United States Department of the Interior

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In Reply Refer To:
AESO/SE
02-21-04-M-0299 June 8, 2007

Ms. Jeanine Derby
Forest Supervisor
Coronado National Forest
300 West Congress, 6th Floor
Tucson, Arizona 85701

Dear Ms. Derby:

This letter constitutes our biological opinion (BO), based on our review of the wildfire-suppression actions associated with the Nuttall-Gibson Complex Wildfire located in the Pinaleño Mountains on the Coronado National Forest, Graham County, Arizona. This biological opinion analyzes the project's effect on the Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*, MGRS) and its associated critical habitat and the Mexican spotted owl (*Strix occidentalis lucida,* MSO) and its associated critical habitat in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). We received your August 31, 2005, request for formal consultation on September 1, 2005. In that request, you determined that suppression activities associated with the Nuttall-Gibson Complex Wildfire likely adversely affected MGRS and MSO and each species' critical habitat. You also requested our concurrence that suppression activities may have affected, but did not likely adversely affect, Apache trout (*Oncorhyncus apache*). Our concurrence with that determination is provided in Appendix A.

This BO is based on information provided in the August 31, 2005, biological assessment (BA)**,** discussions with your staff, and information in our files. Literature cited in this BO is not a complete bibliography of all literature available on the species of concern, wildfire suppression and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office**.** This consultation is being conducted in accordance with emergency consultation procedures (50 CFR 402.05).

CONSULTATION HISTORY

June 27, 2004: We received a call from the Forest Service requesting initiation of emergency consultation. We discussed minimizing impacts to MSO and MGRS habitat, including limiting the number of trees removed and placement of fire lines. A Resource Advisor had been assigned to the fire.

July 2, 2004: We discussed using Forest Road 507 as a fire break with the Forest Service Resource Advisor via phone call. We advised him that we would support opening the road if that was necessary to stop the fire and to ensure the safety of the fire crews. We also advised the Resource Advisor that Forest Road 507 was closed as part of the Arizona-Idaho Conservation Act (AICA) due to impacts to MGRS.

July 12, 2004: We visited the Nuttall-Gibson Complex Wildfire to begin assessing effects to MGRS, MSO, and their respective critical habitat.

July 19, 2004: We visited the Nuttall-Gibson Complex Wildfire again to radio-track MGRS in both burned and unburned areas around the Mount Graham International Observatory.

July 20, 2004: We attended a Burned Area Emergency Rehabilitation (BAER) team meeting to help discuss the effects and implementation of rehabilitation.

September 1, 2005: We received the August 31, 2005 BA.

December 15, 2005: We requested a 60-day extension to complete the formal consultation.

December 21, 2005: We received verbal concurrence for the 60-day extension of formal consultation.

March 14, 2006: We requested an additional 60-day extension to complete the formal consultation.

April 5, 2006: We received your concurrence for the second 60-day extension.

May 11, 2006: We requested an additional 60-day extension to complete the formal consultation.

May 15, 2006: We received your concurrence for another 60-day extension.

July 27, 2006: We requested an additional 60-day extension to complete the formal consultation.

August 2, 2006: We received your concurrence for another 60-day extension.

September 8, 2006: We requested an additional 90-day extension to complete the formal consultation.

September 26, 2006: We received your concurrence for the additional 90-day extension.

December 18, 2006: We requested an additional 90-day extension to complete the formal consultation.

December 27, 2006: We received your concurrence for the additional 90-day extension.

April 10, 2007: We sent the draft biological opinion to you.

June 1, 2007: We received your comments on the draft biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE EMERGENCY ACTION

The Nuttall-Gibson Complex Wildfire began as two small, separate fires: the Gibson Fire, which started on June 22, 2004, and the Nuttall Fire, which started June 26, 2004. Both fires were caused by lightning strikes. The Gibson Fire held at less than one acre for approximately one week before spreading. The Nuttall Fire spread rapidly within the first few days. Heavy fuel-loading, extended drought conditions, erratic winds, steep terrain, and the remoteness of their locations hampered suppression actions and allowed the fires to grow rapidly.

A Type I Incident Management Team was assigned to the fire on June 27, 2004. Personnel and equipment assigned to the fire at its peak included 12 hotshot crews, three regular crews, three air tankers (P-3 Orions), six helicopters (Types I, II, and III), 20 engines, 16 water tenders, four dozers (Caterpillar D-8s), 204 support personnel, and 683 firefighters.

The Nuttall-Gibson Complex burned 29,900 acres in areas of oak woodland, ponderosa pine, mixed-conifer, and spruce-fir forest. Elevation of the fire and associated suppression actions ranged from 4,500 to 11,000 feet. Approximately eleven percent of the area received high-severity burn effects, resulting in complete consumption of needles/leaves, branches, shrubs and herbaceous growth. In addition to standard fire suppression rehabilitation efforts, a Burned Area Emergency Rehabilitation (BAER) team was assembled to help reduce the effects of the fire itself. A map of the fire location, along with other details, can be found in the August 31, 2005, Forest Service BA.

Actions

The actions consisted of wildfire suppression, emergency post-fire suppression rehabilitation, and BAER emergency rehabilitation and stabilization measures. At the peak of the fire, nearly 900 people were working on the fire with support from engines, helicopters, and air tankers.

Objectives of the firefighting efforts included:

1. Firefighter and public safety;

2. Providing accurate information to interested and affected parties;

3. Protecting and minimizing threats/loss to wildlife habitat (specifically, habitat for MGRS, MSO, and Apache trout) by avoiding placing fire-lines through marked middens, not dumping retardant in riparian areas and wet canyons, and minimizing removal of large trees in squirrel and owl habitats;

3. Minimizing threats/loss to wilderness study area values, Columbine and Turkey Flat recreational residences, Heliograph electronic site, Mount Graham International Observatory (MGIO), and Forest Service recreational facilities;

4. Containing the Complex at a maximum of 50,000 acres; and

5. Keeping the Nuttall-Gibson Complex on the north side of Swift Trail (Highway 366), within the Forest Service boundary, and east of West Peak.

The fire line was worked with retardant, water buckets, dozers, engines, and hand crews. As much as possible, the Swift Trail was used as fire line. Sections of the road near Clark Peak, Arcadia Campground, and Noon Creek were used as part of the fire lines; and existing trails and side roads were used as fire lines as much as possible. Hand lines consisted of a 2-foot wide line that was scraped to mineral soil and extended from the pre-existing Clark Peak Trail along the western edge of the fire and around the northern edge of the Old Columbine area. Dozer lines varied from eight to 15 feet wide and were created from Chesley Flat to Webb Peak, from Old Columbine up to and around the MGIO to connect with Forest Roads 507 and 669 (which were re-opened and cleared for use as firebreaks). Vegetation that could fall over the line or encourage fire escape was cut using power saws and hand tools. Trenches were also constructed on steep slopes to catch rolling hot materials and keep them within the fire perimeter.

Fire-retardant drops were limited mainly to helicopters. The air tankers were limited to only two days of use due to other wildfires burning in the state. Furthermore, retardant was limited in supply due to the other wildfires burning. Air-tanker drops totaled approximately eight to ten drops on those two days, with approximately 2,000 gallons per drop (16,000 to 20,000 total gallons). Retardant drops were restricted to high-value sites such as the communication towers on Heliograph Peak and areas around Turkey Flat. Type I helicopters are capable of holding up to 2,000 gallons of retardant or water; however, the actual amount carried is usually less due to payload and the elevations at which they are flying. Type II and III helicopters hold significantly less than that and carry water in collapsible buckets attached under the body. Buckets loads are usually 250 to 300 gallons per load for Type III helicopters and approximately 100 gallons for Type I helicopters. Because of the limited supply of fire retardant, water bucket drops were the main type of fire suppression related to aviation activities. Water for the bucket drops was obtained directly from Riggs Flat Lake, Snow Flat Lake, and Cluff Pond. Small amounts of water were also gathered from Wet Canyon and Ash Creek by pumps for use by firefighters with hoses.

Five helispots were constructed within the forest boundary, consisting of 125-foot by 200-foot clearings, from which trees, brushy vegetation, and large rocks were cleared with bulldozers. In Carter Canyon, at the base of the Pinaleno Mountains, this consisted of clearing a small number of agaves and creosote bushes, and dragging large rocks to the perimeter of the helispot. At higher elevations, creation of helispots involved a variety of treatments, ranging from the use of pre-existing meadow areas (such as the field at Columbine Administrative Site) to removal of pine, fir, and spruce trees.

Hand and dozer crews used spike camps at Treasure Park Campground and the Columbine Administrative Site. Seven safety zones were also created. These were placed along the edge of the fire: one in Carter Canyon, one just west of Webb Peak along the dozer line (north end of Peters Flat), two along the dozer line between Old Columbine and MGIO, two along Forest Road 507, and one near the Twilight Campground (see Figure 2 of the BA).

Burn-out operations were conducted throughout the action area, but were most extensive along Forest Roads 507 and 669 as well as in the vicinity of Old Columbine. Approximately 520 acres of habitat were documented as affected by burn-out operations along Forest Roads 507 and 669 and the dozer line between MGIO and Webb Peak. It is likely that more acres of habitat were affected by burn-out operations; however, it is difficult to distinguish between the effects of the burn-out operations and the effects of the wildfire itself. Burn-out operations were conducted to remove fuels in front of the advancing main wildfire. These burn-out operations were conducted at night when temperatures were lower and relative humidity was higher in order to produce low-intensity flames that resulted in low-intensity burn effects. Burn-out operations were conducted by hand crews walking along the fire line igniting fuels with drip-torches. Because of the steepness of the terrain, firefighters did not work far from the fire lines. The burn-out operations along Forest Road 669 were placed within 15 feet of the fire line and concentrated on the south side of Hawk Peak to stop the advancing wildfire, which was moving fast up the north side of Hawk Peak and Frye Canyon. Maps produced after the burn-out operations indicated that the burn-out operations around Hawk Peak resulted in mostly low-intensity burn effects with small amounts of high-intensity burn effects. Most of this area contained trees that had previously been killed by insect infestations, especially the areas of high-intensity burn effects.

In addition to the burn-out operations along Forest Road 507, burn-out operations were conducted along Forest Road 507 and the dozer-lines from MGIO to Old Columbine and Chesley Flat to Webb Peak. Along Forest Road 507 from east of Upper Hospital Flat Campground to near Plain View Peak, burn-out operations were conducted within 10 feet of the fire line in order to consume fuels in front of the rapidly advancing wildfire, similar to that described above. This area is characterized by very steep and rugged terrain going downhill from the road. The wildfire was moving fast up the major canyons east of Forest Road 507, including Crazy Horse and Marijilda canyons. No burn-out operations were conducted along Forest Road 507 from roughly Plain View Peak to the junction with Forest Road 669.

Burn-out operations were conducted along the dozer line from MGIO to Webb Peak, within 30 feet of the fire line, in order to combine the two separate wildfires (Nuttall and Gibson). Fire crews anticipated that the two separate wildfires would merge eventually, as they were spreading toward each other. These particular burn-out operations allowed the fire crews to manage the two fires more safely and control the conditions in which fuels between the two wildfires were consumed. The areas along the dozer line that were subjected to burn-out operations consumed approximately 509 acres and occurred above steep terrain and north-facing canyons and slopes.

These areas had higher relative humidity and lower temperatures, which resulted in mostly low-intensity burn effects and several areas of unburned fuels. The high relative humidity and lower temperatures prevented the burn-out operations from traveling far. The resultant burn-out area occurred as a thin line between the two fires. Of the 509 acres consumed along the dozer line, 441 acres (86 percent) were classified as either unburned or low-severity burn effects. Twenty-one acres (four percent) along the dozer line resulted in moderate-severity burn effects with several pockets of unburned habitat, while less than less than one-tenth of a percent were categorized as high-severity burn effects.

Emergency post-fire rehabilitation efforts were accomplished in two phases. The first phase was “emergency fire suppression rehabilitation”, which addressed the effects of the fire suppression efforts, and the second phase was BAER activities, which addressed the effects of the fire itself. Rehabilitation actions focused on softening the effects of localized suppression actions. Fire-suppression rehabilitation actions included covering safety zones and fire lines (hand lines and dozer lines) with vegetation and downed trees, and water-barring trails and fire lines to decrease erosion, off-road use, and safety hazards. BAER activities were conducted throughout the fire perimeter. BAER activities included the removal of dead trees near trails and public use areas, seeding and mulching burned areas to help prevent erosion, building trash racks in riparian areas where heavy flooding was predicted to occur after the fire, and setting up monitoring points for weather activity and to assess the effectiveness of treatments such as seeding and mulching (see Fig. 3 of the BA).

CONSERVATION MEASURES

Discussions with a Forest Service biologist after the fire indicated that the following conservation measures were initiated during fire-suppression activities:

1. Resource Advisors were assigned to the fire on the first day.

2. Fire and dozer lines were placed to avoid MGRS middens whenever possible.

3. Dumping retardant in riparian areas was avoided whenever possible.

4. Removal of large trees and snags in MGRS and MSO habitat was minimized.

5. Fire-suppression rehabilitation efforts were carried out in such a way as to minimize the effects of the suppression actions on listed species and their habitats.

6. In order to avoid prolonged negative effects to MGRS, and because of the 1988 AICA, Forest Roads 507 and 669 will be re-closed and allowed to revegetate naturally.

These conservation measures were consistent with the annual pre-fire season letter that we sent out in the Spring of 2004. That letter discussed the procedures for fire-management agencies to conduct emergency fire consultations and a list of suggested conservation measures.

MEXICAN SPOTTED OWL

STATUS OF THE SPECIES

The MSO was listed as a threatened species in 1993 (58 FR 14248). The primary threats to the species were cited as even-aged timber harvest and the threat of catastrophic wildfire, although grazing, recreation, and other land uses were also mentioned as possible factors influencing the MSO population. We appointed the MSO Recovery Team in 1993, which produced the Recovery Plan for the MSO (Recovery Plan) in 1995 (U.S. Fish and Wildlife Service 1995). The Recovery Plan is currently being revised and is scheduled to be out for public review in 2007.

A detailed account of the taxonomy, biology, and reproductive characteristics of the MSO is found in the Final Rule listing the MSO as a threatened species (U.S. Fish and Wildlife Service 1993a) and in the Recovery Plan (U.S. Fish and Wildlife Service 1995). The information provided in those documents is included herein by reference. Although the MSO's entire range covers a broad area of the southwestern United States and Mexico, the MSO does not occur uniformly throughout its range. Instead, it occurs in disjunct localities that correspond to isolated forested mountain systems, canyons, and in some cases steep, rocky canyon lands. Surveys have revealed that the species has an affinity for older, well-structured forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico.

A reliable estimate of the numbers of owls throughout its entire range is not currently available (U.S. Fish and Wildlife Service 1995) and the quality and quantity of information regarding numbers of MSO vary by source. The U.S. Fish and Wildlife Service (1991) reported a total of 2,160 owls throughout the United States. Fletcher (1990) calculated that 2,074 owls existed in Arizona and New Mexico. However, Ganey *et al.* (2000) estimates approximately 2,950 〈≡~ 1,067 (SE) MSOs in the Upper Gila Mountains RU alone. The Forest Service Region 3 most recently reported a total of approximately 987 protected activity centers (PACs) established on National Forest lands in Arizona and New Mexico (U.S. Fish and Wildlife Service 2005). Currently, we estimate that there are likely 12 PACs in Colorado (not all currently designated) and 105 PACs in Utah.

Researchers studied MSO population dynamics on one study site in Arizona (n = 63 territories) and one study site in New Mexico (n = 47 territories) from 1991 through 2002. The Final Report, titled "Temporal and Spatial Variation in the Demographic Rates of Two Mexican Spotted Owl Populations," (Gutierrez *et al.* 2003) found that reproduction varied greatly over time, while survival varied little. The estimates of the population rate of change (Λ=Lambda) indicated that the Arizona population was stable (mean Λ from 1993 to 2000 = 0.995; 95% Confidence Interval = 0.836, 1.155) while the New Mexico population declined at an annual rate of about 6% (mean Λ from 1993 to 2000 = 0.937; 95% Confidence Interval = 0.895, 0.979). The study concludes that MSO populations could experience great (>20%) fluctuations in numbers from year to year due to the high annual variation in recruitment. However, due to the high annual variation in recruitment, the MSO is then likely very vulnerable to actions that impact adult survival (e.g., habitat alteration, drought, etc.) during years of low recruitment.

The current condition of MSO habitat within Arizona and New Mexico is a result of historical and recent human use, as well as climate change, vegetation species conversion, and wildfires. Historical and current anthropogenic uses of MSO habitat include both domestic and wild ungulate grazing, recreation, fuels-reduction treatments, resource extraction (e.g., timber, oil, gas), and development. These activities have the potential to reduce the quality of MSO nesting, roosting, and foraging habitat, and may cause disturbance during the breeding season. Livestock and wild ungulate grazing is prevalent throughout Region 3 National Forest lands and is thought to have a negative effect on the availability of grass cover for prey species. Recreational impacts are increasing on all forests, especially in meadow and riparian areas. There is anecdotal information that indicates owls in heavily used recreational areas are much more erratic in their movement patterns and behavior. Fuels-reduction treatments, though critical to reducing the risk of catastrophic wildfire, can have short-term adverse affects to MSO through habitat modification and disturbance. As the human population grows, especially in Arizona, small communities within and adjacent to National Forest System lands are being developed. This trend may have detrimental effects to MSO by further fragmenting habitat and increasing disturbance during the breeding season. West Nile Virus also has the potential to adversely impact the MSO. The virus has been documented in Arizona, New Mexico, and Colorado, and preliminary information suggests that owls may be highly vulnerable to this disease. Unfortunately, due the secretive nature of owls and the lack of intensive monitoring of banded, individual birds, we will most likely not know when owls contract the disease or the extent of its impact to MSO range-wide.

