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Mr. John C. Bedell
Forest Supervisor
Apache/Sitgreaves National Forest
P.O. Box 640
Springerville, Arizona 85938-0640

Dear Mr. Bedell:

This document transmits the U.S. Fish and Wildlife Service's (Service) final biological and conference opinion based on our review of the proposed issuance of a 10-year livestock grazing permit for the Udall Allotment and the ongoing grazing activity and its management on the P.S. and Hayground Allotments in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). At issue are the effects of the proposed action on threatened loach minnow (*Tiaroga cobitis*) and its critical habitat, Mexican spotted owl (MSO) (*Strix occidentalis lucida*), and the proposed threatened Chiricahua leopard frog (*Rana chiricahuensis*). Your May 14, 2001, request for formal consultation was received on May 15, 2001.

This biological opinion and conference report covers three allotments contained in the Apache-Sitgreaves National Forest (Forest) within the Black River watershed located in Apache County, Arizona. These three allotments are a portion of the twenty-eight allotments for which formal consultation was initially requested on May 30, 2001. On July 12, 2001, the Service requested to batch the twenty-eight allotments by watershed (Blue/San Francisco, Eagle Creek, and Black River), a 60-day extension, and to do separate conferences on the allotments throughout the Forest which contained only the Chiricahua leopard frog. On July 23, 2001, the Forest concurred with the requests of the Service. The three allotments and the determinations by the Forest are outlined in Table 1.

Table 1: Forest Service Determination and List of Species and Critical Habitat Included in This Biological Opinion/Conference Report

Allotment	Forest Service's Determination	Included in this Biological Opinion/Conference Report
P.S. Allotment		
Spikedace and Critical Habitat	No Effect	No
Loach minnow and Critical Habitat	Likely to Adversely Affect	Yes
Chiricahua leopard frog	Not Likely to Jeopardize/ Likely to Adversely Affect	Yes
Hayground Allotment		
Spikedace and Critical Habitat	No Effect	No
Loach minnow and Critical Habitat	Likely to Adversely Affect	Yes
Chiricahua leopard frog	Not Likely to Jeopardize	No
Udall Allotment		
Mexican Gray Wolf	Not Likely to Jeopardize	No
Jaguar	No Effect	No
Black Footed Ferret	No Effect	No
Bald Eagle	Not Likely to Adversely Affect	No
Southwestern Willow Flycatcher	Not Likely to Adversely Affect	No
Mexican Spotted Owl	Not Likely to Adversely Affect *	Yes
Loach minnow and Critical Habitat	Likely to Adversely Affect	Yes
Spikedace and Critical Habitat	Not Likely to Adversely Affect	No
Little Colorado Spinedace	Not Likely to Adversely Affect	No
Apache Trout	Not Likely to Adversely Affect	No
Chiricahua leopard frog	Not Likely to Jeopardize	No
Mountain Plover	Not Likely to Jeopardize	No
Brown Pelican	No Effect	No
* The Service did not concur with this determination.		

This biological opinion is based on information provided in numerous biological assessments

and addenda. Table 2 is a detailed list of primary documentation used in this biological opinion.

Table 2: Primary Documentation used in Biological Opinion

ALLOTMENT	PRIMARY DOCUMENTATION USED IN BIOLOGICAL OPINION
P.S.	1997 Allotment Management Plan for the P.S. Allotment
	1999 Environmental Assessment Allotment Management Plan for Cow Flat, Foote Creek, P.S., and Stone Creek Allotments
	1999 Decision Notice and Finding of No Significant Impact - Allotment Managment Plan for Cow Flat, Foote Creek, PS, and Stone Creek Allotments
	2001 Addendum to the Biological Assessment and Evaluation In Regards To the P.S. Grazing Allotment Management Plan
Hayground	May 2001 Addendum to the Biological Assessment and Evaluation In Regards to the Burro Creek, Hayground, and Reservation Allotments and a Watershed Approach to a Coldwater Fisheries on the West Fork of the Black River
	March 2001 Grazing Consultation Forms for Hayground Allotment
	February 1993 Biological Evaluation for Threatened, Endangered, and Sensitive Species - Allotment Management Plan Revisions for the Burrow Creek, Hayground, and reservation Allotments and A Watershed Approach to a Coldwater Fisheries on the West Fork of the Black River
	February 1994 West Fork of the Black River Watershed and Fisheries Restoration Project Implementation Plan
Udall	April 2001 Udall Allotment Environmental Assessment
	April 2001 Biological Assessment of the effects to Endangered, Threatened & Proposed species for the Udall Allotment, Allotment Management Plan Revision
	May 2001 Biological Assessment and Evaluation for Loach Minnow and Spikedace Allotment Management Plan Revision for the Udall Allotment

Literature cited in this biological and conference opinion is not a complete bibliography of all literature available on the species of concern, grazing activity and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

On May 15, 2001, the Forest requested formal section 7 consultation under the Act with the Service for twenty-eight grazing allotments and their effect on recently designated critical habitat for the federally threatened spikedace and loach minnow. On July 12, 2001, the Service requested to batch consultations by watershed, a 60-day extension, and to do separate

conferences on the allotments which contained only the Chiricahua leopard frog. On July 23, 2001, the Forest concurred with the requests of the Service. With the 60-day extension granted from the Forest, the due date for the final biological opinion was set for November 26, 2001.

A letter to the Forest Service dated August 8, 2001, issued concurrences for the Udall Allotment for the jaguar (*Panthera onca*), black-footed ferret (*Mustela nirgripes*), spikedace (*Meda fulgida*) and its critical habitat, brown pelican (*Pelecanus occidentalis californicus*), Mexican gray wolf (*Canis lupus baileyi*), bald eagle (*Haliaeetus leucocephalus*), southwestern willow flycatcher (*Empidonax traillii extimus*), Apache trout (*Oncorhynchus apache*), and Little Colorado spinedace (*Lepidomeda vittata*). In the same letter the Service discussed the fact that we were unable to concur with the Forest's determination of may affect, not likely to adversely affect for the Mexican spotted owl. Our reasons for this decision are as follows: A protected activity center (PAC, OD Ridge PAC) encompasses 426 acres within the Udall Allotment. Since formal surveys for the Mexican spotted owl have not occurred since 1989-1990, we cannot discount the possibility that a nest is located within the allotment. Whether or not a nest occurs in the allotment, grazing (albeit at reduced levels) is proposed in the PAC, and because such grazing is proposed in areas that are documented with a downward vegetation and grassland trend in areas, the rodent prey base for the spotted owl may be affected. In addition, there is a large amount of restricted habitat within the allotment that has not been surveyed for Mexican spotted owls.

The Forest also requested formal conferencing on the effects to Chiricahua leopard frog, and yellow-billed cuckoo (*Coccyzus americanus*). On August 3, 2001, in a letter to the Regional Forester we issued concurrences for effects to Chiricahua leopard frog on the Hayground and Udall allotments. The yellow-billed cuckoo is not a proposed species and therefore does not require a conference. A subsequent letter on August 16, 2001, from the Forest asked to initiate formal consultation for the proposed threatened Chiricahua leopard frog on the P.S. Allotment. A formal conference report is included within this biological opinion for the Chiricahua leopard frog on the P.S. Allotment. A concurrence with your determination of not likely to jeopardize the proposed Chiricahua leopard frog on the Udall and Hayground allotments was issued in a letter dated August 3, 2001, to the Forest Service. Based on the draft guidance criteria for the Chiricahua leopard frog, we concluded that the species is not likely to be adversely affected by the proposed actions on either the Udall or Hayground allotments and a conference is not necessary.

On August 13, 2001 Mr. Dick Udall was designated as an applicant by the Forest for the Udall Allotment. A draft Biological Opinion was sent to the Forest on November 29, 2001. The Service received comments from the Forest on January 29, 2002, and from the applicant, Flying Box Ranch, on February 1, 2002. The Service requested a 60-day extension on February 5, 2002. With the 60-day extension granted from the Forest on February 14, 2002, the due date for the final biological opinion was set for March 1, 2002.

BIOLOGICAL OPINION

Description of Proposed Action

The P.S., Hayground, and Udall allotments are located in eastern Arizona in the Black River 5th code watershed. These allotments are located on the Forest, Apache County, Arizona. The Hayground and Udall allotments are found on the Springerville Ranger District, while the P.S. Allotment is located on the Alpine Ranger District. The P.S. Allotment is the southern-most allotment of the three, Hayground is located in the middle, and the Udall Allotment is the northern-most allotment. Appendix A provides a map of the location of the three allotments on the Forest.

The action area for these projects are defined as all areas affected directly or indirectly by the Federal action. For the proposed projects, the action area includes the area contained within and 25 miles downstream of the P.S., Hayground, and Udall allotments. Included within this action area are all perennial and non-perennial tributaries of the Black River within the area described above, and the uplands that drain into these tributaries or into the Black River. With streams, the action area is often much larger than the area of the proposed project because impacts may be carried downstream with the flow. Therefore, using Forest Service guidelines, twenty-five miles downstream of each allotment within the Black River 5th Code Watershed will also be considered to be within the action area for these projects. Watersheds and sub-watersheds are comprised of numerous inter-connected upland and riparian areas that function together as an ecological unit. As a result, activities in one part of the watershed can affect adjacent areas and activities in the uplands can affect riparian areas.

Specifics of the proposed action for each allotment as provided by the Forest Service are discussed below:

PS Allotment

The PS Allotment encompasses approximately 3,334 acres within the Black River watershed in Apache County, Arizona. The approximate center is T4N, R28E, NE1/4 Sec 2, Gila and Salt River Meridian (G&SRM) (longitude 109°22'01"; latitude 33°46'27"). The ongoing action of the project area authorizes cattle grazing within the PS Allotment for 10 years (1999-2009). As currently managed, the existing term grazing permit for the PS Allotment authorizes 126 cow/calf from May 15 to October 15. The grazing system is a rest-rotation schedule whereby each pasture of the three main use pastures (PS West, PS East, and River Pasture) receives rest every other year.

This is the southern most allotment of the three mentioned in this Biological Opinion. It is directly downstream of Hayground Allotment along the West Fork of the Black River (WFBR). The allotment contains six pastures (Double Bar K, PS West, PS East, Trap and Holding, River, and Home Creek Exclosure). Double Bar K is a short-term use pasture, and the Trap and Holding pasture is used for gathering and shipping. Appendix B provides a detailed map of the allotment.

According to the PS Environmental Assessment (USFS 1999a) the livestock management for this allotment is a yearlong rest rotation grazing system whereby each pasture receives rest every

other year including the April through mid-July period every other year. Allowable forage use levels (grazing utilization standards) will be implemented as noted in the P.S. Allotment Management Plan (USFS 1997). These grazing standards will be applied regardless of scheduled grazing periods for each pasture and regardless of the number of livestock in each pasture. These standards are a point-in-time measurement upon which pasture moves will be based. The grazing utilization standard on shrubs which are browsed will be 40%. The grazing utilization standards for grazed or "key herbaceous species in key areas, based on range condition, are outlined in Table 3.

TABLE 3: GRAZING UTILIZATION STANDARD BY RANGE CONDITION FOR THE P.S. ALLOTMENT AS OUTLINED IN THE DECISION NOTICE FOR THE ALLOTMENT MANAGEMENT PLAN

	Percent Use Per Various Range Conditions			
Season of Use	Good	Fair	Poor	Very Poor
5/16-10/15	45%	40%	30%	20%
10/16-5/15	45%	15%	35%	20%

Key species and areas may be adjusted as necessary to reflect those species and areas receiving the most grazing pressure based on the time of year (USFS 1999a). Key species and key areas are outlined in the Allotment Operating Plan.

Monitoring is scheduled by the Forest Service as noted in the Environmental Assessment, including monitoring of grazing utilization standards and effectiveness monitoring of Best Management Practices (BMPs) (USFS 1999a). Seven specific BMPs are outlined and can be found in Appendix C of the USFS PS EA for reference (USFS 1999a) and Appendix E of this document. Grazing utilization monitoring will be conducted a minimum of two times for each pasture scheduled for livestock use; once prior to livestock entry and once at about the mid-point of the scheduled pasture use period. Monitoring of BMPs will occur via various methods, one of which is grazing utilization monitoring which will insure proper grazing use is not exceeded and will be the basis for pasture moves. Proper Functioning Condition (PFC) and General Aquatic Wildlife (GAWS) are two other methods that will be conducted and include assessment of factors that reflect effectiveness of BMPs.

Hayground Allotment

Hayground Allotment is centrally located between the other two allotments contained within this biological opinion. The Hayground Allotment is on the Springerville Ranger District on the Forest. Hayground Allotment is presently grazed by cattle under a 10-year permit issued in 1993. Therefore, this BO analyzes effects of the remaining two years of that livestock permit. As currently managed, the existing term grazing permit for the Hayground Allotment authorizes 200 cow/calf and 6 horses from May 16 to October 31.

The grazing plan calls for the use of eight pastures or grazing areas, including the Point, Cienega, East, Centerfire, South, Riparian, Holding, and Horse pastures. A deferred grazing system is used. Livestock management on the Hayground Allotment will be based on ecological principles tied to range conditions and trends and the improvement of riparian and stream conditions. Key areas of concern within each pasture have been identified that will be monitored for utilization. Table 4 details the utilization standards as outlined in the Hayground Allotment Management Plan (USFS 1993 and 2001 Grazing Consultation Forms):

Table 4: Utilization Limits for Livestock Grazing on the Hayground Allotment

Meadow and Riparian Areas	45% grass and Grass-like species
	45% shrubs
Grasslands	50% Grass
All Other Areas	35% Maximum Allowable Use

According to the 1993 Allotment Management Plan (AMP) (USFS 1993), the Hayground Creek Riparian pasture is being managed to emphasize riparian improvement and enhancement of the stream habitat condition for Apache trout. Key habitat features are monitored to determine if objectives are being met. If monitoring indicates that the stream/riparian habitat within this pasture is not moving toward the desired future condition at a comparable rate to the livestock exclosure, rest will be prescribed in an attempt to accelerate improvement. This change will be implemented if the recovery rate is significantly and measurably slower in the riparian pasture.

Monitoring of riparian areas and stream stability occur through a number of different mechanisms. Twenty one photo points are located along Hayground Creek to survey the stream. Additional permanent photo points have been established to monitor stream bank and channel stability and streamside vegetative cover. Riparian/stream monitoring will also occur on stream sections along Hayground Creek and Centerfire Creek.

Udall Allotment

The Udall Allotment is located on the Springerville Ranger District, fifteen miles south and southwest of Springerville, Arizona. The Udall Allotment contains approximately 10,820 acres within portions of Township 6N and Ranges 28E and 29E, G&SRM divided among 6 pastures (Elk Pasture, Timber Pasture, Milkpen Pasture, OD Pasture, West OD Trap, East OD Trap) and numerous exclosures. The Udall Allotment is the northern-most allotment of the three allotments contained within this analysis.

According to Udall Biological Assessment (USFS 2001c) the proposed action is to issue a new ten-year term grazing permit to graze 334 cows and calves from July 1 to October 31. The proposed grazing system will be a four pasture rotational deferred system. The four main

pastures and allowable use are: Milkpen Pasture with an allowable use of 35% in key areas; OD Pasture with an allowable use of 35% in key areas; Elk Pasture with an allowable use of 30% in key areas; and the Timber Pasture with an allowable use of 25% in key areas. Livestock pasture rotation will be made when allowable use standards are met on the key areas of the pasture unit. Key areas are a relatively small portion of a pasture or management unit selected because of their location, use or grazing value as a monitoring point for grazing use. It is assumed that key areas, if properly selected, will reflect the overall range condition resulting from grazing management over the pasture or management unit as a whole. Four riparian areas are proposed for total livestock exclusion until satisfactory riparian and fisheries conditions are achieved, at which time livestock may be allowed to use the areas, which is not expected to occur during the life of this analysis. Approximately nine miles of poorly located roads are scheduled for closure and 33 watershed improvement structures are proposed in areas of active headcutting and erosion. Construction timing and vehicle use restrictions are required to reduce short-term adverse effects associated with watershed, fencing, and road closure projects. The following outlines the proposed range improvements for the Udall Allotment:

- Install a cattleguard on Forest Road 285 south of Crosby Crossing as part of Exclosure #4.
- Construct 1.5 miles of new fence in Section 13 T6N, R28E, Section 18, T6N, R29E and section 19, T6N, R29E to create Exclosure #4 in the Milkpen and OD Pastures expanding Crosby Crossing Administrative Unit (CCAU).
- Remove 1.2 miles of fence from the CCAU to improve access for wildlife and recreation.
- Construct 1.5 miles of new conventional fence in Sections 14 and 23 T6N, R28E to create Exclosure 33 in the Timber Pasture.
- Construct 1.5 miles of new electric fence in Sections 25 T6N, R28E to create Exclosure #1 and Exclosure #2 in the Milkpen Pasture.
- Remove the vehicle gate on the dead-end two-track road and install a walk-through gate at the allotment boundary fence between the Elk Pasture and the Black River Allotment on the Alpine RD in Section 31, T6N, R29E.
- Clean 12 existing earthen stock tanks.
- Develop Ambers Spring and construct approximately one mile of pipeline to a float box and trough in SW ¼, NW ¼, Section 18, T6N, R29E within OD Pasture.
- Construct 1.3 miles of new conventional fence in Sections 24 & 25, T6N, R28E, to create the southern portion of Exclosure #4 to form the eastern boundary of Elk Pasture.
- Remove approximately 0.3 mile of conventional fence in Section 24, T6N, R28E and Section 19, T6N, R29E within the interior of Exclosure #4 after the exclosure has been completed.

Proposed Watershed Improvements for Udall Allotment:

- Shape, contour and place four rock structures in the sidecuts located in the drainage in SW ¼ Section 11, T6N, R28E, Milkpen Pasture.
- Contour, shape and re-seed a headcut in the drainage located in SW ¼ Section 17, T6N, R29E, OD Pasture.
- Construct 2-3 earthen water diversion structures to break up concentrated flows on an

old road slope in SW ¼ Section 19, T6N, R29E, Elk Pasture.

- Improve drainage at the road crossing leading to private land in Section 13, T6N, R28E.

Note: Due to the Forest Service wish for flexibility, the specific erosion control structures for this project are unknown. Therefore, the following five actions will not be addressed in this Biological Opinion since the effects of these actions cannot be determined. Future consultation may be requested to address these actions and their effects on threatened and endangered species.

Construct four erosion control structures in the headcuts in SW ¼ Section 10, T6N, R28E, Milkpen Pasture.

