Decision Record: Gila River Hazardous Fuels Reduction And Riparian Restoration Environmental Assessment

Background

Salt cedar (Tamarix spp., Family Tamaricaceae) has displaced or replaced native plant communities within the entire Gila River project area. In the Gila River drainage and flood plain, thick heavy accumulations of salt cedar are present in both the wet and dry channels and washes. In this area wildfires readily start and spread with high intensity. The fires that occur in the area are difficult for firefighters to suppress because of the high fire line intensity. These fires pose a threat to the public in the wildland urban interface.

In addition to the fire threat that salt cedar pose, this species can have a profound negative impact on underground hydrology such that streams and rivers dry completely, due to water consumption by salt cedar. Additionally, river channeling can be dramatically altered, which can cause flooding in nearby farmlands and homes. In areas with establish salt cedar stands, soil becomes saline to the point where native plants have a hard time germinating. Native plant biodiversity is adversely affected as dense stand of salt cedar crowd out any other plants from growing.

Proposed Action and Alternatives

The project area comprises approximately 3,404 acres. The Project area is a half hour drive from the Phoenix metropolitan area. It is located near the communities of Buckeye, Palo Verde, and Arlington Arizona. Under the proposed action, fuel breaks will be created using combinations of mechanical, prescribed fire, and herbicide treatments to break up the continuity of the hazardous accumulations of salt cedar in the river corridor area between the Highway 85 bridge and the Gillespie dam. Revegetation will be accomplished by either active or passive restoration of native riparian plant species that will contribute to the idea of a “green” fuel break.

The no-action alternative would entail no removal of salt cedar and the riparian environment will continue to be dominated by dense stands of salt cedar and will continue to result in high intensity and high severity wildfires.

Compliance with the National Environmental Policy Act

Environmental assessment # DOI-BLM-AZ-P020-2011-007-EA was prepared to assess the potential environmental impacts anticipated to result from implementation of the above-described alternatives for Fuels reduction and native plant restoration. A Finding of No Significant Impact (FONSI), dated April 19, 2011, was made pursuant to this proposed project and environmental assessment. Both the FONSI and EA are incorporated herein as integral parts of this decision.

Plan Conformance

The proposed action is in conformance with the Lower Gila South Resource Management Plan as amended by the Proposed Arizona Land Use Plan Amendment for Fire, Fuels, and Air Quality Management Environmental Assessment (Amendment EA) and Finding of No Significant Impact (2005). The proposed action also tiers off the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement dated June 27, 2007 (VEG EIS).

Persons and Agencies Consulted

AK-Chin Indian Community

Salt River Pima-Maricopa Indian Community

Gila River Indian Community

Tohono O'odham Nation

Arizona Ecological USFWS

Arizona Game and Fish Department

Decision and Rationale on Action

I have decided to implement the proposed action, analyzed by the Gila River Hazardous Fuels Reduction and Riparian Restoration Environmental Assessment. This alternative will result in a reduction in fire extent and fire-line intensity because the project area will not remain a continuous area of salt cedar stands. The proposed action will also result in the restoration of native riparian plant communities.

The Gila River Hazardous Fuels Reduction and Riparian Restoration Environmental Assessment was posted to the BLM Arizona NEPA log on February 28th, 2011 and notice of its availability was sent to interested members of the public on March 8th, 2011 for review and comment. During the comment period, the BLM received one comment letter from the Salt River Project. The letter contained three comments. The following includes a summary of the comment along with response:

Comment	Response
Request to coordinate with pertinent utility providers prior to and during all prescribed fire	A stipulation to coordinate with local utility

activities within the project area	providers has been added below.
Request to clarify the source of water to be utilized in all riparian restoration activities associated with the project	Clarification of the water source for irrigation has been added to the Environmental Assessment. See page 10
Request to utilize new published research in forthcoming projects of this nature.	Comment noted. No action taken in this project

The following stipulations are required as conditions of implementation:

1. Cultural surveys will be completed by a BLM archaeologist, or a properly qualified cultural resources specialist designated by a phoenix District archaeologist, prior to any surface disturbing activities.

2. If any cultural and or paleontological resource, site of object is discovered during the course of the restoration measures as detailed above a BLM Phoenix district archaeologist will be immediately notified. All work will cease until an evaluation of the discovery is made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The consulted Indian tribes will be consulted.

3. The BLM coordinate with pertinent utility companies prior to and during all prescribed burning activities to minimize the risk of outages caused by smoke generated from the fires.

4. The following conservation measures, per the Biological Opinion on Hazardous Fuels Reduction and Vegetation Restoration in the Lower Gila River (AESO/SE 22410-2009-F-0509) will ensure that there is no significant impact to threatened or endangered species. This list includes conservation measures and terms and conditions from the Arizona Statewide Land Use Plan Amendment and Environmental Assessment for Fire, Fuels, and Air Quality Management Biological Opinion (#02-21-03-F-0210) (Fire BO) and other measures developed specifically for this project. Some measures from the Fire BO have been edited specifically for this project as necessary.

    - Implement the Conservation Measures for Fire Management Activities in Riparian and Aquatic Habitats listed in the Fire BO, as appropriate (see species-specific conservation measures below).
    - Implement the Conservation Measures for Fire Management Activities listed in the Fire BO, as appropriate (see species specific conservation measures below).
    - Pre-project surveys for threatened and endangered species will be required in and adjacent to each treatment unit with suitable habitat in the year before implementation in that unit. Surveys during the year of treatment will also occur, as well as post-treatment monitoring for species occurrence for two years following treatment. Suitable habitat in and adjacent to the treatment unit will be considered occupied if pre-

treatment surveys are not able to be conducted and all applicable conservation measures will be applied.

- Any vegetation removal projects within or adjacent to flycatcher or rail habitat will occur outside the breeding/nesting/fledging season (April-September), except if site-specific surveys have been implemented that determine flycatchers or rails are not present in or adjacent to the treatment area. If surveys determine areas are occupied, treatment actions will avoid occupied areas or appropriate conservation measures will be applied (see species-specific conservation measures below).
- Transporting and disposing of garbage will be done off-site and in accordance with the Solid Waste Disposal Act.
- All refueling, oil changes, and lubrication of large-wheeled and tracked equipment (e.g., passenger vehicles, bulldozers) will be done outside of the riparian area, and be done in a manner to prevent spills.
- All terrain vehicle (ATV) or tractor-mounted herbicide applications will be timed to occur outside the flycatcher and rail breeding/nesting season (April through September).
- Pedestrian backpack foliar treatments and cut-stump applications will be permissible throughout the year with the implementation of species-specific conservation measures below.
- Pedestrian backpack foliar treatments and cut-stump applications during the April to September breeding/nesting season will be implemented greater than 10 or 60 feet from marsh areas in accordance with the species-specific conservation measures below.
- Herbicide will be marked with colored dye to identify areas treated.
- A buffer of 10 or 100 feet (see YCR conservation measures below) will be used any time herbicide is applied near a sensitive water source (pool, open water, surface water, and drainage) to reduce potential impacts to YCR, unless the herbicide is approved for aquatic application as stated by the manufacturer and application follows the label guidelines. This measure meets or exceeds the FWS pesticide guidelines (White 2004).
- Sensitive water sources in the vicinity will be tested for active herbicide to determine environmental fates of herbicides.
- All personnel working with or in the vicinity of the herbicide application will have daily briefings that would inform them of federally listed species concerns.

<u>Southwestern willow flycatcher</u>

- Surveys for the flycatcher will occur the year prior to treatment, the year of the treatment, and two years post treatment. Due to timing of the project, surveys the year prior to treatment will not occur for 2011, but surveys will occur the year of treatment in 2011. If breeding or nesting activity is observed or territory establishment is documented, these sites will be monitored and the location of the fuels treatment may be changed to avoid impacts to flycatchers during the breeding/nesting/fledging season.
- Fuel breaks and WUI buffers will be established to the extent possible in areas not occupied by flycatchers as determined by existing and future surveys.
- The use of chainsaws or bulldozers to construct fuel breaks through occupied or suitable habitat will be minimized except where necessary to reduce the overall acreage of occupied habitat or other important habitat areas that would otherwise be burned if not treated. Use of motorized equipment will occur outside of the flycatcher breeding/nesting/fledging season.

- Activities to reduce hazardous fuels or improve riparian habitats (mechanical, herbicide, or burning treatments) within occupied or unsurveyed suitable habitat for flycatchers will only be implemented during the non-breeding season (October 1 to March 31).
- Developing access roads that would result in fragmentation or a reduction in habitat quality will be avoided. All roads that were necessary for project implementation will be closed and rehabilitated.
- Burning will only occur to treat slash piles, not to create fuel breaks or buffers. Slash will be piled and burned in areas where flycatchers will not be affected by the activity or dispersing smoke.
- Vegetation treatment projects adjacent to occupied or unsurveyed suitable habitat will only be conducted when flycatchers are not present (October 1 – March 31).
- If survey results or other project activities indicate potential effects beyond those addressed by these conservation measures, the BLM PDO will contact the USFWS Arizona Ecological Services Office for guidance on how to proceed with the project.

<u>Yuma clapper rail</u>

- Surveys for the rail will occur the year prior to treatment, the year of the treatment, and two years post treatment. Due to timing of the project, surveys the year prior to treatment will not occur for 2011, but surveys will occur the year of treatment in 2011. If breeding or nesting activity is observed, these sites will be monitored and the location of the fuels treatment may be changed to avoid impacts to rails during the breeding/nesting/fledging season.
- Fuel breaks and WUI buffers will be established to the extent possible in areas not occupied by rails as determined by existing and future surveys.
- Fuel breaks and WUI buffers will typically not be established in areas with open water or marsh habitat suitable for rails. These areas naturally provide fuel breaks. Therefore, most activities under this project will occur outside areas of suitable rail habitat. However, suitable rail habitat is ephemeral and can occur in changing locations within the river based on floods, vegetation conditions, and precipitation patterns. Therefore, the following conservation measures are applicable.
- Any fuels reduction or buffer treatments implemented in occupied or suitable marsh habitat will only occur between September 1 and March 15 to avoid the rail breeding and molting seasons. The rail is resident in the area year round. Treatment activities will avoid occupied habitat during the post-breeding season or the appropriate conservation measures will be applied as outlined below.
- Mechanical removal of overstory habitat (*Tamarix*) may occur as early as August 15, after the breeding season for rails, but will not occur in open water or marsh habitats. Mechanical treatments may occur outside the breeding season, but must be at least 100 feet from suitable open water/marsh habitat.
- Use appropriate herbicide-free buffer zones for herbicides not labled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand applications. Drift-inhibiting agents should be used to assure that the herbicide does not enter adjacent marsh areas. Spot treatment by hand can occur at any time of the year due to low disturbance and buffers associated with this type of treatment. This measure meets or exceeds the FWS pesticide guidelines (White 2004).

- Minimize disturbance to rails during burning activities. Fire will only be used to burn slash piles. Slash will be piled and burned in areas where the activity and smoke associated with the burning will not affect areas occupied by rails.

Authority for Decision

43 CFR-4190.1A

43 CFR 9212

EO11990 Protection of Wetlands

EO 11988 Floodplain Management

EO 13112 Invasive species Control

Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States Programmatic Environmental Impact Statement.

Implementation Date

This decision will be effective thirty (30) days from the date indicated below.

____/s/_____ _____7/20/2011_____

Rich Hanson, Acting Lower Sonoran Field Office Manager Date

Administrative Review of Appeal Opportunities

This decision is subject to appeal per the procedures at 43 CFR 4.410-4.415. An appeal may be accompanied by a petition for stay of the decision in accordance with 43 CFR 4.21, pending final determination on appeal. The appeal and petition for stay must be filed in the office of the authorized officer, as noted below, within 30 days following receipt of this decision:

Bureau of Land Management

Lower Sonoran Field Office

ATTN: Emily Garber

21605 North 7th Avenue

Phoenix, AZ 85027

The appeal shall state the reasons, clearly and concisely, why the appellant feels that the decision here is in error.

In accordance with 43 CFR 4.21(b)(1) a petition for stay, if filed, must show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied.

(2) The likelihood of the appellant's success on the merits.

(3) The likelihood of immediate and irreparable harm if the stay is not granted, and

(4) Whether the public interest favors granting the stay.

Contact Person

For additional information concerning this decision contact Brian Achziger (623) 580-5622 or Emily Garber (623) 580 5616

Gila River Hazardous Fuels Reduction and Riparian Restoration
Finding of No Significant Impact

EA DOI-BLM-AZ-P020-2011-007-EA

I have reviewed the Environmental Assessment No. DOI-BLM-AZ-P0202-2011-007-EA, attached, which analyzes potential environmental effects that will result from implementation of alternative A in the Gila River corridor from Highway 85 Bridge to the Gillespie Dam. I have determined that environmental effects that will result from implementation of any of the fuel removal techniques outlined in Alternative A will not negatively affect the project area. Rather, the project will improve the quality of wildlife habitat and will significantly reduce fire-line intensity and spread in the wildland urban interface (WUI) area. The project will benefit the public and firefighter safety by making suppression efforts more effective. The fuel breaks placed throughout the project area will protect wildland urban interface areas, improve the likelihood that wildfires will be suppressed at reduced acreages, will facilitate any prescribed burning and will protect areas of native riparian vegetation. Alternative A will allow areas burned in wildfires to be restored to native riparian vegetation, areas of native vegetation to be enhanced/enlarged, and allow degraded areas to be restored to native riparian vegetation that is less flammable and higher quality wildlife habitat. An Environmental Impact Statement is not required for this proposed project.

Context

The project area comprises approximately 3404 acres within the riparian zone of the Gila River it covers PLO 1015 lands and the Fred J. Weiler Green Belt, both of which were established to manage the area for wildlife such as water fowl and white wing dove; along with other multiple use benefits. These lands have been segregated from all forms of appropriation under Public Land Order 1015.

Intensity

The Alternative A attempts to provide means for improved management of wildfire and riparian restoration of a unique riparian area that flows through the Lower Sonoran Field Office. The following discussion is organized around the 10 Significance Criteria described at 40 CFR 1508.27. The following have been considered in evaluating intensity for this proposal:

1. **Impacts that may be both beneficial and adverse.**
   The environmental assessment has considered both beneficial and adverse impacts anticipated resulting from implementation of the alternatives. All action alternatives are expected to result in improved protection of the objects for which the project area lands where designated.
2. **The degree to which the proposed action affects public health or safety.**
   During the previous three years, four wildfires have spread through the proposed project area, threatening homes adjacent to fire perimeters and causing smoke concerns within the Ozone, PM-10, and Carbon Monoxide non-attainment areas within Maricopa County. The alternatives will have a beneficial impact in lessening the severity of fire within the WUI. No other impacts to public safety are expected to result from implementation of the preferred alternative.
3. **Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.**
   The project area includes a portion of the Robbins and Powers Butte State Wildlife Area and is adjacent to the communities of Palo Verde and Arlington, Arizona. The project will provide increased protection from wildfires to the WUI and areas of concern that provide recreation opportunities for the public.
4. **The degree to which the effects on the quality of the human environment are likely to be highly controversial.**
   Impacts expected to result from the proposed project and described herein will not be controversial.
5. **The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.**
   No uncertain, unique or unknown risks are anticipated to result from the project.
6. **The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.**
   While implementation of the proposed action will establish a positive precedent for any future actions, this action is not making a decision in principle about any future considerations or anticipated actions.
7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.**
   The action is not related to any other present or reasonably foreseeable future actions that pose cumulatively significant environmental effects.

8. **The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.**
   The project area does not contain any known properties listed, or eligible for listing, on the National Register of Historic Places. The project area does contain Native American sites that have been identified and possibly some that are not yet known. This project may create fuel breaks in known areas of cultural sites.
9. **The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.**
   The following conservation measures per the Biological Opinion on Hazardous Fuels Reduction and Vegetation Restoration in the Lower Gila River (AESO/SE 22410-2009-F-0509) will ensure that there is no significant impact to threatened or endangered species.

   This list includes conservation measures and terms and conditions from the Arizona Statewide Land Use Plan Amendment and Environmental Assessment for Fire, Fuels, and Air Quality Management Biological Opinion (#02-21-03-F-0210) (Fire BO) and other measures developed specifically for this project. Some measures from the Fire BO have been edited specifically for this project as necessary.

   a. Implement the Conservation Measures for Fire Management Activities in Riparian and Aquatic Habitats listed in the Fire BO, as appropriate (see species-specific conservation measures below).
   b. Implement the Conservation Measures for Fire Management Activities listed in the Fire BO, as appropriate (see species specific conservation measures below).
   c. Pre-project surveys for threatened and endangered species will be required in and adjacent to each treatment unit with suitable habitat in the year before implementation in that unit. Surveys during the year of treatment will also occur, as well as post-treatment monitoring for species occurrence for two years following treatment. Suitable habitat in and adjacent to the treatment unit will be considered occupied if pre-treatment surveys are not able to be conducted and all applicable conservation measures will be applied.
   d. Any vegetation removal projects within or adjacent to flycatcher or rail habitat will occur outside the breeding/nesting/fledging season (April-September), except if site-specific surveys have been implemented that determine flycatchers or rails are not present in or adjacent to the treatment area. If surveys determine areas are occupied, treatment actions will avoid occupied areas or appropriate conservation measures will be applied (see species-specific conservation measures below).
   e. Transporting and disposing of garbage will be done off-site and in accordance with the Solid Waste Disposal Act.

f. All refueling, oil changes, and lubrication of large-wheeled and tracked equipment (e.g., passenger vehicles, bulldozers) will be done outside of the riparian area, and be done in a manner to prevent spills.

g. All terrain vehicle (ATV) or tractor-mounted herbicide applications will be timed to occur outside the flycatcher and rail breeding/nesting season (April through September).

