**Sherry Barrett**
11/25/2003 10:31 AM

To: Jim Rorabaugh/R2/FWS/DOI@FWS
cc: Scott Richardson/R2/FWS/DOI@FWS
Subject: Significance of the pygmy-owl

I'd appreciate your review of this too.

thx.

sb
----- Forwarded by Sherry Barrett/R2/FWS/DOI on 11/25/2003 10:31 AM -----

**Scott Richardson**
11/25/2003 10:25 AM

To: Steve Spangle/R2/FWS/DOI@FWS, Sherry Barrett/R2/FWS/DOI@FWS, Susan Jacobsen/RO/R2/FWS/DOI@FWS, Steve Chambers/RO/R2/FWS/DOI@FWS
cc:
Subject: Significance of the pygmy-owl

All,

Here is the latest and greatest. We look forward to discussing it at noon (Sorry for the short time frame). I am faxing a complete hard copy to Steve S. and Susan J. with all the figures (we don't have them all electronically). Please note that Marty is still working on numbers (go where xx is in text) and on Figure 2. We will work on making it all pretty after our phone call.

I have incorporated comments from Aaron Flesch and Glenn Proudfoot related to their data.

Have fun and thanks for your input on this.

Scott

CFPO DPS3.wpc

# WHITE PAPER: SIGNIFICANCE OF THE WESTERN POPULATION(S) OF THE CACTUS FERRUGINOUS PYGMY-OWL
(November 25, 2003)

## INTRODUCTION:

The Regional Office of the Fish and Wildlife Service (FWS) asked the Arizona Ecological Services Office to analyze the significance of cactus ferruginous pygmy-owl populations to the taxon as a whole. This comes in the wake of the 9th Circuit Court of Appeals ruling in which it found the FWS "arbitrary and capricious" in its determination to list the Arizona portion of the subspecies' range as an endangered distinct population segment (DPS) under the Endangered Species Act (ESA).

Both the District and Appellate courts deferred to the FWS' DPS policy. This policy requires that, to qualify as a DPS, a population must first be found to be "discrete". Once discreteness has been established, we must then determine that the population is "significant" to the taxon as a whole. If both of those findings are made, the FWS then analyzes the status and threats to the population, using the ESA's five listing factors, to determine whether the population meets the definition of "threatened" or "endangered" under the ESA.

The 9th Circuit Court of Appeals overturned the Arizona District Court's ruling that the FWS had adequately documented its finding that the Arizona population of the pygmy-owl was discrete, significant, and, based on the definition of "endangered" under the ESA, appropriately listed as an endangered DPS. The Appellate Court upheld the District Court's finding that the FWS had adequately documented the discreteness of the Arizona DPS, but did not concur that our finding of significance to the "taxon as a whole" was adequate and found, therefore, that it was arbitrary and capricious.

Although both the District and Appellate courts upheld our finding of discreteness, we present new discreteness analyses in this document. We do this because 1) the FWS must make a finding that a DPS is discrete before considering the significance issue; 2) substantial information on genetics, distribution, status and threats in Mexico, and other aspects of the pygmy-owl's conservation status have become available since the 1997 final rule; and 3) this new information brings to light the possibility that other DPSs (the western population, the Sonoran Desert biome, etc.) may be appropriate for consideration under the DPS policy (see below).

Conversely, we do not address the species' status under the five listing factors. However, we do discuss the status of the species, particularly threats and lack of conservation measures, as appropriate in our analysis of discreteness and significance.

DOCUMENT ORGANIZATION AND CONTENT

We first re-examine our 1997 determination on the discreteness and significance of the western portion of the subspecies' range. Although both courts upheld that determination, we feel it is important to incorporate the information learned since the 1997 finding so that decision makers have an updated analysis and so as to frame the subsequent analyses in this document.

We then step down to look at the discreteness and significance of the Sonoran Desert biome population. This subdivision of the western population segment includes those areas classified as Sonoran desert scrub and semidesert grasslands and has been identified as possibly meeting the DPS criteria due to its ecological uniqueness from the southern Sonoran and Sinaloan vegetation communities (Sinaloan thornscrub and deciduous forest) of the western range. The significance of this possible DPS is then assessed relative to the western population and, in turn, to the taxon as a whole.

Finally, we examine discreteness and significance of the Arizona population. Again, our original discreteness analysis was affirmed as adequate by both courts, but we feel it is important to update that analysis by incorporating recent information. For the significance analysis, we "step upward" by looking at its significance to the Sonoran Desert biome populatin, then to the western population segment, and finally to the taxon as a whole.

