Department of the Interior

Bureau of Land Management

An Evaluation of Standards for Rangeland Health for the Hualapai Mountains North Evaluation 2016

BLM COLORADO RIVER DISTRICT

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INTRODUCTION

The Kingman Field Office (KFO) has completed an evaluation for the Hualapai Mountains North area according to the three Arizona Standards for Rangeland Health established by BLM-AZ IM-99-012. Let us look at the three Arizona Standards for Rangeland Health*:*

- ⇒ Standard 1, Upland Health - *Upland soils exhibit infiltration, permeability, and erosion rates that are appropriate to soil type, climate and landform (Ecological site).*
- ⇒ Standard 2, Riparian-Wetland Sites - *Riparian-wetland areas are in proper functioning condition*
- ⇒ Standard 3, Desired Resource Conditions - *Productive and diverse upland and riparian-wetland plant communities of native species exist and are maintained*.

These are the determinations that must be made when evaluating the health of Arizona BLM public land:

- Are plants as diverse and abundant as they should be?
- Is the soil protected from erosion?
- Are the riparian areas functioning as they should?

These are some of the questions that are answered when the BLM evaluates rangeland health. They are important questions to answer because the health of the rangelands is essential for the continued use and enjoyment of these public rangelands.

The purpose of this evaluation is to determine if Rangeland Health Standards are being met within the evaluation area. This evaluation is completed in accordance with the BLM Washington Office Instruction Memorandum 2009-007. The grazing allotment is mentioned throughout the evaluation only as a method of distinguishing the key areas.

EVALUATION AREA

The Hualapai Mountains North Evaluation Area is located in the northwest corner of Arizona, in Mohave County and includes approximately 213,750 acres of public land (Map: Appendix 3-1). It is located on the eastern and western slopes of the north half of the Hualapai Mountains in a transition zone between the Mohave and Sonoran Deserts. Vegetation is comprised of a mix of Mohave and Sonoran Desert Scrub, Desert Grassland, Arizona Interior Chaparral, Pinyon-Juniper, and Ponderosa Pine-Oak. Precipitation range from 6-9 inches in the lowest elevations (2,100 ft. in Sacramento Valley) to 16-20 inches in the highest (8,013 ft. at Dean Peak) elevations. Most precipitation is received in the winter (70%) and a lesser amount in erratic summer monsoons (30%). The document is organized by livestock grazing allotments: Yellow Pine, Hualapai Peak, Hibernia Peak (Unit A), Hibernia Peak (Unit B), Walnut Creek, Lazy YU and Cane Springs Wash.

KEY AREA

Several methods are used to collect land health information but first, "key areas" must be chosen. Key areas are chosen to reflect the effect of grazing on vegetation within the major ecological sites in the evaluation area. There are 27 key areas within the evaluation area. Each key area is comprised of many different perennial plant species and although data is collected for each

species, “key” species are chosen and given closer scrutiny. Key species are selected as they are important palatable species within ecological sites that serve as an indicator of change in the plant community.

By monitoring the long-term change in abundance of these key species, conclusions can usually be drawn about the health and maintenance of not only these plants, but also the other perennial plants and the overall health of the evaluation area. Therefore, the vegetative component of this evaluation (perennial plant frequency and composition), other than perennial plant cover, will be focused on key species at each key area. (Note: perennial cover data and perennial cover objectives include *all* perennial plants at the key area.)

METHODS USED FOR DETERMINING STANDARDS FOR RANGELAND HEALTH

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

Upland health is assessed by an interdisciplinary (ID) team using the 17 indicators from Technical Reference 1734-6 Interpreting indicators of Rangeland Health. This qualitative method uses 17 indicators to evaluate how well ecological processes are functioning based on the three attributes of soil/site stability, hydrologic function, and biotic integrity. Each indicator is evaluated by the ID team and compared to what is expected for the site. Expectations for the site are based on monitoring data (shown in Standard 3 below), NRCS Ecological Site Descriptions, NRCS Reference Sheets, weather data, and professional judgment. Indicators are rated according to their departure from the expected and when combined give the ID team an idea of how the three ecological processes are functioning and whether the site is meeting Standard 1.

If one or more of the attributes (soil/site stability, hydrologic function, and biotic integrity) exhibit a reduced functionality then it may be determined that Standard 1 is not being met. A “preponderance of evidence” approach was used to determine the appropriate departure category for each attribute and helped to determine if Standard 1 is met. However, if the departure from expected of one indicator is of particular concern this could justify a determination that the site is not meeting Standard 1. For example, if the structural/functional group indicator was rated at moderate to extreme because the grass component is greatly reduced or absent, this could justify a determination that the site is not meeting Standard 1.

Each indicator is evaluated by the ID team and compared to what is expected for the site. Expectations for the site are based on past monitoring data, NRCS Ecological Site Descriptions, weather data, and professional judgment. Indicators are rated according to their departure from the expected and when combined give the ID team an idea of how the three ecological processes are functioning and whether the site is meeting Standard 1.

Scientific names of plant species are cross-referenced with common names in Appendix 1.

Standard 2 Riparian-Wetland Sites: Riparian-wetland areas are in proper functioning condition. Proper functioning condition was assessed by an interdisciplinary team following the guidance in Technical Reference 1737-15 and 1737-16 Riparian Area Management. This qualitative method uses a series of indicators to determine if a riparian habitat and its ecological

functions are intact and are capable of being sustained through drought, flooding, and current land uses.

Scientific names of plant species are cross-referenced with common names in Appendix 1.

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

Objectives for Standard 3 were developed by an interdisciplinary team for each key area. The team used NRCS Ecological Site Descriptions, vegetation measures for composition, cover, and frequency, and professional judgment to describe site specific plant community objectives. Current monitoring data was compared to the objectives for each study to determine if an area was meeting Standard 3. Attainment of the site specific objectives would ensure that Standard 3 is met. In order to meet Standard 3 all of the following must be obtained:

a.) Objectives for site-specific plant composition, cover, and frequency are obtained.

b.) The frequency data indicates: Trend is static or upward.

At each key area, cover, frequency (pace frequency), and composition (dry weight rank) were measured following guidance in BLM Technical Reference 1734-4. This information is gathered at 200 points along four transect lines using a 40 cm x 40 cm frame. The point cover data provides information about soil exposure, pace frequency provides information about how frequently a particular species occurs, and dry weight rank provides information about the composition of a particular species relative to other species at the key area.
Scientific names of plant species are cross-referenced with common names in Appendix 1.

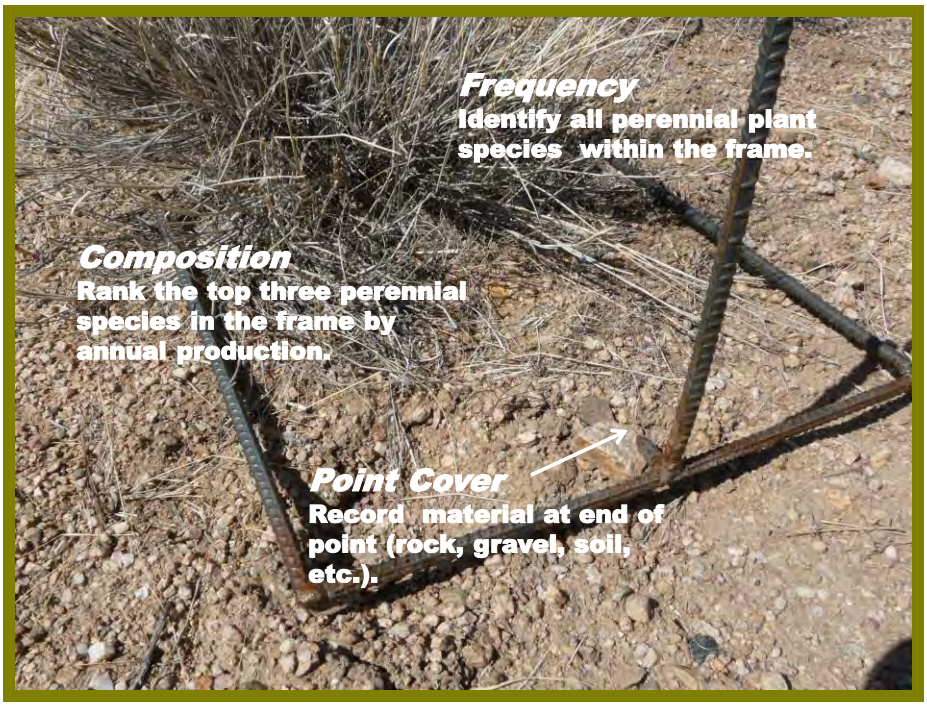


Figure 1. Frame for Frequency and Dry Weight Rank Methods.

APPARENT TREND

Apparent trend is a qualitative single point in time evaluation of a site, based on plant composition, abundance of seedlings and young plants, amount of plant litter, plant vigor, and the condition of the soil surface. Apparent trend was evaluated on each site by an interdisciplinary team using the Natural Resource Conservation Service Apparent Trend worksheet NE-ECS-12 from Nebraska. Apparent trend can be rated as "towards" site potential, "away" from site potential or, trend is not apparent.

OBJECTIVES, DATA SUMMARY, AND ANALYSIS

The data analysis will look at each upland key area or riparian area and how it rated for Standards 1, 2 and 3 of the Standards for Rangeland Health**.** Key areas are organized by livestock grazing allotments: Yellow Pine, Hualapai Peak, Hibernia Peak (Unit A), Hibernia Peak (Unit B), Walnut Creek, Lazy YU and Cane Springs Wash.

YELLOW PINE ALLOTMENT (Map: Appendix 3-2).

Figure 2. Yellow Pine Allotment, approximately 3 miles from Stokes Well.

KEY AREAS

Key Area 1 Yellow Pine

Ecological Site – Granitic Hills, 12-16" p.z., (precipitation zone); 5,200' elev. RO38XA104AZ.

Table 1. Key Area 1 Yellow Pine, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	7%		11%	7-16%
Black grama	T		1%	0-3%
Squirreltail	T		1%	0-3%
Giant dropseed	3%		9%	5-14%
Desert needlegrass	3%		9%	5-14%
Total desirable grass Composition*	13%	8-42%		
Three-awn	3%	T-7%	4%	2-8%
Black-foot daisy	7%	5-9%	3%	1-6%
Desert globemallow	7%	0-1%	10%	6-15%
Turtlebush (MATO)	5%	3-7%	21%	16-27%
Total desirable forbs Composition*	19%	8-17%		
T=trace amount found at the key area.				
Perennial Plant Cover Objective: 54-68%		Current Live Perennial Cover: 50%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many young sideoats grama plants. Black grama was rare but healthy. Red brome is present but very uncommon. Erosion and litter movement was not apparent.

CONCLUSION –Key Area 1 Yellow Pine

Standard 1: Meeting

Rationale: Sixteen of 17 indicators were rated as a "none to slight departure" from expected. One indicator was not measured. Perennial vegetative cover was 71% in 1986 and has decreased to 50% in 2011. A decline in perennial plant cover is attributed to a decline in shrub cover as a result of a prescribed fire that occurred in 2002. Perennial herbaceous cover increased on this site from 1% in 1985 to 4% in 2011.

Standard 3: Meeting

Rationale: The overall trend of this site is up as determined by the significant increase of perennial grasses and forbs, many which are very palatable. Especially noticeable is the appearance or increase of the highly palatable species such as turtle bush, black-foot daisy, and sideoats grama. The plant diversity of this site is high with nine new species detected since the

key area was first established. The trend for sideoats grama, three-awn, and giant dropseed is up. Giant dropseed is a new species for this site and was not detected in the 1980s. The trend for black grama, blue grama, squirreltail, and desert needlegrass is static. The trend for snakeweed and turbinella oak is up. The trend for manzanita and desert ceanothus is down (probably fire related). Perennial plant cover has decreased from 71% in 1986 to 50% in 2011. However, herbaceous cover has increased from 1 to 4% during the same time period. All of the observed changes in cover are probably a result of the prescribed fire in 2002. The overall composition of perennial grass is within the expected levels found in the ecological site description for Granitic Hills. There has been a significant increase of palatable species as evidenced by the 2011 frequency and composition data.

Key Area 2 Yellow Pine

Ecological Site – Granitic Hills, 12-16" p.z., 5,000' elev. RO38XA104AZ.

Table 2. Key Area 2 Yellow Pine, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	2%		5%	3-9%
Black grama	2%		4%	1-5%
Blue grama	1%		3%	0-4%
Sand dropseed	1%		2%	0-4%
Desert needlegrass	T		3%	1-7%
Slim tridens	T		1%	0-2%
Total desirable grass composition*	7%*	6-43%		
Black-foot daisy	6%	0-1%	10%	2-8%
T=trace amount found at the key area Current Live Perennial Cover: 39%		Perennial Plant Cover Objective: 32% to 46%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description

APPARENT TREND

Rating: Trend is Upwards

Rationale: There is a slight presence of invasive species. Desired key species were abundant. There were quite a few young plants and plant vigor was high. No apparent erosion. Site trend is moving slightly upward.

CONCLUSION –Key Area 2 Yellow Pine

Standard 1: Meeting

Rationale: Fifteen of 17 indicators were rated as a "none to slight departure" from expected. The Functional/structural groups indicator was rated as slight to moderate as the diversity of perennial grasses is lower than called for in the ecological site description. One indicator was not measured. Overall perennial vegetation cover and bare ground has remained static.

Standard 3: Meeting

Rationale: This site is predominately a chaparral plant community based on the ecological site description composition information. Shrubs make up 81% of the plant community. Perennial grass naturally makes up a low composition percentage in this community type. The desired plant community meets the composition objectives as it relates to the ecological site description. The overall trend of this site is static for perennial grasses as determined by frequency data however the trend of sideoats grama and black grama, both highly palatable species are up. At the same time the trend for blue grama is down, a less palatable perennial grass species. There has been an increase in plains black-foot daisy as determined by frequency data. Perennial plant cover on this site is static. The overall composition of perennial grass is 7% which is at the lower end but still within the composition objective for this site. The frequency of perennial grasses species are all within the frequency objectives cited in Table 2.

Key Area 3 Yellow Pine

Ecological Site – Granitic Hills, 12-16" p.z., 4,280' elev. RO38XA104AZ.

Table 3. Key Area 3 Yellow Pine, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Three-awn	T		1%	0-4%
Desert needlegrass	8%		17%	8-18%
Bush muhly	T		1%	0-2%
Total grass composition*	9%	5-24%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 54%		Perennial Plant Cover Objective: 44-58 %		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

APPARENT TREND

Rating: Trend not apparent.

Rationale: There is a slight presence of invasive species and desired key species had a moderate presence. There were quite a few young plants and plants with high vigor.

CONCLUSION –Key Area 3 Yellow Pine

Standard 1: Meeting

Rationale: Thirteen of 17 indicators were rated as a "none to slight departure" from expected and one indicator was not measured. Three soil and hydrologic indicators rated as slight to moderate and there was soil movement and some rills observed. Overall perennial vegetative cover and bare ground has remained static.

