Altar Valley Fire Management Plan 2008

September 18, 2008

EXECUTIVE SUMMARY

Fire played an important role in the Altar Valley's ecology prior to Euro-American settlement. According to Bahre (1985), fires were "fairly frequent" in southern Arizona grasslands prior to 1882 and much larger in aerial extent within the grasslands. The cessation of major grassland fire preceded the brush invasion of the 1890s. Kaib (1998) further suggests that desert grasslands in this area likely burned once every 8–12 years. Those fire regimes likely played a crucial role in maintaining the area's grasslands by suppressing woody species and encouraging new growth (Sayre 2000, 2002). However, fire incidence in the Altar Valley decreased dramatically during most of the twentieth century. This is a result of several factors including: discontinuation of managed range fires with the introduction of wood fencing in the 1910s and 1920s, lack of sufficient herbaceous cover to sustain fires, increasingly effective and thorough fire suppression policies, and Endangered Species Act (ESA) considerations.

In recent years, the steady increase of woody species and decrease of herbaceous species in the Altar Valley has resulted in a renewed interest in restoring fire to the ecosystem—both in its natural form and as a management tool.

A consortium of cooperating agencies and organizations is proposing the Altar Valley Fire Management Plan (AVFMP) to allow for the re-introduction of fire as a functioning component of the ecosystem within the planning area. The consortium includes the Altar Valley Conservation Alliance (AVCA), Natural Resource Conservation Service (NRCS), U.S. Fish and Wildlife Service (Ecological Services (AESO) and Buenos Aires National Wildlife Refuge (BAWNR)), Arizona Game and Fish Department (AGFD), Arizona State Land Department (ASLD), Arizona Date Forestry Division (ASFD), Pima County Natural Resources, Parks and Recreation Division, and The Nature Conservancy (TNC). The plan addresses ESA compliance/recovery goals, while implementing a fire management plan that reestablishes fire as a component of the grassland ecosystem in the planning area.

1.0 Introduction and Background

1.1. The Altar Valley is an area approximately 52 miles long and 20 miles wide through which the Altar Wash flows out of the Arivaca watershed (Figure 1). The southern third of the wash and its tributaries are within the Buenos Aires National Wildlife Refuge (BANWR), which has its own fire management plan.

The planning area covers approximately 609,900 acres of land within the area generally bounded on the south by the U.S./Mexico border, on the north by State Route (SR) 86, on the west by the Baboquivari and Coyote Mountains, and on the east by the Sierrita, Las Guijas, Cerro Colorado, and San Luis Mountains. The planning area also encompasses three small towns: Three Points at the SR 86/SR 286 intersection, Arivaca at the extreme southeastern end of the Valley, and Sasabe at the southern end of the Valley (Figure 2).

In addition, residential development associated with Tucson, a major metropolitan area located just 20 miles to the northeast, has begun to encroach on the northern end of the valley.

Elevation ranges from 2,500 feet above mean sea level (msl) on the valley floor near SR 86 to 7,730 feet above msl at the top of Baboquivari Peak. Elevation increases relatively rapidly east to west from the valley floor to the tops of the surrounding mountains, and gradually from north to south on the valley floor.

The Altar Wash is the principal drainage feature that runs south to north through the center of the Altar Valley. The wash drains the entire 546,000-acre Altar Valley watershed, flows into Brawley Wash, which flows into the Santa Cruz River, northwest of downtown Tucson. The climate of the area is semiarid with relatively low precipitation, low humidity, and high summer temperatures. Precipitation averages 12 to 24 inches per year depending on elevation and falls primarily during two rainy periods—summer rainfall, which usually occurs in local convection showers, and winter rainfall, which is usually frontal and can occur over several days duration (Westland Resources 2000).

Geologically, the valley consists of four major zones: (1) mountains, in the upper reaches of the watershed; (2) pediments, which run from the base of the mountains to an average of 1 mile below the mountains; (3) alluvial fans or bajadas below the pediments; and (4) the central bottomlands or floodplain, which contains Altar Wash (Andrews 1937). The bajadas and central bottomlands consist of deep, unconsolidated material and generally represent the valley's richest soils.

This geologic makeup determines the hydrology. Rainfall runs quickly off the mountains surrounding the valley, across the pediments, and into the alluvia of the bajadas and bottomlands where it sinks into the groundwater. As a result, Altar Wash does not support perennial water, but flows only during heavy rain or flood events. Furthermore, perennial surface water within the watershed is extremely rare, occurring in various quantities only at Arivaca Creek, Arivaca Cienega, Brown Canyon, Thomas Canyon, San Luis Creek, and Sabino Creek. Groundwater, on the other hand, is abundant, and water levels in the deep wells across the valley have remained constant for as long as records have been kept (Sayre 2000).

Ranching families living and working in the Altar Valley formed the AVCA in 1995 and incorporated the organization as a 501(c)3 in 2000. The AVCA's mission is to conserve the Altar Valley for future generations, and its work is structured around the following program areas: resource stewardship, policy and planning, land protection, and community education. Membership in the AVCA is voluntary. Members currently include valley landowners; cooperating agencies and organizations; and concerned citizens from the Tucson area, as well as across the country. Approximately 43 percent of private lands, 77 percent of federal lands, and 70 percent of State Trust land in the planning area are within AVCA-member ranches.

1.2. Land Ownership

Primary land ownership in the Altar Valley is currently a mosaic of privately owned lands and lands owned and administered by Indian reservations, U.S. Department of Agriculture, U.S. Forest Service (FS), Department of Interior - Bureau of Land Management (BLM), Pima County, Arizona State Land Department, and Department of Interior - Fish Wildlife Service (FWS) (Figure 2). Nearly half the Altar Valley is State Trust Land. Therefore, the majority of the land within the Altar Valley planning area is still open space with minimal developments.

1.2.1. State Trust Lands

State lands within the Altar Valley were established in 1912 under the terms of the Arizona Enabling Act. On February 24, 1863, the congressional act that established the Territory of Arizona set aside section 16 and 36 of each township to benefit the Common Schools. In 1910, the Enabling Act for the State of Arizona further set aside sections 2 and 32 of each township to be held in trust for the Common Schools. Because many townships lacked unclaimed lands, the state was authorized to acquire in lieu sections elsewhere. As a result, much of the land in the Altar Valley planning area—at that time unclaimed— was taken into possession by the State. The State remains the largest landowner in the planning area, managing approximately 294,000 acres, or 48 percent of the planning area. These lands—called state trust lands—are administered by the ASLD. State trust lands are managed primarily to produce revenue for the Arizona State Trust beneficiaries, including the state's school system. In the Altar Valley planning area, state trust lands are leased primarily for livestock grazing (Lehman 2003).

1.2.2. Private Lands

Private lands within the Altar Valley planning area are found primarily in two areas: 1) the margins of the mountain ranges surrounding the valley and 2) along the Altar Wash. This distribution is a reflection of the constraints of water availability at the time the Valley was first settled. The majority of these lands is undeveloped and consists of private ranches; however, a small but growing amount of land has been converted to residential and commercial uses.

Land uses in the planning area consist primarily of ranching and livestock grazing. Other land uses include mining, fuelwood cutting, hunting, and other recreational activities (e.g., hiking, off-road vehicle use). Each ranch is composed of privately owned lands in combination with state trust and/or public grazing leases on County, ASLD, BLM, or FS lands (Figure 2). Ranches in the planning area (Figure 3) vary in size from 10,000 to 70,000 acres and, in total, support approximately 5,100 cows. Those cows, in turn, produce about 3,800 calves and yearlings each year, which equates to nearly $2 million annually in gross livestock revenues (Westland Resources 2000). All developed ranch facilities—with the exception of some holding corrals, roads, fences, and water sources—occur within the private portions of the ranches. Individual livestock pastures, however, generally do not observe the boundaries between public and private lands but follow

natural (i.e., ridgeline) or manmade (i.e., fenceline) features. The result is that private lands and governmental lands intersect within individual pastures and are indistinguishable from each other—at least with respect to livestock management. The Altar Valley supports a total of 19 individual ranches, or a portion thereof, with all those currently participating as AVCA members. Private lands compose approximately 13 percent of the planning area.

1.2.3. Federal Lands

The primary block of Federal land in the Altar Valley consists of the 116,000-acre BANWR, which runs north to south in the south-central portion of the planning area and is administered by the FWS. Formerly a private ranch, the BANWR was established to support the reintroduction of the masked bobwhite quail. Management goals of the BANWR are outlined in the BANWR *Comprehensive Conservation Plan* (USFWS 2002). Livestock grazing has been excluded from the area since its conversion to a wildlife refuge.

In addition to the BANWR, the BLM and the FS administer small portions of land within the Altar Valley. BLM lands include approximately 24,000 acres, or 3.9 percent of the planning area, and include 16 livestock-grazing allotments managed in association with private and state land-grazing operations. These operations are scattered primarily around the margins of the planning area and make up only minor portions of most individual Altar Valley ranches. Similarly, only a small amount of FS land—about 85,000 acres, or 13.9 percent, located at the extreme southeastern tip of the valley—occurs within the planning area. However, some Altar Valley ranches (e.g., the Rancho Seco/Santa Lucia, Chilton-Arivaca, and Sierrita ranches) include large FS or BLM grazing leases.

1.2.4. Tribal Lands

Tribal lands are within the Schuk Tauk District of the Tohono O'Odham Nation. These lands are totally private and may be used only by tribal members.

1.2.5. Pima County Lands

In 2001, the Pima County Board of Supervisors adopted the Sonoran Desert Conservation Plan (SDCP). The comprehensive regional planning effort combines short-term actions, which protect and enhance the natural and cultural environment with long-range planning to ensure that the conserved and urban environments not only co-exist, but develop an interdependent relationship - where one enhances the other. In 2004, the County began implementation of a $ 174 million bond program to acquire biologically sensitive and important community open space lands across the County, as identified within the SDCP. A number of large parcels of land in the Altar Valley planning area have been acquired under the bond program. To date the County has acquired title to almost 13,000 acres in the Altar Valley planning area and has over 32,000 acres in associated grazing leases on state and federal lands. Pima County Natural Resources, Parks and Recreation

administers these lands. While conservation is the primary goal of the acquisitions, many of the parcels will also be maintained as working landscapes and previous uses like farming, ranching and dispersed recreation will continue under sustainable management strategies.

1.2.6. City of Tucson Lands

The City of Tucson controls much of the land immediately north and south of 86 along the Brawley Wash.

1.3. Assessment of Existing Vegetation

In 1999 and 2000, a survey of the Altar Valley's rangeland resources was conducted. This survey documented the condition of the valley's vegetative resources, mesquite (*Prosopis* spp.) densities, nonnative plant cover, and overall rangeland health (Meyer 2000). Survey procedures followed Natural Resources Conservation Service (NRCS) standards for natural resource inventories, which delineate Common Resource Areas/ Major Land Resource Areas (CRA/MLRA) based on physiographic features, soils, climate, and other factors (Figure 4). Additionally, The Nature Conservancy (TNC) conducted a recent review of grasslands within southern Arizona that depict current grassland condition types (Gori and Enquist 2003). Both sets of data were reviewed and combined into one vegetation data set for the Altar Valley planning area.

1.3.1. Vegetation Classification from Meyer 2000

1.3.1.1. Mexican Oak-Pine and Oak Savanna

This CRA/MLRA occurs on the upper slopes of the Baboquivari and Sierrita Mountains (above 4,300–5,000 feet above msl) and is clearly in the best overall habitat condition within the watershed. Similarity indexes for the ecological sites in this area are in the range of 80 percent; soils, biotic integrity, and watershed function are all rated stable, intact, and functioning, respectively. Mesquite canopies are light and there are few to no nonnative grasses. These conditions probably reflect the high-elevation location of this CRA/MLRA, which results in less grazing pressure, fewer vegetative impacts (e.g., mesquite encroachment), greater rainfall, and less erosion.

1.3.1.2. Sonoran Semidesert Grassland and Upper Sonoran Desert

The Sonoran Semidesert Grassland CRA/MLRA extends from the lower slopes of the mountains, across the bajadas and foothills, and into the Altar Valley (ranging in elevation between 3,200 and 5,000 feet). The upper Sonoran Desert CRA/MLRA occurs at elevations below 3,200 feet on the west side of the valley and below 3,400 feet on the east side. A number of ecological sites occur in both CRA/MLRAs, including loamy uplands, sandy loam uplands, sandy bottoms, and deep sandy bottoms. These ecological sites constitute the majority of the Altar Valley's rangelands. These sites also received the greatest historic grazing pressure and display the majority of the current ecological

problems in the watershed.

Similarity indexes in these ecological sites range from a low of 29 percent to a high of 67 percent, which is primarily because of two factors: (1) the presence of mesquite where grasslands once occurred and (2) the presence of nonnative grasses where native grasses once occurred. It is important to note, however, that mesquite encroachment is always undesirable while nonnative grasses, though not preferable, is often beneficial because it prevents erosion (Gould 1982; Martin and Morton 1993; Parizek, Rostagno, and Sottini 2002). The area of the watershed in the poorest overall condition is the valley's uplands—occurring midway between the valley floor and the mountains (i.e., the Sonoran Grassland CRA/MLRA). Rangeland health criteria for a number of the ecological sites in this area (e.g., loamy uplands, loamy bottoms, and sandy bottoms) are nearly all considered at-risk—the result of mesquite encroachment, loss of grassland cover, sheet erosion, and gully erosion in the washes. On the valley floor (i.e., the Upper Sonoran Desert CRA/MLRA), overall conditions are better, because enough annual vegetation grows here to hold the soil in place. The Altar Wash arroyo, however, is still one of the valley's most substantial ecological challenges.

The current ecological conditions in the Altar Valley watershed, as a whole, are better today than at any time in the past 75 years (Meyer 2000). The mountain areas are in near historic condition and many ecological sites in the Upper Sonoran Desert CRA/MLRA (e.g., shallow uplands, loamy uplands, deep sandy bottoms, loamy bottoms) and the Sonoran Semidesert Grassland CRA/MLRA (e.g., granitic hills, shallow uplands, loamy hills) are rated as stable, intact, and functioning. Furthermore, no ecological site evaluated during the survey rated as not stable, not intact, or not functioning.

1.3.2 Grassland Classification from Gori and Enquist 2003

.

Gori and Enquist (2003) developed a series of six grassland classes or types using information from range management experts and the literature to define threshold values for shrub cover. These grassland classes have been reviewed and were considered in developing fire danger rating fuel models and fire behavior prediction models. The Gori and Enquist types include the following:

TYPE A—*Native grassland with low shrub cover*. Grassland with less than 10 percent shrub cover whose herbaceous component is entirely or predominantly native perennial grasses and herbs; nonnative perennial grasses are uncommon or absent.

TYPE B—*Shrub-invaded native grassland with restoration potential*. Grassland composed of native perennial grasses and herbs (nonnatives absent or uncommon) with 10–35 percent total shrub cover and mesquite or juniper cover less than 15 percent. A key characteristic of this type is its restoration potential. Shrub cover can be reduced using prescribed burns, and the site can be restored to TYPE A grassland when sufficient fine fuels have accumulated for fire spread.

TYPE C—*Sacaton riparian grassland*. Grassland dominated by giant sacaton that

occurs on floodplain terraces along drainages.

TYPE D—*Nonnative grassland with low shrub cover*. Grassland with less than 10 percent shrub cover where nonnative perennial grasses are common or dominant.

TYPE E—*Shrub-invaded nonnative grassland*. Grassland with 10–35 percent total shrub cover and mesquite or juniper cover less than 15 percent; nonnative perennial grasses are common or dominant. A defining characteristic for this type is its potential for shrub reduction using prescribed burns and for "restoration" to TYPE D grassland.

TYPE F—*Shrubland-former grassland*. Former grassland with greater than 15 percent canopy cover of mesquite and juniper combined or greater than 35 percent total shrub cover; perennial grass canopy cover usually less than 1 percent, always less than 3 percent; type conversion to shrubland that is either permanent or may require a longer time period or more livestock exclusion for partial recovery of perennial grasses.

1.4. Understanding the Outcomes of Prescribed Fire Use

"Fire is an essential ecological process in many fire dependent ecosystems. In large areas of the country, fire exclusion from these ecosystems has led to unhealthy forest, woodland and rangeland conditions. These areas are at risk of intense, severe wildfires that threaten communities and cause significant damage to key ecological components. As one component of fire management, prescribed fire is used to alter, maintain, or restore vegetative communities; achieve desired resource conditions; and to protect life, property, and values that would be degraded and/or destroyed by wildfire." (USDI/USDA 2006)

The exclusion of natural fire from the ecosystem is a main contributing factor to the changes in grassland composition. As a result, shrub encroachment has occurred on over 84 percent of existing and former grassland in the U.S. (Gori and Enquist 2003). On the Santa Rita Experimental Range (SRER) "the most conspicuous change is the increase of mesquite, which began before 1903 when the spread of seed by livestock and cessation of fire led to the establishment of mesquite in the open grasslands" (McClaran 2003). Over the past century woody plants have increased in abundance on sites formerly occupied by grasslands in the Sonoran Desert (Cox et al. 1993). The woody invasion of grassland by honey mesquite (*Prosopis glandulosa*), creosote bush (*Larrea tridentata*), and joint fir (*Ephedra* spp.) has also been noted in the Chihuahuan Desert (Desmond and Montoya 2006) and Ansley et al. (2001) note long-term increases in mesquite canopy cover in North Texas. The attributing factors identified are "climate change, over grazing, fire suppression, distribution of shrub seeds by domestic livestock, and removal of native herbivores" (Herbel et al 1972; Nielson 1986; Schlesinger et al. 1990). Scott et al. (2006) "suggest that carbon and water cycling in semiarid riparian ecosystems of the southwestern U.S. are fundamentally altered by vegetation change." Thirty-two percent of shrub-invaded native grasslands are considered to have restoration potential. Thus, the opportunity for restoration through prescribed fire is substantial, but time sensitive, considering the amount of grasslands already converted to shrublands.

1.4.1. History: Settlement-Fire-Grazing

The presence of whitethorn (*Acacia constricta*) and mesquite (*P. velutina*) was largely limited to riparian areas prior to 1890 (Hastings and Turner 1965). Humphrey (1953) proposed that the desert grassland of southwestern Arizona and northern Mexico is not true climax vegetation for the region. Instead, they are a subclimax maintained by fire. Suppression of fire has allowed the onset of succession to true climax of low trees, brush, and cacti, with an understory of grasses and low growing shrubs. Mesquite, creosote bush, prickly pear cactus (*Opuntia* spp.), burroweed (*Isocoma tenuisecta*) and snakeweed (*Gutierrezia sarothrae*) are among the principal native invaders with various lovegrasses (*Eragrostis* spp.) as principal nonnative invaders. Humphrey (1958) states, "Had fires continued to sweep the grasslands down through the years to the present with their original frequency, the desert grassland would probably occupy about the same area today as it did prior to the white settlement of the Southwest."

Cox et al. (1993) note that Humphrey's hypotheses as to the occurrence of large, destructive wildfires at 2 to 3 year intervals between 1859 and 1890 are supported by Bahre (1985). Some federal land managers apparently promoted overgrazing in an attempt to reduce timber losses by wildfire (Leopold 1924).

"The decision to create the Santa Rita Experimental Range in 1903 rested on at least two interlocking premises. The first was that it was biogeographically representative of a large swath of Southwestern rangelands. Within its boundaries could be found conditions of vegetation, topography, soils, and climate similar to those of some 20 million acres in Arizona, New Mexico, and Texas (USDA 1952). The second was that it was a representative management unit, similar in size to the larger ranches that dominated the region. Both premises reflected the judgment that the highest economic use of Southwestern rangelands was grazing, such that research aimed at the needs of ranchers and range managers could benefit the entire region" (Sayre 2003). The Santa Rita Experimental Range (SRER) has served as a unique scientific baseline for over 100 years.

Studies of vegetation on the SRER summarized by Humphrey and Mehrhoff (1958) specifically noting the changes in area and abundance of the four most common woody plants: mesquite, creosotebush, burroweed, and cholla (*Cylindopuntia* spp.). Their conclusions included reference to the influence of cattle on vegetation composition, the assertion that fires maintained the desert grassland prior to the introduction of livestock, and that the shrub invasion in these grasslands is due primarily to reduction of range fires.

Clearly, grasslands in central and southern Arizona have undergone dramatic vegetative changes over the past 130 years, including encroachment by shrubs, loss of perennial-grass cover, and spread of non-native species. These changes, however, have not occurred uniformly across the region; the full extent and distribution of these changes are still being discovered. Records from the SRER document "a steady increase of mesquite trees, four cycles of burrowweed eruption and decline, one cholla cactus cycle,

interannual and interdecadal variation in native grass composition, and the recent dominance of the nonnative Lehmann lovegrass" (McClaran 2003). Documentation of vegetation change using repeat photography and analyses of the probable causes have included many portions of the Sonoran Desert (Hastings and Turner 1965; Turner, Webb, Bowers, and Hastings 2003).

1.4.2. The Altar Valley Grassland Communities at Present

The Altar Valley has not been immune to grassland habitat alterations and is experiencing several rangeland management challenges because of drought, ranch operations, rangeland conservation actions, and special-status species management. A priority need for the Altar Valley is a range improvement measure that would begin to correct and make better a number of ecological problems that partly stem from range management practices dating to the late 1800s. These ecological problems include the Altar Wash arroyo, an extremely large incised channel that has formed on the valley floor over many decades; the encroachment of mesquite into many of the valley's historical grassland habitats; and the loss of native grasslands to non-native invasive grasses.

One improvement-measure recommendation for the Altar Valley is the reintroduction of fire. As a management tool, fire can restore historic vegetation types by reducing woody-species encroachment; by improving wildlife biodiversity with emphasis on threatened, endangered, and sensitive species; by improving watershed stability and hydrologic function through increased herbaceous vegetative cover; and by creating a watershed with a mosaic of vegetation that will allow fire to resume its historical regime.

1.4.2.1. Fire Plan Coordinating Agencies

To reintroduce fire into the Altar Valley ecosystem, the AVCA, AGFD, ASFD, ASLD, USDA NRCS, BLM, FS, FWS - AESO, FWS - BANWR, Pima County, and TNC collaboratively developed the AVFMP. The purpose of this collaborative partnership has been to develop, facilitate, and implement scientifically sound land-resource management and conservation strategies in the Altar Valley. All parties have agreed to work together to identify, prioritize, and implement fire management strategies on private, county, and state trust lands to enhance range and watershed conditions.

1.4.2.2. Lead Agency

Acting as the lead agency, the NRCS has agreed to conduct the National Environmental Policy Act (NEPA) review, to pursue ESA Section 7 consultation with the FWS, and to issue a determination and decision for implementation of the AVFMP. The AVFMP, developed under a Memorandum of Understanding (MOU) with the partners listed above, establishes and designates its signatories as "cooperating agencies." It is important to note, however, that the BANWR and the Coronado National Forest (CNF) have current decisions governing wildland fire use on the lands under their administration within the AVFMP planning area and that this plan will not affect the *Biological Opinion for the Buenos Aires National Wildlife Refuge Fire Management Plan for the 2005-2008 Burn*

Season (AESO 02-21-05-F-0243), or the *Wildland Fire Amendment to the Coronado National Forest Land and Resource Management Plan* (June 2005). The remaining signatories to the MOU have agreed to follow the NEPA process as outlined in the NRCS *National Environmental Compliance Handbook* (2003) for the development and implementation of the AVFMP.

1.5. Current Conditions

Ecological conditions in the Altar Valley have improved dramatically since the 1970s and are overall, relatively good compared to previous decades. These improvements are due, in part, to the use of prescribed fire or wildland fire management in the Altar Valley from the mid 1970's to the mid 1990's. Assessment of present conditions in the watershed confirms that the management practices of the past three decades have generally stabilized or improved range conditions.

Carl D. Jones, chaired the development of the Altar Valley Fire Management Plan/Action Guidelines in 1998 (Jones 1998). The Plan consisted of a short narrative and two computer generated maps done by the University of Arizona Advanced Resource Technology Group. The first display map contained numbered fire management blocks delineated by roads, trails and natural features along with land ownership and ranch boundaries. This information was also displayed on the 7.5-minute USGS topographic maps for field use. The second display map was a fire occurrence map showing all natural and human caused fires from 1975 on, along with the location of the start and final burned boundary areas. The information was gathered in the field to be used in the future by fire managers for making fire management decisions. AVCA's *Watershed Action Plan and Final Report* (2001) shows specific problems where at least two of three rangeland health attributes are rated at-risk in the following areas: (1) a large area (approximately 5 by 12 miles) of uplands along the west side of the valley floor; (2) an area of uplands (approximately 5 by 7 miles) on the east-central side of the valley floor; (3) on the valley floor floodplain and its associated Altar Wash arroyo; and (4) in many washes on the east side and south end of the watershed. The remainder of the watershed, and representing the majority of its land area, is rated as stable, intact, or functioning in at least two rangeland health attributes. Trends are generally static with mesquite densities higher than desired and where nonnative grasses replaced native grass species. The vegetative community is not at its potential with the desired mix of native grassland species. Two factors present serious obstacles to long-term sustainability of the Altar Valley watershed. These include (1) the Altar Wash arroyo, which impairs watershed function by increasing sediment transport, decreasing infiltration, and lowering soil moisture in the valley soils; and (2) mesquite encroachments in the uplands which create higher rates of sheet runoff, evapo-transpiration, erosion, and sediment transport. These trends are recognized as irreversible on human time scales without management intervention, including restoration of fire to the ecosystem.

Conditions vary from place to place in the watershed and there are substantial problem areas. These are reflected in three of the four resource issues the AVCA has specifically identified as concerns: (1) invasive nonnative grasses, (2) woody shrub encroachment

into grassland habitats, and (3) erosion in the Altar Wash arroyo (AVCA 2001). These issues will be addressed to some degree through the AVFMP.

1.5.1. Invasive Nonnative Grasses

Nonnative grasses have been both a solution and a problem in the Altar Valley watershed. Although they have been effectively employed over the years to control erosion and restore grasslands, today nonnative grasses are often considered undesirable compared to native grasses. Meyer (2000), for example, found in many upland areas that it was often nonnative grasses that held the soil in place and prevented erosion. Meyer also noted, however, that nonnative grasses dominated in many areas at the expense of native grasses.

