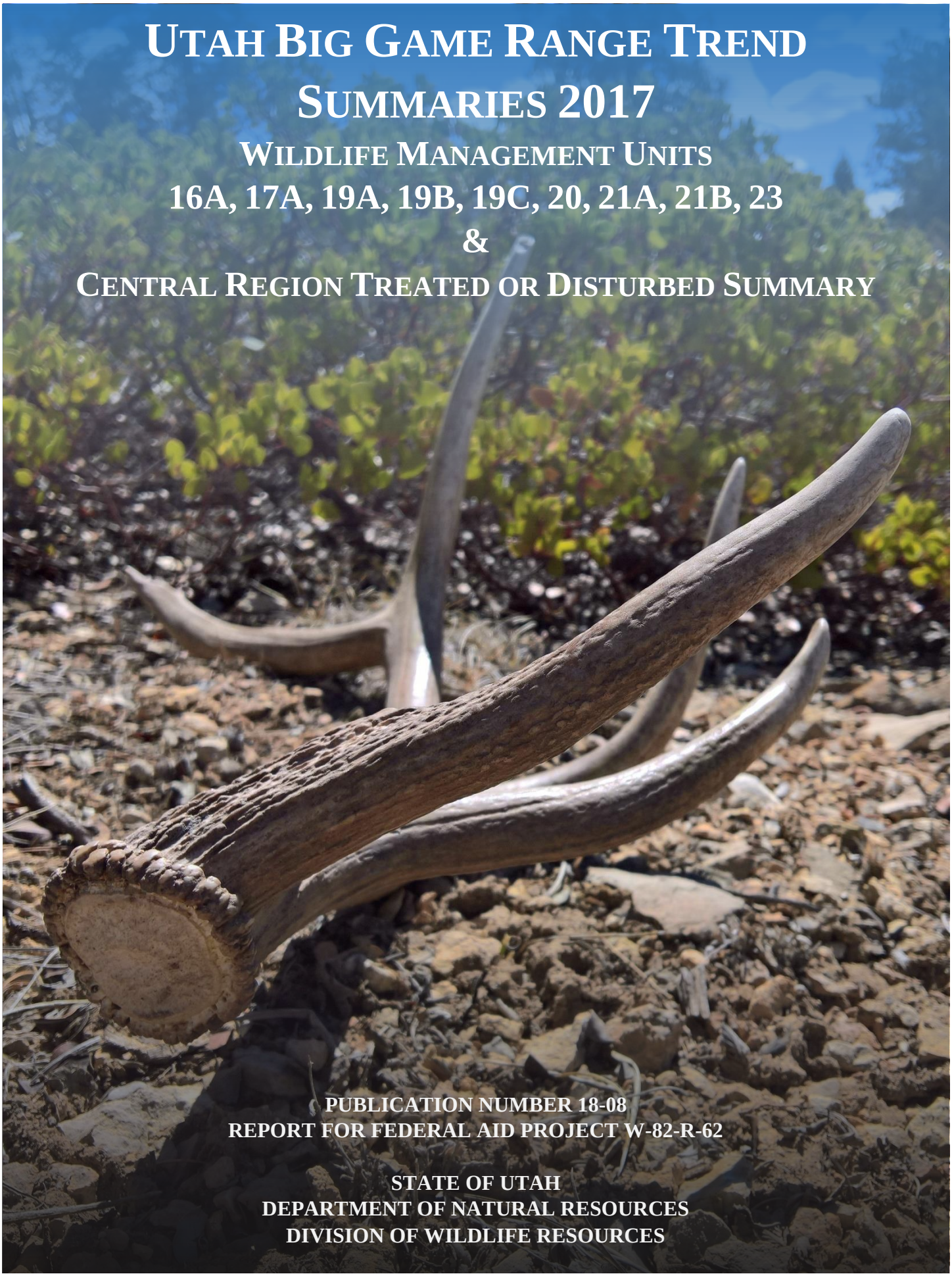
Utah Big Game Range Trend Summaries 2017

Wildlife Management Units
16A, 17A, 19A, 19B, 19C, 20, 21A, 21B, 23
&
Central Region Treated or Disturbed Summary



PUBLICATION NUMBER 18-08
REPORT FOR FEDERAL AID PROJECT W-82-R-62

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

UTAH BIG GAME RANGE TREND UNIT SUMMARIES
2017
WILDLIFE MANAGEMENT UNITS
16A, 17A, 19A, 19B, 19C, 20, 21A, 21B, 23
&
CENTRAL REGION TREATED OR DISTURBED SUMMARY

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Elk Shed Antler by Jason Cox (2018)

Performance Report for Federal Aid Project W-82-R-62

Publication No. 18-08

UTAH DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife Resources
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TABLE OF CONTENTS

Reports for study sites, with accompanying photographs, are available online at http://wildlife.utah.gov/range-trend.html.

PROGRAM NARRATIVE

State: UTAH

Project Number: W-82-R-62

Grant Title: Wildlife Habitat Research and Monitoring

Project Title: Wildlife Habitat Monitoring/Range Trend Studies

Need: The ability to detect changes in vegetation composition (range trend) on big game winter ranges is an important part of the Utah Division of Wildlife Resources (UDWR) big game management program. The health and vigor of big game populations are closely correlated to the quality and quantity of forage in key areas. The majority of the permanent range trend studies are located on deer and elk winter ranges, however on certain management units, studies are located on spring and/or summer ranges, if vegetation composition on these ranges is the limiting factor for big game populations. Range trend data are used by wildlife biologists for habitat improvement planning purposes, reviewing Bureau of Land Management (BLM) and United States Forest Service (USFS) allotment management plans, and as one of several sources of information for revising deer and elk herd unit management plans.

Objective: Monitor, evaluate, and report range trend within designated key areas throughout the state, and inform DWR biologists, public land managers and private landowners of significant changes in plant community composition in these areas.

Expected Results or Benefits: Range trend studies in each region will be reread every five years, and vegetation condition and trend assessments will be made for key areas. UDWR biologists, land management personnel from the USFS and BLM, and private landowners will use the range trend database to evaluate the impact of land management programs on big game habitat. Annual reports are readily available on the Division's website, on USBs, and in hard copies located in UDWR regional offices, BLM and USFS offices, and public libraries. Special studies (habitat project monitoring and big game/livestock forage utilization studies) will give UDWR biologists and public land managers' additional information to address local resource management problems.

REMARKS

The work completed during the 2017 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Central and Southern Region. Most trend studies surveyed in these management units were established in the 1980s and reread at 5-year intervals.

The following Bureau of Land Management and U.S. Forest Service offices provided information and/or assistance in completion of the trend studies, which add to the value of this interagency report:

Bureau of Land Management
- Salt Lake Field Office
- Fillmore Field Office
- Richfield Field Office

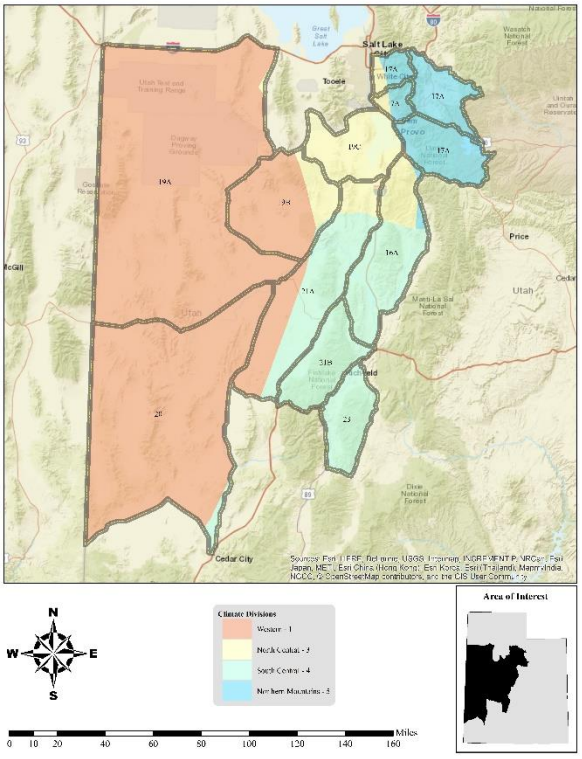
United States Forest Service
- Uinta National Forest
- Fishlake National Forest

Private landowners were cooperative in allowing access to study sites located on their land.

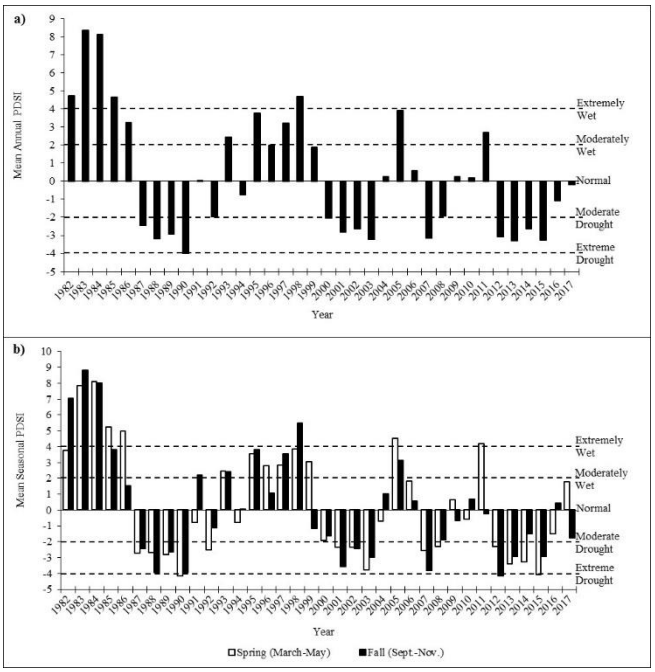
RANGE TREND UNIT SUMMARY OVERVIEW

Boundary Description and Geography: Each unit summary includes the boundary description outlining the boundary of the unit. The geography section details the major features of the unit

Palmer Drought Severity Index Climate Divisions



Climate Data: The state of Utah is divided into seven climatic divisions for estimating the Palmer Drought Severity Index (PDSI) and the Central region occurs within four of these divisions: Western (Division 1), North Central (Division 3), South Central (Division 5), and Northern Mountains (Division 5). The PDSI shows cumulative drought conditions based on precipitation and temperature. Long-term drought is cumulative, so the intensity of the current drought is based not only upon the prevailing conditions but also upon those of previous months (Climate Prediction Center Internet Team, 2005).
The PDSI is based on climate data gathered from 1895 to 2017. The data reported in this summary covers the years over which these sites have been sampled (1982-2017). The PDSI uses a scale where zero indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data, 2018). In the figure below, graph "a" represents the mean annual PDSI for the Western division (Division 1) and graph "b" shows the mean PDSI by season, spring (March-May) and fall (Sept.-Nov.) for the Western division (Division 1) (Climate Prediction Center Internet Team, 2005).



Big Game Habitat: Big game habitat is discussed within each of the unit summaries. This section is a general description of the big game habitat within the unit. Habitat maps for big game animals show the seasonal ranges for year-long, winter, transitional, and summer habitat.

Land Ownership: Land ownership and big game seasonal range were overlaid within a Geographic Information System (GIS) program to create tables for big game animals to display estimated habitat acreage by season and ownership. If there was not habitat for a specific season (summer, winter, transitional, year-long) then that column was omitted.

LANDFIRE Existing Vegetation Coverage: The Existing Vegetation Cover (EVC) layer represents the vertically-projected percent cover of the live canopy layer for a 30-m grid cell. EVC is generated separately for tree, shrub, and herbaceous cover functional groups using training data and other layers. Percentages of tree, shrub, and herbaceous canopy cover training data are generated using plot-level ground-based visual assessments. Once the training data is developed, relationships are then established separately for each functional group between the training data and a combination of Landsat, elevation, and ancillary data. Each of the derived data layers (tree, shrub, herbaceous) has a potential range from 0-100 percent, which are merged into a single composite EVC layer (LANDFIRE, n.d.).

The LANDFIRE data reported in this summary includes the major functional groups (shrubland, conifer, grassland, and other) and various subgroups of importance found within the unit boundaries. Acres and percent of total are reported for each individual vegetation type with the group percent of total for each of the major groups also reported. Agricultural, developed, riparian, and other groups are classified as "other."

Limiting Factors to Big Game Habitat: This section discusses some of the major limiting factors for big game habitat in the unit. Many of the limitations are determined from the range trend study site data, such as abundance of cheatgrass, pinyon and juniper, sagebrush, and other habitat types. Other known limitations such as wildfire, energy development, habitat fragmentation, etc. are determined from other sources.

Treatments/Restoration Work: There has been an active effort to address many of the limitations within each unit through the Watershed Restoration Initiative (WRI). This section outlines the work that has been done on the unit through WRI projects. A map of the projects that have occurred on the management unit through the WRI program and a map of the fire history from 2000-2015 is available for each unit. A total acreage amount for each type of treatment is provided in a table for each unit.

Range Trend Studies: Many of the range trend study sites were established in the 1980s and have many years of data associated with them. A table details the year an individual study was established, whether it is active or suspended, and the ecological site description. Another table shows the disturbance history for those sites that have had a known disturbance that occurred on the site.

Study Trend Summary: Trends were reported by grouping sites into an ecological site based on soil characteristics, elevation, precipitation, and dominant vegetation type. Trends for each individual ecological site were evaluated by analyzing directional shifts in mean densities and covers for shrubs and trees. Not all sites had shrubs or trees present: when this was the case, these graphs were omitted from the summary. The implied trend for the herbaceous understory was evaluated by comparing mean values of nested frequencies and covers from sample year to sample year. Occupancy trends of big game species are also discussed and were evaluated by comparing mean pellet group counts of individual species from sample year to sample year.

Range trend study sites were summarized based on their ecological site descriptions (ESD). ESDs provide a consistent means for interpreting the landscape. Additionally, ESDs provide a way to identify similar ecological potentials and allow for predictable landscape responses to disturbances or management inputs based on repeating landscape patterns. Sites are classified based on abiotic and biotic features such as soil characteristics and plant community composition. The most common ESDs within big game seasonal ranges study sites are semidesert ESDs, which are lower in elevation, upland ESDs, which are mid elevation, and mountain ESDs, which are higher elevation sites.

WRI and Range Trend Summary (Disturbed Sites): Study sites that have experienced a treatment or disturbance over the study years have been grouped together based on treatment or disturbance type. Treatments were further broken down into pre- and post-treatment categories. Only the latest pre-treatment year from each site was averaged into pre-treatment data while the post-treatment years were categorized into five-year increments that were averaged with their corresponding post-treatment years and are presented as 1-3 years post-treatment, 4-8 years-post-treatment, etc. Changes in shrubs, trees, herbaceous understory, and occupancy of wildlife and domestic animals were also described for each of the treatment types.

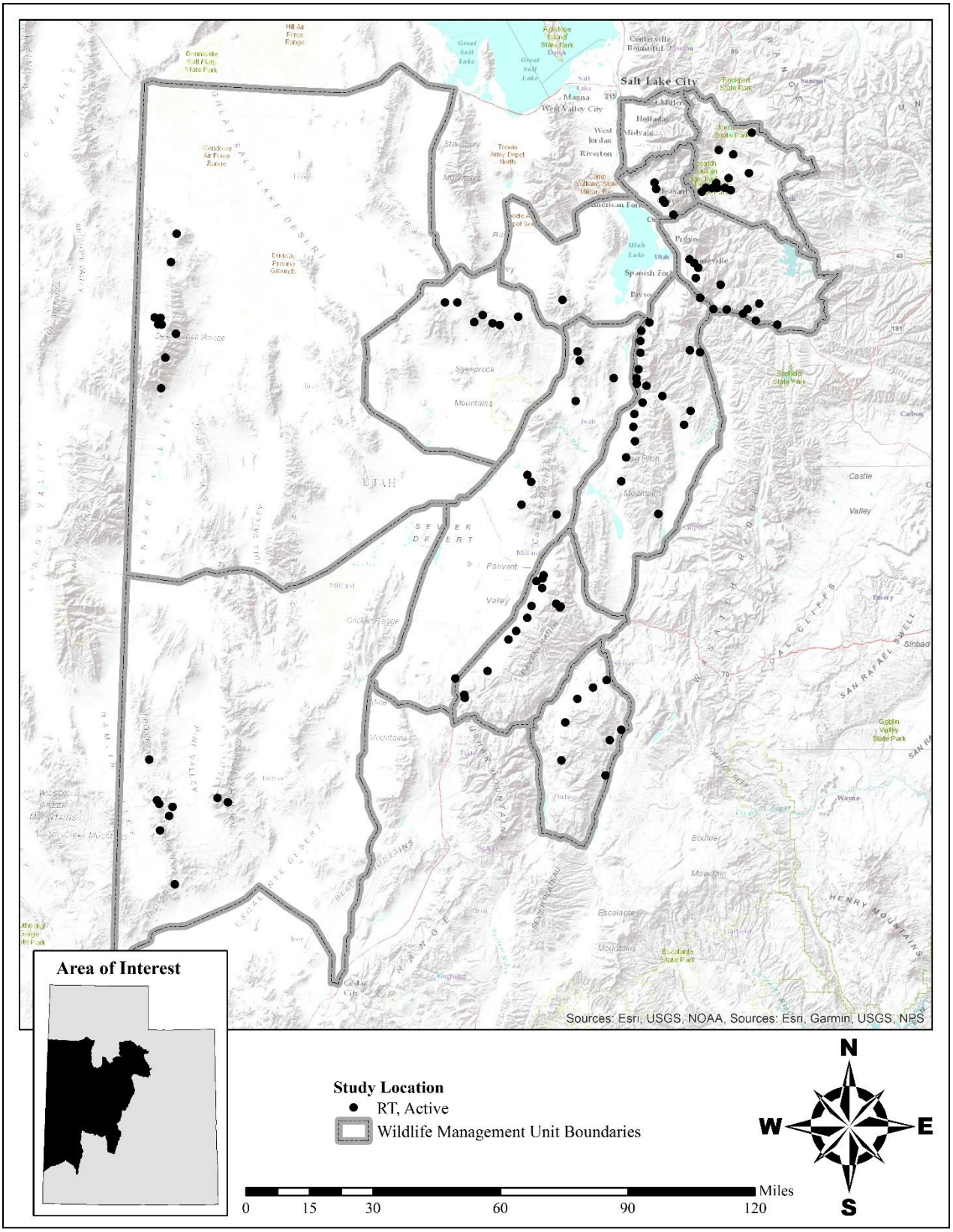
Deer Winter Range Condition Assessment: The desirable components index (DCI) for deer was created by Range Trend Program personnel as a tool to address condition and/or value of winter ranges for mule deer. This index is meant to be a companion to, and not a replacement for, the site-specific range trend assessments that are found in the annual Utah Big Game Range Trend Studies report. This index was designed to score mule deer winter range based upon several important vegetation components (i.e. preferred browse cover, shrub decadence, recruitment of young shrubs, cover of perennial grasses, cover of perennial forbs, cover of annual grasses, and presence of noxious weeds). Although the index may be useful for assessing habitat for other species (i.e. sage grouse and elk), the rating system was devised to specifically address mule deer winter range requirements.

This index is used primarily to determine whether a particular site has the vegetation components necessary to be good winter range for mule deer. It can also be used to identify areas where habitat restoration projects may be needed and assist land managers in determining possible rehabilitation options. Because it does not take soil stability, hydrologic function, and other environmental factors into account, this index should not be used to assess a sites function and/or condition as typically used by federal land management agencies.

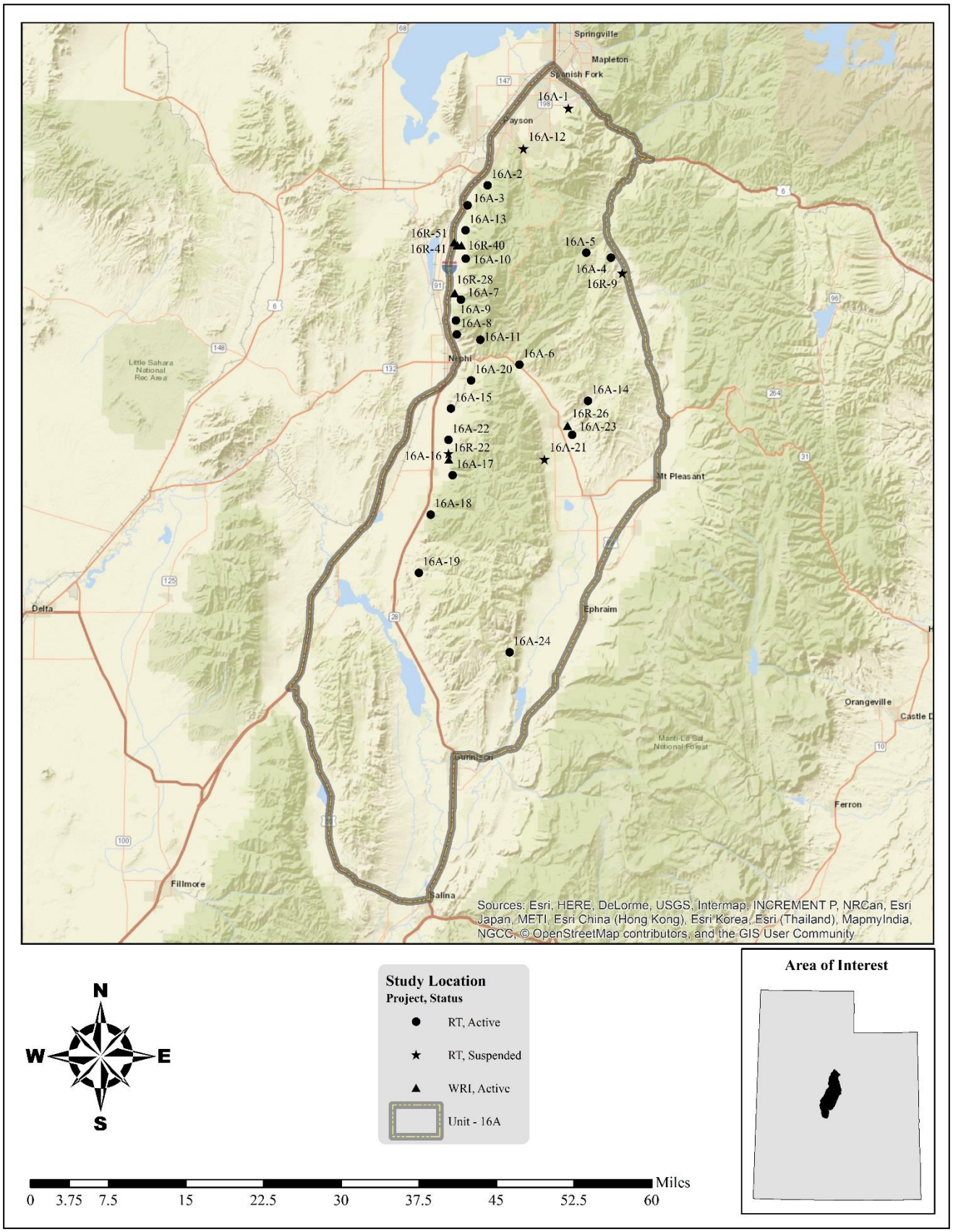
Changes in DCI over the sample years for both treated and untreated sites are included in the figures near the end of the summary. Care should be taken when interpreting these tables as the number of sites included in each year may vary. This could be misleading if the overall DCI seems to be improving, when really the very poor or poor sites may be excluded due to a lack of sampling in a certain year.

Discussion and Recommendations: Each of the ecological site descriptions were assessed for their overall threats based on species composition and cover. Common threats to these sites were pinyon-juniper encroachment and introduced perennial and/or annual grass species. Impacts of these threats include reduced vigor of understory species, a decrease in herbaceous diversity, and/or increased fire potential. Some sites did not have these issues and were classified as “none identified.”

UNIT SUMMARIES



1. WILDLIFE MANAGEMENT UNIT 16A – NEBO



WILDLIFE MANAGEMENT UNIT 16A – NEBO

Boundary Description

Utah, Juab, and Sanpete Counties - Boundary begins at the junction of I-15 and US-6 in Spanish Fork; southeast on US-6 to US-89 at Thistle Junction; south on US-89 to US-50 at Salina, northwest along US-50 to I-15 at Scipio; north along I-15 to US-6 in Spanish Fork.

Management Unit Description

Geography

This management unit incorporates most of the old North and South Nebo deer herd units and is approximately 943,923 acres in size. Nephi Canyon divides the northern and southern parts of the unit running east to west. A majority of the permanent range trend studies are placed on the western faces of the Wasatch and San Pitch Mountains.

The northern section of the Nebo unit is dominated by high mountains such as Santaquin Peak, Bald Mountain, and Mount Nebo. Mount Nebo represents the southernmost extension of the Wasatch Range. This range is high and rugged, with steep slopes on the western portion and less steep slopes on the eastern portion of the mountain range. The San Pitch and Valley Mountains make up the majority of the southern portion of the unit. These mountains are lower and less steep than the northern part of the unit with shallow canyons throughout. Towns within this unit include Fountain Green, Moroni, Levan, Fayette, Payson, Chester, Wales and Salem. Towns partially included in the unit include Spanish Fork, Fairview, Mount Pleasant, Ephraim, and Manti.

Climate Data

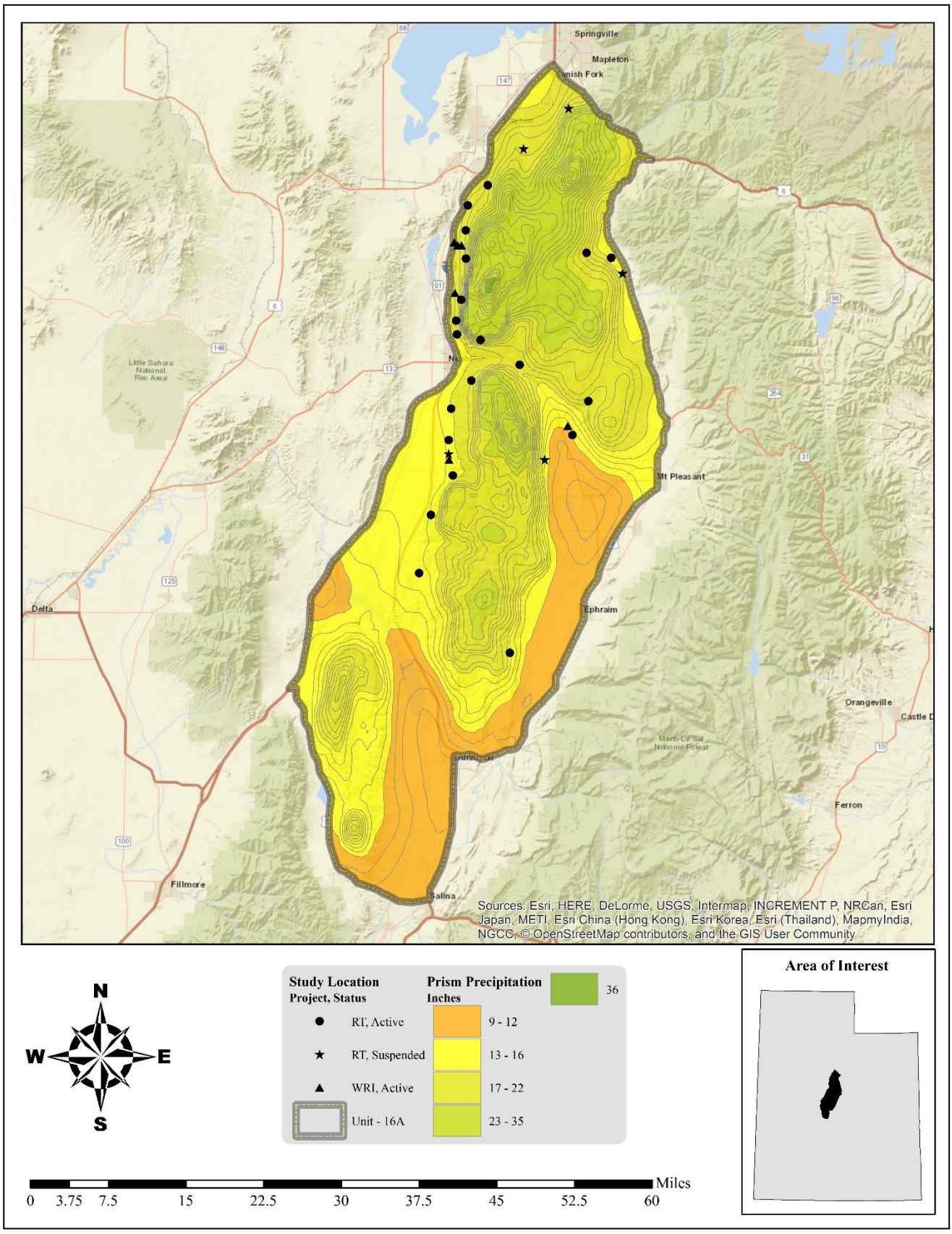
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 9 inches in the Sanpete Valley and along the I-15 corridor near Yuba Reservoir to 35 inches on Mount Nebo. All of the Range Trend and WRI monitoring studies on the unit occur between 9 and 23 inches of precipitation (**Map 1.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the North Central, South-Central, and Northern Mountain divisions (Divisions 3, 4, and 5).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 1.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 1.2b**).

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015; moderately to extremely wet years were displayed from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 1.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 1.1b**).

The mean annual PDSI of the Northern Mountains division displayed years of moderate to extreme drought from 1988-1990, 2000-2003, and 2012-2013 and moderately to extremely wet years from 1982-1986, 1995, 1997-1998, 2005, and 2011 (**Figure 1.3a**). The mean spring (March-May) PDSI displayed moderate to extreme drought in 1989-1990, 1992, 2000-2004, and 2012-2014; moderately to extremely wet years were displayed in 1982-1986, 1995-1996, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1988-1990, 2000-2003, 2007, and 2012-2013; moderately to extremely wet years were displayed in 1982-1986, 1995, and 1997-1998 (**Figure 1.3b**) (Time Series Data, 2018).



Map 1.1: The 1981-2010 PRISM Precipitation Model for WMU 16A, Nebo (PRISM Climate Group, Oregon State University, 2013).

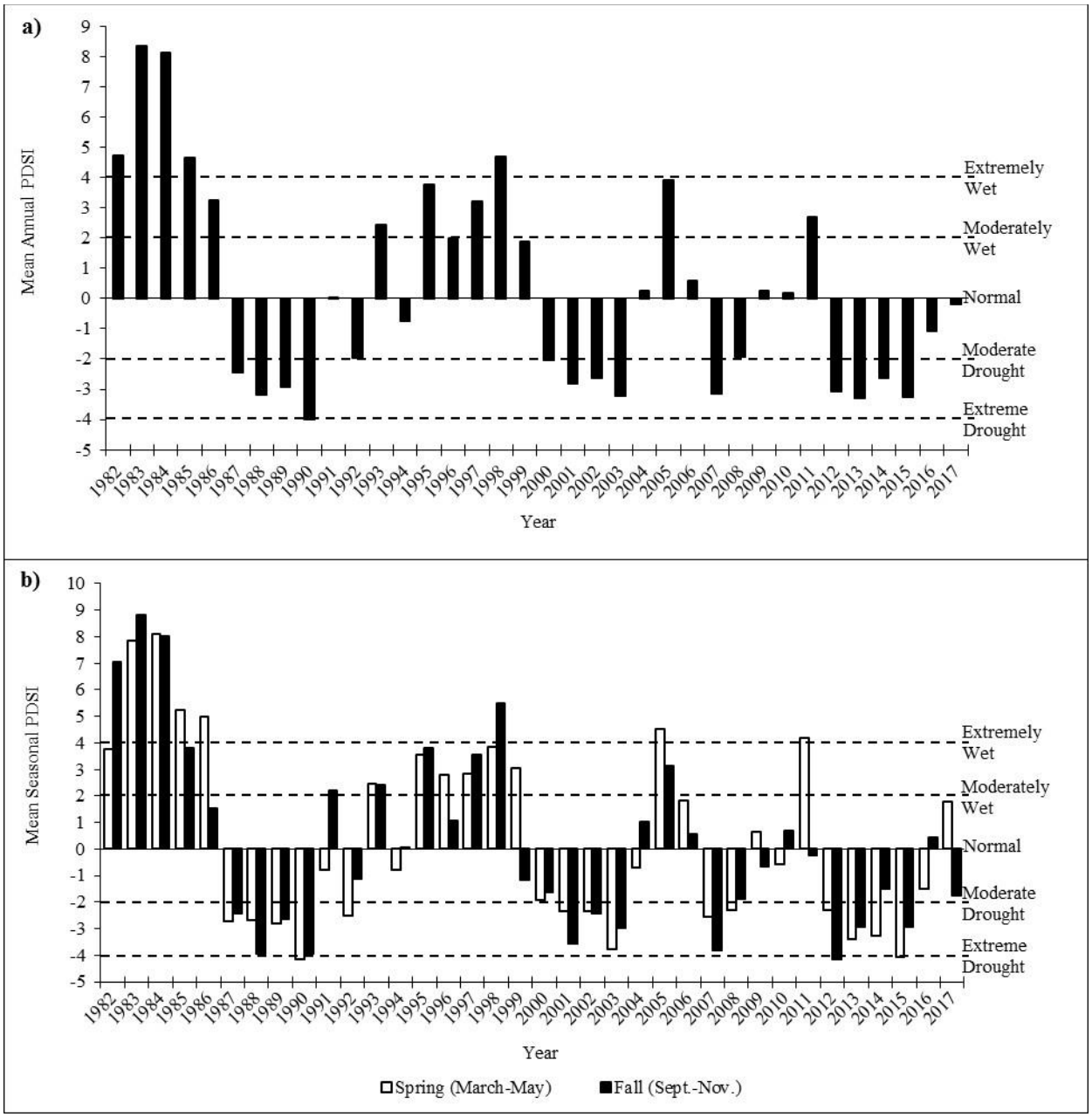


Figure 1.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

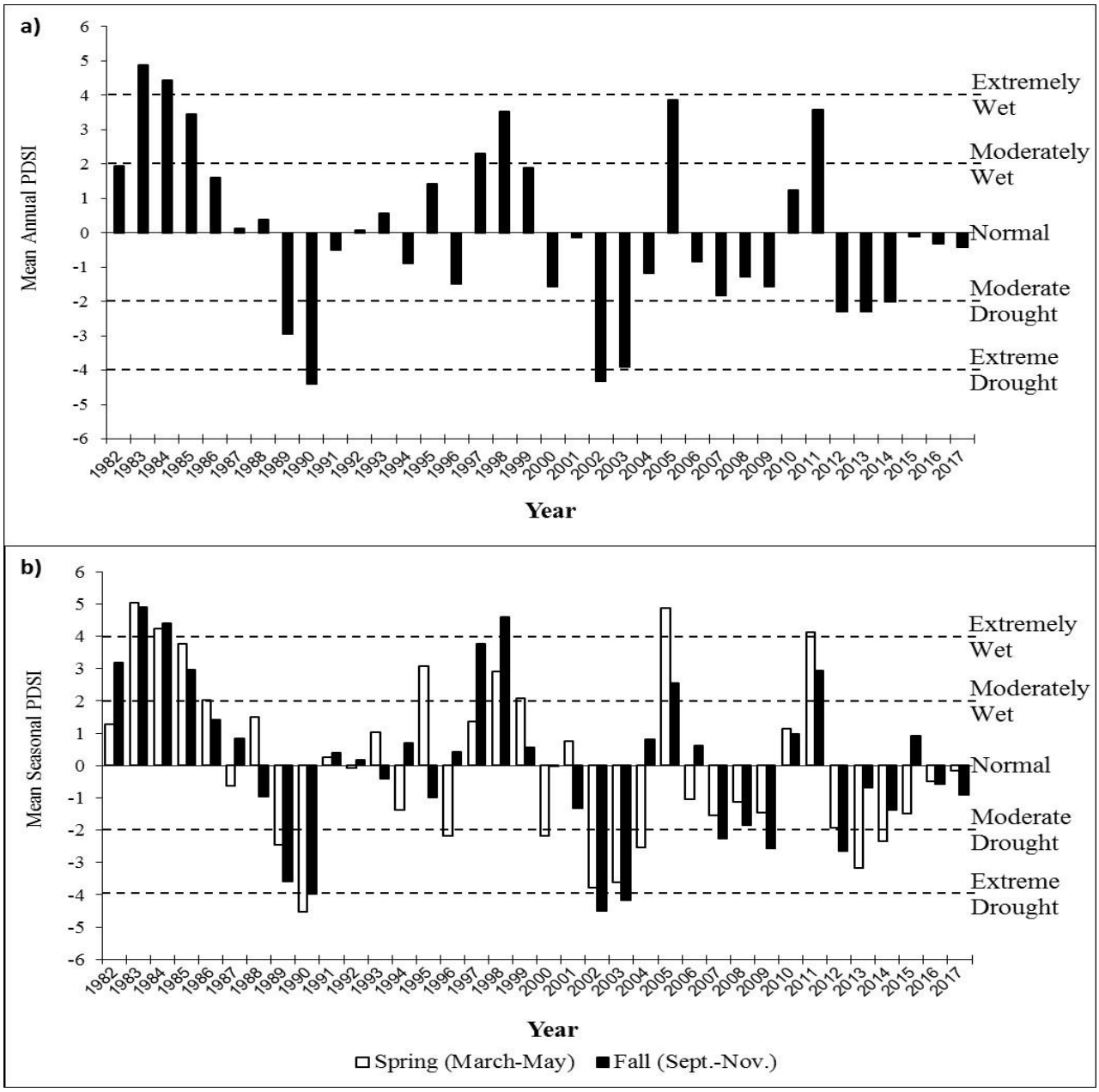


Figure 1.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

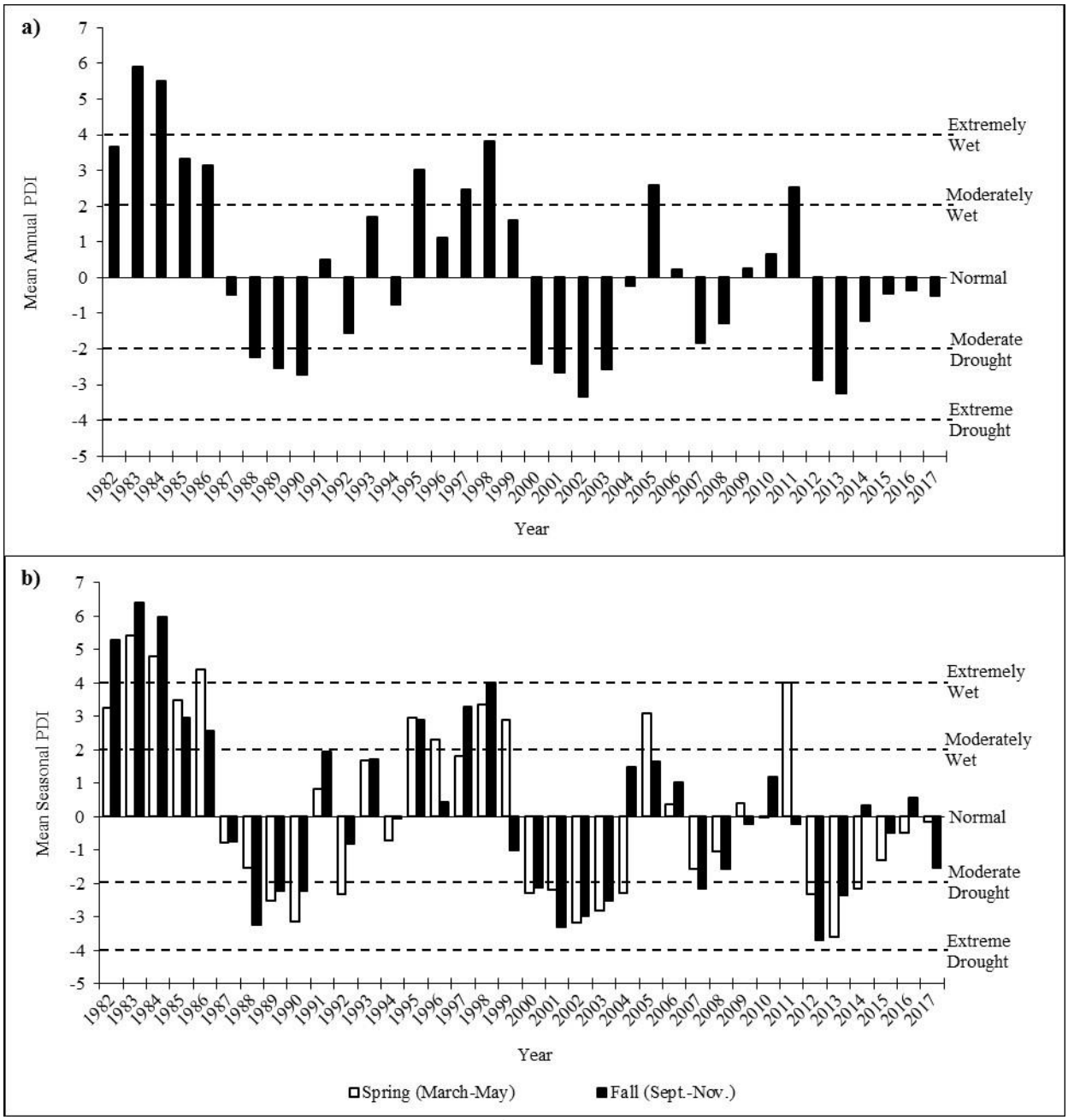


Figure 1.3: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

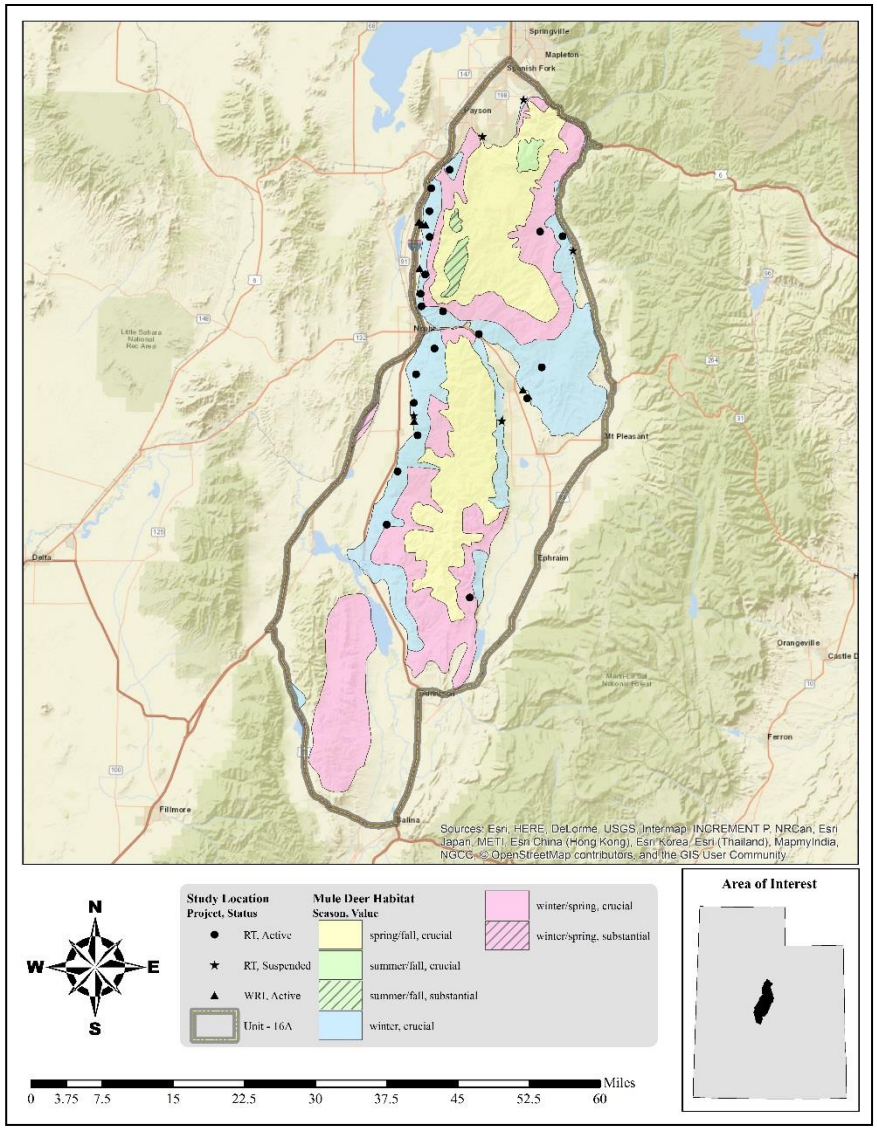
Big Game Habitat

There are an estimated 571,702 acres classified as deer range on Unit 16A with 38% classified as spring/fall range, 2% as summer/fall, 27% as winter range, and 37% as winter/spring range (**Table 1.1**, **Map 1.2**).

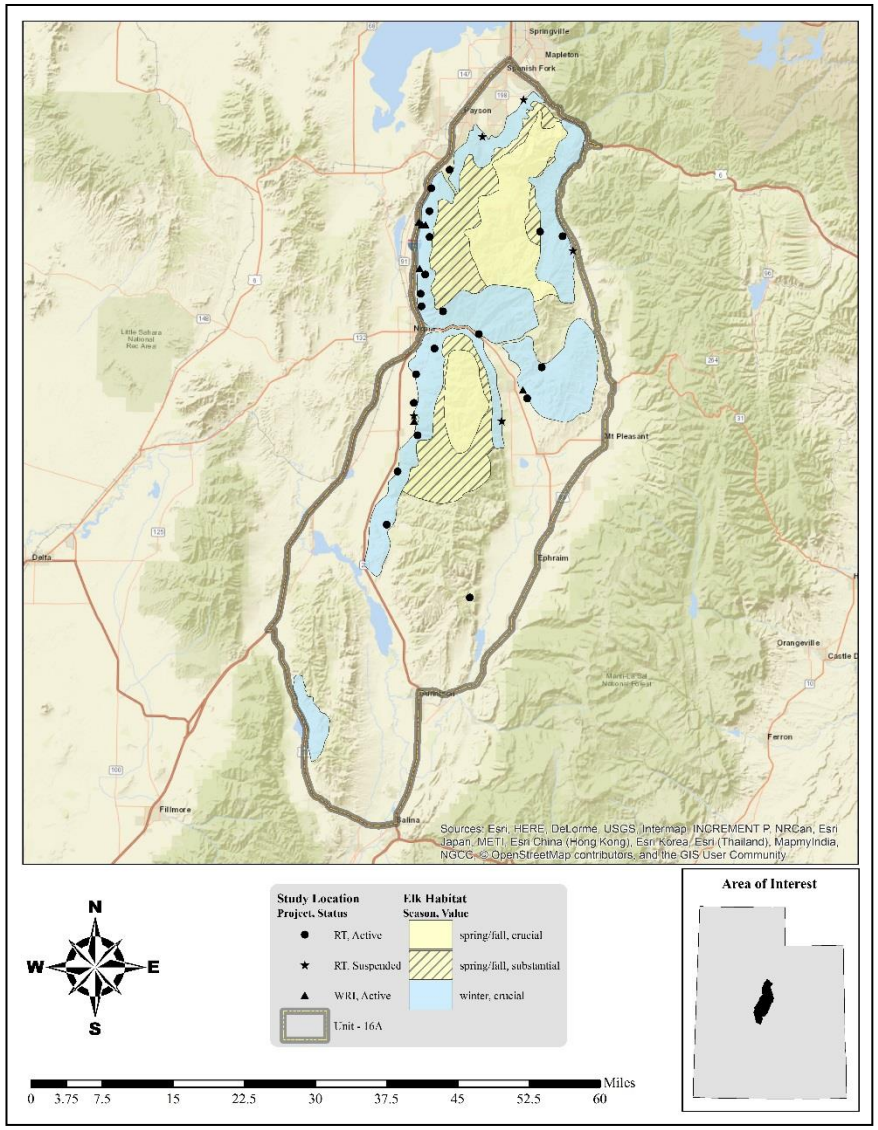
Privately owned land comprises 57% of the winter range, 18% is managed by the Bureau of Land Management (BLM), Utah Division of Wildlife Resources (UDWR) manages 11% of winter range, 9% is managed by the United States Forest Service (USFS), and 4% is managed by the Utah School and Institutional Trust Lands Administration (SITLA) (**Table 1.2**, **Map 1.2**, **Map 1.6**). Of the elk winter range, 53% is privately owned, 19% is managed by the USFS, the BLM manages 12%, there is 12% is managed by the Utah Division of Wildlife Resources, and 3% managed by SITLA (**Table 1.3**, **Map 1.3**, **Map 1.6**).

Deer winter range is located mostly along the foothills of the ranges within the unit; the lower portions of deer winter range follows I-15 and US 89 north and south. This unit is limited by I-15 and associated fencing on the west side, which has hindered access to former winter range further west. During severe winters, this side is limited by the small area of severe winter range, which are in some areas only a few hundred yards in size. The east side of the unit is not limited by severe winter range to the same degree.

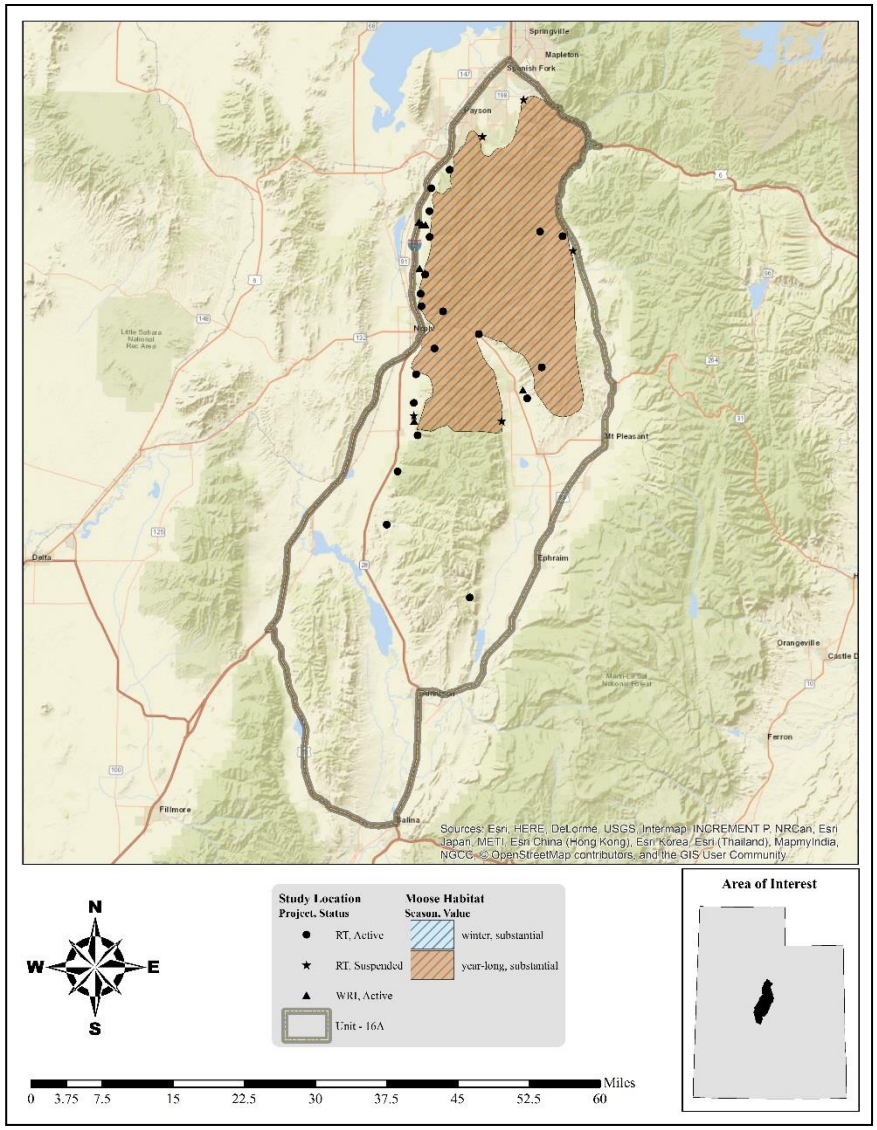
Both sagebrush and mixed mountain brush are major components of the winter range within this unit. Mountain big sagebrush occupies many of the lower flats and foothill regions. Mixed mountain brush communities, composed of Stansbury cliffrose, serviceberry, Gambel oak and mountain mahogany, occur within much of the winter ranges in the unit, often on the sides of foothill areas. There are pinyon-juniper communities present throughout the winter range, though many encroachment removal efforts have taken/are currently taking place across the unit. Residual tree cover can help provide thermal cover in wintering areas.



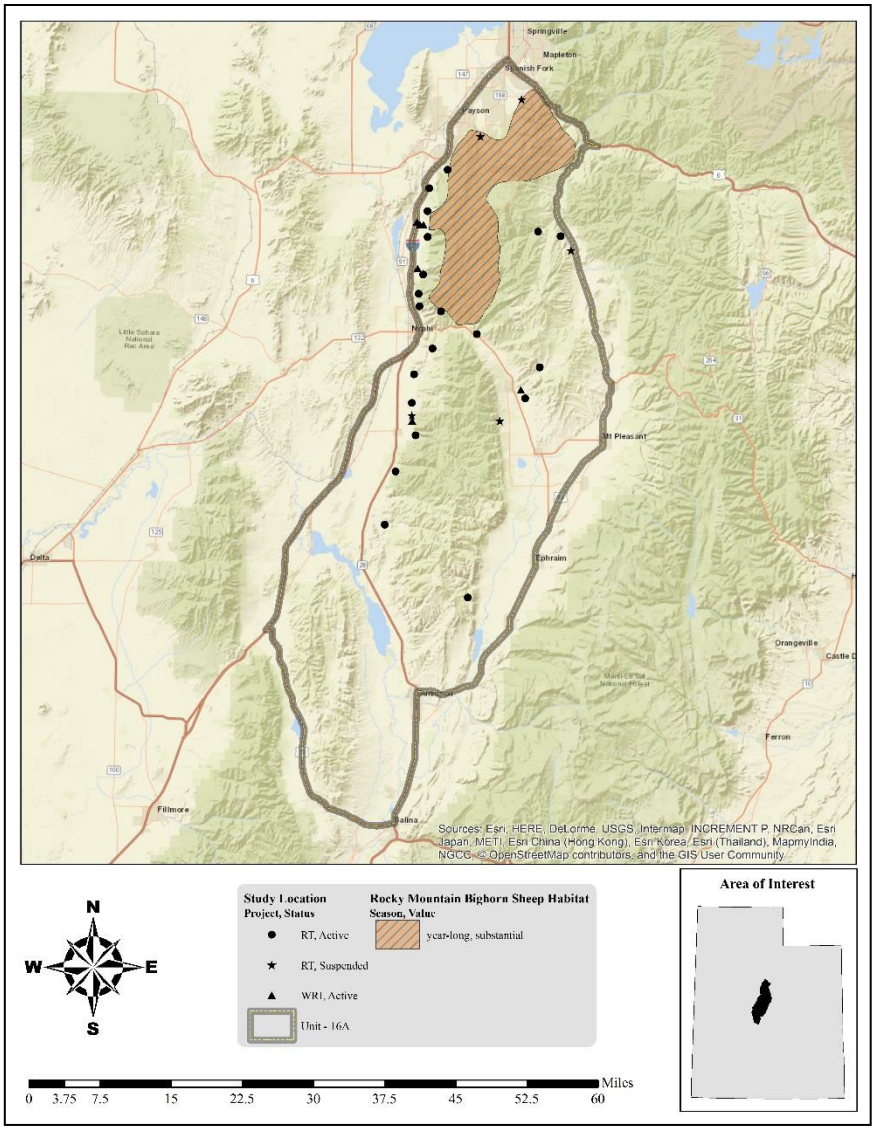
Map 1.2: Estimated mule deer habitat by season and value for WMU 16A, Nebo.



Map 1.3: Estimated elk habitat by season and value for WMU 16A, Nebo.



Map 1.4: Estimated moose habitat by season and value for WMU 16A, Nebo.



Map 1.5: Estimated Rocky Mountain Bighorn Sheep habitat by season and value for WMU 16A, Nebo.

	Year Long Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	0	0%	11,930	2%	153,253	28%	213,768	37%	192,751	34%
Elk	0	0%	0	0%	189,092	52%	0	0%	176,107	48%
Bighorn Sheep	102,113	100%	0	0%	0	0%	0	0%	0	0%
Moose	276,654	99%	0	0%	3,880	1%	0	0%	0	0%

Table 1.1: Estimated mule deer, elk, Rocky Mountain bighorn sheep (RMBS), and moose habitat acreage by season for WMU 16A, Nebo.

	Spring/Fall Range		Summer/Fall Range		Winter Range		Winter/Spring Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	8,596	4%	40	<1%	27,643	18%	86,289	40%
DOD	0	0%	0	0%	117	<1%	0	0%
Private	46,636	24%	9	<1%	88,075	57%	64,157	30%
SITLA	3299	2%	0	0%	6,122	4%	14,731	7%
UDWR	7923	4%	2,454	21%	17,385	11%	8,594	4%
USFS	126,297	66%	9,429	79%	13,911	9%	39,997	19%
Total	192,751	**100%**	11,930	**100%**	153,253	**100%**	213,768	**100%**

Table 1.2: Estimated mule deer habitat acreage by season and ownership for WMU 16A, Nebo.

	Spring/Fall Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	849	<1%	23,055	12%
Private	13,915	8%	100,940	53%
SITLA	87	<1%	6,105	3%
UDWR	11,869	7%	22,452	12%
USFS	149,387	85%	36,540	19%
Total	176,107	**100%**	189,092	**100%**

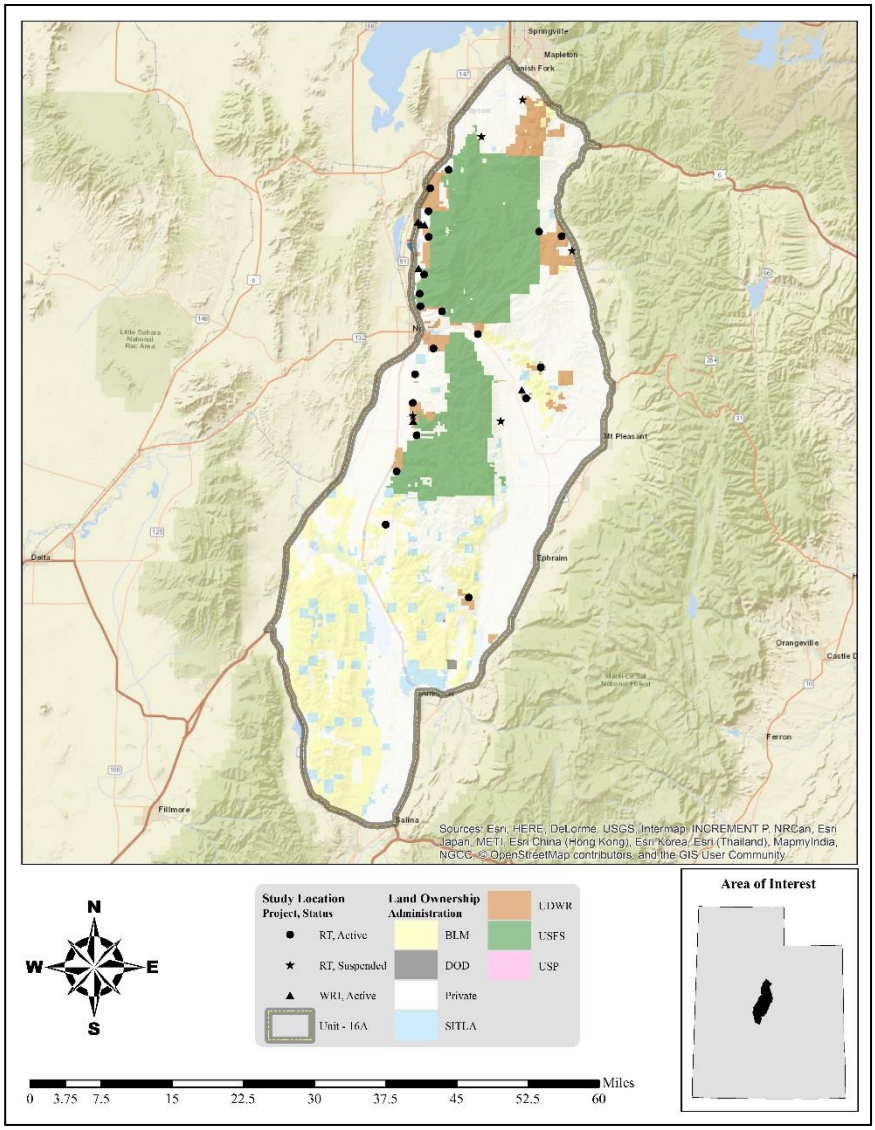
Table 1.3: Estimated elk habitat acreage by season and ownership for WMU 16A, Nebo.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	1,926	2%
Private	16,690	16%
SITLA	160	<1%
UDWR	12393	12%
USFS	70,945	69%
Total	102,113	**100%**

Table 1.4: Estimated Rocky Mountain bighorn sheep habitat acreage by season and ownership for WMU 16A, Nebo.

	Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	2	<1%	8,762	3%
Private	463	12%	91,945	33%
SITLA	3,334	86%	0	0%
UDWR	5	<1%	28,719	10%
USFS	76	2%	147,228	53%
Total	3,880	**100%**	276,654	**100%**

Table 1.5: Estimated moose habitat acreage by season and ownership for WMU 16A, Nebo.



Map 1.6: Land ownership for WMU 16A, Nebo.

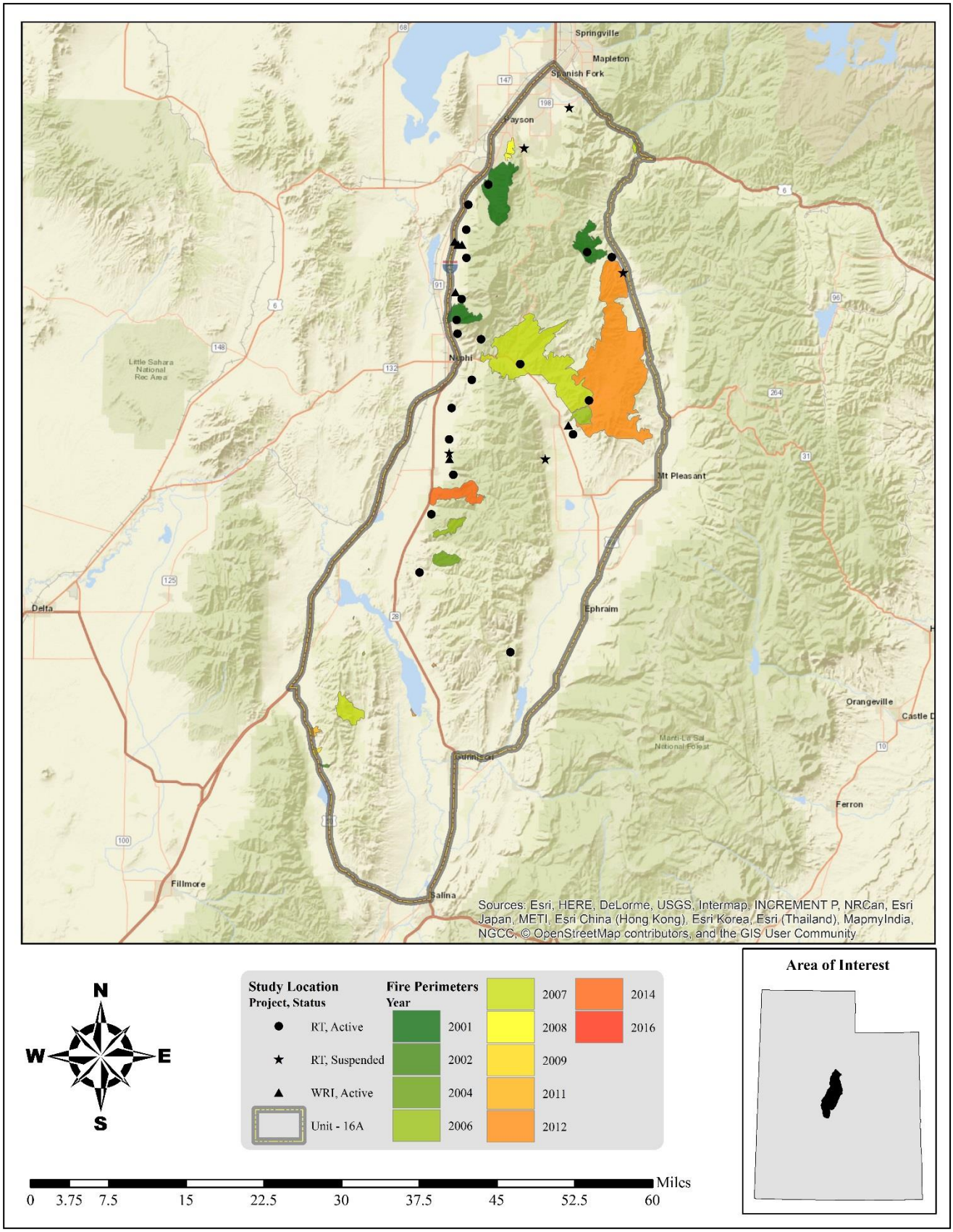
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Colorado Plateau Pinyon-Juniper Woodland	216,106	22.89%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	22,726	2.41%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	14,086	1.49%	
	Abies concolor Forest Alliance	8,062	0.85%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	6,997	0.74%	
	Great Basin Pinyon-Juniper Woodland	4,091	0.43%	
	Other Conifer	1,692	0.18%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,611	0.17%	29.17%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	47,100	4.99%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	3,719	0.39%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	3,264	0.35%	5.73%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	25,632	2.72%	
	Inter-Mountain Basins Semi-Desert Grassland	2,842	0.30%	
	Southern Rocky Mountain Montane-Subalpine Grassland	974	0.10%	
	Other Grassland	63	0.01%	3.13%
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	83,018	8.79%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	43,793	4.64%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	29,949	3.17%	
	Quercus gambelii Shrubland Alliance	24,666	2.61%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	23,119	2.45%	
	Inter-Mountain Basins Greasewood Flat	22,575	2.39%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	8,155	0.86%	
	Rocky Mountain Lower Montane-Foothill Shrubland	7,112	0.75%	
	Inter-Mountain Basins Montane Sagebrush Steppe	6,877	0.73%	
	Great Basin Xeric Mixed Sagebrush Shrubland	6,670	0.71%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	4,087	0.43%	
	Coleogyne ramosissima Shrubland Alliance	2,113	0.22%	
	Inter-Mountain Basins Big Sagebrush Steppe	2,037	0.22%	
	Other Shrubland	1,044	0.11%	28.10%
Other	Agricultural	101,756	10.78%	
	Hardwood	86,218	9.13%	
	Developed	63,725	6.75%	
	Riparian	19,493	2.07%	
	Conifer-Hardwood	17,775	1.88%	
	Open Water	13,088	1.39%	
	Sparsely Vegetated	9,883	1.05%	
	Barren	6,746	0.71%	
	Quarries-Strip Mines-Gravel Pits	876	0.09%	33.85%
Total		943,923	100%	100%

Table 1.6: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 16A, Nebo.

Limiting Factors to Big Game Habitat

The principal limiting factor and management concern in the Nebo management unit is the lack of winter range in good condition, especially severe winter range on the west side of the unit. In the area from Spanish Fork Canyon south to Nephi, the normal winter range averages two miles or less in width. Severe winter range is even narrower, ranging from a few hundred yards to 1.5 miles in width. However, the winter range on the east and south sides of the unit is more expansive and not nearly as critical.

Some of the major problems related to the limited winter range on the unit (especially low elevation severe winter range) include: restricted access to traditional wintering areas west of I-15, predominantly private ownership of critical ranges (57% of normal winter range), and agricultural depredation. To remedy the situation, the UDWR has acquired approximately 12,800 acres of winter range in the unit (11% of total winter range) and has attempted treatments and rehabilitation projects in these critical areas. The available winter range, especially critical areas on the west side of the unit, remains threatened by urban development and a high fire hazard caused by the presence of significant amounts of cheatgrass (*Bromus tectorum*). As previously mentioned, a major threat to deer winter habitat is the development of winter range on private property. Most of the winter range on the north end of the Nebo unit is privately owned: there is continual expansion of new home construction in the higher elevations of winter range in the communities of Spanish Fork, Salem, Woodland Hills and Elk Ridge. The same is true on the central part of the Nebo Unit, along Water Hollow and Big Hollow; the development there, however, is more for cabin lots and not for residential housing. Both of these areas have historically been very important winter ranges for large populations of mule deer. State-owned WMAs along the east and west side of the unit are important areas of protection. However, these WMAs may prove inadequate to sustain the deer population at the desired objective as private development continues in the future. Therefore, further habitat acquisition and rehabilitation are necessary to adequately maintain the winter range in this management unit (**Table 1.6**).



Map 1.7: Land coverage of fires by year from 2000-2018 for WMU 16A, Nebo (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

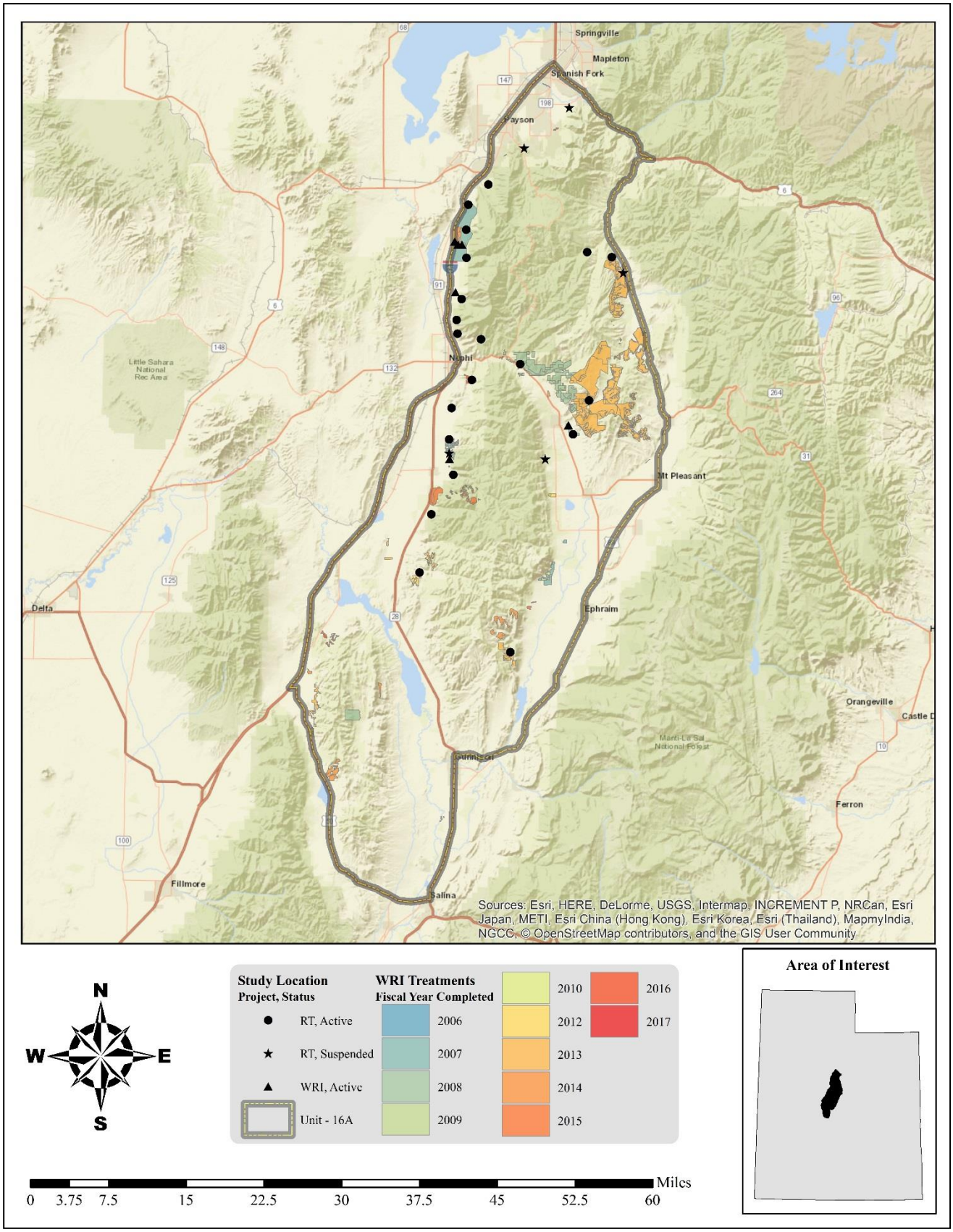
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 47,250 acres of land have been treated within the Nebo unit since the WRI was implemented in 2004 (**Map 1.8**). An additional 2,636 acres are currently being treated and treatments have been proposed for 1,321 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 51,207 acres for this unit (**Table 1.7**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Anchor chaining to remove pinyon and juniper is the most common management practice in this unit. Bullhog treatments to treat pinyon and juniper are also frequently used. Seeding plants to augment the herbaceous understory is also very common. Other management practices include (but are not limited to): container stock planting, hand crews to remove pinyon and juniper, herbicide application to remove weeds, harrow, and other similar vegetation removal techniques (**Table 1.7**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**20,250**	**621**	**0**	**20,872**
Ely (One-Way)	17,381	0	0	17,381
Ely (Two-Way)	165	0	0	165
Smooth (One-Way)	2,704	621	0	3,325
Bullhog	**1,927**	**1,963**	**809**	**4,699**
Full Size	1,111	1,154	0	2,265
Skid Steer	816	809	809	2,434
Chain Harrow	**29**	**0**	**0**	**29**
≤ 15 ft. (Two-Way)	29	0	0	29
Harrow	**285**	**0**	**0**	**285**
≤ 15 ft. (One-Way)	209	0	0	209
≤ 15 ft. (Two Way)	76	0	0	76
Herbicide Application	**2,796**	**0**	**492**	**3,288**
Aerial (Fixed-Wing)	471	0	390	861
Aerial (Helicopter)	610	0	102	712
Ground	1,697	0	0	1,697
Spot Treatment	18	0	0	18
Interseeding	**26**	**0**	**0**	**26**
Interseeding	26	0	0	26
Planting/Transplanting	**14**	**60**	**6**	**79**
Bareroot Stock	5	0	0	5
Container Stock	0	60	6	66
Other	8	0	0	8
Seeding (Primary)	**18,046**	**36**	**15**	**18,095**
Broadcast (Aerial Fixed-Wing)	11,004	36	0	11,040
Broadcast (Aerial Helicopter)	4,639	0	0	4,639
Drill (Rangeland)	1,177	0	15	1,191
Drill (Truax)	36	0	0	36
Ground (Mechanical Application)	1,056	0	0	1,056
Hand Seeding	134	0	0	134
Seeding (Secondary/Shrub)	**945**	**0**	**0**	**945**
Broadcast (Aerial Fixed-Wing)	945	0	0	945
Vegetation Removal/Hand Crew	**4,646**	**0**	**0**	**4,646**
Lop and Chip	319	0	0	319
Lop and Scatter	4,327	0	0	4,327
Grand Total	**49,274**	**2,680**	**1,321**	**53,275**
***Total Land Area Treated**	**47,250**	**2,636**	**1,321**	**51,207**

Table 1.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 16A, Nebo. Data accessed on 02/08/2018. *Does not include overlapping treatments.



Map 1.8: WRI treatments by fiscal year completed for WMU 16A, Nebo.

Range Trend Studies

Range Trend studies have been sampled within WMU 16A on a regular basis since 1983, with studies being added or suspended as was deemed necessary (**Table 1.8**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 1.9**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
16A-1	Strawberry Highline Canal	RT	Suspended	'83, '89, '97	Not Defined
16A-2	Santaquin Bench	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Oak)
16A-3	Santaquin Hill	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Oak)
16A-4	Wash Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
16A-5	Nebo Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Gravelly Loam (Mountain Big Sagebrush)
16A-6	Hop Creek Browse	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
16A-7	Willow Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Stony Loam (Cliffrose)
16A-8	Gardner Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Stony Loam (Cliffrose)
16A-9	Birch Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Stony Loam (Cliffrose)
16A-10	North Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Stony Loam (Oak)
16A-11	Rees Flat	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Gravelly Loam (Oak)
16A-12	Tithing Mountain	RT	Suspended	'97, '02, '07, '12	Mountain Stony Loam (Browse)
16A-13	Steele Ranch	RT	Active	'89, '97, '02, '07, '12, '17	Mountain Gravelly Loam (Oak)
16A-14	Big Hollow	RT	Active	'89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
16A-15	Old Pinery	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Loam (Mountain Big Sagebrush)
16A-16	Levan Farm Chaining	RT	Suspended	'97, '02, '07	Not Defined
16A-17	Chicken Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Loam (Cliffrose)
16A-18	Deep Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Loam (Cliffrose)
16A-19	Flat Canyon	RT	Active	'89, '97, '02, '07, '12, '17	Upland Gravelly Loam (Wyoming Big Sagebrush)
16A-20	Triangle Ranch	RT	Active	'89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
16A-22	Levan North	RT	Active	'07, '12, '17	Upland Loam (Mountain Big Sagebrush)
16A-23	Fountain Green Plateau	RT	Active	'07, '12, '17	Upland Loam (Wyoming Big Sagebrush)
16A-24	Maple Canyon	RT	Active	'12, '17	Upland Loam (Mountain Big Sagebrush)
16R-9	Lasson CE	RT	Suspended	'99	Not Defined
16R-22	Levan Spray and Drill	WRI	Active	'06, '10, '17	Upland Loam (Mountain Big Sagebrush)
16R-26	Fountain Green Dixie and Plateau	WRI	Active	'07, '10, '15	Upland Loam (Basin Big Sagebrush)
16R-28	Willow Creek Dixie	WRI	Active	'08, '11, '17	Upland Loam (Mountain Big Sagebrush)
16R-40	Mona Bench	WRI	Active	'11, '14	Upland Stony Loam (Mountain Big Sagebrush)
16R-41	Mona Bench 2	WRI	Active	'11, '14	Not Defined
16R-51	North Canyon	WRI	Active	'13	Upland Stony Loam (Mountain Big Sagebrush)

Table 1.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 16A, Nebo.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
16A-2	Santaquin Bench	Wildfire	Mollie Fire	August 2001	8,021	
		Seed Unknown		January 2002		
16A-5	Nebo Creek	Wildfire	Nebo Creek	July 2001	4,378	
16A-6	Hop Creek Browse	Wildfire	Salt Creek	July 2007	25,913	
		One-Way Ely Chain	Salt Creek Wildfire Rehabilitation	December 2007	1,197	970
		Aerial Before	Salt Creek Wildfire Rehabilitation	November 2007	1,197	970
16A-9	Birch Creek	Wildfire	Birch	September 2001	2,681	
16A-11	Rees Flat	Wildfire				
		Seed Unknown				
16A-14	Big Hollow	Wildfire	Salt Creek	July 2007	25,913	
		One-Way Ely Chain	Salt Creek Wildfire Rehabilitation	November 2007	221	970
		Aerial Before	Salt Creek Wildfire Rehabilitation	November 2007	1,197	970
		Wildfire	Wood Hollow	July 2012	47,387	
		Aerial	Wood Hollow Fire	January 2013	301	2481
16A-15	Old Pinery	Chain Unknown				
		Seed Unknown				
16A-20	Triangle Ranch	Chain Unknown				
		Seed Unknown				
16A-22	Levan North	Chain Unknown				
		Seed Unknown				
		Lop and Scatter	Levan Farm WMA Habitat Improvement	July 2006	700	271
16A-23	Fountain Green Plateau	Herbicide - Plateau	Fountain Green WMA Habitat Improvement	September 2007	275	288
16A-24	Maple Canyon	Bullhog	Maple Canyon WMA Habitat Improvement	September 2012	514	2352
16R-22	Levan Spray and Drill	Agricultural Field				
		Herbicide - Plateau, Roundup, Paramount	Levan Farm WMA Habitat Improvement	September 2006	62	271
		Herbicide - Roundup	Levan Farm WMA Habitat Improvement	May 2007	62	271
		Herbicide - Plateau, Roundup	Levan Farm WMA Habitat Improvement	October 2007	62	271
		Rangeland Drill	Levan Farm WMA Habitat Improvement	October 2007	40	271
16R-26	Fountain Green Dixie and Plateau	Herbicide - Plateau	Fountain Green WMA Habitat Improvement	September 2007	240	288
		One-Way Dixie Harrow	Fountain Green WMA Habitat Improvement	Fall 2007	20	288
		One-Way Dixie Harrow	Fountain Green WMA Habitat Improvement	April 2008	35	288
		Broadcast Before	Fountain Green WMA Habitat Improvement	April 2008	35	288
16R-28	Willow Creek Dixie	One-Way Dixie Harrow	Willow Creek Habitat Improvement	November 2008	52	1101
		Broadcast Before	Willow Creek Habitat Improvement	November 2008	52	1101
16R-40	Mona Bench	Herbicide	Mona Bench Project	May 2011	62	1934
		Herbicide	Mona Bench Project	November 2011	190	1934
		Two-Way Chain Harrow	Mona Bench Project	October 2011	190	1934
		Broadcast Before	Mona Bench Project	October 2011	190	1934
		Aerial After	Mona Bench Project	January 2012	190	1934
		Herbicide	Mona Bench Project	May 2012	62	1934
16R-41	Mona Bench 2	Herbicide	Mona Bench Project	November 2011	190	1934
		Two-Way Chain Harrow	Mona Bench Project	October 2011	190	1934
		Broadcast Before	Mona Bench Project	October 2011	190	1934
		Aerial After	Mona Bench Project	January 2012	190	1934
16R-51	North Canyon	Herbicide - Plateau (Aerial)	North Canyon Knapweed Project Phase I	Fall 2013	447	2688
		Herbicide - Milestone (Aerial)	North Canyon Knapweed Project Phase I	Fall 2013	662	2688
		Two-Way Chain Harrow	North Canyon Knapweed Project Phase I	Fall 2013	447	2688
		Broadcast Before	North Canyon Knapweed Project Phase I	Fall 2013	447	2688

Table 1.9: Range trend and WRI studies known disturbance history for WMU 16A, Nebo.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are five studies [Wash Canyon (16A-4), Nebo Creek (16A-5), Hop Creek Browse (16A-6), Big Hollow (16A-14), and Triangle Ranch (16A-20)] classified as Mountain (Big Sagebrush) ecological sites. Wash Canyon and Nebo Creek are located in the foothills west of US-89 near Indianola. The Hop Creek Browse site is located on the north side of Nephi Canyon. The Big Hollow site is located northeast of Fountain Green. Finally, the Triangle Ranch study site is located in the foothills southeast of Nephi.

Shrubs/Trees: The primary browse species on these sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with lesser amounts of cover contributed by other species. The Big Hollow and Hop Creek Browse sites have burned in recent years and do not hold significant populations of browse species. Overall, preferred browse cover has decreased with the fires likely being the dominant factor (**Figure 1.4**). Utilization of preferred browse has increased slightly over time, with the 2017 sample year displaying heavy utilization of plants (**Figure 1.7**).

Tree sampled on these sites include both Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*). Both tree cover and density decreased in 2017 (**Figure 1.5**, **Figure 1.6**).

Herbaceous Understory: The herbaceous understory on these sites is primarily composed of perennial grasses and forbs with cover remaining steady. Annual grass and forb cover and frequency have fluctuated over the study years. Bulbous bluegrass (*Poa bulbosa*) cover has slowly increased on these sites. Native grass species contribute significant cover to most of the sites. Cheatgrass (*Bromus tectorum*) is present on all study sites, with cover fluctuating from year to year (**Figure 1.9**, **Figure 1.10**).

Occupancy: Pellet transect data shows that deer are the primary occupants on the site and that usage has varied from 10 days use/acre in 2012 to 84 days use/acre in 2002. Elk pellet groups have had an abundance varying from 4 days use/acre in 2012 to 15 days use/acre in 2007. Finally, abundance of cattle pellet groups has fluctuated from 3 days use/acre in 2002 to a high of 17 days use/acre in 2017 (**Figure 1.11**).

Mountain (Oak)

There are five studies [Santaquin Bench (16A-2), Santaquin Hill (16A-3), North Canyon (16A-10), Rees Flat (16A-11), and Steele Ranch (16A-13)] that are classified as Mountain (Oak) ecological sites. Santaquin Bench and Santaquin Hill are located on the benches south of Santaquin along I-15. The North Canyon site is located at the base of the foothills northeast of Mona. Rees Flat is along the hillsides near the mouth of Nephi Canyon. The Steele Ranch site is located east of I-15 near Mona Reservoir.

Shrubs/Trees: Preferred browse cover (excluding sagebrush) has remained steady on these sites, with the primary species being Gambel oak (*Quercus gambelii*). The cover of sagebrush, mainly mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) has decreased over time (**Figure 1.4**). Recruitment of young has fluctuated, with the majority of the population consisting of mature plants (**Figure 1.7**). Utilization has varied between sample years (**Figure 1.8**).

Herbaceous Understory: The understories of these sites are split between annual and perennial species. Bulbous bluegrass (*Poa bulbosa*) is present on these sites with cover and frequency remaining steady over time (**Figure 1.9**, **Figure 1.10**). The perennial grass cover for Rees Flat and Santaquin Bench is primarily contributed by introduced species; namely intermediate wheatgrass (*Thinopyrum, intermedium*) and smooth brome (*Bromus inermis*).

Occupancy: Pellet transect data shows that deer are the main occupants on the site and that pellet group abundance has fluctuated from 17 days use/acre in 2012 to 63 days use/acre in 2007. Elk utilization has fluctuated from 3 days use/acre in 2012 to 7 days use/acre in 2017. Finally, pellet group abundance of cattle has varied from 0 days use/acre in 2012 to 4 days use/acre in 2002 (**Figure 1.11**).

Upland (Big Sagebrush)

There are four studies [Old Pinery (16A-15), Levan North (16A-22), Fountain Green Plateau (16A-23), and Maple Canyon (16A-24)] classified as Upland (Big Sagebrush) ecological sites. The Old Pinery study site is located along the west foothills of the San Pitch Mountains between Nephi and Levan. The Levan North study site is located along the San Pitch foothills near Levan. The Fountain Green Plateau site is located southeast of Fountain Green along the base of Cedar Hills. The Maple Canyon site is located on the benches to the west of the town of Manti.

Shrubs/Trees: Preferred browse cover on these sites has remained steady across sampling years (**Figure 1.4**). The dominant browse species are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*). The other preferred shrub that is present on these sites is antelope bitterbrush (*Purshia tridentata*). Preferred browse density and age demographics have fluctuated slightly, but have been mostly consistent (**Figure 1.7**). Browse utilization has remained stable with the exception of the 2007 sample year which showed very high usage (**Figure 1.8**).

Tree cover and density on these sites decreased significantly between 2012 and 2017 with the bullhog treatment on Maple Canyon likely being a significant factor for this decrease of trees (**Figure 1.5**).

Herbaceous Understory: The herbaceous understory for these sites has fluctuated through the years, but cover and frequency have increased overall. Annual grasses and forbs as well as the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) are the dominant understory species. Perennial grass and forb cover and frequency have remained consistent but it is a minor component of the understory (**Figure 1.9**, **Figure 1.10**).

Occupancy: Pellet transect data shows that deer are the primary occupants and that pellet group abundance has varied from a low of 11 days use/acre in 2012 to a high of 69 days use/acre in 2002. Cattle have been present on the sites and average pellet group abundance has varied from 3 days use/acre in 2012 to a high of 11 days use/acre in 2002. Abundance of elk pellet groups has varied from 0 days use/acre in both 2002 and 2017 to 1 days use/acre in 2007 (**Figure 1.11**).

Upland (Cliffrose)

Within the Nebo management unit, there are four study sites [Willow Creek (16A-7), Gardner Canyon (16A-8), Birch Creek (16A-9), Chicken Creek (16A-17), and Deep Creek (16A-18)] that are considered to be Upland (Cliffrose) ecological sites. Willow Creek is located up Water Hollow east of Mona. Gardner Canyon is in the foothills northwest of Nephi. The Birch Creek site is east of I-15 near Nortonville. The Chicken Creek study site is located approximately two miles east of Levan. The Deep Creek study site is located in the San Pitch Mountains south of Levan.

Shrubs/Trees: Preferred browse cover on these sites has been consistent over the study years (**Figure 1.4**). The demographics have been similar with most of the community being composed of mature individuals (**Figure 1.7**). The co-dominant browse species on these sites include Stansbury cliffrose (*Purshia stansburiana*), Utah serviceberry (*Amelanchier utahensis*), and alderleaf mountain mahogany (*Cercocarpus montanus*). The utilization of species has fluctuated but heavy utilization has shown an overall decrease (**Figure 1.8**).

Trees present on these sites include both Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*). Tree cover has fluctuated but the density has shown steady decreases (**Figure 1.5**, **Figure 1.6**).

Herbaceous Understory: The herbaceous understory of these sites has remained consistent through the study years. Annual grasses and forbs are dominant on these study sites while perennial grasses and forbs are a minor component of the understory (**Figure 1.9**, **Figure 1.10**). Bulbous bluegrass (*Poa bulbosa*) has shown a slight increase through time, it is possible that it will continue to increase (**Figure 1.9**).

Occupancy: The pellet transect data for these sites shows that the primary occupants on this site are deer. The deer pellet group abundance varied from 30 days use/acre in 2012 to 64 days use/acre in 2007. Elk are also present on the site and pellet group abundance has fluctuated from 4 days use/acre in 2012 to 21 days use/acre in 2002 (**Figure 1.11**).