Currently, high intensity, stand-replacing fires are influencing ponderosa pine and mixed conifer forest types in Arizona and New Mexico. MSO habitat in the southwestern United States has been shaped over thousands of years by fire. Since MSO occupy a variety of habitats, the influence and role of fire has most likely varied throughout the owl's range. In 1994, at least 40,000 acres of nesting and roosting habitat were impacted to some degree by catastrophic fire in the Southwestern Region (Sheppard and Farsnsworth 1995). Between 1991 and 1996, the Forest Service estimated that approximately 50,000 acres of owl habitat underwent stand-replacing wildfires (Sheppard and Farnsworth 1995). However, since 1996, fire has become catastrophic on a landscape scale and has resulted in hundreds of thousands of acres of habitat lost to stand-replacing fires. This is thought to be a result of unnatural fuel loadings, past grazing and timber practices, drought, insect damage, unusually warm winters, and a century of fire suppression efforts. The 2002 Rodeo-Chediski fire, at 462,384 acres, burned through approximately 55 PACs on the Tonto and Apache-Sitgreaves National Forests and the White Mountain Apache Reservation (within the Upper Gila Recovery Unit). Of the 11,986 acres of PAC habitat that burned on National Forest lands, approximately 55% burned at moderate to high severity. Based on the fire-severity maps for the fire perimeter, tribal and private lands likely burned in a similar fashion.

The U.S. range of the MSO has been divided into six recovery units (RU), as discussed in the Recovery Plan. The project area is within the Basin and Range West RU, which encompasses a small portion of New Mexico and the majority of southeastern Arizona and is the second largest RU in the United States. The northern border of this RU is defined by the base of the Mogollon Rim. The western boundary defines the western extent of the MSO's range. Land ownership within this RU is a mosaic of public and private lands, with the MSO primarily occupying Forest Service lands. The Forest Service has designated 154 PACs on the Coronado, Tonto, Prescott, and Apache-Sitgreaves National Forests within the Basin and Range West RU.

The RU is characterized by numerous mountain ranges that rise abruptly from the broad, plain-like valleys and basins. These mountain ranges are often referred to as the Sky Islands. Vegetation ranges from desert scrubland and semi-desert grassland in the valleys upward to montane forests (chaparral and pine-oak woodlands at low and middle elevations and ponderosa pine, mixed-conifer, and spruce-fir forests at higher elevations). Within the Sky Islands, MSO habitat is characterized by woodland habitat, and territories occur in both heavily forested terrain and in areas with hardwood and conifer stringers dominated by Madrean evergreen woodland. In general, however, much of the MSO habitat occurs in forested, steep-slope canyons and drainages. The mature trees throughout much of the forest outside of these canyons and drainages were historically partially or completely harvested, but have largely regenerated.

The primary threats to MSO within this RU are catastrophic wildfire, recreation, and livestock grazing (U.S. Fish and Wildlife Service 1995). As in the Upper Gila Mountain RU, this area has experienced multiple wildfires that have influenced MSO habitat. The Clark Peak, Gibson Canyon, Miller, Noon, Rattlesnake, Shovel, Bullock, Florida, and Oversite fires burned at varying intensities throughout MSO PACs on the Coronado National Forest. The Four Peaks/Lone Fire was a catastrophic, high-intensity wildfire on the Tonto National Forest that burned through two MSO PACs. In 2003, there were two fires that burned at high-intensity across significant acreage that included MSO habitat. The Aspen Fire on the Coronado National Forest burned approximately 85,000 acres and partially burned nine MSO PACs, and the Helen's 2 Fire burned approximately 3,500 acres and impacted three MSO PACs within Saguaro National Park.

The Coronado, Tonto, and Prescott National Forests are used heavily for recreation, mainly due to their proximity to the large urban areas of Tucson and Phoenix. Riparian areas may provide important dispersal habitat between mountain ranges in this RU, so grazing in these areas is of concern due to potential negative impacts.

There are a total of 38 wildland urban interface projects in this RU. Nineteen of the proposed projects contain MSO PACs; 28 PACS within this project area will receive fuels-reduction treatments. The Prescott National Forest is expecting to treat seven of the 15 known PACs on the forest. The WUI programmatic biological opinion stated that only four of the PACs are expected to receive intensive treatments. Approximately 8,927 acres of protected habitat and 55,000 acres of restricted habitat occurs within the proposed Prescott National Forest project area. No more than 2,000 acres of protected habitat are expected to be intensively treated, with the remainder of protected habitat treated per the recommendations in the Recovery Plan. The restricted habitat is all located within 0.5 mile of private land and will most likely receive fairly intensive treatments.

Since the owl was listed, we have completed or have in draft form a total of 182 formal consultations for the MSO. These formal consultations have anticipated incidental take of MSO in 376 PACs. The form of this incidental take is almost entirely harm or harassment. These consultations have primarily dealt with actions proposed by the Forest Service, Region 3. However, in addition to actions proposed by the Forest Service, Region 3, we have also reviewed the impacts of actions proposed by the Bureau of Indian Affairs, Department of Defense (including Air Force, Army, and Navy), Department of Energy, National Park Service, and Federal Highway Administration. These proposals have included timber sales, road construction, fire/ecosystem management projects (including prescribed natural and management ignited fires), livestock grazing, recreation activities, utility corridors, military and sightseeing overflights, and other activities. Only two of these projects (release of site-specific owl location information and existing forest plans) have resulted in biological opinions that the proposed action would likely jeopardize the continued existence of the MSO.

In 1996, we issued a biological opinion on Forest Service Region 3 adoption of the Recovery Plan recommendations through an amendment to their Land and Resource Management Plans (LRMPs). In this non-jeopardy biological opinion, we anticipated that approximately 151 PACs would be affected by activities that would result in incidental take of MSOs, with approximately 61 of those PACs located in the Basin and Range West RU. In addition, on January 17, 2003, we completed a reinitiation of the 1996 Forest Plan Amendments biological opinion, which anticipated the additional incidental take of five MSO PACs in Region 3 due to the rate of implementation of the grazing standards and guidelines, for a total of 156 PACs. Consultation on individual actions under these biological opinions resulted in the harm and harassment of MSO in approximately 243 PACs on Region 3 National Forest System Lands. Region 3 of the Forest Service reinitiated consultation on the LRMPs on April 8, 2004. On June 10, 2005, the FWS issued a revised biological opinion on the amended LRMPs. We anticipated that while the Region 3 Forests continue to operate under the existing LRMPs, take is reasonably certain to occur to MSO in an additional 10 percent of the known PACs on Forest Service lands. We expect that continued operation under the plans will result in harm to MSO in 49 PACs and harassment to MSO in another 49 PACs. To date, consultation on individual actions under the amended Forest Plans, as accounted for under the June 10, 2005, biological opinion, has resulted in the incidental take of MSO associated with 26 PACs, with 7 of those PACs in the Basin and Range West RU.

Mexican spotted owl Critical Habitat

The final MSO critical habitat rule designated approximately 8.6 million acres of critical habitat in Arizona, Colorado, New Mexico, and Utah, mostly on Federal lands (69 FR 53182). Within this larger area, critical habitat is limited to areas that meet the definition of protected and restricted habitat, as described in the Recovery Plan. Protected habitat includes all known owl sites and all areas within mixed conifer or pine-oak habitat with slopes greater than 40 percent where timber harvest has not occurred in the past 20 years. Restricted habitat includes mixed conifer forest, pine-oak forest, and riparian areas outside of protected habitat.

The primary constituent elements for MSO critical habitat were determined from studies of their habitat requirements and information provided in the Recovery Plan (U.S. Fish and Wildlife Service 1995). Since owl habitat can include both canyon and forested areas, primary constituent elements were identified in both areas. The primary constituent elements occurring within mixed-conifer, pine-oak, and riparian forest types that provide for one or more of the MSO's habitat needs for nesting, roosting, foraging, and dispersing are in areas defined by the following features for forest structure and prey species habitat:

Primary constituent elements related to forest structure include:

- A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30% to 45% of which are large trees with diameter at breast height (dbh) of 12 inches or more;
- A shade canopy created by the tree branches covering 40% or more of the ground; and,
- Large, dead trees (snags) with a dbh of at least 12 inches.

Primary constituent elements related to the maintenance of adequate prey species include:

- High volumes of fallen trees and other woody debris;
- A wide range of tree and plant species, including hardwoods; and
- Adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration.

The forest habitat attributes listed above usually are present with increasing forest age, but their occurrence may vary by location, past forest management practices or natural disturbance events, forest-type productivity, and plant succession. These characteristics may also be observed in younger stands, especially when the stands contain remnant large trees or patches of large trees. Certain forest-management practices may also enhance tree growth and mature stand characteristics where the older, larger trees are allowed to persist. There are 16 critical habitat units located in the Basin and Range West RU that contain approximately 1.2 million acres of designated critical habitat.

ENVIRONMENTAL BASELINE

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

A. Status of MSO within the action area.

The action area comprises all areas that burned within the fire perimeter (approximately 29,900 acres) as well as areas outside of the fire perimeter affected by suppression actions (helispots, base camps, water-dip sites, etc.).

Within the action area, 21 PACs were affected by fire suppression and emergency rehabilitation and stabilization actions, either directly or indirectly; however, not all 21 of these PACs have been recently monitored due to inaccessibility, safety concerns (steep and rugged terrain), and budget constraints. Seven of the 21 PACs were not surveyed during 2000-2006. The remaining 14 PACs were surveyed, either through formal or informal monitoring, intermittently from 2000-2006 during. Of the 14 PACs monitored, six were not monitored prior to the Nuttall-Gibson Complex Fire. The Mill Site and Nuttall PACs were monitored for the first time in 1999 and 2005 respectively. The Mill Site PAC was determined to be occupied while the Nuttall PAC was determined to be unoccupied. The Clark Peak, Lefthand, Ash Creek, and Eagle Rock PACs were monitored for the first time since 1997 (Ash Creek was monitored in 1999) in 2006. Of the four PACS monitored in 2006, only the Eagle Rock PAC was determined to be occupied; however, its nesting status was not known. The other eight PACs have a history of occupancy (some with reproduction) since 2001 (Table 1).

Of the 14 PACs that have been monitored over the last seven years, eight of them were monitored in 2004 (Table 1). Pre-fire monitoring (per Monitoring Survey Protocol) in 2004 indicated that six of the PACs within the fire perimeter were occupied by either a pair of MSO or a single adult. Post-fire monitoring indicated that six PACs were also occupied after the fire. One PAC (Webb Peak) that was occupied by a pair before the fire successfully fledged one young post-fire (U.S. Forest Service 2005). Following is a summary of PAC occupancy pre- and post-fire in those PACs where MSO were detected 2004:

Riggs Lake (0504003): No MSO detected before or after the fire.

Chesley Flat (0504004): Single adult MSO before the fire; no MSO detected after the fire.

Webb Peak (0504006): Pair occupancy before the fire and after the fire. One young MSO was fledged in this PAC during the year of the fire.

Hagens Point (0504015): Pair occupancy before the fire; a lone male detected after the fire.

Heliograph (0504016): No MSO detected before the fire; a lone male detected after the fire.

Wet Canyon (0504020): Single MSO detected before and after the fire.

Turkey Flat (0504021): Lone male detected before the fire; pair occupancy and a second male detected after the fire.

Pitchfork Canyon (0504022): Pair occupancy before and after the fire. No young detected; nesting status unknown.

Table 1: MSO PAC Occupancy Record for PACs Within the Nuttall-Gibson Complex Fire Perimeter.

PAC Name	PAC No.	2000	2001	2002	2003	2004	2005	2006
Clark Peak	0504001	NS	NS	NS	NS	NS	NS	A
Nuttall Canyon	0504002	NS	NS	NS	NS	NS	A	A
Riggs Lake	0504003	NS	NS	NS	P	A	A	O, NU
Chesley Flat	0504004	NS	M	P	P	P	NS	A
Lefthand Canyon	0504005	NS	NS	NS	NS	NS	NS	A
Webb Peak	0504006	NS	O	P	O	O, 1Y	A	A
Mill Site	0504007	NS	NS	NS	NS	NS	O, NU	O, 1Y
Ash Creek	0504008	NS	NS	NS	NS	NS	NS	A
Hagens Point	0504015	NS	NS	O, 2Y	M	O, NY	NS	O, 2Y
Heliograph	0504016	NS	NS	P	M	M	P	A
Marijilda	0504017	NS	NS	NS	NS	NS	NS	NS
Crazy Horse	0504018	NS	NS	NS	NS	NS	NS	NS
Eagle Rock	0504019	NS	NS	NS	NS	NS	NS	O, NU
Wet Canyon	0504020	NS	NS	NS	O	P	NS	O, 2Y
Turkey Flat	0504021	NS	O	O	O (2 pr)	O, NU, & M	NS	M
Pitchfork Canyon	0504022	NS	A	NS	M	O, NU	NS	O?
Frye Canyon	0504028	NS	NS	NS	NS	NS	NS	NS
Deadman	0504029	NS	NS	NS	NS	NS	NS	NS
Gibson	0504030	NS	NS	NS	NS	NS	NS	NS
Too Steep	0504031	NS	NS	NS	NS	NS	NS	NS

(Kielberg Peak)								
Walkabout	0504033	NS	NS	NS	NS	NS	NS	NS

O= Pair Occupancy Confirmed, P= Presence of Single Owl Confirmed, Sex Undetermined, NS= No Information, NU= Nesting Undetermined, A= Absent, NY=No Young Produced, M= Male Inferred or Confirmed 1Y/2Y= Number of Young Fledged

We first visited the site on July 12, 2004, in order to better assess the impacts of the fire suppression activities on all listed species and their associated critical habitat. We looked at the accessible areas where helispots and safety zones were created within MSO habitat and looked at the area along Forest Roads 507 and 669. The dozer lines, safety zones, and helispots created along these two roads removed significant amounts of trees greater than nine inches dbh. Additionally, burn-out operations conducted along these two roads appeared to have resulted in high-severity burn intensity as described above. Many trees, both less and greater than nine inches dbh, and significant amounts of understory and downed logs were consumed by fire associated with burn-outs along both Forest Roads 507 and 669. As previously mentioned, distinguishing between the effects of the main fire and the effects of the burn-out operations is often difficult. Typically, within 100 yards from the control lines, the overall burn pattern resulted in a mosaic of burned and unburned patches, with significant amounts of live trees of all sizes and understory. Subsequent site visits were made on July 19th and then during the Fall of 2004 and Spring 2005 MGRS census. Although the purpose of the bi-annual MGRS census is to track MGRS populations, we also used those times to further assess the effects of the rehabilitation efforts and the overall recovery of the landscape and vegetation post-fire.

Several areas subjected to burn-out operations have begun to regenerate vegetation. Additionally, several trees that appeared to be dead have regenerated new leaves and appear to be recovering from the stresses associated with the fire and associated suppression actions. Although no MSO were observed or detected on these post-fire visits, some MSO habitat appears to be recovering since the Nuttall-Gibson Complex Fire, while other habitats will likely take decades to become MSO habitat again. Several areas of the MSO habitat were subjected to low-to moderate burn severity, resulting in a mosaic burn pattern. This mosaic burn pattern has resulted in suitable MSO habitat remaining. Canopy closure, tree density, understory vegetation, and snag availability are relatively unchanged compared to pre-fire conditions in several areas.

Approximately 11,350 acres of habitat burned with moderate-severity burn effects (38 percent). Generally, the moderate-severity burn areas are scattered throughout the fire perimeter; however, most of them are concentrated on the northern and eastern portions of the mountain range (Gibson Fire area). The moderate-severity burn areas on the western part of the fire perimeter are concentrated around the ignition point of the Nuttall Fire and occur in significant portions of two PACs and small amounts of three PACs. The areas of moderate-severity burn effects along the eastern portion of the fire perimeter encompass significant portions of eight PACs and small portions of two PACs. The majority of the moderate-severity burn effect areas occurs outside of PACs, but is still within MSO habitat. Although tree death occurs in moderate-severity burn areas, 100 percent tree death does not typically occur. Pockets of live, unburned trees remain scattered throughout these moderate-severity burn areas. Furthermore, as mentioned above, shrubs and small trees have begun repsrouting, and partially damaged trees have begun healing. Some parts of the moderate-severity burn areas will undoubtedly take decades to become suitable breeding habitat for MSO; however, due to the nature of the mosaic burn patterns and the pockets of live trees observed, new snags created, as well as the difficulty in assessing remote areas because of the steepness and ruggedness of the terrain, it is difficult to quantify how much of the 11,350 acres of the moderate-severity burn areas are no longer suitable MSO habitat.

Although most of the high-severity burn effects areas were devoid of vegetation immediately after the fire and are currently not viable MSO habitat, grasses and shrubs have re-grown and re-sprouted throughout much of the area, resulting in sufficient ground cover to provide habitat for future MSO prey base, and new snags have been created as a result of the fire and associated suppression actions. Nonetheless, because of tree death, high-severity burn areas will take decades before they once again become suitable as breeding habitat for MSO. About nine percent of the habitat within the fire perimeter (2,675 acres of 29,725 total acres) was subjected to high-severity burn effects. These areas are scattered throughout the fire perimeter, including within MSO habitat; however, the majority of these areas are outside of MSO PACs. Furthermore, pockets of suitable habitat for MSO remain scattered throughout these high-severity-burn effects areas, similar to the moderate-severity burn-effects areas. MSO have high sight fidelity and will often continue to use these areas (including within PACs) for up to five years for breeding habitat while foraging in the more open areas. As the habitat deteriorates, MSO will likely find other suitable habitat (Shaula Hedwall, FWS, personal observation).

B. Factors affecting MSO in the action area.

Most of the action area has supported significant recreational use by researchers, hikers, campers, birders, wildlife and plant collectors, fuel wood collectors, and hunters. Much of the action area is in steep and rough terrain that is inaccessible on foot. Additionally, summer-home owners and sometimes their pets inhabit the action area and use the forest lands surrounding their cabins for a variety of activities, including those mentioned above.

Additional information about the action area can be found in the Environmental Baseline for the MGRS, including information about recent wildfires.

C. Status of Critical Habitat within the action area.

At the time of the fire and associated suppression and BAER activities, critical habitat for MSO had not been designated, but was proposed for the entire action area. Critical habitat was designated shortly after the fire was declared 100 percent contained and all actions associated with suppression and rehabilitation ended (August 31, 2004). Within the fire perimeter, 21,426 acres of critical habitat was designated. Approximately 2,371 acres of the fire perimeter were located outside of the critical habitat boundaries.

