# Final Watershed and Riparian Report

# Sunflower Allotment Grazing Analysis

*July 2015*

## Table of Contents

# Introduction

The Sunflower Allotment is located on the Mesa Ranger District. The Salt River forms the southern boundary for the allotment. Highway 87 runs north and south through the western portion of the allotment. The southeastern quarter of the allotment lies within the Four Peaks Wilderness Area. Sycamore Creek, which occurs in the Sycamore Riparian Pasture, is the major stream on the allotment.

There are approximately 160 miles of named streams on the USGS 1:24,000 topographic quadrangles within the project area. In addition to the named streams, there are nearly as many miles of unnamed streams (delineated as blue lines) on the USGS topographic quadrangles. These unnamed streams are the ephemeral and intermittent tributaries to the named streams and are primarily headwater streams dominated by upland vegetation and ephemeral channels dominated by upland and xeric riparian vegetation. They provide the function relating to water quantity, water quality, flood regime, hydrological connectivity, riparian vegetation and wildlife habitat (Meyer et al. 2003, Levick et al. 2007) within the watershed.

The US Army Corp of Engineers (2015) defines ephemeral, intermittent and perennial streams as follows:

> ***Ephemeral stream:*** An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.
> ***Intermittent stream***: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.
> ***Perennial stream:*** A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

# Historic Conditions

The existing condition of watersheds, stream channels and riparian areas has been affected by many factors, both natural disturbances, including drought, fire, and floods, and human activities, including fire suppression and grazing.

Cattle were introduced to Arizona in the late 1870s following the Civil War and the subjugation of the Apaches. By the early 1890s, one and a half million cattle had been brought to Arizona (Allen 1989). During this time period, there was no regulation of grazing. There have been many accounts of the overgrazing and subsequent drought and flood events that occurred throughout central and southeastern Arizona which resulted in arroyo cutting and washed out stream channels (Wagoner 1952, Dobyns 1981). In 1905, the Tonto National Forest was designated to protect the watersheds that provide water to the Phoenix area.

Range inspection reports dating back to the 1930s indicate that from the 1930s through 2000, springs and channel bottoms were used as waters. Salting occurred near the waters, causing cattle concentration and heavy use in these areas. The Brushy Basin portion of the allotment was heavily grazed in the 1960s and 1970s. There are reports of loss of top soil and large areas of bare ground, especially near the road[1].

## *Recent Flood Events*

Stream channels are dynamic systems that are constantly being changed by the water and sediment flowing through the system. These changes obey the natural forces of gravity, friction and fluid cohesion (Janicke, 2000). A stable or properly functioning stream channel is dependent on its ability to resist the forces of erosion and will maintain its dimensions (width/depth ratio, gradient, and sinuosity) over time without excessive erosion or deposition (Barrett 1993, Rosgen 1996, Mason and Johnson 1999, Janicke 2000). A healthy riparian ecosystem contributes to channel stability by increasing resistance, thereby reducing flood peaks, trapping sediment and increasing groundwater recharge (Briggs 1996). Modifications that cause removal of vegetation will lower the channel's resistance to erosion and lead to an increased frequency and magnitude of flood impacts (Trimble and Mendel 1995, Rosgen 1996, Janicke 2000).

Over half of the stream channels assessed in the project area are in impaired or unstable condition (Mason and Johnson 1999) in large part due to past or current lack of riparian vegetation. These streams are less able to resist the erosive forces of flood waters, even during smaller events of lower water velocities (Janicke 2000). When large flood events with high water velocities occur, the channels experience severe erosion and/or aggradation causing heavy loss of riparian vegetation. Channels that are in stable condition, or impaired but with sufficient riparian vegetation to resist the erosive forces of flood waters, experience little erosion or aggradation, and retain riparian woody and herbaceous species.

In mid-January 2010, three low pressure systems passed through Arizona within a week, causing intense rainfall and record flooding south and west of the Mogollon Rim (NOAA 2010). The USGS gage, Sycamore Creek near Fort McDowell, AZ, (near the lower end of Sycamore Creek and within the Sunflower Allotment) recorded the fourth highest flow of record at 15,500 cubic feet per second (cfs) in 2010 (USGS 2013). This flood was greater than a ten year recurrence interval event, (Pope et al, 1998).

The Flood Control District of Maricopa County (2013) installed a stream gage on Sycamore Creek after the Sunflower Fire (both the burned area and the gage are a short distance above the Sunflower Allotment) in June 2012. On August 16, 2012, a peak flow of 7906 cfs was recorded, which, according to USGS regression equations (Thomas, et al 1995), is nearly the 100 year recurrence interval flood.

Given the initial impaired and unstable condition of many of the stream channels in the allotment and the magnitude of the flood events, some of the streams within the project area have lost riparian vegetation, downcut, eroded, and experienced excessive deposition (aggraded).

[1] The Forest Service Range Management Planning (2210) files located at the Tonto National Forest Supervisor's Office in Phoenix

# Affected Environment

There are approximately 2,160 acres of mapped riparian vegetation on the Sunflower Allotment (Tonto NF GIS files). This area represents less than two percent of the allotment. Presently, of approximately 160 miles of named stream channels, there are about 40 miles of perennial and intermittent stream channels that support obligate riparian vegetation. Obligate riparian vegetation needs access to perennially available surface or shallow sub-surface water. Based on Tonto NF 2210 (range) files, and associated changes in both upland and riparian vegetation, the extent of riparian vegetation has been reduced from historic conditions (Croxen 1926, Haskett 1935, Heffernan 2008).

On these allotments, many of the stream channels evaluated in the field are in unstable or impaired condition (Table A3)[2]. Riparian areas and springs have been relied upon as the primary source of livestock water for many years causing stream channels and adjacent riparian areas to receive concentrated grazing pressure.

## *Key Reaches*

A stream reach is defined as any length of stream between two points. Key reaches, similar to upland key areas (Interagency Technical Team 1996), are stream channels/springs/riparian areas that are representative, responsive to changes in management, accessible to livestock, and contain key species. Key reaches are synonymous with designated monitoring areas (DMA's) defined by Burton et al. (2011) as the location where monitoring occurs. Table 1 displays the key reaches by pasture. The six riparian areas identified in Table 1 have the potential to improve within a relatively short time period (10 years) or have reached desired condition, and have been identified as key reaches for this analysis.

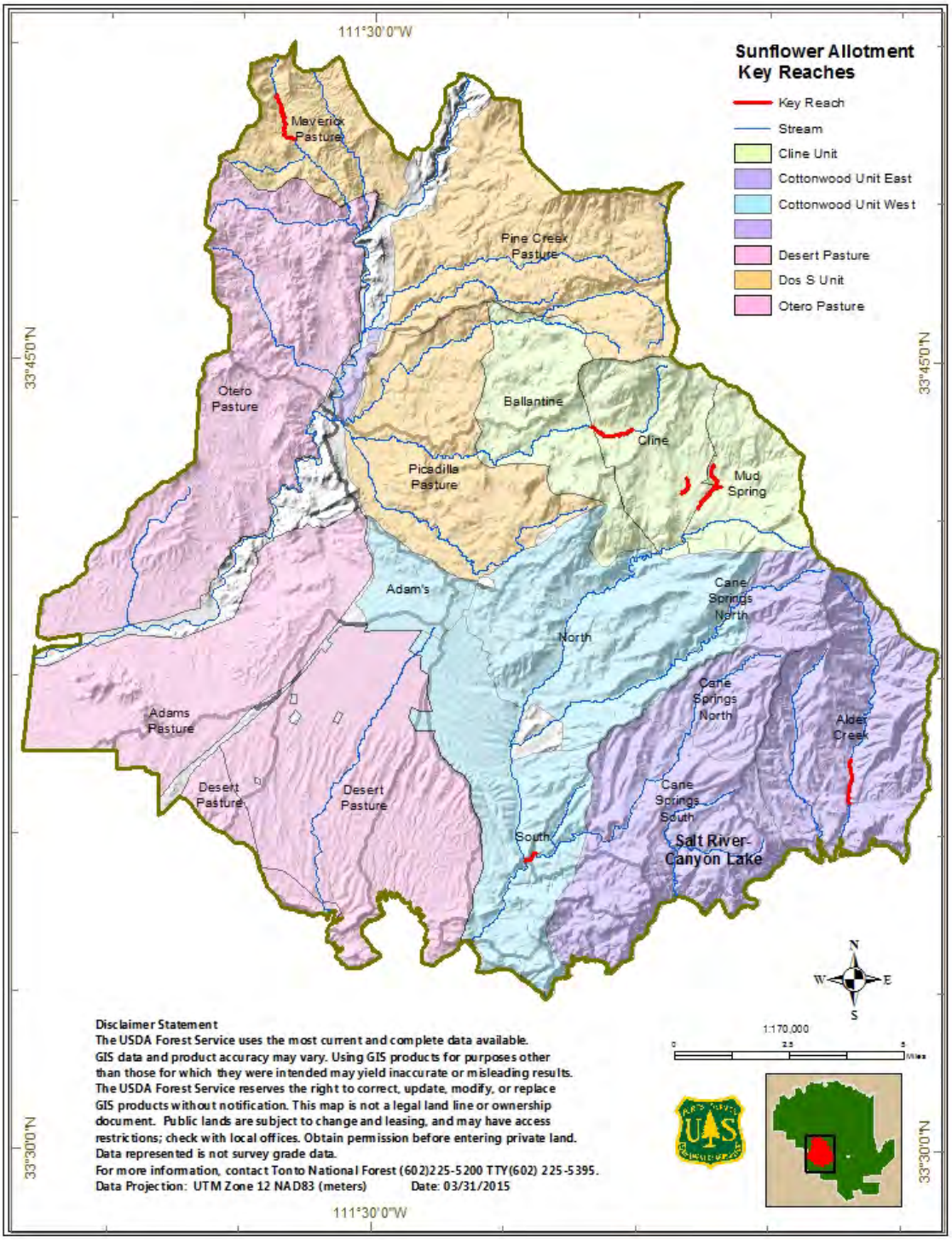
**Table 1: List of key reaches within each pasture**

| Unit | Pasture | Key Reach |
|---|---|---|
| Dos S | Maverick | Maverick Spring Canyon |
| Cline | Cline | Picadilla Creek |
| | | Brushy Basin |
| | Mud Springs | Tejanos Spring |
| Cottonwood East | Cottonwood | Cane Spring Canyon (Hidden Water Spring) |
| | Alder Creek | Alder Creek |

Existing and desired conditions of these key reaches are discussed below, by unit and pasture. Key reaches displayed on Map 1 are approximated locations for monitoring. Existing conditions for each stream reach include condition assessment (Mason and Johnson 1999), stream type (Rosgen 1996), and/or monitoring data. In addition, the water sources for each pasture that contains a key reach are described. The availability of alternative, developed water sources within a pasture can reduce the amount of time cattle may spend in riparian areas. Many of the water developments have been inventoried and data is available in Table A4. Water source inventory data for this allotment is from 2004-2013.

[2] For a more detailed description of how stream channel conditions are assessed, see Appendix A of this report.