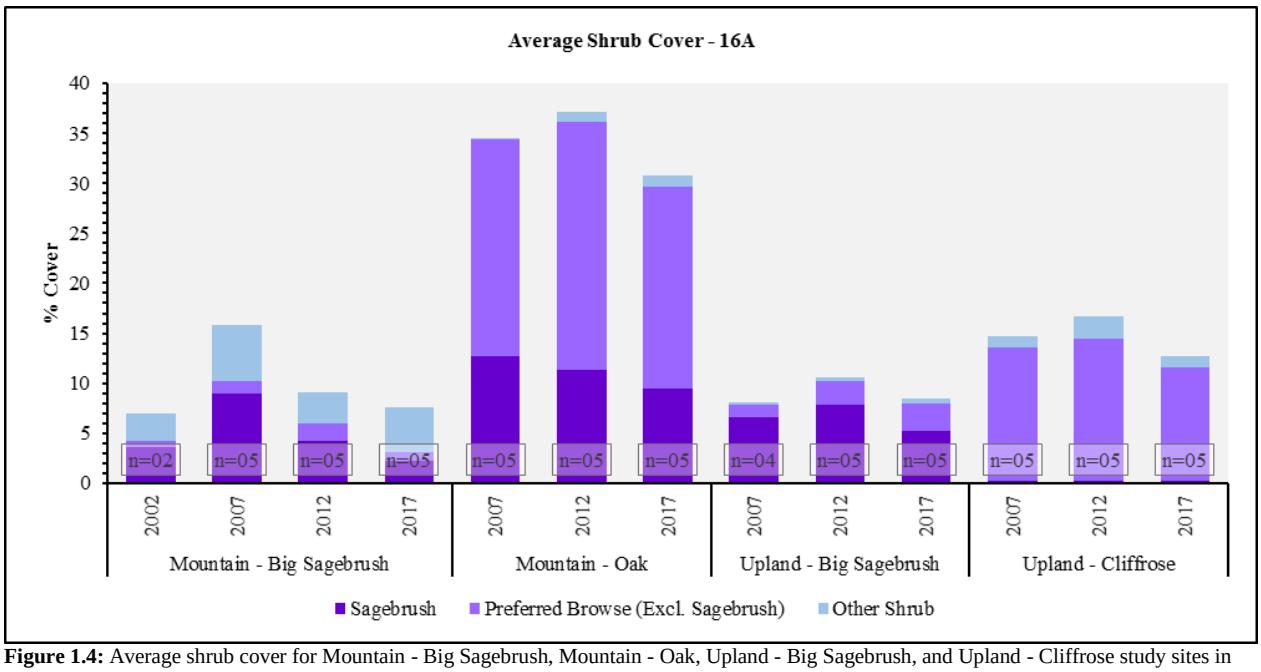


Figure 1.4: Average shrub cover for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

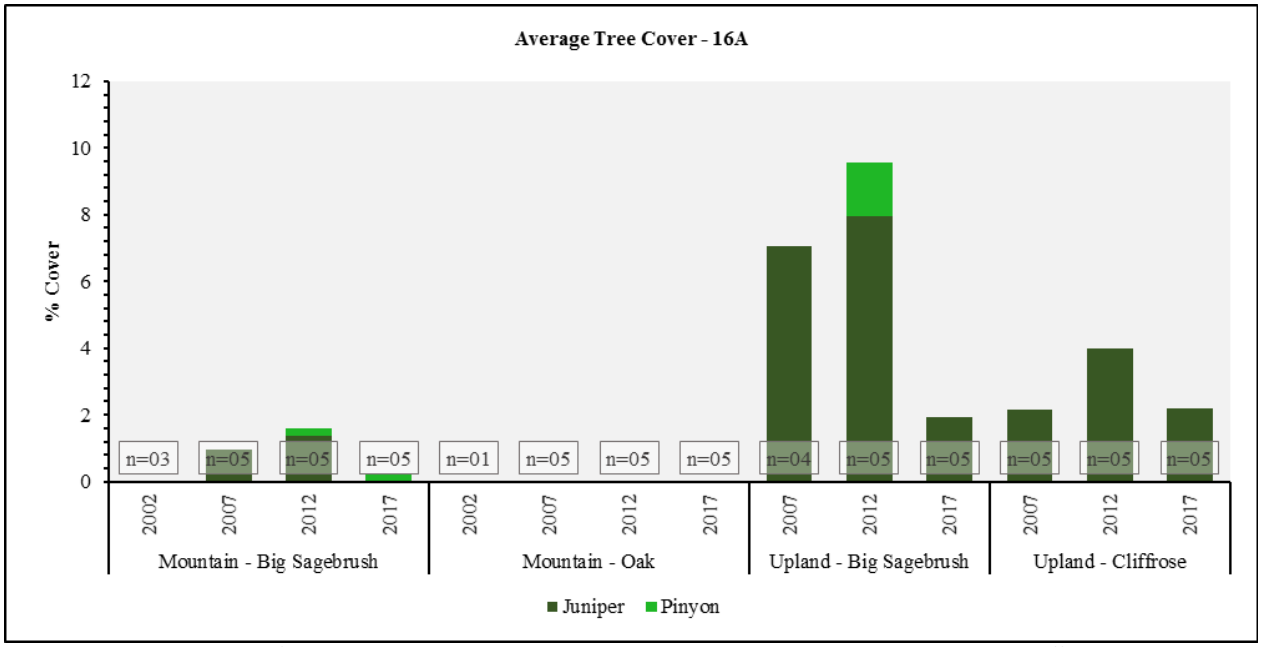


Figure 1.5: Average tree cover for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

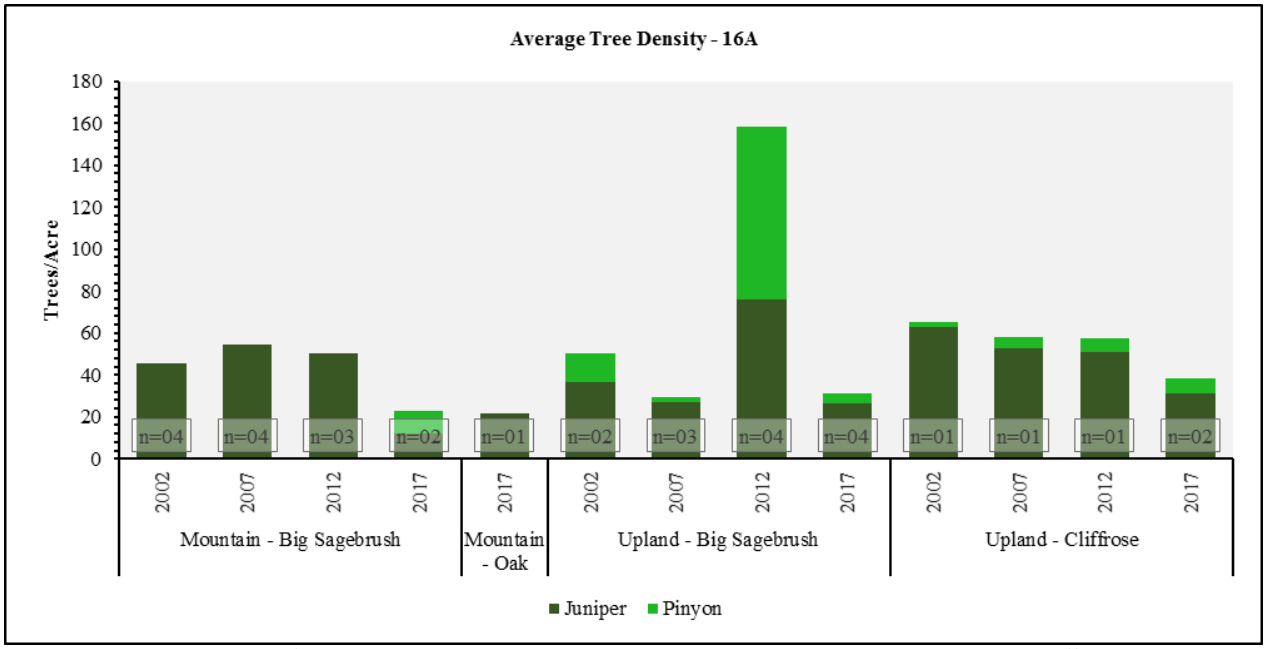


Figure 1.6: Average tree density for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

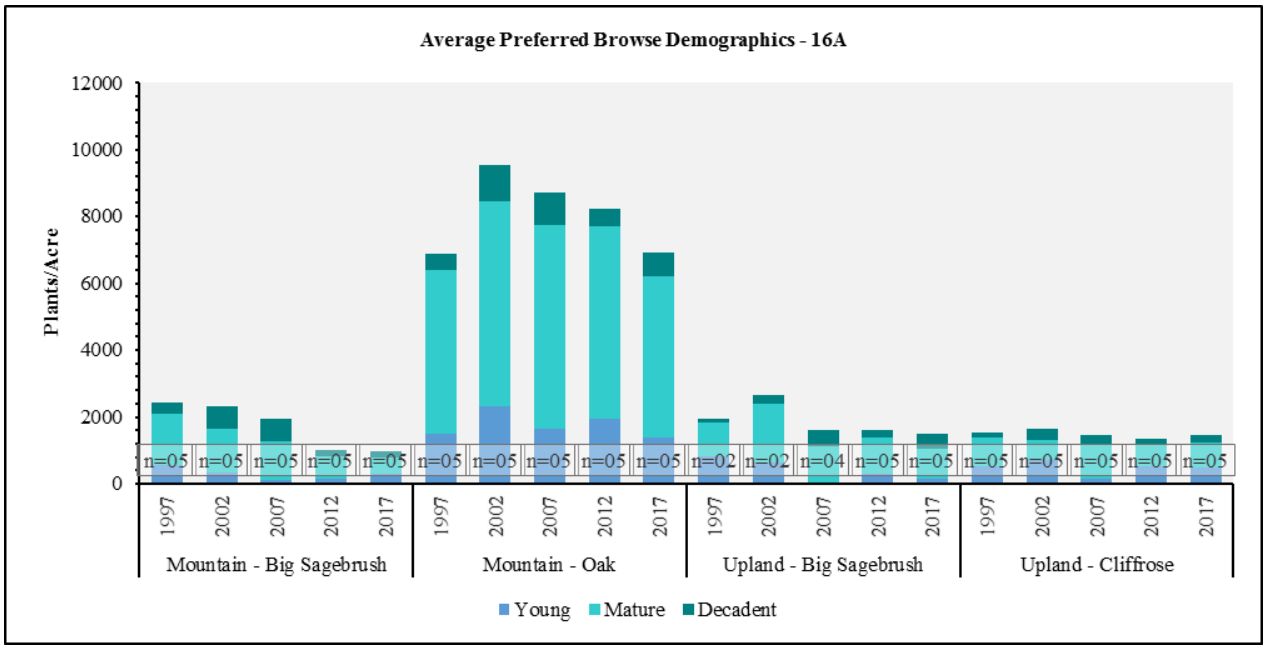


Figure 1.7: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

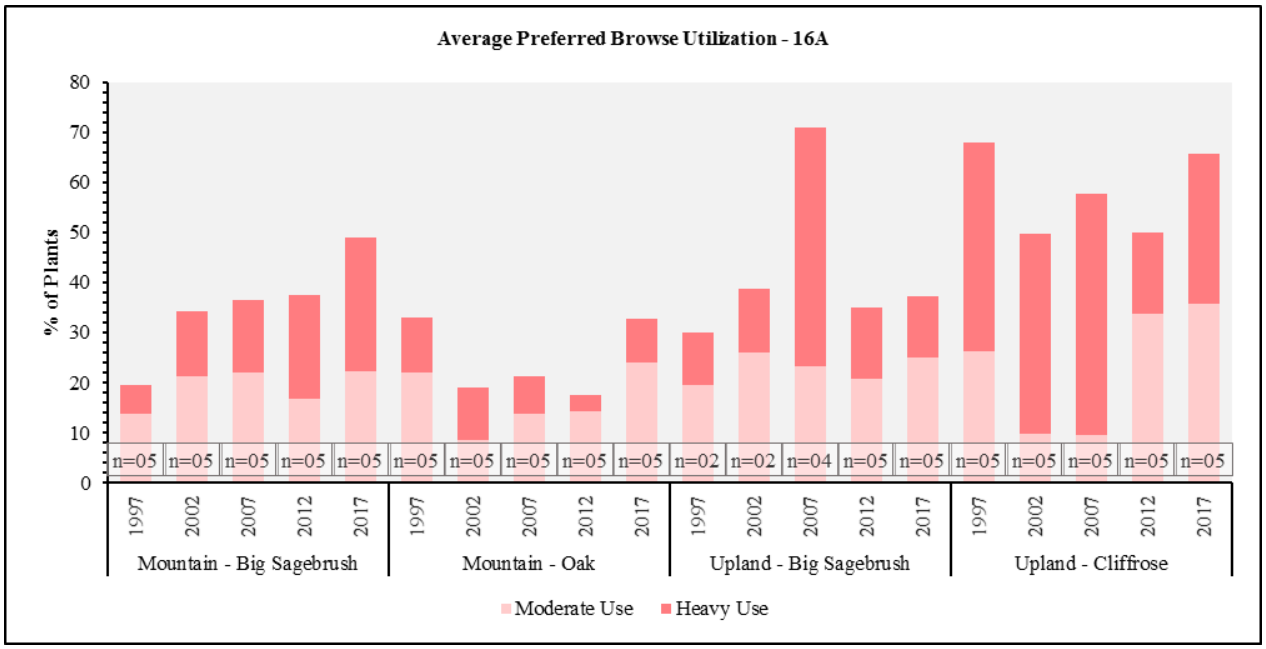


Figure 1.8: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

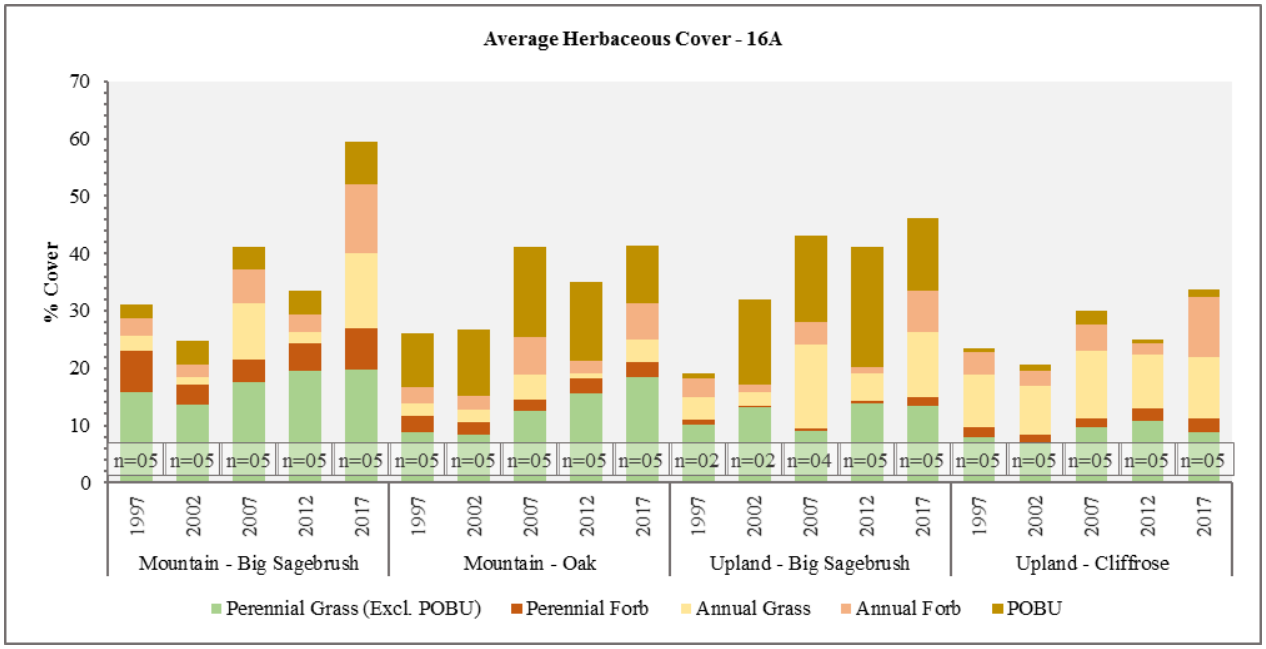


Figure 1.9: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

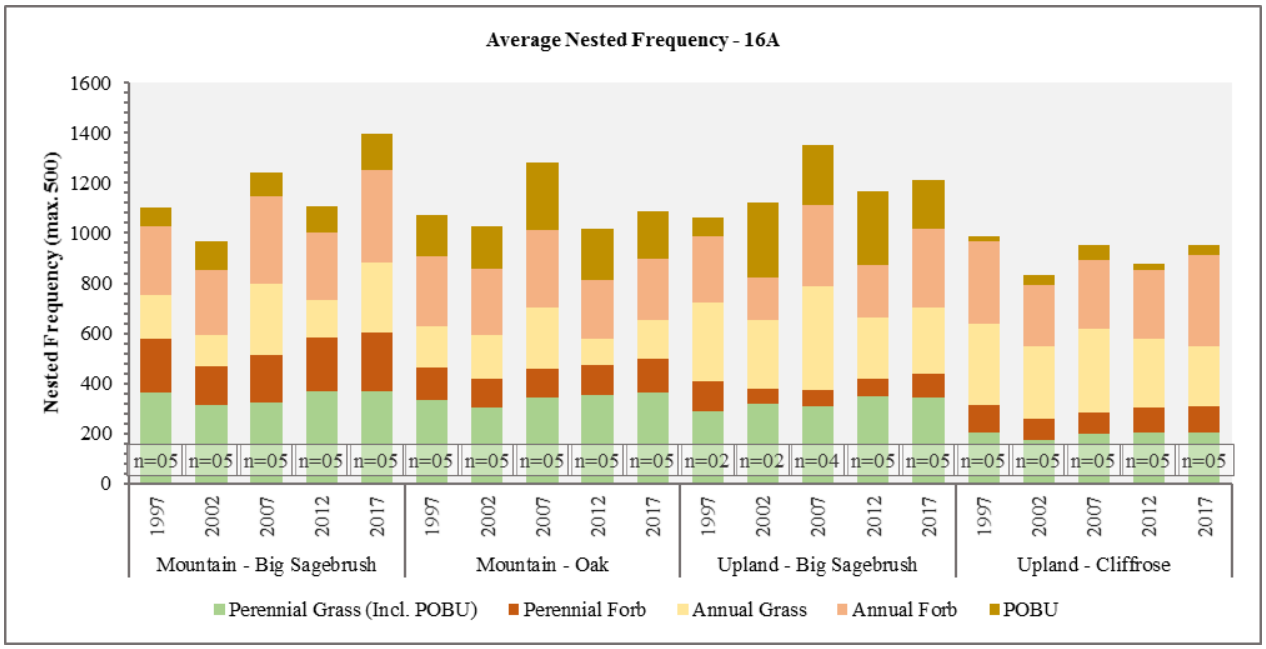


Figure 1.10: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

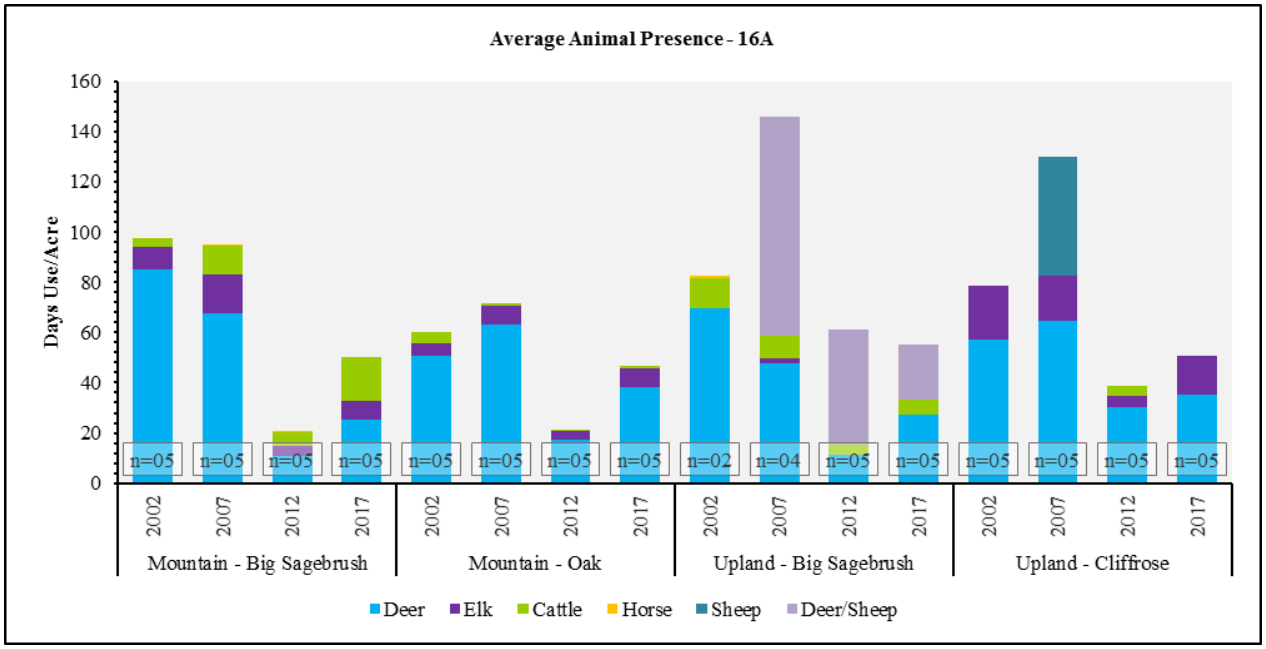
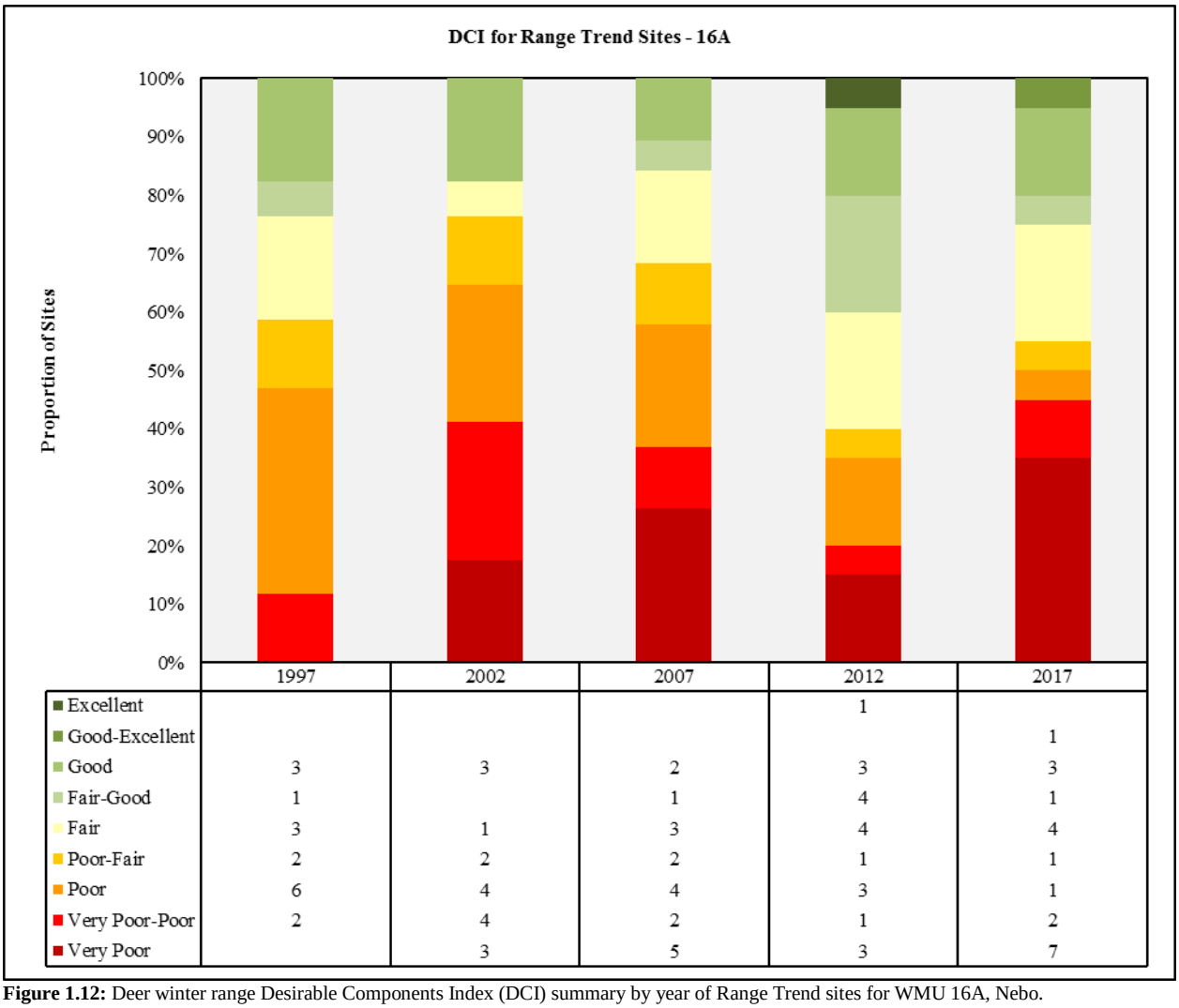


Figure 1.11: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Oak, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 16A, Nebo.

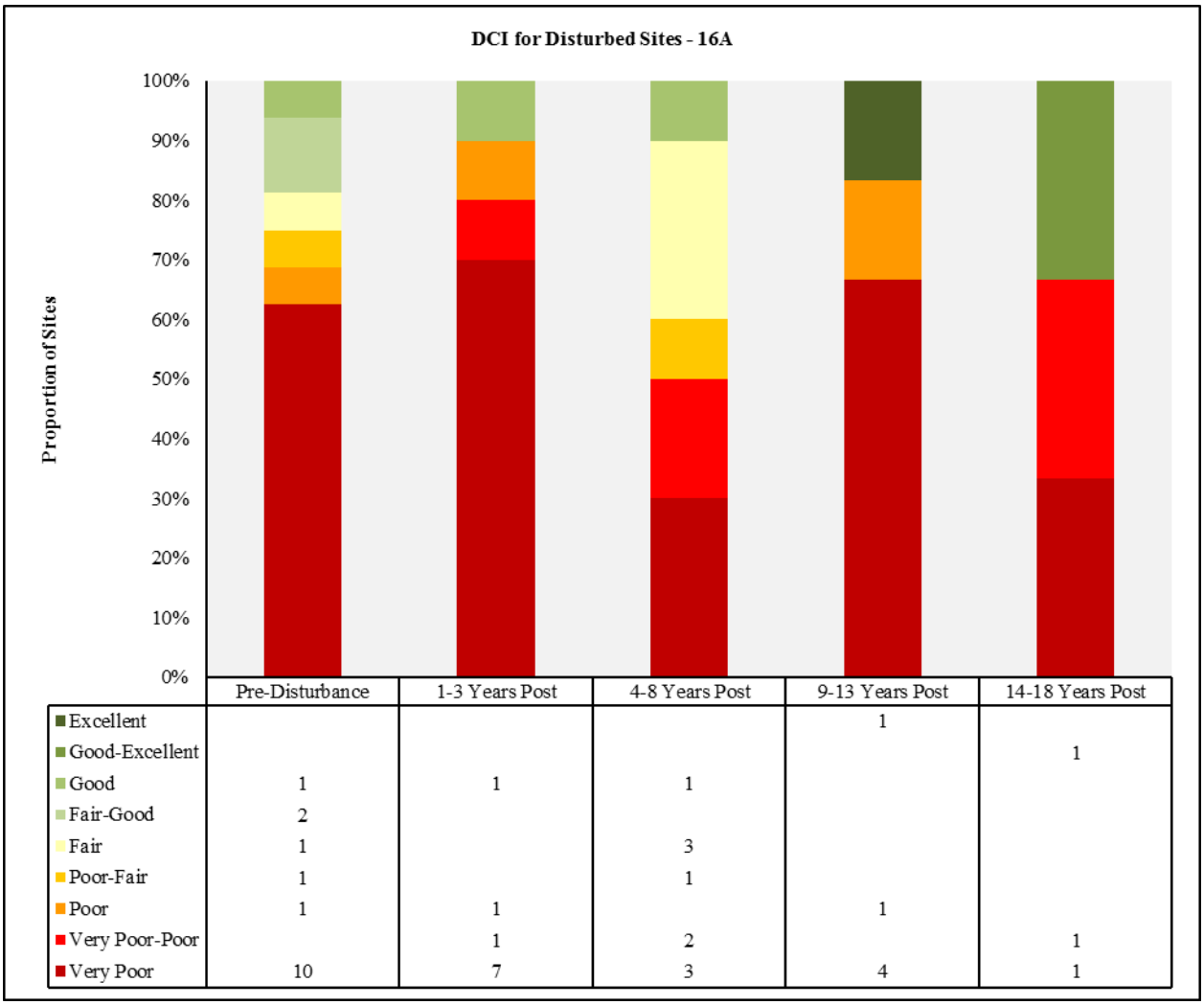
Deer Winter Range Condition Assessment

The condition of deer winter range within the Nebo management unit has continually changed on the sites sampled since 1997. The active Range Trend sites sampled within the unit are considered to be in very poor to good-excellent condition as of the 2017 sample year (**Figure 1.12**, **Table 1.10**). Santaquin Bench is the sole site in good-excellent condition. Rees Flat, Chicken Creek and Triangle Ranch are considered to be in good condition. Santaquin Hill is ranked as fair-good condition. Sites in fair condition are Wash Canyon, North Canyon, Steele Ranch, and Deep Creek. The Flat Canyon site is considered to be in poor-fair condition while Gardner Canyon is considered in poor condition. Birch Creek and Maple Canyon were classified as being in very poor to poor condition. The sites categorized as in very poor condition are Nebo Creek, Hop Creek Browse, Willow Creek, Big Hollow, Old Pinery, Levan North, and Fountain Green Plateau; lack of preferred browse cover, depauperate understories, and invasive species are some of the various reasons for why these sites were categorized in very poor condition. In general, the treated sites have not shown significant improvement (**Figure 1.13**); the exception to this is the Willow Creek Dixie study, which went from very poor to fair condition (**Table 1.11**). The other sites: Levan Spray and Drill, Fountain Green Dixie and Plateau, Mona Bench, and Mona Bench 2 have remained in very poor condition. It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1997	2002	2007	2012	2017
Excellent				1	
Good-Excellent					1
Good	3	3	2	3	3
Fair-Good	1		1	4	1
Fair	3	1	3	4	4
Poor-Fair	2	2	2	1	1
Poor	6	4	4	3	1
Very Poor-Poor	2	4	2	1	2
Very Poor		3	5	3	7

Figure 1.12: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 16A, Nebo.



	Pre-Disturbance	1-3 Years Post	4-8 Years Post	9-13 Years Post	14-18 Years Post
Excellent				1	
Good-Excellent					1
Good	1	1	1		
Fair-Good	2				
Fair	1		3		
Poor-Fair	1		1		
Poor	1	1		1	
Very Poor-Poor		1	2		1
Very Poor	10	7	3	4	1

Figure 1.13: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 16A, Nebo.

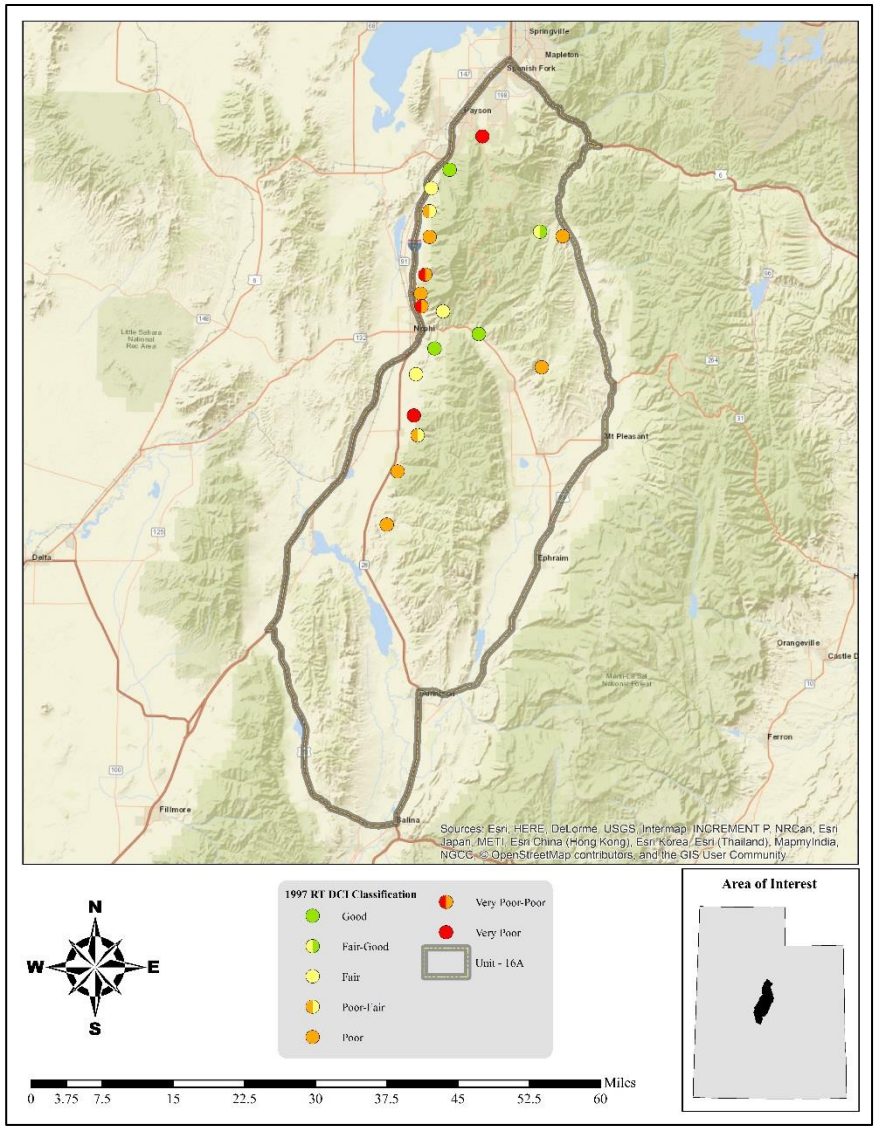
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
16A-2	1997	25.0	12.5	10.9	30.0	-0.5	10.0	0.0	**87.9**	**G**
16A-2	2002	0.0	0.0	0.0	9.2	-0.2	10.0	0.0	**19.1**	**VP**
16A-2	2007	30.0	15.0	3.0	29.6	-4.4	9.8	-2.0	**81.1**	**G**
16A-2	2012	30.0	15.0	14.0	30.0	-0.1	10.0	0.0	**98.9**	**E**
16A-2	2017	27.4	13.5	8.0	30.0	-0.2	10.0	0.0	**88.7**	**G-E**
16A-3	1997	22.4	10.3	10.9	22.8	-2.0	1.0	0.0	**65.4**	**F**
16A-3	2002	16.3	7.3	1.9	22.8	-1.4	0.6	0.0	**47.5**	**P**
16A-3	2007	26.3	5.4	9.4	18.0	-4.0	1.8	-2.0	**54.8**	**P-F**
16A-3	2012	30.0	11.4	5.7	23.6	-1.1	3.4	0.0	**73.0**	**G**
16A-3	2017	21.9	10.6	8.2	30.0	-1.4	0.6	0.0	**70.0**	**F-G**
16A-4	1997	10.1	7.3	9.4	18.4	-4.6	5.8	0.0	**46.4**	**P**
16A-4	2002	10.8	8.6	2.8	22.8	-0.5	3.4	0.0	**47.8**	**P**
16A-4	2007	14.3	8.6	7.9	17.0	-2.6	6.6	0.0	**51.8**	**P**
16A-4	2012	14.5	11.1	8.0	27.4	-0.3	10.0	0.0	**70.7**	**F-G**
16A-4	2017	10.8	6.5	7.8	29.0	-5.5	10.0	0.0	**58.7**	**F**
16A-5	1997	9.2	14.2	8.7	30.0	-1.9	10.0	-2.0	**68.3**	**F-G**
16A-5	2002	0.0	0.0	0.0	20.0	-0.4	10.0	0.0	**29.6**	**VP**
16A-5	2007	0.0	0.0	0.0	27.0	-18.2	10.0	-2.0	**16.8**	**VP**
16A-5	2012	0.3	-2.7	0.0	30.0	-2.6	10.0	-2.0	**33.0**	**VP**
16A-5	2017	0.2	0.0	0.0	30.0	-20.0	10.0	-2.0	**18.2**	**VP**
16A-6	1997	16.2	11.7	12.9	30.0	-0.5	10.0	0.0	**80.2**	**G**
16A-6	2002	16.7	6.1	13.5	30.0	-0.6	8.2	0.0	**74.0**	**G**
16A-6	2007	20.8	4.6	2.0	30.0	-4.9	10.0	0.0	**62.5**	**F**
16A-6	2012	0.5	0.0	0.0	30.0	-0.8	10.0	0.0	**39.7**	**VP-P**
16A-6	2017	1.3	0.0	0.0	30.0	-9.5	10.0	0.0	**31.8**	**VP**
16A-7	1997	23.2	14.2	0.4	8.6	-13.0	3.4	0.0	**36.8**	**VP-P**
16A-7	2002	24.1	7.2	1.8	11.4	-11.1	2.4	0.0	**35.8**	**VP-P**
16A-7	2007	30.0	7.9	4.5	14.8	-11.7	2.0	0.0	**47.5**	**P**
16A-7	2012	30.0	11.0	2.5	20.4	-13.7	3.0	0.0	**53.2**	**F**
16A-7	2017	18.7	0.6	1.0	13.6	-13.8	4.0	0.0	**24.2**	**VP**
16A-8	1997	11.6	10.1	4.4	15.2	-8.5	1.8	0.0	**34.6**	**VP-P**
16A-8	2002	14.1	7.4	1.1	15.8	-7.0	4.4	0.0	**35.8**	**VP-P**
16A-8	2007	19.2	5.7	0.0	17.6	-8.9	3.0	0.0	**36.6**	**VP-P**
16A-8	2012	20.3	4.2	3.0	19.8	-6.2	3.6	0.0	**44.7**	**P**
16A-8	2017	13.2	9.7	0.0	17.4	-4.7	4.8	0.0	**40.5**	**P**
16A-9	1997	10.0	11.8	6.9	14.2	-4.6	3.6	0.0	**41.9**	**P**
16A-9	2002	3.5	0.0	0.0	11.0	-7.4	1.6	0.0	**8.7**	**VP**
16A-9	2007	11.2	14.2	15.0	23.0	-12.9	2.2	0.0	**52.7**	**F**
16A-9	2012	7.6	14.6	8.7	22.0	-9.4	2.0	0.0	**45.4**	**P**
16A-9	2017	9.8	11.8	7.1	19.0	-15.4	2.2	0.0	**34.5**	**VP-P**
16A-10	1997	27.7	12.1	5.5	7.6	-4.3	5.4	-2.0	**52.0**	**P**
16A-10	2002	29.2	2.0	3.0	21.2	-4.2	3.4	0.0	**54.6**	**P-F**
16A-10	2007	30.0	5.7	5.3	25.4	-4.3	3.8	-2.0	**63.9**	**F**
16A-10	2012	24.1	9.9	5.4	29.6	-1.6	3.0	0.0	**70.4**	**F-G**
16A-10	2017	23.7	8.9	2.4	30.0	-6.8	3.8	0.0	**62.0**	**F**
16A-11	1997	12.8	14.6	15.0	15.2	-1.7	2.8	0.0	**58.7**	**F**
16A-11	2002	23.1	13.5	14.8	19.2	0.0	1.8	0.0	**72.4**	**G**
16A-11	2007	30.0	13.9	4.1	30.0	0.0	1.6	0.0	**79.6**	**G**
16A-11	2012	30.0	12.8	5.4	30.0	0.0	2.2	0.0	**80.5**	**G**
16A-11	2017	30.0	11.7	2.9	30.0	0.0	1.4	0.0	**76.1**	**G**
16A-12*	1997	25.9	8.6	1.8	1.6	-20.0	10.0	-2.0	**25.9**	**VP**
16A-12*	2002	22.6	10.1	1.5	0.1	-11.6	10.0	-2.0	**30.6**	**VP**
16A-12*	2007	14.4	8.9	0.0	0.0	-20.0	10.0	-2.0	**11.3**	**VP**
16A-12*	2012	15.6	0.8	3.9	0.0	-20.0	10.0	-6.0	**4.4**	**VP**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
16A-13	1997	30.0	12.3	5.2	6.8	-0.2	1.8	0.0	**55.8**	**P-F**
16A-13	2002	30.0	5.7	3.3	10.8	-0.5	2.4	0.0	**51.7**	**P**
16A-13	2007	30.0	9.5	15.0	13.0	-0.7	2.6	0.0	**69.4**	**F-G**
16A-13	2012	30.0	12.3	15.0	9.4	-0.4	1.8	0.0	**68.1**	**F-G**
16A-13	2017	30.0	12.2	14.4	7.0	-3.4	3.4	0.0	**63.6**	**F**
16A-14	1997	22.2	7.1	6.3	10.4	-2.8	1.2	0.0	**44.4**	**P**
16A-14	2002	22.9	3.4	3.0	18.4	-3.7	1.4	0.0	**45.4**	**P**
16A-14	2007	19.9	0.0	0.4	17.2	-10.0	1.4	0.0	**28.9**	**VP**
16A-14	2012	7.6	10.4	0.0	30.0	-3.7	2.0	0.0	**46.3**	**P**
16A-14	2017	0.0	0.0	0.0	30.0	-8.5	2.6	0.0	**24.1**	**VP**
16A-15	1997	7.5	14.7	15.0	27.8	-1.7	1.6	-2.0	**62.9**	**F**
16A-15	2002	12.7	13.5	15.0	30.0	-2.5	0.6	0.0	**69.3**	**G**
16A-15	2007	18.6	13.8	2.0	8.8	-6.8	0.8	-2.0	**35.3**	**VP-P**
16A-15	2012	27.9	12.5	2.8	19.6	-1.4	0.8	0.0	**62.2**	**F**
16A-15	2017	17.9	0.4	0.0	18.6	-9.6	2.4	0.0	**29.7**	**VP**
16A-16*	1997	4.2	0.0	0.0	2.1	-3.2	1.0	-4.0	**0.1**	**VP**
16A-16*	2002	8.9	12.0	1.5	2.2	-11.0	0.3	0.0	**13.9**	**VP**
16A-16*	2007	10.4	8.7	1.5	5.8	-18.4	0.5	-4.0	**4.5**	**VP**
16A-17	1997	7.8	8.5	15.0	25.4	-7.7	2.8	0.0	**51.8**	**P-F**
16A-17	2002	7.1	1.0	7.5	23.4	-6.5	1.6	0.0	**34.1**	**VP-P**
16A-17	2007	13.8	9.0	1.0	25.6	-7.7	3.2	0.0	**44.9**	**P**
16A-17	2012	20.4	13.2	15.0	30.0	-5.1	4.2	-2.0	**75.7**	**G**
16A-17	2017	17.6	12.5	15.0	27.0	-5.8	3.8	0.0	**70.1**	**G**
16A-18	1997	11.2	10.3	4.4	15.2	-0.8	6.4	0.0	**46.7**	**P**
16A-18	2002	14.4	4.7	2.1	6.8	-0.2	5.4	0.0	**33.1**	**VP-P**
16A-18	2007	12.9	1.3	4.6	15.2	-2.6	5.8	0.0	**37.2**	**P**
16A-18	2012	19.5	11.4	9.1	13.2	-0.8	9.6	0.0	**62.1**	**F**
16A-18	2017	20.1	10.1	8.4	12.0	0.0	9.8	0.0	**60.3**	**F**
16A-19	1997	15.5	11.4	7.0	12.4	-4.4	2.0	0.0	**44.0**	**P**
16A-19	2002	19.8	9.1	2.6	20.0	-1.0	0.6	0.0	**51.1**	**P-F**
16A-19	2007	14.2	5.3	1.5	18.4	-9.2	1.0	0.0	**31.2**	**VP**
16A-19	2012	23.3	10.6	1.0	19.0	-3.1	0.8	0.0	**51.7**	**P-F**
16A-19	2017	25.2	12.7	2.4	17.8	-10.2	2.8	-2.0	**48.7**	**P-F**
16A-20	1997	15.9	12.7	13.2	30.0	-0.3	6.6	0.0	**78.1**	**G**
16A-20	2002	18.6	6.3	4.6	30.0	-0.1	7.4	0.0	**66.7**	**F**
16A-20	2007	10.1	3.8	2.9	30.0	-0.6	8.2	0.0	**54.4**	**P-F**
16A-20	2012	15.0	9.8	8.4	30.0	0.0	6.6	0.0	**69.7**	**F-G**
16A-20	2017	7.2	11.5	15.0	30.0	-0.2	10.0	0.0	**73.5**	**G**
16A-22	2007	2.6	0.0	0.0	30.0	-7.2	0.4	-2.0	**23.8**	**VP**
16A-22	2012	4.0	0.0	0.0	30.0	-2.3	1.8	-2.0	**31.4**	**VP**
16A-22	2017	3.0	0.0	0.0	30.0	-3.2	2.2	-2.0	**30.0**	**VP**
16A-23	2007	4.6	0.0	0.0	3.8	-20.0	0.8	0.0	**-10.8**	**VP**
16A-23	2012	10.3	10.5	15.0	30.0	-7.4	0.2	0.0	**58.6**	**F**
16A-23	2017	2.8	0.0	0.0	16.0	-19.7	1.0	0.0	**0.0**	**VP**
16A-24	2012	1.3	0.0	0.0	21.6	0.0	1.8	0.0	**24.7**	**VP**
16A-24	2017	3.9	0.0	0.0	30.0	-0.2	3.6	-2.0	**35.3**	**VP-P**

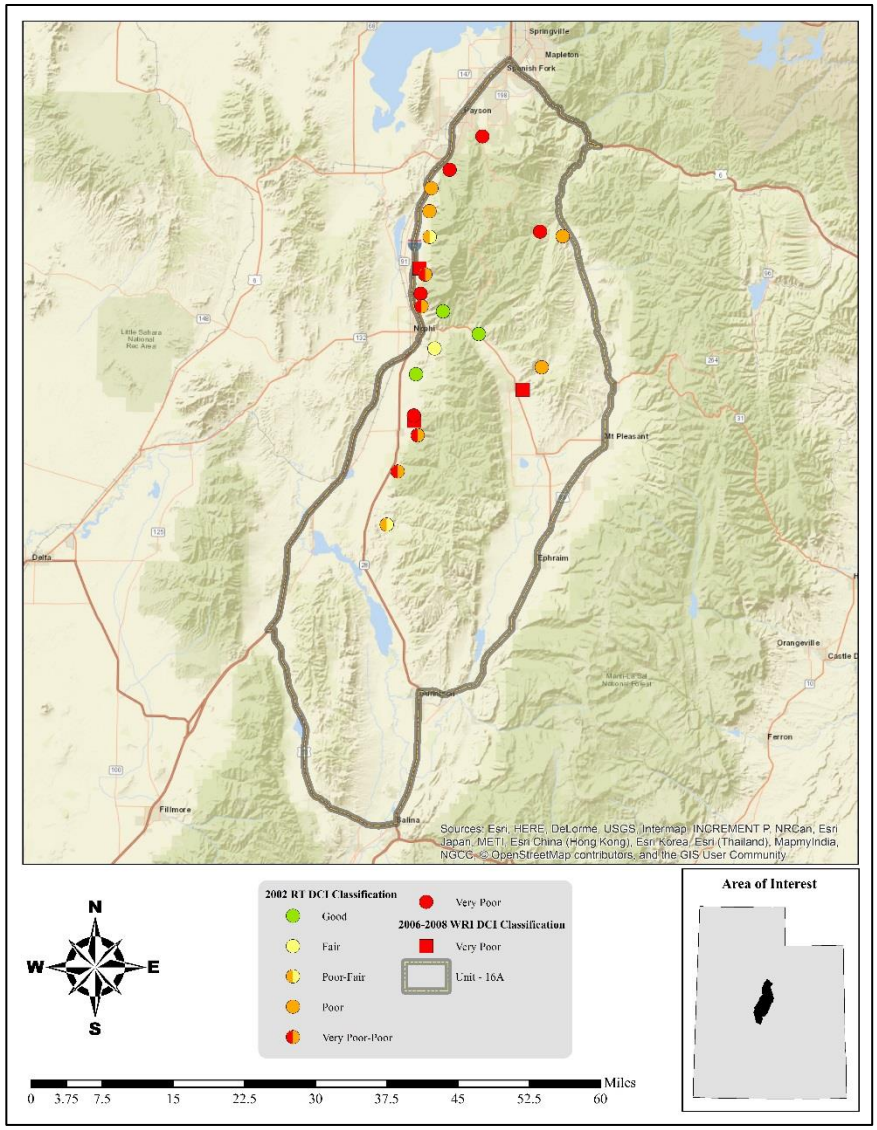
Table 1.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 16A, Nebo.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
16R-22	2006	0.0	0.0	0.0	4.8	-11.7	0.2	0.0	**-6.7**	**VP**
16R-22	2010	0.0	0.0	0.0	13.2	-20.0	0.0	0.0	**-6.8**	**VP**
16R-22	2017	0.0	0.0	0.0	26.4	-20.0	10.0	0.0	**16.4**	**VP**
16R-26	2007	2.5	0.0	0.0	0.1	-16.9	3.5	0.0	**-10.8**	**VP**
16R-26	2010	1.0	0.0	0.0	12.9	-14.8	10.0	0.0	**9.2**	**VP**
16R-26	2015	1.0	0.0	0.0	4.4	-15.9	0.4	0.0	**-10.0**	**VP**
16R-28	2008	0.0	0.0	0.0	7.8	-3.5	2.6	-2.0	**4.9**	**VP**
16R-28	2011	0.0	0.0	0.0	23.2	-20.0	10.0	-2.0	**11.2**	**VP-P**
16R-28	2017	0.0	0.0	0.0	30.0	-1.7	0.0	0.0	**28.3**	**F**
16R-40	2011	14.7	15.0	4.3	9.1	-20.0	2.4	0.0	**25.5**	**VP**
16R-40	2014	2.5	0.0	0.0	8.2	-20.0	1.0	0.0	**-8.3**	**VP**
16R-41	2011	0.0	0.0	0.0	30.0	-20.0	2.8	0.0	**12.8**	**VP**
16R-41	2014	0.1	0.0	0.0	30.0	-20.0	4.7	0.0	**14.9**	**VP**
16R-51	2013	11.0	7.8	3.0	3.7	-10.5	2.6	-2.0	**15.6**	**VP**

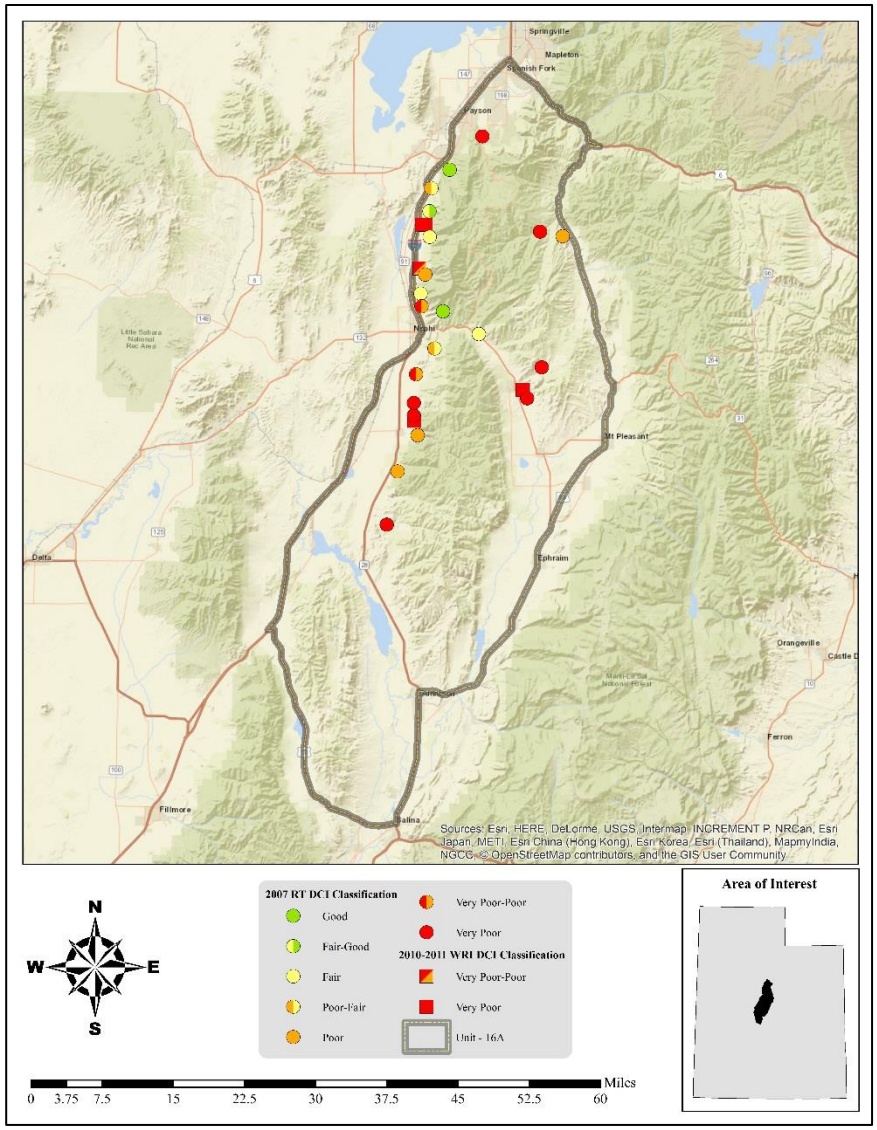
Table 1.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 16A, Nebo.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



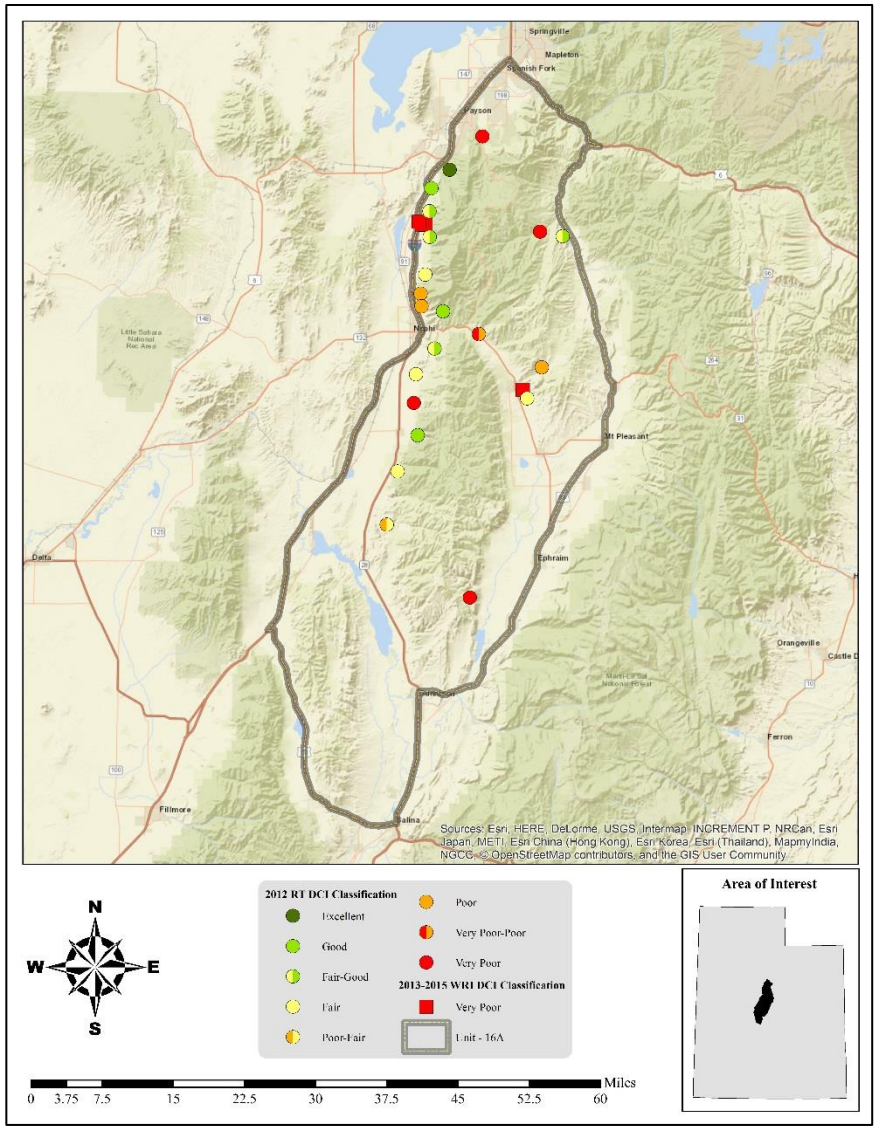
Map 1.9: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 16A, Nebo.



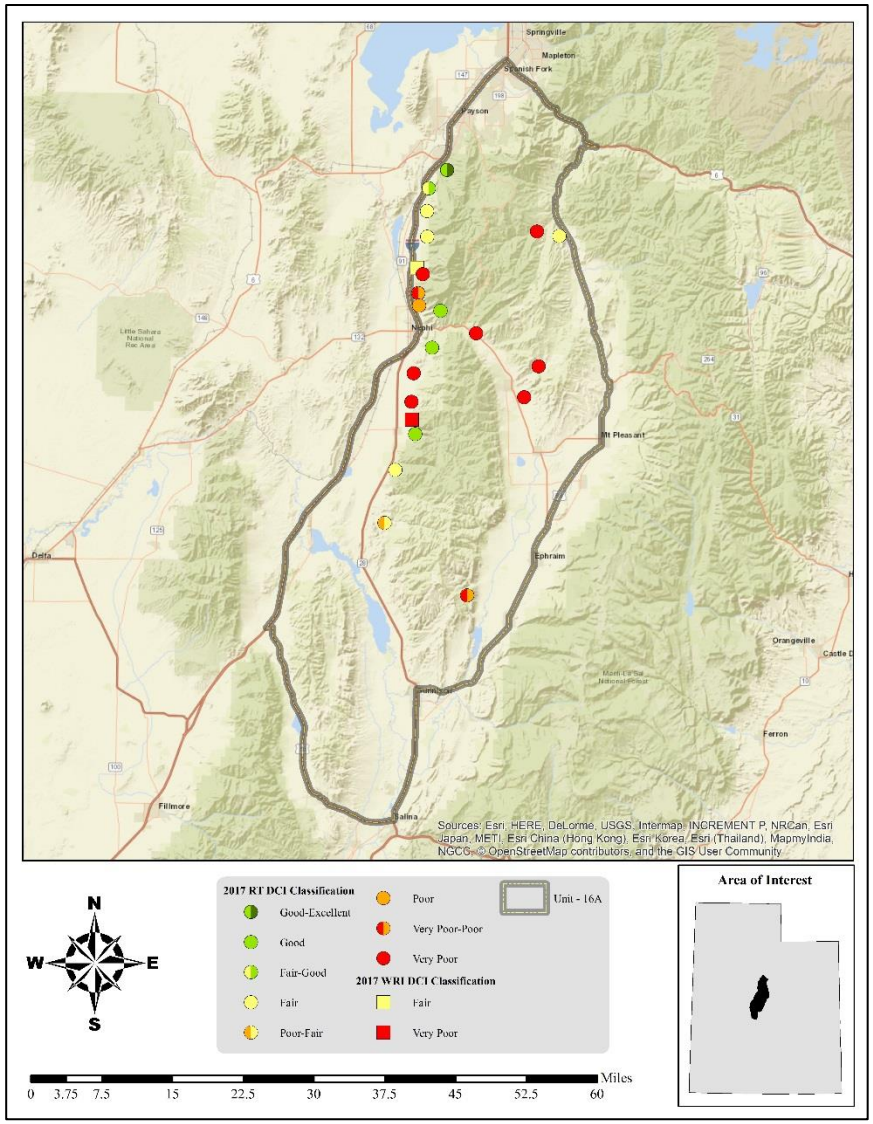
Map 1.10: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 16A, Nebo.



Map 1.11: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 16A, Nebo.



Map 1.12: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 16A, Nebo.



Map 1.13: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 16A, Nebo.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
16A-2	Santaquin Bench	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased Fire Potential
16A-3	Santaquin Hill	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-4	Wash Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-5	Nebo Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
16A-6	Hop Creek Browse	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
16A-7	Willow Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
16A-8	Gardner Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
16A-9	Birch Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
16A-10	North Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
16A-11	Rees Flat	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
16A-13	Steele Ranch	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
16A-14	Big Hollow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-15	Old Pinery	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-17	Chicken Creek	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-18	Deep Creek	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-19	Flat Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-20	Triangle Ranch	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16A-22	Levan North	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
16A-23	Fountain Green Plateau	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
16A-24	Maple Canyon	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
16R-13	Upper Porphyry	Annual Grass	Low	Increased Fire Potential
		Energy Development	High	Fragmentation and degradation of habitat
16R-14	Consumer Bench North	Annual Grass	Low	Increased Fire Potential
		Energy Development	High	Fragmentation and degradation of habitat
16R-15	Consumer Bench 2	Annual Grass	Low	Increased Fire Potential
		Energy Development	High	Fragmentation and degradation of habitat
16R-52	Helper Benches	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Energy Development	High	Fragmentation and degradation of habitat

Table 1.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 16A, Nebo. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The study sites within the Mountain (Big Sagebrush) ecological type vary in condition from very poor to good for deer winter range habitat. The sagebrush communities support plant populations that provide winter forage for wildlife. Introduced annual grasses are present on all sites in varying amounts. Bulbous bluegrass (*Poa bulbosa*) is also present on all sites within this ecological type and can reduce the ecological integrity and diversity of the plant communities. The Wash Canyon and Triangle Ranch study sites are both in Phase I of woodland encroachment and have potential for future encroachment.

Treatments to reduce the undesirable grasses may become necessary on some sites if these grasses persist on the sites. Areas with conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.) where feasible. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Oak)

The studies that are considered to be Mountain (Oak) ecological sites vary in condition from very poor to good for deer winter range habitat. The oak communities provide cover and forage for wildlife in winter. Bulbous bluegrass is present on all the sites sampled, and threatens the integrity and diversity of the plant communities. Introduced annual grasses are also present on all sites except Rees Flat: these grasses can increase fuel loads and pose a risk for wildfire. The Santaquin Hill site is currently in Phase I of woodland encroachment and has potential for future encroachment.

Treatments to reduce undesirable grasses may become necessary on some sites if high levels of these grasses persist. Areas with conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.) where feasible. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The study sites within the Upland (Big Sagebrush) ecological type vary in condition from very poor to very poor-poor for deer winter range habitat on this unit. These lower elevation sagebrush communities support populations that provide winter forage for wildlife. The Old Pinery, Maple Canyon, and Levan North sites are currently in Phase I of woodland encroachment, indicating the potential for future encroachment or infilling. Introduced annual grasses are present on all sites to varying degrees, and can increase fuel loads and pose a risk for wildfire. Bulbous bluegrass is also present on all sites except Maple Canyon: this grass can alter and reduce the diversity of the plant community.

Treatments to reduced undesirable grasses might be necessary if high levels of these grasses persist. It is recommended that areas with significant conifer encroachment be treated (e.g. bullhog, chaining, lop and scatter, etc.) where feasible and maintenance should continue on sites that have already been treated. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

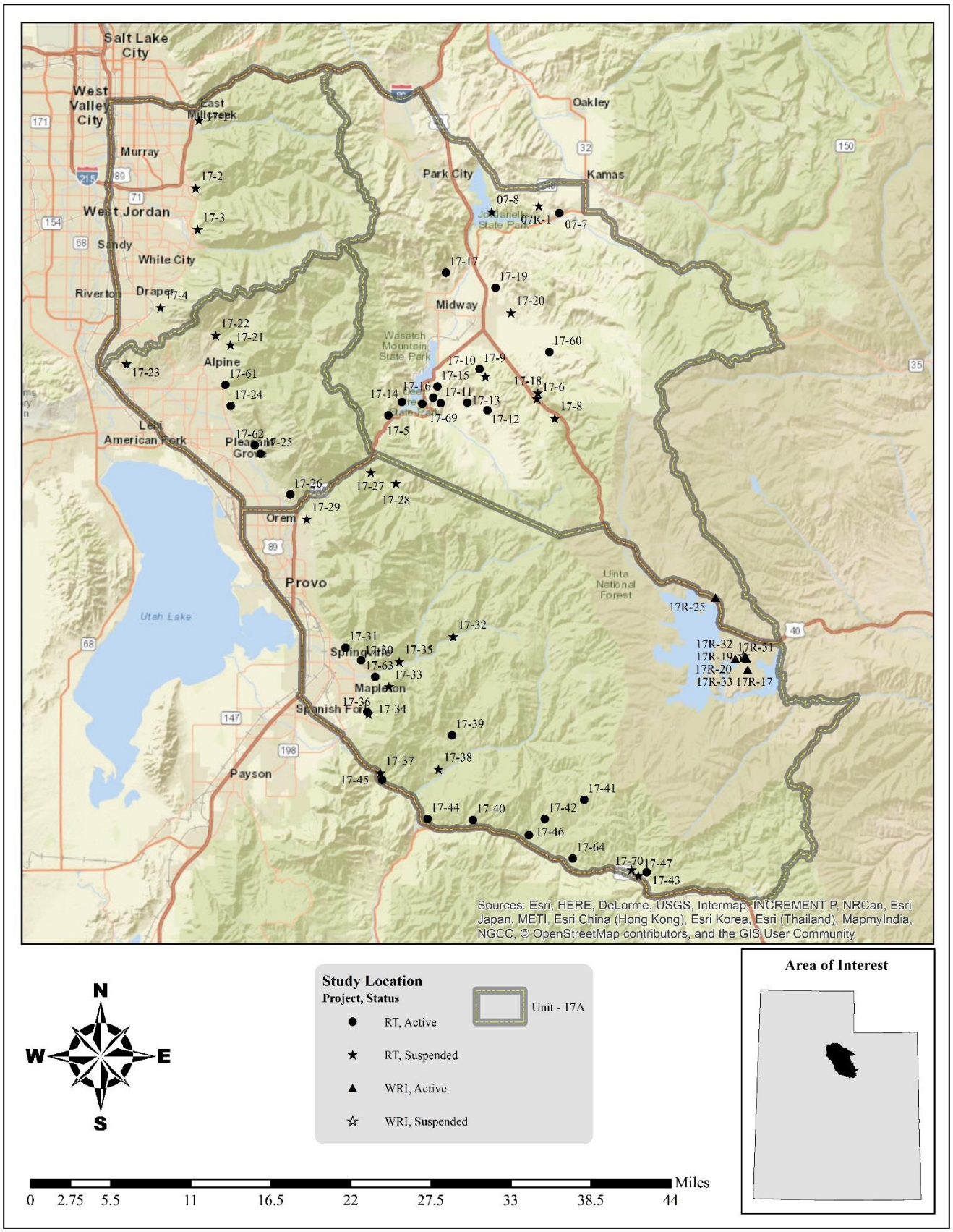
Upland (Cliffrose)

Studies that are considered to be Upland (Cliffrose) ecological sites vary in condition from very poor to good for deer winter range habitat on this unit. These cliffrose communities support browse populations that provide good winter forage for wildlife. These communities have the potential for invasion by annual grasses and introduced perennial grasses. Annual grasses, specifically cheatgrass (*Bromus tectorum*), can increase fuel loads and exacerbate the risk for wildfire. The Chicken Creek and Deep Creek study sites are currently in Phase I of conifer encroachment and are at risk for further encroachment.

Treatments to reduce annual grass might be necessary if high levels of these grasses become an issue in these communities. It is recommended that areas with significant conifer encroachment undergo a tree-removing

treatment (e.g. bullhog, chaining, lop and scatter, etc.) where feasible. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

2. WILDLIFE MANAGEMENT UNIT 17A – WASATCH MOUNTAINS



WILDLIFE MANAGEMENT UNIT 17A – WASATCH MOUNTAINS

Boundary Description

Carbon, Duchesne, Salt Lake, Summit, Utah and Wasatch counties—Boundary begins at the junction of I-15 and I-80 in Salt Lake City; east on I-80 to US-40; south on US-40 to SR-32; east on SR-32 to SR35; southeast on SR-35 to SR-87; south on SR-87 to Duchesne and US-191; south on US-191 to US-6; northwest on US-6 to I-15; north on I-15 to I-80 in Salt Lake City. Excludes all Native American Trust land.

Management Unit Description

Geography

The Wasatch Mountains Management Unit is composed of the Wasatch Mountains, Wasatch Front, Heber Valley and areas surrounding Strawberry Reservoir. Towns within the boundary include Heber City, Park City, and the Wasatch Front Complex (Mapleton bordering the south and Millcreek bordering the north). Big game range occurs across a majority of the unit, though significant parts of historical winter range are no longer functional due to urbanization. The permanent range trend studies are located in Spanish Fork Canyon, along the Wasatch Front, and in Heber Valley.

The Wasatch Mountains run north-south, with the Wasatch Front on the west side and Park City, Heber Valley, and Currant Creek Mountain bordering the east side. The Wasatch Mountains are generally tall with rugged terrain; the highest point is Mount Timpanogos at 11,752 feet. Willow Creek Ridge and Strawberry Ridge surrounding Strawberry Reservoir are less pronounced than the Wasatch Mountains with gentler terrain.

Climate Data

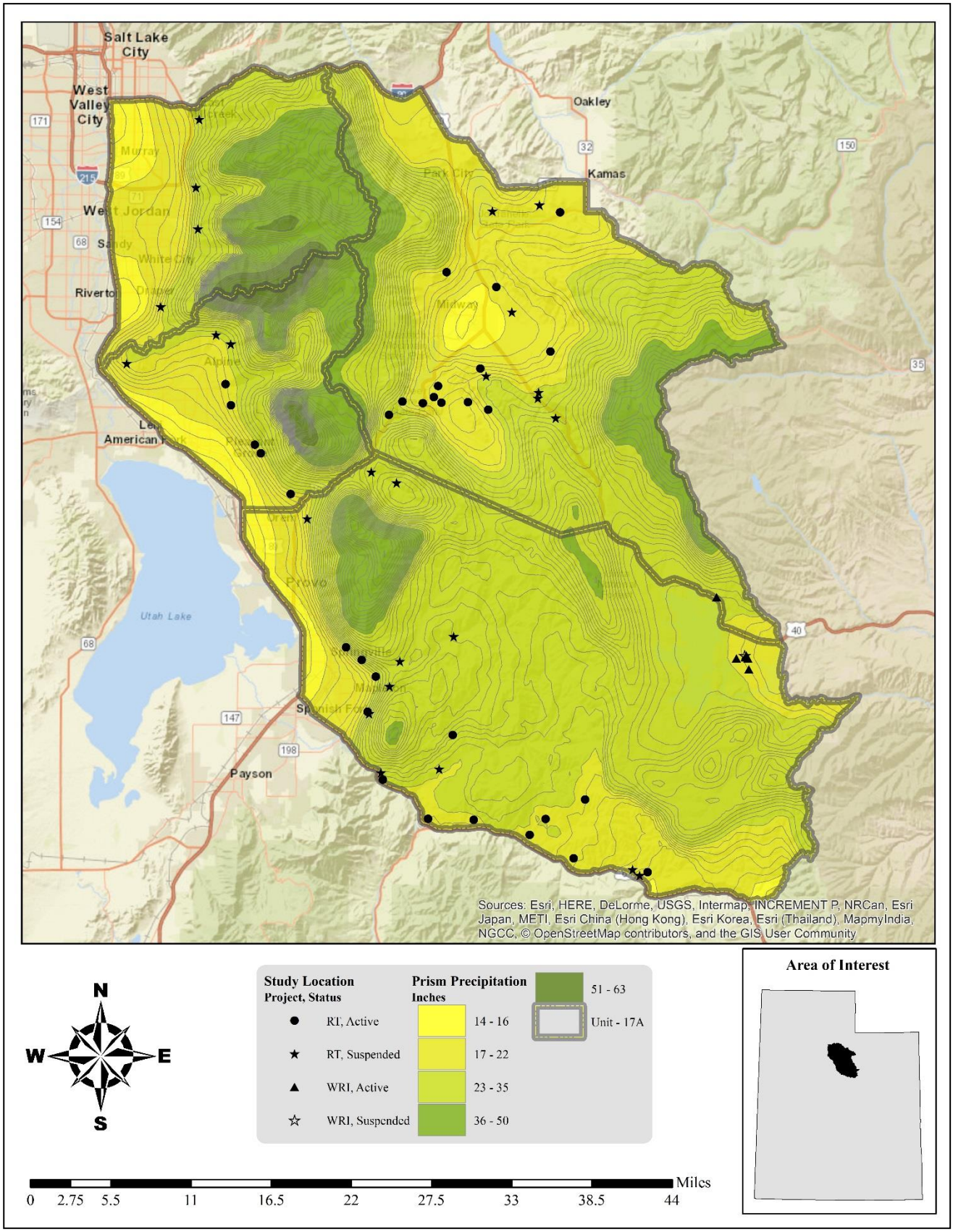
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 14 inches along portions of the Wasatch Front and Heber Valley to 63 inches on the peaks of Mt. Timpanogos and Twin Peaks. All of the Range Trend and WRI monitoring studies on the unit occur within 17-35 inches of precipitation (**Map 2.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the North Central and Northern Mountain divisions (Divisions 3 and 5).

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 2.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 2.1b**).

The mean annual PDSI of the Northern Mountains division displayed years of moderate to extreme drought from 1988-1990, 2000-2003, and 2012-2013. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1995, 1997-1998, 2005, and 2011 (**Figure 2.2a**). The mean spring (March-May) PDSI displayed moderate to extreme drought in 1989-1990, 1992, 2000-2004, and 2012-2014; moderately to extremely wet years were displayed in 1982-1986, 1995-1996, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1988-1990, 2000-2003, 2007, and 2012-

2013; moderately to extremely wet years were displayed in 1982-1986, 1995, and 1997-1998 (**Figure 2.2b**) (Time Series Data, 2018).



Map 2.1: The 1981-2010 PRISM Precipitation Model for WMU 17A, Wasatch Mountains (PRISM Climate Group, Oregon State University, 2013).

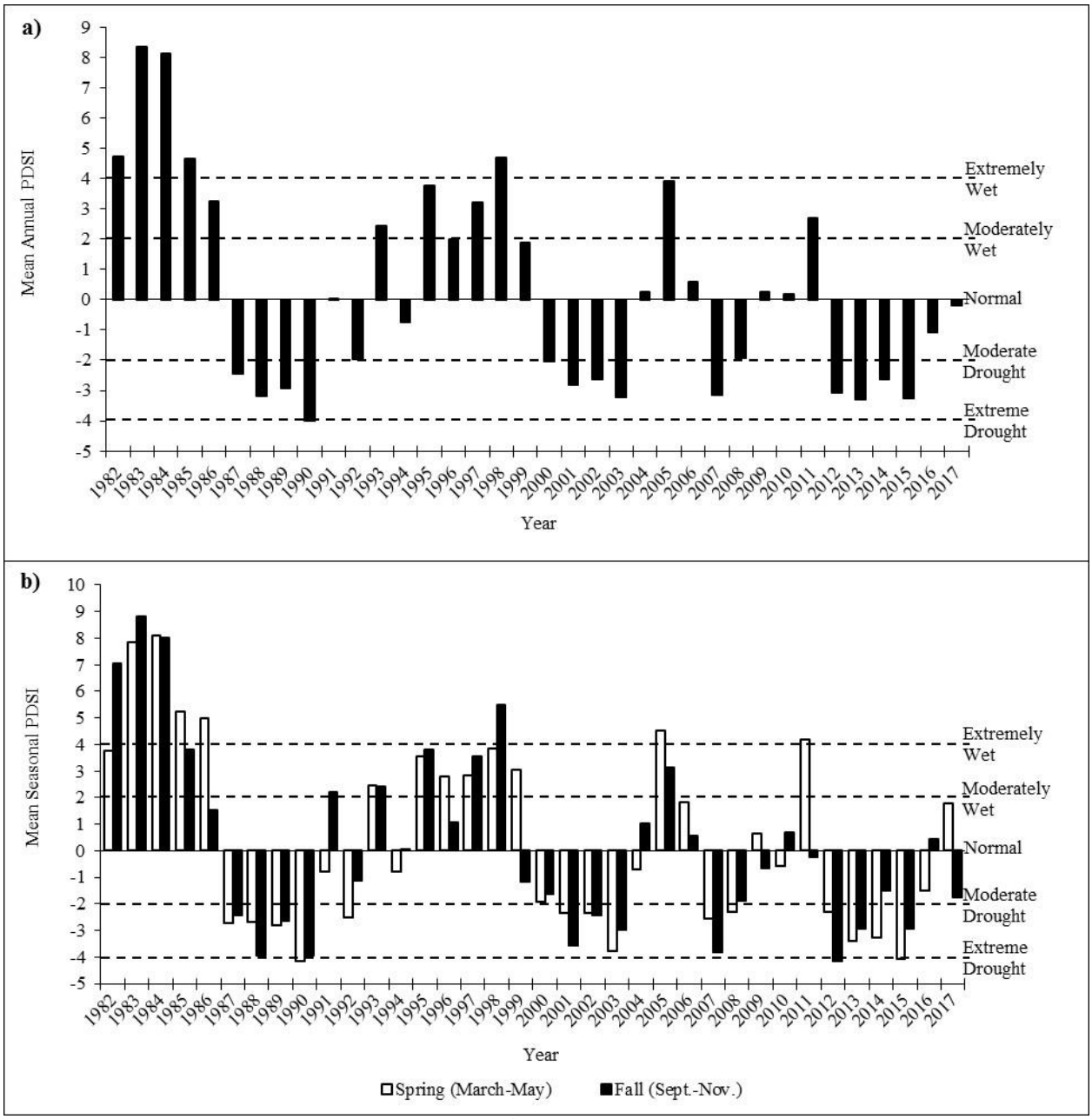


Figure 2.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

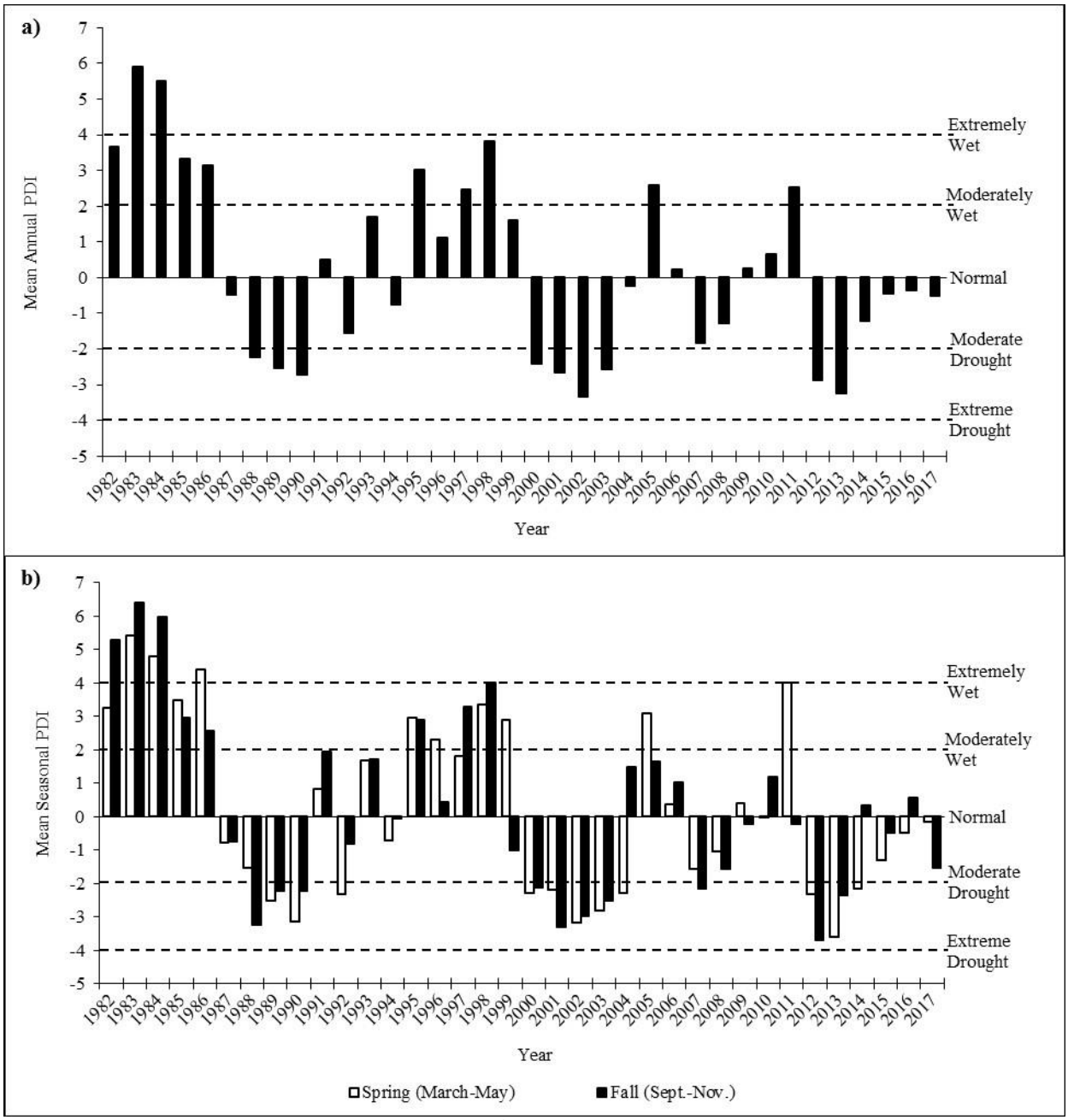


Figure 2.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

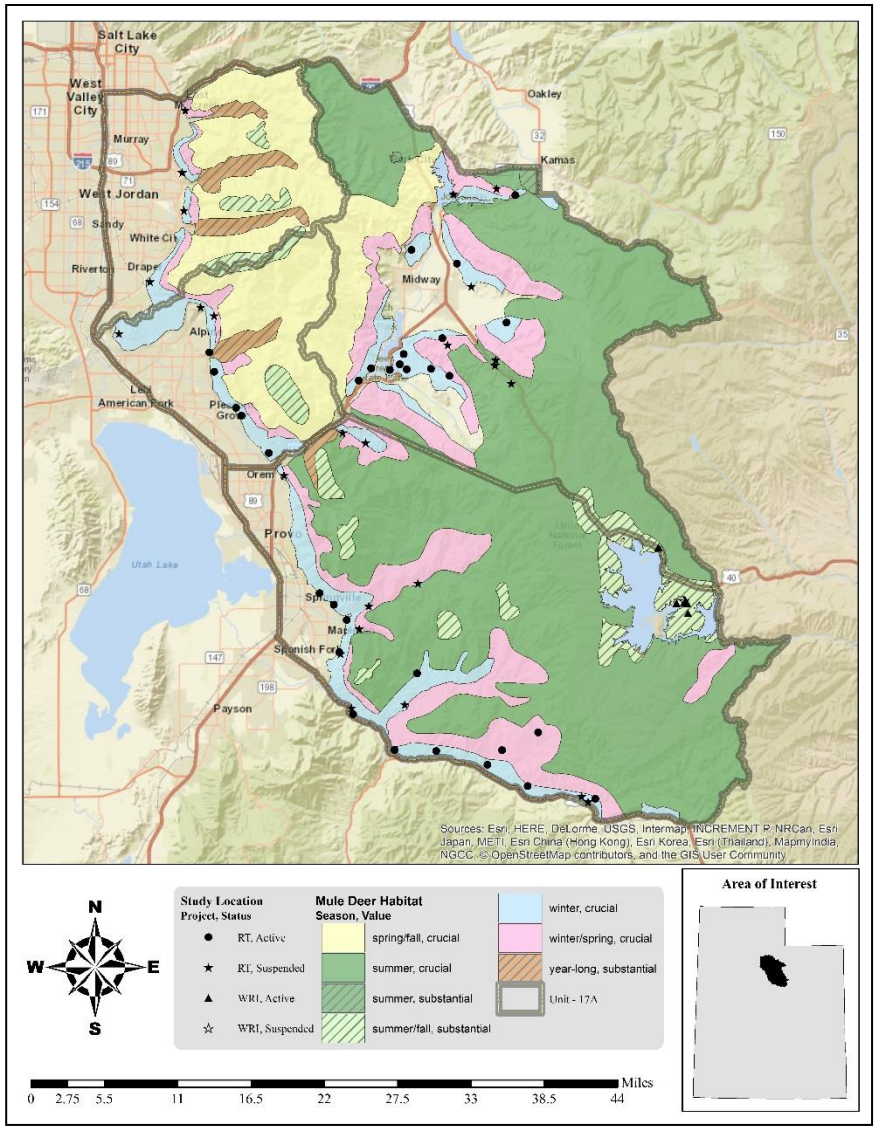
Big Game Habitat

There are an estimated 926,665 acres classified as deer range on Unit 17A with 9% classified as winter range, 53% as summer range, 2% as year-long range, 5% as summer/fall range, 14% as winter/spring range, and 17% as spring/fall range (**Table 2.1**, **Map 2.2**). Privately owned land comprises 45% of the winter range, 40% is managed by the United States Forest Service (USFS), 10% is managed by the Utah Division of Wildlife Resources (UDWR), 5% is managed by the United State Parks (USP), and School and Institutional Trust Lands Administration (SITLA) manages 1% (**Table 2.2**, **Map 2.2**, **Map 2.7**). Of the elk winter range, 48% is administered by the BLM, 31% is privately owned, the USFS manages 13%, and 8% is managed by SITLA (**Table 2.3**, **Map 2.3**, **Map 2.7**). The unit presents several challenges to public land and wildlife managers, with issues arising from the urbanization and degradation of winter range. Deer winter range throughout the unit is concentrated in Spanish Fork Canyon, Heber Valley and the Bonneville Shoreline. The deer winter range in Spanish Fork Canyon is higher elevation winter range and may not be heavily used in more severe winters.

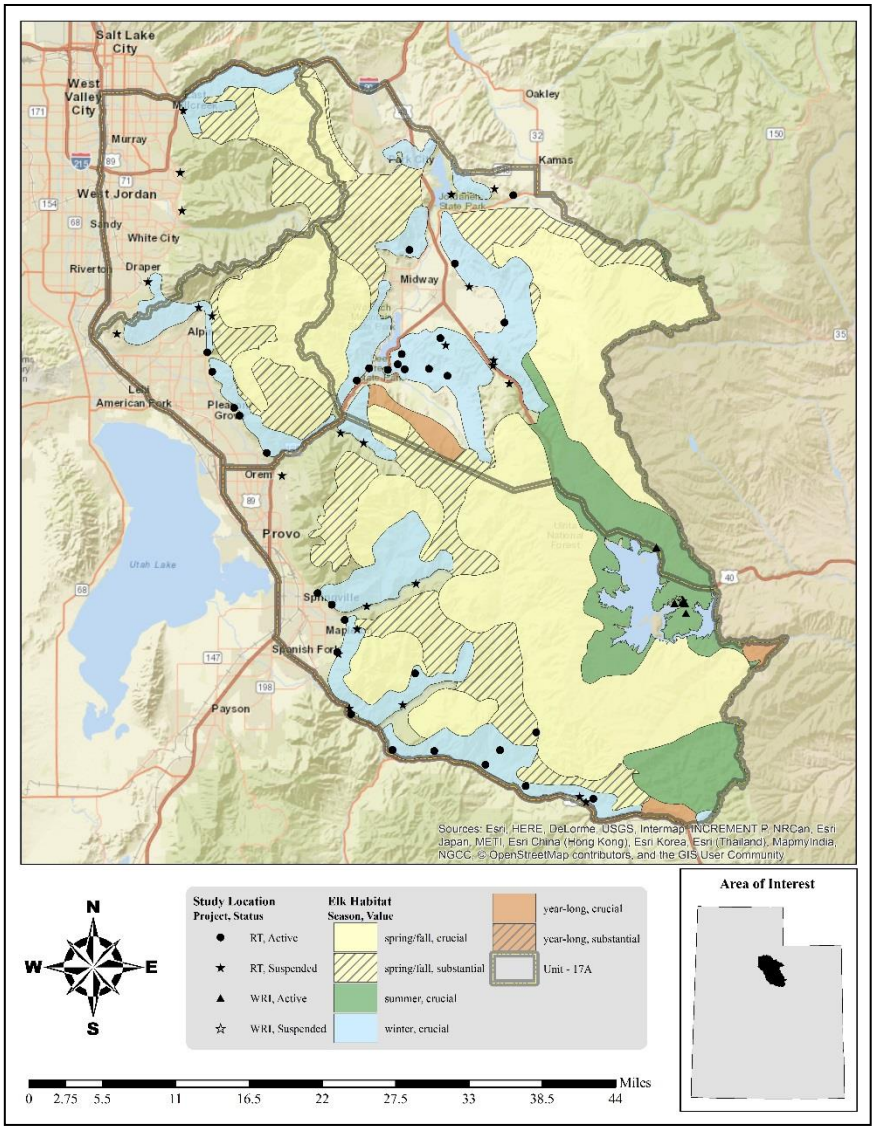
Much of the winter range in the Heber Valley area (50%) is privately owned and development has been a continuing concern. Since the early 2000s, development has accelerated and some of the most critical range is being converted to housing. Division of Wildlife Resources, State Parks, and federal lands will likely be the key to the deer habitat into the future on this portion of the unit. Important vegetation types monitored include antelope bitterbrush, mixed mountain browse, mixed oakbrush/sagebrush, and mountain big sagebrush.

Winter habitat along the Bonneville shoreline is limited by quality and quantity in this area of the unit. A large portion of deer winter range is privately owned making it susceptible to development. Housing developments in recent years have consumed much of this important winter range and will likely continue to do so in the future. Most winter range has been reduced to a narrow bench above the communities of Alpine, Pleasant Grove, Orem, Springville and Mapleton. Important vegetation types monitored include antelope bitterbrush, true mountain mahogany, mixed mountain browse, mixed oakbrush/sagebrush, and Stansbury cliffrose.

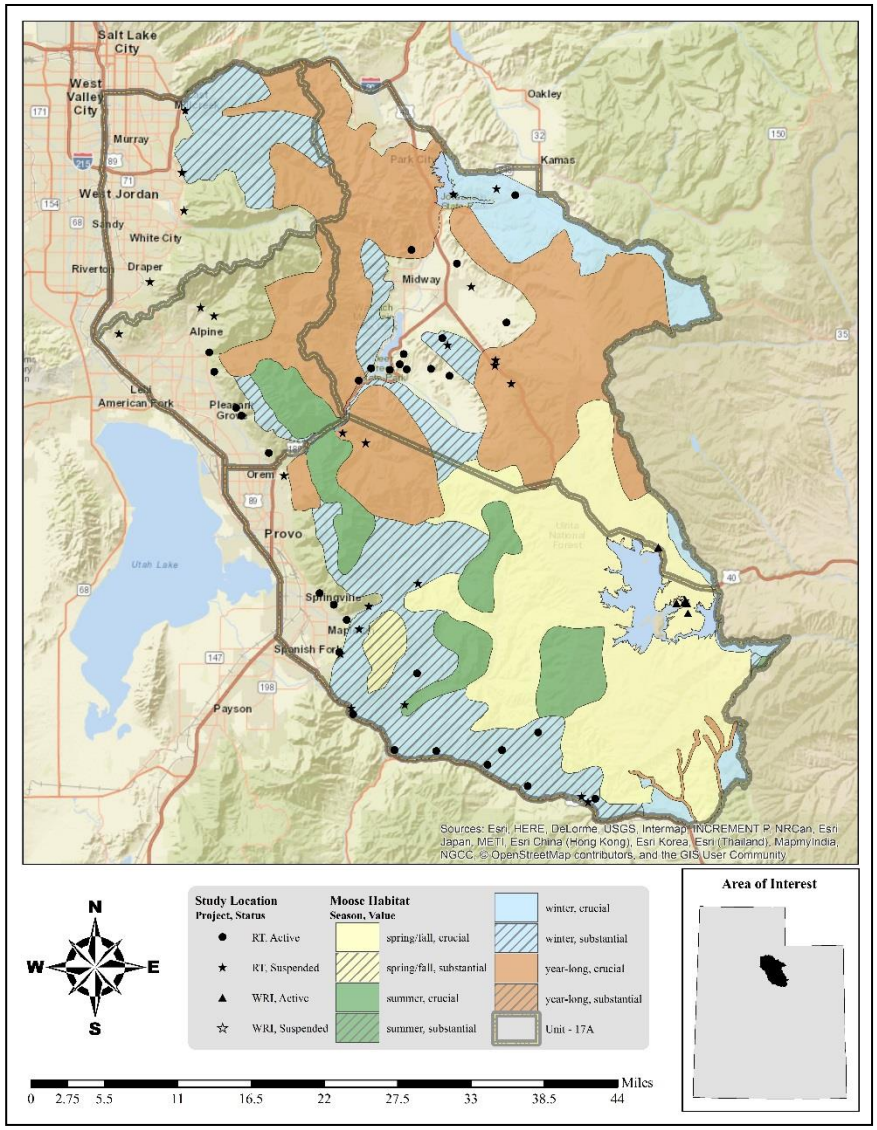
The majority of deer winter range in Spanish Fork Canyon is managed by the US Forest Service. These sites are typically higher elevation winter range and may not be used as heavily in more severe winters. Important vegetation types monitored include mixed mountain browse, mixed oakbrush/sagebrush, and sagebrush.



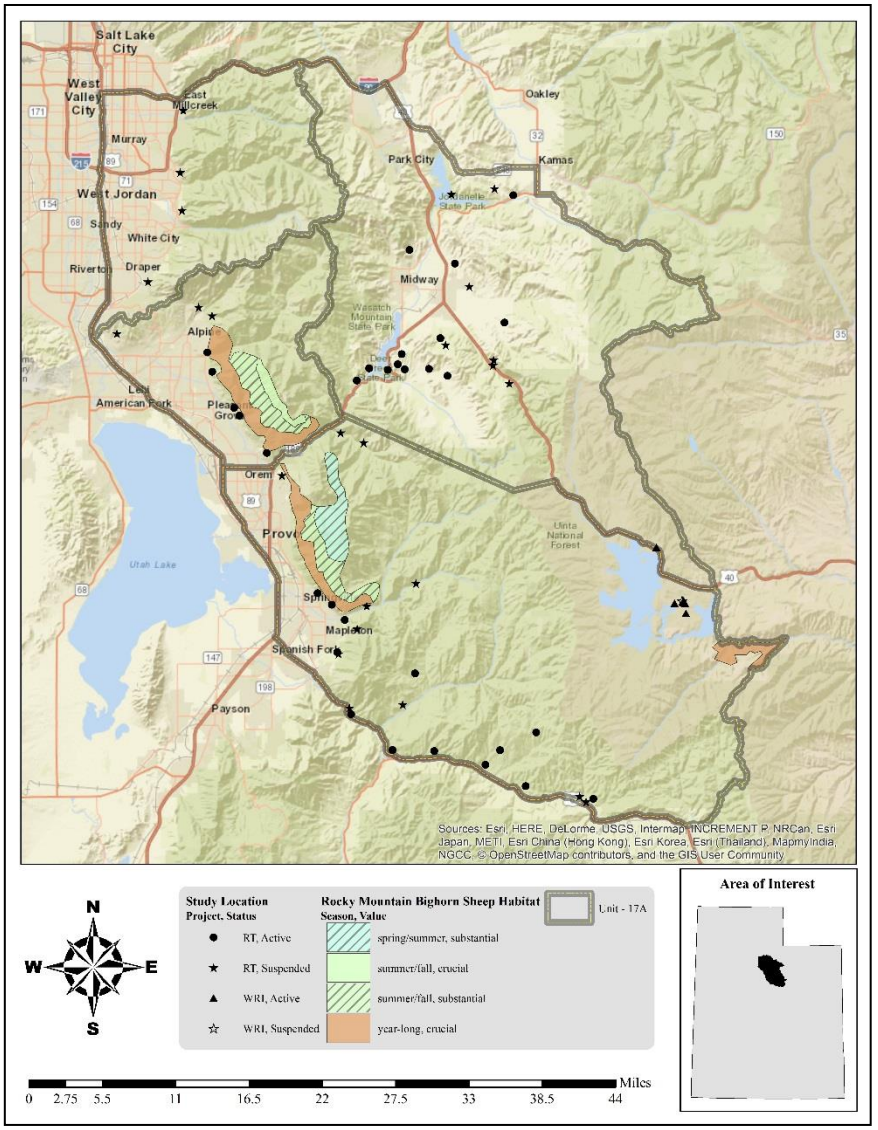
Map 2.2: Estimated mule deer habitat by season and value for WMU 17A, Wasatch Mountains



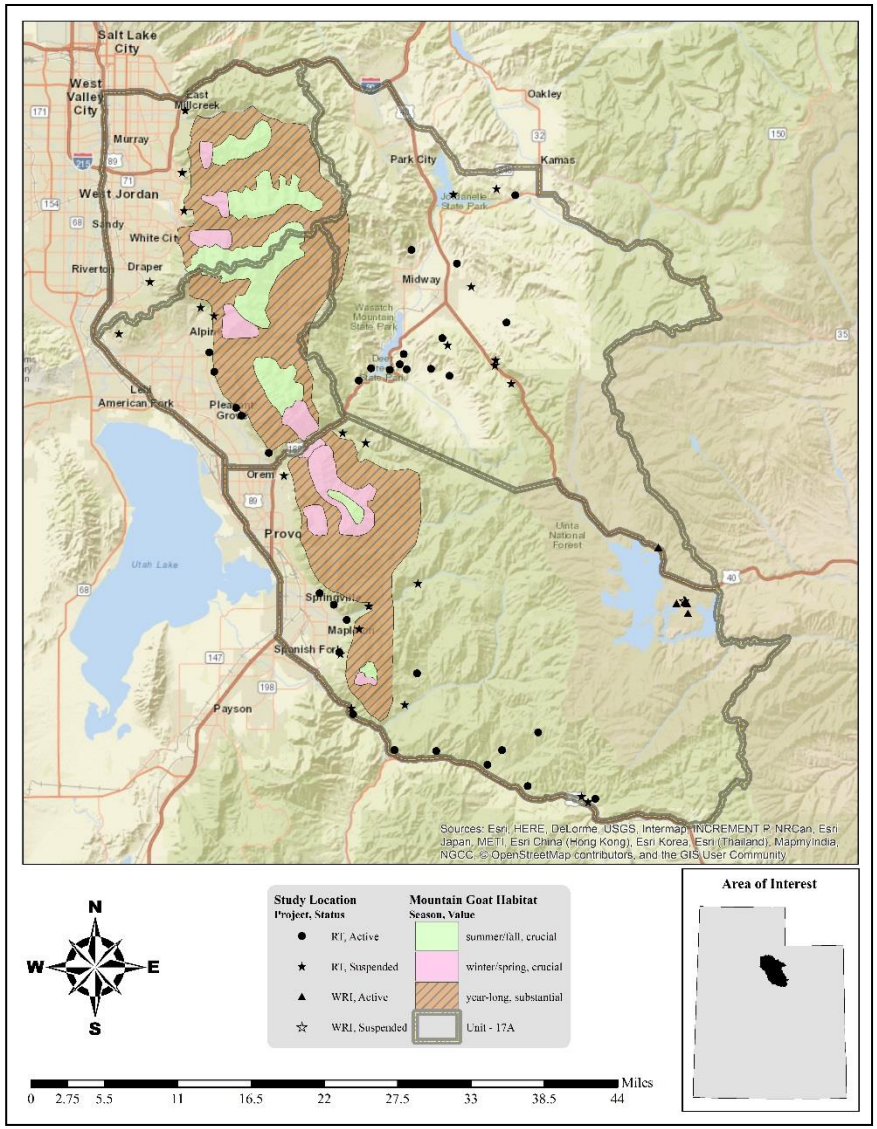
Map 2.3: Estimated elk habitat by season and value for WMU 17A, Wasatch Mountains.



Map 2.4: Estimated moose habitat by season and value for WMU 17A, Wasatch Mountains



Map 2.5: Estimated Rocky Mountain Bighorn Sheep habitat by season and value for WMU 17A, Wasatch Mountains.



Map 2.6: Estimated Mountain Goat habitat by season and value for WMU 17A, Wasatch Mountains.

	Year Long Range		Summer Range		Summer/Fall Range		Winter Range		Winter/Spring Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	21,129	2%	489,495	53%	50,082	5%	80,226	9%	130,801	14%
Elk	12,673	2%	90,103	12%	0	0%	154,090	20%	0	0%
Moose	273,996	34%	65,682	8%	0	0%	143,867	18%	0	0%
RMBS	20,101	47%	0	0%	15,274	36%	0	0%	0	0%
Mountain Goat	148,343	70%	0	0%	40,756	19%	0	0%	23,713	11%

	Spring/Fall Range		Spring/Summer Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	154,932	17%	0	0%
Elk	527,635	67%	0	0%
Moose	225,507	28%	0	0%
RMBS	0	0%	7,266	17%
Mountain Goat	0	0%	0	0%

Table 2.1: Estimated mule deer, elk, pronghorn, bison, and Rocky Mountain bighorn sheep (RMBS) habitat acreage by season for WMU 17A, Wasatch Mountains

	Year Long Range		Summer Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	639	<1%	0	0%	239	<1%	741	1%	580	<1%
NPS	254	1%	0	0%	0	0%	0	0%	0.2	<1%	0	0%
Private	2,743	13%	130,364	27%	4,772	10%	35,742	45%	43,041	33%	32,494	21%
SITLA	0	0%	1,838	<1%	0	0%	476	1%	1,084	1%	457	<1%
Tribal	0	0%	1,974	<1%	769	2%	0	0%	0	0%	0	0%
UDWR	0	0%	4,427	1%	0	0%	7,940	10%	5,030	4%	42	<1%
USFS	18,132	86%	349,425	71%	44,541	89%	32,139	40%	73,591	56%	111,253	72%
USP	0	0%	828	<1%	0	0%	3,691	5%	7,314	6%	10,107	7%
Total	21,129	**100%**	489,495	**99%**	50,082	**100%**	80,226	**100%**	130,801	**100%**	154,932	**100%**

Table 2.2: Estimated mule deer habitat acreage by season and ownership for WMU 17A, Wasatch Mountains.

	Year Long Range		Summer Range		Winter Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	0	0%	1,283	1%	501	<1%
NPS	0	0%	0	0%	0	0%	254	<1%
Private	9,403	74%	13,572	15%	68,641	45%	101,806	19%
SITLA	0	0%	0	0%	2,807	2%	673	<1%
Tribal	0	0%	772	1%	0	0%	1,970	<1%
UDWR	1005	8%	493	1%	13,828	9%	419	<1%
USFS	2,265	18%	75,267	84%	59,896	39%	409,966	78%
USP	0	0%	0	0%	7,635	5%	12,047	2%
Total	12,673	**100%**	90,103	**100%**	154,090	**100%**	527,635	**100%**

Table 2.3: Estimated elk habitat acreage by season and ownership for WMU 17A, Wasatch Mountains

	Year Long Range		Summer Range		Winter Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	1,448	1%	0	0%	260	<1%	0	0%
NPS	218	<1%	0	0%	0	0%	0	0%
Private	109,875	40%	6,520	9%	74,283	32%	17,386	8%
SITLA	2129	1%	0	0%	786	<1%	0	0%
Tribal	0	0%	0	0%	0	0%	2,741	1%
UDWR	914	<1%	89	<1%	7,009	3%	233	<1%
USFS	144,389	53%	65,682	91%	143,867	62%	205,146	91%
USP	15,024	5%	0	0%	7,388	3%	0	0%
Total	273,996	**100%**	72,291	**100%**	233,592	**100%**	225,507	**100%**

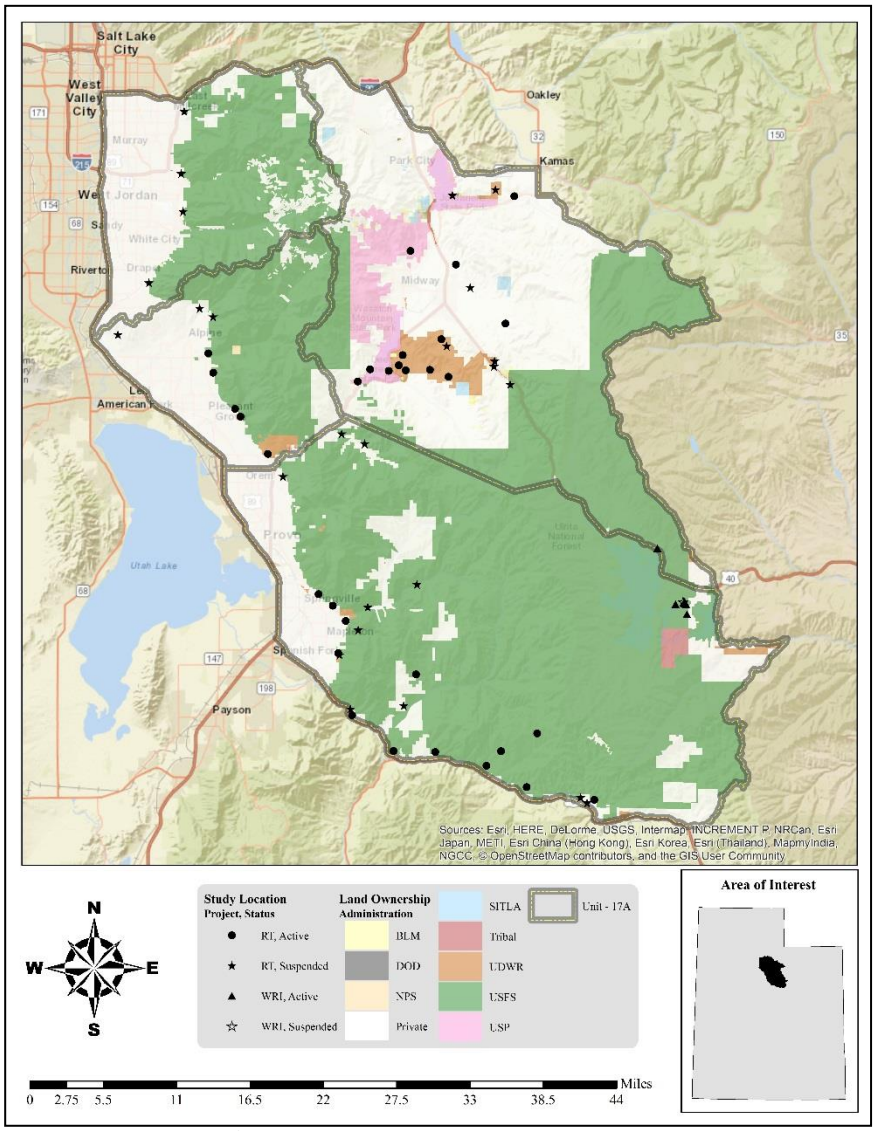
Table 2.4: Estimated moose habitat acreage by season and ownership for WMU 17A, Wasatch Mountains

	Year Long Range		Spring/Summer Range		Summer/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
NPS	11	<1%	0	0%	18	<1%
Private	3,061	15%	40	1%	182	1%
UDWR	3154	16%	82	1%	0.2	<1%
USFS	13,875	69%	7,144	98%	15,073	99%
Total	20,101	**100%**	7,266	**100%**	15,274	**100%**

Table 2.5: Estimated bighorn sheep habitat acreage by season and ownership for WMU 17A, Wasatch Mountains.

	Year Long Range		Winter/Spring Range		Summer/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
NPS	254	<1%	0	0%	0	0%
Private	18,186	12%	770	3%	3,963	10%
UDWR	1257	1%	98	<1%	0	0%
USFS	128,646	87%	22,845	96%	36,793	90%
Total	148,343	**100%**	23,713	**100%**	40,756	**100%**

Table 2.6: Estimated mountain goat habitat acreage by season and ownership for WMU 17A, Wasatch Mountains.



