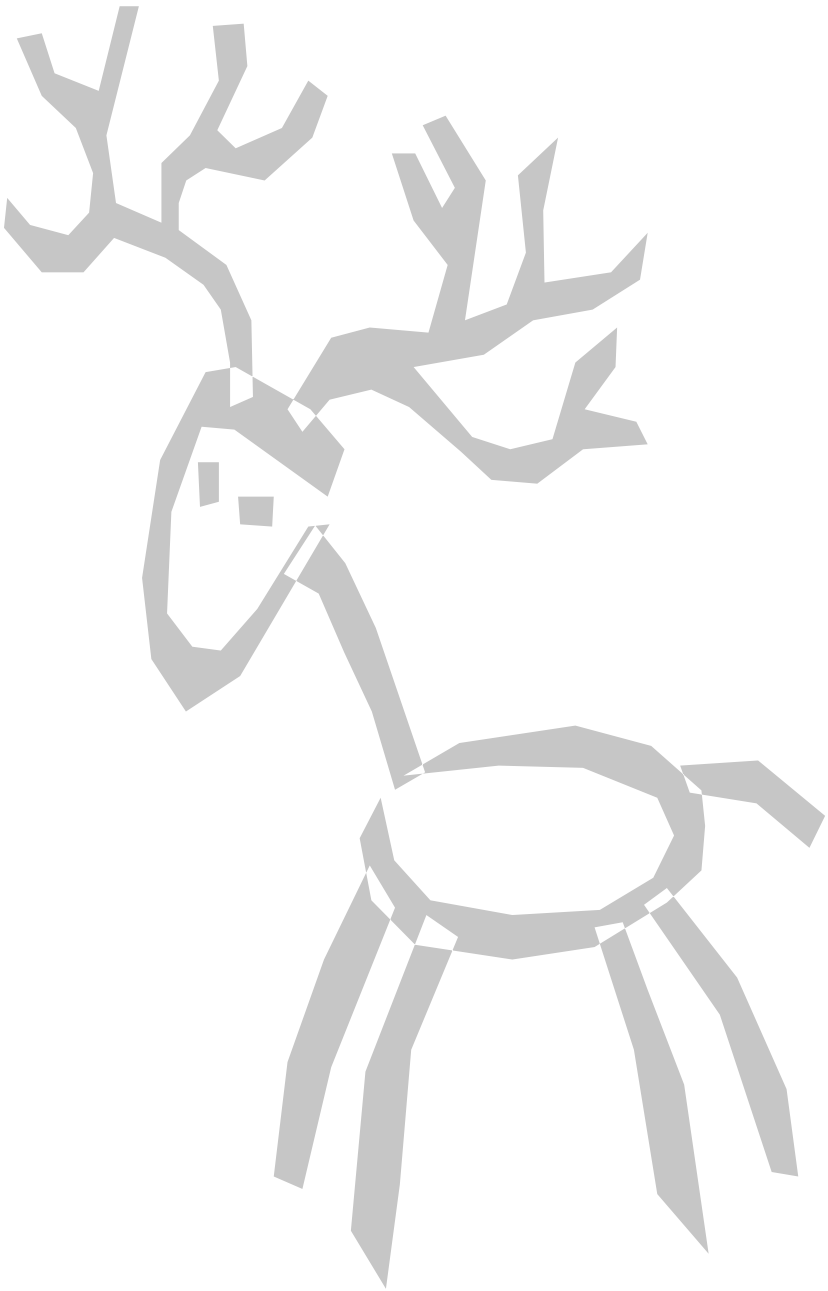
CORONADO NATIONAL FOREST MANAGEMENT INDICATOR SPECIES POPULATION STATUS AND TRENDS

United States Department of Agriculture
Forest Service – Southwestern Region
Coronado National Forest



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Introduction
Regulatory Context

The role of management indicator species (MIS) in National Forest planning is described in the 1982 implementing regulations for the National Forest Management Act (NFMA) of 1976. These regulations require that certain vertebrate and/or invertebrate species present in the area be identified as MIS and that they be selected because "*their population changes are believed to indicate the effects of management activities*" (36 CFR 219.19(a)(1).

The Forest Service Manual (FSM) defines management indicators as *"Plant and animal species, communities or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent."* (FSM 2620.5).

The NFMA regulations identify five categories of species that may be considered, where appropriate, as management indicator species:

- *Endangered and threatened plant and animal species identified on State and Federal lists for the area.*
- *Species with special habitat needs that may be influenced significantly by planned management programs.*
- *Species commonly hunted, fished or trapped*
- *Nongame species of special interest*
- *Plant and animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.*

Section 219.19(a)(6) requires that "*Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with State fish and wildlife agencies to the extent practicable*."

In order to meet the spirit and intent of the planning regulations, thirty-three Management Indicator Species and one group - primary and secondary cavity nesters - in eight indicator groups were identified in the Coronado National Forest Land and Resource Management Plan adopted in 1986 (U.S. Forest Service 1986: 128-129). The sections of this document that follow describe the process for selection of MIS on the Coronado National Forest (CNF), summarize monitoring information for these species and, where possible, asses their status and utility as MIS after 16 years of Forest Plan implementation. Species accounts are updated periodically as additional monitoring information becomes available.

Management Indicator Species Selection

The Coronado National Forest Land and Resource Management Plan (Forest Plan) was adopted in 1986. The process for selecting management indicator species is described in the Wildlife and Fish chapter of the Coronado National Forest Analysis of the Management Situation (USFS 1982) on file in the Coronado National Forest Supervisor's Office. Table 1 and Table 2 display management indicator species by indicator group. According to the records on file, only a single species – Bell's vireo – and cavity nesters as a group were considered suitable for selection as indicators whose population changes could be used to indicate the effects of management on

other species. The remaining 32 species were selected largely because they had identifiable special habitat needs, but were not considered suitable for tracking Forest-wide habitat conditions. Indeed, many species had very narrow habitat tolerances or occur over a very restricted range on the Forest. Each of the 5 categories of MIS described in the MFMA regulations (above) is represented in the Forest Plan list.

Management indicator species are displayed in the Forest Plan in 8 indicator groups (Table 1); however, there is no information in the planning records to indicate how the 8 groups were derived. The indicator groups themselves are general descriptions of a desired condition (diversity, riparian, dense canopy, etc.) but are not statements of a quantifiable plant community or habitat type identified in the Forest Plan. Several species occur in more than one group (Table 2). For example, Elegant Trogons are included in the Cavity Nesters, Riparian Species, Species Needing Diversity, Special Interest and Threatened and Endangered Species groups.

Table 1. Coronado National Forest Management Indicator Species by Group

	Group	Species
1	Cavity Nesters	Coppery-tailed (Elegant) Trogon Sulphur-bellied Flycatcher Other primary and secondary cavity nesters*
2	Riparian Species	Gray hawk Blue-throated hummingbird Coppery-tailed (elegant) trogon Rose-throated becard Thick-billed kingbird Sulphur-bellied flycatcher Northern Beardless tyrannulet Bell's vireo Black bear
3	Species Needing Diversity	White-tailed deer Merriam's turkey Coppery-tailed (elegant) trogon Sulphur-bellied flycatcher Buff-breasted flycatcher Black bear
4	Species Needing Herbaceous Cover	White-tailed deer Mearn's quail Pronghorn antelope Desert massassauga Baird's sparrow
5	Species Needing Dense Canopy	Bell's vireo Northern beardless tyrannulet Gray hawk
6	Game Species	White-tailed deer Mearn's quail Pronghorn antelope Desert bighorn sheep Merriam's turkey Black bear
7	Special Interest Species	Mearn's quail Gray hawk Blue-throated hummingbird Coppery-tailed (elegant) trogon Rose-throated becard

	Group	Species
		Thick-billed kingbird Sulphur-bellied flycatcher Buff-breasted flycatcher Northern beardless tyrannulet Five-striped sparrow
8	Threatened and Endangered Species	Desert bighorn sheep Gray hawk Peregrine falcon Blue-throated hummingbird Coppery-tailed (Elegant) trogon Rose-throated becard Thick-billed kingbird Sulphur-bellied flycatcher Buff-breasted flycatcher Northern beardless tyrannulet Bell's vireo Baird's sparrow Five-striped sparrow Mexican stoneroller Arizona (Apache) trout Gila topminnow Gila chub Sonora chub Desert massassauga Twin-spotted rattlesnake Arizona ridge-nosed rattlesnake Huachuca (Sonora) tiger salamander Tarahumara frog Western barking frog Spikedace Arizona treefrog Mt. Graham spruce (red) squirrel Gould's turkey

**Primary Cavity Nesters*

Ladder-backed woodpecker, Arizona woodpecker, northern flicker, Gila woodpecker, acorn woodpecker, hairy woodpecker

Secondary Cavity Nesters

American kestrel, elf owl, flammulated owl, whiskered screech owl, western screech owl, Northern pygmy-owl, Mexican spotted owl, elegant trogon, eared trogon, Sulphur-bellied flycatcher, brown-crested flycatcher, ash-throated flycatcher, dusky capped flycatcher, Cordilleran flycatcher, violet green swallow, juniper titmouse, bridled titmouse, brown creeper, white-breasted nuthatch, red-breasted nuthatch, pygmy nuthatch, house wren, Bewick's wren, eastern bluebird, European starling, Lucy's warbler.

Table 2. Coronado National Forest Management Indicator Species and Indicator Categories

Indicator Species	Cavity Nesters	Riparian Species	Species needing Diversity	Species Needing Herbaceous Cover	Species Needing Dense Canopy	Game Species	Special Interest Species	T&E Species
Desert Bighorn Sheep						X		X
Pronghorn antelope				X		X		
Mt. Graham Red Squirrel								X
White-tailed deer			X	X		X		
Black bear		X	X			X		
Elegant trogon	X	X	X				X	X
Sulphur-bellied flycatcher	X	X	X				X	X
Gray hawk		X			X		X	X
Blue-throated hummingbird		X					X	X
Rose-throated becard		X					X	X
Thick-billed kingbird		X					X	X
Northern beardless tyrannulet		X			X		X	X
Bell's vireo		X			X			X
Buff-breasted flycatcher			X				X	X
Mearns' quail				X		X	X	
Merriam's turkey			X			X		
Five-striped sparrow							X	X
Peregrine falcon								X
Baird's sparrow				X				X
Gould's turkey								X
Primary and secondary cavity nesters	X							
Desert Massassauga				X				X
Twin-spotted rattlesnake								X
Arizona ridge-nosed rattlesnake								X
Huachuca (Sonora) tiger salamander								X
Tarahumara frog								X
Western barking frog								X
Arizona treefrog								X
Mexican stoneroller								X
Arizona (Apache) trout								X
Gila topminnow								X
Gila chub								X
Sonora chub								X
Spikedace								X

Occupied habitats.

Occupied habitat was defined in the Analysis of the Management Situation (AMS) as habitat necessary for the survival of the species at the time the Forest Plan was adopted. Estimates of occupied habitats were derived from estimates provided by the Arizona and New Mexico Natural Heritage Programs and from the game and fish agencies of the respective states. Estimates of occupied habitats were not available for all MIS (Table 3). For most species, occupied habitats were broken out by vegetation types. This will be described in greater detail in the individual accounts for each MIS.

Table 3. Minimum habitat estimates for management indicator species from the Coronado National Forest Land and Resource Management Plan, 1986.

Indicator Species	Acres or Miles of Occupied Habitat
White-tailed deer	1,430,071
Mearns' quail	225,410
Pronghorn Antelope	57,692
Desert bighorn sheep	72,468
Merriam's turkey	422,901
Gray Hawk	567
Peregrine falcon	No data
Blue-throated hummingbird	No data
Elegant (Coppery-tailed) trogon	12,190
Rose-throated becard	752
Thick-billed kingbird	1,200
Sulphur-bellied flycatcher	No data
Buff-breasted flycatcher	90
Northern beardless tyrannulet	1,270
Baird's sparrow	No data
Five-striped sparrow	18,279
Bell's vireo	No data
Desert massassauga	389
Arizona ridge-nosed rattlesnake	28,175
Twin-spotted rattlesnake	46,351
Huachuca tiger salamander	640
Tarahumara frog	1,339
Western barking frog	891
Mexican stoneroller	3.3 miles
Apache (Arizona) trout	19.6 miles
Gila topminnow	4.5 miles
Gila chub	4.4 miles
Sonora chub	3.7 miles
Spikedace	No data
Arizona treefrog	No data
Mount Graham red (spruce) squirrel	2,603
Black bear	641,113
Gould's turkey	No data

Monitoring requirements.
The Forest Plan monitoring requirements for MIS are displayed in Appendix 1. Only 8 species are specifically identified in the monitoring methods section and 6 of these are the game species listed in Group 5 (Table 1). The plan indicates that monitoring of MIS will be accomplished using third party data, especially Arizona Game and Fish Department (AGFD) survey data. This is consistent with the direction set out in Section 219 of NFMA. The bulk of costs noted for MIS monitoring were earmarked for research into the population/habitat relationships for MIS. The AMS emphasized that basic habitat and distribution data were lacking for many of the MIS on the Forest and that MIS monitoring should be focused on the development of baseline inventories for many species (USFS 1982). In the 16 years since the Forest Plan was adopted, the CNF has supported numerous studies aimed at achieving this objective. These are described in the individual species evaluations that follow.

MIS/habitat relationships.

Not all of the species selected in 1986 have utility as MIS. First, some of the selected MIS do not actually occur on the CNF or occur too infrequently to be reliable indicators for the habitats they were selected to represent. Some species occur marginally or seasonally on the Forest, but their populations are influenced significantly by habitat conditions in other parts of their ranges well off of the Forest. Some species have very narrow habitat preferences unique to that species, but the habitats themselves are not affected by management. Still other species have proven to be simply impractical to monitor and others are poor indicators of the effects of management on the Forest.

For species with populations of sufficient size and distribution, or for which significant effort has gone into population monitoring, population trends can be determined or inferred. However, the information has limited usefulness for management because the observed population changes can not be conclusively related to management actions and effects. Nevertheless, monitoring of most species has occurred over the years and research into population/habitat relationships has continued.

Monitoring
Standards and Guidelines.
Applicable Forest Plan standards and guidelines MIS forest-wide are displayed below:

1. *Maintain or improve occupied habitat of commonly hunted species, listed threatened or endangered species, and management indicator species through mitigation of Forest activities with cooperation of New Mexico Department of Game and Fish, Arizona Game and Fish Department, and US Fish and Wildlife Service.* (page 31-1).

11. *Evaluate through consultation with Arizona Game and Fish, New Mexico Departments of Game and Fish and Natural Resources, along with other wildlife and plan-oriented groups where appropriate, population viability of Management Indicator Species through determination of: (1) amount of suitable habitat; (2) distribution of suitable habitat; (3) number of individuals that support regional population goals; and (4) likelihood of continued existence*. (page 32).

In addition, management prescriptions for each management area on the Forest direct the Forest to "*maintain or improve current levels of occupied habitats*" for MIS appropriate to that management area (USFS 1986).

Population viability

The Committee of Scientists (COS) report (1999) defined a viable species as consisting of self-sustaining populations that are well distributed throughout the species range. Self-sustaining populations are those that are sufficiently abundant and have sufficient genetic diversity to provide for their persistence and adaptability in the planning area over time. The COS report described an assessment approach using four possible outcomes to be used in viability analysis in forest planning. The four outcomes are described as:

Outcome A: Habitat is of sufficient quality, distribution and abundance to allow the species population to stabilize and be well distributed across federal lands.

Outcome B: Habitat is of sufficient quality, distribution and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution on federal land. These gaps cause some limitations in interactions among local populations.

Outcome C: Habitat only allows continued species existence in refugia with strong limitations on interactions among local populations.

Outcome C: Habitat conditions result in species extirpation from federal land.

Within occupied habitats, wildlife species populations can fluctuate over time in response to a variety of environmental or management-related influences. This phenomenon is more pronounced for species at the margins of their distributional ranges. The majority of the MIS on the CNF are species at the margins of their ranges. As metapopulations expand and contract in response to changing environmental conditions, smaller subpopulations can become isolated and therefore more susceptible to stochastic events that serve to reduce or eliminate that population. Many of the MIS on the Forest were selected *because* they had a very limited distribution on the CNF, so their populations will never be well distributed across federal lands. Therefore, this analysis will focus on the status and trends of occupied habitats for the species on the CNF. Where possible, populations will be related on one of the possible outcomes.

Unlike many forests within the National Forest System, the Coronado National Forest does not have an active timber program. Resource management activities that potentially affect MIS and their habitats are primarily related to recreation, livestock grazing and to some extent, special uses. While these activities potentially affect species and habitats through disturbance, short term changes in herbaceous vegetation and long term and subtle changes in soil condition, they rarely if ever result in large and rapid changes in habitat structure that occur as a result of timber harvest.

In the desert southwest, the primary influence on wildlife populations is often annual rainfall and its effect on forage production and cover. Therefore, an apparent population change for a particular species over time does not necessarily indicate a corresponding change in the amount of habitat for that species, but rather a short-term reduction in the carrying capacity of that

habitat. These natural fluctuations tend to mask the effects of management on MIS species and their habitats.

By far, the greatest changes in Forest habitats have been related to the effects of fires that have occurred throughout the Forest since 1986. Between 1982 and 2004, an estimated 353,220 acres of the Forest (approximately 20% of the Forest) have burned as a result of human-caused and natural fires (see following table).

Fire occurrence on the Coronado National Forest 1982-2003.

