United States Department of the Interior

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In Reply Refer To:
AESO/ES
2-21-96-F-160R5 December 11, 2001

Memorandum

To: State Director, Bureau of Land Management, Phoenix, Arizona

From: Field Supervisor

Subject: Reinitiation/Amendment Number 5: Programmatic Biological Opinion for the Safford/Tucson Field Offices' Livestock Grazing Program, Southeastern Arizona

This memorandum is in response to your December 21, 2000, request for reinitiation of formal consultation on the Safford/Tucson Field Offices' livestock grazing program, southeastern Arizona. We also respond herein to a May 31, 2001, request from the Safford Field Office for informal consultation in regard to two allotments addressed in the Safford/Tucson grazing program biological opinion. In a September 26, 1997, biological opinion the Fish and Wildlife Service (Service) evaluated effects of proposed grazing activities on Kearney's blue star (*Amsonia kearneyana*), Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*), Nichol's turk's head cactus (*Echinocactus horizonthalonius* var. *nicholii*), Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*), Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*), desert pupfish (*Cyprinodon macularis*), spikedace (*Meda fulgida*), Gila topminnow (*Poeciliopsis occidentalis occidentalis*), loach minnow (*Tiaroga cobitis*), razorback sucker (*Xyrauchen texanus*), southwestern willow flycatcher (*Empidonax traillii extimus*), cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), jaguar (*Panthera onca*), and New Mexico ridgenose rattlesnake (*Crotalus willardi obscurus*), and critical habitat designated for the southwestern willow flycatcher and razorback sucker. The Service's biological opinion concluded that implementation of the project is not likely to jeopardize the continued existence of these species nor result in destruction or adverse modification of critical habitat. Incidental take statements were included for all animal species. The opinion also included concurrences on Bureau of Land Management (Bureau) determinations that the action may affect, but is not likely to adversely affect, eight additional species.

In your December 21, 2000, memorandum, you requested reinitiation of consultation pursuant to 50 CFR 402.16(d), because of recent designation of critical habitat for spikedace and loach minnow in the project area. In your May 31, 2001, memorandum, you requested concurrence that the proposed action may affect, but is not likely to adversely affect, the Mexican spotted owl

(*Strix occidentalis lucida*) on the Horse Mountain allotment. Your memo also requested concurrence that the proposed action for the C-Spear allotment (called the Soza Mesa allotment in the 1997 opinion) would have no effect on the cactus ferruginous pygmy-owl or its critical habitat. All three of these requests will be addressed herein as the fifth reinitiation/amendment of the Safford/Tucson grazing biological opinion.

This reinitiated biological opinion was prepared using information from the following sources: the May 1996 biological evaluation for the project (U.S. Bureau of Land Management 1996); the 1997 biological opinion and its reinitiations/amendments, information provided in your December 21, 2000, and May 31, 2001, requests for consultations, including attached biological evaluations, and our files. Literature cited in this biological opinion is not a complete bibliography of all literature available on the affected species, nor is it a complete review of the effects of livestock grazing programs on these species. A complete administrative record of this consultation is on file in our office. A list of acronyms used in this document is included as Appendix 1.

CONSULTATION HISTORY

The biological opinion has been previously reinitiated or amended four times. In a November 3, 1998, memorandum from this office to the Bureau's Safford Field Office Manager, modifications to the proposed action were made in regard to operation of the Harper and Guthrie allotments (amendment No. 1). In a November 16, 1998, memorandum from this office to the State Director, the opinion was amended by replacing term and condition 1.b for the pygmy-owl, which called for removal of grazing on 10 allotments, with a term and condition that required that utilization rates not exceed 30 percent in suitable pygmy-owl habitat on five allotments, at least until completion of a study described in (c)(3) of the mitigation measures in the opinion (pages 62-63) (amendment No. 2). In a November 17, 1998, memorandum from the Service's Regional Director in Albuquerque, to the Bureau's Arizona State Director, the effective date of terms and conditions that required removal of cattle from riparian areas and management of trailing in riparian areas to minimize take of the cactus ferruginous pygmy-owl and razorback sucker was delayed until a reinitiation of consultation on these species could be completed, or until May 1, 1999, which ever occurred first (amendment No. 3). In an April 12, 2000, memorandum from this office to the Bureau's State Director, the Service evaluated proposed changes to the proposed action, including: 1) management revisions on the Smuggler Peak allotment, 2) revisions in grazing policies in cactus ferruginous pygmy-owl habitat in the grazing program, 3) revisions in razorback sucker, pygmy-owl, and Arizona hedgehog cactus mitigation measures, and other changes (amendment No. 4). In all four amendments/reinitiations and the 1997 biological opinion, the Service found that the proposed action is not likely to jeopardize any listed species or result in adverse modification or destruction of critical habitat.

On February 1, 2001, the Service redesignated critical habitat for the Mexican spotted owl on 1.9 million acres in Arizona, New Mexico, Colorado, and Utah. The designation included portions of the Bureau's Horse Mountain allotment in the upper Aravaipa Creek watershed. In a

September 21, 2001, order, the U.S. District Court for Arizona set aside the critical habitat designation for the cactus ferruginous pygmy-owl and remanded the designation to the Service. As a result, analyses and conclusions regarding pygmy-owl critical habitat in amendment 4 of this opinion are mooted. However, effects analyses on the species and its habitat and conclusions regarding the species in that amendment, previous amendments, and the opinion are still valid.

A draft of this document was sent via electronic mail to Ted Cordery (Bureau, Arizona State Office) and Jim Gacey (Safford Field Office) for review and comment on October 30, 2001. Comments on the draft were received in this office via electronic mail from Ted Cordery on November 29, 2001. The Service considered those comments and changes were made herein in response.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is ongoing grazing and related activities (range improvement projects, prescribed fire, and vegetation management) on 288 allotments in southeastern Arizona through 2006. The proposed action and its revisions are described in detail in the 1997 biological opinion and its revisions. Those descriptions are included herein by reference. In the current reinitiation, the Bureau proposes no changes to the proposed action. Thus, the only sections of the biological opinion needing revision are the Status of the Species, Environmental Baseline, Effects of the Proposed Action, and Conclusion for spikedace, loach minnow, Mexican spotted owl, and cactus ferruginous pygmy-owl. These revisions follow, and include not only descriptions of critical habitat, but other new information about these species that has come to light since the opinion was written. The Mexican spotted owl was addressed informally as a concurrence in the 1997 opinion; and is also addressed informally herein. Note that this consultation is programmatic in nature, in that it addresses the grazing program in total, rather than in a batched consultation, allotment by allotment. The Bureau requested our concurrence that proposed grazing activities on the C-Spear allotment may affect, but are not likely to adversely affect, the cactus ferruginous pygmy-owl or its critical habitat. To maintain this programmatic level of consultation, we will not provide herein a concurrence specifically for the C-Spear allotment, but will consider it as part of this reinitiation of formal consultation.

SPIKEDACE AND LOACH MINNOW
STATUS OF THE SPECIES
Spikedace

Spikedace was listed as a threatened species on July 1, 1986 (U. S. Fish and Wildlife Service 1986a). Critical habitat was designated for spikedace on April 25, 2000 (U.S. Fish and Wildlife Service 2000). Critical habitat includes portions of the Verde, middle Gila, San Pedro, San Francisco, Blue, and upper Gila rivers and Eagle, Bonita, Tonto, and Aravaipa creeks and several tributaries of those streams.

Spikedace is a small silvery fish whose common name alludes to the well-developed spine in the dorsal fin (Minckley 1973). Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from the Verde, middle Gila, and upper Gila Rivers, and Aravaipa and Eagle creeks (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Marsh *et al*. 1990, Sublette *et al*. 1990, Jakle 1992, Knowles 1994, Rinne 1999). Habitat destruction along with competition and predation from introduced nonnative species are the primary causes of the species' decline (Miller 1961, Williams *et al.* 1985, Douglas *et al.* 1994).

Spikedace lives in flowing water with moderate to fast velocities over sand, gravel, and cobble substrates (Propst *et al*. 1986, Rinne and Kroeger 1988). Specific habitat for this species consists of shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at the downstream riffle edges (Propst *et al*. 1986). Spikedace spawns from March through May with some yearly and geographic variation (Barber *et al*. 1970, Anderson, 1978, Propst *et al*. 1986). Actual spawning has not been observed in the wild, but spawning behavior and captive studies indicate eggs are laid over gravel and cobble where they adhere to the substrate. Spikedace lives about two years with reproduction occurring primarily in one-year old fish (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). It feeds primarily on aquatic and terrestrial insects (Schreiber 1978, Barber and Minckley 1983, Marsh *et al*., 1989).

Recent taxonomic and genetic work on spikedace indicate there are substantial differences in morphology and genetic makeup between remnant spikedace populations. Remnant populations occupy isolated fragments of the Gila basin and are isolated from each other. Anderson and Hendrickson (1994) found that spikedace from Aravaipa Creek is morphologically distinguishable from spikedace from the Verde River, while spikedace from the upper Gila river and Eagle Creek have intermediate measurements and partially overlap the Aravaipa and Verde populations. Mitochondrial DNA and allozyme analyses have found similar patterns of geographic variation within the species (Tibbets 1992, 1993).

The status of spikedace is declining rangewide. Although it is currently listed as threatened, the Service has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal is pending; however, work on it is precluded due to work on other higher priority listing actions (U. S. Fish and Wildlife Service 1994b). Although spikedace is common in some portions of its highly reduced range, it is uncommon to rare in most. At present, the species is common only in Aravaipa Creek and some parts of the upper Gila River in New Mexico. Spikedace in the Verde River and Eagle Creek have not been found since 1999 and 1987, respectively, and their status is uncertain (Arizona Game and Fish Department [AGFD] unpublished data, Marsh *et al*. 1989, Rinne 1999).

STATUS OF THE SPECIES
Loach Minnow

Loach minnow was listed as a threatened species on October 28, 1986 (U. S. Fish and Wildlife

Service 1986b). Critical habitat was designated for loach minnow on April 25, 2000 (U. S. Fish and Wildlife Service 2000). Critical habitat includes portions of the Verde, Black, middle Gila, San Pedro, San Francisco, Tularosa, Blue, and upper Gila rivers and Eagle, Bonita, Tonto, and Aravaipa creeks and several tributaries of those streams.

Loach minnow is a small, slender, elongate fish with markedly upwardly-directed eyes (Minckley 1973). Historic range of loach minnow included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila rivers (Minckley 1973, Sublette *et al.* 1990). Habitat destruction plus competition and predation by nonnative species have reduced the range of the species by about 85 percent (Miller 1961; Williams *et al.* 1985; Marsh *et al.* 1989). Loach minnow remains in limited portions of the upper Gila, San Francisco, Blue, Black, Tularosa, and White rivers and Aravaipa, Turkey, Deer, Eagle, Campbell Blue, Dry Blue, Pace, Frieborn, Negrito, Whitewater, and Coyote creeks in Arizona and New Mexico (Barber and Minckley 1966, Silvey and Thompson 1978, Propst *et al.* 1985, Propst *et al.* 1988, Marsh *et al.* 1990, Bagley *et al.* 1995, U. S. Bureau of Land Management 1995, Bagley *et al.* 1996, Miller 1998).

Loach minnow is a bottom-dwelling inhabitant of shallow, swift water over gravel, cobble, and rubble substrates (Rinne 1989, Propst and Bestgen 1991). Loach minnow uses the spaces between, and in the lee of, larger substrate for resting and spawning (Propst *et al.* 1988; Rinne 1989). It is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat (Barber and Minckley 1966). The life span of loach minnow is about 2 years (Britt 1982; Propst and Bestgen 1991). Loach minnow feeds exclusively on aquatic insects (Schreiber 1978; Abarca 1987). Spawning occurs in March through May (Britt 1982; Propst *et al.* 1988); however, under certain circumstances loach minnow also spawn in the autumn (Vives and Minckley 1990). The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al.* 1988; Vives and Minckley 1990).

Recent biochemical genetic work on loach minnow indicates there are substantial differences in genetic makeup between remnant loach minnow populations (Tibbets 1993). Remnant populations occupy isolated fragments of the Gila River basin and are isolated from each other. Based upon her work, Tibbets (1992, 1993) recommended that the genetically distinctive units of loach minnow should be managed as separate units to preserve the existing genetic variation.

The status of loach minnow is declining rangewide. Although it is currently listed as threatened, the Service has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal is pending; however, work on it is precluded due to work on other higher priority listing actions (U. S. Fish and Wildlife Service 1994b). In its highly reduced remaining range, loach minnow varies from common to rare. At present, the species is common only in Aravaipa Creek, the Blue River, and limited portions of the San Francisco, upper Gila and Tularosa rivers. Remnant populations in the Black, White, and Eagle creeks are very small and their continued existence is tenuous.

