landowners. While public access is sometimes granted, it cannot be guaranteed. Constructing the Sycamore Connector Road as a NFSR will continue to provide legal public access to the roads that currently exist on NFS lands in this area. Improved accessibility in this area will likely result in increased public access (both vehicular and pedestrian traffic) to jaguar habitat which may lead to ~~somewhat~~ increased 1) disturbance to jaguars in the area, 2) risk of collision with jaguars, 3) habitat degradation, 4) risk of human-caused fire, ~~and~~ 5) risk of illegal killing of jaguars and their prey, and 6) increased human presence in remote areas (i.e., roads may facilitate increased off-road vehicle and pedestrian traffic in the area). ~~Possible~~ Likely increased vehicle and pedestrian traffic and resulting human disturbance would occur in an area already highly constricted by the proposed project (i.e., between the proposed mine and ~~Imery's~~Imerys mine).

Comment [FWS2]: I will renumber the figures once we have all figures in here we want.

Disturbed ground will be susceptible to colonization by invasive nonnative plants such as buffelgrass and Lehmann lovegrass. Nonnative species may out-compete native species and the introduced grasses also carry fire better and burn hotter than the native species, which would degrade jaguar habitat.

5) Increase in Human Disturbance

As stated above, jaguars avoid areas of human activity. The project and action areas could subjectively be classified as relatively unpopulated. Northwest of the Santa Rita Mountains is a major population center (i.e., the Tucson metropolitan area). Northeast of the project area is a small community, and Sonoita is to the south. There are some inholdings of a few ranch homes on the Coronado National Forest. Overall, the action area has a low human density and contains no large communities. The major road in the vicinity is ~~State Route~~SR 83 immediately east of the project area, a paved two-lane highway between Sonoita and the Tucson metropolitan area. A certain level of recreation already exists in the area and thus, the primary adverse effect from an increase in human disturbance to the jaguar will be from the activities associated with the mine such as human presence, machinery, lighting, noise from blasting, and increased vehicles using SR 83. That said, Also, due to the construction of two access roads and a connector road, there will be an increased possibility of legal and illegal access to the area which increases the risk of threats to jaguars as described above.

In the same or similar manner that human activity affects jaguars, this anthropogenic

disturbance may also adversely affect jaguar prey, leading to a reduced prey base for jaguars. So, as stated above, while the project will directly impact and result in the permanent loss of 14 white-tailed deer and 56 javelinas, we anticipate the project will result in additional impacts to prey due to increased human disturbance and possible increased legal and illegal access to the area.

Effects of the Action on Proposed Critical Habitat

The effects of the action on each of the primary constituent elements within the proposed critical habitat are discussed below.

Physical and Biological Feature: expansive open spaces in the southwestern United States of at least 84 to 100 square kilometers (32 to 37 square miles; 20,757 to 24,710 acres)

The proposed action would impact this Physical and Biological Feature because the security fence will encircle and directly affect (permanently remove) 3,102 acres of proposed critical habitat in Unit 3 and the roads will directly affect (permanently remove) ~~478-504~~ acres within Unit 3 and 50 acres in Unit 4b (a total loss of 3,656 acres). This represents a permanent loss of 1.1% of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.4~~43~~9% of all proposed critical habitat rangewide. Outside of the security fence, a perimeter barbed-wire fence will be constructed. The perimeter fence plus roads outside the fence will impact 5,3~~4923~~ acres of land within Unit 3 and 50 acres within Unit 4b (total of 5,399 acres). This represents an impact to 1.6 % of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.64% of all proposed critical habitat rangewide. Except where specific features such as the primary or secondary access roads are located, the land between the perimeter fence and the security fence will not be disturbed. However, given the influence of human and vehicular activity, noise, and lighting (see discussion above for information on effects of noise, lights, and traffic on jaguars) within the perimeter fence, we anticipate that jaguars will likely avoid most or all areas within the perimeter fence.

The location of the proposed project in the northern portion of Patagonia Unit 3 would restrict connectivity between Patagonia Critical Habitat Unit 3 and the Whetstone-Santa Rita Subunit 4b which provides connectivity to the Whetstone Mountains and to Mexico (see Figure 5 below above). The mine (measured from the edge of the perimeter fence) would constrict the connection within proposed critical habitat between Unit 3 and Subunit 4b to a strip approximately 1.5 km (0.93 mi) in width from its present minimum width of 3.6 km (see Figure 4 below). The 1.5 km area of semidesert grassland would thus be between the existing mine (i.e., ~~Imery's~~Imerys Quarry) and the proposed action. As explained in greater detail below, a portion of this 1.5 km bottlenecked area will be impacted by noise, vibrations, ~~and~~ lights, ~~vehicle traffic, and human recreation~~ from the proposed project, making it significantly less likely that jaguars will travel through the area. Refer to figures 4, 5 and 6 in the December 7, 2012 WestLand Resources report on the potential effects of lighting from the Rosemont project for a depiction of simulated light levels within jaguar critical habitat; there is no similar depiction of simulated noise effects. Furthermore, construction and operation of the Sycamore connector road will improve public access (vehicle and pedestrian) to the 1.5 km constricted corridor. The direct (noise, lights, vibrations, dust) and indirect effects (likely increased public access and resulting increase in threats to jaguars) of this road will likely further reduce the likelihood that jaguars will travel through the narrowed corridor between the mine and critical habitat.

Additionally, the secondary access road, although not situated in the narrowest corridor, will be constructed/reconstructed across a narrowed portion of the corridor between the mine and edge of critical habitat. The effects of this road (presence and use) will likely further reduce the likelihood that jaguar will travel through the corridor between the mine and critical habitat.

If jaguar movements through the constricted corridor are curtailed due to the proposed project, as is likely based on discussions with jaguar experts and analysis of the extent of human disturbance in that area, the northern portion of Unit 3 and Subunits 4b and 4a will become unavailable to jaguars traveling from the western portion of Unit 3 (Figure 5). Specifically, within Unit 3, 14,277 acres; within subunit 4b, 26,406 acres; and within subunit 4a, 50,335 acres of proposed critical habitat would be rendered unavailable to jaguars traveling from the western portion of Unit 3; this equates to 91,018 acres or 11 percent of the total proposed critical habitat. Portions of these areas may still be available to jaguars traveling through Unit 4 c (i.e., from the east); however, jaguars traveling from this direction would likely avoid the western portion of Unit 4b and the northern portion of Unit 3 due to the influence of the mine. Importantly, if jaguars cannot move from Unit 4a via 4b to the western portion of Unit 3 and ultimately to Mexico, then the function of Unit 4b (i.e., providing connectivity from the Whetstone Mountains to Mexico) is completely lost. The effect of reduced availability of habitat in Units 3 (northern portion), 4b, and 4a relates to all the PCEs below (i.e., all the PCEs in these Units would become unavailable or less available to jaguars if jaguars cannot move through the narrowed corridor); however, this concept will not be repeated under each PCE.

PCE 1: Connectivity to Mexico

The Patagonia Unit 3, occupied at the time of listing, extends from the border with Mexico in the Patagonia Mountains, northward to the north end of the Santa Rita Mountains, just north of the project area. There is a more or less contiguous chain of rugged mountains in western Unit 3 composed of the Patagonia and Santa Rita Mountains. The Patagonia Mountains extend into Mexico. The issue of connectivity between the United States and Mexico has been highlighted as a major conservation concern for the jaguar (FWS 2012a and b). The mountain ranges within the Patagonia Unit 3 contain all elements of the physical or biological feature essential to the conservation of the jaguar. Although Whetstone-Santa Rita Subunit 4b was not occupied at the time of listing, subunit 4b is essential to the conservation of the jaguar because it provides connectivity from the Whetstone Mountains to Mexico and contributes to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit (FWS 2012b). As explained above, the proposed project will narrow Unit 3 in the north from a 3.6 km wide corridor to a 1.5 km wide corridor, considering the perimeter fence as the project boundary (Figure 4). The project will also increase disturbance (from lighting, noise, vibrations, dust, roads) making it difficult for jaguars to move through the 1.5 km wide corridor. If jaguars will not move through this corridor, they will be unable to move from the Whetstones (Unit 4a) to Mexico via subunit 4b. Thus, the proposed action would eliminate the conservation value of Whetstone-Santa Rita Subunit 4b because this unit's purpose is to provide connectivity from the Whetstone Mountains to Mexico pursuant to the proposed rule. Figure 5 below depicts the mine and proposed critical habitat units 3 and 4. Loss of connectivity, in this case between Units 4a and 3, and therefore to Mexico, can lead to decreased genetic fitness and unfavorable demographic conditions for jaguars (Haag 2010). Although connectivity from the Whetstones Mountains to Mexico will still

exist via Unit 4c, with the proposed action, 50% of the connectivity to Mexico from the Whetstones will likely be lost. At this time, we are uncertain which direction a jaguar may move to travel between the Whetstone Mountains and Mexico (i.e., via 4 b or 4c), therefore, maintaining all critical habitat that allows for this movement is extremely important to jaguar conservation.

PCE 2: Adequate levels of prey species

Deer, collared peccary (javelina), and medium-sized prey species, such as white-nosed coati, skunks, raccoon, or jackrabbits, are important prey species (USFWS 2012). The project and action areas are within the known range of all of these species, including two species of deer (White-tailed and Mule), four species of skunk (Hog-nosed, Striped, Western Spotted, and Hooded), and four species of lagomorphs (Desert Cottontail, Eastern Cottontail, Black-tailed Jackrabbit, and Antelope Jackrabbit) (Hoffmeister 1986; Reid 2006). According to AGFD (2012), the proposed project will result in the permanent loss of 14 white-tailed deer and 56 javelina, both key prey species for jaguar. This loss was calculated by multiplying the average density of these species per square mile by the total square miles directly impacted by the project; it did not take into consideration the potential indirect impacts of the project on prey species. The same types of effects described below regarding impacts of water loss on jaguars, can also affect jaguar prey species. While it is possible that some prey would continue to use habitat near the mine, prey species may avoid portions of the action area because of increased human activities, noise, and lighting. Sawyer et al. (2006) for example found that mule deer (*Odocoileus hemionus*) are significantly more likely to select habitat away from noise-producing oil and gas developments. Habitat is present for all of these species; thus the combination of permanent prey habitat destruction, ~~and~~ 20 year habitat disturbance, and water loss would significantly impact PCE 2.