Construct six erosion control structures in the drainage located in NW ¼, Section 14, T6N R28E, Milkpen Pasture.

Construct nine erosion control structures in the drainage located in SW ¼ Section 18, T6N, R29E, OD Pasture.

Construct 2 erosion control structures in the drainage located in SW ¼ Section 29, T6N, R29E, Elk Pasture.

Construct three erosion control structures in the drainage located in SW ¼ Section 14, T6N, R28E, Timber Pasture.

Proposed Road Closures for Udall Allotment:

- Close and rehabilitate approximately 0.5 miles of road to the north side of the private land in Sections 13 and 14, T6N, R28E.
- Close and rehabilitate approximately 1.0 miles of road in Section 10, T6N, R28E.
- Close and rehabilitate approximately 0.4 miles of road in Section 12, T6N, R28E.
- Close and rehabilitate approximately 0.2 miles of road in Section 16 and 22, T6N, R28E.
- Close and rehabilitate approximately 0.2 miles of road in SW ¼, Section 3, T6N, R28E.
- Close and rehabilitate approximately 1.8 miles of road in SE ¼ Section 10, SW ¼ Section 11 and NW ¼ Section 14, T6N, R28E.
- Close and rehabilitate approximately 0.3 miles of road in Section 15 and 22, T6N, R28E.
- Close and rehabilitate approximately 0.5 miles of road in Section 23, T6N, R28E.
- Close and rehabilitate approximately 0.8 miles of road in Section 24, T6N, R28E.
- Close and rehabilitate approximately 0.5 miles of road in Section 24, T6N, R28E.
- Close and rehabilitate approximately 0.3 miles of road in Section 24 and 25, T6N, R28E.
- Close and rehabilitate approximately 0.8 miles of road in Section 17 and 22, T6N, R29E.
- Close and rehabilitate approximately 0.5 miles of road in the S ½ Section 17, T6N, R29E.
- Close and rehabilitate approximately 0.9 miles of road in the N ½ Section 18 and NW ¼ Section 17, T6N, R29E.
- Place barrier and road closure at the meadow edge in NE ¼, Section 18, T6N, R29E.
- Remove barrier and road closure at the road in S ½, Section 10, T6N, R28E.

As described in the Environmental Assessment for the Udall Allotment (USFS 2001c), the

proposed action includes the addition of a series of four proposed livestock exclosures along the North Fork East Fork of the Black River (NFEFBR) to prevent livestock access to the river and to promote accelerated riparian recovery and improved in-stream fisheries habitat (See Appendix D of this document for a layout of Udall Allotment). Three of the exclosures are upstream from private land. CCAU will no longer be grazed by livestock and will be expanded to become one of four livestock exclosures (Exclosure #4). Exclosure #4 would eliminate direct access by livestock to loach minnow critical habitat. In addition, there are three other areas of riparian and fisheries concern along the NFEFBR. The reaches of concern are a 1.2 mile segment in the Timber Pasture (Exclosure 3 which contains approximately 261 acres) and two short segments of stream, 0.24 and 0.20 miles each, contained within the Milkpen Pasture (Exclosure 1 will be approximately 9 acres, while Exclosure 2 will be 18 acres). Exclosures will be built around these stream segments and will be excluded from livestock grazing for the term of the grazing permit. District resource specialists will monitor recovery of riparian habitat and a journey level fisheries biologist will determine fisheries habitat effects.

Implementation of the new term grazing permit will be over a three-year period including the one-year notification to the permittee. Implementation of site-specific utilization standards and riparian exclusion fencing will begin in 2001. Table 5 details site specific improvements by year for the Udall Allotment.

Table 5: IMPLEMENTATION OF RANGE IMPROVEMENTS FOR THE NEW TERM GRAZING PERMIT ON THE UDALL ALLOTMENT

Year	Change in livestock season of use	Change in Livestock Numbers	Fencing
2001			Implementation of site-specific utilization standards begin Livestock no longer permitted to graze CCAU Southern portion of exclosure #4, which will exclude the eastern 2/3 of Elk Pasture will be completed The primary 1.2 mile reach of concern in Timber Pasture will be fenced prior to the entry of livestock
2002	No Changes		
2003	From 6/1-10/31 to 7/1 - 10/31	1/3 Reduction in permitted numbers	Northern portion of exclosure #4 in the OD Pasture will be completed prior to grazing season
2004		Additional 1/3 Reduction in permitted numbers	The two smaller units located in the Milkpen Pasture will be fenced prior to livestock entry. All Riparian exclusion fencing completed prior to grazing season

2005		Final 1/3 Reduction in permitted numbers	

* Full implementation of the above projects and changes will be completed in 2005 and remain in place until the grazing permit expires in 2011.

Status of Species/Critical Habitat

Loach Minnow

Loach minnow was listed as a threatened species on October 28, 1986 (USFWS 1986). Critical habitat was designated April 25, 2000 (USFWS 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, USBLM 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). Loach minnow feeds exclusively on aquatic insects (Schrieber 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).

When critical habitat was designated for loach minnow, the Service determined the primary constituent elements for loach minnow. These elements include permanent, flowing, unpolluted water; living areas for loach minnow adults, juveniles, and larvae with appropriate flow regimes and substrates; spawning areas; low amounts of fine sediment and substrate embeddedness; riffle, run, and backwater components; low to moderate stream gradients; appropriate water temperatures; periodic natural flooding; an unregulated hydrograph, or, if flows are modified, a hydrograph that demonstrates an ability to support a native fish community; and, habitat devoid of nonnative aquatic species detrimental to loach minnow, or habitat where such nonnative species are at levels which allow persistence of loach minnow. These constituent elements are generalized descriptions and ranges of selected habitat factors that are critical for the survival and

recovery of loach minnow. 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 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.

Recent biochemical genetic work on loach minnow indicate that 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 (USFWS 1994b).

Mexican Spotted Owl

The Mexican spotted owl was listed as threatened on March 16, 1993 (USFWS 1993). The Service designated critical habitat for the MSO on February 1, 2001 (USFWS 2001).

In Arizona, a total of 11 critical habitat units totaling 830,803 acres were designated as critical habitat. The Service elected to exclude from critical habitat designation those lands where adequate special management considerations or protection are provided by a legally operative plan or agreement that addresses the maintenance and improvement of the primary constituent elements important to the species, and manages for the long-term conservation of the species. The Service determined that the Southwest Region of the Forest Service amended their Forest Plans in Arizona and New Mexico in 1996 to incorporate the MSO Recovery Plan guidelines as management direction and, as a result, is providing adequate special management for the MSO. Based on this conclusion, the Service excluded National Forest lands in Arizona and New Mexico from final critical habitat designation. Therefore, no critical habitat for the MSO occurs within the proposed project area.

The MSO is mottled in appearance with irregular white and brown spots on its abdomen, back, and head. Several thin white bands mark an otherwise brown tail. Unlike most owls, spotted owls have dark eyes. The MSO is distinguished from the California and northern subspecies chiefly by plumage and geographic distribution. The spots of the MSO are larger and more numerous than in the other two subspecies, giving it a lighter appearance. The MSO has the largest geographic range of the three subspecies. The range extends from the southern Rocky Mountains in Colorado and the Colorado Plateau in southern Utah southward through Arizona and New Mexico, and discontinuously through the Sierra Madre Occidental and Oriental to the mountains at the southern end of the Mexican Plateau. While there are no estimates of the owl's

historic population size, its historic range and present distribution are thought to be similar. The current known range of the MSO extends north from Aguascalientes, Mexico through the mountains of Arizona, New Mexico, and western Texas, to the canyons of southern Utah and southwestern Colorado, and the Front Range of central Colorado (USFWS 1995b). Although this range covers a broad area of the southwestern United States and Mexico, much remains unknown about the species' distribution within this range. This is especially true in Mexico where much of the owl's range has not been surveyed. Information gaps also appear in the species' distribution within the United States, however, it is apparent that the owl occupies a fragmented distribution throughout its United States range corresponding to the availability of forested mountains and canyons, and in some cases, rocky canyon lands.

The Forest Service is the primary administrator of lands occupied by owls in the United States. According to the MSO Recovery Plan (Recovery Plan) (USFWS 1995b), 91 percent of owls known to exist in the United States between 1990 and 1993 occur on land administered by the Forest Service. The majority of known owls have been found within Region 3 of the Forest Service, which includes 11 National Forests in Arizona and New Mexico. Forest Service Regions 2 and 4, which include two National Forests in Colorado and three National Forests in Utah, support fewer owls.

A reliable estimate of the numbers of owls throughout its entire range is not currently available. Owl surveys conducted from 1990 through 1993 indicate that the species persists in most of the locations reported prior to 1989, with the exception of riparian habitats in the lowlands of Arizona and New Mexico, and all previously occupied areas in the southern states of Mexico. Increased survey efforts have resulted in additional sightings for all recovery units. Fletcher (1990) calculated that 2,074 owls existed in Arizona and New Mexico in 1990 using information gathered by Region 3 of the Forest Service. Modifying Fletcher's calculations, the Service estimated that there were a total of 2,160 owls in the United States (USFWS 1991). While the number of owls throughout its range is not currently available, the Recovery Plan (USFWS 1995b) reports an estimate of owl sites based on 1990 - 1993 data. 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. Surveys from 1990 through 1993 indicate one or more owls have been observed at a minimum of 758 sites in the United States and 19 sites in Mexico. At best, total numbers in the United States range from 777 individuals (assuming one owl per site) to 1,554 individuals (assuming one pair of owls per site).

The range of the MSO in the United States has been divided into six recovery units (RUs) as identified in the Recovery Plan (USFWS 1995b, Part II.B.). An additional five RUs were designated in Mexico. The recovery plan identifies recovery criteria by RU. The upper Gila Mountain RU has the greatest known concentration of owls sites in the United States. This RU is considered a critical nucleus for the owl because of its central location within the owl's range, and the presence of over 50 percent of the known owls.

Past, current, and future timber-harvest practices in Region 3 of the Forest Service, in addition to catastrophic wildfire, were cited as the primary factors leading to listing of the MSO as a threatened species. Fletcher (1990) estimates that 1,037,000 acres of habitat were converted from suitable (providing all requirements of the owl, e.g., nesting, roosting, and foraging) to capable (once suitable, but no longer so). Of this, about 78.7 percent, or 816,000 acres, was a result of human management activities, whereas the remainder was converted more or less

naturally, primarily by wildfire.

MSOs breed sporadically and do not nest every year. MSOs reproductive chronology varies somewhat across the range of the owl. In Arizona, courtship apparently begins in March with pairs roosting together during the day and calling to each other at dusk (Ganey 1988). Eggs are laid in late March, or, more typically, early April. Incubation begins shortly after the first egg is laid, and is performed entirely by the female. The incubation period for the MSO is assumed to be 30 days (Ganey 1988). During incubation and the first half of the brooding period, the female leaves the nest only to defecate, regurgitate pellets, or to receive prey from the male, who does all or most of the foraging (Forsman *et al*. 1984, Ganey 1988). Eggs usually hatch in early May, with nestling owls fledgling four to five weeks later, and then dispersing in mid-September to early October (Ganey 1988).

MSOs nest, roost, forage, and disperse in a diverse array of biotic communities. Nesting habitat is typically in areas with complex forest structure or rocky canyons, and that contain mature or old-growth stands which are uneven-aged, multi-storied, and have high canopy closure (Ganey and Balda 1989, USFWS 1991). In the northern portion of the range (southern Utah and Colorado), most nests are in caves or on cliff ledges in steep-walled canyons. Elsewhere, the majority of nests appear to be in Douglas-fir trees (Fletcher and Hollis 1994, Seamans and Gutierrez 1995). A wider variety of tree species is used for roosting; however, Douglas-fir is the most commonly used species (Ganey 1988, Fletcher and Hollis 1994). Foraging owls use a wider variety of forest conditions than for nesting or roosting. In northern Arizona, owls generally foraged slightly more than expected in logged forests, and less so in selectively logged forests (Ganey and Balda 1994). However, patterns of habitat use varied among study areas and individual birds, making generalizations difficult.

Seasonal movement patterns of MSOs are variable. Some individuals are year-round residents within an area, some remain in the same general area but show shifts in habitat-use patterns, and some migrate considerable distances (12-31 miles) during the winter, generally migrating to more open habitats at lower elevations (Ganey and Balda 1989, Willey 1993, Ganey et al. 1998).

A diverse prey base is dependent on the availability and quality of diverse habitats. Prey availability is determined by the distribution, abundance, and diversity of prey and by the owl's ability to capture it. Diet studies conducted on MSOs have indicated that prey species of the owl include woodrats (*Neotoma* spp.), white-footed mice (*Peromyscus* spp.), voles (*Microtus* and *Clethrionomys* spp.), rabbits and hares (*Sylvilagus* and *Lepus* spp.), pocket gophers (*Thomomys* spp.), and other animals including a variety of bats, birds, insects, and reptiles. Ward and Block (1995) reported that rangewide, 90% of an "average MSO diet would contain 30 percent woodrats, 28 percent peromyscid mice, 13 percent arthropods, nine percent microtine voles, five percent birds, and four percent medium-sized rodents, mostly diurnal sciurids. These rangewide patterns are not consistent among RUs. In two studies in Arizona and New Mexico, Ward and Block (1995) found that the owl's food is most abundant during the summer months when young are being raised.

The Recovery Plan (USFWS 1995b) provides for three levels of habitat management: protected areas, restricted areas, and other forest and woodland types. Protected habitat includes all known

owl sites, and all areas in mixed conifer or pine-oak forests with slopes greater than 40 percent where timber harvest has not occurred in the past 20 years, and all reserved lands. Protected Activity Centers, or PACs, are delineated around known MSO sites. A PAC includes a minimum of 600 acres designed to include the best nesting and roosting habitat in the area. The recommended size for a PAC includes, on average from available data, 75 percent of the foraging area of an owl. The management guidelines for protected areas from the recovery plan are to take precedence for activities within protected areas. Restricted habitat includes mixed conifer forest, pine-oak forest, and riparian areas. The Recovery Plan provides less specific management guidelines for these areas. The Recovery Plan provides no owl specific guidelines for "other habitat .

Grazing and the Mexican Spotted owl

The MSO recovery plan (USFWS 1995) provides guidance regarding grazing in areas with MSOs. Grazing impacts to spotted owls are discussed in four broad ways: (1) altering prey availability, (2) altering susceptibility to fire, (3) degeneration of riparian plant communities, and (4) impairing the ability of plant communities to develop into spotted owl habitat. The recovery plan goes on to provide explicit goals for managing grazing in protected and restricted spotted owl habitat:

Monitor grazing use by livestock and wildlife in "key grazing areas. Key areas are primarily riparian areas, meadows, and oak types.

The intent is to maintain good to excellent range conditions in key areas while accommodating the needs of the owl and its prey.

Implement and enforce grazing utilization standards that would attain good to excellent range conditions within the key grazing areas.

Establish maximum allowable use levels that are conservative and that will expedite attaining and maintaining good to excellent range conditions.

Ensure that the allowable use of plant species will maintain plant diversity, density, vigor, and regeneration over time.

Restore adequate levels of residual plant cover, fruits, seeds, and regeneration to provide for the needs of prey species.

Restore good conditions to degraded riparian communities.

The 1996 Forest Service Record of Decision for the Amendments of the Forests Plan incorporated the recommendations for MSO management into Forest direction in the form of standards and guidelines and suggested utilization levels, for combined use by livestock and wildlife, based on range conditions and allotment management strategy.

The MSO recovery plan specifically identifies overgrazing as a threat to the owl in the Upper Gila Mountain Recovery Unit.

"Overgrazing is suspected to be detrimental in some areas and can affect both habitat structure and the prey base. Effects on the prey base are difficult to quantify, but removal of herbaceous vegetation can reduce both food and cover available to small mammals (Ward and Block 1995). This is especially true with respect to voles, which are often associated with dense grass cover. Direct effects on habitat occurs with livestock browsing on gambel oak (*Quercus gambelii*). In some areas, oak is regenerating well but unable to grow beyond the sapling stage because of this

browsing... Grazing effects on habitat are also potentially significant in canyon-bottom riparian areas. We do not attribute these effects solely to livestock. Forage resources are shared by livestock and wild ungulates (U.S. Fish and Wildlife Service 1995, p. 101).

The effect livestock and wildlife grazing can have on MSO prey species and their habitat is also a complex issue. Impacts can vary according to grazing species (domestic or wild), degree of use, including stocking density, grazing intensity, grazing frequency, and timing of grazing, habitat type and structure, and plant and prey species composition (Ward and Block 1995). It is well documented that repetitive, excessive grazing of plant communities by livestock can significantly alter plant species density, composition, vigor, regeneration, above or below ground phytomass, soil properties, nutrient flow and water quality, especially when uncontrolled (Belsky and Blumenthal 1997; Ward and Block 1995). These effects have both direct and indirect adverse impacts on animal species that are dependent on plants for food and cover. However, moderate to light grazing can benefit some plant and animal species under certain conditions and in certain environments, maintain communities in certain seral stages, and may increase primary productivity (Ward and Block 1995). No studies document the direct and indirect effects of livestock grazing on the MSO or its prey (USFWS 1995b). However, Ward and Block (1995) indicate that, under heavy grazing, decreases in populations of voles would be expected, and this would improve conditions for deer mice in meadow habitat. Increases in deer mouse abundance in meadows would not offset decreases in vole numbers because voles provide greater biomass per individual and per unit of area. Such decreases could negatively influence spotted owls (Ward and Block 1995).

Ward and Block (1995) examined correlates between the MSO's diet and reproduction. Their results suggested that the owl's reproductive success was not influenced by a single prey species, but by many species in combination. None of the specific prey groups significantly influenced owl reproductive success, but rather, they concluded it was more likely that the owl's reproductive success was influenced by total prey biomass consumed in a given year. More young were produced when moderate to high amounts of the three most common prey groups (woodrats, peromyscid mice, and voles) were consumed.

Chiricahua Leopard Frog

The Chiricahua leopard frog was proposed for listing as a threatened species without critical habitat in a Federal Register notice dated June 14, 2000 (65 FR 37343, June 14, 2000). The rule included a proposed special rule to exempt operation and maintenance of livestock tanks on non-Federal lands from the section 9 take prohibitions of the Act. This species is distinguished from other members of the *Rana pipiens* complex by a combination of characters, including a distinctive pattern on the rear of the thigh consisting of small, raised, cream-colored spots, or tubercles, on a dark background; dorsolateral folds that are interrupted and deflected medially; stocky body proportions; relatively rough skin on the back and sides; and often green coloration on the head and back (Platz and Mecham 1979). The species also has a distinctive call consisting of a relatively long snore of one to two seconds in duration (Platz and Mecham 1979). Snout-vent lengths of adults range from approximately 2.1 to 5.4 inches (Stebbins 1985, Platz and Mecham 1979).