	TOTAL	
Lightning	# of Fires	Acres
Broadleaf Woodland (Evergreen)	464	39139.45
Chaparral	37	831.1
Coniferous Forest (mixed conifer)	189	1073.1
Coniferous Forest (spruce-fir)	12	6.9
Coniferous Forest (transition)	379	33923.9
Coniferous Riparian	1	320
Coniferous Woodland	67	2725.8
Deciduous Forest	0	0
Deciduous Riparian	20	1372
Desert Grassland	114	28550.4
Dry Desert Riparian	0	0
Higher Ecosystem Extension	8	23.55
Mountain Grassland/Meadow	3	0.3
Plains Grassland	11	607
Southwestern Desertscrub	87	28042.8
Total Lightning	**1392**	**136616.3**

Human	# of Fires	Acres
Broadleaf Woodland (Evergreen)	521	44319.55
Chaparral	11	110.4
Coniferous Forest (mixed conifer)	166	937.55
Coniferous Forest (spruce-fir)	1	0.5
Coniferous Forest (transition)	244	85804.2
Coniferous Riparian	1	0.1
Coniferous Woodland	32	1033.5
Deciduous Forest	2	0.4
Deciduous Riparian	43	718.65
Desert Grassland	84	3351.2
Dry Desert Riparian	2	80.1
Higher Ecosystem Extension	8	70.7
Mountain Grassland/Meadow	5	2.7
Plains Grassland	20	17481.55
Southwestern Desertscrub	101	32993.45
Total Human Caused	**1241**	**186904.55**

Total of all Fires and Acres	**2633**	**323520.85**

Species Evaluations

Species-by-species evaluations of the CNF management indicator species follow. To the extent possible, the evaluations: 1) describe the reasons a particular MIS was selected, 2) document the relationship between the MIS and the habitat or indicator group, 3) identify the methods used to monitor MIS populations and/or habitats, 4) describe trends in the MIS population, and 5) provide an evaluation of the utility or reliability of the MIS for the purpose for which it was selected.

Population status and trends for the species addressed in this report were evaluated based on the following sources: Arizona Game and Fish Department (AGFD) Heritage Data Management System (HDMS), North American Breeding Bird Survey (NABBS) data from 1980-2000 (U.S. Geological Survey web site http://www.mbr.nbs.gov/bbdbbs.html), Christmas Bird Count (CBC) data (http://www.audubon.org/bird/cbc/), the Arizona Partners in Flight Bird Conservation Plan (Latta, et al 1999), the Forest's report of MIS status and trends (USFS 2002) and supporting documentation on file in Forest Service offices, and a wide variety of other literature related to Arizona wildlife and habitat types. Much of it is derived from state, federal agencies, university studies and private individuals who have monitored MIS populations on the CNF. In many cases, the data come from monitoring efforts accomplished by CNF biologists.

Only monitoring for MIS is included in this report. Several other species are monitored on the CNF, primarily to fulfill the requirements of terms and conditions of a variety of Biological Opinions issued by the U.S. Fish and Wildlife Service. These activities are reported annually in the USFWS Monitoring Report. In addition, the Arizona and New Mexico Game and Fish Departments accomplish a variety of game species surveys on the forest on an annual basis.

Species are evaluated in a species-by-species manner rather than by indicator groups. The diversity of species within each indicator group is so great that no conclusions can be drawn for the group based on population performance for the individual species within the group.

Birds

Elegant Trogon (*Trogon elegans*)

Background. Identified as the Coppery-tailed trogon in the Forest Plan, this species is included in the Cavity Nesters, Riparian Species, Species Needing Diversity and the Special Interest Species indicator groups. The species was selected because it inhabits diverse sycamore riparian with free water available in summer and requires flicker-sized cavities for nesting. It is a secondary cavity nester. It is considered sensitive to concentrated recreation (USFS 1982). The Elegant Trogon is listed as a priority bird species for High Elevation Riparian habitat in the Arizona Partners in Flight Bird Conservation Plan (Latta et al 1999).

The relationships between this Species and its habitats have been summarized by Kunzmann et al (1998). This species frequents mixed deciduous riparian bottoms in the pine-oak belt from 4,500 to 6,500 feet. Birds arrive in southeastern Arizona as early as April. Trogons often select cavities in Arizona sycamores (*Platanus wrightii*) for nesting. Other nest trees include silver-leaf and Arizona white oak (*Quercus spp*.) and Apache Pine (*Pinus englemanii*) and Chihuahua pine (*Pinus leiophylla*). Eggs are laid in May and June. Elegant trogons forage by flycatching or gleaning invertebrates from vegetation. The species also uses available fruits from southwestern chokecherry, madrone (*Arbutus arizonica*), birchleaf buckthorn (*Rhamnus betulaefolia*), and Virginia creeper (*Parthenocissus inserta*). After fledgling of the young, most birds migrate south starting in August, although a few birds have over-wintered in selected sites (Hall 1996, Taylor 1994).

Table 4. Estimates of occupied habitat for Elegant trogon: 1986 Coronado National Forest Plan.

Vegetation Community	Habitat Acres
Chaparral	162
Broadleaf evergreen woodlands	8769
Coniferous woodlands	2249
Deciduous forests	132
Coniferous forest (transition)	878
Deciduous riparian	1963
Total	14,153

Population trends. Annual trogon surveys are accomplished in the Chiricahua Mountains. The number of pairs observed between 1991 and 1999 averaged 6.2 pairs with no discernable trend. The most recent Forest-wide survey data comes from Hall (1996) who studied trogons in all four mountain ranges in which they occur on the Forest. A comparison of her data with similar forest-wide data collected by Taylor between 1977 and 1982 is shown in Table 5. Hall et al (2002) determined relative abundance of 84 bird species in and around the Huachuca Mountains by re-surveying sites originally surveyed by Strong and Bock (1990) between 1984 and 1986. For elegant trogon, no trend in relative abundance was observed. Morrison et al (1996) calculated relative abundance and density estimates for trogons in 6 mountain ranges on the CNF between 1993 and 1995 as part of a contract to establish sampling protocols for riparian bird species on the CNF. On a state scale, the species is uncommon or restricted with 21 to 50 occurrences and is fairly common in a rather restricted range within Arizona (Arizona Game and Fish 2001). Within the CNF, the species is limited in distribution by its selectivity for a certain riparian habitat type, which is itself limited to a handful of canyons on the Forest. The existing

data indicate that populations have fluctuated somewhat within individual canyons, but that overall populations are apparently stable.

Table 5. Average number of trogons in 4 mountain ranges on the Coronado National Forest for 2 periods: 1977-1982 and 1993-1995 (Hall 1996).

Mountain Range	77-82 Average	93-95 Average
Atascosas	9	6
Chiricahuas	22	9
Huachucas	20	46
Santa Ritas	16	17
Totals	67	78

Habitat Trends. The Forest Plan identifies12,190 acres of occupied habitat for the Coronado National Forest, but the AMS identified 14,153 acres. The difference of 1,963 acres is the amount of deciduous riparian and appears to have been an omission in totaling acreage in the final plan (Table 4). Regardless, no significant changes in habitat quantity or quality have occurred within occupied riparian canyons, so the amount of occupied habitat is considered stable since 1986.

Evaluation. Because of the patchy nature of their preferred habitat, trogons will never be well distributed across the forest. Although habitats are well described in a qualitative sense, quantitative data on habitat parameters that affect occupancy or nesting success are lacking. Habitats are of sufficient quality and abundance to allow the species to persist in all historic habitats. Elegant trogon populations have persisted over the past 20 years within suitable habitats and monitoring has been sufficient to detect occupancy, if not population trends. The amount of occupied habitat for the species has not been recently quantified, but it appears to be similar to the amount identified in 1986. The species may be a reliable indicator of mixed deciduous sycamore riparian habitats; however, populations on the CNF are seasonal and at the northern extension of the species range. Thus, populations may be influenced by conditions off of the Forest in non-breeding areas or stochastic events (e.g. fires or floods) that result in significant changes in the species' numbers or amounts of habitat. The species is highly sought by bird watchers and subject to disturbance from this activity. However, populations have persisted in the face of annual disturbance.

Revised: 5-2002 (RAG)
2-17-2005 (RAG)

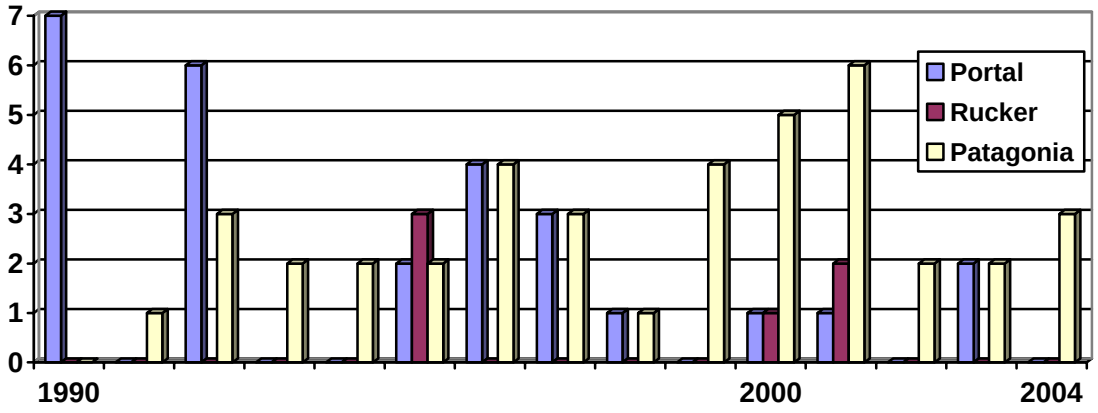
Sulphur-bellied Flycatcher (Myiodynastes luteiventris).

Background. This species is included in the Cavity Nesters, Riparian Species, Species Needing Diversity and Special Interest Species indicator groups. The species was selected because habitat requirements are "similar to Coppery-tailed Trogon (…Highly diverse riparian with free water available through the summer. Require flicker-sized cavities, primarily in sycamores, for nesting), but less susceptible to human disturbance". (USFS 1982). The species is not listed as a priority bird species in Arizona (Latta et al 1999).

Sulphur-bellied Flycatchers breed from extreme southeast Arizona south to Costa Rica. Within Arizona, they are summer residents in the Santa Rita, Huachuca and Chiricahua Mountains and rarely in the Santa Catalina and Pinaleno Mountains (Phillips et al 1964). They winter in South America in Peru and Bolivia. The species nests in mid-elevation (5,000-7,000 ft) mixed deciduous riparian canyons composed of Arizona Sycamore and Walnut (*Juglans major*). They build a nest of small sticks inside a cavity, usually in an Arizona Sycamore at a height between 20 and 50 feet above the ground (Scott et al 1977). They reside on the forest only during the nesting season, generally June-September.

Population trends. No organized surveys are conducted specifically for the species; however, they have been detected on breeding bird survey routes in Portal, Rucker and Patagonia on the Forest since 1986 (Sauer 2004). Figure 1 shows the number of birds detected on three survey routes between 1990 and 2004. The number of nesting birds fluctuates from year to year within individual canyons, but the Forest-wide total of birds detected has remained relatively stable.

Figure 1. Sulphur-bellied flycatcher occurrence in three Breeding Bird Survey routes on Coronado National Forest – 1990-2004.



Morrison et al (1996) calculated relative abundance and density estimates for Sulphur-bellied flycatchers in 6 mountain ranges on the CNF between 1993 and 1995 as part of a contract to establish sampling protocols for riparian bird species on the CNF. Hall et al (2002) determined relative abundance of 84 bird species in and around the Huachuca Mountains by re-surveying sites originally surveyed by Strong and Bock (1990) between 1984 and 1986. No changes in relative abundance were identified for Sulphur-bellied flycatcher. Taylor (1995a,b) considered the species common in sycamore canyons along the U.S.-Mexico border, with up to 6 pairs per mile in suitable habitats in the Huachuca and Chiricahua Mountains.

On a global scale, the Sulphur-bellied flycatcher is considered demonstrably secure with over 100 occurrences. In Arizona, it is fairly common within a restricted range (AGFD 2001). Sulphur-bellied flycatchers are highly sought by birders, so there is abundant anecdotal evidence every year on the status of birds on and near the Forest.

Habitat trends. The CNF Plan gives no estimate of occupied habitat on the Forest. As noted above, the species' habitat preferences are similar to the Elegant trogon, so the amount of occupied habitat is considered similar as well. No significant changes in habitat quantity or quality have occurred within occupied riparian canyons, so the amount of occupied habitat is considered stable since 1986.

Evaluation. As with Elegant trogons, Sulphur-bellied flycatchers are highly selective for sycamore riparian habitats within the CNF and the distribution of the birds is restricted to available habitats. Habitats are of sufficient quality and abundance to allow populations of the species to persist in all suitable areas on the CNF. Monitoring has been sufficient to detect occupancy within known habitats. Populations appear stable, although a small sample size makes it difficult to detect trends. Because the CNF is at the far northern edge of the species' range and the bird occurs only seasonally on the Forest, conditions or events off of the Forest could effect the small breeding population on the Forest. These factors tend to impact the species value as a MIS on the Forest.

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2-10-2005 (RAG)

Other Primary and Secondary Cavity Nesters.
Primary cavity nesters are those species that excavate and nest in cavities, whereas secondary cavity nesters use cavities excavated by primary cavity nesters. On the Forest, cavity nesters occur primarily within forested areas including riparian habitats, Madrean evergreen woodlands, coniferous forests, and in Sonoran desert habitats that contain saguaro cactus (*Carniegia gigantea*). The LRMP did not quantify the amount of occupied habitat. At least 6 primary cavity nesters and approximately 30 secondary cavity nesters are found on the CNF. These are listed at the bottom of Table 1. In general, cavity nesters require large, older age class trees and snags to provide a suitable substrate for cavities. Although the species in this group specifically nest in cavities, some of them make use of many other habitats in completing their life cycles. For example, the American kestrel and eastern bluebird often forage in open grasslands (Ehrlich et al. 1988), and many members of the group winter in Mexico or Central America. The value of snags to cavity-nesting birds is widely recognized (Scott 1977). Many forest plans, including the Coronado's, included standards and guidelines for snag retention to provide cavity-nesting bird habitat.

Cavity nesters were selected as MIS because they were considered sensitive to fuelwood and timber harvest and watershed rehabilitation projects. (USFS 1982). Coronado Forest standards and guidelines call for retention of 100% of occupied cavity nester habitats outside of designated fuel wood harvest areas and 80% or more of occupied habitat within fuel wood stands. No standards exist for other vegetation communities.

Population trends. No monitoring of cavity nesting birds as a group occurs on the Forest. North American Breeding Bird Survey information for the Cavity Nester group in the Mexican Highlands physiographic region show slight but statistically insignificant declines for Ash-throated Flycatcher and Bewick's Wren (USGS 2004). The trend for the Ladder-back Woodpecker indicates a slight, but statistically insignificant increase. Trends for Elegant trogon and Sulphur-bellied flycatcher are described above. Several cavity nesting species are detected during annual breeding bird survey routes and trends for some of these are reported the U.S. Geological Survey. NABBS data for 1980-2003 in the Sierra madre Occidental Region show significant downward trends for Northern Flicker and American Kestrel (USGS 2004). For all other primary or secondary cavity nesters, trends were not significant or no data were available.

Hall et al (2002) determined relative abundance of 84 bird species, including selected cavity nesters, in and around the Huachuca Mountains by re-surveying sites originally surveyed by Strong and Bock (1990) between 1984 and 1986. So significant trends were detected for any of the cavity nesters in their survey sample.

Habitat Trends. Since the Forest Plan was adopted in 1986, several large fires in the pine and mixed conifer plant communities have left thousands of dead standing trees in the Huachuca, Santa Catalina, Pinaleno and Chiricahua Mountains. In addition, insect infestations have resulted in the loss of thousands of acres of spruce-fir and mixed conifer trees on the Pinaleno Mountains. The result has been a substantial but unquantified increase in potential habitats (snags) for high elevation cavity-nesters.

Evaluation. As a group, cavity nesting birds share little in common except the tendency to build or use holes for nesting. Because of this diversity, no conclusions can be drawn regarding trends of cavity nesters in general. In general, habitat is considered to be of sufficient quality, distribution and abundance to allow cavity nesters to be well distributed across the Forest. As a group, cavity nesters habitat requirements are too broad to provide any meaningful interpretation of the effects of management on the group.

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2-10-2005 (RAG)

Northern Gray Hawk (*Asturina nitida maxima*)

Northern gray hawk is included in the Riparian Species, Species Needing Dense Canopy, and Special Interest Species indicator groups. The species was selected because of its need for "cottonwood and sycamore galleries with adjacent mesquite bosques or uplands". It was considered "sensitive to grazing, fuelwood harvest and concentrated recreation use such as off-road vehicles and campgrounds". The Analysis of the Management Situation (AMS) for the Forest Plan (USFS 1982) estimated the Forest-wide population as 2 breeding pairs and gave an estimate of 567 acres of occupied habitat (Table 6). It is also a Forest sensitive species.

Table 6. Estimated occupied habitat for Northern Gray Hawk in the 1986 Coronado National Forest Plan.

Vegetation Community	Habitat Acres
Desert grasslands	207
Broadleaf evergreen woodlands	180
Dry desert riparian	180
Total	567

This species generally prefers well-developed lower elevation deciduous riparian areas, specifically the tropical-subtropical riparian deciduous woodlands of mesquite (*Prosopis juliflora*) and hackberry (*Celtis reticulata*) bordering strands of cottonwood (*Populus fremontii*) and willow (*Salix goodingii*) (Glinski 1983). Sites on Forest also include more open stands of cottonwood, sycamore, and Madrean oaks with adjacent mesquite uplands (Tom Deecken, pers. obs.). Glinski (1983) identified the mix of woodland and thornscrub as important foraging habitats. Often surface water is nearby.

Population trends. Gray hawks nest in very low numbers on the CNF. No organized survey protocol is in place, but known nest sites are visited on an annual basis and nesting activity is reported. Since 1999, an estimated 4-6 occupied nests have been documented on the Nogales Ranger District (T. Newman, pers. comm.). Nesting activity is tracked through the Arizona Heritage Data Management System (HDMS). While the number of nesting birds is too small to make any meaningful assessment of population trend, it appears that the limited suitable habitat on the CNF is occupied and that more birds are nesting on the CNF than in 1986. On a statewide scale, the population trend is considered stable (AGFD 2001). Glinski (1998) estimated 80 breeding pairs of northern gray hawks in Arizona. On a global scale, the northern gray hawk is considered demonstrably secure with more than 100 occurrences.

Habitat trends. The background information for the Forest Plan does not indicate how the quantity of occupied habitat was derived, so it is difficult to determine changes in habitat quantity for the species. Based on the apparent increase in nesting birds on the Forest, habitat trends are presumed to be stable or improving.

Evaluation. Preferred habitats for northern gray hawks are generally found in lower elevation river valleys like the San Pedro River, Sonoita Creek and the Santa Cruz River. There is little potential for these types of habitats to exist on the CNF except in isolated pockets at lower elevations. However, where these habitats are found within the limited range of the species, gray hawks are nesting. Because of the limited numbers of gray hawks on the CNF and the limited amount of capable habitat, the species is not well suited as a MIS, even though numbers are

relatively easy to track. Habitats for the species are considered generally secure and are not affected by management activities. Monitoring should continue through HDMS.