**Map 1**


Sunflower Allotment
Key Reaches
Key Reach
Stream
Cline Unit
Cottonwood Unit East
Cottonwood Unit West
Desert Pasture
Dos S Unit
Otero Pasture
111°30'0"W
33°45'0"N
33°30'0"N
Maverick Pasture
Pine Creek Pasture
Otero Pasture
Ballantine
Cline
Picadilla Pasture
Mud Spring
Adam's
Cane Springs North
North
Cane Springs North
Adams Pasture
Alder Creek
Desert Pasture
Desert Pasture
Cane Springs South
South
Salt River-Canyon Lake
N
W
E
S
1:170,000
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Data Projection: UTM Zone 12 NAD83 (meters) Date: 03/31/2015

## Dos S Unit

This unit would include the Maverick, Pine Creek, and Picadilla pastures and has not been grazed since 2002.

### *Maverick Pasture*

Water in this pasture is provided by two springs and one stock tank, which was functioning when inventoried.

***Maverick Spring Canyon Key Reach,*** Maverick Spring Canyon is an intermittent stream that originates just east of Maverick Mountain and flows south to its confluence with Brush Corral Canyon. The Riparian vegetation layer (Tonto GIS) indicates 1.7 miles of Fremont cottonwood-conifer riparian vegetation occurs up and downstream from Maverick Spring. Riparian vegetation is also evident on Google Earth (1/29/2013). There is no field data for this reach.

## Cline Unit

This unit would include the Ballantine, Cline, and Mud Spring pastures

### Cline Pasture

The proposed action includes combining the former Cline and Coldwater pastures and multiple Brushy Basin Traps into one pasture, to be known as the "Cline" pasture. Multiple developed water sources (with pipelines and troughs) provide water for livestock away from riparian areas. Many of the developed springs are fenced to exclude livestock. Other riparian areas are not fenced to exclude livestock, however.

***Picadilla Creek Key Reach,*** Picadilla Creek is an intermittent stream that originates east of Pine Mountain and flows south and west to its confluence with Mesquite Wash. The reach in these pastures was monitored in 1998 and 1999, and visited again in 2013. In 1998 and 1999, there was little vegetation to monitor and use was high on vegetation present in the reach. In 2013, the vegetation consisted of sapling and pole size sycamore, pole size Goodding's willow and cottonwood, hackberry, sugar sumac, seep willow and desert broom. Dense, large deergrass occurs on the banks and small floodplain. There are a couple spots with scirpus (sedge) species. Livestock use was not evident. The riparian health rating (see Appendix A for a description of Riparian Health Rating process) for the majority of the key reach was 100% ( a rating greater than 67% is considered stable). The remainder of the key reach was last assessed in 1998 and a health rating was not assigned. The channel is a Rosgen "B" type in stable condition. The dominant sediment size is boulder and gravel, with gravel from the 2005 Edge Fire filling some pools.

A photo point downstream of the key reach shows some increase in woody riparian vegetation from 1996 to 2010. The remaining photo points show little change.

***Brushy Basin Key Reach,*** An unnamed tributary to Cottonwood Creek flows through Brushy Basin. The stream below FR143 lies in a very narrow valley, <30 feet wide. The channel is about 6-8 feet wide and supports sapling and pole size sycamore and some small sapling willow. Deergrass lines the channel and is thick in some places. The riparian health rating for this portion of the channel was rated as stable (94% rating). The channel is a Rosgen "B" type in slighty

impaired condition due to the large amount of sediment, probably from the 2005 Edge Fire, and the road. The dominant sediment is large cobble embedded in gravel and sand. Near the road is a short reach with large boulders that would make cattle access difficult. About 0.2 mile downstream there is a drop-off that makes the downstream reach innaccessible.

Upstream from the road the stream is impacted by OHVs driving in the channel and on the floodplain. Vegetation is sparse and consists of sapling and pole sycamore, and occasional deergrass. The riparian health rating for this portion of the channel was assessed as impaired (58% rating). Photo points up and downstream of the road taken from 1996 to 2010 show an establishment of some woody riparian vegetation but a widening of the channel, probably due to OHVs.

### *Mud Spring Pasture*

The proposed Mud Spring Pasture, combines the former Tejanos and Mud Spring Pastures, and includes several traps (Brushy Basin) for processing livestock. The proposed pasture includes one stock tank, which was functioning when inventoried, and four developed springs with troughs.

***Tejanos Spring Key Reach,*** Tejanos Spring lies on a headwater tributary of Cottonwood Creek in Brushy Basin. It is approximately two miles from Tejanos Spring to its confluence with Cottonwood Creek. Riparian vegetation extends above and below FR143. Monitoring occurred in 1998 and 1999, and a field visit in 2013. In 1998 and 1999, there was little vegetation to monitor and use was high on what was there. Heavy livestock concentration was evident, by hoof prints, trailing, and feces. In 2013, the reach above the spring is a Rosgen "B" type in stable condition. Vegetation consists of spotty deergrass, sapling and pole sycamore with a few large trees. Below the spring the channel is a steeper Rosgen "A" type with large boulders which limit access. Photo points taken from 1996 to 2010 show an increase in density of riparian vegetation. The riparian health rating for the reach of the channel below FR 143was stable (89%) in 2013. The reach above FR 143 and the tributary to Tejanos Spring have have not been assessed since 1998.

## Cottonwood Unit East

The proposed action includes dividing this unit into three pastures, Cane Springs North, Cane Springs South, and Alder Creek. It also contains several small traps, which may or may not be functioning. The unit lies entirely within the Four Peaks Wilderness. Water within this unit is provided by 13 springs, five of which are developed with troughs, and one stock tank, which was functioning when inventoried. Additionally, one of the developed springs, Cane Spring, is a developed water improvement consisting of a steel pipeline which conveys water to three existing troughs located south of the spring. This unit has not been grazed since 2000.

### *Alder Creek Pasture*

This pasture is watered by seven springs and by perennial reaches of Alder Creek

#### Alder Creek Trap

The trap lies within the pasture and is watered by two springs and Alder Creek.

Alder Creek Key Reach, Alder Creek originates on Four Peaks and flows south through the Cottonwood East Unit for approximately six miles to its confluence with Apache Lake. It is primarily an intermittent stream but does support some reaches of perennial flow.

Upstream from Forest Trail 82, the channel flows in a narrow valley (30-100 feet) with a steep gradient (<4%). In 1998, several mature individuals of Fremont cottonwood and Goodding's willow were present. There was ample regeneration of both species within the active channel. No native herbaceous species were noted. The stream was downcut and had been impacted by flooding after the Lone Fire (1996).

Monitoring occurred in 1999 and 2000. Regeneration of cottonwoods and willows was occurring. Deergrass was sparse. Use on the woody species was within guidelines. Google Earth (6-5-2012) shows about a quarter mile of dense riparian vegetation above the trail, with spotty riparian vegetation continuing upstream. Riparian health ratings were not assessed during this monitoring effort.

## Cottonwood Unit West

The proposed action would divide this unit into three pastures; North, South and Adams East pastures. More than half of this unit lies within the Four Peaks Wilderness. Water within this unit is provided by five springs (three are developed with pipelines and troughs), two wells, and two stock tanks.

***Cane Spring Canyon Key Reach,*** Cane Spring Canyon originates just west of Four Peaks and flows approximately 9.5 miles to its confluence with Cottonwood Creek. Most of the canyon lies within the Cottonwood Unit East. It is mostly intermittent with a perennial reach just below Hidden Water Spring in the Cottonwood Unit West. The majority of the stream is in a narrow steep canyon.

The reach below Hidden Water Spring was visited several times. In 1997, 1998 and 1999 there was very high use on woody vegetation and heavy trampling of streambanks and vegetation. There were many fish and frogs. Vegetative diversity was very low. There was no herbaceous vegetation to monitor. In 2013, the channel was a Rosgen "F" stream type in impaired condition (Mason and Johnson 1999). At the beginning of the reach (downstream), the channel is deep and narrow with defined banks, but upstream it is wide and shallow and braided in places, with no channel features. The reach adjacent to the spring supports dense vegetation consisting of hop bush, pole size willows, and seep willow. The riparian health rating is stable (80%) at the spring but has not been rated above the spring. Above the spring vegetative diversity is low and consists of pole size willows, a few deergrass plants and a couple of sites with cattails. Bermuda grass covers the floodplain and there is thick rabbits foot grass in portions of the channel. There is not enough available, palatable riparian vegetation to provide for statistically valid annual use monitoring.

## *Climate*

Climate in the project area is characterized by a bimodal precipitation pattern with about 60 percent occurring as frontal systems in the winter from December to March and about 40 percent occurring as

monsoons in the summer from July to September. Summer storms can be more intense than winter storms but are generally of shorter duration and smaller aerial extent.

The nearest climate gage to the project area with current data is Roosevelt 1WNW. The period of record is 1905-present (WRCC 2013) and the average annual precipitation is 16.48 inches (NOAA 2013). Of the last ten years (2003-2012) the data indicate seven years had below average precipitation (NOAA 2013). For the period 2002-2011, the temperature was above average eight of the years (WRCC 2013).

## *Wild and Scenic Rivers*

There are no designated or potentially eligible wild and scenic rivers on the Sunflower Allotment.

## *Water Quality*

The Arizona Department of Environmental Quality (ADEQ) evaluates the water quality status of waters within the state in a Nonpoint Source Assessment Report (2012). One stream and three lakes within the project area have been monitored by ADEQ (Table 2). For descriptions of abbreviations of uses, see note 1 below Table 2.

The water quality assessment for Sycamore Creek rates the creek as Inconclusive due to lack of seasonal sampling. Apache Lake is rated Impaired because dissolved oxygen violates the standard for to support the A&Ww designated use. FBC, DWS and AgI are Inconclusive due to lack of seasonal coverage and the need for additional samples to assess cadmium (dissolved), manganese, and lead (dissolved). All other uses are meeting water quality standards. Attaining. Canyon Lake is rated Impaired due to violations of the dissolved oxygen standard for A&Ww. All other uses are Attaining. Saguaro Lake is rated Attaining some uses because FC is Attaining and all other uses are Inconclusive due to some exceedances of pH, dissolved oxygen, nitrogen, phosphorus and thallium but sampling was not done as composites at 1, 2, and 5 meters as required.

**Table 2: List of water bodies monitored by ADEQ and their designated uses (ADEQ 2011)**

| Stream Name | Designated Uses | Overall Assessment |
|---|---|---|
| Sycamore Creek | A&Ww, AgI, AgL, FBC, FC | Inconclusive |
| Apache Lake | A&Ww, AgI, AgL, FBC, FC, DWS | Impaired |
| Canyon Lake | A&Ww, AgI, AgL, FBC, FC, DWS | Impaired |
| Saguaro Lake | A&Ww, AgI, AgL, FBC, FC, DWS | Attaining some uses |

[1] *Descriptions of abbreviations: A&Ww - aquatic and wildlife-warm water fisheries; FBC - full body contact recreation; FC - fish consumption; DWS – domestic water source; AGI – agricultural irrigation; AGL - agricultural livestock watering; A&We - aquatic and wildlife-ephemeral water fisheries; and PBC - partial body contact recreation.*

Designated uses for non-ephemeral, unlisted tributaries above 5000 feet are A&Wc, FBC and FC. Designated uses for non-ephemeral, unlisted tributaries below 5000 feet are A&Ww, FBC and FC. Designated uses for ephemeral, unlisted tributaries are A&We and PBC (A.A.C. R18-11-105).