The Chiricahua leopard frog is an inhabitant of cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet in central and southeastern Arizona; west-central and southwestern New Mexico; and in Mexico, northern Sonora, and the Sierra Madre Occidental of Chihuahua, northern Durango and northern Sinaloa (Platz and Mecham 1984, Degenhardt *et al.* 1996, Sredl *et al.* 1997). The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa (especially *Rana montezumae*) in the southern part of the range of the Chiricahua leopard frog. In New Mexico, of sites occupied by Chiricahua leopard frogs from 1994-1999, 67 percent were creeks or rivers, 17 percent were springs or spring runs, and 12 percent were stock tanks (Painter 2000). In Arizona, slightly more than half of known historic localities are natural lotic systems, a little less than half are stock tanks, and the remainder are lakes and reservoirs (Sredl *et al.* 1997). Sixty-three percent of currently extant populations in Arizona occupy stock tanks (Sredl and Saylor 1998).

Based on Painter (2000) and the latest information for Arizona, the species is still extant in all major drainages in Arizona and New Mexico where it occurred historically; however, it has not been found recently in many rivers, valleys, and mountains ranges, including the following in Arizona: White River, East Clear Creek, West Clear Creek, Silver Creek, Tonto Creek, Verde River mainstem, San Francisco River, San Carlos River, upper San Pedro River mainstem, Santa Cruz River mainstem, Aravaipa Creek, Babocomari River mainstem, Sonoita Creek, Pinaleno Mountains, Peloncillo Mountains, Sulphur Springs Valley, and Huachuca Mountains. In many of these regions Chiricahua leopard frogs were not found for a decade or more despite repeated surveys. Recent surveys suggest the species may have recently disappeared from some major drainages in New Mexico (C. Painter, pers. comm. 2000). The species has been extirpated from about 75 percent of its historic localities in Arizona and New Mexico. The status of the species in Mexico is unknown.

Threats to this species include predation by nonnative organisms, especially bullfrogs, fish, and crayfish; disease; drought; floods; degradation and destruction of habitat; water diversions and groundwater pumping; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; and environmental contamination. Numerous studies indicate that declines and extirpations of Chiricahua leopard frogs are at least in part caused by predation and possibly competition by nonnative organisms, including fish in the family Centrarchidae (*Micropterus* spp., *Lepomis* spp.), bullfrogs (*Rana catesbeiana*), tiger salamanders (*Ambystoma tigrinum mavortium*), crayfish (*Oronectes virilis* and possibly others), and several other species of fish (Fernandez and Rosen 1998, Rosen *et al.* 1996, 1994; Snyder *et al.* 1996; Fernandez and Bagnara 1995; Sredl and Howland 1994; Clarkson and Rorabaugh 1989). For instance, in the Chiricahua region of southeastern Arizona, Rosen *et al.* (1996) found that almost all perennial waters investigated that lacked introduced predatory vertebrates supported Chiricahua leopard frogs. All waters except three that supported introduced vertebrate predators lacked Chiricahua leopard frogs. Sredl and Howland (1994) noted that Chiricahua leopard frogs were nearly always absent from sites supporting bullfrogs and nonnative predatory fish.

Disruption of metapopulation dynamics is likely an important factor in regional loss of populations (Sredl *et al.* 1997, Sredl and Howland 1994). Chiricahua leopard frog populations are often small and habitats are dynamic, resulting in a relatively low probability of long-term

population persistence. Historically, populations were more numerous and closer together. If populations winked out due to drought, disease, or other causes, extirpated sites could be recolonized via immigration from nearby populations. However, as numbers of populations declined, populations became more isolated and were less likely to be recolonized if extirpation occurred. Also, most of the larger source populations along major rivers have disappeared.

An understanding of the dispersal abilities of Chiricahua leopard frogs is key to determining the likelihood that suitable habitats will be colonized from a nearby extant population of frogs. Dispersal of leopard frogs away from water in the arid Southwest may occur less commonly than in mesic environments during the wet season. However, there is evidence of substantial movements even in Arizona. In August, 1996, Rosen and Schwalbe (1998) found up to 25 young adult and subadult Chiricahua leopard frogs at a roadside puddle in the San Bernardino Valley, Arizona. They believed that the only possible origin of these frogs was a stock tank located 3.4 miles away. Rosen *et al.* (1996) found small numbers of Chiricahua leopard frogs at two locations in Arizona that supported large populations of nonnative predators. The authors suggested these frogs could not have originated at these locations because successful reproduction would have been precluded by predation. They found that the likely source of these animals were populations 1.25 - 4.35 miles distant. In the Dragoon Mountains, Arizona, Chiricahua leopard frogs breed at Halfmoon Tank, but frogs occasionally turn up at Cochise Spring (0.8 miles down canyon in an ephemeral drainage from Halfmoon Tank) and in Stronghold Canyon (one mile down canyon from Halfmoon Tank). There is no breeding habitat for Chiricahua leopard frogs at Cochise Spring or Stronghold Canyon, thus it appears observations of frogs at these sites represent immigrants from Halfmoon Tank. In the Chiricahua Mountains, a population of Chiricahua leopard frogs disappeared from Silver Creek stock tank after the tank dried up; but frogs then began to appear in Cave Creek, which is about 0.62 miles away, again, suggesting immigration. Movements away from water do not appear to be random. Streams are important dispersal corridors for young northern leopard frogs (Seburn *et al.* 1997). Displaced northern leopard frogs will return home, and apparently use olfactory and auditory cues, and possibly astronomic cues, as guides (Dole 1968, 1972). Rainfall or humidity may be an important factor in dispersal because odors carry well in moist air, making it easier for frogs to find other wetland sites (Sinsch 1991).

Recent evidence suggests a chytridiomycete skin fungi is responsible for observed declines of frogs, toads, and salamanders in portions of Central America (Panama and Costa Rica), South America (Atlantic coast of Brazil, Ecuador, and Uruguay), Australia (eastern and western States), New Zealand (South Island), Europe (Spain and Germany), Africa (South Africa, "western Africa , and Kenya), Mexico (Sonora), and United States (8 States) (Speare and Berger 2000, Longcore *et al.* 1999, Berger *et al.* 1998, S. Hale pers. comm. 2000). Ninety-four species of amphibians have been diagnosed as infected with the chytrid *Batrachochytrium dendrobatidis.* In Arizona, chytrid infections have been reported from four populations of Chiricahua leopard frogs (M. Sredl, pers. comm. 2000), as well as populations of Rio Grande leopard frog (*Rana berlandieri*), Plains leopard frog (*Rana blairi*), lowland leopard frog (*Rana yavapaiensis*), Tarahumara frog (*Rana tarahumarae*), canyon treefrog (*Hyla arenicolor*), and Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*) (Davidson *et al.* 2000, Sredl and Caldwell 2000, Morell 1999, S. Hale pers. comm. 2000). The disease was recently reported from a metapopulation of Chiricahua leopard frogs from New Mexico; that metapopulation may have been extirpated (C. Painter, pers. comm. 2000).

The role of the fungi in the population dynamics of the Chiricahua leopard frog is as yet undefined; however, it may well prove to be an important contributing factor in observed population decline. Rapid death of recently metamorphosed frogs in stock tank populations of Chiricahua leopard frogs in New Mexico was attributed to post-metamorphic death syndrome (Declining Amphibian Populations Task Force 1993). Hale and May (1983) and Hale and Jarchow (1988) believed toxic airborne emissions from copper smelters killed Tarahumara frogs and Chiricahua leopard frogs in Arizona and Sonora. However in both cases, symptoms of moribund frogs matched those of chytridiomycosis. Chytrids were recently found in a specimen of Tarahumara frog collected during a die off in 1974 in Arizona. This earliest record for chytridiomycosis corresponds to the first observed mass die-offs of ranid frogs in Arizona.

The origin of the disease is unknown, but epizootiological data from Central America and Australia (high mortality rates, wave-like spread of declines, wide host range) suggest introduction of the disease into native populations and the disease subsequently becoming enzootic in some areas. Alternatively, the fungus may be a widespread organism that has emerged as a pathogen because of either higher virulence or an increased host susceptibility caused by other factors such as environmental changes (Berger *et al.* 1998), including global climate change (Daszak 2000, Pounds and Crump 1994). If it is a new introduction, its rapid colonization could be attributable to humans. The fungus does not have an airborne spore, so it must spread via other means. Amphibians in the international pet trade (Europe and USA), outdoor pond supplies (USA), zoo trade (Europe and USA), laboratory supply houses (USA), and species recently introduced (*Bufo marinus* in Australia and bullfrog in the USA) have been found infected with chytrids, suggesting human-induced spread of the disease (Daszak 2000). Chytrids could also be spread by tourists or fieldworkers sampling aquatic habitats (Halliday 1998). The fungus can exist in water or mud and thus could be spread by wet or muddy boots, vehicles, cattle, and other animals moving among aquatic sites, or during scientific sampling of fish, amphibians, or other aquatic organisms. The Service and Arizona Game and Fish Department are employing preventative measures to ensure the disease is not spread by aquatic sampling.

The effects of livestock grazing on ranid frog populations are not well-studied with results suggesting that grazing could have adverse or beneficial influences on frogs. Maintenance of viable populations of Chiricahua leopard frogs is thought to be compatible with well-managed livestock grazing. Grazing occurs in most of the habitats occupied by this frog. For instance, a large and healthy population of Chiricahua leopard frogs coexists with cattle and horses on the Tularosa River, New Mexico (Randy Jennings, Western New Mexico University, pers. comm. 1995). Effects of grazing on Chiricahua leopard frog habitat probably include both creation of habitat and loss and degradation of habitats. Construction of tanks for livestock has created important leopard frog habitat, and in some cases has replaced destroyed or altered natural wetland habitats (Sredl and Saylor 1998). Sixty-three percent of extant Chiricahua leopard frog localities in Arizona are stock tanks, versus only 35 percent of extirpated localities (Sredl and Saylor 1998), suggesting Arizona populations of this species have fared better in stock tanks than in natural habitats. Stock tanks provide small patches of habitat, which are often dynamic and subject to drying and elimination of frog populations. However, Sredl and Saylor (1998) also found that stock tanks are occupied less frequently by nonnative predators (with the exception of bullfrogs) than natural sites.

Munger *et al*. (1994) found that sites with adult Columbia spotted frogs (*Rana luteiventris*) had significantly less grazing pressure than sites without spotted frogs. However, in a subsequent survey he found no differences (Munger *et al.*1996). Bull and Hayes (2000) evaluated reproduction and recruitment of the Columbia spotted frog in 70 ponds used by cattle and 57 ponds not used by cattle. No significant differences were found in the number of egg masses or recently metamorphosed frogs in grazed and ungrazed sites. Seventeen percent of the sites were livestock tanks. The California red-legged frog (*Rana aurora draytonii*) coexists with managed livestock grazing in many places in California. Ponds created as livestock waters have created habitats for red-legged frogs and livestock may help maintain habitat suitability by reducing coverage by cattails, bulrush, and other emergent vegetation (USFWS 2000). On the other hand, exclusion of cattle from the Simas Valley, Contra Costa County, corresponded with reestablishment of native trees and wetland herbs, reestablishment of creek pools, and expansion of red-legged frog populations (Dunne 1995).

Native riparian ecosystems, especially in the arid Southwest, are disappearing rapidly and this could play a vital role in the recovery of the Chiricahua leopard frog. Because riparian zones often follow the gradual elevation changes of a watershed, they are often desirable for road and pipeline construction leading to greater impacts to riparian ecosystems. In the early years of livestock management, emphasis was on the uplands with very little concern for riparian areas. In fact riparian areas were considered "sacrifice areas in range management schemes. As a result, serious damage to stream channels and aquatic habitat occurred. It was not until the 1970's that serious consideration was given to managing riparian areas. Riparian areas are widely recognized as crucial to the overall ecological health of rangelands in the western U.S.; however, many are in degraded condition, largely as a result of poorly managed livestock grazing (U.S. General Accounting Office 1988). Livestock tend to congregate in riparian areas for extended periods, eat much of the vegetation, and trample streambanks, often eliminating other benefits of riparian habitat (e.g., fish and wildlife habitat, erosion control, floodwater dissipation). Riparian areas, however, have ecological importance far beyond their relatively small acreage because they have a greater quantity and diversity of plant species than adjoining land.

Additional information about the Chiricahua leopard frog can be found in Sredl *et al.* (1997), Jennings (1995), Degenhardt *et al.* (1996), Rosen *et al.* (1996, 1994), Sredl and Howland (1994), Platz and Mecham (1984, 1979), and Painter (2000).

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat to provide a platform to assess the effects of the actions now under consultation.

P.S. Allotment

This is the southern-most allotment of the three mentioned in this Biological Opinion. It is directly downstream of Hayground Allotment along the WFBR on the Forest, Alpine Ranger District. The P.S. Allotment is a total of 3,787 acres in size, ranging in elevation from 7,500 to 8,100 feet. Sixty-two percent of this allotment is in fair to good condition, with 68% of the soils having full capability. Approximately 11.6 miles of riparian stream occur within the P.S. Allotment including Home and Horse Creeks, and East and West Forks of the Black River (Appendix B of this document).

According to the addendum to the biological assessment and evaluation (USFS 2001a) vegetation overstory is primarily ponderosa pine (78%), mixed conifer (4%), and meadow/riparian (15%). The majority of ponderosa pine canopy cover is generally at medium densities. Principle browse species are gambel oak (*Quercus gambelii*), buckbrush (*Ceanothus sp.*), snowberry (*Symphoricarpos sp.*), and rose (*Rosa sp.*). The understory is composed of screwleaf muhly (*Muhlenbergia virescens*), blue grama (*Bouteloua gracilis*), pine dropseed (*Blepharoneuron tricholepis*), dryland sedge, fleabane (*Erigeron sp.*), pussytoes *(Antennaria sp.*), paintbrush (*Castilleja sp.*), squirreltail (*Sitanion*), junegrass (*Koeleria sp.*), yarrow (*Achillea sp.*), mutton bluegrass (*Poa fendleriana*), groundsel (*Senecio sp.*), bracken fern (*Pteridium sp.*), mountain brome (*Bromus sp.*), Ross sedge (*Carex sp.*), and silvertop sedge (*Carex sp.*). The mixed conifer overstory is variously composed of Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), and southwest white pine (*Pinus reflexa*). Scattered stands of aspen (*Populus tremuloides*) are also present. Principle browse species are gambel oak, Oregon grape (*Vitis sp.*), mountain willow (*Salix sp.*), snowberry, honeysuckle (*Lonicera sp.*), common juniper (*Juniperus communis*), and rose. Meadow/riparian areas are very floristically diverse. Herbaceous species include bluegrass (*Poa sp.*), bentgrass (*Agrostis sp.*), tufted hairgrass (*Deschampsia caespitosa*), spike muhly (*Muhlenbergia wrightii*), sedges (*Carex sp.*), rushes (*Juncaceae sp.*), wheatgrasses (*Agropyron sp.*), iris (*Iridaceae sp.*), yarrow, fleabane, and monkey flower (*Mimulus sp.*).

According to the P.S. addendum, woody riparian species can be and have been negatively affected by browsing and trampling (USFS 2001a). Small areas of the grassland on P.S. Allotment exhibit sheet erosion with plant pedestalling (USFS 1999a). Furthermore, because riparian areas are the major source of water on this allotment, livestock spend a disproportionate amount of time in these areas. Consequently riparian areas are impacted. Many of the meadows and floodplain benches have greater than 50% exposed soil surface area.

According to the 7.5 minute USGS quads, there are a total of 23 miles of perennial flow and 45 miles of intermittent flow within the allotment. Approximately ten river miles of loach minnow critical habitat (West Fork and the East Fork of Black River) are within the action area of the allotment. Although unoccupied, this critical habitat General Aquatic Wildlife System (GAWS) surveys were done in 1989 and 1990 for the East and West forks of Black River (USFS 2001a). According to the General Aquatic Wildlife System (GAWS) definitions, riparian conditions are unsatisfactory for the East and West forks of the Black River and satisfactory in the lower reach of Home Creek.

<u>Loach minnow in the P.S. Allotment</u>

Loach minnow were first documented in the Black River in 1996 at the Three Forks Crossing (FR 249) (Bagley et. al. 1996). There were no previous records of this species in the Black River system (Minckley 1973). Speculation that these fish were moved there in recent years from elsewhere is not supported by genetic data, which indicate the Black River population of loach minnow is distinctive from other known populations (Tom Dowling, Arizona State University, October 31, 2001, pers. comm.). The discovery of this remnant population in such a relatively heavily sampled location points out the difficulty in locating populations of loach minnow and other small native fishes and identifying the extent of their occupied area. Not only are loach minnow usually one of the least numerous of the species found in an area, they are also somewhat secretive, difficult to sample effectively, and are often confused with the more common native speckled dace.

The loach minnow population in the East Fork (EFBR) and NFEFBR of the Black River is known to extend from Diamond Rock upstream to about 2 miles above Boneyard Creek (USFWS 1986) and may actually extend further upstream and most probably extends downstream, at least during years of good hydrologic conditions. It is also known to occupy the lower reaches of Boneyard Creek.

This population of loach minnow occupies habitat that appears to be somewhat different than that occupied by other remaining populations. It is substantially higher in elevation than other known populations. The gradient is also much steeper than that found in other occupied habitats. In addition, the substrate is substantially larger at this location. These factors make it difficult to predict the downstream extent of the population and it may extend thoughout the action area.

Between 1996 and 1997, Arizona State University Center for Environmental Studies completed fish surveys from the Forest Service boundary of the Black River up to FS road 116 (T6N R27E Sec23) of the West Fork and up to .63 miles above the confluence of the North Fork of East Fork and Boneyard Creek (T5S R28E Sec 5) (Bagley 1997). Table 6 lists those areas where loach minnow were found.

Table 6. 1996-1997 recorded occupied sites for loach minnow within the Black River watershed.

North Fork of East Fork of Black River	Date of Survey	Loach Minnow #	Spikedace	Approximate river miles upstream from action area
¼ mile above FS road 249	07/06/96	1	0	9
@ Boneyard 328 ft above FS road 249	06/12/96	11	0	9
@ Boneyard near FS road 249	06/12/96	15	0	9
@ Three Forks	07/24/97	3	0	9
@ Three Forks	06/10/97	4	0	9
2 miles below Three Forks	08/08/96	14	0	7
@ Open Draw	07/23/97	2	0	6

In addition, the P.S. addendum notes that fish surveys within Home Creek in 1984 and 1986 did not find loach minnow or spikedace. The addendum also mentions that fish surveys within the EFBR in 1998 and within the WFBR between 1989 and 1990 also did not find loach minnow. Although not found during these surveys there is possibility that the species does occur within

the action area of this project.