The first nonnative grass to appear in the Altar Valley seems to have been Johnson grass. This grass had entered the valley by World War I and was planted in the bottomlands in subsequent decades to be harvested as hay (Sayre 2000). Lehmann lovegrass (*Eragrostis lehmanniana*) was another nonnative grass that was typically used by the Arizona Department of Transportation (ADOT) for erosion control as early as the 1930s. Bermuda grass (*Cynodon dactylon*), Boer lovegrass (*E. chloromelas),* and other nonnatives were introduced over the years. By the 1950s, the Soil Conservation Service (now the NRCS) was advocating the use of Lehmann lovegrass for range restoration purposes (Sayre 2000). Consequently, nonnative grasses have been used throughout the watershed for many years, and Lehmann lovegrass in particular continues to dominate where it has been seeded within the watershed. Lovegrass is so successful because it germinates earlier than native perennials, stays green longer, withstands drought and fire, and tends to receive lighter grazing pressure than native grasses. These facts suggest that Lehmann lovegrass and other nonnative grasses, without some management, will persist in the Altar Valley planning area.

Across the West, the ecological value of nonnative species no longer takes precedence over the restoration of native grasses. Although past benefits in preventing erosion by seeding nonnative grasses cannot be denied, restoration of native grass species is now the desirable ecological goal for rangeland restoration. Therefore, the intention of the AVCA is to contain or reverse the spread of Lehmann lovegrass and other nonnative species in the watershed, to encourage strategies that favor the establishment of native perennial grasses and, where possible, to restore grassland communities to a more desirable mix of native species (AVCA 2001).

1.5.2. Woody Shrub Encroachment

According to historical records, vegetation in the Altar Valley prior to Euro-American settlement was predominantly perennial grassland, with mesquite and other shrubs occurring primarily along the margins of Altar Wash and its tributary drainages (Sayre 2000). The uplands were dominated by perennial bunchgrasses. Mesquite densities appear to have increased from south to north through the watershed, with most of the mesquite occurring in the lower northern end of the valley. Cacti, palo verde (*Cercidium*

spp.), and other desert shrub vegetation also occurred in the valley's northern lowlands, and increased south to north as elevation decreased through the valley. Larger trees, including oaks (*Quercus* spp.), sycamores (*Platanus* spp.), cottonwoods (*Populus* spp.), and junipers (*Juniperus* spp.) were limited to higher-elevation mountain areas and a few riparian areas. In addition, the broad bottomlands of the valley floor formed a nearly flat floodplain up to 1.5 miles wide, which supported relatively dense vegetation dominated by sacaton grass (*Sporobolus wrightii*).

The encroachment of mesquite from the Altar Valley's lowlands into its upland grasslands appears to have begun with the formation of the Altar Wash arroyo (about 1890). In the years following the initial formation of the arroyo, giant sacaton grasses in the valley's bottomlands were replaced by Johnson grass (*Sorghum halapense*) and eventually by mesquite. Over the years, mesquite continued to expand from the margins of the Altar Wash and its tributary drainages into the valley's uplands. This seems to have occurred at gradually increasing rates and was substantially accelerated by the drought of the mid-1950s (Sayre 2000). Today, mesquite occurs in excessively high densities across approximately one-third of the watershed and represents a potentially permanent shift in vegetation from grassland to shrubland (AVCA 2001; Gori and Enquist 2003).

The effects of mesquite encroachment can be severe. For example, when mesquite canopy cover exceeds about 16 percent, herbaceous cover is greatly reduced (Kincaid et al. 1959), which significantly increases erosion rates, since the amount of bare ground and soil movement increases as vegetative cover decreases. Experiments in the SRER showed that 16 times as many mesquite seedlings were established on bare ground as in vigorous stands of perennial grasses (Glendening and Paulsen 1955, as reported in USDA 2005, sec. 3, p.70). Moreover, once established, growth of young mesquite was severely restricted in good stands of grass (Wright et al. 1976 as reported USDA 2005, sec. 3, p.70). Because of such factors, numerous areas of soil instability were found in certain ecological sites within the watershed, and mesquite occurrence negatively affected all three indicators of rangeland health, soil stability, biotic integrity, and watershed function (Meyer 2000).

Considerable wildfire suppression efforts, coupled with the uninterrupted invasion of mesquite and brush species, have created vegetative components that are not consistent with the historic vegetation that sustained the natural fire regime in the past.

1.5.3. Erosion in the Altar Watershed

Riparian habitat, particularly in the arid Southwest, is highly important to both humans and wildlife. While only 2 percent of Arizona's landscape is composed of perennial rivers, streams, and other water resources such as wetlands and springs, over 80 percent of Arizona's wildlife depend on these aquatic resources and their associated riparian habitat. Over the past century, however, 90 percent of these water resources have been altered, degraded, or lost. The emphasis toward improving watershed health as identified

in this plan will help maintain riparian systems and allow them to persist as high-quality wildlife habitat.

According to Sayre (2000) the Altar Valley, consisting of the Brawley Wash-Los Robles Wash and drainages of the Rio Concepción, has changed dramatically over the past 120 years, mostly because of the direct and indirect effects of human land uses. The most drastic changes occurred between the 1890s and 1930s through the combined effects of drought, uncontrolled grazing, floods, and fuelwood cutting. Generally, heavy stocking rates during the drought of 1898–1904 resulted in a massive loss of forage and vegetative cover within the watershed, followed by a period of flooding in the winter of 1904–1905. Heavy flood flows during this period probably triggered the formation of the Altar Wash arroyo, which triggered a number of further effects. As the arroyo grew, runoff from the surrounding mountains funneled rapidly through it and out of the watershed rather than spreading across the floodplain and percolating into the bottomland soils. This caused the alluvial water table to drop, which favored woody species (e.g., mesquite) in the bottomlands at the expense of perennial grasses. In addition, "headcutting" from the Altar Wash arroyo caused smaller arroyos to form at the mouths of its tributary washes. These smaller arroyos cut their way into the uplands, forming gullies and bank erosion. This process often caused vegetation loss in the washes and prevented re-growth. Although some of these processes have been slowed or reversed over the years, others, especially erosion in the Altar Wash arroyo and mesquite encroachment, have continued and remain serious problems.

The primary types of erosion occurring in the Altar Valley are sheet, rill, stream channel, and gully erosion. Sheet and rill erosion account for a majority of erosion in the watershed in terms of sediment produced; however, stream channel and gully erosion—while localized—are more visible and severe (Westland Resources 2000). In addition to the Altar Wash arroyo, many smaller arroyos have formed within the watershed's tributary washes—the result of "headcutting" (which moves up the washes from their mouths at the Altar Wash arroyo) and gully erosion (which moves downward from the steeper slopes as runoff cuts through inadequately vegetated uplands and washes). The results of these processes have created a network of incised arroyos and washes throughout the watershed, especially in the uplands of the watershed's east-central and southern portions. All these types of erosion produce excessive quantities of sediment, much of which finds its way to the Altar Wash. Under present conditions, it is estimated that approximately 900 acre-feet of sediment per year is generated from the watershed, of which approximately 532 acre-feet is transported past SR 86 annually (Westland Resources 2000).

The development of the Altar Wash arroyo has resulted in the loss of much of the valley floor's most productive soils and usable land and also lowered the alluvial water table. From 1936 to 1987, for example, about 341 acres of land were lost to bank erosion in the arroyo between SR 86 and SR 286 alone, and it is estimated that approximately 7 acres of land per year continue to be lost in this reach (Westland Resources 2000). Furthermore, over the years sediment removed from the wash (and elsewhere in the watershed) has been deposited on agricultural and rangelands in the northern end of the watershed in the

Garcia Strip (part of the Tohono O'odham Reservation) and Tortuga Ranch, where 1–2.5 feet have been deposited across several thousand acres (Sayre 2000). As the arroyo continues to widen, roads, road crossings, and various ranch facilities—including corrals, barns, fences, water tanks, and levees—have been lost or suffered the impacts of sedimentation. The costs of maintenance and cleanup on SR 286 because of sediment deposition, for example, total approximately $45,000 per year (Westland Resources 2000). When implemented, the AVFMP will begin to slow the erosion associated with washes in the planning area by increasing the herbaceous ground cover and limiting mesquite encroachment.

The AVCA has continued efforts to control erosion on the side channels of the main Brawley Wash. In 2006 two workshops were sponsored for local ranchers and agency personnel to demonstrate methods of controlling erosion along ranch roads. These workshops included actual installation of several types of "road dikes" on several ranches. In 2003, several dikes were repaired at Palo Alto Ranch as well using an AZDWR 319 Grant in combination with private funds, although flooding during the summer of 2006 caused some of these repairs to fail. Smaller rock and brush erosion structures have been installed on other ranches. The Anvil Ranch supported an AmeriCorps Team in 2000 that spent two weeks constructing several types of erosion control structures on side channels. The Los Encinos Ranch used NRCS cost-share funds to complete brush control and land smoothing in a pasture with major head cuts on a side channel in the late 1990's.

Martin and Morton (1993) studied the results of mesquite control on paired gully headcuts on year-round grazed and rotation grazed areas on the Santa Rita Experimental Range. Prior to mesquite control grass densities were low under both grazing regimes. After three years the perennial grass densities were greater in areas where mesquite was controlled. The study documented that soil loss, advances in headcuts, and changes in gully depth were less in areas of mesquite control. On four pairs of watersheds, there was more total runoff in areas where mesquites were alive than in areas where mesquites were dead. Increases in grass densities associated with mesquite control can be effective in slowing this type of arroyo cutting.

Altar Valley ranchers have undertaken a variety of efforts to control erosion over the years. Grasses have been restored in many areas, which has slowed or eliminated sheet and rill erosion, while many measures to combat gully and stream channel erosion have also been implemented. In the early years (1920s and 1930s) of the Altar Wash arroyo, for example, earthen spreader dams were constructed to lift floodwaters out of the arroyo and across the adjacent floodplain (Sayre 2002). Spreader dams were also built in other areas, such as Arivaca Wash and other tributary washes in from the 1930s to 1950s (Sayre 2000). Earthen spreader dams, however, do not withstand continued flood flows, and many have been washed out over the years (Sayre 2002).

Other past erosion control practices include (1) contour plowing (to slow runoff and increase infiltration); (2) construction of earthen reservoirs equipped with spillways and sandtraps (to prevent washouts and capture sediment); (3) construction of dikes and drop

structures (to prevent "headcutting"); (4) installation of spillways, culverts, and water bars around stocktanks and roadways (to prevent erosion); and (5) placement of rock dams and gabions in gullies (to capture sediment). In addition, the introduction of rotational grazing management in the mid to late 1970s contributed significantly to the slowing of erosion. All these remedies have resulted over time in watershed improvements; however, more work is needed in an integrated approach to build additional structures and replace old structures.

1.6. Current and Past Resource Management Projects

Recently, NRCS, ASLD, and Altar Valley ranchers have been working together to develop Coordinated Resource Management Plans (CRMP) for some ranches. These CRMPs are more comprehensive than cooperator agreements and have a proposed planning horizon of 10 years. The CRMPs establish specific range management goals for a subject ranch; describe the grazing systems that the rancher agrees to implement; and details planned improvements (fencelines, stocktanks, etc.) and monitoring strategies. According to the NRCS, CRMPs have been completed and signed for four Altar Valley ranches; five more are in various states of completion. The AVCA is supportive of programs designed to stimulate local industries that reduce heavy fuels and remove invading mesquite on upland areas located in the planning area. Contracts for fuel wood and other commercial uses are also supported by the AVCA. Habitat enhancement treatments that have been employed in the analysis area intermittently since 1966 include chaining, fencing, grazing rotation, and prescribed burning.

2.0 Altar Valley Fire Management Plan 2007

2.1. Need for the AVFMP

Fire played an important role in the Altar Valley's ecology prior to Euro-American settlement. According to Bahre (1985), fires were "fairly frequent" in southern Arizona grasslands prior to 1882 and much larger in aerial extent within the grasslands; cessation of major grassland fire preceded the brush invasion of the 1890s. Kaib (1998) further suggests that desert grasslands in this area likely burned once every 8–12 years. In addition, evidence suggests that both Native Americans and early settlers in the Altar Valley used fire as a management tool (Sayre 2000). In the Southwest, the episodic occurrence of years with high fire activity has been correlated with El Niño and La Niña events (Swetnam and Betancourt 1990). Those fire regimes likely played a crucial role in maintaining the area's grasslands by suppressing woody species and encouraging new growth (Sayre 2000, 2002). However, fire incidence in the Altar Valley has decreased dramatically during most of the twentieth century. This is a result of several factors including:

- discontinuation of managed range fires with the introduction of wood fencing in the 1910s and 1920s,
- lack of sufficient herbaceous cover to sustain fires,
- increasingly effective and thorough fire suppression policies, and
- ESA considerations.

In recent years, the steady increase of woody species and decrease of herbaceous species in the Altar Valley has resulted in a renewed interest in restoring fire to the ecosystem—both in its natural form and as a management tool. During the *Altar Valley Watershed Resource Assessment,* Meyer (2000), noted (1) that numerous grassland areas within the watershed that had recently been burned showed vegetative components similar to presettlement conditions; (2) that burning appeared to be an effective control of small mesquite trees and reduced the vigor of midsized trees; and (3) that live basal areas, grasses, and forage production were significantly greater, and bare ground and trees and shrubs were significantly less, in burned areas as compared to unburned areas within Granitic Hills ecological sites located in the watershed.

The cooperating agencies are proposing the development of the AVFMP to allow for the re-introduction of fire as a functioning component of the ecosystem of the planning area. One of the main objectives of this plan is to set forth a process to address ESA compliance/recovery goals, while implementing a FMP that reestablishes fire as a component of the grassland ecosystem in the planning area. The AVFMP, once implemented, will be in effect for a 10-year period. The AVFMP fire prescriptions will be annually reviewed and periodically revised according to monitoring results.

The AVFMP and associated Biological Assessment (BA) will disclose fire prescriptions parameters. Prescribed fire will be the primary management tool used across the landscape to produce and maintain a mosaic of shrub and native grasslands in near-historic conditions with naturally functioning riparian systems, while reducing woody plant encroachment of upland vegetation communities. Resultant vegetation communities will approach historic condition and function (Meyer 2000), enhancing the distribution of native vegetative communities. Restoring the historical vegetation, fire regime, and Condition Class into the ecosystem of the planning area will maintain a mosaic of vegetative landscapes with irregular or clumpy appearance and patterns, age structure, and cover types. The cooperating agencies anticipate that the desired historic vegetative composition and pattern will enhance native grasses and will improve range and watershed health and wildlife biodiversity.

The goal of prescribed fire management within the AVFMP is to maintain a mixture of woodlands, shrublands and grasslands while reducing woody plant encroachment and reducing invasive plant species through the reintroduction of fire as a naturally functioning and sustaining component of the ecosystem.

2.2. Prescribed Fire Management Goals

The cooperating agencies have established the following primary goals of the AVFMP:

1. Integrate the fire management activities of all major non-Federal land users of the Altar Valley.
2. Minimize adverse effects of prescribed fire on listed, and candidate species under the Act, as well as other fish and wildlife resources.

3. Provide for habitat enhancements for listed and candidate species under the Act, as well as other fish and wildlife resources.
4. Provide a voluntary landowner agreement template through which a landowner may participate in the implementation of prescribed fire.
5. Provide long-term watershed improvement.

These goals provide the opportunity to apply two evaluative tools: 1) fire regime condition class and 2) range management classification. The first of these is applied in the context of forestry and forest management. The second is applied in the context of range management and is the Similarity Index of the MLRA and Ecological site guides.

2.2.1. Fire Regime Condition Class

The desired future condition of federal land within the AVFMP planning area is a return to Condition Class 1 (USDA 2003).

AVFMP lands were evaluated for Fire Regime Condition Class—a general classification of the role a fire would play across a landscape in the absence of modern human mechanical intervention. To support national-level fire planning and risk assessment, the FS produced fire regimes from seven coarse-scale spatial data layers for the contiguous United States. They developed five categories of natural (historic) fire regimes based on fire frequency (i.e. the number of years between fires) and severity of fire on dominant overstory vegetation (Schmidt et al. 2002). The severity of fire was characterized as either low (less than 75 percent replacement) or high (greater than 75 percent, which results in stand replacement).

The majority of AVFMP lands are composed of natural fire regime 1. The five historic regimes are as follows:

- Regime I: 0–35 years, low
- Regime II: 0–35 years, high
- Regime III: 35–100^{+} years, low
- Regime IV: 35–100^{+} years, high
- Regime V: 200^{+} years, high

Condition Class is the classification of the extent of departure from the natural fire regime. Condition Class 1 lands have a natural range of vegetation components, soil and hydrology function, insect and disease populations, and limited or no presence of nonnative or invasive species. Condition Class 2 lands moderately depart from historic conditions due to decreased watershed function; increased erosion; altered disease and insect populations; and increased presence and expansion of shrubs, trees, and invasive species. Condition Class 3 lands significantly depart from their historic regime due to high encroachment of shrubs and invasive species.

According to Schmidt et al. (2002), 82 percent of AVFMP lands are categorized as fire regime I and Condition Class 1 lands. The remaining 18 percent of the planning area is

classified as Condition Class 2 lands. Because Condition Class categories are based on coarse-scale data that is intended to support national-level planning, any interpolation of this data for localized conditions may not be valid. Therefore, local agencies are asked to provide data for localized conditions. "With few exceptions, the overall rangeland resources in the Altar Valley are healthy, stable, and in functioning (good) condition" (Meyers 2000).

Condition Class I for this vegetation type would be open park-like savanna grassland or woodland, or frequent surface fires of mixed severity maintain shrub structures. Surface fires typically burn through the understory removing fire-intolerant species and small-size classes of fire-tolerant species; typically removing less than 25 percent of the upper layer, thus maintaining an open single-layer overstory of relatively large trees. Mosaic fires create a mosaic of different-age classes, post fire grassland, savanna woodlands, or open shrub patches, generally less than 40 hectares [100 acres], by leaving greater than 25 percent of the upper layer. Intervals can range up to 50 years in systems with high temporal variability. (Schmidt et al. 2002, p.10)

The BLM has developed specific desired future conditions for semidesert grassland and desert scrub communities described in the *Arizona Statewide Land Use Plan Amendment for Fire, Fuels and Air Quality Management Finding of No Significant Impact (FONSI) and Environmental Assessment* (USDI 2004):

Perennial grasses to cover their historic range of variability, annual grass cover is reduced, an adequate cover and mix of natural plant species, which have good vigor, and are dominant. In terms of fire management and fire ecology, the desired future conditions are to promote fire control or reduce exotic annual weeds, such as red brome (*Bromus rubens*), and to limit woody vegetation, such as mesquite to non-hazardous levels. (USDI 2004, p. 2–3)

Forest-wide desired conditions, goals, and objectives for the vegetative types within the CNF are identified in the *Wildland Fire Amendment to the Coronado National Forest Land and Resource Management Plan* (USDA 2005) and include the following:

Desert scrub: Protect the sensitive species while returning selected desert scrub back to a more natural grassland condition. Density of desert scrub is reduced through establishment of a natural fire regime. Fires occur every 5 to 10 years.

Grassland: Maintain grasslands to existing extent and expanded where possible. Woody species occur at near natural levels. Species composition of grasses is predominantly native; exotic species are not causing decline in vigor or density of native species. Historically, fires in this ecosystem occurred every 5 to 10 years. When grasslands are in good condition fire can be used as an effective tool to control a variety of invading species. Grasslands in the desired condition hold a great variety and abundance of species in the climax communities and account for much of the herbaceous production of the southwest. The composition of perennial grasses varies in location with a wide variety of cool and warm season grasses. Shrubs are also a key element in this

ecosystem. Some tree species such as piñon-juniper or mesquite will be present but should not be major component of the flora. This variety in plant life will provide forage for wildlife and domestic livestock on a year-round basis.

Woodland: Should have a divergent mix of landscapes, such as open areas and scattered groups or clumps of woodland tree species. Open canopies, light grass and ground fuels will create an environment resulting in flame lengths of four feet or less, which is desirable to prevent high intensity fires. A natural fire regime consists of fire every 10 to 30 years in piñon-juniper vegetation type and every 50 to 100 years in oak-woodland. Stand replacement fires may occur every 300 years or more.

2.3. Use of Fire in the Past

Historically, natural wildland fire regimes within southern Arizona grasslands have limited mesquite and woody vegetation invasion, have reduced some types of noxious weeds, and have increased grass and forb production. The restoration of natural fire regimes into the Altar Valley is a goal of both cooperating agencies and many Altar Valley ranchers who wish to reintroduce prescribed fire onto their lands as an integral component of ranch management. The AVFMP is complex and requires many layers of agency and individual oversight to implement a strategy to reintroduce prescribed fire as a critical natural process. Timing prescribed fire and the type and arrangement of fuels across the landscape are critical components considered within this plan. The AVFMP will analyze existing wildland fuel loads by vegetation type and recommend specific parameters for prescribed fire to meet objectives of overstory reduction while maintaining or improving Threatened and Endangered (TE) species habitats. The fire management activities analyzed in this section include prescribed fire designed to improve rangeland and watershed conditions in the Altar Valley and conducted under specific parameters on-the-ground fire management, control, and monitoring activities and practices normally associated with prescribed fire management.

Prescribed fire is usually ignited by handheld drip torches, fusees, other hand held ignition devices, and by helicopter drops of an ignition agent. Natural fires are ignited by lightning or unconfirmed causes. In both cases, a variety of firefighting equipment (e.g., fire engines, water tenders, pickup trucks) and personnel are maintained on site to manage and control the fire. Most wildland fire management activities (confinement, containment, and control) are associated with existing roads or other infrastructure, allowing access for fire suppression activities. However, fire lines are often constructed by hand crews or mechanical means during wildland fire events for confinement, containment, and control of the fire. Such confinement, containment, and control lines may be constructed anywhere in or adjacent to the burn area.

Wildland fires do not typically consume all existing vegetation within the burn perimeter but rather burn in a mosaic pattern. The size, pattern, and intensity of wildfires generally depend on fuel loads, wind, humidity, and temperature. On average, 25 to 50 percent of vegetation will remain unburned in most range fires (Sayre 2002). Fires may burn through xeroriparian areas that have higher fuel loads. Cool-season and low-intensity fire

in xeroriparian areas will consume fine fuels, but have little to no effect on the overstory xeroriparian vegetation. Since some xeroriparian areas do have moderate to heavy fuel loading, a summer season, high intensity fire could cause high mortality of overstory xeroriparian vegetation.

Fire intensities can be effectively controlled through planning, appropriate prescriptions, and timing. Prescribed fire conducted under this plan would not intentionally be stand-replacement fires or fires that would appreciably reduce overstory xeroriparian vegetation.

This section of the AVFMP will outline the analysis of vegetative, atmospheric, geographic and other influencing components of wildland fire in the Altar Valley planning area. The analysis of existing data and information will be used to establish specific prescribed fire conditions for prescribed fire within the planning area for range and watershed improvement while minimizing negative effects on TE and wildlife species.

2.3.1. Vegetation Management Objectives and Range Condition Classification

Specific objectives of each landscape fire are to create a mosaic of burned and unburned fuels within the range of allowable fire intensity thresholds. Range condition objectives will be based on the Similarity Index, "the percentage of a specific vegetation state plant community that is presently on the site" (NRCS 2006). The objective within each vegetative community is to maintain a similarity index of 0.6 or greater (formerly good to excellent condition) per NRCS Ecological Site Description (Interagency Technical Reference 1996 Sampling Vegetation Attributes). Established pace frequency transects will be read as part of the long-term monitoring plan. NRCS may establish additional frequency monitoring transects as needed.

Objectives:

1. Within shrub-invaded native grasslands**,** kill 30 percent to 70 percent of the half shrubs, and maintain native-grass dominance with mesquite densities at less than 10 percent.

2. Within shrub-invaded nonnative grasslands, top kill 30 percent to 70 percent of mesquites less than 4 inches in diameter stimulate native grass production, and maintain mesquite densities at less than 10 percent.

3. Prescribed fires have been indefinitely deferred for Southwest desertshrub vegetative associations. Although prescribed fire is not deferred in desert scrublands, these will require periods of favorable weather conditions to created continuous fine fuels at greater than 800lbs per acre to implement prescribed fire. Prescribed fire will be implemented to maintain native perennial grass cover at the historic range of variability with adequate mix of native shrub species in good vigor.

4. Within mesquite woodlands, top kill 20 percent to 50 percent of mesquites less than 6 inches diameter, and maintain total shrub and mesquite canopy cover at 10-25 percent.

5. Within deciduous riparian habitats, including xeroriparian habitats and mesquite bosque, periodic cool season burns can be used to reduce fuels with a 1-hour time lag, to maintain tree overstory with no fuel laddering, and to maintain mesquite densities greater than 60 percent in clumps of mature trees greater than 6 inches in diameter at root collar (drc).

6. Within oak, juniper, or piñon-oak canyons, reduce the 1-hour-time-lag fuels (0.01-to 0.125-inch diameter) by 30 to 80 percent, the 10-hour-time-lag fuels (0.26-to 0.99-inch diameter) by 10 to 40 percent, the 100-hour-time-lag fuels (1-to 3-diameter) by 1 to 10 percent, and 1,000-hour-time-lag fuels (3.1-to 12-inch diameter) by 1 to 20 percent.

3.0 Project Description

The AVFMP proposes to implement prescribed fire management to achieve improved range and watershed health. It establishes measures to fully comply with the ESA and to minimize adverse effects to federally listed species that could occur during the implementation of prescribed fire. It includes monitoring and an adaptive management program that allows the AVFMP to adjust to new information and to do so as outlined by the regulatory requirements. It also provides Altar Valley ranchers a clearly defined process that will remain predictable over the life of the plan.

If Arizona State Land Department, Division of Forestry fire management policy changes or is amended in the future, the Altar Valley Fire Management Plan will be amended to reflect those changes. (2-6-07)

3.1. Wildland Fire Management

The AVFMP defines wildland fire as any nonstructural fire that occurs in the wildland (WFIP; USDI/USDA 2005). Two distinctive types of wildland fire have been defined as follows:

> • Wildfire: An unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped prescribed fire projects, and all other wildland fire in which the objective is to put out the fire.
>
> • Prescribed fire: Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist and NEPA requirements (where applicable) must be met prior to ignition.

Wildfire management strategies will range between the following tactics:

- Full suppression: To complete the control line around a fire, any spot fires, and any interior islands to be saved. Burn out any unburned areas adjacent

to the fire side of the control line and cool down all hot spots that are immediate threats to the control line until the line can be expected to hold under favorable conditions.