## *Watershed Condition Assessment*

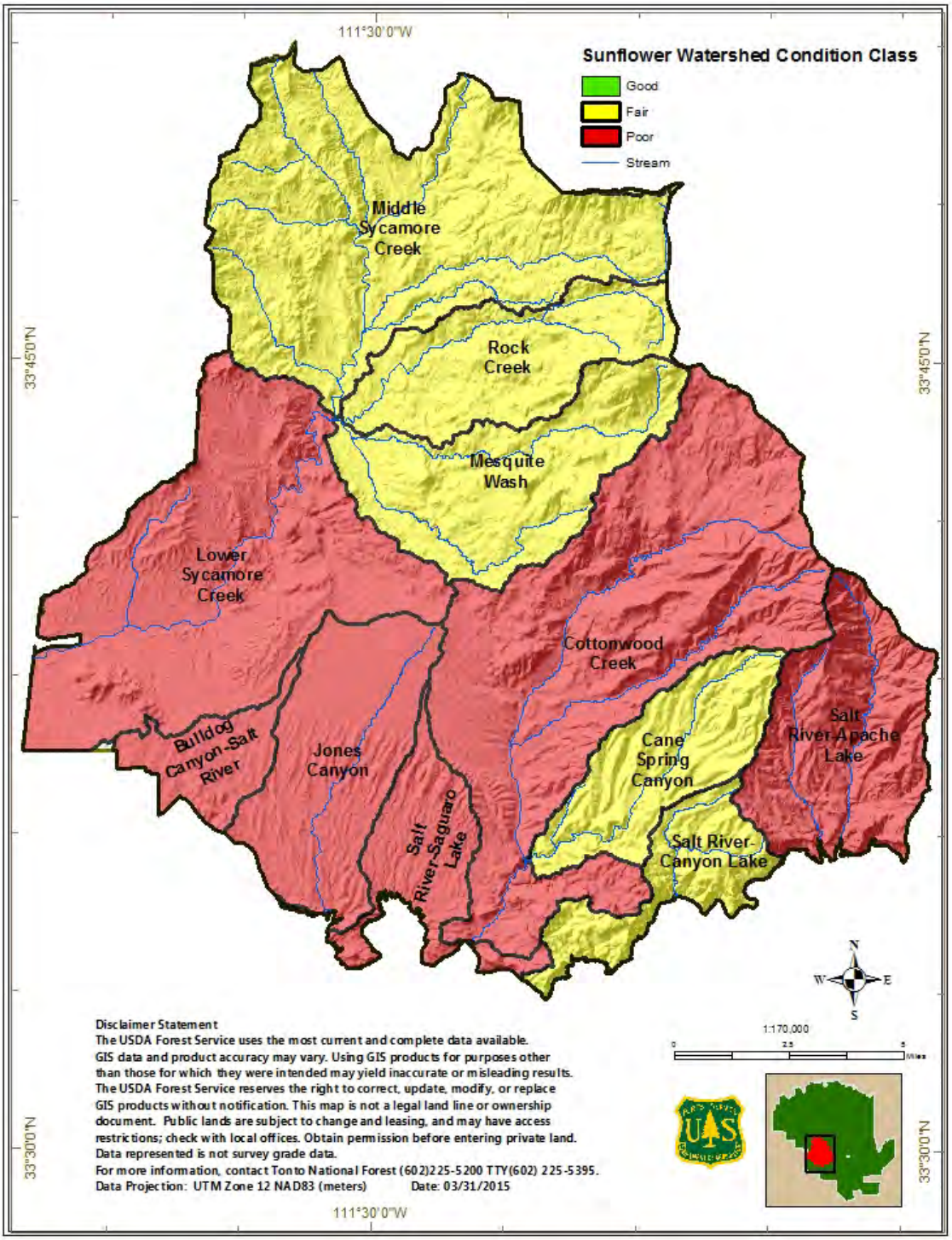
In 2010, a national effort was completed by the Forest Service to assess the condition of all 6th code watersheds on National Forest System (NFS) land. Sixth code watersheds are typically 10,000 to 40,000 acres in size. Twelve indicators were assessed including: water quality, water quantity, aquatic habitat, aquatic biota, riparian vegetation, road and trail network, soil, fire regime or wildfire effects, rangeland vegetation, terrestrial invasive species, forest cover, and forest health. Each indicator has its own definition of Functioning, Functioning at risk, and Impaired and was assessed a point value based on its condition. Each 6th code watershed was given an overall rating of Functioning, Functioning at risk, or Impaired based on the indicator scores. The results of the assessment for the 6th code watersheds in the project area are listed in Table 3 (Potyondy and Geier, 2011) and displayed in Map 2 (condition descriptions in the figure correlate with the condition ratings in Table 3 as follows: Good – Functioning, Fair – Functioning at Risk, Poor – Impaired) . Six of the 11 watersheds in the project area are in impaired condition. The indicators that received the lowest scores in these impaired condition watersheds include: aquatic biota, aquatic habitat, soil, rangeland, and invasive species.

**Table 3: Watershed condition for 6th Code Watersheds in the Project Area**

| 6th Code Watershed | Condition |
|---|---|
| Middle Sycamore Creek | Functioning at risk |
| Lower Sycamore Creek | Impaired |
| Rock Creek | Functioning at risk |
| Mesquite Wash | Functioning at risk |
| Cottonwood Creek | Impaired |
| Cane Spring Canyon | Functioning at risk |
| Salt River-Apache Lake | Impaired |
| Salt River-Canyon Lake | Functioning at risk |
| Salt River-Saguaro Lake | Impaired |
| Bulldog Canyon-Salt River | Impaired |
| Jones Canyon | Impaired |

Indicators assessed as impaired within the Sunflower Allotment portion of each of the 6th code watersheds are identified in Appendix B.

**Map 2**


111°30'0"W
Sunflower Watershed Condition Class
Good
Fair
Poor
Stream
Middle Sycamore Creek
Rock Creek
Mesquite Wash
Lower Sycamore Creek
Cottonwood Creek
Bulldog Canyon-Salt River
Jones Canyon
Salt River-Saguaro Lake
Cane Spring Canyon
Salt River-Apache Lake
Salt River-Canyon Lake
33°45'0"N
33°30'0"N
N
W
E
S
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## *Desired Conditions*

The most common conditions limiting proper functioning condition of stream channels in the project area are high width-depth ratios, excessive erosion or deposition, and lack of riparian vegetation (elements of Mason and Johnson 1999). Restoration and recovery of stream channel stability and proper functioning condition is dependent upon restoration and recovery of riparian vegetation.

Based on direction from FSH 2209.13 (Grazing Permit Administration Handbook) Chapter 90 (2007), specific statements of desired condition should be developed for each allotment within the context of the Forest Plan. The following project-specific desired condition statements have been developed for the riparian areas and stream channels in the project area, with the intent of achieving stream channel proper functioning condition (Barrett et al, 1993).

Desired conditions for key reaches include both short-term (up to 10 years) and long-term (greater than 10 years) timeframes. The most important short-term desired conditions are to:

- Maintain residual herbaceous vegetation along the greenline or streambank whenever precipitation is expected;
- Improve Riparian Health rating (Thompson et al, 1998) to greater than 67% in key reaches with a current health rating of less than 67%. Maintain or improve riparian health rating in key reaches with a current health rating of greater than 67%.

The most important long-term desired conditions are to:

- Optimize riparian tree and shrub establishment, especially following episodic, regional winter storms;
- Increase the density, vertical and horizontal canopy cover of woody riparian tree species;
- Increase the proportion of obligate and facultative riparian species;
- Maintain or increase canopy cover of herbaceous species to at least 50% (or 5% to 25% for reaches now at trace to 1%);
- Decrease the greenline to greenline width;
- Optimize the establishment of floodplains and streambanks; and
- Improve stream channel function and stability.

Reaching desired conditions for riparian areas and stream channels will depend not only on management activities, but on climatic events. Both drought and floods have the potential to affect riparian areas and stream channels. High flows (greater than 10 year recurrence interval) are likely to scour impaired or unstable channels. Even moderate flows (about 2 year recurrence interval) could cause unstable channels to widen or incise.

# Environmental effects

## *Legal and Regulatory Compliance*

## Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act)

Objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Among other things it specifies that nonpoint sources of pollution be identified and that procedures be set forth to control them to the extent feasible.

Forest and Rangeland Renewable Resources Planning Act of 1974
Contains references to the need to protect and where appropriate improve the quality of the soil and water resources.

National Forest Management Act of 1976
Stresses the need to protect and improve the quality of soil and water resources, and avoid permanent impairment of productive capability of the land.

## Clean Water Act of 1977

Stresses federal agency compliance with Federal, State and local substantive and procedural requirements related to the control and abatement of pollution to the same extent as required of nongovernmental entities.

## Executive Order 11988

Among other things this Order requires each agency to provide leadership and take action to restore and preserve the natural and beneficial values of floodplains.

## Executive Order 11990

This order requires each agency to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

## Forest Service Manual Direction

The Forest Service Manual (USDA 2004) provides direction for managing all Forest Service lands. Objectives and policy for riparian areas (FSM 2526.02 and 2526.03) include:

- To protect, manage, and improve riparian areas while implementing land and resource management activities.
- To manage riparian areas in the context of the environment in which they are located, recognizing their unique values.
- Manage riparian areas under the principles of multiple-use and sustained-yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.
- Give attention to land along all stream channels capable of supporting riparian vegetation (36 CFR 219.27e).

- Give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This distance shall correspond to at least the recognizable area dominated by the riparian vegetation (36 CFR 219.27e).
- Give special attention to adjacent terrestrial areas to ensure adequate protection for the riparian-dependent resources.

## Best Management Practices

The Arizona Department of Environmental Quality (ADEQ) has jurisdiction from the Environmental Protection Agency (EPA) to implement the Clean Water Act in Arizona. The Southwestern Region of the Forest Service has a Memorandum of Understanding with ADEQ (2014) in which the Forest Service agrees to use Best Management Practices (BMPs) to control nonpoint sources of pollution for on the ground projects.

The BMPs that follow are taken from FSH 2509.22 - Soil and Water Conservation Practices Handbook and will be used to protect soil and water resources. The list contains the objective for each BMP. The handbook also contains an explanation and implementation section for each BMP.

### *Range Management*

**22.11 - Controlling Livestock Numbers and Season of Use.** Safeguard water and soil resources under sustained forage production. Manage forage utilization by livestock to maintain healthy ecosystems for all resource objectives.

**22.12 - Controlling Livestock Distribution.** To manage sustained forage production and forage utilization by livestock while protecting soil and water resources. Maintaining healthy ecosystems for wildlife and other resources.

**22.13 - Rangeland Improvements.** To improve, maintain or restore range resources, including soil and water through the use of rangeland improvements.

**22.14 - Determining Grazing Capability of Lands.** To maintain or improve soil stability, soil productivity, and water quality by grazing the land within its capability.

**22.15 - Revegetation of Areas Disturbed by Grazing Activities.** To establish a vegetative cover on disturbed sites to prevent accelerated erosion and sedimentation.

