United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Office
9828 North 31st Avenue, Suite C3
Phoenix, Arizona 85051
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:
AESO/SE
02EAAZ00-2018-F-1235

October 4, 2018

Mr. Kerwin S. Dewberry
Forest Supervisor
Coronado National Forest
300 West Congress Street
Tucson, Arizona 85701

RE: Tumacacori Red Springs Trail Project

Dear Mr. Dewberry:

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. § 1531-1544), as amended (Act). Your initial request was dated May 8, 2018. We provided a 30-day letter dated July 5, 2018, requesting some additional information, which you provided to us in your revised Biological Assessment (BA) dated July 17, 2018. At issue are impacts that may result from the proposed Tumacacori Red Springs Trail Project located in Pima and Santa Cruz counties, Arizona. The proposed action may affect and is likely to adversely affect the threatened yellow-billed cuckoo (*Coccyzus americanus*), the endangered Pima pineapple cactus (*Coryphantha sheeri* var. *robustispina*), the endangered jaguar (*Panthera onca*) and its designated critical habitat, and the endangered ocelot (*Leopardus pardalis*).

This biological opinion is based on information provided in the revised July 2018 biological assessment, our June 21, 2018 meeting, field investigations, and other sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, recreational trail development and its effects, or on other subjects considered in this opinion. A complete record of this consultation is on file at this office.

Consultation History

- May 8, 2018: We received your initial request for consultation and associated biological assessment

- June 21, 2018: We held a meeting to discuss Coronado National Forest consultation priorities, including the Red Springs Trail Project.
- July 5, 2018: We sent you a 30-day letter requesting additional information.
- July 17, 2018: We received your revised biological assessment containing the additional information we requested; formal consultation was initiated.
- August 24- Sept. 10, 2018: You provided updated information for the BA with regard to the staging area and Pima pineapple cactus surveys.
- September 17, 2018: We provided you with a draft BO for review.
- October 3, 2018: We received your comments on the draft BO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is to construct/improve 24.26 miles of single-track trail for use by motorized and non-motorized mountain bikes. The Coronado National Forest (CNF) has received funding through a grant from the Arizona State Parks Off-Highway Vehicle Program to create a long-distance dedicated motorized single-track trail system to serve multiple-use needs taking advantage of existing National Forest System (NFS) roads where possible. The intent of the proposed action is to take advantage of locations already disturbed by foot or motor traffic such as social hiking trails, user created four-wheel drive trails, and existing motor vehicle use trails in the CNF transportation system. The primary purpose for action is to provide additional trail opportunities, trail connections, and reasonable access points, and to reduce or limit resource damage from soil erosion. Reducing or limiting resource damage on trails is completed by using sustainable design and construction methods.

This trail system is primarily intended for motorcycles and mountain bikes. The vegetation clearing of these trails will be to a lesser standard and may have tight rocky sections that would be unsafe for most equestrian travel. The purpose of these trails is not to exclude equestrians, but to provide a naturally challenging opportunity for motorcycles and mountain bikes.

In summary, the proposed trail project includes:

<u>Single-track trail</u>

- 6.70 miles of new motorized single-track
- 17.56 miles of social trails converted to motorized single-track
- 24.26 total miles of new system single-track trail
- The newly constructed trail width is proposed to be approximately 12 – 24 inches wide. The trail will be constructed using hand tools such as a McLeod, Pulaski, small hand tools and in some cases a mini single-track trail dozer. Improvements to existing social trails that are part of the proposed action will mainly consist of installation of erosion/drainage control features and delineation of the trail tread. In general, the trail system will be engineered in such a fashion as to minimize environmental impacts and built to Forest Service trail engineering standards so as to be as sustainable as possible, while incorporating best management practices.

<u>Staging/parking/information area</u>

- In addition to the trail system, a 0.45 acre staging area is proposed with an information kiosk, one ramada, one concrete picnic table and parking space for approximately 10 vehicles (120 feet) with approximately 70 by 100 feet for trailer parking and turnaround capability. Surfacing will be crushed landscape gravel requiring approximately 23 tons or 10 dump trucks.
- The perimeter of this area will be fenced off to control parking and unwanted access to the single-track trail by unauthorized vehicles and to protect valued natural and historic resources.

- An informational Kiosk will be installed. It will provide a map depicting the trail system route with information regarding trail difficulty, distance, and proximity to local commercial businesses. It will also include information on off-highway vehicle (OHV) regulations, trail etiquette, and brochures from the Arizona Game and Fish Department, State Parks, and the Arizona State Land Department.
- A covered Ramada with concrete floor approximately 12x18 feet in size will be constructed to provide a measure of relief from the sun or rain while putting on or taking off riding gear. It will have a Forest Service accessible picnic table under the ramada. This structure is not intended for camping or parking of motorized vehicles.
- The proposed location of the staging area was moved to the south to avoid Pima pineapple cacti and habitat that were discovered during surveys in accordance with the conservation measures included as part of the proposed action.

Monitoring

Monitoring of the project trails and staging area for needed maintenance/improvements will be organized and performed at least biannually by the Trail Riders of Southern Arizona, with guidance from the Forest Service. Forest Service Law Enforcement Officers will patrol the area to ensure recreational users are staying on designated trails and adhering to other federal laws. If monitoring shows considerable adverse effects are occurring, or are likely to occur, immediate corrective action will be taken. Corrective actions may include, but are not limited to, reduction in the amount of motorized use, signing, or barriers to redistribute use, partial closure of areas, rotation of use on areas, closure to causative vehicle type(s), or total closure, and structural solutions, such as culverts and bridges. Closure is accomplished through authority of the Forest Supervisor.

Maintenance

The Forest Service will be responsible for maintaining the trails and staging area with the assistance of the Trail Riders of Southern Arizona through the Adopt-a Trail Program. Maintenance will involve such activities as trash clean up, improvements to erosion control features, signage replacement, and closure of any unauthorized, user-created trails within the project area.

Conservation Measures

As part of the proposed action, the Nogales Ranger District has proposed a number of conservation measures to reduce or eliminate potential effects to listed species and their critical habitats. These conservation measures include:

- Nighttime use of the trail system will be prohibited to avoid disturbance of jaguars and ocelots, which are primarily nocturnal.
- Construction of new trail and the staging/parking area, as well as routine maintenance of the trail system will occur outside of Western Yellow-billed Cuckoo breeding season (May 15 – September 30). However, unscheduled maintenance activities needed to prevent impacts to natural or cultural resources will not be postponed. Initial construction of the trail system is currently scheduled for late 2018/early 2019 within this window.
- To avoid direct impacts to Pima pineapple cactus, such as crushing or burying with loose substrate, the proposed trail will be surveyed for individuals prior to construction. If Pima

pineapple cactus are found in the trail corridor the route will be realigned, and at minimum a 30 meter exclusion zone will be established using natural barriers, fencing, and/or signage.

- As required by the Travel Management Rule, newly designated National Forest System trails would be monitored, as appropriate and feasible, to determine user compliance with the motor vehicle use map.
- Newly designated National Forest System trails would have physical barricades at their end-point of rock or other natural material, temporary man-made barriers, or some combination of these things, if necessary to prevent unauthorized extension of the road by vehicle users.
- An information kiosk will be constructed at the staging area that will include the following regulatory information: It is unlawful to chase or harass wildlife. It is unlawful to travel off-road, tread lightly measures will be practiced. Nighttime use of the trail system is prohibited.
- Comply with the Clean Water Act and other relevant laws, regulations, and policies regarding resource protection.
- Utilize drainage ditches and out slope trail design to move water. Avoid water bars that are often less effective and require maintenance. Trail design will take advantage of natural contours. Switchbacks will be avoided since they can create potential for abuse. The intent is to adopt sustainable best management practices (BMPs) (USFS 2014a) to minimize the potential for erosion and sedimentation by dispersing and limiting the concentration of storm runoff on the trail.
- If a final trail alignment falls in a Streamside Management Zone (SMZ), coordination will occur with the forest’s hydrologist and BMPs will be established to ensure proper mitigation for protection of these areas. Additional mitigations measures, such as hardening, armoring with additional rock, and additional rolling dips, will be implemented where trails features lie within SMZs, on sensitive soils, or are deemed pertinent to protect soil and water resources.
- If a final trail alignment falls within a high risk area, 40% or greater slope gradient, and/or severe plasticity soils, coordination will occur with the forest’s soils specialist before construction to ensure proper documentation and adherence to BMPs.
- Minimize the extent to where the trail is within an identified drainage area according to a USGS quadrangle map. During trail construction, minimize the amount of soil disturbance at stream crossings. In areas of high traffic or steep slopes, armor the trail with large material and increase the occurrences of gradient reversal. Side-casting soil, including rocks and boulders in areas that may reach a drainage area, is prohibited. Prior to the start of construction or maintenance activities, waste areas must be located where excess material can be deposited and stabilized.
- All equipment utilized for construction/maintenance will be washed/cleaned to ensure it is free of plant material, in order to prevent the spread of invasive plants and disease. Map invasive weed-infested areas and establish measures such as no-travel zones to prevent spread from these areas. Locate weed-free areas where project equipment can be staged prior to commencement of project activities. Avoid invasive species populations when feasible and minimize spread of invasive species during any soil disturbing activities. Inform and encourage public land users to inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before recreating on public lands.
- Monitor trail condition at regular intervals to identify drainage and trail surface maintenance needs to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. Erosional areas will be inventoried, and possible solutions identified, including

trail reroutes. Manage designated trails to mitigate adverse effects to soil, water quality, and riparian resources from over-use when closure and rehabilitation is not practicable or desired.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area generally occurs within Pima and Santa Cruz Counties within the Nogales Ranger District of the Coronado National Forest. The proposed action will occur in the Tumacacori Mountains located west of Interstate 19 and the Town of Tubac.

Temporally, the potential on-site and off-site impacts resulting from the proposed project encompass all the activities associated with construction and then subsequent indefinite use of the trail system. The action area for this analysis is based on the area of the trail footprint; and areas outside the trail footprint that may be affected by noise, dust, erosion, or other activities including all areas for which trail use may affect groundwater and surface water. The action area is approximately 6,200 acres, consisting of the trail system and surrounding areas.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The information in this section summarizes the rangewide status of each species that is considered in this BO. Further information on the status of these species can be found in the administrative record for this project, documents on our web page (Arizona Ecological Services Office Documents by Species), and in other references cited in each summary below.

Yellow-Billed Cuckoo

The western distinct population segment (DPS) of the yellow-billed cuckoo was listed as a threatened species under the ESA on October 3, 2014 (USFWS 2013b, 2014b; 78 FR 61622, 79 FR 59992). Within the DPS (see Figure 1 at 79 FR 59994, in the final listing rule (79 FR 59992; October 3, 2014)), the habitat areas used by the species for nesting are located from southern British Columbia, Canada, to southern Sinaloa, Mexico, and may occur from sea level to 7,000 feet (ft) (2,154 meters (m)) in elevation (or slightly higher in western Colorado, Utah, and Wyoming). Critical habitat for the yellow-billed cuckoo DPS was proposed on August 15, encompassing 546,335 acres across the western United States (USFWS 2014a; 79 FR 48548). The discussions of the status of this species in these documents are incorporated herein by reference.

The yellow-billed cuckoo is a member of the avian family Cuculidae and is a Neotropical migrant bird that winters in South America and breeds in North America. The breeding range of the entire species formerly included most of North America from southeastern and western Canada (southern Ontario and Quebec and southwestern British Colombia) to the Greater Antilles and northern Mexico [American Ornithologists Union (AOU) 1983, 1998].

Based on historical accounts, the western yellow-billed cuckoo was formerly widespread and locally common in California and Arizona, more narrowly distributed but locally common in New Mexico, Oregon, and Washington and uncommon along the western front of the Rocky Mountains north to British Columbia (AOU 1998, Hughes 1999). The species may be extirpated from British Colombia, Washington, and Oregon (Hughes 1999). The western yellow-billed cuckoo is now very rare in scattered drainages in western Colorado, Idaho, Nevada, and Utah, with single, nonbreeding birds most likely to occur (FWS 2014a, 2014b). The largest remaining breeding areas are in southern and central California, Arizona, along the Rio Grande in New Mexico, and in northwestern Mexico (FWS 2014b).

Phillips *et al*. (1964) described the species a common resident in the (chiefly lower) Sonoran zones of southern, central, and western Arizona at the time of publication. The yellow-billed cuckoo now nests primarily in the central and southern parts of the state.

Yellow-billed cuckoos spend the winter in South America, east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (Ehrlich *et al*. 1992, AOU 1998). Wintering yellow-billed cuckoos generally use woody lowland vegetation near fresh water. However, wintering habitat of the western yellow-billed cuckoo is poorly known.

Western populations of yellow-billed cuckoos are most commonly found in dense riparian woodlands, consisting primarily of cottonwood (*Populus fremontii*), willow (*Salix* spp.), and mesquite (*Prosopis* spp.), along riparian corridors in otherwise arid areas (Laymon and Halterman 1989, Hughes 1999). Occupied riparian habitat in Arizona may also contain box elder (*Acer negundo*), Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), oak (*Quercu*s spp.), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), Mexican elderberry (*Sambuccus mexicanus*), tamarisk (*Tamarix* spp.; also called salt cedar), acacia (*Acacia* spp.), and seepwillow (*Baccharis glutinosa*) (Corman and Magill 2000, Corman and Wise-Gervais 2005, FWS unpubl. data). Tamarisk may be a component of breeding habitat, but there is usually a native riparian tree component within the occupied habitat (Gaines and Laymon 1984, Johnson *et al*. 2008, McNeil *et al*. 2013, Carstensen *et al*. 2015). Although cuckoos are most commonly found in gallery riparian forest, in Arizona they may also use narrow bands of riparian woodland [Arizona Game and Fish Department (AGFD) 2017, Cornell Lab of Ornithology 2017]. Adjacent habitat on terraces or in the upland (such as mesquite) can enhance the value of these narrow bands of riparian woodland. In most of the range, western yellow-billed cuckoos primarily breed in riparian habitat along low-gradient (surface slope less than 3 percent) rivers and streams, and in open riverine valleys that provide wide floodplain conditions (greater than 325 feet). However, in the southwest, cuckoos can also breed in higher gradient drainages, and narrower and drier reaches of riparian habitat.

Western yellow-billed cuckoos in Arizona will also use areas of mesquite and oak woodlands some distance from riparian gallery forests, including in the mountains of southeastern Arizona. Recent surveys found yellow-billed cuckoos with some regularity in these non-traditional habitats (Corman and Magill 2000; WestLand Resources, Inc. 2013a, 2013b, 2015a, 2015b, 2015c; Tucson Audubon 2015).

Throughout the western yellow-billed cuckoo range, a large majority of nests are placed in willow trees, but cottonwood, mesquite, walnut, box elder, sycamore, hackberry, oak, alder, soapberry (*Sapindus saponaria*), acacia, and tamarisk are also used (Laymon 1980, Hughes 1999, Corman and Magill 2000, Corman and Wise-Gervais 2005, Holmes *et al*. 2008, Tucson Audubon 2015, FWS unpublished data).

Within the boundaries of the western distinct population segment (DPS) (see Figure 2 at 78 FR 61631), cuckoos occur from sea level to 7,000 feet (or slightly higher in western Colorado, Utah, and Wyoming) in elevation. The moist conditions that support riparian plant communities that provide western yellow-billed cuckoo habitat typically exist in lower elevation, broad floodplains, as well as where rivers and streams enter impoundments. In southeastern Arizona, however, cuckoos are also found nesting along more arid ephemeral and intermittent drainages with sycamore, mesquite, walnut, hackberry, alder, or mixed oak assemblages (Corman and Magill 2000; Corman and Wise-Gervais 2005;WestLand Resources, Inc. 2013a, 2013b, , 2015a, 2015b, 2015c; American Birding Association 2014; AGFD 2017; Tucson Audubon 2015; Cornell Lab of Ornithology 2017). In the extreme southern portion of their summer range in the States of Sonora (southern quarter) and Sinaloa, Mexico, western yellow-billed cuckoos also nest in upland thorn scrub and dry deciduous habitats away from the riparian zone (Russell and Monson 1988), although their densities are lower in these habitats than they are in adjacent riparian areas.

