FEDERAL REGISTER

Vol. 76 Wednesday,
No. 193 October 5, 2011

Part IV

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Cactus Ferruginous Pygmy-Owl as Threatened or Endangered With Critical Habitat; Proposed Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[FWS–R2–ES–2011–0086; MO 92210–0–0008]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Cactus Ferruginous Pygmy-Owl as Threatened or Endangered With Critical Habitat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) as threatened or endangered and to designate critical habitat under the Endangered Species Act of 1973, as amended (Act). Additionally, the petition requested that we recognize and list a western subspecies of the cactus ferruginous pygmy-owl (*Glaucidium ridgwayi cactorum*), or, alternatively, two potential distinct population segment (DPS) configurations. After review of all available scientific and commercial information, we find that *Glaucidium ridgwayi cactorum* is not a valid taxon, and, therefore, not a listable entity under the Act. Additionally, using the currently accepted taxonomic classification of the pygmy-owl (*Glaucidium brasilianum cactorum*), we find that listing the pygmy-owl is not warranted at this time throughout all or a significant portion of its range, including the petitioned and other potential DPS configurations. However, we ask the public to submit to us at any time any new information concerning the taxonomy or status of the pygmy-owl, as well as any new information on the threats to the pygmy-owl or its habitat.

DATES: The finding announced in this document was made on October 5, 2011.

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number FWS–R2–ES–2011–0086. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Arizona Ecological Services Office, 2321 West Royal Palm Road, Suite 103, Phoenix, AZ 85021–4951. Please submit any new information, materials, comments, or questions regarding this finding to the above address.

FOR FURTHER INFORMATION CONTACT: Steve Spangle, Field Supervisor, Arizona Ecological Services Office (see **ADDRESSES**); telephone 602–242–0210; or by facsimile 602–242–2513. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(B) of the Endangered Species Act (Act) (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Endangered and Threatened Wildlife and Plants that contains substantial scientific and commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we determine whether the petitioned action is: (1) Not warranted, (2) warranted, or (3) warranted, but immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are threatened or endangered, and expeditious progress is being made to add or remove qualified species from the Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted annually on the date of such finding. Therefore, a new finding is to be made within 12 months and subsequently thereafter until we take action on a proposal to list or withdraw our original finding. We must publish these 12-month findings in the **Federal Register.**

Previous Federal Actions

On March 20, 2007, we received a petition dated March 15, 2007, from the Center for Biological Diversity and Defenders of Wildlife (petitioners) requesting that we list the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) (pygmy-owl) as a threatened or endangered species under the Endangered Species Act (Act) (CBD and DOW 2007). Additionally, the petition requested the designation of critical habitat concurrent with listing. The petition clearly identified itself as a petition and included the identification information, as required in 50 CFR 424.14(a). We acknowledged the receipt of the petition in a letter to the petitioners dated June 25, 2007, stating that we were proceeding with a review of the petition.

The petitioners described three potentially listable entities of the pygmy-owl: (1) An Arizona distinct population segment (DPS) of the pygmy-owl; (2) a Sonoran Desert DPS of the pygmy-owl; and (3) the western subspecies of the pygmy-owl, which they identified as *Glaucidium ridgwayi cactorum.* As an immediate action, the petitioners requested that we promulgate an emergency listing rule for the pygmy-owl. In our June 25, 2007, response letter to the petitioners, we described our evaluation of the need for emergency listing and stated our determination that emergency listing was not warranted for the pygmy-owl. We also stated that the designation of critical habitat would be considered if listing of the pygmy-owl was found to be warranted.

In the **Federal Register** of June 2, 2008 (73 FR 31418), we published a 90-day finding in which we determined that the petition presented substantial scientific and commercial information to indicate that listing the pygmy-owl may be warranted. A more thorough summary of previous Federal actions related to the pygmy-owl can be found in the June 2, 2008 90-day finding (73 FR 31418).

Following the publication of our 90-day finding on this petition, we initiated a status review to determine if listing of the pygmy-owl was warranted. During our status review, we solicited and received information from the general public and other interested parties on the status of the pygmy-owl. We consulted with experts, agencies, countries, and tribes to gather pertinent information, and ensure that experts and affected parties were aware of the status review and of the opportunity to provide input. We identified, contacted, and consulted with a diverse group of experts and interested persons in an effort to ensure that we gathered and evaluated the best available scientific and commercial information on this subspecies to inform our 12-month finding.

On December 12, 2009, we received a 60-day Notice of Intent to Sue from the petitioners for failure to produce a timely 12-month finding on their petition. They subsequently filed suit on February 17, 2010, in the U.S. District Court for the District of Arizona. That complaint was subsequently consolidated in the U.S. District Court for the District of Columbia along with another case filed by the Center for Biological Diversity and thirteen cases filed by Wild Earth Guardians, all related to petition finding deadlines. The court in the consolidated case approved two settlement agreements between the parties on September 9, 2011. *In re Endangered Species Act Deadline Litigation,* Misc. Action No. 10–377 (EGS), MDL Docket No. 2165 (D.D.C. Sept. 9, 2011) (Docs. 55 & 56). The settlement agreements stipulate that the Service will submit to the Federal Register a proposed listing rule or a not warranted finding for the cactus ferruginous pygmy-owl no later than the end of Fiscal Year 2011, which is September 30, 2011.

This notice constitutes a 12-month finding for the petition to list the pygmy-owl as threatened or endangered. We base our finding on a review of the best scientific and commercial information available, including all substantive information received during our status review.

In this finding, we first provide background information on the biology of the pygmy-owl. Included in this background is our analysis of the petitioner's request that we recognize a western subspecies of the pygmy-owl (*Glaucidum ridgwayi cactorum*), which represents a proposed change in the taxonomic classification of the pygmy-owl. Then, we consider each of the five factors listed in section 4(a)(1) of the Act. For each factor, we first determine whether any negative impacts appear to be affecting the pygmy-owl anywhere in the subspecies' range, and whether any of these impacts rise to the level of threats such that the pygmy-owl is endangered or threatened throughout its range, according to the statutory standard.

After the rangewide assessment, we evaluate the validity of the petitioned distinct population segments (DPSs), as well as other potential DPS configurations suggested by information submitted during the status review or by the ecology, occurrence, and distribution of the pygmy-owl. This analysis determines whether any of the DPS configurations meet the criteria for discreteness and significance under our DPS policy (see Distinct Vertebrate Population Segment section below). We then evaluate whether there is a significant portion of the pygmy-owl's range that warrants further evaluation, consistent with the Act's definitions for ''endangered species'' and ''threatened species,'' which requires analysis of whether a ''species'' is endangered or threatened within ''a significant portion of its range'' (see Significant Portion of the Range section below). Finally, we make our finding with regard to the petitioned action and our evaluation as described above.

Species Information

Description

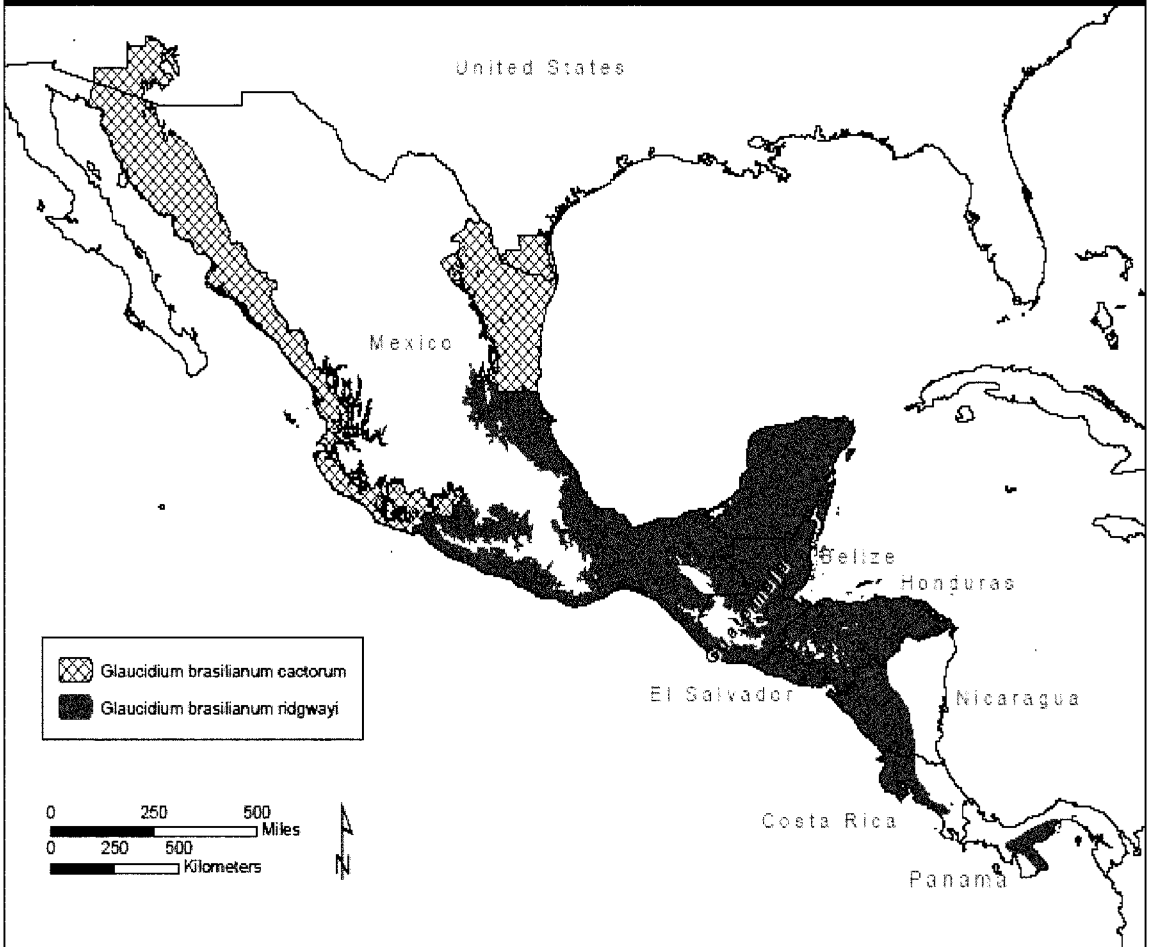
The pygmy-owl is in the order Strigiformes and the family Strigidae. It is a small bird, approximately 17 centimeters (cm) (6.75 inches (in)) long. Generally, male pygmy-owls average 58 grams (g) to 66 g (2.0 to 2.3 ounces (oz)) and females average 70 g to 75 g (2.4 to 2.6 oz) (AGFD 2008b, p. 3; Proudfoot and Johnson 2000, p. 16; Johnsgard 1988, p. 159). The pygmy-owl is reddish brown overall, with a cream-colored belly streaked with reddish brown. Color may vary, with some individuals being more grayish brown (Proudfoot and Johnson 2000, pp. 15–16). The crown is lightly streaked, and a pair of dark brown or black spots outlined in white occurs on the nape, suggesting ''eyes,'' leading to the name ''Cuatro Ojos'' (four eyes), as it is sometimes called in Mexico (Oberholser 1974, p. 451). The species lacks ear tufts, and the eyes are yellow. The tail is relatively long for an owl and is reddish brown in color, with darker brown bars. Pygmy-owls have large feet and talons relative to their body size.

Taxonomy

The petitioners requested that we recognize a change in the taxonomic classification of the pygmy-owl (CBD and DOW 2007, pp. 1–2). In considering taxonomic data, the Service relies ''on standard taxonomic distinctions and the biological expertise of the Department and the scientific community concerning the relevant taxonomic group'' (50 CFR 424.11(a)) and on ''the best available scientific and commercial information'' (50 CFR 424.11(b)). The use of specific taxonomic data is at the discretion of the Service, as long as the information is reliable and meets the above standards. With regard to the pygmy-owl, existing avian checklists attempt to present the most current taxonomic classifications, but discrepancies among checklists demonstrate that there is scientific debate and disagreement over some accepted taxonomic designations. Taxonomic changes within these checklists generally occur as a result of a proposal to change the existing taxonomy. Lack of reference to a proposed taxonomic change within these checklists cannot be interpreted as rejection (or acceptance) of a proposed change. It may simply mean a proposal has not been submitted or evaluated. Absolute reliance on one or more of these avian checklists, absent consideration of recent studies, would be arbitrary on the part of the Service. The Service has the responsibility for deciding what taxonomic entities are to be protected under the Act, based on the best available scientific information. We address any conflicting information or conflicting expert opinion by carefully evaluating the underlying scientific information and weighing its reliability and adequacy according to the considerations of the Act and our associated policies and procedures.

When we previously listed the pygmy-owl as endangered in 1997 (62 FR 10730; March 10, 1997), and in all subsequent regulatory and legal actions, we followed the currently accepted taxonomic classification, *Glaucidium brasilianum cactorum.* We considered *G. b. cactorum* to occur from lowland central Arizona south through western Mexico to the Mexican states of Colima and Michoacán, and from southern Texas south through the Mexican states of Tamaulipas and Nuevo Leon, consistent with most of the contemporary literature (Johnsgard 1988, p. 159; Millsap and Johnson 1988, p. 137; Oberholser 1974, p. 452; Friedmann *et al.* 1950, p. 145), and the last American Ornithologist Union (AOU) list that addressed avian classification to the subspecies level (AOU 1957) (Figure 1). The AOU checklist is generally accepted as the primary authority for avian taxonomic classification, and the 1957 AOU checklist description is the currently accepted taxonomic classification of the pygmy-owl at the subspecies level.

Figure 1. Range of currently accepted cactus ferruginous pygmy-owl taxonomy including *Glaucidium brasilianum cactorum* and *G. b. ridgwayi*. Ranges are approximate and for illustrative purposes only.



The petitioners requested a revised taxonomic consideration for the pygmy-owl based on Proudfoot *et al.* (2006a, p. 9; 2006b, p. 946) and König *et al.* (1999, pp. 160, 370–373), classifying the northern portion of *Glaucidium brasilianum's* range as an entirely separate species, *G. ridgwayi,* and recognizing two subspecies of *G. ridgwayi*—*G. r. cactorum* in western Mexico and Arizona and *G. r. ridgwayi* in eastern Mexico and Texas (Figure 1). Other recent studies proposing or supporting the change to *G. ridgwayi* for the northern portion of *G. brasilianum's* range have been published in the past 15 years (Heidrich *et al.* 1995, p. 2, 25; Navarro-Siguenza and Peterson 2004, p. 5).

Groups classified within species, such as subspecies, are important in the discussion of biodiversity because they represent the evolutionary potential within a species. Recognizing this, a number of existing lists of threatened, endangered, or special status species include subspecific groups (Haig *et al.* 2006, p. 1585). We considered the information in these existing lists and other literature as we evaluated the petitioned taxonomic classification. The 1957 AOU checklist is the last AOU checklist that described subspecies. Subsequent AOU checklists have limited their descriptions to the species level only and are, therefore, not helpful in our evaluation.

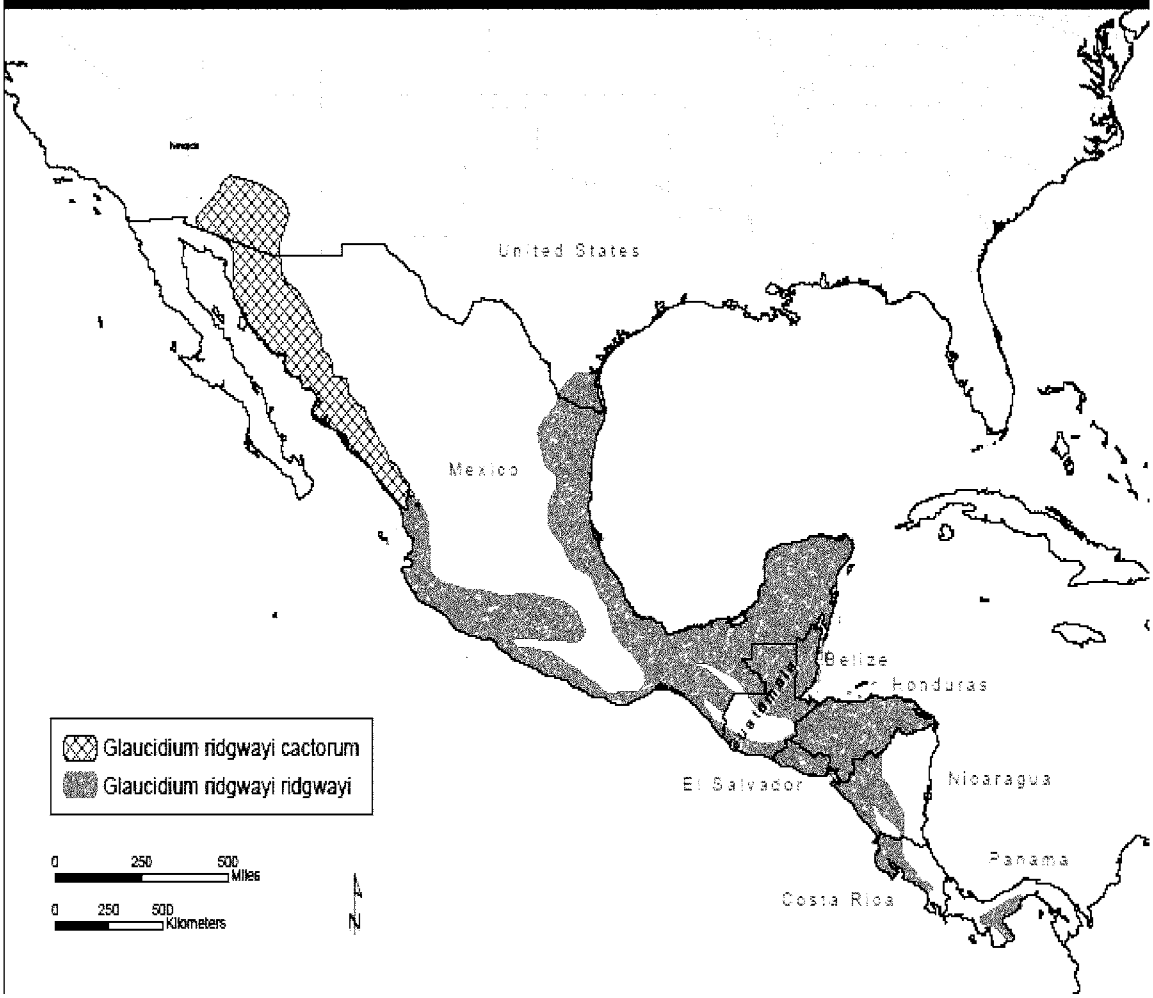
In our 90-day finding for this petition (73 FR 31418), we indicated that the petition presented reliable and substantive information that a taxonomic revision may be warranted. The suggested taxonomic change is based on recently published recommendations (Proudfoot *et al.* 2006a, p. 9; 2006b, p. 946; König *et al.* 1999, pp. 160, 370–373) to revise pygmy-owl taxonomy. Various other publications also provide evidence that the taxonomic status of the pygmy-owl has not been resolved (Proudfoot and Johnson 2000, pp. 4–5; König *et al.* 1999, p. 373; Phillips 1966, p. 93; Buchanan 1964, p. 107). Information received during our status review also indicates that pygmy-owl taxonomy needs additional work to resolve current questions (Johnson and Carothers 2008b, pp. 5–6; Robbins 2008, p. 1; Voelker 2008, p. 1).

Taxonomic nomenclature for the pygmy-owl has changed over time. Originally called *Glaucidium ferrugineum* in 1872 by Coues (Coues 1872, p. 370), the pygmy-owl has also been known as *G. ferrugineus* (Aiken 1937, p. 29) and *G. phalo(a)enoides* (Fisher 1893, p. 199; Gilman 1909, p. 115, Swarth 1914, p. 31; Kimball 1921, p. 57). Since the 1920's, the pygmy-owl has been classified as *G. brasilianum* (van Rossem 1937, p. 27; Bent 1938, p. 435; Peters 1940, p. 130; Brandt 1951, p. 653; Sutton 1951, p. 168). We will focus our discussion at the subspecies level since the petitioned entity is at the subspecies level of classification. As such, we will not evaluate or discuss whether the appropriate species classification is *G. brasilianum* or *G. ridgwayi.*

The petitioners asked the Service to recognize a subspecies, *Glaucidium ridgwayi cactorum,* described by

Proudfoot *et al.* (2006a, pp. 9–10; 2006b, p. 2, 9) as the listable entity in the petition. The primary difference between the petitioned subspecies and the currently accepted description of *G. brasilianum cactorum* is the latter's more extensive distribution to the south and east (Figure 1). The range of the *G. b. cactorum* subspecies we originally listed in 1997 is Arizona, northwestern Mexico, the Lower Rio Grande Valley of Texas, and northeastern Mexico, for a general distribution that runs from central Mexico northward on both sides of the Sierra Madre mountains into Arizona and Texas. The range of the proposed *G. r. cactorum* does not extend as far south as *G. b. cactorum.* The two *G. ridgwayi* subspecies proposed by the petition encompass the northwestern (*G. r. cactorum*) and northeastern (*G. r. ridgwayi*) extensions of the range of *G. b. cactorum.* Specifically, the petition describes the range of the suggested subspecies, *G. r. cactorum,* as extending from Arizona on the north through the States of Sonora and Sinaloa in Mexico (Figure 2).

Figure 2. Petitioned range of *Glaucidium ridgwayi cactorum* and *G. r. ridgwayi*. Ranges are approximate and for illustrative purposes only.



Our analysis of whether to accept the petitioners' proposed *Glaucidium ridgwayi cactorum* subspecies as a listable entity includes an evaluation of whether there are historical or current descriptions or studies of the proposed subspecies that would support the description of the petitioned subspecies based on Proudfoot *et al.* (2006a, 2006b). A number of subspecies of *G. brasilianum* have been described or suggested (Proudfoot and Johnson 2000, p. 4; Friedmann *et al.* 1950, pp. 145–147), including various descriptions of a *cactorum* subspecies, the distribution of some of which generally match the petitioned subspecies. Therefore, the delineation of a *cactorum* subspecies as petitioned is not a new classification, but one that has been described previously in the literature under *G. brasilianum.*

With regard to existing literature, van Rossem (1937, pp. 27–28) described the earliest *cactorum* subspecies that approximates the distribution of the petitioned subspecies. This was a newly described subspecies of ferruginous pygmy-owl and was described from a ''giant cactus grove between Empalme and Guaymas * * * Sonora, Mexico'' (van Rossem 1937, p. 27). Van Rossem restricted this new subspecies to northwestern Mexico and Arizona (Figure 3). Van Rossem also included a more southern and eastern subspecies, *ridgwayi,* that was described as occurring in southern Mexico and central America, but also Texas (van Rossem, 1937, pp. 27–28). He specifically excluded the Texas population from *cactorum,* about which he wrote ''they approximate very closely the measurements and tail characters of *cactorum* * * * in color they are best referred to *ridgwayi''* (van Rossem 1937, pp. 27–28; italics added). The 1944 AOU checklist accepted this classification and described its distribution as southern Arizona to Nayarit, in western Mexico (AOU 1944, p. 50) (Fig. 3). However, in a later publication van Rossem (1945, p. 111) indicated that *cactorum* extended only to the Sonora and Sinaloa border in Mexico (Figure 3), perhaps excluding Nayarit, because his 1937 publication indicates that the specimen from Nayarit was not typical (van Rossem 1937, p. 28). Karalus and Eckert (1971, p. 223) give a southern distribution for *cactorum* of western and northwestern Sonora (Figure 3). Proudfoot *et al.* (2006a, p. 9; 2006b, p. 7) indicate the state of Sinaloa is the southern extent of the range, while König *et al.* (1999, p. 373) extend the distribution of *cactorum* into Nayarit and Jalisco in western Mexico (Figure 3). Freethy (1992, p. 121) simply states that western Mexico is the southern limit of *cactorum.* Clements (2007, p. 171) recognizes the *cactorum* subspecies, but gives no distribution.

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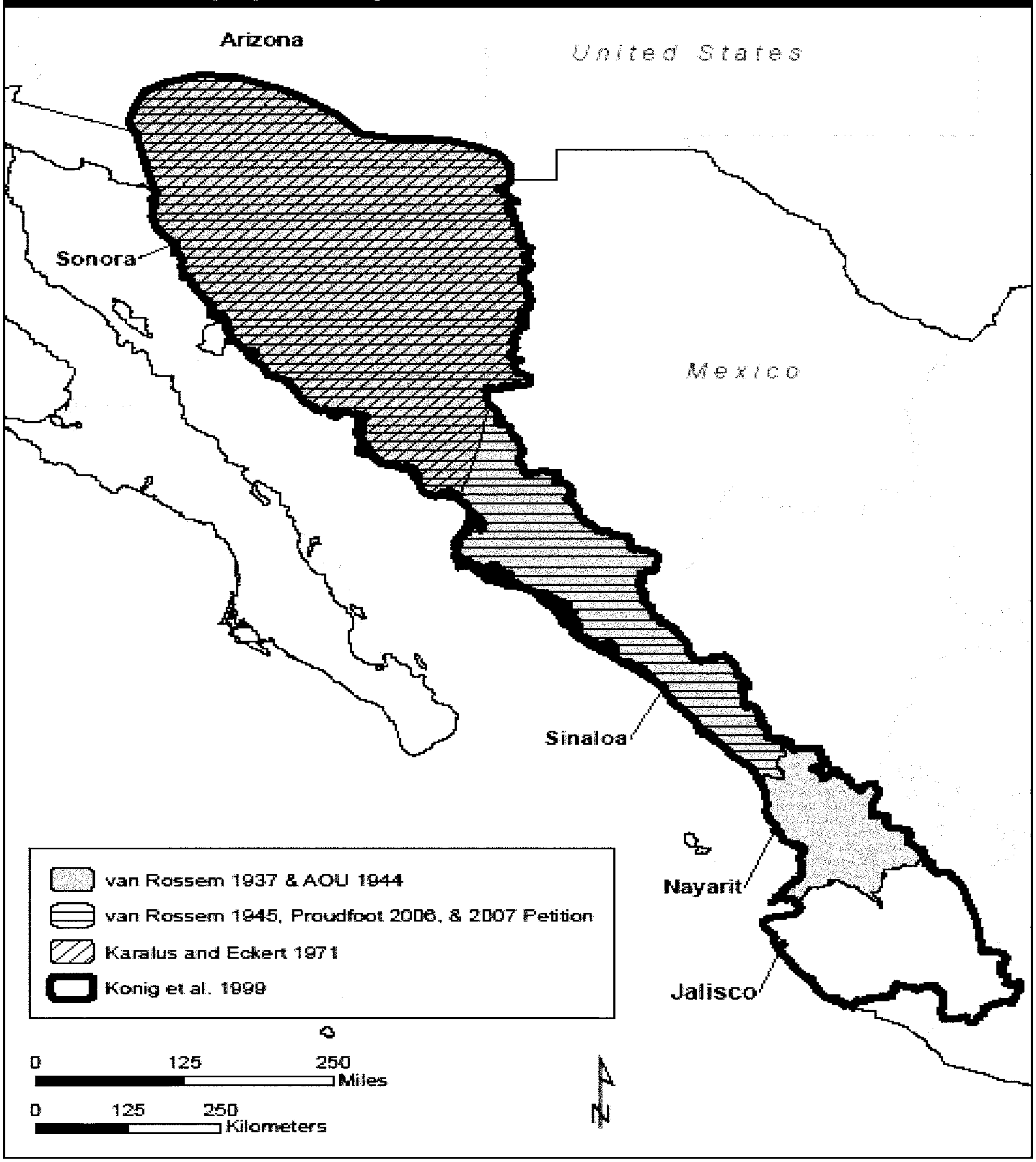
Figure 3. Cactus Ferruginous Pygmy-owl : Various configurations of the range of *cactorum* subspecies found in the literature. Ranges are approximate and for illustrative purposes only.



