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LIST OF ACRONYMS AND ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
AIM	Assessment Inventory and Monitoring
AUM	Animal Unit Month
BLM	Bureau of Land Management
C	“Custodial” Management Category
CFR	Code of Federal Regulations
CFU	Coliform forming unit
cfs	cubic feet per second
CWA	Clean Water Act
DPC	Desired plant community
DWR	Dry Weight Rank
E. Coli	*Escherichia Coli*
ESA	Endangered Species Act
ESD	Ecological Site Description
FAR	Functional at Risk
FBC	Full Body Contact
GLO	General Land Office
GPS	Global positioning system
Guidelines	Guidelines for Grazing Administration
HCPC	Historical climax plant community
HDMS	Heritage Data Management System
I	“Improve” Management Category
ID	Interdisciplinary
IPaC	Information for Planning and Conservation
lbs.	pounds
LHE	Land Health Evaluation
M	“Maintain” Management Category
ml	milliliter
MLRA	Major Land Resource Area
NAD	North American Datum
NLCD	National Land Cover Dataset
NRCS	Natural Resources Conservation Service
PFC	Proper Functioning Condition
P.L.	Public Law

p.z.	Precipitation zone
RMP	Resource Management Plan
RMZ	Recreation Management Zone
ROD	Record of Decision
SPRNCA	San Pedro Riparian National Conservation Area
SR	State Route
Standards	Arizona Standards for Rangeland Health
TEC	Topographic Engineering Center
U.S.C	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	Visual Resource Management

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1. INTRODUCTION

The purpose of this Land Health Evaluation (LHE) report for the Babocomari Allotment is to evaluate existing monitoring data against the Arizona Standards for Rangeland Health (Standards) and other site-specific objectives. An evaluation is not a decision document, but a stand-alone report that clearly records the analysis and interpretation of the available inventory and monitoring data. As part of the Land Health Evaluation process, allotment-specific objectives were established for the biological resources within the Babocomari Allotment.

The BLM made the draft LHE available for public comment May 18-June 24, 2021. This LHE has been updated and a stand-alone final land health determination document has been signed. The final determination document identifies the causal factors for the non-achievement of land health Standards and informs the development of alternatives to make progress towards achieving Standards on the Babocomari Allotment.

The Secretary of the Interior approved the Arizona Bureau of Land Management (BLM) Standards for Rangeland Health and Guidelines for Grazing Administration (Standards and Guidelines) in April 1997. The Decision Record signed by the Arizona BLM State Director (BLM 1997) provides for full implementation of the Standards and Guidelines in Arizona land-use plans. Standards and Guidelines are implemented by the BLM through the terms and conditions of grazing permits, leases, and other authorizations, grazing-related portions of activity plans, and through range improvement-related activities. The Standards are measurable and attainable goals for the desired condition of the biological resources and physical components/characteristics of desert ecosystems found within the allotment.

1.1 Definitions of Arizona Standards for Rangeland Health and Guidelines for Grazing Administration

The Standards are expressions of levels of physical and biological condition or degree of function required for healthy, sustainable rangelands and define minimum resource conditions that must be achieved and maintained. Determination of rangeland health is based upon conformance with these Standards.

Guidelines consider the type and level of grazing use. Guidelines for grazing management are types of methods and practices determined to be appropriate to ensure the Standards can be met or that significant progress can be made toward meeting the Standards. Guidelines are tools that help managers and lessees achieve Standards.

Although the process of developing Standards and Guidelines applies to grazing administration, present rangeland health is the result of the interaction of many factors in addition to grazing livestock. Other contributing factors may include, but are not limited to, past land uses, land use restrictions, recreation, wildlife, rights-of-way, wild horses and burros, mining, fire, weather, and insects and disease (Standards and Guidelines, BLM 1997).

The Arizona Standards and Guidelines identify three standards regarding (1) upland sites, (2) riparian-wetland sites, and (3) desired resource conditions based on specific indicators.

2. ALLOTMENT PROFILE AND GENERAL DESCRIPTION

2.1 Location

The BLM portion of the Babocomari Allotment is located about 10 miles north of the town of Sierra Vista in Cochise County, Arizona. The BLM-managed lands within the allotment comprise approximately 15% of the total livestock operation. The allotment borders the Sands Ranch allotment to the west and Fort Huachuca to the south. Most of the public lands in the allotment are in the San Pedro Riparian National Conservation Area (SPRNCA) towards the southeast of the allotment as shown in Appendix A: Figure A-1 and A-3.

2.2 Physical Description

This section describes physical, or abiotic, characteristics within the Babocomari Allotment, such as land ownership, soils, and infrastructure.

2.2.1 Surface Land Ownership

The Babocomari Allotment land ownership is a mix of BLM, state, and private land (Table 1 and Appendix A: Figure A-3). The allotment is predominately comprised of state lands, with lesser amounts of private and public lands. Some of these land ownership boundaries are not separated by fence lines. BLM-managed lands comprise about 15% of the allotment with most BLM land within the SPRNCA boundary. The SPRNCA boundary is only fenced in one location for about a half mile and thus the SPRNCA is not fully separated from the rest of the allotment. The majority of BLM-managed lands are located in the river pasture, which is a mixture of BLM, state, and private lands (Appendix A: Figure A-4). Private lands (about 17% of the allotment) are a combination of controlled and uncontrolled lands (Table 1). Private controlled lands are owned or leased by the livestock operator on the allotment and contribute to the total grazing operation within the Babocomari Allotment. Private uncontrolled lands within the allotment boundary are not under control of the livestock operator (e.g., housing developments) and do not contribute to the forage base on the Babocomari Allotment.

Table 1. Acreage of Landownership.

Land Ownership	Babocomari Allotment
Public Acres Inside SPRNCA	*1,881*
Public Acres Outside SPRNCA	*149*
Total Public Acres *(inside and outside the SPRNCA)*	**2,030**
State Acres	**8,942**
Controlled Private Land Acres	**676**
Uncontrolled Private Land Acres	**1,529**
Total Acres	**13,177**

2.2.2 Climate

This section describes the long-term climate for the Tombstone area using the most recent published 30-year Climate Normal data (1981-2010) from the Tombstone Cooperative Observer Program (COOP) weather station (Arguez et al. 2012). The annual rainfall Climate Normal for the 30-year period at the Tombstone site is 14.14 inches for precipitation (Table 2). The NRCS Ecological Site Descriptions (ESD) used in this evaluation for reference conditions are based on a 12 to 16” annual precipitation zone (p.z).

Using six rain gauges in the Walnut Gulch Experimental Watershed (WGEW), Goodrich et al. (2008) found the long term (1956-2006) average annual rainfall to be approximately 12.2 inches. Thomas and Pool (2006) computed the long-term average from 1902 to 2002 at the Tombstone Weather Station to be 13.6 inches. The slightly higher average found with the Climate Normals is due to the inclusion of above average rainfall in the late 1980's and early 1990's in the shorter time period. The established Climate Normal serves as the baseline against which more recent site-specific allotment data (found in Section 6.1) is compared.

Rainfall in Southern Arizona is typically split into two seasons: summer and winter. Summer monsoon season rainfall accounts for approximately 60% of annual rainfall totals. Summer rains fall July through September, originate in the Gulf of Mexico, and are convective, usually brief, intense thunderstorms. This causes the rainfall to be unevenly distributed across the landscape. Even small areas separated by a relatively short distance can receive a drastically different amount of rain. Cool season moisture originates in the Pacific and Gulf of California, tends to be frontal, and falls in widespread storms with long duration and low intensity. Snow rarely lasts more than one day. May and June are the driest months of the year. Humidity is generally very low throughout the year.

Table 2. Precipitation and Temperature Averages.

Calendar Year Rainfall and Mean Temperatures per Month – NOAA 30-Year Climate Normal at Tombstone, AZ (1981-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
Precipitation (Inches)													**Total**
Average	1.01	0.77	0.73	0.32	0.28	0.61	2.98	3.17	1.6	0.98	0.64	1.05	14.14
Temperature (°F)													**Average**
High	59.5	62.7	68.7	76.7	85.4	93.7	92.3	89.2	87.1	78.4	67.9	59.6	76.8
Low	35.7	37.9	41.4	47.5	55.3	63.1	66.3	65	61.3	52.2	42.9	36.1	50.4
Average	47.6	50.3	55.1	62.1	70.3	78.4	79.3	77.1	74.2	65.3	55.4	47.9	63.6
Source: Arguez et al. (2012)													

The allotment is characterized by hot summers and mild winters. Data on average temperatures are also located in Table 2. The hottest days are during June, July, and August when some days may exceed 100°F. Freezing temperatures are common at night from December-April; however, temperatures during the day are frequently above 50°F. Occasionally from December through February, temperatures may drop briefly to 0°F at night (c.f., Limy Upland Ecological Site Description [ESD] via the *Ecosystem Dynamics Interpretive Tool* [EDIT] 2020).

2.2.3 Watershed and Water Resources

The Babocomari Allotment is located just west of the San Pedro River and lies within the Upper San Pedro HUC-8 Subbasin (Appendix A: Figure A-2). Within this subbasin, the allotment is included in the smaller Babocomari River and Clifford Wash-San Pedro River HUC-10 Watersheds.

The largest drainage inside the allotment boundary is the Babocomari River, which starts in its headwaters in the Sonoita/Elgin area and reaches its terminus at the confluence with the San Pedro River. It has a drainage area of 306 square miles. The Babocomari River is approximately 27 miles long, of which roughly 4.6 miles are in the allotment. Of those, 2 miles are on BLM-managed public lands. The reach on public lands is considered mostly intermittent with smaller segments of perennial flow. The

riparian resources in the allotment are found along the perennial and intermittent portions of the Babocomari River. There are no additional wetlands or spring sites in the allotment.

A United States Geologic Survey (USGS) streamgage (USGS 09471400) is located on the Babocomari River approximately 3.1 miles upstream from the confluence with the San Pedro River. It has a 19-year period of record from 2001 to 2020. The highest flow was recorded in 2006 at 9,600 cubic feet per second (cfs) while the lowest annual peak flood was 157 cfs in 2015. The annual peak for 2019 (2,410 cfs) was the highest in the last 10 years (USGS 2020). The lowest amount of stream flow and shortest length of water reaches occur in the hottest part of the summer before the onset of monsoon rains (June). Surveys of the extent of surface water (wet-dry) in the allotment during June dry season indicate that only 0.5 mile of the channel stays wet year-round. Baseflows in the Babocomari are predicted to continue to decrease into the future as a result of groundwater pumping in the basin (Pool and Dickinson 2007; Lacher 2011, 2017). Discharge measurements taken at the confluence of the Babocomari and the San Pedro River indicate flow into the San Pedro during the winter months.

The Babocomari River inside the SPRNCA can be split into two reaches at the USGS gage based on geomorphology. The reach from the SPRNCA boundary to the USGS gage is confined by the bedrock with no floodplain pockets. The lower reach is also controlled by bedrock but has floodplain pockets and larger floodplain access near the confluence with the San Pedro. The sinuosity for the upper reach is 1.25 and the sinuosity of the lower reach is 1.45. The difference is related to the amount of geologic confinement controlling each reach.

In accordance with the Clean Water Act (CWA), the Arizona Department of Environmental Quality (ADEQ) is required to produce a section 305(b) water quality assessment and section 303(d) listing of threatened or impaired waters in the state every two years. In the 2012/2014 report, the Babocomari River is listed as category 2, attaining for some uses, and noting one sample of *Escherichia Coli (E. coli)* above the standard for the Full Body Contact (FBC) use (ADEQ 2012). In the 2016 Water Quality in Arizona 305(b) report, the reach of the San Pedro River from the confluence of the Babocomari River to Dragoon wash is listed as category 5, impaired, for exceedances in *E. coli* for the Full Body Contact designated use (ADEQ 2016). More sampling along the Babocomari has occurred recently and the results of that sampling are discussed in Section 6.2.3 Water Quality.