- **i.** Pedestrian backpack foliar treatments and cut-stump applications will be permissible throughout the year with the implementation of species-specific conservation measures below.
- **ii.** Pedestrian backpack foliar treatments and cut-stump applications during the April to September breeding/nesting season will be implemented greater than 10 or 60 feet from marsh areas in accordance with the species-specific conservation measures below.

h. Herbicide will be marked with colored dye to identify areas treated.

i. A buffer of 10 or 100 feet (see YCR conservation measures below) will be used any time herbicide is applied near a sensitive water source (pool, open water, surface water, and drainage) to reduce potential impacts to YCR, unless the herbicide is approved for aquatic application as stated by the manufacturer and application follows the label guidelines. This measure meets or exceeds the FWS pesticide guidelines (White 2004).

j. Sensitive water sources in the vicinity will be tested for active herbicide to determine environmental fates of herbicides.

k. All personnel working with or in the vicinity of the herbicide application will have daily briefings that would inform them of federally listed species concerns.

<u>Southwestern willow flycatcher</u>

a. Surveys for the flycatcher will occur the year prior to treatment, the year of the treatment, and two years post treatment. Due to timing of the project, surveys the year prior to treatment will not occur for 2011, but surveys will occur the year of treatment in 2011. If breeding or nesting activity is observed or territory establishment is documented, these sites will be monitored and the location of the fuels treatment may be changed to avoid impacts to flycatchers during the breeding/nesting/fledging season.

b. Fuel breaks and WUI buffers will be established to the extent possible in areas not occupied by flycatchers as determined by existing and future surveys.

c. The use of chainsaws or bulldozers to construct fuel breaks through occupied or suitable habitat will be minimized except where necessary to reduce the overall acreage of occupied habitat or other important habitat areas that would otherwise be burned if not treated. Use of motorized equipment will occur outside of the flycatcher breeding/nesting/fledging season.

d. Activities to reduce hazardous fuels or improve riparian habitats (mechanical, herbicide, or burning treatments) within occupied or unsurveyed suitable habitat for flycatchers will only be implemented during the non-breeding season (October 1 to March 31).

e. Developing access roads that would result in fragmentation or a reduction in habitat quality will be avoided. All roads that were necessary for project implementation will be closed and rehabilitated.
f. Burning will only occur to treat slash piles, not to create fuel breaks or buffers. Slash will be piled and burned in areas where flycatchers will not be affected by the activity or dispersing smoke.
g. Vegetation treatment projects adjacent to occupied or unsurveyed suitable habitat will only be conducted when flycatchers are not present (October 1 – March 31).
h. If survey results or other project activities indicate potential effects beyond those addressed by these conservation measures, the BLM PDO will contact the USFWS Arizona Ecological Services Office for guidance on how to proceed with the project.

<u>Yuma clapper rail</u>

a. Surveys for the rail will occur the year prior to treatment, the year of the treatment, and two years post treatment. Due to timing of the project, surveys the year prior to treatment will not occur for 2011, but surveys will occur the year of treatment in 2011. If breeding or nesting activity is observed, these sites will be monitored and the location of the fuels treatment may be changed to avoid impacts to rails during the breeding/nesting/fledging season.
b. Fuel breaks and WUI buffers will be established to the extent possible in areas not occupied by rails as determined by existing and future surveys.
c. Fuel breaks and WUI buffers will typically not be established in areas with open water or marsh habitat suitable for rails. These areas naturally provide fuel breaks. Therefore, most activities under this project will occur outside areas of suitable rail habitat. However, suitable rail habitat is ephemeral and can occur in changing locations within the river based on floods, vegetation conditions, and precipitation patterns. Therefore, the following conservation measures are applicable.
d. Any fuels reduction or buffer treatments implemented in occupied or suitable marsh habitat will only occur between September 1 and March 15 to avoid the rail breeding and molting seasons. The rail is resident in the area year round. Treatment activities will avoid occupied habitat during the post-breeding season or the appropriate conservation measures will be applied as outlined below.
e. Mechanical removal of overstory habitat (*Tamarix*) may occur as early as August 15, after the breeding season for rails, but will not occur in open water or marsh habitats. Mechanical treatments may occur outside the breeding season, but must be at least 100 feet from suitable open water/marsh habitat.
f. Use appropriate herbicide-free buffer zones for herbicides not labled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand applications. Drift-inhibiting agents should be used to assure that the herbicide does not enter adjacent marsh areas. Spot treatment by hand can occur at any time of the year due to low disturbance and buffers associated with

this type of treatment. This measure meets or exceeds the FWS pesticide guidelines (White 2004).

g. Minimize disturbance to rails during burning activities. Fire will only be used to burn slash piles. Slash will be piled and burned in areas where the activity and smoke associated with the burning will not affect areas occupied by rails.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

No Federal, State, local, or tribal law will be violated by implementation of the action. Some of the project area will require federal section 404 (Clean water act) permits for stream area clearing and restoration activities. Any prescribed burning will follow burn plans that include strict conformance to the Arizona Department of Environmental Quality (ADEQ) State Implementation Plan.

____/s/_____ ____07/20/2011_____

Rich Hanson Date

Acting Lower Sonoran Field Office Manager

Gila River Hazardous Fuels Reduction and Riparian Restoration Environmental Assessment

EA DOI-BLM-AZ-P020-2011-007-EA

BLM Phoenix District
Lower Sonoran Field Office
21605 North 7th Avenue
Phoenix, Arizona 85027

February 2011

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Introduction

The Bureau of Land Management's (BLM) Lower Sonoran Field Office (LSFO) in Arizona is responsible for a fuels reduction project within the Phoenix District Fire Management Zone (PDFMZ) in accordance with the National Fire Plan and the President's Healthy Forest Initiative. This project will reduce hazardous fuels and reverse environmental degradation caused by saltcedar infestation along the Gila River.

The project (Appendix 1: Maps & Figures) is located within the riparian zone of the Gila River between the bridge at Highway 85 (upstream boundary) and Gillespie Dam (downstream boundary). The total BLM management area within this reach is 3,404 acres.

Purpose and Need for Action

The purpose of the proposed action is to reduce hazardous fuel accumulations and restore degraded habitat caused by saltcedar infestations along the Gila River.

According to the BLM's Phoenix/Kingman Fire Management Plan (2006) for Fire Management Unit (FMU) 1:

> "In the Gila River drainage and flood plain, thick and heavy accumulations of saltcedar/tamarisk fuels are present both in the wet and dry river channel and washes....The saltcedar/tamarisk fuel type limits escape routes and safety zones, creating a health and safety concern during fire suppression activities…The presence of saltcedar has significantly increased fire occurrence and severity in riparian areas, reducing the presence of native species."

Reducing hazardous fuel accumulations will increase public and firefighter safety, protect cultural resources, and provide an opportunity for habitat restoration. Reversing the damage caused by saltcedar infestations will improve habitat conditions for wildlife, including threatened and endangered species and game. Habitat restoration will also reduce fire risk by replacing fire-prone saltcedar infestation with fire-resistant native plant communities and improve recreational, economic and aesthetic conditions.

Background

The invasion by saltcedars (*Tamarix* spp., family *Tamaricaceae*), exotic shrubs to medium-sized trees from the Old World, is arguably one of the worst ecological disasters affecting western riparian ecosystems of the United States. Deciduous saltcedar (SC) has displaced or replaced native plant communities, degraded wildlife habitat, and is probably a major cause in the decline of many native species, including several now threatened or endangered (T&E) species (reviewed by DeLoach 1991, DeLoach and Tracy 1997, Lovich and DeGouvenain 1998). SC was documented as a cause of decline of the southwestern subspecies of the willow flycatcher (*Empidonux trailii extimus Phillips*) (sw WIFL) when it was listed as endangered (USFWS 1995).

According to Philip Westra (2006) of the US Forest Service:

- Luxury water consumption by this invasive weed is cited as a universal threat across the region to sustainable stream and river flows, to reliable water supplies for irrigation in agriculture, and for water demands by increasing urbanization which is occurring in many areas where salt cedar is found. Saltcedar can have a profound negative impact on stream and underground hydrology, to the point where streams or reservoirs can dry up due to water use by salt cedar.

- Saltcedar, which was originally introduced for stream bank stabilization, has often done too good a job of stabilizing stream banks to the point where channel characteristics have been dramatically altered. In severe cases, flood plains surrounding streams have silted in due to the impediment salt cedar presents to flowing water, thereby forcing the streams into ever narrower channels. In some unusual cases, salt cedar becomes so dense that water flow ceases.

- Salt cedar accumulates salt in its scale-like leaves, and when they drop to the soil surface, these leaves increase the salt contents of surface soil layers to the point where many native species cannot germinate or thrive.

- Saltcedar commonly creates dense monoculture stands which exclude desirable native species, thereby altering riparian biodiversity and adversely impacting recreational use of riparian areas for hunting, fishing, and camping. Heavy salt cedar stands can be prone to intense fires which can themselves alter the plant community. Once saltcedar becomes established, it is very difficult for other desirable species to penetrate and dominate such degraded plant communities.

Ecology of Saltcedar (from Deloach et al 2001)

SCs are facultative phreatophytic and facultative holophytic plants that propagate by windblown or waterborne seed or vegetatively. They are pollinated mainly by insects but probably also by wind (Shmida 1991), fire tolerant, tolerant of drought and inundation, and difficult to control by individual treatment methods such as herbicides or bulldozing (Hefley 1937, Everitt 1980, DeLoach 1991, 1996). SC qualifies under 10 of the 12 criteria of Baker (1974) that define the ideal weed. SC, being a facultative phreatophyte, can survive on soil water alone, whereas willows and cottonwoods are obligate phreatophytes that can lose contact with the water table only temporarily (Smith et al. 1998). As SC stands mature, their extremely high water usage tends to lower water tables to levels that are often below the root zone of cottonwoods and willows, especially of young small plants. SC can utilize saline groundwater and excretes the excess salts through leaf glands, that then falls to and accumulates on the soil surface, killing saline intolerant willows and other plants. The fallen SC foliage is highly flammable, causing increased fire frequency; fires kill native cottonwoods and willows but not SC. Native North American insects cause little or no damage to SC. Over time, desertification and salinization of the watershed results in localized extinction of the native trees and eventually to complete dominance of the floodplain by mono-specific SC thickets. Once this dominance is attained, SC appears to control whole ecosystem processes and to effectively preclude the re-establishment of native species through natural processes (Smith and Devitt 1996, Cleverly et al. 1997, Smith et al. 1998).

Conformance with Land Use Plans

The proposed action is in conformance with the Lower Gila South Resource Management Plan as amended by the Proposed Arizona Land Use Plan Amendment for Fire, Fuels, and Air Quality Management Environmental Assessment (Amendment EA) and Finding of No Significant Impact (2005). The proposed action to reduce hazardous fuels and restore native vegetation complies with the following management objectives (as amended):

- Maintaining fuels in wildland urban interface (WUI) areas at nonhazardous levels to provide for public and fire fighter safety;
- Ensure prescribed fire activities comply with Federal and State air quality regulations;
- Ensure each vegetation community is maintained within its natural range of variation in plant composition, structure, and function, and that fuel loads are maintained below levels that are considered to be hazardous. Appendix C of the Amendment EA specifies the following Desired Future Conditions for riparian vegetation:
    - "…that annual weed cover and density are controlled and ladder fuels and downed woody debris are limited or not present. Disturbances such as livestock grazing, mining, and off road vehicle travel, that can potentially reduce natural vegetation cover and vigor, are managed to maintain adequate cover and mix of natural plant species."

Relationship to Other Plans, Statues, Regulations and Policies

The area is within the Fred J. Weiler Green Belt which was established to manage the area for multiple uses and was segregated from all forms of appropriation under Public Land Order 1015.

The proposed action is also in conformance with Public Land Order 11988 which directs "avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative" *(Floodplain Management Guidelines, 43* CFR 6030, 1978). It is Bureau policy to retain base 100-year floodplains except: "Where federal, state, public and private institutions and parties have demonstrated the ability to maintain, restore and protect the floodplain on a continuous basis."

The proposed action will be following the Phoenix/Kingman Fire Management Plan of 2004, FMU #1 which states:

"Mechanical thinning or vegetation removal may be conducted to reduce the presence of saltcedar/tamarisk and other undesirable hazardous vegetation along riparian corridors. In limited instances prescribed fire may be used to reduce hazardous fuel accumulations along riparian corridors where the presence of saltcedar/tamarisk and other undesirable species poses a significant risk to improvements or critical habitat. Prescribed fire may be used as a means of fuel reduction following mechanical treatments."

The basis for managing vegetation, riparian-wetland, and invasive or noxious weeds on BLM administered lands can be found in the following Federal and State laws, regulations, policies, and guidance (refer to Table 2: Critical Areas Matrix for additional regulations):

- Executive Order (EO) 11990 Protection of Wetlands;
- EO 11988 Floodplain Management;
- Federal Noxious Weed Act of 1974;
- EO 13112 Invasive Species Control;
- BLM MS 1740 *Renewable Resource Improvements and Treatments*;
- BLM Manual 9011 *Chemical Pest Control*; *Environmental Impact Statement for Vegetation Treatments, Watersheds and Wildlife Habitats on Public Lands Administered by the BLM in the Western United States, including Alaska* (USDOI BLM 1991);
- Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement dated June 27, 2007 (VEG EIS);
- USDOA NRCS *Ecological Site Guides*;
- BLM *Manual* 6500 – *Wildlife, Fish and Plant Resources*;
- BLM Manual 6840 – *Special Status Species*.

Riparian restoration on the subject area would follow those strategies described under Goal Number 1-Restoration and Maintenance in the Strategic Plan *Riparian-Wetland Initiative for the 1990's* (BLM/WO/GI/001+4340). Habitat restoration is also prescribed in the BLM's *Nongame Migratory Bird Conservation Plan* under Management Strategies of the Future B. Habitat Management Goal 3. These two plans are part of *BLM's Fish and Wildlife 2000 Plan*. The plan also falls under the *Arizona Riparian-Wetland Area Management Strategy, 1990*. It would follow the BLM's commitment to the *Partners in Flight Program* which calls for restoring riparian habitat for neotropical migratory birds. The *Interagency Fire Management Plan* identifies the proposed project area as a hazardous fuel priority. It further calls for consideration of fuels modification to prevent destruction of endangered species habitat and maintain riparian habitat values and conditions (BLM 1998).

The U.S. Fish and Wildlife Service's *Southwestern Willow Flycatcher Recovery Plan* seeks in part to protect, reestablish, mimic, and/or mitigate for the loss of the natural processes that establish, maintain, and recycle riparian ecosystems. Additionally, this plan advocates management of exotic plant species and continuing research to refine management practices and knowledge of ecology (USFWS 2001).

Required Permits and Authorizations

The proposed action will require consultation with the USFWS under Section 7 of the Endangered Species Act of 1976, as amended. Project implementation is dependent on concurrence from the federal services that the proposed action will not adversely affect threatened or endangered species.

Federal project review under Section 106 of the National Historic Preservation Act (as amended) has been initiated.

Mechanized clearing of riparian areas may require Federal Section 404 (Clean Water Act) permits. EPA and the US Army Corps of Engineers (USACE) have issued a rule stating that they regard the use of

mechanized earth-moving equipment to conduct activities in waters of the United States (e.g. land clearing, ditching, channelization, and in-stream mining) as regulated discharge of dredged or fill material under Section 404 unless project-specific evidence shows otherwise.

Any prescribed burns will be done under an approved BLM burn plan and authorized daily by the Arizona Department of Environmental Quality.

Proposed Action and Alternatives

Alternative A: Proposed Action

The proposed action will accomplish the purpose and need for the project through the construction of fuel breaks and WUI buffers, and by restoring treated areas using passive or active restoration methods.

Fuel breaks and WUI buffers will be created using combinations of mechanical, prescribed fire and herbicide treatments. Restoration will be accomplished by revegetating treated fuel breaks, WUI buffers and areas burned by wildfire with native plant communities.

Fuel breaks will be constructed across the area, enclosing approximately 50-150 acres in each block. They will be linear in nature, generally running perpendicular to the Gila River channel and parallel to the channel on each end. They will be built between 50 and 300 feet wide, depending on the fuels adjacent to them. Heavy fuels will require wider fuel breaks and lighter, discontinuous fuels will only require the minimum width or no fuel break depending on the fuel loading. They will be constructed using heavy equipment, dozers, excavators or other construction type equipment. Some small areas around native riparian vegetation would be removed by hand clearing. Vegetation will be cleared to mineral soil. Vegetation cleared will be piled and burned or chipped and scattered to provide mulch. Cottonwoods, willow or mesquites encountered in fuel break construction will be avoided if possible. These fuel breaks will be maintained using either mechanical equipment or herbicides, or both. Choice of maintenance tools will be dependent upon environmental effects, efficiency and costs. In the event of a wildfire in one of the cleared blocks, this block will receive priority for further maintenance and restoration by planting and herbicide treatments.