ENVIRONMENTAL BASELINE - Spikedace and Loach Minnow

The environmental baselines for these species remains the same with the addition of the following at the end of each section:

Critical habitat was designated for spikedace in the action area in the following areas: 1) lower San Pedro River from the Aravaipa Creek confluence to the Gila River (13 miles), 2) lower San Pedro River from Alder Wash (near Redfield) to Ash Creek (46 miles), 3) Aravaipa Creek from the confluence with Stowe Gulch to the San Pedro River (28 miles), 4) Redfield Canyon from its confluence with the San Pedro River upstream to Sycamore Canyon (14 miles), 5) Hot Springs Canyon from its confluence with the San Pedro River upstream to Bass Canyon (12 miles), 6) Bass Canyon from its confluence with Hot Springs Canyon upstream to Pine Canyon, 7) upper San Pedro River from its confluence with the Babocomari River upstream to the U.S./Mexico border (37 miles), 8) Gila River from the Brown Canal in the upper end of the Safford Valley upstream to the confluence with Owl Canyon at the upper end of the Gila Box (23 miles), 9) Gila River from the San Pedro River confluence to Ashurst-Hayden Dam (39 miles), 10) Bonita Creek from the confluence with the Gila River upstream to the confluence with Martinez Wash (15 miles), 11) Eagle Creek from the Phelps-Dodge diversion dam upstream to the confluence of Dry Prong and East Eagle creeks (45.2 miles), and 12) San Francisco River from its confluence with the Gila River upstream to its confluence with the Tularosa River, New Mexico (113.2 miles).

Critical habitat was designated for the loach minnow in the action area in the same reaches, described above for the spikedace, on the lower and upper San Pedro River, Redfield Canyon, Hot Springs Canyon, Bass Canyon, Gila River, San Francisco River, Bonita Creek, and Eagle Creek. The only difference between spikedace and loach minnow critical habitat in regard to the action area is the addition for loach minnow of Turkey Creek, from its confluence with Aravaipa Creek upstream to Oak Grove Canyon (2.7 miles), and Deer Creek, from its confluence with Aravaipa Creek upstream to the boundary of the Aravaipa Wilderness (2.3 miles)

Not all of the stream or river miles listed above are actually within allotments or would be affected by grazing activities. We include for detailed analysis here those allotments that include critical habitat (Table 1 - 14 allotments) or are upstream in the watershed of critical habitat (Table 2 - 60 allotments) (note that the 14 allotments that include critical habitat also include the watershed of critical habitat, but are not repeated in Table 2). For information about the size and location of these allotments, grazing systems, percent or acres of land in public ownership, permitted use in animal unit months (AUMs), and other data, see Figure 1 and Table 3 of the 1997 biological opinion. Table 5 of the opinion summarizes range condition and trend data for each allotment.

Table 1: Allotments that include BLM-managed spikedace or loach minnow critical habitat. (These allotments also contain grazed lands within the watershed of critical habitat.)

Critical Habitat Segment	Allotments Within Those Segments
1. **Aravaipa Creek**	Quintana [2] 4519 Hell Hole[3] 4528 South Rim[1,2] 4529 Brandenberg Mtn [2] 4530 Massacre[1, 2] 4532
2. **Deer Creek** (loach minnow only)	Hell Hole[4] 4528
3. **Turkey Creek** (loach minnow only)	South Rim[1,2] 4529
4. **Redfield Canyon**	C-Spear[5] 4409 Muleshoe [1,2] 4401
5. **Hot Springs Canyon**	Muleshoe [1,2] 4401
6. **Bass Canyon**	Muleshoe [1,2] 4401
7. **Upper San Pedro**	Brunchow Hill 5251
8. **Gila River**	Bonita Creek[2] 4616 Twin C [2] 4021 Bullgap [2] 4617 Morenci [2] 4003 Gila [2] 4014 Smuggler Peak[6]

[1]Permittee taking nonuse
[2]Grazing excluded from critical habitat
[3]Grazing excluded from critical habitat except for limited trailing (see text)
[4]Cattle can not physically access Deer Creek
[5]This allotment was referred to as "Soza Wash" in the original opinion.
[6]Grazing in critical habitat only during riparian plant dormancy (roughly November to early April)

Table 2: Allotments that include BLM lands upstream in the watershed of spikedace or loach minnow critical habitat

Allotment	Critical Habitat Segment Downstream
Lower San Pedro Watershed[1]	
Zapata 4533	L San Pedro
Painted Cave 4518	L San Pedro, Aravaipa
Malpais Hills 4517	L. San Pedro
Dudleyville [2] 4516	L. San Pedro
Eskiminzin 4542	L. San Pedro
Antelope 6124	L. San Pedro
Haydon 6078	L. San Pedro
Willow Springs 6123	L. San Pedro
Tiger 4535	L. San Pedro
Dry Camp 4520	L. San Pedro, Aravaipa, Deer Creek
Horse Mountain 4524	L. San Pedro, Aravaipa, Deer Creek
South Aravaipa 4521	L. San Pedro, Aravaipa
Laurel Cyn 4525	L. San Pedro, Aravaipa
Aravaipa 4522	L. San Pedro, Aravaipa, Deer Creek
Reliable [2] 4536	L. San Pedro
Copper Creek 4537	L. San Pedro
Hotwell [2] 4539	L. San Pedro
Soza Mesa 4402	L. San Pedro, Hot Springs Canyon
Riley West 4414	L. San Pedro
Sheep Wash 5416	L. San Pedro
Turner 5201	L. San Pedro
Monzingo 5220	L. San Pedro
McGoffin 5412	L. San Pedro
Starlight 5404	L. San Pedro
Monzingo2 5226	L. San Pedro
Q Miller 5261	L. San Pedro
Hopp 5242	L. San Pedro
Babocamari 5208	L. San Pedro, U. San Pedro
Upper San Pedro Watershed	
J.J. Escapule 5232	U. San Pedro, L. San Pedro
Lucky Hills 5252	U. San Pedro, L. San Pedro
Cox 5274	U. San Pedro, L. San Pedro

Marco 5255	U. San Pedro, L. San Pedro
Powers 5227	U. San Pedro, L. San Pedro
Powers2 5205	U. San Pedro, L. San Pedro
Cleveland 5219	U. San Pedro, L. San Pedro
Susnow 5240	U. San Pedro, L. San Pedro
Wildcat Canyon 5258	U. San Pedro, L. San Pedro
J.E. Warren Jr. 5295	U. San Pedro, L. San Pedro
Ramirez 5268	U. San Pedro, L. San Pedro

Gila River Watershed[3]

No Name 5057	Gila River
Woods Canyon 5049	Gila River
Wilky 5066	Gila River
Rhyolite Peak 5041	Gila River
Sheldon Mtn 5035	Gila River
Sand Wash 5046	Gila River
Saddleback Mtn 5044	Gila River
China Camp 5043	Gila River
Willow Mtn 5037	Gila River
Willis 5016	Gila River
Twin Peaks 5018	Gila River
Harper 5024	Gila River
Guthrie Peak 4034	Gila River
Tollgate 4033	Gila River
Buck Canyon 4023	Gila River
County Line 4022	Gila River
Zorilla 4011	Gila River
Red Hickey Hills 4005	Gila River, San Francisco River
Metcalf 4001	Gila River, San Francisco River
San Francisco 4002	Gila River, San Francisco River
Turtle Mtn 4618	Gila River, Eagle Creek
Johnny Creek 4615	Gila River, Bonita Creek

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[1]Note: All San Pedro River allotments are in the watershed of critical habitat on the Gila River downstream of the San Pedro confluence.

[2]Permittee taking nonuse

[3]Gila River allotments upstream of Safford are in the watershed of critical habitat on the Gila River downstream of the San Pedro River confluence; however, any watershed effects in these allotments do not manifest below Coolidge Dam (upstream of the San Pedro confluence).

The Service is currently in consultation or reinitiation of consultation with several National Forests and the Bureau in Arizona and New Mexico in regard to grazing activities in spikedace and loach minnow critical habitat. We have yet to fully evaluate the effects of these grazing activities on critical habitat or the species; however, effects are generally similar to those evaluated herein and in the 1997 Safford/Tucson grazing biological opinion.

EFFECTS OF THE PROPOSED ACTION - Spikedace and Loach Minnow

A Review of Literature and Other New Information Generated Since the 1997 Opinion

Effects of the action on spikedace and loach minnow were described in detail in the 1997 biological opinion and are included here by reference. Since 1997, substantial new literature on the effects of grazing activities on riparian and aquatic systems has been published. Belsky *et al.* (1999) published an excellent review of the effects of livestock grazing on stream and riparian ecosystems in the western United States. The authors found that livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. Effects occurred at the landscape and regional level, and effects continue to occur under current grazing strategies. No positive environmental impacts were noted. Fitch and Adams (1998) asked the question “can cows and fish coexist?” Their study, which focused on aquatic systems in northern prairie ecosystems in Alberta, concluded that unmanaged grazing results in overuse and degradation of riparian areas. Grazing management needs to address the fundamental issues of utilization and season of use specific to riparian areas. If accomplished on a landscape scale, cows and fish can co-exist. The authors find that the needs of riparian systems have long been ignored in grazing strategies, which typically focus on the uplands where most of the forage occurs.

Gresswell (1999) reviewed literature on the effects of fire on aquatic ecosystems in forested biomes of North America. Fishes are often extirpated from stream reaches post-fire, but Gresswell found that even in the case of extensive high-severity fires, local extirpation is patchy and recolonization is rapid. An exception is in the case of isolated, declining native fish populations for which local extirpation may be long-term due to degraded metapopulation dynamics (such as with native Arizona fishes). Larsen *et al.* (1998) evaluated the quality of information available about effects of livestock grazing on riparian areas and fish and concluded that the literature is weighted towards unpublished studies in which grazing practices were inadequately described, study designs were weak, and in which pretreatment data or controls were absent. Rinne (1999) found similar problems with existing studies, and noted that the literature is biased towards domestic livestock and salmonid fishes, and that cypriniform fishes and wild ungulates, especially elk, must be considered in future studies. Rinne found clear evidence in the literature that grazing adversely affects riparian vegetation; however, less information is available, and that information is less conclusive, in regard to effects of grazing on fishes. Rinne’s conclusions about effects to riparian vegetation are bolstered by the findings of Krueper *et al.* (2000) on the upper San Pedro River and Dobkin *et al.* (1998) in the northwestern

Great Basin. In both studies, riparian vegetation responded rapidly to removal of livestock, and avian populations rebounded, as well. Appendix G of the Service's (2001a) draft Southwestern Willow Flycatcher Recovery Plan also gives an excellent review of grazing effects to riparian vegetation and examples of how riparian plants can recover quickly once cattle are removed.

New information is also available in regard to the effects of grazing in uplands and watersheds. Jones (2000) quantitatively reviewed the effects of cattle grazing on North American arid ecosystems. Eleven of 16 analyses reviewed revealed significant detrimental effects of cattle grazing. Soil related variables were most affected, followed by vegetation characteristics, and rodent populations. Grazed areas had significantly reduced cryptobiotic crust cover, infiltration rates, and greater soil loss to erosion when compared to ungrazed areas. Grazed areas also had significantly reduced litter biomass and cover, total vegetation biomass, and grass and shrub cover, than ungrazed areas. Rodent species diversity and richness were reduced in grazed versus ungrazed areas. Similar to Rinne (1999) and Larsen *et al.* (1998), Jones found that most of the studies she evaluated were "quasi-experiments and many failed to present any measure of variability", which precluded quantitative analyses.

Jerry Holecheck and his colleagues have published several important new papers, and a revision of Holecheck *et al.'s* grazing textbook was published in 1998 (Holecheck *et al.* 1998). Among the important findings in these new papers and the revised textbook are that Chihuahuan desert scrub and semi-desert grasslands can sustain about 40 percent use of annual herbage production. Use in drought years may approach 55-60 percent, while use in wet years may be 20-25 percent. However, routine stocking rates should be conservative, resulting in an average of 30-35 percent use with some destocking in drought years (Holechek *et al.* 1999). Holechek *et al.* (1998) found that the following average utilization rates are appropriate for maintaining range condition: 25-35 percent (desert scrub), and 30-40 percent (semi-desert grassland and pinyon-juniper woodland). Within these ranges, several factors determine whether a low, medium, or high value should be selected. Holecheck *et al.* (1998) suggest that, on ranges in good condition with relatively flat terrain and good water distribution, the higher utilization limit may be appropriate. If the range is in poor or fair condition, or the allotment has thin soils, rough topography, and poor water distribution, the lower utilization rate may be appropriate. Galt *et al.* (2000) hold the opinion that a 25 percent harvest coefficient is a sound idea for most western rangelands. Because of better ecological condition and forage production, cattle productivity is substantially higher in conservatively stocked pastures than in more intensely grazed scenarios. Holecheck *et al.* (2000) found that short-duration grazing, if stocking rates are conservative or moderate, can facilitate improved management of livestock, and it gives ranchers more control over how specific parts of their ranch are grazed as compared to continuous grazing. However, short-duration, high intensity grazing, as promoted by Allan Savory (1988) and others, has failed in the Southwest.

The new information discussed above by and large supports the analysis in the 1997 biological opinion. New findings include the need to be cautious in drawing conclusions from the grazing effects literature unless it is based on rigorous study, negative grazing effects to riparian vegetation is better supported by peer-reviewed quantitative analysis than are effects to fish and fish populations, and stocking and use rates in uplands and watersheds should be conservative to maintain range condition and cattle productivity.

The effects analyses that follow focus on effects of the action on critical habitat. For analyses of effects to the species please refer to the 1997 opinion and the discussion above.