Habitat for the western yellow-billed cuckoo in much of its range is largely associated with perennial rivers and streams that support the expanse of vegetation characteristics needed by breeding western yellow-billed cuckoos. The range and variation of stream flow frequency, magnitude, duration, and timing that will establish and maintain riparian habitat can occur in different types of regulated and unregulated flows depending on the interaction of the water and the physical characteristics of the landscape (Poff *et al*. 1997; FWS 2002). Hydrologic conditions at western yellow-billed cuckoo breeding sites can vary widely between years and during low rainfall years, water or saturated soil may not be present. Cuckoos may move from one area to another within and between years in response to hydrological conditions. They may also nest at more than one location in a year. Some individuals also roam widely (several hundred miles), apparently assessing food resources before selecting a nest site (Sechrist *et al*. 2013).

Humid conditions created by surface and subsurface moisture appear to be important habitat parameters for western yellow-billed cuckoo. The species has been observed as being restricted to nesting in drainages where humidity is adequate for successful hatching and rearing of young (Hamilton and Hamilton 1965, Gaines and Laymon 1984, Rosenberg *et al*. 1991).

At the landscape level, the available information suggests the western yellow-billed cuckoo requires large tracts of willow-cottonwood or mesquite forest or Madrean evergreen woodland for their nesting season habitat. Habitat can be relatively dense, contiguous stands, irregularly shaped mosaics of dense vegetation with open areas, or narrow and linear. The association of breeding with large tracts of suitable riparian habitat is likely related to home range size. Individual home ranges during the breeding season average over 40 hectares, and home ranges up to 202 hectares have been recorded (Laymon and Halterman 1987, Halterman 2009, Sechrist *et al*. 2009, McNeil *et al*. 2011, McNeil *et al*. 2012). Within riparian habitat, western yellow-billed cuckoos require relatively large (>20 hectares), patches of multilayered habitat for nesting, with optimal size generally greater than 80 hectares (Laymon and Halterman 1989). The multilayered canopy provides shade and traps moisture to create the relatively cooler and more humid streamside conditions, which are believed to be important for nesting success. They are also known to nest in early to mid-successional native riparian habitat.

In addition to the dense nesting grove, western yellow-billed cuckoos need adequate foraging areas near the nest. Foraging areas can be less dense or patchy with lower levels of canopy cover and may be a mix of shrubs, ground cover, and scattered trees (Carstensen *et al*. 2015, Sechrist *et al*. 2009, FWS, unpublished data). Cuckoos often forage in open areas, woodlands, orchards and adjacent streams (Hughes 1999), which include stands of smaller mesquite trees and even tamarisk (Rosenberg *et al*. 1991). In Arizona, adjacent habitat is usually more arid than occupied nesting habitat. This adjacent habitat can be used for foraging where large insects are produced. Habitat types include Sonoran desertscrub, Mojave desertscrub, Chihuahuan desertscrub, chaparral, semidesert grassland, plains grassland, and Great Basin grasslands (Brown and Lowe 1982, Brown 1994, Brown *et al*. 2007).

Large expanses of gallery riparian woodland (hydroriparian) habitat supports greater densities of cuckoos than less dense reaches of scattered riparian trees (cottonwood, willow, walnut, ash, mesquite) or xeroriparian woodlands of mesquite, oak, acacia, hackberry, desert willow, and juniper (Halterman *et al*. 2016, McNeil *et al*. 2013, Sechrist *et al*. 2009). However, these less dense reaches of scattered riparian trees and xeroriparian woodlands are also important to yellow-billed cuckoos as nesting substrate, foraging habitat (WestLand Resources, Inc. 2013a and 2013b), and as a buffer between more hydric sites and the adjacent, xeric uplands, which decreases the edge/interior ratio of a given hydroriparian patch.

Migration habitat needs are not well known, although they appear to include a relatively wide variety of conditions. Migrating yellow-billed cuckoos have been found in coastal scrub, second-growth forests and woodlands, hedgerows, forest edges, and in smaller riparian patches than those used for breeding.

The primary threat to the western yellow-billed cuckoo is loss or fragmentation of high-quality riparian habitat suitable for nesting (Corman and Wise-Gervais 2005, FWS 2014a, 2014b). Habitat loss and degradation results from several interrelated factors, including alteration of flows in rivers and streams, mining, encroachment into suitable habitat from agricultural and other development activities on breeding and wintering grounds, stream channelization and stabilization, diversion of surface and ground water for agricultural and municipal purposes, livestock grazing, wildfire, establishment of nonnative vegetation, drought, and prey scarcity due to pesticides (Ehrlich *et al*. 1992, FWS 2014b). Pesticide use is widespread in agricultural areas in the western yellow-billed cuckoo breeding range in the United States and northern Mexico. Yellow-billed cuckoos have also been exposed to the effects of pesticides on their wintering grounds, as evidenced by DDT found in their eggs and eggshell thinning in the United States (Grocki and Johnston 1974, Laymon and Halterman 1987, Hughes 1999). Because much of the species' habitat is in proximity to agriculture, the potential exists for direct and indirect effects to a large portion of the species in these areas through altered physiological functioning, prey availability, and, therefore, reproductive success, which ultimately results in lower population abundance and curtailment of the occupied range (Laymon 1980, Laymon 1998, Hughes 1999, Colyer 2001, Mineau and Whiteside 2013, Hopwood *et al*. 2013, Mineau and Palmer 2013, FWS 2014b).

The ongoing threats, including small isolated populations, cause the remaining populations to be increasingly susceptible to further declines and local extirpations through increased predation rates, barriers to dispersal by juvenile and adult yellow-billed cuckoos, chance weather events, fluctuating availability of prey populations, collisions with tall vertical structures during migration, defoliation of tamarisk by the introduced tamarisk leaf beetle (*Diorhabda* spp.), increased fire risk, and climate change events (Thompson 1961, McGill 1975, Wilcove *et al*. 1986). The warmer temperatures already occurring in the southwestern United States may alter the plant species composition of riparian forests over time. An altered climate may also disrupt and change food availability for the western yellow-billed cuckoo if the timing of peak insect emergence changes in relation to when the cuckoos arrive on their breeding grounds to feed on this critical food source.

Habitat for the western yellow-billed cuckoo has been modified and curtailed, resulting in only remnants of formerly large tracts of native riparian forests, many of which are no longer occupied by western yellow-billed cuckoos. Despite recent efforts to protect existing, and restore additional, riparian habitat in the Sacramento, Kern, and Colorado Rivers, and other rivers in the range of the western yellow-billed cuckoo, these efforts offset only a small fraction of historical habitat that has been lost. Therefore, we expect the threats resulting from the combined effects associated with small and widely separated habitat patches to continue to affect a large portion of the range of the western yellow-billed cuckoo.

Critical habitat for this species has been proposed within both Pima and Santa Cruz counties; however, the proposed action does not affect any areas that have been proposed as critical habitat.

Previous Consultations

Since listing in 2014, at least 22 Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the yellow-billed cuckoo's range. Activities continue to adversely affect the distribution and extent of yellow-billed cuckoo habitat throughout its range (development, urbanization, grazing, recreation, native and non-native habitat removal, dam operations, river crossings, ground and surface water extraction, mines, utilities, etc.).

Pima Pineapple Cactus

The Pima Pineapple cactus was listed as an endangered species without critical habitat on September 23, 1993 (58 FR 49875). Factors that contributed to the listing include habitat loss and degradation, habitat modification and fragmentation, limited geographical distribution and species rareness, illegal collection, and difficulties in protecting areas large enough to maintain functioning populations. In 2005, a 5-year review was initiated for the Pima Pineapple cactus (70 FR 5460). This review was completed in 2007 and recommended no change to the cactus's classification as an endangered species (U.S. Fish and Wildlife Service 2007).

Recent investigations of taxonomy and geographical distribution focused in part on assessing the validity of the taxon (see Baker 2004, Baker 2005, and Schmalzel *et al.* 2004). Although there is evidence for a general pattern of clinal variation across the range of the species (Schmalzel *et al.* 2004), this does not preclude the recognition of taxonomic varieties within *C. sheeri* (= *C. robustispina*). Baker (2005) found that there are distinct geographical gaps between the distribution of this subspecies and the other subspecies, which occur in eastern Arizona, New Mexico, and Texas, and that the subspecies are morphologically coherent within their respective taxa (Baker 2004). His geographical and morphological work supports the idea that the subspecific groups within *C. robustispina* are indeed discrete, and merit separate taxonomic status as subspecies (U.S. Fish and Wildlife Service 2007).

We have determined that Pima Pineapple cactus that are too isolated from each other may not be effectively pollinated. For example, the major pollinator of Pima Pineapple cactus is thought to be *Diadasia rinconis*, a ground-nesting, solitary, native bee. McDonald (2005) found that Pima Pineapple cactus plants need to be within approximately 600 m (1,969 ft) of each other in order to facilitate effective pollination. Based on this information and other information related to similar cacti and pollinators, we have determined that Pima Pineapple cactus plants that are located at distances greater than 900 meters from one another become isolated with regard to meeting their life history requirements. The species is an obligate outcrosser (not self-pollinating), so it is important for plants to be within a certain distance to exchange pollen with each other. Also, the study found that pollination was more effective when other species of native cacti are near areas that support Pima Pineapple cactus. The native bees pollinate a variety of cacti species and the sole presence of Pima Pineapple cactus may not be enough to attract pollinators.

The Pima Pineapple cactus occurs south of Tucson, in Pima and Santa Cruz counties, Arizona, as well as in adjacent northern Sonora, Mexico. In Arizona, it is distributed at very low densities throughout both the Altar and Santa Cruz valleys, and in low-lying areas connecting the two valleys. This cactus generally grows on slopes of less than 10 percent and along the tops (upland areas) of alluvial bajadas. The plant is found at elevations between 2,360 feet (ft) and 4,700 ft (Phillips *et al.* 1981, Benson 1982, Ecosphere Environmental Services Inc. 1992), in vegetation characterized as either or a combination of Arizona upland of the Sonoran desertscrub community and semi-desert grasslands (Brown 1982, Johnson 2004). Paredes-Aguilar *et al.* (2000) reports the subspecies from oak woodlands in Sonora. Several attempts have been made to delineate habitat within the range of Pima Pineapple cactus (McPherson 2002, RECON Environmental Inc. 2006, U.S. Fish and Wildlife Service unpublished analysis) with limited success. As such, we are still unable to determine exact ecological characters to help us predict locations of Pima Pineapple cactus or precisely delineate Pima Pineapple cactus habitat (U.S. Fish and Wildlife Service 2007), except perhaps in localized areas (U.S. Fish and Wildlife Service 2005).

As a consequence of its general habitat requirements, considerable habitat for this species appears to exist in Pima and Santa Cruz counties, much of which is unoccupied. Pima Pineapple cactus occurs at low densities, widely scattered, sometimes in clumps, across the valley bottoms and bajadas. The species can be difficult to detect, especially in dense grass cover. For this reason, systematic surveys are expensive and have not been conducted extensively throughout the range of the Pima Pineapple cactus. As a result, location information has been gathered opportunistically, either through small systematic surveys, usually associated with specific development projects, or larger surveys that are typically only conducted in areas that seem highly suited for the species. Furthermore, our knowledge of the distribution and status of this species is gathered primarily through the section 7 process; and we only see projects that require a Federal permit or have Federal funding. There are many projects that occur within the range of Pima Pineapple cactus that do not undergo section 7 consultation, and we have no information regarding the status or loss of plants or habitat associated with those projects. For these reasons, it is difficult to address abundance and population trends for this species.

The AGFD maintains the Heritage Data Management System (HDMS), a database identifying elements of concern in Arizona and consolidating information about their distribution and status throughout the state. This database has 5,553 Pima Pineapple cactus records, 5,449 Pima Pineapple cactus of which have coordinates. Some of the records are quite old, and we have not confirmed whether the plants are still alive. We also cannot determine which plants may be the result of multiple surveys in a given area. Of the known individuals (5,553), approximately 1,340 Pima Pineapple cactus plants are documented in the database as extirpated as of 2003. There have been additional losses since 2003, but that information is still being compiled in the database. The database is dynamic, based on periodic entry of new information, as time and staffing allows. As such, the numbers used from one biological opinion to the next may vary and should be viewed as a snapshot in time at any given moment. We have not tracked loss of habitat because a limited number of biological assessments actually quantify habitat for Pima Pineapple cactus.

We do know the number and fate of Pima Pineapple cactus that have been detected during surveys for projects that have undergone section 7 consultation. Through 2010, section 7 consultations on development projects (e.g., residential and commercial development, mining, infrastructure improvement) considered 2,680 Pima Pineapple cactus plants found on approximately 15,192 acres within the range of the Pima Pineapple cactus. Of the total number of plants, 1,985 Pima Pineapple cactus (74 percent) were destroyed, removed, or transplanted as a result of development, mining, and infrastructure projects. In terms of Pima Pineapple cactus habitat, some of the 15,192 acres likely did not provide Pima Pineapple cactus habitat, but that amount is difficult to quantify because Pima Pineapple cactus habitat was not consistently delineated in every consultation. Of the 15,192 acres, however, we are aware that 14,545 acres (96 percent) have been either permanently or temporarily impacted. Some of these acres may still provide natural open space, but we have not been informed of any measures (e.g., conservation easements) that have been completed to ensure these areas will remain open.

Through section 7 consultation on non-development-related projects (e.g., fire management plans, grazing, buffelgrass control), we are aware of an additional 781 plants within an unknown number of acres; we do not know the number of acres because these types of projects are often surveyed for Pima Pineapple cactus inconsistently, if at all. Across the entire Pima Pineapple cactus range, it is difficult to quantify the total number of Pima Pineapple cactus lost and the rate and amount of habitat loss for three reasons: 1) we review only a small portion of projects within the range of Pima Pineapple cactus (only those that have Federal involvement and are subject to section 7 consultation), 2) development that takes place without any jurisdictional oversight is not tracked within Pima and Santa Cruz counties, and 3) many areas within the range of the Pima Pineapple cactus have not been surveyed; therefore, we do not know how many plants exist or how much habitat is presently available.

Some additional information related to the survival of Pima Pineapple cactus comes from six demographic plots that were established in 2002 in the Altar Valley. The results from the first year (2002-2003) indicate that the populations were stable; out of a total of over 300 Pima Pineapple cactus measured, only 10 died, and two Pima Pineapple cactus seedlings were found (Routson *et al.* 2004). The plots were not monitored in 2004, but were visited again starting in May 2005. In the two years between September 2003 and September 2005, 35 individuals, or 13.4 percent, of the original population had died and no new seedlings were found (Baker 2006). Baker (2006) suggests that recruitment likely occurs in punctuated events in response to quality and timing of precipitation, and possibly temperature, but there is little evidence until such events occur. He goes on to say that further observations need to be made to determine the rate at which the population is declining, because, based on an overall rate of die-off of 13.4 percent every two years, few individuals will be alive at this site after 15 years. As this monitoring program continues, critical questions regarding the life cycle of this species will be answered.

