United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona

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Printed on recycled paper - June 2003

Environmental Assessment for Management of Noxious Weeds and Hazardous Vegetation on Public Roads on National Forest System Lands in Arizona

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Abstract

The USDA Forest Service, Southwestern Region, proposes to authorize the Arizona Department of Transportation (ADOT) to use U.S. Environmental Protection Agency-registered herbicides as part of an annual vegetation management program along public roadways that pass through National Forest System lands throughout Arizona. The objectives of the proposal are to (1) contain, control, or eradicate noxious weeds that are spreading from highway and road easements onto adjacent forests and rangelands; and (2) control vegetation that presents safety hazards to drivers using public roadways. Public roadways include interstate highways, Federal highways, and State roads.

The Federal Highway Administration (FHWA) has the authority to approve herbicide use for all or portions of interstates, U.S. highways, and some State highways under U.S. Department of Transportation (USDOT) easements within the boundaries of the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests. Approval by a Forest Service official is required for the proposed use of herbicides on easements not authorized by the FHWA and in a 200-foot strip outside of USDOT easements on each side of and along other public roadways. Treatment of the 200-foot strip could be needed where noxious weed infestations extend outside the road easement. The objective of such a treatment would be to maintain the integrity of a site-specific noxious weed control operation.

Vegetation requiring control involves both native and introduced (exotic) species. Authorization to use herbicides would be provided to ADOT based on an annual work plan with each national forest prior to implementation of annual treatments. This proposal would provide the opportunity for the Forest Service, FHWA, and ADOT to coordinate treatment schedules to provide, to the extent possible, alternate routes of travel for individuals with multiple chemical sensitivity (MCS).

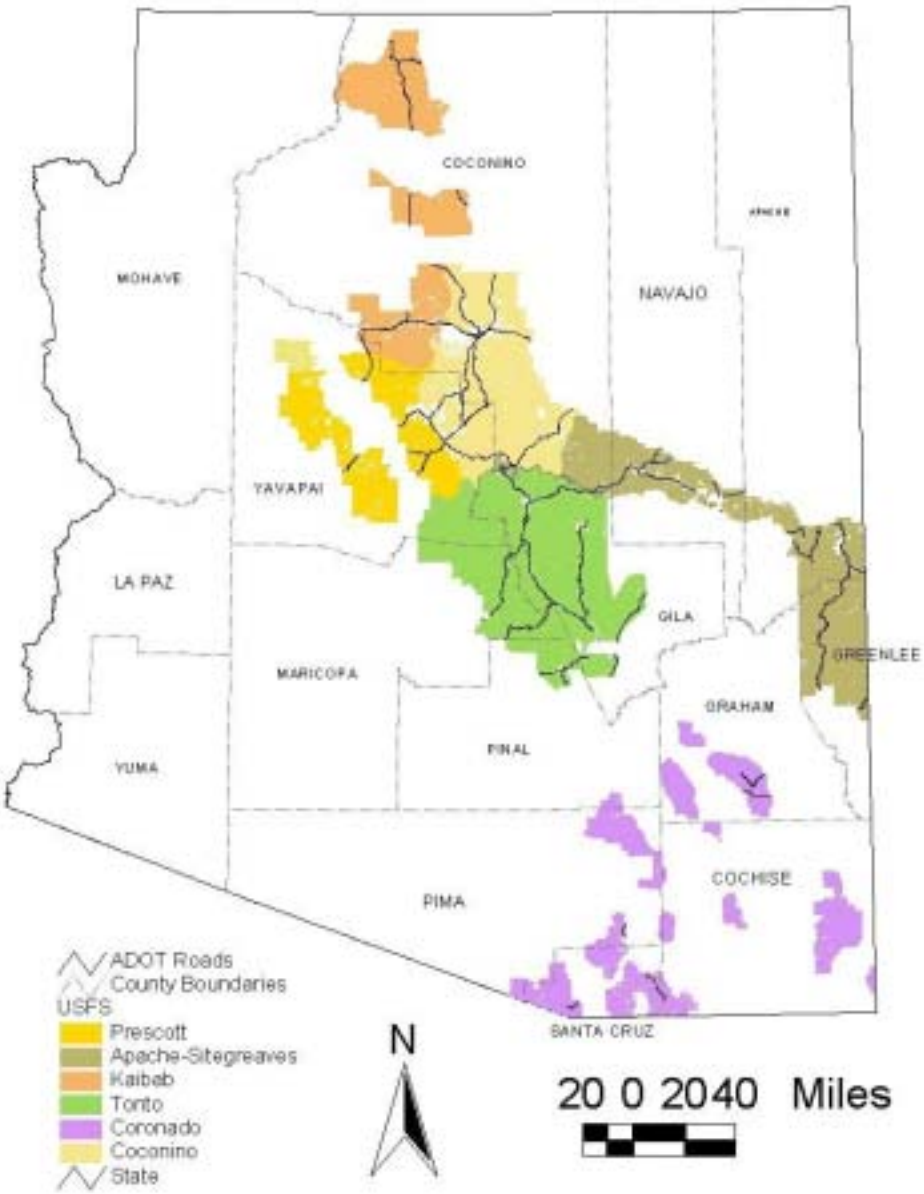
Throughout the State, ADOT has responsibility to manage vegetation along about 6,000 miles of highways, which includes about 378,000 acres of rights-of-way. About 2,700 miles (170,100 acres) pass through National Forest System lands. It is estimated that about 5,000 acres could be treated with herbicides on an annual basis. This is about 3 percent of the total area along and adjacent to these public roadways on National Forest System lands and about 1 percent of the rights-of way statewide. Aerial application of herbicides will not be considered.

This environmental assessment provides an analysis of the major vegetation management considerations and effects to the human environment for national forests throughout the State, including the (1) No Action and (2) Proposed Action alternatives. An adaptive management approach will be used, and decision-making will be focused on desired outcomes, using the best information available.

This environmental assessment is organized as follows:

- Chapter 1 is devoted to identifying the purpose and need for action, public involvement process, and issues identified by the interdisciplinary team;
- Chapter 2 describes the alternatives being considered and mitigations and Best Management Practices for the proposed action;
- Chapter 3 describes the environments comprising the highway system within National Forest System land in Arizona;

- Chapter 4 identifies and assesses environmental effects that may occur for the five issues for the alternatives; and
- Chapter 5 identifies team members, public contacts, reference, glossary of abbreviations, and definitions of terms used in the document.
- Supplemental information and supporting documentation is provided in the Appendices.



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Chapter 1 - Purpose of and Need for Action

Introduction

The Forest Service and cooperating agencies believe there is a need to be proactive in controlling hazardous vegetation and noxious weed and invasive plant infestations along public roadways in Arizona. User safety is a requirement of the Highway Safety Act, and management of vegetation that obscures roadway structures can reduce the risk of vehicle accidents. Noxious weeds and other invasive plant species pose a significant threat to native plant communities and early detection and control of infestations along the sides of roads could prevent them from spreading onto National Forest System lands, adversely affecting resource values and uses.

Public roads are under the jurisdiction of, and maintained by, a public authority and open to public travel (23 U.S.C. 101). Public Road Authorities (PRAs) are those Federal, State, county, town or township, Indian tribe, municipal or other local government or instrumentality thereof, with authority to finance, build, operate, or maintain toll or toll-free highway facilities (23 CFR 460.2(b)). In this proposal, these roads are interstates, U.S. and State highways that cross National Forest System lands. They are further identified by PRA and Forest Service Transportation Atlases as being under State jurisdiction and suitable for passenger car travel.

The presence of healthy plant communities along roadsides and on National Forest System (NFS) lands is considered to be desirable. Most plant communities, especially those composed of native species, stabilize roadside soils against erosion, provide a visible boundary at the pavement edge, and offer aesthetic appeal. However, when plants along roadsides present a hazard to motorists or endanger environmental quality to adjacent National Forest System lands, such as with noxious weeds, Integrated Vegetation Management (IVM) procedures may need to be initiated, including the use of herbicides.

Often, the terms “noxious weed” or “invasive plants” are used to apply to the same plants, but these terms are not considered to be synonymous in this document. Generally, a weed is an unwanted plant that grows or spreads aggressively. An invasive plant is one that grows and spreads rapidly, replacing desirable native plants. Executive Order 13112 defines an invasive weed as an alien species. The term “noxious” has legal ramifications for States that have noxious weed laws or regulations.

Noxious and other exotic weeds are becoming widespread in Arizona. Noxious weed species are abundant along roadways in northern portions of the State, especially on the Coconino and Kaibab National Forests. Elsewhere, non-native weed infestations, such as bufflegrass, are spreading rapidly and the associated adverse environmental effects are a major concern. Movement of plant parts and seeds on vehicles is a substantial means of introduction of new noxious and invasive weed species to Arizona from adjoining states.

Roadside environments are generally harsh sites for native plant life due to soil disturbances during construction, continued soil compaction by vehicles, and a host of other associated disturbances. In some areas, especially in low elevation deserts, frequent fires have modified vegetation along roadways and allowed invasive species, some of which are exotics, to gain dominance. These weeds are generally rapidly growing annual grasses and forbs that are tall and flammable and the hot, dry conditions, common in Arizona, can create an extreme fire hazard that can threaten manmade structures and properties as well as adjacent plant communities. The continued disturbances on the sides of roadways provides an ideal condition favoring the introduction of noxious weed species from seeds or plant parts carried by vehicles, and

infestations can then spread into adjacent forest and rangeland ecosystems. In addition, some native trees, large shrubs, and tall herbaceous plants thrive on disturbed sites along roadways. These plants can decrease sight distance, obscure the view of roadside hazards, and compromise the effectiveness of the roadside recovery area for vehicles (also referred to as the clear zone; see definition section in Chapter 5).

It usually is difficult to visualize the threat from noxious weeds and describe the potential adverse environmental and social effects that can occur. Initially, only a few plants show up in an area and they often go unnoticed. When they are found, most people are unconcerned with the presence of a few plants. Unfortunately, people find the flowers of some noxious weeds to be attractive and some species are used as ornamentals, such as Dalmatian toadflax. People usually are not concerned until weeds become widespread, aggressive, and environmentally damaging. By then, it is often too late to implement effective prevention and eradication programs.

Awareness of noxious weeds and invasive plants has been slowly increasing over the past 30 years, and it has reached a level where more emphasis and funding will be made available to attempt to reduce the threat and impact from these plants. In the 1970s, Federal and State resource managers became concerned about the accelerating rate of spread of undesirable vegetation, especially exotic weeds, in the northern tier of states in the West. At about the same time, the Federal Noxious Weed Act became law in 1974 and was updated in 1990 with the passage of the Food, Agricultural Conservation and Trade Act, commonly called the Farm Bill. The Farm Bill directed Federal agencies to coordinate with State and local governments to contain and control undesirable plant species by directing Federal agencies to develop policy direction. Forest Service Manual 2080 was issued in November 1995 providing direction to agency personnel. In 1998, the Forest Service issued a National Strategy entitled “Stemming the Invasive Tide: Forest Service Strategy for Noxious and Nonnative Plant Management” (USDA FS, 1998). A Southwestern Regional strategy for the “Protection and Restoration of Native Plant Communities” was completed in January 1999. President Clinton signed Executive Order 13112 in February 1999 to mobilize the Federal government, in cooperation with States and others, to address the invasive species problem. The Plant Protection Act, Public Law 106-224, June 20, 2000, supersedes previously mentioned Federal laws concerning invasive plants.

The Forest Service is also directed by Section 302(b) of the Federal Land Policy and Management Act of 1976 to “take any action necessary to prevent unnecessary or undue degradation of the [public] lands” (43 U.S.C. 1732). Supplementing this mandate is Section 2(b)(2) of the Public Rangelands Improvement Act of 1978 in which Congress reaffirms a national policy and commitment to “manage, maintain, and improve the condition of public rangelands” (43 U.S.C. 1711). The regulations for implementing the National Forest Management Act of 1976 (36 CFR Part 219.27 a.3.) also provide direction for control of noxious weeds.

Control of hazardous vegetation along public roads is a requirement of the Highway Safety Act of 1966 and other Federal safety standards. The American Association of State Highway and Transportation Officials (AASHTO) consolidate these standards in “A Policy on Geometric Design of Highways and Streets”. AASHTO is an amalgamation of State and Federal transportation agencies that develop and adopt uniform standards for highway construction, operation, safety, and maintenance. These standards are based on traffic studies, research, and accident statistics and are the minimum criteria used by ADOT to provide for motorist and public safety. Control of noxious weeds and invasive plants is regulated by the Arizona State Noxious Weed Laws (Arizona Administrative Code. Title 3. Chapter 4. Article 2. Rule R3-4-244.

Regulated and Restricted Noxious Weeds, and Rule R3-4-245. Prohibited Noxious Weeds; and Arizona Administrative Code. Title 3. Chapter 4. Article 4. Rule R3-4-403. Noxious Weed Seeds), and Executive Order 13112.

It is easy to visualize how a tree on the side of a road can present a hazard to an errant motorist. To reduce roadside hazards, there is an area immediately adjacent to and parallel with the roadway that is kept free of hazards. This area is called the “clear zone” (reference definition on page 67). Transportation departments manage clear zones by removing vegetation considered to be an impact danger to errant motorists or which could block a driver’s view of things like guardrails, culvert outlets, driveways, road intersections, and wildlife approaching the road.

A requirement of a Public Road Authority vegetation management program is to provide safe highway travel to protect human lives and property. In addition, an important objective is to protect the natural resources along highway corridors. Thus, implementation of right-of-way vegetation management is necessary to:

- protect roadbed and pavement integrity;
- preserve visibility of highway facilities, and wildlife;
- promote road system drainage;
- inhibit ignition and spread of fire;
- maintain designed vehicle recovery areas;
- allow clearance for large vehicles and snowplows;
- promote melting of ice and snow on the road surface by removing trees which shade the road;
- minimize soil erosion and slope instability;
- suppress noxious weeds;
- eliminate damaged vegetation that may fall onto the road surface;
- maintain an attractive roadside appearance; and
- protect landscape plantings.

Need for Action

It has been estimated that noxious and exotic weeds now infest over 100 million acres in the continental United States, with an additional 3 million acres being infested annually. On Federal lands, these weeds are spreading at an average rate of over 5,000 acres per day (Westbrook 1998). The total cost to the U.S. economy is estimated at over $40 billion every year. Without intervention, noxious weed infestations will continue to expand exponentially and environmental and social impacts will intensify annually.

Compared to other Western States, such as Montana and Idaho, noxious weed infestations in Arizona are at a relatively low level, but the potential for spread and the disruption of native plant communities and associated environmental and social impacts are still a concern. Currently, it is

estimated that more than 190,000 acres are infested with noxious weeds on the Coconino, Kaibab, and Prescott National Forests. The heaviest infestations are on the Coconino and Kaibab National Forests, especially along Interstate 40. Noxious weed infestations on the Prescott, Apache-Sitgreaves, Tonto, and Coronado National Forests are at a lower level; however, several species of exotic grasses infest thousands of acres. Excluding exotic grasses, over half of noxious weed infestations in the central and southern portions of Arizona occur along roadways. Importantly, new invasions are expected to occur along roadways through transport of plant parts and seeds attached to vehicles coming from adjoining states.

Vegetation along public highways and roads cause several substantial problems and the following aspects are of concern:

Roadbed Integrity: Vegetation growing in pavement, cracks and joints, and on the edge of roads can threaten roadbed integrity. Vegetation in pavement cracks and joints funnels water underneath roadbeds, causing softening and destabilization of the roadbed. Vehicle travel damages these weakened areas, causing potholes to form. Pavement cracks and joints can be enlarged by root growth and frozen water, and they cannot be sealed if vegetation is present. Plants like camelthorn (*Alhagi pseudoalhagi*), which is a noxious weed, have the capacity to grow through up to 6 inches of pavement.

Visibility: Unobstructed views of road features, designated passing zones, road edges, traffic, highway facilities, and wildlife movement are essential to highway safety.

Drainage: Ensuring the drainage of water from pavement areas is critical for suitable tire performance as well as roadbed integrity. Undesirable vegetation along pavement edges can cause ponding of sheet flow on the roadway. Vegetation in drainage ditches can impede water flow, particularly in ditches with gentle grades, and subsequently contribute to ponding in the ditch and on the travelway. Water ponding in the ditch can result in weakened subgrades and pavement failure. Water ponding on the pavement may cause vehicles to hydroplane and drivers may lose control.

Fire Hazard Reduction: Vehicle passengers throwing away burning objects, like cigarettes, can ignite dry vegetation along pavement edges. Catalytic converters on vehicles also can cause fires. Smoke obscures highway visibility, and fires can quickly move to bordering wildlands and threaten homes and other structures. Fuel loads and the potential for fire spread vary depending on climate and vegetation type. Exotic grasses in the Sonoran Desert are especially subject to burning and resulting fires can favor the formation of monotypic (pure) stands of such grasses, which could permanently modify desert plant communities.

Designed Vehicle Recovery Areas (Clear Zones): This is the immediate area along the side of a road, including the shoulder, available for recovery of an errant vehicle. The width of this area varies depending on the design speed for the road, road curvature, steepness of slopes, and environmental considerations. Recovery areas are intended to be clear of: (1) individual trees with a diameter greater than 6 inches measured 4 inches above the surrounding ground; (2) small trees or other woody vegetation with multiple trunks that have a combined cross section greater than 28 square inches when they are less than 8 feet apart; (3) large rocks that are loose and over 4 inches in height; and (4) solid tree stumps over 6 inches in diameter and over 4 inches in height, etc (Highway Safety Act and other safety standards, see page 2). Essentially, any object in a recovery area can be considered to be hazardous if it could cause a

vehicle to abruptly stop, cause penetration of the passenger compartment, or cause a vehicle to become unstable resulting in a spin, vault, or rollover.

Clearance: Branches from trees and shrubs can encroach into the space above travelways thereby impeding the space required for safe passage of trucks and other large vehicles. Snowplows operating along road edges often require even greater clearance of vegetation to ensure adequate safety during snow removal operations.

Snow and Ice Melt: Trees and tall shrubs in forested areas can substantially reduce the amount of thermal energy reaching the road surface in winter. The resulting patches of ice and snow present a significant safety hazard to motorists.

Control of Erosion: Native vegetation plays an important role in protecting soils from erosion. Soil erosion along roadways can adversely affect aquatic ecosystems through sedimentation. Sediments can accumulate on roadways and clog drainage facilities. Extreme erosion can induce instability in cutbanks and fills, raising the risk of slope failure during wet periods. Several of the exotic plants have taproots, and solid stands of such plants can intensify soil erosion on the road shoulder causing small erosion channels that can pose a safety problem. Maintaining soils stability is especially important when overstory trees are removed for forestry and safety purposes.

Control of Noxious Weeds: Federal and State regulations require control of designated noxious weeds.

Hazard Tree Reduction: Dead or dying trees and large shrubs must be removed if they are an immediate threat of falling in the clear zone or onto the roadway or shoulders, either striking vehicles directly or placing an obstacle on the travelway. The hazard is worst during windstorms, heavy rain, and snow events.

Appearance and Protection of Landscape Plantings: The retention of vegetation along highway rights-of-way, especially native grasses, is beneficial, but some plants must be controlled in order to protect landscape plantings. In addition, some vegetation is considered to be unattractive, such as plants growing in pavement cracks or around highway structures, although most highway managers do not control plants based on their appearance. Insect and disease infested trees within rights-of-way can pose a threat of infestation to adjoining forested areas.

Forest Service officials realize there is a need to better respond to the increasing noxious weed and hazardous vegetation problems in Arizona. Since roadways are a primary factor influencing the introduction of noxious weeds, Agency officials are also concerned about the effectiveness of control options to protect native plant communities and resource values and uses. Further delays that prevent ADOT and other Public Road Authorities from being able to control weeds along roadways will contribute to the rapid expansion of noxious weed infestations and require increasingly larger funding for control. Within the past 15 years, ten species of noxious weeds in the northern part of Arizona have expanded from a few spot infestations along roadways to about 190,000 acres in 2002. These infestations are expected to increase from 8 to 12 percent per year without intervention (USDA Forest Service 1998). In addition, it is reasonable to expect that infestations of new species will be discovered and they could pose an additional threat to resource values and uses.

The opportunity exists to prevent the introduction of noxious weeds, prevent the spread of existing infestations, and eradicate some species that occur on a few acres of roadways. Effective vegetation management programs will reduce weed infestations and protect native plant communities. Any further delay will result in the continued spread of weed infestations and significantly increase the cost of future control work, including a substantial increase in the amount of herbicide that would be necessary to control infestations.

With regard to the safety of the public use roadways within national forests, it would be desirable for ADOT and other Public Road Authorities to have every method available at their disposal, including the use of herbicides, to give them a reasonable opportunity to effectively manage vegetation problems. The National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation, released a report entitled "Traffic Safety Facts 2000, A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting system and the General Estimates System" with the following statistics and study facts for calendar year 2000: Deaths, 41,821; injuries 3,189,000; damaged vehicles, $28 million; lost productivity, $80 billion, property damage, $59 billion; travel delay, $26 billion; medical, $33 billion; and the total monetary loss was $198 billion. About 75 percent of these costs are paid by those not involved in the accidents through higher insurance rates, higher taxes, and travel delays. The cost to each citizen is about $750 per year. The NHTSA found that about 3,000 motorists a year are killed as a result of running off the road and striking a tree, shrub, or clump of brush. Also, safety studies by the Transportation Research Board indicate that about 30 percent of vehicle fatalities are the result of run-off-the-road type accidents involving striking trees, shrubs, or other roadside obstacles or overturning. Even one accident associated with hazardous vegetation can result in a lawsuit of several million dollars for loss of life, injury, and property damage.

The pervasiveness and complexity of the noxious weed and hazardous vegetation situation, combined with the complexity of management, necessitates using an integrated approach. Forest plans are consistent with the general principles of Integrated Pest Management (IPM), but they do not address specific vegetation management strategies, like the use of herbicides, to control vegetation. With regard to methods, IPM and IVM mean the same thing, but IVM is more specific in addressing vegetation. This analysis was necessary because forest plans do not cover herbicide use to manage unwanted vegetation, especially on road rights-of-way.

Roadway managers use a variety of methods to manage vegetation along roadways throughout Arizona. Most methods have been approved. The entire program would be considered as an IVM approach. A description of the various approved methods follows:

Manual Methods: Manual vegetation control involves the use of weed eaters, chain saws, small power mowers, as well as hand tools like hoes, shovels, and pruning shears. Hand pulling of weeds is also a manual control method. Manual control can be effective for shallow-rooted weeds, but this approach is ineffective for deep-rooted species. An advantage of manual control is that it can be performed selectively to remove target weeds, while preserving desirable plants. Disadvantages, relative to what can be accomplished, for manual methods are as follows: (1) they are labor-intensive, and (2) they are extremely expensive.

Cultural Methods: Cultural control refers to the use of organic mulches, such as wood chips, and material coatings, like plastic, to prevent vegetation emergence. Mulching can be effective for controlling herbaceous annual plants, but it is ineffective against aggressive woody perennials. Mulching is most effective in landscape areas, but it is not considered a practical or economical alternative for vegetation control along roadways in national forests.

The use of grazing animals, such as goats or sheep, is another cultural approach, although this technique is not an option on highway rights-of-way because of the danger of animals entering the travel lanes.

Synthetic Herbicides: Outside of National Forest System lands, and within USDOT easements crossing National Forest System lands, Public Road Authorities, like ADOT, use a variety of herbicides to control noxious and invasive weeds using the following approaches:

> **Spot Applications**: Spot techniques consist of various means to apply herbicides manually to individual plants or small clumps of plants. These techniques afford a high degree of selectivity because only specific plants are killed. Surrounding vegetation can be retained to prevent establishment of unwanted plants. Spot treatments are most effective when target plants are low in density and access to the site is not hazardous or difficult. Spot applications along highways can be accomplished with: (1) a truck mounted spray systems; (2) a handgun attached to a truck-mounted or other vehicle-mounted sprayer with up to 200 feet of hose; (3) powered or hand-pump backpacks; (4) granular herbicides placed within the root zone of plants; (5) wick or roller applications; (6) treatment of stumps (recently cut surfaces), trees, or shrubs; and (7) stem injections or hack-and-squirt applications
>
> **Broadcast Applications**: Broadcast application techniques are used to treat weeds over relatively large areas, starting at about a tenth of an acre. These techniques are not selective in terms of the area treated, but they can be selective depending on the plants affected, the type of herbicide used, timing of the application, and the application rate. The primary advantage of broadcast applications is that large areas and many plants can be treated quickly and efficiently. Broadcast applications of herbicide solutions along roadways are made from trucks or trailers carrying a tank and pumping system. These spraying units use varying nozzle arrangements, including downward spraying booms, side-spraying nozzles, and cluster nozzles.

Controlled Burning: Fire can be used to remove flammable fuels, such as stands of annual grasses, to reduce the risk of a wildfire. A single, low intensity fire, however, is usually not effective in controlling most weeds because it does not get hot enough to prevent sprouting from crowns or re-establishment from seeds in the soil. In some situations, fire may create the type of disturbance that promotes the colonization of many weeds. In some instances, prescribed burns can be an effective means of increasing the vulnerability of some weeds, such as bufflegrass, to subsequent herbicide applications.

Grading: Grading is not commonly used as a maintenance approach to control weeds. However, this method can be used to remove vegetation in drainage ditches or other sites where other methods would be infeasible or inadequate. Grading is accomplished by scraping of the soil surface with ridged blades that remove vegetation or move soil. The most frequent use of grading is to remove debris from roadsides that slips from slopes or is moved by other means. On many sites, grading is considered to be undesirable because it creates erosion and waste disposal problems. It is also expensive in terms of labor and equipment, and the visual results are considered to be unattractive. Importantly, grading creates a disturbed area that increases the potential for noxious weed invasion and expansion.

Mowing: The use of rotary and flail mowers, within an IVM plan, can provide another tool to assist roadside managers in maintaining proper vegetation height for line of sight visibility, fire protection, and roadside appearance. A major disadvantage of mowing as an IVM tool, however, is the transportation and spread of seeds and plant parts to adjacent sites, holding areas, maintenance yards, and up and down highway corridors; thus, increasing the spread of weeds encountered during mowing operations.

Tillage: The practice of tilling is most commonly used in a cropland setting, not on highway rights-of-way. Tillage can be effective in controlling some deep-rooted plant species, such as Canada thistle, by conducting repeated tilling every 21 days during the growing season. However, some rhizomatous plants, like leafy spurge, are spread by such tillage applications. Another disadvantage of tillage is that it disturbs the soil, which can provide a favorable environment for noxious and invasive weeds. Also, the approach is not selective and desirable native plants will be removed as well.

Biological Control: Insect and plant pathogens can be used as biological control agents on exotic weed species. Classical biological control seeks to establish a self-sustaining population of control agents that come from the same place of origin as the exotic weed. The goal is not to eradicate the host but to reduce it to a level that is tolerable because elimination of the host would lead to the elimination of the biological control agent. Any release of a biological control agent on National Forest System lands will be based on another environmental assessment approved by the USDA Animal Plant and Health Inspection Service.

Restoration: Maintaining a healthy plant community of desirable plants along roadsides is necessary to offer competition to undesirable weeds and slow their invasion and spread. In some cases, natural seeding of desirable plants will occur, but mechanical or hand seeding is often necessary to establish desirable native plants in the harsh environment along roadsides. Selection of competitive seedling species is an important component of this approach.

A combination of IVM methods, techniques, and practices is needed to achieve vegetation management goals to maintain clear zones and protect native plant communities and natural resources. However, the use of herbicides to control noxious weeds and invasive vegetation has not been approved for roadways on National Forest System lands. Without synthetic herbicides, it may not be possible to achieve effective, economical, and environmentally acceptable management of weeds along roadways.

As with most vegetation management programs, it would be necessary to coordinate roadway treatments with programs being undertaken by other Federal agencies, State and local government agencies, and private landowners. Noxious and invasive weeds are a widespread problem and would require coordinated efforts.

Invasive Plant Infestations

Regulation by State and Federal law is the greatest difference between noxious weeds and invasive plants. Although noxious and invasive plants have similar effects on native plant communities, not all invasive plants have been listed on noxious weeds lists in Federal and State laws or State regulations. This occurs for a variety of reasons, including lack of information about the distribution of the species, differing public opinion about the effects of a species, and lack of proponents to list a species.

Officially listed noxious weeds are inherently invasive. Their ability to establish themselves in a variety of habitats and then quickly dominate an area is the prime reason that noxious vegetation is so problematic. However, invasive plants that are not classified as noxious, and not regulated by law, can and do exist along rights-of-way and other disturbed areas and pose just as serious a threat to natural ecosystems. These species, whether native like the common sunflower (*Helianthus annuus*), or naturalized exotics like Russian thistle (*Salsola kali*) and kochia (*Kochia scoparia*), have the ability to infest roadsides and adjacent lands at the expense of native plants. Other invasive plant species include camphorweed (*Heterotheca subaxillaris*), Russian olive (*Elaeagnus angustifolia*), Johnsongrass (*Sorghum halepense*), and mullein (*Verbascum thapsus).* Just like noxious weeds, most invasive plant species form monocultures that reduce soil stability, destroy the complex structure of native plant communities, and degrade the natural aesthetics of the area. They can infest riparian areas (e.g. saltcedar, *Tamarix ramosissima*), block culverts (e.g. Russian thistle), and obscure highway safety features such as signs, guardrails, and delineators, (e.g. desert broom, *Baccharis sarothroides*).

Because the threat of invasive plants to native ecosystems and public safety rivals that of noxious weeds, Public Road Authorities and their personnel control invasive vegetation in conjunction with noxious weed and hazardous vegetation. This is done with the intention of preventing many invasive plant species from reaching the point of needing government restrictions.

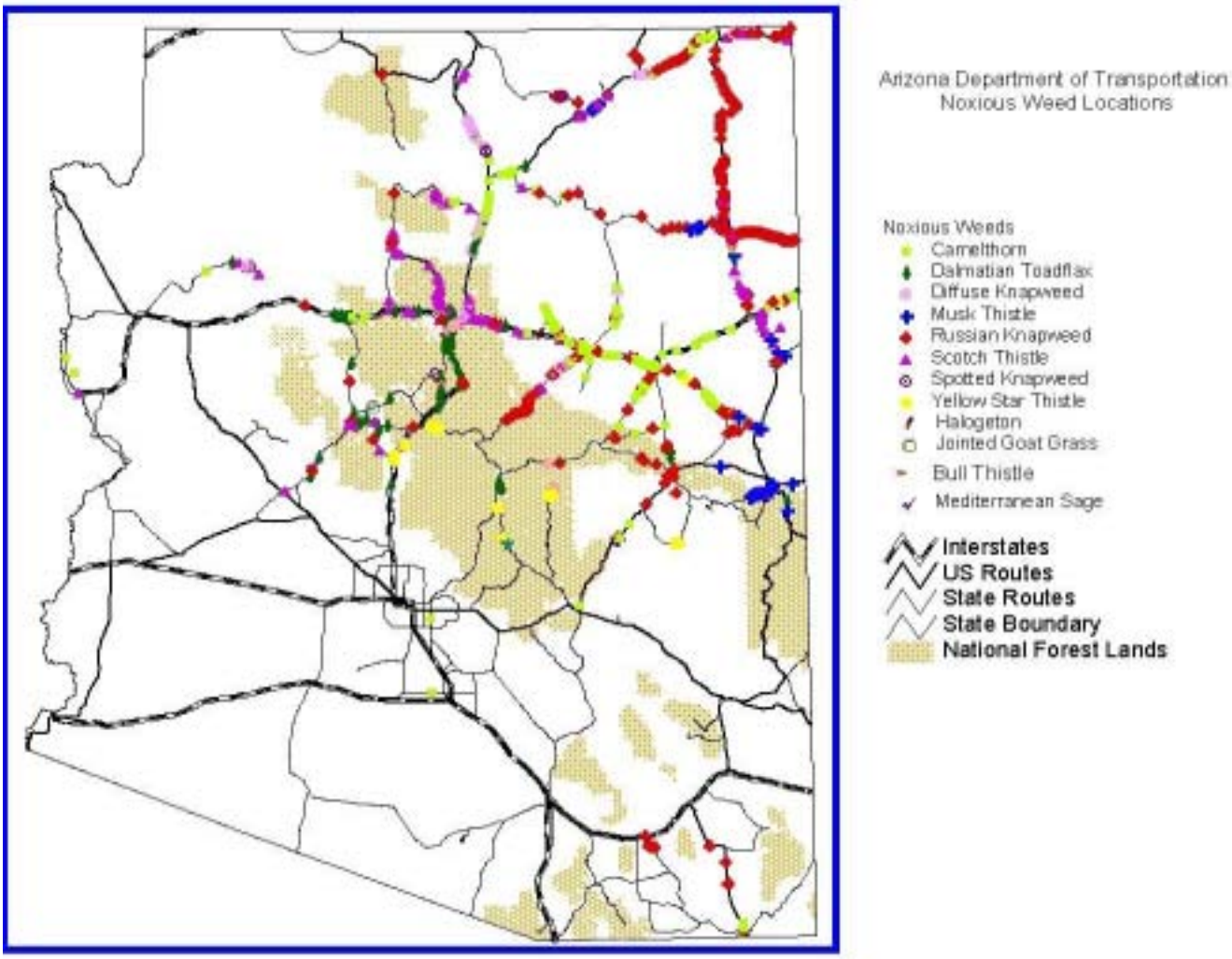

Figure 2. Map showing noxious weed infestations on public roadways in Arizona

Hazardous Vegetation

Hazardous vegetation is any plant that poses a threat to drivers, roads, biotic communities, or adjacent lands. The threat can be in the form of collision hazards, such as vehicles hitting trees that are too close to the road; sight distance impediments, such as drivers being unable to see wildlife approaching the roadway, around curves in passing zones, signs and safety features because of tall vegetation; vegetation encroachment into the travel lanes; fire hazards; and degradation of the roadbed.

Any plant species can be considered hazardous vegetation depending on its abundance and its location in the right-of-way. Those species, such as paloverdes (*Cercidium* spp.), mesquites (*Prosopis spp.*), pines (*Pinus spp.*) etc., that establish themselves immediately adjacent to the road with trunk diameters of 6 inches or greater at a height of 4 or more inches above the ground pose a collision hazard to motorists who lose control of their vehicles. Trees and brush species, like skunkbrush (*Rhus spp.*), that populate the area adjacent to the pavement edge have branches that extend into the roadway, causing drivers to swerve out of their lane to avoid them. Junipers (*Juniperus* spp.), acacia (*Acacia spp.*), Johnsongrass (*Sorghum halepense*), and other tree, brush,

or grass species can be hazardous when they grow in front of and around road signs and guardrails preventing drivers from seeing them. Plants like sunflowers (*Helianthus* spp.) and kochia (*Kochia scoparia*) grow over 6 feet tall. They obscure culverts and safety features such as delineators, guardrails, and signs. Dense stands of any of these species and many others hide the presence of wildlife along the right-of-way. The growth of plants in pavement cracks is very destructive to the roadbed. The roots of plants enlarge these fissures and allow water to funnel under the pavement; thereby undermining the integrity of the roadbed.

Bufflegrass (*Pennisetum ciliare*), a common grass planted for cattle forage in Mexico and southern Arizona; Fountain grass (*Pennisetum setaceum*); and Bermuda grass (*Cynadon dactylon*); escaped landscape plantings and now present a fire hazard on road shoulders and surrounding natural areas. In addition, invasive annual grasses like wild oats (*Avena fatua*) and red brome (*Bromus rubens*), pose an extreme fire hazard in the Sonoran Desert when they infest roadsides. Highway travelers who toss cigarettes out of car windows and those who pull off the pavement along the highway can cause these grasses to ignite and create a wildfire in a habitat unaccustomed to the effects of fire. These fires cause severe damage to the native Sonoran Desert flora and fauna.

Regardless of the species, hazardous vegetation can exist in a variety of places within the right-of-way, from medians and shoulders to guardrails and the pavement itself. Each plant in each location presents a different threat to the safety of motorists, the integrity of the roadbed, and the preservation of native plant communities. Because of the multifaceted danger of hazardous vegetation, control for these plants, whether native, invasive, or noxious, remains a priority for public road authorities.

Proposed Action

The Forest Service proposes to authorize ADOT to conduct annual treatment programs, using EPA approved herbicides, to contain, control, or eradicate noxious, invasive, and native plant species that pose safety hazards or threaten native plant communities on road easements and National Forest System lands up to 200 feet beyond the road easement on the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests.

Herbicides currently being considered for possible use include: Chlorsulfuron, clopyralid, 2,4-D, dicamba, fluroxypyra, glyphosate, imazapyr, imazapic, isoxaben, metsulfuron methyl, pendimethalin, picloram, sethoxydim, sulfometuron methyl, tebuthiuron, and triclopyr.

Decision to be Made

The responsible official is the forest supervisor, Tonto National Forest, who has been delegated the authority to act on behalf of and issue the final decision for all Arizona forest supervisors. Regional foresters are responsible for reviewing and approving or disapproving all proposed pesticide uses on National Forest System lands (FSM 2151.04a). The Regional forester may delegate this authority to other line officers on a case-by-case basis or by supplement to FSM 2151.04a, except for (1) any pesticide use in wilderness, which includes Wilderness Study Areas, and (2) any pesticide use in candidate Research Natural Areas. The completed Environmental Assessment (EA) will provide the responsible official with the basis upon which to make an informed decision. The decision will outline the requirements necessary to authorize the proposed use of herbicides for noxious weed and hazardous plant management. Following a review of the completed EA, the responsible official will decide to do one of the following:

1. Determine if significant environmental impacts would result from implementing the proposed use of herbicides, which would require the preparation of an Environmental Impact Statement, or if there is a Finding of No Significant Impact.

2. Determine if the proposed program, using selected herbicides to manage noxious weeds and hazardous vegetation, has acceptable environmental consequences that, individually or cumulatively, are not considered to be significant (CEQ regulations 1508.27).

3. Do not allow the use of herbicides for management of noxious weeds, invasive plants, and hazardous vegetation.

Adaptive Management and Managerial Flexibility are tools that allow decision makers to take advantage of new information that becomes available after a decision has been made. It is possible that new or improved herbicide products could become available during implementation of this proposal. If implementation monitoring shows that herbicides being used are not effective in meeting the purpose and need for this project, and a new or improved product is available, the new herbicide product could be considered for use without further NEPA analysis. This would be the case only if the new or improved product fits within the same effects analysis disclosure as the herbicides proposed in this document. An analysis would be done to determine the similarities of effects and if the decision would be adapted to include that herbicide product.

Scoping

On May 8, 2002, a scoping letter was sent to 2,088 forest users, private individuals or groups, and county, State, and tribal governments, and other Federal agencies that expressed interest or may be affected by this decision. In addition, public notices were provided in several newspapers, including the Arizona Republic. Through the scoping process, a total of 145 responses were received. After reviewing the public responses, the Interdisciplinary (ID) Team developed five key issues to evaluate the proposed action and develop alternatives. The key issues will be tracked through the remainder of this document. The comments received are included in the project file for this proposal. The key issues, which are further discussed in Chapter 2, are:

Issue 1: The effectiveness of alternatives in controlling noxious weeds, invasive plants, and hazardous vegetation.

Issue 2: Effects of alternatives upon human health (public and workers), including multiple chemical sensitivity (MCS).

Issue 3: Effects of alternatives on non-target native vegetation, including threatened, endangered, and sensitive plants.

Issue 4: Effects of alternatives on non-target aquatic and terrestrial animals, including threatened, endangered, and sensitive animals.

Issue5: Effects of alternatives on water quality.

Issues Beyond the Scope of this Document

Other issues were raised through the scoping process. Each was evaluated by the ID Team and compared against the decision to be made, legal requirements, and Forest Service policy. The following issues were determined to be beyond the scope of this EA:

- Effectiveness and comparative cost of mechanical, manual, and other non-herbicidal techniques. Previous land management decisions allocated National Forest System lands for highway use purposes, including all maintenance activities, except the use of pesticides, for maintaining the roadways and adjacent areas for safe and efficient highway use (FSH 2709.11, Chapters 20 and 30).
- Providing a 5-mile buffer around residences and campgrounds and herbicide free access routes along roadways for those suffering from multiple chemical sensitivity to obtain commodities and services. The Forest Service only has authority within the boundaries of National Forest System lands and roadways outside the boundary could still be treated.
- Use biological control agents to control noxious weeds. Again, this method is authorized by other environmental analyses conducted by the USDA Animal and Plant Health Inspection Service.

Incorporation by Reference

Regulations to implement the National Environmental Policy Act (NEPA) provide for the reduction of bulk and redundancy (40 CFR 1502.21) through incorporation by reference when the effect will reduce the size of the document without impeding agency and public review of the action. The following documents are incorporated by reference to ensure that the most recent information is reflected in this environmental assessment. The conclusions related to human health and effects on non-target organisms are consistent with those identified in the 1992 Risk Assessment.

1. Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4, and 10 and on Bonneville Power Administration Sites (September 1992).
2. 2,4-D — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 24, 2001.
3. Clopyralid — WordPerfect Worksheet for Human Health and Ecological Risk Assessment. USDA Forest Service. November 28, 2001.
4. Selected Commercial Formulations of Glyphosate — Accord, Rodeo, Roundup, and Roundup Pro, Risk Assessment, Final Report. USDA Forest Service. April 25, 1999.
5. Effects of Surfactants on the Toxicity of Glyphosate, with specific Reference to Rodeo. USDA Forest Service. February 6, 1997.
6. Imazapyr — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 30, 2001.
7. Imazapic (Plateau and Plateau DG) — Human Health and Ecological Risk Assessment, Final Report. January 28, 2001.
8. Isoxaben — WordPerfect worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. December 2, 2001.
9. Metsulfuron methyl — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. December 4, 2001.

10. Picloram — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. December 1, 2001.

11. Sethoxydim (Poast) — Human Health and Ecological Risk Assessment, Peer Review Draft. USDA Forest Service. October 31, 2001.

12. Sulfometuron methyl (Oust) — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 23, 2001.

13. Triclopyr Acid (Garlon 3A) — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 23, 2001.

14. Triclopyr-Bee (Garlon 4) — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 23, 2001.

15. Neurotoxicity, Immunotoxicity, and Endocrine Disruption with Specific Commentary on Glyphosate, Triclopyr, and Hexazinone: Final Report. USDA Forest Service. February 14, 2002.

16. Vanquish (Dicamba) — WordPerfect Worksheets for Human Health and Ecological Risk Assessments. USDA Forest Service. November 27, 2001.

Chapter 2 - Alternatives

Introduction

The alternatives are the heart of this environmental assessment, and this chapter describes the activities of both the No Action and the proposed alternatives. These alternatives will be evaluated against the issues identified in Chapter 1 with respect to the affected environment described in Chapter 3 providing a clear basis for choice among the options for the decision maker and the public. This chapter displays the two alternatives developed in response to the public comments received and issues identified by the Interdisciplinary Team. Additional alternatives were identified through the analysis process, but they were later eliminated because they were outside the scope of the proposed action, irrelevant to the decision to be made, or conjectural and not supported by scientific or factual evidence. This chapter also contains mitigation measures and Best Management Practices developed for each of the alternatives to address significant issues.

Alternative 1 – No Action

Intent: No action would be taken to use any herbicide to control hazardous vegetation and noxious weeds and invasive plants along public roadways that are within the boundaries of National Forest System lands in Arizona and under the approval authority of Forest Service officials.

Under this alternative, ADOT and other Public Road Authorities would continue to implement annual herbicide treatment programs on about 6,000 miles of roadways outside National Forest System lands and U.S. Department of Transportation (USDOT) easements crossing National Forest System lands. The Federal Highway Administration has the authority to approve herbicide use within rights-of-way for USDOT easements crossing national forest lands. Prior to herbicide applications within USDOT easements, FHWA consults with the Forest Service. These applications are normally done on a project-by-project basis and do not involve annual maintenance treatments. Also, control of existing weed populations, using mechanical, manual, and site rehabilitation, is already authorized and would continue. ADOT's vegetation management projects would occur within the existing USDOT easement. The USDA Forest Service would continue to manage lands adjacent to the easement in accordance with established policies and procedures.

Principal Activities of the No Action Alternative

Roadway managers currently use a variety of methods to manage vegetation along roadways throughout Arizona. These techniques for control of hazardous and noxious vegetation are considered components of an Integrated Vegetation Management (IVM) approach. These activities would continue if the No Action Alternative were selected. Descriptions of the various methods follow.

Manual Methods

Manual vegetation control involves the use of weed eaters, chain saws, small power mowers, as well as hand tools like hoes, shovels, and pruning shears. Hand pulling of weeds is also a manual control method. Manual control can be effective for shallow-rooted weeds, but this approach may not be effective for controlling deep-rooted species. An advantage of manual control is that it can be performed selectively to remove target weeds, while preserving desirable plants. Disadvantages relative to what can be accomplished for manual methods are that they are labor-

intensive and extremely expensive. ADOT would use mechanical vegetation control as appropriate to control hazardous and noxious vegetation.

Mechanical Methods

Mechanical vegetation control methods utilized by roadway managers follow:

Mowing: The use of rotary and flail mowers within an IVM plan can provide another tool to assist roadside managers in maintaining proper vegetation height for line of sight visibility, fire protection, and roadside appearance. One disadvantage of mowing is the scattering and transport of seeds and plant parts to surrounding sites, holding areas, maintenance yards, and up and down highway corridors, thus, potentially increasing the spread of these species.

Tillage: The practice of tilling is most commonly used in a cropland setting, not on highway rights-of-way. Tillage can be effective in controlling some deep-rooted plant species, such as Canada thistle, by conducting repeated tilling activities every 21 days during the growing season. However, some rhizomatous plants, like leafy spurge, are spread by these tillage applications. Another disadvantage of tillage is that it disturbs the soil, which can provide a favorable environment for noxious and invasive weeds. Also, the approach is not selective and desirable native plants may be removed as well.

Grading: Grading is not commonly used as a maintenance approach to control weeds; however, this method can be used to remove vegetation in drainage ditches or other sites where other methods would be infeasible or inadequate. Grading is accomplished by scraping of the soil surface with ridged blades that remove vegetation or move soil. The most frequent use of grading would be to remove debris from roadsides that slips from slopes or is moved by other means. On many sites, grading would be considered to be undesirable because it creates erosion and waste disposal problems. It would also be expensive in terms of labor and equipment, and the visual results are considered to be unattractive. Importantly, grading would create a disturbed area that increases the potential for hazardous and noxious weed invasion and expansion.

Cultural Methods

Cultural control refers to the use of organic mulches, such as wood chips, and material coatings, like plastic, to prevent vegetation emergence. Mulching can be effective for controlling herbaceous annual plants, but it is ineffective against aggressive woody perennials. Mulching is most effective in landscape areas, but it is not considered as a practical or economical method for roadside vegetation control along roadways on national forests. The use of grazing animals, such as goats or sheep, is another cultural approach, although this technique is not an option on highway rights-of-way because of the danger of animals entering the travel lanes. Controlled burning of hazardous and noxious plant species and revegetation projects would be considered cultural vegetation management techniques as well. ADOT and other Public Road Authorities would use cultural vegetation control as appropriate to manage hazardous and noxious vegetation.

Controlled Burning: Fire can be used to remove flammable fuels, such as stands of annual grasses, to reduce the risk of a wildfire. However, a single, low intensity fire will not effectively control most weeds because it does not get hot enough to prevent resprouting from crowns or re-establishment from seeds in the soil. Fire may create the type of disturbance that promotes the colonization of many weeds. However, when prescribed burns are coordinated in conjunction with other vegetation management techniques, it can be a very effective means

of increasing the vulnerability and susceptibility of species such as buffelgrass to other methods of control. The NFS must approve a Public Road Authority Burn Plan prior to any burn activities taking place on NFS lands

Restoration/Rehabilitation: Maintaining a healthy plant community of desirable plants along roadsides is necessary to offer competition to undesirable weeds and slow their invasion and spread. In some cases, natural seeding of desirable plants will occur. However, mechanical or hand seeding is often necessary to establish desirable native plants in the harsh environment along roadsides. Selection of competitive seedling species is an important component of this approach.

Synthetic Herbicides

Public Road Authorities like ADOT use a variety of herbicides to control hazardous and noxious plant species. On USDOT easements through Forest Service lands, ADOT would apply chemicals as authorized by FHWA through coordination with the Forest Service on a project-by-project basis to control hazardous and noxious vegetation. Chemical herbicide applications would not occur outside the existing USDOT rights-of-way. ADOT would apply herbicides using the following approaches:

Spot Applications: Spot techniques consist of various means to apply herbicides manually to individual plants or small clumps of plants. These techniques afford a high degree of selectivity because only specific plants are killed. Surrounding vegetation can be retained to prevent establishment of unwanted plants. Spot treatments are most effective when target plants are low in density and access to the site is not hazardous or difficult. Spot applications along highways can be accomplished with: (1) a truck mounted spray systems; (2) a handgun attached to a truck-mounted or other vehicle-mounted sprayer with up to 200 feet of hose; (3) powered or hand-pump backpacks; (4) granular herbicides placed within the root zone of plants; (5) wick or roller applications; (6) treatment of stumps (recently cut surfaces), trees, or shrubs; and (7) stem injections or hack-and-squirt applications.

Broadcast Applications: Broadcast application techniques would be used to treat weeds over relatively large areas, starting at about a tenth of an acre. These techniques are not selective in terms of the area treated, but they can be selective depending on the plants affected, the type of herbicide used, timing of the application, and the application rate. The primary advantage of broadcast applications is that large areas and many plants can be treated quickly and efficiently. Broadcast applications of herbicide solutions along roadways are made from trucks or trailers carrying a tank and pumping system. These spraying units use varying nozzle arrangements, including downward spraying booms, side-spraying nozzles, and cluster nozzles.

Monitoring

ADOT natural resource planners currently review IVM projects on an individual basis. The planners develop site-specific mitigation for natural and cultural resources that may potentially be impacted by vegetation management activities. Natural resource managers and field personnel will then implement mitigative measures. Mitigation is developed to reduce potential impacts to threatened and endangered species, sensitive habitats, and other non-target plant and animal species. Cultural resources and public concerns may also be addressed. Mitigation for ADOT'S IVM may include reviewing the EPA's *Office of Pesticide Programs Endangered Species Bulletin* to identify listed species that may be susceptible to

vegetation management activities utilizing chemicals. The EPA's recommended mitigative measures will be implemented to avoid known locations of threatened and endangered species. Furthermore, mitigation will require coordination with the Forest Service prior to spraying activities taking place on NFS lands. All chemical herbicides shall be applied according to label directions by certified applicators, and a toll free number will be maintained for members of the public to provide updated notification of herbicide application activities and locations.

ADOT Natural Resources Management Section personnel monitor the Level of Service (LOS) provided to rights-of way through an annual review of operational activities in conjunction with visual inspections of all ADOT rights-of-way. Natural resource personnel record the occurrence of hazardous and noxious vegetation observed within the transportation easement during the annual statewide LOS survey. ADOT natural resources managers then use the LOS data to develop a work plan for each region. This LOS monitoring would identify areas in need of vegetation management within rights-of-way crossing Forest Service lands in Arizona, and provide feedback to Natural Resources Managers as to the success of the previous years' vegetation management activities.

All national forests in Arizona are currently conducting environmental analyses for management of noxious weeds on rangelands, forested areas, riparian areas, wilderness areas, and forest roads and trails. Following completion of these analyses and a decision by responsible officials, treatments could be implemented, including the use of herbicides. As a result of the aforementioned analyses, the treatment of noxious weed infestations that extend from rangelands or forests into road right-of ways could begin in 2003.

Alternative 2 - Proposed Action

Intent: The Forest Service, in cooperation with the Federal Highway Administration (FHWA), Arizona Division, proposes to authorize the Arizona Department of Transportation to treat hazardous vegetation, noxious weeds and invasive plants with 16 herbicides along public roadways on National Forest System lands throughout Arizona.

This alternative would involve the ground application of 16 registered herbicides through the use of power sprayers and other ground equipment. There would be no aerial application of herbicides. It is estimated that no more than 5,000 acres would be treated annually along about 2,700 miles of interstate highways, U.S. highways, and State routes within the boundaries of 6 national forests: Apache-Sitgreaves, 500 acres; Coconino, 1,500 acres; Coronado, 500 acres; Kaibab, 500 acres; Prescott, 1,000 acres; and Tonto, 1,000 acres.

This alternative would provide the opportunity to effectively and economically control noxious weeds, invasive plants, and hazardous vegetation. Since undesirable plants are often spread by human activities, especially via vehicles and roads (Roche and Roche 1991), this alternative would provide for early identification and treatment of new noxious weed infestations. Noxious weeds pose a significant threat to native plant communities in Arizona, and this alternative would augment potential noxious weed control efforts on adjacent NFS lands. Also, one focus of this alternative involves the long-term management of noxious weeds. It is anticipated that most noxious weed infestations require many years of treatment until the seed bank in the soil is depleted.

User safety on public roadways is a maintenance priority of ADOT and a requirement of the Highway Safety Act. This alternative is considered the best approach to meet this priority. When roadside vegetation becomes hazardous, there is a substantial increase in the potential accident risk for drivers, and about 30 percent of accidents are run-off-the-road type accidents involving a tree strike or another object near the roadway. Vehicle accidents result in substantial loss of life, mental anguish, physical suffering, and property damage. In Arizona, accidents result in an estimated economic loss of almost three billion dollars each year.

Herbicides proposed for use in this alternative include chlorsulfuron, clopyralid, 2,4-D, dicamba, fluroxypyr, glyphosate, imazapic, imazapyr, isoxaben, metsulfuron methyl, pendimethalin, picloram, sethoxydim, sufometuron methyl, tebuthiuron, and triclopyr. These herbicides are marketed under a variety of trade names (Table 13, page 86). The U.S. Environmental Protection Agency (EPA) has registered all of the herbicides being considered for use and the various product labels include requirements and restrictions.

Herbicides are categorized as selective and non-selective. Selective herbicides can kill certain groups of plants and have little or no effect on other plants. For example, clopyralid is a selective herbicide that can kill certain broadleaf plants, but grass species are especially tolerant of this compound. In addition, certain herbicides can be selective depending on the amount and application technique used. For example, spotted knapweed can be controlled with less picloram than is needed to control leafy spurge. In this instance, the lower amount of picloram used to control spotted knapweed will have less impact on non-target broadleaf plants. Picloram, dicamba, and 2,4-D are all auxin-type compounds that affect the growth of plants and are selective for broadleaf plants, making them effective tools in some environments for controlling weeds while maintaining grasses and conifer trees. On the other hand, glyphosate and sethoxydim are non-selective herbicides and can kill a broad spectrum of plants, including monocotyledons and dicotyledons. Care must be taken when broad-spectrum herbicides are considered for use around desirable, non-target plant species, especially those that are considered to be sensitive or rare.

There is considerable variation in the persistence of herbicides in soil. Some materials can remain active for over a year while other compounds break down in a few days. Long-term persistence in soil can be a beneficial trait for control of plants, like Scotch thistle, after seed set. The residual herbicide in the soil can prevent development of the next generation of plants arising from the seed bank. Tebuthiuron can remain viable for more than a year, depending on weather and soil conditions, and this herbicide could be one choice for a hard-to-kill species like camelthorn, especially at locations where there are no concerns of this herbicide moving in soil or where non-target vegetation could be affected. Glyphosate, 2,4-D, dicamba, sethoxydim and fluroxypyr are short-lived herbicides that remain in the soil for less than a month.

Table 1. Persistence (average half-life) in soil for the herbicides proposed for use (Vencill 2002).

Herbicide	Persistence in Soil
2,4-D	10 Days
Chlorsulfuron	40 Days
Clopyralid	40 Days
Dicamba	Less than 14 Days*
Fluroxypyr	11-38 Days
Glyphosate	47 Days
Imazapic	120 Days
Imazapyr	25-142 Days*
Isoxaben	50-120 Days
Metsulfuron methyl	30 Days
Pendimethalin	44 Days
Picloram	90 Days*
Sethoxydim	5 Days
Sulfometuron methyl	20-28 Days
Tebuthiuron	Over 360 Days*
Tricolpyr	30 Days

*May persist significantly longer under conditions of low moisture and rainfall and soil types.

All of the herbicides proposed for use in this alternative, except for 2,4-D, are classified by the U.S. Environmental Protection Agency as slightly toxic (Category III) to almost non-toxic to humans (Category IV). However, 2,4-D is rated moderately toxic (Category II), but the use of protective equipment and following safety procedures will reduce the risk to applicators. It should be understood that humans and plants have different metabolic pathways, and a compound that is toxic to plants can be relatively non-toxic to humans. The same concept applies to animals and insects.

Table 2. Categories of acute pesticide toxicity and the associated signal word (Miller 1997)

Category	Signal word Required on Label	LD50		LC50 Inhalation Mg/l	Approximate Oral Dose That Can Kill an Average Person
		Oral Mg/kg	Dermal Mg/kg		
I Highly Toxic	DANGER-POISON!	0 to 50	0 to 200	0 to 0.2	A few drops to 1 teaspoon [or a few drops on the skin]
II Moderately Toxic	WARNING!	50-500	200-2,000	0.2 to2	Over 1 teaspoon to 1 ounce
III Slightly Toxic	CAUTION!	500 to 5000	2,000 to 20,000	2.0 to 20	Over 1 ounce to 1 pint or 1 pound
IV Relatively Nontoxic	CAUTION!	More than 5,000	More than 20,000	Greater than 20	Over 1 pint or 1 pound

Table 3. Relative acute toxicity and toxicity category of herbicides and common household compounds (Vencill 2002)

Common Name or Designation	Oral LD50 for Rats (mg/kg)	Toxicity Category
2,4-D	375	II
Chlorsulfuron	> 5,000	IV
Clopyralid	> 5,000	IV
Dicamba	> 5,000	IV
Fluroxypyr	> 2,000	III
Glyphosate	> 5,000	IV
Imazapic	> 5,000	IV
Imazapyr	> 5,000	IV
Isoxaben	> 10,000	IV

Common Name or Designation	Oral LD50 for Rats (mg/kg)	Toxicity Category
Metsulfuron methyl	> 5,000	IV
Pendimethalin	> 5,000	IV
Picloram	> 5,000	IV
Sethoxydim	> 2,600	III
Sulfometuron methyl	> 5,000	IV
Tebuthiuron	644	III
Triclopyr	> 1,500	III
Aspirin*	750	III
Caffeine*	200	II
Ethyl alcohol *	13,700	III
Sugar *	30,000	IV
Table salt*	3.320	IV

*Included for comparison

A more detailed description of each herbicide proposed for use follows (Reference Table 13, page 74, for a list of trade names):

2,4-D: This is one of the most commonly used home and garden herbicides in the United States, and it is one of the most extensively studied. It is a selective, foliar absorbed, translocated, phenoxy herbicide used mainly in post-emergence applications. The action that kills plants mimics natural plant hormones. 2,4-D is effective against many annual and perennial broadleaf weeds. Plants are most susceptible when they are young and growing rapidly. The average field half-life is 10 days. An important utility of 2,4-D is in riparian areas for products with an aquatic label. There are many different brands for sale on the market, such as Weed-Be-Gone, which can be purchased by the public in grocery stores, nurseries, etc.

Chlorsulfuron: This is a selective pre-emergence or early post-emergence herbicide used at very low rates, ½ to 3 ounces per acre. It is in a group of herbicides called sulfonylureas. Its action in plants is described as a rapid mitotic inhibitor. The product on the market is ***Telar***, and it is a dry flowable material that is mixed in water and applied as a spray to control many annual, biennial, and perennial weeds on non-crop sites. It is very soluble in water and mobile; thus, it will not be considered for use in buffer zones near water. It has a soil half-life of 40 days.

Clopyralid: This is a selective, post-emergence herbicide that is mainly used to control broadleaf species in three plant families: composites (Asteraceae), legumes (Fabaceae), and

buckwheats (Polyganaceae). Its selectiveness makes this herbicide a useful material for control of invasive plants like knapweeds while preventing adverse effects to many native species. Grass species are especially tolerant to clopyralid. This herbicide is readily absorbed by roots and foliage and is readily transported in plant tissues. There is some information indicating that clopyralid may be more persistent in compost than soil, but there are no plans to use any compost along roadways as part of this hazardous vegetation management and noxious weed control. The material has moderate persistence, high mobility, and high leaching potential. Thus, it will not be used within designated buffer zones along streams or near water in compliance with label requirements. Available product is ***Transline*.**

Dicamba: Dicamba is a broad spectrum herbicide for broad-leaved plants. It is a growth-regulating herbicide readily absorbed and translocated from either roots or foliage. This herbicide produces effects similar to 2,4-D. It has moderate persistence (half-life in soil under 14 days), high mobility, and high leaching potential. This herbicide would not be used within buffer zones near water or areas identified as shallow and sensitive aquifers. Since it can move in surface runoff, it would not be used where impervious surfaces (compacted earth) exist proximal to water. However, the use of vegetated buffer zones would mitigate the risk of runoff-related contamination to surface water sources. ***Vanquish*** is a dicamba product that is labeled for non-crop situations. Dicamba can be mixed with 2,4-D to increase its effect on certain plants.

Fluroxypyr: The trade name for this product is ***Vista***. This is a broad spectrum, “auxin-type” herbicide. It offers a novel mode of action and is efficacious against many broadleaf and sulfonylurea-resistent weeds. It is a post-emergence herbicide with little soil activity. The compound is systemic and is readily absorbed by the foliage of growing plants and moves throughout the plant. It mimics plant hormones, causing an imbalance of plant growth hormones. The leaching potential is small and the soil half-life is 1-4 weeks.

Glyphosate: This is a non-selective herbicide that controls virtually all annual and perennial weeds, but it is generally most phytotoxic to annual grasses. It works by inhibiting amino acid pathways in plants. These amino acid pathways are not found in animals; thus, this herbicide has relatively low toxicity to humans. The compound is absorbed by foliage, but rainfall within 6 hours may reduce effectiveness. It has no soil activity. Persistence and mobility are low, and the compound tends to adhere to sediments when released into water. ***Roundup*** is the commercial name for the product, and ***Rodeo*** is an aquatically labeled formulation. Since this herbicide kills a broad spectrum of plants, care is needed when it is to be applied within buffer zones along streams to limit adverse effects on non-target plants.

Imazapic: This herbicide also is considered to be non-selective, although the rate and timing of application can provide some selectivity. It destroys weeds by blocking the pathways that produce branch chain amino acids in plants. As with glyphosate, humans and animals do not have such pathways, and the compound has low toxicity to humans. Many native grasses and wildflowers are tolerant of this herbicide at lower rates of application, while annual weedy species are susceptible. This herbicide is particularly effective for control of leafy spurge and perennial pepperweed. The product name is ***Plateau***.

Imazapyr: This herbicide is non-selective and it provides pre-emergence and post-emergence control, including residual control, of a variety of grasses, broadleaf weeds, and woody plants. Half-life in soil ranges from 25-142 days, depending on soil type and environmental

conditions (Vencill 2002). Foliar absorption usually is rapid (within 24 hours). The product name is ***Arsenal***.

Isoxaben: This is a selective herbicide that is applied as a pre-emergent material that requires a light cultivation or at least 1.3 cm of rainfall within 3 weeks of application to be effective. It is readily absorbed into roots from soil by passive diffusion, but penetration into leaves is limited. Significant concentrations of the compound can accumulate in leaves within 3 days following root uptake. Many susceptible weeds fail to emerge following application. Broadleaf weeds generally show stunting, reduced root growth, root hair distortions and root clubbing (Vencill 2002). It works by inhibiting cell wall biosynthesis in susceptible weed species. The leaching potential is slight and the half-life in soil is 50-120 days. The trade name is ***Gallery***.