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The chronology described in the previous paragraph, which excludes the currently accepted distribution of *Glaucidium brasilianum cactorum,* focuses on descriptions in the literature which generally approximate the petitioned description of *G. ridgwayi cactorum,* and there is consensus that *cactorum* extended northward into Arizona. However, it is evident there is inconsistency regarding the southern extent of the subspecies. With the exception of van Rossem (1937, pp. 27–28), who uses morphological characteristics to describe the subspecies, most of the above descriptions of the *cactorum* subspecies do not indicate why they have ascribed the subspecies to the ranges indicated in these publications. König *et al.* (1999, p. 373) simply uses the morphological characters of van Rossem (1937, pp. 27–28). König *et al.* (1999, entire) and Proudfoot *et al.* (2006a; 2006b, entire) do classify *cactorum* using genetic data, but draw different conclusions with regard to the southern boundary. The incremental southward extension of the various *cactorum* ranges may provide some support for the idea of a clinal pattern of differentiation in which genetic and morphological differences occur in an incremental manner, as opposed to more abrupt changes that are more likely to represent a boundary between two distinct subspecies groupings. The data presented in the petition (Proudfoot *et al.* 2006a; 2006b, entire) are not sufficient to clarify the groupings in the literature, nor does it allow us to determine if the subspecies ranges are distinct because there is a lack of adequate sampling in southern and eastern Mexico. The uncertainty of the southern boundary would suggest that additional sampling is needed to refine this portion of the range of *cactorum.* In the presence of unresolved inconsistencies, the Service relies upon the ''standard taxonomic distinctions (50 CFR 424.11(a)); in this case, the currently accepted taxonomic classification (AOU 1957).

In addition to reviewing historical and current descriptions of the subspecies, we requested review and input on the issue of taxonomic classification of the petitioned entity from 10 individuals with biological expertise and background in this issue. Of the 10 we consulted, 5 provided comments on specific questions we asked regarding the issues of taxonomic classification, genetic differentiation, and genetic diversity based on recent and historical studies and publications related to pygmy-owl taxonomic classification. Information submitted by all five experts indicated that, while there are certain aspects of the information presented in the petition that support acceptance of the petitioned entity, there is insufficient information regarding how to define a distinct subspecies. Additional work is needed to clarify the distribution of the subspecies, especially in regards to the southern boundary (Voelker 2008, p. 1; Cicero 2008, p. 2; Robbins 2008, p. 1; Oyler-McCance 2008, pp. 1–2; Dumbacher 2008, pp. 2–8). A summary of their comments is presented below.

Dumbacher (2008, p. 7) provided a summary of considerations in response to our request for input on this issue: ''In summary, Proudfoot *et al.* 2006a and 2006b do not provide a critical test for the subspecies *Glaucidium ridgwayi ridgwayi* or *G.r. cactorum* or their geographical ranges. The data are consistent with current subspecies names in that they show: (1) Isolation by distance across the range, albeit with larger genetic breaks in the region that corresponds with the subspecies names [as described by van Rossem 1937]; (2) and significant variation among major geographical areas that broadly correspond to present subspecies names [van Rossem 1937]. However, it is not clear: (1) Where exactly the subspecies boundaries occur; (2) whether the boundary will be geographically distinct or correspond to characters used in the original subspecies designation, such that the two groups would qualify for subspecies under the 75 percent rule [75 percent of individuals in a new subspecies (or region) are diagnosably different from the other possible subspecies]; or (3) whether a broad hybrid zone or cline would be discovered that might call the two subspecies into question. Further data are needed to critically test the validity of the subspecies and to identify the most appropriate geographic boundary between them. Proudfoot *et al.* (2006b) make a plea for more data in critical areas, such as between Sonora and Sinaloa, and I would argue further south as well.''

Cicero (2008, p. 2) adds, ''On the basis of these data, I would argue that Arizona and Texas populations should be managed as separate units. However, further study of the variation in morphology and plumage (the characters originally used to describe *cactorum*) is needed before we can reliably apply names to these populations. Thus, in my opinion, the molecular data provided by Proudfoot *et al.* (2006a and 2006b) do not clarify subspecific limits and ranges in North American populations of *G. brasilianum''.* Similarly, Oyler-McCance (2008, p. 2) indicates that, ''within the United States, it is clear that the Arizona group is much different from the Texas group and should not be considered as one group. What is less clear, however, is where exactly to draw the boundary between the two subspecies * * *. It would be informative to look at other characteristics (morphology, behavior, geographic distribution) and see how well they fit with the patterns provided by the genetic data. Only then, using all those characteristics, would it be prudent to make a decision.''

Robbins (2008, p. 1) indicated that work on a molecular-based phylogeny of New World pygmy-owls is about to be completed that will inform this issue. He suggested that acceptance of the petitioned entity be delayed until this work has been published. However, the study to which Robbins refers will focus on species-level analyses, and it may not provide additional information regarding the distribution of subspecies and, as of the date of this finding, has not yet been published.

Recently, the Committee on Classification and Nomenclature on North and Middle American birds (the Checklist Committee) of the AOU considered a proposal to separate *Glaucidium brasilianum ridgwayi* as a distinct species, but rejected that proposal, citing the need to wait for additional work (AOU 2009).

In fairness to Proudfoot and his collaborators, their two 2006 studies are more general in nature and did not have the objective of defining pygmy-owl classification to the subspecies level. In addition, Proudfoot and his fellow authors, similar to the authors of many other publications related to pygmy-owl taxonomy, pointed out the need for additional work to clarify the taxonomic classification of pygmy-owls. Therefore, when we consider the recent information provided by Proudfoot *et al.* (2006a; 2006b, entire) and König *et al.* (1999, entire), in combination with the historical descriptions of distributions for the subspecies *cactorum,* there is evidence of a general nature that the petitioned subspecies may have merit. However, after reviewing the best available information, we find that uncertainty and inconsistency exists with regard to the delineation of the range of these subspecies.

The peer reviewers who provided information to the Service regarding this issue represent respected experts with considerable knowledge of the current science regarding avian taxonomy and classification. They point out that a combination of factors, including morphological, vocal, and genetic, need to be considered in greater depth, with additional sampling, to determine if the petitioned taxonomic classification should be accepted, and we are in agreement with these comments. Given the uncertainty and lack of clarification found in the best available scientific and commercial information, we rely on the ''biological expertise of the Department and the scientific community concerning the relevant taxonomic group'' (50 CFR 424.11(a)).

In summary, we find that there is considerable uncertainty as to whether the genetic differentiation found at the far ends of the pygmy-owl's distribution represented by Arizona and Texas are adequate to define the eastern and western distributions as separate subspecies. These differences may simply represent isolation by distance with a clinal gradation of genetic differentiation between the two extremes of the range, which would be inconsistent with the existence of two different subspecies. Therefore, the best available scientific and commercial information does not suggest that genetic differentiation reported by Proudfoot *et al.* (2006a; 2006b, entire) and König *et al.* (1999, entire) supports their proposed *Glaucidium ridgwayi cactorum* subspecies classification at this time. Future work and studies may clarify and resolve these issues, but, in the meantime, we will continue to use the currently accepted distribution of *G. brasilianum cactorum* as described in the 1957 AOU checklist and various other publications (Johnsgard 1988, p. 159; Millsap and Johnson 1988, p. 137; Oberholser 1974, p. 452; Friedmann *et al.* 1950, p. 145). The Service accepted this information under the previous listing of the pygmy-owl (62 FR 10730). We, therefore, reject the petitioned listing of a western subspecies of pygmy-owl, *G. r. cactorum,* as an insufficiently supported taxonomic subspecies at this time.

The following discussion will examine the potentially listable entities of *Glaucidium brasilianum cactorum,* the currently recognized subspecies of pygmy-owl.

Distribution and Status

The currently accepted distribution of the pygmy-owl is described as south central Arizona and southern Texas in the United States, south through the Mexican States of Sonora, Sinaloa, Nayarit, Jalisco, Colima, and Michoacán on the west and Nuevo Leon and Tamaulipas on the east (Figure 1). Available information on the specific distribution of the pygmy-owl within this general area is not comprehensive, especially in the southern portions of Mexico. As described below, we have relatively detailed information on pygmy-owl distribution in the United States and Sonora, Mexico. The following is a description of the available information we have related to the distribution of the pygmy-owl.

The cactus ferruginous pygmy-owl is the northernmost subspecies of the ferruginous pygmy-owl. This subspecies was originally described as being common in the lower Rio Grande River in southern Texas (Oberholser 1974, p. 452) and along the Salt and Gila Rivers in central Arizona (Fisher 1893, p. 199; Breninger 1898, p. 128; Gilman 1909, p. 148). In Arizona and Texas, apparent range and population declines have occurred, reducing the current distribution of the pygmy-owl in these areas (Oberholser 1974, p. 452; Monson and Phillips 1981, p. 72; Proudfoot and Johnson 2000, p. 3). Historical records for the pygmy-owl in Arizona span at least five counties in southern and south-central Arizona, including Maricopa, Pima, Pinal, Santa Cruz and Yuma Counties (Johnson *et al.* 2003, p. 394). Most of the historical (pre-1900) and recent (post-1990) records are from Pima County. Between 1872 and 1971, a total of 56 published records or specimens were recorded for Arizona. Of those, almost half (27) were from Pima County (Johnson *et al.* 2003, pp. 392–395). Although the pygmy-owl was historically recorded primarily from lowland riparian habitats, all recent records are from upland and xeroriparian (vegetation community in drainages associated with seasonal or intermittent water) Sonoran desertscrub (Abbate *et al.* 2000, pp. 15–16, Service 2009b, p. 1: 2011, p. 1).

Some information provided by the public suggested that the pygmy-owl is an obligate wet riparian species in south-central Arizona and a preferential wet riparian species in southern Arizona, tying its distribution to these types of areas. In addition, the information states that recent records in upland habitats have occurred primarily in areas associated with ''cultivated riparian'' habitats resulting from the human influences of irrigation and ornamental plantings, such as in suburban areas of Tucson (Johnson and Carothers 2008b, pp. 13–14). We agree that riparian ecosystems provide important pygmy-owl habitat within its range. However, we disagree with the suggestion that pygmy-owls are riparian obligates, and thus limited in occurrence to these areas. For example, there are numerous recent locations in which pygmy-owls were detected in Sonoran desert uplands and semi-desert grasslands of southern Pinal County, Avra Valley, Altar Valley, Cabeza Prieta National Wildlife Refuge, Organ Pipe Cactus National Monument, and northern Sonora that are not in proximity to ''cultivated riparian'' or naturally occurring hydro- or mesoriparian (wet riparian) habitats.

Two members of the public provided extensive information in support of the idea that pygmy-owls have never been common in Arizona; therefore, the current low numbers and reduced distribution are not sufficient reason to determine that the pygmy-owl is endangered in Arizona (James 2008, pp. 8–10; Parker 2008, pp. 2–10). This conclusion is based on the historical records from early naturalists and ornithologists regarding their observations or collections of pygmy-owls or their nests or eggs, or the lack thereof. Specifically, this information points out that a number of early naturalists or ornithologists that made trips of various lengths and in various locations in Arizona where pygmy-owls would have been expected to occur did not make mention of observing pygmy-owls in their trip reports (James 2008, pp. 46–48; Parker 2008, pp. 6–8). We appreciate the effort and research represented by this information. It provides an excellent summary of historical ornithological efforts in Arizona. In assessing the information provided, we must determine if it is comparable to the information currently available on pygmy-owl numbers and distribution in Arizona. Current information comes from extensive surveys focused on locating only pygmy-owls using tape-playback or call imitation to locate the owls. We can find no evidence from the information provided that this same effort or methodology was used to locate pygmy-owls in the historical record; thus comparison with current surveys is not appropriate.

We do not discount the ability of early naturalists and ornithologists to find and identify pygmy-owls. However, finding pygmy-owls was not the objective of the trips reported in the literature, and unfortunately, most of these early reports do not contain enough information for us to determine that the effort was adequate to find pygmy-owls if they were present or that the absence of documentation of pygmy-owls truly means that no pygmy-owls were encountered. Additional information received from the public points out the problems in interpreting these early reports, ''While certainly instructive as to the critical value of surface water diversions, irrigation, and agriculture to Cactus ferruginous pygmy owls, lack of necessary specific information prevents Breninger's 1898 account from serving as a source of support for the petitioner's claim that this owl was historically common across the lowlands of central and southern Arizona. This is because Breninger neither shows how much time he spent in the field nor the locations he actually visited along either the Salt and Gila Rivers that caused him to conclude that Cactus ferruginous pygmy owls were then ''of common occurrence'' ''among the growth of cottonwood'' that fringed both on a highly localized basis'' (Parker 2008, pp. 3–4).

While early records provide information that shows the range of the pygmy-owl has contracted in Arizona, this conclusion relies on information at a large scale and is not dependent on specific population numbers, only presence or absence. The logical assumption may follow that pygmy-owl numbers are likely reduced as well. However, these early records do not have enough specific information for us to quantify historical pygmy-owl population numbers in a way that allows comparison to our current information. Glinski (1998, p. 3) provides a summary of this issue in *The Raptors of Arizona,* ''From the perspective of the variety and numbers of raptors, what did Arizona's landscape harbor two centuries ago? Is the answer to this question in the early literature? Unfortunately, no. Detailed records that accurately depict the status of Arizona raptors before 1970 are entirely lacking. The records of early explorers are full of errors, and later interpretations of them have added to the problem (G.P. Davis 1982).''

We received information from various agencies and municipalities that contained survey results from Arizona indicating that the pygmy-owl is likely absent from some areas in Maricopa and Pima Counties. Survey data submitted by the USDA Forest Service covering over 4,050 hectares (ha) (10,000 acres (ac)) in a 6-year period on the Tonto National Forest in Maricopa County detected no pygmy-owls (USFS 2008, p. 1). Burger (2008, p.1) indicated that the Arizona Game and Fish Department (AGFD) had conducted 3 years of surveys in Maricopa County without any pygmy-owl detections. Annual pygmy-owl surveys have been conducted by the Air Force on the Barry M. Goldwater Range of southwestern Arizona from 1993 to the present with no verified pygmy-owl detections (Uken 2008, p. 1). The Pima County Department of Transportation conducts pygmy-owl surveys for their capital improvement projects. These pygmy-owl surveys are associated with specific projects, and do not represent systematic surveys throughout Pima County. To date, they have conducted 383 surveys at 152 locations in Pima County with no detections (Pima County 2008, p.1). Some of the above surveys, and other negative surveys conducted throughout Arizona since 1997, occurred in areas where the pygmy-owl was historically located. This provides strong evidence that the current range of the pygmy-owl in Arizona has contracted.

Currently in Arizona, the pygmy-owl is found only in portions of Pima and Pinal Counties. The Arizona Breeding Bird Atlas reports confirmed occurrences of the pygmy-owl in only three blocks distributed in Pima and Pinal Counties (Arizona Breeding Bird Atlas (ABBA) 2005, p. 219). Twelve other blocks recorded probable (3) or possible (9) occurrences, but none occurred outside of Pima and Pinal Counties (ABBA 2005, p. 219). Recent surveys indicate that probably fewer than 50 adult pygmy-owls exist in the state, with 10 or fewer nest sites on an annual basis (Abbate *et al.* 2000, pp. 15–16, AGFD unpublished data). However, since the pygmy-owl was delisted in 2006 (71 FR 194521; April 14, 2006), surveys, monitoring, and other research on pygmy-owls has declined. Limited survey and monitoring in Arizona from 2009 to 2011 documented that pygmy-owls still occupy historical locations in the Altar Valley, Avra Valley, and Organ Pipe Cactus National Monument, all within Pima County (Service 2009b, p. 1; Tibbitts 2011, p. 1; Service 2011, p. 1). Comprehensive surveys have not been conducted on the Tohono O'odham Nation (Nation), which is located in the central portion of both the historical and current distribution of pygmy-owls in Arizona. However, a number of surveys have been completed for various utility projects on the Nation, and the pygmy-owl is known to occur there. Distribution of the data from these surveys has been restricted by the Nation and is not available for analysis. There are large areas of suitable habitat on the Nation, but the information we have indicates that pygmy-owls are patchily distributed, just as in other areas of the State, and occur at similar densities.

In summary, because the early records found in the literature provide no basis for consistent interpretation, the statements that the pygmy-owl was ''not uncommon,'' ''of common occurrence,'' and ''fairly numerous'' in lowland central and southern Arizona may be as appropriate as the commenter's interpretation that the pygmy-owl was never common in Arizona. The bottom line is that these early records provided no quantifiable information on which to base trends in pygmy-owl populations. Consequently, we must base our evaluation of the current pygmy-owl status on the best available scientific and commercial data, which is the information that does, at least, provide some ability to quantify pygmy-owl population numbers. Regardless of the lack of quantified historical data, the early records found in the literature give us some idea of the historical distribution of the pygmy-owl in Arizona that, when compared to the current distribution, has unquestionably been reduced.

In Texas, the pygmy-owl was formerly common in the Rio Grande delta. Griscom and Crosby (1926, p. 18) reported that the pygmy-owl was considered a ''common breeding species'' in the Brownville region of southern Texas. Even as late as 1950, Friedman *et al.* (1950, p. 145) considered the pygmy-owl to be ''a very common breeding bird.'' However, Oberholser (1974, pp. 451–452) indicates that agricultural expansion and subsequent loss of native woodland and thornscrub habitat, beginning in the 1920s, preceded the rapid demise of the pygmy-owl populations in the Rio Grande delta. By the 1970s, the pygmy-owl was encountered only rarely in Texas.

Nonetheless, Wauer *et al.* (1993, pp. 1074–1076) indicate that private ranches in Kenedy and Brooks Counties in Texas support a ''large and apparently thriving population of ferruginous pygmy-owls.'' Currently, the pygmy-owl is most consistently found only in the southernmost counties in Texas, mainly in Starr and Kenedy Counties (Tewes 1992, p. 21; Oberholser 1974, p. 451). More recent work documents occupancy in Brooks and Kenedy Counties on the King Ranch and adjacent ranches in Texas (Proudfoot 1996, p. 6; Mays 1996, p. 29). Population estimates in Texas include estimates of greater than 100 owls in Kleberg County (Tewes 1992, p. 24), 654 pairs in Kenedy, Brooks, and Willacy Counties (Wauer *et al.* 1993, p. 1074), and 745 to 1,823 pygmy-owls on ranches in Kenedy and Brooks Counties (Mays 1996, p. 32).

Recent concern about the populations in Texas has been raised because of an apparent decline in the number of pygmy-owl nestlings banded as part of an ongoing nest box study in Texas (Proudfoot 2010, p. 1). The numbers of nestlings banded at more than 200 nest boxes in 2003 and 2004 were 84 and 96 respectively. The numbers suggest a steady decline from 2004 to 2010, with 25 and 24 nestlings banded in 2009 and

2010, respectively (Proudfoot 2010, p. 1). This represents an approximate 70 percent decline in the number of nestlings banded over an 8-year period. Proudfoot (2011b, p. 1) indicates this decline is likely the result of the loss of suitable habitat around nest boxes due to recent hurricanes and fires. Without a more comprehensive survey effort in southern Texas, we cannot definitively state that the overall population of pygmy-owls in south Texas matches the decline of nestlings documented during this nest box study. However, it does raise our level of concern for this population. More work is needed in Texas to determine the overall population status and the extent of habitat loss and fragmentation. It may simply be that the pygmy-owls in these areas have moved to adjacent suitable habitat as former habitat and the associated nest boxes have been destroyed.

The pygmy-owl occurs in portions of eight States in Mexico. The pygmy-owl was thought to be uncommon throughout much of Sonora (Russell and Monson 1998, p. 141; Hunter 1988, pp. 1–6). However, recent surveys and capture efforts have shown that the pygmy-owl commonly occurs in both northern and southern Sonora, but is uncommon or absent in central Sonora (Flesch 2003, p. 39; AGFD 2008a, p.6; Service 2009a, p. 1). The highest densities of pygmy-owls occurred in the Sinaloan deciduous forest of southern Sonora (Flesch 2003, p. 42). Flesch (2003, p. 39) documented 438 males, 74 females, and 12 pygmy-owls of unknown sex along 1,113 kilometers (km) (1,780 miles (mi)) of transects in Sonora, and an additional 112 pygmy-owls incidentally detected.

During capture efforts in 2008, AGFD (2008a, p. 6) documented multiple pygmy-owls commonly responding at capture sites in the thornscrub and tropical deciduous forests of southern Sonora. In areas of central Sonora sampled by AGFD, some sites had no pygmy-owl responses, but responses increased as sampling moved into northern Sonora. These results are similar to patterns of occupancy documented by Flesch (2003, p. 40). However, it is clear that the number and density of pygmy-owls is higher in the thornscrub and deciduous forest community types than in the Sonoran desert community type. This occurrence and distribution agrees with conclusions found in the literature (Hunter 1988, p. 7; Russell and Monson 1988, p. 141; Shaldach 1963, p. 40). A total of 119 pygmy-owls were captured by AGFD over 15 days of trapping in northern Sinaloa and Sonora (AGFD 2008a, p. 6). The most recent monitoring of pygmy-owls in northern Sonora showed that, in 2010, sites sampled had the highest occupancy rates in the past 10 years at nearly 64 percent (Flesch 2011, p. 1). However, early results from the 2011 monitoring show occupancy of these same sites at around 50 percent, not far from the 10-year low of 45.7 percent (Flesch 2011, p. 1).

In summary, recent surveys and research in northwestern Mexico indicate that numbers and density of pygmy-owls are higher in thornscrub and tropical deciduous forest communities of southern Sonora and Sinaloa than in the Sonoran desertscrub and semi-desert grassland vegetation communities of the Sonoran Desert Ecoregion (Flesch 2003, pp. 39–42; AGFD 2008a, p. 6).

The best available information we have from the literature for the southern portion (areas south of Sonora and northern Sinaloa) of the pygmy-owl range indicates that pygmy-owls are one of the most common birds collected in these areas (Cartron *et al.* 2000, p. 5; Enriquez-Rocha *et al.* 1993, p. 154; Binford 1989, p. 132; Hunter 1988, p. 7; Johnsgard 1988, p. 161; Oberholser 1974, p. 451; Schaldach 1963, p. 40). It is important to note, however, that most of these references apply to the ferruginous pygmy-owl as a species and not to the *cactorum* subspecies specifically. However, the more recent survey, monitoring, and capture work discussed above all occurred within the range of the *cactorum* subspecies.

Tewes (1993, pp. 15–16) provides the most current information on pygmy-owls in northeastern Mexico. During surveys in 1991, he estimated 96 pygmy-owls in association with 142 plots at 12 locations (Tewes 1993, pp. 15–16). He concludes that no published empirical evidence suggests any change in the distribution of this species in Texas or northeastern Mexico, although the likelihood of finding pygmy-owls is low in some historically occupied areas (Tewes 1993, p. 22).

In addition, pygmy-owls are not evenly distributed across their current range; rather they tend to be patchily distributed across the landscape. Pygmy-owl populations, particularly in the northern portion of its range, likely function as metapopulations (a group of spatially separated populations that act at some levels as a single large population). Genetic and population support for individual groups of pygmy-owls likely occurs as a result of dispersal. Therefore, habitat connectivity among these population groups is important to maintain genetic diversity, as well as demographic support. Interaction among these population groups likely varies with distance, but pygmy-owls have been documented to disperse up to 260 km (161 mi.) (AGFD 2008a, p. 5). Individual pygmy-owl groups throughout the range are important to the survival of the subspecies as a whole in providing metapopulation support.

In conclusion, pygmy-owl distribution in the United States has contracted, with pygmy-owls no longer found in Maricopa, Cochise, Yuma, and Santa Cruz Counties in Arizona, nor in the Lower Rio Grande Valley in Texas. Despite this range contraction in the United States, pygmy-owls remain in Arizona and Texas. Survey results for Arizona indicate that approximately 50 adult pygmy-owls remain. In addition, there are a few large expanses of Arizona with suitable pygmy-owl habitat that have not been completely surveyed or for which pygmy-owl information is not available for evaluation. Pygmy-owl populations in Texas are estimated to range up to 1,800 birds, although there have been some declines in pygmy-owl nestlings associated with a nest box study in Texas. Pygmy-owls are still found in Sonora and northern Sinaloa, with higher densities reported in thornscrub and dry tropical forested areas compared to the arid desert areas. Based on Tewes study (1993, entire), pygmy-owls still occupy suitable habitat in northeastern Mexico and the pygmy-owl's distribution remains unchanged in Texas and northeastern Mexico. In addition, it appears that pygmy-owls still occur in the same areas of Mexico reported in the literature, suggesting that the current distribution is similar to the historical distribution. The available information, although dated, suggests that pygmy-owls remain common in the southern portion of their range.

Habitat

Pygmy-owls are found in a variety of vegetation communities, including Sonoran desertscrub and semidesert grasslands in Arizona and northern Sonora, thornscrub and dry deciduous forests in southern Sonora south to Michoacán, and Tamaulipan brushland in Texas and northeastern Mexico. However, available information regarding specific pygmy-owl habitat elements within these vegetation communities is limited to Arizona, Texas, and northern Sonora.

In Arizona, pygmy-owls rarely occur below 300 meters (m) (1,000 feet (ft)) or above 1,200 m (4,000 ft) (Proudfoot and Johnson 2000, p. 5), except perhaps during dispersal (AGFD 2008b, p. 3). Historically, in Arizona, the pygmy-owl nested in Fremont cottonwood-mesquite forests and mesquite bosques (woodlands) associated with major drainages and their tributaries and the subspecies is considered by some to be a preferential riparian nesting species. The pygmy-owl in Arizona also occupies upland Sonoran desertscrub, often associated with xeroriparian areas. Species associated with these areas are *Prosopis* spp. (mesquite), *Parkinsonia* spp. (palo verde), *Acacia* spp. (acacia), *Olneya tesota* (ironwood), and *Carnegiea gigantea* (saguaro cactus) (Proudfoot and Johnson 2000, p. 5).

In Texas, the pygmy-owl was historically found in *Prosopis* spp., *Ebenopsis ebano* (ebony), and *Arundinaria gigantea* (cane) along the Rio Grande River, and a more general distribution in riparian trees, brush, palm, and mesquite thickets (Oberholser 1974, p. 451). It is now found primarily in undisturbed live oak-mesquite forests and mesquite brush, ebony, and riparian areas of the historical Wild Horse Desert north of Brownsville, Texas (Proudfoot and Johnson 2000, p. 5).

In Mexico, the pygmy-owl occurs from sea level to 1,200 m (4,000 ft) (Friedmann *et al.* 1950, p. 145). In Sonora, it was originally common in the lower Sonoran and Tropical Zones, primarily in giant cactus associations (van Rossem 1945, p. 111). The subspecies is resident throughout most of the desertscrub, tropical thornscrub, and dry subtropical forests of Sonora, being most common in the latter association (Russell and Monson 1998, p. 141). The pygmy-owl is absent from tropical deciduous forests and higher vegetation zones in west Mexico, where it is replaced by the least pygmy-owl (*Glaucidium minutissimum*) and the northern pygmy-owl (*G. gnoma*) (Schaldach 1963, p. 40; Buchanan 1964, pp. 104–105), as well as the Colima pygmy-owl (*G. palmarum*) (Howell and Robbins 1995, pp. 19–20). Dry, subtropical forests provide important pygmy-owl habitat elements, as evidenced by pygmy-owls being more common in this vegetation community type than in other community types in Mexico. The dry, subtropical forests comprise the majority of the pygmy-owl's southern range in Mexico. The presence of large trees and columnar cacti for nesting, and diversity of cover and prey types, contribute to the value of dry subtropical forests as pygmy-owl habitat.

The pygmy-owl is a creature of edges found in semi-open areas of thorny scrub and woodlands in association with giant cacti, scattered patches of woodlands in open landscapes, mostly dry woods, and evergreen secondary growth (König *et al.* 1999, p. 373). It is often found at the edges of riparian and xeroriparian drainages and even habitat edges created by villages, towns, and cities (Proudfoot and Johnson 2000, p. 5; Abbate *et al.* 1999, pp. 14–23). The pygmy-owl is a secondary cavity nester, and nests occur within woodpecker holes and natural cavities in giant cacti, but also in trees and even in a sand bank (Flesch 2003, pp. 130–132; Proudfoot and Johnson 2000, p. 11; Russell and Monson 1998, p. 141; Johnsgard 1988, p. 162). Tewes (1992, p. 22) contends that status and occurrence of the pygmy-owl is related to the availability of nest cavities.