THE DPS POLICY

Discreteness: A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.

2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Significance: If a population segment is considered discrete under one or more of the above conditions, its biological and ecological significance will then be considered in light of Congressional guidance. In carrying out this examination, the FWS considers available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,

2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon,

3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or

4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

ANALYSIS

**Western Population**

Discreteness

1. Physical separation - As described in literature, the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*, hereafter, pygmy-owl) was divided into two geographically distinct populations (AOU 1957). The eastern population segment (Texas and the eastern Mexican states of Tamaulipas, Nuevo Leon, and Veracruz) is separated from the western population (Arizona and the western Mexican states of Sonora, Sinaloa, and Nayarit) by the altitudinal mountains and highlands of the Sierra Madre Occidental and Oriental and the Mexican Plateau, including the Chihuahuan desert (Proudfoot and Johnson 2000, Cartron et al. 2000a, AOU 1957). These features represent an elevational barrier that separates the two population segments by distances ranging from 550 miles (885 kilometers) to 1056 miles (1700 kilometers). Interchange between these two populations is highly unlikely based on distance and elevation (Figure 1. Distribution of the cactus ferruginous pygmy-owl in Mexico and the U.S.). Recent results from genetic analysis supported two distinct populations, the western population occurring in Arizona, Sonora, and Sinaloa and the eastern population occurring in Chiapas, Jalisco, Michoacan, Nayarit, Oaxaca, Tabasco, Tamaulipas, Texas, Veracruz, and Yucatan (Proudfoot and Slack 2001). In their discussion, Proudfoot and Slack suggested that "The separation of these two groups is probably the consequence of barriers to gene flow provided by the altitudinal Sierra Madre Occidental, because FEPO (pygmy-owl) rarely occur above 1,300 m (Proudfoot and Johnson, 2000)."

2. Ecological differences - Pygmy-owls in the eastern population segment (EPS) occupy live oak-mesquite forests, mesquite brush, ebony and riparian areas. In eastern Mexico, the pygmy-owl occurs in heavy riparian forest and in areas more tropical in nature, including cypress. In Veracruz, pygmy-owls are described as occurring "at almost any thicket or the edge of any jungle ..." (Proudfoot and Johnson 2000, Lowery and Dahlquist 1951).

While pygmy-owls of the western population segment (WPS) occur in riparian community types, the majority of their distribution is within areas classified as Sonoran desertscrub and semidesert grasslands. Xeroriparian areas are important within these community types. Pygmy-owls occupy Sinaloan thornscrub and Sinaloan deciduous forest further south, in southern Sonora, Sinaloa, and Nayarit (Flesch 2003, Proudfoot and Johnson 2000, Cartron et al. 2000b) (Figure 2. Vegetation communities of the WPS).

In summary, the EPS occupies more humid, forested vegetation communities. The WPS occurs in drier, more desert-like conditions and vegetation communities. While some unifying characteristics can be found in areas occupied by the two population segments, overall ecological conditions are different.

3. Morphological differences - Differences in coloration occur between the EPS and WPS. Pygmy-owls from the EPS tend to be more rufous in their coloration and are darker and more richly colored. WPS pygmy-owls tend to be paler and more gray (Proudfoot and Johnson 2000, Phillips et al. 1966, AOU 1957, van Rossem 1937, Ridgeway 1914).

Significance to taxon

1. Unique Ecological Setting - The WPS of the pygmy-owl occurs in an ecological setting that is unique when compared to the EPS. The WPS extends farther north in latitude. As a result, conditions within the WPS tend to be cooler and drier. Climate for the western area is classified as arid to very arid, with the exception of Sinaloa and Nayarit (subtropical in nature, but deciduous elements are more common than in the EPS), and the eastern is considered semi-arid to subtropical. Additionally, soil types differ between the areas occupied by the two population segments. Western areas are dominated by regosols and xerosols, while the eastern portion is primarily solonchak and vertisol soils. Soil type often contributes to the vegetation type that occurs on a site. As expected, vegetation communities differ between the two population segments. The eastern area is dominated by forest communities such as mesquite forest, riparian forest, thorn forest, and tropical deciduous forest. The majority of the western area is desertscrub and semidesert grassland. Only in the southern portion do thornscrub and deciduous forests dominate (http://mexico channel.net/maps, Cartron et al. 2000b, Proudfoot and Johnson 2000, Leopold 1950). While the northern portion of the WPS is ecologically quite distinct, the southern portion exhibits many similarities to the EPS' ecological setting.