Revegetation will be accomplished by either passive or active restoration. Passive restoration is characterized by allowing natural succession to occur in treated sites. Active restoration facilitates revegetation with soil treatments, seeding and planting, irrigation, and maintenance.

The general implementation procedure will be:

A. Site Selection
B. Hazardous Fuels Reduction
C. Site Characterization
D. Engineering & Design
E. Site Preparation
F. Site Maintenance

Site Selection

Each fuel break will be tailored to site-specific conditions that include access for mechanical clearing and maintenance equipment, recreation and cultural protection, feasibility of sequestering treated areas from livestock, wildlife habitat features, and suitability for passive or active restoration.

Cultural Resources Criteria

Fuel breaks will be constructed well away from known cultural sites so as to preclude vandalism or direct impacts from hazardous fuels reduction activities. In addition, if unknown sites are encountered in or near the path of a proposed fuel break, breaks will be re-routed avoid the site completely (including a buffer zone to avoid unearthing buried cultural deposits). As each new individual task area is identified and proposed for treatment, Section 106 of the National Historic Preservation Act (NHPA) would be applied to that area. All proposed activities will be subject to a pedestrian survey prior to implementation. If no sites eligible for the National Register are found, the fuels treatment may proceed provided that an archaeological monitor is present throughout the duration of the project. Areas where archaeological sites are known to exist will be marked and avoided. In addition, only existing roads and trails will be used as access routes. If any of these routes have not been subject to cultural survey in the recent past, one will be conducted prior to using the route.

Wildlife Criteria

At the request of the Arizona Game and Fish Department (Smith, personal comm.), any clearing that is done should be conducted to preserve dove nesting habitat until the native riparian restoration areas have become established.

No territorial or nesting SWFL have been identified along this reach of the Gila River. However, if any SWFL presence or nesting is observed in potential fuel breaks, activities will be stopped for further evaluation or adjusted to avoid negative impacts. Yuma clapper rail (*Rallus longirostris yumanensis*) habitat (inundated cattail (*Typha spp.*) marsh) will be avoided completely.

Vegetation Criteria

Fuel breaks will be designed to create discontinuities in hazardous fuels to prevent or reduce the rate of spread, with a focus on higher density saltcedar thickets. Native vegetation such as cottonwood, willow, and mesquite will be left intact.

Passive or Active Restoration Criteria

Passive restoration, or natural revegetation, is a suitable approach for those sites subject to flooding (natural irrigation and leaching) and with a native species seed source adjacent to the site. Active restoration factors include soil texture, salinity and depth to groundwater.

Hazardous Fuels Reduction

Mechanical Treatment

Mechanical removal is the use of heavy equipment to physically remove tamarisk. This is accomplished with root crown removal, mulching or with a combination of these methods.

Figure 1 Large equipment incorporating brush bar and a deep root plow used to remove tamarisk vegetation and the root crown, Bosque del Apache National Wildlife Refuge, NM. (Tamarisk Coalition 2006)

Root crown removal will be accomplished by either of two methods (from Tamarisk Coalition 2006):

1) D-7 or D-8 bulldozers equipped with brush bars are used to remove the above ground vegetation (see Figure 1). This is followed by root plows for cutting the root system below the crown and then removing the root crown using a root rake (Taylor 2003). The resulting ground surface is entirely disturbed and stripped of all vegetation. Removed biomass is stockpiled for later mulching or prescribed pile burns. Root crown removal does not use herbicide during the treatment process. This approach is most suitable for dense, monotypic saltcedar stands and terrain appropriate for bulldozer operations.

2) A second root crown removal method is to use a large excavator or specially-designed skid steers equipped with mechanical claws to pluck individual trees from the ground (see Figure 2). This approach is applicable to both monotypic stands and mixed native vegetation stands. This mechanical process completely removes the target trees and their root balls from the soil, together with a significant amount of their lateral roots. Tree mortality ranges from 80 to 95 percent. This approach provides treatment for ditches and steep river banks inaccessible to other equipment, removes only the target species, and does not use herbicides. For these methods, soil will require stabilization and erosion control features such as silt fences or straw bales to prevent flash sedimentation to standing water in the river channel.

Figure 2: Extraction of tamarisk near Socorro, New Mexico (Tamarisk Coalition 2006)

Mulching

Tamarisk can be effectively controlled by mulching the above ground tamarisk plants using specialized equipment followed by herbicide application (triclopyr) to the cut stumps. The trees are typically mulched in a six-foot wide path through tamarisk thickets at a rate of .25 to 1.5 acres per hour depending on density and terrain. The cutting heads are typically a rotary drum with knife blades or carbide teeth. Low volume herbicide application of resprouts using either the foliar or basal bark treatment method is appropriate. The carrier equipment can be any of a number of tracked or rubber tired systems typically ranging from 100 to 225 horsepower but can be as large as 500 horsepower equipment for large diameter trees (greater than 12 inches).

Figure 3: Medium-sized mulching equipment using a rotary drum cutting head, Moab, Utah (Tamarisk Coalition2006)

The use of this equipment is principally limited to areas with good to moderate access; thus, its use would not be suitable for steep embankments, canyons, or other remote locations. The mulching-in-place option as shown in Figure 3 precludes the necessity for soil stabilization/erosion control.

Herbicide Treatment

During mechanical removal operations or when density of infestations are light such as for resprout control, the use of a foliate, stump or basal bark spray can be effective using backpack sprayers, horseback sprayers or vehicle mounted equipment.

Effectiveness of both foliate and basal bark sprays are approximately 85 percent and will require some level of maintenance to kill resprouts. As density increases and access becomes more difficult, this method becomes both more expensive and less effective because of limiting abilities to spray herbicide onto all exposed basal bark or leaf surfaces.

Table 1: Herbicide Mix

Chemical	Fish Toxicity (ppm)	EEC (ppm)	Risk Category Fish
Triclopyr salt (Garlon 3A®)	500	2.21	Low
Triclopyr ester (Garlon 4®)	1	2.21	High
Imazapyr salt (Arsenal®/Habitat®)	>100	0.55	Low
Glyphosate (e.g. Roundup®)	5-1000	1.84	Low-High

Based on risk categories to fish, wildlife and invertebrates and environmental fate and transport information, only Triclopyr salt (Garlon 3A®) or Imazapyr salt (Arsenal®/Habitat®) formulations are likely to be used on this project. In general, the total characteristics of Garlon 3A® render this herbicide the preferred choice for stump applications during mechanical treatment. Both herbicides may be appropriate for spot applications to control resprouts with Garlon 3A® requiring a surfactant to enable basal bark applications. A detailed review of both herbicides is available in Appendix 2.

All herbicide treatment will be in conformance with the BLM publications:

- BLM Manual 9011 *Chemical Pest Control*; *Environmental Impact Statement for Vegetation Treatments, Watersheds and Wildlife Habitats on Public Lands Administered by the BLM in the Western United States, including Alaska* (USDOI BLM 1991)
- Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement dated June 27, 2007

Prescribed Burning

Prescribed fires (both piles and broadcast burning) will be conducted in accordance with BLM procedures and will have applicable permits (Arizona Department of Environmental Quality burn permit). Fires will generally be used under low humidity and low wind conditions to allow maximum consumption of woody materials. Burning under low wind conditions will also reduce the probability of escape.

Engineering and Design

Primarily a function of active restoration, supplemental irrigation and planting matrices will be engineered and designed for site specific conditions and water availability.

Surface Treatments

Surface treatments are often required in active restoration sites to:

- Enhance precipitation capture and infiltration
- Reduce, redistribute, and/or dilute salts and Tamarix leaf litter
- Create more spatially uniform soil texture
- Assure proper depth placement and incorporation of broadcast seed and/or mycorrhizal inoculum.

Surface treatments can involve mechanized equipment (Figure 4) leaching (irrigation prior to planting) or chemical desalinization (e.g. Hydrahume®).

Figure 4: Soil imprinting to promote moisture retention and microsites (Lair & Wynn 2004)

Planting and Maintenance

Native trees, shrubs and grasses would be used to plant the site. Regionally-obtained stock, including but not limited to, cottonwood, willow, mesquite, palo verde (*Cercidium floridum)*, saltbush (*Atriplex spp.*), inkweed (*Suaeda Torreyana*), wolfberry (*Lycium*), and seep willow (*Salix exigua*) would be planted to increase the habitat complexity. BLM would possibly use flood-irrigation, drip irrigation or subsurface irrigation to water sites, a method that has shown success in other Arizona saltcedar restoration sites. Flood irrigation emulates historic hydrologic events. The BLM office would irrigate plants for at least 2 years. The BLM will be using only contracted water hauled in for the establishment of native riparian vegetation. Should the BLM in the future find the need to drill a well or re-establish an existing well in the area, the BLM will go through the Arizona Department of Water Resources. Plant growth and survival would be carefully monitored. Any plants that die within the first 2 years of the proposed project would be replaced. Other maintenance including fencing to exclude herbivores may occur on the proposed project site. Some pole planting of cottonwood and willow trees may also take place during

the winter. Fire management using hazardous fuels funds may provide for annual maintenance to keep nonnative vegetation eradicated from the site.

Alternative B: Fuel Breaks Only

The "fuel break only" alternative includes all the treatment methods described under Alternative A: Proposed Action, less the revegetation component. Treated areas would be maintained bi-annually.

Alternative C: No Action

Under the no action alternative, the proposed project would not occur and current trends of increasing hazardous fuels accumulation and riparian habitat degradation would continue.

Alternatives Considered but not Analyzed in Detail

- Individual Treatments

Of the available saltcedar control methods, only those mechanical treatments extracting rootballs from the soil demonstrate reliable efficacy when employed independent of other treatment methods. However, these treatment options are expensive and do not typically provide complete control. Mowing, mulching, fire and chemical herbicide treatments are not effective controls when employed independent of other treatments.

- Aerial Herbicide Treatment

Broadcast aerial applications of Arsenal® is not feasible due to the lack of plant specificity, potential for residual accumulation, and proximity to sensitive resources.

- Biological Herbicide Treatment

Biological control with *Diorhabda elongata deserticola* (an Asian beetle) is not currently feasible south of the 36th parallel. Summer day lengths south of this latitude are too short to prevent the adult insects from entering winter hibernation in the summer months, preventing survival until the following spring (Tamarisk Coalition 2006).

Affected Environment

Climate & Air Quality

The area is characterized by a hot, dry climate. Average annual rainfall at Buckeye, AZ, the nearest town is about 7.5 inches. Summers are hot with temperatures over 110 degrees Fahrenheit being recorded annually. Winters are mild with very few days of freezing temperatures. Most rainfall occurs between July and September, with another rainy period experienced between November and March.

Portions of Maricopa County have been designated nonattainment for three pollutants: particulate matter (PM10), carbon monoxide (CO) and ozone (O3).

A State Implementation Plan (SIP) is an enforceable plan developed at the state and local level that explains how the area will comply with the NAAQS according to the Clean Air Act. The SIP is the cumulative record of all air pollution strategies, state statutes, state and local rules, and local ordinances implemented under Title I of the Clean Air Act by governmental agencies within the state. In general, a SIP will include historical background information, a description of the nonattainment area, an assessment of air quality conditions and ambient air quality data for the area, an emissions inventory of sources of pollutants, control strategies, an attainment demonstration, and contingency provisions. The first Arizona SIP submittal was in 1972. Because there have been so many changes to federal, state and local air quality programs over the past 30 years, there is not a single definitive document that contains all of the SIP requirements. Rather than re-writing the entire SIP regularly, parts of the SIP are simply revised as needed.

The SIP contains rules and management practices designed to allow the non-attainment area come into Federal Compliance with the Clean Air Act.

Soils & Vegetation

The project area occupies the floodplain of the Gila River from Highway 85 bridge to the Gillespie Dam. The topography is flat, level or nearly level, with slopes less than two percent. The area is bisected by shallow gullies that carry runoff into the Gila river during overland flow events.

Soils field mapping of the project area was completed in 1984 and published in May 1997 as *"Soil Survey of Gilabend-Ajo Area, Arizona. Parts of Maricopa and Pima Counties." By William W. Johnson, Jr. USDA Natural Resources Conservation Service.*

All the soils of the project area are flood plain soils, formed from mixed recent alluvium. Before dams were constructed on the Gila and tributary rivers, these soils were subject to periodic flooding which leached them of salts and increased their fertility. They are now subject to very infrequent overflows, mainly from local overland flow events.

Soil series represented are Agualt, Ripley and Glenbar, with inclusions of Gilman and Vint. Generally the soils are coarser textured on the east (upstream) end of the area and finer textured on the downstream end due to the presence of Gillespie Dam which allowed finer textured materials to be deposited behind the dam.

This area may also include soils that are saline or sodic (alkali or sodium) affected. SC is able to utilize saline groundwater and excrete the excess salts through leaf glands (Hem 1967). The brine then drips to the soil surface, or falls with the leaves in autumn, forming a layer of salt. This prevents other plants from germinating or growing among SC stands (Shafroth et al. 1995). Cottonwoods and willows can tolerate salinity levels of only 1500-2000 ppm but SC can grow at 18,000 - 36,000 ppm (Jackson et al. 1990). SC does not favor saline conditions; it only tolerates them better than do most other plants.

These soils are suitable for irrigated agriculture and have high fertility and productivity in an irrigated setting. In the subject area, the water table is between 10 and 40 feet below ground level which makes them suitable for deep rooted tree species without irrigation.

The proposed project area is located within the Sonoran Desert. Uplands are chiefly vegetated with creosote bush (*Larrea tridentata*) in plant communities containing a variety of other species. Facultative and obligate riparian trees and shrubs characterize uncultivated floodplains.

Within the proposed project area, the dominant vegetation is the nonnative tamarisk. Arrowweed *(Pluchea sericea,)* quailbush (*Atriplex lentiformis),* cattails and seep willow are also present. Tamarisk ranges in size, age class and density. Few athel tamarisk (*Tamarix aphylla*) are present. Cottonwood *(Populus fremontii),* mesquite *(Prosopis juliflora)* several species of willow *(Salix spp.)*, comprise the preferred riparian tree species, but they are in the vast minority in the subject area. Other species occuring are four-winged salt bush *(Atriplex canescens),* seepwillow *(baccharis glutinosa)*, and other typical Sonoran Desert upland species.

Small linear areas in the channel proper contain cattails and bamboo. These areas would not be disturbed.

Native plant communities

The assessment area has been compromised as have the areas described in the literature that is documented within the following paragraphs. The Gila River between the Highway 85 bridge and the Gillespie Dam native plant communities have dwindled in numbers where we are only seeing occasional native plants. The few remaining native plants within the project area are at risk to the point when wildfire occurs tamarisk outcompete all other native species. The native plant communities are not in proper functioning condition anywhere within the proposed project area.

The "original" floodplain vegetation along many of the streams in the arid southwestern U.S. was comprised of gallery forests of native cottonwoods (*Populus* spp.) and willows (S*alix* spp.); thickets of screwbean mesquite (*Prosopis pubescens*), seepwillow baccharis (*Baccharis salicifolia*), arrowweed (*Pluchea sericea*), quailbush (*Atriplex lentiformis*), and seepweed (*Suaeda occidentalis*); and low woodlands of mesquite (*Prosopis glandulosa* and *P. velvtina*) (Grinnell 1914; Ohmart et al. 1977, 1988; Tracy and DeLoach 1999). These areas were in dynamic equilibrium, in which semi-predictable natural disturbances maintained the vegetation in an early successional state. The native plants and animals are adapted to those conditions and, in fact, depend upon flood disturbance to maintain diverse structure, age classes, and community composition. The pattern of change was termed "perpetual succession" by Campbell and Green (1968) and fell within well-defined limits (Turner 1974).

By the 1950's, SC occupied most western riparian areas along major streams, from the central Great Plains to the Pacific and from northern Mexico to southern Montana. Major infestations have replaced at least 50%, and often approach 100%, of the native vegetation along large areas of nearly all the major streams within its distribution (Horton and Campbell 1974). SC occupied 900,000 acres by the mid 1960's (Robinson 1965). Today, SC probably occupies 1.5 million acres (Brotherson and Field 1987), including 29,000 acres on 33 western national wildlife refuges (Stenquist 1996).

Ohmart et al. (1977) and Turner (1974) describe the demise of the cottonwood forests along the lower Colorado River, from wood cutting and later from replacement by SC. From an original estimated 5,000 to 10,000 acres only ca. 500 acres remained in 1972. Ohmart et al. (1977) questioned whether the native plants could have withstood the SC invasion even without dams. On the middle Gila River, SC

replaced the native species without the effects caused by dams (Turner 1974). The plant is still spreading rapidly into tributaries, smaller streams and around desert springs throughout the West (Deuser 1997, Lovich and DeGouvenain 1998, Barrows 1998, Tracy and DeLoach 1999). Cottonwoods have been nearly eliminated in many of these areas and willows have been greatly reduced. A near complete replacement of the native plant communities by invasive exotics (SC and Russian olive) is predicted unless human intervention controls their spread and enhances recruitment of native species (Howe and Knopf 1991).