While native and nonnative plant species composition differs among the various locations within the range of the pygmy-owl, there are certain unifying characteristics such as the presence of vegetation in fairly dense thickets or woodlands; the presence of trees, saguaros, *Stenocereus thurberi* (organ pipe cactus), or other columnar cacti large enough to support cavities for nesting; and elevations typically below 1,200 m (4,000 ft) (Swarth 1914, p. 31; Karalus and Eckert 1974, p. 218; Monson and Phillips 1981, pp. 71–72; Johnsgard 1988, Enriquez-Rocha *et al.* 1993, p. 158; Proudfoot 1996, p. 75; Proudfoot and Johnson 2000, p. 5). Large trees provide canopy cover and cavities used for nesting, and the density of mid- and lower-story vegetation provides foraging habitat and protection from predators and contributes to the occurrence of prey items (Wilcox *et al.* 2000, pp. 6–9).

Life History

Usually, pygmy-owls first nest as yearlings (Proudfoot and Johnson 2000, p. 13; Abbate *et al.* 1999, pp. 17–19), and both sexes breed annually thereafter. Territories normally contain several potential nest and roost cavities from which responding females select a nest. Hence, cavities per unit area may be a fundamental criterion for habitat selection. Historically, pygmy-owls in Arizona used cavities in cottonwood, mesquite, and ash trees, and saguaro cacti for nest sites (Millsap and Johnson 1988, pp. 137–138). Recent information from Arizona indicates nests were located in cavities in saguaro cacti for all but two of the known nests documented from 1996 to 2002 (Abbate *et al.* 1996, p. 15; 1999, p. 41; 2000, p. 13; AGFD 2003, p. 1). Pygmy-owl nests in Texas were primarily in mesquite and live oak trees (Proudfoot 1996, pp. 36–38), and nests in Sonora, Mexico, were nearly always in columnar cacti (Flesch and Steidl 2002, p. 6). Pygmy-owls will also use nest boxes for nesting (Proudfoot 1996, p. 67).

Pygmy-owls begin courtship and advertisement calls early in the year from January into February. Nest selection then occurs, with eggs typically being laid from late March into June. Average clutch size as reported by Johnsgard (1988, p. 162) for the United States and Mexico was 3.3 (range 2 to 5, n = 43). In Texas, Proudfoot and Johnson (2000, p. 11) report an average clutch size of 4.9 (range 3 to 7, n = 58). First eggs hatch generally around mid-May, and fledging occurs from late-May through June. The first dispersal of fledglings in Arizona and Texas was documented as July 24th and August 14th, respectively (Proudfoot and Johnson 2000, p. 10). Pygmy-owl juveniles typically disperse at 8 weeks post-fledging. Males typically disperse shorter distances than females. Dispersal distance ranges from 2.5 to 20.91 km (1.55 to 13.00 mi) in Arizona (Abbate *et al.* 2000, p. 21) and 16 to 31 km (9.6 to 18.6 mi) in Texas (Proudfoot and Johnson 2000, p. 13). One juvenile female pygmy-owl in Arizona recently dispersed a total of 260 km (161 mi) between August 2003 and April 2004 (AGFD 2008a, p. 5). In Sonora, Mexico, Flesch and Steidl (2007, p. 37) documented dispersal distances ranging from 1.1 to 19.2 km (0.7 to 11.5 mi).

Pygmy-owls are considered nonmigratory throughout their range. There are winter (November to January) pygmy-owl locations from throughout their historical range in Arizona (University of Arizona 1995, pp. 1–2; Snyder 2005, pp. 4–5; Abbate *et al.* 1999, pp. 14–17; 2000, pp. 12–13) and also in Texas (Proudfoot 1996, p. 19; Mays 1996, p. 14). These winter records suggest that pygmy-owls are found within their home ranges throughout the year and that they do not migrate seasonally. The pygmy-owl is primarily diurnal (active during daylight) with crepuscular (active at dawn and dusk) tendencies.

The pygmy-owl is a perch-and-wait hunter. It is largely a generalist with regard to prey and diet. Oberholser (1974, p. 451) indicated that the pygmy-owl's diet included lizards, large insects, rodents, and birds (some as large as the owl). In Texas, insects, reptiles, birds, small mammals, and amphibians, to a lesser extent, are eaten by pygmy-owls (Proudfoot and Johnson 2000, p. 6). In Arizona, reptiles, birds, small mammals, and insects have all been recorded in the diet of the pygmy-owl (Abbate *et al.* 1999, pp. 35–40). Seasonal and annual variations in diet occur throughout its range (Proudfoot and Johnson 2000, p. 6; Abbate *et al.* 1999, pp. 35–40).

The pygmy-owl is commonly mobbed (harassed) by many species of passerines, presumably in response to being a regular predator on those species (Proudfoot and Johnson 2000, p. 10; Abbate *et al.* 1999, pp. 25–26; Hunter 1988, p. 1). The mobbing behavior of birds can often aid in locating a well hidden pygmy-owl, as multiple individuals and species will often participate in the mobbing and identify the perch of the pygmy-owl. The dark eye-spots on the back of the pygmy-owl's head may act to fend off mobbing or increase predatory efficiency by confusing prey (Heinrich 1987 in Proudfoot and Johnson 2000, p. 10).

Due to their small size and occurrence in similar habitats as many of their predators, pygmy-owls are preyed upon by a variety of species. Documented and likely predators in Texas and Arizona include raccoons (*Procyon lotor*), great horned owls (*Bubo virginianus*), Cooper's hawks (*Accipiter cooperii*), Harris' hawks (*Parabuteo unicinctus*), western screech owls (*Megascops kennicottii*), bull snakes (*Pituophis melanoleucus*), and domestic cats (*Felis domesticus*) (Abbate *et al.* 1999, p. 27; Proudfoot and Johnson 2000, p. 10). Pygmy-owls may be particularly vulnerable to predation and other threats during and shortly after fledging (Abbate *et al.* 1999, p. 50). Lifespan has been documented to be 7 to 9 years in the wild (Proudfoot 2009b, p. 1) and 10 years in captivity (AGFD 2009, p. 1).

Summary of Information Pertaining to the Five Factors Affecting the Pygmy-Owl Throughout Its Range

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

In making our 12-month finding on the petition we considered and evaluated the best available scientific and commercial information.

In considering whether the five statutory factors in section 4(a) might constitute threats, we must look beyond the mere exposure of the species to the factor and determine whether the species responds to the factor in a way that causes actual negative impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine how significant a threat it is. If the threat is significant, it may drive or contribute to the risk of extinction of the species such that the species warrants listing as threatened or endangered as those terms are defined by the Act. This does not necessarily require empirical proof of a significant threat. The combination of exposure and some corroborating evidence of how the species is likely impacted could suffice. The mere identification of factors that could impact a species negatively is not sufficient to compel a finding that listing is appropriate; we require evidence that these factors are operative threats that act on the species to the point that the species meets the definition of threatened or endangered under the Act. A species may be threatened or endangered based on the intensity or magnitude of one operative threat alone or based on the synergistic effect of several operative threats acting in concert.

Through our five-factor analysis, we identified a number of factors negatively impacting the pygmy-owl or its habitat. To determine whether these impacts individually or collectively rise to the level of threats such that the pygmy-owl is in danger of extinction throughout its range, or likely to become so in the foreseeable future, we first considered whether these impacts to the subspecies were causing long-term, range-wide, population-scale declines in pygmy-owl numbers, or were likely to do so in the foreseeable future. Although some of these impacts seem significant individually, we found these impacts to be localized in their effects, but not placing the pygmy-owl in danger of extinction throughout its range now or in the foreseeable future. In other words, the severe impacts were restricted to an area that constitutes a relatively small portion of the pygmy-owl's range.

The detailed information we have on impacts covers only about 27 percent of the pygmy-owl's range. For this area, which includes Arizona and Texas in the United States, and Sonora and northern Sinaloa in Mexico, information describing the impacts to pygmy-owls was relatively complete. For the remaining 73 percent of the pygmy-owl range in Mexico, information regarding impacts to pygmy-owls was relatively sparse. The best available scientific and commercial information indicates that the impacts to pygmy-owls in the northern portion of their range are severe. However, the best available information indicates that pygmy-owls in the southern portion of their range remain common and that some of the threats that are severe in the northern portion of the species' range appear to be less severe or non-existent in the southern portion. Thus we conclude that pygmy owls are not threatened throughout their range, or likely to become so. The details supporting our conclusion are found in the following analysis.

Factor A: Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

For this factor, we evaluate available information related to impacts to pygmy-owl habitat throughout its range. Our evaluation identified general activities affecting or potentially affecting pygmy-owl habitat that included urbanization, nonnative species invasions, fire, agricultural development, wood cutting, improper grazing, border issues, and off-highway vehicle use. However, with the exception of the United States and Sonora, Mexico, detailed information related to these activities is limited, and we were unable to specifically evaluate the effects of many of these activities for much of the pygmy-owl's range in Mexico. The following discussion presents the best available information regarding these activities and their effects to pygmy-owl habitat.

Urbanization

Increasing human populations result in expanding urban areas. Urbanization causes permanent impacts on the landscape that potentially result in the loss and alteration of pygmy-owl habitat. Residential, commercial, and infrastructure development replace and fragment areas of native vegetation resulting in the loss of available pygmy-owl habitat and habitat connectivity needed to support pygmy-owl dispersal and metapopulation function. Increasing human populations require additional water, and increasing water consumption can reduce available surface and ground water needed to support pygmy-owl and pygmy-owl prey habitats. Added human presence on the landscape can potentially lead to increased pygmy-owl mortality through introduced predators, collisions, etc. The following discussion presents the available information related to pygmy-owl habitat impacts associated with urbanization.

Human population growth results in the expansion of urbanization (Travis *et al.* 2005, p. 2). Arizona's population increased by 394 percent from 1960 to 2000, and was second only to Nevada as the fastest growing State during this timeframe (Social Science Data Analysis Network (SSDAN) 2000, p. 1). Since 1990, Arizona's population has grown by 44 percent. From 1960 to 2000, population growth rates in Arizona counties where the pygmy-owl occurs, or recently occurred, have varied by county, but all are increasing: Maricopa (463 percent); Pima (318 percent); Pinal (54 percent); and Santa Cruz (355 percent) (SSDAN 2000).

Urban expansion and human population growth trends in Arizona are expected to continue into the future. The Maricopa-Pima-Pinal County areas of Arizona are expected to grow by as much as 71 percent in the next 15 years, creating rural-urban edge effects across thousands of acres of pygmy-owl habitat (AIDTT 2000, p. 10; BLM files-Lands Livability Initiative). In another projection, the Arizona population is expected to more than double within the next 20 years, compared to the 2000 population estimate (U.S. Census Bureau 2005, p. 1). Many cities and towns within the historical distribution of the pygmy-owl in Arizona already experienced substantial growth during the 8-year time span from 2000 to 2008: Town of Carefree (30.5 percent); Casa Grande (56 percent); Town of Cave Creek (44.2 percent); City of Eloy (22.3 percent); City of Florence (20.3 percent); City of Mammoth (45 percent); Town of Marana (139.9 percent); Town of Oro Valley (32.5 percent); and the Town of Sahuarita (507.3 percent) (U.S. Census Bureau 2008, pp. 1–4).

This population growth has spurred a significant increase in urbanization and development in these areas. Regional development is predicted to be high in certain areas within the distribution of the pygmy-owl in Arizona. In particular, a wide area from the international border in Nogales, through Tucson, Phoenix, and north into Yavapai County (called the Sun Corridor ''Megapolitan'' Area) is predicted to have 8 million people by 2030, an 82.5 percent increase from 2000 (Gammage *et al.* 2008, pp. 15, 22–23). If build-out occurs as expected, it will encompass a substantial portion of the current and historical distribution of the pygmy-owl in Arizona.

Development pressure across Arizona has slowed due to the recent economic downturn and decline in the housing market. However, development will likely continue in the future, although perhaps at a slower pace than in the earlier part of this century. We also recognize that economic trends are difficult to predict into the future. The most recent draft Pinal County Comprehensive Plan (February 2009) acknowledges that the county is in the middle of the Sun Corridor Megapolitan and proposes four shorter-term growth areas in defining where development will likely occur over the next decade, but does not discourage growth outside of these areas (Pinal County Comprehensive Plan 2009, p. 109). Areas within two of the four growth areas (West Pinal and Red Rock) support historically occupied and recently occupied areas.

Because most of the pygmy-owl habitat in Texas occurs on private ranch lands, the impact of habitat loss and fragmentation of the remaining pygmy-owl habitat due to urbanization is greatly reduced. Some housing, ranch facilities, roadways, and utilities will undoubtedly be constructed with changing ranch plans, and this may affect individual pygmy-owl territories. However, the overall impact to pygmy-owl habitat from current rates of urbanization in Texas is much less than that in Arizona and parts of Mexico.

In Mexico, the greatest increases in population have occurred mostly in coastal resort areas, State capitals, and along the United States-Mexico border. In the Sonoran Desert Ecoregion of Mexico (a relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables), the human population nearly doubled between 1970 and 1990, to a total population of 6.9 million (Gorenflo 2002, p. 13). The Sonoran capital, Hermosillo, grew by 116 percent. When considering urban growth within individual biotic communities, the human population more than doubled in three of the seven major biogeographic communities of Mexico (Arizona Upland and Lower Colorado River Valley, Plains of Sonora, and Magdalena Plain) (Gorenflo 2002, p. 28), all of which provide important pygmy-owl habitat.

The United States-Mexico border region has a distinct demographic pattern of permanent and temporary development related to warehouses, exports, and other border-related activities, and patterns of population growth in this area of northern Mexico have been accelerated relative to other Mexican States (Pineiro 2001, pp. 1–2). This focuses development, and potential barriers or impediments to pygmy-owl movements, in a region that is important for pygmy-owl metapopulation support and other movements such as dispersal. The Arizona-Sonora border region's population growth is expected to reach 2.1 million (Walker and Pavlakovich-Kochi 2003, p. 1) in an area that will affect cross-border movement by pygmy-owls and other important population linkages needed to support the pygmy-owl metapopulation structure. Based on 1990 human population numbers, the land cover types currently most valuable to the pygmy-owl—Mesquite Bosque and Palo Verde-Mixed Cactus—were the most heavily human-populated in the Sonoran Desert Ecoregion. The Mesquite Bosque type makes up 8.2 percent of the area, but supports 10.4 percent of the human population. Similarly, the Palo Verde-Mixed Cactus type covers 29 percent of the area, but supports 49.4 percent of the population (Gorenflo 2002, p. 28).

Human activity, most notably in the past century, has dramatically altered the landscape of the Arizona-Sonora border, affecting both the quantity and quality of its ecological resources. Urbanization not only reduces the amount of open space, but impacts the biological value of areas (Walker and Pavlakovich-Kochi 2003, p. 3). The Sonoran border population has been increasing faster than that State's average and faster than Arizona's border population; between 1990 and 2000, the population in the Sonoran border municipios increased by 33.4 percent, compared to Sonora's average (21.6 percent) and the average increase of Arizona's border counties (27.8 percent). Urbanization has increased habitat conversion and fragmentation, which, along with immigration, population growth, and resource consumption, were ranked as the highest threats to the Sonoran Desert Ecoregion (Nabhan and Holdsworth 1998, p. 1).

Urbanization has also affected pygmy-owl habitat in other parts of Mexico. Trejo and Dirzo (2000, p. 133) indicate that areas of dry subtropical forests, important habitat for pygmy-owls in southwestern Mexico, have been used by humans through time for settlement and various other activities. The long-term impact of this settlement has converted these dry subtropical forests into shrublands and savannas lacking large trees, columnar cacti, and cover and prey diversity that are important pygmy-owl habitat elements Trejo and Dirzo (2000, p. 134) state that in Mexico dry tropical forest is the major type of tropical vegetation in the country, covering over 60 percent of the total area of tropical vegetation. According to official governmental maps, about 8 percent (approximately 160,000 square km (61,776 square mi)) of this forest remained intact by the late 1970s, and an assessment made at the beginning of the present decade suggested that 30 percent of these tropical forests have been altered and converted to agricultural lands and cattle grasslands. The remaining forests are restricted to steep slopes where it is not likely that land will be cleared for additional agricultural or development purposes (Allnutt 2001, p.3). However, the information about the current actual extension and condition of dry tropical forests in Mexico is unclear due to confusion in their classification and difficulty using remote sensing to delineate intact dry forest (Allnutt 2001, p. 3). The best available information indicates that there are still expanses of dry tropical forest along the Pacific coast in Mexico, including some areas below 1,200 m (4,000 ft) where pygmy-owls are found, but there has been loss of this forest type throughout Mexico.

The actual effects of urbanization on biodiversity are many and mutually reinforcing, including the aggravation of the ''urban heat island effect''; the channelization or disruption of riverine corridors; the proliferation of exotic species; the killing of wildlife by automobiles, toxins, and pets; and the fragmentation of remaining patches of natural vegetation into smaller and smaller pieces that are unable to support viable populations of native plants or animals (Ewing and Kostyack 2005, pp. 1–2; Nabhan and Holdsworth 1998, p. 2). Human-related mortality (e.g., shooting, collisions, and predation by pets) increases as urbanization increases (Banks 1979, pp. 1–2; Churcher and Lawton 1987, p. 439). The above statements, while general in their nature, point out the vulnerability of habitats that support pygmy-owls and the impacts that urbanization can have on the extent and quality of available habitat. We would expect these types of impacts in areas that have experienced or are experiencing urban growth in or near pygmy-owl habitats. Not all areas in the United States and Mexico are experiencing this type of growth, especially in the southern portion of the pygmy-owl's range.

Development of roadways and their contribution to habitat loss and fragmentation is a particularly widespread impact of urbanization (Nickens 1991, p. 1). Data from Arizona and Mexico indicate that roadways and other open areas lacking cover affect pygmy-owl dispersal (Flesch and Steidl 2007, pp. 6–7; Abbate *et al.* 1999, p. 54). Nest success and juvenile survival were lower at pygmy-owl nest sites closer to large roadways, suggesting that habitat quality may be reduced in those areas (Flesch and Steidl 2007, pp. 6–7).

Currently, most roadways in Sonora are relatively narrow. However, the Sonoran government is starting to implement plans to build new highways and other infrastructure improvements. Governor Bours of Sonora formed the Sonoran Strategic Projects Operator, in conjunction with other investors, to carry out the construction of highway improvements (Wild Sonora 2009, p. 2). Of specific concern related to pygmy-owl impacts is the recent improvement of the road between Saric, in the upper Rio Altar valley, and Sasabe, in the heart of the distribution of the pygmy-owl in northern Sonora. Instead of just paving the existing Altar/Sasabe road, a new highway was constructed resulting in an increase of habitat impacts and fragmentation (Wild Sonora 2009, p. 2). Another development project proposed for northern Sonora is the Quitovac toxic waste dump south of Organ Pipe Cactus National Monument that could accept up to 45,000 tons of toxic waste per year (Wild Sonora 2009, p. 7). The proposed site for this project is located in the vicinity of a rare spring in this very arid region that supports pygmy-owl habitat. There are documented pygmy-owls nesting at Quitovac (Flesch 2003, pp. 40–41). While this project is currently on hold, it represents the potential for impacts to pygmy-owls related to development and urbanization in Sonora.

Significant human population expansion and urbanization in the Sierra Madre foothill corridor may represent a long-term risk to pygmy-owls in northeastern Mexico. In Texas, the pygmy-owl occurred in good numbers until approximately 90 percent of the mesquite-ebony woodlands of the Rio Grande delta were cleared in 1910–1950 (Oberholser 1974, p. 452). Habitat removal in northeastern Mexico is widespread and nearly complete in northern Tamaulipas (Hunter 1988, p. 8). The pygmy-owl metapopulation structure is threatened by ongoing loss and fragmentation of habitat in this area. Urbanization has the potential to permanently alter the last major landscape linkage between the pygmy-owl population in Texas and those in northeastern Mexico (Tewes 1992, pp. 28–29).

With regard to Mexico, for those areas outside of Sonora and northeastern Mexico discussed above, human population growth in Sinaloa, Nayarit, Colima, and Jalisco are relatively slow compared to Sonora. The Sinaloan population grew at a rate of 0.9 percent over the last decade. The population in Nayarit grew at a rate of 1.8 percent over the last decade. The Jalisco population grew by 1.6 percent per year during 2000–2010. Colima, one of the smallest States in Mexico, has a total population of approximately 650,500 and grew annually at a rate of 1.9 percent over the last decade. These areas of Mexico are not experiencing the high growth rates of Sonora, and likely will not have the concurrent spread of urbanization in the foreseeable future. In addition, most of the growth is taking place in the large cities, and not the rural areas of these countries (*http:www.citypopulation.de/Mexico-Cities.html*). Also, some of the large cities of the southern Mexican States, such as Guadalajara in Jalisco and Morelia in Michoacán, are not within the range of the pygmy-owl, so their growth would not be affecting pygmy-owl habitat. The rural areas likely contain the remaining habitat for the pygmy-owl. It is reasonable to assume that slow or stagnant population growth will result in fewer developments and infrastructure projects, such as new highways, or destruction and fragmentation of habitat on a landscape scale. The impacts associated with urbanization are, therefore, much reduced and less severe in this portion of the pygmy-owl's range. While the magnitude of the impacts associated with urbanization are significant in Arizona and northern Mexico, we would expect these impacts to be much reduced in the remaining 73 percent of the pygmy-owl's range in Mexico and we expect these impacts to remain less significant in this part of its range into the foreseeable future because of the difference in population growth.

Nonnative Invasive Species

The invasion of nonnative vegetation, particularly nonnative grasses, has altered the natural fire regime over the Sonoran portion of the pygmy-owl range. As a result, fire has become a significant threat to the native vegetation of the Sonoran Desert. Esque and Schwalbe (2002, pp. 180–190) discuss the effect of wildfires in the Arizona Upland and Lower Colorado River subdivisions of Sonoran desertscrub, which comprise the primary portions of the pygmy-owl's range within Sonoran desertscrub. The widespread invasion of nonnative annual grasses appears to be largely responsible for altered fire regimes that have been observed in these communities, which are not adapted to fire (Esque and Schwalbe 2002, p. 165). In areas comprised entirely of native species, ground vegetation density is mediated by barren spaces that do not allow fire to carry across the landscape. However, in areas where nonnative species have become established, the fine fuel load is continuous, and fire is capable of spreading quickly and efficiently (Esque and Schwalbe 2002, p. 175). Nonnative annual plants prevalent within the Sonoran range of the pygmy-owl include *Bromus rubens* and *B. tectorum* (brome grasses) and *Schismus* spp. (Mediterranean grasses) (Esque and Schwalbe 2002, p. 165). *Brassica tournefortii* (Sahara mustard) is an Old World forb that can cover 100 percent of the ground under certain conditions (ASDM 2009, p. 1). In 2006, fires that burned thousands of acres of Sonoran desertscrub in southwestern Arizona had Sahara mustard as the primary fuel. However, the nonnative species that is currently the greatest threat to vegetation communities in Arizona and northern Sonora, Mexico is the perennial *Pennisetum ciliare* (buffelgrass), which is prevalent and increasing throughout much of the Sonoran range of the pygmy-owl (Burquez and Quintana 1994, p. 23; Van Devender and Dimmit 2006, p. 5).

Buffelgrass is an Indo-African grass introduced to Mexico between 1940 and 1960 (Burquez *et al.* 1998, p. 25). The distribution of this grass has been supported and promoted by governments on both sides of the United States-Mexico border as a resource to increase range productivity and forage production. Buffelgrass is first established by stripping away the native desertscrub and thornscrub (Franklin *et al.* 2006, p. 69). Following establishment, it fuels fires that destroy Sonoran desertscrub, thornscrub, and, to a lesser extent, tropical deciduous forest; the disturbed areas are quickly converted to open savannas composed entirely of buffelgrass. Buffelgrass is now fully naturalized in most of Sonora, southern Arizona, and some areas in central and southern Baja California (Burquez-Montijo *et al.* 2002, p. 131), and now commonly spreads without human cultivation (Arriaga *et al.* 2004, pp. 1509–1511; Perramond 2000, p. 131; Burquez *et al.* 1998, p. 26).

However, buffelgrass is adapted to dry, arid conditions and does not grow in areas with high rates of precipitation or high humidity, above elevations of 1,265 m (4,150 ft), and in areas with freezing temperatures. Areas that support pygmy-owls south of Sonora and northern Sinaloa typically are wetter and more humid, and the best available information does not indicate that buffelgrass is invading the southern portion of the pygmy-owl's range. Buffelgrass is most often located on steep, rocky, south-facing slopes, with poor soil development (Van Devender and Dimmitt 2006, pp. 25–26). Surveys completed in Sonora and Sinaloa in 2006 noted buffelgrass was present in Sonora and northern Sinaloa, but the more southerly locations were noted as sparse or moderate (Van Devender and Dimmitt 2006, p. 7). This was in comparison to northerly sites in Sonora that were rated as dense with buffelgrass. As such, this nonnative species only significantly affects a portion of the pygmy-owl's range. The best available information indicates that buffelgrass is not significantly affecting areas in Mexico beyond Sonora, and northern Sinaloa.

Buffelgrass is not only fire-tolerant (unlike native Sonoran Desert plant species), but is actually fire-promoting (Halverson and Guertin 2003, p. 13). Invasion sets in motion a grass-fire cycle where nonnative grass provides the fuel necessary to initiate and promote fire. Nonnative grasses recover more quickly than native grass, tree, and cacti species and cause a further susceptibility to fire (D'Antonio and Vitousek 1992, p. 73; Schmid and Rogers 1988, p. 442). While a single fire in an area may or may not produce long-term reductions in plant cover or biomass, repeated wildfires in a given area, due to the establishment of nonnative grasses, are capable of ecosystem type-conversion from native desertscrub to nonnative annual grassland, and render the area unsuitable for pygmy-owls and other native wildlife due to the loss of trees and columnar cacti and reduced diversity of cover and prey species (Brooks and Esque 2002, p. 336). Buffelgrass competes with neighboring native species for space, water, and nutrients (Halverson and Guertin 2003, p. 13; Williams and Baruch 2000, pp. 128–135; D'Antonio and Vitousek 1992, pp. 68–72). Buffelgrass conversion is associated with increased soil erosion and changes in nutrient dynamics and primary productivity (Abbot and McPherson 1999, p. 3). These changes make it more difficult for native vegetation to reestablish, even if the conversion process or fires are discontinued (Franklin *et al.* 2006, p. 69; Rogers and Steele 1980, pp. 17–18).

Within the past 15 years, the establishment of nonnative grasslands has been identified as the most serious threat to the biological diversity of the Sonoran Desert (Burquez and Quintana 1994, p. 23). Economic subsidies from the State of Sonora and low-interest loans from banks made funds available for more widespread plantings of buffelgrass in the 1980s (Camou-Healy 1994). By 1997, more than 1 million ha (2.5 million ac) of desertscrub and thornscrub (both communities occupied by the pygmy-owl) had been cleared in central Sonora to plant buffelgrass, and more than 2 million ha (5 million ac) were scheduled for future vegetation conversion (Burquez and Quintana 1994, p. 23; Johnson and Navarro 1992, p. 118), often as part of government programs to support the ranching industry (Van Devender *et al.* 1997, p. 3). Researchers during this time period predicted that, if not halted, this practice of buffelgrass planting will permanently change the landscape of the Sonoran desert and deplete its associated biological diversity (Burquez and Quintana 1994, p. 23). Also, given the government subsidies to establish exotic grasslands in order to maintain large cattle herds, and to support marginal cattle ranching, it is less likely that control measures will be implemented, and the desertscrub and thornscrub in Sonora will probably be replaced in the near term by ecosystems with significantly lower species diversity and reduced structural complexity (Burquez and Martinez-Yrizar 1997, p. 387).