Constituent Elements

Effects analyses must determine if the proposed action would destroy or adversely modify critical habitat. "Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR 402.02). The primary constituent elements identified in the final rule as necessary for the survival and recovery of the spikedace are as follows:

1. Permanent, flowing, unpolluted water.
2. Living areas for adult spikedace with slow to swift flow velocities in shallow water with shear zones where rapid flow borders slower flows, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at downstream riffle edges.
3. Living areas for juvenile spikedace with slow to moderate flow velocities in shallow water with moderate amounts of instream cover.
4. Living areas for larval spikedace with slow to moderate flow velocities in shallow water with abundant instream cover.
5. Sand, gravel, and cobble substrates with low to moderate amounts of fine sediment and substrate embeddedness.
6. Pool, riffle, run, and backwater components present in the aquatic habitat.
7. Low stream gradient.
8. Water temperatures in the approximate range of 1-30^{o} C with natural diurnal and seasonal variation.
9. Abundant aquatic insect food base.
10. Periodic natural flooding.
11. A natural, unregulated hydrograph or, if flows are modified or regulated, then a hydrograph that demonstrates an ability to support a native fish community.
12. Habitat devoid of nonnnative aquatic species detrimental to spikedace, or habitat in which detrimental nonnative species are at levels that allow persistence of spikedace.

The constituent elements for loach minnow are very similar, but differ in some aspects, which reflect minor differences in the habitat use and life history of the two species:

1. Permanent, flowing, unpolluted water.
2. Living areas for adult loach minnow with moderate to swift flow velocities in shallow water with gravel cobble, and rubble substrates.
3. Living areas for juvenile loach minnow with moderate to swift flow velocities in shallow water with sand, gravel, cobble, and rubble substrates.

4. Living areas for larval loach minnow with slow to moderate velocities in shallow water with sand, gravel, and cobble substrates and abundant instream cover.
5. Spawning areas for loach minnow with slow to swift velocities in shallow water with uncemented cobble and rubble substrates.
6. Low amounts of fine sediment and substrate embeddedness.
7. Riffle, run, and backwater components present in the aquatic habitat.
8. Low to moderate stream gradient.
9. Water temperature in the approximate range of 1-30º C with natural diurnal and seasonal variation.
10. Abundant aquatic insect food base.
11. Periodic natural flooding.
12. A natural unregulated hydrograph or, if flows are modified or regulated, ability to support a native fish community.
13. Habitat devoid of nonnative aquatic species detrimental to loach minnow, or habitat in which detrimental nonnative species are at levels that allow persistence of loach minnow.

The constituent elements are generalized descriptions and ranges of selected habitat factors that are critical for the survival and recovery of spikedace. The appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level, or value of the constituent elements must include consideration of the season of concern and the characteristics of the specific location. The constituent elements are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the constituent elements need to be assessed in a relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrologic patterns, and overall aquatic faunal community structure.

Direct Effects - Allotments That Include Critical Habitat

Direct effects to spikedace and loach minnow critical habitat occur in those allotments in which grazing activities occur within the boundaries of critical habitat. Table 1 lists 14 allotments that include portions of critical habitat segments. Through the 1997 consultation and decisions made concerning management of the Gila Box Riparian National Conservation Area (RNCA), grazing has been excluded from most BLM-administered lands within the critical habitat segments. Exceptions include the Smuggler Peak, C-Spear, Hell Hole, and Brunchow Hill allotments. On the Smuggler Peak allotment, the grazing strategy consists of winter grazing (November to April) in the riverbottoms of the Gila and San Francisco rivers by up to 30-50 head of cattle. Gates are opened after the first hard freeze, allowing cattle to move into the riverbottom. When the trees begin to bud out in the spring, cattle are gathered and moved to the uplands. Grazing by an average of 30 cattle occurs in this fashion on three miles of the Gila River and 6.6 miles of the San Francisco River in the Smuggler Peak allotment. The C-Spear allotment (formerly Soza Wash) includes a small portion (0.8 mile) of Redfield Canyon. Cattle are not excluded from this reach, but the rugged terrain in the area is generally avoided by cattle and few cattle use the area. In the Hell Hole allotment, no more than 10 cattle are trailed through Aravaipa Creek no more than three times per year. Critical habitat on Deer Creek (2.3 miles) in the Hell Hole allotment is not excluded from grazing, but cattle can not physically access Deer Creek, so no grazing occurs there (Tim Goodman, Bureau, pers. comm. 2001). The Brunchow Hill allotment, on the upper San Pedro River, is the only active grazing allotment that includes a portion of the San Pedro River RNCA. Approximately 0.5 mile of the San Pedro River in the allotment is grazed by cattle. In the 1997 opinion we found that no cattle had been run in the riparian area of the allotment in recent years. Annual reports on implementation of the opinion indicate that no grazing occurred on the river in the allotment during 1997-2000. The current status of livestock grazing in this allotment is unknown. During consultation in 1997, the Bureau proposed as mitigation for the Huachuca water umbel, closure to grazing of the Bureau administered lands in riparian zone in the Brunchow allotment.

In the 1997 opinion we noted there was a problem with trespass cattle on the San Pedro River RNCA, and on the Gila River where cattle trespass from private lands on Eagle Creek. We continue to receive reports of trespass cattle on the San Pedro River RNCA, but the problem has attenuated, and the Bureau has made an effort to remove trespass cattle and prevent their entry into the RNCA. In September 1998, the Bureau completed livestock exclusion fencing of the RNCA. In 1999 and 2000, the Bureau issued notices of intent to impound trespass cattle. Annual reports from the Bureau note problems with trespass cattle in Bonita Creek (Bonita Creek allotment) at its confluence with the Gila River and in the upper reaches of the allotment, where cattle trespass from the San Carlos Reservation. When cattle are found at the Bonita Creek/Gila River confluence, the Bureau takes action to remove these cattle. Recently, the Bureau worked with the San Carlos Indian Tribe Cattle Associations to construct additional fencing and corrals on the reservation adjacent to the Bonita Creek allotment to facilitate livestock management and removal of cattle that trespass onto Bureau lands. The water gap fence at the boundary with the reservation breaks during large storm events, which leads to cattle trespass. However, the Bureau has committed several range technician work months to maintaining the fence and removing trespass cattle when such events occur. The Bureau has not reported any recent trespass problems at the Gila River - Eagle Creek confluence.

The Bureau, in their April 2000 progress report to the Service on implementation of the 1997 opinion, noted that the water gap fence proposed to be built above the Black Hills Backcountry Byway bridge over the Gila River has not yet been completed. This is still the case (Tim Goodman, pers. comm. 2001); thus cattle from the Smuggler Peak allotment are drifting downstream and trespassing on the Gila Box RNCA. However, the water gap fence is scheduled for completion in early FY 2002.

Direct effects to spikedace and loach minnow from grazing in occupied habitats are described in the 1997 biological opinion and are included here by reference. In critical habitat reaches grazed by cattle, a number of adverse effects may occur to the constituent elements of critical habitat, as well. Six mechanisms by which project activities within the boundaries of critical habitat may directly affect spikedace and loach minnow critical habitat are discussed below. Discussion of these mechanisms follow directly from the 1997 opinion, with minor revision.

1) Physical destruction and alteration of streambanks, stream channels, and water column

Cattle presence on streambanks destabilizes streambanks through chiseling, sloughing, compaction, and collapse and results in wider and shallower stream channels (Armour 1977, Platts and Nelson 1985b, Platts 1990, Meehan 1991). Channel erosion in the form of downcutting or lateral expansion may result (Heede and Rinne 1990, U.S. Bureau of Land Management 1990). Physical damage to streambanks and channels in conjunction with loss or reduction of riparian vegetation may change the timing and magnitude of streamflow (Stabler 1985, Meehan 1991). Flood flows may increase in volume and decrease in duration, and low flows may decrease in volume and increase in duration. Cattle trampling and grazing of the riparian corridor makes banks and vegetation more susceptible to severe damage during catastrophic flooding (Platts *et al.* 1985). These effects trigger adjustments in other variables of hydraulic geometry and results in changes to the configuration of pools, runs, riffles, and backwaters; levels of fine sediments and substrate embeddedness; availability of instream cover; and other fish habitat factors (Bovee 1982, Rosgen 1994).

Effects occur at all levels of cattle presence, but increase as number of livestock and length of time the cattle are present increase (Marlow and Pogacnik 1985). Damage begins to occur almost immediately upon entry of the cattle onto the streambanks and use of riparian zones may be highest immediately following entry of cattle into a pasture (Goodman *et al.* 1989, Platts and Nelson 1985a). Vegetation and streambank recovery from long rest periods may be lost within a short period following grazing reentry (Duff 1979). Bank configuration, soil type, and soil moisture content influence the amount of damage with moist soil being most vulnerable to damage (Marlow and Pogacnik 1985, Platts 1990). Cattle presence on streambanks retards rehabilitation of previous damage as well as causing additional alteration (Platts and Nelson 1985a).

Physical alteration of streambanks and channels by cattle affects many of the constituent elements for spikedace and loach minnow. Alteration of stream morphology, flood effects, and increased erosion may alter the stream velocity (spikedace constituent elements 2, 3, 4; loach minnow constituent elements 2, 3, 4, and 5); distribution and composition of substrate types (spikedace constituent element 5, loach minnow constituent elements 2, 3, 4, 5, and 6); and distribution and frequency of riffle, run, and backwater components (spikedace constituent elements 2 and 6, loach minnow constituent element 7). Changes in stream depth and velocity may also affect water temperature (spikedace constituent element 8 and loach minnow constituent element 9).

2) Alteration of the riparian vegetation community

Cattle grazing in and on riparian vegetation may cause changes in the structure, function, and composition of the riparian community (Szaro and Pase 1983, Warren and Anderson 1987, Platts

1990, Schulz and Leininger 1990, Schulz and Leininger 1991, Stromberg 1993). Species diversity and structural diversity may be substantially reduced and nonnative plant species may be introduced and spread in cattle feces. Reduction in riparian vegetation quantity and health, and shifts from deep rooted to shallow rooted vegetation contribute to bank destabilization and collapse and production of fine sediment (Meehan 1991).

Litter is reduced by trampling and churning into the soil, thus reducing cover for soil, plants, and wildlife (Schulz and Leininger 1990). The capacity of the riparian vegetation to filter sediment and pollutants to prevent their entry into the river and to build streambanks is reduced (Lowrance *et al.* 1984, Elmore 1992).

Loss of riparian shade results in increased fluctuation in water temperatures with higher summer and lower winter temperatures (Karr and Schlosser 1977, Platts and Nelson 1989). Spikedace and loach minnow appear to be relatively tolerant of warm water. Alteration of water temperature patterns may be of more importance in assessing effects to these species than alteration of highs and lows. Initiation of spawning in spikedace is believed to be related to water temperature (Barber *et al.* 1970, Langhorst and Marsh 1986, Propst *et al.* 1986, Tyus and Karp 1990). Changes in water temperature fluctuations and timing may disrupt spawning initiation.

Increased water temperature fluctuations may also adversely affect larval fish. Larvae have a much more limited thermal range than do adults and exhibit subtle habitat shifts to accomplish thermal regulation. Increasing temperature fluctuations in shallow edgewater areas may cause direct mortality of larvae through thermal shock or may cause larvae to move out into deeper, faster water where they are more vulnerable to predation or to being swept downstream.

Alteration of riparian vegetation and associated changes in litter and water temperature affect several of the constituent elements for spikedace and loach minnow. Changes in the composition and structure of riparian vegetation affect composition of bottom substrates (spikedace constituent element 5, loach minnow constituent elements 2, 3, 4, 5, and 6). Changes in litter due to trampling reduces the ability of riparian systems to filter sediment and pollutants (spikedace constituent elements 1 and 5, loach minnow constituent elements 1-6). Increased water temperature affects spikedace constituent element 8 and loach minnow constituent element 9.

3) Increased nutrients and alteration of the aquatic flora and fauna

Increases in nutrients in streams have been documented to result from livestock grazing (Kauffman and Krueger 1984). Increased nutrients may beneficially affect spikedace and loach minnow through increased food production (may benefit spikedace constituent element 9 and loach minnow constituent element 10). However, spikedace and loach minnow apparently require a high level of dissolved oxygen. Excessive nutrient input and resulting algal growth may result in temporary conditions of oxygen depletion with resulting stress or death of fish.

4) Increased sediment production

Increased sediment production and transport is probably the most commonly acknowledged effect of livestock grazing on streams (Platts 1990, Meehan 1991, Johnson 1992, Weltz and Wood 1994). Adverse effects of stream sedimentation to fish and fish habitat have been extensively documented (Murphy *et al.* 1981, Wood *et al.* 1990, Newcombe and MacDonald 1991, Barrett 1992, Megahan *et al.* 1992). Adult and juvenile spikedace and loach minnow are not inordinately sensitive to moderate amounts of sediment. However, excessive sedimentation may cause channel changes that are adverse to the species. Excessive sediment may fill backwaters that provide larval and juvenile fish habitat, and sediment deposition in the main channel may cause a tendency toward stream braiding, thus reducing adult fish habitat. Excessive sediment may smother invertebrates, reducing food production and availability and related turbidity may reduce ability of spikedace and loach minnow to see and capture food. Excessive sediment can cover spawning habitats and reduce reproductive success.