Wildlife

(From Deloach et al, 2001): Wildlife habitat has been seriously degraded in many SC infested areas. The population of all birds found in SC on the lower Colorado was only 39% of the levels in native vegetation during the winter and 68% the rest of the year; the number of bird species found in SC was less than half that in native vegetation during the winter (Anderson et al. 1977). SC was the most important negatively correlated variable identified with bird populations (Anderson and Ohmart 1984). Frugivores, granivores and cavity dwellers (woodpeckers, bluebirds and others) are absent, and insectivores are reduced in SC stands (Cohan et al. 1979). Seven bird species, Arizona Bell's vireo (*Vireo bellii),* Gila woodpecker (*Centurus uropygialis*), gilded northern flicker (*Colaptes chysoides*), vermilion flycatcher (*Pyrocephalus rubinus*), summer tanager (*Piranga rubra*), western yellow-billed cuckoo (*Coccyzus americanus*), and elf owl (*Micrathene whitneyi*) are in serious decline along the lower Colorado River and the Sonoran yellow warbler (*Dendroica petechia*) and sw WIFL have been extirpated from the area (Hunter 1984). Only 2% of the yellow-billed cuckoos were found in SC, 0% of Bell's vireos, 2% of summer tanagers, and 8% of the yellow-breasted chats (*Icteria virens*) (Hunter et al. 1985). At Camp Cady in southern California, the bird population was only 49% as great in SC as in cottonwood/willow/mesquite (Schroeder 1993). Bird preference for SC was much lower than for native vegetation along the middle Rio Grande, TX (Engle-Wilson and Ohmart 1978) and somewhat lower on the middle Pecos River (Hildebrandt and Ohmart 1982). Few birds were attracted to dense, monocultural stands of SC but the inclusion of some native trees, especially cottonwoods, willows or mesquites, greatly enhanced the attractiveness of the area to birds (Engle-Wilson and Ohmart 1978, Hildebrandt and Ohmart 1982).

En route Neotropical migratory birds. Cohan et al (1977) found some migratory bird species avoided monotypic stands of tamarisk during migration. Existing conditions would likely contribute to the decline of those migratory bird species that depend on cottonwood-willow habitat during migration. Migrating birds forced to occupy low-quality habitat reduce their body mass and increase their length of stay at stopover sites (Russell et al 1994). Because high-quality stopover sites are a critical link between breeding and wintering grounds, high-quality stopover habitat could have population-level implications to birds (Russell et al 1994). (From BLM 2001).

Tamarix habitats have been found to provide shelter and roosting for white-wing and mourning doves (Anderson et al. 1977a). However, *Tamarix* areas have low forage value, which forces doves to use nearby fields for food supply (Kerpez and Smith 1987). (From McDaniel et al 2004).

Populations of game animals, furbearers and small rodents are lower in SC than in other vegetation types on the Rio Grande of western Texas (Engle-Wilson and Ohmart 1978) and on the Pecos of New Mexico (Hildebrandt and Ohmart 1982). On the Rio Grande of western Texas, SC wetlands ranked

fourth and SC sixth in numbers of small rodents caught, among seven vegetative types sampled (Engle-Wilson and Ohmart 1978). In Big Bend National Park, Ord's kangaroo rat and beavers have been nearly eliminated because of the SC invasion (Boeer and Schmidly 1977). On the middle Rio Grande, SC types ranked 9th, 15th and 16th among 25 community-structural types in numbers of small mammals trapped (Hink and Ohmart 1984).

Along the Gila River near Florence, AZ Jakle and Gatz (1985) trapped 3 to 5 times as many lizards, snakes and frogs in native vegetation types as in SC. SC dried up springs and small streams, and forced wildlife to flee or die in Death Valley (Rowlands 1989). Many desert fish species are adversely affected by the narrower, deeper, and more homogenous stream habitats and by the reduction in numbers and types of food insects caused by the SC invasion (Graf 1978, 1979; Blackburn et al. 1982, Schoenherr 1988, Bestgen and Platainia 1991).

Some wildlife can use SC for some components of their needs but SC does not provide for all their needs and they must then forage on other native plants. As SC dominance increases, and the native plants decrease, populations of these wildlife species are likely to decrease for lack of resources, including the type and quantities of insects required by insectivores. SC degrades the habitat and further stresses some 40 T&E species in the southwest (Anonymous 1995, DeLoach and Tracy 1997).

Floodplains

(From McDaniel et al 2004)**:** Robinson (1965) suggested that dense *Tamarix* stands could increase in areas inundated by floods. The extensive root system of *Tamarix* is more stable and resistant to erosion than most native riparian trees and shrubs. When stream channels are stabilized, they become more immobile and inflexible (Graf 1978), which progressively restricts channel width by increasing sediment deposition. Narrowing of the water channel increases the rate of water flow and the potential and severity of subsequent floods (Egan et al. 1993; Frasier and Johnsen 1991; Friederici 1995; Kerpez and Smith 1987). A *Tamarix*-infested area on the Gila River in Arizona had a 30% increase in water flow velocity and 13% increase in water depth (Great Western Research 1989).

As the river recedes, *Tamarix* establishes itself further into the channel. This process continues until stream flow is severely reduced. *Tamarix* infestations increased on the Brazos River in northcentral Texas beginning in 1941. At this time, the mean width of the river channel along a 75-mi (121-km) stretch was 508 ft (155 m). By 1979, the mean width had been reduced to 217 ft (66 m). Narrowing channel width increased the incidence of flooding, as well as the area inundated by floodwaters (Blackburn et al. 1982). However, Everitt (1980) noted that while vegetation can promote local sediment deposition, the concept that vegetation over large areas can increase regional deposition of sediment is unfounded.

Water

SC uses great amounts of groundwater in these arid regions where availability is critical for natural ecosystems, agriculture, municipalities and industry (reviewed by Horton 1976, DeLoach 1991). The usage of water by SC has been much studied by various inflow-outflow methods along reaches of rivers (Gatewood et al. 1950), for plants growing in lysimter tanks (Gatewood et al. 1950, USDI-BOR 1973, van Hylckama 1980) by evapotranspiration measurements over stands growing in river bottoms (Gay and

Fritschen 1979, Gay 1985), by stem-flow methods (Busch et al. 1992, Cleverly et al. 1997) and in river bottoms before and after clearing SC on the Gila River (Culler et al. 1970) and on the Pecos River (Weeks et al. 1987). Best estimates of usage vary from ca. 5.7 acre feet of water lost through evapotranspiration per year in the lowest and hottest areas along the lower Colorado to 3.2 ft. at higher elevations along the middle Rio Grande, NM. In one experiment in lysimeter tanks, SC used 51 to 72% more water at 40 to 60 in. depth to water table than did seepwillow baccharis (Gatewood et al. 1950). SC, being much deeper rooted and more salinity tolerant, can grow further back from the river, in more saline areas, and can extract water from a deeper level than can C/W and thus can occupy a larger area and use more water across the floodplain than would be possible by the native phreatophytes. Under natural conditions, less dense communities of mesquites, quailbush or other mesic plants, which use less water than SC (Sala et al. 1996, Cleverly et al. 1997), would occupy these areas further from the river. Smith et al. (1998) discussed that the higher leaf area per unit sapwood area and per unit area of soil surface, tighter stomatal control, and quick recovery after drought gave SC a strong advantage over other riparian plants. (From Deloach et al 2001).

Fire

(From Deloach et al 2001): Wildfires are rare in native riparian plant communities (Agee 1988). SC-infested areas, however, burn more frequently and more destructively than the native vegetation, especially after dry litter has accumulated under the stands. These fires often kill all cottonwoods, damage other native vegetation, destroy wildlife breeding areas, including nests of the sw WIFL (Paxton et al. 1996), and destroy campsites, fences, etc. (Akashi 1988, Ohmart et al. 1988, Busch and Smith 1992, Belnap 1997). Efficient post-fire resprouting mechanisms are lacking in willows and cottonwoods but are efficient in saltcedar. Indeed, saltcedar may have developed adaptive characteristics that influence the flammability of the communities where they grow, such as the accumulation of leaf litter. Saltcedar thus can alter whole ecosystem properties including fire (Busch and Smith 1993), nutrient dynamics, and alluvial hydrology (Vitousek 1990). The project area has seen considerable fire activity within the last 5 years (3 Wildfires) that has played a crucial role in the replacement of native plant communities with salt cedar. The fire intensity that fire personnel have witnessed during Wildfires in the project area are not conducive to any suppression tactics within the heavy thickets of salt cedar. As wildfires burn the native plants suffer mortality not able to recover as salt cedar quickly re-sprouts and out competes the native plants. Normal fire return intervals for riparian areas are greatly increased by the flammability of the salt cedar and its abilities to spread.

Recreation

(From Deloach et al 2001): SC substantially reduces recreational usage of parks, national wildlife refuges and other riparian areas for camping, hunting and fishing, boating, bird watching and wildlife photography (Kunzmann et al.1989, DeLoach 1991). SC in this area of the Gila River has caused declines in many desirable species but also because SC creates nearly impenetrable stands that block access to other habitats, it drips brine in humid mornings, and it accumulates dust. The recreation opportunities are in steady decline because of the nature of salt cedar and its abilities to grow in closed canopies and produce thick stands that humans cannot even walk through. This area recreation uses include hunting, bird watching, fishing and shooting.

Agriculture and Grazing

SC reduces livestock stocking capacity by displacing forage grasses, by using ground water or irrigation water that otherwise could be available to grow forage or crop plants, by increasing soil salinity, and by increasing the incidence of fires. Also, it is of low palatability to livestock and is inferior to native cottonwood/willow for resting or loafing areas during the summer.

The Powers Butte Grazing Allotment #3068, containing 11646 acres of BLM administered lands is the only grazing allotment in the project area. It is classified as an ephemeral allotment and follows the Special Rule for Ephemeral Ranges published in the Federal Register, Vol. 33, No. 238, Saturday, December 7, 1968 (Livestock Grazing Ephemeral Range: Arizona, California and Nevada). Ephemeral range does not consistently produce forage, but periodically provides annual vegetation suitable for livestock grazing. In years of abundant moisture and other favorable climatic conditions a large amount of forage may be produced. Favorable years are highly unpredictable and the season is usually short lived. Ephemeral areas fall generally below the 3,200-foot contour and below the eight-inch precipitation isoline. A minor percentage of the total plant composition is made up of desirable perennial forage plants and potential to improve range condition and produce a dependable supply of forage by applying intensive management practices is lacking. Because of the unique characteristics of ephemeral range the following special rule applies:

Applicable allotments or uses shall be formally designated by the District Manager as ephemeral range. An annual application by qualified licensees or permittees is not required unless grazing use is desired. On a year-to-year basis whenever forage exists or climatic conditions indicate the probability of an ephemeral forage crop, livestock grazing may be authorized upon application pursuant to any management requirements for the allotment. Use of base property (water base) during nonforage years is not feasible or economical and no use of base properties is required except during these periods when ephemeral forage is available and livestock grazing occurs.

These ephemeral allotments are only grazed sporadically and for relatively short periods of time. Whether these ephemeral allotments are grazed depends on forage available, market conditions and decisions of the permittee. The Powers Butte allotment has only been grazed for 4 years out of the last 10 years. Livestock authorized in that 10 year period have been as follows: 1998-120 Animal Unit Months (AUMs), 2003-113 AUMs, 2005-268 AUMs, and 2008-135 AUMs, for an average of 159 AUMs each year grazed (an AUM is 1 adult cow or its equivalent for one month.) During the years grazing was authorized, livestock only grazed for a 60 to 90 day period each time.

Since the riparian area is not fenced to keep livestock out during restoration plantings, fencing would be necessary to prevent livestock damage to the planted vegetation. A temporary electric fence powered by a solar fence charger would be used to protect the plantings. Electric fencing using two hot wires and one ground wire or two wire electric fencing would be built around the cleared areas prior to re-vegetation. Materials needed would be less than for a standard permanent fence and the fence would only have to be energized whenever livestock use is authorized. Fence construction would involve clearing of the proposed fence line using heavy machinery, if necessary, installing posts and stretching

the wire. Fences would be built to BLM Fence Standards. Standard Cultural Clearances for a fence project would be done and if necessary, the fence location would be moved to prevent damage to cultural resources.

Cultural and Native American Resources

A total of 13 archaeological surveys have been conducted within or adjacent to the area of potential effect from 1963-2006. The surveys yielded 12 archaeological sites. Among these, a total of eleven sites are prehistoric and are affiliated with the Hohokam and Patayan cultures. Most sites consist of artifact scatters, some with associated features. These features include prehistoric trash mounds, room block remnants, and rock lined, "D-shaped" terraces found on both Robbins and Powers Buttes. In addition, two sensitive petroglyph sites have been identified on both of these buttes which are located immediately adjacent to the proposed project area. BLM staff have conducted site visits to six of these sites within or adjacent to the area of potential effect. None of the sites visited were given an eligibility determination for the National Register of Historic Places upon initial recording. During the re-visit, the petroglyph sites were evaluated pursuant to National Register criteria for eligibility. These petroglyph sites are recommended as eligible for the National Register of Historic Places (NRHP). The other four sites visted are recommended as eligible to the NRHP as well. The remaining six sites are inaccessible due to environmental constraints and heavy fuel loading (dense tamarisk) and will need further evaluation for eligibility as they become accessible.

The proposed three-phase fuels treatment (fuel break construction, lagoon construction, and reintroduction of native tree species such as cottonwood, willow and mesquite) would reduce the potential of large catastrophic wildfires spreading through the project area. Fuel break construction would ensure that these areas would be less likely to revert to the dense tamarisk stands and heavy fuel loads. This would make the damage or destruction of valuable archaeological data and cultural properties as a whole, less likely.

The phased nature of these fuels treatments allows for additional surveys and archaeological monitoring prior to the implementation of the proposed treatment. The BLM's IM 90-52 states that "areas that would be subjected to surface disturbance would be inventoried at the Class III level". This includes the construction of fuel breaks or any areas to be cleared by hand or machines.

Native American consultation was initiated by letter in September 2008. The Ak - Chin Indian community, the Gila River Indian Community, the Salt River Pima - Maricopa Indian Community, the Tohono O'odham Nation, and the Hopi Tribe were all included in this consultation effort. Throughout the Fall of 2008, follow-up telephone calls were made by BLM staff to the Cultural staff at each of the tribal offices to make sure that they received the letter and accompanying map. The Hopi Tribe and the Ak-Chin Indian Community both responded by letter. On December 16, 2008, LSFO staff met with tribal representatives in the field for a tour and further consultation. Cultural staff from the Gila River Indian Community and Salt River Pima-Maricopa Indian Community were able to make a field visit and view a large area of the proposed project. These representatives appeared to agree with the goals of the project and appreciated all efforts to minimize effects to resources. Several of the tribes would like to

receive cultural reports generated by this project as the various task areas receive funding for treatment activities.

Environmental Effects

The following table summarizes potential impacts to various elements of the human environment, including the "critical elements" listed in BLM Manual H-1790-1, Appendix 5, as amended. BLM considers critical elements of the human environment to fall into 3 categories:

1. Uses of or resources that are not affected by the proposed action (NA);
2. Uses of or resources that are present and that may or may not be affected by the proposed action (PA);
3. Uses or resources not present and not affected by the proposed action (NP).

Table 2: Critical Element Matrix

Critical Element	*Regulation*	*Not Present*	*Not Affected*	*Possibly Affected*
Air Quality	The Clean Air Act as amended (42 USC 7401 et seq.)	☐	☐	☒
Vegetation and Soils	Resource identified as pertinent during internal scoping.	☐	☐	☒
Cultural Resources	National Historic Preservation Act, as amended (16 USC 470)	☐	☐	☒
Wetlands and Riparian Zones	EO 11990 Protection of Wetlands 5/24/77	☐	☐	☒
Fish Habitat	Magnuson-Sevens Act Provision: essential Fish Habitat (EFH): Final Rule (50 CFR Part 600; 67 FR 2376, January 17, 2002)	☐	☐	☒
Forest and Rangelands	Healthy Forests Restoration Act of 2003 (P.L. 108-148)	☐	☐	☒
Migratory Birds	E.O. 131186, "Responsibilities of Federal Agencies to Protect Migratory Birds" January 10, 2001 Migratory Bird Treaty Act of 1918, as amended (16 USC 703 et seq.)	☐	☐	☒
Native American Religious Concerns	American Indian Religious Freedom Act of 1978 (42 USC 1996)	☐	☐	☒
Threatened or Endangered Species	Endangered Species Act of 1983, as amended (16 USC 1531)	☐	☐	☒
Wastes (Hazardous & Solid)	Resource Conservation and Recovery Act of 1976 (43 USC 6901 et seq.) Comprehensive Environmental Response Compensation, and Liability Act of 1980, as amended (43 USC 9615)	☒	☐	☐
Water Quality (Drinking-Ground)	Safe Drinking Water Act, as amended (43 USC 300f et seq.)	☐	☒	☐

Wild & Scenic Rivers	Wild and Scenic Rivers Act, as amended (16 USC 1271)	☒	☐	☐
Wilderness	Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.); Wilderness Act of 1964 (16 USC 1131 et seq.)	☒	☐	☐
Environmental Justice	E.O. 12898, "Environmental Justice" February 11, 1994	☒	☐	☐
Floodplains	E.O.11988, as amended, Floodplain Management, 5/24/77	☐	☐	☒
Mining (Sand & Gravel)	Resource identified as potentially pertinent during internal scoping.	☒	☐	☐
Invasive Non-Native Species	Resource identified as pertinent during internal scoping and project impact analysis.	☐	☐	☒
Wildlife	Resource identified as pertinent during internal scoping and external scoping.	☐	☐	☒
Visual Resources	Resource identified as potentially pertinent during internal scoping.	☐	☒	☐
Energy Resources	Resource identified as potentially pertinent during internal scoping.	☒	☐	☐
Prime Unique Farmlands	Resource identified as potentially pertinent during internal scoping.	☒	☐	☐
Recreational Resources	Resource identified as pertinent during internal scoping and project impact analysis.	☐	☐	☒

Air Quality

Alternative A – Proposed Action

The use of gasoline or diesel-powered heavy machinery during clearing of fuel breaks and mechanical treatment may produce small amounts of carbon monoxide. Small amounts of herbicide would be released into the atmosphere at the point of the spray nozzle. However, the affects would be temporary. The proposed action would contribute to levels of PM-10 (in the form of dust) for a limited duration during mechanical activities. Prescribed fire would increase the levels of PM-10 and PM25 pollutants from smoke for short periods (estimated 12-24 hours) while burning is taking place. A burn permit issued daily by the Arizona Department of Environmental Quality assesses proposed emissions and determines whether a permit will be issued on a given day based on atmospheric criteria.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A.