Standard 3: Meeting

Rationale: This site like Key Area #2 is predominately a chaparral plant community based on the composition data with shrubs making up 77% of the plant community. The desired plant community meets the composition and frequency objectives for desirable perennial grasses as it relates to the ecological site description. The overall trend of this site is static for perennial grasses and shrubs as determined by frequency data with the exception of non-palatable linear-leaf goldenbush which is down. Perennial plant cover on this site is static. The overall composition of perennial grass is 9% which is at the lower end but still within the composition objective for this site. The frequency of perennial grasses species are all within the frequency objectives cited in the Table 3.

Key Area 4 Yellow Pine

Ecological Site: Sandy Loam Upland, 12-16" p.z., (precipitation zone); 3,800' elev. RO30XA315AZ.

Table 4. Key Area 4 Yellow Pine, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	1%		1%	0-2%
Black grama	17%		21%	15-27%
Big galleta	13%		16%	11-21%
Bush muhly	7%		4%	1-7%
Desert needlegrass	5%		6%	3-9%
Total desirable grass composition*	43%	12-49%		
Desert rock pea	T	2-4%	2%	0-4%

T= trace amount found at the key area.
Current Live Perennial Cover: 43% (herb canopy sig. increase) woody canopy sig. decrease, bare ground the same. Perennial forbs sig. increase in species diversity and frequency.
Perennial Plant Cover Objective: 36-50%

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

APPARENT TREND

Rating: Trend is Upward.

Rationale: Seedlings and young of desired plants are abundant and vigor of palatable species is high. Erosion is slight and there is a slight presence of invading undesirables (red brome).

CONCLUSION –Key Area # 4 Yellow Pine

Standard 1: Meeting

Rationale: Thirteen of 16 indicators were rated as a "none to slight departure" from expected, three of the hydrologic indicators were rated as slight to moderate. Overall this site has a very healthy plant community and healthy soils.

Standard 3: Meeting

Rationale: The overall trend of this site is up as determined by the significant increase of perennial grasses and forbs, many which are very palatable. Especially noticeable is the appearance or increase of the highly palatable species such as turtle bush and black-foot daisy. Perennial forb diversity made an increase along with a significant increase in frequency of the perennial grasses such as black grama and desert needlegrass. Composition of the desirable perennial plant species is within range of the composition found in the ecological site guide with the exception of bush muhly which is higher.

Key Area 5 Yellow Pine

Ecological Site –Limy Upland, 12-16" p.z., 4,440' elev. RO38XA106AZ.

Table 5. Key Area 5 Yellow Pine, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	4%		14%	19-31%
Black grama	12%		32%	29-43%
Big galleta	23%		42%	21-33%
Desert needlegrass	1%		4%	1-7%
Slim tridens	3%		9%	1-7%
Total desirable grass composition*	43%	≥18%		
Three-awn	7%	0-1%	21%	39-53%
Eragrostis sp.	4%	≤4%	11%	<11%
Black-foot daisy	1%		3%	2-8%
Desert rock pea	2%		4%	0-4%
White-stem paperflower	1%		4%	2-8%
Short-leaf baccharis	1%		3%	1-7%
Total desirable shrubs and forbs composition*	5%	3%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 52%		Perennial Plant Cover Objective: 36-50%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

APPARENT TREND

Rating: Trend Toward.

Rationale: The site is chaparral and grass due to its elevation and aspect. Vigor of desirable species is very high with no apparent erosion. Young plants and seedling of desired plants are very abundant. There is a slight presence of invading undesirable species (lovegrass, Eragrostis sp.). Plant diversity was high with many perennial grass and forb species.

CONCLUSION –Key Area 5 Yellow Pine

Standard 1: Meeting

Rationale: Fifteen of 17 indicators were rated as a "none to slight departure" from expected. One indicator, Plant Community Composition, was rated as slight to moderate due to the increase in perennial grass over chaparral shrubs. One indicator was not measured. Plant diversity was high with many perennial grass and forb species.

Standard 3: Meeting

Rationale: All of the desirable grass species are meeting their frequency objectives with the exception of sideoats grama which is slightly below. These same species are meeting or exceeding their composition levels as compared to the ecological site description. Big galleta is well above the composition levels with sideoats grama and black grama just above the levels set in the site description. As a group the desirable grass species are at 43% composition, well exceeding the ≥ 18% composition objective set for this group. All desirable forbs and shrubs are meeting the frequency objectives and composition objectives with the exception of black-foot daisy which is slightly above the objective. The increase in frequency of the invasive lovegrass from 1% to 11% is of concern.

HUALAPAI PEAK ALLOTMENT (Map: Appendix 3-3).

KEY AREAS

Key Area 2 Hualapai Peak

Ecological Site –Granitic Hills, 12-16" p.z., (precipitation zone); 5,297' elev. RO38XA104AZ

Table 6. Key Area 2 Hualapai Peak , Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	11%		15%	10-20%
Black grama	2%		17%	12-22%
Cane beardgrass	T		2%	0-4%
Desert needlegrass	8%		42%	27-41%
Green sprangletop	2%		3%	0-2%
Total desirable grass composition*	23%	17-41%		
Three-awn	3%	T-4%	6%	6-14%
Desert globemallow	1%		3%	1-5%
Twinberry	11%		20%	14-26%
Total desirable forb composition*	12%	1-4%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 39%		Perennial Plant Cover Objective: 36-50%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

APPARENT TREND

Rating: Trend is Upward

Rationale: The site is very healthy with high vigor and a lot of seed heads on perennial grass. Grass and forb productivity is high. Seedlings of black grama, desert needlegrass, and twinberry were abundant. Erosion was not apparent and there were no invading undesirable plants.

CONCLUSION –Key Area 2 Hualapai Peak

Standard 1: Meeting

Rationale: Sixteen of 17 indicators were rated as a "none to slight departure" from expected. One indicator was not measured. There were no rills and no soil movement. Where the soil was not covered with gravel and rock, the area was well vegetated. There was very little bare ground, the soils were stable with organic matter. Annual perennial plant production and reproduction was excellent for all perennial grasses and twinberry. Plant diversity was high with many perennial grass and forb species.

Standard 3: Meeting

Rationale: The trend of green sprangletop, desert needlegrass, and twinberry all palatable perennial plant species is up. The trend for all desirable grass and forb species are within the frequency objectives and the total desirable grass composition is within the composition objective. Desirable forb composition is above the composition objective set for this key area. There is a high diversity of plants on this site, especially perennial grasses and forbs. Perennial plant cover is static. However, herbaceous cover has increased in the plant community since the late 1980s while woody canopy cover has declined. This decline may be a result of a drop in the frequency of goldenbush, a species that is not palatable.

Key Area 4 Hualapai Peak
Ecological Site – Granitic Hills, 12-16" p.z., 4,600' elev. RO38XA104AZ.

Table 7. Key Area 4 Hualapai Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	5%		9%	12-22%
Black grama	9%		13%	16-28%
Big galleta	21%		28%	13-23%
Slim tridens	12%		22%	12-22%
Total desirable grass composition*	47%	≥25%		
Three-awn	4%	T-7	9%	6-14%
Black-foot daisy	T		1%	0-2%
Twinberry	9%		13%	12-22%
Total desirable forb composition*	10%	≥2%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 46%		Perennial Plant Cover Objective: 39-53%		

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 4 Hualapai Peak

Standard 1: Meeting

Rationale: Fifteen of 17 indicators were rated as a "none to slight departure" from expected. One indicator was not measured. Due to the presences and productivity of non-native annual grass, the invasive plants indicator was rated as moderate. Perennial plant cover has increased on this site from 36% in 1988 to 46% in 2012.

Standard 3: Meeting

Rationale: The trend of big galleta and slim tridens, both palatable perennial plant species, is up. The trend for sideoats and black grama is down, therefore the frequency objective for these two grasses are not being met. The trend for twinberry is also down. The increase in big galleta and slim tridens does help offset the decline of other grasses. Although, the frequency is down for some grasses, the total desirable grass composition is above the composition objective. There is a high diversity of plants on this site, especially perennial grasses. Desirable forb composition is above the composition objective and within the frequency objectives set for this key area.

Perennial plant cover has increased on this site from 36% in 1988 to 46% in 2012 with the herbaceous canopy improving from 9% in 1988 to 21% in 2012. Although, the frequency is down for some grasses overall cover for grasses and forbs has shown a significant increase.

Key Area # 5 Hualapai Peak

Ecological Site –Sandy Loam Slopes, 10-13" p.z., Limy, Skeletal, 4,200' elev. RO30XC331AZ

Table 8. Key Area 5, Hualapai Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	2%		2%	0-5%
Black grama	29%		57%	50-64%
Big galleta	16%		23%	12-23%
Bush muhly	3%		9%	3-8%
Squirreltail	1%		0	0-2%
Desert needlegrass	T		0%	0-2%
Total desirable grass composition*	51%	≥40%		
Three-awn	3%	0-3%	11%	7-15%
Black-foot daisy	T		1%	1-5%
Desert globemallow	T		0.5%	0-2%
Total desirable forb composition*	T	0-6%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 26%		Perennial Plant Cover Objective: 20-38%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 5 Hualapai Peak

Standard 1: Meeting

Rationale: Fifteen of 17 indicators were rated as a "none to slight departure", one indicator, Plant Mortality and Decadence was rated as slight to moderate from expected. One indicator was not measured. Bare ground has declined from 39% in 1993, to 22% in 2012 and litter went up at the same time. Most litter would have been from perennial plants as few annuals were present.

Standard 3: Meeting

Rationale: The frequency of bush muhly (3% in 1993 to 9% in 2012) and big galleta (13% in 1993 to 23% in 2012) has increased. The frequency of sideoats grama, squirreltail, desert needlegrass, desert globemallow, and black-foot daisy are static. Three awn (49% frequent in 1993 to 11% frequent in 2012) and black grama (73% frequent in 1993 to 57% in 2012) have

declined in frequency. The composition of black grama is 29%, which is 3 times higher than the 10% described in the ecological site description. Big galleta composition is 16% which is within the range given in the site description. Bare ground has declined from 39% to 22%. Seed heads of big galleta are commonly found in the open. Plant diversity was high with many perennial grass and forb species.

Key Area # 6 Hualapai Peak

Ecological Site –Sandy Loam Slopes, 10-13" p.z., Limy, Skeletal, 4,200' elev. RO30XC331AZ

Table 9. Key Area 6 Hualapai Peak , Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Black grama	5%		8%	10-20%
Big galleta	47%		46%	33-47%
Bush muhly	2%		5%	2-8%
Sand dropseed	4%		6%	1-7%
Total desirable grass composition*	58%	≥37%		
Three-awn	6%	0-3%	3%	12-22%
T=trace amount found at the key area.				
Current Live Perennial Cover: 28%		Perennial Plant Cover Objective: 21-33%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 6 Hualapai Peak

Standard 1: Meeting

Rationale: Nine of the 16 indicators measured are rated as "none to slight departure", 7 were rated as slight to moderate departure from expected. One indicator was not measured. Rills and water flow patterns, litter movement, plant community composition, functional structural groups and plant mortality and decadence, litter amount, and invasive plants are all slight to moderate departure. Bare ground has remained static at 46% since 1993 with an average of 42%. Plant diversity is low. Perennial plant cover has fluctuated from 33% in 1993, 7% in 1998, to 28% in 2012. Litter has also fluctuated from 21% in 1993, 39% 1998, then to 24% in 2012

Standard 3: Not Meeting but Making Significant Progress

Rationale: The frequency of big galleta is static from 1993 to 2012 (42% in 1993 to 29% in 1998, and 46% in 2012). Bush muhly is static. The frequency of black grama decreased in the same time period from 60% in 1993, 3% in 1998, to 8% in 2012. Although the frequency of black grama had a significant drop from 1993 to 1998, it has improved from 1998 to 2012

indicating that this species is making progress towards the frequency objective. Three-awn also decreased from 40% in 1993, 7% in 1998, to 3% in 2012. Sand dropseed increased from 1% in 1993 to 6% in 2012.

The composition of big galleta and three-awn is twice the expected amount when compared to the ecological site. The composition of all other palatable species is within the range found in the ecological site guide however black grama is at the lower end of the spectrum.

Overall, perennial plant cover is static however woody canopy decreased from 19% in 1993 to 10% in 2012. The drop in woody canopy is most likely from the unpalatable snakeweed which decreased from 55% in 1993, to 29% in 2012. The frequency of some grasses is down and overall herb cover is static. The significant drop in the frequency of black grama early in the evaluation period is the biggest factor in this site not meeting Standard 3. However, since 1998 black grama has improved from 3% to 8% which indicates this species is making significant progress towards meeting Standard 3.

Key Area 7 Hualapai Peak

Ecological Site –Sandy Loam Slopes, 10-13" p.z., Limy, Skeletal, 4,200' elev. RO30XC331AZ

Table 10. Key Area 7 Hualapai Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Black grama	12%		22%	24-36%
Big galleta	41%		41%	35-49%
Sand dropseed	2%		4%	0-4%
Total desirable grass composition*	55%	≥32%		
Three-awn	3%	0-3%	6%	19-31%
Short-leaf baccharis	T	0-3%	1%	0-2%
T=trace amount found at the key area.				
Current Live Perennial Cover: 33%		Perennial Plant Cover Objective: 20-32%		

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area # 7 Hualapai Peak

Standard 1: Meeting

Rationale: Fifteen of the 17 indicators measured are rated as "none to slight departure, and one indicator was rated as slight to moderate. There was some pedestalling indicative of erosion, present on the site. One indicator was not measured. Bare ground has decreased from 38% in

1990 to 29% in 2012. Perennial plant cover has increased from 26% in 1990 to 33% in 2012, due to an increase of woody canopy. The increase in woody canopy may be due to an increase in snakeweed. Litter has also fluctuated primarily due to ephemeral plant production.

Standard 3: Not Meeting

Rationale: The frequency of black grama has significantly declined from 1990 to 1998 (87% to 47%). It also declined from 1998 to 2013 (47% to 22%). The trend of big galleta is static from 35% in 1990 to 41% in 2013. Three-awn is down from 31% in 1990 to 6% in 2013. Snakeweed has increased from 19% in 1990 to 51% in 2013. Sand dropseed increased from 1% in 1990 to 4% in 2013. Short-leaf baccharis a highly palatable species is static.

The composition of big galleta in 2013 is double the amount called for in the ecological site description. Black grama at 12% is slightly above the 5-10% composition called for in the site description. Sand dropseed, three-awn, and short-leaf baccharis are all within the composition range found in the ecological site description.

Perennial plant cover has increased from 26% in 1990 to 33% in 2013, due to an increase of woody canopy. However, this increase was most likely from an increase in snakeweed an invasive native plant. Overall, cover for herbaceous species is down from 24% in 1990 to 16% in 2013. The significantly declined in the frequency of black grama coupled the increase in snakeweed is why this site is not meeting Standard 3.