2.2.4 Soils

The soil composition on the Babocomari Allotment was determined using the Natural Resources Conservation Service (NRCS) *Web Soil Survey* (2020a) (Appendix A: Figure A-5). Soil data were used to help identify ecological sites on the allotments. *Web Soil Survey* narrows down what soils are in a general area and soils at a specific area are verified with a soil pit. For example, 42% of the soils within this allotment are Major complex, with 0 to 5% slopes (Appendix A: Figure A-5). Two common ecological sites that are within this soil type are Limy Uplands and Saline Bottoms. Other common soil types on the BLM portion of the allotment are Brunkcow-Chiricahua-Andrada complex, Luckyhills-McNeal complex, and Brunkcow-Chiricahua-Lampshire complex (Appendix A: Figure A-5)

2.2.5 Range Improvements

The Babocomari Allotment boundary is entirely fenced and is further divided into 11 pastures (Appendix A: Figure A-4). There are three corrals and nine water troughs on state and private lands (Appendix A: Figure A-4). Range improvements were located on aerial imagery and verified by the lease holder.

2.2.6 Management Category

The Management Category currently given to the Babocomari Allotment is Maintain (M).

The Selective Management Category process was initiated in 1982 and was used primarily to establish priorities for investing in range improvements. Those categories include: Improve (I), Maintain (M) and Custodial (C).

Category I: Allotments where current livestock grazing management or level of use on public land is, or is expected to be, a significant causal factor in the non-achievement of land health standards or where a change in mandatory terms and conditions in the grazing authorization is or may be necessary. When identifying Category I allotments, review condition of critical habitat, conflicts with sage-grouse, and whether projects have been proposed specifically for implementing the Healthy Lands Initiative.

Category M: Allotments where land health standards are met or where livestock grazing on public land is not a significant causal factor for not meeting the Standards and current livestock management is in conformance with guidelines developed by the State Directors in consultation with Resource Advisory Councils. Allotments where an evaluation of land health standards has not been completed, but existing monitoring data indicates that resource conditions are satisfactory.

Category C: Allotments where public lands produce less than 10% of the forage in the allotment or are less than 10% of the land area. An allotment should generally not be designated Category C if the public land in the allotment contains: 1) critical habitat for a threatened or endangered species, 2) wetlands negatively affected by livestock grazing.

2.3 Biological Resources

2.3.1 Major Land Resource Areas

Major Land Resource Areas (MLRA) are geographically associated land resource units, usually encompassing several thousand acres. Soil scientists with NRCS in appropriate geographic states wrote the descriptions of MLRAs and are responsible for describing new MLRAs and/or adjusting the boundaries of existing MLRAs. A MLRA may be one continuous area or several separate nearby areas. MLRAs are characterized by patterns of soils, geology, climate, water resources, and land use. The Babocomari Allotment is in MLRA 41—Southeastern Arizona Basin and Range, which makes up about 15,730 square miles. MLRAs are further broken down into ecological sites, which are associated units of soil and vegetation with quantifiable characteristics.

2.3.2 Ecological Sites

An ecological site is a distinctive kind of land that is unique in its ability to produce a distinctive kind and amount of vegetation. The soils, hydrology, and vegetation within an ecological site are the product of many environmental, biotic, and abiotic factors, which are described in the ESD as established by the NRCS. Ecological sites are named/classified based on soil parent material or soil texture and precipitation and provide a consistent framework for classifying and delineating land units that share similar capabilities to respond to management activities or disturbance. State and transition models in the ESD describe multiple plant community states and the natural range of variability within those states that may result from activities and disturbances, such as land use, vegetation management, climate change, and spread of invasive species. The NRCS also produces reference sheets for many ecological sites that detail the natural variability in rangeland health indicators. ESDs and reference sheets were accessed online through the *Ecosystem Dynamics Interpretive Tool* (EDIT 2020).

Soil map units were used to help identify ecological sites in the Babocomari Allotment. Most soil map units are comprised of two or more ecological sites. For example, a soil map unit described as “Clayey Swale 90%, Loamy Swale 10%” refers to the approximate proportion of each ecological site found in a

particular soil map unit. In other words, 90% of the unit is Clayey Swale ecological site and 10% of the unit is Loamy Swale ecological site. These are also referred to as blended sites. The ecological site map for the Babocomari Allotment (Appendix A: Figure A-6) is generalized to larger scales and on the ground ecological site identification and verification is necessary in determining the correct ESD and reference sheet. There are a total of six ecological sites within the BLM portion of the allotment (Appendix A: Figure A-6) and more details on pertinent ecological sites can be found in Section 4.3.

2.3.3 Vegetation Communities

Table 3 below lists the vegetation communities within the Babocomari Allotment, with the individual vegetation community acreages separated by whether they fall inside or outside the SPRNCA boundary. The vegetation community acreages are shown for the SPRNCA specifically as these acreages tie to SPRNCA RMP vegetation objectives. They are also shown in Appendix A: Figure A-7. The Chihuahuan Desertscrub is the primary vegetation community for the Babocomari Allotment comprising 82% of the allotment total acreage. The data source for lands outside the SPRNCA is Landfire. Data on BLM-managed land inside the SPRNCA is a combination of data from the U.S. Army Topographic Engineering Center (TEC) (2001), Southwest Regional Gap Analysis Project, and ESDs. The data source on non-BLM lands within the allotment is U.S. Army TEC (2001).

Table 3. Vegetation communities in the Babocomari Allotment.

Vegetation Community	Inside SPRNCA		Outside SPRNCA		Total	
	Acres	Percent Area	Acres	Percent Area	Acres	Percent Area
Agriculture	0	0%	17	<1%	17	<1%
Chihuahuan Desertscrub	1,782	14%	9,059	69%	10,841	82%
Cottonwood/Willow	19	<1%	75	1%	94	1%
Desert Washes (Xeric Riparian)	0	0%	6	<1%	6	<1%
Developed	7	<1%	159	1%	166	1%
Mesquite Bosque	41	<1%	0	0%	41	<1%
Other	16	<1%	22	<1%	37	<1%
Semidesert Grassland	56	<1%	1,919	15%	1,975	15%
Grand Total	**1,921**	**15%**	**11,256**	**85%**	**13,177**	**100%**

Chihuahuan Desertscrub

Dominant shrub species are whitethorn acacia, tarbush, and creosote bush. Other shrubs present are mariola, desert sumac, and mesquite. Bush muhly and threeawn grasses are common perennial grass species. Other important plant species are ocotillo, soap tree yucca, and Palmer's century plant. These species all provide nectar for migrating birds and certain bat species.

Semidesert Grassland

Semidesert grassland once covered vast areas of the San Pedro River Valley, where now only remnants remain (Latta et al. 1999). This habitat is now associated with drainages in the Chihuahuan Desertscrub. Native perennial grasses may include sideoats grama, blue grama, vine mesquite grass, tobosa grass, cane beardgrass, Arizona cottontop, and threeawn grasses. Lehmann lovegrass (*Eragrostis lehmanniana*), a non-native perennial grass, can also be common in this community, particularly in the Limy and Granitic Upland (Shallow Upland) ecological sites (EDIT 2020).

Fremont Cottonwood-Gooding's Willow Forest

The two dominant tree species in this community are Fremont cottonwood and Goodling's willow, but the community is also composed of a variety of mesic tree species endemic to the southwest (e.g., seep

willow, arroyo willow, Arizona ash, Arizona black walnut, netleaf hackberry, and velvet mesquite). Herbaceous vegetation, such as deer grass, scratch grass, horsetail, giant sacaton, and spike rush, occur in the understory. High diversity and productivity in these riparian forests make them focal points for fish and wildlife habitat and a priority habitat for the BLM. Most of this community type is on private land in the Babocomari Allotment. The condition of the Fremont cottonwood-Goodding's willow forest is described by the Proper Functioning Conditioning (PFC) Assessment found in Section 6.2.2.

Mesquite Bosque

Mesquite bosques are characterized as dense stands of velvet mesquite trees that rely on groundwater depths of less than 50 feet. Mesquite forests, or bosques, historically represented one of the most abundant riparian communities in the southwestern United States but are now reduced to remnant status (Stromberg et al. 1993). Of the 41 acres of mesquite bosque in the Babocomari Allotment, roughly 60% of them are on BLM-managed public lands.

2.3.4 Wildlife Resources

General Wildlife

The expected wildlife species composition on the allotment is characteristic of the Madrean Basin and Range province in southeastern Arizona. Possible common species include, but are not limited to, mule deer, Couse white-tailed deer, mountain lion, coyote, bobcat, raccoon, skunk, white-throated woodrat, white-footed mouse, a variety of bats, gopher snake, king snake, western diamondback rattlesnake, coachwhip, patch-nosed snake, western whiptail lizard, side-blotched lizard, and tree lizard.

Migratory bird species that utilize the area include, but are not limited to, red-tailed hawk, Cooper's hawk, bald eagle, golden eagle, American peregrine falcon, raven, turkey vulture, meadowlark, ladder-back woodpecker, ash-throated flycatcher, and a wide variety of small passerine birds. No surveys have been conducted specifically within this allotment for this project to determine presence, however these species have the potential to occur within the vegetation communities located on this allotment (Appendix B). The allotment is both within and adjacent to the SPRNCA, which encompasses the SPRNCA Important Bird Area, an area designated for the value it holds for native birds.

Livestock may impact wildlife in a variety of ways, by their presence, through behavioral disturbance, and through competition for forage. Behavioral impacts resulting from inter-specific encounters (including human and livestock) are difficult to quantify, as they vary by species and by type of interaction. Wildlife currently present on the allotments have, to varying degrees, acclimated to the presence of livestock and associated human disturbances.

Special Status Species

US Fish and Wildlife Service (USFWS) *Information for Planning and Conservation* (IPaC) (USFWS 2020) and Arizona Game and Fish Department (AGFD) *Heritage Data Management System* (HDMS) (AGFD 2020) online databases show that 11 federally threatened or endangered species, 14 migratory birds protected under the Migratory Bird Treaty Act, and eight BLM sensitive species could occur within the Babocomari Allotment boundary as well as within a 5-mile buffer (see species lists in Appendix B). In addition, yellow-billed cuckoo and northern Mexican gartersnake have proposed critical habitat within the allotment boundary.

Some of the migratory birds that have the potential to occur within the allotment include black throated sparrow, guilded flicker, common black hawk, lark bunting, and Virginia warbler. The BLM sensitive species documented within the 5-mile buffer include: desert box turtle, Sonoran mud turtle, lowland

leopard frog, cave myotis, longfin dace, desert sucker, golden eagle, and San Pedro River wild buckwheat.

2.4 Special Management Areas

2.4.1 San Pedro Riparian National Conservation Area

Part of the Babocomari grazing allotment is within the SPRNCA (Appendix A: Figure A-1), encompassing approximately 47 miles of the San Pedro River and 55,990 acres of federal lands administered by the BLM's Tucson Field Office (TFO). Congress designated the SPRNCA as the nation's first riparian National Conservation Area on November 18, 1988, through Public Law (P.L.) 100-696. The SPRNCA contains four of the rarest habitats in the southwest, a rich diversity of plants and animals, and a number of nationally significant paleontological and cultural sites. The enabling legislation recognizes these, and other characteristics, as conservation values to be conserved, protected, and enhanced in perpetuity.

The Babocomari grazing allotment includes approximately 1,881 acres of public land in the SPRNCA and 149 acres outside the SPRNCA (Table 1).

2.4.2 Wild and Scenic Rivers

Within the SPRNCA, the allotment also includes approximately 4 miles of the Babocomari River Wild, Scenic and Recreational Study River and 400 acres of its study corridor. The Study River was analyzed during the RMP development process and found eligible and suitable for addition to the National Rivers System with a 'Recreational' classification. Grazing operations in the part of the allotment within the river study corridor are subject to management guidelines to protect its river values described in the SPRNCA RMP (BLM 2019).

2.5 Recreation Resources, Visual Resources and Access

There are no developed recreation sites within the allotment. The BLM-managed lands in the Babocomari grazing allotment provide opportunities for dispersed recreation and are used in conjunction with adjacent state lands and other adjacent lands within the SPRNCA. Recreational use is low, primarily consisting of small and big game hunting, sightseeing, wildlife viewing, hiking, target shooting and off-highway riding vehicle operation on lands outside the SPRNCA.