2. Significant Gap in the Range of the Taxon - The EPS and WPS cover approximately equal areas. The loss of the WPS would represent the loss of approximately 50% of the taxon's population numbers and range (Figure 1). Given the genetic differences mentioned above and discussed below, the WPS should be considered a distinct entity. The discrete nature of the WPS, in conjunction with genetic and ecological differences would not allow pygmy-owls from the EPS to "rescue" the WPS should that population segment decline or disappear. Thus the loss of the WPS would result in a significant gap that could not be filled by the EPS.

Threats to the WP are increasing the likelihood that a significant gap will occur. In Mexico, millions of acres of Sonoran Desert and Thornscrub are being converted to buffelgrass (*Pennisetum ciliaris*) which represents a direct and an indirect loss of habitat because of invasion into adjacent areas and increased fire frequency and intensity (Burquez-Montijo et al. 2002). Low population numbers and habitat loss and fragmentation in Arizona already threatens that portion of the population (Abbate et al. 1996, 1999, 2000). Large portions of Coastal Plain have been converted to agricultural lands south and west of Hermosillo and in other areas of southern Sonora and northern Sinaloa. (Figure 3. Map of Mexico showing extent of buffelgrass occurrence) As a result, physical gaps in habitat connectivity , which already occur along a broad

ecotone between thornscrub and desertscrub vegetation communities in central Sonora, are being exacerbated and are projected to increase as agriculture and buffelgrass uses claim additional areas (Flesch 2003). (Figure 4 and Figure 5. Bimodal distribution of pygmy-owls in Sonora due to habitat loss from agricultural and buffelgrass conversion) Nested clade analysis of mitochondrial DNA sequences suggested populations in Sonora and Sinaloa were experiencing genetic fragmentation (i.e., reduced gene flow between Sonoran and Sinaloan populations) (Proudfoot pers. comm.). Based on his recent (2002) travels in Sonora and Sinaloa, Proudfoot hypothesized that this fragmentation may be due to loss of habitat connectivity due to agricultural conversion in southern Sonora and northern Sinaloa (Figure 6. Aerial photograph of Mexico showing significant areas of agriculture).

Buffelgrass occurs in areas purposely converted from native vegetation communities to buffelgrass plantations, and it is also invading into and becoming dominant in other areas of native vegetation. Its occurrence is changing the ecology of these areas by increasing the frequency and intensity of fire, which in turn is resulting in the conversion of native vegetation communities into savanna grasslands. The consequent elimination of trees, shrubs, and columnar cacti from these areas is a serious threat to the survival of the pygmy-owl, as these vegetation components are necessary for roosting, nesting, protection from predators, and thermal regulation.

In Sonora, the Mexican government has subsidized the clearing of native vegetation and seeding of buffelgrass since the 1960s (Van Devender and Dimmit 2000) under the classification "range improvement", to increase livestock stocking rates. Mexican governmental agencies have delineated an area for proposed buffelgrass conversions that covers most of the Plains of Sonora subdivision of the Sonoran Desert, portions of the Foothills of Sonora, and tropical deciduous forests (Johnson and Navarro 1992; Navarro 1988). Approximately one-third of Sonora is suitable for conversion into buffelgrass (Ibarra et al. 1995; Navarro 1988). Conversions occur as a result of state and federal subsidies, which are matched by cattle owners at between 30 and 60 percent of the cost (as free bulldozer services, fuel, salaries, seed, etc (Burquez-Montijo et al. 2002).

The area already deliberately converted to buffelgrass in Sonora has been estimated at up to 4 million acres (about 10 percent of the state's area) (Burquez et al. 2002), including approximately 2 million acres below 2,900 feet elevation (Yetman and Burquez 1994). Van Devender and Dimmit (2000) estimate that in central Sonora, more than 470,000 acres have been cleared to plant buffelgrass. This acreage is in addition to those areas that have also been cleared or converted for agriculture and urban development.

