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In reply refer to:
AESO/SE
02EAAZ00-2012-F-0165
02EAAZ00-2018-F-0171

December 7, 2018

Memorandum

To: Refuge Manager, U.S. Fish and Wildlife Service, Buenos Aires National Wildlife Refuge, Sasabe, Arizona

From: Field Supervisor

Subject: Biological Opinion for the Buenos Aires National Wildlife Refuge Grassland Multi-Unit Burn Plan for 2018 – 2022

Thank you for your request for re-initiation of 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 request was dated June 12, 2018, and received by us that same day. At issue are impacts that may result from the proposed Buenos Aires National Wildlife Refuge (BANWR) Grassland Multi-Unit Burn Plan for 2018 - 2022 located in Pima County, Arizona. The proposed action may affect and is likely to adversely affect the endangered Pima pineapple cactus (*Coryphantha sheeri* var. *robustispina*).

In your request for consultation, you also requested our concurrence that the proposed action may affect, but is not likely to adversely affect the following species:

Gila Topminnow *(Poeciliopsis occidentalis)*(Endangered)
Chiricahua Leopard Frog *(Rana chiricahuensis)*(Threatened)
Northern Mexican Gartersnake (*Thamnophis eques*)(Threatened)
Southwestern Willow Flycatcher *(Empidonax traillii extimus)*(Endangered)
Western Yellow-billed Cuckoo (*Coccyzus americanus*)(Threatened)
Masked Bobwhite Quail *(Colinus virginianus ridgwayi)*(Endangered)
Ocelot (*Leopardus pardalis*) (Endangered)
Jaguar *(Panthera onca)*(Endangered)

We concur with your determinations and include our rationale in Appendix A.

You also determined that the action would have "no effect" on designated critical habitat for the Chiricahua leopard frog and the jaguar, nor on proposed critical habitat for the yellow-billed cuckoo and the northern Mexican gartersnake. "No effect" determinations do not require our review and are not addressed further in this re-initiation of consultation.

This biological opinion is based on information provided in your August 2, 2018 updated biological assessment, telephone conversations, emails, meetings, 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, prescribed burning 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

- April 27, 2012: Consultation was completed on the BANWR 2012 – 2017 Multi-Unit Burn Plan (Consultation #02EAAZ00-2012-F-0165)
- March 14, 2018: BANWR provided a draft request for re-initiation of the Multi-Unit Burn Plan consultation due to changes in the time period, proposed action, and additional species listings and critical habitat designations.
- June 12, 2018: We met with you, your staff to clarify the proposed action and effects determinations included in the draft Biological Assessment, and you provided a formal request to reinitiate consultation.
- August 2, 2018: You provided an updated Biological Assessment and 2018 – 2022 Multi-Unit Burn Plan in response to our request for additional clarification related to your proposed action and effects determinations.
- November 20, 2018: We provided you with a draft BO for your review
- November 29, 2018: We received comments on the draft BO

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

This Biological Opinion (BO) represents re-initiation of formal consultation regarding the Buenos Aires National Wildlife Refuge (BANWR) Multi-Unit Grassland Burn Plan for the 2018-2022 burn seasons pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended. There are overall prescribed burn strategies described in the newly developed 2018 – 2022 Multi-Unit burn plan (see Appendix A of the BA) that differ from previous plans, changed conditions exist, and some wildlife species have been federally-listed that were not considered in the previous BA. Therefore, BANWR is seeking to reinitiate consultation regarding this current Multi-Unit Grassland Burn Plan that will address changes as described above and extend the time period to be covered by consultation to 2018 – 2022. The information considered in this re-initiation is different from previous planning efforts, a result of "adaptive management" as refuge staff learn from previous efforts and implement some different strategies for managing refuge grasslands.

Goal #1 of the BANWR Habitat Management Plan is to restore, conserve, and manage the natural abundance and diversity of wildlife and habitats utilizing strategies that focus on environmental and biological integrity. One of the objectives identified in the plan to help meet this goal is to restore and enhance native Sonoran semi-desert grasslands on the refuge. In 1988, the refuge initiated a prescribed burning program in an effort to restore the historical role of fire in the grasslands and to restore native grasses, reduce the density of woody species, and to improve habitat for the masked bobwhite quail. Refuge fire crews have implemented cool season burns, but eventually shifted to summer burns in May and June to better mimic the historical fire season (natural pre-monsoon lightning fires) with the hopes of having better control on mesquite. Anywhere from 10,000 to 20,000 acres were burned on the refuge annually. Subsequent analysis of refuge data shows that previous use of prescribed fire has not met the anticipated habitat restoration objectives of controlling the spread of Lehmann's lovegrass (*Erogrostis lehmanniana*), controlling mesquite, or significantly help restore the density and abundance of native grass species (Geiger 2002), and it is time to experiment with some different approaches to reaching habitat objectives.

The proposed action is the programmatic implementation of prescribed burns for the years 2018 through 2022. Burn units will be selected within the entire grassland area of the refuge based on Habitat Management Plan goals and objectives, site-specific soil moisture, and fuel conditions for each respective year of the burn plan. This approach is similar to previously approved fire management plans, but the approach differs from planning prior to 2012, which required selection of specific burn units up to four years in advance of the burn irrespective of site-specific conditions at the time of the burn implementation. The proposed action addresses effects of prescribed burns within the broader grassland region rather than the effects to specific burn units since ecological characteristics are reasonably uniform throughout the grassland region of the refuge. This approach provides a greater degree of habitat enhancement flexibility for on-the-ground resource management actions and is consistent with the adaptive management philosophy described in the HMP. Burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the

entire refuge grassland area. The refuge manager must approve final site selections and burn prescriptions prior to implementation of this action. Burn plans for individual burn units will also be approved prior to their implementation each year.

Historically, most of the large fires occurred in this region during dry years, before the onset of monsoonal rains, and were typically caused by lightning strikes. Therefore, the associated plants and animals were judged to be adapted solely to an early-summer fire regime (Brown 2009). Using this logic, the majority of prescribed fire treatments on BANWR were typically planned and implemented for May and June to emulate naturally occurring pre-monsoon fire events. However, due to the invasion and proliferation of non-native grass species especially Lehmann's lovegrass on BANWR, most prescribed burning will be conducted during other seasons to test and ultimately evaluate differing fire effects pertaining to habitat management objectives.