The 149 acres of BLM-managed lands in the Babocomari Allotment that are outside of the SPRNCA are accessed from State Route (SR) 82 and receive very light recreational use. The BLM-managed lands in the allotment within the SPRNCA between SR 82 and the Babocomari River are within a Back-Country Recreation Management Zone (RMZ). Management in this zone is aimed at preserving non-motorized recreation resource values, with a largely natural setting, minimal facilities or improvements, and generally low to moderate recreation use. The historic railroad grade is a designated component of the San Pedro Trail system for non-motorized use (hiking, horseback riding, bicycling). The trail is accessed by an administrative primitive road from SR 82 across state land. The administrative road is not open to public vehicle use and is unsecured due to the lack of a boundary fence. The BLM-managed lands in the allotment south of the Babocomari River are within a Primitive RMZ. Management in this zone is aimed at preserving non-motorized recreation resource values, with a relatively remote natural setting, no facilities or improvements, and generally low recreation use.

Visual resources on BLM-managed lands in the allotment are managed to preserve visual quality. The Babocomari River canyon is under a Visual Resource Management (VRM) Class II to preserve the character of the landscape. The uplands are under VRM Class III objectives to partially retain the character of the existing landscape. Grazing operations which cause modifications to the landscape or

placement of structures are subject to design review and mitigation if needed to comply with visual quality objectives.

The 149-acre BLM-managed parcel in the Babocomari Allotment outside the SPRNCA is designated pursuant to 43 CFR 8340 to limit motor vehicle use to existing roads and trails. This parcel is accessed from SR 82 and has an existing road south of SR 82 under a right-of-way to access private land. The 1,881 acres of BLM-managed land within the SPRNCA in the Babcomari allotment are designated pursuant to P.L. 100-696 and 43 CFR 8340 to limit motor vehicle use to designated roads and trails. The two existing routes in the SPRNCA portion of the allotment (the Babocomari railroad grade and the access route from SR82) are designated for administrative use only; there are no routes currently designated for public vehicle travel. The existing route to the SPRNCA from SR 82 across state land is under a temporary right-of-way held by the USGS and is available for public use by vehicle to the SPRNCA boundary under Arizona State Land Department regulations, but long term legal public access is not guaranteed. Grazing lease operations are subject to the vehicle use designations, unless specifically authorized otherwise.

2.6 Cultural Resources

The BLM's evaluation of Standards of Rangeland Health includes considerations for the protection and conservation of cultural resources (such as prehistoric and historic-age sites, buildings, and structures) as well as plants and other resources with potential cultural significance to Native American tribes. Should the BLM identify impacts to cultural heritage sites or traditional-use resources, revised lease terms and conditions may be warranted and rangeland management directives could be modified to achieve desired resource conditions. The following sections describe the BLM's assessment efforts regarding cultural and traditional-use resources within the Babocomari Allotment.

A BLM Cultural Resources Specialist completed a comprehensive Class 1 (existing information) assessment of the Babocomari Allotment between February 20 and March 16, 2020. Data reviewed were obtained from BLM cultural program project files, site reports, and atlases, in addition to BLM-maintained General Land Office (GLO) plats and patent records. Electronic files also were reviewed using online cultural resource databases including *AZSite* (2020), Arizona's statewide cultural resource inventory system, and the *National Register of Historic Places NPGallery Digital Asset Search* (2020). Archival information was compared with livestock grazing and range improvement data to determine the potential for resource conflicts, particularly in livestock concentration areas such as around water sources, at chutes/corrals, and near supplemental feeding locations. The results of archival research are summarized as follows; data provided are applicable to BLM-administered lands within the Babocomari Allotment and based on currently available information from the aforementioned sources.

Background research identified 11 prior cultural resources investigations (Table 4) that, collectively, have inventoried approximately 170 acres and documented 14 cultural resource sites on BLM-administered lands. Known site types include prehistoric resource procurement and/or processing locales, agricultural features, habitation sites, two historic-age camps, and a railroad alignment. A historic-age GLO plat map also was reviewed that depicted a road that runs between Fort Huachuca and Fairbanks, a telegraph line, the Southern Pacific R.R., and houses with related ranch features labeled as "Ramon Escudero," "Ramon Yesus," and "John Gebhart" (plat no. 2390, dated 1912).

Table 4. Prior Cultural Resources Investigations within the Babocomari Allotment.

№	Project No.	Project Name	Reference(s)
1	1994-479.ASM	U.S. West Buried Cable Easement	Carpenter 1995
2	2001-815.ASM	SR 82 Tombstone	Shepard 2002

№	Project No.	Project Name	Reference(s)
3	2003-910.ASM	360 Networks Fiber Optic Lines	Railey and Yost 2001
4	2012-73.ASM	Valley Telephone Fiber Optic	Knoblock 2001
5	BLM-422-2017-039	SSVEC Fairbank ROW	Copperstone 2017
6	BLM-060-46-93	BLM Survey	AZSite 2020
7	BLM-060-08-01	BLM Survey	AZSite 2020
8	BLM-060-6901	BLM Survey	AZSite 2020
9	AZ-045-907	BLM Survey	AZSite 2020
10	AZ-060-SP-00-24	BLM Survey	AZSite 2020
11	S#88-16	BLM Survey	AZSite 2020

Several of these features correspond with range improvements and livestock concentration areas on BLM-managed surface; however, these historic land-use features—in particular, those related to ranching and mining—may exist throughout the Babocomari Allotment. Such features serve as evidence of the long-term history of grazing and mining in the area, much of which predates the mid-to-late 1800's. As such, many of these features have likely been removed, repurposed, or substantially modified over time.

2.6.1 Tribal Interests

The BLM is consulting with nine Native American tribes who claim cultural affiliation to and/or traditional use of the area as determine through the online *Arizona Government-to-Government Consultation Toolkit* (2020). Identified tribes for consultation initiation include the Fort Sill Apache Tribe, Hopi Tribe, Mescalero Apache Tribe, Pascua Yaqui Tribe, Tohono O'odham Nation, San Carlos Apache Tribe, White Mountain Apache Tribe, Yavapai-Apache Nation, and Zuni Tribe. The BLM has preliminarily identified one plant species, velvet mesquite (*Prosopis velutina*), as having potential cultural significance (NRCS 2020b).

Currently, there are no known adverse impacts to any culturally significant plants, items, sites, or landscapes. If new information is provided by consulting tribes, additional or edited terms and conditions of land-use or mitigation may be required to protect or restore resource values.

3. GRAZING MANAGEMENT

The Babocomari Allotment has a long history of livestock grazing, predating the establishment of the SPRNCA or the BLM. Cochise County remains one of the top two livestock producing counties in Arizona and Tombstone was a historic livestock market (Collins 1996). The following section discusses the allotment-specific management, permitted use, and terms and conditions on the current lease for the Babocomari Allotment.

3.1 Allotment-specific Management

Historic and recent grazing use has been by cattle on the Babocomari Allotment since it was purchased by the current lease holder in the late 1980's. The Babocomari Allotment consists of 13,177 acres of BLM, state, and private lands used in a nine-pasture, yearlong, rest-rotation grazing system. The BLM-managed lands within the allotment comprise approximately 15% of the total livestock operation. The 180 Animal Unit Months (AUMs) under the BLM grazing lease are included in the total head of cattle on the private land and state lease and are managed together on the entire allotment. The lease holder has primarily used the river pasture in the winter months (usually October through March). The river pasture contains the majority of the BLM-managed lands (93%) in the allotment as well as the entire reach of the Babocomari River that is located in the allotment.

3.2 Current Terms and Conditions for Authorized Use

Grazing use on the Babocomari Allotment is in accordance with the terms and conditions of the current lease issued for 180 AUMs on public lands. The Mandatory Terms and Conditions of the lease are listed below.

Table 5. Mandatory Terms and Conditions of the current Babocomari lease.

Total Livestock on the BLM acres of the Allotment	Livestock Kind	Grazing Period of Use	Percent Public Land*	Type Use	AUMs on Public Land
15	Cattle	3/1 to 2/28	100	Active	180

***** Percent Public Land is used for calculating AUMs on the BLM-managed acreage. This is not stating the percent of public land within the total allotment.

Existing Other Terms and Conditions

1. In order to improve livestock distribution on the public lands, all salt blocks and/or mineral supplements will not be placed within a ¼ mile of any riparian area, wetland meadow, or watering facility (either permanent or temporary) unless stipulated through a written agreement or decision in accordance with 43 CFR 4130.3-2(c).

2. If, in connection with operations under this authorization, any human remains, funerary objects, or sacred objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act (P.L. 101-601; 104 Stat. 3048; 25 U.S.C. 3001) are discovered, the permittee/lessee shall stop operations in the immediate area of the discovery, protect the remains and objects, and immediately notify the Authorized Officer of the discovery. The permittee/lessee shall continue to protect the immediate area of the discovery until notified by the Program Manager that operations may resume.

3. In accordance with 43 CFR 4130.8-1(F), failure to pay grazing bills within 15 days of the due date specified in the bill shall result in a late fee assessment of $25.00 or 10 percent of the grazing bill, whichever is greater, but not to exceed $250.00. Payment made later than 15 days after the due date shall include the appropriate late fee assessment. Failure to make payment within 30 days may be a violation of 43 CFR Secs. 4150.1 and 4160.1-2.

4. STANDARDS AND OBJECTIVES

Arizona Rangeland Health Standards 1, 2 and 3 are applicable to all BLM lands in Arizona. The BLM is required to evaluate the Standards on lands that contain livestock grazing on them as part of the LHE process. Standard 3 requires the development of Desired Plant Community (DPC) objectives that tier to the relevant RMPs. Because the Babocomari Allotment covers lands inside and outside of the SPRNCA, both the SPRNCA RMP (BLM 2019) and the Safford District RMP (BLM 1994) apply to the respective portions of these lands. Section 4.2 lists the relevant SPRNCA RMP (BLM 2019) objectives that the required DPC objectives must tier to and Section 4.3 goes on to describe the allotment-specific DPC objectives.

4.1 Land Health Standards

This section describes the Arizona Standards for Rangeland Health and the criteria for meeting each standard. The following descriptions are taken directly from the "Arizona Standards for Rangeland Health and Guidelines for Grazing Administration" (BLM 1997).

Standard 1: Upland Sites
"Upland soils exhibit infiltration, permeability, and erosion rates that are appropriate to soil type, climate and landform (ecological site)."

Criteria for meeting Standard 1:

- Soil conditions support proper functioning of hydrologic, energy, and nutrient cycles. Many factors interact to maintain stable soils and healthy soil conditions including appropriate amounts of vegetative cover, litter, soil porosity, and organic matter. Under proper functioning conditions, rates of soil loss and infiltration are consistent with the potential of the site.
- Ground cover in the form of plants, litter, or rock is present in pattern, kind, and amount sufficient to prevent accelerated erosion for the ecological site; or ground cover is increasing as determined by monitoring over an established period of time.
- Signs of accelerated erosion are minimal or diminishing for the ecological site as determined by monitoring over an established period of time.

Standard 2: Riparian-Wetland Sites
"Riparian-wetland areas are in proper functioning condition."

Criteria for meeting Standard 2:

- Stream channel morphology and functions are appropriate for proper functioning condition for existing climate, landform, and channel reach characteristics. Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows.
- Riparian-wetland functioning condition assessments are based on examination of hydrologic, vegetative, soil and erosion-deposition factors. The BLM has developed a standard checklist to address these factors and make functional assessments. Riparian-wetland areas are functioning properly as indicated by the results of the appropriate checklist application.

Standard 3: Desired Resource Conditions
"Productive and diverse upland and riparian-wetland plant communities of native species exist and are maintained."