More recent figures indicate that this is indeed occurring, with buffelgrass present in more than two-thirds of Sonora, and 1.6 million ha (4 million ac) having been deliberately cleared and seeded with the species (Burquez-Montijo *et al.* 2002, p. 132). A 2006 publication estimates that 1.8 million ha (4.5 million ac) have been converted to buffelgrass in Sonora, and that between 1990 and 2000, there was an 82 percent increase in buffelgrass coverage (Franklin *et al.* 2006, pp. 62, 66). Buffelgrass pastures have doubled in area in Sonora approximately every 10 years since 1973 (Franklin *et al.* 2006, p. 67) and the conversion to buffelgrass is expected to continue into the foreseeable future.

It is not only Sonoran desertscrub communities in Sonora and northern Sinaloa that are impacted by the spread of buffelgrass. Another unique vegetation community in this region, dry subtropical forests, are being lost and fragmented due to the planting of buffelgrass in association with cattle ranching, which results in vast tracts of forest being removed and replaced by buffelgrass (Allnut *et al.* 2001, pp. 3–4).

Buffelgrass invasion in the United States is such an urgent and significant issue that the Governor of Arizona, and nearly all southern Arizona municipalities and agencies have joined together to address the issue. The Governor formed the Arizona Invasive Species Advisory Council in 2005, and the Southern Arizona Buffelgrass Working Group developed the Southern Arizona Buffelgrass Strategic Plan in 2008 (Buffelgrass Working Group 2008) in order to coordinate the control of buffelgrass. Because of its negative impacts to native ecosystems, buffelgrass was declared a noxious weed by the State of Arizona in March 2005. It is not currently known whether these programs will be successful in controlling buffelgrass invasion.

The impacts of buffelgrass establishment and invasion are substantial for the pygmy-owl in the United States and Sonora because conversion results in the loss of all important habitat elements, particularly columnar cacti and trees that provide nest sites. Buffelgrass invasion and the subsequent fires eliminate most columnar cacti, trees, and shrubs of the desert (Burquez-Montijo *et al.* 2002, p. 138). This elimination of trees, shrubs, and columnar cacti from these areas is a significant negative impact and potentially a threat to the survival of the pygmy-owl in the northern portion of its range, as these vegetation components are necessary for roosting, nesting, protection from predators, and thermal regulation. Because tree canopy cover is an important pygmy-owl habitat feature, the fact that buffelgrass fires reduce the number of tree-dominated patches and the recruitment opportunities for those native species dependent on them [such as saguaros] (Burquez and Quintana 1994, p. 11), is significant. Franklin *et al.* (2010, p. 7) report significant changes in vegetation structure as a result of creating buffelgrass pastures for grazing. There were 90 percent fewer trees and shrubs of the size used by pygmy-owls (2 to 5 m (6 to 15 ft) tall) in buffelgrass pastures as compared to native vegetation communities. Loss of diversity and availability of prey species due to conversion are also detrimental (Franklin *et al.* 2006, p. 69; Avila Jimenez 2004, p. 18; Burquez-Montijo *et al.* 2002, pp. 130, 135).

Some information we received from the public downplays the significance of the conversion of Sonoran desertscrub to buffelgrass savannas on pygmy-owl habitat by stating that there is no indication that the conversion is occurring in areas occupied by the pygmy-owl (Johnson and Carothers 2003, pp. 6–7). However, when compared to the maps of current and predicted buffelgrass invasion in Sonora found in Arriaga *et al.* (2003, Figure 1), the distribution of pygmy-owl locations from Flesch (2003, Figure 2), AGFD (2008a, p. 1), and Westland Resources (2008, Figure 4), as well as the known pygmy-owl locations and the documented occurrence of buffelgrass in Tucson, Avra Valley, Altar Valley, Organ Pipe Cactus National Monument, Pinal County, the Tohono O'odham Nation, and Sonora and northern Sinaloa show that there is almost 100 percent overlap in the areas occupied by pygmy-owls and the areas under greatest threat from buffelgrass invasion. One of the principle reasons that nonnative plants pose such a significant negative impact on the pygmy-owl in its northern range, and the native plant communities on which they depend, is because few, if any, reasonable methods currently exist to control the ongoing invasion of these plants or to remediate areas where they are already established. Mechanical removal, herbicides, and fire have all been tested for their effectiveness in control of this nonnative grass. However, none have proven effective at the scale of the current invasion.

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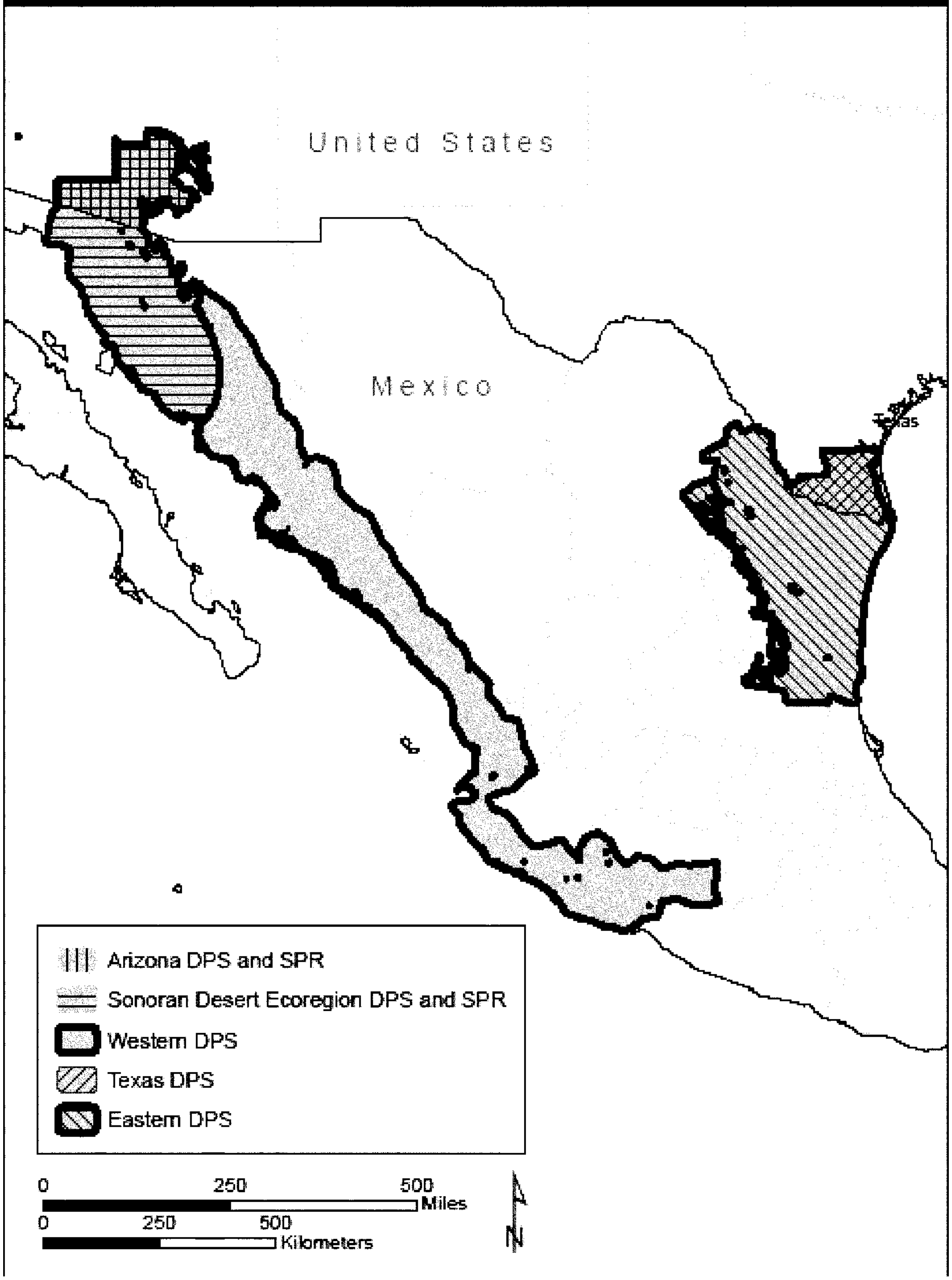
Figure 4. Cactus Ferruginous Pygmy-owl Distinct Population Segments (DPSs) and Significant Portions of the Range (SPR)s. DPSs and SPRs are approximate and for illustrative purposes only.



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In Texas and other portions of the pygmy-owl's range in the United States, such as semi-desert grasslands, invasive species and fire are not as significant in their impact because the vegetation communities in these areas are adapted to periodic fire. However, while fire may not be a primary issue, nonnative species can cause other effects to pygmy-owl habitat elements. For example, in Texas, studies indicate that the spread and prevalence of the nonnative grass, *Bothriochloa ischaemum* (King Ranch bluestem), results in this grass dominating native grasses, forbs, and endemic species, thus decreasing plant and animal species diversity and altering the vegetative structure of the community (Davis 2011, p. 4). It is not known if these changes in plant community structure affect pygmy-owls.

The best available scientific and commercial information, as presented in the discussion above, leads us to conclude that conversion of Sonoran desertscrub to nonnative plant pastures composed of buffelgrass, and the subsequent change in the fire regime, has resulted in the loss of large areas of pygmy-owl habitat in the northern range of the pygmy-owl, is negatively impacting the remaining areas of pygmy-owl habitat in the Sonoran desert and tropical thornscrub/dry deciduous forest communities of Arizona, Sonora, and northern Sinaloa, and is expected to continue to do so in the foreseeable future. Other areas in Texas and the United States, such as semidesert grassland, are not as affected by buffelgrass and subsequent changes in fire behavior, but may be invaded by other nonnative species. However, the effect, if any, on pygmy-owls, has not been studied.

In contrast to the severity of buffelgrass invasion as a significant negative impact to the pygmy-owl in the northern portions of its range, it appears to have less impact or no impact at all further south. The area in Mexico that is susceptible to buffelgrass invasion and planting represents only just over 22 percent of the pygmy-owl's range. The magnitude of the impact diminishes in the southern portion of the range where buffelgrass has not been reported in the dry tropical forests, which comprise the majority of pygmy-owl habitat in the southern portion of its range. In addition, buffelgrass is not likely to invade and persist in these areas in the foreseeable future because it is adapted to dry, arid savannahs and grasslands in its native Africa (Burquez et al. 1998, p. 25). The elevational conditions, canopy coverage, and precipitation patterns of the dry tropical forest communities are not as suitable for the establishment of buffelgrass as the arid desert and semi-desert vegetation communities (Arriaga *et al.* 2004, pp. 1508–1510.). The best available scientific and commercial information suggests that buffelgrass invasion should not be an issue in the southern portions of the pygmy-owls range, nor should it become an issue in the future.

Agricultural Production and Wood Harvesting

Agricultural development and wood harvesting can result in substantial impacts to the availability and connectivity of pygmy-owl habitat. Conversion of native vegetation communities to agricultural fields or pastures for grazing has occurred within historical pygmy-owl habitat in both the United States and Mexico, and not only removes existing pygmy-owl habitat elements, but also can affect the long-term ability of these areas to return to native vegetation communities once agricultural activities cease. Wood harvesting has a direct effect on the amount of available cover and nest sites for pygmy-owls and is often associated with agricultural development. Wood harvesting also occurs to supply firewood and charcoal, and to provide material for cultural and decorative wood carvings. While we do not have detailed information regarding the impacts of agricultural development and wood harvesting for all areas within the range of the pygmy-owl, the following provides a discussion of the extent of the impacts from these activities for areas for which we do have sufficient information.

The extent of agricultural development and woodcutting as a current or ongoing impact to pygmy-owl habitat differs between the United States and Mexico. For example, in the United States, habitat loss and conversion due to agricultural development is more of a historical issue because less area is being used currently for agriculture, and wood cutting is primarily for personal, rather than commercial use. However, impacts to pygmy-owl habitat from historical agricultural use and wood harvesting are still evident. The vegetation and soils of many valleys in the Sonoran Desert were shaped by the periodic flooding of dynamic wash systems, which partially recharged a shallow, fluctuating groundwater table. Because of agricultural development, these valleys no longer experience these defining processes and there has been a permanent loss of meso- and xero-riparian habitat (Jackson and Comus 1999, pp. 233, 249). These riparian habitats are important pygmy-owl habitat, especially within drier upland vegetation communities like Sonoran desertscrub and semi-desert grasslands.

In Arizona, although new agricultural development is limited and is expected to remain limited in the foreseeable future, the effects to historical habitat are still evident. Jackson and Comus (1999, pp. 249–250) describe the long-term effects of agricultural development on native vegetation communities, ''The groundwater has been mined, river flows have been relocated, tributaries have been channelized, and smaller waterways are blocked by roads or the canals of the Central Arizona Project. Soil-surface characteristics have been greatly altered by field leveling and irrigation ditches. Compounding these large-scale changes, soil in some areas has increased salinity, pesticide residues, or loss of physical structure due to repeated tillage, soil compaction, and irrigation.'' There have been important biological losses and introductions as well. Seed sources of native plants in these old agricultural fields are now rare. Natural regeneration of many of the old agricultural fields is unlikely because they are no longer near to a native seed source (Jackson and Comus 1999, pp. 243–247, 250).

It is not known to what extent the loss of certain pollinators, predators, detritivores (organisms that obtain nutrients by consuming decomposing organic matter), cryptogamic crusts (soil with crusts formed by an association of algae, mosses, and fungi; such crusts stabilize desert soil, retain moisture, and protect germinating seeds), mycorrhizae (a fungus that grows in a symbiotic association with plant roots), etc., as well as the addition of exotic species, will have on recovery of habitat. Because of these profound changes, we believe that habitat recovery, either by natural succession or through various attempts at ecological restoration, will be very limited (Jackson and Comus 1999, p. 250). The significance of this lies in the fact that many acres of pygmy-owl habitat have been lost to agricultural development, especially along valley bottoms and drainages that were important for pygmy-owls as they supported higher quality meso- and xero-riparian habitats. A well-known example of this is the huge mesquite bosque (woodland) south of Tucson on the San Xavier District of the Tohono O'odham Nation that comprised old-growth mesquites supporting cavities for pygmy-owl nests, adequate cover, and prey diversity, and which was lost due to groundwater pumping and diversion for agriculture and urban growth (Stromberg 1993, pp. 117–119). Mesquite bosques provide important pygmy-owl habitat. The viability of these bosques is dependent upon the ability of native trees, like mesquite, to reach the water table with their taproots. Only then can they grow to sizes that provide habitat for pygmy-owls. Even when abandoned and left to return to their natural state, there has been such extensive alteration of soils, drainage patterns, and contamination that these impacted bosques are unlikely to ever regain the historical habitat values. Restoration of old agricultural areas often meets with either limited success or failure.

Historically, agriculture in Sonora, Mexico, was restricted to small areas with shallow water tables, but it had, nonetheless, seriously affected riparian habitats by the end of the nineteenth century. Large-scale agriculture was introduced in the 1940s, with the construction of dams in the Rio Yaqui and Rio Mayo watersheds. By the late 1970s, the delta regions and alluvial plains of these rivers were almost entirely converted to field crops. Huge expanses of natural vegetation had been cleared. The vast mesquite forests of the Llanos de San Juan Bautista in the plains of the Rio Sonora disappeared with the development of the Costa De Hermosillo irrigation district. In the Rio Mayo and Rio Yaqui coastal plains, nearly one million ha (2.5 million ac) of mesquite, cottonwood, and willow riparian forests and coastal thornscrub disappeared after dams upriver started to operate (Burquez and Martinez-Yrizar 2007, p. 543). In 1980, a national food system was initiated and the total area under cultivation in northern Mexico increased significantly (Stoleson *et al.* 2005, p. 59).

Based upon the amount of area currently in irrigated agriculture, Sonora, with 530,000 ha (1.3 million ac), ranks second among the States in Mexico to Sinaloa (747,800 ha (1.85 million ac)), a State which is also occupied by pygmy-owls. The area equipped for agricultural irrigation in Sonora is 668,900 ha (1.65 million ac), resulting in the potential future loss of approximately 139,000 ha (343,000 ac) of natural vegetation communities (AQUASTAT 2007, p. 2) if these areas are developed for agriculture. Other Mexican States within the range of the pygmy-owl show similar potential for habitat loss. For example, in Tamaulipas, area under irrigation increased from 174,400 to 494,472 ha (431,000 to 1.22 million ac) between 1998 and 2004, with an area of 668,872 ha (1.65 million ac) equipped for irrigation. Michoacán supports 24,900 ha (61,500 ac) of irrigated lands with a potential infrastructure for 222,800 additional ha (550,600 ac). Although the amount of land converted to agriculture seems to be on the increase, we do not know where these areas are in relation to pygmy-owl habitat. Dry tropical forests on steeper slopes are not likely to be used for agricultural production. In addition, agricultural development in the States of Colima, Jalisco, Nayarit, and Nuevo Leon had substantial decreases in the amount of irrigated lands over the same period. Colima dropped from 64,100 ha (158,394 ac) to 37,800 ha (93,406 ac), Jalisco went from 161,600 ha (399,322 ac) to 95,600 ha (236,233 ac), Nayarit decreased from 55,400 ha (136,896 ac) to 43,200 ha (106,749 ac), and Nuevo Leon dropped from 143,000 ha (353,361 ac) to 32,484 ha (80,270 ac). These numbers indicate that continuing destruction of habitat for agricultural production is not occurring with the same intensity throughout the range of the pygmy-owl, and may be declining in large parts of its southern range (AQUASTAT 2007, p. 2).

Agricultural development is declining in some parts of the pygmy-owl's range, but seems concentrated in the northern portion of the range. In certain localities in northwestern Mexico, especially Sonora, it has remained the same and even increased over the past few decades. In the Sonoyta Valley of Sonora flanking Organ Pipe Cactus National Monument across the United States-Mexico border, cropland quadrupled in extent between 1977 and 1987, due in part to government-supported agricultural development. Proximity to U.S. fruit and vegetable markets, inexpensive labor, good quality water, and government agency interest in increased fruit and vegetable crops in the area mean that agricultural production and the associated descent of groundwater levels will likely continue in the future (Nabhan and Holdsworth 1998, p. 36). Some scientists surveyed noted that clearing for agriculture was becoming more severe in portions of the Lower Colorado River Valley, Central Gulf Coast, and Viscaino. Current Sonoran Desert cropland is most extensive in the border municipality of Mexicali and the extreme southern end of the Sonoran Desert where most municipalities have from one-quarter to three quarters of their land surface as cropland. The central section around Hermosillo, Sonora, is 15 to 25 percent cropland, and the rest of the area is less than 15 percent (Nabhan and Holdsworth 1998, p. 36). However, these figures do not include the millions of hectares (acres) of abandoned agricultural land. While not all the area converted for agriculture was or could be suitable pygmy-owl habitat, agricultural development has typically occurred along river bottoms and other drainages that support important riparian habitat for pygmy-owls (Flores-Villela and Fernandez 1989, p. 2). Additionally, associated habitat fragmentation exacerbates the actual impacts to available pygmy-owl habitat through loss of habitat connectivity (Stoleson et al. 2005, p. 60; Saunders et al. 1991, pp. 23–24).

Prescribed burning to reduce mesquite invasion into rangelands represents another potential threat to pygmy-owl habitat associated with agriculture. In general, improved grassland health adjacent to pygmy-owl habitat should benefit pygmy-owls through improved hydrology and enhance prey habitat. However, if woodlands providing important pygmy-owl habitat are not protected during prescribed burns, impacts to pygmy-owl habitat can be significant due to the loss of nest structures, predator and thermal cover, and prey habitat. For example, in Texas, two prescribed burns over the past 3 years have consumed 1,200 to 1,600 ha (3,000 to 4,000 ac) respectively, including areas that supported natural pygmy-owl nests, as well as pygmy-owl nest boxes (Proudfoot 2011b, p. 1). Other documented fires on the King Ranch consumed from several hundred up to 3,200 ha (8,000 ac) over this same time period (Caller 2009, NOAA 2011, Texas-Fire.com 2011, Firerescue 2008). While the loss of woodlands to fire is often a temporary impact, it can take many years for trees to reach adequate size to once again support cavities used for nesting by pygmy-owls.

Mesquite harvesting also has negative impacts on pygmy-owl habitat. Mesquite wood is a valuable commodity. Historically in Arizona, mesquite trees have been harvested for decades. In the late 1800s through the early 1900s, Arizona saw large-scale harvesting for fuel and for mining. Fuelwood cutting once had a major impact on the riparian forests, mesquite thickets, and evergreen woodlands near most of southeastern Arizona's major cities and mining centers (Bahre 1991, p. 143). This whole-scale harvest may explain the scarcity of riparian trees in early (1890) photographs of southern rivers such as the San Pedro (Stromberg 1993, p. 119). In the Sonoran Desert of Mexico, the mesquite tree is being harvested in order to fulfill the demand for mesquite charcoal, and former mesquite forests have disappeared at an alarming rate (Burquez and Martinez Yrizar 2007, p. 545). Ironwood trees are also being harvested in Mexico where the wood is cherished for its hardness and carving potential for native artwork by groups such as the Seri Indians.

Mesquite and ironwood woodlands provide pygmy-owl habitat elements related to tree canopy cover and a diverse prey base. Unfortunately, woodcutters and charcoal makers do not use scrubby-type mesquite, but rather take advantage of large, mature mesquite and ironwood trees growing in riparian areas (Taylor 2006, p. 12), the exact tree class that is of most value as pygmy-owl habitat. From the time ''mesquite charcoal'' became popular in U.S. restaurants in the early 1980s, both mesquite and ironwood have been harvested from the same lands, with as much as 15 to 40 percent of each mesquite charcoal bag consisting of ironwood prior to 1991. As a result, both trees were locally overexploited in Sonora and Baja California Sur (Taylor 2006, p. 12).

Sonora supports 1,888,000 ha (4,665,000 ac), or 46 percent of total mesquite woodlands in Mexico; more than double that of any other State in Mexico. This also means that much of the mesquite harvested in Mexico comes from Sonora (Taylor 2006, p. 12). Current estimates suggest that ironwood is being rapidly depleted across an area roughly equivalent to twice the size of Massachusetts. In northern Mexico, over 202,000 ha (500,000 ac) of mesquite have been cleared to meet the growing demand for mesquite charcoal (Haller 1994, p. 1). Haller (1994, p. 3) predicted that, if this trend continued, the entire ecosystem of the Sonoran Desert could crumble, and used the examples of the degraded ecosystem along the coast of Sonora near Kino Bay where most of the mesquite and ironwood had already been removed and virtually all plant and animal life has disappeared. Declining tree populations in the Sonoran Desert as a result of commercial uses and land conversion threatens other plant species, and may alter the structure and composition of the vertebrate and invertebrate communities as well (Bestelmeyer and Schooley 1999, p. 644). This has implications for pygmy-owl prey availability because pygmy-owls rely on a seasonal diversity of vertebrate and invertebrate prey species; loss of tree structure and diversity reduces prey diversity and availability.

In the Sonoyta region of Sonora, an area occupied by pygmy-owls, more than 193,000 ha (478,000 ac) have been affected by deforestation related to charcoal production, brick foundries, tourist crafts, and pasture conversion (Nabhan and Suzan 1994, p. 64). The accelerated rate of legume tree (trees belonging to the family *Leguminosae* whose characteristic fruit is a seed pod, including the mesquite and ironwood) depletion for charcoal and carvings in the Mexican States of Sonora and Baja California has clearly affected the health of ironwood populations and associated plant communities (Suzan *et al.* 1997, p. 955). This is evidenced by an increased number of damaged and dying trees, as well as generally small size classes for sampled areas (Suzan *et al.* 1997, pp. 950–955).

Pressure for fuelwood and crafts materials has been so intense in Mexico south of Organ Pipe Cactus National Monument that wood harvest, especially ironwood, has been detected more than 500 m (1600 ft) into the Monument as supplies have been depleted south of the border (Suzan *et al.* 1999, p. 1499). The structure of both wash and upland habitats in the Monument have been affected by this harvest (Suzan *et al.* 1999, p. 1499). Organ Pipe Cactus National Monument is one of four areas in Arizona that has been consistently occupied by pygmy-owls. In the arid environment of the Monument, tree canopy and structure are particularly important pygmy-owl habitat features.

Mesquite used as fuelwood is a thriving cross-border trade, although not on the same scale as charcoal. However, local impacts can be significant in the areas where the fuelwood is harvested. For example, Mexican trucks loaded with mesquite cross the border to Arizona at Sasabe. Interviews with these truck drivers indicated that most of the wood they haul comes from ejidos (communally owned lands) within a 20-km (12.4-mi) radius of the Town of Sasabe, an area occupied by nesting pygmy-owls (Taylor 2006, p. 5; Flesch 2008, p. 2).

In 2008, during field work in Sonora to gather pygmy-owl genetic samples, large areas of charcoal production were observed near Hermosillo. Impacts to vegetation were not limited to just the removal of the trees, but a significant area around the production sites was covered with fine, black charcoal dust covering all native vegetation (Service 2009, p. 1). The effects of these production areas are verified by reports of the complete removal of a dense mesquite bosque to the axe and charcoal pits just east of Hermosillo (Taylor 2006, p. 5). The immediate area around charcoal pits is often treeless. Walking transects away from charcoal pits revealed that all trees within a 1-km (0.6-mi) radius bear the scars of the chainsaw (Taylor 2006, p. 7).

Native woodlands in Sonora are additionally threatened as ranchers and charcoal producers team up to first clear the land of native trees for planting buffelgrass, and then use the dead trees to produce charcoal (Taylor 2006, pp. 6–7). The end result is the incentive to clear more native woodlands. Professional woodcutters are only permitted to harvest dead wood. However, dead wood to meet export demands is hard to come by. A simple solution practiced by many wood cutters is to ring trees and let them die; then the dead wood can be legally harvested (Taylor 2006, p. 7).

Impacts to pygmy-owl habitat in northwestern Mexico from these activities are resulting in the loss and fragmentation of habitat in this part of Mexico, and the inability to recover or restore habitats and habitat connectivity in Arizona. Impacts related to surface- and groundwater loss and channel diversions are long-term and are particularly significant as riparian habitat, both meso- and xero-riparian, are crucial for maintaining viable pygmy-owl populations in the arid portions of their range in Arizona and Sonora, Mexico. Loss of leguminous trees results in long-term effects to the soil as they add organic matter, fix nitrogen, and add sulfur and soluble salts, affecting overall habitat quality and quantity (Rodriguez Franco and Aguirre 1996, p. 6–47). Ironwood and mesquite trees are important nurse species for saguaros, the primary nesting substrate for pygmy-owls in the northern portion of their range (Burquez and Quintana 1994, p. 11). Demand for mesquite charcoal and firewood contributes to the loss of extensive, mature mesquite forests in riparian areas of northern Mexico.

The harvest of mature mesquites in the Sonoran Desert for charcoal and firewood permanently alters desert ecosystems because leguminous trees like mesquite and ironwoods are such important anchors for these systems and their associated flora and fauna (Taylor 2006, p. 8). Thus, ongoing wood harvesting can reduce or eliminate pygmy-owl habitat in the Sonoran Desert region of Arizona and Mexico by perpetuating scrubby trees that are unsuitable for nest substrates, supporting increased fire frequency associated with nonnative grass invasion, eliminating important nurse trees for saguaro protection, reducing tall canopy coverage important for pygmy-owl cover, and altering prey availability through the reduction of structural diversity.