Map 2.7: Land ownership for WMU 17A, Wasatch Mountains.

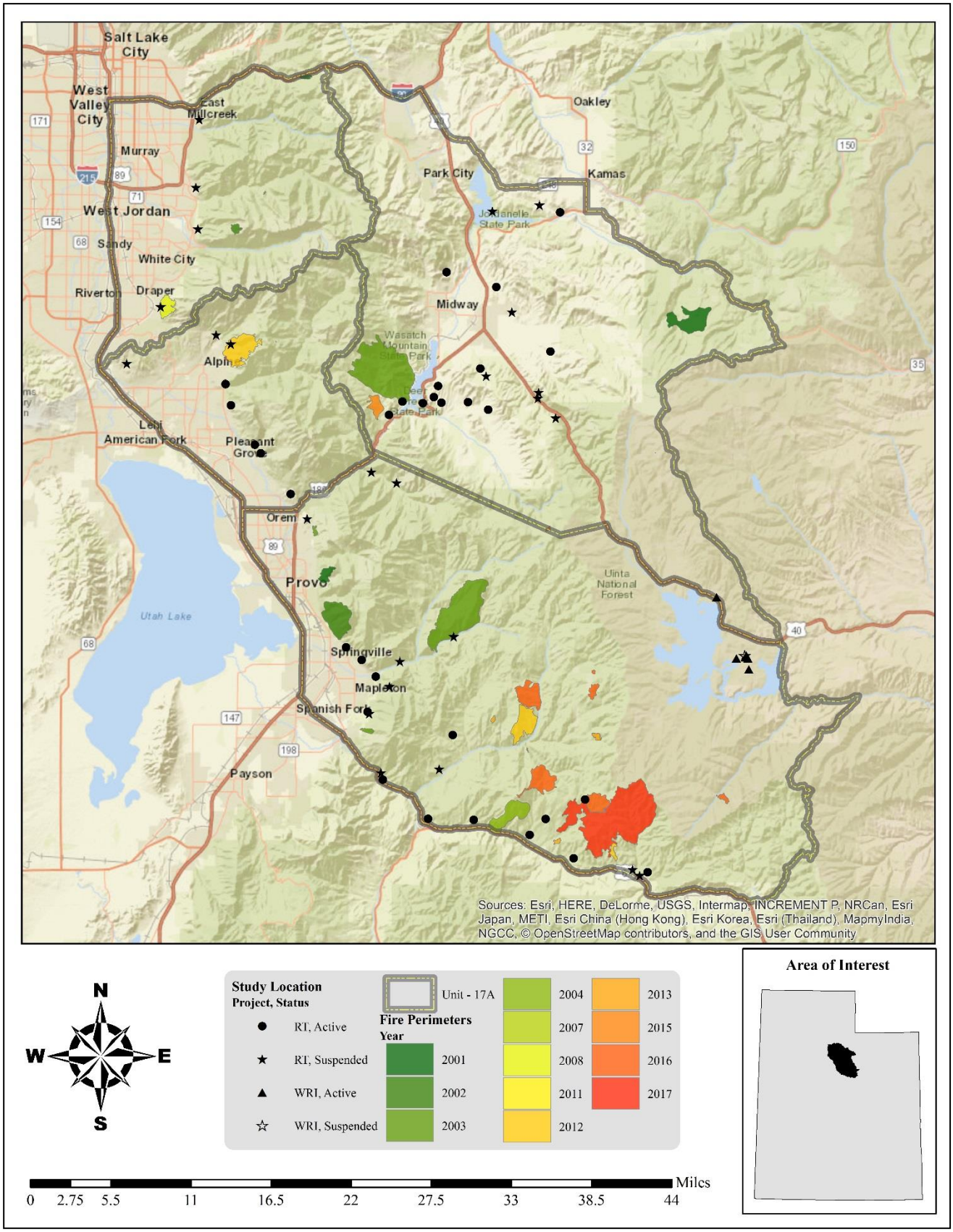
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Colorado Plateau Pinyon-Juniper Woodland	222,907	12.08%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	81,173	4.40%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	46,408	2.51%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	20,945	1.13%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	18,845	1.02%	
	Abies concolor Forest Alliance	12,924	0.70%	
	Rocky Mountain Lodgepole Pine Forest	3,620	0.20%	
	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	1,913	0.10%	
	Southern Rocky Mountain Ponderosa Pine Woodland	767	0.04%	
	Other Conifer	322	0.02%	22.20%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	9,742	0.53%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	10	0.00%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	2	0.00%	0.53%
Exotic Tree-Shrub	Introduced Riparian Shrubland	415	0.02%	
	Introduced Riparian Forest and Woodland	2	0.00%	0.02%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	31,872	1.73%	
	Southern Rocky Mountain Montane-Subalpine Grassland	3,101	0.17%	
	Inter-Mountain Basins Semi-Desert Grassland	1,224	0.07%	
	Other Grassland	800	0.04%	2.00%
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	121,459	6.58%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	111,347	6.03%	
	Quercus gambelii Shrubland Alliance	95,682	5.18%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	50,207	2.72%	
	Inter-Mountain Basins Montane Sagebrush Steppe	31,283	1.69%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	29,118	1.58%	
	Rocky Mountain Lower Montane-Foothill Shrubland	17,747	0.96%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	6,786	0.37%	
	Great Basin Xeric Mixed Sagebrush Shrubland	3,331	0.18%	
	Inter-Mountain Basins Big Sagebrush Steppe	1,553	0.08%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	1,074	0.06%	
	Inter-Mountain Basins Greasewood Flat	911	0.05%	
	Great Basin Semi-Desert Chaparral	771	0.04%	
	Other Shrubland	511	0.03%	25.56%
Other	Hardwood	498,464	27.00%	
	Developed	152,081	8.24%	
	Conifer-Hardwood	112,548	6.10%	
	Barren	50,618	2.74%	
	Agricultural	38,086	2.06%	
	Open Water	25,498	1.38%	
	Sparsely Vegetated	22,532	1.22%	
	Riparian	16,691	0.90%	
	Quarries-Strip Mines-Gravel Pits	698	0.04%	
	Snow-Ice	5	0.00%	49.69%
Total		943,923	100%	100%

Table 2.7: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 17, Wasatch Mountains.

Limiting Factors to Big Game Habitat

Major human activities within this unit include recreation and livestock grazing. Urban development is a primary concern and a significant factor in the loss of winter habitat. Public land winter range availability and winter range forage conditions are both major limiting factors to big game habitat on this unit.

The winter range within the Heber Valley and Spanish Fork Canyon areas of the subunit appears suitable to support planned deer population objectives. Winter range on the Bonneville Shoreline is more limited primarily due to development and poor quality habitat; deer will likely be forced to winter in an urban setting during more severe winters in this area. The abundance of bulbous bluegrass (*Poa bulbosa*) is a concern in all areas of the subunit. Once established, bulbous bluegrass populations persist and invade native plant communities (Kulmatiski, 2006): this introduced perennial species can form dense mats that may compete with other more desirable herbaceous species, seedlings, and young shrubs, potentially limiting the establishment of new plants into the population. The abundance of cheatgrass (*Bromus tectorum*) in the Heber Valley and Bonneville Shoreline areas of the unit is also a concern because this introduced annual species can increase fuel loads and the chance of a catastrophic fire event. According to the current Landfire Existing Vegetation Coverage model, 12.08% of the Wasatch Mountains unit is comprised of pinyon-juniper woodlands (**Table 2.7**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000)



Map 2.8: Land coverage of fires by year from 2000-2018 for WMU 17A, Wasatch Mountains (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

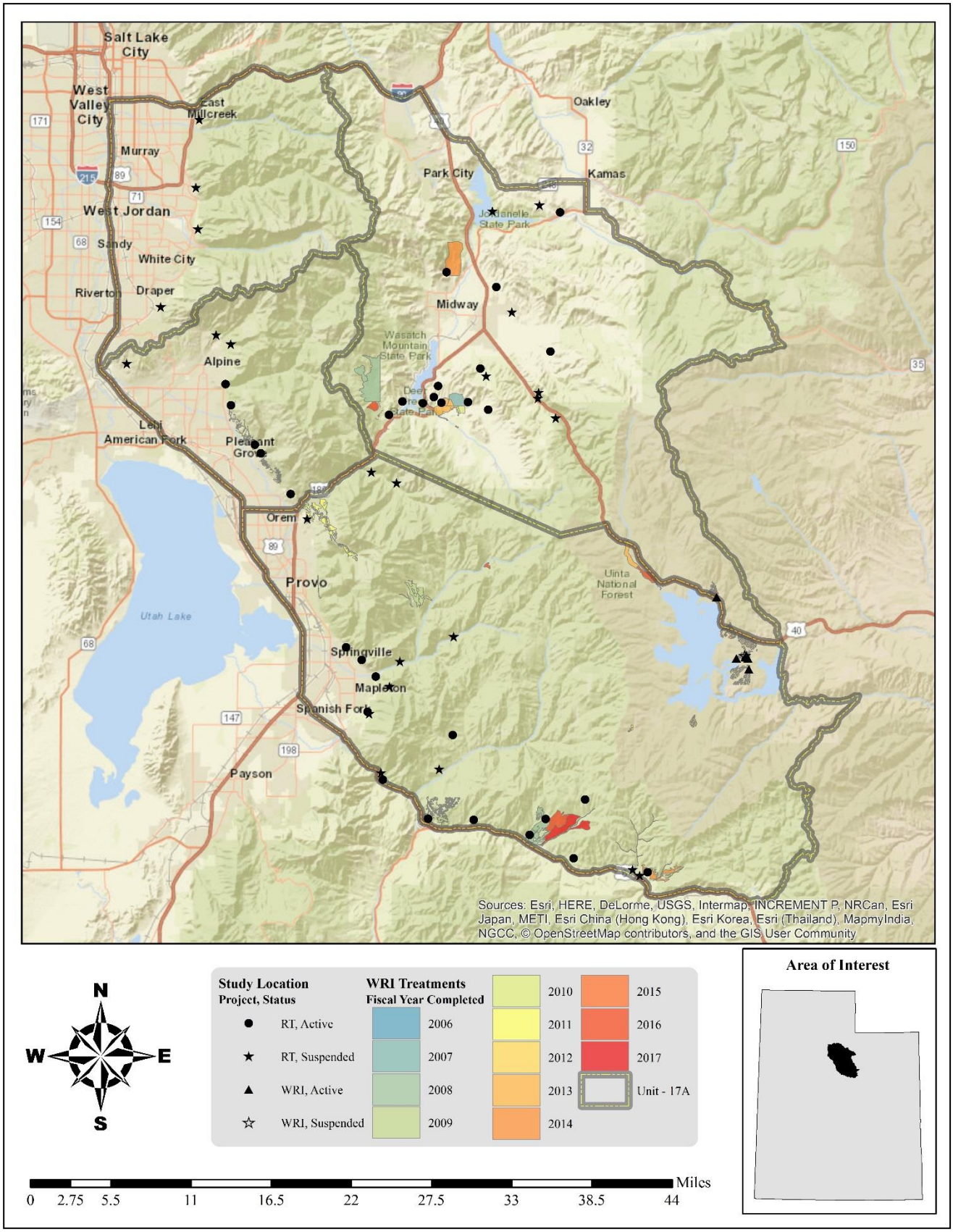
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 12,774 acres of land have been treated within the Wasatch Mountains unit since the WRI was implemented in 2004 (**Map 2.9**). An additional 7,872 acres are currently being treated and treatments have been proposed for 4,536 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 14,312 acres for this unit (**Table 2.8**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Bullhog treatments to remove pinyon and juniper are the most common management practice in this unit. Herbicide application to reduce undesirable plants is also very common. Other management practices include (but are not limited to) chain harrow, mowing, planting/transplanting, seeding species to augment the herbaceous understory, and hand vegetation removal (such as lop and scatter and lop-pile-burn) are all used across the unit (**Table 2.8**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Biological Control (of Vegetation)	**47**	**0**	**0**	**47**
Insects	47	0	0	47
Bullhog	**4,329**	**277**	**0**	**4,606**
Full Size	4,329	0	0	4,329
Skid Steer	0	277	0	277
Chain harrow	**744**	**0**	**0**	**744**
≤ 15 ft. (One-Way)	75	0	0	75
≤ 15 ft. (Two-Way)	63	0	0	63
> 15 ft. (One-Way)	199	0	0	199
> 15 ft. (Two-Way)	406	0	0	406
Disk	**10**	**0**	**0**	**10**
Plow (One-Way)	10	0	0	10
Greenstripping	**2**	**0**	**0**	**2**
Harrow	**501**	**0**	**0**	**501**
≤ 15 ft. (One-Way)	147	0	0	147
> 15 ft. (One-Way)	85	0	0	85
> 15 ft. (Two-Way)	270	0	0	270
Herbicide Application	**4,319**	**852**	**3,548**	**8,719**
Aerial (Fixed-Wing)	205	0	0	205
Ground	184	0	0	184
Spot Treatment	3,930	852	3,548	8,330
Mowing	**384**	**0**	**0**	**384**
Brush Hog	384	0	0	384
Planting/Transplanting	**575**	**0**	**79**	**654**
Container Stock	0	0	79	79
Other	575	0	0	575
Prescribed Fire	**0**	**5,619**	**858**	**6,477**
Road Decommissioning	**10**	**60**	**60**	**130**
Seeding (Primary)	**1,671**	**1,065**	**0**	**2,736**
Broadcast (Aerial Fixed-Wing)	205	1,051	0	1,256
Broadcast (Aerial Helicopter)	0	8	0	8
Ground (Mechanical Application)	25	0	0	25
Hand Seeding	1,441	5	0	1,446
Vegetation Removal/Hand Crew	**1,719**	**0**	**0**	**1,719**
Lop and Scatter	601	0	0	601
Lop-Pile-Burn	1,117	0	0	1,117
Total Treatment Acres	**14,312**	**7,872**	**4,545**	**26,729**
***Total Land Area Treated**	**12,774**	**7,872**	**4,536**	**25,182**

Table 2.8: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 17A, Wasatch Mountains. Data accessed on 02/08/2018. *Does not include overlapping treatments.



Map 2.9: WRI treatments by fiscal year completed for WMU 17A, Wasatch Mountains.

Range Trend Studies

Range Trend studies have been sampled within WMU 17 on a regular basis since 1983, with studies being added or suspended as was deemed necessary (**Table 2.9**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 2.10**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
17-5	Deer Creek Dam	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-6	Daniels Canyon	RT	Suspended	'83, '96	Not Verified
17-7	Provo River Canyon	RT	Active	'96, '01, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-9	Lower Big Hollow	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Browse)
17-10	Upper Big Hollow	RT	Suspended	'83, '89, '96	Not Verified
17-11	Wallsburg Turn	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Oak)
17-12	North Wallsburg Reseeding	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Stony Loam (Oak)
17-13	North Wallsburg	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-14	Hoovers Hollow	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Stony Loam (Mountain Big Sagebrush)
17-15	Island Boat Camp	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Browse)
17-16	Rainbow Bay	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Stony Loam (Mountain Big Sagebrush)
17-17	Dutch Canyon	RT	Active	'83, '89, '96, '02, '07, '12, '17	Mountain Loam (Oak)
17-19	Coyote Canyon	RT	Active	'84, '96, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-20	Lake Creek Road	RT	Suspended	'84, '96	Not Verified
17-21	Box Elder Canyon	RT	Suspended	'83, '89, '97	Not Verified
17-22	Schoolhouse Springs	RT	Suspended	'83, '89, '97	Not Verified
17-23	Oak Hollow	RT	Suspended	'83, '89, '97	Not Verified
17-24	Heisetts Hollow	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-25	North Battle Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Stony Loam (Cliffrose)
17-26	Orem Water Tank	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Oak)
17-28	Spring Hollow	RT	Suspended	'83, '89, '97	Not Verified
17-29	Above Edgemont	RT	Suspended	'83, '89, '97	Not Verified
17-30	Spring Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Very Steep Stony Loam (Cliffrose)
17-31	Round Peak	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Stony Loam (Hackberry)
17-33	Maple Canyon	RT	Suspended	'83, '89, '97	Not Verified
17-34	Maple Mountain Face	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-35	Hobble Creek Golf Course	RT	Suspended	'83, '89, '97	Not Verified
17-36	Big Slide	RT	Suspended	'97	Not Verified
17-38	North Fork Diamond Canyon	RT	Suspended	'83, '89, '97	Not Verified
17-39	Little Diamond Fork	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-40	Long Hollow	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Gravelly Loam (Mountain Big Sagebrush)
17-41	Upper Sheep Creek	RT	Active	'83, '97, '02, '07, '12, '17	Mountain Clay (Mountain Big Sagebrush)
17-42	Tank Hollow	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Browse)
17-43	Tie Fork	RT	Suspended	'83, '89, '97	Not Verified
17-44	Billies Mountain	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Clay (Mountain Big Sagebrush)
17-45	North Bench	RT	Active	'89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-46	Lower Tank Hollow	RT	Active	'89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-47	Tie Fork East	RT	Suspended	'89, '97, '02, '07, '12	Mountain Stony Loam (Browse)
17-60	Center Creek	RT	Active	'02, '07, '12, '17	Mountain Gravelly Loam (Mountain Big Sagebrush)
17-61	American Fork Canyon	RT	Active	'02, '07, '12, '17	Mountain Shallow Loam (Mountain Big Sagebrush)
17-62	Grove Creek	RT	Active	'02, '07, '12, '17	Upland Stony Loam (Cliffrose)
17-63	Hobble Creek Bench	RT	Active	'02, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-64	Water Hollow	RT	Active	'02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
17-69	Zipline Hill	RT	Active	'17	Mountain Loam (Mountain Big Sagebrush)

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
17-70	Indian Creek Road	RT	Active	'17	Upland Shallow Loam (Wyoming Big Sagebrush)
17R-17	Strawberry Grouse 1	WRI	Active	'05, '12, '16	Mountain Loam (Mountain Big Sagebrush)
17R-19	Road Hollow	WRI	Active	'05, '12, '16	Mountain Shallow Loam (Mountain Big Sagebrush)
17R-20	Road Hollow Ridge	WRI	Active	'05, '12, '16	Mountain Loam (Mountain Big Sagebrush)
17R-25	Trout Creek Dixie	WRI	Active	'06, '10, '14	Mountain Loam (Mountain Big Sagebrush)
17R-31	Badger Hollow Mow	WRI	Active	'11, '14	Mountain Loam (Mountain Big Sagebrush)
17R-32	Badger Hollow Control	WRI	Suspended	'11	Not Verified
17R-33	Badger Hollow Harrow	WRI	Active	'11, '14	Mountain Loam (Mountain Big Sagebrush)

Table 2.9: Range trend and WRI project studies monitoring history and ecological site potential for WMU 17A, Wasatch Mountains.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
17-9	Lower Big Hollow	Wildfire Seed Unknown		January 1976 September 1976		
17-11	Wallsburg Turn	Wildfire Seed Unknown		August 1976 September 1976		
17-12	North Wallsburg Reseeding	Wildfire Seed Unknown		August 1976 September 1976		
17-14	Hoovers Hollow	Wildfire	Cascade	January 2003		
17-16	Rainbow Bay	Wildfire				
17-26	Orem Water Tank	Seed Unknown Wildfire Wildfire Seed Unknown		Historic Prior to 1983 January 1996 January 1996		
17-34	Maple Mountain Face	Wildfire Seed Unknown		January 1989		
17-39	Little Diamond Fokr	Chain Unknown Aerial Unknown	Lower Diamond Revegetation Project Lower Diamond Revegetation Project	January 1969 January 1969	1,500 1,500	
17-46	Lower Tank Hollow	Chain Unknown Seed Unknown Lop and Scatter	 Tank Hollow Habitat Improvement Project	January 1971 January 1971 July 2007	 1,116	 658
17-64	Water Hollow	Two-Way Smooth Chain Seed Unknown		January 1990 January 1990	60	
17R-19	Road Hollow	One-Way Chain Harrow Mow	Badger Hollow /Chicken Spring Ridge Habitat Improvement Badger Hollow /Chicken Spring Ridge Habitat Improvement	August 2011 August 2011	125 60	1816 1816
17R-31	Badger Hollow Mow	Mow	Badger Hollow/Chicken Spring Ridge Habitat Improvement	August 2011	60	1816
17R-33	Badger Hollow Harrow	Two-Way Chain Harrow	Badger Hollow/Chicken Spring Ridge Habitat Improvement	August 2011	384	1816

Table 2.10: Range trend and WRI studies known disturbance history for WMU 17A, Wasatch Mountains.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are 20 studies [Deer Creek Dam (17-5), Provo River Canyon (17-7), Wallsburg Turn (17-11), North Wallsburg (17-13), Hoovers Hollow (17-14), Rainbow Bay (17-16), Coyote Canyon (17-19), Heisetts Hollow (17-24), Maple Mountain Face (17-34), Little Diamond Fork (17-39), Long Hollow (17-40), Upper Sheep Creek (17-41), Billies Mountain (17-44), North Bench (17-45), Lower Tank Hollow (17-46), Center Creek (17-60), American Fork Canyon (17-61), Hobble Creek Bench (17-63), Water Hollow (17-64), and Zipline Hill (17-69)] classified as Mountain (Big Sagebrush) ecological sites.

The Deer Creek Dam study is situated southwest of Deer Creek Dam, and the Provo River Canyon site is located west of Francis and east of Jordanelle Reservoir. The Wallsburg Turn study site is located northwest of the town of Wallsburg and east of Deer Creek Reservoir, and North Wallsburg can be found on a southwest-facing slope north of Wallsburg. The Hoovers Hollow study site is located on a slope just west of the southwest portion of Deer Creek Reservoir, while the Rainbow Bay study is situated east of the southeast portion. Coyote Canyon can be found north of a housing development in Heber City. Heisetts Hollow is situated north of Heisetts Hollow on the slopes facing the city of Cedar Hills, and the Maple Mountain Face study is located west of Middle Slide Canyon near the city of Mapleton. The Little Diamond Fork study site is situated near a phosphate mining road north of Little Diamond Creek. The Long Hollow study can be found in Long Hollow, north of US Highway 6, and Upper Sheep Creek is found on the slopes above Sheep Creek and south of Rays Valley Road. The Billies Mountain study is situated on the lower slopes of Billies Mountain about 0.5 miles west of the intersection of US Highways 6 and 89. The North Bench study site is located on a bench between Joes Canyon and Sterling Hollow with Highway 6 to the east. Lower Tank Hollow is found on the east slope of Knoll Hollow. The Center Creek study site is located southwest of Heber City and north of a gravel pit. The American Fork Canyon study is situated on a bench which is at the mouth of American Fork Canyon and above a neighborhood in the city of Highland. Hobble Creek Bench is found on the lower slopes of Rattlesnake Point on a bench directly above a housing development in Mapleton. The Water Hollow study is located southeast of Water Hollow and north of Highway 6. Finally, the Zipline Hill study site is situated on the east-facing slope of a hill near the southeast portion of Deer Creek Reservoir.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the most dominant preferred browse species on many study sites; other browse species such as antelope bitterbrush (*Purshia tridentata*) contribute a majority of the browse cover on a small number of sites. Average cover of preferred browse (including sagebrush) and other shrubs has remained stable throughout the study years, although one should note that the number of study sites (the 'n value') varies from year to year (**Figure 2.3**). The density of preferred browse has also remained fairly stable overall. Demographic data shows that the browswe communities on these study sites are mainly comprised of mature plants while densities of young and decadent individuals have exhibited a slight decrease (**Figure 2.7**). Utilization of preferred browse has fluctuated from year to year and less than 50% of plants were moderately or heavily browsed in most sample years. However, the percentage of moderately used plants has remained stable overall while that of heavily used plants has nearly doubled from 1996-97 to 2017 (**Figure 2.9**).

The American Fork Canyon, Lower Tank Hollow, and Billies Mountain studies have contributed a majority of the tree cover in most sample years, although cover has remained low overall (**Figure 2.5**). Tree density has decreased over the study years: much of this decrease is due to the increased number of study sites with lower density values between 2012 and 2017 (**Figure 2.6**).

Herbaceous Understory: These study sites have rich and abundant herbaceous understories that have fluctuated in composition from year to year. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) contributed the most cover of any herbaceous component in 1996-97 and 2002, a trend driven by the North Bench, Little Diamond Fork, Maple Mountain Face, and Hobble Creek Bench study sites; other more desirable perennial grass species became co-dominant components in 2007. Perennial forbs have exhibited a slight decrease in cover and frequency over the study years. Annual grass cover has increased overall, while

frequency has generally remained stable. Finally, annual forb cover and frequency increased from 2012 to 2017: the increase in cover is likely driven by the Provo River Canyon, Maple Mountain Face, and Hobble Creek Bench studies (**Figure 2.11**, **Figure 2.13**).

Occupancy: Average pellet transect data indicates that occupancy has decreased over time and that the primary occupants have been deer/sheep in most sample years. Deer/sheep pellet groups have had a mean abundance ranging from 52 days use/acre in 2017 to 187 days use/acre in 2002. Mean abundance of deer pellet groups has ranged from 29.5 days use/acre in 2012 to 57 days use/acre in 2002. Mean abundance of elk pellet groups has been as low as 6 days use/acre in 2012 and 2017 and as high as 32 days use/ace in 2007. Cattle pellet groups have had a mean abundance ranging from 6 days use/acre in 2012 to 11.5 days use/acre in 2007. Horse pellet groups have had a mean abundance as low as 0.1 days use/acre in 2002 and as high as 3.5 days use/acre in 2012. Mean abundance of bighorn sheep pellet groups has varied from 0 days use/acre in 2002, 2012, and 2017 to less than 1 days use/acre in 2007. Finally, deer/bighorn sheep usage has been as low as nearly 9 days use/acre in 2017 and as high as 84 days use/acre in 2002 (**Figure 2.15**).

Mountain (Browse)

There are three study sites [Lower Big Hollow (17-9), Island Boat Camp (17-15), and Tank Hollow (17-42)] that are classified as Mountain (Browse) ecological sites. The Lower Big Hollow study is located in Big Hollow, south of Heber City, and Island Boat Camp is situated on the slopes above the east portion of Deer Creek Reservoir. The Tank Hollow study is located on the top of a steep hill about two miles west of Sheep Creek Road.

Shrubs/Trees: These study sites are dominated by a variety of browse species, including (but not limited to): mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and Utah serviceberry (*Amelanchier utahensis*). Cover of sagebrush has remained stable, while that of other preferred browse species has exhibited a slight increase overall. Cover of other shrubs has also marginally increased, a trend, which is largely driven by yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* var. *viscidiflorus*) on the Island Boat Camp study (**Figure 2.3**). Density of preferred browse has decreased over the study period, and demographic data indicates that mature individuals have comprised a majority of the populations in all sample years (**Figure 2.7**). Preferred browse utilization has varied over time, but over half of all plants exhibited moderate to heavy use in all sample years (**Figure 2.9**).

Tree cover has fluctuated over the study years, but has decreased overall; the decrease between 2007 and 2012 is due to the Tank Hollow site which underwent a lop and scatter treatment after the 2007 reading (**Figure 2.5**). Density values have also exhibited an overall decrease (**Figure 2.6**).

Herbaceous Understory: These study sites have remained dominated by perennial grasses in all study years; cover and frequency have exhibited a slight overall increase. Annual grass cover remained minimal in most sample years, but increased between 2012 and 2017, and frequency has fluctuated. Perennial forbs have decreased in both cover and frequency, and annual forbs have contributed little cover in all sample years (**Figure 2.11**, **Figure 2.13**).

Occupancy: Pellet transect data shows overall occupancy of these sites has decreased over time and that deer have been the primary occupants of this site in most sample years. Mean abundance of deer pellet groups has ranged from 39 days use/acre in 2007 to 106 days use/acre in 2002. Elk pellet groups have had a mean abundance ranging from 6 days use/acre in 2012 to 32 days use/acre in 2007. Finally, mean abundance of cattle pellet groups has been as low as 3 days use/acre in 2002 and 2017 and as high as 11 days use/acre in 2007 (**Figure 2.15**).

Mountain (Oak)

Three sites [North Wallsburg Reseeding (17-12), Dutch Canyon (17-17), and Orem Water Tank (17-26)] are classified as Mountain (Oak) ecological sites. The North Wallsburg Reseeding study is situated roughly two miles north of the town of Wallsburg. Dutch Canyon can be found north of Donkey Ridge near the city of Midway. Finally, Orem Water Tank is located on the slopes above Orem City, northeast of the water tanks and the Orem City Rifle Range.

Shrubs/Trees: Gambel oak (*Quercus gambelii*) and/or mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are the dominant browse species on all study sites, although additional species such as antelope bitterbrush (*Purshia tridentata*) may also be present. Cover of sagebrush, other preferred browse species, and other shrubs has displayed an overall decrease (**Figure 2.3**). The density of preferred browse populations has fluctuated, but has exhibited a general increase. According to average demographics, these browse populations have been mainly comprised of mature individuals in most sample years. However, young plants were the most abundant individuals in 1996-97, largely due to the Orem Water Tank study site (**Figure 2.7**). Utilization of preferred browse has decreased over the study years, with most plants exhibiting little to no use (**Figure 2.9**).

Trees are not present on these study sites and will therefore not be discussed for this ecological type (**Figure 2.5**, **Figure 2.6**).

Herbaceous Understory: The herbaceous understories of these sites are generally diverse and show an increasing trend in cover – nested frequency has fluctuated, but has remained largely consistent overall. Perennial grasses have been the main herbaceous component in all years with an overall increase in cover and fairly stable frequency values. Although annual grass cover and frequency have varied, there was a notable increase in cover between 2012 and 2017: this increase can largely be attributed to the Wallsburg Turn and Dutch Canyon study sites. Perennial forb cover and frequency have fluctuated, but have remained mostly consistent overall. Annual forb cover has exhibited a marginal increase and frequency has also fluctuated (**Figure 2.11**, **Figure 2.13**)

Occupancy: Average occupancy on these sites has exhibited an overall decrease, with deer being the primary occupants in all years. Mean abundance of deer pellet groups has ranged from 14 days use/acre in 2012 to 61 days use/acre in 2002. Elk pellet groups have had a mean abundance ranging from just over one day of use/acre in 2012 to nearly 44 days use/acre in 2007 (**Figure 2.15**).

Mountain (Hackberry)

There is one study [Round Peak (17-31)] that is classified as a Mountain (Hackberry) ecological site. The Round Peak study is located on the west-facing slopes above the Bonneville Shoreline Trail in Springville.

Shrubs/Trees: Netleaf hackberry (*Celtis laevigata* var. *reticulata*), broom snakeweed (*Gutierrezia sarothrae*) and smooth sumac (*Rhus glabra*) have been the dominant shrub species in most sample years; sagebrush (*Artemisia sp.*) is not present on this study site. Total shrub cover has increased over the sample years (a trend which can largely be attributed to broom snakeweed), but preferred browse cover has remained relatively stable (**Figure 2.3**). Average preferred browse demographics indicate that a majority of the population has been comprised of mature individuals and that overall density has exhibited a slight decrease (**Figure 2.7**). Utilization of preferred browse species has fluctuated. Over half of the plants were moderately or heavily used in 1996-97, 2002, and 2017, but most plants were not used or lightly used in 2007 and 2012 (**Figure 2.9**).

Tree cover and density have not been recorded in any sample year on this study site and will therefore not be discussed for this ecological type (**Figure 2.5**, **Figure 2.6**).

Herbaceous Understory: Overall cover of the herbaceous understory has increased while frequency has remained generally stable. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has

contributed most of the herbaceous cover throughout the study period. Other perennial grasses have co-dominated in various sample years, as did annual grasses in 2012 and 2017. Perennial forbs have contributed moderate cover and remained moderately abundant in comparison to grasses. Annual forbs have generally remained rare: the exception to this is the 2017 sample year in which they contributed just over 10% cover (**Figure 2.11**, **Figure 2.13**).

Occupancy: Deer have been the primary occupants of this site in all years; occupancy has fluctuated over time. Mean abundance of deer pellet groups has ranged from just over 30 days use/acre in 2012 to 74 days use/acre in 2007. Elk pellet groups have had a mean abundance ranging from 7 days use/acre in 2012 to just over 36 days use/acre in 2007 (**Figure 2.15**).

Upland (Big Sagebrush)

There is one study site [Indian Creek Road (17-70)] that is considered to be an Upland (Browse) ecological site; this study is situated just north of Indian Creek Road and northeast of the Tie Fork Rest Area.

Shrubs/Trees: As the only study site of this ecological type was established in 2017, general vegetation trends over time cannot be determined for this report. Yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* var. *viscidiflorus*) and spineless horsebrush (*Tetradymia canescens*) contribute the most cover of any shrub species on this site. The dominant preferred browse species on this study site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), although other preferred browse species such as antelope bitterbrush (*Purshia tridentata*) are also present (**Figure 2.4**). Preferred browse demographics indicate that mature individuals make up a majority of the plant population. In addition, nearly 91% of plants were moderately or heavily used in 2017 (**Figure 2.8**, **Figure 2.10**).

This study site was treated with a bullhog in 2014, and as such, trees contributed no cover in the 2017 sample year (**Figure 2.5**). However, Utah juniper (*Juniperus osteosperma*) was observed in point-quarter measurements with an average density of 44 trees/acre (**Figure 2.6**).

Herbaceous Understory: The herbaceous understory of this study site was abundant and diverse in 2017, with perennial grasses – particularly bluebunch wheatgrass (*Pseudoroegneria spicata*) – as the dominant component. Annual forbs provided less cover, but were also abundant. Annual grasses, perennial forbs, and the introduced perennial grass bulbous bluegrass (*Poa bulbosa*) were rare in comparison (**Figure 2.12**, **Figure 2.14**).

Occupancy: Average pellet transect data indicates that deer are the primary occupants of this study site with 168 days use/acre in 2017; mean abundance of elk pellet groups was 6 days use/acre, while that of cattle was 4 days use/acre (**Figure 2.16**).

Upland (Cliffrose)

Three studies [North Battle Creek (17-25), Spring Canyon (17-30), and Grove Creek (17-62)] are classified as Upland (Cliffrose) ecological sites. North Battle Creek is located north of Battle Creek on the west-facing slopes above the city of Pleasant Grove. The Spring Canyon study is situated on the steep south-facing slopes near the mouth of Spring Canyon, just east of the city of Springville. Finally, the Grove Creek study can be found just north of Grove Creek at the mouth of Grove Creek Canyon.

Shrubs/Trees: The dominant preferred browse species on these study sites has been Stansbury cliffrose throughout the study period, although other species such as big sagebrush (*Artemisia tridentata*) and rubber rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa* var. *speciosa*) are also often present; overall shrub cover has exhibited a general increase over the study years (**Figure 2.4**). Average preferred browse demographics show that density has slightly decreased overall and that mature plants have been the main component of the population in all sample years. Although minimal, recruitment of young has increased over time: this is likely driven by the Spring Canyon and Grove Creek studies (**Figure 2.8**). Average utilization of preferred browse

has fluctuated from year to year, but more than half of plants were moderately to heavily browsed in every sample year (**Figure 2.10**).

No tree cover or density have been observed in any sample year on these study sites and will therefore not be discussed for this ecological type (**Figure 2.5**, **Figure 2.6**).

Herbaceous Understory: Total cover of the herbaceous understory has fluctuated, but remained largely stable overall; frequency has also remained stable since 2002. Dominant herbaceous components have varied, with the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) contributing the most cover in 1996-97. Annual grass cover and frequency increased over time and it has remained as a dominant or co-dominant component since 2002. Finally, annual forb cover increased on all three study sites and it was also co-dominant in the 2017 sample year (**Figure 2.12**, **Figure 2.14**).

Occupancy: Average occupancy has fluctuated over the sample years; deer/bighorn sheep have been the primary occupants in all years with mean abundance of pellet groups ranging from 37 days use/acre in 2012 to 120 days use/acre in 2007. Mean abundance of elk pellet groups has been as low as 0.2 days use/acre in 2012 and as high as 21 days use/acre in 2007. Deer pellet groups have had a mean abundance ranging from 19 days use/acre in 2017 to 45.5 days use/acre in 2007 (**Figure 2.16**).

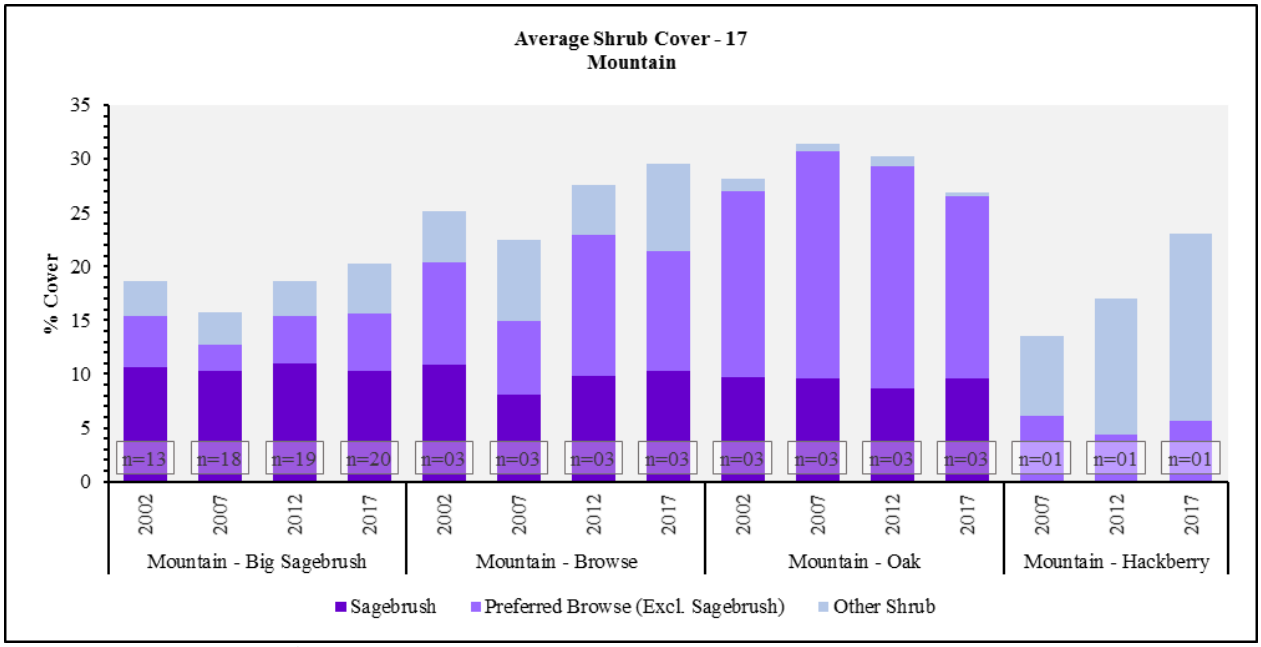


Figure 2.3: Average shrub cover for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

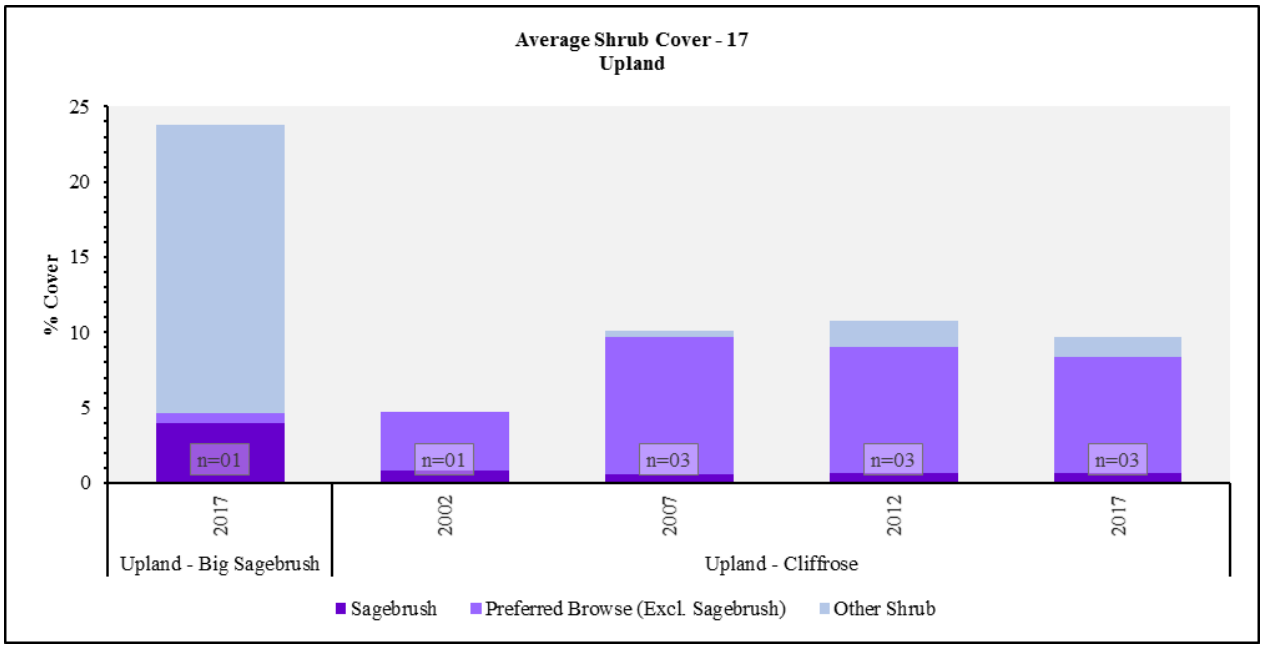


Figure 2.4: Average shrub cover for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

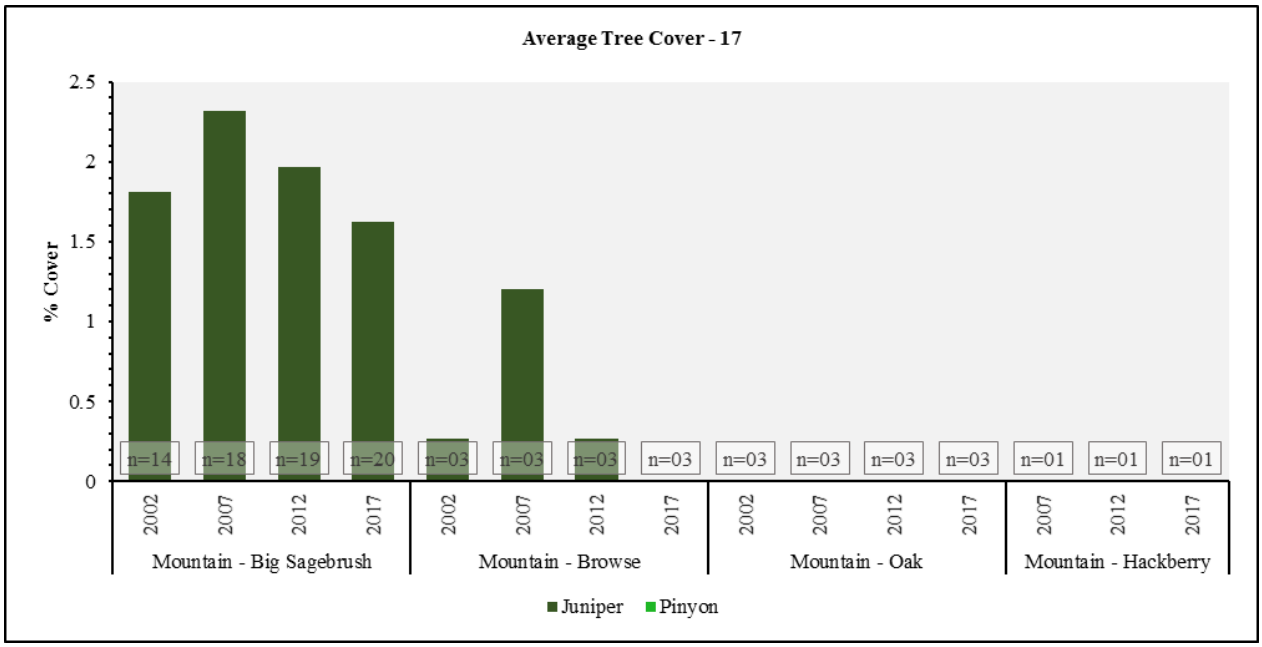


Figure 2.5: Average tree cover for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

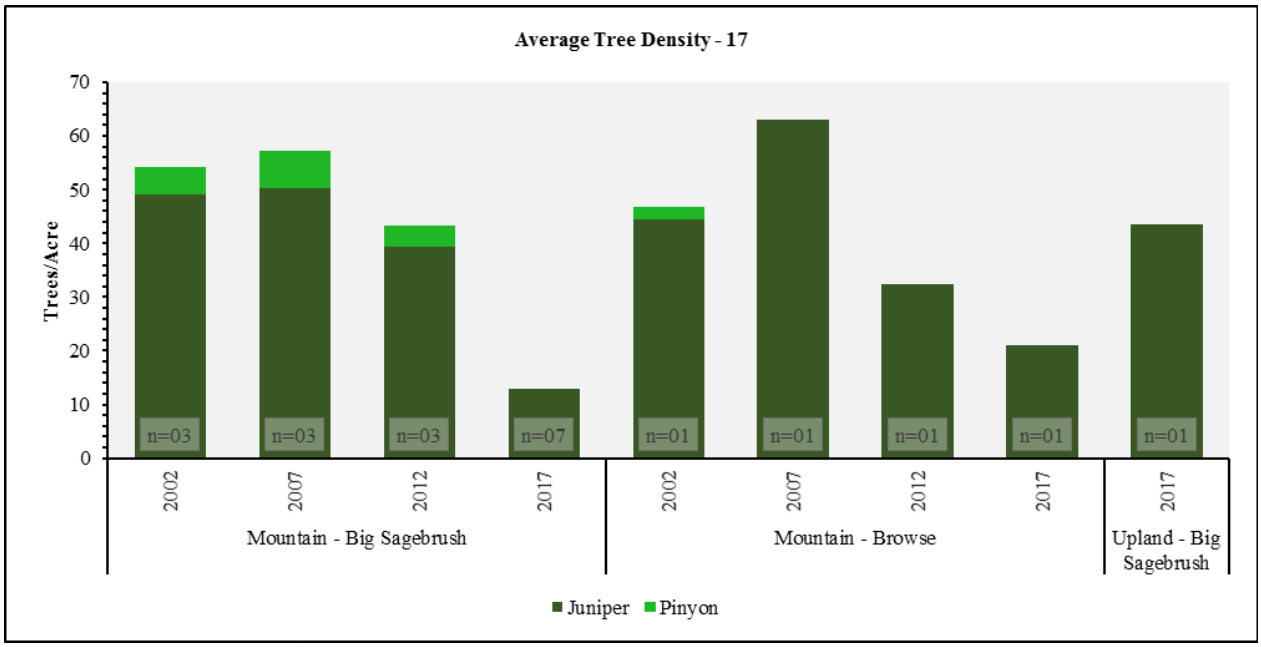


Figure 2.6: Average tree density for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 17A, Wasatch Mountains.

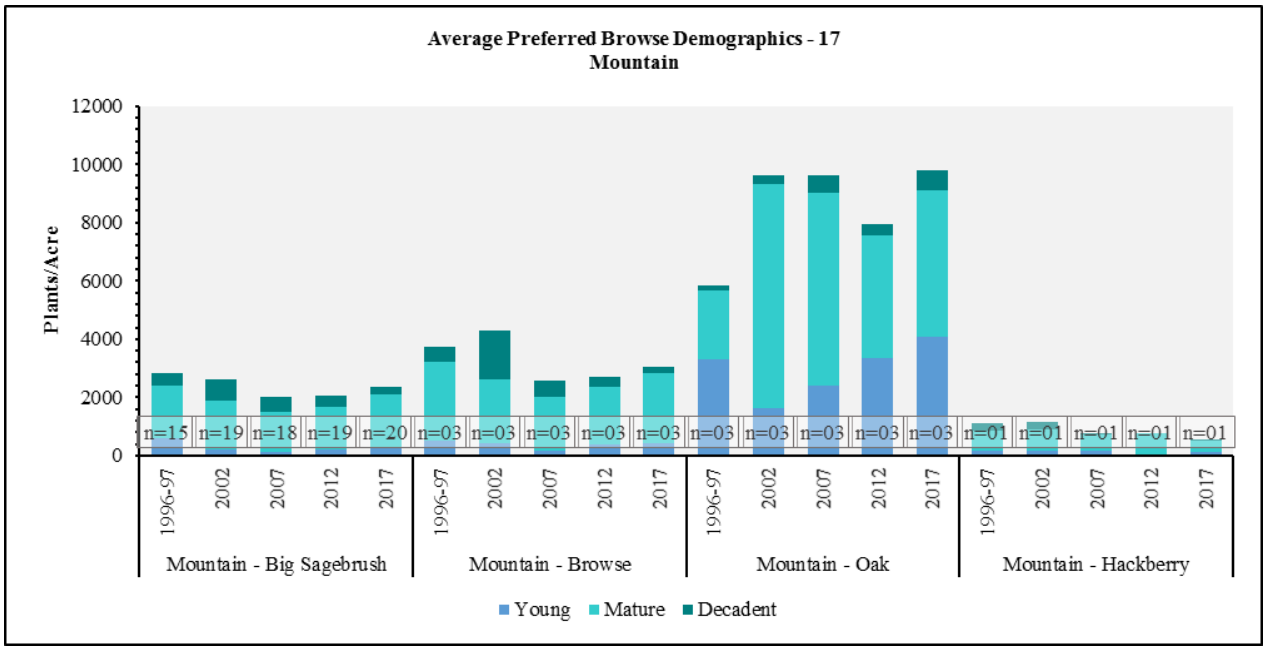


Figure 2.7: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

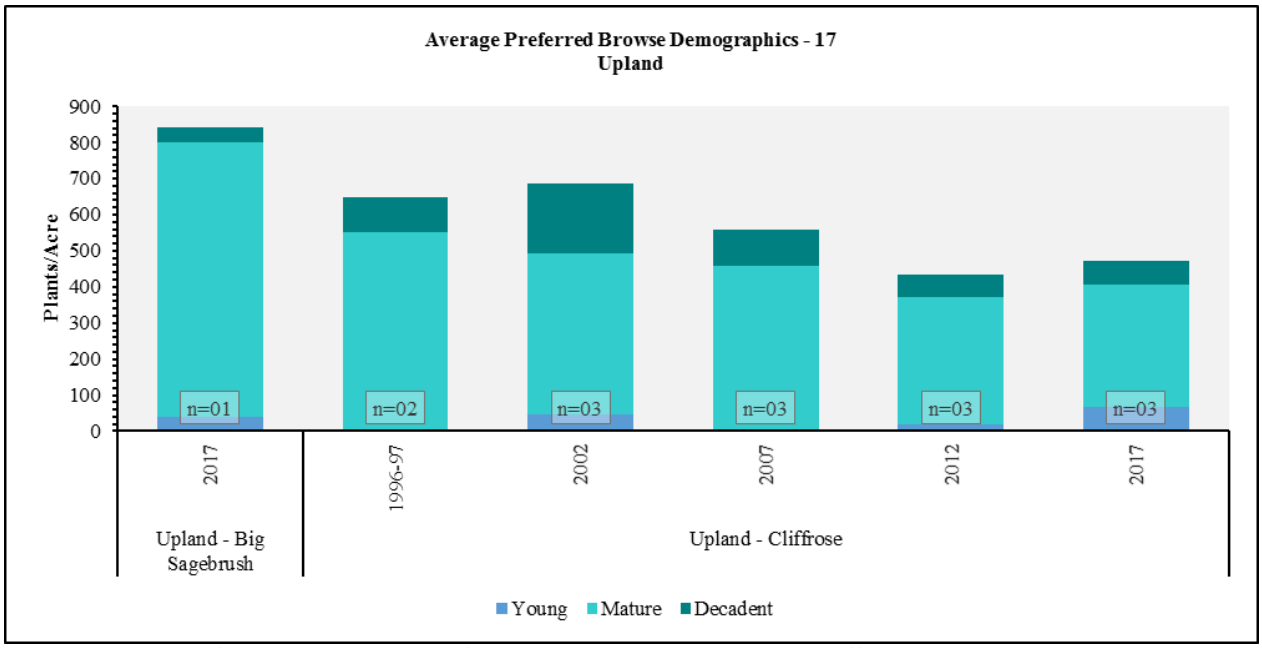


Figure 2.8: Average preferred browse demographics for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

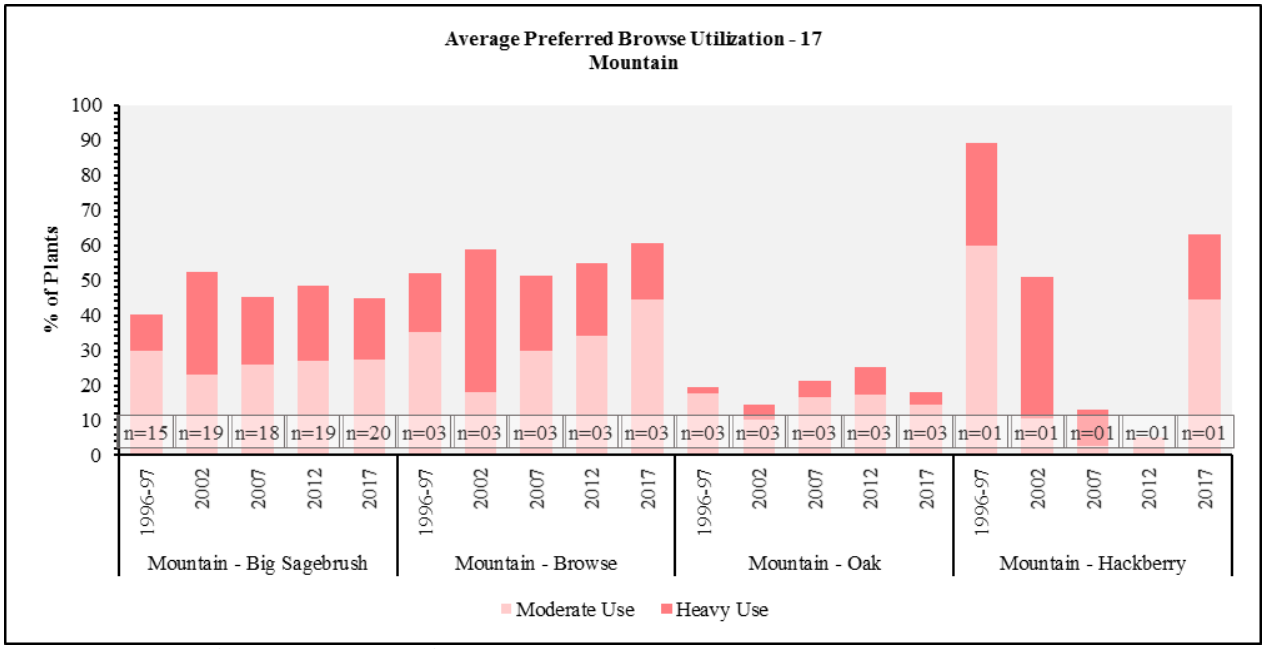


Figure 2.9: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain – Hackberry study sites in WMU 17A, Wasatch Mountains.

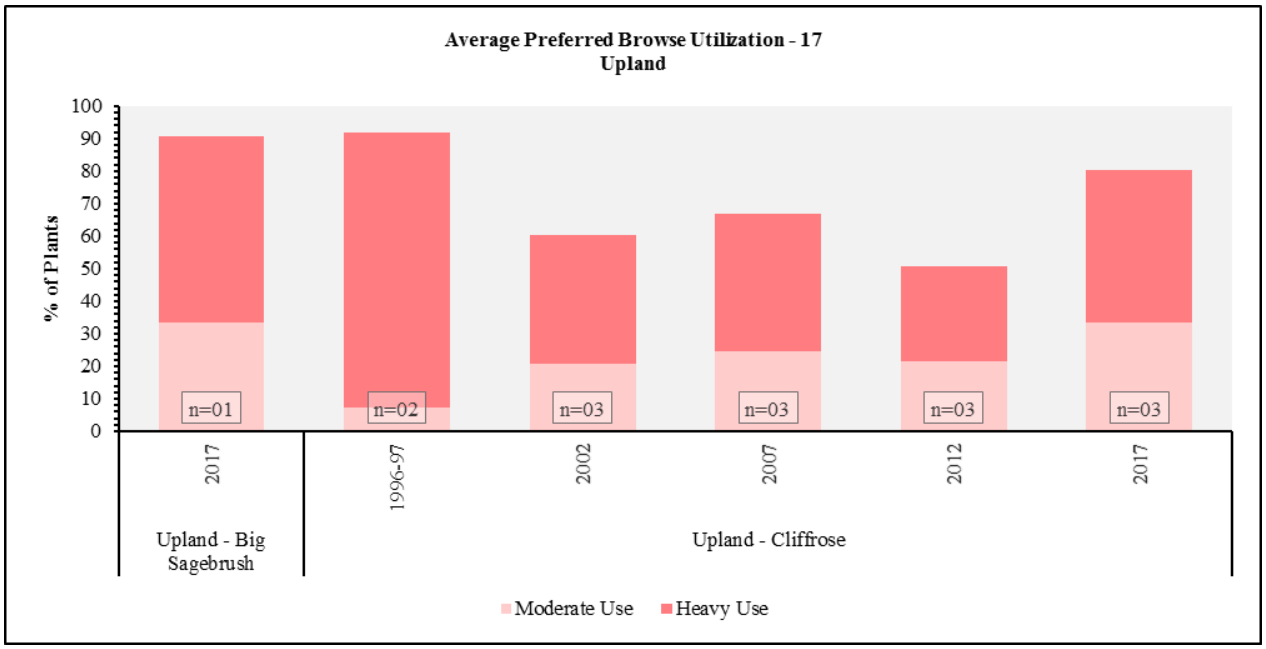


Figure 2.10: Average preferred browse utilization for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

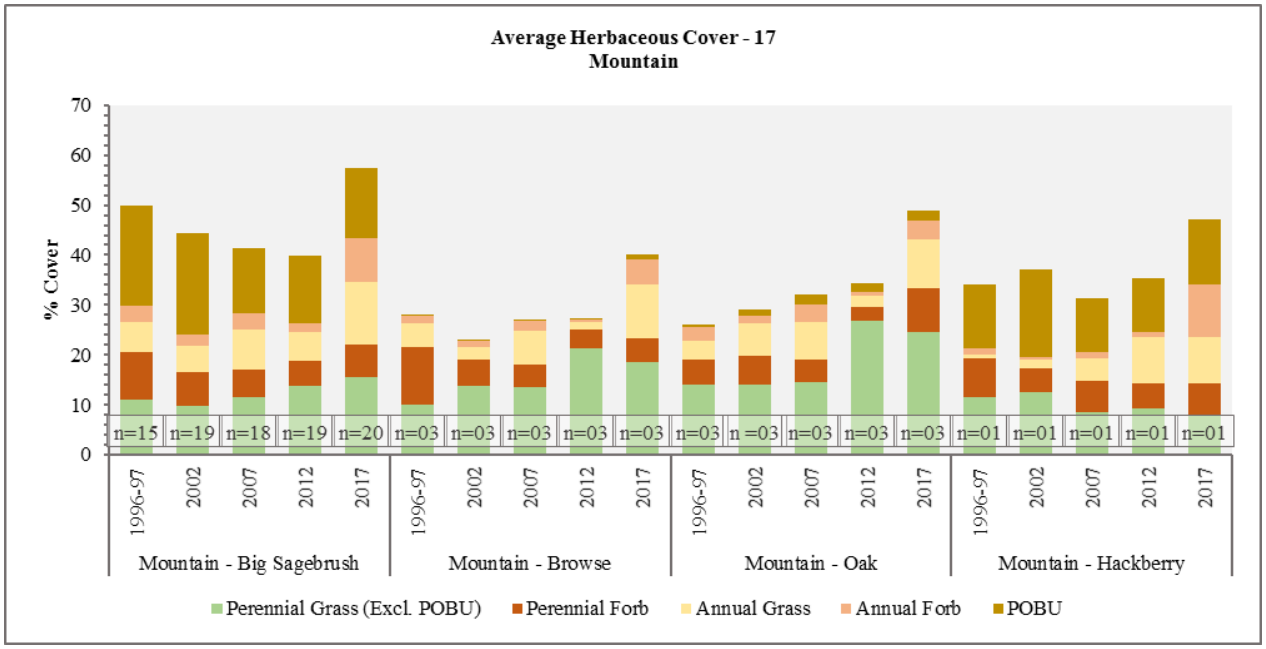


Figure 2.11: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

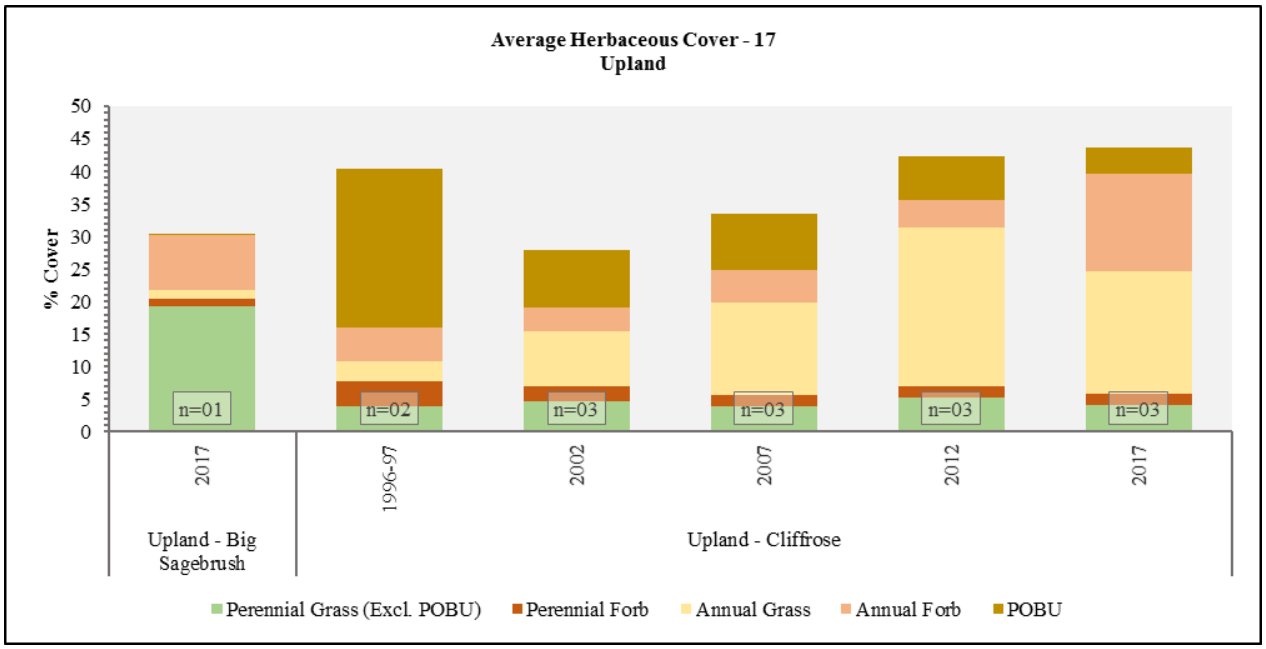


Figure 2.12: Average herbaceous cover for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

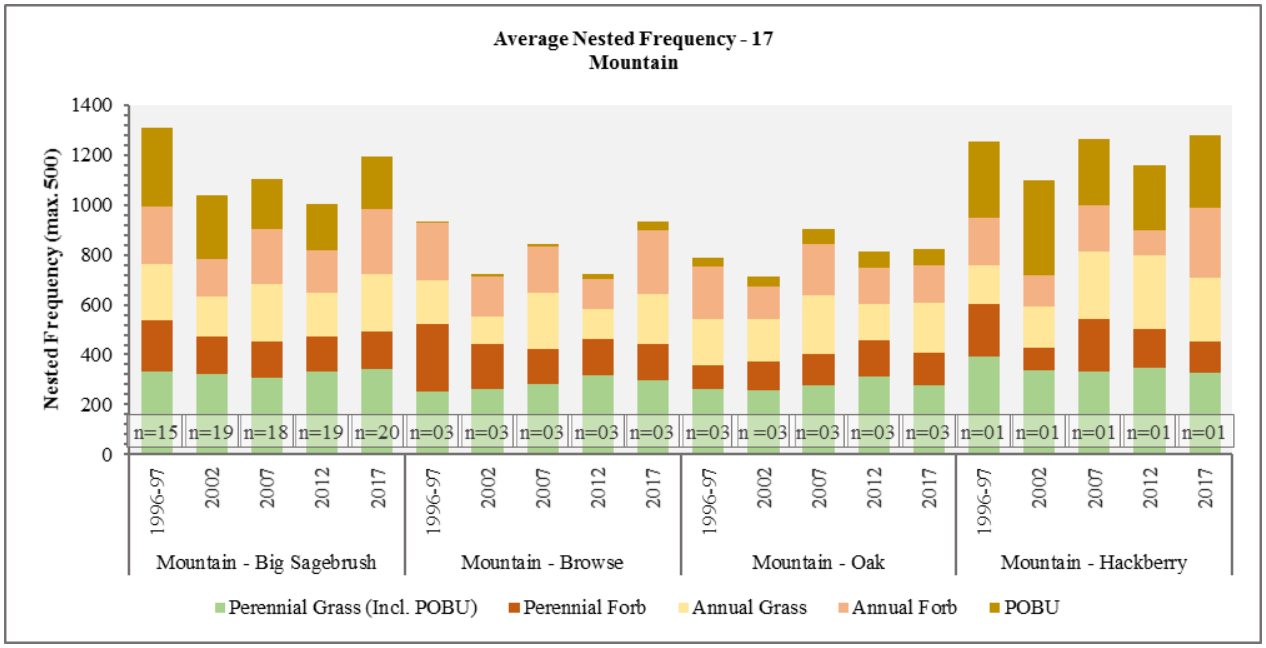


Figure 2.13: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

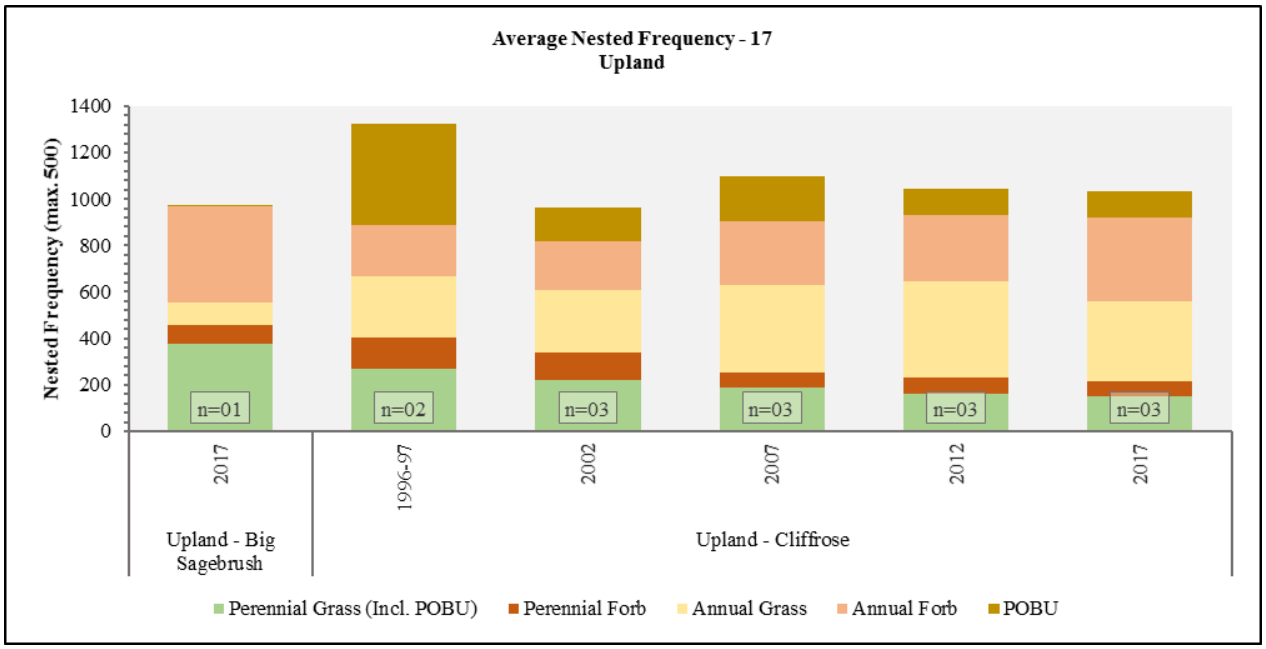


Figure 2.14: Average herbaceous nested frequency of herbaceous species for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

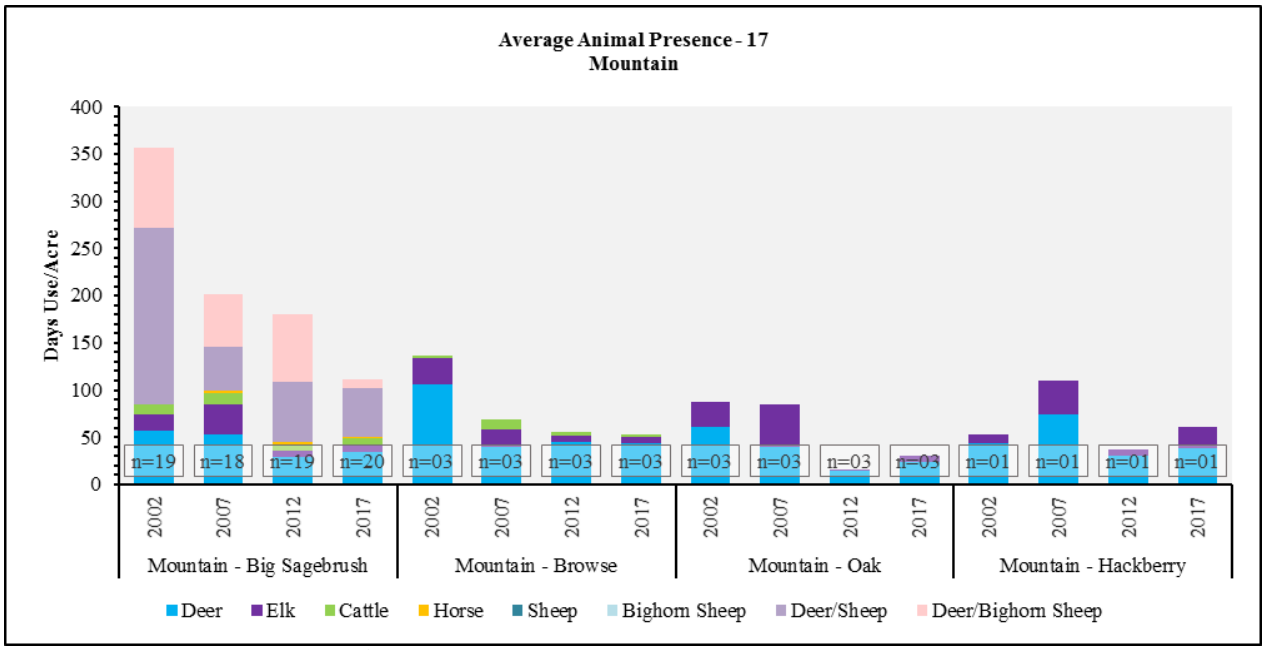


Figure 2.15: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Oak, and Mountain - Hackberry study sites in WMU 17A, Wasatch Mountains.

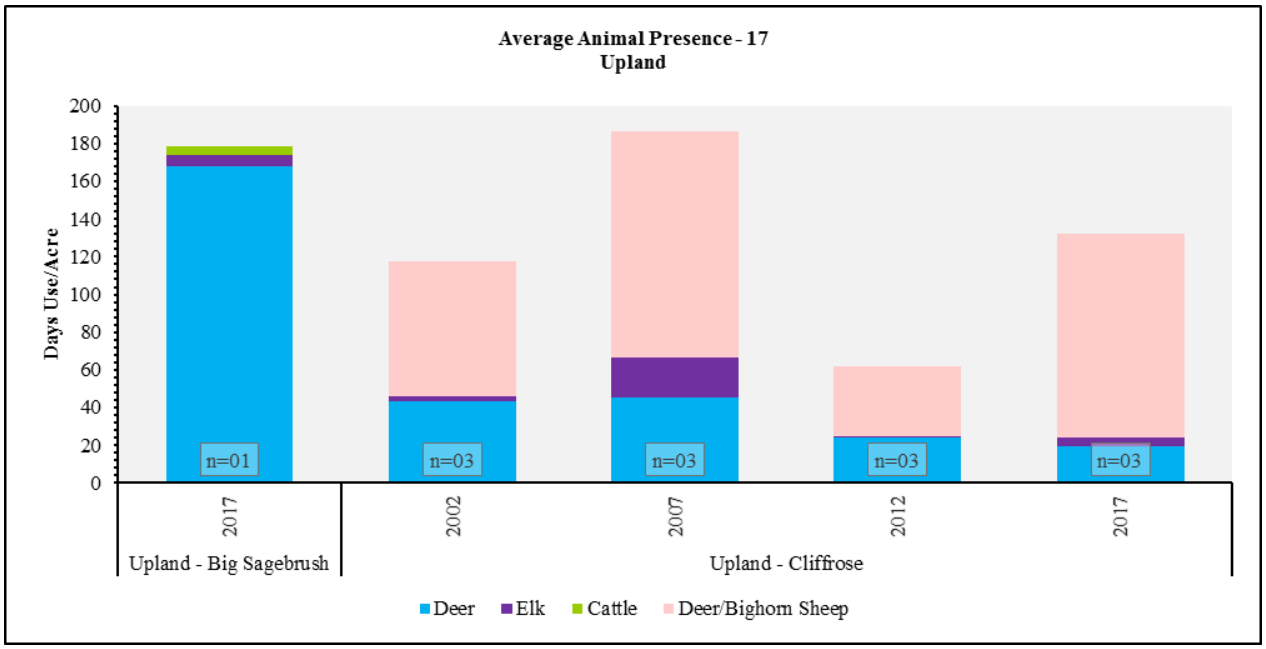
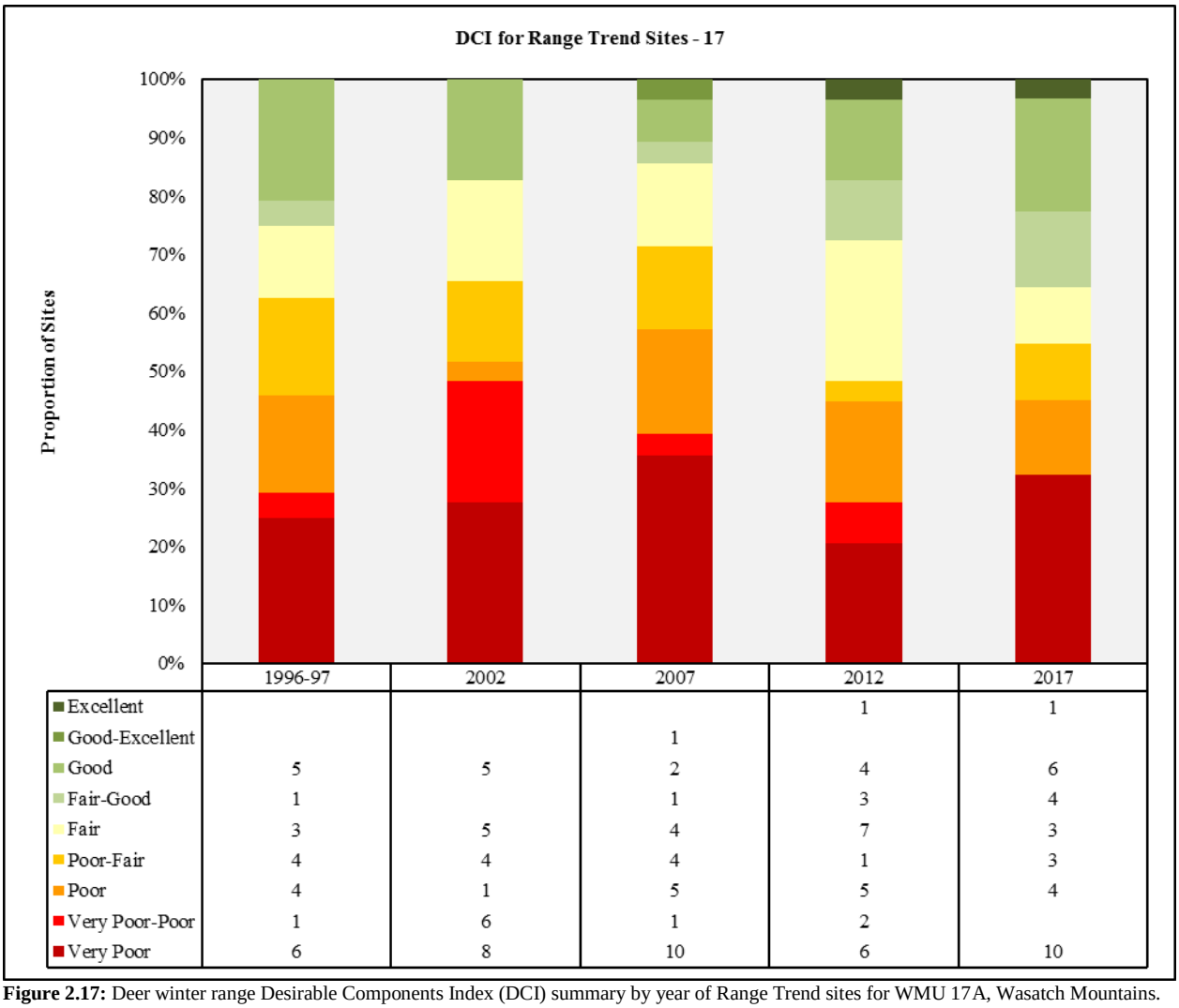


Figure 2.16: Average pellet transect data for Upland - Big Sagebrush and Upland - Cliffrose study sites in WMU 17A, Wasatch Mountains.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Wasatch Mountains management unit has continually changed on the sites sampled since 1996. The active Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2017 sample year (**Figure 2.17**, **Table 2.11**). Orem Water Tank is in excellent condition, while North Wallsburg Reseeding, Island Boat Camp, Maple Mountain Face, Little Diamond Fork, Billies Mountain, and North Bench are considered to be in good condition. The Upper Sheep Creek, Tank Hollow, Hobble Creek Bench, and Zipline Hill studies are in fair-good condition, and Deer Creek Dam, Provo River Canyon, and Lower Tank Hollow are in fair condition. Lower Big Hollow, Wallsburg Turn, and Water Hollow are considered to be in poor-fair condition, and the Rainbow Bay, Round Peak, Center Creek, and Indian Creek Road studies are in poor condition. Finally, the North Wallsburg, Hoovers Hollow, Dutch Canyon, Coyote Canyon, Heisetts Hollow, North Battle Creek, Spring Canyon, Long Hollow, American Fork Canyon, and Grove Creek studies are considered to be in very poor condition, generally due to annual grass cover and/or lack of preferred browse cover and diversity. The condition of treated sites has generally improved or not deteriorated as time since treatment has increased (**Figure 2.18**, **Table 2.11**); all of the treated studies are also considered to be Range Trend sites and are discussed above. It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1996-97	2002	2007	2012	2017
Excellent				1	1
Good-Excellent			1		
Good	5	5	2	4	6
Fair-Good	1		1	3	4
Fair	3	5	4	7	3
Poor-Fair	4	4	4	1	3
Poor	4	1	5	5	4
Very Poor-Poor	1	6	1	2	
Very Poor	6	8	10	6	10

Figure 2.17: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 17A, Wasatch Mountains.

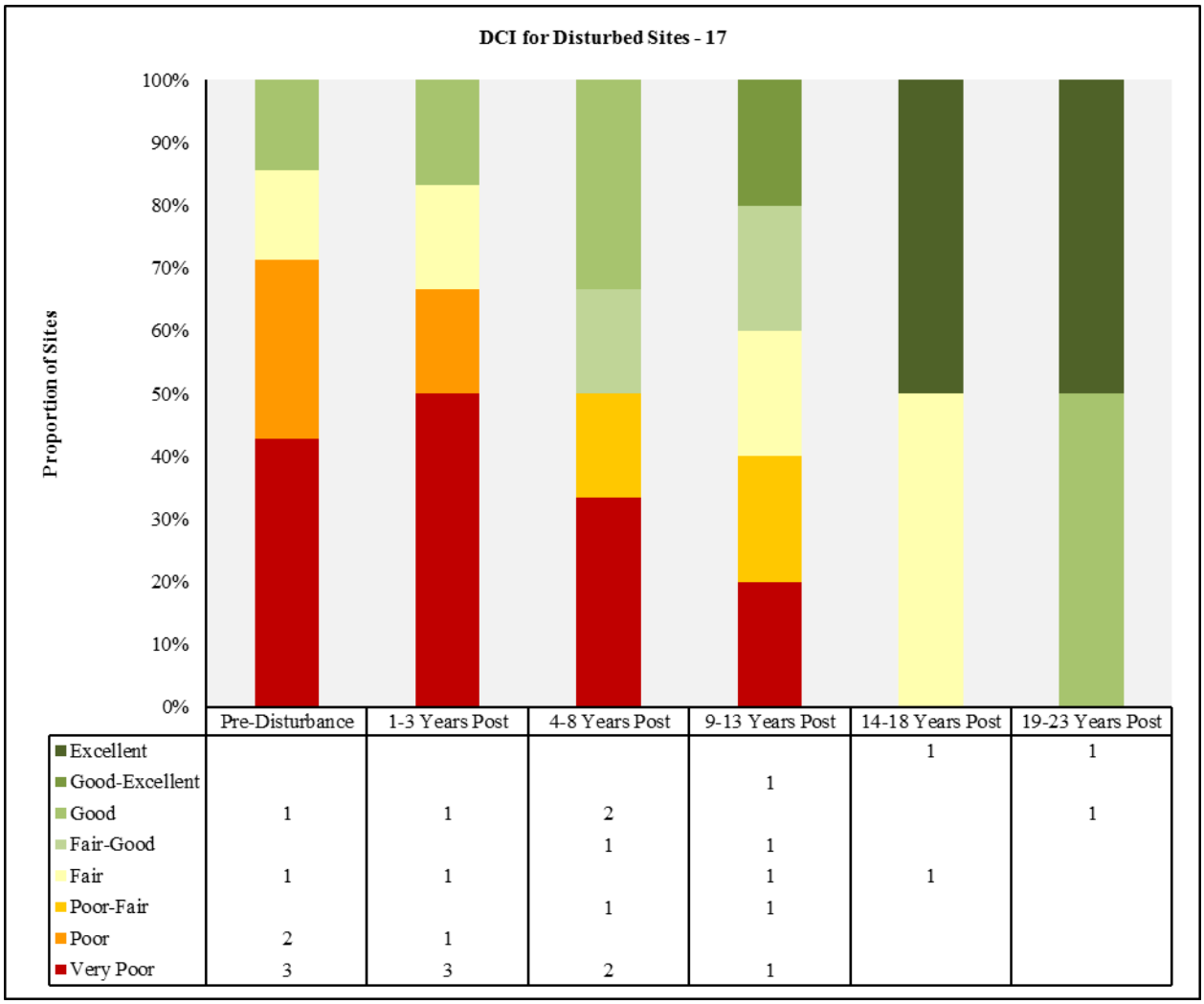


Figure 2.18: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 17A, Wasatch Mountains.

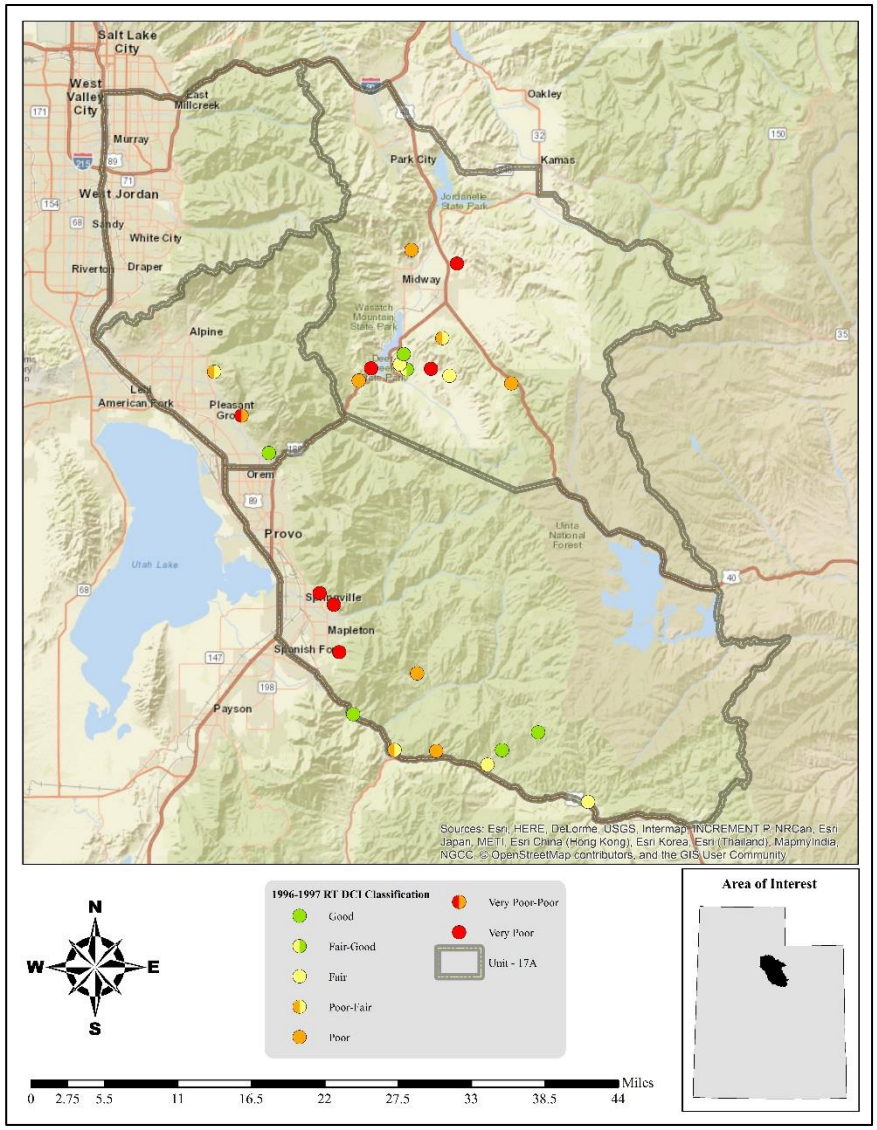
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
07-8*	1996	30.0	9.6	5.5	8.0	-10.9	4.0	0.0	**46.3**	**P**
07-8*	2001	30.0	5.1	1.5	12.5	-1.1	10.0	0.0	**58.0**	**F**
17-5	1996	27.5	12.5	15.0	6.6	-14.3	8.2	-4.0	**51.5**	**P**
17-5	2002	30.0	10.4	6.9	6.2	-2.3	9.8	-4.0	**56.9**	**P-F**
17-5	2007	23.9	4.3	3.2	7.0	-7.3	10.0	-6.0	**35.2**	**VP**
17-5	2012	21.2	8.7	12.1	16.2	-2.1	10.0	-4.0	**62.1**	**F**
17-5	2017	30.0	13.0	9.6	8.0	-4.0	10.0	-6.0	**60.6**	**F**
17-7	1996	30.0	9.1	1.5	13.4	-5.6	0.6	0.0	**49.0**	**P-F**
17-7	2002	30.0	4.5	0.9	18.0	-1.1	7.6	0.0	**60.0**	**F**
17-7	2007	30.0	0.8	0.9	16.0	-13.3	1.2	0.0	**35.6**	**VP-P**
17-7	2012	30.0	3.5	0.0	30.0	-4.9	0.2	0.0	**58.8**	**F**
17-7	2017	30.0	6.6	1.4	27.8	-6.7	2.2	0.0	**61.4**	**F**
17-9	1996	26.7	11.6	9.8	11.6	-10.1	4.4	0.0	**54.1**	**P-F**
17-9	2002	30.0	9.5	4.4	13.0	-5.5	3.2	0.0	**54.6**	**P-F**
17-9	2007	27.5	11.4	1.4	13.0	-12.5	3.6	0.0	**44.3**	**P**
17-9	2012	30.0	11.9	8.1	17.0	-2.8	6.8	0.0	**71.0**	**F-G**
17-9	2017	30.0	11.7	3.2	18.8	-15.2	7.0	0.0	**55.5**	**P-F**
17-10*	1996	17.7	14.4	14.1	30.0	0.0	5.8	0.0	**81.9**	**G**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
17-11	1996	12.6	14.7	4.0	30.0	-0.5	10.0	0.0	**70.9**	**F-G**
17-11	2002	17.1	7.2	1.0	30.0	-0.5	10.0	0.0	**64.9**	**F**
17-11	2007	18.5	-0.9	0.0	30.0	-2.5	9.8	0.0	**54.9**	**P-F**
17-11	2012	19.6	7.8	3.0	30.0	-0.2	7.0	0.0	**67.2**	**F**
17-11	2017	15.3	6.9	1.0	30.0	-8.3	10.0	0.0	**54.8**	**P-F**
17-12	1996	9.5	13.5	7.9	30.0	-0.1	3.0	0.0	**63.9**	**F**
17-12	2002	20.7	13.6	8.0	30.0	-0.4	1.2	0.0	**73.2**	**G**
17-12	2007	16.4	8.5	12.4	30.0	-0.5	2.2	0.0	**69.1**	**F-G**
17-12	2012	20.8	12.9	15.0	30.0	-0.1	2.6	0.0	**81.3**	**G**
17-12	2017	17.6	13.1	15.0	30.0	-0.5	3.4	0.0	**78.6**	**G**
17-13	1996	13.6	6.1	7.6	8.6	-12.0	0.2	0.0	**24.2**	**VP**
17-13	2002	21.6	4.1	2.3	8.6	-3.9	0.0	0.0	**32.8**	**VP**
17-13	2007	24.4	1.4	0.9	8.2	-6.8	0.2	0.0	**28.2**	**VP**
17-13	2012	30.0	9.6	0.5	4.8	-5.3	0.2	0.0	**39.7**	**VP-P**
17-13	2017	24.4	7.6	0.9	2.8	-15.5	0.2	0.0	**20.5**	**VP**
17-14	1996	2.5	0.0	0.0	14.6	-4.4	7.0	0.0	**19.8**	**VP**
17-14	2002	4.6	0.0	0.0	14.0	-15.6	4.2	0.0	**7.2**	**VP**
17-14	2007	0.5	0.0	0.0	13.6	-11.0	7.4	0.0	**10.6**	**VP**
17-14	2012	0.7	0.0	0.0	26.4	-9.5	10.0	0.0	**27.6**	**VP**
17-14	2017	0.6	0.0	0.0	6.4	-20.0	7.2	0.0	**-5.9**	**VP**
17-15	1996	26.3	9.2	3.9	27.4	-0.5	10.0	-2.0	**74.2**	**G**
17-15	2002	30.0	5.1	3.3	30.0	0.0	10.0	0.0	**78.4**	**G**
17-15	2007	16.6	5.8	3.0	30.0	-1.8	10.0	0.0	**63.7**	**F**
17-15	2012	26.9	9.6	3.0	30.0	-0.2	10.0	0.0	**79.3**	**G**
17-15	2017	25.9	14.5	3.8	30.0	-8.3	10.0	-2.0	**73.9**	**G**
17-16	1996	17.2	3.8	2.8	26.4	-2.3	10.0	0.0	**58.0**	**F**
17-16	2002	17.1	6.1	1.7	30.0	-6.0	10.0	-2.0	**56.9**	**P-F**
17-16	2007	11.1	6.1	1.8	30.0	-6.8	10.0	0.0	**52.2**	**P**
17-16	2012	13.5	9.4	1.6	30.0	-1.1	10.0	-2.0	**61.4**	**F**
17-16	2017	17.1	13.6	0.4	26.6	-20.0	10.0	-2.0	**45.8**	**P**
17-17	1996	18.9	11.9	12.5	2.8	-6.1	2.6	0.0	**42.6**	**P**
17-17	2002	30.0	11.2	4.6	2.2	-6.7	1.4	-2.0	**40.8**	**VP-P**
17-17	2007	30.0	9.9	3.0	1.4	-4.2	1.6	-4.0	**37.7**	**VP**
17-17	2012	30.0	9.2	6.6	3.0	-1.7	1.8	-4.0	**44.9**	**P**
17-17	2017	30.0	10.5	1.9	4.4	-17.0	0.6	-2.0	**28.4**	**VP**
17-19	1996	23.1	8.4	8.9	4.2	-15.9	1.2	0.0	**29.8**	**VP**
17-19	2002	27.0	3.6	4.0	4.4	-2.1	0.0	0.0	**36.9**	**VP**
17-19	2007	18.3	5.5	3.9	3.6	-14.8	0.4	0.0	**17.0**	**VP**
17-19	2012	30.0	9.1	3.9	1.2	-5.2	0.2	0.0	**39.3**	**VP-P**
17-19	2017	30.0	9.1	1.6	3.8	-20.0	2.4	0.0	**27.0**	**VP**
17-20*	1996	14.3	13.8	14.5	7.4	-2.5	1.4	0.0	**48.9**	**P**
17-21*	1997	20.2	15.0	7.0	9.8	-1.9	2.8	0.0	**52.9**	**P**
17-22*	1997	19.4	13.0	6.1	8.4	-6.4	8.0	-2.0	**46.4**	**P**
17-23*	1997	18.0	11.9	15.0	8.0	-11.6	4.6	-2.0	**43.8**	**P**
17-24	1997	10.3	8.1	3.5	30.0	-1.1	3.2	0.0	**53.9**	**P-F**
17-24	2002	0.3	0.0	3.5	30.0	-0.2	2.0	0.0	**35.6**	**VP**
17-24	2007	7.8	6.1	3.0	30.0	-1.2	5.2	0.0	**50.9**	**P**
17-24	2012	9.2	9.2	0.0	30.0	-1.9	2.6	-4.0	**45.0**	**P**
17-24	2017	2.4	0.0	6.1	28.2	-2.3	3.4	-2.0	**35.8**	**VP**
17-25	1997	13.0	10.2	0.0	7.4	-1.9	10.0	-2.0	**36.7**	**VP-P**
17-25	2002	14.5	5.9	1.4	7.8	-0.2	8.2	-2.0	**35.7**	**VP-P**
17-25	2007	20.8	13.4	1.4	2.8	-6.2	1.4	-2.0	**31.5**	**VP**
17-25	2012	16.7	9.5	0.0	3.2	-20.0	1.8	0.0	**11.1**	**VP**
17-25	2017	12.8	8.8	0.0	1.6	-17.7	3.0	-4.0	**4.5**	**VP**
17-26	1997	7.6	15.0	15.0	30.0	-2.5	10.0	-2.0	**73.1**	**G**
17-26	2002	24.9	13.2	8.0	30.0	-7.7	10.0	-2.0	**76.4**	**G**
17-26	2007	30.0	13.2	11.5	30.0	-12.2	10.0	-2.0	**80.6**	**G-E**
17-26	2012	30.0	10.2	15.0	30.0	-3.1	5.4	-2.0	**85.5**	**E**
17-26	2017	28.6	11.4	15.0	30.0	-4.7	10.0	-4.0	**86.3**	**E**