The introduction of non-native Lehmann's lovegrass has significantly altered the structure and composition of native grasslands on BANWR. It can become the dominant species in a previously healthy, undisturbed native grassland in as little as six years. The proliferation of this grass in semi-desert grasslands is happening across the southwestern United States, with or without the influence of fire, but the combination of the plant's fire tolerance, abundant wind-borne seed, and seed bank viability favors its persistence and dominance in burned or otherwise disturbed areas (Martin 1983). Considerable evidence indicates that periodic fires (especially during drought periods) enhance establishment of Lehmann's lovegrass (McPherson 1995). However, other work shows that the proportion of Lehmann's lovegrass on plots changed in response to weather rather than fire, and do not support findings of other studies on non-native grasses nor predictions about the response of Lehmann's lovegrass based on its germination responses to fire and its growth characteristics relative to native grasses (Albrecht, et al. 2008). Analysis of long-term monitoring data from BANWR suggests that using prescribed fire to convert habitat dominated by Lehmann's lovegrass back to native grassland cannot be expected (Geiger 2002). Fire provides the ideal site for establishment of Lehmann's lovegrass because open spaces are created and seed germination is enhanced (Ruyle et al. 1988). Following fire, an abundance of Lehmann's lovegrass seedlings quickly become established and are able to produce mature seeds the first growing season following a fire (Crider 1945, Cable 1965). Because Lehmann's lovegrass is capable of producing 2-4 times more biomass annually than native grasses (Anable et al. 1992), it quickly changes the density of fine fuels available on a landscape, making such grasslands unusable as foraging habitat for many bird species, and further increasing the probability of wildfire spread across a grassland dominated by this species. Domination of Lehmann's lovegrass is detrimental to masked bobwhite quail populations (USFWS 1995) because it acts as a "keystone" species that leads to reduced diversity and altered structure and function of native ecosystems (McPherson 1995).

Additionally, areas dominated by nonnative grasses are not considered suitable bobwhite habitat due to their associated lower plant diversity, lower insect abundance (Bock et al. 1986), and lower seed germination rates of important seed-producing plants (Nurdin and Fulbright 1990). However, especially during drought periods, bobwhite have been noted using pastures containing buffelgrass (*Pennisetum ciliare*), and perhaps buffelgrass provides escape cover and nesting cover when little else is available (Kuvlesky et al. 2002). King (1998) reported a similar number of observations of masked bobwhite at BANWR in both areas dominated by Lehmann's

lovegrass and in areas dominated by native vegetation. Though bobwhite have been documented utilizing Lehmann's lovegrass for nesting on BANWR (S. Gall pers. obs.), the structure of Lehmann's lovegrass is generally considered inappropriate for use by nesting masked bobwhite quail.

However, planned burns can be managed by BANWR to influence or mitigate the effects of naturally occurring fire across a Lehmann's lovegrass-dominated landscape, and can be used to help provide young, tender grass shoots and forbs during springtime for use by invertebrates, small mammals, and birds.

For the purposes of this document all designated burn units shown in Appendix A of the 2018 – 2022 Multi-Unit Burn Plan may be considered for prescribed fire treatments. A cap of 5,000 total acres may be burned in any given year, avoiding the July – September nesting season of masked bobwhite quail to minimize potential short-term negative impacts to breeding birds. Fall, winter, and spring burns will take place as long as that total area of prescribed fire does not exceed 5,000 acres within a given year. This would allow for situations wherein fuels were inadequate on some portions of the refuge but abundant in others. It allows the fire staff to respond quickly and take advantage of opportunities to burn units when conditions are most favorable. Criteria for burn unit selection include the vegetation structure and density, soil moisture, fuel loadings, and landscape geography. Additionally, the presence or absence of federally-listed threatened or endangered species will be evaluated during this site selection process. The presence of masked bobwhite populations, detection of masked bobwhite nests, or other needs yet unanticipated could result in the removal of a burn unit from prescribed burn implementation for a given year.

Refuge fire staff have developed fire prescriptions designed to create a patchy mosaic of burn throughout smaller areas within these burn units in which no more than 50% of all vegetation present will be subjected to fire. This approach will have minimal negative impacts on desired leguminous shrubs, create micro-edge effects, and promote a post-fire vegetation response beneficial to masked bobwhite quail and other species. The unburned vegetation patches will provide escape cover and ensure that insect and vegetation food sources remain available for bobwhite quail. The prescriptions for these burns require atmospheric humidity of 20% and wind speeds up to 5 mph, which are necessary to achieve the desired fire effects. A complete description of the fire prescriptions and conditions, as well as burn implementation methods and protocols are discussed in detail in the 2018 – 2022 Multi-Unit Fire Plan (See Appendix A of the BA).

Conservation Measures

The following measures are actions that BANWR will take as part of the proposed action to reduce adverse impacts to and to conserve listed species:

<u>Pima Pineapple Cactus</u>

The refuge currently conducts pre-fire surveys for this species prior to the prescribed fire season. When cacti are located, they are marked, and UTM coordinates are collected with GPS. Originally, any cacti located within a burn unit prior to a prescribed burn were protected from the

effects of fire by mowing away fine fuels to proactively prevent potential damage from fire effects, and all cacti were then monitored post-fire during multiple visits to discern whether they had indeed been impacted by fire. More recently, and in cooperation with a valley-wide effort to document the effects of fire on Pima pineapple cacti, Pima pineapple cacti within a burn unit are located and monitored multiple times following a fire, but are not otherwise protected in any way prior to the burn. This "adaptive management" approach has allowed data to be gathered respective to post-fire survivability of cactus.

Firebreaks, essentially non-vegetated or sparsely vegetated areas that prevent the spread of fire, are used to help contain a prescribed burn within a specified management unit. Typically, most firebreaks on BANWR are existing roads located along the margins of management units, and are maintained by grading to rid them of vegetation (mostly grasses). Other forms of firebreaks include the use of low intensity fire applied by individuals to create black-lined areas, or the use of foam fire retardants applied to create areas that will not burn. Such techniques would minimize potential impacts to Pima pineapple cactus populations.