There is a common perception that the number of pygmy-owls recently located in Sonora (Flesch 2003) represent a large enough population to insure the persistence of the WPS. In fact, in certain areas just south of the international border, Flesch observed a decline in northern Sonora of nests and nest productivity from 2000 - 2003 (email communication to scott_richardson@fws.gov, November 21, 2003). Flesh also indicated that the conversion of native vegetation to buffelgrass and the associated direct and indirect effects on habitat were an observed and ongoing significant threat to pygmy-owls in Mexico (Flesch 2003). Additionally,

he noted that limited regeneration of large columnar cacti (the primary nesting substrate for pygmy-owls), likely associated with overgrazing, constituted another threat to pygmy-owls in northern Sonora. Surveys indicate that pygmy-owls are patchily distributed in Sonora, Mexico (Flesch 2003). Thus, impacts from habitat conversion (loss, fragmentation, isolation, etc.) can affect significant numbers of pygmy-owls even if the geographic area converted is not expansive. The large-scale, ongoing conversion of native vegetation communities in areas occupied by the WPS, as well as pygmy-owl abundance patterns across Sonora, creates a unique ecological setting that is creating a significant gap in the range of the taxon (See Appendix A for more information on threats related to buffelgrass conversion).

3. Genetic Differences - Proudfoot and Slack (2001) conducted mitochondrial DNA analysis of 95 ferruginous pygmy-owl samples: 14 from Arizona, 18 from Texas, and 63 from Mexico. Mitochondrial DNA analysis was selected because it is the technique best suited for determining geographic variation within the range of the ferruginous pygmy-owl (FEPO). Based on this analysis, the study concludes: "Phylogenetically, Arizona and Texas populations are unique, with no shared haplotypes. Populations from Sonora and Sinaloa, Mexico were distinct from remaining populations in Mexico and grouped closest to haplotypes in Arizona. Similarly, populations from Texas and Tamaulipas, Mexico, constitute a distinct group. FEPOs in Arizona differed by as much as 1.0% from FEPOs in Oaxaca, Mexico, and by as much as 0.7% from FEPOs in Texas (Proudfoot and Slack 2001)." This study indicates that pygmy-owls in Texas and eastern Mexico are genetically similar and pygmy-owls in Arizona and western Mexico are genetically similar. However, the two groups are distinctly different from each other with regard to the mitochondrial DNA analysis. In fact, the difference between the two groups suggest that subspecies separation may be warranted. Such a conclusion indicates the two population segments differ markedly with regard to genetic characteristics, and in fact, may represent separate subspecies of the ferruginous pygmy-owl. The differentiation of the population segments into separate subspecies would increase the significance of the WPS for the cactus ferruginous pygmy-owl as the WPS would then become the range of the taxon.

**Sonoran Desert Biome Population**

As we evaluated the western population segment and the new information available on distribution, habitat, and genetics of pygmy-owls in Mexico, we observed a logical division within the WPS. In our analysis of potential DPS boundaries for the pygmy-owl, this division presented a logical DPS boundary based on ecological conditions, pygmy-owl distribution, and genetics. The boundaries of the Sonoran Desert Biome population segment (SDBPS) include all areas below 4,000 feet elevation that fall within the Sonoran Desert and Semidesert Grassland biotic communities in Arizona and Sonora, Mexico (Figure 2). Within these communities, riparian and xeroriparian areas are also included.

Discreteness

1. Physical barrier - An extensive presence/absence survey for pygmy-owls was conducted throughout Sonora during 2000 and 2001 by Flesch (2003). Results of this survey showed a bimodal distribution pattern across latitude with relatively high pygmy-owl abundance in

northern and southern Sonora and low abundance in central Sonora. Detections of pygmy-owls were limited or absent in central Sonora in the vicinity of Hermosillo (Figure 4. Map of distribution within Mexico, Figure 5. Bimodal distribution figure). Flesch (2003) indicated that low pygmy-owl abundance in central Sonora was due to a lack of suitable habitat. This lack of pygmy-owl habitat was attributed to low abundance of columnar cacti (and the nesting cavities they provide) along the ecotone between desertscrub and thornscrub vegetation communities, as well as the conversion of the native vegetation to agricultural crops and buffelgrass pastures for livestock grazing (Flesch 2003). Vegetation loss and fragmentation also occurs during urban development. Hermosillo has a population of 0.5 million (www.ourplanet.com/aaas/pages/case06.html) and continues to grow and contribute to the vegetation alteration in central Sonora.