Alternative C – No Action

Air quality would not be directly affected if the proposed project does not take place. However, wildfires not contained by the fuel breaks to limit their size and duration as in the proposed action would potentially emit smoke for several days duration.

Vegetation

Alternative A – Proposed Action

Vegetation in the proposed project area would be disturbed or removed. If any cottonwood, willow, mesquite or athel tamarisk are discovered during proposed project operations, this vegetation would be avoided when possible during the fuels reduction procedure. Species left during fuel break construction would benefit from reduced competition from the tamarisk removed. Native understory vegetation such as arrowweed and quailbush would be disturbed, but is likely to regenerate in time due to seed and vegetative dispersal. Planting native riparian vegetation along with recruitment from existing seed beds and neighboring lands would augment the structural complexity of habitat and generally enhance ecological diversity. Since the area would be treated in blocks of 75-150 acres, large areas of vegetation would not be disturbed at any one time. Fuel breaks would reduce the amount of vegetation present but would have no overall adverse effect on the present vegetation. Fuel breaks would have a beneficial impact from their role in allowing wildfires to be controlled to relative small acreages.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less beneficial effects of restoration.

Alternative C – No Action

Existing vegetation would continue to increase in height and density. Tamarisk would exclude recruitment of native species. Non-native vegetation would continue to pose a hazardous fuel threat. No fuel breaks in place would allow wildfires to become larger and kill any native riparian vegetation present.

Soils

Alternative A - Proposed Action

Soils over the entire proposed project area would be disturbed by the action of bulldozers, front-end loaders, and other heavy equipment during the removal of primarily nonnative vegetation. Mulch may be left on site and blended into the soils. This disturbance would not be detrimental except for fugitive dust during construction activities. Overall soil salinity would decrease due to tamarisk removal, leaching and mixing of the soil layers. Implementation of standard stormwater and erosion control best management practices associated with construction sites (such as revegetation, straw bales, silt fences, etc.) will prevent negative impacts from erosion.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less beneficial effects of restoration.

Alternative C - No Action

No soil would be disturbed as a result of this alternative. Soils would be likely to increase in salinity as the result of tamarisk dominance.

Cultural Resources & Native American Religious Concerns

Alternative A – Proposed Action

The proposed action will reduce the potential of large catastrophic wildfires spreading through the project area. Fuel break construction would ensure that these areas would be less likely to revert to the

dense tamarisk stands and heavy fuel loads. This would make the damage or destruction of valuable archaeological data and cultural properties as a whole, less likely.
The phased nature of these fuels treatments allows for additional surveys and archaeological monitoring prior to the implementation of the proposed treatment. Clearing of portions of the project area would make the area more accessible for pothunters and could lead to increased vandalism of the site.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A.

Alternative C – No Action

Under the no action alternative, no fuels treatment projects will be conducted. This lack of treatments could result in damage or destruction of all cultural sites present by large, uncontrolled, excessively hot wildfires. The damage would likely be severe due to extremely heavy fuel loadings. Examples of damage in this catastrophic fire regime include, but are not limited to, increased hydration in obsidian, extensive smoke and/or heat damage (spalling) of petroglyphs and artifacts, and increased oxidation in historic metal objects. In addition, unknown cultural resources could sustain damage during wildfire suppression activities, especially during activities associated with the protection of other resources, such as life and property. These activities may include cutting wide emergency fuel breaks with heavy equipment. Erosion would be increased after these wildfires and this could lead to total or partial loss of the site. Erosion could also lead to the discovery of sites not previously discovered.

Wetlands and Riparian Zones

Alternative A – Proposed Action

The entire proposed action occurs within the riparian zone of the Gila River. A primary purpose for this project is to improve the quality of that riparian zone. Impacts to specific riparian features are discussed in appropriate sections (vegetation, soil, wildlife, etc.). Overall, the net impact from the proposed action will be positive to each riparian ecosystem component. The project will have no impact on primary wetlands (these areas will be avoided).

Alternative B – Hazardous Fuels Reduction Only

Impacts similar Alternative A, less beneficial effects of restoration.

Alternative C – No Action

Under the no action alternative, the proposed project would not occur, and the riparian and wetland functions and values would continue to deteriorate. Areas burned by wildfires would not be restored and would soon revert back to saltcedar. Low-value, nonnative vegetation communities would continue to persist and expand. Hazardous fuels would accumulate, further increasing the possibility of wildfire and increasing risk of deleterious effects to the riparian zone.

Fish Habitat

Alternative A – Proposed Action

The primary threat posed by project activities is increased sediment loading. Implementation of standard best management practices for erosion control (revegetation, straw bales, silt fences, etc.) will prevent negative impacts to fish habitat. Herbicide use is not expected to pose any negative impact to fish or fish habitat (see Appendix 2: Herbicides). Expected positive impacts include improvements to channel morphology and heterogeneous habitat conditions and improvements to numbers and types of food insects.

Alternative B – Hazardous Fuels Reduction Only

Direct impacts similar to Alternative A, less positive effects from the restoration component. Indirect impacts could include increased stormwater turbidity and negative water quality impacts, degrading fish habitat.

Alternative C – No Action

Taking no action to control saltcedar or reestablish native vegetation would have little or no effect on baseline conditions in heavily infested areas. However, some existing habitat along the fringes of standing water may be negatively impacted as saltcedar encroaches on wetland habitat. Many desert fish species are adversely affected by the narrower, deeper, and more homogenous stream habitats and by the reduction in numbers and types of food insects caused by the SC invasion.

Rangelands

Alternative A – Proposed Action

The proposed action would not limit the use of the grazing allotment but would require the exclusion of livestock from restored areas since livestock eat young cottonwood and willow shoots and could trample and damage plantings. After the planted vegetation reaches a height above the grazing height of cattle (6-8 feet), damage from browsing would be minimal. Subsequent evaluation would determine if the fence would no longer be necessary as the area revegetates. If the restored area were not excluded from livestock grazing effects on the riparian plantings would be adverse. The adverse affects would be limited because of the sporadic and limited nature of ephemeral grazing.

Alternative B – Hazardous Fuels Reduction Only

With hazardous fuels reduction only, no fencing would be required to protect restored areas. No negative or beneficial effects are anticipated to rangelands under this alternative.

Alternative C – No Action

Implementation of the no action alternative would have no effect on current livestock grazing activities.

Migratory Birds

Alternative A – Proposed Action

The proposed action is expected to have no negative impact on migratory birds during hazardous fuels reduction or restoration activities. Sufficient habitat will be available adjacent to treated areas. Selected herbicides are not expected to negatively impact avian species. Restoration of native plant communities is expected to benefit migratory birds in the long term.

Alternative B – Hazardous Fuels Reduction Only

Impacts same as Alternative A, less beneficial effects of restoration.

Alternative C – No Action

Populations of neotropical migratory birds are likely to continue the trend of decline, corresponding with the decline in riparian habitat quality. Low foraging habitat value reduces survivorship and fecundity of migratory birds en route to breeding and wintering grounds.

Threatened and Endangered Species

Alternative A – Proposed Action

SWFL is not documented in the project area. However, The proposed action could adversely affect the SWFL if mitigating measures are not followed. Mitigating measures would include no hazardous fuels reduction allowed during the nesting period from May 1-September 15. By only treating areas within established fuel breaks, disruption of habitat would be kept to a minimum. Restoration of the areas cleared would produce suitable habitat within 5 years. By treating the subject area in a stepwise manner, large amounts of habitat destruction would not occur. The long term impacts would be positive to the Southwestern Willow Flycatcher. Yuma clapper rail habitat will not be directly affected by project activities. Indirectly, Yuma clapper rail habitat will be protected by reducing saltcedar encroachment.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less beneficial effects of restoration.

Alternative C – No Action

Saltcedar remains negatively correlated to saltcedar infestation. Taking no action will allow saltcedar to continue and increase negative impacts to threatened and endangered species.

Water Quality

Alternative A – Proposed Action

The proposed action would remove high-density tamarisk, therefore reducing localized evapotranspiration. Increased groundwater availability would give native plants a better opportunity to establish. Herbicide use as prescribed should have no impact on water quality (surface or ground).

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A.

Alternative C - No Action.

Surface water would not be affected. Negative groundwater impacts (depletion) would continue unabated.

Floodplains

Alternative A – Proposed Action

Although saltcedar is associated with altered floodplain hydraulics, the only anticipated positive effect from restoration is to arrest negative habitat impacts associated with those floodplain dynamics discussed in Affected Environment: Floodplains. It is not expected that revegetation will reverse floodplain alterations.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A.

Alternative C – No Action

Expansion of negative impacts to floodplain dynamics (channel narrowing, deepening, etc.) will occur as saltcedar continues to spread under the no action alternative.

Invasive Non-native Species

Alternative A – Proposed Action

The hazardous fuels reduction component will have a beneficial impact by reducing saltcedar, enabling restoration. Restoration will reverse negative impacts associated with saltcedar infestation.

Alternative B – Hazardous Fuels Reduction Only

Invasive species density will be reduced. No reversal of invasive species effects will occur.

Alternative C – No Action

The no action alternative will enable saltcedar to expand its territory and negative impacts on critical ecosystem elements.

Wildlife

Alternative A – Proposed Action

Direct impacts. While removing tamarisk, heavy equipment could crush, bury or kill smaller, less mobile animals such as rodents, lizards, or snakes. After piling tamarisk, small animals may establish homes within piles, and shredding/chipping piles or burning could kill animals residing within piles. Prescribed burning would also kill smaller the smaller less mobile animals.

Indirect impacts. The loss of tamarisk habitat would negatively affect animals within and adjacent to the proposed project area initially. Animals living in the area would be potentially displaced into poorer habitats, or forced to encroach into the territories of other individuals adjacent to the proposed project area. Consequently, displaced and encroached upon individuals would have more difficulty finding food, seeking shelter, and attracting mates because of higher animal densities and competition for limited resources.

Despite the short-term negative impacts to wildlife in the proposed project area, wildlife should benefit in the long-term after successfully planting and establishment of native cottonwood, willow, or mesquite.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less positive effects from restoration.

Alternative C – No Action

Effects on habitat from taking no action would be indirect. Existing habitat would continue to provide insufficient functions and values, and expanded saltcedar boundaries would degrade encountered habitat functions and values. The no action alternative would have no impact on wildlife individuals.

Visual Resources

Alternative A – Proposed Action

Visual resources would be altered by the proposed action. Cleared land would be a sharp contrast from the neighboring nonnative vegetation coverage. Replanting the cleared areas with native vegetation would be an improvement over the present tamarisk vegetation type. In time, the restored vegetation would closely resemble pre-settlement conditions, which would be a beneficial impact. It is assumed that inequalities in mortality and vigor would emulate natural patchiness.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less positive effects of restoration.

Alternative C – No Action

The no-action alternative would have no impact on existing visual resources.

Recreational Resources

Alternative A – Proposed Action

The proposed action would possibly initially reduce dove populations due to removal of tamarisk and thus reduce hunter opportunities and recreational visitations. However, successful restoration of the riparian vegetation will improve dove and other wildlife habitat and increase recreation visits to the area. Fishing, hiking and birdwatching opportunities would not be affected. The overall impact would be beneficial to recreation.

Alternative B – Hazardous Fuels Reduction Only

Effects same as Alternative A, less positive effects of restoration.

Alternative C – No Action

There would be no effect from the no action alternative. Recreational activities would remain unchanged.

Cumulative Impacts

Cumulative effects on select critical elements were analyzed for the immediate geographic scope of the Gila River project area within a 5-year planning horizon. No other federal or state actions, other than the state actions associated with the Robbins Butte Wildlife Refuge, were identified in the project area. However, the proposed actions are a series of hazardous fuels reduction projects and associated revegetation and burned area emergency rehabilitation responses. Over the 5-year planning period for these actions, the results will be a net cumulative improvement in:

- The number and diversity of wildlife along this reach of the Gila River;
- Firefighter and public safety;
- Soil conditions for unassisted native plant regeneration.

Tribes, Individuals, Organizations or Agencies Consulted

Tribes & Native American Communities
• Ak-Chin Indian Community • Salt River Pima-Maricopa Indian Community • Gila River Indian Community • Tohono O'odham Nation • Hopi Tribe