Threats to Pima Pineapple cactus include habitat loss and fragmentation, competition with non-native species, and inadequate regulatory mechanisms to protect this species. We believe residential and commercial development, and its infrastructure, is by far the greatest threat to Pima Pineapple cactus and its habitat. However, we have only a limited ability to track the cumulative amount of development within the range of Pima Pineapple cactus. What is known with certainty is that development pressure continues in Pima and Santa Cruz counties. Invasive grass species are a threat to the habitat of Pima Pineapple cactus. Habitat in the southern portion of the Altar Valley is now dominated by Lehmann lovegrass (*Eragrostis lehmanniana*). According to Gori and Enquist (2003), Boer lovegrass (*Eragrostis chloromelas*) and Lehmann lovegrass are now common and dominant on 1,470,000 acres in southeastern Arizona. They believe that these two grass species will continue to invade native grasslands to the north and east, as well as south into Mexico. These grasses have a completely different fire regime than the native grasses, tending to form dense stands that promote higher intensity fires more frequently. Disturbance (like fire) tends to promote the spread of these non-natives (Ruyle *et al.* 1988, Anable *et al.* 1992). Roller and Halvorson (1997) hypothesized that fire-induced mortality of Pima Pineapple cactus increases with Lehmann lovegrass density. Buffelgrass (*Pennisetum ciliare*) has become locally dominant in vacant areas in the City of Tucson and along roadsides, notably in the rights-of-way along Interstate 10 and State Route 86. Some portions of Pima Pineapple cactus habitat along these major roadways are already being converted to dense stands of buffelgrass, which can lead to recurring grassland fires and the destruction of native desert vegetation (Buffelgrass Working Group 2007).

The effects of climate change (i.e., decreased precipitation and water resources) are a threat to the long-term survival and distribution of native plant species, including the Pima Pineapple cactus. For example, temperatures rose in the twentieth century and warming is predicted to continue over the twenty-first century. Although climate models are less certain about predicted trends in precipitation, the southwestern United States is expected to become warmer and drier.

In addition, precipitation is expected to decrease in the southwestern United States, and many semi-arid regions will suffer a decrease in water resources from climate change as a result of less annual mean precipitation and reduced length of snow season and snow depth. Approximately half of the precipitation within the range of the Pima Pineapple cactus typically falls in the summer months; however, the impacts of climate change on summer precipitation are not well understood. Drought conditions in the southwestern United States have increased over time and may have contributed to loss of Pima Pineapple cactus populations through heat stress, drought stress, and related insect attack, as well as a reduction in germination and seedling success since the species was originally listed in 1993, and possibly historically. Climate change trends are likely to continue, and the impacts on species will likely be complicated by interactions with other factors (e.g., interactions with non-native species and other habitat-disturbing activities). The Arizona Native Plant Law can delay vegetation clearing on private property for the salvage of specific plant species within a 30-day period. Although the Arizona Native Plant Law prohibits the taking of this species on State and private lands without a permit for educational or research purposes, it does not provide for protection of plants *in situ* through restrictions on development activities. Even if Pima Pineapple cactus are salvaged from a site, transplanted individuals only contribute to a population if they survive and are close enough (within 900 m [(2,970 ft]) to other Pima Pineapple cactus to be part of a breeding population from the perspective of pollinator travel distances and the likelihood of effective pollination.

Transplanted Pima Pineapple cactus have variable survival rates, with moderate to low levels of survival documented. Past efforts to transplant individual Pima Pineapple cactus to other locations have had limited success. For example, on two separate projects in Green Valley, the mortality rate for transplanted Pima Pineapple cactus after two years was 24 percent and 66 percent, respectively (SWCA, Inc. 2001, WestLand 2004). One project southwest of Corona de Tucson involved transplanting Pima Pineapple cactus into areas containing *in situ* plants. Over the course of three years, 48 percent of the transplanted individuals and 24 percent of the *in situ* individuals died (WestLand 2008). There is also the unquantifiable loss of the existing Pima Pineapple cactus seed bank associated with the loss of suitable habitat. Furthermore, once individuals are transplanted from a site, Pima Pineapple cactus is considered to be extirpated from that site, as those individuals functioning in that habitat are moved elsewhere.

Pima County regulates the loss of native plant material associated with ground-disturbing activities through their Native Plant Protection Ordinance (NPPO) (Pima County 1998). The NPPO requires inventory of the site and protection and mitigation of certain plant species slated for destruction by the following method: the designation of a minimum of 30 percent of on-site, permanently protected open space with preservation in place or transplanting of certain native plant species from the site. There are various tables that determine the mitigation ratio for different native plant species (e.g. saguaros, ironwood trees, Pima Pineapple cactus) with the result that mitigation may occur at a 1:1 or 2:1 replacement ratio. Mitigation requirements are met through the development of preservation plans. The inadvertent consequence of this ordinance is that it has created a market for Pima Pineapple cactus. Any developer who cannot avoid this species or move it to another protected area must replace it. Most local nurseries do not grow Pima Pineapple cactus (and cannot grow them legally unless seed was collected before the listing). As a result, environmental consultants are collecting Pima Pineapple cactus seed from existing sites (which can be done with a permit from the Arizona Department of

Agriculture and the permission of the private landowner), germinating seed, and placing Pima Pineapple cactus plants grown from seed back on these sites. There have been no long-term studies of transplant projects, thus the conservation benefit of these actions is unknown. Moreover, growing and planting Pima Pineapple cactus does not address the loss of Pima Pineapple cactus habitat that necessitated the action of transplanting cacti in the first place. Other specific threats that have been previously documented (U.S. Fish and Wildlife Service 1993), such as overgrazing, illegal collection, prescribed fire, and mining, have not yet been analyzed to determine the extent of effects to this species. However, partial information exists. Overgrazing by livestock, illegal collection, and fire-related interactions involving exotic Lehmann lovegrass and buffelgrass may negatively affect Pima Pineapple cactus populations. Mining has resulted in the loss of hundreds, if not thousands, of acres of potential habitat throughout the range of the plant.

The protection of Pima Pineapple cactus habitat and individuals is complicated by the varying land ownership within the range of this species in Arizona. An estimated 10 percent of the potential habitat for Pima Pineapple cactus is held in Federal ownership. The remaining 90 percent is on Tribal, State, and private lands. Most of the federally-owned land is either at the edge of the plant‘s range or in scattered parcels. The largest contiguous parcel of federally-owned habitat is the Buenos Aires National Wildlife Refuge, located at the southwestern edge of the plant‘s range at higher elevations and with lower plant densities. No significant populations of Pima Pineapple cactus are known from Sonora or elsewhere in Mexico (Baker 2005). There have been some notable conservation developments for this species. As of 2010, there are two conservation banks for Pima Pineapple cactus, one on a private ranch in the Altar Valley (Palo Alto Ranch Conservation Bank) and another owned by Pima County that includes areas in both the Altar Valley and south of Green Valley. In the Palo Alto Ranch Conservation Bank, approximately 700 acres have been conserved to date. In Pima County‘s Bank, a total of 530 acres are under a conservation easement at this time (the County offsets its own projects within this bank). Additionally, three large blocks of land totaling another 1,078 acres have been set aside or are under conservation easements through previous section 7 consultations (see consultations 02-21- 99-F-273, 02-21-01-F-101, and 02-21-03-F-0406). While not formal conservation banks, these areas, currently totaling 1,739.6 acres, are set aside and managed specifically for Pima Pineapple cactus as large blocks of land, and likely contribute to recovery of the taxon for this reason; therefore, we consider these acres conserved. Another 647 acres of land have been set aside as natural open space within the developments reviewed through section 7 consultation between 1995 and 2010. However, these are often small areas within residential backyards (not in a common area) that are difficult to manage and usually isolated within the larger development, and often include areas that do not provide Pima Pineapple cactus habitat (e.g., washes). Some conservation may occur onsite because of these open space designations, but long-term data on conservation within developed areas are lacking; the value of these areas to Pima Pineapple cactus recovery over the long-term is likely not great.

In summary, Pima Pineapple cactus conservation efforts are currently hampered by a lack of information on the species. Specifically, we have not been able to determine exact ecological characters to help us predict locations of Pima Pineapple cactus or precisely delineate its habitat, and considerable area within the Pima Pineapple cactus range has not been surveyed. Further, there are still significant gaps in our knowledge of the life history of Pima Pineapple cactus; for instance, we have yet to observe a good year for seed germination. From researcher observations and motion sensing cameras, we have learned that ants, Harris' antelope squirrels, and jackrabbits act as seed dispersal agents. Demographic plots have been only recently established, and information is just now beginning to be reported with regard to describing population dynamics for Pima Pineapple cactus in the Altar Valley.

Development and associated loss of habitat remain important and continuing threats to this taxon. However, the expanding threat of non-native grasses and resulting altered fire regimes are a serious concern for the long-term viability of the species, as is ongoing drought. The full impact of drought and climate change on Pima Pineapple cactus has yet to be studied, but it is likely that, if recruitment occurs in punctuated events based on precipitation and temperature (Baker 2006), Pima Pineapple cactus will be negatively affected by these forces. Already we have seen a nearly 25% loss of individuals across six study sites in the Altar Valley between 2010 and 2011; these deaths were attributed largely to drought and associated predation by native insects and rodents (Baker 2011). Conservation efforts that focus on habitat acquisition and protection, like those proposed by Pima County and the City of Tucson, are important steps in securing the long-term viability of this taxon. Regulatory mechanisms, such as the native plant protection ordinances, provide conservation direction for Pima Pineapple cactus habitat protection within subdivisions, and may serve to reduce Pima Pineapple cactus habitat fragmentation within areas of projected urban growth.

Previous Consultations

In the past 10 years, at least 31 Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the Pima pineapple cactus' range. Activities continue to adversely affect the distribution and extent of Pima pineapple cactus habitat throughout its range (development, urbanization, grazing, recreation, native and non-native habitat removal, fire management, land use planning, border infrastructure, mines, utilities, etc.).

Jaguar and Critical Habitat

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 FWS 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 FWS 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 FWS 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 FWS 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 FWS 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 FWS published a final rule clarifying that endangered status for the jaguar extended into the United States (62 FR 39147).

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.

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).

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 +/- 15.0 km^2 (38.7 +/- 5.8 mi^2) and four females was 42.5 +/- 16 km^2 (16.4 +/- 6.2 mi2) (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. 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), 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 +/- 2.3 km (1.5 +/- 1.4 mi), with that of one male being significantly larger [3.3 +/- 1.8 km (2.0 +/- 1.1 mi)] than that displayed by females (1.8 +/- 2.5 km) (Crawshaw and Quigley 1991). Additionally, the mean distance travelled by all animals during one-day intervals in the dry season [2.7 +/- 2.5 km (1.7 +/- 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).

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). 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. 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), Grigione *et al.* (2009), Sanderson and Fisher (2013a, 2013b). 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. 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.

More recently, Sanderson and Fisher (2013a, 2013b) modeled jaguar habitat in the Northwestern Jaguar Recovery Unit (NRU) (see description below) following a variant of the Hatten *et al.* (2005) method. Habitat factors used to characterize potential jaguar habitat were: (1) percentage of tree cover; (2) ruggedness index; (3) human influence; (4) ecoregion; (5) elevation (some model versions only); and (6) distance from water. Altogether, 13 habitat model versions were produced with input from the Technical Subgroup of the Jaguar Recovery Team. The habitat models were also translated into carrying capacity. The final habitat model (version 13) suggests a potential carrying capacity of more than 3,400 jaguars over an area of over 226,000 km2. This capacity was further broken down into smaller geographic areas or subunits of the NRU which, from south to north, may have the potential to contain: approximately 1,318 jaguars in the Jalisco Core Area, approximately 929 jaguars in the Sinaloa Secondary Area, approximately 1,124 jaguars in the Sonora Core Area, and approximately 42 jaguars in the Borderlands Secondary Area (which include portions of northern Sonora, southern Arizona, and southeastern New Mexico). The current populations are substantially below these carrying capacities, but are not zero according to recent observations in all four subunits (Sanderson and Fisher 2013a, 2013b).

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 (JCUs) 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. Male jaguars have been documented in southern Arizona, within and near the proposed action area, as recently as August 2013 (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).

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 (47), 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 mapping study to construct a blueprint of priority conservation areas for jaguars, as well as ocelots and jaguarundis, in the U.S. – Mexico border region. 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 Lis (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. The Sky Islands Unit was ranked as ―very high priority for a conservation area for jaguars (Grigione *et al.* 2009:83).

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 (FWS 2012b).

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 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). Medellin *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). These threats are relevant to jaguars throughout most of their range; however, no jaguars have been documented in collisions with vehicles in the U.S. despite the fact that they have documented to cross roads, including two lane highways in Arizona. For example, the same male jaguar has been photo-documented in both the Whetstone and Santa Rita mountains. This jaguar would have had to cross over or through a passage beneath State Route 82 or 83 to move between the mountain ranges.

Habitat fragmentation may disrupt original patterns of gene flow and lead to drift-induced differentiation among local population units and 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 range-wide, 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.

Critical habitat for the jaguar is designated in the United States for approximately 309,263 ha (764,207 ac) in Pima, Santa Cruz, and Cochise counties, Arizona, and Hidalgo County, New Mexico in six critical habitat units (79 FR 12571): (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, Empire, and Huachuca Mountains, and the Canelo and Grosvenor 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. The unit affected by the proposed action is Unit 2. The primary constituent elements (PCEs) of jaguar designated critical habitat are listed briefly below (USFWS 2016b):

PCE 1: Provide connectivity to Mexico.
PCE 2: Contain adequate levels of prey species, including deer and javelina, as well as other medium-sized prey.
PCE 3: Surface water resources available within 20 km (12.4 mi) of each other.
PCE 4: Contain from greater than 1 to 50 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.
PCE 5: Intermediately, moderately, or highly rugged terrain.
PCE 6: Below 2,000 m (6,562 feet) in elevation.
PCE 7: Characterized by minimal to no human population density, no major roads, or no stable nighttime lighting over any 1 km^2 (0.4 mi^2) area.

Previous Consultations

In the past 10 years, at least eight Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the jaguar's range. Activities continue to adversely affect the distribution and extent of jaguar habitat throughout its range (development, recreation, native and non-native habitat removal, land use planning, border infrastructure, mines, utilities, etc.).

Ocelot

The ocelot was listed as endangered in 1972 under the authority of the Endangered Species Conservation Act of 1969 (FWS 1972). The 1969 Act maintained separate lists for foreign and native wildlife. The ocelot appeared on the foreign list, but due to an oversight, not on the native list. Following passage of the ESA in 1973, the ocelot was included on the January 4, 1974, list of Endangered Foreign Wildlife that grandfathered species from the lists under the 1969 Act into a new list under the ESA (FWS 1974). The entry for the ocelot included Central and South America under the Where Found column in the new ESA list. Endangered status was extended to the U.S. portion of the ocelot's range with a final rule published July 21, 1982 (FWS 1982). The Historic Range column for the ocelot's entry in the rule reads, U.S.A. (TX, AZ) south through Central America to South America. However, the current list reads "Where ever found" under "Where listed". The ocelot was upgraded to CITES Appendix I in 1986 (Nowell and Jackson 1996) and is considered endangered in Mexico (SEMARNAT 2002).

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 ocelot was originally addressed in Listed Cats of Texas and Arizona Recovery Plan (with Emphasis on the Ocelot) (USFWS 1990). The Recovery Plan for the Ocelot (*Leopardus pardalis*), First Revision, finalized in August 2016 (USFWS 2016), has the goal of improving the status of the species to the point that it no longer needs the protection of the ESA. Objectives of the plan call for 1) the assessment, protection, and restoration of sufficient habitat to support viable populations of the ocelot in the borderlands of the U.S. and Mexico; 2) the reduction of effects of human population growth and development to ocelot survival and mortality; 3) the maintenance or improvement of genetic fitness, demographic conditions, and health of the ocelot; 4) the assurance of long-term viability of ocelot conservation through partnerships, the development and application of incentives for landowners, application of existing regulations, and public education and outreach; 5) the use of adaptive management, in which recovery is monitored and recovery tasks are revised by the FWS in coordination with the Recovery Team as new information becomes available; and 6) the support of international efforts to ascertain the status and conserve the ocelot south of Tamaulipas and south of Sonora.