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Blue-throated hummingbird (*Lampornis clemenciae*).
The Blue-throated hummingbird is included in the Riparian Species and Special Interest Species indicator groups. The species was selected as an indicator for the Forest Plan because of its relationship to riparian and grazing impacts (USFS 1982). The Forest Plan gives no data for acres of occupied habitat for the Coronado National Forest. The species is not listed as a priority bird species in Arizona (Latta et al 1999), but is listed as a priority bird species for riparian on the Partners in flight web site. The blue-throated hummingbird is found on the CNF during the spring and summer in wet pine-oak and oak canyons above 4,500 feet in elevation. Habitats within the CNF are at the very northern extreme of the species' range. It forages on the nectar of several species of flowers and also feeds on insects. It is highly tolerant of human activity and readily habituates to sugar water feeders.

Population trends. There are currently no systematic efforts to monitor populations. On a state scale, the species is apparently secure with more than 100 occurrences within Arizona (Arizona Game and Fish 2001d). Williamson (2000) described the population trend for the region as unknown, although she suggests that breeding populations may have increased in Arizona since the 1970's as a result of riparian improvement. Low numbers of birds are usually observed during NABBS routes in Rucker and Portal but data are insufficient to detect trends. Birds have also been recorded during the winter months, usually at hummingbird feeders. The species was observed on 5 of the last 6 Ramsey Canyon Christmas bird counts in the Huachuca Mountains. Numbers ranged from 1 to 3.

Habitat Trends. No quantitative data are available on habitat trends. However, since 1986, implementation of the Forest Plan has resulted in reductions in livestock grazing in most occupied riparian canyon habitats. Therefore, the amount of suitable habitat is not thought to have changed significantly since the mid-1980's.

Evaluation. The Blue-throated hummingbird has a very limited distribution on the Forest. The species is confined to a few montane canyons with running water at higher elevations. The limited available habitats are occupied and appear to be of sufficient quality and abundance to allow the species to persist in small numbers on the CNF. Very little grazing currently occurs in Blue-throated hummingbird habitat, so habitats are considered secure in that regard. Because populations are restricted to a few high elevation moist canyons, fires or other catastrophic events could affect or eliminate local populations. Because of its limited distribution and the current lack of threats to occupied habitats, the species is of limited utility as a MIS.

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2-10-2005 (RAG)

Rose-throated Becard (*Pachyramphus aglaiae*)

Rose-throated becard is included in the Riparian Species and Special Interest Species indicator groups. The species was selected because of its dependence on well developed riparian below 4,000 feet and restricted breeding range (USFS 1982). It is also listed as Wildlife of Special Concern in Arizona. This species inhabits cottonwood and sycamore groves along streams and rivers in extreme south-central Arizona. Arizona nesting locations represent the northernmost extensions of the species range which extends south to Costa Rica. It breeds in Sonoita Creek, adjacent to the CNF but is known from only one location, Sycamore Creek, on the Forest. Historic breeding locations along Arivaca Creek (off of CNF) and in Guadelupe Canyon in the Peloncillo Mountains are no longer occupied.

Population trends. The Arizona Game and Fish Heritage Abstract describes population trends as "unknown" (AGFD 2001). Data on breeding birds are collected and entered into the Arizona Natural Heritage Data Management System (Deeble 1999), but the species is generally not detectable on NABBS routes. There are no trend data for the species in the Breeding Bird Survey database. On a state scale, the species is very rare with 1 to 5 occurrences in Arizona or very few individuals or acres occupied. The Nature Conservancy (Deeble 1999) states that there is no trend information for Arizona, but that the becard's future as a breeding bird in Arizona is tenuous given the small populations. A range of 2 to 7 nesting pairs present in the state annually was given in the same report.

Habitat Trends. The Forest Plan identified 752 acres of occupied habitat in the deciduous riparian plant community for the species on the Forest, presumably in Sycamore Canyon. Sycamore Canyon is a Research Natural Area and an identified Important Bird Area (Arizona Audubon). It is fenced to exclude livestock grazing and managed to protect riparian values. Habitats are not affected to any degree by management activities and are not thought to have changed since 1986.

Evaluation. Habitat for the species on the CNF only allows continued species existence in refugia with limitations on interactions between local populations. Populations of the species in Arizona are extremely limited and only one site is located on the CNF. The species has never been widespread. The small population on the CNF is highly susceptible to impacts occurring off of the Forest. The factors influencing range contraction for the species are poorly understood, but such contractions are common at the fringe of a species range (Deeble 1999). The species has limited utility as a MIS because of its extremely limited distribution on the Forest and poorly understood habitat relationships.

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Thick-billed Kingbird (Tyrannus crassirostris).
Thick-billed kingbird is included in the Riparian Species and Special Interest Species indicator groups. It was selected because of its association with open riparian having tall native trees, its limited distribution and impacts of livestock grazing (USFS 1982). This bird is found in lower elevation sycamore and cottonwood stands in canyons at the base of mountains or in larger creeks and rivers. The Forest Plan identifies 1,200 acres of occupied habitat for the Coronado National Forest: 502 acres of broadleaf evergreen woodland and 698 acres of deciduous riparian. The habitat requirements of this species are similar to the Rose-throated becard. As is the case with many other MIS bird species on the Forest, the Thick-billed kingbird is a Mexican species at the extreme northern edge of its range on the CNF. The species breeds south from southern Arizona into southern Mexico and winters into Guatemala.

Population trends. No systematic surveys are conducted for the species, and no trend data are contained in the Breeding Bird Survey database. The species is tracked in the Arizona Heritage Database (AGFD 2001f). On a state scale, the species is rare with 6 to 20 occurrences in Arizona or very few individuals or acres occupied. The species was detected in low numbers by Morrison et al (1996) in the Atascosa Mountains during surveys throughout the CNF. Taylor (1995b) noted the bird as casual in the Huachuca Mountain area. The species has been recorded several miles to north and west near Patagonia (Taylor 1995a). Population trends for the species are unknown, although Thick-billed kingbirds have also expanded their range northward since the middle of the 20th century (Arizona Game and Fish 2001).

Habitat trends. No data are available on habitat trends specific to the species. In general, the quantity and quality of deciduous riparian habitats on the CNF are believed to have increased since 1986 as a result of modifications of livestock use and fencing of riparian areas.

Evaluation. Populations of the species are limited on the CNF by the availability of suitable habitats. Because of the patchy distribution and limited extent of suitable habitats, the species will never be widespread on the Forest. While the species appears to have strong affinities to mixed deciduous riparian communities, its limited distribution and low occurrence on the CNF limit its utility as a MIS.

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Northern Beardless Tyrannulet *(Camptostoma imberbe*)

Northern beardless tyrannulet is included in the Riparian Species, Species Needing Dense Canopy, and Special Interest Species indicator groups. The species was selected as an indicator for the Forest Plan because it inhabits dense riparian mesquite understory and it could be an indicator of activities such as grazing and fuelwood harvest that alter that habitat (USFS 1982).

The Northern beardless tyrannulet is the only U.S. representative of a subfamily of tropical flycatchers that extends to South America. As is the case with several other MIS birds on the CNF, the species range is centered in Mexico and Central America where it is found in lowland tropical deciduous forests. It only reaches the U. S. in extreme southern Arizona, and only in small numbers (Tenney 2000). Mesquite, hackberry, and cottonwood thickets in valleys are the preferred habitat for this species during the breeding season (Taylor 1995a, b). Preferred habitats for the species are generally at lower elevations than are found on the CNF. It may wander into higher elevations during the winter. The Forest Plan identifies 1,270 acres of occupied habitat for the CNF: 518 acres of broadleaf evergreen woodlands and 752 acres of dry desert riparian.

Population trends. On a global scale, the northern beardless tyrannulet is considered demonstrably secure with more than 100 occurrences (AGFD 2001). On a state scale, the species is apparently secure with more than 100 occurrences in Arizona, although it could be considered quite rare in some areas (AGFD 2001). Population trend data are not displayed for this species in the Breeding Bird Survey database. In the Patagonia breeding bird survey route, the species has been recorded 6 times in the last 11 years. Numbers of birds seen ranged from 0 to 3 (Sauer 2004). Tenney (2000) noted little apparent change in populations in the United States. There are not sufficient data to determine population trends on the CNF, but optimal habitats are very limited, primarily because much of the Forest is above the elevational range of the species. Arizona HDMS data show only four occurrences of the species on the Forest.

Habitat Trends. Suitable habitat on the Forest is found in the Sycamore Canyon Research Natural Area. Sycamore Canyon is a Research Natural Area and an identified Important Bird Area (Arizona Audubon). It is fenced to exclude livestock grazing and managed to protect riparian values. Habitats are not affected to any degree by management activities and are not thought to have changed since 1986.

Evaluation. As is the case with other riparian songbird MIS, this species provides limited insight into Forest management effects. The Arizona population of the species is at the far northern extension of the species' range and suitable habitats within Arizona occur almost entirely off of the CNF. Within the CNF the limited suitable habitats appear to be occupied and appear to be of sufficient quality to allow the species to persist in small numbers. Habitats on the CNF likely contribute very little to population trends for the species. It is not possible to detect the effects of management on populations of the Northern beardless tyrannulet.

Bell's vireo (Vireo bellii)

Bell's vireo is included in the Riparian Species and Species Needing Dense Canopy indicator groups. The species was selected to represent riparian understory condition at elevations below 4,400 feet. It could be potentially impacted by the loss of dense riparian habitats through woodcutting and grazing (USFS 1982). This is the only species thought to meet the criteria of a species whose population changes could potentially indicate the effects of management activities on a major biological community (USFS 1982). It is susceptible to brood parasitism by brown-headed cowbirds. It is also a Forest Service Sensitive Species.

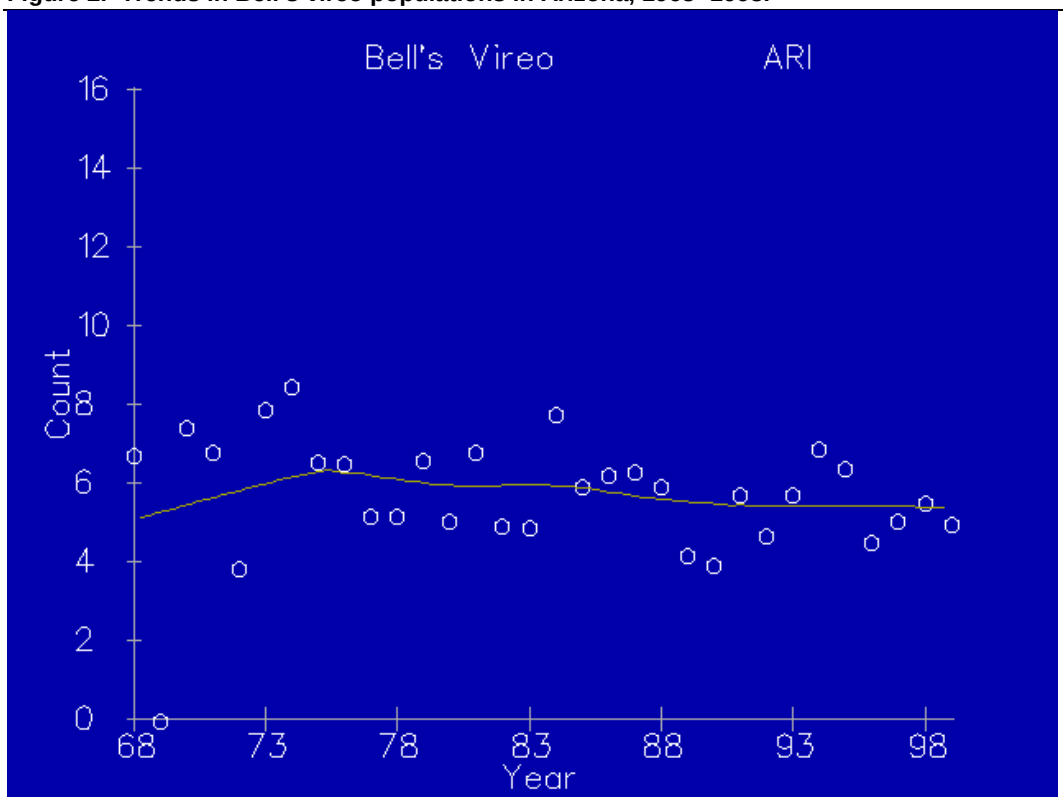
Bell's vireos are widespread, breeding throughout central and southwestern U.S. and northern Mexico. They winter from Mexico south to Central America. This species occurs near rivers and desert washes with thick understory vegetation. On the CNF, their distribution is limited to lower elevation mesquite thickets near the Forest boundary. Most high quality habitat for the species occurs off of the Forest at lower elevation river valleys between the mountains. The Forest Plan gives no data for acres of occupied habitat on the CNF.

Population Trends. No systematic surveys are conducted specifically for Bell's vireos on the CNF; however, it is regularly detected during breeding bird surveys in southeastern Arizona. It is considered common along the San Pedro River (Taylor 1995b). Morrison et al (1996) calculated a high relative abundance for the species where it was breeding in Florida Canyon in 1994. NABBS (Sauer 2004) data for Bell's vireo in Arizona indicate a very slight downward trend in the population for this species in Arizona since 1980 (Figure 2). Using only data from the Sonoran desert, Bell's vireo populations show an upward trend of 3.4%, based on a smaller sample. Populations in Arizona and northern Mexico are considered stable overall based on NABBS data (Deeble 2000b).

Habitat Trends. Habitats for the species occur primarily in lower elevation riparian areas in the Santa Catalina, Santa Rita and Tumacacori Ecosystem Management Areas. By and large these are areas that are managed to preserve high valued biotic resources (Sycamore Canyon) or recreation values (Sabino Canyon) or both. These areas are generally excluded from grazing, wood cutting or other activities that would remove riparian vegetation. As a result, the limited potential habitat for the species is not thought to have changed significantly over the life of the plan.

Evaluation. Bell's vireo populations are correlated to dense riparian vegetation dominated by mesquite, willow and salt cedar below 3500 feet in elevation. Within southern Arizona, Bell's vireo habitats appear to be of sufficient quality, distribution and abundance to allow the species to persist within historic habitats. These types of habitats are very limited on the CNF and are unlikely to contribute substantially to range-wide populations for the species. The species occurs infrequently on the CNF, but has been shown to be relatively abundant within limited suitable habitat.

Figure 2. Trends in Bell's vireo populations in Arizona, 1968- 1998.



Merriam's Turkey (*Meleagris gallopavo merriami*).
Merriam's turkey is included in the species Needing Diversity and the Game Species indicator groups. The species was selected as MIS because they have special habitat needs: "Mixed conifer, ponderosa pine, encinal-grasslands with sufficient tree roosting sites, free water and green feed and insects during breeding season. Sensitive to grazing, fuelwood and concentrated recreation use" (USFS 1982). The Forest Plan identified 422,901 acres of occupied habitat, although it was likely less, based on factors described below.

The native turkey population on the CNF is believed to have been extirpated during the early 1900's. While no taxonomical records exist, it is likely that these birds were the Gould's subspecies (*M. g. mexicana*) based on the proximity to and connectivity between existing Gould's turkey habitats in northern Mexico and mountain ranges on the CNF. Starting in the mid-1920's and continuing through the mid-1950's, turkey were aggressively restocked into mountain ranges in southeastern Arizona. The source population for these transplants was almost exclusively Merriam's turkeys captured in northern Arizona. Although the transplant appeared to be initially successful, over time each of these transplanted populations declined to a point where they were no longer viable. Accounts from the 1970's indicated that translocated populations had been reduced to only a few birds (Heffelfinger et al 2000). Merriam's turkeys were hunted on the CNF from the 1940's until the mid-1990's. The last turkey harvested in the Santa Catalina Mountains was in 1994, the last kill reported from the Chiricahua Mountains in 1995. There have been no turkey hunts since 1997 in the CNF.

In the 1980's, beginning with a transplant in the Huachuca Mountains, agency efforts focused on the establishment of the Gould's subspecies into suitable habitats on the CNF. In March 2000, these efforts became formalized as the Southeastern Arizona Turkey Management Plan, a cooperative effort between CNF, AGFD, BLM, Fort Huachuca and the national Wild Turkey Federation. The goal of this plan is to establish self-sustaining populations of Gould's turkeys throughout southeast Arizona (Heffelfinger et al 2000).

Population trends. Because of the lack of observations since approximately 1990, it is generally believed that Merriam's turkeys on the CNF are extirpated or nearly so. Annual surveys are conducted for Gould's turkeys and are described in the discussion for that subspecies.

Habitat Trends. There are no data on habitat trends for the species.

Evaluation. Since 1986, Merriam's turkey populations have declined on the CNF to the point where the populations are not considered viable. However, Merriam's turkeys are likely not endemic to the Forest and recent efforts have been focused on the restoration of the native Gould's subspecies. Wild turkeys have been used successfully by other national forests in Arizona as management indicators and could serve that function on the CNF. However, monitoring should focus on the Gould's subspecies.

Gould's Turkey (*Meleagris gallopavo mexicana*)

This species is included in the threatened and endangered species indicator group for the Forest Plan because it inhabits oak-grassland-riparian associations with trees of sufficient size for roosting, free water, and green feed and insects during the breeding season. The subspecies at the time of release of the Forest Plan was not thought to be a good indicator because of interbreeding with domestic birds in the Peloncillo Mountains (USFS 1981). It is a Forest sensitive species.

The Gould's turkey is distributed throughout northern Mexico and into the southwestern U.S. Populations seem abundant and well distributed in Mexico (Heffelfinger 2000) but occur only in isolated pockets in the Huachuca, Peloncillo and Galiuro Mountains on the CNF. The native turkey population on the CNF is believed to have been extirpated from Arizona during the early 1900's. While no taxonomical records exist, it is likely that these birds were the Gould's subspecies (*M. g. mexicana*) based on the proximity to and connectivity between existing Gould's turkey habitats in northern Mexico and mountain ranges on the CNF. A small but apparently stable population of Gould's turkeys has persisted in the Peloncillo, Animas and San Luis Mountains in southeastern New Mexico. The Peloncillo Mountains are within the CNF.