PCE 3: Surface water sources within 12.4 miles (20 km) of each other

The action area is drained by ephemeral, intermittent, and perennial watercourses that flow primarily in a northeasterly direction from high-elevation ridges on the eastern flank of the Santa Rita Mountains through foothills toward larger drainages located at lower elevations on the basin floor. Four major drainages occur in the primary area of disturbance: Wasp, McCleary, Scholefield, and Barrel Canyons. Scholefield, Wasp, and McCleary Canyons drain to Barrel Canyon, which then joins Davidson Canyon approximately 4 miles to the east of the project area. Davidson Canyon wash flows northwesterly between the Empire and Santa Rita Mountains into Cienega Creek, which eventually enters Pantano Wash outside of the action area. The distance from the confluence of Barrel and Davidson Canyons to the outlet of Davidson Canyon at Cienega Creek is approximately 14 miles. Drainage from these systems eventually reaches the Santa Cruz River north of Tucson.

In the action area (as defined by the Forest Service) perennial streams are known to exist at Box Canyon, Empire Gulch, and Cienega Creek; all of these are intermittent during dry periods (early summer low flow and drought) but tend to have some pools remaining. There are several named ephemeral streams (e.g., Barrel, McCleary, Scholefield, Wasp, and Davidson Canyons), numerous constructed waters (primarily stock tanks and drinkers), and some seeps with surface water in the project and action areas.

~~Any~~All surface water would be eliminated within the footprint of the mine and thus, impacting PCE 3. As a result of groundwater drawdown after the life of the mine, the amount or volume of water within regional perennial pools could decrease, which could result in indirect effects on PCE 3. Disruption of surface water flow resulting from the capture of runoff in the pit are expected to occur along the Barrel Canyon drainage through Davidson Canyon to its confluence with Cienega Creek. Groundwater flow models were designed to simulate conditions prior to pit development, during pit dewatering, and for a 1,000-year post-closure period of groundwater level recovery and potential pit lake development (Montgomery and Associates 2010; Tetra Tech 2010c), and it was determined that groundwater level drawdown could result in the dewatering of streams, seeps, and springs, which may serve as water sources for jaguars. Uncertainties in the variables used to build the models, however, could be manifested as greater reductions of groundwater and greater impact to surface water levels (e.g., lower water level, more extensive dry reaches) and riparian vegetation than modeled. The timing and amount of groundwater drawdown at Box Canyon–Dam Structure, Ophir Gulch Well, and South Sycamore Canyon have not been modeled. These impacts could be more pronounced during periods of low flow (May and June) because even small flow reductions could cause some portions of Cienega Creek, or other aquatic areas, to stop flowing. These modeled decreases in groundwater (less than 1 foot) would occur over a long period of time but could cause changes in riparian vegetation extent or health; the reduction in stream flow could impact jaguars, which need free-standing water sources, and PCE 3. According to the Forest Service, a loss of surface water is anticipated from the project. However, how much water, where, and when is a topic of debate among Forest Hydrologists. The Forest Service has stated that no specific mitigation or conservation measures are being proposed that will offset the effects of the loss of surface water within proposed critical habitat for the jaguar. ~~(Make this section more specific and consistent with the aquatic/riparian section which has more detail).~~

PCE 4: Madrean evergreen woodland or semidesert grassland vegetation community between 3 to 40 percent canopy cover

Jaguars actually occupy a wide variety of habitats throughout their range, including tropical deciduous forests, rainforests, swamps, thornscrub, and pampas grassland (IUCN website, access date 20 September 2012). Vegetation communities used by jaguars correspond to biogeographic areas that provide for life history needs. In the NMU and much of northern Mexico, these needs are met by the Madrean evergreen woodland and semidesert grassland vegetation communities. Hence, these habitats are actually typical and necessary for jaguars in the NMU (along with other suitable vegetation communities, such as thornscrub), an area where jaguars have bred and persisted since records were kept by European settlers (and where an extensive fossil record is present) (see Brown and López González 2000, 2001; Grigione et al. 2009; Gutiérrez-González et al. in press; Hatten et al. 2003, 2005; Hoffmeister 1986; Johnson et al. 2009; McCain and Childs 2008; Rabinowitz 1999; Rosas-Rosas and Bender 2012). The three recent jaguar detection records in 2011, 2012, and 2013 were all in these habitat types.

Within the project area (as described in the BA and above) and most of the action area (as described in the BA), the vegetation community is composed of semidesert grassland and Madrean evergreen woodland. The only part of the project area not in this vegetation type is along the spine of the mountains, where some rock outcrops and talus slopes may have less than 3% cover.). The proposed action would significantly impact PCE 4 because the security fence will encircle and directly affect (permanently remove) 3,102 acres of proposed critical habitat

Unit 3 and the roads will directly affect (permanently remove) 478 acres within Unit 3 and 50 acres in Unit 4b. This represents a permanent loss of 1.1% of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.43% of all proposed critical habitat rangewide. Outside of the security fence, a perimeter barbed-wire fence will be constructed. The perimeter fence plus roads outside the fence will impact 5,323 acres of land within Unit 3 and 50 acres within Unit 4b. This represents an impact to 1.6 % of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.64% of all proposed critical habitat rangewide. Except where specific features such as the primary or secondary access roads are located, the land between the perimeter fence and the security fence will not be disturbed. However, given the influence of human and vehicular activity, noise, and lighting (see discussion above for information on effects of noise, lights, and traffic on jaguars) within the perimeter fence, we anticipate that jaguars, will likely avoid most or all areas within the perimeter fence.

As explained above, the proposed project will narrow Unit 3 in the north from a 3.6 km wide corridor to a 1.5 km wide corridor, considering the perimeter fence as the project boundary (Figure 4). The project will also increase disturbance (from lighting, noise, vibrations, dust, roads) making it difficult for jaguars to move through the 1.5 km wide corridor. If jaguars will not move through this corridor, they will be unable to move from the Whetstones to Mexico via subunit 4b. If this occurs, many additional acres of PCE 4 (Madrean evergreen woodland and semidesert grassland) would become unavailable to jaguars (see above under Physical and Biological Feature for numbers of acres lost).

PCE 5: Moderate to highly rugged terrain

Rugged topography (including canyons, ridges, and some rocky hills to provide sites for resting) is acknowledged as an important component of jaguar habitat in the northwestern-most portion of its range (Jaguar Recovery Team 2012:15–16). The habitat model for the Northern Jaguar Recovery Unit created by Sanderson and Fisher (2011:9) determined that jaguars in this area were most frequently found in intermediately, moderately, and highly rugged terrain. Specifically, they determined that approximately 70 percent of the 333 locations used in their model for the Northwestern Recovery Unit of the jaguar were found in intermediately, moderately, or highly rugged terrain. Similarly, our analysis of 130 records of jaguar locations in the United States resulted in approximately 93 percent occurring in intermediately, moderately, or highly rugged terrain. Therefore, based on this information, we identify areas of intermediately, moderately, or highly rugged terrain as an essential component of the physical or biological feature essential for the conservation of the jaguar in the United States.

The eastern edge of the mine, located on private land, is not within proposed critical habitat for jaguar. Construction and operation of the mine would completely eliminate rugged terrain within the perimeter/security fence decreasing the availability of rugged terrain in Unit 3. The security fence will encircle and directly affect (remove) 3,102 acres of proposed critical habitat in Unit 3 and the roads will directly affect (remove) 478 acres within Unit 3 and 50 acres in Unit 4b. This represents a permanent loss of 1.1% of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.43% of all proposed critical habitat rangewide.

As explained above, the proposed project will narrow Unit 3 in the north from a 3.6 km wide corridor to a 1.5 km wide corridor, considering the perimeter fence as the project boundary (Figure 4). The project will also increase disturbance (from lighting, noise, vibrations, dust, roads) making it difficult for jaguars to move through the 1.5 km wide corridor. Additionally, the topography that exists in the 1.5 km corridor does not facilitate movement through the corridor.

In areas with rugged terrain, large ~~carnivores~~felids, (including jaguars'), travel patterns generally follow canyon bottoms and ridgelines (Beier 1995). Consistent with Beier's findings, Dickson et al. (2005) found that cougars consistently used travel paths that were less rugged than their general surroundings. This suggests that individuals consider the energetic cost of alternative paths; hunting or traveling individuals minimize energetic expense by frequenting landscape features that cost the least. The canyon bottoms and ridgelines in the aforementioned 1.5 km corridor generally run north-south, meaning that if a jaguar attempted to move through the corridor it would have to travel perpendicular to its normal travel pattern (i.e., up and down slope faces instead of via canyon bottoms and ridgelines) resulting in additional energetic expenditure. If jaguars avoid movement through this narrowed corridor, they will be unable to move from the Whetstones to Mexico via subunit 4b. If this occurs, many additional acres of PCE 5 (moderate to highly rugged terrain) will become unavailable to jaguars (see above under Physical and Biological Feature for numbers of acres lost).

PCE 6: Little human influence or disturbance

This PCE was developed using research that highlights the fact that jaguars avoid areas of human activity. Artificial night lights along with noise and other human disturbance will result in a concentrated source of human activity centered on the proposed mine and extending along access roads. Specifically, this PCE includes minimal to no human population density, no major roads, and no stable nighttime lighting over any 0.4-square-mile (1-km²) area (USFWS 2012). This reflects the fact that jaguars avoid areas of human activity. The project and action areas (as described by the Forest Service in the BA) can generally be classified as relatively unpopulated. Northwest of the Santa Rita Mountains is a major population center (i.e., the Tucson metropolitan area). Northeast of the project area is a small community, and Sonoita is to the south. There are some inholdings of a few ranch homes on the Coronado National Forest. Overall, the action area has a low human density and contains no large communities. The major road in the vicinity is State Route 83 east of the project area, a paved two-lane highway between the town of Sonoita and the Tucson metropolitan area. At the south end of the action area is a maintained dirt road, Box Canyon Road. These roads are probably not a significant deterrent to movement by jaguar currently.

The proposed project is currently in an area with an HII values between 14 and 18. Although overall human influence and disturbance will increase in the project area, at this time we do not know how the HII will be affected due to the complicated way a number of variables interact to create HII. Similarly, although overall human influence and disturbance will increase within the areas between ~~Imery's~~Imerys Quarry and the proposed action, we do not know how HII will be affected. As stated above, pursuant to the proposed rule, an HII of 20 or less was an essential element of PCE 6 essential for the conservation of the jaguar in the United States.

As part of the proposed project, a primary access road, a new 2-lane ~~gravel-paved~~ road, will be constructed to provide access between SR 83 and the mine. SR 83 will be widened where it meets the primary accesses road. The primary access road will leave SR 83 along a straight section of the highway, just to the east of the northern portion of the perimeter fence. The majority of the primary access road skirts the northeastern portion of the perimeter fence. Portions of the road will be open to the public during mine operations; after the mine site is restored, other portions will be opened to the public. The physical construction of this paved road and its associated traffic will further contribute to increased human influence in the area, and possibly increased HII.