The Allotment Management Plan notes that there are other activities within the allotment. The P.S. Allotment contains about ¼ mile of the WFBR and about 3 miles of the EFBR. Both sections of the Black River consist of heavily used forest roads and the EFBR contains a campground and receives heavy recreation use such as fishing and hiking. There is also one developed campground on P.S. Allotment called Buffalo Crossing.

Chiricahua leopard frog and the P.S. Allotment

The Chiricahua leopard frog populations above the Mogollon Rim in Arizona appear to have relatively poor persistence (J. Rorabaugh, USFWS, pers. comm. 2001). There have not been any surveys conducted specifically for this species on the P.S. Allotment. Suitable habitat exists on the P.S. Allotment which could support populations. The P.S. Allotment contains livestock tanks, springs, cienegas, and streams that receive water from the Black River. Furthermore, Chiricahua leopard frogs are found in the Three Forks area (approximately 6 miles away) and were recently reintroduced at Concho Bills springs in 2000. These locations are within a relatively close proximity to the P.S. Allotment, which increases the likelihood that habitats within the allotments are occupied by the Chiricahua leopard frog. In addition, Chiricahua leopard frogs are known to disperse up to distances of five miles. This dispersal tendency of leopard frogs makes it highly likely that Chiricahua leopard frogs occupy habitat on the P.S. Allotment. Due to these factors it is considered that the Chiricahua leopard frog occupy habitat on the P.S. Allotment.

The Chiricahua leopard frog occurs in the NFEFBR at Three Forks. Only rough estimates of frog numbers in the Three Forks area are available. Fernandez and Rosen (1996) conducted cursory surveys from 1986-1996, but the surveys lacked the scientific rigor needed for definitive numbers or trend analysis (e.g., surveys were not conducted at night). However, the authors incidentally noticed that frogs were much more abundant at sites lacking introduced crayfish (*O. virilis*). The crayfish population at Three Forks has steadily grown in the past decade (or more), and crayfish have damaged aquatic vegetation, stream banks, and the invertebrate community of the springs complex. Crayfish have effectively removed substantial amounts of aquatic vegetation such as water cress (*Rorippa nasturtium-aquaticum*) and water buttercup *(Ranunculus aquatilis*) from the springs complex, which eliminates refugia for the Chiricahua leopard frog, and may make the frog more vulnerable to predation.

Since many areas in the Three Forks springs complex are devoid of significant amounts of aquatic vegetation, the invertebrate community that relies on such vegetation is impaired. Crayfish probably also affect invertebrate numbers directly, as supported by the significantly lower numbers of invertebrates in areas occupied by crayfish in the Three Forks area (Fernandez and Rosen 1996). The damage caused by crayfish extends to stream health at Three Forks in other ways by altering the stream channel by creating extensive burrow tunnels, which leads to bank erosion, increases in water turbidity, and siltation.

Hayground Allotment

As described in the Biological Evaluation, the Hayground Allotment is a total of 5,371 acres in

size, ranging in elevation from 9,020 feet on high elevation pastures to 7,760 feet where the WFBR leaves the south end of the allotment. The allotment is wholly within the WFBR watershed. Hayground Creek is the principle stream within the allotment. Topography is generally gentle and rolling. The allotment is dissected on the east side by the WFBR.

As described in the Hayground BA the dominant vegetation types include montane grasslands, wet meadows, stream associated riparian, spruce-fir, mixed conifer and ponderosa pine. The grasslands are dominated by Arizona fescue (*Festuca arizonica*) and mountain muhly (*Muhlenbergia montana*). The dominant vegetation in the wet meadows is tufted hairgrass, redtop bentgrass (*Agrostis alba*), mannagrass (*Glyceria sp.*), and sedges. Streamside riparian habitats within the analysis area tend to be a mosaic of the tufted hairgrass/redtop/sedge community interspersed with areas dominated by Kentucky bluegrass (*Poa pratensis*), thinleaf alder (*Alnus tenuifolia*) and willows (USFS 1993).

The northeast portion of the Hayground Allotment drains into the EFBR. According to the BA, a survey conducted in 1991 indicated that the water quality conditions in the Black River Watershed were generally excellent with the exception of sediment contributed from stream bank erosion and isolated areas generally related to roads .

Loach Minnow on the Hayground Allotment

Loach minnow have not been documented within the streams of the Hayground Allotment. The WFBR is a perennial stream within the allotment, and the lower two miles within the allotment are critical habitat for the loach minnow. Critical habitat occurs downstream of the allotment (within the action area) within the WFBR for approximately 4.5 miles. According to the addendum to the Biological Assessment and Evaluation (Hayground Addendum), in July and August of 1996, the Forest and Arizona State University sampled for fish in the upper Black River and its tributaries. Fish species known from the Black River include brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), Apache trout, speckled dace (*Rhinichthys osculus*), Sonora sucker (*Catostomus insignis*), and desert sucker (*Catostomus clarki*). Hayground Creek was also sampled within the allotment, and no fish were collected. Numerous surveys in 1984, 1986, 1989, 1990, 1997, and 1998 have failed to establish the presence of loach minnow within the Hayground Allotment. Refer to the P.S. Allotment Environmental baseline for a thorough review of loach minnow in the Black River watershed system.

Critical habitat within the WFBR consist of shallow water habitat, with slow to moderate flows, which are usually available between April and mid-July and between September and December. Due to a reduction in sinuosity and entrenced stream channels, there is a limited low to moderate flow velocity habitat during spring rains/snow melt and the monsoons. Instream cover on the allotment is also lacking due to the lack of woody debris component within the West and East Forks of the Black River action area (USFS 2001b). Livestock grazing on this allotment has impacted the aquatic and riparian habitats.

Areas of degraded riparian and aquatic conditions within the allotment are the result of a combination of past and ongoing management actions, use by wild ungulates and other wildlife species, and natural geologic processes that have resulted in reduced ground cover and other vegetative and physical alterations of upland and riparian conditions, according to the Hayground addendum (USFS 2001b). These impacts and alterations to hydrologic processes have resulted

in changes to stream channel morphology and other physical, biological, and chemical characteristics of aquatic and riparian habitat within, and downstream of, the allotment. Furthermore, due to the topography and distribution of water on this allotment, the movement of livestock occurs primarily within the riparian corridors.

The Hayground addendum also mentions other historical factors influencing the species on this allotment (USFS 2001b). Such historical and ongoing factors that influence the existing conditions on this allotment are timber harvest and other vegetation management activities, fire suppression and management, recreation activities and management, and the roads and trails associated with all of these activities. The introduction and presence of nonnative aquatic species within, upstream from, and downstream of the allotment have also impacted the loach minnow and their critical habitat. Degraded loach minnow habitat reduces the competitive edge of these fish and allows for more interactions which could potentially be detrimental to the fish.

Previous consultations for this area include a July 20, 1993 Biological Opinion regarding the revision of the livestock grazing allotment management plan for the Hayground Allotment. This biological opinion addressed the effects of the revision of three livestock grazing allotment management plans in the WFBR on the Apache trout (*Oncorhynchus apache*), Mexican spotted owl, and Arizona willow (*Salix arizonica*). Five objectives for minimizing incidental take for the Apache trout were given.

Udall Allotment

The Udall Allotment is located on the Springerville Ranger District. The allotment is located fifteen miles south and southwest of Springerville, Arizona. The Udall Allotment is a total of 10,820 acres in size, ranging in elevation from 8,500 to 9,500 feet.

The topography is mostly gentle with some steep slopes adjacent to the NFEFBR. Forested areas are located mostly around the edges of the allotment. Forested areas are composed of ponderosa pine forests on south-facing slopes and mixed conifer forests on north-facing slopes. Aspen occurs in scattered small stands, stringers and pockets. The allotment is surrounded by mixed conifer and ponderosa pine on all sides. Aspen occurs in small stands, stringers, and pockets. The central portion of the allotment is predominantly open, rolling, montane grassland with timbered knolls and stringers. Common upland herbaceous species are: Arizona fescue, mountain muhly, muttongrass (*Poa fendleriana*), carex, tufted hairgrass, pine dropseed, and screwleaf muhly in the ponderosa pine type. Buckwheat (*Erigonum sp.*) and fleabane are common forbs (USFS 2001d). Range conditions on the allotment vary from very poor (6%) to good condition (4%) with approximately equal amounts of fair condition (44%) and poor condition (46%) (USFS 2001e). Very poor and poor range conditions are generally associated with the ponderosa pine and mixed conifer cover types (48% of the allotment). Changes in livestock management are not expected to influence conditions in any significant way in the timbered areas. Grazing use by cattle and elk is heaviest in the open grasslands, wet meadows and along the EFBR, which is generally in fair or better range condition (USFS 2001d).

The present livestock management practices on the Udall Allotment have not resulted in

improved resource conditions within desired time frames. Current utilization rates exceed forage use standards contained in the Forest Plan. Current capacity estimates indicate over-stocking and over-utilization of vegetation on rangelands by livestock and wild ungulates. The current management practices are not adequate to provide physiological requirements of forage and browse plants, which precludes improving resource conditions. Consequently, current management practices are not adequate to return areas of unsatisfactory watershed and riparian condition to satisfactory condition (USFS 2001e). Therefore, the proposed actions are more in line with Forest Plan guidelines are intended to improve allotment conditions.

The principle riparian areas on the allotment are associated with the NFEFBR . According to the EA there are 19.12 miles of perennial stream on the Udall Allotment (USFS 2001e). The allotment is generally bisected from west to east by the NFEFBR before the river turns abruptly south through a steep sided canyon that drains into the Three Forks area on the adjacent Alpine Ranger District. Areas along the NFEFBR above Big Lake confluence and at Crosby Crossing are in poor streambank and riparian condition (USFS 2001e). There are a significant number of small drainage dissecting the allotment. Cienegas (wetlands), wet marshes, marshes, ponds and springs occur throughout the allotment. The BA describes degraded riparian and aquatic habitat conditions within the allotment that are the results of past and ongoing management actions that have resulted in reduced ground cover and other vegetative and physical alterations of upland and riparian conditions. As a result of these degraded conditions, there is a general lack of woody riparian species throughout the stream corridors. Livestock congregation in channel bottoms is causing areas of bank hoof shear, raw bank, and head cutting. Additionally, the BA notes that the majority of the stream reaches within the Udall Allotment are rated as functional at risk (USFS 2001c). The vegetation lacks vigor and is not continuous along the channel. Poor riparian vegetative conditions make the stream reaches susceptible to degradation. Heavy ungulate grazing in riparian meadow reaches has compacted soils and degraded both riparian vegetation and streambank stability. Upland ungulate grazing has also resulted in diminished vertical stability downslope within the channel. Stream channel downcutting and widening has occurred in the past, throughout the allotment on most of the perennial and intermittent drainages (USFS 2001d). This most likely resulted primarily from vegetation removal and alterations by ungulates in both the riparian and upland areas of the allotment.

A watershed condition evaluation that was completed in the mid 1980's by the A-S National Forest indicated that satisfactory watershed conditions existed on the Udall Allotment. Approximately 619 acres of meadow were classified as unsatisfactory with static or downward apparent trend and 3,028 acres of open grassland and meadow was classified as slightly to moderately impaired with static or upward apparent trend (USFS 2002). The remaining 7,130 acres of the allotment were rated as satisfactory watershed condition. These watershed conditions were based upon 1986 TES survey and a 2000 field review by Forest Soil Scientist. However, according to the Udall BA, there is concern that watershed conditions on the upper NFEFBR are contributing sediment and impacting downstream aquatic habitats. While the Udall Allotment only represents a portion of the upper (EFBR) watershed, there is a concern in the entire EFBR regarding watershed conditions. Specifically, the overall EFBR watershed concerns center on turbidity, poor stream bank stability, and unsatisfactory riparian and aquatic habitat conditions that can be attributed to impoundments, recreation, forestry practices (including forest roads), grazing, and natural conditions in the watershed (USFS 2001c).

Though the watershed within the allotment was determined to be in satisfactory condition during the mid-1980's, areas of head cutting and side cutting are evident today in uplands and side drainages, according to the Udall BA. Livestock grazing on the upland areas of the allotment can result in changes to surface infiltration rates and alter other hydrologic conditions of the watershed within, and downstream of, the allotment.

Loach minnow in the Udall Allotment

The NFEFBR is a perennial stream within the allotment, and the lower 1.5 miles within the allotment are critical habitat for the loach minnow. Critical habitat also occurs downstream of the allotment within the NFEFBR and EFBR for approximately 11 miles. Alterations in watershed processes result in changes to stream morphology and water velocity, increases in sedimentation rates, and alterations to the natural hydrograph which affects the constituent elements of the critical habitat. The accumulation of fine sediment in the interstitial spaces of cobble and gravel in riffle habitat is detrimental to the successful reproduction of loach minnows. Due to past livestock grazing, ungulate use, and natural geologic processes, such conditions exist on this allotment, therefore making the critical habitat unlikely to be able to support loach minnow at this time. Loach minnows require cobble and gravel substrates for spawning and lay their eggs on the underside of cobble pockets that are susceptible to becoming embedded in fine sediment. According to the Biological Assessment and Evaluation for loach minnow and spikedace, in July and August of 1996, the Forest and Arizona State University sampled for fish in the upper Black River and its tributaries. During this survey approximately 0.5 miles of the NFEFBR within the allotment were sampled at two locations. Brown trout, rainbow trout, Apache trout, speckled dace, Sonora sucker, and desert sucker were collected. The Big Lake drainage was also sampled within the allotment, and rainbow and brown trout, speckled dace, and Sonora sucker were collected. Surveys have failed to establish the presence of loach minnow on the Udall Allotment but they are known to exist downstream of the allotment at Three Forks (within the action area of the proposed action). Three Forks is approximately five miles downstream of the allotment. Refer to the P.S. baseline discussion for a thorough review of loach minnow in the Black River watershed.

Mexican spotted owl in the Udall Allotment

A PAC (OD Ridge PAC) encompasses 426 acres within the Udall Allotment. The Biological Assessment notes that approximately 60% of all suitable MSO habitat on the allotment was last surveyed in 1989-90. Informal monitoring work since that time, although inconclusive, has failed to verify MSO within the PAC. In addition, there are small pockets of restricted habitat within the allotment that have not been surveyed for MSOs.

The Udall Allotment is located within the Upper Gila Mountains Recovery Unit for the MSO, as defined by the recovery plan (USFWS 1995b). This recovery unit is a relatively narrow band bounded on the north by the Colorado Plateau Recovery Unit and to the south by the Basin and Range West Recovery Unit. The southern boundary of the Upper Gila Mountains Recovery Unit includes the drainage below the Mogollon Rim in central and eastern Arizona. The eastern boundary extends to the Black, Mimbres, San Mateo, and Magdalena mountain ranges of New Mexico. The northern and western boundaries extend to the San Francisco Peaks and Bill

Williams Mountain north and east of Flagstaff, Arizona. This is a topographically complex area consisting of steep foothills and high plateaus dissected by deep forested drainage. This recovery unit can be considered a "transition zone, because it is an interface between two major biotic regions: the Colorado Plateau and Basin and Range provinces (Wilson 1969). Habitat within this recovery unit is administered by the Kaibab, the Coconino, A-S, Tonto, Cibola, and Gila National Forests. The north half of the Fort Apache and northeast corner of the San Carlos Indian Reservations are located in the center of this recovery unit and contain an important habitat link between owl subpopulations at the western and eastern ends of the recovery unit and the subpopulations directly south within the Basin and Range West Recovery Unit.

A PAC is located almost entirely within the Timber Pasture. Soil trend is mostly fair with a downward trend in the open grasslands and good with a downward trend in the meadows which is attributable to an increase in bare ground. Upland soil conditions were reviewed in September 2000, and were found to have either satisfactory or impaired soil condition. Cover data indicate that bare ground has increased from approximately 20% to 40% on xeric sites between 1913 and 1998. Bare ground on mesic sites has increased from approximately 10% to 32%. Similarly, the vegetative trend is generally downward. These conditions are associated with livestock concentrations and overuse in this area. The Environmental Assessment states that the unsatisfactory range conditions associated with heavy over-story tree canopy will not improve significantly with the implementation of any livestock grazing prescription (USFS 2001d).

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Extrapolations of general hydrologic and biologic principles and site-specific research data provide a large body of evidence linking degradation of watersheds, stream channels, aquatic and riparian communities, and fish habitat and populations in western North America to grazing and grazing management (Leopold 1924, Leopold 1951, York and Dick-Peddie 1969, Hastings and Turner 1980, Dobyns 1981, Kauffman and Krueger 1984, Skovlin 1984, Kinch 1989, Chanel *et al*. 1990, Platts 1990, Armour *et al.* 1991, Bahre 1991, Meehan 1991, Fleischner 1994).

Effects of the Action to Loach Minnow

The loach minnow population in the EFBR, and NFEFBR is small, and may be highly sensitive to environmental perturbations (e.g., altered stream flow, sedimentation, water temperatures). Degraded aquatic habitat conditions are the result of past and ongoing management actions, although the proposed action attempts to improve some of the ground conditions, these adverse impacts and alterations to hydrologic processes (which are expected to continue with this project) have resulted in changes to stream channel morphology and other physical, biological, and

chemical characteristics of aquatic and riparian habitat within and downstream of the allotments. Livestock grazing activities on the P.S., Hayground, and Udall allotments generate sediments and/or nutrients that could degrade occupied loach minnow habitat in the WFBR and the NFEFBR. Additionally, grazing activities can have an indirect effect on loach minnow critical habitat constituent elements through habitat destruction by trampling and sediment generation. In summary, the constituent elements include permanent unpolluted water; living areas for adult, juvenile, and larval loach minnow of appropriate velocities and substrates; spawning areas for loach minnow or appropriate velocity and substrate, low amounts of sediments and substrate embeddedness, riffle, run, and backwater components; low to moderate stream gradients; appropriate temperature regimes; abundant food base; periodic natural flooding; an appropriate hydrograph; and an absence or minimal level of nonnative aquatic species detrimental to loach minnow.