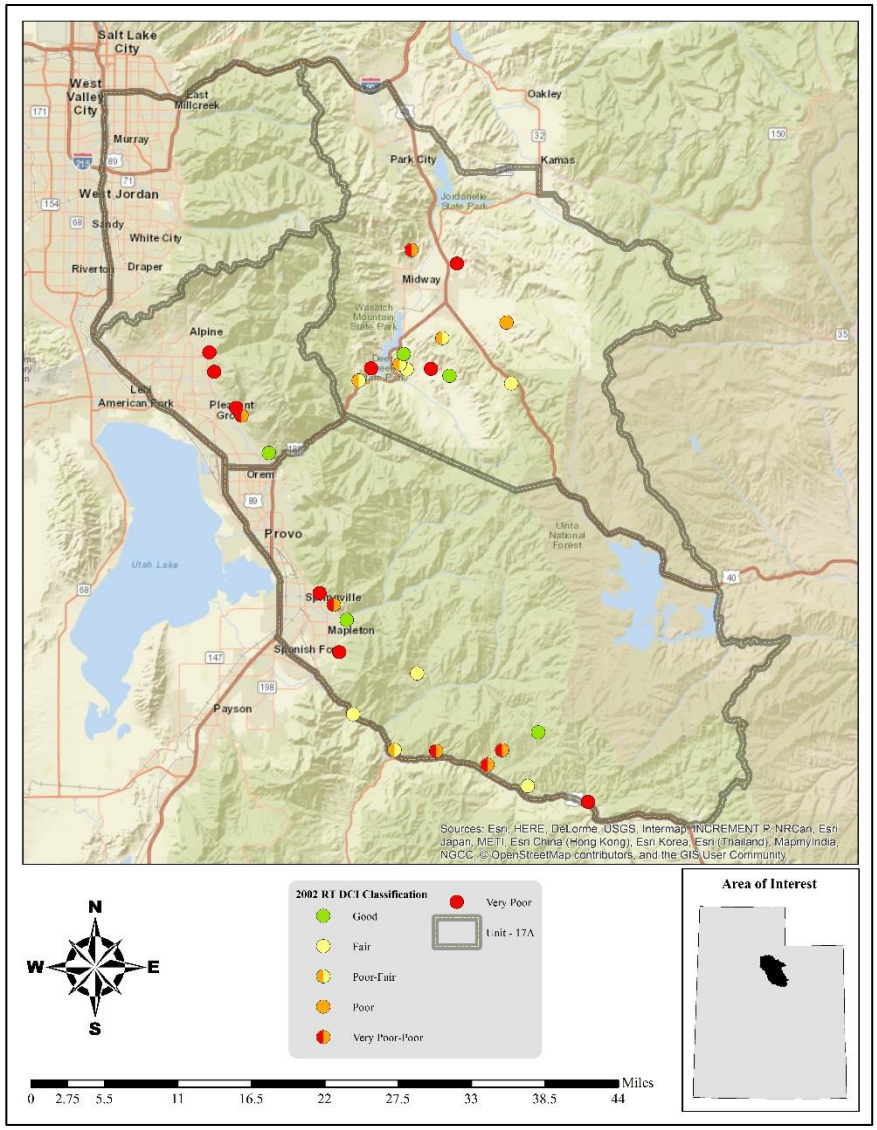
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
17-28*	1997	4.5	0.0	0.0	16.2	-1.8	0.8	-2.0	**17.7**	**VP**
17-29*	1997	1.3	0.0	0.0	17.6	-5.1	7.2	0.0	**21.0**	**VP**
17-30	1997	4.9	0.0	0.0	8.0	-2.6	4.8	0.0	**15.1**	**VP**
17-30	2002	6.8	11.4	4.1	11.4	-4.5	5.6	0.0	**34.8**	**VP-P**
17-30	2007	12.1	10.7	0.0	12.2	-10.6	8.2	0.0	**32.6**	**VP**
17-30	2012	9.0	15.0	3.7	11.6	-17.0	4.4	0.0	**26.8**	**VP**
17-30	2017	10.0	14.1	12.0	11.4	-18.8	4.0	0.0	**32.6**	**VP**
17-31	1997	2.2	0	0	23.2	-0.6	10	0	**34.8**	**VP**
17-31	2002	1.1	0	0	25	-1.2	9.8	0	**34.7**	**VP**
17-31	2007	6.1	13.5	11	17.2	-3.3	10	0	**54.5**	**P-F**
17-31	2012	4.4	0	0	18.6	-7.0	10.0	-2.0	**24.0**	**VP**
17-31	2017	5.6	13.9	13.1	16.2	-7.0	10.0	-2.0	**49.8**	**P**
17-33*	1997	21.9	14.2	6.5	4.4	-18.5	10.0	0.0	**38.5**	**VP-P**
17-34	1997	1.9	0.0	0.0	8.8	-0.5	10.0	-2.0	**18.2**	**VP**
17-34	2002	5.1	0.0	0.0	4.2	-0.2	10.0	-2.0	**17.1**	**VP**
17-34	2007	18.5	13.4	7.5	9.8	-1.1	10.0	-2.0	**56.1**	**P-F**
17-34	2012	24.6	14.8	8.6	16.8	-2.9	10.0	-4.0	**67.9**	**F**
17-34	2017	24.0	13.7	7.1	30.0	-6.8	10.0	-4.0	**74.0**	**G**
17-35*	1997	11.5	13.8	15.0	7.6	-2.9	2.6	0.0	**47.6**	**P**
17-36*	1997	4.3	0.0	0.0	4.0	-9.2	10.0	0.0	**9.2**	**VP**
17-38*	1997	3.3	0.0	0.0	30.0	-0.4	10.0	-2.0	**40.9**	**VP-P**
17-39	1997	7.8	2.1	7.5	21.2	0.0	10.0	-2.0	**46.6**	**P**
17-39	2002	10.3	10.2	3.5	28.2	0.0	10.0	-2.0	**60.2**	**F**
17-39	2007	17.8	11.9	6.9	30.0	0.0	10.0	0.0	**76.5**	**G**
17-39	2012	13.8	13.0	4.4	30.0	0.0	10.0	-2.0	**69.1**	**F-G**
17-39	2017	25.0	11.9	5.3	30.0	0.0	8.2	0.0	**80.3**	**G**
17-40	1997	10.1	12.1	4.5	17.2	-5.9	10.0	-4.0	**44.0**	**P**
17-40	2002	11.8	0.3	0.9	17.6	-0.5	10.0	-2.0	**38.1**	**VP-P**
17-40	2007	10.1	8.1	0.6	30.0	-0.5	10.0	-4.0	**54.3**	**P-F**
17-40	2012	15.0	10.1	1.0	15.0	-0.4	10.0	-4.0	**46.7**	**P**
17-40	2017	10.6	8.7	0.0	13.8	-9.1	10.0	0.0	**34.0**	**VP**
17-41	1997	30.0	12.8	4.3	23.6	0.0	10.0	0.0	**80.7**	**G**
17-41	2002	30.0	10.8	4.5	20.4	0.0	10.0	-2.0	**73.7**	**G**
17-41	2007	27.1	8.7	0.7	21.0	-0.1	10.0	0.0	**67.5**	**F**
17-41	2012	30.0	9.6	5.0	24.2	0.0	8.2	-2.0	**75.0**	**G**
17-41	2017	30.0	11.6	2.3	18.6	0.0	10.0	-2.0	**70.5**	**F-G**
17-42	1997	30.0	10.1	5.2	20.0	-0.7	10.0	0.0	**74.7**	**G**
17-42	2002	13.0	-6.0	2.2	23.8	-0.2	5.4	0.0	**38.2**	**VP-P**
17-42	2007	14.0	4.7	3.5	30.0	-1.1	6.2	0.0	**57.2**	**F**
17-42	2012	23.4	10.7	2.6	30.0	-0.2	2.2	0.0	**68.8**	**F-G**
17-42	2017	24.1	11.0	1.6	30.0	-0.3	4.2	0.0	**70.6**	**F-G**
17-43*	1997	3.2	0.0	0.0	17.0	-0.1	10.0	0.0	**30.1**	**VP**
17-44	1997	9.6	4.0	2.7	30.0	-0.7	10.0	-2.0	**53.7**	**P-F**
17-44	2002	9.9	2.3	3.3	30.0	0.0	10.0	-2.0	**53.5**	**P-F**
17-44	2007	11.5	6.6	4.0	30.0	-0.5	10.0	0.0	**61.6**	**F**
17-44	2012	7.9	12.0	7.7	30.0	-0.2	10.0	-2.0	**65.3**	**F**
17-44	2017	9.0	12.8	14.1	30.0	-0.7	10.0	-2.0	**73.3**	**G**
17-45	1997	11.0	12.3	15.0	30.0	-0.1	10.0	-2.0	**76.2**	**G**
17-45	2002	16.4	8.7	5.5	30.0	0.0	10.0	-4.0	**66.6**	**F**
17-45	2007	23.5	10.8	1.0	30.0	0.0	10.0	-2.0	**73.3**	**G**
17-45	2012	13.5	7.9	7.9	30.0	0.0	10.0	-2.0	**67.3**	**F**
17-45	2017	24.6	13.5	6.5	30.0	-0.5	10.0	-2.0	**82.1**	**G**
17-46	1997	5.2	13.9	11.5	30.0	-0.4	9.4	-2.0	**67.6**	**F**
17-46	2002	7.3	-0.2	1.4	30.0	0.0	3.6	-2.0	**40.1**	**VP-P**
17-46	2007	5.9	10.9	0.9	30.0	-0.1	3.8	-2.0	**49.4**	**P**
17-46	2012	9.2	13.1	1.1	30.0	0.0	3.4	0.0	**56.7**	**P-F**
17-46	2017	8.8	14.1	6.2	30.0	-0.5	7.4	0.0	**66.0**	**F**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
17-47*	1997	7.5	12.1	13.3	16.1	-0.4	9.6	-4.0	**54.2**	**F**
17-47*	2002	5.2	0.0	0.0	10.6	0.0	7.1	-4.0	**18.9**	**VP**
17-47*	2007	5.4	0.0	0.0	10.3	-0.9	10.0	-4.0	**20.8**	**VP**
17-47*	2012	4.6	0.0	0.0	13.1	-0.8	4.2	-2.0	**19.1**	**VP**
17-60	2002	26.6	6.7	1.0	7.6	-3.3	3.8	0.0	**42.4**	**P**
17-60	2007	23.4	5.4	0.5	6.0	-7.7	1.6	0.0	**29.3**	**VP**
17-60	2012	30.0	9.9	0.5	11.0	-5.9	3.4	0.0	**49.0**	**P**
17-60	2017	30.0	5.1	2.0	14.6	-10.7	7.2	0.0	**48.2**	**P**
17-61	2002	9.4	2.8	0.9	0.0	-20.0	0.0	0.0	**-6.8**	**VP**
17-61	2007	10.7	8.6	0.9	5.4	-20.0	0.0	0.0	**5.5**	**VP**
17-61	2012	14.7	9.5	2.8	12.2	-20.0	0.2	0.0	**19.3**	**VP**
17-61	2017	0.6	0.0	0.0	0.0	-0.2	0.0	0.0	**0.5**	**VP**
17-62	2002	6.6	0.0	0.0	8.4	-14.4	1.0	0.0	**1.6**	**VP**
17-62	2007	8.9	-5.2	0.0	8.4	-15.0	0.8	-4.0	**-6.1**	**VP**
17-62	2012	12.2	1.2	9.0	17.2	-15.5	3.4	-2.0	**25.5**	**VP**
17-62	2017	12.9	-1.1	6.4	12.0	-5.9	3.4	-2.0	**25.8**	**VP**
17-63	2002	30.0	11.3	1.7	30.0	-0.5	5.2	0.0	**77.7**	**G**
17-63	2012	30.0	13.1	6.5	30.0	-12.5	7.2	0.0	**74.2**	**G**
17-63	2017	29.8	13.0	3.4	30.0	-13.1	5.0	0.0	**68.1**	**F-G**
17-64	2002	1.1	15.0	12.6	30.0	0.0	0.6	-2.0	**57.2**	**F**
17-64	2007	2.4	15.0	0.0	30.0	-0.5	0.8	0.0	**47.6**	**P**
17-64	2012	3.0	7.3	6.3	30.0	-0.2	0.2	0.0	**46.6**	**P**
17-64	2017	2.9	15.0	7.1	30.0	-0.5	0.6	-2.0	**53.2**	**P-F**
17-69	2017	26.4	14.3	7.1	30.0	-13.9	10.0	-2.0	**71.8**	**F-G**
17-70	2017	5.9	0.0	0.0	30.0	-0.9	2.4	0.0	**37.4**	**P**

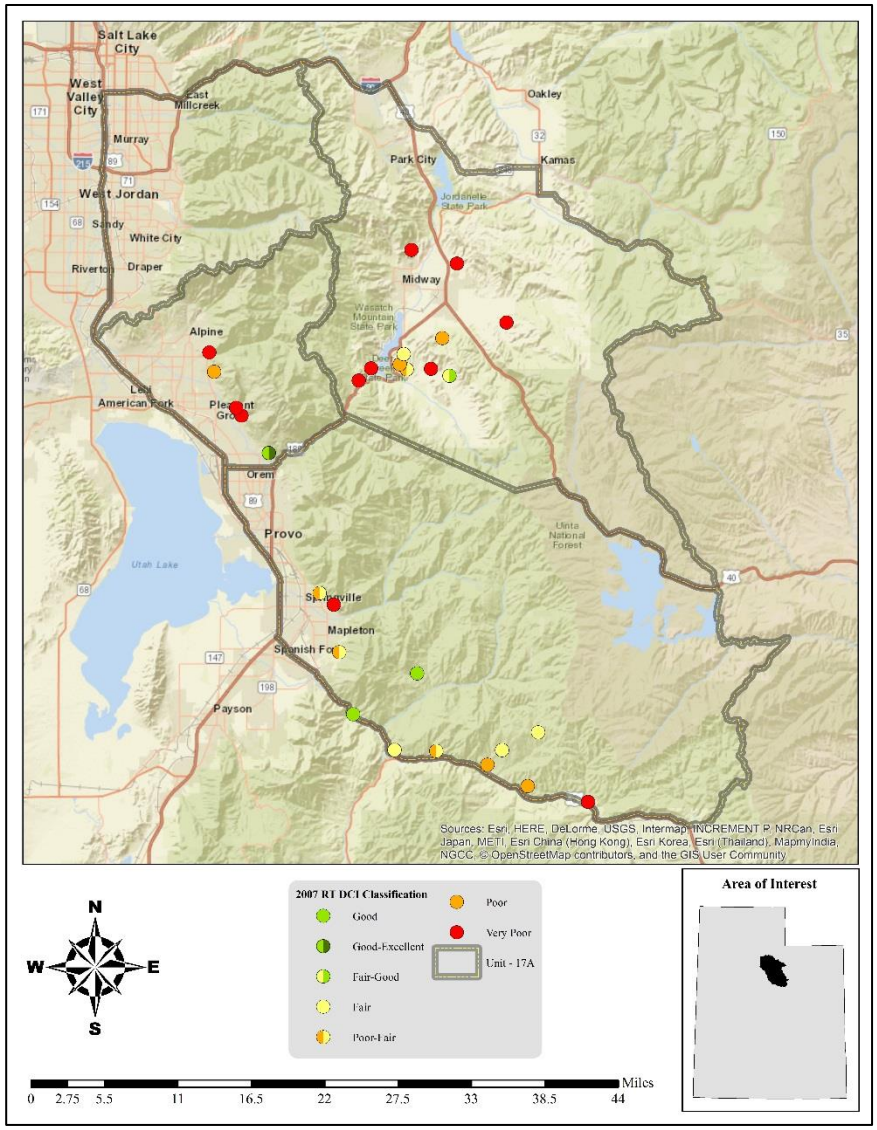
Table 2.11: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 17A, Wasatch Mountains.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



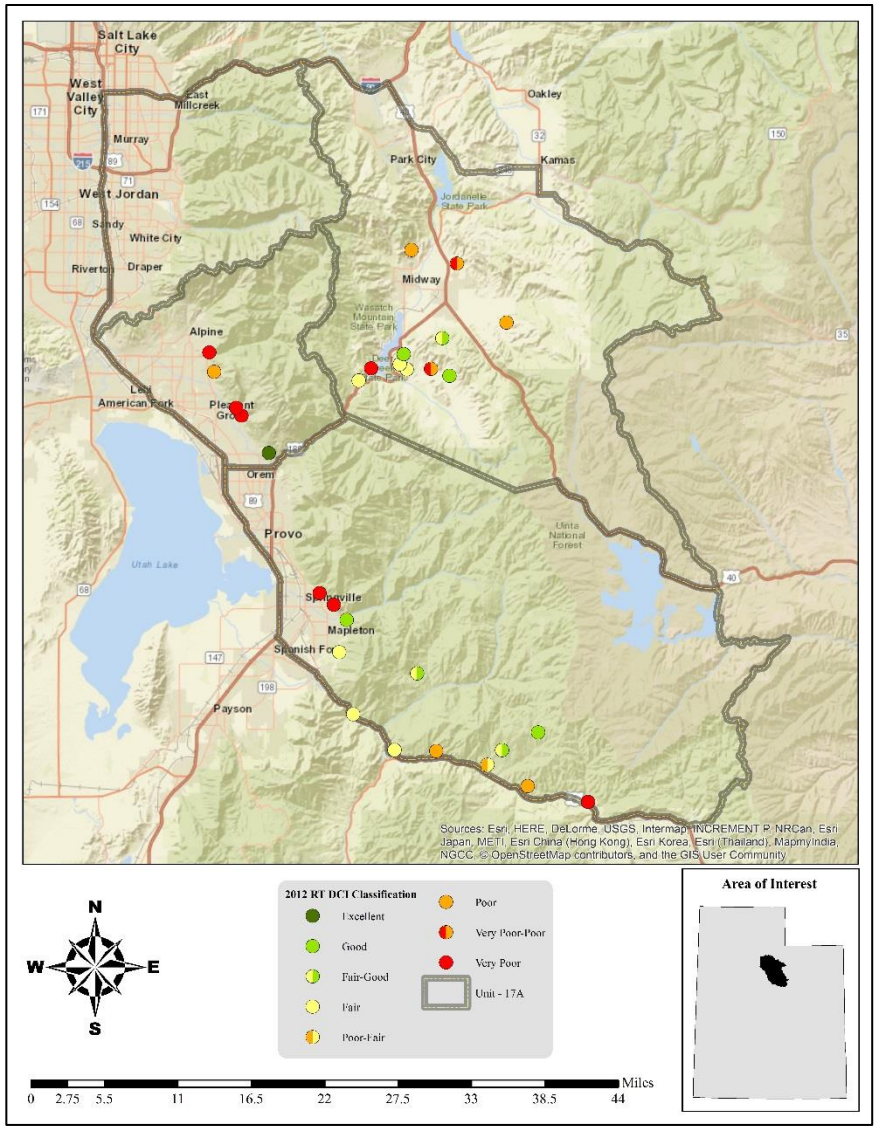
Map 2.10: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 17A, Wasatch Mountains.



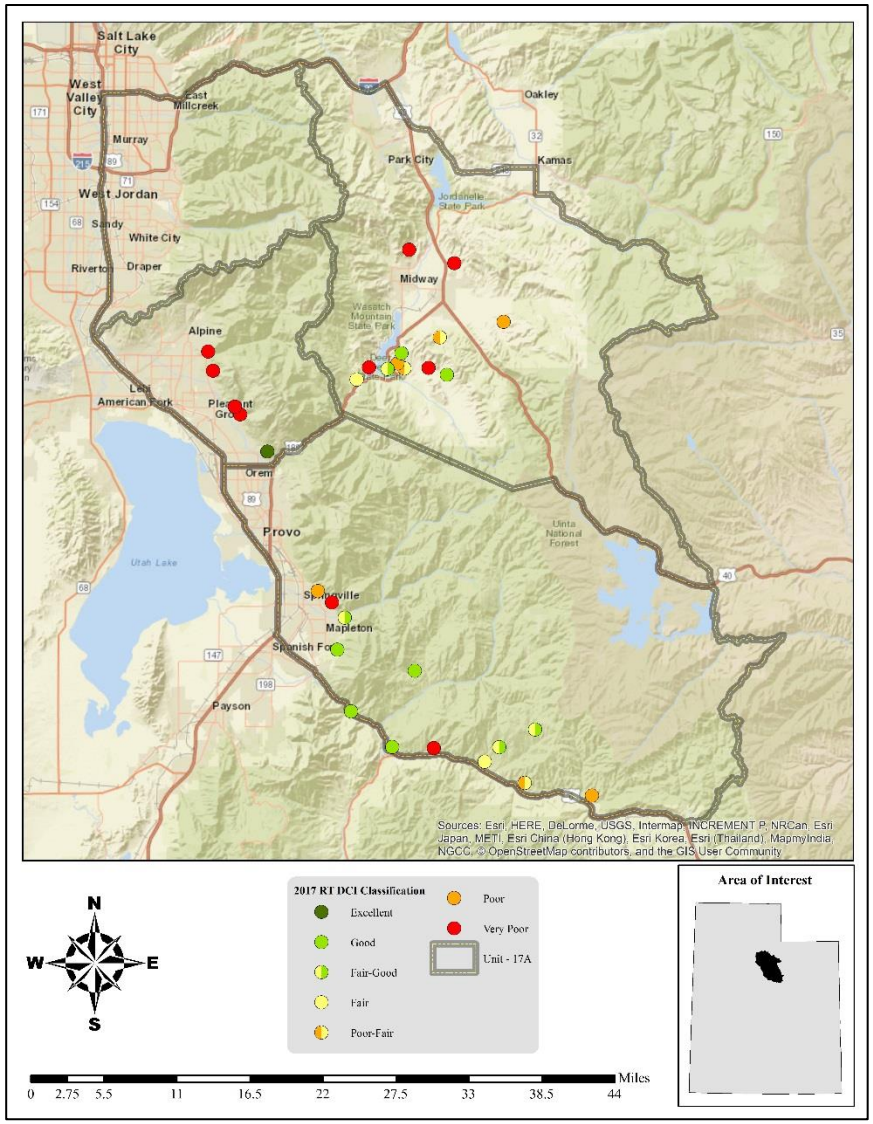
Map 2.11: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 17A, Wasatch Mountains.



Map 2.12: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 17A, Wasatch Mountains.



Map 2.13: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 17A, Wasatch Mountains.



Map 2.14: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 17A, Wasatch Mountains.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
17-5	Deer Creek Dam	Annual Grass	Medium	Increased Fire Potential
		Noxious Weeds	Medium	Reduced diversity of desirable grass and forb species
17-7	Provo River Canyon	Annual Grass	Medium	Increased Fire Potential
17-9	Lower Big Hollow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
17-11	Wallsburg Turn	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-12	North Wallsburg Reseeding	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-13	North Wallsburg	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-14	Hoovers Hollow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-15	Island Boat Camp	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-16	Rainbow Bay	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-17	Dutch Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Medium	Reduced diversity of desirable grass and forb species
17-19	Coyote Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Urban Development	Medium	Fragmentation and loss of habitat
17-24	Heisetts Hollow	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-25	North Battle Creek	Annual Grass	High	Increased Fire Potential
		Noxious Weeds	Medium	Reduced diversity of desirable grass and forb species
17-26	Orem Water Tank	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-30	Spring Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
17-31	Round Peak	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-34	Maple Mountain Face	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Urban Development	Low	Fragmentation and loss of habitat
		Noxious Weeds	Medium	Reduced diversity of desirable grass and forb species
17-39	Little Diamond Fork	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-40	Long Hollow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-41	Upper Sheep Creek	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-42	Tank Hollow	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-44	Billies Mountain	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-45	North Bench	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-46	Lower Tank Hollow	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-60	Center Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-61	American Fork Canyon	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
17-62	Grove Creek	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species

17-63	Hobble Creek Bench	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
17-64	Water Hollow	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-69	Zipline Hill	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
17-70	Indian Creek Road	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor

Table 2.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 17A, Wasatch Mountains. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are within the Mountain (Big Sagebrush) ecological type are considered to be in very poor to good condition for deer winter range on the Wasatch Mountains management unit. These communities generally support shrub populations that can provide valuable browse for wildlife. Annual grasses are of concern on a majority of these study sites, as their presence can increase fuel loads and alter wildfire regime. Introduced perennial grasses and noxious weeds also pose a threat on many study sites as they can be aggressive at higher elevation and are capable of reducing the diversity and abundance of other more desirable native grass and forb species. Urban development is yet another concern on the Coyote Canyon and Maple Mountain Face studies; construction of homes and other structures can lead to fragmentation and loss of valuable big game habitat.

Pinyon and juniper encroachment is occurring on some of these study sites and may pose a risk to the vigor of understory shrub and herbaceous species. It is recommended that when necessary, work to prevent and reduce these tree species should continue. Care should be taken to select methods that will not increase annual grass cover. Treatments to reduce annual grasses might be needed in some areas. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Browse)

Study sites that are considered to be of the Mountain (Browse) ecological type range from poor-fair to good condition for deer winter range on the unit. These communities often support mountain browse populations that provide browse for wildlife. Annual grass is a concern in the herbaceous understories of all three studies, as its presence increases fuel loads and can exacerbate the risk of wildfire. Introduced perennial grasses also pose a low-medium risk on these study sites: they are often aggressive at higher elevations and may reduce diversity and abundance of more desirable grass and forb species. Noxious weeds are also a threat to the understory of the Island Boat Camp study.

Although it is currently only in Phase I of pinyon-juniper encroachment, the Tank Hollow study site is at risk of further encroachment in the future which can reduce shrub and herbaceous health and productivity if not addressed. While the conifer community of this particular study is currently small, it is recommended that work to prevent future pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) begin on this study site if/when it is deemed necessary. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Oak)

The studies within the high elevation oak communities range from being in very poor to excellent condition for deer winter range. Study sites of this ecological type support plant communities which provide valuable browse such as Gambel oak (*Quercus gambelii*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) for wildlife in the winter months. Annual grasses are present on all sites in varying amounts and may be of concern because of the increased risk of wildfire. In addition, all sites are host to introduced perennial grasses. While they provide forage, introduced perennial grasses can be aggressive and reduce the prevalence and abundance of other more desirable native grasses and forbs.

Treatment to reduce annual grasses may be necessary in some areas. When reseeding is necessary to restore native species, care should be taken in species selection and preference given to native species when possible.

Mountain (Hackberry)

The study that is classified as a Mountain (Hackberry) ecological site is considered to be in poor condition for deer winter habitat. The community type supports hackberry (*Celtis laevigata* var. *reticulata*) and preferred browse species such as smooth sumac (*Rhus glabra*) which can provide browse for wildlife in winters. While the herbaceous understory is abundant, it is dominated by introduced perennial grasses: these have the potential to reduce the prevalence and abundance of other more desirable native grasses and forbs. Furthermore, annual grasses pose a medium-level threat as they can increase fuel loads and exacerbate the risk of wildfire.

If reseeding is needed to restore the herbaceous community on this study site, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The mid-elevation study site that is considered to be in good condition for deer winter range supports shrub species which provide browse for wildlife. The herbaceous understory is generally in good condition, but annual grasses are present, posing a moderate-level risk due to their potential to increase fuel loads and alter fire regimes. Introduced perennial grasses are also present in low amounts. Should they increase in abundance in future sample years, these grasses may have the potential to reduce the abundance of more desirable native grass and forb species. Although the study was treated with a bullhog in 2014, it is currently in Phase I of woodland succession and is therefore at risk for future encroachment if it is not addressed.

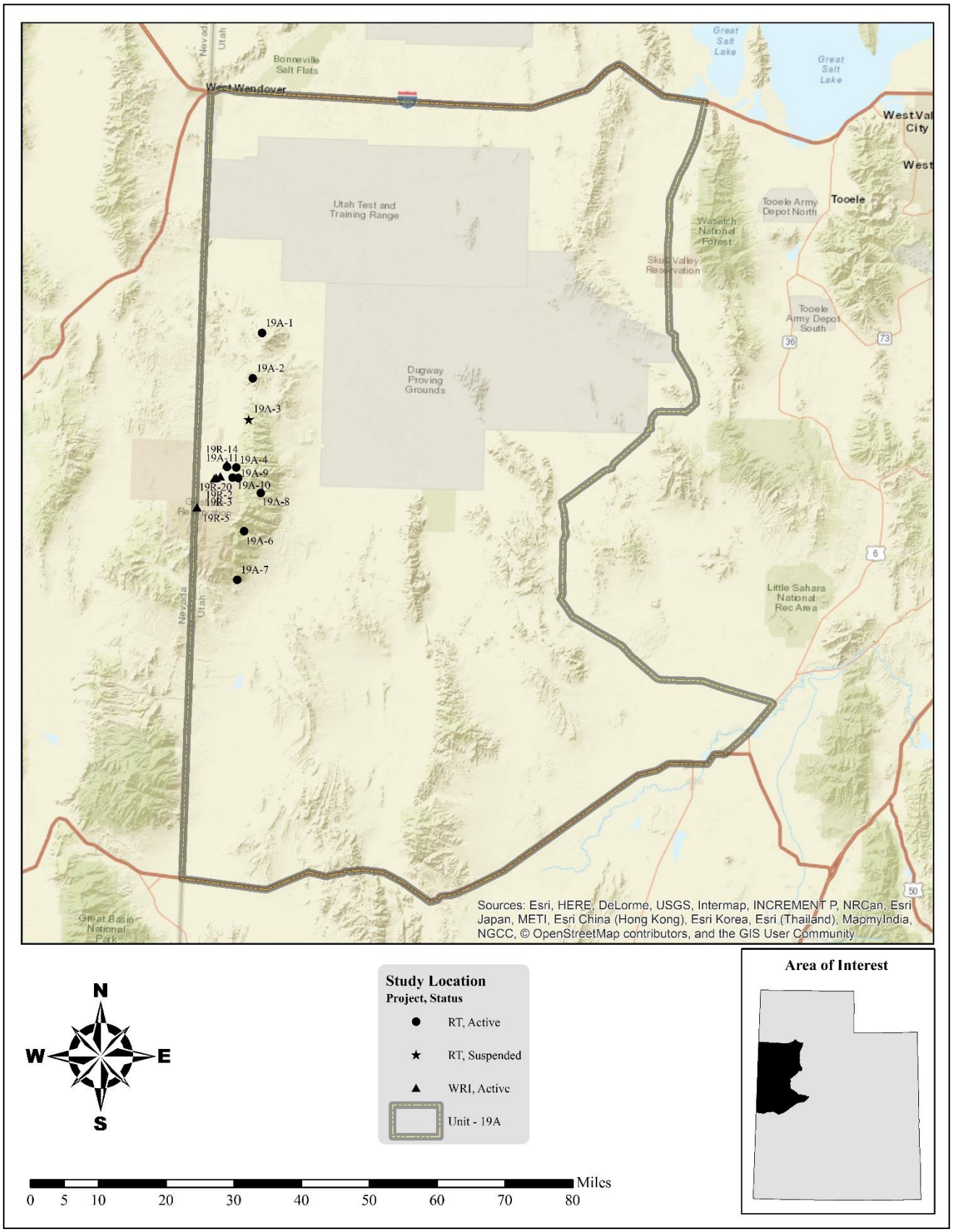
Treatments to reduce annual grass might be necessary if they increase in abundance and cover. In addition, this site may require conifer-reducing treatments in the future (e.g. bullhog, chaining, lop and scatter, etc.) if density and cover increase. If reseeding is necessary to restore the herbaceous understory, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Cliffrose)

The studies that are classified as Upland (Cliffrose) ecological sites are considered to be in very poor condition for deer winter range habitat on this unit. These study sites support shrub populations that provide browse for wildlife in the winter months. Annual grasses are present in significant amounts on all study sites: increased amounts of cheatgrass can increase fuel loads and raise the potential for wildfire. Introduced perennial grasses are also present on the Spring Canyon and Grove Creek sites, posing a low-medium level threat. Introduced perennial grass species can be aggressive at higher elevations, reducing the diversity and abundance of more desirable native grasses and forbs. Furthermore, noxious weed species have been observed on the North Battle Creek and Grove Creek sites: these plant species present the same threats as introduced perennial grasses.

Treatments to reduce annual grass might be necessary if higher levels of annual grasses persist on these study sites. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

3. WILDLIFE MANAGEMENT UNIT 19A – WEST DESERT - DEEP CREEK



WILDLIFE MANAGEMENT UNIT 19A – WEST DESERT - DEEP CREEK

Boundary Description

Tooele, Utah, Juab and Millard counties - Boundary begins at the Utah-Nevada state line and I-80 in Wendover; east on I-80 to the Dugway road at exit 77, Rowley Junction; south on this road to 14-Mile road (Dugway Valley road); south on 14-Mile road to the Pony Express road: east on this road to SR-36; north on SR-36 to SR-73; east on SR-73 to I-15 in Lehi; south on I-15 to Exit 207 and Mills Road; west on this road to the Sevier River; north along this river to SR-132; west on 132 to US-6; south on US-6 to its junction with US-50 near Delta; west on US-50 & 6 to the Utah-Nevada state line; north along this state line to I-80 at Wendover.

Management Unit Description

Geography

The West Desert-Deep Creek Unit is located in the West Desert along the Nevada border. The Bonneville Salt Flats and Dugway Proving Ground make up significant portions of the unit. The land area of this subunit consists of the Deep Creek Mountains, Cedar Mountains and the House Range. All of the range trend sites in the unit are located on the Deep Creek mountain range. A significant amount of the winter range occurs on tribal land, but most of the summer range in the unit is publicly held. Towns in this unit include Wendover, Delta, and Ibapah.

The Deep Creek Mountains run north-south along the Nevada border; the Cedar Mountains and House Range run north-south as well. The Cedar Mountains are south of I-80 near Skull Valley, and the House Range Mountains are south of Dugway Proving Grounds. The highest point is Ibapah Peak at 12,087 feet, and the lowest point is on the Bonneville Salt Flats at around 4,200 feet. The Deep Creeks are the most prominent range in the unit and are steep, with many deep canyons leading up to the peaks.

Climate Data

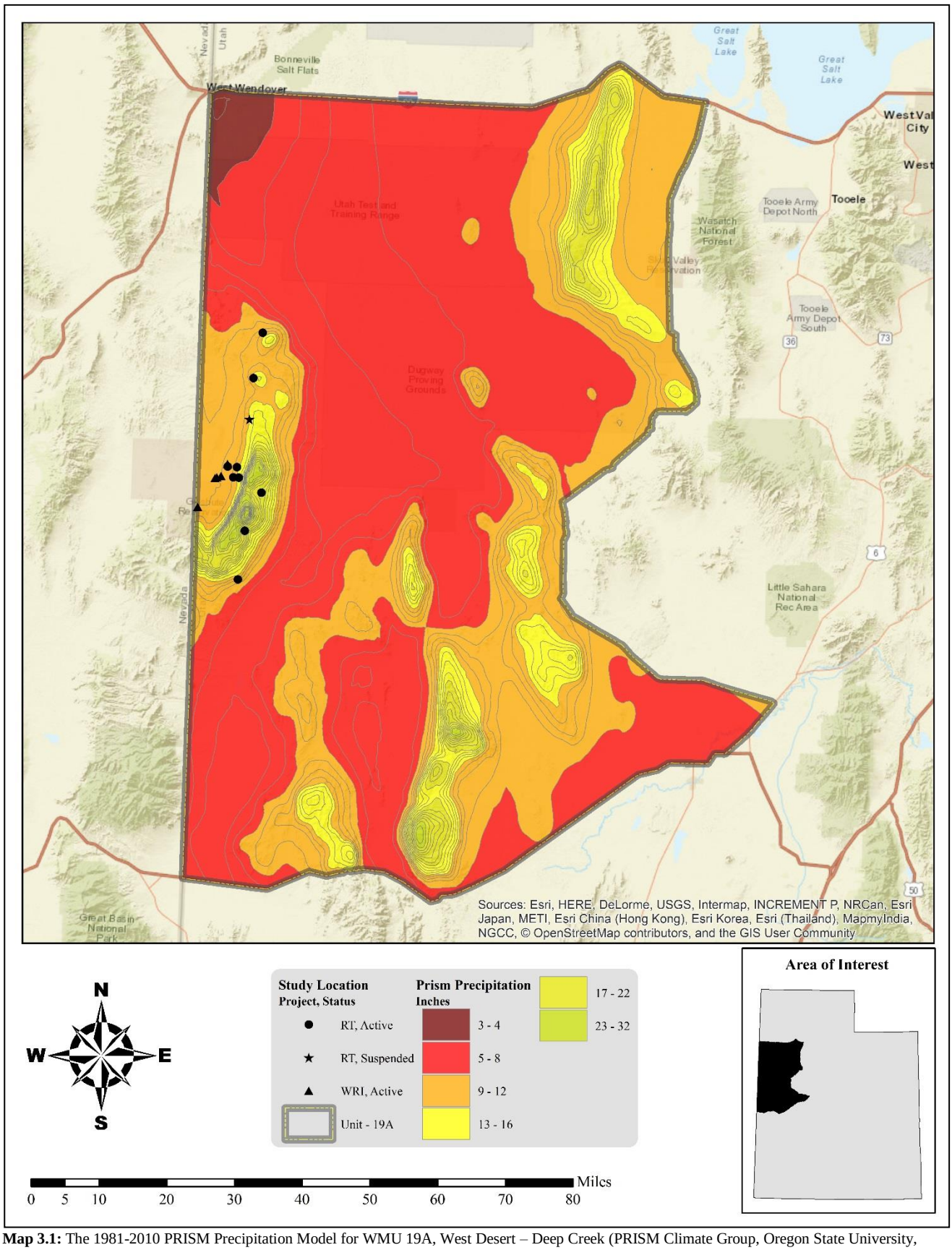
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 3 inches along portions of the Utah-Nevada border near Wendover to 32 inches on the peaks of the Deep Creek Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 9-22 inches of precipitation (**Map 3.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Western and North Central, (Divisions 1 and 3).

The mean annual PDSI of the Western division displayed years of moderate to extreme drought from 1989-1990, 2000-2003, 2007-2008, 2012-2013, and 2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1985, 1993, 1995, 1997-1998, 2005, and 2011 (**Figure 3.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2001-2003, 2007-2008, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (**Figure 3.1b**).

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 3.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005,

and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 3.2b**).



Map 3.1: The 1981-2010 PRISM Precipitation Model for WMU 19A, West Desert – Deep Creek (PRISM Climate Group, Oregon State University, 2013).

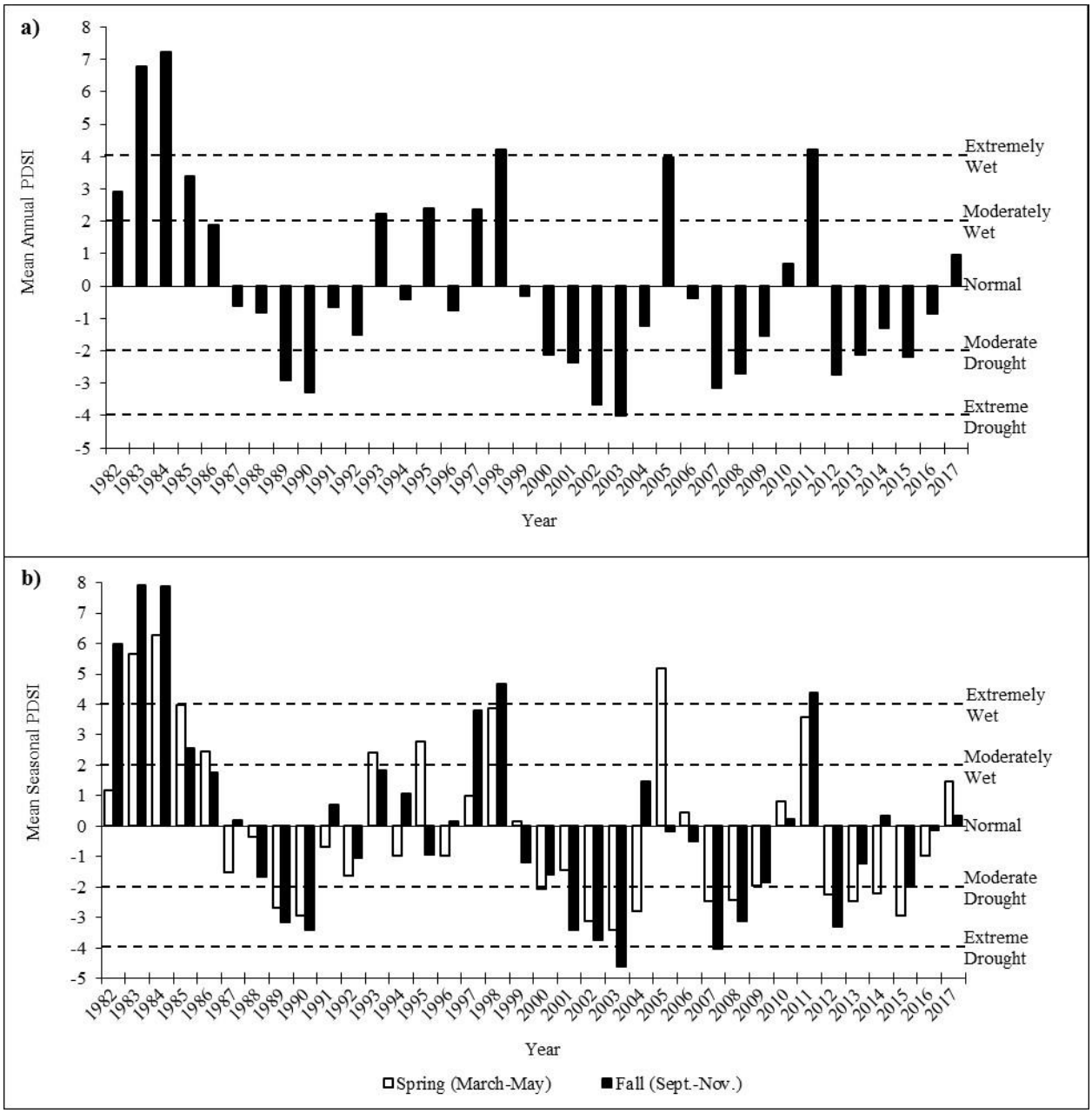


Figure 3.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

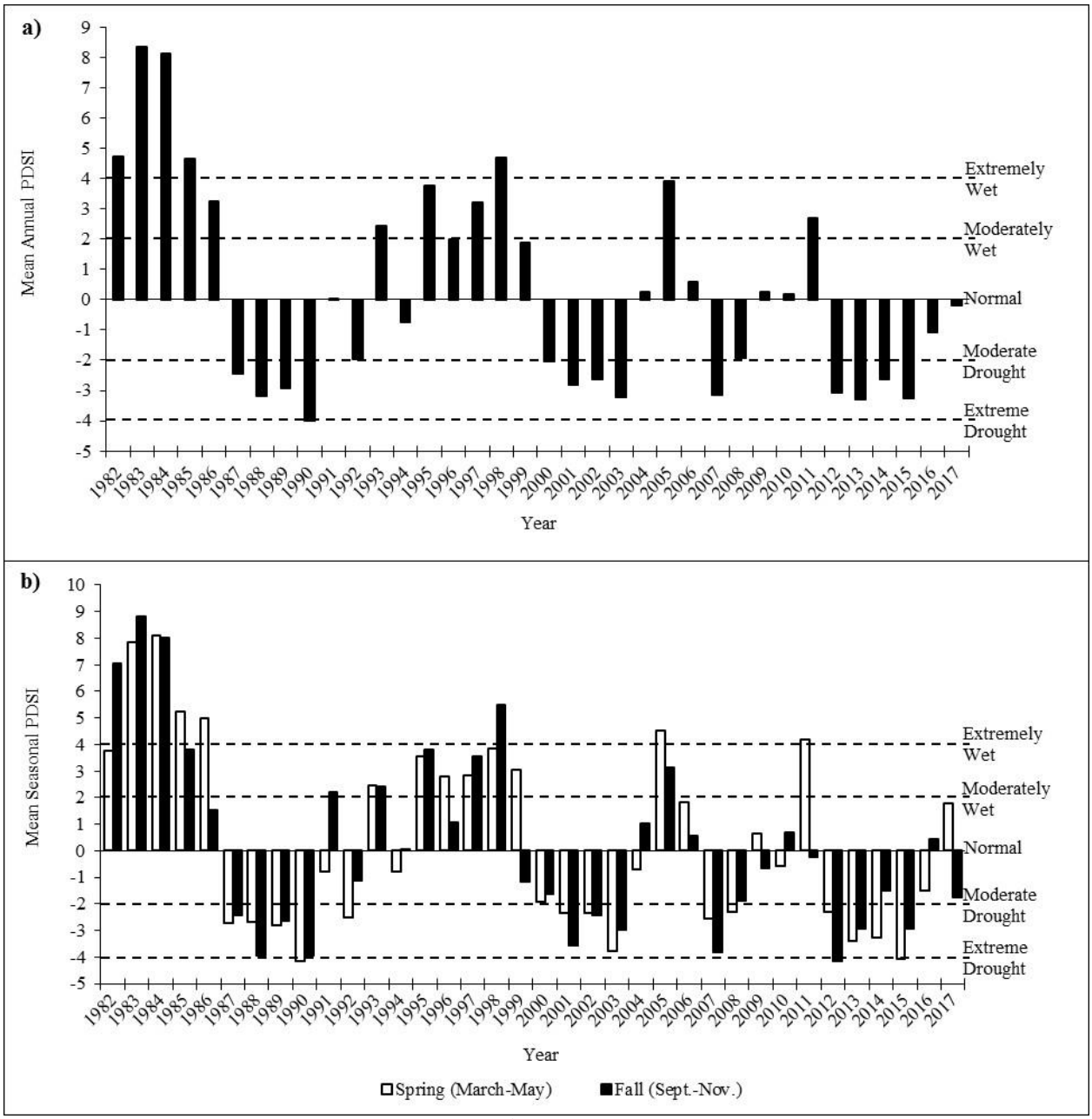
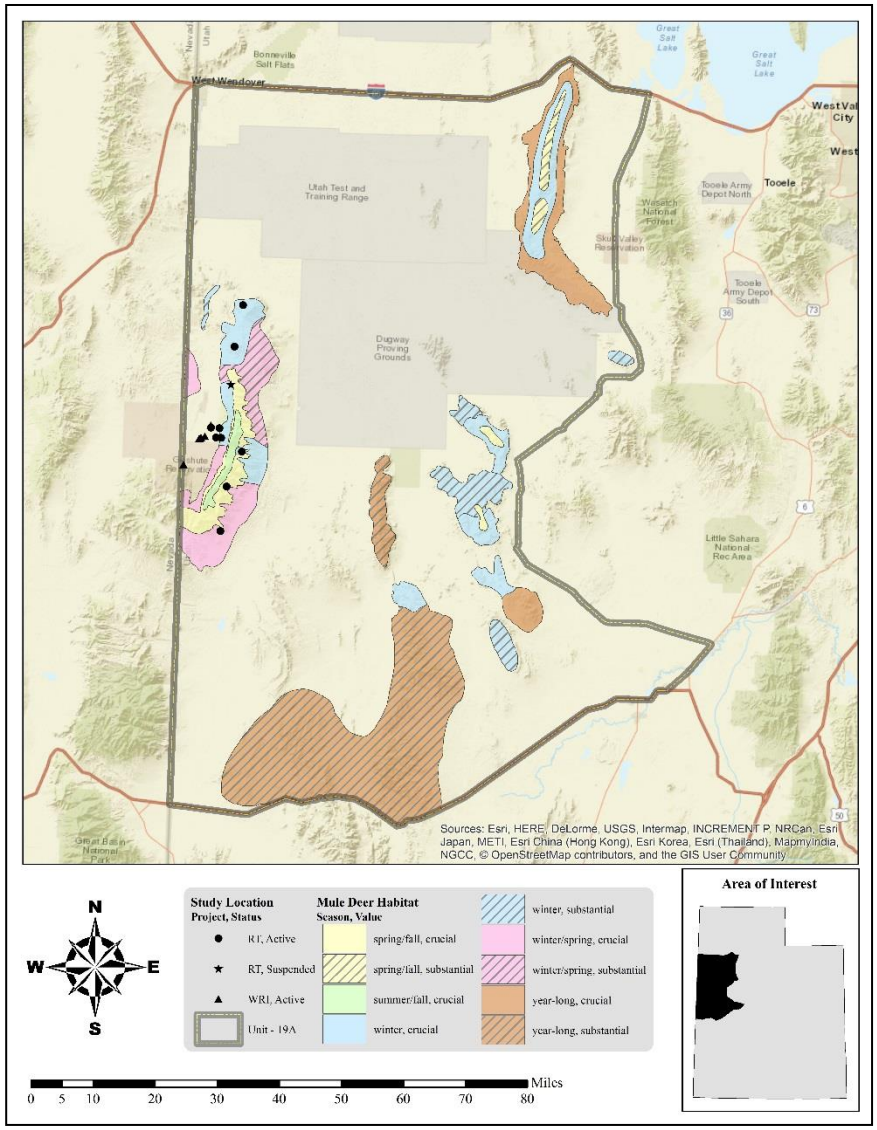


Figure 3.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

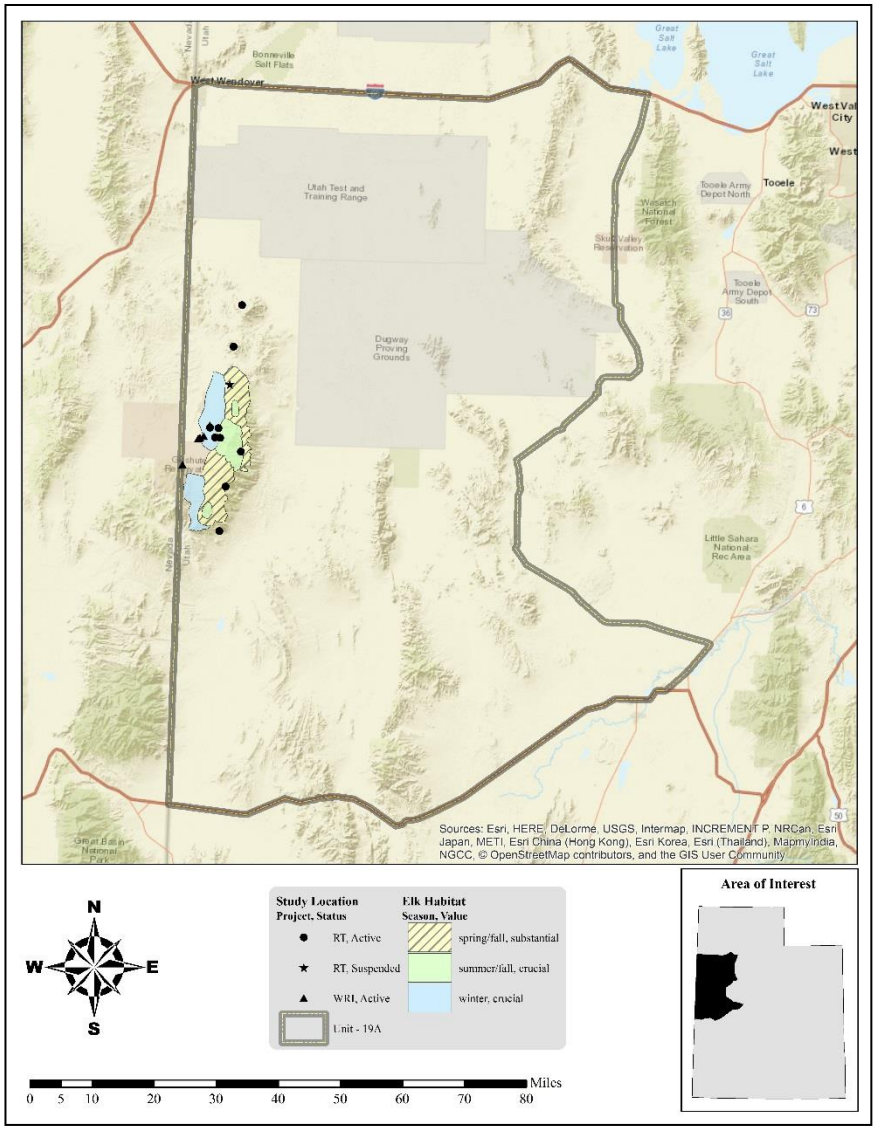
Big Game Habitat

There are an estimated 986,672 acres classified as deer range on Unit 19A with 58% as year-long range, 22% classified as winter range, 11% as winter/spring range, 7% as spring/fall range, and 2% as summer/fall range (**Table 3.1**, **Map 3.2**). The Bureau of Land Management (BLM) manages 91% of the winter range, 6% is managed by School and Institutional Trust Lands Administration (SITLA), and 2% is privately held (**Table 3.2**, **Map 3.2**, **Map 3.6**). Of the elk winter range, 54% is administered by the BLM, 34% is tribally managed, 8% is privately held, and 4% is managed by SITLA (**Table 3.3**, **Map 3.3**, **Map 3.6**). This unit is limited by quality summer range on the unit: the Deep Creek Mountains are the only feature in the unit that provides significant amounts of summer range. The Deep Creek range contains winter habitat along the lower edges of the range, but is limited at the lower elevations by transition into the expanses of barren salt flats and unsuitable salt desert scrub. The House Range and Cedar Mountains also contain some winter habitat, but they do not have significant summer habitat.

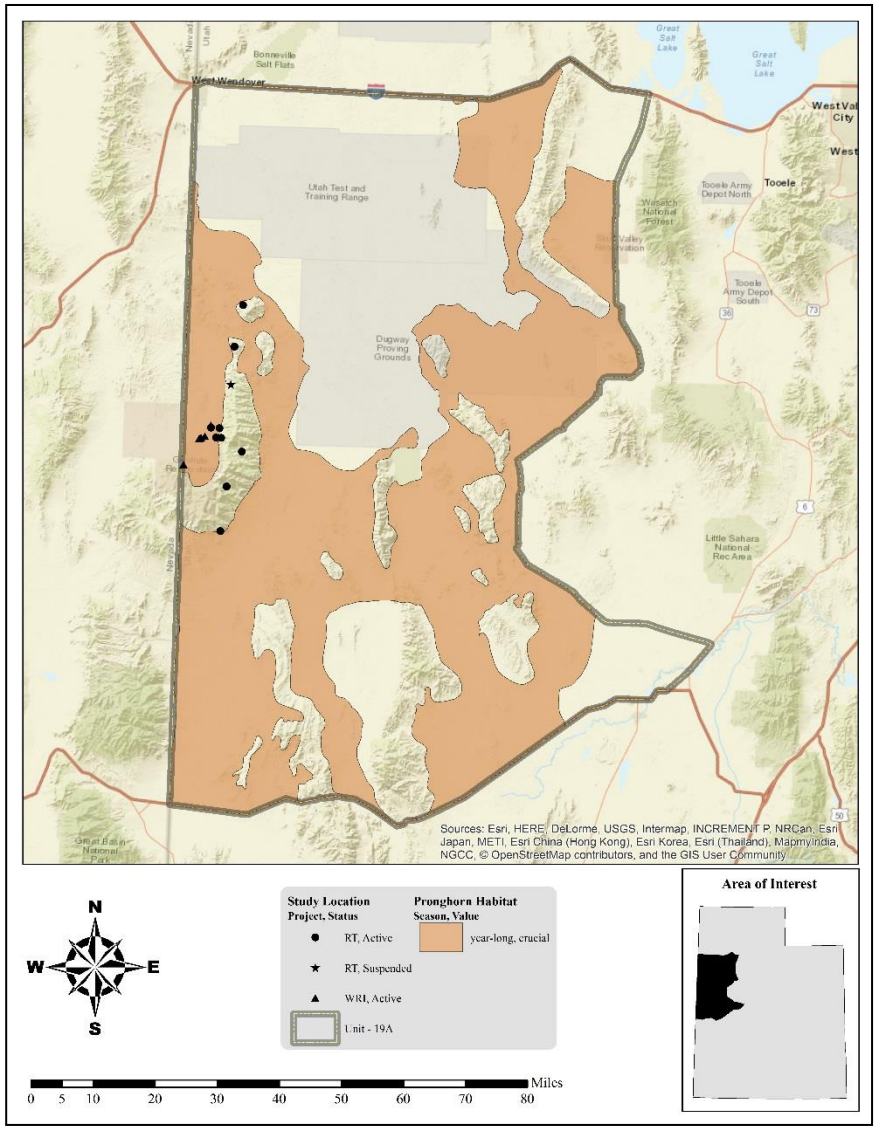
Deer winter range around the Deep Creeks typically follows the base of the mountains and extends to the foothills northwest of the mountains. It is possible that some wintering deer would move out to the Ferber Hills in Nevada depending on the year.



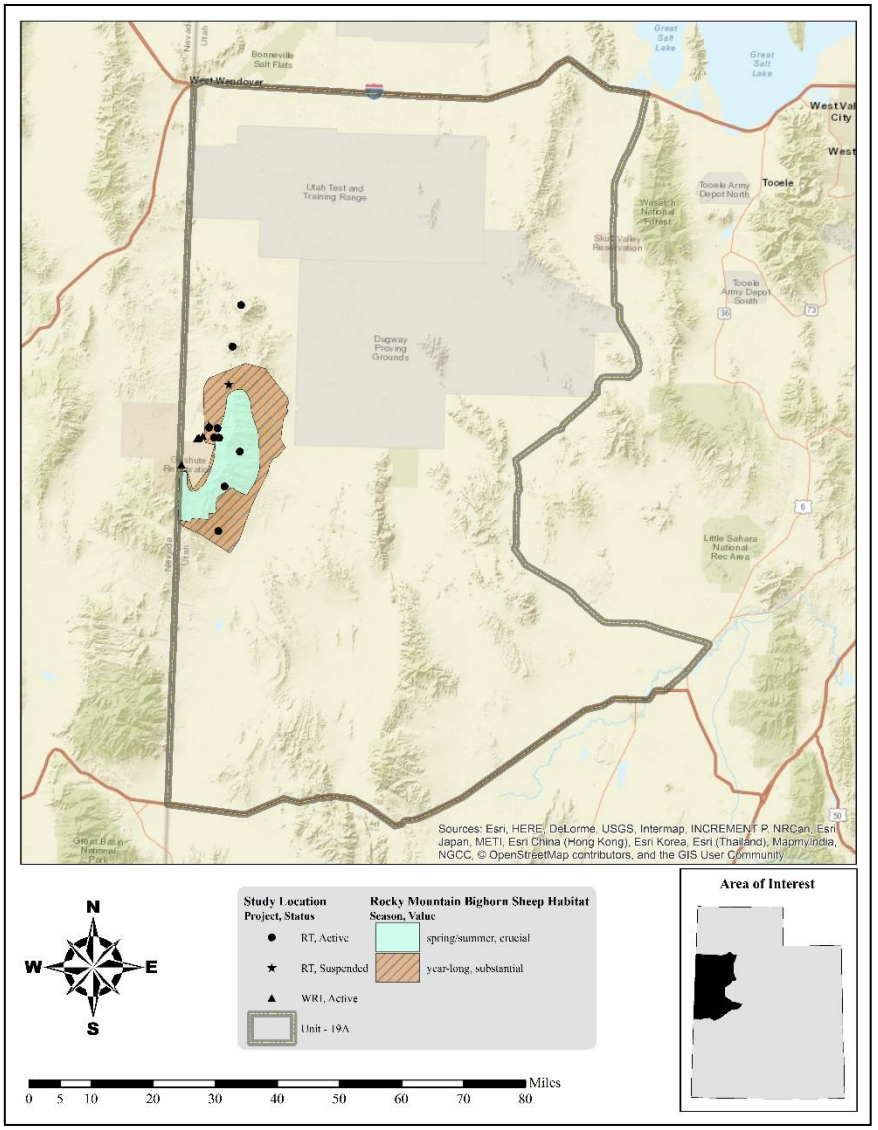
Map 3.2: Estimated mule deer habitat by season and value for WMU 19A, West Desert - Deep Creek.



Map 3.3: Estimated elk habitat by season and value for WMU 19A, West Desert – Deep Creek.



Map 3.4: Estimated pronghorn habitat by season and value for WMU 19A, West Desert – Deep Creek.



Map 3.5: Estimated Rocky Mountain bighorn sheep habitat by season and value for WMU 19A, West Desert – Deep Creek.

	Spring/Fall Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Year Long Range		Spring/Summer Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Elk	51,367	47%	20,275	19%	36,795	34%	0	0%	0	0%	0	0%
Mule Deer	70,067	7%	13,575	1%	219,247	22%	111,169	11%	572,610	58%	572,610	0%
Bighorn Sheep	0	0%	0	0%	0	0%	0	0%	114,321	56%	90,692	44%
Pronghorn	0	0%	0	0%	0	0%	0	0%	2,482,813	100%	0	0%

Table 3.1: Estimated elk, mule deer, Rocky Mountain bighorn sheep (RMBS), and Pronghorn habitat acreage by season for WMU 19A, West Desert - Deep Creek.

	Spring/Fall Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	59,458	85%	10,834	80%	199,728	91%	90,376	81%	509,965	89%
DOD	0	0%	0	0%	2,682	1%	0	0%	22,146	4%
Private	2,756	4%	0	0%	3,345	2%	5,859	5%	4,034	1%
SITLA	205	<1%	0	0%	13,319	6%	5,194	5%	36,464	6%
Tribal	7,649	11%	2,741	20%	173	<1%	9,740	9%	0	0%
Total	70,067	**100%**	13,575	**100%**	219,247	**100%**	111,169	**100%**	572,610	**100%**

Table 3.2: Estimated mule deer habitat acreage by season and ownership for WMU 19A, West Desert - Deep Creek.

	Spring/Fall Range		Summer/Fall Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	37,836	74%	16,810	83%	19,834	54%
Private	1,041	2%	760	4%	3,109	8%
SITLA	0	0%	0	0%	1,475	4%
Tribal	12,490	24%	2,706	13%	12,377	34%
Total	51,367	**100%**	20,275	**100%**	36,795	**100%**

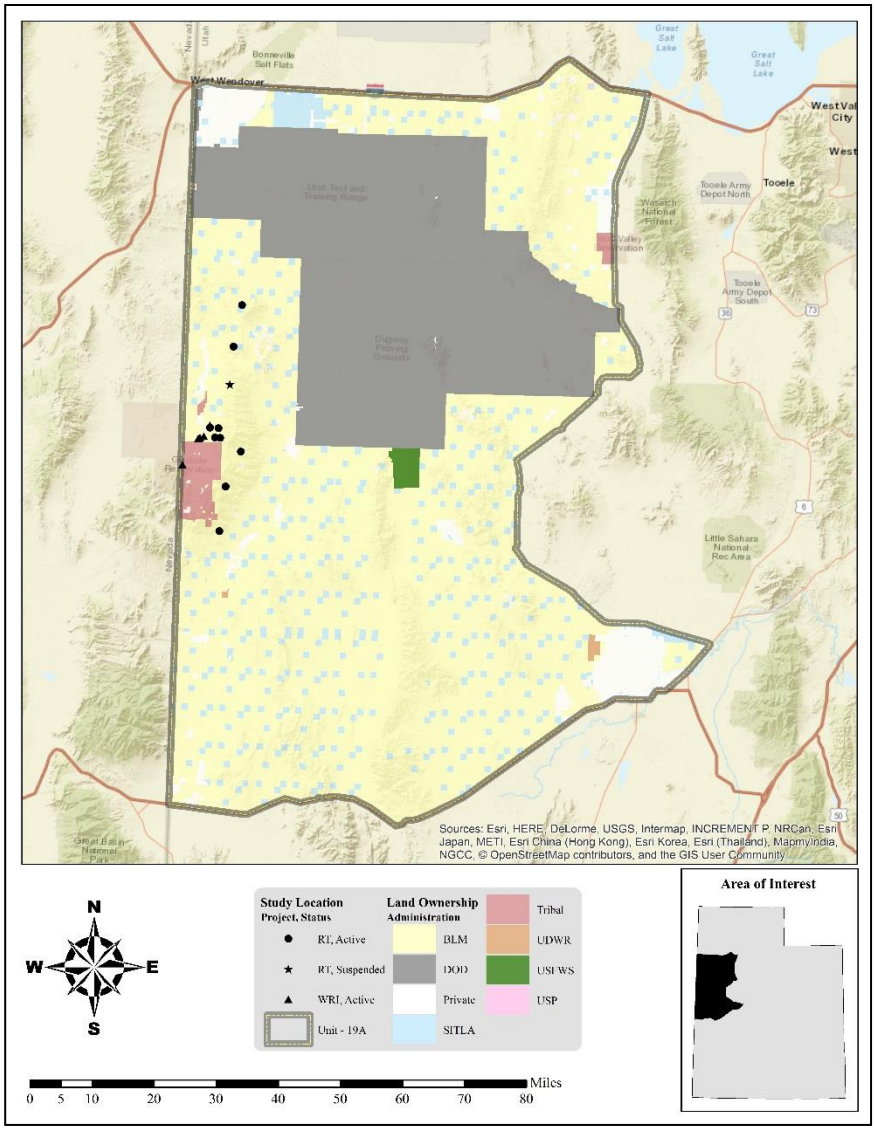
Table 3.3: Estimated elk habitat acreage by season and ownership for WMU 19A, West Desert - Deep Creek.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	1,862,459	75%
DOD	308,267	12%
Private	77,407	3%
SITLA	198587	8%
Tribal	32,408	1%
UDWR	1092	<1%
USFS	2,594	<1%
Total	2,482,813	**100%**

Table 3.4: Estimated pronghorn habitat acreage by season and ownership for WMU 19A, West Desert - Deep Creek.

	Spring/Summer Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	60,270	66%	105,403	92%
Private	3,692	4%	2,636	2%
SITLA	5,471	6%	0	0%
USFS	21,259	23%	6,282	5%
Total	90,692	**100%**	114,321	**100%**

Table 3.5: Estimated bighorn sheep habitat acreage by season and ownership for WMU 19A, West Desert - Deep Creek.



Map 3.6: Land ownership for WMU 19A, West Desert - Deep Creek.

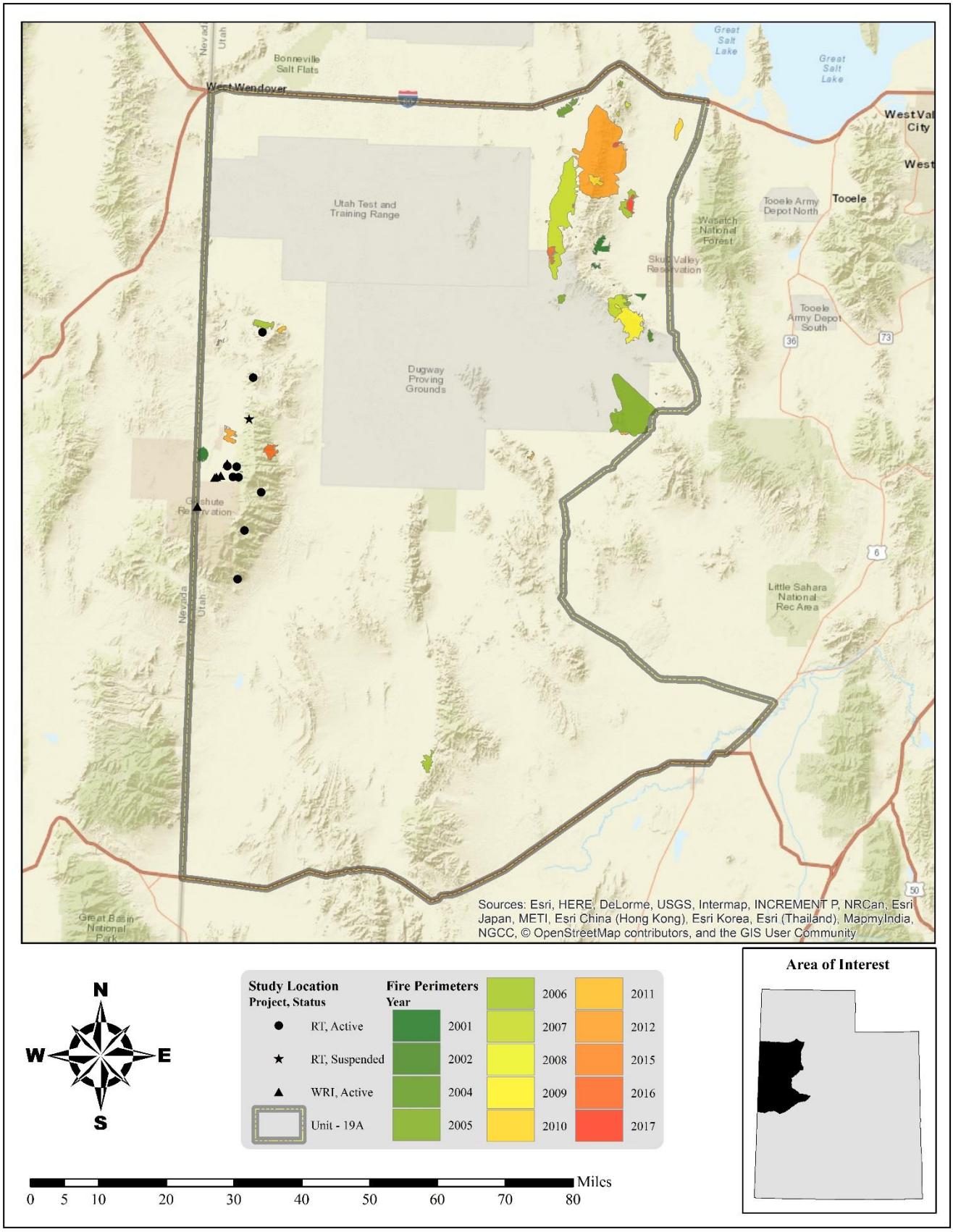
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	173,639	3.58%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	24,599	0.51%	
	Abies concolor Forest Alliance	7,537	0.16%	
	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	4,016	0.08%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	3,649	0.08%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,662	0.03%	
	Inter-Mountain Basins Juniper Savanna	1,015	0.02%	
	Other Conifer	427	0.01%	4.47%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	239,189	4.93%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	64,668	1.33%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	404	0.01%	6.27%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	8,038	0.17%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	729	0.02%	
	Southern Rocky Mountain Montane-Subalpine Grassland	120	0.00%	0.19%
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	1,747,183	36.00%	
	Great Basin Xeric Mixed Sagebrush Shrubland	492,674	10.15%	
	Inter-Mountain Basins Greasewood Flat	232,872	4.80%	
	Inter-Mountain Basins Big Sagebrush Shrubland	107,761	2.22%	
	Mojave Mid-Elevation Mixed Desert Scrub	52,338	1.08%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	18,146	0.37%	
	Grayia spinosa Shrubland Alliance	10,898	0.22%	
	Inter-Mountain Basins Big Sagebrush Steppe	10,748	0.22%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	1,779	0.04%	
	Sonora-Mojave Semi-Desert Chaparral	1,251	0.03%	
	Coleogyne ramosissima Shrubland Alliance	641	0.01%	
	Rocky Mountain Lower Montane-Foothill Shrubland	612	0.01%	
	Columbia Plateau Low Sagebrush Steppe	258	0.01%	
	Other Shrubland	365	0.01%	55.17%
Other	Barren	1,482,261	30.54%	
	Agricultural	51,529	1.06%	
	Sparsely Vegetated	50,369	1.04%	
	Developed	40,188	0.83%	
	Open Water	12,383	0.26%	
	Quarries-Strip Mines-Gravel Pits	810	0.16%	
	Hardwood	7,448	0.15%	
	Riparian	933	0.02%	
	Snow-Ice	99	0.00%	34.06%
Total		4,853,237	100%	100%

Table 3.6: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 19A, West Desert - Deep Creek.

Limiting Factors to Big Game Habitat

The major human activities in the area consist of mining, livestock grazing and off-road recreation. Habitat degradation and loss, water availability, summer range availability, and winter range forage conditions are factors affecting big game habitat. Significant portions of the winter range for elk fall on tribal lands and are therefore outside of Utah DWR management. Encroachment of pinyon-juniper woodland communities are a threat to the sagebrush communities in the area and treatments should concentrate on the north and west slopes of the Deep Creek Mountains.

A significant limiting factor in the unit is the presence of exotic introduced grasses, such as cheatgrass (*Bromus tectorum*). According to the Landfire Exisiting Vegetation Coverage model, 6.27% of the unit is comprised of exotic herbaceous species (**Table 3.6**). Increased amounts of cheatgrass exacerbate the risk of catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). The unit has suffered from several wildfires, particularly in the Cedar Mountains (**Map 3.7**).



Map 3.7: Land coverage of fires by year from 2000-2018 for WMU 19A, West Desert - Deep Creek (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

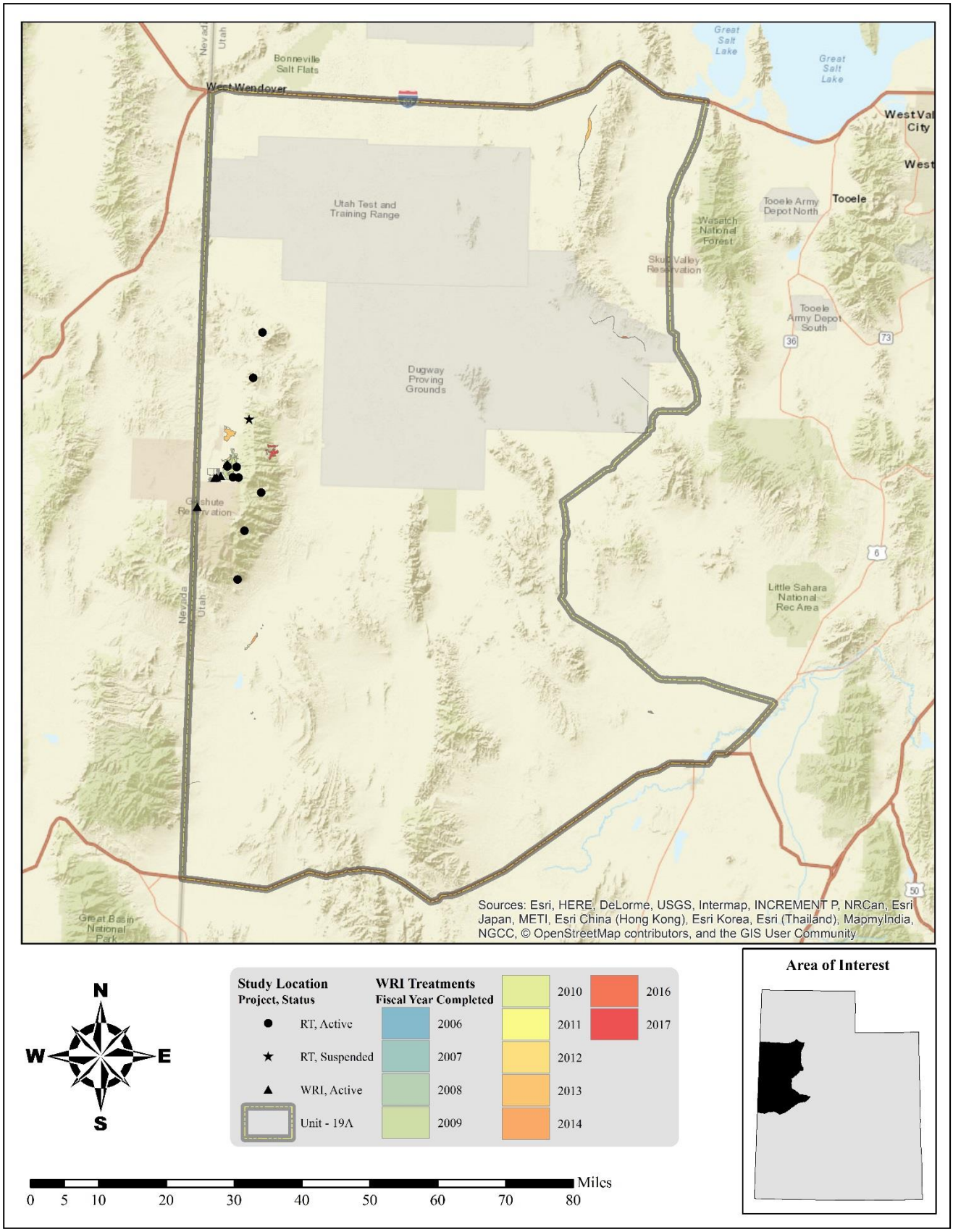
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 9,413 acres of land have been treated within the West Desert-Deep Creek unit since the WRI was implemented in 2004 (**Map 3.8**). An additional 2,136 acres are currently being treated. Treatments frequently overlap one another bringing the total completed treatment acres to 11,549 acres for this unit (**Table 3.7**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Herbicide treatments to treat undesirable plants are the most common treatment by acreage. Bullhog and lop and scatter treatments for pinyon-juniper removal are very common across the unit as well. Seeding plants to augment the herbaceous understory is used in conjunction with some of these treatments. Other management practices include (but are not limited to): aerator treatments, anchor chaining, bulldozing, disking, greenstripping, harrowing, prescribed fire, and manual vegetation removal (**Table 3.7**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Aerator	**257**	**0**	**0**	**257**
Double Drum (One-Way)	257	0	0	257
Anchor chain	**439**	**0**	**0**	**439**
Ely (One-Way)	439	0	0	439
Bulldozing	**126**	**0**	**0**	**126**
Other	126	0	0	126
Bullhog	**1,723**	**0**	**0**	**1,723**
Full Size	1,723	0	0	1,723
Disk	**387**	**0**	**0**	**387**
Off-Set (Two-Way)	306	0	0	306
Plow (One-Way)	82	0	0	82
Greenstripping	**38**	**0**	**0**	**38**
Harrow	**445**	**0**	**0**	**445**
≤ 15 ft. (Two-Way)	445	0	0	445
Herbicide Application	**2,839**	**1,108**	**0**	**3,947**
Aerial (Fixed-Wing)	1,314	5	0	1,319
Ground	1,407	1,103	0	2,509
Spot Treatment	119	0	0	119
Prescribed Fire	**62**	**0**	**0**	**62**
Road/Parking Area Improvements	**9**	**0**	**0**	**9**
Seeding (Primary)	**1,741**	**1,028**	**0**	**2,769**
Broadcast (Aerial-Helicopter)	1,350	0	0	1,350
Drill (Rangeland)	391	1,028	0	1,420
Vegetation Improvements	**72**	**0**	**0**	**72**
Manual Removal/Hand Crew	72	0	0	72
Vegetation Removal/Hand Crew	**1,538**	**0**	**0**	**1,538**
Lop and Scatter	1,538	0	0	1,538
Total Treatment Acres	**9,678**	**2,136**	**0**	**11,814**
***Total Land Area Treated**	**9,413**	**2,136**	**0**	**11,549**

Table 3.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 19A, West Desert – Deep Creek. Data accessed on 02/08/2018. *Does not include overlapping treatments.



Map 3.8: WRI treatments by fiscal year completed for WMU 19A, West Desert - Deep Creek.

Range Trend Studies

Range Trend studies have been sampled within WMU 19A on a regular basis since 1983, with studies being added or suspended as was deemed necessary (**Table 3.8**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 3.9**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
19A-1	Trail Gulch	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Shallow Loam (Cliffrose)
19A-2	Ochre Mountain	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Gravelly Loam (Wyoming Big Sagebrush)
19A-3	Sevy Mountain	RT	Suspended	'83, '89, '97	Not Verified
19A-4	Durse Canyon	RT	Active	'83, '89, '97, '02, '12, '17	Upland Stony Loam (Cliffrose)
19A-5	Chokecherry Springs	RT	Suspended	'84, '90, '96, '01, '06, '11, '16	Not Verified
19A-6	Granite Creek	RT	Active	'83, '89, '97, '17	Mountain Stony Loam (Mountain Big Sagebrush)
19A-7	Wood Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Semidesert Stony Loam (Black Sagebrush)
19A-8	The Basin	RT	Active	'89, '97, '17	Mountain Loam (Mountain Big Sagebrush) and Mountain Shallow Loam (Low Sagebrush)
19A-9	Rocky Canyon	RT	Active	'02, '07, '12, '17	Mountain Shallow Loam (Mountain Big Sagebrush)
19A-10	Rocky Spring	RT	Active	'02, '07, '12, '17	Mountain Stony Loam (Mountain Big Sagebrush)
19A-11	Ibapah Harrow	RT	Active	'07, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-2	Deep Creek Aerator	WRI	Active	'05, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-3	Deep Creek Drill	WRI	Active	'05, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-5	Goshute Chaining	WRI	Active	'06, '12, '17	Upland Shallow Loam (Black Sagebrush)
19R-14	Ibapah Harrow	WRI	Active	'08, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-20	East Pasture Harrow	WRI	Active	'07, '12	Semidesert Loam (Wyoming Big Sagebrush)

Table 3.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 19A, West Desert - Deep Creek

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
19A-11	Ibapah Harrow	Two-Way Dixie Harrow	Ibapah Sagebrush Improvement - Year 1	October 2007	166	730
		Broadcast Before Aerial	Ibapah Sagebrush Improvement - Year 1	October 2007	166	730
19R-2	Deep Creek Aerator	Truax Drill	Deep Creek Valley Sagebrush Improvement - Year 2	October 2005	444	24
		Aerial After	Deep Creek Valley Sagebrush Improvement - Year 2	December 2005	194	24
19R-3	Deep Creek Drill	Truax Drill	Deep Creek Valley Sagebrush Improvement - Year 2	October 2005	389	24
		Aerial After	Deep Creek Valley Sagebrush Improvement - Year 2	December 2005	389	24

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
19R-5	Goshute Chaining	Two-Way Ely/Smooth Chain	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	May 2006	776	354
		Aerial Before	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	November 2006	776	354
		Dribbler	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	December 2006	776	354
19R-14	Ibapah Harrow	Two-Way Dixie Harrow	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
		Broadcast Before	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
19R-20	East Pasture Harrow	Two-Way Dixie Harrow	Deep Creek East Pasture Habitat Enhancement	November 2007	145	662
		Broadcast Before	Deep Creek East Pasture Habitat Enhancement	November 2007	145	662

Table 3.9: Range trend and WRI studies known disturbance history for WMU 19A, West Desert - Deep Creek.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are four studies [Granite Creek (19A-6), The Basin (19A-8), Rocky Canyon (19A-9), and Rocky Spring (19A-10)] classified as Mountain (Big Sagebrush) ecological sites. The Granite Creek site is located up Granite Canyon to the east of Ibapah Peak. The Basin is located up Big Canyon on the east slopes of the Deep Creek Range. The Rocky Canyon and Rocky Springs study sites are located on the west slopes near Rocky Peak.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the most dominant preferred browse species, with other species such as little sagebrush (*A. arbuscula*) and black sagebrush (*A. nova*) also contributing cover. Cover of overall preferred browse has shown a slight decrease over time with most of the cover being provided by sagebrush (**Figure 3.3**). Preferred browse demographic data shows that the community is primarily composed of mature individuals. Recruitment of young has been fairly low, but numbers have remained stable. The density of preferred browse has shown an overall increase since 2007 (**Figure 3.6**). Utilization of preferred browse has fluctuated, but the usage has typically remained light (**Figure 3.7**).

Trees provide cover on all sites with cover provided by Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*). Cover and density of trees has steadily increased through sample years (**Figure 3.4**, **Figure 3.5**).

Herbaceous Understory: These sites provide significant herbaceous cover mainly contributed by perennial forbs and grasses. However, there is a significant annual grass component that has displayed an overall increase: this is primarily driven by the Rocky Spring site. Perennial grasses and forbs have shown a slight increase over time. Native grasses provide significant amounts of cover on the sites, with The Basin and Granite Creek being composed almost entirely of native grasses and forbs (**Figure 3.8**, **Figure 3.9**).

Occupancy: The primary occupants on these sites are deer, with mean pellet group abundance ranging from 2 days use/acre in 2012 to 41 days use/acre in 2002. Elk have a significant presence with mean pellet group abundance varying from 7 days use/acre in 2017 to 31 days use/acre in 2007. Cattle usage on these sites has been low with 1 days use/acre being observed in 2007 and a high of 12 days use/acre being noted in 2017 (**Figure 3.10**).

Upland (Big Sagebrush)

There are two studies [Ochre Mountain (19A-2) and Ibapah Harrow (19A-11)] classified as Mountain (Big Sagebrush) ecological sites. The Ochre Mountain site is located between Deep Creek Valley and Clifton Flat. The Ibapah Harrow study site is located in the Deep Creek Valley south of Ibapah.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the most dominant preferred browse species with black sagebrush (*A. nova*) contributing a smaller amount of cover. Average shrub cover

has decreased slightly over time, but the density of preferred shrubs has shown a stable trend (**Figure 3.3**). Age class demographics have remained similar with mature individuals being the primary component of these communities in most sample years.

Tree cover and density were first observed in 2017, with Ochre Mountain being the only site that tree were sampled on. Both Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*) were sampled on this site during the 2017 sample year (**Figure 3.4**, **Figure 3.5**).

Herbaceous Understory: The study sites of this ecological type have herbaceous understories co-dominated by perennial grasses and annual grasses. Total cover of both perennial and annual grasses has increased through time, although frequency has remained consistent. Both Ibapah Harrow and Ochre Mountain have shown an increase in annual grass through the study period. Annual forb cover and frequency have fluctuated from year to year (**Figure 3.8**, **Figure 3.9**).

Occupancy: Pellet transect data shows that deer and elk are the primary occupants of these study sites. Deer usage has varied from 1 day use/acre in 2007 to 43 days use/acre in 2002. Average abundance of elk pellet groups has fluctuated from 7 days use/acre in 2017 to 22 days use/acre in 2007. Cattle pellet data showed a low of 2 days use/acre in 2007 and a high of 16 days use/acre in 2012. Finally, horse presence on the site has ranged from 0 day use/acre in 2012 to 5 days use/acre in 2002 (**Figure 3.10**).

Upland (Cliffrose)

There are two studies [Trail Gulch (19A-1) and Durse Canyon (19A-4)] that are classified as Upland (Cliffrose) ecological sites. The Trail Gulch site is located east of Dutch Mountain near Gold Hill. The Durse Canyon site is located in the Deep Creek Valley on the west side of the Deep Creek Range.

Shrubs/Trees: Stansbury cliffrose (*Purshia stansburiana*) is the dominant preferred browse species, with black sagebrush (*Artemisia nova*) contributing a lesser, but still significant, amount of cover. The overall shrub cover has increased, but the cover of sagebrush has remained stable (**Figure 3.3**). Demographic data for preferred browse shows that the communities on these study sites are primarily composed of mature individuals with decadence displaying a decreasing trend (**Figure 3.6**). Utilization of preferred browse has remained consistent across study years (**Figure 3.7**).

Trees, particularly Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*), provide cover on both of these sites. Tree cover and density has increased steadily since they were first sampled (**Figure 3.4**, **Figure 3.5**).

Herbaceous Understory: The understories of these study sites are typical of rocky landscapes with low precipitation. Perennial grasses and forbs have remained consistent in cover and frequency through the study years, while cover of annual forbs has fluctuated over time. The Trail Gulch site drives the trend for annual grass while the Durse Canyon site has consistently had low amounts of annual grass; the overall cover of annual grass has fluctuated from year to year (**Figure 3.8**, **Figure 3.9**).

Occupancy: Average pellet transect data shows that deer are the primary occupants of these sites and that overall utilization has generally decreased. Deer usage has displayed a high of 28 days use/acre in 2002 and a low of 0 days use/acre in 2017. Elk have had a mean pellet group abundance ranging from 3 days use/acre in 2002 to 0 days use/acre in 2017 (**Figure 3.10**).

Semidesert (Black Sagebrush)

There is one study [Wood Canyon (19A-7)] classified as a Semidesert (Black Sagebrush) ecological site. The Wood Canyon site is located on the east side of the mountains at the south end of the Deep Creek range.

Shrubs/Trees: The most dominant browse species on this site is Nevada jointfir (*Ephedra nevadensis*) with lesser amounts of winterfat (*Krascheninnikovia lanata*) and shadscale saltbush (*Atriplex confertifolia*) also present. Average cover of preferred browse has fluctuated, but overall it has shown an increasing trend (**Figure 3.3**). The age class for preferred browse has remained steady with decadence fluctuating slightly; the majority of the community is comprised of mature individuals (**Figure 3.6**). Preferred browse utilization has exhibited a decreasing trend over time (**Figure 3.7**).

Herbaceous Understory: The herbaceous understory of the Wood Canyon study is typical for this ecological type and precipitation range. The cover of perennial grasses and forbs has increased slightly, while frequency has fluctuated between sample years; all perennial grass cover is provided by native species. Annual grass cover has fluctuated between all sample years, which is potentially a result of certain precipitation amounts and timings (**Figure 3.8**, **Figure 3.9**).

Occupancy: Pellet transect data has shown that deer/antelope are the primary occupants on this site. Usage has varied from 14 days use/acre in 2002 to 2 days use/acre in 2017. Mean abundance of cattle pellet groups has fluctuated from 8 days use/acre in 2002 to 0 days use/acre in 2017. Elk pellet group data has ranged from 0 days use/acre in 2002 to 6 days use/acre in 2017. Horse usage has varied from 0 days use/acre in 2017 to 1 day use/acre in both 2002 and 2012 (**Figure 3.10**).

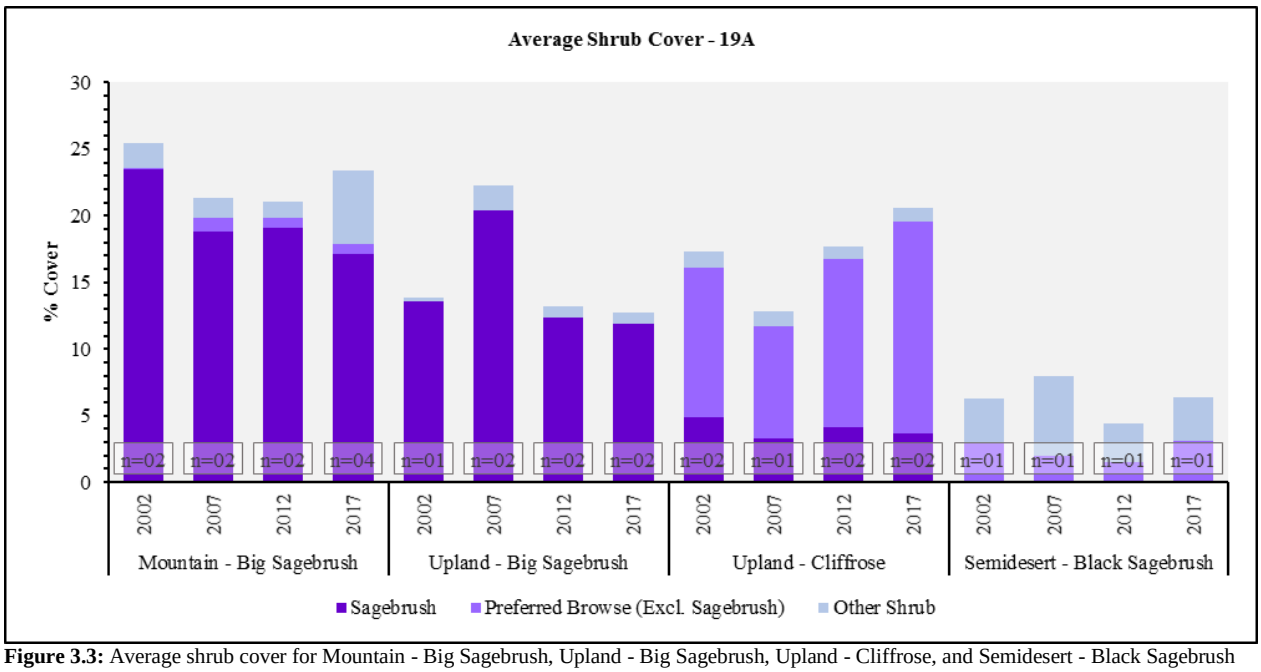


Figure 3.3: Average shrub cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

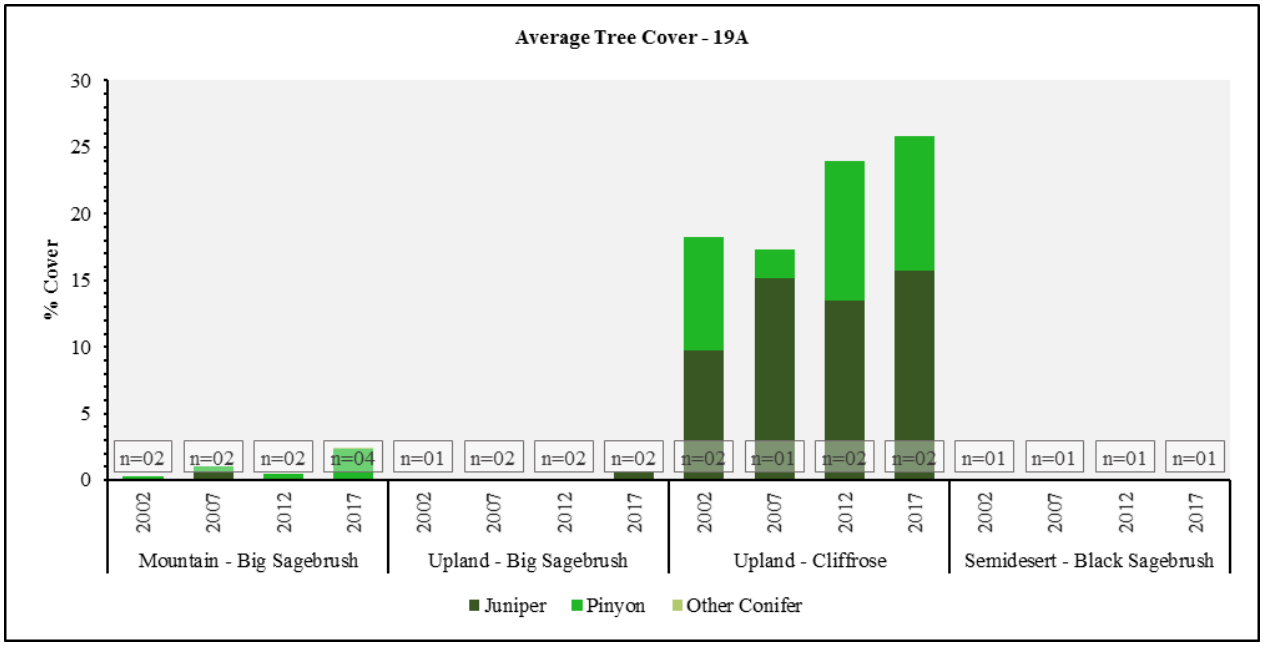


Figure 3.4: Average tree cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

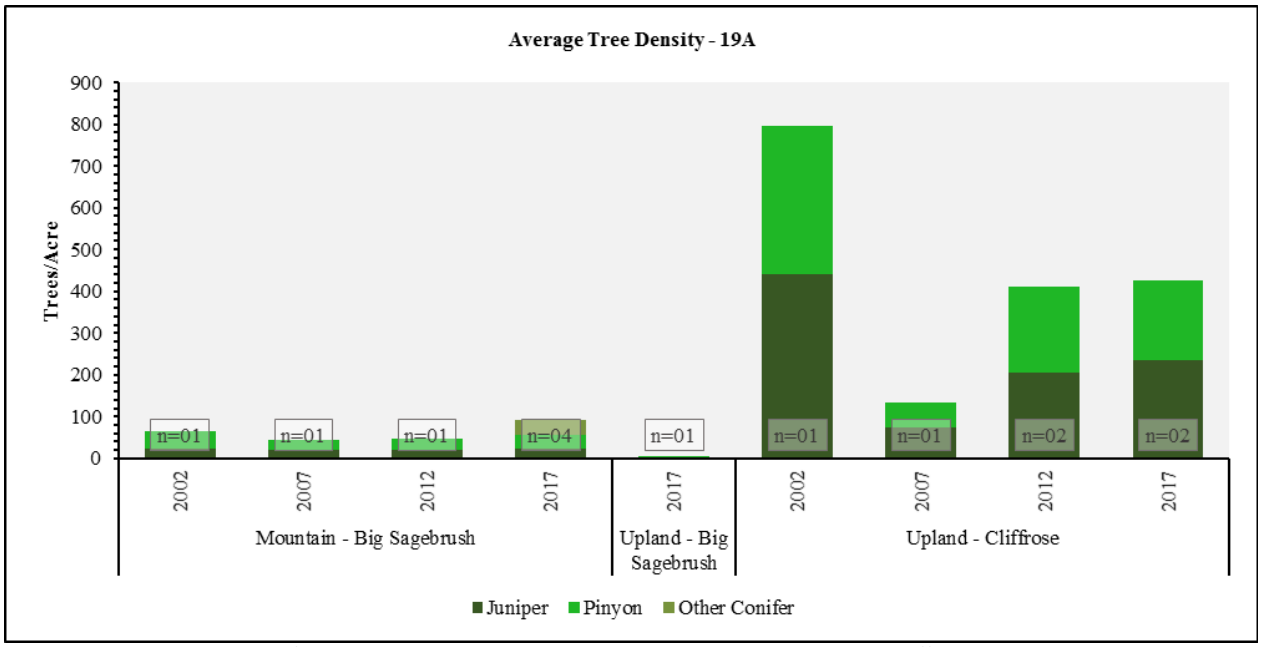


Figure 3.5: Average tree density for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Upland - Cliffrose study sites in WMU 19A, West Desert - Deep Creek.