In the 1980's, beginning with a transplant in the Huachuca Mountains, agency efforts focused on the establishment of the Gould's subspecies into suitable habitats on the CNF. In March 2000, these efforts became formalized as the Southeastern Arizona Turkey Management Plan, a cooperative effort between CNF, AGFD, BLM, Fort Huachuca and the National Wild Turkey Federation. The goal of this plan is to establish self-sustaining populations of Gould's turkeys throughout southeast Arizona (Heffelfinger 2000).

Population trends. Population estimates for the Huachuca Mountains are based on spring and fall counts conducted by the Arizona Game and Fish Department and incidental sightings. Results for the period 1993 to 2004 are shown in Table 7, below.

Table 7. Gould's turkey spring surveys in the Huachuca Mountains, 1993 to 2004 (*from:* Heffelfinger et al 2000:9, Arizona Game and Fish unpublished)

Year	No. Observed/Heard	Locations
1993	9 (7 males:2 females	Sawmill, Scotia, Sunnyside Canyons
1994	44	Ramsey Canyon, Patagonias, FR 49 Santa Niña, Huachuca Canyon, Peterson Ranch (Scotia Canyon), Pyeatt Ranch
1995	25 (13 males:19 females)	Copper Glance (Sunnyside Canyon), Sawmill Canyon, Scotia Canyon
1996	37 (16 males:21 females	Ramsey Canyon
1997	15	
1998	14	Ramsey Canyon, other locations
1999	41 (20 males:21 females	Sunnyside Canyon, Ramsey Canyon, West Gate Guard House
2000	46 (8 adult males, 4 subadult males, 13 to 14 adult females, 20 to 21 subadult females)	Population estimated at >75
2001	42 (10 males, 30 hens, 2 unclassified)	Population estimated at 100 to 150
2002		
2003	72	
2004	90 (45 males, 45 females)	31 routes throughout the rountain range

Population information presented above indicates numbers increasing from releases in the 1980s. Surveys after 2000 represent a better population estimate because of methodology and breadth of effort.

In addition to monitoring populations, the CNF, AGFD Fort Huachuca are engaged in efforts to re-establish populations of Gould's turkeys into suitable habitats within the CNF. These efforts were formalized in the Southeastern Arizona Turkey Management Plan (Heffelfinger et al 2000). The goal is to establish self-sustaining populations of Gould's turkey throughout southeastern Arizona. In 1983 and 1987, a total of 21 turkeys were released into the Huachuca Mountains. After some initial mortality, this population has increased in numbers and distribution to the point where it appears to be self-sustaining. Gould's turkeys in the Huachucas can now be observed in a variety of habitats at all elevation ranges. In 1994 and 1997, a total of 67 turkeys trapped in Mexico were released in the Galiuro Mountains, but the releases suffered high mortality. Many, if not all of these birds eventually died. Efforts are continuing to establish new populations, with efforts being focused on using the Huachuca population as the source for additional transplants.

Habitat Trends. The species is not identified as an indicator for habitat.

Evaluation. Gould's turkey populations on the CNF have increased since 1986. Increases since 1990 have been largely due to natural reproduction in the Huachuca Mountains. Habitat on the CNF is of sufficient quality and distribution to allow the population to increase. There remain some significant gaps in historic distribution of the species, but further implementation of the Southeastern Arizona Turkey Management Plan should serve to reduce these gaps. The Gould's turkey is not currently a habitat indicator but may be a useful indicator for habitats in the next revision of the Forest Plan.

Buff-breasted Flycatcher *(Empidonax fulvifrons*)

Buff-breasted flycatcher is included in the Species Needing Diversity and Special Interest Species indicator groups. It was selected as an indicator for the Forest Plan because it inhabits open pine forests above 6,000 feet and because "habitat in limited breeding range needs to be protected from activities that would change its current nature." It was considered sensitive to timber harvest and prescribed burning (USFS 1981, USFS 1982). There is nothing in the planning records to indicate why the species was considered a good indicator of diversity.

The buff-breasted flycatcher occurs quite widely in open pine forests south of the United States in Mexico and Central America. As is the case with several MIS songbirds on the CNF, habitats on the Forest are at the extreme northern edge of this species' range. The distribution and numbers of Buff-breasted flycatchers in Arizona were reported to have decreased markedly over the last century (Phillips 1964, Bowers and Dunning 1994). Habitat often includes an open under story of grasses and small trees or burned forest with patches of living pines (Latta et al. 1999). The Forest Plan identified 90 acres of occupied mixed conifer habitat for the Coronado National Forest located in Carr and Scotia Canyons in the Huachuca Mountains (USFS 1986). The species is found on the CNF only during the breeding season (March to September). It winters in Mexico and Central America. The population of the species is probably affected by fire maintenance of preferred habitat.

Population trends. On a state scale, the species is very rare with 1 to 5 occurrences in Arizona or very few individuals or acres occupied (AGFD 2001). Bowers and Dunning (1994) noted that population numbers varied widely between years in Arizona, but speculated that increases in population size in the Huachuca Mountains followed the Carr Fire in 1977. For the years 1980 to 1983 population totals for 3 mountain ranges in southeastern Arizona are shown in Table 8, below.

Table 8. Population of buff-breasted flycatchers in southeastern Arizona from 1980 to 1983 with emphasis on the Huachuca Mountains (*from* Bowers and Dunning 1994:11)

Mountain Range Canyon	1980	1981	1982	1983
Huachuca				
Carr	5 adults	2 adults	8 adults	9 adults, 1 juvenile
Garden	no data	no data	2 adults, 3 juveniles	2 adults
Rock Spring	no data	2 adults, 1 juvenile	no data	no data
Sawmill	>4 adults	6 adults	11 adults, 15 juveniles	7 adults, 9 juveniles
Scotia	no data	2 adults, 1 juvenile	6 adults	2 adults
Sunnyside	no data	2 adults, 3 juveniles	1 adult	1 adults
Total	9 adults	14 adults, 5 juveniles	28 adults, 18 juveniles	21 adults, 10 juveniles
Chiricahua				
Total	1 adult	2 adults	5 adults, 3 juveniles	3 adults
Santa Catalina				
Total	1 adult	no data	2 adults	0 individuals
Total All Ranges	11 adults, 0 juveniles	16 adults, 5 juveniles	36 adults, 21 juveniles	24 adults, 10 juveniles

Martin (1997) did extensive surveys for the species in canyons where the bird has been seen during the last 20 years. He also surveyed in randomly selected sites concentrating on the Chiricahua, Santa Catalina, and Huachuca Mountains. This author reported 121 birds observed including 19 in canyons not previously having records. In 2000, Conway and Kirkpatrick (2001) repeated Martin's surveys and reported significant population declines between 1996 and 2000.

Chase (2001) provides more recent information on species abundance in the Huachuca Mountains. This author surveyed 3 areas. Relative abundance was measured as the number of individuals detected per census during 6 censuses over the 1998 and 1999 breeding periods. Results of this study are presented in Table 9.

Table 9. Relative abundance of buff-breasted flycatchers in 3 locations in the Huachuca Mountains, 1998 and 1999. (*from* Chase 2001:156)

Location (habitat)	**Garden Canyon** (riparian forest)	**Sawmill Canyon** (pine-oak forest)	**Reef (Upper Carr Canyon)** (pine-oak forest)
Relative Abundance (*mean ± standard deviation for individuals detected/census*)	.02 ± .08	.28 ± .44	.38 ± 0.45

Healy (2002) also noted the frequency of the species being seen during visits to Sawmill Canyon on Fort Huachuca from 1994 to 2001. This observer saw buff-breasted flycatchers on at least 80 of his visits from late March to early August during that period.

Habitat Trends. The species appears to benefit from fires that open up the forest overstory and create and maintain herbaceous understory. Fire suppression since the turn of the century has likely reduced habitat suitability across the Forest. However, since 1982, fires have occurred within 123,000 acres of potentially suitable habitat in the Ponderosa pine, mixed conifer and coniferous forest transition vegetation types. Recovery of many of these areas may take many years, but should ultimately result in conditions suitable as flycatcher habitat.

Evaluation. The Buff-breasted flycatcher has one of the most restricted breeding ranges of any bird in the U.S. (Bowers and Dunning 1994). An estimated 98% of the U.S. breeding population is restricted to a few canyons in the Huachuca and Chiricahua Mountains. Because it is a species at the northern end of its breeding range and very limited in distribution, the population on the Forest is easily influenced by events off of the Forest or stochastic events that affect the species primary breeding areas. A significant effort has been expended over the past few years to evaluate the status of this species. It appears that sufficient information exists to detect trends in population on the Forest, but information is lacking on population demographics (Conway and Kirkpatrick 2001). Information on recruitment and immigration and the status of the Mexico populations is needed to help determine management strategies for the species. The species may have utility as an indicator for the open montane and riparian forests it prefers, but this utility is affected by the very limited distribution and small population of the bird.

Revised and updated: 05-2002 (RAG);
2-17-2005 (RAG)

Montezuma (Mearns') Quail (*Cyrtonyx montezumae mearnsi*)

Mearns' quail are included in the Species Needing Herbaceous Cover, Game Species and Special Interest Species indicator groups. The species was selected as MIS because it inhabits high quality grassland in encinal oak habitats (USFS 1982). It is "dependent upon good grass cover during the nesting season; moderately heavy to heavy grazing destroys needed nesting cover, resulting in the disappearance of the birds" (USFS 1981). In areas mapped as "high density" Mearns' quail habitats, additional management direction is provided in Forest Service Manual 2631, restricting livestock utilization to 45% or less by weight. The Forest Plan identified 225,410 acres of occupied habitat within several vegetation types (Table 10). High-density habitats are designated in the Chiricahua, Santa Rita Patagonia and Huachuca Mountains.

Table 10. Acres of occupied habitat for Mearns' quail identified in the 1986 Coronado National Forest Plan.

Vegetation Community	Habitat Acres
Southwestern desertscrub	16,320
Desert Grassland	10,871
Plains grassland	26,349
Chaparral	306
Broadleaf evergreen woodlands	154,440
Coniferous woodlands	7,841
Dry desert riparian	1,149
Deciduous riparian	3,070
Evergreen riparian	5,064
Total	225,410

Mearns' quail breeding range extends northward from central Mexico to the mountains of southwest Texas, southwest New Mexico and Southeast Arizona. On the Coronado National Forest, they are commonly found in Madrean evergreen woodlands throughout the Forest at elevations from 3,500 to 5,500 ft. Highest densities are found in the Atascosa, Tumacacori, Santa Rita, Patagonia, Huachuca, Chiricahua and Peloncillo Mountains.

Mearns' quail habitat on the Forest consists predominantly of open Madrean evergreen woodlands containing oak *(Quercus spp.*), juniper (*Juniperus spp.*) and pines (*Pinus spp*.) with abundant grass understory (Bristow and Ockenfels 2000). A perennial grass understory over 6 inches (15 centimeters) in height is important to this species as hiding cover from predators. Lack of suitable hiding cover is thought to decrease survival (Hefflefinger and Olding 2000). Tall grass is also important as thermal cover for roosting birds. At night, the birds huddle in tight groups on the ground in tall grass commonly in a drainage bottom. The roost site is often near habitat structure that provides additional thermal cover (Stromberg 1990). In addition to grass cover, quail use is positively related to tree canopy cover greater than 20%. They rarely venture more than 45 yards from the edge of the trees (R. Brown 1978).

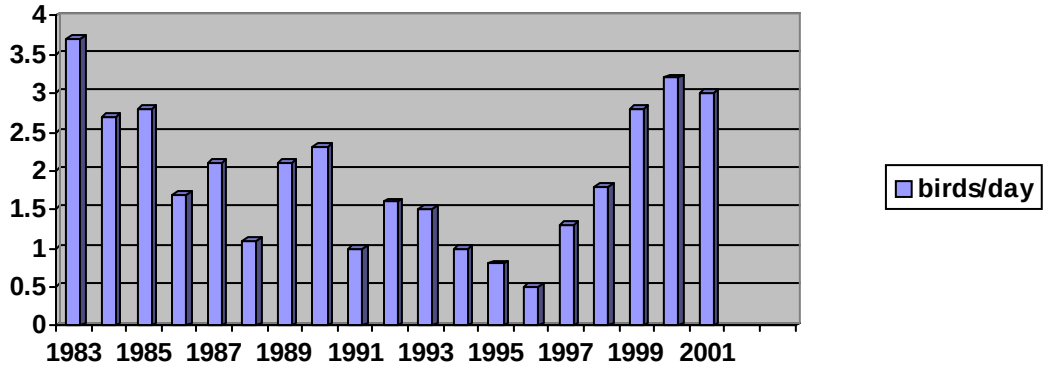
Montezuma quail breeding typically begins in mid-June and young birds are hatched in August. Reproductive timing coincides with the summer "monsoon" storms that begin in early July and provide the majority of the annual precipitation throughout much of Montezuma quail range. Nearly all of the plants the quail rely on for food and cover grow in response to summer precipitation. Montezuma quail are highly terrestrial. They feed exclusively on the ground

where they dig for bulbs and tubers of wood sorrel (*Oxalis amplifolia*) and flat sedge (*Cyperus rusbyi*) that comprise the majority (50-85%) of their diet. The remainder of their diet is comprised of seeds and insects (Bishop and Hungerford 1965, Brown 1978). They occasionally drink water, but are capable of subsisting on moisture provided by their food (D. Brown 1989).

Heavy grazing in Montezuma quail habitats has been shown to impact quail populations regardless of food availability. R. Brown (1978, 1982) found that 95% of the mated pairs counted during his study were located in areas averaging 45% grazing utilization or less for their entire home range. Grazing in excess of 55% by weight nearly eliminated local quail populations by removing available cover, even though production of preferred quail food plants was higher on heavily grazed pastures. Bristow and Ockenfels (2000) studied quail populations in both grazed and ungrazed sites on the forest. They concluded that the Forest's grazing program as currently administered on the study area was not significantly affecting the Mearns' quail population.

Population trends: Effective techniques for measuring Mearns' quail abundance are lacking (Stromberg 2000). Unlike Gambel's, scaled and masked bobwhite quail, Mearns' quail cannot be reliably censused using breeding season call counts. Brown (1976) attempted to use taped recorded calls to elicit a response, but met with limited success. Methods including mark-recapture and surveying for sign have also proved unreliable (Brown 1976). Bristow and Ockenfels (2000) successfully used pointing dogs to estimate relative abundance of birds among various areas, seasons and years. A total of 51 survey routes were censused on 5 study sites in southeastern Arizona between 1997 and 2000. Arizona Game and Fish Department biologists, Forest Service biologists and volunteers have conducted periodic flush counts since the mid-1990's. Survey efforts have concentrated in the core of Mearns' quail distribution on the Forest, which consist of the Tumacacori, Santa Rita and Huachuca EMAs. These efforts were recently terminated because of difficulty in finding good bird dogs and collecting statistically valid data. In addition, AGFD has collected harvest data from quail hunters in selected canyons since approximately 1980. Since 1987, harvest data has been collected annually by AGFD via a small game mail questionnaire. Harvests have fluctuated widely, but are currently at the same levels they were at in 1986 (Figure 3).

Figure 3. Mearns' quail harvest trends in southeastern Arizona, 1983-2001.



Evaluation. Quail population fluctuations are highly correlated with two things: the amount and timing of summer precipitation and the presence of suitable cover, yearround. Like many small game species, populations can fluctuate dramatically from year to year in response to rainfall, but are capable of rapid recovery. Grazing utilization rates have been generally reduced in Mearns' quail habitats across the Forest as allotment management plans have been revised, but the number of acres affected has not been quantified. Mearns' quail habitat is of sufficient quality, distribution and abundance to allow the species to be well distributed across the CNF. The species appears to have utility as an indicator of residual herbaceous cover in Madrean evergreen woodlands.

Revised and updated: 05-2002 (RAG)
02-16-2005 (RAG)

Baird's Sparrow (*Ammodramus bairdii*)

Baird's sparrow is included in the Species Needing Herbaceous Cover indicator group. The species was selected for the Forest Plan because of its association with tall, dense tobosa/gramma grasslands. This habitat is impacted by livestock grazing (USFS 1982).

The Baird's sparrow breeds in the mixed grass prairies of the northern Great Plains. The species winters in the southwest from Texas to Arizona. In southeastern Arizona, it prefers hilly grasslands at 4,000 to 5,000 feet. The CNF is in the northwest corner of the winter range for the species. Structure of the grassland may be more important than species composition. The species apparently avoids overgrazed rangeland and most agricultural land. It occurs only in the winter and can be sporadic in numbers and distribution (Whetstone 1995). The Forest Plan gives no data for acres of occupied habitat on the Coronado National Forest. It is the only non-breeding species selected as a MIS.

Monitoring data and population trends. On a state scale, the species is rare with 6 to 20 occurrences in the Arizona or few individuals or acres (AGFD 2001). BBS data indicate a 1.9% annual decline in Baird's sparrow populations from 1966-1990 (USGS 2002). The decline appears to be related to agricultural practices in nesting habitats, specifically conversion of native prairie to agriculture. On wintering grounds, threats include overgrazing and urban development, but only a small percentage of suitable habitat is found on the CNF. Whetstone (1995) conducted an extensive inventory of potential habitats for the species on the CNF. He identified the San Rafael Valley as the most significant wintering area for the bird on the Forest. Ruth (U.S. Geologic Survey, pers. comm. with T. Deecken) offers the most comprehensive survey information for that valley. This author noted the number caught in mist nets after flushing birds in 7-hectare plots over a 3-year period. Preliminary results are presented in Table 11, below.

Table 11. Densities of Baird's sparrows in the San Rafael Valley, 1999 to 2001. (*from* Janet Ruth, U.S. Geologic Survey, pers. comm.)

	Density by Year *(no. birds/7 hectare)*		
Plot No.	1999	2000	2001
1	3	5	3
2	4	0	0
3	6	3	0
4	1	0	1
5	6	4	3
6	6	2	1
Average	4.33	2.33	1.33

These data suggest an apparent downward trend in the species wintering population over the 3 years of the study. Ruth also suggested an apparent species affinity for grass stands of 4 to 8 inches in height, and negative associations with grass structure greater than 15-20 inches in height.

During the period 1996 to 2001, Baird's sparrow was recorded only twice on the Ramsey Canyon Christmas Bird Count. During 1997 to 2000, the species was seen 4 times with a high number of 5 in 2000 on the nearby Patagonia count (National Audubon Society 2002).

