

HORSESHOE RANCH WILDLIFE HABITAT ENHANCEMENT PLAN

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ABSTRACT

The Arizona Game and Fish Department (hereafter Department) acquired Horseshoe Ranch in 2011. The Ranch includes approximately 200 deeded acres (ac), and serves as the base property for an active ranching operation associated with two federal grazing leases on surrounding public land. The Ranch is a private (now Arizona Game and Fish Commission owned) inholding within Agua Fria National Monument (AFNM). The wildlife habitat enhancement plans presented herein align directly with the purpose, goals and objectives set forth by the Arizona Game and Fish Commission and the Horseshoe Ranch Property Operational Plan (AGFD 2012c); and support the Department's 20/20 Strategic Plan (AGFD 2012a) to implement conservation actions for habitat and wildlife populations, partner with a wide range of stakeholders to achieve the Department's mission in support of conservation and recreation, encourage stewardship, make science-informed decisions, and to inform and educate the public regarding wildlife and recreation.

This wildlife habitat enhancement plan describes activities intended to benefit wildlife, including several federally-listed ESA associated with Horseshoe Ranch (hereafter Ranch); facilitate research that could be valuable to habitat restoration while allowing continued operation of the Ranch as a destination for meetings and public events and as the base property for two federal livestock grazing permits; and to allow continued partnerships and research activities such as the experimental cottonwood garden. The ESA species that could potentially benefit from the habitat enhancements include Northern Mexican Gartersnake (*Thamnophis eques megalops*), Gila Chub (*Gila intermedia*), Gila Topminnow (*Poeciliopsis occidentalis*), Desert Pupfish (*Cyprinodon macularius*), Western Yellow-billed Cuckoo (*Coccyzus americanus*), and Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Activities include establishment of a prey base for Northern Mexican Gartersnake also including Longfin Dace (*Agosia chrysogaster*) and Lowland Leopard Frogs (*Rana/Lithobates yavapaiensis*).

Wildlife habitat enhancements on the Ranch are focused on the Ranch stock pond and fallow cropland. Management objectives for the stock pond are the establishment of a captive to semi-captive breeding population of Northern Mexican Gartersnake and a replicate population of Gila Chub. The management objectives for the fallow cropland are a three acre experimental cottonwood garden for use in climate change and genetics research; as well as establishment of a native grass and forb plant community and annual upland game bird seed crops on 15 acres of fallow cropland to benefit upland game birds and pollinator species.

The enhancement plan includes background on the Ranch and enhancement projects, the description of habitat and current status of ESA-listed species that may be associated with the Ranch, a detailed description of management activities associated with each of the three enhancement projects, monitoring and adaptive management approaches for the projects, and identification of potential for incidental take on ESA-listed species and extenuating factors that may impact project goals or progress. The appendix describes an inventory conducted in July 2014 to classify landcover on the Ranch by the Department. Discreet areas were mapped and quantified (acres) and each area was described as a biotic community type using Brown (1994) or as a developed landcover type.

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INTRODUCTION

The primary activities associated with wildlife habitat enhancements and improvements on Horseshoe Ranch (hereafter Ranch) provide for establishment of a captive to semi-captive breeding population of Northern Mexican Gartersnakes (*Thamnophis eques megalops*) as a replicate population and as a potential source of snakes for future re-introduction into the Agua Fria watershed; to provide a replicate population for Gila Chub (*Gila intermedia*); to create an experimental cottonwood garden for use in climate change and genetics research, which may be used by Western Yellow-billed Cuckoo (*Coccyzus americanus*) and/or Southwestern Willow Flycatcher (*Empidonax traillii extimus*); and to establish a native grass and forb plant community and annual upland game bird seed crops on fallow cropland to benefit upland game birds and pollinator species. All these projects will occur on the Arizona Game and Fish Department's (Department/AGFD) deeded Ranch property. If future funding permits, the Department will also consider removal of nonnative Tamarix (*Tamarix* spp.) planting of additional native riparian tree, shrub or herbaceous species along portions of the Agua Fria River, which would provide additional habitat for Yellow-billed Cuckoo and perhaps create habitat for the Southwestern Willow Flycatcher. The Department intends to pursue these projects, which will benefit these federally-listed ESA species, while allowing continued operation of the Ranch as a destination for meetings and public events; as the base property for two federal livestock grazing permits; and to allow continued partnerships and research activities such as the experimental cottonwood garden.

BACKGROUND

The Department acquired Horseshoe Ranch in 2011. The Ranch includes approximately 200 deeded acres (ac), which provides a wildlife management nexus for approximately 70,000 ac of federal grazing lands adjacent to the Ranch. The Ranch is a private (now Arizona Game and Fish Commission owned) inholding within Agua Fria National Monument (AFNM). It serves as the base property for both the Horseshoe and Copper Creek Allotments, each of which represents about half of a 70,000 ac total. The Bureau of Land Management (BLM) administers the Horseshoe Allotment, and Tonto National Forest (TNF) administers the Copper Creek Allotment. The Department has a Memorandum of Understanding with both BLM and TNF, indicating the Ranch will continue to hold the grazing preferences and be the base property for the two grazing allotments.

Broadly defined, the Ranch management goals include: 1) preserve the historic ranch and conserve natural resources, 2) comply with objectives of the Heritage Fund, including conservation and enhancement of wildlife habitat; 3) develop the ranch for promoting outreach and educational activities. The wildlife habitat enhancement plans presented herein align directly with the purpose, goals and objectives set forth by the Arizona Game and Fish Commission and the Horseshoe Ranch Property Operational Plan (AGFD 2012c); and support the Department's 20/20 Strategic Plan (AGFD 2012a) to implement conservation actions for habitat and wildlife populations, partner with a wide range of stakeholders to achieve the Department's mission in support of conservation and recreation, encourage stewardship, make science-informed decisions, and to inform and educate the public regarding wildlife and recreation.

The Ranch includes a pond that at the time of Department purchase was full of sediment and supported a large breeding population of American Bullfrogs (*Rana/Lithobates catesbeiana*). As of late 2015, the Department had drained and dredged the pond, eliminated the bullfrogs, and fenced the pond to prevent recolonization by bullfrogs which occur nearby in the Agua Fria River. The Department also translocated Desert Pupfish (*Cyprinodon macularius*), Longfin Dace (*Agosia chrysogaster*) and Lowland Leopard Frogs (*Rana/Lithobates yavapaiensis*) into the pond. The Longfin Dace and Lowland Leopard Frogs were moved to the pond to establish breeding populations as a prey base in anticipation of translocating Northern Mexican Gartersnakes to the pond.

In 2011, at the time of purchase by the Department, the Ranch included about 22 ac of recently fallow cropland. In October 2014, in cooperation with researchers from Northern Arizona University (NAU), over 4,000 Fremont Cottonwood (*Populus fremontii*) seedlings were planted on approximately three acres of that cropland to create an experimental cottonwood garden. The garden is dedicated to a 5-plus-year research project managed by NAU researchers investigating how various genetic strains of cottonwood grow in three experimental areas [southwest Arizona, central Arizona (Horseshoe Ranch), and southern Utah]. The trees were 1-1.5 foot (ft) seedlings when planted, and by October 2016 they ranged between 4 and 14 ft in height. This experimental garden is likely to be used by Yellow-billed Cuckoo and perhaps by Southwestern Willow Flycatcher. The intent of the Department is such that the garden can be allowed to continue to grow and provide benefit to the ESA-listed bird species, while allowing management of the garden as required for its primary research purpose.

Early 2017, the Department initiated planting of the fallow cropland to establish a native grass and forb plant community and annual upland game bird seed crops that will benefit upland game birds and pollinator species. Annual seed crops were planted as a first step and assembly of the irrigation system will follow. The establishment of native grass, forb and pollinator plants will be done in phases over time.

Lastly, with the Ranch being a destination for meetings, workshops, and other gatherings of Department personnel, other agency personnel, educators, students, publics involved in conservation activities; whether or not Yellow-billed Cuckoo or Southwestern Willow Flycatchers actually use and are detected in the experimental garden or otherwise on Ranch lands; they will be among the listed species highlighted and included in management activities including education and outreach.

DESCRIPTION OF DEEDED LANDS

Horseshoe Ranch is an in-holding within Agua Fria National Monument in central Arizona, about 50 miles north of Phoenix (Figure 1). The Ranch is located along the Bloody Basin Road about eight miles east of Interstate-17 and approximately nine miles southeast of Cordes Junction in Yavapai County, Arizona. The property is located in Township 10 North, Range 3 East, Sections 8 and 9. The Ranch elevation is approximately 3,250 ft (990 m). The Ranch lies in the upstream triangle of the confluence of the Agua Fria River and Indian Creek, with a surrounding

upland buffer. This location presents a flat alluvial floodplain for small-scale farming and a relative abundance of surface and subsurface water.

The scope of this plan covers the approximately 200-acre Ranch deeded property, referred to as the deeded land (Figure 2). The pond is visible in the upper center of Figure 2. The experimental garden had not yet been planted when the image was taken in 2014, but now exists in the southwest corner of the cropland south of the Ranch buildings. The footprint of the now existing experimental garden is illustrated in Figure A1 (Appendix A). Similarly, the fallow cropland has not yet been restored to native grassland and wildlife forage plots as of the time of the 2014 image or this report, but the spatial extent of the planned enhancement is illustrated in Figure A1 as cropland.

Habitats found on the Ranch include a 0.6-mile reach of the Agua Fria River and a 0.2-mile reach of Indian Creek, a tributary to the Agua Fria. The Agua Fria River flows are seasonal, and the Indian Creek flows are ephemeral during precipitation events on the Ranch. Habitats along the river corridors include both Interior Riparian Deciduous Woodland and more xeric Sonoran Riparian Scrubland. Undeveloped upland habitat on the Ranch is predominantly Arizona Uplands Sonoran Desert scrub/Semi-desert grassland transition. Developed areas of the Ranch include fallow croplands, livestock facilities and various housing and ranch building structures.