Key Area 8 Hualapai Peak

Ecological Site – Granitic Hills, 12-16" p.z., 4,350' elev. RO38XA104AZ

Table 11. Key Area 8 Hualapai Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	T		0%	1-5%
Black grama	6%		6%	7-15%
Big galleta	42%		43%	23-35%
Slim tridens	T		1%	0-2%
Desert needlegrass	1%		1%	0-4%
Total desirable grass composition*	50%	≥40%		
Three-awn	4%	T-7%	8%	8-13%
Black-foot daisy			1%	1-7%
Twinberry	1		7%	3-9%
Shrubby buckwheat	2		6%	1-7%
Total desirable forb composition*	3% 6%	T-9%		

T=trace amount found at the key area.
Current Live Perennial Cover: 41% Perennial Plant Cover Objective: 27-41%

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 8 Hualapai Peak

Standard 1: Meeting

Rationale: Sixteen of the 17 indicators measured are rated as "none to slight departure, and one indicator was rated as slight to moderate. One indicator was not measured. No apparent erosion such as pedestalling was noted. Vigor of desirable species was very high. Seedlings and young desired plants were very abundant. Bare ground has been static slightly fluctuating from 9% in 1988, to 8% in 1993, and 10% in 2012. Perennial plant cover has increased from 26% in 1988, 35% in 1993, and up to 41% in 2012. Woody canopy remained static but herb canopy increased from 5% to 18% in the same time period. Litter has fluctuated primarily due to ephemeral plant production. Plant diversity is what is expected for the site.

Standard 3: Meeting

Rationale: The frequency of black grama and sideoats grama has significantly declined. Black grama went from 12% in 1988 to 6% in 2012. Sideoats grama went from 8% in 1988 to 0% in 2012. It is important to point out that sideoats grama is not absent from the site as it was picked up in composition data collection. Big galleta has increased from 16% to 43% over the same time period. Shrubby buckwheat also increased in frequency from 2% to 6%. Twinberry, slim tridens, and desert needlegrass have remained static. Snakeweed an invasive native plant species decreased from 75% in 1988 to 35% in 1993, to 8% in 2012.

Big galleta in 2013 is double the amount called for in the ecological site description. Black grama at 6% is within the 1-8% composition called for in the site description. Even though the increase in big galleta is a good trend, it doesn't make up for the loss in frequency of grama grass on this site. Black-foot daisy, twinberry and shrubby buckwheat are all within the composition and frequency objectives. The composition of desirable grasses is above the composition objectives and herb canopy increased from 5% in 1988 to 18% in 2012. Overall, plant diversity is high, herb canopy increased, and snakeweed dropped in frequency.

The loss in production and frequency of grama grasses at this site is not surprising since most species of grama grasses are short lived (6 to 8 year average) and are less drought tolerant than other grass species found at the key area, such as big galleta.. Research has shown that tobosa grass, a similar species and close relative to big galleta can live for over one hundred years. It is suspected that big galleta grass and tobosa grass have similar long life spans. Besides living longer, big galleta grass is commonly found in a wide variety of ecological sites including those with precipitation ranges of 3 to 6 inches. Ecological sites with a 6 inch or less average annual rainfall are usually located on low elevations hyper thermic soils. Typically these ecological sites have the highest average air temperature in the Kingman Field Office. Grama grasses are usually not found in these hotter and drier ecological sites.

Review of Kingman climate data (NOAA and BLM weather stations) suggest that the frequency and duration of drought has been increasing since the late 1980's. The increase in drought conditions may favor species such as big galleta that can occur in low rainfall, high temperature areas. Monitoring data from this key area appears to support this hypothesis, since both the frequency and composition of big galleta has increased, whereas the frequency of the grama grasses has decreased. The climate has become warmer and dryer. The latest prediction on future climate conditions is less rainfall and higher temperatures. Therefore the plant community that currently is present may be the new normal for this area. Key area objectives have therefore been set accordingly.

HIBERNIA PEAK ALLOTMENT – UNITS A & B (Map: Appendix 3-4).

Key Area 1, Mountain Pasture, Hibernia Peak Allotment Unit A

Ecological Site: Granitic Hills 12-16" p.z., (precipitation zone); 4,460' elev. RO38XA104AZ

Figure 6. Key Area 1, 1983

Figure 7. Key Area 1, 2009

Table 12. Key Area 1, Hibernia Peak Unit A, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	16%		26%	33-47%
Green sprangletop	26%		57%	32-46%
Black grama	2%		5%	2-8%
Desert needlegrass	1%		3%	0-2%
Total desirable grass composition*	46%	≥37 *		
Desert globemallow	1%	0-1%	3%	0-4%
False mesquite	28%		54%	46-60%
Short-leaf baccharis	T		1%	0-4%
Total desirable shrub composition*	28%	>7%*		
T=trace amount found at the key area.				
Current Live Perennial Cover: 34%		Perennial Plant Cover Objective: 21-33 %		

* Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

Allotment Management Plan (AMP) Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data has been collected at this study site seven times over the evaluation period, during this time utilization levels have never exceeded 50%. During this same time frame the average use levels have been 17% on sideoats grama which is the heaviest utilized species at this site.

2.) Maintain or increase the frequency of the following key species* over the next 10 years. **Meeting**

*Sideoats grama- maintain at 53%
*Black grama- maintain at 6%

Rationale: The trend for sideoats grama is down with the frequency currently at 26% however, the composition for this species is still above levels found in the ESD. During the same time period, the highly palatable species green sprangletop has shown a significant increase in frequency from 6% in 1986 to the current 57%. Green sprangletop a palatable warm season grass may be replacing or displacing sideoats grama. The trend for black grama and desert needlegrass is static. The plant community as a whole has high productivity and diversity of key forage species.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many young green sprangletop plants. Sideoats grama is slightly above the levels called for in the ecological site description. Sideoats grama and black grama have average vigor and reproductive capability. The overall health of the key area is acceptable and meeting standards. Red brome is present but very uncommon. Erosion and litter movement was not apparent.

CONCLUSION Key Area 1, Mountain Pasture, Hibernia Peak Allotment Unit A

Standard 1: Meeting

Rationale: Sixteen of 16 indicators were rated as a "none to slight departure" from expected and one indicator was not measured. Since 1986 live perennial vegetation cover has increased from 11% to 34% in 2009.

In 2009 the percentage of bare ground was 3% compared to 58% in 1986 when the key area was established. The increase in cover is due to an increase in perennial herb and woody canopy cover.

The reproductive capability of palatable species is good with average plant vigor for all species. Reproduction is evident. There were many young plants and abundant seed heads observed at the key area. The site supports a diversity of perennial plant species. Plant stature of palatable

plant species is as expected for a healthy plant community. The functional structural groups that are present are diverse.

All soil and hydrological indicators are meeting the standards.

Standard 3: Meeting

Rationale: The desired plant community meets the composition objectives as it relates to the ecological site description. The overall trend of this site is up as determined by the significant increase of perennial grasses and shrubs many which are very palatable. The combined composition of palatable perennial grass is high at 46%. Especially noticeable is the increase in a highly palatable species, such as green sprangletop which may be replacing or displacing sideoats grama which is showing a downward trend. Green sprangletop is a short lived species and the increase of the frequency of this species may be short-term depending on environmental conditions. The plant diversity of this site is high with new species detected in the last few years. The trend for black grama, three-awn, and desert needlegrass is static. The trend for sideoats grama is down however plant composition for this species is still above levels found in the ESD. A significant decrease in the frequency of plants such as snakeweed and linear-leaf goldenbush, indicate trend is down for these undesirable species. Perennial plant cover has increased from 11% in 1986 to 34% in 2009. The overall composition of perennial grass is 46% which is above the composition objective of 37%. 37% is the upper composition level cited in the ecological site description for the perennial grasses species shown in the table above.

Figure 9. Hibernia Peak Unit B Allotment North Pasture.

Key Area 2, Mountain Pasture, Hibernia Peak Allotment Unit A

Ecological Site – Granitic Hills, 12-16" p.z., 4,416' elev., RO38XA104AZ.

Table 13. Key Area 2 Hibernia Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	2%		5%	5-13%
Black grama	27%		58%	29-43%
Green sprangletop	T		1%	0-2%
Cane beardgrass	11%		26%	9-19%
Big galleta	1%		2%	0-4%
Bush muhly	T%		1%	0-2%
Sand dropseed	1%		2%	5-13%
Slim tridens	T		1%	0-2%
Total desirable grass composition*	42%	≥37%		
False mesquite	18%	>7%	36%	21-33%
T=trace amount found at the key area.				
Perennial Plant Cover Objective: 31-45%		Current Live Perennial Cover: 48%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data has been collected at this study site eight times over the evaluation period and during this time utilization levels have never exceeded 50%. During this same time frame the average use levels have been 20% on black grama which had the highest utilization levels on this site.

2.) Maintain or increase the frequency of the following key species over the next 10 years. **Meeting**

* Key species: Sideoats grama- maintain at 6%
Black grama- maintain at 33%
Cane beardgrass- maintain at 14%

Rationale: Frequency data indicates sideoats grama has been static over the evaluation period and has a frequency of 5%. During the same time frame both black grama and cane beardgrass have shown a significant increase in frequency. These two palatable species almost doubled in frequency. In 1992, black grama had a frequency of 33% and by 2014 had increased to 58%. During the same time frame the frequency of cane beardgrass increased from 14% to 26%. The increase in the frequency of black grama and cane beardgrass indicate an upward trend.

Figure 10. 1987 Key Area 2 **2014 Key Area 2**

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many young plants (cane beardgrass and black grama). Black grama has increased from 26% in 1987 to 58% in 2014. Red brome is present but very uncommon. Erosion and litter movement was not apparent.

CONCLUSION –Key Area 2, Mountain Pasture, Hibernia Peak Allotment Unit A

Standard 1: Meeting

Rationale: Sixteen of 17 indicators were rated as a "none to slight departure" from expected one indicator was not measured. Since 1987, live vegetation or perennial plant cover has increased, going from 30% in 1987 to 48% in 2014. In early photos of the key area rocks are a dominant feature with perennial grass not apparent in the photos. Comparing photos taken in 1987 to 2014, rocks have become obscured by abundant perennial plant cover, primarily perennial grass. All soil and hydrological indicators are meeting the standards.

Standard 3: Meeting

Rationale: The overall trend of this site is up as determined by the significant increase in frequency of palatable perennial grasses and shrubs. The composition of perennial grass is at 42% which is greater than the 37% composition objective. Especially noticeable is the appearance of palatable species such as cane beardgrass and green sprangletop which has improved the diversity and productivity of this site. The frequency of cane beardgrass and black grama has almost doubled since 1987. The trend for sideoats grama is slightly down and the trend for bush muhly, slim tridens, green sprangletop, and big galleta are static. The trend for unpalatable native plants such as snakeweed and linear-leaf goldenbush, are down. Perennial plant cover has increased from 30% in 1987 to 48% in 2014. The overall composition and diversity of perennial grass is within or close to the expected levels found in the ecological site description for Granitic Hills.

Key Area 3, Mountain Pasture, Hibernia Peak Allotment Unit A

Ecological Site – Granitic Hills, 12-16" p.z., 4,455' elev., RO38XA104AZ.

Table 14. Key Area 3, Hibernia Peak Unit A, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	31%		46%	39-53%
Black grama	7%		16%	11-21%
Sand dropseed	T		1%	1-7%
Desert needlegrass	T		0%	0-2%
Total desirable grass composition*	38%	≥33%		
Shubby buckwheat.	7%	T-7%	14%	18-30%
T=trace amount found at the key area.				
Perennial Plant Cover Objective: 26-41 %		Current Live Perennial Cover: 26% (38%)		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data has been collected at this study site eight times over the evaluation period and during this time utilization levels have never exceeded 50%. During this same time frame the average use levels have been 24% on black grama which has the highest average utilization levels on this site.

2.) Maintain or increase the frequency of the following key species over the next 10 years. **Meeting**

* Key species: Sideoats grama- maintain at 54%
Black grama- maintain at 20%
Sand dropseed- maintain at 3%

Monitoring data indicates the frequency of black grama and sand dropseed is static and has been maintained over the evaluation period. During the same period of time the frequency of sideoats grama has decreased from 54% to 46%. The key area was setup in a chaparral plant community which had been treated (burned) just prior to it being established (see rational for Standard #3 below for more information). The fact that the site potential for this key area is chaparral, the objective to maintain or increase grass species at the indicated levels may be unrealistic. The team recommends the AMP

Objectives for this key area be modified to reflect the potential plant community of chaparral. Another option would be to move or establish a new key are to a site with a higher potential for understory species.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many seed heads on sideoats grama and stolon sets (seedlings) of black grama. Red brome is present but very uncommon. Erosion and litter movement was not apparent.

CONCLUSION Key Area 3, Mountain Pasture, Hibernia Peak Allotment Unit A

Standard 1: Meeting

Rationale: Sixteen of 17 indicators were rated as a "none to slight departure" from expected, one was not measured. Shrubs have increased in frequency at this key area. The key area is located on a north facing slope and an increase in shrubs is expected on north facing aspects in the Hualapai Mountains.

Standard 3: Meeting

Rationale: The overall trend of this site is static based on perennial plant frequency data. Over the evaluation period the trend of black grama, squirreltail, sand dropseed, desert needlegrass, and slim tridens is static. The trend for sideoats grama and shrubby buckwheat is down. The trend for unpalatable native plants such as snakeweed and linear-leaf goldenbush is down. Perennial plant cover is down. The overall composition of perennial grass is above the composition objective and above the expected levels found in the ecological site description for Granitic Hills. The composition of sideoats grama is above what is called for in the ecological site description. Since 1987, live vegetation or perennial plant cover has decreased. A decline in woody plant cover may have contributes to the decline in overall perennial plant cover. Since 1987, woody canopy decreased from 38% to 26% in 2016.

This key area is on a north facing aspect which is typically dominated by large shrub species. This type of plant community is known as Arizona Interior Chaparral. This site was burned in 1987 in order to open up closed stands of chaparral and allow more understory species (grasses and forbs) to occupy this plant community. It was expected that over time these treated areas would once again return to a chaparral plant, shrub dominated community and the composition of understory species such as perennial grass would decline. Monitoring data and photos from this site indicates that large shrub species have increased and understory species have declined over the evaluation period. This sites potential plant community is chaparral and according to the monitoring data the plant community is moving toward its potential.

HIBERNIA PEAK ALLOTMENT – UNIT B

Key Area 4, Mountain Pasture, Hibernia Peak Allotment Unit B

(See Figure 9)

Ecological Site – Granitic Hills 12-16"p.z., 4,390' elev. R038XA104AZ

Table 15. Key Area 4 Hibernia Peak Unit B, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	3%		6%	3-9%
Black grama	4%		6%	3-11%
Sand dropseed	2%		3%	1-5%
Desert needlegrass	7%		12%	1-5%
Total desirable grass composition*	16%	13-37%*		
Three-awn	1%	T-3%	18%	0-4%
Lehmann's lovegrass	1%	0	2%	0
Shrubby buckwheat	1%	T-7%	1%	0-4%
False mesquite	0	2-7%	0	2-8%
T=trace amount found at the key area.				
Current Live Perennial Cover: 13% (30%)		Perennial Plant Cover Objective: 22-34%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

No AMP Objectives were established for this site.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many seed heads and seedlings of grama grasses. The functional structural groups are all present and plant production is high. Erosion and litter movement was not apparent.