D. Factors affecting Critical Habitat in the action area.

The same factors that affect the species in the action area also affect critical habitat (see above).

EFFECTS OF THE ACTION

The potential effects from fire suppression and emergency rehabilitation and stabilization efforts on MSO and associated critical habitat included disturbance through increased noise, application of fire retardant, water bucket drops, and burn-out operations, and habitat alteration during the breeding season. The suppression activities and emergency rehabilitation and stabilization activities also reduced the extent and nature of effects of the wildfire on MSO and its habitat.

Suppression and rehabilitation activities can produce noise of varying intensity, duration, and frequency as well as habitat disturbance from equipment and personnel (crews using hand tools and chainsaws to cut hand line, dozers, burnout operations, etc.). Selected cutting of large (greater than 12 inches dbh) hazard trees and snags within some PACs may have altered small amounts of MSO habitat. We discuss the effects of fire suppression and rehabilitation in each PAC below.

Frye, Deadman, Too Steep, and Walkabout PACs: MSO and habitat in these PACs were mostly affected by suppression actions in the form of low-level air operations. These air operations consisted of helicopters used in water bucket drops, retardant delivery, and aerial reconnaissance. Limited air operations involving air tankers may have occurred over these PACs as well. Dozer line was created when the 507 Road was cleared, which is within 0.25 mile of Deadman PAC; however, because of the remote location and the steep terrain, no other suppression actions occurred in these four PACs.

Riggs Lake, Hagens Point, and Pitchfork Canyon PACs: MSO and habitat in these PACs were predominantly affected by noise disturbance. Noise disturbance included low-flying aircraft and line cutting/mechanical disturbance along the edges of the PACs. The Riggs Lake PAC was affected by limited hand-line construction where the fire jumped across the Swift Trail. Additionally, the Riggs Lake PAC was on the edge of burn-out activities. The Riggs Lake PAC has one known roost site within 0.15 mile of the fire line and associated suppression activities.

Chesley Flat, Webb Peak, and Lefthand Canyon PACs: MSO and habitat in these PACs were all affected by dozer-line and hand-line construction in or along the edges of the PACs, water/retardant drops, and noise disturbance from low-level aircraft and mechanical equipment within the PACs. Furthermore, the Chesley Flat PAC was subjected to burn-out operations that resulted in moderate-severity burn effects along the edge of the PAC, and a safety zone was created along the edge of the Webb Peak PAC.

Eagle Rock, Heliograph, and Gibson PACs: MSO and habitat in these PACs were affected by noise disturbance from low-flying aircraft and water/retardant drops. Additionally, dozer line was created within 0.5 mile of the Gibson PAC when the 507 Road was cleared. The Heliograph PAC was also affected by the construction of hand line through the middle of the PAC, running perpendicular to the PAC from one edge of the PAC to the other. Hand line was used in this PAC to connect areas of the Swift Trail being used as a control line.

Crazy Horse, Marijilda, Nuttall, and Clark Peak PACs: MSO and habitat in these PACs were affected by noise disturbance from low-flying aircraft, water/retardant drops, noise associated with the creation of hand and dozer lines along the edges of the PACs, and the creation of helispots in close proximity to the PACs. The Crazy Horse and Marijilda PACs are bordered by the 507 Road, and two helispots were created within 0.25 mile of the Nuttall PAC. The Clark Peak PAC has one known roost site within 0.15 mile of the fire line and associated suppression activities.

Wet Canyon, Turkey Flat, Ash Creek, and Mill Site PACs: MSO and habitat in these PACs were affected by noise disturbance from low-flying aircraft and creation of hand and dozer lines along the edges of the PACs, water/retardant drops, noise, and burn-out operations associated with aerial "ping-pong" dispensers. Ignitions in the Ash Creek and Mill Site PACs were not as successful as in the Turkey Flat and Wet Canyon PACs due to increased fuel moistures in the former two PACs.

Noise and Human Disturbance from Fire Crew Activities:
Mechanical noise and human presence may be disruptive to MSO, particularly during the breeding season. Owls have more sensitive hearing than other birds (Bowles 1995). If noise arouses an animal, it has the potential to affect its metabolic rate by making it more active. Increased activity can, in turn, deplete energy reserves (Bowles 1995). Noisy human activity can cause raptors to expand their home ranges, but often birds return to normal use patterns when humans are not present (Bowles 1995). Such expansion in home ranges could affect the fitness of the birds, and thus their ability to successfully reproduce and raise young. Species that are sensitive to the presence of people may be displaced permanently, which may be more detrimental to wildlife than recreation-induced habitat changes (Hammit and Cole 1987, Gutzwiller 1995, Knight and Cole 1995). If animals are denied access to areas that are essential for reproduction and survival, that population will most likely decline. Likewise, if animals are disturbed while performing behaviors such as foraging or breeding, that population will also likely decline (Knight and Cole 1995).

Birds may respond to disturbance during the breeding season by abandoning their nests or young; by altering their behavior such that they are less attentive to the young, which increases the risk of young being preyed upon; by disrupting feeding patterns; or by exposing young to adverse environmental stress (Knight and Cole 1995). There is also evidence that disturbance during years of diminished prey base can result in increased foraging time, which in turn may cause some raptors to leave an area or to not breed at all (Knight and Cole 1995). At National Parks in Utah, Swarthout and Steidl (2003) examined behavioral responses of nesting MSO to individual hikers that passed within 36 to 210 feet of active nests every 15 minutes. Among various behavioral changes observed during treatments, female and male MSO increased the frequency of contact vocalizations by 58 and 534 percent, respectively. Female owls decreased the amount of time they handled prey by 57 percent and decreased the amount of time they performed daytime maintenance by 30 percent. Swarthout and Steidl (2003) examined flush response of MSOs in canyon situations to recreationists, and found that if hikers are excluded from a 79-foot radius around roost sites, 95 percent of owl flush responses would be eliminated.

The location of the nest or roost sites is known for only four of the 21 PACs, and not all 100-acre core areas (as recommended in the Recovery Plan) have been delineated in the PACs. Three of these nest or roost sites (Ash Creek, Mill Site, and Riggs Flat PACs) were not affected by suppression actions. The fourth nest site (Webb Peak PAC) may have been subjected to suppression actions (noise disturbance from fire-line construction); however, the pair of MSO in this PAC successfully fledged one young. These impacts occurred over a period of four weeks. Data gathered after the 2002 Oversite Fire indicate that MSO were still using some of the most heavily affected PACs (U.S. Fish and Wildlife Service 2004). Although they are not yet capable of flight by mid-June, MSO young are typically capable of short hopping movements away from the nest by this time and become more mobile by mid-July, thus the adults and young are not as closely tied to the nest as they would be in May or early June.

Hand crews creating hand lines and running chainsaws, and dozer crews creating dozer lines, safety zones, and helispots within and adjacent to PACs can have the same disruptive effects on MSO as those described above. No safety zones or helispots were created within PACs; however, they were created along the edges of PACs. A safety zone was created along the edge of the Webb Peak PAC, and two helispots were created within 0.25 mile of the Nuttall PAC. Dozer lines were created along the edges of six PACs (Crazy Horse, Marijilda, Wet Canyon, Turkey Flat, Ash Canyon, and Mill Site), within 0.25 mile of Deadman PAC, and within 0.5 mile of Gibson PAC. Hand line was created, to some extent, along the edges of most of the PACs. Both the Clark Peak and Riggs Lake PACs have known MSO roost sites within 0.15 mile of fire lines and associated suppression actions, and the Turkey Flat PAC has a known roost and nest site within 0.10 mile of fire lines and associated suppression actions. The MSO pair documented in the Webb Peak PAC prior to the fire successfully fledged one young after the fire, despite having extensive disruption from dozer-line construction within and adjacent to the PAC, as well as having a safety zone created along the edge of the PAC.

Habitat Modification due to Fire and Dozer Line Construction:
Hand line and dozer line construction may have modified MSO habitat by significantly changing the key habitat components for the species, depending on the amount, type, location, and number of large trees and mid-story vegetation cut. Five of the 21 PACs were affected by either hand line, dozer line, or both. Dozer lines that varied from eight to 15 feet wide were placed in three of the five PACs (Chesley Flat, Webb Peak, and Lefthand Canyon), while hand lines, two to five feet in width, were constructed in the other two PACs (Riggs Lake and Heliograph). Chainsaw crews were also working along with the hand line crews to help remove snags and trees that presented a danger to firefighter safety. Removal of large trees during handline and dozer line construction may result in loss of nest and/or roost trees, active or inactive. The number of trees >9 inches dbh cut during handline construction is unknown; however, that number was probably high based on the large nature of the fire and associated hand lines and dozer lines, our conversations with the Resource Advisor, and observations during our site visits. Possible effects of large tree removal include increased nest vulnerability and discovery by MSO predators, microhabitat alteration, and increased edge effects, such as tree blowdown, along dozer lines and hand lines. Because the fire was large (29,000+ acres), the dozer and hand lines associated with containing the fire were extensive (more than three miles); however, fire crews placed waterbars along the steep portions of the handline to minimize and reduce the potential for erosion. Brush and trees were placed across the dozer line to help minimize and reduce the potential for erosion on those areas.

Habitat Modification Due to Base Camps and Helispots:
Due to the large nature of the fire and the long duration of suppression actions, a formal base camp (Incident Command [IC]) and two spike camps were established. The IC was established at the Safford High School, in the town of Safford, outside of the forest boundary. Both spike camps were established at previously disturbed sites within the forest. One camp was set up at Treasure Park Campground and the other one was established at the Columbine Administration Site. No habitat removal was necessary for either of the spike camps, and neither spike camp was within a MSO PAC.

As previously mentioned, five helispots were constructed, consisting of 125-foot by 200-foot clearings, from which trees, brushy vegetation, and large rocks were cleared with bulldozers. Two helispots were created within 0.25 mile of one PAC (Nuttall). Creation of these helispots required the removal of all trees and understory within the 125-foot by 200-foot area. Large trees (greater than nine inches dbh) were cleared for these helispots. This PAC had not been monitored since 1997 (occupied, 2 young) so MSO occupancy at the time of the fire is not known. Protocol monitoring conducted in 2005 indicated that the PAC was not occupied during that breeding season. It is possible that the PAC was occupied prior to the fire and that MSO in were subjected to and disturbed by the noise associated with creation of these helispots; however, no data exist to evaluate this possibility.

Seven safety zones were also created, resulting in the removal of MSO habitat. Five of these safety zones occurred within MSO habitat and required the removal of large (greater than nine inches dbh) trees and understory. Although no safety zones were created within PACs, some of these safety zones were created along the edges of PACs. MSO within these PACs would have been subjected to the noise associated with the creation of the safety zones; however, the safety zones were created concurrently with the dozer lines, hand lines, and helispots. It is unlikely that the creation of safety zones would have had any increased detrimental effect on MSO over the rest of the suppression actions.

Effects of Low-flying Aircraft:
During suppression and rehabilitation efforts, MSO may have been impacted by aircraft noise as air tankers and helicopters flew low (less than 1,000 feet above ground level [AGL]) over the PACs and, likely, the 100-acre core areas of some of the PACs. Because of concurrent fires, flights by air tankers as well as availability of retardant were limited (eight to ten flights over two days); helicopters were used extensively to drop retardant and water on this fire. In four of the 21 PACs (Frye, Deadman, Too Steep, and Walkabout) no water or retardant were dropped, but the PACs were overflown by air tankers and helicopters. Aerial operations in these four PACs were less than 1,000 feet AGL; however, they were likely more than 500 feet AGL as they flew en route to areas where water and retardant was necessary. The low-level flights for the remaining 17 PACs were likely close to, if not less than 300 feet AGL for all aircraft. In order to place water from bucket drops, helicopters were at or below 300 feet AGL. Similarly, tankers and single engine air tankers (SEATs) flew at or below 300 feet AGL in order to place retardant precisely where it was needed, including within the PACs and, possibly, within 100-acre core areas. Air operation noise, especially from low-and-slow flying aircraft and helicopters, either during overflights, moving to and from sling loads and crew drops, or while dropping water or retardant, can disturb MSO. Low-level flights have the greatest potential to disturb owls because the planes are closer and slower, expanding the time and increasing the decibel levels to which MSO are exposed (Delaney *et al*. 1997 and 1999). Delaney *et al*. (1997 and 1999) found that helicopter flights above 345 feet AGL did not significantly affect breeding success of MSO on the Lincoln National Forest, New Mexico. Although MSO responded behaviorally to the aircraft, no flushing was noted when recorded noise levels from helicopters were less than 92 decibels. MSO returned to pre-disturbance behavior within 15 minutes. All adult MSO flushes occurred after juveniles had left the nest, probably reflecting adult fidelity to the nest during portions of the breeding cycle.

The same study (Delaney *et al*. 1997 and 1999) revealed that MSO exhibited alert responses when helicopters were an average of 1,322 feet (± 486 feet) away and no response when helicopters were more than 2,165 feet away. A seasonal change in MSO response was also noted. The time elapsed between initiation of a disturbance and an associated alert behavior decreased as the nesting season progressed. The distance from the disturbance that elicited an alert behavior also decreased during the breeding season. There was indication of habituation to flights by the species; however, sample sizes were too small to establish trends. In their study, Delaney *et al*. (1997 and 1999) conducted helicopter flights August 1-22 in the first year and April 30 to July 25 in the second year. In addition, Delaney *et al.* (1999) found that MSO did not flee from helicopters when caring for young at the nest, but fled readily during the post-fledgling period. The helicopter used in this study was similar in size to the light helicopters (Type III) flown on the Nuttall-Gibson complex fire. Based on the work of Delaney *et al.* and the timing of the Nuttall-Gibson complex fire (June – before MSO nestlings have fledged), MSO overflown by aircraft likely showed alert responses, but probably few if any flushed from the nest.

Effects of Burn-out Operations:
Although it is often difficult to distinguish between the effects of the burn-out operations and the effects of the main fire, we recognize that burn-out operations are part of the suppression actions and have the potential to affect listed species. Burn-out operations were used extensively during the Nuttall-Gibson complex fire to help consume fuels in front of the main fire and to aid in containing the fire. Due to safety issues associated with having personnel on the ground during burn-out operations, it is difficult to determine where the wildfires and the burn-out operations merged; however, it is believed that the burn-out fires and wildfires merged quickly, thus minimizing the amount of habitat affected by burn-out activities. Five PACs (Chesley Flat, Wet Canyon, Turkey Flat, Ash Creek, and Mill Site) were directly affected by burn-out operations. Riggs Lake PAC was on the edge of burn-out operations, but was not directly affected by these suppression actions. Of the PACs directly affected by burn-out operations, Chesley Flat was subjected to intense fire along a small portion of its northern edge (less than 100 acres) as a result of the burn-outs. Burn-out operations in the Chesley Flat PAC resulted in a very small area of moderate-to-low severity burn intensity, resulting in limited tree-kill, partial understory removal, and scattered areas of hydrophobic soils. Although most of this PAC lies outside of the fire perimeter, burn-out operations, in conjunction with overflights and fire-line construction in the Chesley Flat PAC were likely severe enough, based on post-fire data and post-fire site visits, to cause MSO detected pre-fire to abandon the PAC. If fires set by burn outs swept through nest areas, the nestling owls were likely not able to avoid smoke, flames, or heat by flying away. Wet Canyon and Turkey Flat PACs were also subjected to intense flames from burn-outs; however, these operations resulted in moderate-to-low severity burn intensity. These burn intensities do not always result in widespread tree-kill, do not completely consume understory vegetation, and soil integrity usually remains intact.

Burn-out operations occurred within the 100-acre core area of two PACs (Ash Creek and Mill Site), but these actions were limited to aerial burn-out operations (ping-pong balls dropped from helicopters) resulting in a mosaic of low-severity burns. Based on maps of known historical nest/roost sites and post fire monitoring, these low-intensity flames that resulted in low-severity burns did not affect the known nest and roost sites for these two PACs. Much of this particular burn-out area did not burn due to the high moisture content associated with Ash Creek and the onset of summer rains.

Effects of Water and Retardant Drops:
It is possible that retardant and water-bucket drops adversely affected MSO or an MSO nest within several of the PACs. At least 16,000 to 20,000 total gallons of retardant were dropped from tankers, and likely several thousand gallons of both retardant and water were dropped from helicopters with buckets and snorkels. We did not observe any dead or injured MSO during our site visits in July 2004 and in 2005; however, the odds of finding a dead or injured MSO are low. If adult birds and young were present in the nest core during the overflights and water drops, they were likely killed, injured, harmed, and/or harassed by the suppression actions. Harm, injury, or death was reasonably certain to have resulted from water/retardant drops made in the vicinity of known nest and roost locations, causing branches to break and snags/trees to fall, which could result in death, injury, or harm to an owl, especially to a recently fledged bird that is

not adept at flying. Broken branches and snags/trees knocked over by water and retardant drops were observed during our site visits.

Effects of Emergency Suppression, Rehabilitation, and BAER Activities:
Rehabilitation of helispots, hand lines, dozer lines, and safety zones had also begun in several areas by our first site visit. Large pieces of brush, trees, and other debris were placed across these areas to help minimize erosion, promote natural revegetation within these disturbed areas, and to provide cover for wildlife using these areas. Waterbars were established along hand lines and trails used as fire line to help decrease erosion along those areas as well. BAER activities included aerial operations such as aerial mulching and seeding to protect heavily burned areas, safety zones and helispots within the fire perimeter. BAER activities may have had the same short-term noise effects to any MSO still occupying PACs as aerial operations associated with fire suppression activities. Aerial mulching and seeding operations likely required low level flights (500 feet or less) over PACs; however, these used smaller helicopters (Type III) similar to those used in Delaney *et al*. (1997 and 1999). Additionally, aerial operations associated with BAER activities were shorter in duration and intensity than those associated with suppression actions. Furthermore, areas where BAER activities were carried out were mostly devoid of vegetation since they were areas of moderate-to-severe burn intensity. Hazard trees along hiking trails, roads, and fire lines were also removed by hand crews with chainsaws to prevent them from falling down and possibly injuring firefighters, hikers, or other persons using the forest. This hazard-tree removal would have had minimal noise effect on MSO since all of these activities occurred outside of the MSO breeding season of March through August. Although the fire-suppression and rehabilitation activities had potentially negative short-term effects to MSO, they also had long-term positive effects on the action area. The suppression activities minimized damage caused by the fire. The rehabilitation activities (fire suppression rehabilitation and BAER) were designed to help minimize the effects of both fire-suppression activities and the potentially severe effects of the fire itself and benefit the action area over time. The water bars placed in fire lines and the aerial mulching and seeding helped reduce soil erosion and promote the regeneration of native vegetation.