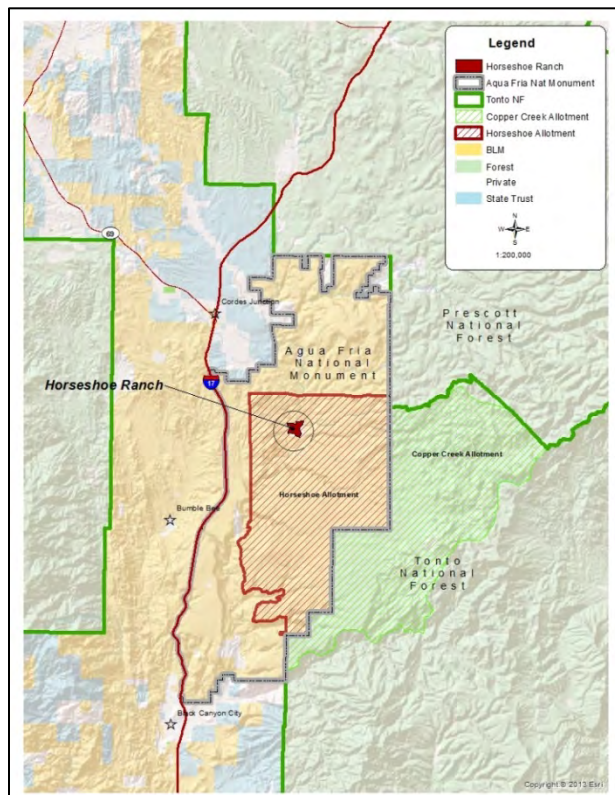


Figure 1. General location of Horseshoe Ranch and allotments within the Agua Fria National Monument, Yavapai County, Arizona.

The Department conducted an inventory in July 2014 to classify landcover on the Ranch. Overall, the area can be described with nine broad classifications summarized in Table 1. Additional details, including representative photographs are provided in Appendix A.

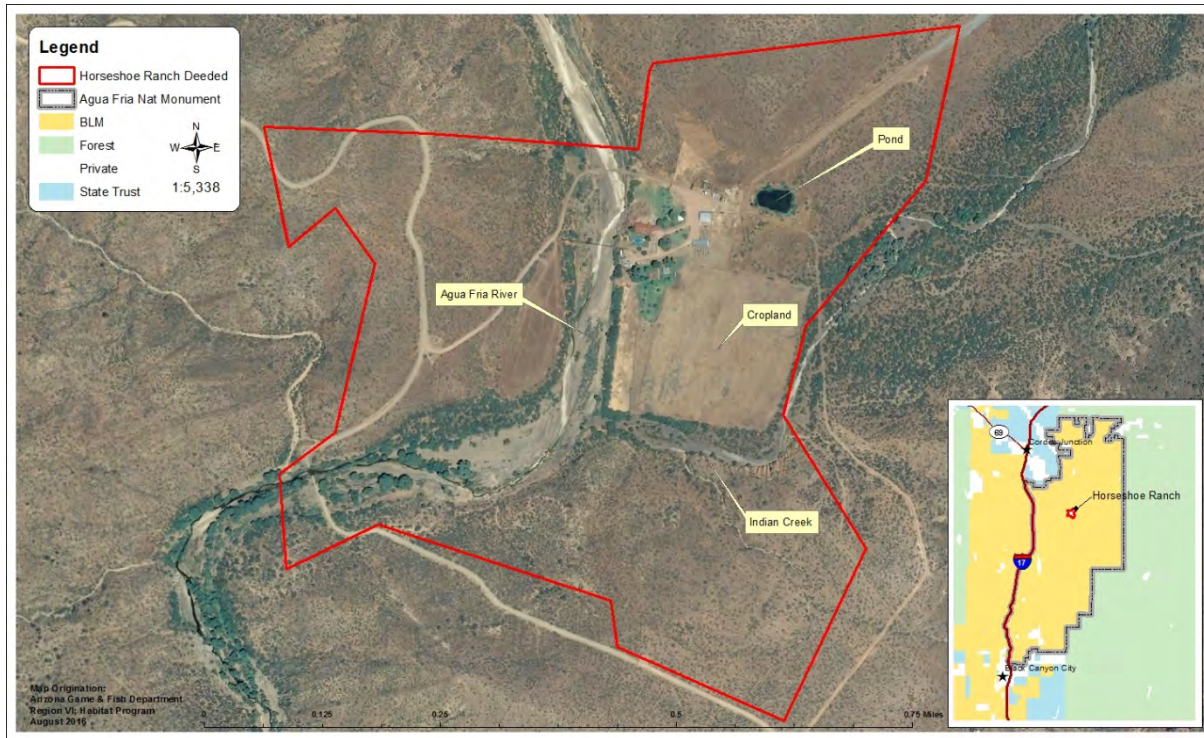


Figure 2. 2014 Aerial image of the 200 acres of deeded land of Horseshoe Ranch, Yavapai County, Arizona.

Table 1. Landcover Types on Horseshoe Ranch Deeded Land

Landcover Type	Acres ²
Rock Outcrop	0.4
Pond	0.5
Pond Enclosure	1.2
Experimental Garden	3.4
Interior Riparian Deciduous Forest and Woodland	6.7
Sonoran Riparian Scrubland	13.7
Sonoran Riparian Scrubland-disclimax	15.5
Cropland	18.6
Developed	21.5
Sonoran Desertscrub-Grassland Transition	117.3

DESCRIPTION OF ESA-LISTED SPECIES AND HABITAT ON DEEDED LANDS

Currently Southwest Willow Flycatcher, Northern Mexican Gartersnake, and Gila Chub are not extant on the Ranch deeded lands for reasons noted below. Yellow-billed Cuckoo is regularly detected in summer months along the Agua Fria River and intermittently on the Ranch. There is a 6.7-acre patch of riparian habitat along the Agua Fria River on the Ranch that is suitable as nesting habitat for Yellow-billed cuckoo when combined with adjacent habitat extending downstream of the deeded lands.

NORTHERN MEXICAN GARTERSNAKE

Northern Mexican Gartersnake was listed as threatened under the Endangered Species Act (ESA) in 2014 (USFWS 2014a). Decline of Northern Mexican Gartersnake is attributed to declines in its native prey species (i.e., frogs and fish), the prevalence of nonnative species that compete with and prey upon both the gartersnake and its prey, and degradation of waters and riparian areas in the southwestern United States. This species is not known to occur on the Ranch. The only suitable habitat would be in the ranch pond and they have not been detected there. There is normally no water in reaches of Indian Creek, and only the downstream-most approximate one-quarter mile of the Agua Fria River on the Ranch has more than ephemeral flows.

There were records of Northern Mexican Gartersnake in the Agua Fria drainage into the mid-1980s (Rosen and Schwalbe, 1988), and a credible though not documented detection in 1992. Rosen and Schwalbe (1988) surveyed four sites in the Agua Fria drainage in 1984-1986 and found Northern Mexican Gartersnake at two. Although they reported on a 1980 record of Northern Mexican Gartersnake at the Bloody Basin Road crossing (near Horseshoe Ranch), they did not find the species at that location despite two surveys. Tim Hughes (BLM, personal communication on November 2, 2015 and on prior dates) reported that he found one Northern Mexican Gartersnake on a bulrush covered sand bar at the confluence of Ash and Little Ash Creeks upstream of the Ranch in July 1992. He reported walking all riparian drainages within the Agua Fria National Monument while conducting riparian surveys and fall fish counts for five years in the early 1990s, and catching hundreds of Black-necked Gartersnake (*Thamnophis cyrtopsis*) but only the one Northern Mexican Gartersnake. Holycross *et al.* (2006) conducted surveys for Northern Mexican Gartersnake at locations throughout the Gila River drainage, including short surveys at twelve locations in the Agua Fria drainage. The study found Northern Mexican Gartersnake in other areas of central Arizona, but none in the Agua Fria drainage. Holycross *et al.* (2006) also documented a substantial change from native leopard frogs and only a few bullfrogs along the Agua Fria in the mid-1980s (Rosen and Schwalbe, 1988) to a system dominated by nonnative bullfrogs, crayfish, and nonnative fish; which likely contributed to making the habitat less suitable for the gartersnakes.

Burger (2016) reported on an intensive survey for Northern Mexican Gartersnake along the Agua Fria River in wetted areas within about 1.9-miles (3 km) upstream and downstream of Horseshoe Ranch deeded lands. That effort involved about 15,728 trap-hours and 237 person-hours but found no evidence of Northern Mexican Gartersnake. Crayfish and other nonnative species numerically dominated captures, with species/taxa caught in traps in order of abundance being crayfish (*Orconectes virilis*), Green Sunfish (*Lepomis cyanellus*), Longfin Dace, invertebrates

other than crayfish, Fathead Minnow (*Pimephales promelas*), unidentified small tadpoles, bullfrogs (frogs and tadpoles), bullhead catfish (*Ameiurus* sp.), and one Lowland Leopard Frog.

The Department has had a presence at the Ranch since 2010; and the Department, BLM, Audubon and others have been conducting fisheries and other surveys along the Agua Fria River and its tributaries in recent years. Many of the biologists involved in surveys were aware of the potential then actual ESA-listing of Northern Mexican Gartersnake, and knew that reporting any encounters would be important; however, there have been no credible or documented reports of Northern Mexican Gartersnake since the Tim Hughes record in 1992.

The U.S. Fish and Wildlife Service (Service/USFWS) considers the population in the Agua Fria drainage “likely not viable”, meaning there is a post-1980 record for the species, it is not reliably found with minimal to moderate survey effort, and threats exist which suggest the population may be low (USFWS 2014a).

GILA CHUB

Gila Chub was listed as endangered with designated critical habitat in 2005 (USFWS 2005). At that time Gila Chub was considered eliminated from 85 to 90 percent of formerly occupied habitat. Threats to the species at the time of listing included habitat loss, alteration, and degradation from ground water pumping, stream diversions, and other land management practices that led to negative impacts on stream habitat; and predation by and competition with nonnative species. The establishment of nonnative fishes within the Gila River basin is currently considered a primary threat to Gila Chub (USFWS 2015). Gila chub do not currently occur on deeded land.

Gila Chub currently exists within Indian Creek, a tributary to the Agua Fria River, at a location about three miles upstream from the Ranch. The Indian Creek population is estimated to have fewer than 500 adults and considered to be one of the smaller remaining populations of the species (USFWS 2015). The other known population of Gila Chub nearest the Ranch is in Silver Creek, a downstream tributary to the Agua Fria River. That population is about one mile overland from the Ranch but without a direct water connection. Most of the Agua Fria River on the Ranch, and reaches of Indian Creek are normally dry; and those areas do not support Gila Chub.