Increased sediment affects a number of the constituent elements through subsequent modifications to the channel morphology and bottom substrates (spikedace constituent elements 2-6, loach minnow constituent elements 2-7), and reduced food supply (spikedace constituent element 9, loach minnow constituent element 10).

5) Reduced habitat complexity

Reduction in aquatic habitat complexity due to livestock grazing effects is probably the most important adverse effect to spikedace. Habitat complexity is reduced via loss of bankline structure and riparian vegetation, loss of woody debris, and reduced pool habitat. Grazed streams are likely to be characterized by increased channel width and decreased water depth (or in the case of headcuts, narrow deep channels), rather than complex systems of pools, riffles, runs, and backwaters (Belsky 1999). Habitat complexity allows partitioning of habitat among the various fish species and their life stages. Reduction of habitat complexity increases inter-species and inter-lifestage conflicts. It also exacerbates the adverse effects of generalistic nonnative species on native species (Bestgen 1986, Rinne and Minckley 1991, Baltz and Moyle 1993, Douglas *et al.* 1994). Most nonnative species in the critical habitat reaches are predatory and decreased habitat complexity results in decreased hiding cover, thus making predator-naive native species more vulnerable to predation (Minckley 1983, Fraser *et al.* 1987). Cover is an important factor in the ability of fish species to avoid adverse effects from flooding (Bulkley and Pimentel 1983, Meffe 1984). Livestock grazing and its attendant reduction in habitat complexity make spikedace and loach minnow more vulnerable to death and displacement from flooding, at the same time that livestock effects on the watershed and streambanks contribute to increased flood volume, velocity, and abrasive power.

Loss of habitat complexity through changes in channel morphology affects directly or indirectly virtually every constituent element for both spikedace and loach minnow, because these fishes need a variety of habitat types for the needs of different life stages and for critical behaviors, such as spawning. Loss of habitat heterogeneity reduces the potential for spikedace and loach minnow to avoid thermal extremes (spikedace constituent element 8, loach minnow constituent element 9). Increased susceptibility to predation by nonnative fishes affects spikedace constituent element 12 and loach minnow constituent element 13.

6) Effects from associated features of the grazing program, including range improvement projects, mechanical or chemical vegetation management, and prescribed fire

Construction of water gap fences or pipelines, or use of roads across critical habitat reaches will result in localized degradation of banklines and riparian vegetation, and acts to mobilize sediments. These effects would occur temporarily during construction of fences and pipelines. Prescribed fire in the uplands could temporarily increase erosion and runoff, and cause sedimentation, high peak flows, and downcutting in critical habitat reaches before vegetation and soils recover post fire (DeBano and Neary 1996). If a prescribed fire unintentionally spread to the riparian zone, loss of riparian cover would result. Mechanical vegetation management in the uplands would also result in temporary loss of vegetation cover and disturbance of soils, with similar watershed effects as described for fire. In the case of both fire and mechanical management, the intent would be to improve watershed condition, thus in time, these treatments would have beneficial effects, although in the short term, some adverse effects would be expected.

In salmonid fish, ash and slurry flow into streams can be toxic and populations of macroinvertebrates can be drastically reduced after a fire (Rinne 1996), at least temporarily (Roby and Azuma 1995). Smoke diffusion into water and ash flow can result in high levels of phosphorus and nitrogen (Spencer and Hauer 1991), with corresponding algal blooms and depressed oxygen levels.

Construction or reconstruction of stock tanks would provide new potential habitat for introduction of nonnative fish. Existing stock tanks may also support nonnative fish. Once in the watershed, these fish could be transported by anglers or others to critical habitat reaches. Nonnative fish could also disperse into spikedace or loach minnow critical habitat via drainages that may carry ephemeral flows during storm events. Introduction of fish is of particular concern on Aravaipa Creek where relatively few nonnative fishes occur. Although stock tanks pose a threat to spikedace and loach minnow, in the 1997 consultation, the Bureau committed to evaluating all stock tanks on Bureau lands in the watersheds of Aravaipa Creek and the San Francisco River above Clifton for their degree of risk to introduce nonnative fish to habitats of the loach minnow and spikedace. In conjunction with the Service and Arizona Game and Fish Department, the Bureau agreed to develop and implement management techniques or practices for tanks in each risk category. The inventory has been completed, but as yet management techniques have not been developed or implemented. The Bureau has not committed to implementation of these measures on allotments in the Gila River, Bonita Creek, Eagle Creek, San Pedro, or Hot Springs Canyon watersheds.

Table 3: Range condition and trend in Bureau-administered lands in the watersheds of critical habitat

Watershed	Bureau Acres[1]	% Acres by Condition Class: Potential Natural Community	% Acres by Condition Class: Late Seral	% Acres by Condition Class: Mid Seral	% Acres by Condition Class: Early Seral	% Acres by Trend Class: Downward	% Acres by Trend Class: Static	% Acres by Trend Class: Upward
Aravaipa[2]	57,191	19	50	29	2	0	18	82
Hot Springs Canyon[3]	26,360	1	57	42	0	0	0	100
Bass Canyon[3]	26,360	1	57	42	0	0	0	100
Redfield Canyon[3]	26,800	1	58	41	0	0	2	98
Upper San Pedro	29,676	1	17	41	41	0	43	54
Lower San Pedro[4]	133,409	10	43	34	13	0	28	72
Eagle Creek	16,535	0	63	31	6	0	0	100
Bonita Creek[5]	20,069	5	81	9	5	0	0	100
San Francisco River	10,789	0	46	54	0	0	77	23
Gila River[6]	148,038	5	59	31	5	5	28	67

[1]Compiled by allotment. If the majority of Bureau lands within an allotment was inside the watershed, it was tallied as part of that watershed's total. If the majority was outside the watershed, data for that allotment is not reflected in the total.
[2]Includes Deer Creek and Turkey Creek
[3]These 3 watersheds are dominated by the Muleshoe allotment. Data is inadequate to split the range condition and trend analysis on the Muleshoe allotment by watershed, thus the numbers presented for these watersheds are similar and primarily reflect conditions on the Muleshoe allotment as a whole.
[4]Includes acres and range condition and trend data for Upper San Pedro, Aravaipa Creek, Deer Creek, Turkey Creek, Hot Springs Canyon, Bass Canyon, and Redfield Canyon
[5]Reflects acreage in one allotment (Johnny Creek), some of which drains directly to the Gila River.
[6]Includes Bonita Creek, Eagle Creek, and San Francisco River watersheds.

Indirect Effects - Allotments in the Watersheds of Critical Habitat

Grazing in the watersheds of critical habitat is expected to cause damage and destruction of cryptobiotic crusts and disturbance of soils with resulting increased soil erosion, reduced water infiltration, increased runoff, reduced nutrient content of soils (Jones 2000, Belnap 1992, Harper and St Clair 1985, Belnap and Gardner 1993), and secondary changes in vegetation communities and loss of vegetation cover (Menke 1988). Hoof action on soils and grazing/trampling of shrubs and grasses is also expected to result in elevated soil erosion and runoff, reduced water infiltration, changes in vegetation communities, and loss of vegetation cover (Jones, 2000, Klemmedson 1956, Ellison 1960, Arndt 1966, Gifford and Hawkins 1978, Webb and Stielstra 1979, McClaran and Anable 1992). The way in which these factors would manifest and the magnitude of their effect in the watershed would depend on local site conditions such as soils, vegetation communities, precipitation, and slope. Watershed effects of grazing are generally expected to be more evident where stocking levels are high and year long, and where rangelands are in fair or poor condition.

The condition of Bureau-administered rangelands in each of the critical habitat watersheds is summarized in Table 3. These data are based on Table 5 of the 1997 biological opinion, which is the most recent information available to us. Condition classes correspond to community seral stages as follows. Percentages are percent similarity to potential natural communities:

Early seral stage (0-25 percent) (equivalent to poor range condition)
Mid seral stage (26-50 percent) (equivalent to fair range condition)
Late seral stage (51-75 percent) (equivalent to good range condition)
Potential natural community (76-100 percent) (equivalent to excellent range condition)

Allotments lie within the watersheds of 2 major rivers that support critical habitat - the San Pedro and Gila rivers. Tributaries to the San Pedro containing critical habitat and allotments include Deer Creek, Turkey Creek, Aravaipa Creek, Redfield Canyon, Hot Springs Canyon, and Bass Canyon. The San Francisco River, Bonita Creek, and Eagle Creek are tributaries to the Gila River that contain critical habitat (Table 3).

Table 3 shows that most Bureau lands in the watersheds of critical habitat are in either late or mid seral condition, and the condition of most is improving. However, range condition and trend of Bureau lands vary among the watersheds. Lands in the Aravaipa watershed are in the best condition, and the trend is upward on 82 percent of those lands (Table 3). Range condition is least desirable on the San Francisco River watershed where the majority of Bureau lands are in mid seral condition and most are in a static trend.

No data exist on watershed condition, per se. In the 1997 consultation, the Bureau committed to developing and using a method to evaluate watershed condition. Currently, the Bureau is using upland assessment to determine whether watersheds in grazing allotments are proper functioning upland watersheds. The method involves observing a set of physical and biological attributes at a site to determine upland health. Attributes are placed into one of five categories depending on their degree of presence or absence (none to slight, slight to moderate, moderate, moderate to extreme, extreme). Attributes include, among others, plant pedestaling, flow patterns, movement by wind or water of soil and litter, presence of rills, and active gullies. A final upland health determination is made by summing all of the attributes. However, upland assessments are not yet complete and we have no preliminary data or conclusions from these ongoing assessments.

Although the effects of livestock grazing on watershed function depend on many site-specific factors, we assume that watershed condition is in many or most cases correlated with range condition, because range condition is related to grazing pressure, and grazing pressure adversely affects watershed condition. This assumption is borne out by a large body of information on the effects of grazing on soils, vegetation, cryptobiotic crusts, and other watershed characteristics. A notable exception is in the case of semi-desert grassland communities dominated by Lehman lovegrass (*Eragrostis lehmanniani*). Areas dominated by Lehman lovegrass may exhibit good to excellent watershed condition but are likely to be in low seral or poor range condition.

The Bureau (1996) suggested that effects of Bureau authorized grazing in the Aravaipa watershed are likely to be small, because only about 20 percent of the 537 mi^2 Aravaipa watershed is managed by the Bureau, and of that, less than one percent occurs at elevations above 7,000 feet where 90 percent of the precipitation falls. A similar argument could be made for the other watersheds. For instance, of the 2,500 mi^2 upper San Pedro watershed (U.S. Bureau of Land Management 1998), only 46.4 mi^2 (1.8 percent) are managed by the Bureau in grazing allotments. Bureau allotments cover 5.3 percent of the 3,860 mi^2 U.S. portion of upper and lower San Pedro River watersheds. Bureau allotments include about 231 mi^2 (1.9 percent) of the 12,000 mi^2 Gila River watershed above Safford (including Bonita Creek, Eagle Creek, and San Francisco River) (Lilburn and Associates 1984). Bureau allotments cover 17 mi^2 (0.6 percent) of the 2,766 mi^2 San Francisco River watershed. Bureau-administered allotments are much more important in the smaller watersheds of Deer and Turkey creeks - more than 50 percent of these watersheds are in Bureau allotments. Turkey Creek is in the South Rim allotment, which is currently in non-use. The critical habitat reach of Deer Creek is in the Hell Hole allotment, which is grazed and has roughly equal acreages in mid-seral and late-seral condition in an upward trend. Bureau lands in the Aravaipa and Horse Mountain allotments, in the upper portions of Deer Creek, together have most lands in mid or late seral condition. Range condition trend is upward in the Horse Mountain allotment, and is static in the Aravaipa allotment. Important reaches of the Bass and Hot Springs canyons watersheds are also in Bureau allotments; these watersheds are dominated by the Muleshoe allotment, which has been in non-use for a number of years and is in an upward trend.

Bureau allotments may, in some cases, have a disproportionate effect on stream and river condition if grazing occurs in the immediate watersheds of critical habitat. Also, if allotments occur high in the watershed, and those watersheds are degraded, effects may manifest downstream for considerable distances. Allotments on the upper San Pedro River are mostly set back from the river itself by at least a mile due to cattle exclusion in the San Pedro River RNCA. Bureau allotments in the lower San Pedro watershed are also mostly set back from the river a ways because of private ownership along the river corridor. Although grazing is largely excluded from the Gila Box, San Francisco River, and Aravaipa Creek, cattle graze up to the edge of the riparian zone in many cases. On the San Francisco River, Bureau allotments are clustered in about the lower 15 miles of the 60+ mile river, thus watershed effects would be focused on the lower quarter of that river.

Measures included in the proposed action together with terms and conditions in the 1997 biological opinion have brought about changes to improve range and watershed conditions. Allotments have been undergoing evaluations to ensure compliance with the Arizona Standards and Guidelines. Where allotments do not comply, changes are made in allotment management as needed. The standards and guidelines include guidance for both upland and riparian-wetland portions of the allotments. The Bureau also committed to actions necessary to maintain or improve watershed conditions in Aravaipa Creek, San Francisco and Gila rivers, the upper San Pedro River, and Bonita and Eagle creeks. Recent range condition and trend analysis are not available to determine if these efforts have been successful.