The major focus of the revised recovery plan is on two cross-border management units, the Texas/Tamaulipas Management Unit and the Arizona/Sonora Management Unit (ASMU). The boundaries of the ASMU are defined as the original range of the subspecies (*L. p. sonoriensis*) which generally extends from central Arizona south to southern Sinaloa. Delisting criteria for the ASMU are: 1) the ASMU metapopulation is estimated through reliable scientific monitoring to be at least 1,000 animals for 10 years and populations should be stable or increasing; 2) threats from habitat loss, habitat fragmentation, and poaching are reduced such that the ocelot can maintain healthy, viable populations for the foreseeable future; and 3) habitat linkages to facilitate an ASMU metapopulation have been identified and are conserved for the foreseeable future.

The ocelot is included on CITES Appendix I and is protected across most of its range (Caso et al. 2008). Part of the species range includes protected areas, including some capable of maintaining long-term viable populations (Caso et al. 2008). While loss and fragmentation of habitat adversely affect ocelot populations, there have been notable efforts to acquire, protect, and restore habitat, and decrease mortality of the species throughout its range. See a detailed account of planning and conservation efforts for the ocelots in the Texas-Tamaulipas and Arizona-Sonora Management Units in the 2016 Recovery Plan for the Ocelot, First revision.

The ocelot is a medium-sized spotted cat weighing from 7-16 kg (15-35 lbs), with males weighing more than females (FWS 2010). The coloration of the upper parts of the body is pale gray to cinnamon. There are spots on the head, two black stripes on the cheeks, and four to five longitudinal black stripes on the neck. The body shows elongated black-edged spots arranged in chain-like bands. The rounded ears are black dorsally, with a conspicuous white spot. The underparts are whitish, spotted with black. The tail is marked with dark bars or incomplete rings (Hall 1981).

The life history of the ocelot has been summarized by Laack (1991), Laack *et al.* (1991 and 2005), Tewes and Schmidly (1987), and others. Ocelots may live greater than 10 years in the wild and can live longer (18 years plus) in captivity (Murray and Gardner 1997). Gestation lasts about 70-80 days, and breeding reaches a peak during autumn in Texas (Tewes and Schmidly 1987); however breeding peaks may vary throughout the ocelot range. Wild ocelots probably first produce young at about 18 to 30 months-of-age (Eaton 1977, Tewes and Schmidly 1987), although Laack (1991) observed first reproduction in wild female ocelots between 30 and 45 months-of-age. Average litter size is about 1 to 1.5 kittens per litter (Laack *et al.* 2005, Mora *et* *al.* 2000, Murray and Gardner 1997). Males are believed to contribute little to direct parental care (Tewes 1986, Laack 1991) and young may become independent at one year of age (Murray and Gardner 1997). There is little information on the interval between successive litters in the wild, but it is likely two years (Murray and Gardner 1997, FWS 2010).

Although ocelots usually disperse from the natal range, sometimes females may remain in their natal range (Laack 1991). The age at which subadult ocelots disperse from the natal range varies, but is about two years of age (Ludlow and Sunquest 1987, Laack 1991). Laack (1991) found that there was no obvious sex difference in age at dispersal and that duration of successful dispersal (time elapsed between leaving natal range and establishing an independent home range) was 7 to 9.5 months. Studies have shown that dispersal distance varies considerably, for example, in Texas, dispersal distances have been documented between 2.5 km and 42.5 km (Navarro-Lopez 1985, Tewes 1986, Laack 1991, FWS 2010). The longest documented dispersal distance (50 km/31 miles) that we are aware of was of a male ocelot in Tamaulipas, Mexico (Booth-Binczik 2007).

No studies have documented dispersal distance of ocelots in Sonora and Arizona; however, a subadult male ocelot was documented in Arizona in 2010 just west of Globe (it was killed by a car) (Holbrook *et al.* 2011). Ocelots have also been recently detected in the Whetstone (detected in 2009) (Avila-Villegas and Jessica Lamberton-Moreno 2012) and Huachuca Mountains (detections from 2011 to 2013) (email from Tim Snow, AGFD, March 13, 2013). The nearest recently (in 2011) documented female with young (one kitten) was located about 48 km (30 miles) south of the international border in the Sierra Azul of Sonora, Mexico (Avila-Villegas and Jessica Lamberton-Moreno 2012). If ocelots documented in Globe and the Huachuca and Whetstone mountains dispersed from the nearest breeding population, assuming the nearest breeding population is the one previously mentioned, it means the ocelots moved about 220 km (135 miles) to Globe; 55 km (35 miles) to the Huachuca Mountains (email from Tim Snow, AGFD, March 18, 2013), and 110 km (70 miles) to the Whetstone Mountains (Avila-Villegas and Jessica Lamberton-Moreno 2012). Avila-Villegas and Jessica Lamberton-Moreno (2012), however, believe that travel from northern Sonora to Globe seems unlikely. Additionally, a minimal travel distance (round trip) of 84 kilometers (52 miles) was documented for an ocelot in the Huachuca Mountains who subsequently was documented in the Patagonia Mountains and then back in the Huachucas (Culver 2016).

Ocelots are solitary animals that maintain home ranges (Emmons 1988, Ludlow and Sunquist 1987, Laack 1991, Crawshaw 1995). Home range for the ocelot varies throughout its range. Adult female home range sizes vary from approximately 2 km^2 to 17 km^2 (494 to 4,201 acres) while adult male home range sizes vary from approximately 5 km^2 to 38 km^2 (1,235 to 9,390 acres), both depending on the habitat type in which they are found (Tewes 1986, Ludlow and Sunquist, 1987, Crawshaw and Quigley 1989, Emmons 1988, Konecny 1989, Laack 1991, Caso 1994, Crawshaw 1995, Fernandez 2002). In the Tamaulipan thornscrub of south Texas and northeastern Mexico, mean ocelot home range sizes reported include: Laack (1991): 6.2 km^2 (1,544 acres) for males, 2.87 km^2 (709 acres) for females; Navarro-Lopez (1985): 2.5 km^2 (623 acres) for males, 2.1 km^2 (512 acres) for females; Tewes (1986): 12.3 km^2 (3,039 acres) for males and 7.0 km^2 (1,730 acres) for females; and Caso (1994): 8.1 km^2 (2,006 acres) for males, 9.6 km^2 (2,372 acres) for females. No home range studies have been done for ocelots in Arizona or northwestern Mexico. However, in western Mexico, specifically, in the tropical deciduous forest of Jalisco, average home range size using the Kernel estimator for male ocelots was 11.7 km^2 (2,891 acres) and for females was 5.8 km^2 (1,433 acres); average home range size using the 95% Minimum Convex Polygon estimator was 16.26 km^2 (4,018 acres) for males and 7.34 km^2 (1,814 acres) for females (Fernandez 2002). Additionally, Culver (2016) estimated minimum observed ranges for ocelots in Arizona and Sonora. The average minimum observed range of three Arizona ocelots was 30.09 km^2 (11.62 mi^2), with minimum observed ranges ranging from 7.76 to 63.40 km^2 (3.00 to 24.48 mi^2). The average minimum observed range of 9 Sonora ocelots was 11.75 km^2 (4.54 mi^2) (1.97 to 31.49 km^2 / 0.76 to 12.16 mi^2) (Culver et al. 2016).

Ocelots inhabit a wide variety of densely vegetated habitat types, including, but not limited to, thorn scrub, semi-arid woodland, tropical deciduous and semi-deciduous forest, subtropical forest, lowland rainforest, palm savanna, and seasonally flooded savanna woodland (Tewes 1986, Ludlow and Sunquist 1987, Crawshaw and Quigley 1989, Crawshaw 1995, Fernandez 2002). In south Texas, ocelots occur predominantly in dense thornscrub communities (Navarro-Lopez 1985, Tewes 1986, Laack 1991). Laack (1991) also documented minimal use of Johnsongrass (*Sorghum halepense*) by ocelots. Caso (1994) found ocelots used primarily forest or woody communities in Tamaulipas, Mexico, and used the open pastures much less often. In Sonora, López González *et al.* (2003) reported 27 of 36 (75%) of verified ocelot records in Sonora were associated with tropical or subtropical habitats, namely subtropical thornscrub, tropical deciduous forest and tropical thornscrub; a few ocelots were recorded in oak woodlands, but were all males. The mean elevation of the 33 records located with precision was 700 +/- 450 meters (2,297 +/- 1,476 feet), at which altitudes subtropical thornscrub is the main habitat (López González *et al.* 2003). They report that ocelots were associated largely with the mountainous Sierra region of eastern Sonora and that records closer to the Sonoran desert biome were mainly associated with riparian areas, where the shrub cover is relatively thicker than the surrounding areas. Avila-Villegas and Jessica Lamberton-Moreno (2012) collected 68 camera photographs of ocelots in the Sierra Azul in northern Sonora, all of which were taken at elevation ranges between 1,275 and 1,625 meters (4,183 and 5,331 feet) in Madrean evergreen woodland.

Of the six ocelots recently recorded in Arizona, the one in the Whetstone Mountains was documented (via remote camera) in Madrean evergreen woodland (Avila-Villegas and Jessica Lamberton-Moreno 2012). A male ocelot that was killed by a vehicle west of Globe, Arizona, in 2010 (Holbrook et al. 2011) was in the interior chaparral vegetation community, at an elevation of 1,334 m within the Greater Oak Flat Watershed (AGFD as cited by Featherstone et al. 2013). Recent detections of three other ocelots in Arizona (in the Huachuca and Santa Rita Mountains) were located in the semidesert grassland (46%), Madrean evergreen woodland (46%), and Great Basin grassland (8%) biotic communities (Culver 2016). On average, all ocelot locations had 23% tree cover and were found at an elevation of 1,832 m. Additionally, on average, they were 2,335 m from perennial water sites and 6,337 m from major roads (Culver 2016).

Despite the variation in habitat use, the species does not appear to be a habitat generalist. Ocelot spatial patterns are strongly linked to dense cover or vegetation, suggesting it uses a fairly narrow range of microhabitats (Emmons 1988, Horne 1998). Horne (1998), in southern Texas, was the first to statistically analyze ocelot habitat selection patterns. He found ocelots used closed (>95% canopy closure) cover types more than cover types with less-than-moderate canopy cover and avoided mixed cover type (50-75% canopy closure). Also in southern Texas, Jackson *et al.* (2005) suggested that ocelots prefer closed canopy over other land cover types, but that areas used by this species tended to consist of more patches with greater edge. No habitat use studies have been conducted in Arizona or Sonora.

Ocelots are generally active for more than half of each 24-hour period and are typically most active at night and during crepuscular periods with more limited diurnal activity (Ludlow and Sunquist 1987, Crawshaw and Quigley 1989, Fernandez 2002, Avila-Villegas and Jessica Lamberton-Moreno 2012). Ocelots are likely generally nocturnal because they follow the nocturnal habits of their primary prey, small mammals (Ludlow and Sunquist 1987, Emmons 1988, and Crawshaw and Quigley 1989).

Ocelots are solitary hunters and eat a wide variety of prey, but small mammals, especially rodents, comprise most of their diet (Emmons 1987, Ludlow and Sunquist 1987, Crawshaw 1995, De Villa Meza *et al.* 2002, Fernandez 2002). Ocelot diets, however, also include medium to large mammals, reptiles, amphibians, birds, fishes, and insects (Emmons 1987, De Villa Meza *et al.* 2002, Fernandez 2002). Based on these results some authors have suggested that ocelots are opportunistic feeders (Bisbal 1986, Emmons 1987).

Estimating population sizes of secretive nocturnal carnivores, especially species that inhabit dense vegetative cover, such as the ocelot, is difficult. We are not aware of any range-wide estimates for ocelots; however, population size has been estimated in a number of countries. An effective population size of 10,000 to 528,732 individuals was estimated for Brazil (Oliveira 2013). A total population of 1,500 to 8,000 individuals was estimated for Argentina (Aprile et al. 2012). A population of 2,025 +/- 675 ocelots in Sonora was estimated by López González et al. (2003) based on the distribution of these records and the availability of potential habitat. Gómez-Ramírez (2015) estimated a population of 1,421 ocelots in Sonora. The U.S. population of the Texas ocelot subspecies has fewer than 100 individuals, found in two separated populations in southern Texas (USFWS 2016). A third and larger population of the Texas/Tamaulipas ocelot subspecies occurs more than 200 km (~124 mi) south of the Texas/Mexico border in the Sierra of Tamaulipas, Mexico (Caso 1994). Stasey (2012) reported a population estimate of 371 ocelots in a 1,560 km^2 patch of habitat in the Sierra of Tamaulipas.

Since 2009, a total of six ocelots have been detected in Arizona, including five detected by trail cameras and hunting dogs, and one dead ocelot that had been struck by a vehicle. A description of these detections follows. In November 2009, a live ocelot (sex unknown) was documented in the Whetstone Mountains in Cochise County, Arizona, with the use of camera-traps (Avila-Villegas and Lamberton-Moreno 2013). In April 2010, a second ocelot was found dead on a road near Globe, Arizona. A genetic analysis was conducted and all data indicated the young male ocelot was not of captive but wild origin (Holbrook et al. 2011). Origin of the ocelot recovered in Globe is still unclear due to a lack of comparative samples from Arizona or Sonora although in the DNA analysis, it clustered with samples from Mexico. A two-year camera-trap study in the area near Globe, Arizona, did not photograph any additional ocelots (Featherstone et al. 2013).

In February 2011, a third male ocelot was treed by a hunting dog and photographed in the Huachuca Mountains. He was subsequently detected multiple times by trail cameras, including once in the Patagonia Mountains in May 2012 (Culver et al. 2016), and was also treed by hunting dogs again (in the Huachuca Mountains). After being detected in the Patagonia Mountains he returned to the Huachuca Mountains, meaning that he traveled an approximate round trip distance of 84 km (Culver et al. 2016). He was most recently detected in May 2013. In May 2012, a fourth male ocelot was detected in the Huachuca Mountains via trail camera. He has been detected many times via trail cameras, most recently in 2018, and treed by hunting dogs once. In April 2014, a fifth male ocelot was detected in the Santa Rita Mountains via trail camera. He was photographed several times over a two-month period and has not been detected since. Additionally, an ocelot was detected in December 2013 in the Santa Rita Mountains; however, it is unknown if this was the same as the fifth ocelot described above or a different ocelot. In March 2018, a 6th ocelot (sex undetermined) was documented in the Huachuca Mountains.

In addition to the recent Arizona sightings, a number of ocelots have been documented just south of the U.S. border in Sonora, Mexico. Specifically, with the use of camera traps, six ocelots were documented between February 2007 and April 2011 in the Sierra Azul, about 30 miles southeast of Nogales, including two males, one female, one kitten, and two of undetermined sex (Avila-Villegas and Lamberton-Moreno 2012). Additionally, one ocelot was documented in 2009 in the Sierra de Los Ajos, about 30 miles south of the U.S. border near Naco, Mexico (USFWS 2016). Also in Sonora, López González et al. (2003) obtained 36 verified ocelot records, 21 of which were obtained after 1990, including 19 individual male records, 6 females, and 11 of undetermined sex. Out of these records, the northern-most record of a female was at 30°30‘ latitude and only one record was of a kitten (located in the southern part of Sonora) (López González et al. 2003).

Although methods used to calculate densities vary among studies, some ocelot population density estimates for particular habitats include: 5.7/100 km^2 (38.6 $miles^2$) in subtropical thornscrub to tropical deciduous forest in Sonora, Mexico (Carrillo and López González 2002); 25/100 km^2 to 225/100 km^2 in the tropical deciduous forest of Jalisco (Casariego Madorell 1998; Fernandez 2002); 30 adult ocelots/100 km^2 in Bolivian dry-forests (Maffei et al. 2005); and 40 adult ocelots/100 km^2 in the llanos (interspersed dry tropical forest in savanna) of central Venezuela (Ludlow and Sunquist 1987).