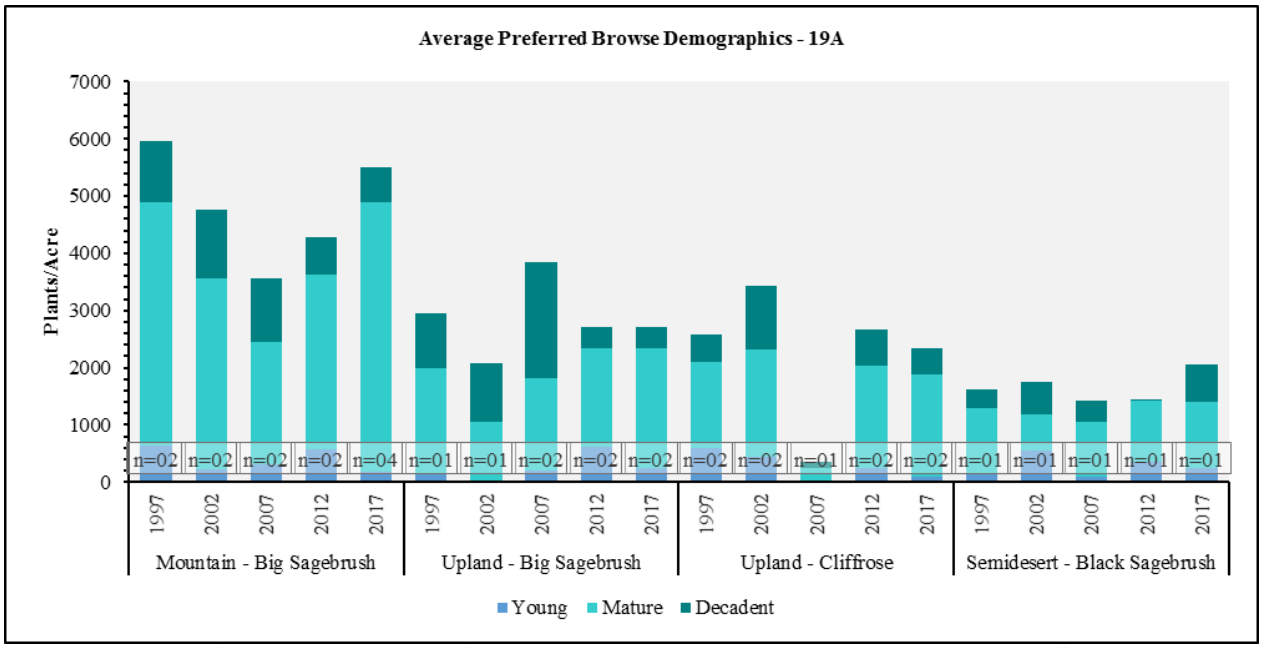


Figure 3.6: Average preferred browse demographics for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

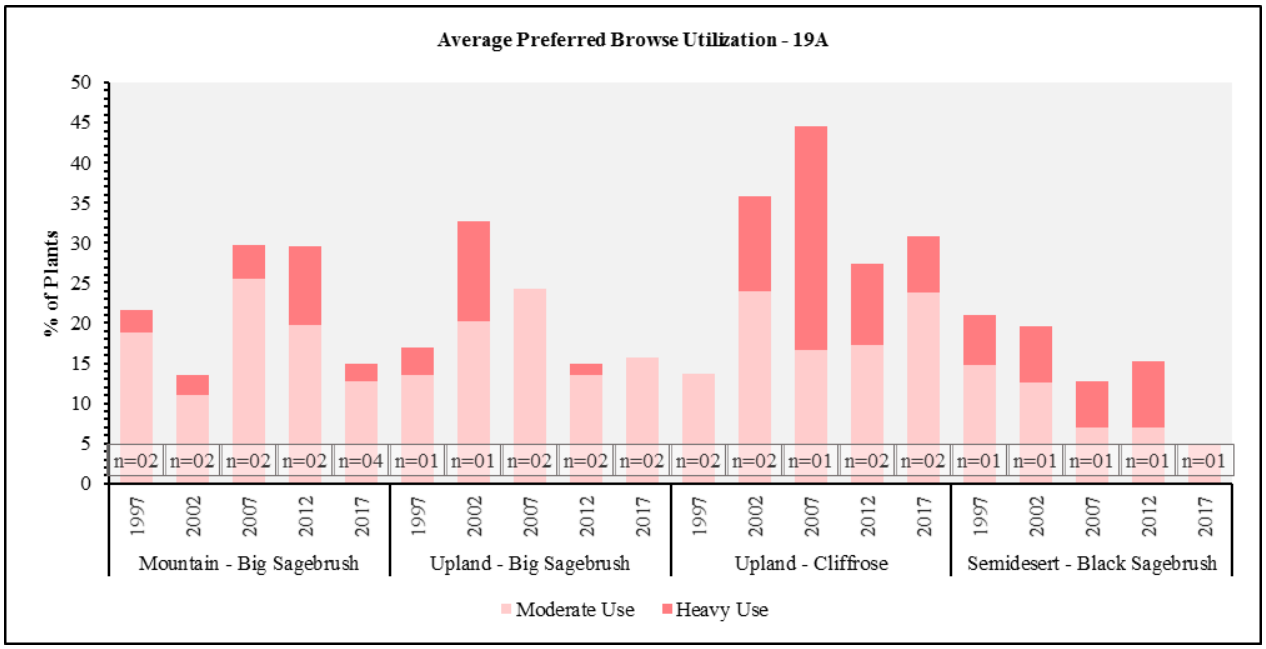


Figure 3.7: Average preferred browse utilization for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

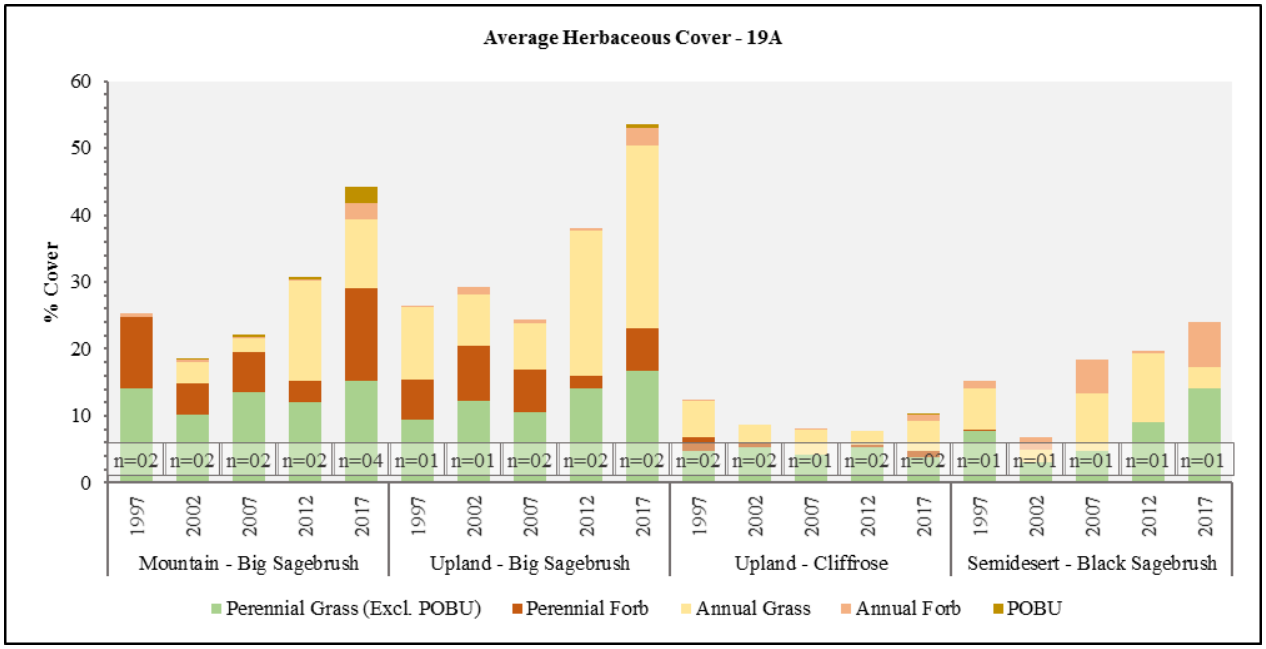


Figure 3.8: Average herbaceous cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

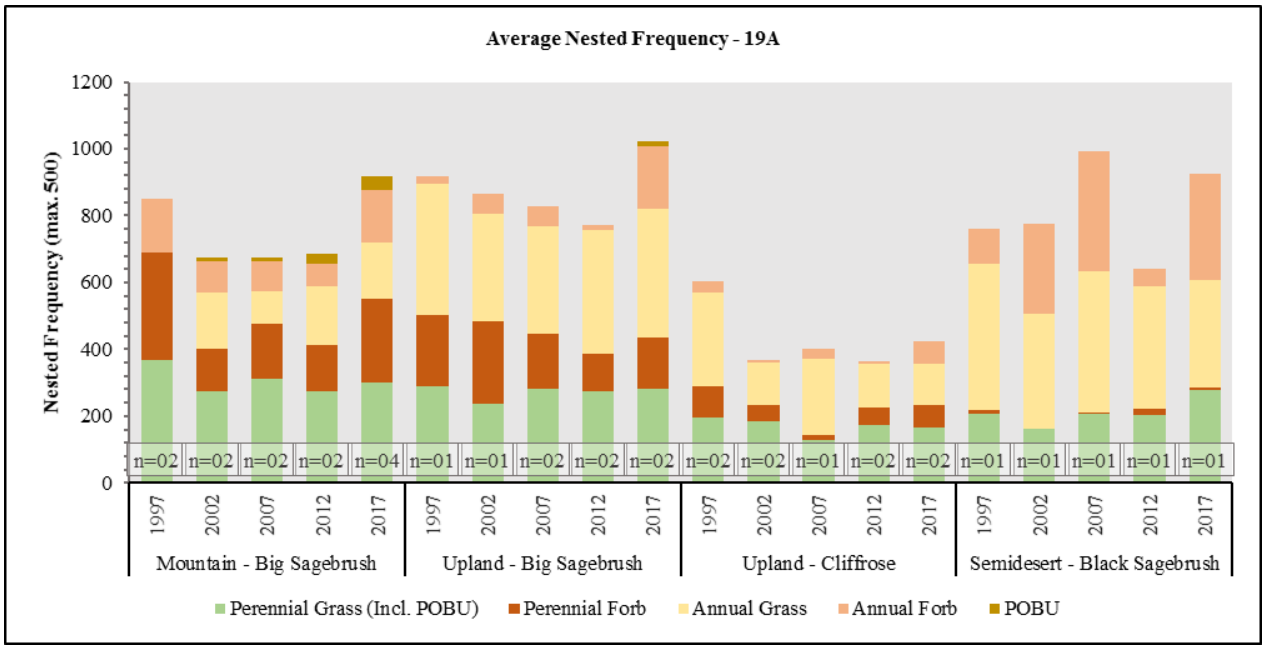


Figure 3.9: Average herbaceous nested frequency of herbaceous species for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

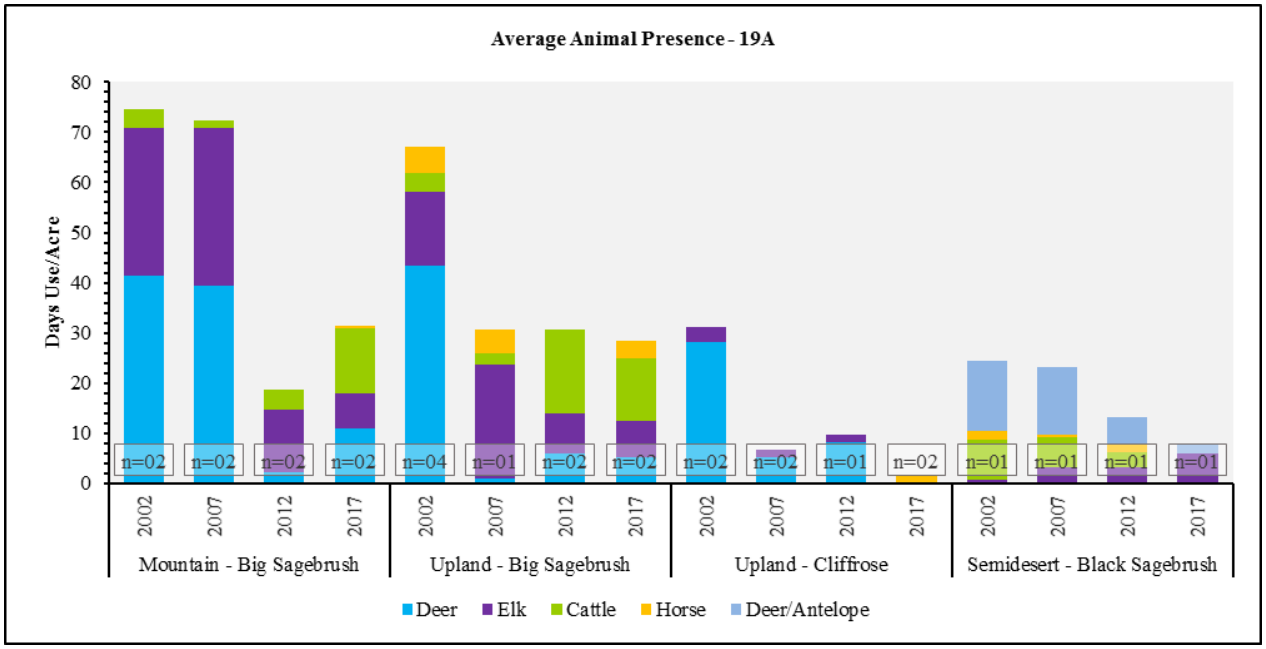
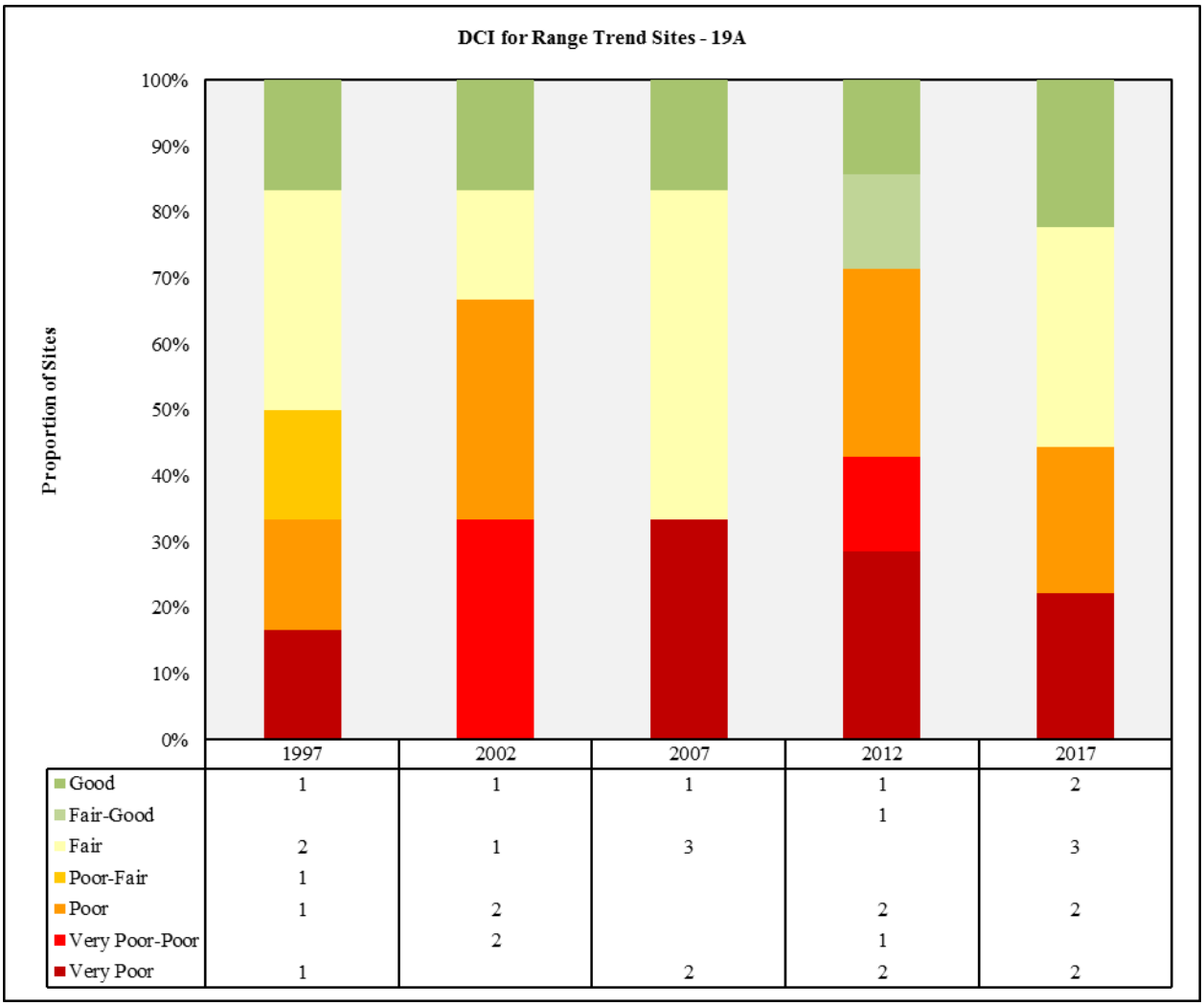


Figure 3.10: Average pellet transect data for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 19A, West Desert - Deep Creek.

Deer Winter Range Condition Assessment

The condition of deer winter range within the West Desert - Deep Creek management unit has continually changed on the sites sampled since 1997. The active Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the 2017 sample year (**Figure 3.11**, **Table 3.10**). The Basin and Rocky Canyon sites are considered to be in good condition. Wood Canyon, Granite Creek and Durse Canyon are considered to be in fair condition for mule deer winter range. The Ochre Mountain and Ibapah Harrow studies are considered to be in poor condition. Trail Gulch and Rocky Spring are considered to be in very poor condition. The treated sites have generally improved as time since treatment has increased (**Figure 3.12**); the exception to this is the East Pasture Harrow study, which went from fair-good to fair. Deep Creek Aerator went from poor to poor-fair, Deep Creek Drill went from fair-good to good, Goshute Chaining went from very poor to fair-good, and Ibapah Harrow went from poor to good (**Table 3.11**). It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1997	2002	2007	2012	2017
Good	1	1	1	1	2
Fair-Good				1	
Fair	2	1	3		3
Poor-Fair	1				
Poor	1	2		2	2
Very Poor-Poor		2		1	
Very Poor	1		2	2	2

Figure 3.11: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 19A, West Desert - Deep Creek.

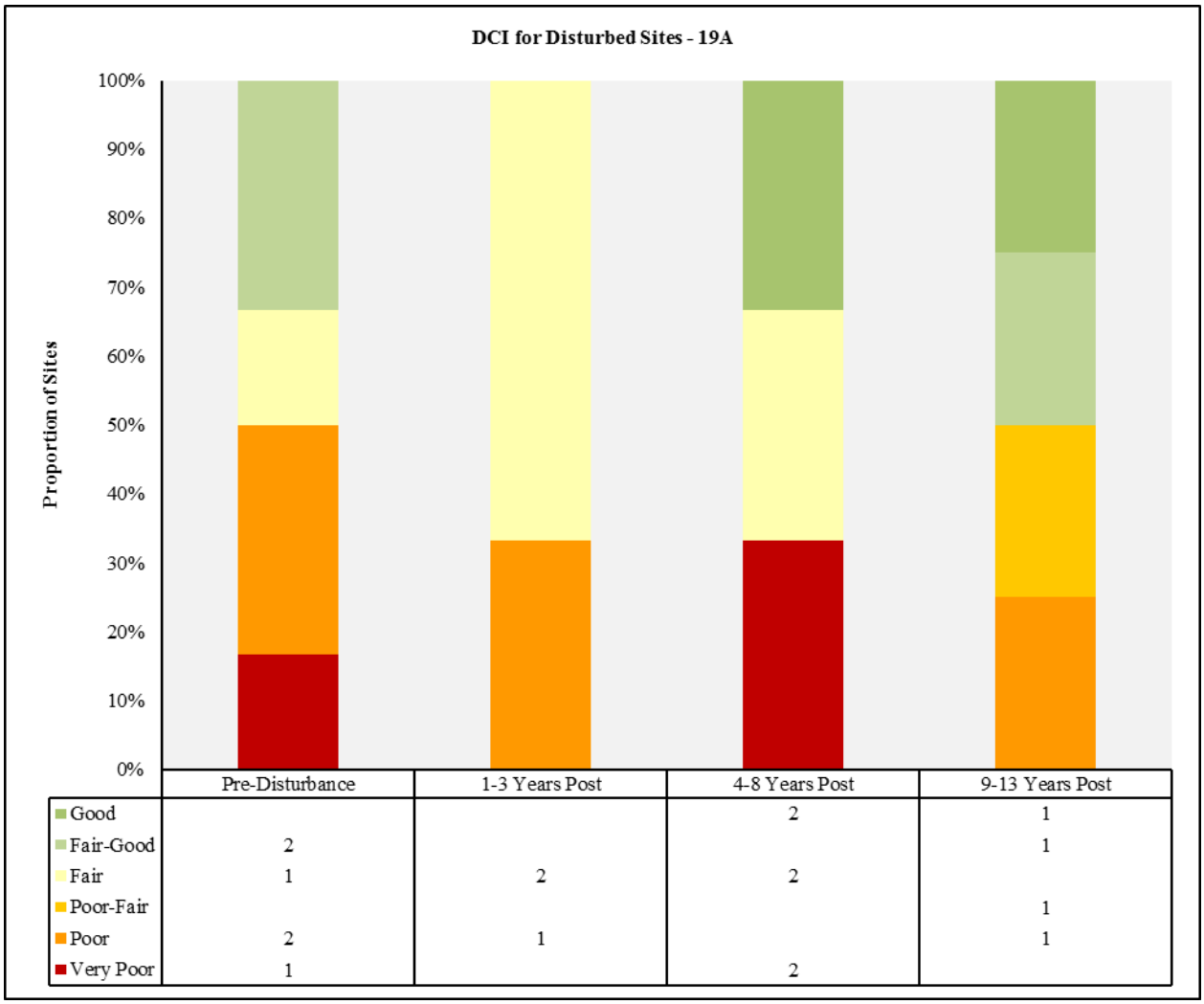


Figure 3.12: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 19A, West Desert - Deep Creek.

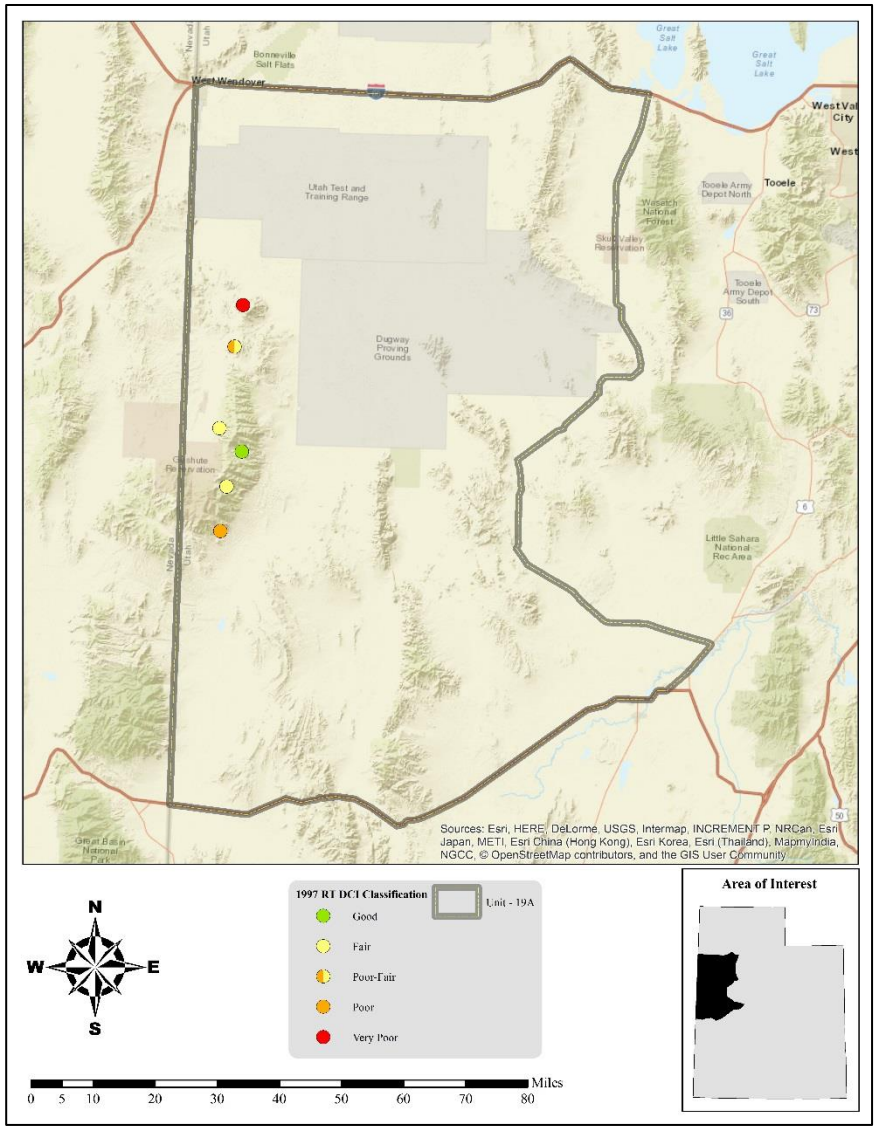
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19A-1	1997	13.3	9.8	4.5	8.2	-5.3	0.2	0.0	**30.6**	**VP**
19A-1	2002	19.2	7.7	1.7	9.8	-4.1	0.0	0.0	**34.4**	**VP-P**
19A-1	2007	16.6	4.9	0.3	8.2	-2.8	0.2	0.0	**27.4**	**VP**
19A-1	2012	15.7	4.9	4.1	7.6	-2.6	0.0	0.0	**29.7**	**VP**
19A-1	2017	19.1	12.3	0.0	6.2	-6.4	0.2	0.0	**31.4**	**VP**
19A-2	1997	20.8	5.2	2.9	18.8	-8.1	10.0	0.0	**49.6**	**P-F**
19A-2	2002	17.0	-0.3	0.0	24.4	-5.7	10.0	0.0	**45.4**	**P**
19A-2	2007	22.5	2.3	4.5	27.4	-9.4	10.0	0.0	**57.4**	**F**
19A-2	2012	24.9	4.2	1.9	27.4	-17.6	6.0	0.0	**46.8**	**P**
19A-2	2017	21.0	8.6	0.5	23.6	-20.0	10.0	0.0	**43.7**	**P**
19A-3*	1997	15.0	1.0	1.6	17.0	-0.6	10.0	0.0	**44.0**	**P-F**
19A-4	1997	19.3	10.5	15.0	10.8	-2.8	7.8	0.0	**60.6**	**F**
19A-4	2002	26.1	7.7	7.7	11.6	-0.2	1.8	0.0	**54.7**	**F**
19A-4	2012	30.0	11.7	7.4	13.4	-0.5	2.0	0.0	**64.1**	**F-G**
19A-4	2017	30.0	10.0	3.9	9.0	-0.5	3.4	0.0	**55.9**	**F**
19A-6	1997	16.1	6.6	3.5	27.8	0.0	10.0	0.0	**64.0**	**F**
19A-6	2017	12.9	8.1	1.5	30.0	0.0	10.0	0.0	**62.5**	**F**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19A-7	1997	3.3	0.0	0.0	15.6	-4.7	0.2	0.0	**14.5**	**P**
19A-7	2002	3.7	0.0	0.0	6.0	-1.5	0.0	0.0	**8.2**	**VP-P**
19A-7	2007	2.3	0.0	0.0	9.4	-6.5	0.0	0.0	**5.3**	**VP**
19A-7	2012	1.8	0.0	0.0	18.0	-7.7	0.2	0.0	**12.2**	**P**
19A-7	2017	3.9	0.0	0.0	28.2	-2.4	0.0	0.0	**29.7**	**F**
19A-8	1997	18.0	10.9	6.1	28.8	0.0	10.0	0.0	**73.8**	**G**
19A-8	2017	23.1	12.7	2.3	30.0	-0.2	10.0	0.0	**78.0**	**G**
19A-9	2002	30.0	8.8	3.0	27.8	-1.0	9.6	0.0	**78.2**	**G**
19A-9	2007	24.0	5.0	3.8	30.0	-0.1	10.0	0.0	**72.6**	**G**
19A-9	2012	25.3	11.9	3.5	30.0	-0.4	6.6	0.0	**76.8**	**G**
19A-9	2017	29.6	11.2	0.0	30.0	-1.9	10.0	0.0	**79.0**	**G**
19A-10	2002	24.8	2.9	0.9	12.8	-3.8	9.2	0.0	**46.8**	**P**
19A-10	2007	25.7	5.0	6.2	19.8	-2.9	10.0	0.0	**63.8**	**F**
19A-10	2012	24.4	7.4	7.5	16.2	-20.0	6.2	0.0	**41.7**	**VP-P**
19A-10	2017	24.0	8.6	1.9	11.2	-20.0	10.0	0.0	**35.7**	**VP**
19A-11	2007	28.6	-1.5	2.0	14.8	-1.0	1.2	0.0	**44.2**	**F**
19A-11	2012	6.0	0.0	0.0	29.0	-15.0	1.4	0.0	**21.4**	**VP**
19A-11	2017	8.8	12.0	6.0	30.0	-12.2	2.2	0.0	**46.7**	**P**

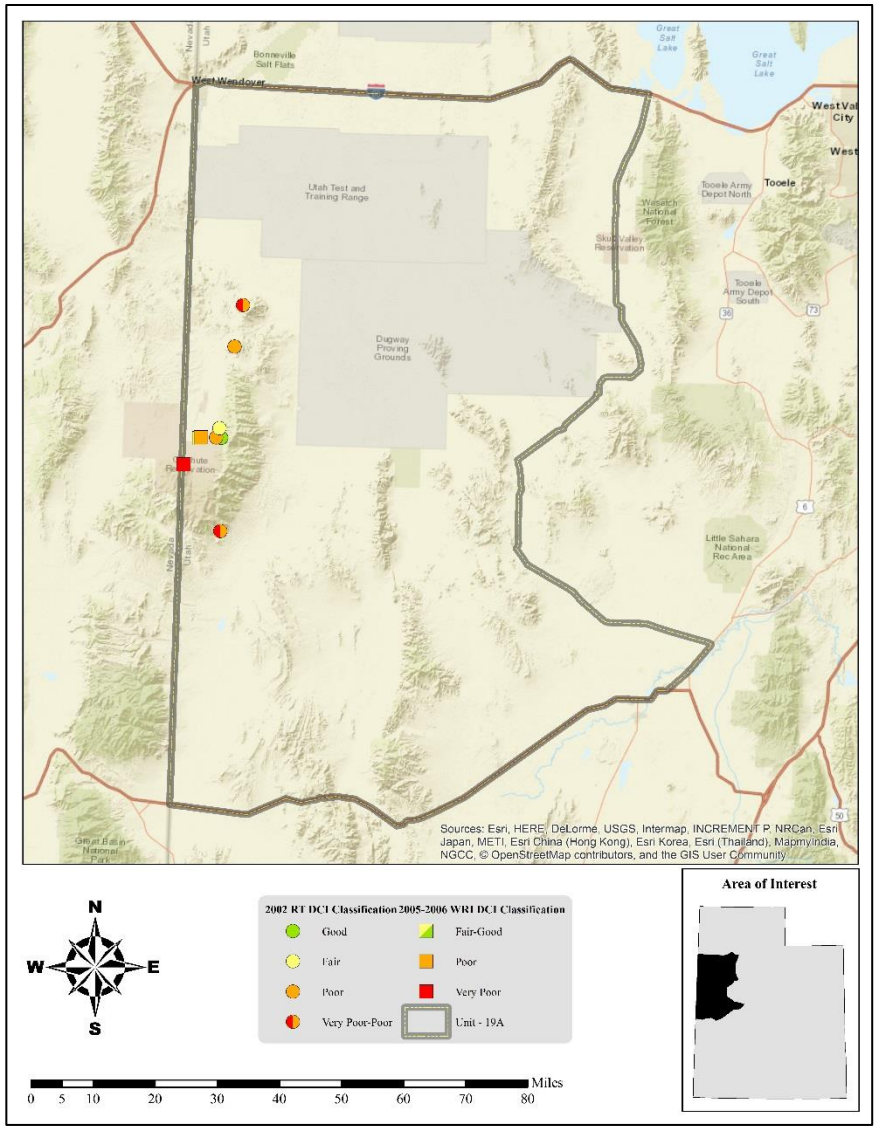
Table 3.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 19A, West Desert - Deep Creek. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19R-2	2005	20.9	-0.9	0.5	9.4	-17.6	1.2	0.0	**13.5**	**P**
19R-2	2008	11.2	0.9	3.6	4.2	-7.4	1.2	0.0	**13.7**	**P**
19R-2	2012	10.0	7.2	6.3	13.4	-6.4	0.4	0.0	**30.9**	**F**
19R-2	2017	14.6	8.6	3.3	16.4	-20.0	3.2	0.0	**26.1**	**P-F**
19R-3	2005	15.6	0.0	1.0	30.0	-1.4	0.2	0.0	**45.4**	**F-G**
19R-3	2008	13.0	-6.0	1.5	23.4	-0.1	0.0	0.0	**31.8**	**F**
19R-3	2012	14.8	5.2	2.6	30.0	0.0	0.6	0.0	**53.1**	**G**
19R-3	2017	17.6	6.7	5.6	30.0	-1.0	1.6	0.0	**60.5**	**G**
19R-5	2006	8.9	6.0	1.8	9.8	0.0	6.0	0.0	**32.5**	**VP**
19R-5	2012	6.0	0.0	0.0	25.4	-2.4	2.6	0.0	**31.6**	**VP**
19R-5	2017	9.9	14.1	9.0	25.6	-1.4	5.8	0.0	**63.0**	**F-G**
19R-14	2008	24.4	-12.0	0.5	5.8	-0.2	3.0	0.0	**21.5**	**P**
19R-14	2012	7.6	3.3	2.5	26.4	-8.4	4.4	0.0	**35.8**	**F**
19R-14	2017	9.0	11.4	1.5	30.0	-3.8	2.4	0.0	**50.6**	**G**
19R-20	2007	26.1	-1.5	2.0	21.0	-1.7	0.2	0.0	**46.2**	**F-G**
19R-20	2012	17.3	14.1	15.0	7.0	-10.6	0.2	0.0	**43.0**	**F**

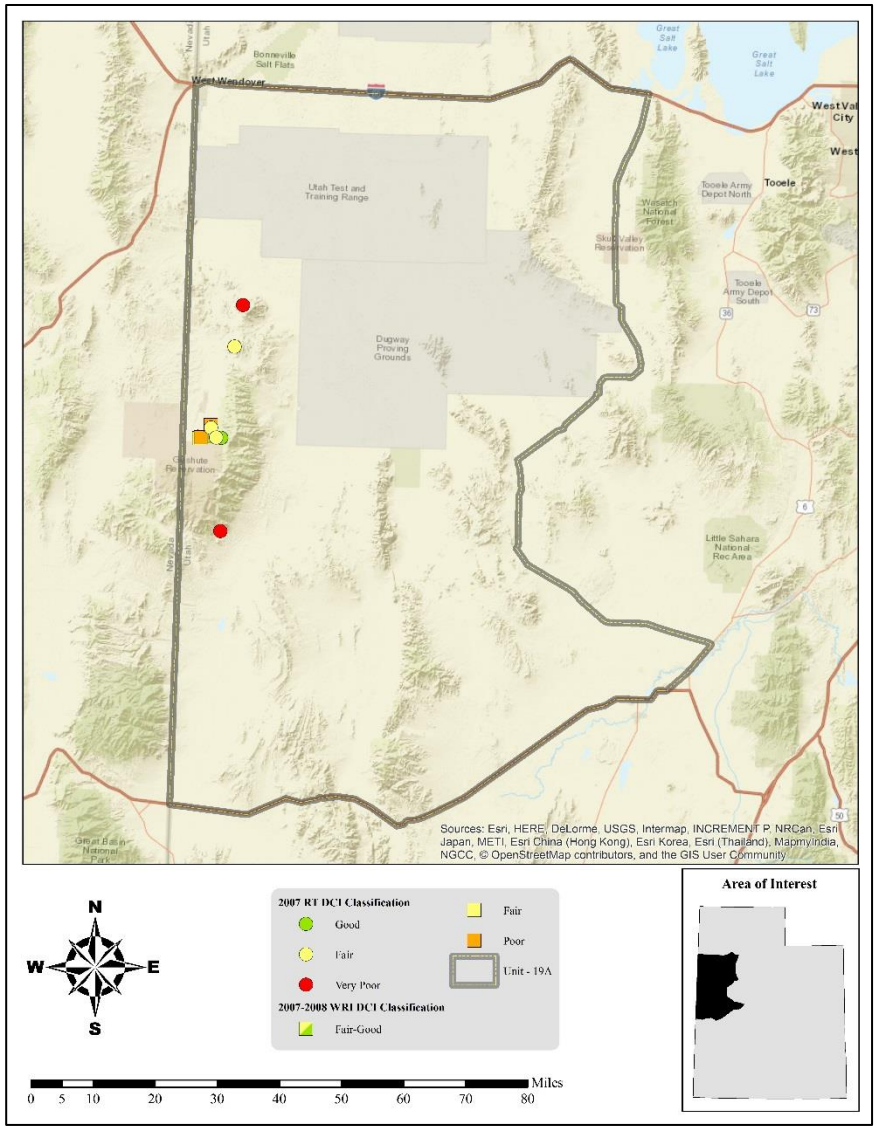
Table 3.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 19A, West Desert - Deep Creek. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



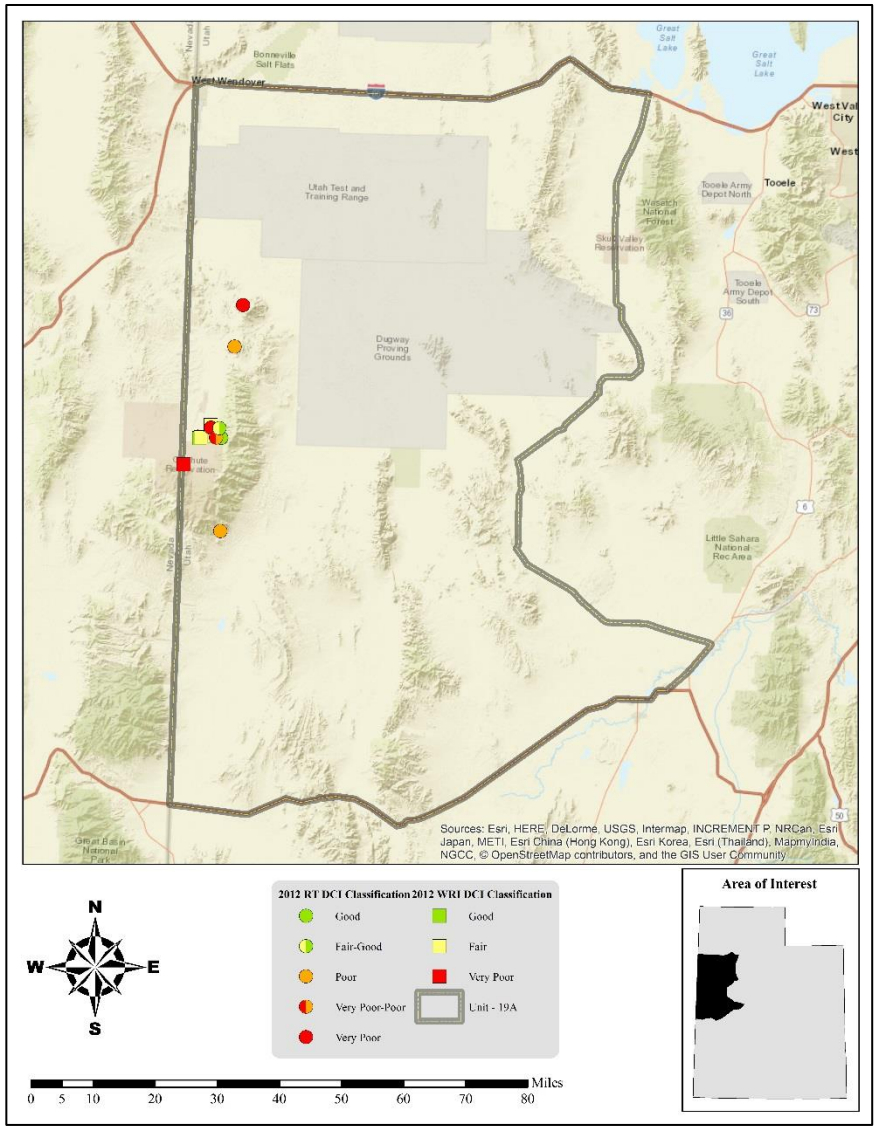
Map 3.9: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 19A, West Desert - Deep Creek.



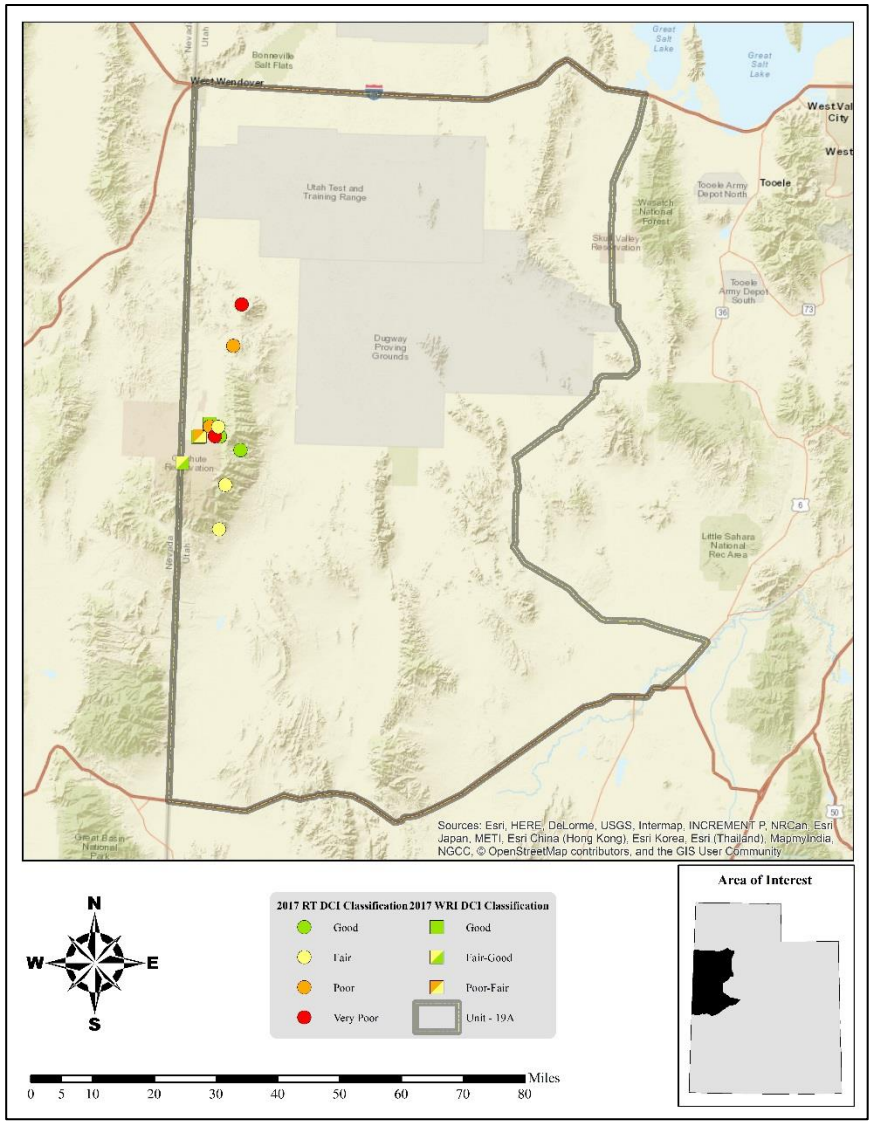
Map 3.10: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 19A, West Desert - Deep Creek.



Map 3.11: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 19A, West Desert - Deep Creek.



Map 3.12: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 19A, West Desert - Deep Creek.



Map 3.13: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 19A, West Desert - Deep Creek.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
19A-1	Trail Gulch	Annual Grass	Medium	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19A-2	Ochre Mountain	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19A-4	Durse Canyon	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
19A-6	Granite Creek	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19A-7	Wood Canyon	Annual Grass	Medium	Increased Fire Potential
19A-8	The Basin	Annual Grass	Low	Increased Fire Potential
19A-9	Rocky Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19A-10	Rocky Spring	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19A-11	Ibapah Harrow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-1	West Lee's Creek	Annual Grass	Medium	Increased Fire Potential
19R-2	Deep Creek Aerator	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-3	Deep Creek Drill	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-5	Goshute Chaining	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19R-14	Ibapah Harrow	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-16	Benmore Harrow	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species

Table 3.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 19A, West Desert - Deep Creek. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies within the Mountain (Big Sagebrush) ecological type are considered to be in very poor to good condition for deer winter range on the unit. These communities support sagebrush populations and understories that provide browse to wildlife. The two sites (Rocky Canyon and Rocky Spring) on the west side of the mountains are ecologically threatened compared to the two sites (Granite Creek and The Basin) on the east side as they have significant cover of introduced annual and perennial grasses. The herbaceous understories of the two east side sites are in good condition with a robust and diverse variety of perennial forbs and grasses.

Conifer communities are present on these studies and treatments (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in these communities where it is feasible. The studies on the west side of the mountains have significant presence of annual grasses and introduced perennial grasses; treatments to reduce these grasses are advisable in areas where the ecological integrity is threatened. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies that are considered to be of the Upland (Big Sagebrush) ecological type are considered to be in poor condition for deer winter range within the unit. The plant communities on these sites support sagebrush populations and understories that provide browse to wildlife. The herbaceous understories of these sites are host to high levels of annual grass which raises the risk of severe wildfire.

Conifer communities are present on these ecological sites and tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in these communities where and when feasible. Treatment to

reduce annual grasses may be advisable in areas where ecological integrity is threatened. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Cliffrose)

The studies within the Upland (Cliffrose) ecological type are considered to be in very poor to fair condition for deer winter range. The cliffrose communities on these sites support browse populations that provide good winter browse for wildlife. The understories for these sites are mostly depleted, with increased annual grass levels present on the Trail Gulch study.

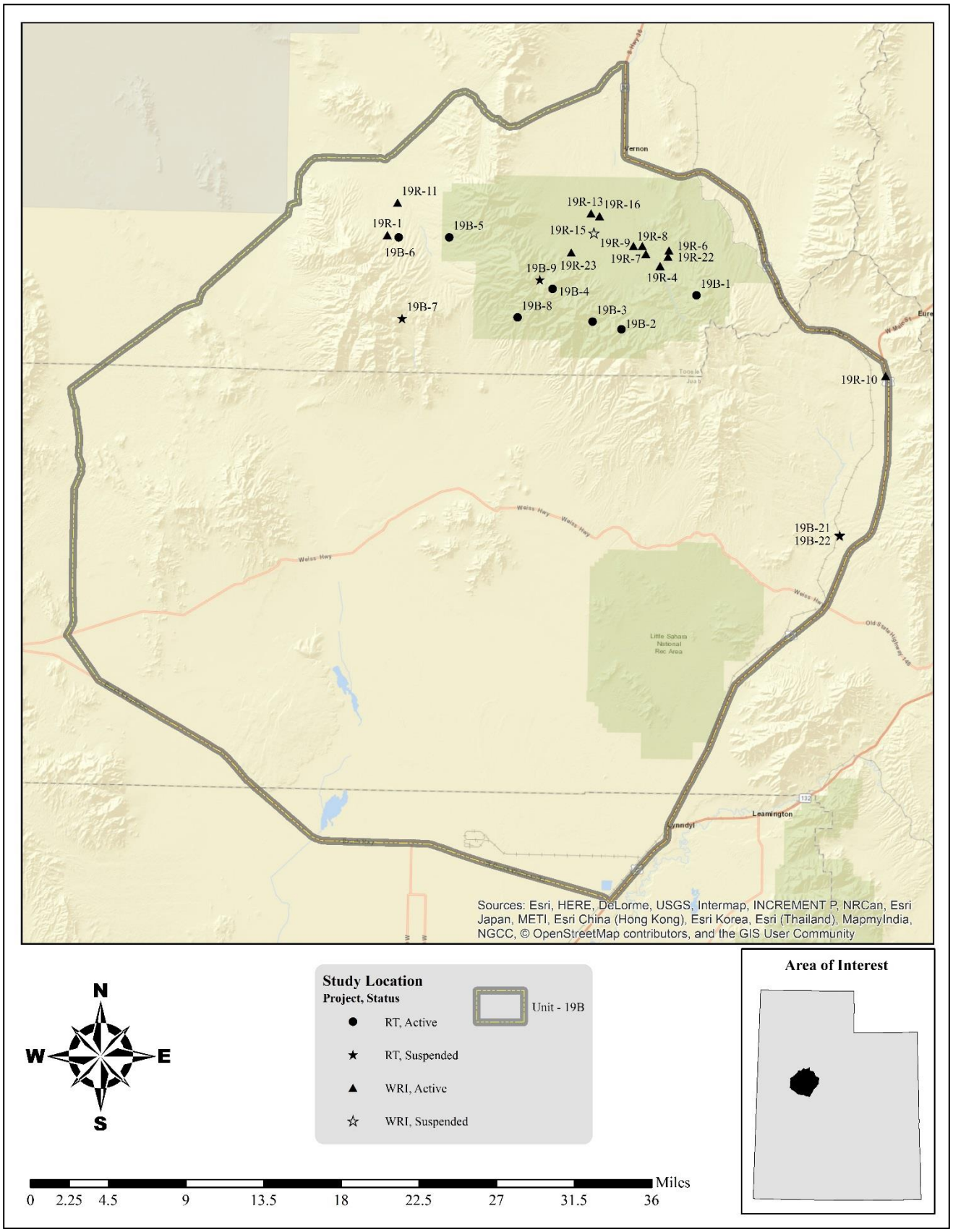
Conifer communities are present on these ecological sites with the Durse Canyon site being in Phase III of woodland encroachment. Treatments to reduce trees (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in areas where it is feasible in order to restore browse communities. Treatments to reduce undesirable grasses may be necessary in areas with high cover. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Semidesert (Black Sagebrush)

The study that is considered to be a Semidesert (Black Sagebrush) ecological site is considered to be in poor condition for deer winter range on the unit. Communities of this ecological type often support sagebrush populations that provide browse for wildlife. The herbaceous understory is in good condition, with only a small amount of cheatgrass being observed. While currently only in Phase I of pinyon-juniper encroachment, this study is at risk of further encroachment in the future, which can reduce shrub and herbaceous health and productivity if not addressed.

While the conifer community at this particular study is currently small, it is recommended that work to prevent future pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) begin if and when necessary. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

4. WILDLIFE MANAGEMENT UNIT 19B – WEST DESERT - VERNON



WILDLIFE MANAGEMENT UNIT 19B – WEST DESERT - VERNON

Boundary Description

> **Juab, Millard and Tooele** counties—Boundary begins at SR-36 and the Pony Express road; south on SR-36 to US-6; southwest on US-6 to SR-174 (the IPP road); northwest on SR-174 to the Dugway Valley road; north on this road to the Pony Express road; northeast on this road to SR-36. USGS 1:100,000 Maps: Lynndyl, Delta, Fish Springs, Rush Valley.

Management Unit Description

Geography

The West Desert - Vernon unit has a variety of terrain with a small amount of the unit being suitable big game habitat. Most of the unit is publicly managed, with the United States Forest Service (USFS) managing most of the summer range and the Bureau of Land Management (BLM) managing most of the winter range. Most of the public land in the Sheeprock range is managed by the USFS, while the BLM manages most of the West Tintic and Simpson Mountains.

The Sheeprock and Tintic Mountains run north to south on the north end of the unit. The highest point is Black Crook Peak at 9,264 feet. The Simpson Mountains sit on the northwest part of the unit between 7,000 and 8,000 feet. The Simpson and West Tintic Mountains have mostly gentle topography and are shallowly sloped at the base. The Sheeprock Mountains are more rugged with steeper canyons running to the peaks. Towns located within the management unit include Lynndyl and Vernon.

Climate Data

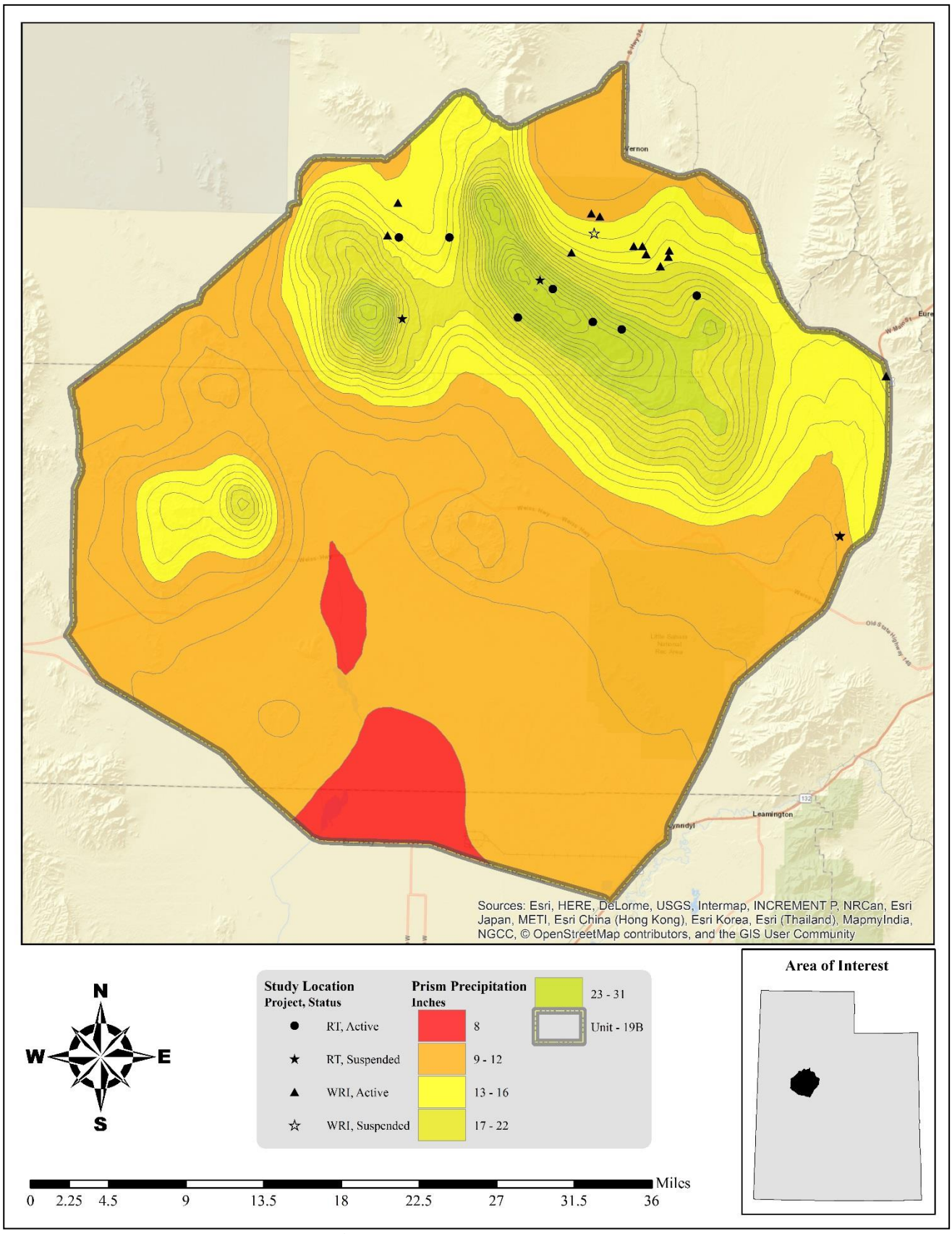
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches near Delta and Crater Bench Reservoir to 31 inches on the peaks of the Simpson and Sheeprock Mountains. All of the Range Trend and WRI monitoring studies on the unit occur between 9-31 inches of precipitation (**Map 4.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Western, North Central, and South Central Mountains divisions (Divisions 1, 3, and 4).

The mean annual PDSI of the Western division displayed years of moderate to extreme drought from 1989-1990, 2000-2003, 2007-2008, 2012-2013, and 2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1985, 1993, 1995, 1997-1998, 2005, and 2011 (**Figure 4.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2001-2003, 2007-2008, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (**Figure 4.1b**).

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 4.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 4.2b**).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 4.3a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 4.3b**).



Map 4.1: The 1981-2010 PRISM Precipitation Model for WMU 19B, West Desert - Vernon (PRISM Climate Group, Oregon State University, 2013).

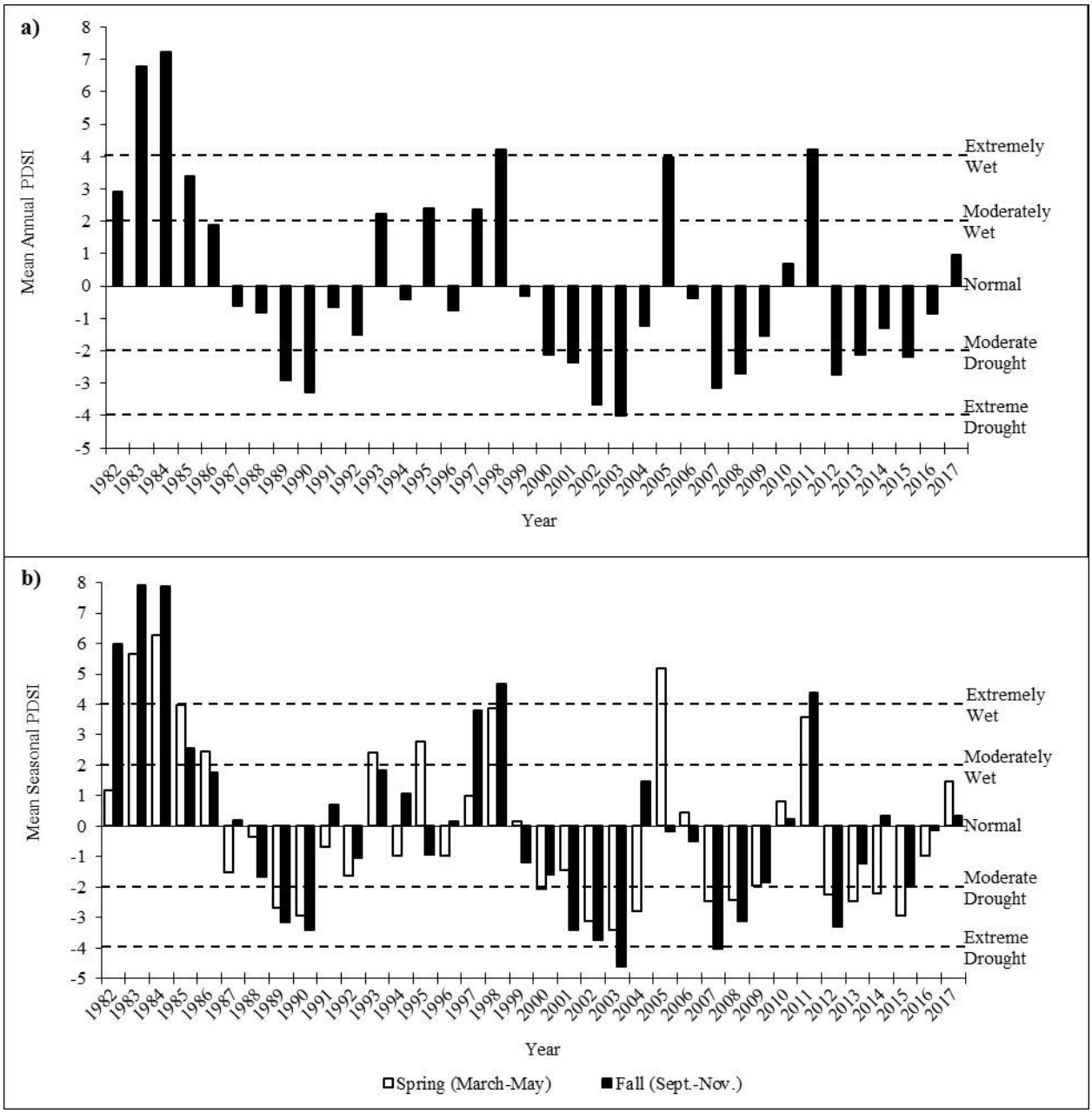


Figure 4.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

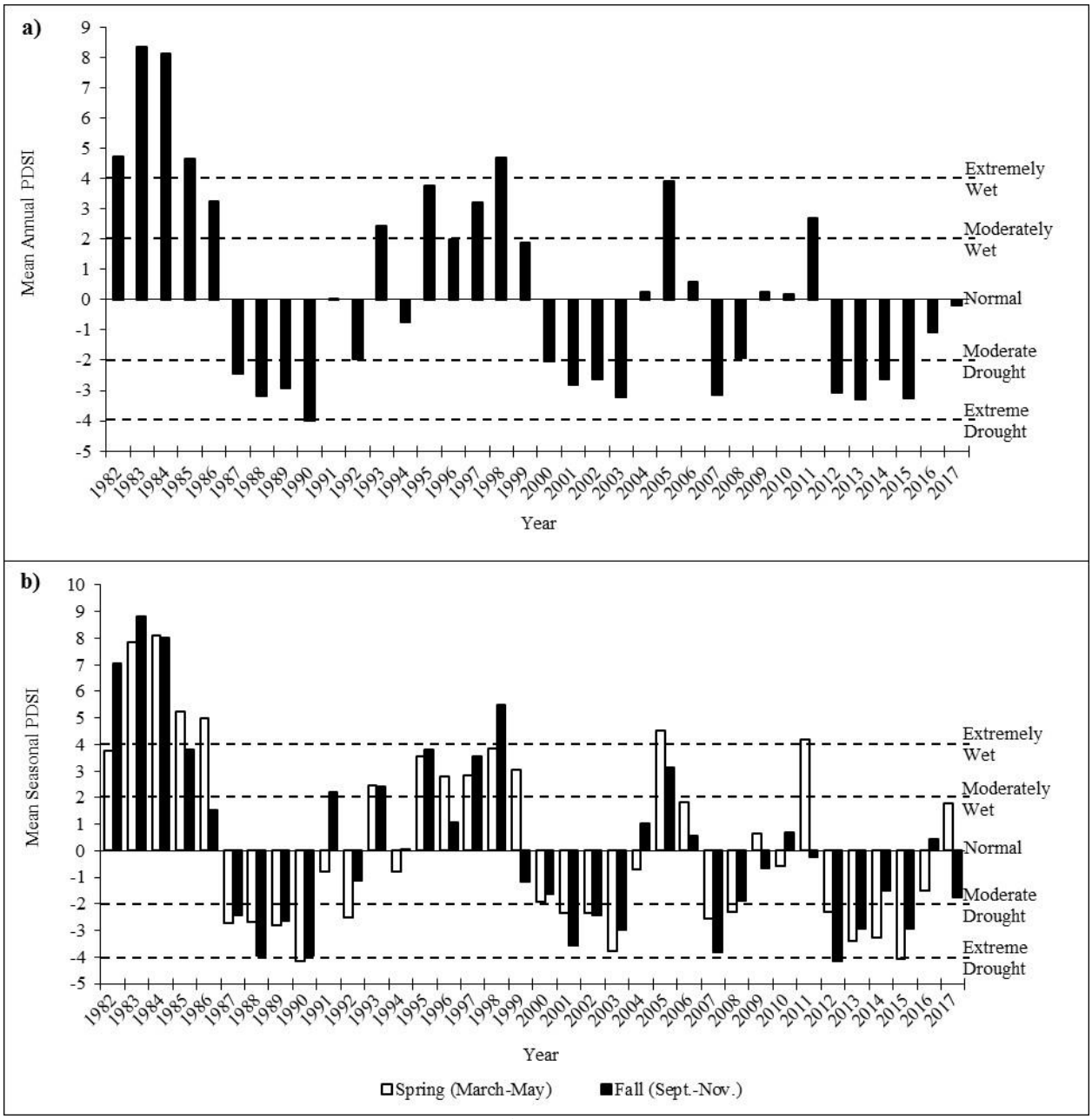


Figure 4.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

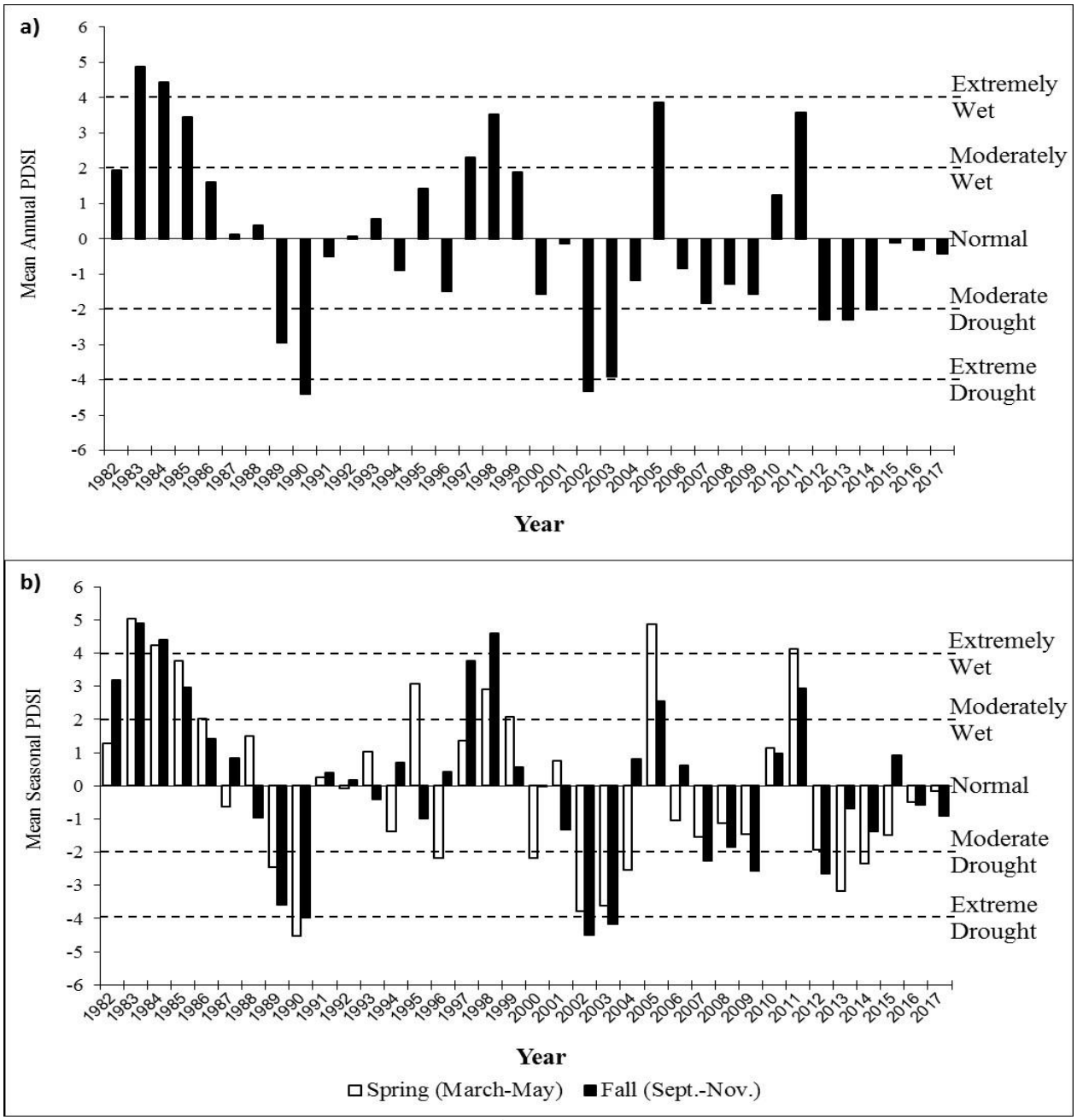


Figure 4.3: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

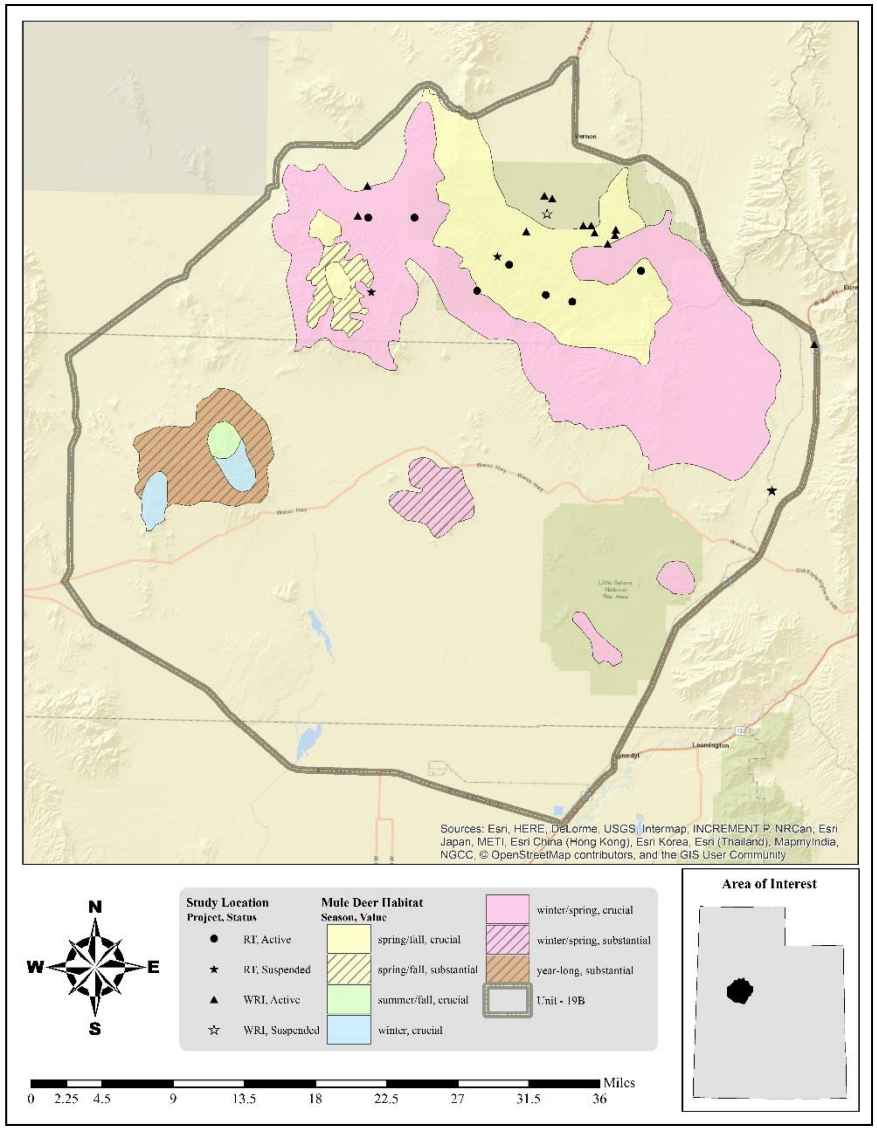
Big Game Habitat

There are an estimated 282,808 acres classified as deer range within Unit 19B with 60% classified as winter/spring range, 28% as spring/fall range, 8% as year-long range, 2% as winter range, and 1% as summer/fall range (Table 4.1, Map 4.2). Most of the unit consists of winter/spring range, and of this the Bureau of Land Management (BLM) manages 64%, 15% is privately held, the United States Forest Service (USFS) manages 14%, and the School and Institutional Trust Lands Administration (SITLA) manages 7%.

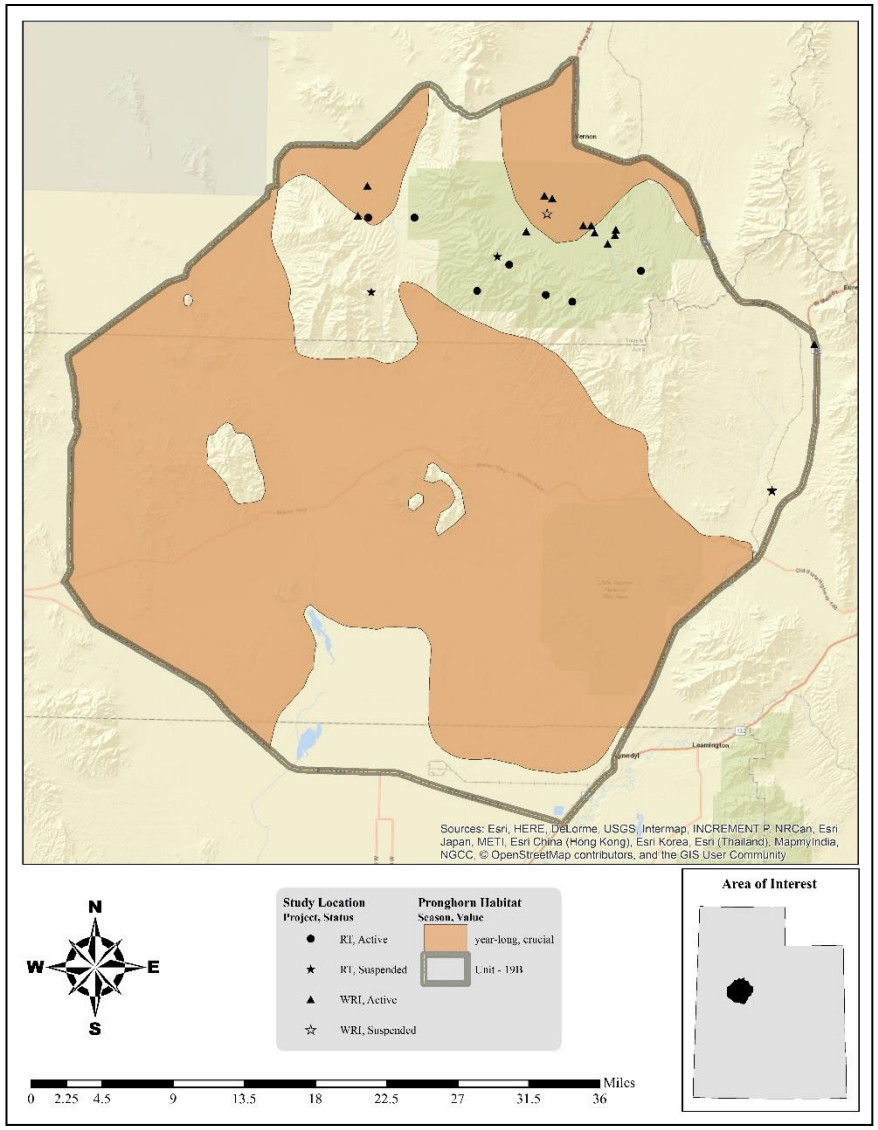
Deer winter range mainly follows the foothills of the Sheeprock and Simpson Mountains, with a stretch of winter habitat near Keg Mountain. The upper limit of normal deer winter range is around 7,000 feet and the

lower limit is around 5,500 feet. The unit is limited at the low elevation portions of the unit where the vegetation switches to the more unpalatable salt desert vegetation.

This unit contains mixed mountain brush and aspen communities at higher elevations that are summer and fall ranges: these communities support diverse understories, which are crucial for these ranges. However, this unit does not have significant amounts of summer range. Sagebrush-juniper and juniper communities are present at the edges of the winter range on this unit; in these ecological types, juniper trees do provide thermal cover, but they also pose a threat of encroachment.



Map 4.2: Estimated mule deer habitat by season and value for WMU 19B, West Desert - Vernon.



Map 4.3: Estimated pronghorn habitat by season and value for WMU 19B, West Desert - Vernon.

	Spring/Fall Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	79,986	28%	2,402	1%	5,959	2%	170,826	60%	23,636	8%
Pronghorn	0	0%	0	0%	0	0%	0	0%	624,355	100%

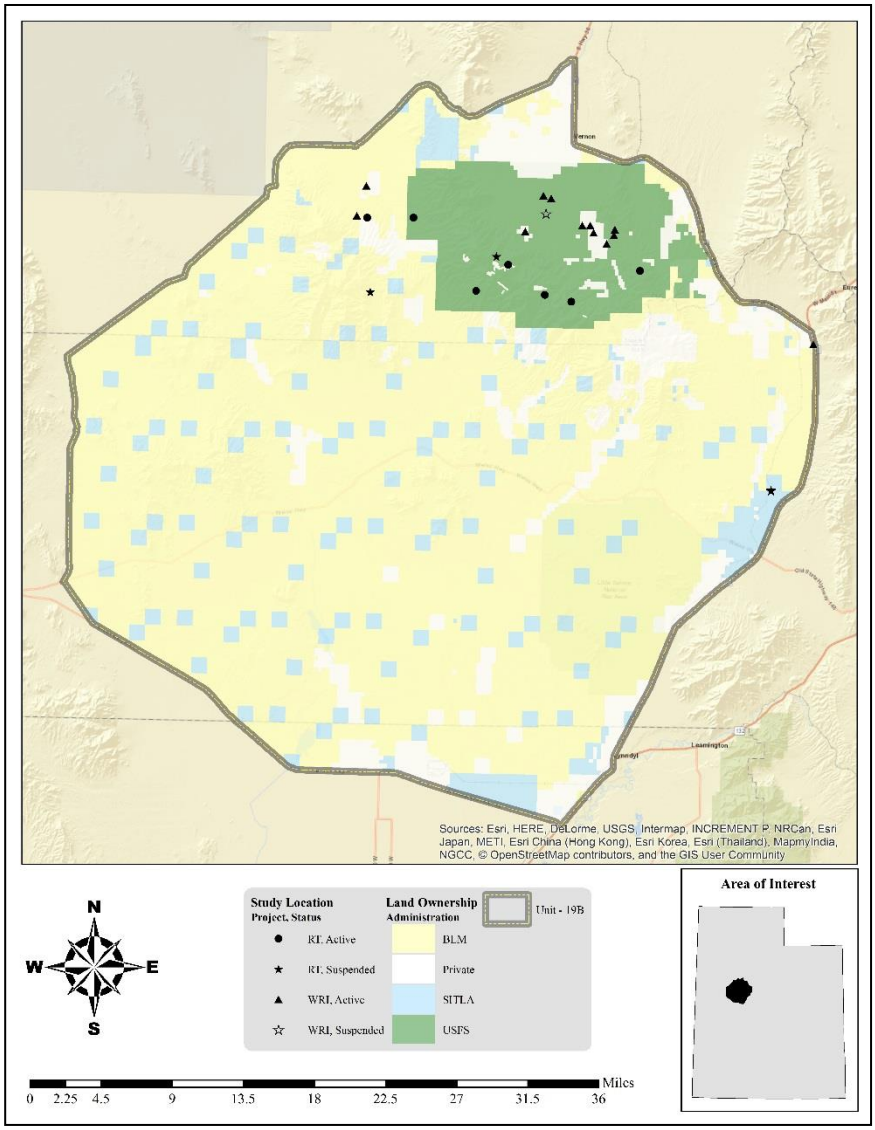
Table 4.1: Estimated mule deer and pronghorn habitat acreage by season for WMU 19B, West Desert - Vernon.

	Spring/Fall Range		Summer/Fall Range		Winter Range		Winter/Spring Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	19,374	24%	2,013	84%	5,277	89%	109,711	64%	20,963	89%
Private	7,032	9%	0	0%	0	0%	25,355	15%	0	0%
SITLA	4414	6%	389	16%	681	11%	11,883	7%	2,673	11%
USFS	49,165	61%	0	0%	0	0%	23,878	14%	0	0%
Total	79,986	**100%**	2,402	**100%**	5,959	**100%**	170,826	**100%**	23,636	**100%**

Table 4.2: Estimated mule deer habitat acreage by season and ownership for WMU 19B, West Desert - Vernon.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	503,042	81%
Private	47,653	8%
SITLA	56,271	9%
USFS	17,390	3%
Total	624,355	**100%**

Table 4.3: Estimated pronghorn habitat acreage by season and ownership for WMU 19B, West Desert - Vernon.



Map 4.4: Land ownership for WMU 19B, West Desert - Vernon.

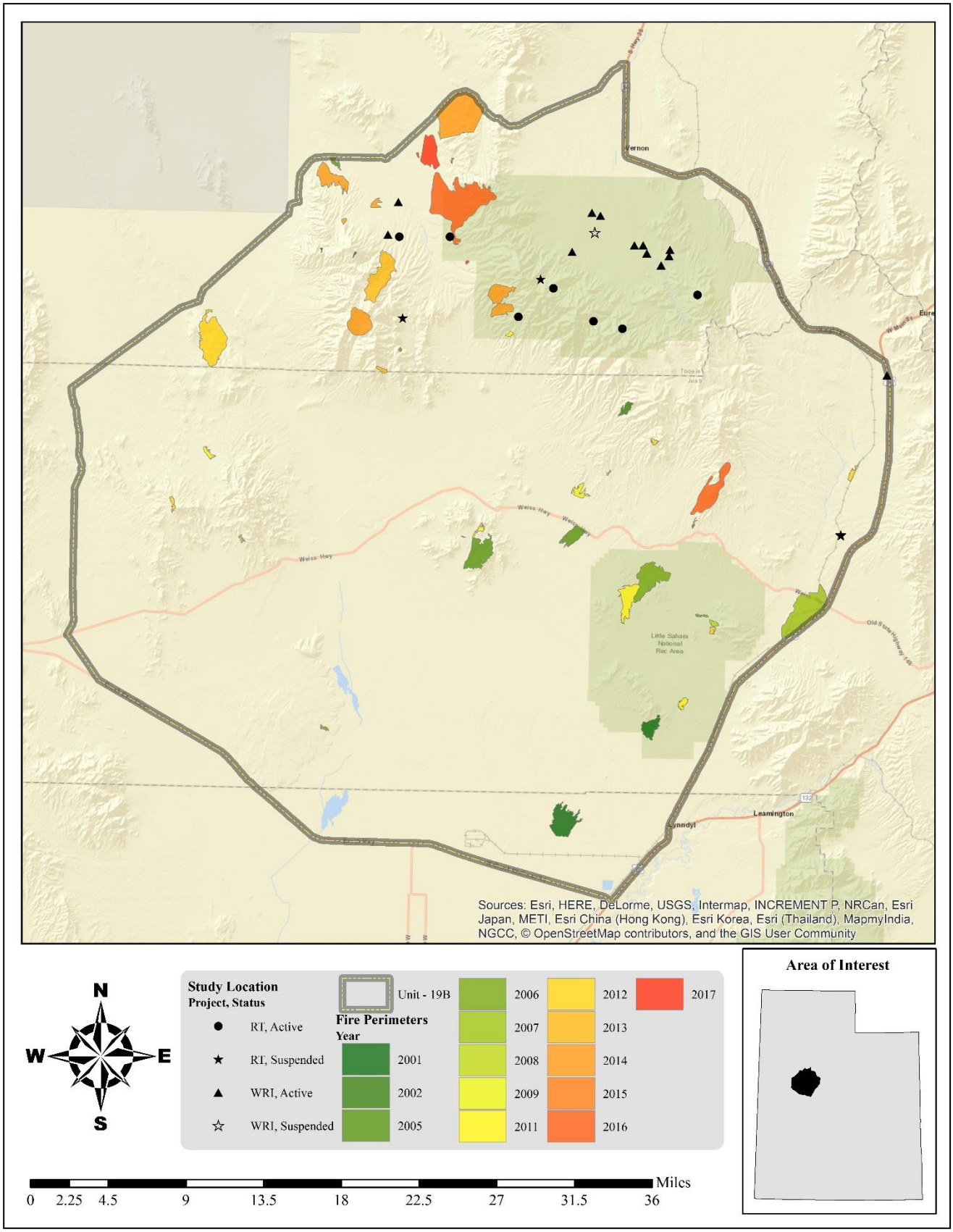
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	143,777	14.76%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	5,869	0.60%	
	Inter-Mountain Basins Juniper Savanna	4,177	0.43%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	130	0.01%	
	Other Conifer	110	0.01%	15.81%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	86,216	8.85%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	20,246	2.08%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	3,410	0.35%	11.28%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	1,820	0.19%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	444	0.05%	
	Southern Rocky Mountain Montane-Subalpine Grassland	317	0.03%	0.27%
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	296,162	30.41%	
	Inter-Mountain Basins Big Sagebrush Shrubland	130,170	13.37%	
	Great Basin Xeric Mixed Sagebrush Shrubland	83,223	8.55%	
	Inter-Mountain Basins Greasewood Flat	67,928	6.97%	
	Inter-Mountain Basins Big Sagebrush Steppe	35,621	3.66%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	11,390	1.17%	
	Quercus gambelii Shrubland Alliance	7,725	0.79%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	6,848	0.70%	
	Mojave Mid-Elevation Mixed Desert Scrub	2,127	0.22%	
	Rocky Mountain Lower Montane-Foothill Shrubland	546	0.06%	
	Inter-Mountain Basins Montane Sagebrush Steppe	351	0.04%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	296	0.03%	
	Other Shrubland	203	0.02%	65.99%
Other	Barren	37,748	3.88%	
	Developed	12,292	1.26%	
	Agricultural	6,183	0.63%	
	Sparsely Vegetated	3,786	0.39%	
	Hardwood	3,258	0.33%	
	Riparian	816	0.08%	
	Open Water	740	0.08%	6.65%
Total		973,929	100%	100%

Table 4.4: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 19B, West Desert - Vernon.

Limiting Factors to Big Game Habitat

Major human activities in the area include livestock grazing, off-road recreation, and some agriculture. In addition, encroachment by pinyon-juniper woodland communities poses a threat to important sagebrush rangelands. There has been significant work in this unit to reduce tree cover in order to improve sage grouse habitat. According to the current Landfire Existing Vegetation Coverage model, 14.76% of the West Desert - Vernon unit is comprised of pinyon-juniper woodlands. Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000).

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). According to the current Landfire Existing Vegetation Coverage model, 11.28% of the unit is comprised of exotic herbaceous species (**Table 4.4**). Increased amounts of cheatgrass increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 4.5: Land coverage of fires by year from 2000-2018 for WMU 19B, West Desert - Vernon (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

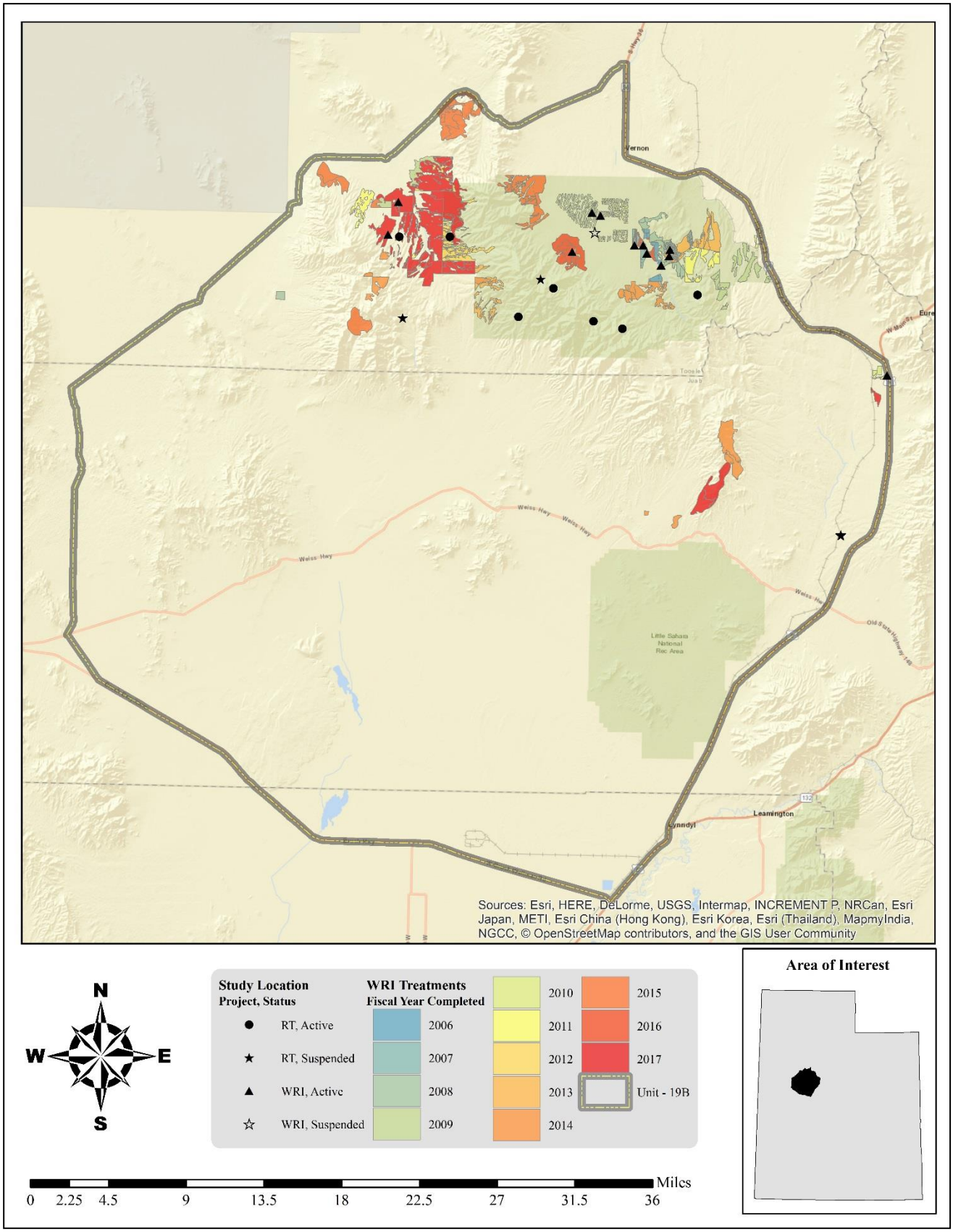
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 43,215 acres of land have been treated within the Vernon subunit since the WRI was implemented in 2004 (**Map 4.6**). An additional 11,591 acres are currently being treated and treatments have been proposed for 13,384 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 62,524 acres for this unit (**Table 4.5**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Lop and scatter as well as bullhog treatments are common treatments across the unit. Anchor chaining is also commonly used. Seeding to supplement the herbaceous understory is frequently combined with some of the conifer removal projects (**Table 4.5**). Other treatments include (but are not limited to): disking, harrow, herbicide application, mowing, and road decommissioning.

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**4,609**	**1,474**	**0**	**6,083**
Ely (One-Way)	4,014	471	0	4,485
Ely (Two-Way)	595	1,003	0	1,598
Bullhog	**13,169**	**6,155**	**5,642**	**24,966**
Full Size	12,358	6,155	5,642	24,156
Skid Steer	810	0	0	810
Disc	**41**	**0**	0	**41**
Off-Set (Two-Way)	41	0	0	41
Harrow	**2,092**	**0**	0	**2,092**
≤ 15 ft. (One-Way)	117	0	0	117
≤ 15 ft. (Two-Way)	162	0	0	162
> 15 ft. (Two-Way)	1,813	0	0	1,813
Herbicide Application	**999**	**248**	**0**	**1,247**
Aerial (Fixed-Wing)	623	248	0	871
Ground	377	0	0	377
Mowing	**30**	**0**	0	**30**
Other	30	0	0	30
Road Decommissioning	**2**	**0**	0	**2**
Seeding (Primary)	**7,353**	**399**	**1,612**	**9,363**
Broadcast (Aerial Fixed-Wing)	3,020	0	1,612	4,632
Broadcast (Aerial Helicopter)	3,252	0	0	3,252
Drill (Rangeland)	698	399	0	1,096
Drill (Truax)	383	0	0	383
Vegetation Removal/Hand Crew	**14,919**	**3,315**	**6,130**	**24,364**
Lop and Scatter	14,919	3,315	6,130	24,364
Total Treatment Acres	**43,215**	**11,591**	**13,384**	**68,190**
***Total Land Area Treated**	**37,549**	**11,591**	**13,384**	**62,524**

Table 4.5: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 19B, West Desert - Vernon. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 4.6: WRI treatments by fiscal year completed for WMU 19B, West Desert - Vernon.

Range Trend Studies

Range Trend studies have been sampled within WMU 19B on a regular basis since 1983, with studies being added or suspended as was deemed necessary (**Table 4.6**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 4.7**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
19B-1	Sabie Mountain	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
19B-2	Upper Little Valley	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Browse)
19B-3	Bennion Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Stony Loam (Browse)
19B-4	Harker Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Browse)
19B-5	West Government Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Loam (Mountain Big Sagebrush)
19B-6	Lee's Creek	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Loam (Mountain Big Sagebrush)
19B-7	Judd Creek	RT	Suspended	'97, '02, '07	Not Verified
19B-8	South Pine Canyon	RT	Active	'83, '89, '02, '07, '12, '17	Mountain Shallow Loam (Mountain Big Sagebrush)
19B-9	North Oak Brush Canyon	RT	Suspended	'89, '97	Not Verified
19B-21	Jericho State Section	RT	Suspended	'98, '02, '07	Not Verified
19B-22	Jericho BLM	RT	Suspended	'98, '02, '07, '12	Semidesert Loam (Wyoming Big Sagebrush)
19R-1	West Lee's Creek	WRI	Active	'04, '07, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-4	Bennion Chaining	WRI	Active	'05, '10, '15	Upland Gravelly Loam (Wyoming Big Sagebrush)
19R-6	Sage Valley Dixie	WRI	Active	'06, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-7	Bennion Sagebrush Chaining	WRI	Active	'06, '10, '14	Not Verified
19R-8	Bennion Spike 1	WRI	Active	'06, '10, '14	Not Verified
19R-9	Bennion Spike 2	WRI	Active	'06, '10, '14	Upland Loam (Wyoming Big Sagebrush)
19R-10	Tintic Knapweed Control	WRI	Active	'08, '11, '15	Upland Loam (Wyoming Big Sagebrush)
19R-11	James Ranch Bullhog	WRI	Active	'08, '11, '15	Upland Loam (Wyoming Big Sagebrush)
19R-13	Diagonal/Electric Harrow	WRI	Active	'08, '09, '10, '14	Upland Loam (Wyoming Big Sagebrush)
19R-15	Benmore Reference	WRI	Suspended	'09	Not Verified
19R-16	Benmore Harrow	WRI	Active	'09, '12, '17	Upland Loam (Mountain Big Sagebrush)
19R-22	East Vernon Bullhog	WRI	Active	'12, '15	Upland Gravelly Loam (Bonneville Big Sagebrush)
19R-23	Lion Hill	WRI	Active	'15	Upland Loam (Mountain Big Sagebrush)

Table 4.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 19B, West Desert - Vernon.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
19B-5	West Government Creek	Chain Unknown Seed Unknown Lop and Scatter	West Government	July 2011	1,613	2024
19B-6	Lee's Creek	Two-Way Chain Unknown Aerial Before	James Seeding James Seeding	August 1970 August 1970	1,500 1,500	
19B-21	Jericho State Section	Wildfire Aerial	Leamington Burn Complex	1996	138,340	
19B-22	Jericho BLM	Wildfire One-Way Ely Chain Aerial Before Dribbler	Leamington Burn Complex	1996 After Fire After Fire After Fire	138,340	

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
19R-1	West Lee's Creek	Two-Way Chain	James Seeding	August 1970	1,500	
		Unknown				
		Aerial Before	James Seeding	August 1970	1,500	
		Bullhog	Lee Canyon HFR	November 2004	700	PDB
		Aerial Before	Lee Canyon HFR	November 2004	700	PDB
		Bullhog	Lee Canyon HFR	May 2009	720	PDB
19R-4	Bennion Chaining	Lop and Scatter	Bennion Ranch Lop and Scatter	May 2016	1,047	3408
		Two-Way Smooth Chain	Bennion Ranch Sage Grouse Demonstration Year 1	Fall 2005/2006	450	55
		Aerial Before	Bennion Ranch Sage Grouse Demonstration Year 1	Fall 2005/2006	450	55
		Dribbler	Bennion Ranch Sage Grouse Demonstration Year 1	Fall 2005/2006	450	55
		Aerial After	Bennion Ranch Sage Grouse Demonstration Year 1	Fall 2005/2006	450	55
19R-5	Goshute Chaining	Two-Way Ely/Smooth Chain	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	May 2006	776	354
		Aerial Before	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	November 2006	776	354
		Dribbler	Discretionary Seed for Goshute Reservation Pinyon Juniper Chaining Project	December 2006	776	354
19R-6	Sage Valley Dixie	Two-Way Dixie Harrow	Sage Valley/Vernon Sagebrush Enhancement-Year 1	October 2006	162	291
		Broadcast Before	Sage Valley/Vernon Sagebrush Enhancement-Year 1	October 2006	162	291
19R-7	Bennion Sagebrush Chaining	Two-Way Ely Chain	Bennion Ranch Sage Grouse Demonstration Year 2		192	396
		Aerial Before	Bennion Ranch Sage Grouse Demonstration Year 2		192	396
19R-7	Bennion Sagebrush Chaining	Dribbler	Bennion Ranch Sage Grouse Demonstration Year 2		192	396
		Broadcast After	Bennion Ranch Sage Grouse Demonstration Year 2		192	396
19R-8	Bennion Spike 1	Herbicide	Bennion Ranch Sage Grouse Demonstration Year 2	Fall 2006	158	396
19R-9	Bennion Spike 2	Herbicide	Bennion Ranch Sage Grouse Demonstration Year 2	Fall 2006	158	396
19R-10	Tintic Knapweed Control	Herbicide - Plateau, Milestone	Tintic Junction Knapweed Control and Habitat Improvement Project	Summer 2010	53	1348
		Herbicide	Tintic Junction Knapweed Control and Habitat Improvement Project	Summer 2009	55	1102
		Prescribed Fire	Tintic Junction Knapweed Control and Habitat Improvement Project	October 2008	55	1102
		Rangeland Drill	Tintic Junction Knapweed Control and Habitat Improvement Project	November 2008	55	1102
19R-11	James Ranch Bullhog	Bullhog	James Ranch Juniper Bullhog		473	1131
19R-13	Diagonal/ Electric Harrow	Two-Way Dixie Harrow	Diagonal-Electric Sagebrush Improvement	Fall 2008	993	659
		Broadcast Before	Diagonal-Electric Sagebrush Improvement	Fall 2008	993	659
19R-14	Ibapah Harrow	Two-Way Dixie Harrow	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
		Broadcast Before	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
19R-16	Benmore Harrow	Two-Way Chain Harrow	Benmore Pastures Dixie Harrow Project	October 2009	731	1361
		Broadcast Before	Benmore Pastures Dixie Harrow Project	October 2009	731	1361
19R-20	East Pasture Harrow	2-way Dixie Harrow	Deep Creek East Pasture Habitat Enhancement		145	662
		Broadcast Before	Deep Creek East Pasture Habitat Enhancement		145	662
19R-22	East Vernon Bullhog	Bullhog	East Vernon Habitat Restoration	September 2012	413	2292

Table 4.7: Range trend and WRI studies known disturbance history for WMU 19B, West Desert - Vernon.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are two study sites [Sabie Mountain (19B-1) and South Pine Canyon (19B-8)] that are classified as Mountain (Big Sagebrush) ecological sites. The Sabie Mountain study is located in the West Tintic Mountains southeast of Vernon. The South Pine Canyon study site is in the Sheeprock Mountains south of Erickson Pass.

Shrubs/Trees: The dominant browse species on the two sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) with lesser amounts of Utah serviceberry (*Amelanchier utahensis*), antelope bitterbrush (*Purshia tridentata*), and Wood's rose (*Rosa woodsii*). The cover of both sagebrush and other preferred browse has steadily increased over time (**Figure 4.4**). Density of sagebrush has exhibited a slight increase, with the population primarily comprised of mature plants (**Figure 4.7**). The utilization of browse has fluctuated with most of the usage being light and moderate, although in 2002 almost half of the utilization was heavy (**Figure 4.8**).

Tree cover for the sites has been low with little fluctuation. Both Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*) exhibited slight variations in density, but density has been stable overall (**Figure 4.5**, **Figure 4.6**).

Herbaceous Understory: Nested frequency and cover have displayed an increasing trend, although the composition of the understory has varied. Annual grasses and forbs have fluctuated but have shown a general increase: the South Pine Canyon site was the primary driver of this trend. While annual grasses have been the dominant component of the sites, perennial grasses and forbs have been consistently increasing; the perennial grass component is primarily comprised of native species (**Figure 4.9 Figure 4.10**).

Occupancy: Pellet transect data has shown that deer are the main occupants of the study sites with average pellet group abundance varying from 36 days use/acre in 2002 to 7 days use/acre in 2012. Elk use is varied with 0 days use/acre noted in 2002 and 2012 and up to 8 days use/acre in 2007. Mean abundance of cattle pellet groups has ranged from 1 day use/acre in 2012 to 8 days use/acre in 2017 (**Figure 4.11**).

Mountain (Browse)

There are three study sites [Upper Little Valley (19B-2), Bennion Creek (19B-3) and Harker Canyon (19B-4)] that are classified as Mountain (Browse) ecological sites. All three of these sites are located south of Vernon in the Sheeprock Mountains.

Shrubs/Trees: The browse species present on these sites are co-dominated by Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), and Wood's rose (*Rosa woodsii*). Cover of sagebrush and other preferred browse species has increased significantly (**Figure 4.4**). The utilization of browse has decreased significantly with the number of plants with heavy utilization decreasing to a small percentage (**Figure 4.7**). The preferred browse age class demographics has remained largely consistent with most of the population being composed of mature individuals, while the numbers of decadent plants has slightly decreased (**Figure 4.8**).

Herbaceous Understory: The herbaceous understories have increased in cover over the study years. All sites have shown consistent increases in perennial grasses and forbs.The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has shown consistent increases in cover since first sampled in 2007, and it has been observed on all sites in this ecological type. In addition, cover of annual grasses has exhibited increases in each consecutive sampling year (**Figure 4.9**, **Figure 4.10**).

Occupancy: Average pellet transect data shows that the deer are the primary occupants of these study sites with a mean pellet group abundance that has varied from 11 days use/acre in 2012 to 31 days use/acre in 2002. Elk usage has generally been low with less than 1 day use/acre in 2012 and 2017 and a high of 6 days use/acre

being sampled in 2007. Mean abundance of cattle pellet groups has ranged from a low of less than 2 days use/acre in 2012 to a high of 12 days use/acre in 2002 (**Figure 4.11**).

Upland (Big Sagebrush)

There are two sites [West Government Creek (19B-5) and Lee's Creek (19B-6)] that are classified as Upland (Big Sagebrush) ecological sites. West Government Creek is located on the foothills of the Sheeprock Mountains north of Erickson Pass. Lee's Creek is located at the base of the Simpson Mountains north of Erickson Pass.

Shrubs/Trees: The dominant browse species present on these sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with lesser amounts of cover provided by antelope bitterbrush (*Purshia tridentata*). Overall cover of preferred browse has been stable with little fluctuation noted between years (**Figure 4.4**). Utilization of browse has decreased since 2007 with most of the plants being not used or lightly used in 2012 and 2017 (**Figure 4.7**). Average preferred browse demographic data shows that the recruitment of young plants has exhibited a steady decrease and that the majority of plants are mature individuals as of the most recent sample year (**Figure 4.8**).

Utah juniper (*Juniperus osteosperma*) is the tree species present on this site, the cover of which has shown slight increases: the Lee's Creek site is the primary influence of this trend. While cover has increased, density has shown slight decreases which might indicate a transition to a later phase of PJ encroachment (**Figure 4.5**, **Figure 4.6**)

Herbaceous Understory: The herbaceous understory of these sites is dominated by perennial grasses and forbs. The main perennial grasses are the introduced perennial species crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*), although native species are also present on both study sites. Annual grasses are present on these sites, but are sparse in both cover and frequency. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) was sampled on West Government Creek for the first time in 2017 (**Figure 4.9**, **Figure 4.10**).