SOUTHWESTERN WILLOW FLYCATCHER

Southwest Willow Flycatcher was listed as endangered under the ESA in 1995 (USFWS 1995). Critical habitat was designated in 1997. The decision was set aside in 2001, but critical habitat was again designated in 2013 (USFWS 2013). The primary reason for the species decline is considered to be riparian habitat reduction, degradation, and elimination from land and water management actions associated with agricultural and urban development.

In Arizona, Southwest Willow Flycatcher has been documented using numerous drainages, with the largest currently known breeding populations along the Gila River and the San Pedro River. In central Arizona, Southwest Willow Flycatcher has been documented nesting in recent years

along the Verde, Salt, Gila, San Pedro, and occasionally Hassayampa Rivers, but not along the Agua Fria River (McCarthy 2005, Munzer *et al.* 2005, and USFWS 2014b).

The nearest known nesting population of Southwest Willow Flycatcher to the Ranch is along the Verde River over 20 miles away (McCarthy 2005, Munzer *et al.* 2005, BLM 2010, USFWS 2014b). BLM biologists noted that the linear nature of the riparian vegetation along the Agua Fria River within AFNM (which surrounds the Ranch deeded lands) does not provide for the development of suitable habitat for this species (BLM 2010). Department biologists (Troy Corman, Bill Burger, and Dana Warnecke) examined the habitat on the Ranch September 23, 2015, and determined that there was no habitat that appeared likely to be used by Southwest Willow Flycatcher for nesting because of the generally dry ground; thin stringers of vegetation; and lack of dense Tamarix, young willow or other likely nesting substrate.

The Department conducted a protocol survey for Southwest Willow Flycatcher in 2014 on the Ranch, but the species was not detected (unpublished AGFD data submitted to USFWS). In addition, there have been numerous other bird surveys along the Agua Fria River, but none of those have detected Southwest Willow Flycatcher. Sonoran Audubon Society led and reported general bird surveys in the Agua Fria Important Bird Area (IBA) in 2006 through 2008 (Sonoran Audubon Society 2006, 2007, 2008); and Audubon Arizona led and reported yellow-billed cuckoo surveys in the Agua Fria drainage in 2010 through 2015 (Wise and Prager 2010; Prager and Wise 2011, 2012, 2013, 2014, 2015, 2016). The only willow flycatcher detected on any of those surveys was on the Sycamore Creek East IBA survey in August 2007 (Sonoran Audubon Society 2007). It is suspected that willow flycatchers of unknown subspecies use the Agua Fria's riparian areas as migration corridors, as suggested by the one flycatcher noted in 2007; but there is currently no suggestion that Southwest Willow Flycatcher nest in the Agua Fria drainage. E-bird (Sullivan *et al.* 2009) has four "hotspots" (an eBird term indicating an area that is frequently visited by birders) within the AFNM, including one bordering Ranch lands, but with no willow flycatchers of any subspecies documented on the AFNM.

WESTERN YELLOW-BILLED CUCKOO

Yellow-billed Cuckoo in the western portion of the United States were determined to be a distinct population segment, and listed as threatened in November 2014 (USFWS 2014c). The primary threat to the Yellow-billed Cuckoo is the loss and degradation of native riparian habitat. Critical habitat has been proposed but not yet finalized as of October 2016. The cuckoo is a Neotropical migrant bird that winters in South America and breeds in North America, including in Arizona (Corman 2005, USFWS 2014c). Surveys in Arizona have been intermittent in time and space, but cuckoo have been documented in many mid to lower elevation drainages in the state (Corman and Magill 2000, Corman 2005).

Sonoran Audubon conducted Important Bird Area (IBA) bird count surveys on the AFNM IBA in 2006-2008 (Sonoran Audubon Society 2006, 2007, 2008). Those surveys include transects along the Agua Fria River upstream and down of the Ranch, including the Horseshoe Ford transect, which begins on the Ranch and continues downstream. The 2006-2008 surveys detected Yellow-billed Cuckoo along the Horseshoe Ford transect each year (Sonoran Audubon 2006, 2007, 2008). There were five detections and detection of a nest in 2006. In 2007, there

were two cuckoo detections, one each in August and September; and in 2008, there were two detections in August.

Audubon Arizona partnered with Sonoran Audubon, BLM, Friends of Agua Fria National Monument (FAFNM), and more recently, the Department to conduct surveys for Yellow-billed Cuckoo within the AAFNM annually since 2010 (Wise and Prager 2010; Prager and Wise 2011, 2012, 2013, 2014, 2015, 2016; AGFD unpublished 2014, 2015, and 2016 data submitted to USFWS). Table 2 below summarizes the results from the three survey sites nearest the Ranch. Of those sites, Horseshoe Ford (South) has consistently had the most use by cuckoos, with up to three estimated territories per year. The Horseshoe Ford (South) transect begins on the Ranch and continues downstream along the Agua Fria River, and cuckoos, likely from either the upstream-most territory on that transect, or transient birds, have occasionally been detected on the Ranch.

The Department conducted protocol surveys for Yellow-billed Cuckoo on Ranch lands four times each in 2014, 2015 and 2016. Areas covered in the surveys included the portion of the Agua Fria River from just south of the Bloody Basin Road crossing (Horseshoe Ford) upstream to the Horseshoe Ranch access road; and the lowest portion of Indian Creek downstream to the confluence with the Agua Fria River (which is normally dry but has some riparian trees). The approximate one-quarter mile stretch of the Agua Fria River upstream from the Bloody Basin Road crossing is frequently wet, and has a relatively well developed patch of riparian vegetation including cottonwood, willow, Arizona Sycamore (*Platanus Wrightii*), Netleaf Hackberry (*Celtis reticulata*), and other riparian trees that are suitable nesting habitat for Yellow-billed Cuckoo. This patch of vegetation was determined to be 6.7 ac. It is the 6.7 ac patch of “Interior Riparian Deciduous Forest and Woodland” indicated in Table 1; and as shown in Appendix A, Figure A1.

The Department surveys did not detect Yellow-billed Cuckoo in 2014. In 2015, one cuckoo was detected during each of the four survey periods; the detections were near the Bloody Basin Road crossing and the downstream end of the Ranch during the first three survey periods (June and July); and then near the Ranch access road the final survey (August). In 2016, a single Yellow-billed Cuckoo was detected on the Ranch deeded land during three of the four surveys. In each instance it was located in a relatively isolated cottonwood along the Agua Fria riverbed west of the cropland.

Survey data suggests a territory, and likely nest, in recent years has been just downstream of the Ranch on BLM lands along the Agua Fria River; but that cuckoos periodically use the Ranch lands. To date, use of the Ranch by cuckoos seems to be for foraging, or by transient or dispersing cuckoos; and with no evidence of breeding by cuckoos on deeded lands. The experimental garden may eventually develop into suitable habitat and be used by Yellow-billed Cuckoo, but as of late 2016 it is not grown enough to be suitable for nesting.

Table 2. Details for Horseshoe Ford, Silver Creek and Indian Creek surveys for Western Yellow-billed Cuckoo on Agua Fria National Monument, as coordinated by Audubon Arizona.

Year		Horseshoe Ford (South)*	Silver Creek	Indian Creek
2010	Total # detections	8	3	4
	Max # detections/period	4	2	3
	Estimated territories	3	0	1
2011	Total # detections	13	2	1
	Max # detections/period	4	2	1
	Estimated territories	3	0	0
2012	Total # detections	19	2	3
	Max # detections/period	–	2	3
	Estimated territories	2	0	0
2013	Total # detections	6	0	0
	Max # detections/period	–	0	0
	Estimated territories	1	0	0
2014	Total # detections	2	0	Not surveyed
	Max # detections/period	2	0	
	Estimated territories	0	0	
2015	Total # detections	14	0	Not surveyed
	Max # detections/period	–	0	
	Estimated territories	3	0	
2016	Total # detections	14	Not surveyed	Not surveyed
	Max # detections/period	–		
	Estimated territories	3		

*Horseshoe Ford was termed Lower Agua Fria in Wise and Prager (2010).

DESCRIPTION OF COMMON WILDLIFE SPECIES ON DEEDED

There are many common wildlife species that occur on the Ranch and vicinity. For the sake of brevity species will be listed by common name only. Mammals that frequent the Ranch the most include Mule Deer, White-tailed Deer, Javelina, Coyote, Raccoon, Mountain Lion, Bobcat, Striped and Hooded Skunk, Black-tailed Jackrabbit, Desert Cottontail, Pocket Gopher, Wood rats and several species of mice. Black Bear and Elk are two species that occasionally wander through the Ranch. Ringtail and Coati are known to occur in the rugged canyons along the Agua Fria River and many tributary canyons that bisect the grassland mesas of the area, and may be occasional visitors on the Ranch. Several bat species can be seen foraging over the pond, Agua Fria riparian corridor and Ranch in general including Pallid, Townsend's Big-eared, Western Red Bat, California Myotis, Big Brown and Western Pipistrelle bats to name a few. Feral hog are a more recent nonnative mammal that has established within the Agua Fria grasslands area but are infrequently seen.

Reptile species are too numerous to list but a few of the more common found on the Ranch include the Western Diamondback, Mohave and Black-tailed rattlesnakes, Gophersnake, Sonoran Whipsnake, Coachwhip, Ring-necked Snake, Gila Monster, Sonoran Desert Toad, Red-spotted Toad, Woodhouse's Toad, Spadefoot Toad, and Western Banded Gecko. The Lowland Leopard Frog and American Bullfrog are common along the Agua Fria River corridor.