Although the ocelot is protected over most of its range (Fuller *et al.* 1987), it is still threatened by habitat loss and fragmentation due to increased human development, agriculture, and cattle grazing; illegal killing (e.g., retaliatory killing due to depredation of poultry); and illegal trade (pet and pelt) (Fernandez 2002, FWS 2010, Caso *et al.* 2008). Widespread commercial harvests for the fur trade ceased decades ago (Caso *et al.* 2008); however, human population growth and development continue throughout the ocelot‘s range. Connectivity among ocelot populations or colonization of new habitats is discouraged by the proliferation of highways and increased road mortality among dispersing ocelots. Increased illegal and law enforcement actions along the Mexico-United States border could limit ocelot movement across the border, but it is uncertain if and how much this is affecting that movement.

In Texas, collisions with motor vehicles appear to be the leading cause of known ocelot mortality and accounted for 45 percent of deaths of 80 radio-tagged ocelots between 1983 and 2002 (FWS 2010). Twenty-six of 61 ocelot deaths between 1983 and 2004 were caused by vehicle collisions in Texas (FWS 2010). Since 2007, in Arizona and Northern Sonora, there have been four documented cases of ocelots being killed by vehicles or illegally killed, including: one ocelot struck close to Globe; one ocelot struck on Mexico Highway 2, between Imuris and Cananea, Sonora; and two ocelots illegally killed in the Sierra Azul (email from Sergio Avila, Sky Island Alliance, March 15, 2013).

Previous Consultations

In the past 10 years, five Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the ocelot's range. Activities continue to adversely affect the distribution and extent of ocelot habitat throughout its range (military activities, recreation, native and non-native habitat removal, land use planning, border infrastructure, mines, utilities, etc.).

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.

Description of the Action Area

As mentioned above, the action area for this analysis is based on the area of the trail footprint; and areas outside the trail footprint that may be affected by noise, dust, erosion, other activities including all areas for which trail use may affect groundwater and surface water. The action area is approximately 6200 acres, consisting of the trail system and surrounding areas.

The ecological response units (ERUs) represented in the action area consists of 50.6% juniper grassland, 48.7% semi-desert grassland, and the remaining 0.7% consisting of various ERUs (USFS 2014b). Elevation ranges from 3550 – 4550 feet.

The Juniper Grass ERU is typically found on warmer and drier settings beyond the environmental limits pinyon, and just below and often intergrading with the pinyon-juniper zone. The Juniper Grass ecosystem is generally uneven aged and very open in appearance, primarily on mollisol soils. Trees occur as individuals or in smaller groups and range from young to old. A dense herbaceous matrix of native grasses and forbs characterize this type. Typical disturbances (fire, insects, disease) are low severity and high frequency. These disturbance patterns create and maintain the uneven-aged, open-canopy nature of this type. The tree and grass species composition varies throughout the Region, consisting of a mix of one or more juniper species. Typically, native understory grasses are perennial species, while forbs consist of both annuals and perennials. Shrubs are characteristically absent or scattered. This type is typically found on sites with well-developed, loamy soil characteristics, generally at the drier edge of the woodland climatic zone. Generally these types are most extensive in geographic areas dominated by warm (summer) season or bi-modal precipitation regimes.

Semi-desert grassland occurs throughout southeastern Arizona and southern New Mexico at elevations ranging from 3,000 to 4,500 ft. These grasslands are bounded by Sonoran or Chihuahuan desert at the lowest elevations and woodlands or chaparral at the higher elevations. Species composition and dominance varies across the broad range of soils and topography that occur within the two states. Dominant grassland associations/types are black grama (*Bouteloua eriopoda*) grassland, blue grama (*Bouteloua gracilis*) grassland, tobossa (*Hilaria mutica*) grassland, giant sacaton (*Sporobolus wrightii*) grassland, mixed native perennial grassland, and non-native perennial grassland. Shrubs also occupy these grasslands and their abundance and species composition also varies. As described, this ERU may have had over 10% shrub cover historically, but had less than 10% tree cover.

The action area is characterized by a number of existing roads and trails with conditions that allow for various classes of vehicle, pedestrian, and equestrian uses. The roads and trails are not all maintained, but some of the roads are used by Border Patrol and are maintained by that agency. Recreational use, especially hunting, is a primary activity within the action area. Livestock grazing and associated activities occur regularly within the action area.

Status of the Species and Critical Habitat Within the Action Area

Yellow-Billed Cuckoo

Since the proposed critical habitat rule for the western yellow-billed cuckoo was published (August 15, 2014), new information has emerged that indicate cuckoos may be using and nesting in forested habitats other than riparian woodlands. Recent survey efforts in Madrean oak and pine-oak woodland, juniper woodland, and dense Sonoran desert scrub have documented WYBC breeding in these atypical vegetation types. On the District (and elsewhere on the CNF), cuckoos are being detected within Madrean evergreen woodlands more extensively than previously known. This information is in the form of cuckoo survey reports, eBird records, historical records, and personal communications. In addition, cuckoo surveys conducted for the Hermosa Mine by WestLand Resources Inc. (2013) found that the vegetation associated with cuckoo detections was mostly Emory oak, Arizona white oak, velvet mesquite, desert willow, Arizona sycamore, Arizona walnut, and Goodding's willow. All the aforementioned detections were documented along sandy bottom drainages that do not support perennial surface water.

During the 2017 breeding season, two routes within the project area were surveyed using USFWS protocols (USFWS 2015). Yellow-billed cuckoos were detected along both routes. Detections occurred on multiple occasions on Forest Road 4139 near Coyote Tank, and south of Forest Road 4137 near Lower Sardina Well. Other riparian avian species were also detected along these routes (Tucson Audubon 2017). Other WYBC detections have been recorded along Forest Road 684 (Puerto Canyon Road), near Puerto Spring (eBird Feb 2018).

Based on this information, it is likely that yellow-billed cuckoos occurs throughout the action area in areas that support yellow-billed cuckoo habitat as described above. While nesting yellow-billed cuckoos have not been documented in the action area, cuckoos have been documented during the breeding season. On the Nogales Ranger District and elsewhere on the Coronado National Forest, yellow-billed cuckoos have been detected within Madrean encinal woodlands more extensively than previously known. The action area is primarily classified as grass and scrubland (50.6% juniper grass, 48.7% semi-desert grassland), but a patchwork of riparian species along ephemeral drainages at minimum supports foraging WYBC and likely nesting. Currently, there is no critical habitat proposed for yellow-billed cuckoos in the action area.

Pima Pineapple Cactus

No comprehensive surveys for Pima pineapple cactus have been conducted on the Nogales Ranger District, nor have known populations been regularly monitored. There are two historical populations of Pima pineapple cactus to the east of the proposed trail system near Doodlebug Tank. There are also several records off Forest to the east along Puerto Canyon Road and the El Paso Natural Gas Pipeline (see Figure 4 of the Biological Assessment).

With historical Pima pineapple cactus records in the vicinity of the action area, and the action area containing Pima pineapple cactus habitat, it is reasonable to assume individuals may occur within the action area. For example, we received information from you on August 24, 2018, regarding the results of the Pima pineapple surveys completed for the staging area/trail head that is part of this proposed action and associated conservation measures. Pima pineapple cacti were found within the proposed boundaries of the staging area/trail head, as well as adjacent to the proposed staging area. As per the conservation measures, the staging area/trail head was relocated to avoid the newly located Pima pineapple cacti and habitat.

Jaguar and Critical Habitat

While no jaguars have been documented within the action area, they have been documented in the same mountain range as the proposed action. Since 2001, photos of multiple jaguars have been taken or tracks identified in the Atascosa and Tumacácori Mountains. In addition, biologically suitable corridors have been identified as potential jaguar movement corridors or “strands” linking to other areas where other jaguars have been documented (Beier et al. 2006). Because jaguars can travel long distances and have relatively large home ranges, it is reasonable to assume that a jaguar would occupy the action area at some point during the indefinite time frame of the proposed action.

There are 132,810 acres of designated critical habitat within the Tumacácori EMA. 16.1 miles of the proposed trail system occur within this critical habitat.

Ocelot

Life history of the ocelot 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). No home range studies have been done for ocelots in Arizona, recently, however, Culver (2016) estimated minimum observed ranges for ocelots in Arizona (two in the Huachuca Mountains and one in the Santa Rita Mountains). The average minimum observed range of the three Arizona ocelots was 30.09 km^2 (11.62 mi^2), with minimum observed ranges ranging from 7.76 to 63.40 km^2 (3.00 to 24.48 mi^2). Although no habitat use studies have been conducted for ocelots in Arizona, based on limited records, Arizona ocelots appear to be associated with Madrean evergreen woodland (Culver *et al.* 2016, Avila-Villegas and Jessica Lamberton-Moreno 2013), semidesert grassland, and Great Basin grassland biotic communities (Culver *et al.* 2016).

Ocelots are rare in Arizona and have not been documented within the action area. As discussed in the Status of the Species, since 2009, six ocelots have been documented in Arizona, including in the Santa Rita, Patagonia, Huachuca, and Whetstone mountains. The action area has been identified as part of a corridor between two large areas of conserved wildlands, specifically the Tumacacori and Santa Rita Mountains (Beier et al 2006). Vegetation conditions within some portions of the action area provide the appropriate habitat elements to support ocelots.

Threats to ocelots in Arizona are similar to threats to the species throughout its range as described under "Status of the Species." Other threats to ocelots in this region are mining (such as the proposed Rosemont, Hermosa, and Sunnyside mines) and 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) likely also prevent passage of ocelots. Other infrastructure (e.g., vehicle barriers, towers, roads, and lighting) and human activity may limit ocelot movement across the border, but it is uncertain if and how much this is affecting that movement. Connectivity to Mexico is likely essential for maintaining ocelots in Arizona (the northern portion of the ASMU). As included in the recovery criteria for this species, delisting the species will require that habitat linkages to facilitate an ASMU metapopulation are identified and conserved for the foreseeable future.

Ocelots have the documented ability to travel relatively long distances. Given the presence of habitat and the location of the action area within an identified corridor connecting the action area to an area where ocelots have been documented, it is reasonable to assume that an ocelot would occupy the action area at some point during the indefinite time frame of the proposed action.

EFFECTS OF THE ACTION

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 and interdependent with that action, which will be added to the environmental baseline. 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.

Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Yellow-Billed Cuckoo

Currently, there is no proposed yellow-billed cuckoo critical habitat within the action area, therefore, none will be affected. New information has emerged that indicates yellow-billed cuckoos may be foraging and nesting in habitats other than the riparian gallery woodlands. On the Nogales Ranger District and elsewhere on the Coronado National Forest, yellow-billed cuckoos have been detected within Madrean encinal woodlands more extensively than previously known. The action area is primarily classified as grass and scrubland (50.6% juniper grass, 48.7% semi-desert grassland), but a patchwork of riparian species along ephemeral drainages at minimum supports foraging yellow-billed cuckoos and, potentially, nesting.

The proposed action could directly impact individual yellow-billed cuckoos through acoustic/auditory and visual disturbance by trail users. While it is difficult to predict, the development of this trail system will likely result in an increase in vehicular traffic in the action area (both passenger vehicle and OHV). This will result in some level of increased disturbance, although the action area is already impacted by a relatively high level of disturbance. There is also the potential for vehicular collisions, although that is unlikely. We anticipate that these effects to the yellow-billed cuckoo will occur irregularly and be short-term in nature.

Although little vegetation will be removed for trail construction, trail use can lead to erosion via altered runoff patterns, removal of root zone structure, and an increase in soil compaction. The probability of non-native vegetation propagules being introduced within the action area from vehicles and equipment will increase, and possible erosion within the action area could increase their likelihood of successful establishment. Non-native propagules could also be introduced with fill material for the staging area. An increase in non-native vegetation within the action area could lead to long-term alteration of vegetation structure, which could alter nesting and/or foraging opportunities. We expect that such effects to the yellow-billed cuckoo habitat will be minimal.

Although potential effects will depend largely on the popularity of this trail system, during the indefinite life span of this trail system, it is possible that yellow-billed cuckoos will experience adverse effects from the proposed action. Conservation measures included in the proposed action should reduce the potential for these effects.

Pima Pineapple Cactus

With historical Pima pineapple cactus records in the vicinity of the action area, and the action area containing suitable habitat, it is reasonable to assume individuals may occur within the action area. To avoid direct impacts, such as crushing or burying with loose substrate, the proposed trail will be surveyed for individuals prior to construction. If Pima pineapple cactus are found in the trail corridor the route will be realigned, and at minimum a 30-meter exclusion zone will be established using natural barriers, fencing, and/or signage. This will not only help prevent individual Pima pineapple cacti from being run over or crushed, it will also reduce the effects of dust on the cacti. As discussed earlier, Pima pineapple cacti were found during a survey of the proposed staging area and conservation measures included in the proposed action were effectively implemented and the Pima pineapple cacti and habitat were avoided.

Trail signage and annual monitoring will also help to deter unauthorized cross-country travel which could directly impact individuals through crushing or burial. While little vegetation will be removed for trail construction, trail use can lead to erosion via altered runoff patterns, removal of root zone structure, and an increase in soil compaction. The probability of non-native vegetation propagules being introduced within the action area from vehicles and equipment will increase, and possible erosion within the action area could increase their likelihood of successful establishment. Non-native propagules could also be introduced with fill material for the staging area. An increase in non-native vegetation within the action area could lead to long-term alteration of vegetation structure and density and could affect the Pima pineapple cactus.

Although potential effects will depend largely on the popularity of this trail system, during the indefinite life span of this trail system, it is possible that Pima pineapple cacti will experience adverse effects from the proposed action. Conservation measures in the proposed action will reduce or avoid the above described effects.

Jaguar and Critical Habitat

Although jaguars are not known to currently occupy the action area, they have occurred in proximity to the action area in the past 20 years. Critical habitat for the jaguar occurs in the action area. Jaguars could be directly impacted by the proposed action through acoustic/auditory disturbance from trail riders, causing avoidance of the project area. Per the conservation measures for the proposed action, OHV use is typically a daytime activity and nighttime use would be prohibited. Jaguars could be indirectly impacted through prey reduction due to prey avoiding portions of the action area due to a potential increase in human presence in the action area. While little vegetation will be removed for trail construction, trail use can lead to erosion via altered runoff patterns, removal of root zone structure, and an increase in soil compaction. The probability of non-native vegetation propagules being introduced within the action area from vehicles and equipment will increase, and possible erosion within the action area could increase their likelihood of successful establishment. Non-native propagules could also be introduced with fill material for the staging area. An increase in non-native vegetation within the action area could lead to long-term alteration of vegetation structure and/or density which could deter or alter jaguar movement patterns in the action area. We expect that these effects will have a minimal effect on jaguars, their prey, and designated critical habitat due to their irregular occurrence and short-term nature.

The action area has been identified as a corridor between two large areas of conserved wildlands, specifically the Tumacacori and Santa Rita Mountains (Beier et al 2006). Dispersal corridor alteration could occur (habitat fragmentation and avoidance) due to increased motorized use and increased human presence in the action area. Habitat loss and fragmentation can be mitigated by conserving well-connected networks of large wildland areas where natural ecological and evolutionary processes operate over large spatial and temporal scales. Conserving wildlife movement between such areas can maintain top-down regulation by large predators, natural patterns of gene flow, pollination, dispersal, energy flow, nutrient cycling, inter-specific competition, and mutualism. We do not believe that the proposed action will affect the overall value and effectiveness of the above habitat corridor.

With regard to critical habitat, the Red Springs Trail Project would not change the biological and physical features of PCEs 3, 5, or 6. Connectivity to Mexico (PCE 1) and levels of prey species (PCE 2) could be impacted due to avoidance of the action area. Canopy cover (PCE 4) could be impacted through vegetation removal in the action area but should be negligible. Human density (PCE 7) in the action area will likely increase. However, we do not expect these effects to diminish the overall function and value of this critical habitat unit.

Although potential effects will depend largely on the popularity of this trail system, during the indefinite life span of this trail system, it is possible that jaguars will experience adverse effects from the proposed action. Conservation measures included in the proposed action will reduce the effects to jaguars and critical habitat discussed above.