Once common in areas of the Rio Grande delta, significant habitat loss and fragmentation due to woodcutting have now caused the pygmy-owl to be a rare occurrence in this area of Texas. Oberholser (1974, p. 452) concluded that agricultural expansion and subsequent loss of native woodland and thornscrub habitat, begun in the 1920's, preceded the rapid demise of pygmy-owl populations in the Lower Rio Grande Valley of southern Texas. Because much of the suitable pygmy-owl habitat in Texas occurs on private ranches, habitat areas are subject to potential impacts that are associated with ongoing ranch activities such as grazing, herd management, fencing, pasture improvements, construction of cattle pens and waters, road construction, and development of hunting facilities. Brush clearing, in particular, has been identified as a potential factor in present and future declines in the pygmy-owl population in Texas (Oberholser 1974, p. 452). However, relatively speaking, the current loss of habitat is much reduced in comparison to the historic loss of habitat in Texas. Conversely, ranch practices that enhance or increase pygmy-owl habitat to support ecotourism can contribute to conservation of the pygmy-owl in Texas (Wauer *et al.* 1993, p. 1076). The best available information does not indicate that current ranching practices are significantly affecting pygmy-owl habitat in Texas.

Tamaulipan brushland is a unique ecosystem that is found only in the Lower Rio Grande Valley of south Texas and northeastern Mexico. This vegetation community has historically supported occupancy by pygmy-owls. Brush clearing, pesticide use, and irrigation practices associated with agriculture have had detrimental effects on the Lower Rio Grande Valley (Jahrsdoerfer and Leslie 1988, p. 1). Since the 1920's, more than 95 percent of the original native brushland in the Lower Rio Grande Valley has been converted to agriculture or urban use. Along the Rio Grande River below Falcon Dam, 99 percent of the land has been cleared for agriculture and development. Cook *et al.* (2001, p. 3) indicated that both banks of the Rio Grande are now completely developed with homes or farms, and that the only remaining natural habitat areas south of the river are salt marshes and mudflats, both communities that are not used by pygmy-owls. A large percentage of similar habitat has been cleared in Mexico (Jahrsdoerfer and Leslie 1988, p. 17). This is supported by Tewes' (1992, p. 29) conclusion that most of the Rio Grande delta of Texas and Mexico has been developed over the past 60 years. Hunter (1988, p. 8) states, ''Habitat removal in Mexico is widespread and nearly complete in northern Tamaulipas.''

Habitat fragmentation in northeastern Mexico is extensive, with only about two percent of the ecoregion remaining intact, and no habitat blocks larger than 250 square km (96.5 square mi), and no protected areas (Cook *et al.* 2001, p. 4). This has the potential to limit pygmy-owl movements and dispersal, exacerbating the effects of small, isolated populations. Fire is often used to clear woodlands for agriculture in this area of Mexico, and many of these fires are not adequately controlled. There may be fire-related effects to native plant communities (Cook *et al.* 2001, p. 4); however, there is no available information of how much area may be affected by this activity.

The best available scientific and commercial information indicates that historical land clearing, as a result of wood harvesting and agricultural development has caused the loss and alteration of a considerable area of pygmy-owl habitat in Arizona, Sonora, Texas, and northeastern Mexico. Past impacts continue to affect the extent of available pygmy-owl habitat in these areas, because of the extended time it takes for these lands to recover, even if negative actions cease, and impacts are expected to continue in many of these same areas into the foreseeable future. However, based on our review of the best available scientific and commercial information, we conclude that these impacts are limited in magnitude, because they are significant only in the northern portion of the range (Arizona, Texas, northwestern and northeastern Mexico). Moreover, the best available scientific and commercial data indicate that habitat loss due to woodcutting or agriculture is primarily historical in Texas, and these activities are not currently impacting habitats occupied by pygmy-owls on the private ranches in Texas. Further, the impacts in the southern portion of the range are less extensive, both because woodcutting and agricultural development appear to have less impact in the southern portion of the pygmy-owl's range, and because the pygmy-owl seems to be common throughout this area. Therefore, after reviewing and evaluating the best available scientific and commercial data, we conclude that woodcutting and agricultural development are not threats to the continued existence of the pygmy-owl rangewide, and are not likely to become so in the future.

Improper Livestock Grazing

Probably no single land use has had a greater effect on the vegetation of southeastern Arizona or has led to more changes in the landscape than improper livestock grazing and range-management programs (Carothers 1977, p. 4). Undoubtedly, grazing since the 1870s has led to soil erosion, destruction of those native plants most palatable to livestock, changes in the regional fire ecology, the spread of both native and alien plants, and changes in the age structure of evergreen woodlands and riparian forests (Bahre 1991, p. 123). Many areas of pygmy-owl habitat have recovered from these historical effects of grazing; however, other areas are slow to recover and may never recover due to the arid nature of the Sonoran Desert.

Livestock grazing in northwestern Mexico is probably the most widespread human use of Sonoran ecoregional landscapes. Grazing by cattle, goats, and other livestock has reduced vegetation cover and helped change grasslands to shrublands. Livestock grazing in the Sonoran Desert has fluctuated greatly in the last few centuries from being relatively confined and intensive to being extensive and intensive. In the 19th century, repeated Apache raids on ranchers and the paucity of water limited cattle production to relatively small areas (Bahre 1991, pp. 114–115). However, the late 19th century saw the largest stocking rates in history; extensive cattle production played a major role in the transformation of grasslands to scrublands, down-cutting of arroyos, the spread of nonnative plants, and degradation of riparian areas. Stocking rates are now much lower than in the 1890s because regulations such as those of the Taylor Grazing Act of 1934 helped improve rangeland quality in the United States. However, overstocking still continues in parts of northwestern Mexico, and Mexico's COTECOCA (Comisión Técnico Consultiva de Coeficientes de Agostadero) statistics confirm that 2 to 5 times the recommended stocking rates occur with regularity on the Sonoran side of the border (Walker and Pavlakovich Kochi 2003, p. 14; Nabhan and Holdsworth 1998, p. 2).

Available information on livestock grazing in Mexico that we evaluated was focused primarily on the border areas adjacent to the United States and in the arid areas of northwestern Mexico, such as Sonora. In Sonora, rangelands are often heavily grazed, with effects particularly apparent during drought (Rorabaugh 2008, p. 25). Sonora's higher stocking rate is likely due to its greater amounts of private and ejidal (communal) land, less regulation, and the greater dependence on ranching and farming in Mexico. Demand in North America drives the number of cattle in Sonora. The number of cattle in Sonora nearly doubled between 1950 and 1960. The Sonoran cattle population was 1,652,771 in 1990 according to official government statistics (Hawks 2003, p. 5). Other authors estimate the overstocking at 177 percent (Lopez 1992), with 60 to 400 percent overstocking in some areas (Burquez-Montijo *et al.* 2002, p. 134). Excessive grazing of vegetation by livestock, especially when combined with conversion of plant cover to exotic pasture grasses, ranked as number four on a list of threats to the Sonoran Desert Ecoregion (Nabhan and Holdsworth 1998, p. 1).

One research study showed that overgrazing in Sonora leaves the Mexican landscape more exposed and, as a result, it dries out more rapidly following summer convective precipitation. After about 3 days, depletion of soil moisture evokes a period of higher surface and air temperatures in northwestern Mexico (Bryant *et al.* 1990, pp. 254–258). These drier soils and higher temperatures can result in impacts to vegetation survival and persistence. Effects of poorly managed livestock grazing in Sonora include changes in plant species composition and vegetation cover and structure, soil compaction, erosion, altered fire regimes, and nonnative plant species introductions and invasions (Stoleson *et al.* 2005, pp. 61–62). With regard to pygmy-owl habitat, improper stocking rates can result in reduced saguaro reproduction through trampling and alteration of microclimates (Abouhaider 1989, pp. 40–48), reduced tree cover and reproduction through grazing of seedlings and seed pods, and impacts to prey availability from reduced vegetation structural diversity and species composition.

One of the most significant adverse impacts within western riparian systems has been the perpetuation of improper grazing practices. Belsky *et al.* (1999, p. 419) found that grazing by livestock has damaged 80 percent of the streams and riparian ecosystems in the arid regions of the western United States. The initial deterioration of western riparian systems began with the severe overgrazing in the late nineteenth century. Livestock grazing can affect four general components of riparian systems: (1) Streamside vegetation; (2) stream channel morphology; (3) shape and quality of the water column; and (4) structure of streambank soil. Vegetation impacts include: (1) Compaction of soil, which increases runoff and decreases water availability to plants; (2) herbage removal, which allows soil temperatures to rise, thereby increasing evaporation; (3) physical damage to vegetation by rubbing, trampling, and browsing; and (4) alteration of growth form of plants by removing terminal buds and stimulating lateral branching (Fleischner 1994, p. 635).

In a summary of studies investigating the impacts of livestock grazing on riparian areas, Belsky *et al.* (1999, p. 425) found that none of the studies showed positive impacts or ecological benefits that could be attributed to livestock activities when grazed areas were compared to protected areas. It was mostly negative effects that were reported, and there was little debate about those effects. Most of these studies tended to agree that improper livestock grazing can damage stream and riparian ecosystems. All types of riparian habitats provide important pygmy-owl habitat elements due to the increased size, diversity, and structure associated with riparian communities and enhanced moisture availability. Larger trees provide substrates for nest cavities. Structure diversity provides important predator and thermoregulatory cover, as well as an increased number and diversity of prey species. A reduction of the extent or quality of riparian habitats within the range of the pygmy-owl represents direct impacts on the availability and quality of pygmy-owl habitat.

Although proper management has greatly improved riparian communities in some areas, field data compiled in the last decade showed that riparian areas throughout much of the West were in the worst condition in history due mainly to the complications initiated by improper grazing techniques (Krueper 1993, p. 322). However, information submitted during the public comment period supports the idea that, in certain areas, riparian habitat has returned and, perhaps, even increased in certain areas in Arizona, including areas that are being grazed by livestock. Parker (2008, p. 13) points out that Webb *et al.* (2007, pp. 388–389, 404–408) conclude that, in the drainages they studied, increases in riparian vegetation from 24 percent to 49 percent had occurred since the late 1800s and early 1900s, and that increases in the density of riparian plants appear to have accelerated in the 1970s. We are encouraged by this positive information indicating that riparian habitats in some areas may become suitable for pygmy-owls in the future if grazing continues to be properly managed. It is not our contention that grazing per se has a negative effect on riparian areas, but that improper or overgrazing can have detrimental effects. Parker (2008, p. 14) reiterates this by stating, ''While there is little question that overgrazing can degrade riparian ecosystems, the question here is whether grazing has had long-term negative effects on woody riparian vegetation in Arizona.'' We acknowledge that, with proper management, riparian areas can recover and provide habitat for the pygmy-owl.

In Mexico, increasing human population numbers and the extent of subsistence agriculture threatens the future of Mexico's extensive riparian systems. Grazing impacts include contamination and an increasing demand for agricultural and forage production (Deloya 1985, pp. 9–11). Riparian destruction is evident throughout Mexico, but especially in areas of denser human population. Of particular relevance to the pygmy-owl has been the loss and destruction of virtually all of the dense woodlands within the Rio Grande River valley. Despite the evident destruction of riparian systems, little information exists on the problem and there is apparently no strategy at a national level to solve the problem. The present trends pose serious concerns for the future of Mexico's riparian ecosystems (Deloya 1985, pp. 11–12).

In Texas, areas occupied by pygmy-owls are primarily on large, private ranches where livestock production is a primary objective. However, alternative sources of revenue for these ranches also include hunting and ecotourism. As a result, habitat management for the benefit of wildlife is also a high priority for these ranchers. Livestock management is often conducted with consideration of impacts to wildlife.

Pygmy-owls are known to exist in areas that are grazed. Grazing, itself, does not appear to negatively affect pygmy-owls. Properly managed grazing can enhance certain pygmy-owl habitat elements (Loeser *et al.* 2007, p. 96; Holechek *et al.* 1982, p. 208). Climatic variation is important in determining the ecological effects of grazing practices in arid rangelands (Loeser *et al.* 2007, pp. 93–96). However, improper grazing at inappropriate stocking rates or during seasons or years when drought and other conditions reduce forage availability can affect pygmy-owls directly through the loss of important habitat elements (e.g., saguaros, tree cover, riparian vegetation, vegetation reproduction) and prey availability. No studies specifically related to the effects of livestock grazing on pygmy-owls have been conducted; however, impacts to pygmy-owls can be determined indirectly from studies on related species or issues. For example, studies in Arizona and Sonora show that the number of lizard species and abundance of lizards declined significantly in heavily grazed areas (Jones 1981, p. 111); there is also a likely loss of lizard species in areas invaded by buffelgrass. Lizards are an important food resource for pygmy-owls; therefore, impacts to lizard abundance can affect pygmy-owls.

An additional concern related to grazing lands is that, faced with rising land prices, unstable markets, and unpredictable climate, many ranchers in the United States are choosing or are forced to sell their private lands to real estate developers or subdivide it themselves. This results in these lands being subject to the threats described above related to urbanization. There was no available information to determine if these same pressures apply to grazing lands in Mexico.

Improper livestock grazing has a negative impact on pygmy-owl habitat under some circumstances in Arizona and Sonora. While we expect that continued implementation of improved grazing-management techniques will reduce grazing impacts on pygmy-owls in Arizona and Texas, we expected that overgrazing will continue to negatively impact pygmy-owls in Sonora and other parts of northern Mexico. Within the Sonoran desert, over grazing can result in loss of structural habitat components important to pygmy-owls, as well as reducing prey availability and diversity. Additionally, improper grazing during droughts can affect the long-term viability of riparian habitats, which are an important habitat type for pygmy-owls in Arizona and Sonora. However, there is no indication that livestock grazing precludes occupancy by pygmy-owls in any part of its range. While improper livestock grazing can have negative impacts to local pygmy-owl populations, we do not believe livestock grazing is significantly affecting pygmy-owl populations throughout its range. The best available scientific and commercial information does not appear to indicate that improper grazing is affecting pygmy-owl populations in Texas. We have no readily-available information to determine whether the effects of livestock grazing on pygmy-owl habitat in Mexico outside of Sonora are greater or more harmful than in Arizona and Sonora, but we suspect impacts are similar. Based on the best available scientific and commercial data, we conclude that improper livestock grazing is not a threat to the continued existence of the pygmy-owl rangewide, nor is it likely to become so.

Border Issues

One of the most pressing issues for the Arizona-Sonora border is the impact of illegal human and vehicular traffic through these unique and environmentally sensitive areas. Many of these locations now bear the scars of wildcat trails, abandoned refuse, and trampled vegetation (Marris 2006, p. 339; Walker and Pavlakovich-Kochi 2003, p. 15). Monitoring activities by the U.S. National Park Service (NPS) estimate that, annually, 300,000 individuals illegally cross through Organ Pipe Cactus National Monument in southwestern Arizona. Video surveillance equipment erected at Coronado National Memorial, in southeastern Arizona, indicates traffic volumes ranging from 100 to 150 immigrants per night (Walker and Pavlakovich-Kochi 2003, p. 15). In the Cabeza Prieta National Wildlife Refuge, located in southwestern Arizona, which supports resident pygmy-owls, there are over 640 km (400 mi) of illegal roads plus another 1,280 km (800 mi) of unauthorized foot trails as a result of illegal border activities (Cohn 2007, p. 96). These activities result in direct impacts to pygmy-owl habitat.

Additional information from the NPS indicates a significant issue ''* * * is the increasing drug smuggling, illegal immigrants, and law enforcement activity which results in much greater human disturbance of the birds.'' Further elaboration shows that the NPS believes ''* * * that cactus ferruginous pygmy-owls within the Monument have been subject to repeated disturbance events and some habitat degraded as a result of long-term drought and impacts associated with illegal migration, drug smuggling, and law enforcement interdiction efforts'' (Snyder 2005, pp. 1–3). Trails and roadways remove pygmy-owl habitat features, noise and disturbance from people and vehicles disrupt important behaviors, and there is an increased risk of fire in important habitats resulting from cooking and warming fires, as well as signal fires used by cross-border immigrants and smugglers. Areas occupied by pygmy-owls in Organ Pipe Cactus National Monument have been abandoned by the owls, likely due, at least in part, to heavy illegal immigrant traffic and associated enforcement actions.

There is fear that efforts to curb illegal border activities through the construction of infrastructure such as fences and barrier will fragment the Sonoran Desert ecosystem, damage the desert's plant and animal communities, and prevent free movement of wildlife between the United States and Mexico (Cohn 2007, p. 96). During the time the pygmy-owl was listed under the Act, we consulted on the effects of Federal border infrastructure projects and identified a number of potential impacts (Service 2003, pp. 66–85). The construction of new border infrastructure in the form of pedestrian fences, vehicle barriers, and patrol roads create impediments to pygmy-owl movement across the border due to pygmy-owl flight patterns and behavior (Marris 2006, p. 239; Vacariu 2005, p. 354). The fences and vehicle barriers, when considered in conjunction with patrol roads, drag roads, and vegetation removal, result in a combination of nonvegetated area with a raised structure in the middle causing an impediment to pygmy-owl movement, particularly given their normal flight patterns, where normal flights are generally less than 30 m (100 ft) and typically only 1.5 to 3.0 m (5 to 11 ft) above the ground (Flesch and Steidl 2007, p. 35; AGFD 2008b, p. 5). Flesch *et al.* (2009, pp. 7–9) show that the vegetation gaps, in association with the tall fences, may limit transboundary movements by pygmy-owls. Raptors are often attracted to artificial hunting perches, especially in areas that lack tall trees (Oles 2007, p. 1; Heintzelman 2004, p. 35; Askham 1990, p. 147). Border fences can provide open hunting areas and improved hunting perches for a variety of raptors that are potential predators of pygmy-owls. This combination of perches, open area, and an impediment to movement may result in increased predation of pygmy-owls, particularly dispersing juvenile pygmy-owls. Because the overall population of pygmy-owls likely functions as a metapopulation, the pygmy-owl depends on dispersal, emigration, and immigration to maintain the genetic and demographic fitness of regional populations. To the extent that border infrastructure and activities reduce or prevent such movements, and increase the likelihood of pygmy-owl predation, it follows that population-level impacts may result.

Impacts to pygmy-owls from border infrastructure and illegal activities are likely limited to the immediate border areas of Arizona and northern Sonora. Information was not readily available so that we could determine the extent of these impacts in Texas and northeastern Mexico, although they are likely to be similar (habitat gaps, perches for raptors, *etc.*). Nevertheless, these impacts are restricted to the border regions of Arizona and Texas, and only affect a relatively-small portion of the pygmy-owl range. This localized effect reduces the magnitude of this impact to the overall pygmy-owl population. Therefore, based on the best available scientific and commercial data, we conclude that effects associated with border activities are not a threat to the continued existence of the pygmy-owl rangewide, and are not likely to become so in the future.

Off-Highway Vehicle (OHV) Use

The information we have on impacts to the pygmy-owl from OHV use relates primarily to Arizona. Information was not readily available on any potential OHV impacts to pygmy-owls or pygmy-owl habitat in Texas and Mexico.

OHV use is widespread in Arizona and occurs on lands under a variety of management entities including the Forest Service, Bureau of Land Management, State Land Department, Tribes, and private individuals. The use of OHVs has grown considerably. For example, as of 2007, 385,000 OHVs were registered in Arizona (a 350 percent increase since 1998) and 1.7 million people (29 percent of Arizona's population) engaged in off-road activity from 2005 to 2007 (Sacco 2007). Over half of OHV users reported that merely driving off the paved road was their primary activity, versus using the OHV for the purpose of seeking a destination to hunt, fish, or hike (Sacco 2007). Specific impacts to the pygmy-owl or its habitat from OHV use when driving off road include disturbance from noise and human activity, vegetation damage, changes in plant abundance and species composition, reduced habitat connectivity, soil compaction, soil erosion, reduced water infiltration, higher soil temperatures, destruction of cryptogamic soils (soil with crusts formed by an association of algae, mosses, and fungi; such crusts stabilize desert soil, retain moisture, and protect germinating seeds), and increased fire-starts (Boarman 2002, pp. 46–47; Ouren *et al.* 2007, pp. 6–7, 11, 16).

Of specific concern is the regular use by OHV operators to utilize xero-riparian washes as travel ways. These washes provide important habitat elements for pygmy-owls due to the increased structure and productivity of vegetation resulting from the presence of increased moisture. Pygmy-owls use these wash areas for foraging, dispersal, thermal and predator cover, and for movements within their home range. Wash areas are often narrow and constrained, resulting in OHV impacts to vegetation and concentrated noise and disturbance, affecting the use and suitability of these areas as pygmy-owl habitat.

Pygmy-owls may be affected by OHV use in riparian areas. However, this effect is temporary and not continuous. Pygmy-owls may leave the area if disturbed by noise and return once the activity has ceased. Pygmy-owl habitat destruction in Arizona may result from OHV activity, but the magnitude and severity of this impact is relatively minor. Based on our evaluation of the best available scientific and commercial data, we conclude that OHV use does not threaten the continued existence of pygmy-owl, and is not likely to do so in the future.

Summary of Factor A

In summary, pygmy-owls require habitat elements such as mature woodlands that include appropriate cavities for nest sites, adequate structural diversity and cover, and a diverse prey base. A number of negative impacts described in Factor A are affecting pygmy-owl habitat within portions of its range. However, the best available scientific and commercial information indicates that most of these impacts are either restricted to or are greater in a smaller subset of the pygmy-owl's range (approximately 27 percent). For instance, we have detailed information that in the Arizona and Sonoran Desert Ecoregion, pygmy-owl habitat loss and fragmentation resulting from urbanization, changing fire regimes due to the invasion of buffelgrass, agricultural development and woodcutting, overgrazing, and border issues have had significant negative impacts on pygmy-owl habitat in these areas and will likely continue to do so to varying degrees in the foreseeable future. In Texas, which comprises approximately five percent of the pygmy-owl's range, historical loss of habitat has reduced the pygmy-owl range, but current impacts, such as livestock grazing and the invasion of nonnative plants, are reduced in their magnitude and severity.

For the larger part of the pygmy-owl's ranger in Mexico (the remaining 73 percent south of Sonora), the best available data indicates that many impacts to pygmy-owl habitat are reduced in their magnitude and severity or absent altogether. The rate of growth in these southern Mexican States is relatively slow compared with growth in Sonora and the Arizona border region and is expected to remain that way. Agricultural development has decreased in these areas, and buffelgrass is not a known threat to pygmy-owl habitat in this area and is not expected to become a threat in the future because of unfavorable growth conditions for buffelgrass. Historical loss of pygmy-owl habitat in northeastern Mexico has occurred, but there is no available evidence that significant habitat destruction is currently taking place. In addition, pygmy-owls are still considered common in the southern portion of their range. This information indicates that the negative impacts to pygmy-owl habitat discussed herein have different levels of effects on the populations of pygmy-owls throughout their range, and are much reduced or absent in the southern portion of the pygmy-owl's range. Based on the best available scientific and commercial information, we conclude that the present or threatened destruction, modification, or curtailment of its habitat or range is not a threat to the pygmy-owl rangewide now or in the foreseeable future.

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

We are unaware of any overutilization of pygmy-owls for commercial, scientific, or educational purposes. However, the pygmy-owl is highly sought after by birders, who concentrate at several of the remaining known locations of pygmy-owls in the United States. For example, in 1996, a resident in Tucson reported a pygmy-owl sighting (documented pair) that subsequently was added to a local birding hotline, and the location was added to their website on the internet. Several carloads of birders were later observed in the area of the reported location (AGFD 1999, p. 12). As recently as 2003, property owners in Tucson have expressed concerns that birders and others have been documented trying to get photos or see pygmy-owls at occupied sites (AGFD 2003, p. 1).

In Texas, Tewes (1992, p. 28) states, ''Frequent disruption by well-intentioned bird enthusiasts with call imitations may produce a local risk to the pygmy-owls, especially during breeding season.'' We believe this disturbance problem is most significant in southern Texas. Oberholser (1974, p. 452) made a similar observation: ''They [pygmy-owls] are considerably disturbed by hordes of bird watchers, some of whom keep their portable tape recorders hot for hours at a time in hopes that one of these rare birds will answer.'' Recreational disturbance of pygmy-owls in Texas is particularly an issue in the side patches of mesquite, ebony, and cane in Starr and Hidalgo Counties (Oberholser 1974, p. 452). Oberholser (1974, p. 452) and Hunter (1988, p. 6) suggest that recreational birding may disturb pygmy-owls in highly visited areas, affecting their occurrence, behavior, and reproduction. Tewes (1992, p. 12) indicates that many amateur and professional ornithologists have strictly controlled or eliminated their use of taped calls to locate pygmy-owls because of the potential to affect the pygmy-owl's behavior.

Currently, a number of ranches in Texas offer the opportunity to view and photograph pygmy-owls. An internet search revealed invitations to birders to view pygmy-owls on the Canelo, King, and San Miguelito ranches. Additionally, both the AGFD and the Service continue to get requests to view and photograph pygmy-owls in Arizona.

Summary of Factor B

In summary, impacts to pygmy-owls from over-zealous birdwatchers have been documented in some areas within the range of the pygmy-owl. While pygmy-owls continue to be a highly sought after species by birders, there is some indication that compliance with etiquette related to use of tape-playback or call imitation has improved. We were unable to find any information on the effects of birding on pygmy-owls in Mexico, but we do not believe that it is a significant issue in Mexico, except perhaps on local ranches or ejidos where ecotourism and bird watching are promoted. While the above impacts may negatively affect individual pygmy-owls on a local basis, landowners in areas that promote ecotourism are also likely to implement actions that have positive effects for the pygmy-owl. We conclude, based upon our review of the best commercial and scientific data available, that overutilization for commercial, recreational, scientific, or educational purposes is not a threat to the pygmy-owl now or likely to become so.

Factor C: Disease or Predation

Documentation of disease or predation as a significant mortality factor within a wildlife population requires extensive monitoring and the ability to observe individuals in hand. With regard to pygmy-owls, monitoring and capture has only occurred with any regularity in Arizona and Texas within the United States. This has included the capture of hundreds of individual pygmy-owls and subsequent monitoring using radio telemetry. Consequently, all of the available information on disease and predation is from Arizona and Texas. We are aware of only limited, anecdotal information related to predation for northwestern Mexico (Flesch 2010, pers. comm.). The following discussion outlines our evaluation of the information related to disease and predation that we have available from Arizona and Texas.

Little is known about the rate or causes of mortality in pygmy-owls; however, they are susceptible to predation from a wide variety of species. Recent research indicates that natural predation likely plays a key role in pygmy-owl population dynamics, particularly after fledging and during the postbreeding season (AGFD 2003, p. 2). AGFD telemetry monitoring in 2002 indicated at least three of the nine young produced that year were killed by predators prior to dispersal during a year when tree species failed to leaf out due to drought conditions (AGFD 2003, p. 2). Increased predation during a particularly harsh drought year (2004) in Arizona prompted a rescue effort by the AGFD and the Service during which two hatch-year pygmy-owls were temporarily brought into captivity to increase their chances of survival. They were subsequently released when habitat conditions improved (Service 2004, p. 1). Pygmy-owl predation by screech owls has been identified as a potential factor contributing to the decline of regional pygmy-owl population groups (AGFD 2008b, p. 9). However, there is not enough information to conclusively support this hypothesis. Predation is a significant pygmy-owl nest mortality factor associated with nest boxes and tree cavities in Texas. Proudfoot (2011a, p. 1) indicates that predation rates on natural cavities and unprotected nest boxes have been as high as 40 to 60 percent, with an average of 25 to 30 percent.

Domestic cat predation of pygmy-owls has been documented in both Texas and Arizona (AGFD 2003, p. 1; Proudfoot 1996, p. 79). Human population growth can increase the numbers of subsidized predators, such as household cats, that can affect pygmy-owl populations. As the number of potential predators increases, the chance of predation on pygmy-owls increases. In addition, domestic house cats consume considerable quantities of birds, reptiles, insects, and small mammals, reducing available pygmy-owl prey availability (Barratt 1995, p. 185; Coleman *et al.* 1997, p. 2; Evans 1995, p. 4). This introduction of additional potential predators and a reduction in prey availability negatively affects pygmy-owls.