Metsulfuron Methyl: This is another sulfonylurea herbicide that is primarily absorbed through the foliage. It interrupts a biological process necessary for plant growth. It is a dry flowable that is mixed with water and applied at very low rates (1-3 ounces per acre) for control of a variety of weed species, including such difficult to control species as hoary cress (whitetop, *Cardaria draba*) and perennial pepperweed (*Lepidium latifolium*). It is moderately residual in soil with a typical half-life of 30 days (Vencill 2002). The product labeled for non-crop areas is called ***Escort***.

Pendimethalin: This herbicide provides pre-emergent control of most annual grasses and certain broadleaf weeds as they germinate in any non-cropland site. The formulation is mixed with water and applied to the soil. The active ingredient is absorbed by roots, and it works by inhibiting polymerization of microtubles at the growth end of the tubule; thus preventing the alignment and separation of chromosomes during mitosis. It has little leaching potential and the soil half-life is about 44 days. The trade name is ***Pendulum***.

Picloram:. Picloram is an active ingredient in ***Tordon***, which is the trade name. It is an organic chemical that is a plant growth regulator used for controlling unwanted broadleaf vegetation. Grasses are generally not susceptible to this herbicide. Picloram is considered to be rate-selective, meaning that the plants that can be controlled are dependent upon the rate of application. At one pint per acre, picloram kills knapweeds while leaving many native species unharmed. At one quart per acre for leafy spurge control, this herbicide kills many more plant species. This is the only “restricted use” herbicide proposed for use, and the purchase and application of this compound can only be done under the direction of a certified pesticide applicator with a valid license. The average field half-life is 90 days (Vencill 2002), although it can persist for a longer period of time. Its persistence makes it particularly useful for control of weeds, but it must be used in such a way that it does not contaminate water.

Sethoxydim: This is a selective, post-emergent herbicide used for control of annual and perennial grasses that are considered weeds. It does not control sedges or broadleaf weeds. The compound readily enters the target grass through its foliage and moves throughout the plant. Growth ceases within a few days of application with young and actively growing tissues being affected first. Leaf yellowing and eventual death develops within 1-3 weeks of application. The compound inhibits fatty acid synthesis in target grass species. The half-life in soil is 5 days. The trade name is ***Poast***.

Sulfometuron Methyl: This compound is another sulfonylurea herbicide that has broad spectrum properties. It is a dry flowable material that is mixed with water and is toxic to

target plants at very low rates (1 to 3 ounces per acre). Roots and foliage readily absorb the active ingredient; thus, it is used as a pre-emergent and post-emergent herbicide. The product name is ***Oust.*** Great care is needed to prevent dispersal of this product by wind or water to off-target areas.

Tebuthiuron: This herbicide can be used in pastures, rangelands, and non-crop situations for control of certain broadleaf weeds and woody species. It is persistent in soil with a half-life of 115 months making this compound particularly useful for difficult to control species like camelthorn and woody species. The product name is ***Spike***.

Triclopyr: This herbicide is selective and especially useful for trees and woody shrubs. It acts by mimicking the activity of auxin, a natural growth hormone. The active ingredient is readily absorbed by foliage. Average half-life in soil is 30 days (Vencill 2002). Commercial formulations, ***Garlon 3A*** and ***Garlon 4*** are used for vegetation management programs, and **Renovate 3** is a new aquatic formulation.

Active ingredients in herbicide formulations are defined as the chemicals that actually control the weed. So, imazapic, clopyralid, and the other herbicides discussed earlier in this chapter are active ingredients. Because the water solubility of the some of these active ingredients is too low to feasibly dissolve large amounts in water, other ingredients are mixed with them to create a formulation. Other active ingredients like ester formulations of triclopyr are mixed with vegetable oils and products like limonene, which is a compound needed to move the active ingredient through bark for oil-basal bark applications for plants like saltcedar. These additional chemicals are called “inert ingredients” because they are not toxic to weeds at the designated rates of application (Felsot 2001).

Inert ingredients are identified on the herbicide label as a percentage of the entire formulation weight or volume. For example, the formulation containing imazapyr is called Arsenal. Arsenal is composed of 28.7 percent imazapyr and 71.3 percent inert ingredients. Thus, the majority of this formulation is actually inert ingredients.

Under pesticide law, the specific chemicals and amounts in the inert ingredients is considered proprietary information and they do not have to be identified. However, some manufacturers have released the list of inert ingredients and they have been posted on the Internet.

The Environmental Protection Agency (EPA) has identified about 1,200 inert ingredients that are used in registered pesticides. The EPA reviews existing human health data for inert ingredients including common carriers. The existing data include laboratory studies, epidemiological studies, and activity and structure relationships. EPA categorized inert ingredients into one of four categories:

Level 1 includes inert ingredients of toxicological concern.

Level 2 inert ingredients are potentially toxic and considered of high priority for further testing.

Level 3 inert ingredients are considered of “unknown toxicity.” For these chemicals, the data is insufficient to classify them at a higher level or at a lower level of concern. It must be understood, however, that the chemicals on this list do have some toxicity information, but EPA has not made a decision as to their classification. A number of chemicals on this list are also used in commonly sold consumer products without incident (Felsot 2001). Level 3 inert

ingredients that may be used in herbicide formulations include borax, carbon dioxide, castor oil, jojoba bean oil, orange oil, and coconut oil soap. Bear in mind that inclusion of a chemical on the Level 3 list does not mean the chemical is hazardous when it would be used in a prudent manner.

Level 4 inert ingredients are regarded by the EPA as being generally innocuous. Thus, the EPA indicates there should be no concern relative to adverse effects on public health or the environment when Level 4 compounds are used in herbicide formulations.

Inert ingredients likely to be in herbicide formulations to be used in Arizona include water, ethanol, isopropanol, triethylamine, EDTA (ethylenediaminetetracetic acid), polyglycol non-ionic surfactant, triisopropanolamine, and versene acid. None of these inert ingredients are listed as Level 1 or 2 compounds. The water and alcohols (ethanol and isopropanol) are Level 4 compounds, and all others are listed as Level 3.

The same method used to assess the risk of exposure and effects applied to herbicide active ingredients can be applied to the inert ingredients. The 1992 Risk Assessment for the Southwestern Region provided herbicide carrier profiles for diesel oil, limonene, kerosene, and mineral oil (III-C-90 to III-C-94), although diesel oil and other petroleum hydrocarbons will not be used as herbicide carriers added to tank mixes. However, some herbicide formulations may contain minor amounts of some petroleum hydrocarbons.

Herbicides are widely used for vegetation management because low hazard products are available, they can be safely applied in a variety of terrain, and they can effectively decrease the economic costs of management. Compared to other methods of control, herbicides can provide the highest level of control at the least cost. For example, a study of the cost and efficacy of spotted knapweed management with integrated methods in Montana provided the following results (Brown, et al. 1998): (1) Tordon 22 at one pint per acre, 95 percent control of plants at $30.75 per acre; (2) mowing, no plant control at $200 per acre; (3) hand-pulling, 25 percent control plants at $13,900 per acre. The average costs per acre for various vegetation control methods shown in Table 4 were provided by ADOT.

Table 4. Average cost for various vegetation control methods (ADOT)

Activity Description	Cost Per Acre	Cost Per Tree
ROW Herbicide (Large Truck, Spot Application)	$24.01	
ROW Herbicide (Large Truck, Broadcast)	$24.28	
Herbicide (Pre-Emergent Application)	$37.39	
Herbicide (Off-Road Truck)	$37.83	
ROW Herbicide (Small Truck, Spot Application)	$45.31	
Herbicide (Hand Application of Dry Products)	$71.82	

Activity Description	Cost Per Acre	Cost Per Tree
Herbicide (Off-Road, Hand Wand)	$87.03	
Herbicide (Small Truck, Safety Features)	$97.94	
Herbicides (Hand Application, Liquids)	$151.93	
ROW Mowing (Native Vegetation)	$59.87	
Mowing (Standard Swath)	$60.95	
Prescribed Burning	$60.81	
Mechanical Tree and Brush Removal	$177.23	
Hand Tree and Brush Removal	$195.84	
Mechanical, Tumbleweed Disposal	$334.17	
Mechanical Removal of Large Trees		$46.25

Mitigations and Best Management Practices

The application of herbicides is tightly controlled by State and Federal agencies. The Forest Service is required to follow all State and Federal laws and regulations applicable to the application of herbicides. The following mitigation measures will be followed if herbicides are used:

- All herbicide label requirements would be followed.
- All applications would be under the direction of a Certified Pesticide Applicator.
- Herbicides would be applied only by ground-based equipment, including backpack sprayers, and spray units on ATVs, trucks, etc.
- All Best Management Practices (BMPs) would be followed
- Clopyralid, dicamba, picloram, and the sulfonylurea herbicides would not be used where the water table is within 6 feet of the surface or where soil permeability would be conducive to water contamination.
- Glyphosate, and amine formulations of 2,4-D and triclopyr are currently labeled for aquatic use and would be the materials used within designated buffer zones along streams and bodies of water (1992 Risk Assessment, pages III-F-32 and 39). Imazapic, imazapyr, and triclopyr could be used in buffer zones as long as they would not be directly applied to water.
- Applicators would be required to wear appropriate personal protective equipment as required on the label.
- All requirements in a Safety and Spill Plan (Appendix B) would be followed.

- The public would be able to access ADOT's timing and location of treatments along roadways by calling the following toll free number 1-800-546-6591.

When any herbicide is applied, best management practices (BMPs) should be used to ensure maximum safety (Felsot, 2001).

Pre-spray BMPs

- Determine the necessity for weed management by scouting the area for weed density.
- The Forest Service recognizes the significance of protecting Native American ethno-botany locations, and each forest will coordinate and consult with interested tribes to protect the integrity of sites where native plants may be collected.
- Use herbicides only when they will provide the most effective control relative to the cost and potential hazard of other management techniques.
- Choose the most effective herbicide that requires the least number of applications.
- Choose the lowest effective rate of application.
- Scout the area and identify sensitive situations like residential structures, campgrounds that will be used by the public, etc.
- Survey any suitable habitat for threatened, endangered, or sensitive species to find any previously unknown populations.
- Plan to leave an appropriate buffer zone (at least 30 feet on relatively level ground) around bodies of water, and adjacent sensitive areas, and populations of threatened, endangered, or sensitive species. Buffer zones will be marked as needed to guide herbicide applicators.

Herbicide Spraying BMPs

- Ensure meteorological conditions are favorable.
- Highway right-of-ways are closed areas to the pedestrian public, and it is illegal to stop on the highway except in emergency situations.
- Post informational signs at designated pullouts and rest areas and place signs on spray vehicles listing the herbicide being used.
- Use the lowest pressure, largest droplet size, and largest volume of water permitted by the label to obtain adequate treatment success.
- Use the lowest spray boom and release height possible consistent with operator safety.
- Spot applications of triclopyr, glyphosate, imazapic, and imazapyr could be done to the edge of some bodies of water in compliance with label requirements.
- Broadcast applications of glyphosate and other broad spectrum herbicides would not be considered where threatened, endangered, and sensitive plant species are known to occur.

- Buffer zones will be marked around any populations of threatened, endangered, and sensitive (TES) plant species, and undesirable plant control in buffer zones will include spraying with selective herbicides that will not affect the TES plants, or spot applications of individual weeds with backpack sprayers, daubing, or hand grubbing with no herbicide use.
- Require all herbicide applicators to use appropriate personal protective equipment (PPE).
- Only those herbicides labeled for use to the edge of bodies of water or with aquatic labeling shall be used within buffer zones and aquatic situations.

Herbicide Post-Spray BMPs

- Periodically scout treated areas to assess efficacy.
- Monitor populations of threatened, endangered, or sensitive species to ensure there were no adverse effects.

Alternatives Considered but Eliminated from Further Study

Eliminate the Use of 2,4-D: Consideration was given to eliminating the use of this herbicide along roadways within National Forest System lands to allow roadway access for individuals with MCS opposed to its use. This alternative was not considered in detail for several reasons: 2,4-D is one of the most commonly used agricultural and home and garden products in the United States, and anyone driving along a roadway through an agricultural area or a community could experience some level of exposure, albeit a very minimal amount. Second, this product, along with triclopyr and dicamba, is one of the most commonly used herbicides to selectively control weeds in road right-of-ways outside national forests in Arizona. Also, 2,4-D applications are already being done within the boundaries of national forests along roadways under the authority and approval of the Federal Highway Administration. As a result, restricting the use of this herbicide on roadways within national forests could not realistically provide 2,4-D-free access routes for public roadways in the State. However, it should be noted that the Forest Service would coordinate with Public Road Authorities on an annual basis, under the proposed action for this environmental assessment, to provide, to the extent possible, alternate access routes when herbicides would be proposed on and off National Forest System lands. Interested individuals can determine treatment schedules for roadways under ADOT jurisdiction by calling the toll-free number (1-800-546-6591). Finally, environmental analyses for noxious weed control are currently underway on all national forests in Arizona, and 2,4-D is being proposed in every instance. Currently, 2,4-D is one of the most commonly used herbicides for noxious weed control in the West due to its selectivity. In addition, 2,4-D products are registered for aquatic weed control, and this is another important reason for maintaining it as a viable option for control of noxious weeds along rights-of-way when they occur near streams, lakes, or in riparian areas.

Provide No Spray Buffers Around Homes (5-10 mile radius): Since this environmental analysis only addresses the use of herbicides on National Forest System lands, the Forest Service would have little, if any, influence over herbicide applications that could be done on private lands where homes are located. Herbicide spraying of roadways outside national forests, which is outside the scope of this analysis, would be proximal to communities and homes for people with MCS. Additionally, private homeowners often use herbicides. Therefore, the establishment of no spray buffers on National Forest System lands adjacent to private lands would have little effect in preventing potential herbicide exposure of people with MCS. In addition, it also is well known

that sites most prone to the spread of noxious weeds are along travel routes for people. The effectiveness of proposed weed management programs on National Forest System lands would be seriously compromised through the use of no spray buffers around communities. For these reasons, this alternative was not considered in detail.

Use Vinegar, Salt, Boiling Water, or Steam to Control Weeds: It would be illegal to use salt, vinegar, or similar compounds to control weeds. Any chemical that is used to effect, retard, or kill a living organism must have a pesticide label, in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act. The use of boiling water or steam was not considered in detail for the following reasons: (1) the possibility of injury to workers applying the boiling water or steam is considered to be too great; (2) there is no credible research to show that this approach would be effective for the various weed species that occur on roadways; and (3) the potential adverse effects on non-target plants is considered to be too great.

Place Used Carpet Along the Sides of Roads to Control Weeds: This alternative was not considered in detail because it would be contrary to Forest Service objectives for visual quality and aesthetics. Also, this approach is not supported by sufficient scientific evidence that it would be effective in controlling target weeds. Further, the use of carpet was considered to be impractical and uneconomical. Importantly, carpet would present a significant safety hazard for drivers using roadways because there would be no practical method to adequately anchor it to the ground and strong winds could blow the carpet onto the roadway creating a safety hazard. In addition, this approach would have unacceptable and adverse effects on native plants.

Use Burning to Control Weeds: The use of fire can be a viable option for control of some weeds, although prescribed burning can favor the development of other weed species. However, the use of fire, manual, mechanical, and other non-herbicidal weed control methods have been approved through another process and these techniques were considered to be beyond the scope of this analysis. It should be noted that ADOT and other Public Road authorities have the approval to use several non-herbicidal techniques, including the use of fire.

Use Goats and Other Livestock to Control Weeds: As previously stated, this analysis only addresses the option to use or not to use herbicides to control weeds and other options would be authorized through other processes. Thus, this alternative is beyond the scope of this analysis. In addition, although the use of goats or sheep can be a viable option in some areas, especially when used in combination with other techniques, the effectiveness of this approach for right-of-way weed control is questionable. It would not be practical to keep goats along the sides of roadways for a long enough period of time to achieve any significant level of control.

Comparison of Alternatives

This section displays the alternatives in tabular form so that they may be compared. Effects of each alternative to a variety of resources are discussed in Chapter 3.

Table 5. Comparison of Alternatives

Measurement Parameters	Alternative 1 – No Action (No Herbicide Use)	Alternative 2 – Proposed Action (Use of Herbicides)
Address the purpose and need?	No. Allows for slowing the spread of noxious weeds through the use of non-	Yes. Allows for the selection of a full range of management options,

Measurement Parameters	Alternative 1 – No Action (No Herbicide Use)	Alternative 2 – Proposed Action (Use of Herbicides)
	herbicidal methods, but infestations would still threaten native plant communities on National Forest System lands. Hazardous vegetation could be removed by manual and mechanical methods, but they would be too costly and jeopardize overall effectiveness of the program. Manual and mechanical treatments could be more hazardous to people doing the work.	including herbicides, to manage noxious weeds using an Integrated Vegetation Management approach. Offers the best protection of native plant communities on national forests and removal of hazardous vegetation to protect public safety.
Consistent with laws and policy for noxious weeds?	No. Not responsive to Farm Bill of 1990, Forest Service Manual 2080, the Forest Service National Strategy (Stemming the Invasive Tide), or Executive Order 13112.	Yes. Allows the Agency to cooperate with the Federal Highway Administration and Arizona Department of Transportation and other Public Road Authorities to effectively manage noxious weeds on public roadways and prevent their spread as required by Federal and State laws.
Consistent with American Association of State Highway and Transportation Officials (AASHTO) standards for highway operation, safety, and maintenance?	Yes. Minimal standards for motorist and public safety could be met, but it would be more costly.	Yes. Allows for meeting standards for motorist and public safety.

Chapter 3 - Affected Environment

Introduction

This chapter summarizes human activities and existing environmental conditions within and adjacent to public roadways that pass through the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests (NFs) in Arizona as they pertain to the key issues presented in Chapter 1. These issues were developed through the public scoping process and evaluated by the Interdisciplinary Team. Five key issues were identified. Each issue will be addressed later in this chapter. The affected environment for each of the issues is described in association with the actions outlined in this EA. This presentation to the issues will be used in the evaluation of each of the alternatives in Chapter 4.

Arizona's natural environment is characterized by an extreme diversity of climate, soils, vegetation, and wildlife. The northern half of the State is mainly a series of plateaus, and the southern half consists of deserts broken by numerous isolated mountain ranges. Like most arid and semiarid regions, Arizona is a land of great climatic contrasts. In the Sonoran Desert, freezing temperatures seldom, if ever, last longer than 24 hours, and summer temperatures are typically among the highest in the United States with daily highs often exceeding 100º F. Precipitation averages less than 2 to about 12 inches annually in the desert areas, depending on elevation, with well-defined winter and summer rainy seasons. Temperatures are much lower at higher elevations in the northern part of the State, and heavy snow events and below zero temperatures are common in winter. Annual precipitation can approach 60 inches at the higher elevations. The plant covering is extremely varied as would be expected from the great diversity of topography, altitude, soils, and climate. The life zones range from arctic-alpine at the top of the San Francisco Peaks near Flagstaff to lower Sonoran in the low deserts of the southwestern portion of the State. Likewise, there is a great diversity in plant life ranging from tall ponderosa pines and Douglas-fir trees of the high mountains to xerophytic (having various means of protections against loss of water by excessive transpiration) low shrubs and grasses in the desert areas. Human uses of the land are exceedingly diverse, and populations range from sparse over much of the State to highly concentrated in and around the Phoenix and Tucson areas.

A description of the environments through which roadways pass on each national forest in Arizona follows:

Apache-Sitgreaves NFs – Environments along public roadways in the Apache-Sitgreaves National Forests vary from alpine (example: SR 261 in the Big Lake area), ponderosa pine (example: SRs 260 and 60) on the Mogollon Plateau, open grasslands near Springerville (example: US 60), to piñon pine, juniper, and scrub oak (example: US 191).

Coconino NF – Environments along public roadways in the Coconino National Forest vary from ponderosa pine on the Mogollon Plateau (example: I-17, I-40, US 180, SR 87) to piñon pine, juniper and scrub oak (example: I-17, I-40).

Coronado NF – Environments along public roadways in the Coronado National Forest vary from alpine and ponderosa pine (example: SR 366 in the Mt. Graham area) to piñon pine, juniper, scrub oak and Sonoran Desert (example: SR 83, 266 & 289).

Kaibab NF – Environments along public roadways in the Kaibab National Forest vary from alpine and ponderosa pine on the north rim of the Grand Canyon (example: SR 67), ponderosa pine (example: I-40, SR 64), to piñon pine, juniper and scrub oak (example: I-40, US 180, SR 64).

Prescott NF – Environments along public roadways in the Prescott National Forest vary from ponderosa pine (example: SR 89) to piñon pine, juniper and scrub oak (example: SR 89, SR 89A).

Tonto NF – Environments along public roadways in the Tonto National Forest vary from ponderosa pine (example: SR 260), piñon pine, juniper, and scrub oak (example: US 188) to Sonoran Desert (example: SR 88).

The Arizona Department of Transportation, the largest of the Public Road Authorities in Arizona, is responsible for operating and maintaining over 6,000 miles of highways and roads throughout the State. Within the boundaries of national forests, there are about 2,700 miles of ADOT maintained roadways. Roadway widths vary from about 60 feet for lightly traveled 2-lane roads with narrow shoulders to about 1,000 feet for large freeways. Most of the roads are composed of asphalt, but some are composed of gravel or concrete. The system includes travel lanes, ramps, bridges, frontage roads, safety hardware, and other structures. Description of the roadway environment follows:

Roadside Soils: Highway construction is a soil-disturbing process involving excavation, movement, mixing, and compaction of large amounts of soil. Gravel, binder clays, and other materials are usually imported to provide a structural base for the roadbed. Compaction and topographic changes increase surface runoff and surface erosion and reduces infiltration. As a result, roadside soils differ considerably from soils on adjacent NFS lands. While the original soil may still be present, soil profiles may have been obliterated, and soils may have reduced porosity, increased bulk density, and changed texture. In addition, there may be little organic matter, and mychorrizal and other microbe activity in the surface horizon. These changes often reduce the water-holding capacity of the soil and decrease its inherent fertility, limiting the type and amount of vegetation it is able to support.

Roadside Drainage and Water Quality: Runoff rates from impervious highway surfaces and compacted soils along the sides of roadways tend to be high compared to adjacent sites outside of roadway easements with undisturbed natural vegetation. Where concentrated runoff is discharged into unlined ditches or natural drainages, surface flow is promoted and sediment loads tend to increase offsite unless channel protection is installed. Also, toxic substances can be present in highway runoff and, in some instances, can pose a threat to surface water and ground water quality. Besides some heavy metals, like lead and zinc, or organic compounds, like oil and grease, herbicide residues can be associated with highway runoff.

Roadside Vegetation: Roadside vegetation environments have the following conditions in common: (1) initial disturbance produced during construction, and (2) stressful and ongoing disturbance created by topographic reconfiguration and perpetuated by highway use and maintenance (mowing, snowplowing, grading, etc.). Some plant species spread readily to colonize exposed soils following highway construction. These species may exhibit a variety of life forms ranging from tall woody species, like ponderosa pine; shrubs, like desert broom; to annual grasses and herbs. Generally, these invading species have light, windblown seeds and exhibit rapid growth in bare soil and full sunlight. Species able to invade roadsides also include non-native colonizing species that are adapted to natural disturbances such as fire. Plants that tolerate repeated disturbance are annuals that reinvade after each disturbance cycle (e.g. wild oats) and perennials that sprout after cutting or mowing (e.g. mesquite, alligator juniper). Sprouting, tall-growing, perennial species often dominate along portions of

roadways away from the stressful edge of the pavement. Some of the more common plants found along roadsides include:

- Common sunflower (*Helianthus annuus*)
- Russian thistle (*Salsola iberica*)
- Desertbroom (*Baccharis sarothroides*)
- Johnsongrass (*Sorghum halepense*)
- Bufflegrass (*Cenchrus ciliaris*)
- Cheesebush (*Hymonoclea salsola*)
- Burrobush (*Hymonoclea monogyra*)
- Paloverde trees (*Cercidium spp.* and *Parkinsonia aculeate*)
- Creosote bush (*Larea tridentata*)
- Juniper (*Juniperus spp.*)
- Ponderosa pine (*Pinus ponderosa*)

Special-Status Plant Species: Four Federally listed threatened or endangered plant species are known to occur or have suitable habitats within the project area. Also, several species of agave, principally *Agave palmeri*, are food plants for the endangered lesser longnose bat (*Leptonycteris curasae yerbabuenae*) and these agaves often occur in public road easements on national forests in Arizona. Twenty-seven Forest Service sensitive plant species are known to occur or have suitable habitats within the project area. None of the threatened or endangered plants and only a few of the sensitive plants are likely to occur within the clear zone maintained on highway shoulders. However, noxious weeds could invade the suitable or occupied habitats of some of these plants, and selective spot treatment with herbicides on individual noxious weeds or groups of weeds might be needed.

Roadside Wildlife: Roadsides provide several distinct environments that may encourage the presence or absence of certain species in relation to surrounding areas. Water collected in drainage facilities is attractive to a wide variety of species. Salt used for ice control is attractive to mammals. Roadside vegetation control favors low-growing forbs and grasses that are attractive to ground-feeding birds, such as horned larks and dark-eyed juncos, and small rodents. Thus, snakes and raptors can be attracted to roadways due to the presence of small rodents. On the other hand, vehicle travel may discourage the presence of certain species, like deer or elk, although ungulates may be attracted to roadside vegetation, which can, at times, offer the best forage available during periods of drought. Collisions of animals with vehicles increase when animals are attracted to the side of roads.

Special Status Animal Species: Twenty Federally listed threatened or endangered animal species have suitable habitat and could occur within the project area. These include 4 mammals, 6 birds, 8 fish, and 2 amphibians. The mammals and birds can be expected to occur in roadways only on an incidental basis while moving or foraging. None are known to exclusively occupy roadway habitats. The fish and amphibians are mostly not in roadways,

but occur at distances of 2 miles or less downstream from roadways. There are 37 species of Forest Service sensitive animals that have suitable habitat and could occur within the project area. These include 6 mammals, 6 birds, 9 amphibians or reptiles, and 14 invertebrates. Some of these species, particularly the small mammals and some of the invertebrates, could be residents of roadside habitats.

Road and Right-of-Way Use: The human use of roadside areas on the six national forests in Arizona varies depending largely on the type of highway and the adjacent land uses. Two-lane conventional roadways, even though they may carry relatively light traffic volumes, present many opportunities for highway and roadside contact with herbicides used to control vegetation. Freeways may carry much more traffic, but they are designed to prevent pedestrian and non-motorized access, which would limit human contact. The potential for human contact on roadside areas can be categorized as high, medium, or low. High contact sites are those where road system features or environmental conditions encourage people to have ground or foliage contact, such as at rest areas, vista points, and segments that may contain plants that might be collected for food (berries), fiber (beargrass), or collected by American Indians or others for ceremonial or medicinal purposes. Medium contact areas are those where occasional ground or foliage contact is possible, such as roadway segments with frequent pedestrian bicycle use or attractions like a lake. Low contact areas are those where ground or foliage contact is infrequent, such as through conventional highway use or all controlled-access routes.

Adjacent Land Use: Noxious weeds are often spread by human activities associated with vehicles and roads (Roche and Roche 1991). Left untreated, infestations that start on roadway easements can increase and spread to adjacent Federal, State, and private lands threatening native plant communities. Under the various forest plans, these adjacent lands are designated for multiple uses. When noxious weeds dominate a site, resource values, like forest and rangeland health, and uses, such as recreation, can be adversely impacted. The Arizona Department of Transportation has conducted surveys for noxious weeds along the public roadways and on national forest System lands and the results are displayed in Figure 2, page 10.

Affected Environment

The following is the affected environment as it relates to the action alternative and the key issues identified through scoping.

Issue 1. Effectiveness of the action alternative in controlling noxious weeds, invasive plants, and hazardous vegetation.

The area affected by this EA encompasses approximately 170,100 acres along the 2,700 miles of public roadways that would be managed by ADOT on 6 national forests. Roadway easements vary in width from about 60 feet for 2-lane roads to over 1,000 feet for freeways, and the average width of all public roadways is estimated to be 120 feet. When 200 feet each side of a roadway is added to the average width, the total average width would be 520 feet. Thus, the average area per mile of roadway was computed to be about 63 acres (5,280 feet per mile times 520 feet equals 2,745,600 square feet and dividing this by 43,560 square feet per acre equals slightly over 63 acres per mile of roadway).

ADOT personnel estimate the maximum area that would be considered for treatment of noxious weeds and hazardous vegetation along the roadways on an annual basis would be 5,000 acres. A breakdown by national forest is shown in Table 6.

Table 6. Estimated acres of proposed treatment by herbicides on an annual basis

Forest	Acres Estimated To Be Treated Annually	Total NF Acres
Apache-Sitgreaves	500	2,017,725
Coconino	1,500	1,853,780
Coronado	500	1,717,857
Kaibab	500	1,559,203
Prescott	1,000	1,239,270
Tonto	1,000	2,873,164
Total	5,000	11,260,999

The estimated annual acreage that would be considered for treatment would be about 3 percent of the overall area covered by this EA and it would be 0.0004 percent of the total National Forest Systems lands. Refer to Figure 1 for a map showing Interstate, U.S., and State routes crossing national forest lands

Some of the noxious weeds known to occur along public roadways include: bull thistle, camelthorn, Dalmatian toadflax, diffuse knapweed, musk thistle, Russian knapweed, Scotch thistle, spotted knapweed, and yellow starthistle (refer to Figure 2, page 10). Additional information on noxious weed locations on interstate, U.S., and State routes is kept at ADOT district offices and regional ADOT Natural Resource Section offices.

Table 7. Approximate acreages of noxious weeds on National Forest System lands by ADOT Natural Resource Region.

Noxious Weed	Approximate Acreage by Natural Resource Region			
	Flagstaff	Prescott	Phoenix	Tucson
Bull Thistle	10	0	0	0
Camelthorn	340	5	11	0
Dalmation Toadflax	160	5	85	0
Diffuse Knapweed	120	0	75	0
Halogeton	40	0	0	0

Noxious Weed	Approximate Acreage by Natural Resource Region			
	Flagstaff	Prescott	Phoenix	Tucson
Jointed Goatgrass	10	7	3	0
Mediterranean Sage	0	0.5	0	0
Musk Thistle	30	0	0	0
Russian Knapweed	310	3	0.5	2
Scotch Thistle	150	1	0	0
Spotted Knapweed	4	0	0	0
Yellow Starthistle	10	0.25	10	0

Hazardous vegetation includes trees, shrubs, and grasses, regardless of size, that prevent drivers from maintaining control of their vehicles if they run off the road or from seeing oncoming or stopped vehicles, objects in or near the travelway, and fixed obstacles such as guardrails, signs, and bridge abutments. Hazardous vegetation also relates to the potential for roadside fire starts, physical damage to the roadway such as break-up of road edges, and fixed vegetation (either single or clumped plants) within the recovery zone. As a rule of thumb, woody plants near the roadway over 6 inches in diameter and greater than 4 inches in height are considered to be hazardous.

The effectiveness issue will be evaluated by identifying how well noxious weeds and hazardous vegetation are contained, controlled, or eradicated. The ultimate goal would be to eliminate recent and small infestations of noxious weeds and remove all vegetation that would present a hazard to the motoring public. During scoping, one individual expressed concern that some weed species may develop resistance to the proposed herbicides. The Committee on the Future Role of Pesticides in U.S. Agriculture (2002) indicated that herbicide resistance is still relatively rare. The relative rarity of herbicide resistance is likely due to low persistence of many herbicides relative to the generation time of the weeds, a large reserve of susceptible genotypes in the seed bank, and a few other factors. The most important practice to prevent herbicide resistance is to integrate management methods and rotate among different herbicide modes of action (Sheley and Petroff, 1999).

Issue 2. Effects of the action alternative upon human health (public and worker), including Multiple Chemical Sensitivity (MCS).

The Forest Service has supplemented the chemical registration process with a series of risk assessments. These assessments review available research and information on herbicides and then apply this information to conditions that will likely occur during application. These risk

assessments, in concert with registration and pesticide label instructions, form the basis for the analysis of effects on human health. The Forest Service has analyzed the risk of weed control upon human health for 14 of the 16 herbicides being considered for use, and this 1992 risk assessment covers human health effects for the following herbicides: 2,4-D, chlorsulfuron, clopyralid, dicamba, glyphosate, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, and triclopyr. In addition, four carriers are analyzed in this risk assessment. Similarly, more recent risk assessments have been completed for several of the herbicides being considered (Chapter 1, page 13). These documents have been consulted to ensure that the most recent information is reflected in this EA. These risk assessments were completed under Forest Service contracts from 1996 to 2001 and they are included in the project file. The Forest Service has not analyzed the risk to human health for fluroxypyr and pendimethalin; however, risk assessments for these herbicides are available from the U.S. Environmental Protection Agency as part of the registration process (http://www.epa.gov/pesticides/cumulative). Although information is not as complete as for the other compounds, it has been assumed that the effects to human health are similar and within the range of effects identified for the other herbicides being considered. Under the adaptive management strategy, additional herbicides and differing rates of application can be considered as long as the affects are within the range of effects being analyzed. Fluroxypyr and pendimethalin would be applied according to label instructions.

The 1992 risk assessment is comprised of three parts: the exposure analysis, the hazard analysis, and the risk analysis. In the exposure analysis, a range of possible doses to the public and workers is estimated. A variety of scenarios and exposure pathways are examined that could result in dermal and oral doses. In general, the exposure analysis assumes that the more a person is exposed to a particular compound, the higher the dose will be. All herbicide application scenarios would be at or below the routine typical application rates. These estimated rates assume a minimal exposure to workers and an even lower exposure of the general public. In the hazard analysis, tests and data related to the toxicity of the various compounds are reviewed. Data indicate the doses at which toxic effects are seen and, conversely, dose levels at which no toxic effect are observed. To deal in part with incomplete information, a margin of safety, which is 100 times less than the no effect level, is used. The hazard analysis also reviews the data on the possible carcinogenicity of the herbicides. This analysis assumes that any dose of a carcinogen has some probability of causing cancer and that the higher the dose, the greater the probability of cancer. The third part of the risk assessment involves the analysis and characterization of risk. In this section, dose levels calculated in the exposure analysis are compared to determine the non-carcinogenic, systemic, and reproductive effects of herbicides. The risk analysis also indicates the probability of developing cancer based on a projection of the doses received over a lifetime (assumed to be 70 years for humans). Certain baseline criteria are set to evaluate the possible risk to humans. Cancer risk is set at a benchmark value of one in one million, which is commonly accepted by the scientific community as representing a negligible addition to the current U.S. cancer rate. Evaluation of systemic and reproductive health risk is based on the “no observed effect level” (NOEL). In evaluating the potential impact of herbicides to humans, it must be kept in mind the small amount that is typically used. This is normally less than two pounds per acre. Sulfonylurea herbicides are usually applied at 1-3 ounces per acre.

There is a possibility that a small percentage of the population in Arizona will be hypersensitive or allergic to any one or more of the herbicides proposed for use. Since allergenic and hypersensitive reactions can occur with even small amounts of a specific substance, information will be made available to those individuals who want to avoid potential treatment sites by calling a toll free number (1-800-546-6591).

Issue 3. Effects of the action alternative on non-target target vegetation, including threatened, endangered, and sensitive plants.

The plant covering of Arizona is extremely varied due to the great diversity in topography, altitude, soils, and climate. The life zones range from artic-alpine at the summits of two mountains to lower Sonoran desert. Public roadways on the national forests pass through many vegetation types, including evergreen forests, grasslands, chaparral, and deserts.

Four Federally threatened or endangered plant species are known to occur or have suitable habitats within the project area. These species are Arizona agave, Arizona cliffrose, Arizona hedgehog cactus, and Huachuca water umbel. Twenty-seven Forest Service sensitive plant species are known to occur or have suitable habitats within the project area. Various conservation measures will be taken to protect these plants. These measures include annual coordination meetings between Forest Service, Public Road Authority, and ADOT personnel, mitigation measures, and best management practices identified in Chapter 2, page 28. Descriptions of these plants and their habitats are discussed in the biological evaluation and assessment that will be completed at a later date and included as Appendix D.

Controlling hazardous vegetation, invasive plants, and noxious weeds will have associative effects to non-target vegetation. Herbicide drift could have the greatest impact. Non-target vegetation adjacent to weeds may be damaged during herbicide spraying. Where threatened, endangered, or sensitive species are absent, non-target plant mortality will be acceptable as long as damage does not reduce the vegetative condition, i.e. no loss of habitat health.

Failure to control noxious weeds in road right-of-ways provides the greatest risk to native plant communities on adjacent National Forest System lands. Displacement of native grasses and forbs by noxious weeds increase soil displacement and reduce native species diversity. Also, exotic grasses like buffelgrass and red brome greatly increase the risk of wildfire, and such fires can permanently modify native plant communities in desert areas.

Issue 4. Effects of the action alternative on non-target terrestrial and aquatic animals, including threatened, endangered, and sensitive animals

Highways may affect wildlife populations through their impact on habitats and animal movements. Depending on the type of road and characteristics of the surrounding habitat and wildlife community, roads could act as either corridors or barriers to animal movements, enhancing or isolating populations. For example, in forested landscapes, species that favor open habitats use roadways as travel and hunting routes. Other animals typically avoid well traveled roads. Some smaller vertebrates may choose to never cross roads. Highway mortality of animals can be a serious problem, especially during periods of drought.

Roadside vegetation management could influence wildlife populations through its effects on habitat and through direct impacts on wildlife. These effects may be either beneficial or harmful depending on the location, site characteristics, species affected, and the timing, intensity, and frequency of treatment. In some cases, the effect depends on the habitat changes caused by the treatment, rather than the particular method utilized. To the extent that vegetation management supports habitat use and normal movements of desirable native species of wildlife, it would be a beneficial management tool. Where vegetation management reduces the diversity of native vegetation, or promotes the dispersal of opportunistic, invasive plant species, it is undesirable.

The introduction and expansion of exotic weed infestations influences wildlife by displacing forage, modifying habitat structure, such as changing grasslands to a forb-dominated community, and changing species interactions within ecosystems. Native ungulate foraging can be reduced in noxious weed infested grassland habitats, which is often attributed to lower forage production. Bird species composition and small mammal populations have been reduced due to noxious weeds displacing native plant species. Affects to non-target animals are evaluated in Chapter 4 as direct physical and habitat modification impacts.

Herbicide treatments have the potential to impact wildlife either directly through toxicities to animals, or indirectly through manipulation of habitat. Ground-based herbicide applications were not specifically analyzed in the 1992 risk assessment because they have a very low potential to affect wildlife. The likelihood of wildlife receiving a direct spray of herbicide from ground applications or coming in contact with vegetation treated with ground application equipment is significantly lower than the exposure potential from aerial applications. Consequently, the potential risks from ground application will likely be much lower than the risks associated with aerial applications. In addition, for the herbicides proposed for use, there is little chance of bioaccumulation through the consumption of treated vegetation or prey species. The risk from herbicide use to threatened, endangered, sensitive, and management indicator species is no greater than that posed to other animal species. However, the EPA has set a standard twice as stringent as the “no observed effect level” for non-category animals. Habitat manipulations as a result of herbicide applications would benefit some animals and potentially harm others. For example, the elimination of shrubs could lead to a decline, albeit small, of species that depend on shrubs for nesting or cover, but it could cause a small increase in numbers of grass-adapted species. In general, wildlife impacts will depend on the herbicide used, its specific characteristics, and how and when it is applied.

Twenty Federally threatened or endangered animal species have suitable habitat and could occur within the project area. These include four mammals (black-footed ferret, jaguar, lesser long-nosed bat, Mexican gray wolf), six birds (bald eagle, brown pelican, California condor, Mexican spotted owl, southwestern willow flycatcher, Yuma clapper rail), eight fish (Apache trout, Colorado pikeminnow, Gila chub, Gila topminnow, Little Colorado spikedace, loach minnow, razorback sucker, spikedace), and two amphibians (Chiricahua leopard frog, Sonora tiger salamander). There are 37 species of Forest Service sensitive animals that have suitable habitat and could occur within the project area. These include 6 mammals, 6 birds, 9 amphibians or reptiles, and 14 invertebrates. Various conservation measures will be taken to protect these animals. These measures include annual coordination meetings between FS and ADOT personnel, mitigation measures, and best management practices identified in Chapter 2, page 28. Descriptions of these animals and their habitats are discussed in the biological evaluation and assessment to be included in Appendix D.

Although infrequent, aquatic habitats occur immediately next to some roadways that pass through NFS lands. It should be noted that there is usually a significant distance or buffer area with vegetation between most roads and aquatic systems that would intercept sediments and pollutants. The potential impacts of roadside vegetation management on aquatic habitats and organisms would be directly related to the water quality impacts described under Issue 5. Aquatic habitat degradation resulting from increased sediment and nutrients is the most likely adverse effect of a roadside vegetation management, but there is a possibility, albeit small, for overland movement of herbicides. Potential effects to aquatic organisms could include reduced survival and reproduction directly related to habitat degradation or exposure to toxic concentrations of herbicides or other

pollutants. In general, however, roadside vegetation control treatments are not known to have caused significant losses of aquatic organisms in adjacent waters (Jones and Stokes 1991). Implementation of mitigations and BMPs (Chapter 2, page 28) would reduce the potential for adverse effects. The analysis of effects will be based on the concentration of herbicide that could be delivered to waters.

Issue 5. Effects of the Action Alternative on Water Quality.

Protecting water quality is one of the primary reasons for maintaining a healthy vegetative cover in the roadside environment. Potential impacts on water quality from roadside vegetation management are primarily related to mechanical, cultural, and herbicide methods, which may cause accelerated soil erosion, transport, and deposition of sediment (including sediments from road surfaces), and to the use of herbicides, which could introduce synthetic chemicals into non-target waters. Accelerated erosion may result from vegetation management where soil disturbance and compaction influence the natural infiltration and runoff process. Adverse effects on streams and lakes resulting from the transport and deposition of eroded sediments include nutrient enrichment, increased turbidity, decreased dissolved oxygen levels (if nutrient concentrations sufficiently stimulate algal blooms), and the accumulation of toxic pollutants. These effects, in turn, may adversely impact fish and aquatic resources.

Herbicide treatment impacts can be summarized as either direct or indirect. Direct impacts would result from the introduction of compounds directly into water from drift, runoff, or leaching. Indirect impacts would result if the vegetative cover were reduced to the degree that erosion increased.

This issue will be evaluated by how and where the herbicides will be applied and the mitigation measures that will be used to reduce potential contamination of water.

Chapter 4 - Environmental Consequences

Introduction

This chapter describes the potential consequences or effects of each of the alternatives presented in Chapter 2 evaluated against the issues described in Chapters 1 and 3. A summary of the effects by issue is provided in Table 12, page 61.

Issue 1. The effectiveness of the different alternatives in controlling noxious weeds and hazardous vegetation.

Alternative 1. No Action (No Herbicide Use)

Implementation of this alternative would be less effective and more expensive than the proposed action of controlling noxious weeds, invasive plants, and hazardous vegetation. Under this alternative, a limited amount of herbicide treatments would occur on sections of interstate and Federal highways within the boundaries of national forests because herbicide use on these highways has already been approved by the FHWA. The primary approach to management of vegetation on the public roadways through national forests, however, would rely on non-herbicidal methods. Thus, this alternative would involve a considerable amount of mechanical and manual labor, requiring a substantial investment in machinery and the development of a large labor force by Public Road Authorities or would require contracting the work.

Mechanical and manual treatment could be very effective for managing small trees, shrubs, and herbaceous vegetation on some sites. However, the operation of equipment on some soils may reduce vegetative cover, allowing a buildup of undesirable invasive plants. Repeated mowing of bunch grasses and forbs can weaken plants and mechanically degrade soil surfaces. Operation of even lightweight mowers can remove vegetative cover and allow invasion of undesirable species. Also, mowing can contribute to increased spread of weeds by spreading seeds and weed parts. Over time, vegetation would develop along normal successional pathways, if left undisturbed. On sites where some topsoil remains or has been replaced following construction, desirable native species could establish rapidly. However, due to the highly disturbed nature of rights-of-ways, cut and fill slopes and bare and compacted soils, most sites may revert to early successional plant communities composed of weedy annual and perennial grass and forb species. On sites where all upper soil horizons have been removed, communities of pioneer species may dominate the disturbed sites for long periods of time.

Some species of shrubs and trees controlled by mechanical methods often resprout from roots and root-crowns, creating higher plant/stem densities than before control. Many desert shrubs and resprouting trees, like mesquite and alligator juniper, respond vigorously after aerial-portions of plants have been removed, producing more and bigger stems, limbs, and suckers. Mechanical vegetation control measures should be applied in a manner that has the greatest adverse effect on the target species, and proper timing of treatment can be critical. Otherwise, removal of regrowth may be required two or more times year after year. Some areas may not be suitable for mechanical equipment due to steepness of the terrain and would require hand treatment.

Vegetation encroachment in pavement cracks cannot be treated mechanically and manual approaches are needed. Manual methods include the use of hand tools and hand operated power tools to cut, clear, or prune vegetation, generally above or at ground level. Hand treatment is tedious and slow and exposes the worker to safety hazards associated with nearby traffic. Pulling or digging out plant root systems for plants, like camelthorn, to prevent resprouting and regrowth, would be extremely difficult and impossible in most instances. Selection of this alternative is

expected to result in the replacement of weed-infested pavement every 7-10 years, where the expected life could be 20 years without weeds. Manual methods are usually not a viable option due to the large scale of most projects, such as removing hazardous vegetation around structures along many miles of a highway. Also, manual treatment techniques generally require multiple visits to a site to control regrowth of a single species or to treat different selected species. Forbs and grasses are usually too numerous and extensive to be controlled effectively by manual techniques, except in small roadside areas, such as for a new infestation of a noxious weed.

A No Action (no herbicide) approach to roadside vegetation management would be undesirable. Under this alternative, native and exotic weedy vegetation would become established and dominate recently disturbed areas along roadways. Weed dominance within the clear zone or around roadway structures would require repetitive treatment. It would not be practical to control noxious weeds and invasive plants along the edges of all public roads on national forests using mechanical and manual methods due to limited funding available to Public Road Authorities for maintenance, and also because of the ineffectiveness of non-herbicidal approaches for many deep-rooted or sprouting species. As a result, infestations would become established and existing infestations would expand and move on to adjacent National Forest System lands threatening resource values and uses. Cooperative weed-fighting efforts would be hampered by the lack of effective treatment of noxious weeds along public roadways, and Federal laws and State regulations would be violated with selection of this alternative.

Overall, noxious weeds would not be effectively managed by this alternative, and the cost for treatment of hazardous vegetation would be many times higher than for the proposed action (Table 4, page 27). Current infestations of noxious weeds already present within public roadway easements on National Forest System lands would increase in size and density and spread to new locations through the transport of seed and plant parts through typical vectors of spread (vehicles, animals, wind, and/or water). These infestations would continue to spread on to the national forests in Arizona and adverse impacts to native plant communities would become increasingly apparent. In general, the cover and diversity of native species would be reduced, and the exotic species would form homogenous, monoculture-like conditions with reduced structural diversity (Belcher and Key 1989). Key forage species would be reduced in rangelands on national forests (Losensky 1987). Also, the vegetation changes produced by these invasive species would alter fire regimes at infested sites (Toney 1996). A greater quantity and continuity of fine fuels would be produced by stands of exotic plants, particularly grass species like red brome. This increase in fuels could lead to an increased frequency of damaging wildfires and adversely impact native perennials. It is impossible to accurately predict the rate of spread of the various noxious weeds on roadways and adjoining national forests, but it has been estimated that the total area infested in the West is expanding by 8-12 percent annually (USDA 1998).

The cumulative effects of this alternative would be adverse because infestations of invasive species would continue to spread and increase in density and native plant communities would be progressively replaced. Over time, resource values and uses on national forests in Arizona would be progressively degraded.

Alternative 2. Proposed Action (Use of Herbicides)

This alternative provides the most effective means of controlling hazardous vegetation, invasive plants, and noxious weeds in the most economical and environmentally compatible way. This alternative is a comprehensive, proactive approach to vegetation control and weed management, and the focus is on long-term management and control. All options are available for vegetation

management, including the use of herbicides, used singly or in combination with other techniques, under an Integrated Vegetation Management concept. A fully integrated approach to invasive plant management represents the most efficient and cost effective control available (Bechinski, et al., 1991, and Everett, 1994). Consequently, this project would provide the greatest long-term protection to the integrity of native plant communities on national forests and nearby lands of mixed ownership. Rangeland condition and native plant communities would receive the most protection and the frequency and severity of wildfires would be reduced.

Followup treatments would be required at infested sites since the application of herbicides being considered for use or a combination of herbicides and manual/mechanical methods usually would not eliminate target species in one effort. Some spot treatments of hazardous vegetation and invasive plants can be close to 100 percent effective; but control effectiveness of most noxious weed species would be in the 70-90 percent range. Also, most noxious weeds have seeds that remain viable in the soil for many years, and repeated treatments would be needed to remove plants that germinate from seeds.

The effectiveness of vegetation management would be influenced by many factors: funding levels, success of annual treatments, success of finding and mapping new infestations, weather conditions, the degree of success of developing cooperative weed control across multiple ownerships, and other aspects. Cooperative working agreements with adjacent landowners are critical to the success of noxious weed management programs. Lands with unmanaged infestations become sources of seed dispersal. As infestations increase on unmanaged lands, the influx of weed seeds from neighboring areas can become overwhelming, including infestations on National Forest System lands. To address this problem along public roadways, this proposal includes a strip on National Forest System lands up to 200 feet on both sides of public roadways beyond the easement boundary. Public Roadway Authorities could be allowed to treat noxious weed and invasive plant infestations in this area when they extend from the right-of-way onto National Forest System lands. The Forest Service will authorize annual treatment programs based on a memorandum of understanding and an annual operating plan (Appendix C, page 97). Also, Forest Service crews or contractors could treat infestations within roadway easements to maintain the integrity of projects to manage noxious weeds. Such Forest Service programs would be authorized under another environmental analysis and decision.

The cumulative effects of this alternative would most likely be beneficial since noxious weed and invasive plant infestations would be reduced. Also, this would prevent the spread and expansion of noxious weed infestations. Thus, the condition of native plant communities would be improved in currently infested sites and the spread of new infestations would be prevented and roadway safety could be enhanced. Also, this alternative would provide the most effective, economical, and environmentally compatible approach for the management of hazardous vegetation. People who gather native plants for traditional purposes could benefit as well.

Issue 2. Effects of the alternative upon human health (public and workers), including multiple chemical sensitivity.

Alternative 1. No Action (No Herbicide Use)

Since there would be no herbicide use on roadways under the authority of the Forest Service, neither the public nor workers would be at risk from herbicides on these routes. However, herbicides would continue to be used within the boundaries of national forests on sections of interstate and major state highways under the approval authority of the FHWA and outside of

National Forest System lands on ADOT managed roads. Thus, the potential for exposure of individuals with MCS might be reduced but not eliminated. However, there would not be a coordinated approach between the three agencies for spray-free alternative routes.

There could be increased human health consequences to taking a no action approach. The potential for public injury would come from accidents related to the need to increase the number of road maintenance crews and equipment traveling to work sites to do manual or mechanical treatments. These problems could make this alternative a greater threat to human health than the use of herbicides.

The risks to workers would be somewhat higher for this alternative than for the preferred alternative. In addition to the risks from traveling and transportation of equipment to work sites, workers involved in hand pulling or grubbing of plants would be at an increased risk of physical injury while digging, although this risk can be mitigated through the use of safety procedures and safety equipment. Minor skin irritation may result from contact with thorny plants or those that contain toxic substances in their sap, such as leafy spurge.

Alternative 2. Proposed Action (Use of Herbicides)

Based on the summary of information in Appendix A (page 73), no toxic effects to public health are expected from the sixteen herbicides being considered for use. Routes and duration of exposure are important factors determining effect of toxins to human health. Exposure to the public would mainly come from skin contact with sprayed vegetation and, to a lesser extent, from consumption of sprayed vegetation and sprayed water. The chances of these exposures are low since individuals using roadways do not stop where spraying operations are being done. However, if an individual did enter a spray area, the skin is a protective barrier that slows movement of a material into the body, and studies show that about 10 percent or less of a chemical applied to skin is absorbed (Felsot 2001). Importantly, herbicide labeling requires low application rates for rights-of-way. In addition, the target for spraying is the hazardous vegetation, invasive plants, and noxious weeds and not native vegetation. Also, spraying will take place no more than twice in any one site in a season. Thus, potential exposure levels to the general public — those who might have dermal contact with a dilute concentration of a small quantity of herbicide — would be well below a threshold of concern. Exposure levels of workers could be of concern in extreme scenarios without protective clothing and equipment. Therefore, it is important for workers to mitigate this concern through the proper use of protective clothing and personal protective equipment and through careful handling of herbicide concentrates.

With respect to the herbicides identified for potential use, none pose a risk to public health for systemic or reproductive effects. None of the herbicides were found to pose greater than 1 in 1 million cancer risk. The various risk assessments indicate all of the herbicides analyzed show little tendency for bioaccumulation and the small amounts that could be absorbed through the skin are readily and completely eliminated from the body (Felsot 2001).

The risk to workers is low for all herbicides being considered, other than 2,4-D and dicamba, but this risk would be mitigated by limiting exposure as identified in Chapter 2, page 27 (1992 Risk Assessment, Table III-E-4, page E-III-8, 1992 Risk Assessment). In any 24-hour period, workers using backpacks will not be allowed to apply more than 0.9 pounds of 2,4-D or 2.3 pounds of dicamba (1992 Risk Assessment, Table III-E-21, page III-E-45).

As a general rule, the inert ingredients in the herbicide formulations proposed for use are less acutely toxic than the active ingredients (1992 Risk Assessment, Table III-F-1, page III-F-2-3). Diesel oil, kerosene, and mineral oil are considered to be in the EPA Toxicity Category of “very slightly toxic,” and limonene is considered “slightly toxic.” In addition, exposure to any one inert ingredient is significantly lowered due to the large amount of dilution for spray mixes. For example, one pint of Tordon 22K containing 75.6 percent inert ingredients is mixed with 35 gallons of water for every acre sprayed during ground applications. Thus, the concentration of the inert ingredients would be diluted with water approximately 370 fold prior to spraying, and the Tordon would constitute about 0.09 percent of the total volume of spray. After spraying, the inert ingredients will dry on plant surfaces or deposit in the soil, where they would be subject to plant and microbial metabolism just like the active ingredient.

People who have hypersensitive or allergic reactions to herbicides are generally aware of their sensitivities and will be provided a toll free number (1-800-546-6591) to find out the location and timing of herbicide applications taking place on roads under ADOT jurisdiction to allow them to seek alternative routes to obtain needed services. An advantage of the cooperative effort between the Forest Service and Public Road Authorities is that treatments will be coordinated and sections of roadways will be treated at one time instead of random treatments.

With respect to cumulative effects, the probability of Forest Service applicators or the general public being exposed simultaneously to herbicide applications done along roadways within National Forest System lands or other projects on adjacent State and private lands, in addition to that done on national forest, appears to be very remote. Once the spray mixture dries on plants or moves into plant tissues, the risk of exposure is very small. Likewise, the risk of exposure to herbicides applied in the previous year is even less likely. Most of the herbicides being considered for use do not persist for very long in the environment, since they are degraded by sunlight and soil microbes. Some compounds only remain in the soil for a few days while others may be present for a few months. Exposure from the various programs done in the past, and the possible exposure from proposed operations, would not likely approach the acceptable daily intake (ADI) for any of the proposed herbicides.

Table 8. Acceptable daily intake (ADI) mg/kg/day; reference dose RfD

Herbicide	ADI/RfD
2,4-D	0.1
Chlorsulfuron	0.05
Clopyralid	0.5
Dicamba	3.0
Fluroxypyr	0.5
Glyphosate	0.1
Imazapic	0.5
Imazapyr	2.5

Herbicide	ADI/RfD
Isoxaben	0.05
Metsulfuron methyl	0.3
Pendimethalin	0.1
Picloram	0.07
Sethoxydim	0.2
Sulfometuron methyl	0.02
Tebuthiuron	0.07
Triclopyr	0.05

Issue 3. Effects of the alternative on non-target vegetation, including threatened, endangered, and sensitive plants.

Alternative 1. No Action (No Herbicide Use)

Manual methods are highly selective and would have little unintended effects on non-target vegetation, especially if the locations are known for threatened, endangered, and sensitive plants.

Mechanical methods such as mowing, grading, and disking are much less selective and effects to non-target plants would occur, although adverse effects could be mitigated by restricting the use of mechanical methods at known locations of the sensitive plants. Nevertheless, the expanded use of mechanical methods for this alternative would have a greater potential effect to non-target vegetation than through the use of selective herbicides under the preferred alternative. Grading and disking would involve repeated disturbance of the soil surface, providing a favorable substrate for seed of undesirable species, including noxious weeds. The equipment can transport seeds and other plant parts capable of establishment on the disturbed soil surfaces. Undesirable vegetation is expected to continue to flourish in the right-of-way and be available for spread to adjacent areas when soils are disturbed. Mowing can be an effective means of controlling hazardous vegetation where accessible. Mower height can be adjusted to minimize disruption of plant roots and the soil surface to encourage successful competition by preferred ground cover species. However, some noxious weed species, like yellow starthistle, are adaptive to mowing regimes and will overcome the adverse pressure of mowing by altering their growth form to flower and set seed below the level of a mower deck (Callihan, et al. 1995 and Lass, et al. 1999). This adaptive nature effectively minimizes the positive results achieved by mowing. If noxious weeds are present in an area treated mechanically, equipment would need to be cleaned of plant materials before moving to uninfested areas. Adverse effects to threatened, endangered, and sensitive plants would be eliminated by using the same coordination, mitigations, and best management practices that are planned for the preferred alternative.

Cumulative effects would be the same as those described under the No Action alternative for Issue 1, page 43. Over the long term, noxious weeds would not be controlled through the

exclusive use of manual and mechanical methods, and this would pose a greater threat to native plant populations, including threatened, endangered, and sensitive species.

Alternative 2. Proposed Action (Use of Herbicides)

The use of herbicides can greatly impact non-target plant populations if the herbicide being used would kill the species of concern in occupied habitat. Although several of the herbicides being considered for use are selective, which means that they can kill the species of concern while causing little or no effect to non-target plants, many of the target plants and threatened, endangered, and sensitive plants are dicotyledons. Therefore, a selective method of application that would keep the herbicide off species of concern would be required. Broadcast applications of glyphosate, a broad-spectrum herbicide, would not be used where sensitive plants are known to occur. The impacts of treatment with selective herbicides would vary depending on how closely the target and non-target plant species are related and the rate of application.

Annual plants are generally more sensitive to herbicides, and they would be affected to a greater degree than perennial plants, especially if they are treated before seed production. Annual and perennial weed species growing at a site for more than a few years often have large seed reserves in the upper soil horizons. Infested sites could require repeated treatment until the majority of the seeds have germinated and the plants killed. Repeated applications of broad-leaf selective herbicides could lead to grass-dominated roadsides

Whether herbicidal or mechanical means are being considered, the locations of threatened, endangered, and sensitive plant populations will be identified prior to planned treatments of hazardous vegetation, invasive plants, and noxious weeds. To protect populations of sensitive plant populations that are known to occur within easements and the 200-foot buffer areas outside of easements, broadcast applications of herbicides will only be authorized by the Forest Service if a selective herbicide is applied that will not harm the plants of concern. In the event that harm could occur from broadcast applications of the herbicides being considered, spraying will be limited to individual target plant applications, such as with backpack sprayers, or by truck-mounted hand wands.

There are four species of endangered plants and 27 species of sensitive plants that either occur or have suitable habitats within the project area (Table 9). Most roadways have had no thorough plant surveys. The coordination, mitigation, and best management practices described elsewhere in this document would ensure the conservation of TES plant populations. Annual coordination meetings between USDA-FS and ADOT personnel will be held before the growing season to identify areas to be treated with herbicides. Most treatments will be for maintenance of the highway clear zone rather than noxious weed control. Treatment of clear zone will be in highly modified areas directly adjacent to the road surface. These areas are not suitable habitat for most TES plants. When known populations or suitable habitats of TES plants are identified as being in a proposed treatment area, surveys will be done prior to herbicide applications. Buffer zones will be marked around any populations that are found. Treatments to eliminate hazardous vegetation, invasive plants, and noxious weeds within buffer zones could include spraying with selective herbicides that would kill target plants, but not harm the TES plants. Spot treatments with backpack sprayers or with daubing, or hand grubbing with no herbicide use would be the method of treatment.

Post spray monitoring will be done to ensure that the protective measures were effective and to determine the effectiveness of the treatments on the target species. With these protective measures

in place, the proposed action will not adversely affect any of the four threatened or endangered plants in the project area. These same measures will ensure that none of the Forest Service sensitive plants will be reduced in population viability or harmed in a way that would increase their likelihood of trending toward Federal listing. These determinations are discussed in more detail in the biological assessment and evaluation, Appendix D.

Table 9. Threatened, endangered, or sensitive plants along Federal and State highways passing through National Forest System lands in Arizona.

Common Name	Scientific Name	Status	National Forest
Arizona agave	***Agave arizonica***	Endangered	Tonto
Arizona cliffrose	***Purshia subintegra***	Endangered	Coconino
Arizona hedgehog cactus	***Echinocereus triglochidiatus var. arizonicus***	Endangered	Tonto
Huachuca water umbel	***Lilaeopsis schaffneriana* ssp. *recurva***	Endangered	Coronado
Arizona alumroot	***Heuchera glomerulata***	Sensitive	Apache-Sitgreaves
Arizona sneezeweed	***Helenium arizonicum***	Sensitive	Coconino, Apache-Sitgreaves
Arizona willow	***Saliz arizonica***	Sensitive	Apache-Sitgreaves
Beardless cinchweed	*Pectis imberbis*	Sensitive	Coronado
Blumer's dock	***Rumex orthoneurus***	Sensitive	Apache-Sitgreaves, Tonto
Chiricahua mountain brookweed	***Samolus vagans***	Sensitive	Coronado
Fish Creek rock daisy	***Perityle saxicola***	Sensitive	Tonto
Flagstaff beardtongue	***Penstemon nudiflorus***	Sensitive	Tonto
Gila groundsel	***Senecio quaerens***	Sensitive	Apache Sitgreaves
Goodding's onion	***Allium gooddingii***	Sensitive	Apache-Sitgreaves
Haulapai milkwort	***Polygala rusbyi***	Sensitive	Coconino, Prescott
Heartleaf wild buckwheat	***Eriogonum ericifolium* var. *ericifolium***	Sensitive	Coconino, Prescott

Common Name	Scientific Name	Status	National Forest
Hohokam agave	***Agave murpheyi***	Sensitive	Tonto
Kaibab bladderpod	***Lesquerella kaibabensis***	Sensitive	Kaibab
Kaibab paintbrush	***Castilleja kaibabensis***	Sensitive	Kaibab
Kaibab pincushion cactus	***Pediocactus paradinei***	Sensitive	Kaibab
Mearns sage	*Salvia dorrii* ssp. *mearnsii*	Sensitive	Coconino, Prescott
Mogollon paintbrush	***Castilleja mogollonica***	Sensitive	Apache-Sitgreaves
Mt. Dellenbaugh sandwort	***Arenaria aberrans***	Sensitive	Kaibab
Ripley wild buckwheat	***Eriogonum ripleyi***	Sensitive	Coconino, Prescott
Rock fleabane	***Erigeron saxatilis***	Sensitive	Coconino
Rusbyi's milkvetch	***Astragalus rusbyi***	Sensitive	Coconino
Sunset Crater beardtongue	***Penstemon clutei***	Sensitive	Coconino
Supine bean	***Macroptilum supinum***	Sensitive	Coronado
Tonto Basin agave	***Agave delamateri***	Sensitive	Coconino, Tonto
Tusayan rabbitbrush	***Chrysothamnus molestus***	Sensitive	Kaibab
White Mountain clover	***Trifolium longipes* ssp. *neurophyllum***	Sensitive	Apache-Sitgreaves

In general, the proposed alternative would provide the best long-term management of target plants utilizing herbicidal and other methods, under an Integrated Vegetation Management approach, and the combined use of all methods would provide the best protection for populations of sensitive plant species. The uncontrolled spread of noxious and invasive plant species poses the greatest threat to threatened, endangered, sensitive and native plant communities.