The effects that livestock management activities can have on riparian and aquatic habitats, both direct and through upland/watershed effects, have been well documented and discussed in recent years (Platts 1990, Bahre 1991, Meehan 1991, Fleischner 1994). Livestock grazing activities in the uplands can contribute to changes in surface runoff quantity and intensity, sediment transport, soil chemistry, and infiltration and water holding capabilities of the watershed; flood flows may increase in volume while decreasing in duration, and low flows may decrease in volume and increase in duration (Brown *et al.* 1974, Gifford and Hawkins 1978, Johnson 1992). All of these impacts relate directly to the critical habitat of the loach minnow by changing stream velocity, the natural flood regime, and natural sediment load levels. Reduced herbaceous vegetation is expected to result in accelerated soil loss due to increased exposure of soils to rainfall events and reduced sediment filtering capabilities of the vegetation (Erman *et al.* 1977, Mahoney and Erman 1992, Osborne and Kovacic 1993). Hoof action can cause loss of cryptobiotic soil crusts, soil compaction, erosion, and gullying (Harper and Marbel 1988, Marrs *et al*. 1989, Orodho *et al*. 1990, Schlesinger *et al.* 1990, Bahre 1991, Gifford and Hawkins 1978). Litter is reduced by being trampled and churned into the soil thus reducing cover for soil, plants, and wildlife (Schulz and Leininger 1990). Overuse of vegetation by livestock can cause changes to plant root structures, and alter plant species composition and overall biomass (Martin 1975, Vallentine 1990, Popolizio *et al.*1994). Historically, these conditions on these allotments have been caused by overuse, and many of the conditions are thought to continue with any grazing on the allotments (USFS 2001a, USFS 2001b, USFS 2001c). These conditions may increase sediment delivery into the stream (Platts 1990, Meehan 1991, Johnson 1992, Weltz and Wood 1994), change the way in which flood flows interact with the stream channel, and may exacerbate flood damage to banks, channel bottoms, and riparian vegetation.

Excessive sediment deposition will eliminate the under-cobble pockets needed by loach minnow, making potential habitat unsuitable. Adverse effects of stream sedimentation to fish and fish habitats have been extensively documented (Murphy *et al.* 1981, Wood *et al.* 1990, Newcombe and MacDonald 1991, Barrett 1992, Megahan *et al.* 1992, Waters 1995, Newcombe and Jensen 1996). Excessive sediment may smother invertebrates, reducing fish food production and availability. Excessive fine sediment buries gravel, cobble, and coarse sand substrates. Loach minnow and their eggs are particularly vulnerable to substrate sedimentation that reduces available habitat and smothers eggs (Propst *et al*. 1988).

Sedimentation from tributary canyons and streams leading to the EFBR and WFBR contributes to the condition of the river downstream. The riparian vegetation and streambank condition in tributaries, including intermittent and ephemeral channels, form important buffers between upland impacts and the mainstream or perennial stream. A healthy riparian zone with substantial herbaceous cover is a very effective buffer for filtering sediment and pollutants before they can reach the stream (Erman *et al.* 1977, Mahoney and Erman 1981, Lowrance *et al.* 1984, Bisson *et al.* 1992, Osborne and Kovacic 1993). The riparian vegetation also serves to reduce streambank erosion (Thomas *et al.* 1979, Heede 1985, Stromberg 1993).

The short lifespan of the loach minnow, coupled with the comparatively low fecundity of the species and small population in the EFBR, makes it vulnerable to serious adverse effects from activities which may only impact the species and its habitat for relatively short time periods, especially during the spawning season. Any situation that eliminated or greatly reduced a year-class would severely deplete recruitment to a population. For example, excessive sedimentation during the spawning season might suffocate a large portion of that year's reproductive effort. In the succeeding year, total reproductive effort would be diminished. The net effect would be a major reduction in population size.

Loach minnow are likely to continue to be adversely affected by activities which contribute to altering the flow regime (water quality, quantity, intensity, and duration), degrading the stream channel, and modifying the floodplain and riparian vegetation structure and diversity within the action area. These impacts will occur at all levels of cattle presence, regardless of season, but are likely to increase as number of livestock and the length of time the cattle are present increases (Marlow and Pogacnik 1985). The way in which the effects of livestock grazing is manifested and the magnitude of the effects in the watershed are dependent on local site conditions. Range condition, considered together with soil, watershed, and riparian condition, is assumed to be closely correlated with ecological condition and function. Watershed/ecological effects of grazing are generally expected to be more evident where stocking levels are high, soils are impaired, and /or rangelands are in fair, poor, or very poor condition.

Allotment-Specific Analysis of Effects

P.S. Allotment

The on-going management of this allotment authorizes 126 cows and calves from May 15 to October 15. The grazing system is a rest-rotation schedule whereby each pasture receives rest every other year. The on-going management will allow cattle access to approximately ten river miles of unoccupied loach minnow critical habitat.

Cattle have direct access to portions of loach minnow critical habitat in portions of Home Creek and the EFBR. As described in the Environmental Baseline neither stream reach is properly functioning. With the added perturbation of cattle directly trampling both stream reaches, neither stream will have the opportunity to recover to a fully functioning system. In addition, upland use by livestock on the allotment will contribute to poor stream recovery.

Although no loach minnow are present within the action area of this project on the P.S.

Allotment, critical habitat will be adversely affected. The Service believes that the proposed action is likely to adversely affect critical habitat, both directly and indirectly, by degrading bank conditions through trampling and removal of vegetation, increasing soil compaction and thereby decreasing infiltration at the stream and within the uplands, decreasing the ability of the stream system to handle high energy flows by removing essential vegetation, and increasing the instability of the river system. Critical habitat is essential to the recovery of the species. Future recovery of the species could be hindered by modifying or destroying critical habitat and special consideration should be given to these areas. However, the impacts caused by this action on the critical habitat will not affect individuals of the species due to this area being unoccupied. In addition, the Forest has implemented monitoring to ensure proper grazing in order to reduce adverse grazing effects to stream conditions.

Hayground Allotment

As currently managed, the existing term grazing permit for the Hayground Allotment authorizes 200 cow/calf and 6 horses from May 16 to October 31. Unoccupied critical habitat also occurs downstream of the allotment within the WFBR for approximately 4.5 miles.

Due to the topography and distribution of water on this allotment, the movement of livestock occurs primarily within the riparian corridors, according to the Hayground addendum. Livestock concentrations and use within riparian areas will reduce vegetative cover and sediment filtering capabilities. Livestock trampling and hoof action/shear results in reduced ground cover and water infiltration rates, and results in the physical alteration and destabilization of stream banks and channel morphology. As discussed in the Hayground addendum, areas of the aquatic and riparian habitats within this allotment are highly degraded from a combination of past and ongoing management activities and use by wild ungulates and other wildlife species. Natural geologic processes provide little or no buffering or filtering capability before entering the WFBR and the NFEFBR.

Livestock grazing on this allotment will continue to alter the flow regime (water quality, quantity, timing, and duration) through continued alterations in hydrologic functions and processes. The resulting erosion and sedimentation into the WFBR and its tributaries and NFEFBR will be detrimental to loach minnow critical habitat. Increased sedimentation in the interstitial spaces of loach minnow habitat is detrimental to loach minnow reproduction and will impact and alter the quantity and composition of their invertebrate food base. Several of the critical habitat constituent elements necessary for the loach minnow will be adversely affected, such as low amount of fine sediment and substrate embeddedness, an abundant aquatic insect food base, and spawning areas with uncemented cobble substrate.

Similarly to the effects analysis on the P.S. Allotment, the Hayground Allotment contains unoccupied critical habitat for loach minnow. Critical habitat constituent elements will be adversely affected by the action, but individual loach minnow are not expected to be directly affected by these actions.

Udall Allotment

The proposed action is to issue a ten-year term grazing permit beginning in 2002 to graze 334 cows and calves from July 1 to October 31 on the Udall Allotment. The proposed grazing

system will be a four pasture rotational deferred system. According to the Udall EA the NFEFBR fencing surrounding loach minnow critical habitat will be completed prior to cattle entering Elk Pasture in 2001. This relieves the direct effects to loach minnow critical habitat in this allotment. However, livestock grazing upstream of the habitat will have adverse effects on the downstream habitat. Critical habitat occurs downstream of the allotment within the NFEFBR and EFBR for approximately 11 miles. The Three Forks area is located three miles downstream of the Udall Allotment and is occupied by loach minnow. Livestock grazing activities in the uplands can contribute to changes in surface runoff quantity and intensity, sediment transport, soil chemistry, and infiltration and water holding capabilities of the watershed; flood flows may increase in volume while decreasing in duration, and low flows may decrease in volume and increase in duration (Brown *et al.* 1974, Fifford and Hawkins 1978, Johnson 1992). The OD pasture is directly upstream of loach minnow critical habitat on the NFEFBR. The one mile of riparian area that livestock would graze is rated as Functional at Risk, in OD pasture. As discussed above, the effects of grazing in the uplands will result in increased erosion and sediment input into streams which will adversely affect prey availability and spawning sites for loach minnow downstream. However, the reduction in livestock numbers expected to occur between the years 2003 and 2005 will alleviate some of the grazing pressures in the uplands. However, grazing pressure is expected to occur before all the fencing is completed and the reductions in livestock is achieved.

Livestock grazing on this allotment will continue to impact water quality, timing, and duration through continued alterations in hydrologic functions and processes. The resulting erosion and sedimentation into the tributaries and NFEFBR and its and EFBR will be detrimental to loach minnow critical habitat. Increased sedimentation in the interstitial spaces of loach minnow habitat is detrimental to loach minnow reproduction by causing a decrease in suitable sites/surfaces for egg deposition and a decrease in successful hatching due to smothering of deposited eggs. In addition, the increased sedimentation will impact and alter the quantity and composition of their invertebrate food base.

The management plan for the Udall Allotment calls for fencing and road closures that will enhance the ground conditions of the allotment. Approximately nine miles of poorly located roads are scheduled for closure which will decrease the miles of road per square mile in the allotment area. Four riparian areas are scheduled to be fenced. Construction timing and vehicle use restrictions are required to reduce short-term adverse effects associated with fencing and road closure projects. This will be an overall net benefit to the area due to the decreased access and improved riparian habitat.

Effects of the Action to Mexican Spotted Owl

Allotment-Specific Analysis of Effects

P.S. Allotment

The effects to Mexican spotted owl are not being analyzed on this allotment.

Hayground Allotment

The effects to Mexican spotted owl are not being analyzed on this allotment.

Udall Allotment

Approximately 60% of all suitable habitat on the Udall Allotment was surveyed for MSOs in 1989-90. Since that time, only informal surveys have occurred. A PAC was established in 1989 that encompasses 426 acres within the Timber Pasture on the Udall Allotment. Additionally, there is restricted habitat located on the allotment. The Recovery Plan (USDI 1995) notes that restricted habitat provisions were made because it is recognized that owls may occur in areas other than protected habitat. Guidelines for riparian habitat, which falls within the restricted category, were developed to maintain healthy riparian ecosystems where they exist and to initiate restoration measures to return degraded areas to healthy conditions.

The Forest Service plans to fence several riparian and meadow areas on the Udall Allotment from livestock use in the next three years. The Service believes this will assist in allowing these areas to maintain more ground cover for MSO prey, particularly in the late summer and fall when the livestock have traditionally used these areas. Even with proposed fencing, some adverse effects to MSO on the allotment are still likely, due to the current condition resulting from past overuse, as well as from the use by ungulates in both the past and the future. Proposed utilization monitoring (USFS 2001d) will be useful for determining cattle movement from pastures, but may allow for overutilization since it is only required to check utilization levels at the end of the grazing period. According to the Udall EA, a mid-point utilization check may be conducted if resources permit (USFS 2001d). A mid-point check would allow for monitoring to anticipate future changes that may need to be made on the allotment and would prevent overutilization and protection of MSO prey.

The proposed action on the Udall Allotment represents a reduction in many areas of grazing management for this allotment with respect to past use. The permitted livestock numbers is reduced from 618 cow/calf to 334 cow/calf over the next three years. The proposed action involves a reduction in permitted livestock numbers, a shortened grazing season, and reduced forage consumption. The season of use has been reduced by 1 month, and a deferred rotation system is proposed, both of which will provide much needed periods of rest for pastures. In summary, the Service believes that the Forest is taking many measures to ensure the success of MSOs on the Udall Allotment but the time needed for the allotment to recover is still of concern. The reproductive success of MSO associated with the PAC located on the Udall Allotment may be negatively affected due to the high utilization by ungulates of springs and meadows within this allotment. Range condition information for this allotment indicate “fair and “poor conditions. The 25% allowable use is reasonable and may help alleviate some of the watershed and soil problems associated with the Timber Pasture. The Service believes that while the Forest is taking several measures to alleviate these problems, prey species for the owl may still be negatively impacted by livestock grazing in these areas.

Grazing by livestock can alter the vegetation community. Canyon bottoms and meadows are often preferred foraging sites by both livestock and wildlife, and grazing contributes significantly to degradation of these habitats. Many of these effects are occurring to some degree on the Udall

Allotment due to ongoing livestock grazing activities within protected and restricted MSO habitat. Many of these effects are evident through the degraded status of range; other effects are more subtle. Degraded riparian conditions within the allotment are the result of past and ongoing management actions that have resulted in reduced ground cover and other vegetative and physical alterations of upland and riparian conditions. (USFS 2001d). The proposed grazing management will alleviate many of these grazing pressures that could have negative influences on the prey source of the MSO if not corrected.

To minimize these impacts, the Recovery Plan (USDI 1995) recommends that grazing by livestock and wildlife be monitored in key areas, including riparian areas, meadows, and oak types. The Recovery Plan (USFWS 1995) further recommends implementing and enforcing grazing utilization standards that would attain good to excellent range conditions within the key grazing areas. Strategies to accomplish this may include reductions in grazing levels and increased numbers of exclosures, complete rest, as required, limited winter use, or other methods. The Forest is implementing several of these measure on the Udall Allotment.

Effects of the Action on Chiricahua leopard frog

Allotment-Specific Analysis of Effects

P.S. Allotment

There are a total of 23 miles of perennial flow and 45 miles of intermittent flow within the P.S. Allotment. Livestock have direct access to Horse Springs. No formal surveys for Chiricahua leopard frogs have been conducted on the P.S. Allotment although it is highly probable that the allotment contains Chiricahua leopard frogs. The nearest known occupied site of Chiricahua leopard frogs occurs at Three Forks, approximately 6 miles upstream of the allotment along the EFBR. Numerous stock ponds are found between the allotment and the Three Forks area which could potentially be Chiricahua leopard frog habitat. Due to the high probability of frogs existing on the allotment and the negative effects that cattle can potentially have on the frogs, there is a possibility of adverse effects to Chiricahua leopard frogs if range conditions deteriorate.

Adverse effects to the Chiricahua leopard frog and its habitat as a result of grazing on this allotment may occur under certain circumstances. These effects include facilitating dispersal of nonnative predators; trampling of egg masses, tadpoles, and frogs; deterioration of watersheds; erosion and/or siltation of stream courses; elimination of undercut banks that provide cover for frogs; loss of wetland and riparian vegetation and backwater pools; and spread of disease (USFWS 2000, Belsky *et al.* 1999, Ohmart 1995, Hendrickson and Minckley 1984, Arizona State University 1979, Jancovich *et al.* 1997). Creation of livestock waters in areas without aquatic habitats may provide the means for nonnative predators, such as bullfrogs and crayfish, to move across arid landscapes that would otherwise serve as a barrier to their movement. Increased erosion in the watershed caused by grazing can accelerate sedimentation of deep pools used by frogs (Gunderson 1968). Sediment can alter primary productivity and fill interstitial spaces in streambed materials with fine particulates that impede water flow, reduce oxygen levels, and restrict waste removal (Chapman 1988). Eggs, tadpoles, and metamorphosing Chiricahua leopard frogs are probably trampled by cattle on the perimeter of stock tanks and in

pools along streams (USFWS 2000). Juvenile and adult frogs can probably avoid trampling when they are active. However, leopard frogs are known to hibernate on the bottom of ponds (Harding 1997), where they may be subject to trampling during the winter months. Cattle can remove bankline vegetation cover that provides escape cover for frogs and a source of insect prey. However, dense shoreline or emergent vegetation in the absence of grazing may favor some predators, such as garter snakes (*Thamnophis* sp.), and the frogs may benefit from some open ground for basking and foraging.

Generally, the Forest proposes a forage and browse utilization of no more than 45% by weight in riparian areas, and a forage and browse utilization of no more than 40% by weight on upland sites for the P.S. Allotment. The Forest proposes a 45% utilization on areas characterized by good range condition, 40% on areas characterized by fair range condition, and 30% on riparian areas and those areas with poor range condition on the P.S. Allotment. These utilization levels were established despite riparian conditions are being considered unsatisfactory on the P.S. Allotment. Many of the meadows and foodplain benches have greater than 50% exposed soil surface area. In addition, woody riparian species were, and will continue to be, negatively affected by browsing and trampling. Furthermore, because riparian areas are the major source of water on this allotment, livestock spend a disproportionate amount of time in these areas.

In addition to the mechanical damage (trampling) associated with livestock grazing in riparian areas, livestock trampling along drainages and in the upper watershed may generate sediments and/or nutrients that could enter potentially occupied leopard frog habitat along the drainages listed above. Such drainages are also near enough to occupied sites (Three Forks), that they may serve as a movement corridor to other suitable habitats. Sediments and/or nutrients may impact this species in the following ways: (1) sediments and/or nutrients may influence the invertebrate food base in some undefined manner by impacting the physical and vegetative characteristics of the aquatic habitat; and (2) sediments may be detrimental to successful reproduction by smothering egg masses and early larval stages. As discussed in the environmental baseline of this document, overgrazing contributes to reducing the quality and quantity of riparian and wetland habitats through deterioration of watersheds, erosion and/or siltation of stream courses, elimination of undercut banks that provide cover for frogs, and loss of wetland and riparian vegetation and backwater pools. In addition, eggs and tadpoles of Chiricahua leopard frogs may be trampled by domestic livestock along the perimeters of stock tanks and in pools along streams. Cattle also contribute to degraded water quality at stock tanks, including elevated hydrogen sulfide concentrations, which are toxic to frogs (Sredl *et. al* 1997).

Hayground Allotment

The effects to Chiricahua leopard frog are not being analyzed on this allotment.

Udall Allotment

The effects to Chiricahua leopard frog are not being analyzed on this allotment.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are

reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

There are 106,584 acres within the Upper Black watershed as reported in the P.S. addendum. Fort Apache Reservation contains 310 acres within this watershed. Grazing, timber harvest, road maintenance, and prescribed burning are significant activities that are occurring within the reservation. There is also private land distributed across the Black River watershed which is used in a variety of ways. For example, the private land located on the Udall Allotment is grazed by livestock in conjunction with the Udall Allotment, and is described as being in a highly degraded condition (USFS 2001d).