These vegetation conversions eliminate the vegetation structure needed for pygmy-owl occupancy and movement. Adequate vegetation cover, particularly tree cover, and nesting substrates (large trees and columnar cacti) are needed to support pygmy-owl nesting and dispersal (Proudfoot and Johnson 2000, Wilcox et al. 2000). Some areas converted to buffelgrass that still harbor trees and large columnar cacti may temporarily support pygmy-owls, but are unlikely to persist due to the increased frequency and intensity of fire (Burquez-Montijo et al. 2002). As a result, the resources needed for pygmy-owls to move through and occupy this area are limited or absent. The results of surveys conducted by Flesch (2003) show this barrier affects pygmy-owl distribution in Sonora (see Appendix A for more information regarding the effects of buffelgrass conversion). Pygmy-owls may use areas of native vegetation in the foothills and mountains to the east of the coastal plain communities where agriculture and buffelgrass conversion is occurring. However, dispersal through these areas is likely limited due to their high elevation, distance from a large source population of potential emigrants, and competitive exclusion by other species (Colima and northern pygmy-owls) (Flesch 2003).

In summary, the SDBPS is physically separated from the southern portion of the WPS by the lack of pygmy-owl habitat in central Sonora that is being exacerbated by agricultural conversion, urban development, and the conversion of native vegetation to buffelgrass for livestock grazing. The SDBPS is physically separated both geographically and elevationally from the EPS by the altitudinal mountains and highlands of the Sierra Madre Occidental and Oriental and the Mexican Plateau, including the Chihuahuan desert, as described above.

2. Ecological Differences - Within the WPS, the SDBPS occurs in a unique ecological setting. Pygmy-owls within the SDBPS are all found within Sonoran Desertscrub or Semidesert Grassland biotic communities and associated riparian and xeroriparian communities. All owls outside the SDBPS occur within the more tropical Sinaloan thornscrub and Sinaloan deciduous forest community types and associated riparian types (Brown 1994, Phillips and Comus 2000)(Figure 2). These vegetation communities differ significantly in species composition, vegetation structure, temperature, humidity, precipitation, and soils (http://mexico channel.net/maps (soils, vegetation, temperature, and climate maps).

Significance

1. Significance to Western Population - The SDBPS occurs in a unique ecological setting when compared to the remainder of the WPS. The SDBPS occurs at the northern end of the WPS distribution and is subject to unique climatic conditions. The SDBPS occupies an area that is cooler and drier than the southern portion of the WPS. Vegetation communities within the SDBPS are desert-like, consisting of Sonoran desertscrub and semidesert grasslands. In contrast, the southern portion of the WPS is characterized by warmer, wetter conditions classified as tropical or subtropical, represented by Sinaloan thornscrub and deciduous forests (Brown 1994, Phillips and Comus 2000, http://mexico channel.net/maps (soils, vegetation, temperature, and climate maps) (Figure 2).

Within the SDBPS, large-scale conversion of native vegetation communities to buffelgrass represents immediate and long-term effects to the ecological setting of this population segment. The climatic conditions of the SDBPS make it the primary target for conversion to buffelgrass (elevation and precipitation). The SDBPS has and is experiencing the largest extent of buffelgrass conversion within the WPS (Figure 2). Sonora also supports some of the largest mining operations in Mexico (Burquez and Martinez-Yrizar 1997). This creates a unique ecological setting of diminishing and changing native vegetation communities on a scale not seen throughout the remainder of the WPS or within the EPS (see Appendix A for more information on buffelgrass conversion). Genetic diversity is the key to population persistence in the face of a changing environment. The SDBPS contains a point of documented genetic divergence subject to ongoing environmental changes (Proudfoot 2003).

The loss of the SDBPS represents a significant gap in range of the WPS. The SDBPS represents approximately 50% of the WPS. Given the evidence presented by Proudfoot and Slack (2001), showing that the WPS is a potentially distinct subspecies, the loss of the SDBPS would represent approximately 50% of the range of the taxon. Regardless of the scale of analysis, the loss of the SDB would result in a significant gap in the range of the WPS and the taxon as a whole. Given the unique ecological setting within which the SDB occurs, the significance of this gap is solidified.

2. Significance to the Taxon as a Whole - As the range of the taxon is currently defined, the SDBPS represents approximately 25% of the range of the taxon. Genetic evidence is presented (Proudfoot and Slack 2001) suggesting that the WPS is a distinct subspecies of pygmy-owl. The significance of the SDBPS to the taxon is stepped up by an entire level when this is considered. Under this scenario, the SDBPS represents approximately 50% of the range of the taxon. The SDBPS occurs in an ecological setting that is unique with regard to both the WPS and the EPS. The ecological setting of the SDBPS is created by unique climate, soils, vegetation and land-use conditions. The loss of the SDBPS segment would result in a significant gap in the range of the species and the loss of a population segment that occurs in a unique ecological setting.