Issue 4. Effects of the alternative on non-target terrestrial and aquatic animals, including threatened, endangered, and sensitive animals.

Alternative 1. No Action (No Herbicide Use)

Under this alternative, intensive vegetation management in the roadside environment by maximizing the use of mechanical and manual methods would have some adverse impacts on

wildlife, wildlife habitat, and adjacent aquatic sites. More frequent disturbance to soils and vegetation would prevent native plant communities from remaining or becoming established. Mowing of roadside vegetation would reduce cover for nesting and hiding and food availability for many small birds and mammals. Mowing during the breeding season could damage habitat, destroy nestlings, and reduce productivity of ground-nesting birds. Conversely, mowing may stimulate the production of palatable grasses and forbs, thus providing food for various wildlife species and attracting large ungulates. This attraction could cause an increase in vehicle/animal collisions. The use of mechanical equipment could result in increased soil compaction and accelerated erosion which, in turn, could inhibit the growth of new vegetation, damage the habitat for burrowing animals, open sites to invasive plants, and damage adjacent aquatic environments due to increased sedimentation. Over time, selection of this alternative would increase sediment delivery to aquatic habitats, alter aquatic ecosystems, and negatively affect aquatic organisms. On the other hand, there would be little or no herbicide residues that could move into aquatic habitats by selection of this alternative. Any direct adverse effects to threatened, endangered, and sensitive animals would be eliminated by using the same coordination, mitigations, and best management practices that are planned for the preferred alternative.

The direct, indirect, and cumulative effects for this alternative would be greater than for the proposed action. The greatest threat to terrestrial wildlife and aquatic species over the long term would come from habitat loss and erosion related to the continued expansion of noxious weed and invasive plant infestations. Monocultures of these species would develop along roadways and move onto National Forest System lands. Palatable forage for game and non-game wildlife species would progressively decrease. Ground cover, grass production, seed producing food sources, and the prey base would continue to decline. The continued expansion of noxious weed infestation would lead to a reduction in populations of deer and non-game animals. For example, in Colorado, the invasion of Russian knapweed resulted in a large reduction in the availability of winter range for wildlife (Goold 1994). It was estimated that there would be a loss of 220 elk annually in Montana due to noxious weed invasions of big game winter ranges (Westbrooks 1998). In Arizona, extensive stands of Lehmann lovegrass (Eragrostis lehmanniana) had fewer quail, small mammals, and seed-harvester ants (Westbrooks 1998).

Alternative 2. Proposed Action (Use of Herbicides)

Impacts of herbicidal vegetation control to terrestrial and aquatic organisms include direct toxicological effects and indirect effects from habitat alternation. The toxicological impacts to terrestrial and aquatic organisms are discussed in Appendix A, pages 75 to 81.

Risk assessments prepared by the Forest Service reviewed the toxicity levels of 14 of the 16 herbicides being considered for use. Comparisons of the expected environmental concentrations with the toxic levels of these 14 herbicides indicate that adverse effects on birds, rodents, and grazing animals are not expected. Levels to which the organisms would be exposed would be hundreds to thousands of times lower than the levels that would cause toxic effects. Forest Service risk assessments are not available for fluroxypyr and pendimethalin, but the toxicological properties and application rates for fluroxypyr, imazapic, isoxaben, and pendimethalin are similar and the range of effects are expected to be similar. All of the herbicides being considered are quickly excreted by exposed animals and do not accumulate in body tissues or organs. Thus, secondary effects on predators, such as coyotes or raptors, are not reasonably expected.

The direct and indirect impacts to animals, including insects, from herbicide applications are expected to be negligible. Since these herbicides do not bioaccumulate and they are degraded in

the environment, the cumulative effects of the proposed use of herbicides would be insignificant. In addition, the proposed herbicides kill weeds by a mode of action that is unique to plants, and the toxic effects to animals, especially for dilute solutions, is relatively low or negligible.

There are 17 species of threatened or endangered animals and one proposed endangered animal that occur, have designated or proposed critical habitat, or have suitable habitats within the project area (Table 10). For aquatic animals, this includes habitats that are within 2 miles downstream from roadways. Threatened or endangered mammals and birds occur adjacent to roadways only on an incidental basis while moving or foraging. None are known to exclusively occupy roadway habitats. Threatened or endangered fish and amphibians are mostly not in roadways, but occur at distances of 2 miles or less downstream from roadways. Herbicides are unlikely to be applied directly to any of these species and because of the timing and frequency of applications any contact with herbicides, such as from rubbing against vegetation, would occur very infrequently. Because the herbicides proposed for use have low toxicity to animals and any contact with herbicides will be very infrequent, if at all, the application of herbicides is not likely to adversely affect any threatened, endangered, or proposed animals.

Table 10. . Threatened, endangered, proposed, candidate, or sensitive animals along Federal and State highways passing through National Forest System lands in Arizona.

Common Name	Scientific Name	Status	National Forest
Mammals			
Black-footed ferret	*Mustela nigripes*	Endangered	Coconino
Jaguar	*Panthera onca*	Endangered	Apache-Sitgreaves
Lesser long-nosed bat	*Leptonycteris curasae yerbabuenae*	Endangered	Coronado
Mexican gray wolf	*Canis lupus baileyi*	Experimental Nonessential Population	Apache-Sitgreaves
Navajo Mexican vole	*Microtus mexicanus Navaho*	Sensitive	Coconino
New Mexican meadow jumping mouse	*Zapus hudsonius luteus*	Sensitive	Apache-Sitgreaves
Silky pocket mouse	*Perognathus flavus goodpasteri*	Sensitive	Apache-Sitgreaves
Southwestern river otter	*Lutra Canadensis Sonora*	Sensitive	Coconino
White Mountains ground squirrel	*Spermophilus tridecemlineatus*	Sensitive	Apache-Sitgreaves
Wupatki Arizona pocket mouse	*Perognathus amplus cineris*	Sensitive	Coconino

Common Name	Scientific Name	Status	National Forest
pocket mouse	*cineris*		
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Apache-Sitgreaves, Coconino, Kaibab, Tonto
Brown pelican	*Pelecanus occidentalis*	Endangered	Apache-Sitgreaves
California condor	*Gymnogyps californianus*	Experimental Nonessential population	Kaibab
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Apache-Sitgreaves, Coconino Kaibab, Tonto
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Apache-Sitgreaves, Coconino
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Coconino
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate	Coconino
Bell's vireo	*Vireo bellii*	Sensitive	Coconino
Common blackhawk	*Buteogallus anthracinus*	Sensitive	Coconino, Tonto
Eared trogan	*Euptilotis neoxenus*	Sensitive	Tonto
Northern goshawk	*Accipiter gentilis*	Sensitive	Apache-Sitgreaves, Coconino, Kaibab
Northern peregrine falcon	*Falco perefrinus anatum*	Sensitive	Tonto
Fish			
Apache trout	*Oncorhynchus apache*	Threatened	Apache-Sitgreaves
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Coconino
Gila topminnow	*Poeciliposis occidentalis occidentalis*	Endangered	Coronado, Tonto
Little Colorado spinedace	*Lepidomeda vittata*	Threatened, Critical	Apache-Sitgreaves, Coconino

Common Name	Scientific Name	Status	National Forest
spinedace		Habitat	Coconino
Loach minnow	*Tiaroga cobitis*	Threatened	Coconino, Tonto
Razorback sucker	*Xyrauchen texanus*	Endangered	Coconino, Tonto
Spikedace	*Meda fulgida*	Threatened	Coconino, Tonto
Gila chub	*Gila intermedia*	Proposed Endangered, Proposed Critical Habitat	Coronado
Little Colorado sucker	*Catostomus sp3*	Sensitive	Coconino
Roundtail chub	*Gila robusta*	Sensitive	Coconino, Tonto
Reptiles/Amphibians			
Chiricahua leopard frog	*Rana chiricahuensis*	Threatened	Apache-Sitgreaves, Coconino, Coronado
Sonora tiger salamander	*Ambystoma tigrinum stebbinsi*	Endangered	Coronado
Arizona night lizard	*Xantusia vigilis arizonae*	Sensitive	Coconino
Arizona ridgenose rattlesnake	*Crotalus willardi willardi*	Sensitive	Coronado
Arizona southwestern toad	*Bufo microscaphus microscaphus*	Sensitive	Apache-Sitgreaves, Coconino
Lowland leopard frog	*Rana yavapaiensis*	Sensitive	Coconino, Tonto
Mexican garter snake	*Thamnophis eques megalops*	Sensitive	Coconino, Coronado
Narrowheaded garter snake	*Thamnophis rufipunctatus*	Sensitive	Apache-Sitgreaves, Coconino
Northern leopard frog	*Rana pipiens*	Sensitive	Apache-Sitgreaves, Coconino
Ramsey Canyon leopard frog	*Rana subaquavocalis*	Sensitive	Coronado
Sonoran desert tortoise	Gopherus agassizii	Sensitive	Tonto

Common Name	Scientific Name	Status	National Forest
Invertebrates			
A tiger beetle	*Cicindela hirticollis corpuscular*	Sensitive	Coconino
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*	Sensitive	Coconino
California floater	Anodonta californiensis	Sensitive	Coconino
Constock's hairstreak	*Callophrys comstocki*	Sensitive	Coconino
Early elfin	*Incisalia fotis*	Sensitive	Coconino
Freeman's agave borer	*Agathymus baueri freemani*	Sensitive	Coconino
Giant aryxna skipper	*Agathymus aryxna*	Sensitive	Coconino
Huachuca springsnail	*Pyrgulopsis thompsii*	Sensitive	Coronado
Maricopa tiger beetle	*Cicindela oregona Maricopa*	Sensitive	Coconino
Mountain silverspot butterfly	*Speyeria nokomis nitocris*	Sensitive	Coconino
Neumogen's giant skipper	*Agathymus neumoegeni*	Sensitive	Coconino
Obsolete viceroy butterfly	*Limenitis archippus obsolete*	Sensitive	Coconino
Spotted skipperling	*Piruna polingii*	Sensitive	Coconino
White Mountains water penny beetle	*Psephenus montanus*	Sensitive	Apache-Sitgreaves

The use of herbicides may affect the habitat of some threatened, endangered, or proposed animals, but any changes would be minor and for the most part beneficial. Most herbicide treatments will be for hazardous vegetation management in highly modified areas directly adjacent to the road surface. These areas are not suitable habitat for threatened or endangered animals and pose a threat to them from vehicle collisions when the animals approach roadsides to scavenge or move across the roadway. The removal of hazardous vegetation will make mammals or birds along roadsides more visible to motorists and, therefore, less likely to be struck by vehicles. The removal of noxious weeds and invasive plants will benefit the habitat and the areas of designated or proposed critical habitat for threatened, endangered, or proposed animals. As discussed elsewhere, the invasion of noxious weeds into native habitats has the potential to seriously degrade them and make them unsuitable for native wildlife, including threatened, endangered, and proposed animals.

The coordination, mitigation, and best management practices described elsewhere in this document would further ensure the conservation of threatened, endangered, and proposed animals. Annual coordination meetings between Forest Service and ADOT personnel will be held before the growing season to identify areas to be treated with herbicides. When known populations, suitable habitats, or designated or proposed critical habitats of threatened, endangered, or proposed animals occur in a proposed treatment area, surveys will be done, as needed, prior to herbicide applications. Buffer zones will be marked. Treatments to eliminate noxious weeds and invasive plants within buffer zones could include spraying with selective herbicides that would kill the target plants but not harm important native plants, spot treatment of the target plants with backpack sprayers or truck mounted hand wands, or hand grubbing with no herbicide use. Post spray monitoring will be done to ensure that the protective measures were effective and to determine the effectiveness of the treatments in eliminating target plants. With these protective measures in place, the proposed action will not adversely affect any of the 17 species of threatened or endangered animals or areas of designated critical habitat and the one proposed endangered animal and its proposed critical habitat. These determinations are discussed in more detail in the biological assessment and evaluation, Appendix D.

There are 36 species of Forest Service sensitive animals that occur or have suitable habitats within the project area (Table 10). For aquatic species, this includes habitats that are within 2 miles downstream from roadways. As with the threatened and endangered animals, most of the sensitive animals are not permanent residents of roadway habitats and the affects on them will be the same as for the threatened and endangered animals. There are, however, several sensitive species (small mammals and some invertebrates) that may be permanent residents of roadway habitats. The conservation of these species will be through the coordination, mitigation, and best management practices already described. Overall impacts to these and other sensitive species will be minimal because only a small part of their suitable habitat is along roadways. Treatments in these habitats will be limited to areas with noxious weed infestations. With these protective measures in place, no Forest Service sensitive animals will be reduced in population viability or harmed in a way that would increase the likelihood of trending toward Federal listing. These determinations will be discussed in more detail and included in the biological assessment and evaluation, Appendix D.

To prevent certain herbicides from entering water, several mitigations and Best Management Practices (Chapter 2, page 27) would be implemented under this alternative to limit potential adverse effects. These measures include establishing a buffer area next to bodies of water for broadcast applications of herbicide products that do not have aquatic labels. Glyphosate, 2,4-D, triclopyr formulations are labeled for aquatic use and would be the herbicides used next to bodies of water. Spot applications of material like triclopyr, glyphosate, imazapic, and imazapyr could occur to the edge of some bodies of water in compliance with label requirements. Through the use of these resource protection measures and following herbicide label restrictions, the potential for adverse effects to aquatic organisms and habitats would be negligible. For all of the herbicides being considered, it does not appear that an observed level of effect would occur, including threatened, endangered, and sensitive animals.

Directly, indirectly, and cumulatively, this alternative provides the greatest protection for terrestrial and aquatic animals, including threatened, endangered, and sensitive animals, through the most aggressive approach for control of noxious and invasive weeds and protection of native plant communities.

Issue 5. Effects of the alternative on water quality

Alternative 1. No Action (No Herbicide Use)

The potential impact to water quality for this alternative would be related to the increased use of mechanical and manual methods to treat vegetation. Impacts would include increased runoff, soil erosion, and sedimentation. Frequent use of heavy equipment for mechanical management of vegetation could result in significant soil disturbance or compaction. Mechanical vegetation management activities that remove extensive areas of vegetation would reduce the capacity for filtration and the removal of pollutants. Mowing, cutting, and trimming of vegetation may temporarily reduce the ability of vegetation to protect soil surfaces from erosion and to filter pollutants from water produced during storms. Adverse effects on water quality would result from the transport and deposition of eroded sediments that would include nutrient enrichment, increased turbidity, decreased oxygen levels (if nutrient concentration sufficiently stimulate algal blooms), and the accumulation of toxic pollutants (oil products, heavy metals, etc.) from vehicle use on roadways. On the other hand, careful mechanical treatments like mowing, in some areas, could improve the vegetative cover along roadways and these areas would help to intercept sediments and contaminants. However, in other areas of the State, particularly Prescott and Kingman, repeated mowing pressure on native grasses reduces their vigor and leads to an increase in brush and annual weed species, which do not bind the soil and cause an increase in soil erosion. It is important to remember that cultural practices, such as seeding, would be used where practicable to reclaim areas that have an erosion problem. However, the potential adverse effects related to reliance on mechanical and manual methods would be expected to be greater than for the proposed action.

The greater the precipitation, the greater the likelihood for experiencing runoff for a given area of roadway. Runoff is defined as the movement of water across the soil surface until it reaches a defined natural stream channel. If the soil surface on a highway right-of-way is disturbed during construction or maintenance, the infiltration capacity may be significantly reduced and runoff may occur. During heavy rain events, such as thunderstorms, even undisturbed sites could experience some runoff. Moreover, the impervious road surface creates additional volumes of water and increases runoff.

For roadways at high elevations with temperate climates, it is expected that a mixture of grasses, forbs, and wildflowers would quickly occupy the sides of roadways that have received mechanical or manual treatments. Grasses are particularly effective in intercepting sediments and filtering pollutants. However, where woody vegetation moves onto the right-of-way and out-competes grasses, a decrease in filtration could occur. Likewise, noxious weed infestations would reduce grasses and increase the potential for runoff. In general, the absence of any vegetation management could increase the risk of erosion of roadside soils and decrease soil stability, thereby reducing the ability of the right-of-way vegetation to filter pollutants from storm water before it reaches nearby streams.

In arid and desert sites, surface water is generally ephemeral and present only after rainstorms. Vegetation along roadsides is usually sparse, except during particularly wet periods. The potential for surface runoff during heavy storms is usually high with or without mechanical and manual treatments. Overall, it is not likely that water quality would be substantially impacted on these sites through selection of this alternative.

Roadways are considered linear features on national forests, and they generally comprise only a small portion of the total drainage basin for streams or lakes. For this reason, the impact of mechanical treatments along a highway corridor on overall water quality should be minimal in most cases. However, roadside vegetation management practices, which lead to a decrease in grass and other plant species that have good soil binding root systems, could have significant effects on small streams flowing parallel to a roadway.

Cumulatively, this alternative would not be as effective in controlling noxious weeds and invasive plants, and erosion from adjacent lands of mixed ownership would increase as these plant infestations expand over the long run.

Alternative 2. Proposed Action (Use of Herbicides)

Both direct and indirect water quality impacts can result from the use of herbicides to control roadside vegetation. Direct adverse effects could result from improper applications for the following situations: (1) waters receiving herbicide from spray, drift, or spills; or (2) the possibility of large-scale applications to impervious roadway surfaces and compacted soils, combined with runoff, transporting herbicides to water resources. However, the herbicides proposed for use are expected to have little to no negative impact on water quality if they are applied in accordance with registered label directions. Utilization of mitigation measures and Best Management Practices will further reduce the potential adverse effects (refer to Chapter 2, page 28). To ensure proper application and to avoid problems related to runoff, all herbicide applications would be conducted by or under the supervision of a certified pesticide applicator.

Several mechanisms prevent or retard the migration of herbicides through the soil profiles. These mechanisms include chemical precipitation, chemical degradation, volatilization, physical and biological degradation, biological uptake, and adsorption (Table 2, page 21). Clays and organic matter in the soil adsorb certain organic compounds like herbicides (e.g. glyphosate). As a result, the ability of herbicides to leach through the soil column for entry to ground water would be reduced significantly (Table 11). However, some herbicides have some soil activity, that is, they can dissolve in water and move down the soil column. An example would be picloram. An extensive study of the environmental fate of picloram determined that, at normal application rates, picloram was not detectable in surface or groundwater over a 445-day study (Watson et al. 1989). Nevertheless, where soil permeability could be conducive to water contamination, picloram and other water-mobile compounds will not be used where the water table is within 6 feet of the surface. Also, a buffer of 10 feet for flat terrain and up to 100 feet for steep slopes will be imposed for herbicides that could move over the surface and contaminate water sources. Aquatically labeled formulations of 2,4-D, glyphosate, and triclopyr can be safely applied up to the edge of water sources. These herbicides have a short half-life, do not move readily through soil, have low toxicity to aquatic organisms, and have other properties that allow for their safe use near water. Imazapic, imazapyr, and triclopyr can be applied up to the edge of non-irrigation water sources, but they cannot be applied to water. The other materials considered in this analysis should not pose any significant threat to water quality as long as they are not applied within the buffer zone established for surface water sources.

Table 11. Potential for surface runoff and leaching for proposed herbicides (Vencill 2002)

Common Name of Herbicide	Solubility in Water (mg/L)	Half Life in Soil	Potential for Surface Runoff	Potential for Leaching
2,4-D	796 (salt)	10 Days	Low	Moderate
Chlorsulfuron	587 (pH 5) – 31,800 (pH 7)	40 Days	Low	Moderate at pH 7, but less at pH 6
Clopyralid	1,000 (acid) – 300,000 (salt)	40 Days	Low	Moderate
Dicamba	4,500 (acid) – 4000,000 (salt)	Less than 14 Days*	Low	Low to Moderate
Fluroxpyr	4,000 (acid, pH 6.95)	11-38 Days	Low	Low
Glyphosate	15,700 (pH 7) – 900,000 (salt, pH 7)	47 Days	Low	Low
Imazapic	2,200	120 Days	Low	Low
Imazapyr	11,272 (pH 7)	25-142Days*	Low	Low
Isoxaben	1	50-120 Days	Low	Low
Metsulfuron methyl	548 (pH 5) – 2,790 (pH 7)	30 Days	Low	Moderate at pH 7, but less at pH 6
Pendimethalin	0.275	44 Days	Low	Low
Picloram	430	90 Days*	Moderate	High
Sethoxydim	257 (pH 5) – 4,390 (pH 7)	5 Days	Not Available	Not Available
Sulfometuron methyl	10 (pH 5) – 300 (pH 7)	20-28 Days	Low	Moderate at pH 7, but less at pH 6
Tebuthiuron	2.57	Over 360 Days*	Small	High
Triclopyr	23 (ester) – 2,100,000 (salt)	30 Days	Not Available	Not Available

*May persist significantly longer under conditions of low soil moisture and rainfall and soil types.

Changes to roadside vegetative cover through the use of selective herbicides can have a substantial affect on protecting water quality. Removal of target noxious weeds and invasive plants, which are currently minor components of roadside vegetation, will favor establishment of healthy vegetation that will serve to intercept herbicide residues, other contaminants, and sediments. Also, herbicides will be applied in narrow bands or as spot treatments for treatment of hazardous vegetation, minimizing the impacts on water quality. These conservative treatments would target only a tiny fraction of the land in any watershed. Further, as covered in Chapter 2, most of the herbicides being considered rapidly degrade by contact with sunlight, water, or soil (Table 2, page 21).

Since the herbicides considered for use are short-lived and degrade in the environment and mitigations and BMP's will reduce the chances of herbicides moving into water, it is concluded that the typical application rates will not contribute to any significant cumulative impacts to water quality.

Alternatives Compared

Table 12. Summary of the comparison of the alternatives against the five issues

Key Issues	Alternative 1. No Action (No Herbicide Use)	Alternative 2. Proposed Action (Use of Herbicides)
Issue 1. Effectiveness of the alternatives in controlling noxious weeds and hazardous vegetation	Marginally effective for hazardous vegetation and ineffective for most noxious weeds and invasive plants.	Best and most economical method for controlling hazardous vegetation, invasive plants, and noxious weeds.
Issue 2. Effects of the alternative upon human health (public and workers)	For the public, no risk from herbicides, but moderate risk to drivers related to increased equipment used to remove hazardous vegetation and noxious weeds and invasive plants. The risk to workers would be higher than for the proposed action due to potential for vehicle accidents.	For the public, negligible risk from herbicide use, and lowest risk related to accidents from removal of hazardous vegetation and reduced use of mechanical equipment. For workers, lower risk associated with equipment/vehicle accidents, and negligible risk from herbicides.
Issue 3. Effects of the alternative on non-target vegetation, including threatened, endangered, and sensitive species	No risk to non-target plants from herbicide use, but the long-term risk to native plant communities on national forests would be much higher than the proposed action due to the continued expansion of noxious weeds and invasive plant infestations.	Highest risk to non-target plants where herbicide use would occur, but the long-term risk to native plant communities on adjacent National Forest System lands would be lower than for the No Action alternative.

Key Issues	Alternative 1. No Action (No Herbicide Use)	Alternative 2. Proposed Action (Use of Herbicides)
Issue 4. Effects of the alternative on non-target terrestrial and aquatic species, including threatened, endangered, and sensitive species	No risk to non-target species from use of herbicides, but the long-term risk would be higher due to habitat modification caused by expansion of noxious weeds and invasive plant infestations.	Negligible risk associated with herbicide use, but the long-term risk would be lower than the No Action alternative due to preventing the spread of noxious weed and invasive plant infestations.
Issue 5. Effects of the alternative on water quality	No risk from herbicide use, but increased use of mechanical methods would result in higher risk to water quality.	Possible high risk associated with herbicide use, but maintaining healthy vegetation would prevent adverse effects to water quality.

Chapter 5 – Team Members, Public Contacts, References, Acronyms, and Glossary

Team Members

The following individuals participated in the environmental analysis and preparation of the assessment:

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Public Contacts

Over 2,000 forest users; private individuals or groups; county, State, and tribal governments; and other Federal Agencies expressed interest or may be affected by this decision. Through the scoping process, a total of 145 comments were received. A complete list of the responses received is contained in the project file in the Regional Office, Engineering staff.

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Acronyms

AASHTO: American Association of State Highway and Transportation Officials

ADI: Allowable daily intake

ADOT: Arizona Department of Transportation

BMP: Best management practices

Chemtrec: Chemical Transportation Center, Manufacturing Chemicals Association

EPA: U.S. Environmental Protection Agency

FHWA: Federal Highway Administration

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

IPM: Integrated Pest Management

IVM: Integrated Vegetation Management

MSDS: Materials Safety Data Sheet

MCS: Multiple Chemical Sensitivity

NHTSA: National Highway Traffic Safety Administration

NEPA: National Environmental Policy Act

NFS: National Forest System

NOEL: No observable effect level

PPE: Personal Protective Equipment

PRA: Public Road Authority

RfD: Reference Dose

SERA: Syracuse Environmental Associates, Inc.

Glossary

Absorb: To take up by attraction to a surface. Soil particles, dust, activated charcoal, or other substances often absorb chemicals.

Absorbed dose: The amount of a substance (e.g., a chemical) that enters the body of an exposed organism.

Absorption: The movement of a substance (e.g., a chemical) through a membrane into the body after exposure has occurred.

Active ingredient (a.i.): The effective part of a pesticide formulation that actually destroys the target pest or performs the desired functions, or the actual amount of a technical material present in the formulation.

Acute effects: The adverse effects caused by a toxic agent that shows up within a short period of time after exposure.:

Adsorption: The attachment of one substance to the surface of another.

Adjuvant: Material added to the pesticide mixture to help the active ingredient do a better job of control. Examples of an adjuvant include: wetting agent, spreader, adhesive, emulsifying agent, and bark penetrant.

Adaptive Management: A concept of allowing decisions, which are focused on desired outcomes, to be made with the best information available and to adjust operations to achieve desired conditions.

ADI (Acceptable Daily Intake): The amount of a chemical (dose), presumed by the EPA, that a person could receive every day for a lifetime of 70 years without any adverse health effects.

Allergen: A foreign substance that induces a response from the immune system of some people that subsequent exposures to the substance cause allergic reaction (wheezing, sneezing, runny nose, red eyes, hives, other dermatitis, shock, etc.). Also, called an antigen.

Allergic reaction: A reaction to an antigen or allergen, such as pollen or a chemical, that is acquired from previous contact with the material and that is far stronger than would be expected in most people.

Amino acid: Any of numerous nitrogen-containing acids, which include some that are the building blocks of proteins.

Annual (plant): A plant species living for only one year or season.

Benchmark value: An established quantitative limit at which no more than one individual in one million would have the potential to contract cancer from exposure to a chemical under a set of conditions.

Bioaccumulation: The retention and concentration of a substance by an organism.

Biodegradation: The series of processes by which living systems, particularly microorganisms, degrade chemical compounds, and the breakdown products may be either more or less toxic than the parent compound.

Biological diversity: The variety of life and its processes, including all life forms from one-celled organisms to complex organisms such as insects, plants, birds, reptiles, fish, other animals and the processes, pathways and cycles that link such organisms into natural communities.

Buffer strip: A strip of vegetation that is left unmanaged or is managed to reduce the impact that a treatment or action on one area would have on an adjacent area, especially for streams or other water sources.

Carcinogen: A substance that causes or induces cancer.

Chronic exposure: Adverse effects occurring after exposure to a toxic agent for a long period (with animal testing, this is considered to be the majority of the animal's life). These effects are considered to be permanent or irreversible.

Clear zone: An unobstructed area needed along highways to allow motorists to recover control of their vehicles if they run off the road. Width varies depending on design speed, alignment, and environmental factors. Minimum width is generally 10 feet. Maximum width can exceed 40 feet.

Degradation: Physical or biological breakdown of a complex compound into simpler compounds.

Dermal exposure: Contact between a chemical and the skin.

Dicotyledons: A group of flowering plants characterized by two cotyledons in a seed. A cotyledon is a food-digesting and food-storing part of an embryo, also known as a seed leaf.

Diffusion: The movement of suspended or dissolved particles from a more concentrated to a less concentrated region as a result of the random movement of individual particles. The process tends to distribute the particles uniformly throughout the available volume.

Dose: The quantification of exposure. For oral and dermal exposures, it is typically expressed as the amount of chemical in grams or milligrams per kilogram of body weight, and for inhalation, as the concentration of the chemical in the air.

Dose-response: A quantitative relationship between the dose of a chemical and the effect caused by the substance.

Endangered species: Any species that is seriously threatened with extinction throughout all or a sign.

Exotic plant: A non-native plant.

Exposure analysis or assessment: The determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, route, and extent (number of people) of exposure to a substance.

Exposure pathways: Routes that a substance (e.g., a chemical) could enter the body: dermal, ingestion, inhalation.

Exposure scenario: A set of conditions or assumptions about sources, exposure pathways, concentrations of toxic chemicals, and populations (numbers, characteristics, and habits) that aid the investigator in evaluating and quantifying exposure in a given situation.

Extrapolation: An inference (unknown data) from known data.

Forbs: A group of herbaceous (non-woody) plants, other than grasses, generally including wildflowers and many other plants, including those commonly referred to as weeds.

Formulation: The form in which a pesticide is packaged or prepared for use. A chemical mixture that includes a certain percentage of active ingredient (technical chemical) with an inert carrier.

Grasses: A group of herbaceous (non-woody) plants with fibrous roots, jointed stems, sheathed, and alternating leaves originating from nodes, and flowers occurring from spikelets.

Half-life: The length of time required for the mass, concentration, or activity of a chemical or physical agent to be reduced by one-half.

Hazard analysis: Involves gathering and evaluating data on the types of injury or disease that may be produced by a substance and on the conditions of exposure under which injury or disease occurred.

Hazardous vegetation: Any plant that poses a threat to drivers, roads, biotic communities, or adjacent lands. The threat can be in the form of collision hazards, such as vehicles hitting trees that are too close to the road; sight distance impediments, drivers being unable to see wildlife approaching the roadway, around curves in passing zones, signs and safety features because of tall vegetation; vegetation encroachment into the travelway; fire hazard; and degradation of the roadbed.

Herbicide: A chemical that regulates the growth of or kills specific weeds or undesirable plants.

Hypersensitivity: A state of extreme sensitivity to an action of a chemical; a state of altered reactivity in which the body reacts with an exaggerated immune response to a foreign substance.

Immune system: The body' system that protects against infectious agents, controls white blood cell maturation and immuno/globulin production, and guards against the proliferation of cancerous cells.

Individual lifetime risk: The estimated incremental lifetime risk of an adverse effect incurred by an individual owing to exposure to a specific concentration of risk for a given period of time.

Inert ingredients: All ingredients in a formulated pesticide product that are not classified as active ingredients.

Inhalation: The movement of a chemical from the breathing zone, through lung tissues, and into the blood system.

Intake: Amount of material inhaled, absorbed through the skin, or ingested during a specified period of time.

Integrated Pest Management (IPM): A multi-disciplinary, ecological approach to managing a pest, which involves the use of several control techniques in a planned, coordinated program, to limit the impacts of the pest.

Integrated Vegetation Management (IVM): This is the same concept as IPM, but it is specific to plants.

Invasive plant: An invasive plant is a weed that grows and spreads rapidly, replacing desirable native plants.

Kilogram: A Kilogram is 2.205 pounds.

LC50 (Median Lethal Concentration): A measure of acute toxicity. The dose level that kills 50 percent of the test animals exposed. Used in aquatic toxicity and inhalation studies.

LD50 (Median Lethal Dose): A measure of acute toxicity. The dose level that kills 50 percent of the test animals exposed.

Likelihood: Statistical probability that an event, such as harm or injury, may occur as a result of exposure to a risk agent.

Margin of safety (MOS): A separation between the highest no-effect level of a chemical found by animal experimentation and the level of exposure estimated to be safe for humans. It is derived by reducing the NOEL by 100 times, which is considered to be a low risk.

Mitigation measures: The identification of specific practices and methods that will reduce or eliminate adverse effects related to implementation of an alternative.

Monocotyledons: A group of flowering plants that produces seeds having only one cotyledon. Grasses are included in this group of plants.

Mutagen: A substance that can produce change in the genetic material (DNA) of cells that can be transformed during cell division.

Mutagencity: The capacity of a chemical or physical agent to cause permanent alteration of the genetic material within living cells.

Natural community: An assemblage of organisms indigenous to an area that is characterized by distinct combinations of species occupying common ecological zones and interacting with one another.

Nesting cover: An assemblage of vegetation exhibiting a specific growth form to allow nesting activities associated with wildlife reproduction.

Neurotoxicity: Exerting a destructive or poisonous effect on nerve tissue.

NOEL (No Observed Effect Level): In dose-response experiments, it is the exposure level which causes no statistically significant increase in frequency or severity of any effect between the exposed population and its appropriate controls.

Non-target: Any plant, animal, or organism that a method of application is not aimed at, but may accidentally be injured by the application.

Noxious Weed: A noxious weed is a plant species listed in State laws or regulations or specifically listed by a Federal agency.

Perennial: A plant species that has a lifespan of more than 2 years.

Persistence: Resistance to degradation due to low volatility and chemical stability. A persistent substance is expected to remain in the environment for a long time.

Pesticide: Any substance used to control, prevent, destroy, repel, or mitigate insects, rodents, fungi, weeds, or other forms of plant or animal life that are considered to be pests.

Plant community: An association of plants or various species found growing together in different areas with similar site characteristics.

Poison: A substance that may be dangerous to life or health. Often considered to be a substance with relatively high acute toxicity; legally defined as having an acute oral toxicity of less than 50 milligrams per kilogram of body weight.

Public Roadways: Interstates, U.S. highways, and State and county roads are considered public roadways.

Reference Dose (RfD): The term preferred by the U.S. Environmental Protection Agency to express acceptable daily intake (ADI).

Registered herbicide: All pesticides sold or distributed in the United States must be registered by the U.S. Environmental Protection Agency, based on scientific studies, showing that they can be used without posing unreasonable risks to people or the environment.

Right-of-way (ROW): The land provided for a highway, usually including the roadway itself, shoulders, and areas between the roadway and adjacent properties.

Risk: In risk assessment, the probability that an adverse effect (injury, disease, or death) will occur under specific conditions of exposure to a risk agent.

Risk agent: Chemical substance, biological organism, radioactive material, or other potentially hazardous substance or activity.

Risk characterization: Integration of the data and analysis involved in hazard identification, exposure assessment, and dose-response assessment to estimate the nature and likelihood of adverse effects.

Risk estimate: A description of the probability that organisms exposed to a specific dose of a chemical will develop an adverse response, such as cancer.

Roadside recovery area: Synonymous with clear zone and denotes a strip of at least 10 feet on roadsides to allow motorists an unobstructed area in which to recover control of their vehicles if they run off the road.

Route of exposure: An avenue by which a chemical comes in contact with an organism, including inhalation, ingestion, and dermal contact.

Runoff: The movement of water across the soil surface until it reaches a defined natural stream channel.

Safety: Practical certainty that a substance will not cause injury under carefully defined circumstances of use.

Safety factor: A factor conventionally used to extrapolate human tolerance for chemical agents below no-observable-effect levels in animal test data. For Forest Service risk assessments, a safety factor of 100 is used.

Slope failure: Gradual or rapid downslope movement of soil or rock under gravitational stress, often as a result of human-caused factors, e.g., removal of material from the base of a slope.

Solvent: A liquid capable of dissolving another substance. Many solvents are organic, or carbon-based; many of these are volatile, flammable, and toxic. Examples of organic solvents include acetone, trichloroethylene (TCE), ethanol, isopropanol, and benzene. Water is a nonorganic solvent.

Succession: The progressive development of trees or other plants towards their highest role in their ecology; their climax. An example would be the replacement of shrubs and grasses by a forest.

Synthetic: Made by humans.

Systemic effects: Effects observed at sites distant from the entry of a chemical owing to its absorption and distribution into body.

Teratogenic: Capable of producing birth defects.

Threatened species: Any species that is not presently endangered but could become so in the foreseeable future.

Threshold level: A dose or exposure below which there is no apparent or measurable adverse effect.

Toxicity: The quantity or degree of being poisonous or harmful to plant, animal, or human life.

Toxicology: The study of toxic chemicals and their effects on organisms.

Volatilization: To evaporate or cause to evaporate.

Water-soluble: Dissolves in water.

Xerophytic: Plants having various means of protection against the loss of water by excessive transpiration.

Appendix A - Risk Assessment for Humans and Non-Target Species

Introduction

The potential effects on humans and non-target species are somewhat complicated to analyze when synthetic herbicides are considered for use to control noxious weeds and invasive plants on rangelands and in forests and riparian areas. A method commonly used to analyze such effects is known as a risk assessment, which is an analytical tool that attempts to quantify the long-term risks from an action utilizing standards of safety generally accepted by the scientific and health communities. The Southwestern Region has analyzed the risk of the use of 21 herbicides and 4 carriers (USDA 1992). In addition, specific risk assessments are available for 14 of the herbicides being considered (http://www.fs.fed.us/foresthealth/pesticide/risk_assessments). A comparison of the 1992 risk assessment and the updated risk assessments indicate that the conclusions are essentially the same. All of these risk assessments are incorporated by reference and included in the project file.

"The Assessment for the Southwestern Region (1992)" displays estimated risks to the public and applicators when selected herbicides are used. In addition, estimated risks to non-target species of mammals, fish, birds, reptiles, amphibians, and invertebrates are displayed. These estimates are based on a comparison of laboratory toxicity studies with estimated exposures of representative species. The assessments display risks from "routine typical" and "routine extreme" cases. Routine typical cases represent risks to workers, the public, and other organisms that may occur as a result of routine operations. The routine extreme approach is used to estimate doses that would occur under conditions of maximum use and maximum exposure.

The risk assessment has three parts:

Exposure Analysis: This analysis estimates the range of possible doses to workers, the general public, aquatic organisms, etc. A variety of scenarios and exposure pathways are examined that could result in dermal and oral exposures.

Hazard Analysis: Tests and data related to the toxicity of herbicides are reviewed under this analysis. Data are reviewed to indicate the doses at which toxic effects occur and, conversely, levels at which no toxic effects are seen. Of particular interest is a value known as the "No Observed Effect Level" or NOEL. NOEL is the highest dose at which no adverse effects were noted in test animals. The NOEL, in combination with the various safety factors, is a partial basis for determining the safety of human doses and is useful for determining the possible noncarcinogenic effects of herbicides, such as effects on liver or kidney functions. The hazard analysis also reviews data on the possible carcinogenicity of the chemical.

Risk Analysis: Under this analysis, the dose levels calculated in the exposure analysis are compared to the NOEL levels to determine the noncarcinogenic effects of herbicides. Because NOEL levels are based on animal tests, it is assumed that the NOEL should be at least 100 times greater than the doses to establish a margin of safety (MOS). This risk analysis also indicates the probability of developing cancer based on a projection of the lifetime doses received from Forest Service spraying.

Proposed Action

The Forest Service proposes to authorize the Arizona Department of Transportation and other Public Road Authorities to treat about 5,000 acres of noxious weeds, invasive plants, and hazardous vegetation annually along public roadways that pass through the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests. The acreage of treatment each year may vary depending on infestation levels, new introductions, funding, and weather conditions. Even at the maximum level of annual treatments, only a small percentage of the rights-of-way acreage on the forests, less than 3 percent, would be treated with herbicides. All applications would be done by ground-based equipment, including low-pressure systems on pickup trucks or other vehicles, backpacks, and other hand-held devices.

Table 13 is a list of herbicides being considered for use through this document, including trade and common names. This is not an exclusive list and additional products may be registered.

Table 13. Herbicide trade name list

Common Name	Trade Name
2,4-D	Clean Crop Amine 4CA other products
Chlorsulfuron	Telar
Clopyralid	Transline
Dicamba	Dicamba & 2,4-D
Fluroxypyr	Vista
Glyphosate	Roundup & Rodeo
Imazapic	Plateau
Imazapyr	Arsenal
Isoxaben	Gallery
Metsulfuron Methyl	Escort
Pendimethalin	Pendulum
Picloram	Tordon 22K
Sethoxydim	Poast
Sulfometuron Methyl	Oust
Tebuthiuron	Spike
Triclopyr	Garlon 3A & Garlon 4

Human Health Risk

A considerable body of information from tests on laboratory animals is available for the herbicides considered for possible use in controlling noxious and invasive weeds and hazardous species. Most of these tests were conducted as a requirement of the U.S. Environmental Protection Agency (EPA) for the registration process. Only those herbicides approved by the EPA will be considered for use. In addition, all of the herbicides proposed for use have been subjected to long-term feeding studies that test for general systemic effects, such as kidney and liver damage. Also, tests of the effects on reproductive and developmental toxicity (birth defects), mutagenicity (permanent transmissible change in genetic material), neurotoxicity (destructive or poisonous effect upon nerve tissue), carcinogenicity (ability or tendency to produce cancer), and immunotoxicity (poisonous to components of the entire immune system) have been conducted. NOELs are available for most types of these tests.

Extrapolating a NOEL from an animal study to humans is an uncertain process. No one can predict a safe exposure to any substance, natural or synthetic, unless the specific situation or context of exposure and dose are known. In other words, the risk or probability of harm from any substance or activity is never zero, but it can be so low as to be negligible. The EPA compensates for the uncertainty by dividing NOELs from test animals by a safety factor, typically 100, to derive a Reference Dose (RfD). Thus, the RfD is defined as the dose to humans at which there is a reasonable certainty of no harm. The factor of 100 is a risk management device that allows extrapolation of the data from animals to humans under the assumption that animals are less sensitive than humans. The factor also allows the data to be applicable to the most vulnerable members of the population — children and senior citizens. Because the NOEL is mostly based on animal lifetime exposure tests, the RfD actually represents the tolerable daily exposure over a lifetime (assumed to be 70 years for humans).

To evaluate the possible risk to humans, certain baseline criteria were set. Cancer risk is set at a benchmark value of 1 in 1 million. This benchmark is commonly accepted by the scientific community as a negligible addition to the current U.S. cancer rate. Evaluation of systemic and reproductive health risk will be based on a “no observed effect level” (NOEL), which is a long-term dose that does not result in apparent adverse effects.

In evaluating the potential impact of herbicides, it must be kept in mind the small amount that is typically used on National Forest System lands. This is normally less than 2 pounds per acre. Some products are applied at an ounce per acre.

Direct effects for workers are those that may occur from direct contact (dermal exposure) with an herbicide. Potential applications will be by backpack and ground based mechanical methods, and the area treated per day will be dependent on the specific site and type of application. It is determined that the proposed noxious weed, invasive plant, and hazardous species treatments fall within the typical scenario for herbicide use considering the proposed application rates (Table III-B-1, page III-B-3) and acres treated per day per worker (Table III-D-8, page III-D-23) in the 1992 risk assessment. It is determined that it is very unlikely that a project would include all of the conditions that exist in the routine extreme scenario (Table III-D-6, page III-D-20; Table III-B-2, page III-B-4; Table III-D-8, page III-D-23, 1992 risk assessment). The conditions of herbicide application will affect the exposure; thus, implementation of the mitigation measures and Best Management Practices, covered in Chapter 2 (page 28), will reduce possible exposures. Also, using personal protective equipment, as covered in the Safety and Spill Plan (Appendix B, page 83) will lower exposure of workers by as much as 68 percent, since most application exposure is

through the skin and not through the lungs by breathing vapors (Monnig 1988). Proper training and certification of applicators on mixing, loading, and application is essential to reduce the risks to workers.

For the herbicides being considered for use, 2,4-D and triclopyr pose a moderate risk of systemic effects for backpack applicators and ground mechanical applicator/mixer loader (Table III-E-13, page III-E-17, 1992 risk assessment). In addition, 2,4-D, dicamba, and tebuthiuron have a moderate risk for reproductive effects. These risks would be mitigated by measures covered in the preceding paragraph and by limiting maximum exposure to these herbicides. Worker doses for the remaining herbicides proposed for use are likely to be well below the RfD if reasonable safety precautions are followed.

There is the possibility that workers could receive dermal exposures from the spill of a herbicide concentrate and/or the spill of a herbicide mixture, including carriers. Table III-E-14 (page III-E-18), 1992 risk assessment, for right-of-way sites, displays the risks associated with accidents (assuming a 2,000-gallon tank spill). The risk to workers associated with accidental spills is expected to be negligible if they are trained, use required protective clothing and equipment, and follow steps outlined in the Safety and Spill Plan (Appendix B).

Concern has been raised about the collection and consumption of native herbs, medicinal plants, berries, etc., that could be inadvertently sprayed. The main concern appears to center on the increased risk of cancer that could result from exposure to low levels of an herbicide. All of the herbicides being considered for use have undergone testing for cancer. Clopyralid and dicamba tests have shown no evidence of cancer initiation or promotion. The evidence for 2,4-D and picloram have been debated. Nevertheless, the 1992 risk assessment assumes that the various herbicides are carcinogens. The analyses also assume that any dose of a carcinogen could cause cancer and the probability of cancer increases with increased doses. Estimates of the probability of developing cancer from exposure to these compounds are based on a conservative extrapolation from cancer rates in animals subjected to the chemical for a lifetime. The projected cancer rates are highest for workers since their dose could be higher. Even for the workers, the risks seem relatively low compared to other commonly encountered risks. For example, one round-trip transcontinental aircraft trip carries with it an increased risk of cancer from cosmic rays in the order of one in a million. Smoking two cigarettes increases the risk of cancer by one in a million as does eating six pounds of peanut butter due to aflaxtoxin. Cancer probabilities would increase by one in a million after spraying 2,4-D for 137 days or spraying picloram for about 11,000 days. Since the average American has about a one in four chance of developing cancer in his or her lifetime, the cumulative impact from spraying herbicides at the proposed rates is considered to be insignificant. Nevertheless, studies by the California Environmental Protection Agency, Department of Pesticide Regulation, for tribal people who gather plant materials for food, medicinal, ceremonial, or basketry purposes show that herbicides were no longer detectable or plant materials were no longer available after 80 weeks (California Environmental Protection Agency, May 2001). As a result, if and when treatments are done, information on the timing and location of spraying will be provided upon request to individuals who want to avoid these areas (1-800-546-6591).

There is the possibility that a small percentage of the population in Arizona will be hypersensitive or allergic to any one or more of the herbicides proposed for use. Well-known allergenic substances include common foods, pollen, bacterial and fungal toxins, insect bites and stings, etc. Less frequent are hypersensitivities to certain fragrances and solvents. Allergies and

hypersensitivities are atypical reactions exhibited by very few individuals in any population (Felsot 2001). Typical allergic symptoms include runny nose, watery eyes, swelling, and hives. Symptoms exhibited by allergic individuals are caused by specific immunological reactions of the body that are triggered by exposure to very low doses of allergens. Allergic reactions result when the body's normal immune system defenses overproduce antibodies to specific foreign substances. Allergenic and hypersensitive reactions occur by different mechanisms than toxicity. Toxic reactions result when chemical doses become high enough to interfere with normal physiological functions of cells and tissues. Individuals who have allergic reactions or hypersensitivity are generally aware of their sensitivities and such people would not be permitted to work on spray crews. In addition, a toll free number (1-800-546-6591) is available to allow concerned members of the public to avoid the possibility of exposure from proposed herbicide applications conducted by the Arizona Department of Transportation. Other Public Road Authorities would need to be contacted directly regarding herbicide operations.

In summary, the risk or probability of harm to humans is not zero, but it is reasonable to expect that the human health impacts from the proposed herbicide applications would be insignificantly small.

Effects on Aquatic Resources

The potential impact of herbicides proposed for use on fish and other aquatic organisms is a function of three factors: 1) toxic characteristics of the active ingredient; 2) amount of the active ingredient in the water where aquatic organisms live, and 3) length of time an organism is exposed to the active ingredient.

Whether an organism is affected by an herbicide is generally measured in a laboratory using a "LC50" test. The LC50 is the herbicide concentration that is lethal to 50 percent of the organisms exposed to the active ingredient for a given time. Although the LC50 is frequently used as a toxicity standard, 50 percent mortality of fish or other aquatic organisms would not be acceptable under any circumstance on a national forest. For this reason, biologists calculate a "No Observed Effect Level" (NOEL). This is the amount of active ingredient that would have no measurable effects on test organisms after several days of exposure.

The herbicides proposed for use are all characterized by relatively low aquatic toxicity under typical case water concentrations (Table III-H-6. page III-H-13. 1992 risk assessment). The only exceptions are for triclopyr and limonene, which may present a high risk for trout in streams and a moderate risk for trout in lakes. Picloram, dicamba, and 2,4-D may present a moderate risk under extreme water concentration, but this case seems highly unlikely under the conditions of proposed application. Clopyralid, dicamba, and glyphosate are roughly 1/5 to 1/50 as toxic to various aquatic organisms.

In regard to the risk to endangered and threatened (T&E) or sensitive aquatic organisms, triclopyr products not labeled for aquatic use may present an unacceptable risk to T&E cold water fish under the typical case scenario. Likewise, 2,4-D not labeled for aquatic use may present an unacceptable risk to T&E aquatic invertebrates. It must be noted that the assessment was made using aerial application as the treatment approach. A ground-based application would reduce the risk. Also, it does not appear that any proposed applications will occur where these organisms are present; however, to mitigate the concern, triclopyr products not labeled for aquatic use will not be sprayed within the high water zone of any stream or water course were cold water T&E or

sensitive fish are present. In addition, 2,4-D products not labeled for aquatic use will not be sprayed in any location where there are T&E or sensitive aquatic invertebrate species.

The majority of herbicide applications near water will be by hand backpack or truck mounted hand wand applications, and this will result in minimal risk to contamination of surface water. Leaching of herbicides through soil is not a significant process. Herbicides do have the potential for overland flow during heavy rainstorms, but the likelihood of such movement on infiltration-dominated sites makes water contamination unlikely. Mitigation measures and Best Management Practices will serve to reduce the potential for possible adverse effects to aquatic organisms.

Non-Target Animal Species

A short list of management indicator species (MIS) for the Southwestern Region (Region 3) were identified in the 1992 risk assessment (Table III-H-10, page III-H-2) and these species can serve as general indicators for the proposed program's effect on non-target animal species. To analyze the program's potential risk to MIS, the various species were paired with the most closely related representative species used in the non-target species analysis. The results of the non-target species risk analysis were then extrapolated to the indicator species by assuming that the doses received by the representative species also apply to the indicator species.

There currently are 66 species listed as Management Indicator Species (MIS) that occur on National Forest System lands in Arizona. Population and habitat trends for each species can be found in MIS reports for the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests. Copies of the MIS reports are maintained at the forest supervisor's office for each national forest in Arizona. A list of the MIS species follows:

Birds

Goshawk
Pygmy nuthatch
Merriam's turkey
Yellow-bellied sapsucker (red-naped sapsucker)
Mexican owl
Plain titmouse (juniper titmouse)
Hairy woodpecker
Lincoln's sparrow
Lucy's warbler
Yellow-breasted chat
cinnamon teal
coppery-tailed trogon
sulpher-bellied flycatcher
gray hawk
blue-throated hymmingbird
rose-throated becard
thick-billed kingbird
northern beardless tyrannulet

Bell's vireo
buff-breasted flycatcher
Mearn's quail
Baird's sparrow
five-spotted sparrow
peregrine falcon
Gould's turkey
rufous-sided towhee
violet green swallow western bluebird
ash-throated flycatcher
fray vireo
Townsend's solitaire
common flicker
black-chinned sparrow
savannah sparrow
horned lark
black-throated sparrow
brown towhee
Birds (continued)
bald eagle
summer tanager
hooded oriole
warbling vireo
western wood pewee
black hawk

Mammals

Abert's squirrel
elk
mule deer
antelope
red squirrel
black bear
white-tailed deer
Mt Graham spruce squirrel
Arizona gray squirrel

Macro-invertebrates

Macro-invertebrates

Herptiles

desert massassauga
twin-spotted rattlesnake
Arizona ridge-nosed rattlesnake
Huachuca tiger salamander
Tarahumara frog
western barking frog
Arizona tree frog

Fish

Mexican stoneroller
Arizona trout
Gila topminnow
Gila chub
Sonora chub
Spikedace

Pages III-H-1 through III-H-9 and Table III-H-2 (page III-H-7), 1992 risk assessment, address possible effects on representative species. Under the typical case, all species are in the low risk category given the materials proposed for use. Although the 66 MIS listed above are not specifically addressed in either the 1992 risk assessment or the risk assessments for specific herbicides that are incorporated by reference (page 13), no additional information is available to assess the potential risks from the proposed use of the herbicides. Because the proposed herbicides have low toxicity to animals and any contact with herbicides would be very infrequent, it was concluded that the proposed application of the herbicides is not likely to have a greater affect on MIS than for threatened, endangered, sensitive, or other species.

An analysis of the potential effects of the proposed use of herbicides on MIS population trends and habitats was completed and included in the process record, and it was determined that the potential affects would not be significant. Linear roadways that pass through National Forest System lands in Arizona are disturbed sites that would not provide suitable habitat for MIS. Significantly, it is estimated that the majority (70 percent or more) of the proposed herbicide applications would occur within 5 feet of roadway edges. In addition, the proposed applications of herbicides would involve spot treatments and no more than 3 percent of the total area within easements could be treated. Thus, modification of habitats for individual species would be very small and the potential affect on MIS populations is expected to be negligible.

Appendix B - Herbicide Safety and Spill Plan

Information and Equipment

All individuals applying herbicides will receive training on safety and application procedures prior to any spraying.

Only Arizona Department of Transportation and Public Road authority employees, who have been certified by the Arizona Structural Pest Control Commission, will conduct spray operations.

A copy of the Labels and Material Safety Data Sheets (MSDS) for all herbicides will be available at all times during project operations. Employees will be completely familiar with the information in these documents in case it is needed in the event of a spill or incident.

Required Personal Protective Equipment (PPE) will be worn at all times when herbicides are being mixed and applied. Label requirements for specific herbicides will be followed. Applicators and handlers must wear the maximum PPE required by the labels for each herbicide being applied.

An emergency spill kit, with directions for use, will be present when herbicides are being mixed, transported, and applied. Employees will be trained in the use of the spill kit prior to initiation of operations.

The spill kit will contain the following equipment:

- Shovel
- Broom
- Ten pounds of absorbent material
- Box of large plastic bags
- Nitrile gloves

Procedures for Herbicide Spill Containment

Information in this section is derived from the EPA document "Applying Pesticides correctly: A Guide for Private and Commercial Applicators," and the rules and regulation of the State of Arizona Structural Pest Control Commission.

The following information will be reviewed by all workers who handle herbicides:

Immediately notify the direct supervisor of an incident or spill. Identify the nature of the incident and extent of the spill, including the product and chemical names and the EPA registration number(s).

Remove any injured or contaminated person to a safe area. Remove contaminated clothing and follow MSDS guidelines for emergency first aid procedures regarding exposure. Do not leave an injured person alone. Obtain medical help for any injured employee.

Contain the spilled herbicide as much as possible on the site. Prevent the herbicide from entering ditches, gullies, wells, or water systems.

Small Spills (Less than 1 gallon of herbicide formulation or less than 10 gallons of herbicide mixture)

- Qualified employees will be present to confine a spill.
- Follow MSDS guidelines for emergency first aid procedures in the event of an accidental exposure.
- Restrict entry to the spill area.
- Contain the spread of the spill with earthen dikes.
- Cover the spill with absorbent material.
- Place contaminated materials into leak-proof container(s) and label.
- Dispose of contaminated material according to label instructions and State requirements.

Large Spills (More than 1 gallon of herbicide formulations or more than10 gallons of herbicide mixture)

- Keep people away from the spill.
- Follow MSDS guidelines for emergency first aid procedures in the event of an accidental exposure.
- Contain the spread of the spill with earthen dikes.
- Cover the spill with absorbent material.
- Spread the absorbent material around the perimeter of the spill and sweep toward the center.
- Call the direct supervisor and the local fire department; follow their instructions for further actions.

Procedures for Herbicide Mixing, Loading, and Disposal

1. Mixing of herbicides and adjuvants will be done at least 100 feet from well heads or surface waters.
2. Dilution water will be added to the spray container prior to addition of the herbicide concentrate.
3. Hoses used to add dilution water to spray containers shall be equipped with a device to prevent back-siphoning, or a minimum 2-inch air gap.
4. Workers mixing herbicides will wear the maximum personal protective equipment required by the label.

Empty containers will be triple rinsed. Rinsate will be added to the spray mix or disposed of on the application site at a rate that does not exceed amounts addressed on the label.

Unused herbicide will be stored in a locked facility in accordance with herbicide storage instructions provided by the manufacturer, and in accordance with Arizona Structural Pest Control Commission Regulations.

Empty and rinsed herbicide containers will be punctured and disposed of according to label directions.

Appendix C - Memorandum of Understanding

FS Agreement No. 03-MU-11031600-048
Cooperator's No. _____

Memorandum of Understanding Between the Arizona Department of Transportation, Federal Highway Administration, and USDA Forest Service, Southwestern Region

Purpose

In recognition of the severe impact from invasive species, President Clinton issued Executive Order 13112 on February 3, 1999, which mobilized the Federal government, in cooperation with States and others, to address the invasive species problem. The USDA Forest Service (USFS), the Federal Highway Administration (FHWA), and the Arizona Department of Transportation (ADOT), collectively called the "parties," have entered into this agreement to carry out their separate activities in a coordinated and mutually beneficial manner for management of invasive plants and hazardous vegetation through the proposed use of herbicides. The purpose of this agreement is to support preservation of Arizona's native ecosystems and reduce the hazard to the motoring public through cooperative management of invasive species and hazardous vegetation along public roadways managed by ADOT that pass through National Forest System lands. It provides for coordination between ADOT, FHWA, and the USFS to facilitate prompt identification of weed problems, provide a public information source related to proposed herbicide spraying, and facilitate the control of invasive weeds and hazardous vegetation.

Scope

A. ADOT, FHWA, and USFS shall:

1. Meet at least once annually, preferably in February, to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties or conflicts. It is agreed that ADOT, Natural Resources, will coordinate all such meetings.

2. Conduct surveys and share information on location and potential for spread of invasive plants and identify hazardous vegetation concerns related to public safety.

3. Jointly develop a long-term plan to control invasive weeds and hazardous vegetation and update the plan, as needed, to include:

    a. Assess previous year's program and, if necessary, modify established treatments and methods to achieve desired results;

    b. Identify locations of planned treatments;

    c. Establish schedule for treatments;

    d. Identify treatment methods;

    e. Establish mitigations and other constraints;

    f. Determine equipment and supplies to be shared, and execute any necessary agreements or paperwork; and

    g. Identify other operational aspects.

4. Check treatment sites for compliance with jointly established mitigations and constraints.

B. The USDA-FS shall:

1. Complete required environmental documents in compliance with the National Environmental Policy Act and associated regulations for implementation of this agreement.

2. On an annual basis, at the annual meeting, identify all sites along and near public roadways that have threatened, endangered, or sensitive plant species and discuss necessary mitigation measures and other constraints.

C. The ADOT Shall:

1. Provide direction to all Natural Resource crews and Agents of the Natural Resource Section to ensure compliance with established procedures, mitigations, and other constraints.

2. Maintain a toll free number (1-800-546-6591) to allow the public to assess the timing and location of proposed herbicide applications.

3. If herbicides are used, provide an annual report to the Forest Service Regional Pesticide Coordinator by November 15 for the previous Federal fiscal year (October 1 through September 30) including:

   a. National Forest: Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto;

   b. Active ingredient: Common name (trade name) of individual herbicides. When mixtures of herbicides are used, list herbicides separately;

   c. EPA Number;

   d. Management objective (Noxious weeds or hazardous vegetation);

   e. Unit treated (acres);

   f. Total pounds of active ingredient;

   g. Primary target plant; and

   h. Comment (record active ingredient mixes, tank (T) or formulated mix (M).

   i. Maintain required records for restricted use herbicides.

D. It Is Mutually Agreed and Understood by the Parties that:

1. The USDA-FS, FHWA, and ADOT will handle their own activities and utilize their own resources, including the expenditure of their own funds, in pursuing these objectives. Each party will carry out its separate activities in a coordinated and mutually beneficial manner.

2. Nothing in this MOU shall obligate the USDA-FS, FHWA, or ADOT to obligate or transfer any funds. Specific work projects or activities that involve the transfer of funds,

services, or property among the various agencies and offices of the USFS and ADOT will require execution of separate agreements and be contingent upon the availability of appropriated funds. Such activities must be independently authorized by appropriate statutory authority. This MOU does not provide such authority. Negotiation, execution, and administration of each such agreement must comply with all applicable statutes and regulations.

3. This MOU takes effect upon the signature of the USFS, FHWA, and ADOT, and shall remain in effect for 5 years from the date of execution. This MOU may be extended or amended upon written request of the USFS, FHWA, or ADOT and the subsequent written concurrence of the other(s). The USFS, FHWA, or ADOT may terminate this MOU with a 60-day written notice to the other(s).

4. This MOU is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a party against the United States, its agencies, its officers, or any person.

E. PRINCIPAL CONTACTS. The principal contacts for this instrument are:

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IN WITNESS WHEREOF, the Parties hereto have executed this agreement as of the dates shown below.

ARIZONA DEPARTMENT of TRANSPORTATION

BY: /s/ Bill Higgins_____ **DATE:**___4/10/03_____

FEDERAL HIGHWAY ADMINISTRATION

BY: /s/ Stephen D. Thomas_____ **DATE:**____4/16/03_____

USDA FOREST SERVICE

BY: /s/ Lucia M. Turner_____ **DATE:**_____5/27/03_____

The authority and format of this instrument has been reviewed and approved for signature.

__/s/ _Susan McDonnell_____ Date:___5/27/03_____

SUSAN McDONNELL
Grants & Agreements Specialist

Appendix D - Biological Assessment and Evaluation

This document will be prepared and reviewed by the U.S. Fish and Wildlife Service concurrently with the review of this environmental assessment. The biological assessment and evaluation will be included with the final environmental assessment.

Appendix D. Revised Biological Assessment and Evaluation

Introduction

The USDA Forest Service, Southwestern Region (Forest Service), proposes to authorize the Arizona Department of Transportation (ADOT) and Federal Highway Administration (FHWA) to use herbicides as part of vegetation management along Interstate Highways, Federal Highways, and State roads that pass through National Forest System lands in Arizona. The purpose of this program is: 1) to control vegetation that presents a safety hazard to motorists; and 2) to contain, control, or eradicate noxious weeds that can spread from highways onto adjacent forests and rangelands.

This Biological Assessment and Evaluation (BAE) determines the effects of this program (*i.e.* herbicide use) on 21 animals and 4 plants that are listed or proposed under the Endangered species Act of 1973, as amended (Table 1). It also determines the effects of this program on 36 animals and 27 plants designated as Sensitive by the Regional Forester of the Southwestern Region (Table 2). This BAE will not analyze the effects of other vegetation management techniques (*i.e.* mowing, grading, *etc*.) that are already authorized and being used.

We have determined that this program of herbicide use with its proposed conservation measures **is not likely to adversely affect or will have no effect** on any endangered, threatened, or proposed species; any designated or proposed critical habitat areas; or, any nonessential experimental populations. We have further determined that this program of herbicide use with its proposed conservation measures **will not reduce population viability or harm any Forest Service Sensitive species in a way that would increase its likelihood of trending toward Federal listing**.