Ocelot

Ocelots have not been documented in the action area. However, ocelot habitat elements occur in the action area and habitat connectivity occurs between the action area and the Santa Rita Mountains where ocelot have been confirmed. Similar to jaguar, ocelots could be directly impacted by the proposed action through acoustic/auditory disturbance from trail riders, causing avoidance of the project area. In accordance with the conservation measures included in the proposed action, OHV use is typically a daytime activity and nighttime use would be prohibited. Ocelots could be indirectly impacted through prey reduction from avoidance due to an increase in human presence and noise in the action area. While little vegetation will be removed for trail construction, trail use can lead to erosion via altered runoff patterns, removal of root zone structure, and an increase in soil compaction. The probability of non-native vegetation propagules being introduced within the action area from vehicles and equipment will increase, and possible erosion within the action area could increase their likelihood of successful establishment. Non-native propagules could also be introduced with fill material for the staging area. An increase in non-native vegetation within the action area could lead to long term alteration of vegetation structure and/or density which could deter or alter landscape movement patterns. We expect effects of the project on ocelots and ocelot prey will be minimal because of the relatively small amount of habitat that will be impacted and because of the irregular and short-term nature of possible disturbance to ocelots from human and OHV activity.

The action area has been identified as a corridor between two large areas of conserved wildlands, specifically the Tumacacori and Santa Rita mountains (Beier et al 2006). Dispersal and movement corridor alteration could occur (habitat fragmentation and avoidance) due to increased motorized use and increased human presence in the action area. Habitat loss and fragmentation can be reduced by conserving well-connected networks of large wildland areas where natural ecological and evolutionary processes operate over large spatial and temporal scales. Conserving wildlife movement between such areas can maintain top-down regulation by large predators, natural patterns of gene flow, pollination, dispersal, energy flow, nutrient cycling, inter-specific competition, and mutualism. We do not expect that the proposed action will reduce the overall value and effectiveness of the above habitat corridor.

Direct collisions with ocelots are not anticipated because OHV use associated with the project will occur only on 24.26 miles of single-track dirt roads. Vehicle collisions with ocelots on dirt roads have not been documented in Arizona or throughout their range that we are aware of.

Although potential effects will depend largely on the popularity of this trail system, during the indefinite life span of this trail system, it is possible that ocelots will experience adverse effects from the proposed action. Conservation measures included in the proposed action will reduce the effects to ocelot discussed above.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, 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 pursuant to section 7 of the Act.

The action area is entirely under Federal management by the Coronado National Forest. Therefore, future actions would all likely be considered future Federal actions not considered as cumulative effects in this section. Common activities in the area include hunting, camping, motorized and non-motorized trail use, and general recreation. All of these actions within the action area related to the above activities would likely be considered future Federal actions of some sort.

JEOPARDY AND ADVERSE MODIFICATION ANALYSIS

Section 7(a)(2) of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

Jeopardy Analysis Framework

Our jeopardy analysis relies on the following:

“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 the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on four components: (1) Status of the Species, which evaluates the range-wide condition of the listed species addressed, the factors responsible for that condition, and the species’ survival and recovery needs; (2) Environmental Baseline, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) Effects of the Action (including those from conservation measures), which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the species; and (4) Cumulative Effects, which evaluates the effects of future, non-federal activities in the action area on the species. The jeopardy analysis in this biological opinion emphasizes the range-wide survival and recovery needs of the listed species and the role of the action area in providing for those needs. We evaluate the significance of the proposed Federal action within this context, taken together with cumulative effects, for the purpose of making the jeopardy determination.

Destruction/Adverse Modification Analysis Framework

Past designations of CH have used the terms PCEs, PBFs or "essential features" to characterize the key components of CH that provide for the conservation of the listed species. The new CH regulations (79 FR 27066) discontinue use of the terms "PCEs" or "essential features," and rely exclusively on use of the term "PBFs" for that purpose because that term is contained in the statute. However, the shift in terminology does not change the approach used in conducting a destruction or adverse modification analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. For those reasons, references to PCEs or essential features should be viewed as synonymous with PBFs. All of these terms characterize the key components of CH that provide for the conservation of the listed species.

The final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" became effective on March 14, 2016 (81 FR 7214). The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

Similar to our jeopardy analysis, our adverse modification analysis of critical habitat relies on the following four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of designated critical habitat in terms of [PCEs/PBFs], the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the Effects of the Action, which determine the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the [PCEs/PBFs] and how they will influence the recovery role of affected critical habitat units; and (4) Cumulative Effects, which evaluate the effects of future, non-federal activities in the action area on the [PCEs/PBFs] and how they will influence the recovery role of affected critical habitat units.

Conclusion

After reviewing the current status of the yellow-billed cuckoo, Pima pineapple cactus, jaguar and critical habitat, and the ocelot, the environmental baseline for the action area, the effects of the proposed Red Springs Trail Project, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of these species and is not likely to destroy or adversely modify designated critical habitat for jaguar. We base these conclusions on the following:

Yellow-Billed Cuckoo

- Construction of new trail and the staging/parking area, as well as routine maintenance of the trail system will occur outside of yellow-billed cuckoo breeding season (May 15 – September 30). Effects to migrant yellow-billed cuckoos are expected to be minimal.
- Conservation Measures are included in the proposed action that will avoid or minimize effects of the project on yellow-billed cuckoo habitat.
- We anticipate that disturbance related to this project and future use of the trail system will be irregular and that disturbance levels will not be substantially above existing baseline for disturbance from activities such as hunting, camping, and motorized and non-motorized use of trail systems already in the action area.
- We do not anticipate vehicle collisions with yellow-billed cuckoos.
- No proposed yellow-billed cuckoo critical habitat occurs within the action area.

Pima Pineapple Cactus

- Pima pineapple cacti are not extensively distributed across the action area and, where they do occur, they occur at relatively low densities.
- Conservation measures were appropriately implemented to avoid Pima pineapple cacti and habitat discovered during surveys for the proposed staging area.
- Conservation measures will reduce or eliminate the potential for adverse effects to the Pima pineapple cactus, including surveys and avoidance and protection measures.
- Conservation measures will monitor compliance with trail use regulations and reduce the potential for off-trail effects to Pima pineapple cacti, including crushing and dust effects.
- Conservation measures will reduce the potential for the introduction and expansion of non-native invasive species that can affect Pima pineapple cacti.
- There is no critical habitat designated for Pima pineapple cacti.

Jaguar and Critical Habitat

- Jaguars are not know to currently occupy the action area. Jaguars occur at extremely low densities within the United States.
- Conservation measures included as part of the proposed action will help to avoid and reduce effects of the proposed action on jaguar habitat.
- Nighttime use of the trail system is prohibited and will reduce potential disturbance of jaguars during the time when jaguars are primarily active.
- We anticipate that disturbance related to this project and future use of the trail system to both jaguars and their prey will be irregular and that disturbance levels will not be substantially above existing baseline for disturbance from activities such as hunting, camping, and motorized and non-motorized use of trail systems already in the action area.

- We do not anticipate vehicle collisions with jaguars.
- Implementation of the proposed action is not anticipate to substantially affect any of the PCE's of jaguar critical habitat.

Ocelot

- Ocelots are not know to currently occupy the action area. Ocelots occur at extremely low densities within Arizona. Although abundance and population trends for the ocelot range-wide are not well known and populations throughout the species' range continue to be at risk, implementation of this project will not have an appreciable impact on the population at the rangewide or management unit scales. Thus, the proposed action is not expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of the ocelot in the wild by reducing the reproduction, numbers, or distribution of the species.
- Nighttime use of the trail system is prohibited and will reduce potential disturbance of ocelots during the time when ocelots are primarily active.
- Conservation measures included as part of the proposed action will help to minimize and reduce effects of the proposed action on ocelot habitat.
- We anticipate that disturbance related to this project and future use of the trail system to both ocelots and their prey will be irregular and that disturbance levels will not be substantially above existing baseline for disturbance from activities such as hunting, camping, and motorized and non-motorized use of trail systems already in the action area.
- We do not anticipate vehicle collisions with ocelots.

The conclusions of this biological opinion are based on full implementation of the project as presented in the BA and the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and 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 (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR § 17.3) as intentional or negligent 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 of 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 agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to entities involved in the construction or maintenance of the Red Springs Trail Project, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions or (2) fails to require other entities involved in the project to adhere to the terms and conditions of the 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 Forest Service and other entities involved in the construction or implementation of the Red Springs Trail Project must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Yellow-Billed Cuckoo, Jaguar, and Ocelot

The FWS does not anticipate the proposed action will incidentally take any yellow-billed cuckoos, jaguars, or ocelots for the following reasons:

- Jaguars and ocelots are not currently known to exist within the action area and, therefore, are not likely to be taken. Habitat for both species does occur within the action area, as does a habitat corridor connecting the action area to an area that has been historically occupied. However, while it is possible that a jaguar or ocelot could occupy the action area at some point in the future, the irregular and short-term nature of the disturbance caused by implementation of this project does not rise to the level of take for these species.
- Yellow-billed cuckoos do occupy the action area. However, project construction will avoid the nesting season for cuckoos and migrant cuckoos are unlikely to be affected to the extent that take will occur. Disturbance resulting from the implementation of the proposed trail system will be irregular and short-term in nature. Such effects on cuckoos will not rise to the level of take.
- The beneficial effects associated with the Conservation Measures included in the proposed action will eliminate much of the potential for incidental take for all three of these species.

Pima Pineapple Cactus

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

The Fish and Wildlife Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §

703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. § 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that your agency participate in the development of the recovery plan for the yellow-billed cuckoo and implement the recovery plans for the Pima pineapple cactus, the jaguar, and the ocelot.
2. We recommend that your agency work to control non-native species in the action area, including Russian thistle, to promote native species and their conservation and recovery.
3. We recommend that your agency support research and monitoring proposals for the species included in this BO, especially within the action area.
4. We recommend that your agency submit all listed species' location data that result from the implementation of this BO to the Arizona Game and Fish Habitat Data Management System to further conservation and outreach for these species.

In order for the FWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the FWS requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the for the [proposed action]. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Certain project activities may also affect species protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. sec. 703-712) and/or bald and golden eagles protected under the Bald and Golden Eagle Protection Act (Eagle Act). The MBTA prohibits the intentional taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when authorized by the FWS. The Eagle Act prohibits anyone, without a FWS permit, from taking (including disturbing) eagles, and including their parts, nests, or eggs. If you think migratory birds and/or eagles will be affected by this project, we recommend seeking our Technical Assistance to identify available conservation measures that you may be able to incorporate into your project.

For more information regarding the MBTA and Eagle Act, please visit the following websites. More information on the MBTA and available permits can be retrieved from FWS Migratory Bird Program web page and FWS Permits Application Forms. For information on protections for bald eagles, please refer to the FWS's National Bald Eagle Management Guidelines (72 FR 31156) and regulatory definition of the term "disturb" (72 FR 31132) published in the Federal Register on June 5, 2007, as well at the Conservation Assessment and Strategy for the Bald Eagle in Arizona (Southwestern Bald Eagle Management Committee website).

In keeping with our trust responsibilities to American Indian Tribes, we encourage you to continue to coordinate with the Bureau of Indian Affairs in the implementation of this consultation and, by copy of this biological opinion, are notifying the following Tribes of its completion [list Tribes]. We also encourage you to coordinate the review of this project with the Arizona Game and Fish Department.

We appreciate the Forest Service's efforts to identify and minimize effects to listed species from this project. Please refer to the consultation number, 02EAAZ00-201X-F-1235 in future correspondence concerning this project. Should you require further assistance or if you have any questions, please contact Scott Richardson (520-670-6150 x 242) or Julie McIntyre (x 223).

Sincerely,

Jeff Humphrey
Field Supervisor

cc (electronic):
Field Supervisor, Fish and Wildlife Service, Phoenix, AZ
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ

Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ (pep@azgfd.gov)

Manager, Cultural Resources, Ak Chin Indian Community, Maricopa, AZ
Tribal Historic Preservation Officer, Gila River Indian Community, Sacaton, AZ
Director, Cultural Preservation Office, Hopi Tribe, Kykotsmovi, AZ
Chairman, Pascua Yaqui Tribe, Tucson, AZ
Director, Cultural Resources, Salt River Pima-Maricopa Indian Community, Scottsdale, AZ
Manager, Cultural Affairs, Tohono O'odham Nation, Sells, AZ
Branch Chief, Environmental Quality Services, Western Regional Office, Bureau of Indian Affairs, Phoenix, AZ
Archaeologist, Western Regional Office, Bureau of Indian Affairs, Phoenix, AZ

LITERATURE CITED

American Birding Association. 2014. Birding News. Arizona cuckoo records.

American Ornithologists Union (AOU). 1998. Checklist of North American birds. 7th ed. American Ornithologists' Union, Washington, D.C.

Anable, M.E., M. P. McClaran, and G.B. Ruyle. 1992. Spread of introduced Lehmann lovegrass (*Eragrostis lehmanniana* Nee.) in southern Arizona, USA. Biological Conservation 61:181-188.

AOU. 1983. Checklist of North American birds. 6th ed. American Ornithologists' Union, Washington, D.C.

Aprile G., Cuyckens, E., De Angelo, C., Di Bitetti, M., Lucherini, M., Muzzachiodi, N., Palacios, R., Paviolo, A., Quiroga, V. and Soler, L. 2012. Family: Felidae. In: R.A. Ojeda, V. Chillo, Vand G.B. Díaz Isenrath (ed.), Libro Rojo de los Mamíferos Amenazados de la Argentina, SAREM, Mendoza.

Arizona Game and Fish Department (AGFD). 2017. Yellow-billed Cuckoo records. Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ.

Avila-Villegas, S. and J.A. Lamberton-Moreno. 2012. "Wildlife Survey and Monitoring in the Sky Island Region with an Emphasis on Neotropical Felids" in Gottfried, Gerald J.; Ffolliott, Peter F.; Gebow, Brooke S.; and Eskew, Lane G., compilers. 2012. Merging science and management in a rapidly changing world: biodiversity and management of the Madrean Archipelago III. 2012 May 1-5, Tucson, AZ. Proceedings RMRS-P-67. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Baker, M. 2004. Phenetic analysis of *Coryphantha*, section *Robustispina* (Cactaceae), part 1: stem characters. Final report submitted to U.S. Fish and Wildlife Service under contract with the Arizona Board of Regents, University of Arizona, Tucson. 21 pp.

Baker, M. 2005. Geographic distribution and DNA analysis of *Coryphantha robustispina* ssp. *robustispina*, part 1: geographic distribution. Final report submitted to the Department of Agriculture on 7 July 2005. 7 pp. + appendices.

Baker, M. 2006. 2005 demographic study of *Coryphantha robustispina* ssp. *robustispina*. Status report prepared for Bureau of Reclamation. 17 pp.

Baker, M. 2011. A demographic study of *Coryphantha robustisipina* ssp. *robustispina* – report to BOR. Phoenix Area Office. 51 pp.

Benson, L. 1982. The Cacti of the United States and Canada. Stanford University Press, Stanford, CA. Page 820.

Bisbal, F.J. 1986. Food habits of some neotropical carnivores in Venezuela (Mammalia, Carnivora). Mammalia 50: 330-339.

Booth-Binczik, S.D. 2007. Report from the field: monitoring Ocelot Dispersal with Satellite telemetry. Endangered Species Update 24(4): 110-112.

Boydston, E.E. and C.A. López-González. 2005. Sexual differentiation in the distribution potential of northern jaguars (*Panthera onca*). Pp. 51-56 *in* Gottfried, G.J., B.S. Gebow, L.G. Eskew, and C.B. Edminster, comp., Connecting Mountain Islands and Desert Seas: Biodiversity and Management of the Madrean Archipelago II, RMRS-P-36, Rocky Mountain Research Station, Forest Service, Fort Collins, CO.

Brown, D.E. 1994. Biotic communities of the Southwestern United States and northwestern Mexico. University of Utah Press, Salt Lake City, 342 pp.

Brown D.E. 1989. Cat fever. Game Country (May/June 1989):63-72.