Criteria for meeting Standard 3:

- Upland and riparian-wetland plant communities meet DPC objectives. Plant community objectives are determined with consideration for all multiple uses. Objectives also address native species, and the requirements of the Taylor Grazing Act, Federal Land Policy and Management Act, Endangered Species Act, Clean Water Act, and appropriate laws, regulations, and policies.
- Desired plant community objectives will be developed to assure that soil conditions and ecosystem function described in Standards 1 and 2 are met. They detail a site-specific plant community which, when obtained, will assure rangeland health, State water quality standards, and habitat for endangered, threatened, and sensitive species. Thus, DPC objectives will be used as an indicator of ecosystem function and rangeland health.

Desired Plant Community Objectives
DPC objectives are established for important biological resources. The DPC objectives for the Babocomari Allotment have quantifiable indicators that 1) ensure the natural diversity and abundance of native vegetation occurs as expected for the ecological site and 2) density, vigor, cover, and species richness of native perennial grass, shrub, and forb species are maintained or enhanced based on the ecological site potential. Allotment DPC objectives tie directly back to the broader SPRNCA RMP (BLM 2019) objectives to ensure that the requirements of P.L. 100-696 are being met. The objectives address resource conditions based on vegetation attributes, such as composition, structure, and cover that are desired within the allotments. The DPC objectives for each site were based on current resource reference conditions and overall site potential as defined in the NRCS ESDs (EDIT 2020).

4.2 Land Use Plan Management Objectives

4.2.1 SPRNCA RMP

This section outlines applicable SPRNCA RMP (BLM 2019) resource objectives that are applicable to the Babocomari Allotment.

Meeting Standard 3 of the Arizona Standards for Rangeland Health is specifically contingent upon the following SPRNCA RMP objective because one of the guidelines to meet this standard is to “maintain, restore, or enhance water quality in conformance with State or Federal Standards”.

Water Resource Objectives (SPRNCA RMP ROD, p. 2-3):

- **ob-WAT-1:** Reduce or prevent contamination of surface and groundwater by nonpoint source pollution to meet State requirements.

Standard 3 also depends on meeting allotment-specific objectives described in Section 4.3. Those allotment-specific objectives must all tier to the following SPRNCA RMP (BLM 2019) objectives.

All Vegetation Community Objectives (SPRNCA RMP ROD, p. 2-4):

- **ob-VEG-ALL-1:** Ensure that the natural diversity and abundance of native vegetation occurs as expected for landform and ecological sites.

- **ob-VEG-ALL-2:** Maintain or improve the ecological processes and function of habitats that support priority or special status plant species.

Upland Vegetation Resource Objectives (SPRNCA RMP ROD, p. 2-7):

- **ob-VEG-UP-1:** Manage 1,838 acres of upland vegetation toward restoring the perennial native grass component to address shrub encroachment.

- **ob-VEG-UP-2:** In the grassland vegetation community, maintain or enhance density, vigor, cover, and species richness of native perennial grass, shrub, and forb species based on ecological site potential.

- **ob-VEG-UP-3:** In the Chihuahuan Desertscrub vegetation community, increase native annual and perennial herbaceous plants based on ecological site potential.

Riparian Vegetation Resource Objectives (SPRNCA RMP ROD, p. 2-6):

- **ob-VEG-RIP-3:** Provide sufficient vegetated bank cover to prevent erosion, slow down water, and improve bank soil condition including porosity for recharge.

Fish, Wildlife, and Special Status Species (SPRNCA RMP ROD, p. 2-8):

- **ob-WILD-1:** Conserve, protect, and enhance wildlife and aquatic resources in accordance with the aquatic, wildlife, scientific, cultural, educational, and recreational values of the SPRNCA.

- **ob-WILD-2:** Restore and maintain habitat of suitable quality and quantity to support identified priority fish and wildlife species.

- **ob-WILD-5:** Manage springs for priority wildlife habitat.

- **ob-WILD-6:** Conserve, protect, and enhance desert washes with adequate cover and width while considering habitat connectivity and adequate patch size.

Livestock Grazing Objectives (SPRNCA RMP ROD, p. 2-15):

- **ob-GRAZ-2:** Maintain productive, diverse upland, riparian, and wetland plant communities of native species.

- **ob-GRAZ-3:** Ensure utilization of current year's growth on upland native perennial grass does not exceed 40 percent at the allotment scale, except for targeted grazing treatments.

4.2.2 Safford District RMP

This section outlines applicable Safford District RMP (BLM 1994) resource objectives. The Safford District RMP objectives are applicable to lands in the Babocomari Allotment that are outside of the SPRNCA.

Wildlife Habitat Objectives (Safford District Proposed RMP, p. 33):

- Maintain and enhance priority species (see Safford District RMP for the list of priority species) and their habitats.

- Manage priority wildlife species habitat (vegetation communities) or special features of that habitat (water, riparian vegetation, cliffs, etc.) to maintain or enhance population levels.

- Focus management efforts on enhancing biological diversity.

Soil Erosion (Safford District Proposed RMP, p. 44):

- Reduce accelerated erosion.

Vegetation (Safford District Proposed RMP, p. 45):

- The objective for management of upland vegetation is to restore and maintain plant communities for wildlife, watershed condition, and livestock. The DPCs will be determined in the preparation of activity plans.

4.3 Allotment-specific Objectives

The Babocomari Allotment-specific objectives are the DPC Objectives. This section describes the DPC objectives and provides detailed rationale on how they align with the relevant RMP objectives. The RMP vegetation objectives are directly related to ecological site potential thus the DPC objectives tie to the historic climax plant community (HCPC). In general, objectives were developed based on site potential as described in the ESDs, site-specific monitoring data, professional judgement, and wildlife habitat requirements.

The DPC objectives developed in this LHE are supportive of wildlife objectives and priority species enhancement as described in the SPRNCA RMP (BLM 2019). Specifically, grassland birds, mule deer, and lesser long-nosed bats would benefit. Upland sites adjacent to riparian areas also support riparian species as wildlife move throughout the landscape for necessary resources. Attainment of the DPC objectives helps meet the RMP objectives ob-WILD-1, 2, and 3 as described in Section 4.2.1 and directly benefit all priority species listed in the RMP for upland sites noted in RMP ama-WILD-1 (BLM 2019).

The DPC objectives will maintain perennial grass and shrub cover that is supportive of wildlife habitat. An appropriate amount of perennial grass cover is necessary for nesting and protection of ground nesting birds, such as Gambel's and scaled quail, lesser nighthawk, greater roadrunner, grasshopper sparrow, and Botteri's sparrow. Reptiles such as ornate box turtle and northern Mexican gartersnake benefit from adequate perennial grass cover because of thermal and predator protection. A wide variety of small mammals such as white-throated woodrat, cactus mouse, banner-tailed kangaroo rat, and pocket gopher also use perennial grasses for protection and forage.

4.3.1 DPC Objective Methodology

The ESDs describe expected amounts of cover for various plant functional/structural groups, such as shrubs and perennial grasses. However, there is a small, noteworthy discrepancy in how the BLM's Assessment, Inventory, and Monitoring (AIM) protocol collects vegetative cover and how the ESD reports vegetative cover. The AIM protocol collects foliar cover, which is the percentage of ground covered (if the sun were directly overhead) by the vertical projection of the aerial portion of plants. Small openings in the canopy and intraspecific overlap are excluded in foliar cover. However, ESDs and corresponding reference sheets report expect canopy cover, which is defined as the percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included with canopy cover (NRCS 2003). Foliar cover is always less than canopy cover and the sum of all species cover for canopy or foliar cover may exceed 100% (NRCS 2003).

Given the discrepancy between canopy cover and foliar cover, the BLM relied heavily on the 2019 and 2020 AIM foliar cover data to establish DPC objectives. After two more years of AIM data collection at key areas and at the un-grazed reference sites (see description below), key area foliar cover objectives will be updated to reflect an average of three years of AIM data. The BLM will seek to utilize a working group[1]

[1] A working group would be comprised of technical experts for the applicable resource area such as wildlife, vegetation, and soils, who review monitoring data and provide input. A working group would be composed of representatives from other federal, state, and local agencies and organizations who have specific technical expertise and qualifications.

who would review AIM data and provide input on updated objectives. Updated objectives, along with the associated rationale, will be posted on the ePlanning website.

There are some minor differences in the methodology that the BLM used to develop DPC perennial grass foliar cover objectives. For Limy Uplands, the BLM used the perennial grass key species bush muhly (*Muhlenbergia porteri)* to establish DPC objectives because bush muhly is a deep-rooted perennial grass that prevents erosion more effectively than shallow rooted perennial grasses such as fluff grass *(Dasyochloa pulchella)* which also occurs on Limy Uplands. The other dominant ecological sites on the Babocomari Allotment, support a variety of deep-rooted perennial grass species and thus it was not necessary to base those DPC objectives on one key perennial grass species.

The more abundant Limy Upland and Shallow Upland ecological sites are present on un-grazed portions of BLM lands in the SPRNCA and were used as reference sites to determine perennial grass and shrub foliar cover potential specific to the area. In addition, using these un-grazed reference sites allowed for direct comparison of foliar cover which is not available using ESDs. The BLM collected foliar cover at four Limy Upland and two Shallow Upland reference sites in fall 2019 and fall 2020 to help establish realistic site-specific objectives. The BLM used the reference data, in addition to the Limy Uplands and Shallow Uplands state and transition models, to establish the associated DPC objectives.

4.3.2 Babocomari Allotment Key Area DPC Objectives

The two most common ecological sites in the BLM-managed portion of the Babocomari Allotment are Shallow Upland and Limy Upland (Appendix A: Figure A-6). There are two key areas (GRZ-02 and Babo-05) on Limy Upland and two key areas (Babo-03 and GRZ-05) on Shallow Upland (Table 6 and Figure A-6). All four key areas are within the SPRNCA. Key area Babo-03 was established by the BLM and University of Arizona Extension in 2007 and pace frequency, ground cover, dry weight rank, and fetch data were collected intermittently from 2007-2017 using protocols described in Appendix C.

Table 6. Location of the Babocomari Allotment Key Areas.

Name	Ecological Site	Ecological Site ID	GPS Coordinates (Lat., Lon.)	Year data was collected	Protocol
Babo-05	Limy Upland 12-16	R041XC309AZ	3,508,899 574,394	2019	AIM, IIRH*
Babo-03	Shallow Upland 12-16	R041XC322AZ	3,507,627 574,403	2007, 2012, 2013, 2014, 2015, 2016, 2017	Pace frequency, ground cover, dry weight rank, and fetch
				2019	AIM, IIRH
GRZ-02	Limy Upland 12-16	R041XC309AZ	3,507,003.98 574,031.43	2019	AIM, IIRH
GRZ-05	Shallow Upland 12-16	R041XC322AZ	3,508,303.52 574,161.64	2019	AIM, IIRH

*Interpreting Indicators of Rangeland Health (IIRH)

Site-specific DPC objectives for the Babocomari Allotment are identified below. These site-specific DPC objectives are used to inform the evaluation of land health standards for Standard 3 (desired plant communities).