CONCLUSION: Key Area 4, Mountain Pasture, Hibernia Peak Allotment Unit B

Standard 1: Meeting

Rationale: 15 of the 17 indicators measured were rated as "none to slight departure, 2 were rated slight to moderate. The soils are heavily armored with 40% of the cover made up of gravel and rock. Bare ground has significantly decreased since the key area was established probably due to an increase in litter from 18% to 41%. Perennial cover has decreased possibly due to a significant decrease in the frequency of unpalatable woody species such as snakeweed and linear-leaf goldenbush. The reproductive capability of palatable species is as expected for the plant community. There were abundant seed heads on perennial grasses.
The site supports a diversity of perennial plant species. Plant stature of palatable plant species is as expected for a healthy plant community. The functional structural groups that are present are diverse and production is high for most species.

All soil and hydrological indicators are meeting the standards.

Standard 3: Meeting

Rationale: All species meet the desired plant community composition objectives with the exception of sideoats grama which is slightly below the desired composition and false mesquite which was not detected in 2015. The frequency of sideoats grama, black grama, and sand dropseed are static. There has been a significant increase in desert needlegrass in the community. Lehmann's lovegrass an exotic species was detected for the first time in 2015 and was at 1% composition and 2% frequency (see Rationale, Standard 3, Key Area 7 on this allotment for more detail about this species). Overall this is a healthy plant community showing an increase in the diversity of perennial grass species and a decrease in the frequency of snakeweed.

Key Area 5, South Pasture, Hibernia Peak Allotment Unit B

Ecological Site – Loamy Upland 10-13" p.z., Limy 4,080' elev. RO40XA130AZ

Table 16. Key Area 5 Hibernia Peak Unit B, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	1%		3%	1-5%
Bush muhly	8%		16%	15-27%
Big galleta	14%		31%	21-33%
Black grama	26%		44%	40-54%
Desert needlegrass	T		1%	0-2%
Total desirable grass composition*	49%	44-64%*		
Lehmann's lovegrass	13%		29%	< 23%
Slender poreleaf	2%		2%	1-5%
Whitestem paperflower	2%	<6%	3%	3-9%
False mesquite	2%	T-2%	4%	1-7%
Total desirable shrub composition*	4%	2-3%*		
T=trace amount found at the key area.*				
Current Live Perennial Cover: 28%		Perennial Plant Cover Objective: 27-41%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data was collected twice, in years 2014 and 2016. Sideoats grama had the highest use level at 33% average with the highest use at 46%.

2.) In all plots maintain or increase the frequency and production of the key species. **Meeting.**

Rationale: See Standard 3 for analysis.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many seed heads and seedlings of desert needlegrass, sideoats grama and black grama. The site supports a high diversity of perennial plant species. Plant species composition is as expected. The functional structural groups are all present and plant production is high. Erosion and litter movement was not apparent.

CONCLUSION: Key Area 5, South Pasture, Hibernia Peak Allotment Unit B

Standard 1: Meeting

Rationale: Thirteen of the 17 indicators measured were rated as "none to slight departure" from expected. One indicator was not measured. At this site all soil and hydrological indicators are close to or within what is expected for those ecological sites. The soils are heavily armored with gravel and rock making up 34% of the cover at this site.

All of the biotic indicators are within what is expected with the exception of the three indicators No. 12 (Functional/ Structural Groups), No. 16 (Invasive Plants) and No. 17 (Reproductive Capability of Native Species.). All three indictors were rated as slight to moderate departure from the expected. The reason for this rating is directly related to the non-native Lehmann's lovegrass which currently makes up 13% plant composition. There are concerns with Lehmann's lovegrass increasing in both frequency and composition at this site in the future.

Standard 3: Meeting

Rationale: This key area has been established for only a short period of time and has been read twice, the readings being two years apart. The desired plant community meets the composition objectives as it relates to the ecological site description with the exception of the presence of Lehmann's lovegrass. In two years Lehmann's has remained static and has not increased in frequency. The key area is meeting the frequency objectives for all species with the exception of Lehmann's lovegrass. The frequency of sideoats grama, black grama, desert needlegrass, Lehmann's lovegrass, and false mesquite are static. The frequency of big galleta is up and bush muhly is down. It is important to point out that increase or decrease in frequency and/or composition at this site, are most likely related to differences in sampling between the different observers because vegetative attributes in desert ecosystems change very slowly. Therefore, this site should not have changed much in only two years.

There is a concern that over time Lehmann's lovegrass may increase in frequency and composition as it has at Key Area #7 (see Rationale, Standard 3, Key Area 7 on this allotment for more detail about this species). The Key Area overall, supports a healthy plant community therefore, this site is meeting Standard 3.

Key Area 6, Middle Pasture, Hibernia Peak Allotment Unit B

Ecological Site – Sandy Loam Slopes, 10-13"p.z., Limy Skeletal, 3,280' elev. R030XC331AZ

Table 17. Key Area 6 Hibernia Peak Unit B, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Slim tridens	9%		43%	38-52%
Big galleta	12%		28%	25-37%
Bush muhly	T		2%	0-4%
Black grama	4%		21%	26-38%
Total desirable grass composition*	25%	17-40%		
Three-awn	3%	0-3%	20%	14-26%
False mesquite	13%	1-5%	35%	28-42%
T=trace amount found at the key area.				
Current Live Perennial Cover: 32%		Perennial Plant Cover Objective: 26-38%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data was collected three times in years 2014, 2015, and 2016. Black grama was the heaviest used species with an average use of 45%, with the highest use at 49%.

2.) In all plots maintain or increase the frequency and production of the key species. **Meeting.**

Rationale: See Standard 3 for analysis.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. Diversity of desirable perennial plan species is high. Plant species composition is as expected. The functional structural groups are all present and plant production is as expected. Erosion and litter movement was not apparent.

CONCLUSION: Key Area 6, Middle Pasture, Hibernia Peak Allotment Unit B

Standard 1: Meeting

Rationale: Sixteen of the 17 indicators measured were rated as "none to slight departure and 1was not measured. The soils are armored with 34% of the cover made up of gravel and rock. Bare ground is 21%. The site supports a diversity of perennial plant species. Plant stature of palatable plant species is as expected for a healthy plant community. The functional structural groups are all present and plant production is high. Soil and hydrological indicators were as expected for the site.

Standard 3: Meeting

Rationale: This key area was newly established in 2015. The desired plant community meets the composition objectives as it relates to the ecological site description. The half shrub false mesquite is above the amount listed, however this is not of concern as it is a palatable species. The frequency and diversity of palatable perennial grasses is high. Desirable grass species are all meeting the frequency objectives with the exception of black grama which is slightly below the objective. The overall health of this key area is acceptable and meeting standards with adequate perennial plant cover.

Key Area 7 North Pasture, Hibernia Peak Allotment Unit B

Ecological Site – Sandy Loam Slopes, 10-13"p.z., Limy Skeletal, 4,000' elev. R030XC331AZ

Table 18. Key Area 7, Hibernia Peak, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	4%		30%	13-23%
Big galleta	2%		6%	8-18%
Black grama	2%		10%	3-11%
Desert needlegrass	T		4%	7-17%
Total desirable grass composition*	8%	17-40%*		
Three-awn	4%	0-3%	13%	7-17%
Lehmann's lovegrass	65%	<50%	94%	24-36%
False mesquite	10%	1-5%	53%	40-54%
T=trace amount found at the key area.				
Current Live Perennial Cover: 44%		Perennial Plant Cover Objective: 33-47%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

    Rationale: Utilization data was collected three times in years 2008, 2014, and 2015. Sideoats grama was the heaviest used species with an average use of 10%, with the highest use at 15%.

2.) In all plots maintain or increase the frequency and production of the key species. **Meeting.**

    Rationale: See Standard 3 for analysis.

APPARENT TREND

Rating: Upward

Rationale: Vigor of desirable species is very high. There were many young green sprangletop plants. Sideoats grama is slightly above the levels called for in the ecological site description. Sideoats grama and black grama have average vigor and reproductive capability. Lehmann's lovegrass has significantly increased since 2008, becoming the dominant plant species on this site. Erosion and litter movement was not apparent and all soil and hydrological indicators are meeting the standards.

CONCLUSION: Key Area 7, North Pasture, Hibernia Peak Allotment Unit B

Standard 1: Not Meeting

Rationale: Thirteen of the 17 indicators measured were rated as "none to slight departure" from expected. One indicator was not measured. At this site all soil and hydrological indicators are close to or within what is expected for the ecological sites. The soils are armored with gravel and rock making up 21% of the cover.

All of the biotic indicators are within what is expected with the exception of the three indicators: No. 12 (Functional/Structural Groups), No. 16 (Invasive Plants) and No. 17 (Reproductive Capability of Native Species.). All three indictors were rated as moderate to extreme departure from expected due to the increase in frequency and composition of Lehmann's lovegrass since 2008. There are concerns with Lehmann's lovegrass increasing in both frequency and composition at this site in the future.

The site still supports a diversity of native perennial plant species but the increase in Lehmann's lovegrass a non-native invasive perennial grass may have caused a decrease in the native grasses big galleta and possibly desert needlegrass. Lehmann,s lovegrass may be replacing some of the native grass species such as desert needlegrass and big galleta.

Standard 3: Meeting

Rationale: The three key species black grama, sideoats grama, and false mesquite have shown a significant increase at this key area. According to frequency data, sideoats grama is exceeding its objective for frequency. Black grama and false mesquite are meeting the frequency objectives. Big galleta and desert needlegrass have declined in frequency and are not meeting objectives for frequency. The increase in frequency of sideoats grama and black grama may offset the decrease of other palatable native grass species. The frequency data suggest this site is currently meeting this standard.

The composition of desired perennial grass is not meeting composition objectives when compared to the ecological site description levels. The increase in the non-native Lehmann's lovegrass at this location is not meeting the objectives of lowering the composition and frequency of this species. Lehmann's lovegrass has significantly increased in the plant community in composition from 48% in 2008 to 65% in 2015, and in frequency from 75% to 94% over the same time period. The concern with this non-native species is that research suggests that Lehmann's lovegrass replaces the native grasses and shrubs which have died due to shorter life spans or due to drought conditions. Composition data appears to suggest that Lehmann's is replacing some of the native species at this site. Once Lehmann's lovegrass becomes established it will most likely always be present in the plant community. Lehmann's is considered to be a naturalized grass species in Arizona and therefore an objective was added for this species. The objective is to lower the composition and frequency Lehmann's lovegrass at this site.

Rainfall data from the NOAA weather station in Wikieup, Arizona (Appendix 2) shows annual drought conditions occurred frequently throughout the evaluation period at around one-third of the time. However, at the end of evaluation period seasonal drought in the spring occurred 86% of the time and summer drought condition about 45% from 1994 to 2015. The adverse impact to plant associated with drought may have had a negative effect on the plant communities across these allotments such as potentially favoring an increase in composition and frequency of Lehmann's lovegrass.

Over all, this site has a healthy and diverse native plant community with all soil and hydrological indicators within what is expected for this ecological site. Although, Lehmann's lovegrass has significantly increased at this location in both composition and frequency, so have many of the native species. Three key species sideoats grama, black grama and false mesquite have shown a significant increase in frequency, indicating an upward trend at this key area and therefore this site is meeting Standard 3. However, monitoring data may indicate that the plant community may be moving away from meeting this standard, as long as Lehmann's lovegrass continues to increase at is location.

The amount of precipitation a plant community receives seasonally directly effects the health of every plant species in the community. Review of past precipitation records suggest that prolonged drought at the end of the evaluation is likely the cause of most downward trends on this site.

Key Area 8, North Pasture, Hibernia Peak Allotment Unit B

Ecological Site – Sandy Loam Slopes, 10-13"p.z., Limy Skeletal, 3,700' elev. R030XC331AZ

Table 19. Key Area 8 Hibernia Peak Unit B, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Slim tridens	1%		2%	0-2%
Bush muhly	9%		15%	7-17%
Big galleta	13%		23%	14-26%
Black grama	37%		68%	51-65%
Total desirable grass composition*	60%	≥40%*		
Three-awn	5%	0-3%	15%	9-19%
Lehmann's lovegrass	9%	<5%	20%	<14%
Shrubby buckwheat	2%	0-2%	3%	0-4%
T=trace amount found at the key area.				
Current Live Perennial Cover: 45%		Perennial Plant Cover Objective: 29-43%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

AMP Objectives

1.) Achieve a 50% average utilization level on key forage species and limit utilization of key forage species to 60% each year. **Meeting**

Rationale: Utilization data was collected two times in years 2009 and 2011. Bush muhly was the heaviest used species with an average use of 10%, with the highest use at 11%.

2.) In all plots maintain or increase the frequency and production of the key species. **Meeting.**
Rationale: See Standard 3 for analysis.

APPARENT TREND

Rating: Upward

Rationale: The frequency of black grama, bush muhly, and big galleta has significantly increased at this key area. Slim tridens was not detected in 2008 but measured in 2014 at 2% improving species diversity at this key area. Vigor of desirable species is very high and there were many young plants. The composition of black grama and bush muhly is above the levels found in the ecological site description. Erosion and litter movement was not apparent. All soil and hydrological indicators are meeting the standards.

CONCLUSION: Key Area 8, North Pasture, Hibernia Peak Allotment Unit B

Standard 1: Meeting

Rationale: 16 of the 17 indicators measured were rated as "none to slight departure and 1was not measured. The soils are armored with 22% of the cover made up of gravel and rock. The cover of live perennial vegetation increased from 27% in 2008 to 45% in 2014. Cover data indicates herb cover significantly increased from 21% in 2008 to 38%.The reproductive capability of palatable species is good with high plant vigor for all species. Reproduction is evident. There were a lot of young plants and abundant seed heads observed at the key area.

The site supports a diversity of perennial plant species. Plant stature of palatable plant species is as expected for a healthy plant community. The functional structural groups are present, diverse and the productivity of these species is high. Although Lehmann's lovegrass is present at this location, composition data suggest Lehmann's lovegrass has had limited effects on the composition of native species. All soil and hydrological indicators are meeting the standards.

Standard 3: Meeting

Rationale: The desired plant community meets or exceeds the composition objectives for desirable perennial grass species as it relates to the ecological site description. Native grasses are very productive on this site. Currently the composition of black grama is over three times higher than composition levels shown in the ecological site description for this site. The frequency of black grama, bush muhly, and big galleta has significantly increased at this key area. Slim tridens was not detected in 2008 but measured in 2014 at 2% improving the species diversity at this key area. Of concern is the presence of invasive Lehmann's lovegrass however the frequency of this species has remained static from 2008 to 2014 (see Rationale, Standard 3, Key Area 7 on this allotment for more detail about this species).