Brown, D.E., T.C. Brennan, and P.J. Unmack. 2007. A digitized biotic community map for plotting and comparing North American Plant and Animal Distributions. Arizona State University. CANOTIA Vol. 3 (1)

Brown, D.E. and C.H. Lowe. 1982. Biotic Communities of the Southwest [map]. Scale1:1,000,000. General Technical Report RM-78. U.S. Forest Service, Fort Collins. Reprinted (and revised) 1994 by University of Utah Press, Salt Lake City.

Brown, D.E. and C.A. López-González. 2001. Borderland jaguars: tigres de la frontera. University of Utah Press. 170 pp.

Buffelgrass Working Group. 2007. Buffelgrass invasion in the Sonoran Desert: Imminent risks and unavoidable mitigation. 4 pp. http://www.buffelgrass.org/pdf/invasion.pdf, accessed May 19, 2009.

Carroll, C., R. F. Noss, and P. C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. Ecological Applications 11:961-980.

Carstensen, D., D. Ahlers, D. Moore. 2015. Yellow-billed Cuckoo Study Results – 2014, Middle Rio Grande from Los Lunas to Elephant Butte Reservoir, New Mexico. Prepared for Albuquerque Area Office, Bureau of Reclamation, Albuquerque, NM. Technical Service Center, Fisheries and Wildlife Resources Group, Bureau of Reclamation, Denver, CO.

Casariego Madorell, M. A. 1998. Estimacion del tamaño poblacional del ocelote (*Leopardus pardalis*) en una selva baja caducifolia de la costa de Jalisco, Mexico. Bachelor’s Thesis ENEP-UNAM Iztacala, Mexico.

Caso, A. 1994. Home range and habitat use of three neotropical carnivores in northeast Mexico. Unpublished M.S. thesis, Texas A&M University, Kingsville, TX, 78 pp.

Caso, A., C. Lopez-Gonzalez, E. Payan, E. Eizirik, T. de Oliveira, R. Leite-Pitman, M. Kelly, and C. Valderrama. 2008. *Panthera onca*. *In*: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 31 May 2011.

Cavalcanti, S.M.C. and E.M. Gese. 2009. Spatial ecology and social interactions of jaguars (*Panthera onca*) in the southern Pantanal, Brazil. Journal of Mammalogy 90(4):935-945.

Chávez, C., and G. Ceballos. 2006. Memorias del Primer Simposio. El Jaguar Mexicano en el Siglo XXI: Situación Actual y Manejo. CONABIO-Alianza WWF Telcel-Universidad Nacional Autónoma de México. México D.F.

Chávez, C., G. Ceballos, R. Medellin, and H. Zarza. 2007. Primer censo nacional del jaguar. Pp. 133-141 *in* Ceballos, G, C. Chávez, R. List y H. Zarza (editores). 2007. Conservación y manejo del jaguar en México: estudios de caso y perspectivas. Conabio - Alianza WWF-Telcel – Universidad Nacional Autónoma de México. México.

Childs, J. L. 1998. Tracking the felids of the borderlands. Printing Corner Press, El Paso, TX. 77 pp.

Colchero, F., D.A. Conde, C. Manterola, C. Chávez, A. Rivera, and G. Ceballos. 2010. Jaguars on the move: modeling movement to mitigate fragmentation from road expansion in the Mayan Forest. Animal Conservation 14: 158-166.

Colyer, M. *in litt*. 2001. Letter from Marilyn Colyer to Wayne White regarding yellow-billed cuckoos distribution in southwestern Colorado. 5 February 2001.Durst, S.L., M.K. Sogge, H.C. English, H.A. Walker, B.E. Kus, and S.J. Sferra. 2008. Southwestern willow flycatcher breeding site and territory summary – 2007. U.S. Geological Survey, Colorado Plateau Research Station, Flagstaff, AZ.

Conde, D.A., F. Colchero, H. Zarza, N.L. Christensen Jr, J. Sexton, C. Manterola, A. Rivera, C. Chavez, D. Azuara, and G. Ceballos. 2010. Sex matters: modeling male and female jaguar habitat for conservation. Biological Conservation 143, 1980–1988.

Corman, T. E., and C. Wise-Gervais, eds. 2005. Arizona breeding bird atlas. University of New Mexico Press, Albuquerque, NM. 636pp.

Corman, T. E., and R. T. Magill. 2000. Western yellow-billed cuckoo in Arizona: 1998 and 1999 survey report. Nongame and Endangered Wildlife Program, Tech. Rept. 150, Arizona Game and Fish Dept., Phoenix, AZ. 49pp.

Cornell Lab of Ornithology. 2017. E-bird web site.

Crawshaw, P. G., Jr. 1995. Comparative ecology of ocelot (*Felis pardalis*) and jaguar (*Panthera *onca*) in a protected subtropical forest in Brazil and Argentina. Ph.D. dissertation, University of Florida, Gainesville, Florida.

Crawshaw, P.G. and H.B. Quigley. 1991. Jaguar spacing, activity and habitat use in a seasonally flooded environment in Brazil. Journal of Zoology 223: 357-370.

Crashaw, P.G., Jr., and H.B. Quigley. 1989. Notes on ocelot movement and activity in the Pantanal Region, Brazil. Biotropica 21:377-379.

Culver, Melanie, 2016, Jaguar surveying and monitoring in the United States (ver. 1.1, November 2016): U.S. Geological Survey Open-File Report 2016–1095, 228 p., http://dx.doi.org/10.3133/ofr20161095.

de Villa Meza, A., E. Martinez Meyer, C.A. López González. 2002. Ocelot (*Leopardus pardalis*) food habits in a tropical deciduous forest of Jalisco, Mexico. American Midland Naturalist 148: 146-154.

Eaton, R. 1977. Breeding biology and propagation of the ocelot (*Leopardus* [*Felis*] *pardalis*). Zool. Garten Jena 47:9-23.

Ecosphere Environmental Services Inc. 1992. Final Report: A survey for threatened and endangered plant species at three proposed reservoir sites and associated pipelines. Bureau of Reclamation contract 0-CS-32-1950. Farmington, NM. 69 pp.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1992. Birds in jeopardy. Stanford University Press, Stanford, CA.

Emmons, L.H. 1988. A field study of ocelots (*Felis pardalis*) in Peru. Review of Ecology (*Terre Vie*) 43:133-157.

Emmons, L.H. 1987. Comparative feeding ecology of felids in a neotropical forest. Behavioral Ecology and Sociobiology 20:271-283.

Featherstone, R., S. Jacobs, S. Avila-Villegas, and S. Doumas. 2013. Wildlife Surveys and Monitoring with the use of remote camera traps in the Greater Oak Flat Watershed near Superior, Arizona. Pages 441-447 *in* G.J. Gottfried, P.F. Folliott, B.S. Gebow, L.G. Eskew, and L.C. Collins, editors. Merging science and management in a rapidly changing world: biodiversity and management of the Madrean Archipelago. RMRS-P-67. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, USA.

Fernandez, E. C. 2002. Ocelot (*Leopardus pardalis*) ecology in the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico. M.S. thesis. University of Wyoming, Laramie, WY.

Gaines, D., and S. A. Laymon. 1984. Decline, status, and preservation of the yellow-billed cuckoo in California. Western Birds 15:49–80.

Glenn, W. 1996. Eyes of fire: encounter with a borderlands jaguar. Printing Corner Press, El Paso, Texas. 28 pp.

Gómez-Ramírez, M.A. 2015. Densidad poblacional del ocelote Leopardus pardalis en Sahuaripa, Sonora, México. Thesis, Universidad Autónoma de Querétaro, Querétaro México.

Gori, D. F. and C. A. F. Enquist. 2003. An assessment of the spatial extent and condition of grasslands in Central and Southern Arizona, Southwestern New Mexico and Northern Mexico. Prepared by the Nature Conservancy, Arizona Chapter. 28 pp.

Grigione, M.M., K. Menke, C. Lopez-Gonzalez, R. List, A. Banda, J. Carrera, R. Carrera, A.J. Giordano, J. Morrison, M. Sternberg, R. Thomas, and B. Van Pelt. 2009. Identifying potential conservation areas for felids in the USA and Mexico: integrating reliable knowledge across an international border. Oryx, 43, 78-86.

Grocki, D.R.J. and D.W. Johnston. 1974. Chlorinated hydrocarbon pesticides in North American cuckoos. Auk 91:186–187.

Haag, T., A.S. Santos, D.A. Sana, R.G. Morato, L. Cullen Jr., P.G. Crawshaw Jr., C. de Angelo, M.S. Di Bitetti, F.M. Salzano, and E. Eizirik. 2010. The effect of habitat fragmentation on the genetic structure of a top predator: loss of diversity and high differentiation among remnant populations of Atlantic Forest jaguars (*Panthera onca*). Molecular Ecology 2010: 1-16.

Hall, E.R. 1981. The mammals of North America. Vol. II. John Wiley and Sons, NY.

Hass, C.C. 2002. Home range dynamics of white-nosed coatis in southeastern Arizona. Journal of Mammalogy 83:934–946.

Halterman, M. D. 2009. Sexual dimorphism, detection probability, home range, and parental care in the yellow-billed cuckoo. Ph.D. Dissertation, Univ. of Nevada, Reno, NV.

Halterman, M.D., M.J. Johnson, J.A. Holmes and S.A. Laymon. 2016. A natural history summary and survey protocol for the western distinct population segment of the yellow-billed cuckoo: U.S. Fish and Wildlife Service.

Hamilton, W. J., III, and M. E. Hamilton. 1965. Breeding characteristics of yellow-billed cuckoos in Arizona. Proc. California Academy of Sciences, 4th Series, 32:405–432.

Hatten, J.R., A. Averill-Murray, and W.E. Van Pelt. 2002. Characterizing and mapping potential jaguar habitat in Arizona. Technical Report 203, Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix. 32pp.

Hatten, J.R., A. Averill-Murray, and W.E. Van Pelt. 2005. A spatial model of potential jaguar habitat in Arizona. Journal of Wildlife Management 69(3):1024-1033.

Holbrook, J.D., R.W. DeYoung, M.E. Tewes, J.H. Young, J.L. Mays, and E. Meyers. 2011. Natural dispersal or illegal pets? Limitations on assigning origin to road-killed ocelots in the southwestern United States. Wildlife Society Bulletin 35: 504–507.

Holmes, J. A., C. Calvo, and M. J. Johnson. 2008. Yellow-billed cuckoo distribution, abundance, habitat use, and breeding ecology in the Verde River watershed of Arizona, 2004–2005 Final Report. Admin Rept., Arizona Game and Fish Dept. 34pp.

Hopwood, J., S.H. Black, M. Vaughan, and E. Lee-Mader. 2013. Beyond the birds and bees: Effects of Neonicotinoid insecticides on agriculturally important beneficial invertebrates. The Xerces Society. 25 pp.

Horne, J.S. 1998. Habitat partitioning of sympatric ocelot and bobcat in southern Texas. Thesis, Texas A & M University-Kingsville, Kingsville, TX.

Hughes, J. M. 1999. Yellow-billed cuckoo (*Coccyzus americanus*), the birds of North America online. *In* Poole, A., ed., Ithaca, Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: Cornell Lab of Ornithology yellow-billed cuckoo web site.

Jackson, V.L., L.L. Laack, and E.G. Zimmerman. 2005. Landscape metrics associated with habitat use by ocelots in south Texas. Journal of Wildlife Management 69:733-738.

Johnson, M. B. 2004. Cacti, other succulents, and unusual xerophytes of southern Arizona. Boyce Thompson Southwestern Arboretum, Superior, AZ. 96 pp.

Johnson, T.B., W.E. Van Pelt, and J.N. Stuart. 2011. Jaguar conservation assessment for Arizona, New Mexico and Northern Mexico. Nongame and Endangered Wildlife Program, AGFD, Phoenix. 81pp.

Johnson, M. J., S. L. Durst, C. M. Calvo, L. Stewart, M. K. Sogge, G. Bland, and T. Arundel. 2008. Yellow-billed cuckoo distribution, abundance, and habitat use along the lower Colorado River and its tributaries, 2007 annual report. USGS Open-file report 2008–1177. 284pp.

Konecny, M.J. 1989. Movement patterns and food habits of four sympatric carnivore species in Belize, Central America. Pages 243-264 *in* K.H. Redford and J.F. Eisenberg, editors. Advances in neotropical mammalogy. Sandhill Crane Press, Gainesville, FL.

Laack, L.L. 1991. Ecology of the ocelot (*Felis pardalis*) in south Texas. M.S. thesis, Texas A&I University, Kingsville, TX. 113 pp.

Laack, L. L., M. E. Tewes, A. H. Haines, J. H. Rappole. 2005. Reproductive ecology of ocelot (*Leopardus pardalis*) in southern Texas. Acta Theriologica 50:505-514.

Lange, K. I. 1960. The jaguar in Arizona. Transactions of the Kansas Academy of Sciences 63:96-101.

Laymon, S. A. 1998. Yellow-billed Cuckoo (*Coccycus americanus*). In The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. The Riparian Bird Conservation Plan web site.

Laymon, S. A. 1980. Feeding and nesting behavior of the yellow-billed cuckoo in the Sacramento Valley. Admin Rep. 80-2, Wildlife Management Branch, California Dept. of Fish and Game, Sacramento, CA.

Laymon, S. A., and M. M. Halterman. 1989. A proposed habitat management plan for yellow-billed cuckoos in California. U.S. Department of Agriculture, Forest Service General Technical Report PSW-110: 272-277.

Laymon, S. A., and M. D. Halterman. 1987. Can the western subspecies of the yellow-billed cuckoo be saved from extinction? Western Birds 18:19-25.

López-González 2011, pers. comm.

López-Gónzalez, C.A. and D. Brown. 2002. Pp. 379-391 *in* Medellin, R.A., C. Equihua, C.L.B. Chetkiewicz, P.G. Crawshaw, Jr., A. Rabinowitz, K.H. Redord, J.G. Robinson, E.W. Sanderson, and A.B. Taber, comps. 2002. El jaguar en el nuevo millenio. Fondo de Cultura Económica, Universidad Nacional Autónoma de México, Wildlife Conservation Society, México. 647pp.

López-González, C. A. and B. J. Miller. 2002. Do jaguars (*Panthera onca*) depend on large prey? Western North American Naturalist 62(2): 218–222.

López González, C. A., D. E. Brown, and J. P. Gallo-Reynoso. 2003. The ocelot *Leopardus pardalis* in north-western Mexico: ecology, distribution and conservation status. Oryx 37:358-364.

Ludlow, M. E., and M. E. Sunquist. 1987. Ecology and behavior of ocelots in Venezuela. National Geographic Research and Exploration 3:447-461

Maffei, L., A. J. Noss, E. Cuellar, and D. I. Rumiz. 2005. Ocelot (*Felis pardalis*) population densities, activity, and ranging behavior in the dry forests of eastern Bolivia: data from camera trapping. Journal of Tropical Ecology 21:1-6.

Manriquez 2011 (July 15, 2011, email to FWS)

McCain, E.B. and J.L. Childs. 2008. Evidence of resident jaguars (*Panthera onca*) in the southwestern United States and the implications for conservation. Journal of Mammology, 89(1):1-10.

McDonald, C. J. 2005. Conservation of the rare Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*): recruitment after fires and pollination in the Altar Valley of southern Arizona. Master of Science Thesis, School of Natural Resource, The University of Arizona. 82 pp.

McGill, R. R. 1975. Land use changes in the Sacramento River riparian zone, Redding to Colusa. State of California Water Resources. 23pp.

McNeil, S.E., D. Tracy, J.R. Stanek, and J.E. Stanek. 2013a. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008–2012 summary report. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by SSRS. http://www.lcrmscp.gov/reports/2012/d7_sumrep_08-12.pdf.