Ectoparasites have recently been identified as a potential threat to pygmy-owl populations (Proudfoot *et al.* 2005, pp. 186–187; Proudfoot *et al.* 2006c, pp. 874–875). These recent investigations in Texas and Arizona have indicated the regular occurrence of avian parasites in the materials inside of pygmy-owl nest cavities. The numbers of parasites may be high enough to affect nestling pygmy-owl health and survival. Blood parasites have been implicated in reduced body condition and impacts to survival and dispersal in small raptors (Dawson and Bortolotti 2000, pp. 3–5). Proudfoot *et al.* (2005, pp. 186–187) could not rule out that blood loss from external parasites, in combination with other factors, may have contributed to the loss of an entire clutch of pygmy-owls in Arizona.

The West Nile virus has been identified as the cause of a number of raptor mortalities throughout the United States, including Arizona. A number of North American owl species have documented mortality from West Nile virus, including the northern pygmy-owl (Gancz *et al.* 2004, p. 2139). However, the West Nile virus has not been documented in cactus ferruginous pygmy-owls in either the United States or Mexico, and no pygmy-owl mortalities have been suspected to be the result of an infection with the West Nile virus.

Summary of Factor C

In summary, our review of the best available information suggests that disease and predation clearly have the potential to affect pygmy-owl individuals and populations, and have done so in local populations. However, information related to these factors is limited to pygmy-owl populations in the United States. We have only limited, anecdotal information related to predation on pygmy-owls in Mexico. Even in the United States, where predation has been documented, we conclude that it is not resulting in significant effects to the status of the pygmy-owl, because no disease or predation effects have been identified as having population-level effects on pygmy-owls. Based upon our review of the best commercial and scientific data available, we conclude that disease and predation are not threats to the pygmy-owl now or in the future.

Factor D: Inadequacy of Existing Regulatory Mechanisms

Regulations that could potentially address conservation of the pygmy-owl or pygmy-owl habitat in both the United States and Mexico may occur at a number of different levels of government, from Federal to local. The following discussion addresses the existing regulatory mechanisms related to the conservation of pygmy-owls and pygmy-owl habitat based on the best available information.

Although the pygmy-owl in Arizona is considered nonmigratory, it is protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703–712). The MBTA prohibits ''take'' of any migratory bird; however, unlike take under the Endangered Species Act, some Federal courts have concluded that the MBTA does not apply to indirect forms of take such as habitat destruction, unless direct mortality or destruction of an active nest occurs during the activity that causes the habitat destruction. Other Federal and State regulations and policies, such as the Clean Water Act, the Department of Defense's Integrated Natural Resources Management Plans (Barry M. Goldwater Range) (Uken 2008, p.1), National Park Service policy, the inclusion of the pygmy-owl on the State of Arizona's list of Species of Special Concern (AGFD 1996, p. 15), and various municipal planning documents (Oro Valley 2008, p. 1) provide varying levels of protection, but have not been effective in protecting the pygmy-owl in Arizona from further decline. As a result of the implementation of the 2005 Real ID Act, the U.S. Department of Homeland

Security has waived application of the Endangered Species Act and other environmental laws in the construction of border infrastructure, including areas occupied by the pygmy-owl (73 FR 5271). Some local conservation mechanisms, such as habitat conservation plans, are in development in southern Arizona. These plans include conservation measures for pygmy-owls, but are at least a year from completion, and as drafts, do not afford the pygmy-owl any level of protection or conservation (although some pygmy-owl habitat has been conserved through acquisitions related to these plans). There are currently no statutory or regulatory provisions under Arizona law addressing the destruction or alteration of pygmy-owl habitat.

One member of the public provided information indicating that, because the current distribution of pygmy-owls occurs primarily on lands under Federal, State, or Tribal control, these lands are not at risk for the primary threats that have been identified (James 2008, p. 8). However, activities occur on all these lands that can result in all of the negative impacts to pygmy-owls identified in our 90-day finding and this document. None of these types of lands are immune to or restricted from impacts of facilities development, nonnative invasive species, changing fire regimes, drought, climate change, wood harvesting, bird watching, avian disease and predation, border issues, or any of the other impacts discussed above. In fact, it is on these very lands that many of these impacts, such as border issues, nonnative species invasions, fire, and recreation are concentrated. As discussed above, existing regulations governing these lands do not specifically protect pygmy-owls or their habitats, particularly absent protection under the Act.

A potential regulatory effect not specifically related to protection of the pygmy-owl, but which will affect our ability to conserve the pygmy-owl, has recently come to light with regard to Arizona State Trust lands. The Arizona State Land Department is considering restricting access to State Trust Lands for the purposes of conducting wildlife studies. Such access restrictions might prohibit further surveys, research, and monitoring of pygmy-owls on State Trust lands, due to new permit requirements and substantial cost. This has not been formally adopted and may be changed prior to finalization (Latimer 2010, p. 1). However, if implemented as described by Latimer (2010, p. 1), these proposed procedures and fees would likely limit pygmy-owl research on State Trust lands because of our and other biologists' inability to meet the requirements or pay the fees. This would have a substantial negative effect on our ability to conserve pygmy-owls within Arizona.

The State of Texas lists the pygmy-owl as threatened (TPWD 2009, p. 1). This designation requires permits for take of individuals for propagation, zoological gardens, aquariums, rehabilitation purposes, and scientific purposes (Texas Parks and Wildlife Code Chapters 67 and 68; Texas Administrative Code Sections 65.171–65.176, Title 31). There are no provisions for habitat protection. The pygmy-owl is also on the Texas Organization for Endangered Species (TOES) ''watch list,'' but this list provides no regulatory protection for the species or its habitat (TOES 1995, p. 1).

The establishment of protected areas of habitat and management to enhance or restore habitat are important to the conservation of pygmy-owl populations in both the United States and Mexico. In the United States, this could potentially be accomplished on lands managed by Federal agencies such as the Park Service, Bureau of Land Management, Department of Defense, and the Service. However, many of these lands have a multiple-use mandate and do not focus solely on pygmy-owl conservation, or even wildlife conservation in general. Similar issues exist in Mexico as well. Goals and objectives of wildlife management in Mexico have primarily focused on huntable or harvestable species.

A Mexican program to protect sensitive habitats and species is the National Natural Protected Areas (NPAs) system. NPA designation is supposed to protect areas that have not been significantly altered by human activities and that provide diverse ecosystem services. However, prior to 1994, most NPAs lacked sound and comprehensive management plans. By 2000, approximately 30 percent of new and existing NPAs had developed management plans. However, under the NPA model, these plans lacked detailed information, and in many cases could be considered obsolete. NPA goals to promote sustainable natural resources were often unattainable because of conflicting land ownership interests (Valdez *et al.* 2006, p. 272). The allocation of funds for management of natural reserve areas in Sonora is precarious, and some reserves have not received protection other than that given by government edicts or their natural isolation (Burquez and Martinez-Yrizar 1997, p. 378). Urban development has taken its toll on Sonora's natural reserves. Three of the reserves have already disappeared, which reflects the tenuous state of many nature reserves in Mexico during the 1990s (Burquez and Martinez-Yrizar 2007, p. 546).

Another program set up to promote wildlife management on private property in Mexico is the development of wildlife management units, or UMAs. The UMA program in Mexico has not been effective in promoting wildlife management or biodiversity conservation. It has increased the introduction of exotic wildlife species to meet hunting demands. There is a lack of technical capability on private lands to conduct proper wildlife monitoring and management (Weber *et al.* 2006, p. 1482). In Mexico, the exploitation of minerals and industrial development has not been matched by strong measures to protect the environment (Burquez and Martinez-Yrizar 2007, p. 547). Riparian management in particular seems to lack sufficient efforts (Kusler 1985, p. 6).

Summary of Factor D

In summary, Federal laws such as the Migratory Bird Treaty Act and Arizona and Texas State laws do address direct take of pygmy-owls within the United States. Existing regulations in Mexico do not protect or conserve pygmy-owls. Laws and regulations within the range of the pygmy-owl in both the United States and Mexico do not address the loss of or impacts to pygmy-owl habitat. However, within the majority of the range of the pygmy-owl, the inadequacy of existing regulations does not appear to affect the frequency or magnitude of impacts to pygmy-owls and their habitat. Therefore, based on the best scientific and commercial information available, we find that, despite the lack of specific laws or regulations addressing impacts to and conservation and protection of pygmy-owls and their habitat, the inadequacy of regulatory mechanisms does not threaten the pygmy-owl rangewide, and is not likely to do so in the future.

Factor E: Other Natural or Man-Made Factors Affecting Its Continued Existence

We briefly discussed the effects of introduced predation on pygmy-owls by domestic house cats in our Factor C analysis above. While this is a manmade factor affecting pygmy-owls, for Factor E we will discuss human-caused mortality that is not associated with any of the other factors, for example, collisions with fences, cars, and windows, and shooting. Natural factors affecting pygmy-owl habitat availability and suitability not related to Factor A will also be discussed under Factor E. These include drought, climate change, hurricanes, and the effects of small populations.

Human-Caused Mortality

Direct and indirect human-caused mortalities (*e.g.,* collisions with cars, glass windows, fences, power lines, introduced competitors and predators, etc.), while likely uncommon, are often underestimated, and probably increase as human interactions with pygmy-owls increase (Banks 1979, pp. 13–14; Klem 1979, pp. 1–2; Churcher and Lawton 1987, p. 439). This may be particularly important in areas of the pygmy-owl's range where pygmy-owls are located in proximity to urban development. Documentation exists of pygmy-owls flying into windows and fences, resulting in serious injuries or death to the birds. In one incident, a pygmy-owl collided with a closed window of a parked vehicle; it eventually flew off, but had a dilated pupil in one eye, indicating neurological injury as a result of this encounter (Abbate *et al.* 1999, p. 58). In another incident, an adult pygmy-owl was found dead at a wire fence; apparently it flew into the fence and died (Abbate *et al.* 2000, p. 18). AGFD also has documented an incident of individuals shooting BB guns at birds perched on a saguaro that contained an active pygmy-owl nest. The information we have related to human-caused mortality is limited to the United States and does not generally appear to be a significant effect on pygmy-owl populations. Information from Mexico does not indicate that these activities are affecting pygmy-owls in a manner different than the United States.

Drought and Climate Change

''Climate'' refers to an area's long-term average weather statistics (typically for at least 20- or 30- year periods), including the mean and variation of surface variables such as temperature, precipitation, and wind, whereas ''climate change'' refers to a change in the mean and/or variability of climate properties that persists for an extended period (typically decades or longer), whether due to natural processes or human activity (Intergovernmental Panel on Climate Change (IPCC) 2007a, p. 78). Although changes in climate occur continuously over geological time, changes are now occurring at an accelerated rate. For example, at continental, regional and ocean basin scales, recent observed changes in long-term trends include: a substantial increase in precipitation in eastern parts of North American and South America, northern Europe, and northern and central Asia, and an increase in intense tropical cyclone activity in the North Atlantic since about 1970 (IPCC 2007a, p. 30); and an increase in annual average temperature of more than 2° F (1.1°C) across US since 1960 (Global Climate Change Impacts in the United States (GCCIUS) 2009, p. 27). Examples of observed changes in the physical environment include: An increase in global average sea level, and declines in mountain glaciers and average snow cover in both the northern and southern hemispheres (IPCC 2007a, p. 30); substantial and accelerating reductions in Arctic sea-ice (*e.g.,* Comiso *et al.* 2008, p. 1), and a variety of changes in ecosystem processes, the distribution of species, and the timing of seasonal events (*e.g.,* GCCIUS 2009, pp. 79–88).

The IPCC used Atmosphere-Ocean General Circulation Models and various greenhouse gas emissions scenarios to make projections of climate change globally and for broad regions through the 21st century (Meehl *et al.* 2007, p. 753; Randall *et al.* 2007, pp. 596–599), and reported these projections using a framework for characterizing certainty (Solomon *et al.* 2007, pp. 22–23). Examples include: (1) It is virtually certain there will be warmer and more frequent hot days and nights over most of the earth's land areas; (2) it is very likely there will be increased frequency of warm spells and heat waves over most land areas, and the frequency of heavy precipitation events will increase over most areas; and (3) it is likely that increases will occur in the incidence of extreme high sea level (excludes tsunamis), intense tropical cyclone activity, and the area affected by droughts (IPCC 2007b, p. 8, Table SPM.2). More recent analyses using a different global model and comparing other emissions scenarios resulted in similar projections of global temperature change across the different approaches (Prinn *et al.* 2011, pp. 527, 529).

All models (not just those involving climate change) have some uncertainty associated with projections due to assumptions used, data available, and features of the models; with regard to climate change this includes factors such as assumptions related to emissions scenarios, internal climate variability and differences among models. Despite this, however, under all global models and emissions scenarios, the overall projected trajectory of surface air temperature is one of increased warming compared to current conditions (Meehl *et al.* 2007, p. 762; Prinn *et al.* 2011, p. 527). Climate models, emissions scenarios, and associated assumptions, data, and analytical techniques will continue to be refined, as will interpretations of projections, as more information becomes available. For instance, some changes in conditions are occurring more rapidly than initially projected, such as melting of Arctic sea ice (Comiso *et al.* 2008, p. 1; Polyak *et al.* 2010, p. 1797), and since 2000 the observed emissions of greenhouse gases, which are a key influence on climate change, have been occurring at the mid- to higher levels of the various emissions scenarios developed in the late 1990's and used by the IPPC for making projections (*e.g.,* Raupach *et al.* 2007, Figure 1, p. 10289; Manning *et al.* 2010, Figure 1, p. 377; Pielke *et al.* 2008, entire). Also, the best scientific and commercial data available indicates that average global surface air temperature is increasing and several climate-related changes are occurring and will continue for many decades even if emissions are stabilized soon (*e.g.,* Meehl *et al.* 2007, pp. 822–829; Church *et al.* 2010, pp. 411–412; Gillett *et al.* 2011, entire).

Changes in climate can have a variety of direct and indirect impacts on species, and can exacerbate the effects of other threats. Rather than assessing ''climate change'' as a single threat in and of itself, we examine the potential consequences to species and their habitats that arise from changes in environmental conditions associated with various aspects of climate change. For example, climate-related changes to habitats, predator-prey relationships, disease and disease vectors, or conditions that exceed the physiological tolerances of a species, occurring individually or in combination, may affect the status of a species. Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and adaptive capacity (IPCC 2007, p. 89; Glick *et al.* 2011, pp. 19–22). As described above, in evaluating the status of a species, the Service uses the best scientific and commercial data available, and this includes consideration of direct and indirect effects of climate change. As is the case with all potential threats, if a species is currently affected or is expected to be affected by one or more climate-related impacts, this does not necessarily mean the species is a threatened or endangered species as defined under the Act. If a species is listed as threatened or endangered, this knowledge regarding its vulnerability to, and impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

While projections from global climate model simulations are informative and in some cases are the only or the best scientific information available, various downscaling methods are being used to provide higher-resolution projections that are more relevant to the spatial scales used to assess impacts to a given species (see Glick *et al,* 2011, pp. 58–61). With regard to the area of analysis for the pygmy-owl, downscaled models predict that the Sonoran Desert Ecoregion will be drier through the 21st century and that the transition to a more arid climate is likely already under way (Seager *et al.* 2007, p. 1181). Future drought is projected to occur under warmer temperature conditions as climate change progresses. Seager *et al.* (2007, p. 1181) predict that the recent multiyear droughts, the Dust Bowl, and 1950s drought conditions will become the new climatology of the American Southwest with a timeframe of years to decades. Already, the current, multiyear drought in the western United States, including most of the Southwest, is the most severe drought recorded since 1900 (Overpeck and Udall 2010, p. 1642).

Although specifically looking at pinyon-juniper communities, Breshears *et al.* (2005, pp. 15147–15148) showed that a particular concern under these drought conditions is regional-scale mortality of overstory trees, which rapidly alters ecosystem type, associated ecosystem properties, and land-surface conditions for decades. Woodlands providing important pygmy-owl habitat, including meso- and xeroriparian trees, thornscrub, and tropical deciduous forests may respond in a similar manner. Gitlin *et al.* (2006, p. 1482) documented increased mortality of *Populus fremontii* (Fremont cottonwood) (an important riparian tree in Sonoran Desert mesoriparian communities) during the recent drought.

Northern areas of Mexico are most vulnerable to droughts and desertification because erosion and drought severity will increase with higher temperatures and rainfall variations in these arid and semi-arid regions (Conde and Gay 1999, p. 2). The three Mexican regions most vulnerable to climate change are, in order of importance, Central, Northern (in areas occupied by pygmy-owls), and the Tabasco Coast (Conde and Gay 1999, p. 2). Magana and Conde (2000, p. 183) showed the vulnerability of northern Mexico, specifically Sonora, to interannual climate variability and climate change. They found that future major challenges that will result from climate change are increasing demand for water, competition among water users, and decline in water quality, along with the resultant loss or reduction of riparian woodlands and other pygmy-owl habitat elements. Smith *et al.* (2000, p. 79) noted the following with regard to nonnative grass invasions and climate change, ‘‘This shift in species composition in favor of exotic annual grasses, driven by global [climate] change, has the potential to accelerate the fire cycle, reduce biodiversity, and alter ecosystem function in the deserts of western North America.’’

Changes in the timing of precipitation due to climate change may have effects related to pygmy-owl prey availability and abundance. Flesch (2008, p. 8) found that timing and quantity of precipitation affected both lizard and rodent abundance in ways that suggested rainfall is an important driver of population and community dynamics. In general, cool-season rainfall had a positive correlation with rodent populations and warm-season rainfall was positively correlated with lizard populations. Because various climate change models predict that climate conditions will become more variable, lizard species that are most affected by variations in precipitation will tend to decline in abundance across time. This is an important finding given that lizards are the primary prey item for pygmy-owls during the summer.

The majority of the current range of the pygmy-owl occurs in tropical or subtropical vegetation communities that may be reduced in coverage if climate change results in hotter, more arid conditions. The Sonoran Desert Ecoregion is already characterized by hot, arid conditions, and pygmy-owls in this portion of the range are already adapted to the hotter, more arid conditions that may prevail in the future. This adaptation may be important to the continued existence of the subspecies as desertification spreads in response to climate change, but may be offset as some future model scenarios predict a reduction in columnar cacti densities, the primary pygmy-owl nesting substrate within the Sonoran Desert Ecoregion (Weiss and Overpeck 2005, p. 2074). Already studies have documented a noticeable shift north of bird species in association with changing climates. Christmas Bird Count data show a shift northward in 56 percent of the 305 most widespread, regularly occurring wintering bird species (NABCI 2010). This same report indicates that bird species that are rare or nonexistent in the United States at present will expand their ranges into our country from the south (NABCI 2009, p. 15).

Climate change may have a negative impact on some pygmy-owl populations because it will exacerbate the current and ongoing effects discussed above. For example, drought has been documented in Arizona and northern Sonora to reduce juvenile pygmy-owl survival. Under the predicted climate change scenarios, drought will occur more frequently and increase in severity. The invasion of nonnative species has been documented in the loss of pygmy-owl habitat and native vegetation communities. A common prediction under climate change is for conditions that will favor the increased occurrence and distribution of nonnative species. Riparian areas, both permanent and ephemeral, support important pygmy-owl habitat elements such as thermal and predator cover, and increased prey availability. Precipitation events under most climate change scenarios will decrease in frequency and increase in severity. This may reduce available cover and prey for pygmy-owls by affecting riparian areas through scouring flood events and reduced moisture retention. However, the extent to which changing climatic patterns will affect the pygmy-owl is not known with certainty at this time.

Hurricanes

Although not generally considered a historical impact to pygmy-owl habitat, the loss of habitat and nest structures as a result of hurricanes has recently been identified as a potential contributor to an apparent decline in pygmy-owl nestlings documented as part of an ongoing pygmy-owl nest box study in south Texas (Proudfoot 2011b, p. 1; Proudfoot 2010, p. 1). Hurricanes within the past five years have impacted thousands of acres of occupied pygmy-owl habitat by removing trees and reducing cover and structural diversity. Within the current range of the pygmy-owl, hurricanes are most likely to affect pygmy-owl habitat in southern Texas and northeastern Mexico, although hurricanes in the Pacific Ocean also have the potential to affect pygmy-owl habitat in western Mexico. Historically, major hurricanes have made landfall in southern Texas on average about once every decade. However, more recently, hurricanes (Erika in 2003, Dolly in 2008, and Alex in 2010) have occurred more often than in the past, suggesting that major hurricanes may be occurring more frequently now. If hurricanes continue to occur every few years, this frequency of hurricanes resulting in loss of woodlands may not allow some areas of previously suitable pygmy-owl habitat to regenerate trees of adequate size to support the cavities needed for nesting by pygmy-owls. However, the effects are expected to be localized.

Scattered, Small Population Groups

An important principle of conservation genetics is that small, isolated populations will experience reductions in the health of the population due to the expression of negative population characteristics as a result of inbreeding. Loss of individual adaptation can also occur and may adversely affect population demography and increase the risk of population extinction (Caughley 1994, p. 217). Inbreeding in small, isolated populations often occurs because of a lack of mates to choose from, not from preferential mating among related individuals. This can lead to increased chances that both parents will contribute genes containing harmful traits, some of which may affect important adaptive and physiological characteristics, such as survival, fertility, and physiological vigor (Soule and Mills 1998, p. 1658).

Inbreeding has been documented within the small pygmy-owl population in Arizona (Abbate *et al.* 2000, p. 21). Lack of genetic diversity has also been documented during recent genetics studies (Proudfoot and Slack 2001, pp. 5–7). Loss of isolated population groups has occurred in Arizona due to lack of productivity and inadequate dispersal (AGFD 2008, p. 1). In 2008, a possible genetic heart condition was diagnosed in the mortality of three related pygmy-owls in the captive breeding research project, a possible expression of the detrimental effects of the inbreeding of pygmy-owls in Arizona (Fox 2008, p. 1).

In addition to genetic factors, habitat degradation or human-caused mortality can cause shifts in population characteristics that drive population decline. Genetic factors may simply hasten the extinction process once a population is small (Miller and Waits 2003, p. 4334). In the face of ongoing loss and fragmentation of habitat, the potential for inbreeding increases as populations or groups of pygmy-owls are increasingly isolated. This increases the need for management that maintains, restores, or substitutes for historical patterns of between-population gene flow (Hogg *et al.* 2006, p. 1491). In addition to inbreeding, genetic drift (a change in the gene pool of a population that takes place strictly by chance) in small populations can depress population fitness and increase extinction risk (Tallmon *et al.* 2004, p. 489), as well as diminish future adaptations to a changing environment (Lande 1988, p. 1455). A significant loss in genetic variation within small populations may decrease population health or limit the long-term capacity of a population to respond to environmental challenges (Keller *et al.* 1994).

Similarly, chance environmental and demographic events may pose a more substantial threat to small populations than to large populations (Westemeier *et al.* 1998, p. 1695). Caughley and Gunn (1996, p. 166) noted that small populations can become extinct entirely by chance even when their members are healthy and the environment favorable. Demographic characteristics of small populations can be significant contributors in determining minimum viable population sizes. Viability of small populations is likely dependent on both demography and population genetics and should not be considered independently (Keller *et al.* 2002, p. 356; Lande 1988, p. 1459). Consequently, for those areas of the pygmy-owl's range where local small population size is an issue, if the result of any of the above factors negatively affects pygmy-owl demography or genetics, effects, at least at the local population scale, may be significant.

Genetic rescue within a metapopulation structure can occur through periodic immigration into small, inbred, at-risk populations and can alleviate inbreeding depression and boost fitness, but habitat connectivity and adequate dispersal opportunities must be present. However, immigration of genetically divergent individuals can lead to the opposite effect—a reduction in population fitness due to outbreeding depression (when crosses between individuals from different populations have lower fitness than progeny from crosses between individuals within the same population) (Tallmon *et al.* 2004, p. 489).

In conclusion, small population size and inadequate dispersal, as well as a reduced ability to adapt due to low genetic diversity, can result in increased vulnerability of extinction for pygmy-owls in small, isolated populations. The best information we have indicates that small, isolated populations probably occur in Arizona, Texas, and northeastern Mexico. We know of no small, isolated populations in southern Mexico, and thus conclude that small population size is not likely to be a threat in that area.

Summary of Factor E

In summary, direct, human-caused mortality of pygmy-owls can occur and may, locally, have some impact on isolated population segments. However, it is unlikely that direct human-caused mortality will have significant population-level impacts on the pygmy-owl throughout its range. Impacts to pygmy-owl populations from factors related to drought and small population size have been documented in portions of the pygmy-owl's range, specifically Arizona. All but one model evaluating changing climatic patterns for the southwestern United States and northern Mexico predict a drying trend for the region (Seager *et al.* 2007, pp. 1181–1184), which will negatively affect riparian and other plant communities that provide habitat for pygmy-owls. The extent to which changing climatic patterns will affect the pygmy-owl is not known with certainty at this time. However, predicted impacts of climate change may exacerbate and intensify the effects of long-term drought and other negative impacts within the range of the pygmy-owl identified under Factor A. One concern in the northwestern portion of the species' range is the potential decline in large columnar cacti, an essential pygmy-owl habitat element that provides nest sites. However, given the persistence of pygmy-owl populations in the more arid areas of its range (northwestern Mexico and Arizona), pygmy-owls in these areas may provide the genetic adaptations necessary to adapt to changing conditions.

Given the current pygmy-owl population status, the effects of small population size are likely to continue, especially in the northern portion of the range. Reduced population connectivity as a result of habitat impacts identified under Factor A will likely continue to increase the potential for inbreeding and the associated loss of genetic diversity. At least in Arizona, lack of dispersing juveniles and floating nonbreeding individuals in the population due to low numbers of breeding pygmy-owls will also affect long-term occupancy of breeding territories and further erode the metapopulation structure in Arizona and northern Sonora. However, these effects appear to be localized, and we do not find that impacts under Factor E are significantly affecting pygmy-owls rangewide. Based upon our review of the best commercial and scientific data available, we conclude that other natural and manmade factors are not immediate threats to the pygmy-owl rangewide, and are not likely to become so in the future.

Pygmy-Owl Finding Throughout Its Range

As required by the Act, we conducted a review of the status of the species and considered the five factors from section 4(a) in assessing whether the pygmy-owl is threatened or endangered throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the species. We reviewed the petition, information available in our files, other available published and unpublished information, and we consulted with species and subject experts, including peer review, and other Federal, State, Tribal, and local agencies.

In considering what factors might constitute threats, we must look beyond the mere exposure of the species to the factor and determine whether the species responds to the factor in a way that causes actual impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine how significant a threat it is. If the threat is significant, it may drive or contribute to the risk of extinction of the species such that the species warrants listing as threatened or endangered as those terms are defined by the Act. This does not necessarily require empirical proof of a threat. The combination of exposure and some corroborating evidence of how the species is likely impacted could suffice. The mere identification of factors that could impact a species negatively is not sufficient to compel a finding that listing is appropriate; we require evidence that these factors are operative threats that act on the species to the point that the species meets the definition of threatened or endangered under the Act.

Through our five-factor analysis, we identified a number of factors that are negatively affecting the pygmy-owl, including the following: (1) Habitat loss and fragmentation due to urbanization, improper grazing, nonnative-species invasions and associated changes in fire regimes, OHV use, agricultural development, and wood cutting; (2) border issues; (3) inadequate regulatory mechanisms; (4) drought and climate change; and (5) small size of some local populations. To determine whether these factors individually or collectively rise to a ''threat'' level such that the pygmy-owl is in danger of extinction throughout its range, or likely to become so in the foreseeable future, we first considered whether these negative factors to the subspecies were causing long-term, range-wide, population-scale declines in pygmy-owl numbers, or were likely to do so in the foreseeable future.