In conclusion, taking into account range condition and trend analysis, percent area covered by Bureau allotments, and proximity and location of allotments in the watershed, watershed effects of the proposed action are mostly likely to manifest on Deer Creek (Hell Hole allotment). Effects are next most likely to occur on Aravaipa Creek and the lower reaches of the San Francisco River. Other critical habitat reaches are less likely to be significantly affected due to relatively small proportions or acreages of watersheds grazed in Bureau allotments, or allotments are mostly removed from the immediate watersheds of critical habitat reaches.

Effects of Range Improvement Projects, Vegetation Management, and Prescribed Fire

The Bureau's proposed action includes development of range improvement projects, chemical or mechanical vegetation manipulation, and prescribed fire. The Bureau (1996) anticipated relatively few new range improvement projects in the areas addressed in this reinitiation. Proposed projects are primarily designed to exclude cattle from riparian areas, distribute cattle, and allow greater management capability. They can result in improved range, watershed, and riparian condition. Localized temporary disturbance from construction of pipelines, fences, corrals, water sources, and other projects would cause negligible and localized increases in erosion and runoff.

Of greater concern are development and maintenance of stock tanks, which may support populations of nonnative fishes, or may provide habitat into which nonnative fishes may be introduced for sport fishing or other purposes. As discussed in the *Direct Effects*, these fish may subsequently be introduced into critical habitat reaches or may traverse drainages between stock tanks and the creek during storm events. Once into critical habitat, nonnatives would prey upon and/or compete with spikedace and/or loach minnow, and could potentially greatly reduce or eliminate spikedace and loach minnow from stream reaches (effects to spikedace constituent element 12 for loach minnow element 13). Of particular concern would be introduction of a species not currently known from critical habitat reaches. Any new construction or reconstruction of roads to stock tanks would facilitate public access and increase the chance that nonnative fish may be introduced or moved among tanks. As discussed in the *Direct Effects*, the Bureau is working with the Service and Arizona Game and Fish Department to identify stock tanks with nonnnative fish populations, and to manage these tanks as appropriate to reduce risks to spikedace, loach minnow, and other native fishes.

No evaluations or treatments are proposed for allotments in the San Pedro River watershed. However, nonnative fish introductions from stock tanks in this watershed are of somewhat less concern because of the distance of most allotments from the river.

Chemical or mechanical vegetation manipulation may be used in the uplands where range condition is degraded. If successful, such actions could improve watershed condition and function. Prescribed fire in uplands could also be used to improve range condition and trend. Short term adverse effects to critical habitat may occur through soil erosion, increased runoff, and sedimentation, and potential toxicity from ash and smoke following the fire. If fire spread to the riparian zone of critical habitat, reduction or elimination of riparian vegetation could cause dramatic changes in channel morphology, water temperature, water quality, and other components of critical habitat.

Cumulative Effects

Cumulative effects are those adverse effects of future non-Federal (State, local government, and private) actions that are reasonably certain to occur in the action area. Future Federal actions would be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Effects of past Federal and private actions are considered in the Environmental Baseline. Large parcels of critical habitat in the project area are managed by Federal agencies, particularly the Bureau. Effects of actions that may occur on these Federal lands will be subject to section 7 consultation and thus are not considered cumulative effects. However, many activities are expected to occur on private and State lands that are not subject to the section 7 process. The State Land Department is the primary owner/manager of lands in the U.S. portion of the San Pedro River watershed, away from the mountains, which are managed mostly by the Coronado National Forest. In the action area in Gila watershed, the Bureau is the primary land owner /manager, although the San Carlos Apache Nation and Forest Service own/manage considerable lands upstream of the action area.

The primary use of State lands is livestock grazing, with effects similar to those described here. As land value increases on these lands, they may be sold to the public for development in accordance with local land use plans. Uses of Forest Service lands are similar to what occurs on Bureau lands (i.e. grazing, recreation, mining, etc.). Similar activities are also anticipated on lands managed by the San Carlos Apache Nation.

Groundwater pumping in excess of recharge threatens critical habitat in the upper San Pedro River basin. Groundwater pumping threatens to lower groundwater elevations and reduce or eliminate surface flows in the San Pedro River (San Pedro Expert Study Team 1999). Much of the groundwater pumping is by private entities without a Federal nexus. However, in the 1999 biological opinion and its reinitiations, the Service found that groundwater pumping attributable to Fort Huachuca is not likely to jeopardize the continued existence of spikedace, loach minnow, and other listed species that use the river, or result in destruction or adverse modification of critical habitat. The rationale for this conclusion was that the efforts of the Fort and other public and private water users in the basin, combined with national and international initiatives, were expected to develop a solution to groundwater overdrafts before significant effects occurred to the river.

Some activities on State and private lands in critical habitat will require Federal permits (such as Clean Water Act 404 permits). These activities would be subject to section 7 consultation, and thus their effects are not considered cumulative.

Conclusion - Spikedace and Loach Minnow

After reviewing the current status of the spikedace and loach minnow, the environmental baseline for the action area, the cumulative effects, and the anticipated effects of the proposed Safford/Tucson Field Office's grazing program, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the spikedace and loach minnow or result in the destruction or adverse modification of their critical habitats.

We present these conclusions for the following reasons:

1. Cattle are excluded or do not have access to, or in the case of Gila Box, will soon be excluded from, most the critical habitat reaches.

2. Range condition and trend in the watersheds of critical habitats are mostly mid to late seral, and the Bureau has committed to actions that would improve range and watershed condition.

3. A process has been initiated to reduce or eliminate the threat of nonnative fish introduction posed by stock tanks in the watersheds of Aravaipa, Bonita, and Eagle creeks; and the Gila and San Francisco rivers.

4. The Bureau proposes substantial measures that reduce the potential impacts of the proposed action.

5. No grazing or trailing of cattle that would jeopardize the continued existence of the spikedace and loach minnow would occur on Bureau lands in Aravaipa Creek.

INCIDENTAL TAKE STATEMENT

The incidental take statements for spikedace and loach minnow from the 1997 opinion are included here by reference.

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information on listed species. The recommendations provided here do not necessarily represent complete fulfillment of the agency's section 2(c) or 7(a)(1) responsibilities for spikedace and loach minnow. In furtherance of the purposes of the Act, we recommend implementing the following actions:

1. The Bureau should evaluate stock tanks in the San Pedro River watershed that are within 5 miles of the river for risk of nonnative fish introductions, similar to the process employed on Aravaipa Creek and elsewhere in critical habitat. If populations of nonnative fish are found in these tanks, the Bureau should work with Arizona Game and Fish Department and the Service to develop and implement fish control, if appropriate, to reduce risks to spikedace and loach minnow.

2. The Bureau should promptly complete the water gap fence on the Gila River at the Black Hills Backcountry Byway Bridge.

3. The Bureau should promptly complete new range condition and trend analyses for the allotments addressed in Tables 1 and 2 and take action if needed to ensure that range condition is maintained in areas of late seral or potential natural community, and is improving in areas of mid or early seral stages.

4. The Bureau should work with the permittee on the Smuggler Peak allotment to remove trespass cattle from the Gila Box and to terminate seasonal grazing on the Gila and San Francisco allotments.

5. The Bureau should work with the permittee of the Brunchow Hill allotment to ensure that cattle do not use the riparian zone of the San Pedro River.

6. The Bureau should work with the Service to evaluate the implementation of the 1997 opinion and its amendments/reinitiations, and promptly complete conservation measures that were part of the proposed action and all terms and conditions.

CACTUS FERRUGINOUS PYGMY-OWL

The Bureau has asked for concurrence with their determination that grazing activities on the C-Spear allotment (called the Soza Mesa allotment - 4409- in the 1997 opinion) would have no effect on the cactus ferruginous pygmy-owl or its critical habitat. The pygmy-owl was included in formal consultation in previous consultation documents concerning the Safford and Tucson grazing program. The conclusions in the 1997 opinion and its amendments/reinitiations apply to the C-Spear allotment, as well as the other 287 allotments addressed. As a result, and as discussed in the introduction to this reinitiation, the Bureau's request for concurrence will be considered a request for reintiation of formal consultation. As mentioned in the introduction to this document, critical habitat was invalidated by a recent court decision, and thus will not be discussed further herein.

Following is a focused discussion of the proposed action on the C-Spear allotment and its effects on the pygmy-owl.

C-Spear Allotment - Proposed Action

The following discussion of the proposed action on the C-Spear allotment is taken from the May 31, 2001, biological evaluation that accompanied your request for concurrence of the same date, and information included in the 1997 opinion and the original biological evaluation. Further information about the allotment can be found in these documents.

The C-Spear allotment lies between the San Pedro River and the Galiuro Mountains, and between Redington and Cascabel. The total acreage of the allotment was not defined by the Bureau, but Bureau-managed lands total only 440 acres, all of which are in the Redfield Canyon area of the western slope of the Galiuro Mountains. The balance of the allotment is managed primarily the Arizona State Land Department, with minor private inholdings. Bureau lands are in rugged terrain that is infrequently used by cattle; these lands are all above 4,000 feet, and thus are above the elevational range of the pygmy-owl in Arizona. The allotment employs a deferred rotation grazing system.

STATUS OF THE SPECIES

A detailed description of the life history and ecology of the pygmy-owl may be found in the Birds of North America (Proudfoot and Johnson 2000), Ecology and Conservation of the Cactus Ferruginous Pygmy-owl in Arizona (Cartron and Finch 2000), and other information available at the Arizona Ecological Services Field Office. Information specific to the pygmy-owl in Arizona is limited. Research in Texas has provided useful insights into the ecology of the subspecies, and in some instances represents the best available information; however, habitat and environmental conditions are somewhat different in Arizona and conclusions based on Texas information is tentative.

Species description

The Service listed the Arizona population of the pygmy-owl as a distinct population segment (DPS) on March 10, 1997, effective April 9, 1997 (U.S. Fish and Wildlife Service 1997 [62 FR 10730]). The past and present destruction, modification, or curtailment of habitat is the primary reason for the decrease in population levels of the pygmy-owl. On July 12, 1999 we designated approximately 731,712 acres critical habitat supporting riverine, riparian, and upland vegetation in seven critical habitat units, located in Pima, Cochise, Pinal, and Maricopa counties in Arizona (U.S. Fish and Wildlife Service 1999 [64 FR 37419]). However, on September 21, 2001, the U.S. District Court for the District of Arizona vacated this final rule designating critical habitat for the pygmy-owl, and remanded its designation back to the Service for further consideration.

Life history

Pygmy-owls are small birds, averaging 6.75 inches in length. Pygmy-owls are reddish-brown overall, with a cream-colored belly streaked with reddish-brown. The pygmy-owl is crepuscular/diurnal, with a peak activity period for foraging and other activities at dawn and dusk. During the breeding season, they can often be heard calling throughout the day, but most activity is reported between one hour before sunrise to two hours after sunrise, and late afternoon/early evening from two hours before sunset to one hour after sunset (Collins and Corman 1995).

A variety of vegetation communities are used by pygmy-owls, such as: riparian woodlands, mesquite “bosques” (Spanish for woodlands), Sonoran Desert scrub, and semidesert grassland communities, as well as nonnative vegetation within these communities. While plant species composition differs among these communities, there are certain unifying characteristics such as the presence of vegetation in a fairly dense thicket or woodland, the presence of trees or saguaros large enough to support cavity nesting, and elevations below 4,000 feet. Historically, pygmy-owls were associated with riparian woodlands in central and southern Arizona. Plants present in these riparian communities include cottonwood, willow (*Salix* spp.) and hackberry (*Celtis* spp.). Cottonwood trees are suitable for cavity nesting, while the density of mid- and lower-story vegetation provides necessary protection from predators and an abundance of prey items for the pygmy-owl. Mesquite bosque communities are dominated by mesquite trees, and are described as mesquite forests due to the density and size of the trees.

Over the past several decades, pygmy-owls have been primarily found in the Arizona Upland Subdivision of the Sonoran Desert, particularly Sonoran Desert scrub (Brown 1994). This community in southern Arizona consists of paloverde, ironwood, mesquite, acacia, bursage (*Ambrosia* spp.), and columnar cacti (Phillips *et al.* 1964, Monson and Phillips 1981, Davis and Russell 1984, Johnson and Haight 1985, Johnsgard 1988). However, over the past several years, pygmy-owls have also been found in riparian and xeroriparian habitats and semidesert grasslands as classified by Brown (1994). Desert scrub communities are characterized by an abundance of saguaros or large trees, and a diversity of plant species and vegetation strata. Xeroriparian habitats contain a rich diversity of plants that support a wide array of prey species and provide cover. Semidesert grasslands have experienced the invasion of mesquites (*Prosopis velutina*) in uplands and linear woodlands of various tree species along bottoms and washes.