- Containment: to surround a fire or spot fires with control lines, as needed, that can be expected to hold the fires spread under prevailing and predicted conditions.
- Conditional suppression: To limit spread within a predetermined area principally through natural or pre-constructed barriers.

Suppression actions may be minimal and limited to surveillance under appropriate conditions. Specific response action will be dependent on the expected fire behavior within specific FMUs that are predicted either to remain within prescription guidelines or to burn outside of them. A WFSA (Wildland Fire Situation Analysis) will be initiated for all wildland fires within the AVFMP area in accordance with each agency's polices and guidelines.

Response to wildland fire occurring on state lands and private property will be consistent with Arizona Revised Statute (ARS) 37-623 and the policy of the Arizona State Forester to organize and suppress wildland fire to minimize costs, resource loss, and for public and firefighter safety. The "least cost containment" policy as described in the state statute allows for flexibility of response to ensure minimal fire spread across determined containment lines.

3.1.1. Wildland Fire Ignition Sources

Wildland fires in the AVFMP area originate from three primary sources: natural ignitions (lightning), human-caused fires, and planned ignitions (i.e., prescribed burns). Natural ignitions are the most common source occurring primarily between late spring and early summer, with the most significant fires from natural ignition occurring during May, June, and early July before the advent of monsoon storms. Fire-ignition data from 1979 to 2004 indicate an average of 74 natural ignition fire responses annually for this 25-year period. In addition, there is field evidence of lightning starts naturally extinguishing without direct management or suppression action. During this time frame, less than 73,129 acres (12 percent of the AVFMP area) had burned with varying intensity. The size of the suppressed fires ranged from 5 to 10,000 acres with the average fire size being approximately 930 acres. With the proposed change in fire management, the average fire size is predicted to increase and the fire interval for any affected area is predicted to shorten, as a more naturally functioning ecosystem evolves and prescribed fire becomes the primary management tool for maintaining range and watershed health.

Between 1979 and 2004, there have been 101 human-caused fires, which have burned 85,091 acres within the AVFMP area during this period. While these types of ignitions have the potential to occur at any time of the year, they are most likely to occur during the peak fire season—April through July—of each year. ASLD Division of Forestry records indicate that approximately 90 percent of human-caused fires annually occur between April and the first two weeks of July.

The third ignition source is planned ignitions, or prescribed burns, initiated by agency land managers and private landowners. Over 53,284 acres have been treated within the AVFMP during the past five years. A majority of the treated areas have not been reburned by prescribed fire within the past three years. Prescribed fire is specific to vegetation types, individual FMU objectives, seasons, and specific burning parameters. In addition to reintroducing fire into the AVFMP analysis area, objectives such as wildland fuel reduction to minimize effects of subsequent prescribed burns, minimizing possible effects of catastrophic wildland fire, and retaining site-specific habitat components can be achieved.

3.1.2. Wildland Fire Seasons

Wildland fire seasons have been grouped into cool, summer, and monsoon categories based on the season of occurrence. Wildland fires occurring from October through April are considered cool season fires. These fires are typically less frequent in occurrence, burn at low intensities, are small in burn acreage, and reduce light fuel with minimal effects on existing vegetation components.

Wildland fires occurring from May to mid-July are considered summer season fires. Summer season ignitions are expected to have the greatest potential to carry wildland fire, to burn larger in size, and to be more diverse in intensity than fires in other seasons. The location of ignition, expected direction of spread, and current and predicted fire behavior will be evaluated for potential suppression response. Fires within the summer season that are within prescription will be continually monitored. In some cases, the potential for stand-replacement events or proximity to suppression zones will require that full suppression activities be implemented.

Ignitions that occur from mid-July through September are considered Monsoon (wet season) fires. Wildland fires within the monsoon vary in size and intensity according to the relative amounts of live fuel moisture due to vegetative green-up following the onset of the monsoon weather pattern.

3.1.3. Fuel Types

According to Sayre (2000), vegetation in the Altar Valley prior to Euro-American settlement was predominantly perennial grassland, with mesquite and other shrubs occurring primarily along the margins of the Altar Wash and following the margins of its tributary drainages into the uplands. The uplands themselves were dominated by perennial bunchgrasses. Mesquite densities appear to have increased from south to north through the watershed, with most occurring in the lower, northern end of the valley and very few at the higher, southern end. Cacti, paloverde, and other desert shrub vegetation also occur in the valley's northern lowlands, and increase south to north through the valley. Larger trees—including oaks, sycamores, cottonwoods, and junipers—were limited to the higher elevation mountain areas and the few riparian areas within the analysis area containing surface water (e.g., Arivaca Creek). In addition, the broad

bottomlands of the valley floor formed a nearly flat floodplain up to a mile and a half wide, which supported relatively dense vegetation dominated by sacaton grass.

According to Gori and Enquist (2003), vegetative change in southern Arizona, southwestern New Mexico, and northern Mexico grasslands have been extensive and dramatic. Native grassland with low shrub cover is limited to 15 percent of current and former grassland, with some grasslands restorable to native conditions through prescribed burns and grazing rest (29 percent of current and former grasslands), while shrub cover has exceeded a threshold producing a type conversion from grassland to shrubland in 36 percent of the historic extent of grasslands within the ecoregion. Gori and Enquist (2003) also developed a series of six grassland classes or types as well as threshold values for shrub cover. These grassland types and ranking system were used in combination with agency vegetative data and Sayre's (2000) vegetative data to describe and map vegetative types across the Altar Valley and to assign fire danger rating fuel models and fire behavior prediction fuel models to each major vegetative type. Table 1 describes fuel models, fire danger rating models, and predicted fire behavior for each major vegetative type.

Table 1. Expected fire behavior by fuel type

Fuel type	Fuel model	Fire danger rating model [a]	Flame length (ft)	Rate of spread ft/hr (ch/hr)
Grassland	GR1	A and L	1–3	3,950–13,200 (1-20)
	GR1 and GR2	A and L	1–8	5,000–6,000 (1–100)
	GR4	L and N	2–15	5,950–16,500 (1-200)
	GR 7	N	5 - 30	5,950–16,500 (1-300)
Mesquite	GR2 and GR4	A, L and N	1-15	2,100 (1-200)
Semi desert shrubland and desertscrub	GS1	A	1-6	4,950 (1-6)
	GS1 and SH1	A	1-6	2,100 (1-6)
Deciduous Southwest	TL9	E	2-8	2,300 (1-30)
	GR1	A, E and L	1-3	4,950 (1-20)
	GR4	B, L and N	2-15	4,950 (10-500)
Oak-juniper-piñon	GR2 and GR4	L and N	1 - 15	5,000–16,500 (1-200)

Source: *The National Fire Danger Rating System—1978 USDA Forest Service GTR INT-*(USDA 1978).

[a] See Appendix B, (Scott and Burgan 2005) for fuel model descriptions.

Normal or extreme fire seasons are generally determined by one component of the National Fire Danger Rating System (NFDRS) - the Energy Release Component (ERC). The ERC is a calculated output of the NFDRS. The ERC is a number related to the available energy (British Thermal Units) per unit area (square foot) within the flaming front at the head of a fire. The ERC is considered a composite fuel moisture index as it reflects the contribution of all live and dead fuels to potential fire intensity. As live fuels cure and dead fuels dry, the ERC will increase and can be described as a build-up index. The ERC considers the past seven days in calculating the new daily number. Daily variations of the ERC are relatively small as wind is not part of the calculation. The ERC relates well to the condition of the fuels. Fire managers and planners have found that the ERC can be used as a decision tool to prepare for an approaching fire season or it can be used as a tool for daily staffing when used in combination with other NFDRS components such as 100-hr fuel moisture or the Burning Index.

3.1.4. Wildland Fire Intensity

The two major fuel types, as classified in southeast Arizona within the *Wildland Fire Suppression Tactics Reference Guide* (NWCG 1996), found within the Altar Valley watershed are grass and shrub/brush fuels. These two fuel types have differing fire behaviors. Grass fuel types react quickly to changes in relative humidity and can result in high-intensity, fast-moving, erratic fire spread. Grasses are important for the ignition of shrub/brush fuels in flat terrain and areas without interlocking crowns. Shrub/brush fuels can produce high-intensity rapid-spreading fires by wind and topographic features. Relative humidity (RH) less than 40 percent, with 1-hour and 10-hour fuel moisture less than 10 percent, can allow for high ignition potential with moderate burning conditions. As RH decreases below 25 percent and fuel moisture drops below 7 percent, quick ignition with a high rate of spread and high burn intensity (near-total fuel consumption) occurs.

Changes in weather patterns greatly influence fire behavior. West-southwest winds, with accompanying low humidity, occur from late March to early May and create mostly wind-driven fires. Hot, dry, unstable conditions exist prior to the monsoon season of late May through early July, when dry lightening strikes most often occur, leading to high-intensity fuel, slope, and wind-driven fires. Monsoon activity is prevalent from mid-July through September and is accompanied by higher humidity, sporadic rainfall, and less wind, producing reduced fire behavior. After the monsoon, dry and mild conditions of early fall can increase potential fire behavior before the onset of winter. This range of parameters and predicted severity of fire effects will be used to determine strategy decisions—full or conditional—for wildfire within any FMU. Similar wildfire management prescription tables have been developed in southeastern Arizona to predict fire effects by vegetative type during varying weather conditions. These fire-effects severity tables disclose the predicted weather conditions that will produce the desired severity of wildfire and prescribed fire necessary to meet vegetative objectives within a specific fire management unit (Helbing 2004; USDI 2005a.).

The parameter guidelines contained in Table 2 will also be used to guide the creation of fire prescriptions in management-ignited prescribed fires. Project-level burn plans with prescriptions will use the elements of relative humidity, wind speed, and ambient air temperature for fuel modeling to predict fire behavior and desired intensity level. Topographical influences of slope and aspect will be mitigated and compensated through firing techniques, timing, and firing patterns.

3.1.5. Fire Size

Exact fire size or actual acres burned is not practical to determine. Variable conditions at the time of ignition, location, and season will influence fire behavior throughout the burn period. Geographic features such as ridges, canyon bottoms, roads, and trails will become natural hindrances to fire movement. Suppression actions will include the use of these features for firefighter safety and to reduce suppression costs. Using suppression actions in addition to geographic features may be necessary to protect private property, specific TE species or their habitat features.

Although there will be limit or restriction on the total number of acres affected by a single prescribed fire event or by multiple burning events, fire-intensity level acreage ceilings obtained through prescribed fire will be established. These "constraints" will further guide the management of the prescribed fire for resource benefit. If a prescribed fire is expected to burn at an intensity level that exceeds the prescription for a FMU or for the collective fuel type, appropriate measures will be taken to suppress it. Strategies such as containment, control with direct attack, and control with indirect attack are all acceptable given considerations of firefighter safety and values at risk. The ability to successfully manage wildland fire within prescription will be dictated by several factors such as burning conditions, fire size, management resources, and firefighter safety. An adaptive management process based on the analysis of the final fire results will be used to predict outcomes and suggest management actions for similar wildland fire ignitions, with similar vegetative fuel types, for the current year and in future prescribed fire planning.

Table 3 quantifies the maximum acreage thresholds permitted relative to the prescription guidelines and expectations for a particular fire event. These maximum threshold levels are not attainment goals or objectives but are maximum desired outcomes of prescribed fire, taking into account habitat requirements of TE species or desired vegetative structure objectives for a particular FMU.

3.1.6. Prescribed Fire

Prescribed fire may be used in all vegetative types to meet natural resource needs and desired wildland fuel inventories; however, prescribed fire will be deferred in areas containing desertscrub and deciduous riparian vegetative associations. Most prescribed fire will be conducted during the normal fire season beginning in May of each year. Prescribed fire will be managed to meet specific objectives, including the desired acreage

Table 2. Ignition parameters.

Ignition season Vegetation type	Minimum Relative humidity (%)	Maximum Wind speed (mph)	Maximum Ambient temperature (^{o}F)
Cool season ignitions			
Oak-piñon-juniper	5	15	85
Riparian	25	20	85
Mesquite-grassland	2	15	85
Semi desert shrubland	2	15	85
Grassland	2	15	85
Summer season ignitions			
Oak- piñon-juniper	2	15	95
Riparian	2	20	100
Mesquite-grassland	2	15	105
Semi desert shrubland	2	15	105
Grassland	2	15	105
Monsoon ignitions			
Oak-piñon-juniper	20	15	75
Riparian	30	20	70
Mesquite-grassland	15	30	80
Semi desert shrubland	15	30	70
Grassland	15	30	85

and intensity of burns within each fuel type to meet TE species objectives. Therefore, prescribed fire will be conducted when levels of treatment acres are not being met through prescribed fire in FMUs where conservation measures are in place. Some FMUs may be burned during the cool season (October–April) to conserve specific habitat types, to protect facilities or wildlife, and to meet specific habitat management or wildland fuel inventory objectives, such as protecting and stimulating sacaton growth or reducing understory fuels in sensitive riparian areas. Mesquite bosque that contain numerous trees with cavities may also be burned with a cooler fire to protect the potential pygmy-owl habitat from catastrophic wildfire by reducing fine-fuel loading.

Xeroriparian and deciduous riparian areas may be burned during the cool season by low-intensity prescribed fire for the management of unnaturally high herbaceous wildland fuels or when specific resource values will be enhanced. Cool season prescribed fire allows for an increased control of fire intensity, maintenance of buffer strips along the riparian ecotone, and a reduction in the amount of heat to which trees are exposed. Cool season low-intensity prescribed fire is a safe approach for preserving resource values and gives fire crews greater opportunities to confine, contain, and control. Xeroriparian and deciduous riparian habitats that run through or are adjacent to FMUs designated for prescribed fire will be further protected through planning the ignition patterns so that a

Table 3. Vegetation association and fire effects limits based upon the acreages burned on an annual basis.

Vegetation associations [Fire Behavior Model]	**Low**[2] % of area	**Moderate/High**[2] % of area
Nonnative or Lehmann Grassland GR1,GR2 and GR4	10	90
Johnson Grass /Sacaton/Russian Thistle GR4 and GR7	25	75
Native Grass GR1,GR2	50	50
Lehmann/Native Grass Mix (depending on species and density) GR2 and GR4	25	75
Mesquite (moderate to dense understory grass with dominant mesquite cover) GR2 and GR4	10	90
Mesquite (low to moderate grass understory with dominant mesquite cover**)** GR1 and GR2	50	50
Semi desert shrubland GS1	80	20
Southwest Desertscrub GS1 and SH1	Confinement/ Containment/ Control	Confinement/ Containment/ Control
Deciduous Riparian TL9	25	Confinement/ Containment/ Control
Oak-juniper-piñon GR2 and GR4	70	30

[1] Fires with low-severity effects refer to stand-maintaining surface or ground fires that burn only along the ground and never reach the tree canopy; such fires only burn the litter, debris and small plants on the surface of the soil but may burn down into the organic material of the upper soil layer. Moderate-severity fires also are stand-maintaining fires, which may reach into the canopy of some trees, but do not cause complete mortality of all the trees in the area. Fires with high-severity effects or stand-replacement fires refer to those fires that result in high mortality of trees in the canopy within a given "fire" boundary. This results in a change in composition and structure of plant communities. While high-severity fire effects can result in loss of forest plant communities, they may be used to maintain upland grassland plant communities.

[2] The percentage refers to the actual area per event.

head fire will not remove canopy cover. Since 2002 the BANWR has utilized this ignition technique that allows fire to creep into deciduous riparian areas but to burn at low intensity, thus minimizing effects on habitat components. The higher humidity and cooler temperatures in xeroriparian habitats also assist in minimizing fire effects. Although wildland fire can be expected to temporarily reduce or replace certain vegetative components within an area (some deliberately, such as mesquite), fires of appropriate intensity and frequency will assist with regeneration and long-term survival of desired vegetative components. Among these are Pima pineapple cacti and Palmer's agave (a primary food plant for the lesser long-nosed bat, also a protected species). Consequently, to minimize the likelihood of long-term adverse effects of prescribed fire on TE species and to ensure healthy, sustained populations of these species, the AVFMP establishes maximum fire effect thresholds for the planning area. This conservation strategy allows for the integration of wildland fire as a sustaining rangeland management activity, minimizing adverse effects of wildland fire and enhancing habitats for TE species.

3.1.7. Conservation strategies

The AVFMP planning area describes areas that are not appropriate for any wildland fire and where wildland fires are actively suppressed because of public safety concerns within the WUI of local communities, wildland fire management implementation through existing agreements such as the BANWR and Coronado National Forest (CNF), or by the decision of individual ranchers within the planning area to defer and suppress wildland fire. These wildland fire suppression zones will not be identified for management of wildland fire, and therefore, implementation of the AVFMP will not affect TE species or other resource values within the suppression zones or on federal lands where wildland fire is managed through existing agency decisions. The planning area consists of 609,900 acres of wildland habitat. The BANWR consists of 116,542 acres and will be managed under the existing BANWR Fire Management Plan and BO. The CNF consists of 84,742 acres and will be managed under the existing CNF Fire Management Plan and BO. In addition, 125,116 acres have been identified for full suppression of wildland fire.

Therefore, implementation of prescribed fire under the AVFMP will only cover approximately 283,500 acres, or 46.5 percent of the planning area. The "maximum fire effect threshold" is the maximum acreage that could be burned through prescribed fire for any one year or over a three-year planning period and is defined by a 15 percent maximum, three year average of the 283,500 acres covered by the plan and the fire severity limits in Table 3 based upon all fires that occur in the area covered by the plan. This maximum fire effect threshold is designed to minimize the likelihood of long-term adverse effects of prescribed fire management on TE species and ensure that watershed condition and vegetative cover improves.

Wildland fire management will be limited to the maximum fire effect threshold across the planning area including sensitive species habitats such as Pima pineapple cactus and Palmer's agave. Pima pineapple cactus habitats occur primarily within the Sonoran and semi desert grassland communities and their ecotone, normally between 2,300 and 5,000

feet in elevation. Palmer's agave habitat is also found within these vegetative communities, occurring generally above 3,500 feet in elevation. Wildland fire has been deferred in these vegetative communities (southwest desertscrub) or limited by maximum fire effect thresholds (semi desert shrublands). Cactus ferruginous pygmy-owl habitat also occurs within the Sonoran semi desert shrublands and desertscrub habitat as well as within the riparian corridors consisting of mature mesquite and other tree species that support cavity-nesting birds. Low-intensity prescribed fire are deferred in deciduous riparian unless needed to manage increases in fine wildland fuel loads; moderate and high-intensity prescribed fire are deferred without exception in these areas. Although wildland fire may creep into xeroriparian riparian areas within some FMUs during prescribed fire, fire ignition patterns and fire management techniques will be employed to minimize effects on riparian and xeroriparian habitat components.

The area covered by the AVFMP is restricted to 283,500 acres. The AVCA has estimated that no more than a 3-year mean of 15 percent of the maximum fire effect threshold acres would be planned for prescribed fire to obtain ranch rangeland improvement objectives while considering the cost of prescribed fire monitoring as well as pasture restocking. Over the life of the AVFMP, there will certainly be favorable and unfavorable burning periods. During periods of favorable burning conditions, the 3-year mean maximum fire effect threshold provides flexibility for several ranches to conduct planned prescribed fire burns while ensuring that potential negative effects of prescribed fire to specific TE species and other habitat effects are minimized. No more than 45 percent (127,350 acres) of these acres would be burned over a 3-year period and no vegetative association maximum fire effect threshold would be exceed, Table 3. During planning periods consisting of multiple years of favorable burning conditions, 15 percent of the maximum fire effect threshold acres (42,525 acres) would be planned each year for prescribed fire. During a 3-year planning period, however, acres identified for prescribed fire may vary within the vegetation association constraints and within the 3-year mean constraints of the maximum fire effect threshold acres. Therefore, if 45 percent of available acres are treated and/or the acreage within a particular vegetation association has met the moderate or high-intensity prescribed fire thresholds in Table 3, during a single year, no prescribed fire would be planned for the next two years, and all wildland fires would be controlled for the next two consecutive years. Additionally, if a single vegetative association is treated by moderate or high-intensity prescribed fire during a single year, no additional prescribed fire will be planned for that vegetative type, and wildland fires will be controlled for the next two consecutive years.

In addition to the above strategies, acreages burned by prescribed fire and acreages burned by wildfire are additive with respect to the maximum fire effect threshold as described in Table 3. All unplanned ignitions from natural and human causes will be suppressed. Prescribed fire will not be conducted when the described threshold specific FMU fire and resource management objectives have been met. Also habitat acreages burned by prescribed fire in excess of acres that are suppressed by fire responding agencies or departments will also apply to the acreage burn limits described in Table 3:

1. Prescribed Fire Burn Plan:
Before implementing prescribed fire in the planning area, which includes private, county, or state-trust ranchlands, the individual or agency initiating the use of fire will work together with the AVFMP collaborative group to prepare a Prescribed Fire Burn Plan in accordance with Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide and agency policies.

2. Prescribed Fire and incorporation of conservation measures:
Before implementing prescribed fire on private or state-trust ranchlands of any participating rancher, the affected participating rancher, AVCA, ASLD, NRCS, and USFWS, as appropriate, will ensure that all applicable conservation measures described in Section 5.C, as well as any additional conservation strategies or conservation measures recommended in the BO by the FWS, are incorporated into the burn plan.

Any participating rancher who requests that prescribed fire be permitted within a specific FMU—assuming all conservation measures are in place—should understand that approval of that prescribed fire plan will be subject to acres burned by subsequent prescribed fire or suppressed wildland fire. Depending on the acreages actually burned by prescribed fire and wildfire, the prescribed fire may need to be postponed or reduced in size to ensure that the AVFMP's maximum fire effect threshold acres are not exceeded. Conversely, wildfire occurring within a specific FMU after fuel and natural resource management objectives have been met by prescribed fire may need to be suppressed.

The attainment of these acreage levels will principally result from "natural" phenomena. Prescribed fires will create a mosaic of localized intensities. Although stand-maintenance fires may be achieved by both low and moderate fire intensities, a mosaic pattern of cover and vegetation over the landscape are preferred, and small-scale, localized vegetation type conversions may occur as an element of prescribed fire events conducted under moderate and high-intensity burn levels. Habitat components normally will not be altered from low-intensity fires other than single-season reduction in fine fuels (i.e., 1-hour to 10-hour fuels). Low-intensity prescribed fire, when implemented properly, will also produce a mosaic burn pattern so that not all fine fuels in any one prescribed fire will be affected.

3.2. Fire Management Units (FMUs)

The AVCA developed the Fire Management Unit Map (FMUM) of the Altar Valley watershed-depicting areas of confinement, containment, or control for wildland fire as well as water tanks, wells, fences, and vegetation transects that may provide access for emergency resource response for wildland fire suppression. The AVFMP evaluated and where necessary, for fuel reduction and natural resource benefit, realigned or reconfigured FMUs to meet fire response needs through natural or man-made barriers to wildfire movement. The BANWR has described and mapped the refuge FMUs that are reflected in the AVFMP. The AVFMP was drafted to meet fire management planning requirements of the land management agencies and private landowners through the use of

applied geographical information system (GIS) analysis. The AVFMP describes 158 FMUs within the planning area by associated livestock allotments or land-use designation (Figure 3).

From GIS analysis, it was evident that the various ecological elements (e.g., vegetative cover) were not randomly distributed throughout the AVFMP analysis area. Analysis of the various ecological components revealed grouping or clumping of features. The development of these FMUs is based on general environmental considerations such as vegetation type, fuel loading, and specific TE wildlife habitat considerations. Specific wildlife habitat parameters analyzed include actual and potential Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*) habitat (Figure 5) and potential cactus ferruginous pygmy owl habitat (*Glaucidium brasilianum cactorum*)(Figure 6). Finally, the FMUs were overlaid on the wildfire potential map to identify areas at higher risk for wildland fire (Figure 7). Refer to Appendix B for a more detailed display of the analysis criteria that were considered in the development of the delineated FMUs.

From the analysis, the 158 FMUs range in size from 2 acres to 22,897 acres. Wherever possible, roads and drainage boundaries were used as logical divisions between the FMUs. Since some watersheds contain sensitive vegetation communities they were also included as criteria in the FMU development and analysis process. Each FMU is primarily composed of one of the major vegetative-cover types present. However, since desert grassland and mesquite habitats are the two most common vegetative types, usually one or both of these are abundant in other vegetative-type classifications. For example, desert grassland vegetation type was a codominant form in many FMUs.

From a TE standpoint, several FMUs are less-sensitive areas composed of few xeroriparian, riparian, or desert scrub vegetation types, while many are more complex because of the presence of sensitive habitats. Consequently, management of fires within the boundaries of the respective FMUs will be variable within and between FMUs. Fires within similar sensitive FMUs may still be managed differently because of the range of preferred habitat, structural features, or community values.

3.3. Vegetation Types and Objectives

Individual burn blocks will have criteria for grazing deferment during the growing season following treatment. Each site will be assessed as to length of rest based on several factors including precipitation, burn intensity, and post fire herbaceous production.

3.3.1. Vegetation Types

Nonnative or Lehmann grassland

This vegetation association is dominated by Lehmann lovegrass. This association occurs primarily on uplands characterized by shallow soils. Small mesquites (less than or equal to 15 years of age) are distributed throughout the association with canopy cover less than 10 percent. Young mesquites may be increasing and showing above the grass. Lehmann

lovegrass is a very prolific seed producer and is drought and fire tolerant. However, Ruyle et al. (1988) note "The increase in germinability of Lehmann lovegrass seeds associated with fire may be one of several factors important in its observed ability to re-establish after mature plants are killed by burning." Rogers (2004) states, "Regardless of the time of year Lehmann lovegrass was burned, the grass grew back and, in some cases, increased in amount." In stands of non-native grasses early spring burns have been used to the benefit of established native grasses with a goal to stimulate increases in densities and frequencies of native grasses. This association lends itself to more frequent fire re-entry every two years (two growing seasons), and some units could be burned as soon as fine-fuel loadings are adequate to carry a fire of moderate to high intensity. This association lends itself to more frequent fire re-entry (two growing seasons), and some units could be burned as soon as fine-fuel loadings are adequate to carry a fire of moderate to high intensity. It generally takes 3 – 5 years after a burn to build up adequate fine-fuel loadings to carry moderate to high intensity fires. Fires could be ignited on burn units on a 3-to-5-year cycle to maintain low mesquite densities and enhance native grass establishment.