CONCLUSION

Loach Minnow

After reviewing the current status of the loach minnow, the environmental baseline for the action area, the effects of the proposed reauthorization and on-going livestock grazing on the P.S., Hayground, and Udall Allotments, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the loach minnow, and is not likely to result in the destruction or adverse modification of critical habitat. We make these findings for the following reasons:

1. There have been recent efforts by the National Forest to ameliorate some of the erosion and sedimentation problems aggravated by ongoing livestock grazing activities of allotments within the watershed. For example on the Udall Allotment, the Forest has identified proper utilization standards, duration of use, and number of cattle proposed for this grazing action.

2. Loach minnow are not known to be common in this area. Therefore, the effects of the proposed action on the species will be reduced.

Mexican Spotted Owl

After reviewing the current status of the MSO, the environmental baseline for the action area, the effects of the proposed reauthorization of livestock grazing on the Udall Allotment, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the MSO. Critical habitat for this species has been designated; however, this action does not affect any areas of critical habitat and no destruction or adverse modification of that critical habitat is anticipated. We make these findings for the following reasons:

1. No incidental take of MSOs is expected to occur due to the proposed action.

2. The Forest is implementing several measures consistent with the MSO recovery plan to ensure adequate prey base for MSO on the allotment and recovery of habitat.

Chiricahua Leopard Frog

After reviewing the current status of the Chiricahua leopard frog, the environmental baseline for the action area, and the anticipated effects of proposed livestock grazing activities on the P.S. Allotment and the cumulative effects, it is the Service's conference opinion that the proposed action is not likely to jeopardize the continued existence of the Chiricahua leopard frog. No critical habitat has been proposed, thus none would be affected. We make these findings for the following reasons:

1. The Chiricahua leopard frog occurs over a large area of eastern Arizona, western New Mexico and portions of northwestern Mexico. The proposed action affects a very small portion of the species' range.

2. Chiricahua leopard frogs can coexist with well-managed livestock grazing.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the Forest so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the [agency or applicant] must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take Anticipated

P.S. Allotment

Loach minnow

The P.S. Allotment contains critical habitat that could potentially support loach minnow populations. Loach minnow are known to occur upstream of this allotment and, for this reason, the Service believes that potential use of this area in the future is possible. However, the proposed action area has been surveyed, and no loach minnow have been located. Therefore, the Service anticipates that no take of individual loach minnow will result from the proposed action.

Hayground Allotment

Loach minnow

The allotment contains critical habitat that could potentially support loach minnow populations. Loach minnow are known to occur upstream of this allotment and, for this reason, the Service believes that potential use of this area in the future is possible. However, the proposed action area has been surveyed, and no loach minnow have been located. Therefore, the Service anticipates that no take of individual loach minnow will result from the proposed action.

Udall Allotment

Loach minnow

As stated above, loach minnow are known to have historically occupied portions of the Black River running through the Udall Allotment and the allotment contains approximately 1.5 miles of loach minnow critical habitat. However, no loach minnow have been located on the allotment, and grazing has been removed from stream reaches classified as critical habitat for the loach minnow. Therefore, the Service anticipates that no take of individual loach minnow will result from the proposed action.

Mexican Spotted Owl

Although the Udall Allotment contains a MSO PAC, the proposed action is adhering to the grazing recommendations of the recovery plan. We do not anticipate incidental take related to the proposed action.

P.S. Allotment

Chiricahua Leopard Frog

The prohibitions against taking the species found in section 9 of the Act do not apply until the species is listed. However, the Service advises the Forest Service to consider implementing the following reasonable and prudent measures. If this conference opinion is adopted as a biological opinion following a listing or designation, these measures, with their implementing terms and conditions, will be nondiscretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to the permittee, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the

activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions or (2) fails to require the permittee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest Service or permittee must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

P.S. Allotment

Chiricahua leopard frog

Although the occurrence of Chiricahua leopard frogs in the project area is certain, the abundance of frogs in the Three Forks complex is uncertain. Also, because the status of the species could change over time through immigration, emigration, and loss or creation of habitats, the precise level of take resulting from this action cannot be quantified. We anticipate take could occur in the following fashion:

1. Mortality of all frogs at any given livestock tank due to maintenance activities.

2. Trampling and destruction of egg masses, small tadpoles, and metamorphs.

3. Mortality of recently metamorphosed frogs at one locality (livestock tanks, streams, or springs) due to unintentional introduction of chytridiomycosis resulting from cattle moving among frog populations or unintentional transport of water or mud among aquatic sites by ranch hands.

4. Mortality and lost productivity due to sedimentation of pools, loss of bankline and emergent cover, and other forms of habitat degradation in sites where Chiricahua leopard frogs may occur.

The taking of Chiricahua leopard frogs is expected to result primarily from harm and/or harassment, which will result from effects that alter the suitability of the habitat for Chiricahua leopard frogs. The Service anticipates, however, that incidental take of Chiricahua leopard frogs associated with the proposed action will be difficult to quantify because: dead or impaired individuals are difficult to find and losses may be masked by seasonal fluctuations in environmental conditions. In cases where the extent of anticipated take cannot be quantified accurately in terms of number of individuals, the Service may anticipate take in terms of loss of a surrogate species, food, cover, or other essential habitat elements, such as water quality or quantity. Thus, incidental take will be exceeded if the following condition occurs:

1. If forage utilization standards are exceeded by ten percent on any successive three entries within a given pasture on the allotment, and applied rest does not demonstrate effective recovery of herbaceous forage plants.

2. If livestock grazing in the aquatic or riparian corridor results in a 10% decrease in woody cover, herbaceous cover or a significant (10%) alteration of streambanks (outside of natural conditions) on selected reaches as a direct result of this action. Standard Forest Service methodologies will be used to determine baseline conditions. Ecological conditions on the allotment will be assessed at years 1,3, 6, and 9, (as outlined in Term and Condition 4.1).

Reasonable and Prudent Measures

The prohibitions against taking Chiricahua leopard frog found in section 9 of the Act do not apply until the species is listed. However, the Service recommends that the agency implement the following reasonable and prudent measures and terms and conditions. If this conference opinion is adopted as a biological opinion following a listing or designation, these measures, with their implementing terms and conditions will be nondiscretionary.

1. The Forest shall continue to monitor the Chiricahua leopard frog and its habitat to document levels of take.

2. Measures shall be implemented to reduce trampling of egg masses, tadpoles, and metamorph frogs.

3. Personnel education programs and well-defined operational procedures shall be implemented.

4. Actions will be taken to improve ecological conditions (watershed, soil, range, riparian, and stream channel conditions) on allotments within this opinion.

Terms and Conditions – Chiricahua leopard frog P.S. Allotment

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary if the Chiricahua leopard frog is listed.

1. The following term and condition implements reasonable and prudent measure number one:

    1.1 During the first spring after a final listing of the species, the Forest shall, in coordination with the Service and Arizona Game and Fish Department, identify potential habitat within the P.S. Allotment and survey[1] those sites for the presence/abundance of Chiricahua leopard frogs. Where frogs are found, the Forest shall work with the Service to evaluate effects of the action on the frog and its habitat, and shall develop a plan with the Service within 90 days to minimize the effects of the action on the frog. The plan shall be approved by the Service.

2. The following term and condition implements reasonable and prudent measure number two:

    2.1 Where new leopard frogs are found within the P.S. Allotment, the Forest shall inform the Service within 10 calendar days and shall work with the Service to develop plans

within 90 days for minimizing take of leopard frogs at those sites. The plan shall be approved by the Service.

3. The following terms and conditions implement reasonable and prudent measure number three:

   3.1 Live fish, crayfish, bullfrogs, leopard frogs, salamanders, or other aquatic organisms shall not be moved among livestock tanks or other aquatic sites.

   3.2 Where new or existing sites occupied by Chiricahua leopard frogs exist, water shall not be hauled to the site from another aquatic site or tank that supports leopard frogs, bullfrogs, crayfish, or fish.

   3.3 Where new or existing sites occupied by Chiricahua leopard frogs exist on the P.S. Allotment, the permittee shall be required to clean any equipment, boots, etc. used at an aquatic site and treat with a 10 percent bleach solution, or allow such equipment, boots, etc. to dry thoroughly, before using the same equipment, boots, etc. at another aquatic site on the allotment.

   3.4 All ranch hands, construction personnel, and others implementing the proposed action shall be given a copy of these terms and conditions, and informed of the need to comply with them.

   3.5 At least 20 days prior to maintaining or cleaning out livestock tanks, the permittee shall inform the Forest of planned activities. The Forest shall survey the tank for Chiricahua leopard frogs[1] and if frogs are found, shall work with the Service to develop and implement a plan to minimize take of frogs. Measures to minimize take should include salvage and temporary holding of frogs, limiting disturbance and work areas to the minimum area practicable, leaving stands of emergent vegetation in place, and/or measures to minimize that likelihood of disease transmission. Plans to minimize take shall be approved by the Service.

4. The following terms and conditions implement reasonable and prudent measure number four:

   4.1 Monitoring will take place at year 1 to establish baseline conditions, and subsequently every 3 years (beginning in 2002) in select drainages in the allotment. Data collected for monitoring must adhere to the following guidelines at a minimum: 1) a journey-level fish biologist must design, review, and approve the data collection, 2) monitoring

[1]Surveys shall include a night visit to prospective habitat during which all or at least 1,200 feet of the best habitat along creeks and the entire perimeter of tanks are searched for frogs. Surveys shall be carried out with flashlights/headlamps, and a dip net shall be used to sample for tadpoles and frogs concealed in undercut banks or at the base of emergent vegetation. Surveyors shall also listen for the distinctive call of the Chiricahua leopard frog (Davidson 1996) and watch for egg masses. Surveys shall be carried out from April-September when frogs are most active.

must be standardized so that the same variables are measured for each of the three years, 3) monitoring must include riparian transects located at heavily-used areas on several, lower-end portions of all pertinent drainages, and 4) data on embeddedness and water temperature (using a data-logger type device) will be collected, and photopoints will be taken at the riparian transect locations. Other measurements might include: vegetative litter; plant vigor and species diversity; bank, terrace, and floodplain morphology; channel profile; base flow; and other riparian and aquatic habitat measures. If monitoring does not show improvement of unsatisfactory conditions or maintenance of existing satisfactory conditions during the period covered by this consultation, evaluate the grazing management and identify and implement changes as appropriate. Ensure that the language in the term grazing permit allows for this type of adaptive management. After every monitoring event, the Forest shall submit a report to the Arizona Ecological Services Field Office within 90 days of monitoring completion.

Disposition of Dead or Injured Listed Animals

Upon finding a dead or injured threatened or endangered animal, initial notification must be made to the Service's Division of Law Enforcement, Federal Building, Room 8, 26 North McDonald, Mesa, Arizona (480/835-8289) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible condition.

CONSERVATION RECOMMENDATIONS

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

MSO

1. Develop and initiate studies to gain a comprehensive understanding of how grazing affects the habitat of the MSO and its prey species.

2. Conduct surveys, according to established protocols, to determine the occupancy status of the restricted habitat within the allotment, and on other areas within the Forest that contain similar habitat to determine whether or not MSOs are present.

Loach minnow

1. Implement a basin-wide program for monitoring of loach minnow and its accompanying native fish community. Descriptive linear habitat mapping should be conducted along all occupied, suitable, or potential habitat to identify suitability or capability for loach minnow and other components of the native fish community. Surveys and monitoring should be

conducted by journey-level fish biologists with expertise in southwestern fishes and desert stream habitats. The monitoring program should be coordinated with any existing monitoring or surveying efforts to avoid over sampling. Monitoring protocols and habitat suitability criteria should be agreed upon with the New Mexico and Arizona Game and Fish Department and the Service to ensure consistency and validity, and to avoid redundancy of effort.

2. Remove cattle from directly trampling loach minnow critical habitat in the P.S. Allotments through pasture closure or fencing of riparian areas.

Chiricahua leopard frog

1. If listed, assist the Service in development and implementation of a recovery plan for the species.

2. Work with the Service and the Arizona Game and Fish Department to reintroduce the Chiricahua leopard frog to suitable habitats.

3. Work with the Service and the Arizona Game and Fish Department to begin an aggressive program to control nonnative aquatic organisms on the Forest, particularly bullfrogs, fish, and crayfish.

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

CONFERENCE CONCLUSION

This concludes formal conference for the Chiricahua leopard frog. You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

After listing as threatened or endangered and any subsequent adoption of this conference opinion, the Federal agency shall request reinitiation of consultation if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued

through formal consultation. At that time, the project will be reviewed to determine whether any take of the proposed species has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the proposed species may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation. Although not required, we recommend that the Federal agency implement the reasonable and prudent measures and terms and conditions herein prior to our final listing decision. If the species is subsequently listed, implementation of reasonable prudent measures and terms and conditions in any conference opinion adopted as a biological opinion, is mandatory.

REINITIATION NOTICE

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

The Service appreciates your consideration of threatened and endangered species in allotment management development. For further information, please contact Jennifer Graves (x239) or Debra Bills (x232) . Please refer to the following consultation numbers: (1) 2-21-01-F-305 for the P.S. Allotment, (2) 2-21-90-F-120 for the Hayground Allotment, and (3) 2-21-01-F-313 for the Udall Allotment in future correspondence concerning these projects.

Sincerely,

/s/ David L. Harlow
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
District Ranger, Alpine Ranger District, Apache-Sitgreaves National Forest
District Ranger, Springerville Ranger District, Apache-Sitgreaves National Forest
Project Leader, Fisheries Resources Office, Pinetop, AZ

Regional Supervisor, Arizona Game and Fish Department, Phoenix, AZ
Dick Udall, Applicant, Flying Box Ranch Inc., Eager, AZ

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LITERATURE CITED

Abarca, F.J. 1987. Seasonal and diet patterns of feeding in loach minnow (Tiaroga cobitis Girard). Proceedings of the Desert Fishes Council 20:20.

Arizona State University. 1979. Resource inventory for the Gila River complex, Eastern Arizona. Report to the Bureau of Land Management, Safford District. Contract No. YA-512-CT6-216.

Armour, C.L., D.A. Duff, and W. Elmore. 1991. The effects of livestock grazing on riparian and stream ecosystems. Fisheries 16(1):7-11.

Bagley, B. 1997. Black River fish surveys, 1996-97. Arizona State University, Center for Environmental Studies. Tempe, AZ.

Bagley, B.E., G.W. Knowles, and T.C. Inman. 1995. Fisheries surveys of the Apache-Sitgreaves National Forests, trip reports 1-9. May 1994 to September 1995. Arizona State University, Tempe, Arizona. 50 pp.

Bagley, B.E., G.H. Schiffmiller, P.A. Sowka, and P.C. Marsh. 1996. A new locality for loach minnow, Tiaroga cobitis. Proceedings of the Desert Fishes Council 28:8.

Bahre, C.J. 1991. A legacy of change. Historic human impact on vegetation in the Arizona borderlands. University of Arizona Press, Tucson, Arizona.

Barber, W.E. and W.L. Minckley. 1966. Fishes of Aravaipa Creek, Graham and Pinal Counties, Arizona. The Southwestern Naturalist 11(3):313-324.

Barrowclough, G.F. and R.J. Gutierrez. 1990. Genetic variation and differentiation in the spotted owl (*Strix occidentalis*). Auk 107:737-744.

Belsky, A.J. and D.M. Blumenthal. 1997. Effects of livestock grazing on stand dynamics and soils in upland forests of the interior west. Conservation Biology 11(2):315-327. Barrowclough, G.F. and R.J. Gutierrez. 1990. Genetic variation and differentiation in the spotted owl (*Strix occidentalis*). Auk 107:737-744.

Belsky, A.J., A. Matzke, and S. Usselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. Journal of Soil and Water Conservation First Quarter 1999:419-431.

Berger L., R. Speare, P. Daszak, D.E. Green, A.A. Cunningham, C.L. Goggins, R. Slocombe, M.A. Ragan, A.D. Hyatt, K.R. McDonald, H.B. Hines, K.R. Lips, G. Marantelli, and H. Parkes. 1998. Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. Proceedings of the National Academy of Science, USA 95:9031-9036.

Bowers, J.E., and S.P. McLaughlin. 1994. Flora of the Huachuca Mountains. Pages 135-143 *in*

L.F. DeBano *et al.* (Tech. Coord.), Biodiversity and management of the Madrean Archipelago: the sky islands of the Southwestern United States and Northwestern Mexico. USDA Forest Service General Technical Report RM-GTR-264.

Britt, K.D. 1982. The reproductive biology and aspects of the life history of Tiaroga cobitis in southwestern New Mexico. New Mexico State University, Las Cruces. 56 pp.

Brown, H.E., M.B. Baker, Jr., J.J. Rogers, W.P. Clary, J.L. Kovner, F.R. Larson, C.C. Avery, and R.E. Campbell. 1974. Opportunities for increasing water yields and other multiple use values on ponderosa pine forest lands. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, Research Paper RM-129, Ft. Collins, Colorado. 36 pp.

Campbell, J.A. 1998. Amphibians and Reptiles of northern Guatemala, the Yucatan, and Belize. University of Oklahoma Press, Norman, Oklahoma.

Chaney, E., W. Elmore, and W.S. Platts. 1990. Livestock grazing on western riparian areas. Produced for the U.S. Environmental Protection Agency by the Northwest Resource Information Center, Eagle, Idaho. 45 pp.

Clarkson, R.W., and J.C. Rorabaugh. 1989. Status of leopard frogs (*Rana pipiens* Complex) in Arizona and southeastern California. Southwestern Naturalist 34(4):531-538.

Danzer, S.R., C.H. Baisan, and T.W. Swetnam. 1997. The influence of fire and land-use history on stand dynamics in the Huachuca Mountains of southeastern Arizona. Appendix D in Robinett, D., R.A. Abolt, and R. Anderson, Fort Huachuca Fire Management Plan. Report to Fort Huachuca, AZ.

Daszak, P. 2000. Frog decline and epidemic disease. International Society for Infectious Diseases. Http://www.promedmail.org.

Davidson, C. 1996. Frog and toad calls of the Rocky Mountains. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, NY.

Davidson, D., Pessier, A.P., J.E. Longcore, M. Parris, J. Jancovich, J. Brunner, D. Schock, and J.P. Collins. 2000. Chytridiomycosis in Arizona (USA) tiger salamanders. Page 23 *in* Conference and Workshop Compendium: Getting the Jump! On amphibian diseas. Cairns, Australia, August 2000.