Occupancy: Pellet transect data shows that deer and cattle are the primary occupants on the site. Mean pellet group abundance of deer has displayed a low of 4 days use/acre in 2012 and a high of 25 days use/acre in 2007. Elk usage was only noted in 2007 with 1 day use/acre. Finally, mean abundance of cattle pellet groups on the site has ranged from 0 days use/acre noted in 2012 to 35 days use/acre in 2017 (**Figure 4.11**).

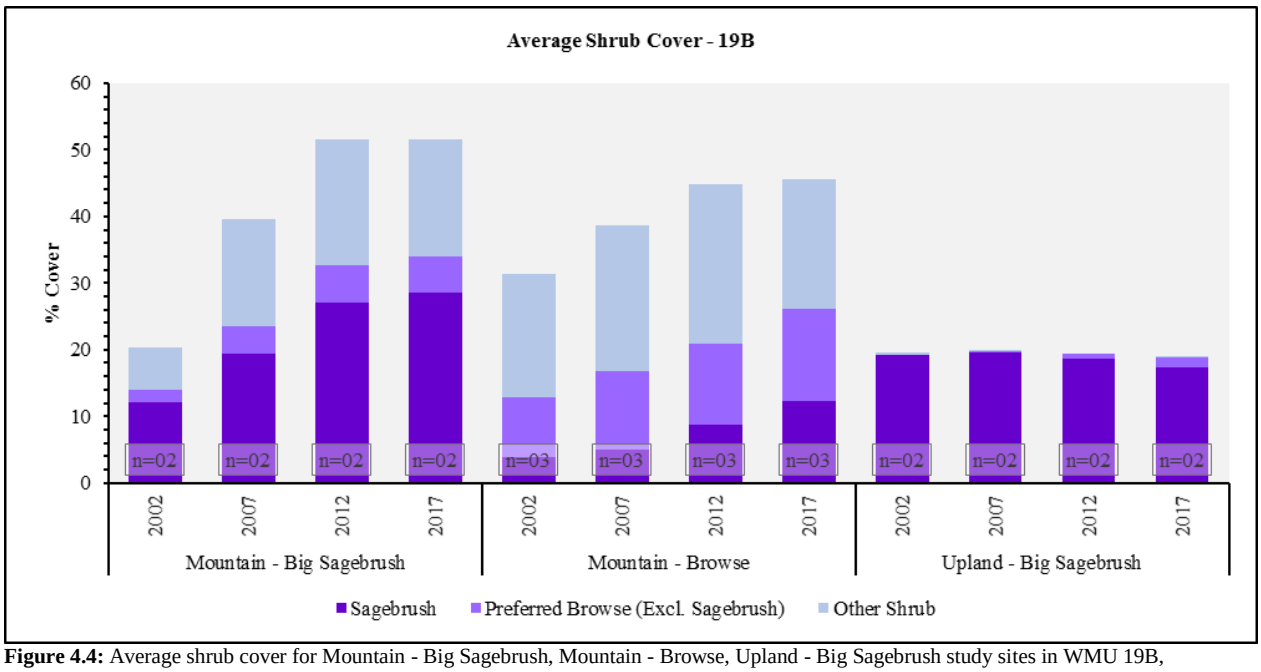


Figure 4.4: Average shrub cover for Mountain - Big Sagebrush, Mountain - Browse, Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

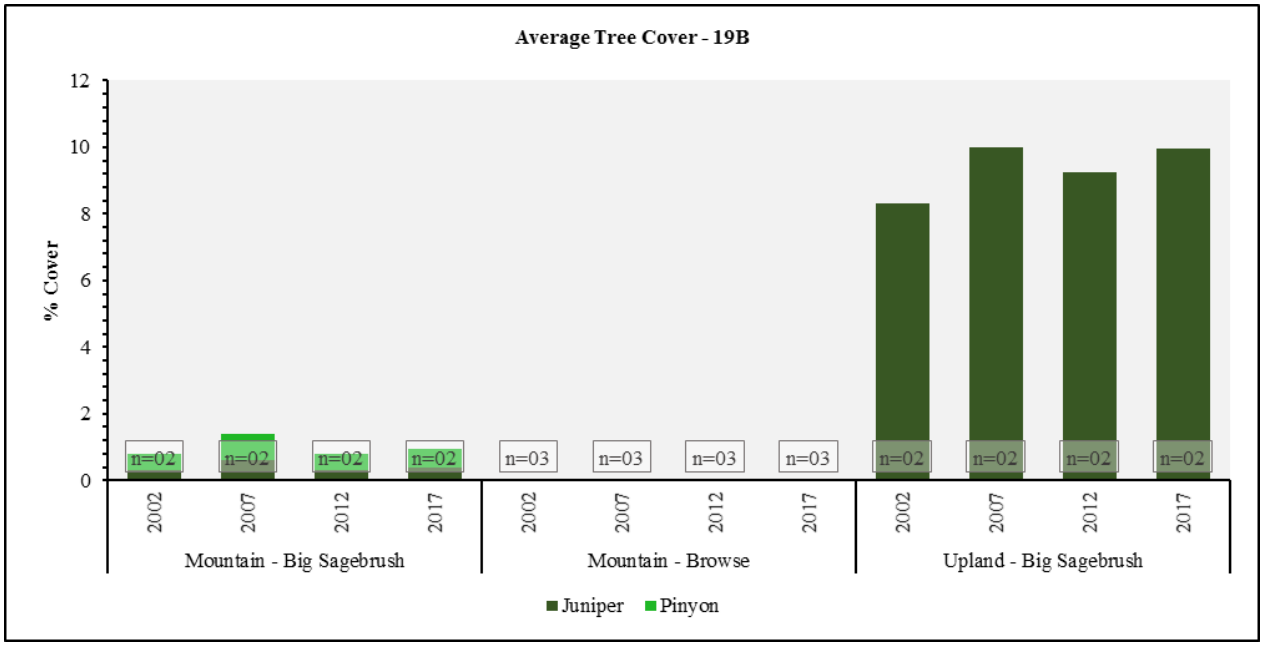


Figure 4.5: Average tree cover for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

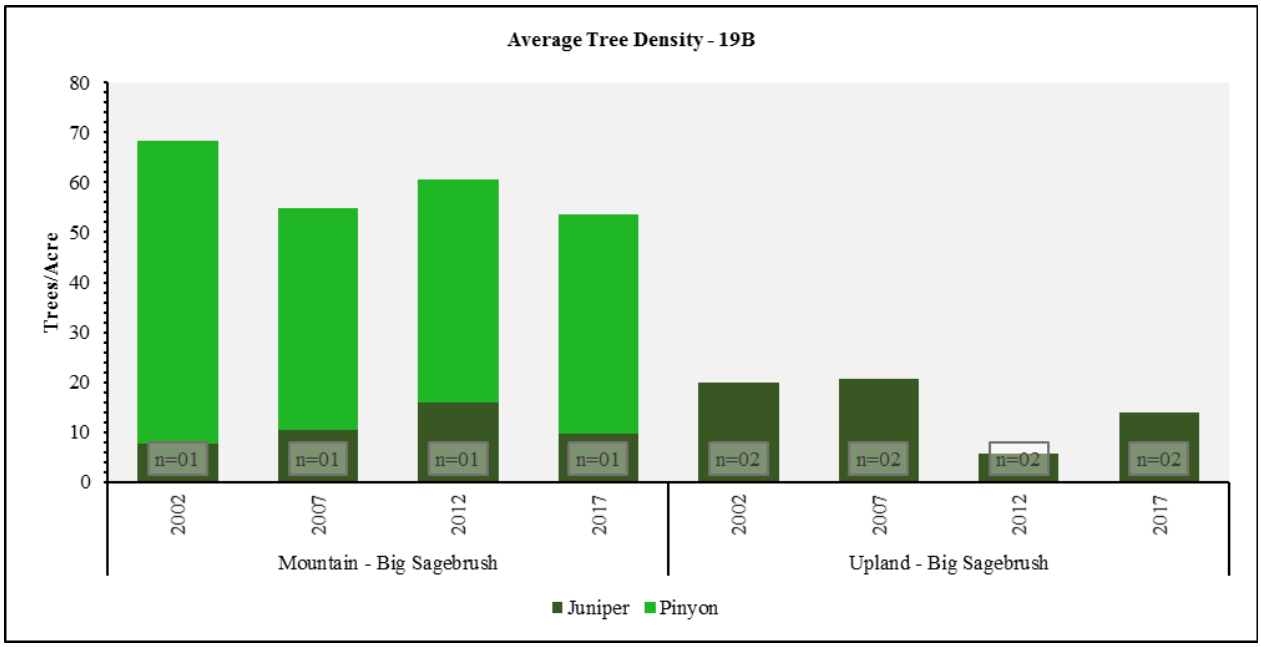


Figure 4.6: Average tree density for Mountain - Big Sagebrush and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

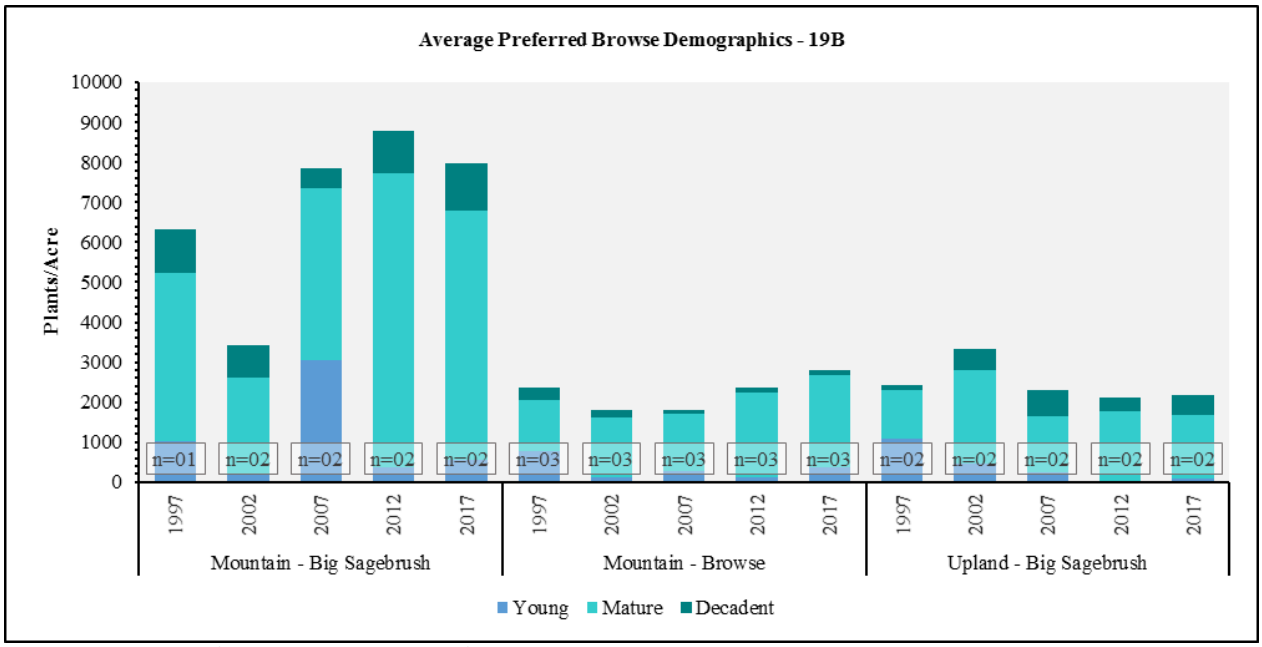


Figure 4.7: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

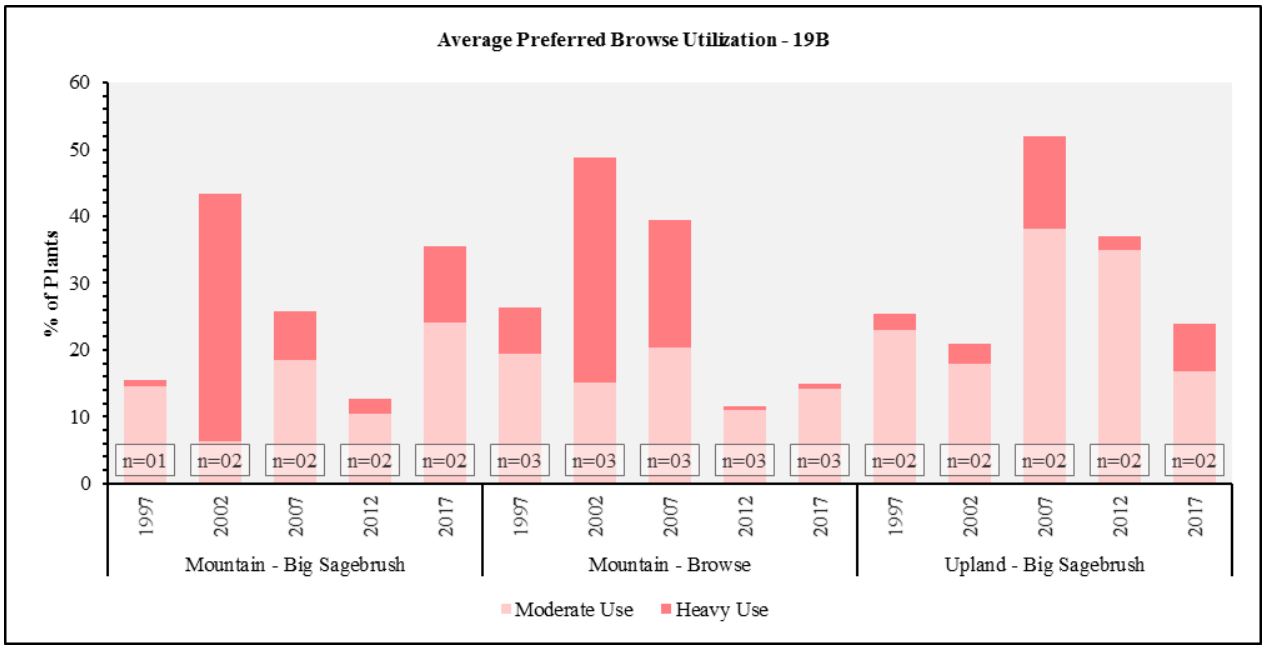


Figure 4.8: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

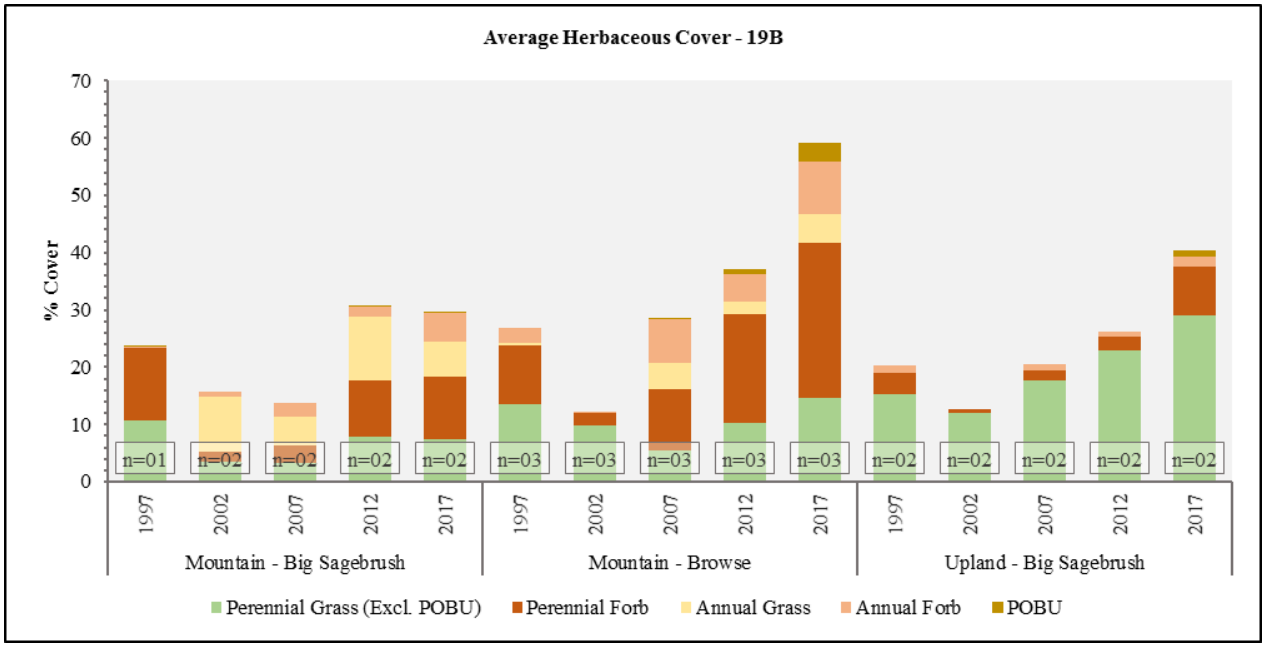


Figure 4.9: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

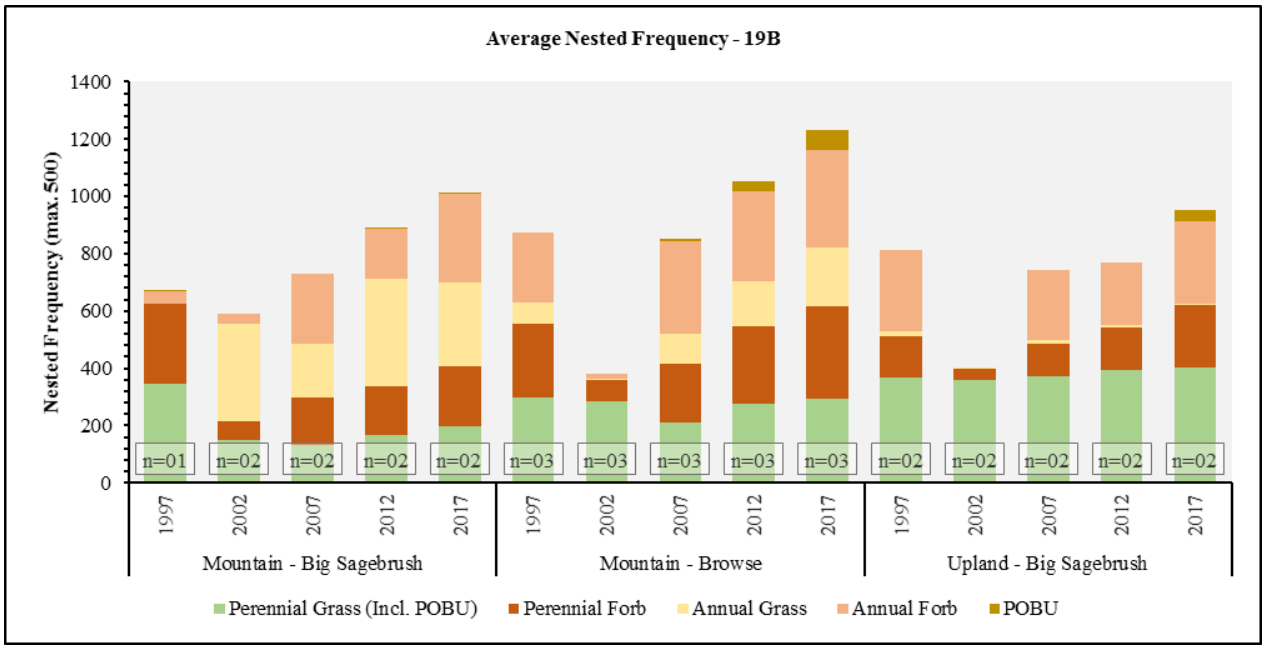


Figure 4.10: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon.

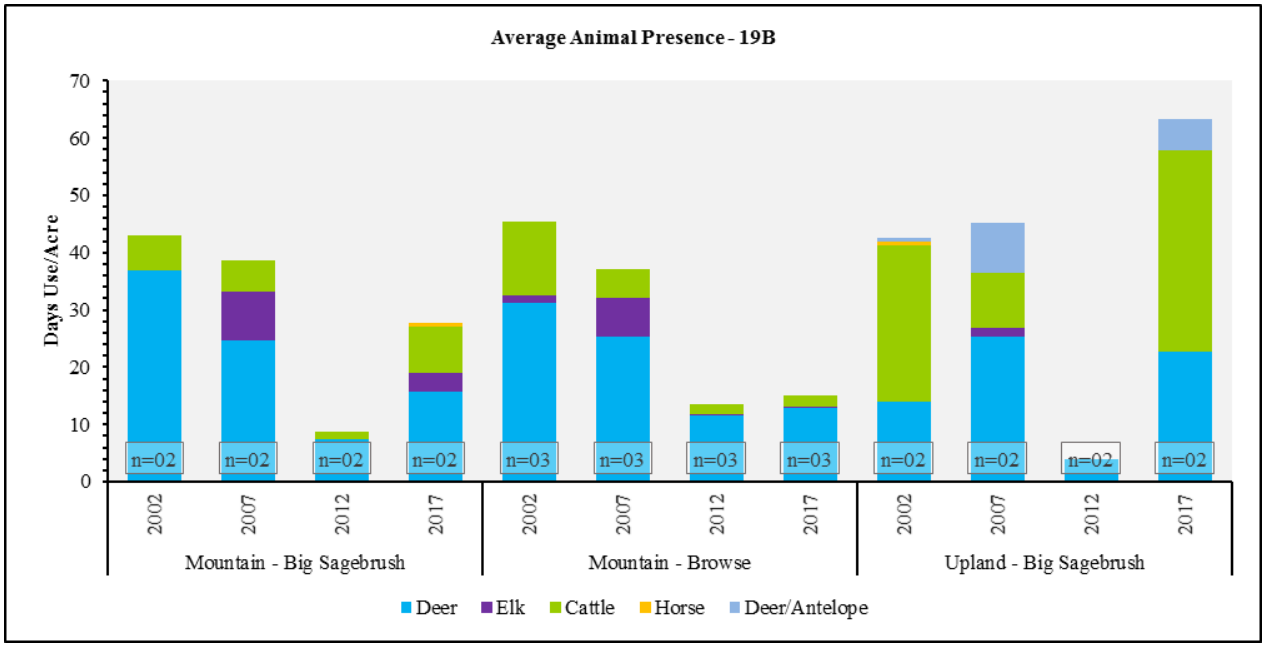


Figure 4.11: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 19B, West Desert - Vernon

Deer Winter Range Condition Assessment

The condition of deer winter range within the West Desert - Vernon management unit has continually changed on the sites sampled since 1997. The active Range Trend sites sampled within the unit are considered to be in very poor-poor to good condition as of the 2017 sample year (**Figure 4.12**). West Government Creek and Lee's Creek are considered to be in good condition for deer winter range. South Pine Canyon is considered to be in very poor to poor condition. The treated sites have generally improved as time since treatment has increased (**Figure 4.13**): the exceptions to this are Sage Valley Dixie, Bennion Sagebrush Chaining, Bennion Spike 1, and Bennion Spike 2, all of which deteriorated in condition. In addition, Tintic Knapweed Control and East Vernon Bullhog remained the same (**Map 4.11**). It is possible given more time and continual monitoring that these sites will (continue to) improve.

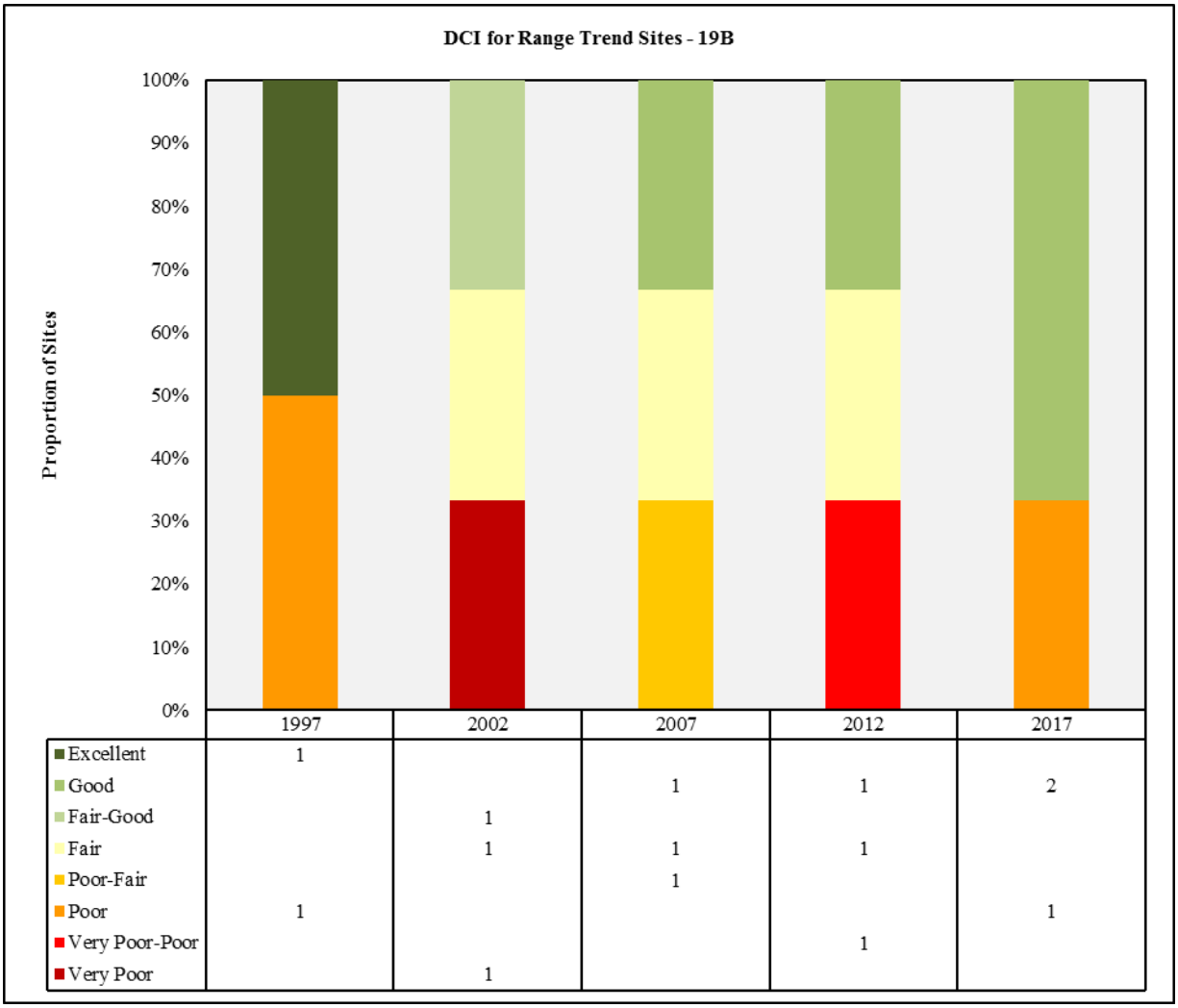


Figure 4.12: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 19B, West Desert - Vernon.

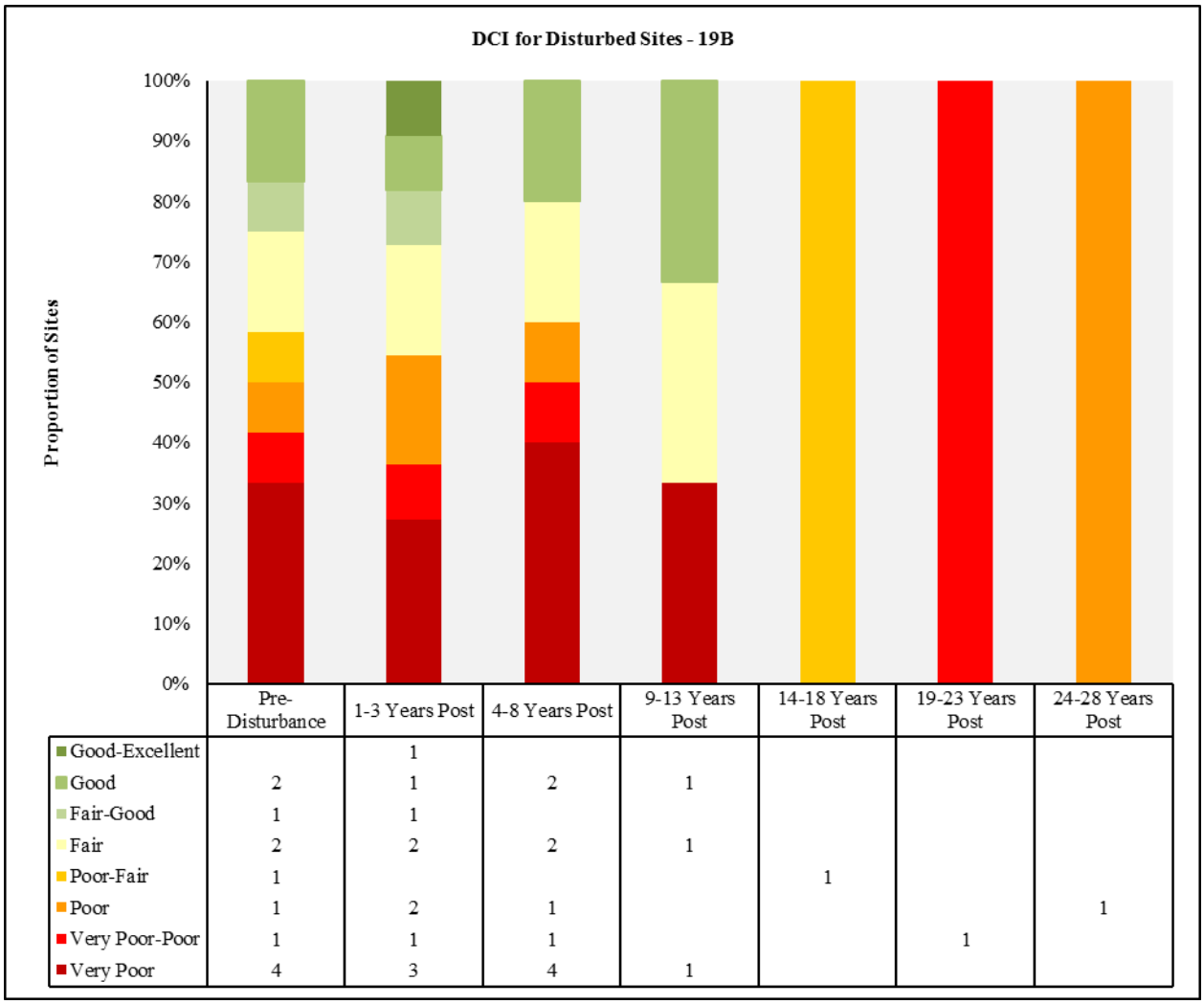


Figure 4.13: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 19B, West Desert - Vernon.

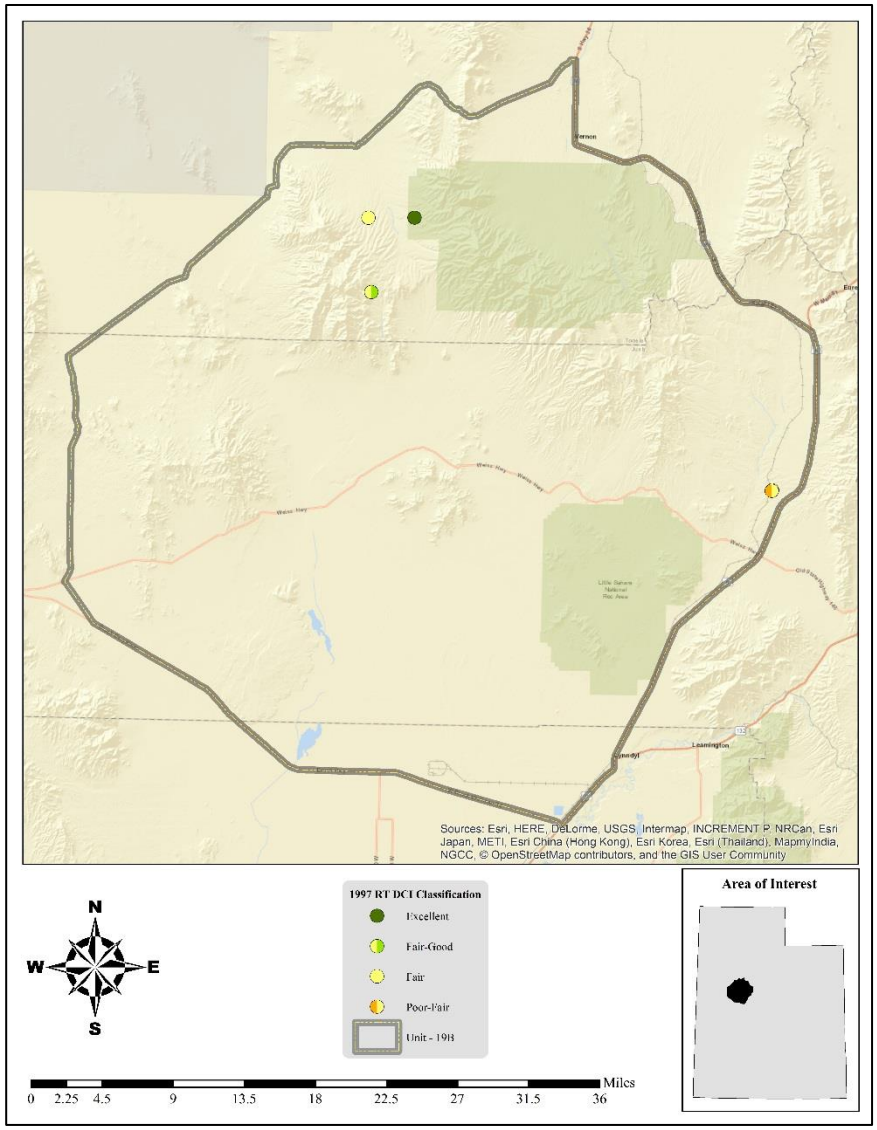
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19B-5	1997	22.9	12.4	8.1	30.0	0.0	10.0	0.0	**83.4**	**E**
19B-5	2002	30.0	7.8	1.5	23.8	0.0	0.6	0.0	**63.7**	**F-G**
19B-5	2007	30.0	3.4	0.5	30.0	-0.1	6.0	0.0	**69.8**	**G**
19B-5	2012	30.0	8.2	0.0	30.0	0.0	7.6	0.0	**75.8**	**G**
19B-5	2017	30.0	5.9	0.0	30.0	0.0	10.0	0.0	**75.9**	**G**
19B-6	1997	5.8	0.0	0.0	29.0	-0.2	3.8	0.0	**38.4**	**P**
19B-6	2002	8.9	12.5	11.3	24.2	0.0	1.8	0.0	**58.7**	**F**
19B-6	2007	13.3	9.3	9.5	28.4	0.0	1.2	0.0	**61.7**	**F**
19B-6	2012	10.9	12.9	2.5	30.0	0.0	2.0	0.0	**58.3**	**F**
19B-6	2017	11.8	11.4	5.0	30.0	0.0	9.0	0.0	**67.2**	**G**
19B-7*	1997	8.6	8.6	9.4	11.6	-2.6	10.0	0.0	**45.6**	**F-G**
19B-7*	2002	4.7	0.0	0.0	15.6	0.0	8.0	0.0	**28.3**	**F**
19B-7*	2007	9.8	12.2	3.5	30.0	-0.2	10.0	0.0	**65.3**	**G-E**
19B-8	2002	6.0	0.0	0.0	3.6	-7.4	0.6	0.0	**2.9**	**VP**
19B-8	2007	27.1	13.9	15.0	1.8	-7.6	2.8	0.0	**53.0**	**P-F**
19B-8	2012	30.0	12.4	1.1	1.6	-8.4	2.6	0.0	**39.3**	**VP-P**
19B-8	2017	30.0	10.6	3.4	4.0	-4.5	3.2	0.0	**46.7**	**P**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19B-21*	1998	0.0	0.0	0.0	30.0	-4.5	10.0	0.0	**35.5**	**F**
19B-21*	2002	0.0	0.0	0.0	30.0	-0.4	10.0	0.0	**39.6**	**F**
19B-21*	2007	0.0	0.0	0.0	30.0	-0.8	0.2	0.0	**29.5**	**F**
19B-22*	1998	0.4	0.0	0.0	30.0	-7.4	0.0	0.0	**23.0**	**P-F**
19B-22*	2002	0.8	0.0	0.0	30.0	-0.1	0.0	0.0	**30.7**	**F**
19B-22*	2007	1.8	0.0	0.0	30.0	-1.4	0.0	0.0	**30.4**	**F**
19B-22*	2012	0.8	0.0	0.0	30.0	-1.9	0.0	0.0	**28.9**	**F**

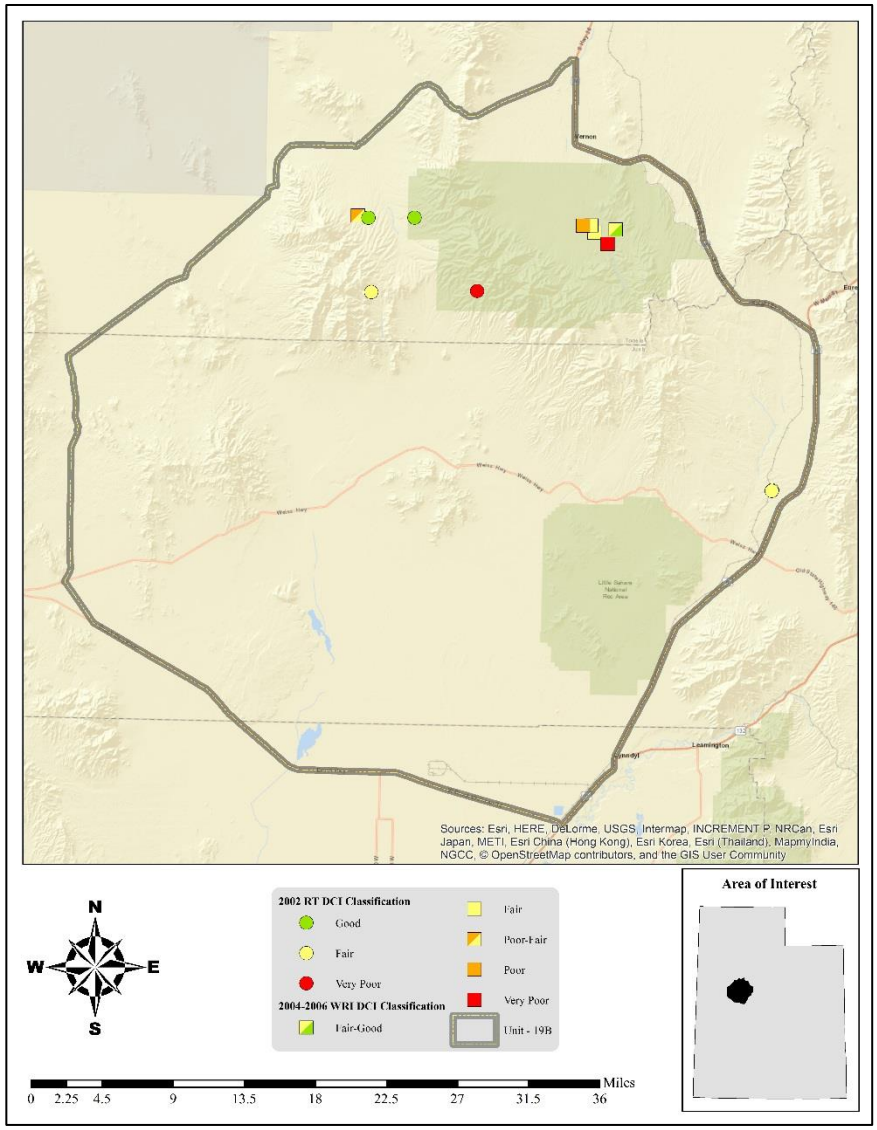
Table 4.8: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 19B, West Desert - Vernon. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
19R-1	2012	12.7	15.0	12.3	30.0	-3.7	9.6	0.0	**75.9**	**G**
19R-1	2017	19.4	14.0	8.1	30.0	-1.4	10.0	0.0	**80.1**	**G-E**
19R-4	2005	0.1	0.0	0.0	4.0	-0.1	0.1	0.0	**4.1**	**VP**
19R-4	2010	6.9	0.0	0.0	15.3	-7.5	10.0	0.0	**24.7**	**VP**
19R-4	2015	16.0	15.0	15.0	22.3	-3.4	5.8	0.0	**70.7**	**G**
19R-6	2006	26.5	8.1	4.0	24.4	-0.4	4.2	0.0	**66.8**	**F-G**
19R-6	2008	3.6	0.0	0.0	30.0	-1.0	5.4	0.0	**38.1**	**P**
19R-6	2012	5.6	0.0	0.0	30.0	-1.0	9.0	0.0	**43.7**	**P**
19R-6	2017	8.3	14.1	0.5	30.0	-0.8	10.0	-2.0	**60.1**	**F**
19R-7	2006	19.5	-0.4	0.5	30.0	-0.8	6.4	0.0	**55.2**	**F**
19R-7	2010	2.4	0.0	0.0	30.0	-2.5	9.2	0.0	**39.1**	**P**
19R-7	2014	2.4	0.0	0.0	30.0	-0.2	4.4	0.0	**36.6**	**VP-P**
19R-8	2006	19.0	0.3	0.0	30.0	-0.1	3.4	0.0	**52.6**	**F**
19R-8	2010	2.4	0.0	0.0	30.0	-0.9	3.0	0.0	**34.5**	**VP-P**
19R-8	2014	1.1	0.0	0.0	30.0	-2.2	1.0	0.0	**30.0**	**VP**
19R-9	2006	23.4	2.7	4.0	9.8	-0.1	1.4	0.0	**41.2**	**P**
19R-9	2010	0.5	0.0	0.0	30.0	-0.7	0.2	0.0	**30.0**	**VP**
19R-9	2014	0.1	0.0	0.0	30.0	-0.9	0.0	0.0	**29.2**	**VP**
19R-10	2008	1.7	0.0	0.0	3.7	-5.3	5.2	-2.0	**3.3**	**VP**
19R-10	2011	2.1	0.0	0.0	30.0	-9.7	0.1	0.0	**22.4**	**VP**
19R-10	2015	2.6	0.0	0.0	30.0	-1.1	0.4	0.0	**31.9**	**VP**
19R-11	2008	5.5	0.0	0.0	17.0	-0.2	0.6	0.0	**22.8**	**VP**
19R-11	2011	7.4	9.3	15.0	30.0	-1.3	0.8	0.0	**61.2**	**F**
19R-11	2015	11.2	14.1	15.0	22.2	-5.5	0.8	0.0	**57.8**	**F**
19R-13	2008	16.0	-1.2	4.5	30.0	0.0	0.8	0.0	**50.1**	**P-F**
19R-13	2010	7.6	12.9	15.0	26.0	0.0	3.0	0.0	**64.5**	**F-G**
19R-13	2014	8.6	13.2	15.0	30.0	0.0	1.6	0.0	**68.4**	**G**
19R-22	2012	0.7	0.0	0.0	30.0	-0.3	2.1	0.0	**32.5**	**VP**
19R-22	2015	2.6	0.0	0.0	18.4	-10.2	0.0	0.0	**10.8**	**VP**
19R-23	2015	1.3	15.0	0.0	16.9	-0.1	1.1	0.0	**34.2**	**VP-P**

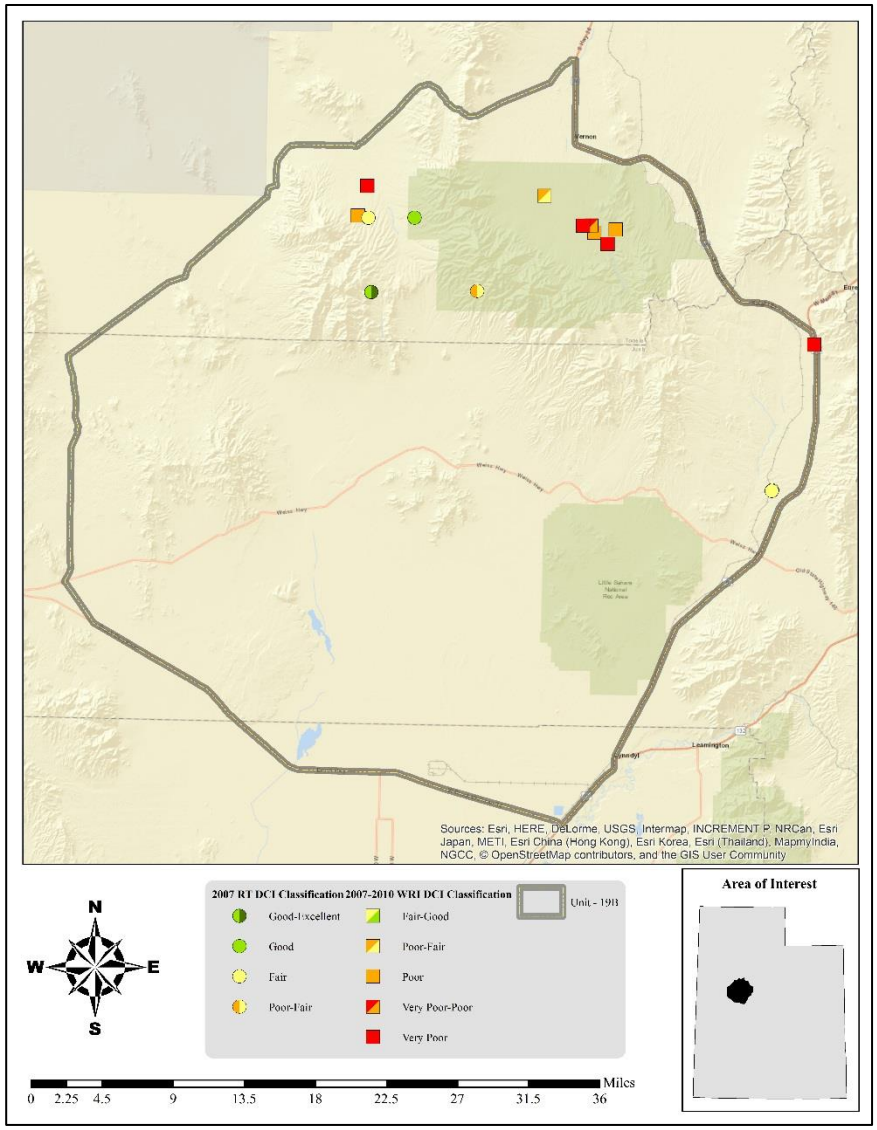
Table 4.9: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 19B, West Desert - Vernon. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



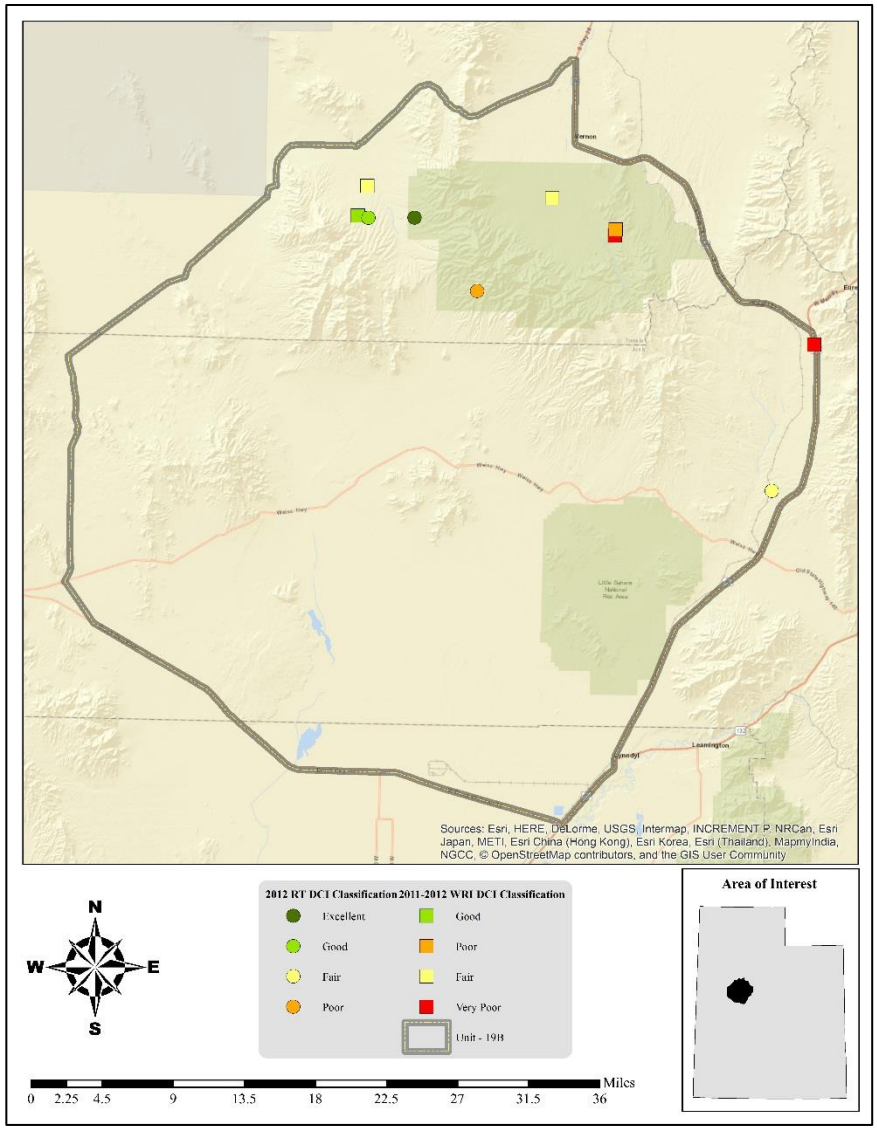
Map 4.7: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 19B, West Desert - Vernon.



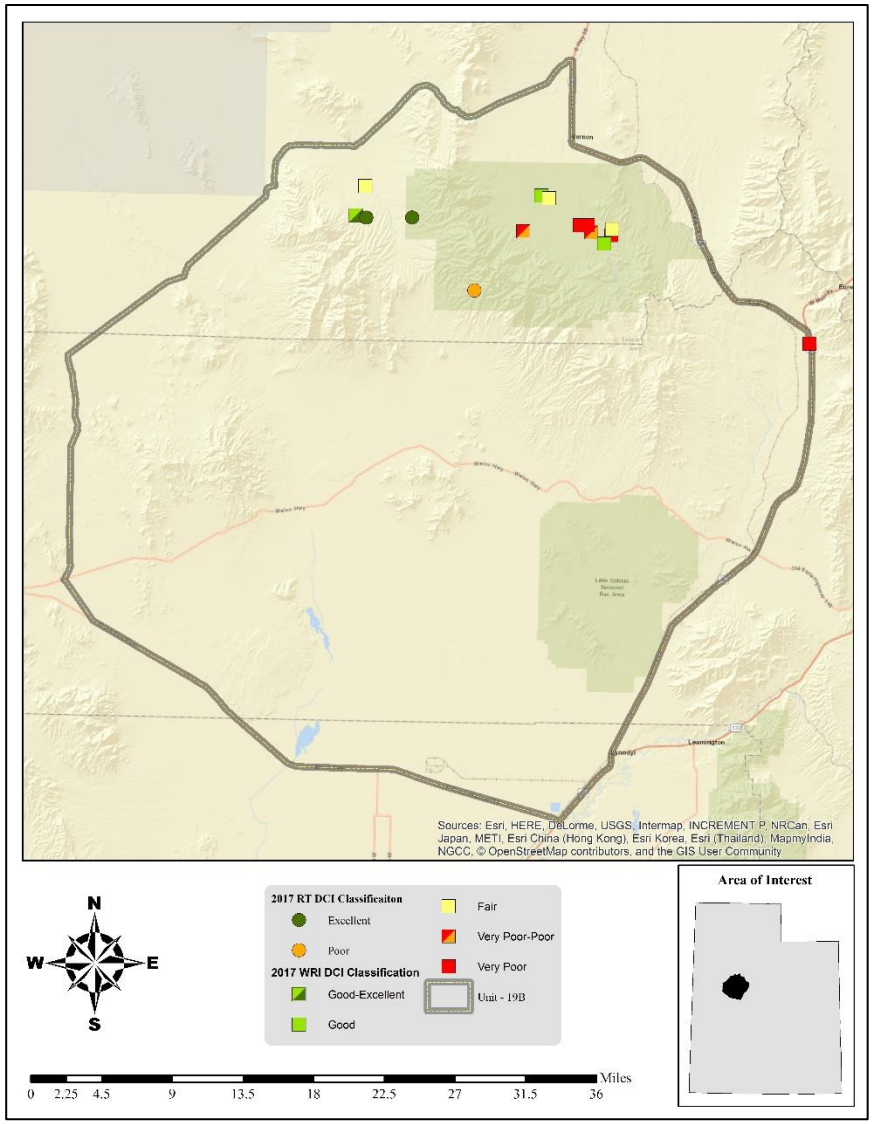
Map 4.8: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 19B, West Desert - Vernon.



Map 4.9: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 19B, West Desert - Vernon.



Map 4.10: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 19B, West Desert - Vernon.



Map 4.11: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 19B, West Desert - Vernon.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
19B-1	Sabie Mountain	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19B-2	Upper Little Valley	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19B-3	Bennion Creek	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
19B-4	Harker Canyon	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19B-5	West Government Creek	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
19B-6	Lee's Creek	Annual Grass	Medium	Increased Fire Potential
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
19B-8	South Pine Canyon	Annual Grass	Medium	Increased Fire Potential
19R-1	West Lee's Creek	Annual Grass	Medium	Increased Fire Potential
19R-2	Deep Creek Aerator	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-3	Deep Creek Drill	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-5	Goshute Chaining	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19R-6	Sage Valley Dixie	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
19R-14	Ibapah Harrow	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
19R-16	Benmore Harrow	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species

Table 4.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 19B, West Desert - Vernon. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies within the Mountain (Big Sagebrush) ecological type support sagebrush and other mixed browse communities and herbaceous understories that provide forage for deer and other game. Conifer encroachment is occurring on some of these sites with Sabie Mountain being in Phase I of woodland succession. The herbaceous understories are in good condition overall, although presence of annual grass is of concern on the South Pine Canyon site.

While one study is in Phase I woodland succession, it may not be representative of the entire ecological type. Areas that show significant amounts conifer encroachment may be considered for a tree-removing treatment (e.g. bullhog, chaining, lop and scatter, etc.). Annual grass cover fluctuates on these studies and treatments would likely not be beneficial. However, areas with consistent annual grass cover may benefit from treatment as it may reduce the potential for wildfire. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Browse)

The studies that are classified as Mountain (Browse) sites support mixed browse communities and diverse understories which provide feed for deer and other game during the summer months. The understories are diverse with significant cover provided by both perennial forbs and grasses. The mixed browse community is in overall good condition. There is no conifer encroachment on any of the sites sampled, though this may not be true for all areas within the mixed browse ecological type.

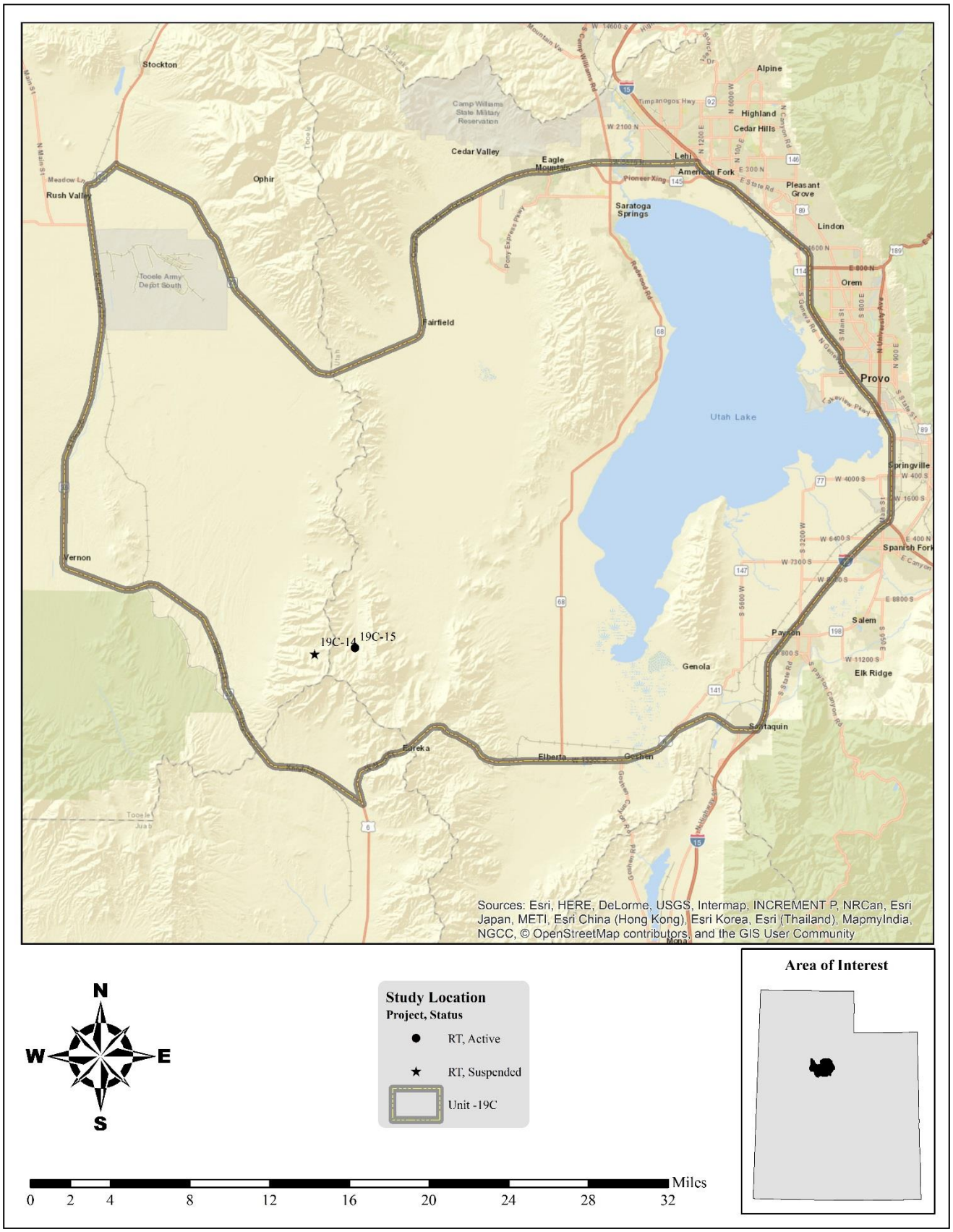
On these sites, the primary threats are introduced understory species: these include annual grasses, bulbous bluegrass (*Poa bulbosa*), and invasive forb species. Appropriate treatments or management practices could be used to help manage these species. Possible treatments appropriate for this threat include herbicide treatments and grazing management changes. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies classified within the Upland (Big Sagebrush) ecological type support browse communities which provide browse and habitat for deer during the winter months. The understories of these ecological types maintain good cover of perennial grasses and forbs. The sagebrush communities are generally in good and stable condition. There is conifer encroachment and infill on both of the sites sampled: this encroachment is likely a threat in many other areas of this ecological type.

The primary threats on these ecological sites are PJ encroachment, annual grasses and bulbous bluegrass (*Poa bulbosa*). Areas that have significant conifer encroachment might be considered for treatments (e.g. bullhog, chaining, lop and scatter, etc.). For threats in the herbaceous understories, there are treatments or management practices could be used to help manage these species. Herbicide treatments and grazing management changes are possible treatments for undesirable understory species. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

5. WILDLIFE MANAGEMENT UNIT 19C – NORTH TINTIC - WEST DESERT



WILDLIFE MANAGEMENT UNIT 19C – NORTH TINTIC - WEST DESERT

Boundary Description

Tooele, Juab, Utah and Millard counties – Boundary begins at I-15 and SR-73 in Lehi; south on I-15 to US-6 in Santaquin; west to SR-36; north on SR-36 to SR-73; east on SR-73 to I-15 in Lehi. Excludes all CWMUs.

Management Unit Description

Geography

The North Tintic Unit is a small unit with mule deer habitat congregated around the East Tintic and Lake Mountains. A majority of the unit outside of the mountains is considered to be pronghorn habitat. The single range trend study in the unit is located in the East Tintic Mountains.

A significant portion of this unit is covered by Utah Lake. The primary geographic features in this unit are the East Tintic Mountains and the Lake Mountains: both ranges are fairly wide, with gradual slopes. The highest point in the East Tintic Mountains is Boulter Peak at 8,312 feet and the Lake Mountains top out at 7,655 feet.

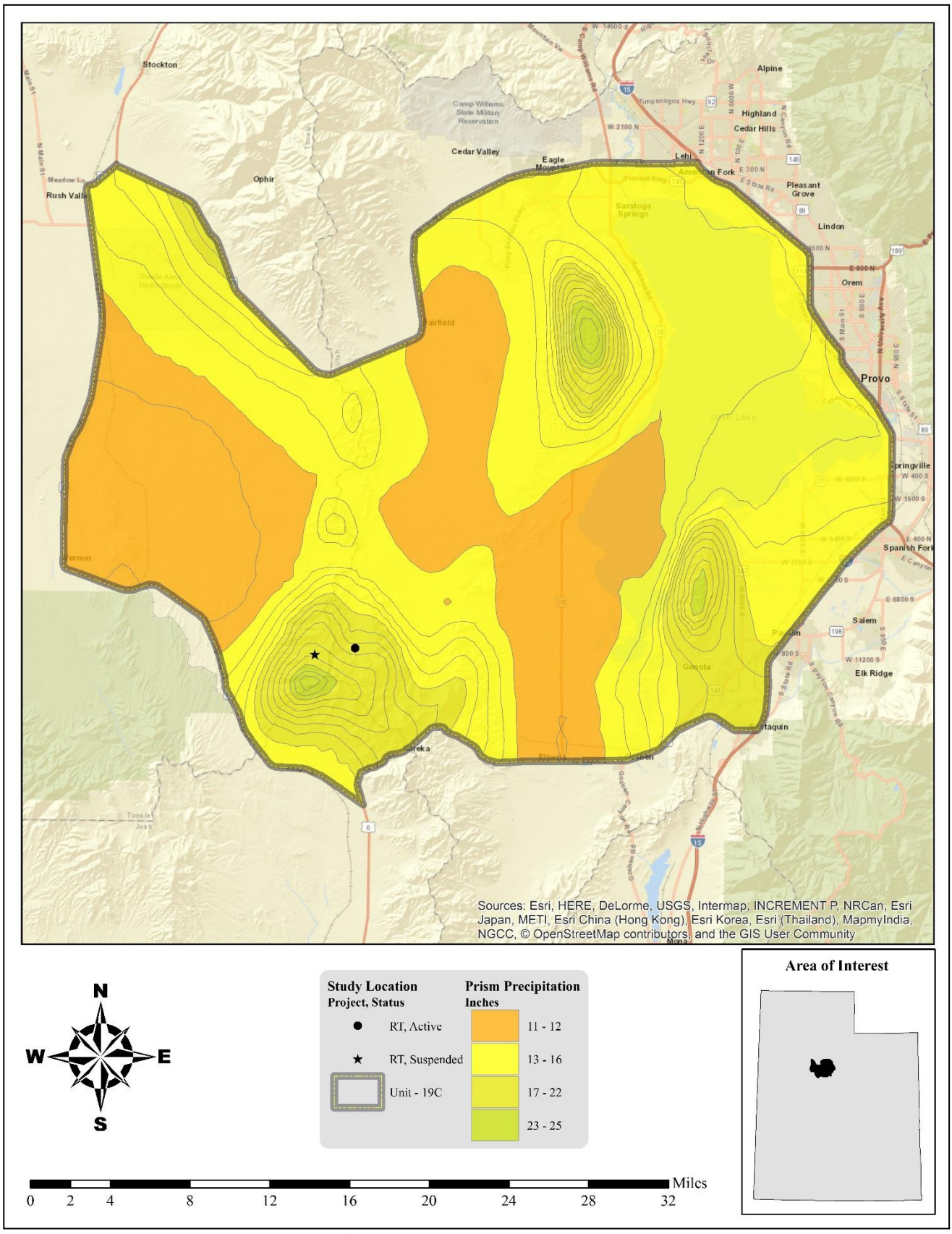
Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 11 inches along portions of Rush and Cedar Valley to 25 inches on the peaks of the East Tintic and Lake Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 10-23 inches of precipitation (**Map 5.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the North Central and Northern Mountains divisions (Divisions 3 and 5)

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 5.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 5.1b**).

The mean annual PDSI of the Northern Mountains division displayed years of moderate to extreme drought from 1988-1990, 2000-2003, and 2012-2013. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1995, 1997-1998, 2005, and 2011 (**Figure 5.2a**). The mean spring (March-May) PDSI displayed moderate to extreme drought in 1989-1990, 1992, 2000-2004, and 2012-2014; moderately to extremely wet years were displayed in 1982-1986, 1995-1996, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1988-1990, 2000-2003, 2007, and 2012-2013; moderately to extremely wet years were displayed in 1982-1986, 1995, and 1997-1998 (**Figure 5.2b**) (Time Series Data, 2018).



Map 5.1: The 1981-2010 PRISM Precipitation Model for WMU 19C, North Tintic - West Desert (PRISM Climate Group, Oregon State University, 2013).

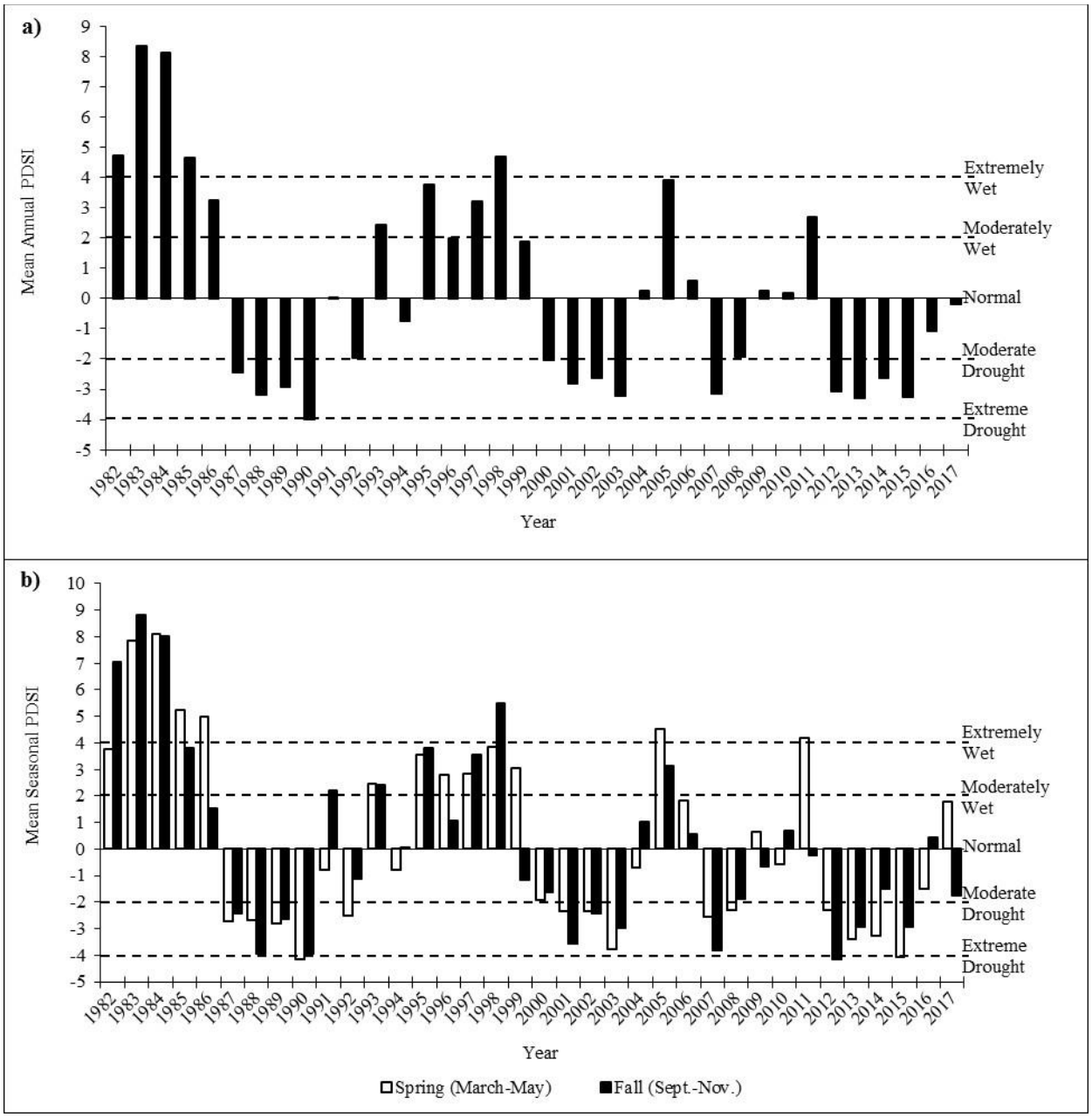


Figure 5.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

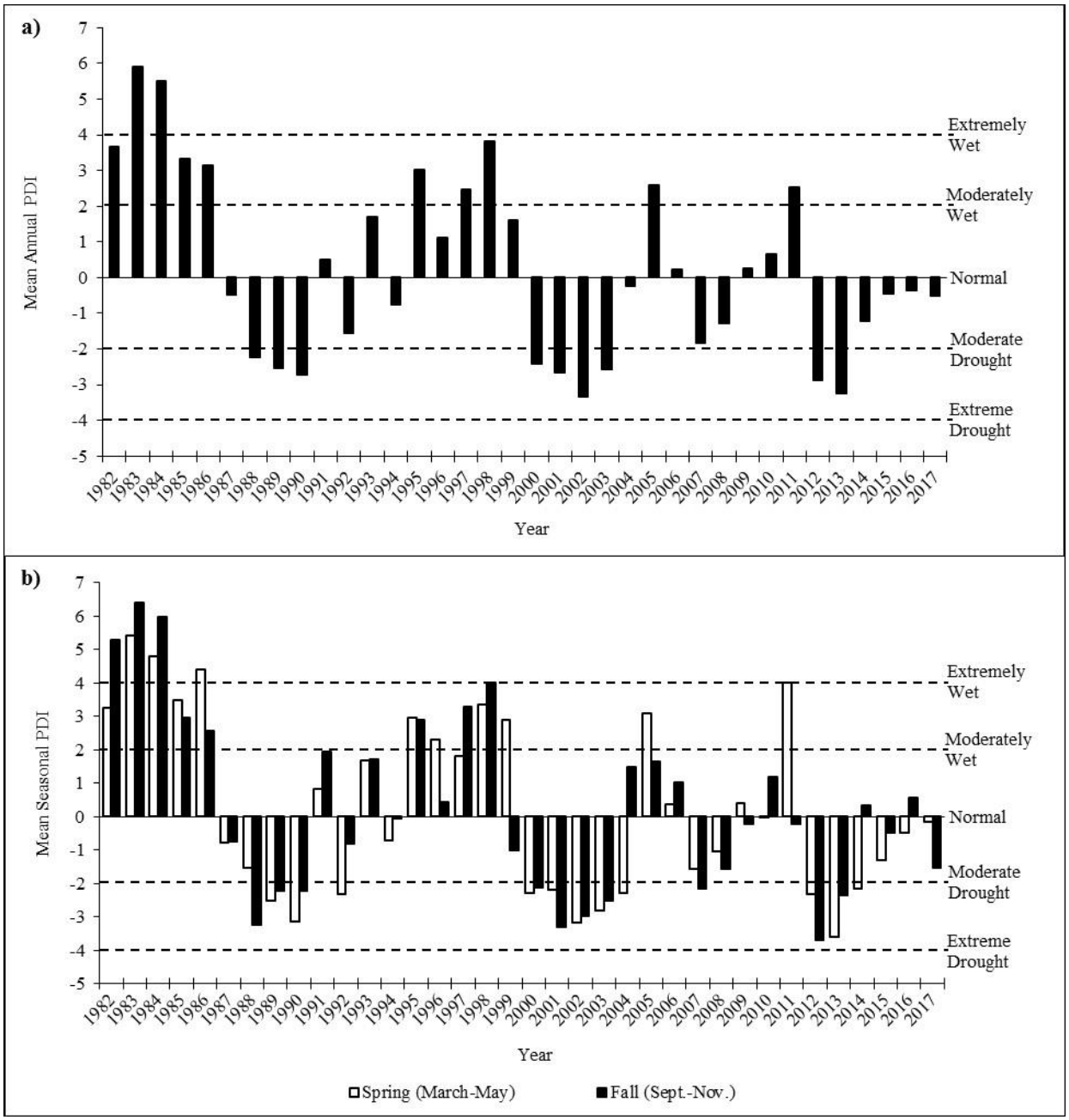


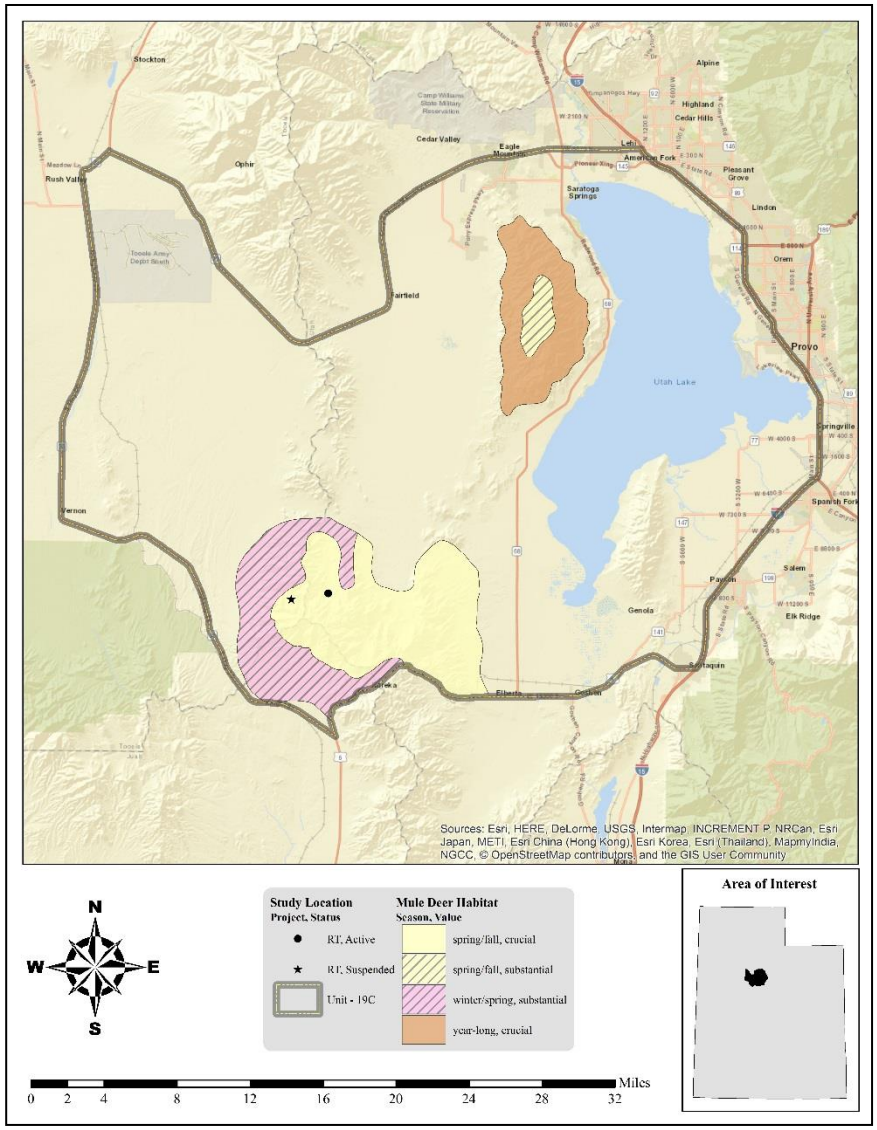
Figure 5.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

Big Game Habitat

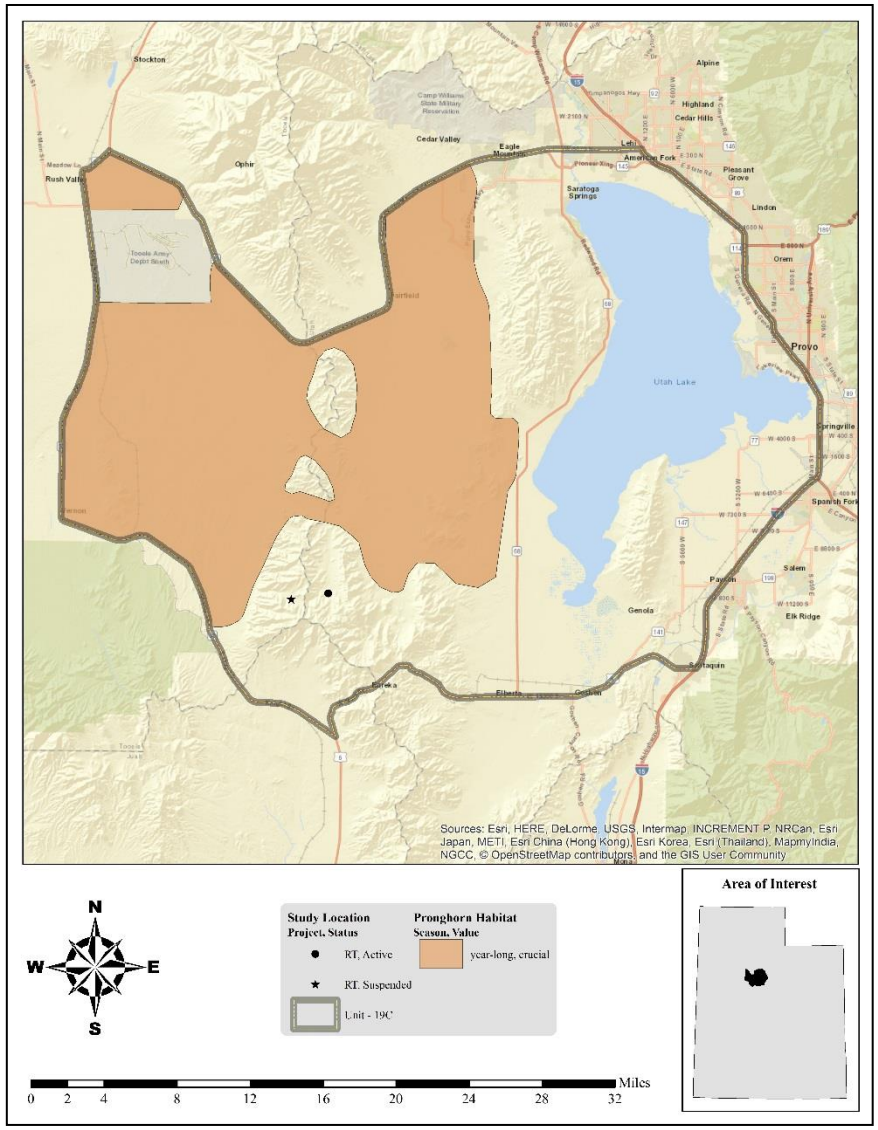
There are an estimated 91,948 acres classified as deer range within Unit 19C with 28% classified as winter/spring range, 22% as year-long range, and 50% as spring/fall range (**Table 5.1**, **Map 5.2**). Across all mule deer range, 59% is managed by the Bureau of Land Management (BLM), 27% is privately owned, and 14% is managed by the Utah School and Institutional Trust Lands Administration (SITLA), (**Table 5.2**, **Map 5.2**, **Map 5.4**). Both ranges are limited in quality summer habitat and water sources are not abundant.

Deer winter range mainly follows the lower elevation areas of the mountain ranges within the unit; the upper limit of normal deer winter range varies from 5,200 to 7,300 feet based on the mountain range on which it occurs. The lower range of normal deer winter range typically follows the lower elevations into the Tintic and Cedar Valleys.

Within the summer range, the browse species consist of sagebrush in the drier areas and mixed mountain brush communities in some of the more mesic locations. Sagebrush-PJ and pinyon-juniper communities are present in both the winter and summer range. Within these areas, pinyon and juniper trees can encroach on the browse communities and reduce productivity.



Map 5.2: Estimated mule deer habitat by season and value for WMU 19C, North Tintic - West Desert.



Map 5.3: Estimated pronghorn habitat by season and value for WMU 19C, North Tintic - West Desert.

	Spring/Fall Range		Winter/Spring Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	45,611	50%	26,012	28%	20,326	22%
Pronghorn	0	0%	0	0%	228,124	100%

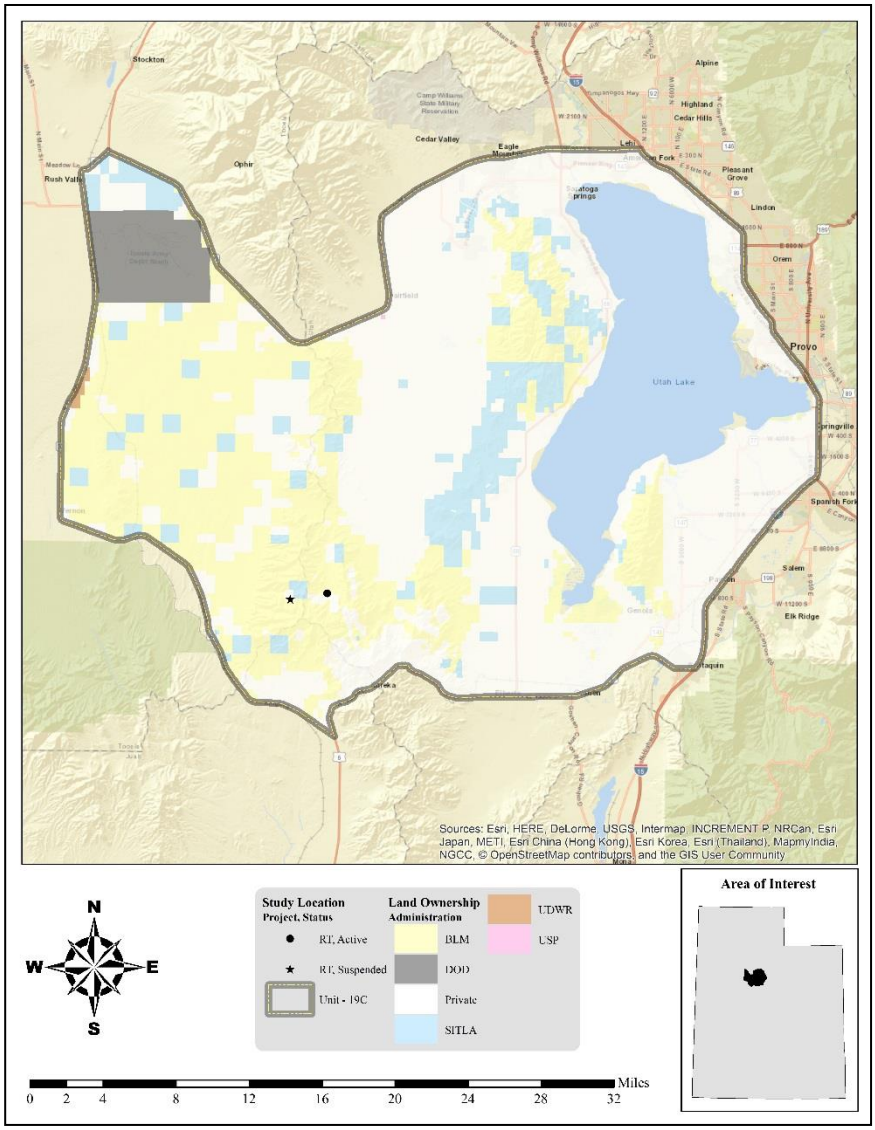
Table 5.1: Estimated mule deer and pronghorn habitat acreage by season for WMU 19C, North Tintic - West Desert.

	Spring/Fall Range		Winter/Spring Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	26,690	59%	17,014	65%	10,721	53%
Private	15,536	34%	7,338	28%	1,915	9%
SITLA	3,385	7%	1,661	6%	7,690	38%
Total	45,611	**100%**	26,012	**100%**	20,326	**100%**

Table 5.2: Estimated mule deer habitat acreage by season and ownership for WMU 19C, North Tintic - West Desert.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	89,034	39%
DOD	62	<1%
Private	110,517	48%
SITLA	27,844	12%
UDWR	624	<1%
USP	44	<1%
Total	228,124	**100%**

Table 5.3: Estimated pronghorn habitat acreage by season and ownership for WMU 19C, North Tintic - West Desert.



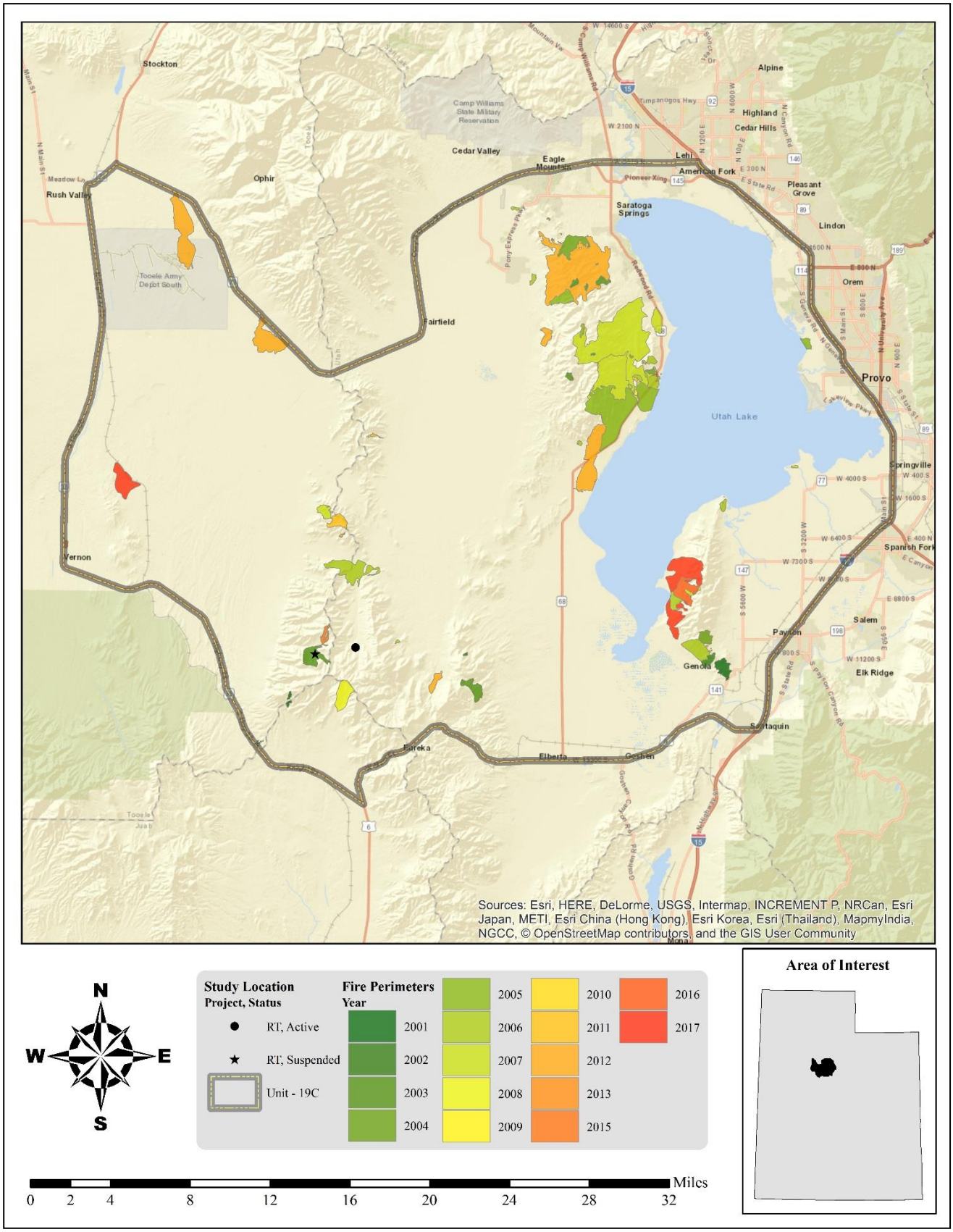
Map 5.4: Land ownership for WMU 19C, North Tintic - West Desert.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	49,516	8.35%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	5,414	0.91%	
	Inter-Mountain Basins Juniper Savanna	1,762	0.30%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	234	0.04%	
	Other Conifer	135	0.02%	9.62%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	54,687	9.22%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	7,129	1.20%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	1,558	0.26%	10.68%
Grassland	Southern Rocky Mountain Montane-Subalpine Grassland	811	0.14%	
	Inter-Mountain Basins Semi-Desert Grassland	404	0.07%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	270	0.05%	
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	108,036	18.21%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	42,541	7.17%	
	Inter-Mountain Basins Greasewood Flat	25,425	4.29%	
	Inter-Mountain Basins Big Sagebrush Steppe	15,213	2.56%	
	Great Basin Xeric Mixed Sagebrush Shrubland	13,975	2.36%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	3,979	0.67%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	2,033	0.34%	
	Columbia Plateau Low Sagebrush Steppe	995	0.17%	
	Quercus gambelii Shrubland Alliance	802	0.14%	
	Other Shrubland	595	0.10%	36.01%
Other	Agricultural	104,056	17.54%	
	Open Water	91,603	15.44%	
	Developed	55,711	9.39%	
	Barren	2,257	0.38%	
	Hardwood/Conifer-Hardwood	2,249	0.38%	
	Riparian	944	0.16%	
	Quarries-Strip Mines-Gravel Pits	605	0.10%	
	Sparsely Vegetated	229	0.04%	43.44%
Total		593,169	100%	100%

Table 5.4: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 19C, West Desert - North Tintic.

Limiting Factors to Big Game Habitat

Major human activities in the area include agriculture, livestock grazing, recreation, and urban development. Limiting factors on this unit include habitat degradation and loss, winter range availability on public land, winter range forage condition, predation, and parasites and disease. In addition, encroachment by pinyon-juniper woodland communities poses a threat to important sagebrush rangelands. According to the current Landfire Existing Vegetation Coverage model, 8.35% of the North Tintic unit is comprised of pinyon-juniper woodlands (**Table 5.4**). Increased amounts of cheatgrass increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). Finally, this unit has had several wildfires, resulting in loss of big game habitat (**Map 5.5**).



Map 5.5: Land coverage of fires by year from 2000-2018 for WMU 19C, West Desert - North Tintic (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

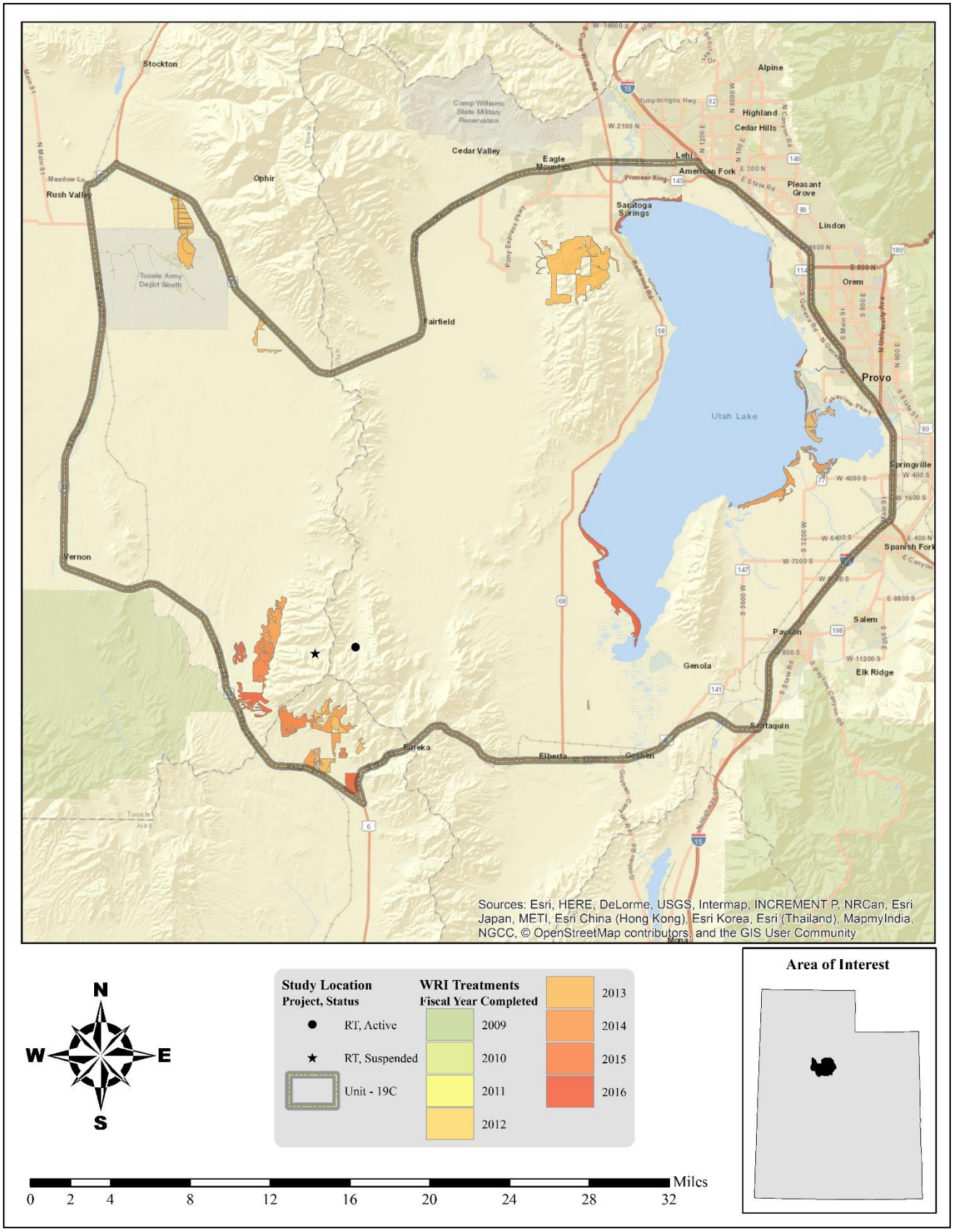
Treatments/Restoration Work

There has been an active effort to address the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 14,541 acres of land have been treated within the North Tintic subunit since the WRI was implemented in 2004 (**Map 5.6**). Treatments frequently overlap one another; bringing the total completed acres to 13,541 acres for this unit (**Table 5.5**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Bullhog treatment to remove pinyon and juniper is the most common management practice in this unit, with anchor chaining as well as lop and scatter treatments being less common but still used. Herbicide application to reduce undesirable species and seeding to augment the herbaceous understory are common treatments. Prescribed fire has also been used within this unit (**Table 5.5**).

Type	Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**669**	**0**	**669**
Ely (One-Way)	669	0	669
Bullhog	**5,777**	**0**	**5,777**
Full Size	5,777	0	5,777
Herbicide Application	**3,440**	**0**	**3,440**
Aerial (Fixed-Wing)	824	0	824
Aerial (Helicopter)	829	0	829
Ground	1,787	0	1,787
Prescribed Fire	**112**	**0**	**112**
Seeding (Primary)	**3,985**	**0**	**3,985**
Broadcast (Aerial-Helicopter)	3,337	0	3,337
Drill (Rangeland)	600	0	600
Ground (Mechanical Application)	48	0	48
Vegetation Removal/Hand Crew	**573**	**0**	**573**
Lop and Scatter	573	0	573
Total Treatment Acres	**14,556**	**0**	**14,556**
***Total Land Area Treated**	**13,541**	**0**	**13,541**

Table 5.5: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 19C, West Desert - North Tintic. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 5.6: WRI treatments by fiscal year completed for WMU 19C, West Desert - North Tintic.

Range Trend Studies

Range Trend studies have been sampled within WMU 19C on a regular basis since 1983, with studies being added or suspended as was deemed necessary (**Table 5.6**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment.

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
19C-14	Black Rock Canyon	RT	Suspended	'89, '97	Not Verified
19C-15	Upper Broad Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Shallow Loam (Mountain Big Sagebrush)

Table 5.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 19C, North Tintic - West Desert.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There is one study [Upper Broad Canyon (19C-15)] classified as a Mountain (Big Sagebrush) ecological site. The Upper Broad Canyon site is located up Broad Canyon in the East Tintic Mountains.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred browse species study site, although the preferred browse species antelope bitterbrush (*Purshia tridentata*) is also present, but contributes less cover. The cover of both sagebrush and preferred browse has shown a slight decrease over the study years (**Figure 5.3**). Preferred browse demographics have fluctuated but have shown a slight increase in the recruitment of young plants (**Figure 5.6**). The utilization of preferred browse has remained stable albeit with slight variations from year to year (**Figure 5.7**).

Tree cover has exhibited steady increases over time (**Figure 5.4**). Density of tree cover has increased, as has the progression of age class: this indicates a shift to a later phase of woodland succession (**Figure 5.5**).

Herbaceous Understory: The understory of this study site has exhibited increases of undesirable annual grasses and the introduced perennial bulbous bluegrass (*Poa bulbosa*). Frequency of perennial grasses and forbs have remained stable while cover has shown a steady decrease. Most of the perennial grass cover is provided by the native species bluebunch wheatgrass (*Pseudoroegneria spicata*). While this study site is the only sample for this ecological type, the overall trend of the herbaceous understory is one shifting toward more undesirable annual species (**Figure 5.8**, **Figure 5.9**).

Occupancy: The pellet transect data shows that the primary occupants are deer/sheep. Mean abundance of deer/sheep pellet groups has fluctuated between sample years with a low of 15 days use/acre in 2012 and a high of 63 days use/acre in 2017 (**Figure 5.10**).