Effects of Conservation Measures:
The conservation measures enacted by the Forest likely helped reduce the severity of the effects of suppression actions on MSO. In some cases, the conservation measures may have completely removed the effects of certain suppression actions. Having a Resource Advisor assigned to the fire ensured that someone with local knowledge of the area and experience with fire-suppression actions would be on site at all times to work with crews to minimize the impacts of their actions. The Resource Advisor worked with hand and machine crews (dozer operators, excavator operators, etc.) to have fire lines placed in such a manner that MSO habitat was affected as minimally as possible. The Resource Advisor encouraged crews to minimize and avoid, whenever possible, the cutting of large trees and snags in MSO habitat. Additionally, the Resource Advisor worked with the fire crews and BAER team to rehabilitate the fire lines and burned areas to further reduce the long-term effects of the suppression actions as well as effects of the fire, itself, on MSO. These efforts to rehabilitate the fire lines (dozer and hand lines) and the burned areas helped decrease the effects of erosion and downstream sedimentation.

Summary:

In summary, suppression actions likely adversely affected MSO directly through noise associated with fire-line construction, burn-out operations, and low-level overflights. Suppression actions also likely indirectly affected MSO through habitat modification associated with fire-line construction, safety-zone and helispot construction, burn-out operations, and application of water and retardant in MSO habitat. These actions may have caused MSO to abandon their roosts and/or nests or any young in nests. Additionally, these actions may have lead to the direct mortality of MSO, although, as previously mentioned, no injured or dead MSO were observed during site visits. Habitat-altering actions likely rendered some PACs or portions of PACs uninhabitable or unsuitable for use by MSO. Although suppression activities had adverse effects, they also minimized the size and intensity of the wildfire, which without suppression could have had much greater impacts to MSO and their habitats in the Piñaleno Mountains.

As described in Table 1 and the narrative above, two PACs were occupied by one or more MSO prior to the fire and determined likely to be unoccupied or reduced in occupancy after the fire. The Chesley Flat PAC was occupied by a single adult MSO before the fire. This PAC was subjected to burn-out operations that resulted in moderate-severity burn effects along and within a small portion of the northern edge of the PAC (approximately 100 acres), extensive hand-line and dozer-line construction within and adjacent to the PAC, and the effects of aerial operations (noise and water/retardant drops). Post-fire monitoring indicated that no MSO inhabited this PAC after the fire and associated suppression actions. The Hagens Point PAC was occupied by a pair of MSO prior to the fire and suppression actions, and only a single male was detected after the fire. The Pitchfork Canyon PAC was occupied by a pair of MSO prior to and after the fire. Both of these latter PACs (Hagens Point and Pitchfork Canyon) were subjected to the effects of aerial operations (noise and water/retardant drops) over and within the PACs and mechanical operations (hand line construction, chainsaws, etc.) along the edges of the PACs.

Monitoring immediately after the fire in 2004 can show immediate or direct effects of fire suppression, emergency rehabilitation and stabilization effects, or the effects from the wildfire itself. However, MSO may still be present immediately after the fire, or may even complete a successful nesting season, in habitats that are rendered marginal or unsuitable by the fire and/or suppression/rehabilitation. Monitoring from 2005 and 2006 is more likely to reveal longer-term effects due to changes in habitats. Post-fire monitoring in 2005 was limited; only five of the 21 PACs affected in the 2004 fire were monitored (Table 1 above). The three PACs that were occupied before the fire and likely unoccupied after the fire were not monitored in 2005. Also noted in Table 1, two of the three PACs (Chesley Flat and Hagens Point) had a consistent occupancy record for three years prior to the fire (Chesley Flat) and two years prior to the fire (Hagens Point). Furthermore, the Hagens Point PAC has a history of reproduction (two young in 2002). The Pitchfork Canyon PAC has an intermittent monitoring record with only one year of occupancy documented prior to 2004 (lone male in 2003).

Monitoring efforts in 2006 were more extensive than in 2005, with 14 of the 21 PACs being monitored, including four PACs that were surveyed for the first time since 1997 (Clark Peak, Lefthand Canyon, Ash Canyon, and Eagle Rock PACs). Clark Peak, Lefthand Canyon, and Ash Canyon PACs had no MSO detected during 2006. Eagle Rock PAC, however, was determined to be occupied by a pair of MSO, although their nesting status was undetermined. The three PACs mentioned above that were occupied before the fire with no MSO detected afterward and then not monitored in 2005 were monitored in 2006. Chesley Flat PAC, which was not monitored in 2005, was determined to likely be unoccupied in 2006. Because this PAC was not monitored in 2005, a trend is difficult to establish. It is possible that the MSO were not breeding in 2006 and, therefore, not vocalizing in defense of a territory. Both Hagens Point and Pitchfork Canyon PACs, which were not monitored in 2005, were occupied by a pair of MSO, and the pair in Hagens Point produced two young. Seven of the 14 PACs monitored in 2006 were occupied, while the other seven were determined to likely be unoccupied. Without consistent data over the years, it is difficult to establish a long-term trend in MSO occupancy. MSO have a high sight fidelity and have been documented occupying PACs that were heavily burned during wildfires for up to four or five years past fire (Shaula Hedwall, FWS personal observation). Furthermore, MSO do not always reproduce every year, thus making determinations about long-term trends more difficult (U.S. Fish and Wildlife Service 1995).

Effects to Critical Habitat

The effects to critical habitat are similar to those effects to habitat described above. The potential impacts from fire suppression and rehabilitation efforts include possible habitat degradation due to fire retardants, crew movements, burn-out activities, and vegetation-clearing activities that may have altered the primary constituent elements of critical habitat. Without fire-suppression activities, it is likely that the primary constituent elements of critical habitat would have been more severely damaged by the fire. Furthermore, the previously mentioned conservation measures initiated during suppression activities and rehabilitation activities that followed the suppression activities minimized effects to critical habitat and surrounding vegetation after the fire.

As previously mentioned, a formal base camp was established in the town of Safford. Two spike camps were established at previously disturbed sites (one campground and one administrative site) within the forest; however these spike camps were not in MSO critical habitat. Three helispots were constructed within MSO critical habitat. One helispot (near Carter Canyon) was created in an area of agaves and creosote plants at the base of the mountains and, therefore, was not in critical habitat. Since permanent water sources were available throughout the fire perimeter (three lakes/ponds), no water-dip sites were established within critical habitat boundaries. Creation of the three helispots within MSO critical habitat required the removal of primary constituent elements. Large (greater than nine inches dbh) conifer trees, snags greater than 12 inches dbh, and understory, including downed logs, were all removed to create the helispots. In total, approximately 1.7 acres of CH were degraded by construction of helispots. Similar to the helispots, five of the seven safety zones occurred within MSO critical habitat and required the removal of large trees, snags, and understory. One safety zone (near Twilight Campground) in critical habitat lacked primary constituent elements before work began. This safety zone was less than 100 square feet on a flat spot of a ridge and appeared to be previously disturbed. Construction of the remaining four safety zones resulted in degradation of approximately 3.7 acres of critical habitat. During BAER and fire-suppression rehabilitation activities, cut material (whole trees and bucked logs) was spread in helispots and safety zones to help minimize the potential for erosion. Spreading of the cut material also helped restore some of the understory vegetation and prey-base cover necessary for foraging MSO. Retardant dip sites were established outside of the boundaries of critical habitat.

Fire crew movement, vegetation clearing, and burn-out operations within the nine PACs affected by these operations likely adversely affected some of the primary constituent elements of critical habitat. As stated above, 21,426 acres of critical habitat occur within the fire perimeter. A conservative estimate of the amount of hand line and dozer line indicates that approximately 3.5

acres of MSO habitat was affected by these operations. Although the exact number of trees greater than nine inches dbh and large snags cut or scorched in critical habitat during suppression actions is not known, the number is anticipated to have been high, based on the large nature of the fire and associated hand line, dozer line, burn-out operations, conversations with the Resource Advisor, and observations during our site visits. Much of the dozer line and hand line, as well as all of the burn-out operations, occurred within areas identified as wildland-urban interface (WUI) which were excluded from critical habitat. The acreage of critical habitat affected by burn-out operations is difficult to determine due to the rugged terrain within several areas of critical habitat. Additionally, the acres affected by burn-out operations are difficult to determine due to the safety concerns of having personnel on the ground monitoring where the burn-out fires merged with the wildfires. However, a rough estimate is that approximately 43 acres of critical habitat were affected by burn-out operations.

Despite the nature of the effects to primary constituent elements, one PAC (Webb Peak) that had extensive ground operations (dozer line and hand line) still produced one young MSO after the fire. Based on our post-fire site visits (including MGRS monitoring), loss of long-term viability of most of the PACs is not anticipated as a result of the fire or fire-suppression and rehabilitation efforts. The severity of the burn-out operations along the edge of and within the small portion of the Chesley Flat PAC was moderate; however, this PAC, along with the Webb Peak PAC, is located in the WUI exclusion zone and, thus, does not contain critical habitat. Like the Chesley Flat PAC, only a small portion of the Hagens Point PAC lies within the fire perimeter and most of this PAC and all areas affected by suppression are within the WUI exclusion zone for critical habitat. Additionally, based on our site visits, vegetation within and around several of the PACs is beginning to recover and can provide suitable nesting, roosting, and foraging habitat for MSO. Although approximately 46.5 acres of critical habitat were affected by suppression actions (including burn-out operations), this is a small amount compared to the amount of critical habitat affected by the fire and the amount available within the mountain range. As previously mentioned, 5,928 acres within the fire perimeter were excluded from critical habitat as WUI areas, and most of the burn-out operations occurred within the WUI areas. Of the remaining 23,797 acres of MSO habitat within the fire perimeter, 21,426 acres was critical habitat. Approximately 2,371 acres of MSO habitat within the fire perimeter is not designated as critical habitat. The amount of critical habitat and associated primary constituent elements affected by suppression actions is less than one percent of the critical habitat available on the mountain. Although we were able to conservatively estimate that approximately 43 acres of critical habitat were affected by burn-out operations, we cannot determine the total amount of critical habitat affected by burn-out operations. Even if we were able to measure the total amount of critical habitat affected by burn-out operations, the amount would likely be minimal given that burn-out operations would have merged with the wildfires relatively quickly. Furthermore, this constitutes less than one-tenth of a percent of critical habitat designated throughout the range of MSO. Without the suppression actions, the fire likely would have consumed and, potentially, adversely affected more critical habitat than if no suppression actions had occurred.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Only Forest Service lands occur within the action area, thus all activities likely to occur will have some Federal nexus. Thus, the effects of such activities are subject to section 7 consultation, and are not cumulative effects.

CONCLUSION

After reviewing the current status of the MSO and its associated critical habitat, the environmental baseline for the action area, the effects of the actions taken to suppress and rehabilitate the Nuttall-Gibson Complex Fire, and the cumulative effects, it is our biological opinion that the actions, as described, neither jeopardized the continued existence of MSO, nor resulted in destruction or adverse modification of MSO critical habitat. We note that this BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Our findings are based on the following:

- The fire and associated suppression activities did not permanently reduce the suitability of the area for future MSO occupancy. Significant MSO habitat still exists within the fire perimeter and around the areas of suppression actions.

- Although 21 PACs were affected to varying degrees by suppression actions, not all PACS were heavily affected. Most of the PACS still have pockets of suitable habitat that can still be used by MSO. Furthermore, these 21 PACs constitute less than two percent of the known PACs throughout the range of MSO.

- Although suitable MSO habitat was affected by the establishment of three helispots, five safety zones, burn-out operations, and significant hand line and dozer line, the total amount of MSO habitat affected by suppression actions was small compared to the amount of habitat affected by the fire (less than one percent). The percentage of MSO habitat affected is less than one-tenth of a percent of the amount of MSO habitat available throughout the range of MSO, and 15% percent of the known PACs within the Basin and Range-West RU.

- Much of the suppression actions occurred in areas designated as WUI areas that are excluded from critical habitat designation, thus minimizing the effects to critical habitat. The total amount of MSO critical habitat affected by suppression actions was small compared to the amount of critical habitat affected by the fire (less than one percent). The percentage of critical habitat affected is less than one-tenth of one percent of the amount of critical habitat available throughout the range of MSO.

- Fire-suppression and rehabilitation activities prevented the fire from doing more damage to MSO and critical habitat. Conservation measures and rehabilitation efforts further minimized effects of suppression activities.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal Regulations pursuant to section 4(d) of the Act, prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. “Harm” is defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

For the purpose of evaluating incidental take of MSO from the action under consultation, incidental take can be anticipated as either the direct mortality of individual birds, or the alteration of habitat that affects behavior (i.e. breeding or foraging) of birds to such a degree that the birds are considered lost as viable members of the population and thus “taken.” They may fail to breed, fail to successfully rear young, raise less fit young, or desert the area because of disturbance or because habitat no longer meets the owl’s needs.

In past BOs, we used the management territory to quantify incidental take thresholds for the MSO (see BOs provided to the Forest Service from August 23, 1993 through 1995). The current section 7 consultation policy provides for incidental take if an activity compromises the integrity of an PAC to an extent that we are reasonably certain that incidental take occurred. Actions outside PACs will generally not cause incidental take, except in cases when areas that may support owls have not been adequately surveyed.

Using available information as summarized within this document, we have identified incidental take due to harm and harassment of MSO associated with suppression activity in the Chesley Flat and Hagens Point PACs. Although it is possible that some effects to MSO in the PACs may have resulted from the wildfire itself, it is the effects of the suppression actions that must be addressed in this emergency consultation. Based on the best available information concerning the MSO, habitat needs of the species, the project description, and information furnished by the Forest Service, incidental take of MSO and associated young in two PACs (four adult MSO and associated young) is reasonably certain to have occurred as a result of tanker or helicopter water and retardant drops; or hand line, dozer line, and burn-out operations within these two PACs. These suppression actions within the PACs resulted in scorched trees, understory consumption, complete habitat removal, broken tree tops, broken limbs, and fallen snags, which can result in disturbance and/or injury or death to juvenile or adult MSO. In addition, low-level flights (300 feet AGL or less) occurred over the PACs and were likely in close proximity to the last known nest sites. Both of these PACs were documented to be occupied prior to the start of the fire and associated suppression actions. Protocol monitoring indicated that the Chesley Flat PAC was occupied by a single MSO prior to the fire, and no MSO were detected after the fire. As previously mentioned, the Chesley Flat PAC was subjected to very hot burn-out operations along its edge and in a small portion of the PAC. Additionally the Chesley Flat PAC was subjected to extensive fire line construction (hand and dozer line) through the same small portion of the PAC. These burn-out operations and fire-line construction activities likely caused the MSO in this PAC to leave the area. The Hagens Point PAC was occupied by a pair of MSO prior to the fire and only a single male MSO was detected after the fire. This PAC also has a history of pair occupancy and successful reproduction (Table 1). It is likely that suppression actions associated with the Nuttall-Gibson Complex Fire disrupted this pair of owls and possibly caused failed nesting attempts or fledglings to be abandoned. Even if the owls were not nesting, these suppression actions likely significantly disrupted normal behavior patterns of these same MSO.

We do not anticipate that incidental take of MSO occurred in the remaining 19 PACs. Although suppression actions associated with the remaining PACs included some of the same activities described above, protocol monitoring efforts have indicated that the five PACs that were monitored were either not occupied (one PAC), successfully produced young (one PAC), or increased in occupancy after the fire (three PACs). The remaining 13 PACs were not monitored during 2004 and were not monitored for the four years prior to the fire. It is possible that incidental take occurred in some, or all, of these 13 PACs; however, we cannot be reasonably certain that the PACs were occupied during the fire, fire suppression actions, and BAER activities. Therefore, we cannot be reasonably certain that incidental take occurred in those PACs.

REASONABLE AND PRUDENT MEASURES/TERMS AND CONDITIONS

Incidental take statements in emergency consultations do not include reasonable and prudent measures or terms and conditions to minimize take unless the agency has an on-going action related to the emergency (U.S. Fish and Wildlife Service 1998). The Forest Service has not advised us of any on-going actions related to the emergency; however, as previously mentioned, the Forest Service implemented minimization measures. Known MSO nest and roost sites were avoided by hand and dozer line construction whenever possible and the removal of large trees and snags was minimized to the greatest extent possible. Additionally, unburned patches of habitat were left intact and not subjected to further burn-out operations. The Forest Service also agreed to rehabilitate Forest Roads 507 and 669 after opening them for use as a fire break. These actions likely reduced the amount of incidental take on MSO.

CONSERVATION RECOMMENDATIONS

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

1. We recommend that you monitor MSO to protocol in all 21 PACs for at least 10 years to determine reproductive status, as funding and safety allow, and include your results in an annual report to us.

2. We recommend that you monitor MSO habitat throughout the entire mountain range so that correlations can be made between MSO occupancy and habitat quality.

3. We recommend that you pursue opportunities to research actual effects to and recovery of MSO and nest/roost sites in regard to fire-suppression actions, especially direct drops from aircraft and particularly in relation to future site occupancy by MSO.

4. We recommend that you continue to assist us in the implementation of the MSO recovery plan.

5. We recommend that you pursue the completion of a forest-wide consultation on wildland fire use and wildfire-suppression activities.

In order to keep us informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitat, we request notification of the implementation of any conservation recommendations.