Evaluation. Baird's sparrow habitat is neither abundant nor well distributed on the Forest, and observations of the species are few. Limited suitable habitats exist on the Forest, but the species appears to prefer open grasslands at lower elevations off of the Forest. The bird is among the most difficult of North American birds to observe (Whetstone 1995). It is solitary, secretive and easily confused with other sparrows, even by experienced observers. It is a non-breeding winter migrant at the fringe of its range in southern Arizona. The species' population trends appear to be primarily influenced by conditions in its northern prairie breeding grounds. These factors all tend to diminish the species' value as an MIS.

American Peregrine Falcon *(Falco peregrinus anatum)*

This species is included in the Threatened and Endangered Species group in the Forest Plan. It was selected as an indicator for the Forest Plan because it requires suitable cliffs for nesting and is sensitive to recreation (rock climbing), mining and localized timber and fuelwood harvest (USFS 1982). The species was listed by the USFWS as an Endangered Species in 1986 when the Forest Plan was adopted, but de-listed in 1999 when it was determined that recovery plan goals had been exceeded. It is still a Forest Service Sensitive species. The Forest Plan gives no data for acres of occupied habitat on the Coronado National Forest, although it was noted that there were limited yearlong sightings on the Forest.

Population trends. More than 200 breeding pairs are known for Arizona, a number that has risen significantly from 20 years ago (Glinski 1998). Garrison and Spencer (1996) noted that fledging production averaged 1.2 birds per eyrie during the 1995 breeding season in the State. Selected falcon nests are monitored annually on the CNF. Reproductive success for the period 1990 to 2001 for samples of the 29 known eyries on the Coronado National Forest is presented in Table 12 below. Populations have increased on the CNF since 1986. Nationwide, the Peregrine falcon population is considered secure and has been increasing for the past 30 years (USFWS 2003). A monitoring plan has been developed as part of the de-listing strategy for the bird (USFWS 2003). Twelve territories on the Forest have been identified for continued long-term monitoring in the monitoring plan.

Table 12. Reproductive success for monitored eyries on the Coronado National Forest, 1990 to 2001 (U.S. Forest Service, unpublished)

	Year											
Reproductive Success	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*
No. of Eyries Monitored	10	no data	8	8	9	8	5	no data	5	1	1	9
Average no. of young fledged/eyrie	.8	no data	.8	.9	1.1	1.4	no data	no data	.8	2.0	3.0	1.2

Habitat trends. The cliff habitats used by nesting peregrines are relatively unaffected by management, so the amount of available habitat is considered stable. Beginning in approximately 1990, annual seasonal closures have been in effect on several eyries where recreational rock climbing has been shown to negatively affect falcons. Reductions in nesting season disturbance have resulted in increases in the quality of available habitats. Closures are expected to remain in effect as long as falcons are using the affected territories.

Evaluation. Populations of Peregrine falcons are found in suitable habitats in nearly all mountain ranges on the CNF and are considered secure. Habitat for the species is sufficient to allow the species to be well distributed across the Forest, although the availability of suitable cliff sites will eventually limit population expansion. Threats to the population have been reduced through seasonal closures to protect nest sites. The species is relatively easy to monitor although periodic natural fluctuations in such a small breeding population make trends difficult to detect. Because of the sensitivity of the species to recreational disturbance, it has some utility as a management indicator for this type of activity. However, large-scale population trends may be affected by events and conditions off of the Forest. The range-wide increase in population for

the species is no doubt due in large part to the elimination of organochloride pesticides in the U.S.

Revised and updated: 5-2002 (RAG);
2-16-2005 (RAG)

Five-striped sparrow (Aimophila quinquestriata)

The Five-striped sparrow is included in the Special Interest Species and the Threatened and Endangered Species indicator groups. The species was identified with subtropical desert grasslands, scrub and thornscrub in steep walled canyons. It was identified as being sensitive to recreation, grazing and fuelwood harvesting (USFS 1982). The range for Five-striped sparrows is centered in Mexico. The population nesting on the CNF is at the extreme northern edge of the species' distribution. The Forest Plan identified 18,279 acres of occupied habitat on the CNF (Table13). In 1981, five breeding localities were known on the CNF: Tonto, Sycamore and Holden Canyons in the Atascosa Mountains and Chino Canyon in the Santa Rita Mountains. Management activities that could threaten the species existence on the forest are grazing and brush removal projects that reduce grass and shrub density essential for nesting.

Table 13. Acres of occupied habitat for Five-striped sparrow identified in the Coronado National Forest Plan.

Vegetation Community	Habitat Acres
Southwestern desertscrub	1,509
Broadleaf evergreen woodlands	15,610
Dry desert riparian	408
Deciduous riparian	752
Total	18,279

Habitat for Five-striped sparrows consists of dense hillside vegetation ranging from brushy semidesert to tropical deciduous woodland (Groschupf 1992). The density of the vegetation, rather than the species composition or topography, appears to be the most important factor determining habitat suitability (AGFD 1998). The species is migratory in the northern extreme of its range. Nesting in Arizona occurs June through September and the species has left breeding territories by October.

Monitoring methods and population trends. No formal surveys have been accomplished for Five-striped sparrows since 1991 when Groschupf (1994) revisited sites intensively monitored during the 1970's. The species has not been detected on the Pena Blanca breeding bird survey route (USGS 2002). The only trend data available are provided by Groschupf (1992) showing an apparent decline in bird numbers between 1977 and 1991. No reasons for the apparent decline were evident, but periodic range contractions and expansions are not uncommon for species at the edge of their geographic range. Because of its rarity, the bird is highly sought after by birders and has been observed on the Forest every year. Historic habitats are presumed to be occupied based on regular observations.

Evaluation. The Five-striped sparrow is a Mexican species and southern Arizona is at the very northern tip of its breeding range. It was first observed in Arizona in 1957, apparently as a result of northward range expansion of the main population centered in Mexico. Its range within the CNF is limited by its requirement for dense, brushy tropical deciduous woodland between 3500-4000 feet; therefore it is unlikely that the species will ever be abundant and well distributed across the Forest. Because of its extremely limited distribution on the CNF, the population on the Forest is easily influenced by events off of the Forest or stochastic events that affect the species primary breeding areas. Demographic data on local populations are lacking, as are

quantified habitat parameters. These factors tend to limit the usefulness of the species as a Forest-wide MIS; however, because of the species' rarity in the U.S., the Forest should continue to support monitoring efforts.

Revised and updated: 5-2002 (RAG); 2-10-2005 (RAG)

Mammals

Black Bear (*Ursus americanus*)

Black bear is included in the Riparian Species, Species Needing Diversity and the Game Species indicator groups. It was selected primarily because of the occurrence of a high-density population in the Pinaleno Mountains and because it is dependent on heavy cover. The Forest Plan identified 641,113 acres of occupied habitat in all vegetation types except plains grassland and dry desert riparian. Because of the "sky island" nature of the CNF, black bear populations tend to be isolated from each other by wide expanses of non-suitable habitat between the mountain ranges. Some movement between ranges is known to occur, but is not common.

Black bears are habitat generalists and do best in areas of high vegetative diversity. They will use riparian areas for cover and as travel corridors. Individuals establish home ranges but are capable of moving great distances in response to climatic conditions or food availability. They feed on a variety of items including berries, acorns, grass, insects, mesquite beans and carrion. Prickly pear cactus fruits are seasonally important in some years. In general, their diet consists of approximately 90% plant material and only 10% animal matter, primarily in the form of insects. Black bears are relatively intelligent and opportunistic and will occasionally become a nuisance in developed campgrounds where human food is available. They can be effective predators, and have been known to take livestock, especially calves, on occasion. Black bears are normally solitary and will establish and defend territories, a behavior that tends to limit population densities in any given area.

Population Trends: Black bear populations are highly correlated to annual precipitation and its effect on the production of preferred foods such as oak acorns and manzanita berries. Bear numbers are also influenced by hunting, which is regulated by the AGFD. Because of their secretive nature and affinity for dense cover, black bears are extremely difficult to census. AGFD estimates populations based on qualitative analyses of habitat carrying capacity. In 1980, the population was estimated to be 209 animals on the CNF, based on AGFD estimates (USFS 1982). In 1999, the statewide population was estimated to be 2500 black bears in 12,600 square miles of occupied habitat (AGFD 1999). A current forest-wide population estimate is not available, but the range of the species on the CNF has not changed significantly since 1986.

Hunt structures are generally conservative with an annual harvest target of no more than 125 females and a total of 250 or more bears. Recently, bear hunt structures have been aimed at reducing populations in areas where nuisance bear activity is high. Sport and depredation harvest data are collected by the AGFD (Table 14). An additional number of bears are annually captured and moved or killed as nuisance bears in southeastern Arizona. Many of these animals are presumed to have originated on the CNF. The number of nuisance bears captured is generally small, although the number has risen over the past few years. Twenty-five bears were captured during 2000-2001. Bear management activities on the CNF have focused on reducing bear-human interactions through installation of "bear proof" trash containers and food boxes throughout the Forest.

Table 14. Black bear sport harvest from game management units within the Coronado National Forest, 1995-2000.

	Management Unit						
Year	29	31	32	33	34A	35A	Total
1995	8	7	2				17
1996	1	7	3	3	1	1	16
1997	23	8	7				38
1998	4	7	1				12
1999	15	27	5			1	47
2000	13	23	16		1		53
2001							
2002							
2003	18	8	6		1	4	37
2004							

Evaluation. Black bears are both wide-ranging and secretive, making them extremely difficult to census with any degree of accuracy. No attempts are made to survey for bears on the Forest. However, they are highly adaptable generalists and are not highly correlated with a particular habitat except for dense cover in the 1-6 foot height class. This type of cover is abundant across the forest. Populations are primarily influenced by annual rainfall and by sport hunting or depredation removal.

Across the Forest, habitat is of sufficient quality and abundance to allow the species to be well distributed across federal lands. Historic habitats remain occupied, although the population fluctuates within occupied habitats based on the availability of forage. No discernable population trends can be detected, although it is generally believed that poor mast crops over the past several years have led to a decrease in the carrying capacity for bears on the Forest. This has been evidenced by an increase in nuisance bear interactions both on and off of the Forest. This is part of a long-term cycle in populations related to climate and is not influenced to any degree by management. Black bears are not well suited as a MIS as it is difficult to estimate population numbers and to correlate population numbers to a specific habitat type on a Forest-wide scale. The limited information available on annual harvest provides little insight into habitat conditions.

Revised and updated: 5-2002 (RAG); 7-5-2004 (RAG); 2-10-2005 (RAG)

White-tailed Deer (*Odocoileus virginianus couesi*).
White-tailed deer is included in the Species Needing Diversity, Species Needing Herbaceous Cover and Game Species indicator groups. The species was selected as a management indicator of light to moderate quality encinal oak and oak grassland habitats (USFS 1982). According to the background materials in Forest Files: "Overgrazing of these habitats results in invasion by shrubs causing disappearance of white-tailed deer. Large scale fuel wood cutting can open up encinal stands permitting invasion by shrubs with subsequent loss of white-tailed deer…Prescribed burns can open up chaparral and dense stands of pinyon-juniper creating favorable conditions for white-tailed deer." (USFS 1981). The Forest Plan identifies 1,430,071 acres of occupied habitat for the species in all vegetation types on the Forest.

Coues white-tailed deer range from the mountain ranges of northern Mexico north through central and southeastern Arizona to the Mogollon Rim. They occur primarily in mixed oak woodlands and higher elevation semidesert grasslands and locally in pine forests and along riparian corridors (Ockenfels 1991).

Monitoring Methods and Population Trends: The AGFD conducts annual surveys of white-tailed deer to determine annual recruitment in order to set hunting permit numbers for the following season. The data are collected on the basis of a game management unit, but the majority of whitetail habitat in southeastern Arizona is found on the CNF. The Coronado Forest Plan identifies 1,430,071 acres of occupied habitat for Coues white-tailed deer. The amount of occupied habitat has not changed significantly since 1986. Observational evidence tends to indicate that as mule deer populations decline, whitetails are moving into areas previously occupied by mule deer on the CNF (Gerhart, pers. obs.). In 1999 the Arizona Game and Fish Department (AGFD) estimated a total of 80,000 post-hunt adult deer in approximately 9000 square miles of habitat statewide (AGFD 1999). Statewide population trend is slightly down. This trend is thought to be related primarily to changes in the amount and timing of precipitation since the mid-1990's and the subsequent effects on fawn survival. White-tailed deer on the CNF are following this trend. Since 1986, fawn survival has declined somewhat throughout southeastern Arizona, but white-tailed deer populations in 1986 were at near record high levels and probably above the long-term carrying capacity of the habitat (Figure 4).

Since 1986, several large wildfires have occurred on the CNF in white-tailed deer habitat. These include the Redington and Rattlesnake Fires (1994), the Shovel Fire (1995), Clark Peak Fire (1996), Lone Fire (1999), the Ryan and Bullock Fires (2002), Aspen fire (2003) and the Nuttall Complex Fire (2004). It is anticipated that the effects of these fires will benefit white-tailed deer over the long term by opening up the forest canopy and creating a variety of seral stages.

White-tailed deer harvest data for game management units included within the CNF are shown in Table 15. Since 1986 when the CNF Plan was approved, average annual whitetail harvests have fluctuated in the vicinity of 3500 deer, but no clear trends are discernable (Figure 5).

Figure 4 . White-tailed Deer Survey Information, 1986-2001

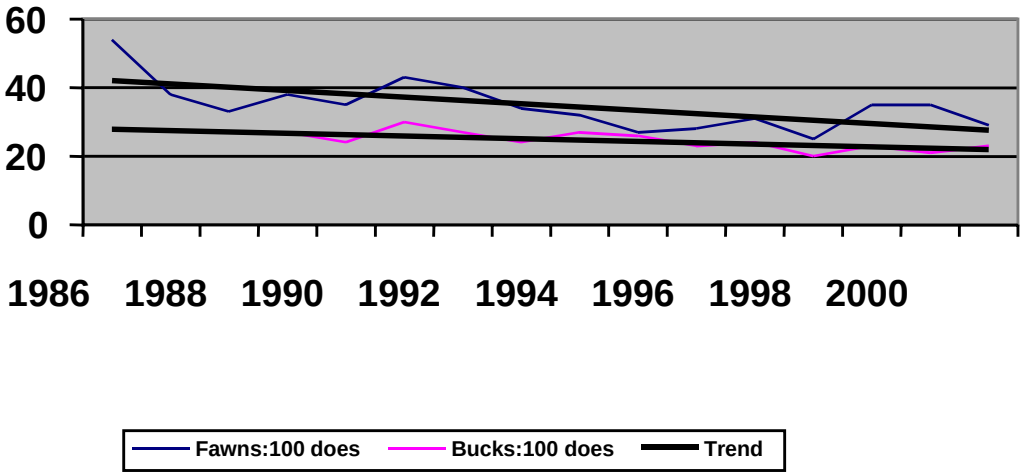
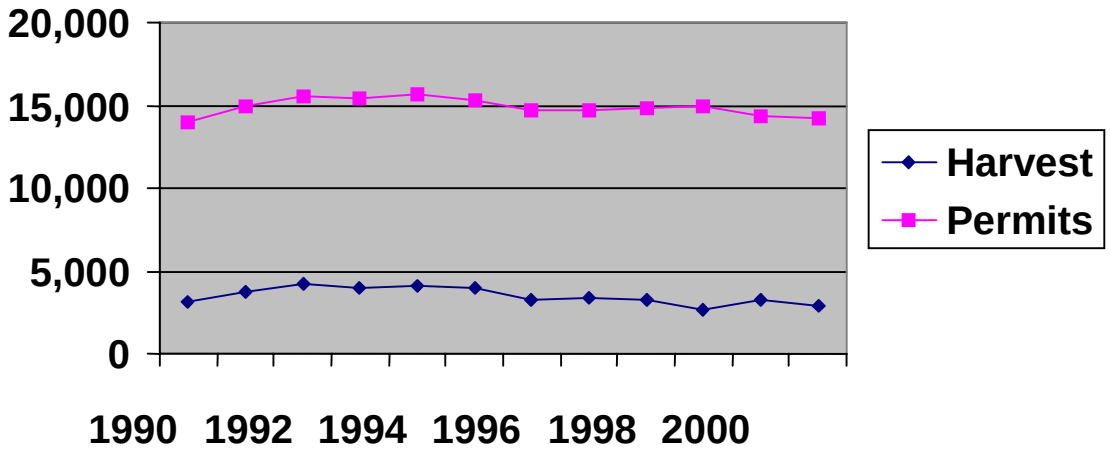


Table 15. White-tailed deer harvest data for SE Arizona, 1986-2003.

Year	Permits	Harvest	Percent Success
1986	18,000	4,094	28.5
1987	15,000	3,198	24.5
1988	13,100	2,855	24.8
1989	13,850	2,976	24.3
1990	14,000	3,165	25.0
1991	15,000	3,770	28.5
1992	15,600	4240	30.3
1993	15,408	3998	29.2
1994	15,633	4122	29.4
1995	15,341	3943	28.7
1996	14,678	3209	23.7
1997	14,725	3338	25.3
1998	14,771	3266	24.7
1999	14,927	2661	20.1
2000	14,375	3253	25
2001	14,259	2874	23
2002		3160	22
2003		3502	25

Figure 5. Southern Arizona white-tailed deer harvest trends, 1990-2001



Evaluation. White-tailed deer were selected as an indicator of herbaceous cover and diversity. No targets for either of these characteristics were set in the CNF Plan. However, white-tailed deer habitat is of sufficient quality, distribution and abundance to allow species population to stabilize and to be well distributed across the CNF. Populations of the species have declined somewhat since 1986, primarily as a result of the effects of precipitation, but annual recruitment is still sufficient to provide a harvestable surplus averaging 3500 bucks per year in southeastern Arizona. Suitable habitats remain occupied throughout the Forest.

Revised and updated: 6-15-2004 (RAG); 2-16-2005 (RAG)

Pronghorn Antelope (Antilocapra americana)

Pronghorn is included in the Species Needing Herbaceous Cover and Game Species indicator groups. It was selected as an indicator for the Forest Plan because it inhabits plains and semi-desert grasslands with a diversity of forbs and grasses. It is sensitive to grazing, human development and fencing (USFS 1982).