Johnson Grass/Sacaton/Russian thistle

The Johnson grass/Sacaton/Russian thistle (*Sorghum halapense*/*Sporobolus* spp./*Salsola kali*) association grasslands occur mostly on the deeper soils adjacent to wash basins and drainages. A few woody species, such as mesquite, catclaw (*Acacia greggii*), and desert willow (*Chilopsis linearis*), occur within this association, though few native grass species are present. Small patches of this association provide good cover for masked bobwhite, and both Johnson grass and Russian thistle seeds provide potentially important winter food. However, large expanses of Johnson grass and Russian thistle provide poor habitat for masked bobwhite (*Colinus virginianus ridgewayi*). This association has dominated areas adjacent to the large washes for more than a decade. These areas could be improved by simply encouraging the reestablishment of native grasses. Fine fuel loads are extremely high for this vegetation type. Since very hot fires are anticipated, woody plant invasions should be effectively suppressed in this vegetation association. Fire intensities are quite variable within this association as only Johnson grass and sacaton stands carry hot, high intensity fires. Many of these areas are dominated by pigweed, which does not generally carry hot fires. Early spring (February-March) burns, with adequate soil moisture (2" – 4" of precipitation during January and February), are used to maintain and enhance sacaton stands. Early summer (May-June) hot burns run a risk of seriously reducing stand densities of sacaton due to heavy accumulations of fine, dead fuels around the crowns of the plants.

Native grass

Native grass associations are composed predominantly of native perennial grass species with less than 10 percent shrub cover. Early spring burns leave the soil exposed and subject to erosion for long periods of time. This may also increase the possibility of invasion by lovegrass as it germinates much earlier than most native grasses (March-April vs. July-August). However, hotter burns in early summer are favored because cool

burns have little effect on mesquites, which can cause the mesquite canopy to increase in native grass associations. This association presents a challenge, because these sites tend to be located on shallower upland sites that, in many cases, do not produce adequate vegetative biomass to carry hot fires. This makes mesquite control very difficult, and other mesquite control methods need to be explored to maintain the integrity of these communities.

Lehmann lovegrass/native grass mix

The Lehmann lovegrass and native grass grassland associations consist of a mixture of Lehmann lovegrass (35–65 percent) and native grasses (65–35 percent), with mesquite and desert shrubs distributed throughout (10–35 percent total shrub cover and less than 15 percent mesquite canopy cover and increasing). Lehmann and native grass associations represent a transition from a native species to introduced exotic species and occur adjacent to the major washes and drainages. Grass is the fire carrier in this vegetative type with down and dead fuels, shrubs, and trees adding very little to the fire behavior. In this situation mesquites act more as a heat sink, retarding fire behavior rather than adding to it. The heavy fuels present are generally not consumed during fires. Many trees are top-killed but do not function as available fuel. Flame lengths range from 5 to10 feet, depending on the fine-fuel loading. Fire is particularly effective in reducing lovegrass densities following dry winters, although this can be a fine line as natives are more heavily affected during dry years. Winter rains tend to favor Lehmann lovegrass with good monsoons favoring natives. Hot fires are recommended on a 3 to10-year rotation depending on growing conditions and grazing pressure in an attempt to reduce mesquite encroachment and stimulate native grass establishment.

3.3.2. Mesquite Associations

Mesquite and Lehmann lovegrass

A mixture of mesquite and Lehmann lovegrass characterizes this Type F grassland vegetation association (Gori and Enquist 2003). Fuel models 1 and 3, depending on the fine-fuel loading, again represent this vegetative association. Typically, the level of mesquite canopy with Lehmann's understory will fall into fuel model 3. If the understory mix is mostly native, the vegetative type will fall into fuel model 1. Mesquite is distributed within a matrix of Lehmann lovegrass and native grasses. However the foliage in this vegetation type is not highly flammable, and dead woody material does not significantly contribute to the fire intensity. Mesquite canopy cover ranges between 5 and 20 percent. Prescribed fire could be used to reduce mesquite density and canopy cover as well as Lehmann lovegrass density and distribution, to expedite native grass recovery, and to improve native habitat components. The management regime would consist of hot fires planned on a 3 to10-year cycle. Hot fires could be ignited on burn units 3-5 growing seasons after an initial high-intensity fire if preliminary transect data indicates that this fire regime will favor native grasses.

Mesquite

This Type F grassland association (Gori and Enquist 2003) is dominated by mature mesquite (greater than or equal to 30-years-old) and is restricted to the deeper soils adjacent to xeroriparian areas. Canopy cover over most of the association exceeds 80 percent and often approaches 100 percent. The extensive shading typified by this plant association creates microclimatic conditions that are not conducive to herbaceous production under the mesquite canopy. Fine-fuel biomass is therefore generally low throughout this association. Heavy-fuel accumulations are also discontinuous, occurring wherever openings in the canopy permit sufficient sunlight for heavy forb and grass production. Because of insufficient fine-fuel accumulation (less than 800 lbs/acre) evident in most of these mesquite-dominated associations, it would be difficult to ignite or maintain a prescribed fire. It would be necessary to permit fine fuels to accumulate for several years before a management burn could be successfully achieved. Within upland habitats, mechanical management practices may have to be implemented to reduce canopy cover to allow for increased ground fuels before prescribed fire could be considered. Although wildland fire may be allowed to creep through xeroriparian habitats, these areas, which are dominated by mature mesquite, provide possible habitat for the cactus ferruginous pygmy- owl; therefore prescribed fire is typically deferred.

3.3.3. Desertscrub Associations

Semi desert scrubland

The semi desert scrub/grass Type B or E grasslands mix (Gori and Enquist 2003) occurs primarily on uplands and is composed of a mixture of snakeweed, burro brush, creosote bush, half shrubs (35–65 percent) and grass (65–35 percent). The grass component may consist of natives, Lehmann lovegrass, or buffel grass (*Pennisetum cilare*) an invasive nonnative that is spreading into Sonoran desert habitats. Stands of sub shrubs are difficult to burn because of insufficient fine-fuel loads within a stand. Generally this vegetative type is classified within fuel model 1. Hot fires appear to cause high mortality among sub shrubs. Wildland fire of this intensity (representative of fuel model 1) usually occurs only in years of above-average precipitation, which produces an abundance of annual vegetation. Consequently, late spring and early summer fires hold great potential for rehabilitating large acreages that are threatened by sub shrub invasion. Semi desert scrub associations could be exposed to hot fires on long-return intervals, when fine-fuel loads reach 800 lbs per acre or more. A shorter fire return cycle is not feasible because fine fuel would probably not accumulate in sufficient amounts to carry a fire under a 2 to 8-year regime.

Southwest desertscrub

Southwest desertscrub vegetative associations including saguaro (*Carnegiea gigantea*), palo verde, mesquite, ironwood (*Olneya tesota*), mixed scrub, and cacti, occur primarily on uplands and are composed of little herbaceous vegetation and scattered desert scrub areas. This vegetative association is typically not suitable for prescribed fire. Wildland

fire typically does not play a role in the maintenance of this ecosystem and fire-return intervals are very long. Prescribed fire therefore should be deferred in desertscrub management units. Prescribed fire would be very rare and individually reviewed for meeting vegetative type objectives.

3.3.4. Riparian Associations

Deciduous riparian

The nature and species composition of riparian vegetative associations change depending on elevation and adjacent upland vegetation. Lower elevations within the AVFMP consist of xeroriparian species, while higher elevations consist of deciduous riparian species with steeper stream gradients. Typical xeroriparian species include mesquite, sandbar willow (Sal*ix interior*), seep willow (*Baccharis glutinosa*), desert broom (*B. sarothroides*), and hackberry (*Celtis pallida*). Higher-elevation deciduous riparian vegetation association species include maple (*Acer* spp.), Goodding willow (*S. gooddingii*), velvet ash (*Fraxinus velutina*), elder (*Sambucus* sp.), sycamore, walnut (*Juglans* sp.), and cottonwood. Fire is spread mostly through fine fuels consisting of annual weedy litter with clumps of heavier fuels associated with the riparian corridor. Perennial grasses may be limited because of an overstory of riparian shrubs and trees. Ladder fuels consisting of desert and semi desert scrub species may be present in higher-elevation riparian corridors. This association is extremely variable due to a wide range of fuel loadings based on canopy cover and species present. This vegetative community can include fuel models 1, 2, 3, and 9 and, in extreme cases, at higher elevations with manzanita (*Arctostaphylos* spp.) in the understory, may approach fuel model 4 (Appendix B). The mesquite and deciduous riparian falls mainly into fuel model 1 with some areas within fuel model 2 and fuel model 3 depending on fine-fuels. Areas dominated by cottonwood, willow, and sycamore would normally be considered within fuel model 9. Cool season or low-intensity fires may be recommended for wildland fuel management when fine fuels are present at 800 lbs per acre or greater.

3.3.5. Oak-juniper-piñon Association

Oak woodland and oak-juniper-piñon

The oak-juniper-piñon woodland is normally present at elevations above 4,000 feet, including steep slopes within the major mountain areas. The plant community is dominated by evergreen oak species, junipers, and scattered piñon pines (*Pinus cembroides*). The major vegetation association includes a mix of cool and warm season grasses, forbs, and succulents. Canopy cover can range from less than 20 percent to greater than 50 percent. Additional upland scrub species include semi desert vegetation, such as catclaw, mimosa (*Mimosa biuncifera*), ocotillo (*Fouquieria splendens*), kidneywood (*Eysenhardtia orthocarpa*) with grass species such as sideoats grama (*Bouteloua curtipendula*), cane beardgrass (*Bothriochloa barbinodis*), and plains lovegrass (*E. intermedia*). Oak woodlands consist of open areas with scatted groupings of heavier fuels. Open canopies, light grass, and ground (surface) fuels normally result in

flame lengths of 4 feet or less, preventing crowning or overstory burns. Depending on density of trees, slopes, and ground fuels, some stand-replacement, high-intensity burns are achieved in clumps of heavier fuels where continuous ladders are present from abundant ground fuels and continuous ladder fuels into the overstory in association with dead woody material within the crowns. Natural fire return intervals are estimated at 50–100 years with stand replacement fires occurring every 300 years or more. Cool season burns for fuel mitigation may be conducted when fine ground fuels reach an average of 800 lbs/acre or greater. Many of these areas within the Altar Valley are currently set up for stand replacement fires. Fine-fuel loadings of grass and scrub species are currently very high in the 1500 – 3000 lb/acre category. Flame lengths will be in the 5 – 20 foot range.

3.4. Community Suppression Values

Valued resources potentially at-risk include structures, communication facilities, power lines, recreation areas, cultural or historic areas, sensitive wildlife habitat, grazing improvements, and natural resources. These values have a negative influence on the potential of an area to sustain or to be planned for wildland fire management.

Developed land and infrastructure were given the highest value in the AVFMP area for suppression activities. Recreation areas including campgrounds, parks and trail systems, and sensitive wildlife habitats were given a moderate value.

1. Housing, Essential Infrastructure, and Suppression Areas

Transportation corridors, SR 86 and SR 286, between communities that serve as suppression-response corridors in the event of wildland fire or that are located within suppression areas have also been identified. Structures associated with housing and commercial developments located in subdivisions and in more dispersed areas of the Altar Valley are also identified for aggressive suppression. The cooperating agencies have delineated infrastructures such as power lines, communication facilities, rangeland improvements, and suppression corridors and have recommended fuel-modification treatments that will reduce the threat of wildland fire affecting these facilities. A Community Wildfire Protection Plans (CWPP) has been developed for the communities of Sasabe and Arivaca.

2. Wildlife Species and Habitat

The Altar Valley watershed supports a wide variety of animals common to the Southwest desert. Among these are mule (*Odocoileus hemionus crooki*) and white-tailed (*O. virginianus*) deer: Mule deer range throughout the Altar Valley watershed with white-tailed deer found in the higher elevations of the San Luis, Las Guijas, and Baboquivari mountains. Pronghorn antelope (*Antilocarpa americana sonoriensis*) have been reintroduced within the Altar Valley watershed, a part of their historical range. Many species of small mammals, reptiles, and birds are found within the planning area. The BANWR has an outstanding variety of bird life, with 289 species of documented birds

including four species of quail, as well as mourning (*Zenaida macroura*) and white-winged (*Z. asiatica*) doves. Many year-round resident, winter-migrant, and summer-resident raptors are found in the Altar Valley. Existing ponds also attract waterfowl, shore, and wading birds during winter and fall migrations.

The cooperating agencies have determined that reintroducing fire within prescribed limits benefits watersheds and wildlife within the Altar Valley. Prescribed fire management will lessen the threat of catastrophic wildland fire in riparian corridors, will lower the loss of mature nesting trees, will enhance native grasslands that preserve sensitive habitats and wildlife species, and will protect recreational values and livestock grazing uses.

The proposed fuel treatments recommended within the AVFMP may potentially affect Act-listed species. Therefore, consultation with the FWS will be required, and because of Federal actions necessary to implement the recommendations of the AVFMP, a NEPA analysis will be necessary. Any treatments in these species' habitat areas may require further analysis in accordance with Federal and State regulations. Measures to minimize the effects on sensitive species are included in the AVFMP analysis. The cooperating agencies, with the NRCS as the lead agency for FWS consultation, will initiate formal consultation with the FWS under a Programmatic Consultation process to be completed by the NRCS in 2008.

Conservation measures are part of the proposed action and are included in the FMP to reduce potential impacts of prescribed fire on species listed under the Act. These conservation measures will be evaluated as part of the FMP during section 7 consultation with FWS on the AVFMP. Additional evaluation and consultation may be required if project boundary or treatment recommendations are not consistent with proposals outlined in the project's NEPA document.

3. Watersheds

The AVFMP planning area includes several significant watersheds including both federal and nonfederal lands, including the Brawley Wash–Los Robles Wash, Rio Concepción, San Simon Wash, and a small portion of the Aquirre Wash–Tat Mormoli Wash. Most of the watersheds in the AVFMP are located on state trust lands and are at some risk of mesquite and invasive species encroachment.

Prescribed fire will enhance ground cover, decrease erosion and enhance percolation abilities of the watersheds and will affect the water supply downstream of each watershed. The reintroduction of prescribed fire to the Altar Valley will begin to restore a healthy watershed that can provide many positive attributes. These include enhanced water quality, diverse aquatic and wildlife species, and vegetation that protects the soil and prevents erosion. Good stewardship activities can help maintain and enhance a healthy watershed, restore an unhealthy one, and lower the risk of habitat degradation from the encroachment of brush and exotic vegetative species.

3.5. Endangered Species Considerations

Until recently, range improvement measures had routinely been implemented in the Altar Valley to maintain ecosystem health. Beginning in the early 1990s, those practices began to conflict with ESA considerations (e.g., the listing of the Pima pineapple cactus and cactus ferruginous pygmy-owl as endangered species in 1993 and 1997, respectively) that ultimately resulted in a reduction in the application of these practices. The AVFMP is needed not only to enable Altar Valley land managers and ranchers to resume wildland fire management practices, but to ensure that such practices do not impede the simultaneous goal of recovering and protecting federally listed species.

Verified sightings of TE species in recent years include the Pima pineapple cactus (*Coryphantha scheeri* var. *robustispina*), Kearney blue star (*Amsonia kearneyana*), bald eagle (*Haliaeetus leucocephalus*), masked bobwhite, southwestern willow flycatcher (*Empidonax traillii extimus*), Mexican spotted owl (*Strix occidentalis lucida*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), Chiricahua leopard frog (*Rana chiricahuensis*), and jaguar (*Panthera onca*). A Biological Assessment (BA) will be completed to assess the impacts the AVFMP implementation may have on TE species. The BA address species listed under the ESA that may be affected by implementation of the AVFMP and will be included in the appendices of this document.

3.5.1. Pima pineapple cactus conservation measures:

Pima pineapple cactus is a small spherical cactus that is found in Sonoran desert scrub and grassland vegetation communities in the Altar and Santa Cruz River Valley. Suitable Pima pineapple cactus is defined as:

- Those habitats within the action area that are between 700 m and 1,400 m (2,300 to 4,500 ft) in elevation that are in the following vegetation types:
    - Semi-arid grasslands
    - Desert scrub

Soils associated with PPC populations on the BANWR are congruent with areas in the planning area.

The fire tolerance of the species has not been documented but given that it is associated with native grassland habitats that are subject to periodic fire, some level of fire adaptation may be inherent in the species. The original listing states: “The Fish an Wildlife Service (Service) presumes the Pima pineapple cactus, a resident of fire-adapted semidesert grasslands, has evolved with fire, but it is unknown what circumstances and strategies allow the species to survive fire” (FR58, No. 183, p.49875). “The assumption that a decreased fire frequency or not burning at all benefits the Pima pineapple cactus and its ecosystem presumes that fire is detrimental to the species and ecosystem. The Service has no data to support this assumption” (FR58, No. 183, p.49877). Data from the BANWR burn program will provide some baseline information regarding this factor. A more complete description of this species life history and biology is included in the associated BA. The following are the conservation measures that are part of the proposed

fire management plan.

Prescribed fire plans developed for areas without suitable Pima pineapple cactus habitat – as described above, do not require conservation measures.

Prescribed fire plans developed for areas that include suitable Pima pineapple cactus habitat will include the following:

- Single pass surveys to locate individual cactus will be performed over the suitable Pima pineapple cactus habitat within the boundaries of the proposed burn.
    - Suitable habitat will be determined by elevation and habitat type. If developed, a Pima pineapple cactus habitat model similar to the model used by the Buenos Aires National Wildlife Refuge will be used to determine suitable habitat.
    - Surveys are valid for a maximum of 6 years.
- Individual cactus will be protected from the effects of the prescribed fire.
    - This will be accomplished through the clearing of fuels from around individual cactus from the area between 2 to 3 m from the plant, leaving the vegetation within the 2 m radius immediately surrounding the plant untouched. Alternatively, a fire-proof, cone-like structure may be used to protect each plant.
    - An area with a high density of cacti or a group of cacti may be protected through blacklining a similar area around the cacti.
- Post fire census of the known cactus to determine effectiveness of protective measures will also be made.
    - This should occur within 30-60 days after the fire and again within 120 days.
- The acreage of each fire will be reported as will the location of cactus, protective measures used, and their effectiveness in protecting individual cactus. This information will be used to determine the short-term vs. the long-term effects of the FMP.

Exceptions to these basic conservation measure are possible as part of a quantitative research study of fire within various fuel loads and types on Pima pineapple cactus approved by the Service. This study should include:

- Single pass surveys to locate individual cactus shall be performed as part of the study.
- No protective measures will be required for individual cactus within the study related burns up to a maximum of 20% of the individuals in the burn perimeter.
- Prescription parameters, fuel types, fuel loads, fire behavior, and fire severity should be part of the information to determine the fire effects on individual cactus and potentially the population as a whole.
- Post fire surveys to determine the fire effects on individual cactus within 30-days of the fire, within 6 months of the fire, and approximately 1 year after the fire. This schedule may be modified to fit approved research design.

- The results will be used to evaluate the basic conservation measures listed above. Modifications to the conservation measures will be proposed based upon these results and modifications to the FMP may be made if applicable.

Prescribed burns on the Pima pineapple cactus mitigation bank will need to be consistent with the mitigation bank agreement.

3.5.2. Masked bobwhite conservation measures:

- Seasonal restriction if birds are present.
- Aerial ignition patterns should be not have flame fronts ignited closer than ¼ mile apart to allow for escape routes and a more natural, mosaic-burn pattern, with exceptions for firefighter safety, personal property, or other resource protection measures.

3.5.3. Lesser long-nosed bat conservation measures:

- Prescribed burns will not include areas where smoke could affect roosts while bats are present.
- Ignition patterns should avoid high severity fire effects in Agave patches

3.5.4. Chiricahua leopard frog conservation measures:

- Avoid high severity fire effects upstream from any occupied habitat
- If extensive erosion is possible, sediment traps should be placed above occupied habitat to reduce potential take of this species.

3.5.5. Kearney's bluestar conservation measures:

- Avoid known populations

3.5.6. Southwest willow flycatcher conservation measures:

- Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans.

3.5.7. Mexican spotted owl conservation measures:

Prescribed Burns that are planned to include suitable habitat of the Mexican spotted owl will have surveys conducted, per established Mexican spotted owl survey protocol (FWS 2003) as amended, to determine occupancy of the habitat within and adjacent to the burn perimeter.

If occupancy can't be demonstrated the burn may progress as planned.

If occupancy is demonstrated, the burn will be implemented:

- Outside the Mexican spotted owl breeding season March 1 through August 31.

If occupancy is demonstrated and the burn is planned during September 1 through February 28, the burn will be implemented:

- So that the nest cores are left undisturbed, approximately 100 acres around the nest, or
- Fire and fire management activities will remain more than a ¼ mile away from the next.

Candidate Species:

3.5.8. Western yellow-billed cuckoo (*Coccyzus americanus*) conservation measures:

- Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans.

3.6. Management and Oversight

The NRCS has agreed to initiate Section 7 consultation, as the lead federal agency, on the potential effects of the AVFMP on listed and proposed species. The NRCS has also agreed to assist with the coordination and application of prescribed fire as the plan is implemented and to assist, as time permits, with the implementation of the monitoring requirements. The NRCS has accepted the lead role in coordinating annual burn plans among the cooperating agencies and AVCA members. The NRCS will produce an annual burn plan report consisting of a "current year burn map" that NRCS will provide to the FWS for review and comment. In cooperation with the FWS, the annual burn plan and map may be revised to meet TE requirements depending on the status of conservation measures, a review of the previous year's prescribed fire objectives, current and predicted wildfire season, and any new information or amendments to the AVFMP that will be applicable during the planned prescribed fire period. The cooperating agencies will review the annual report, determine the desired prescribed fire application that will meet the AVFMP objectives, and provide this information to the NRCS by December 31 of each year. The annual monitoring report will include a list and map of areas approved for prescribed fire. Additionally, the report will include proposed new or revised conservation measures or amendments to the AVFMP that were adopted by the cooperating agencies and participating private landowners. Changes to the AVFMP will be based on monitoring data from the previous year or independent research reviewed and accepted by the cooperating agencies and participating private landowners.

3.6.1. Access Agreements

Subject to the restrictions below, participating ranchers and ASLD will grant access to their lands to the cooperating agencies and their designated agents or contractors for the

purpose of conducting monitoring activities and studies specified by the AVFMP. Any legitimate scientific research on the covered species and any surveys for the covered species not otherwise specified by the AVFMP which the cooperating agencies wish to carry out, are also part of the agreement. No entry onto private ranchlands within the AVFMP area to conduct these activities may occur without a written or verbal request to the rancher at least 10 days prior to any such entry or the rancher's permission, which may include additional circumstances or conditions specified by the rancher. The reasons for access and the locations visited on the ranch, unless otherwise permitted by the rancher, are restricted to those necessary to carry out specific monitoring, research, and survey activities that are either required by or specifically identified in the AVFMP. Participating ranchers will grant access for monitoring, survey, and research activities unless they express a specific concern or objection to an individual or organizations entry. In that event, the rancher will explain to the cooperating agencies in writing within 7 days of the receipt of a request for access, the reasons of concern or refusal to grant entry to the cooperating agency to the private ranchlands. Upon receipt of any such notice, the cooperating agencies will work with the ranchers to resolve the issue. No participating landowner can be compelled under the AVFMP to grant access to private lands. If access for monitoring purposes or conservation measure compliance is postponed or denied, planned or future prescribed fire will not be implemented within FMUs on the ranch or ranches controlled by the individuals who have not met their monitoring and/or conservation measures obligations under the AVFMP. Monitoring programs conducted on Pima County, state-trust, or Federal lands require notification of the land managing agency and obtaining necessary permits and agency requirements. Monitoring and conservation measure information gathered on private or state-trust lands within the AVFMP analysis area will be made available to the participating landowner and cooperating agencies and will be contained within annual performance reporting.

Coordination of the monitoring program is assigned to the NRCS; however, the cooperating agencies will work together to assist in finding funding and supporting the AVFMP monitoring program and will participate in carrying out specific monitoring program activities in association with specific burns. Given that monitoring funds and resources may be limited, first priority under the program will be given to TE species conservation measures related to AVFMP implementation; followed by wildland fuel and vegetative objectives.

3.6.2. Local Preparedness and Protection Capability

A principle component of the AVFMP is the emphasis the cooperating agencies have placed on coordination in systematically reestablishing fire on the landscape. The AVFMP follows the policies and procedures of the cooperating agencies and private landowners; however the AVFMP does not make decisions. It provides the operational parameters for fire and land managers to implement the goals and objectives of the cooperating agencies and private landowners within the Altar Valley. Wildland fire response is provided by the ASLD, CNF, BLM, and BANWR. The Three Points and Arivaca Volunteer Fire departments may provide response to structural fires within their communities and support for wildland fire response based upon their current

qualifications and readiness status at the time of an incident. There is no structural fire response within the community of Sasabe. The large number of private structures adjacent to the BANWR in the Arivaca area, coupled with the distance from the BANWR headquarters, makes wildfire response problematic in this area.

3.7. Monitoring

Monitoring involves the repeated measurements of variables over time to determine if actions have caused either expected or unexpected changes or trends. As opposed to causal observation, monitoring is designed to assist cooperating agencies in identifying what changes are occurring because of project implementation and whether these changes are due to the action of the project. Monitoring is essential to evaluate the progress towards the AVFMP goals. Monitoring also allows for a clear accounting of effects (both adverse and beneficial) and the actions mitigating negative effects and meeting conservation goals. To develop adequate information to validate assumptions of the major AVFMP goals—in particular, effects on TE species—detailed monitoring data will be imperative. For example, Pima pineapple cactus has historically co-existed with natural wildland fire in the landscape. The long-term effects of prescribed fire under specified intensities over the planning area, however, have not been documented by published research. As a result, the total effects of the methods, timing, and extent of habitat exposed to prescribed fire must be systematically monitored for the cooperating agencies to make informed decisions for future modifications to the AVFMP. The determination of obtaining long-term natural resource management goals often follows an adaptive management (AM) approach, which is a resource management approach that combines science and practical experience by treating management actions as experiments. AM involves careful observations of the ecological systems' responses to management actions and adjusting future management based on what is learned. This allows frequent review and feedback on progress toward reaching project goals while the project is being implemented (USDA 2004a). AM also ensures communication between cooperating agencies (USDA 2003). This collaborative communication allows project managers to take corrective action when faced with changing ecological, economic, or social conditions. Additionally important to ecosystem restoration, this collaborative communication effort helps to assist habitat managers and practitioners in recognizing how implemented treatments change habitats and how future treatments can be modified to meet project goals. It also aids managers in determining the effects of treatments and the effectiveness of the conservation measures. The cooperating agencies have developed an AM monitoring program to determine if AVFMP goals are being accomplished. Effective monitoring is an essential element of AM, because it provides reliable feedback on the effects of project actions.