The Sycamore connector road will be a new road constructed from a point on the primary access road outside the north edge of perimeter fence, to connect with NFSR 4050-0.36R-1 (which intersects NFSR 4050 about 0.3 mile farther west). This road is needed to provide lost connectivity and public access to ~~roads the area~~ north of the proposed perimeter fence. Both the physical construction of the road, new traffic on the road, and likely increased public access ~~(vehicle and pedestrian)~~ and ~~presence-use~~ in the area north of the perimeter fence (including in the 1.5 mile constricted corridor area) will further contribute to increased human influence in the area, and possibly increased HII.

A secondary access road (utility corridor) will be constructed and will cross the area between the proposed mine and the western edge of proposed critical habitat unit 3 (see Figure 4). The road will be closed to the public during mine construction and operation; however, after the mine is closed, portions of the road may be reopened to the public. Although, for the first 20+ years the secondary access road will not be as heavily traveled as the primary access road, this road, as well as the primary access road, will contribute to increased human influence in the area, and possibly increased HII.

Additionally, the nearby SR 83 will experience an increase in traffic. To accommodate such increases in traffic, we anticipate SR 83 may need to be widened leading from the mine site north to the intersection with I-10. As part of the proposed project, SR 83 will be widened where the primary access road meets SR 83. If travelers attempt to avoid heavier traffic on SR 83, they may use Box Canyon Road as an alternative route. Increased traffic on SR 83 and possibly on Box Canyon and the possible widening of SR 83 will further contribute to increased human influence in the area, and possibly increased HII. Increased traffic on SR 83 will further limit jaguar access to the northern portion of Unit 3 via 4b.

The area in and adjacent to the project area currently is dark at night because there are few artificial light sources and no developed areas to affect night sky views or the natural light conditions and cycles that are important to native plants and animals. Although there is little other information on the current baseline light levels at night, according to the Forest Service, the majority of the action area (as defined by the Forest Service) is relatively dark on moonless nights and the lights of Tucson are blocked by the ridgeline west of the project area. Sky glow, however, is visible in the project area, caused primarily by lighting in the Tucson metropolitan area to the north, with distant sky glow caused by lighting in Nogales and Sierra Vista to the south. Background sources of lighting in the action area (as defined by the Forest Service) include headlights from vehicles traveling at night along SR 83 and along forest roads; however, there are no pole-mounted fixtures along those roadways, nor is there lighting in visitor use areas to illuminate the roads, signs, access paths and trails, or parking areas. There is also some mine exploration activity in the project area and some light from adjacent private lands. Additionally, an existing limestone quarry, operated by ~~Imery's~~ Imerys Marble Inc., is located near the town of Helvetia on the western flank of the Northern Santa Rita Mountains, just west of the proposed mine. The quarry occupies approximately 22 acres ~~and~~ Roughly twenty truckloads of materials depart the mine site each day according to XX. (Green Valley Recreation Hiking Club 2013). According to the Green Valley Recreation Hiking Club, the mine operates 24 hours a day, seven days a week; however according to the BLM, work occurs during the day time only; however lights are operated 24 hours per day. Roughly twenty truckloads of materials depart the mine site each day according to XX.

The Forest Service's February 8, 2013, supplemental BA provided substantial specifics regarding the effect of artificial night lighting on jaguar habitat; such lighting could impact

movement within and between proposed critical habitat units. These impacts include (1) high level of mine-site illumination (i.e., the project area must be bright enough for conducting mining operations, per Mine Safety and Health Administration standards); (2) sky glow at the source will be about as bright as a town the size of Sells or Ajo, Arizona; (3) horizontal light will extend to at least 12 miles beyond the project in some areas; (4) artificial lights will be persistent at night for 20 plus years; (5) sky glow and an increase in visible horizontal light in Units 3 and 4b; (6) added effects of artificial night lighting from vehicles in the project area and beyond and; (7) cumulative effects of artificial night lighting (i.e., additive light to existing sky glow and spatial fragmentation of dark areas). According to the Forest Service, the effects of artificial night lights are synergistic with other effects. Thus, artificial night lights along with noise will result in an obvious source of human activity centered on the proposed mine and extending along roads. Therefore, the amount of disturbance from the proposed action would remove PCE 6 from the project area and a portion of the action area.

The effects of human disturbance and artificial night lighting on large felids have been documented by several studies. Beier (1995) for example found dispersing pumas (*Puma concolor*) avoided night-lights in conjunction with open terrain. Ngopresert et al.'s (2007) regression model showed that leopard (*Panthera parus*) habitat use increased with distance from human settlements. Harmsen et al. (2010) found at locations associated with armadillos (jaguar prey), jaguar activity declined with brighter illumination. More importantly, a manual on the problem of depredation caused by jaguars and puma on cattle ranches states that the installation of lights in livestock corrals is a useful measure to deter jaguars from killing livestock

(Hoogesteijn 2010). Although lighting in a corral may be different than the lighting produced by the proposed action, the above studies document the avoidance of lighted areas by large felids.

The presence of a jaguar in the action area in 2012 and 2013 suggests that the amount of ambient light present was not great enough to repel the jaguar, indicating the area is currently "dark enough" for jaguars. It also suggests that the current HII is currently "low enough" for jaguars. The September 2012 camera detection of the jaguar was particularly close to the proposed mine (i.e., roughly less than 0.5 mile from the west portion of the proposed perimeter fence). This camera detection was approximately 6.4 km (4 mi) away from the existing mine

(Imery's Imerys Quarry). However, once the proposed action is in place, jaguars are likely to avoid the area between the proposed mine and the existing limestone mine because of decreased width of the corridor and increased lighting, noise, and other human disturbance associated with the proposed mine, resulting in a relatively narrow corridor with extensive human activity on either side and unfavorable topography for jaguar movement (see Figure 4). In other words, it is our opinion that the jaguar is not likely to travel between the two mines.

As explained above, if jaguar movements through this area are curtailed due to the proposed project, the northern portion of Unit 3 and Subunits 4b and 4a will become unavailable to jaguars traveling from the western portion of Unit 3 (Figure 5). Specifically, within Unit 3, 14,277 acres; within subunit 4b, 26,406 acres; and within subunit 4a, 50,335 acres of proposed critical habitat will be rendered unavailable to jaguars traveling from the western portion of Unit 3; this equates to 91,018 acres or 11 percent of the total proposed critical habitat. Portions of these areas may still be available to jaguars traveling through Unit 4 c (i.e., from the east); however, jaguars traveling from this direction will likely avoid the eastern portion of Unit 4b and the northern portion of Unit 3 due to the influence of the mine. Importantly, if jaguars cannot move from Unit 4a via 4b to the western portion of Unit 3 and ultimately to Mexico, then the

function of Unit 4b (i.e., providing connectivity from the Whetstone Mountains to Mexico) is completely lost.

Summary of Effects to PCEs

In summary, the mine's project area will remove and therefore adversely affect all PCEs (i.e., connectivity to Mexico, prey, surface water, canopy cover, rugged terrain, and human influence) in the northern portion of Unit 3 for 20+ years. Furthermore, the mine will constrict the connection within proposed critical habitat between Unit 3 and Subunit 4b to a strip approximately 1.5 km in width (its present minimum width is 3.6 km) with an active mine on either side of this narrow corridor. The effects of light, noise, vibrations, and traffic associated with construction and 24-hour operations at the mine, and likely increased public use in the area associated with construction and 24-hour operations at the mine due to roads that will be constructed as part of the proposed action will adversely affect, and functionally, further narrow, some portion of this strip of land and therefore affect PCE 1 (connectivity to Mexico), PCE 6 (minimal human disturbance) and possibly PCE 2 (adequate prey base, presuming prey species are also subject to disturbance) within it. The topography within this resulting narrowed corridor will additionally hinder jaguar movement through it. If jaguars will not move through this constricted corridor, as is anticipated (see discussion above), many additional acres of critical habitat and PCEs will become unavailable to jaguars in Units 3, 4b, and 4a. Importantly, if jaguars will not move through the constricted corridor, the role (i.e., providing connectivity to Mexico) of Unit 4b will be completely eliminated. The direct loss of critical habitat (in Units 3 and 4b) and likely indirect loss of critical habitat (in Units 3, 4b, and 4a) will appreciably reduce the conservation value of those critical habitat units for the jaguars.

Effects to the Conservation Value of Critical Habitat with the Proposed Action

Critical habitat is defined as: (1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) Essential to the conservation of the species and (b) Which may require special management considerations or protection; and (2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided under the Act are no longer necessary. Specific areas within the U.S. that provide the physical and biological features essential to jaguar habitat can contribute to the species' persistence and, therefore, overall conservation by providing areas to support some individuals during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit. As such, critical habitat was developed to allow the above functions to occur. Specifically, as explained above, critical habitat for the jaguar was defined as expansive open spaces in the southwestern United States with adequate connectivity to Mexico that contain a sufficient native prey base and available surface water, have suitable vegetative cover and rugged topography to provide sites for resting, and have minimal human impact

(USFWS 2012b). These areas are limited within the U.S. and therefore have an important conservation role for the jaguar.

Unit 3 connects with Mexico in two separate areas, through the Huachuca and Patagonia Mountains. Unit 4 contains three subunits (4a, 4b, and 4c), one of which (4a) was considered occupied at the time of listing. The Whetstone-Santa Rita Subunit (4b) and Whetstone-Huachuca Subunit (4c) are essential to the conservation of the jaguar because they provide connectivity from the Whetstone Mountains to Mexico and contribute to the species' persistence by providing connectivity to occupied areas that support individuals during dispersal movements and during cyclical expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit. Both 4b and 4c were included in critical habitat because we made no assumption about which way jaguars would move to Mexico from the Whetstones and each contained some combination of at least two PCEs. Because we cannot predict which way jaguars may move between the Whetstones and Mexico, both subunits are important to the conservation of jaguars in the NRU.

Although not discussed in the Proposed Rule for Critical Habitat (FWS 2012b), the “Three Rs”, representation, resiliency, and redundancy, are important considerations in recovery planning for listed species. As stated in our recovery planning guidance (NMFS 2010), recovery planning should address the biodiversity principles of representation, resiliency, and redundancy (Schaffer and Stein 2000). Representation involves conserving the breadth of the genetic makeup of the species to conserve its adaptive capabilities. Resiliency involves ensuring that each population is sufficiently large to withstand stochastic events. Redundancy involves ensuring a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events. Proposed critical habitat for jaguar, including the two aforementioned subunits (4b and 4c), incorporates the principles of representation and resiliency. Specifically, it addresses representation in that it provides for conservation of the northern-most jaguars within the NRU and the unique genetic diversity they may add to the species. Proposed critical habitat also addresses resiliency by providing areas to allow for the natural expansion of jaguar populations in the NRU, creating resiliency to stochastic event as these populations recover.