Pronghorn inhabit the grasslands in the Sulphur Springs, San Rafael and San Bernardino Valleys and Altar Valleys and the Sonoita grasslands north of the Canelo Hills. In general, pronghorn populations in southeastern Arizona are found off of the CNF, with Forest lands providing seasonal or fringe habitats. The Forest Plan identifies 57,692 acres of occupied habitat for the Coronado National Forest (Table 16).

Table 16. Acres of occupied habitat for Pronghorn antelope in the Coronado National Forest Plan.

Vegetation Community	Habitat Acres
Desert grasslands	11,687
Plains grasslands	16,518
Broadleaf evergreen woodlands	21,788
Coniferous woodlands	5,890
Evergreen riparian	1,809
Total	57,692

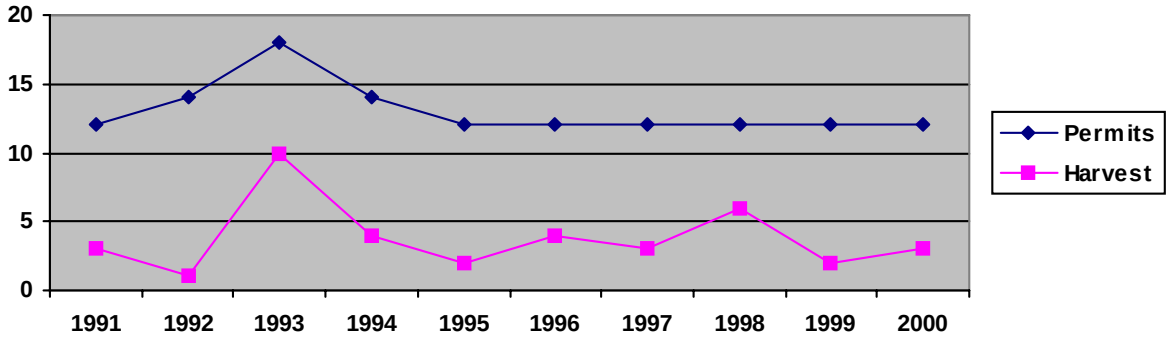
Monitoring Data and Population Trends. The Arizona Game and Fish Department conducts surveys for pronghorn on an annual basis. The following information is available for Units 35A and 35B.

Table 17. Survey information for pronghorn in Wildlife Management Unit 35A and 35B, 1987 to 2002 (*from*: John Millican, Arizona Game and Fish Department, unpublished)

	Population Estimate by Area					
	San Rafael Valley		Elgin		Total	
Year	*buck:does:fawns*	*total*	*buck:does:fawns*	*total*	*buck:does:fawns*	*total*
1987/1988	5:30:6	41	21:46:7	74	26:76:13	115
1988/1989	9:33:8	50	17:22:2	41	26:55:10	91
1989/1990	5:28:5	38	11:22:2	35	16:50:7	73
1990/1991	10:26:5	41	19:23:5	47	29:49:10	88
1991/1992	10:16:5	31	12:25:11	48	22:41:16	79
1992/1993	15:15:4	34	20:41:20	81	35:56:24	115
1993/1994	7:8:4	19	22:54:8	84	29:62:12	103
1994/1995	11:10:3	24	10:50:7	67	21:60:10	91
1995/1996	11:16:1	28	9:51:15	75	20:67:16	103
1996/1997	5:7:0	12	15:58:18	91	20:65:18	103
1997/1998	7:10:2	19	7:85:21	113	14:95:23	132
1998/1999	8:10:7	25	19:62:14	95	27:72:21	120
1999/2000	10:10:0	20	27:56:5	88	37:66:5	108
2000/2001	7:14:2	23	15:75:8	98	22:89:10	121
2001/2002	7:11:1	19	24:54:11	89	31:65:12	108

Units 35A and 35B include everything south of State Highway 82, west of the San Pedro River, and north of the Mexican border. Harvest and permit number trends for Unit 35A and 35B are presented in Figure 6, below.

Figure 6. Permit numbers and harvest trends for pronghorn in Wildlife Management Units 35A and 35B, 1991 to 2000 (*from*: Arizona Game and Fish Department, unpublished).



Pronghorn populations in southeastern Arizona were considered to be stable or slightly increasing through much of the 1990's. Recent poor fawn recruitment is thought to be causing a slight decline in total numbers. Numbers of animals in the San Rafael Valley herd have been declining over the past several years. Causes include periodic drought, possible poaching in nearby Mexico, and past over utilization of forage by livestock in other portions of the San Rafael Valley. Private land conversion from undeveloped to semi-residential "ranchettes" and attendant new fencing may be limiting the distribution of animals in the Elgin/Sonoita herd.

Evaluation. Management of pronghorn on the CNF is complicated by the fact that large areas of habitat are on private lands adjacent to the Forest. In general, habitat on the Forest is not of sufficient size or distribution to support a population of pronghorn without adjacent private or state parcels. While pronghorn might otherwise be a reliable indicator for herbaceous cover, populations on the CNF are significantly influenced by off-forest management and habitat conditions. This influence tends to mask the effects of Forest management on the species.

Revised and Updated: 5-2002 (RAG);
2-16-2005 (RAG)

Desert Bighorn Sheep (*Ovis Canadensis deserti*)

Desert bighorn sheep are listed in the Game Species and Threatened and Endangered Species groups in the Forest Plan. They were identified with (USFS 1982). Bighorn were endemic to the Pusch Ridge Wilderness Area (PRWA) of the Santa Catalina Mountains. It was selected as a management indicator because of its special habitat needs (rugged, open canopied mountains with scattered stands of grass and water) and sensitivity to dispersed recreation. The Forest Plan identified 72,458 acres of occupied habitat in (Table 18).

Table 18. Acres of occupied habitat for Desert bighorn sheep identified in the 1986 Forest Plan.

Vegetation Community	Habitat Acres
Southwestern desertscrub	15,829
Chaparral	3,227
Broadleaf evergreen woodlands	44,227
Coniferous forests (mixed conifer)	7,722
Dry desert riparian	125
Evergreen riparian	1,328
Total	72,458

Monitoring data and population trends. The Forest Plan identified the following items for monitoring bighorn in the Santa Catalina Mountains: Human effects, vegetation use and population trend (Appendix 1). A prescribed burn on the PRWA was accomplished in 1990 and effects were monitored by the University of Arizona in cooperation with the CNF. Over the past decade, the forest has supported research into the effects of human recreation on bighorn in the PRWA (Harris 1992, Schoenecker 1997, and others) and public attitudes toward wildlife (Devers 1999). The AGFD continued to fly helicopter surveys until 1997 when they were discontinued due to a lack of observations.

The bighorn population in the PRWA has declined over the past 15 years to the point where it is likely not viable. The reasons for the decline are the subject of a great deal of speculation and research, but it appears likely that a combination of urban encroachment, recreational disturbance, habitat fragmentation and predation are to blame. In 1996, the PRWA was closed to off-trail hiking and to dogs in an effort to minimize known disturbances to bighorn. This closure remains in effect.

Evaluation. The decline of the PRWA bighorn population was likely underway in 1986 when the Forest Plan was adopted. Recent habitat evaluations conducted by the AGFD indicate that suitable habitats persist on the PRWA, but that these habitats are being impaired by proximity to urban development and dense brush in portions of the range. The CNF, in cooperation with the AGFD, are continuing to evaluate the potential of an experimental release of bighorn back into the PRWA in order to determine habitat use, dispersal and limiting factors for bighorn on Pusch Ridge. Until the reasons for the decline of the population are more fully understood, and given the absence of population data, the species has low utility as a MIS.

Revised and updated: 5-2002 (RAG)

Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*)

The Mount Graham red squirrel is listed in the Threatened and Endangered Species group in the Forest Plan. This subspecies was listed as Endangered by the USFWS in 1987 (52 FR 20997). In 1982, when the Analysis of the Management situation was being developed, the status of the squirrel's population was poorly documented and it was not originally considered as a MIS (USFS 1982).

The Mount Graham red squirrel inhabits spruce-fir and mixed conifer forests at higher elevations of the Pinaleno Mountains on the CNF. Threats to the subspecies currently include habitat loss caused by cumulative effects of human activity, including recreational development, fire suppression and development of an astrophysical complex and potentially, competition from introduced tassel-eared squirrels (*Sciurus aberti*). Recently, insect and disease outbreaks in the Pinaleno Mountains have impacted occupied habitats by killing trees over large areas of occupied habitat.

Population trends. Long-term monitoring of red squirrel populations began in 1986 and has continued through to the present. Intensive monitoring of squirrel populations has centered on determining the impacts of the construction of the Mount Graham International Observatory. Much of this work has been carried out by the University of Arizona and has been reported by Young et al (2001). Additional monitoring throughout occupied habitats has been accomplished by the CNF and the AGFD in the form of semi-annual midden census. The results of 15 years of midden census were recently compiled by the CNF and are shown in Figure 7 and Table 19.

Figure 7. Trends in Mount Graham red squirrel population estimates, 1991-2001.

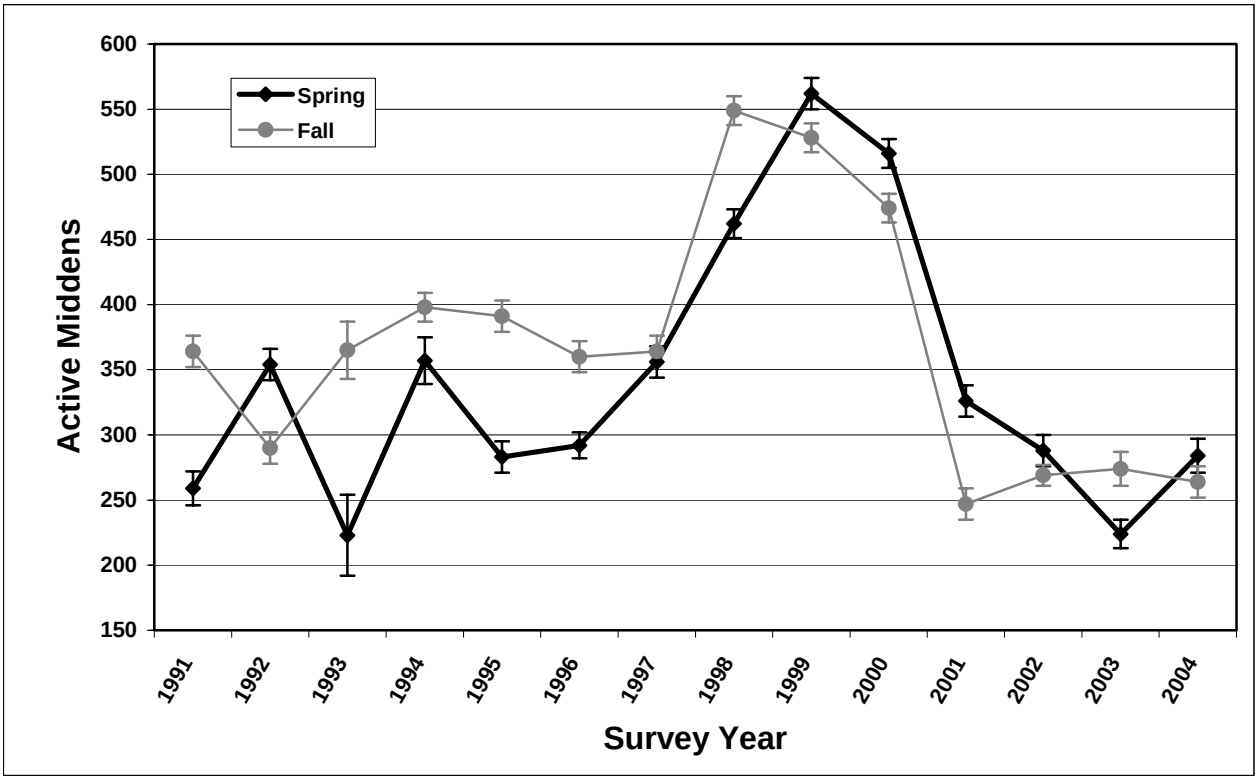


Table 19. Results of Mt. Graham Red Squirrel Population Estimates, 1986-2001

Survey	Sample Size	Conservative	Optimistic
Spring 86	207	348 +/- 55	
Fall 87	150	235 +/- 40	
Spring 88	45	210 +/- 62	
Fall 88	45	194 +/- 62	258 +/- 62
Spring 89	166	146 +/- 29	221 +/- 32
Fall 89	267	191 +/- 15	204 +/- 15
Spring 90	271	152 +/- 15	169 +/- 16
Fall 90	396	260 +/- 7	265 +/- 7
Spring 91	208	272 +/- 13	280 +/- 13
Fall 91	236	380 +/- 16	400 +/- 17
Spring 92	250	370 +/- 16	383 +/- 16
Fall 92	217	306 +/- 16	355 +/- 19
Spring 93	210	223 +/- 31	301 +/- 31
Fall 93	231	365 +/- 22	385 +/- 22
Spring 94	234	375 +/- 18	372 +/- 19
Fall 94	246	409 +/- 11	428 +/- 11
Spring 95	239	283 +/- 12	352 +/- 12
Fall 95	251	391 +/- 12	423 +/- 12
Spring 96	246	291 +/- 10	323 +/- 12
Fall 96	254	360 +/- 12	402 +/- 12
Spring 97	265	356 +/- 12	376 +/- 12
Fall 97	305	364 +/- 12	420 +/- 11
Spring 98	251	462 +/- 11	492 +/- 11
Fall 98	238	549 +/- 11	583 +/- 11
Spring 99	252	562 +/- 12	571 +/- 11
Fall 99	276	528 +/- 11	531 +/- 11
Spring 00	252	516 +/- 11	544 +/- 11
Fall 00	184	474 +/-12	491 +/-12
Spring 2001	259	326 +/-12	367 +/- 12
Fall 2001	263	247 +/-11	292 +/-11

Habitat Trends. Beginning in 1998, large numbers of mature spruce trees on Mount Graham began dying from a spruce beetle outbreak. As of the summer of 2004, at least 1,400 acres of mature spruce trees have been killed by beetles. This tree mortality has greatly reduced the ability of the area to support red squirrel populations. In June 2004, the Nuttall Complex wildfire burned 29,700 acres on Mount Graham, including areas providing red squirrel habitat. As a result, habitats for the squirrel on the mountain have been substantially reduced.

Evaluation. Habitats for the Mount Graham red squirrel remain occupied, but significant threats to the species continue in the form of insect and disease outbreaks and the potential for catastrophic fire. Monitoring of the species will continue into the foreseeable future, regardless of its status as MIS.

Revised and updated: 5-2002 (RAG)
2-16-2005 (RAG)

Reptiles

Desert massassauga (*Sistrurus catenatus edwardsii*)

The Desert Massassauga is included in the Species Needing Herbaceous cover and Threatened and Endangered Species groups in the Forest Plan. It is also a Forest Service Sensitive species and is protected from collection by Arizona State law. It was selected as an indicator of high quality grasslands. It is sensitive to grazing and collection (USFS 1982). A total of 389 acres of occupied habitat was identified in the Forest Plan; however, there are no records that the species ever occurred on Forest lands (AGFD 2001). The massassauga is found primarily in tobossa (*Hilaria mutica*) grasslands in the San Bernardino Valley at the southeast corner of the Chiricahua Mountains. It is a small nocturnal rattlesnake that spends most of its time underground. It is active April to October (AGFD 2001).

Population and habitat trends. The species has not been found on the Forest so no estimate of population or habitat trends on the CNF is possible. Lowe et al (1986) speculate a stable population along Highway 80 in the San Bernardino valley based on a fairly constant number of road kills each year.

Evaluation. The massassauga is Arizona's most rare rattlesnake (Lowe et al. 1986). No conclusions can be drawn regarding massassauga populations on the Forest. There are no historic records from the Forest. As an indicator for habitats on the Forest, the species has no utility.

Revised and updated: 5-2002 (RAG)

Arizona Ridge-nosed Rattlesnake *(Crotalus willardi willardi)*

This species is included in the threatened and endangered species indicator group for the Forest Plan. It was noted during the planning process that the species could be potentially impacted by clear-cut logging and by mining in the Patagonia Mountains (USFS 1981). Habitat was described as bottoms and hillsides in evergreen oak and pine-oak woodland. The species is designated as a Forest Service Sensitive species, and is protected from collection by Arizona State law. Illegal collectors alter rock crevices and forest floors while searching for ridge-nosed rattlesnakes and remove an unknown number of individuals from the population.

The Arizona ridge-nosed rattlesnake is found in 4 mountain ranges in southeastern Arizona. Elevations for the species range from 4,800 to 9,000 feet. It is most often associated with broadleaf evergreen woodland, evergreen woodland, deciduous and evergreen riparian, and mixed and transition coniferous forest. Chaparral is used to a lesser extent. Microsites within these broader vegetation types include rock crevices, dense leaf litter, and bunchgrasses (Arizona Game and Fish 2001n; Johnson 1983). The Forest Plan identifies 28,175 acres of occupied habitat for the species on the Coronado National Forest (Table 20).

Table 20. Occupied habitat for Arizona ridge-nosed rattlesnake: 1986 Forest Plan.

Vegetation Community	Habitat Acres
Plains grassland	1,867
Broadleaf evergreen woodlands	14,642
Coniferous woodlands	2,766
Coniferous forests (transition)	7,401
Coniferous forest (mixed conifer)	1,279
Riparian	220
Total	28,175

Monitoring methods and population trends. Species population rankings are shown in the Arizona Heritage Database. On a global scale, the Arizona ridge-nosed rattlesnake is considered demonstrably secure with more than 100 occurrences. On a state scale, the species is apparently uncommon or restricted with 21 to 50 occurrences (Arizona Game and Fish 2001n).

Regional trend information for the Arizona ridge-nosed rattlesnake is not available and no systematic surveys are conducted for the species. A “general feeling” exists that it may be less common locally in the Huachuca Mountains than 25 years ago (Arizona Game and Fish 2001n).

Evaluation. Suitable habitats are extensive and abundant throughout the Huachuca, Santa Rita, Patagonia and Whetstone Mountains and Canelo Hills where the species has been documented. Commercial logging does not occur to any extent within occupied habitats and is not considered a factor. Potential habitats exist in the Chiricahua Mountains where the species has not been detected. Habitat appears to be of sufficient quality and distribution to allow the species to be well distributed; however, because of its secretive and inconspicuous nature, the snake is difficult to monitor on a large scale. Habitat, population and life history studies for the species continue to be needed.