Table 1. Species with Federal Endangered Species Act status and proposed or designated critical habitat areas that may be affected by the use of herbicides along Federal or State highways that pass through National Forest System lands in Arizona

Common Name	Scientific Name	Status	Forest Where There May be an Effect
Mammals			
Black-footed ferret	*Mustela nigripes*	Endangered	Coconino
Jaguar	*Panthera onca*	Endangered	Coronado
Lesser long-nosed bat	*Leptonycteris curasae yerbabuenae*	Endangered	Coronado
Mexican gray wolf	Canis lupus baileyi	Nonessential Experimental Population	Apache-Sitgreaves
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Apache-Sitgreaves, Coconino, Kaibab, Tonto
Brown pelican	*Pelecanus occidentalis*	Endangered	Apache-Sitgreaves, Tonto
California condor	*Gymnogyps californianus*	Nonessential Experimental Population	Kaibab, Coconino
Mexican spotted owl	*Strix occidentalis lucida*	Threatened, Proposed	Apache-Sitgreaves,

Common Name	Scientific Name	Status	Forest Where There May be an Effect
		Critical Habitat	Coconino, Coronado, Kaibab, Prescott, Tonto
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Apache-Sitgreaves, Tonto
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Coconino, Tonto
Fish			
Apache trout	*Oncorhynchus apache*	Threatened	Apache-Sitgreaves, Coronado
Colorado pikeminnow	*Ptychocheilus lucius*	Nonessential Experimental Population	Coconino
Gila chub	*Gila intermedia*	Proposed Endangered, Proposed Critical Habitat	Coronado
Gila topminnow	*Poeciliposis occidentalis*	Endangered	Tonto
Little Colorado spinedace	*Lepidomeda vittata*	Threatened, Critical Habitat	Apache-Sitgreaves
Loach minnow	*Tiaroga cobitis*	Threatened, Critical Habitat	Coconino, Prescott, Tonto
Razorback sucker	*Xyrauchen texanus*	Endangered, Critical Habitat	Apache-Sitgreaves, Coconino, Prescott, Tonto
Spikedace	*Meda fulgida*	Threatened, Critical Habitat	Coconino, Prescott, Tonto
Amphibians			
Chiricahua leopard frog	*Rana chiricahuensis*	Threatened	Apache-Sitgreaves, Coconino, Coronado
Sonora tiger salamander	*Ambystoma tigrinum stebbinsi*	Endangered	Coronado
Plants			
Arizona agave	*Agave arizonica*	Endangered	Tonto
Arizona cliffrose	*Purshia subintegra*	Endangered	Coconino
Arizona hedgehog cactus	*Echinocereus triglochidiatus* var. *arizonicus*	Endangered	Tonto
Huachuca water umbel	*Lilaeopsis schaffneriana* ssp. *recurva*	Endangered	Coronado

Table 2. Forest Service Sensitive species, including Federal candidate species, that may be affected by the use of herbicides along Federal or State highways that pass through National Forest System lands in Arizona.

Common Name	Scientific Name	Status	Forest
Mammals			
Navajo Mogollon vole	*Microtus mogollonensis navaho*	Sensitive	Coconino
New Mexican meadow jumping mouse	*Zapus hudsonius luteus*	Sensitive	Apache-Sitgreaves
Silky pocket mouse	*Perognathus flavus goodpasteri*	Sensitive	Apache-Sitgreaves
White Mountains ground squirrel	*Spermophilus tridecemlineatus monticola*	Sensitive	Apache-Sitgreaves
Wupatki Arizona pocket mouse	*Perognathus amplus cineris*	Sensitive	Coconino
Birds			
Bell's vireo	*Vireo bellii*	Sensitive	Coconino
Common blackhawk	*Buteogallus anthracinus*	Sensitive	Coconino, Tonto
Eared trogon	*Euptilotis neoxenus*	Sensitive	Tonto
Northern goshawk	*Accipiter gentilis*	Sensitive	Apache-Sitgreaves, Coconino, Kaibab
Northern peregrine falcon	*Falco peregrinus anatum*	Sensitive	Tonto
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate, Sensitive	Coconino
Fish			
Little Colorado sucker	*Catostomus sp3*	Sensitive	Coconino
Roundtail chub	*Gila robusta*	Sensitive	Coconino, Tonto
Amphibians and Reptiles			
Arizona night lizard	*Xantusia vigilis arizonae*	Sensitive	Coconino
Arizona ridgenose rattlesnake	*Crotalus willardi willardi*	Sensitive	Coronado
Arizona southwestern toad	*Bufo microscaphus microscaphus*	Sensitive	Apache-Sitgreaves, Coconino
Lowland leopard frog	*Rana yavapaiensis*	Sensitive	Coconino, Tonto
Mexican garter snake	*Thamnophis eques megalops*	Sensitive	Coconino, Coronado
Narrowheaded garter snake	*Thamnophis rufipunctatus*	Sensitive	Apache-Sitgreaves, Coconino
Northern leopard frog	*Rana pipiens*	Sensitive	Apache-Sitgreaves, Coconino
Ramsey Canyon leopard frog	*Rana subaquavocalis*	Sensitive	Coronado
Sonoran desert tortoise	*Gopherus agassizii*	Sensitive	Tonto
Invertebrates			
Arizona giant-skipper	*Agathymus aryxna*	Sensitive	Coconino

Common Name	Scientific Name	Status	Forest
A tiger beetle	*Cicindela hirticollis corpuscula*	Sensitive	Coconino
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*	Sensitive	Coconino
California floater	*Anodonta californiensis*	Sensitive	Coconino
Desert green hairstreak	*Callophrys comstocki*	Sensitive	Coconino
Desert elfin	*Callophrys fotis*	Sensitive	Coconino
Four-spotted skipperling	*Piruna polingi*	Sensitive	Coconino
Freeman's agave borer	*Agathymus baueri freemani*	Sensitive	Coconino
Huachuca springsnail	*Pyrgulopsis thompsoni*	Candidate, Sensitive	Coronado
Maricopa tiger beetle	*Cicindela oregona Maricopa*	Sensitive	Coconino
Mountain silverspot butterfly	*Speyeria nokomis nitocris*	Sensitive	Coconino
Obsolete viceroy butterfly	*Limenitis archippus obsolete*	Sensitive	Coconino
Orange giant skipper	*Agathymus neumoegeni*	Sensitive	Coconino
White Mountains water penny beetle	*Psephenus montanus*	Sensitive	Apache-Sitgreaves
Plants			
Arizona alumroot	*Heuchera glomerulata*	Sensitive	Apache-Sitgreaves
Arizona sneezeweed	*Helenium arizonicum*	Sensitive	Coconino, Apache-Sitgreaves
Arizona willow	*Salix arizonica*	Sensitive	Apache-Sitgreaves
Beardless cinchweed	*Pectis imberbis*	Sensitive	Coronado
Blumer's dock	*Rumex orthoneurus*	Sensitive	Apache-Sitgreaves, Coronado, Tonto
Chiricahua mountain brookweed	*Samolus vagans*	Sensitive	Coronado
Fish Creek rock daisy	*Perityle saxicola*	Sensitive	Tonto
Flagstaff beardtongue	*Penstemon nudiflorus*	Sensitive	Tonto
Gila groundsel	*Senecio quaerens*	Sensitive	Apache Sitgreaves
Goodding's onion	*Allium gooddingii*	Sensitive	Apache-Sitgreaves
Haulapai milkwort	*Polygala rusbyi*	Sensitive	Coconino, Prescott
Heathleaf wild buckwheat	*Eriogonum ericifolium* var. *ericifolium*	Sensitive	Coconino, Prescott
Hohokam agave	*Agave murpheyi*	Sensitive	Tonto
Kaibab bladderpod	*Lesquerella kaibabensis*	Sensitive	Kaibab
Kaibab paintbrush	*Castilleja kaibabensis*	Sensitive	Kaibab
Kaibab pincushion cactus	*Pediocactus paradinei*	Sensitive	Kaibab
Mearns sage	*Salvia dorrii* ssp. *mearnsii*	Sensitive	Coconino, Prescott
Mogollon paintbrush	*Castilleja mogollonica*	Sensitive	Apache-Sitgreaves
Mt. Dellenbaugh sandwort	*Arenaria aberrans*	Sensitive	Kaibab

Common Name	Scientific Name	Status	Forest
Ripley wild buckwheat	*Eriogonum ripleyi*	Sensitive	Coconino, Prescott
Rock fleabane	*Erigeron saxatilis*	Sensitive	Coconino
Rusbyi's milkvetch	*Astragalus rusbyi*	Sensitive	Coconino
Sunset Crater beardtongue	*Penstemon clutei*	Sensitive	Coconino
Supine bean	*Macroptilum supinum*	Sensitive	Coronado
Tonto Basin agave	*Agave delamateri*	Sensitive	Coconino, Tonto
Tusayan rabbitbrush	*Chrysothamnus molestus*	Sensitive	Kaibab
White Mountain clover	*Trifolium longipes* ssp. *neurophyllum*	Sensitive	Apache-Sitgreaves

Consultation and Coordination

Informal section 7 consultation on this proposed program began with a National Environmental Policy Act (NEPA) scoping request dated May 8, 2002. The U.S. Fish and Wildlife Service (FWS), Arizona Ecological Services Field Office responded to this request with a letter and species list dated June 14, 2002 (Cons. # 2-21-02-I-208).

A Memorandum of Understanding (MOU) for the conduct of this program was established between the Forest Service, FHWA, and ADOT on May 27, 2003 (Appendix C, USDA Forest Service 2003).

Information on endangered and threatened species and critical habitats was requested from the six Arizona national forests (Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto) on September 24, 2002. The forests were asked to identify endangered, threatened, and proposed species, and designated and proposed critical habitat areas that occur within and for a distance of 60 m (200 ft) beyond the right-of-way boundaries of Interstate, Federal, and State highways that pass through their Forests. For aquatics species, they were asked to identify any occupied habitat or designated critical habitat areas that occur at a distance of 3.2 km (2 mi) or less downstream from a highway. They were requested to identify both occupied and suitable habitat and estimate the highway distances of each.

An initial BAE was submitted to FWS on August 7, 2003, with determinations that the program of herbicide use with its proposed conservation measures is not likely to adversely affect or will have no effect on any endangered, threatened, or proposed species; any designated or proposed critical habitat areas; or, any nonessential experimental populations. The FWS responded to the BAE in a letter dated October 31, 2003, with recommendations of additional conservation measures that would be needed before FWS could concur with the Forest Service's determinations for some species.

The Forest Service, ADOT, and FWS met on December 18, 2003, to discuss the proposed program and the conservation measures for some species. The ADOT and FWS met several times from January through March 2004, to discuss specific conservation measures in greater detail. The Forest Service and FWS communicated through e-mail and phone from March through April, 2004, to further discuss specific conservation measures mostly as these related to the FWS working draft document titled, "Recommended Protection Measures for Pesticide Applications in the Southwest Region of the U.S. Fish and Wildlife Service" (U.S. Fish and Wildlife Service,

March 2004). The conservation measures developed during those communications have been incorporated into the proposed program. Those conservation measures are included in this revised BAE in the “effects finding” section for the species to which they apply.

Description of the Proposed Action

The Forest Service proposes to authorize ADOT and FHWA to use approved herbicides for vegetation management along Interstate Highways, Federal Highways, and State roads that pass through National Forest System lands in Arizona (Figure 1). This authorization will add herbicide use to other vegetation management techniques (mowing, grading, tillage, controlled burning, manual methods, cultural methods, and vegetation restoration) that are already being used along highways on National Forest System lands. The FHWA is already authorized to use herbicides on all or portions of Interstates and U.S. highways, but this proposed authorization will extend the distance 60 m (200 ft) beyond the right-of-way boundary.

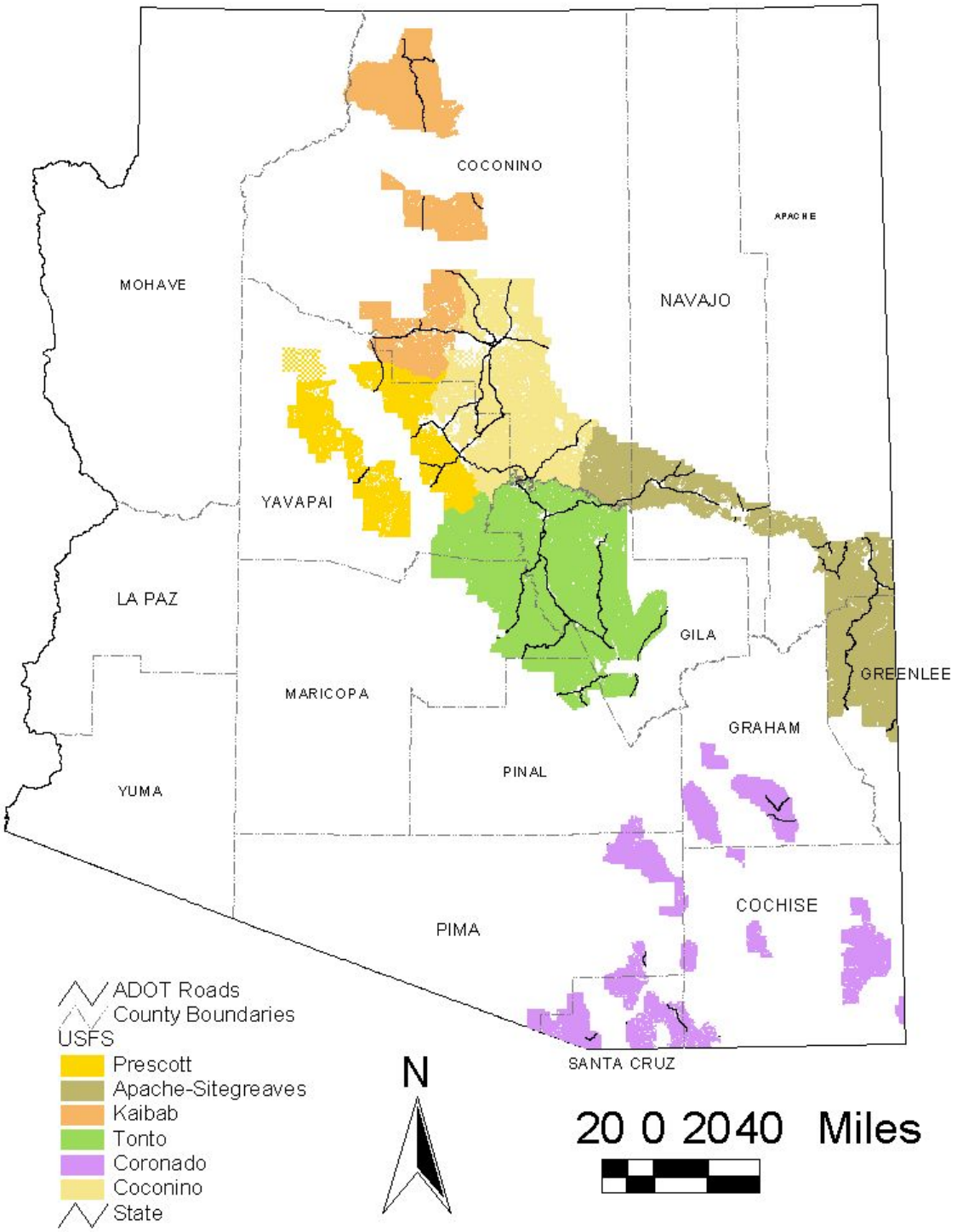

Figure 1. Location of public roadways managed by Arizona Department of Transportation on the six national forests in Arizona.

Approved herbicides would be used in conjunction with other measures as part of the overall vegetation management program along highways on National Forest System lands. The goals of vegetation management along highways are: 1) to control vegetation that is hazardous to motorists, and 2) to contain, control, or eradicate noxious weeds that can spread onto adjacent forests and rangelands. Highways have an area called the "clear zone" immediately adjacent to the pavement that is kept free of removable hazards or has markers for non-removable hazards like culverts. Vegetation is removed from the clear zone that could endanger motorists or block their view of non-removable hazards. The introduction of noxious weeds into a new area is usually along highways (Roche and Roche 1991) and left untreated these infestations can spread to adjacent native plant communities. When noxious weeds dominate a site, forest and rangeland health and resource values like recreation can be adversely affected. The ADOT has surveyed for noxious weeds along highways and on National Forest System lands (Figure 2).

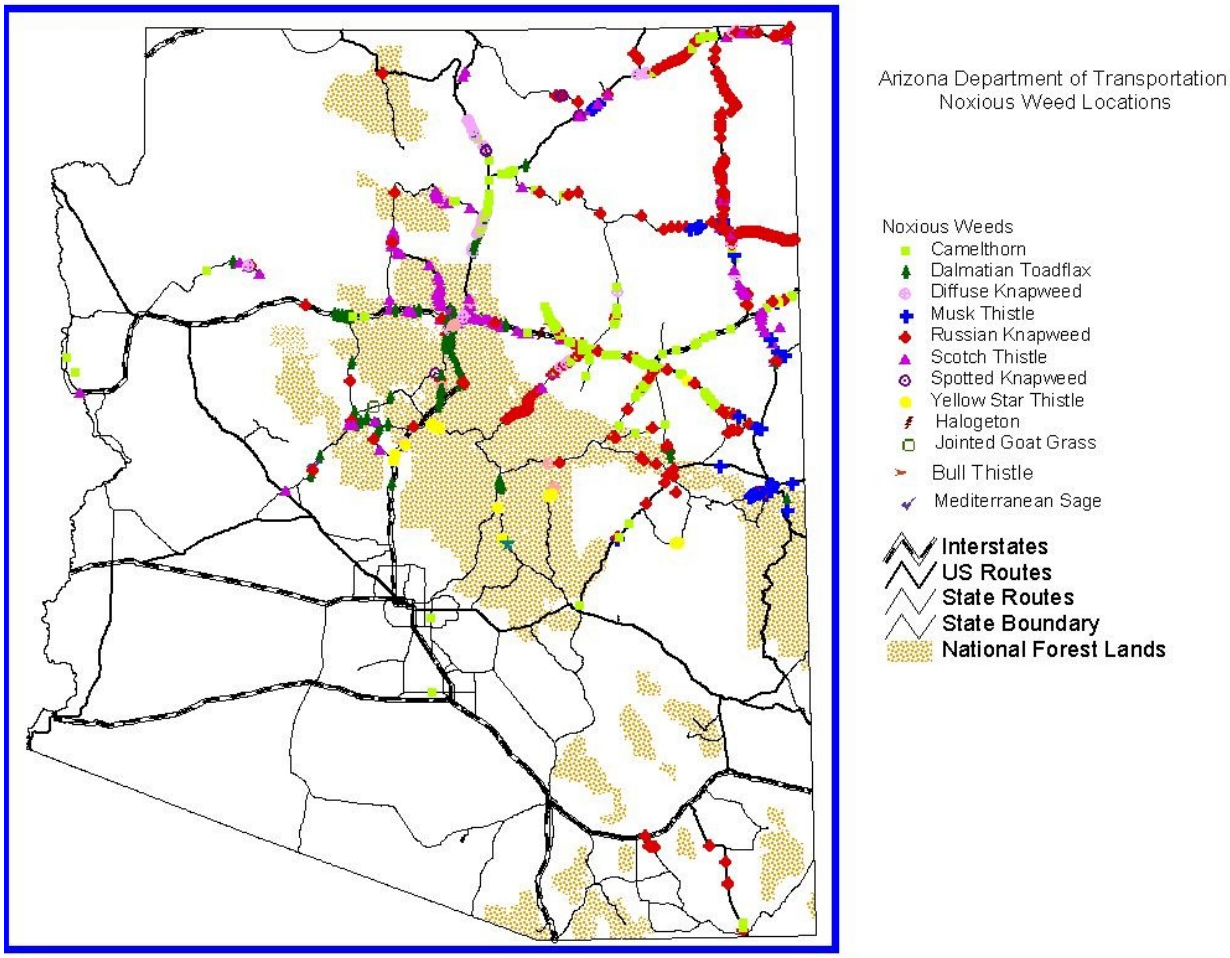

Figure 2. Noxious weed infestations on public roadways in Arizona.

ADOT will be able to treat noxious weeds for a distance of 60 m (200 ft) beyond right-of-way boundaries on National Forest System lands. This will allow ADOT to treat spot infestations that extend a short distance beyond the right-of-way.

All herbicide applications will be done with low pressure vehicle-mounted systems, backpack sprayers, and other hand-held devices. There will be no aerial applications. ADOT estimates that about 2,020 ha (5,000 ac) could be treated with herbicides in any one year. Sixteen herbicides are being considered for use. They are: chlorsulfuron, clopyralid, 2,4-D, dicamba, fluroxypyra, glyphosate, imazapyr, imazapic, isoxaben, metsulfuron methyl, pendimethalin, picloram, sethoxydim, sulfometuron methyl, tebuthiuron, and triclopyr. These herbicides are all EPA-registered. They will be used in accordance with all product label requirements and restrictions.

Description of the Action Area

There are about 4,350 km (2,700 mi) of Federal and State highways passing through National Forest System lands in Arizona (Figure 1). The potential treatment area is about 68,800 ha (170,100 ac) (25 ha or 63 ac per mi) based on an estimated average right-of-way width of 37 m (120 ft) plus 60 m (200 ft) on each side of the right-of-way. ADOT estimates that about 2,000 ha (5,000 ac) would be considered for herbicide treatment in any one year, which is about 2 percent of the potential herbicide treatment area. ADOT acreage estimates for each national forest are given in Table 2. Most herbicides (70 percent or more) will be used in the highway clear zone (within 1.5 m or 5 ft of roadway edges), which is an area that is already greatly modified. The clear zone will be maintained even if herbicides are not used.

Table 3. Estimated acres of proposed annual herbicide treatment.

Forest	Estimated Hectares (Acres) of Annual Treatment	Total National Forest Hectares (Acres)
Apache-Sitgreaves	200 (500)	816,548 (2,017,725)
Coconino	600 (1,500)	750,201 (1,853,780)
Coronado	200 (500)	695,195 (1,717,857)
Kaibab	200 (500)	630,990 (1,559,203)
Prescott	400 (1,000)	501,517 (1,239,270)
Tonto	400 (1,000)	1,162,733 (2,873,164)
Total	**2,000 (5,000)**	**4,557,183 (11,260,999)**

The roadway environment includes the road pavement, road shoulders, and such structures as guardrails, culvert outlets, and signs. This is generally a harsh area for native vegetation due to soil disturbances during construction, continued soil compaction by vehicles, and numerous other associated disturbances. The area immediately adjacent to the roadway, called the clear zone, is kept free of all shrubs and trees with a trunk diameter of 15 cm (6 in) or greater. Low-growing herbaceous vegetation is encouraged, which helps reduce erosion. The continued disturbances on

roadsides provide ideal conditions for the introduction of noxious weeds from seeds or plant parts carried by vehicles.

Native vegetation is allowed to persist from the edge of the clear zone outward. This vegetation is extremely varied as would be expected from the great diversity of topography, altitude, soils, and climate across Arizona. It may include conifer forest, ponderosa pine forest, subalpine grassland, pine-oak woodland, pinyon-juniper woodland, evergreen chaparral, mesquite savanna, desertscrub, and desert grassland. Riparian communities are limited, but may be found where highways go across streams or where highways are along streams in river valleys.

Because of the potential for herbicide movement in water, the action area includes all aquatic habitats for a distance of 3.2 km (2 mi) downstream from where a highway crosses a stream.

Conservation Measures

Coordination

A MOU between the Forest Service, FHWA, and ADOT was established on May 27, 2003 (Appendix C, USDA Forest Service 2003). This document specifies that ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. All parties agree to jointly develop a long-term plan to control invasive weeds and hazardous vegetation that will, among other things, include the location of planned treatments, a schedule of treatments, treatment methods, and establish mitigations and other constraints. All parties agree to jointly check treatment sites for compliance with jointly established mitigations and constraints. The Forest Service agrees annually to identify all sites along and near public roadways that have threatened, endangered, or sensitive plant species and discuss necessary mitigation measures and other constraints.

Mitigations

State and Federal regulations tightly control how herbicides will be used. These regulations are intended to ensure the safety of applicators, the public, and the general environment. This program would include several mitigation measures to ensure human and environmental safety. Conservation measures in addition to those listed below will be applied to many threatened and endangered species. Those “special conservation measures” are found in this document in the “effects finding” section for the species to which they apply. Measures that apply to the conservation of all threatened, endangered, and sensitive species are:

- All herbicide label requirements would be followed.
- Only ground-based equipment, including backpack sprayers, and spray units on ATVs, trucks, *etc*. will be used (there will be no aerial applications).
- Clopyralid, dicamba, picloram, and the sulfonylurea herbicides would not be used where the water table is within 1.8 m (6 ft) of the surface or where soil permeability would be conducive to water contamination. These are water-soluble herbicides. They can move in surface runoff, are highly mobile in the water column, and have high leaching potential.

- No herbicides will be applied to streams or other bodies of water, wetlands, or to either populations or unsurveyed suitable habitat of threatened, endangered, or sensitive species.
- A buffer zone of at least 10 m (30 ft) on relatively level ground, greater on slopes, will be placed around bodies of water, wetlands, and either populations or unsurveyed suitable habitat of threatened, endangered, or sensitive species. If noxious weed control or hazardous vegetation management is required in the terrestrial buffer zones established around aquatic habitats, the only herbicides applied will be those labeled for aquatic uses.

Best Management Practices (BMPs)

BMPs are intended to ensure that resource values are protected and that treatments are efficient and effective. BMPs that apply to the conservation of threatened, endangered, and sensitive species are:

Pre-spray BMPs

- If infestations of noxious weeds are found in suitable habitat for threatened, endangered, or sensitive species, surveys will be done before doing herbicide applications to ensure no threatened, endangered, or sensitive species are present.
- Plan to leave an appropriate buffer zone of at least 10 m (30 ft) on relatively level ground, greater on slopes, around bodies of water, wetlands, and either populations or unsurveyed suitable habitat of threatened, endangered, or sensitive species. Buffer zones will be marked as needed to guide herbicide applicators.
- Determine the necessity for weed management by scouting the area for weed density.
- Use herbicides only when they will provide the most effective control relative to the cost and potential hazard of other management techniques.
- Choose the most effective herbicide that requires the least number of applications.
- Choose the lowest effective rate of application.

Herbicide Spraying BMPs

- Make no broadcast applications of glyphosate and other broad spectrum herbicides where threatened, endangered, and sensitive plants are known to occur.
- Make no herbicide applications within marked buffer zones (except for the use of aquatically labeled herbicides around aquatic habitats as described in the above mitigation measures). Methods used to control undesirable plants in buffer zones will be worked out between ADOT and the Forest Service. When threatened or endangered species are involved, the FWS will be consulted. Control of undesirable vegetation within buffer zones might be done by spraying with selective herbicides that will not affect threatened, endangered, or sensitive plants; spot applications to individual weeds with backpack sprayers or daubing; or hand grubbing with no herbicide use.
- Ensure weather conditions are favorable.
- Use the lowest pressure, largest droplet size, and largest volume of water permitted by the label to obtain adequate treatment success.
- Use the lowest spray boom and release height possible consistent with operator safety.

Herbicide Post-Spray BMPs

- Monitor populations of threatened, endangered, or sensitive species in treatment areas to ensure that conservation measures were followed and that no adverse effects occurred. Reinitiate consultation with FWS if any adverse effects are observed.
- Periodically scout treated areas to assess efficacy.

Herbicide Risk Assessment

The herbicides proposed for use include chlorsulfuron, clopyralid, 2,4-D, dicamba, fluroxypyr, glyphosate, imazapic, imazapyr, isoxaben, metsulfuron methyl, pendimethalin, picloram, sethoxydim, sufometuron methyl, tebuthiuron, and triclopyr. These herbicides are marketed under a variety of trade names (Appendix A, USDA Forest Service 2003). The U.S. Environmental Protection Agency (EPA) has registered all of these herbicides and the various product labels include requirements and restrictions.

There is considerable variation in the persistence of herbicides in soil. Some materials break down in a few days while other compounds can remain active for over a year. Of the herbicides proposed for use, 3 will remain active in the soil for less than 30 days, 8 will remain active for 30 to 59 days, 4 will remain active for 90 to 365 days, and 1 will remain active for more than 365 days (Chapter 2, USDA Forest Service 2003). The herbicide 2,4-D will be used the most because of its cost and effectiveness against a wide range of broadleaf weeds. It persists in the soil for only about 10 days. None of the herbicides proposed for use bioaccumulate and, therefore, none pose a risk to upper food chain consumers.

Animals and plants have different metabolic pathways so a compound that is toxic to plants can be relatively non-toxic to animals. The EPA classifies all of the herbicides proposed for use, except for 2,4-D, as slightly toxic (Category III) to almost non-toxic (Category IV) to humans. The rating for 2,4-D is moderately toxic (Category II) (Chapter 2, USDA Forest Service 2003).

The risk assessment is a common method for analyzing potential effects of various chemicals on humans and non-target species. It uses generally accepted standards of safety to quantify the long-term risks from an action. The USDA Forest Service, Southwestern Region has analyzed the risk of the use of 21 herbicides and 4 carriers (USDA Forest Service1992). In addition, specific risk assessments are available for 14 of the herbicides being considered (http://www.fs.fed.us/foresthealth/pesticide/risk_assessments). A comparison of the 1992 risk assessment and the updated risk assessments indicate the conclusions remain the same (Appendix A, USDA Forest Service 2003).

The risk assessment for the Southwestern Region (USDA Forest Service 1992) displays estimated risks to non-target species of mammals, fish, birds, reptiles, amphibians, and invertebrates. These estimates are based on a comparison of laboratory toxicity studies with estimated exposures of representative species. The assessments display risks from “routine typical” and “routine extreme” cases. Routine typical cases represent risks to workers, the public, and other organisms that may occur as a result of routine operations. The routine extreme approach is used to estimate doses that would occur under conditions of maximum use and maximum exposure (Appendix A, USDA Forest Service 2003).

The potential impact of herbicides proposed for use on fish and other aquatic organisms is a function of three factors: 1) toxic characteristics of the active ingredient; 2) amount of the active ingredient in the water where aquatic organisms live, and 3) length of time an organism is exposed to the active ingredient. Whether an organism is affected by an herbicide is generally measured in a laboratory using a “LC50” test. The LC50 is the herbicide concentration that is lethal to 50 percent of the organisms exposed to the active ingredient for a given time. Although the LC50 is frequently used as a toxicity standard, 50 percent mortality of fish or other aquatic organisms would not be acceptable under any circumstance on a national forest. For this reason, biologists calculate a “No Observed Effect Level” (NOEL). This is the amount of active ingredient that would have no measurable effects on test organisms after several days of exposure (Appendix A, USDA Forest Service 2003).

The herbicides proposed for use are all have low aquatic toxicity under typical case water concentrations (Table III-H-6. page III-H-13. 1992 risk assessment). The only exceptions are triclopyr not labeled for aquatic application and the inert ingredient limonene, which may both present a high risk for trout in streams and a moderate risk for trout in lakes. All herbicides will be used in accordance with label directions so triclopyr will not be used where it might enter water. No herbicides that use limolene as an inert ingredient will be used where they might enter water. Picloram, dicamba, and 2,4-D not labeled for aquatic applications may present a moderate risk under extreme water concentration, but this case seems highly unlikely under the conditions of proposed application. Nevertheless, these herbicides will not be used where they might enter water. Clopyralid, dicamba, and glyphosate are roughly 1/5 to 1/50 as toxic to various aquatic organisms, so under conditions of proposed application they are highly unlikely to pose a risk to aquatic organisams (Appendix A, USDA Forest Service 2003).

For threatened, endangered, or sensitive aquatic organisms, triclopyr products not labeled for aquatic use may present an unacceptable risk to cold-water fish under the typical case scenario. Likewise, 2,4-D not labeled for aquatic use may present an unacceptable risk to aquatic invertebrates. However, in accordance with label directions, these products will not be used in aquatic applications. It must be noted that the assessment was made using aerial application as the treatment approach realizing that aerial application poses the potential risk of inadvertent application to water. The majority of herbicide applications near water will be hand backpack or truck mounted hand wand applications, and this will result in minimal risk of contamination to surface water. Leaching of herbicides through soil is not a significant process. Herbicides do have the potential for overland flow during heavy rainstorms, but the likelihood of such movement on infiltration-dominated sites makes water contamination unlikely. Mitigation measures and BMPs will reduce the potential for possible adverse effects to aquatic organisms (Appendix A, USDA Forest Service 2003).

The 1992 risk assessment addresses possible effects on representative terrestrial animals. These animals represent different types, sizes, and feeding habits that serve as surrogates for threatened, endangered, and sensitive animals. Again, aerial application was used in the analysis because it was assumed ground application would result in much lower herbicide exposures. Under the typical case, all species are in the low risk category given the materials proposed for use.

Effects Findings for Federally Listed or Proposed Species and Designated or Proposed Critical Habitats

Black-footed ferret (Mustela nigripes)

Endangered Species Act Status:	Endangered, 1967
Forest Occurrence in Arizona:	None
Recovery Plan:	Final, 1988; currently in revision
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. The black-footed ferret is a member of the weasel family. It depends almost exclusively on prairie dog colonies for food, shelter, and denning. The range of the black-footed ferret coincided with the range of three species of prairie dogs (black-tailed, white-tailed, and Gunnison's), and ferrets with young have only been observed in the vicinity of active prairie dog colonies (U.S. Fish and Wildlife Service 2002a).

Distribution. The historical distribution of the black-footed ferret was similar to the range of black-tailed, white-tailed, and Gunnison's prairie dogs. This range included 12 western states (Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming) as well as part of Canada (U.S. Fish and Wildlife Service 2002a). In Arizona, the Apache-Sitgreaves, Coconino, and Kaibab NFs are within the historical range of the black-footed ferret (U.S. Fish and Wildlife Service 1978).

Status (Range-wide). The decline in the distribution and abundance of the black-footed ferret was largely due to the reduction or elimination of prairie dog colonies. This reduction was due to both intentional control efforts in the early 20th century, as well as the conversion of grassland to cropland and urban development. In addition, outbreaks of sylvatic plague and canine distemper accelerated the decline in both prairie dog and ferret populations, since these species have no natural immunity to these pathogens (U.S. Fish and Wildlife Service 2002a).

The black-footed ferret was considered extinct until the discovery of a small population in Wyoming in 1981. Due to an outbreak of disease in this population, the remaining individuals were removed from the wild in 1986 and 1987 to serve as founders for a captive breeding program. Since 1991, black-footed ferrets have been reintroduced to the wild as non-essential experimental populations at seven sites in the United States and one in Mexico (U.S. Fish and Wildlife Service 2002a). An eighth reintroduction in the United States was proposed in South Dakota in 2002 (U.S. Fish and Wildlife Service 2002a).

Although reintroduced to areas throughout its range, the black-footed ferret has failed to become re-established in the wild with the possible exception of one site in South Dakota (U.S. Fish and Wildlife Service 2002a). Reintroduction sites require large prairie dog complexes capable of supporting a population of ferrets. Ideal sites are prairie dog complexes exceed 4,000 ha (10,000 acres) in size, although complexes greater than 2,000 ha (5,000 acres) may be considered for ferret reintroduction (U.S. Fish and Wildlife Service 2002b).

Status (Within the Action Area). No black-footed ferrets occur on National Forest System lands in Arizona. The last survey for black-footed ferrets on national forests was conducted by Ruffner in 1980. No ferrets were found, but Ruffner (1980) did locate 29 Gunnison's prairie dog colonies

and measured the area of 22 of these colonies (Table 3). These data show that in 1980 there were no sites on Arizona national forests capable of supporting ferret reintroduction. No recent quantitative estimates for Gunnison's prairie dog colonies are available, but the largest towns surveyed by Ruffner (1980) were on the Gila NF (6 colonies totaling 762 ha or 1,884 ac). These towns have increased in size since 1983, although populations do fluctuate from year to year (P. Morrison, personal communication, e-mail dated 14 May, 2003).

Table 4. Gunnison's prairie dog colonies on national forest lands in Arizona and New Mexico (Ruffner 1980).

Forest	# Active	# Abandoned or Status Unknown	# Active Colonies Measured For Area	Area (ha) of Active Colonies	Area (ac) of Active Colonies	Average Colony Cize (ac)
Apache-Sitgreaves	3	2	3	30	73	24
Cibola	1	6	1	116	287	287
Coconino	8	10	7	269	664	95
Gila	6	4	6	762	1,884	314
Kaibab	11	9	5	268	661	132
Total	29	31	22	1,445	3,569	853

No ferret reintroductions have occurred on National Forest System lands in Arizona, although ferrets were released in 1996 in the Aubrey Valley, Arizona, near the Kaibab National Forest (U.S. Fish and Wildlife Service 1996). This area is about 32 km (20 mi) west of the Kaibab NF. Populations of prairie dogs appear to be increasing on National Forest System lands, but the presence and high incidence of plague makes these populations unstable and currently unsuitable for ferret reintroduction.

Gunnison's prairie dog colonies occur on the Coconino NF and some extend into highway right-of-way. None of these colonies are presently large enough to support ferret reintroductions.

Effects Analysis (Black-footed Ferret). No black-footed ferrets occur on national forests in Arizona so herbicide use on right-of-ways will have no direct affect on ferrets. The only possible indirect effect would be through effects on ferret habitat (*i.e.* prairie dog colonies). Presently, no prairie dog colonies are large enough to support ferrets, but perhaps they could expand to suitable size in the future. Herbicide use on right-of-ways at the levels proposed should not inhibit the growth of prairie dog colonies because application will be infrequent, the risk from application is low, and only a small part of any colony would be treated. Treatment for noxious weeds or hazardous vegetation could benefit prairie dog habitat by helping to maintain the open conditions prairie dogs prefer.

Effects Finding (Black-footed Ferret). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the black-footed ferret.

Jaguar (Panthera onca)

Endangered Species Act Status:	Endangered, 1997
Forest Occurrence in Arizona:	Coronado
Recovery Plan:	None
Critical Habitat:	None Designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. The jaguar is the largest cat species native to the western hemisphere. Jaguars are muscular cats with relatively short massive limbs and a deep-chested body. They are cinnamon-buff in color with many black spots; melanistic forms are known from the southern part of their range. Jaguars breed year-round range-wide, but at the southern and northern ends of their range there is evidence of a spring breeding season. Gestation is about 100 days; litters range from one to four cubs (usually two). Cubs remain with their mothers for nearly 2 years. Females begin sexual activity at 3 years of age, males at 4 years. Studies have documented few jaguars over the age of 11. Jaguars take more than 85 species of prey but the two species most used are javelina and deer.

Distribution. The historical range of the jaguar in the southwestern U.S. includes the mountainous regions of eastern Arizona and southwestern New Mexico (Lange 1960). In Arizona, it may have included lands on the Apache-Sitgreaves, Coconino, Coronado, Prescott, and Tonto NFs. No breeding populations are known to exist in the U.S. at this time. Individuals occur in the Southwestern U.S. and may be from established populations in Sonora, Mexico. An adult jaguar was photographed in the Peloncillo Mountains on the Coronado NF, Arizona, in March of 1996. In August of 1996, an adult jaguar was photographed in the Baboquivari Mountains southwest of Tucson, Arizona. The last confirmed report of a jaguar in Arizona prior to 1996 was in 1987 (Girmendonk 1994). For Arizona, the total number of jaguar records (known specimens, killings reported, and credible sight records) since 1848 is now 84 (Lange 1960, Brown 1983, Girmendock 1994). In January of 2002, a jaguar was photographed in Sycamore Gulch on the Coronado NF. Infrared cameras set out by Jack Childs caught the big cat on film. Although additional cameras were set out, no other evidence of this cat's activities in the U.S. has been obtained.

Jaguars are known to use a variety of habitats. They show a high affinity for lowland wet habitats, typically swampy savannas or tropical rain forests. They also occurred historically in upland habitats in warmer regions of North and South America. In Arizona, jaguars have been seen in a variety of ecological communities from Sonoran desert scrub through sub-alpine conifer forest. Most records are from Madrean evergreen-woodland, shrub-invaded semidesert grassland, and along rivers (Brown 1983).

Status (Range-wide and Within the Action Area). Brown (1983) presented an analysis suggesting there was a resident breeding population of jaguars in the United States at least into the 20th century. A source population stills exists 220 km (135 mi) south of the Mexican border (Valdez 2001).

In the past, the primary threat to jaguars in the U.S. was from shooting (59 FR 35675) and possibly the reduction in understory vegetation density in riparian areas. In Arizona, the decline of the species was concurrent with the predator control associated with land settlement and development of the livestock industry (Brown 1983, U.S. Fish and Wildlife Service 1990). To

date, shooting still remains a threat to jaguars. At least 64 jaguars have been killed in Arizona since 1900 (Brown 1991), one as recently as 1986 (Girmendonk 1994).

Other impacts include clearing of preferred habitat, alteration and destruction of riparian areas, fragmentation or blocking of corridors that jaguars may use to move between Mexico and the U.S., and any trapping or animal control activities that target jaguars or other large predators (U.S. Fish and Wildlife Service 1994).

Currently, it is believed no jaguars are breeding within the U.S. and it is likely most sightings in the U.S. are transients from Mexico.

Effects Analysis (Jaguar). Jaguars are infrequent transients in southern Arizona, mostly in the vicinity of the Coronado NF. They are secretive nocturnal animals that are seldom seen. They can be expected to avoid roads and other developed areas as much as possible. It is highly unlikely a jaguar would pass through a highway area that was just treated with herbicides and even if this happened there would be an extremely low risk to the animal from herbicide exposure. With the small amount of treatment area, herbicide use along highways will have no adverse affect on deer, javalina, or other potential jaguar prey.

Effects Finding (Jaguar). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the jaguar.

Lesser long-nosed bat (Leptonycteris curasoae verbabuenae)

Endangered Species Act Status:	Endangered, 1988
Forest Occurrence:	Coronado
Recovery Plan:	Final, 1994
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. The lesser long-nosed bat is a nectar, pollen, and fruit-eating bat that migrates seasonally from Mexico to southern Arizona and southwestern New Mexico. Caves and mines are used as day roosts, and the lesser long-nosed bat is known to fly long distances from roosts to forage (Dalton, *et al.* 1994, U.S. Fish and Wildlife Service 1995). Suitable day roosts and associated concentrations of food plants are crucial for the lesser long-nosed bat (U.S. Fish and Wildlife Service 1995).

The lesser long-nosed bat consumes nectar and pollen of paniculate agave flowers and the nectar, pollen, and fruit of columnar cacti. The agaves include Palmer's agave (Agave palmeri), Parry's agave (*A. parryi*), desert agave (*A. deserti*), and amole (*A. schotti*). Amole is considered to be an incidental food source. The cacti include saguaro (Carnegiea giganteus) and organ pipe cactus (*Stenocereus thurberi*).

Lesser-long-nose bats arrive in the U.S. (Arizona/New Mexico) during late pregnancy and join other females in maternity colonies in April and early May. Young are born during May and can fly by the end of June. Litter size is one. The species resides in both New Mexico and Arizona until departing in mid-September to late October (Cockrum and Petryszyn 1991, Hoyt et al. 1994).

Distribution. This migratory bat is found throughout its historical range from southern Arizona and extreme southwestern New Mexico through western Mexico and south to El Salvador. In southern Arizona, lesser long-nosed bat roosts have been found from the Picacho Mountains (Pinal County) southwest to the Agua Dulce Mountains (Pima County), southeast to the Chiricahua Mountains (Cochise County), and south to the international boundary. Individuals have been observed from the vicinity of the Pinaleno Mountains (Graham County) and as far north as Phoenix and Glendale (Maricopa County). This bat is also known from far southwestern New Mexico in the Animas and Peloncillo Mountains (Hidalgo County).

Lesser long-nosed bat roosts have been documented on the Coronado NF. While some potential habitat occurs on and adjacent to the Tonto NF (bats day roosting in the McDowell Mountains), the Coronado NF is the only Forest where its presence has been confirmed. There are no known maternity colonies on Forest Service lands.

Status (Rangewide and Within the Action Area). The Recovery Plan (U.S. Fish and wildlife Service 1995) indicates that the lesser long-nosed bat may not be in danger of extinction in Arizona or Mexico. There has been significant debate among scientists regarding the actual population size and the listing status for this species. There is, however, considerable evidence for the dependence of this species on certain agaves and cacti. Excessive harvest of agaves in Mexico, collection of cacti in the U.S., and the conversion of habitat for agricultural uses, livestock grazing, wood cutting, and other development may contribute to the decline of long-nosed bat populations (U.S. Fish and wildlife Service 1988). Furthermore, the species appears to be sensitive to human disturbance at roosting sites.

Within national forest lands, roosting occurs only on the Coronado NF. The Coronado NF includes all of the major mountain ranges in the southeastern part of Arizona and a small part of the New Mexico Bootheal area. The sky island mountain ranges on the Coronado NF are divided into twelve Ecosystem Management Areas (EMAs). There are eight primary roost sites in these EMAs. There are four primary roost sites in the Chiricahua EMA, two with more than 1,000 bats and one with more than 3,000 bats. There is one primary roost site in the Dragoon EMA, although surveys have not been done throughout the entire EMA. There are at least two large roost sites in the Santa Rita EMA, one in Sawmill Canyon and one in a mine adit within 1.6 km (1 mi) of the formerly occupied Cave of the Bells. One roost has been found in the Tumacacori EMA in the Pajarito Mountains. Only foraging bats have been found in the Galiuro, Pinaleno, and Peloncillo EMAs and there are no known roosts, but no intensive surveys have been done. Although there are no recent records in the Santa Catalina EMA, there are roosts on neighboring Saguaro National Park and BLM lands and bats could be foraging within the EMA (T. Skinner, personal communication, email dated May 15, 2003).

No roost sites occur in the action area along State or Federal highways. However, the right-of-ways for many highways support long-nosed bat food plants. No agaves occur in the highway clear zone because these large plants are already being removed. Agaves are found in areas beyond the clear zone. No large columnar cacti occur along ADOT-managed roadways on the Coronado NF.

Special Conservation Measures for the Lesser Long-nosed Bat. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

- ADOT will contact the nearest FWS field office for information on the species before application of herbicides in the immediate vicinity of potential bat roosting sites such as caves and mines.
- No agaves, other species of century plants, or columnar cacti will receive chemical applications.
- Chlorsulfuon, glyhposate, imazapic, imazapyr, metsulfuron methyl, pendimethalin, picloram, sulfometuron methyl, and tebuthiuron (Class D, M, or NS herbicides) will not be used for areas greater than 5 acres when the following three conditions are met: 1) the proposed application time is between the dates of July 1 and October 30; 2) the area is within 65 km (40 mi) of a known bat roosting site; and 3) agaves, century plants, or columnar cacti are in the proposed treatment area.
- Dicamba (rated as Class 2 in the Small Mammal Toxicity Group) will have a buffer zone for all liquid formulations of 3 m (10 ft) for spot applications and 18 m (60 ft) for mechanized ground applications from 1) any entrance to an occupied roost, or 2) any potential roost site that has not been surveyed.

Effects Analysis (Lesser Long-nosed Bat). There are only about 80 km (45 mi) of ADOT-managed roadways on the Coronado NF (Figure 1). Also, the level of noxious weeds is relatively low in this part of the State (Figure 2) so it is unlikely that much herbicide treatment of noxious weeds will occur here. The herbicides used in this program have low toxicity to small mammals. No known roost sites occur in the action area so the only route of herbicide exposure would be for foraging bats to brush against vegetation that had just been sprayed. Since bats forage at night, any herbicide on vegetation will have dried and be unlikely to be brushed onto a bat. Also, bats are most likely to come in contact with agaves and large columnar cacti when feeding and these plants will not receive herbicide applications. Given the low toxicity of the herbicides and the low probability of herbicide exposure (due to infrequent application, timing of application during daytime only, and nonspraying of bat food plants), the possibility of direct adverse affects to the lesser long-nosed bat are insignificant and discountable.

No agaves or large columnar cacti that are lesser long-nosed bat food plants will receive chemical applications. Therefore, the proposed program will have no effect on lesser long-nosed bat food sources.

Effects Finding (Lesser Long-nosed Bat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the lesser long-nosed bat or its food plants.

Mexican gray wolf (*Canis lupus baileyi*)

Endangered Species Act Status:	Endangered, all subspecies, 1976; Relisted, 1978; Non-essential Experimental Population, 1998
Forest Occurrence:	Apache-Sitgreaves
Recovery Plan:	Final, 1982
Critical Habitat:	None designated
Effects Finding (Exp. Population):	Not Likely to Adversely Affect

Natural History. Mexican gray wolves were extirpated from the wild before their natural history and ecological role could be described and studied. The natural history of the Mexican gray wolf

is assumed to be similar to that of other gray wolves (Bednarz 1988, U.S. Fish and Wildlife Service 1982). Smith and Phillips (2000), Paradiso and Nowak (1983), and Mech (1970) have described the life history of gray wolves; the following summary draws primarily on these references.

Wolf groups (or packs) usually have a set of parents (alpha pair), their offspring from the current and previous years, and possibly unrelated wolves that have been accepted into a pack. Wolves begin mating when they are 2 to 3 years old and are typically monogamous unless a mate dies. Wolves usually rear their pups in subterranean dens for the first 6 weeks. Wolves may also use some other type of shelter for dens such as a cave. The same wolves can use a den site year after year. On average, five pups are born in early spring and the entire pack may care for them. Pups depend on their mother's milk for the first month of their life and then are gradually weaned as the adults feed them regurgitated meat. Pups begin traveling with the adults at 7 to 8 months of age. A young wolf will leave its natal pack (disperse) at 1 to 2 years of age looking for a mate to form its own pack. Lone dispersing wolves have traveled as far as 800 km (500 mi) in search of a new home (Fritts 1983) and wolves may travel as far as 50 km (30 mi) in a day.

Wolf packs usually live within a specific territory that they defend to the exclusion of other wolves and often conspecifics such as coyotes. Territory size ranges from 85 km² (50 mi²) to greater than 1,600 km² (1,000 mi²) depending on the availability and seasonal movements of prey. Wolves are habitat generalists and typically only require adequate prey to survive. For the Mexican gray wolf this has historically been the Madrean evergreen forests and woodlands, including pine, oak woodlands, pinyon-juniper woodlands, riparian areas, and grasslands at elevations above 1,370 m (4,500 ft) (Brown 1983).

Distribution. Mexican gray wolves are the southernmost, rarest, and most genetically distinct gray wolf in North America. They historically occurred in the mountainous regions of the Southwest from throughout portions of southern Arizona, New Mexico, and Texas into central Mexico. Aggressive predator control programs extirpated Mexican gray wolves from the U.S. (Brown 1983). Field research has not confirmed that Mexican gray wolves continue to occur in Mexico. Currently a reintroduced non-essential experimental population occurs in the Apache-Sitgreaves and Gila NFs.

Status (Rangewide and Within the Action Area). On January 12, 1998, the U.S. Fish and Wildlife Service published an Endangered Species Act (ESA) section 10(j) rule on the Mexican gray wolf that provided for the designation of specific populations in the United States “as experimental” (50 CFR 17.84(k)). Under 10(j), a population of a listed species re-established outside its current range but within its probable historical range may be designated as an experimental population. Non-essential experimental populations located outside of national wildlife refuges or national parks are treated as if they are proposed for listing. This means that under section 7 of the ESA, Federal agencies must conference with the U.S. Fish and Wildlife Service on their proposed actions that are likely to jeopardize the continued existence of the species. Section 10(j) rules provide for management flexibility of experimental populations to address the concerns of local residents.

Current estimates suggest that about 37 animals are alive in the wild. Eight wolf packs are expected to have litters in 2003. Since the reintroduction began 11 of the released wolves have been shot and 4 have been hit by cars on highways. Human-caused mortalities continue to be the primary cause of death for released Mexican wolves. In 2003, four family groups are scheduled

for release, two in New Mexico, and two in Arizona, one of which will be on White Mountain Apache tribal lands.

Wolves will likely cross highways occasionally as they move within their territories, but they are unlikely to remain long in these open areas where they would be vulnerable.

Effects Analysis (Mexican Gray Wolf Non-essential Experimental Population). The estimated area of annual herbicide treatment for the Apache-Sitgreaves NF is only 200 ha (500 ac), 70 percent or more of this treatment will be for maintenance of the highway clear zone, no areas will be treated more than once a year, and there is little chance of herbicide contact after the few hours that it takes for the herbicide to dry on plants. Given these circumstances, it is highly unlikely that any Mexican gray wolves will come in contact with the herbicides used in this program. Even if exposed to herbicides, the risk assessment indicates the possibility of harm is low.

Effects Finding (Mexican Gray Wolf Non-essential Experimental Population). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the non-essential experimental population of the Mexican gray wolf.

Bald Eagle (Haliaeetus leucocephalus)

Endangered Species Act Status:	Threatened, 1995
Forest Occurrence:	Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, Tonto
Recovery Plan:	Final, 1982 for SW Recovery Region
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. The bald eagle is the only species of sea eagle native to North America. It frequents estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats. Fish are the major component of its diet, but waterfowl, seagulls, and carrion are also eaten.

Bald eagles usually nest in trees near water, but are known to nest on cliffs. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternative nests. Bald eagle pairs begin courtship about a month before egg-laying. The nesting season lasts about 6 months. After an incubation period of 35 days the nestlings hatch; fledging takes place at 11 to 12 weeks of age. Parental care may extend 4 to 11 weeks after fledging (U.S. Fish and Wildlife Service 1999).

Bald eagles found in the Arizona and New Mexico, specifically those found in Arizona, demonstrate some unique behavioral characteristics in contrast to bald eagles in the remaining lower 48 states. Eagles in the Southwest frequently construct nests on cliffs as opposed to trees and establish their breeding territories earlier, typically in November and December (U.S. Fish and Wildlife Service 1982). Eggs are laid in January or February. The early onset of breeding is believed to be a behavioral adaptation allowing chicks to avoid the extreme desert heat of midsummer and allowing adults to take advantage of food resources for the rearing of eaglets (U.S. Fish and Wildlife Service 2002).

In Arizona, the diet consists mostly of fish, but they will also eat birds, amphibians, reptiles, small mammals, and carrion.

Distribution. The bald eagle historically ranged and nested throughout North America except extreme northern Alaska, northern Canada, and central and southern Mexico. Due, in part, to reintroduction efforts in many states, the species present nesting distribution is close to its historical distribution (U.S. Fish and Wildlife Service 1999). Within Arizona, bald eagles are found nesting in the Tonto, Coconino, Apache-Sitgreaves, and Prescott NFs, and they winter throughout all six national forests in Arizona.

Bald eagle breeding areas in Arizona are predominantly located in the upper and lower Sonoran life zones with the exception of the Luna Lake breeding area on the Apache Sitgreaves NF, and the Rock Creek and DuPont breeding areas on the Tonto NF which are found in coniferous forests. Most breeding areas in Arizona are close to a variety of aquatic habitats including reservoirs, regulated river systems, and free-flowing rivers and creeks. The alteration of natural river systems through the construction of dams and other water developments, has had both beneficial and detrimental effects on the bald eagle.

Status of the Species (Rangewide and Within the Action Area). In 1978, the FWS classified the bald eagle as endangered in 43 states and threatened in 5 others. It was not listed as endangered or threatened in Alaska and is not found in Hawaii. In 1995, the species was reclassified to threatened (U.S. Fish and Wildlife Service 1995). The bald eagle was proposed for delisting on July 6, 1999 (U.S. Fish and Wildlife Service 1999). If the proposal is finalized, the bald eagle would be removed from protections under the ESA. However, once it is delisted under the ESA, the bald eagle will still be protected by the Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and other Federal laws. No critical habitat has been designated for this species.

Since its original listing in 1967, bald eagles have increased in number and expanded in range due to the banning of DDT, habitat protection, and additional recovery efforts. Surveys conducted between 1963 and 1998 show that occupied breeding areas in the lower 48 states have grown from 417 to over 5,748 (U.S. Fish and Wildlife Service 1995, 1999). In addition, the average number of young produced per nest has increased from 0.59 in 1963 to 1.16 in 1994 over the range of the species (U.S. Fish and Wildlife Service 1995).

In the 1999 proposal to delist the species, the U.S. Fish and Wildlife Service stated that the number of breeding pairs in the Southwestern Recovery Unit, which includes Arizona, has more than doubled in the last 15 years (U.S. Fish and Wildlife Service 1999). However, research by the Arizona Department of Fish and Game indicates that Arizona's breeding population is not supported by immigration from other states or regions, therefore, continued attention to the survivorship of bald eagles in Arizona is important.

In the 20 years from 1970 to 1990, 226 eaglets fledged in Arizona (Hunt *et al.* 1992). In the 4 years from 1999 to 2002, 118 eaglets fledged (Driscoll and Kolosza 2001, 2002; U.S. Fish and Wildlife Service 2002). About 60 percent (28) of the breeding areas in Arizona are on national forests. There are 20 on the Tonto, 4 on the Coconino, and 2 each on the Prescott and Apache-Sitgreaves.

In addition to breeding eagles, Arizona provides habitat for wintering eagles. Of the 300 to 400 birds typically seen during statewide winter counts, most occur on the Coconino NF near lakes, west along the Mogollon Rim, and east throughout the White Mountains (Apache-Sitgreaves

NF); however, the Salt River can have about 30 birds and the Verde River about 40 (J. Driscoll, Arizona Game and Fish Department, Phoenix, pers. comm. 2003).

A few highways in Arizona are near lakes or streams where bald eagles nest and feed. Bald eagles may roost on trees or cliffs adjacent to highways and they may sometimes feed on road-kill carrion. No bald eagles nest in highway right-of-ways, but some could nest along streams less than 3.2 km (2 mi) downstream from a highway.

Special Conservation Measures for the Bald Eagle. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- Herbicides will not be applied by any method within 0.8 km (0.5 mi) of any known bald eagle nest from October 1 to July 1, or until juveniles have left the nest to protect eagles from disturbance.
- Herbicides will not be applied by any method within 30 m (90 ft) of known winter roost sites that are not associated with aquatic habitats from October to April to protect eagles from disturbance.
- To protect eagle forage species, pendamethalin, 2,4-D (aquatic and nonaquatic ester formulations), and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish or warm water fish will have buffer zones from the edge of water bodies that are within 1.6 km (1 mi) of eagle nests of at least 3 m (10 ft) for spot applications and 25 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These buffer zones apply to lakes or reservoirs that are less than 40 surface hectares (100 surface acres) and rivers or streams that are less than 90 m (300 ft) wide (these limits exclude relatively large water bodies where pesticide concentarations will not ordinarily impact fish resources for the bald eagle).

Effects Analysis (Bald Eagle). Herbicides will be used almost exclusively in the summer so there will be little overlap between program activities and the presence of migratory bald eagles that winter in Arizona. Nevertheless, a 30 m (90 ft) buffer zone will be applied around known winter roost sites for all herbicides that may be applied from October to April. The bioaccumulation of pesticide residues in the body tissues of this upper food chain predator was formerly a major threat to bald eagles. None of the herbicides being used will bioaccumulate in body tissues. There is virtually no chance that bald eagles will come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation. It is unlikely that bald eagles will ingest herbicides that are on prey because fish make up most of the bald eagle's diet and there are buffer zones around aquatic habitats. In the rare instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion. The general mitigations and BMPs for this program will protect food sources in aquatic environments. As further protection of aquatic food sources, pendamethalin, 2,4-D (ester formulations), and triclopyr (ester formulation) will not be applied within 3 m (10 ft) for spot applications and 25 m (80 ft) for mechanized ground applications of shorelines (e.g., of streams, rivers and lakes) that are within 1.6 km (1 mi) of eagle nests. Protection from direct disturbance to bald eagles will be provided by prohibiting herbicide application by any method within 0.8 km (0.5 mi) of any known bald eagle nest from October 1 to July 1, or until juveniles have left the nest. The

combination of low herbicide toxicity, low potential for herbicide exposure, and protection from disturbance makes the possibility of adverse affects to the bald eagle insignificant and discountable.

Effects Finding (Bald Eagle). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the bald eagle.

Brown pelican (Pelecanus occidentalis)

Endangered Species Act Status:	Endangered, 1995; Alabama, Florida, and Atlantic Coast populations delisted, 1985
Forest Occurrence:	Apache-Sitgreaves, Tonto
Recovery Plan:	Final, 1980 for Atlantic subspecies; final 1983 for west coast subspecies; final, 1986 for Caribbean subspecies
Critical Habitat:	None designated
Effects Finding:	No effect

Natural History. The adult brown pelican is a large dark gray-brown water bird with white about the head and neck. It can weigh up to (3.6 kg) 8 lb and larger individuals have wing spreads of over 2.1 m (7 ft).

Brown pelicans nest in colonies mostly on small coastal islands. The nests are usually built in mangrove trees of similar size vegetation, but ground nesting may also occur. Ground nests vary from practically nothing to well built nests of sticks, reeds, straws, palmetto leaves, and grasses. Tree nests are made of similar materials, only they are more firmly constructed. All courtship behavior is confined to the nest site. The male carries nesting materials to the female and she builds the nest. Normal clutch size is three eggs. Both birds share in incubation and rearing duties.

The species is considered to be long-lived; one pelican captured in Edgewater, Florida, in November 1964, was banded in September 1933, over 31 years previously (U.S. Fish and Wildlife Service 1995).

Distribution. The brown pelican is found along the coast in California and from North Carolina to Texas, Mexico, the West Indies and many Caribbean Islands, and to Guyana and Venezuela in South America. Although brown pelicans were extirpated from the Louisiana coast during the 1960s, a small number have since been reintroduced.

Birds are found feeding primarily in shallow estuarine waters and seldom venture more than 32 km (20 mi) out to sea except to take advantage of especially good fishing conditions, and even then it is rare to find one more than 64 km (40 mi) out. Sand spits and offshore sand bars are used extensively as daily loafing and nocturnal roost areas. The preferred nesting sites are small coastal islands which provide protection from mammal predators, especially raccoons, and sufficient elevation to prevent widescale flooding of nests (U.S. Fish and Wildlife Service 1995).

Status (Rangewide). The decline in the brown pelican that led to its listing as endangered in 1970 was primarily caused by a collapse of thin-shelled eggs or another impairment of reproductive success. Ingestion of pesticide residues in food fish caused these problems. The principal residues are DDT compounds (including DDE and DDD), and polychlorinated

biphenyls (PCB's, dieldrin, and endrin). Between 1957 and 1961, pesticides drastically reduced the Texas population and completely eliminated the original Louisiana population, with lesser impacts occurring in other Southeastern states. In 1972, the EPA banned the use of DDT in the U.S. and since that time has also sharply curtailed the use of endrin. As a result, the environmental residue levels of these persistent compounds have steadily decreased in most areas. There has been a corresponding increase in the eggshell thickness and reproductive success of brown pelicans (U.S. Fish and Wildlife Service 1995).

Within the U.S., the eastern population (Alabama, Florida, Georgia, North and South Carolina) appears to be stable and even increasing. Recent increase in North Carolina is attributed to expansion of the South Carolina population, aided by creation of dredge spoil islands that provide additional nesting habitat. Gulf Coast populations are increasing steadily, but those in the U.S. Caribbean have declined over the last 10 years. Colonies on the San Lorenzo Islands in the Gulf of California contained about 32,000 birds in 1970, but had decreased to approximately 8,200 in 1977. However, southern populations of subspecies *californicus*, occurring in Mexico, evidently are stable. The U.S. Fish and Wildlife Service in 1990 categorized the status of subspecies *californicus* as "stable". Data are needed on Central and South American populations where organochlorine pesticides are still used. Aside from large reproductively viable populations in Panama and Mexico, population status in Central and South America is poorly known (NatureServe 2003).

Status (Within the Action Area). The brown pelican is a rare vagrant at Luna Lake on the Apache-Sitgreaves NF and other lakes in Arizona. These are solitary birds that may have been carried inland by storms or perhaps are sick and disoriented. They show up only irregularly.