MOUNT GRAHAM RED SQUIRREL

STATUS OF THE SPECIES

We published a final rule on June 3, 1987, designating the species as endangered without critical habitat (52 CFR 20994). The final rule concluded that MGRS was endangered because its range and habitat have been reduced and its habitat was threatened by a number of factors, including the proposed construction of an astrophysical observatory, occurrences of annual forest fires, proposed road construction and improvement, and recreational development at high elevations. The rule concluded the MGRS might also suffer due to resource competition with the introduced Abert's (tassel-eared) squirrel (*Sciurus aberti*). On January 5, 1990, we designated MGRS critical habitat (55 FR 425). We finalized the MGRS Recovery Plan in 1993; it is currently undergoing review.

Found in the southernmost portion of the species' range, MGRS inhabits only the Pinaleño Mountains. MGRS originally resided predominantly in upper elevation, mature to old-growth associations of mixed conifer, ecotone, and spruce-fir above approximately 8,000 feet. The spruce-fir vegetation association, which has been considered as the most important forest community for the squirrel (U.S. Fish and Wildlife Service 1993), is now limited in distribution due to large-scale, stand-replacing, catastrophic wildfires (Clark Peak in 1996 and Nuttall-Gibson Complex in 2004) and a four-insect epidemic that devastated the spruce-fir ecosystem on the mountain (1996 to present). Most MGRS are now located at lower elevation in the mixed-conifer associations. Some drainage bottoms reach well down the mountain, which is believed to have resulted in closer association and likely more resource competition between MGRS and the introduced Abert's squirrel.

Human development is considered a threat because it includes the direct effect of removal of vegetation, which could result in decreased food sources, potential increase of tree blow-down, changes in microhabitat, and increased vulnerability to predation. Additional effects include increased habitat fragmentation, population isolation, and increased tourism. Increases in tourism and development would lead to noise disturbance and increased traffic. Greater traffic can lead to increasing deaths from vehicles.

Additional losses to squirrel habitat could be caused by forest fires, road construction and improvement, new recreation development, and collection of dead and down wood. The threat was summarized by the statement that "any new potential habitat disturbance" would be a cause for concern, and that cumulative effects could be severe over time (52 CFR 20994).

The Recovery Team agreed that habitat loss was the most significant threat to the MGRS (unpubl. meeting notes 2002). Habitat loss from construction of roads, trails, housing, administrative sites, lookouts, and special uses accounts for a maximum of 5.8 percent of the area of potential habitat (Froehlich 1990).

As recently as the 1960s, the species ranged possibly as far east as Turkey Flat and as far west as West Peak, but it is now only located as far west as Clark Peak. A local extirpation occurred on West Peak, possibly due to a fire in the mid-1970s that both isolated the West Peak subpopulation from the rest of the range and destroyed existing MGRS habitat that has not recovered to date (U.S. Fish and Wildlife Service 1993).

Observations from the Pinaleños indicate that the foods of MGRS include: (1) conifer seeds from closed cones, (2) above-ground and below-ground macro-fungi and rusts, (3) pollen (pistillate cones) and cone buds, (4) cambium of conifer twigs, (5) bones, and (6) berries and seeds from broadleaf trees and shrubs. Each food is used seasonally: pollen and buds in the spring, bones by females during lactation, fungi in the spring and late summer, and closed cones low in lipids in the early summer. Closed cones high in lipids are stored for winter-time use (Smith 1968).

MGRS eat seeds and store cones from Englemann spruce, white fir, Douglas-fir, corkbark fir, and white pine. MGRS midden (cone debris piles used for winter food caching) surveys indicate that Engelmann spruce and Douglas-fir are the most common tree species supplying food to MGRS. Douglas-fir, generally a consistent cone producer (Finely 1969), is important in the Pinaleños, especially in areas where it co-exists with Engelmann spruce, which is more prone to cone-crop failure. Use of Ponderosa pine seeds or caching Ponderosa pine cones by MGRS is extremely limited, probably due to microclimate considerations. Cone caching and consumption of cone seeds by red squirrels has been reported in more northerly latitudes (Hatt 1943, Finley 1969, Ferner 1974). The number of mature seed trees per territory needed to supply MGRS food requirements in the Pinaleño Mountains has not been determined. Miller (1991) found that nutritional values of seeds from several conifer species in the Pinaleños vary seasonally and by tree species.

In most populations studied, red squirrels breed from February through early April. Nests can be in a tree hollow, hollow snag, downed log, or among understory branches of a sheltered canopy. Nests may be built in natural hollows or abandoned cavities made by other animals, such as woodpeckers, and enlarged by squirrels. Snags are important in the Pinaleños for cone storage as well as nest location. Both nests and stored cones have been found in the same log or snag. Froehlich (1990) found that MGRS built 60 percent of their nests in snags, 18 percent in hollows or cavities in live trees, and 18 percent in logs or underground. Only four percent of nests were bolus grasses built among branches of trees. Recent data collected by Koprowski indicate that female MGRS go into estrus for approximately six hours on one day each year and average fewer young per litter (2-4 young) than other red squirrels (Koprowski *et al*. 2006). Studies further indicate that most MGRS only reproduce once in their lifetime, due to high mortality rates (Koprowski March 2006 recovery team meeting minutes).

Trends in age-specific red squirrel survivorship demonstrate a classic mammalian Type III survivorship curve (Steele 1998) in which mortality is >60 percent during the first year of life, about half that rate during the second year of life, followed by relatively high survivorship and constant mortality through the adult years (Kemp and Keith 1970, Davis and Sealander 1971, Rusch and Reeder 1978, Halvorson and Engeman 1983, Erlien and Tester 1984). Recent studies indicate, however, that MGRS differ in survivorship from red squirrels in other parts of their range and that mortality is high during the winter. Koprowski (March 2006 recovery team meeting minutes) determined that up to 50 percent of adults and yearlings perish from December to June. Additional studies by Koprowski (2005a) further indicate that adult MGRS typically survive less than one year in the Pinaleno Mountains, with no difference in survivorship between males and females. The mean survivorship of adult MGRS is 215 days, and only 20 percent of them survive to the second year of reproduction. Maximum longevity in the wild is reported to be 10 years (Walton 1903). Studies of radio-collared animals suggest that predation accounts for a large majority of mortality in red squirrels (Kemp and Keith 1970, Rusch and Reeder 1978, Stuart-Smith and Boutin 1995a&b, Kreighbaum and Van Pelt 1996, Wirsing *et al.* 2002); however, the availability of alternative prey for predators (Stuart-Smith 1995a), availability of food for red squirrels (Halvorson and Engeman 1983, Wirsing et al. 2002), and variation in vigilance and use of open areas by individual squirrels (Boutin 1995b) has been suggested to predispose some animals to higher susceptibility to predation.

Mammalian predators of MGRS include mountain lions, black bear, bobcat, coyote and gray fox (Hoffmeister 1956, Coronado National Forest 1988). On Mt. Graham, a bobcat was observed stalking a MGRS (Schauffert *et al.* 2002), and a gray fox captured an adult female MGRS (24 Feb 2003, Koprowski, unpubl. data).

Avian predators likely to prey on MGRS are goshawks, red-tailed hawks, MSOs, great horned owls, and Cooper's hawks (Coronado National Forest 1988, Schauffert *et al.* 2002). On Mt. Graham, Kreighbaum and Van Pelt (1996) reported that four juvenile MGRS were killed by raptors during natal dispersal. Additionally, a MSO was documented killing a juvenile MGRS near the natal nest (Schauffert *et al.* 2002). During Fall-Winter 2002-2003, raptors accounted for up to 80 percent of over 30 mortalities of MGRS (Koprowski, unpubl. data).

Until recent years, the highest densities of middens were located in the upper elevations supporting Engelmann spruce/cork bark fir and Mexican white pine sub-dominants (P. Young, University of Arizona, unpubl. data). The red squirrel is highly territorial (Smith 1968), and the concept of one squirrel per midden is widely accepted and used for MGRS management (Vahle 1978). Occasionally, conditions arise where more than one squirrel occupies a midden, or a MGRS uses more than one midden (Froehlich 1990), but these are likely exceptional cases and usually seams to occur when food is extremely abundant or rare.

Rangewide multi-agency MGRS surveys, based on a sample of middens throughout the range of the MGRS, have been conducted since 1986. In 1998, the surveys were expanded from a single survey per year to two surveys per year, timed in the Fall and Spring. Midden surveys show increasing numbers of MGRS into 1998-2000, with peaks over 500, after which the population declined. Population estimates dropped 42% in 2001 as compared to 1998-2000. However since that time, population estimates have remained fairly stable, varying from 199 to 346. Fall 2003 MGRS numbers were approximately 274 MGRS throughout the mountain range. Immediately before the Nuttall-Gibson Complex Wildfire in Spring 2004, MGRS numbers were estimated at 284. The fall 2004 census, immediately post-fire, revealed that numbers were approximately 264. About 214 MGRS were documented during the spring 2005 census, and 270 during the Fall 2005 census. The estimate was approximately 199 MGRS in Spring 2006, but increased to 276

MGRS in the Fall 2006 census. Both Fall 2005 and Fall 2006 census numbers are similar to the Fall 2003 pre-fire MGRS numbers.

The Mt. Graham Red Squirrel Monitoring Program at the University of Arizona (UAZ) was established by the Arizona-Idaho Conservation Act of 1988 to monitor effects of the MGIO on the MGRS. As part of that program, Koprowski *et al.* (2005) monitored all middens in 624 acres surrounding the MGIO from 1989-2002. Middens were visited monthly from 1989-1996, and quarterly thereafter. Their study area contained 17.8% of all middens known in the mixed conifer forest and 66.9% of all middens known in the spruce-fir forest. From 1994-2002, the mixed conifer forest supported 54-83 middens, while the spruce-fir forest contained 120-224 middens. The population trend in the mixed conifer forest was found to be relatively stable from 1994-2002; however, by 2002 only two occupied middens were found in the spruce-fir forest. Population declines in the spruce-fir forest corresponded with a period of insect damage and wildfires that began in 1996 and had devastated that forest type by 2002. Census data collected by the Mt. Graham Red Squirrel Monitoring Program indicates a more dramatic decline than do the data of the interagency surveys (which has shown fairly stable populations since Fall 2001 after a steep decline from 1998-2000). The differences in the results are likely due to differences of scale. The Mt. Graham Red Squirrel Monitoring Program has focused on a subset of the mountain in which impacts of fire and insect damage have been pronounced in the spruce fire forest, whereas the multi-agency surveys sample the population rangewide.

Koprowski *et al.* (2005b) characterized the decline of the Mt. Graham red squirrel in their study area as catastrophic. They note that in areas of high tree mortality in Alaska and Colorado, red squirrels did not completely disappear, but rather persisted in residual stands of trees where conditions remained suitable. The ability of the Mt. Graham red squirrel to survive the current catastrophic decline is unknown; however, it apparently survived a similar situation in the late 1600s. Grissino-Mayer *et al.* (1995) sampled fire-scarred trees in four areas of the Pinaleño Mountains from Peter's Flat east to Mt. Graham. The oldest trees in the spruce-fir forest were about 300 years old. They found evidence for a widespread, stand-replacing fire in 1685 that probably eliminated much of the forest atop the Pinaleños. Although the MGRS population persisted through that event, and may persist through the current catastrophic event, small populations can exhibit genetic or demographic problems that further compromise the ability of the subspecies to survive. Low genetic variability in small populations is a concern because deleterious alleles are expressed more frequently, disease resistance might be compromised, and there is little capacity for evolutionary change in response to environmental change. Koprowski *et al.* (2005b) recommended management actions to increase available habitat and population size in the near and distant future. A captive-breeding program was also recommended, the concept of which has been endorsed by the MGRS Recovery Team.

In 2003, the Coronado National Forest began developing the Pinaleno Ecosystem Restoration Project. This project is being designed to restore the higher elevations of the Pinaleno Mountains to "pre-settlement" conditions and to reduce the risk of catastrophic wildfire. The project, which targets primarily mixed conifer communities, will reduce stand stocking and fuel loading and promote the more open and healthy conditions that existed before widespread fire-suppression actions lead to unnatural and unhealthy forest conditions. The Pinaleno Ecosystem Restoration Project will be designed in such a way as to be sensitive to the needs of MGRS; and, when completed, it should reduce the risk of catastrophic wildfire severely impacting MGRS.

MGRS Critical Habitat

Designated critical habitat includes three areas: the area above 10,000 feet surrounding Hawk and Plain View peaks and a portion of the area above 9,800 feet; the north-facing slopes of Heliograph Peak above 9,200 feet; and the east-facing slope of Webb Peak above 9,700 feet. The main attribute of these areas was dense stands of mature spruce-fir forest. The 1988 BO that coincided with the Arizona-Idaho Conservation Act of 1988 (P.L. 100-696, November 18, 1988) established a MGRS refuguim with a boundary that was considered to be the same as the critical habitat boundary (approximately 2,000 acres). In 1996, the first signs of mortality due to invasive forest insects were documented, especially within the spruce-fir zone at high elevations, which are within the MGRS critical habitat boundaries. By the fall of 1999, approximately 300,000 spruce trees were killed on over 14,820 acres (Wilson *et al*. 1999). Insect mortality, along with the effects of drought over the last several years, have rendered most, if not all, of the area within the boundaries of MGRS critical habitat useless to MGRS. As discussed, Koprowski *et al*. (2005) documented catastrophic decline of MGRS in the spruce-fir zone within critical habitat.

Although MGRS critical habitat has been fragmented by wildfire and insect mortality, Koprowski (2005b) indicates that red squirrel densities are higher in fragmented landscapes relative to continuous forests. Koprowski (2005b) also notes that high densities of squirrels in small woodlots might suggest that areas with increased edge provide higher quality habitat than large continuous forests. Forest fragments may be able to subsidize high densities of tree squirrels due to higher productivity, including increased tree growth and increased production of tree seeds at forest edges. Small fragments with high edge:area ratios may be more productive than large fragments enabling densities to be maintained at higher levels, at least until other changes in community structure occur (Koprowski 2005b). Koprowski *et al*. (2005) also noted that red squirrel populations declined significantly in areas with greater than 40 percent mortality of spruce trees due to beetle infestations in Alaska and Colorado; however, red squirrels were not observed to completely disappear from areas with high levels of insect infestation and tree mortality. Koprowski *et al*. (2005) further indicate that these red squirrels were only reduced in number in these areas, persisting within the residual mosaic where conditions remained suitable. The ability of red squirrels to use remnant forest patches and persist throughout secondary succession is likely the result of their long evolutionary history of association with coniferous forests (Smith 1970), which enables persistence through historical, temporal, and spatial patterns of natural disturbance (Koprowski *et al*. 2005).

The Forest Service is planning to replant Englemann spruce and corkbark fir trees, possibly within the high-mortality areas of the refugium (fire and insect infestation) of the spruce-fir zone, which is also within critical habitat. This replanting effort will help begin the long-term re-establishment of MGRS habitat at higher elevations.

ENVIRONMENTAL BASELINE

A. Status of MGRS within the action area.

The action area comprises all areas that burned within the fire perimeter (approximately 29,900 acres) and areas outside of the fire perimeter affected by suppression actions (helispots, base camps, water-dip sites, etc.).

A BO for the proposed astrophysical development and Forest Management Plan was completed on July 14, 1988. The Forest Management Plan was found not to jeopardize the continued existence of the MGRS; but the proposed seven-telescope astrophysical development was found to jeopardize the species. Three reasonable and prudent alternatives were described, but before the Forest Service agreed to any, the Arizona-Idaho Conservation Act of 1988 (P.L. 100-696, November 18, 1988) was passed by Congress. It mandated the third alternative (which authorized the construction of three telescopes on Emerald Peak, necessary support facilities, and an access road to the site). The law further required the University of Arizona (UAZ), with the concurrence of the Secretary of the Interior, to develop a management plan for the MGRS. Construction of the four remaining telescopes will require a new consultation pursuant to the Act. The Arizona-Idaho Conservation Act also established a MGRS refuguim; the boundary of which was the same as the critical habitat boundary.

As stated previously, an interagency MGRS census (midden surveys) is conducted twice a year (fall and spring) to monitor the population of MGRS. The area along the Swift Trail, from Riggs Lake east across the Old Columbine area to Plain View Peak has the highest concentration of middens; however, the status of all the middens (active, inactive, disappearing, etc.) is not known. Spring numbers are typically lower due to overwintering mortality and loss of juveniles.

The Fall 2003 MGRS census resulted in an estimate of approximately 274 MGRS throughout the mountain range. The census conducted in the Spring of 2004, immediately prior to the Nuttall-Gibson Complex Fire, indicated that there were approximately 284 MGRS in the forest. The Fall 2004 census, immediately post-fire, yielded an estimate of 264 MGRS, showing a slight decline in the population from Fall 2003, likely due to the fire. Approximately 214 MGRS were estimated during the Spring 2005 census, while numbers increased to over 270 MGRS during the Fall 2005 census, indicating that the squirrels were back up to pre-fire numbers. By Spring of 2006, census data provided an estimate of approximately 199 individuals. The Fall 2006 census data indicated a MGRS population of approximately 276. Fall numbers have shown little evidence of decline, even immediately after the fire in Fall 2004. By Fall 2005, MGRS populations once again reached pre-fire numbers. In contrast, the Spring census numbers show a decline from 284 in 2004 before the fire to 199 in Spring of 2006 (a post-fire decline of about 30%). The discrepancy between the Fall and Spring population could be caused by several factors. Although Spring numbers are thought to be lower due to overwintering mortality and loss of juveniles, as mentioned above, it is also believed that the Spring numbers underestimate the population of MGRS due to the lack of presence of cones in the Spring. This problem was exacerbated by the fire, in that it is very difficult to determine if burned or partially burned middens are active, particularly in the Spring when cones and evidence of feeding are scarce in middens (Tim Snow, email communication 13 March 2007). This phenomenon would tend to increase the difference between Fall and Spring census numbers, but that difference should decline over time as middens are rebuilt. However, the reverse has been true – that difference is growing - suggesting increasing over-winter mortality but adequate reproduction and survivorship in Summer and Fall for populations to rebound. If Spring numbers are in fact declining, it seems unlikely that even good Summer and Fall reproduction and survivorship will prevent declining numbers during the Fall census; however, that has not occurred so far.