Key Areas GRZ-02 and Babo-05 Allotment-specific DPC Objectives for Limy Upland 12-16" p.z. Ecological Site

KA GRZ-02 DPC Objective

- Perennial grass foliar cover of ≥10%
- Shrub foliar cover <30%

KA Babo-05 DPC Objective

- Perennial grass foliar cover of ≥1%
- Shrub foliar cover <30%

Rationale for establishment of Limy Upland DPC objective

The ESD for Limy Uplands identifies a potential of >5% canopy cover of perennial grass (labelled as MUPO [bush muhly] and ARIST [threeawn]) and <45% canopy cover of shrubs (labelled as LATR [creosote] and ACCO [whitethorn]) in its historical climax plant community (HCPC) state (Figure 1). The Limy Upland key area GRZ-02 is currently in the desired HCPC state ("Native shrub, grass, and forb") (Figure 1) with 12.0% perennial grass foliar cover and 39% shrub foliar cover in 2019 (Appendix D: Table D-15). The Limy Upland key area Babo-05 is currently in a shrub increased HCPC state (Figure 1) with 0% perennial grass and 54.6% shrub foliar cover in 2019 (Appendix D: Table D-20). Reference data collected at four nearby un-grazed Limy Upland sites on the SPRNCA show foliar cover between 0-1% and 22-62% for perennial grasses and shrubs, respectively (Appendix D: Tables D-29 through D-32). The reference sites show the general potential for Limy Uplands in un-grazed areas. However, given that the perennial grass foliar cover at key area GRZ-02 exceeds that of the reference sites, the GRZ-02 key area specific objective is to maintain 2019 cover levels of the key perennial grass species bush muhly (*Muhlenbergia porteri*) at this site. Bush muhly is the primary perennial grass species found at GRZ-02 and is listed in the ESD as a key perennial grass species for Limy Uplands as it helps prevent erosion. Key area Babo-05 is a much less productive site, therefore the perennial grass cover objective was set closer to what was measured at the un-grazed sites. Maintaining bush muhly cover levels will keep Limy Upland key area GRZ-02 in the "Native shrub, grass, forb" state (Figure 1). Achieving the objective of ≥1% perennial grass foliar cover will help keep the Limy Upland key area Babo-05 in the "Native shrub, grass, forb" state (Figure 1). Although shrubs are the expected dominant functional/structural group on Limy Uplands, maintaining the objective of <30% shrub foliar cover would maintain an open shrub canopy appropriate for site potential and prevent key area Babo-05 from moving further into a shrub increased state.

The Limy Upland site GRZ-02 and Babo-05 DPC objectives support wildlife and priority species enhancement objectives described in the SPRNCA RMP (2019) by maintaining and increasing perennial grass and reducing shrub cover as described in Section 4.3.1.

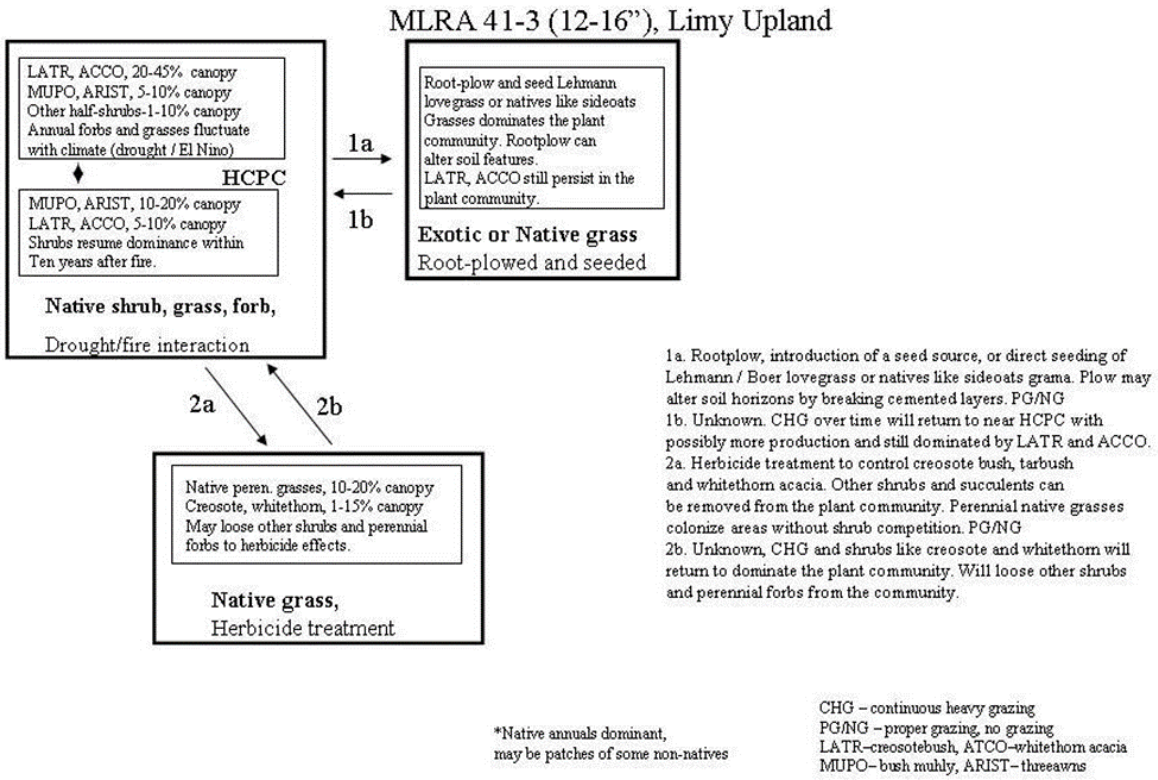

Figure 1. State and transition model for Limy Upland.

Key Areas Babo-03 and GRZ-05 Allotment-specific DPC Objectives for Shallow Upland 12-16" p.z. Ecological Site

- Perennial grass foliar cover of ≥20%.
- Shrub foliar cover <10%.

Rationale for establishment of Shallow Upland DPC objective

The ESD for Shallow Uplands identifies a potential of 20-35% canopy cover of perennial grass and <15% canopy cover of shrubs in its HCPC state (Figure 2). The Shallow Upland key area Babo-03 is currently in the desired HCPC state ("Native grass, forb, and half-shrub") (Figure 2) with 18.1% perennial grass foliar cover and 20.1% shrub foliar cover in 2019 (Appendix D: Table D-10). The Shallow Upland key area GRZ-05 is currently in the "Native grass, forb, and half-shrub" state moving toward the "Shrub Increase" state (Figure 2) with 3.4% perennial grass and 30.6% shrub foliar cover in 2019 (Appendix D: Table D-25). Reference data collected at two nearby un-grazed Shallow Upland reference sites on the SPRNCA in 2019 show perennial grass foliar cover between 25-39% and shrub foliar cover between 24-25% (Appendix D: Table D-33 and D-34). These reference site data show a similar natural range of variability, expressed in foliar cover, to the expected range of variability in canopy cover as described in the ESD (Figure 2), therefore 20% perennial grass foliar cover is within the range expected for the Shallow Uplands HCPC. The shrub foliar cover objective of <10% would also prevent the sites from moving into the "Shrub Increase" state and would create an open shrub canopy appropriate for site potential.

The Shallow Upland DPC objectives support wildlife and priority species enhancement objectives described in the SPRNCA RMP (2019) by increasing perennial grass and reducing shrub cover. In addition to the benefits to species described in Section 4.3.1, species of economic importance, such as mule deer, white-tail deer, javelina, and a variety of predatory fur-bearing mammals, are more likely to rely on Shallow Upland habitat due to the relatively greater forage production and cover.

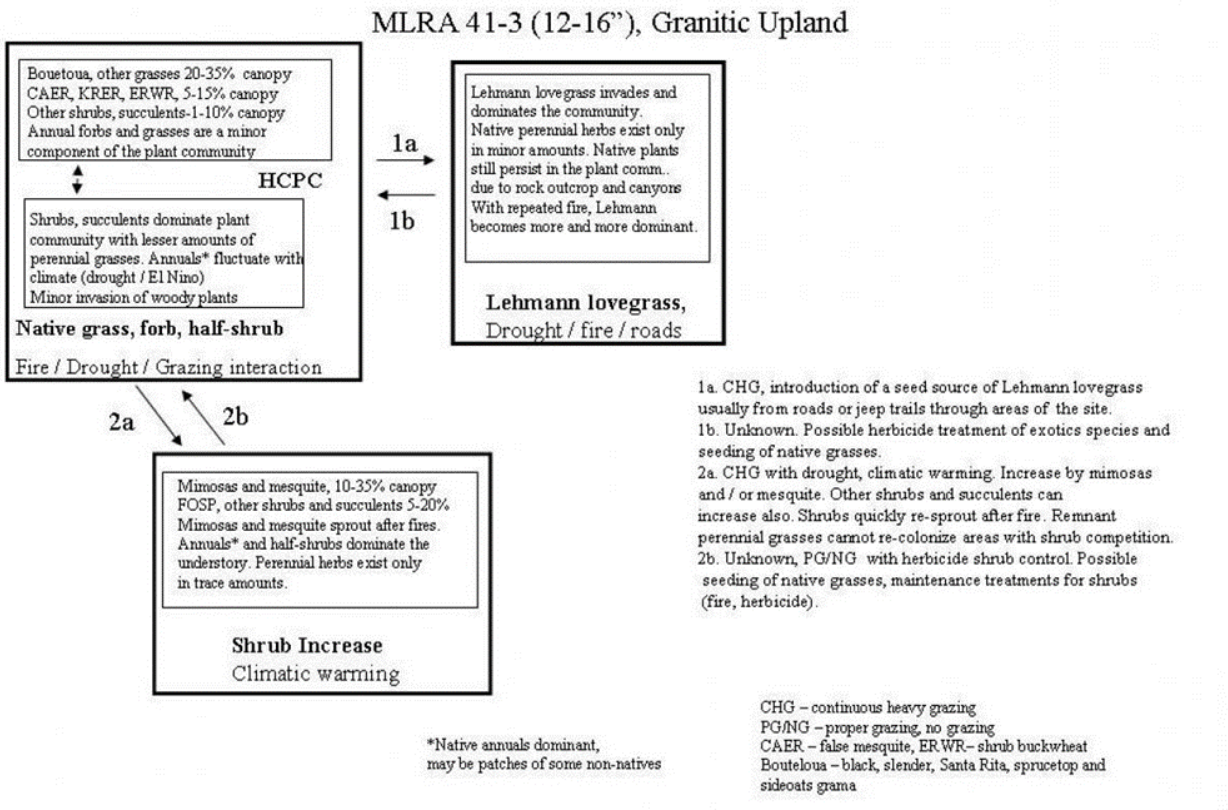

Figure 2. State and Transition Model for Shallow Uplands (also called Granitic Uplands).

5. RANGELAND INVENTORY AND MONITORING METHODOLOGY

This section describes the protocols used by BLM to conduct current inventory and monitoring. Historic monitoring protocols are provided in Appendix C for additional information.

5.1 Rangeland Inventories

The following protocols describe qualitative assessments of land health in upland and riparian settings.

5.1.1 Indicators of Rangeland Health

The protocol Interpreting Indicators of Rangeland Health (IIRH) (Pellant et al. 2020) was used to help evaluate Standards 1 and 3. During the IIRH process, 17 indicators of three rangeland health attributes are assessed: soil and site stability, hydrologic function, and biotic integrity. The BLM uses this protocol to assess the presence or absence, quantity, and distribution of multiple components of a system. By using this qualitative, observational procedure, the functional status of rangeland indicators can be assessed and used to guide future management.

This LHE evaluates the three rangeland health attributes and provides information on the functioning of ecological processes (water cycle, energy flow, and nutrient cycle) relative to the reference state for the ecological site. The IIRH assessments are a snapshot of the status of the rangeland attributes at key areas at the time of the site evaluation.

Attribute ratings reflect the degree of departure from expected levels for each indicator per the ESD reference sheet. The degree of departure may be categorized (rated) as:

- None to Slight
- Slight to Moderate
- Moderate
- Moderate to Extreme
- Extreme to Total

5.1.2 Proper Functioning Condition Assessments

Proper Functioning Condition (PFC) assessments are used to evaluate Standard 2. A PFC assessment is intended to qualitatively determine the overall physical function of a stream segment's riparian area and complex set of natural processes. The PFC assessment is not designed to be a quantitative monitoring tool, but a qualitative tool completed by an interdisciplinary (ID) team that provides a snapshot assessment of conditions on the ground. The PFC procedure for lotic (flowing) water, such as a stream, is fully described in Dickard et al. (2015). The following is a brief overview of the PFC assessment protocol that was used in this LHE to document the condition of the stream and riparian resources along the San Pedro River.

A PFC assessment is an inventory of 17 indicators which are categorized into three groups of questions relating to either hydrologic, vegetative, or geomorphic features of the stream or river reach being assessed. The hydrologic indicators relate to floodplain connectivity, channel dimensions, and lateral extent of the riparian area. The vegetative indicators relate to stream and riparian function (e.g., plant age-class diversity, distribution, and vigor). The geomorphic indicators highlight the presence of erosional or depositional features found in the field and how they relate to the current state and ability of the stream to function with the supplied sediment and flow from the watershed.