## Forest Plan Direction

The analysis of environmental consequences is based primarily on data collected during past and present field visits conducted for the purposes of monitoring riparian use, stream channel classification, condition assessment and inspections. Direction for managing riparian areas on the Tonto National Forest is found in the Tonto National Forest Plan (Forest Plan), as amended (USDA 1985). The intention of the Forest Plan is to manage riparian areas for protection of soil, water, vegetation, wildlife, and fish populations. The Forest Plan defined the following long-term management direction for water, riparian areas, wildlife and fish (pages 19-20):

- emphasize improvement of soil productivity, air and water quality;
- enhance riparian ecosystems by improved management;

- ensure coordination that provides for species diversity and greater wildlife and fish populations through improvement of habitat.

In addition, key standards and guidelines/desired conditions from the Forest Plan include (pages 41-42):

- Coordinate with range to achieve utilization in the riparian areas that will not exceed 20% of the current annual growth by volume of woody species.
- Coordinate with range to achieve at least 80% of the potential riparian overstory crown coverage.
- Coordinate with range to achieve at least 50% of the cottonwood-willow and mixed broadleaf acres in structural Type I (tall trees with well-developed understory) by 2030.
- Rehabilitate at least 80% of the potential shrub cover in riparian areas through the use of appropriate grazing systems and methods.
- Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80% of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas.
- Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas.
- Rehabilitate cottonwood willow Type II (tall trees with little or no understory) to achieve conversion to Type I (tall trees with well-developed understory) by the year 2030. Natural regeneration is anticipated to achieve most of this goal, but artificial regeneration may be necessary in some areas.

## *Assumptions and Methodologies*

The analysis of environmental consequences is based primarily on data collected during past and present field visits conducted for the purposes of monitoring riparian use, stream channel classification, condition assessment, and inspections

## *Data Collection*

Multiple sources of field methods and protocols are used to determine stream type, stream condition, and annual use including:

- GIS layers and feature classes used to provide allotment-wide information include National Wetland Inventory (NWI) (USDI 1991-1995), riparian vegetation, perennial streams, photo points, stream route, water points and constructed features.
- Photo points are repeat photography taken at the same location, year after year. A total of 49 photo points have been established in the project area, GIS points show the approximate locations.
- Documented riparian use monitoring and field trips, including stream channel classification using stream channel type description (Rosgen 1996), condition assessment, and water source inventory.

For a more detailed description of the methodology for data collection, see Appendix A of this report.

## *General Direct and Indirect Effects from Grazing Authorization*

Riparian areas have ecological importance beyond the small percentage of land area they occupy. This percent area is smaller in the arid southwestern United States than in the country as a whole, but their ecological importance is even more critical in the Southwest. Although volumes of literature have been written on riparian systems in the southwest, little actual research has been accomplished (Milchunas 2006). The limited research available shows that grazing has greater effects on southwestern riparian understory plant communities than adjacent upland plant communities. Southwestern riparian plant communities are more sensitive to livestock grazing and more likely to experience reductions in plant species diversity than plant communities that evolved with ungulate grazing (Milchunas 2006). Clary and Kruse (2003) concur that southwestern riparian systems have not had the intensive study that other regional riparian ecosystems have had. In their review of environmental impacts, management practices, and management implications for Southwestern riparian areas, they state the necessity to rely on proven principles and practices from other similar riparian areas to fill the gaps in management applications in the Southwest.

**Direct Effects**. Riparian areas, with their high species diversity and structural complexity, provide critical terrestrial and aquatic habitat to wildlife species from adjacent upland and riparian area environments. Cattle tend to congregate in many riparian areas. They favor riparian forage and water availability, shade in warm months and gentle topography. Excessive grazing, trampling and trailing impacts can destabilize and break down streambanks, cause mechanical damage to shrubs and small trees, reduce or eliminate woody seedlings and saplings, expose soils, eliminate or shift native herbaceous species to weedy or exotic species with reduced root systems, and cause widening or incision of stream channels (Trimble and Mendel 1995, Clary and Kruse 2003). These changes may lead to loss of stream stability and function (Rosgen 1996). Stream channel profile, stream bank stability, streamside vegetation, channel bottom embeddedness, stream sediments and stream temperature are all aquatic species habitat features that can be directly or indirectly affected by livestock grazing practices. Maintaining native obligate riparian plants is extremely important to many streams because of their resistance to the erosive energy of flowing water (Clary and Kruse 2003). Herbaceous riparian vegetation is especially important to stabilizing stream bank, point bar and floodplain deposits. Development of these features is critical to the channel restoration process (Clary and Kruse 2003). One of the most important factors influencing riparian conditions is utilization (Mosley et al 1999, Clary and Kruse 2003).

**Indirect effects**. Stream channels and riparian areas can also be affected indirectly by watershed condition and/or stream channel conditions above and below the stream reach of interest. Soil compaction, decreased infiltration, and loss or alteration of upland vegetation can cause increased runoff and higher peak flows, leading to channel adjustments and decrease in stream function (Gori and Backer 2005).

## *Alternative 1 – No grazing*

**Direct Effects.** Riparian areas are generally regarded as having high inherent potential for recovery from disturbance (Milchunas 2006). Stream channel and riparian area recovery are considered optimal when the direct effects of livestock grazing are eliminated (Clary and Kruse 2003). The amount of time required for riparian recovery after severe degradation can vary from several years to decades (Clary and Kruse 2003). Recovery is dependent on the size and existing condition of the watershed, stream channel and riparian area (flow regime, channel gradient, dominant channel substrate, watershed area, type and extent of riparian vegetation), future management, climate and natural disturbances (Kindschy 1987, 1994). With 10 years rest, the riparian vegetation on some of the streams on this allotment (Picadilla Creek and Brushy Basin) has made substantial recovery, although the channels still need more time to be fully functional. The riparian vegetation on other streams on this allotment (such as Cane Spring Canyon) still needs more time to recover. Implementation of this alternative will allow recovery, or maintain or improve the existing condition of the riparian areas and stream channels.

**Indirect Effects.** The No Grazing Alternative usually provides the most rapid increase of upland vegetative cover, species diversity, and improvement of impaired and unsatisfactory condition soils. These changes reduce surface runoff, dampen peak flows, and decrease the probability of channel adjustments, impacts to riparian vegetation, and loss of channel function. Implementation of this alternative should maintain or improve the existing condition of the upland portion of the watersheds and benefit channel and riparian conditions.

***Consistency with the Riparian Area Management Direction.*** The No Grazing Alternative eliminates the direct and indirect effects of cattle grazing to recovering stream channels, riparian areas, and watersheds within the allotment. This alternative meets the intent of Forest Plan direction to protect, manage, and restore riparian areas.

## *Alternative 2 – Proposed Action*

**Direct Effects of Grazing.** Riparian vegetation utilization, residual stubble height of emergent vegetation, and availability of off-channel water developments are the elements most likely to affect riparian area and stream channel condition and recovery. Many of the stream channels on the allotment are in impaired or unstable condition (Mason and Johnson 1999). In some pastures, most of the water available to livestock is located in springs and riparian areas. Many springs are currently fenced to exclude livestock and the remaining unfenced springs will be fenced as part of the proposed action. Riparian conditions in pastures placed in non-use status (Otero and Ranger Station pastures within the Dos S Unit and the Adams West and Desert Pastures within the Desert Unit), non-use in the Sycamore Creek corridor, and in the exclosure constructed above and below Hidden Water Spring in Cane Spring Canyon should recover in a manner similar to that described in the No Grazing Alternative.

Implementation of the riparian utilization guidelines that are recommended for monitoring livestock impacts to riparian areas and stream channels are intended to maintain or increase existing riparian vegetation. The Annual Operating Instructions AOIs prepared by the Forest Service each year recommend mitigating the direct effects of livestock grazing in key reaches by

using riparian utilization measurements (implementation monitoring) (ITT 1999, Burton et al. 2011). If riparian area utilization guidelines are followed and cattle are moved when use guidelines are met, the negative, direct effects of grazing will be minimized, and riparian area and stream channel condition should be maintained or improved. This mitigation measure should be effective for all of the key reaches in grazed pastures.

Many of the reaches with perennial stream flow would be excluded from grazing. These include the mainstem of Sycamore Creek, Log Corral Canyon, Mesquite Wash and the perennial reach above and below Hidden Water Spring in Cane Spring Canyon. Direct impacts to water quality would not be expected in these reaches. The only reaches with perennial flow that would be grazed would be the reach below Tejanos Spring and Alder Creek. Direct impacts to water quality in the portion of these reaches accessible to livestock could include increases in *E. coli* when livestock are in the pasture and increased sediment movement from direct disturbance to the channel.

**Indirect Effects of Grazing.** Grazing of impaired and unsatisfactory condition uplands may slow the rates of upland recovery, indirectly slowing the rate of riparian area and stream channel recovery from the scouring effects of increased runoff and higher peak flows. If management prescriptions are followed and cattle are moved when use guidelines are met, the negative, indirect effects of grazing will be minimized. BMPs would be implemented to protect water quality.

***Consistency with Riparian Area Management Direction.*** This alternative should meet the intent of Forest Plan direction to protect, manage, and restore riparian areas if mitigation measures are successfully implemented and can be maintained.

## *Effects of Range Improvement Infrastructure*

No Action Alternative – New range improvement infrastructure would not be constructed in this alternative. There would be no effects

Proposed Action – Additional fencing, livestock handling facilities, and spring protection would improve livestock distribution which should benefit riparian vegetation and vegetative ground cover in the uplands. Spring protection would prevent adverse impacts to riparian vegetation and other resources dependent on water from the spring. New spring developments and addition of troughs, storage tanks, and pipelines at existing spring developments have the potential to dewater these springs and impact water dependent resources at the springs. Implementing a mitigation measure to ensure water remains at the spring source should minimize impacts to these resources. Additional troughs located away from riparian areas should improve livestock distribution away from riparian areas and help to protect these valuable resources.

## *Effects of Alternatives on Watershed Condition Assessment Ratings*

There are one or more attributes rated for each of the twelve indicators used to assess overall watershed condition, Twenty-one total attributes were rated for each of the watersheds within the project area. Only six of these are likely to be affected by grazing management on the allotment. These include: presence of large woody debris in stream channels, stream channel shape and

function, riparian vegetation condition, soil productivity and soil erosion (which were combined and assessed as soil condition), and rangeland vegetation condition (Potyondy and Geier, 2011).

The portion of the Bulldog Canyon-Salt River 6th code watershed within the Sunflower Allotment is only nine percent of the 6th code watershed area. Changes in attribute ratings within the allotment portion of the watershed would not affect the overall watershed condition rating.

The riparian vegetation condition and large woody debris attributes are rated Functioning for the Rock Creek and Salt River-Canyon Lake 6th code watersheds and should remain so under Alternative 1, or with successful mitigation measures under the Proposed Action. These attributes will not affect the watershed condition rating in these watersheds.

## No Action Alternative

Table 4 displays expected change in attribute ratings for the six attributes potentially affected by grazing management in the Sunflower allotment for this alternative. The attribute rating for riparian vegetation condition and large woody debris would be expected to improve a condition class in the Cane Spring Canyon and Middle Sycamore Creek watersheds. Improvement in these attributes alone would not be sufficient to improve the overall condition rating of these watersheds. The channel shape and function attribute is dependent on establishment of riparian vegetation and will take longer to achieve. The rating for this attribute may not improve within the time-frame of this project. Attributes with a “Very Slow Improvement” rating would require many years or decades to improve a condition class. Attributes with this rating would also not improve within the timeframe of this project. It is unlikely riparian vegetation condition and large woody debris would improve in the following watersheds due to OHV use: Lower Sycamore Creek, Mesquite Wash, Jones Canyon, Salt River-Saguaro lake, and Cottonwood Creek.