The Ranch and surrounding lands are known for significant biodiversity when it comes to avian species. So much so that the Agua Fria River and tributaries have been designated an Important Bird Area by Arizona Audubon. Arizona Audubon reports that approximately 179 species have been recorded over time within the Agua Fria IBA by Sonoran Audubon during IBA surveys (<http://www.audubon.org/important-bird-areas/agua-fria-national-monument-riparian-corridors>), of which 111 are considered confirmed breeding by other survey efforts such as the Arizona Breeding Bird Atlas (Corman and Wise-Gervaise 2005). Audubon considers the IBA to be critical for several species with special conservation status for wintering and migration stop-over habitat; as well as breeding habitat for a few. A few of the most frequent avian species to visit the Ranch noted by the Ranch manager (pers. comm. Stephen Kyles December 2016) include: White-winged, Mourning, Inca and Eurasian Collared dove, Gambel's Quail, House Sparrow, Great-tailed Grackle, Verdin, Northern Flicker, Gila and Ladder-backed woodpeckers, Yellow Warbler, Yellow-rumped Warbler, Yellow-breasted Chat, Summer and Western Tanager, Vermillion Flycatcher, Cactus Wren, Greater Roadrunner, White-throated Swift and several species of swallow. The Ranch pond attracts many shorebirds and migratory waterfowl including Great Blue Heron, Green Heron, Sora Rail, Pied-billed Grebe, Common and Hooded Merganser, Green-winged Teal, Cinnamon and Blue-winged Teal, Canvasback, Redhead, Goldeneye, American Wigeon, Northern Pintail, Mallard, Ring-necked and Wood ducks. Canada Goose have been an infrequent visitor. Raptors are fairly common across the Agua Fria grasslands and not unusual visitors to the Ranch including the Great Horned Owl, Western Screech-owl, American Kestrel, Zone-tailed Hawk, Harris Hawk, Common Black-Hawk, Red-tailed Hawk, Northern Harrier and Golden Eagle.

HABITAT ENHANCEMENT PROJECTS

The primary reason for habitat enhancement projects is to either benefit wildlife, including species listed under the ESA, or facilitate research that could be valuable to habitat restoration. Habitat enhancement projects do not preclude other Ranch uses detailed in the operational plan (AGFD 2012b). In this plan, the Department describes management of a stock pond which supported a breeding population of nonnative bullfrogs into a pond which is being prepared for introduction of Northern Mexican Gartersnake and Gila Chub. Likewise, the Department has taken what was fallow cropland and, in conjunction with researchers from Northern Arizona University, has planted an experimental garden of cottonwood trees, which may be used in the future by Yellow-billed Cuckoo and perhaps by migrant Southwestern Willow Flycatcher. This plan also indicates establishment of a native grass/forb... possible improvements to riparian vegetation in the Agua Fria River channel, perhaps to include removal of Tamarix and planting of cottonwood, willow, and other native species, if future funding allows.

The Department currently intends to maintain the pond improvements, experimental garden and native grassland indefinitely into the future. It is anticipated that the pond will eventually include replicate populations of Northern Mexican Gartersnake, Gila Chub, Gila Topminnow (*Poeciliopsis occidentalis*), and Desert Pupfish; and that these populations may serve as source populations for translocations to other sites. It is anticipated that the experimental garden, though specifically planted as part of a large-scale climate change research project, could provide foraging and perhaps nesting habitat for Yellow-billed Cuckoo; and potential stop-over habitat

for migrant Southwestern Willow Flycatcher. However, the actions described in this plan, or others which result in increased number of any of the four ESA-listed species using the deeded lands may be abandoned or un-done; thus potentially returning habitat conditions for the listed species to condition similar to that at the time of Ranch acquisition.

Management actions related to habitat enhancement projects undertaken to date have been approved through the Department's Environmental Assessment Checklist (EAC) process which involves consultation with the Service/USFWS and the State Historic Preservation Office (SHPO). Throughout this plan we have noted the Department's EAC number (e.g. M12-02282231) applicable to each management action described that has been approved through previous environmental compliance documentation. Below is a list of all relevant EAC's for this plan:

- M10-08025232: Arizona Game and Fish Department Operation and Maintenance Statewide Programmatic Environmental Assessment Checklist (AGFD 2010).
- M12-02282231 and Amendments 1-3: Horseshoe Ranch Pond renovation, maintenance, and native aquatic species stocking and management (AGFD 2012c).
- M12-01193810: Programmatic Aquatic Inventory, Survey, and Monitoring Activities, and Conservation Activities for Aquatic Species (AGFD 2012d)
- M14-0403020406: Horseshoe Ranch Adaptive Restoration and Community Stewardship Project – Phase I (AGFD 2014).
- M14-0403020406 Amendment 1: Horseshoe Ranch Adaptive Restoration and Community Stewardship Project – Phase I (AGFD 2016).

Management actions to stock Gila Topminnow and Desert Pupfish in the Horseshoe Ranch pond, will serve as a replicate population under the Department's Safe Harbor Agreement (AGFD 2007).

POND FOR NATIVE AQUATIC WILDLIFE

Since the Department acquired Horseshoe Ranch in 2011, we have renovated the existing pond, which had heavy sedimentation and a breeding population of bullfrogs; into a pond which currently supports a breeding population of Desert Pupfish (422 pupfish were stocked in 2015, and reproduction was documented later that year) and a population of Gila Topminnow (247 released in 2016 and reproduction was documented later in the year). The Department intends to translocate Northern Mexican Gartersnake and Gila Chub into the pond to establish replicate populations for those two species. If the populations of gartersnake and chub become established in the pond, they may serve as source populations for reintroductions of those two species to other areas within the Agua Fria drainage. Such potential introductions into areas off deeded lands are beyond the scope of this plan, but they would be facilitated by the establishment of breeding populations of the gartersnake and chub in the Ranch pond.

In order to provide a suitable native-species prey base for Northern Mexican Gartersnake and Gila Chub; Longfin Dace, Gila Topminnow, Desert Pupfish, and Lowland Leopard Frog have also been translocated into the pond. The Department will continue to translocate additional leopard frogs, dace, or other native fish species, into the pond based on monitoring surveys. It is noted that having multiple ESA-listed species in the pond will likely result in predation on one

another, but it is anticipated that this will replicate a more natural, historic system where such species co-existed.

Renovation of the pond began in 2012, and as of 2016, pond improvement activities have included draining and lining the pond, elimination of bullfrogs, adding and maintaining a perimeter fence to preclude re-colonization by bullfrogs, renovating a well as a water source for the pond, planting native plants and seed, removal of nonnative vegetation, construction of wintering hibernaculum for snakes, and installation of irrigation line for upland vegetation management. The pond has an estimated capacity of 2.4 acre-feet (af) and is supplied from an irrigation well (ground water); and it includes a liner and erosion mat. The pond was designed to have various depths, shoreline areas with and without vegetation and spawning substrate, and to provide habitat for native fish, frogs, and gartersnake. This renovation has resulted in the elimination of a large breeding population of bullfrogs in the pond; however, a breeding population of bullfrogs does remain in the Agua Fria River in areas adjacent to the Ranch and pond.

Management Actions

The Department intends to manage the pond to provide suitable habitat for Gila Chub and Northern Mexican Gartersnake. A net conservation benefit will be provided for Northern Mexican Gartersnake through establishment of a replicate, captive population, likely of Verde River snakes. Although Northern Mexican Gartersnake appears to be relatively well distributed along the middle portion of the Verde River drainage, there is currently no captive breeding population of Verde River snakes.

Likewise, the pond is intended to provide a replicate, breeding population of Gila Chub. One of the possible source populations being considered for replication is Indian Creek, which is one of the nearest to the Ranch, and as noted in the 2015 Gila Chub Draft Recovery Plan (USFWS 2015), Indian Creek is among the smaller populations and it is not yet replicated. The pond on the Ranch could serve as insurance against catastrophic loss of that native population, and as a source for future reestablishment efforts. If another population other than Indian Creek is decided upon, similar benefits would occur.

Following translocation of Gila Chub and Northern Mexican Gartersnake into the pond, the Department will conduct annual surveys to determine continued presence/absence of those species for at least three years following the first introduction of each species. Additional surveys will be conducted as needed to determine success or failure of the establishment of chub and gartersnake.

Lowland leopard frogs were translocated from wild populations existing nearby. Source populations for completed and future translocations are the Agua Fria, Roundtree Canyon, Silver Creek, Lousy Creek, Larry Creek, and Long Gulch (EAC M12-02282231).

- Efforts will be made to move egg masses from one or multiple donor sites listed above. This will lessen the potential loss to the wild populations. This will occur in the months of March through May, and/or during times when these egg masses are present. Egg masses will be collected and placed in wetted buckets or coolers and taken directly to the

pond where they will be placed in the pond around aquatic vegetation where they will likely have the best possible chance to be successful (EAC M12-02282231).

- In addition to the egg masses, if leopard frog tadpoles are located at one of the donor sites, they will be collected and placed in buckets with aerators and moved directly to the pond and released. These collections would most likely occur during the summer months (EAC M12-02282231).
- If needed, adult leopard frogs would be collected at night using spotlights and hand/net capture. This could be done throughout the year but is most effective from March through October. Adults will be held in damp pillow cases, held in buckets and/or coolers and taken directly to the pond and released (EAC M12-02282231).
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists (EAC M12-02282231).
- Augmentations may be completed annually as needed based upon surveys (EAC M12-02282231).

Gila Topminnow and Desert Pupfish were stocked as an additional replicate population for these species (EAC M12-02282231). They will serve as a replicate population under the Department's Safe Harbor Agreement (AGFD 2007), as well as for mosquito control and provide a secondary prey base for other species in the pond.

- Gila Topminnow were collected from the Department's refuge site at Robbins Butte (EAC M12-02282231).
- 1,000 Gila Topminnow were collected and transferred directly from the refuge to the pond. The fish were triple sorted to ensure no non-targets were transferred (EAC M12-02282231).
- Desert Pupfish were collected from the Phoenix Zoo, Deer Valley High School, or Robbins Butte (EAC M12-02282231).
- 500 Desert Pupfish were transferred directly from the refuge to the pond. The fish were triple sorted to ensure no non-targets were transferred (EAC M12-02282231).
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists (EAC M12-02282231).
- Augmentations may be completed annually as needed based upon survey results (EAC M12-02282231).

Longfin Dace were collected from wild populations existing nearby and stocked into the pond to provide a secondary prey base for other species in the pond. Source populations for completed and future translocations are the Agua Fria, Silver Creek, Lousy Creek, Larry Creek, and Long Gulch.

- 1,000 dace were collected and transferred directly from one or multiple wild sites to the pond. The fish were triple sorted to ensure no non-targets are transferred (EAC M12-02282231).
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists (EAC M12-02282231).
- Augmentations may be completed annually as needed based upon surveys (EAC M12-02282231).

Northern Mexican Gartersnake will be introduced to the pond in the future.