LAZY YU ALLOTMENT (Map: Appendix 3-5).

Key Area 1, Lazy YU Allotment

Ecological Site – Basalt Slopes, 10-13" p.z., (precipitation zone), 3,800' elev. RO30XC330AZ.

Table 12. Key Area 1, Lazy YU, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Big galleta	23%	5-10%	20	15-27%
Bush muhly	3%	5-15%	4	7-15%
Slim tridens	0	0-2%	0	6-14%
Total desirable grass composition*	26%	20-27%		
White-stem paperflower	2%	0-2%	2	3-11%
Desert globemallow	T	1-5%	1	0-4%
Mormon tea	1	3-10%	1	0-2%
Snakeweed	7%	0-8%	9	5-13%
T=trace amount found at the key area.				
Current Live Perennial Cover: 15%		Perennial Plant Cover Objective: 16-28%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 1, Lazy YU Allotment

Standard 1: Not Meeting

Rationale: 11 of the 17 indicators measured are rated as "none to slight departure", 1 rated as slight to moderate departure from expected, 3 rated as moderate, and 1 rated as moderate to extreme. One indicator was not measured. All soil indicators are meeting the standard. This site is well armored with abundant basalt rock and gravel on the surface. Hydrological indicators received non to slight ratings save litter which had a slight to moderate departure from expected. Overall the biological indicators of this site are showing greater than expected departures from the reference. Functional structural groups, perennial plant production, litter, reproductive capability of perennials, and invasive species had a slight to moderate, moderate, and moderate to extreme departure from expected.

Bare ground has slightly decreased from a high of 8% in 1988 to 2% in 2012. The decrease in bare ground may be a result of an abundance of exotic annual plant production in 2012. Plant diversity may be static however slim tridens was not detected in 2012. Live perennial plant cover has declined from a high of 22%, 23%, and 29% in 1986, 1988, and 1999 respectively to 15% in 2012.

Standard 3: Not Meeting

Rationale: The biological components of Key Area 1 have declined and are not meeting standards. The frequency of bush muhly and slim tridens significantly declined from 1986 to 2012. Bush muhly is found mostly in protected areas near rocks or inside shrubs. Slim tridens and black grama may have disappeared from the site. The stature of the palatable perennial species is smaller than expected.

The frequency of big galleta is static from 1986 to 2012 (24% in 1986 to 17% in 1999, and 20% in 2012). The trend of bush muhly has significantly declined from a frequency of 19% in 1986, 10% in 1999 to 4% in 2012. The trend of slim tridens has declined from 22% frequent in 1986, 8% in 1999, to 0% in 2012. Seed heads of all perennial grass species were present primarily in protected areas and very little in open areas. Perennial grass was mostly small in stature. The trend of Mormon tea is static however plants were small in stature and hedged. The frequency of snakeweed a non-desirable species went from 43% in 1986, 5% in 1999, to 9% in 2012.

The composition of palatable perennial plants was not as expected when compared to the ecological site description. Four (slim tridens, bush muhly, desert globemallow, and Mormon tea) out of 6 species are below the composition levels found in the ecological site descriptions. Two are at or above composition levels (big galleta and white-stem paperflower).

Bare ground has slightly decreased from a high of 8 % in 1988 to 2% in 2012 possibly due to an influx of ephemeral plants in 2012.

Live perennial plant cover declined from a high of 22% in 1986 to 15% in 2012. The big drop in plant cover was primarily from herbaceous species.

WALNUT CREEK ALLOTMENT (Map: Appendix 3-6).

Key Area 1 Walnut Creek

Ecological Site –Limy Upland 6-9" p.z., (precipitation zone), 2,460' elev. R030XB214AZ

Table 13. Key Area 1 Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Big galleta	0%	0-1%	0%static	0-2%
White ratany	15%		6%up	3-9%
Mormon tea	8%		3%static	0-4%
White stem paperflower	0%		0%down	3-9%
Total desirable shrubs composition*	23%	≥18%		
Desert senna				
Desert trumpet	1%		3%static	0-4%
Total desirable forb composition*	4%		2%Static	1-2%
	5%	1-9%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 16% Perennial Plant Cover Objective: 11-21%				

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION: Key Area 1, Walnut Creek Allotment

Standard 1: Not Measured - No Upland Health data collected on this site

Standard 3: Meeting

Rationale: This is a low elevation and low rainfall site and typically only used by livestock during ephemeral plant green-up in the spring. Because of the low rainfall and elevation, perennial grass productivity and potential is low. The trend of all palatable species is static with the exception of white stem paperflower which is down and white ratany which is up. All composition objectives are being met or exceeded (white ratany and Mormon tea). The perennial plant cover objective has been met. Bare ground is static.

Key Area 3 Walnut Creek

Ecological Site – Granitic Hills, 12-16" p.z., 3,200' elev. RO38XA104AZ.

Table 14. Key Area 3 Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Slim tridens	2%		4%	1-5%
Desert needlegrass	1%		1%	0-2%
Three-awn	1%		1%	0-2%
Total desirable grass composition*	4%	2-23%		
Twinberry	6%		8%	3-11%
Slender poreleaf	1%		3%	0-4%
Total desirable shrubs composition*	7%	2-9%		
Desert rock pea	1%		1%	0-4%
Short-leaf baccharis	0%		0%	1-5%
Total desirable forb composition*	1%	T-4%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 30%		Perennial Plant Cover Objective: 24-36%		

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 3 Walnut Creek

Standard 1: Not Measured - No Upland Health data collected on this site

Standard 3: Meeting

Rationale: All palatable perennial species have met the composition and frequency objectives with the exception of short-leaf baccharis which was not detected in 2011. Trend is static or up for all palatable perennial species with the exception of short-leaf baccharis. Short-leaf baccharis frequency was 3% in 1987 and was not detected in 2000 or 2011.

Bare ground has slightly fluctuated from 3% in 1987, 5% in 2000, and 4% in 2011. Rock and gravel make up a large percentage of the ground cover.

Live perennial plant cover is static at 30% in 1987, 23% in 2000, to 30% in 2011.

Key Area 5 Walnut Creek – This key area has been abandoned due to the fact that palatable perennial grass species have never been present at this site.

Key Area 8 Walnut Creek

Ecological Site – Basalt Hills, 10-13" p.z., 4,080' elev. RO40XA101AZ.

Table 15. Key Area 8 Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	1%		2%	3-11%
Black grama	1%		T	2-8%
Big galleta	11%		13%	6-14%
Desert needlegrass	0%		0%	1-5%
Slim tridens	1%		1%	0-2%
Three-awn	0%		0%	3-11%
Total desirable grass composition*	13%	T-14%		
Short-leaf baccharis	1%		T	0-2%
Mormon tea	1%		1%	0-2%
Total desirable shrub composition*	2%	0-6%		
	1%		1%	0-2%
Twinberry	1%		T	0-2%
Desert rock pea	1%		1%	1-5%
Black-foot daisy				
Total desirable forb composition*	3%	T-3%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 25%		Perennial Plant Cover Objective: 24-36%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 8 Walnut Creek

Standard 1: Not Meeting

Rationale: 12 of the 17 indicators measured were rated as "none to slight departure, 3 were rated as "slight to moderate departure", 1 rated as "moderate", and 1 indicator was not measured. All soil indicators are meeting the standard. All hydrological indicators are meeting standards with the exception of the indicator that measures plant community composition and distribution relative to infiltration. Of concern is the significant decrease of several key forage plant species

at this key area. Therefore, this indicator was rate as a "moderate" departure from the reference. Biological indicators of plant mortality/decadence, invasive plants, and perennial plant production, received a slight to moderate departure from the reference as there were many dead plants throughout the key area. Red brome, an invasive species, occurred throughout the key area. Several key forage plant species have significantly declined and no longer produce the amount of forage as expected. The site supports a diversity of perennial plant species. All functional structural groups are present.

The soils are well armored, with 52% of the surface cover points made up of abundant basalt rocks and gravel. Currently the percentage of bare ground makes up 11% and has remained static when compared to prior year's data.

Standard 3: Not Meeting

Rationale: When compared to the ecological site description all palatable perennial plants are meeting composition objectives with the exception of big galleta which is above what is expected for this site. This may be a reflection of the downward trend seen in sideoats grama and black grama. This may have allowed the less palatable big galleta to represent a greater percentage of the plant community composition.

Of concern is the decline in frequency of sideoats grama, black grama, and desert needlegrass. All have all declined in frequency while big galleta has increased. The trend is static for all other palatable perennial species.

Perennial plant cover meets the cover objective however the current cover is at the lowest end of the objective.

Key Area 10 Walnut Creek

Ecological Site – Granitic Hills, 12-16" p.z., 5,200' elev. RO38XA104AZ.

Table 16. Key Area 10 Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	1%		4%	5-13%
Black grama	3%		9%	15-27%
Big galleta	11%		18%	14-24%
Bush muhly	1%		1%	1-2%
Slim tridens	0%		0%	1-5%
Total desirable grass composition*	15%	11-33%		
Three-awn	15%	T-7%	35%	28-42%
Desert rock pea	2%		6%	10-20%
Black-foot daisy	1%		3%	7-15%
Total desirable forb composition*	3%	T-7%		
Shrubby buckwheat	1%	T-7%	3%	10-20%
T=trace amount found at the key area.				
Current Live Perennial Cover: 21%		Perennial Plant Cover Objective: 30-44%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 10 Walnut Creek

Standard 1: Meeting

Rationale: 16 of the 17 indicators measured were rated as "none to slight departure. One indicator was not measured. All soil, hydrological, and biological indicators are meeting the standard. The soils are well armored, covered with abundant granitic rocks and gravel on the surface. Currently the percentage of bare ground makes up 7% and has remained static when compared to previous year's data. The site supports a diversity of perennial plant species. All functional-structural groups are present.

Standard 3: Not Meeting

Rationale: Palatable perennial plants of Key Area 10 are all meeting composition objectives with the exception of sideoats grama which is below what is expected. Big galleta, three awn and black-foot daisy compositions are above what is expected.

The frequency of sideoats grama, black grama, slim tridens, three-awn, black-foot daisy, desert rock pea, and shrubby buckwheat all have significantly declined. The trend of the other key forage species is static. Perennial plant cover has significantly declined since between 1987 and 2011. Both woody and herb canopy declined and current perennial plant cover does not meet the perennial plant cover objective.

Key Area 11 Walnut Creek

Ecological Site – Granitic Hills, 12-16" p.z., 5,200' elev. RO38XA104AZ.

Table 16. Key Area 11 Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	6%		14%	7-15%
Black grama	1%		2%	0-4%
Slim tridens	1%		1%	0-2%
Desert needlegrass	15%		28%	30-44%
Total desirable grass composition*	23%	18-36%		
Three-awn	13%	1-7%	21%	11-21%
Black-foot daisy	5%	0-1%	13%	5-13%
Twinberry	1%	0-1%	4%	1-5%
Total desirable forb composition*	4%	T-7%	11%	5-13%
Shrubby buckwheat	9%	0-1%	21%	14-21%
T=trace amount found at the key area.				
Current Live Perennial Cover: 46%		Perennial Plant Cover Objective: 38-52%		

*Objective for like plants grouped

The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 11 Walnut Creek

Standard 1: Meeting

Rationale: 16 of the 17 indicators measured were rated as "none to slight departure. One indicator was not measured. All soil, hydrological, and biological indicators are meeting the standard. The soils are well armored, covered with abundant granitic rocks and gravel on the surface. Vegetation produces abundant cover at this key area. The percentage of bare ground makes up 3% of this site. The site supports a diversity of perennial plant species. Plant stature is as expected for a healthy plant community. The functional structural groups that are present are diverse, the perennial plant production is high, and the reproductive capability of perennials high as evidenced by abundant perennial grass seed heads and black grama stolon sets.

Bare ground has been static and is at 3%.

Standard 3: Meeting

Rationale: Palatable perennial plants of Key Area 11 are all meeting composition objectives with the exception of desert needlegrass, and black-foot daisy, which are above the ecological site description. Although the frequency of desert needlegrass has declined, the composition of this species is just above levels cited in the site description. Therefore the drop in frequency may not be a cause for concern. Broom snakeweed and three-awn, increaser species, are also above what is listed in the ecological site description. It is expected that with a continual improvement in the health of this key area the composition of these two species may decline.

Live perennial plant cover has remained high at 46%.

Key Area 12 Walnut Creek – Key Area 13 (which is close to Key Area 12) replaces this key area as it has a much more diverse plant community, more productive and a higher number of key forage plant species upon which change is more likely to be detected.

Key Area 13 Walnut Creek

Ecological Site – Granitic Hills, 12-16" p.z., 4,440' elev. RO38XA104AZ.

Table 17. Key Area 13, Walnut Creek, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Sideoats grama	17%	4-14%	26%	20-32%
Black grama	2%	1-8%	5%	2-8%
Desert needlegrass	1%	1-14%	3%	1-5%
Big galleta	1%	0-3%	2%	0-4%
Cane beardgrass	1%	T-4%	1%	0-2%
Total desirable grass composition*	22%	17-43%		
Three-awn	5%	T-7%	11%	7-15%
Black-foot daisy	2%	0-2%	3%	1-5%
Louisiana sagewort	2%	0-2	4%	1-7%
Desert rock pea	4%	T-3%	9%	5-13%
Twinberry	2%	0-2%	5%	2-8%
Total desirable forb composition*	10%	1-9%		
Shrubby buckwheat	4%	T-7%	9%	5-13%
Snakeweed	4%	0-1%	10%	6-10%
T=trace amount found at the key area.				
Current Live Perennial Cover: 30%		Perennial Plant Cover Objective: 24-36%		

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

CONCLUSION –Key Area 13 Walnut Creek

This key area was established in 2012. This was the only year that this key area was read.

Standard 1: Meeting

Rationale: 14 of the 17 indicators measured were rated as "none to slight departure, 2 were rated as slight to moderate, and 1 indicator was not measured. The soils are heavily armored with 49% of the cover made up of gravel and abundant granite rock. The percentage of bare ground makes up 7% of this site. All soil and hydrological indicators are meeting the standard.

The two biological attributes invasive plants and reproductive capability of perennial plants were rated at a slight to moderate departure from expected. Red brome, an invasive species occurs throughout the key area. The reproductive capability of sideoats grama and black grama has

been reduced at this key area. The vigor of sideoats grama was average to poor. Reproduction is evident, but mostly occurs in protected areas. Black grama lacks reproductive stolons in the open, but stolons were abundant in protected areas.

The site supports a diversity of perennial plant species. Plant stature is as expected for a healthy plant community with concerns for sideoats grama and black grama, both palatable species. The functional structural groups that are present are diverse and the perennial plant production is high for most species.

Standard 3: Meeting

Rationale: This key area is a newly established site and has only one year of data collection. The desired plant community meets the composition objectives as it relates to the ecological site description. Sideoats grama is slightly above the levels called for. All species meet the frequency objectives. Although sideoats grama and black grama have average to low vigor and reproductive capability appears to have been affected by high use levels, the overall health of the key area is acceptable and meeting standards. Because this key area has only been monitored one time conclusions are tentative until more information and a bigger data set are collected.