Effects Analysis (Brown Pelican). Brown pelicans are a water bird that will stay on water or near lake shores. They are not found along rivers. The mitigations and BMPs for this program will protect aquatic environments from any herbicide contamination. The birds would not be expected to land on or near highways.

Effects Finding (Brown Pelican) The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures will have no effect on the brown pelican.

California condor (Gymnogyps californianus)

Endangered Species Act Status:	Endangered, 1967; Non-essential Experimental Population, 1996
Forest Occurrence	Coconino, Kaibab
Recovery Plan:	Final, 1996
Critical Habitat	Yes, 1976
Effects Finding (Exp. Population):	Not Likely to Adversely Affect
Effects Finding (Critical Habitat):	No Effect

Natural History. The California condor is the largest North American vulture. It is a strict scavenger and historically fed on the carcasses of deer, elk, antelope, and, in coastal areas, beached whales. Condors spend much of their time roosting on cliffs or tall conifers. They nest on rock crevices, overhung ledges, or rarely in cavities in sequoia trees. They generally breed once very other year, laying a single egg. Incubation times are long (56 days average), as are rearing

times (young fledge at 6 months), requiring extensive parental care (U.S. Fish and Wildlife Service 1996a).

Distribution. The historical distribution of the California condor was along the Pacific coast from British Columbia, Canada, to Baja California Norte, Mexico. By 1987, the range of the condor had been reduced to six counties north of Los Angeles, California. At that time, all existing condors were removed from the wild for captive breeding. In 1992, captive condors were released into the wild in California on the Los Padres NF. A second captive-bred release program was initiated at the Vermillion Cliffs area in northern Arizona in 1996 (U.S. Fish and Wildlife Service 1996b).

Reasons for the decline of the California condor are varied, including loss of habitat and eggshell thinning due to DDT. However, the largest factor in the condor's decline has been adult mortality through ingestion of lead shot and shooting. As scavengers, condors are very susceptible to lead poisoning from ingestion of shot in animals hunters wound or kill (U.S. Fish and Wildlife Service 1996a). Collisions with power lines have been a factor in birds released since 1992 (U.S. Fish and Wildlife Service 1996a).

Status (Rangewide and Within the Action Area). Currently there are two California condor release areas in the United States, one in California and the second in Arizona. Condors were released at the Vermillion Cliffs site in Arizona in 1996. These released birds are part of a non-essential experimental population (U.S. Fish and Wildlife Service 1996b). As of 2002, the total number of free-flying California condors in Arizona was 31 birds.

Although the release site is not on National Forest System lands, the non-essential experimental population area includes portions of the Kaibab and Coconino NFs. Condors may use these areas for foraging or roosting. It is possible that condors could scavenge for road-kill along highways, but this is expected to be infrequent. Nesting has only been attempted in Grand Canyon National Park (U.S. Fish and Wildlife Service 2002).

Special Conservation Measures for the California Condor. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- ADOT will contact FWS immediately prior to herbicide applications in condor habitat to determine if any roosting or nesting condors are in the proposed application area. If condors are present, no herbicides will be used within 0.2 km (0.125 mi) for spot applications using hand operated equipment, or within 0.4 km (0.25 mi) for mechanized ground applications of roost or nest sites to protect California condors from disturbance.

Effects Analysis (California Condor Non-essential Experimental Population). The bioaccumulation of pesticide residues in body tissues was formerly a major threat to California condors. None of the herbicides being used will bioaccumulate in body tissues. With herbicides only being applied once a year in any given area and this mostly limited to the highway clear zone, there is virtually no chance that California condors will come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation. It is equally unlikely that California condors will ingest herbicides that are on road-killed animals because these animals also have a low likelihood of exposure. In the extremely unlikely instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion. The potential for direct disturbance to roosting or nesting California condors will be

eliminated by prohibiting herbicide application by any method within 0.2 km (0.125 mi) (by spot applications using hand operated equipment) or 0.4 km (0.25 mi) (by mechanized ground applications) of roosting California condors or their occupied nest sites. The combination of low herbicide toxicity, low potential for herbicide exposure, and protection from disturbance makes the possibility of adverse affects to the California condor insignificant and discountable.

Effects Finding (California Condor Non-essential Experimental Population). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the non-essential experimental population of the California condor.

Critical Habitat. Critical habitat for the California condor has been designated in nine areas in Kern, Los Angeles, San Luis Obispo, Santa Barbara, Tulare, and Ventura counties California.

Effects Finding (California Condor Critical Habitat). The proposed program of herbicide use on highway right-of-ways in Arizona will have no effect on the critical habitat for the California condor.

Mexican spotted owl (Strix occidentalis lucida)

Endangered Species Act Status	Threatened, 1993
Forest Occurrence:	Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, Tonto
Recovery Plan:	Final, 1995
Critical Habitat:	Yes, 2001; proposal reopened 2003
Effects Finding (Species):	Not Likely to Adversely Affect
Effects Finding (Proposed Critical Habitat):	Not Likely to Adversely Affect

Natural History. Mexican spotted owls are nocturnal predators that feed primarily on small mammals. They are “perch and pounce” predators that locate prey from an elevated perch by sight or sound, then pounce on the prey and capture it with their talons. They consume a variety of prey throughout their range, but commonly eat small and medium-sized rodents such as woodrats, peromyscid mice, and microtine voles. They also eat bats, birds, reptiles, and arthropods. Spotted owls in mountain ranges with forest-meadow interfaces take relatively more voles than in other areas (U.S. Fish and Wildlife Service 1995).

Home range is defined as the area an animal uses during its normal activities. The home-range size for Mexican spotted owls was determined by monitoring movements of radiotagged owls. Across the owl’s range in the southwestern U.S., home ranges varied from 261 to 1,487 ha (645 to 3,672 ac) for individuals and from 381 to 1,551 ha (941 to 3,831 ac) for pairs (U.S. Fish and Wildlife Service 1995).

Mexican spotted owls live in forested habitats with uneven stand structure. They form monogamous pairs and do not attempt nesting every year. If they attempt nesting, they generally lay their eggs in late March or early April. The female incubates the eggs while the male forages for food and feeds the female. After the eggs hatch, the male feeds both the female and the young until the young leave the nest. The nest is typically in a cavity, a platform, or occasionally a cave. Fledging of young occurs in July and August (U.S. Fish and Wildlife Service 1995).

Distribution. The historical and current ranges of the Mexican spotted owl include the states of Utah, Colorado, Arizona, New Mexico, and extreme western Texas. It also occurs in Mexico. The

owl's distribution within this range was never continuous; instead, the owl occurred in patches of suitable habitat. The present and historical ranges are similar, except the owl no longer occurs in lower elevation riparian areas (U.S. Fish and Wildlife Service 1995).

The U.S. Fish and Wildlife Service (1995) has organized the distribution of the Mexican spotted owl into six recovery units (RUs) in the U.S. These are the Colorado Plateau (southern Utah, northern Arizona, northwestern New Mexico, and southwestern Colorado), the Southern Rocky Mountains in Colorado (all of Colorado except the eastern plains and the northwestern and southwestern corners), the Southern Rocky Mountains in New Mexico (north-central New Mexico), the Upper Gila Mountains (The Mogollon uplift from Flagstaff to the New Mexico border and the Gila Mountains in west-central New Mexico), the Basin and Range-West (southern Arizona south of the Mogollon uplift and extreme southwestern New Mexico), and Basin and Range-East (central and southern New Mexico from roughly the southern end of the Sangre de Cristo Mountains to the Texas and Mexico borders). National forests in Arizona are in the Colorado Plateau, Upper Gila Mountains, and Basin and Range-West RUs (Table 4).

Table 5. Mexican spotted owl recovery units for Arizona national forests.

Forest	Recovery Unit				
	Basin-Range, W	Basin-Range, E	Upper Gila Mtns.	CO Plateau	S. Rocky Mtns
Apache-Sitgreaves	X		X		
Coconino			X		
Coronado	X				
Kaibab			X	X	
Prescott	X				
Tonto	X		X		

Status (Range-wide). Relatively little was known about the abundance of Mexican spotted owls prior to the U.S. Fish and Wildlife Service being petitioned to list it under the ESA in 1989. Reports of owls go back many years and multiple records may exist from the same site over time, so it is impossible to determine historical owl totals. Beginning in 1990, the Forest Service and others began more systematic surveys to determine the number and location of owls (Table 5) (U.S. Fish and Wildlife Service 1995). Despite problems with these data, they do show that the Upper Gila Mountains RU in western New Mexico and east-central Arizona contains about 58 percent (424 out of 758) of the Mexican spotted owls in the U.S. National forests account for most of the land management responsibility in this RU.

Table 6. Number of Mexican spotted owl sites by recovery unit prior to 1990 and from 1990-1993 (U.S. Fish and Wildlife Service 1995).

Recovery Unit	No. Sites prior to 1990	No. Sites, 1990-1993
Colorado Plateau	87	62
S. Rocky Mtns-CO	20	14
S. Rocky Mtns-NM	41	34
U. Gila Mtns	253	424
Basin/Range-W	169	103

Recovery Unit	No. Sites prior to 1990	No. Sites, 1990-1993
Basin/Range-E	30	121
Totals	600	758

The Forest Service has determined the amount of suitable habitat for Mexican spotted owls on national forest in Arizona. This corresponds to all lands that are in mixed conifer forest, pine-oak forest, or riparian cover types and totals about 1.1 million ha (2.8 million ac) (Table 6). The Forest Service has also designated Mexican spotted owl Protected Activity Centers (PACs) around all nesting and roosting spotted owls, as well as territorial owls detected at night for which daytime locations were not recorded. The number of PACs does not necessarily represent the number of owl pairs, since all PACs may not be occupied in any given year. PACs are about 240 ha (600 ac) in size and irregular in shape. They are estimates made by forest biologists of the best habitat around a particular owl occurrence. There are about 517 Mexican spotted owl PACs on Arizona national forests (Table 6). This number changes slightly from year to year as new owls are discovered and habitat is lost from such things as forest fire and disease.

Table 7. Mexican spotted owl PACs and suitable habitat on Arizona national forests (Source: unpublished Forest Service maps compiled for the regional Land and Resource Management Plan programmatic consultation 2003).

National Forest	Spotted Owl PACs	Hectares (Acres) of Suitable Habitat
Apache-Sitgreaves	136	353,910 (874,530)
Coconino	181	294,630 (728,050)
Coronado	107	96,560 (238,610)
Kaibab	6	66,340 (163,940)
Prescott	15	62,060 (153,350)
Tonto	72	219,390 (542,120)
Totals	517	1,092,890 (2,800,600)

Status (Within the Action Area). Highways in the action area for this project pass through a considerable amount of suitable Mexican spotted owl habitat (*i.e.* mixed conifer forest, pine-oak forest, or riparian cover types). Table 7 gives the highways and rough distance estimates for this habitat. There are also 55 owl PACs on four forests that are 0.8 km (0.5 mi) or less from highways (Table 8). Because owls can have home ranges of up to 1,551 ha (3,831 ac) for pairs and PACs are only about 240 ha (600 ac), PACs near highways, but not actually touching the roadway are included as being potentially affected by the proposed action.

Table 8. Estimates of distances that highways on national forests in Arizona pass through suitable Mexican spotted owl habitat (Source: unpublished Forest Service maps compiled for the regional Land and Resource Management Plan programmatic consultation 2003).

Forest	Highway	Kilometers (Miles) of Distance through Suitable Owl Habitat
Apache-Sitgreaves	State 260 U.S. 191 U.S. 60	55 (34) 69 (43) 5 (3)

Forest	Highway	Kilometers (Miles) of Distance through Suitable Owl Habitat
Coconino	State 87 State 89a State 260 I-17 I-40	48 (30) 24 (15) 16 (10) 37 (23) 11 (7)
Coronado	State 366	19 (12)
Kaibab	I-40	8 (5)
Prescott	State 89	8 (5)
Tonto	State 260 State 87/260 State 288 State 77 U.S. 60	48 (30) 16 (10) 29 (18) 2 (1) 8 (5)
Total		404 (251)

Table 9. Mexican spotted owl PACs near highways that pass through national forests in Arizona (Source: unpublished Forest Service maps compiled for the regional Land and Resource Management Plan programmatic consultation 2003).

Forest	Highway	Number of PACs
Apache-Sitgreaves	State 260 U.S. 191	1 9
Coconino	State 87 State 89a State 260 U.S. 180 I-17 I-40	6 8 3 1 2 1
Coronado	State 366	14
Tonto	State 260 State 288 U.S. 60	5 4 1
Total		55

Special Conservation Measures for the Mexican Spotted Owl. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- Pesticide applicators will follow the recommendations in the FWS regional guidance concerning surveys and application of herbicides in or near PACs. In addition, the following measures will apply.
- Dicamba (rated as Class 2 in the Avian Predator Toxicity Group) will not be used in established Protected Activity Centers (PACs) or unsurveyed habitat.
- If repeated herbicide treatments within a PAC area are necessary within a given year, ADOT/USFS will contact the FWS for further discussion and/or consultation.

Effects Analysis (Mexican Spotted Owl). Highways in the action area pass through a considerable distance of suitable Mexican spotted owl habitat and owls, as PAC designations indicate, can occupy habitats directly adjacent to these highways. However, there is virtually no chance that Mexican spotted owls will come in contact with herbicides either from direct application or from brushing against freshly sprayed vegetation because owls are nocturnal and spraying will be done in the daytime. Likewise, the prey of owls, mostly rodents, tends to be nocturnal and they also are unlikely be directly sprayed. Therefore, owls will probably not ingest herbicides that are on prey they capture in right-of ways. No areas will have herbicide treatments more than once a year so herbicide contamination would be a rare event, even if it did occur. The herbicides risk analysis indicates a low risk to either the owl or its prey from this amount of herbicide exposure. Owls in or near rights-of-way are likely habituated to road noise from passing vehicles and will not be disturbed from the brief presence of spray equipment. The combination of low herbicide toxicity, low potential for herbicide exposure, and low likelihood of direct disturbance makes the possibility of adverse affects to the Mexican spotted owl insignificant and discountable.

Herbicide treatments in the highway clear zone or to control noxious weeds are expected to help maintain grassy vegetation that would be favorable to rodents. Therefore, the proposed action may improve Mexican spotted owl foraging habitat.

Effects Finding (Mexican Spotted Owl). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Mexican spotted owl.

Proposed Critical Habitat. Critical habitat for the Mexican spotted owl was designated on February 1, 2001 (66 FR 8530). No critical habitat areas were designated on national forests in Arizona (U.S. Fish and Wildlife Service 2001). However, under an October 10, 2003, court decision, the FWS has reopened comments on the July 21, 2000, proposal (65 FR 45336) upon which the February 1, 2001 designation was based (U.S. Fish and Wildlife Service 2003). The proposal contained 1,330,339 ha (3,287,339 ac) of National Forest System lands in Arizona. Within that area, actual proposed critical habitat was limited to areas that met the definition of protected and restricted habitat in the Mexican Spotted Owl Recovery Plan. Some of the proposed critical habitat areas are within the action area for this program (U.S. Fish and Wildlife Service 2000).

In determining which areas to propose as critical habitat, the FWS is required to consider those physical and biological features (primary constitute elements) that are essential to conservation of the species and that may require special management considerations or protection. The FWS determined the primary constituent elements for Mexican spotted owl from studies of their habitat requirements and the information provided in the Mexican Spotted Owl Recovery Plan (U.S. Fish and Wildlife Service 1995 and references therein). Since owl habitat can include both canyon and forested areas, the FWS identified primary constituent elements in both areas. The primary constituent elements that occur in mixed conifer, pine-oak, and riparian forest types, as described in the Recovery Plan, have the following attributes (U.S. Fish and Wildlife Service 2000):

- High basal area of large diameter trees;
- Moderate to high canopy closure;
- Wide range of tree sizes suggestive of uneven-age stands;

- Multi-layered canopy with large overstory trees of various species;
- High snag basal area;
- High volumes of fallen trees and other woody debris;
- High plant species richness, including hardwoods;
- Adequate levels of residual plant cover to maintain fruits, seeds, and regeneration to provide for the needs of Mexican spotted owl prey species.

For canyon habitat, the primary constituent elements include the following attributes:

- Cooler and often more humid conditions than the surrounding area;
- Clumps or stringers of trees and/or canyon wall containing crevices, ledges, or caves;
- High percent of ground litter and woody debris;
- Riparian or woody vegetation (although not at all sites).

Effects Analysis (Mexican Spotted Owl Proposed Critical Habitat). Most herbicide use (about 70 percent) along highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. The roadway clear zone is an area where the natural vegetation is already greatly modified. It contains none of the primary constituent elements of proposed critical habitat. Project activities in the clear zone will not adversely affect proposed critical habitat for the Mexican spotted owl.

Surveys will be done to determine the extent of noxious weeds infestations in right-of-ways and herbicide applications will be limited to the areas needed to control these infestations. These spot applications will be done with low pressure vehicle-mounted systems, backpack sprayers, and other hand-held devices that will keep herbicide effects within the target area. All of the targeted noxious weeds are annuals or herbaceous perennials. These plants generally grow in open disturbed habitats and not in the areas of moderate to high canopy closure, high basal area of large diameter trees, and high volumes of downed woody debris that characterize Mexican spotted owl proposed critical habitat. However, noxious weeds may occur in herbaceous communities that provide for the needs of some Mexican spotted owl prey species. Here, noxious weeds reduce species diversity and habitat quality for prey species. The removal of noxious weeds will benefit habitat for prey species and therefore have a beneficial effect on proposed critical habitat for the Mexican spotted owl.

Effects Finding (Mexican Spotted Owl Proposed Critical Habitat)

The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect Mexican spotted owl proposed critical habitat and is likely to have beneficial effects.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Endangered Species Act Status:	Endangered, 1995
Forest Occurrence:	Apache-Sitgreaves, Tonto
Recovery Plan:	Final, 2002
Critical Habitat:	None Designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. The southwestern willow flycatcher is one of five subspecies of the willow flycatcher. It is a neotropical migrant that breeds in the southwestern United States and winters in Mexico, Central America, and extreme northern South America. Flycatchers arrive on breeding grounds in Arizona and New Mexico in late April and early May. Nesting begins in late May and early June. Average clutch size is three to four eggs. The time from egg laying to fledging is short (28 days). Renesting is uncommon if the first nesting attempt is successful, but is regularly attempted if the first clutch is lost or abandoned (U.S. Fish and Wildlife Service 2002).

Flycatchers nest in lowland riparian communities typically where there are dense patches of willow, buttonbush, boxelder, and *Baccharis* spp., sometimes with a scattered overstory of cottonwood. Nest sites typically have a dense canopy. In almost all cases, water that is still or slowly moving or saturated soils are present at or near the breeding site (U.S. Fish and Wildlife Service 2002). Nests are open cup structures typically placed in the fork of a branch from 2 to 7 m (6.5 to 23 ft) above ground (U.S. Fish and Wildlife Service 2002).

Flycatchers feed on small to medium-sized insects. They use “sit-and-wait” foraging with long periods of perching interspersed with foraging bouts (U.S. Fish and Wildlife Service 2002).

Distribution. Historically, the southwestern willow flycatcher bred in lowland riparian areas in California, Arizona, New Mexico, Texas, and Utah, with possible breeding in Nevada and Colorado. In California, the historical range of the flycatcher included all lowland riparian areas in the southern third of the state. In Arizona, the flycatcher nested in portions of all major watersheds (the Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro rivers). In New Mexico, the flycatcher occurred in the Rio Grande, Chama, Zuni, San Francisco, and Gila drainages, with records from the Pecos River and Penasco Creek. In Texas, the flycatcher occurred in the Rio Grande, Guadalupe Mountains, and Davis Mountains. In southern Utah, the flycatcher was a locally common breeding resident along the Colorado River and its tributaries (U.S. Fish and Wildlife Service 1995).

Currently, flycatchers no longer breed in Texas, but still breed in the other states where they were found historically. However, there have been declines in all of the states in the number of breeding territories and nesting locations (U.S. Fish and Wildlife Service 2002).

Southwestern willow flycatchers occurs on the Apache-Sitgreaves and Tonto NFs in Arizona. On the Tonto NF, flycatchers nest at Roosevelt Lake at the confluence of the Upper Salt River and Tonto Creek, and on the Verde River at Horseshoe Reservoir. On the Apache-Sitgreaves NFs, flycatchers nest at two sites near Greer (Little Colorado River headwaters), and at one site near Alpine (San Francisco River headwaters).

Status (Range-wide). The southwestern willow flycatcher recovery plan (U.S. Fish and Wildlife Service 2002) divides the range of the flycatcher into six Recovery Units (RU). These recovery units represent major river drainages. Each recovery unit is further subdivided into smaller Management Units (MU) (Table 9). The breeding territory is the measure of abundance used for each MU and for the RU as a whole. There are 816 breeding territories range-wide.

Table 10. Current status of the southwestern willow flycatcher by recovery unit and management unit (Survey data from M. Sogge, e-mail pers. comm. with C. Woods, 24 June 2003).

Recovery Unit	Management Unit	Number of Territories (avg. of last 3 surveys)
Basin and Mojave	Amargosa	5
	Kern	24
	Mojave	8
	Owen's	20
	Salton	3
Coastal California	San Diego	80
	Santa Ana	30
	Santa Clara	5
	Santa Ynez	17
Upper Colorado	Powell	no data
	San Juan	2
Lower Colorado	Virgin	26
	Middle Colorado	12
	Little Colorado	7
	Pahranagat	24
	Hoover-Parker	16
	Bill Williams	33
	Parker-Southerly International Boundary	3
Gila	Lower Gila	no data
	Hassayampa-Aqua Fria	1
	Verde	5
	Roosevelt	110
	San Francisco	2
	Upper Gila	204
	Middle Gila-San Pedro	124
	Santa Cruz	0
Rio Grande	San Luis Valley	34
	Upper Rio Grande	18
	Middle Rio Grande	36
	Lower Rio Grande	5
	Texas	no data
	Pecos	no data

Southwestern willow flycatchers are known to breed in four MUs (Roosevelt, San Francisco, Verde, and Little Colorado) on national forests in Arizona. The Roosevelt and Verde MUs are on

the Tonto NF and the San Francisco and Little Colorado MUs are on the Apache-Sitgreaves NF. Table 10 shows the territories in these MUs from 1993 to 2001. There was a 3-year average of 115 breeding territories on Arizona national forests as of 2001. Surveys in 2002 located 146 territories in the Roosevelt MU, 13 territories in the Verde MU, 1 territory in the San Francisco MU, and 1 territory in the Little Colorado MU (Smith *et al*. 2002). In addition, there are old records of southwestern willow flycatchers on the Verde River in the vicinity of Cottonwood and Camp Verde on or near the Coconino and Prescott NFs. Surveys in these areas in 2002 detected no birds (Smith *et al*. 2002.

Table 11. Known southwestern willow flycatcher territories on national forests in Arizona, 1993-2001 (Survey data from M. Sogge, e-mail pers. comm. with C. Woods, 24 June 2003).

Year	Gila RU			Lower Colorado RU
	Roosevelt MU	Verde MU	San Francisco MU	Little Colorado MU
1993	5	1	5	5
1994	33		5	5
1995	21		4	9
1996	39		3	11
1997	39	2	2	7
1998	48	0	3	7
1999	76	0	3	5
2000	115	0	2	3
2001	140	0	1	2
3-year avg.	110	0	2	3

Riparian habitat loss and modification are the main reasons for the flycatcher's decline and lack of recovery. Riparian habitat loss and modification occur due to dams and reservoirs, which alter natural stream flow patterns; groundwater pumping, which may lower water tables and reduce riparian potential; stream channelization and bank stabilization, which separate the stream from its floodplain; removal of riparian vegetation; livestock grazing; recreation; fire; agricultural development and urban development (U.S. Fish and Wildlife Service 2002).

Secondary threats to the flycatcher are exotic plant species (especially tamarisk) and brood parasitism from brown-headed cowbirds (U.S. Fish and Wildlife Service 2002). Because of the small population size, and the degree of fragmentation between breeding populations, southwestern willow flycatchers are susceptible to demographic stochasticity and reduced genetic variation (U.S. Fish and Wildlife Service 2002).

Status (Within the Action Area). Several highways in the action area are in the general vicinity of southwestern willow flycatcher MUs. On the Tonto NF, State Highway 188 runs parallel to the Tonto Creek inflow to Roosevelt Lake where flycatchers are using the riparian habitats at the upper end of the lake. Vegetation for the flycatcher varies from a saltcedar (*Tamarix* spp.) dominated understory with patchy Fremont cottonwood (*Populus fremontii*) and/or Goodding's willow (*Salix gooddingii*) overstory to pure stands of saltcedar. Portions of this area had standing water through most of the 2002 breeding season (Smith *et al*. 2002). State Highway 288 crosses

the Salt River just above the upper end of Roosevelt Lake and runs parallel of the upper end of the lake for several miles. Flycatchers are using riparian habitat at the Salt River inflow to Roosevelt Lake. This habitat expanded in recent years as lake levels receded. Vegetation varies from pure stands of saltcedar to nearly pure stands of Goodding's willow (Smith *et al*. 2002). Also on the Tonto NF, there are no highways near the Verde MU.

On the Apache-Sitgreaves NFs, State Highway 373 to Greer is near the Little Colorado MU where there is suitable habitat near Bunch, Tunnel, and River reservoirs. State Highway 180 north and east of Alpine is near the San Francisco MU where there is suitable riparian habitat along the San Francisco River. The highway runs parallel to the San Francisco River from about 8 km (5 mi) north of Alpine to Luna Lake about 8 km (5 mi) east of Alpine.

In addition to MUs, the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service 2002) identifies reaches of streams throughout Arizona that could provide habitat for expanding willow flycatcher populations. Highways in the action area that are near these stream reaches include State Highway 188 along Tonto Creek from just south of the State Highway 87/188 junction to the State Highway 88/188 junction at Roosevelt Dam, State Highway 373 near the West Fork of the Little Colorado River from the State Highway 260/373 juntion to Greer, U.S. Highway 191 along Nutrioso Creek south of Springerville, and U.S. Highway 180 along the San Francisco River from north of Alpine to Luna Lake.

Special Conservation Measures for the Southwestern Willow Flycatcher. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- No herbicides will be applied within occupied or unsurveyed southwestern willow flycatcher habitat during the breeding season to protect birds from potential disturbance.
- Chlorsulfuron, chlopyralid, 2,4-D (any formulation), glyphosate (nonaquatic Roundup), imazapyr (technical formulation), isoxaben, metsulfuron methyl, pendimethalin, and triclopyr (amine salt formulation) will not be used within 15 m (50 ft) (by spot applications using hand operated equipment) or 30 m (100 ft) (by mechanized ground applications) of the edge of southwestern willow flycatcher habitat to protect woody vegetation.
- Dicamba (rated as Class 2 in the Small Avian Toxicity Group) will have a buffer zone for all liquid formulations of 3 m (10 ft) for spot applications using hand-operated equipment and 18 m (60 ft) for mechanized ground applications from the edge of southwestern willow flycatcher habitat.

Effects Analysis (Southwestern Willow Flycatcher). There are no southwestern willow flycatchers nesting in the project area. The project area may provide some suitable habitat for flycatchers near and just beyond right-of-way boundaries, but these areas will be left in natural vegetation. Saltcedar, which can provide willow flycatcher habitat, is an undesirable plant, but it is not targeted for removal as a noxious weed in this project. The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are concerns about herbicide treatments that might either disturb flycatchers or damage their habitat, mitigations can be worked out that would avoid the possibility of these adverse effects. These mitigations might include timing restrictions to avoid disturbance and/or the use of selective

herbicides or hand application of herbicides to remove only noxious weeds and leave desirable vegetation.

Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. This area provides minimal, if any, flycatcher habitat. Flycatchers prefer to forage over riparian or marshy areas where prey insects are abundant. They would rarely be expected to use the highway clear zone for foraging. There is virtually no chance that southwestern willow flycatchers will come in contact with herbicides through direct application or through brushing against freshly sprayed vegetation. It is unlikely flycatchers will ingest herbicides that are on insect prey because herbicide applications, even those to maintain the clear zone, will be very infrequent (not more than once a year). In the rare instance that some herbicides were consumed, the risk analysis indicates a low risk from this amount of ingestion.

The possibility of effects to willow flycatchers or their habitat from herbicide use is further reduced by the special conservation measures of not applying herbicides within known/occupied southwestern willow flycatcher habitat and not applying chlorsulfuron, chlopyralid, 2,4-D (any formulation), glyphosate (nonaquatic Roundup), imazapyr (technical formulation), isoxaben, metsulfuron methyl, pendimethalin, and triclopyr (amine salt formulation) within 15 m (50 ft) (by spot applications using hand operated equipment) or 30 m (100 ft) (by mechanized ground applications) of the edge of known southwestern willow flycatcher habitat. The combination of low herbicide toxicity, low potential for herbicide exposure, and application of the special conservation measures makes the possibility of effects to the Southwestern willow flycatcher from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

The mitigations, BMPs, and special conservation measures for the southwestern willow flycatcher listed above will protect insect prey in aquatic environments.

The practice of not using Chlorsulfuron, chlopyralid, 2,4-D (any formulation), glyphosate (nonaquatic Roundup), imazapyr (technical formulation), isoxaben, metsulfuron methyl, pendimethalin, and triclopyr (amine salt formulation) within 15 m (50 ft) (by spot applications using hand operated equipment) or 30 m (100 ft) (by mechanized ground applications) of the edge of southwestern willow flycatcher habitat to protect woody vegetation will also apply to stream reaches that have been identified in the Southwestern Willow Flycatcher Recovery Plan (U.S. Fish and Wildlife Service 2002) as suitable for occupation by expanding flycatcher populations.

Effects Finding (Southwestern Willow Flycatcher). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the southwestern willow flycatcher.

Yuma clapper rail (Rallus longirostris yumanensis)

Endangered Species Act Status:	Endangered, 1967
Forest Occurrence:	Coconino, Tonto
Recovery Plan:	Final, 1983
Critical Habitat:	None designated

Effects Finding: No effect

Natural History. The Yuma clapper rail is one of seven subspecies of Rallus longirostris. The Yuma clapper rail breeds in shallow water near shore of fresh water or brackish marshes with cattail and bullrush stands. Densities of rails are highest in light cattail stands, followed in descending order by light bullrush stands, dense bullrush stands, and dense cattail stands. Stands dissected with narrow channels of flowing water have higher densities of birds (U.S. Fish and Wildlife Service 1983).

Clapper rails feed on crayfish, small fish, clams, isopods, and insects (U.S. Fish and Wildlife Service 1983). They begin nesting in February, with egg-laying occurring from March to July (Salt River Project 2002). Clutch size is typically 6 to 8 eggs, and young are precocial (Salt River Project 2002).

Distribution. There is reason to believe that the Yuma clapper rail expanded its range northward along the Colorado and Gila rivers due to the creation of marsh habitat from diversion dams (U.S. Fish and Wildlife Service 1983). Historically, the Yuma clapper rail occurred in the southern part of the Colorado River from Yuma, Arizona, southward. Construction of dams along the Colorado and other rivers caused the formation of large silt deposits, which in turn developed into cattail marshes (U.S. Fish and Wildlife Service 1983). Depending on sediment load and dam height, clapper rail habitat takes from 10 to 15 years to develop after the construction of an impoundment (U.S. Fish and Wildlife Service 1983). The increased habitat availability let the clapper rail expand its range northward as the habitat developed.

Currently, the Yuma clapper rail breeds in marshes along the Colorado River from the Nevada-California border south to the Colorado River delta in Mexico. Smaller breeding populations are also found around the Salton Sea and the Gila River basin in Arizona (U.S. Fish and Wildlife Service 1983). Within national forests, vagrant birds occur at Roosevelt Lake on the Salt River (Tonto NF), and wintering birds have been observed adjacent to the Coconino NF at Tavasci Marsh near Flagstaff.

Status (Rangewide and Within the Action Area). From about 1970 through 1983, an estimated 1,700 breeding Yuma clapper rails occurred from the Colorado River delta to Arizona, including the birds around the Salton Sea in California (U.S. Fish and Wildlife Service 1983). More recent data (Salt River Project 2002) estimates 500 to 1,100 birds in the lower Colorado River Basin, including the 9 to 55 birds on the Gila River near Phoenix, Arizona.

Within National Forest System lands in Arizona, the Yuma clapper rail occurs on the Tonto NF at Roosevelt Lake (Salt River Project 2002), and on lands adjacent to the Coconino NF (C. Overby, pers. comm. 19 June 2003). A single bird was observed on the Tonto NF in 2002. This bird was most likely a vagrant (B. Burger, pers. comm., e-mail dated 11 June 2003). Adjacent to the Coconino NF, several Yuma clapper rails were observed wintering in Tavasci Marsh in 2003 (C. Overby, pers. comm. 19 June 2003). No breeding Yuma clapper rails have been documented, although suitable habitat exists on both the Tonto and Coconino NFs.

Highways that pass through National Forest System lands near where Yuma clapper rails have been observed include State Highways 88, 188, and 288 in the vicinity of Roosevelt Lake, and Interstates 17 and 40, and State Highway 89 in the vicinity of Tavasci Marsh near Flagstaff.

Limiting factors for the Yuma clapper rail are availability of marsh habitat and food (U.S. Fish and Wildlife Service 1983). Threats to the Yuma clapper rail are the loss of marsh habitat due to river management activities, including fluctuating reservoir levels (Salt River Project 2002). However, the impoundments along the lower Colorado River and its tributaries have created habitat for the rail.

Special Conservation Measures for the Yuma Clapper Rail. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

No herbicides will be applied within occupied or unsurveyed Yuma clapper rail habitat during the breeding season to protect birds from potential disturbance.

Chlorsulfuron, clopyralid, 2,4-D (acid, aquatic amine salt, nonaquatic amine salt, and butyric acid formulations), glyphosate (Roundup), imazapyr (technical formulation), isoxaben, metsulfuron methyl, pendimethalin, and triclopyr (amine salt formulation) will not be used within 3 m (10 ft) for spot applications and 25 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size) of the edge of Yuma clapper rail habitat. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Dicamba (rated as Class 2 in the Waterfowl Avian Toxicity Group) will have a buffer zone for all liquid formulations of 6 m (20 ft) for spot applications using hand-operated equipment and 30 m (100 ft) for mechanized ground applications from the edge of Yuma clapper rail habitat. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Yuma Clapper Rail). Yuma clapper rails are water birds that will stay near their marsh habitats. They feed on crayfish, small fish, clams, isopods, and insects and would not be expected to forage near highways. The mitigations, BMPs, and special conservation measures described above will protect Yuma clapper rails from any herbicide exposure and will protect the rail's aquatic environment from any herbicide contamination. These conservation measures make the possibility of effects to the Yuma clapper rail from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Yuma Clapper Rail). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures will have no effect on the Yuma clapper rail.

Apache Trout (Oncorhynchus apache)

Status:	Threatened, 1975
National Forest Occurrence:	Apache-Sitgreaves, Coronado, Kaibab
Recovery Plan	Final, 1979; First Revision, 1983; Draft Second Revision, 2003
Critical Habitat:	None Designated
Effects Finding:	Not likely to adversely affect

Natural History. Apache trout occur mainly in headwater areas upstream from natural and artificial barriers (U.S. Fish and Wildlife Service 2003). This environment is subject to extreme variations in both temperature and flow. During winter, formation of anchor ice and ice bridges is common (Harper 1978). Alcorn (1976) and Lee and Rinne (1980) studied temperature tolerances of Apache trout and found that critical upper limits were similar to other species of trout. Apache trout generally require water temperatures below 25°C (77°F) (U.S. Fish and Wildlife Service 2003).

Prey of Apache trout is typically invertebrates, but varies depending on fish size (Harper 1978). Clarkson and Dreyer (1996) found Apache trout they examined from Lee Valley Reservoir (Apache-Sitgreaves NFs) were omnivorous. Apache trout fed on organisms found at both the lake surface and bottom, including both aquatic and terrestrial insects, zooplankton, crustaceans, snails, leeches, nematodes, and fish (Clarkson and Dreyer 1996). Robinson and Tash (1979) reported on Apache trout feeding in relation to light intensity and contrasted findings with brown trout, which were found to be more nocturnal.

Spawning in White Mountain streams occurs from March through mid-June, varying with stream elevation. Redd construction starts as water temperatures reach 8°C (46°F) (Harper 1978). Egg production in Apache trout is related positively to size, ranging from 72 to 4,215 eggs (Harper 1978, Roselund 1974). The smallest mature male studied was less than 150 mm (6 in) in total length, corresponding to a spawning age of 3 years (Harper 1978). Harper (1978) suggested that each fish may deposit eggs in several redds during a single spawning season. Redds are constructed primarily at downstream ends of pools in pool tail crests in coarse gravel. Eggs hatch in about 60 days (Harper 1978).

Distribution. The historical distribution of Apache trout is unclear. The original distribution was described as upper Salt River drainage (Black and White rivers), San Francisco River drainage (Blue River), and headwaters of the Little Colorado River, Arizona (Miller 1972) above 1,800 m (5,900 ft) in elevation (U.S. Fish and Wildlife Service 2003). The historical distribution appeared to be about 1,470 km (911 mi) of stream (U.S. Fish and Wildlife Service 2003).

Status (Range-wide and Within the Action Area). There are currently 23 pure (20 uncompromised and 3 mixed with brook or brown trout) populations within historical range representing 13 natural stocks of Apache trout and occupying 150 km (93 mi) of stream, about 10 percent of the historical range. Of the uncompromised populations, 4 occur solely on the Apache-Sitgreaves NFs, 2 are shared with Fort Apache Indian Reservation, and 14 are solely on Apache tribal lands (U.S. Fish and Wildlife Service 2003).

There are 4 introduced populations on the Coronado NF (Porath and Nielson 2003) and 1 introduced population on the Kaibab NF (U.S. Fish and Wildlife Service 2003). The Coronado NF populations are slated to be replaced with Gila trout, which has been determined were the native species in those streams (S. Gurtin, Arizona Game and Fish Department, pers. comm. with T. Myers, 3 July 2003; U.S. Fish and Wildlife Service 2003). North Canyon Creek on the Kaibab NF was stocked with pure Apache trout in 1967. While this is outside of its historical range, this population was used as broodstock for a reintroduction project in 1996 (U.S. Fish and Wildlife Service 2003).

Several occupied Apache trout streams are near highways that pass through National Forest System lands. State Highway 366 in the Pinaleno Mountains on the Coronado NF is within 3.2

km (2 mi) of one occupied stream. This stream presently has Apache trout, but it is one of the streams that may be replaced with the endangered Gila trout. On the Apache-Sitgreaves NFs, U.S. Highway 191 from about 8 km (5 mi) south of Alpine to about 13 km (8 mi) south of Hannagan Meadow is within 3.2 km (2 mi) of eight occupied Apache trout streams. One occupied stream, Hannagan Creek, runs parallel to Highway 191 for about 5 km (3 mi).

Habitat alterations, competition and predation by non-indigenous fishes, and hybridization are the primary threats to Apache trout. These threats continue to limit Apache trout survival and greatly limit the species' present range (U.S. Fish and Wildlife Service 2003).

Special Conservation Measures for the Apache Trout. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Apache Trout). Most herbicide use (about 70 percent) in the action area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed Apache trout habitat. These special conservation measures will protect Apache trout and its environments. They will make the possibility of effects to the Apache trout from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Apache Trout). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Apache trout.

Colorado pikeminnow (*Ptychocheilus lucius*)

Status:	Endangered, 1967; Non-essential Experimental Population, 1985
Forest Occurrence:	Coconino, Prescott, Tonto
Recovery Plan:	Approved, 1978; revised, 1991; amended with recovery goals, 2002
Critical Habitat:	Yes, 1994
Effects Finding (Species):	No Effect
Effects Finding (Critical Habitat):	No Effect
Effects Finding (Exp. Population):	Not likely to adversely affect

Natural History. Colorado pikeminnow is the largest member of the minnow family (Cyprinidae) native to North America (Miller 1961, Behnke and Benson 1980). It has been reported that this species can live more than 50 years (U.S. Fish and Wildlife Service 2002), and that it can grow to lengths exceeding 1.8 m (6 ft) and weights exceeding 36 kg (100 lbs) (Minckley 1973).

Juveniles feed primarily on insects and crustaceans, while individuals as small as 2.1 cm (0.9 in) (Muth and Snyder 1995), or on average, those over 5 cm (2 in) start feeding on fish (Vaniceck 1967, U.S. Fish and Wildlife Service 2002). Adult pikeminnows are almost exclusively piscivores (Vanicek and Kramer 1969).

Spawning occurs usually between late June and about mid-August, depending on local hydrology and temperature regimes. Spawning coincides with rising water temperature and decreasing flow; peak spawning activity is reported to occur between 22 to 25°C (72 to 77°F) (Vanicek and Kramer 1969, Tyus 1990). Spawning areas are a complex of deep pools, eddies, and rapid velocity water over cobble substrates (Propst 1999, Tyus and Karp 1989, Miller 1995). Eggs are broadcast over gravel and cobble substrates in riffles and rapids. After hatching, the larvae drift downstream to nursery areas (Tyus and Haines 1991). Nursery areas consist of shoreline, backwater, and embayment areas (Haynes *et al.* 1984, Haines and Tyus 1990). Migration is an important component in the reproductive cycle as seen in research where Colorado pikeminnow migrated more than 300 km (186 mi) to specific river reaches to spawn (Tyus and Karp 1989; Tyus 1985, 1986, 1990; McAda and Kaeding 1991).

Colorado pikeminnow is adapted to life in highly variable big river systems with extremes in flow and turbidity (Tyus 1990). Adult pikeminnows are found in a variety of water velocities, depths, and substrates (Holden and Wick 1982). Adult seasonal habitat use varies (Holden and Wick 1982, Tyus 1990). In the spring, when flows are high, adults are often found in backwater areas and flooded bottomlands (Tyus and Karp 1989). When spring flows recede, adults return to the main channel and some mature individuals congregate near the mouths of tributaries. These confluences may serve as staging areas prior to spawning migrations. Small individuals occupy shallow backwater areas with little or no current and silt/sand substrates (Ryden and Ahlm 1996).

Distribution. Colorado pikeminnow formerly inhabited the Colorado River basin from its mouth in Baja, California, upstream to Southern Wyoming (Propst 1999). In Arizona the pikeminnow occupied the Salt, Gila, Verde, and San Pedro rivers of the Colorado River basin (U.S. Fish and Wildlife Service 2002). Colorado pikeminnow are believed to have ranged in the Verde River up to Perkinsville, Arizona. This belief is based on bone samples taken from an archaeological site near Perkinsville (Minckley and Alger 1968). By the mid-1970s, Colorado pikeminnow were apparently extirpated from the lower Colorado River basin, which includes the entire state of Arizona (U.S. Fish and Wildlife Service 2002).

Status (Range-wide and within the Action Area). Wild populations of Colorado pikeminnow are found only in the Colorado River upper basin and the species currently occupies only about 25 percent of its historical range basin-wide (U.S. Fish and Wildlife Service 2002). There are no wild populations in Arizona.

Currently, Colorado pikeminnow is limited mainly to three areas in the upper Colorado River basin. In these primary areas of occurrence, it is comparatively common only in the Green-Yampa River system of northwestern Colorado and northeastern Utah (Tyus 1990, 1991; Propst 1999). A

reproducing population still occurs in the western part of Colorado in the Colorado and Gunnison rivers (Osmundson and Kaeding 1989, Osmundson and Burnham 1996). A small population of reproducing pikeminnows still occurs in the San Juan River of New Mexico (Platania *et al*. 1991, Ryden and Ahlm 1996, Propst 1999).

The near extinction of Colorado pikeminnow is due to a combination of factors, the most significant being those associated with water development projects (*i.e.* dams) that have altered stream morphology, flow patterns, temperatures, water chemistry, and silt loads of most major streams throughout the Colorado River basin. Dams have blocked access to most spawning areas. Water temperature changes resulting from the construction of dams and habitat degradation may be having a significant affect; cold water temperatures below dams can inhibit embryonic development and increase early-life mortality. Interactions with nonnative fishes may be an important factor in the continued survival or success of reintroduced populations of Colorado pikeminnow (U.S. Fish and Wildlife Service 2002).

Effects Analysis (Colorado Pikeminnow). There are no wild populations of Colorado pikeminnow in Arizona. The wild populations in the Colorado River upper basin in Utah, Colorado, and New Mexico are upstream from the project area. There is virtually no chance that wild populations will become naturally re-established in Arizona due to the presence of water development projects and nonnative fishes.

Effects Finding (Colorado Pikeminnow). The proposed program of herbicide use on highway right-of-ways in Arizona will have no effect on wild populations of Colorado pikeminnow.

Critical Habitat. In March 1994, the U.S. Fish and Wildlife Service designated 1,848 km (1,148 mi), or 29 percent of the Colorado pikeminnow's historical range in the Colorado River basin as critical habitat (U.S. Fish and Wildlife Service 1994). All of the critical habitat areas are in the upper basin in Utah, Colorado, and New Mexico. There is no designated critical habitat in Arizona (U.S. Fish and Wildlife Service 1994).

Effects Analysis (Colorado Pikeminnow Critical Habitat). The critical habitat areas in Utah, Colorado, and New Mexico are all upstream from the project area. There is no way herbicides used in this project could reach any of the critical habitat areas.

Effects Finding (Colorado Pikeminnow Critical Habitat). The proposed program of herbicide use on highway right-of-ways in Arizona will have no effect on the designated critical habitat of Colorado pikeminnow.

Status (Non-essential Experimental Population). In 1985, the U.S. Fish and Wildlife Service designated that Colorado pikeminnows reintroduced into the Salt and Verde river drainages in Arizona would be part of a non-essential experimental population (U.S. Fish and Wildlife Service 1985). A non-essential experimental population is not subject to the protection of section 7(a)(2) of the ESA, but instead is subject to provisions of sections 7(a)(1) and (4), which authorize Federal agencies to establish programs furthering their conservation. Under these provisions of the ESA, the Colorado pikeminnow is treated as a species proposed for listing. Under Section 7(a)(4), Federal agencies are required to informally confer with the U.S. Fish and Wildlife Service on any actions that might jeopardize the continued existence of a proposed species.

Over 623,000 Colorado pikeminnows were reintroduced into the Salt and Verde Rivers, Arizona, between 1981 and 1990. These stockings was done with fry and fingerling-sized fish and proved

unsuccessful due to high nonnative fish predation (Hendrickson 1994). Since 1991, all stockings have been with fish larger than 30 cm (12 in) as this size was thought to be able to withstand nonnative predation. The goal of the Colorado pikeminnow reintroduction program is to stock 2,000 fish per year. The majority of these fish are being stocked in the Verde River at Beasley Flat and Childs river access points. The fish are expected to occupy the Verde River from Perkinsville, Arizona downstream to Horseshoe Reservoir. The Salt River was stocked only in 1996 (A. Sillas, U.S. Forest Service, pers. comm. via e-mail with S. Ferrell, 6 June 2003; Jahrke and Clark 1999).

Special Conservation Measures for the Colorado Pikeminnow Non-essential Experimental Population. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for

cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).

- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Colorado Pikeminnow Non-essential Experimental Population). The Tonto, Prescott, and Coconino NFs have watersheds that drain into the Salt and Verde rivers. There are several highways in the project area that cross the Salt or Verde rivers or their perennial tributaries. Most herbicide use (about 70 percent) in the action area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed Colorado pikeminnow habitat. These special conservation measures will protect Colorado pikeminnow and its environments. They will make the possibility of effects to the Colorado pikeminnow from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Colorado Pikeminnow Non-essential Experimental Population). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the non-essential experimental population of Colorado pikeminnow.

Gila chub (Gila intermedia)

Status:	Proposed Endangered, 2002
Forest Occurrence	Apache-Sitgreaves, Coronado, Prescott, Tonto
Recovery Plan:	Not Applicable
Critical Habitat:	Proposed, 2002
Effects Finding (Species):	Not likely to adversely affect
Effects Finding (Proposed Critical Habitat):	Not likely to adversely affect

Natural History. Gila chub occupy smaller streams, springs, cienegas and some artificial impoundments (Minckley 1973, Rinne 1975, Weedman *et al.* 1996). They are highly secretive and are usually found in deeper water or close to cover. Spawning may occur over beds of aquatic plants (Minckley 1973). Specific habitat associations have been observed to vary with the developmental stage of the fish and likely with the season and geography. For example, Minckley (1969) found young fish in Monkey Spring, Arizona, in swifter areas than adult fish, which used areas of little or no flow in undercut banks and heavily vegetated margins of the spring run. Griffith and Tiersch (1989) collected Gila chubs from both riffles and pools in Redfield Canyon, Arizona. Gila chub appear to be closely associated with healthy cienegas and broadleaf riparian communities in lotic and lentic systems.

Gila chub reproduction can take place from late winter to early autumn in stable spring-fed systems, but the peak season in other areas is during late spring and summer (Minckley 1973). Most Gila chub become sexually mature in their second or third year (Griffith and Tiersch 1989). Optimal water temperature for spawning appears to be from 20 to 24°C (Griffith and Tiersch 1989). They feed mainly on aquatic and terrestrial insects, filamentous and diatomaceous algae (Minckley 1973), organic debris, and other fish (Griffith and Tiersch 1989, Rinne and Minckley 1991). They have been observed chasing Gila topminnows (Minckley 1969). The presence of gravel in the gastrointestinal tract suggests Gila chub may be benthic feeders (Weedman *et al.* 1996). Adults feed primarily during the twilight hours, whereas the young are observed feeding during daylight hours (Minckley 1973, Griffith and Tiersch 1989). No information is available on dietary feeding habits between size or age classes (NatureServe 2001).

Distribution. Historically, the Gila chub was found throughout the Gila River basin of southern Arizona, southwestern New Mexico, and northeastern Sonora, Mexico (Bestgen and Propst 1989, Miller 1946, Minckley 1973). There are 26 populations of Gila chub remaining in the U.S. with only 1 considered to be stable and secure (Weedman *et al.* 1996). The other 25 populations are considered small, isolated, and threatened. Two re-established populations exist in Larry Creek and Lousy Canyon with a newly discovered population occurring in Mineral Creek in Arizona (U.S. Fish and Wildlife Service 2002). An observation of a fish in Turkey Creek, New Mexico, may have been a Gila chub (U.S. Fish and Wildlife Service 2002), however, the population may be the newly described headwater chub, *Gila nigra* (Minckley and Demarias 2000, Voeltz 2002). Further investigation is needed on this population. Isolated populations of Gila chub remain in about 10 to 15 percent of previously occupied habitat. In Arizona, these populations are in Eagle and Bonita Creeks (Graham and Greenlee counties); Indian, Larry, Little Sycamore, Silver, and Sycamore creeks and Lousy Canyon (Agua Fria drainage, Yavapai County); Harden Cienega and Dix Creek (San Francisco drainage, Greenlee County); Blue and San Carlos rivers (San Carlos Apache Indian Reservation, Gila and Graham Counties); Babocomari River (Cochise and Santa Cruz Counties); Redfield, O'Donnell, and Bass canyons (San Pedro drainage; Cochise, Graham, Pima, and Santa Cruz counties); Sabino Canyon, Sheehy Spring, and Cienega Creek (Santa Cruz River drainage, Pima and Santa Cruz counties); and Walker Creek, Williamson Valley Wash, and Spring Creek (Verde River drainage, Yavapai County) (U.S. Fish and Wildlife Service 2002). The Gila chub was thought extirpated in New Mexico (Sublette *et al.* 1990), however, two small isolated populations may still persist. These are in Turkey Creek, a Gila River tributary (Grant County), mentioned above, and Mule Creek (Grant and Catron counties), a tributary to the San Francisco River (Propst 1999, Bestgen and Propst 1989). In Mexico, Gila chub previously occupied habitat throughout the San Pedro and Santa Cruz River basins, however, they are currently restricted to two populations (Varela-Romero *et al.* 1992).

Status (Range-wide). The major threats to Gila chub include predation and competition from nonnative organisms, disease, and alteration, destruction, and fragmentation of habitat (U.S. Fish and Wildlife Service 2002). The introduction of predators, competitors, and disease through the movement of nonnative organisms can severely impact previously secure populations. Of the extant populations in the mid-1990s, 58 percent were subject to grazing within the riparian zone at the occupied site or upstream, 42 percent contained exotic species, 25 percent had limited habitat, and 25 percent were found in systems with impoundments or water diversions; some populations are exposed to multiple factors (Weedman *et al*. 1996). Gila chub abundance has declined significantly during the past several decades. Less than 20 percent of previously occupied range currently has populations of Gila chub. Land and water development and invasion of nonnative predatory and competitive species continue to cause habitat loss and population declines (Hubbs 1954, Miller 1961, Minckley and Deacon 1968, Meffe 1985, Weedman *et al*. 1996). Contaminants also appear to be a threat in certain areas (Weedman *et al*. 1996).

Of the 26 populations in the U.S., 12 occur on national forests in Arizona. There are 3 populations on Apache-Sitgreaves NFs (Eagle, Harden Cienega, and Dix creeks), 2 on Coronado NF (O'Donnell and Sabino canyons), 5 on Prescott NF (Indian, Little Sycamore, Sycamore, Walker, and Spring creeks), and 2 on Tonto NF (Silver and Mineral creeks). Almost all of the populations not on national forests occur in drainages that have their headwaters on national forests.

Status (Within the Action Area). Of the 12 populations on national forests in Arizona, 2 are in the action area. U.S. Highway 191 is adjacent to the Eagle Creek population for about 6.4 km (4 mi) on the Apache-Sitgreaves NFs. State Highway 83 is adjacent to the O'Donnell Canyon population for about 1.6 km (1 mi) and then crosses the canyon on the Coronado NF.

Special Conservation Measures for the Gila Chub. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats (including proposed or designated critical habitat areas) that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at

least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats (including proposed or designated critical habitat areas) that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Gila Chub). Most herbicide use (about 70 percent) in the action area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed Gila chub habitat. These special conservation measures will protect Gila chub and its environments. They will make the

possibility of effects to the Gila chub from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near Gila chub populations, detailed plans and mitigations can be worked out at that time that would avoid the possibility of any adverse effects to the chub.

Effects Finding (Gila Chub). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the proposed Gila chub.

Proposed Critical Habitat. The U.S. Fish and Wildlife Service (2002) proposed 38 stream segments in Arizona and New Mexico as critical habitat for the Gila chub. The total distance is about 337 km (208 mi). Of the total, about 197 km (122 mi) are on Federal lands managed by either the Forest Service or Bureau of Land Management.

Of the 38 stream segments proposed as critical habitat, 15 are completely or partly on national forests in Arizona. There are 3 stream segments on the Apache-Sitgreaves NFs; they are Harden Cienega, Dix, and Eagle creeks in Area 1 (Upper Gila River) of the proposal. There are 4 stream segments on the Coronado NF; they are Post Canyon, O'Donnell Canyon, and Turkey Creek in Area 3 (Babocomari River) and Sabino Canyon in Area 5 (Lower Santa Cruz River) of the proposal. There are 6 stream segments on the Prescott NF; they are Walker Creek, Spring Creek, and Red Tank Draw in Area 6 (Upper Verde River) and Sycamore, Little Sycamore, and Indian creeks in Area 7 (Agua Fria River) of the proposal. There are 2 stream segments on the Tonto NF; they are Mineral Creek in Area 2 (Middle Gila River) and Silver Creek in Area 7 (Agua Fria River) of the Proposal.

Proposed critical habitat areas in the action area are along or near U.S. Highway 191 (Eagle Creek on the Apache-Sitgreaves NFs), State Highway 83 (O'Donnell Canyon and Turkey Creek on the Coronado NF), and Interstate 17 (Red Tank Draw on the Prescott NF).

Effects Analysis (Gila Chub Proposed Critical Habitat). The mitigations, BMPs, and special conservation measures for Gila chub that are part of this project will protect the proposed critical habitat areas from any herbicide contamination.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near proposed Gila chub critical habitat areas, detailed plans and mitigations can be worked out at that time that would avoid the possibility of any adverse effects to the proposed critical habitat.

Effects Finding (Gila Chub Proposed Critical Habitat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect Gila chub proposed critical habitat.

Gila topminnow (Poeciliopsis occidentalis)

Status:	Endangered, 1967
Forest Occurrence:	Coronado, Prescott, Tonto

Recovery Plan:	Final, 1984
Critical Habitat:	No
Effects Finding:	Not likely to adversely affect

Natural History. Gila topminnow is a small member of the livebearer family Poeciliidae. Males seldom exceed 25 mm (1.0 in) standard length and females 50 mm (2.0 in) (Minckley 1973). The mode of reproduction in poeciliid fish is internal fertilization and development, with the young born alive (Meffe and Snelson 1989, Moyle and Cech 1988). Water temperature, photoperiod, food availability, and predation all affect the onset of breeding and brood size (Schoenherr 1977). Breeding takes place year-round in natural constantly warm-temperature springs (Constantz 1974, Schoenherr 1977); breeding occurs from April to August in naturally fluctuating habitats (Constantz 1979). Brood size is 1 to 20, and the female can carry two broods simultaneously, one much further developed than the other (Minckley 1973). Gestation period is 24 to 28 days (Minckley 1973). Gila topminnow life span is about 1 year, with young produced early in the breeding season reaching sexual maturity in a few weeks to several months (Minckley 1973). Gila topminnow foods include bottom debris, vegetative materials, and amphipod crustaceans; they feed voraciously on insect larvae, including mosquitoes (Minckley 1973).

Gila topminnows live in shallow, warm, and quiet waters, but have been seen living in quiet to moderate currents in depths up to 1 m (3.3 ft) (U.S. Fish and Wildlife Service 1984). They live in water temperatures from a constant 26 to 28ºC (79 to 82º F) in springs (Schoenherr 1977) to ranges of 6 to 37°C (43 to 99º F) in naturally fluctuating streams (Meffe *et al.* 1983). Gila topminnows can live in a wide variety of waters such as springs, cienegas, marshes, permanent or interrupted streams, and along the edges of large rivers (U.S. Fish and Wildlife Service 1984). Gila topminnows have been collected in aquatic environments that contain dense mats of algae and debris, usually along stream margins or below riffles that have sandy substrates sometimes covered with organic mud and debris (Minckley 1973). Gila topminnows can withstand a wide range of water chemistries with pHs of 6.6 to 8.9, dissolved oxygen readings of 2.2 to 11 ppm (mg/L), and salinities from tap water to seawater (Schoenherr 1974).

Distribution. The Gila topminnow is native to the Gila River basin in Arizona, New Mexico, and northern Mexico (Lowe 1964, Minckley 1973). Hubbs and Miller (1941) described the Gila topminnow as one of the most common fish in southern Arizona in the 1940s. They were found throughout the Gila River system from 1,372 m (4,500 ft) in elevation down to the confluence with the Colorado River near Yuma (Minckley and Deacon 1968), the Salt River from the Gila River upstream to the present site of Roosevelt Dam (Miller 1961, U.S. Fish and Wildlife Service 1984), and high up the Verde River (Minckley 1973). There is one Gila topminnow record from the San Francisco River in New Mexico (Koster 1957), probably from the Frisco Hot Springs (U.S. Fish and Wildlife Service 1984). Few records exist for the San Pedro River system (U.S. Fish and Wildlife Service 1984), but there are many records for the Santa Cruz River system, including various tributary streams and springs (Minckley *et al.* 1977, U.S. Fish and Wildlife Service 1984). It is possible that the Gila topminnow was once distributed throughout the San Simon River drainage to its source in the San Simon Cienega on the Arizona-New Mexico border (Minckley *et al.* 1977, U.S. Fish and Wildlife Service 1984).

Presently, the Gila topminnow is extant at only 32 locations (14 natural and 18 reintroduced) (J. Voeltz, Arizona Game and Fish Department, pers. comm. to R. Maes, 21 July 2003), with 13 of these on National Forest System lands. There are 10 populations on the Tonto NF, 2 on the Prescott NF, and 1 on the Coronado NF. The population in Redrock Canyon on the Coronado NF

is the only natural population on National Forest System lands, all others are reintroduced (J. Voeltz, Arizona Game and Fish, pers. comm. to R. Maes, 21 July 2003). The 10 populations on the Tonto NF occur at Charlebois, Hidden Water, Mud, Walnut, Kayler and Dutchman Grave springs; Campaign and Lime creeks; and Unnamed Drainage #68B (R. Calamusso, Tonto NF, pers. comm. to S. Ferrell, 6 June 2003). The 2 populations on the Prescott NF occur at Lower Mine and Johnson Wash springs (A. Sillas, Prescott NF, pers. comm. 11 July 2003).

Status (Range-wide). Range-wide, Gila topminnow has gone from being one of the most common fishes of the Gila River basin to one that exists in no more than 32 known locations (14 natural and 18 stocked). There are also 20 captive populations (J. Voeltz, Arizona Game and Fish Department, pers. comm. to R. Maes, 21 July 2003). The reasons for decline of this fish include past dewatering of rivers, springs and marshlands; impoundments; channelization; diversions; flow regulation; land management practices that promote erosion and arroyo formation; and the introduction of predacious and competing non-native fishes (Miller 1961, Minckley 1985, U.S. Fish and Wildlife Service 1984). Gila topminnows are highly vulnerable to adverse effects from nonnative aquatic species (Johnson and Hubbs 1989), including nonnative crayfish (Fernandez and Rosen 1996) and bullfrogs. Predation and competition from nonnative fishes have been a major factor in their decline and continue to be a major threat to the remaining populations (Meffe *et al*. 1983, Meffe 1985, Brooks 1986, Marsh and Minckley 1990, Stefferud and Stefferud 1994, Weedman 1999). Mosquitofish can eliminate a topminnow population within a few years. The spread of mosquitofish has continued virtually unchecked since their introduction to Arizona in 1926.

Gila topminnows have been stocked into at least 175 sites, however, they persist at only 18 of them. Of the 18 sites, 1 is outside topminnow historical range and 4 now contain non-native fish (Weedman 1999).

Status (Within the Action Area). Most of Gila topminnow sites on National Forest System lands are remote from any highways. Of the occupied sites, Kayler Spring on the Tonto NF is within 3.2 km (2 mi) of State Highway 188 and Johnson Wash Spring on the Prescott NF is within 3.2 km (2 mi) of State Highway 169. However, due to their topographic positions, neither of these springs could receive any highway runoff. State Highway 88 crosses Campaign Creek, which is an occupied site, south of Roosevelt Lake on the Tonto NF. This is the only location where a highway is close enough to a Gila topminnow population to have a potential effect.

Special Conservation Measures for the Gila Topminnow. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic

arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Gila Topminnow). Most herbicide use (about 70 percent) in the project area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed Gila topminnow habitat. These special conservation measures will protect Gila topminnow and its environments. They will make the possibility of effects to the Gila topminnow from the proposed program of herbicide use on highway right-of-ways insignificant and discountable. These conservation measures make the possibility of effects to the Gila topminnow from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near the Gila topminnow population in Campaign Creek, plans and mitigations can be worked out at that time that would avoid any possible adverse effects to the topminnow.

Effects Finding (Gila Topminnow). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Gila topminnow.

Little Colorado spinedace (L*epidomeda vittata*)

Endangered Species Act Status:	Threatened, 1987
Forest Occurrence:	Apache-Sitgreaves, Coconino
Recovery Plan:	Final, 1998
Critical Habitat:	Yes, 1987
Effects Finding (Species):	Not likely to adversely affect
Effects Finding (Critical Habitat):	Not likely to adversely affect

Natural History. Little Colorado spinedace inhabit small to moderate sized streams (Minckley and Carufel 1967; U.S. Fish and Wildlife Service 1987, 1998). Generally, spinedace occupy the mid-water portions of medium depth clear flowing pools (*e.g.* 0.3 to 0.9 m, 1 to 3 ft) that have fine gravel bottoms and undercut banks and boulders for cover. They avoid the deepest heavily shaded pools and shallow open areas (Miller 1963, Minckley and Carufel 1967). The species is apparently able tolerate a wide range of conditions, including stagnant turbid pools (Miller 1963, Blinn and Runck 1990).