- Prior to snakes being translocated, both lowland leopard frog and native fish populations must be established to provide sufficient food source (EAC M12-02282231).
- This will be the first ever wild to wild translocation of northern Mexican Gartersnake ever conducted. Due to this, there are currently no translocation protocols for this action; therefore we will directly coordinate this activity through the Terrestrial Wildlife program and other experts (EAC M12-02282231).
- The Northern Mexican Gartersnake will come from their nearest neighbor population, which is Bubbling Ponds Fish Hatchery (EAC M12-02282231).
- The initial efforts will be focused on collection of neonates and juveniles that have not established a home range and are expected to acclimate better when translocated. We will collect neonates as close to the normal birthing season as possible, typically around June (EAC M12-02282231).
- We will make every attempt to minimize handling (EAC M12-02282231).
- Snakes will be placed in damp pillow cases and transported in coolers directly to the pond and released (EAC M12-02282231).
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists (EAC M12-02282231).
- Augmentations may be completed annually as needed based upon surveys (EAC M12-02282231).

White Amur will be stocked for aquatic vegetation control.

- The fish will be bought from Mr. Fish, a sole source vendor for fish purchasing (EAC M12-02282231).
- These fish are certified disease free and certified triploid, which prevents any reproduction in the pond (EAC M12-02282231).
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists (EAC M12-02282231).
- Augmentations may be completed annually as needed based upon surveys (EAC M12-02282231).

Gila Chub will be stocked into the pond as an additional refugium for the Indian Creek lineage.

- Indian Creek is thought to contain less than 500 individual chub and is currently replicated only at the Phoenix Zoo. Since the Indian Creek population is less than 500 it is imperative that collection efforts are coordinated between the AGFD, USFWS, USFS, BLM, and the Phoenix Zoo, prior to collections. The purposed is to make sure all agencies and the Phoenix Zoo are aware of and agree with the source (Indian Creek or the Phoenix Zoo refuge) and the number of chub collected. The goal is to reach up to 500 individuals over the course of five years; however, given the small population size it may take longer to reach this goal. The fish will be triple sorted to ensure no non-target species are transferred.
- Three month, six month, and annual surveys will be completed. These survey activities are covered in our programmatic EA checklists.
- Augmentations may be completed as needed based upon surveys.

Chemical nonnative and native vegetation control will be used to manage aquatic and terrestrial (upland) vegetation to optimize habitat conditions for native wildlife species. The ability for long-term vegetation control is crucial to the success of the pond and its wildlife.

- Approved herbicides for removal/control of weeds and noxious plants will be used around the upland perimeter of the pond. The herbicides will be applied according to label by an authorized applicator (EAC M10-08025232).
- Rodeo Aquatic Herbicide will be applied per the label to control aquatic vegetation, including cattail regeneration, in select areas of the pond. Cattail plants have the ability to fill in the complete perimeter of the pond, reducing vital habitat for various life stages of fish, frogs, and snakes.
- Triclopyr, Clopyralid, and Picloram Herbicides will be used on woody upland vegetation including mesquite (*Prosopis* spp.), catclaw (*Acacia* spp.) and *Mimosa* species. Herbicides will be applied per the label by an authorized applicator to control woody vegetation that is currently growing along the fence surrounding the pond. These plants are causing buried parts of the fence to be pulled to the surface and exposing holes where nonnative species such as bullfrogs can enter. These herbicides have been approved by the Bureau of Land Management (BLM 2007) and Prescott National Forest (Forest Service 2015) to use for woody plant species management, in addition to other plant species, on nearby public lands.

Native vegetation will be planted as needed to enhance habitat diversity and structure within the emergent zone of the pond and/or the terrestrial (upland) zone around the pond (EAC M12-02282231).

- Native aquatic vegetation, including but not limited to sedges and rushes, may be hand dug from the Agua Fria channel in the active flood plain on deeded land in map areas: 7, 8, 25, and 27 (Figure A1). Vegetation may be translocated for establishment in the pond for additional aquatic habitat enhancement.
- Native plant seed or potted transplants may be used to enhance upland vegetation surrounding the pond.

Bullfrog and crayfish will be actively removed from the pond (EAC M12-01193810).

- Effort will be made to promptly eliminate the crayfish or bullfrogs by netting, trapping, or shooting if either species are detected in the pond.
- The pond may be drained using a pump in the event of a severe nonnative species invasion. Care to minimize negative impacts to the native aquatic species would be taken if this action occurs.

EXPERIMENTAL COTTONWOOD GARDEN

The Department is interested in establishment of additional native riparian vegetation along the Agua Fria River channel, eradication of Tamarix, stream bank stabilization, and enhancement of wildlife habitat on the upper river terrace on Ranch lands. In 2014, a collaborative research and riparian restoration project was launched with researchers from NAU, dubbed the “Horseshoe Ranch Adaptive Restoration and Community Stewardship Project”. A 3-acre experimental garden, research plots of Fremont Cottonwood trees (Figure A2), was constructed October 2014 as Phase I of the project. Approximately 4,096 cottonwood seedlings were planted on the upper

river terrace, on land that was previously used for agricultural crops. This garden was established as one of several such experimental gardens in the southwest United States to investigate the impacts of climate change and exotic species invasions on riparian ecosystems in the southwest, and funded as part of a National Science Foundation Macrosystems Biology grant NAU received. Initial emphasis is on propagation of cottonwoods and study of genetic responses to assisted migration. Over time other native plants may be incorporated into the garden to increase habitat diversity and structure. The Department anticipates that, over time, the garden will provide habitat likely to be used by Yellow-billed Cuckoo, perhaps by Southwestern Willow Flycatcher, and by many other resident and migratory birds; however the garden will be managed for its primary research objectives.

At the time of planting, irrigation infrastructure was installed to provide drip irrigation to the 3-acre experimental garden. The water source is the Horseshoe Irrigation Well (ADWR well registration # 55-623446). The well was drilled in 1956 to a depth of 120 ft and has a static water depth that fluctuates around 20 ft. The maximum pump capacity is rated at 700 gallons per minute (gpm) and the Department has a Statement of Claim filed with the Arizona Department of Water Resources for 40 af per year for year round irrigation of 30 ac of cropland. The well runs on a propane-powered generator to pump water.

Phase II of the “Horseshoe Ranch Adaptive Restoration and Community Stewardship Project”, if implemented, would involve Tamarix removal within the Agua Fria and Indian Creek drainages, native plant (e.g. cottonwood and willow) re-vegetation through pole and/or pot plantings, and implementation of practices to stabilize stream banks along Ranch lands with threatened infrastructure. It is anticipated that the experimental garden may become the source of cottonwood and possibly other native plant species stock or cuttings for these future in-channel restoration activities on the Ranch and elsewhere in the Agua Fria watershed.

Yellow-billed Cuckoo will likely benefit from the expanded three acres of habitat on Ranch lands, as the trees in the experimental garden grow. There is the potential that cuckoos could use this new habitat for foraging and/or breeding. Yellow-billed Cuckoo is commonly detected in the Agua Fria watershed in summer as transients and breeding birds. Although specific conservation benefit for Southwestern Willow Flycatcher is less likely than for cuckoo, it is possible that migrating individuals of this species could use and benefit from the experimental garden. This species is quite uncommon in the Agua Fria; however, it is known from multiple other drainages in central Arizona and does breed along the Verde River about 20 miles from the Ranch. Further, many other riparian obligate resident and migratory species could benefit from riparian habitat restoration and enhancement actions on the Ranch, including many of those confirmed breeding within the Agua Fria IBA by Sonoran Audubon (<http://www.audubon.org/important-bird-areas/agua-fria-national-monument-riparian-corridors>) and others (Corman and Wise-Gervaise 2005).

Management Actions

Operation and maintenance of the experimental garden during the spring/summer/fall growing season includes: planting and/or removal of trees, understory weed management, fence and water infrastructure maintenance, and biological monitoring and research. All of these activities

require access to the experimental garden area by multiple researchers and maintenance staff year-round, including during the cuckoo and willow flycatcher breeding season.

Research and monitoring conducted by NAU within the experimental garden includes: measurement of plant growth, phenology, morphology and chemical characteristics including tree survivorship, height/diameter, below ground root growth, budset and leaf nutrient resorption; monitoring soil properties (nutrients and carbon availability) soil moisture and temperature; monitoring plant water stress through rates of gas exchange, transpiration and water potential; monitoring weather using a portable weather station; and monitoring tree litter using a portable 2 ft x 2 ft litter-trap. Monitoring also includes use of pitfall traps and flight-intercept traps to estimate invertebrate diversity (pitfall trap dimensions: 4 in diameter x 5 in soil depth; flight intercept trap dimensions are 6 ft tall x 1 ft wide x 1 ft high) (EAC M14-0403020406).

NAU researchers are currently using an octocopter UAV equipped with a hyperspectral sensor to acquire spectral reflectance data on the plant species growing within the 3-acre experimental garden at Horseshoe Ranch. The purpose of their work is to determine if spectral differences exist among the different genotypes and establish baseline data for successful phenotyping. Repeat images acquired at varying frequency will be used to estimate growth rates via change detection (EAC M14-0403020406 Amendment I).

- NAU expects to perform one flight session (three flights) per year during the growing season.
- The UAV flights will occur during the leaf-on growing season as the plant leaves provide the key component of the spectral reflectance data. However, images can be acquired only once a year. The hyperspectral and multispectral images need to be acquired mid-day close to solar noon under clear sky conditions to avoid shadow effects.
- Only one UAV will be in the air at a time to keep logistics simple, avoid collision, and comply with the Federal Aviation Administration regulations.
- The UAV flights will occur only over the garden covering approximately one acre in spatial extent per battery charge. Maximum flight altitude for the UAV is 230 ft (70 m) above ground due to the lidar sensor operational requirement, although the maximum altitude authorized by the FAA is <400 ft.
- Each octocopter UAV flight lasts for approximately nine minutes including take-off and landing to photograph the garden; given that three flights will be required to cover the entire 3-acre cottonwood garden, total flight time each season would be approximately 27 minutes.

The experimental garden is watered with approximately five gallons of water per tree, three days per week during the growing season (April-Oct.), totaling approximately six af of water per year. The intent is to drip irrigate during the summer growing season until roots reach groundwater (~3-5 years). If the tree roots do not reach the water table after five years of irrigation, the project design would be re-evaluated to determine if a change in amount and/or timing of irrigation is necessary, or if it is necessary to thin the plot to reduce tree competition for water (EAC M14-0403020406).