As described above, the mine's project area will remove and therefore adversely affect all PCEs (i.e., connectivity to Mexico, prey, surface water, canopy cover, rugged terrain, and human influence) in the northern portion of Unit 3 for 20+ years. Furthermore, the mine will constrict the connection within proposed critical habitat between Unit 3 and Subunit 4b to a strip approximately 1.5 km in width (its present minimum width is 3.6 km) with an active mine on either side of this narrow corridor. The effects of light, noise, vibrations, and traffic associated with construction and 24-hour operations at the mine, and likely increased public use in the area due to roads that will be constructed as part of the proposed action will adversely affect, and functionally, further narrow, some portion of this strip of land and therefore affect PCE 1 (connectivity to Mexico), PCE 6 (minimal human disturbance) and possibly PCE 2 (adequate prey base, presuming prey species are also subject to disturbance) within it. The topography within this resulting narrowed corridor will additionally hinder jaguar movement through it. The effects of light, noise, traffic, and likely increased public use in the area associated with construction and 24-hour operations at the mine will adversely affect, and functionally, further narrow, some portion of this strip of land and therefore affect PCE 1 (connectivity to Mexico), PCE 6 (minimal human disturbance) and possibly PCE 2 (adequate prey base, presuming prey species are also subject to disturbance) within it. If jaguars will not move through this

constricted corridor, many additional acres of critical habitat and PCEs will become unavailable to jaguars in Units 3, 4b, and 4a. Importantly, if jaguars will not move through the constricted corridor, the role (i.e., providing connectivity to Mexico) of Unit 4b will be completely eliminated. Losing the function of Unit 4b further limits the ability of critical habitat to function as intended providing areas to support some individuals during transient movements by providing patches of habitat, and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the NRU. Furthermore, the integrity of the critical habitat complex comprised of Units 3 and 4 will be weakened.

The direct loss of critical habitat (in Units 3 and 4b) and likely indirect loss of critical habitat (in Units 3, 4b, and 4a) and resulting loss of the function of Unit 4b, as well as loss of 50% of the connectivity between Unit 4a and Mexico, will reduce the conservation value of those critical habitat units for the jaguars. This likely complete loss of function of a subunit (Unit 4b) of 1/6 of all critical habitat units and partial loss of function of two additional units (Unit 3 and 4a) representing 1/3 of all units will appreciably diminish the conservation value of critical habitat as a whole for survival and recovery of the jaguar.

As explained above, the areas in the U.S. that provide the physical and biological features essential to jaguar habitat and contribute to the species' persistence and, therefore, overall conservation by providing areas to support some individuals during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit are limited within the U.S. and therefore have an important conservation role for the jaguar. Losing significant portions of these essential areas (i.e., critical habitat areas), as is likely to occur with the proposed project, reduces the ability of critical habitat to function as intended.

Effects of the Action on Proposed Critical Habitat in Relation to Recovery

As described above, by definition critical habitat is habitat determined to be essential for the conservation (i.e., recovery) of the species. Critical habitat for jaguars in the U.S. contributes to the conservation of jaguars by providing areas to support some individuals during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit. Providing connectivity from the United States to Mexico is a key element to maintaining those processes. Losing significant portions of these limited critical habitat areas and compromising connectivity to Mexico, as is likely to occur with the proposed project (as described above), reduces the ability of critical habitat and the northern most secondary area (i.e., NMU) to contribute to the recovery of jaguars in the NRU.

As described above in the Status of the Species, a draft recovery plan for the jaguar has not been finalized, thus no recovery criteria exist to date to be used in this opinion. However, the 2012 Recovery Outline for the Jaguar developed eight "recovery objectives," which provide the best scientific information we have at this time. Recovery objectives collectively describe the specific conditions under which the goals (i.e., delisting) for recovery of the jaguar, throughout its range, will be met. As described throughout the effects analysis above, the proposed action would impact five out of eight recovery objectives within the Jaguar Recovery Outline, including the following: 1) Assess, protect, and restore sufficient habitat to support viable populations of jaguars in the two recovery units; 2) Mediate or mitigate the effects of human population growth and development on jaguar survival and mortality where possible; 3) Reduce direct human-

caused (i.e., illegal and legal killing) mortality of jaguars; 4) Reduce illegal hunting of jaguar prey and improve regulation of legal hunting where appropriate; and 5) Maintain or improve genetic fitness, demographic conditions, and health of the jaguar. Therefore, recovery within the U.S. portion of the Northwestern Recovery Unit could be delayed as a result of the effects of the proposed project on jaguars and proposed jaguar critical habitat.

Proposed Conservation Measures and their effects

The conservation measures that are part of the proposed action are meant to avoid or offset some adverse effects. The Forest Service provided conservation measures in the BA that include:

1. Mitigation with regard to lighting (see Monrad 2012) includes the reduction of lumens ~~from x.x million lumens~~ to 5.2 million lumens.
2. Rosemont will ensure that restored or replaced springs within jaguar critical habitat are constructed in accordance with jaguar PCEs for surface water.
3. As part of the concurrent reclamation program, Rosemont will establish 3 to 40 percent woody vegetation cover averaged over the reclamation area, excluding the pit. This shall be established as a prescriptive obligation of the concurrent reclamation program in appropriate areas as determined in conjunction with the biological monitor during project development.
4. Rosemont will monitor road-kill weekly on SR 83, adjacent to mine site, from the northern extent of currently proposed critical habitat to Gardner Canyon Road, to assess loss of jaguar, ocelot, or jaguar prey base (white-tailed and mule deer, collared peccary, white-nosed coati, in particular). Monitoring will begin at the commencement of mine construction and continue through the second year of mine operation, a total of four years. After the initial four years of monitoring, the Biological Monitor, working with Rosemont, AGFD and USFWS, will determine if additional field data collection is necessary to inform determination of crossing need and location. Rosemont will report road-kill in the annual report. Smaller jaguar prey (lagomorphs, rodents) ~~do not need will not to~~ be reported. Mortality of any FS and BLM sensitive species will also be reported. This work may be conducted by the Biological Monitor as part of their regular site visits funded by Rosemont, with funding from the proponent. In addition to increasing knowledge regarding the movement of wildlife in the area, information collected during this investigation may identify a suitable wildlife crossing structure location.
5. Rosemont will report all jaguar and ocelot sightings immediately to the Biological Monitor.
6. Rosemont will provide \$50,000 to AGFD or other suitable entity approved by the CNF to support camera studies for large predators including jaguar and ocelot. The money will be provided for additional monitoring efforts between the Santa Rita and the Whetstone Mountains and along the Santa Rita Mountains. In addition to increasing knowledge regarding the movement of wildlife in the area, information collected during this investigation may identify a suitable wildlife crossing structure location.

7. ~~Rosemont will acquire or record restrictive covenants or conservation easements on the~~ following parcels of land ~~are being acquired by Rosemont as part of conservation measures~~ (see Figure 7):

- a. ~~Sonoita Creek Ranch: This land will be purchased and made available to AGFD or other suitable land trust. It contains a total of approximately 1,200 acres of semidesert grassland, Madrean evergreen woodland, and riparian habitat along upper Sonoita Creek and includes surface water rights that support two perennial ponds and associated riparian vegetation. It is within proposed jaguar critical habitat. Sonoita Creek Ranch will be managed for conservation purposes to provide habitat and connectivity for jaguars and ocelots between the Canelo Hills/Patagonia Mountains and the Santa Rita Mountains, slightly over a mile away to the west of the ranch, in perpetuity. The southern portion of the ranch has been identified by the Arizona Wildlife Linkages Workgroup and the Arizona Missing Linkages Corridor design as a likely corridor between these two CNF land blocks.~~
- b. ~~Davidson Canyon Watershed Parcels: Rosemont will record a restrictive covenant or conservation easement on these parcels. These properties consist of six parcels on the eastern side of the Santa Rita Mountains and total approximately 574 acres of semidesert grassland and associated riparian habitat. Some of these parcels are within and some are outside of proposed jaguar habitat. These will be included as available land for the establishment of water features beneficial to listed species such as jaguars.~~
- c. ~~(1) Fullerton Ranch—this parcel contains approximately 1,780 acres of semidesert grassland in the Sierrita Mountains; (2) Helvetia Ranch North: Rosemont will record a restrictive covenant or conservation easement on these parcels which—this parcel contains approximately 940 acres of semidesert grassland on the west side of the northern Santa Rita Mountains near the proposed project’s infrastructure corridor. The parcels are outside of proposed jaguar critical habitat. These will be included as available land for the establishment of water features beneficial to listed species such as jaguars.~~
- a. ~~; (3) Sonoita Creek Ranch—this parcel contains a total of approximately 1,200 acres of semidesert grassland, Madrean evergreen woodland, and riparian habitat along upper Sonoita Creek and includes surface water rights that support two perennial ponds and associated riparian vegetation and; (4) Rosemont Ranch Lands—these properties consist of four distinct parcels on the east side of the Santa Rita Mountains totaling approximately 545 acres of semi-desert grassland. (Analyze extent to which this conservation is of value to the jaguar).~~

Comment [FWS3]: need to find out how many in and out and acres - Jason checking

Comment [FWS4]: FYI, This was withdrawn as a conservation land

The conservation measures listed above are anticipated to avoid and offset adverse effects of the proposed project to jaguars to some extent. ~~Sonoita Creek Ranch and XX number of the Davidson Canyon parcels are located within proposed jaguar critical habitat and therefore may help protect connectivity within critical habitat. The ranches other conservation lands are not located within proposed critical habitat and thus will not contribute to the protection of connectivity within critical habitat. They will, however, likely contribute to some extent to jaguar conservation in general. may protect connectivity to a small extent, although the ranches are not located in jaguar critical habitat and thus are likely not ideal for this purpose.~~ Although the funding to conduct carnivore monitoring may provide some information on jaguar use of the area, \$50,000 is likely only enough funding to conduct carnivore monitoring in a limited

Comment [FWS5]: Jason asking

geographic area for about six months, which is generally not a sufficient amount of time to collect quality data on cryptic carnivore movement.

Summary of Effects of the Action

Jaguar

The proposed project will directly and indirectly affect jaguars and jaguar habitat within the NMU. The proposed project (including the security fence and roads), will permanently remove 5,393 acres of jaguar habitat, or an equivalent of about one quarter of a jaguar home range, possibly more considering home range overlap. The perimeter fence will encompass 7,042 acres of jaguar habitat; although land between the security fence and the perimeter fence will not be disturbed, we anticipate jaguars will not use the area due to the human influence near the mine. If this is the case, then the mine will impact about one quarter to one third of a jaguar home range, possibly more considering home range overlap. The mine will also eliminate 5,393 acres of jaguar prey habitat and adversely affect another 1,649 acres (area within perimeter fence). At a minimum, this direct loss of habitat will result in the loss 14 white-tailed deer and 56 javelina, both key prey species for jaguar.