While range-wide surveys have not been conducted for the pygmy-owl, information from surveys that have been conducted in Texas and Arizona in the United States, and in Sinaloa and Sonora in Mexico can be used to help us determine the general population status of the pygmy-owl throughout its range. The best available information we have indicates that local populations of pygmy-owls in Arizona, northern Sonora, and Texas have likely experienced population declines; however, the pygmy-owl is still found in these areas. Pygmy-owls are still found in southern Mexico, and the best available information indicates that they may remain relatively common throughout this area. Based on the level of information we do have, it appears pygmy-owls persist in most areas where they have been historically documented in the literature and during recent survey efforts. The most recent IUCN (International Union for Conservation of Nature) Red List (an international standard for species extinction risk) contains the following statement with regard to the status of the ferruginous pygmy-owl, ''Despite the fact that the population trend appears to be decreasing, the decline is not believed to be sufficiently rapid to approach thresholds for Vulnerable under the population trend criterion (greater than a 30 percent decline over ten years or three generations).'' (IUCN 2008, p. 2). So, while this statement may be an indication of a range-wide population decline, it does not appear that such a decline is significant enough to place the pygmy-owl in a category of concern for IUCN. In addition, this statement applies to ferruginous pygmy-owls as a species, and does not separate status for the individual subspecies. Therefore, based on the best available scientific and commercial information, we do not find evidence of a sufficient declining trend in the subspecies' population to indicate it is in danger of range-wide extinction now, or in the foreseeable future. In other words, based on a review of the best available data, the data do not suggest that the combined effects of the negative impacts discussed in our five-factor analysis are resulting in an overall, long-term reduction in the distribution of the pygmy-owl, or an associated significant range-wide decline in pygmy-owl numbers, such that the subspecies is currently in danger of extinction or likely to become so.

There are severe impacts to certain portions of the pygmy-owl's range. However, those impacts are restricted to a relatively small (27 percent) portion of the entire range. We found no evidence that these impacts are of sufficient magnitude and severity to affect the rangewide population of pygmy-owls. Although it appears there are localized declines in pygmy-owl populations in Arizona and, possibly Texas and northern Sonora, there does not appear to be an ongoing, significant, long-term decline in range-wide pygmy-owl numbers that would lead us to believe the subspecies is currently in danger of extinction or likely to become so throughout its range due to factors identified in our five-factor analysis.

We also considered whether any of the negative impacts began recently enough that their effects are not yet manifested in current subspecies' population numbers, but are likely to have an effect in the foreseeable future. Impacts from climate change are a particular impact that has recently been accelerating. These effects are so recent that we have no information on the long-term effects to pygmy-owl populations. However, drought is predicted to become more prevalent within the Sonoran range of the pygmy-owl, and drought has had a historically-negative impact on pygmy-owl populations in this area. The predictions of drought throughout the remainder of the range are uncertain; however, as discussed under Factor E, pygmy-owls in the northern portion of their range may be more resilient and better adapted to drought conditions. Other impacts are largely limited to specific portions of the subspecies' range, and we do not believe they would manifest their future effects as range-wide population declines. Therefore, the pygmy-owl is not currently in danger of extinction, or likely to become so, due to potential threats that began recently enough that their long-term effects are not yet manifest.

Next, we considered whether any of the current negative factors are likely to increase within the foreseeable future, such that the species is likely to become in danger of extinction in the foreseeable future. We do believe that some of the negative factors identified will increase in the foreseeable future including urbanization, nonnative invasions and fires, agricultural development, woodcutting, grazing, and climate extremes. However, as discussed above in our five-factor analysis, these impacts occur in a limited portion of the range, primarily Arizona, Texas, and Sonora. For the remaining portions of Mexico, the best available information indicates that the negative factors are less severe or that there is no evidence of the negative impact. The best available information also indicates that pygmy-owls are relatively common in this portion, which is 73 percent of their range. Therefore, we conclude that there is no evidence that negative factors, such as urbanization, agricultural development, or woodcutting, will increase in the foreseeable future in the majority of the pygmy-owl's range.

Finally, we considered whether stochastic events might decrease the long-term viability of the species (species viability requires a naturally-reproducing population large enough to maintain sufficient genetic variation to provide for its continued evolution and response to natural environmental changes). We considered whether, given a currently stable population range-wide, is the pygmy-owl likely to become in danger of extinction in the foreseeable future because stochastic events might reduce its current numbers to a point where its long-term viability would be in question. Current information suggests that stochastic events such as hurricanes, extreme drought, and catastrophic fires could reduce the viability of local pygmy-owl populations in Arizona, Texas, and northern Sonora. However, because of the pygmy-owl's wide distribution and historical indications of relatively higher numbers throughout most of its range, even if a stochastic event were to occur within the foreseeable future that negatively affected this subspecies, the range-wide population would still be unlikely to fall to such a low level that it would be in danger of extinction.

Despite some regional declines in pygmy-owl population numbers, the subspecies has been able to maintain what appears to be range-wide population viability. Negative factors affecting pygmy-owls seem to be restricted, for the most part, to a relatively small portion of its range. The areas where we have detailed information to evaluate potential threats and pygmy-owl population status (Arizona, Texas, and Sonora) represent approximately 27 percent of the overall pygmy-owl range. The best available information suggests that the range-wide pygmy-owl population is not significantly declining, despite regional changes in population numbers, and that most of the immediate impacts to the pygmy-owl and its habitats are geographically concentrated. In summary, based on our review of the best available scientific and commercial information pertaining to the five factors, we find that threats throughout the majority of the pygmy-owl's range are not of sufficient imminence, severity, or magnitude to indicate that the pygmy-owl is in danger of extinction (endangered), or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

After determining the subspecies is not currently in danger of extinction or likely to become so in the foreseeable future throughout its range, we next consider whether a distinct vertebrate population segment (DPS) or whether any significant portion of the pygmy owl's range is in danger of extinction or is likely to become so in the foreseeable future.

Distinct Vertebrate Population Segment

Under the Service's Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (61 FR 4722, February 7, 1996), three elements are considered in the decision concerning the establishment and classification of a possible DPS. These are applied similarly for additions to or removal from the Federal List of Endangered and Threatened Wildlife. These elements include:

(1) The discreteness of a population in relation to the remainder of the species to which it belongs;

(2) The significance of the population segment to the species to which it belongs; and

(3) The population segment's conservation status in relation to the Act's standards for listing. delisting, or reclassification (i.e., is the population segment endangered or threatened).

Discreteness

Under the DPS policy, a population segment of a vertebrate taxon may be considered discrete if it satisfies either one of these 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 conditions described in the Service's DPS policy, its biological and ecological significance will be considered in light of Congressional guidance that the authority to list DPSs be used ''sparingly'' while encouraging the conservation of genetic diversity. In making this determination, we consider available scientific evidence of the discrete population segment's importance to the taxon to which it belongs. Since precise circumstances are likely to vary considerably from case to case, the DPS policy does not describe all the classes of information that might be used in determining the biological and ecological importance of a discrete population. However, the DPS policy describes four possible classes of information that provide evidence of a population segment's biological and ecological importance to the taxon to which it belongs. As specified in the DPS policy (61 FR 4722), this consideration of the population segment's significance may include, but is not limited to, the following:

(1) Persistence of the discrete population segment in an ecological setting unusual or unique to 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.

A population segment needs to satisfy only one of these conditions to be considered significant. Furthermore, other information may be used as appropriate to provide evidence for significance.

Analysis of Potential Distinct Population Segments

The petitioners requested that we consider two potential DPS's of the pygmy-owl for protection under the Act, a Sonoran Desert DPS and an Arizona DPS. The petitioners did not suggest any additional DPS configurations to be evaluated. However, in order to be complete in our analysis of potentially listable pygmy-owl entities, we also considered other potential DPS configurations including an eastern/western DPS and a Texas DPS. Our analysis of these two other potential DPS configurations follows our evaluation of the petitioned DPS configurations.

Potential Sonoran Desert DPS

As described, none of the boundaries of the petitioner's Sonoran Desert DPS include an international border or boundary (CBD and DOW 2007, pp. 4–6) (Figure 4). Therefore, the petitioned DPS must meet the first condition for discreteness in order to be considered a valid DPS, because it does not meet the second condition. The eastern and western portions of the range of the pygmy-owl are separated by the Sierra Madre and other mountain ranges in north-central Mexico (Proudfoot *et al.* 2006a, p. 9). However, there are no obvious physical or geographic barriers that separate the petitioned Sonoran Desert DPS from the rest of the pygmy-owl's range to the south. There is a documented area in central Sonora, near Hermosillo, Mexico, that may act as an impediment to pygmy-owl movements and dispersal, because of the lack of contiguous suitable habitat resulting from natural and artificial conditions (Flesch 2003, pp. 40, 100). However, the extent of this band of unsuitable habitat does not prevent regular or occasional movements by pygmy-owls between northern and southern Sonora. This is supported by genetic sampling and analysis that has recently been completed, that indicates that there is likely gene flow between the two groups (Proudfoot 2009a, p. 1).

Proudfoot's earlier assessment of mitochondrial DNA (mtDNA) and microsatellite DNA of pygmy-owls from Arizona, Sonora, and Sinaloa implied restricted gene flow between the Sonoran and Sinaloan populations (Proudfoot *et al.* 2006a, p. 10; Proudfoot *et al.* 2006b, p. 9). However, the authors implied that limited sampling and geographic distance between sample sites in Sonora and Sinaloa may have influenced the results of these studies. To verify the inference of restricted gene flow, a joint effort among Proudfoot, AGFD, and the Service resulted in the collection and analysis of an additional 119 samples collected in areas not previously sampled (Proudfoot 2009, p. 1; AGFD 2008a, pp. 1–10). Analysis of the genotypic variation revealed isolation by distance with significant gene flow between pygmy-owl populations. Estimates of migrants per generation time for pygmy-owl populations were 8.62 (Arizona-Sonora), 6.65 (Arizona-Sinaloa) and 23.46 (Sonora-Sinaloa) (Proudfoot 2009, p. 1).

So, while no haplotypes from Arizona, Sonora, or Sinaloa are shared with the remainder of Mexico and Texas, there are shared haplotypes among Arizona, Sonora, and Sinaloa, indicating there is exchange of genetic material within this grouping (Proudfoot *et al.* 2006a, p. 7). This would argue against the Sonoran Desert Ecoregion being markedly separate from the remainder of Sonora and Sinaloa. Based on observations of pygmy-owls during survey and capture activities in Arizona, and in both northern and southern Sonora as described above, the best available scientific and commercial data does not indicate that there is any evidence that there are marked behavioral, morphological, or physiological differences within the petitioned DPS (AGFD 2008a, pp. 1–4). As a result, this study indicates that there is no marked genetic or morphological separation between the petitioned Sonoran Desert DPS and southern Sonora populations (Proudfoot 2009a, p. 1; AGFD 2008a, p. 10).

The Sonoran Desert Ecoregion does differ ecologically from the remainder of the areas within its range. Despite the fact that occurrence of some plant species overlaps with other ecoregions to the south and east, the Sonoran Desert is a unique dry desert area that does function ecologically in a different way when compared to adjacent ecoregions. However, as described above, the best available scientific and commercial data do not indicate that this ecological difference has resulted in any morphological, physiological, or genetic differentiation within pygmy-owl populations in the Sonoran Desert. Environmental characteristics within the Sonoran Desert have likely resulted in the reduced numbers and densities of pygmy-owls found in this area. However, this does not appear to have resulted in any physical differentiation, at least anecdotally, from adjacent pygmy-owl populations.

We find that there is no evidence that the Sonoran Desert population of pygmy-owl is markedly separated in any way from the remainder of the taxon. Therefore, we determine, based on a review of the best available information, that the petitioned Sonoran Desert DPS of the pygmy-owl does not meet the discreteness conditions of the 1996 DPS policy. As such, this population segment does not qualify as a DPS under our policy and is not a listable entity under the Act.

The DPS policy indicates that significance should be analyzed only if a population segment has been identified as discrete. Because we found that the Sonoran Desert population segment did not meet the discreteness element and, therefore, does not qualify as a DPS under the Service's DPS policy, we will not conduct an evaluation of significance.

Potential Arizona DPS

Because we are evaluating this petitioned entity based on the currently accepted taxonomic classification of the pygmy-owl (see Description and Taxonomy section above), the taxon considered in this finding is the same as for our 1997 listing of the pygmy-owl (62 FR 10730). Consequently, the petitioned Arizona DPS is exactly the same DPS configuration that was the subject of litigation and, ultimately, the same DPS configuration that the Service removed from the Federal List of Endangered and Threatened Wildlife in 2006 (71 FR 19452; April 24, 2006) (Figure 4). That final rule presents our analysis showing that, while the discreteness criteria for the DPS were met, we could not show that this DPS was significant to the taxon as a whole. The petition states that ''the Arizona DPS occurs in a unique ecological setting and differs markedly in its genetic characteristics from pygmy-owls in Sinaloa and elsewhere in the species range. Loss of the Arizona DPS would also create a significant gap in the species' range, resulting in loss of roughly a third of the subspecies' range, and half of the species' range in the Sonoran Desert. The Arizona DPS is also significant because it represents the entire range of *G. ridgwayi cactorum* in the United States'' (CBD and DOW 2007, p. 12).

Our analysis in the final rule to delist the pygmy-owl showed that the then-listed Arizona DPS of the pygmy-owl was not markedly different in its genetic characteristics from pygmy-owls in northern Sonora, Mexico; did not occur in a unique ecological setting; nor would loss of the DPS represent a significant gap in the range of the taxon (71 FR 19452). We are unaware of any scientific information compiled since the delisting that would alter the conclusions made in that final rule. Therefore, we determine, based on a review of the best available information, that the petitioned Arizona DPS of the pygmy-owl does not meet the significance conditions of the 1996 DPS policy. Therefore, this population segment does not qualify as a DPS under our policy and is not a listable entity under the Act.

Potential Texas DPS

We have reviewed new information regarding the status of the pygmy-owl in Texas (Proudfoot 2010, p. 1; 2011b, p. 1). In addition, the peer reviewers of the current genetic information provided insight and recommendations regarding the genetic diversity and management of pygmy-owls in Arizona and Texas. Upon consideration of this new information, we concluded that it was appropriate to evaluate a potential Texas DPS that includes the current range of the pygmy-owl in Texas to the international border with Mexico.

Discreteness

The use of the international border to define discreteness of the Arizona pygmy-owl DPS was upheld by the courts (No. 02–15212, CV00–0903 SRB at 11586, 2003) because of the differences in status and management of the pygmy-owl between Arizona and Mexico. Defining the discreteness of the Texas DPS is appropriate using the same rationale. For example, Mexico has no regulations or laws specifically protecting the pygmy-owl. In Texas, the pygmy-owl is listed as threatened, and State law prohibits take without the appropriate permit. Therefore, we determine that the Texas DPS is discrete due to differences in status and management of the pygmy-owl between the United States, in Texas, and Mexico.

Significance

The best available scientific and commercial information does not indicate that the Texas population of pygmy-owls occurs in an ecological setting that is unusual or unique to the taxon. For example, the vegetation community that supports pygmy-owls in Texas is classified as Tamaulipan brushland (Jahrsdoerfer and Leslie 1988, p. 1). This vegetation community and the associated pygmy-owl habitat elements are found in southern Texas and northeastern Mexico (Jahrsdoerfer and Leslie 1988, pp. 1–9; Hunter 1988, p. 8; Cook *et al.* 2001, pp. 1–2) and comprise most of the eastern portion of the pygmy-owl's current range. Texas represents approximately 15 percent of the eastern portion of the range of the pygmy-owl. In other words, approximately 85 percent of the pygmy-owl habitat that is characterized as Tamaulipan brushland occurs outside of Texas. Therefore, the Texas population of pygmy-owls does not occur in an unusual or unique setting for the taxon.

Texas represents approximately 5 percent of the overall range of the pygmy-owl. From a geographic perspective, loss of this portion of the range does not represent a significant gap in the range of the pygmy-owl. However, we must also consider where the loss of the contribution of this population segment to overall population numbers would represent a significant gap in the range. Pygmy-owl population estimates for Texas range from 100 owls in Kleberg County (Tewes 1992, p. 24), to 654 pairs in Kenedy, Brooks, and Willacy Counties (Wauer *et al.* 1993, p. 1074), and 745 to 1,823 pygmy-owls on ranches in Kenedy and Brooks Counties (Mays 1996, p. 32). This is considerably higher than population estimates in Arizona (approximately 50 owls (Abbate *et al.* 2000, pp. 15–16)), but likely similar to the densities occurring in thornscrub and dry tropical forest habitats further south in Mexico. Field data indicate that pygmy-owls in the southern portions of Sonora (within thornscrub and tropical deciduous forests) are common and likely number on the order of thousands, while further north within the Sonoran Desert Ecoregion, they are fewer in number, more patchily distributed, and likely number on the order of hundreds (Flesch 2003, pp. 39–42; AGFD 2008a, p. 6). Given that the majority of the pygmy-owl's range appears to support similar numbers and densities of pygmy-owls as Texas, we do not believe that the loss of the population in Texas would represent a significant gap from the perspective of contribution to overall pygmy-owl population numbers.

While there is some evidence that the Texas population of pygmy-owls contributes key genetic diversity to the overall population of pygmy-owls and is, to some extent, genetically unique (Proudfoot 2006a, p. 7; Cicero 2008, p. 2; Oyler-McCance 2008, pp. 1–2; Dumbacher 2008, p. 9), the best available scientific and commercial information suggests that pygmy-owls in Texas are genetically similar to pygmy-owls across the international border in Mexico (Proudfoot 2006a, pp. 9–10). This lack of genetic differentiation from adjacent pygmy-owl populations suggests that the Texas population segment does not differ markedly from adjacent populations of pygmy-owls. Proudfoot *et al.* (2006a, p. 7) indicated that Texas is characterized by a single haplotype; and that one haplotype is shared with pygmy-owls from Tamaulipas, Mexico, indicating there has been some exchange of genetic material. Based on the best available scientific and commercial information, we do not find that the Texas DPS is significant to the taxon as a whole, and is, therefore, not a listable entity under the Act. No further analysis of the Texas DPS is warranted at this point.

Potential Western and Eastern DPSs

Discreteness

The current range of the pygmy owl, as discussed above, is defined as occurring from lowland central Arizona south through western Mexico to the States of Colima and Michoacán, and from southern Texas south through the Mexican States of Tamaulipas and Nuevo Leon (Johnsgard 1988, p. 159; Millsap and Johnson 1988, p. 137; Oberholser 1974, p. 452; Friedmann *et al.* 1950, p. 145), consistent with the last American Ornithologist Union (AOU) list that addressed avian classification to the subspecies level (AOU 1957). In the United States, the eastern and western portions of the pygmy-owl's range are separated by over 1,600 km (1,000 mi) of unsuitable habitat (Chihuahuan desert and grasslands, oak and pine forests) and elevations greater than 1,200 m (4,000 ft) associated with various mountain ranges. There has never been any record of occurrence for pygmy-owls in the area between south Texas and Tucson, Arizona. In Mexico, this distribution is separated throughout its entirety by the Sierra Madre Occidental and the Sierra Madre Oriental. These mountain ranges extend south beyond the southern boundary of the described range of this subspecies and represent a significant geographical barrier between the eastern and western segments of the distribution (Cartron *et al.* 2000, p. 6). The elevational range of peaks in these mountain ranges is from 1,880 m to over 3,600 m (6,000 ft to over 12,000 feet). Given the elevational limits of the pygmy-owl's distribution within its range (Freidman *et al.* 1950, pp. 145–147), and the fact that pygmy-owls are replaced by the least pygmy-owl (*G. minutissimum),* Colima pygmy-owl (*G. palmarum*), and the northern pygmy-owl (*G. gnoma)* at higher elevations (Schaldach 1963, p. 40; Howell and Robbins 1995, pp. 19–20), mountains with elevations as significant as those separating the eastern and western portions of the pygmy-owl's distribution in Mexico represent a significant physical barrier, as discussed in the Service's DPS policy (61 FR 4725). The eastern and western portions of the current distribution of *cactorum* never meet (Figure 1).

Recent evaluation of genetic characteristics appears to indicate that the eastern and western portions of the pygmy-owl's current distribution differ from each other genetically (Proudfoot *et al.* 2006b, pp. 7–9). As we have discussed previously in this document, this genetic differentiation may not be adequate to define a subspecies, but it does provide further evidence that the eastern and western portions of the pygmy-owl's range are markedly separate. There is genetic evidence that the western group containing this portion of the range does group closer together than it does to owls in the eastern portion of the overall range. Proudfoot (2006a, p. 7) indicates that pygmy-owls in this portion of the range share no haplotypes with populations in Texas or in the remainder of Mexico. Additionally, in considering the work of Proudfoot *et al.* (2006a and 2006b), expert review concluded that, based on evidence of restricted gene flow between the Arizona/western Mexico and Texas/eastern Mexico populations, Arizona and Texas should be managed as separate units and should be considered genetically distinct (Cicero 2008, p. 2; Oyler-McCance 2008, pp. 1–2; Dumbacher 2008, p. 9), indicating that Arizona and Texas, as portions of the western and eastern distributions of the pygmy-owl, contribute to the respective genetic diversity of each of these regions. Therefore, we find that the eastern and western portions of the range of *Glaucidium brasilianum cactorum* are markedly separated from each other as a consequence of physical and ecological factors. As such, we determine that the eastern and western portions of the current distribution of the pygmy-owl are discrete (Figure 4).

Significance

The Service's DPS policy indicates that one of the ways a DPS may be significant to the taxon as a whole is if the loss of the DPS would result in a significant gap in the range of the taxon (61 FR 4725). A gap in the range can be interpreted as a physical gap, but may also be considered to be a gap in the continuous cline of genetic variation found within the distribution of the species. With regard to the pygmy-owl, the western portion of the range comprises approximately 68 percent of the entire range of the taxon and, consequently, the eastern portion of the range represents approximately 32 percent of the range. Physically, the loss of either of these geographic areas represents a significant gap in the distribution of the taxon. In addition, Proudfoot *et al.* (2006a and 2006b) indicate that the genetic characteristics of the pygmy-owl may vary from Texas to Arizona as a cline of variation based on distance of separation. Loss of either the western or eastern portion of this cline represents a significant gap in the distribution of genetic variation within the overall pygmy-owl population. Therefore, the loss of the current range of the pygmy-owl as represented by the western and eastern portions of the current range, and the loss of a substantial portion of the genetic variation represented within the taxon as a whole, would result in a significant gap in the range of the pygmy-owl. As such, we find that the eastern and western population segments are significant, based on evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon.

Determination for the Potential Western DPS

Of the negative impacts we identified in our 5-factor analysis above, the following occur within western portions of the pygmy-owl's range: (1) Habitat loss and fragmentation due to urbanization, improper grazing, nonnative species invasions, fire, agricultural development, and wood cutting; (2) border issues; (3) inadequacy of existing regulatory mechanisms; (4) drought and climate change; (5) predation; and (6) small population size. Therefore, within the potential western DPS configuration, impacts to pygmy-owls and their habitat discussed under factors A, C, and E may be affecting this pygmy-owl population segment.

Despite the potential effects of these impacts within the western portion of the pygmy-owl's range, low population numbers, and apparent population declines in local pygmy-owl populations in the northern portion of this population segment, the best available scientific and commercial data indicate that pygmy-owls remain common in the majority of the western portion of the pygmy-owl's range. Recent survey and monitoring in Sonora indicated that the highest densities of pygmy-owls occurred in the Sinaloan deciduous forest of southern Sonora (Flesch 2003, p. 42). During capture efforts in 2008, AGFD (2008, p. 6) documented multiple pygmy-owls commonly responding at capture sites in the thornscrub and tropical deciduous forests of southern Sonora and northern Sinaloa, an occurrence which only rarely happened further north in Sonoran desertscrub habitats. While anecdotal, it appears that the number and density of pygmy-owls is higher in the thornscrub and deciduous forest community types than in the Sonoran Desert community type. This occurrence and distribution agrees with past conclusions found in the literature (Hunter 1988, p. 7; Russell and Monson 1988, p. 141; Shaldach 1963, p. 40). Because pygmy-owl habitat in the southern portion of the western population segment is primarily thornscrub and dry tropical forests, it logically follows that pygmy-owls are more common in this portion of the population segment. Based upon our review of the best available commercial and scientific data, we conclude that pygmy-owl population numbers are not being significantly affected by the identified negative impacts in most of the western portion of the pygmy-owl's range such that the population is in danger of extinction or likely to become so in the foreseeable future. Therefore, we find that listing a western DPS of the overall pygmy-owl population is not warranted under the Act.

Determination for the Potential Eastern DPS

Of the negative impacts we identified in our 5-factor analysis above, the following occur within the eastern portion of the pygmy-owl's range: (1) Habitat loss and fragmentation due to urbanization, improper grazing, nonnative species invasions, fire, agricultural development, and wood cutting; (2) loss or alteration of habitat as a result of hurricanes; (3) lack of adequate regulatory mechanisms; (4) drought and climate change; (5) predation; and (6) small population size. Therefore, within the potential eastern DPS configuration, impacts to pygmy-owls and their habitat discussed under factors A, C, E may be affecting this pygmy-owl population segment.

The historical loss of pygmy-owl habitat in the eastern portion of its range has had significant effects on the pygmy-owl. As discussed above, the pygmy-owl was once a common breeding species in Texas and northeastern Mexico (Griscom and Crosby 1926, p. 18; Friedmann *et al.* 1950, p. 145), but is now extirpated or extremely rare in the area of the Rio Grande Delta (Oberholser 1974, pp. 451–452). However, a disjunct population generally occurring in the area of Kenedy County, Texas, has been estimated at 100 pygmy-owls (Tewes 1992, p. 24), 654 pairs (Wauer *et al.* 1993, p. 1074), and up to 1,823 pygmy-owls (Mays 1996, p. 32). It should be noted that these studies used different methodologies and study areas, and are not directly comparable, but do provide estimates for the general area. A recent concern about the populations in Texas has been raised because of an apparent decline in the number of pygmy-owl nestlings banded in this population as part of an ongoing nest box study in Texas (Proudfoot 2010, p. 1). However, comprehensive pygmy-owl surveys throughout southern Texas have not occurred for over a decade, and, without a more comprehensive survey effort in southern Texas, we cannot definitively state that the overall population of pygmy-owls in southern Texas matches the decline of nestlings documented during this nest box study. Pygmy-owls may simply have moved to other areas supporting suitable nesting habitat (Proudfoot 2011b, p. 1).

While the literature indicates that significant areas of pygmy-owl habitat have been lost and fragmented throughout the eastern portion of the pygmy-owl's range, there is no indication that, where areas of suitable habitat remain, numbers and densities of pygmy-owls would not be similar to those found in the same type of habitat in Texas. Numbers of pygmy-owls in Texas remain substantially higher than those in the northwestern portion of the pygmy-owl's range, and similar to the apparently higher numbers found in the southwestern portion of the range in thornscrub and dry tropical forests.

Additionally, while urbanization and agricultural development and woodcutting may be ongoing negative impacts in northeastern Mexico (AQUASTAT 2007, p. 2; Cook *et al.* 2001, p. 4; Jahrsdoerfer and Leslie 1985, p. 17; Tewes1993, pp. 28–29), the occurrence of the majority of suitable pygmy-owl habitat in Texas on private ranches may reduce the potential for these impacts to significantly affect pygmy-owl populations in this area. Wauer *et al.* (1993, p. 1076) state, ''Changes in the ranch land habitats of Kenedy and Brooks Counties have been relatively limited, suggesting that rancher landowners, at least in south Texas, are being good land stewards.'' At least currently, the Texas population of pygmy-owls appears to be viable (Wauer *et al.* 1993, p. 1071) and the primary recruitment base for pygmy-owl populations in this area (Wauer *et al.* 1993, p. 1076).

The best available scientific and commercial information demonstrates that, despite the ongoing negative impacts to pygmy-owl habitat in the eastern portion of its range, numbers and densities have remained relatively high. Therefore, we find that listing an eastern DPS of the overall pygmy-owl population is not warranted under the Act.

Significant Portion of the Range

The Act defines ''endangered species'' as any species which is ''in danger of extinction throughout all or a significant portion of its range,'' and ''threatened species'' as any species which is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The definition of ''species'' is also relevant to this discussion. The Act defines the term ''species'' as follows: ''The term 'species' includes any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature.'' The phrase ''significant portion of its range'' (SPR) is not defined by the statute, and we have never explicitly addressed it in our implementing regulations either: (1) The consequences of a determination that a species is endangered or likely to become so throughout a significant portion of its range, but not throughout all of its range; or (2) what qualifies a portion of a range as ''significant.''