The density of trees and the amount of canopy cover preferred by pygmy-owls in Arizona is unclear. However, preliminary results from a habitat selection study indicate that nest sites tend to have a higher degree of canopy cover than random sites (Wilcox *et al.* 2000). For areas outside Arizona, pygmy-owls are most commonly characterized by semi-open or open woodlands, often in proximity to forests or patches of forests. Where they are found in forested areas, they are typically observed along edges or in openings, rather than deep in the forest itself (Binford 1989, Sick 1993), although this may be a bias of increased visibility. Overall, vegetation density may not be as important as patches of dense vegetation with a developed canopy layer interspersed with open areas. The physical settings and vegetation composition varies across *G. brasilianum's* range and, while vegetation structure may be more important than composition (Wilcox *et al.* 1999, Cartron *et al.* 2000a), higher vegetation diversity is found more often at nest sites than at random sites (Wilcox *et al.* 2000).

Pygmy-owls typically hunt from perches in trees with dense foliage using a perch-and-wait strategy; therefore, sufficient cover must be present within their home range for them to successfully hunt and survive. Their diverse diet includes birds, lizards, insects, and small mammals (Bendire 1888, Sutton 1951, Sprunt 1955, Earhart and Johnson 1970, Oberholser 1974) and frogs (Proudfoot *et al.* 1994). The density of annuals and grasses, as well as shrubs, may be important to the pygmy-owl's prey base. Shrubs and large trees also provide protection against aerial predation for juvenile and adult pygmy-owls and cover from which they may capture prey (Wilcox *et al.* 2000).

Pygmy-owls are considered non-migratory throughout their range by most authors, and have been reported during the winter months in several locations, including Organ Pipe Cactus National Monument (OPCNM) (R. Johnson unpubl. data, T. Tibbitts, Organ Pipe Cactus National Monument unpubl. data). Pygmy-owls begin nesting activities in late winter to early spring. In Arizona differences between nest sites may vary by as much as two months (Abbate et al. 1996, S. Richardson, AGFD unpubl. data). As with other avian species, this may be the result of a second brood or a second nesting attempt following an initial failure (Abbate *et al.* 1996). In Texas, juveniles remained within approximately 165 feet of adults until dispersal. Dispersal distances (straight line) of 20 juveniles monitored from their natal sites to nest sites the following year averaged 5 miles (ranged from 0.75 to 19 miles (G. Proudfoot unpubl. data). Telemetry studies of dispersing juveniles in Arizona during 1999 and 2000 ranged from 1.4 to 12.9 miles (straight line distance) (n=6, mean 6.2 miles) in 1999, and 1.6 to 11.7 miles (n=6, mean 5.8 miles) in 2000 (S. Richardson and M. Ingraldi, Arizona Game and Fish Department unpubl. data). Pygmy-owl telemetry studies have documented movement of owls between southern Pinal County and northwest Tucson (S. Richardson and M. Ingraldi, AGFD unpubl. data). Juveniles typically dispersed from natal areas in July did not appear to defend a territory until September. They may move up to one mile in a night; however, they typically fly short distances from tree to tree instead of long single flights (S. Richardson, AGFD unpubl. data). Subsequent surveys during the spring have found that locations of male pygmy-owls are in the same general location as last observed the preceding fall.

Apparently unpaired females may also remain in the same territory for some period of time. In the spring of 2001, an unpaired female (the male died in 2000) remained in its previous years territory well into the spring, exhibiting territorial behavior (calling) for 2 months until ultimately switching territories and paring with an unpaired male and successfully nesting (S. Richardson, AGFD unpubl. data). Researchers suspect that if this unpaired female could have attracted an unpaired male during that time, she would have likely remained in her original territory. Apparently at some point the urge to pair is too strong to remain and they seek out new mates.

In Texas, Proudfoot (1996) noted that, while pygmy-owls used between 3 and 57 acres during the incubation period, and they defend areas up to 279 acres in the winter. Therefore, a 280 acre home range is considered necessary for pygmy-owls. Proudfoot and Johnson (2000) indicate males defend areas with radii from 1,100 - 2,000 feet. Initial results from ongoing studies in Texas indicate that the home range of pygmy-owls may also expand substantially during dry years (G. Proudfoot unpubl. data).

Species status and distribution range wide

The cactus ferruginous pygmy-owl is one of four subspecies of ferruginous pygmy-owl. This subspecies is known to occur from lowland central Arizona south through western Mexico to the States of Colima and Michoacan, and from southern Texas south through the Mexican States of Tamaulipas and Nuevo Leon. It is unclear at this time if the ranges of the eastern and western populations of the ferruginous pygmy-owl merge in southern Mexico. Recent genetic studies suggest that ferruginous pygmy-owl populations in southern Arizona and southern Texas are distinct subspecies, and that there is no genetic isolation between populations in the United States and those immediately south of the border in northwestern or northeastern Mexico (Proudfoot and Slack 2001). Results also indicate a comparatively low haplotypic diversity in the northwest Tucson population, suggesting that it may be recently separated from those in the Altar Valley, Arizona, and in Sonora and Sinaloa, Mexico.

The Service is currently funding habitat studies and surveys in Sonora, Mexico to determine the distribution and relative abundance of the pygmy-owl there. Preliminary results indicate that pygmy-owls are present in northern and central Sonora (U.S. Fish and Wildlife Service unpubl. data). Further studies are needed to determine their distribution in Mexico.

The range of the Arizona distinct population segment (DPS) of the pygmy-owl extends from the International Border with Mexico north to central Arizona. The northernmost historic record for the pygmy-owl is from New River, Arizona, about 35 miles north of Phoenix, where Fisher (1893) reported the pygmy-owl to be "quite common" in thickets of intermixed mesquite and saguaro cactus. According to early surveys referenced in the literature, the pygmy-owl, prior to the mid-1900s, was "not uncommon," "of common occurrence," and a "fairly numerous" resident of lowland central and southern Arizona in cottonwood forests, mesquite-cottonwood woodlands, and mesquite bosques along the Gila, Salt, Verde, San Pedro, and Santa Cruz rivers and various tributaries (Breninger 1898, Gilman 1909, Swarth 1914). Additionally, pygmy-owls were detected at Dudleyville on the San Pedro River as recently as 1985 and 1986 (AGFD unpubl. data, Hunter 1988).

Records from the eastern portion of the pygmy-owl's range include a 1876 record from Camp Goodwin (nearby current day Geronimo) on the Gila River, and a 1978 record from Gillard Hot Springs, also on the Gila River. Pygmy-owls have been found as far west as the Cabeza Prieta Tanks in 1955 (Monson 1998).

While the majority of Arizona pygmy-owl detections in the last seven years have been from the northwest Tucson area in Pima County, pygmy-owls have also been detected in southern Pinal County, at OPCNM, Cabeza Prieta National Wildlife Refuge (CPNWR), Buenos Aires National Wildlife Refuge (BANWR), and on the Coronado National Forest. The following is a brief summary of recent owl numbers and distribution[1]:

In 1997, survey efforts of AGFD located a total of five pygmy-owls in the Tucson Basin study area (the area bounded to the north by the Picacho Mountains, the east by the Santa Catalina and Rincon Mountains, the south by the Santa Rita and Sierrita Mountains, and the Tucson Mountains to the west). Of these owls, one pair successfully fledged two young which were banded. Two adult males were also located at OPCNM, with one reported from a previously unoccupied area (T. Tibbitts, Organ Pipe Cactus National Monument pers. comm. 1997).

In 1998, survey efforts in Arizona increased substantially and, as a result, more pygmy-owls were documented, which may at least inpart account for a larger number of known owls. In 1998, a total of 35 pygmy-owls were confirmed (S. Richardson, AGFD unpubl. data, U.S. Fish and Wildlife Service unpubl. data, T. Tibbitts, Organ Pipe Cactus National Monument unpubl. data, D. Bieber, Coronado National Forest unpubl. data).

In 1999, a total of 41 adult pygmy-owls were found in Arizona at 28 sites. Of these sites, 11 had nesting confirmed by AGFD and the Service. Pygmy-owls were found in three distinct regions of the state: Tucson Basin, Altar Valley, and OPCNM. Almost half of the know owl sites were in the Altar Valley. Overall, mortality was documented for a number of fledglings due to natural (e.g., predation) or unknown causes. Of the 33 young found, only 16 were documented as surviving until dispersal (juveniles known to have successfully dispersed from their natal area). It is unclear what the survival rate for pygmy-owls is; however, as with other owls and raptors, a high mortality (50% or more) of young is typical during the first year of life.

[1] To a large degree, survey effort plays an important factor in where owls have been documented. Survey effort has not been consistent over the past several years in all areas of the state, affecting the known distribution and numbers of owls in any particular area.

Surveys conducted in 2000 resulted in 24 confirmed pygmy-owl sites (i.e. nests and resident pygmy-owl sites) and several other unconfirmed sites (S. Richardson, AGFD unpubl. data, T. Tibbitts, OPCNM unpubl. data, U.S. Fish and Wildlife Service unpubl. data). A total of 34 adult pygmy-owls were confirmed. Nesting was documented at 7 sites and 23 fledglings were confirmed. A total of 9 juveniles were known to have successfully dispersed from their natal areas in 2000. Successful dispersal was not confirmed at two nests with four fledglings. The status of the remaining fledglings was unknown; however, they were presumed dead.

Surveys conducted during the 2001 season resulted in a total of 47 adult pygmy-owls confirmed at 29 sites in Arizona (S. Richardson, AGFD unpubl. data, T. Tibbitts, OPCNM unpubl. data, U.S. Fish and Wildlife Service unpubl. data). There were also several other unconfirmed sites that are not included in these totals. Nesting was documented at 17 sites and 24 young were confirmed to have successfully fledged (left their nest cavity). In addition, there were 2 nests with young that potentially could have fledged young; however, this was not confirmed. Similar to the previous three years, there was over a 50 percent fledgling mortality documented again in 2001 (S. Richardson, AGFD unpubl. data). The following regions of the state are currently known to have pygmy-owls:

- **Tucson Basin** (northwest Tucson and southern Pinal County) - A total of 8 adults (3 pairs and 2 single resident males) were confirmed at 5 sites, all of which were in Pima County. One single unpaired male pygmy-owl was documented in southern Pinal County. Three nests in northwest Tucson were confirmed, all with young.

- **Altar Valley** - A total of 18 adult pygmy-owls were documented at 12 sites. As a result of increased access to portions of the valley, the number of known owls increased to 7 pairs and 4 resident single owls. A total of 7 nests were confirmed.

- **OPCNM and CPNWR** - Twelve adults, consisting of 2 pairs and 4 single pygmy-owls were confirmed at 8 sites. Three nests were active. Two new sites were documented on the CPNWR and 1 north of OPCNM near Ajo, Arizona.

- **Other Areas** - A total of 9 adults, consisting of 4 pairs and 1 single pygmy-owl at 5 sites documented elsewhere in southern Arizona. Nesting was confirmed at 4 of these sites. It is unknown how many of these young successfully dispersed. There were several other possible pygmy-owl detections reported elsewhere in the state, but they were not confirmed.

Recent extensive surveys in southern Arizona are changing our perception of pygmy-owl distribution and habitat needs. For example, before 1998, very few surveys had been completed in the Altar Valley in southern Pima County. Prior to 1999, the highest known concentration of pygmy-owls in the state was in northwest Tucson. However, in 1999, after extensive surveys in Altar Valley, more owls were found there (18 adults) than in northwest Tucson (11 adults), although until 2001, there have been fewer nest sites in Altar Valley than in the Tucson Basin (S. Richardson, AGFD unpubl. data).

Range wide trend

One of most urgent threats to pygmy-owls in Arizona is thought to be the loss and fragmentation of habitat (U.S. Fish and Wildlife Service 1997, Abbate *et al.* 1999). The complete removal of vegetation and natural features required for many large scale and high-density developments directly and indirectly impacts pygmy-owl survival and recovery (Abbate *et al.* 1999). Pima County's population has grown from 666,000 in 1990 to estimates of at least 850,000 in 2000 or a 30 percent increase. This annual growth rate has varied from 15,000 to 30,000 persons each year, consuming at the present urban density approximately 7-10 square miles of Sonoran Desert each year (Pima County 2001). As fragmentation increases, competition for fewer productive Pygmy-owl territories may occur (Abbate *et al.* 1999). Unlike other larger birds that can fly long distances over unsuitable or dangerous areas to establish new territories, pygmy-owls, because of their small size, and their short style of flight are exposed to greater risks from predation and other threats (Abbate *et al.* 1999).

In northwest Tucson, all currently known pygmy-owl locations, particularly nest sites, are in low-density housing areas where abundant native vegetation separates structures. Additionally, they are adjacent to or near large tracts of undeveloped land. Pygmy-owls appear to use non-native vegetation to a certain extent, and have been observed perching in non-native trees in close proximity to individual residences. However, the persistence of pygmy-owls in areas with an abundance of native vegetation indicates that a complete modification of natural conditions likely results in unsuitable habitat conditions for pygmy-owls. While development activities are occurring in close proximity to owl sites, particularly nest sites, overall noise levels are low. Housing density is low, and as a result, human presence is also generally low. Roads in the areas are typically dirt or two-lane paved roads with low speed limits which minimizes traffic noise. Low density housing areas generally have lower levels of traffic noise because of the limited number of vehicles traveling through the area.