Using bulldozers or road graders to mechanically create firebreaks by removing vegetation down to bare earth would only be used to protect urban interface structures around Arivaca or Sasabe. Gyrotrack equipment is no longer used to create firebreaks at BANWR, as this method was potentially damaging to cacti. Currently a tractor/mower is sometimes used to mow down brush and grass on the edges of burn units adjacent to roads, thereby enhancing the road's effectiveness as a break. The height of the mower can be adjusted to miss large cactus plants, yet still provide effective fuel breaks. Additionally, fire crew members commonly walk ahead of the mower looking for rocks or other obstacles that might damage the mower and these personnel could easily monitor for cactus ahead of the mower. Mowing in this manner, when used, is unlikely to damage or kill cactus within the firebreak swath, but such damage could occur. The area affected would be minimal as the break would be no wider than 10 feet. The likelihood of Pima pineapple cactus occurring within such a firebreak is minimal, but should they occur, destruction is possible. Every attempt will be made to locate the potential firebreak around any existing cacti that are located.

The following measures will continue in all planned prescribed burn units to reduce adverse impacts to and to conserve the Pima pineapple cactus: Cactus surveys will be conducted in each burn unit scheduled for burning, using the valley-wide approach of belt transect sampling which ultimately results in approximately 20% survey coverage of the unit. One hundred percent of all viable Pima pineapple cacti detected in pre-burn surveys will be re-visited to assess potential fire damage to individual cacti. Data collected as part of each survey will include cactus measurements, number of pups present, percent vegetative cover, map of the area surveyed, hours surveyed, number of people surveying, number of cacti located, and UTMs for each individual cactus. Datasheets will be completed for each individual cactus. Both a pre-burn assessment of level and type of surrounding vegetation and fuels and a post-burn assessment at time intervals consistent with the valley-wide approach will be done.

Gila Topminnow

The refuge wetlands that provide potential habitat for this species are typically surrounded by elevated berms for most of their periphery that effectively protect the tanks from ash and sediment inflow. Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss. Because measures being implemented to reduce impacts to Chiricahua leopard frogs in such wetlands (identified below) will provide the same benefits to Gila topminnow, those measures will be implemented to benefit all wetland species on the refuge.

Chiricahua Leopard Frog

The wetlands that provide potential occupied habitat for this species on BANWR are typically surrounded by elevated berms for most of their periphery that effectively protect the tanks from ash and sediment inflow. However, the inlets to the tanks remain somewhat vulnerable to potential ash inflow. In the situation of Rock and State Tanks, both are double tanks where a smaller dugout area is designed to function as a silt trap. In order to protect tanks from any infiltration of harmful ash, either the trap will be cleaned at some interval following the burn or a straw bale-type sediment trap will be used at the inlet in order to prevent harmful ash from entering the tanks. Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss.

Protective measures at some tanks will not be necessary if burns are conducted during dry periods when adult leopard frogs, tadpoles, and fish are absent. While Choffo, Carpenter, Banado, Triangle, Cactus Barrel, and Garcia Tanks are not in burn units and no special protection is anticipated, refuge staff will ensure that any potential runoff from distant burns is monitored and addressed with straw bale type sediment traps will still monitor such tanks. The small display pond at refuge headquarters is a cement structure located adjacent to the visitor center, and protective measures involve protecting the entire headquarters area from fire. All of the above measures will provide benefits to all wetland species on the refuge.

Northern Mexican Gartersnake

The refuge wetlands that provide potential habitat for this species are typically surrounded by elevated berms for most of their periphery that effectively protect the tanks from ash and sediment inflow. Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss. Because measures being implemented to reduce impacts to Chiricahua leopard frogs in such wetlands (identified above) will provide the same benefits to northern Mexican gartersnakes, those measures will be implemented to potentially benefit all wetland species on the refuge.

Southwestern Willow Flycatcher

Occurrence of this bird within the grassland units of BANWR would be rare, and restricted to their short-term migration periods during spring and late summer. Prescribed burning, utilizing incremental black-lining techniques as part of a ground- ignition strategy, provides ample opportunities for passerine birds to depart the area that is being burned by flying to other locations and therefore escaping harm. Some mesquite trees will be maintained by ensuring mesquite trees along all lines do not pose holding threat (limb, clear-out underbrush, or remove to prevent potential torching and spotting). Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss. Burning grasslands is expected to have no effect on southwestern willow flycatcher critical habitat.

Yellow-billed Cuckoo

Occurrence of this bird within the grassland units of BANWR would be rare, and restricted to their breeding season (typically June – September). Use of prescribed fire for grassland burns during the month of June could adversely affect yellow-billed cuckoos, some of which begin to arrive on portions of the refuge during that time period. However, prescribed burning, utilizing incremental black-lining techniques as part of a ground-ignition strategy, provides ample opportunities for passerine birds to depart the area that is being burned by flying to other locations and therefore escaping harm. Some mesquites will be maintained by ensuring that mesquite trees along all lines do not pose holding threat (limb, clear-out underbrush, or remove to prevent potential torching and spotting). Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss.

Use of prescribed fire during July, August, and September does not typically occur on the refuge because monsoonal moisture and humidity make the planned use of fire for habitat management impractical. Use of prescribed fire for grassland burns during all other months of the year would have no effect on yellow-billed cuckoos. Burning grasslands is expected to have no effect on yellow-billed cuckoo critical habitat.

Masked Bobwhite Quail

During the next five years, units on BANWR that are known to be occupied by masked bobwhite quail will not be burned. Additionally, refuge units having habitat that is proposed to receive quail reintroductions will also not be burned. Rather, prescribed use of fire will be planned only in identified units where quail habitat is expected to be improved by suitable mosaic burning, and then monitored to document whether or not bobwhite quail move into and utilize such post-burn areas.

Manipulation or experimentation is a powerful method used to identify suspected limiting factors, and, once identified, these factors may be altered to help manage wildlife (Stoddard 1931). Therefore, prescribed burning will also be accomplished in non-occupied (by bobwhite quail) units where the Service expects to experiment with different fire management techniques (timing, firing methods, etc.) designed to measure impacts on non-native grass, for enhancement of shrub habitat, or to facilitate the early spring green-up of forbs and non-native grasses expected to be used as forage for quail and invertebrates. Several investigations attributed the early and vigorous growth of plants in the spring to blackened ground after fire (Ahlgren and Ahlgren 1960; Anderson 1972; Daubenmire 1968; Sykes 1971), and both developments could improve the food supply to birds and mammals at this critical time of year (Siivonen 1957). A long-term study is needed to determine specific items such as the most desirable fire frequency, effectiveness with various kinds of grasses and woody plants, and the relationship between fire and size of woody plants (Humphrey 1974).