The experimental garden is cleared of competing vegetation with a hand mower and gasoline powered weed-eater to control understory grasses and weeds (EAC M14-0403020406 and EAC

M10-08025232). Occasionally gopher traps are used to eradicate gophers depredating seedling trees, and insecticide is used to control harvester ant colonies that are harvesting seedling tree leaves.

The garden is currently fenced with as 7 ft high wildlife exclusion fencing. Activities may include fence repair, and fence removal or fence replacement to a standard barbed-wire type fence once the garden is well established and trees are mature (EAC M14-0403020406).

In the future, there may be a need to cut and remove mature dead and/or live cottonwood trees or other native species established in the experimental garden for the purpose of: thinning to improve stand health, thinning to plant other species, thinning to alter age class composition, and/or thinning to remove dead tree safety hazards. There may also be the desire to remove the experimental garden in entirety due to significant management constraints related to sustainability (e.g. reduced water supply or downstream impacts to Agua Fria riparian habitat as a result of watering practices) or change in management direction (EAC M14-0403020406).

In the future, the understory of the experimental garden may be enhanced by seeding and/or potted plants or plugs of native upland grasses, forbs or shrubs appropriate for the site and native to the surrounding landscape. Consultation with ecological site guides, AFNM floristic studies (Southwest Environmental Information Network 2016) and other expert sources will be utilized to identify appropriate species. Planting of one liter or larger pots will be done by drilling holes approximately 12 in deep, with a gas-powered auger operated manually, or with an auger attachment to a bobcat tractor (EAC M14-0403020406).

Three erosional head-cuts (5-10 ft long) are present along the southern boundary of the experimental garden, north of Indian Creek. These head-cuts may present a threat to the garden if they continue to erode north into the fields. The experimental garden was set back approximately 10 ft from the edge of the cropland and Indian Creek stream bank to avoid the head-cuts. In the future, the head-cuts may be filled in with rip/rap and soil, and native grasses may be planted to provide a buffer between the experimental garden and the head-cuts, and to help stabilize the soil on and around the erosion (EAC M14-0403020406).

Two piezometers were installed in the experimental garden to evaluate subsurface water table levels and estimate depth to ground water (EAC M14-0403020406). The information is being used to help evaluate long-term site suitability, how many years irrigation may be required until tree roots reach ground water levels, and potential changes in local water table levels. Water levels are measured each month in the piezometer well locations with a Solinst water level meter, which requires access to the garden during the cuckoo breeding season. Subsurface water table levels are also monitored upstream of the experimental garden on the Ranch utilizing the Horseshoe “old” well (ADWR well registration # 55-623448) located adjacent to the Agua Fria River channel; and the Horseshoe Irrigation Well (ADWR well registration # 55-623446).

CROPLAND

The Department intends to establish a native grass and forb plant community and annual upland game bird seed crops on approximately 15 ac of fallow cropland adjacent to the cottonwood

garden (Figure 2, AI and Figure 3). The cropland is currently used periodically to hold horses and cows for shipping and pasturing. The site has been impacted by past plowing and other farming, truck and quad traffic, as well as livestock grazing and trampling.

The cropland will be planted with an interior area of cool and warm season annual grain seed crops such as oats, barley, wheat, triticale and cereal rye, or forage type sorghums, to provide cover and forage for upland game bird species and other wildlife. A 50-75 ft buffer of native grasses, forbs and pollinator plants will surround the annual grain seed crop. This buffer area will be comprised of native warm and cool season plant species known to occur throughout the surrounding semi-desert grasslands of the AFNM. Plant species important to native pollinators such as the Monarch Butterfly (*Danaus plexippus*) will be established, including several species of milkweed (*Asclepias* spp.) that occur throughout central Arizona.

The intent is to achieve a habitat mosaic that benefits common wildlife throughout the area; benefits upland game bird populations and hunting opportunity throughout the region; and contributes to conservation goals for threatened pollinator species by establishing a waystation (breeding, shelter and/or foraging habitat patch). Further, the plantings will be comprised of native flora appropriate for the ecological site and/or sterile annual grain crops that will not colonize in the surrounding landscape; and once established will require lower levels of irrigation than traditional ranch crops such as alfalfa.

Although cropland management is not directly beneficial to the ESA-listed species described in this plan; due to the immediate adjacency to the experimental cottonwood garden management actions are described further below. Farming and livestock management activities within the cropland will be conducted as needed based on the phenology of the cropland species and standard farming practices. Typically, activities such as tilling and planting would be conducted for a short period in fall, winter and spring, outside of breeding season for Yellow-billed Cuckoo. Mechanized activities of any type would be of limited duration due to the small size of the cropland. Currently, the cropland is approved for planting to occur spring 2017 (EAC M10-08025232). The anticipated time for mechanized equipment use for tilling and planting would be approximately one hour per planting period. The cropland will be planted in phases, according to funding and compliance documentation.



Figure 3. Fallow cropland on Ranch deeded lands.

Management Actions

Two farming practices have been identified to manage the cropland, no-till drill or a traditional 3-step farming practice of till, landplane and grain drill. Both alternatives would also include continued use by livestock and occasional vehicle access (truck, tractor and quad) to repair fencing or conduct farming activities. Both alternatives may be implemented as a periodic annual management action to establish and maintain the native plant buffer and annual grain seed crops (EAC M10-08025232).

- No-Till Drill (<6 in depth of ground disturbance): the cropland is planted with a no-till seed drill; the drill has variable widths (would use a 10-12 ft wide) and is pulled by a tractor; with additional row of discs that cut through compact ground like a knife up to 3-4 in (round rolling knife blades); with second row of round disc blades that are angled to open soil like a grain drill and a seed is dropped into the slice and then there are packer wheels that roll over and close the slice around the seed. That is the end of the planting process.
- Traditional 3-step process of till, landplane, grain drill (plant) and irrigation (up to ~18 in ground disturbance): the cropland is tilled using a tractor to pull a ~12 ft wide disc with rotating round individual disc blades that till up to a depth of 12 in (and is adjustable to zero inches); the front row cuts the ground and throws dirt to the left and the back row throws dirt to right – so it rolls the soil over. After disking, a “landplane” pulled by a tractor would be used to smooth the surface of uneven valleys/berms in preparation for seeding and more efficient planting and germination. Subsequent planting would use a grain drill, similar to a no-till drill ~12 ft wide with one disc blade that opens soil like a knife at an adjustable depth for the seed mix (0-3 in; most likely <1/2 in for native grasses) and then it has a chain that covers the seed by dragging over the ground and moving soil over the top of seed.
- Farming practices will utilize mechanized tractors and planting implements, as well as motorized UTV, quad, trucks and trailers throughout the cropland area as needed.

To improve soil condition and reduce weeds; an annual cover crop may be planted prior to establishing the native plant buffer and annual grain seed crops. Annual cover crops improve soil condition through the addition of organic matter (roots and above ground biomass). Cover crops also compete with weeds for soil moisture and shade the soil, reducing the amount of sunlight needed by typical farm weeds to germinate. Use of cover crops is a temporary strategy to help establish a native semi-desert grassland species assemblage (EAC M10-08025232).

- Cool season small grain annual cover crops which may be planted include oats, barley, wheat, Triticale and cereal rye. Typical planting rates are 50-70 lbs per acre. Planting depths will vary from 0.5-2 in depending on soil textures.
- Warm season annual grain cover crops which may be planted include Sudan grass and forage type sorghums. Typical planting rates are 10-35 lbs per acre. Planting depths vary from 0.5-1 in.

To help with the establishment of the annual grain seed crops and native plant buffer an above ground irrigation system will be put in place. The irrigation system would be a portable system of pipes and sprinklers (EAC M10-08025232).

The water source for irrigation is the Horseshoe Irrigation Well (ADWR well registration # 55-623446). This is the same well used to irrigate the cottonwood garden. The irrigation strategy is to supplement natural rainfall and minimize water use. For example, irrigation will be used to establish native plant buffers, but once the buffer plants are established irrigation will be limited to supplementing natural rainfall if there are periods of drought stress. Irrigation will be routine for portions of the cropland planted with annual grain seed crops.

MONITORING AND ADAPTIVE MANAGEMENT

The Department is currently monitoring various biological and physical parameters associated with the Agua Fria River, cottonwood garden, ESA-listed species and water use in association with the enhancement projects herein described. The purpose of the monitoring is two-fold: a) collect baseline and trend information that can help to inform an adaptive management for the Ranch; and b) monitor for unintended negative impacts to natural resources from project activities. Adaptive management strategies will be used to balance Ranch activities and resource use with conservation and/or enhancement of resources for the benefit of ESA-listed species and other wildlife; consistent with the purposes for which the Ranch was acquired.

A suite of physical and biological measures currently used are presented in Table 3. In the future, additional or alternative indicators/parameters may be monitored as the need occurs or adaptive management dictates. Monitoring is currently designed to a) detect changes in riparian habitat on the Ranch; b) monitor water use from irrigation activities in the cottonwood garden, cropland and pond; c) detect potential changes in water table levels in the vicinity of cropland on the Ranch; d) establish occurrence/status and trends on Ranch lands by ESA-listed species; and e) establish a baseline understanding of flow regimes associated with the Agua Fria River on the Ranch.

Table 3. Summary of Adaptive Management Indicators, Methods and Metrics

Indicator	Method	Metric
Changes in riparian woody species canopy cover	Woody Plant belt transects	Density and age class of key riparian woody species
Changes in river channel morphology	Channel cross-sections (Weedman and Warnecke 2015)	Laser measured elevational changes from river left to right
Riparian plant canopy cover	Photo points	Changes noted qualitatively
Water table on the Ranch adjacent to the Agua Fria River channel	Water table monitoring wells – Piezometers & Irrigation Wells	Below ground depth to water
Intermittent surface flows on Ranch	Instream flow using Marsh-McBirney Flow Meter	Cubic feet per second (cfs); seasonally or monthly
Intermittent surface flows on Ranch	Stream gauge data – #3733 Agua Fria & Horseshoe	Flood stage (height) and volume (cfs)
Water Use	Flow meters on all output locations associated with water for cropland, pond, cottonwood garden and livestock use	Gallons/Acre Feet; monthly and annually
Monitor threatened and endangered species	Standardized species-specific survey protocols	Occurrence and/or trend
NAU cottonwood garden research	Cottonwood tree growth	Various metrics; see management actions (Page 22)

The complexity of monitoring that would be required to quantitatively link Ranch water use to downstream changes in riparian habitat conditions or stream flows, apart from watershed-wide influences, is impractical and infeasible. Ranch consumption is extremely small in magnitude compared to watershed-wide consumption. The monitoring and adaptive management framework is therefore designed to alert managers to potential negative changes, from which further investigation and/or adaptive management steps can be taken.