B. Factors affecting MGRS in the action area.

In addition to the activities described for the MSO (above), two wildfire events – the Clark Peak Fire and the Nuttall-Gibson Complex Fire, have dramatically affected the extent and quality of

MGRS habitat in recent years. The Clark Peak fire was a human-caused fire that started on April 24, 1996 in the Riggs Lake area at the northwest end of the mountain range. The fire was contained at about 6,500 acres on May 9. On June 9, 1999, we issued a biological opinion on the effects of suppression activities during the fire (2-21-96-F-286). The opinion concluded that suppression was not likely to have jeopardized the continued existence of the MGRS; nor did it result in destruction or adverse modification of critical habitat. However, 15 MGRS were thought to have been taken incidentally. Twenty-one percent of MGRS habitat burned in the fire, including 528 acres that burned at high intensity (>80% trees killed), 88 acres at moderate intensity (40-80% tree kill), and 1,934 acres at low intensity (<40% tree kill). The Forest Service estimated that about 50 percent of the middens within the burned area were destroyed, but the remaining middens were still suitable for red squirrel habitation. In the conclusion of the opinion, we found that the Clark Peak Fire "had the potential to push the red squirrel into extinction if immediate and decisive suppression actions had not been taken by the Forest Service."

Most of the burn on the UAZ-monitored areas (approximately 84 acres in the mixed-conifer habitat and 61 acres in the spruce-fir habitat) was very intense and completely destroyed the forest. Thirty-three midden sites were destroyed and several more damaged by less-intense ground fires. Twenty-three of the destroyed middens had been occupied by red squirrels before the fire began. After the fire, only one destroyed midden, which was close to an unburned area, continued to be occupied for the next 2 months. Another midden was occupied until mid-June.

The fire perimeter of the Nuttall-Gibson Complex Fire covered most of the northeastern half of the Pinaleño range at elevations above 4,500 feet. Within the UAZ study area, 217 acres of spruce-fir habitat was burned (43% of the total 506 acres). As with the Clark Peak fire, not all of the middens within the burn perimeter were totally destroyed. Whereas the Clark Peak fire damaged more middens in the mixed conifer transitional habitat, the Nuttall Fire Complex hit the spruce-fir habitat the hardest.

Koprowski *et al.* (2006) studied the effects of the Nuttall-Gibson Complex fires on the MGRS in 1,088 acres above 8,530 feet. Fifty-seven MGRS were trapped, marked with ear tags, and equipped with radio collars and tracked from April 2002 through the end of July 2004. After the fire, middens of all marked animals were visited, effects of the fire were quantified, and radio-telemetry was used to assess survival. All forested habitats within eight miles of middens were surveyed to look for surviving squirrels that may have dispersed out of burned areas. Twenty squirrels resided in areas affected by the fire. Fifteen middens were burned, while five were unburned and intact. All marked squirrels in unburned areas (37) survived, while seven (35%) of the 20 squirrels within the burn perimeter did not. The three females that did not survive were lactating at the time of the fire and their litters (typically 2-4 young) were presumably lost, as well. For five of the seven squirrels that did not survive, the nest tree was entirely reduced to ash. The five squirrels within the burn perimeter for which their middens did not burn remained at their home sites. Based on radio telemetry, there is no evidence that squirrels in the burn perimeter moved to the mixed conifer forest, or farther after the fire than squirrels outside of the burn perimeter (Koprowski *et al.* 2006). Neither has the population in the mixed conifer type grown or changed significantly since 1994, which might be expected if squirrels were moving from burned spruce-fir forests into the unburned mixed conifer zone (Koprowski *et al.* 2005b). At the March 2006 Recovery Team Meeting, Koprowski provided additional information about the effects of Nuttall-Gibson Complex Fire. He estimated that 26% of all 1251 middens known burned completely, and 2.4% of those 1251 middens partially burned; however, it is important to note that the 1,251 middens include all middens ever recorded, including middens that have disappeared or were lost to previous wildfires (including the Clark Peak Wildfire). According to the Arizona Game and Fish Department database, there were approximately 455 middens considered active or available for use (potentially active) by MGRS as of April 2006 (Tim Snow, personal communication, April 21, 2006).

The Koprowski *et al.* (2006) study documented immediate, direct effects of the fire, but the authors also discuss possible long-term consequences that could cause further declines in the population. Loss of larderhoarded foods stored in the middens might decrease future survival and reproductive success. Also, avian and mammalian predators are likely to increase use of burned areas, leading to increased mortality.

Using the spectrally suitable habitat described and mapped as available to MGRS by Jim Hatten (in press), we were able to determine how many acres of MGRS habitat were burned during the Nuttall-Gibson Complex Wildfire. The habitat mapped (8,520 acres) is what was available to MGRS as of 2003 and accounts for habitat lost during the Clark Peak Fire in 1996 and the continuing insect infestation; therefore, it is helpful in determining what was available to MGRS prior to and after the wildfire. Approximately 3,314 acres of MGRS habitat throughout the fire perimeter was classified as either unburned or low-severity burn effects. When classifying burn severities, no distinction is made between unburned habitat and habitat that was subjected to low-severity burn effects; however, the latter areas typically experience low-intensity flames that consume grasses, shrubs, and other light fuels on the ground. Shrubs and grasses typically resprout after the onset of the first rains. Our initial site visits during and after the fires indicated that these areas did, in fact, burn in a mosaic pattern with much of the area left unburned. Active middens remain throughout the unburned/low-severity burn-effects areas. Furthermore, new middens have also been documented in these areas.

Approximately 498 acres (about six percent) of MGRS habitat within the fire perimeter burned with moderate-severity burn effects. Similar to MSO habitat that burned with moderate-severity effects, pockets of unburned habitat remain within the mapped areas of moderate-severity burn effects. Although tree death occurs in moderate-severity burn areas, 100 percent tree death does not typically occur (e.g. 40-80% tree death occurred in moderate-severity burn areas in the Clark Peak Fire). Pockets of live, unburned trees remain scattered throughout these moderate-severity burn areas. Furthermore, as previously mentioned, shrubs and small trees have begun repsrouting throughout much of these areas, and partially damaged trees have begun healing. Additionally, active middens have been documented within the pockets of unburned habitat and adjacent to these moderate-severity burn areas. Nonetheless, some parts of the moderate-severity burn areas will undoubtedly take decades to become suitable breeding and foraging habitat for MGRS; however, due to the nature of the mosaic burn patterns and the pockets of live trees observed, new snags created, as well as the difficulty in assessing remote areas because of the steepness and ruggedness of the terrain, it is difficult to quantify how much of the 498 acres of the moderate-severity burn areas is no longer suitable MGRS habitat.

Although most of the high-severity burn effects areas were devoid of vegetation immediately after the fire and are currently not viable MGRS habitat, grasses and shrubs have re-grown and re-sprouted throughout much of the area, providing minimal ground cover to provide habitat for MGRS movement. New snags have been created as a result of the fire and associated suppression actions. Nonetheless, because of tree death, high-severity burn areas will take decades before they once again become suitable as breeding habitat for MGRS. About four percent of the MGRS habitat within the fire perimeter (355 acres of 8,520 total acres) was subjected to high-severity burn effects and these areas are scattered throughout the fire perimeter; however, the majority of these areas appear to coincide with areas where the wildfire made very hot runs up steep canyons before being stopped by burn-out operations. Furthermore, pockets of suitable habitat for MGRS remain scattered throughout these high-severity burn effects areas similar to the moderate-severity burn effects areas. MGRS have high site fidelity (Koprowski *et. al*. 2006) and have been documented returning to these areas and reestablishing middens; however, food sources are not always readily available, and MGRS can be subjected to increased predation as avian and mammalian predators increase their use of these areas (Koprowski *et. al*. 2006).

Based on our analysis above regarding effects to MGRS habitat, and the findings of Koprowski *et al.* (2006), we would expect that the MGRS population should have declined substantially after the fire, and due to long-term habitat degradation and loss, at least some of those population declines should be long-term. However, as discussed in "**Status of MGRS within the action area"** above, although there is some indication of decline, particularly during the Spring census, reproduction and survival during Summer and Fall has apparently been adequate each year for the population to rebound in the Fall. Thus far, the effects of the Nuttall-Gibson Complex Fires on the population do not appear to have been as dramatic as effects to MGRS habitat. Although there is a growing discrepancy between Spring and Fall census numbers, suggesting increasing over-winter mortality, as of the last survey (Fall 2006) numbers were similar to those documented pre-fire.

C. Status of Critical Habitat within the action area.

Within the action area, 1,323 acres of MGRS critical habitat are within the fire perimeter. As mentioned above, the main attribute of MGRS critical habitat is dense stands of mature spruce-fir forest. The key-habitat components (primary constituent elements) related to micro-climates have not been determined, although studies are currently ongoing to determine these key features. Much of the high-elevation spruce-fir forest, particularly the parts that contained critical habitat, has been lost to widespread insect outbreak. Past wildfires and insect infestations have also diminished several areas of critical habitat within the action area. MGRS has been eliminated from much of the spruce-fir forest devastated by insect damage and fire. Using the same spectrally suitable MGRS habitat data described above (Hatten, in press), we determined that 786 of the 1,323 acres of critical habitat were suitable MGRS habitat in 2003. The remaining 537 acres of critical habitat were unsuitable for use by MGRS, either as a result of past fire damage or insect infestation. Approximately 360 acres (46 percent) of the 786 acres of suitable critical habitat was classified as unburned or low-severity burn effects in the Nuttall-Gibson Complex Wildfire. Approximately 27 percent (214 of 786 acres) of the critical habitat was categorized as having moderate-severity burn effects. The same percentage (27 percent) of critical habitat was categorized as high-severity burn effects (212 of 786 acres). All three burn-area categories within critical habitat have the same characteristics as described above, including the remaining pockets of suitable habitat within each category. With the loss of most of the spruce-fir forest, the mixed conifer zone is now much more important for survival of the MGRS; however, most of that forest type is not designated as critical habitat.

D. Factors affecting Critical Habitat in the action area.

The same factors that affect the species in the action area affect critical habitat (see above).

EFFECTS OF THE ACTION

The potential effects resulting from suppression actions in occupied MGRS habitat and associated critical habitat include those resulting from noise, application of fire retardant, water bucket drops, burn-out operations, and habitat alteration during the breeding season. Much of this activity occurred in close proximity to or through MGRS middens and nest trees. Noise disturbance included low flying (less than 500 feet) retardant planes (tankers and SEATs) and helicopters (dropping off crews, carrying retardant, and carrying water buckets), dozers (creating fire line, safety zones, and helispots), and crews using chainsaws and hand tools (creating fire line, safety zones and helispots, and conducting burn-out operations).

Effects Along the Two-Mile Dozer Line:
Immediately after the Nuttall-Gibson Complex fire, Forest Service wildlife technicians walked the length of the two-mile-long dozer line to assess rehabilitation and suppression effects to the 47 middens located within 100 yards of the dozer line. Three of those 47 middens were active prior to the fire, 16 were inactive, and 28 had been removed from the database. Of the three active middens, one was completely burned, and mechanical suppression did not occur within 200 feet of any of them. The survey results are summarized in the following table:

Table 2: Mount Graham Red Squirrel Middens and Fire Effects along the Dozer line created during the Nuttall Complex Wildfire (2004, Safford Ranger District)

Midden #	Pre-fire Status	Fire Effects to the Midden
EM43	Removed (4/04)	Completely burned
CO173	Removed (4/04)	Unburned
CO188	Removed (10/01)	Completely burned
EM38	Removed (10/01)	Unburned
CO25	Removed (4/04)	Unburned
CO220	Removed (6/00)	Unburned
CO182	Removed (10/01)	Completely burned
CO194	Removed (9/01)	Unburned
CO21	Removed (4/04)	Unburned
Midden #	**Pre-fire Status**	**Fire Effects to the Midden**
EM36	Removed (4/04)	Unburned
CO179	Removed (9/01)	Unburned
CO51	Removed (4/04)	Completely burned
CO159	Removed (4/04)	Completely burned
CO81	Removed (3/05)	Unburned
CFNEW02	Removed (6/01)	Completely burned
CF68	Removed (1/05)	Partially burned
CF52	Removed (1/05)	Completely burned
CO07	Removed (3/05)	Unburned
CO142	Removed (3/05)	Completely burned
CO166	Removed (4/04)	Completely burned
CO163	Removed (6/01)	Completely burned
CO128	Removed (4/04)	Unburned
CO71	Removed (8/04)	Unburned
CO181	Removed (3/05)	Unburned
CO59	Removed 1993	Unburned
CO168	Removed (4/04)	Unburned
CO63	Removed (date unknown)	Unburned
WP75	Removed (date unknown)	Unburned
CO61	Inactive (Fall 03)	Completely burned
CO172	Inactive (Fall 03)	Completely burned
CO218	Inactive (Spring 03)	Unburned
CO23	Inactive (Spring 96)	Completely burned
CO167	Inactive (Spring 03)	Unburned
CO24	Inactive (Fall 03)	Completely burned
CO164	Inactive (Fall 03)	Unburned
CO217	Inactive (Spring 03)	Completely burned
CO160**	Inactive (Fall 03)	Completely burned
CO09	Inactive (Spring 02)	Completely burned
WP63	Inactive (Fall 02)	Unburned
CO177	Inactive (Spring 02)	Unburned
CO251	Inactive (Spring 01)	Completely burned
CO183	Inactive (Fall 03)	Partially burned
CO197	Inactive (Spring 98)	Unburned
CO72	Inactive (Spring 04)	Unburned
CF31	Active (Spring 03)	Completely burned
WP19	Active (Spring 03)	Unburned
CO82	Active (Fall 96)	Unburned

Note: Pre-fire status is based on the most recent date the midden was surveyed.
** Midden destroyed during the creation of dozer line.

When determining MGRS activity at a midden, middens are categorized as either active or inactive. Active middens are currently being used by MGRS for food caching, have signs of freshly eaten food materials, or have the potential to be active at some point. Inactive middens are not currently being used by MGRS for food caching and do not show evidence of recent feeding activities. Because the biannual census is a random sampling of the available middens, not all middens are visited every year, and some middens were not visited for several years prior to the fire. Although we do not have the midden activity status immediately prior to the fire for every midden, the table above represents the best available data for our analysis.

In our analysis of effects to MGRS, we are only considering those middens that were documented as active. Middens that were classified as inactive at the time of fire-suppression actions are not considered in our analysis because those middens did not have MGRS associated with them. Middens that have been removed from the database are also not considered in our analysis because they are no longer visited during the bi-annual census. These are middens that have disappeared over time for various reasons, including wildfire, natural decomposition, or lack of use by MGRS.

Creation of the dozer-line cleared significant amounts of vegetation within MGRS habitat. As previously mentioned, the dozer-line was from eight to 15 feet wide and over two miles long (roughly 2-4 acres). One midden was confirmed to have been destroyed by creation of the dozer-line (U.S. Forest Service 2005); however, according to Table 2, this midden was inactive prior to the fire. The dozer-line also created larger openings that can leave MGRS susceptible to increased predation. Our discussions with the Resource Advisors, UAZ researchers, and the fire crews lead to the placement of whole logs (downed trees) across the dozer-lines in occupied MGRS habitat. The placement of these logs helps create safe travel corridors by allowing MGRS to run across the openings under the logs, thus avoiding predation.

J. Koprowski (March 2006 recovery team meeting minutes) recommends maintaining an uncut, undisturbed radius of 92 feet around each midden to minimize the likelihood of predation. At the time of the wildfires and the subsequent analysis, the standard was a 50-foot buffer, which the Forest Service used to determine effects of suppression actions on middens. None of the middens described above had cutting within the 50-foot no-impact buffer. Furthermore, no trees were cut within 92 feet of any of the three active middens; however, the habitat for squirrels trying to reestablish middens or create new ones in these areas was degraded by this activity. Of the 47 middens observed, no active middens were affected by cutting of trees or dozer-line construction and one was affected by burn-out operations.

Burn-out operations were also conducted along the dozer-line from MGIO to Webb Peak, within 30 feet of the fire line, in order to combine the two separate wildfires (Nuttall and Gibson). Fire crews anticipated that the two separate wildfires would merge eventually, as they were spreading toward each other. These particular burn-out operations allowed the fire crews to manage the two fires more safely and control the conditions in which fuels between the two wildfires were consumed. Additional discussion of burn-out operations along the dozer-line can be found in "Effects of Burn-Out Operations".

Middens burned or destroyed by the dozer would reduce available food resources for associated MGRS and potentially adversely affect survival or reproductive success (Koprowski *et al.* 2006). Cutting of trees that occurred within 92 feet of middens would have opened up the canopy and perhaps made MGRS more susceptible to avian predators. Although loss of a midden can lead to reduced survivorship from loss of food sources, data suggest that loss or depletion of a midden does not necessarily equate to decreased survivorship or reproductive success. Larsen *et al.* (1997) showed that depletion of cached cones from middens had no significant effect on over-winter survival compared to the control group (83 percent survival versus 89 percent survival, respectively). Additionally, Koprowski *et al.* (2006) found that, of 13 radio-collared MGRS that survived the fire, only four abandoned their middens during the two weeks following the fire, and all of these middens were in areas that experienced intensive crown fire.

Effects of Noise:
Similar to MSO, mechanical noise and human presence may be disruptive to MGRS, particularly during the breeding season. If noise arouses an animal, it has the potential to affect its metabolic rate by making it more active. Increased activity can, in turn, deplete energy reserves (Bowles 1995). Species that are sensitive to the presence of people may be displaced permanently, which may be more detrimental to wildlife than recreation-induced habitat changes (Hammit and Cole 1987, Gutzwiller 1995, Knight and Cole 1995). If animals are denied access to areas that are essential for reproduction and survival, that population will most likely decline. Likewise, if animals are disturbed while performing behaviors such as foraging or breeding, that population will also likely decline (Knight and Cole 1995).

Noise associated with fire crews, dozer operations, hand-line construction, vehicles, and other aspects of on-the-ground fire suppression activities may have disturbed MGRS as just described. During suppression and rehabilitation efforts, MGRS may have also been affected by aircraft noise from low-flying tankers and helicopters (less than 1,000 feet); however, these noise effects would likely have been overshadowed by the noise associated with ground operations (dozers, hand crews, vehicle traffic, etc.).