In units planned for prescribed burning, in order to ensure the survival of any unknown – but potentially present - masked bobwhite quail utilizing the unit, prescribed fire will typically be implemented using incremental black-lining of units rather than using aerial ignition. In any rare instances that aerial ignition is deemed preferable over black lining (example: human safety concerns), there will be a 1/4-1/2 mile distance between parallel ignition lines.

Adjacent refuge units will not be burned during the same year in order to potentially preserve habitat for birds to move into if the area they are using becomes undesirable for some reason. An exception to this practice may be small units that, for practical reasons, might be burned together for administrative efficiency. These include such units as Headquarters/Mormon (710 acres combined) and Horse North/Horse South (1246 acres combined).

Ocelot

To reduce potential impacts to ocelots, adjacent refuge units will not be burned during the same year in order to potentially preserve habitat for wildlife to move into if the area they are using becomes undesirable for some reason. Also, refuge fire units are relatively small in comparison to the larger landscape, minimizing disorientation, and providing ample habitat for mammals to escape harm during fire events. Finally, in order to ensure the survival of any unknown ocelots occurring in burn units during prescribed burning of grasslands, prescribed fire will typically be implemented using incremental black-lining techniques as part of a ground ignition strategy, rather than using aerial ignition. This will provide ample opportunities for mammals to depart the area this is being burned by fleeing to other locations and therefore escaping harm. In any rare instances that aerial ignition is deemed preferable over black lining (example: human safety concerns), there will be a 1/4-1/2 mile distance between parallel ignition lines. Actions will be taken to ensure mesquite trees along all lines do not pose holding threat (limb, clear-out underbrush, or remove to prevent potential torching and spotting). Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss.

Jaguar

To reduce potential impacts to jaguars, adjacent refuge units will not be burned during the same year in order to potentially preserve habitat for wildlife to move into if the area they are using becomes undesirable for some reason. Also, refuge fire units are relatively small in comparison to the larger landscape, minimizing disorientation, and providing ample habitat for mammals to escape harm during fire events. Finally, in order to ensure the survival of any unknown jaguars occurring in burn units during prescribed burning of grasslands, prescribed fire will typically be implemented using incremental black-lining techniques as part of a ground ignition strategy, rather than using aerial ignition. This will provide ample opportunities for jaguars to depart the area this is being burned by fleeing to other locations and therefore escaping harm. In any rare instances that aerial ignition is deemed preferable over black lining (example: human safety concerns), there will be a 1/4-1/2 mile distance between parallel ignition lines. Actions will be taken to ensure mesquite trees along all lines do not pose holding threat (limb, clear-out underbrush, or remove to prevent potential torching and spotting). Burns will utilize specific ignition techniques such as dot firing to minimize unwanted fire behavior in areas of special concern and reduce impact on values. These ignition patterns will be discussed and understood by ignition staff and firing boss. Burning grasslands is expected to have no effect on jaguar critical habitat.

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.

Because of the conservation measures and prescriptions that BANWR will use to conduct the burns proposed in the BANWR 2018 – 2022 Grasslands Multi-Unit Burn Plan, effects of the proposed action are expected to remain within the refuge boundaries. Therefore, the action area for the proposed action includes all of the fire management Burn Units on BANWR (See Appendix A of the 2018 – 2022 BANWR Multi-unit Burn Plan included as Appendix A of the BA).

The BANWR is located in an area of primarily semi-desert grasslands in Pima County, Arizona. The town of Sasabe, Arizona is 7.5 miles south of the refuge headquarters, and the town of Arivaca, Arizona is approximately 18 miles from the refuge headquarters.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The information in this section summarizes the rangewide status of the Pima pineapple cactus that is considered in this BO. Further information on the status of the Pima pineapple cactus 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. See Appendix A of this BO for information related to species covered through our concurrences under informal consultation.

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), these forces will negatively affect Pima Pineapple cactus. 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.

No critical habitat has been designated for this species.

Previous Consultations

In the past 10 years, at least 31 Federal agency actions have undergone (or are currently undergoing) 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.).

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

The semi-desert grasslands of BANWR are typified by rolling hills not generally exceeding 200 feet in vertical elevation relief. The burn units in this plan lie within a broad sweeping valley aligned north/south known as the Altar Valley and are in proximity to several major drainages varying in width not generally exceeding ½ mile. Major drainages in this area include the Altar Wash, Puertocito Wash, Arivaca Wash, and the San Luis Wash.

Additionally, there are several mountain ranges enclosing the Altar Valley on the eastern and western flanks although none of the burn units lies directly adjacent to these ranges. These include the Cerro Colorado Mountains, Las Guijas Mountains, and the San Luis Mountains to the east and the Baboquivari Mountains to the west.

It is theorized that intense livestock grazing of this area led to a reduction in the amount of native grass cover, which in turn increased soil erosion, raised evaporation and transpiration rates, and eliminated fuels that fed the formerly occurring natural fires. It was the removal of the cured grasses and the reduction in the incidence of fire that permitted the brush invasion of semi-desert grasslands (Brown 2009). Refuge habitat management objectives include prescribed fire actions that will increase the proliferation of various shrub species that provide cover and food for quail and grassland birds in some areas of BANWR, open up grassland areas by limiting the spread and thickening of mesquite woodlands on some refuge areas, and enhance upland conditions to favor a variety of grass species capable of providing nesting cover, escape cover, forage, and supporting a diversity of invertebrates and other organisms across the landscape.

Burn unit boundaries are primarily created by the maintained network of roads that crisscrosses the Refuge. The roads were primarily created as a means of controlling fire and as such provide an adequate holding feature for nearly all fire events. Where roads are not maintained as part of the Refuge road system, holding lines may be constructed as conditions warrant. Additionally, hand lines, trails, open areas, and other natural features will provide portions of burn unit boundaries in some areas. Unmapped roads and undocumented immigrant trails exist in most burn units as well.

Status of the species and critical habitat within the action area

The Pima pineapple cactus occurs in widely scattered, low density populations in the grassland areas of BANWR, where it seems to be found mostly in relatively flat areas characterized by gravelly soil. A GIS model was created to predict occurrence of the cacti within the refuge units,

and this dynamic model has been successfully used to determine where to expect cacti within burn units. Monitoring activities throughout Pima County, Arizona show an overall decline in the population of Pima pineapple cactus, and researchers continue to seek information documenting the ecology and potential threats relative to this cactus. Through 2017, basic condition assessments have not been conducted for this species on the refuge.