Two recent district court decisions have addressed whether the SPR language allows the Service to list or protect less than all members of a defined ''species'': *Defenders of Wildlife* v. *Salazar,* 729 F. Supp. 2d 1207 (D. Mont. 2010), concerning the Service's delisting of the Northern Rocky Mountain gray wolf (74 FR 15123; Apr. 12, 2009); and *WildEarth Guardians* v. *Salazar,* 2010 U.S. Dist. LEXIS 105253 (D. Ariz. Sept. 30, 2010), concerning the Service's 2008 finding on a petition to list the Gunnison's prairie dog (73 FR 6660; Feb. 5, 2008). The Service had asserted in both of these determinations that it had authority under the Act to protect only some members of a ''species,'' as that term is defined by the Act (i.e., species, subspecies, or DPS). Both courts ruled that the determinations were arbitrary and capricious on the grounds that this approach violated the plain and unambiguous language of the Act. The courts concluded that reading the SPR language to allow protecting only a portion of a species' range is inconsistent with the Act's definition of ''species.'' The courts concluded that, once a determination is made that a species (i.e., species, subspecies, or DPS) meets the definition of ''endangered species'' or ''threatened species,'' it must be placed on the list in its entirety and the Act's protections applied consistently to all members of that species (subject to modification of protections through special rules under sections 4(d) and 10(j) of the Act).

Consistent with that interpretation, and for the purposes of this finding, we interpret the phrase ''significant portion of its range'' in the Act's definitions of ''endangered species'' and ''threatened species'' to provide an independent basis for listing; thus there are two situations (or factual bases) under which a species would qualify for listing: A species may be endangered or threatened throughout all of its range (which we have determined is not the case with the pygmy-owl); or a species may be endangered or threatened in only a significant portion of its range. If a species is in danger of extinction throughout an SPR, the species is an ''endangered species.'' The same analysis applies to ''threatened species.'' Based primarily on existing case law, the consequence of finding that a species is endangered or threatened in only a significant portion of its range is that the entire species shall be listed as endangered or threatened, respectively, and the Act's protections shall be applied across the species' entire range.

We conclude, for the purposes of this finding, that interpreting the SPR phrase as providing an independent basis for listing is the best interpretation of the Act because it is consistent with the purposes and the plain meaning of the key definitions of the Act. This interpretation does not conflict with established past agency practice (prior to the 2007 Solicitor's Opinion, which interpreted language in section 4(c) as limiting the application of ESA protections to the significant portion of a species' range where it is endangered or threatened, rather than throughout its range) because no consistent, long-term agency practice has been established, and it is consistent with the most recent judicial opinions that have most closely examined this issue. Having concluded that the phrase ''significant portion of its range'' provides an independent basis for listing and protecting the entire species, we next turn to the meaning of ''significant'' to determine the threshold for when such an independent basis for listing exists.

Although there are potentially many ways to determine whether a portion of a species' range is ''significant,'' we conclude, for the purposes of this finding, that the significance of the portion of the range should be determined based on its biological contribution to the conservation of the species. For this reason, we describe the threshold for ''significant'' in terms of an increase in the risk of extinction for the species. We conclude that a biologically-based definition of ''significant'' best conforms to the purposes of the Act, is consistent with judicial interpretations, and best ensures species conservation. Thus, for the purposes of this finding, a portion of the range of the pygmy-owl is ''significant'' if its contribution to the viability of the species is so important that, without that portion, the pygmy-owl would be in danger of extinction. Therefore, if we determine that the pygmy-owl is endangered or threatened in a significant portion of its range, and it would be in danger of extinction in the rest of its range without that portion, that portion is significant and we will list the entire species according to its status there.

We evaluate biological significance based on the principles of conservation biology using the concepts of redundancy, resiliency, and representation. *Resiliency* describes the characteristics of a species that allow it to recover from periodic disturbance. *Redundancy* (having multiple populations distributed across the landscape) may be needed to provide a margin of safety for the species to withstand catastrophic events. *Representation* (the range of variation found in a species) ensures that the species' adaptive capabilities are conserved. Redundancy, resiliency, and representation are not independent of each other, and some characteristic of a species or area may contribute to all three. For example, distribution across a wide variety of habitats is an indicator of representation, but it may also indicate a broad geographic distribution contributing to redundancy (decreasing the chance that any one event affects the entire species), and the likelihood that some habitat types are less susceptible to certain threats, contributing to resiliency (the ability of the species to recover from disturbance). None of these concepts is intended to be mutually exclusive, and a portion of a species' range may be determined to be ''significant'' due to its contributions under any one of these concepts.

For the purposes of this finding, we determine if a portion's biological contribution is so important that the portion qualifies as ''significant'' by asking whether, without that portion, the representation, redundancy, or resiliency of the species would be so impaired that the species would have an increased vulnerability to threats to the point that the overall species would be in danger of extinction (i.e., would be ''endangered''). Conversely, we would not consider the portion of the range at issue to be ''significant'' if there is sufficient resiliency, redundancy, and representation elsewhere in the species' range that the species would not be in danger of extinction throughout its range if the population in that portion of the range in question became extirpated (extinct locally).

We recognize that this definition of ''significant'' establishes a threshold that is relatively high. On the one hand, given that the consequences of finding a species to be endangered or threatened in an SPR would be listing the species throughout its entire range, it is important to use a threshold for ''significant'' that is robust. It would not be meaningful or appropriate to establish a very low threshold whereby a portion of the range can be considered ''significant'' even if only a negligible increase in extinction risk would result from its loss. Because nearly any portion of a species' range can be said to contribute some increment to a species' viability, use of such a low threshold would require us to impose restrictions and expend conservation resources disproportionately to conservation benefit; listing would be rangewide, even if only a portion of the range of minor conservation importance to the species is imperiled. On the other hand, it would be inappropriate to establish a threshold for ''significant'' that is too high. This would be the case if the standard were, for example, that a portion of the range can be considered ''significant'' only if threats in that portion result in the entire species being currently endangered or threatened. Such a high bar would not give the SPR phrase independent meaning, as the Ninth Circuit held in *Defenders of Wildlife* v. *Norton,* 258 F.3d 1136 (9th Cir. 2001).

The definition of ''significant'' used in this finding carefully balances these concerns. By setting a relatively high threshold, we minimize the degree to which restrictions will be imposed or resources expended that do not contribute substantially to species conservation. But we have not set the threshold so high that the phrase ''in a significant portion of its range'' loses independent meaning. Specifically, we have not set the threshold as high as it was under the interpretation presented by the Service in the *Defenders* litigation. Under that interpretation, the portion of the range would have to be so important that current imperilment there would mean that the species would be *currently* imperiled everywhere. Under the definition of ''significant'' used in this finding, the portion of the range need not rise to such an exceptionally high level of biological significance. (We recognize that if the species is imperiled in a portion that rises to that level of biological significance, then we should conclude that the species is in fact imperiled throughout all of its range, and that we would not need to rely on the SPR language for such a listing.) Rather, under this interpretation we ask whether the species would be endangered everywhere without that portion, *i.e.,* if that portion were completely extirpated. In other words, the portion of the range need not be so important that even being in danger of extinction in that portion would be sufficient to cause the remainder of the range to be endangered; rather, the *complete extirpation* (in a hypothetical future) of the species in that portion would be required to cause the remainder of the range to be endangered.

The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose to analyzing portions of the range that have no reasonable potential to be significant *and* threatened or endangered. To identify only those portions that warrant further consideration, we determine whether there is substantial information indicating that: (1) The portions may be ''significant,'' and (2) the species may be in danger of extinction there or likely to become so within the foreseeable future. Depending on the biology of the species, its range, and the threats it faces, it might be more efficient for us to address the significance question first or the status question first. Thus, if we determine that a portion of the range is not ''significant,'' we do not need to determine whether the species is endangered or threatened there; if we determine that the species is not endangered or threatened in a portion of its range, we do not need to determine if that portion is ''significant.'' In practice, a key part of the portion status analysis is whether the threats are geographically concentrated in some way. If the threats to the species are essentially uniform throughout its range, no portion is likely to warrant further individual consideration. Moreover, if any concentration of threats applies only to portions of the species' range that clearly would not meet the biologically-based definition of ''significant,'' such portions will not warrant further consideration.

Therefore, having determined that the pygmy-owl does not meet the definition of a threatened or endangered species throughout its range or within any considered DPS configuration, we next considered whether there are any significant portions of the range where the pygmy-owl is in danger of extinction or is likely to become endangered in the foreseeable future. We engaged in a systematic process that began with identifying any portions of the range of the pygmy-owl that may warrant further consideration.

To determine whether any portions of the pygmy-owl's range warranted further consideration as possible threatened or endangered significant portions of the range, we reviewed the entire supporting record for the status review of this species with respect to the geographic concentration of threats, and the significance of portions of the range to the conservation of the species. We chose to first identify any portions of the pygmy-owl's range where the species may be in danger of extinction or likely to become so within the foreseeable future. We found that documented and potential population declines are occurring in some parts of the pygmy-owl's range, but not throughout the range of the pygmy-owl, indicating the possibility that threats affect the species to varying degrees across the range of the pygmy-owl. Additionally, the best available data indicates that the impacts identified above do not occur uniformly throughout the range of the pygmy-owl.

Analysis of Potential Significant Portions of the Range

We identified one area of the pygmy-owl's range that warrants further consideration as a possible threatened or endangered significant portion of the range. Based on our five-factor analysis of threats throughout the range of the pygmy-owl, we found that the Sonoran Desert Ecoregion was an area where documented and potential declines in pygmy-owl populations have occurred, indicating the species may be threatened or endangered there.

Sonoran Desert Ecoregion SPR Analysis

We identified the Sonoran Desert Ecoregion as a portion of the pygmy-owl's range that was potentially significant, and that could potentially meet the criteria for threatened or endangered (Figure 3). The decision to use this area to define the boundaries of that portion of the overall pygmy-owl range that may be significant was based on factors related to pygmy-owl ecology and information available related to the status of the pygmy-owl. This portion of the pygmy-owl's range is characterized by a generally unique vegetation community. The Sonoran Desert has the greatest diversity and vegetative growth of any desert worldwide. It is the most tropical of the three North American warm deserts (Sonoran, Mojave, and Chihuahuan) (Williams *et al.* 2001, pp. 1–2; MacMahon and Wagner 1985, pp. 105–202). The boundaries of this vegetation community have been consistently described in a number of papers (Marshall et al. 2000, pp. 4–7; McLaughlin and Bowers 1999, pp. 3–7; Dimmitt 2000, pp. 13–15; Brown 1994, p. 181; Leopold 1950, p. 513; Shreve 1951, pp. 1–3; and Nabhan and Holdsworth 1998, pp. 1–5). Finally, number and density estimates from formal studies and incidental observations from the field show that this area has markedly lower numbers and densities of pygmy-owls than the other areas of its range, and that population declines have occurred within the area (AGFD 2008a, p. 2; Flesch and Steidl 2006, p. 869).

For the purposes of this analysis, the current range of the pygmy-owl within the Sonoran Desert Ecoregion includes those areas of the ecoregion within the Arizona Counties of Pima and Pinal, and the Mexican State of Sonora, from the area immediately south of the western border of Pima County, east to Nogales, and south from Nogales to Guaymas and then back northwest to the western coast of Sonora.

Pygmy-Owl Population Status Within the Sonoran Desert Ecoregion

Within the Arizona portion of the Sonoran Desert Ecoregion, the pygmy-owl occurs in very low numbers in widely scattered population groups within the State. Historically (i.e., late 1800s and early 1900s), pygmy-owls occupied areas of south-central Arizona, from New River, about 56 km (35 mi.) north of Phoenix, south to the United States and Mexico border, west to Agua Caliente near Gila Bend and Cabeza Prieta Tanks, and east to Tucson, and, rarely, the San Pedro River (Bent 1938, pp. 435–438; Monson and Phillips 1981, pp. 71–72; Johnson *et al.* 2003, pp. 390–391). The geographic area historically occupied by pygmy-owls in Arizona includes portions of Gila, Pima, Pinal, Maricopa, Graham, Santa Cruz, Cochise, Greenlee, and Yuma Counties. Currently, the known locations of pygmy-owls in Arizona are restricted to two counties, Pima and Pinal (Service 2011, p. 1; Service 2009b, p. 1; Abbate *et al.* 2000, pp. 15–16). The current distribution of pygmy-owls within Arizona is significantly reduced from its historical distribution.

Historically, the pygmy-owl was found as far north as New River in Maricopa County, and, prior to the mid-1900s, early naturalists considered the pygmy-owl ''not uncommon,'' ''of common occurrence,'' and a ''fairly numerous'' resident of the areas in which they traveled in Arizona (Breninger 1898, p. 28; Gilman 1909, p. 148; Swarth 1914, p. 31). Recent data indicate that there are fewer than 50 adult pygmy-owls and fewer than 10 nest sites in Arizona in any given year (Abbate *et al.* 2000, pp. 15–16). Limited surveys and monitoring conducted in 2009 indicate that pygmy-owls in Arizona still occupy the areas of Avra Valley, Altar Valley, and Organ Pipe Cactus National Monument (Service 2009b, p. 1; 2011, p. 1). However, populations of pygmy-owls in Arizona are in an ongoing decline (AGFD 2008a, p. 2). Comprehensive surveys have not been conducted on the Tohono O'odham Nation in Arizona. A number of surveys have been completed on the Nation with respect to various utility and roadway projects, and some of these surveys did document the presence of pygmy-owl. But distribution of the data from these surveys has been restricted by the Nation and is not readily available for analysis. There are large areas of suitable habitat on the Nation, but the information we have indicates that pygmy-owls are patchily distributed in those areas as in other areas of the State and occur in similar densities.

Within the Mexico portion of the Sonoran Desert Ecoregion, pygmy-owl numbers are higher, but, similar to their distribution in Arizona, pygmy-owls also occur here as scattered population groups throughout the occupied area (Flesch 2003, pp. 123–124). Recent surveys and research in northwestern Mexico indicate that numbers and density of pygmy-owls are higher in thornscrub and tropical deciduous forest communities of southern Sonora and Sinaloa than in the Sonoran desertscrub and semi-desert grassland vegetation communities of the Sonoran Desert Ecoregion (Flesch 2003, pp. 39–42; AGFD 2008a, p. 6). Long-term monitoring of pygmy-owl sites in northern Sonora indicates that the extended drought has resulted in reduced occupancy at monitored sites (Flesch 2008, pp. 4–5). Pygmy-owl survivorship is tied to precipitation (Flesch 2008, pp. 5–6; Service 2004, p. 1). As in Arizona, drought has negatively affected the numbers and distribution of pygmy-owls on the landscape within the analysis area (Flesch 2008, pp. 5–6). While data adequate to define population trends in Sonora, Mexico, are lacking, field data indicate that pygmy-owls in the southern portions of the State (within thornscrub and tropical deciduous forests) are common and likely number on the order of thousands, while further north within the Sonoran Desert Ecoregion, they are fewer in number, more patchily distributed, and likely number on the order of hundreds (Flesch 2003, pp. 39–42; AGFD 2008a, p. 6).

Significance of the Sonoran Desert Ecoregion

This part of the pygmy-owl's range contains habitat that meet the needs of the pygmy-owl for reproduction and survival, and can support self-sustaining population groups. It also provides a mosaic of connected habitat maintaining dispersal and genetic exchange among subpopulations. The habitat found in this portion of the range may become increasingly important if the predictions about climate change prove correct. As hotter, drier conditions prevail, this area, which already provides habitat under these conditions, may provide the largest, most contiguous blocks of higher quality habitat if the wetter, more tropical habitats (thornscrub and tropical deciduous forests) are reduced due to climate change. Conditions in the Sonoran desert are also likely to become hotter and drier. However, the population groups of pygmy-owls found in the Sonoran Desert Ecoregion are already adapted to the drier climate that is likely to become more widespread under current climate change scenarios and, therefore, this shift in temperature and precipitation may have a reduced effect on pygmy-owls in this area. Saguaros and other columnar cacti may experience range-shifts associated with climate change, however, there is much uncertainty associated with the current models of individual species responses to climate change. Therefore, predictions about the decline of columnar cacti are too speculative to consider in this finding. This population group of pygmy-owls is likely to become a more significant contributor to the long-term viability of this species.

Given the presumed adaptation of this segment of the population to drier, more extreme conditions, we considered whether the demographic characteristics of this population might be important for the species to recover from predicted changes in the ecosystem due to climate change. Although birds in every terrestrial habitat will be affected by climate change, birds in arid lands show lower overall vulnerability to the effects of climate change (NABCI 2010). Pygmy-owls in the Sonoran Desert Ecoregion may be more likely to be able to provide population support for the remainder of its range. Therefore, demographic characteristics and population size within this portion of the range might allow for at least partial recovery of pygmy-owl populations within this portion of the range following disturbance events.

Pygmy-owls are secondary cavity nesters, using cavities excavated in trees and cacti. Within the Sonoran Desert Ecoregion, pygmy-owls typically nest in large, columnar cacti found throughout the area. The Sonoran Desert Ecoregion contains the greatest concentration of large columnar cacti (saguaro, organ pipe, hecho) anywhere in the range of the pygmy-owl. While other areas to the south of this portion of the range also contain large, columnar cacti, they do not occur in as high of densities, nor are they as extensively distributed. In other portions of its range, the pygmy-owl nests in tree cavities; therefore, this aspect of the pygmy-owl's life history requirements is not exclusive to columnar cacti, but it is an important and necessary element in this part of its range because nesting in saguaros reduces the impacts to eggs and nestlings from the temperature extremes and predation found in this portion of the range.

There is some information indicating that this subdivision of the western part of the range is different genetically than the remainder of the range. Proudfoot (2006a, p. 7) indicates that pygmy-owls in this portion of the range share no haplotypes with populations in Texas or in the remainder of Mexico. Using information in Proudfoot *et al.* (2006a, pp. 6–9 and 2006b, pp. 5–7), we have determined that the Arizona/Sonora pygmy-owls contribute approximately 10 percent of the species total mitochondrial DNA (mtDNA) variation and 5 percent of the total alleles (gene types) detected in their study (Service 2009c, p. 1). This data analysis indicates that this part of the range does have unique alleles and contributes to the genetic variation within the range of the pygmy-owl. There is evidence of restricted gene flow between the Arizona/western Mexico and Texas/eastern Mexico populations (Cicero 2008, p. 2; Oyler-McCance 2008, pp. 1–2; Dumbacher 2008, p. 9).

We have found that the Sonoran Desert Ecoregion has unique habitat characteristics and the pygmy-owls in this area possess some unique behavioral and genetic adaptations to this area. Next, we evaluated whether, should this portion of the range theoretically be extirpated, the remaining portion of the pygmy-owl's current range would be in danger of extinction. This evaluation focused on the pygmy-owl's rangewide population status and the importance of this part of the range to the entire range.

There is general consensus in the literature and other reports that pygmy-owls remain common throughout most of the areas of Mexico south of Sonora and Texas. As noted above, the population of pygmy-owls in this ecoregion is small and scattered, and thus represents only a small portion of the overall pygmy-owl population. The best available information does not indicate that, under the theoretical removal of the Sonoran Desert Ecoregion from the current range of the pygmy-owl, the remaining portion of the range is likely to become extinct. Therefore, we do not find the Sonoran Desert Ecoregion of the pygmy-owl to be significant, and thus it is not an SPR.

Sonoran Desert Ecoregion SPR Analyses in Relation to the Eastern and Western DPS's

We determined that the eastern and western portions of the pygmy-owl's current range represent DPSs; that is, we found that they are discrete and significant to the taxon as a whole (see DPS discussion above). We found that the best scientific and commercial information did not indicate that the negative impacts in these DPSs affect the pygmy-owl's status such that these DPSs warrant listing under the Act. However, because we found that these DPS configurations were appropriate under our DPS policy, we next evaluated whether the Sonoran Desert Ecoregion represents significant portions of the western and eastern DPSs respectively.

Potential Sonoran Desert Ecoregion SPR of the Western DPS

The portion of the Sonoran Desert Ecoregion currently occupied by pygmy-owls represents approximately 33 percent of the Western DPS (Figure 3). Even though this is only approximately one-third of the Western DPS, this portion of the DPS may provide important contributions to population numbers, genetic diversity, and status of the pygmy-owls within this DPS.

In considering the portion of the western DPS outside of the Sonoran Desert Ecoregion and whether it may be in danger of extinction, we find it is likely that the population of pygmy-owls in this area is large enough to withstand environmental catastrophes and random perturbations. This is because the area outside of the Sonoran Desert Ecoregion represents approximately 67 percent of the DPS, and it likely supports a higher proportion of the overall population than the Sonoran Desert Ecoregion, because this portion of the DPS is characterized by thornscrub and tropical deciduous forest communities, which have been documented to support higher numbers and densities of pygmy-owls than Sonoran desertscrub communities (Swarth 1914, p. 31; Karalus and Eckert 1974, p. 218; Monson and Phillips 1981, pp. 71–72; Johnsgard 1988, Enriquez-Rocha *et al.* 1993, p. 158; Proudfoot 1996, p. 75; Proudfoot and Johnson 2000, p. 5). The production and population growth of the pygmy-owls outside the Sonoran Desert Ecoregion are likely high enough to maintain viability of the population under current conditions. Because the Sonoran Desert Ecoregion occurs at the northern end of the Western DPS, the theoretical loss of that portion would not result in fragmentation of the DPS in a way that would affect movements and connectivity of the pygmy-owl population.

However, the theoretical loss of a third of the range might represent a significant loss of important habitat and genetic diversity, affecting the redundancy and representation of the overall pygmy-owl population, and possibly affect the remaining portion of the population by reducing metapopulation support including genetic adaptation and demographic rescue. The current genetic structure of the western DPS indicates that there is population movement within the DPS and, as a consequence, exchange of genetic material among population groups, even though the distribution of pygmy-owls on the landscape is patchy. Removal of approximately 33 percent of the DPS might reduce the viability and potential for long-term survival of the remaining portion of the DPS. For example, the Sonoran Desert Ecoregion supports the portion of the DPS population that is adapted to the unique environment of the Sonoran Desert. Loss of this segment of the population might substantially decrease the genetic diversity of the overall DPS to the point that the pygmy-owl may not be able to adapt to what may be the predominant vegetation community under the predicted effects of climate change. However, the thornscrub and tropical deciduous forest communities have already been substantially reduced, and this reduction and fragmentation is likely to continue. Sonoran desertscrub will likely expand to the north and south as climates to the north become warmer and climates to the south become drier (Weiss and Overpeck 2005, p. 2074).

Pygmy-owl adaptations documented in the Sonoran Desert Ecoregion include the use of saguaro cavities as nest sites, paler plumage coloration, ability to obtain moisture from prey rather than free-standing water, and the ability to select nest locations that maintain productivity during drought conditions (AGFD 2008a, pp. 1–2 and b, pp. 3–7; Flesch 2008, p. 3; Flesch and Steidl 2010, p. 1021). The ability of the western DPS to adapt to impacts from climate change may be substantially reduced with the theoretical loss of the Sonoran Desert Ecoregion.

The Sonoran Desert Ecoregion population is characterized by lower numbers and density of pygmy-owls. This is likely the result of reduced habitat quality and location of this population group at the northern extent of the Western DPS. While this population may be considered marginal, it is important to recognize that marginal populations may have a high adaptive significance to the species as a whole, and marginal habitat conservation, preservation and management is one of the best ways to conserve genetic diversity and resources (Scudder 1989, p. 1). The portion of the western DPS outside of the Sonoran Desert Ecoregion may lack sufficient resiliency to meet future environmental changes that are already manifesting themselves within this DPS. However, the pygmy-owl is somewhat of a habitat generalist and, if impacts to habitat occur over an extended period of time, these populations may still be able to adapt to environmental changes in this DPS.

The primary vegetation communities found outside of the Sonoran Desert Ecoregion in the Western DPS, thornscrub and subtropical dry forests, are under significant stress. As discussed above, thornscrub and subtropical dry forests are among the most threatened vegetation communities in Mexico. Loss of dry tropical forest occurs on as great, or greater, scale than the loss of tropical rain forests (Trejo and Dirzo 2000, p. 133). Only approximately two percent of the original distribution of subtropical dry forests remains in Mesoamerica, including Mexico. Some areas of intact dry tropical forest remain on steep slopes within the western DPS (Allnutt 2001, p. 3; Lugo 1999, p. 4). However, the topography of such slopes, above 1,200 m (4,000), renders these areas unsuitable for occupancy by pygmy-owls. In areas occupied by pygmy-owls, dry tropical forests are threatened by woodcutting, clearing for agriculture, urbanization, and impacts from invasive species. Urbanization is increasing, particularly in the southern portion of the Western DPS (Lugo 1999, p. 2; Trejo and Dirzo 2000, p. 133). In Mexico specifically, only approximately 27 percent of the original cover of seasonally dry forest remains intact (Trejo and Dirzo 2000, p. 139).

In addition, increasing temperatures due to climate change pose a serious threat to subtropical dry forests due to the transitional nature of the community, and the narrow temperature and precipitation requirements of many of its native species (Allnutt 2001, p. 4). Trejo and Dirzo (2000, p. 140) predicted that, under current rates of deforestation, by the year 2030, intact seasonally dry forests would be reduced to 10 percent of their original area. Additionally, the remaining 10 percent would likely be characterized by small, vegetation islands separated from each other, causing significant ecological repercussions at the genetic, ecological, and ecosystem function levels of the ecoregion. Protected areas in Mexico that include seasonally dry forests are few and total less than 10 percent of the remaining, intact forest areas in Mexico (Trejo and Dirzo 2000, p. 140). This loss and fragmentation of habitat, and the influence of climate change on the remaining areas of native habitat, may substantially reduce the availability of pygmy-owl habitat and, consequently, pygmy-owl populations in the foreseeable future.

We acknowledge that the Sonoran Desert Ecoregion represents an important portion of the Western DPS, and of the taxon as a whole. However, in order to find that the portion of the western DPS in the Sonoran Desert Ecoregion is significant under our SPR policy, our position is that its contribution to the viability of the species must be so important that, without that portion, the pygmy-owl would be in danger of extinction. As noted above in the discussion under Sonoran Desert Ecoregion SPR Analysis, even though pygmy-owls in this area possess some unique behavioral and genetic adaptations, the population of pygmy-owls in this ecoregion is small and scattered, and thus represents only a small portion of the overall pygmy-owl population. The best available information does not indicate that, if the Sonoran Desert Ecoregion portion of the pygmy-owl's range is extirpated, the remaining portion of the Western DPS is likely to become extinct. Therefore, we do not find the Sonoran Desert Ecoregion of the pygmy-owl to be significant, and thus it is not an SPR.

SPR Conclusion

In summary, we have thoroughly analyzed all potentially-listable entities of the pygmy-owl. For the reasons described above, we find that the pygmy-owl is not in danger of extinction now, nor is it likely to become endangered within the foreseeable future, throughout all or any significant portion of its range. Therefore, listing the pygmy-owl as endangered or threatened under the Act is not warranted at this time.

We request that you submit any new information concerning the status of, or threats to, the pygmy-owl to our Arizona Ecological Services Office (see ADDRESSES) whenever it becomes available. New information will help us monitor the pygmy-owl and encourage management of this subspecies and its habitat. If an emergency situation develops for the pygmy-owl or any other species, we will act to provide immediate protection.

References Cited

A complete list of all references cited in this document is available on the Internet at *http://www.regulations.gov* and upon request from the Arizona Ecological Services Office (see ADDRESSES).

Authors

The primary authors of this notice are the staff members of the Arizona

Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Authority

The authority for this action is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: September 27, 2011.

Rowan W. Gould,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 2011–25565 Filed 10–4–11; 8:45 am]

BILLING CODE 4310–55–P