**Arizona Population**

Discreteness

1. International Boundary - The court found that the FWS' determination that pygmy-owls were "extremely limited in distribution" in Arizona, but existed in greater numbers in northwestern Mexico (Listing Rule, 62 Fed. Reg. At 10,740), was an adequate exercise of agency expertise. Thus, the court held that the FWS' use of the international border, in light of differences in conservation status, to satisfy the discreteness element of the DPS Policy was not arbitrary (9th Circuit Opinion - CV 00-0903 SRB).

Significance

1. Significance to the SDBPS - Land-use patterns in Arizona differ from those occurring within the remainder of the SDBPS in Mexico. Agriculture and livestock grazing are the primary land uses within the SDBPS in Mexico, where large areas of native vegetation have been converted for these purposes and where it is likely to continue (Burquez and Martinez-Yrizar 1997, http://aria.arizona.edu/courses/arl642/cochise98/sonora/history_long.html). Within Arizona, urban development is the land use with the most significant impact on ecological conditions. Arizona is not experiencing large-scale, purposeful conversion of native habitats for agriculture or buffelgrass, although buffelgrass has invaded some areas. In Arizona, many of the areas suitable for buffelgrass are managed as FWS wildlife refuges, national monuments and parks, or occur on the Tohono O'odham Nation, where such conversion is unlikely to occur. Efforts are underway in some of these areas to restore areas where exotic plant invasions have occurred. Thus, ecosystem conditions are less likely to be altered in Arizona, at least with regard to the ecological impacts of vegetation community conversion for livestock and agriculture. However, urban expansion is occurring within the range of the taxon in Arizona. Urban growth and development have local, long-term impacts as a result of the loss and fragmentation of habitat. Indirect effects include changes in hydrology impacting vegetation communities, increased recreational use, predation by domestic pets, increased presence of pesticides in the environment, increased potential for fire, and mortality due to increased roads and traffic.

Conservation efforts targeting the pygmy-owl are not occurring in Mexico. The pygmy-owl does not receive any special status or protection in Mexico. In fact, several areas set aside as natural reserves have recently been opened to resource extraction (Burquez and Martinez-Yrizar 1997). In Arizona, pygmy-owl research efforts are ongoing with the objective of improved management and protection. Large- and small-scale conservation planning efforts are underway which include measures specific to the pygmy-owl. As a result of different land use patterns and the presence of conservation activities, both of which are issues affecting current and projected environmental conditions, the Arizona population of pygmy-owls occurs in an unusual ecological setting.

The range of the Arizona population represents approximately xx% of the total range of the SDBPS. Loss of the Arizona population would represent a significant gap in the SDBPS, particularly given the current and ongoing threats of large-scale vegetation conversion occurring outside of Arizona within the SDBPS in Mexico. Survey work in Arizona and Mexico (Abbate

et al. 2000, Flesch 2003) indicates there are considerably more pygmy-owls in the SDBPS outside of Arizona. However, significant threats have been identified outside of Arizona and some evidence of population and productivity declines have been observed in the SDBPS in Mexico (Aaron Flesch e-mail communication to scott_richardson@fws.gov, November 21, 2003). The significance of the Arizona population to the SDBPS is increased in light of threats and lack of population conservation measures outside of Arizona.

Proudfoot and Slack (2001) indicated that the low haplotypic diversity and distinct clade occurring in northwest Tucson may suggest separation between populations in northwest Tucson and populations in the Altar Valley, Sonora and Sinaloa. The separation of the northwest Tucson population would increase the potential for the population to diverge from populations in Altar Valley, Sonora, and Sinaloa. Although there is not a marked genetic difference, as a peripheral population experiencing genetic separation, the Arizona population becomes significant with regard to maintaining genetic diversity within the SDBPS. As discussed earlier, this genetic divergence is more significant in the face of ongoing environmental changes.