Arizona Game and Fish Department

- Phil Smith, Robbins Butte Wildlife Refuge

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Appendix 1 – Maps & Figures

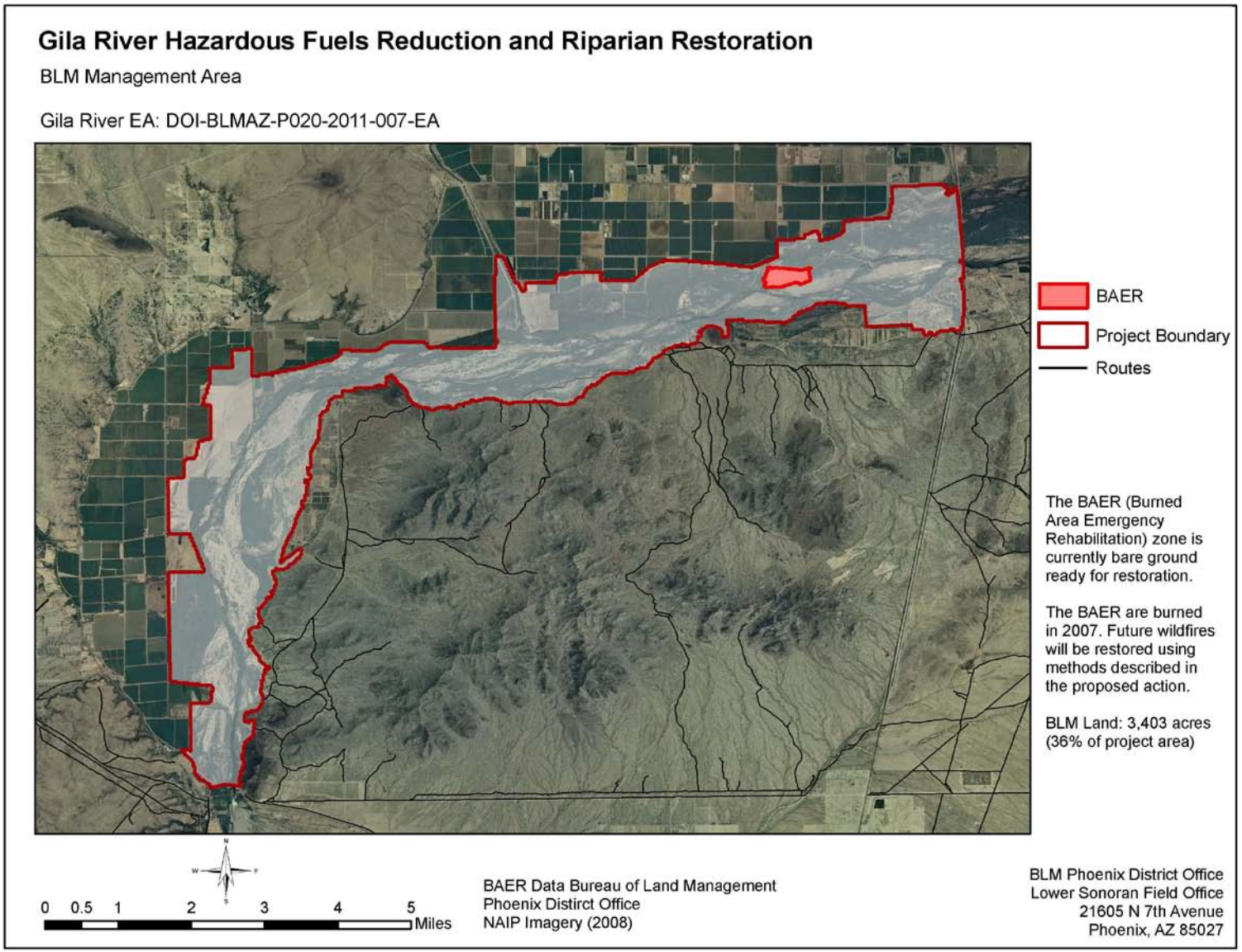


Figure 5: Project Area Boundary

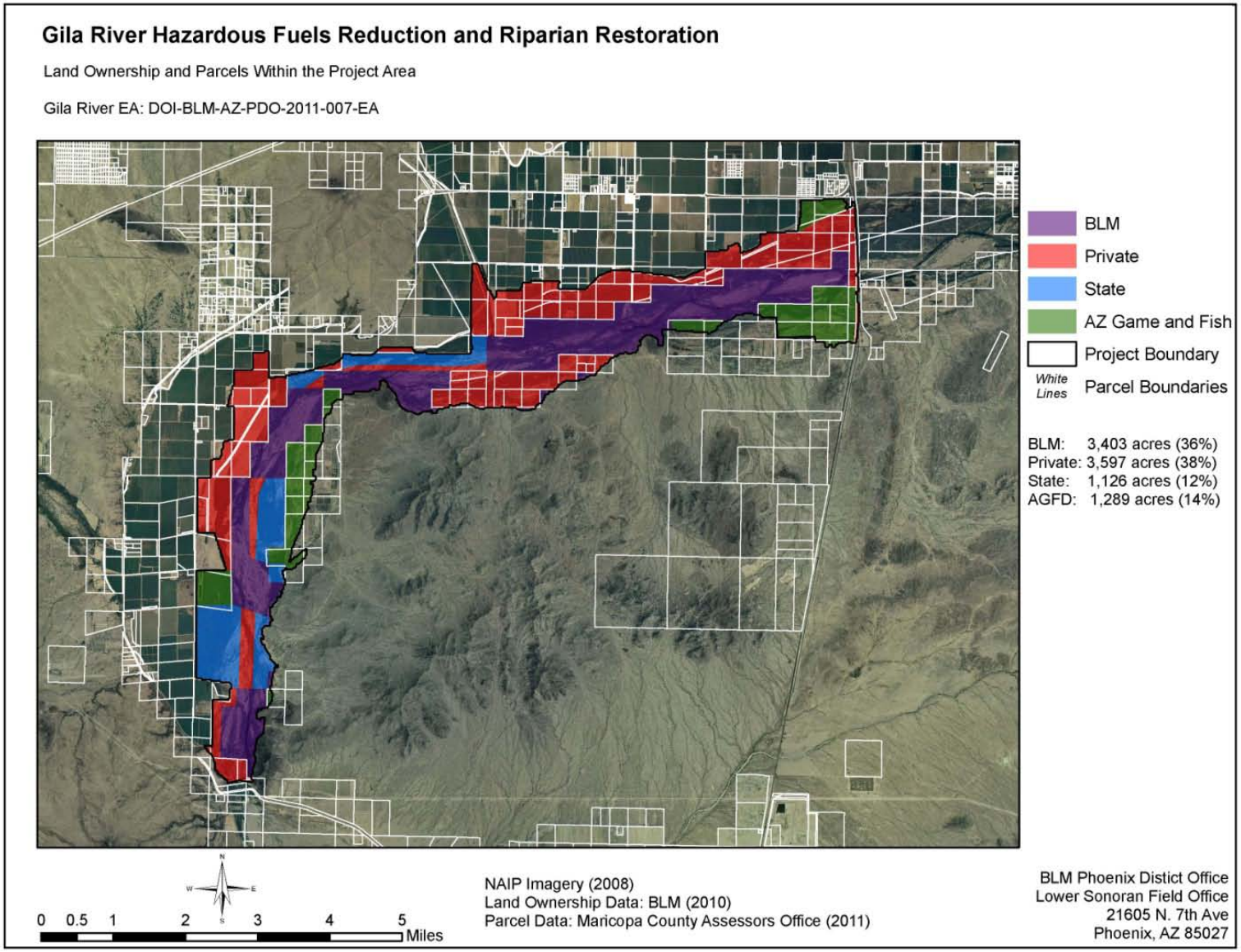


Figure 6: Land Ownership Parcels within the Project Area

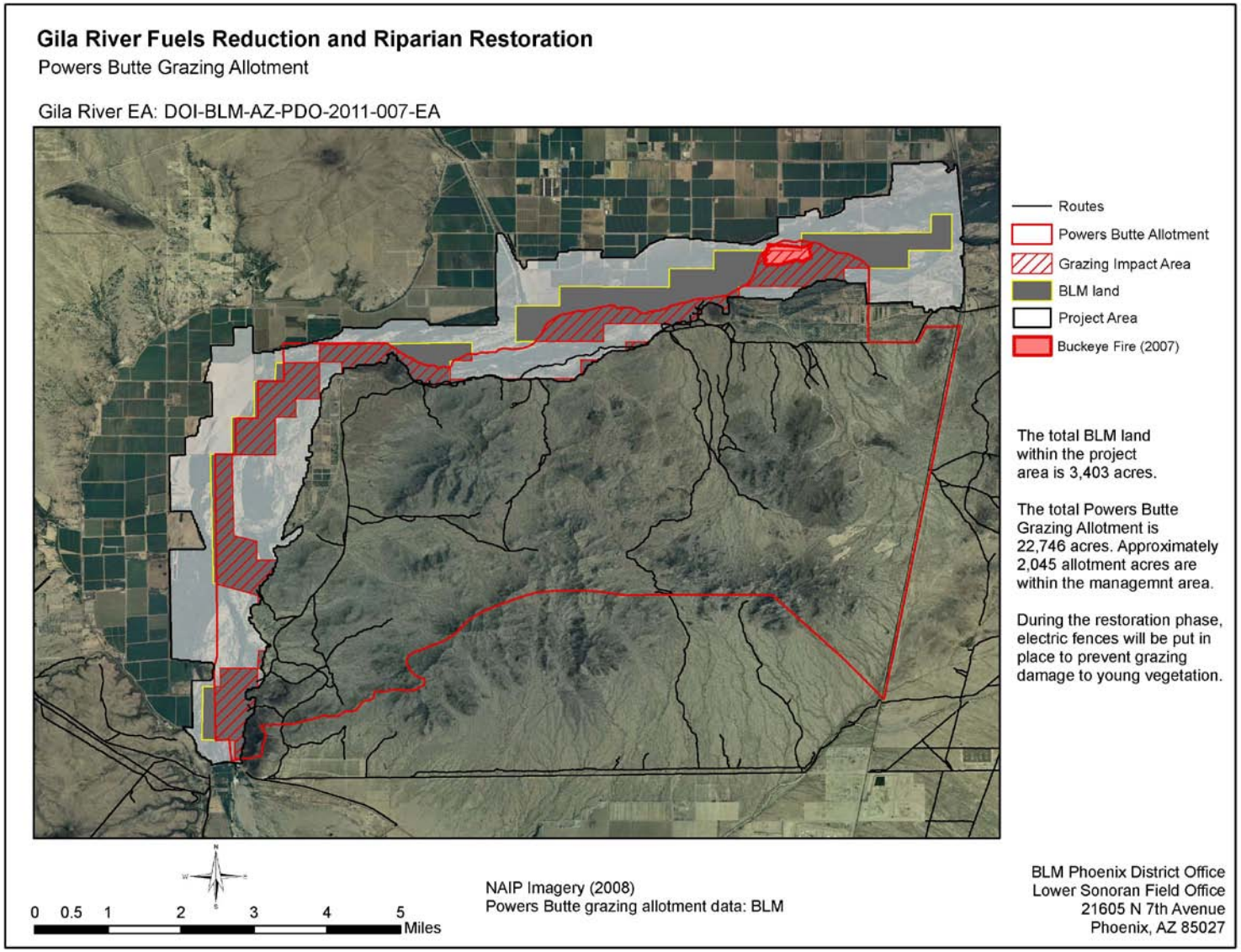


Figure 7: Powers Butte Grazing Allotment

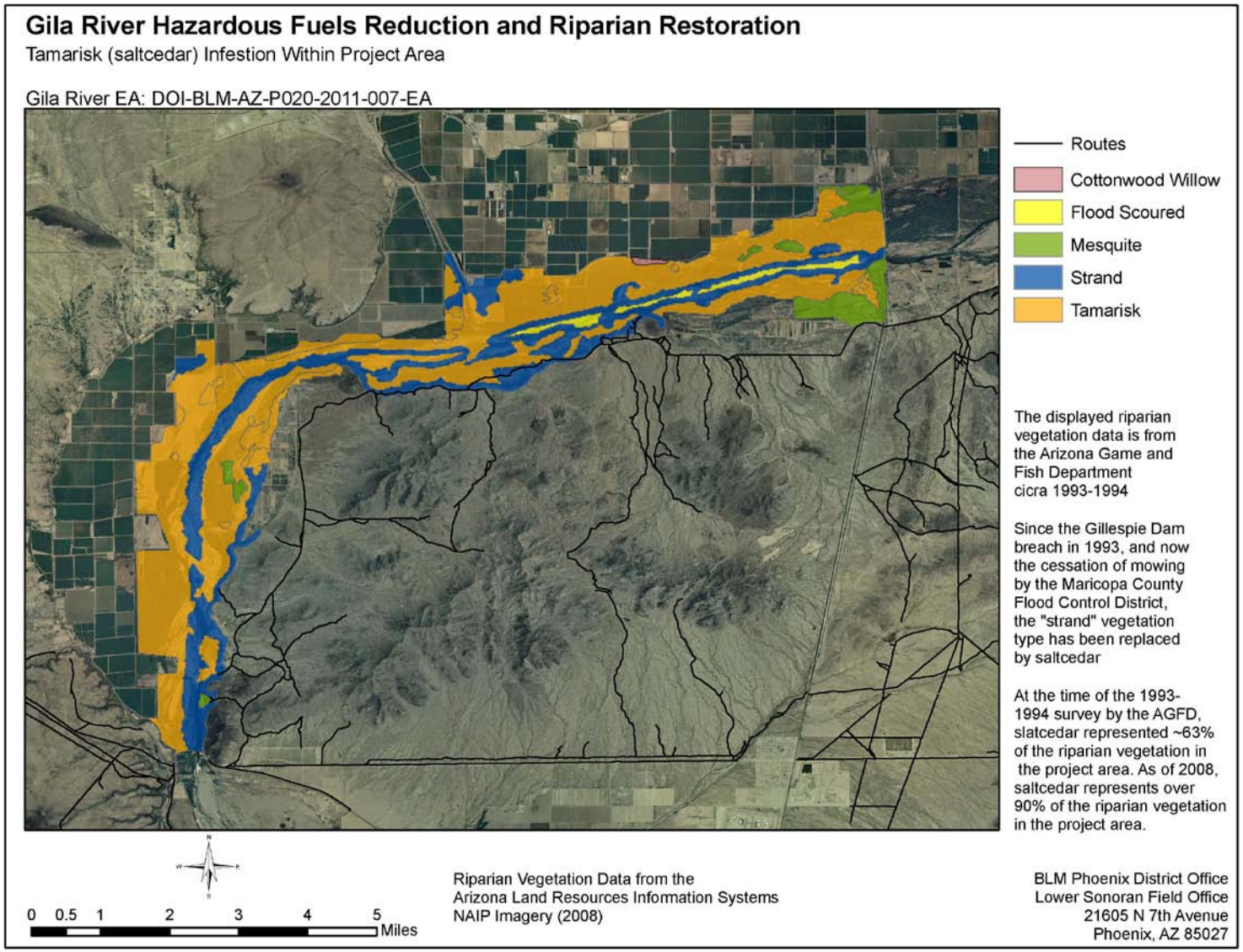


Figure 8: Tamarisk Infestation within Project Area

Appendix 2 – Herbicides

Weed Control Methods Handbook, The Nature Conservancy, Tu *et al*.

TRICLOPYR

M. Tu, C. Hurd, R. Robison & J.M. Randall

Herbicide Basics **Chemical formula:** [(3,5,6 trichloro-2-pyridinyl)oxy] acetic acid

Herbicide Family: Pyridine (Picolinic acid)

Target Species: Broadleaf herbs and woody species

Forms: salt & ester

Formulations: EC, SL

Mode of Action: Auxin mimic

Water solubility: 430 ppm (acid), 23 mg/L (ester), 2,100,000 mg/L (salt)

Adsorption potential: Intermediate (higher for ester than salt)

Primary degradation mech: Microbial metabolism, photolysis, and hydrolysis

Average Soil Half-life: 30 days

Mobility Potential: Intermediate

Dermal LD50 for rabbits: >2,000 mg/kg

Oral LD50 for rats: 713 mg/kg

LC50 for bluegill sunfish: 148 mg/L

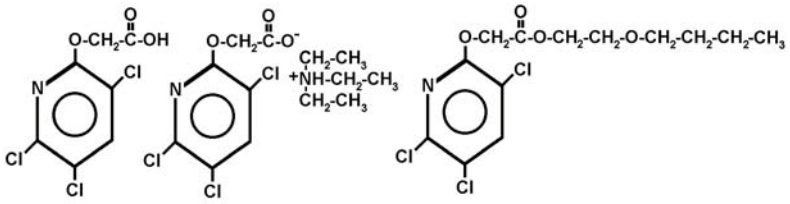
Trade Names: Garlon® and Access®

Manufacturers: Dow Agro-Sciences and Platte

Synopsis

Triclopyr is a selective systemic herbicide used to control woody and herbaceous broadleaf plants along right-of-ways, in forests, and in grasslands and parklands. It has little or no impact on grasses. Triclopyr controls target weeds by mimicking the plant hormone auxin, causing uncontrolled plant growth. There are two basic formulations of triclopyr - a triethyamine salt, and a butoxyethyl ester. In soils, both formulations degrade to the parent compound, triclopyr acid. Degradation occurs primarily through microbial metabolism, but photolysis and hydrolysis can be important as well. The average half-life of triclopyr acid in soils is 30 days. Offsite movement through surface or subsurface runoff is a possibility with triclopyr acid, as it is relatively persistent and has only moderate rates of adsorption to soil particles. In water, the salt formulation is soluble, and with adequate sunlight, may degrade in several hours. The ester is not water-soluble and can take significantly longer to degrade. It can bind with the organic fraction of the water column and be transported to the sediments. Both the salt and ester formulations are relatively non-toxic to terrestrial vertebrates and invertebrates. The ester formulation, however, can be extremely toxic to fish and aquatic invertebrates. Because the salt

cannot readily penetrate plant cuticles, it is best used as part of a cut-stump treatment or with an effective surfactant. The ester can be highly volatile and is best applied at cool temperatures on days with no wind. The salt formulation (Garlon 3A®) can cause severe eye damage.



Triclopyr acid Triethylamine salt Butoxyethyl ester

Herbicide Details

Chemical Formula: [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid

Trade Names: There are two basic formulations of triclopyr: a triethylamine salt (triclopyr amine or salt), and a butoxyethyl ester (triclopyr ester). The amine formulation is sold under the trade name Garlon 3A® and is marketed in garden shops and hardware stores as Turflon Amine® or as Brush-B-Gone®. The ester formulation is sold under the trade name Garlon 4® and is marketed in garden shops and hardware stores as Turflon Ester®. Other trade names include Access®, Crossbow®, ET®, PathFinder II®, Redeem®, and Remedy®. These products also may be mixed with picloram or 2,4-D to increase their versatility.

Manufacturers: Dow Agrosciences (formerly known as DowElanco or Dow Chemical), Platte

Use Against Natural Area Weeds: Triclopyr is used to control broadleaf herbs and woody species (WSSA 1994). It is particularly effective at controlling woody species with cut-stump or basal bark treatments. Susceptible species include the brooms (*Cytisus* spp., *Genista* spp., and *Spartium* spp.), the gorses (*Ulex* spp.), and fennel (*Foeniculum vulgare)*. Triclopyr ester formulations are especially effective against root- or stem-sprouting species such as buckthorns (*Rhamnus* spp.), ash (*Fraxinus* spp.), and black locust (*Robinia pseudoacacia*), because triclopyr remains persistent in plants until they die.

Even though offsite movement of triclopyr acid through surface or sub-surface runoff is a possibility, triclopyr is one of the most commonly used herbicides against woody species in natural areas. Bill Neil, who has worked extensively on tamarisk/saltcedar (*Tamarix* spp.) control, concluded that Pathfinder II®, a triclopyr ester formulation by DowElanco, is the most cost effective herbicide for combating saltcedar. On preserves across the U.S., triclopyr has provided good control of tree-of-heaven (*Ailanthus altissima*), salt cedar (*Tamarix* spp.), glossy buckthorn (*Frangula alnus*), common *buckthorn (Rhamnus cathartica*), sweet fennel (*Foeniculum vulgare*), Brazilian peppertree (*Schinus terebinthifolius*), and Chinese tallow tree (*Sapium sebiferum*). TNC preserves in Hawaii have successfully used triclopyr to control blackwood acacia (*Acacia melanoxylon*), bush honeysuckle

(*Lonicera maackii*), Chinese banyan (*Ficus microcarpa*), corkystem passionflower (*Passiflora suberosa*), eucalyptus (*Eucalyptus globulus*), Florida prickly blackberry (*Rubus argutus*), Mexican weeping pine (*Pinus patula*), Monterey pine (*Pinus radiata*), strawberry guava (*Psidium cattleianum*), tropical ash (*Fraxinus uhdei*), and velvet leaf (*Miconia calvescens*). Triclopyr can also be used in forest plantations to control brush without significant impacts to conifers (Kelpsas & White). Spruces (*Picea* spp.) can tolerate triclopyr, but some species of pine (*Pinus* spp.) however, can only tolerate triclopyr during the dormant fall and winter months (Jotcham et al. 1989).