McNeil, S. E., D. Tracy, J. R. Stanek, and J. E. Stanek. 2012. Yellow-billed cuckoo distribution, abundance, and habitat use on the lower Colorado River and tributaries, 2011 annual report. Lower Colorado River Multi-species Conservation Program, Bureau of Reclamation, Boulder City, NV. 121pp.

McNeil, S. E., D. Tracy, J. R. Stanek, J. E. Stanek, and M. D. Halterman. 2011. Yellow-billed cuckoo distribution, abundance, and habitat use on the lower Colorado River and tributaries, 2010 annual report. Lower Colorado River Multi-species Conservation Program, Bureau of Reclamation, Boulder City, NV. 179pp.

McPherson, G. R. 2002. Relationship of ecological variables in the field with the presence of Pima pineapple cactus. Report to USFWS under agreement 1448-20181-01-J818. 4 pp.

Medellin, R.A. 2009. The conservation of jaguars: A top priority for Latin America. Jaguar News 35: 2.

Medellin, R.A., C. Equihua, C.L.B. Chetkiewicz, P.G. Crawshaw, Jr., A. Rabinowitz, K.H. Redord, J.G. Robinson, E.W. Sanderson, and A.B. Taber, comps. 2002. El jaguar en el nuevo millenio. Fondo de Cultura Económica, Universidad Nacional Autónoma de México, Wildlife Conservation Society, México. 647pp.

Menke, K.A., and C.L. Hayes. 2003. Evaluation of the relative suitability of potential jaguar habitat in New Mexico. Report to New Mexico Department of Game and Fish, Santa Fe, New Mexico. 31pp.

Mineau, P. and C. Palmer. 2013. The impact of the Nation's most widely used insecticides on birds. American Bird Conservancy. 96 pp.

Mineau, P. and M. Whiteside. 2013. Pesticide acute toxicity is a better correlate of U.S. grassland bird declines than agricultural intensification. PLOS One (February 2013, e57457) 8:1–8

Mora, M.A., L.L Laack, M.C/ Lee, J. Sericano, R. Presley, P.R. Gardinali, L.R. Gamble, S. Robertson, and D. Frank. 2000. Environmental contaminants in blood, hair, and tissues of ocelots from the Lower Rio Grande Valley, Texas, 1986-1997. Environmental Monitoring and Assessment 64:447-492.

Murray, J. L. and G. L. Gardner. 1997. *Leopardus pardalis*. Mammalian Species 548:1-10.

Navarro-Lopez, D. 1985. Status and distribution of the ocelot in South Texas. M.S. thesis, Texas A & I University, Kingsville, TX. 92 pp.

Noss, R.F., H.B. Quigley, M.G. Hornocker, T. Merril, and P.C. Paquet. 1996. Conservation biology and carnivore conservation in the Rocky Mountains. Conservation Biology 10:949–963.

Nowak, R.M. 1975. Retreat of the jaguar. National Parks Conservation Magazine 49:10-13.

Nowell, K., and P. Jackson. 1996. Wild cats: status survey and conservation action plan. IUCN/SSC Cat Specialist Group, Gland, Switzerland and Cambridge, United Kingdom.

Núñez-Pérez 2011 (August 2, 2011, email to FWS)

Núñez-Pérez, R. 2006. Área de actividad, patrones de actividad y movimiento del jaguar (*Panthera onca*) y del puma (*Puma concolor*), en la Reserva de la Biosfera “Chamela – Cuixmala”, Jalisco. M.S. Thesis, Universidad Nacional Autónoma de México, México, D.F.

Núñez, R., B. Miller, and F. Lindzey. 2000. Food habits of jaguars and pumas in Jalisco, Mexico. Journal of Zoology, London, 252: 373-379.

Núñez, R., B. Miller, and F. Lindzey. 2002. Ecología del jaguar en la reserva de la biosfera de Chamela-Cuixmala, Jalisco, México. Pp. 99-118 in Medellin, R.A.,C. Equihua, C.L.B. Chetkiewicz, P.G. Crawshaw, Jr., A. Rabinowitz, K.H. Redord, J.G. Robinson, E.W. Sanderson, and A.B. Taber, comps. 2002. El jaguar en el nuevo millenio. Fondo de Cultura Económica, Universidad Nacional Autónoma de México, Wildlife Conservation Society, México. 647pp.

Oliveira, T.G. de, Almeida, L.B. de and Campos, C.B. de. 2013. Avaliação do risco de extinção da jaguatirica Leopardus pardalis no Brasil. Biodiversidade Brasileira 3(1): 66-75.

Panthera. 2011. Jaguars. http://www.panthera.org/species/jaguar, accessed on June 13, 2011.

Phillips, A. M. III, B. G. Phillips, and N. Brian. 1981. Status report for *Coryphantha scheeri* var. *robustispina*. Unpublished Report. U.S. Fish and Wildlife Service, Office of Endangered Species, Albuquerque, NM.

Phillips, A.R., J. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona

Press, Tucson, Arizona. 212 pp.

Pima County. 1998. Native Plant Preservation. Chapter 18.72.

Poff, N. L., J .D. Allan, M. B. Bain, J. R. Karr, K .L. Prestegaard, B. D. Richter, R. E. Sparks, and J. C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. BioScience 47:769–784.

Rabinowitz, A. 1999. Present status of jaguars (*Panthera onca*) in the southwestern United States. The Southwestern Naturalist 44(1):96-100.

Rabinowitz A.R and B. G. Nottingham Jr. 1986. Ecology and behaviour of the jaguar (*Panthera onca*) in Belize, Central America. Journal of Zoology 210:149-159.

Rabinowitz and Zeller 2010

RECON Environmental, Inc. 2006. Draft Pima County Multi-Species Conservation Plan, Pima County, Arizona and Attachments.

Robinson, M.J., C. Bradley, and J. Boyd. 2006. Potential habitat for jaguars in New Mexico. Report to AGFD (AGFD) from Center for Biological Diversity, Silver City, New Mexico.

Roller, P. S. and W. L. Halvorson. 1997. Fire and Pima pineapple cactus (*Coryphantha scheeri* Kuntze var. *robustispina* Schott) in southern Arizona. *In* Proceedings of Fire Effects on Rare and Endangered Species and Habitats Conference, Coeur d'Alene, Idaho. Pp. 267-274.

Rosas-Rosas O.C. 2006. Ecological status and conservation of jaguars (*Panthera onca*) in northeastern Sonora, Mexico. Ph.D. Dissertation, New Mexico State University, Las Cruces, New Mexico.

Rosas-Rosas O.C., L.C. Bender, and R. Valdez. 2008. Jaguar and puma predations on cattle calves in northeastern Sonora, Mexico. Rangeland Ecology and Management 61(5):554-560.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter, and B. W. Anderson. 1991. Birds of the lower Colorado River Valley. University of Arizona Press, Tucson.

Russell, S. M., and G. Monson. 1998. The birds of Sonora. University of Arizona Press, Tucson, AZ.

Ruyle, G. B., B. A. Roundy, and J. R. Cox. 1988. Effects of burning on germinability of Lehmanns lovegrass. Journal of Range Management 41:404-406.

Sanderson, E.W., and K. Fisher. 2013a. Jaguar Habitat Modeling and Database Update. Wildlife

Conservation Society. Bronx, New York. 10 pp. plus appendices.

Sanderson, E.W., and K. Fisher. 2013b. Jaguar Habitat Modeling and Database Update (Final Report). Wildlife Conservation Society. Bronx, New York. 10 pp. plus appendices.

Sanderson, E.W., K.H. Redford, C.B. Chetkiewicz, R.A. Medellin, A.R. Rabinowitz, J.G. Robinson, and A.B. Taber. 2002. Planning to save a species: the jaguar as a model. Conservation Biology 16(1):58-72.

Schmalzel, R. J., R. T. Nixon, A. L. Best, and J. A. Tress. 2004. Morphometric variation in *Coryphantha robustispina* (Cactaceae). Systematic Botany 29:553-568.

Sechrist, J.D., D.D. Ahlers, K. Potak Zehfuss, R.H. Doster, E.H. Paxton, and V.M. Ryan. 2013. Home range and use of habitat of western yellow-billed cuckoos on the Middle Rio Grande, New Mexico. Southwestern Naturalist 58(4):411-419.

Sechrist, J., V. Johanson, and D. Ahlers. 2009. Western yellow-billed cuckoo radio telemetry study results, middle Rio Grande, New Mexico: 2007–2008. Bureau of Reclamation, Technical Services Center, Denver, CO. 58pp.

SEMARNAT. 2002. NORMA Oficial Mexicana (NOM-059-ECOL-2001) - Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. Diario Oficial de la Federación.

Seymour, K.L. 1989. *Panthera onca*. Mammalian Species 340:1-9.

Sierra Institute Field Studies Program in Arizona. 2000. Jaguar habitat in southern Arizona and New Mexico. Unpublished report, University of California Extension, Santa Cruz.

Sky Island Alliance. 2013. Northern Mexico Conservation Program. http://www.skyislandalliance.org/jaguars.htm. Accessed 20 March 2013.

Stasey, W.C. 2012. Evaluating translocation strategies for ocelot in the Tamaulipan Biotic Province. Dissertation. Texas A&M University - Kingsville, Kingsville, Texas, USA.

Swank, W.G. and J.G. Teer. 1989. Status of the jaguar - 1987. Oryx 23:14-21.

SWCA, Inc. 2001. September 12, 2001 Technical Memorandum regarding the PPC mitigation program at Las Campanas.

Tewes, M. E. 1986. Ecological and behavioral correlates of ocelot spatial patterns. Unpublished Ph.D. dissertation, University of Idaho, Moscow, ID. 128 pp.

Tewes, M.E., and D.J. Schmidly. 1987. The neotropical felids: jaguar, ocelot, margay, and jaguarundi. Pp 695-712 *in* M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, editors.

Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Thompson, K. 1961. Riparian forests of the Sacramento Valley, California. Annals of the Association of American Geographers 51:294–315.

Tucson Audubon Society. 2017 Yellow-billed Cuckoo Surveys on the Coronado National Forest within Five Sky Island Mountain Ranges in Southeast Arizona in 2017 DRAFT

Tucson Audubon. 2015. March 13, 2015 Comment letter on Proposed Western Yellow-billed Cuckoo Critical Habitat Designation. Tucson, AZ. Via the Federal eRulemaking Portal, Docket No. Attn: Docket No. FWS–R8–ES–2013–0011; 4500030114, Public Comments Processing, U.S. Fish and Wildlife Service, Arlington, VA 22203.

U.S. Fish and Wildlife Service (USFWS). 2016. Endangered and threatened wildlife and plants; amending the formats of the lists of endangered and threatened wildlife and plants; final rule. 81 FR:51550, August 4, 2016.

USFWS. 2016. Recovery Plan for the Ocelot *(Leopardus pardalis*), First Revision. U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico.

USFWS. 2015. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo. Halterman, M., M.J. Johnson, J.A. Holmes and S.A. Laymon

USFWS. 2014a. Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo: Proposed Rule. Federal Register 79 (158): 48548.

USFWS. 2014b. Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus*): Final Rule. Federal Register 79 (192): 59992.

USFWS. 2013b. Proposed rule to list the yellow-billed cuckoo (*Coccyzus americanus*) as a threatened species in the western continental United States. FR 78:61622.

USFWS. 2012a. Recovery outline for the jaguar (*Panthera onca*). April 2012. 59 pp.

USFWS. 2012b. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Jaguar: Proposed Rule 77 FR 50214-50242.

USFWS. 2010. Draft Ocelot *(Leopardus pardalis*) Recovery Plan (revised). FWS, Southwest Region, Albuquerque, NM. 170 pp.

USFWS. 2007. 5-year review for Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*). Arizona Ecological Services Office, Phoenix, Arizona. 17 pp. Available at:

http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/PimaPineappleCactus/PPC_5yrReview.pdf

USFWS. 2005. Biological Opinion on the Buenos Aires National Wildlife Refuge Fire Management Plan for the 2005-2008 Burn Seasons. AESO 02-21-05-F-0243. Arizona Ecological Services Office, Phoenix, Arizona. May 20, 2005. 56pp.

USFWS. 2003. Endangered and threatened wildlife. Code of Federal Regulations, Title 50, Section 17.11.

USFWS. 2002. Southwestern Willow Flycatcher Recovery Plan, Region 2, Albuquerque, NM.

USFWS. 1993. Determination of endangered status for the plant PPC (*Coryphantha scheeri* var. *robustispina*). Federal Register 58(158):49875-49880.

USFWS. 1990. Listed cats of Texas and Arizona recovery plan (with emphasis on the ocelot). FWS, Albuquerque, NM. 131 pp.

USFWS. 1982. Endangered Status for the U.S. Population of the Ocelot. 47 FR:31670, July 21, 1982.

USFWS. 1974. Endangered foreign wildlife. 39 FR:1171, January 4, 1974.

USFWS. 1972. List of Endangered Foreign Fish and Wildlife. 37 FR:2589, March 28, 1972.

Valdez, R., A. Martínez-Mendoza, O.C. Rosas-Rosas. 2002. Componentes históricos y actuales del hábitat del jaguar en el noroeste de Sonora, México. Pp. 367-377 *in* Medellin, R.A., C. Equihua, C.L.B. Chetkiewicz, P.G. Crawshaw, Jr., A. Rabinowitz, K.H. Redord, J.G. Robinson, E.W. Sanderson, and A.B. Taber, comps. 2002. El jaguar en el nuevo millenio. Fondo de Cultura Económica, Universidad Nacional Autónoma de México, Wildlife Conservation Society, México. 647pp.

WestLand Resources, Inc. 2004. January 26, 2004, Technical Memorandum regarding the transplanted PPC at the Madera Highland Reserve.

WestLand Resources, Inc. 2008. May 22, 2008, Technical Memorandum regarding the survival of transplanted Pima pineapple cactus on the Sycamore Highland Property.

WestLand Resources, Inc. 2013a. Revised 2012 Survey For Yellow-Billed Cuckoo (*Coccyzus americanus*) in the Patagonia Mountains, Near Harshaw, Arizona. April. Prepared for Arizona Minerals, Inc. Tucson, AZ.

WestLand Resources, Inc. 2013b. 2013 Survey for Yellow-Billed Cuckoo (*Coccyzus americanus*) In The Patagonia Mountains, near Harshaw, Arizona. Prepared for Arizona Minerals, Inc. Tucson, AZ.

WestLand Resources, Inc. 2015a. 2013 Survey for Yellow-billed Cuckoo (*Coccyzus americanus*). Rosemont Project. Prepared for HudBay. Tucson, AZ.

WestLand Resources, Inc. 2015b. 2014 Yellow-Billed Cuckoo (*Coccyzus americanus*) survey. Rosemont Project. Prepared for HudBay. Tucson, AZ.

WestLand Resources, Inc. 2015c. 2015 Yellow-billed Cuckoo survey data sheets for Barrel, McCleary, and Wasp canyons. Prepared for HudBay. Tucson AZ.

Wilcove, D. S., C. H. McLellan, and A. P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pages 237–256 in Soulé, M., ed., Conservation Biology: Science of Scarcity and Diversity, Sinauer Associates, Sunderland, MA. 584 pp.

Zarza, H., C. Chávez, and G. Ceballos. 2007. Uso de hábitat del jaguar a escala regional en un paisaje dominado por actividades humanas en el sur de la península de Yucatán. Pp 101-110 in Ceballos, G, C. Chávez, R. List y H. Zarza (editores). 2007. Conservación y manejo del jaguar en México: estudios de caso y perspectivas. Conabio - Alianza WWF-Telcel – Universidad Nacional Autónoma de México. México.

Zarza, H., C. Chávez, and G. Ceballos. 2010. Asesoría para la coordinación e integración de los trabajos realizados sobre las poblaciones de jaguar en México. Instituto de Ecología, Universidad Nacional Autónoma de México. México.

Zeller, K. 2007. Jaguars in the New Millenium Data Set Update: The State of the Jaguar in 2006. Unpublished Report. Wildlife Conservation Society, Bronx, New York, USA.