Effects of Mechanical Habitat Destruction or Degradation:
Hand-line construction may modify MGRS habitat by significantly changing the key habitat components for the species, depending on the amount, type, location, and number of large trees and mid-story vegetation cut. Hand lines had the least effect on MGRS, as they were approximately two feet wide and constituted less than a mile of fire line (0.25 acre). Resource Advisors worked with hand crews and the Incident Command Team to avoid putting hand lines through MGRS middens. Observations during our site visits during and after the fire indicated that middens were successfully avoided during the placement of hand lines. Hand lines were also rehabilitated by creating water bars and covering them with brush. Any openings created by hand lines would not have been significant enough to expose any MGRS crossing them to predation.

In addition to the hand-line, five safety zones were created along the dozer line within occupied MGRS habitat. Creation of the safety zones involved the removal of pine, spruce, and fir trees, which provide cover, travel corridors, and food (cones) for MGRS and resulted in the loss of approximately 4.6 acres of critical habitat. No middens were within the affected area of the safety zone along FR 507 at the head of Marijilda Creek. The other four safety zones (one just west of Webb Peak, two southeast of Old Columbine, and one at the junction of Forest Roads 507 and 669) may have affected MGRS or midden microclimates at five midden sites within 100 yards of the safety zones; however, at least two of these midden sites were inactive. Similar to the fire lines (hand and dozer) and helispots, all safety zones were covered with fallen trees, logs, and other debris as part of the emergency post-fire suppression rehabilitation efforts.

Spike camps were established at Columbine Administrative Site and Treasure Park campground. These camps were returned to their original state after the fire, when trash and temporary facilities were removed; however, they may have caused temporary disturbance to MGRS by encouraging daylong occupation of these areas by large groups of people. The field behind Columbine Administrative Site was also temporarily used as a helispot. While this did not require vegetation clearing, it did involve additional noise disturbance.

Structural-protection efforts were also conducted around MGIO telescopes and outbuildings. These efforts included the removal of standing snags, dead and down material, and the limbing of live and standing dead trees to remove ladder fuels from the nearby area (within 100-400 feet of buildings). Additionally, trees that died and posed a potential hazard to buildings or roadways were also removed during the Nuttall-Gibson complex fire. The entire area had suffered significant tree mortality as the result of a spruce-beetle epidemic. This insect outbreak had already greatly reduced the capability of the area to support MGRS, thus the impacts of the additional structural protection efforts were likely minimal. According to Hatten's data (in press), approximately two to 20 acres of the area within 100-400 feet of the MGIO can be classified as suitable MGRS habitat. Therefore, standing snags, dead and down material, ladder fuels, and hazard trees were removed from two to 20 acres of MGRS habitat around MGIO during fire-suppression efforts. MGRS were observed near middens within the footprint of the MGIO during our July 12 and July 19, 2004 site visits.

<u>Effects of Water and Retardant Drops:</u>
It is possible that retardant and water-bucket drops adversely affected MGRS, either with a direct hit or by breaking vegetation used by MGRS for nesting, foraging, or perching. At least 16,000 to 20,000 total gallons of retardant were dropped from tankers and the SEATs, and likely several thousand gallons of both retardant and water were dropped from helicopters with buckets and snorkels. We did not observe any dead or injured MGRS during our site visits in July 2004; however, the odds of finding dead or injured MGRS are unlikely. Neither did Koprowski *et al.* (2006) observe any dead or injured MGRS. Similar to MSO habitat, we observed several trees, branches, snags, and logs that appeared to have been broken or knocked over by the aerial application of retardant and water. It is possible that MGRS were affected directly by being hit by aerial applications. It is also possible that MGRS were affected indirectly when middens were subjected to direct hits from the aerial application of water and retardant. Although it is possible that MGRS were affected both directly and indirectly (through loss of middens or depletion of larderhorded food) by aerial suppression operations, it is difficult to quantify how many, if any, MGRS were directly or indirectly affected by aerial suppression operations.

<u>Effects of Burn-Out Operations:</u>
Of the various suppression activities, burn-out operations affected the greatest acreage of MGRS habitat. Determining where the line is between the burn-out operations and the wildfire is impossible, but that line may not be essential to this effects analysis because we believe most of the burn out areas would have burned in the wildfire had they not been intentionally ignited. Burn-out fires are ignited in front of an approaching wildfire. The intent is for the burn out to meet the oncoming wildfire and stop it due to lack of fuels. Hence, unless fire fighters miscalculate the direction of the oncoming wildfire, the burn out areas would have been consumed in the wildfire regardless. In most cases, the burn outs prevented the wildfire from expanding beyond and past the ignition sites.

As previously mentioned, burn-out operations were conducted throughout the action area, but were most extensive along Forest Roads 507 and 669 as well as in the vicinity of Old Columbine. These burn-out operations were conducted at night when temperatures were lower and relative humidity was higher in order to produce low-intensity flames that resulted in low-intensity burn effects. Burn-out operations were conducted by hand crews walking along the fire line igniting fuels with drip-torches. Because of the steepness of the terrain, firefighters did not work far from the fire lines. The burn-out operations along Forest Road 669 were placed within 15 feet of the fire line and concentrated on the south side of Hawk Peak to stop the advancing wildfire, which was moving fast up the north side of Hawk Peak and Frye Canyon. The burn-out operations met with the advancing wildfire quickly. Fire-intensity maps produced after the burn-out operations indicated that the burn-out operations around Hawk Peak resulted in an unknown number of acres of mostly low-intensity burn effects with small amounts of high-intensity burn effects. Most of this area contained trees that had previously been killed by insect infestations, especially the areas of high-intensity burn effects.

In addition to the burn-out operations along Forest Road 669, burn-out operations were conducted along Forest Road 507 and the dozer-lines from MGIO to Old Columbine and Chesley Flat to Webb Peak. Along Forest Road 507 from east of Upper Hospital Flat Campground to near Plain View Peak, burn-out operations were conducted within 10 feet of the fire line in order to consume fuels in front of the rapidly advancing wildfire, similar to that described above, affecting an unknown number of acres. This area is characterized by very steep and rugged terrain going downhill from the road. The wildfire moved quickly up the major canyons east of Forest Road 507, including Crazy Horse and Marijilda canyons. No burn-out operations were conducted along Forest Road 507 from roughly Plain View Peak to the junction with Forest Road 669.

As previously mentioned, burn-out operations were conducted along the dozer line from MGIO to Webb Peak, within 30 feet of the fire line, in order to combine the two separate wildfires (Nuttall and Gibson). Fire crews anticipated that the two separate wildfires would merge eventually, as they were spreading toward each other. These particular burn-out operations allowed the fire crews to manage the two fires more safely and control the conditions in which fuels between the two wildfires were consumed. The areas along the dozer line that were subjected to burn-out operations consumed 462 acres and occurred above steep terrain and north-facing canyons and slopes. These areas had higher relative humidity and lower temperatures, which resulted in mostly low-intensity burn effects and several areas of unburned fuels. The high relative humidity and lower temperatures prevented the burn-out operations from traveling far. The resultant burn-out area between the two fires was a relatively narrow band. Of the 462 acres consumed, 441 acres (95 percent) were classified as either unburned or low-severity burn effects. Twenty-one acres (about 5 percent) resulted in moderate-severity burn effects with several pockets of unburned habitat. Less than 0.25 acre (less than one-tenth of a percent) was categorized as high-severity burn effects. Monitoring within 100 yards of the dozer-line documented one active midden that was completely burned by burn-out operations. The remaining two active middens within 100 yards of the dozer-line were unburned, even though they were in areas of burn-out operations. As previously mentioned, the burn-out operations were likely more extensive than we can analyze; however, it is impossible to determine where the burn-out operations and wildfire met and how long it took them to merge.

Observations made during our initial site visit on July 12, 2004, indicated that fires along Forest Roads 507 and 669 resulted in intense flames with high-severity burn effects, although it was difficult to determine what was a result of burn-out operations and what was a result of the wildfire. We observed middens that had been completely consumed by fire; however, it was difficult to determine how many were burned as a result of burn-out operations and how many were burned as a result of the main fire. Additionally, a few middens were observed in the area of Merrill Peak along the Swift Trail that appeared to have been partially burned by burn-out operations. Burn-out operations along the Swift Trail did not burn as intensely as those along Forest Roads 507 and 669 and resulted in low- to moderate-severity burn effects. Several middens remained unburned in these areas. MGRS census data and observations from Fall 2004 through Fall 2006 have indicated that several partially burned middens are still being used. Nests, including young (2-4 per nest) that may have been present, would have perished if the nest tree was destroyed or burned very hot. However, in low-severity effect burn-out operations (most [95 percent] of burn-outs were low severity) and in areas of moderate severity where trees were not killed, MGRS nests and young likely survived. The lack of substantial declines in the MGRS after the fire (based on the Fall 2004 census) suggests that mortality due to nest destruction was not demographically very important. Koprowski (March 2006 recovery team meeting minutes) determined that up to 50 percent of adults and yearlings perish from December to June. Additional studies by Koprowski (2005a) further indicate that adult MGRS typically survive less than one year in the Pinaleno Mountains, with no difference in survivorship between males and females. The mean survivorship of adult MGRS is 215 days, and only 20 percent of them survive to the second year of reproduction. Juvenile survival during the first three months of age is markedly lower than for adults (Boutin and Larsen 1993, Stuart-Smith and Boutin 1995a), but often approaches adult survival by the first winter of life (Stuart-Smith and Boutin 1995a). As Koprowski's (March 2006 recovery team meeting minutes) data indicate, juvenile MGRS in the nest have high mortality rates, so loss of juveniles to burn-out operations is less meaningful than loss of adults, because most of the juveniles would have died regardless before reaching maturity.

During post-fire MGRS censuses (Fall 2004 and Spring 2005), middens that had been consumed by slow-moving, low-intensity surface fires were observed. Some of these low-severity burn areas were thought to be from burn-out operations resulting in low-intensity flames and low-severity burn effects, while other burn areas were thought to be a result of the wildfire. The presence of unburned grasses, logs, and trees, and the mosaic pattern of the burn indicated that this area received low-intensity flames and low-severity burn effects. Although the flames appeared to be low intensity, some of the middens were consumed when flames smoldered on them. Other middens were only partially consumed as flames spread rapidly across the top, leaving bottom layers of the middens intact. Subsequent site visits since the fire by us and Forest Service personnel have indicated that some MGRS are reinhabiting areas that were subjected to high-severity burn effects. New, active middens have been located within the high-severity burn areas. Many of these middens reestablished in the high-severity burn areas are in close proximity (less than 100 yards) to low- to moderate-severity burn areas, and thus provide access to food sources. Although limited reestablishment in high-severity burn areas may be occurring, these areas typically exhibit 100% tree death, leaving no food resources for MGRS. Koprowski *et al.* (2006) found that spruce-fir forests that had supported 120-224 middens before the onset of insect damage and fires in 1996 supported almost no MGRS by 2002. Koprowski and his colleagues are currently studying occupancy and persistence in high-severity burn areas.

Effects of Emergency Suppression Rehabilitation and BAER Activities:

Rehabilitation of helispots, hand lines, dozer lines, and safety zones had also begun in several areas by our first site visit. Large pieces of brush, trees, and other debris were placed across these areas to help minimize erosion, promote natural revegetation within these disturbed areas, and to provide cover for wildlife using these areas. Waterbars were established along hand lines and trails used as fire line to help decrease erosion along those areas as well. BAER activities included aerial operations such as aerial mulching and seeding to protect heavily burned areas, safety zones, and helispots within the fire perimeter. BAER activities may have had the same short-term noise effects to any MGRS still in the area as aerial operations associated with fire-suppression activities. Aerial mulching and seeding operations likely required low-level flights (500 feet or less); however, these activities used smaller helicopters (Type III) and likely had minimal effects on MGRS. Additionally, aerial operations associated with BAER activities were shorter in duration and intensity than those associated with suppression actions. Furthermore, areas where BAER activities were carried out were often in areas heavily impacted by wildfire. Hazard trees along hiking trails, roads, and fire lines were also removed by hand crews with chainsaws to prevent them from falling down and possibly injuring firefighters, hikers, or other persons using the forest. This hazard-tree removal would have had minimal noise effect on MGRS due to its relatively short duration. Although the fire suppression and rehabilitation activities had potentially negative short-term effects to MGRS, they also had long-term positive effects on the action area. The suppression activities minimized damage caused by the fire. The rehabilitation activities (fire-suppression rehabilitation and BAER) were designed to help minimize the effects of both fire-suppression activities and the potentially severe effects of the fire itself and benefit the action area over time. The water bars placed in fire lines and the aerial mulching and seeding helped reduce soil erosion and promoted the regeneration of native vegetation.

Effects of Conservation Measures:

The conservation measures implemented by the Forest likely helped reduce the severity of the effects of suppression actions on MGRS. In some cases, the conservation measures may have completely removed the effects of certain suppression actions. Having a Resource Advisor assigned to the fire ensured that someone with local knowledge of the area and experience with fire-suppression actions would be on site at all times to work with crews to minimize the impacts of their actions. The Resource Advisor worked with hand and machine crews (dozer operators, excavator operators, etc.) to have fire lines placed in such a manner that MGRS habitat and middens were affected as minimally as possible. The Resource Advisor encouraged crews to minimize and avoid, whenever possible, the cutting of large trees and snags in MGRS habitat and to place fire lines away from middens. Additionally, the Resource Advisor worked with the fire crews and BAER team to rehabilitate the fire lines and burned areas to further reduce the long-term effects of the suppression actions as well as effects of the fire. Fallen trees were placed perpendicular to dozer lines in several places to provide MGRS in the area safe travel corridors when moving from burned to unburned areas. These efforts to rehabilitate the fire lines (dozer and hand lines) and the burned areas helped decrease the effects of erosion and downstream sedimentation.

Summary:

An undetermined number of MGRS and their habitat were affected by mechanical suppression activities, including dozer lines, hand lines, construction of safety zones, noise and other disturbance, crew and spike camps, water and retardant drops, and structural protection. The dozer line affected 2-4 acres, safety zones affected 4.6 acres, structural protection affected 2-20 acres, and hand lines affected about 0.25 acre. Other features probably resulted in similar, relatively small amounts of habitat degradation or loss and effects to associated MGRS. Some of that occurred in areas previously burned or that experienced tree death, which no longer provided habitat for MGRS.

Of greater significance were areas subjected to burn-out operations. Approximately 500 acres of MGRS habitat were confirmed as affected by burn-out operations; however, most of these acres were subjected to low-severity burn effects and are still viable as MGRS habitat. Within this area, one active midden was confirmed as completely burned by burn-out operations. In addition to the one midden confirmed as affected by burn-out operations, an unknown, but likely larger number of middens were either completely or partially burned by burn-out operations; however, due to the uncertainty of separating the effects of burn-out operations from the wildfire, we cannot quantify how many other middens were affected by the burn-out operations. In general, the areas affected by moderate- and high-severity burn effects will take decades to become viable MGRS habitat again but pockets of unburned habitat remain within areas of both of these categories. We believe that more than 500 acres of MGRS habitat were likely affected by burn-out operations; however, the precise number of acres affected by burn-out operations is unknown and impossible to determine due to the difficulty and dangers associated with having a monitor on the ground to determine where the burn-out fires and wildfire met. Furthermore, if these areas had not been burned in these intentionally set fires, they would have likely burned in the wildfire, and probably would have burned hotter. The burn-out operations prevented the wildfire from becoming larger and likely served to minimize the destruction the unchecked wildfire would have caused.

Effects of suppression activities for the Nuttall-Gibson Complex Fires can also be examined from the perspective of changes in squirrel populations before and after the fire. As described in the Environmental Baseline, Koprowski *et al.* (2006) found that, in his study area, of 20 squirrels in the burn perimeter, 15 lost their middens to fire, and seven perished. An estimated 26% of all 1,251 middens known throughout the range of the MGRS burned completely, and 2.4% of those 1,251 middens partially burned. It is important to note that the 1,251 middens include all middens ever recorded, including middens that have disappeared or were lost to previous wildfires (including the Clark Peak Fire). According to the Arizona Game and Fish Department database, there were approximately 455 middens considered active or available for use (potentially active) by MGRS as of April 2006 (Tim Snow, personal communication, April 21, 2006).

Despite the Nuttall-Gibson Complex Fire, rangewide midden census data do not clearly show post-fire dramatic declines in numbers of MGRS. The Spring 2006 census yielded the lowest population estimate since 1990; however, Spring numbers are typically lower due to over-winter mortality. Furthermore, it is believed that the Spring numbers underestimate the population of MGRS due to the lack of presence of cones in the Spring, and this phenomenon was exacerbated by the fire, which made it difficult to determine midden activity. Therefore, it is likely that the actual MGRS population was higher than what was documented during the post-fire Spring census (Tim Snow, email communication 13 March 2007). Fall 2006 census numbers were similar to the Fall 2005 estimate with a conservative estimate of 276 MGRS. The Fall census data indicate that the MGRS population has recovered to pre-fire numbers. If we use the Spring census numbers, the population declined from 284 in 2004 before the fire to 199 in Spring of

2006 (a decline of about 30%). The discrepancy between the Fall and Spring can be partially explained by how the fire reduced the ability of surveyors to determine midden occupancy. However, this effect should be declining as effects of the fire wane. Instead, the difference between Fall and Spring censuses is growing, suggesting increasing over-winter mortality but also good reproduction and survivorship in Summer and Fall allowing populations to rebound. If declines in Spring numbers are real and continue, it seems unlikely that even good Summer and Fall reproduction and survivorship will prevent declining numbers during the Fall census; however, that has not occurred so far.

Overall, neither the wildfire nor the suppression actions appeared to have had a dramatic effect on the overall population. Furthermore, post-fire declines described above could be resulting from other factors as well, such as tree death in the spruce-fir forest. The overall effects of the suppression activities on the MGRS population must be considered within the context of the Nuttall-Gibson and Clark Peak fires, tree death in the spruce-fir forest due to insects and drought, and potentially other factors that drive changes in population. Within that context, effects of suppression are probably small. As previously described, loss of a midden can lead to reduced survivorship from loss of food sources; however, data suggest that loss or depletion of a midden does not necessarily equate to decreased survivorship or reproductive success. Larsen *et al*. (1997) showed that depletion of cached cones from middens had no significant effect on over-winter survival compared to the control group (83 percent survival versus 89% survival, respectively). Additionally, Koprowski *et al*. (2006) further note that, of 13 radio-collared MGRS that survived the fire, only four abandoned their middens during the two weeks following the fire, and each of these middens was in an area that experienced intensive crown fire.