Under the PFC protocol, stream reaches can be categorized as:

- Proper Functioning Condition (PFC)
- Functional – At Risk (FAR) (Trend: Upward, Downward, Not Apparent)
- Nonfunctional
- Unknown

5.2 Monitoring Protocols

Quantitative data is also used to assess Standards 1, 2, and 3. The following monitoring protocols describe the type of monitoring data collected at key areas used in this LHE.

5.2.1 Assessment Inventory and Monitoring (AIM) Strategy

The AIM strategy provides a framework for the BLM to inventory, monitor, and quantitatively assess the condition and trend of natural resources on public lands and is used to evaluate Standards 1 and 3 in this LHE. The standardized terrestrial data measurements (or indicators) collected with the AIM protocol include bare ground (soil not covered by plant foliar cover or any of the ground cover categories), species-specific foliar cover, species-specific basal cover, ground cover (rock fragment, biological soil crust, and litter), species diversity, vegetation height, plant canopy gaps, soil texture, and soil stability. In addition, plot characterization information is collected, such as slope, aspect, landscape position, ecological site identification, and noted at the time of data collection. AIM indicator data are used in the IIRH assessments for each monitoring location. Key area repeat monitoring data will be collected using the AIM protocol. Additional information regarding the BLM's AIM strategy can be accessed online through the *AIM Landscape Toolbox* (BLM 2020).

5.2.2 Legacy data collection methods (University of Arizona)

Prior to using the AIM strategy, the BLM collected monitoring data with the University of Arizona using the protocols found in Appendix C.

Ground Cover

Ground cover is the amount of surface area comprised of bare ground, perennial plant bases, litter, gravel, or rocks. Ground cover data, each soil protection category expressed as a percentage of total hits, reflect the amount of litter, vegetative root bases, gravel, and rocks available to intercept raindrop impact before reaching the soil and of bare ground exposed to climatic elements. Ground cover data are collected with each quadrat placement. A single point from the quadrat is consistently the focal point for cover category classification.

Pace Frequency

Pace frequency is the number of times a plant species is present within a given number of uniformly sized sample quadrats (plot frames placed repeatedly across a stand of vegetation). Plant frequency is expressed as percent presence for each species encountered within total number of quadrat placements, therefore, frequency reflects the probability of encountering a particular plant species within a specifically sized area (quadrat size) at any location within the key area. The total number of frequency hits among all species will not equal the total number of quadrat placements and frequency is insensitive to the size or number of individual plants. Frequency is a very useful monitoring method but does not express species composition, only species presence. Frequency is an index that integrates species' density and spatial patterns.

5.2.3 Water Quality

Water quality data used in this assessment are collected by the regulatory authority (i.e., ADEQ) or associated volunteers. The sampling and testing are done in accordance with ADEQ and Environmental Protection Agency (EPA) approved methodologies for *E. coli* using the Colilert system (Jones 2018). The water quality monitoring data is used to help inform evaluation of Standard 3.

5.3 Actual Use

Actual use was determined from billed use, which has been paid at full use since 1992. Allowable AUMs are calculated on BLM-administered land only. Lease holders are billed for their maximum use available on public lands unless non-use is requested and approved. Non-use by the lessee was not requested during the evaluation period.

6. MANAGEMENT EVALUATION AND SUMMARY

6.1 Precipitation Data

Rainfall data from 2010 to 2020 was gathered from one rain gauge located inside the allotment boundary. This data is collected by the Agricultural Research Service Southwest Watershed Research Center, made available through Data Access Project (Goodrich et al. 2008). The graph below (Figure 3) displays the annual total rainfall for the last 10 years. It also includes the 30-year Climate Normal from the Tombstone gauge (see Section 2.3.2). Only four of the last 10 years are close to (within one inch) or greater than the previous 30-year normal for annual rainfall totals.

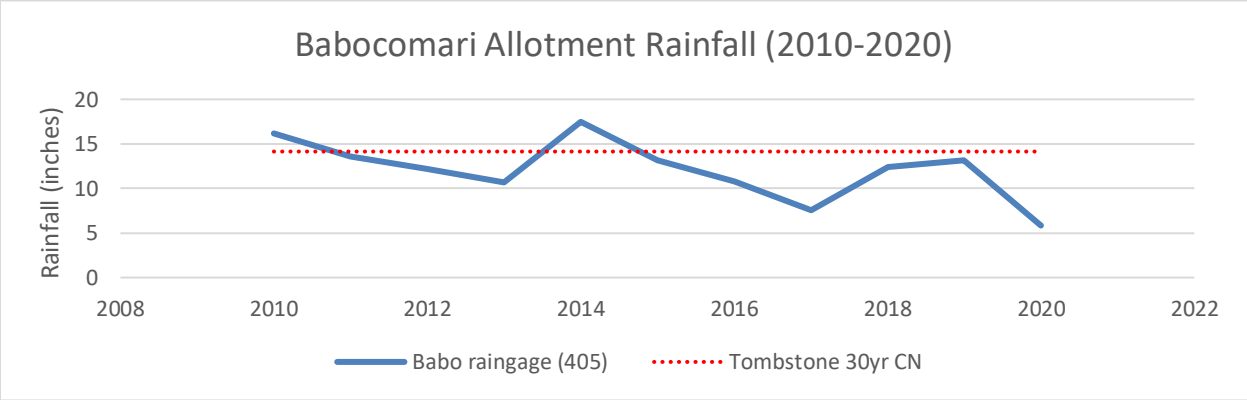

Figure 3. Annual rainfall totals for the allotment for the last 10 years.

Monthly precipitation data from 2019 was collected by the lessee at the Babocomari Ranch headquarters. The majority of precipitation in 2019 fell outside of the growing season in September, November, and February (Table 7).

Table 7. 2019 Precipitation Data for the Babocomari Allotment.

2019 Precipitation Gauge within Babocomari Allotment												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inches	0.75	4.03	0.75	0.17	0.18	0.34	1.69	1.30	4.11	0	3.95	0.58

6.2 Rangeland Health Assessments

The following section analyzes and evaluates Indicators for Rangeland Health (IIRH), AIM data, pace frequency data, PFC assessments, and water quality data as they apply to Standards 1, 2, and 3 on the Babocomari Allotment.

The IIRH assessments were completed by an ID team consisting of a rangeland management specialist, wildlife biologist, GIS specialist, hydrologic technician, range technician, and vegetation biological technician on January 27 and 29, 2020. In addition to AIM data collected at key areas, documents and publications used in the assessment process include the *Web Soil Survey of Arizona* (NRCS 2020a), ESDs for MLRA 41 (NRCS 2006), Interpreting Indicators of Rangeland Health Technical Reference 1734-6 (Pellant et al. 2020), The Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems (Herrick et al. 2005), Sampling Vegetation Attributes Technical Reference 1734-4 (Coulloudon et al. 1999), and the National Range and Pasture Handbook (NRCS 2003). All reference materials are available online or at the BLM TFO for public review.

Comprehensive AIM data tables, IIRH assessment data sheets, and photographs of key areas used in this analysis are in Appendix C. Table 8 is a summary of the degree of departure of soil and site stability, hydrologic function, and biotic integrity at all monitoring locations on the Babocomari Allotment. Monitoring locations are listed in Table 6and maps are Appendix A: Figure A-5 through A-7. All locations are within the SPRNCA.

Table 8. Summary of Range Health Assessment Ratings.

Key Area	Ecological Site	Range Health Attributes – Degree of Departure		
		Soil and Site Stability	Hydrologic Function	Biotic Integrity
Babo-03	Shallow Upland 12-16”	None to Slight	None to Slight	None to Slight
GRZ-05	Shallow Upland 12-16”	None to Slight	None to Slight	Slight to Moderate
GRZ-02	Limy Upland 12-16”	None to Slight	None to Slight	None to Slight
Babo-05	Limy Upland 12-16”	None to Slight	Slight to Moderate	Moderate

6.2.1 Standard 1: Upland Sites

This section describes the results of the Indicators for Rangeland Health and AIM data as they apply to Standard 1 and each key area.

Standard 1 of the Arizona Standards for Rangeland Health is:

- *Upland soils exhibit infiltration, permeability, and erosion rates that are appropriate to soil type, climate, and landform (ecological site).*

Shallow Uplands sites (Babo-03 and GRZ-05)

Key areas Babo-03 and GRZ-05 are in the Shallow Uplands 12-16” p.z. ecological site. The Shallow Uplands ecological site potential plant community is warm season perennial grass dominant and shrub sub-dominant. Perennial forbs and annual grasses and forbs are a minor component on this site. All major perennial grasses and shrubs are expected to be well dispersed throughout the plant community. Common plant species include grama grasses (*Bouteloua spp.*), curly mesquite grass (*Hilaria belangeri*), and fairy duster (*Calliandra eriophylla*). Most common plant species can re-sprout and recover quickly after disturbances such as drought and fire. This site occurs in the middle elevations of the Madrean Basin and Range province in southeastern Arizona, southwestern New Mexico, as well as Chihuahua and Sonora, Mexico on gently sloping to moderately steep pediments which flank mountain areas. Small rock outcroppings can be common on Shallow Uplands (see the ESD via EDIT 2020).

Babo-03

Table 9. Key area Babo-03 AIM data compared to Shallow Upland ESD.

	Basal Cover				Biological Crust	Litter	Surface Fragments ¼" - 3"	Surface Fragments > 3"	Bedrock	Bare Ground
	Grass	Forb	Shrub	Tree						
Shallow Uplands ESD R041XC322AZ	3-10%	0-1%	3-5%	0-1%	0-1%	15-50%	25-65%	0-10%	1-10%	5-50%
Babo-03	2.7%	0%	0%	0%	0%	30%	38%	0%	0%	19.3%

Babo-03 Rangeland Health Attribute 1: Soil and Site Stability

The overall rating for soil and site stability on Babo-03 was None to Slight departure from reference state. All ten indicators for soil site stability were within the natural range of variability. The site had high rock cover and the soil matched that expected for the site. Vegetation composition and cover on the site were appropriate to reduce or prevent erosion and provide litter in amount and size appropriate for the site potential.

Babo-03 Rangeland Health Attribute 2: Hydrologic Function

The overall rating for hydrologic function on Babo-03 was None to Slight departure from reference state. All ten of the indicators for hydrologic function were within the natural range of variability. The site had a high amount of rock cover that can break and dissipate any energy.

Babo-03 Rangeland Health Attribute 3: Biotic Integrity

Table 10. AIM foliar cover data at Babo-03.

Functional Group	Foliar Cover %
Shrub	20.1
Perennial Grass	18.1
Forb	11.4

The overall rating for biotic integrity on Babo-03 was Slight to Moderate departure from reference state. Seven indicators for biotic function were rated as None to Slight. Indicator 12 (plant functional/structural groups) was rated Slight to Moderate and Indicator 16 (invasive species) was ranked Moderate. There was good cover of perennial grass on the site, however shrubs had become co-dominant, which is leading to a Slight to Moderate departure from reference state (Table 10). In addition, Lehmann lovegrass and mesquite (invasive species at this site) are present and scattered throughout.

The pace frequency data collected at Babo-03 can be used to look at past trends while the 2019 AIM data establishes a baseline. Table 11 and 12 show ground cover and shrub canopy and perennial grass percent frequency collected intermittently using the pace frequency protocol at key area Babo-03 from 2007-2016.

Table 11. Pace frequency transect ground cover data Babo-03 from 2007-2016.

	8/28/07	5/5/12	6/12/13	9/8/14	9/8/15	5/17/16	11/17/16
Bare Ground	16%	13%	4%	3%	2%	12%	11%
Litter	49%	52%	68%	76%	71%	59%	47%
Live Basal Vegetation	7%	0%	1%	3%	1%	4%	4%
Rock Fragment	28%	36%	27%	18%	27%	26%	38%

Though not directly comparable with AIM, the pace frequency ground cover at Babo-03 shows similar results to the 2019 AIM data with relatively high litter and rock fragment cover. The pace frequency data show litter was 49-76%, rock fragment cover ranged from 18-38%, and bare ground was 2-15% from 2007-2016. These data show that appropriate ground cover has remained constant at Babo-03 with some of the variation attributed to changes in annual weather, timing of monitoring, and small differences in the exact location of the line that was paced at the time of data collection.