Soil Condition is also an attribute that changes slowly and although improvements in soil condition are possible in some watersheds the rating for this attribute may not improve within the timeframe of this project. No change in the soil condition rating is expected in watersheds receiving heavy OHV use. Rangeland vegetation condition changes slowly in the sonoran desert (see rangeland analysis). More than 50 percent of all watersheds except the Salt River-Apache Lake watershed are occupied by sonoran desert vegetation. Improvements in these watersheds will happen very slowly. If rangeland vegetation condition improves within ten years in the Salt River-Apache Lake watershed then the overall condition rating of this watershed would also improve, from impaired to functioning at risk.

## Proposed Action

Table 5 displays expected change in attribute ratings for the proposed action.

**Table 4: Change in Attribute Conditions from No Action Alternative**

| 6th code Watershed | % in allotment | Large Woody Debris | Channel Shape and Function | Riparian Vegetation condition | Soil Condition | Rangeland Vegetation Condition |
|---|---|---|---|---|---|---|
| Salt River-Apache Lake | 39 | No Change | very slow improvement | No Change | very slow improvement | slow improvement |
| Salt River-Canyon Lake | 30 | No change | very slow improvement | no change | very slow improvement | Very Slow Improvement |
| Cane Spring Canyon | 100 | improve | very slow improvement | improve | very slow improvement | Very Slow Improvement |
| Cottonwood Creek | 100 | no change | No change | no change | very slow improvement | Very Slow Improvement |
| Jones Canyon | 96 | no change | no change | no change | no change | no change |
| Salt River-Saguaro Lake | 48 | no change | no change | no change | no change | no change |
| Bulldog Canyon-Salt River | 9 | no change | no change | no change | no change | no change |
| Rock Creek | 99 | no change | very slow improvement | no change | very slow improvement | Very Slow Improvement |
| Mesquite Wash | 100 | No change | No Change | No Change | No Change | Very Slow Improvement |
| Middle Sycamore Creek | 85 | improve | very slow improvement | Improve | very slow improvement | Very Slow Improvement |
| Lower Sycamore Creek | 92 | no change | no change | no change | no change | no change |

Attribute Ratings

- Improve would be expected to improve a condition class within 10 years
- Slow Improvement may also improve a condition class within 10 years
- Very Slow Improvement would not be expected to improve a condition class within 10 years

| 6th code Watershed | % in allotment | Large Woody Debris | Channel Shape and Function | Riparian Vegetation condition | Soil Condition | Rangeland Vegetation Condition |
|---|---|---|---|---|---|---|
| Salt River-Apache Lake | 39 | No Change | very slow improvement | No Change | very slow improvement | Very slow improvement |
| Salt River-Canyon Lake | 30 | No change | very slow improvement | no change | very slow improvement | No change to Very Slow Improvement |
| Cane Spring Canyon | 100 | improve | slow improvement | improve | very slow improvement | No Change to Very Slow Improvement |
| Cottonwood Creek | 100 | no change | No change | no change | very slow improvement | No change to Very Slow Improvement |
| Jones Canyon | 96 | no change | no change | no change | no change | no change |
| Salt River-Saguaro Lake | 48 | no change | no change | no change | no change | no change |
| Bulldog Canyon-Salt River | 9 | no change | no change | no change | no change | no change |
| Rock Creek | 99 | no change | very slow improvement | No change | very slow improvement | No Change to Very Slow Improvement |
| Mesquite Wash | 100 | no change | No Change | No Change | No Change | No Change to Very Slow Improvement |
| Middle Sycamore Creek | 85 | improve | slow improvement | Improve | very slow improvement | No Change to Very Slow Improvement |
| Lower Sycamore Creek | 92 | no change | no change | no change | no change | no change |

Attribute Ratings

- Improve would be expected to improve a condition class within 10 years
- Slow Improvement may also improve a condition class within 10 years
- Very Slow Improvement would not be expected to improve a condition class within 10 years

Both the large woody debris and riparian vegetation condition attribute ratings would improve in the Cane Spring Canyon (due to fencing of riparian area adjacent to Hidden Water Spring) and Middle Sycamore Creek (due to continued non-use of Sycamore Creek) watersheds. These improvements would not change the condition class of these watersheds.

## *Cumulative Effects*

### Cumulative Effects Common to All Alternatives

The existing condition of streams and riparian areas on this allotment is the result of the cumulative effects of historic and recent management, natural disturbances, and the interaction between these two agents of change. This discussion includes the 6th code watersheds listed in the tables above, the Sycamore Creek watershed for effects to Sycamore Creek, and begins with the settlement of lands in the 1880s.

Historic over-grazing has had the most extensive effect on watersheds, stream channels and riparian areas. The range was considered over stocked with cattle by 1891 (Allen 1989). There have been many accounts of the overgrazing and subsequent drought and flood events that occurred throughout central and southeastern Arizona (Wagoner 1952). Forest Service Range Management files (File Code 2210) document the overgrazed condition of the uplands as well as springs and riparian areas.

Unmanaged OHV use, especially in the southern and Sycamore Creek portions of this allotment, is having adverse effects on stream channels and riparian areas, as well as the uplands. Sediment from the uplands is traveling down tributaries and depositing in streams like Cottonwood Creek and Sycamore Creek. Driving in channels and on stream banks is causing destruction of riparian vegetation and banks, which maintains a high width/depth ratio. High width/depth ratios mean the channel is wide and shallow and that high flows have less power to move sediment through the system thereby causing excessive deposition. Because driving in stream reaches such as lower Sycamore Creek, lower Log Corral Canyon, Brushy Basin above FR143 and Tejanos Spring above FR143 is preventing recruitment of woody and herbaceous species, which are needed to facilitate stream bank recovery and a functioning stream, these reaches are not considered key reaches for this project. OHV use will continue to impact stream channel and riparian area condition and trend.

The Travel Management Rule is intended to analyze motorized route alternatives in order to provide access and a recreation experience sufficient so vehicle operators no longer feel compelled to travel off established roads or trails. Once routes are established, maps will be available to the public and modified as needed to reflect any changes. Enforcement of the Travel Management Rule will be essential to assure compliance and prevent resource damage. Successful implementation of the Travel Management Rule should accelerate recovery of riparian areas where these areas are currently being impacted by cross country travel.

The most recent wildfire to impact the project area was the Sunflower Fire in 2012. The fire burned an area north of the project area within the Sycamore Creek watershed. The effects of flooding after the fire can be seen in Sycamore Creek in the project area as large downed trees across the channel below Log Corral Canyon, ash deposits in the banks further downstream, and

scoured channels below the burned area. Other large wildfires that impacted the project area by eroding uplands and channels and depositing sediments in channels include Lone Fire in 1996 and Edge Complex in 2005.

The only other grazing allotment within the 6th code watersheds listed that may have cumulative downstream effects on stream channels and riparian areas within the project area is Diamond. Diamond Allotment is grazed but has current NEPA, so additional impacts should be minimal.

Other activities and management actions that have occurred within the watersheds include road development, lack of road maintenance, highway reconstruction, mining, and fire suppression. These activities can cause short and/or long-term sedimentation into stream channels.

Climate change has the potential for additional impacts. According to the Arizona Drought Monitor Report for January 2015 (ADWR 2015), the area containing the Sunflower Allotment would be classified as being within moderate drought. According to NOAA National Climatic Data Center data, there has been a marked upward trend in the globally averaged annual mean surface temperature since the mid-1970s (Shein 2006). The Federal Advisory Committee Draft Climate Assessment Report is projecting higher temperatures and lower precipitation for the southwestern US (Garfin et al. 2013). New modeling efforts for the North American monsoons indicate that the amount of monsoon moisture will change little, however, the monsoons will be delayed and most of the precipitation will come late in the season (September-October) (Cook and Seager 2013).

Some stream reaches, such as Cottonwood Creek, Rock Creek, Boulder Creek and lower Picadilla Creek, that were considered riparian reaches in the 2000 NEPA assessment for the Sunflower Allotment, no longer seem to have potential to support riparian vegetation due to a combination of long term drought, impacts from OHVs, and historical grazing.

## Cumulative Effects – No Grazing Alternative

The direct and indirect effects of this alternative, when combined with other past, present or reasonably foreseeable actions (cumulative effects) as listed above, should result in reaching desired conditions at the fastest rate. As stated in the direct effects, potential for recovery and rate of recovery will vary by key reach. Where there is potential for recovery of riparian vegetation, eliminating the direct and indirect effects of livestock grazing should allow the most rapid rates of recovery, unless there are new or continued impacts from OHVs. Where riparian vegetation is meeting desired conditions this alternative would provide the most protection for maintaining those conditions.

## Cumulative Effects – Proposed Action

The direct and indirect effects of this alternative on key reaches that are grazed, when combined with other past, present or reasonably foreseeable actions (cumulative effects discussed above), are likely to result in attainment of desired conditions for the key reaches that do not sustain impacts from OHVs, but at a slower rate than for Alternative 1. Key reaches that would be grazed in this alternative include Maverick Spring Canyon, Picadilla Creek, Tejanos Spring (below FR143), Brushy Basin (below FR143), and Alder Creek. The key reach in Cane Springs Canyon (the fenced area above and below Hidden Water Spring) should recover at a rate greater

than the grazed key reaches but at a rate slower than under the No Action alternative due to continued grazing of the uplands.

The key reaches that continue to incur impacts from unmanaged OHV travel, which at this time include Sycamore Creek and Mesquite Wash, are not likely to attain desired conditions unless implementation of the Travel Management Rule results in improved OHV management in these reaches. Neither of these reaches would be grazed under the proposed action.

# APPENDIX A

## Summary of Data and Data Sources for Stream Channels and Riparian Areas

The data used to describe the stream channels and riparian areas in the project area are provided by a variety of sources discussed below. All of the following data are on file at the Forest Supervisor's Office in Phoenix, Arizona.

### *2210 Forest Service Range Allotment Planning Files*

These files are housed at the Tonto National Forest Service Supervisor's Office in Phoenix, Arizona. Information from these files was used to describe past management and condition of riparian areas.

### *GIS layers and maps*

GIS layers and feature classes used to provide allotment-wide information include National Wetland Inventory (NWI) (USDI 1991-1995), riparian vegetation, perennial streams, photo points, stream route, fire history, 6$^{th}$ code watersheds, water points and constructed features.

The streams listed in Table A1 include named streams delineated on the Tonto National Forest Stream Route feature class and unnamed streams that support riparian vegetation on the Riparian Vegetation feature class. Riparian vegetation is estimated from the riparian vegetation feature class which classifies riparian potential as: Fremont cottonwood-conifer, Arizona alder-willow, Fremont cottonwood-oak, sycamore-Fremont cottonwood, Fremont cottonwood-shrub, narrowleaf cottonwood-shrub, desert willow; or streams found on field visits to support riparian vegetation.