All succulents can be damaged or destroyed by fire, but can also survive burning when the plants occupy rocky or otherwise open areas characterized by low fuel abundance, when cacti are missed by fire due to the mosaic pattern of burns, and by producing thick callous tissue following previous damage that may help protect the plant from subsequent fire damage. Initially, in places where prescribed burns were scheduled to take place on the refuge, refuge staff and volunteers conducted clearance surveys for Pima pineapple cactus in the burn area. Vegetation surrounding all known Pima pineapple cactus was then cleared to minimize fire impacts to these cacti. Vegetation was cleared for a distance of ten feet in a doughnut shaped area at a distance beginning one foot away from each cactus to protect it from fire yet leaving vegetation immediately adjacent to each cactus to provide beneficial micro-habitat conditions surrounding the plants. Although pre and post burn monitoring was done to evaluate impacts to these plants and to provide additional information to improve protective measures, no clear results emerged (probably due to varying fire intensities, timing, and other unmeasurable variables). The refuge cactus population probably increases or decreases over time based upon local rainfall patterns, grass production, and fire dynamics. What is clear is that post-fire survivorship of Pima pineapple cactus at BANWR was 31% in areas having a high density of lovegrass, and post-fire survivorship of the cactus was 70% in areas having a low density of lovegrass (Roller and Halvorson 1997).

More recently, belt transects have been utilized to locate cactus as part of clearance surveys. About 30-35% of all burn units are surveyed and, when a cactus is located, the position is documented using GPS and habitat features and cactus condition are recorded prior to burning. Immediately after a burn, the site characteristics and condition of each previously located cactus are evaluated in the same manner as before the burn. Such data is collected periodically for three years following the burn. Additionally, post burn surveys are conducted to locate any cacti potentially missed during pre-burn surveys. Ultimately, data is analyzed to help evaluate the effects of fire on unprotected cacti. Such surveys focus on how unprotected cacti respond to fires of varying intensities.

This cactus is sparsely distributed on the refuge, where limited evidence shows it has declined in its overall population. Still, the cactus is well established and shows evidence of natural reproduction. Refuge personnel plan to continue pre-burn clearance surveys for the Pima pineapple cactus, with the goal of better measuring the plant's response to differing fire effects, are additionally establishing a standardized methodology to adequately survey refuge populations of Pima pineapple cactus, and are hosting research to help provide population trends. Threats to this plant on BANWR include continuing long-term drought, the introduction and continuing spread of non-native grasses, possible disruption of habitat and pollination corridors, and possible predation by mammals and insects. Within the plant's larger geographic range, the same threats occur, and the cactus has declined largely due to increasing urbanization, commercial and residential development, and the potential increase of mining projects. Plants

already stressed from prolonged drought are more susceptible to insect attack and disease (Mattson and Haack 1987).

As of 2012, a total of 607 Pima pineapple cactus locations are known on the Refuge, although the current status of each of these plants is unknown because each individual is not monitored each year. The current total of Pima pineapple cacti on the BANWR is not known.

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.

Pima pineapple cacti grow in low densities within the grasslands constituting the bulk of the refuge. Limited information regarding fire-caused mortality is available for the Pima pineapple cactus. This species seems to prefer relatively flat areas that are sparsely vegetated, offering some protection from the burning of fine fuels. However, fire can damage epidermal and mesophyll tissue of cacti, which can kill the plant. Following initial fire caused mortality, cactus deaths can continue for several years (Thomas and Goodson 1991). Aside from direct mortality, fire can reduce or terminate sexual reproduction of cactus species and impact species-specific pollinators. Fire can result in loss of cactus spines and pubescence, leading to reduced carbon assimilation (Thomas 1991). Loss of spines and burning of associated vegetation can make the plant easier to locate and more susceptible to various herbivores.

Two main theories exist regarding the potential adaptation of Pima pineapple cactus to fire (Warren and MacLaughlin 1992). Since wildfire once maintained the integrity of the grasslands which once dominated the Altar Valley prior to the onset of livestock grazing, it is theorized that the cactus evolved adaptations which allowed it to survive periodic exposure to fire. Alternatively, it has been suggested that the plant has not evolved a tolerance to fire, but instead exploits bare patches of ground that will not burn well. In either case, the prevalence of the now dominant Lehmann's lovegrass has likely increased the fuel load within cactus habitat thereby putting the cactus at higher risk of burning than in the past.

Data collected at BANWR support both theories. Four of five cacti that were subjected to a July 1993 wildfire on the refuge and located during a post-burn survey appear to have been directly killed by fire. Conversely, 17 cacti exposed to prescribe fire conducted on the refuge in May and June 2001 and located following the burns appear to have survived the fire. Many showed signs of having reproduced.

Although fire likely poses some level of threat to this species, Pima pineapple cactus likely has a combination of adaptations that allow it to perpetuate in a fire-prone grassland community. Fire intensity is related to a variety of dynamic conditions that likely kills some percentage of plants, damages some plants, and has no effect over yet other plants by skipping over them. Cacti

surviving the fire likely serve as seed sources for recolonizing the burned area. Potential adverse effects to this species may result if prescribed burning is not conducted on BANWR, in that the accumulation of fine fuel loads would likely increase in density and increase the threat of killing cactus during high intensity wildfires. Even in the absence of fire, the density and overall ground cover provided by Lehmann's lovegrass likely results in the non-native grass out-competing the Pima pineapple cactus. Prescribed burning can release Pima pineapple cacti from this competition.

Smoke should have no effect on the Pima pineapple cactus. Temporary thinning of surrounding vegetation, being an ephemeral effect, has been shown to produce no negative effect to the cactus.

Effects of implementation of the fire management program could have variable long-term effects on the Pima pineapple cactus. When cacti are located in sparsely vegetated areas, which is typical, fire will likely be able to sweep through and area, sparing most of the cactus. When cacti inhabit more densely vegetated areas, they may be destroyed either by the fire itself or by the heat produced. This detrimental effect could conceivably lower the reproductive rate of the population, increasing the plant's rarity. In addition, with increasing scarcity, effective pollination may become less likely, which may further increase risk to the population. Annual prescribed burning of refuge management units, which are not in adjacent proximity to one another will create a refuge-wide mosaic of grasslands having differing densities of fine fuels, and will help retard high intensity, catastrophic landscape scale wildfires.