Spawning generally occurs during the late spring and early summer, although some evidence indicates females may also spawn into the autumn and more than once (Minckley and Carufel 1967, U.S. Fish and Wildlife Service 1998). Females broadcast eggs over the stream bottom or on aquatic vegetation, laying perhaps 650 to 1,000 eggs (U.S. Fish and Wildlife Service 1998). Growth of juvenile spinedace is rapid, with individuals reaching sexual maturity in about 3 months and living at least 3 years (U.S. Fish and Wildlife Service 1998).

The diet of Little Colorado spinedace varies seasonally (Runck and Blinn 1992). Foods include a variety of larval and adult aquatic insects, terrestrial insects, filamentous algae, and vascular plant fragments (U.S. Fish and Wildlife Service 1998).

Distribution. Little Colorado spinedace are known from five general locations in the upper part of the Little Colorado River basin in Arizona. This includes East Clear Creek and its tributaries (including an historical occurrence in upper Clear Creek), Chevelon Creek, Silver Creek, the upper Little Colorado River, and Nutrioso Creek (including Rudd Creek) (U.S. Fish and Wildlife Service 1987, 1998). Miller (1963) suggested the species may have occurred in New Mexico in the Zuni River drainage. Genetic analyses indicate three populations of the species: 1) East Clear Creek, 2) Chevelon Creek, and 3) the upper Little Colorado River including the mainstem, Nutrioso Creek, and Rudd Creek (Tibbets *et al*. 1993).

Little Colorado spinedace occur on the Coconino and Apache-Sitgreaves NFs (U.S. Forest Service 1999, Young *et al*. 2001). Part of the East Clear Creek population is on the Coconino NF. Part of the East Clear Creek population east of and including Leonard Canyon, the Chevelon Creek population, the Silver Creek population, the upper Little Colorado River population (at least the portion upstream of Lyman Reservoir), and the Nutrioso Creek (including Rudd Creek) population are on the Apache-Sitgreaves NFs. Some occupied drainages (*e.g*. Chevelon Creek, Silver Creek, Little Colorado River mainstream) are downstream from the national forests.

Status (Range-wide). Populations of Little Colorado spinedace are highly dynamic, expanding and contracting in response to the amount of perennial water in the upper Little Colorado River drainage. During drought, spinedace persist in deep pools and spring heads that retain water (Minckley and Carufel 1967, Dorum and Young 1995). When surface waters increase and drainage flows are maintained, spinedace increase rapidly in numbers and disperse throughout the system (Dorum and Young 1995). For example, the species appeared to have declined drastically between the late 1930s and early 1960s, leading Miller (1963) to surmise that, “It seems highly probable that [Little Colorado spinedace] is now restricted to the Clear Creek drainage…”, and if that population were to be lost, “…there is every reason to expect that the Little Colorado spinedace would become extinct.” However, between 1963 and 1966, the species “enjoyed marked reproductive success and re-invaded most of its former range” in response to “favorable water conditions” (Minckley and Carufel 1967). A decline was documented in 1983 when surveys showed Little Colorado spinedace at only 11 of 54 historically occupied sites (Minckley 1984). Populations were considered “good” at only 5 of these 11 sites (Minckley 1984). Sampling in 1990 and 1991 continued to indicate a “greatly reduced” distribution and abundance with “alarming” declines in the entire East Clear Creek population (Denova and Abarca 1992). Although Dorum and Young (1995) reported some improvement at certain locations, spinedace populations generally remained depressed from 1993 to 1995 with populations dropping to undetectable levels in Silver Creek and much of the East Clear Creek drainage. The Silver Creek population was again detected in 1997 for the first time since its original detection in 1965 (Minckley and Carufel 1967, Little Colorado Spinedace Recovery Team 2003). During the early 2000s, continued drought eliminated surface water from several previously inhabited drainages. As a result, the species’ range within some systems has been further reduced with spinedace being eliminated from some areas, restricted to a few pools, or reduced to undetectable levels (Little Colorado Spinedace Recovery Team 2003). In 2002, the species’ distribution on the Coconino NF appeared to be limited to one in-channel pool in West Leonard Canyon and one in-channel pool in Dane Canyon (where the species was stocked in 2002 with fish salvaged from the West Leonard Canyon pool), although repopulation of this system is anticipated when surface waters are re-

established (C. Benedict, Region II, Arizona Game and Fish Department, pers. comm.; M. Whitney, Coconino NF, pers. comm.). Although spinedace numbers and distribution have declined in the last few decades, some new populations have been discovered in lower Chevelon Creek in 1977, Nutrioso Creek in 1983, and Rudd Creek, a tributary to Nutrioso Creek in 1992 (Blinn *et al.* 1977, Dorum and Young 1995, U.S. Fish and Wildlife Service 1998).

Status (Within the Action Area). On the Coconino NF, State Highway 87 runs roughly parallel to East Clear Creek and Clear Creek for about 50 km (30 mi), but the highway is never closer to the creeks than about 4 km (2.5 mi) and usually much further away.

On the Apache-Sitgreaves NFs, State Highway 260 crosses a tributary of Chevelon Creek at Willow Spring Lake in the extreme southeastern corner of Coconino County, U.S. Highway 60 crosses Silver Creek and several of its tributaries just east of Show Low, and U.S. Highway 191 runs in the stream valley of Nutrioso Creek for about 16 km (10 mi) between Springerville and Alpine.

Special Conservation Measures for the Little Colorado Spinedace. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in

any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Little Colorado Spinedace). Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment areas, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed Little Colorado spinedace habitat. These special conservation measures will protect Little Colorado spinedace and its environments. These conservation measures make the possibility of effects to the Little Colorado spinedace from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Little Colorado Spinedace). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Little Colorado spinedace.

Critical Habitat. Critical habitat for the Little Colorado spinedace includes about 52 km (31 mi) of East Clear Creek, 13 km (8 mi) of Chevelon Creek, and 8 km (5 mi) of Nutrioso Creek (U.S. Fish and Wildlife Service 1987). In East Clear Creek, critical habitat extends from the confluence with Leonard Canyon (NE ¼ Sec. 11, T. 14 N., R. 12 E.) upstream to the Blue Ridge Reservoir dam (SE ¼ Sec. 33, T. 14 N., R. 11 E.), and from the upper end of Blue Ridge Reservoir (east boundary SE ¼ Sec. 36, T. 14 N., R. 10 E.) upstream to Potato Lake (NE ¼ Sec. 1, T. 12 N., R. 9 E.). Critical habitat in Chevelon Creek extends from the confluence with the Little Colorado River (NW ¼ Sec. 23, T. 18 N., R. 17 E.) upstream to Bell Cow Canyon (SE ¼ Sec. 11, T. 17 N., R. 17 E.). In Nutrioso Creek, critical habitat extends from the Apache-Sitgreaves NFs boundary (north boundary Sec. 5, T. 8 N., R. 30 E.) upstream to the Nelson Reservoir dam (NE ¼ Sec. 29, T. 8 N., R. 30 E.). Constituent elements for all areas of critical habitat include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate (U.S. Fish and Wildlife Service 1987).

The East Clear Creek critical habitat area is on the Coconino NF. State Highway 87 runs roughly parallel to this critical habitat area for the entire length of critical habitat, but the highway is never closer than about 4 km (2.5 mi) and usually much further away. The East Clear Creek critical habitat is not considered to be within the action area for this project.

The Nutrioso Creek critical habitat area is on the Apache-Sitgreaves NFs. U.S. Highway 191 runs in the Nutrioso Creek stream valley for about 16 km (10 mi) between Springerville and Alpine. About 4.8 km (3 mi) of the critical habitat area is directly adjacent to the highway. Also, runoff from Highway 191 will drain into the critical habitat area from upstream. The Nutrioso Creek critical habitat area is within the action area for this project.

Effects Analysis (Little Colorado Spinedace Critical Habitat). The mitigations, BMPs, and special conservation measures for Little Colorado spinedace listed above will protect the Nutrioso Creek critical habitat area from any herbicide contamination.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near the Nutrioso Creek critical habitat area, detailed plans and mitigations can be worked out at that time that would avoid any adverse effects to the critical habitat.

Effects Finding (Little Colorado Spinedace Critical Habitat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the critical habitat of Little Colorado spinedace.

Loach minnow (*Tairoga cobitis*)

Endangered Species Act Status:	Threatened, 1986
Forest Occurrence:	Apache-Sitgreaves, Coconino, Prescott, Tonto
Recovery Plan:	Final, 1991
Critical Habitat:	Yes, 2000
Effects Finding (Species):	No effect
Effects Finding (Critical Habitat):	Not likely to adversely affect

Natural History. The loach minnow is a small slender elongate fish rarely exceeding 6 cm (2.4 in) long (Minckley 1973). The eyes are directed upward and the mouth is terminal with no

barbels. Loach minnow have an olivaceous coloration that is highly blotched with darker pigment. Whitish spots are present at the origin and insertion of the dorsal fin as well as the dorsal and ventral portions of the caudal fin base. Breeding males develop bright red-orange coloration at the bases of the paired fins, on adjacent fins, on the base of the caudal opening, and often on the abdomen. Breeding females become yellowish in color on their fins and lower body (Minckley 1973).

The first spawn of loach minnow generally occurs in their second year, primarily from March through May (Britt 1982, Propst *et al*. 1988). Loach minnow may also spawn in autumn (Vives and Minckley 1990). Spawning occurs in the same riffles adults occupy during the non-spawning season. The loach minnow's adhesive eggs are attached under the downstream side of a rock that forms the roof of a small cavity in the substrate. The number of eggs per rock ranges from 5 to 250+, with an average of 52 to 63 (Propst *et al*. 1988). Eggs incubated at 18 to 20°C (66.2 to 68ºF) hatched in 5-6 days. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al*. 1988, Vives and Minckley 1990). Longevity is typically 15 to 24 months, although loach minnow can live as long as 3 years (Britt 1982, Propst *et al*. 1988, Propst and Bestgen 1991).

Loach minnows feed exclusively on aquatic insects (Abarca 1987, Barber and Minckley 1983, Britt 1982). Loach minnows are opportunistic benthic insectivores, feeding primarily on riffle-dwelling larval emphemeropterans, simulids, and chironomid dipterans. They actively seek their food on bottom substrates, rather than pursuing food items in the drift.

The loach minnow is found in turbulent rocky riffles of rivers and tributaries up to about 2,200 m (7,200 ft) in elevation. Loach minnows are bottom-dwelling inhabitants of shallow swift waters flowing over gravel, cobble, and rubble substrates in mainstream rivers and tributaries (Rinne 1989, Propst and Bestgen 1991). Most growth occurs during the first summer. Loach minnows use the spaces between and in the lee of larger substrates for resting and spawning (Propst *et al*. 1988, Rinne 1989). The species is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991).

Distribution. The loach minnow is endemic to the Gila River basin of Arizona and New Mexico, and Sonora, Mexico. Its historical range included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila rivers (Minckley 1973, Sublette *et al*. 1990). The species is believed to be extirpated from Mexico. During the last century, both the distribution and abundance of the loach minnow have been greatly reduced (Propst *et al*. 1988). Extant populations are geographically isolated and inhabit the upstream ends of their historical range.

Historically in Arizona, the loach minnow occupied up to 2,250 km (1,400 mi) of stream, but it is now found in less than 225 km (140 mi) (Propst *et al*. 1988). The loach minnow is generally rare to uncommon where it is found in the following areas: Aravaipa Creek (Pinal and Graham counties); limited reaches of the White River (Gila County) and the North and East forks of the White River (Navajo County); Three Forks area of the Black River; throughout the Blue River; Campbell Blue Creek; sporadic in Eagle Creek; and in the San Francisco River between Clifton and the New Mexico border (Greenlee County) (Marsh *et al*. 1990; Velasco 1994; Bagley *et al*. 1995, 1996).

In New Mexico, the loach minnow historically occupied about 330 km (205 mi) of stream; now it is found in about 260 km (160 mi). The loach minnow has become very rare in substantial

portions of this remaining range. The species is extant in the upper Gila River, including the East, Middle, and West forks, the San Francisco and Tularosa rivers, and Dry Blue Creek. Recent biochemical work on this species indicates that there are substantial differences in genetic makeup between the remnant loach minnow populations that occupy isolated fragments of the Gila River basin (Tibbets 1992).

Status (Rangewide and Within the Action Area). During the last century, habitat destruction and nonnative fish competition and predation have reduced the loach minnow's distribution and abundance about 85 percent (Miller 1961; Hendrickson and Minckley 1984; Williams *et al*. 1985; Propst *et al*. 1988; Marsh *et al*. 1989; U.S. Fish and Wildlife Service 1986, 1994). Domestic livestock grazing, mining, agriculture, timber harvest, recreation, development, and impoundments have impacted both historical and present landscapes surrounding loach minnow habitats (Hendrickson and Minckley 1984; Belsky *et al*. 1999). These activities alter flow regimes, increase watershed and channel erosion and thus sedimentation, and add contaminants to streams and rivers thus degrading loach minnow habitats (Belsky *et al*. 1999). This may affect loach minnow through direct mortality, interference with reproduction, and reduction of invertebrate food supplies.

Competition with non-native fishes is often cited as a major factor in the decline of loach minnow (Propst 1999). The red shiner, in particular, is frequently indicated in the decline of this fish (Minckley and Deacon 1968, Minckley 1973). The red shiner out-competes loach minnow for food and habitat; it is very tolerant of many extremes found in desert and semi-desert aquatic habitats (Matthews and Hill 1977). Channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*) frequent riffles occupied by loach minnow, especially at night when catfish move onto riffles to feed (Propst 1999) and may prey on loach minnow. In addition, largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui)*, green sunfish (*Lepomis cyanellus*), and introduced trout (Salmonidae) may co-occur and prey on loach minnow. These non-native fish may also impact loach minnow populations through competition for food and space.

With its present reduced range, there are no confirmed loach minnow populations within the action area of this project. No highways on National Forest System lands contact or come close to any presently occupied loach minnow streams. However, there is suitable but degraded habitat in the action area. Much of this habitat has not been surveyed recently and is potentially occupied. Further, it is difficult to confirm the absence of loach minnows from suitable habitat because the fish are difficult to detect through electrofising or seining (E-mail communication from Mary Richardson, U.S. Fish and Wildlife Service, to William Austin, U.S. Fish and Wildlife Service, March 10, 2004). Loach minnow suitable habitat in or near the action area occurs on the Coconino, Prescott, and Tonto NFs. On the Coconino NF, State Highway 89a crosses the Verde River at Bridgeport. The Prescott NF is on the south side of the river. There is a mixture of private and National Forest System lands in this area. State Highway 260 crosses West Clear Creek east of Camp Verde. On the Prescott NF, Interstate 17 crosses the Verde River near Camp Verde. There is a mixture of land ownerships in this area. State Highway 260 runs parallel to the Verde River from Bridgeport to Camp Verde. The highway crosses several creeks and arroyos that enter the Verde River less than 1.6 km (1 mi) from the highway. On the Tonto NF, State Highway 87 crosses Rye Creek south of Payson. State Highway 188 runs parallel to Tonto Creek from the upper end of Roosevelt Lake to near the junction with State Highway 87. The highway is sometimes directly adjacent to the stream channel and in other places it crosses creeks and arroyos that enter Tonto Creek less than 1.6 km (1 mi) from the highway.

Special Conservation Measures for the Loach Minnow. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from

aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Loach Minnow). Most herbicide use (about 70 percent) in the project area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed loach minnow habitat. These special conservation measures will protect loach minnow and its environments. These conservation measures make the possibility of effects to the loach minnow from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Loach Minnow). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the loach minnow.

Critical Habitat. Critical habitat for the loach minnow was redesignated on April 25, 2000 (U.S. Fish and Wildlife Service 2000). It includes 1,448 km (898 mi) of streams in Arizona and New Mexico. The U.S. Fish and Wildlife Service organized the critical habitat areas into seven complexes. Complex 1 (Verde River) includes about 281 km (175 mi) of streams in Yavapai and Gila counties, Arizona. The streams are the Verde River, Fossil Creek, West Clear Creek, Beaver and Wet Beaver creeks, Oak Creek, and Granite Creek. Complex 2 (Black River) includes about 42 km (26 mi) of streams in Apache and Greenlee counties, Arizona. The streams are East Fork Black River, North Fork of the East Fork Black River, Boneyard Creek, Coyote Creek, and West Fork Black River. Complex 3 (Tonto Creek) includes about 86 km (53 mi) of streams in Gila County, Arizona. The streams are Tonto Creek, Greenback Creek, and Rye Creek. Complex 4 (Middle Gila/Lower San Pedro Rivers) includes about 137 km (85 mi) of streams in Graham and Pinal counties, Arizona. The streams are the Gila River, San Pedro River, Aravaipa Creek, Turkey Creek, and Deer Creek. Complex 5 (San Pedro River) includes about 180 km (112 mi) of streams in Cochise, Graham and Pinal counties, Arizona. The streams are the San Pedro River (two segments), Redfield Canyon, Hot Springs Canyon, and Bass Canyon. Complex 6 (San Francisco River) includes about 482 km (300 mi) of streams in Graham and Greenlee counties, Arizona, and Catron County, New Mexico. The streams are the Gila River, Bonita Creek, Eagle Creek, San Francisco River, Tularosa River, Negrito Creek, Whitewater Creek, Blue River, Campbell Blue

Creek, Dry Blue Creek, Pace Creek, Frieborn Creek, and Little Blue Creek. Complex 7 (Upper Gila River) includes about 238 km (148 mi) of streams in Grant and Catron counties, New Mexico. The streams are Gila River, East Fork Gila River, Middle Fork Gila River, and West Fork Gila River.

Land management responsibility for critical habitat areas is 830 km (516 mi) of Federal (mostly Forest Service and Bureau of Land Management), 527 km (327 mi) of private, 56 km (35 mi) of State, and 35 km (22 mi) of other government. Most of Complex 1 (Verde River) is on the Prescott, Coconino, and Tonto NFs. Most of Complex 2 (Black River) is on the Apache-Sitgreaves NFs. Most of Complex 3 (Tonto Basin) is on the Tonto NF. Most of Complex 4 (Middle Gila/Lower San Pedro Rivers) is on Bureau of Land Management, private and State of Arizona lands. Complex 5 (San Pedro River) is on Bureau of Land Management, Private, and State of Arizona lands. Much of Complex 6 (San Francisco River) is on the Apache-Sitgreaves NFs in Arizona and the Gila NF in New Mexico. Much of Complex 7 (Upper Gila River) in on the Gila NF in New Mexico (U.S. Fish and Wildlife Service 2000).

Critical habitat in Complex 1 (Verde River) is near several highways on the Coconino and Prescott NFs. On the Coconino NF, State Highway 89a crosses the Verde River at Bridgeport. The Prescott NF is on the south side of the river. There is a mixture of private and National Forest System lands in this area. State Highway 260 crosses West Clear Creek east of Camp Verde. On the Prescott NF, Interstate 17 crosses the Verde River near Camp Verde. There is a mixture of land ownerships in this area. State Highway 260 runs parallel to the Verde River from Bridgeport to Camp Verde. The highway crosses several creeks and arroyos that enter the Verde River less than 1.6 km (1 mi) from the highway.

Critical habitat in Complex 3 (Tonto Basin) is near two highways on the Tonto NF. State Highway 87 crosses Rye Creek south of Payson. State Highway 188 runs parallel to Tonto Creek from the upper end of Roosevelt Lake to near the junction with State Highway 87. The highway is sometimes directly adjacent to the stream channel and in other places it crosses creeks and arroyos that enter Tonto Creek less than 1.6 km (1 mi) from the highway.

Effects Analysis (Loach Minnow Critical Habitat). Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. The mitigations, BMPs, and special conservation measures for loach minnow listed above will protect the loach minnow critical habitat areas from any herbicide contamination.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near loach minnow critical habitat areas, detailed plans and mitigations can be worked out at that time that would avoid any adverse effects to the critical habitat.

Effects Finding (Loach Minnow Critical Habitat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the critical habitat of loach minnow.

Razorback sucker (*Xyrauchen texanus*)

Status:	Endangered, 1991
National Forest Occurrence:	Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, Tonto
Recovery Plan:	Final, 1998; amended, 2002
Critical Habitat:	Yes, 1994
Effects Finding (Species):	Not likely to adversely affect
Effects Finding (Critical Habitat)	Not likely to adversely affect

Natural History. The razorback sucker is one of the larger members of the sucker family (Catostomidae). The razorback may reach lengths of 0.9 m (3 ft) and weigh up to 6 kg (13 lbs) (Minckley 1973). They are long-lived, reaching ages of at least the mid-40s (McCarthy and Minckley 1987).

For the first period of life, larval razorback suckers are nocturnal and hide during the day. Diet during this period is mostly plankton (Marsh and Langhorst 1988). Young fish grow fairly quickly with growth slowing once adult size is reached (McCarthy and Minckley 1987).

The diet of razorback suckers is midge larvae, planktonic crustaceans, diatoms, filamentous algae, and detritus. Razorback suckers feed mostly from the bottom, but have elongated, "fuzzy" gillrakers and a subterminal mouth, both characteristics of planktonic or detrital feeding habits (U.S. Fish and Wildlife Service 2002).

Razorback suckers tend to use low velocity main channel habitats such as pools, eddies, nearshore runs, and channels associated with sand or gravel bars (Bestgen 1990). Backwaters, oxbows, and sloughs are well-used habitats adjacent to the main channel (U.S. Fish and Wildlife Service 2002).

Flooded bottomlands are important to the species in the spring and early summer (Bestgen 1990). Spawning migrations have been observed or inferred in several locales (Jordan 1891, Minckley 1973, Osmundson and Kaeding 1989, Bestgen 1990, Tyus and Karp 1990). Razorback suckers breed in spring (mostly April to June) when flows in riverine environments are high (U.S. Fish and Wildlife Service 2002) and temperatures range from 10 to 20°C (50 to 68ºF) (Bestgen 1990). Spawning areas include gravel bars or rocky runs in the main channel (Tyus and Karp 1990) and flooded bottomlands (Osmundson and Kaeding 1989). Fertilized eggs are deposited in the gravel substrate and hatch in several days. There is an increased use of higher velocity waters in the spring, although they move into warmer shallower backwaters and inundated bottomlands in early summer (McAda and Wydoski 1980, Tyus and Karp 1989, Osmundson and Kaeding 1989). Both sexes mature as early as 4 years. Larvae and juveniles suffer very high mortality from predation, particularly from nonnative species (U.S. Fish and Wildlife Service 2002).

Distribution. The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the Colorado River basin, occupying about 5,600 km (3,500 mi) of river in the United States and Mexico (U.S. Fish and Wildlife Service 2002).

In the lower Colorado River basin, razorback suckers were found in abundance in the lower river from the delta in Mexico north to what is now Lake Mohave in Arizona, and in the Gila, San Pedro, Verde and Salt rivers (Miller 1961, Minckley 1983, Minckley *et al*. 1991). Early accounts place these fish in the Gila River from its confluence with the Colorado River (Evermann and

Rutter 1895) almost to the Arizona-New Mexico border, and in the San Pedro River as far south as Tombstone, Arizona (Minckley 1973). Archaeological remains document occurrence in the Verde River as far upstream as Perkinsville, Arizona (Miller 1961). Razorback suckers were so numerous in the Salt River above Lake Roosevelt, in Saguaro Lake, and in irrigation canals near Phoenix that they were removed by the wagon load and sold commercially for food and fertilizer (Minckley 1983).

Historical distribution of razorback sucker in the Colorado River upper basin included the Colorado, Green and San Juan drainages (Minckley *et al.* 1991, Holden 1999, Muth *et al.* 2000). Although evidence is sparse and anecdotal, razorback suckers were thought to occupy the San Juan River drainage as far up as the Animas River (Jordan 1891, Minckley *et al*. 1991, U.S. Fish and Wildlife Service 1998).

Status (Range-wide). The present range of the razorback sucker in the Colorado River upper basin is much less than its historical distribution (Holden and Stalnaker 1975, McAda and Wydoski 1980). Relatively speaking, razorbacks are still widely distributed in the Green River basin; the largest concentrations are in the upper Green River (U.S. Fish and Wildlife Service 2002). A small reproducing population occurs in the lower Green River (Tyus *et al.* 1987; McAda *et al*. 1994, 1996; Muth *et al*. 1998). In the Upper Colorado River, most documented occurrences have come from the Grand Valley area. A few suckers have been sampled in the mainstem of the Colorado River downstream from the Green River confluence. Individuals have been captured in the San Juan arm of Lake Powell; few specimens have been confirmed in the river portion of the San Juan (U.S. Fish and Wildlife Service 2002).

Present distribution in the Colorado River lower basin includes extant populations in lakes Mohave and Mead, and small numbers in the Grand Canyon and downriver from Davis Dam to the Mexican border. No significant recruitment to any population has been documented in recent years. Juveniles are most often collected from irrigation canals in Arizona and California (U.S. Fish and Wildlife Service 2002).

Hatchery-raised razorback suckers were stocked into the mainstem and tributaries of the Salt, Verde, Gila, and lower Colorado rivers during the past decade. Recaptures from these stockings have been scarce to date. Monitoring is difficult given the large reintroduction area and its geography (U.S. Fish and Wildlife Service 2002). Indications are that populations are being established in isolated habitats and in the uppermost reservoirs of the drainage being stocked (Marsh and Brooks 1989, Minckley *et al*. 1991; Mueller 1995). Individuals have been captured in the Verde River and Horseshoe Reservoir, and in Fossil Creek. The few remaining unaltered rivers (*e.g.* upper Verde and Salt rivers and their tributaries) are vital to the continued existence of razorback suckers (U.S. Fish and Wildlife Service 2002).

The decline of the razorback sucker in the lower Colorado River basin is primarily attributable to the impoundment of large portions of the Colorado River and its tributaries. These dams dewatered, cooled, or impounded most of the lower basin system so that little natural riverine habitat exists today. These impoundments significantly reduced flows in some reaches and modified temperature regimes in others greatly affecting the razorback sucker. Extreme pressure from introduced fish-eating predators is limiting recruitment of razorback suckers in impoundments and in habitats with natural flows. Alteration of historical flow regimes and construction of reservoirs have created favorable conditions for these predators (U.S. Fish and Wildlife Service 2002).

All six national forests in Arizona manage lands with watersheds that drain into occupied razorback sucker habitat. On the Apache-Sitgreaves, drainages flow into the Blue, San Francisco, Gila, and Salt rivers. On the Coronado, drainages flow into the Gila River. On the Tonto, drainages flow into the Verde and Salt rivers. On the Coconino, drainages flow into Oak Creek and the Verde River. On the Prescott, drainages flow into the Verde River. On the Kaibab, drainages flow into the Colorado River.

Between 1981 and 1990, more than 13 million hatchery-produced razorback sucker fry and fingerling-sized fish were released at 57 Arizona sites where the natural population had been extirpated; these reintroductions were primarily in the Verde, Gila, and Salt rivers and their tributaries (Hendrickson 1994). Low short-term survival and no long-term survival were reported from these releases, primarily because of nonnative fish predation. Since 1994, over 17,000 razorback suckers over 30 cm (12 in) long have been stocked into the Verde River at Beasley Flat and Childs river access points (Jahrke and Clark 1999). Numerous fish have been recaptured and survival up to 2 years has been documented. In addition, ripe males have been found in the Verde River, but there is no evidence of reproduction or recruitment. Adults were recently reported from Fossil Creek, a tributary to the Verde River (on Coconino and Tonto NFs) (U.S. Fish and Wildlife Service 2002). The goal of the razorback sucker reintroduction program is to stock 2,000 fish annually in the Verde River. Since 1990, the Salt River was stocked only once in 1996 (Jahrke and Clark 1999).

Special Conservation Measures for the Razorback Sucker. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Razorback Sucker). All six national forests in Arizona manage lands with watersheds that drain into razorback sucker habitat. With the many razorback sucker reintroductions in the lower Colorado River basin, it is impossible to know where fish may persist. Some highways on the Apache-Sitgreaves, Tonto, Coconino, and Prescott NFs cross major rivers or their perennial tributaries where razorback suckers could be present. Most herbicide use (about 70 percent) in the project area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed razorback sucker habitat. These special conservation measures will

protect razorback sucker and its environments. These conservation measures make the possibility of effects to the razorback sucker from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Razorback Sucker). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the razorback sucker.

Critical Habitat. Fifteen river reaches in the Colorado River basin covering about 49 percent of the razorback sucker's historical habitat are designated as critical habitat. The total river distance is 2,775 km (1,724 mi). Of the total, 1,519 km (944 mi) are in the upper Colorado River basin in Colorado, Utah, and New Mexico

In Arizona, critical habitat includes segments of the Colorado, Gila, Salt, and Verde rivers. For the Colorado River, this includes: from the confluence with the Paria River to Hoover Dam, including Lake Mead to the full pool elevation (Coconino and Mohave counties); from Hoover Dam to Davis Dam, including Lake Mohave to the full pool elevation (Mohave County); and from Parker Dam to Imperial Dam, including Imperial Reservoir to the full pool elevation, or 100 year floodplain, whichever is greater (La Paz and Yuma counties). For the Gila River, this includes from the Arizona-New Mexico border to Coolidge Dam, including the San Carlos Reservoir to the full pool elevation (Graham, Greenlee, Gila, and Pinal counties). For the Salt River this includes from the old U.S. Highway 60/State Route 77 bridge to Roosevelt Diversion Dam (Gila County). For the Verde River this includes from Perkinsville to Horseshoe Dam, including Horseshoe Lake to the full pool elevation (Yavapai County) (U.S. Fish and Wildlife Service 1994).

Three primary constituent elements have been identified for razorback sucker critical habitat: water, physical habitat, and the biological environment (U.S. Fish and Wildlife Service 1994). The water element includes consideration of water quality and quantity. Water quality is defined by parameters such as temperature, dissolved oxygen, environmental contaminants, nutrients, turbidity, and others. Water quantity refers to the amount of water that must reach specific locations at a given time of year to maintain biological processes and to support the various life stages of the species. The physical habitat elements include areas of the Colorado River system that are or could be suitable habitat for spawning, nursery, rearing, and feeding, as well as corridors between such areas (U.S. Fish and Wildlife Service 2002).

Habitat types include bottomland, main and side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated may provide habitat or corridors to habitat necessary for the feeding and nursery needs of the razorback sucker. The biological environment elements include the living components of the food supply and interspecific interactions. Food supply is a function of nutrient supply, productivity, and availability to each life stage. Negative interactions include predation and competition with introduced nonnative fishes (U.S. Fish and Wildlife Service 2002).

Effects Analysis (Razorback Sucker Critical Habitat). No highways on the Apache-Sitgreaves, Coronado, Kaibab, or Tonto NFs are close enough to critical habitat areas for there to be any effect from herbicides used in highway right-of-ways.

Critical habitat on the Verde River is near several highways on the Coconino and Prescott NFs. On the Coconino NF, State Highway 89a crosses the Verde River at Bridgeport. The Prescott NF

is on the south side of the river. There is a mixture of private and National Forest System lands in this area. State Highway 260 crosses West Clear Creek east of Camp Verde. West Clear Creek enters the Verde River only a few miles downstream from the highway crossing. On the Prescott NF, Interstate 17 crosses the Verde River near Camp Verde. There is a mixture of land ownerships in this area. State Highway 260 runs parallel to the Verde River from Bridgeport to Camp Verde. The highway crosses several creeks and arroyos that enter the Verde River less than 1.6 km (1 mi) from the highway.

The mitigations, BMPs, and special conservation measures for razorback sucker listed above will protect razorback sucker critical habitat.

Effects Finding (Razorback Sucker Critical Habitat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the critical habitat of razorback sucker.

Spikedace (*Meda fulgida*)

Endangered Species Act Status:	Threatened, 1986
Forest Occurrence:	Coconino, Prescott, Tonto
Recovery Plan:	Final, 1991
Critical Habitat:	Yes, 2000
Effects Finding (Species):	Not likely to adversely affect
Effects Finding (Critical Habitat)	Not likely to adversely affect

Natural History. Adult spikedace are 6.3 to 7.5 cm (2.5 to 3.0 in) long (Sublette *et al*. 1990). The eyes are large, the snout fairly pointed, and the mouth is slightly subterminal with no barbels present. The species is slender, somewhat compressed anteriorly. Scales are present only as small deeply embedded plates. The first spinous ray of the dorsal fin is the strongest and most sharp-pointed. Spikedace are olive-gray to light brown above with brilliant silver sides and black specks and blotches on the back and upper side. Breeding males have bright brassy yellow heads and fin bases, with yellow bellies and fins (Minckley 1973, Page and Burr 1991).

Spikedace can live up to 24 months, although few survive more than 13 months (Propst *et al*. 1986). Reproduction occurs primarily in one-year-old fish (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). Spawning extends from mid-March into June and occurs in shallow (less than 15 cm [5.9 in] deep) riffles with gravel and sand bottoms and moderate flow (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). Most spawning has occurred by mid-May, although in years of high water flows spawning can continue into late May or early June (Propst *et al*. 1986).

Reproduction is apparently initiated in response to a combination of declining stream discharge and increasing water temperature. The ova are adhesive and demersal and adhere to the substrate. The number of eggs produced varies from 100 to 800+, depending on the size of the individual. The young grow rapidly, attaining a length of 3.5 to 4.0 cm (1.4 to 1.6 in) by November of the year spawned.

Spikedace feed primarily on aquatic and terrestrial insects (Barber and Minckley 1983, Marsh *et al*. 1989, Propst *et al*. 1986). In addition, Barber *et al*. (1970) reported that spikedace feed on food items in the drift including some fish fry. Type of habitat and time of year largely determines diet composition (Minckley 1973).

Spikedace occupy mid-water habitats usually less than 1 m (3 ft) deep with slow to moderate water velocities over sand, gravel, or cobble substrates (Propst *et al*. 1986, Rinne and Kroeger 1988). Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (Propst *et al*. 1986). The preferred habitat of the spikedace varies seasonally and with maturation (Propst *et al*. 1986). In winter, they congregate along stream margins with cobble substrates. The periodic and recurrent flooding of southwestern streams that scours the sands and keeps gravels clean are essential to spikedace feeding and reproduction (Propst *et al.* 1986). Spikedace larvae and juveniles tend to occupy shallow peripheral portions of streams that have slow currents and sand or fine gravel substrates, but they will also occupy backwater habitats. The young typically occupy stream margin habitats where the water velocity is less than 5 cm/sec (0.16 ft/sec) and the depth is less than 5 cm (2 in).

Distribution. Since the 1800s, the spikedace has declined markedly in distribution and abundance throughout its range (Propst *et al.* 1986, U.S. Fish and Wildlife Service 1986). By 1996, the spikedace had been eliminated from over 85 percent of its historical range (New Mexico Department of Game and Fish 1996). Recent taxonomic and genetic work indicates there are substantial differences in morphology and genetic makeup among remnant spikedace populations.

The spikedace is native to the Gila River drainage, including the San Francisco River drainage, except in the extreme headwaters (Propst *et al.* 1986). The spikedace currently persists only in the upper Verde River and Aravaipa Creek in Arizona and portions of the Gila River in New Mexico (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Barrett *et al.* 1985, Bestgen 1985, Jakle 1992, Marsh *et al.* 1990, Sublette *et al.* 1990). The species is generally absent from the Gila River from the confluence of the West and East forks downstream to the mouth of Turkey Creek, and occurs irregularly downstream from the mouth of the Middle Box of the Gila River to the Arizona/New Mexico state line (Propst *et al.* 1986).

Status (Range-wide and Within the Action Area). Spikedace distribution and abundance have declined due to riparian degradation, sedimentation, water diversion, and groundwater pumping. Introduction and spread of nonnative predatory and competitive fishes have also contributed to the decline.

Habitat destruction, and competition and predation from introduced non-native fish are the primary causes of the species' decline (Miller 1961). Competition with non-native fishes is often cited as a major factor in spikedace decline (Propst 1999). The red shiner in particular is frequently indicated as causing spikedace declines (Minckley and Deacon 1968, Minckley 1973). The red shiner is a very competitive species that out-competes spikedace for food items and habitat and is very tolerant of many extremes found in the desert and semi-desert aquatic habitats (Matthews and Hill 1977). Nonnative fish such as channel catfish and flathead catfish frequent riffles occupied by spikedace, especially at night when catfish move onto riffles to feed (Propst 1999) and may prey on spikedace. In addition, largemouth bass, smallmouth bass, green sunfish, and introduced trout may co-occur and prey on spikedace. These non-native fish may also impact spikedace populations through competition for food and space.

The occupied habitat in Aravaipa Creek is a great distance from any highways that pass through National Forest System lands. The occupied habitat in the upper Verde River is near several highways on the Coconino and Prescott NFs. On the Coconino NF, State Highway 89a crosses the

Verde River at Bridgeport. The Prescott NF is on the south side of the river. There is a mixture of private and National Forest System lands in this area. State Highway 260 crosses West Clear Creek east of Camp Verde. On the Prescott NF, Interstate 17 crosses the Verde River near Camp Verde. There is a mixture of land ownerships in this area. State Highway 260 runs parallel to the Verde River from Bridgeport to Camp Verde. The highway crosses several creeks and arroyos that enter the Verde River less than 1.6 km (1 mi) from the highway.

Special Conservation Measures for the Spikedace. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are small water bodies (*i.e.* ponds, lakes, and reservoirs of less than 10 surface acres; springruns, streams, and rivers of less than 100 cubic feet per second mean monthly discharge; or shallows of relatively large water bodies) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic ester formulations) that are rated in toxicity class 3 for aquatic arthropods will have buffer zones from aquatic habitats of at least 30 m (100 ft) for spot applications and at least 120 m (400 ft) for mechanized ground applications. These measures will also be applied for at least 1.6 km (1.0 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

For occupied or unsurveyed suitable habitats (including designated critical habitat areas) that are large water bodies (*i.e.* lakes and reservoirs of more than 10 surface acres; or springruns, streams, and rivers of more than 100 cubic feet per second mean monthly discharge) the following buffers will be applied.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for

cold water fish, warm water fish, and aquatic arthropods may be applied to the edge of the water body to be protected (but there will be no application to water).

- The herbicides 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of 3 m (10 ft) for spot applications and 24 m (80 ft) for mechanized ground applications (15 m (50 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or when the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides 2,4-D (aquatic and nonaquatic amine salt formulations), pendimethalin, triclopyr (ester formulations), and 2,4-D (aquatic and nonaquatic ester formulations) that are rated either toxicity class 2 or toxicity class 3 for either cold water fish, warm water fish, or aquatic arthropods will have buffer zones from aquatic habitats of at least 6 m (20 ft) for spot applications and 30 m (100 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

Effects Analysis (Spikedace). Most herbicide use (about 70 percent) in the project area will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. No herbicides will be applied to aquatic habitats. Buffer zones as described above will be used for all herbicides around occupied or unsurveyed spikedace habitat. These special conservation measures will protect spikedace and its environments. These conservation measures make the possibility of effects to the spikedace from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near spikedace populations, detailed plans and mitigations can be worked out at that time that would avoid the possibility of any adverse effects to the spikedace.

Effects Finding (Spikedace). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the spikedace.

Critical Habitat. Critical habitat for the spikedace was redesignated on April 25, 2000 (U.S. Fish and Wildlife Service 2000). It is similar to the critical habitat for the loach minnow, but does not extend as far up some headwater streams. It includes 1,297 km (807 mi) of streams in Arizona and New Mexico. The U.S. Fish and Wildlife Service organized the critical habitat areas into six complexes. Complex 1 (Verde River) includes about 281 km (175 mi) of streams in Yavapai and Gila counties, Arizona. The streams are the Verde River, Fossil Creek, West Clear Creek, Beaver and Wet Beaver creeks, Oak Creek, and Granite Creek. Complex 2 (Black River) was designated

for the loach minnow only and is not critical habitat for spikedace. Complex 3 (Tonto Creek) includes about 62 km (38 mi) of streams in Gila County, Arizona. The streams are Tonto Creek, Greenback Creek, and Rye Creek. Complex 4 (Middle Gila/Lower San Pedro Rivers) includes about 129 km (80 mi) of streams in Graham and Pinal counties, Arizona. The streams are the Gila River, San Pedro River, and Aravaipa Creek. Complex 5 (San Pedro River) includes about 180 km (112 mi) of streams in Cochise, Graham and Pinal counties, Arizona. The streams are the San Pedro River (two segments), Redfield Canyon, Hot Springs Canyon, and Bass Canyon. Complex 6 (San Francisco River) includes about 415 km (258 mi) of streams in Graham and Greenlee counties, Arizona, and Catron County, New Mexico. The streams are the Gila River, Bonita Creek, Eagle Creek, San Francisco River, Blue River, Campbell Blue Creek, and Little Blue Creek. Complex 7 (Upper Gila River) includes about 230 km (144 mi) of streams in Grant and Catron counties, New Mexico. The streams are Gila River, East Fork Gila River, Middle Fork Gila River, and West Fork Gila River.

Critical habitat in Complex 1 (Verde River) is near several highways on the Coconino and Prescott NFs. On the Coconino NF, State Highway 89a crosses the Verde River at Bridgeport. The Prescott NF is on the south side of the river. There is a mixture of private and National Forest System lands in this area. State Highway 260 crosses West Clear Creek east of Camp Verde. On the Prescott NF, Interstate 17 crosses the Verde River near Camp Verde. There is a mixture of land ownerships in this area. State Highway 260 runs parallel to the Verde River from Bridgeport to Camp Verde. The highway crosses several creeks and arroyos that enter the Verde River less than 1.6 km (1 mi) from the highway.

Critical habitat in Complex 3 (Tonto Basin) is near two highways on the Tonto NF. State Highway 87 crosses Rye Creek south of Payson. State Highway 188 runs parallel to Tonto Creek from the upper end of Roosevelt Lake to near the junction with State Highway 87. The highway is sometimes directly adjacent to the stream channel and in other places it crosses creeks and arroyos that enter Tonto Creek less than 1.6 km (1 mi) from the highway.

Effects Analysis (Spikedace Critical Habitat). Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. The mitigations, BMPs, and special conservation measures for spikedace listed above will protect spikedace critical habitat.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments near spikedace critical habitat areas, detailed plans and mitigations can be worked out at that time that would avoid any adverse effects to the critical habitat.

Effects Finding (Spikedace Critical Habitat). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the critical habitat of spikedace.

Chiricahua leopard frog (*Rana chiricahuensis*)

Status:	Threatened, 2002
Forest Occurrence:	Apache-Sitgreaves, Coconino, Coronado, Tonto
Recovery Plan:	No
Critical Habitat:	None Designated
Effects Determination:	Not likely to adversely affect

Natural History. Leopard frogs, as a group, are habitat generalists that can adapt to a variety of wetland situations. Suitable Chiricahua leopard frog habitat includes lakes, rivers, streams, springs, ponds, and man-made structures such as reservoirs, stock tanks, and acequias (Sredl and Jennings, in press). This frog is found at elevations of 1,000 to 2,710 m (3,200 to 8,900 ft) (Platz and Mecham 1979, Sredl *et al.* 1997). It is occasionally found in livestock drinkers, irrigation sloughs and acequias, wells, abandoned swimming pools, backyard ponds, and mine adits (Sredl and Jennings, in press). The frog uses permanent or nearly permanent pools and ponds for breeding. Most sites that support populations of this frog will hold surface water yearlong in most years. Time from hatching to metamorphosis is shorter in warm water than in cold water; water permanency is probably more important at higher elevations and in the northern portion of the species' range.

Likely to be occupied habitats include: 1) currently suitable habitat where the frog has been documented within the last 10 years, but is apparently now absent, or 2) suitable habitat that is (a) within 1.6 km (1 mi) overland of occupied habitat, (b) within 4.8 km (3 mi) along an ephemeral or intermittent drainage from occupied habitat, or (c) within 8 km (5 mi) along a perennial stream from occupied habitat. Most of the Forests have been surveyed extensively for ranid frogs within the last 10 years.

Understanding Chiricahua leopard frog dispersal abilities is key to determining the likelihood that a frog population will colonize nearby suitable habitats. In August 1996, Rosen and Schwalbe (1998) found up to 25 young adult and subadult Chiricahua leopard frogs at a roadside puddle in San Bernardino Valley, Arizona. They believed the only possible origin of these frogs was a stock tank located 5.5 km (3.4 mi) away. Rosen *et al.* (1996) found small numbers of Chiricahua leopard frogs at two locations in Arizona that supported large nonnative predator populations. They suggested these frogs must have come from elsewhere because predation would have precluded successful reproduction. They believed populations 2 to 7 km (1.2 to 4.3 mi) away were the likely source of these frogs. In the Dragoon Mountains of Arizona, Chiricahua leopard frogs breed at Halfmoon Tank, but frogs occasionally turn up at Cochise Spring, which is 1.3 km (0.8 mi) down the canyon in an ephemeral drainage, and in Stronghold Canyon, which is 1.7 km (1.1 mi) down the canyon. No breeding habitat exists for Chiricahua leopard frogs at Cochise Spring or Stronghold Canyon, thus it appears frogs at these sites are immigrants from Halfmoon Tank. In the Chiricahua Mountains, a population of Chiricahua leopard frogs disappeared from the Silver Creek stock tank after the tank dried up, but frogs then began to appear in Cave Creek, which is about 1.0 km (0.6 mi) away, again suggesting immigration. Movements away from water appear to be nonrandom. Streams are important dispersal corridors for young northern leopard frogs (Seburn *et al.* 1997). Displaced northern leopard frogs will "home" and apparently use olfactory, auditory, and possibly celestial orientation as guides (Dole 1968, 1972). Rainfall or increased ambient humidity may be an important factor in dispersal because odors carry well in moist air making it easier for frogs to find other wetland sites (Sinsch 1991).

Distribution. The Chiricahua leopard frog is found in central and southeastern Arizona and in west-central and southwestern New Mexico. In Mexico, the species is found in northern Sonora, the Sierra Madre Occidental of Chihuahua, and northern Durango. In Arizona, the species was historically widely distributed on the Coronado, Tonto, and Apache-Sitgreaves NFs. The most extant localities are on the Coronado NF. The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa (especially *Rana montezumae*) in the southern part of the range of the Chiricahua leopard frog.

In Arizona, slightly more than half of historical localities were natural lotic systems, a little less than half were stock tanks, and the rest were lakes and reservoirs. Currently in Arizona, 63 percent of extant populations are in stock tanks. In New Mexico, of the sites Chiricahua leopard frogs occupied from 1994 to 1999, 67 percent were creeks or rivers, 17 percent were springs or spring runs, and 12 percent were stock tanks.

Status (Range-wide and Within the Action Area). Threats to this species include predation by nonnative bullfrogs, fishes, and crayfish; disease; drought; floods; degradation and destruction of habitat; water diversions and groundwater pumping; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; fire regimes altered due to livestock grazing and fire suppression; and environmental contamination. Chytridiomycosis is a disease affecting amphibian populations globally and has been found in Chiricahua leopard frogs in Arizona and New Mexico.

The species is rarely found where nonnative fish, bullfrogs, or crayfish inhabit aquatic sites. Chiricahua leopard frogs may occur in the presence of low densities of nonnative predators in complex systems or large aquatic sites.

Aquatic habitats may become unsuitable for Chiricahua leopard frogs due to increased amounts of sediments, longer or more frequent periods of intermittency, reduced flows, dewatering of ponds or bank chiseling. In certain situations, altering livestock grazing practices may help restore aquatic habitats.

In Arizona, 63 percent of the extant Chiricahua leopard frog localities are stock tanks, versus only 35 percent of the extirpated localities (Sredl and Saylor 1998), suggesting Arizona populations of this species have fared better in stock tanks than in natural habitats. Stock tanks provide small patches of habitat that are often dynamic and subject to drying and elimination of frog populations. However, Sredl and Saylor (1998) also found that non-native predators (with the exception of bullfrogs) occupy stock tanks less frequently than natural sites.

The majority of Chiricahua leopard frog occurrences on National Forest System lands in Arizona are on the Coronado NF. Most highways in this part of the state are in lowlands between the sky island mountain ranges that make up the Coronado NF, so few highways on the forest are included in the action area for this project. State Highway 83 in the Canelo Hills on the Coronado NF passes near suitable Chiricahua leopard frog habitat. There are no known leopard frog occurrences in the highway right-of-way, but there are occurrences less than 3.2 km (2 mi) downstream from the highway.

There are few Chiricahua leopard frog occurrences on the Coconino NF. State Highway 260 east of Camp Verde in the vicinity of the West Clear Creek and Fossil Springs wilderness areas is near several leopard frog occurrences. Three of these occurrences are directly adjacent to the roadway

either within the right-of-way or within 60 m (200 ft) of the right of way. At least 6 occurrences are less than 3.2 km (2 mi) downstream from the highway.

There are a few Chiricahua leopard frog occurrences scattered in the Apache-Sitgreaves NFs. Some of these occurrences are in creeks along U.S. Highway 191 from Springerville to south of Hannagan Meadow. Some of these streams like Nutrioso, Coleman, Campbell Blue, and Hannagan creeks, and the San Francisco River run directly adjacent to the Highway.

There are a few Chiricahua leopard frog occurrences on the Tonto NF, but none of these are near highways that are in the action area for this project.

Special Conservation Measures for the Chiricahua Leopard Frog. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted for Chiricahua leopard frog habitat that is occupied, unsurveyed, or inconclusively surveyed.

- Aquatic herbicides such as 2,4-D (Aqua-Kleen) and glyphosate (Rodeo) will not be used within 1.6 km (1.0 km) of aquatic Chiricahua leopard frog habitat.
- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), and triclopyr (amine salt formulations) that are rated as toxicity class 0 for aquatic amphibians, and as either toxicity class 0 or toxicity class 1 for arthropods may be applied to the edge of the estimated annual high water line of the water body or wetland to be protected (there will be no application to water).
- The herbicides 2,4-D (acid formulations), 2,4-D (aquatic and nonaquatic ester formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated as toxicity class 1 for aquatic amphibians plus the herbicides 2,4-D (aquatic and nonaquatic amine salt formulations) that are rated as toxicity class 0 for aquatic amphibians but are rated as toxicity class 2 for arthropods will have buffer zones from the edge of the estimated annual high water line of the water body or wetland to be protected of 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications (90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water, or the herbicide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- The herbicides pendimethalin and triclopyr (ester formulations) that are rated as toxicity class 2 for aquatic amphibians will have buffer zones from the edge of the estimated annual high water line of the water body or wetland to be protected of 30 m (100 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local

conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Effects Analysis (Chiricahua Leopard Frog). Chiricahua leopard frogs can potentially live in highway right-of-ways directly adjacent to the pavement. Road ditches sometimes have low spots that retain water for months during wet periods and many culverts have deep pools on the downstream side that retain almost permanent water. Also, these roadside habitats often have no leopard frog predators. When these habitats are: 1) within 1.6 km (1 mi) overland of occupied habitat, 2) within 4.8 km (3 mi) along an ephemeral or intermittent drainage from occupied habitat, or 3) within 8 km (5 mi) along a perennial stream from occupied habitat, it is possible Chiricahua leopard frogs will occupy them.

To date, no noxious weeds infestations have been mapped on State Highway 83, State Highway 260, or U.S. Highway 191 in the vicinity of Chiricahua leopard frog occurrences (Figure 2) so any herbicide use for noxious weeds control likely will be very infrequent and confined to very small areas for spot control. The mitigations, BMPs, and special conservation measures for Chiricahua leopard frog listed above will protect Chiricahua leopard frog environments. These conservation measures make the possibility of effects to the Chiricahua leopard frog from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. The mitigations, BMPs, and special conservation measures for Chiricahua leopard frog listed above provide buffer zones that will protect Chiricahua leopard frog environments. This includes ephemeral wetlands like pools on the downstream sides of culverts that Chiricahua leopard frogs could occupy.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments in Chiricahua leopard frog habitat, mitigations can be worked out at that time that would avoid the possibility of any adverse effects to the leopard frog.

Effects Finding (Chiricahua Leopard Frog). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Chiricahua leopard frog.

Sonora tiger salamander (Ambystoma tigrinum stebbinsi)

Status:	Endangered, 1997
Forest Occurrence:	Coronado
Recovery Plan:	Final, 2002
Critical Habitat:	None
Effects Finding:	Not likely to adversely affect

Natural History. Sonora tiger salamanders can begin breeding as early as January and eggs are layed until early May (U.S. Fish and Wildlife Service 1997a). Terrestrial adults (those that have

undergone metamorphosis and spend most of their lives out of the water) return to water to breed along with the branchiate adults (gilled, mature salamanders that have not undergone metamorphosis and spend their entire lives in water) (U.S. Fish and Wildlife Service 1997a). Though it is not known if Sonora tiger salamanders exhibit site fidelity, most other Ambystoma species do (Shoop 1965, 1968; Shoop and Doty 1972; Douglas and Monroe 1981; Semlitsch 1981; Madison 1997; Madison and Farrand 1998).

Eggs are attached individually or in clumps of up to 50 to aquatic vegetation, rocks, or other substrates (U.S. Fish and Wildlife Service 1997a). Eggs hatch within a few days (Smart Office Resource Center 1999). Larvae may develop to a suitable size for metamorphosis in 2 months, but because many breeding sites are in permanent water, some larvae may remain in the water longer, or develop into branchiate adults without metamorphosing (U.S. Fish and Wildlife Service 1997a). Sexual maturity is reached in 5 to 6 weeks (Smart Office Resource Center 1999).

All larvae that hatch in ephemeral waters metamorphose into the terrestrial form. Larvae must be at least 4.5 cm (1.8 in) long in order to make the transformation (U.S. Fish and Wildlife Service 1997a).

Distribution. Historical range cannot be determined due to lack of surveys performed prior to the 1980s (U.S. Fish and Wildlife Service 1997a, 2002). However, it is speculated that the range did not exceed the plains grassland and Madrean evergreen woodlands (Brown 1994) of the San Rafael Valley and the adjoining mountain ranges in Arizona and Mexico (U.S. Fish and Wildlife Service 2002).

Current range of the Sonora tiger salamander includes the San Rafael Valley of Arizona and Mexico. This region lies between the Patagonia and Huachuca Mountains, is bordered on the north end by the Canelo Hills, and stretches from Santa Cruz County in Arizona south into Sonora, Mexico. Salamanders are also known from adjacent portions of Cochise County (U.S. Fish and Wildlife Service 1997a).

Status (Range-wide). U.S. Fish and Wildlife Service listed Sonora tiger salamander as endangered under the Endangered Species Act on January 6, 1997. No critical habitat was designated (U.S. Fish and Wildlife Service 1997a)

Collins *et al.* (1988) documented a total of 36 Sonora tiger salamander sites from 1979 to 1996 (Collins 1996, U.S. Fish and Wildlife Service 1997b). All Sonora tiger salamander sightings have been in the Santa Cruz and San Pedro River drainages, and all historical and extant aquatic populations are found in tanks, ponds, or impounded cienegas within 31 km (19 mi) of Lochiel, Arizona. Additional surveys were conducted recently on the San Rafael Cattle Ranch (under management of Arizona State Parks and The Nature Conservancy), bringing the total ponds and tanks surveyed to well over 100 (U.S. Fish and Wildlife Service 1997a, 2002).

In all, researchers have found Sonora tiger salamanders in 53 ponds (U.S. Fish and Wildlife Service 2002). Forty-five have contained salamanders in the last 5 years (U.S. Fish and Wildlife Service 1997a, 2002), and 43 of the 53 are located on Forest Service grazing allotments on the Coronado NF (U.S. Fish and Wildlife Service 1999). Of these known populations, about 25 percent appear to contain at least some salamanders with genetic sequences resembling the non-native barred salamanders (Ziemba *et al.* 1998).

In the 1990s, the largest breeding populations were located in the southeastern part of the San Rafael Valley (U.S. Fish and Wildlife Service 1997b). One source cites the current population as 600, though no other sources give exact numbers (Smart Office Resource Center 1999). Because populations are very dynamic, it is very difficult to assess whether a population is extant or has been extirpated (U.S. Fish and Wildlife Service 1997b, 2002). Surveys in ponds or tanks may not detect terrestrial salamanders present in the area (U.S. Fish and Wildlife Service 1997b, 2002).

The most important habitat requirement for the Sonora tiger salamander is the availability of standing water (U.S. Fish and Wildlife Service 1997a). This is key during the breeding season from January until June when salamanders must have water in which to breed, develop into larvae, and metamorphose. Historically, this species likely inhabited cienegas, springs, and backwaters in the San Rafael Valley (U.S. Fish and Wildlife Service 1997b). Due to erosion and arroyo cutting in the 1800s and early 1900s, these natural habitats have dried up and virtually disappeared (Hendrickson and Minckley 1984, Hadley and Sheridan 1995). Today manmade livestock tanks, ponds and impounded cienegas provide the only remaining breeding habitat (U.S. Fish and Wildlife Service 1997a, 1997b). However, there are still some springs on the San Rafael Cattle Ranch that may be suitable breeding habitat (U.S. Fish and Wildlife Service 2002)

Threats to Sonora tiger salamanders include: 1) Restricted distribution; 2) disappearance of natural standing water habitat; 3) predation by non-native fish, bullfrogs and crayfish; 4) genetic swamping by introduced, non-native barred salamanders; 5) disease; 6) low genetic diversity; 7) collection for bait or translocation by anglers; 8) maintenance of impoundments; 9) use of occupied sites as water sources for fire suppression; and 9) loss of cover around occupied sites (U.S. Fish and Wildlife Service 1997a).

Status (Within the Action Area). State Highway 83 for about 24 km (15 mi) in the Canelo Hills is the only roadway in the action area that is within the range of the Sonora tiger salamander. There is one known salamander site along this highway. It is outside the right-of-way, but less than 440 m (.25 mi) from the roadway. There are no other known sites within 3.2 km (2 mi) of the roadway; however, there is other suitable, but unsurveyed habitat on private lands near the roadway.

Special Conservation Measures for the Sonora Tiger Salamander. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted for suitable Sonoran tiger salamander habitat known to have been occupied within the last 5 years or for unsurveyed suitable habitat.

- The herbicides chlorsulfuron, clopyralid, glyphosate (aquatic), imazapic, imazapyr (all formulations), triclopyr (amine salt formulations), 2,4-D (aquatic and nonaquatic amine salt formulations), 2,4-D (aquatic and nonaquatic ester formulations), 2,4-D (acid formulations), 2,4-DB, dicamba, fluroxypyr (all formulations), glyphosate (nonaquatic), isoxaben, metsulfuron-methyl, picloram, sethoxydim, sulfometuron-methyl, and tebuthiuron that are rated either toxicity class 0 or toxicity class 1 for aquatic amphibians will have buffer zones from aquatic habitats of at least 9 m (30 ft) for spot applications (at least 3m (10 ft) when the spot applications are applied with hand-operated equipment) and at least 110 m (350 ft) for mechanized ground applications (at least 90 m (300 ft) when a steady wind of at least 3 mph is blowing away from the body of water). These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing

channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.

- The herbicides, pendimethalin, and triclopyr (ester formulations) that are rated toxicity class 2 for aquatic amphibians will have buffer zones from aquatic habitats of at least 15 m (50 ft) for spot applications and 110 m (350 ft) for mechanized ground applications. These measures will also be applied for at least 0.8 km (0.5 mi) upstream in any contributing channel, tributary, or springrun, and for at least 90 m (300 ft) downstream from any habitat.
- If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications should only occur when it is anticipated that there shall be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

Effects Analysis (Sonora Tiger Salamander). To date, no noxious weeds infestations have been mapped on State Highway 83 in the vicinity of Sonoran tiger salamander habitat (Figure 2) so any herbicide use for noxious weeds control likely will be very infrequent and confined to very small areas for spot control. The mitigations, BMPs, and special conservation measures for Sonoran tiger salamander listed above will protect Sonoran tiger salamander environments. These conservation measures make the possibility of effects to the Sonoran tiger salamander from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Most herbicide use (about 70 percent) along these highways will be directly adjacent to the roadway to maintain the clear zone. Herbicides will be applied only once a year in narrow strips using ground-based equipment such as backpack sprayers and spray units on trucks. These methods will make it possible to apply minimum amounts of herbicide directly to the treatment area, so the amount of herbicide that could be washed into drainages will be small. The mitigations, BMPs, and special conservation measures for Sonoran tiger salamander listed above provide buffer zones that will protect Sonoran tiger salamander environments and make the possibility of effects to the salamander from the proposed program of herbicide use for hazardous vegetation management on highway right-of-ways insignificant and discountable.

Salamanders have both terrestrial and aquatic forms, so it is possible that terrestrial salamanders could be in or directly adjacent to the highway right-of-way. Terrestrial activity is during or after rainfall when the ground is wet. To date, no noxious weeds infestations have been mapped on State Highway 83 in the Canelo Hills (Figure 2) so the need for any herbicide use for noxious weeds control likely will be very infrequent within occupied or unsurveyed terrestrial Sonora tiger salamander habitat. If there is a high probability (80 percent chance) of local moderate rain (0.25 inches or less within 24 hours), then applications will only occur when it is anticipated that there will be sufficient time (at least four hours) for the application to dry before rainfall occurs. If rainfall of more than a moderate amount (more than 0.25 inches) is predicted locally within 48 hours, applications will be discontinued until predictable local conditions improve. When plant cover is wet from recent rain, heavy dew, or frost, applications will be delayed until conditions are nearly dry.

The mitigations, BMPs, and special conservation measures for Sonora tiger salamander listed above provide buffer zones and timing restrictions (for weather conditions) that will protect both Sonara tiger salamander aquatic and terrestrial habitats.

The ADOT will coordinate at least one annual meeting with the Forest Service and FHWA to identify issues and opportunities, plan vegetation control actions, and resolve potential difficulties and conflicts. If there are further concerns about possible herbicide treatments in Sonoran tiger salamander habitat, mitigations can be worked out at that time that would avoid the possibility of any adverse effects to the salamander.

Effects Finding (Sonora Tiger Salamander). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Sonora tiger salamander.

Arizona agave (*Agave arizonica*)

Endangered Species Act Status:	Endangered, 1984
Forest Occurrence:	Tonto
Recovery Plan:	None
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. Arizona agave is a succulent perennial that matures in 22 to 35 years. It flowers once and then dies. Flowering is in May to June (Hodgson 1999). Hummingbirds and insects are the major pollinators (Arizona Game and Fish Department 1997). Plants flower normally, but pollen viability and seed production are low. This plant is probably of hybrid origin with the parental species being *Agave chrysantha* and *Agave toumeyana* var. *bella* (DeLamater and Hodgson 1987).

Arizona agave occurs as isolated plants or clusters of plants in close proximity to its putative parents. It reproduces sparingly from offshoots (pups) that develop around the base of the parent plant (Arizona Game and Fish Department 1997).

Distribution. Arizona agaves occur on open rocky slopes in Sonoran desertscrub, chaparral, or juniper-grassland communities. Elevations range from 1,100 to 1,750 m (3,600 to 5,800 ft) (Arizona Rare Plant Committee 2002).

Arizona agaves are known from Yavapai, Maricopa, and Gila counties, Arizona. The majority of plants occur in the New River Mountains north of Phoenix, with a few plants southeast of the town of Payson and in the Parker Creek drainage of the Sierra Ancha Mountains (Arizona Game and Fish Department 1997).

Status (Range-wide and Within the Action Area). Fewer than 100 Arizona agave clones are known with the majority of these in the New River Mountains on the Tonto NF. There are a few plants on private land (U.S. Fish and Wildlife Service 1999).