DeBano, L.F., and D.G. Neary. 1996. Effects of fire on riparian systems. Pages 69-76 *in* P.F. Ffolliott, L.F. DeBano, M.B. Baker, G.J. Gottfried, G. Solis-Garza, C.B. Edminster, D.G Neary, L.S. Allen, and R.H Hamre (tech. coords.). Effects of fire on Madrean province ecosystems, a symposium proceedings. USDA Forest Service, General Technical Report RM-GTR-289.

Declining Amphibian Populations Task Force. 1993. Post-metamorphic death syndrome. Froglog 7:1-2.

Degenhardt, W.G., C.W. Painter, and A.H. Price. 1996. Amphibians and reptiles of New Mexico. University of New Mexico Press, Albuquerque.

Dobyns, H.F. 1981. From fire to flood: historic human destruction of Sonoran Desert riverine oasis. Ballena Press Anthropological Papers No. 22, 222 pp.

Dole, J.W. 1972. Evidence of celestial orientation in newly-metamorphosed *Rana pipiens*. Herpetologica 28:273-276.

Dole, J.W. 1971. Dispersal of recently metamorphosed leopard frogs, *Rana pipiens*. Copeia 1971:221-228.

Dole, J.W. 1968. Homing in leopard frogs, *Rana pipiens*. Ecology 49:386-399.

Dunne, J. 1995. Simas Valley lowland aquatic habitat protection: Report on the expansion of red-legged frogs in Simas Valley, 1992-1995. East Bay Municipal District Report, Orinda, California.

Fernandez, P.J., and J.T. Bagnara. 1995. Recent changes in leopard frog distribution in the White Mountains of east central Arizona. Page 4 in abstracts of the First Annual Meeting of the Southwestern Working Group of the Declining Amphibian Populations Task Force, Phoenix, AZ.

Fernandez, P.J. and P.C. Rosen. 1996. Effects of an introduced crayfish (*Orconectes virilis*) on the stream habitat of the Chiricahua leopard frog (*Rana chiricahuensis*) at Three Forks, White Mountains, Arizona. Final report to Arizona Game and Fish Heritage Program.

Fernandez, P.J. and P.C. Rosen. 1998. Effects of introduced crayfish on the Chiricahua leopard frog and its stream habitat in the White Mountains, Arizona. Page 5 *in* abstracts of the Fourth Annual Meeting of the Declining Amphibian Populations Task Force, Phoenix,

Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. Conservation Biology 8(3):629-644.

Fletcher, K. 1990. Habitat used, abundance, and distribution of the Mexican spotted owl, *Strix occidentalis lucida*, on National Forest System Lands. U.S. Forest Service, Southwestern Region, Albuquerque, New Mexico. 78 pp.

Fletcher, K. and H. Hollis. 1994. Habitat used, abundance, and distribution of the Mexican spotted owl, *Strix occidentalis lucida*, on National Forest System Lands. U.S. Forest Service, Southwestern Region, Albuquerque, New Mexico. 78 pp.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Ganey, J.L. 1988. Distribution and habitat ecology of Mexican spotted owls in Arizona. MS

Thesis. Northern Arizona University, Flagstaff, Arizona.

Ganey, J.L. and R.P. Balda. 1989. Distribution of habitat use of Mexican spotted owls in Arizona. Condor 91:355-361.

Ganey, J.L. and R.P. Balda. 1994. Habitat selection by Mexican spotted owls in Northern Arizona. The Auk 111(1):162-169.

Ganey, J.L., W.M. Block, J.K. Dwyer, B.E. Strohmeyer, and J.S. Jenness. 1998. Dispersal, movements, and survival rates of juvenile Mexican spotted owls in Northern Arizona. Wilson Bulletin 110(2):206-217.

Gifford, G.F. and R.H. Hawkins. 1978. Hydrologic impact of grazing on infiltration: a critical review. Water Resources Research 14(2):305-313.

Hale, S.F., and J.L. Jarchow. 1988. The status of the Tarahumara frog (*Rana tarahumarae*) in the United States and Mexico: part II. Report to the Arizona Game and Fish Department, Phoenix, Arizona, and the Office of Endangered Species, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Hale, S.F., and C.J. May. 1983. Status report for *Rana tarahumarae* Boulenger. Arizona Natural Heritage Program, Tucson. Report to Office of Endangered Species, US Fish and Wildlife Service, Albuquerque, NM.

Halliday, T.R. 1998. A declining amphibian conundrum. Nature 394:418-419.

Harper, K.T. and J.R. Marble. 1988. A role for nonvascular plants in management of arid and semiarid rangelands. Pp. 137-169 *In* Vegetation science applications for rangeland analysis and management. P.T. Tueller (ed.). Kluwer Academic Publishers, Boston, Massachusetts.

Hastings, J.R. and R.M. Turner. 1980. The changing mile. University of Arizona Press, Tucson, Arizona. 327 pp.

Hendrickson, D.A., and W.L. Minckley. 1984. Cienagas - vanishing climax communities of the American Southwest. Desert Plants 6(3):131-175.

Jancovich, J.K., E.W. Davidson, J.F. Morado, B.L. Jacobs, J.P. Collins. 1997. Isolation of a lethal virus from the endangered tiger salamander *Ambystoma tigrinum stebbinsi*. Diseases of Aquatic Organisms 31:161-167.

Jennings, R.D. 1995. Investigations of recently viable leopard frog populations in New Mexico: *Rana chiricahuensis* and *Rana yavapaiensis*. New Mexico Game and Fish Department, Santa Fe.

Jennings, R.D. 1987. The status of *Rana berlandieri*, the Rio Grande leopard frog, and *Rana yavapaiensis*, the lowland leopard frog, in New Mexico. Report to New Mexico Department

of Game and Fish, Santa Fe, New Mexico.

Johnson, K.L. 1992. Management for water quality on rangelands through best management practices: the Idaho approach. Pp. 415-441 *In* Watershed management; balancing sustainability and environmental change. R.J. Naiman (ed.). Springer-Verlag, New York, New York.

Kauffman, J.B. and W.C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications ... a review. Journal of Range Management 37 (5): 430-438.

Kinch, G. 1989. Riparian area management: grazing management in riparian areas. U.S. Bureau of Land Management, Denver, Colorado. 44 pp.

Leopold, A. 1924. Grass, brush, timber, and fire in southern Arizona. Journal of Forestry 22(6):1-10.

Leopold, A. 1951. Vegetation of southwestern watersheds in the nineteenth century. The Geographical Review 41:295-316.

Longcore, J.E. 2000. Information excerpted from Joyce Longcore. Biosafety chapter, workbook for Amphibian Health Examinations and Disease Monitoring Workshop, US Fish and Wildlife Service, National Conservation Training Center, Sherpherdstown, WV, Feb 17-18, 2000.

Longcore, J.E., A.P. Pessier, and D.K. Nichols. 1999. *Batracytrium dendrobatidis* gen. Et sp. Nov., a chytrid pathogenic to amphibians. Mycologia 91(2):219-227.

Marlow, C.B. and T.M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. Pages 279-284 in R.R. Johnson, C.D. Zeibell, D.R. Patton, P.F. Ffolliot, and R.H. Hamre (Technical Coordinators) Riparian ecosystems and their management: reconciling conflicting uses. GTR RM-120, USDA Forest Service, Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado. 523 pp.

Marrs, R.H., A. Rizand, and A.F. Harrison. 1989. The effects of removing sheep grazing on soil chemistry, above-ground nutrient distribution, and selected aspects of soil fertility in long-term experiments at Moor House National Nature Preserve. Journal of Applied Ecology 26:647-661.

Marsh, P.C., F.J. Abarca, M.E. Douglas, and W.L. Minckley. 1989. Spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis) relative to introduced red shiner (Cyprinella lutrensis). Arizona Game and Fish Department, Phoenix, Arizona. 116 pp.

Marsh, P.C., J.E. Brooks, D.A. Hendrickson, and W.L. Minckley. 1990. Fishes of Eagle Creek, Arizona, with records for threatened spikedace and loach minnow (Cyprinidae). Journal of the Arizona-Nevada Academy of Science 23(2):107-116.

Martin, S.C. 1975. Ecology and management of southwestern semidesert grass-shrub ranges. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, Research Paper RM-156, Ft. Collins, CO. 39 pp.

Meehan, W.R. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland. 751 pp.

Miller, D. 1998. Fishery survey report. Negrito Creek within the Gila National Forest, New Mexico. 29 and 30 June 1998. Gila National Forest, Silver City, New Mexico. July 14, 1998. 7 pp.

Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts, and Letters XLVI:365-404.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, Arizona. 293 pp.

Morell, V. 1999. Are pathogens felling frogs? Science 284:728-731.

Munger, J.C., M. Gerber, M. Carroll, K. Madrid, and C. Peterson. 1996. Status and habitat associations of the spotted frog *Rana pretiosa* in southwestern Idaho. Technical Bulletin No 96-1. Bureau of Land Management.

Ohmart, R.D. 1995. Ecological condition of the East Fork of the Gila River and selected tributaries: Gila National Forest, New Mexico. Pages 312-317 *in* D.W. Shaw and D.M. Finch (tech. coords.). Desired future conditions for Southwestern riparian ecosystems: bringing interests and concerns together. USDA Forest Service, General Technical Report RM-GTR-272.

Orodho, A.B., M.J. Trlica, and C.D. Bonham. 1990. Long-term heavy-grazing effects on soil and vegetation in the four corners region. The Southwestern Naturalist 35(1):9-15.

Osborne, L.L. and D.A. Kovacic. 1993. Riparian vegetated buffer strips in water-quality restoration and stream management. Freshwater Biology 29:243-258.

Painter, C.W. 2000. Status of listed and category herpetofauna. Report to US Fish and Wildlife Service, Albuquerque, NM. Completion report for E-31/1-5.

Platts, W.S. 1990. Managing Fisheries and Wildlife on Rangelands Grazed by Livestock. Nevada Department of Wildlife. December 1990.

Platz, J.E. 1993. *Rana subaquavocalis*, a remarkable new species of leopard frog (*Rana pipiens* Complex) from southeastern Arizona that calls under water. Journal of Herpetology 27(2):154-162.

Platz, J.E., and J.S. Mecham. 1984. *Rana chiricahuensis*. Catalogue of American Amphibians

and Reptiles 347.1.

Platz, J.E., and J.S. Mecham. 1979. *Rana chiricahuensis*, a new species of leopard frog (*Rana pipiens* Complex) from Arizona. Copeia 1979(3):383-390.

Pounds, J.A., and M.L. Crump. 1994. Amphibian declines and climate disturbance: the case of the golden toad and the harlequin frog. Conservation Biology 8(1)72-85.

Propst, D.L. and K.R. Bestgen. 1991. Habitat and biology of the loach minnow, Tiaroga cobitis, in New Mexico. Copeia 1991(1):29-38.

Propst, D.L., K.R. Bestgen, and C.W. Painter. 1988. Distribution, status, biology, and conservation of the loach minnow (Tiaroga cobitis) Girard in New Mexico. U.S. Fish and Wildlife Service Endangered Species Report 17, Albuquerque, NM. 75 pp.

Propst, D.L., P.C. Marsh, and W.L. Minckley. 1985. Arizona survey for spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis): Fort Apache and San Carlos Apache Indian Reservations and Eagle Creek, 1985. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 8pp. plus maps.

Rinne, J.N. 1988. Effects of livestock grazing exclosure on aquatic macroinvertebrates in a montane stream, New Mexico. Great Basin Naturalist 48:146-153.

Rinne, J.N. 1989. Physical habitat use by loach minnow, Tiaroga cobitis (Pisces: Cyprinidae), in southwestern desert streams. The Southwestern Naturalist 34(1):109-117.

Rinne, J.N. and W.L. Minckley. 1991. Native fishes of arid lands: a dwindling resource of the desert southwest. USFS Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-206, Ft. Collins, Colorado. 45 pp.

Rosen, P.C., C.R. Schwalbe, D.A. Parizek, P.A. Holm, and C.H. Lowe. 1994. Introduced aquatic vertebrates in the Chiricahua region: effects on declining native ranid frogs. Pages 251-261 *in* L.F. DeBano, G.J. Gottfried, R.H. Hamre, C.B. Edminster, P.F. Ffolliott, and A. Ortega-Rubio (tech. coords.), Biodiversity and management of the Madrean Archipelago. USDA Forest Service, General Technical Report RM-GTR-264.

Rosen, P.C., C.R. Schwalbe, and S.S. Sartorius. 1996. Decline of the Chiricahua leopard frog in Arizona mediated by introduced species. Report to Heritage program, Arizona Game and Fish Department, Phoenix, AZ. IIPAM Project No. I92052.

Rosen, P.C., and C.R. Schwalbe. 1998. Using managed waters for conservation of threatened frogs. Pages 180-202 *in* Proceedings of Symposium on Environmental, Economic, and Legal Issues Related to Rangeland Water Developments. November 13-15, 1997, Tempe, AZ.

Schlesinger, W.H., J.F. Reynolds, G.L. Cunningham, L.F. Huenneke, W.M. Jarrell, R.A. Virginia, and W.G. Whitford. 1990. Biological feedbacks in global desertification. Science 246: 1043-1048.

Schulz, T.T. and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. Journal of Range Management 43(4):295-299.

Schreiber, D.C. 1978. Feeding interrelationships of fishes of Aravaipa Creek, Arizona. Arizona State University, Tempe, Arizona. 312 pp.

Seamans, M.E. and R.J. Gutierrez. 1995. Breeding habitat of the Mexican spotted owl in the Tularosa Mountains, New Mexico. The Condor 97:944-952.

Seburn, C.N.L., D.C. Seburn, and C.A. Paszkowski. 1997. Northern leopard frog (*Rana pipiens*) dispersal in relation to habitat. Herpetological Conservation 1:64-72.

Silvey, W. and M.S. Thompson. 1978. The distribution of fishes in selected streams on the Apache-Sitgreaves National Forest. Completion Report to USDA Forest Service. Arizona Game and Fish Department, Phoenix, Arizona. 49 pp.

Sinsch, U. 1991. Mini-review: the orientation behaviour of amphibians. Herpetological Journal 1:541-544.

Skovlin, J.M. 1984. Impacts of grazing on wetlands and riparian habitat: a review of our knowledge. Pp. 1001-1103 *In* Developing strategies for rangeland management. National Research Council/National Academy of Sciences. Westview Press. Boulder, Colorado.

Snyder, J., T. Maret, and J.P. Collins. 1996. Exotic species and the distribution of native amphibians in the San Rafael Valley, AZ. Page 6 *in* abstracts of the Second Annual Meeting of the Southwestern United States Working Group of the Declining Amphibian Populations Task Force, Tucson, AZ.

Speare, R., and L. Berger. 2000. Global distribution of chytridiomycosis in amphibians. Http://www.jcu.edu.au/school/phtm/PHTM/frogs/chyglob.htm.11 November 2000.

Sredl, M.J., and D. Caldwell. 2000. Wintertime populations surveys - call for volunteers. Sonoran Herpetologist 13:1.

Sredl, M.J., and J.M. Howland. 1994. Conservation and management of madrean populations of the Chiricahua leopard frog, *Rana chiricahuensis*. Arizona Game and Fish Department, Nongame Branch, Phoenix, AZ.

Sredl, M.J., J.M. Howland, J.E. Wallace, and L.S. Saylor. 1997. Status and distribution of Arizona's native ranid frogs. Pages 45-101 *in* M.J. Sredl (ed). Ranid frog conservation and management. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Technical Report 121.

Sredl, M.J., and L.S. Saylor. 1998. Conservation and management zones and the role of earthern cattle tanks in conserving Arizona leopard frogs on large landscapes. Pages 211-225 *in*

Proceedings of Symposium on Environmental, Economic, and Legal Issues Related to Rangeland Water Developments. November 13-15, 1997, Tempe, AZ.

Stebbins, R.C. 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, MA.

Sublette, J.E., M.D. Hatch, and M. Sublette. 1990. The fishes of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 393 pp.

Swetnam, T.W., and C.H. Baisan. 1996. Fire histories of montane forests in the Madrean Borderlands. Pages 15-36 *in* P.F. Ffolliott *et al.* (Tech. Coord.), Effects of fire on Madrean Province ecosystems. USDA Forest Service, General Technical Report, RM-GTR-289.

Tibbets, C.A. 1992. Allozyme variation in populations of the spikedace Meda fulgida and the loach minnow Tiaroga cobitis. Proceedings of the Desert Fishes Council 24:37.

Tibbets, C.A. 1993. Patterns of genetic variation in three cyprinid fishes native to the American southwest. MS Thesis. Arizona State University, Tempe, Arizona. 127 pp.

U.S. Bureau of Land Management (USBLM). 1995. File report on fishery inventory of Oak Grove Canyon, Graham County, and Deer Creek, Pinal County. July 1995. U.S. Bureau of Land Management, Tucson, Arizona. 19 pp.

U.S. Fish and Wildlife Service (USFWS). 1986. Endangered and threatened wildlife and plants; determination of threatened status for the loach minnow. Federal Register 51(208):39468-39478. October 28, 1986.

U.S. Fish and Wildlife Service (USFWS). 1991. Mexican spotted owl status review. Endangered species report 20. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1993. Endangered and threatened wildlife and plants; final rule to list the Mexican spotted owl as threatened. Federal Register 58:14248-14271.

U.S. Fish and Wildlife Service (USFWS). 1994a. Endangered and threatened wildlife and plants; designation of critical habitat for the threatened loach minnow (Tiaroga cobitis). Federal Register 59(45):10898-10906. March 8, 1994.

U.S. Fish and Wildlife Service (USFWS). 1994b. Notice of 90-day and 12-month findings on a petition to reclassify spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis) from threatened to endangered. Federal Register 59(131):35303-35304. July 11, 1994.

U.S. Fish and Wildlife Service (USFWS). 1995a. Endangered and threatened wildlife and plants; final rule to designate critical habitat for the Mexican spotted owl. Federal Register 60:29914-29951.

U.S. Fish and Wildlife Service (USFWS). 1995b. Mexican spotted owl recovery plan.

Albuquerque, New Mexico.

U.S. Fish and Wildlife Service (USFWS). 1998. Endangered and threatened wildlife and plants; revocation of critical habitat for the Mexican spotted owl, loach minnow, and spikedace. Federal Register 63(57):14378-14379.

U.S. Fish and Wildlife Service (USFWS). 2000. Endangered and threatened wildlife and plants; final designation of critical habitat for the spikedace and loach minnow. Federal Register 65(80):24328-24372.