**Table A1.** Miles of important named streams and unnamed streams that support riparian vegetation within pastures (as displayed in GIS) in the project area. Miles of obligate riparian vegetation is taken from the Riparian Vegetation GIS feature class (USDA 2011). An asterisk (*) indicates the miles were adjusted per field data.

| Unit | Pasture | Stream Name | Perennial Streams (miles) | Non-Perennial Streams (miles) | Miles of Obligate Riparian Vegetation |
|---|---|---|---|---|---|
| Cottonwood East | Alder Creek | Alder Creek | 1 | 6.0 | 1.4 |
| | | Long Canyon | | 5.1 | |
| | | Boulder Creek | | 0.1 | |
| | Cane Springs South | Hells Hip Pocket | | 2.4 | |
| | | Blue Tank Canyon | | 3.9 | |
| | | Cane Spring Canyon | | 4.2 | |

| Unit | Pasture | Stream Name | Perennial Streams (miles) | Non-Perennial Streams (miles) | Miles of Obligate Riparian Vegetation |
|---|---|---|---|---|---|
| | Cane Springs North | Boulder Creek | | 2.7 | |
| | | Cane Spring Canyon | | 3.2 | |
| | | Cottonwood Creek | | 0.1 | |
| Cline | Cline | Picadilla Creek | | 3.2 | 0.5 |
| | | Cottonwood Creek | | 0.7 | |
| | Ballantine | Ballantine Canyon | | 0.1 | |
| | | Cottonwood Creek | | 0.2 | |
| | | Picadilla Creek | | 3.4 | |
| | | Rock Creek | | 2.4 | |
| | Mud Spring | Cottonwood Creek | | 3.3 | 0.8 |
| Cottonwood West | North | Cottonwood Creek | | 6.1 | 0.7 |
| | | Boulder Creek | | 5.6 | 0.3 |
| | | Mesquite Wash | | 0.3 | |
| | Adam's East | Jones Canyon | | 0.2 | |
| | South | Cottonwood Creek | | 6.0 | 5.4 |
| | | Boulder Creek | | 0.1 | 0.1 |
| | | Cane Spring Canyon | 0.3 | 1.7 | 0.4 |
| | | Jones Canyon | | 0.6 | |
| | | Seucito Canyon | | 1.8 | |
| Desert Unit | Desert | Jones Canyon | | 7.0 | 0.8 |
| | Otero | Brush Corral Canyon | | 0.5 | 0.1 |
| | | Log Corral Canyon | 0.5 | 3.7 | 0.7 |
| | | Ironwood Wash | | 4.0 | 0.03 |
| | | Indian Springs Canyon | | 0.7 | |
| | | Otero Canyon | | 4.8 | |
| Dos S Unit | Picadilla | Picadilla Creek | | 3.2 | 0.8 |
| | | Rock Creek | | 4.1 | 2.3 |
| | | Mesquite Wash | | 7.8 | 2.9 |
| | | Mud Springs | 0.06 | | 0.06 |
| | Maverick | Maverick Spring Canyon | | 2.7 | 1.7 |
| | | Brush Corral Canyon | | 3.5 | |
| | | Indian Springs Canyon | | 3.5 | |
| | Dos-S Holding | Mesquite Wash | | 0.9 | |
| | | Picadilla Creek | | 0.3 | |
| | | Rock Creek | | 0.8 | |
| | Pine Creek | Ballantine Canyon | | 4.3 | |
| | | Camp Creek | | 5.2 | |
| | | Pine Creek | | 8.9 | |
| | | Rock Creek | | 1.1 | |
| Sycamore Riparian | Nonuse | Sycamore Creek | 6.8 | 16.8 | 19.7 |

| Unit | Pasture | Stream Name | Perennial Streams (miles) | Non-Perennial Streams (miles) | Miles of Obligate Riparian Vegetation |
|---|---|---|---|---|---|
| | | Mesquite Wash | | 0.6 | 0.4 |
| | | Pine Creek | | 1.4 | 0.3 |
| | | Log Corral Canyon | | 0.1 | 0.1 |
| | | Rock Creek | | 0.2 | 0.2 |
| | | Indian Springs Canyon | | 0.1 | 0.05 |
| | | Camp Creek | | 0.4 | 0.1 |
| | | Otero Canyon | | 0.1 | 0.03 |
| | | Ironwood Wash | | 0.01 | 0.01 |
| | | **Total** | **8.7** | **150.1** | **39.9** |

## *Permanent Photopoints*

A total of 49 photo points have been established in the project area (see Table A2). Several of the streams, especially dryer reaches, show an increase in riparian vegetation in 2005. The vegetation is not there in subsequent photos. This may be due to the moderately high flows in February 2005 which allowed recruitment of woody species, with a return to dryer conditions in 2006. A photo point GIS layer is available showing approximate photo point locations.

**Table A2.** Photopoints established in the project area, including the date established and last year of repeat photography.

| Unit | Stream Name | Number of Sites | Date Established | Last Repeated |
|---|---|---|---|---|
| Cline | Brushy Basin | 2 | 1996 | 2010 |
| Cline/Cottonwood West | Cottonwood Creek | 3 | 1993, 1996, 1998 | 2010, 2012 |
| Desert | Log Corral Canyon | 5 | 2009 | 2012 |
| Dos S | Mesquite Wash | 3 | 1992, 1996 | 2012 |
| Dos S | Kathy Spring | 1 | 2000 | 2012 |
| Desert | Otero Canyon | 8 | 2001, 2009, 1997 (3), 1996, 2005, 2003 | 2009 |
| Cline/Dos S | Picadilla Creek | 6 | 1992, 1995, 1996 (4) | 2010, 2012 |
| Dos S/Sycamore Ck | Rock Creek | 5 | 1995, 1996 (4) | 2012 |
| Sycamore Creek | Sycamore Creek | 12 | 1992 (9), 1993, 1997 (2) | 2012 |
| Cline | Tejanos Spring | 4 | 1996 | 2010 |

## *Documented Riparian Use Monitoring and Field Trips*

Riparian utilization monitoring and other field trips documented by reports and photographs available in the project record are summarized in Table A3.

## *Stream channel classification and condition assessment*

Stream reaches selected for field visits for this analysis were chosen based on the extent of riparian vegetation indicated on the NWI maps (USDI 1991-1995), and accessibility to livestock. Reaches were classified (Table A3) according to the Rosgen (1996) system.

There are 27 stream reaches within the allotment that were evaluated in the field. The method for assessing stream channel condition was developed for the Tonto National Forest by Mason and Johnson (1999). Condition assessment is based on stream channel stability. Channel stability is defined as the ability of a stream to carry the water and sediment of its watershed while maintaining its dimension, pattern, and profile, without aggrading or degrading, over time and in the present climate (Rosgen 1996). The condition rating classes are stable, impaired (slightly or severely), or unstable. Parameters used to assess stability include depositional pattern, riparian health rating (Thompson et al. 1998), stream channel width/depth ratio, channel stability rating (Pfankuch 1975), and bank erosion hazard index (Rosgen 1996).

Riparian Health Rating: This rating method (Thompason et al. 1998) assesses the condition of 9 riparian vegetation and channel features and compares them to their potential rating. The existing condition divided by the potential condition is converted into a percent value for a summary rating. The features assessed in the rating process include:

1. Amount of the floodplain and streambanks covered by plants.
2. Percent of streambank with a deep, binding root mass
3. Percent of the riparian zone covered by noxious weeds
4. Percent of the site covered by disturbance-induced undesirable herbaceous species
5. Degree of browse utilization of trees and shrubs
6. Woody species establishment and regeneration
7. Percent of site with human-caused bare ground
8. Percent of streambank structurally impaired (altered) by human causes
9. Channel incisement (vertical stability)

## *Stream Channel Type Description (Rosgen 1996)*

**“A” type streams** are steep (>4%), entrenched, and confined channels of the headwaters that contain little or no floodplains. They dissipate energy in cascading step/pools.

**"B" type streams** are moderately entrenched, containing narrow floodplains, and have a moderate gradient (2-4%).

**“Bc” type streams** are moderately entrenched have narrow floodplains, like a “B”, and a low gradient, like a “C”. They are probably a step in the evolutionary sequence, C-G-F-C, between F and C when the channel is just beginning to gain back some floodplain.

**“C" type streams** are not entrenched and have very wide floodplains able to dissipate flood flows and support extensive riparian areas. They have a low gradient (0-2%) and display the typical riffle/pool sequence of a meandering stream. "C" type streams are also sensitive to any disturbance and riparian vegetation is very important for the stability of these streams.

**"D" type streams** evolve from a more stable stream type due to some natural or management caused disturbance but widen rather than downcutting. They straighten, steepen and become braided. Braided streams have more than one channel and may change main channels with each high flow. This results in a loss of riparian vegetation and an unstable floodplain. These stream types are extremely unstable and have low potential for natural recovery.

**"F" type streams** are highly entrenched (downcut), with little or no floodplain to dissipate flood flows, consequently, high flows are concentrated in the stream channel rather than in overbank flow which results in streambank erosion and loss of riparian vegetation. They usually evolve from a more stable stream type due to some natural or management caused disturbance. "F" type streams have a high width/depth ratio (wide and shallow) and lack the stream power, or energy, necessary to move the sediment though the system, causing aggrading. These stream types are generally unstable and extremely sensitive to disturbance.

**“G” type streams** are unstable, moderately steep (2-4%), entrenched gullies with no access to a floodplain. They evolve from a more stable stream type due to some natural or management caused disturbance.

The numbers 1-6 indicate the dominant sediment size, 1=bedrock, 2=boulder (256-2048mm), 3=cobble (64-256mm), 4=gravel (2-64mm), 5=sand (.062-2mm), and 6=silt (<.062mm).