Mode of Action: Triclopyr is an auxin mimic or synthetic auxin. This type of herbicide kills the target weed by mimicking the plant growth hormone auxin (indole acetic acid), and when administered at effective doses, causes uncontrolled and disorganized plant growth that leads to plant death. The exact mode of action of triclopyr has not been fully described, but it is believed to acidify and "loosen" cell walls, allowing cells to expand without normal control and coordination. Low concentrations of triclopyr can stimulate RNA, DNA, and protein synthesis leading to uncontrolled cell division and growth, and, ultimately, vascular tissue destruction. Conversely, high concentrations of triclopyr can inhibit cell division and growth.

Dissipation Mechanisms:
Summary: Both the ester and amine formulations are degraded by sunlight, microbial metabolism, and hydrolysis. In soils, both the ester and amine formulations will degrade rapidly to the parent compound, triclopyr acid. The acid and ester formulations bind well with soils, and therefore, are not likely to be mobile in the environment. The salt however, does not readily adsorb and can be mobile. The ester can be highly volatile (T. Lanini, pers. com.).

Volatilization Ester formulations of triclopyr can be highly volatile, and care should be taken in their application. The potential to volatilize increases with increasing temperature, increasing soil moisture, and decreasing clay and organic matter content (Helling et al. 1971).

Photodegradation Both the ester and salt formulations are degraded readily in sunlight to the parent compound, triclopyr acid, which is also photodegradable. A study of photolysis found the half-life of triclopyr acid on soil under midsummer sun was two hours (McCall & Gavit 1986). Photodegradation can be particularly important in water. Johnson et al. (1995) found triclopyr acid dissolved in water had a half-life due to photolysis of one to 12 hours.

Microbial Degradation Microbial metabolism accounts for a significant percentage of triclopyr degradation in soils. In general, warm, moist soils with a high organic content will support the largest microbial populations and the highest rates of herbicide metabolism (Newton et al. 1990). Johnson et al. (1995a) found that microbial degradation of triclopyr was significantly higher in moist versus dry soils, and higher at 30º C than at 15º C (DT50 is 46 days versus 98 days in dry soils, and 57 days versus 199 days in moist soils, respectively. Additionally, the presence of sunlight plays a role in the rates of microbial metabolism of triclopyr. Johnson et al. (1995a) found that microbial metabolism was slowed when soil was deprived of light.

Chemical Decomposition Hydrolysis of both the salt and ester to the acid form occurs readily in the

environment and within plants (Smith 1976). McCall and Gavit (1986) reported that the ester was converted to an acid with a half-life of three hours, and that the rate of hydrolysis in water increased with an increase in pH.

Adsorption Adsorption temporarily or permanently immobilizes triclopyr, but adsorption is not degradation. Adsorption is more important for the immobilization of the ester than of the salt formulation. The ester binds readily with the organic component of the soil, with adsorption rates increasing as organic content increases and soil pH decreases (Pusino et al. 1994; Johnson et al. 1995a). The salt form is soluble in water and binds only weakly with soil (McCall & Gavit 1986). The strong bond between the ester and soils accounts for the relatively low mobility of the ester in soils, whereas the salt form is much more mobile (McCall & Gavit 1986). In practice, however, both compounds are degraded rapidly to triclopyr acid, which has an intermediate adsorption capacity.

Behavior in the Environment

Summary: In soils, both formulations are degraded by photolysis, microbial metabolism, and hydrolysis to the parent compound, triclopyr acid. Triclopyr acid has an intermediate adsorption potential, limiting movement of the acid in the environment. The acid degrades with an average half-life of 30 days. In water, the salt will remain in the water column until it is degraded, which can occur in as little as a few hours under favorable conditions. The ester formulation, however, is not water-soluble and can take significantly longer to degrade in water. Within plants, both the salt and ester formulations are hydrolyzed to the acid form, and transported through the plant. Residues can persist in the plant until the tissues are degraded in the environment.

Soils Both the ester and salt formulations degrade rapidly in soils to triclopyr acid, and thereafter, behave similarly in soils. Adsorption, photodegradation, microbial metabolism, and volatility, can all play a role in the dissipation of triclopyr from soils. The reported half-life of triclopyr in soils varies from 3.7 to 314 days, but averages 30 days, depending on the formulation applied and the specific soil and environmental conditions. If soil conditions are warm and moist, microbial metabolism can be the primary means of degradation (Newton et al. 1990).

Johnson et al. (1995a) reported an average half-life of triclopyr acid in four laboratory soils of 138 days, but this time varied significantly with soil temperature. At 15ºC half-lives ranged from 64-314 days, while at 30ºC half-lives were 9-135 days (Johnson et al. 1995). In Southwest Oregon, Newton et al. (1990) found 24-51% of triclopyr residues remained after 37 days in a dry and cool climate. Following an increase in warmth and moisture, however, dissipation increased dramatically and triclopyr residues exhibited a half-life of 11-25 days. In a study of triclopyr persistence in soil and water associated with rice production, triclopyr had a half-life of less than ten days in the three soil types tested (Johnson et al. 1995b). In a pasture near Corvallis, Oregon, the half-life of triclopyr acid was estimated to be 3.7 days (Norris et al. 1987).

Because of the importance of photodegradation and a decrease in the size of microbial populations with soil depth, triclopyr located deeper in the soil column (>15 cm) degrades more slowly than residues near the surface (Johnson et al. 1995a). Traces of triclopyr residues have been found at soil depths of 45 cm as late as 477 days after application (Newton et al. 1990). Sandy soils that are

highly permeable may therefore, retain triclopyr longer. Most studies, however, found that triclopyr generally does not tend to move in significant quantities below the top 15 cm of soil (Norris et al. 1987; Newton et al. 1990; Stephenson 1990; Johnson et al. 1995a).

Water In water, the two formulations can behave very differently. The water-soluble salt is degraded in the water column through photolysis and hydrolysis (McCall & Gavit 1985). The ester, however, is not water-soluble and can be persistent in aquatic environments. The ester binds to organic particles in the water column and precipitates to the sediment layers (McCall & Gavit 1986). Bound ester molecules will degrade through hydrolysis or photolysis to triclopyr acid (Smith 1976), which will move back into the water column and continue to degrade. The rate of degradation is dependent on the water temperature, pH, and sediment content.

Triclopyr acid has an intermediate soil adsorption capacity. Thus, movement of small amounts of triclopyr residues following the first significant rainfall are likely (McCall & Gavit 1986), but further leaching is believed to be minor (Newton et al. 1990; Stephenson et al. 1990; Thompson et al. 1991) . Movement of triclopyr through surface and subsurface runoff in areas with minimal rainfall is believed to be negligible (Newton et al. 1990; Stephenson et al. 1990). In southwest Oregon, Norris et al. (1987) found that neither leaching nor long-distance overland water flow contributed significant amounts of the herbicide into a nearby stream, and concluded that the use of triclopyr posed little risk for non-target organisms or downstream water users. Triclopyr can, however, enter waterways via aerial drift and inadvertent overspray. When the acid was applied to rice paddy fields, residues remained in the water column and were not found in significant amounts in the soil (Johnson et al. 1995b). Degradation in water was rapid and showed a half-life of four days.

Vegetation Both the ester and salt formulations are hydrolyzed to the acid after entering plant tissue. The acid tends to remain in plants until they die or dop leaves and begin to decay (Newton et al. 1990). Newton et al. (1990) reported that triclopyr in evergreen foliage and twigs showed remarkable persistence. Although concentrations of triclopyr in the soil will decrease quickly and remain low through the winter, levels can rise again in the spring if a new supply of contaminated foliage falls from defoliating crowns (Newton et al. 1990). The residues of some herbicides in fruit have been shown to persist up to one month (Holmes et al. 1994). There is therefore a potential for long-term exposure of triclopyr to animal species that eat wild fruit. In non-target plants, triclopyr soil residues can cause damage via root uptake (Newton et al. 1990).

Environmental Toxicity

Birds and Mammals Triclopyr is regarded as only slightly toxic to birds and mammals. The oral LD50 for rats is 630-729 mg/kg. The LD50s for mallard ducks and bobwhite quail are 1,698 mg/kg and 2,935 mg/kg, respectively. Newton et al. (1990) predicted that triclopyr would not be present in animal forage in doses large enough to cause either acute or chronic effects to wildlife, and concluded that the tendency for triclopyr to dissipate quickly in the environment would preclude any problems with bioaccumulation in the food chain. Garlon 3A® can cause severe eye damage to both humans and wildlife, due to the high pH of its water-soluble amine salt base. Care must be taken during mixing and application to prevent accidental splashing into eyes.

In a study of the potential effects of herbicide residues on forest songbirds, sub-lethal doses of triclopyr ester (500 mg/kg in the diet for 29 days) were found to cause weight loss and behavior alterations in zebra finches (Holmes et al. 1994). In a 1987 study of triclopyr metabolism using one cow, all traces of triclopyr were eliminated from the cow's urine within 24 hours, and no residues were detected in its milk or feces. This study, however, did not track whether any triclopyr was absorbed into the cow's tissues, or whether the triclopyr recovered in the urine was still active (Eckerlin 1987).

Aquatic Species Triclopyr acid and the salt formulation are slightly toxic to fish and aquatic invertebrates. The LC50 of the acid and the salt formulation for rainbow trout are 117 mg/L and 552 mg/L, respectively, and for bluegill sunfish 148 mg/L and 891 mg/L, respectively. The ester formulation is highly toxic to fish and aquatic invertebrates, with an LC50 (96-hour) of 0.74 mg/L in rainbow trout and 0.87 mg/L in bluegill sunfish (WSSA 1994; EPA 1998). The hydrophobic nature of the ester allows it to be readily absorbed through fish tissues where is it rapidly converted to triclopyr acid. The acid can be accumulated to a toxic level when fish are exposed to sufficient concentrations or for sufficient durations.

The extent to which the toxic effects of the ester are reduced by degradation is poorly understood. Studies have shown that the ester formulation degrades rapidly to less toxic forms (Thompson et al. 1991). Kreutzweiser et al. (1994) however, has shown that there is a significant chance of acute lethal effects to fish exposed to low level residues for more than six hours. In addition, delayed lethal effects were seen in fish exposed to high concentrations for a short duration. Considering that Thompson et al. (1991) concluded that organisms subjected to direct overspray were exposed to a high level of herbicide for short periods of time while organisms downstream were exposed to low levels for longer periods, the findings of Kreutzweiser et al. (1994) are of concern.

Nevertheless, most authors including the authors of the fish mortality study have concluded that if applied properly, triclopyr would not be found in concentrations adequate to kill aquatic organisms. As a measure of precaution, however, Kreutzweiser et al. (1991) suggest that some water bodies remain at risk of lethal contamination levels including shallow and slow moving water bodies where dissipation is slow, and heavily shaded streams that experience reduced photodegradation.

Other Non-Target Organisms Triclopyr inhibited growth of four types of ectomycorrhizal fungi associated with conifer roots at concentrations of 1,000 parts per million (ppm) and higher (Estok et al. 1989). Some evidence of inhibition of fungal growth was detected in bioassays with as little as 100 ppm triclopyr. Typical usage in forest plantations, however, results in triclopyr residues of only four to 18 ppm on the forest floor (Estok et al. 1989).

Application Considerations:

Application Under Unusual Conditions: Several natural area managers have found that Garlon 4® and 3A® are effective when applied in mid-winter as a cut-stump treatment against buckthorns (*Rhamnus cathartica* and *R. frangula*). It is often easier to get to these plants when boggy soils around them are frozen. Randy Heidorn, Deputy Director for Stewardship of the Illinois Nature

Weed Control Methods Handbook, The Nature Conservancy, Tu *et al.*

Preserve Commission (INPC), recommends three protocols to increase the safety of triclopyr ester application in winter: (1) use a mineral oil based carrier;
(2) make sure that at the time of application, no water is at or above the ground surface, and no snow or ice is present that might serve as a route to spread the herbicide following a thaw, and;
(3) initiate a monitoring program to assess ambient water concentrations of triclopyr ester in communities that seasonally have water at or above the ground surface with little or no discharge (i.e. bogs).

Safety Measures

The salt formulation in Garlon 3A® can cause severe eye damage because of the high pH of its water-soluble amine salt base. Care should be taken to prevent splashing or other accident contact with eyes.

Human Toxicology

Because studies into the carcinogenicity of triclopyr have produced conflicting results, EPA has categorized triclopyr as a "Group D" compound, or a chemical that is not classifiable as to human carcinogenicity. The salt formulation in Garlon 3A® can cause severe eye damage.

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Date Authored: April 2001

IMAZAPYR

Herbicide Basics

Chemical formula: (±)-2-[4,5dihydro-4-methyl-4-(1methylethyl)-5-oxo-1H-imidazol2-yl]-3-pyridinecarboxylic acid

Herbicide Family: Imidazolinone

Target Species: grasses, broadleaves, vines, brambles, shrubs and trees, riparian and emerged aquatics

Forms: acid & salt

Formulations: SL, GR

Mode of Action: Amino acid synthesis inhibitor

Water Solubility: 11,272 ppm

Adsorption potential: low

Primary degradation mech: Slow microbial metabolism and photolysis

Average Soil Half-life: 25-141 days

Mobility Potential: high

Dermal LD50 for rabbits: >2,000 mg/kg

Oral LD50 for rats: >5,000 mg/kg

LC50 for bluegill sunfish: >100 mg/L

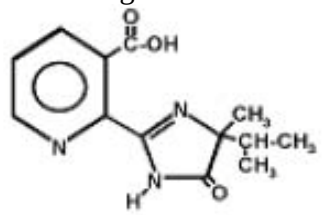
Trade Names: Arsenal®, Habitat®, Chopper®, and Stalker®

Manufacturer: BASF (previously American Cyanamid Company)

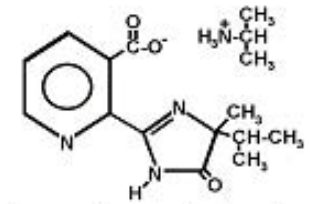
Synopsis

Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It controls plant growth by preventing the synthesis of branched-chain amino acids. Because imazapyr is a weak acid herbicide, environmental pH will determine its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5 the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater

concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils imazapyr is degraded primarily by microbial metabolism. It is not, however, degraded significantly by photolysis or other chemical reactions. The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days. Imazapyr is not highly toxic to birds and mammals, but some formulations (for instance, the inert ingredients in Chopper® and Stalker®) can cause severe, irreversible eye damage. Studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation. It has a low toxicity to fish, and algae and submersed vegetation are not affected. Because imazapyr can affect a wide range of plants and can remain available, care must be taken during application to prevent accidental contact with non-target species. Further, a few studies have reported that imazapyr may be actively exuded from the roots of legumes (such as mesquite), likely as a defense mechanism by those plants. This exudate and the ability of imazapyr to move via intertwined root grafts may therefore adversely affect the surrounding desirable vegetation with little to no control of the target species.



Imazapyr acid



Imazapyr isopropylamine salt

<u>Herbicide Details</u>

Chemical Formula: (±)-2-[4,5-dihdro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid

Trade Names: Arsenal®, Chopper®, and Stalker®. As of September 2003, imazapyr has received an EPA aquatic registration for Habitat®.

Manufacturer: BASF (previously by American Cyanamid Company, which was purchased by BASF in 2000)

Use Against Natural Area Weeds: Imazapyr is a broad-spectrum herbicide that controls terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It can be used where total vegetation control is desired or in spot applications. Imazapyr is relatively slow acting, does not readily break down in the plant, and is therefore particularly good at killing large woody species. Imazapyr can control saltcedar (*Tamarix ramossissima*), privet (*Ligustrum vulgare*), blackberries (*Rubus* spp.), field bindweed (*Convolvulus arvensis*), bahiagrass (*Paspalum notatum*), and downy brome (*Bromus tectorum*) (American Cyanamid 1986). Caution should be used when applying imazapyr, as a few reports to TNC from the field indicate that imazapyr might be exuded from the roots of target species. Some legume species, such as mesquite, may actively exude imazapyr (J. Vollmer pers. comm.). Imazapyr herbicide can be mobile within roots and transferred between intertwined root systems (root grafts) of many different

plants and/or to several species. Movement of imazapyr via root grafts or by exudates (which is a defense mechanism of those plants) may therefore adversely affect the surrounding vegetation. This movement of herbicide may also be compounded when imazapyr is incorrectly overapplied. Movement of soil particles that contains imazapyr can also potentially cause unintended damage to desirable species.

Imazapyr is effective for creating openings for wildlife use. It can be applied pre-emergent, but is most effective when applied as a post-emergent herbicide. Care should be taken in applying it around non-target species, as it is readily adsorbed through foliage and roots, and therefore, could be injurious by drift, runoff, or leaching from the roots of treated plants. To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy).