Given the relatively small size of mechanical suppression activities, and the larger but probably still relatively small (compared to the 29,900 acres burned in the wildfire) acreage affected by burn-outs, and because most burn-outs resulted in unburned or low-severity burn areas, suppression played only a small role in the effects documented by Koprowski *et al.* (2006). Furthermore, and most importantly, suppression activities prevented the fire from becoming even bigger and perhaps burning catastrophically through the mixed conifer forests and remnant spruce-fir stands that are now the stronghold for the MGRS. Conservation measures and subsequent rehabilitation activities further helped to minimize the effects of fire-suppression activities and benefit the action area over time.

Critical Habitat

Approximately 1,323 acres of MGRS critical habitat (out of approximately 2,000 total acres) are located within the fire perimeter; however, as previously mentioned, not all of this critical habitat was suitable to MGRS prior to the Nuttall-Gibson Complex Wildfire. A total of 786 acres of critical habitat within the fire perimeter were determined to be suitable for use by MGRS prior to the fire, according to Hatten's data (in press), as previously described. The remaining 537 acres of critical habitat were determined to be unsuitable for use by MGRS due to previous fire damage and insect infestations. Also as described above, several pockets of unburned habitat remain throughout critical habitat within the fire perimeter, including in all burn-severity categories described. The effects of suppression and rehabilitation activities to critical habitat are similar to those effects to habitat described above. Those effects include crew movements, burn-out activities, and vegetation clearing activities within critical habitat. Without fire-suppression activities, it is very likely that critical habitat would have been more severely damaged by the fire. Furthermore, the previously mentioned conservation measures initiated during suppression activities and rehabilitation activities that followed the suppression activities minimized effects to critical habitat and surrounding vegetation after the fire.

Two spike camps were established at previously disturbed sites (one campground and one administrative site) within the forest. Both of these spike camps were within the mapped boundary of MGRS critical habitat, but because they were in previously disturbed sites, they did not result in the modification of any MGRS critical habitat. Five helispots were established within the forest boundary for loading and off-loading crews and equipment. Only one of these helispots occurred within the boundary of MGRS critical habitat, and it was established in a pre-existing meadow at the Columbine Administrative Site. Because permanent water sources were available throughout the fire perimeter (three lakes/ponds), no water-dip sites were established within critical habitat boundaries. Retardant-dip sites were established outside of the boundaries of critical habitat.

Two of the five safety zones were created within the boundaries of MGRS critical habitat (one along FR 507 and one at the junction of Forest Roads 507 and 669); however, creation of these safety zones affected less than two acres of MGRS critical habitat. Pine, spruce, and fir trees were removed to create these safety zones, resulting in the loss of cover, travel corridors, and food (cones). All safety zones were rehabilitated by covering them with brush and woody debris to prevent erosion and to provide cover for any MGRS that might have moved back into the areas after the fire. Additionally, all safety zones were re-seeded to promote the growth of native vegetation and to further stabilize soils.

As previously described, dozer lines created through MGRS critical habitat ranged from eight to 15 feet wide and were completely cleared of vegetation. These dozer lines removed 2-4 acres of MGRS critical habitat. Although the dozer lines removed cover for safe movements, Resource Advisors worked with fire crews to have downed trees placed perpendicularly across the dozer lines in MGRS critical habitat as part of the rehabilitation process, as previously stated. These perpendicular logs provide the cover habitat necessary for MGRS to safely travel from one area to another with decreased predation.

Burn-out operations were also conducted within MGRS critical habitat. Burn-outs were the most severe along Forest Road 507, which experienced mostly moderate-severity burn effects; however, most of this area was in the high-elevation areas that had experienced high tree mortality due to insect infestation prior to the fire. Approximately 160 acres of MGRS critical habitat were documented as affected by burn-out operations along Forest Roads 507 and 669 and the dozer line between MGIO and Webb Peak. Of these 160 acres, 7 acres of suitable habitat were affected by burn-out operations along Forest Roads 507 and 669. The remaining 153 acres of critical habitat affected by burn-out operations occurred within the area where the two fires were merged. Using Hatten's data (in press), we were able to determine that 138 acres of the 153 total acres subjected to burn-out operations used to merge the two fires (along the dozer line), were suitable critical habitat. Fifteen acres of critical habitat affected by burn-out operations were considered not suitable prior to the fire. Of these 138 acres, 131 acres (95 percent) were classified as either unburned or low-severity burn effects. The remaining five percent (seven acres) burned with moderate-severity burn effects, but still had pockets of unburned habitat within those seven acres. It is likely that more acres of MGRS critical habitat were affected by burn-out operations; however, it is difficult to distinguish between the effects of the burn-out operations and the effects of the fire, itself. The steep terrain where burn-outs were conducted, along with the dangers of having a monitor on the ground measuring where burn-out operations meet with the main fire precluded an exact amount or estimate of how many acres were affected by burn-out operations.

Our site visit with the Resource Advisor immediately after the burn-out operations (July 12, 2004) indicated that MGRS critical habitat along Forest Roads 507 and 669 was, indeed, affected by burn-out operations; however, we could not determine what effects resulted from the main fire and what effects were the result of the burn-out operations. Several of the areas near the burn-out operations along Forest Roads 507 and 669 were classified as moderate- to high-severity burn areas, resulting in complete underbrush consumption as well as consumption of most tree branches. Canopies were completely open in several areas, offering no cover and exposed travel corridors for MGRS. Although much of the area was classified as moderate- to high-severity burns, burn-out operations were conducted at night to use increased relative humidity and cooler nighttime temperatures in order to achieve cooler burns. Most of this area of the critical habitat where burn-out operations occurred and met with the main fire contained large amounts of trees that had been previously killed by insect outbreaks, which rendered most of the area as unsuitable habitat and likely led to moderate- to high-severity burn areas. Some MGRS are still occupying heavily burned areas in close proximity (less than 100 yards) to unburned areas.

Forest Roads 507 and 669 were opened and cleared with dozers in order to use them as defensible fire breaks and to conduct burn-operations to stop the advancing fire. These roads were originally closed as part of the 1988 Arizona-Idaho Conservation Act (AICA). Several small- to medium-sized conifer trees (pine, spruce, and fir) were cleared from the road. This vegetation removal likely removed cover and safe travel corridors for MGRS in the area. Seed trees providing some forage were likely removed as well. In order to avoid prolonged negative effects to MGRS, and because of the 1988 AICA, these roads will be re-closed and allowed to revegetate naturally. During our site visits during the fire and during post-fire MGRS midden censuses, we observed that several smaller trees remained in the road and were able to stand back up. These remaining trees, although small and few, will help in the natural revegetation process. Additionally, rolling water bars were placed in both Forest Roads 507 and 669 in order to reduce erosion and help stabilize soils along the roads.

In summary, 164 acres of critical habitat were affected by fire-suppression activities, which represent 12 percent of the total area of critical habitat for MGRS. Of this area affected, 15 acres were determined to be unsuitable prior to the ignition of the Nuttall-Gibson Complex Fire. Without the suppression activities, it is likely that the wildfire would have become larger and more critical habitat would have been consumed.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Only Forest Service lands occur within the action area, thus all activities likely to occur will have some Federal nexus. Thus, the effects of such activities are subject to section 7 consultation, and are not cumulative effects.

CONCLUSION

After reviewing the current status of the MGRS and its associated critical habitat, the environmental baseline for the action area, the effects of the actions taken to suppress and rehabilitate the Nuttall-Gibson Complex Fire, and the cumulative effects, it is our biological opinion that the actions, as described, neither jeopardized the continued existence of MGRS, nor resulted in destruction or adverse modification of MGRS critical habitat. We note that this BO does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Our findings are based on the following:

- Although critical habitat was affected by the establishment of two safety zones, burn-out operations, and hand line and dozer line, the total amount of habitat affected by suppression actions was relatively small. No helispots were created within the boundaries of MGRS critical habitat. Critical habitat that is still suitable MGRS habitat (as much as 500 of 786 acres) still exists within the fire perimeter and around the areas of suppression actions.

- Fire suppression and rehabilitation activities prevented the fire from doing more damage to MGRS and its associated critical habitat. Conservation measures and rehabilitation efforts further minimized effects of suppression activities.

- MGRS midden census data indicate that the MGRS population has been relatively stable since Fall of 2001, despite the Nuttall-Gibson Complex Fire and tree death associated with insect damage. Post-fire survey data do not show dramatic overall declines. Although the Spring numbers have declined about 30%, the Fall numbers have rebounded to pre-fire levels. These changes in population are driven by a number of factors, including the wildfire itself and tree death in the spruce-fir forest due to insects and drought, which together are much more important than the effects of suppression activities on the MGRS population.

- Mechanical fire-suppression actions and burn-out operations along the dozer line were known to have affected one active midden. To put this number in context, as of April 2006, there were 455 potentially active middens throughout the range of MGRS. The number potentially active just before the fire is unknown. An unknown number of additional middens were undoubtedly consumed by other burn-out operations, but most of these likely would have been consumed by the wildfire if burn outs were not conducted. Although suppression resulted in degradation or loss of middens, we have evidence that these effects do not necessarily result in loss of MGRS. Larsen *et al*. (1997) indicate that 83 percent of red squirrels survived over-winter despite having their cone caches depleted. Furthermore, post-fire population estimates do not clearly show a dramatic decline, which would be expected if a loss of middens equated to a loss of MGRS. Additionally, a few new middens (post-fire) have also been documented in areas both inside and outside of the burn perimeter.

Although we believe the MGRS is critically endangered and recent insect outbreaks, drought, and fires, including the Clark Peak and Nuttall-Gibson Complex fires, have pushed it near the brink of extinction, the primary reason why suppression activities did not jeopardize the continued existence of the MGRS or result in adverse modification or destruction of critical habitat, in addition to the reasons stated above, is that those activities prevented the wildfire from becoming potentially much larger and consuming most or all of the MGRS habitat left atop the Pinaleño Mountains. This conclusion is consistent with our conclusion on the Clark Peak Fire biological opinion.

INCIDENTAL TAKE STATEMENT

Sections 9 of the Act and Federal Regulation pursuant to section 4(d) of the Act, prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. “Harm” is defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

For the purpose of evaluating incidental take of MGRS from the actions under consultation, incidental take can be anticipated as either the direct mortality of individual squirrels, harassment of individual squirrels, or the alteration of habitat that affects behavior (i.e. breeding, foraging, or sheltering) of squirrels to such a degree that the squirrels are considered lost as viable members of the population and thus “taken.” They may fail to breed, fail to successfully rear young, raise less fit young, or desert the area because of disturbance or because habitat no longer meets the squirrels’ needs.

Using available information as summarized within this document, we have identified incidental take of MGRS associated with suppression activities directly affecting squirrels through harm or harassment, and indirectly affecting them through loss or degradation of middens or other habitat features. Although effects to the middens, habitat, and MGRS resulted from the wildfire itself, it is the effects of the suppression actions that must be addressed in this incidental take statement.

As discussed in the Effects of the Proposed Action, one active midden was affected along the 2-mile long dozer-line and this midden was completely burned as a result of burn-out operations. The effects to this midden are considered a short-term loss to MGRS. As discussed above, the work of Larsen *et al.* (1997) indicates that loss of a midden does not necessarily mean loss of a red squirrel. Because habitat was still suitable around the dozer line, these middens may again be used by MGRS returning to their pre-fire territories. Post-fire observations have indicated that some MGRS are, in fact, returning to their middens, rebuilding them, and continuing to use them for food storage where other habitat features remain.

In addition to the active midden described above, an unknown number of middens were likely affected by suppression activities (mechanical and burn-out operations). Although precise quantification of these additional unknown numbers of middens is not possible, the number is probably significantly larger than the one affected along the dozer line. A 36-acre treatment area along the dozer line affected one midden, but the burn-out operations affected about 500 acres. Although those burn-out operations were mostly low-severity, additional middens were likely burned or partially burned. In areas of moderate (21 acres) and high-severity (less than 0.25 acre) burn outs, MGRS were likely directly taken, including juveniles in nest trees destroyed by burn outs. Others were likely harmed due to loss of middens or other degradation of other habitat features. However, based on the best scientific information available to us, as shown in Table 1, we cannot anticipate how many MGRS were taken, beyond the one active midden, with reasonable certainty.

Although additional MGRS were likely harmed or harassed by suppression activities, we believe that relatively few were killed, directly or indirectly, by suppression activities. There are two lines of evidence for this. First, although loss of a midden can lead to reduced survivorship from loss of food sources, data suggest that loss or depletion of a midden does not necessarily equate to decreased survivorship or reproductive success. Larsen *et al.* (1997) showed that depletion of cached cones had no significant effect on over-winter survival compared to the control group (83 percent survival versus 89% survival, respectively). Additionally, Koprowski *et al.* (2006) further note that, of 13 radio-collared MGRS that survived the fire, only four abandoned their middens during the two weeks following the fire, and each of these middens was in an area that experienced intensive crown fire. Secondly, post-fire census data do not support dramatic loss of MGRS due to suppression actions or the wildfire. Census numbers dropped by 20 in the Fall 2004 census and 70 in the Spring 2005 census as compared to the previous year, but there is reason to believe the Spring census underestimated the population because the fire made it difficult to assess midden activity. Although Spring census numbers from 2003-2006 have declined about 30%, Fall census numbers have rebounded, indicating that Summer and Fall reproduction and survival have been adequate to maintain the population.

In summary, post-fire observations and midden survey data, in addition to the findings of Larsen *et al.* (1997), strongly suggest that harm and harassment that may have been caused by suppression activities resulted in no biologically meaningful loss of MGRS. Apparently most MGRS affected by suppression activities survived. An unknown number of juveniles in nests were likely killed when their nest trees were consumed in moderate and high-severity burn out operations, but juveniles in nests are biologically less significant than adults to the population because most would have died in any case before reaching maturity. Similar to our analysis on the known number of middens above, the effects to the unknown number of middens does not necessarily equate to the loss of a MGRS (Koprowski *et al.* 2006, Larsen *et al.* 1997). Finally, MGRS loss, in terms of both individual squirrels and squirrel habitat, would have been more severe if not for an aggressive suppression effort.

EFFECT OF THE TAKE

In this biological opinion we determine that this level of anticipated take was not likely to have resulted in jeopardy to the species.

Incidental take statements in emergency consultations do not include reasonable and prudent measures or terms and conditions to minimize take unless the agency has an on-going action related to the emergency (U.S. Fish and Wildlife Service 1998). As previously mentioned, the Forest Service also agreed to rehabilitate Forest Roads 507 and 669 after opening them for use as fire breaks. Additionally, spruce and fir trees will be replanted within the high elevation spruce-fir zone to promote MGRS habitat. These actions are ongoing; however, we do not anticipate that they will result in incidental take of MGRS.

CONSERVATION RECOMMENDATIONS

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

1. We recommend that you pursue opportunities to research actual effects to and recovery of MGRS and midden sites in regard to fire-suppression actions, especially burn-out operations and associated midden activity in those areas.

2. We recommend that you continue to assist us in the implementation of the MGRS recovery plan, and revision of the plan, including providing funding for carrying out key recovery actions.

3. We recommend that you pursue the completion of a forest-wide consultation on wildland fire use for resource benefit and wildfire-suppression activities.

4. The status of the MGRS is dire, and its habitat has declined precipitously in recent years. We recommend you take immediate action to minimize or eliminate impacts of all Forest-authorized activities in MGRS habitat, and begin rehabilitation and restoration of habitats destroyed by fire and insect damage.

5. We recommend that you plan the Pinaleno Ecosystem Restoration Project very conservatively with the ultimate goal of providing protection from fire while minimizing as much as possible potential direct impacts of the project on the MGRS, the MSO, and their habitats.

In order to keep us informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitat, we request notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the action outlined in your August 2005 BA. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate your consideration of listed species. For further information, please contact Brian Wooldridge of our Tucson Suboffice at (520) 670-6150 (x235), or Jim Rorabaugh at (520) 670-6150 (x230). Please refer to the consultation number 02-21-04-M-0299 in future correspondence concerning this project.

Sincerely,

/s/ Steven L. Spangle
Field Supervisor

cc: Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ (Attn: Sherry Barrett)
Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ (Attn: Brenda Smith)
Arizona MSO Species Lead, Fish and Wildlife Service, Flagstaff, AZ (Attn: Shaula Hedwall)
Arizona MGRS Species Lead, Fish and Wildlife Service, Tucson, AZ (Attn: Thetis Gamberg)
District Ranger, Safford Ranger District, Hereford, AZ (Attn: Toni L. Strauss)
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Tucson, AZ

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Appendix A

CONCURRENCES

This appendix contains our concurrence with your determination that suppression actions associated with the Nuttall-Gibson Complex Fire may have affected, but were not likely to have adversely affected Apache trout. We concur with your findings based on the following reasons:

Apache trout (*Oncorhynchus apache*):

- No fire retardant was dropped in the two drainages containing Apache trout (Ash and Grant creeks).

- Burn-out operations conducted around Ash Creek to connect the two fires (Nuttall and Gibson) were considered unsuccessful, resulting in scattered low-intensity fires with low burn severities. Although in the Ash Creek watershed, these intentionally ignited fires were more than 0.25 mile from Ash Creek. There were significant amounts of unburned vegetation between the fires and Ash Creek, resulting in a buffer zone for any associated ash and sediment run-off resulting from the burn-out operations.

- Only a small portion of upper Grant Creek was affected by burn-out operations. These burn-outs were quickly followed by the onset of the monsoon season, resulting in diminished severity. Remaining vegetation acted as a strong buffer for ash and sediment run-off.

- Post-fire rehabilitation efforts (BAER) and fire-suppression rehabilitation efforts helped expedite the regeneration of vegetation, thus minimizing the effects of ash and sediment runoff.