**Table A3.** Stream type, condition assessment, and/or summary of monitoring notes for stream reaches with field data.

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| Cline | Cline | Brushy Basin #1 | 1/18/2013 | B | Slightly Impaired | Vegetation is stable but channel is full of sediment (gravel, sand) from the fire. Rest of the channel is small boulder, large cobble with pools filled in. Channel is narrow, about 6-8 ft. Valley is narrow, < 30 ft. Veg is mostly sapling/pole sycamore and some small sapling willow. There is thick deergrass in some spots with less dense deergrass on rest of channel. Just down from the road are large boulders that would make cattle access difficult. About 0.2 mile downstream there is a drop-off that makes the downstream reach inaccessible. |
| | Cline | Brushy Basin #2 | 1/18/2013 | F | Impaired | Reach above road is impacted by OHVs, driving in channel and on floodplain. In some places, road on floodplain has become a 2nd channel. Only sparse deergrass, sapling/pole sycamore. Sycamore saplings are thick in some places on floodplain. Sediment is cobble/gravel/sand. Channel is 8-10 ft wide, no channel features. Spot of bank cutting. |
| | Mud Spring | Cottonwood Creek 31 #2 | 1/18/2013 | A | Stable | There was no riparian vegetation, it was steep and rocky until the Mud Spring confluence. There were a few willows and thick deergrass. Sediment consists of boulder and cobble. Access was difficult and its doubtful that cattle could access the area. |
| | Mud Spring | Cottonwood Creek 31 #2 | 10/9/1999 | | | 140 feet stretch of measurable deergrass, use >90%, very few woody trees under 6' tall. None of the sycamore and alder seedlings were used. No cottonwood seedlings in reach. Very little recruitment overall. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Mud Spring | Cottonwood Creek 31 #2 | 8/5/1998 | F4 w/ B4 | Unstable | The channel contains a high percent of sandy sediment with some cobble and boulders. The developing floodplain and active channel maintain |
| | Mud Spring | Cottonwood Creek 31 Trib (Tejanos Spring) #1 | 6/17/1998 | B4 | Unstable | Lone Fire in 1996 has dumped a large amount (3 feet) of sediment in the creek. Vegetation shows very high use by cattle, banks are broken down and channel is trampled. Road crosses creek many times and runs in channel in places. Has high potential for recovery. Few deergrass, ground into the dirt. All gates open. |
| | Mud Spring/Cline | Cottonwood Creek 31 Trib (Tejanos Spring) #2 | 1/18/2013 | B/A | Stable | Above the spring the channel is a B type. The channel is about 6 ft wide, cobble/gravel. Spotty deergrass, sapling/pole sycamore with a few large trees of same. Below the spring it is and A type with very large boulders, making access limited. Veg is sycamore/willow. There is water at the spring. The drinker on the right side slope is filled in with sediment. Some seedling willows. |
| | Mud Spring/Cline | Cottonwood Creek 31 Trib (Tejanos Spring) #2 | 6/21/1999 | | | Very few herbaceous riparian obligates found. Deergrass received heavy use (90%). Very sparse amount of water bentgrass, with no use. No other graminoid riparian species present. Low recruitment of woody species. Only a few sycamore and walnut seedlings present in entire reach, with no use. Heavy livestock traffic, hoof prints and trails through stream bottom, banks and sideslopes. Fecal material also in stream. Recreation signs include: 5 fire rings, ATV trail, shells. Holding pen on east side of spring. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Mud Spring/Cline | Cottonwood Creek 31 Trib (Tejanos Spring) #2 | 8/5/1998 | | | The channel contains a high amount of sand with some cobbles and boulders. The developing floodplain and active channel contain trace cover of any vegetation. Woody vegetation cover is predominately sycamore, with infrequent occurances of willow and one cottonwood. The channel bottom is blanketed with hoof prints and 5 cows were present at the road crossing. Recreational impact is evident. A road follows and traverses this reach for at least 1/4 mi. Trash and fire ring in one location. |
| | Mud Spring/Cline | Cottonwood Creek 31 Trib (Tejanos Spring) #2 | 6/17/1998 | A1&2/B3&4 | Unstable | High degree of use. Areas of accessability are highly used. Severe chisling and altering of banks by livestock. Channel braided in a coulple areas (overflow channels). High recruitment of sycamore after fire. |
| | Mud Spring/Cline | Cottonwood Creek 31 Trib (Tejanos Trib) | 8/5/1998 | G4 | Unstable | Lots of sediment, probably from Lone Fire. Banks and channel >50% impacted by cattle. Few willows and deergrass, 100% use. No regeneration. |
| | Cline | Picadilla Creek #1 | 8/5/1998 | A2 | Stable | Pools filled with gravel. No use on vegetation. |
| | Cline/Ballantine | Picadilla Creek #2 | 1/18/2013 | B | Stable | Valley/channel is narrow, channel is 4-5 ft wide. Sediment is boulder/gravel. Pools are filled with gravel probably from the Edge Fire. Vegetation consists of sapling/pole sycamore, pole willow and cottonwood, hackberry, sugar sumac, seep willow, desert broom. Thick, large deergrass occurs on bank and small floodplain. A couple spots with scirpus. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Cline/Ballantine | Picadilla Creek #2 | 6/8/1999 | | | Very little vegetation to measure. Willow and sycamore seedlings measured in 1998 are no longer present. 50% use on Baccharis and coffee berry. No recruitment of riparian obligates evident. Overstory mainly medium and large size sycamore and Goodding's willow. |
| | Cline/Ballantine | Picadilla Creek #2 | 8/5/1998 | B | Impaired | Fences between reaches:1-shows high use, 2-less use but altered streambank, high W/D ratio, woodies in active channel, floodplain dominated by Bermuda and deergrass. 3-best condition, woodies at bankfull feature, mostly sycamore and willow. Pole size and larger sycamore. Seep willow heavily grazed in areas. |
| | Cline/Ballantine | Picadilla Creek #2 | 6/17/1998 | | | Presence of cow hoof and few deer tracks on upper segment of reach. Upper 1/4 of reach- Goodding's willow seedling size only. Large cobble covering reach. Deergrass present but not stabilizing banks. |
| Dos S | Picadilla | Picadilla Creek #3 | 6/27/2000 | | | Very few riparian obligates. Deergrass was common throughout reach with evidence of previous grazing. Cow manure and tracks throughout reach in both stream channel and banks. |
| | Picadilla | Picadilla Creek #3 | 6/16/1999 | | | No riparian obligates present in reach except one medium size Goodding's willow. Only 6 deergrass plants present in the reach. All were meduim sized and grazed to about 3 inches. |
| | Picadilla | Boulder Creek | 6/16/1999 | | | Few measurable riparian species under 6 feet, less than 10 cottonwoods and 2 willows. Less than 1% use this year on cottonwoods. Previous years use was evident >75% use. Several hedged cottonwoods. Herbaceous vegetation present, only about 10-20 deergrass. No use this year but >90% for last year. Larger cottonwoods present, pole to medium size. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Maverick | Indian Springs Canyon #1 | 9/22/1998 | G4 | Impaired | This reach was very dry but had lots of deer grass and other riparian vegetation. Some quartz mines upslope are contributing sediment to the stream as well as the road which leaves the creek in this reach. |
| | Maverick | Indian Springs Canyon #2 | 9/22/1998 | F4 | Unstable | The road ran down this reach. Its dry and sandy. There are large cut banks, typical of F streams, contributing sediment. The vegetation is being impacted by the road in some places. |
| | Picadilla | Rock Creek 31 | 6/15/1999 | | | No measurable seedlings in reach. No riparian obligates under 6 ft. >90% use on deergrass. Cattle prints and feces in reach. Four cows seen in reach. Trails on banks and fluvial surfaces. No water in channel, no flooding present. |
| Cottonwood East | Alder Creek | Alder Creek 31 #1 | 7/11/2000 | | | Little water present in intermediate reaches. Livestock signs observed (one cow heard in vicinity). No cattle signs downstream of waterfall. There are many cottonwood seedlings throughout reach. Watercress (Veronica) growing in most wet areas of the creek. Most seedlings 3-4 years old; probably after Lone fire (upstream in watershed). Lone fire thought to have caused significant downcutting. Quite a few cottonwood and willow seedlings from this year with very little observed use. The larger willows are more heavily utilized. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Alder Creek | Alder Creek 31 #1 | 7/20/1999 | | | Some use noted from prior years. Some cattle scat observed, though not fresh. Regeneration of cottonwoods and willows occurring. Mature walnut, sycamores and cottonwoods are present. D. McGee said this reach flooded the September after the Lone Fire. There was a variety of graminoids present. Eight deergrass plants were found, none grazed. No fresh sign of cattle in reach. No alteration was present on the streambanks from livestock. |
| | Alder Creek | Alder Creek 31 #1 | 9/15/1998 | G2/3 | | No use. Very rocky. Very little obligate riparian in channel. |
| | Alder Creek | Alder Creek 31 #2 | 9/15/1998 | G | Unstable | |
| Cottonwood West | South | Cane Spring Canyon | 2/5/2013 | F | Impaired | At the spring there is thick veg, mostly hop bush and seep willow. The rest of the channel supports pole size willows (probably from 2005), a few larger willows, a few deergrass, a couple spots with cattails, bermuda grass and rabbitsfoot. Diversity and density are low. This is surprising as it has not been grazed in over 10 years. |
| | South | Cane Spring Canyon | 4/19/1999 | | | Through western 2/3 of reach Gooddings willow have 5-25% canopy cover. Through east 1/3 it is 25-50%. No perennial grass to measure, no woody under 6 ft. 10% of streambanks is alterable, all of alterable bank is altered. Presence of cattle in reach, 5 cows, 3 calves seen. Light use on ragweed and rabbitsfoot. Evidence of high flows, heavy buildup of woody debris at the base of large trees. Channel often enclosed by seep willow (cover 50-75%). 40% of channel enclosed by steep, rocky outcrops. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | South | Cane Spring Canyon | 1/6/1999 | F3 | Slightly Impaired | Lots of frogs and fish. Erodible bank impacts >75%, vegetation impacts >75%, estimated. Cattle use evident even on baccharis, no willow seedlings. |
| | South | Cane Spring Canyon | 8/10/1998 | | | In accessable areas use on willow and cottonwood is high. Stream bottom and areas adjacent to the stream were used by cattle for trailing and grazing, indicated by dung, hoofprints and browsed plants. |
| | South | Cane Spring Canyon | 5/11/1998 | | | Cattle present, permitted use in correct season. Estimated use: <10% current, 100% past. Estimated alteration: <10%. Cattle had not yet been in drainage, but a few willow were used 100% from last season. Pools at Hidden Water contain Gila topminnow. |
| | South | Cottonwood Creek 31 #1 | 2/5/2013 | Bc | | Water running from rain last week. Channel very wide, about 30 feet, and shallow. Full of sand/gravel sediment from tributaries. We saw four sycamores and three cottonwoods. Couldn't find spring. One deergrass and several fountain grass present. With climate change, heavy recreation and historical grazing, this reach seems to have lost potential for riparian recovery. |
| | South | Cottonwood Creek 31 #1 | 2/10/2005 | B4c | | Creek was flowing a few inches deep. All the seep willow near cross section is gone. Channel is wide and filled with sediment. |
| | South | Cottonwood Creek 31 #1 | 6/15/1998 | B4c | Unstable | Degree of use 100%. Streambank alteration 100%, 90% by cattle and 10% by OHV. Streambanks have high water content. They are still observable features but highly altered. Hydrologists and soils personnel felt riparian potential high. Soils of remaining banks have clays and mottled soil. Water no longer flowing. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | South | Cottonwood Creek 31 #3 | 2/5/2013 | F/C | Unstable | There is no riparian vegetation. The channel is full of sand and gravel with a few spots of cobble/boulder. I believe, with climate change, this reach has lost potential for recovery of riparian vegetation. |
| | South | Cottonwood Creek 31 #3 | 5/11/1998 | D | | Estimated use: 100% . Estimated alteration: 100%. All riparian vegetation, except baccharis, has been eliminated. Cattle and OHVs drive the creek. The road goes in and out of the stream channel. |
| | North/South | Cottonwood Creek 31 #4 | 6/14/1999 | | | All measurable woody vegetation was measured to determine use. No perennial riparian grasses. Of the entire reach, the few woodys received 60+% use. |
| | South | Cottonwood Creek 31 Trib | 2/10/2005 | A | | Narrow, seep, step/pool system. Filled with sediment. Side slopes have lots of grass. |
| Desert | Otero | Log Corral Canyon | 1/17/2013 | F | Unstable | Reach before the first spring is occasional pole size willow and seep willow. Channel is impacted by the road, leaving it wide and no channel features. There is fountain grass in this reach. Approaching first spring, valley and channel narrow (valley <50 ft). Road and channel are one. Channel is lined with baccharis and occasional pole size willow. The side slopes are steep and there is no regeneration of riparian species. Just below second spring, valley widens a bit and the riparian area is separate from the road. It supports seep willow, young cottonwood, sugar sumac and mesquite. This spot is rocky and would be difficult access to cattle. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Otero | Log Corral Canyon | 6/11/2000 | | | There was a heavy impact on stream channel due to four wheel vehicles and livestock. Road is found directly in stream channel throughout reach. Places of congregation for cattle, trails bedding areas, and fecal material seen throughout. Very little use was observed on seep willow, however broken branches indicate cattle pushing through the thickets. Very little recruitment of palatable riparian obligates, and the few observed were heavily grazed. No measurable herbaceous plants observed in the reach. |
| Sycamore Ck Nonuse Corridor | Riparian | Sycamore Creek 31 #4 | 12/13/1999 | | | No riparian obligate vegetation present. Bermuda is present. Goodding's willow and cottonwood are present, but not seedling or sapling size. ATV road goes through the creek the entire length of the reach. Banks trampled. |
| | Riparian | Sycamore Creek 31 #4 | 6/1/1992 | F4 | | |
| | Riparian | Sycamore Creek 31 #5 | 1/17/2013 | F | Impaired | The area looks like it was impacted by flooding after the Sunflower Fire (2012). Pole size cottonwoods lying over across the floodplain and channel. Valley is wide (100-200'). No bank features, channel takes up whole valley. Vegetation is thick across the channel-seep willow, baccharis, bermuda, horsetail, sycamore. Lots of sapling/pole willows and cottonwoods. The reach is not too accessable to cattle at this time due to the large amount of vegetation, litter and debris across the channel. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Riparian | Sycamore Creek 31 #5 | 6/12/2000 | | | Heavy past use evident by hedging and altered banks, however bermuda grass is growing on previously altered banks, and signs of recovery is noted. High recruitment of all woody species, but grazing is especially high on Gooding's willow seedlings. Perennial water throughout reach. |
| | Riparian | Sycamore Creek 31 #5 | 2/25/2000 | | | High use on woodys. |
| | Riparian | Sycamore Creek 31 #5 | 12/13/1999 | | | High use on Goodding's willow and cottonwood seedlings. Seedlings are dispersed throughout reach in trace amounts. Bermuda grass is the main perennial grass present in reach. Livestock present in reach. Cattle sign and trails present throughout. Banks are trampled. |
| | Riparian | Sycamore Creek 31 #5 | 6/2/1992 | | | No bankfull features. |
| | Riparian | Sycamore Creek 31 #6 | 1/17/2013 | F | Unstable | Channel is very wide and sandy, with cobbles in some spots, due to OHV impacts. Sapling willows grow along the edge of the channel. Tire tracks evident in most of the reach. |
| | Riparian | Sycamore Creek 31 #6 | 5/26/1992 | F | | No bankfull features. |
| | Riparian | Sycamore Creek 31 #7 | 3/10/2000 | C4 | Impaired | Substrate all sand and small gravel at cross section. Vegetation consists mostly of baccharis, few willows hiding in baccharis, all 100% used. Road in creek, lots of ATV and recreation impacts. Mesquite terraces highly impacted by ATVs, lots of stumps from trees being cut down. |