2. Monitoring Prescribed Fire

Fire-effects monitoring as a visual measure of fire impacts to TE habitat will be accomplished by mapping conducted by the cooperators. Burned-area mapping may be effectively conducted from the ground for prescribed fire. Generally, fire effects are mapped at 500 to 1,500 above ground level on 1:24,000 scale topographic maps. An

appropriate level of ground-truthing and sampling will occur to determine accuracy of fire-boundary delineations. Fire effects will be mapped as follows:

Fire acreage information will be forwarded by the cooperating agencies to the NRCS by December 31 each year for inclusion in the Annual Monitoring Report.

3. Vegetation Surveys

Pace frequency transects will be read by NRCS with the cooperating ranchers on 1 to 3 year intervals, as needed. These data will be used to measure change in plant composition.

3.8. Annual Fire Monitoring Report

Fire occurrence information will be gathered/summarized by NRCS in the fall of each year (Nov/Dec). All participating Ranchers/Agencies will assist with the information gathering and summarizing for an annual report. This report will detail: acres, location, severity of burn, description of burn, any note-worthy comments about burn, etc. Topographic base maps at 1:24,000 scale will be used.

Adaptive Management strategies may be developed or suggested depending on the fire effects on Pima Pineapple Cactus and other TE species, and/or their habitats or habitat components.

In addition to fire occurrence information, pace frequency monitoring information will be maintained by NRCS and available for developing annual prescribed fire planning.

3.8.1 Reporting Timetable

The Annual Fire Monitoring Report will be completed about January 15 of each year.

Literature Cited

AVCA. 2001. Altar Valley Conservation Alliance Watershed Resource Assessment Task 11. Watershed Action Plan and Final Report. Prepared by the AVCA for the Arizona Water Protection Fund Commission. 9 pp.

Andrews, D.A. 1937. Ground water in the Avra-Altar Valley, Arizona. Pp. 163-180 in: Contributions to the hydrology of the United States. Water-supply paper 796-E. Government Printing Office, Washington, D.C.

Ansley, R.J., X.B. Wu and B.A. Kramp. 2001. Observation: Long-term increases in mesquite canopy cover in North Texas. Journal of Range Management 54: 171-176.

Bahre, C.J. 1985. Wildfire in southeastern Arizona between 1859 and 1890. Desert Plants 7: 190-194.

Cox, J.R., A. De Alba-Avila, R.W. Rice and J.N. Cox. 1993. Biological and physical factors influencing *Acacia constricta* and *Prosopis velutina* establishment in the Sonoran Desert; Journal of Range Management 46: 43-48, January 1993.

Desmond, M. and Montoya, J.A. 2006. "Status and Distribution of Chihuahuan Desert Grasslands in the United States and Mexico"; Grasslands Ecosystems, Endangered Species, and Sustainable Ranching in the Mexico-U.S. Borderlands: Conference Proceedings; USDA, Forest Service, Rocky Mountains Research Station, Proceedings RMRS-P-40, June 2006.

Gori, D.F. and C.A.F. Enquist. 2003. An Assessment of the Spatial Extent and Condition of Grasslands in Central and Southern Arizona, Southwestern New Mexico and Northern Mexico. Prepared by The Nature Conservancy, Arizona Chapter. 28 pp.

Gould, W.L. 1982. Wind Erosion Curtailed by Controlling Mesquite. Journal of Range Management 35(5): 563-566.

Hastings, J.R. and R.M. Turner. 1965. The Changing Mile: An Ecological Study of Vegetation Change With Time in the Lower Mile of an Arid and Semiarid Region. University of Arizona Press, Tucson, AZ.

Helbing, Gary L. 2004. USDA Forest Service. Coronado National Forest. Biological Assessment and Evaluation for Peloncillo Programmatic Fire Management Plan. Coronado National Forest September 9, 2004.

Neilson, R.P. 1986. High resolution climatic analysis and southwest biogeography. Science 232:27-33.

Herbel, C.H., F.N. Ares, and R.A. Wright. 1972. Drought effects on a semidesert grassland range. Ecology 53:1084-1093.

Humphrey, R.R. 1953. The desert grassland, past and present. Journal of Range Management 6: 159-164.

Humphrey, R.R. 1958. The desert grasslands: a history of vegetation change and an analysis of causes. Botanical Review 24: 193-252.

Humphrey, R.R. and L.A. Mehrhoff. 1958. Vegetation change on a southern Arizona grassland range. Ecology 39: 720-726.

Jones, C.J. 1998. The 1998 Altar Valley Fire Management Plan developed for the Altar Valley Conservation Alliance.

Kaib, J.M. 1998. Fire history in riparian canyon pine-oak forests and the intervening desert grasslands of the Southwest Borderlands: a dendroecological, historical, and cultural inquiry. Masters thesis. School of Renewable Natural Resources, University of Arizona, Tucson.

Kincaid, D.R., G.A. Holt, P.D. Dalton, and J.S. Tixier. 1959. The spread of Lehmann lovegrass as affected by mesquite and native perennial grasses. Ecology 40(4): 738742.

Lehman, William. January 2003 unpublished. Draft Altar Valley Habitat Conservation Plan for Privately-Owned and State Trust Rangelands in the Altar Valley of Arizona. Prepared for the Altar Valley Conservation Alliance. Tucson, AZ

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

Martin, S.C. and H.L. Morton. 1993. Mesquite control increases grass density and reduces soil loss in southern Arizona. Journal of Range Management 46(2): 170-175.

McClaran, M.P. 2003. "A Century of Vegetation Change on the Santa Rita Experimental Range"; Santa Rita Experimental Range: 100 Years (1903 to 2003) of Accomplishments and Contributions, USDA, Forest Service, Rocky Mountains Research Station, Proceedings RMRS-P-30, September 2003.

Meyer, W.W. 2000. Altar Valley watershed resource assessment. Unpublished report prepared on behalf of the Altar Valley Conservation Alliance, dated April 10, 2000. 49 pp.

NRCS. 2003. Natural Resources Conservation Service, National Environmental Compliance Handbook. Electronic Directives System. General Manual. October 2003.

NRCS. 2006. Natural Resources Conservation Service, National Range and Pasture Handbook, updated 6-9-06.

NWCG. 1996. National Wildfire Coordinating Group, Wildland Fire Suppression Tactics Reference Guide. PMS 465. NFES 1256. April 1996.

Parizek, B., C.M. Rostagno, and R. Sottini. 2002. Soil Erosion as affected by shrub encroachment in northeastern Patagonia. Journal of Range Management 55: 43-48.

Rogers, K. 2004. "*Lehmann Lovegrass Won't Succumb to Fire*," UA News Org., The University of Arizona (http://uanews.org/cgi-bin/WebObjects/USNews.woa/wa/MainSoryDetails?ArticleID=9466)

Ruyle, G.B., B.A. Roundy, and J.R. Cox. 1988. Effects of burning on germinability of Lehmann lovegrass. Journal of Range Management 41(5): 404-406.

Sayre, N.F. 2000. Altar Valley watershed resource assessment, task three: investigate and document historic conditions. Unpublished report prepared on behalf of the Altar Valley Conservation Alliance, dated April 28, 2000. 53 pp.

Sayre, N.F. 2002. Framework for a habitat conservation plan in the Altar Valley watershed. Unpublished report prepared under contract to The Sonoran Institute on behalf of the Altar Valley Conservation Alliance, dated June 21, 2002. 76 pp.

Sayre, N.F. 2003. Recognizing History in Range Ecology: 100 Years of Science and Management on the Santa Rita Experimental Range. Santa Rita Experimental Range: 100 Years (1903 to 2003) of Accomplishments and Contributions, USDA, Forest Service, Rocky Mountain Research Station, RMRS-P-30.

Schlesinger, W.H., J.F. Reynolds, G.L. Cunningham, L.F. Huenneke, W.M. Jarrell, R.A. Virginia, and W.G. Whitford. 1990. Biological feedbacks in global desertification. Science 247:1043-1048.

Schmidt, Kristen M., James P. Menakis, Colin C. Hardy, Wendel J. Hann, and David L. Bunnell. 2002. Development of Coarse-Scale Spatial data for Wildland Fire and Fuel Management RMRS-87.U.S. Department of Agriculture, Forest Service, Washington.

Scott, J.L. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report, RMRS-GTR-153. Department of Agriculture, Forest Service, Washington.

Scott, R.L., T.E. Huxman, D.G. Williams, and D.C. Goodrich. 2006. Ecohydrological impacts of woody-plant encroachment: seasonal patterns of water and carbon dioxide exchange within a semiarid riparian environment; Global Climatic Change Biology, 12: 311-324.

Swetnam, T.W. and J.L. Betancourt. 1990. Fire-Southern Oscillation relations in the southwestern United States, Science 249: 1017-1020.

Turner, R.M., R.H. Webb, J.E. Bowers, and J.R. Hastings. 2003. The Changing Mile Revisited: An Ecological Study of Vegetation Change With Time in the Lower Mile of an Arid and Semiarid Region. University of Arizona Press, Tucson, AZ.

USDA/USDI. 2005. Wildland Fire Use and Implementation Procedures Reference Guide. May 2005

USDA. 1952. The Santa Rita Experimental Range Booklet (revised). Tucson, AZ: USDA, Forest Service, Southwestern Forest and Range Experiment Station, 17 p.

USDA. 2004. Handbook One. What is Multiparty Monitoring USDA. Collaborative Forest Restoration Program Projects January 2004 at www.fs.fed.us/r3/spf/cfrp/monitoring

USDA. 2003. Multiparty Monitoring and Assessment Guidelines for Community Based Forest Restoration in Southwest Pine Forests. USDA February 4, 2003

USDI. 2005. Arizona Statewide Land Use Plan Amendment for Fire, Fuels and Air Quality Management Finding of No Significant Impact (FONSI) and Environmental Assessment, BLM Arizona State Office. March 2004 USDA. Coronado National Forest. 2005.

USDI/USDA. 2006. Interagency Prescribed Fire: Planning and Implementation Procedures Reference Guide.

USFWS. 2002. U.S. Fish & Wildlife Service Biological Opinion, BANWR Comprehensive Conservation Plan, October 24, 2002.

Westland Resources, Inc. 2000. Altar Wash sediment retention structure environmental assessment. Unpublished report submitted to the Arizona Water Protection Fund by the Altar Valley Conservation Alliance and Pima Natural Resource Conservation District, dated April 2000, 32 pp. plus appendices.

Appendix A

Figures

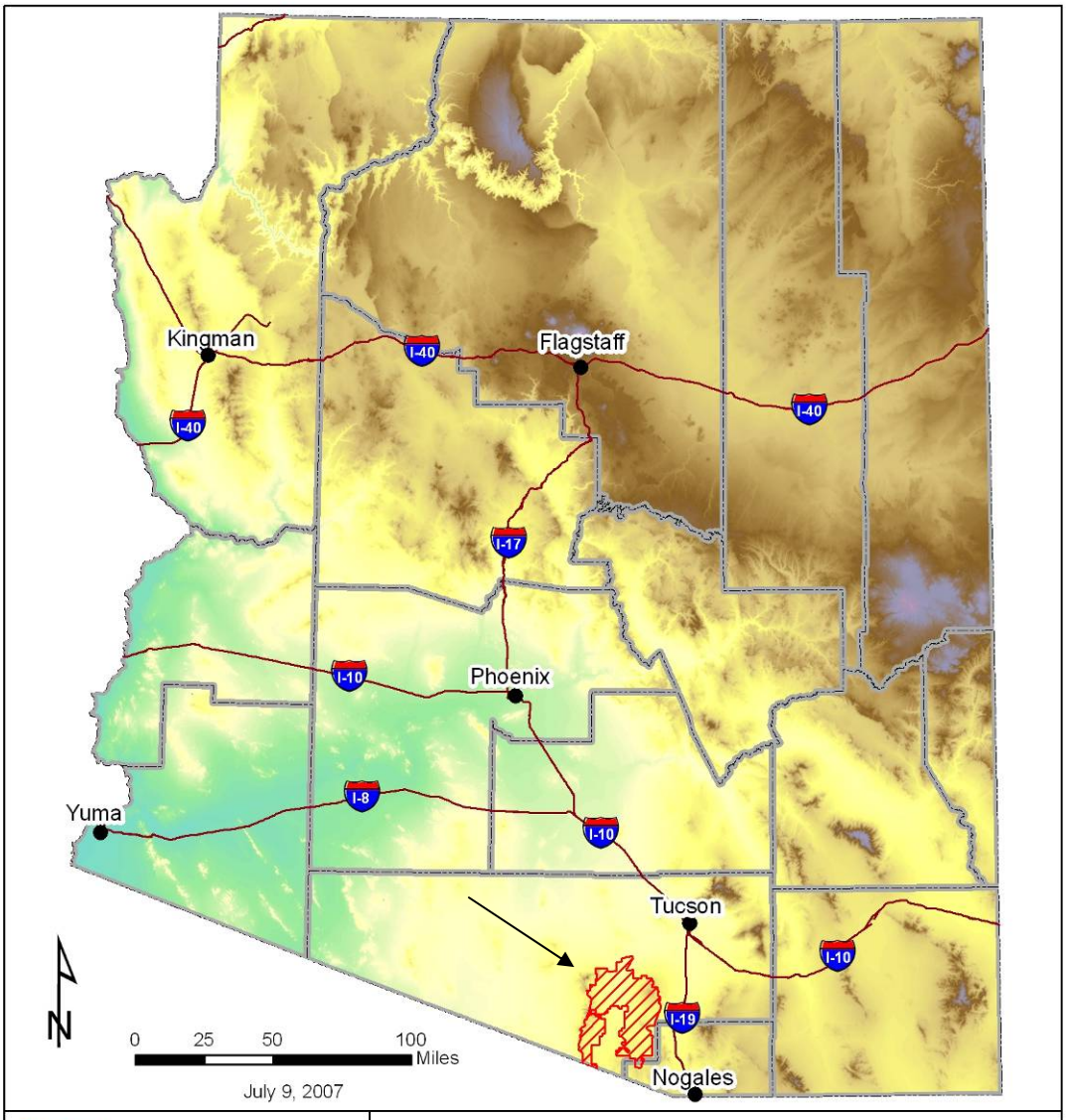


FIGURE I. Planning Area Location

Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

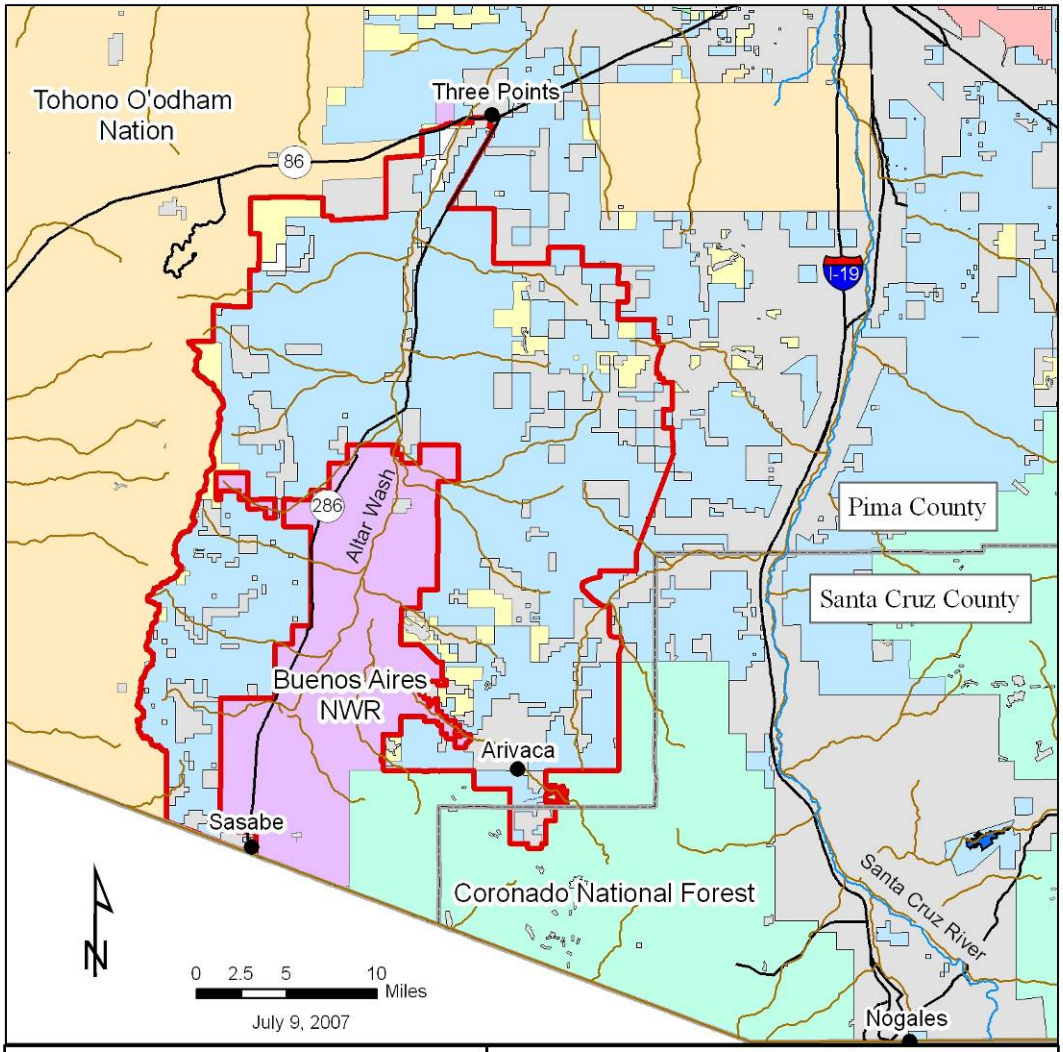


FIGURE 2. Land Ownership within the Planning Area

Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

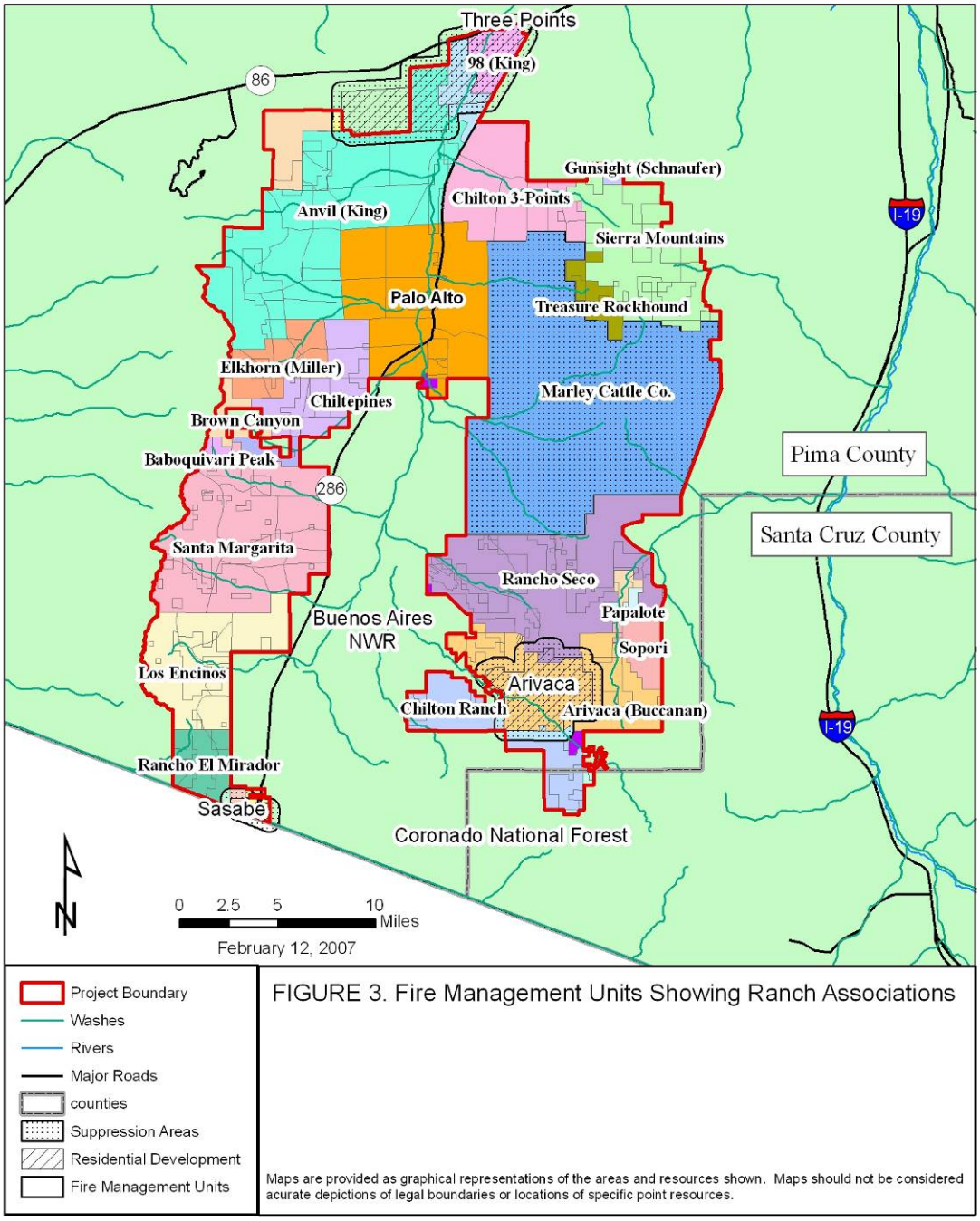


FIGURE 3. Fire Management Units Showing Ranch Associations

Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

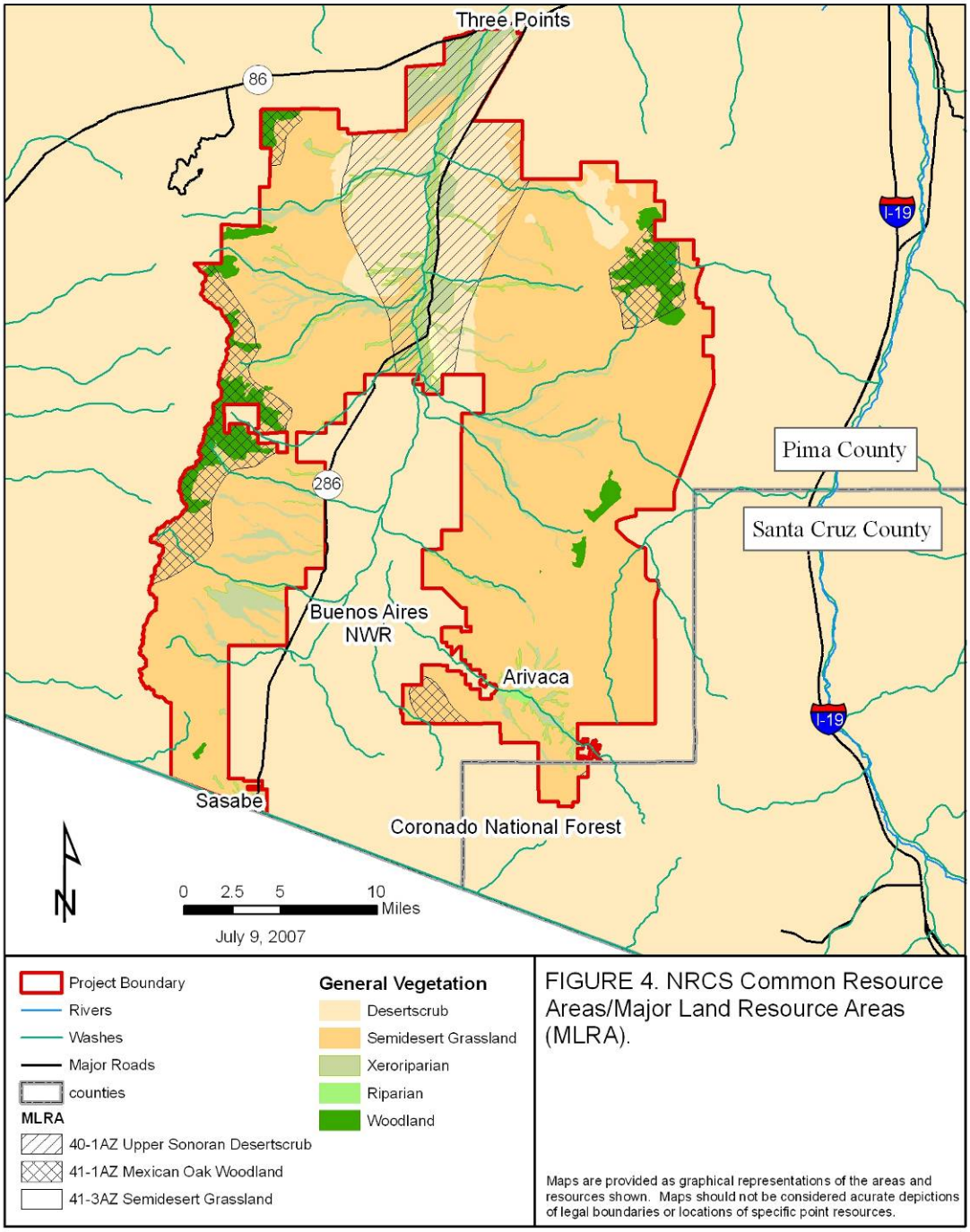


FIGURE 4. NRCS Common Resource Areas/Major Land Resource Areas (MLRA).

Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

FIGURE 5. Illustration of the Extent of Pima Pineapple Cactus Potential Habitat Based Upon Elevation and Plant Community Association.