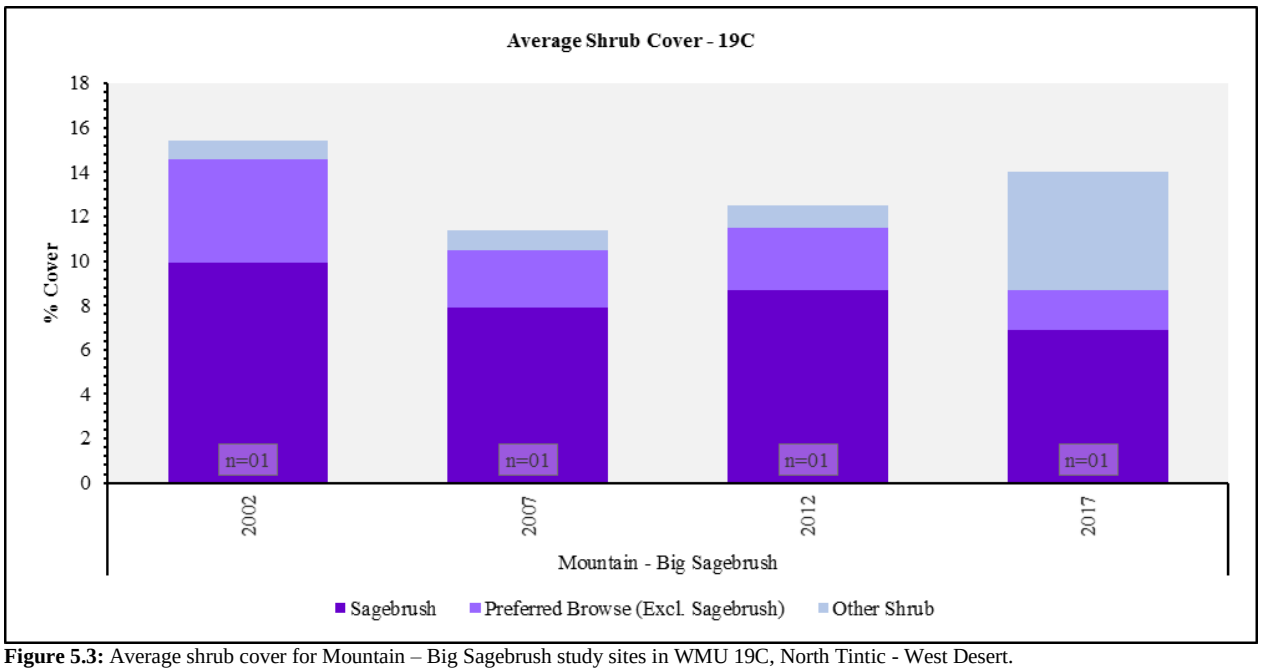


Figure 5.3: Average shrub cover for Mountain – Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

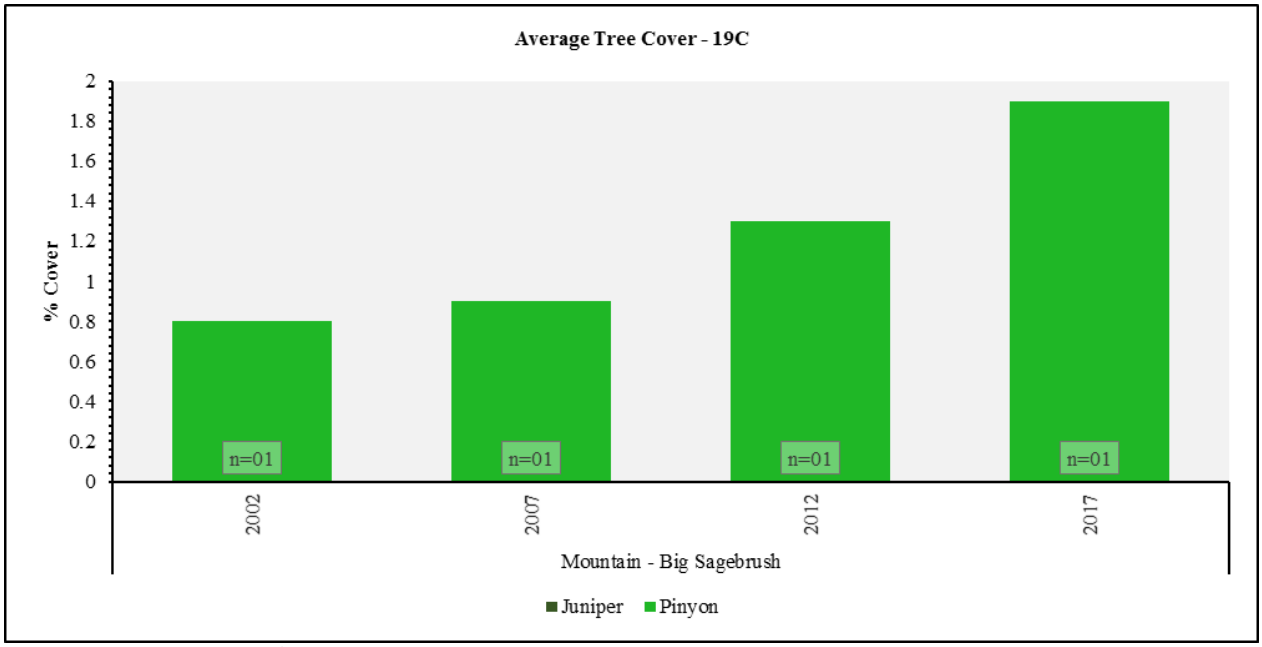


Figure 5.4: Average tree cover for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

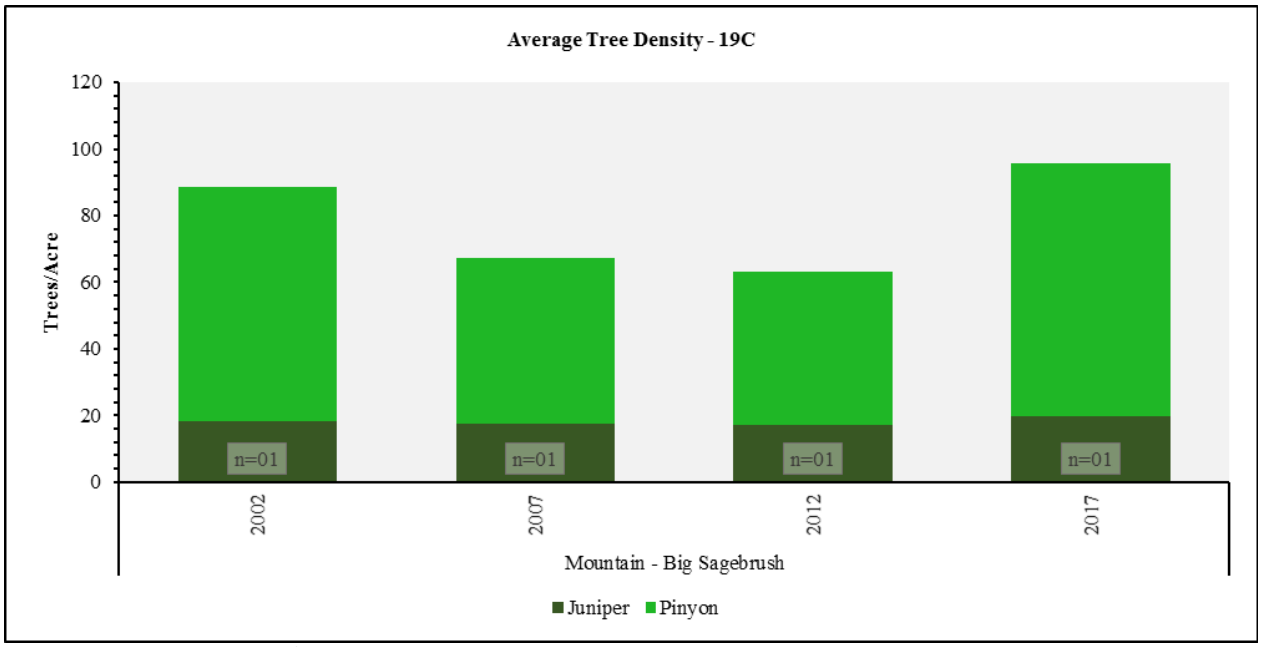


Figure 5.5: Average tree density for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

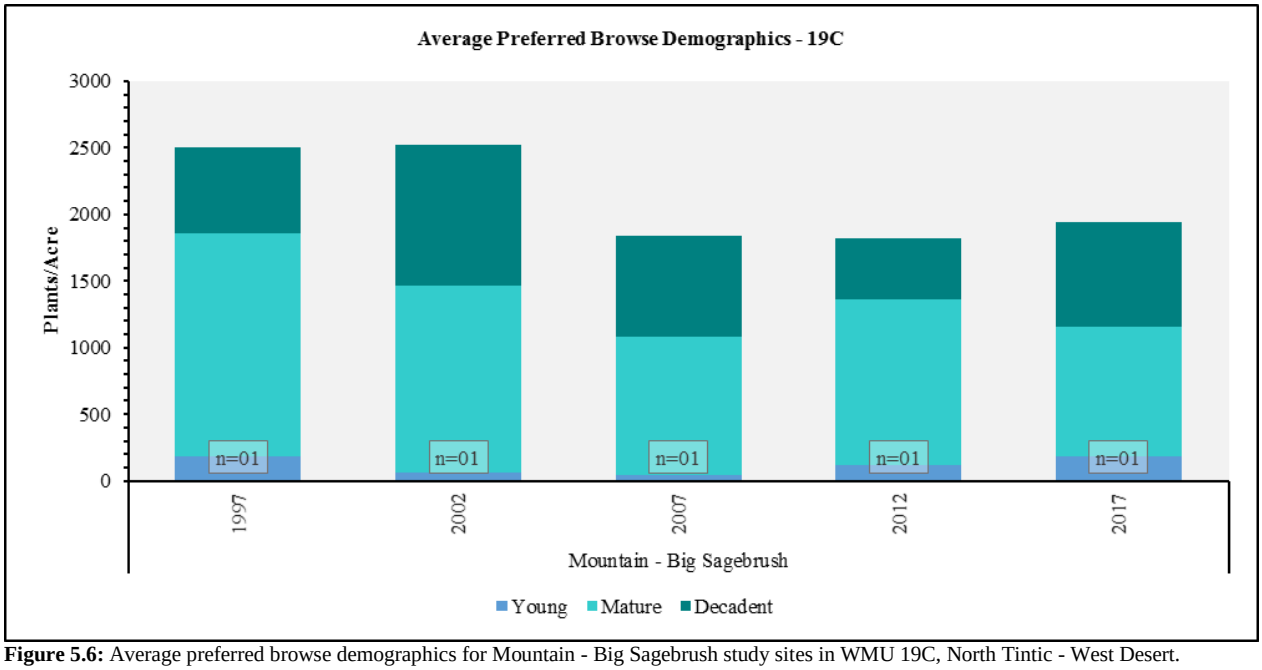


Figure 5.6: Average preferred browse demographics for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

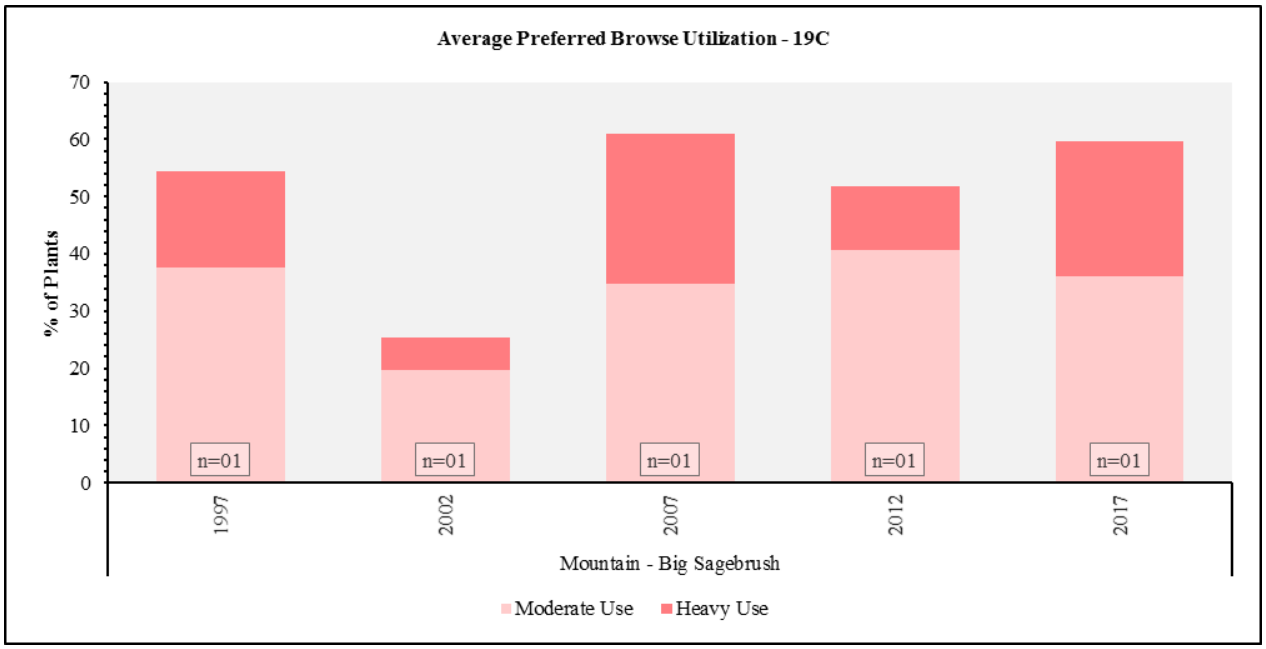


Figure 5.7: Average preferred browse utilization for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

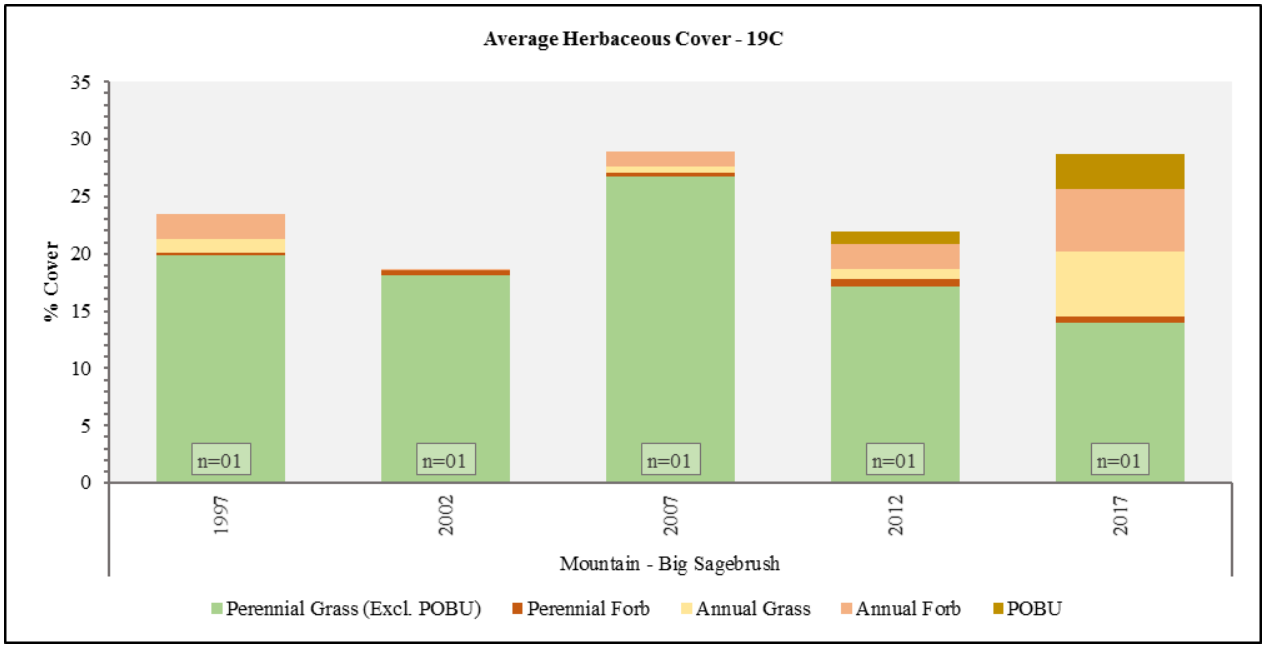


Figure 5.8: Average herbaceous cover for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

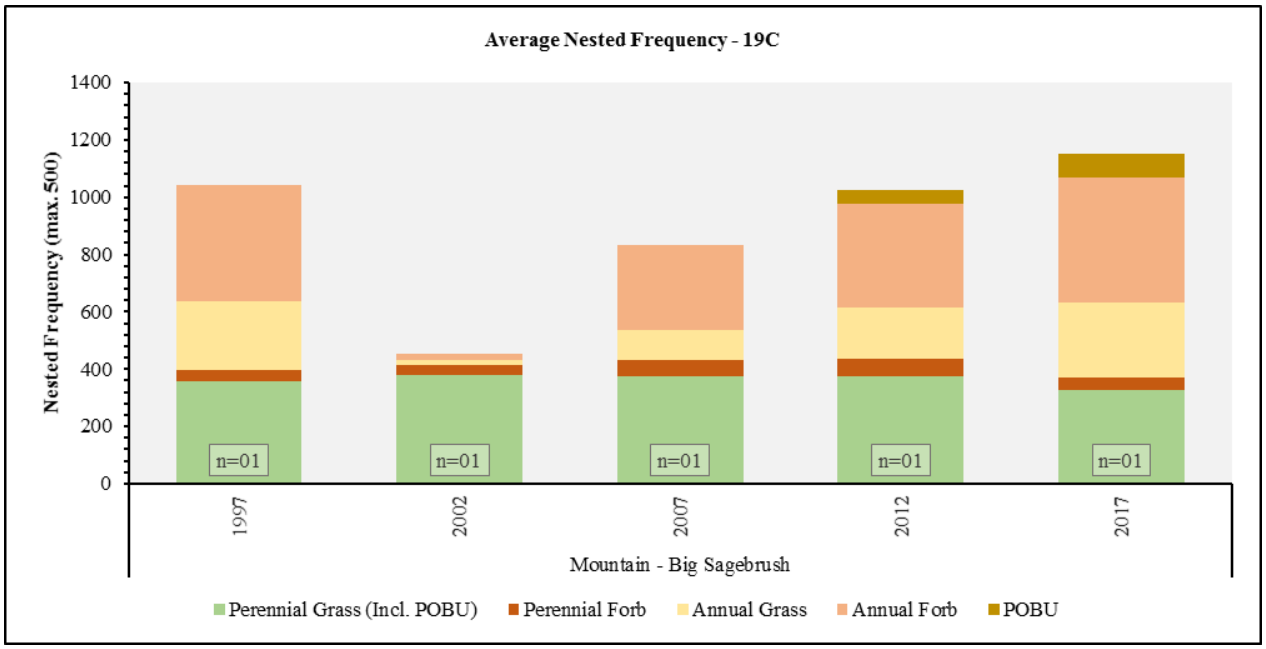


Figure 5.9: Average nested frequency of herbaceous species for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

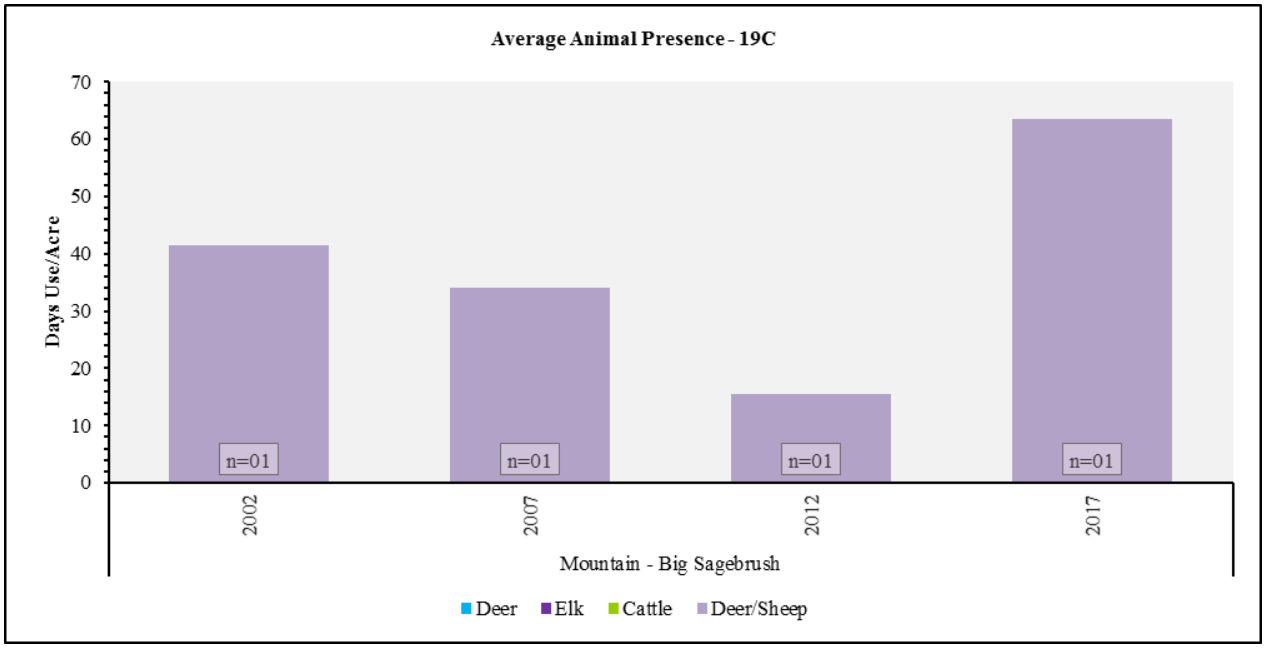


Figure 5.10: Average pellet transect data for Mountain - Big Sagebrush study sites in WMU 19C, North Tintic - West Desert.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
19C-15	Upper Broad Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor

Table 5.7: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 19C, North Tintic - West Desert. All assessments are based off the most current sample date for each study site.

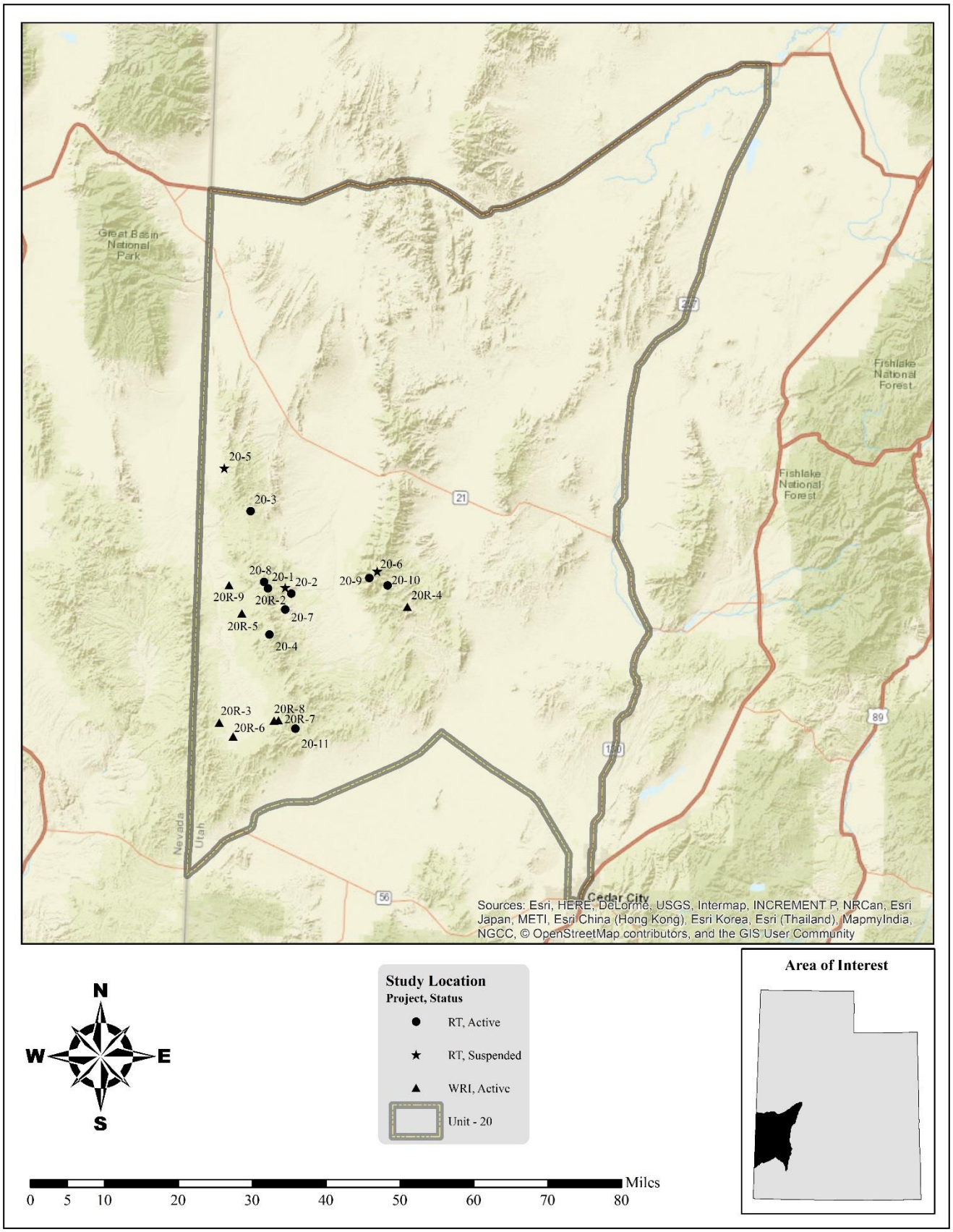
Discussion and Recommendations

Mountain (Big Sagebrush)

The study that is considered to be a Mountain (Big Sagebrush) ecological type is classified as summer range for deer. This community supports browse and understory species for summering deer within the North Tintic unit. Undesirable annual and perennial grasses have shown steady increases within the understory and are a threat to the resilience of the ecological system. These undesirable species can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) can create monocultures and outcompete native species.

There is pinyon and juniper encroachment occurring on this study and encroachment is likely occurring in other areas within the unit. It is recommended that treatments (e.g. bullhog, chaining, lop and scatter, etc.) be implemented on areas where tree removal would be beneficial to the habitat. Herbicide treatments and grazing management changes are possible treatments for undesirable species in the herbaceous understory. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

6. WILDLIFE MANAGEMENT UNIT 20 – SOUTHWEST DESERT



WILDLIFE MANAGEMENT UNIT 20 – SOUTHWEST DESERT

Boundary Description

Beaver, Iron and Millard counties--Boundary begins at the Utah-Nevada state line and US-6/50; east on US-6/50 to SR-257; south on SR-257 to SR-21; south on SR-21 to SR-130; south on SR-130 to I-15; south on I-15 to SR-56; west on SR-56 to the Lund highway; northwest on this highway to Lund and the Union Pacific railroad tracks; southwest along these tracks to the Utah-Nevada state line; north on this state line to US-6/50. Excludes all CWMUs.

Management Unit Description

Geography

The Southwest Desert management unit encompasses the Indian Peaks and Sevier Desert area; significant amounts of this unit serve as big game range. The permanent range trend studies are primarily located on the Indian Peak Range and the Wah Wah Mountains. Many of these sites are located on the summer range as this unit is summer-limited. Towns located within this unit include Modena, Garrison, Beryl, Milford and Minersville as well as parts of Cedar City, Hinckley, and Enoch.

The topographic features of this unit include the Indian Peak, Needle, House, Confusion, and Mountain Home Ranges as well as the Wah Wah Mountains. The highest peak in the unit is Indian Peak at 9,765 feet.

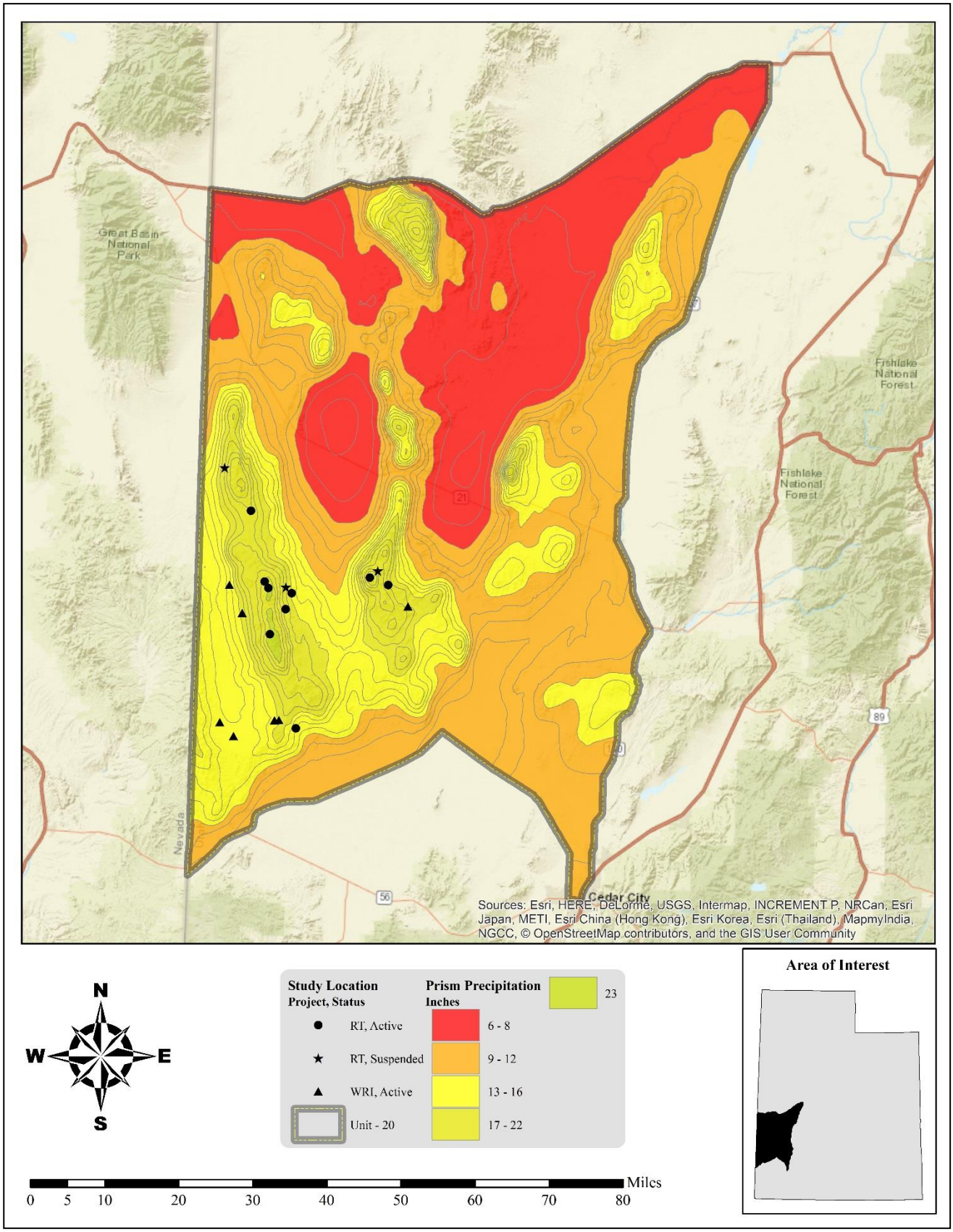
Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 6 inches along portions of upper Wah Wah Valley and Upper Pine Valley to 23 inches on the top of Indian Peak and Twin Peaks. All of the Range Trend and WRI monitoring studies on the unit occur between 13-22 inches of precipitation (**Map 6.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Western and South Central Mountains divisions (Divisions 1 and 4).

The mean annual PDSI of the Western division displayed years of moderate to extreme drought from 1989-1990, 2000-2003, 2007-2008, 2012-2013, and 2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1985, 1993, 1995, 1997-1998, 2005, and 2011 (**Figure 6.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2001-2003, 2007-2008, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (**Figure 6.1b**).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 6.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 6.2b**).



Map 6.1: The 1981-2010 PRISM Precipitation Model for WMU 20, Southwest Desert (PRISM Climate Group, Oregon State University, 2013).

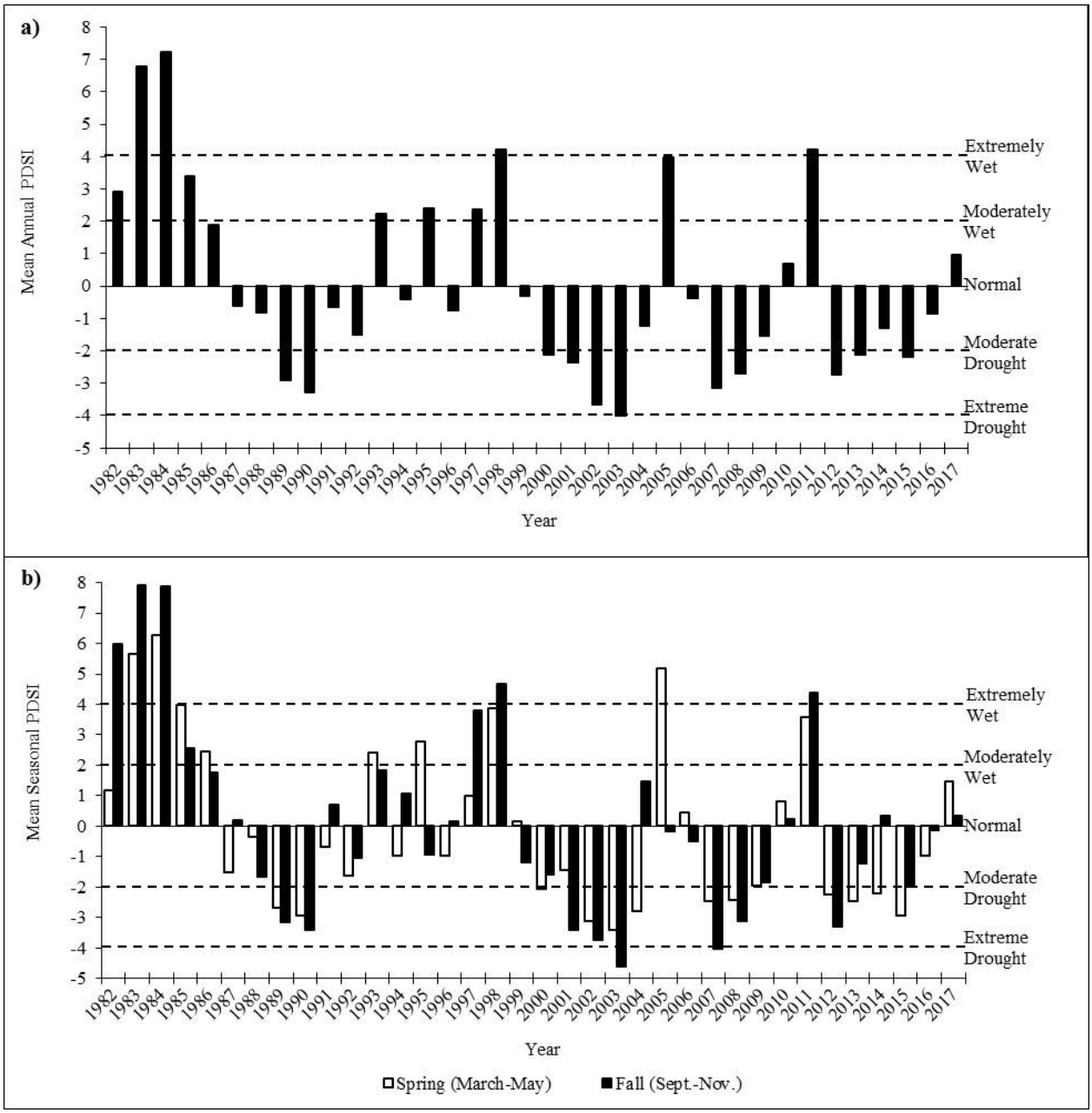


Figure 6.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

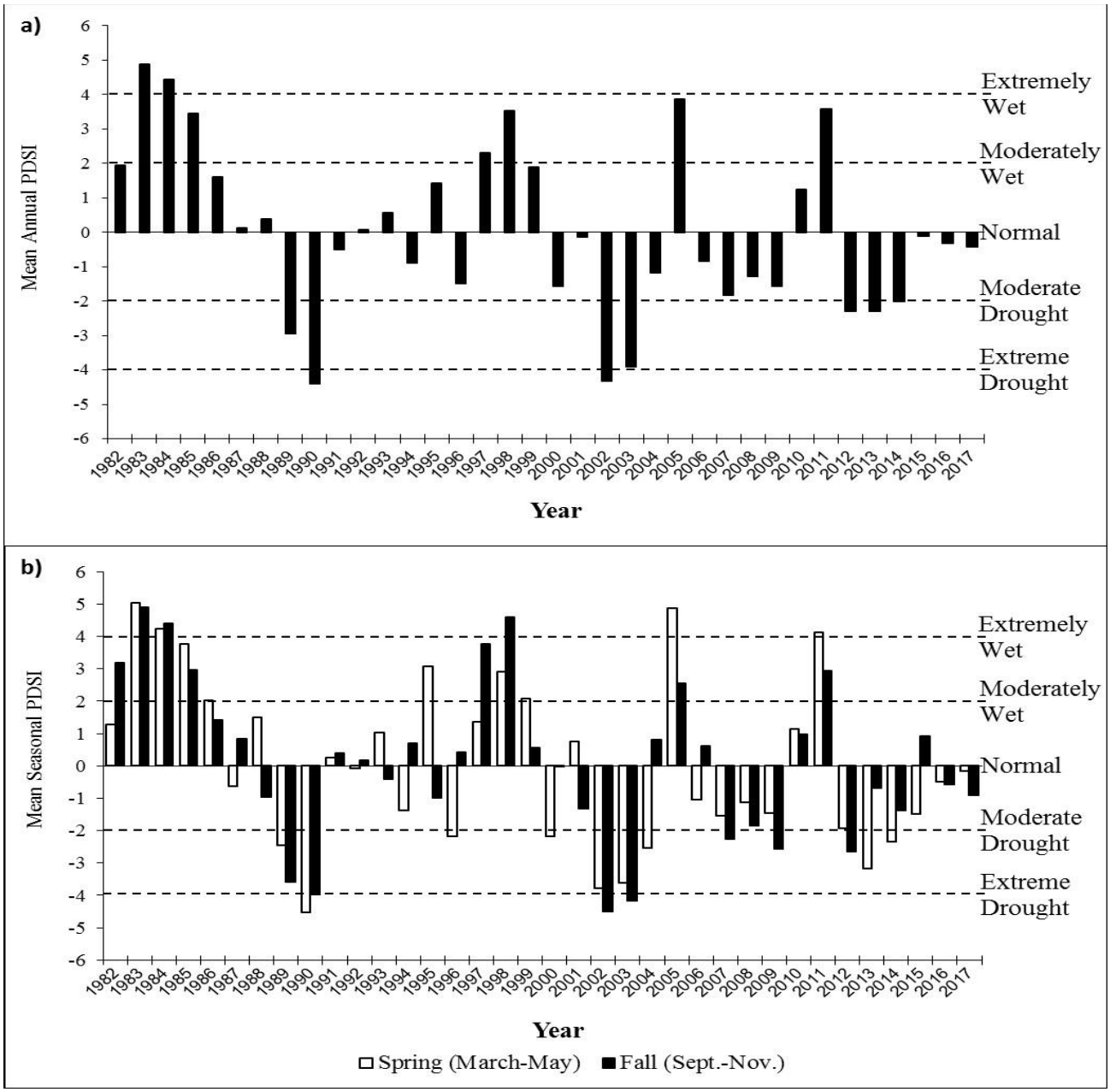
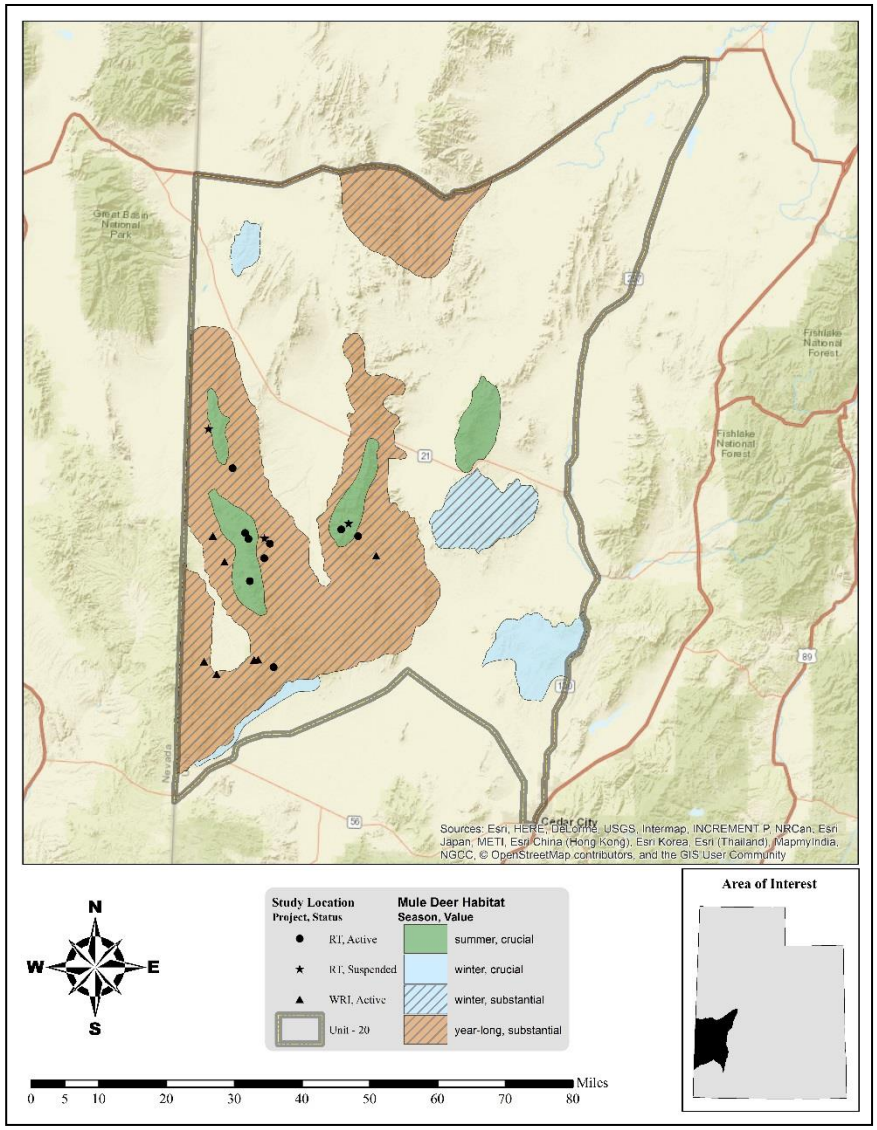


Figure 6.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

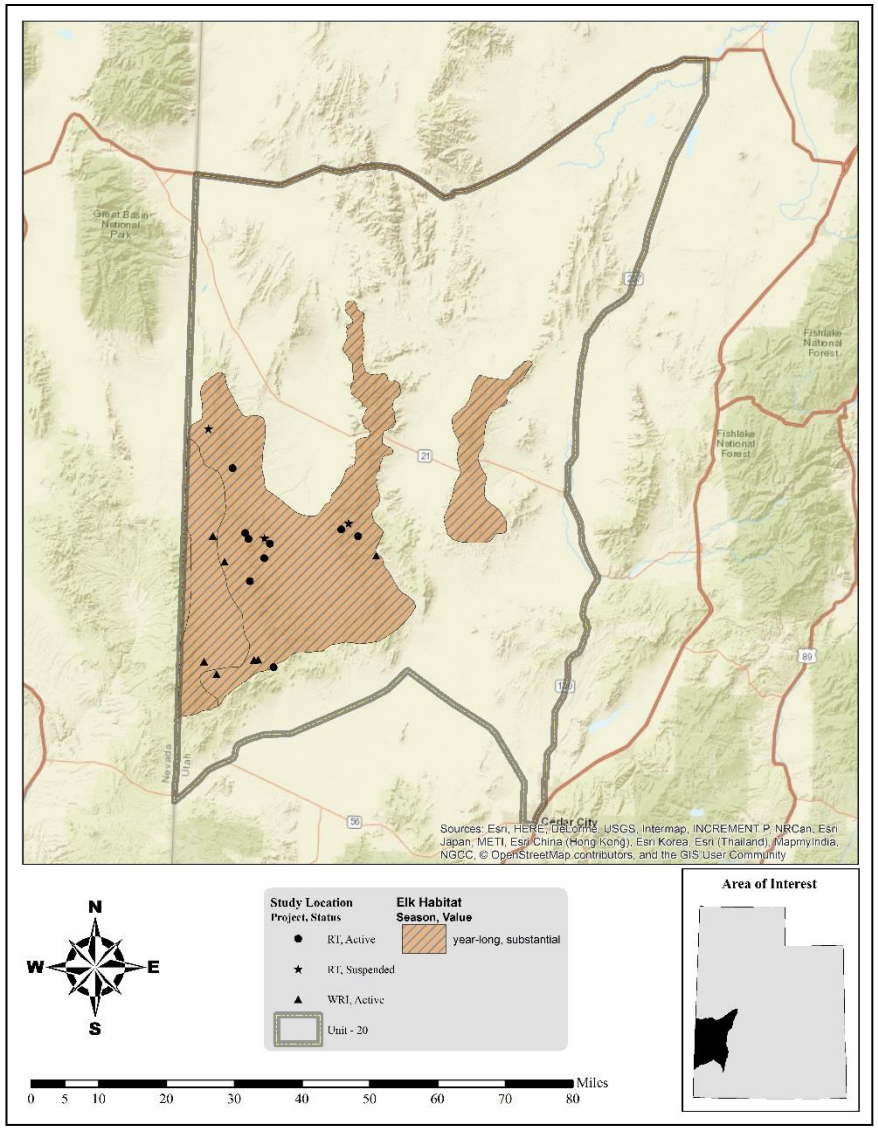
Big Game Habitat

There are an estimated 1,205,200 acres classified as deer range on Unit 20 with 74% classified as year-long range, 15% as winter range, and 11% as summer range (**Table 6.1**, **Map 6.2**). Privately owned land comprises 53% of the winter range, 37% is managed by the Bureau of Land Management (BLM), 9% is managed by the Utah School and Institutional Trust Lands Administration (SITLA), 4% is managed by the United States Forest Service (USFS), and Fire & State Lands (SL&F) manages less than 1% (**Table 6.2**, **Map 6.2**, **Map 6.5**). For the elk range, 48% is administered by the BLM, 31% is privately owned, the USFS manages 13%, and 8% is managed by SITLA (**Table 6.3**, **Map 6.3**, **Map 6.5**). This unit is similar to other desert units in that it is primarily limited by the lack of quality summer range for both deer and elk. The winter range for deer in this unit consists of the areas around the Indian Peak Range and the Wah Wah Mountains. Elevations for this winter range vary from 5,200 feet to 8,000 feet.

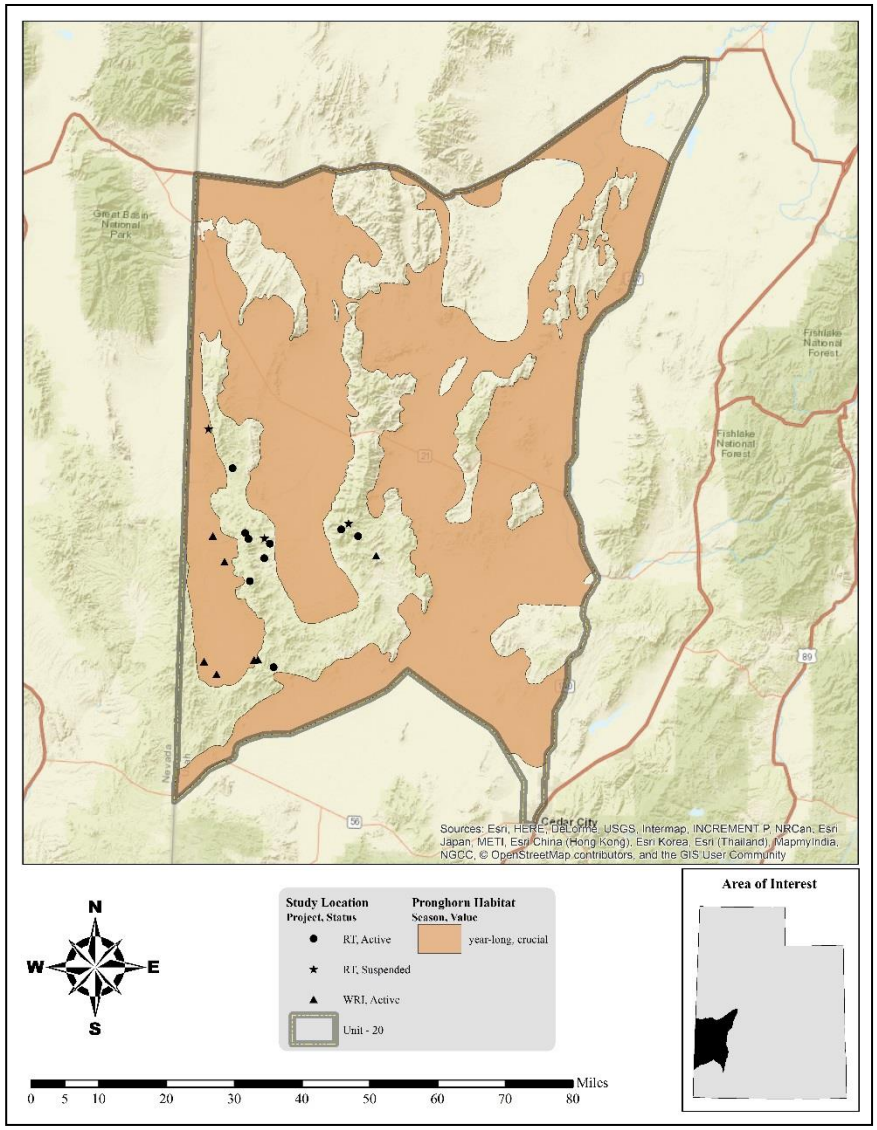
Much of the summer range in Indian Peaks is in mixed mountain brush communities and aspen/conifer communities. Some of the rocky upper elevation sites are dominated by curlleaf mountain mahogany. Much of the winter range is composed of sagebrush with the shallow sites often being composed of black sagebrush and the deeper soils mostly being mountain big sagebrush. Much of the winter range in the Southwest Desert unit borders the edge of pinyon-juniper communities. These tree communities which provide thermal cover for animals, but also pose a risk for encroachment.



Map 6.2: Estimated mule deer habitat by season and value for WMU 20, Southwest Desert.



Map 6.3: Estimated elk habitat by season and value for WMU 20, Southwest Desert.



Map 6.4: Estimated pronghorn habitat by season and value for WMU 20, Southwest Desert.

	Summer Range		Winter		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	129,312	11%	186,796	16%	889,052	74%
Elk	0	0%	0	0%	751,920	100%
Pronghorn	0	**0%**	0	**0%**	2,083,253	**100%**

Table 6.1: Estimated mule deer, elk, and pronghorn habitat acreage by season for WMU 20, Southwest Desert.

	Summer Range		Winter		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	104,958	81%	161,369	86%	761,113	86%
Private	10,813	8%	6,292	3%	33,882	4%
SITLA	10,061	8%	19,134	10%	87,277	10%
UDWR	3,480	3%	0	0%	6,780	<1%
Total	129,312	**100%**	186,796	**100%**	889,052	**100%**

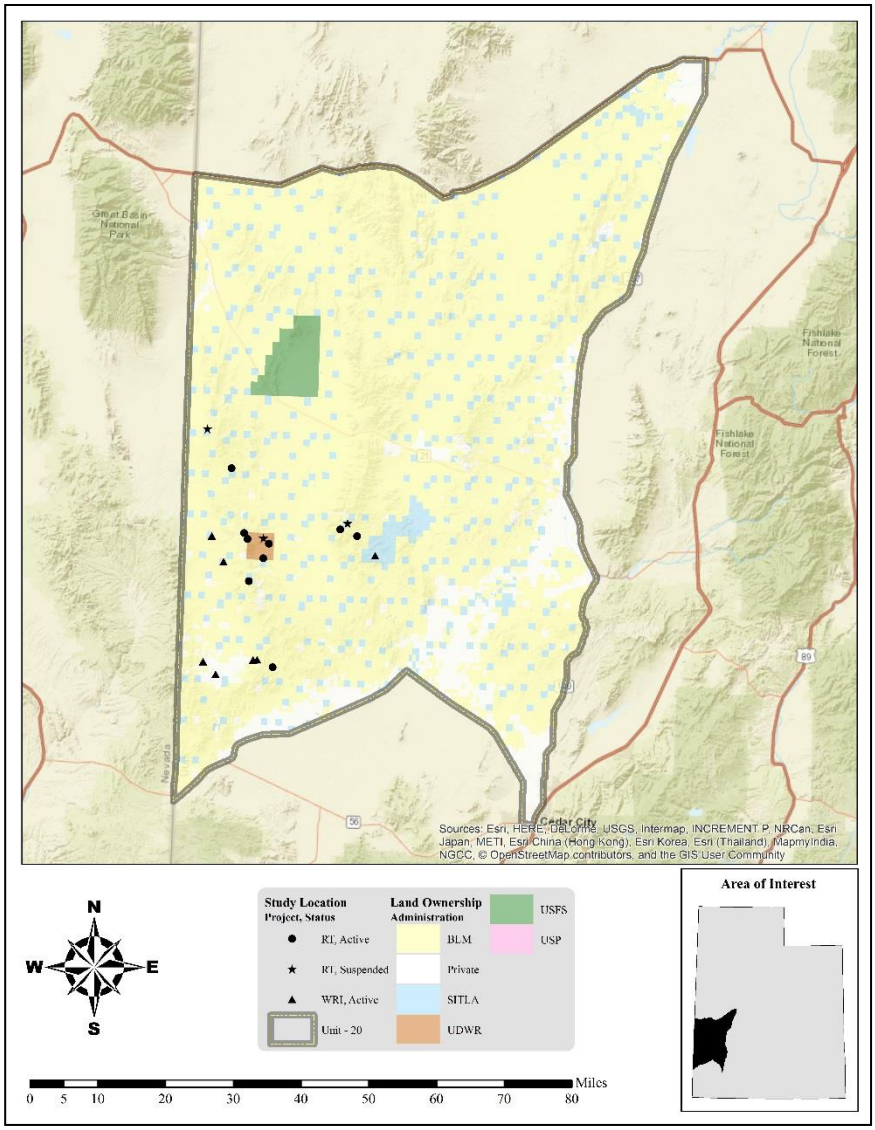
Table 6.2: Estimated mule deer habitat acreage by season and ownership for WMU 20, Southwest Desert.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	632,073	84%
Private	42,359	6%
SITLA	67,228	9%
UDWR	10,260	1%
Total	751,920	**100%**

Table 6.3: Estimated elk habitat acreage by season and ownership for WMU 20, Southwest Desert.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	1,559,959	75%
Private	272,188	13%
SITLA	199,431	10%
UDOT	33	<1%
UDWR	11	<1%
USFS	51,631	2%
Total	2,083,253	**100%**

Table 6.4: Estimated pronghorn habitat acreage by season and ownership for WMU 20, Southwest Desert.



Map 6.5: Land ownership for WMU 20, Southwest Desert.

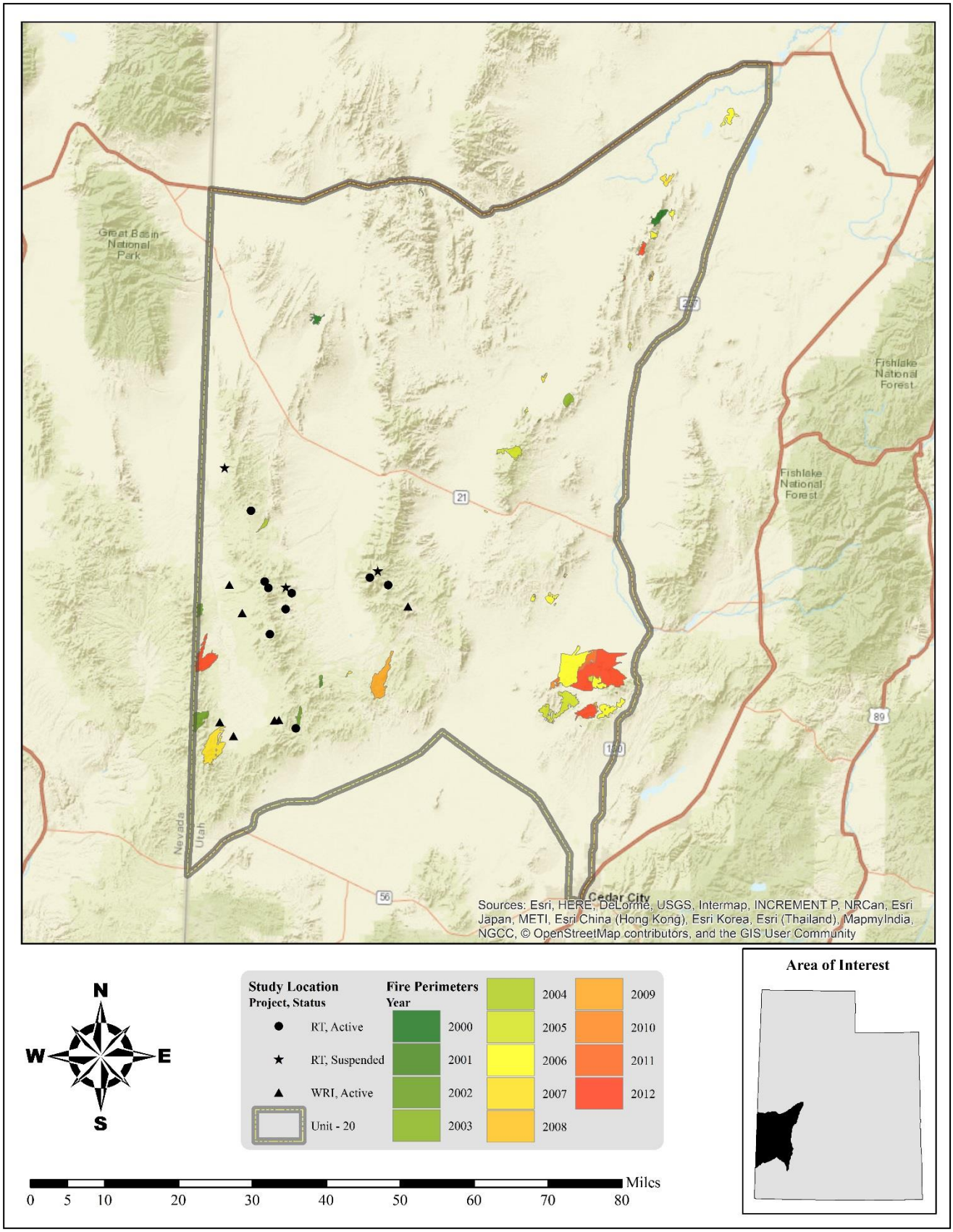
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	691,184	20.84%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	21,443	0.65%	
	Colorado Plateau Pinyon-Juniper Woodland	20,495	0.62%	
	Inter-Mountain Basins Juniper Savanna	5,115	0.15%	
	Abies concolor Forest Alliance	1,731	0.05%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,476	0.03%	
	Other Conifer	849	0.03%	22.37%
Exotic Herbaceous	Introduced Upland Vegetation-Annual and Biennial Forbland	65,009	1.96%	
	Introduced Upland Vegetation-Annual Grassland	66,131	1.99%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	1,407	0.04%	3.99%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	7,975	0.24%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	520	0.02%	
	Southern Rocky Mountain Montane-Subalpine Grassland	8	0.00%	0.26%
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	1,119,432	33.76%	
	Great Basin Xeric Mixed Sagebrush Shrubland	421,971	12.73%	
	Inter-Mountain Basins Big Sagebrush Shrubland	418,929	12.63%	
	Inter-Mountain Basins Greasewood Flat	90,204	2.72%	
	Mojave Mid-Elevation Mixed Desert Scrub	49,272	1.49%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	12,415	0.37%	
	Inter-Mountain Basins Big Sagebrush Steppe	12,031	0.36%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	11,082	0.33%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	5,848	0.18%	
	Coleogyne ramosissima Shrubland Alliance	2,195	0.07%	
	Grayia spinosa Shrubland Alliance	1,395	0.04%	
	Rocky Mountain Lower Montane-Foothill Shrubland	772	0.02%	
	Other Shrubland	435	0.01%	64.71%
Other	Barren	166,761	5.03%	
	Agricultural	39,740	1.20%	
	Developed	30,459	0.92%	
	Sparsely Vegetated	30,111	0.91%	
	Riparian	9,908	0.30%	
	Open Water	5,571	0.17%	
	Quarries-Strip Mines-Gravel Pits	1,863	0.06%	
	Conifer-Hardwood	1,222	0.04%	
	Hardwood	1,023	0.03%	8.66%
Total		3,315,981	100%	100%

Table 6.5: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 20, Southwest Desert.

Limiting Factors to Big Game Habitat

Major human activities in the area include grazing, mining, agriculture, and recreation. Habitat degradation and loss, lack of summer habitat, non-game ungulate competition for forage, and winter range conditions limit big game habitat in this unit. Encroachment by pinyon-juniper woodland communities poses a threat to important sagebrush rangelands. According to the current Landfire Existing Vegetation Coverage model, 20.84% of the Southwest Desert unit is comprised of pinyon-juniper woodlands, but in comparison to sagebrush, these woodlands are significant in size (**Table 6.5**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore negatively impacting the availability of wildlife forage (Miller, Svejcar, & Rose, 2000). Feral horses are a significant problem across the unit, with many sites showing extremely high occupancy by horses. In large numbers, horses can degrade range conditions by overutilization and trampling.

Other limiting factors to big game include introduced exotic herbaceous species such as cheatgrass (*Bromus tectorum*). The current Landfire Existing Vegetation Coverage model indicates that 3.99% of the unit is comprised of exotic herbaceous species (**Table 6.5**): this is more troublesome on the lower elevation sites. Increased amounts of cheatgrass can exacerbate the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 6.6: Land coverage of fires by year from 2000-2018 for WMU 20, Southwest Desert (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

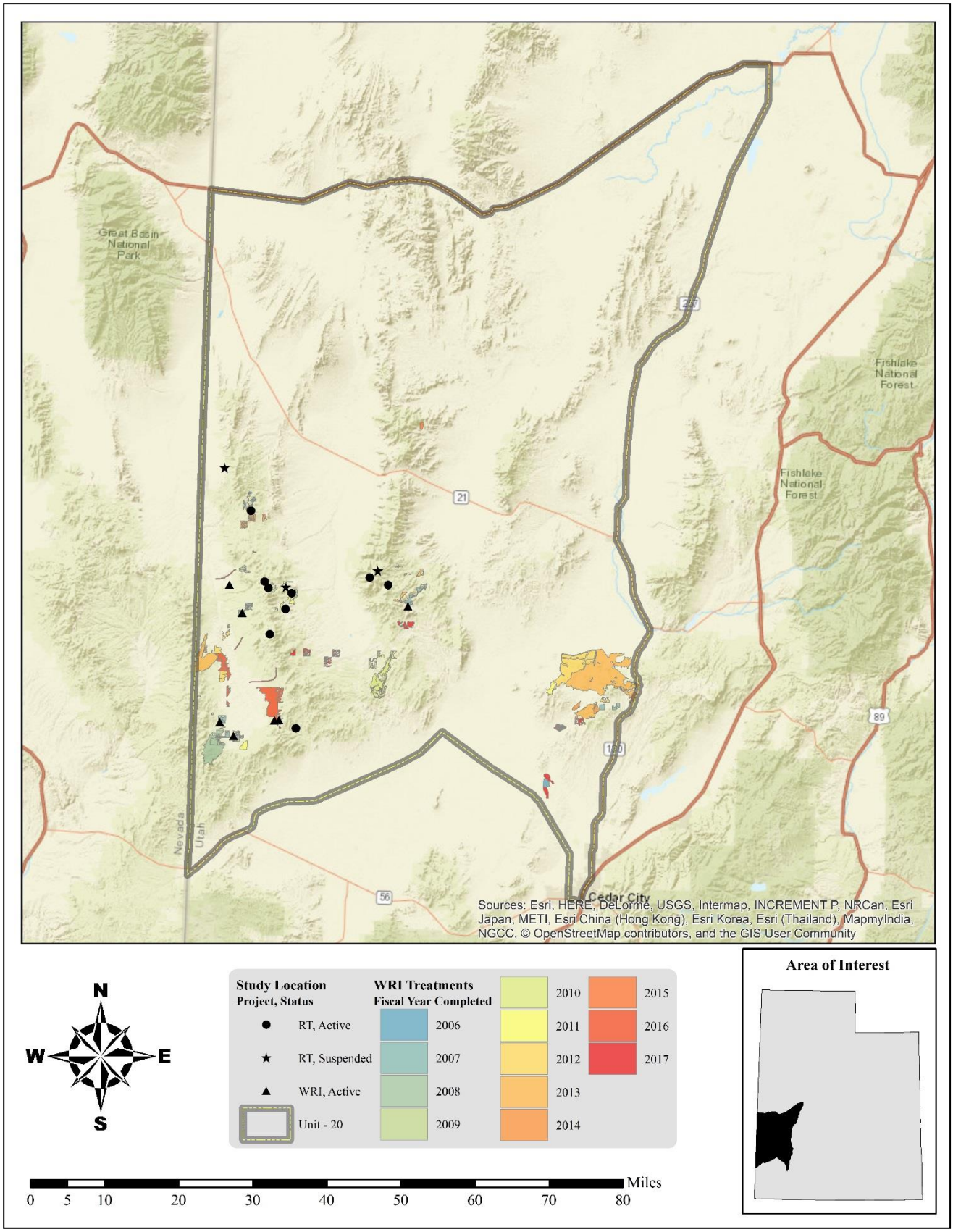
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 71,306 acres of land have been treated within the Southwest Desert unit since the WRI was implemented in 2004 (**Map 6.5**). An additional 21,981 acres are currently being treated and treatments have been proposed for 12,537 acres. Treatments frequently overlap one another bringing the total treated land area to 100,931 acres for this unit (**Table 6.6**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Anchor chaining to remove pinyon and juniper is the most common management practice in this unit. Seeding plants to augment the herbaceous understory is also very common. Other management practices include (but are not limited to): bullhog, lop and scatter, harrowing, discing, herbicide application, interseeding, and mowing (**Table 6.6**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**48,089**	**5,909**	**0**	**53,997**
Ely (One-Way)	39,422	0	0	39,422
Ely (Two-Way)	8,666	5,909	0	14,575
Bullhog	**3,219**	**6,274**	**6,193**	**15,686**
Full Size	3,148	6,274	6,193	15,616
Skid Steer	70	0	0	70
Disk	**447**	**0**	0	**447**
Off-Set (Two-Way)	169	0	0	169
Plow (Two-Way)	278	0	0	278
Harrow	**3,400**	**0**	0	**3,400**
≤ 15 ft. (One-Way)	746	0	0	746
≤ 15 ft. (Two-Way)	1,028	0	0	1,028
> 15 ft. (One-Way)	1,066	0	0	1,066
> 15 ft. (Two-Way)	560	0	0	560
Herbicide Application	**1,214**	**0**	0	**1,214**
Aerial (Fixed-Wing)	1,214	0	0	1,214
Interseeding	**0**	**120**	**0**	**120**
Mowing	**0**	**25**	**0**	**25**
Other	0	25	0	25
Seeding (Primary)	**8,561**	**0**	0	**8,561**
Broadcast (Aerial Fixed-Wing)	7,925	0	0	7,925
Drill (Rangeland)	633	0	0	633
Hand Seeding	3	0	0	3
Seeding (Secondary/Shrub)	**786**	**0**	0	**786**
Hand Seeding	786	0	0	786
Vegetation Removal/Hand Crew	**5,591**	**9,654**	**6,344**	**21,589**
Lop and Scatter	5,591	9,654	6,344	21,589
Total Treatment Acres	**71,306**	**21,981**	**12,537**	**105,824**
***Total Land Area Treated**	**67,636**	**20,758**	**12,537**	**100,931**

Table 6.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 20, Southwest Desert. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 6.7: WRI treatments by fiscal year completed for WMU 20, Southwest Desert.

Range Trend Studies

Range Trend studies have been sampled within WMU 20 on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 6.7**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 6.8**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
20-1	Upper Indian Peak	RT	Active	'85, '91, '98, '03, '08, '12, '17	Mountain Stony Loam (Browse)
20-2	Lower Indian Peak	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Shallow Loam (Black Sagebrush)
20-3	Mountain Home Seeding	RT	Active	'98, '03, '05, '08, '12, '17	Mountain Loam (Mountain Big Sagebrush)
20-4	Merrill's Camp	RT	Active	'12, '17	Mountain Stony Loam (Browse)
20-5	Upper Hamblin Valley	RT	Suspended	'98, '03, '08, '12	Upland Shallow Loam (Utah Juniper-Singleleaf Pinyon)
20-6	Wah Wah Pass	RT	Suspended	'98, '03, '08, '12	Mountain Shallow Loam (Curlleaf Mountain Mahogany)
20-7	South Spring	RT	Active	'99, '03, '08, '12, '17	Mountain Loam (Mountain Big Sagebrush)
20-8	Greens Canyon	RT	Active	'17	Mountain Loam (Browse)
20-9	Burnt Stump Canyon	RT	Active	'17	Mountain Shallow Loam (Low Sagebrush)
20-10	Lamerdorf Canyon	RT	Active	'17	Mountain Stony Loam (Browse)
20-11	Mustang Spring	RT	Active	'17	Upland Loam (Mountain Big Sagebrush)
20R-2	Indian Peaks Willow	RT	Active	'99	Not Verified
20R-3	Bowler Chaining	WRI	Active	'06, '11, '15	Upland Loam (Wyoming Big Sagebrush)
20R-4	Blawn Wash Dixie	WRI	Active	'06, '11, '15	Upland Gravelly Loam (Bonneville Big Sagebrush)
20R-5	Salt Cabin	WRI	Active	'06, '11, '15	Upland Loam (Wyoming Big Sagebrush)
20R-6	Hamlin Valley Harrow	WRI	Active	'08, '11, '15	Upland Loam (Wyoming Big Sagebrush)
20R-7	Spanish George Spring	WRI	Active	'15	Upland Loam (Mountain Big Sagebrush)
20R-8	Spanish George Spring 2	WRI	Active	'16	Upland Loam (Mountain Big Sagebrush)
20R-9	Miners Cabin Wash	WRI	Active	'17	Upland Gravelly Loam (Black Sagebrush)

Table 6.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 20, Southwest Desert.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
20-2	Lower Indian Peak	Chain Unknown		December 1959	100	
		Rangeland Drill		December 1959	100	
		Lop and Scatter	Indian Peaks WMA Lop and Scatter	May 2011	930	1784
20-3	Mountain Home Seeding	Two-Way Chain Unknown	Mountain Home Habitat Improvement 1988	March 1989	1,066	
		Aerial Before	Mountain Home Habitat Improvement 1988	March 1989	1,066	
		One-Way Dixie Harrow	Mountain Home Habitat Improvement	September 2005	746	226
		Broadcast Before	Mountain Home Habitat Improvement	September 2005	746	226
20-7	South Spring	Chain Unknown		January 1960		
		Seed Unknown		January 1960		
		Prescribed Fire	Indian Peak Prescribed Fire	January 1999		
20R-3	Bowler Chaining	Two-Way Ely	Bowler Chaining	Fall 2006	854	563
		Aerial Before	Bowler Chaining	Fall 2006	854	563
20R-4	Blawn Wash Dixie	Chain Unknown				
		Seed Unknown				
		One-Way Dixie Harrow	Blawn Wash Seeding Restoration	Fall-Winter 2006	1,067	391
		Broadcast Before	Blawn Wash Seeding Restoration	Fall-Winter 2006	1,067	391
20R-5	Salt Cabin	Two-Way Ely Chain	Salt Cabin Reseed	November 2006	733	479
		Aerial Before	Salt Cabin Reseed	November 2006	733	479

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
19R-14	Ibapah	Two-Way Dixie Harrow	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
	Harrow	Broadcast Before	Ibapah Sagebrush Improvement - Year 2	October 2008	134	1104
20R-6	Hamlin Valley	Two-Way Dixie Harrow	Hamlin Valley Flinspach	October 2009	320	1185
	Harrow	Broadcast Before	Hamlin Valley Flinspach	October 2009	320	1185

Table 6.8: Range trend and WRI studies known disturbance history for WMU 20, Southwest Desert.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are two studies [Mountain Home Seeding (20-3), South Spring (20-7)] classified as Mountain (Big Sagebrush) ecological sites. The Mountain Home Seeding site is located at the south end of the Mountain Home Range. The South Spring site is located in the Indian Peak range in the foothills near Pine Valley.

Shrubs/Trees: Preferred browse on these sites includes both mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and rubber rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa* var. *hololeuca*) as co-dominant species. The preferred browse demographic data shows that the density of plants has increased overall, with mature individuals comprising a majority of the population. Decadence of plants has remained small (**Figure 6.3**). Preferred browse utilization exhibited a slight decrease from 2003 to the most recent sample year with a small percentage of plants being heavily browsed (**Figure 6.9**).

Tree cover has not been sampled on either site since 1999, when a prescribed fire was used on the South Spring site (**Figure 6.5**). Trees were observed in density measurements only on the Mountain Home Seeding site in 2017 (**Figure 6.7**).

Herbaceous Understory: The herbaceous understories for these sites have fluctuated, but have shown an overall decreasing trend (**Figure 6.13**). Annual grasses have exhibited consistent increases in both cover and frequency. The perennial grass component on these sites is dominated by introduced species, mainly crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*). The cover and frequency for these introduced perennial grass species have remained similar or slightly decreased (**Figure 6.13**, **Figure 6.15**).

Occupancy: Average pellet transect data has shown that the primary occupants of these study sites are elk. Elk usage has been as low as of 8 days use/acre in 2017 and as high as 64 days use/acre in 2003. Deer are also present with mean abundance of pellet groups ranging from 1 day use/acre in 2012 to 12 days use/acre in 2008. Usage by horses has fluctuated with a low of 9 days use/acre in 2012 and a high of 29 days use/acre in 2008 (**Figure 6.17**).

Mountain (Browse)

There are four studies [Upper Indian Peak (20-1), Merrill's Camp (20-4), Greens Canyon (20-8), and Lamerdorf Canyon (20-10)] that are classified as Mountain (Browse) ecological sites. Upper Indian Peaks is located on the Indian Peak WMA at the base of Indian Peak. Merrill's Camp is located near Twin Peaks in the Indian Peak Range. Green's Canyon is located on the ridge approximately one mile north of Indian Peak. Lamerdorf Canyon is located up Rose Spring Canyon in the Wah Wah Mountains.

Shrubs/Trees: The shrubs on these mountain (browse) ecological sites are diverse and abundant with primary species including Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), alderleaf mountain mahogany (*Cercocarpus montanus*), curl-leaf mountain mahogany (*C. ledifolius*), and antelope bitterbrush (*Purshia tridentata*). Cover of sagebrush has increased slightly over time while other preferred browse has displayed a decreasing trend (**Figure 6.5**). Preferred browse utilization has fluctuated, with utilization being higher in 2012 than in other years (**Figure**

6.11). Preferred browse demographics show that mature plants comprise the majority of the browse populations. Recruitment of young plants has remained steady across the sample years (**Figure 6.9**).

Trees present on these sites include singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*). Cover of these trees has exhibited an increase, mainly due to the addition of two new study sites **Figure 6.5**). Density of trees is also influenced by the addition of new sites, although overall density of trees on this ecological sites is still low (**Figure 6.7**).

Herbaceous Understory: These sites support native herbaceous communities with plentiful perennial forbs and grasses. These sites are generally free of introduced species: the exception to this is Merrill's Camp which has contained significant quantities of cheatgrass (*Bromus tectorum*) in both years it was sampled. Cover and frequency of the understory as a whole have fluctuated slightly from year to year but have remained stable overall (**Figure 6.13**, **Figure 6.15**).

Occupancy: Average pellet transect data shows that the primary occupants of these study sites are elk. Mean abundance of elk pellet groups has varied from 60 days use/acre in 2003 to 21 days use/acre in 2017. Deer usage has also been variable with 2 days use/acre being noted in 2003 and 22 days use/acre observed in 2017. The average abundance of horse pellet groups on these sites has ranged from 0 days use/acre in 1998 and 2003, to 13 days use/acre in 2017 (**Figure 6.17**).

Mountain (Low Sagebrush)

There is one study [Burnt Stump Canyon (20-9)] that is classified as a Mountain (Low Sagebrush) ecological site. Burnt Stump Canyon is located at the head of Burnt Stump Canyon in the Wah Wah Mountains.

Shrubs/Trees: Little sagebrush (*Artemisia arbuscula*) is the dominant preferred browse species, although other species such as slender buckwheat (*Eriogonum microthecum*) and curlleaf mountain mahogany (*Cercocarpus ledifolius*) contribute lesser amounts of cover. Average preferred browse demographic data indicates that the majority of plants in this population are mature individuals (**Figure 6.3**). Since the only site in this ecological type was established in 2017, there are no previous study years in which to provide trend information. However, it is likely that without disturbance or management changes that this site will continue in its present condition.

Herbaceous Understory: This site has an abundant understory with the composition being split between perennial forbs and grasses (**Figure 6.13**). Diversity is moderate with native species providing almost all of the cover. There is not yet an established trend for the understory since the only study of this ecological type was established in 2017.

Occupancy: While the site of this ecological type is new and therefore does not have an established trend, average pellet transect data shows that deer, elk and horses were all present in 2017. Elk and deer had a mean pellet group abundance of 4 days use/acre, while that of horses was 5 days use/acre (**Figure 6.17**).

Upland (Big Sagebrush)

There is one study [Mustang Spring (20-11)] that is classified as an Upland (Big Sagebrush) ecological site. Mustang Spring is located at the south end of Hamlin Valley between Spanish George Spring and the town of Beryl.

Shrubs/Trees: Preferred browse species on this site are limited and mainly comprised of small amounts of antelope bitterbrush (*Purshia tridentata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The shrub rubber rabbitbrush (*Ericameria nauseosa*) is the most common shrub species on this site. Preferred browse demographic data shows that mature individuals are the dominant individuals in this plant community (**Figure 6.4**). As this study site was established in 2017 and is the only study within this ecological type, there are not yet established trends for shrubs and trees.

This site was treated with a bullhog in 2005, but Utah juniper (*Juniperus osteosperma*) is present in small amounts (**Figure 6.6**, **Figure 6.8**).

Herbaceous Understory: The herbaceous understory on this ecological site is in moderate condition. Much of the understory is comprised of introduced seeded species or early seral species. A trend is not yet established for the herbaceous component since the only study of this ecological type was established in 2017. Without changes to management or additional disturbances, the understory of this site is likely continue in its present composition (**Figure 6.14**, **Figure 6.16**).

Occupancy: The only site of this ecological type is new and a trend is not yet established. Average pellet transect data shows that horses were the primary occupant, with a mean pellet group abundance of 42 days use/acre in 2017. Deer and elk were also present, with a mean abundance of 4 days use/acre in 2017 (**Figure 6.18**).

Upland (Black Sagebrush)

There is one study [Lower Indian Peak (20-2)] that is classified as an Upland (Black Sagebrush) ecological site; Lower Indian Peak is located south of Indian Creek at the edge of Pine Valley.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) is the dominant preferred browse species on this site with lesser amounts of mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), Mormon tea (*Ephedra viridis*), and antelope bitterbrush (*Purshia tridentata*). Sagebrush has exhibited a slight increase in cover over time, while other preferred browse has displayed a slight decrease. Preferred browse demographics indicate an increase in mature individuals and a slight decrease in the percentage of decadent plants (**Figure 6.4**). Recruitment of young plants has been stable (**Figure 6.10**). Preferred browse utilization has shown marginal decreases overall, although the percentage of heavy utilized individuals increased slightly (**Figure 6.12**).

Trees present on this site include Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*). Tree cover and density has decreased on this study site, a trend likely driven by the lop and scatter treatment that occurred on Lower Indian Peak in 2011 (**Figure 6.6**, **Figure 6.8**).

Herbaceous Understory: This site has exhibited an overall increase in cover of the herbaceous understory: much of this is due to an increase in annual grasses for both nested frequency and cover (**Figure 6.14**, **Figure 6.16**). Perennial forbs are moderately diverse, but contribute little cover. While native grasses are present in the understory, a majority of the grass cover comes from introduced species. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has been present on the site and has increased over time (**Figure 6.14**).

Occupancy: Pellet transect data shows that the primary occupants on this site are elk and deer depending on the year. Mean abundance of elk pellet groups has been as low as 6 days in 2017 and as high as 44 days use/acre in 2003. Deer pellet data shows usage varying from 6 days use/acre in 1998 to 22 days use/acre in 2017. Cattle have had a mean pellet group abundance ranging from 0 days use/acre in 2003, 2008, and 2017 to 5 days use/acre in 1998. Finally, horse usage has been observed with a low of 0 days use/acre in 2003, 2008, and 2012 and a high of 1 day use/acre in 2017 (**Figure 6.18**).

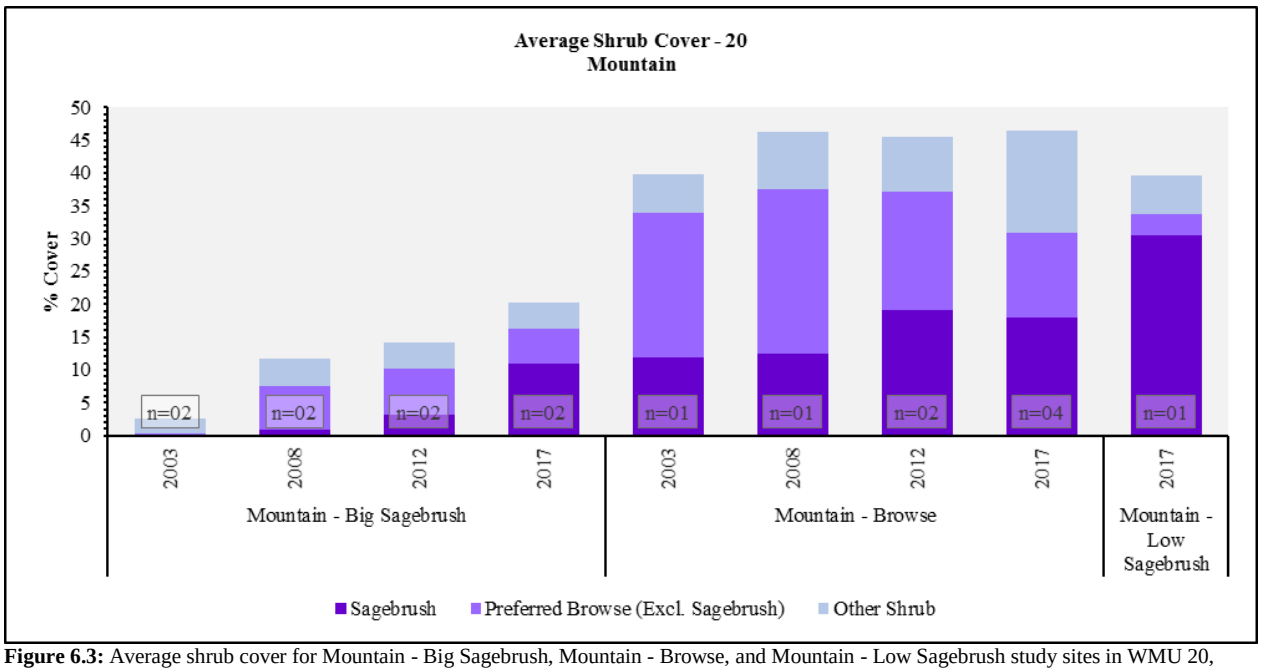


Figure 6.3: Average shrub cover for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

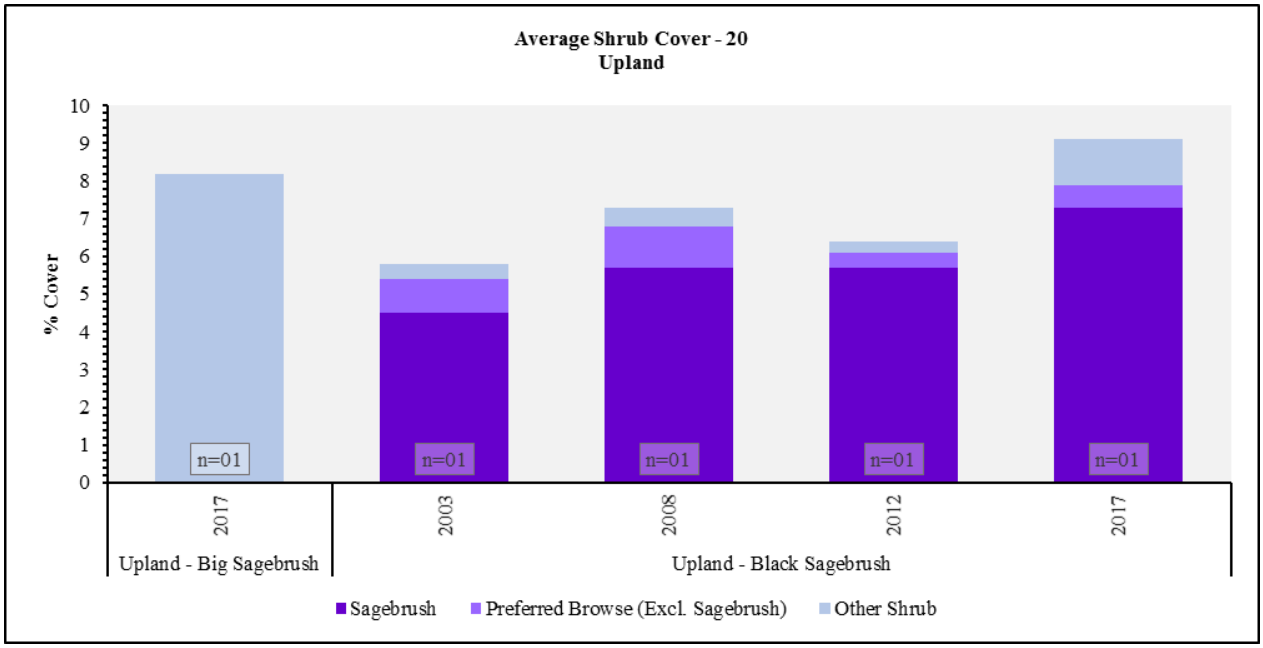


Figure 6.4: Average shrub cover for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

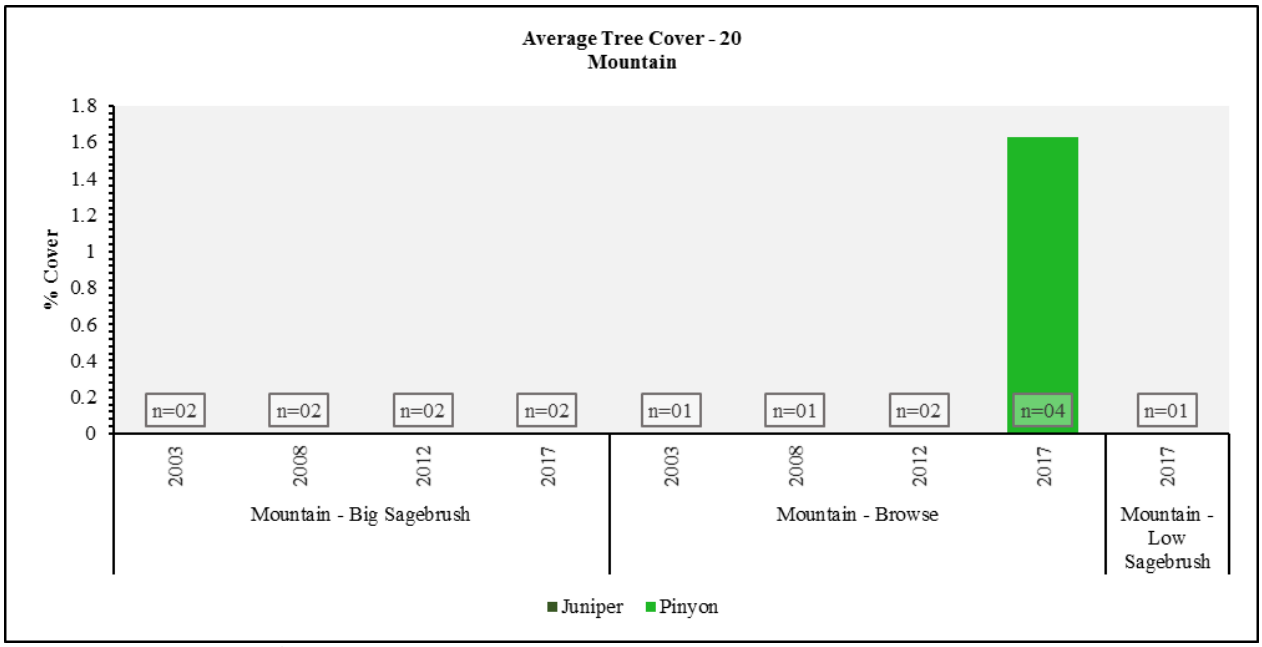


Figure 6.5: Average tree cover for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

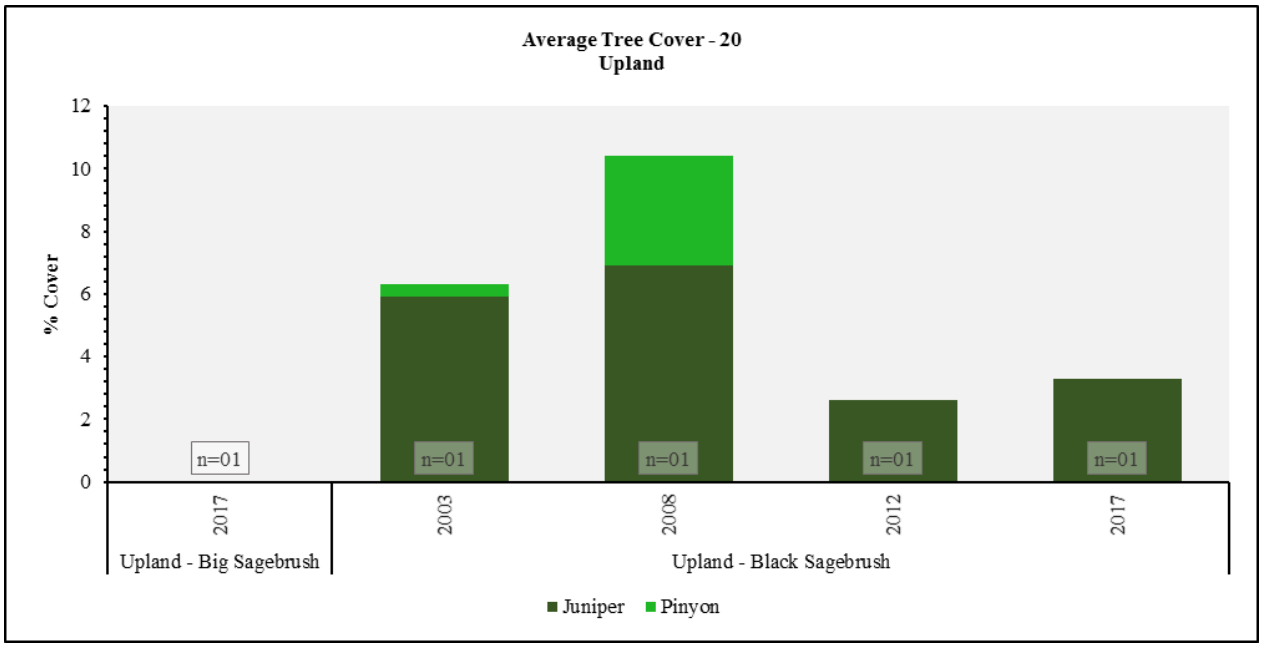


Figure 6.6: Average tree cover for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

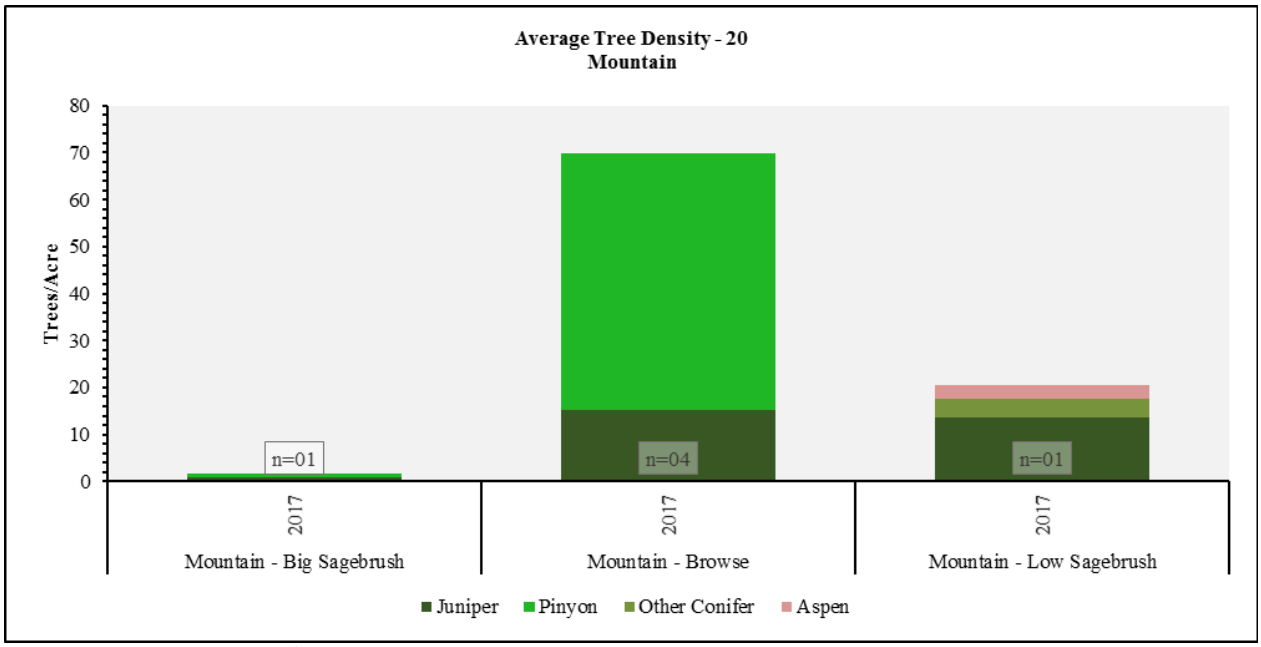


Figure 6.7: Average tree density for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

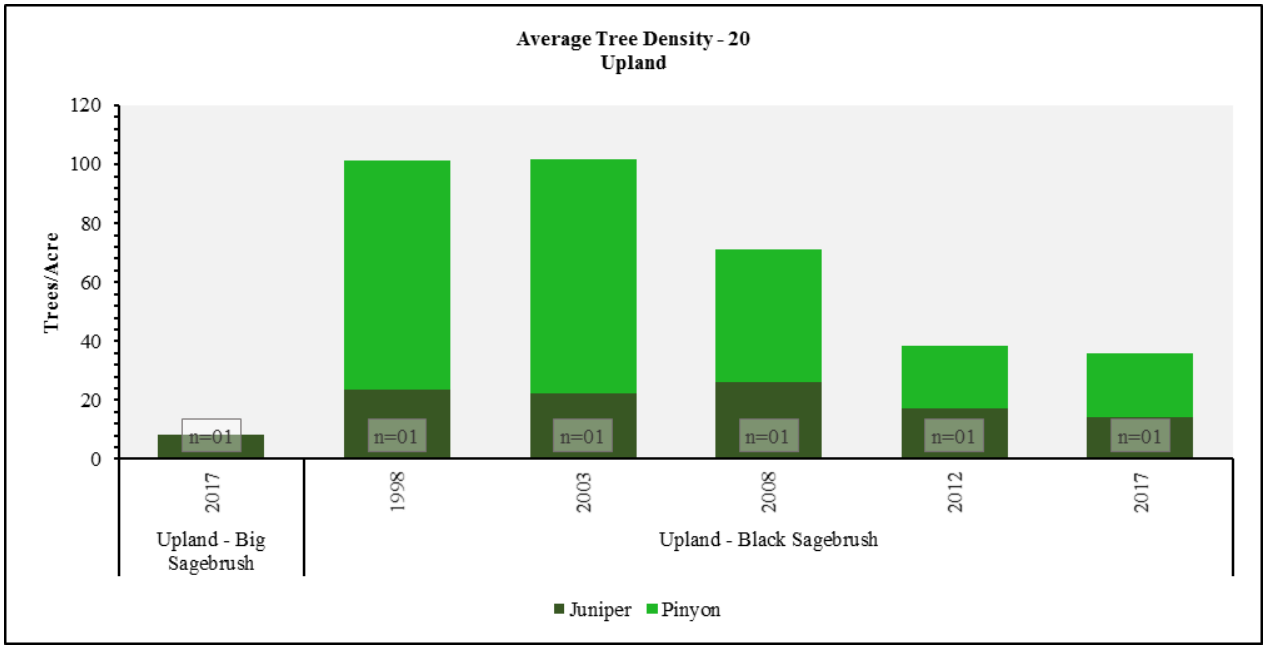


Figure 6.8: Average tree density Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