CANE SPRINGS WASH ALLOTMENT (Map: Appendix 3-7).

Key Area 1, Cane Springs Wash Allotment

Ecological Site –Sandy Loam Upland 10-13 " p.z., (precipitation zone), 2,600' elev.
R030XB214AZ

Table 13. Key Area 1, Cane Springs Wash, Objectives and Data Summary.

Species	Current Composition	Composition Objective	Current Frequency	Frequency Objective
Big galleta	52%		49%	42-56%
Black grama	2%		4%	1-7%
Total desirable grass composition*	54%	≥35%		
False mesquite	4%		6%	3-9%
Short-leaf baccharis	1%		1%	0-2%
Total desirable shrubs composition*	5%	2-10%		
T=trace amount found at the key area.				
Current Live Perennial Cover: 17%		Perennial Plant Cover Objective: 12-22%		

*Objective for like plants grouped
The current plant community was compared to the plant community sited in the ecological site description.

Apparent Trend

Rating: Upward

Rationale: Vigor of desirable species is high. There were many seed heads on big galleta and many stolons on black grama. Red brome is present and is as expected for a site at this elevation. Erosion and litter movement was not apparent.

CONCLUSION: Key Area 1, Cane Springs Wash Allotment

Standard 1: Meeting

Rationale: Fifteen of the 17 indicators measured were rated as a "none to slight departure", one indicator was not measured. The plant community composition was the only indicator rated at a "slight to moderate departure" due to low diversity of grass species. The soils are well armored, covered with abundant granitic rocks and gravel on the surface. Bare ground makes up 24% of this site. Plant stature is as expected for a healthy plant community. The functional structural groups are present, the perennial plant production is high, and the reproductive capability of

perennials is high as evidenced by abundant seed heads for big galleta and black grama stolon sets.

Standard 3: Meeting

Rationale: This key area is a newly established site with only one year of data collection. It is at the lower elevation of the ecological site description range and is therefore at the lower end of rainfall for this site. Because of the lower rainfall, productivity and species diversity is also at the lower end of the ecological site. Perennial grass productivity and potential is as expected. The frequency of all palatable grass and shrub species is within objectives for this site. All composition objectives are being met or exceeded and the perennial plant cover objective has been met. Because this key area has only been monitored one time conclusions are tentative until more information and a larger data set are collected.

STANDARD 2 -RIPARIAN WETLAND AREAS

Figure 14. Bull Canyon in Hibernia Peak Unit A Allotment.

Table 22. Riparian areas and springs evaluated by allotment with findings and rationale for determinations described.

Allotment	Spring	Determination	Rationale	Date Evaluated Location
Yellow Pine	Sugarbowl Spring YP-17	Not Meeting Standard 2 (Functional at Risk, Downward Trend)	Spring vegetation poorly developed and trampled by livestock hoof action. Water is present but there is little to no recruitment of trees or herbaceous vegetation. Red willow, tamarisk, and rushes are present. Historically this spring has supported a lush riparian zone of red willow, seepwillow, ash, tamarisk, giant lupines, and rushes.	8-7-2012 UTM NAD 83 12S E 0239779 N 3882966
	Frog Spring YP-4	Meeting Standard 2	Riparian vegetation is very diverse with red willow, seep willow, canyon grape, velvet ash, and bermuda grass. Surface water was present with red-spotted toads and tadpoles.	7-19-2014 UTM NAD 83 12S E 0241329 N 3893398

Hualapai Spring YP-36	Meeting Standard 2	Velvet ash and seep willow makes up the riparian vegetation at this seasonal spring. The spring appears to flows subsurface most of the year.	7-9-2014 UTM NAD 83 12S E 0242289 N 3892172
Hanson Cabin Switchback Well YP-14	Meeting Standard 2	Riparian vegetation consists of red willow, seep willow, and sedges. Spring is fenced and flows subsurface at this time.	7-9-2014 UTM NAD 83 12S E 0239939 N 3885606
Caterpillar Spring YP- 32	Meeting Standard 2	This spring has little surface water with most water found subsurface. Velvet ash and pinegrass are present in low numbers.	7-9-2014 UTM NAD 83 12S E 0237459 N 3882476
Unnamed Spring YP-33	Meeting Standard 2	This spring is a pond and may have filled by recent rains rather than by a spring source. There was no riparian vegetation which suggests water is present only from rainfall runoff.	7-9-2014 UTM NAD 83 12S E 0237541 N 3882468
Unnamed Spring YP- 13	Meeting Standard 2	This spring vegetation is well developed with velvet ash, red willow and Arizona walnut with an understory of seep willow, deer grass, and pine grass. The spring is seasonal and no surface water was present with the exception of a small trickle coming out of bedrock. The riparian vegetation provides habitat, forage, cover, and a very small amount of water for migratory birds and other wildlife species.	7-9-2014 UTM NAD 83 12S E 0240653 N 3886310
Unnamed Spring YP-34	N/A	Not Riparian	3-19-2014 UTM NAD 83 12S E 0245322 N 3879800
Unnamed Springs YP- 6 and YP-7	Not Meeting Standard 2 (Functional at Risk, Trend Not Apparent)	Surface water is not present at the source of Spring #6 but riparian vegetation of sedges is present, as moisture is found just below the surface. Between Springs 6 and 7 Carex sp. is present in varying densities. Spring areas were trampled by livestock and flow patterns were altered by disturbance (hoof action); vegetation had low vigor, and use on vegetation was heavy.	3-19-2014 UTM NAD 83 12S E 0243632 N 3888388 TO E 0243535 N 3888470

	Unnamed Spring YP-15	Not Meeting Standard 2 (Functional at Risk-Downward Trend)	This spring is vegetated with Fremont cottonwood, red willow, deer grass, seep willow, woolly mule's ears, and deer grass. Vegetation is present to maintain functionality, however, at risk due to excessive removal from livestock. There was a lot of wildlife activity, especially birds, due to the presence of trees and surface water.	3-19-2014 UTM NAD 83 12S E 0241290 N 3884620
	Unnamed Spring YP-12	Not Meeting Standard 2 Functional at Risk (Trend Not Apparent)	This spring is vegetated with velvet ash, Arizona walnut, red willow, pine grass, and canyon grape. Spring is undeveloped although developed in the past. Utilization on velvet ash and pine grass is heavy with 83% and 72% respectively.	7-9-2014 UTM NAD 83 12S E 0239573 N 3886486
Walnut Creek	Spring WK-4	Meeting Standard 2	The riparian community is well developed and composed of young and mature plants of water weed (BASE) and deer grass as well as tamarisk and Carex sp. Spring is developed for livestock and the flow is altered at the spring box. The spring flows naturally above the box for about 75 feet.	4-7-2016 UTM NAD 83 12S E 0233023 N 3888570
	Cottonwood Spring	Meeting Standard 2	Spring is developed with no surface water present. Riparian vegetation is being watered from sub-surface flow. Riparian vegetation consists of Fremont cottonwood, Gooding's willow, and net-leaf hackberry.	4-7-2016 UTM NAD 83 12S E 0228057 N 3888714
	Black Rock Spring WK-3	Meeting Standard 2	Spring is undeveloped, but evidence of past development. Water is found in two small pools. A livestock water is located at the spring. Riparian vegetation of canyon grape, water weed (BASE), deer grass, carex, and columbine is vigorous and healthy.	5-4-2016 N 35° 05' 40.9" W 113° 56' 17.0" T.20N R. 16W, sec. 23, SESE
Hualapai Peak	Pine Spring HP-7	Meeting Standard	Spring is undeveloped although developed in the past. Riparian	7-10-2014

		2	vegetation is vigorous with water weed (BASE) and herbaceous vegetation present.	UTM NAD 83 12S E 0235701 N 3890472
Lazy YU	Boulder Spring LYU-2	Non-Riparian	Spring developed, but no longer functional. An old trough windmill and storage are located near the source. It appears that the spring is no longer present/active. There is no surface water, and no evidence of subsurface water as vegetation consists primarily of mesquite growing within the boulders. Cattle bed in this area. This area is used by recreationists for rock climbing and camping at and around the source.	7-11-2014 UTM NAD 83 11S E 0766585 N 3889185
	Lookout Spring LYU-3	Not Meeting Standard 2 Functional At Risk Downward Trend	Spring is developed. Development consists of a spring box, pipe, and a concrete trough. Spring area is trampled with little opportunity for riparian vegetation to become established. Water pools near the source. Red-spotted toads, dove, quail, and other wildlife observed near the water. One old Fremont cottonwood, and some closely grazed herbaceous vegetation located near the source.	7-11-2014 UTM NAD 83 11S E 0768686 N 3890071
Hibernia Peak Unit B	Unnamed spring section 17, T. 18N, R. 14W, SESE	Non-riparian	One lone net-leaf hackberry tree. No riparian vegetation to suggest this area is riparian.	3-31-2016 E 246339.25 N 3869561 m. T.18N, R.14W, sec. 17, SESE
Hibernia Peak Unit B	Higgen's Spring	Meeting Standard 2	Spring is developed but the source is fenced. Livestock do not have access to the inside of the exclosure. Water is piped to a storage and trough. The spring box is buried. Spring has been dug-out to the source with a 2 foot trench. Water is pooled 1-2 feet deep in the trench for 30 feet from the source on downstream, but no flow at this time. Tamarisk, velvet mesquite and Salix sp. compose the riparian vegetation around the source. Wildlife visit this spring as small groups of birds (chipping and	3-3-2016 UTM NAD 83 12S E 0251472 N 3866994

			Brewer's sparrows) were using the spring along with a lone hummingbird.	
Hibernia Peak Unit A	Silverado Spring	N/A	All of the available water is captured and piped to a trough for livestock use. There are a few individuals of seepwillow and one walnut tree near the source. There is no free subsurface or surface water available for riparian development.	4-12-2016 N 34° 54' 20.0" W 113° 48' 24.4"
Hibernia Peak Unit A	Unnamed Spring near Midway Well	Meeting Standard 2	This is a bedrock controlled spring which backs up water at the source. There is currently only subsurface flow that waters a small grove of ash trees and water weed. Source is in proper functioning condition.	3-31-2016 E 242658.55 N 3870221.94 m. T. 18N, R. 15W, sec. 13, NWSE
Hibernia Peak Unit A	Hibernia Canyon Riparian 1	Meeting Standard 2	This area is in proper functioning condition as evidenced by a diverse composition of riparian vegetation such as red willow, waterweed, seepwillow, and deer grass. Utilization was within the set limits. No surface flow in March, 2016.	3-24-2016 N 35° 55' 4.90" W 113° 49' 39.5"
Hibernia Peak Unit A	Bull Canyon Riparian 1	Meeting Standard 2	PFC Evaluation: Area is in proper functioning condition as evidenced by abundant deer grass and water weed (BASE) in the understory. The overstory consists of seepwillow, red willow, and velvet ash. No surface flow in 2016	3-25-2016 N 35° 57' 04.5" W 113° 50' 57.2"
Hibernia Peak Unit A	Bull Canyon Riparian 1 AMP Objective: Limit utilization of key woody and herbaceous vegetation to 50% of the current years growth at all study sites. * Key species:		Line Intercept Cover and Utilization Evaluation: **Meeting**: The utilization objective has been met in most years. Use on velvet ash, red willow, and deer grass has been below 50% in all years with the exception of 1992 (the year the study was established) when utilization at 56% exceeded the objective. Velvet ash has been the most utilized species with 4 years of data averaging 44% between 1992 and 2016.	

	Velvet Ash (Fraxinus velutina) Willow (Salix spp.) Muhly (Muhlenbergia sp.) AMP Objective: Increase the canopy cover of Velvet Ash in Bull Canyon from 12.8 % to 20%.	**Meeting**: The canopy cover of velvet ash is 18.1 %, which is less than 20%, however a flooding event in 1993 reduced the canopy cover from 12.8 % to 7.9 %. Since that time the cover has slowly improved. The canopy cover of red willow has increased from 1.2 % in 1992 to 2.8 % in 2016. This species is more water dependent than velvet ash. Surface water has been present in 2 of the 5 years data was collected at this key area.

NEXT STEPS

BLM will collaborate with stake holders, interested publics and other agencies to:

- ⇒ Determine the causal factors for areas not meeting Standards.
- ⇒ Identify and analyze possible corrective actions under the National Environmental Policy Act.
- ⇒ Take the appropriate corrective action to ensure that the Hualapai Mountains North Evaluation Area makes significant progress towards meeting Arizona's Standards for Rangeland Health. In terms of evaluating the standards /objectives it is expected that they would be met or making progress towards meeting within ten years of implementing management changes.

Appendix 1. List of plant names used in the Hualapai Mountains North Land Health Evaluation.

Common Name	Scientific Name
Arizona walnut	*Juglans major*
Bermuda grass	*Cynodon dactylon*
Big galleta	*Hilaria rigida*
Black grama	*Bouteloua eripoda*
Black-foot daisy	*Melampodium leucanthum*
Blue grama	*Bouteloua gracilis*
Bush muhly	*Muhlenbergia porteri*
Cane beardgrass	*Bothriochloa barbinoides*
Canyon grape	*Vitis arizonicus*
Carex	*Carex sp.*
Columbine	*Aquilegia caerulea spp. Penetorum*
Deer grass	*Muhlenbergia rigens*
Desert globemallow	*Sphaeralcea ambigua*
Desert needlegrass	*Stipa speciosa*
Desert rock pea	*Lotus rigidus*
Desert senna	*Cassia covesii*
Desert trumpet	*Eriogonum inflatum*
False mesquite	*Calliandra eriophylla*
Fremont cottonwood	*Populus fremontii*
Giant dropseed	*Sporobolus giganteus*
Giant lupine	*Lupinus latifolius*
Gooding's willow	*Salix goodingii*
Green sprangletop	*Leptochloa dubia*
Lehmann's lovegrass	*Eragrostis lehmanniana*
Linear-leaf goldenbush	*Haplopappus linearifolius*
Louisiana sagewort	*Artemesia ludoviciana*
Mormon tea	*Ephedra nevadensis*
Net-leaf hackberry	*Celtis reticulata*
Pinegrass	*Poa pratensis*
Red willow	*Salix laevigata*
Rush	*Juncus sp.*
Salix	*Salix sp.*
Sand dropseed	*Sporobolus cryptandrus*
Sedges	*Carex sp.*
Seepwillow	*Baccharis salicifolia*
Short-leaf baccharis	*Baccharis brachyphylla*
Shrubby buckwheat	*Eriogonum wrightii*
Sideoats grama	*Bouteloua curtipendula*

Appendix 1. continued.