Arizona agaves have very poor seed production, but can reproduce locally by vegetative offshoots. The stability of populations maintained in this way is unknown. Cattle and deer eat the flower stalks before they mature, which reduces potential seed production. Rodents will burrow under plants and eat the caudex and roots. A snout-weevil beetle that damages plants either

transmits or makes plants susceptible to a fungal disease that can kill plants in less than a year (Arizona Game and Fish Department 1997). Other concerns are potential illegal collecting, and loss of plants from livestock management activities (*i.e*. fence placement) (U.S. Fish and Wildlife Service 1984).

No Arizona agave plants occur within or directly adjacent to highway right-of-ways that are in the project area, but there is some suitable habitat. Most Arizona agaves on National Forest System lands are in the New River Mountains on the Tonto NF. These plants are remote from any highways. The nearest highway to the New River Mountains is Interstate 17. This highway is about 10 km (6 mi) west of the national forest boundary and, therefore, outside the project area. There is potentially suitable habitat on National Forest System lands along highways in the Sierra Ancha Mountains on the Tonto NF. This includes Arizona Highway 87 south of Payson, Arizona Highway 260 east of Payson, and Arizona Highway 288 northeast of Roosevelt Lake. Arizona agave has only been found where *Agave chrysantha* and *Agave toumeyana* var. *bella* are found together, so Arizona agave can be searched for not only by looking for the plant itself, but also by looking for these other two agaves and then searching more carefully for Arizona agave in the same area.

Special Conservation Measures for the Arizona Agave. In addition to the measures described in the "Conservation Measures" section of this document, the following conservation measures will be adopted.

- Chlorsulfuron, glyphosate (all formulations), imazapic, imazapyr (all formulations), metsulfuron methyl, pendimethalin, picloram, sethoxydim, sulfometuron methyl, and tebuthiuron will not be used, in or within 6 m (20 ft) when employing spot application using hand operated equipment, or in or within 18 m (60 ft) when employing mechanized ground applications, of occupied or unsurveyed Arizona agave habitat.

Effects Analysis (Arizona Agave). The proposed program of herbicide use on highway right-of-ways on National Forest system lands in Arizona will have no effect on any presently known occurrences of Arizona agave because none of these occurrences are in the project area. There is no suitable habitat for Arizona agave in the highly disturbed highway clear zone directly adjacent to the pavement. Most herbicide use (about 70 percent) will occur in this area to maintain the clear zone. As part of the annual coordination for this project, the Forest Service has agreed to annually identify all sites along and near public roadways that have threatened, endangered, or sensitive plant species and to discuss necessary mitigation measures and other constraints. Surveys will be done to determine the extent of noxious weeds infestations in right-of-ways and herbicide applications will be limited to the areas needed to control these infestations. Surveys of treatment areas for threatened and endangered plants are part of the pre-spray BMPs for this project. The special conservation measures described above will be used if any Arizona agave plants are found. These measures make the possibility of effects to Arizona agave from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Arizona Agave). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Arizona agave.

Arizona cliffrose (*Purshia subintegra*)

Endangered Species Act Status: Endangered, 1984

Forest Occurrence:	Coconino, Tonto
Recovery Plan:	Final, 1995
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. Arizona cliffrose is a long-lived shrub. Mature plants are capable of producing many seeds per year. Plants begin blooming in late March and continue through early May. Normally, hundreds of flowers are produced on each mature plant. Flowers are receptive to pollination on any of the first three days after opening. Native bees and introduced honeybees are the main pollinators. The flowers are primarily cross-pollinated, but are partially self-compatible. Cross-pollinated flowers produce significantly more seeds than self-pollinated flowers. Most fruits develop during April and are dispersed during the summer when rains dislodge the seeds. The timing of seed germination and seedling establishment is unknown (U.S. Fish and Wildlife Service 1995).

Distribution. The Arizona cliffrose is endemic to white tertiary (Miocene and Pliocene) limestone lakebed deposits that are high in lithium, nitrates, and magnesium (Arizona Game and Fish Department 2001). Elevations are 650 to 1,100 m (2,100 to 3,600 ft) (U.S. Fish and Wildlife Service 1995).

Arizona cliffrose occurs in four disjunct populations spread across 320 km (200 mi) in central Arizona. The Burro Creek population in Mohave and Yavapai counties is the largest population. It has three subpopulations the largest of which is in T.14N., R.11W., Secs. 1, 2, 11, and 12. Two small outlier subpopulations are in T.14N., R.11W., Secs. 20, 21, 28, and 29, and in T.14N., R.11W., Secs. 31 and 32. The Cottonwood population in Yavapai County is the second largest population. It is in T.16N., R.3E., Secs. 22-27, 35, and 36, and in T.15N., R.3E., Sec. 1. The Horseshoe Lake population in Maricopa and Yavapai counties has three subpopulations. These are in T.7N., R.6E., Secs. 3 and 4, in T.8N., R.6E., Secs. 22 and 23, and in T.8N., R.6E., Secs. 9, 10, 15, and 16. The Bylas population in Graham County is in T.2S., R.20E., Secs. 23-26. The full extent of this population is unknown due to limited surveys (U.S. Fish and Wildlife Service 1995).

Status (Range-wide). Multiple agencies have management responsibility for Arizona cliffrose. The Burro Creek population is on Federal lands managed by the Bureau of Land Management, Kingman Resource Area. The Cottonwood population is on Federal, State, and private lands. The Federal lands are part of Coconino NF and the State lands are managed as State Trust lands and as Dead Horse Ranch State Park. The Horseshoe Lake population is on Federal land with management of lake operations under the Bureau of Reclamation and surface management under Tonto NF. The Bylas population is on the San Carlos Apache Indian Reservation (U.S. Fish and Wildlife Service 1995).

Arizona cliffrose appears to be long-lived and capable of large reproductive output. Plants with this life history strategy tend to have low recruitment rates and few seedlings and juveniles in each population. However, a viable population should have plants of differing ages and sizes. We do not yet know what recruitment rates are necessary to maintain viable Arizona cliffrose populations. The recruitment rates appear to vary among populations. There are areas in the Cottonwood population that support a relatively large number of established seedlings. In contrast, the other three Arizona Cliffrose populations appear to have insufficient recruitment. Although seedlings have been seen in the Burro Creek population, the age/size class distribution

appears heavily weighted towards large older plants. More than 20 years ago, several observers noted that reproduction at Burro Creek appeared to be insufficient to maintain the population. Several observers noted that that reproduction at Bylas appeared insufficient to maintain the population, while other observers found all age classes represented, including seedlings and senescent plants (U.S. Fish and Wildlife Service 1995).

Major impacts to Arizona cliffrose include urbanization, recreation, road and utility line construction, minerals exploration and mining, and livestock and wildlife browsing. The Cottonwood population is in a developing urban/suburban area. The most serious impacts from land development, road construction, and recreation are occurring here. The soils supporting Arizona cliffrose populations contain high quality bentonite, a type of clay with numerous commercial uses. Most mining and exploration has been in the Burro Creek and Horseshoe Lake populations. Livestock and/or wildlife browse all Arizona cliffrose populations. The greatest use occurs when both livestock and wildlife are present and when livestock are grazed yearlong (U.S. Fish and Wildlife Service 1995).

Status (Within the Action Area). The Tonto NF has management responsibility for the Horseshoe Lake population, but this area is remote from any highways that are part of the action area for this project. The Coconino NF has management responsibility for part of the Cottonwood population. Part of this population is in the highway right-of-way along State Highway 89a where it passes through the national forest north of Bridgeport. This part of highway 89a was recently reconstructed and the Arizona cliffrose plants were removed from the right-of-way. Nevertheless, there is still suitable Arizona cliffrose habitat in the right-of-way and beyond. The Arizona cliffrose grows only in soils derived from white limestone lakebed deposits so it is easy to determine the extent of suitable habitat for this species.

Special Conservation Measures for the Arizona Cliffrose. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

- None of the herbicides proposed for use, with the allowable exception of sethoxydim, will be used, in or within 6 m (20 ft) when employing spot application using hand operated equipment, or in or within 18 m (60 ft) when employing mechanized ground applications, of occupied or unsurveyed Arizona cliffrose habitat.

Effects Analysis (Arizona Cliffrose). There is no suitable habitat for Arizona cliffrose in the highly disturbed highway clear zone directly adjacent to the pavement. Most herbicide use (about 70 percent) will occur in this area to maintain the clear zone. As part of the annual coordination for this project, the Forest Service has agreed to annually identify all sites along and near public roadways that have threatened, endangered, or sensitive plant species and to discuss necessary mitigation measures and other constraints. Surveys will be done to determine the extent of noxious weeds infestations in right-of-ways and herbicide applications will be limited to the areas needed to control these infestations. Surveys of treatment areas for threatened and endangered plants are part of the pre-spray BMPs for this project. The special conservation measures described above will be used if any Arizona cliffrose plants are found. These measures make the possibility of effects to Arizona cliffrose from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Arizona Cliffrose). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Arizona cliffrose.

Arizona hedgehog cactus (Echinocereus triglochidiatus var. arizonicus)

Endangered Species Act Status:	Endangered, 1979
Forest Occurrence:	Tonto
Recovery Plan:	None
Critical Habitat:	None designated
Effects Finding:	Not Likely to Adversely Affect

Natural History. This is a succulent perennial plant that flowers in late April to mid-May and fruits from May to June (Arizona Game and Fish Department 1992). It is an obligate outcrosser that is likely pollinated by hummingbirds, carpenter bees, solitary bees, and honeybees (Tonto National Forest 1996). About 100 seeds are produced per fruit (Arizona Game and Fish Department 1992) and mature plants can produce many fruits each year. Seed germination in cultivation was reported by one source to be 17 percent and by another source to be 90 percent (Arizona Game and Fish Department 1992). Fruits are sweet and the spines fall away at maturity so it appears fruit-eating birds and mammals disperse the seeds. The presence of plants in high crevices and cliff faces where only birds or small mammals could reach is further evidence for this mode of dispersal (Tonto National Forest 1996).

Distribution. The Arizona hedgehog cactus occurs in the Upper Sonoran Life Zone in the Interior Chaparral community at elevations of 1,000 to 1,700 m (3,300 to 5,700 ft). Parent materials of preferred habitat are Schultze Granite and Apache Leap Tuff (dacite), both igneous in origin. Pinal Schist and the Pioneer Formation are also habitat if they are exposed as bedrock in proximity to the dacite and granite (Tonto National Forest 1996).

The main population area of Arizona hedgehog cactus occupies about 7,650 ha (18,900 ac) in Gila and Pinal counties between Miami and Superior, Arizona. This is in T.1N., R.12-13E. and T.1-2S., R.13-14E. Two small subpopulations occur outside this area. The Apache Peak subpopulation is north of Globe in T.2N., R15½E., and the El Capitan subpopulation is South of Globe in T.3S. on the boundary between R.15E. and R.16E.

Land ownership of the main population area is about 7,100 ha (17,500 ac) Tonto NF, 220 ha (550 ac) State trust land, and 330 ha (825 ac) private (Tonto National Forest 1996).

The Arizona hedgehog cactus is in a taxonomically difficult group and plants similar to Arizona hedgehog cactus can be found in populations of other *Echinocereus triglochidiatus* varieties. In the final rule listing Arizona hedgehog cactus as endangered, the U.S. Fish and Wildlife Service (1979) stated, “Different varieties within the species *Echinocereus triglochidiatus* intergrade extensively with one another. Mixed populations showing extensive variation, but with some affinities toward var. *arizonicus* are not to be considered classical var. *arizonicus* and therefore will not be subject to the protection and restrictions of the Endangered Species Act.” The term “classical var. *arizonicus*” refers to the plants in the main population area and two subpopulations described above.

Status (Range-wide and Within the Action Area). Surveys for Arizona hedgehog cactus on Schultze granite and dacite formations found densities of 25.9 and 2.3 plants per hectare (64.05

and 5.72 plants per acre), respectively. The amount of these habitats in the main population area gives a total population estimate of about 257,500 cacti. Intensive surveys were conducted in conjunction with the Carlota Mine Project resulting in close observations of 1,150 cacti. These surveys determined a recruitment ratio of 1.65 new recruits to each loss indicating that the population was both healthy and increasing during the 1992 to 1994 surveys (Tonto National Forest 1996).

Threats identified when Arizona hedgehog cactus was listed as endangered included: mining, livestock damage, highway and utility corridor construction, collection, recreation activities, insect and disease damage, and wildfire (U.S. Fish and Wildlife Service 1979). All of these threats have affected Arizona hedgehog cactus in a minor way, but due to presence of the plant in rocky inaccessible terrain with a significant portion of this in the Superstition Wilderness, none of the human threats have affected a significant number of plants or amount of habitat. Plant deaths from insects or disease were found to be less than recruitment during 1992 to 1994 surveys. No fires have occurred recently in the main population area, but with low fuel loads in much of the rocky terrain, the plant is expected to survive wildfire and perhaps in the long run benefit from reduced competition (Tonto National Forest 1996).

In the project action area, there is occupied Arizona hedgehog cactus habitat for about 10 km (6 mi) of U.S. Highway 60 between Superior and Miami, Arizona, in Gila and Pinal counties. The amount of habitat in the project area in this distance is about 150 ha (380 ac), which is about .02 percent of the total occupied habitat area. Plants can occur anywhere in this area in rocky habitat. The number of plants in or directly adjacent to the right-of-way is unknown. Plants do not occur in the clear zone directly adjacent to the highway. The ADOT has mapped no noxious weeds occurrences in this area (Figure 2).

Special Conservation Measures for the Arizona Hedgehog Cactus. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

- None of the herbicides proposed for use, with the allowable exception of sethoxydim, will be used, in or within 6 m (20 ft) when employing spot application using hand operated equipment, or in or within 18 m (60 ft) when employing mechanized ground applications, of occupied or unsurveyed Arizona hedgehog cactus habitat.

Effects Analysis (Arizona Hedgehog Cactus). There is no suitable habitat for Arizona hedgehog cactus in the highly disturbed highway clear zone directly adjacent to the pavement. Most herbicide use (about 70 percent) will occur in this area to maintain the clear zone. As part of the annual coordination for this project, the Forest Service has agreed to annually identify all sites along and near public roadways that have threatened, endangered, or sensitive plant species and to discuss necessary mitigation measures and other constraints. Surveys will be done to determine the extent of noxious weeds infestations in right-of-ways and herbicide applications will be limited to the areas needed to control these infestations. To date, no noxious weeds infestations have been mapped in Arizona hedgehog cactus habitat. Surveys of treatment areas for threatened and endangered plants are part of the pre-spray BMPs for this project. The special conservation measures described above will be used if any Arizona hedgehog cactus plants are found. These measures make the possibility of effects to Arizona hedgehog cactus from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Arizona Hedgehog Cactus). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Arizona hedgehog cactus.

Huachuca water umbel (Lilaeopsis schaffneriana ssp. recurva)

Endangered Species Act Status:	Endangered, 1997
Forest Occurrence:	Coronado
Recovery Plan:	None
Critical Habitat:	Yes, 1999
Effects Finding (Species):	Not Likely to Adversely Affect
Effects Finding (Critical Habitat):	No Effect

Natural History. The Huachuca water umbel is an herbaceous semi-aquatic perennial plant. It has 3 to 10 very small flowers born on an umbel that emerges from the water (U.S. Fish and Wildlife Service 1997). It flowers from March through October with most flowering in June through August (Arizona Game and Fish Department 1997). It is suspected that flowers self-pollinate (Johnson et al. 1992). Fruits develop from July through September and water disperses the seeds (Arizona Game and Fish Department 1997). Seeds from plants grown in an aquarium have been seen sticking to the aquarium sides and germinating 1 to 2 weeks after falling from the parent plant (Johnson et al. 1992). Although seeds appear to germinate easily, most reproduction is probably asexual from rhizomes and from dislodged clumps of plant that are dispersed downstream (U.S. Fish and Wildlife Service 1997).

Distribution. The Huachuca water umbel grows in cienegas (marshy wetlands) and along streams and rivers (U.S. Fish and Wildlife Service 1997). It can grow in saturated soils or as an emergent in water depths up to about 25 cm (10 in). The surrounding non-wetland vegetation can be desertscrub, grassland, oak woodland, or conifer forest at elevations of 610 to 2,160 m (2,000 to 7,100 ft) (Arizona Game and Fish Department 1997).

This plant has been documented from 16 extant and 6 extirpated sites in Santa Cruz, Cochise, and Pima counties Arizona, and in adjacent Sonora, Mexico. The 16 extant sites are within the San Pedro, Santa Cruz, Rio Yaqui, and Rio Sonora watersheds. There are nine sites in the San Pedro River watershed, four in the Santa Cruz watershed, two in the Rio Yaqui watershed, and one in the Rio Sonora watershed (U.S. Fish and Wildlife Service 1997).

Status (Range-wide). Of the 16 extant sites, 12 are under the management of Bureau of Land Management (Tucson Field Office), Department of Defense (Fort Huachuca), U.S. Fish and Wildlife Service (San Bernardino National Wildlife Refuge), Arizona State Park Department, and private citizens (Arizona Rare Plant Committee 2002). Four sites are under management of the U.S. Forest Service (Coronado NF, Sierra Vista Ranger District).

Density of Huachuca water umbel plants and size of populations fluctuate in response to both flood cycles and site characteristics. Some populations are as small as 1 to 2 m^2 (10 to 20 ft^2). Sites such as Black Draw have a few sparsely distributed clumps, possibly due to the dense shade of the even-aged tree canopy and deeply entrenched channel. The Sonoita Creek population occupies 14.5 percent of a 500 m^2 (5,400 ft^2) patch of habitat. Scotia Canyon, by contrast, contains one of the largest populations occupying about 57 percent of the 1,500 m (4,800 ft) perennial reach of the stream (U.S. Fish and Wildlife Service 1997).

High quality Huachuca water umbel sites have stable perennial stream flow and herbaceous vegetation that stabilizes the banks and channel. Where these conditions are found, Huachuca water umbel often occurs as a common member of the aquatic community and is distributed uniformly along perennial stream segments. Huachuca water umbel seems to benefit from an intermediate level of flooding frequency that reduces competition with larger aquatic plants like cattails, sedges, and bulrushes. Conversely, floods that are too frequent or intense can destroy populations (Johnson *et al.* 1992).

Water withdrawals, diversions, stream channelization, and levies in southern Arizona and Sonora have reduced the habitat available for Huachuca water umbel. Several historical locations no longer provide any suitable habitat because perennial stream flows have ceased due to lowered water tables. Continued human population growth in southern Arizona is expected to put greater pressure on water resources. Widespread watershed degradation occurred in southern Arizona in the late 1800s due to uncontrolled livestock grazing, mining, hay harvesting, timber harvesting, and other practices such as fire suppression. This led to widespread erosion and channel entrenchment that has contributed to long-term or permanent degradation and loss of cienega and riparian habitats throughout southern Arizona and northern Mexico. Poor livestock management can destabilize stream channels and disturb cienega soils creating conditions unfavorable to Huachuca water umbel, which requires stable stream channels and cienegas. Such management can also change riparian structure and diversity causing a decline in watershed conditions. However, livestock grazing that is well managed can be compatible with Huachuca water umbel. Cattle generally do not eat the plants because the leaves are too close to the ground, but they can trample plants. Huachuca water umbel is capable of rapidly expanding from rhizomes and could recover quickly from light trampling. Light trampling may also keep other plant density low thus providing favorable Huachuca water umbel microsites (U.S. Fish and Wildlife Service 1997).

Status (Withn the Action Area). There are no known Huachuca water umbel populations in or adjacent to highway right-of-ways in the action area. However, Huachuca water umbel habitat occurs within 2 miles downstream from National Forest System right-of-way on State Highway 83 in the Canelo Hills, Santa Cruz County.

Special Conservation Measures for the Huachuca Water Umbel. In addition to the measures described in the “Conservation Measures” section of this document, the following conservation measures will be adopted.

- None of the herbicides proposed for use, with the allowable exception of sethoxydim, will be used, in or within 30 m (100 ft) when employing spot application using hand operated equipment, or in or within 110 m (350 ft) when employing mechanized ground applications, of occupied or unsurveyed Huachuca water umbel habitat or designated critical habitat. This measure will be required for the habitat and at least 1.6 km (1 mi) upstream in any contributing channel, tributary, or springrun. This measure will also be required for at least 90 m (300 ft) downstream from the habitat.
- Pendamethalin and 2,4-D will not be used within 0.8 km (0.5 mi) of occupied or unsurveyed Huachuca water umbel habitat or designated critical habitat during the flowering period.

Effects Analysis (Huachuca Water Umbel). There is no suitable habitat for Huachuca water umbel in the highly disturbed highway clear zone directly adjacent to the pavement. Most herbicide use (about 70 percent) will occur in this area to maintain the clear zone. There are no

known Huachuca water umbel populations or habitats in or adjacent to highway right-of-ways in the action area so there will be no effect to Huachuca water umbel from herbicides applied to control noxious weeds in these areas. Also, to date, no noxious weeds infestations have been mapped on State Highway 83 in the Canelo Hills (Figure 2). The only potential effect would be from herbicides (either those used for maintenance of the clear zone or those used for noxious weeds, if any are found) carried downstream in water. The special conservation measures described above will protect Huachuca water umbel aquatic habitats. These measures make the possibility of effects to Huachuca water umbel from the proposed program of herbicide use on highway right-of-ways insignificant and discountable.

Effects Finding (Huachuca Water Umbel). The proposed program of herbicide use on highway right-of-ways with its proposed conservation measures is not likely to adversely affect the Huachuca water umbel.

Critical Habitat. Seven Critical Habitat units have been designated for Huachuca water umbel in Cochise and Santa Cruz counties. These are: part of Soniota Creek in T. 20 S., R. 16 E., Secs. 33 and 34 (Unit 1); part of the Santa Cruz River and a tributary in T. 24 S., R. 17E., Secs. 11, 13, and 14 (Unit 2); in the Huachuca Mountains part of Scotia Canyon in T. 23 S., R. 19 E., Secs. 3, 9, 10, 16, and 21 (Unit 3), part of Sunnyside Canyon in T. 23 S., R. 19 E., Sec. 10 (Unit 4), part of Garden Canyon on the Fort Huachuca Military Reservation (Unit 5), and part of Bear Canyon and tributaries in T. 23 S., R. 19 E., Secs. 25 and 36, T. 23 S., R. 20 E, Secs. 30 and 31, and T. 24 S., R. 19 E., Sec. 1 (Unit 6); and the San Pedro River from T. 19 S., R. 21 E. to T. 23 S., R. 22 E. (Unit 7) (U.S. Fish and Wildlife Service 1999). The Scotia, Sunnyside, and Bear canyon units (3, 4, and 6) are on the Coronado NF (U.S. Fish and Wildlife Service 1999).

Effects Analysis (Huachuca Water Umbel Critical Habitat). None of the critical habitat units are near the project action area.

Effects Finding (Huachuca Water Umbel Critical Habitat). The proposed program of herbicide use on highway right-of-ways in Arizona will have no effect on the critical habitat for the Huachuca water umbel.

Effects Findings for Sensitive Species

Mammals

Navajo Mogollon vole (Microtus mogollonensis navaho)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing.

Natural History. The following natural history information is for Hualapai vole (*Microtus mogollonensis haulpaiensis*), which is closely related and presumably similar to Navajo Mogollon vole. The Haulapai vole is a non-migrant that burrows in the soil or under fallen logs or debris. When inactive, it occupies a nest in a clump of vegetation, under a log, in a depression on the ground, or underground. Young are born in a grass nest. It probably has at least 2 or more breeding periods each season; litter size probably averages 2 to 3. It is active throughout the year

and more active during the day than at night. It is probably most active at midday and in the early evening. It eats primarily green vegetation (NatureServe 2003).

Distribution. Navajo Mogollon vole occurs in a variety of habitats. On Navaho Mountain, voles occupy patches of dense, almost prostrate, carpets of shrubs. Ceanothus, a spiny shrub, appears to be the most important patch component, probably because of the protection provided. Shrub patches occupy about 24 percent of the ground (by coverage) in ponderosa pine and mixed conifer forests on the southeastern slopes of the mountain. Many patches are dominated by shrubs apparently unsuitable for voles. Patches appear to be responses to and maintained by heavy grazing. On Black Mesa, voles occupy sagebrush, tamarisk, chained pinyon-juniper reseeded with non-native grasses, and at least one greasewood/desert olive thicket and one isolated natural, grassed area in pinyon-juniper protected from grazing. On the Defiance Plateau, voles were found in a clearcut pine flat growing back with grass and scattered oak. In the Inner Basin of the San Francisco Peaks, it was present in the grassy areas amid spruce, fir, limber pine, and aspen. North of Williams, voles were taken where junipers had been present but pushed over and new grass had appeared. In Pasture Wash at the west edge of Grand Canyon, it was taken in sagebrush, often nearly pure stands (New Mexico Department of Game and Fish 2002).

The distribution in Arizona includes Navajo Mountain in both Utah and Arizona; along the south side of the Colorado River from near the mouth of the Little Colorado River westward to west of Grand Canyon Village; and the western end of the Mogollon Plateau from the vicinity of Williams eastward to near Mormon Lake, including the San Francisco Mountains (New Mexico Department of Game and Fish 2002). Elevations range from 1,160 m (3,800 ft) along the south rim of the Grand Canyon and 1,645 m (5,400 ft) in Oak Creek to 2,955 m (9,700 ft) on Agassiz Peak in the San Francisco Mountains (New Mexico Department of Game and Fish 2002).

Hoffmann and Koeppl included northwestern (presumably the Zuni Mountains and Mount Taylor) New Mexico within the range of Navajo Mogollon vole and excluded all but Navajo Mountain from the range in Arizona, but provided no evidence for so doing. Specimens of *Microtus mogollonensis* recently collected from Apache and Navajo counties Arizona have not been assessed taxonomically but are considered Navajo Mogollon vole on a geographic basis. Observations of this vole in the New Mexico side of the Chuska Mountains and a specimen from La Plata Co., Colorado, are considered Navajo Mogollon vole on a geographic basis (New Mexico Department of Game and Fish 2002).

Status. Population trends are unknown for this vole, but it has been found in a variety of habitats and in communities that have been modified in various ways.

New Mexican meadow jumping mouse (*Zapus hudsonius luteus*)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This jumping mouse nests in dry soils, but hunts in moist streamside riparian soils at night. It is active only during the growing season of the grasses and forbs on which it depends. It hibernates when the vegetation is dormant, which is as long or longer than most other mammals. Females breed shortly after emerging from hibernation and may give birth to 2 to 7 young per litter, with 1 litter each year, usually between May and September. Young are fully

developed and weaned at 4 weeks. Food items include seeds, fruits, insects, snails, and slugs (Arizona Game and Fish Department 1999).

Distribution. This jumping mouse is usually found in marshes, moist meadows, and riparian habitats in open prairie. This can include permanent streams with moderate to high soil moisture and tall grass-sedge and willow-alder riparian vegetation (New Mexico Department of Game and Fish 2002). Elevations are 1,980 to 2,500 m (6,500 to 8,200 ft) (Arizona Game and Fish Department 1999). They are found in New Mexico at isolated localities from the Sacramento Mountains in Otero County to the San Juan Mountains in Rio Arriba County. In Arizona, they are found in the White Mountains in southern Apache and northern Greenlee counties (Arizona Game and Fish Department 1999). In the project area, there are about 6 km (4 mi) of suitable habitat along U.S. Highway 191 and Arizona Highways 273 and 373 on the Apache-Sitgreaves NF.

Status. The U.S. Fish and Wildlife Service listed the population trend as stable in 1994. Meadow jumping mouse populations were originally impacted by destruction of wetlands. However, it has been found to occupy man-made habitats adjacent to irrigation drains and canals, thus alleviating some of the threat of habitat destruction. Threats to jumping mouse habitat include negative impacts from development, agricultural conversion, grazing, and water diversion (New Mexico Department of Game and Fish 2002).

Silky pocket mouse (Perognathus flavus goodpasteri)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The following natural history information is for the silky pocket mouse (*Perognathus flavus*) as a species, which is presumably similar to that for the subspecies *goodpasteri*. These pocket mice are non-migratory and primarily nocturnal. They apparently hibernate from December to January in some areas; in Arizona and New Mexico they may exhibit torpor and/or short periods of dormancy during adverse weather, but apparently do not hibernate for extended periods. They are basically solitary and intraspecifically aggressive with home ranges of generally less than 0.3 ha (0.7 ac) and home range length averages around 60 m (200 ft). In Texas, the breeding season is April to November. Young are born in underground burrows. In Arizona, most births may occur in winter, spring, or summer, but there are some pregnant females in all months. In New Mexico, most reproduction reportedly occurs April to July and September to October, with little or none in winter. Gestation lasts about 3 to 4 weeks. Litter size is 1 to 6 (average 3 to 4). Young are weaned in about 30 days. In New Mexico, young born in late summer do not become sexually active until the following spring. Apparently there is 1 litter/year in much of the Great Plains, 2+/year in Texas. Most individuals live only a few months; a few live more than 20 months; a very few may live as long as 3 years. The silky pocket mouse feeds almost entirely on seeds of grasses, forbs, and woody plants. It stores food in underground burrows (NatureServe 2003).

Distribution. Most authors consider the species *Perognathus flavus* as occurring predominantly in grassland environments. Some, however, consider pinyon-juniper habitats as suitable (though not optimal). The silky pocket mouse (ssp. *goodpasteri*) has been documented from the eastern end of the Mogollon Plateau near Holbrook, Snowflake, and Springerville, Arizona (New Mexico Department of Game and Fish 2002). In the project area, there are about 130 km (80 mi) of

suitable juniper, pinyon-juniper, and grasslands habitat along Arizona Highways 260, 77, 277, and 377, and U.S. Highway 260 on the western part of the Apache-Sitgreaves NF.

Status. Present population trends are unknown. Pocket mouse populations fluctuate greatly with environmental conditions. These mice were captured at five of six sites in the Lakeside Ranger District, Apache-Sitgreaves NF in 1982 and 1985. Each of the five sites had some type of pinyon-juniper treatment in the previous 40 years. Two of them had been treated as recently as the mid-1980s. At the site where the highest number of pocket mice were captured, it was the only species encountered. This site was converted from a mature pinyon-juniper stand to an open grassland in the mid-1980s (New Mexico Department of Game and Fish 2002).

White Mountains ground squirrel (Spermophilus tridecemlineatus monticola)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This ground squirrel may hibernate for about 6 months of the year. Mating activities begin about 2 weeks after squirrels emerge from hibernation. Normally only one litter is produced annually. The gestation period is 27 to 28 days. The young vary in number from 2 to 13. The young are weaned and entirely dependent on their own resources at the age of 6 weeks. They mature sexually at about 9 to 10 months of age. Their food is chiefly green grasses and herbs in early spring, but seeds, flower heads, and insects contribute importantly to their diet as the season advances. Grasshoppers are often conspicuous items in their stomach contents, and often more than half of the stomach contents are insects including grasshoppers, crickets, caterpillars, beetles, ants, and insect eggs. They also eat mice. Quantities of dry seeds stored in underground caches probably serve to carry the squirrels through the period of scarcity shortly after they emerge in the spring (Sevilleta LTER Station 1998).

Distribution. The thirteen-lined ground squirrel (*Spermophilus tridecemlineatus),* occurs throughout much of the central U.S., but it is found in Arizona only in the White Mountains where it has been classified as spp. *monticola.* White Mountain ground squirrels inhabit the montane grasslands in much of the White Mountains area near Springerville. They occur in open shortgrass subalpine fields between 2,680 to 2,870 m (8,800 to 9,400 ft) and in open grass-sedge meadows along major drainages between 2,580 to 2,650 m (8,470 to 8,700 ft). They are usually on flat or gently rolling terrain (Sevilleta LTER Station 1998). In the project area, there are about 40 km (25 mi) of suitable open grassland habitat along Arizona Highways 260, 261, and 273.

Status. Present population trends are unknown. In 1982, a study conducted during the summer on thirteen-lined ground squirrels indicated that though secretive, *S. t. monticola* is a widespread, apparently common animal in open meadows in the White Mountians and that it is not threatened by current land use practices (there appeared to be a positive correlation between cows and ground squirrels) (Sevilleta LTER Station 1998).

Wupatki Arizona pocket mouse (*Perognathus amplus cineris*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The following natural history information is for the Arizona pocket mouse (*Perognathus amplus*) as a species, which is presumably similar to that for the subspecies *cineris*. Mating season starts in late February to early March; females have been found pregnant in April. There are 1 to 7 young per litter (average 3 to 5). The Arizona pocket mouse is primarily nocturnal, but is sometimes abroad in daylight. This species feeds almost entirely (95 percent) on seeds, with insects and green vegetation forming the remainder of the diet (E-Nature 2003).

Distribution. In northern Arizona, as around Wupatki Ruins, these pocket mice are found in greaswood, rabbitbrush, ephedra, shortgrass, and sometimes even some short shrubby junipers (New Mexico Department of Game and Fish 2002). The Wuptaki Arizona pocket mouse is endemic to north-central Arizona. Its distribution is in a north-south band east of Marble Canyon from near Page, Arizona to just northeast of Flagstaff, which includes the lower part of the Little Colorado River drainage (Arizona Wildlife and Ecology 2003). Potential habitat in the project area includes U.S. Highway 89 north of Flagstaff.

Status. Present population trends are unknown.

Effects Analysis for Sensitive Mammals

The project area includes only a tiny fraction of the suitable habitat for any of these five sensitive small mammals and most of the project activity (about 70 percent) will be to manage hazardous vegetation in the highway clear zone (1.5 m or 5 ft) directly adjacent to the pavement apron. This area is already highly disturbed from vehicles and highway maintenance activities. It provides no suitable habitat for any of these five sensitive mammals. Herbicide use in the right-of-way beyond the clear zone will be limited to spot applications or small-area applications to control specific noxious weeds infestations that ADOT has identified through surveys. If any of these infestations are in suitable habitat for any of these five sensitive mammals, then surveys will be done to determine if sensitive species are present before applying herbicides. If sensitive species are found in any proposed treatment areas, then buffer zones will be applied and alternative treatment measures will be used within the buffer zone and occupied habitat. The Forest Service has agreed in the interagency MOU to identify occupied habitats and any suitable habitats that might need surveys. These measures should virtually eliminate the possibility of herbicide application in occupied habitats of any of these five sensitive species.

The herbicides proposed for use in this program have low toxicity to small mammals and the herbicide risk assessments indicate a low risk of harm with ordinary application methods. ADOT estimates that about 2,000 ha (5,000 ac) would be considered for herbicide treatment in any one year, which is about 2 percent of the potential herbicide treatment area. This means that most parts of the project area will be treated infrequently, if at all. Treated areas will receive herbicide applications only once per year. The combination of low herbicide toxicity and infrequent application make the possibility of harm to any of these sensitive small mammals very small, even if herbicides were inadvertently applied in occupied habitat.

Effects Determination for Sensitive Mammals

Only a small fraction of the suitable habitat for any of the five sensitive mammals is within the project area. Surveys and buffer zones that are part to the mitigations and BMPs for this project will almost eliminate the possibility of herbicides being applied in occupied habitat. The herbicides being used have a low risk of harm to small mammals when applied with the

frequency and methods proposed for the project. We can, therefore, conclude that this program of herbicide use will not reduce population viability or harm any of these five Forest Service Sensitive mammals in a way that would increase their likelihood of trending toward Federal listing.

Birds

Bell's vireo (*Vireo bellii*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This species prefers to nest in low, dense, scrubby vegetation in areas of early succession and is particularly dependent on corridors of habitat along rivers and streams. Research on the endangered Least Bell's Vireo suggests that it is most important to have a dense shrub layer 0.6 to 3.0 m (2 to 10 ft) from the ground. On the breeding grounds, this species feeds on insects and small spiders but its winter feeding habits are unknown. The nest is built by the male and female in a forked branch at a height of 0.5 to 1.5 m (1.6 to 4.9 ft) from the ground. Three to five eggs (usually four) are laid and, depending on location, this species may raise one or two broods (Audubon Society 2003).

Distribution. This species inhabits shrubby and riparian areas. The breeding range of this species extends, in the Midwest, from North Dakota to Indiana, south through Arkansas, and Texas continuing across the Southwest through southern New Mexico and Arizona into California and south into northern Mexico (Audubon Society 2003).

Status. In the southwestern portion of its range, habitat degradation and cowbird parasitism are causing declines and range reduction. Breeding Bird Survey data indicate that the species has shown an overall decline of 2.8 percent per year from 1966 to 2001 across its U.S. range. Loss and degradation of habitat, especially along stream and river corridors through development, flood control projects, firewood cutting, cattle grazing and agriculture are the greatest threats to the continued health of populations of the Bell's Vireo. Overgrazing has been estimated to reduce nesting sites by 50 percent in some areas and has contributed to an increase in non-native invasive plant species that do not provide suitable habitat for the species. Fragmentation of habitat increases brown-headed cowbird parasitism and isolates small fringe populations, which are very susceptible to localized extirpations contributing to large-scale range reductions. Domestic cats are also a significant predatory force in some areas (Audubon Society 2003).

Common blackhawk (Buteogallus anthracinus)

Status:	Sensitive
Forest Occurrence:	Coconino, Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The blackhawk breeding season runs from late February to late May. Nests are usually built within 120 m (480 ft) of permanent flowing waters and are typically constructed 15 to 30 m (60 to 120 ft) above the ground. Occasionally nests have been found in rocky recesses. The clutch size is relatively small in this species, ranging from 1 to 3 eggs. Incubation lasts 38 to 39 days. Fledging is between 43 to 50 days, and post-fledging dependence on the adults lasts 6 to

8 weeks. The blackhawk primarily feeds on snakes, frogs, fishes, young birds, and land crabs. Sometimes it supplements its diet with a variety of insects including grasshoppers and caterpillars. Reportedly, the blackhawks of Belize feed primarily on large land crabs (Steinwand 2000).

Distribution. This species occurs from Arizona to southern Texas and southward to Peru and Paraguay. The common blackhawk reaches its northern limits in the southwestern U.S. In New Mexico, it is an uncommon summer resident that is largely restricted to well-developed riparian habitats in the San Francisco, Gila, and Mimbres drainages. In Arizona, it nests along perennial streams with mature riparian deciduous forests, primarily in the drainages of the Gila, Salt, Verde, Bill Williams and San Pedro rivers (New Mexico Department of Game and Fish 2002).

Status. Currently the North, Central, and South American populations of blackhawks seem to be self sustaining, but the species exhibits a low reproduction rate. Conservation of the blackhawk depends on maintaining vital regions of riparian habitat, like Aravaipa Canyon Preserve in Arizona which is free of disturbance and development (Steinwand 2000). In Arizona, it is threatened by loss of riparian habitat, lack of tree regeneration due to livestock grazing, and by reduction of stream flows due to water diversions and channelization (New Mexico Department of Game and Fish 2002).

Eared trogon (Euptilotis neoxenus)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The eared trogon nests in tree cavities such as in dead pines (dead maple in Ramsey Canyon) (NatureServe 2003).

Distribution. The eared trogon occurs in pine and pine-oak forests; also mixed conifer-broadleaf woodland of other kinds. It is resident in Mexico in the mountains of northwestern Chihuahua, Sinaloa, Durango, Zacatecas, Nayarit, and Michoacan; recorded also from Sonora (not recently). It has been recorded since 1977 (in fall and winter, and probably resident) in southern Arizona (Huachuca and Chiricahua Mountains); it nested unsuccessfully in upper Ramsey Canyon, Huachuca Mountains, in 1991. It has also been sighted in the Animas Mountains, New Mexico. The eared trogon exists at low densities in localized areas within a large range (NatureServe 2003). Arizona is at the northern periphery of its range. In the project area, it has been recorded at one sight on Arizona Highway 288.

Status. Insufficient information is available to assess recent trends, but it is possibly declining from a variety of threats. It is apparently less common now than in the 1800s. Known threats include loss of nesting trees from increased logging pressure, destruction of habitat, agricultural encroachment, and increased human disturbance (NatureServe 2003).

Northern goshawk (*Accipiter gentilis*)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves, Coconino, Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Northern goshawks generally begin breeding at 2 years of age. Birds form life-long pair bonds and have strong nest-site fidelity. Breeding activity begins about mid-April. Usually 2 to 4 eggs are laid (Arizona Game and Fish Department 1997). Eggs hatch in 36 to 41 days. Nestlings fledge at 35 to 42 days old and are fully independent of their parents at 70 to 80 days old (Kissee 2000). Goshawks prey on small birds and mammals (Arizona Game and Fish Department 1997).

Distribution. Northern goshawks occupy ponderosa pine and mixed conifer forests. They breed in the northern hemisphere from timberline in Alaska and Canada south to Mexico and Pennsylvania and from the timberline in Scandinavia and Siberia south to Morocco, Iran, Tibet, and Japan. In Arizona, they breed in high forested mountains and plateaus statewide. Populations on the Kaibab Plateau have one of the highest breeding densities known (Arizona Game and Fish Department 1997).

There is little historical information on goshawk densities, but populations appear to have undergone dramatic declines over the last 50 years. The most complete data is from the Kaibab NF showing a reduction from about 130 breeding pairs in 1972 to about 30 occupied territories in 1990 (Arizona Game and Fish Department 1997).

Northern peregrine falcon (*Falco peregrinus anatum*)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Northern peregrine falcons mate for life and return to the same nest sites year-after-year. In Arizona, peregrine falcons return to breeding areas from mid-February to mid-March and eggs are layed from mid-March through mid-May. Clutch size is usually 3 to 4 eggs. Incubation is about 32 days. Nestlings fledge at 6 weeks of age. These falcons feed almost exclusively on birds (Arizona Game and Fish Department 2002).

Distribution. These birds are found in Arizona wherever sufficient prey is found near cliffs. Optimum habitat is generally considered to be steep, sheer cliffs overlooking woodlands, riparian areas, or other habitats supporting abundant avian prey. Range-wide, the northern peregrine falcon nests from central Alaska, central Yukon territory, and northern Alberta and Saskatchewan, east to the Maritimes and south throughout western Canada and the U.S. to Baja California, Sonora, and the highlands of Central Mexico. In Arizona, areas of spectacular cliffs such as the Mogollon Rim, Grand Canyon, and Colorado Plateau contain most of the State's breeding peregrines (Arizona Game and Fish Department 2002). In the project area, there is occupied habitat near Arizona Highways 88, 260, and 288 on theTonto NF.

Status. Declines in the 1950s and 1960s in Arizona and the rest of the U.S. due to DDT contamination have apparently been reversed. In addition to being found in greater numbers, Arizona's peregrines are being found in areas that would have formerly been considered marginal, suggesting that populations may have reached levels saturating the optimal habitat and forcing new breeding pairs into sub-optimal areas (Arizona Game and Fish Department 2002).

Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

Status:	Candidate, Sensitive

Forest Occurrence: Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The male and female both build the nest, often in willow or mesquite thickets. The clutch is 3 to 4 eggs that hatch synchronously after 4 to 11 days of incubation. The young leave the nest in 7 to 8 days. Yellow-billed cuckoos eat hairy caterpillars, bird eggs, frogs, lizards, ants, beetles, wasps, flies, berries, and fruit. The young are fed insect regurgitant (Arizona Game and Fish Department 2002).

Distribution. In Arizona, yellow-billed cuckoos occupy mainly mature cottonwood-willow stands and to a lesser extent willows or isolated cottonwoods mixed with tall mesquites. Range-wide, it nests from southern Canada through the northeastern U.S., south through the U.S. to the Florida Keys, Central America, and southern Baja, California. In Arizona, it nests in the southern, central, and northeastern parts of the State (Arizona Game and Fish Department 2002).

Status. Populations are extremely reduced. A general decline in all areas seems to be occurring (Arizona Game and Fish Department 2002).

Effects Analysis for Sensitive Birds

None of the six sensitive birds in this analysis nest on the ground or have foraging habits that would cause them to spend much time in highway right-of-ways where herbicides are being applied. In fact, they are most likely to only pass through right-of-ways on a casual basis rather than occupy right-of-way habitats. The Bell's vireo and western yellow-billed cuckoo could use shrubs or willows in riparian areas near the edge of right-of-ways.

Most of the project activity (about 70 percent) will be to manage hazardous vegetation in the highway clear zone (1.5 m or 5 ft) directly adjacent to the pavement apron. This area is already highly disturbed from vehicles and highway maintenance activities. It provides no suitable habitat for any of these six sensitive birds. Herbicide use in the right-of-way beyond the clear zone will be limited to spot applications or small-area applications to control specific noxious weeds infestations that ADOT has identified through surveys. If any of these infestations are in suitable habitat for any of these six sensitive birds, then surveys will be done to determine if there are any resident birds before herbicides are applied. If any residents are found, then buffer zones will be established and alternative treatment measures that do not disturb the birds will be used within the buffer zones and occupied habitat. The Forest Service has agreed in the interagency MOU to identify occupied habitats and any suitable habitats that might need surveys. These measures should virtually eliminate the possibility of herbicide application in occupied habitats of any of these six sensitive species.

Effects Determination for Sensitive Birds

Fish

Little Colorado sucker (*Catostomus sp3*)

Status: Sensitive
Forest Occurrence: Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Distribution. These fish live in creeks, small to medium rivers, and impoundments. They are mostly found in pools with abundant cover. They are endemic to the upper part of the Little Colorado River and many of its north flowing tributaries in Coconino, Navajo, and Apache counties. They are also introduced into the Salt River (Arizona Game and Fish Department 1997).

Roundtail chub (*Gila robusta*)

Status:	Sensitive
Forest Occurrence:	Coconino, Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Distribution. Roundtail chubs occupy cool to warm water, mid-elevation streams and rivers where typical adult microhabitat consists of pools up to 2.0 m (6.6 ft) deep adjacent to swifter riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. Smaller chubs generally occupy shallower, low velocity water adjacent to overhead bank cover. These chubs may also occupy reservoirs. Rangewide, roundtail chubs are known from larger tributaries of the Colorado River from Wyoming south to Arizona and New Mexico. They are also known from the Rio Yaqui south to the Rio Piaxtla in northwestern Mexico. In Arizona, these chubs occur in the mainstem and tributaries of the Verde and Salt rivers, and in tributaries to Tonto Creek (Arizona Game and Fish Department 2002).

Effects Analysis for Sensitive Fish

There is suitable habitat for threatened and endangered fish in most of the streams and rivers in Arizona. Special conservation measures in terms buffer zones and herbicide restrictions have been established for the occupied or unsurveyed suitable habitat of each of these species. In most cases, these conservation measures will also apply to the two sensitive fish, which occupy the same habitats.

Effects Finding for Sensitive Fish

Herbicides applications will be infrequent in any particular area and buffer zones that are part to the mitigations and BMPs for this project will protect all aquatic habitats. We can, therefore, conclude that this program of herbicide use will not reduce population viability or harm either of these two Forest Service Sensitive fish in a way that would increase their likelihood of trending toward Federal listing.

Amphibians and Reptiles

Arizona night lizard (Xantusia vigilis arizonae)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Desert night lizards (Xantusia vigilis), of which the Arizona night lizard is a subspecies, mate in May to June. One to three young are born alive in September to October. These lizards are diurnal with activity continuing after dusk. They feed on termites, ants, beetles, and flies found under decaying vetetation or rocks. The tail breaks off easily (eNature 2003). The

Arizona night lizard (Xantusia vigilis arizonae) is essentially a troglodyte living its entire life in a confined space from which it seldom emerges. All aspects of its biology, its slow metabolism, slow growth and reproductive rates, and dark-adapted eyes suit it to the challenges of its preferred microhabitat (Gauthier 1999).

Distribution. The range for the Desert night lizard (X. vigilis) is southern Nevada, southern Utah, and western and central Arizona through southern California into Mexico. The Arizona night lizard (ssp. arizonae) occurs along the southern edge of the Colorado Plateau in Mohave, Pinal, and Yavapai counties, Arizona (eNature 2003). It lives primarily beneath exfoliating granite, a habitat that is much narrower than for the species as a whole.

Status. The status of this lizard is unknown, but its specialized habitat makes it more vulnerable to some types of disturbance than is the species as a whole that occupies fairly generalized desert habitat (Gauthier 1999).

Arizona ridgenose rattlesnake (*Crotalus willardi willardi*)

Status:	Sensitive
Forest Occurrence:	Coronado
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Arizona ridgenose rattlesnakes mate in midsummer to early fall. Brood size averages about 5.5 young (2 to 9), with the young born from late July through late August. Female reproduction is typically biennial or longer. These rattlesnakes are generally secretive and inconspicuous; when encountered they are more likely to rattle and attempt to escape than to coil and strike. They prey on various rodents, lizards, snakes, birds, and arthropods, including centipedes (Arizona Game and Fish Department 2001).

Distribution. The Arizona ridgenose rattlesnake occurs in oak woodland to pine-fir forests, near rock crevices on forest and woodland floors, and also (especially) in mexic canyon bottoms with canopies of alder, box elder, maple, oak and othe broadleaf deciduous trees; it is infrequently found in high grassland boardering the woodlands. It is found in south-central Arizona and extreme northern Sonora, Mexico. In Arizona, it is found in the Huachuca, Santa Rita, Patagonia, and Whetstone mountains, and the Canelo Hills (Arizona Game and Fish Department 2001).

Status. Population trends are unknown (Arizona Game and Fish Department 2001).

Arizona southwestern toad (Bufo microscaphus microscaphus)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves, Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Adults are nocturnal except during the breeding season. It breeds mostly in February through July. Breeding is not dependent on rainfall as with many other species. Egg strands are laid in the bottom of pools. These toads eat arthropods and some snails (Arizona Game and Fish Department 2002).

Distribution. This toad occurs in rocky streams and canyons in the pine-oak belt. Rangewide, it occurs as isolated populations in southwestern Utah, southern Nevada and adjacent California,

central Arizona, and southwestern New Mexico. In Arizona, it occurs in isolated patches from the west-central to the east-central part of the State just below the Mogollon rim (U.S. Forest Service 2003).

Status. Hybridization with Woodhouse toad has been thought to be a threat in dammed aquatic systems. It is apparently stable at other localities, but there is no good documentation anywhere (Arizona Game and Fish Department 2002).

Lowland leopard frog (*Rana yavapaiensis*)

Status:	Sensitive
Forest Occurrence:	Coconino, Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Male lowland leopard frogs attract a potential mate by emitting an airborn call consisting of a series of low pulses lasting 3 to 8 seconds. Egg masses have been observed from January through late April and in October. Larvae metamorphose in 3 to 9 months and can overwinter. Adults eat arthropods and other invertebrates. Larvae are herbivorous and likely eat algae, organic debris, plant tissue, and minute organisms (Arizona Game and Fish Department 2001).

Distribution. The lowland leopard frog inhabits aquatic systems in desert grasslands to pinyon-juniper woodlands at elevations of 240 to 1,680 m (800 to 5,500 ft) in Arizona. It is a habitat generalist and breeds in a variety of natural and man-made aquatic systems (Arizona Game and Fish Department 2001). Its distribution in Arizona includes most of the southern two-thirds of the State below the Mogollon Rim (Amphibian Research and Monitoring Initiative 2003).

Status. The species is extirpated from southwestern Arizona and is declining in southeastern Arizona. Adequate data is needed to determine the status in central Arizona, but these populations are thought to be stable (Arizona Game and Fish Department 2001).

Mexican garter snake (Thamnophis eques megalops)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Mexican garter snakes are active during the warmer months of the year. They may be seen foraging along watercourses, but they are quick to seek shelter in streamside vegetation or in the stream. Females are larger than males and begin reproducing at 53 to 70 cm (21 to 28 in) total length. Clutch sizes range up to 26 live-born young, which are born from June through August. These snakes prey primarily on frogs, tadpoles, and native fish, although lizards and mice may also be taken (Arizona Game and Fish Department 2001).

Distribution. These snakes are most abundant in densely vegetated habitat surrounding cienegas, cienega streams, stock tanks, and in or near water along streams in valley floors in desert grassland and occasionally in desert and lower oak woodland habitats usually at elevations of 910 to 1,520 m (3,000 to 5,000 ft). The Mexican garter snake occurs mostly in the southeastern part of Arizona from the Santa Cruz Valley eastward and generally south of the Gila. Post-1980 records occur from the San Rafael and Sonoita grasslands area and from Arivaca. It is also known from

the Agua Fria River, Oak Creek, the Verde River, and from several upper Salt/Black River sites, including smaller tributaries (Arizona Game and Fish Department 2001).

Status. Population numbers are declining, with extirpations at several localities since 1950 as habitat is changed and introduced predators invade habitat (Arizona Game and Fish Department 2001).

Narrowheaded garter snake (*Thamnophis rufipunctatus*)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves, Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The narrowheaded garter snake bears its young alive in July. It is inactive in cold temperatures or extreme heat. It is almost strictly aquatic and hunts fish, salamanders, tadpoles, toads, and frogs (Arizona Game and Fish Department 2002).

Distribution. Narrowheaded garter snakes are found in permanently flowing streams, sometimes sheltered by broadleaf trees. They are almost strictly aquatic and are seldom seen more than a meter from water. In Arizona they occur mostly at 1,530 to 1,830 m (5,000 to 6,000 ft) in elevation in pinyon-juniper and pine-oak woodlands into ponderosa pine forest. Rangewide they occur in central and eastern Arizona and west-central New Mexico in the Mogollon Rim area, with disjunct populations in northern Sonora and Chihuahua south in the Sierra Madre Occidental to central Durango. In Arizona, they occur from the White Mountains along the Mogollon Rim up into Oak Creek Canyon. Good populations are found in Oak Creek Canyon and the East Verde River (Arizona Game and Fish Department 2002).

Status. Some populations appear stable, while others are declining. It is believed to be extirpated from the Falgstaff and Wall Lake areas where it was formerly abundant. It is becoming more difficult to find in historical strongholds like Oak Creek Canyon (Arizona Game and Fish Department 2002).

Northern leopard frog (*Rana pipiens*)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves, Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Northern leopard frogs breed from mid-march to early June. In most cases they are sexually mature in 2 years. A female may lay 3,000 to 5,000 eggs in one round mass that measures 7.5 to 15 cm (3 to 6 in) across. Tadpoles hatch in about a week and metamorphose in about 3 months. Aquatic larvae have been found to overwinter in some areas. Adults east mostly small invertebrates; tadpoles eat algae, plant tissue, organic debris, and probably small invertebrates (Arizona Game and Fish Department 2002).

Distribution. The northern leopard frog occurs in a variety of habitats including grassland, brushland, woodland, and forest. It is usually in permanent water with rooted aquatic vegetation (Arizona Game and Fish Department 2002). It has a wide range in North America that extends from southern Quebec west to the extreme southern District of Mackenzie, and south to Pennsylvania and Kentucky in the east with isolated records in Maryland and West Virginia. It

occurs west to the Pacific states and south to Nevada, Arizona, New Mexico, and Texas (Degenhardt et al. 1996). In Arizona, it occurs in the northern and central parts of the State (Arizona Game and Fish Department 2002).

Status. Many local populations of northern leopard frogs have been lost. They no longer occur in the White Mountains. Crayfish (Oronectes virilis) are having major negative effects on native populations of leopard frogs. Where crayfish are abundant, leopard frogs are rare or not present, aquatic snails are eliminated, diversity and abundance of aquatic insects is reduced, and aquatic vegetation is severely reduced. The decline of leopard frogs in the White Mountains apparently began in the late 1970s and corresponded with the widespread introduction of crayfish in the region (New Mexico Department of Game and Fish 2003).

Ramsey Canyon leopard frog (*Rana subaquavocalis*)

Status:	Sensitive
Forest Occurrence:	Coronado
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Adults can reach 10 years of age post metamorphosis. It has been suggested that sexual maturity is reached rather late in life, at about 6 years; but, captive-reared frogs released in Miller Canyon produced egg masses 1 year after metamorphosis. Egg masses have been recorded from mid-March through early October. Mating seems to begin once water temperatures reach 10^0C (50^0F). Egg masses contain about 1,500 eggs that hatch in about 14 days. Larvae take 160 to 200 days to metamorphose; they may overwinter as tadpoles (Arizona Game and Fish Department 2001).

Distribution. Ramsey Canyon leopard frogs occur in pine-oak, oak woodland, and semi-desert grassland areas of the Huachuca Mountains. Most habitats where these frogs are found are modified or artificial aquatic systems and may incude ponds, streams, and plunge pools. Emergent vegetation and root masses provide cover. These frogs are found only in the Huachuca Mountains in Cochise County. Their current known range is limited to aquatic habitats in Tinker, Brown, Ramsey, and Miller canyons, and several ponds in the area (Arizona Game and Fish Department 2001).

Status. Populations appear to be declining and recruitment is low at all known localities except Miller Canyon. At two sites, Tinker Pond and Ramsey Canyon, cytrid fungus has been found in dead frogs. This fungus has been implicated in the declines of amphibians around the world and may play a role in the decline of Ramsey Canyon leopard frog (Arizona Game and Fish Department 2001).

Sonoran desert tortoise (*Gopherus agassizii*)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Mating occurs during the summer monsoon season. Females lay one clutch of about 6 eggs just before or during the onset of summer rains in late June or early July. Some hatchlings emerge in late summer, but some may overwinter in the nest before emerging in the spring. Tortoises grow relatively rapidly early in life and reach about half their maximum size at 5

to 10 years of age. The growth rate tapers off as individuals slowly approach their maximum size. Tortoises reach sexual maturity after 10 to 20 years, at about 220 mm (8.7 in) carapace length (Arizona Game and Fish Department 2001).

Tortoises require loose soil in which to excavate burrows below rocks and boulders. They escape extreme temperatures in burrows, which are cooler in the summer and warmer in the winter than outside temperatures. Tortoise activity begins in the spring as temperatures warm and then decreases as the season moves into the summer drought in May and June. The onset of the summer monsoon season signals the beginning of peak tortoise activity, dramatically rising in early August and peaking during August to September. Activity decreases sharply after mid-October as tortoises withdraw into winter hibernacula. Tortoises eat a variety of annual and perennial grasses, forbs, and succulents (Arizona Game and Fish Department 2001).

Distribution. The Sonoran population of the desert tortoise occurs primarily on rocky slopes and bajadas of Sonoran desertscrub. Rangewide, the desert tortoise occurs from northern Sinaloa north to southern Nevada and southwestern Utah, and from south-central California east to southeastern Arizona. The desert tortoise is divided into two populations for the purposes of the ESA. The threatened Mojave population occurs north and west of the Colorado River and the unlisted Sonoran population occurs south and east of the Colorado River. In Arizona, the northeastern-most records of the Sonoran desert tortoise occur along the Salt River near Roosevelt Lake. The middle San Pedro River drainage has the eastern-most substantial tortoise populations. Tortoises have been found as far southwest as the Barry M. Goldwater Range, Yuma Proving Ground, and the Cabeza Prieta National Wildlife refuge (Arizona Game and Fish Department 2001).

Status. Population density varies from about 15 to over 150 tortoises per square mile among 18 tortoise plots surveyed in Arizona. Abundance at 17 of these sites appears to be stable or increasing (Arizona Game and Fish Department 2001).

Effects Analysis for Sensitive Amphibians and Reptiles

The project area includes only a tiny fraction of the suitable habitat for any of these nine sensitive ampibians and reptiles and most of the project activity (about 70 percent) will be to manage hazardous vegetation in the highway clear zone (1.5 m or 5 ft) directly adjacent to the pavement apron. This area is already highly disturbed from vehicles and highway maintenance activities. It provides no suitable habitat for any of these nine sensitive ampibians and reptiles. Herbicide use in the right-of-way beyond the clear zone will be limited to spot applications or small-area applications to control specific noxious weeds infestations that ADOT has identified through surveys. If any of these infestations are in suitable habitat for any of these nine sensitive ampibians and reptiles, then surveys will be done to determine if sensitive species are present before applying herbicides. If sensitive species are found in any proposed treatment areas, then buffer zones will be applied and alternative treatment measures will be used within the buffer zone and occupied habitat. The Forest Service has agreed in the interagency MOU to identify occupied habitats and any suitable habitats that might need surveys. These measures should virtually eliminate the possibility of herbicide application in occupied habitats of any of these nine sensitive species.

Six of the sensitive amphibians and reptiles live in or near aquatic habitats. As a standard mitigation measure for this project, no herbicides will be applied to wetands, streams, or other

bodies of water. A buffer zone of at least 10 m (30 ft) on relatively level ground, greater on slopes, will be placed around wetlands, streams, or other bodies of water. If any noxious weeds control or hazardous vegetation management is needed in the terrestrial buffer zones established around aquatic habitats, the only herbicides used will be those labeled for aquatic uses. And, as already stated, these herbicides will be applied only on land and never directly to water.

The herbicides proposed for use in this program have low toxicity to amphibians and reptiles, and the herbicide risk assessments indicate a low risk of harm with ordinary application methods, which includes as a BMP applying herbicides only when weather conditions are favorable. Favorable weather conditions include low wind speeds and also avoidance of periods when rainfall is likely that would wash herbicides off target plants before they can dry. ADOT estimates that about 2,000 ha (5,000 ac) would be considered for herbicide treatment in any one year, which is about 2 percent of the potential herbicide treatment area. This means that most parts of the project area will be treated infrequently, if at all. Treated areas will receive herbicide applications only once per year. The combination of low herbicide toxicity and infrequent application (no application to aquatic habitats) make the possibility of harm to any of these sensitive amphibians and reptiles very small, even if herbicides were inadvertently applied in occupied habitats.

Effects Determination for Sensitive Amphibians and Reptiles

Only a small fraction of the suitable habitat for any of the nine sensitive ampibians and reptiles is within the project area. Surveys and buffer zones that are part to the mitigations and BMPs for this project will almost eliminate the possibility of herbicides being applied in occupied habitat. The herbicides being used have a low risk of harm to ampibians and reptiles when applied with the frequency and methods proposed for the project. We can, therefore, conclude that this program of herbicide use will not reduce population viability or harm any of these nineForest Service Sensitive ampibians and reptiles in a way that would increase their likelihood of trending toward Federal listing.

Invertebrates

Arizona giant-skipper (*Agathymus aryxna*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Adults have a fast noisy flight. Males perch near host plants from early morning to noon to wait for receptive females. Eggs are laid singly on Agave palmeri and perhaps other agaves. The eggs fall to the base of the plant. A young caterpillar crawls to a leaf tip and burrows inside where it eats pulp and then hibernates. In the spring, the caterpillar makes a new burrow in a leaf base where it feeds on sap until becoming inactive for the summer. Before pupating, the caterpillar enlarges the opening of its burrow and makes a silk trap door from which the adult can emerge. Adults fly from late August to mid-November. Adult males sip moisture from mud; adult females never feed (Opler et al. 1995).

Distribution. Arizona giant-skippers occupy desert grasslands and rocky canyons at 1,200 to 2,000 m (4,590 to 7,640 ft) where stands of Palmer agave occur. They occur in southeastern

Arizona, in extreme southwestern New Mexico, and in northern Mexico (Arizona Game and Fish Department 2001).

Status. Disturbance or removal of the host plant may impact isolated populations, but both the host and butterfly are widespread enough to presently not be of management concern (Arizona Game and Fish Department 2001).

A tiger beetle (Cicindela hirticollis corpuscula)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The females of Cicindela hirticollis oviposit in late June or July and the larvae reach the third instar during late September; by mid-October they seal their burrows and hibernate. The burrows open in May of the following year and pupation occurs during June or July. The adults emerge in August, overwinter, and become sexually mature the following year (Marshall 2003). Adults are present from April to November on sandy banks of rivers and streams (Coconino National Forest 2000).

Distribution. Cicindela hirticollis occupies sandy beach and dune habitats along large rivers, lakes, and sea coasts. It is one of the most widespread tiger beetle species in North America, occurring throughout the U.S. on both the Atlantic and Pacific coasts, and from the Gulf of Mexico north into Canada as far as Lake Athabasca (Sutherland 1999). The subspecies corpuscula occurs in the Colorado River system in Arizona, California, Colorado, Nevada and Utah (NatureServe 2003). In Arizona, it occurs in Coconino, Graham, Greenlee, Maricopa, Navajo, and Yuma counties where it is probably tied to perennial or intermittent streams (Coconino National Forest 2000).