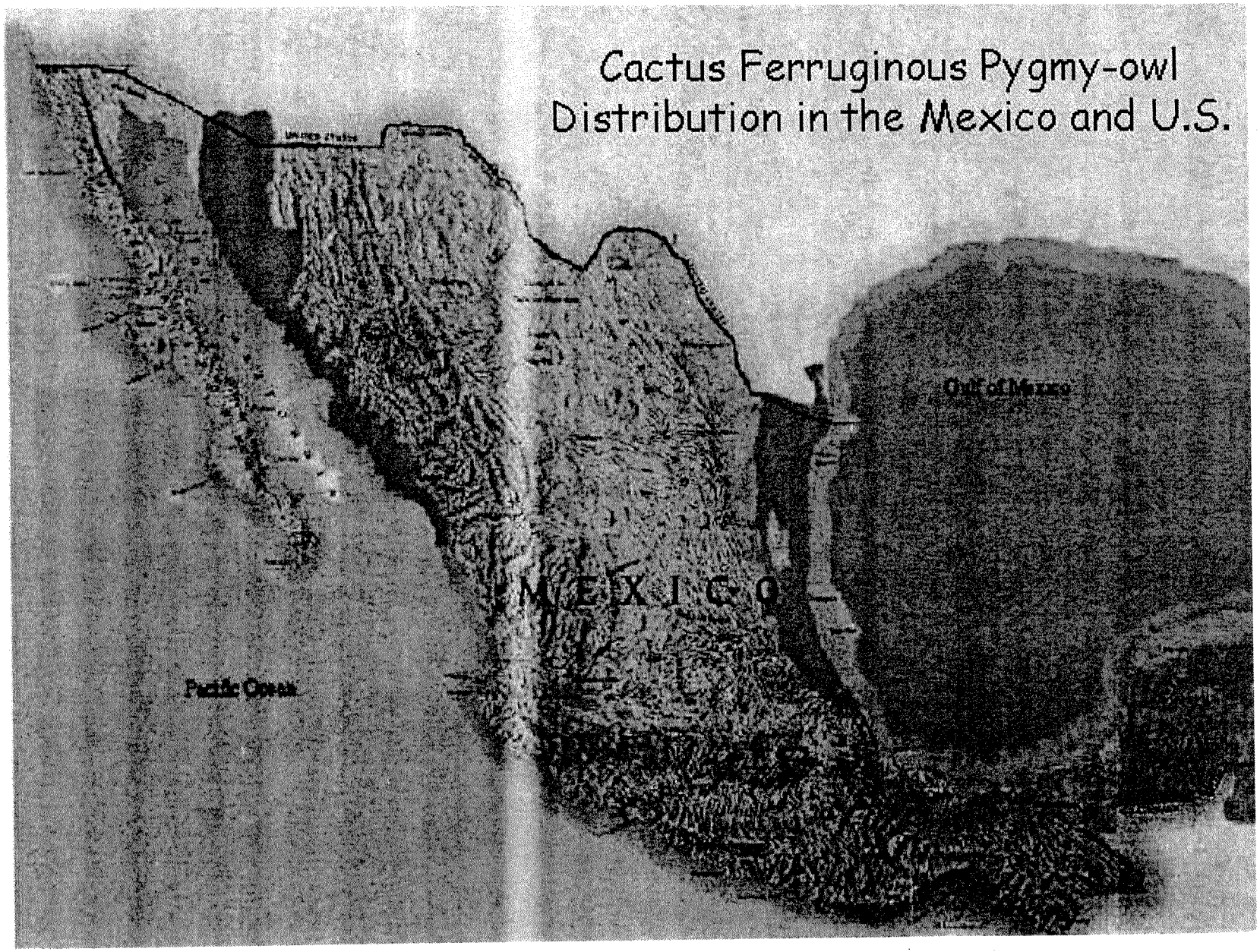
2. Significance to the WPS - The Arizona population occurs in an ecological setting that is unusual to the WPS (desert vegetation community, land use patterns affecting the ecological setting). Loss of this population would create a significant gap in the range of the taxon (Arizona represents xx% of the range of the WPS), and within the gene pool, because, although not marked differences, genetic differences have been observed in the Arizona population.