Lighting, noise, and vibrations from the proposed project are anticipated to disturb jaguars. Light intensity will be highest at the mine and attenuate farther from the mine. Most areas within a 12-mile radius will be blocked from line of sight horizontal light emanating from the project area; however, jaguars are mobile animals that will travel over hills and ridgetops, and therefore would likely see the lighting (horizontal) during regular movement activities or during dispersal. Sky glow, which will be as bright as a town the size of Sells or Ajo, Arizona, will likely be visible to jaguars in the vicinity of the mine at all times of night. In addition to the lighting from the proposed action, the active mine known as ~~Imery's~~[Imerys](#) Quarry (about 1.5 mile from the proposed northern perimeter fence) will also contribute to nighttime lighting. The effect of human disturbance and artificial night lighting on large felids has been documented by several studies (e.g., Beier 1995, Ngopresert et al. 2007). Although the exact effect of artificial lighting on jaguars is not known, since they are extremely secretive and generally avoid human disturbed areas, we anticipate that the jaguar will avoid areas wherever horizontal light and possibly sky glow from the mine is visible. As a result, jaguars are likely to curtail their movements between the two mines (Rosemont and ~~Imery's~~[Imerys](#)). If they do attempt to go through this narrow corridor, movement will be made more difficult due to the existing topography between mines.

Noise and vibrations from construction and operation of the mine including blasting is anticipated to disturb jaguars, possibly causing, among other things, changes in breeding behaviors, home ranges, and habitat use, activity, and foraging patterns; increased stress response; and possibly damaged hearing if the noise is loud enough (NoiseQuest 2013; Pater et al. 2009). As stated above, jaguars selectively use large areas of relatively intact habitat away from certain forms of human influence (Zarza et al. 2007, ~~Monroy-Vichis~~[et al. 2007](#)), likely to avoid human disturbance, including noise. As with lighting, the magnitude of impacts from vibration and noise are uncertain, but these impacts are expected to decrease as the distance from the mine increases. In the same or similar manner that noise and vibrations affect jaguars, these anthropogenic disturbances may also adversely affect jaguar prey, leading to a reduced prey base for jaguars.

Roads will be another source of disturbance to jaguars from the proposed action. As a result of the project, SR 83 is anticipated to experience an increase in traffic and may have to be widened to accommodate such traffic. Travelers attempting to avoid heavier traffic on SR 83 may use Box Canyon Road as an alternative route. The primary access road will be a newly created, very heavily traveled, paved-road that connects the mine to SR 83. Part of it will be open to public access during mine operations; other parts will be opened to the public after mine closure. The Sycamore Canyon Connector Road will connect the primary access road to existing roads that cross the narrowed corridor between the proposed mine and ~~Imery's~~Imerys mine. The secondary access road or utility corridor will be used primarily for maintaining utilities associated with the mine. It will be closed to the public for the life of the project, but will be opened to the public after the mine site is restored. Roads and traffic associated with the proposed action will increase: 1) the risk of injury or mortality to jaguars and their prey due to vehicle strike; 2) legal and possibly illegal public access to/human use of jaguar habitat; 3) human disturbance level in the area likely leading to jaguar avoidance of areas near the roads; and 4) degradation and fragmentation of jaguar habitat which may prevent jaguars from moving between habitat patches on either side of the roads. Increased public access to jaguar habitat, as a result of the roads, may also lead to an increased risk of: 1) illegal killing of jaguars and their prey; 2) human-caused fire; and 3) human disturbance to jaguars in more remote areas (i.e., roads may facilitate increased off-road vehicle and pedestrian traffic in the area). Due to the Sycamore Connector Road, likely increased vehicle traffic and human disturbance would occur in an area already highly constricted by the proposed project (i.e., between the proposed mine and ~~Imery's~~Imerys mine).

Construction and operations activities associated with all aspects of the project may disturb jaguars and cause them to flee and/or avoid the area. Disturbance to jaguars can result in behavioral changes, increased energetic expenditures, and interference with habitat use, including use of movement corridors. These could lead to decreased dispersal opportunities; decreased home range size; increased inter- and intra-specific competition; increased difficulty meeting energetic needs; etc. Once project construction is complete, jaguars would be excluded from the area as it will be devoid of habitat, as described above. Jaguar avoidance of the project area will force them to shift south and travel longer distances, possibly through less suitable habitat. Extra travel would require jaguars to expend additional energy and increase the potential for encounters with humans, vehicles, potential competitors (i.e., cougars and other jaguars), and other stresses.

The conservation measures listed above are anticipated to avoid and offset adverse effects of the proposed project to jaguars to some extent. Some conservation lands (totaling about 1,500 acres) are located within proposed jaguar critical habitat and therefore may help protect connectivity within critical habitat. The other conservation lands (totaling about 1,200 acres) are not located within proposed critical habitat and thus will not contribute to the protection of connectivity within critical habitat. They will, however, likely contribute to some extent to jaguar conservation in general.

Because no recovery criteria have been established for the species, we cannot determine how the proposed project will specifically affect the downlisting and delisting of jaguars; however, it will adversely impact 5 out of 8 recovery objectives. Therefore, recovery within the U.S. portion of the NRU could be delayed as a result of the effects of the proposed project on jaguars.

Comment [FWS6]: Jason tracking down exact number

Comment [FWS7]: ditto

Proposed Jaguar Critical Habitat

Below we summarize the effects of the action to proposed jaguar critical habitat as follows pursuant to the proposed rule (USFWS 2012:50220).

1. Direct loss of proposed critical habitat due to the proposed project footprint:

The security fence plus roads will permanently remove 3,102 acres of proposed critical habitat in Unit 3 and the roads will directly affect (permanently remove) ~~478-504~~ acres within Unit 3 and 50 acres in Unit 4b. This represents a permanent loss of 1.1% of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.4~~43~~% of all proposed critical habitat rangewide. The perimeter fence plus roads outside the fence will impact 5,3~~4923~~ acres of land within Unit 3 and 50 acres within Unit 4b. This represents an impact to 1.6 % of Unit 3, 0.2% of Unit 4b (0.05 % of all of Unit 4), and 0.64% of all proposed critical habitat rangewide. Except where specific features such as the primary or secondary access roads are located, the land between the perimeter fence and the security fence will not be disturbed. However, given the influence of human and vehicular activity, noise, and lighting within the perimeter fence, we anticipate that jaguars will likely avoid most or all areas within the perimeter fence.

2. Indirect loss of habitat due to the proposed project:

The location of the proposed project in the northern portion of Patagonia Unit 3 will restrict connectivity between Patagonia Critical Habitat Unit 3 and the Whetstone-Santa Rita Subunit 4b which provides connectivity to the Whetstone Mountains and to Mexico (see Figure 5). The mine (measured from the edge of the perimeter fence) would constrict the connection within proposed critical habitat between Unit 3 and Subunit 4b to a strip approximately 1.5 km (0.93 mi) in width from its present minimum width of 3.6 km (see Figure 4 below). The 1.5 km area of semidesert grassland would thus be between the existing mine (i.e., ~~Imery's~~Imerys Quarry) and the proposed action. A portion of this 1.5 km bottlenecked area will be impacted by noise, vibrations, and lights from the proposed project, making it significantly less likely that jaguars will travel through the area. Furthermore, construction and operation of the Sycamore connector road will improve public access (vehicle and pedestrian) to the 1.5 km constricted corridor. The direct (noise, lights, vibrations, dust) and indirect effects (likely increased public access and resulting increase in threats to jaguars) of this road will likely further reduce the likelihood that jaguar will travel through the corridor between the mine and the boundary of critical habitat. Additionally, the secondary access road, although not situated in the narrowest corridor, will be constructed across a narrowed portion of the corridor between the mine and edge of critical habitat. The effects of this road (presence and use) will likely further reduce the likelihood that jaguar will travel through the corridor between the mine and critical habitat. The topography within this 1.5 km narrowed corridor will additionally hinder jaguar movement through it.

If jaguar movements through the constricted corridor are curtailed due to the proposed project, the northern portion of Unit 3 and Subunits 4b and 4a will become unavailable to jaguars traveling from the western portion of Unit 3 (Figure 5). Specifically, within Unit 3, 14,277 acres; within subunit 4b, 26,406 acres; and within subunit 4a, 50,335 acres of proposed critical habitat will be rendered unavailable to jaguars traveling from the western portion of Unit 3; this equates to 91,018 acres or 11 percent of the total proposed critical habitat. Portions of these

areas may still be available to jaguars traveling through Unit 4 c (i.e., from the east); however, jaguars traveling from this direction will likely avoid the western portion of Unit 4b and the northern portion of Unit 3 due to the influence of the mine.

3. Loss of connectivity to Mexico due to proposed project:

If jaguars cannot move from Unit 4a via 4b to the western portion of Unit 3 and ultimately to Mexico, then the function of Unit 4b (i.e., providing connectivity from the Whetstone Mountains to Mexico) is completely lost. Although connectivity from the Whetstones Mountains to Mexico will still exist via Unit 4c, with the proposed action, 50% of the connectivity to Mexico from the Whetstones will likely be lost. At this time, we are uncertain which direction a jaguar may move to travel between the Whetstone Mountains and Mexico (i.e., via 4 b or 4c), therefore maintaining all critical habitat that allows for this movement is extremely important to jaguar conservation.

4. Effects to overall proposed critical habitat due to the proposed project:

The mine's project area will remove and therefore adversely affect all PCEs (i.e., connectivity to Mexico, prey, surface water, canopy cover, rugged terrain, and human influence) in the northern portion of Unit 3 for 20+ years. Furthermore, the mine will likely restrict connectivity between Units 3 and 4a via Unit 4b. This will result in loss of function of Unit 4b (i.e., providing connectivity between the Whetstones and Mexico) and partial loss of function of Units 3 and 4a and critical habitat in general (i.e., to support some individual jaguars during transient movements by providing patches of habitat, and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the NRU). Furthermore, the integrity of the critical habitat complex comprised of Units 3 and 4 will be weakened. This likely complete loss of function of a subunit (Unit 4b) of 1/6 of all critical habitat units and partial loss of function of two additional units (Unit 3 and 4a) representing 1/3 of all units will appreciably diminish the conservation value of critical habitat as a whole for survival and recovery of the jaguar.

5. Effects to recovery:

By definition critical habitat is habitat determined to be essential for the conservation (i.e., recovery) of the species. Critical habitat for jaguars in the U.S. contributes to the conservation of jaguars by providing areas to support some individuals during dispersal movements, by providing small patches of habitat (perhaps in some cases with a few resident jaguars), and as areas for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit. Providing connectivity from the United States to Mexico is a key element to maintaining those processes. Losing significant portions of these limited critical habitat areas and compromising connectivity to Mexico in key units, as is likely to occur with the proposed project (as described above), reduces the ability of critical habitat and the northern most secondary area (i.e., NMU) to contribute to the recovery of jaguars in the NRU.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act. Many lands within the action area are managed by Federal agencies; thus, many activities that could potentially affect jaguars are Federal activities that are subject to section 7 consultation. The effects of these Federal activities are not considered cumulative effects. However, a portion of the action area also occurs on private lands. Residential and commercial development, road construction, farming, livestock grazing, mining, off-highway vehicle use, and other activities occur on these lands and are expected to continue into the foreseeable future.