U.S. Fish and Wildlife Service (USFWS). 2001. Endangered and threatened wildlife and plants; final designation of critical habitat for the Mexican spotted owl. Federal Register 66(22):8530-8553.

U.S. Forest Service (USFS). 1993. Biological Evaluation for Threatened, Endangered, and Sensitive Species - Allotment Management Plan Revisions for the Burro Creek, Hayground, and Reservation Allotments and A Watershed Approach to a Coldwater Fisheries on the West Fork of the Black River.

U.S. Forest Service (USFS). 1994. West Fork of the Black River Watershed and Fisheries Restoration Project Implementation Plan.

U.S. Forest Service (USFS). 1997. Allotment Management Plan for the P.S. Allotment.

U.S. Forest Service (USFS). 1999a. Environmental Assessment Allotment Management Plan for Cow Flat, Foote Creek, P.S., and Stone Creek Allotments.

U.S. Forest Service (USFS). 1999b. Decision Notice and Finding of No Significant Impact - Allotment Managment Plan for Cow Flat, foote Creek, PS, and Stone Creek Allotments.

U.S. Forest Service (USFS). 2001a. Addendum to the Biological Assessment and Evaluation In Regards To the P.S. Grazing Allotment Management Plan.

U.S. Forest Service (USFS). 2001b. Addendum to the Biological Assessment and Evaluation Allotment Management Plan Revisions for the Burro Creek, Hayground, and Reservation Allotments and a Watershed Approach to a Coldwater Fisheries on the West Fork of the Black River.

U.S. Forest Service (USFS). 2001c. Biological Assessment of the effects to Endangered, Threatened & Proposed species for the Udall Allotment, Allotment Management Plan Revision.

U.S. Forest Service (USFS). 2001d. Biological Assessment and Evaluation for Loach Minnow and Spikedace Allotment Management Plan Revision for the Udall Allotment.

U.S. Forest Service (USFS). 2001e. Udall Allotment Environmental Assessment.

U.S. Forest Service (USFS). 2002. Response to draft biological opinion Udall Allotment.

U.S. General Accounting Office. 1998. Public rangelands: Some riparian areas restored but widespread improvement will be slow. Report to Congressional Requesters, U.S. General Accounting Office, Washington, D.C.

Vallentine, J.F. 1990. Grazing management. Academic Press, Inc., San Diego, California. 533 pp.

Vives, S.P. and W.L. Minckley. 1990. Autumn spawning and other reproductive notes on loach minnow, a threatened cyprinid fish of the American southwest. The Southwestern Naturalist 35(4):451-454.

Ward, J.P. Jr., and W.M. Block. 1995. Mexican spotted owl prey ecology *In* Mexican Spotted Owl Recovery Plan. U.S. Department of the Interior, Fish and Wildlife Service, Albuquerque, New Mexico.

White, G.C., A.B. Franklin, and J.P. Ward, Jr. 1995. Population Biology. *In* Mexican Spotted Owl Recovery Plan. U.S. Department of the Interior, Fish and Wildlife Service, Albuquerque, New Mexico.

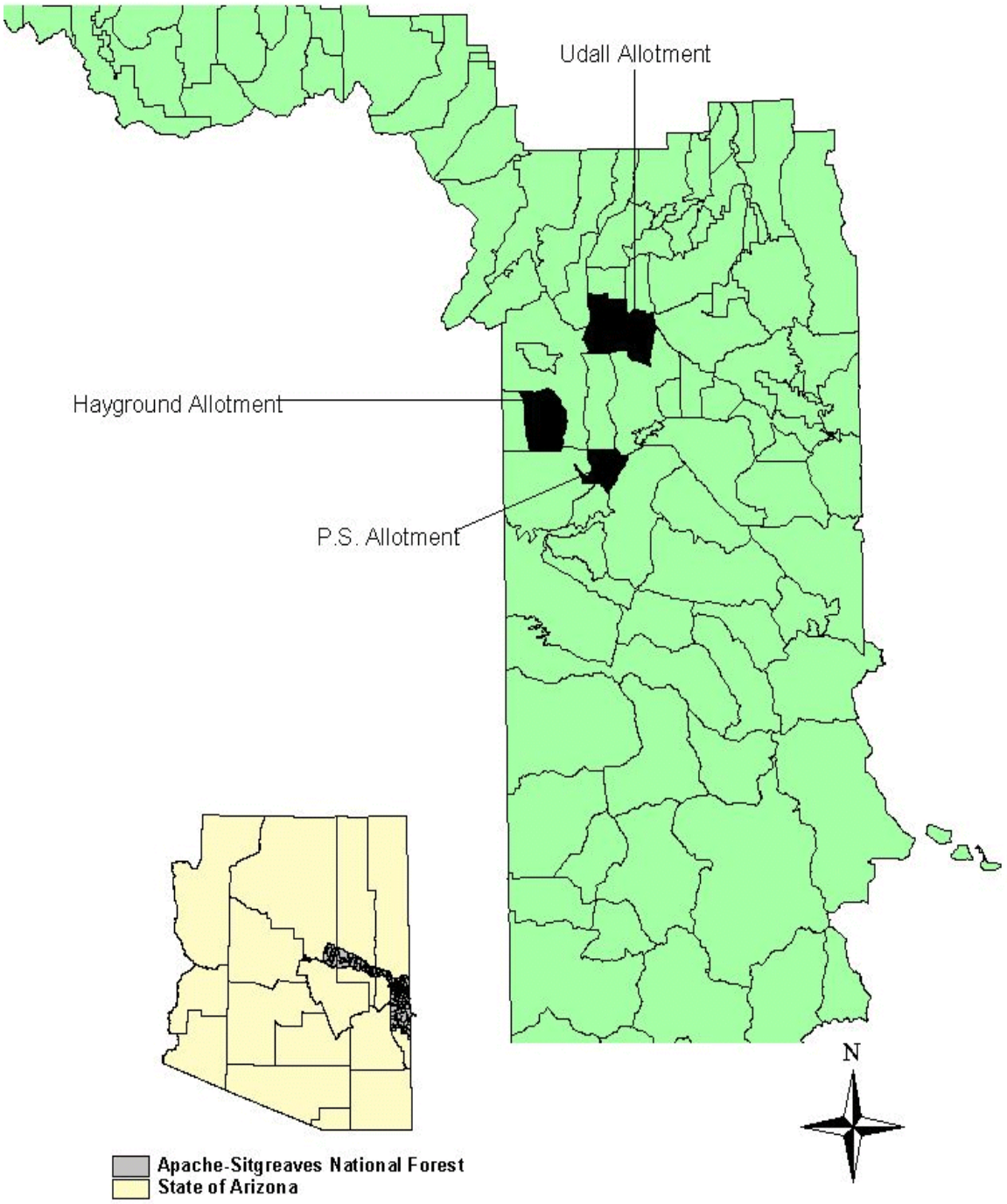
Willey, D.W. 1993. Home range characteristics and juvenile dispersal ecology of Mexican spotted owls in southern Utah. Final Report 1992-93. UDWR Contract No. 91-2577, Amendment #1.

Wilson, E.D. 1969. A resume of the geology of Arizona. University of Arizona Press, Tucson. 140 pp.

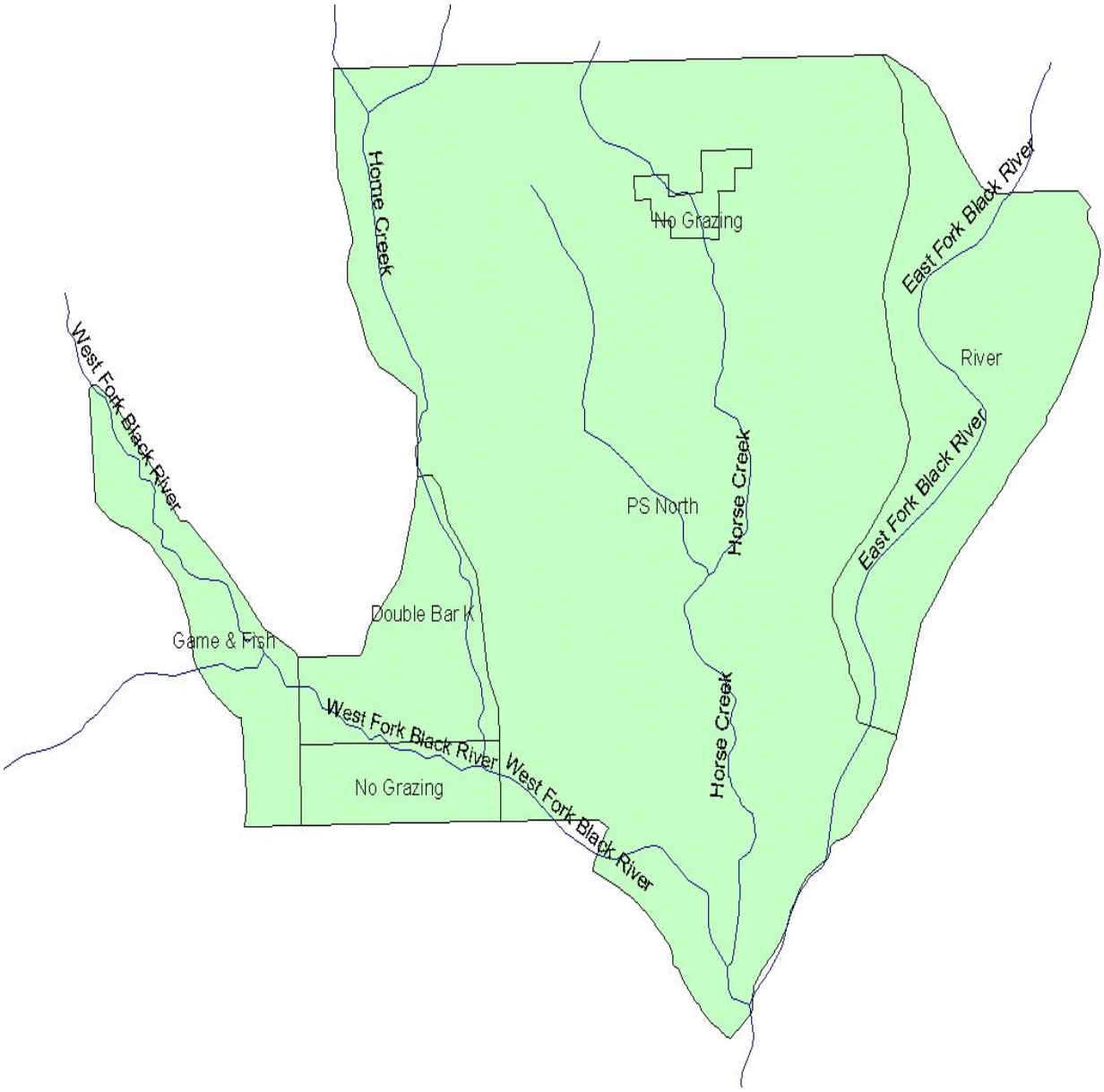
Williams, J.E., D.B. Bowman, J.E. Brooks, A.A. Echelle, R.J. Edwards, D.A. Hendrickson, and J.J. Landye. 1985. Endangered aquatic ecosystems in North American deserts with a list of vanishing fishes of the region. Journal of the Arizona-Nevada Academy of Science 20(1):1-62.

York, J.C. and W.A. Dick-Peddie. 1969. Vegetation changes in southern New Mexico during the past hundred years. Pp. 157-166 *In* Arid lands in perspective. W.G. McGinnies and B.J. Goldman (eds.). University of Arizona Press, Tucson, Arizona.

Appendix A: Location of the P.S., Hayground, and Udall Allotments on the Apache-Sitgreaves National Forest

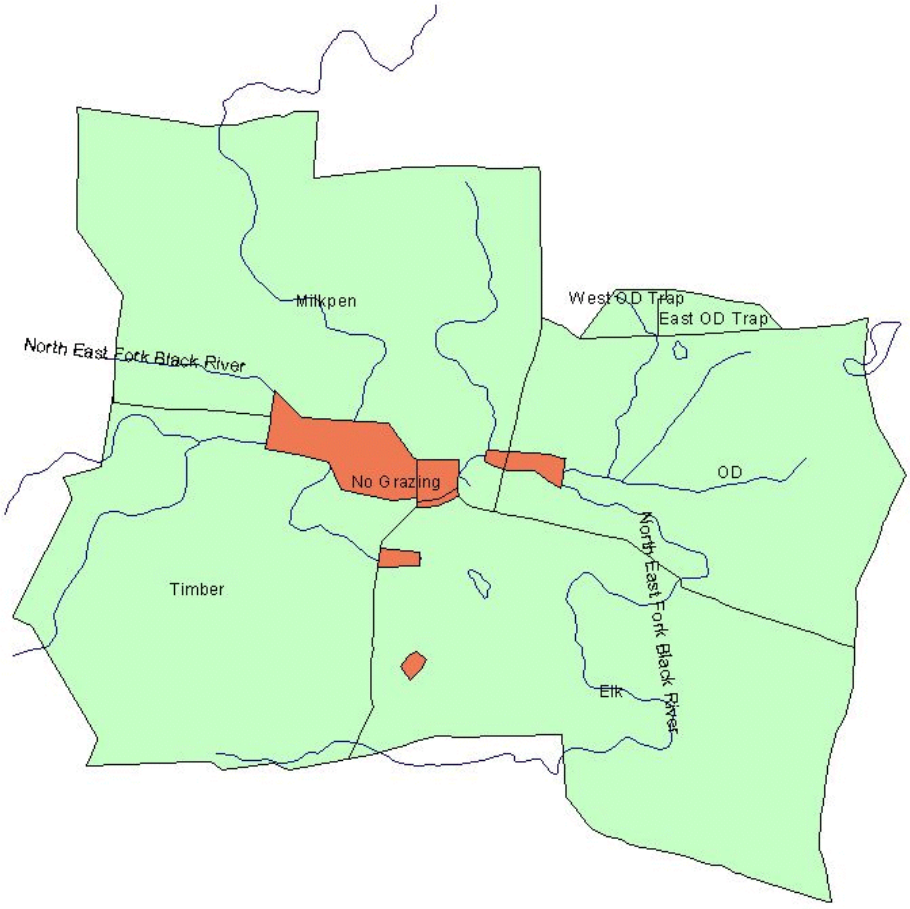


Appendix B: Layout of the P.S. Allotment



Appendix C: Map of the Hayground Allotment

Appendix D: Layout of the Udall Allotment



APPENDIX E: BEST MANAGEMENT PRACTICES (BMPs) AS OUTLINED IN THE PS ENVIRONMENTAL ASSESSMENT

Specific activities to maintain or improve water quality for the PS allotments are:

1. **Brush or woodland management treatments**, if implemented to improve soil quality, shall be accomplished in a manner that will retail at least 5 tons/acre of treatment generated large woody debris (3 inch and larger) dispersed evenly across the site. Ground cover within 2 years of treatment shall be at or above the tolerance ground cover needed to protect soil productivity and hydrologic function. TES map unit 51, 53, and 54 require 40 percent effective ground cover to maintain hydrologic function of the soil. Grazing management or maintenance measures will be applied to enhance the success of the treatment. This may involve 2 growing seasons of rest to let herbaceous cover become established. Use of temporary fencing or modified rotation of livestock may be required. Utilize BMP implementation form for mechanical treatment to evaluate land treatments with regards to potential water quality impacts.

2. **Prescribed fire treatments** should be applied only under conditions that the intensity and rate of spread of the fire are controlled. To protect soil productivity, fire intensity should be low to moderate to prevent loss of soil nutrients, organic matter and the alteration of soil physical properties, such as structure and pores, that would reduce infiltration of water into the soil. Grazing management or maintenance measures will be applied to enhance the success of the treatment. This may involve 2 growing seasons of rest to let herbaceous cover become established. Use of temporary fencing or modified rotation of livestock may be required. Utilize BMP implementation and effectiveness form for prescribed fire to evaluate the treatment with regards to potential water quality impacts. Grazing management or maintenance measures will be applied to enhance the success of the treatment. This may involve 2 growing seasons of rest to let herbaceous cover become established.

3. **Seeding projects** should be implemented in areas where native seed is scarce, or in areas where eroding upland and riparian areas are contributing directly to sedimentation in stream channels, especially in areas used as filter strips to mitigate other management practices. Provide a period of protection form grazing to promote establishment or herbaceous plants. Emphasize native species that are less palatable for greater longevity and persistence on site.

4. **Planned grazing system** shall be implemented to maintain or improve plant cover while properly using the forage available, increasing efficiency be uniformly using all suitable parts of each grazing unit, reducing erosion and improved water quality, insuring a supply of forage thoughout the grazing season, increasing production with improved quality of forage, enhancing wildlife habitat, promoting flexibility in the grazing program and buffer the adverse effects of drought. Proper stocking and improved distribution of livestock will be major considerations for evaluating effects of implementing a system.

5. **Grazing** shall be at an intensity that will maintain enough cover to portect the soil or improve the quantity and quality of desirable vegetation. Allowable forage utilization levels will be adjusted by range condition class on fully and potentially capable land. Key grazing areas will be monitored to determine when livestock should be moved to prevent overuse.

6. **Utilize salt** to improve livestock distribution. Salt at least ¼ mile away from water or natural congregating areas such as roads, trails, and saddles in hills, and avoid key areas. Move salt when distribution objectives are not being met or to correct localized overuse problems.

7. **Access roads** for the maintenance of grazing developments shall be engineered to facilitate reasonable control and disposal of water, to control erosion, and make the best possible use of topographical features, where possible. Access roads shall not be placed along or parallel to the stream channel within the streamside management zone. Crossing shall be perpendicular to the stream and the number of crossings should be minimized. Road gradients should not exceed 10 percent except for short lengths where more acceptable design criteria are presented. All cuts and fills will be stabilized. Drainage structures will be engineered to provide adequate surface drainage to meet site specific criteria and runoff conditions. Culverts, bridges or grade dips for water management shall be provided at all natural drainage ways. Roadside ditches shall be engineered to provide surface drainage for the roadway and deep enough to serve as outlets for subsurface drainage. Drainage channels shall be sited on stable grades or protected with structures or linings for stability. Rolling dips or water bars shall be incorporated into design criteria to control surface runoff. These should be maintained periodically to ensure proper function. Structures shall be placed on all water bar or rolling dip outlets to trap sediment and slow erosive force of water. Lead out ditches shall not be placed directly into water courses. Water quality shall be protected during and after construction by erosion control facilities and maintenance. Filter strips, sediment and water control basins, as well as other accepted conservation practices shall be used and maintained as needed.