Status. This tiger beetle has Heritage Program ranks of S2 for Arizona and California, S2/S3 for Nevada, and S3 for the Navajo Nation (NatureServe 2003). These ranks indicate the tiger beetle is rather rare throughout a fairly wide range with 6 to 20 occurrences recorded in a State for S2 taxa and 21 to 50 occurrences recorded in a State for S3 taxa.

Blue-black silverspot butterfly (*Speyeria nokomis nokomis*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males patrol for receptive females, who walk on the ground to lay single eggs near violets that are the caterpillar host plants. The unfed first-stage caterpillars hibernate; in the spring they feed on leaves of the host. Adult butterflys are seen from late July to September. Adults feed on flower nectar, including that of thistles (Opler et al. 1995).

Distribution. This butterfly uses moist meadows, seeps, marshes, and streamsides where there are an abundance of violets (Coconino National Forest 2000). The species Speyeria nokomis has a distribution from eastern California through Nevada, Utah, Arizona, western Colorado and New Mexico, south into Mexico (Opler et al. 1995). In Arizona, the subspecies nokomis occurs in the north-central part of the State.

Status. The species Speyeria nokomis is apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery (Opler et al. 1995). The status of subspecies nokomis is unknown.

California floater (Anodonta californiensis)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The California floater is a bivalve with larval, parasitic, juvenile, and adult stages. Eggs are held in a brood pouch formed by gills of the female until they hatch into larvae (glochidia). Upon release, the glochidia fall to substrate in clean waters. After growing for some time, attachment threads dissolve (byssi) and young muscles wash downstream to settle in slower water where further maturation takes place. If muscles survive, they await attachment to tail edges or fins of host fish. It is unknown if a species-specific host is required. The host produces tissue forming a cyst, which is the beginning of the parasitic stage that lasts about 27 days. At the completion of this stage, young mussles detach from the host and the juvenile stage begins, which lasts about 2 years. During this time organs are transformed from the immature to the adult state. Although life span of the California floater is unknown, closely related species live about 10 to 15 years (Arizona Game and Fish Department 2001).

Distribution. The total range is from British Columbia south throughout California into Chihuahua and possibly Sonora, Mexico, then east to Idaho, Wyomiing, Utah, and Arizona. Historically, it was found in a majority of the Arizona drainages including the Black, Salt, Santa Cruz, Verde, Gila, and Colorado rivers. Today it is found in Arizona only in the upper Black River and perhaps in Chevelon Creek (Arizona Game and Fish Department 2001).

Status. The California floater is declining throughout much of its former range and may be nearing extirpation in some of the more southern states, including California (Arizona Game and Fish Department 2001).

Desert green hairstreak (*Callophrys comstocki*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males perch to watch for females in depression or gulch bottoms. Females lay eggs singly on host plant leaves, which are various wild buckwheat (Eriogonum) species. Caterpillars eat leaves, although some prefer flowers and young fruits. Pupae overwinter in litter at the base of host plants. There are one or two flights, from March to May and August to September; the second flight is usually small. Adults eat flower nectar (Opler et al. 1995).

Distribution. Most populations of desert green hairstreak are found along riverine bottoms in sagebrush scrub and pinyon-juniper woodland (Opler et al. 1995). It occurs in desert ranges of southern California, largely in the Mojave Desert. It also occurs in parts of Nevada, Arizona, Utah, and southwestern Colorado (NatureServe 2003).

Status. Cheatgrass is invading habitats in some areas (Opler et al. 1995). This species has a Natural Heritage Program rank of S4 in California, which means it is apparently secure with more than 100 occurrences within the State. In the other States where it occurs, it is ranked as either S1 (rare) or "S?" (status unknown) (NatureServe 2003).

Desert elfin (Callophrys fotis)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males perch near host plants on trees and shrubs to wait for females. Eggs are laid singly on flower buds of the cliff rose (Purshia mexicana). Caterpillars feed on buds, flowers, and young fruits. Pupae overwinter. Adults fly from March to June (Opler et al. 1995).

Distribution. The desert elfin occurs in desert mountains and canyons, usually in pinyon or pinyon-juiper habitat where there are substantial populations of cliff rose (NatureServe 2003). The total range includes southwestern California, southern Nevada, Utah (except northeastern portion), extreme western Colorado, northwestern New Mexico, and northern Arizona (Opler et al. 1995).

Status. The Natural Heritage Program global rank for this species is G3, which means it is uncommon or restricted with 21 to 100 occurrences and rather rare throughout a fairly wide range. The Arizona Heritage Program rank is "S?" (status unknown); the Heritage Program rank is "S?" in most of the other states where it occurs (NatureServe 2003).

Four-spotted skipperling (*Piruna polingi*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Adults rest with their wings closed, but bask with hindwings open wide and forewings open to about 45 degrees. Males patrol to find receptive females. Caterpillars live and feed within nests of webbed leaves. Caterpillar food plants are unknown, but are probably grasses, sedges, and rushes. Fully-grown caterpillars hibernate. Adults fly from June to August. Adults feed on flower nectar (Opler et al. 1995).

Distribution. The habitat of the four-spotted skipperling is generally moist meadows and streamsides in low to mid-elevation mountains. Rangewide, it is limited to a relatively few mountain ranges in Arizona, southwestern and south-central New Mexico, western Texas, and northern Mexico (Coconino National Forest 2000, Opler et al. 1995). In Arizona, it occurs in the Huachucas, Chiricahuas, and along the Mogollon Rim (Coconino National Forest 2000).

Status. The four-spotted skipperling is noted as absent from many apparently suitable areas, but found commonly in others. It is expected to occur in some additional ranges in Arizona. Its range in Mexico is not well known, and unlikely to become well known soon. This species is probably not globally secure and probably has under 100 metapopulations. The Natural Heritage Program global rank for this species is G3, which means it is uncommon or restricted with 21 to 100

occurrences and rather rare throughout a fairly wide range. The State ranks for Arizona and New Mexico are S?, which means its status is unknown in these states (NatureServe 2003).

Freeman's agave borer (Agathymus baueri freemani)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Eggs are laid singly on Agave chrysantha or A. mckelveyana (North American Butterfly Association Names Committee 2001). The eggs fall to the base of the plant. A young caterpillar crawls to a leaf tip and burrows inside where it eats pulp and then hibernates. In the spring, the caterpillar makes a new burrow in a leaf base where it feeds on sap until becoming inactive for the summer. Before pupating, the caterpillar enlarges the opening of its burrow and makes a silk trap door from which the adult can emerge (Opler et al. 1995). Adults fly from March until May (U.S. Forest Service 2000). Adult males sip moisture from mud; adult females never feed (Opler et al. 1995).

Distribution. Freeman's agave borers occupy open rocky slopes in high desertscrub, interior chaparral, and juniper grassland (U.S. Forest Service 2000) at 900 to 1,800 m (3,000 to 6,000 ft) where stands of Agave chrysantha or A. mckelveyana occur. Agave chrysantha has a small range and is endemic to central Arizona; A. mckelveyana has an equally small range and is endemic to west-central Arizona (Gentry 1982).

Status. Some authorities do not recognize Agathymus baueri freemani as a distinct taxonomic entity. The North American Butterfly Association Names Committee (2001) includes A. baueri as a subspecies of A. aryxna and gives no status to freemani. Opler et al. (1995) include baueri in what they call the A. aryxna Complex. Both the hosts and butterflys in the A. aryxna Complex are apparently secure globally (Opler et al. 1995); the status of the various subentities of the Complex is unknown.

Huachuca springsnail (*Pyrgulopsis thompsoni*)

Status:	Candidate, Sensitive
Forest Occurrence:	Coronado
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. As with most hydrobiid snails, the natural history and biology of Huachuca springsnails has not been investigated beyond gross descriptions of its habitat associations.

Distribution. Habitats of the Huachuca springsnail are typically marshy areas in plains grasslands, oak or pine-oak woodlands, and coniferous forests. They are typically found in the shallower areas of springs or cienegas, often in rocky seeps at the spring source (Arizona Game and Fish Department 1997, U.S. Fish and Wildlife Service 2003). Huachuca springsnails are known from 16 springs in southeastern Arizona and 2 springs in Sonora, Mexico (U.S. Fish and Wildlife Service 2003).

Status. The Huachuca springsnail is described as locally abundant within its very limited cienega habitats (Arizona Game and Fish Department 1997). Specific information on trends in habitat

conditions or populations is minimal, but does not indicate any imminent threat to the species' continued existence (U. S. Fish and Wildlife Service 2003).

Maricopa tiger beetle (Cicindela oregona maricopa)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The larval stage comprises the longest portion of the tiger beetle life cycle. The entrance to a larval burrow is flush with the surface of the ground and is clean and smooth. Larval burrows appear to be unoccupied when first seen. Larvae are very wary and quickly drop to the bottom of the burrow. Larvae also periodically plug the entrance to their burrow with soil, especially after eating, during rainy weather, during droughts, before hibernation or aestivation, before molting, and before pupation. Adults are generally active from March to mid-June and from September to mid-November. Tiger beetles generally feed on other insects (Arizona Game and Fish Department 2001).

Distribution. The Maricopa tiger beetle occurs most commonly on sandy stream banks and less commonly on gravels and clays along streambanks. In Arizona, it occurs throughout the central highlands below the Mogollon Rim at elevations of 330 to 2,120 m (1,100 to 6,940 ft) (Arizona Game and Fish Department 2001).

Status. Population trends for this tiger beetle are unknown.

Mountain silverspot butterfly (*Speyeria nokomis nitocris*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males patrol for receptive females, who walk on the ground to lay single eggs near violets that are the caterpillar host plants. The unfed first-stage caterpillars hibernate; in the spring they feed on leaves of the host. Adult butterflys are seen from late July to September. Adults feed on flower nectar, including that of thistles (Opler et al. 1995).

Distribution. This butterfly uses moist meadows, seeps, marshes, and streamsides where there are an abundance of violets (Coconino National Forest 2000). The species Speyeria nokomis has a distribution from eastern California through Nevada, Utah, Arizona, western Colorado and New Mexico, south into Mexico (Opler et al. 1995). The subspecies nitocris occurs along the Mogollon Rim, Mogollon Mountains, White Mountains, and into northern New Mexico (Coconino National Forest 2000).

Status. This subspecies has a Natural Heritage Program rank of S? (status unknown) in Arizona, New Mexico, and Colorado. It can be locally very common (NatureServe 2003).

Obsolete viceroy butterfly (*Limenitis archippus obsoleta*)

Status:	Sensitive
Forest Occurrence:	Coconino

Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males fly and perch among stands of the larval food plant to await females. Eggs are laid on the upperside tips of willow (Salix spp.) leaves. Young larvae eat catkins or leaves; mature larvae eat leaves. Larvae of the fall brood hibernate partially grown. They roll a leaf into a tube and attach the leaf petiole to the stem with silk. Feeding is resumed with the leafing out of the host in the spring. Pupae are shiny brown with a white abdomen. Adults fly from mid-April to mid-November in two or three broods. Adults rarely visit flowers; they prefer to feed at tree sap or dung (Arizona Game and Fish Department 2001).

Distribution. These butterflys are found in association with stands of willows along major water courses at elevations below 1,800 m (5,900 ft). Their total range includes southeastern Nevada, extreme southwestern Utah, much of Arizona, most of southern New Mexico, western Texas, and Sonora. They are widespread but local in Arizona (Arizona Game and Fish Department 2001).

Status. Population trends are unknown, but are thought to be declining throughout much of the range. Protection or restoration of riparian habitat will ensure survival of this butterfly (Arizona Game and Fish Department 2001).

Orange giant skipper (*Agathymus neumoegeni*)

Status: Sensitive
Forest Occurrence: Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Males perch near host plants from early morning to noon to wait for receptive females. Eggs are laid singly on Agave parryi. The eggs fall to the base of the plant. A young caterpillar crawls to a leaf tip and burrows inside where it eats pulp and then hibernates. In the spring, the caterpillar makes a new burrow in a leaf base where it feeds on sap until becoming inactive for the summer. Before pupating, the caterpillar enlarges the opening of its burrow and makes a silk trap door from which the adult can emerge. Adults fly from September to October. Adult males take moisture from mud or manure; adult females never feed (Opler et al. 1995).

Distribution. Orange giant-skippers occupy shrub-grasslands or open woodlands where stands of Parry agave occur. Rangewide, they occur from central Arizona to west-central New Mexico and from southern New Mexico to west Texas (Opler et al. 1995).

Status. The Natural Heritage Program global rank for this species is G4, which means it is apparently secure with more than 100 occurrences, though it could be quite rare in some parts of its range. However, the State ranks for Arizona, New Mexico, and Texas are all S? (status unknown) (NatureServe 2003).

White Mountains water penny beetle (*Psephenus montanus*)

Status: Sensitive
Forest Occurrence: Apache-Sitgreaves
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. First instar larvae develop about 2 weeks after eggs are laid. The larval stage includes several instars and lasts 1 to 2 years. Larvae disperse to all parts of the stream, but move

back close to the shoreline shortly before pupation. Larvae graze on diatoms and other algae that occur on rocks and pebbles in stream riffles. Pupation occurs beneath rocks or in other protected sites near the stream. Adults usually emerge from the pupal stage in 10 to 12 days. Peak emergence of adults occurs from about late June to early July, but can continue through early August. Adults of both sexes are short-lived, females for several days, males for 1 to 2 weeks. After mating, females crawl beneath partly submerged stones near the shoreline in riffle habitats where they spend the rest of their life (a few days) laying eggs (Arizona Game and Fish Department 1997).

Distribution. This species is restricted to cold fast-flowing streams in the White Mountains at about 2,500 m (8,200 ft) in elevation. The adults live in riffles within 1 m (3 ft) of the shoreline. The total range of this species is Three Forks and several nearby locals in the West and East Forks of the Black River in Apache and Greenlee counties, Arizona (Arizona Game and Fish Department 1997). In the project area, there are about 11 km (7 mi) of occupied habitat on U.S. Highway 191.

Status. Further surveys are needed to obtain more information about distribution, abundance, and threats to this species. Searches should be done by riffle beetle experts because members of this family are typically distributed patchily in various microhabitats and are difficult to find (Arizona Game and Fish Department 1997).

Effects Analysis for Sensitive Invertebrates

The project area includes only a tiny fraction of the suitable habitat for any of these 14 sensitive invertebrates and most of the project activity (about 70 percent) will be to manage hazardous vegetation in the highway clear zone (1.5 m or 5 ft) directly adjacent to the pavement apron. This area is already highly disturbed from vehicles and highway maintenance activities. It provides little suitable habitat for any of these 14 sensitive invertebrates. Herbicide use in the right-of-way beyond the clear zone will be limited to spot applications or small-area applications to control specific noxious weeds infestations that ADOT has identified through surveys. If any of these infestations are in suitable habitat for any of these 14 sensitive invertebrates, then surveys will be done to determine if sensitive species are present before applying herbicides. If sensitive species are found in any proposed treatment areas, then buffer zones will be applied and alternative treatment measures will be used within the buffer zone and occupied habitat. The Forest Service has agreed in the interagency MOU to identify occupied habitats and any suitable habitats that might need surveys. These measures should greatly reduce the possibility of herbicide application in occupied habitats of any of these 14 sensitive species.

Most of the herbicides proposed for use in this program have low toxicity to terrestrial invertebrates. The exceptions are some formulations of 2,4-D and pendimethalin that may present an unacceptable risk to terrestrial invertebrates. ADOT estimates that about 2,000 ha (5,000 ac) would be considered for herbicide treatment in any one year, which is about 2 percent of the potential herbicide treatment area. This means that most parts of the project area will be treated infrequently, if at all. Treated areas will receive herbicide applications only once per year. Herbicide applications that are infrequent and targeted at specific limited areas (there will be no applications to aquatic habitats) greatly reduce the possibility of harm to any of the sensitive terrestrial invertebrates.

Five of the sensitive invertebrates live in or near aquatic habitats. As a standard mitigation measure for this project, no herbicides will be applied to wetands, streams, or other bodies of water. A buffer zone of at least 10 m (30 ft) on relatively level ground, greater on slopes, will be placed around wetlands, streams, or other bodies of water. If any noxious weeds control or hazardous vegetation management is needed in the terrestrial buffer zones established around aquatic habitats, the only herbicides used will be those labeled for aquatic uses. And, as already stated, these herbicides will be applied only on land and never directly to water.

Food sources for the nine terrestrial invertebrates are agaves (for three species), violets (for two species), wild buckwheat, cliffrose, and willow. None of the noxious weeds targeted for control in this project are closely related to any of these plants. In the long run, the host plants will benefit from the removal of noxious weeds and habitat for the nine terrestrial invertebrate sensitive species should be improved.

Effects Determination for Sensitive Invertebrates

Only a small fraction of the suitable habitat for any of the 14 sensitive invertebrates is within the project area. Surveys and buffer zones that are part to the mitigations and BMPs for this project will greatly reduce the possibility of herbicides being applied in occupied habitat. Most of the herbicides being used have a low risk of harm to invertebrates when applied with the frequency and methods proposed for the project. Even with the precautions taken, a low risk remains for adverse effects to some of the sensitive terrestrial invertebrates. However, given the very small treatment areas relative to the suitable habitat, any harm to sensitive terrestrial invertebrates should be slight. We, therefore, conclude that this program of herbicide use will not reduce population viability or harm any of these 14 Forest Service Sensitive invertebrates in a way that would increase their likelihood of trending toward Federal listing.

Plants

Arizona alumroot (Heuchera glomerulata)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is an herbaceous perennial that grows from a large, somewhat woody, scaly caudex. I flowers in May (Kearney et al. 1951). Very little is known about the biology of this rare plant.

Distribution. This plant grows on shaded rocky slopes at about 1,980 m (6,500 ft) in elevation (Kearney et al. 1951). It occurs in Cochise, Gila, Graham, and Greenlee counties, Arizona, and Hidalgo County, New Mexico (Arizona Game and Fish Department 2003, NatureServe 2003). It occurs in the project area at two occupied sites along perhaps 3.2 km (2 mi) of suitable habitat along U.S. Highway 191.

Status. This species has a Natural Heritage Program rank of G3. Species with this rank are considered uncommon or restricted with 21 to 100 occurrences. They are either rather rare throughout a fairly wide range or fairly common in a rather restricted range. This plant grows on rock outcrops where few disturbances are expected.

Arizona sneezeweed (*Helenium arizonicum*)

Status: Sensitive
Forest Occurrence: Apache-Sitgreaves, Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is an herbaceous perennial that flowers from July to September. Very little is known about the biology of this rare plant.

Distribution. This species is found along roadsides and clearings in ponderosa pine up to spruce-fir forests at elevations ranging from 2,130 to 2,740 m (7,000 to 9,000 ft). It prefers bogs, meadows, or other moist highly productive areas. It is known only from central Arizona from near Flagstaff to near Heber in Coconino, Yavapai, Gila, and Navajo counties. It occurs in the project area along Arizona Highway 260 on the Coconino and Apache-Sitgreaves NFs.

Status. This plant can be relatively abundant in seasonally wet depressions during wet years. It has persisted at some known localities for decades. Although this plant is endemic to central Arizona, there are numerous localities for this plant within its range.

Arizona willow (*Salix arizonica*)

Status: Sensitive
Forest Occurrence: Apache-Sitgreaves
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. The Arizona willow is a shrub with a growth habit that ranges from a large hedge to a prostrate mat. Leaves are shiny, about 3.5 to 4 cm long. Young stems are bright red (NatureServe 2003). It reproduces sexually from catkins and asexually from rhizomes

Distribution. This plant grows in sedge meadows and wet drainages in subalpine coniferous forest at 3,050 to 3,400 m (10,000 to 11,200 ft) in elevation. It occurs in northern New Mexico, eastern Arizona, southern Utah, and southern Colorado (Mygatt 1999). It occurs in the project area for about 1.6 km (1 mi) along Arizona Highway 273.

Status. The Arizona willow was proposed for Federal listing as an endangered species with critical habitat in 1992. At that time it was known only from Mount Baldy in east-central Arizona. New populations discovered in southern Utah in 1994 expanded the known range and the Arizona willow was withdrawn from listing in April 1995. Specimens identified as Salix arizonica (by R. Dorn and D. Atwood) were collected from New Mexico in 1995 to 1996 further expanding its range to the north-central mountains of New Mexico (Mygatt 1999). It was subsequently discovered at several locations in southern Colorado and at additional sites in southern Utah. Most populations are in remote areas away from roads or other development.

Beardless cinchweed (*Pectis imberbis*)

Status: Sensitive
Forest Occurrence: Coronado
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a perennial herb that grows from a woody root. It flowers in August through October in response to rains. Very little is known about the biology of this rare plant (Arizona Game and Fish Department 1998).

Distribution. This plant grows in grasslands and oak/grasslands at 1,220 to 1,680 m (4,000 to 5,500 ft) in elevation (Arizona Rare Plant Committee 2002). It is adapted to disturbance and grows along road cuts. It has an extremely broad range (Arizona Game and Fish Department 1998). It has been recorded at nine sites in Cochise, Pima, and Santa Cruz counties. It is also found in northern Sonora and Chihuahua, Mexico (Arizona Rare Plant Committee 2002). It has been recorded in the project area at one site along Arizona Highway 83.

Status. This species is considered to be the rarest Pectis in the U.S. Several locations on the Coronado NF have not been seen since the late 1970s. Populations are small, ranging from 20 to 30 individuals to a maximum of 100 (Arizona Rare Plant Committee 2002).

Blumer's dock (Rumex orthoneurus)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves, Coronado, Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a long-lived herbaceous perennial plant with a creeping rootstock (rhizomes). It flowers from late July to mid-August and sets seed in late August (Arizona Game and Fish Department 2002).

Distribution. This plant grows in moist organic loamy soils in mid- to high-elevation wetlands at 1,370 to 2,950 m (4,480 to 9,660 ft) (Arizona Game and Fish Department 2002). It is known from about 50 sites in Arizona in the central, east-central, and southeastern parts of the State (Arizona Rare Plant Committee 2002). It occurs in New Mexico from the Gila Wilderness in the southwest to the Pecos Wilderness in the north-central part of the State. It occurs in the project area for about 29 km (18 mi) along U.S. Highway 191 and Arizona highways 260, 261, and 273 on the Apache-Sitgreaves NF; at one site along State Highway 366 on the Coronado NF; and for about .8 km (.5 mi) along Arizona Highway 288 on the Tonto NF.

Status. Blumer's dock was once believed to be a rare endemic plant known from a few wetland sites in the Chiricahua Mountains. Subsequent surveys and taxonomic studies expanded this range to include much of Arizona and New Mexico. The plants grow only in wetlands, which are often sensitive to disturbance, and they are grazed by livestock. Plants grow in two wilderness areas in New Mexico that have no grazing and some other sites have been protected from grazing.

Chiricahua mountain brookweed (*Samolus vagans*)

Status:	Sensitive
Forest Occurrence:	Coronado
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. Chiricahua Mountain brookweed is an aquatic herbaceous perennial. The stems usually prostrate or arching, but sometimes can be stoloniferous or mat-forming. It can flower from April through October. Very little is known about the biology of this rare plant (Arizona Game and Fish Department 1999).

Distribution. This plant grows at springs, seeps, and along streams. It occurs in Cochise, Pima, and Santa Cruz counties, Arizona, and in Chihuahua and Sonora, Mexico (Arizona Game and Fish Department 1999). In the project area, it occurs in aquatic habitats that are less than 3.2 km (2 mi) downstream from State Highway 83

Status. This species is confined to areas with permanent water, but apparently does well in suitable habitat. It is sensitive to activities that degrade or destroy wetlands.

Fish Creek rock daisy (*Perityle saxicola*)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a slender perennial herb with a woody base and herbaceous branches. Local conditions of drought and/or shade may affect the morphology of individual plants, especially leaf size and degree of leaf dissection. It flowers and sets seed from May to June (Arizona Game and Fish Department 1992).

Distribution. This plant grow on rocky slopes and cliffs of canyons and buttes. Substrates are Barnes conglomerate, Mescal limestone, or quartzite. The habitat is very xeric. This plant is a narrow endemic with few localities known. It is sporadic to common in Tonto National Monument and sporadic near Roosevelt Dam. It may occur in the Superstition Wilderness and elsewhere in the Sierra Ancha Mountains. In the project area, it occurs near State Highway 88 near Roosevelt Dam (Arizona Rare Plant Committee 2002).

Status. This plant grows on rock outcrops that are reasonably secure from most disturbances. Potential threats are dam, road, and trail construction (Arizona Rare Plant Committee 2002).

Flagstaff beardtongue (*Penstemon nudiflorus*)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a perennial herb 0.5 to 1.0 m (20 to 40 in) tall with leathery leaves and lavender flowers. It flowers in the summer (Kearney et al. 1951). Little is known about the biology of this rare plant.

Distribution. The species grows on dry slopes in the ponderosa pine forest on light, dry neutral soils in eroded or mountainous lands south of the Grand Canyon at 1,370 to 2,130 m (4,500 to 7,000 ft) in elevation (Kearney et al. 1951). It occurs only in north-central Arizona in Coconino, Gila, Navajo, and Yavapai counties (Arizona Game and Fish Department 2003). It occurs in the project area for about 1.6 km (1 mi) along Arizona Highway 87.

Status. This species has a fairly broad range south of the Grand Canyon, but it is uncommon throughout. Population trends are unknown.

Gila groundsel (*Senecio quarens*)

Status:	Sensitive

Forest Occurrence: Apache-Sitgreaves
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is an herbaceous perennial that reproduces only from seed. It flowers in early spring, perhaps into the summer. The seeds, which have a pappus of numerous white capillary bristles are wind dispersed (Arizona Game and Fish Department 2002).

Distribution. This plant grows in wet meadows and stream banks in upper montane coniferous forest at 2,450 to 2,750 m (8,000 to 9,000 ft) in elevation. It is found in the White Mountains in Arizona and in the Mogollon and San Francisco mountains in adjacent New Mexico (Sivinski 1999). It occurs in the project area for about 10 km (6 mi) along U.S. Highway 191 and Arizona Highway 273.

Status. Senecio quaerens is sympatric and sometimes difficult to distinguish from S. hartianus, which grows in somewhat dried habitats. Intermediate forms may be hybrids with problematic identities (Sivinski 1999). Problems with certain identification make it difficult to evaluate the status of this species. It is likely sensitive to activities that damage or destroy wetland habitats.

Goodding's onion (*Allium gooddingii*)

Status: Sensitive
Forest Occurrence: Apache-Sitgreaves
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is an herbaceous perennial plant that reproduces from seed and from bulbils that arise from division of the rhizomes. Plants begin growing in late spring following snow melt. It flowers from June through August and sets seed from July through September. Seeds germinate readily. It may be locally abundant at certain sites and dominate the herbaceous understory (Arizona Game and Fish Department 1999).

Distribution. This plant grows in moist shaded canyon bottoms in climax conifer forests at 2,140 to 3,450 m (7,000 to 11,300 ft) in elevation. It generally does not occur in meadows though it may be found in semi-open situations along the edge of large clearings or bordering streams. This plant occurs in southern Arizona and New Mexico. It occurs in the White and Santa Catalina mountains in Arizona, and in the Mogollon and Sacramento mountains in New Mexico (Arizona Game and Fish Department 1999). It occurs in the project area for about 0.8 km (0.5 mi) along U.S. Highway 191, although it was not found in a recent search on Hannagan Creek.

Status. There are numerous sites for this plant in the White Mountains of Arizona and the adjacent Mogollon Mountains in New Mexico. Most sites are in remote areas away from roads. Populations appear to be healthy and stable. Management concerns for this species are logging that can remove the canopy and lead to drying-out a site and possibly livestock grazing because plants are very palatable. Many sites are in locations where logging and/or heavy grazing are unlikely to occur.

Haulapai milkwort (*Polygala rusbeyi*)

Status: Sensitive
Forest Occurrence: Coconino, Prescott
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a low sub-shrub 5 to 15 cm (2 to 6 in) tall. The plants bloom in April through July. Little is known about the biology of this rare plant.

Distribution. This species grows on limestone substrates in desert grassland and juniper woodlands. In some areas it occurs on the Verde Formation, which is formed from gypseous limestone lakebed deposits that support several other endemic plant species. It occurs only in northern and central Arizona at elevations of 1,070 to 1,520 m (3,500 to 5,000 ft). The distribution of the species ranges from near Peach Springs on the Hualapai Reservation to areas of the Verde Valley near Camp Verde and Montezuma Castle National Monument. It occurs on Verde Formation soils in the project area. These soils also support heartleaf wild buckwheat, Mearns sage, and Ripley wild buckwheat, which are sensitive species, and Arizona cliffrose, which is endangered. The sites for Hualapai milkwort in the project area are along U.S. Highway 89a near Cottonwood and State Highway 260 both on the Coconino NF, and along State Highway 279 on the Prescott NF.

Status. This species has a Natural Heritage Program rank of G3/S3. Species with this rank are considered uncommon or restricted with 21 to 100 occurrences. They are either rather rare throughout a fairly wide range or fairly common in a rather restricted range.

Heathleaf wild buckwheat (*Eriogonum ericifolium* var. *ericifolium*)

Status:	Sensitive
Forest Occurrence:	Coconino, Prescott
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a low subshrub with spreading branches. It flowers in the late summer to fall. Little is known about the biology of this rare plant.

Distribution. This taxon is endemic to soils of the Verde Formation, which are formed from gypseous limestone lakebed deposits. It occurs only in the Verde Valley (Arizona Rare Plant Committee 2002). The Verde formation supports several other endemic plant species that include Haulapai milkwort, Mearns sage, and Ripley wild buckwheat, which are sensitive, and Arizona cliffrose, which is endangered. The sites for heathleaf wild buckwheat in the project area are along U.S. Highway 89a near Cottonwood and State Highway 260 both on the Coconino NF, and along State Highway 279 on the Prescott NF.

Status. This plant can be abundant within its limited range. Surveys in 1976 found thousands of plants in the Camp Verde vicinity. Urbanization of the Verde Valley may cause local extirpations due to habitat loss and fragmentation (Arizona Rare Plant Committee 2002).

Hohokam agave (*Agave murpheyi*)

Status:	Sensitive
Forest Occurrence:	Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a succulent perennial that grows for many years before flowering. Elongation of flower stalks starts in winter. Plants flower from March to July but the flowers soon abort, thus few seeds are produced. Bulbils are produced on the flower stalks and may take root after the stalk falls if there has been ground disturbance; few bulbils root successfully if not aided.

The primary mode of reproduction is by rhizomatous offsets called “pups” (Arizona Game and Fish Department 2003).

Distribution. Plants are usually found on benches or alluvial terraces on gentle bajada slopes above major drainages in desertscrub. They are usually associated with pre-Colunbian settlement features. The total distribution is from central Arizona to Sonora, Mexico. The Tohono O’odham and ranchers in Sonora continue to cultivate the plant. In Arizona, the plants are found at about 60 sites at elevations of 400 to 980 m (1,300 to 3,200 ft) in foothills north and east of the Phoenix metropolitan area (Arizona Game and Fish Department 2003). It occurs in the project area for about 2.9 km (1.8 mi) along Arizona Highway 188 and for about 1.0 km (0.6 mi) along Arizona Highway 88.

Status. This plant is found at about 60 sites and there are relatively few individual plants. The greatest threat is habitat loss due to urban sprawl and development. Direct impacts should be avoided but little management is required (Arizona Game and Fish Department 2003).

Kaibab bladderpod (Lesquerella kaibabensis)

Status:	Sensitive
Forest Occurrence:	Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a perennial herb with a thickened caudex. It flowers and fruits in June (Arizona Game and Fish Department 2003). Little is known about the biology of this rare plant.

Distribution. It grows at (8,400 to 8,800 ft) in elevation in open sub-alpine grassland meadows on limestone knolls that have a high percentage of exposed surface rock. This species is endemic to the Kaibab Plateau north of the Grand Canyon. Most of the known habitat for this species is in meadows and on the road shoulders along Arizona Highway 67 (Arizona Game and Fish Department 2003).

Status. Poulation trends for this plant are unknown, but are probably stable (Arizona Game and Fish Department 2003).

Kaibab paintbrush (Castilleja kaibabensis)

Status:	Sensitive
Forest Occurrence:	Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a perennial herb that flowers from early July until the end of the growing season. Species in the genus Castilleja are semi-parasites; they require a host plant for water and nutrient uptake, but carry-on their own photosynthesis. Little is known about the biology of this rare plant (Arizona Game and Fish Department 1992).

Distribution. The range of this species is limited to De Motte Park, Pleasant Valley, Upper Little Park and other small nearby parks at elevations of 2,500 to 2,740 m (8,200 to 9,000 ft) on the Kaibab Plateau north of the Grand Canyon. The soils consist of fine silts and clay, to rocky gravelly meadow soils derived from weathered Kaibab limestone. Populations occur in the driest, most exposed sites in open meadows on rounded ridge tops and small knolls relatively free from

competition with forbs and grasses. It occurs in the project area in meadows along Arizona Highway 67 (Arizona Game and Fish Department 1992).

Status. Poulation trends for this plant are unknown, but are probably stable. Many hundreds of thousands of plants occur in an 8 to 10 km (5 to 6 mi) stretch of DeMotte Park (Arizona Game and Fish Department 1992).

Kaibab pincushion cactus (*Pediocactus paradenei*)

Status:	Sensitive
Forest Occurrence:	Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a small green single-stemmed globose cactus usually no more than 4.0 cm (1.6 in) tall above ground, with half of its stem underground. It retracts into the soil during periods of drought and becomes slightly covered with soil and pebbles. Plants begin flowering at about 10 years of age and may live for about 40 to 50 years. Flowering generally occurs in late April with 1 to 2 fruits produced per plant and each fruit having 12 to 15 seeds. A plant can produce about 500 seeds in its life-span, which is a very low reproductive potential. Seeds fall at the base of the parent plant with no apparent adapterion for dispersal (Arizona Game and Fish Department 1999).

Distribution. This cactus grows in gravelly limestone soils. Plants are preferentially associated with grass (blue grama), often occurring within grass clumps. When associated with sagebrush, it grows in grassy openings within open sagebrush stands. It is known exclusively from the eastern slopes of the Kaibab Plateau (East Kaibab monocline) and small portions of adjoining House Rock and Coyote valleys at elevations of 1,530 to 2,200 m (5,000 to 7,200 ft). The entire distribution of this species is an area about 24 km (15 mi) north-to-south and 3 to 5 km (2 to 3 mi) east-to-west (Arizona Game and Fish Department 1999). It occurs in the project area along U.S. Highway 89a from just west of the top of the switchbacks to Trail Canyon.

Status. Monitoring done 1989 through 92 showed some downward population trends. Surveys for this cactus are difficult because plants retract into the soil and are hard to see in grass clumps. Management concerns are loss of habitat to shrub and woodland invasion, high mortality from excessively hot fires, jackrabbit herbivory, livestock trampling, and cactus collecting (Arizona Game and Fish Department 1999).

Mearns sage (Salvia dorrii ssp. mearnsii)

Status:	Sensitive
Forest Occurrence:	Coconino, Prescott
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a small woody shrub with a low spreading habit. It flowers April to May and then during the summer as conditions are favorable. It sets seed from May onward. Little is known about the biology of this rare plant (Arizona Game and Fish Department 2002).

Distribution. This taxon grows in soils of the Verde Formation, which are formed from gypseous limestone lakebed deposits. It also grows in red-brown clay and sandy soils of the Supai/Hermit Formation. The Verde formation supports several other endemic plant species that include

Haulapai milkwort, Heathleaf wild buckwheat, and Ripley wild buckwheat, which are sensitive, and Arizona cliffrose, which is endangered. This plant occurs in central Arizona in the Verde Valley, upper Verde River, and near Sedona (Arizona Game and Fish Department 2002). The sites for Mearns sage in the project area are along U.S. Highway 89a near Cottonwood and State Highway 260 both on the Coconino NF, and along State Highway 279 on the Prescott NF.

Status. Population trends for this plant are not known. Scattered colonies, sometimes with hundreds of plants, occur in localized habitats (Arizona Game and Fish Department 2002).

Mogollon paintbrush (*Castilleja mogollonica*)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a perennial herb that begins above-ground growth in mid-summer. It flowers from late June through August and sets seed from mid-July through September (Arizona Game and Fish Department 1992). Species in the genus Castilleja are semi-parasites; they require a host plant for water and nutrient uptake, but carry-on their own photosynthesis. Little is known about the biology of this rare plant.

Distribution. This plant grows in subalpine meadows within mixed conifer forest at 2,590 to 2,900 m (8,500 to 9,500 ft) in elevation. It grows in moderately drained sites within wet grassy meadows and cienegas associated with permanent or intermittent creeks. It is endemic to the White Mountains of east-central Arizona (Arizona Game and Fish Department 1992). It occurs in the project area for about 5 km (3 mi) along Arizona Highway 273.

Status. Between 17,000 and 20,000 plants were estimated in 1992 to occur in 10 of the 12 known populations occurring over 18.7 km (11.6 mi) of stream habitat. Past impacts have extirpated at least 24 percent of the species historic habitat and fragmented extant populations on the Apache-Sitgreaves NF (Arizona Game and Fish Department 1992).

Mt. Dellenbaugh sandwort (*Arenaria aberrans*)

Status:	Sensitive
Forest Occurrence:	Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is an herbaceous perennial species 5 to 13 cm (2 to 5 in) tall with a somewhat woody caudex. Very little is known about the biology of this rare plant.

Distribution. The habitat of the species includes pine-oak forests and meadows. It is known only from northern and north-central Arizona. The species has been collected north of Williams, at the South Rim of Grand Canyon and in De Motte Park on the North Kaibab Ranger District. It occurs in the project area along Arizona Highway 67 in meadows

Status. Population trends for this rare plant are unknown.

Ripley wild buckwheat (*Eriogonum ripleyi*)

Status:	Sensitive

Forest Occurrence: Coconino, Prescott
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is a woody mat-forming subshrub that grows 5 to 20 cm (2 to 8 in) tall with numerous branches. Branches splaying on the ground will root at the nodes. It flowers April through June (Arizona Game and Fish Department 1997).

Distribution. This species grows in heavy calcareous soils, in sandy clay soils on the edge of limestone mesas, and in volcanic tuffs and ashes and redeposited limestone to sandy clay (Arizona Game and Fish Department 1997). This includes soils of the Verde Formation that support several other endemic plant species that include Haulapai milkwort, Heathleaf wild buckwheat, and Mearns sage, which are sensitive, and Arizona cliffrose, which is endangered. The species occurs at disjunct locations from Peach Springs to Horseshoe Lake. The sites for Ripley wild buckwheat in the project area are on Verde Formation soils along U.S. Highway 89a near Cottonwood and State Highway 260 both on the Coconino NF, and along State Highway 279 on the Prescott NF.

Status. The horseshoe lake and Cottonwood populations each have thousands of plants. Based on the preference of this plant for several different specific soil associations, there are large areas of potential habitat (Arizona Game and Fish Department 1997).

Rock fleabane (Erigeron saxatilis)

Status: Sensitive
Forest Occurrence: Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is an herbaceous perennial plant. It flowers from April through October, especially May through June (Arizona Game and Fish Department 1997). Very little is known about the biology of this rare plant.

Distribution. This plant grows on sheer canyon walls, moist north-facing slopes, steep solid rock, and bedrock outcrops. It grows in canyons above the Mogollon Rim in Coconino and Yavapai counties; these canyons include Oak Creek Canyon, West Fork of Oak Creek Canyon, Sycamore Canyon, Walnut Canyon, Little Elden Spring, East Cleer Creek, Barbershop Canyon, and Tule Canyon (Arizona Game and Fish Department 1997). It occurs in the project area along U.S. Highway 89a in Oak Creek Canyon.

Status. The population trend for this plant appears to be stable. Plants of all size classes from seedlings to adults are present in populations that vary in number from a few plants to over 300. It is fairly abundant with most populations occurring on inaccessible cliffs. Several populations are in wilderness areas or in Walnut Canyon National Monument

Rusbyi's milkvetch (*Astragalus rusbyi*)

Status: Sensitive
Forest Occurrence: Coconino
Effects Finding: Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is an herbaceous perennial. It flowers and fruits from June to September (Arizona Rare Plant Committee 2002). Very little is known about the biology of this rare plant.

Distribution. This plant occurs in openings or meadows in ponderosa pine forests or at the edges of thickets and aspen groves on dry basaltic soils at elevation of mostly 2,130 to 2,440 m (7,000 to 8,000 ft) down to 1,650 m (5,400 ft) in Oak Creek Canyon. It occurs in the Flagstaff area and the lower slopes of the San Francisco Peaks descending into Oak Creek Canyon (Arizona Rare Plant Committee 2002). It may occur in the project area along U.S. Highway 180 north of Flagstaff.

Status. Population trends for this rare plant are unknown.

Sunset Crater beardtongue (*Penstemon clutei*)

Status:	Sensitive
Forest Occurrence:	Coconino
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is an herbaceous perennial. It flowers from June through September. Hummingbirds, carpenter bees, and bumblebees are principal pollinators. Populations contain a variety of age classes of plants indicating regular recruitment. Fire that removes accumulated litter appears to favor this species (Phillips et al.1980).

Distribution. This plant grows in volcanic cinders composed of raw olivine basalt in ponderosa pine forest. It is known only from the cinder hills area northeast of Flagstaff. There are several discontinuous populations surrounding Sunset Crater National Monument. It may occur in the project area along U.S. Highway 89 north of Flagstaff (Phillips et al.1980).

Status. This plant can be abundant within its limited habitat. Its population trend is stable.

Supine bean (Macroptilum supinum)

Status:	Sensitive
Forest Occurrence:	Coronado
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a prostrate perennial herb that grows from an elliptical tuber. It flowers and sets fruit after the onset of summer rains in July and may continue into early October depending on the amount of available moisture. This plant has both aboveground and subterranean flowers. The subterranean flowers are self-fertilizing and grow under the leaf litter or rocks. These “preplanted” seeds account for most of the seed production (Arizona Game and Fish Department 1999).

Distribution. This plant grows on ridge tops and gentle slopes of rolling hills in semi-desert grassland or grassy openings in oak-juniper woodland. It occurs in Santa Cruz County, Arizona, and the states of Sonora and Nayarit, Mexico. There are 12 known sites in the U.S. in the Atascosa-Pajarito, San Luis, and Patagonia mountains, and the southern portion of the Santa Cruz River drainage (Arizona Game and Fish Department 1999). In the project area, it occurs within

61 m (200 ft) of the highway right-of-way on U.S. Highway 82 where the highway passes through the edge of the Coronado NF south of Patagonia.

Status. There are presently 12 known sites in the U.S. that range from about 20 plants to about 3,500. Population numbers in Mexico are unknown. A population in the Atascosa Mountains monitored from 1989 through 1993 declined 43 percent for unknown reasons (Arizona Game and Fish Department 1999).

Tonto Basin agave (*Agave delameteri*)

Status:	Sensitive
Forest Occurrence:	Coconino, Tonto
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a succulent perennial that blooms once after many years of vegetative growth and then dies. Flowering stalks mature in late June through July. Flowers usually abort early. Seed capsules and seeds are not known. This plant produces rhizomatous off-sets prolifically, which are the only form of reproduction. There is virtually no variation among individual plants and clones may be hundreds of years old (Arizona Game and Fish Department 2003).

Distribution. This plant occurs on open hilly slopes in Sonoran desertscrub at about 670 to 1,560 m (2,190 to 5,100 ft) in elevation. All known plants occur in direct or indirect association with pre-Columbian settlement features suggesting that it was once cultivated. Clones occur in central Arizona in a northwest to southeast line from the Verde Valley to San Carlos Reservoir (Arizona Game and Fish Department 2003). It may occur in the project area along Interstate Highway 17 and Arizona Highway 260 in the verde Valley on the Coconino NF. It is known to occur for about 0.8 km (0.5 mi) along Arizona Highway 288 and for about 1.1 km (0.7 mi) along Arizona Highway 188 on the Tonto NF.

Status. This plant is known from about 90 isolated clones. The greatest concentration of sites occurs near the northwest end of Roosevelt Reservoir in an area called the Tonto Basin (Arizona Game and Fish Department 2003). With only asexual reproduction, there is little potential for this plant to disperse to new locations

Tusayan rabbitbrush (*Chrysothamnus molestus*)

Status:	Sensitive
Forest Occurrence:	Kaibab
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This plant is a perennial sub-shrub with a life span of 30 years or more. It reproduces vegetatively by tillering. It flowers in late summer and sets fruit in early fall. Seedlings are rarely seen, but good seedling production was observed in a study conducted when there was an exceptionally wet winter indicating perhaps that seedling establishment is episodic. Soil disturbance benefits plant establishment (Arizona Game and Fish Department 1993).

Distribution. Plants grow in open areas where there is little other competing vegetation. The vegetation varies from desert shrubs and grasses, to desert shrub-grassland with occasional junipers, to open pinyon-juniper woodland. Elevations range from 1,620 to 2,010 m (5,300 to

6,600 ft). This species has three known population centers. These centers are in western Coconino County south of the Grand Canyon, in central Coconino County from north of the San Francisco Peaks to the south rim of the Grand Canyon, and in west-central Apache and east-central Navajo counties north of Petrified Forest National Park (Arizona Game and Fish Department 1993). This plant occurs along U.S. Highway 180 in the project area.

Status. This plant is known from 34 occurrences. Most sites range in size from less than 0.4 ha to 2.0 ha (less than 1.0 ac to 5.0 ac). A few colonies are 10 to 20 ha (25 to 50 ac). This plant is very palatable to cattle, elk, and possibly sheep, and may be heavily grazed (Arizona Game and Fish Department 1993).

White Mountain clover (Trifolium longipes spp. neurophyllum)

Status:	Sensitive
Forest Occurrence:	Apache-Sitgreaves
Effects Finding:	Not likely to reduce viability or cause a trend toward Federal listing

Natural History. This is an erect or decumbent herbaceous perennial plant 14 to 60(-80) cm tall. It flowers late July to September.

Distribution. This plant grows in wet meadows, around springs, and along riparian corridors in montane coniferous forest at 1,950 to 2,750 m (6,500 to 9,000 ft) in elevation (Ladyman 1999). It occurs in the White Mountains of east-central Arizona and in the Mogollon Mountains of southwestern New Mexico (Ladyman 1999). It occurs in the project area for about 3.2 km (2 mi) along U.S. Highway 191.

Status. There are about 19 known sites in Arizona and 20 in New Mexico. Grazing pressures modify the growth habit. Plants in intensely grazed areas are prostrate rather than erect and have very few flowering stems (Ladyman 1999).

Effects Analysis for Sensitive Plants

Even though many of these 27 sensitive plants have very limited distributions, the project area includes only a small part of the suitable habitat for any of them. Most of the herbicide use in the project area (about 70 percent) will be to manage hazardous vegetation in the highway clear zone (1.5 m or 5 ft) directly adjacent to the pavement apron. This area is already highly disturbed from vehicles and highway maintenance activities. It provides no suitable habitat for most of these sensitive plants and poor-quality habitat for just a few of them. Herbicide use in the right-of-way beyond the clear zone will be limited to spot applications or small-area applications to control specific noxious weeds infestations that ADOT has identified through surveys. Because the sensitive plants are restricted to specific habitats within relatively small ranges, it will usually be easy to determine which noxious weeds infestations are in sensitive plant habitats, thus necessitating surveys before doing herbicide spraying. The Forest Service has agreed in the interagency MOU to identify occupied habitats and any suitable habitats that might need surveys. If sensitive plants are found in any proposed treatment areas, then buffer zones will be applied and alternative treatment measures will be used within the buffer zone and occupied habitat. These measures should greatly reduce the possibility of herbicide application in occupied habitats of any of these 27 sensitive species.

ADOT estimates that about 2,000 ha (5,000 ac) would be considered for herbicide treatment in any one year, which is about 2 percent of the potential herbicide treatment area. This means that most parts of the project area will be treated infrequently, if at all. Treated areas will receive herbicide applications only once per year. Herbicide applications that are infrequent and targeted at specific limited areas (there will be no applications to aquatic habitats) greatly reduce the possibility of harm to any of the sensitive plants.

Some noxious weeds have the potential to spread into sensitive plant habitats. Thus, early intervention to control small noxious weeds infestations before the weeds become established over large areas has the potential to greatly benefit sensitive plants.

Effects Determination for Sensitive Plants

Only a small part of the suitable habitat for any of the 27 sensitive plants is within the project area. Surveys and buffer zones that are part to the mitigations and BMPs for this project will greatly reduce the possibility of herbicides being applied in occupied habitats. The control of noxious weeds before they spread into natural habitats away from roadways will benefit sensitive plants. We, therefore, conclude that this program of herbicide use will not reduce population viability or harm any of these 27 Forest Service Sensitive plants in a way that would increase their likelihood of trending toward Federal listing.

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Decision Notice
And
Finding Of No Significant Impact

Management Of Noxious Weeds And Hazardous Vegetation On Public Roads On National Forest Systems Lands In Arizona

USDA Forest Service, Southwestern Region
Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests, Arizona

Introduction

A proposal to authorize the Arizona Department of Transportation (ADOT) to use herbicides to control noxious weeds, invasive plants, and hazardous vegetation along public roads on National Forest System (NFS) lands in Arizona was analyzed in an Environmental Assessment (EA). Treatment of noxious weed infestations within road easements and extending up to 200 feet outside of road easements onto NFS lands was included in the analysis. The EA describes two alternatives: (1) No Action and (2) the Proposed Action to use herbicides. Under the No Action Alternative, herbicides would not be used on public roadways on NFS lands except on U.S. Department of Transportation (USDOT) easements where the USDOT has the authority to approve herbicide use. ADOT and other Public Road Authorities would continue to implement herbicide treatment programs on about 6,000 miles of roadways outside NFS lands, and ADOT would continue to use mechanical, manual, and site rehabilitation vegetation management methods which are authorized on NFS lands. Under the Proposed Action, it is estimated that about 5,000 acres out of approximately 170,100 acres, which is 3 percent of rights-of-way and adjacent areas, would be treated annually along about 2,700 miles of public roads that pass through NFS lands.

Decision and Rationale

I have decided to implement the proposed action to authorize ADOT to use herbicides to control noxious weeds, invasive plants, and hazardous vegetation on public roads on NFS lands in Arizona. Approved herbicides include: 2,4-D, chlorsulfuron, clopyralid, dicamba, fluroxypyr, glyphosate, imazapic, imazapyr, isoxaben, methsulfuron methyl, pendimethalin, picloram, sethoxydim, sulfometuron methyl, tebuthiuron, and triclopyr.

Principles of adaptive management and managerial flexibility will be used during projects. These are tools that allow decision makers to take advantage of new information that becomes available after a decision has been made. It is possible that a new product, approved and labeled by the US Environmental Protection Agency, could become available during implementation. If implementation monitoring shows that the herbicides analyzed in the EA are not effective in meeting the purpose and need and a new or improved product is available, the new product could be considered for use without further analysis. This would be the case only if the new or improved product fits within the same effects analysis disclosure for the herbicides covered in this EA. An analysis would be done to determine the similarities of effects and if the decision should be amended to include new herbicide product.

The EA describes the potential effects of the No Action alternative, not authorizing the use of herbicides, and the Proposed Action to authorize the use herbicides. It also prescribes specific mitigation measures (pages 27-28) and Best Management Practices (pages 28-29) that would be followed during implementation to mitigate the risk of adverse impacts to (1) humans; (2) non-target vegetation, including threatened, endangered, and sensitive plants; (3) non-target terrestrial and aquatic animals, including threatened, endangered, and sensitive animals; and (4) water quality. A biological assessment and evaluation of threatened, endangered, and sensitive (TES) animals and plants (Appendix D) was completed and concurrence was obtained from the U. S. Fish and Wildlife Service on May 19, 2004. Analyses for Management Indicator Species (MIS) and migratory birds were completed and are included in the project file that will be maintained in the Regional Office, Albuquerque, New Mexico.

I have selected Alternative 2, the proposed use of herbicides, because it best meets the purpose and need as described in the EA (Chapter 1, pages 1-3). It will allow ADOT to effectively and efficiently control noxious weeds, invasive plants, and hazardous vegetation along public roadways on NFS lands in Arizona. In addition, implementation of this proposal will protect native plant communities and resource values and uses on NFS lands in Arizona through the control of noxious weeds species that are commonly carried by vehicles and introduced along roadways.

In making my decision, I considered the potential environmental effects and risks associated with the proposed use of herbicides for humans (EA, Appendix A, pages 75-82), including the potential risk to those who may experience hypersensitive, allergic reactions, including Multiple Chemical Sensitivity (page 79). Notification and signing procedures were identified to allow concerned members of the public to avoid possible exposure from the proposed use of herbicides and to find alternative routes to obtain needed services.

The EA, including Appendix D (Biological Assessment and Evaluation), and this Decision Notice and Finding of No Significant Impact can be found at the following website: http://www.fs.fed.us/r3/projects/ro/ea-noxiousweeds/.

Public Involvement and Scoping

As part of the proposed action involving the use herbicides, a public meeting was held on February 6, 2002, in a campground near Prescott, Arizona. The meeting was intended to get input and answer questions regarding concerns over Multiple Chemical Sensitivity and herbicide use.

An advance notice of the proposed action was sent to the Arizona Congressional delegation and other parties on March 26, 2002, informing them that the Forest Service was planning to initiate an environmental analysis for the proposed use of herbicides on public roads in Arizona to control noxious weeds and hazardous vegetation.

On May 8, 2002, a scoping letter was sent to 2,088 potentially affected individuals, groups, organizations, tribes, state agencies, and federal agencies. The letter described the proposed action and need for action, and invited public participation in the analysis process. A total of 150 written responses were received. Beginning in June 2002, the project was listed in the *Schedule of Proposed Projects for* the Apache-Sitgreaves, Coconino, Coronado, Kaibab, Prescott, and Tonto National Forests. These lists are distributed to numerous individuals and can be accessed on the website for each Forest. Comments received during scoping were used to identify

important issues, develop project objectives and alternatives, and guide the environmental analysis.

On July 25, 2003, the EA was mailed for a 30-day comment period to individuals, organizations, Indian Tribes, state agencies, and federal organizations that had responded to the scoping letter or who expressed interest in the project. Legal notices were published in the White Mountain Independent (Apache-Sitgreaves National Forest), Arizona Daily Sun (Coconino and Kaibab National Forests), Arizona Daily Star (Coronado National Forest), Prescott Courier (Prescott National Forest), and East Valley Tribune (Tonto National Forests). The public comment period ended on September 18, 2003. We received 68 responses expressing concerns over human health, MCS, and environmental affects. The Yavapai Prescott Indian Tribe expressed concern about affects to traditional use areas. Some responses were form letters, and one response included a petition. I reviewed and considered all substantive comments in making this decision.

Alternative Considered

The alternatives considered in detail included Alternative 1 (No Action, i.e., no use of herbicides), and Alternative 2 (the Proposed Action to use herbicides).

Alternative 1 was not selected. Effective and economical control of noxious weeds, invasive plants, and hazardous vegetation could not be achieved solely by the use of manual, mechanical, and preventive measures that are available to ADOT, and the limited amount of herbicide use under the approval authority of the USDOT. Manual and mechanical methods have proven to be ineffective for several species of noxious weeds and invasive plants, especially perennial species with deep root systems. In addition, the expense of controlling the remaining species of noxious weeds, invasive plants, and hazardous vegetation was considered to be excessive under this alternative.

Alternative 2 was selected because it provides ADOT managers with the full range of proven methods, including the use of herbicides, to achieve effective and efficient Integrated Vegetation Management of noxious weeds, invasive plants, and hazardous vegetation along public roadways on NFS lands in coordination with programs on public roads elsewhere in the State. The estimated annual program would be about 5,000 acres: Apache-Sitgreaves, 500 acres; Coconino, 1,500 acres; Coronado, 500 acres, Kaibab, 500 acres; Prescott, 1,000 acres, and Tonto, 1,000 acres.

Finding of No Significant Impact

Based on the EA, I have determined that the proposed use of herbicides for management of noxious weeds, invasive plants, and hazardous vegetation on public roads on NFS lands in Arizona is not a major federal action that will significantly affect the quality of the human environment; therefore, an Environmental Impact Statement will not be prepared. The determination is based on the following:

Context

This action applies to treatment of hazardous vegetation, invasive plants, and noxious weeds along public roadways that pass through NFS lands in Arizona. To accomplish public safety objectives, a major portion of herbicide use, possibly as much as 70 percent of herbicide

applications, would be within about 5 feet of the edge of roadways. In addition, noxious weed infestations would be treated up to a maximum of 200 feet outside of USDOT and Forest Road and Trail Act easements to maintain the integrity of treatment of individual infestations within easements. ADOT has the responsibility to manage vegetation along about 6,000 miles of highways in Arizona, and only about 2,700 miles are on NFS lands. It is estimated that about 5,000 acres of the total area of 170,100 acres could be treated annually, which is about 3 percent of the area. This represents about 0.0004 percent of NFS lands in the State.

Intensity

1. *Adverse as well beneficial impacts* were considered (EA Chapter 4). The use of herbicides in combination with other methods of vegetation management would provide the most effective and efficient control of noxious weeds, invasive plants, and hazardous vegetation. However, four of the significant issues identified and analyzed in detail were related to the potential adverse effects that can occur as a result of the use of herbicides.
2. The *risk to humans* associated with toxic effects of herbicides would be negligible (Appendix A, Risk Assessment for Humans and Non-target Species, 75-82; Chapter 3, 39-40; and Chapter 4, 46-48). Control of hazardous vegetation with herbicides would improve the safety for the public using roads that pass through NFS lands and allow ADOT to meet hazardous vegetation maintenance priorities and requirements of the Highway Safety Act (Chapter 1, 6).

   For the percentage of the human population who are aware that they are hypersensitive or allergic to herbicides (Multiple Chemical Sensitivity), a toll free number (1-800-546-6591) will be provided to allow them to avoid the possibility of exposure (Chapter 3, 40). In addition, signing will be provided along roadways where herbicide applications are being conducted (Mitigations and Best Management Practices, Chapter 2, 27-29).

   An *Herbicide Safety and Spill Plan* was developed and is included as Appendix B to the EA to address contingencies related to the possibility of accidents occurring when treating vegetation with herbicides.

3. The use of herbicides is unlikely to adversely impact areas with *unique characteristics* such as historical or cultural resources (addressed specifically in item 8), park lands, prime farmlands, wetlands, designated or eligible wild and scenic rivers, or other ecologically critical areas since federal and State highways have altered the landscape to provide for public transportation. Herbicide use along public roadways is limited to the rights-of-way and the 200-foot linear strip adjacent to road easements and would be similar to general public lawn and garden care.
4. The disclosure of effects using herbicides on the quality of the human environment nearly always generates some level of controversy, as exemplified by 68 responses to the EA for this project. Many of the respondents stated that they opposed any use of herbicides. However, this level of response to a statewide project, with no agencies or organizations responding and only one tribal government, indicate that the effects are not *highly controversial.*
5. The possible effects described in the EA are not *highly uncertain* nor do they involve *unique or unknown risks.* The environmental effects are typical for this type of program using herbicides to control unwanted vegetation. The levels of use would not exceed

limits identified on the labels. Since assessment of risk is an uncertain process, a safety factor of 100 times below the No Observed Effect Level (NOEL) is the accepted method to extrapolate test data for animals to humans (Appendix A).

The analysis of possible effects is based on the best available information, science, and the judgment of vegetation management and herbicide specialists of the Forest Service and ADOT who have experience with similar projects on federal, state, and private lands. The predicted environmental consequences are based on published information and each herbicide, expected patterns of use along public roadways, risk assessments developed for the Forest Service, and a summary of potential risks to humans and non-target species (EA, Appendix A).

6. This decision does not establish any *future precedent* or other actions that may have a significant effect. Future actions involving the use of herbicides to control noxious weeds, invasive plants, and hazardous vegetation on other NFS lands will be evaluated through the NEPA process and will stand on their own merits as to environmental effects.
7. This action is limited to herbicide use to control noxious weeds, invasive plants, and hazardous vegetation by ADOT along public roads on NFS lands in Arizona. The Forest Service has proposed, and will propose in the future, the use of herbicides to control certain species identified as noxious weeds or invasive species on specific National Forests. These proposals will be evaluated through the NEPA process and the effect of the actions in combination with treatments by ADOT will be evaluated for *cumulatively significant impacts*.
8. The possible effects to features listed in or eligible for listing in the *National Register of Historic Places* were considered as well as effects to *significant scientific, cultural, or historical resources*. Letters were sent to tribal leaders on July 25, 2003, requesting comments and concerns regarding traditional, cultural, or religious sites along public roads. The Yavapai-Prescott Tribe expressed general concern with the use of herbicides but not with any specific area. The Region 3 Programmatic Agreement under the National Historic Preservation Act (*First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities, 12/24/2003*) exempts from consultation spray projects that will not affect known properties of traditional cultural and religious value.
9. Effects to species listed under the Endangered Species Act and habitat designated as critical under the Act were disclosed in the EA, Chapter 4 and Appendix D (Biological Assessment and Evaluation (BAE)). The BAE determined that the proposed action with proposed conservation measures identified in the BAE is *not likely to adversely affect or will have no effect on any endangered, threatened, or proposed species; or designated or proposed critical habitat areas*; or nonessential experimental populations. The BAE was submitted to the U.S. Fish and Wildlife Service and they concurred with these determinations in a letter dated May 19, 2004.

10. As disclosed in the EA (Chapter 2, Table 5, 31 and other locations) and items 8 and 9 of this FONSI, this action is in *compliance with all federal, state, and local laws and requirements imposed for environmental protection*.

    This action is in compliance with all Forest Plans and an evaluation of the Analysis for Management Indicator Species (MIS) has been completed. This decision is, therefore, compliant with the National Forest Planning Act (NFMA).

This action does not trigger any permitting under the Clean Water Act.
I have reviewed this action for compliance with Executive Orders including, but not limited to protection of Floodplains, Wetlands and Migratory Birds.

Appeals and Implementation

This decision is subject to appeal pursuant to 36 CFR 215. Only those individuals or organizations who submitted substantive comments during the comment period specified at 215.6 may appeal this decision.

The notice of appeal must meet the appeal content requirement at 36 CFR 215.14. The appeal must be filed (regular mail, fax, email, hand-delivery, or express delivery) with the Appeals Deciding Officer. Written appeals must be submitted to: Appeals Deciding Officer, Lucia Turner, Deputy Regional Forester, USFS SW Regional Office, 333 Broadway SE, Albuquerque, NM 87102. The office business hours for those submitting hand-delivery appeals are 8:00 a.m. through 4:30 p.m., Monday through Friday, excluding holidays. Electronic appeals must be submitted in a format such as an email message, plain text (.txt) rich text format (.rtf) and Word (.doc) to appeals-southwestern-regional-office@fs.fed.us. In cases where no identifiable name is attached to an electronic message, a verification of identity will be required. A scanned signature is one way to provide verification.

Appeals, including attachments, must be filed within 45 days from the publication date of this notice in the East Valley Tribune, which will be the exclusive means for determining the time to file an appeal. Notices of my decision also will be placed in the White Mountain Independent, Arizona Daily Sun, Arizona Daily Star, and Prescott Courier. Those wishing to appeal this decision should not rely upon dates or timeframe information provided by any source other than the East Valley Tribune.

If no appeals are filed within the 45-day period, implementation of the decision may occur on, but not before, the 5th business day from the close of the appeal filing period. When appeals are filed, implementation may occur on, but not before, the 15th business day following the date of the last appeal disposition.

Information Contact Person

Bill Woodward, Group Leader/Engineering, Southwestern Region, 333 Broadway Boulevard SE, Albuquerque, NM, 87102; 505-842-3827

/s/

KARL P. SIDERITS
Responsible Official Representing the Forest Supervisors in Arizona

Date: May 27, 2004