| Unit | Pasture | Stream Name | Date | Stream Type | Condition | Comments |
|---|---|---|---|---|---|---|
| | Riparian | Sycamore Creek 31 #9 | 1/17/2013 | F | Unstable | From FR3456 crossing to spring (on map) - mostly pole and larger sycamore on channel edge, one spot with young cottonwood and seep willow on floodplain, channel very wide and contains a road. Below spring - spotty old sycamore and willow, some young willow and seep willow, thick baccharis on floodplain. ATV tracks throughout. No bank or channel features. Channel still wide and sand/gravel. |
| | Riparian | Mesquite Wash | 11/30/2004 | | | The hanging garden area shows high use by off roaders throughout the channel as well as in the surrounding uplands. Trash is scattered throughout this area too. The perennial water begins at the hanging gardens with the confluence of Sycamore Creek. Sediment is dominated by sand. The channel along this reach is densely covered by Bermuda and what is believed to be knot grass (Paspalum distichum). Smaller age classes of woody riparian obligates are more numerous along this reach as well (ash, sycamore). Recruitment of ash, salt cedar, Goodding's willow was observed throughout the surveyed area. |

## *Water Sources*

The availability of alternative, developed water within a pasture can lessen the amount of time cattle may spend in riparian areas. Waters on the allotment were located using the water points layer in the Forest's Geographic Information System (GIS). This layer contains springs, tanks and wells for which the Tonto has water rights or claims, as well as other sources indicated on the USGS topographic maps. Most of the pastures are watered by springs, some of which support riparian vegetation. Many of the water developments have been inventoried (Table A4).

**Table A4.** Water sources and inventory data for the project area.

| State File Number | Use Name | Date | Remarks |
|---|---|---|---|
| 33-89636 | LOG CORRAL SPRING | 1/17/2013 | Development not functioning; riparian vegetation in channel; road in channel. |
| 36-105377 | KATHY SPRING | | |
| 36-13697 | HIDDEN WATER SPRING | 2/5/2013 | Pole size willows. |
| 36-13698 | BLUE SPRING | 2/20/2004 | Lots of grasses. |
| 36-13699 | PINE MOUNTAIN SPRING | | |
| 36-13700 | COYOTE SPRING | | |
| 36-13725 | BEETLE SPRING | | |
| 36-13726 | AMETHYST SPRING | | |
| 36-13727 | ADAMS SPRING | | |
| 36-13729 | BROWN CABIN SPRING | | |
| 36-13730 | MOUNTAIN SPRING | 10/1/2004 | No development found; willow, baccharis. |
| 36-13731 | OTERO SPRING | | |
| 36-13732 | SKIDMORE SPRING | 6/3/2005 | Functioning; sedges. |
| 36-13736 | TALC SPRING | | |
| 36-13737 | WATA SPRING | | |
| 36-13738 | TUNNEL SPRING | | |
| 36-13741 | CANE SPRINGS | 6/16/2004 | Functioning; walnut, baccharis. |
| 36-13749 | SEUCITO SPRING | 4/23/2004 | Functioning; willows. |
| 36-13769 | TEJANOS SPRING | 1/18/2013 | Not functioning; sycamore, willow. |
| 36-13772 | FISHER SPRING | 10/16/2004 | Not developed; sycamore, walnut. |
| 36-13774 | FOUR PEAKS SPRING | | |
| 36-13775 | MEDLERS SEEP | | |
| 36-13776 | BRUSH CORRAL CANYON SPRING | 10/8/2004 | Not functioning; small dense riparian area. |
| 36-13777 | CAVE SPRING | | |
| 36-13778 | CAMP CREEK SPRING | 6/2/2005 | Spring is underneath a culvert of SR87 overpass. |
| 36-13779 | CIENEGA SPRING | | |
| 36-13780 | CLINE PASTURE | 10/15/2004 | Not developed; walnut, sycamore, sedges. |

| State File Number | Use Name | Date | Remarks |
|---|---|---|---|
| | SPRING | | |
| 36-13783 | AL'S SPRING | | |
| 36-13784 | WILLOW SPRING | 6/17/2004 | Old dam in channel; walnut, sycamore, ash, sedges. |
| 36-13787 | BRUSHY BASIN SPRING | | |
| 36-13789 | CYPRESS TRAP SPRING | | |
| 36-13791 | MUD SPRING | 1/18/2013 | Functioning; large sycamore and willow; runs to Mud Spring Tank. |
| 36-13792 | MESQUITE SPRING | 4/30/2004 | Functioning; cottonwood, willow. |
| 36-25365 | COLD WATER SPRING | 10/1/2004 | No development; walnut, willow, ash, baccharis, sedges. |
| 38-12689 | HUGHES PASTURE TANK #1 | 1/15/2004 | Functioning; high recreation has created "roads" thru tank and around spillway. |
| 38-12771 | INDIAN SPRINGS TANK | 10/9/2004 | Functioning. |
| 38-12773 | OTERO TANK | 7/13/2004 | Functioning. |
| 38-12774 | LOWER SAGUARO TANK | 6/21/2004 | Functioning. |
| 38-12775 | BROWNIE TANK | 2/13/2004 | Functioning; high recreation use. |
| 38-12776 | PALO FIERO TANK | 2/13/2004 | Functioning. |
| 38-12778 | BROWNIE TANK | 4/23/2004 | Functioning. |
| 38-12780 | HUGHES TANK | 2/13/2004 | Functioning; high recreation use. |
| 38-12781 | UPPER SAGUARO TANK | 6/21/2004 | Not functioning. |
| 38-12783 | MUD SPRING TANK | 1/18/2013 | Functioning. |
| 38-12785 | CANE SPRING TANK | 4/23/2004 | Functioning. |
| 38-12788 | THE ROLLS TANK | 1/15/2004 | Functioning. |
| 38-26458 | HUGHES TANK | 1/15/2004 | Functioning; high recreation use |
| 4A-1825 | MINE MOUNTAIN SPRINGS #1,2,3 | 6/25/2004 | Could not locate |
| 4A-2353 | MUD SPRING #1 | 7/26/2010 | Functioning; fish stocking site; fenced. |
| 4A-2354 | MUD SPRINGS #2 | 7/26/2010 | Functioning; fish stocking site; fenced. |
| 55-600830 | LOWER WELL | 10/9/2004 | Functioning. |
| 55-600937 | RIO VERDE WELL | 6/11/2009 | Well no longer exists. |
| 55-600938 | SUGARLOAF WINDMILL | 6/11/2009 | Assume well no longer exists. |
| 55-600939 | JANO GORDO WINDMILL | 11/20/2005 | Functioning; near high recreational usage. |
| 55-600940 | MESQUITE WINDMILL | 6/23/2004 | Not functioning. |
| 55-600941 | HUGHES WELL | 6/11/2004 | Well no longer exists. |

| State File Number | Use Name | Date | Remarks |
|---|---|---|---|
| 55-600945 | COTTONWOOD CAMP WELL | 2/5/2013 | Not functioning; heavy recreation use in area. |
| 55-801982 | MIDNIGHT HORZ WELL | | |
| NA03120303 | SOUTH TT | 12/22/2007 | Functioning. |
| NA03120305 | NORTH TT | 2/1/2008 | Functioning. |
| NA03120308 | BRUSHY TT | | |
| NA03120309 | LONE PINE TT | | |

Appendix B – Watershed Condition Indicators rated as impaired for 6th code Watersheds within Sunflower Allotment

| HUC_12_NAME | Aquatic Habitat Fragmentation | Large Woody Debris | Channel Shape and Function | Aquatic Exotic and/or Invasive Species | Riparian Vegetation Condition | Open Road Density | Road Maintenance | Road Proximity to Water | Rangeland Vegetation Condition |
|---|---|---|---|---|---|---|---|---|---|
| Salt River-Apache Lake | | | | | | | | | |
| Salt River-Canyon Lake | | | | | | | | | |
| Cane Spring Canyon | | X | | | X | | | | |
| Cottonwood Creek | | X | X | | X | | | | |
| Jones Canyon | | | X | | X | X | X | X | X |
| Salt River-Saguaro Lake | | | | | | | X | | X |
| Bulldog Canyon-Salt River | | | | | | | | | X |
| Rock Creek | | | | | | | X | | |
| Mesquite Wash | X | | | X | | | X | | |
| Middle Sycamore Creek | X | | | X | | | X | | |
| Lower Sycamore Creek | X | | | X | | X | X | X | X |

Ratings for Soil Condition, Terrestrial Invasive Species, and Ozone indicators were assessed as impaired for all watersheds within the Sunflower Allotment.

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