Implementation of conservation measures should be based upon actual site condition on the ground and not this illustration. Suitability of potential habitat should be based upon the known habitat features for this species. Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

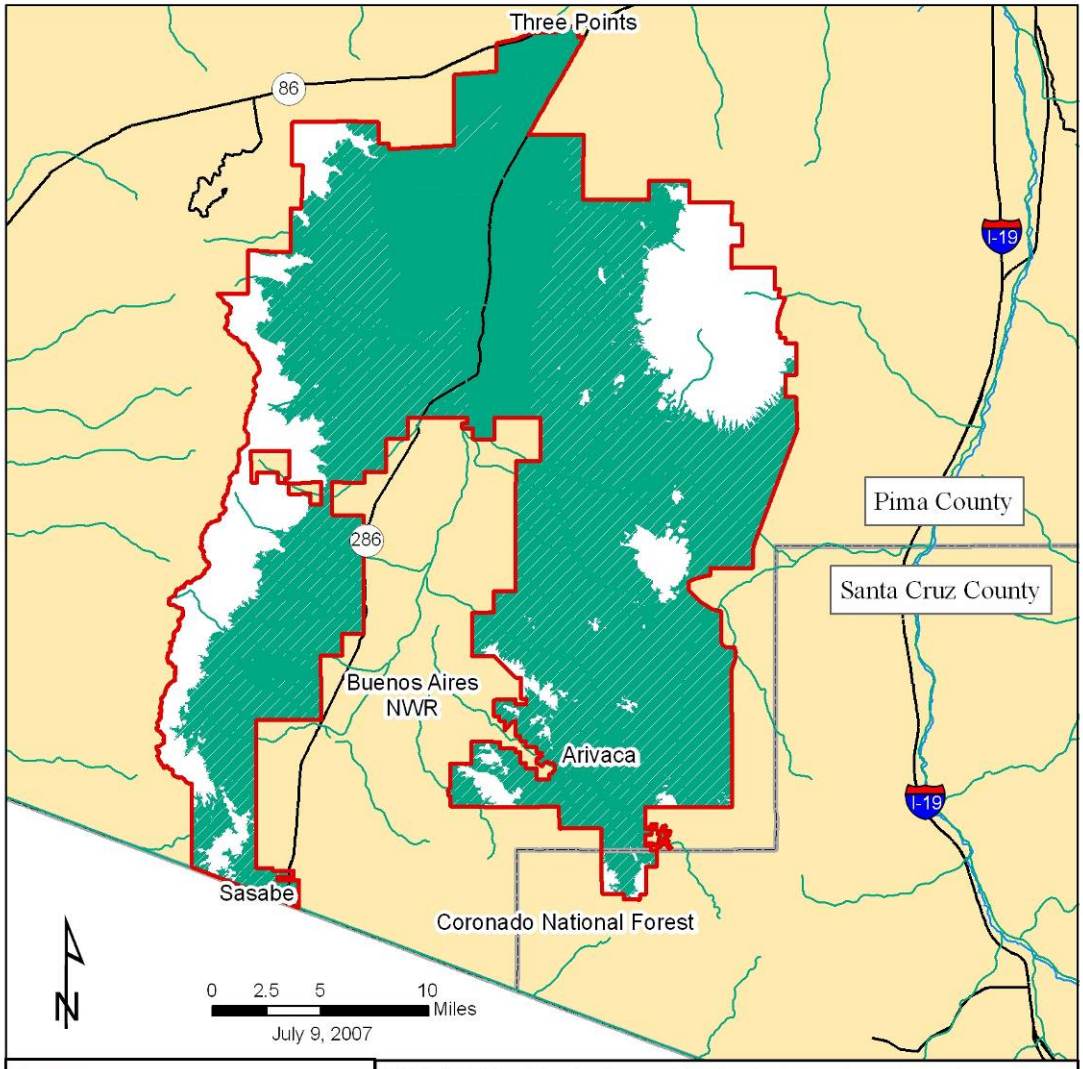


FIGURE 6. Illustration of Potential Cactus Ferruginous Pygmy-owl Habitat. This Illustration is based upon elevation and rough plant community boundaries. White cross-hatches indicate semidesert grassland plant community where patches of suitable habitat may exist.

Implementation of conservation measures should be based upon actual site condition on the ground and not this illustration. Suitability of potential habitat should be based upon the known habitat features for this species. Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

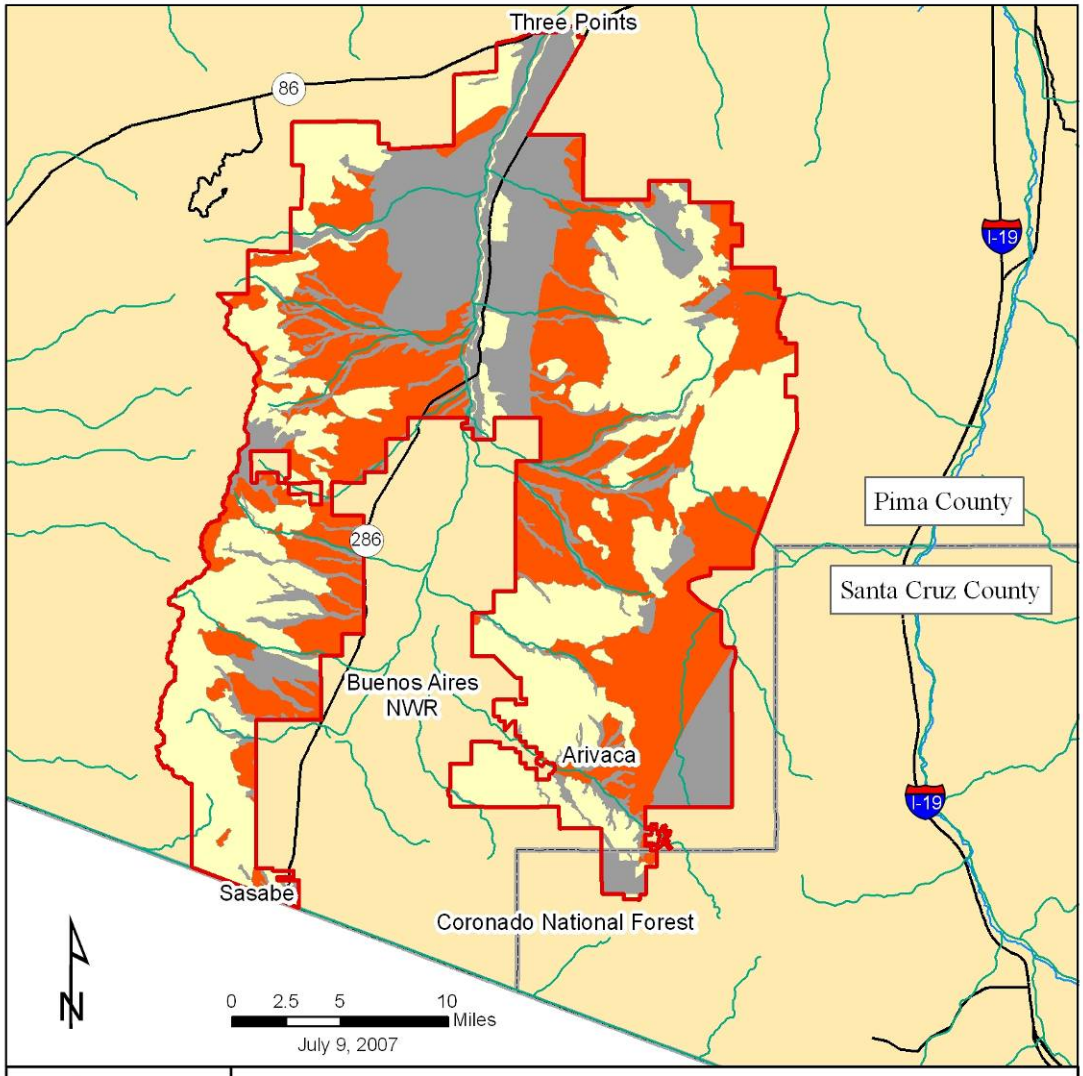


FIGURE 7. Fire Potential within the Planning Area

Maps are provided as graphical representations of the areas and resources shown. Maps should not be considered acurate depictions of legal boundaries or locations of specific point resources.

Appendix B

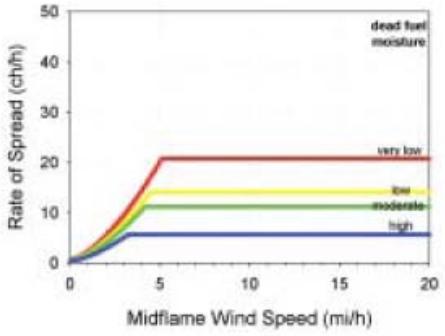
Fire Regimes, Condition Classes, and Fuels Models

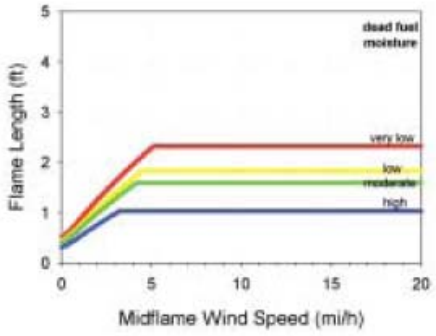
GR1 (101)

Short, Sparse Dry Climate Grass (Dynamic)

Description: The primary carrier of fire in GR1 is sparse grass, though small amounts of fine dead fuel may be present. The grass in GR1 is generally short, either naturally or by grazing, and may be sparse or discontinuous. The moisture of extinction of GR1 is indicative of a dry climate fuelbed, but GR1 may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compared to other GR models.

Fine fuel load (t/ac)	0.40
Characteristic SAV (ft-1)	2054
Packing ratio (dimensionless)	0.00143
Extinction moisture content (percent)	15



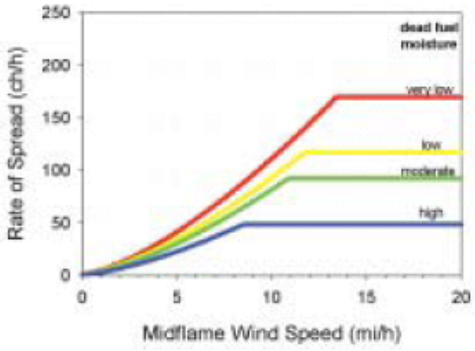


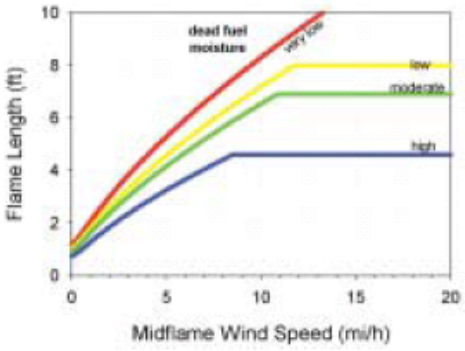
GR2 (102)

Low Load, Dry Climate Grass (Dynamic)

Description: The primary carrier of fire in GR2 is grass, though small amounts of fine dead fuel may be present. Load is greater than GR1, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior.

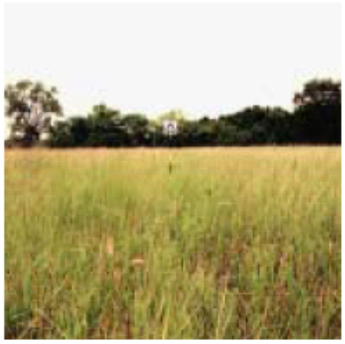
Fine fuel load (t/ac)	1.10
Characteristic SAV (ft-1)	1820
Packing ratio (dimensionless)	0.00158
Extinction moisture content (percent)	15

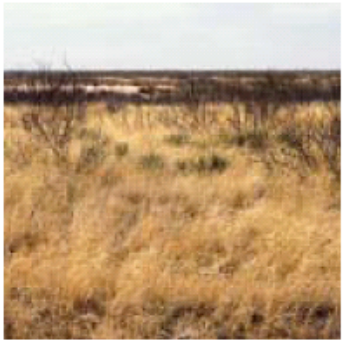




GR4 (104)

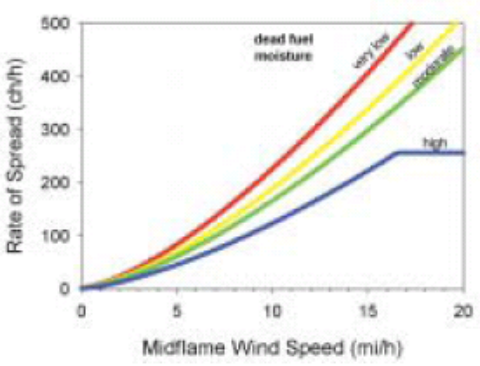
Moderate Load, Dry Climate Grass (Dynamic)

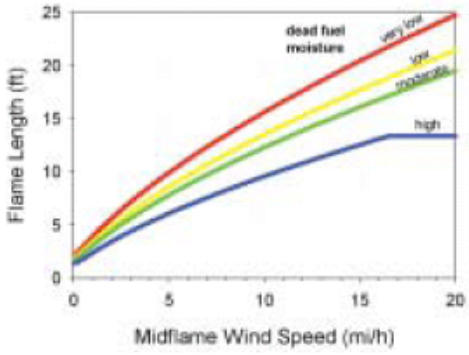




Description: The primary carrier of fire in GR4 is continuous, dry-climate grass. Load and depth are greater than GR2; fuelbed depth is about 2 feet.

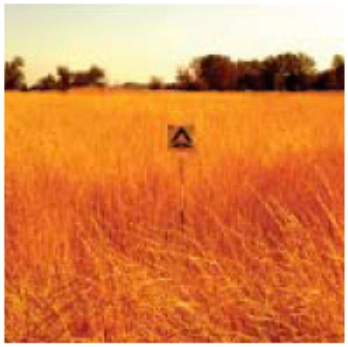
Fine fuel load (t/ac)	2.15
Characteristic SAV (ft-1)	1826
Packing ratio (dimensionless)	0.00154
Extinction moisture content (percent)	15

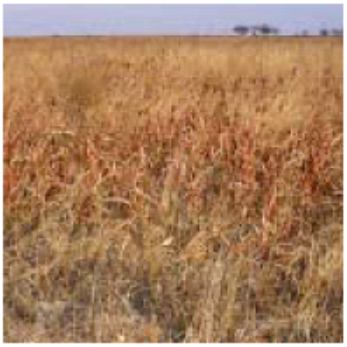




GR7 (107)

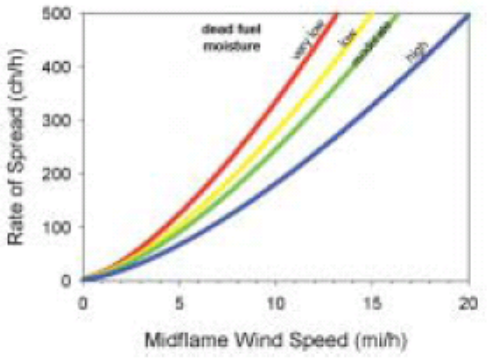
High Load, Dry Climate Grass (Dynamic)

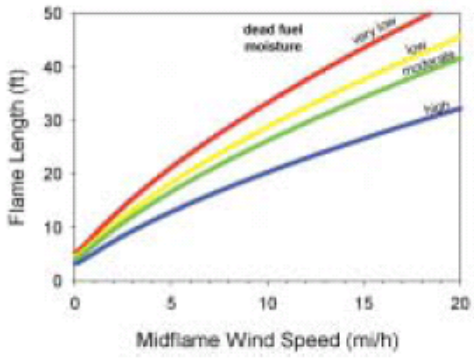




Description: The primary carrier of fire in GR7 is continuous dry-climate grass. Load and depth are greater than GR4. Grass is about 3 feet tall.

Fine fuel load (t/ac)	6.4
Characteristic SAV (ft-1)	1834
Packing ratio (dimensionless)	0.00306
Extinction moisture content (percent)	15



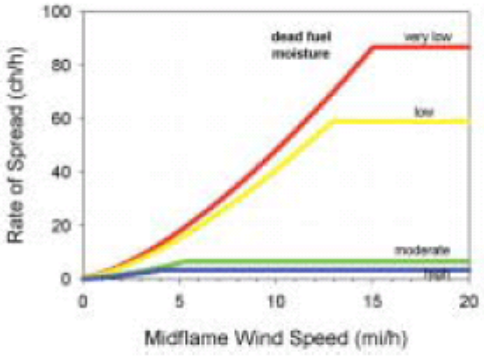


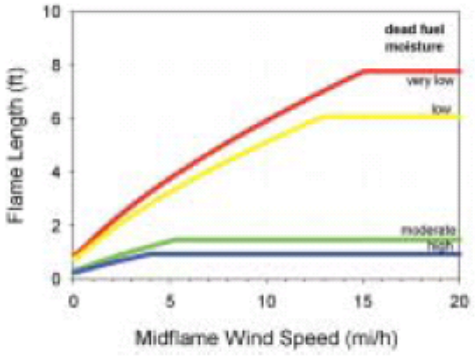
GS1 (121)

Low Load, Dry Climate Grass-Shrub (Dynamic)

Description: The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about 1 foot high, grass load is low. Spread rate is moderate; flame length low. Moisture of extinction is low.

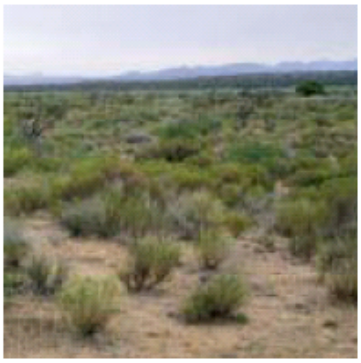
Fine fuel load (t/ac)	1.35
Characteristic SAV (ft-1)	1832
Packing ratio (dimensionless)	0.00215
Extinction moisture content (percent)	15

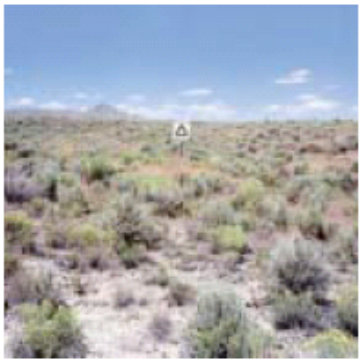




SH1 (141)

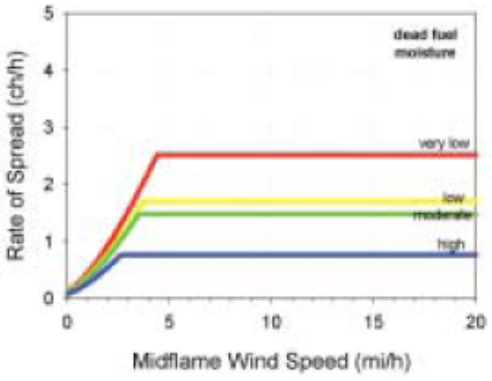
Low Load Dry Climate Shrub (Dynamic)

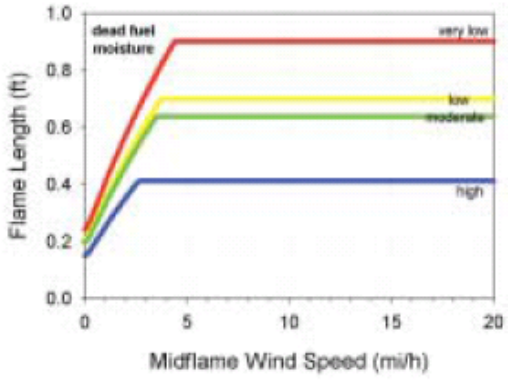




Description: The primary carrier of fire in SH1 is woody shrubs and shrub litter. Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate is very low; flame length very low.

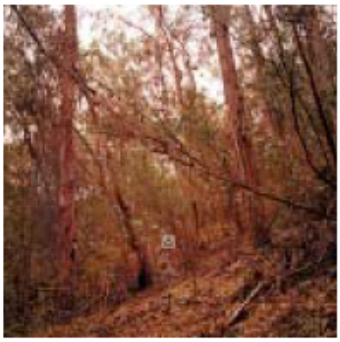
Fine fuel load (t/ac)	1.7
Characteristic SAV (ft-1)	1674
Packing ratio (dimensionless)	0.00280
Extinction moisture content (percent)	15





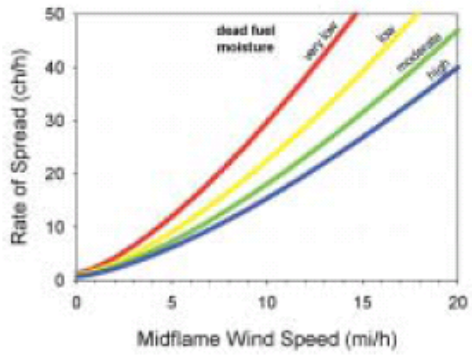
TL9 (189)

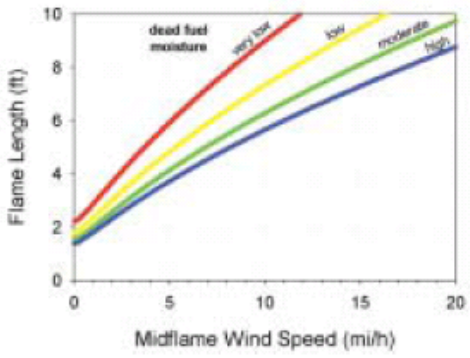
Very High Load Broadleaf Litter



Description: The primary carrier of fire in TL9 is very high load, fluffy broadleaf litter. TL9 can also be used to represent heavy needle-drape. Spread rate is moderate; flame length moderate.

Fine fuel load (t/ac)	6.65
Characteristic SAV (ft-1)	1733
Packing ratio (dimensionless)	0.03372
Extinction moisture content (percent)	35





Appendix C

BIOLOGICAL ASSESSMENT FOR ALTAR VALLEY FIRE MANAGEMENT PLAN

Natural Resources Conservation Service
May 7, 2008

Contacts: Kristen Egen, District Conservationist 520-292-2999
Stu Tuttle, State Biologist 602-280-8777

INTRODUCTION

The purpose of this biological assessment is to review proposed prescribed burning in the Altar Valley in sufficient detail to determine what extent the proposed action may affect any of the threatened, endangered, proposed or candidate species listed below. The special-status species of concern addressed in detail in this BA are the Pima pineapple cactus, masked bobwhite, lesser long-nosed bat, Chiricahua leopard frog, Kearney's blue star, Southwestern willow flycatcher, Mexican spotted owl, and Western yellow-billed cuckoo. This biological assessment is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16U.s.C. 1536 (c)).

LOCATION AND DESCRIPTION OF THE PROPOSED ACTION

The Altar Valley Planning Area (Planning Area) is located in Pima County in southern Arizona and comprises approximately 609,900 acres of land. The planning area is roughly 45 miles long by 20 miles wide; and is bounded on the south by the U.S.-Mexico border, on the north by State Route (SR) 86, on the west by the Baboquivari and Coyote mountains, and on the east by the Sierrita, Las Guijas, Cerro Colorado, and San Luis Mountains. Elevation ranges from 2,500 feet above mean sea level (msl) on the valley floor near SR 86 to 7,730 feet above msl at the top of Baboquivari Peak. Elevation increases relatively rapidly east to west from the valley floor to the tops of the surrounding mountains, and gradually from north to south on the valley floor.

The Planning Area includes two state highways (SR 86, running east to west across the north end of the valley, and SR 286, bisecting the valley north to south) and three small towns (Three Points at the SR 86–SR 286 intersection, Arivaca at the extreme southeastern end of the valley, and Sasabe at the southern end of the valley). In addition, residential development associated with Tucson, a major metropolitan area located approximately 20 miles to the northeast, has begun to encroach on the northern end of the valley.

Mexican Oak-Pine and Oak Savanna occurs on the upper slopes of the Baboquivari and Sierrita Mountains (above 4,300–5,000 feet above msl) and is clearly in the best overall habitat condition within the watershed. Similarity indexes for the ecological sites in this area are in the range of 80 percent; soils, biotic integrity, and watershed function are all rated stable, intact, and functioning, respectively. Mesquite canopies are light and there are few to no nonnative grasses. These conditions probably reflect the high-elevation location of this vegetation type, which results in less grazing pressure, fewer vegetative impacts (e.g., mesquite encroachment), greater rainfall, and less erosion.

Southern Arizona Semidesert Grassland extends from the lower slopes of the mountains, across

the bajadas and foothills, and into the Altar Valley (ranging in elevation between 3,200 and 5,000 feet). Upper Sonoran Desert Shrub occurs at elevations below 3,200 feet on the west side of the valley and below 3,400 feet on the east side. A number of ecological sites occur in both communities, including loamy uplands, sandy loam uplands, sandy bottoms, and deep sandy bottoms. These ecological sites constitute the majority of the Altar Valley's rangelands. These sites also received the greatest historic grazing pressure and display the majority of the current ecological problems in the watershed.

DESCRIPTION OF ACTIONS

For further details, see the AVFMP (Warren and AVFMP working group 2008) and EA (Draft 3 October, 2007), incorporated by reference.

The AVFMP proposes to implement prescribed fire management to achieve improved range and watershed health. It establishes measures to minimize adverse effects to federally listed species that could occur during the implementation of prescribed fire. It includes monitoring and an adaptive management program that allows the AVFMP to adjust to new information and to do so as outlined by the regulatory requirements. It also provides Altar Valley ranchers a clearly defined process that will remain predictable over the life of the plan. If Arizona State Land Department, Division of Forestry fire management policy changes or is amended in the future, the Altar Valley Fire Management Plan will amended to reflect those changes.

A priority need for the Altar Valley is a range improvement measure that would begin to correct and make better a number of ecological problems that partly stem from range management practices dating to the late 1800s. One improvement measure recommendation for the Altar Valley is the reintroduction of fire. As a management tool fire can restore historic vegetation types by reducing woody-species encroachment, improve watershed stability and hydrologic function through increased herbaceous vegetative cover, and create a mosaic of vegetation types; all of which should improve wildlife biodiversity including threatened, endangered, and sensitive species.

The cooperating agencies have determined that reintroducing fire within prescribed limits would benefit watersheds and wildlife within the Altar Valley. Prescribed fire management will lessen the threat of catastrophic fire in riparian corridors, will lower the loss of mature nesting trees, will enhance native grasslands that preserve sensitive habitats and wildlife species, and will protect recreational values and livestock grazing uses. Conservation measures to minimize the short-term adverse effects on sensitive species are included in the AVFMP.

The cooperators are developing the AVFMP to re-introduce fire in the ecosystem. One of the main objectives of this plan is to establish a process to address ESA compliance/recovery goals, while implementing a Fire Management Plan (FMP). The AVFMP is being planned for a 10-year period. The AVFMP fire prescriptions will be annually reviewed and periodically revised according to monitoring results.