Biological monitoring will include past species introduction detection and periodic trend surveys when appropriate. Period surveys for occurrence and/or status of ESA-listed species on the Ranch may also occur. Standardized species-specific survey protocols within appropriate habitats would be used.

There are non-AGFD monitoring efforts that contribute to the broader knowledge base associated with the AFNM, including the Ranch, which may provide information for management regarding resource conditions or wildlife habitat use. Those efforts include: annual wet/dry mapping of the Agua Fria River at summer low-flow base levels, including reaches on the Ranch; annual Agua Fria IBA monitoring; and annual Yellow-billed Cuckoo surveys on the AFNM. Additionally, the research NAU is undertaking in the cottonwood garden will help to inform when cottonwood tree root growth has reached the below-ground water table and define when adaptive management practices can be used to reduce or eliminate irrigation to the garden. Lastly, river stage data and precipitation data are available from Yavapai County Flood Control District (YCFCD) for the Agua Fria River at Horseshoe Ranch precipitation and stream gauge stations (ID Nos. 3730 & 3733). These data will supplement project related data collected by AGFD.

INCIDENTAL TAKE

Incidental take of Northern Mexican Gartersnake, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo and Gila Chub that occur as a result of Department management activities on Horseshoe Ranch would be authorized by the “Enhancement of Survival Permit” issued by the Service/USFWS to the Department following Section 10(a)(1)(A) of the ESA and any Section 7 consultation(s) and permit for this management plan. Incidental take is defined in 50 CFR 402.02 as “take of listed fish and wildlife species that results from, but is not the purpose of, carrying out any otherwise lawful activity conducted by a Federal agency or applicant.”

Normal day-to-day activities on Horseshoe Ranch relating to ranch maintenance; livestock management activities like herding, capture and branding that are part of normal Ranch operations; or unintended impacts from Department personnel or others using the Ranch for various small and large-scale public and Department events; could contribute to higher than usual human activity levels and noise in the vicinity of ESA-listed species habitats, and possibly disrupt nesting activity or lead to avoidance of these habitats. No specific take is anticipated from such activities, but it is important to note that the Ranch lands are the headquarters for a working cattle operation, and that they are used for agency meetings, public events, and other activities that could result in incidental take of a covered species.

In addition to the activities listed above, extenuating factors beyond the Department's control could result in loss of species.

Examples of extenuating factors include, but are not limited to:

- Invasion and predation by native species (e.g. herons and fish-eating ducks have been seen at the pond, and may prey on introduced native fish, frogs and gartersnakes). This is not likely to be a serious problem, but the Agua Fria River is a flyway for birds, and the pond is an attractant to some. Such potential loss to native avian predators is not expected to be significant, but it is likely at some level. If it appears predatory birds are becoming problematic, hazing or other activities might be undertaken to lessen their impact.
- Severe weather or climate that results in overflowing or drying of the pond.
- Wind damage, fire, desiccation, prolonged drought or flooding of the experimental cottonwood garden.
- Water quality fluctuations resulting from natural causes or outside point sources that impact Ranch pond water quality and species.
- Water level fluctuations resulting from use of pond for wildfire or Ranch fire responses (e.g. helicopter bucket use).

CHANGED CIRCUMSTANCES AND MANAGEMENT RESPONSE

Changed circumstances are events that can reasonably be anticipated to occur and are planned for. The Department anticipates that two types of changed circumstances could occur within the vicinity of the Ranch lands over the life of this plan.

DROUGHT

Droughts are a periodic phenomenon in the arid environments of Arizona and certain to persist and re-occur over the life of this plan. During drought, the Department will monitor ESA-listed species and habitat conditions on the deeded lands according to the needs of the situation and will implement corrective measures as needed and feasible. Responses to actual or potential drought conditions may include:

- Improvements in water reliability at the pond or experimental cottonwood garden through water-hauling, well-drilling, deepening, or other means.
- Salvage and relocation of ESA-listed aquatic species from the pond to other sites or temporary holding facilities, either on the Ranch or elsewhere, as agreed upon by the Service/USFWS and the Department. If drought was severe enough to threaten ESA-listed species in the pond, likely other local waters would be similarly impacted.
- Removal of the experimental cottonwood garden due to changes in ground water availability and potential tree mortality; or excessive and unsustainable demand on limited water resources (ground and surface water); or offsite impacts to native riparian habitat and/or surface flows in the Agua Fria River downstream of the project area, as a result of ground water use to irrigate the experimental garden.
- Other measures as agreed upon by the Department and the Service if drought was thought to be impacting ESA-listed.

INVASION BY NONNATIVE ORGANISMS

Colonization or inadvertent introduction of nonnative fish, bullfrogs, crayfish, or other competitors or predators into aquatic habitat is a possibility over the life of this plan. Bullfrogs and crayfish are of special concern, because they both exist in the Agua Fria drainage, and have both been in the Ranch pond in the past. Responses to colonization of the pond by nonnative species will be addressed by the Department, with assistance by the Service/USFWS as requested and feasible, and may include:

- Direct removal of any nonnative fish, bullfrogs, or crayfish through trapping, hand-capture, or any other means that removes the nonnatives while causing as little harm to the covered species as practicable;
- Other measures, up to and including draining the pond if agreed upon by the Department and Service/USFWS.

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APPENDIX A: LANDCOVER DESCRIPTION AND MAPPING FOR HORSESHOE RANCH

Habitats found on the 200 acre Horseshoe Ranch include a 0.6 mi reach of the Agua Fria River and a 0.2 mi reach of Indian Creek, a tributary to the Agua Fria. The Agua Fria River flows are seasonal, and the Indian Creek flows are ephemeral during precipitation events. Habitats along the river corridors include both Interior Riparian Deciduous Woodland habitat and the more xeric Sonoran Riparian Scrubland. Undeveloped upland habitat on the Ranch is predominantly Arizona Uplands Sonoran Desert scrub/Semi-desert grassland transition. Developed areas of the Ranch include fallow croplands, livestock facilities and various housing and ranch building structures.

The Department conducted an inventory in July 2014 to classify landcover on the Ranch. Discreet areas were mapped, quantified (acres) and assigned a map area ID. Each area was described as a biotic community type using Brown (1994) or as a developed landcover type. Each community type was further described by dominant plant associations, based on ocular inventory. Figure A1 shows the resultant landcover classification map, and Table A1 provides additional details regarding each of the mapped polygons in Figure A1. Representative photographs were taken to illustrate general habitat conditions within the map areas and those follow in this appendix.

VEGETATION COMMUNITIES/LAND COVERS

There are 6.7 ac of Interior Riparian Deciduous Forest and Woodland, predominantly Fremont Cottonwood and Goodding Willow habitat along the Agua Fria River channel that extends north from the southern boundary of the Ranch upstream 0.2 mi (Photos 1 and 2 show this habitat near its downstream end; Photos 3 and 4 are near its upstream end). This patch of habitat is what is considered the most likely existing habitat for Yellow-billed Cuckoo on deeded Ranch land (Figure A1, areas 7 and 8). The flow regime in this area is typically seasonal (fall-early spring), with constriction to sparse intermittent pockets of surface water during the late spring/summer period. Surface water in this area does tend to persist for longer periods than the more xeric reaches upstream on the Ranch. The understory in this area is diverse in structure and composition, including a component of aquatic emergent vegetation (Photo 5).



Photos 1 and 2 – View looking downstream (left) and upstream (right) in Map Area 7; 10/9/15



Photos 3 and 4 – View looking upstream (left) and downstream (right) in Map Area 8; 10/9/2015



Photos 5 – Aquatic emergent Cattail species in Map area 8; 10/9/2015

Upstream of the patch described above along the Agua Fria, and in Indian Creek, the plant association becomes drier and dominated by Tamarix; we have classified these areas as Sonoran Riparian Scrubland and Sonoran Riparian Scrubland-disclimax. The Agua Fria River near the Ranch entrance road crossing has seasonal flow during periods of high runoff, but Indian Creek seldom has surface water. In both these areas channels have down-cut, resulting in old river terraces perched over six feet above the channel bottoms in some areas. Vegetation is generally denser on top of these old river terraces than in the channel bottoms (Photo 6). The stream banks are near vertical and highly erodible along these terraces (Photo 7). The plant associations are typified by a diverse assemblage of trees and shrubs adapted to more xeric conditions and often found in adjacent desert scrublands or ephemeral desert washes (Photo 8 – 11). The understory is typically dominated by nonnative grasses such as Bermuda Grass (*Cynodon dactylon*), Red Brome (*Bromus rubens*) and Rabbit's Foot (*Polypogon monspeliensis*). There are scattered individuals and pockets of native riparian deciduous trees such as Fremont Cottonwood, Velvet Ash (*Fraxinus velutina*), Netleaf Hackberry, Goodding Willow, Desert Willow (*Chilopsis linearis*); and along Indian Creek a couple old Sycamore trees. However, the predominant tree and shrub species are Velvet Mesquite (*Prosopis velutina*), Catclaw (*Acacia greggi*), Tamarix, and Desert Broom (*Baccharis sarothroides*).



Photo 6 and 7 – Looking at river right Agua Fria at densely vegetated river terrace and a steeply cut bank (Map Area 27); 10/9/2015



Photo 8 and 9 – Looking downstream along Indian Creek (Map area 28) at Sonoran Riparian Scrubland; 7/25/14



Photo 10 and 11 – Looking east at Map area 24 along the Agua Fria at dense patch of Sonoran Riparian Scrubland; 8/14/2014

Within the Agua Fria River channel bottom the habitat is predominantly Sonoran Riparian Scrub-disclimax with Tamarix, Seep Willow (*Baccharis salicifolia*), Desert Broom and several

other less dominant shrubs. Our use of the term “disclimax” refers to the fact that these areas are characterized by intermittent, sometimes scouring flows, and for this or other reasons have less dense and developed vegetation than adjacent areas without the “disclimax” label. These areas are subject to periodic floods of significant volumes (>10,000 cfs in the Agua Fria) that contribute to channel deposition and degradation and results in vegetation removal (Photos 12 and 13). There is some evidence of younger age class recruitment of cottonwood and willow within the Agua Fria River channel bottom, and within Indian Creek at the confluence with the Agua Fria River in the Riparian Scrub-disclimax areas; particularly along what appears to be the low flow meander of the channel. After spring 2010 floods, seedlings were observed throughout the Agua Fria River channel, and there have been a few more recruitment events since. It is important to note that livestock grazing within the river channel ceased when the Ranch was destocked in 2006, and no grazing in the river channel has remained the management practice since the Department acquired the Ranch in 2010. This change in management may have been a contributing factor to the survival of seedlings and current recruitment of younger cottonwood and willow in these areas (Photo 14).