Twin-spotted Rattlesnake (*Crotalus pricei*)

This species is included in the threatened and endangered species indicator group for the Forest Plan. The snake and its habitat are also impacted by illegal collecting (U.S. Forest Service 1981). It was not selected as a habitat indicator. It is locally common on talus slopes in ponderosa pine, aspen and mixed conifer, generally above 8,000 feet in elevation. The Forest Plan identifies 46,351 acres of occupied habitat on the CNF (Table 21).

Table 21. Occupied habitat for Twin-spotted rattlesnake by vetation type: 1986 forest plan.

Vegetation Community	Habitat Acres
Mountain grassland/meadows	314
Broadleaf evergreen woodlands	3,945
Coniferous woodlands	2,766
Coniferous forests (transition)	21,145
Coniferous forests (mixed conifer)	10,587
Coniferous forests (spruce-fir)	7,585
Total	46,351

The twin-spotted rattlesnake inhabits high elevation rock outcrops and talus slopes generally on south facing slopes in coniferous forests in at least 4 mountain ranges in southeastern Arizona (Lowe et al 1986). It can frequent open grassy forest floors and rock outcroppings in the adjacent oak woodland (Tom Deecken, District Biologist, pers. obs.). Other vegetation units, such as chaparral and evergreen woodland are probably used to an unknown extent. Twin-spotted rattlesnakes are protected from collection by Arizona State law, although illegal collecting removes an unknown number of individuals from the population each year. Collectors also alter rock crevices and forest floors while searching for twin-spotted rattlesnakes.

Population trends. Annual surveys are conducted in the Chiricahua Mountains. Species population rankings are shown in the Arizona Heritage Database. On a state scale, the species is uncommon or restricted with 21 to 50 occurrences in Arizona. It is fairly common in a rather restricted range within the state (Arizona Game and Fish 2001o).

Evaluation. Habitats for Twin-spotted rattlesnakes are relatively secure on the CNF. Much of the occupied habitat is located within designated wilderness where ground-disturbing activities are limited. The greatest threat to the species remains habitat alteration and removal of individuals by illegal collectors. While no quantitative data on population or habitat trends exists, historic habitats appear to remain occupied.

Amphibians

Western Barking Frog (*Eleutherodactylus augusti cactorum*)

This species is in the threatened and endangered species group for the Forest Plan but is not an indicator for a specific habitat type. Forest planning records indicate that it was considered "…little impacted by anything. Too secretive and difficult to census to be an indicator species" (U.S. Forest Service 1981). Nevertheless, it was included in the MIS list in the AMS where it was described as sensitive to mining, quarrying and water draw down. It is also designated as a Forest sensitive species.

The western barking frog often frequents crevices in limestone or rhyolite rock outcrops on hillsides within the Madrean evergreen woodlands. Elevations range from 5,200 to 6,200 feet. Within the CNF, they have been documented in the Huachuca, Pajarito and Santa Rita Mountains. The Forest Plan shows 891 acres of occupied habitat for the species in Broadleaf evergreen woodlands and Evergreen riparian vegetation types.

Population trends. On a global scale, the western barking frog is considered apparently secure with more than 100 occurrences, though it could be quite rare in some areas. The subspecies, *cactorum*, however, is considered uncommon or restricted with 21 to 100 occurrences. On a state scale, the species is very rare with 1 to 5 occurrences in Arizona or very few individuals or acres (AGFD 2001). Goldberg and Schwalbe (2000) studied various aspects of population ecology for the species on the nearby Coronado National Memorial during 5 years of work up to 2000. At 2 sites, densities of 27 and 5 frogs per 2 hectares areas were recorded. Theses densities were based on capture and recapture ratios over the study period on isolated limestone outcrops.

Habitat Trends. Limestone and rhyolite rock outcrops are common and well distributed throughout the Forest, although no attempts have been made to quantify their extent. These habitats are not affected to any degree by management activities and are assumed to be present in the same amount as in 1986.

Evaluation. Western barking frogs are highly secretive and have proven to be quite difficult to monitor. Because of their narrow habitat preferences (limestone outcrops), they are not well suited as indicators of larger habitat areas. There are no known threats to existing habitats. The few known populations appear to be persisting, but populations are small and isolated, so stochastic events could threaten their persistence (Goldberg and Schwalbe 2000). The Forest should continue to support research and monitoring efforts in order to gain insights into the size and distribution of populations, but the species is not well suite as a MIS.

Revised and updated: 5-2002 (RAG)

Mountain Tree Frog *(Hyla wrightorum)*

This species (Arizona tree frog, *Hyla eximia*, in the forest Plan) is in the Threatened and Endangered group but is not an indicator for an identified habitat type. Forest Planning records indicate that the species is sensitive to non-native species introduction, water draw down and activities affecting water quality (USFS 1982). However, the Arizona tree frog was not considered a good indicator species because of its extremely limited distribution (U.S. Forest Service 1981). The Forest Plan gives no data for acres of occupied habitat for the Coronado National Forest.

The species occurs in the mountains of central Arizona and southwestern New Mexico south through the Sierra Madre Occidental to central Mexico (Degenhardt et al 1996). On the CNF, it has been found in only a few locations in the Huachuca Mountains at elevations of 4,920 to 6,560 feet in evergreen woodland and riparian areas in pine-oak woodland (Sredrl and Wallace 2000).

Population Trends. On a global scale, the Arizona tree frog is considered apparently secure with more than 100 occurrences, though it could be quite rare in some areas. There is some question, however, on the taxonomic validity of the species and the global rank may change in the future. On a state scale, the species is apparently secure with more than 100 occurrences although it could be quite rare in some areas. Holm and Lowe (1995) reported the species was persisting in one pool in Scotia Canyon in 1993. No monitoring of this species is accomplished on the CNF and no conclusions regarding population trend can be drawn. There are at least 4 observations for Arizona tree frogs from the Huachuca mountains (Arizona Game and Fish 2001; Eric Wallace, pers. comm.; Tom Deecken, pers. obs.).

Habitat Trends. The species uses permanent and semi-permanent seeps and pools in canyon bottoms. These habitats have persisted and are not affected significantly by management.

Evaluation. Because of its extremely limited distribution on the CNF, it is important to maintain existing occupied habitats. However, the Arizona tree frog has limited value as a Forest-wide management indicator because of its small population size and extremely limited distribution.

Revised and updated: 5-2002 (RAG)
2-16-2005 (RAG)

Sonora Tiger Salamander (*Ambystoma tigrinum stebbinsi*)

This species was included in the threatened and endangered species indicator group for the Forest Plan because of its limited distribution and sensitivity to the introduction of non-native species (USFS 1982). The Sonora tiger salamander inhabits the plains grassland, oak woodland, and pine-oak woodland of the upper Santa Cruz and San Pedro Rivers. The Forest Plan shows 640 acres of occupied habitat for the Coronado National Forest in the Broadleaf evergreen woodlands. Elevations range from 5200 feet near the Mexican border to 6200 feet in upper Scotia Canyon.

Populations consist of aquatic larva, adult branchiates, and terrestrial adult metamorphs. Threats to the species include predation (primarily by nonnative fish and bullfrogs), disease, floods, drought, illegal collecting, introduction of other subspecies of tiger salamanders that could genetically alter the Sonora tiger salamander, trampling of larva, adults, and eggs by livestock, siltation of stock ponds, and use of water from stock ponds for fire suppression. Cleaning out stock ponds is necessary for livestock operations and salamander habitat but could result in mortality of adults, larva, and eggs and loss of shoreline cover.

In 1997, the Coronado National Forest and the U.S. Fish and Wildlife Service developed a management plan for stock ponds in salamander habitat. This plan was part of the terms and conditions in the biological opinion on Forest plans and long-term grazing (U.S. Fish and Wildlife Service 1998, 1999). These guidelines were incorporated into the 1998 annual operating plans for all allotments in salamander habitat. A recovery plan for the species is currently being prepared.

Population trends. Species population rankings are shown in the Arizona Heritage Database (Arizona Game and Fish 2001). On a global scale, the Sonora tiger salamander is considered rare to very rare with less than 20 occurrences. On a state scale, the species is rare to very rare with less than 20 occurrences in the Arizona or few individuals or acres.

As of 1999, there were 53 sites with salamander populations (Arizona Game and Fish 2001m), all of which are located in the San Rafael Valley. The Arizona Game and Fish Department over the last 3 years has expended the number of locations for the species through sampling stock ponds. Dr. James Collins and associates (Arizona State University) have also been actively studying the species for several years. Comprehensive trend information is not available for the Forest. Determining population status is further complicated by the ability of the subspecies to take advantage of available breeding areas that at times may be dry (Arizona Game and Fish 2001). Poorly understood are the dispersion mechanisms for the species away from occupied sites as well as the importance of animal burrows and downed logs (U.S. Fish and Wildlife Service 1997).

Habitat Trends. All stock ponds within the known range represent occupied or potential habitat. The number of stock ponds has not changed significantly since 1986; however, the implementation of the stock pond maintenance guidelines has allowed for the maintenance of suitable sites that would have otherwise silted in and been lost as suitable habitat. There are currently more occupied sites than were known in 1986, but this is likely due to more intensive survey efforts rather than any increase in habitat quantity.

Evaluation. In general, existing Sonora tiger salamander habitat only allows continued existence in refugia restricted to the San Rafael Valley. At present the species occurs only in man-made

stock ponds. The species continues to be threatened by hybridization with other salamanders, predation by nonnative fish and bullfrogs, illegal collection for bait by anglers and disease (USFS 1999). These threats are exacerbated by the increased probability of random extirpation characteristic of small populations (USFS 1999, AGFD 2001). Habitat destruction and grazing-related population loss on the Forest have been mitigated by incorporation of the salamander guidelines into grazing plans. Most historic habitats remain occupied and several new populations have been discovered, but because of the lack of good historic survey data, population trend assessment is problematic.

Revised and updated: 5-2002 (RAG)
2-15-2005 (RAG)

Tarahumara frog (*Rana tarahumarae*)

The Tarahumara frog is listed in the threatened and endangered species group of the Forest Plan. It was identified in planning material in the Forest files as a potential MIS, but was considered a poor indicator species since populations were declining. Nevertheless, it was included in the final Forest Plan. Six historically occupied sites are found on the CNF. Although the last known individual frog was found dead in 1983 (Hale 1992), the 1986 Forest Plan inexplicably identifies 1,339 acres of occupied habitat on the Forest. Habitats include boulder strewn perennial streams and seasonal streams with bedrock beds that include deep drought resistant plunge pools.

The species was extirpated from Arizona in 1983. Causes of the population decline and extirpation are speculative. They include competition and predation by non-native fish and bullfrogs, drought, pollution and the fungal disease chytridiomycosis, among others (Hale 1992, Demlong 1999). The species remains extant in several locations Mexico. Beginning in June 2004, Tarahumara frogs were released at several sites in Santa Rita Mountains, Nogales Ranger District through an effort developed by the Tarahumara Frog Conservation Team using captive-bred frogs raised from larvae collected in the wild in Mexico and raised at the Kofa National Wildlife Refuge (Field, et al 2002).

Population trends. Reintroduced populations have been monitored several times since the re-establishment efforts in order to determine survival, dispersal and reproduction (Rorabaugh 2004 a, b, c, 2005 and Sredl 2004a, b). The data are not sufficient to determine long-term survival or population trends; however, introduced frogs have persisted through the summer and in to the winter dormant season.

Habitat Trends. A survey of historical and potential habitats was undertaken in 1991 in an effort to provide background information for potential reintroduction efforts (Hale 1992). This survey identified potential habitats in at least three historic sites (Big Casa Blanca, Gardner and Sycamore Canyons). The persistence of these sites was confirmed by the Tarahumara Frog Conservation Team in 2000 (Field, et al 2002). Although the amount of habitat was not quantified, it appears that potential habitats available in 1986 have persisted into the present.

Evaluation. Tarahumara frogs were rare and declining on the CNF when the Forest Plan was being drafted. They were extirpated by the time the plan was adopted. Suitable habitats within the species' historic range continue to be limited on the Forest, but have persisted over time and do not appear to be affected by management. Amphibians in general and ranid frogs in particular are subject to periodic population declines from unknown causes apparently unrelated to management. Reestablished populations have been and will continue to be monitored, but population trends are likely influence by factors other than habitat condition. For these reasons, the species currently has limited utility as a MIS.

Revised and updated: 5-2002 (RAG)
2-15-2005 (RAG)

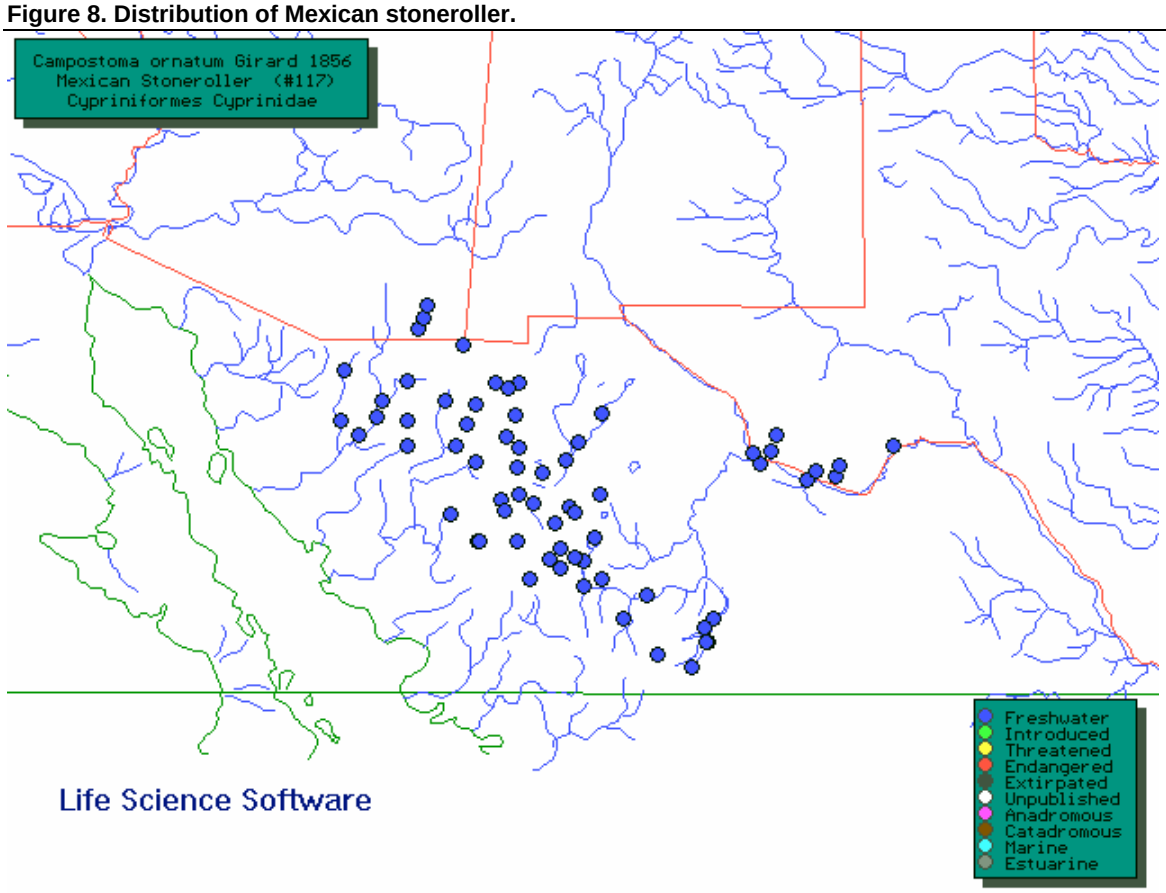
Fish

Mexican stoneroller (*Campostoma ornatum*)

The Mexican stoneroller is listed in the Threatened and Endangered Species group in the Forest Plan. It is also a Forest Service Sensitive species. The reasons for including this species are not evident in the record, except that it was noted at the time that research on the species was lacking (USFS 1981). It is not identified with a specific habitat type in the Forest Plan.

Mexican stonerollers occur throughout the Rio Yaqui drainage in Mexico, in tributaries of the Rio Grande River and south through Sonora Chihuahua and Durango Mexico (Figure 7). In Arizona, it occurs only in Rucker Canyon in the Chiricahua Mountains on the CNF (AGFD 2001). The Forest Plan identified 3.3 miles of occupied habitat for the species. Threats include changes in habitat quality and the presence of non-native predatory fish within Rucker Creek.

Figure 8. Distribution of Mexican stoneroller.



Monitoring data and population trends. Periodic electrofishing surveys have been accomplished over the years, the most recent having been done in June of 2001. Mexican stonerollers have been detected in all surveys. In 1994, the Rattlesnake fire affected nearly half of the Rucker Canyon watershed. Post-fire sediment yield increased dramatically, depositing up to 30 inches of sediment in some portions of the stream channel and completely filling Rucker Lake (LeFevre 1999). The species has declined drastically as a result, but persists in small numbers within the canyon in spite of severe habitat alteration. Like many desert fishes, Mexican stoneroller populations appear to fluctuate dramatically over time in response to changing stream conditions.

Evaluation. Mexican stonerollers occur only in Rucker Canyon. Populations within the canyon have persisted and suitable habitats remain occupied in spite of dramatic habitat alteration. Because of the species rarity and extremely limited distribution, monitoring should continue.

Apache (Arizona) trout (*Oncorhynchus apache*)

The Apache trout is included in the Threatened and Endangered Species indicator group in the Forest Plan. Apache trout are native to the White Mountains in the headwaters of the Little Colorado, Black and White Rivers. Currently listed as Threatened and a Forest Service Sensitive species, recovery activities have been aimed at establishing new populations within historic range. An introduced population has been established since the 1960's in the Pinaleno Mountains in several creeks including Ash and Marijilda and Grant Creeks. Recent genetic work has determined that these populations have at least partially hybridized with stocked rainbow trout in all of these streams (Neilson et al.1999). There are no records of native trout on the CNF.