Other factors contributing to the decline of pygmy-owl habitat include the destruction of riparian bottomland forests and bosques. It is estimated that 85 to 90 percent of low-elevation riparian habitats in the southwestern U.S. have been modified or lost; these alterations and losses are attributed to woodcutting, urban and agricultural encroachment, water diversion and impoundment, channelization, groundwater pumping, livestock overgrazing, and hydrologic changes resulting from various land-use practices (e.g., Phillips *et al.* 1964, Carothers 1977, Kusler 1985, Jahrsdoerfer and Leslie 1988, U.S. Fish and Wildlife Service 1988, U.S. General Accounting Office1988, Szaro 1989, Dahl 1990, State of Arizona 1990, Bahre 1991). Cutting of trees for domestic and industrial fuel wood was so extensive throughout southern Arizona that, by the late 19th century, riparian forests within tens of miles of towns and mines had been decimated (Bahre 1991). Mesquite was a favored species because of its excellent fuel qualities. In the project area, the famous vast forests of "giant mesquites" along the Santa Cruz River in the Tucson area described by Swarth (1905) and Willard (1912) fell to this threat, as did the "heavy mesquite thickets" where Bendire (1888) collected pygmy-owl specimens along Rillito Creek, a Santa Cruz River tributary, in present-day Tucson. Only remnant fragments of these bosques remain.

Regardless of past distribution in riparian areas, it is clear that the pygmy-owl has declined throughout Arizona to the degree that it is now extremely limited in distribution in the state (Johnson *et al.* 1979, Monson and Phillips 1981, Davis and Russell 1984, Johnson-Duncan et al. 1988, Millsap and Johnson 1988, Monson 1998). A very low number of pygmy-owls in riparian areas in recent years may reflect the loss of habitat connectivity rather than the lack of suitability (Cartron *et al.* 2000b).

In recent decades, the pygmy-owl's riparian habitat has continued to be modified and destroyed by agricultural development, woodcutting, urban expansion, and general watershed degradation (Phillips et al. 1964, Brown et al. 1977, State of Arizona 1990, Bahre 1991, Stromberg *et al.* 1992, Stromberg 1993a and 1993b). Sonoran Desert scrub has been affected to varying degrees by urban and agricultural development, woodcutting, and livestock grazing (Bahre 1991). Pumping of groundwater and the diversion and channelization of natural watercourses are also likely to have reduced pygmy-owl habitat. Diversion and pumping result in diminished surface flows, and consequent reductions in riparian vegetation are likely (Brown *et al.* 1977, Stromberg *et al.* 1992, Stromberg 1993a and 1993b). Channelization often alters stream banks and fluvial dynamics necessary to maintain native riparian vegetation. The series of dams along most major southwestern rivers (e.g., Colorado, Gila, Salt, and Verde rivers) have altered riparian habitat downstream of dams through hydrological and vegetational changes, and have inundated former habitat upstream.

In the United States, pygmy-owls are rare and highly sought by bird watchers, who concentrate at a few of the remaining known locations. Limited, conservative bird watching is probably not harmful; however, excessive attention and playing of tape-recorded calls may at times constitute harassment and affect the occurrence and behavior of the pygmy-owl (Oberholser 1974, Hunter 1988, O'Neil 1990, Tewes 1993). Human activities near nests at critical periods of the nesting cycle may cause pygmy-owls to abandon their nest sites. In Texas, 3 of 102 pygmy-owl nests monitored from 1994-1999 were abandoned during the early stage of egg laying. Although unknown factors may have contributed to this abandonment, researchers in Texas associated nest abandonment with nest monitoring (G. Proudfoot pers. comm.). Some outdoor recreational activities (e.g., off road vehicle [ORV] and motor bike use/racing, firearm target practicing, jeep tours, etc.) may disturb pygmy-owls during their breeding season (particularly from February through July (G. Proudfoot pers. comm. 1999 and S. Richardson, AGFD pers. comm. 1999). Noise disturbance during the breeding season may affect productivity; disturbance outside of this period may affect the energy balance and, therefore survival. Wildlife may respond to noise disturbances during the breeding season by abandoning their nests or young (Knight and Cole 1995). It has also become apparent that disturbance outside of a species' breeding season may have equally severe effects (Skagen *et al.* 1991). In general, raptors become less sensitive to human disturbance as their nesting cycle progresses (Newton 1979). Studies have suggested that human activities within breeding and nesting territories could affect raptors by changing home range movements (Anderson *et al.* 1990) and causing nest abandonment (Postovit and Postovit 1987, Porter *et al.* 1973).

Application of pesticides and herbicides in Arizona occurs year-round, and these chemicals pose a potential threat to the pygmy-owl. The presence of pygmy-owls in proximity to residences, golf courses, agricultural fields, and nurseries may cause direct exposure to pesticides and herbicides. Furthermore, ingestion of affected prey items may cause death or reproductive failure (Abbate *et al.* 1999). Illegal dumping of waste also occurs in areas occupied by pygmy-owls and may be a threat to pygmy-owls and their prey; in one case, drums of toxic solvents were found within one mile of a pygmy-owl detection (Abbate *et al.* 1999).

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. In Texas, eggs and nestlings were depredated by racoons (*Procyon lotor*) and bullsnakes (*Pituophis melanoleucus*). Both adult and juvenile pygmy-owl are likely killed by great horned owls (*Bubo virginianus*), Harris' hawks *(Parabuteo unicinctus*), Cooper's hawks, and eastern screech-owls (*Otus asio*) (Proudfoot and Johnson 2000, G. Proudfoot unpubl. data). Pygmy-owls are particularly vulnerable to predation and other threats during and shortly after fledging (Abbate *et al.* 1999). Therefore, cover near nest sites may be important for young to fledge successfully (Wilcox *et al.* 1999, Wilcox *et al.* 2000). Although nest depredation has not been recorded in Arizona, only a few nests have been monitored (n = 21 from 1996-1999). Additional research is needed to determine the effects of predation, including nest depredation, on pygmy-owls in Arizona and elsewhere.

Another factor that may affect pygmy-owls is interspecific competition/predation. In Texas, depredation of two adult female pygmy-owls nesting close to screech-owls was recorded. In 2001, an unpaired female pygmy-owl was found dead in a tree cavity, apparently killed by a screech-owl (S. Richardson, AGFD unpubl. data). Conversely, pygmy-owls and screech-owls have also been recorded successfully nesting within 7 feet of each other in the same tree without interspecific conflict (G. Proudfoot unpubl. data). The relationship between pygmy-owl and other similar small owl species needs further study.

Direct and indirect human-caused mortalities (e.g., collisions with cars, glass windows, fences, power lines, domestic cats [*Felis domesticus*], etc.), while likely uncommon, are often underestimated, and probably increase as human interactions with owls increase (Banks 1979, Klem 1979, Churcher and Lawton 1987). This may be particularly important in the Tucson area where many pygmy-owls are located. Pygmy-owls flying into windows and fences, resulting in serious injuries or death to the birds, have been documented twice. A pygmy-owl collided into a closed window of a parked vehicle; it eventually flew off, but had a dilated pupil in one eye indicating serious neurological injury as the result of this encounter (Abbate *et al.* 1999). In another incident, an adult owl was found dead on a fence wire; apparently it flew into a fence and died (S. Richardson, AGFD unpubl. data). AGFD also has documented an incident of individuals shooting BB guns at birds perched on a saguaro which contained an active pygmy-owl nest. In Texas, two adult pygmy-owls and one fledging were killed by a domestic cat. Predation by cats is also suspected by researchers recently in at least one instance in northwestern Tucson (S. Richardson, AGFD unpubl. data). Free roaming cats can also affect the number of lizards, birds, and other prey species available to pygmy-owls; however, very little research has been done in the Southwest on this potential problem.

Pygmy-owls have been observed moving around the perimeter of golf courses, avoiding non-vegetated areas, roads and other openings may act as barriers to their movements (Abbate *et al.* 1999, S. Richardson, AGFD unpubl. data). On one occasion, a radio-tagged dispersing juvenile stopped within 0.7 mile of Interstate 10 where there were large openings and few trees or shrubs, and reversed its direction (Abbate *et al.* 1999). However, radio-tagged, juvenile pygmy-owls have crossed two-lane roads with low to moderately vehicular traffic, where trees and large shrubs were present on either side (Abbate *et al.* 1999). Most recently, pygmy-owls monitored during the summer 2001 dispersal period were observed near two lane roads on several occasions (AGFD unpubl. data). Although owls were not directly observed crossing roads, radio telemetry data were collected on either side of roadways. Movement across roads appeared to occur during the night.

Pygmy-owls are capable of flying short distances up to 100 feet or more over undisturbed vegetation (e.g., Sonoran Desert scrub, semidesert grasslands, or riparian areas) with little or human activities or structures such as roads, fences, buildings, etc. (G. Proudfoot, unpubl. data, S. Richardson, AGFD unpubl. data). However, as opening size (i.e., gaps between trees or large shrubs) increases, coupled with increased threats (e.g., moderate to high traffic volumes and other human disturbances) relatively wide roads (greater than 40 feet), researchers believe this may act as barriers or significantly restrict owl movement. Wide roadways and associated clear zones causes large gaps between tree canopies on either side of roadways, resulting in lower flight patterns over roads. This low flight level can cause owls to fly directly in the pathway of oncoming cars and trucks, significantly increasing the threat of owls being struck.

Fires can affect pygmy-owls by altering their habitat (Abbate *et al.* 1999). A recent fire altered habitat near an active pygmy-owl nest site (Flesch 1999) and although four mature saguaros in the area survived (at least in the short-term), post-fire mortality of saguaros has been recorded (Steenbergh and Lowe 1977 and 1983, Mclaughlin and Bowers 1982, Esque *et al.* 2000). Flesch (1999) also noted that approximately 20 to 30 percent of the mesquite woodland within 164 feet of the nest was fire- or top-killed, and ground cover was also eliminated until the summer monsoons. Careful use of prescribed fires in areas potentially suitable for pygmy-owls is necessary so that habitat is not lost or degraded (Flesch 1999).

Recent genetic research suggests that pygmy-owls in the action area may be isolated from other populations in Arizona and Mexico (Proudfoot and Slack 2001). They have found that the low level of genetic variation and the absence of shared haplotypes between owls in Northwest Tucson and the remainder of the state and Mexico may be indicative of natural divergence of this population from the rest of the pygmy-owl population in Arizona. However, this may also be a product of sampling (i.e., sampling from one maternal lineage) and or an extremely high level of inbreeding as a result of low population numbers and geographic isolation. Low genetic variability can lead to a reduction in reproductive success and environmental adaptability. Caughley and Gunn (1996) further note that small populations can become extinct entirely by chance even when their members are healthy and the environment favorable. Given the low number of pygmy-owls in the action area, their potential isolation from source populations, the fact that inbreeding has occurred in three documented cases (Abbate *et al.* 1999), and potential pressure from urban development have all contributed to a high level of concern for the Tucson Basin population.

Environmental, demographic, and genetic stochasticity, and catastrophes have been identified as interacting factors that may contribute to a population's extinction (Hunter 1996). When these factors interact with one another, there are likely to be a combination of effects, such that a random environmental change like habitat fragmentation can result in population and genetic changes by preventing dispersal. These factors are much more likely to cause extinction when a species' numbers are already extremely low. The small, fragmented population of pygmy-owls in Arizona may not have the ability to resist change or dramatic fluctuations over time caused by one or more of the factors mentioned above.

Soule (1986) notes that very small populations are in extreme jeopardy due to their susceptibility to a variety of factors, including demographic stochasticity, where chance variations in birth and death rates can result in extinction. A series of environmental changes such as habitat reduction reduce populations to a state in which demographic stochasticity takes hold. In small populations such as with the pygmy-owl, each individual is important for its contributions to genetic variability of that population. As discussed above, low genetic variability can lead to a lowering in reproductive success and environmental adaptability, affecting recovery of this species.

ENVIRONMENTAL BASELINE

The status of the pygmy-owl in the action area has been summarized in the 1997 biological opinion, and in subsequent reinitiations/amendments, particularly amendment no. 4, dated April 12, 2000. The only significant change in the environmental baseline from these previous documents is that critical habitat was set aside by the Arizona District Court on September 21, 2001.

EFFECTS OF THE PROPOSED ACTION

The effects of proposed activities on the C-Spear (or Soza Mesa) allotment on the pygmy-owl and its critical habitat were considered in the 1997 biological opinion and its amendments/reinitiation. Although this allotment was not specifically discussed, the types of activities conducted on this and other allotments were discussed in detail, and the effects of those activities on the pygmy-owl and its habitat were analyzed. The effects analyses in those previous documents are included here by reference.

Because the Bureau lands in the allotment are above 4,000 feet, direct effects to pygmy-owls and their habitat are not anticipated. The remainder of the allotment extends downslope across the bajada to the San Pedro River and includes 10-20 acres along the river west of the Cascabel Road. In the 1997 opinion, we considered activities on the non-Bureau portions of the allotments to be interrelated or interdependent only if Bureau lands comprised more than 30 percent of the allotment (and thus Bureau lands would influence how those other lands would be grazed). Although the total acreage of the allotment is unknown, based on land ownership depicted in Figure 1 of the 1997 opinion, Bureau lands appear to make up much less than 30 percent, probably less than 5 percent, of the allotment. Thus, no interrelated or interdependent effects are anticipated.