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.

Cumulative effects within the action area have not changed from those described in the BO for the BANWR Multi-Unit Burn Plan for 2012 – 2017 (Consultation #02EAAZ00-2012-F-0165).

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.

Conclusion

After reviewing the current status of the Pima pineapple cactus, the environmental baseline for the action area, the effects of the proposed BANWR 2018 – 2022 Multi-Unit Burn Plan, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Pima pineapple cactus. No critical habitat has been designated for this species; therefore, none will be affected.

Our conclusion is based on the discussion of effects found in the "Effects of the Action" section above, and the following:

1) Surveys for Pima pineapple cacti will be completed prior to implementing the prescribed burn. This will increase our knowledge and understanding of the occurrence and distribution of Pima pineapple cacti within the action area. While the proposed action will likely directly affect an increased number of individual Pima pineapple cacti compared to the survey and protection approach previously used by BANWR, we do not believe that every individual Pima pineapple cactus within the burn area will be affected, nor do we believe that this population of Pima pineapple cacti will be eliminated.
2) Although we anticipate that activities associated with the proposed action may result in direct and indirect effects to Pima pineapple cacti, the proposed survey and monitoring approach will document the effects of fire on this species and increase our understanding of the life history and conservation needs of not only the Pima pineapple cactus, but the grassland ecosystem upon which it depends. It is our opinion that the knowledge and understanding achieved through the proposed action will be beneficial to the long-term conservation and recovery of the Pima pineapple cactus.
3) The long-term effects of the BANWR 2018 – 2022 Multi-Unit Fire Management Plan will be to maintain or improve the native vegetation associations of the Altar Valley, including the desert scrub and grasslands within the action area.

The conclusions of this biological opinion are based on full implementation of the project as presented in 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.

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.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 4901 Paseo del Norte NE, Suite D, Albuquerque, NM 87113; 505-248-7889) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

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 implementation of the recently completed recovery plan for the Pima pineapple cactus.

2. Continue working to establish a Pima pineapple cactus survey and monitoring approach that will allow BANWR to better track the occurrence and status of the Pima pineapple cactus on BANWR.
3. Continue working with the Altar Valley Conservation Alliance and FWS Ecological Services Office to research the effects of fire on the Pima pineapple cactus.

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: Hopi, Salt River Pima-Maricopa Indian Community, Gila River Indian Community, Ak Chin Indian Community, Pascua Yaqui, Tohono O'odham Nation. We also encourage you to coordinate the review of this project with the Arizona Game and Fish Department.

We appreciate the BANWR's efforts to identify and minimize effects to listed species from this project. Please refer to the consultation number, 02EAAZ00-2018-F-0171 in future correspondence concerning this project. Should you require further assistance or if you have any questions, please contact Scott Richardson at (520) 670-6150 (x242) or Julie McIntyre (x 223).

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APPENDIX A: CONCURRENCES

This appendix contains our concurrences with your "may affect, not likely to adversely affect" determinations for the Gila topminnow, Chiricahua leopard frog, northern Mexican gartersnake, southwestern willow flycatcher, yellow-billed cuckoo, masked bobwhite quail, ocelot, and jaguar.

Gila Topminnow, Chiricahua Leopard Frog, Northern Mexican Gartersnake

Fire can directly affect fish, amphibian, and aquatic-dwelling reptile populations in several ways. Mortalities can occur from increased water temperature, changes in pH, increased ammonia levels from smoke gases absorbed in water, and increased phosphate levels leached from ash (Brown, 1989, Gresswell 1999, Rinne 1996, Rieman and Clayton 1997, Spencer and Hauer 1991). Adult frogs and gartersnakes that do not seek protective terrestrial cover (such as rodent burrows, etc.) can be directly killed by heat and/or desiccation. Effects are generally not as pronounced following prescribed fires as they would be following wildfires, but they may still be deleterious.

Vegetation and litter are consumed by fire, which changes physical and chemical properties of watersheds and ultimately can impact the drainages and wetlands. Reduction in vegetative cover can cause increased flows as evapotranspiration from vegetation is decreased, and can simply remove the vegetative cover otherwise used to protect frogs and gartersnakes from predators. The ash and soot washed into wetlands can impact functionality of the gills of fish and tadpoles, and produce acute and chronic effects. Charcoal washed into wetlands can reduce oxygen content of the water. Post burn sediment loading can increase and be detrimental to fish and tadpoles. Smoke can negatively impact aquatic systems by contributing nitrogen and ammonia, and the extent of the effect is dependent upon how long smoke lingers near water sources. The ash runoff contributes toxic phosphates to the water. During fires, both ammonia and phosphate levels have been known to increase above lethal limits to fish (Spencer and Hauer 1991) and tadpoles. Macroinvertebrate populations can be altered following fires. This effect can be produced by loss of shading of streams and ponds which, in turn, changes water temperatures. Negative impacts to invertebrate, fish, tadpole, and frog populations can have a subsequent negative impact on the gartersnakes that depend upon those life forms for food, ultimately negatively impacting a large part of a local food chain.

Indirect effects to fish, amphibian, and reptile populations can include effects caused by mechanical creation of fire breaks. Runoff from fire breaks can contribute to the sediment load in wetlands.

Gila topminnow and Chiricahua leopard frogs, like many desert species, are adapted to high turbidity, low dissolved oxygen, higher temperatures and harsher conditions overall than many non-desert species. Despite these adaptations, effects to the species can occur due to reduced prey base, gill obstruction, and juvenile mortality. High fecundity rates of topminnow and leopard frogs may offset this type of loss, however, and render the losses as simply a temporary

condition unless the population is completely extirpated. Although small populations of Gila topminnow have occurred in a few refuge wetlands historically, topminnows are currently absent from the refuge. That is not the case with Chiricahua leopard frogs, which have increased and recolonized wetland habitats in recent years following a systematic, successful removal of bullfrogs from refuge wetlands. Northern Mexican gartersnakes have not been documented on BANWR in several years, and their tenuous presence may already have come to an end on the refuge.

Future actions within the range of all of these aquatic species include overuse by livestock, recreation, illegal introduction of bait and sport fishes, introduction of non-native species such as bullfrogs and crayfish that compete with (and prey upon) native species, groundwater pumping, stream diversion, bank stabilization, irrigated agriculture, water pollution, and commercial and residential development. Introduction of the chytrid fungus, which occurs in southern Arizona, into a wetland containing leopard frogs could harm the species. All of these actions represent potential adverse cumulative effects to native fish, amphibians, and reptiles.