Slender poreleaf	*Porophyllum gracile*
Slim tridens	*Tridens muticus*
Snakeweed	*Guitirezzia sarothrae*
Squirreltail	*Sitanion hystrix*
Tamarisk	*Tamarix pentandra*
Three-awn	*Aristida spp.*
Turtlebush	*Xylohriza tortifolia*
Twinberry	*Menodora scabra*
Velvet ash	*Fraxinus velutina*
Velvet mesquite	*Prosopis velutina*
Waterweed	*Baccharis sergiloides*
White ratany	*Krameria grayi*
White-stem paperflower	*Psilostrophe cooperi*
Wooly mules ear	*Wyethia sp.*

Appendix 2. Precipitation Data taken from Kingman and Wikieup Weather Stations

Appendix 2 displays rainfall data taken from two distinct locations: Kingman and Wikieup Weather Stations. The three Allotments are located in the Big Sandy River Valley, as is the Wikieup Weather Station.

Annual Precipitation Data

Appendix 2 shows data collected by the National Oceanic Atmospheric Administration (NOAA) between the years of 1981 to 2015 for the Wikieup Weather Station. The shaded areas in Appendix 2 highlight what is considered *annual* drought for each of the areas. The 35 years of data has been separated into four categories to point out the following *annual* precipitation variances:

Above Normal: 29%-10 yrs. (1982, ’83, ’84, ‘86, ’92, ’93, ’98, 2004, ’05, ’10)

Normal Years: 40% -14 yrs. (1981, ’85, ’87, ‘88, ‘90, ’91, ’95, ’97, ’99, 2003, ’07, ’08 ’13, ‘15)

Drought: 31% - 11 yrs. (1989, 1994, 1996, 2000,’01,’02,’06,’09, 2011, ’12, ’14)

Severe Drought: 23% - 8 yrs. (1994,’96, 2000,’01, ‘02,’09,’11,’14)

The precipitation data is relative to the plant community on the Hibernia A and B Allotments managed under the AMP (1999) and the Cane Springs Wash Allotment. The thirteen years prior to 1994 were relatively wet with only one year of drought. It is important to note that only looking at annual precipitation amounts can mask the effects of seasonal precipitation on a plant community.

Seasonal Precipitation Data

The shaded areas in Appendix 2 highlight what is considered *seasonal* drought for each of the areas (Cool i.e. spring and Warm i.e. summer, seasons). Seasonal drought is calculated by the average (as shown at the bottom of the table) multiplied by 75%. When the total amount of rainfall for the season is 75% less than the calculated average, the season was considered to be a drought. Analysis for the data in Appendix 2 is referenced in other sections of the document.

Seasonal precipitation during the growing seasons (i.e., spring and summer) is vital to plant productivity more so than total annual precipitation. The NOAA data (Appendix 2) shows the spring and summer growing season rainfall between 1981 and 2015. The highlighted data identifies prolonged periods of drought and severe drought when they occurred over the 35 year timeframe.

Appendix 2, cool season (spring) rainfall, shows that over a 35 year timeframe, drought has occurred 66% of the time. Severe drought occurred 60% of the time for the same period. Between 1994 and 2015, only 3 spring years exceeded drought conditions, resulting in 86% of the spring years experiencing drought and 77% of them in severe drought.

Appendix 2, warm season (summer) rainfall, shows that over the 35 year timeframe, drought occurred 40% of the time and of these 34% were severe. Between 1994 and 2015, all of the

drought periods (12 years or 45%) were in severe drought conditions.

Rainfall data for areas near Hibernia Peak A & B and Cane Springs Wash Allotments.

National Oceanic Atmospheric Administration (NOAA) Rainfall Data

	Kingman Station			Wikieup Station		
Years	Cool	Warm	Annual	Cool	Warm	Annual
1981	2.94	2.47	6.88	2.74	4.85	9.55
1982	2.44	3.84	10.08	2.94	3.16	13.60
1983	3.16	7.83	14.79	4.00	7.35	16.03
1984	0.40	9.53	14.77	0.33	5.87	11.53
1985	1.30	4.14	10.63	1.38	2.27	10.63
1986	2.24	2.87	9.06	2.94	4.02	11.09
1987	2.62	3.66	8.67	0.80	4.04	10.62
1988	2.52	4.49	10.23	1.84	4.95	10.62
1989	0.81	0.42	3.95	0.37	2.27	5.83
1990	3.98	7.47	13.21	1.95	5.76	9.33
1991	3.45	3.39	10.25	5.05	2.38	10.36
1992	7.04	4.03	16.99	7.56	1.88	16.32
1993	1.12	3.28	17.30	1.83	3.49	18.36
1994	1.60	3.48	8.33	0.58	0.81	4.13
1995	5.33	2.56	14.76	2.16	0.96	8.46
1996	0.64	3.03	7.75	0.66	0.06	2.97
1997	0.34	7.00	13.44	0.28	4.38	7.89
1998	1.40	6.07	11.57	1.50	6.63	15.25
1999	3.00	4.63	7.63	1.59	3.98	6.55
2000	0.75	4.25	6.60	0.15	2.56	2.71
2001	2.50	3.6	10.92	1.10	0.83	5.41
2002	0.24	2.80	4.54	0.24	1.75	2.35
2003	1.43	2.65	6.61	1.00	2.12	7.72
2004	1.45	4.27	20.35	2.80	6.48	20.20
2005	1.10	3.61	11.17	0.08	6.24	14.96
2006	1.24	3.84	5.24	0.84	5.25	5.89
2007	0.11	1.44	4.01	0.00	5.12	7.08
2008	0.24	1.12	7.45	0.03	1.60	7.42
2009	0.05	1.69	5.18	0.23	0.16	5.00
2010	0.56	2.71	7.85	1.26	3.15	12.43
2011	1.86	3.06	9.40	0.00	1.74	4.69
2012	1.93	4.16	7.67	0.61	3.36	6.05
2013	0.21	4.78	6.72	0.30	6.01	8.20
2014	0.36	6.36	8.52	0.16	4.61	5.39
2015	3.05	3.13	8.20	2.60	3.61	8.07
Avg. 35 Yrs	**1.81**	**3.93**	**9.65**	**2.22**	**3.53**	**8.55**

Cool= March, April, May, June

Warm=July, August, Sept, Oct,

Annual (12 Months)

1.81*0.75=1.36
1.81*0.65=1.18
3.93*0.75=2.94
3.93*0.65=2.55
9.65*0.75=7.24
9.65*0.65=6.27

2.22*0.75=1.67
2.22*0.65=1.44
3.53*0.75=2.65
3.53*0.65=2.29
8.55*0.75=6.41
8.55*0.65=5.56

Appendix 3. Maps

Appendix 3-1. Hualapai Mountain North Evaluation Area Map

Appendix 3-2. Yellow Pine Allotment

Appendix 3-3. Hualapai Peak Allotment

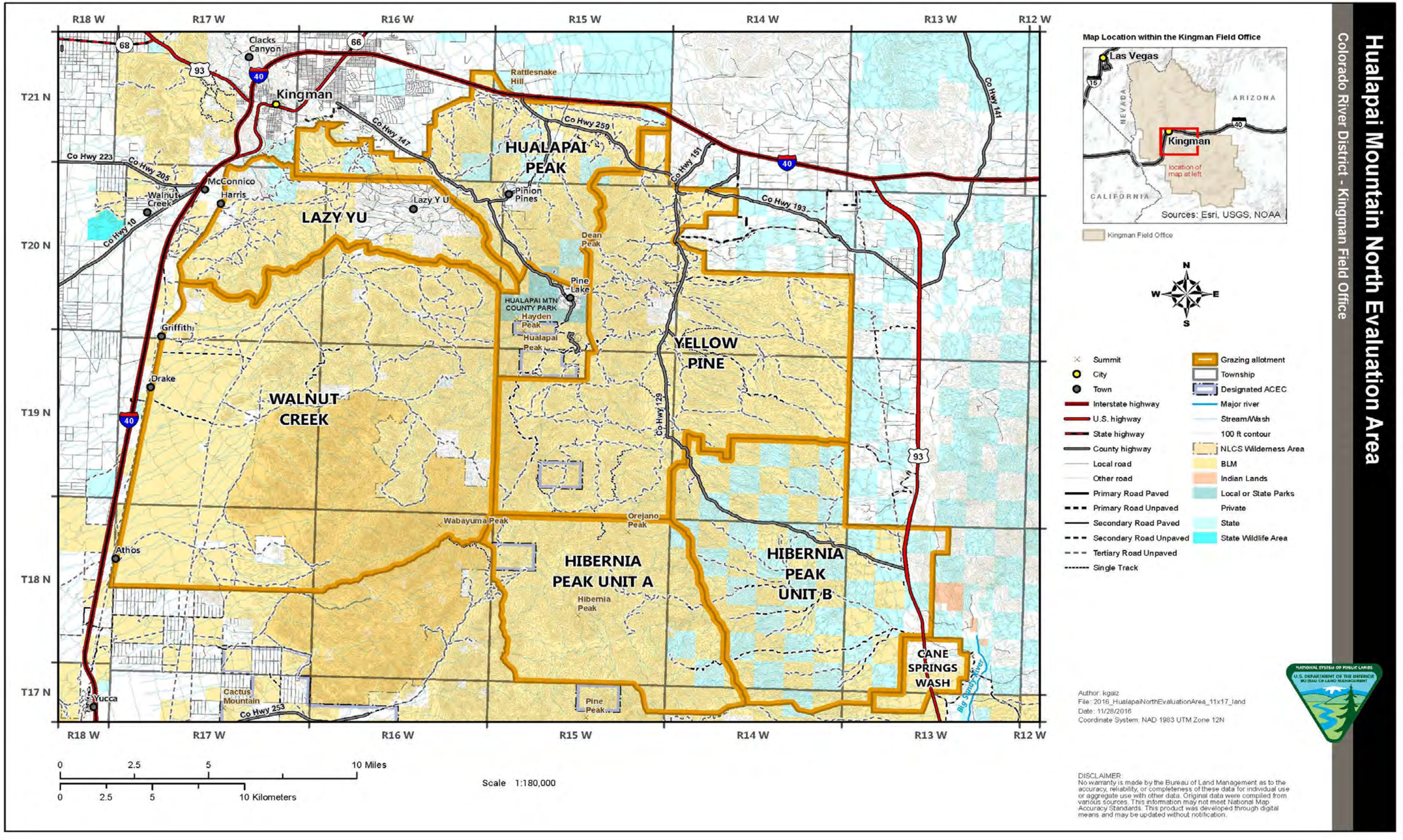
Appendix 3-4. Hibernia Peak Unit A and Hibernia Peak Unit B Allotments

Appendix 3-5. Lazy YU Allotment

Appendix 3-6. Walnut Creek Allotment

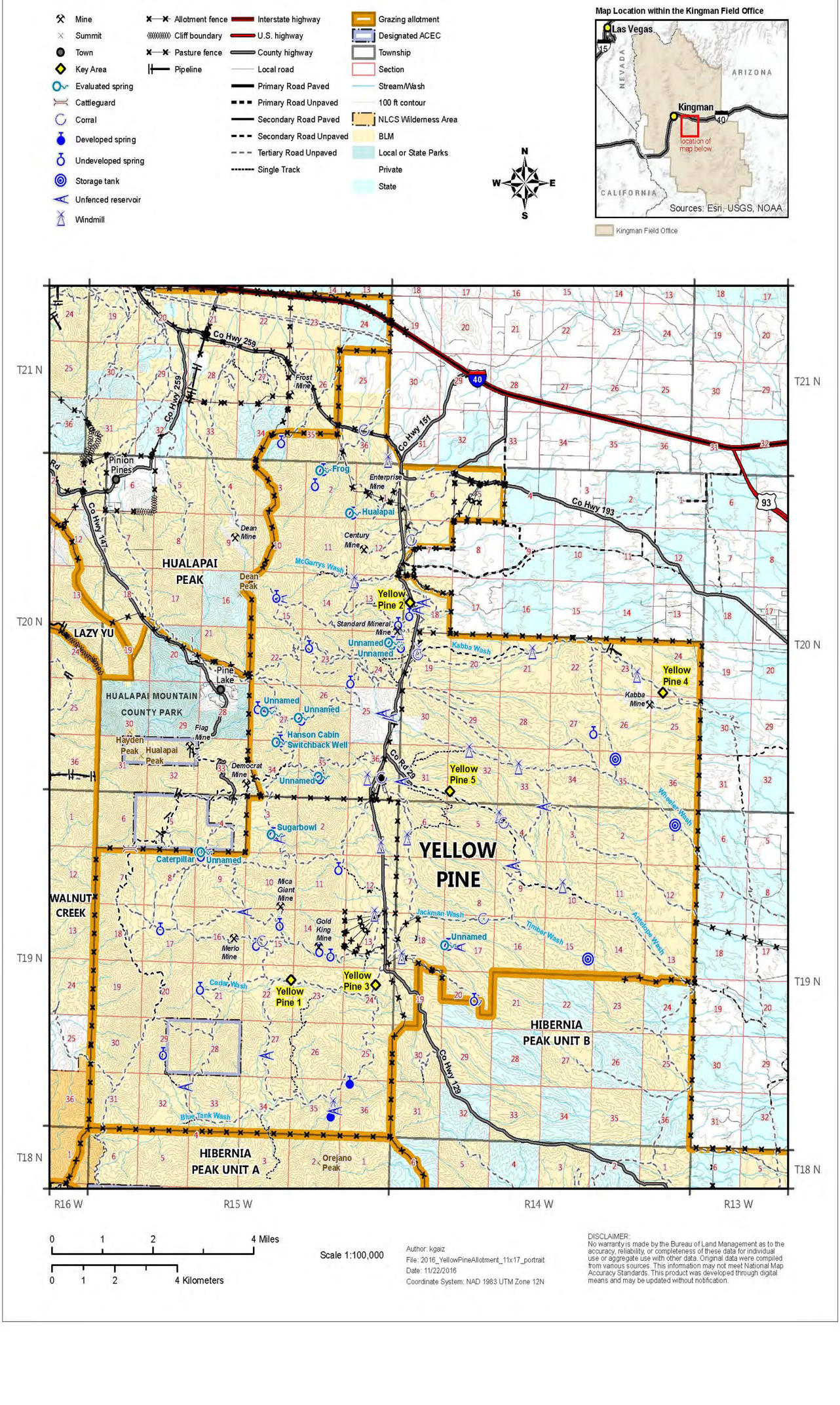
Appendix 3-7. Cane Springs Wash Allotment