Redfield Canyon is in the watershed of the San Pedro River, which had been designated critical habitat for the pygmy-owl, prior to the remand, and is considered suitable for pygmy-owl occupation. As discussed in the 1997 opinion, the only confirmed reports of pygmy-owls from the San Pedro River were near Dudleyville in 1985 and 1986. Comprehensive surveys for pygmy-owls have not been conducted on the San Pedro River. The only likely effects of grazing activities on the C-Spear allotment are indirect effects to habitat on the San Pedro River via effects to the watershed. Range condition on the Bureau lands is late seral in a static trend, which we believe suggests watershed condition is good. Effects of grazing in the watersheds of aquatic systems was discussed in detail in the effects of the action for the spikedace and loach minnow, herein. These same effects would occur in the habitat of the pygmy-owl. However, the elements of the habitat important for the pygmy-owl are tied to the riparian woodlands, rather than the aquatic habitats of the river itself. Because of the small portion of the watershed affected in the C-Spear allotment, the late seral range condition of the Bureau lands in the allotment, and because cattle use the Bureau lands infrequently, any watershed effects from the proposed action are not expected to affect the San Pedro River in any measurable way, if at all. This effects analysis is consistent with that described for the pygmy-owl in regard to the allotments in general in the 1997 opinion and its amendments/reintiations.

CONCLUSION

After reviewing the current status of the cactus ferruginous pygmy-owl, the environmental baseline for the action area, the cumulative effects, and the anticipated effects of the proposed Safford/Tucson Field Office's grazing program (including grazing activities on the C-Spear allotment), it is the Service's biological opinion that the proposed action is not likely to jeopardize the existence of the cactus ferruginous pygmy-owl. No critical habitat is currently designated, thus none will be affected. We base this conclusion on the reasons set forth in the 1997 opinion and its subsequent amendments/reinitiations.

INCIDENTAL TAKE STATEMENT

The incidental take statements for the pygmy-owl in amendment 4 of the 1997 opinion remains unchanged.

CONSERVATION RECOMMENDATIONS

Conservation recommendations from the 1997 opinion and subsequent amendments/reinitiations remain unchanged, with the exception of the following addition:

The Bureau should work with the Service to evaluate the implementation of the 1997 opinion and its amendments/reinitiations, and promptly complete conservation measures that were part of the proposed action and all terms and conditions.

CONCURRENCE

The 1997 opinion included a concurrence with the Bureau's determination that the proposed action may affect, but was unlikely to adversely affect, the Mexican spotted owl. Herein we amend that determination based on redesignation of critical habitat and new information about the habitat of the owl on Bureau lands in the action area.

STATUS OF THE SPECIES
Mexican Spotted Owl

A detailed account of the taxonomy, biology, and reproductive characteristics of the Mexican spotted owl is found in the final rule listing the Mexican spotted owl as a threatened species (U.S. Fish and Wildlife Service 1993) and in the Final Mexican spotted owl Recovery Plan (U.S. Fish and Wildlife Service 1995). The information provided in those documents is included herein by reference. Critical habitat was designated in 1995, but was set aside by court order in 1996, prior to completion of the 1997 opinion. The Service redesignated critical habitat in 2001 on 1.9 million acres in Arizona, New Mexico, Colorado, and Utah.

Although the Mexican spotted owl's entire range covers a broad area of the southwestern United States and Mexico, much remains unknown about the species' distribution and ecology. This is especially true in Mexico where much of the Mexican spotted owl's range has not been surveyed. The Mexican spotted owl currently occupies a broad geographic area but does not occur uniformly throughout its range. Instead, it occurs in disjunct localities that correspond to forested isolated mountain systems, canyons, and in some cases, steep, rocky canyon lands.

Surveys have revealed that the species has an affinity for older, well-structured forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico. The range of the Mexican spotted owl has been divided into six recovery units in the United States, as discussed in the Mexican spotted owl Recovery Plan. The Recovery Plan reports an estimate of owl sites. An owl "site" is defined as a visual sighting of at least one adult owl or a minimum of two auditory detections in the same vicinity in the same year. Based on information collected from 1990-1993, the greatest known concentration of owl sites in the United States occurs in the Upper Gila Mountains recovery unit (55.9 percent), followed by the Basin and Range-East (16.0 percent), Basin and Range-West (13.6 percent), Colorado Plateau (8.2 percent), Southern Rocky Mountain-New Mexico (4.5 percent), and Southern Rocky Mountain-Colorado recovery units (1.8 percent). Owl surveys conducted from 1990 through 1993 indicate that the species persists in most locations reported prior to 1989.

A reliable estimate of the numbers of owls throughout its entire range is not currently available (U.S. Fish and Wildlife Service 1995) and the quality and quantity of information regarding numbers of Mexican spotted owl vary by source. U.S. Fish and Wildlife Service (1991) reported a total of 2,160 owls throughout the United States. Fletcher (1990) calculated that 2,074 owls existed in Arizona and New Mexico.

The primary administrator of lands supporting the Mexican spotted owl in the United States is the Forest Service. According to the Recovery Plan, 91 percent of Mexican spotted owls known to exist in the United States between 1990 and 1993 occurred on lands administered by the Forest Service. Most owls have been found within Forest Service Region 3 (11 National Forests in Arizona and New Mexico). Forest Service Regions 2 and 4 (two National Forests in Colorado and 3 in Utah) support fewer owls. The Forest Service reported a total of approximately 935 protected activity centers (PACs) established on National Forest lands in the Southwestern Region (USDA Forest Service, Southwestern Region, February 28, 2001). The information provided from the Forest Service also included a summary of acres of protected habitat, acres of restricted habitat, and PACs in the Region by Mexican spotted owl Recovery Unit.

From 1991 through 1997, Seamans *et al.* (1999) studied the demographic characteristics of two Mexican spotted owl populations in the Upper Gila Mountains Recovery Unit. The owl populations studied were located on the Coconino and Gila National Forests. Results of this several-year study have shown a decline in the population of Mexican spotted owls within these areas of more than 10 percent per year. Seamans *et al.* (1999) suggest the decline may be due to declining habitat quality and or regional trends in climate.

ENVIRONMENTAL BASELINE

The proposed action occurs in the Basin and Range - West Recovery Unit, which is characterized by numerous fault-block mountains separated by valleys in central and southeastern Arizona and southwestern New Mexico. Mexican spotted owls occupy a wide range of habitats within this recovery unit. Most inhabit encinal oak woodlands, mixed conifer and pine-oak woodlands, and rocky canyons in isolated mountains. Most Mexican spotted owl habitat occurs on the Coronado National Forest. Several PACs also occur on the Fort Huachuca Military Reservation.

The 1997 biological opinion identified potential Mexican spotted owl habitat in the Guadalupe W. allotment of the Peloncillo Mountains, and on the Muleshoe allotment. Both allotments were and still are in non-use. Critical habitat redesignated in 2001 included 796 acres of upper Deer Creek on the Horse Mountain allotment (4524) in the upper portion of the Aravaipa watershed (Figure 1 of the 1997 biological opinion).

Ann Watson and Thetis Gamberg of the Service's Tucson Field Office, and Ben Robles and Jim Gacey of the Bureau's Safford Field Office, visited critical habitat on the Horse Mountain allotment on April 17, 2001, to evaluate potential habitat for Mexican spotted owls. Service and Bureau personnel agreed that the 796 acres did not contain habitat characteristics described as necessary for Mexican spotted owls to nest. The area is mountainous and generally steep-sloped, but the predominant vegetation is chaparral, with widely-scattered individual oak, pinon pine, and juniper trees. The canyon bottoms support thin, discontinuous patches of sycamore, juniper, Arizona walnut, and cottonwood. The canyon bottoms and riparian areas show some cover, perhaps they may support migrating, wintering, or foraging Mexican spotted owls, but they do not appear to be suitable for roosting or nesting. This country appears to be incapable of growing into any better quality Mexican spotted owl roosting or nesting habitat. The nearest known PACs are in the Galiuro Mountains, about 20 miles to the south.

Range condition on the Horse Mountain allotment is in late seral condition and is in an upward trend. In the 2001 biological evaluation, the Bureau reports that the allotment has been in non-use for the last two years, and Deer Creek through the critical habitat reach is in proper functioning condition.

A total of 521 projects have undergone formal consultation for the owl in Arizona and New Mexico. Of that aggregate, 257 projects resulted in a total anticipated incidental take of 483 owls plus an additional unknown number of owls. These consultations have primarily dealt with actions proposed by the Forest Service, Region 3, but have also addressed the impacts of actions proposed by the Bureau of Indian Affairs, Department of Defense (including Air Force, Army, and Navy), Department of Energy, National Park Service, and Federal Highway Administration. These proposals have included timber sales, road construction, fire/ecosystem management projects (including prescribed natural and management ignited fires), livestock grazing, recreation activities, utility corridors, military overflights, and other construction activities. Only one of these projects (release of site-specific owl location information) has resulted in a biological opinion that the proposed action would likely jeopardize the continued existence of the Mexican spotted owl.

EFFECTS OF THE PROPOSED ACTION

Effects of the action on Mexican spotted owl in allotments other than Horse Mountain have not changed from the 1997 biological opinion and are included here by reference.

The Bureau and the Service have developed guidance criteria for evaluating the effects of grazing actions and formulating effects determinations pursuant to 50 CFR 402.14 (a) and (b). However, guidance criteria have not been developed for the Mexican spotted owl. The recovery plan for the Mexican spotted owl provides no specific guidance on grazing within Mexican spotted owl habitat. However, as a means to reduce potential adverse effects, the recovery plan recommends that where grazing may occur within Mexican spotted owl habitat, grazing be monitored within key grazing areas, such as riparian areas, meadows, and oak vegetation communities. The monitoring should be designed to detect any changes in the relative composition of herbaceous and woody plants. The intent should be to maintain good to excellent range conditions in key areas while accommodating the needs of the owl and its small mammal prey.

The recovery plan further recommends that grazing utilization standards be implemented and enforced in order to attain good to excellent range condition within key grazing areas. Additionally, the recovery plan recommends implementing management strategies that will restore good conditions to degraded riparian communities as soon as possible.

Past grazing practices on the Horse Mountain allotment have resulted in good (late seral) range condition in an upward trend. The riparian area that runs through the critical habitat is in proper functioning condition. No changes in grazing practices are proposed, therefore we do not anticipate range condition or trend to deteriorate. As a result, grazing in this potential wintering or foraging owl habitat is in compliance with the recovery plan and the recovery needs of the species.

Conclusion

The Service concurs with the Bureau's determination that the proposed action may affect, but is not likely to adversely affect, the Mexican spotted owl or its critical habitat. We base this determination on the following:

1. No PACs are known to occur in the Bureau allotments.

2. Bureau allotments under consultation generally do not contain habitat characteristics needed for Mexican spotted owls. In the action area, most owl habitat is at higher elevation on lands managed by the Coronado National Forest.

3. Marginal habitat for Mexican spotted owl occurs on Bureau allotments in the Peloncillo Mountains, Galiuro Mountains, and on the Horse Mountain allotment. However, allotments in these areas are in non-use or grazing at the higher elevations in these allotments, where potential Mexican spotted owl habitat occurs, is negligible.

4. A total of 796 acres of critical habitat occurs on the Bureau allotments, and is limited to the Horse Mountain allotment. Range condition is good, trend is upward, and the riparian area in critical habitat is in proper functioning condition, which is consistent with the recommendations of the Mexican spotted owl recovery plan.

Summary of Conclusions for Other Listed Species Addressed in the Biological Opinion

The Bureau has proposed no changes to the action, and no new information has come to light that would alter our previous determinations that the proposed action is not likely to jeopardize the continued existence of Kearney's blue star, Huachuca water umbel, Pima pineapple cactus, Nichol's turk's head cactus, desert pupfish, Gila topminnow, razorback sucker, southwestern willow flycatcher, lesser long-nosed bat, jaguar, and New Mexico ridgenose rattlesnake, and is not likely to adversely modify or destroy critical habitat designated for the razorback sucker and Huachuca water umbel. Nor is there reason to change our concurrences with the Bureau's determinations that the proposed action may affect, but is not likely to adversely affect, eight additional species.

State Director, Bureau of Land Management

If we can be of further assistance in this matter, please contact Jim Rorabaugh (x238) or Sherry Barrett (520) 670-4617.

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Appendix 1: Acronyms and Abbreviations

AGFD (Arizona Game and Fish Department)
AUM (Animal Unit Month)
BANWR (Buenos Aires National Wildlife Refuge)
Bureau (United States Bureau of Land Management)
CFR (Code of Federal Regulations)
CPNWR (Cabeza Prieta National Wildlife Refuge)
DPS (distinct population segment)
DNA (deoxyribonucleic acid)
FR (Federal Register)
Mi^2 (square miles)
OPCNM (Organ Pipe Cactus National Monument)
PAC (protected activity center)
Pygmy-owl (Cactus ferruginous pygmy-owl)
RNCA (Riparian National Conservation Area)
Service (United States Fish and Wildlife Service)
USDA (United States Department of Agriculture)