We concur that the proposed action is not likely to adversely affect the Gila topminnow, the Chiricahua leopard frog, and the northern Mexican gartersnake for the following reasons:

- The relatively small number of acres that might be burned on the refuge during any given year will not negatively impact the overall amount of riparian and wetland habitat on BANWR. Therefore, these effects are insignificant.
- The burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the entire refuge grassland area, helping prevent fast spreading and uncontrolled wildfire that could otherwise impact large numbers of upland acres which support associated wetlands. Therefore, the effects of the proposed action will be insignificant and, overall, will be beneficial to these species.
- Conservation measures will be implemented to reduce the overall effects to these species. Therefore, effects from the proposed action are anticipated to be insignificant.

Southwestern Willow Flycatcher and Yellow-billed Cuckoo

A small percentage of BANWR is utilized by Southwestern willow flycatchers and yellow-billed cuckoos, which are migratory species typically utilizing more restricted refuge habitats. Willow flycatchers and cuckoos can be present in limited numbers during April – September, but only cuckoos are known to breed on the refuge in suitable habitat.

Prescribed burns can create charred vegetation and blackened soil, which typically increase heat input to an area to directly or indirectly influence birds and mammals (Kozlowski 1974), and could benefit insectivorous birds like the southwestern willow flycatcher and, to a lesser extent, the yellow-billed cuckoo through decreased cover to hide prey and increased productivity of prey items. Keeping prescribed fire acreage below the 5,000-acre range in grassland dominated areas will affect about five percent of the refuge grassland habitat each year, and will further limit potential detriment to willow flycatchers and cuckoos.

Any burns conducted during May and June generally miss willow flycatchers, which have already migrated through the refuge toward their destined breeding areas and have not yet begun their southward migration. Yellow-billed cuckoos may arrive as early as June and do not typically begin nesting until July. Spring or winter burns may be used to rejuvenate grasslands on BANWR. By burning in the spring or winter (timing could be variable) to take advantage of increased soil moisture, managers can achieve desired results and avoid overstressing grass species if there is subsequent drought. In addition, spring or winter burns may be used around buildings to meet wildland/urban interface objectives, to safely and efficiently remove undesirable brush piles used by predators, to remove decadent and impenetrable stands of Lehmann's lovegrass, or to promote important spring green-up of forbs and some grasses (important to invertebrates, which in turn are consumed by insectivorous birds) as these burns produce a cooler fire more appropriate for fuel reduction and are less likely to spread and threaten other values. A spring burn in grassland would not impact the nests of cuckoos, and willow flycatchers do not nest on BANWR. Regardless of the timing of the proposed burns, both willow flycatchers and cuckoos are capable of flight and should be able to escape advancing flames. Construction of firebreaks (whether through blacklining or by mechanical means) should also have little or no effect on the species as the areas of potential food and cover that would be removed will be very small compared to the overall area used by the birds.

Smoke produced by fire should have little or no effect on willow flycatchers or cuckoos. Smoke in any one area of the burn unit is of short duration, and the smoke produced by the unit as a whole tends to rise quickly and dissipate. Therefore, no adverse effects are expected due to smoke.

We concur that the proposed action is not likely to adversely affect the southwestern willow flycatcher and the yellow-billed cuckoo for the following reasons:

- While short-term effects may occur on these species and their habitats, they will not be either widespread or long lasting. Therefore, effects are expected to be insignificant.
- The riparian areas used as habitat for these species are not typically the targets of the proposed action. Therefore, any effects to these areas will be insignificant.
- Conservation measures will be implemented to reduce the overall effects to these species. Therefore, effects from the proposed action are anticipated to be insignificant.
- The burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the entire refuge grassland area, helping prevent fast spreading and uncontrolled wildfire that could otherwise impact large areas of habitat. Therefore, the effects of the proposed action will be insignificant and, overall, will be beneficial to these species.

Masked Bobwhite Quail

Fire has long been recognized as having positive influences on Northern bobwhite quail populations (Stoddard 1931, Jackson 1965, Guthery 1986), and prescribed fire is a standard

management tool for bobwhite quail (Rosene 1955). Burned areas in the range of the bobwhite quail (*Colinus*) were warmer and drier by exposure to the sun and wind, both factors that improved the habitat for quail, particularly the chicks (Hurst 1971). Bobwhite quail cannot penetrate the "rough" that develops on the ground in unburned forests and so may be excluded as the forest matures. In addition bobwhite are thought to prefer to walk on more open ground, so that the seeds they feed on must be exposed or in very thin litter in order to be available to them. Burning the rough allows them to move about and feed (Hurst 1971; Stoddard 1931). Fire is also thought to enhance the amount and variety of seeds used by quail due to the effect of scarification of the seed coat. Burning and establishing grain food plots clearly increased numbers of quail. Burning in combination with food plots produced the most quail, but food plots, and burning alone, produced almost as large an increase in abundance (Ellis et al 1969). The importance of edge and interspersion is that some wildlife need a variety of resources, and these are best obtained where two or more kinds of cover come together (Leopold 1933, Buckley 1958).

Many of the benefits of fire that are recognized to benefit Northern bobwhite quail populations may also be applied to masked bobwhite quail. For example, masked bobwhite quail prefer edge habitat where mesquite-lined washes adjoin opened, grass-forb sites (Goodwin and Hungerford, 1977). Masked bobwhite quail prefer areas with a mixture of dense forb growth, dense grasses, and brush or trees, using more woody thickets during winter months (Tomlinson 1972). For northern bobwhite quail, such stands of old brush are recommended to be left about 200 meters apart (Jackson 1969, Guthery 1986). Masked bobwhite use brush piles, mesquite thickets, and "pockets" of dense grass-shrub for cover (Goodwin and Hungerford, 1977). Prescribed fire can be effectively used to promote all of these identified habitat characteristics. Prescribed fire has been used to limit woody plant invasion and to stimulate the growth of shrubby legumes. At Buenos Aires, fire has being used to top-kill mesquite trees, thereby creating the shorter shrub growth form preferred by bobwhite for cover. At the same time, inappropriate use of fire can produce negative impacts to masked bobwhite quail and other wildlife. For example, masked bobwhite quail preferences may reflect the need for a habitat supporting high humidity, which would be drastically altered by fire, and thus be harmful to the bird (Goodwin and Hungerford, 1977). Shrubs used by birds for loafing or perching should be protected (Renwald et al 1978), and prescribed burns should always be conducted at times of above average soil moisture (Wright and Bailey 1982).