Appendix 3-1. Hualapai Mountain North Evaluation Area Map



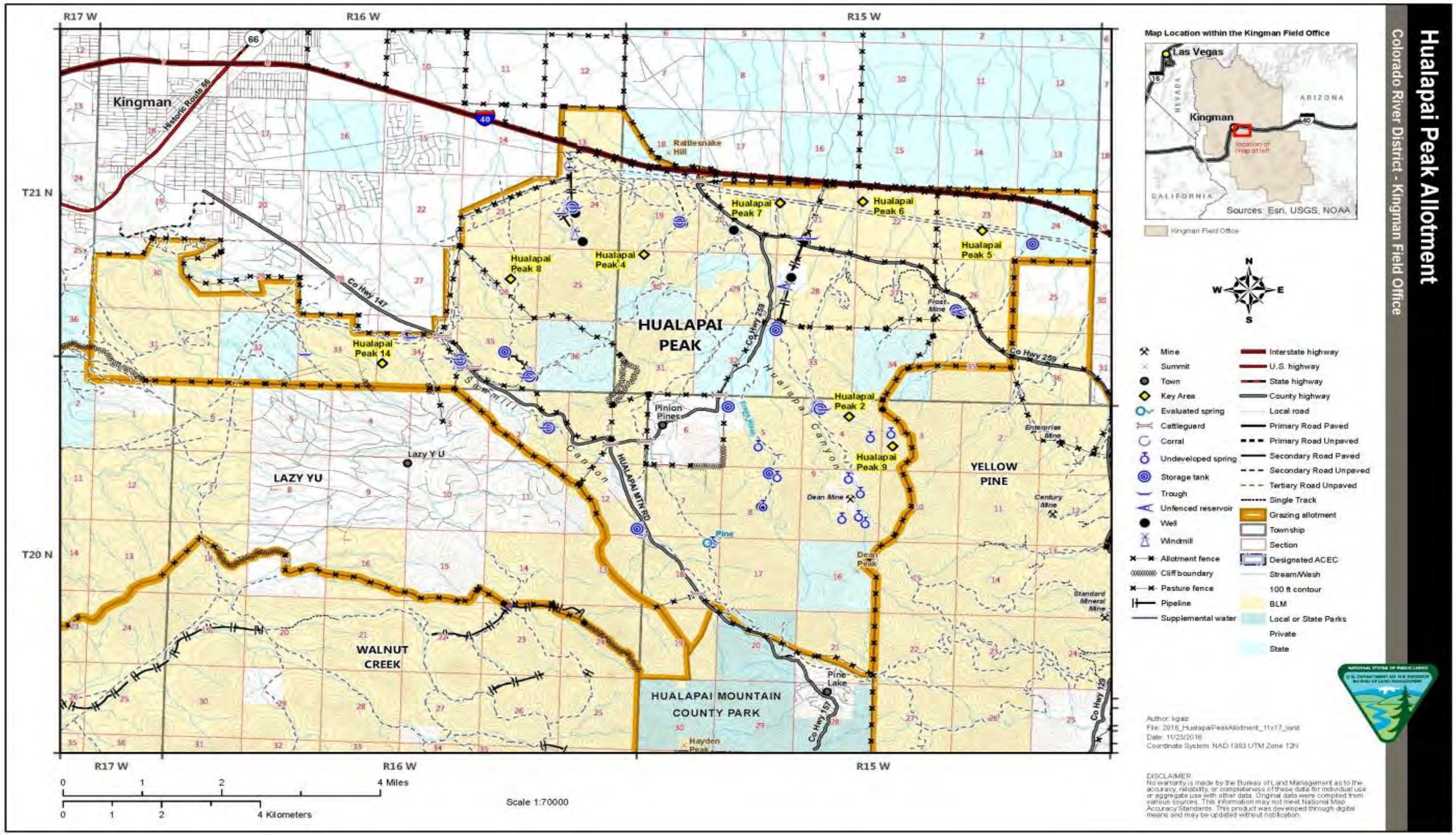
Yellow Pine Allotment

Colorado River District - Kingman Field Office

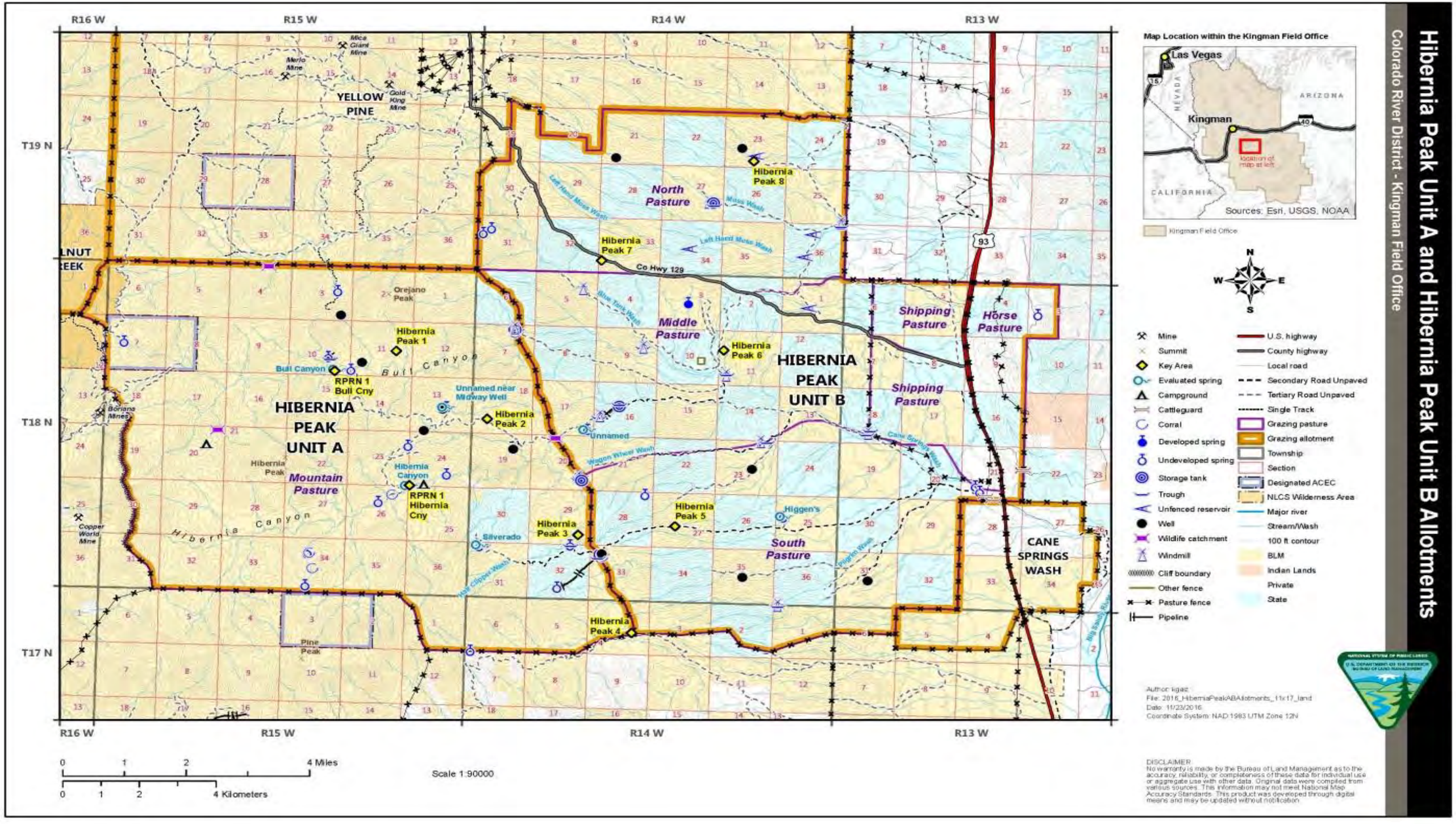


Appendix 3-2. Yellow Pine Allotment

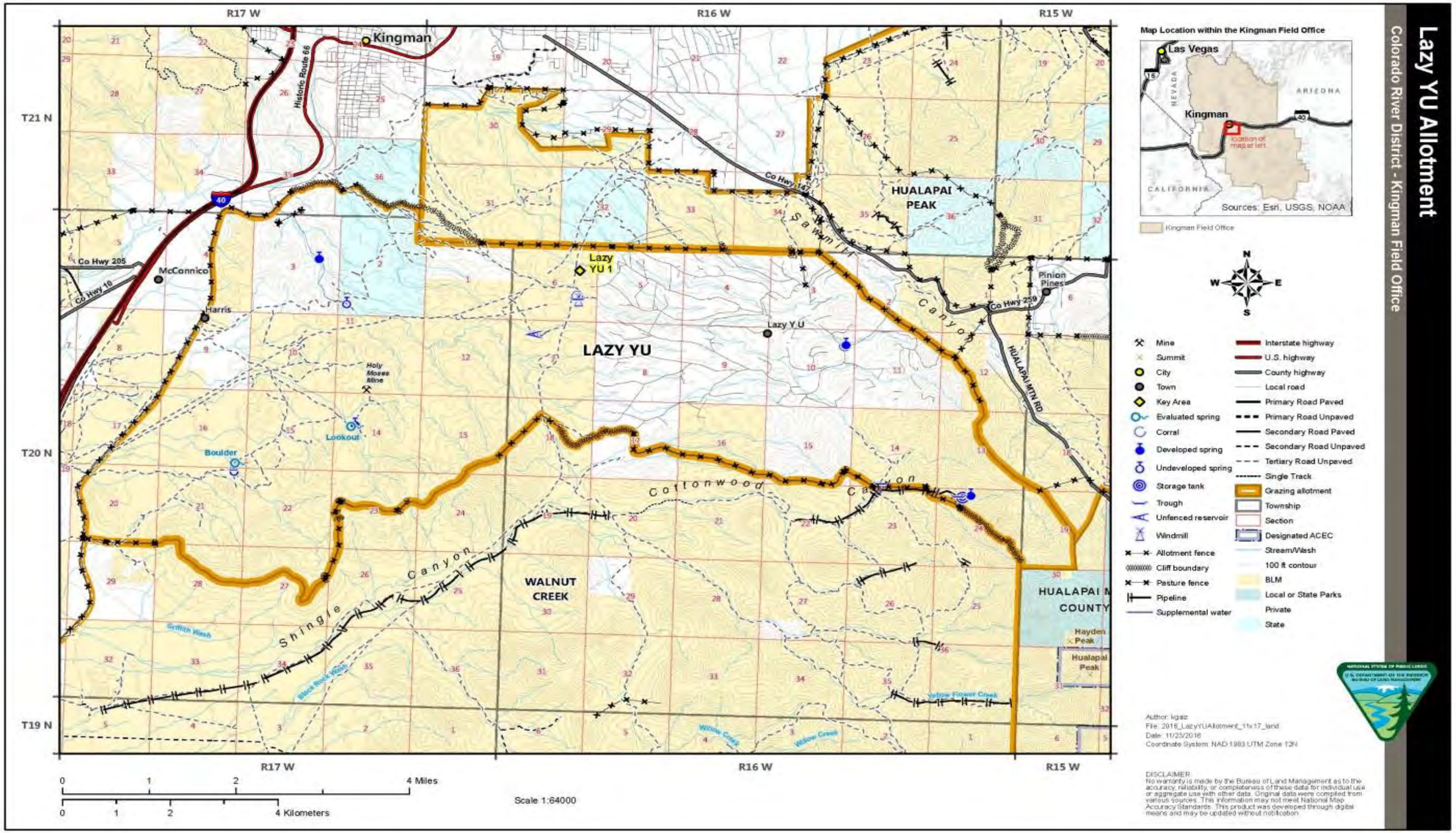
Appendix 3-3. Hualapai Peak Allotment

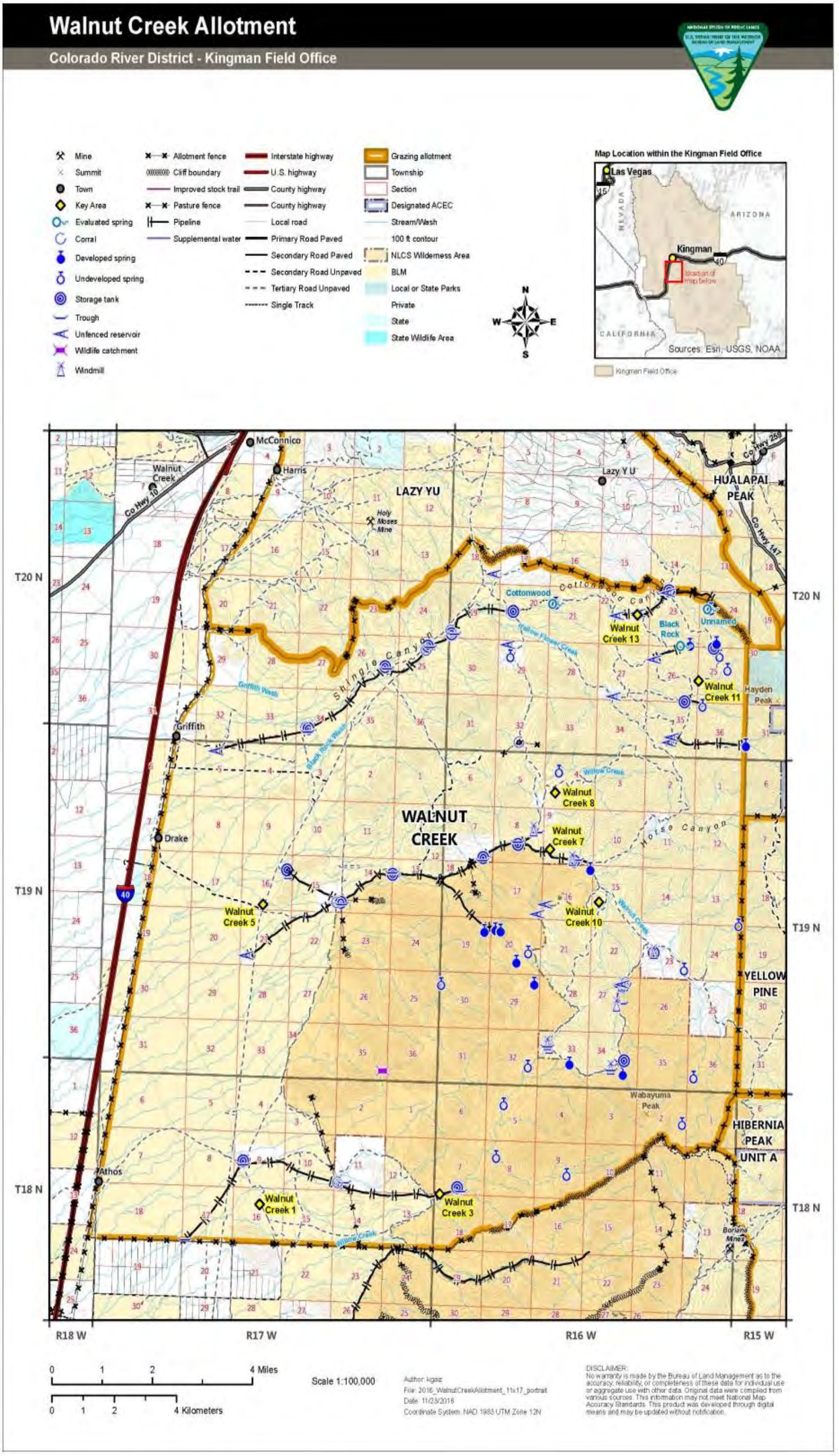


Appendix 3-4 Hibernia Peak Unit A and Hibernia Peak Unit B Allotments



Appendix 3-5. Lazy YU Allotment





Appendix 3-6. Walnut Creek Allotment

Appendix 3-7. Cane Springs Wash Allotment