Photo 12 and 13 – Looking downstream along Agua Fria River (left) in northern (left) and southern (right) portions of Map area 27; 10/9/2015



Photo 14 – Young cottonwood trees in Map area 25; 10/9/2015

Most of the lands on the Ranch have been classified as Sonoran desertscrub-grassland transition (Photos 15 and 16). The dominant overstory is a mix of shrubs, small trees and cacti; including

Mesquite, Catclaw, Snakeweed (*Gutierrezia* sp.), Prickly Pear (*Opuntia* spp.), Hedgehog (*Echinocereus* spp.) and Christmas Cactus (*Cylindropuntia leptocaulis*). There are scattered Juniper (*Juniperus* spp.) in a few areas. The herbaceous understory is a mix of several desert grasses and seasonal warm/cool season forbs. A few of the more common grass species are Tobosa (*Pleuraphis mutica*), Sideoats Grama (*Bouteloua curtipendula*), Threeawn (*Artistida* spp.) and Curly Mesquite (*Hilaria belangeri*).



Photo 15 and 16 – Map area 11 (left) and 12 (right) Sonoran desertscrub-grassland transition; 8/14/2014

The developed portions of the Ranch are lands with infrastructure, roads, livestock management facilities and cropland; which we classified as developed or cropland. Within fallow cropland a 3-acre experimental garden was planted with approximately 4,096 native Fremont Cottonwood trees in an experimental block design October 2014 (Figure A2). The garden is dedicated to a 5-plus-year research project managed by Northern Arizona University. The trees were 1-1.5 ft seedlings when planted, and at the end of the 2016 growing season (November 2016) they ranged between 4-14 ft in height (Photos 17 and 18).



Photo 17 and 18 – Experimental cottonwood garden November 2014 post-planting (left) and after year two growing season November 2016.



Figure A2. Experimental Garden Block Design; courtesy of Northern Arizona University

There is also a Ranch pond that was highly laden with sediment and supported a breeding population of bullfrogs when the Department purchased Horseshoe Ranch, but has since been renovated to increase water volume and eliminate the bullfrogs. The pond covers approximately 0.5 ac (2.4 af in volume) and the uplands within the fenced enclosure around the pond, the area to be managed for Northern Mexican Gartersnake, are another 1.2 ac for a combined area of 1.7 ac.



Photo 19 and 20 – Pond renovation 5/8/2012



Photo 21 and 22 – Pond liner and post-renovation fill 6/28/2012



Photo 23 and 24 – 2015 status of pond and enclosure habitat; south shoreline (left) and north shoreline (right); 7/28/2015

The wetland habitat within the pond is comprised of several species including Three Square Bulrush (*Schoenoplectus americanus*), Spike Rush (*Eleocharis palustris*), Seep Monkeyflower (*Mimulus guttatus*), Nebraska Sedge (*Carex nebraskensis*), and Cattail (*Typha* spp.) to name a few. Around the water edge in moister soils Curlytop Knotweed (*Polygonum lapathifolium*) is well established. In the upland dryer areas of the pond enclosure native and nonnative grass and forb species dominate and include Bermuda Grass, Little Barley (*Hordeum pussilum*), Green Sprangletop (*Leptochloa dubia*), Rabbits Foot, Clover (*Melilotus* spp.), Pepper-weed (*Lepidium* spp.), Mustard (*Sisymbrium* spp.), Globemallow (*Sphaeralcea ambigua*), and Pigweed (*Amaranthus* spp.). Some less desirable species, such as Tumbleweed (*Salsola* spp.) and Tamarix, are manually removed periodically.

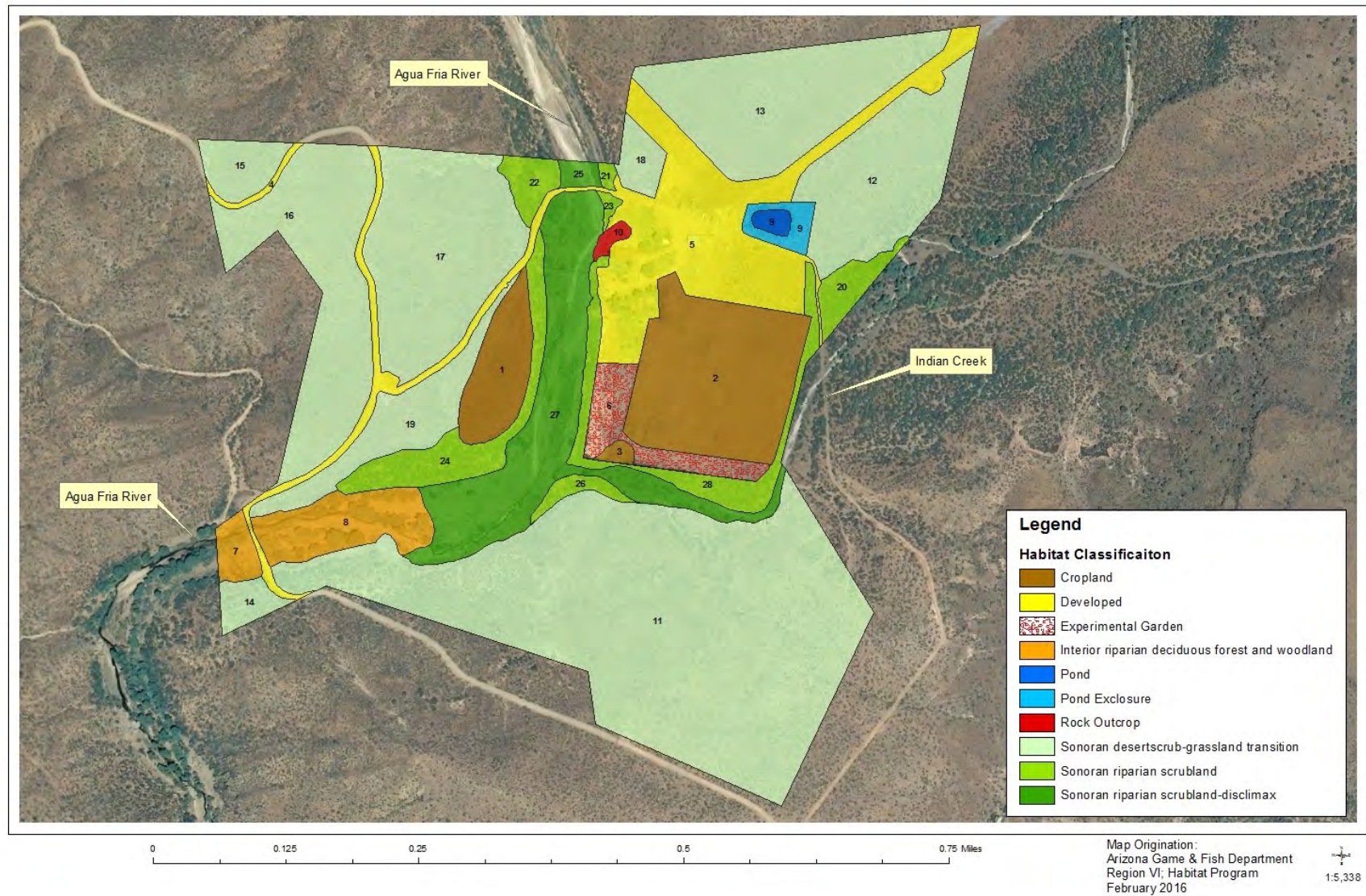


Figure A1. Landcover types on Horseshoe Ranch deeded land.

Table A1. Horseshoe Ranch landcover types – description of Map Areas (Dominant Vegetation and Acreage).

MAP AREA	LANDCOVER DESCRIPTION	DOMINANT VEGETATION	ACRES ²
1	Cropland	Cropland	4.4
2	Cropland	Cropland	13.9
3	Cropland	Cropland	0.4
4	Developed	Developed	0.4
5	Developed	Developed	21.1
6	Experimental Garden	Cottonwood	3.4
7	Interior riparian deciduous forest & woodland	Cottonwood-Goodding Willow	1.4
8	Interior riparian deciduous forest & woodland	Cottonwood-Goodding Willow	5.4
9	Pond	Open Water-Obligate wetland species	0.5
9	Pond Exclosure	Mixed exotic/native grass-forb	1.2
10	Rock Outcrop	Rock Outcrop	0.4
11	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Snakeweed-Mixed cacti-Mixed grass-Juniper	51.2
12	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Tobosa	11.2
13	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	14.1
14	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Snakeweed-Mixed cacti-Mixed grass-Juniper	1.4
15	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	2.4
16	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	14.6
17	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	15.2
18	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	1.5
19	Sonoran desertscrub-grassland transition	Mesquite-Catclaw-Mixed cacti-Tobosa	5.7
20	Sonoran riparian scrubland	Mesquite-Catclaw-Netleaf Hackberry-Juniper-Sycamore	1.7
21	Sonoran riparian scrubland	Saltcedar-Disclimax Scrub-Mesquite-Goodding Willow	0.2
22	Sonoran riparian scrubland	Saltcedar-Disclimax Scrub-Mesquite-Catclaw-Velvet Ash	1.5
23	Sonoran riparian scrubland	Mesquite-Goodding Willow	0.2
24	Sonoran riparian scrubland	Mesquite-Catclaw	4.8
25	Sonoran riparian scrubland-disclimax	Saltcedar-Disclimax Scrub-Cottonwood	0.6
26	Sonoran riparian scrubland	Mesquite-Goodding Willow-Netleaf Hackberry	0.9
27	Sonoran riparian scrubland-disclimax	Saltcedar-Disclimax Scrub-Goodding Willow	14.9
28	Sonoran riparian scrubland	Mesquite-Catclaw-Netleaf Hackberry-Desert Willow-Desert Broom-Saltcedar	4.4