Critical Habitat Units 3 and 4 are closer to rapidly expanding urban areas than any other units and therefore more vulnerable to loss of connectivity. Tucson, Patagonia, Sierra Vista are all expanding populations with increasing land development. Immediately southwest of the Mustang Mountains (Subunit 4c) is the proposed Rain Valley development. On the other (east) side of the Mustang Mountains, the community of Huachuca City is poised for additional development with the impending completion of a new wastewater treatment plant. Subunit 4b, through the Empire Mountains, lies between growth both to the north (Tucson) and the south (Patagonia and Sonoita). The aforementioned actions, the effects of which are considered to be cumulative, may result in fragmentation, loss, or degradation of jaguar habitat and disturbance to jaguars. Although not documented recently in the U.S., illegal hunting of jaguars adversely affects the species. Illegal activities associated with cross-border smuggling and illegal immigration (e.g., human traffic, deposition of trash, creation of trails and routes, and increased fire risk from human traffic) also occur in the action area. These activities can also degrade jaguar habitat and disturb jaguars.

CONCLUSIONS

Jaguar

After reviewing the current status of the jaguar, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our opinion that the Rosemont Copper Mine, as proposed, is not likely to jeopardize the continued existence of the jaguar. Pursuant to 50 CFR 402.02, “jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. We base this conclusion on the following:

(1) Jaguars range from southern U.S., i.e., Arizona and New Mexico, to south America, i.e., Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, ~~El Salvador~~, French Guiana, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, ~~Uruguay~~, Venezuela (Swank and Teer 1989, Caso et al. 2008) and;

(2) Although abundance and population trends for the jaguar range-wide are not well known and populations throughout their range continue to be at risk, the Rosemont Copper mine will not have an appreciable impact on the population range-wide. Thus, the proposed action is not expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of the jaguar in the wild by reducing the reproduction, numbers, or distribution of the species.

Proposed Critical Habitat

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. From section 3(3) of the Endangered Species Act: “The terms ‘conserve,’ ‘conserving,’ and ‘conservation’ mean the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided under the Endangered Species Act are no longer necessary. Thus, designation of critical habitat helps ensure that proposed project actions will not result in the adverse modification of habitat to the point that the species will not be able achieve recovery, i.e. not able to be removed from the threatened or endangered species list.

We used four documents to determine how to analyze whether the threshold for destruction or adverse modification will be reached by the proposed action. These include: 1) 2004 guidance regarding the application of the “Destruction of Adverse Modification” standard under Section 7(a)(2) of the Endangered Species Act (FWS 2004); 2) Section 7 Consultation Handbook; 3) the proposed rule for jaguar critical habitat; and 4) our letter regarding Incremental Effects for the economic analysis for the proposed rule to designate critical habitat for the jaguar (FWS, August 28, 2012).

Our 2004 guidance indicates that destruction or adverse modification may be reached when critical habitat would not remain functional to serve the intended conservation role for the species.

Our Section 7 Consultation Handbook notes that the adverse modification threshold is exceeded when the proposed action will adversely affect the critical habitat’s constituent elements or their management in a manner likely to appreciably diminish or preclude the role of that habitat for recovery of the species.

The 2012 proposed rule (FWS 2012b) to designate critical habitat for the jaguar states that activities that may destroy or adversely modify critical habitat are those that alter the physical or biological feature and PCEs to an extent that appreciably reduces the conservation value of critical habitat for the jaguar.

The incremental effects letter (FWS August 28, 2012) states that destruction or adverse modification is potentially reached when connectivity is severed either between the U.S. and Mexico or within a critical habitat unit or subunit. According to the incremental effects letter, “major construction projects (such as new highways, significant widening of existing highways), or construction of large facilities (such as large mining operations) could constitute adverse modification to jaguar critical habitat in both occupied and unoccupied subunits if connectivity within a critical habitat unit is severed.” Additionally, the letter states that “major construction projects (such as new highways, significant widening of existing highways, or construction of large facilities) that could sever connectivity within these critical habitat subunits could constitute adverse modification. The most likely unoccupied subunits in which these activities may occur are 4b and 4c”. The destruction or adverse modification of critical habitat could occur if the function of one or more critical habitat units is affected by, for example, the construction of impenetrable fencing across a portion of the currently open areas of vegetated, rugged terrain at the U.S.-Mexico border. This could create a situation in which a unit of critical habitat could become inaccessible to jaguars. The loss of one critical habitat unit would not constitute jeopardy to the species, but it could constitute destruction or adverse modification (USFWS 2012 Incremental Effects letter).

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Therefore, following guidance from each of these four sources, considering the effects noted above, and that critical habitat Unit 4b will likely not remain functional to serve the intended conservation role for the jaguar, we conclude that implementation will constitute adverse modification. We base this conclusion on the information below. As described in the effects analysis above, the proposed project will result in the following:

- 1) A direct loss of proposed critical habitat and all PCEs contained within it. Specifically the security fence plus roads will permanently remove 3,102 acres of proposed critical habitat in Unit 3 and the roads will directly affect (permanently remove) ~~478-504~~ acres within Unit 3 and 50 acres in Unit 4b. The perimeter fence plus roads outside the fence will impact 5,3~~4923~~ acres of land within Unit 3 and 50 acres within Unit 4b.
- 2) An indirect loss of critical habitat and PCEs due to the proposed project. Specifically, the mine will constrict the connection within proposed critical habitat between Unit 3 and Subunit 4b to a strip approximately 1.5 km (0.93 mi) in width from its present minimum width of 3.6 km (see Figure 4 below). The 1.5 km area will thus be between the existing mine (i.e., ~~Imery's~~Imerys Quarry) and the proposed action. A portion of this 1.5 km bottlenecked area will be impacted by noise, vibrations, lights, traffic, and likely increased public access from the proposed project, making it significantly less likely that jaguars will travel through the area. Furthermore, the topography within this resulting bottlenecked corridor will hinder jaguar movement through it. If jaguar movements through the constricted corridor are curtailed due to the proposed project, the northern portion of Unit 3 and Subunits 4b and 4a will become unavailable to jaguars traveling from the western portion of Unit 3 (Figure 5). Within Unit 3, 14,277 acres; within subunit 4b, 26,406 acres; and within subunit 4a, 50,335 acres of proposed critical habitat will be rendered unavailable to jaguars traveling from the western portion of Unit 3; this equates to 91,018 acres or 11 percent of the total proposed critical habitat. Portions of these areas may still be available to jaguars traveling through Unit 4 c (i.e., from the east); however, jaguars traveling from this direction will likely avoid the western portion of Unit 4b and the northern portion of Unit 3 due to the influence of the mine.
- 3) Loss of connectivity between the Whetstone Mountains and Mexico. Specifically, if jaguars cannot move from Unit 4a via 4b to the western portion of Unit 3 and ultimately to Mexico, then the function of Unit 4b (i.e., providing connectivity from the Whetstone Mountains to Mexico) is completely lost. Although connectivity from the Whetstones Mountains to Mexico will still exist via Unit 4c, with the proposed action, 50% of the connectivity to Mexico from the Whetstones will likely be lost. At this time, we are uncertain which direction a jaguar may move to travel between the Whetstone Mountains and Mexico (i.e., via 4 b or 4c), therefore, maintaining all critical habitat that allows for this movement is extremely important to jaguar conservation.
- 4) Appreciably diminish the conservation value of critical habitat as a whole for survival and recovery of the jaguar due to the likely complete loss of function of Subunit 4b and partial loss of function of Units 3 and 4a.

- 5) Reduce the ability of critical habitat and the northern most secondary area (i.e., NMU) to contribute effectively to the recovery of jaguars in the NRU due to the loss of significant portions of limited critical habitat areas and compromised connectivity to Mexico.

Additionally, as discussed in the Cumulative Effects section, critical habitat units 3 and 4 are at risk to the effects of expanding urban areas more than any other units and therefore more vulnerable to loss of connectivity, thereby possibly further threatening their conservation value.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act, prohibit take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. “Harm” is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be included by the Service as binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity that is covered by this Incidental Take Statement. If the Service (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of this incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service, or the applicant must report the progress of the action and its impact on the species as specified in the Incidental Take Statement (see 50 CFR 402.14(I)(3)).

Amount or Extent of Take Anticipated

Confirmed jaguar detections have occurred within the action area. The detections were from trail cameras placed by resident hunters and/or researchers from the University of Arizona – jaguar and ocelot survey and monitoring project funded by the U.S. Fish and Wildlife Service and Department of Homeland Security. All detections were located on lands administered by the Coronado National Forest, photographed at night, and all are suspected to be of a single male jaguar. One of the detections was from a trail camera located to the west and adjacent to the proposed action area. Thus, because trail cameras have detected the presence of a male jaguar within the action area, incidental take is likely to occur.

Incidental take of one jaguar over the life of the project in the form of harassment is anticipated for the following activity:

1. Disturbance of jaguars due to construction, operation, and restoration of the mine and associated roads which disrupts normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Construction and operation of the mine is anticipated cause jaguars to shift home range location and travel longer distances, possibly through less suitable habitat. Extra travel would require jaguars to expend

Pre-decisional – Attorney Client Privilege

additional energy and increase the potential for encounters with humans, vehicles, potential competitors, and other stresses.

We anticipate the above anticipated incidental take will be difficult to detect. However, monitoring and reporting requirements will allow us to assess the effects of proposed project activities. In addition, Rosemont will report to us any mortality or injury of jaguars due to collisions with vehicles or other activities. Incidental take will have been exceeded, triggering a requirement for reinitiation (50 CFR 402.16[c]) if:

1. Based on the annual reporting on the status of the proposed project:
 - a. The proposed action results in the loss or degradation of jaguar habitat beyond project area covered in this BO (e.g., no more than 5,393~~67~~ acres will be directly impacted by project construction, etc.).
 - b. Truck traffic associated with the proposed action ~~Vehicle traffic~~ exceeds 23,660~~4,440~~ trips per year (455~~70~~ trips per week multiplied by 52 weeks) on the primary access road.
 - c. Lighting exceeds the analysis provided by the applicant.
 - ~~e.d.~~ Noise exceeds identified levels (need to quantify the latter).

If additional jaguars are documented in the action area in the future, reinitiation of consultation would be prudent to reexamine incidental take.

Effect of the Take

We conclude that this level of anticipated take is not likely to result in jeopardy to the jaguar, for the effects are not expected to appreciably reduce the survival and recovery of the species. Jaguars range from southern United States all the way to Brazil and thus, take of one jaguar in the form of harassment in the U.S. will not jeopardize the species.