Objectives:
1. Within shrub-invaded native grasslands**,** kill 30 percent to 70 percent of the half shrubs, and maintain native-grass dominance with mesquite densities at less than 10 percent.
2. Within shrub-invaded nonnative grasslands, top kill 30 percent to 70 percent of mesquites less than 4 inches in diameter, stimulate native grass production, and maintain mesquite densities at

less than 10 percent.
3. Prescribed fire have been indefinitely deferred for Southwest desertshrub vegetative associations. Although prescribed fire is not deferred in desert scrublands, these will require periods of favorable weather conditions to created continuous fine fuels at greater than 300 lbs per acre to implement prescribed fire. Prescribed fire will be implemented to maintain native perennial grass cover at the historic range of variability with adequate mix of native shrub species in good vigor.
4. Within mesquite woodlands, top kill 20 percent to 50 percent of mesquites less than 6 inches diameter, and maintain total shrub and mesquite canopy cover at 10-25 percent.
5. Within deciduous riparian habitats, including xeroriparian habitats and mesquite bosque, periodic cool season burns can be used to reduce fuels with a 1-hour time lag, to maintain tree overstory with no fuel laddering, and to maintain mesquite densities greater than 60 percent in clumps of mature trees greater than 6 inches in diameter at root collar (drc).
6. Within oak, juniper, or piñon-oak canyons, reduce the 1-hour-time-lag fuels (0.01-to 0.125-inch diameter) by 30 to 80 percent, the 10-hour-time-lag fuels (0.26-to 0.99-inch diameter) by 10 to 40 percent, the 100-hour-time-lag fuels (1-to 3-diameter) by 1 to 10 percent, and 1,000-hour-time-lag fuels (3.1-to 12-inch diameter) by 1 to 20 percent.

CONSERVATION MEASURES

Pima pineapple cactus conservation measures:

Prescribed fire plans developed for areas without suitable Pima pineapple cactus habitat- as described above, do not require conservation measures.

Prescribed fire plans developed for areas that include suitable Pima pineapple cactus habitat will include the following:

- Single pass surveys to locate individual cactus will be performed over the suitable Pima pineapple cactus habitat within the boundaries of the proposed burn.
    - Suitable habitat will be determined by elevation and habitat type. If developed, a Pima pineapple cactus habitat model similar to the model used by the Buenos Aires National Wildlife Refuge will be used to determine suitable habitat.
    - Surveys are valid for a maximum of 6 years.
- Individual cactus will be protected from the effects of the prescribed fire.
    - This will be accomplished through the clearing of fuels from around individual cactus from the area between 2 to 3 m from the plant, leaving the vegetation within the 2 m radius untouched. A fire-proof, cone-like structure may be use instead to protect each plant.
    - An area with a high density of cacti or a group of cacti may be protected through blacklining a similar area around the cacti.
- Post fire census of the known cactus to determine effectiveness of protective measures will also be made.
    - This should occur within 30-60 days after the fire and again within 120 days.
- The acreage of each fire will be reported as will the location of cactus, protective measures used and their effectiveness in protecting individual cactus. This information will be used to determine the short-term vs. the long-term effects of the FMP.

Exceptions to these basic conservation measure are possible as part of a quantitative research study of fire within various fuel loads and types on Pima pineapple cactus approved by the Service. This study should include:

- Single pass surveys to locate individual cactus shall be performed as part of the study.
- No protective measures will be required for individual cactus within the study related burns up to a maximum 20% of the individual in a burn.
- Prescription parameters, fuel types, fuel loads, fire behavior, and fire severity should be part of the information to determine the fire effects on individual cactus and potentially the population as a whole.
- Post fire surveys to determine the fire effects on individual cactus within 30-days of the fire, within 6 months of the fire, and approximately 1 year after the fire. This schedule may be modified to fit approved research design.
- The results will be used to evaluate the basic conservation measures listed above. Modifications to the conservation measures will be proposed based upon these results and modification to the FMP may be made if applicable.

Prescribed burns on the Pima pineapple cactus mitigation bank will need to be consistent with the mitigation bank agreement.

Masked bobwhite conservation measures:

- Seasonal restriction if birds are present.
- Aerial ignition patterns should not have flame fronts ignited closer than ¼ mile apart, with exceptions for firefighter safety, personal property, or other resource protection measures.

Lesser long-nosed bat conservation measures:

- Prescribed burns will not include areas where smoke could affect roosts while bats are present, August 1st through October 31st.
- Ignition patterns should avoid high severity fire effects in Agave patches

Chiricahua leopard frog conservation measures:

- Avoid high severity fire affects upstream from any occupied habitat
- If extensive erosion is possible, sediment traps should be placed above occupied habitat to reduce potential take of this species.

Kearney's bluestar conservation measures:

- Avoid known populations

Southwest willow flycatcher conservation measures:

- Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans.

Mexican spotted owl conservation measures:

Prescribed burns that are planned to include suitable habitat of the Mexican spotted owl will have surveys conducted, per established Mexican spotted owl survey protocol (FWS 2003) as amended, to determine occupancy of the habitat within and adjacent to the burn perimeter.

- If occupancy can't be demonstrated, the burn may progress as planned.

- If occupancy is demonstrated, the burn will be implemented:
    - Outside the Mexican spotted owl breeding season March 1 through August 31.
- If occupancy is demonstrated and the burn is planned during September 1 through February 28, the burn will be implemented:
    - So that the nest core areas are left undisturbed, approximately 100 acres around the nest, or
    - Fire and fire management activities will remain more than a ¼ mile away from the nest.

Western yellow-billed cuckoo conservation measures:

- Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans.

STATUS of and effect on THE SPECIES

CHIRICAHUA LEOPARD FROG *Rana chiricahuensis*

Status: Listed threatened 2002
Description: A medium to large, stocky frog with adult lengths snout to vent from 5.0-13.5 cm (2.0-5.4 in). The ground color on the dorsum is green to brown; the upper lip stripe is faint or absent in front of the eye; the head and face is usually green. The skin is rougher with more tubercles, and dorsal spots are generally smaller and more numerous than in other leopard frogs. Dorsolateral folds are broken toward the rear of the body, angling inward. The eyes are higher on the head and more upturned than other Arizona leopard frogs. The hind feet are webbed, and males have a swollen and darkened thumb base. In adults (and some juveniles), the rear surface of the thigh is speckled with "salt and pepper" markings, or small dots each densely covered with light-tipped tubercles, usually on a dark ground color. The venter is a dull whitish or yellowish color, while gray mottling usually occurs on the throat and sometimes on the chest. The groin and lower abdomen are often yellow. The call is a "snore" of unusually high pulse rate. Chiricahua leopard frogs predominate in permanent tanks and streams.
Total Range: Mountain regions of central and southeastern Arizona, southwestern New Mexico, south in the Sierra Madre Occidental to Western Jalisco, Mexico.
Range within Arizona: Arizona range is divided into two areas. The first (northern population) extends from montane central Arizona east and south along the Mogollon Rim to montane parts of west-southwestern New Mexico. The second is located in the mountains and valleys south of the Gila River in southeastern Arizona and southwestern New Mexico, and extends into Mexico (adjacent Sonora) along the eastern slopes of the Sierra Madre Occidental.
Biology: *Rana chiricahuensis* are highly aquatic habitat generalists. Adults become active in February, and eggs are laid in spring and sporadically through the summer and fall. Male *R. chiricahuensis* usually call above water, but may also advertise below water. Their call consists of a 1-3 second long, low-pitched, hollow snore. Home ranges for males tend to be larger than those for females. Post-metamorphic Chiricahua leopard frogs are generally inactive from November-February, however, a detailed study of wintertime activity or habitat use has not been done.
Reproduction: At high elevation, *R. chiricahuensis* breeds in late May through August. At lower, warmer localities, breeding occurs from mid-February through June and sporadically until September. Females deposit 300 to about 1500 eggs in spherical masses attached to submerged vegetation, suspended within 5 cm of the surface. Eggs take approximately 14 days to hatch; larvae metamorphose in 3-9 months. Tadpoles may over-winter.
Food Habits: Adults eat arthropods and other invertebrates. Larvae are herbivorous and likely eat

available food items including algae, organic debris, plant tissue, and minute organisms in the water. Stomach analyses of other members of the leopard frog complex from the western United States show a wide variety of prey items, including many types of aquatic and terrestrial invertebrates (e.g., snails, spiders, and insects) and vertebrates (e.g., fish, other anurans [including conspecifics], small birds).

Habitat: The primary habitat type of *R. chiricahuensis* is oak, mixed oak and pine woodlands. Other habitat types range into areas of chaparral, grassland, and even desert. *R. chiricahuensis* are habitat generalists that live and breed in lentic and lotic habitats in natural and man-made systems. Natural aquatic systems include cienegas, rocky streams with deep rock-bound pools, river overflow pools, oxbows, permanent springs, permanent pools in intermittent streams, and beaver ponds. Man-made aquatic systems include earthen stock tanks, livestock drinkers, irrigation sloughs, wells, mine adits, abandoned swimming pools, and ornamental backyard ponds.

Elevation: 1066-2408 m (3500-7900 ft).

Plant Community: Wide variety of permanent and semi-permanent aquatic systems in oak, mixed oak and pine woodlands, but also chaparral, grassland, and desert. Vegetation that has been associated with egg masses includes *Potamogeton* sp., *Rorippa* sp., *Echinochloa* sp., and *Leersia* sp.

Population Trends: Statewide decline. Local abundance appears to fluctuate greatly.

Reasons for decline: Most important threats are disease (Chytridiomycosis), non-native predators and competitors (bullfrogs, sport fish, crayfish), effects of small, isolated populations, loss of aquatic habitat through drying, damming, diverting, or siltation, and heavy grazing.

Status of Chiricahua leopard frog in the Action Area: The status of the species within the action area is not well known. Known populations exist within the BANWR as discussed in the BO listed below. Within the planning area, Chiricahua leopard frogs would typically be found within dirt stock tanks, except when the tanks are inhabited by invasive predators such as bullfrogs and crayfish. Some of these tanks are targeted for future treatment to remove the invasive species and thereby improve habitat and population status. The Chiricahua leopard frog has a very high reproductive potential and can repopulate a tank fairly quickly once the aquatic habitat becomes hospitable.

Effects of the Proposed Action on the Species: Dirt tanks containing Chiricahua leopard frogs are typically surrounded by elevated berms, which serve as sediment traps, and effectively protect the tanks from ash and sediment flow. However, the inlets are somewhat vulnerable. To protect tanks from any infiltration of harmful ash, either the trap will be cleaned at some interval following the burn or a straw bale-type sediment trap will be used at the inlet in to prevent harmful ash from settling into the tanks. Dirt tanks are not burned, but may burn individuals during dispersement, depending on burn timing. The removal of vegetation can trigger an increase in water yield and storm-flow discharge resulting in increased transport of ash and nutrients. Heavy ash and soot content in water clogs tadpole and fish gills and leads to acute and chronic chemical effects, and reduced dissolved oxygen concentrations. In addition, inflow of ash and sediment into a water body is capable of smothering eggs and tadpoles, resulting in the loss of individuals and reproductive potential. Sediment and ash flow can also inhibit respiration in macroinvertebrates, resulting in reduced density and composition of macroinvertebrates (a primary food resource for the frogs). A reduction in the amount of prey can ultimately affect leopard frog numbers and reproduction. The conservation measures that are included in this action will minimize these potential indirect effects.

CONCLUSION: After considering the known information on the distribution and habitat

requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, LIKELY TO ADVERSELY AFFECT THE CHIRICAHUA LEOPARD frog***.

From: 1) Arizona Game and Fish Department. 2006. Rana chiricahuensis. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 11 pp. See online abstract for full details and references at www.azgfd.gov. 2) Biological opinion: Biological Opinion on the Buenos Aires National Wildlife Refuge Fire Management Plan for the 2005-2008 Burn Seasons (02-21-05-F-0243). 3) Pers comm. with M. Tuegle, USFWS.

JAGUAR *Panthera onca linnaeus*

Status: Listed Endangered 1997
Description: This is the largest cat native to the Western Hemisphere, measuring 3.7-4.8 ft (1.13-1.5 m) in head and body, while the tail measures 1.5-2.3 ft (0.5-0.7 m). Height at shoulder measures 2.3-2.5 ft (0.7-0.8 m), hind foot 9-12 in (22-30 cm), and weight is 150-225 lb (68-101 kg). Females are usually are 10-20% smaller than males. There are five toes on each forefoot, the pollex or first toe is smaller and set above the others. Each hind foot has four toes, the first being represented only by a tiny vestigial metatarsal bone. Each digit including the pollex has a sharp retractile claw. Skull is robust, relatively short, broad in the rostrum (more so in males than females), and wide in the zygomatic arches, with 30 teeth (canines large). This yellowish to tawny cat is uniformly spotted with black. Horizontal rows of spots on the sides and back form rosettes, a ring of black with a small black spot in the center; belly white with black spots. Ears are small, rounded, without tufts, and black on the back with small white or buff central spots. Pelage is rather short and bristly. The black pupil is round and the iris is golden to reddish yellow. Cubs have a long, coarse, woolly pelage, pale buff in color, and heavily marked with round black spots that may have pale-colored centers. They also have black stripes on their faces at birth, achieving adult coloration around 7 months of age. Mountain Lion (*Puma concolor*) is unspotted, Ocelot (*Leopardus pardalis*) is smaller, and Margay (*Felis wiedi*) is much smaller and lacks rosettes. Although the mountain lion stands taller at the shoulder, it is considerably narrower through the body and neck, and far less heavily muscled than the jaguar.
Total Range: Mexico to Brazil and northern Patagonia. Very rare in the United States: southern Arizona, New Mexico and southern Texas.
Range within Arizona: Southeastern Arizona. Jaguars persisted in central Arizona as late as the early 1960's, when three were taken on the Fort Apache and San Carlos Indian Reservations. Individuals were reported from southeastern Arizona into the 1970's and 1980's. In 1996, photographs documented two individuals from the Baboquivari Mountains, Pima County, and the Peloncillo Mountains, Cochise County. Another individual was documented in 2001 and 2003 west of Nogales.
Biology: Pumas and jaguars are known to have overlapping ranges and little interaction; they seem to mutually avoid one another (this is not the case of jaguar and ocelot). Separation between pumas and jaguars appears to be based upon prey selection with jaguars selecting larger prey items. Their home range varies from 10 to 170 square km, with smaller ranges reported from the rain forest and larger ones from open habitats. They climb trees quite well. Jaguars have been characterized as primarily nocturnal, although radio telemetry has shown that they are often active during the daytime, with activity peaks around dawn and dusk. Hunting primarily occurs at night, and on the ground. They sometimes move their kill to a more secluded or protected place, rarely in a tree, but usually make no attempt to hide their kill as do pumas.
Jaguars usually are solitary, except during mating or when the young are still dependent on their

mothers. They are not known to migrate regularly, although lone males have been known to roam hundreds of kilometers.

Reproduction: They breed year-round range-wide, but at the southern and northern ends of their range there is evidence for a spring breeding season. In northern latitudes, jaguars are thought to breed from December to January. Gestation is about 100 days, with litter size ranging from 1-4 cubs (usually 2). Young are born in April-May, in dens in caves, dense brush or other heavy cover.

Food Habits: In the U.S.-Mexico borderlands, peccaries (javelina) and deer are presumably dietary mainstays, as they are in Jalisco, Mexico. Range-wide, the list of prey taken by jaguars includes more than 85 species, such as javelina, armadillos, caimans, turtles, birds, fish, and various species of livestock.

Habitat: These large cats are known from a variety of habitats, showing a high affinity to lowland wet habitats, typically swampy savannas or tropical rain forests. In the northern and southern periphery, they may occur in warmer, more arid habitat types, including oak-pine woodland. Unlike most cats, jaguars like water and were probably closely associated with the rivers and cienegas (marshes) once prominent in southern Arizona.

Elevation: Recent sightings in Arizona were recorded at 5,200 and 5,700 feet (1586 and 1739 meters).

Plant Community: Desert scrub to pine-oak woodland.

Population Trends: Since 1890, more than 60 jaguars have been documented from Arizona.

Reasons for decline: Past hunting and extermination programs, population isolation, habitat fragmentation from roads and development, and current lack of breeding females in the U.S.

Status of Jaguar in the Action Area: Regular sightings of one male individual by remote research cameras within the project area. No known recent records of females in AZ.

Effects of the Proposed Action on the Species: The rare sightings of jaguar are located in the higher regions on the outside reaches of the burn areas. The highly mobile and shy jaguar will likely leave the area of a burn during human activity. Individuals may be disturbed by fire and heat exposure if remaining in the area or moving through during a burn. The low population status of the jaguar in the action area, coupled with increased activity and restrictions along the international border, result in few individuals exposed to the short-term negative effects form prescribed burns.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE JAGUAR***.

From: Arizona Game and Fish Department. 2004. Panthera onca linnaeus. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department,
Phoenix, AZ. 8pp. See online abstract for full details and references at www.azgfd.gov. 2) *Biological opinion: Biological Opinion on the Pedestrian Fence Proposed along the U.S. and Mexico Border near Sasabe, Naco, and Douglas (22410-2007-F-0416. 3) Pers comm. with M. Tuegle, USFWS.*

KEARNEY'S BLUE STAR *Amsonia kearneyana*

Status: Listed Endangered 1989

Description: Perennial, milky sap multi-stemmed herb up to 90 cm (35.4 in) tall, with a thickened woody root. Alternate leaves with soft spreading hairs along the margins. The

inflorescence is not too conspicuous. White flowers (with pale pinkish/bluish bottom) with large cylindrical, corky, seeds.
Total Range: Western slopes of the Baboquivari Mountains, Pima County, Arizona.
Range within Arizona: South and Sycamore canyons, Baboquivari Mountains, Pima County. Introduced into Brown Canyon, east side of the Baboquivari Mountains.
Biology: Insect predators attack embryo giving sterile appearing seeds. Responds to winter precipitation. Variability in flower shapes and sizes in plants. Hawk moths may pollinate at night. As plants mature, become five to six feet across.
Reproduction: Herbaceous perennial Flowers late April and May, fruiting June through August. Seeds may be sterile
Habitat: : Dry, open, slopes (20-30 degrees) at 4,000-6,000 ft (1220-1830 m) elevation in Madrean evergreen woodlands/interior chaparral transition zone and on stable, partially-shaded, coarse alluvium along dry washes at 3,600-3,800 ft (1095-1160 m) elevation under deciduous riparian trees and shrubs in Sonoran desertscrub or desertscrub-grassland ecotone.
Elevation: 3,600 - 6,400 ft. (1097 - 1950 m).
Plant Community: Madrean evergreen woodland/interior chaparral transition zone to Sonoran desertscrub or desertscrub-grassland ecotone.
Population Trends: The one native population consists of approximately surviving 65 plants (1993). Transplants in Brown Canyon discussed below.
Reasons for decline: Extreme rarity, vulnerable canyon bottom habitat flooding and insect and livestock damage.
Status of Kearney's blue-star in the Action Area: The largest population of Kearney's blue star (over 300 individuals) is in the upper reaches of Brown Canyon on BLM land. There are a few other scattered locations (20-30 plants) in Thomas Canyon. Thomas Canyon locations may be located in designated BLM wilderness. The BLM has paid a contractor to establish monitoring plots for Kearney's blue star, but these plots have not been established yet.
Effects of the Proposed Action on the Species: All know locations are in Brown Canyon or on western side of Babocamari mountains, areas that are not targeted for burn. Possible unidentified individuals within AVFMP project area. These could experience direct effects from flame and heat, and indirect effects from ash and sediment flows.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE KEARNY'S BLUE STAR***.

From: 1) Arizona Game and Fish Department. 2003. Amsonia kearneyana. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department,
Phoenix, AZ. 6pp. See online abstract for full details and references at www.azgfd.gov. 2) Pers comm. with M. Tuegle, USFWS.

LESSER LONG-NOSED BAT *Leptonycteris curasoae yerbabuenae*

Status: Listed Endangered 1988
Description: A medium-sized bat with a forearm measuring 51-56 mm (2.0-2.2 in), wingspan of 36-40 cm (14-16 in), and weight averaging 21-23g (0.7-0.8 oz). The short, dense fur is yellowish-brown or pale gray above and cinnamon-brown below. They have an elongated snout, with a nose-leaf, an erect triangular flap of skin at the tip of the snout. There is no tail, and the interfemoral membrane is reduced to a narrow band along each hind leg. These bats have large eyes and reduced ears compared to other bats in Arizona. There are two molars above and below,

molariform teeth in contact with one another, zygomatic arch complete, and 4 lower incisors, but sometimes these are lost. The loss of incisors might enable the bat to protrude the tongue more easily, to collect nectar.

Total Range: Occupying the lowland deserts of Mexico from Oaxaca and Veracruz through western Mexico to Baja California, and northward to south-central and southeast Arizona and southwest New Mexico, extending southeasterly through Guatemala to El Salvador.

Range within Arizona: Southern Arizona from the Picacho Mountains southwesterly to the Agua Dulce Mountains and southeasterly to the Galiuro and Chiricahua mountains and then southerly into Mexico and beyond. Not present in Arizona during winter months. Both sexes are found in the southern part of their range, at least in Mexico. There appear to be both sexual and seasonal differences in their Arizona range. During the early part of their stay (late April to late July) pregnant females congregate at traditional roost sites, give birth, and raise their young at lower elevations within the range of columnar cacti. Males and perhaps non-pregnant females do not arrive until sometime in July. By late July most females and young have dispersed from the maternity colonies and some have moved to higher elevations where they are found feeding on agave flowers. By late September or October all of these bats are migrating south to Mexico, exactly where is not known.

Biology: These bats do not hibernate. They cannot withstand prolonged exposure to cold.
They migrate in September/October to Mexico, where they breed and spend the winter. They then return to Arizona in the spring to bear young. The tongue is long and tipped with brush-like papillae that help mop up nectar. Like most nectar feeders, the teeth are much modified, having lost the cutting and crushing cusps of the insect feeding species of bats. Unlike most other bats and rodents found in arid and semiarid areas, the kidneys of *Leptonycteris* are not adapted for water conservation and salt excretion. Maximum concentrations of urea and salts in the urine are the lowest reported for any mammal including an aquatic mammal such as the beaver (Carpenter 1969). This is related to *Leptonycteris* feeding on nectar with its high water and low salt content and the need to get rid of large amounts of water rapidly while retaining salts. Even still, its diet of nectar enables this bat to be essentially independent of free water. *L. curasoae* is considered an important pollinator of various agave species, columnar cacti and other Mexican plant species. Pollen collects on their heads and shoulders (sometimes making them look yellow) when they stick their head into a flower to get nectar. As they go from plant to plant, pollen is rubbed off on the pistils at each flower thus pollinating them.

Reproduction: Females arrive in Arizona pregnant and as early as the second week in April. They join other females in maternity colonies late in pregnancy sometime in April or early May. Maternity colonies may number in the hundreds to thousands, and in a few places, in the tens of thousands. Males form separate, smaller colonies. One young per year is born during May. Young can fly by the end of June. Maternity colonies break up by the end of July.

Food Habits: In Arizona, they feed on nectar and pollen from flowers of saguaro and organ pipe cactus in early summer and agave later in the summer and early fall. They may feed on ripe cactus fruits at the end of the flowering season. They may also take a few insects incidentally when taking nectar. *L. curasoae* also takes sugar water from hummingbird feeders at night.

Habitat: Desert grassland and shrubland up to oak transition. They roost in caves, mine tunnels, and occasionally in old buildings. They forage in areas of saguaro, ocotillo, paloverde, prickly pear and organ pipe cactus and later in the summer among agaves. There appear to be seasonal differences in when certain habitats are occupied.

Elevation: 1,190 - 7,320 ft. (363 - 2,233 m).

Plant Community: Palo Verde/Saguaro, Semidesert Grassland, and Oak Woodland.

Population Trends: Populations are presumed to have declined significantly.

Reasons for decline: Thought to be related to reduction of numbers of maternity colonies and decline in size of remaining maternity colonies in Arizona and Sonora due to exclusion and

disturbance. Additionally, thought to be negatively affected by large reductions in acreage of native agaves over large areas of northern Mexico due to excessive harvesting for local manufacture of mescal and tequila. Excessive browsing on newly emergent flower stalks of *Agaves* has also been suggested as possibly decreasing foraging opportunities and thus contributing to declines among these bats. Extreme northern edge of distribution, possible over-harvesting of native (as opposed to cultivated) agaves in northern Mexico, exclusion from some roost sites and disturbance at others. Easily disturbed at roost sites. Livestock grazing in areas with agaves may affect them, particularly if overgrazing is allowed. Also intense grazing could result in trampling of young agaves and livestock may occasionally feed on the flowering stalks of the agaves.

Status of lesser long-nosed bat in the Action Area: There are no known roost sites, and lesser long-nosed bats are only known to use the Altar Valley to forage. In general, survey and monitoring data indicate that the LLNB is slightly more abundant in Arizona and New Mexico than indicated in the final listing rule, although some roost sites have been abandoned or diminished due to human disturbance. Census of 11 roosts in Arizona (2004) was 72,615, a relatively stable number since 2001.

Effects of the Proposed Action on the Species: Foraging of LLNB may be affected by smoke effects from prescribed burns and the loss of some agave. Most prescribed burns will likely occur during May and June to facilitate mesquite control. Although LLNB are foraging at this time, the localized, short-term smoke affects will only prevent foraging in the treatment area, and the bats will move to other areas in the valley to forage. Agaves tend to be higher out of the lower valley in rocky slopes where fire will not carry as well, leaving many agaves untouched by fire. Saguaro cactus and agaves will be protected to the extent possible from habitat restoration and enhancement projects within the plan.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE LESSER LONG-NOSED bat.***

*From: 1) Arizona Game and Fish Department. 2003. Leptonycteris curasoae yerbabuenae. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 8 pp. See online abstract for full details and references at www.azgfd.gov. 2) Biological opinion: Biological Opinion on the Pedestrian Fence Proposed Along the U.S. and Mexico Border near Sasabe, Naco, and Douglas (22410-2007-F-0416. **4**) Pers comm. with M. Tuegle and Scott Richardson, USFWS. 5) Lesser Long nosed bat 5 year review located at:*
http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/LLNB/LLNB_5yr_Final.pdf

MEXICAN SPOTTED OWL *(Strix occidentalis lucida)*

Status: Listed Threatened (1993) Critical Habitat Listed (USDI, FWS 2001)

Description: The subspecies *lucida* is a medium sized owl where males average 23-41 cm (9-16 in) in length and females average 30-34 cm (12-13.4 in).The MSO is a brown colored owl with large, irregular and numerous white spots on the head, neck, back, and underparts, giving it a lighter appearance than the other two subspecies. The sexes are nearly identical, but females have darker head and face color, and breeding females have brood patches. The remiges and rectrices of both sexes are dark brown and barred with light brown and white; tail has about ten light bands. MSO has a round face that lacks ear tufts. The large, round, brownish facial disks are concentrically barred with dark brown, with a dark brown border. Their dark brown eyes appear

almost black. The bill is a pale yellowish green color, and their legs and feet are fully feathered.