Table 12. Pace frequency transect data showing shrub canopy and perennial grass percent frequency collected at Babo-03 from 2007-2016,

Percent Frequency	8/28/07	5/5/12	6/12/13	9/8/14	9/8/15	5/17/16	11/17/16
Shrub Canopy	NA	76	53	62	75	61	65
Black grama	3	8	10	2	0	8	4
Sideoats grama	19	28	11	12	17	16	18
Lehmann lovegrass	56	8	19	6	15	20	24
Threeawn grass	0	14	0	2	15	24	28

Past pace frequency data showed between 53-76% frequency of shrub canopy. This indicates that the site has had high shrub cover since at least 2007. From 2007-2016 black grama was 0-10% frequency, side oats grama was 11-28% frequency, Lehmann lovegrass drastically varied from 6-56% frequency, and threeawn grass was 0-28% frequency. Overall, perennial grass frequency—especially Lehmann lovegrass—varied annually at Babo-03. Production data collected in 2017 at Babo-03 estimated 314 lbs./acre of grass and 736 lbs./acre of woody plants, which is within the range expected under favorable precipitation in Shallow Uplands.

GRZ-05

Table 13. Key area GRZ-05 AIM data compared to Shallow Upland ESD.

	Basal Cover				Biological Crust	Litter	Surface Fragments ¼" - 3"	Surface Fragments > 3"	Bedrock	Bare Ground
	Grass	Forb	Shrub	Tree						
ESD R041XC322AZ	3-10%	0-1%	3-5%	0-1%	0-1%	15-50%	25-65%	0-10%	1-10%	5-50%
GRZ-05	0%	0%	0.7%	0%	0%	26.7%	36.7%	0%	0%	30%

GRZ-05 Rangeland Health Attribute 1: Soil and Site Stability

The overall rating for soil and site stability on GRZ-05 was None to Slight. Eight indicators for soil site stability were rated as None to Slight because they were within the natural range of variability expected under reference conditions. Indicator 5 (number and extent of gullies) was rated as Slight to Moderate because more gullies were present than expected. However, they were showing signs of recovery as they had vegetation growing on the sides and embedded rocks that were helping to prevent head cut formation. Indicator 7 (litter movement) was rated as Moderate because bigger litter size classes were moving on the site than expected.

GRZ-05 Rangeland Health Attribute 2: Hydrologic Function

The overall rating for hydrologic function on GRZ-05 was None to Slight. Eight indicators for hydrologic function were rated as None to Slight because they were within the natural range of variability expected under reference conditions. Indicator 5 (number and extent of gullies) and Indicator 10 (effect of plant community composition on infiltration and runoff) were at Slight to Moderate departure from site potential. Although more gullies were present than expected, they were showing signs of recovery as they had vegetation growing on the sides and embedded rocks that were helping to prevent head cut formation. Water infiltration was reduced at the site, likely due to differences in plant community composition from historic climax condition. Shrubs (creosote and whitethorn acacia) were dominant on the site and perennial grasses, which aid in infiltration and help reduce runoff, were providing less cover than expected.

GRZ-05 Rangeland Health Attribute 3: Biotic Integrity

Table 14. AIM foliar cover data at GRZ-05.

Functional Group	Foliar Cover %
Shrub	30.6
Perennial Grass	3.4
Forb	4.7

The overall rating for biotic integrity on GRZ-05 was Slight to Moderate departure. Eight indicators of biotic integrity were rated as None to Slight because they were within the natural range of variability of the ecological site. Indicator 12 (plant functional/structural groups) was rated at a Moderate departure due to the high shrub cover and low perennial grass cover (Table 14). Although eight of nine indicators of biotic integrity were rated None to Slight, the ID team evaluating the site thought that shrubs replacing perennial grasses as the dominant plant functional group was the most important driver of departure away from reference condition. Because of the relative importance of plant functional groups for the health of this site, the team ranked the biotic integrity attribute as Slight to Moderate.

Limy Upland Sites (Babo-05 and GRZ-02)

Key areas Babo-05 and GRZ-02 are in the Limy Uplands 12-16” p.z. ecological site. Limy Uplands occur in the middle elevations of the Madrean Basin and Range province in southeastern Arizona on pediments, fan terraces, and hillslopes. The expected reference condition and potential plant community for Limy Uplands is a diverse mixture of desert shrubs, half shrubs, perennial grasses, and forbs (listed in order of dominance). Common plant species for this ecological site include creosote bush (*Larrea tridentata*), whitethorn acacia (*Vachellia constricta*), bush muhly (*Muhlenbergia porterii*), and threeawn (*Aristida* spp.). Most of the major perennial grasses are expected to be well dispersed throughout the

plant community. Cryptogam cover (moss, lichen) can be considerable in the plant community but diminishes as the surface cover of gravel increases (see the ESD via EDIT 2020).

Babo-05

Table 15. Key area Babo-05 AIM data compared to Limy Upland ESD.

	Basal Cover				Biological Crust	Litter	Surface Fragments ¼" - 3"	Surface Fragments > 3"	Bedrock	Bare Ground
	Grass	Forb	Shrub	Tree						
ESD R041XC309AZ	1-3%	0-1%	2-3%	0%	1-25%	10-20%	5-45%	0-8%	0-1%	15-55%
Babo-05	0%	0%	0%	0%	0.7%	28%	35.3%	0%	0%	25.3%

Babo-05- Rangeland Health Attribute 1: Soil and Site Stability

The overall rating for soil and site stability on Babo-05 was None to Slight departure from site potential. Seven indicators for soil site stability were rated as None to Slight because they were within the natural range of variability of reference conditions. Indicator 5 (number and extent of gullies), Indicator 8 (soil surface resistance to erosion), and Indicator 9 (soil surface structure and organic matter content) were ranked Slight to Moderate departure. Gullies were present on the site but vegetation growing in the bottom and on the sides of the gullies provided some resistance to further erosion, pushing it into the Slight to Moderate rating. Soil surface resistance to erosion was rated as Slight to Moderate due to slightly lower soil stability tests results under plant canopies. Soil stability is measured at 16 locations throughout an AIM plot and measured on a scale of 1-6, with 6 being the most stable. Values of 4-6 are expected under plant canopies for the Limy Upland site and 3 was the average measured under canopies at Babo-05. Indicator 9 (soil surface structure and organic matter content) was rated Slight to Moderate because soil color was lighter than expected for the site, indicating reduced organic matter.

Babo-05 Rangeland Health Attribute 2: Hydrologic Function

The overall rating for hydrologic function on Babo-05 was Slight to Moderate departure from reference condition. Six indicators for hydrologic function were rated as None to Slight because they were within the natural range of variability for the site. Indicator 5 (number and extent of gullies), Indicator 8 (soil surface resistance to erosion), and Indicator 9 (soil surface structure and organic matter content) were ranked Slight to Moderate. The rationale for the Slight to Moderate departure is the same as described above in the soil and site stability section. Gullies, soil surface resistance to erosion, and soil organic content are all important factors in water infiltration, retention, and distribution through upland sites. Indicator 10 (effect of plant community composition on infiltration and runoff) was Moderately departed from site potential due to high foliar cover of shrubs and lack of perennial grasses reducing the water infiltration capabilities of the site. The Slight to Moderate departures of Indicators 5, 8, and 9 and Moderate departure for Indicator 10 contribute to the overall Slight to Moderate rating for hydrologic function.

Babo-05 Rangeland Health Attribute 3: Biotic Integrity

Table 16. AIM foliar cover data at Babo-05.

Functional Group	Foliar Cover %
Shrub	54.6
Perennial Grass	0.0
Forb	1.3

The overall rating for biotic integrity on Babo-05 was Moderate departure from reference conditions. Four indicators of biotic integrity were rated as None to Slight because they were within the natural variability expected for the site. Indicator 8 (soil surface resistance to erosion) and Indicator 9 (soil surface structure and organic matter content) were rated Slight to Moderate departure. These two indicators were rated Slight to Moderate for the same rationale given above in the soil stability section for the site. Additionally, a lack of soil micro-organisms and biotic soil crust may be contributing to slightly reduced soil surface stability and organic matter observed at Babo-05. Indicator 15 (expected annual production) was Moderately departed from the reference conditions because only an estimated 70% of the expected annual production under unfavorable precipitation was observed. Indicator 12 (functional/structural groups) and Indicator 17 (perennial plant reproductive capability) were rated as a Moderate to Extreme departure. Perennial grasses were found in trace amounts at the site (<1% cover) with reduced vigor and seed head production where they are expected to be a sub-dominant functional group (Table 16) under reference conditions. Creosote bush was the dominant species of the site with 35% foliar cover, followed by whitethorn at 15%. Reduced vigor and annual production at the site may be due in part to major rainfall events in 2019 occurring outside the normal summer growing season (Table 7).

GRZ-02

Table 17. Key area GRZ-02 AIM data compared to Limy Upland ESD.

	Basal Cover				Biological Crust	Litter	Surface Fragments ¼" - 3"	Surface Fragments > 3"	Bedrock	Bare Ground
	Grass	Forb	Shrub	Tree						
ESD R041XC309AZ	1-3%	0-1%	2-3%	0%	1-25%	10-20%	5-45%	0-8%	0-1%	15-55%
GRZ-02	0%	0%	0.7%	0%	0%	32.7%	23.3%	0%	0%	26.7%

GRZ-02- Rangeland Health Attribute 1: Soil and Site Stability

The overall rating for soil and site stability at GRZ-02 was None to Slight departure from reference conditions. Eight indicators for soil site stability were rated as None to Slight because they were within the natural range of variability expected for the ecological site. Indicator 5 (number and extent of gullies) was rated Slight to Moderate because, although gullies were present (none are expected for the site), they were shallow with no observed active erosion. Indicator 8 (soil surface resistance to erosion) was rated as Moderate. Soil stability is measured on a scale of 1-6 with 6 being the most stable. On average, soil stability was 2.4 with no vegetation cover and 1.6 under vegetation at the site. This is lower than what is expected (4-6) for under shrub and grass canopies. The ID team evaluating the site rated soil and site stability attribute as None to Slight departure because the AIM data for the site showed good cover of rock and gravel fragments (23%), vegetation cover (51%), and litter cover (33%), which contribute to soil surface stability.

GRZ-02 Rangeland Health Attribute 2: Hydrologic Function

The overall rating for the hydrologic function attribute at GRZ-02 was None to Slight. Eight indicators of hydrologic function were rated as None to Slight because they were within the natural range of variability expected for the ecological site. Indicator 5 (number and extent of gullies) was rated as Slight to Moderate because, although gullies were present (none are expected for the site), they were shallow with no observed active erosion. Indicator 8 (soil surface resistance to erosion) was rated as Moderate. Soil stability is measured on a scale of 1-6 with 6 being the most stable. On average, soil stability was 2.4 with no vegetation cover and 1.6 under vegetation at the site. This is lower than what is expected (4-6) under shrub and grass canopies. Although Indicators 5 and 8 were departed to some extent, the plant community composition as it relates to infiltration closely matched the reference condition. In addition, there were no concerns with other erosional features or bare ground.

GRZ-02 Rangeland Health Attribute 3: Biotic Integrity

Table 18. AIM foliar cover data at GRZ-02.

Functional Group	Foliar Cover %
Shrub	39.3
Perennial Grass	12.0
Forb	1.4

The overall rating for the biotic integrity attribute on GRZ-02 was None to Slight. Eight indicators of biotic integrity were rated as None to Slight because they were within the natural range of variability of the site. Indicator 8 (soil surface resistance to erosion) was rated as Moderate because of lower-than-expected soil stability values under plant canopies (described in more detail in the previous sections). Although soil stability was lower than expected, it is not of great concern for this site due to the high rock fragment cover (23%) and foliar cover (44%) and the site had the expected relative dominance of plant functional groups (Table 18). In addition, the perennial grasses were producing seed heads and there were no issues with invasive species at the site.