REASONABLE AND PRUDENT MEASURES

The FWS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of jaguar:

1. Minimize the effects of disturbance from noise, lights, and roads to the jaguar.
2. Monitor jaguars in the Santa Rita Mountains.
3. Monitor incidental take resulting from the proposed action and report to the FWS the findings of that monitoring.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Forest Service must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

Pre-decisional – Attorney Client Privilege

1. The following terms and conditions implement reasonable and prudent measure Number 1:
 - a. Minimize the light levels and the distance light emanates from the project site through the use of techniques such as decreasing the use of bright lights, employing methods to deflect lights coming out of project site, and minimizing the lights coming from buildings at the project site.
 - b. Minimize noise, especially at night, through the use of techniques such as no horn use and no loud operations at night.
 - c. Limit speeds on the primary and secondary access roads and employ the use of jaguar crossing signs.
 - d. The aforementioned techniques will be coordinated with and approved by FWS and AGFD before they are employed.
2. The following terms and conditions implement reasonable and prudent measure Number 2:
 - a. The Forest Service will ensure that monitoring will be performed to obtain additional information on jaguar movements in the vicinity of the mine and to enable operations considerations to take into account the presence of jaguars in the immediate vicinity. Ensure that jaguars in the vicinity of proposed project area (within jaguar habitat in a 10 km ~~add~~ radius around the perimeter fence of the mine; 10 km is the radius of an average jaguar home range in the northern portion of its range) are monitored for the life of the project. All aspects of the monitoring plan and implementation of the monitoring (including, but not limited to, who will conduct the study, how the study will be conducted, and when reports will be due) must be coordinated with and approved by FWS and AGFD. Additionally, all monitoring efforts must be coordinated with the FWS, AGFD, the existing University of Arizona jaguar survey and monitoring study, and any other jaguar and carnivore monitoring projects that may be active in the area.
3. The following terms and conditions implement reasonable and prudent measure Number 3:
 - a. The Forest Service will ensure that Rosemont will monitor the impacts of the action and report these to the FWS for the life of the project. A report will be due to the FWS annually on March 1. Among other things, the report will include the number of acres impacted by the project, the number of vehicle trips made on the primary and secondary access roads as well as the Sycamore connector road, a description of how speed limits were enforced and the jaguar road crossing signs employed, the light level emanating from the project site and how it was minimized, the noise level emanating from the project and how it was minimized, details on the installation and monitoring of the SR83 underpass, a description of conservation measures implemented, etc.

Review requirement: The Service believes that no more than one jaguar will be incidentally taken (in the form of harassment) as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental

take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. FS must immediately provide an explanation of the causes of the taking and review with the FWS-AESO the need for possible modification of the reasonable and prudent measures.

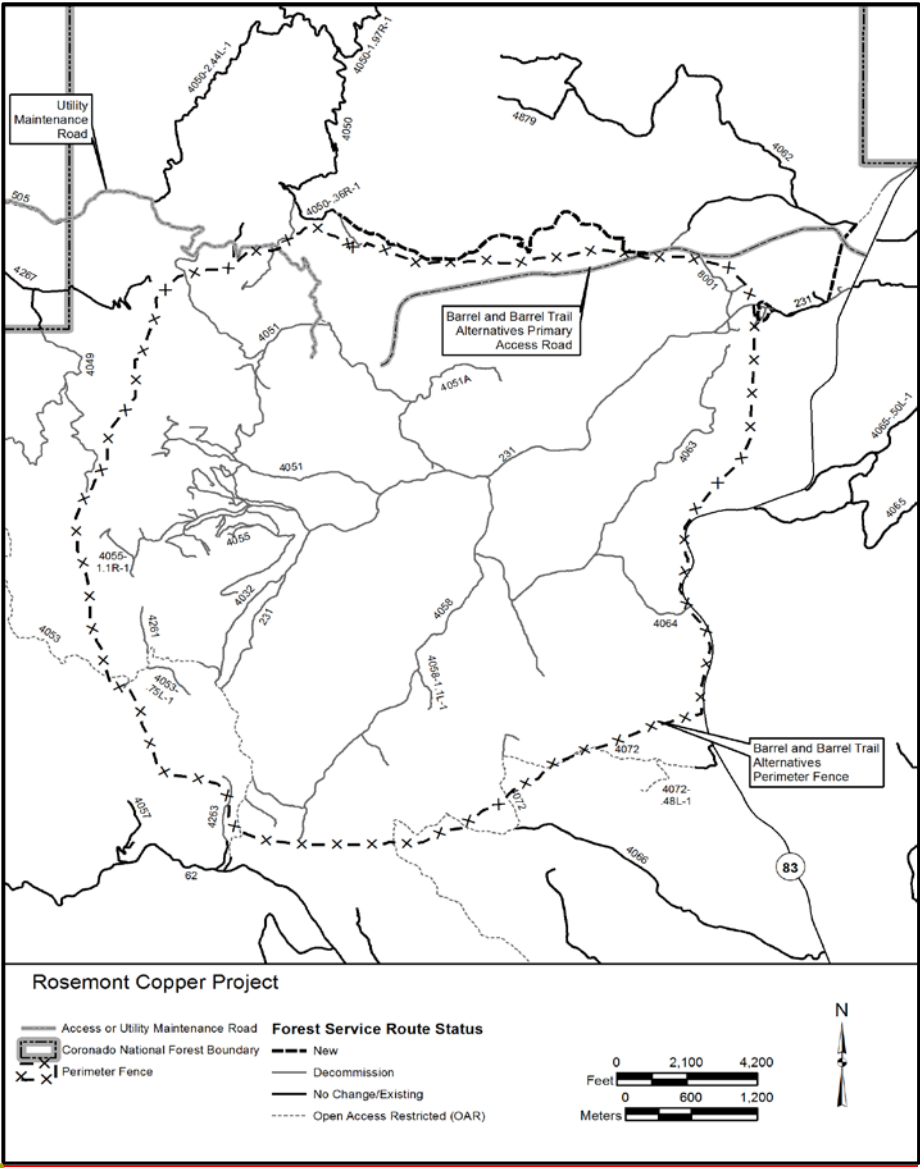
REASONABLE AND PRUDENT ALTERNATIVES

- 1) ~~4)~~ To increase the ability of jaguars to move through the restricted 1.5 km corridor and therefore decrease the indirect loss of critical habitat, no night-time operations other than necessary security shall occur, including no significant nighttime vehicle traffic. Because the lack of nighttime operations would likely to assist jaguars to move through the 1.5 km constricted corridor, install an underpass (with appropriate guide fences, etc.) ~~in~~ under SR83 to facilitate jaguar movement across the road and monitor the crossing for the life of the project. Research will be conducted to determine the best location of the crossing.
- 2) To decrease human activity and access to the 1.5 km constricted corridor between the mines, remove the Sycamore Connector Road from the proposed action.
- 2) ~~3)~~ To improve connectivity of critical habitat to Mexico, protect lands where critical habitat meets the border.
- 3) ~~4)~~ To provide for an alternative connection between the Whetstone Mountains and the Santa Rita Mountains, protect lands in a corridor between the two mountain ranges, south of the proposed project (i.e., in the alternative corridor area suggested by the FS) and install an underpass (with appropriate guide fences, etc.) under SR 83 within the corridor to facilitate jaguar movement across the highway. Research will be conducted to determine the best location of the crossing.
- 4) ~~5)~~ To offset the partial loss of function of Units 3 and 4a and critical habitat in general and allow for the expansion of the nearest core area to the U.S. in the NRU, protect lands in the NRU in Mexico, such as ~~in adjacent to~~ the Northern Jaguar ~~RP~~ reserve.

Tables and Figures

Figure A. Proposed location of the Sycamore Canyon Connector Road and existing National Forest System Roads.

Comment [FWS8]: I will renumber the figures once we have all of them in here that we need.



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Figure 1. Northwestern Jaguar Recovery Unit.



Figure 2. Map showing nighttime lighting from the current ~~Imery's~~Imerys Quarry mine shown in green and the proposed Rosemont mine shown in blue. (Add references and data layer info)

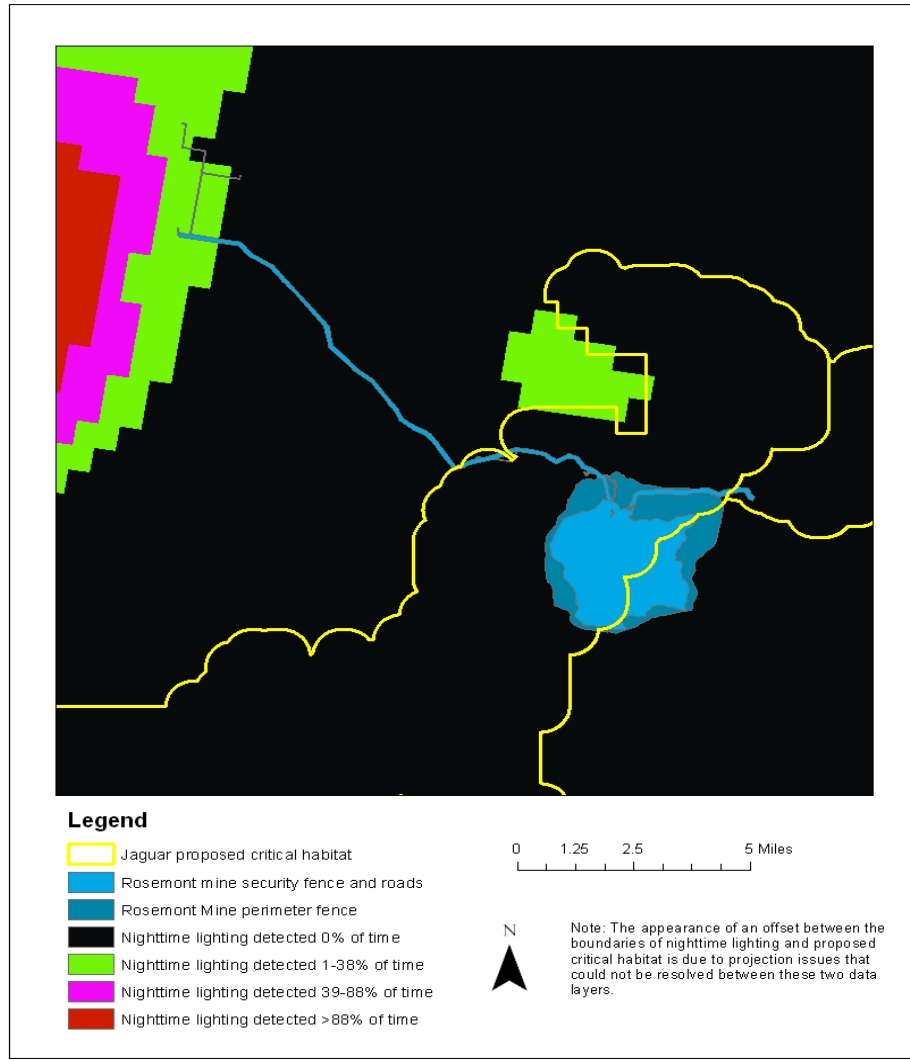


Figure 3. Image of the currently operating mine known as ~~Imery's~~Imerys Quarry located north of the proposed action at night. Image is from Blue Marble Navigator 2012 (<http://www.blue-marble.de/nightlights/2012>).