On TNC preserves in Texas, imazapyr provided good control of saltcedar (*Tamarix* spp.) and Chinese tallow tree (*Sapium sebiferum*). In North Carolina preserves, it was effective against oriental bittersweet (*Celastrus orbiculata*), cut-stumps of Chinese privet (*Ligustrum sinese*), and tree-of-heaven (*Ailanthus altissima*). Recent work in California demonstrated that foliar applications of imazapyr effectively controlled jubatagrass and pampasgrass (*Cortaderia jubata* and *C. selloana*) (DiTomaso et al. 1999; Drewitz 2000), and experimental studies in Washington showed that imazapyr provided excellent control of smooth cordgrass (*Spartina alterniflora*) in tidal estuarine habitats (Patten 2002).

Mode of Action: Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It is translocated in the xylem and phloem to the meristematic tissues, where it inhibits the enzyme acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS). ALS catalyzes the production of three branched-chain aliphatic amino acids, valine, leucine, and isoleucine, required for protein synthesis and cell growth. The rate of plant death usually is slow (several weeks) and is likely related to the amount of stored amino acids available to the plant. Only plants have ALS and produce these three amino acids, and therefore, imazapyr is of low toxicity to animals (including fish and insects). Animals need these three branched chain aliphatic amino acids, but obtain them by eating plants or other animals.

Dissipation Mechanisms:

Summary: Imazapyr is degraded in soils primarily by microbial metabolism. It will quickly undergo photodegradation in aqueous solutions (photohydrolysis), but there is little to no photodegradation of imazapyr in soil, and it is not readily degraded by other chemical processes. Imazapyr does not bind strongly with soil particles, and depending on soil pH, can be neutral or negatively charged. When negatively charged, imazapyr remains available in the environment.

<u>Volatilization</u> Imazapyr does not volatilize readily when applied in the field (T. Lanini, pers. obs.). The potential to volatilize, however, increases with increasing temperature, increasing soil moisture, and decreasing clay and organic matter content (Helling et al. 1971).

<u>Photodegradation</u> Imazapyr is rapidly degraded by sunlight in aquatic solutions. In soils, however,

there is little or no photodegradation of imazapyr (WSSA 1994). The half-life of imazapyr due to photodegradation in aqueous solution is approximately two days, and decreases with increasing pH (Mallipudi et al. 1991, Mangels 1991a).

Microbial Degradation Microbial degradation is the primary mechanism of imazapyr degradation in soils (WSSA 1994). American Cyanamid (1986) reported that the half-life of imazapyr in soils typically ranged from one to seven months, depending on soil type, temperature, and soil moisture (Mangels 1991b). The half-life of imazapyr is shorter at cooler soil temperatures (25° C versus 35° C) and in sandier soils (sandy loam versus clay loam) (American Cyanamid 1986). Degradation rates are decreased in anaerobic soil conditions (WSSA 1994).

In studies of the related compound imazaquin, microbial degradation rates increased with increasing soil moisture content (between 5-75% of field capacity) and increasing soil temperatures (from 15° C to 30° C) (Mangels 1991b). Microbial degradation additionally, was more rapid in soils that did not bind the herbicide strongly. Imazapyr that is bound strongly to soil particles may be unavailable for microbial degradation.

Adsorption The adsorption of imazapyr to soil particles is generally weak, but can vary depending on soil properties (Mangels 1991b). Adsorption is reversible, and desorption occurs readily (WSSA 1994). Because the exact chemical form of the herbicide is determined by environmental pH, the adsorption capacity of imazapyr changes with soil pH. A decline in pH below 5 increases adsorption of imazapyr to soil particles. Above pH 5, imazapyr becomes ionized, increasing its negative charge, and limiting its ability to bind with soils (Mangels 1991b). Vizantinopoulos and Lolos (1994) found that adsorption decreased with increasing soil temperature, and Dickens and Wehtje (1986) found that adsorption increased with time and decreased soil moisture. In general, imidazolinone herbicides show an increase in soil adsorption capacity with an increase in soil clay content and organic matter, but studies of imazapyr have been conflicting (Dickens and Wehtje 1986, Wehtje et al. 1987, Mangels 1991b, McDowell et al. 1997, Pusino et al. 1997, El Azzouzi et al. 1998).
Chemical Decomposition Imazapyr changes form readily with changes in pH, but is not necessarily degraded in this process. It does not readily undergo hydrolysis (Mangels 1991a), and no other chemical degradation mechanisms have been reported.

Behavior in the Environment
Summary: Imazapyr is slowly degraded by microbial metabolism and can be relatively persistent in soils. It has an average half-life in soils that range from one to five months. At pH above 5, it does not bind strongly with soil particles and can remain available (for plant uptake) in the environment. In water, imazapyr can be rapidly degraded by photolysis with a half-life averaging two days. There have been a few reports from the field of unintended damage to desirable, native plants when imazapyr has either exuded out of the roots of treated plants into the surrounding soil, or when intertwined roots transfer the herbicide to non-target plants. Make sure to not overapply imazapyr, and also confirm that soil particles with imazapyr are not moved in-contact with desirable species.

Soils Depending on environmental conditions, imazapyr has an average half-life in soils of several months (Vizantinopoulos and Lolos 1994, El Azzouzi et al. 1998). El Azzouzi et al. (1998) reported

half-lives between > 58 to 25 days in two Moroccan soils. In a laboratory study, the half-life of imazapyr ranged from 69-155 days, but factors affecting degradation rates were difficult to identify because the pH varied with temperature and organic content (McDowell et al. 1997). In a more extreme example, Vizantinopoulos and Lolos (1994) found that in loam and clay loam soils with pH 7-8, half-lives ranged up to 50 months. The manufacturer reports that persistence in soils is influenced by soil moisture, and that in drought conditions, imazapyr could persist for more than one year (Peoples 1984).

Lee et al. (1991) reported that imazapyr residues in soil following postemergent application increased eight days after initial application and continued to increase until a peak of 0.23 ppm at day 231 post-treatment. The authors attributed these increases to runoff of residues from plant surfaces following rainfall and to the release of residues from decaying plant matter.

Under most field conditions imazapyr does not bind strongly to soils and can be highly available in the environment. Above pH 5, the herbicide will take on an ionized form, increasing the risk of herbicide runoff. McDowell et al. (1997) found that heavy rainfall caused significant movement of the herbicide (or more likely, moved the soil particles that the imazapyr was adsorbed to), and leaching up to 50 cm deep in soils have been reported (WSSA 1994).

Water Despite its potential mobility, imazapyr has not been reported in water runoff, and we found no reports of imazapyr contamination in water. If it enters the water column, imazapyr can be photodegraded by sunlight with an average half-life of two days (Mallipudi et al. 1991).

Vegetation Because imazapyr kills a wide variety of plants and can be relatively persistent and remain available in soils, damage to desirable non-target plants is possible. When imazapyr is applied in high rates, directly to soil, it can result in season-long soil activity. Plant species that are resistant to imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner & Mallipudi 1991).

Environmental Toxicity

Birds and Mammals Imazapyr is of relatively low toxicity to birds and mammals. The LD50 for rats is > 5,000 mg/kg, and for bobwhite quail and mallard ducks is >2,150 mg/kg (WSSA 1994). American Cyanamid reports that studies with rats indicate that imazapyr was excreted rapidly in the urine and feces with no residues accumulating in the liver, kidney, muscle, fat, or blood (Miller et al. 1991). Imazapyr has not been found to cause mutations or birth defects in animals, and is classified by the U.S. EPA as a Group E compound, indicating that imazapyr shows no evidence of carcinogenicity.

Aquatic Species Imazapyr is of low toxicity to fish and invertebrates. The LC50s for rainbow trout, bluegill sunfish, channel catfish, and the water flea (*Daphnia magna)* are all >100 mg/L (WSSA 1994). As of September 2003, imazapyr (tradename Habitat®) is registered for use in aquatic areas, including brackish and coastal waters, to control emerged, floating, and riparian/wetland species. A recent study from a tidal estuary in Washington showed that imazapyr, even when supplied at concentrations up to 1600 mg/L, did not affect the osmoregulatory capacity of Chinook salmon

smolts (Patten 2003). Similarly, the Washington State Department of Agriculture reported that the 96-hour LC50 for rainbow trout fry to be 77,716 mg/L (ppm) -22,305 ppm of the active ingredient-which represents a greater concentration of imazapyr than found in commercially-sold containers (J. Vollmer, pers. comm.).

Other Non-Target Organisms Limited information was found on the effects of imazapyr on other non-target organisms such as soil bacteria and fungi. The manufacturers report that Arsenal® is non-mutagenic to bacteria (Peoples 1984).

Application Considerations:
Imazapyr is a slow acting herbicide that is not readily metabolized in plants. It can be very effective against woody species. Due to its persistence in the environment, it may be preferable to apply imazapyr directly to vegetation (using a low-volume backpack, cut-stump, or basal bark application) instead of using a broadcast spray method. When using a cut-stump application, be careful to avoid overapplication of imazapyr on the stump, as this may lead to excess imazapyr to be transferred between root grafts or movement by soil particles. When completing a cut-stump treatment, apply imazapyr only to the outer cambium layer of the stump (versus applying herbicide to the entire cut-stump), and this should sufficiently kill the tree (J. Vollmer, pers. comm.).

A study of wipe-on applications to the reed *Phragmites australis*, however, found that this method provided some suppression of reeds in the short-term, but failed to control them in the long term (Kay 1995). Malefyt and Quakenbush (1991) reported better results when imazapyr was applied at 21° C rather than 32° C. Rainfall is considered important for good activity following soil application (Malefyt and Quakenbush 1991) but can increase movement of imazapyr in the soil column. A non-ionic surfactant can improve the efficacy of imazapyr.

Safety Measures:
Some formulations of imazapyr can cause severe irreversible eye damage. Care should be taken to prevent accidental splashing or other exposure of eyes to the herbicide.

Human Toxicology
Imazapyr is of relatively low toxicity to mammals, and shows no mutagenic or teratogenic potential. It can be an eye and skin irritant, but is not a dermal sensitizer (American Cyanamid 1986; Cyanamid Ltd. 1997).

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Date Authored: April 2001
Updated: June 2004

Appendix 3 – Species

1. USFWS Species List for Maricopa County, AZ

Weed Control Methods Handbook, The Nature Conservancy, Tu *et al*.

Common Name	Scientific Name	Status	Description	County	Elevation	Habitat	Comments
Arizona cliffrose	*Purshia subintegra*	**Endangered**	Evergreen shrub of the rose family (Roseaceae). Bark pale gray and shreddy. Young twigs with dense hairs. Leaves 1-5 lobes and edges curl downward (revolute). Flowers: 5 white or yellow petals <0.5 inches long.	Graham, Maricopa, Mohave, Yavapai	**< 4,000 ft**	White limestone soils derived from teritiary lakebed deposits	Occurs in central Arizona near Bylas, the Horseshoe Lake vicinity, near Burro Creek, and near Cottonwood in the Verde Valley.
Bald Eagle	*Haliaeetus leucocephalus*	**Threatened**	Large, adults have white head and tail. Height 28-38 inches; wingspan 66-96 inches. Dark with varying degrees of mottled brown plumage. Feet bare of feathers.	Gila, Graham, La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma	**Varies**	Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey.	Some birds are nesting residents while a larger number winters along rivers and reservoirs. Once endangered (32 FR 40010, 03-11-1967; 43 FR 6233, 02-14-78) because reproductive failures from pesticide poisoning and loss of habitat, this species was downlisted to threatened on August 11, 1995, and delisted August 8, 2007. Threatened status reinstated for Desert nesting bald eagles.
California Brown **pelican**	*Pelecanus occidentalis californicus*	Proposed **delisted**	Large dark gray-brown water bird with a pouch underneath long bill and webbed feet. Adults have a white head and neck, brownish black breast, and silver gray upper parts.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	**Varies**	Coastal land and islands; species found around many Arizona lakes and rivers.	Subspecies is found on Pacific Coast and is endangered due to pesticides. It is an uncommon transient in Arizona on many Arizona lakes and rivers. Individuals wander up from Mexico in summer and fall. No breeding records in Arizona.
Desert pupfish	*Cyprinodon macularius*	Endangered	Small (2 inches) smoothly rounded body shape with narrow vertical bars on the sides. Breeding males blue on head and sides with	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	**< 5,000 ft**	Shallow springs, small streams, and marshes. Tolerates saline	Critical habitat includes Quitobaquito Springs, Pima County, portions of San Felipe Creek, Carrizo Wash,

			yellow on tail. Females and juveniles tan to olive colored back and silvery sides.			and warm water.	and Fish Creek Wash, Imperial County, California. Two subspeices are recognized: Desert Pupfish (C.m.macularis) and Quitobaquito Pupfish (C.m.eremus).
Gila chub	*Gila intermedia*	**Endangered**	Deep compressed body, flat head. Dark olive-gray color above, silver sides. Endemic to Gila River Basin.	Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	**2,000 - 5,500 ft**	Pools, springs, cienegas, and streams.	Found on multiple private lands, including the Nature Conservancy, the Audubon Society, and others. Also occurs on Federal and state lands and in Sonora, Mexico. Critical habitat occurs in Cochise, Gila, Graham, Greenlee, Pima, Pinal,
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	**Endangered**	Small (2 inches), guppy-like, live bearing, lacks dark spots on its fins. Breeding males are jet black with yellow fins.	Cochise, Gila, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	**< 4,500 ft**	Small streams, springs, and cienegas vegetated shallows.	Species historically occurred in backwaters of large rivers but is currently isolated to small streams and springs.
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	**Endangered**	Elongated muzzle, small leaf nose, and long tongue. Yellowish brown or gray above and cinnamon brown below. Tail minute and appears to be lacking. Easily disturbed.	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Maricopa, Santa Cruz, Yuma	**< 6,000 ft**	Desert scrub habitat with agave and columnar cacti present as food plants.	Day roosts in caves and abandoned tunnels. Forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. This species is migratory and is present in Arizona usually from April to September and south of the border the remainder of the year.
Mexican spotted owl	*Strix occidentalis lucida*	**Threatened**	Medium sized with dark eyes and no ear tufts. Brownish and heavily spotted with	Apache, Cochise, Coconino, Gila, Graham, Greenlee,	**4,100-9,000 ft**	Nests in canyons and dense forests with multilayered	Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type,

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			white or beige.	Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai		foliage structure.	in canyons, and use variety of habitats for foraging. Sites with cool microclimates appear to be of importance or are preferred. Critical habitat was finalized on August 31, 2004 (69 FR 53182) in Arizona in Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, and Yavapai counties.
Razorback sucker	*Xyrauchen texanus*	**Endangered**	Large, up to 3 feet long and up to 6 lbs, high sharp-edged keel-like hum behind the head. Head flattened on top. Olive-brown above to yellowish below	Coconino, Gila, Graham, Greenlee, LaPaz, Maricopa, Mohave, Pinal, Yavapai, Yuma	**<6,000 ft**	Riverine and lacustine areas, generally not in fast moving water and may use backwaters	Big River fish also found in Horseshow reservoir (Maricopa County). Critical habitat includes the 100-year floodplain of the river through eh Grand Canyon from confluence with Paria River to Hoover Dam; Hoover Dam to Davis Dam; Parker Dam to Imperial Dam. Also Gila River from Arizona/New Mexico border to Coolidge Dam; and Salt River from Hwy 50/SR77 Bridge to Roosevelt Dam; Verde River from FS boundary to Horseshoe Lake.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	**Endangered**	Small passerine (about 6 inches) grayish-green back and wings, whitish throat, light olive-gray breast and pale yellowish belly. Two wingbars visible. Eye-ring faint or absent.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	**<8,500 ft**	Cottonwood/willow and tamarisk vegetation communities along rivers and streams.	Migratory riparian-obligate species that occupies breeding habitat from late April to September. Distribution within its range is restricted to riparian corridors. Difficult to distinguish from other members of the Empidonax complex by sight alone. Training seminar required for those conductiong flycatcher surveys. Critical habitat was

							finalized on October 19, 2005 (50 CFR 60886). In Arizona there are critical habitat segments in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, and Yavapai counties.
Woundfin	*Plagopterus Argentissimus*	Endangered	Small (4 inches) silver minnow with fairly large fins and a sharp dorsal fin spine.	Mohave and Maricopa (AZ), Washington (UT), Clark (NV)	**<4,500 ft**	Runs and quiet waters adjacent to riffles over sand and gravel substrates.	Native populations only Virgin River. Critical habitat on Virgin River and its 100 year floodplain. Experimental on o-essential populations (50 FR 30193, 07-24-1985) designated, and introduced into the Hassayampa River in July 2007. The other river segments, portions of Verde, Gila, and San Francisco rivers and Tonto Creek have not been stocked with woundfin. Critical haitat on Virgin River and its 100 year floodplain
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Water bird with long legs and short tail. Long, slender decurved bill. Mottled brown or gray on its rump. Flanks and undersidesare dark gray with narrow vertical stripes producing a barring effect.	Gila, La Paz, Maricopa, Mohaved, Pinal, Yuma	**<4,500 ft**	Fresh water and brackish marshes.	Species is associated with dense emergent riparian vegetation. Requires wet substrate (mudflat, sandbar) with dense herbaceous or woddy vegetation for nesting and foraging. Channelization and marsh destruction are 0rimary sources of habitat loss.