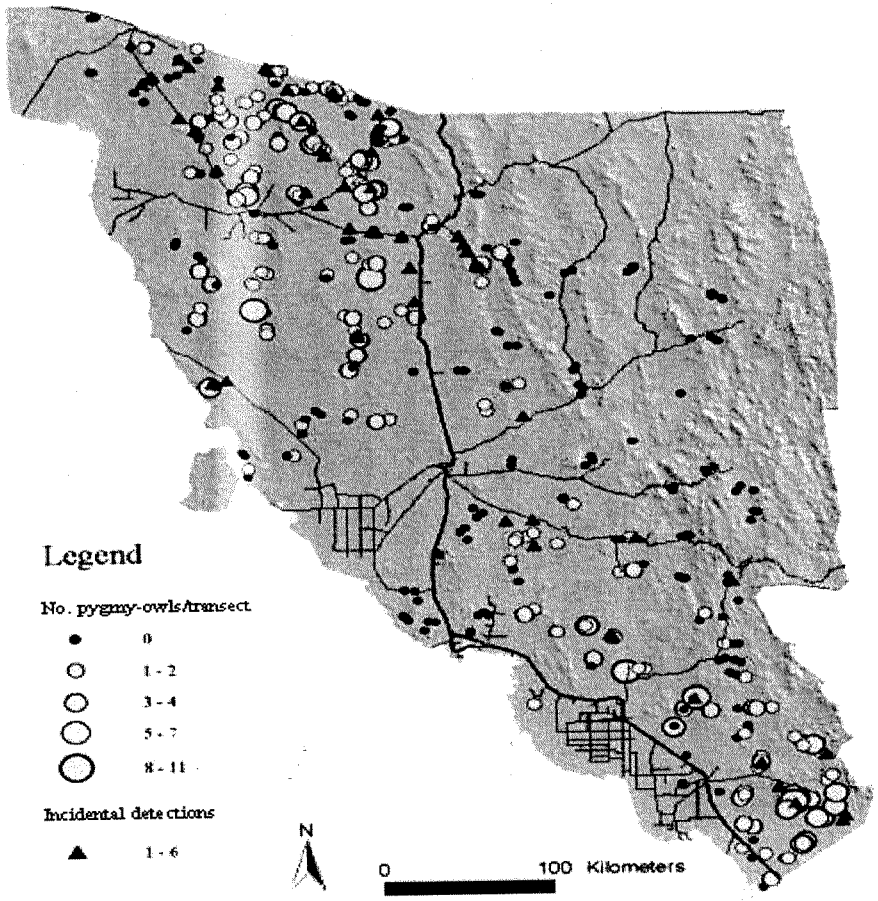
3. Significance to the Taxon - Loss of the Arizona population would create a gap in the range of the taxon which was upheld by the 9th Circuit ("We defer to the FWS' interpretation of a "gap at the end of the fence" because it is not plainly erroneous. Even the loss of a peripheral population, however small, would create an empty geographic in the range of the taxon."(9th Circuit Opinion - CV 00-0903 SRB). This gap is significant to the taxon because the loss of the Arizona population would reduce the genetic variability of the taxon. Genetic divergence tends to occur at the periphery of a species' range (Lesica and Allendorf 1995). This genetic divergence allows adaptation of the species as a whole in the face of environmental change. Loss of genetic diversity translates into a loss of fitness for the species. In addition, Proudfoot and Slack's (2001) genetic research indicates enough genetic difference in the WPS that it could be considered a distinct subspecies. Given the genetic fragmentation within the WPS, the Arizona population represents an even more significant source of genetic diversity when the range of the taxon is represented by the WPS.

The gap created by the loss of the Arizona population is also significant in that it represents the loss of approximately xx% of the current range of the species within the Sonoran Desert biome. This represents a significant void in the species range occurring in this biotic community. Given the documented increase of desertscrub conversion to buffelgrass, as well as other threats in Mexico, the Arizona population will likely increase in significance, representing a growing percentage of the taxon occurring in this community type. Genetic difference in the WPS potentially defining it as a distinct subspecies (Proudfoot and Slack 2001) increases the level of significance of the Arizona population considerably.

The historical range of the pygmy-owl in Arizona extended north of Phoenix to the New River area. Monson (1998) depicts the historical range of the pygmy-owl in Arizona which matches to a large extent the current distribution of potential habitat for the pygmy-owl (Sonoran desert scrub, semidesert grasslands, and riparian communities). Based on this, the loss of the Arizona population would represent the loss of approximately xx% of the historical range of the WPS.

Proudfoot and Slack (2001) present the most current and extensive work on the genetics of the pygmy-owl. They found that there were distinct differences between the Arizona and Texas populations of the pygmy-owl. Their work also showed genetic differences between the eastern and western Mexico populations. The bimodal distribution of pygmy-owls in Sonora documented by Flesch (2003) indicates a physical barrier which may result in further genetic isolation of the WPS. Genetic differences are evident within the taxon. The Arizona population contains one of these points of genetic divergence. The loss of the Arizona population would represent the loss of genetic variability from the taxon as a whole. The loss of genetic variability reduces a species ability to adapt to changing environmental conditions and increases the likelihood of extinction.


Cactus Ferruginous Pygmy-owl
Distribution in the Mexico and U.S.
Gulf of Mexico
M E X I C O
Pacific Ocean




Distribution and abundance (no. detected/transect) of ferruginous pygmy-owls in Sonora, Mexico 2000-01. Number of pygmy-owls detected on transects indicated by size of circles (from Flesch 2003).