Blue Marble Navigator - Night Lights 2012

Page 1 of 1



Google 10 km 10 mi Night-lights imagery by NASA's Earth Observatory

<http://www.blue-marble.de/nightlights/2012>

Figure 4. The proposed action within proposed critical habitat Unit 3 and the distances between the perimeter fence of the proposed action and the active mine to the north (i.e., ~~Imerys~~Imerys Quarry).

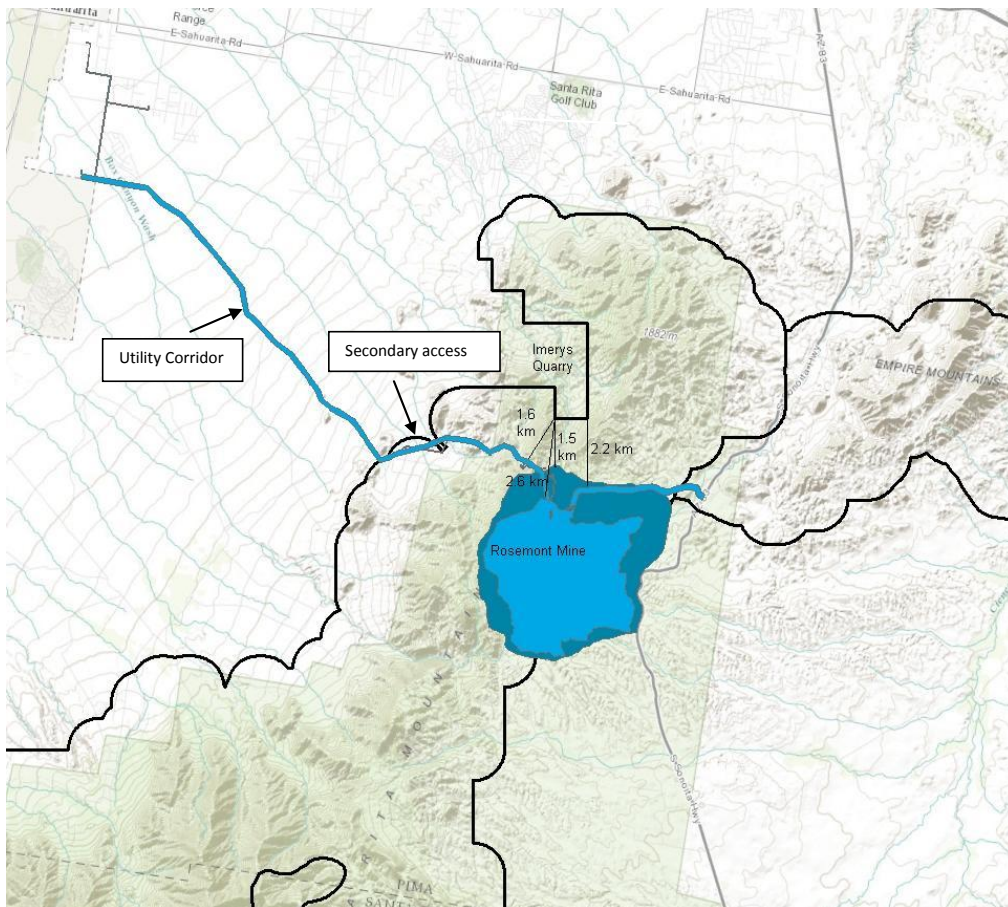


Figure 5. Map showing the proposed action within proposed critical habitat Unit 3 in relation to Critical Habitat Units 4b, 4a, and 4c.

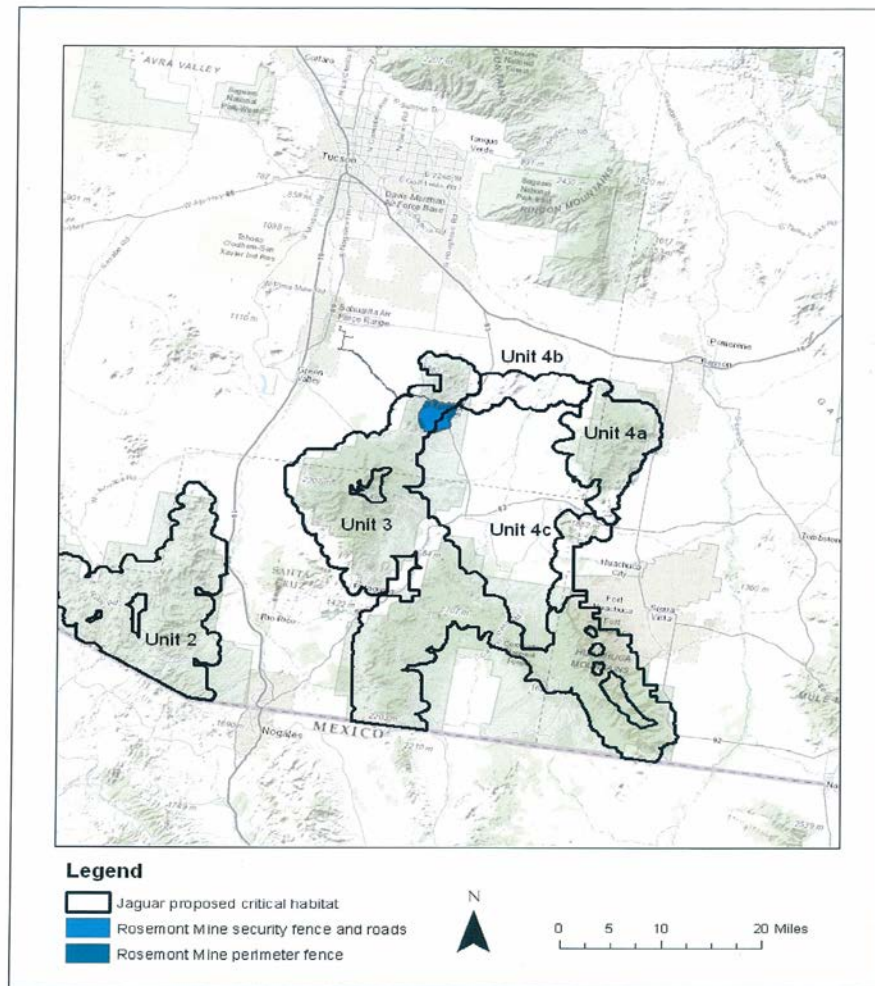


Figure 6. Areas of proposed critical habitat that are likely to become inaccessible to the jaguar

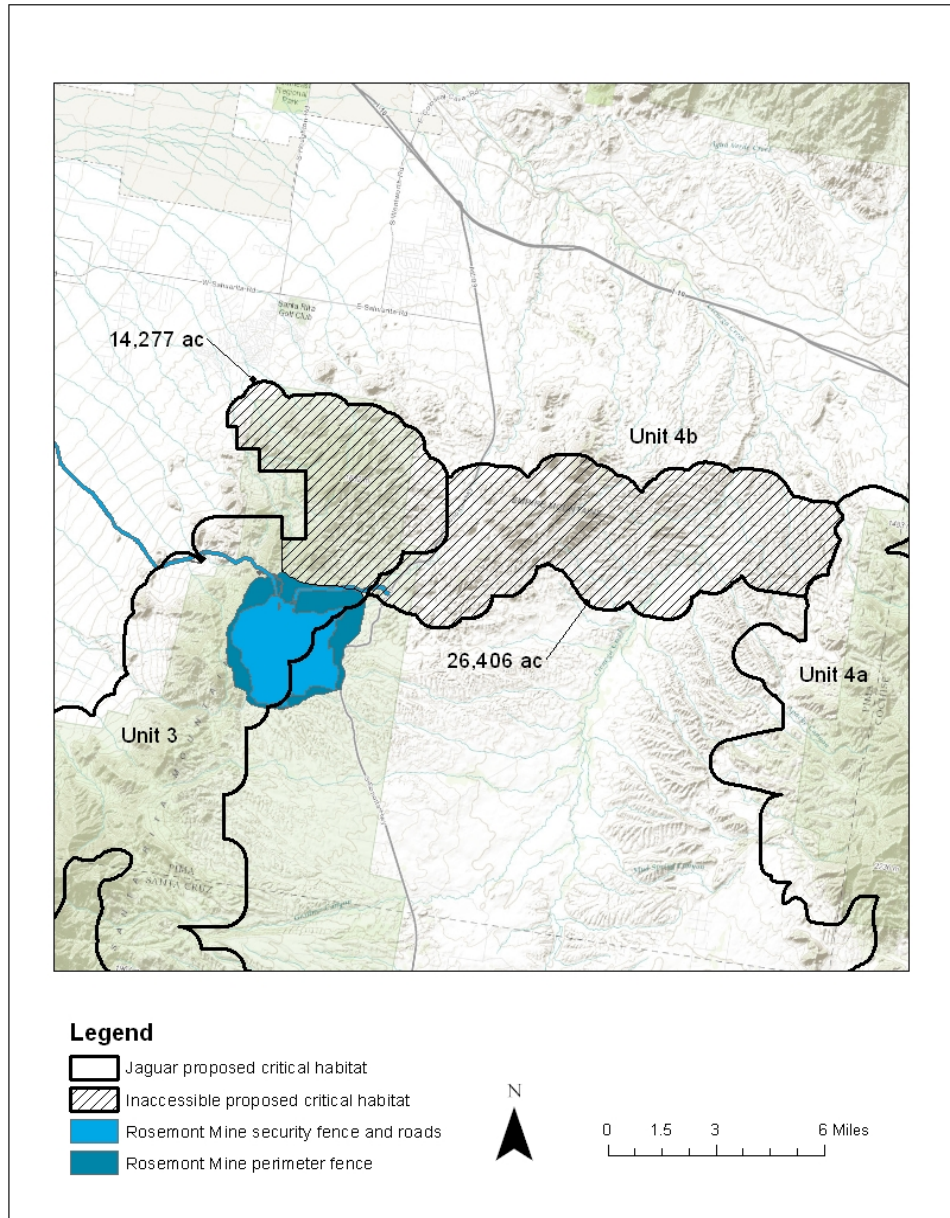


Figure 7. Map showing the parcels of land that will be purchased by Rosemont as conservation measures, some of which may aid in the conservation of jaguars.