An estimated 80 percent of the refuge is current or potential masked bobwhite quail habitat. Keeping prescribed fire acreage below the 5,000-acre range in grassland dominated areas will affect about five percent of the refuge grassland habitat each year, and will further limit potential detriment to bobwhite quail.

A May-June timing identified for prescribed burns in grassland is appropriate for most bobwhite quail habitat enhancement. Such timing allows for burns to take place and some vegetation to regenerate prior to the typical masked bobwhite nesting season of late July through early September. It may also allow for the possible early season breeding occasionally observed in March and April during wet years. In most cases, juveniles should be capable of flight at the time of the burn and should be able to escape advancing flames.

In some cases, spring or winter burns may be used to rejuvenate stands of giant sacaton, which historically may have been used as winter cover by masked bobwhite quail (King 1998). By burning in the spring or winter (timing could be variable) to take advantage of increased soil moisture, managers can achieve desired results and avoid overstressing giant sacaton if there is subsequent drought. In the cases where spring and winter burns are appropriate, it is likely that the entire unit will be burnt at the same time, and not just the targeted grass stands. In addition, spring or winter burns may be used around buildings to meet wildland/urban interface objectives, to safely and efficiently remove undesirable brush piles used by predators, to remove decadent and impenetrable stands of Lehmann's lovegrass, or to promote important spring green-up of forbs and some grasses (important to invertebrates and foraging quail) as such burns produce a cooler fire more appropriate for fuel reduction and are less likely to spread and threaten other values. A spring burn would have the potential to destroy the nests or very young broods of quail, if spring nesting were to occur.

The overall long-term effects of a prescribed burning program in BANWR will be optimized to benefit masked bobwhite quail. Improved habitat conditions should increase survival during all seasons and enhance production of wild birds.

Masked bobwhite quail that are in or adjacent to burn areas may be initially disturbed by the increased human presence resulting from ignition and fire control. Birds displaced during the fires are expected to move to adjacent non-burned areas, which are maintained within the normal movement distances of these birds. Observations by refuge biologists and fire staff during two prescribed fires in 2004 indicated that quail species, in general, tended to either walk ahead of the flames or fly away from fires into unburned areas. One pair of masked bobwhites observed during a refuge burn moved in advance of flames, flew to a small unburned patch under a mesquite, and then dispersed quickly. In many cases spring broods should be capable of sustained flight by the onset of the burning period and should be able to escape. Prescribed fire season should be completed by the onset of the more typical late summer breeding season.

Smoke produced by the fire should have little or no effect on flycatcher, cuckoos, or quail. Smoke in any one area of the burn unit is of short duration, and the smoke produced by the unit as a whole tends to rise quickly and dissipate. If a burn were to take place within or near the Montana Administrative Unit of the refuge there is a potential for smoke to infiltrate in the Quail Facility where a portion of the captive quail population is raised. Precautions will be taken in the form of sealing doors and windows until the fire has burnt out. Therefore, no adverse effects are expected due to smoke.

Construction of firebreaks should also have little or no effect on the species as the areas of potential food and cover that would be removed will be very small compared to the overall area used by the birds.

The indirect effect of reduced cover caused by prescribed burns, will be temporary in most years, but may be exacerbated during years of low rainfall. During drought years, the amount and quality of quail cover and food may be reduced by fire and will not recover in time to be utilized by nesting birds. This effect is somewhat offset by the fact that, for the most part, fire

management units are not burned in large blocks. Appropriate quail habitat is always available somewhere in the vicinity of recent burns.

We concur that the proposed action is not likely to adversely affect the masked bobwhite quail for the following reasons:

- While short-term effects may occur to this species and its habitat, they will not be either widespread or long lasting. Therefore, effects are expected to be insignificant.
- Conservation measures will be implemented to reduce the overall effects to this species. Therefore, effects from the proposed action are anticipated to be insignificant.
- The burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the entire refuge grassland area, helping prevent fast spreading and uncontrolled wildfire that could otherwise impact large areas of habitat. Therefore, the effects of the proposed action will be insignificant and, overall, will be beneficial to this species.

Ocelot and Jaguar

Ocelots and jaguars are transient species that are unlikely to occur within a given burn unit during the particular year when burning is planned within that burn unit on BANWR. Adjacent refuge units will not be burned during the same year in order to potentially preserve habitat for wildlife to move into if the area they are using becomes undesirable for some reason, and this also provides ample habitat for these mammals to escape harm during fire events. Prescribed fire on BANWR will typically be implemented using incremental black-lining techniques as part of a ground ignition strategy, rather than using aerial ignition. The relatively small number of acres that might be burned on the refuge during any given year will not negatively impact the overall amount of upland habitat on BANWR, and the burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the entire refuge grassland area, helping prevent fast spreading and uncontrolled wildfire. All of these conservation measures will provide ample opportunities for ocelots and jaguars to depart the area that is being burned by fleeing to other locations and escaping harm. The important edge effect and interspersion of differing habitat types produced by prescribed fire would be expected to benefit many of the prey species utilized by predators such as ocelots and jaguars.

Smoke produced by fire should have little or no effect on ocelots or jaguars. Smoke in any one area of the burn unit is of short duration, and the smoke produced by the unit as a whole tends to rise quickly and dissipate. Therefore, no adverse effects are expected due to smoke.

We concur that the proposed action is not likely to adversely affect the ocelot or jaguar for the following reasons:

- Ocelots and jaguars are unlikely to occur within a particular burn unit at the time it is planned for burning under the proposed action. Therefore, effects to these species are discountable.

- While short-term effects may occur to these species and their habitats, they will not be either widespread or long lasting. Therefore, effects are expected to be insignificant.
- Conservation measures will be implemented to reduce the overall effects to these species. Therefore, effects from the proposed action are anticipated to be insignificant.
- The burn units will be selected and rotated to yield a diverse landscape mosaic of different aged burns and habitats in various stages of succession over the entire refuge grassland area, helping prevent fast spreading and uncontrolled wildfire that could otherwise impact large areas of habitat. Therefore, the effects of the proposed action will be insignificant and, overall, will be beneficial to this species.