6.2.2 Standard 2: Riparian-Wetland Sites

This section describes the results of the PFC assessment as it applies to Standard 2.

Standard 2 of the Arizona Standards for Rangeland Health is:

- *Riparian-wetland areas are in properly functioning condition.*

The riparian condition in the Babocomari Allotment was evaluated using a PFC Assessment (Dickard et al. 2015). The initial assessment was conducted in the fall of 2013 and divided the Babocomari River segments in the allotment into two reaches. The steep, confined bedrock-lined section at the USGS gage was used as the demarcation between the two assessment reaches (referred to as upper and lower) because of the change in stream geomorphology. The lower reach was re-assessed in 2018. The PFC assessments and findings are summarized below, with field data provided in Appendix C.

Upper Babocomari River PFC

The upper Babocomari PFC assessment reach from the SPRNCA boundary to the USGS gage was rated as being in PFC in 2013. This assessment does not include the roughly 300 feet of stream segment on the western end of the SPRNCA that crosses the upstream BLM-managed lands in Township 20 South, Range 21 East, Section 18.

The stream geomorphology in the assessment reach is strongly controlled both laterally and vertically by the geologic outcropping that occurs in the area. This implies that the stream flow sinuosity, lower width/depth ratio, and higher gradient are in balance with the landscape setting as this is what can be expected from the stream setting. Considering the potential of the reach, the geologic controls on this reach limit the influence of vegetation on the stream geomorphic parameters but their complete absence would demonstrate an at-risk or nonfunctional condition. The 2013 assessment found that diverse composition and age-class of riparian vegetation were present in this assessment reach. It also notes that the present vegetation is able to withstand high flows and exhibits high vigor although utilization is noted on tree saplings. The geomorphic attributes of the assessment are likewise controlled by the landscape setting, thus floodplains, point bars, and lateral channel movement are not applicable indicators. On the other hand, the system is vertically stable as a result of this landscape setting. A slight but noticeable amount of excess sediment is being supplied by the watershed, but not enough to change the rating from PFC.

Lower Babocomari River PFC

The lower Babocomari River PFC assessment reach is approximately 3.5 miles, from the gage to its confluence with the San Pedro River. Nearly half of those miles, 1.75 miles, are inside the Babocomari grazing allotment. As noted in Section 2.2.3, the stream channel characteristics in this reach of the river are still heavily influenced by the landscape setting. It is confined to partly confined by bedrock and upland basin-fill deposits but has a lower gradient and greater available floodplain area than the upper reach.

The Lower Babocomari River was rated Functional-at-Risk (FAR) with a downward trend in 2013, due to degraded bank and floodplain vegetation. This rating was primarily due to the effects of livestock grazing observed in the reach. The apparent vertical instability of the channel and floodplain (secondary cutoff channels following cattle trails) were strong indicators that the stream segment was FAR. In addition, riparian tree saplings showed signs of heavy and repeated browsing and banks showed that their stability was compromised by hoof sheering, bank trampling, and grazing of bank vegetation. This reach was re-evaluated in 2018 and determined to be in PFC. The major issues that were found (e.g., the attributes or processes that were not visibly present or functioning) during the 2013 PFC assessment (Appendix D) were the focus of the re-evaluation in 2018. The re-evaluation found that changes in livestock grazing management since the original assessment has improved vegetation and bank conditions. The channel was relatively stable and unlikely to experience accelerated erosion, forage utilization was acceptable, and most evidence of past cattle trailing was unnoticeable. Further, many heavily browsed riparian trees observed during the 2013 assessment had grown to a height that prevents cattle from browsing on the upper portions. Therefore, the trees are expected to continue to grow and enhance the riparian canopy. Past browsing of sapling cottonwood, willow, and ash trees was evident on nearly all saplings when observed at short distance. Ash tree seedlings and saplings were especially abundant and colonizing newly forming point bars and banks. Cottonwood and willow seedlings and saplings were much less common.

As in 2013, channel incision was observed in 2018 but banks were now well vegetated. The grade adjustments were sloped and composed of cobbles, indicating channel stability, as opposed to being nearly vertical with finer sediments. Livestock trails that were incising into the floodplains in 2013 were now covered with vegetation and filled with sediment that made them disappear into the flat floodplain surface. The exception was one floodplain with a deep incision nearly 2 feet deep and 135 feet long. There was no sign that it was healing although tree roots appeared to be reducing its erosion rate. In both 2013 and 2018, sediment bars were observed in the channel and piles of sediment were observed on

floodplains. Therefore, it was concluded that the river was not in balance with the sediment supply and the watershed was contributing to degradation.

6.2.3 Standard 3: Desired Resource Condition

This section describes the results of the AIM and water quality monitoring data as they are used to evaluate Standard 3. In this section, the AIM data is compared to the DPC objectives established in Section 4.3.

Standard 3 of the Arizona Standards for Rangeland Health is:

- *Productive and diverse upland and riparian-wetland plant communities of native species exist and are maintained.*

Shallow Uplands

Key Area Babo-03

Objective	KA Babo-03 monitoring result	Conclusion
• Perennial grass foliar cover of ≥20%	• 18.1% perennial grass foliar cover	Not Achieved
• Shrub foliar cover <10%	• 20.1% shrub foliar cover	Not Achieved

Key Area GRZ-05

Objective	KA GRZ-05 monitoring result	Conclusion
• Perennial grass foliar cover of ≥20%	• 3.4% perennial grass foliar cover	Not Achieved
• Shrub foliar cover <10%	• 30.6% shrub foliar cover	Not Achieved

Limy Uplands

Key Area Babo-05

Objective	KA Babo-05 monitoring result	Conclusion
• Perennial grass foliar cover of ≥1%	• 0% perennial grass foliar cover	Not Achieved
• Shrub foliar cover <30%	• 54.6% shrub foliar cover	Not Achieved

Key Area GRZ-02

Objective	KA GRZ-02 monitoring result	Conclusion
• Maintain perennial grass foliar cover of ≥10%	• 12% perennial grass foliar cover	Achieved
• Shrub foliar cover <30%	• 39.3% shrub foliar cover	Not Achieved

Water Quality

The SPRNCA RMP objective for water quality (BLM 2019: ob-Wat-01) in Section 4.2 is considered under Standard 3 because one of the guidelines to meet this standard is to “maintain, restore, or enhance water quality in conformance with State or Federal Standards”.

In the perennial reaches of this allotment, *E. coli* is a water quality contaminant of concern. *E. coli* is a species of fecal coliform bacteria that is specific to humans and other mammals, including livestock. In the Upper San Pedro Basin (including samples from the Babocomari watershed), an analysis of bovine and human DNA markers on water samples with high amounts of *E. coli* present indicated the bovine source presence was greater overall compared to human sources (Rock et al. 2018). Livestock fecal deposits can enter streams by direct deposit into the stream (or nearby moist soils) or by transportation from uplands in runoff from rain events. Considering this first mechanism, the water quality at baseflow condition (typical flow outside of rainfall driven floods) in the perennial reach of the stream is directly influenced by nearby livestock, which in this case is the livestock in the grazing allotment (Gary et al. 1983; Line 2003; Sunohara et al. 2012). Fecal coliform bacteria (which *E. coli* is a species of) are found in bovine fecal deposits as old as 30 days or longer and are thus a source of contaminants in the watershed (Thelin and Gifford 1983; Kress and Gifford 1984). During runoff-inducing rainfall events (flood flows) the fecal bacteria can be transported into the soil and into downstream waterways (Doran and Linn 1979; Jawson et al. 1982; Muirhead et al. 2005; Stocker et al. 2015).

As noted in the Section 2.2.3, the applicable designated use for the Babocomari River is Full Body Contact (FBC). The water quality criteria for the FBC use for *E. coli* is a maximum of 410 coliform forming units (CFU) per 100 milliliter (ml) sample or a geometric mean of greater than 126 CFU per 100ml sample (A.A.C. R18-11-109). A water body is not meeting the criteria if there are two or more exceedances in the last 3 years of sampling. As noted in Section 4.2, the water quality objectives of the RMP are to meet or make progress towards meeting state standards. According to ADEQ, the Babocomari is now provisionally listed as impaired and will be officially listed, pending EPA review (Huth 2020a).

Water quality samples collected by ADEQ and trained volunteers over the last 3 years (2018-2020) upstream, inside, and downstream of the allotment boundary have exceeded these water quality criteria (Table 19). There have been 16 aggregated samples taken along the mainstem of the Babocomari River, half of which exceeded the *E. coli* criteria for single sample maximum (> 410 CFU/100ml). Seven of these samples were taken inside the allotment boundary or downstream of the allotment and within the SPRNCA, with two samples exceeding the single point maximum.

Table 19 below separates the sampling results by flow regime and location. The samples taken upstream represent baseline conditions for samples taken inside the allotment within the SPRNCA. The only exceedance during baseflow was found in a sample taken inside the allotment on BLM-managed lands. This sample was taken as part of a series in May of 2020. This series of samples taken along the perennial reach of the Babocomari River inside the allotment during baseflow indicate gradually increasing amounts of *E. coli* moving downstream, with the final sample (taken inside the SPRNCA boundary) exceeding the water quality standard. During the sampling in May 2020, livestock presence and numerous fecal deposits were observed along the stream corridor (Huth 2020b). This baseflow exceedance is the direct result of livestock fecal material inside the allotment boundary.

Considering samples taken during flood flows, the high number of exceedances taken upstream of the allotment indicate sources of contamination in the watershed upstream of the allotment. Without additional sampling and analysis, it is difficult to determine with confidence the impact of livestock use within the BLM portion of the allotment on these exceedances during flood flow events.

Table 19. Results from the 2018-2020 Babocomari River *E. coli* Sampling.

	Number of Samples	Number of Exceedances	Percent (%)
Baseflow Sampling			
Inside Allotment/SPRNCA	6	1	17%
Upstream of Allotment/SPRNCA	3	0	0%
Total Base Flow samples	9	1	11%
Flood Flow Sampling			
Inside Allotment/SPRNCA	1	1	100%
Upstream of Allotment/SPRNCA	6	6	100%
Total Flood Flow samples	7	7	100%
Total Samples	16	8	50%
Source: ADEQ 2020			

7. RECOMENDATIONS

The following section represents recommendations identified through the LHE process.

7.1 Recommended Management Actions

Based on the results of the above evaluation, the BLM recommends the following actions to ensure the Standards are achieved:

- Develop an adaptive management framework to make progress towards achieving Land Health Standards.
- Implement a season of use restriction for the riparian area along the Babocomari River.
- Supplement minerals in the uplands, within the river pasture, to reduce the amount of time livestock spend in riparian areas.
- Implement upland shrub treatments to increase perennial grass cover and reduce shrub encroachment where appropriate based on site-specific conditions.
- Implement erosion control in the uplands including roadway work best management practices in the Blackberry Lane area.
- Conduct erosion control effectiveness monitoring.
- Construct the SPRNCA boundary fence within the Babocomari Allotment.
- Construct larger, more sustainable water gap structures on the Babocomari Allotment boundary.
- Change allotment management category from M (Maintain) to I (Improve).
- Establish a quantitative riparian baseline on the Babocomari Allotment using the Lotic AIM, Multiple Indicator Monitoring, or other applicable monitoring protocols. Once a baseline is established, develop quantitative riparian objectives. The BLM will seek to utilize a working group who would review monitoring data and provide input on the riparian objectives.

7.1.1 Cultural Resources

Future cultural resources inventory and assessment should focus on BLM-administered areas where livestock may concentrate, such as along the Babocomari River and the location(s) of any existing or proposed range improvements. If, as a result of assessment or monitoring, historic properties are identified and found to exhibit potential for or actively occurring grazing impacts, mitigation measures would be developed in coordination with the State Historic Preservation Office and other interested or affected parties, including Native American tribes.

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