Population trends. The Arizona Game and Fish Department surveyed streams in the Pinaleno Mountains in 1989, 1990 and 1997. No population trends are apparent for the hybridized populations in the Pinaleno Mountains, but suitable stream habitats are apparently occupied. Within its native range in the White Mountains, the introduction of non-native salmonids and habitat degradation have led to a range reduction (AGFD 2001). Recovery activities are underway throughout Arizona aimed at stream reclamation and re-establishment of native trout populations. Habitats on the CNF are not considered suitable for this effort because of genetic contamination.

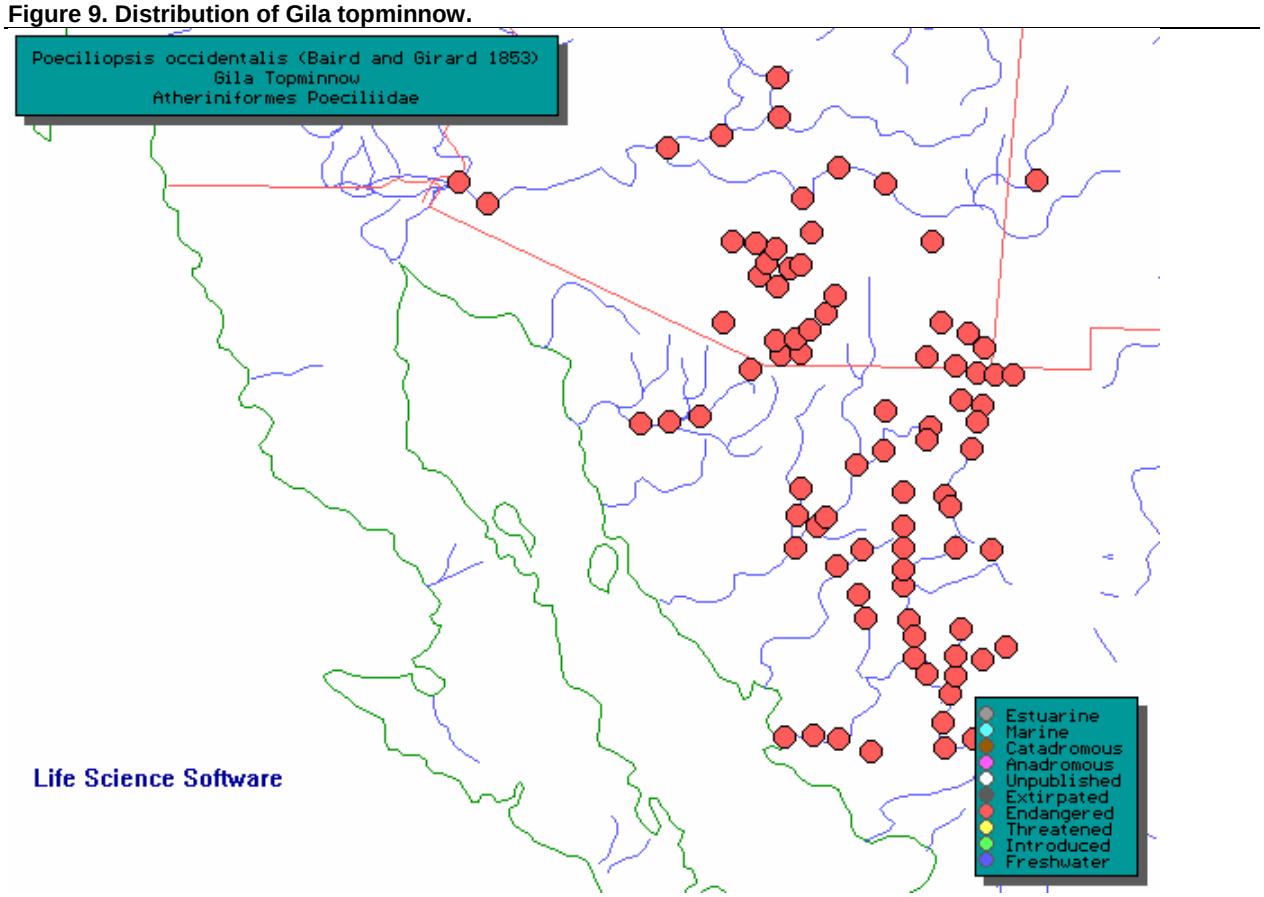
Habitat Trends. The species was not listed as a habitat indicator. The 2004 Nuttall Complex fire resulted in high sediment flows in Marijilda Creek and likely resulted in the loss of habitats in that stream. Other habitats in Grant Creek and Ash Creek were largely unaffected by the fire.

Evaluation. Hybridized populations of Apache trout are persisting in occupied habitats on the CNF. It seems likely, but is not certain, that the species was originally selected as an MIS because it was though to have potential in helping to achieve recovery plan goals. The fact that all populations on the CNF are to some degree hybridized with Rainbow trout reduces this potential. The species is not native and habitat is only sufficient to allow the species to persist in the few creeks where it was stocked. Population trends are difficult to detect and provide little insight into the effects of forest management.

Gila topminnow (*Poeciliopsis occidentalis occidentalis*)

This species is included in the threatened and endangered species indicator group for the Forest Plan because its relationship to the quality of the riparian and absence of mesquitofish (U.S. Forest Service 1981). It is listed Endangered by the USFWS. The Forest Plan lists 4.5 miles of occupied habitat for the species. It currently occurs only in the Redrock Canyon drainage on the CNF.

Figure 9. Distribution of Gila topminnow.



Population trends. Fish populations in Redrock Canyon have been monitored annually in the autumn since 1989 (Stefferud 2001). The results have been reported by Stefferud and Stefferud (1995), USDA Forest Service (1998) and Weedman and Young (1997). Topminnows have been consistently found in the Canyon since sampling began in 1988, although populations have fluctuated widely.

Habitat Trends. Stefferud (2001) reported the results of long term habitat monitoring in Redrock Canyon to track changes that have occurred as a result of implementation of the Redrock Riparian Improvement Plan and other activities. He concluded that substantial improvements in the riparian and aquatic plant community have occurred over the past decade, especially in areas where livestock had been excluded. Stefferud did not estimate the miles of occupied habitat, but he concluded that the livestock exclosures have increased the extent of surface water over time.

Evaluation. Gila topminnows remain restricted to a single canyon on the CNF. However, it appears that over time changes in management have increased the amount of suitable habitats for the species within the canyon. While the species remains extremely limited in distribution on the CNF, its apparent responsiveness to management and large quantity of monitoring data available make it well suited as a management indicator for a limited habitat type and area (aquatic conditions in Redrock Canyon). It is unlikely that the species will ever be well distributed across the Forest in the foreseeable future, so it will remain susceptible to stochastic events that potentially could significantly impact the lone population.

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2-14-2005 (RAG)

Gila chub (*Gila intermedia*)

This species is included in the threatened and endangered species indicator group for the Forest Plan because it is established in selected locales on the Forest. Distribution information, however, was incomplete at the time the Forest Plan was published (U.S. Forest Service 1981). The species is currently proposed for listing under the Endangered Species Act. There were 4.4 miles of occupied habitat identified in the Coronado National Forest Plan. On the CNF the species occurs in Sabino and O'Donnell Creeks.

Population trends. Arizona Game and Fish biologists monitored chubs in Sabino Canyon annually through 2003. While no population estimates were made, populations of fish were consistently been found in the same areas each year. In the summer of 2003, the Aspen fire burned nearly the entire Sabino Creek watershed. Resulting debris flows in the canyon substantially modified aquatic habitats and eliminated all aquatic vertebrates in the canyon. In anticipation of these flows, several hundred Gila chub were salvaged from the creek prior to the flooding and are being held in captivity. Planning is underway to reestablish populations once conditions improve.

Populations of introduced green sunfish are suspected to limit the distribution of Gila chub through competition and predation. In 2000, the CNF and the AGFD cooperated in a successful effort to renovate the downstream portion of Sabino Canyon in order to remove green sunfish. As a result of this effort, habitats in Sabino Canyon were considered to be improving until 2003.

In 2002, a similar renovation effort was undertaken in O'Donnell Creek, resulting in the successful removal of green sunfish from the stream.

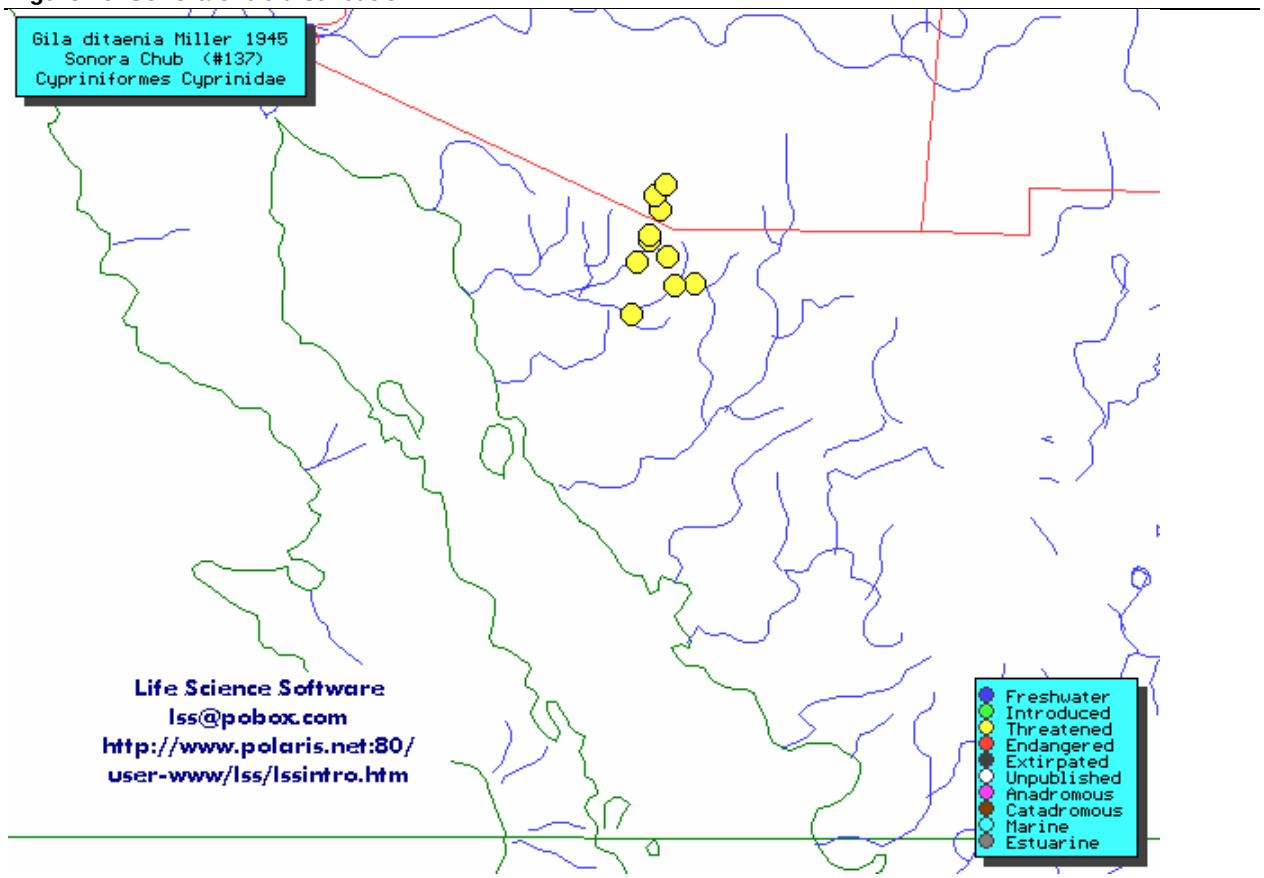
Habitat Trends. The species was not selected as an indicator of a specific habitat. However, occupied habitats in Sabino canyon have been at least temporarily reduced as a result of post-fire flooding and siltation of the stream channel.

Evaluation. Although historically more widespread, Gila chub are restricted to a few sites throughout Arizona including Sabino Canyon and O'Donnell Creek on the CNF. Populations expand and contract naturally over time as climatic events affect aquatic habitats, but long-term trends are downward throughout the species' range (AGFD 2001). On the CNF, historic habitats remained occupied and, until 2003, were considered to be expanding as management efforts eliminate populations of green sunfish from chub habitats. Because of the limited distribution of the species and isolation of the populations, random environmental events could potentially eliminate local populations, as has occurred in Sabino Canyon.

Sonora chub (*Gila ditaenia*)

The Sonora chub is included in the Threatened and Endangered Species indicator group in the Coronado Forest Plan. It is listed as Threatened by USFWS with critical habitat (USFWS 1992). It is endemic to the Rio de la Concepcion drainage of Mexico and southern Arizona. Within Arizona, it occurs only in Sycamore Canyon and California Gulch on the Nogales Ranger District of the CNF. Critical Habitat is designated within portions of Sycamore Canyon. There is no Critical Habitat in California Gulch. Records in the Forest files (USFS 1981) indicate that it was considered susceptible to impacts from mining and predation by green sunfish (*Lepomis cyanellus*). The Forest Plan lists 3.7 miles of occupied habitat in 1986.

Figure 10. Sonora chub distribution.



Habitat on the CNF is at the edge of the species range and is isolated from other populations in Mexico (AGFD 2001). The watershed of Sycamore creek has been highly modified by human activities including mining, grazing, recreation and the introduction of exotic green sunfish.

Population trends. Since 1997, the District Biologist has conducted annual inventories of the number of pools and occupancy by chubs (Table 22). As is the case with many desert fishes, populations of Sonora chub have fluctuated widely over time. Especially in California Gulch, the amount and distribution of Sonora chub habitat changes dramatically on a regular basis. This dynamic makes it difficult to detect long-term trends, but Sonora chub populations have persisted over time. Different sizes of Sonora chub are present in annual surveys; reproduction seems to be sufficient to populate the available habitat.

Table 22. Sonora chub survey results, 1997-2001.

	1997	1998	1999	2000	2001
No. of pools/runs	112	76	114	86	146
Percent of pools occupied by fish	83	87	79	85	96

Habitat Trends. The species was not selected as an indicator of a specific habitat. Occupied sites within Sycamore Canyon and California gulch have persisted over time, with large fluctuations within and between years.

Evaluation. Habitat for Sonora chub remains limited to two canyons within one watershed on the Forest. The species distribution is similar to historic distribution, but local populations change dramatically from year to year. Population fluctuations appear to be correlated with natural flood events that create and destroy isolated pockets of habitat, but the dynamics are not well understood. It appears that these natural events have a greater influence on populations than management activities but natural flood events may be exacerbated by watershed conditions that increase sedimentation and scouring in the stream channel.

Spikedace (*Meda fulgida*)

The Spikedace is a small stream-dwelling minnow listed in the Threatened and Endangered Species Group for the Forest Plan. It is currently listed as Threatened by USFWS and critical habitat is designated in Aravaipa Creek. It was noted that distributional studies were needed to determine the species' status on the Forest (USFS 1981). No populations are known from the CNF. No occupied habitat was listed in the Forest Plan (USFS 1986).

Population trends. Historically, the Spikedace was common and locally abundant throughout the upper Gila River basin in Arizona and New Mexico. It is currently restricted to less than six percent of its former range, occurring only in Aravaipa and Eagle Creeks, the upper Verde River and the upper Gila River in New Mexico (AGFD 2001). No monitoring for Spikedace occurs on the CNF.

Habitat Trends. The species was not selected as an indicator of a specific habitat type. Occupied habitats do not occur on the CNF.

Evaluation. There are no records that the Spikedace ever occurred on the CNF. For this reason, the species has no utility as a management indicator on the Forest.

Revised and updated: 5-2002 (RAG)

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Appendix 1.

Wildlife Monitoring requirements from the 1986 Coronado National Forest Plan, pages 93-94.

WILDLIFE

1.ITEM MONITORED:

A. population and habitat trends of management indicator species.

2. PURPOSE:

A.Federal and State Regulations.

B.Forest issue related.

3. MONITORING METHOD:

A. White-tailed deer - sex and age (NMGF, AGF using aerial, horse, and foot transects). Also hunter kill information.

B. Mearn's quail - Population trend date from hunter wing barrel returns.
C. Pronghorn - Sex and age ratios (AGF using aerial, horse and foot transacts. Also hunter kill information.

D. Merriam's turkey - hunter kill information.

E. Coppery-tailed trogon - sex and age ratios (Private cooperators and wildlife biologist using foot transacts).

F. Gila topminnow - Number of miles of occupied habitat (USFWS. AGF using foot transacts.)

G. Black bear-Recording sign, hunter kill information, depredation reports and campground problems.

H. Human effects on desert bighorn sheep - radio collar tracking (AGF) vegetation use (University of Arizona); population trend (AGF).

I. Other indicator species groups and - threatened and endangered species. Measurements of appropriate habitat components.

4.FREQUENCY:
Annually

5. EXPECTED PRECISION/RELIABILITY:
A.Birds - - 10%/+ 80%

B.Other Came and Fish Data - Variable by species.

6. TIME FOR REPORTING:
Annually

7.COST:

A.White-tailed deer - $400 annually
B.Mearn's quail -$40 annually
C.Pronghorn - $16O annually
D.Merriam's turkey - $80 annually
E.Coppery-tailed trogon - $IOO annually
F.Gila topminnow - $160 annually
G.Black bear - $200 annually
H.Human effects on Bighorn sheep - $200 annually
1.Other indicator species groups and threatened and endangered species
$11,250 annually for first 5 years. then $ll,250 once every 10 years thereafter

8.EVALUATION:

The monitoring system includes Forest Service costs of management, analysis, and interpretation of the data obtained from monitoring. The proposal has an integrated system involving three levels of monitoring:

(1) Species-only (those management indicator species as required by law); (2) management guilds (guilds of birds in habitats especially vulnerable to change through human activities): and (3) habitats (most wildlife species would be monitored by inference from trends in habitats, based on knowledge of each species' habitat requirements).

It should be realized monitoring of wildlife resources on such a scale as proposed is at best tentative and exploratory. State-of-the art knowledge indicates it is a suitable system at the present time, but it must be noted that modifications may be needed within the planning period to better indicate the effects of National Forest management activities on the Coronado's wildlife resources.

Costs shown are Forest Service costs only. They reflect two needs: (1) State and responsible federal agencies would monitor species population within their authority. Costs given are for coordination by the Forest with these agencies. (2) Needed research represents the bulk of costs noted. Evaluation of these needs could be used for base data displays such as integrated stand management, habitat suitability index and wildlife and fish habitat relationships.