Total Range: The MSO currently occupies a broad geographic area, but does not occur uniformly throughout its range. It can be found from southern Utah and central Colorado south through Arizona, New Mexico, and western Texas (mountains in the Trans Pecos) to the Mexican Plateau (Michoacan and Guanajuato).

Range within Arizona: Patchily distributed in forested mountains statewide, along with steep canyons on the Colorado Plateau including the Grand Canyon. They have been found in the following counties: Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, and Yavapai.

Biology: Mexican Spotted owls are mostly solitary outside the breeding season. They roost during the day, and hunt at dusk and at night. Lifetime nest site tenacity has been observed by pairs. Some migrate 20-50 km between summer and winter ranges. Seasonal migration of some individuals occurs in many or most MSO populations, and in both sexes, but not always year to year. Reasons why only some owls migrate are unknown. Adults are generally long-lived; however, there is a low survival of young to breeding age. Based on banding studies, the species often live for 16-17 years. Exploitive competition (where individuals compete for similar resources such as prey and nest sites) may occur with Great Horned owl (*Bubo virginianus*). They are not a fast flier, but are very agile and maneuverable. Observed actively defending nest sites and fledged young against volant predators. Starvation is likely another common source of mortality. Both adults and juveniles may be affected by starvation in those years when there is a low abundance or availability of prey.

Reproduction: MSO's do not build their nests. In Arizona, they use cavity or abandoned platform nests about 80 feet up in coniferous tree, however, they also use ledges on cliffs or pothole sites, and mistletoe clusters. They are monogamous, breeding sporadically, and generally not nesting every year. In good years most of the population will nest, whereas in other years only a small proportion of pairs will nest. They have one brood, with egg laying peaking sometimes as early as early March in Arizona and New Mexico. Incubation of 1-3 eggs by female lasts 28-32 days. Hatching usually occurs in early to mid-May. Young leave the nest at about 5 weeks (June), and fly at about 6-7 weeks of age, and are independent by early fall (dispersal of young occurs in September-October).

Food Habits: MSO regularly caches excess food, usually on tree branches. Prey is snatched from the ground in talons after gliding descent from a perch. In Arizona: most common prey includes cottontails, deer mice, woodrats, and voles but also may prey upon various birds, bats, lizards, and snakes.

Habitat: They primarily breed in dense old growth mixed-conifer forests located on steep slopes, especially deep, shady ravines. These sites have high canopy closure, high basal area, many snags, and many downed logs. For foraging, multistoried forest with many potential patches is desirable. In Arizona, they occur primarily in mixed-conifer, pine-oak, and evergreen oak forests; also occurs in ponderosa pine forest and rocky canyonlands. Range size for single owls in Arizona averages 1,600 acres and combined home ranges occupied by pairs averages 2,000 acres. Nest trees are usually large in size, whereas roosting occurs in both large and small trees. Nest tree species vary somewhat among areas and habitat types, but available evidence suggests that Douglas-fir is the most common species of nest tree.

Elevation: 4,500 - 10,000 ft.

Plant Community: Mixed-conifer forests are commonly used throughout most of the range. These forests are generally dominated by Douglas-fir (*Pseudotsuga menziesii*) and/or white fir (*Abies concolor*), with codominant species including southwestern white pine (*Pinus strobiformis*), limber pine (*Pinus flexilis*), and ponderosa pine (*Pinus ponderosa).* The understory often contains the above coniferous species as well as broadleaved species such as Gambel oak (*Quercus gambelii*), maples (*Acer* sp.), boxelder (*Acer negundo*), and/or New Mexico locust

(*Robinia neomexicana*). In southern Arizona and Mexico, Madrean pine-oak forests are also commonly used, and are typically dominated by an overstory of Chihuahuan pine (*Pinus leiophylla*) and Apache pine (=Engelmann pine, *Pinus engelmannii*), in conjunction with Douglas-fir, ponderosa pine, and Arizona cypress (*Cupressus arizonica*). Evergreen oaks are typically prominent in the understory.

Population Trends: Unknown. According to USFWS (1995), there is inadequate data to estimate population trends in MSO near the Altar Valley. Based on crude population estimates, there may be 600-1,200 MSO's in Arizona.

Reasons for decline: Loss of old-growth forests (its preferred habitat), great horned owl predation, low reproductive success and low juvenile survival rates.

Status of Mexican spotted owl in the Action Area: Status is not well known within the project area. Nesting habitat should be surveyed prior to burns, especially "southern end, Kitt Peak". The Santa Rita Mountains support about 10,000 to 15,000 acres of MSO habitat, divided into 15 known PACs that cover the tops of the mountain range.

Effects of the Proposed Action on the Species: Mexican spotted owls are primarily found on Forest Service managed lands at higher elevations within the planning area. Wildlife biologists will be involved early in the decision-making process for using WFU or Rx within suitable habitats between 4,100 and 9,000 feet above msl. Treatment will be managed as low-intensity fire with scattered patches of moderate-to-high-intensity burns. Mortality of trees larger than 18 inches dbh will be limited to less than 10 percent.

Pre-burn protocol surveys will be completed in areas determined as roosting habitat.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action [insert determination: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE MEXICAN SPOTTED OWL.*** Critical habitat is designated for the MSO, but none occurs on the Coronado National Forest (closest designation is BR-W-13 to the south in Santa Cruz county); therefore, none will be affected.

From: 1) Arizona Game and Fish Department. 2005. Strix occidentalis lucida. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 11 pp. See online abstract for full details and references at www.azgfd.gov. 2*) Biological opinion: Mt Hopkins Summit Dorm (02-21-02-F-110). 3) Federal register, Volume 69, No. 168, August 31, 2004, Final Designation of Critical Habitat for the Mexican Spotted Owl. 4) Pers comm. with M. Tuegle, USFWS.*

MASKED BOBWHITE *Colinus virginianus ridgwayi*

Status: Listed Endangered 1967

Description: A small to medium-sized quail measuring 21-26 cm (8.5-10.5 in). The male is slightly heavier than female. Adult male has brownish upperparts, finely barred with tan and black; white forehead, and triangular patch on chin and throat, contrasting with chestnut crown and nape; remaining areas blackish, becoming chestnut posteriorly. Lower portions of throat, neck, and nape have white streaks bordered with black. Breast, sides, and flanks white, narrowly barred in zigzag pattern with black; some chestnut streaking on sides and flanks. Wings chestnut to brownish gray; many inner feathers patterned with buff, black, and gray. Male has slight head-crest that becomes erect when head is raised in alert. Adult female similar, but white areas on head replaced with buff, and remaining plumage less boldly marked. Juvenile plumage similar to that of adult female, but much duller and less boldly marked.

Total Range: Historically, the masked bobwhite ranged from south central Arizona, south into central Sonora, Mexico. It is estimated that this quail disappeared from Arizona in the early

twentieth century. Existing naturally-occurring populations are limited to Sonora, Mexico. The birds have been reintroduced in southern Arizona.

Range within Arizona: Extirpated before or soon after 1900, the northern edge of range extended to bottomlands of Altar and Santa Cruz valleys. Habitat restoration efforts and reintroductions were halted in the late 1970s and early 1980s, but began again on Buenos Aires National Wildlife Refuge (in the Altar Valley) in 1985, where they still occur today.

Biology: The Bobwhite is typically a diurnal bird that feeds and roosts in coveys except during nesting season, forming groups of usually less than 20 individuals. Within coveys, birds roost together, often in direct contact. When flushed, they fly on noisy wings then glides to cover. Locomotion consists of quick walks and runs on the ground. Populations are typically sedentary, year-round residents, especially in areas of moderate to high quality habitat .Their voice is a clearly whistled *Bob-white!* or *poor, Bob-whoit!* The covey call is a *ko-loi-kee!* answered by *whoil-kee!*

Reproduction: The nesting season of the masked bobwhite corresponds to summer rains, since high humidity is important to successful egg hatch in quail. The nest is a shallow depression lined with grass, etc., concealed by woven arch of vegetation with side entrance. Eggs are white to creamy; clutch size is 5-15. Incubation lasts on average 23 days and hatching with laying and hatching corresponding to monsoon rains. Hatchlings are covered with natal down, and need active brooding by parents for about 2 weeks after hatching. Hatchlings can walk almost immediately upon hatching. Young birds take their first flight about 14 days after hatching, and usually remain with adults through late winter.

Food Habits: Green vegetation and insects contribute substantially to their diet in the spring and summer. Forb and grass seeds are important components of their fall and winter diets. Young birds are capable of procuring food and grit on first day of life.

Habitat: The broad valley desert grassland type with some brush and tree cover is their preferred habitat, especially with dense weed-grass habitats that include large varieties of forbs, grasses and legumes.

Elevation: 3,090 - 3,720 ft. (942 - 1135 m) on Buenos Aires National Wildlife Refuge

Population Trends: Northern limit of historic range is defined by the Altar and Santa Cruz valleys in Arizona. Extirpated from the U.S. by about 1900. They were reintroduced at the Buenos Aires National Wildlife Refuge in southern Arizona; three populations are known in Mexico.

Reasons for decline: Declines are attributed primarily to habitat loss from changing land uses in agriculture, forestry, and expanding suburbanization. Drought and cattle grazing led to the near-complete crash of the Sonoran population by 1985. Effects of cattle grazing include removal of cover, nesting habitat, and food resources overgrazing of weedy bottom lands, grassy and herb-strewn valleys, and forb-rich plains; spread of non-native plants; raptor and mammal predation; possibly competition by other native quail. Depletion of ground cover prevents fires that kill off invading woody plants, which in turn degrade habitat for bobwhite.

Status of masked bobwhite in the Action Area: In fall of 2002, masked bobwhite numbers on BANWR appeared to be stable and the same as in the prior five years, hovering at about 150, which includes audible responses and counted birds from covey flushes. However, recent evidence suggests the population has significantly declined and is “rare to infrequent”. There are no known individuals within the AVFMP area.

Effects of the Proposed Action on the Species: Masked bobwhites are currently found only on BANWR located outside of project area. Affects may occur from smoke and possible fire extending beyond control areas. Habitat improvement from fires may help MB expand their range in the future, but also subject to loss of individuals during fires if they extend beyond BANWR.

CONCLUSION: After considering the known information on the distribution and habitat

requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE MASKED BOBWHITE*.**

From: Arizona Game and Fish Department. 2001. Colinus virginianus ridgwayi. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 7 pp. See online abstract for full details and references at www.azgfd.gov .2) General Species information, UFWS Southwest Ecological Services Field Office website: http://www.fws.gov/southwest/es/arizona/masked.htm. 3) Biological opinion: Biological Opinion on the Buenos Aires National Wildlife Refuge Fire Management Plan for the 2005-2008 Burn Seasons (02-21-05-F-0243). 4) Pers comm. with M. Tuegle, USFWS.

PIMA PINEAPPLE CACTUS *Coryphantha scheeri* var. *robustispina*

Status: Listed Endangered 1993
Description: Hemispherical cactus, adults measuring 10.0-46.0 cm (4.0-18 in.) tall, 8.0-18.0 cm (3.0-
7.0 in.) diameter. Strong straw-colored central spines form cluster, one per areole, measure up to 3.0 cm (1.2 in.) long. Central spine 2.0 mm (0.08 in.) in diameter, curved or hooked at abruptly narrowing tip. Radial spines number 6 in young plants, increasing to 10-15 in older plants. Vary from 19.0-23.0 mm (0.76-0.92 in.) long with upper ones more slender. Areoles covered densely with deciduous wool which disappears at maturity. Tubercles grooved along upper surface. Stems can branch and clumps can form. Silky yellow flowers, coral color on edges, have narrow floral tube. Green fruit ellipsoid, succulent and sweet. Brown or black seeds finely veined or netted. May be confused with juvenile *Ferocactus*. However, *Ferocactus* spines flattened, have transverse ridges, in contrast with round cross-section of *Coryphantha* spines. Also, areoles of *Coryphantha* are on tubercles (bumps) with grooves along upper surface, while areoles of *Ferocactus* are on ridges (ribs).
Total Range: South-central Arizona and north-central Sonora, Mexico
Range within Arizona: Southeastern Arizona. Known range bounded by Santa Cruz County, Santa Rita Mountains (east); Pima County, Baboquivari Mountains (west), Tucson (north), Arizona-Mexican border (south).
Biology/Reproduction: Succulent Perennial Flowers in mid-July with onset of summer rains. Plants very sparsely distributed. Densities can be lower than 1 plant per 4 acres. Seeds are viable; asexual reproduction (offsets) very important. Pollinated by small white and black bees. Obligate out-crossers. Bloom together one day a year (midday).
Habitat: Ridges in semidesert grassland and alluvial fans in Sonoran desertscrub. Plants are found on alluvial hillsides in rocky, sandy soils, habitat type is primarily desert grassland on flat ridgetops with little slope. Soils are mostly rocky loams.
Elevation: About 2,300 - 5,000 feet (702 - 1,525 m).
Plant Community: Lower Sonoran Desertscrub and Semi-desert Grassland (dominated by *Acacia constricta* (white-thorn acacia), *Prosopis velutina* (velvet mesquite), *Gutierrezia microcephala* (thread snakeweed), *Ambrosia deltoidea* (triangle-leaf bursage), and various other cacti and grasses)
Population Trends: Downward due to loss and degradation of habitat
Reasons for decline: Limited range and sparse distribution. Loss of habitat due to urban development,
off-road vehicle use, road construction, agriculture, and mining; habitat degradation due to livestock grazing; alteration of habitat due to aggressive non-native grasses; and illegal collecting; range management practices that cause surface disturbances such as ripping and imprinting.
Status of Pima pineapple cactus in the Action Area: Pima pineapple cacti prefer Sonoran

desertscrub, semi desert grasslands, or the transition zone between these two communities at elevations between 2,300 and 4,500 feet above msl. Pima pineapple cactus densities vary across the AVFMP planning area as does Lehmann lovegrass. These two species generally occupy disparate areas in the Altar Valley—with relatively low pineapple cactus and high Lehmann lovegrass densities occurring within the southern portion of the Altar Valley; relatively high pineapple cactus and low Lehmann lovegrass densities occurring in the northern portion of the Altar Valley; and relatively high densities of both species occurring only in the transition zone between the southern and northern portions.

Effects of the Proposed Action on the Species: The proposed fire management plan may result in direct loss of individuals of Pima pineapple cactus due to prescribed fire and fire related activities. Within Pima pineapple cactus habitat, Rx and WFU activities will not exceed the fire management area maximum fire effects threshold (no more than 60 percent burned under low intensity; no more than 10 percent burned under a moderate-to-high fire intensity). WFU and RX will be deferred in southwest desertscrub vegetative communities. BANWR Fire BO, Robinet's old files. AZGFD HDMS, Draft Habitat Management Plan.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, LIKELY TO ADVERSELY AFFECT THE PIMA PINEAPPLE CACTUS***.

From: 1) Arizona Game and Fish Department. 2001. Coryphantha scheeri var. *robustispina. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp. See online abstract for full details and references at www.azgfd.gov.* 2*) Biological opinion: Buenos Aires National Wildlife Refuge Comprehensive Conservation Plan (02-21-02-F-207) 3) Pers comm. with M. Tuegle, USFWS.*

SOUTHWESTERN WILLOW FLYCATCHER (*Empidonax traillii extimus*)

Status: Listed Endangered (1995)

Description: Small, usually a little less than 6 inches in length, including tail, with conspicuous light-colored wingbars. The body is brownish-olive to gray-green above with a whitish throat, pale olive breast and yellowish belly. It is best identified by vocalizations. The call is a liquid, sharply whistled whit! or a dry *sprrit*. The song is a distinct *fitz-bew*.

Biology: Spring arrival of willow flycatchers in Arizona is in late April with fall migration beginning as soon as the breeding season ends in July-August. The nest is built of shredded bark, cattail tufts, and grasses, and lined with fine grasses and feathers. Usually it is placed in a branch fork in a willow, near water. *E.t. extimus* arrives on breeding territory by late April to early May and migrates southward again in August and September. Preferred nesting habitat is mature *Populus fremontii*/*Salix goodingii* forests along still or slow moving watercourses at the lower elevations. Also found in *Tamarix pentandra* thickets. At higher elevations some are found in pure willow stands (*Salix* spp.). Brown-headed cowbird parasitizes nest by laying an egg in flycatcher's nest. Cowbird eggs hatch sooner and often out-compete the host young. As a result, flycatcher nest parasitized by cowbirds usually produces only cowbirds. Breeding colonies usually about 1.5 acres. Densities about 9-14 pairs per 100 acres. *E.t. extimus* is insectivorous, collecting flying insects by sallying (flying out short distances from perch) and, to a lesser extent, hovering and gleaning. Also eat few berries and seeds.

Reproduction: Males sing repeatedly from exposed perches while on breeding grounds, occasionally during migration. Breeding birds often heavily affected by brood-parasitism by brown-headed cowbirds. Lay clutch of 3 or 4 eggs from May through July. Incubation lasts 12-13

days and nestlings fledge after 12-14 days. Usually 1 brood per year but have been known to raise 2. Young tended by both parents. Leave nest at 12-15 days.

Habitat: In Arizona, this flycatcher breeds principally in (at low elevations) dense willow, cottonwood, and tamarisk thickets and woodland along streams and rivers, and (at high elevations) pure, streamside stands of willow. Migrants may occur more widely. Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated and mixed native/exotic.

Range: The wintering range of *E.t. extimus* is uncertain, but the species is known to winter from the west coast of central Mexico to northern South America. The breeding range includes Arizona and adjacent states. In Arizona, *E.t. extimus* breeds very locally along the Colorado River, the Alamo Lake area, at the headwaters of the Little Colorado and San Francisco rivers, along the middle Verde River, at Roosevelt Lake, and along the middle Gila and the San Pedro Rivers. Many of the breeding sites are occupied by five or fewer pairs.

Elevation: 75 - 9,180 feet (23–2798 m)

Population trends: Extreme population reductions noted range wide since 1800's because of habitat loss, though quantitative data are lacking. In the 1993 statewide survey, 23-27 paired males detected. In 1991 and 1992, Grand Canyon flycatchers, using patches dominated by tamarisk and varying in size from 0.08 hectare (0.2 acre), to 0.32 ha (0.8 acre), to 0.63 ha (1.5 ac), declined from 11 pairs in 1986 to present number of 4-5 singing males (3-4 pairs) (Tibbitts and Sogge 1993).

Reasons for decline: Threats to the species include loss and modification of southwestern riparian habitats from urban/agricultural development, water diversion and impoundment, channelization, livestock grazing, tamarisk invasion (Tamarix sp.), parasitism by brown-headed cowbirds and potential threats from pesticides and recreation.

Critical Habitat: On October 19, 2005, the FWS re-designated critical habitat for the SWWF (USFWS 2005). A total of 737 river miles across southern California, Arizona, New Mexico, southern Nevada, and southern Utah were included in the final designation. The lateral extent of critical habitat includes areas within the 100-year floodplain.

Status of Southwestern Willow Flycatcher in the Action Area: Migrant flycatchers have been observed in Arvaca Creek, but there are no known nesting pairs within AVFMP area. In most of the valley there is not a very wide floodplain, water availability, nor the density of vegetation needed for nesting flycatchers. Additional site evaluation may be needed in riparian areas prior to scheduled burns.

Effects of the Proposed Action on the Species: The species is a riparian obligate; Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans. Smoke will likely drift into riparian areas and cause some short-term disturbance. Some burns may go beyond expected boundaries and result in additional suppression efforts.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE SOUTHWESTERN WILLOW FLYCATCHER***. There is no designated critical habitat for the species within the action area.

From: 1) Arizona Game and Fish Department. 2002. Empidonax traillii extimus. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp. See online abstract for full details and references at www.azgfd.gov. 2) General Species Information, USFWS Southwest Ecological Services

Website: *http://www.fws.gov/southwest/es/arizona/Southwest.htm) Federal register/ volume 70, No. 201, October 19, 2005. Designation of Critical Habitat for the Southwesterrn Willow Flycatcher.*

WESTERN YELLOW-BILLED CUCKOO *Coccyzus americanus occidentalis*

Status: Candidate 2002
Description: Long and slender bird with relatively short dark legs. Grayish-brown above, white below; rufous primaries, lower mandible yellow. Bold black and white pattern under the tail. Song sounds hollow and wooden, a rapid staccato *kuk-kuk-kuk* that usually slows and descends to *a kakakowlp-kowlp* ending.
Total Range: Nests from southern Canada through northeastern United States, south through the United States to the Florida Keys, Central America and southern Baja California. Winters in South America to central Argentina and Uruguay (Terres 1980).
Range within Arizona: Southern and central Arizona and extreme northeast.
Biology: Unlike European cuckoo, only occasionally parasitizes black-billed cuckoo nest. Breeding often coincides with outbreaks of cicadas, tent caterpillars. May lay more eggs in good prey-abundant years. Extra eggs may be parasitized in other birds' nests.
Reproduction: Both male and female build nest, often in willow or mesquite thickets, from 4 to 30 ft above ground. Nest is stick platform, thinly lined with leaves, mesquite and cottonwood strips, grass and catkins with little depression to hold eggs. Incubate 3-4 unmarked, pale greenish-blue eggs. Eggs hatch synchronously. Incubation lasts 4-11 days with eggs changing color to greenish-yellow. Young are atricial but leave nest in 7-8 days.
Food Habits: Hairy caterpillars, bird eggs, frogs, lizards, ants, beetles, wasps, flies, berries and fruit. Young fed insect regurgitant.
Habitat: In Arizona, streamside cottonwood, willow groves, and larger mesquite bosques for migrating and breeding preferred. Rarely observed as transient in xeric desert or urban settings. Important for management of riparian habitat known to support cuckoo populations.
Elevation: 90 – 6,710 feet (27-2045 m) in Arizona
Plant Community: Mainly mature cottonwood-willow stands, to a lesser extent willows or isolated cottonwoods mixed with tall mesquites.
Population Trends: Populations extremely reduced. General decline in all areas seems to be occurring. North American Breeding Bird Surveys indicate population declines of 1.6% per year in North America.
Reasons for decline: Riparian habitat has declined up to 90% in Arizona and New Mexico thus negatively affecting this species. Other factors to consider include clearcutting, grazing, and pesticide use in riparian areas.
Status of Western yellow billed cuckoo in the Action Area: According to Game and Fish when they surveyed the Altar Valley drainage in 1999 they found 13 pairs, and 2 single birds. This was during the breeding season. Additional detections in 1998 were 4 pairs in Arivaca Creek near Arivaca and 2 pairs in Arivaca Cienega (both detected by A. Flesche in June 1998). In 1999 1 pair was found in Arivaca Creek and 2 pairs plus 2 single birds in Arivaca Cienega. The USGS found 8 pairs in Arivaca creek in 1999, 1 pair in Champurrado Wash, 1 pair and 1 single in Lindberg Tank Wash, 1 pair in Penitas Wash, and 2 pairs in San Luis Wash -- all in the Altar Valley drainage.
Effects of the Proposed Action on the Species: Riparian obligate. Riparian areas not targeted for burns. Smoke effects. Burn may go beyond expected boundaries. Depends on timing of burns. Mesoriparian woodlands are not a common habitat feature in the action area and will not be included in any prescribe burn plans.

CONCLUSION: After considering the known information on the distribution and habitat requirements of the species and the distribution of potential habitats within the project area, it is my determination that the proposed action: ***MAY AFFECT, BUT IS NOT LIKELY TO ADVERSELY AFFECT THE YELLOW-BILLED CUCKOO***.

From: 1) Arizona Game and Fish Department. 2002. Coccyzus americanus occidentalis. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ.5 pp. See online abstract for full details and references at www.azgfd.gov.
2) General Species Information, USFWS Southwestern Ecological Services Website: http://www.fws.gov/southwest/es/arizona/Yellow.htm.

GENERAL EFFECTS OF THE ACTION

Some temporary disturbance will occur during fire and until recovery of forage species for wildlife occurs. Short term effects include the potential increase of exotic Lehmann lovegrass within the grassland habitats in the valley, ash flow into riparian areas and tanks, direct los of individuals to heat, flame or smoke; erosion, damage from fire implementation activities (staging areas, fire lines, camps), predation from loss of cover. These effects are expected to be short term and rapidly diminish after the first growing season. Long-term benefits include improved watershed condition, control shrub invasion, maintenance of grassland habitat. The application of prescribed burning should help to restore portions of the ecosystem and improve wildlife habitat diversity. However, an undesired effect may be increased Lehmann lovegrass stands that support higher fuel loads, more intense heat and can burn more often than native grasslands, with the potential result of higher mortality of Pima pineapple cactus and habitat alteration.

Indirect effects of prescribed burning and associated livestock range conservation practices should consist of increased herbaceous vegetation (forage) and cover resources for wildlife species.

The AVFMP includes monitoring and an adaptive management program that allows the AVFMP to adjust to new information and to do so as outlined by the regulatory requirements. It also provides Altar Valley ranchers a clearly defined process that will remain predictable over the life of the plan. If Arizona State Land Department, Division of Forestry fire management policy changes or is amended in the future, the Altar Valley Fire Management Plan will amended to reflect those changes

CUMULATIVE EFFECTS

AV has experienced high levels of illegal immigration and drug smuggling activity over the last few years resulting in disturbance to wildlife through human presence, litter, increased number of foot trails, vandalism and other use of resources. The actions of the U.S. Border Patrol have also increased in response to this increase in activity.

Recreation on federal, state & private lands has increased dramatically over the last decade, including a high increase in the off-road use of ATVs. These activities increase erosion, fragments habitat by adding trails, increases disturbance to wildlife and increases risk of unplanned wildland fires.

In addition to AVFMP burns, the BANWR implements prescribed burns that can have additive

smoke and habitat alteration effects.

In addition, the corridor along SR 86 from Tucson, AZ to Three-points, AZ is being developed at an increased rate, in particular the north end of the Altar Valley. This area is likely to be under increased pressure for urban developments in the near future. Developments in this area could increase human disturbance to wildlife and effectively isolate the southern portion of the Altar Valley from the rest of the range of Pima pineapple cactus.