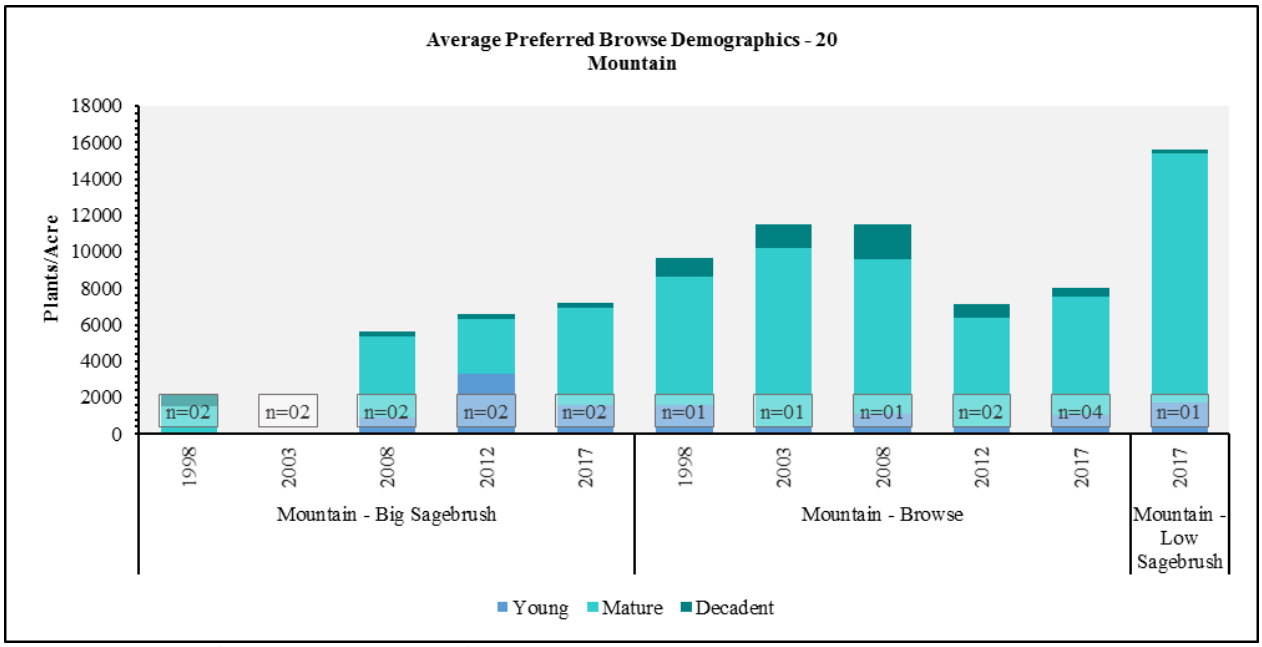


Figure 6.9: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

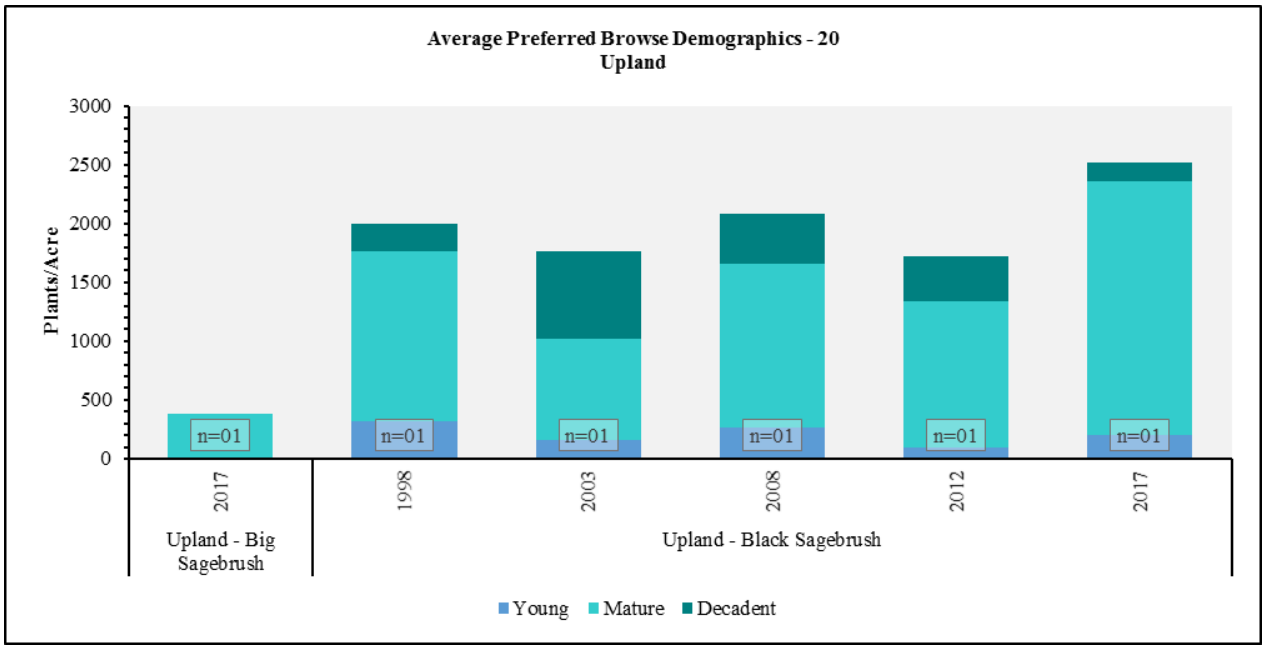


Figure 6.10: Average preferred browse demographics for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

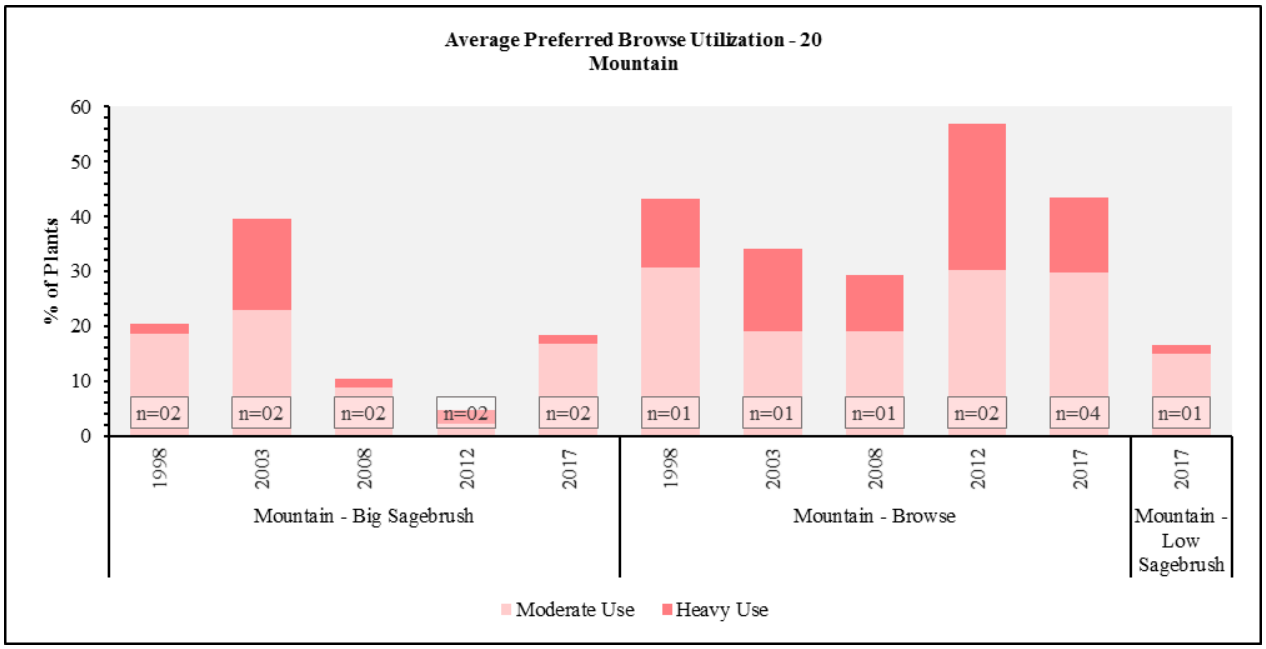


Figure 6.11: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

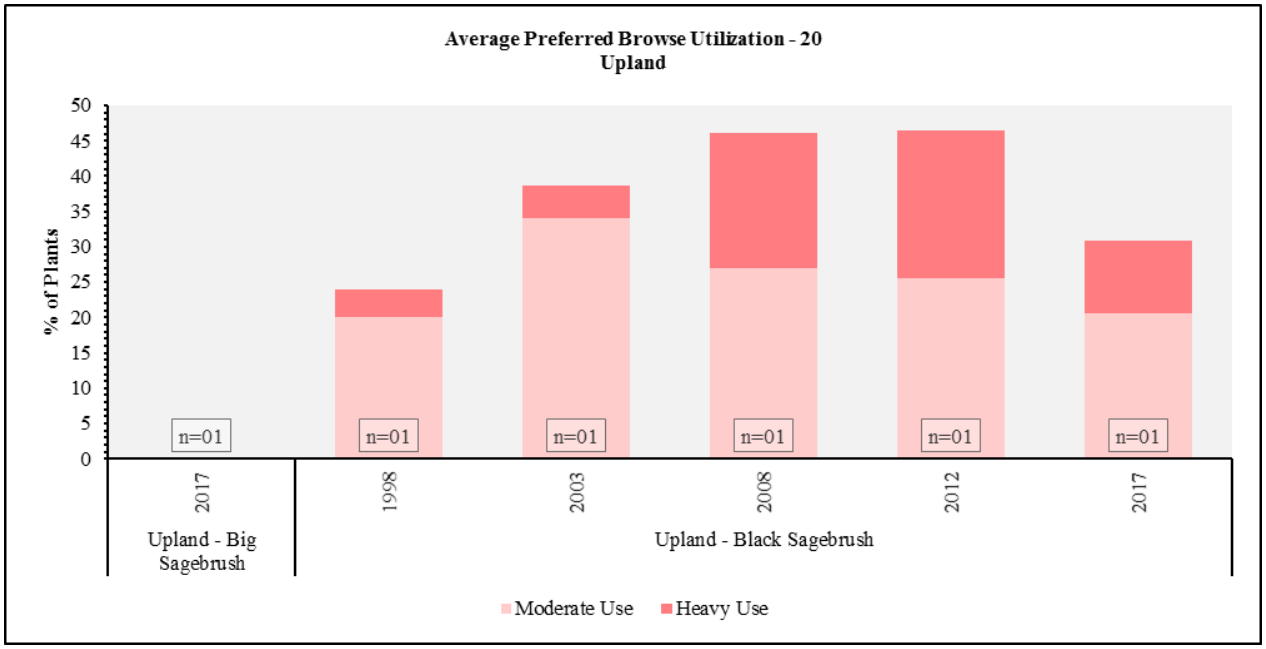


Figure 6.12: Average preferred browse utilization for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

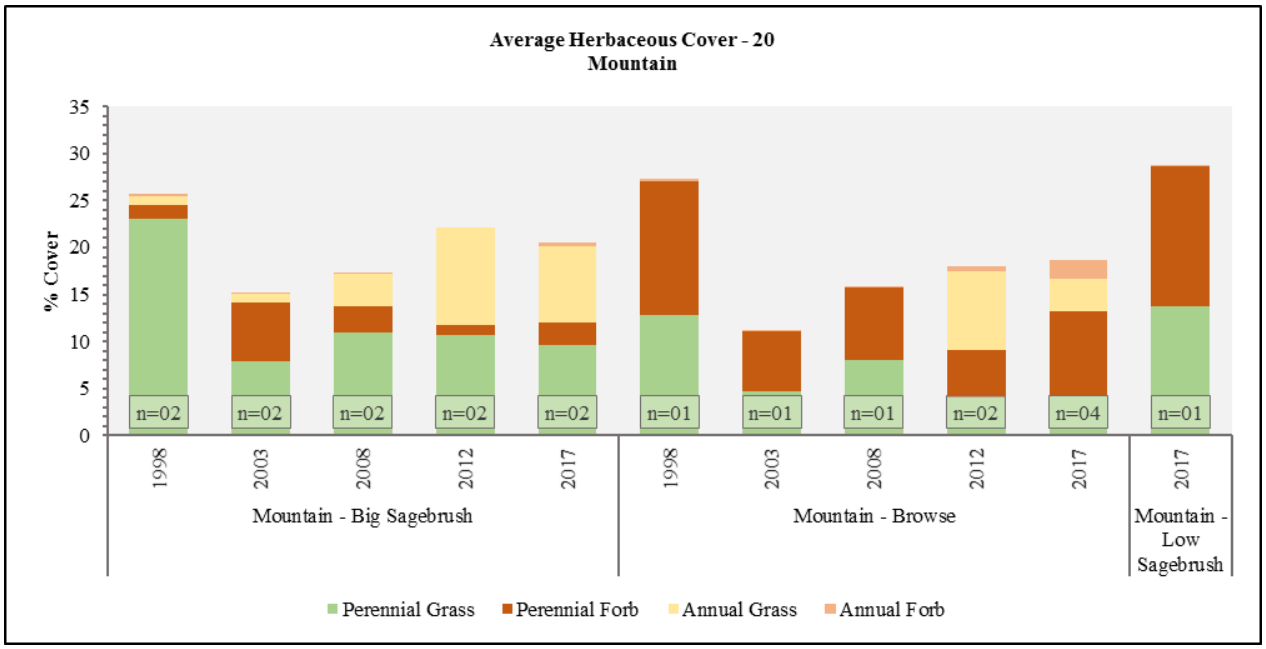


Figure 6.13: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

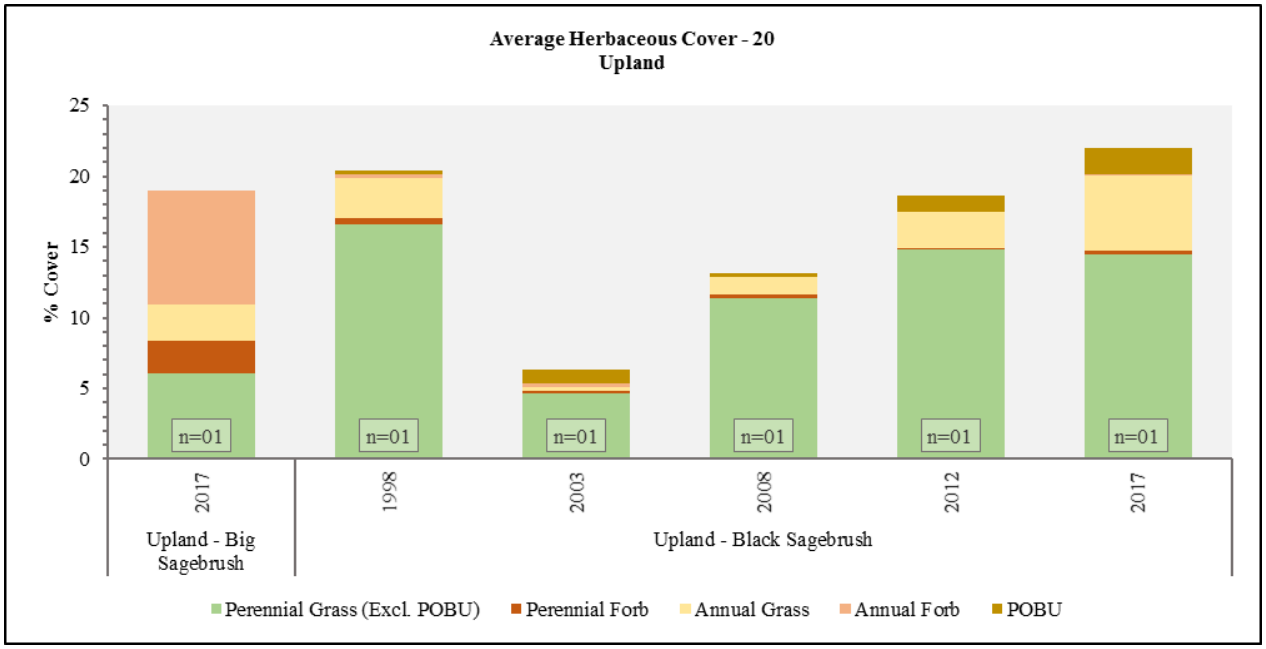


Figure 6.14: Average herbaceous cover for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

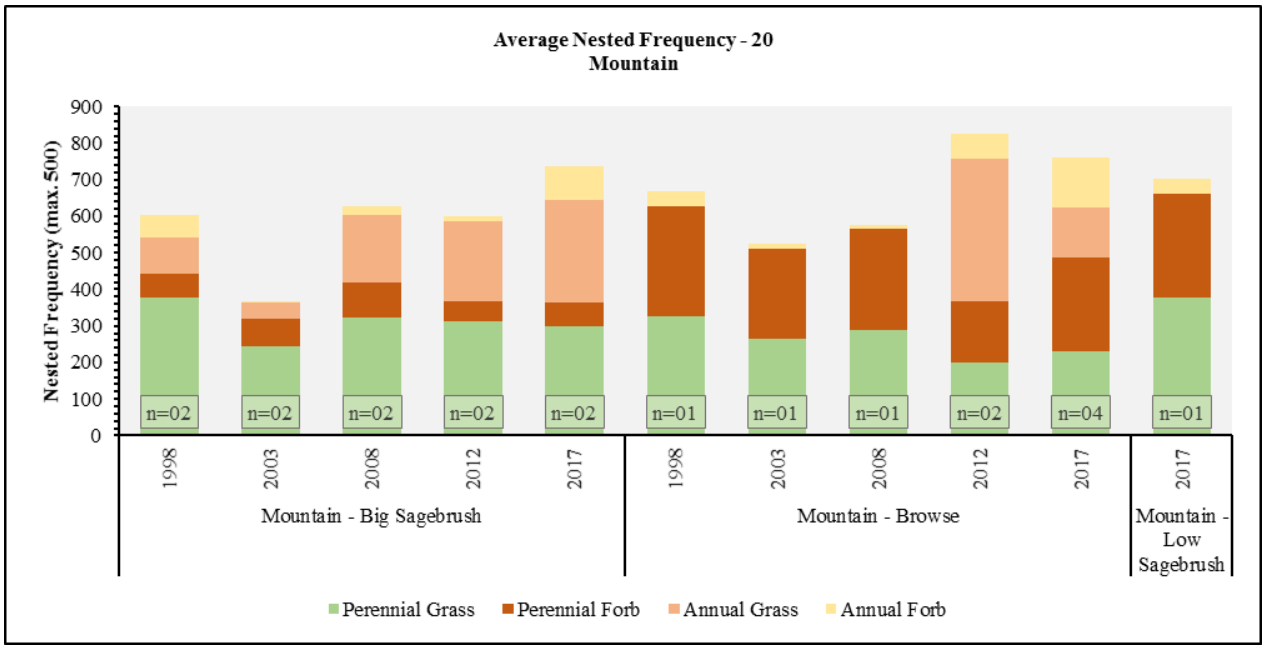


Figure 6.15: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

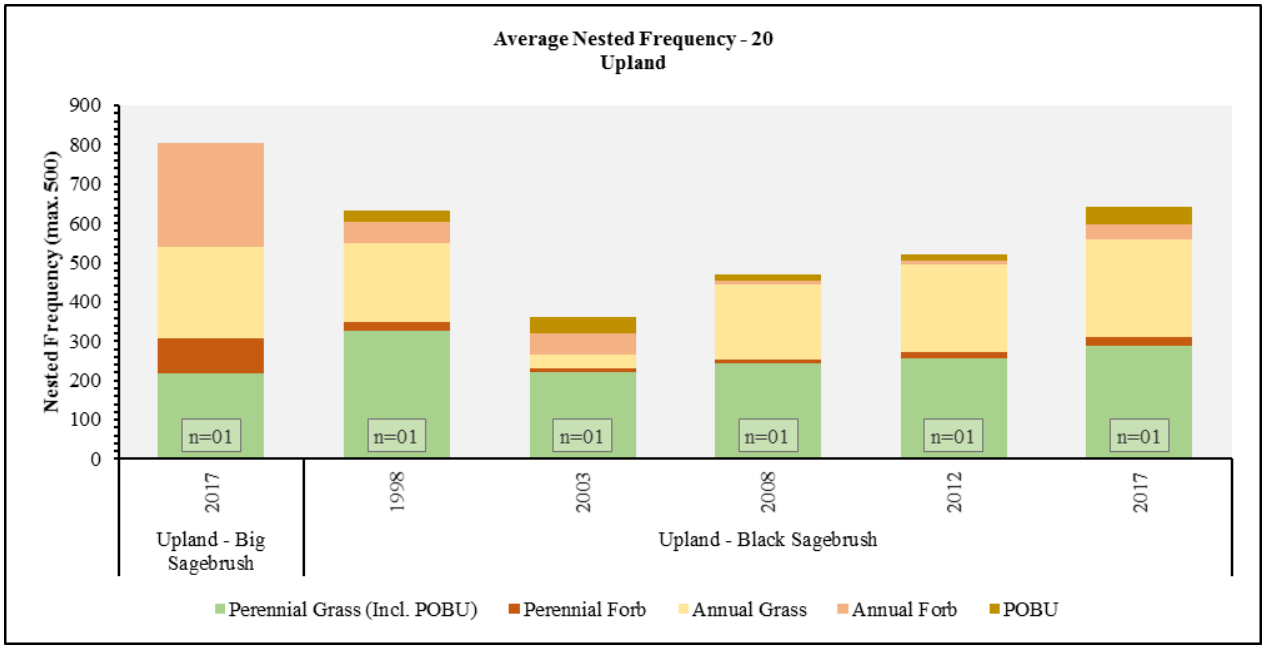


Figure 6.16: Average herbaceous nested frequency of herbaceous species for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

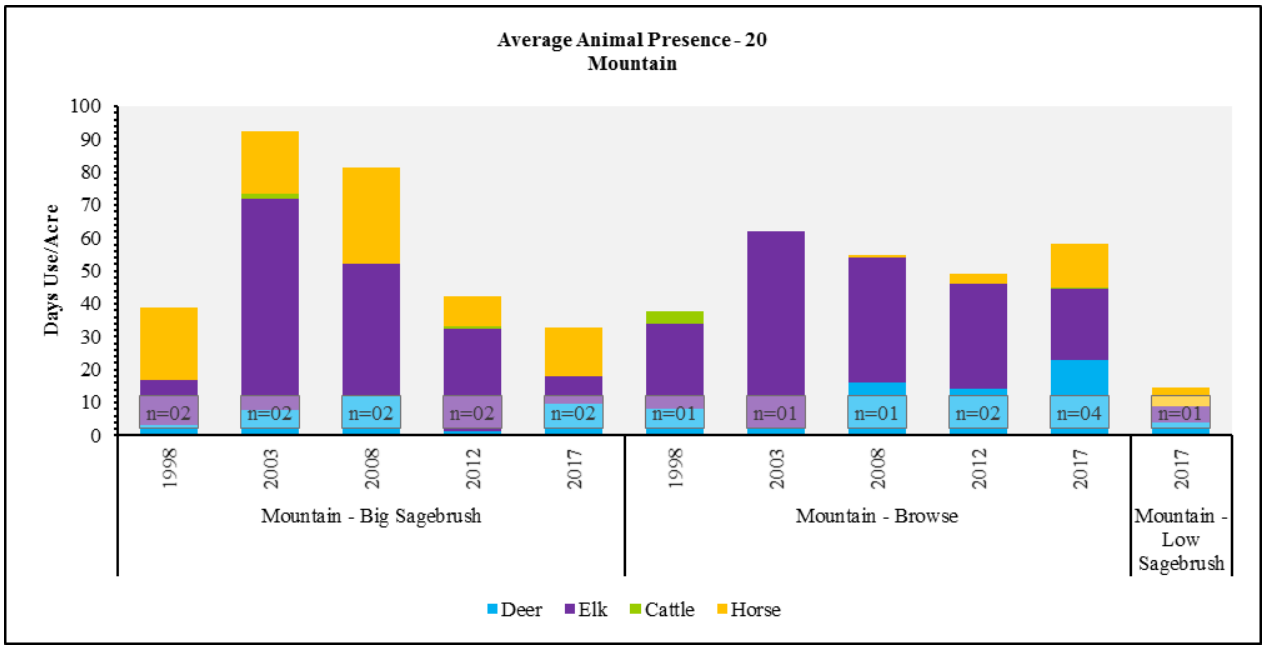


Figure 6.17: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Browse, and Mountain - Low Sagebrush study sites in WMU 20, Southwest Desert.

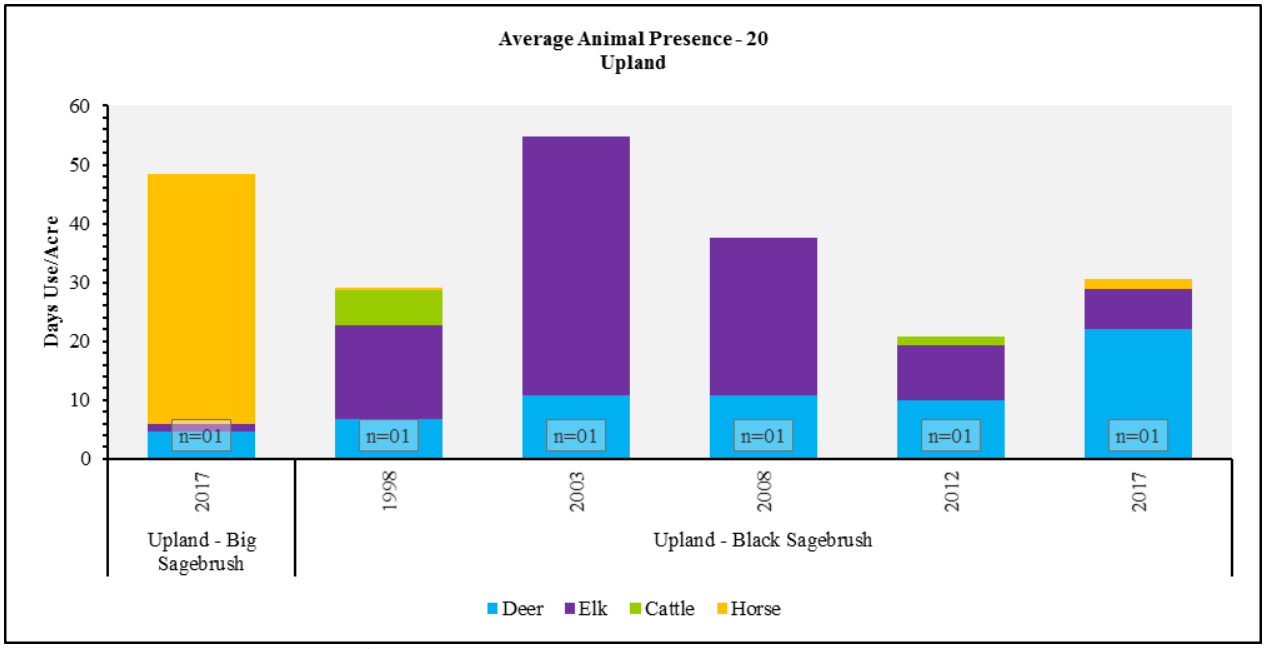


Figure 6.18: Average pellet transect data for Upland - Big Sagebrush and Upland - Black Sagebrush study sites in WMU 20, Southwest Desert.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Southwest Desert management unit has continually changed on the sites sampled since 1998. The active Range Trend sites sampled within the unit are considered to be in very poor to fair-good condition as of the 2017 sample year (**Figure 6.19**, **Table 1.10**). South Spring improved to fair-good condition, while Lower Indian Peak and Lamerdorf Canyon are considered to be in fair condition. Mountain Home Seeding is classified as being in poor-fair condition and Mustang Spring is considered to be in very poor condition. The poor condition sites are considered as such generally due to a lack of perennial grasses and either a lack of preferred browse cover or decadence of preferred browse. The treated sites have generally shown improvement in condition as time since treatment has increased (**Figure 6.20**, **Table 1.11**). The exception is Blawn Wash Dixie, which has remained in fair condition. It is possible given more time and continual monitoring that these sites will (continue to) improve.

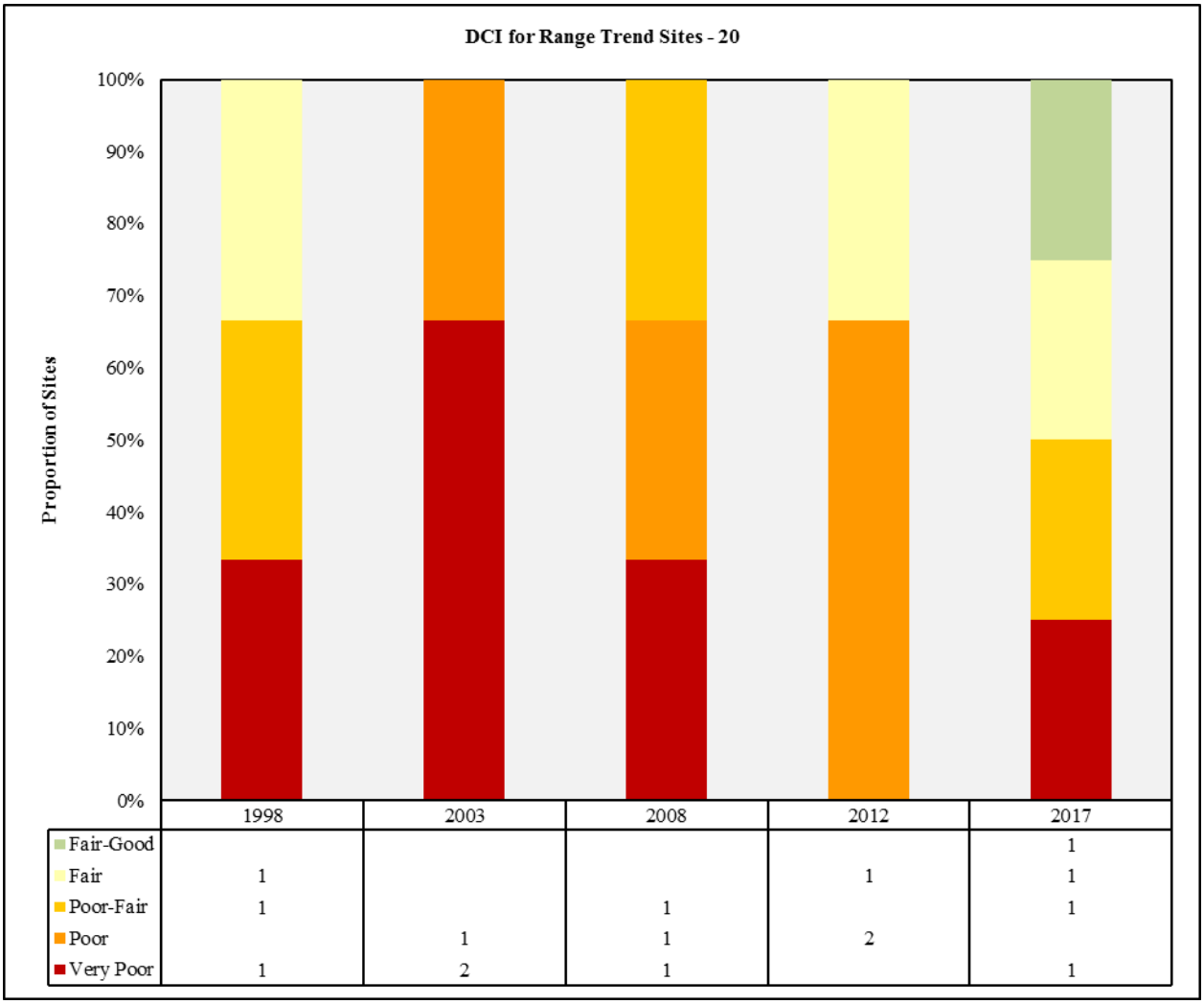


Figure 6.19: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 20, Southwest Desert.

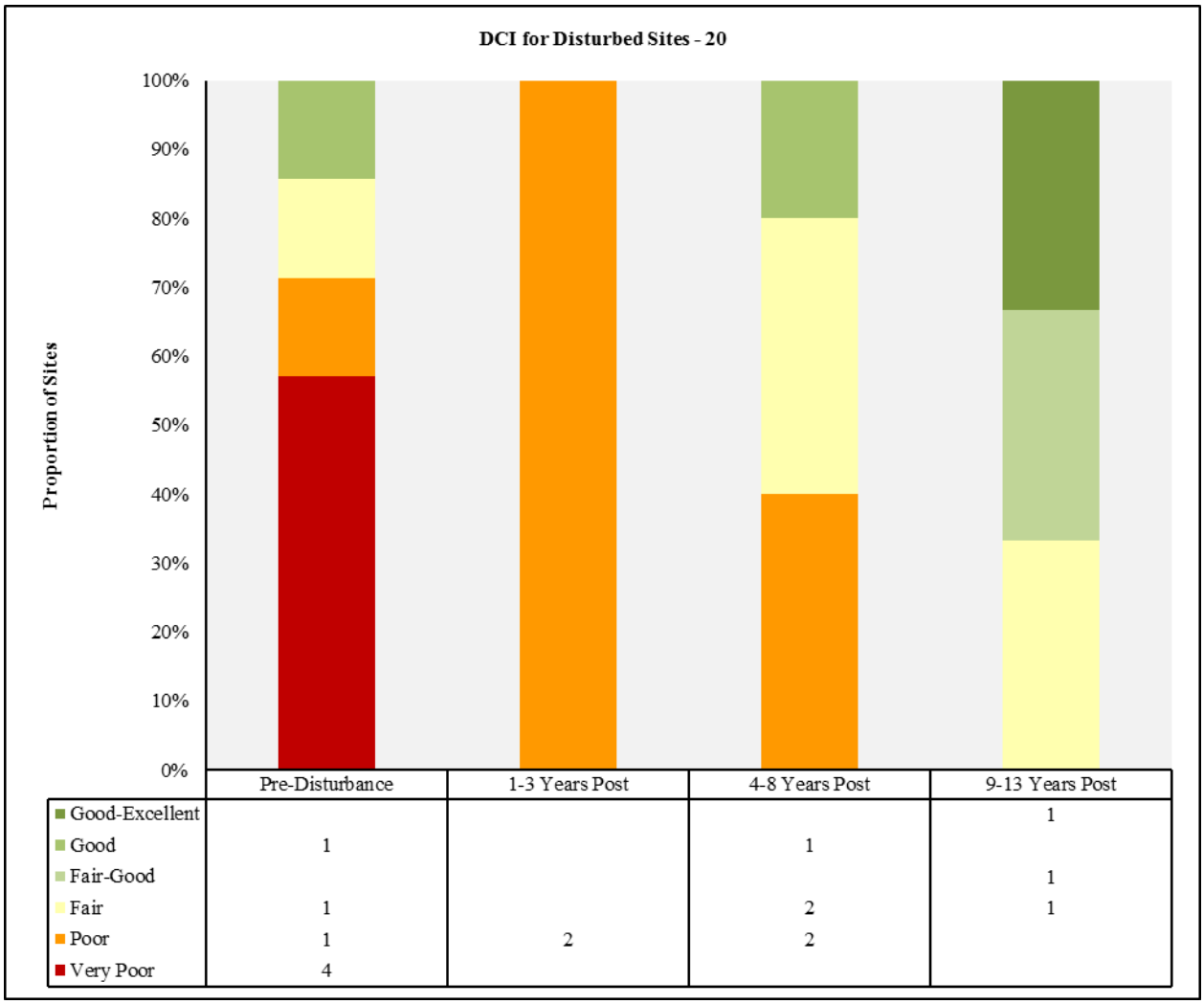


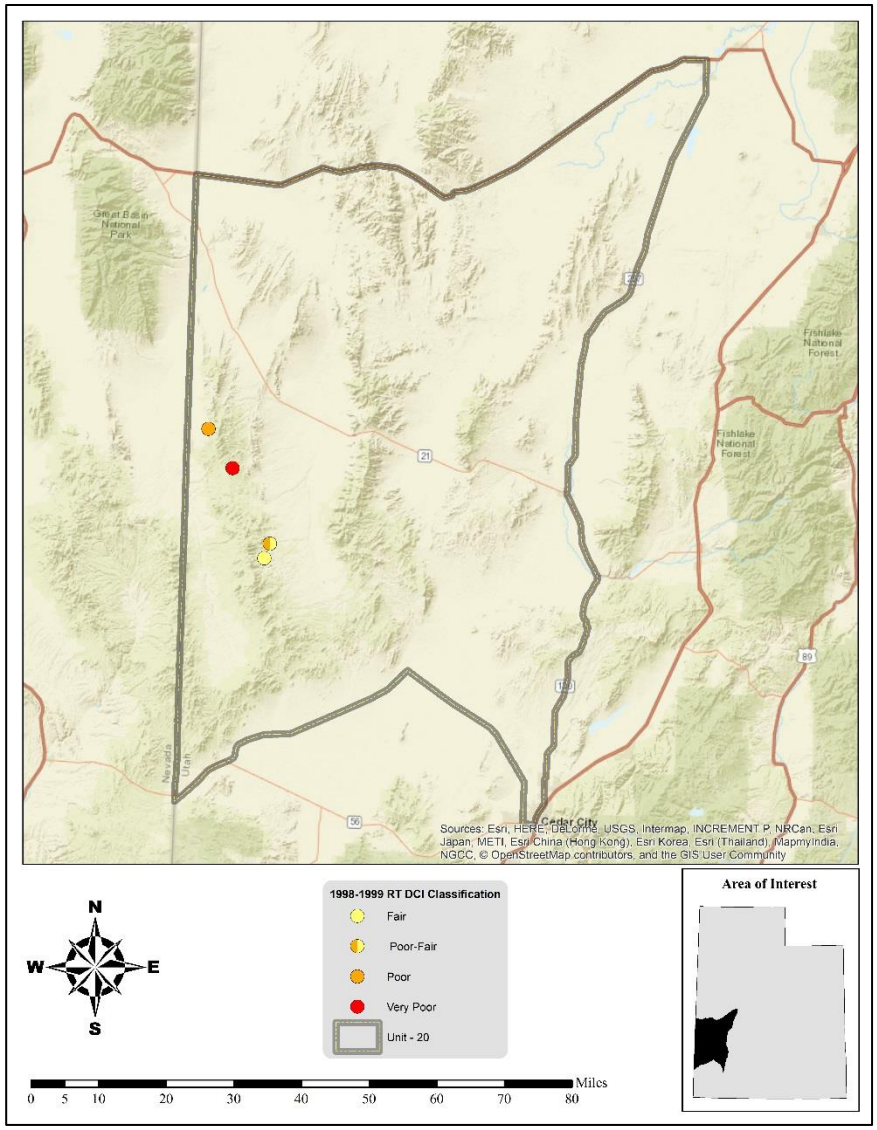
Figure 6.20: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 20, Southwest Desert.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20-2	1998	8.3	8.9	4.7	30.0	-2.2	0.8	0.0	**50.4**	**P-F**
20-2	2003	6.9	0.9	4.6	9.2	-0.2	0.4	0.0	**21.7**	**VP**
20-2	2008	8.6	8.3	5.9	22.8	-1.0	0.4	0.0	**45.0**	**P**
20-2	2012	7.7	7.8	2.5	29.6	-2.0	0.2	0.0	**45.8**	**P**
20-2	2017	9.9	13.4	3.9	28.8	-4.0	0.6	0.0	**52.6**	**F**
20-3	1998	0.5	0.0	0.0	30.0	-0.5	0.8	0.0	**30.8**	**VP**
20-3	2003	0.4	0.0	0.0	18.6	-0.1	0.4	0.0	**19.3**	**VP**
20-3	2005	2.6	0.0	0.0	30.0	0.0	0.6	0.0	**33.2**	**VP**
20-3	2008	4.3	0.0	0.0	26.2	0.0	0.8	0.0	**31.3**	**VP**
20-3	2012	10.6	12.5	15.0	24.6	0.0	0.6	0.0	**63.3**	**F**
20-3	2017	15.6	14.7	14.5	9.4	-1.4	2.2	0.0	**55.0**	**P-F**
20-5*	1998	13.0	9.9	5.4	4.4	-0.1	10.0	0.0	**42.6**	**P**
20-5*	2003	16.2	14.3	1.6	2.4	0.0	10.0	0.0	**44.4**	**P**
20-5*	2008	15.9	4.7	0.5	4.4	0.0	10.0	0.0	**35.5**	**VP-P**
20-5*	2012	13.3	6.8	2.0	3.8	-0.1	10.0	0.0	**35.9**	**VP-P**
20-7	1998	17.0	6.3	0.5	30.0	-0.9	5.2	0.0	**58.1**	**F**
20-7	2003	0.4	15.0	15.0	13.0	-1.4	10.0	0.0	**52.0**	**P**
20-7	2008	14.5	14.4	3.1	18.0	-5.1	10.0	0.0	**54.9**	**P-F**
20-7	2012	14.9	14.1	8.8	18.4	-15.5	3.4	0.0	**44.0**	**P**
20-7	2017	25.0	12.6	6.7	29.0	-10.7	7.6	0.0	**70.1**	**F-G**
20-10	2017	22.9	13.1	15.0	5.8	-0.1	10.0	0.0	**66.7**	**F**
20-11	2017	0.0	0.0	0.0	12.2	-1.9	4.6	0.0	**14.9**	**VP**

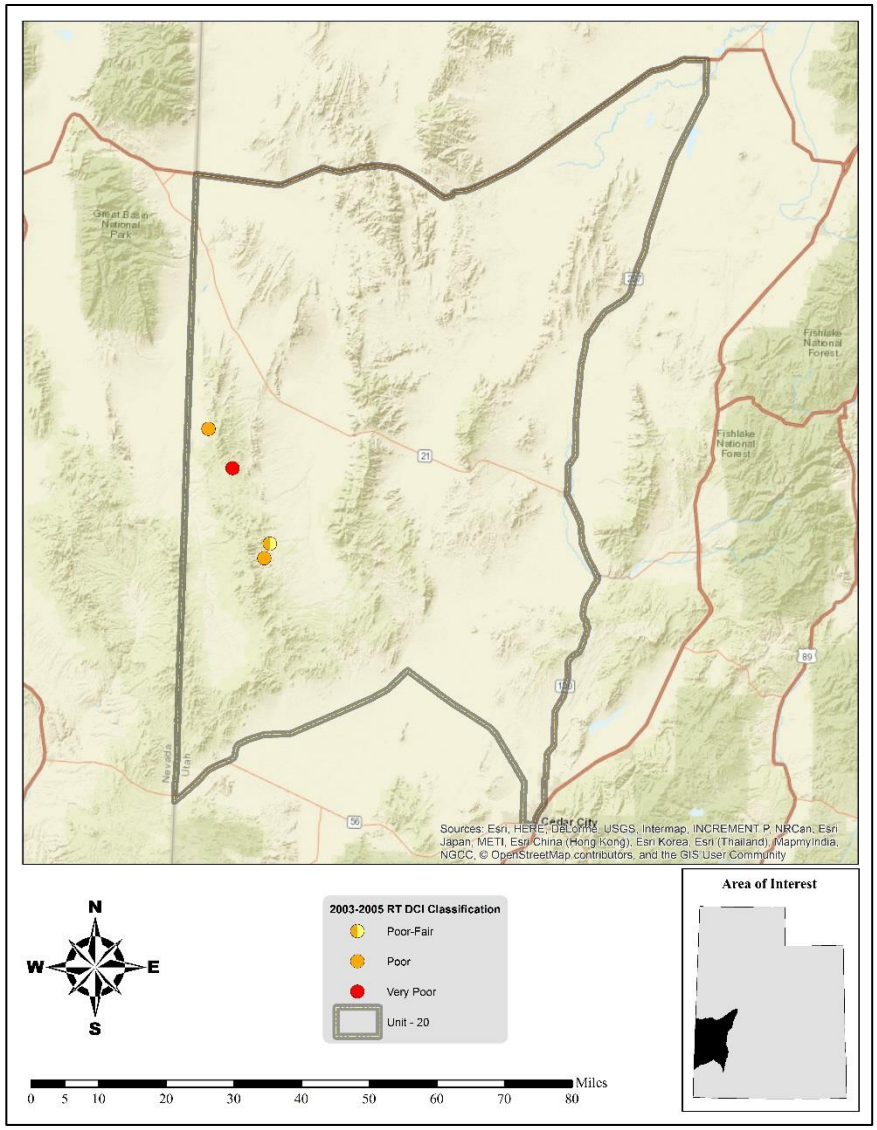
Table 6.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 20, Southwest Desert. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20R-3	2006	1.5	0.0	0.0	6.6	0.0	10.0	0.0	**18.1**	**VP**
20R-3	2011	5.4	0.0	0.0	26.2	-0.1	10.0	0.0	**41.5**	**P**
20R-3	2015	9.5	15.0	15.0	30.0	0.0	8.8	0.0	**78.3**	**G-E**
20R-4	2006	30.0	5.5	1.0	19.4	-2.7	0.2	0.0	**53.4**	**F**
20R-4	2011	29.4	14.2	5.3	9.0	-7.4	2.6	0.0	**53.0**	**F**
20R-4	2015	30.0	13.4	1.4	11.0	-0.5	1.2	0.0	**56.5**	**F**
20R-5	2006	7.1	13.1	15.0	30.0	-0.1	3.0	0.0	**68.1**	**G**
20R-5	2011	5.0	0.0	0.0	30.0	-0.5	4.2	0.0	**38.7**	**P**
20R-5	2015	8.6	15.0	9.4	29.4	-0.1	2.0	0.0	**64.3**	**F-G**
20R-6	2011	2.9	0.0	0.0	30.0	-0.2	10.0	0.0	**42.7**	**P**
20R-6	2015	6.5	15.0	15.0	30.0	0.0	4.0	0.0	**70.5**	**G**
20R-7	2015	0.5	0.0	0.0	2.8	-0.1	0.4	0.0	**3.6**	**VP**
20R-8	2016	0.0	0.0	0.0	0.4	0.0	0.0	0.0	**0.4**	**VP**
20R-9	2017	4.0	7.8	8.5	2.6	-0.4	6.2	0.0	**28.7**	**VP**

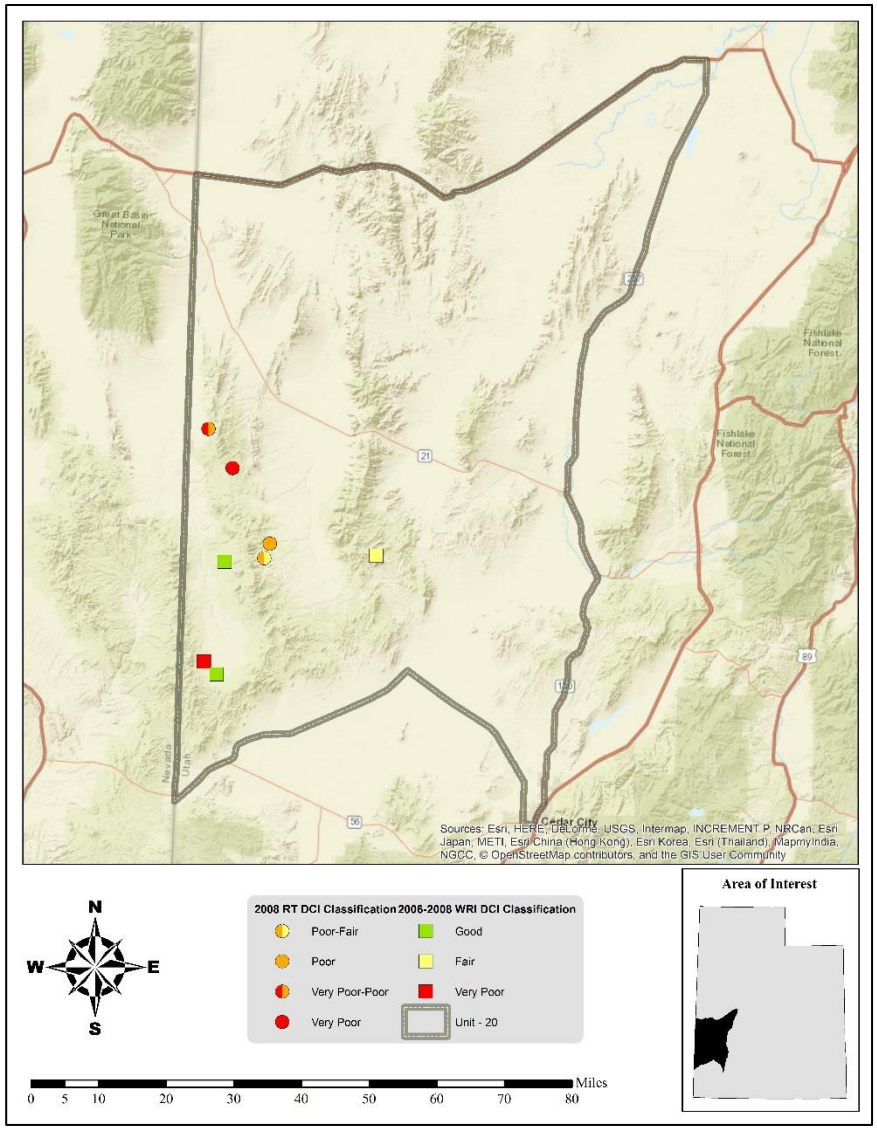
Table 6.10: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 20, Southwest Desert. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



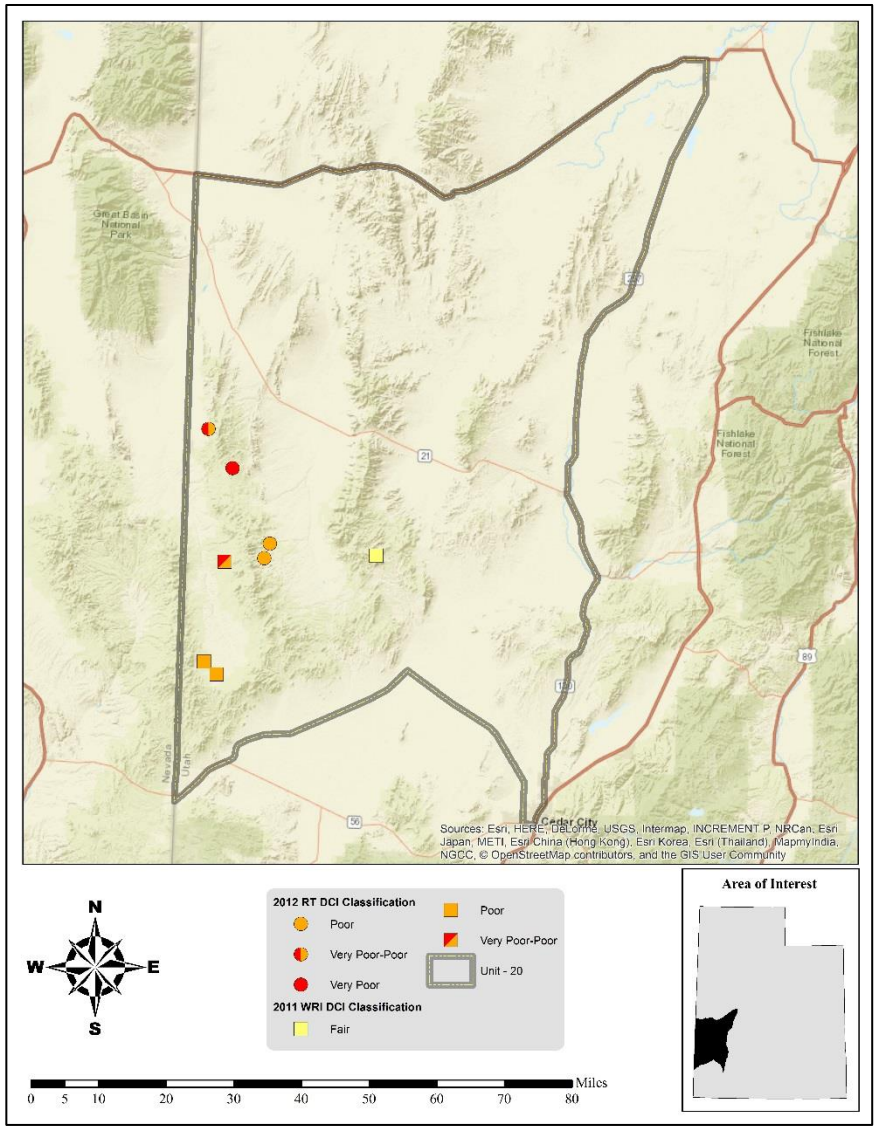
Map 6.8: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 20, Southwest Desert.



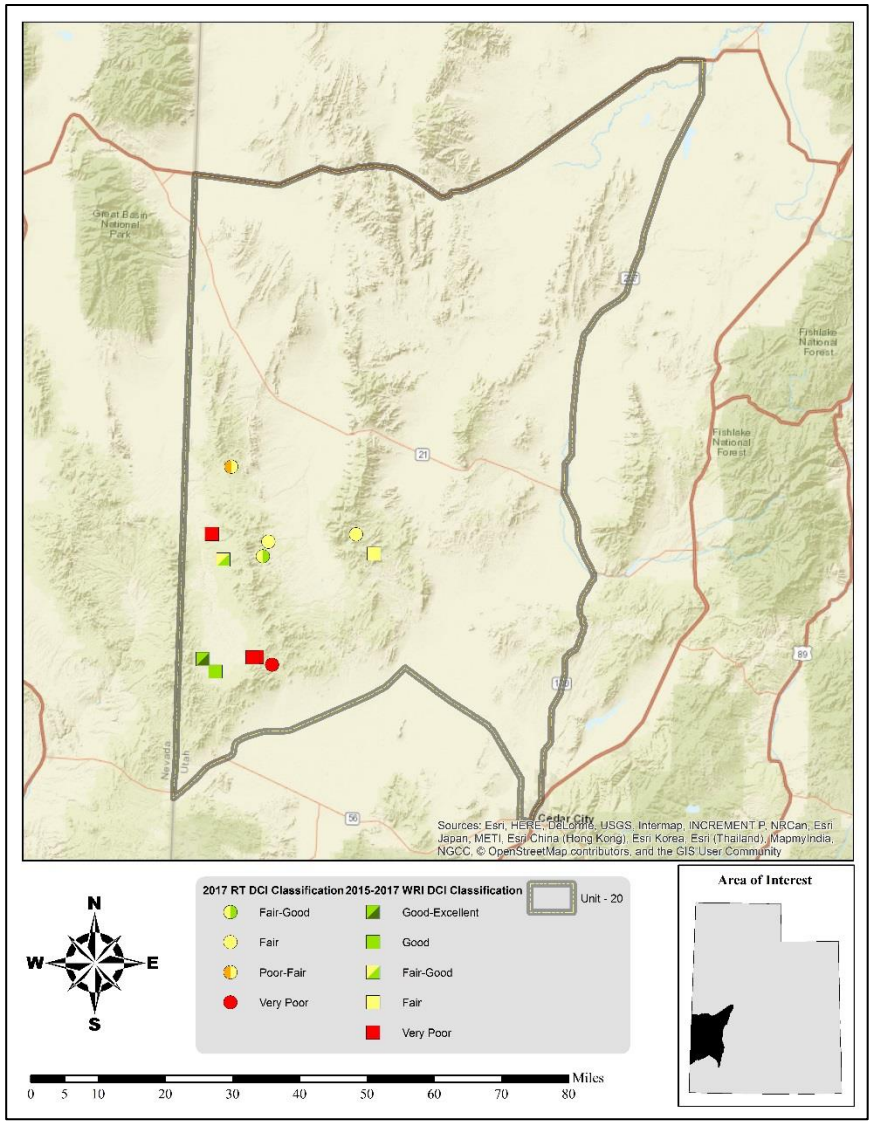
Map 6.9: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 20, Southwest Desert.



Map 6.10: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 20, Southwest Desert.



Map 6.11: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 20, Southwest Desert.



Map 6.12: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 20, Southwest Desert.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
20-1	Upper Indian Peak	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20-2	Lower Indian Peak	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20-3	Mountain Home Seeding	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20-4	Merrill's Camp	Annual Grass	High	Increased Fire Potential
20-7	South Spring	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
20-8	Greens Canyon	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20-9	Burnt Stump Canyon	None Identified		
20-10	Lamerdorf Canyon	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20-11	Mustang Spring	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
20R-9	Miners Cabin Wash	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor

Table 6.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 20, Southwest Desert. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are considered to be of the Mountain (Big Sagebrush) ecological type are classified as deer winter range. These studies are considered to be in poor-fair to fair-good condition. These communities are host to shrub populations that can support deer and elk during the winter season. Both of these sites have some annual grass present, with more being present on the South Spring study. These sites were treated with prescribed fire in the 1980's and 90's to remove tree cover. However, pinyon-juniper communities are present at the edges of both of these sites, indicating a risk for future encroachment. Due to heavy grazing pressure, feral horse usage is a management issue on these sites.

It is recommended that areas with high levels of conifer encroachment or infill be treated with a tree-removing disturbance (e.g. bullhog, chaining, lop and scatter, etc.). Areas with high cover of annual grass should be monitored and if these levels are sustained, treatments to remove these species are advisable to reduce these species; changes in grazing management or herbicide treatments are possible management tools. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Browse)

Most of the studies in the Mountain (Browse) ecological type are not considered to be winter range, with Lamerdorf Canyon being the exception. These communities support robust browse and herbaceous species that provide varied feed for summering animals. Pinyon-juniper communities are present on all the sites and are currently considered to be in Phase I encroachment. Feral horse usage is a significant issue on these sites, due to the heavy grazing pressure that these animals display on sites. Annual grasses are present on some of the sites and Merrill's Camp had high cover of cheatgrass in both years that it was sampled. These grasses can increase fuel loads and raise the risk of wildfire.

It would be recommended to treat areas with conifer encroachment or infill (e.g. bullhog, chaining, lop and scatter, etc.). Areas with high cover of annual grass should be monitored and if these levels are sustained, treatments would be advisable to reduce these species. Changes in grazing management or herbicide treatments are management tools that could be used. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Low Sagebrush)

The lone Mountain (Low Sagebrush) ecological site is considered to be summer habitat for deer and year-long habitat for elk. This community supports shrub and herbaceous components that provide a variety of feed for big game. As the Desirable Components Index is based on mule deer winter range, it is not used for this site. The site had good cover of perennial grasses and forbs with no invasive species present. In addition, good cover of preferred browse species has been observed. Feral horse usage associated with heavy grazing is a significant issue on this site.

No specific threats were identified for this study site. However, grazing should be monitored on this site and other areas within this ecological type; overgrazing can cause ecological issues such as erosion, reduced plant vigor, and changes to the plant community as a whole.

Upland (Big Sagebrush)

The study considered to be of the Upland (Big Sagebrush) ecological type is in very poor condition for deer winter range. Lack of preferred browse and low cover of perennial grass are contributing factors to the unsatisfactory condition of this site. Pinyon-juniper communities are present and this site is currently considered to be in Phase I of woodland encroachment. Feral horses are also a concern on this study as they

exert heavy grazing pressure. In addition, annual grasses are present and contribute moderate cover: these grasses can increase fuel loads and raise the risk of wildfire.

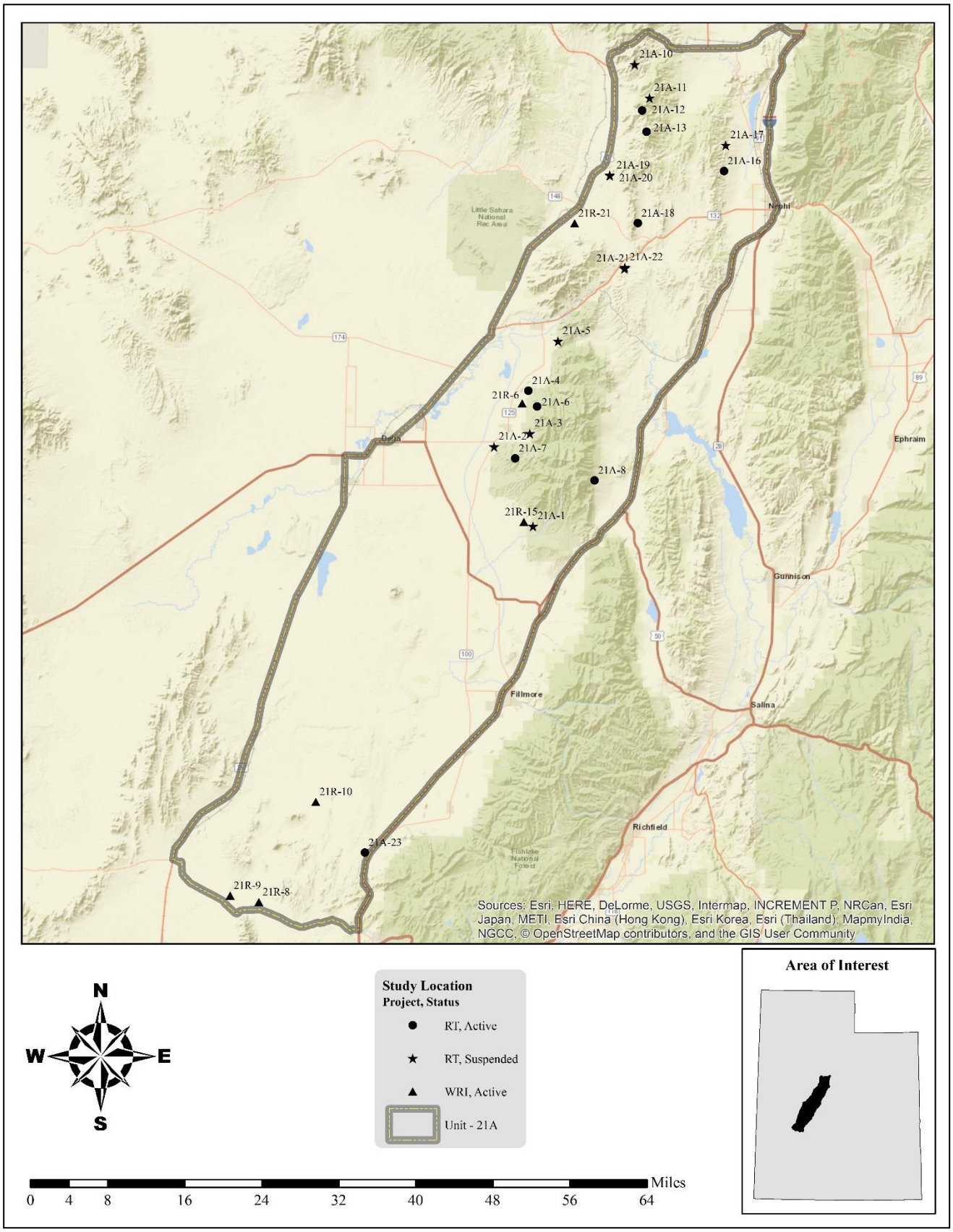
In areas with conifer encroachment or infill, a tree-removing disturbance is recommended (e.g. bullhog, chaining, lop and scatter, etc.). Areas with high cover of annual grasses should be monitored and if these levels are sustained, treatments are advisable to reduce these species. Changes in grazing management or herbicide treatments are possible treatment tools to manage annual grasses. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Black Sagebrush)

Although pinyon and juniper reduction treatments have taken place on this mid-elevation study site, it is likely that encroachment is occurring on other areas within this ecological type. Undesirable annual and perennial grasses have increased within the herbaceous community. These species pose a threat to the resilience of the ecological system as they can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern. Bulbous bluegrass (*Poa bulbosa*) has been sampled on this site: this introduced perennial grass species can create monocultures and outcompete more desirable native species.

It is recommended that treatments for pinyon-juniper (e.g. bullhog, chaining, lop and scatter, etc.) be implemented in areas where it would be beneficial to the habitat. For the herbaceous understory, herbicide treatments and grazing management changes are possible treatments for the undesirable graminoid species. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

7. WILDLIFE MANAGEMENT UNIT 21A – FILLMORE - OAK CREEK



WILDLIFE MANAGEMENT UNIT 21A – FILLMORE - OAK CREEK

Boundary Description

Millard, Utah, and Juab counties: Boundary begins at I-15 and US-6 in Santaquin, south to I-15 and Black Rock Road; west on Black Rock Road to SR-257; north on SR-257 to US-50 and 6; east on US-50 and 6 to US-6; north on US-6 to I-15.

Management Unit Description

Geography

The Fillmore - Oak Creek Unit sits on the transition area between the Wasatch Front and the West Desert geographic features. Mountains within this unit include the East Tintic, Gilson, and Canyon Mountains. Permanent study sites are located in all of these mountains as well as Long Ridge near Nephi. The towns within this unit include Nephi, Mona, Leamington, Holden as well as parts of both Delta and Lynndyl.

The Canyon Mountains, Gilson Mountains, and East Tintic Mountains mostly run north to south. They are primarily shallow sloped, with some moderate slopes and canyons being found in the Canyon Mountains. The tallest peak in the Canyon Mountains is Fool Creek Peak at 9,712 feet. Champlin Peak is the highest point in the Gilson Mountains at 7,510 feet. Finally, the tallest peak in the East Tintic Mountains is Tintic Mountain with an elevation of 8,223 feet.

Climate Data

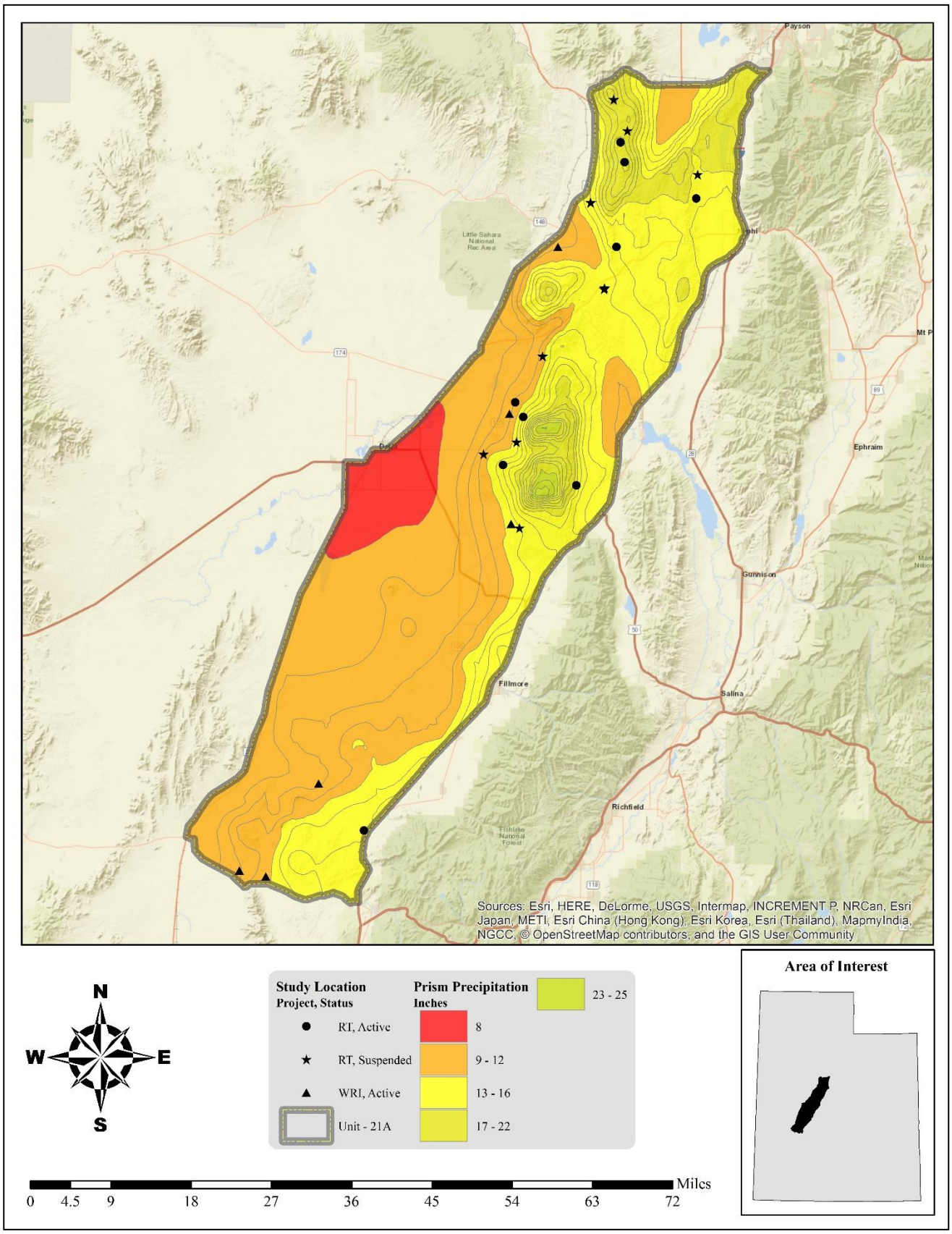
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches in the Sevier Desert near Delta to 25 inches on the peaks of Blue Mountain and Partridge Mountain. All of the Range Trend and WRI monitoring studies on the unit occur within 9-22 inches of precipitation (**Map 7.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Western, South Central and North Central Mountains divisions (Divisions 1, 3, and 4).

The mean annual PDSI of the Western division displayed years of moderate to extreme drought from 1989-1990, 2000-2003, 2007-2008, 2012-2013, and 2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1985, 1993, 1995, 1997-1998, 2005, and 2011 (**Figure 7.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2001-2003, 2007-2008, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (**Figure 7.1b**).

The mean annual PDSI of the North Central division displayed years of moderate to extreme drought from 1987-1990. 2000-2003, 2007, and 2012-2015. The mean annual PDSI displayed moderately to extremely wet years from 1982-1986, 1993, 1995-1998, 2005, and 2011 (**Figure 7.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1987-1990, 1992, 2001-2003, 2007-2008, and 2012-2015.. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1993, 1995-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1987-1990, 2001-2003, 2007, 2012-2013, and 2015; moderately to extremely wet years were displayed in 1982-1985, 1991, 1993, 1995, 1997-1998, and 2005 (**Figure 7.2b**).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 7.3a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 7.3b**).



Map 7.1: The 1981-2010 PRISM Precipitation Model for WMU 21A, Fillmore - Oak Creek (PRISM Climate Group, Oregon State University, 2013).

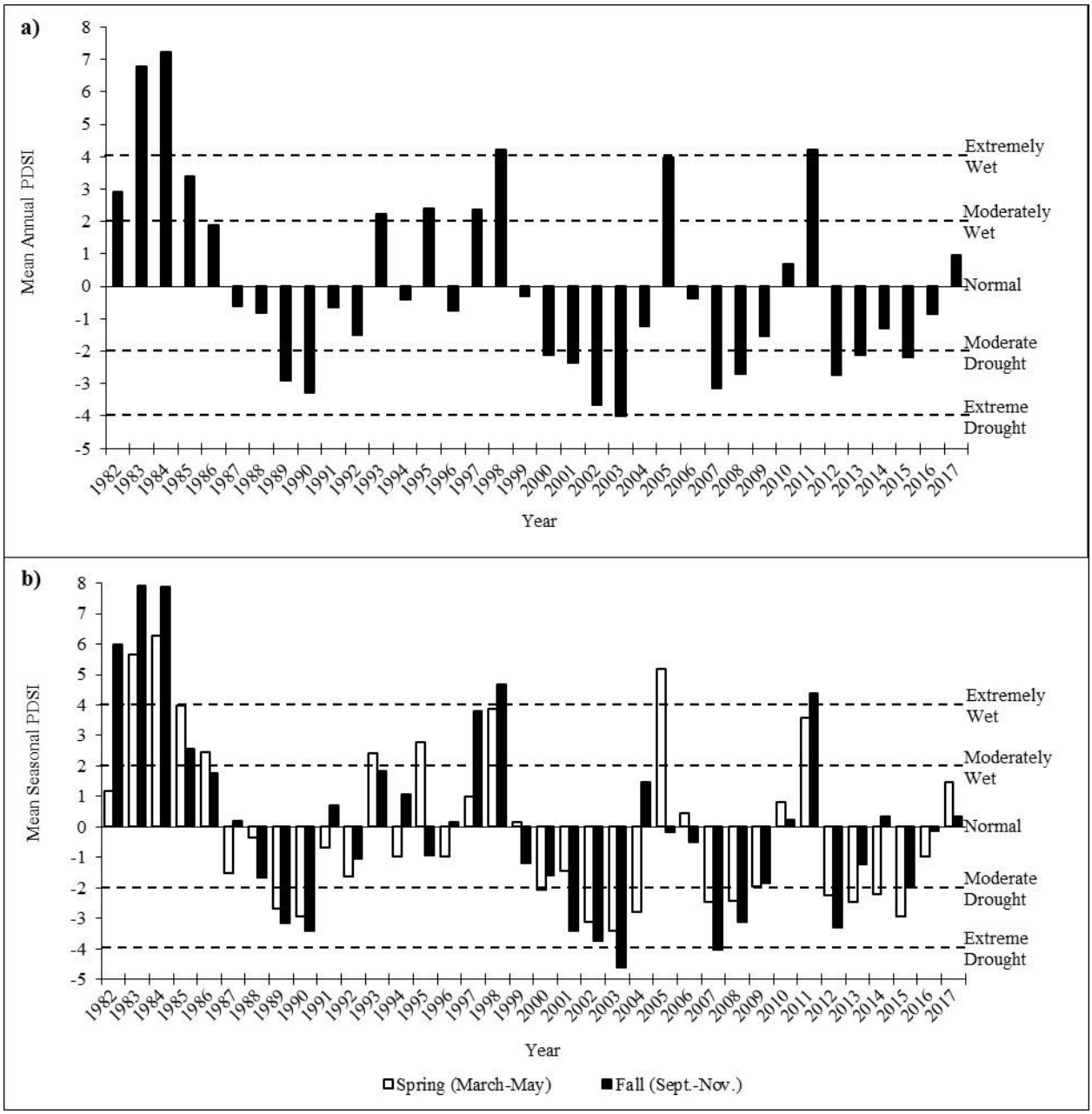


Figure 7.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

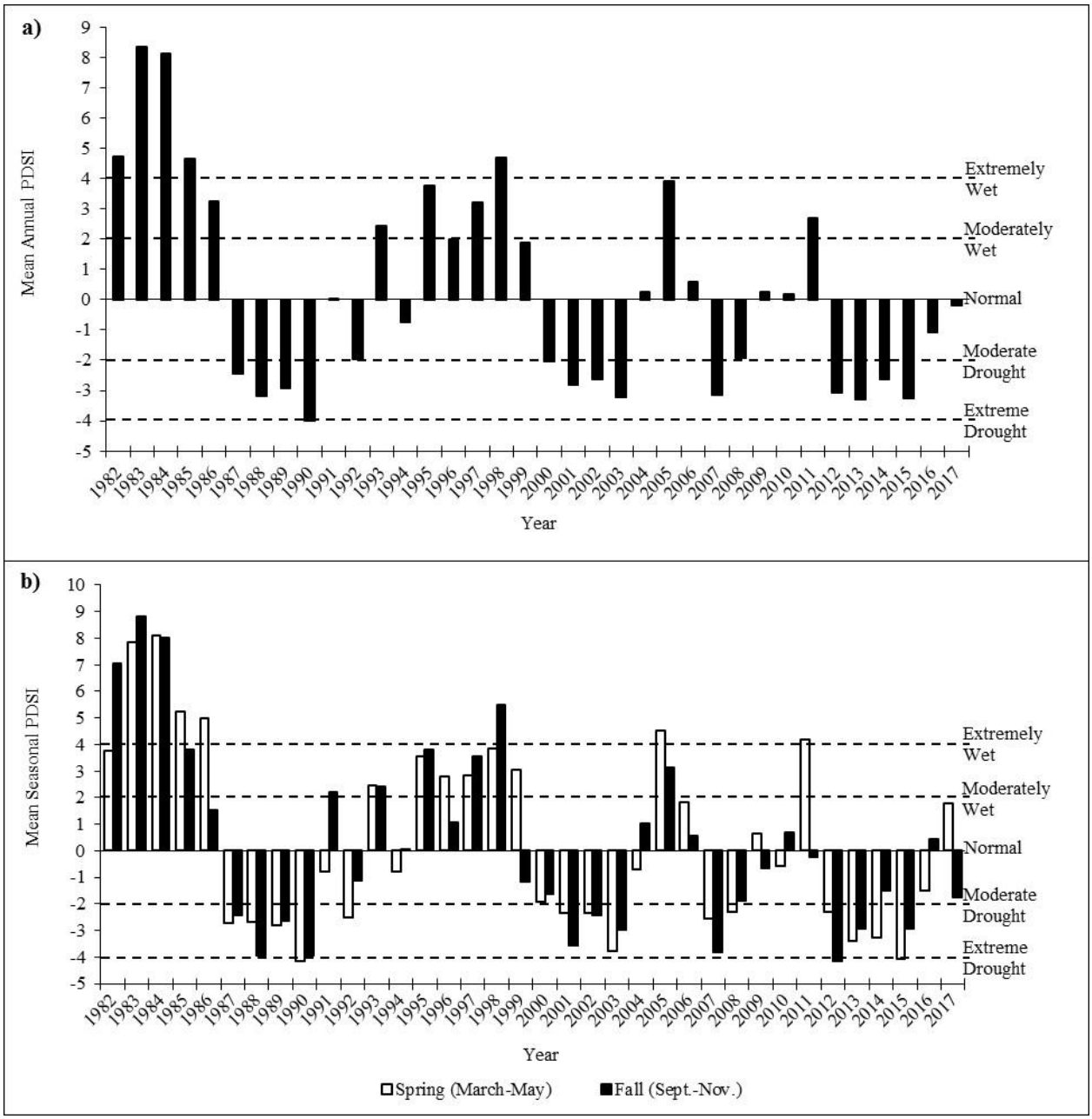


Figure 7.2: The 1982-2017 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

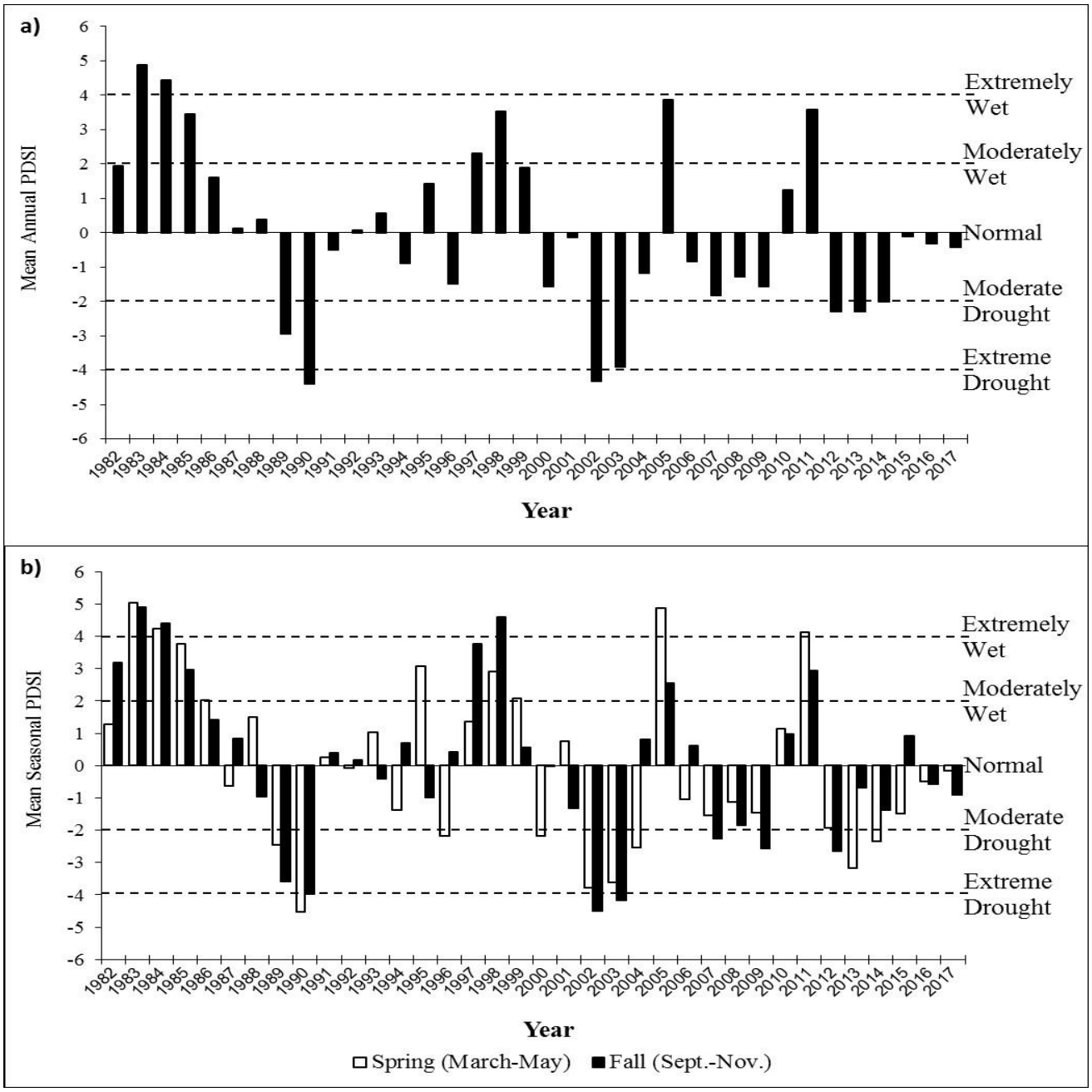


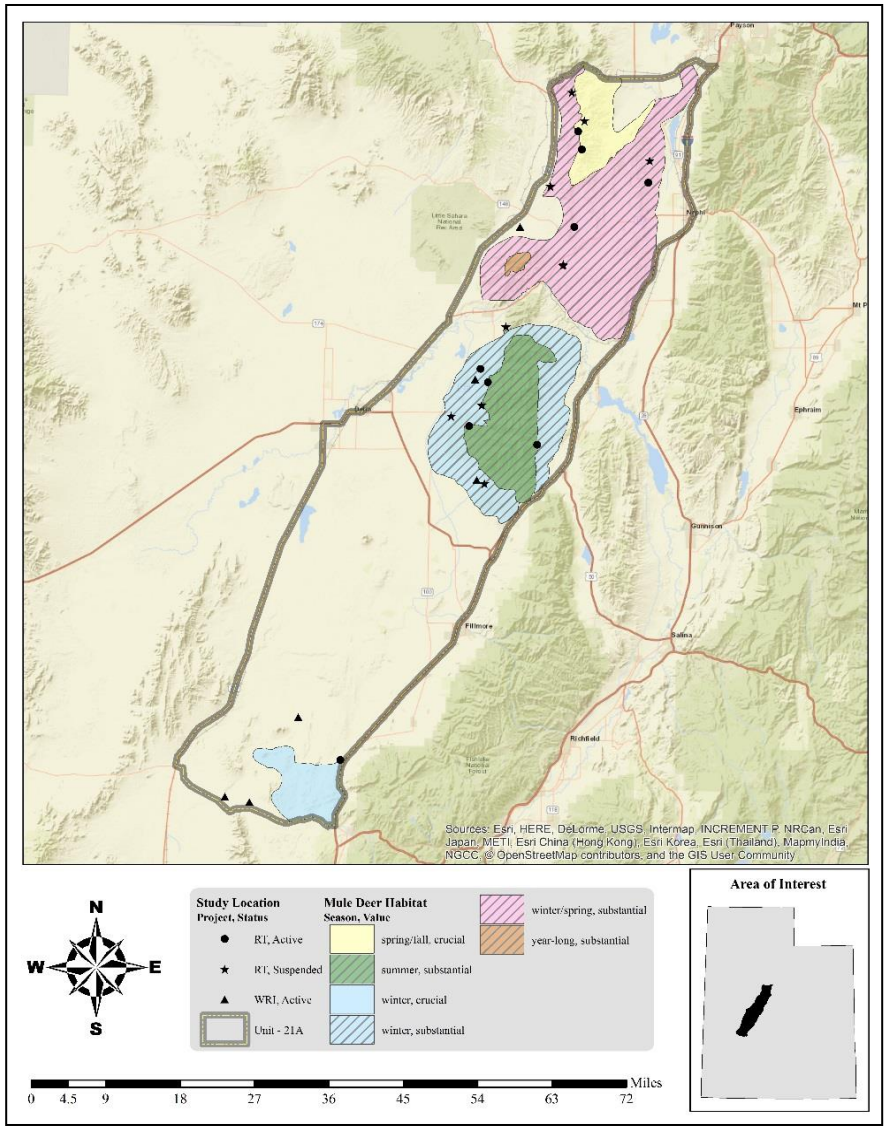
Figure 7.3: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

Big Game Habitat

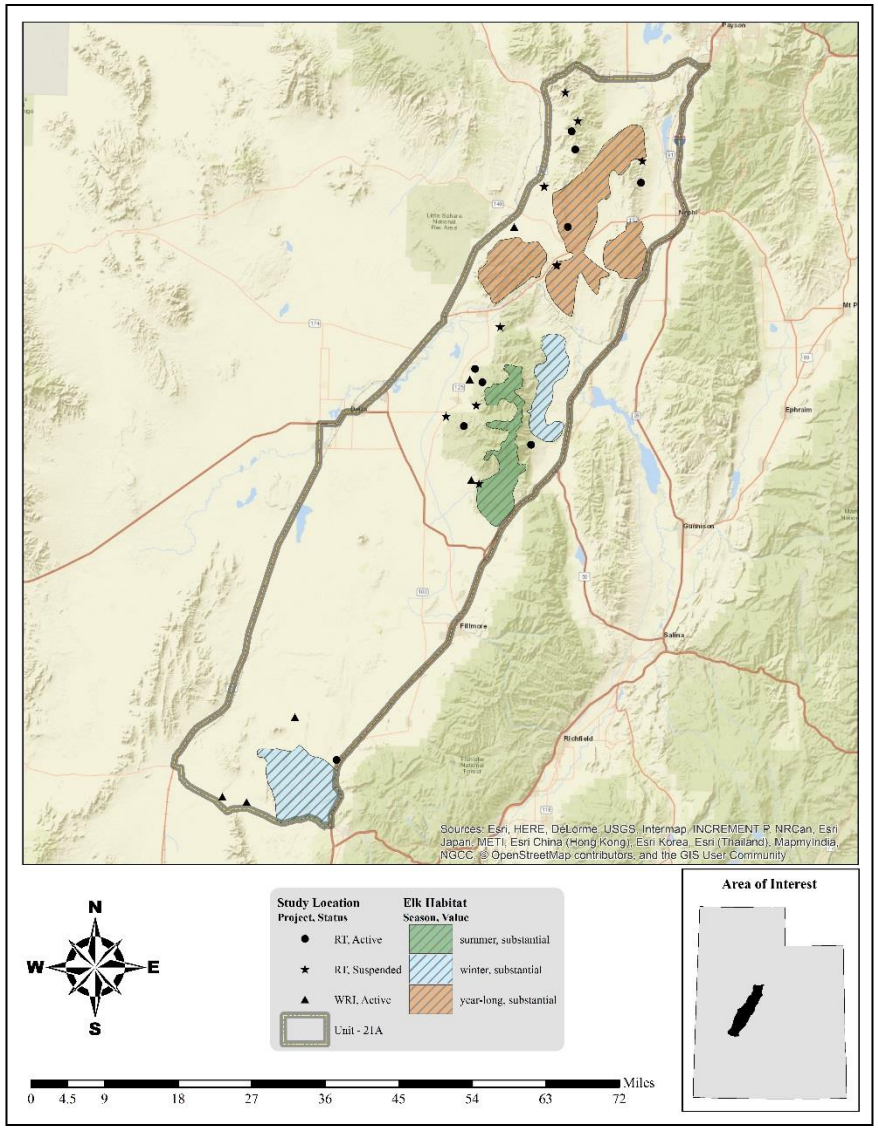
There are an estimated 494,869 acres that are considered to be deer range within Unit 21A with 45% classified as winter/spring range, 30% as winter range, and 16% as summer-range (**Table 7.1**, **Map.7.2**). Of the winter range, 35% is managed by the Bureau of Land Management (BLM), privately owned land comprises 30%, 23% is managed by the United States Forest Service (USFS), 11% is managed by the Utah School and Institutional Trust Lands Administration (SITLA), Utah Division of Wildlife Resources (UDWR) manages less than 1%, and less than 1% is tribally owned (**Table 7.2**, **Map.7.2**, **Map 7.6**). Of the elk winter range, 74% is administered by the BLM, 15% is privately owned, the USFS manages 5%, SITLA manages 5%, and less than 1% is tribally owned (**Table 7.3**, **Map 7.3**, **Map 7.6**).

Deer winter range on the Fillmore - Oak Creek unit consists of the foothills around the Canyon Mountains and in Furner Valley. The lower and upper limits of normal deer winter range vary from approximately 4,800 to 6,800 feet, dependent upon the location.

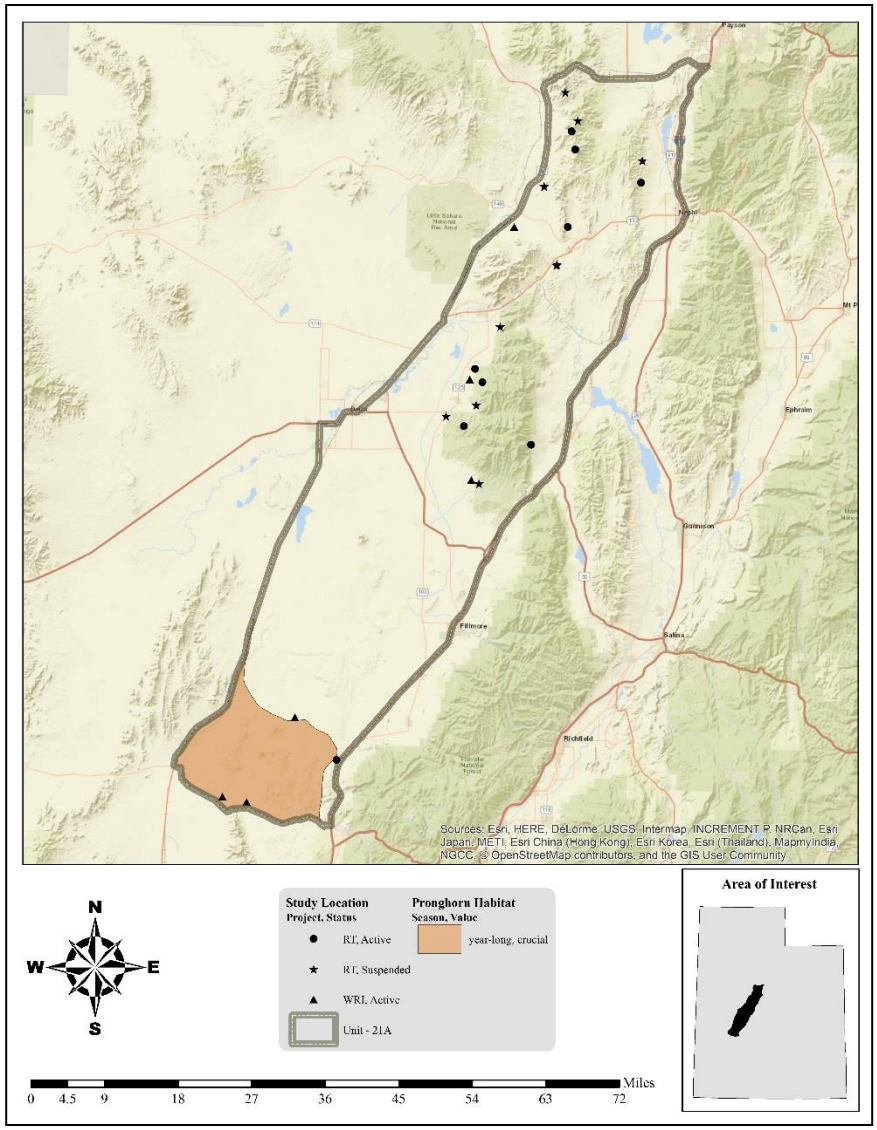
The plant communities on the winter range are varied and the composition depends on the location. Much of the winter range consists of either sagebrush or cliffrose/sagebrush communities. There are some mountain brush communities, although large amounts of this habitat type burned in the fires that have occurred in the past (**Map 7.7**). As such, many of these mountain brush communities have transitioned into perennial grass-dominated sites.



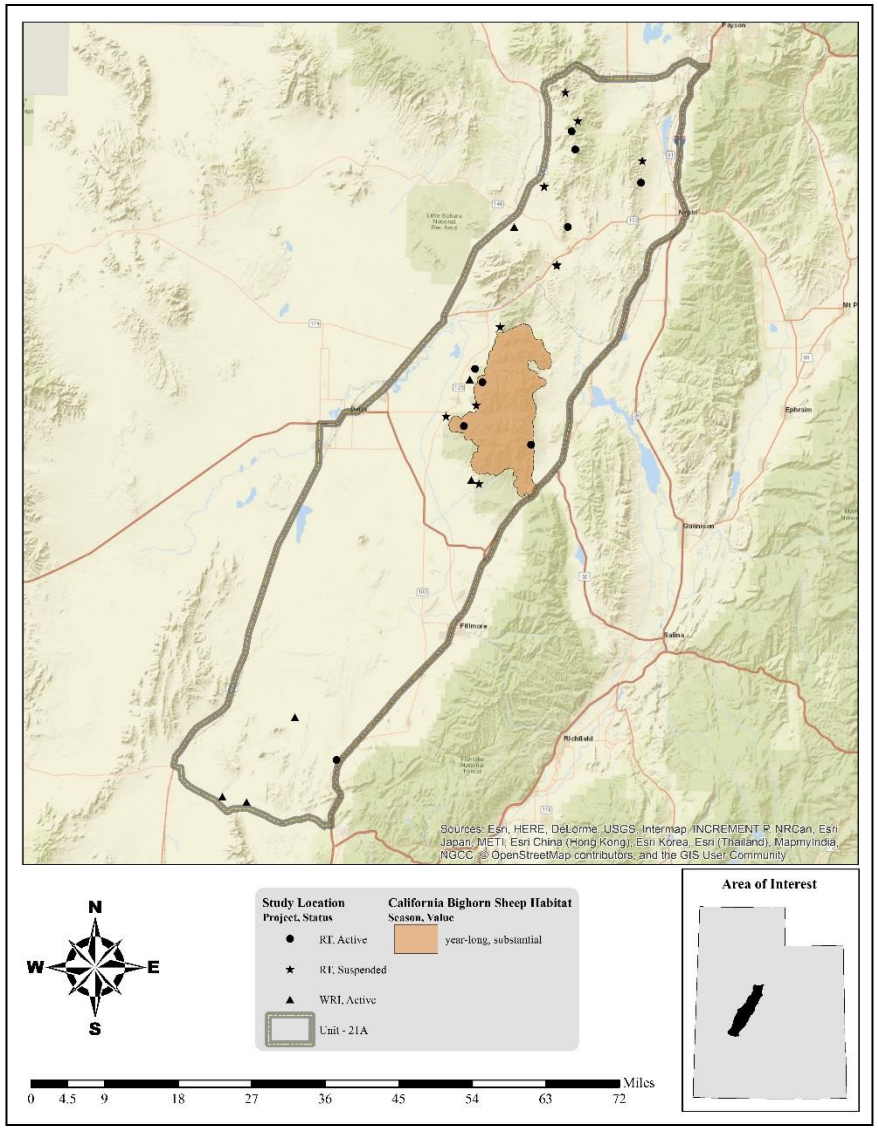
Map.7.2: Estimated mule deer habitat by season and value for WMU 21A, Fillmore - Oak Creek.



Map 7.3: Estimated elk habitat by season and value for WMU 21A, Fillmore - Oak Creek.



Map 7.4: Estimated pronghorn habitat by season and value for WMU 21A, Fillmore - Oak Creek.



Map 7.5: Estimated California bighorn sheep habitat by season and value for WMU 21A, Fillmore - Oak Creek.

	Spring/Fall Range		Summer Range		Winter Range		Winter/Spring Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	41,976	9%	77,846	16%	150,786	31%	220,587	45%	3,674	0%
Elk	0	0%	35,957	17%	65,894	31%	0	0%	108,452	52%
Pronghorn	0	0%	0	0%	0	0%	0	0%	135,628	100%
CBS	0	0%	0	0%	0	0%	0	0%	88,108	100%

Table 7.1: Estimated mule deer, elk, pronghorn, and California Bighorn Sheep (CBS) habitat acreage by season for WMU 21A, Fillmore - Oak Creek.

	Spring/Fall Range		Summer Range		Winter Range		Winter/Spring Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	14,685	35%	1,015	1%	53,102	35%	115,289	52%	3,041	83%
Private	25,132	60%	353	<1%	45,444	30%	92,089	42%	616	17%
SITLA	2,158	5%	205	<1%	17,075	11%	12,436	6%	17	<1%
Tribal	0	0%	0	0%	222	<1%	0	0%	0	0%
UDWR	0	0%	117	<1%	26	<1%	774	<1%	0	0%
USFS	0	0%	76,157	98%	34,916	23%	0	0%	0	0%
Total	41,976	**100%**	77,846	**100%**	150,786	**100%**	220,587	**100%**	3,674	**100%**

Table 7.2: Estimated mule deer habitat acreage by season and ownership for WMU 21A, Fillmore - Oak Creek.

	Summer		Winter		Year Long	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	1,431	4%	48,979	74%	73,657	68%
Private	995	3%	9,870	15%	27,241	25%
SITLA	0	0%	3,302	5%	7,554	7%
Tribal	0	0%	222	<1%	0	0%
UDWR	38	<1%	0	0%	0	0%
USFS	33,493	93%	3,521	5%	0	0%
Total	35,957	**100%**	65,894	**100%**	108,452	**100%**

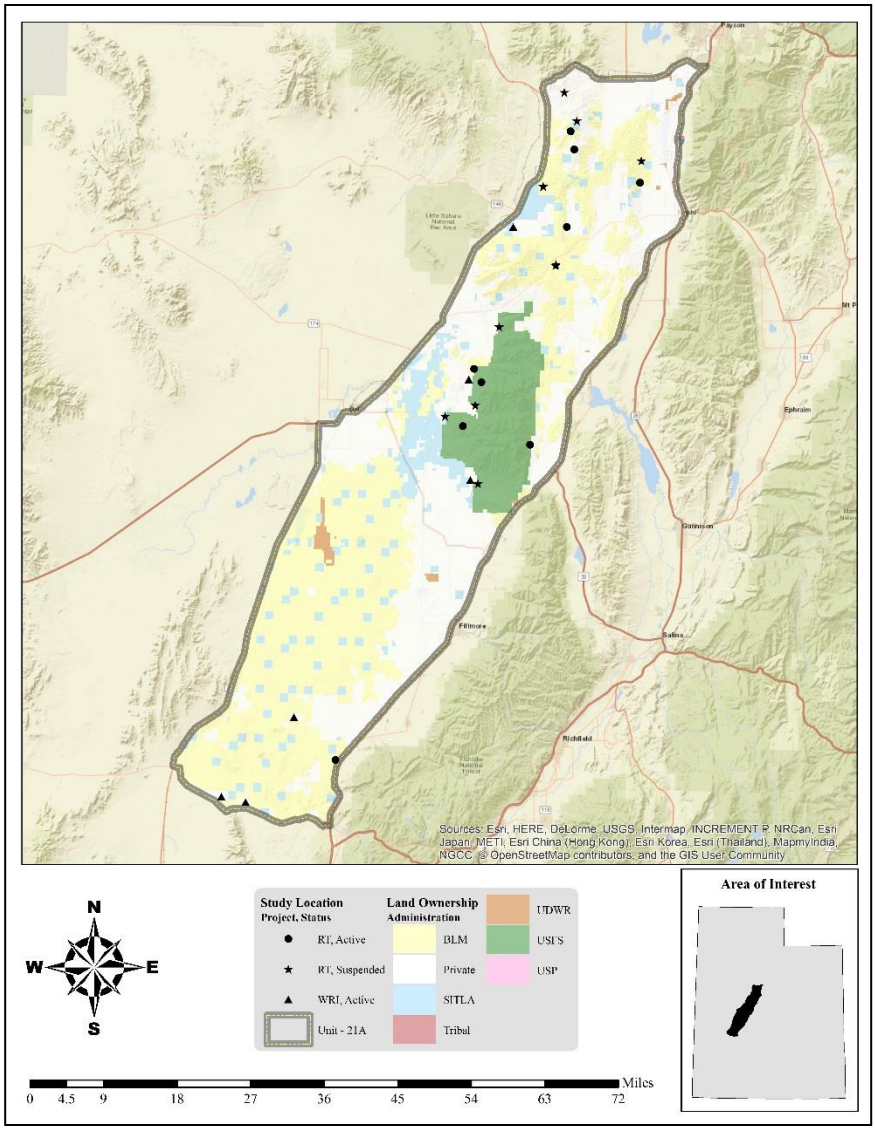
Table 7.3: Estimated elk habitat acreage by season and ownership for WMU 21A, Fillmore - Oak Creek.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	108,553	80%
Private	16,715	12%
SITLA	10,360	8%
Total	135,628	**100%**

Table 7.4: Estimated pronghorn habitat acreage by season and ownership for WMU 21A, Fillmore – Oak Creek.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	2,683	3%
Private	3,406	4%
SITLA	359	<1%
USFS	81,660	93%
Total	88,108	**100%**

Table 7.5: Estimated California bighorn sheep habitat acreage by season and ownership for WMU 21A, Fillmore - Oak Creek.



Map 7.6: Land ownership for WMU 21A, Fillmore - Oak Creek.

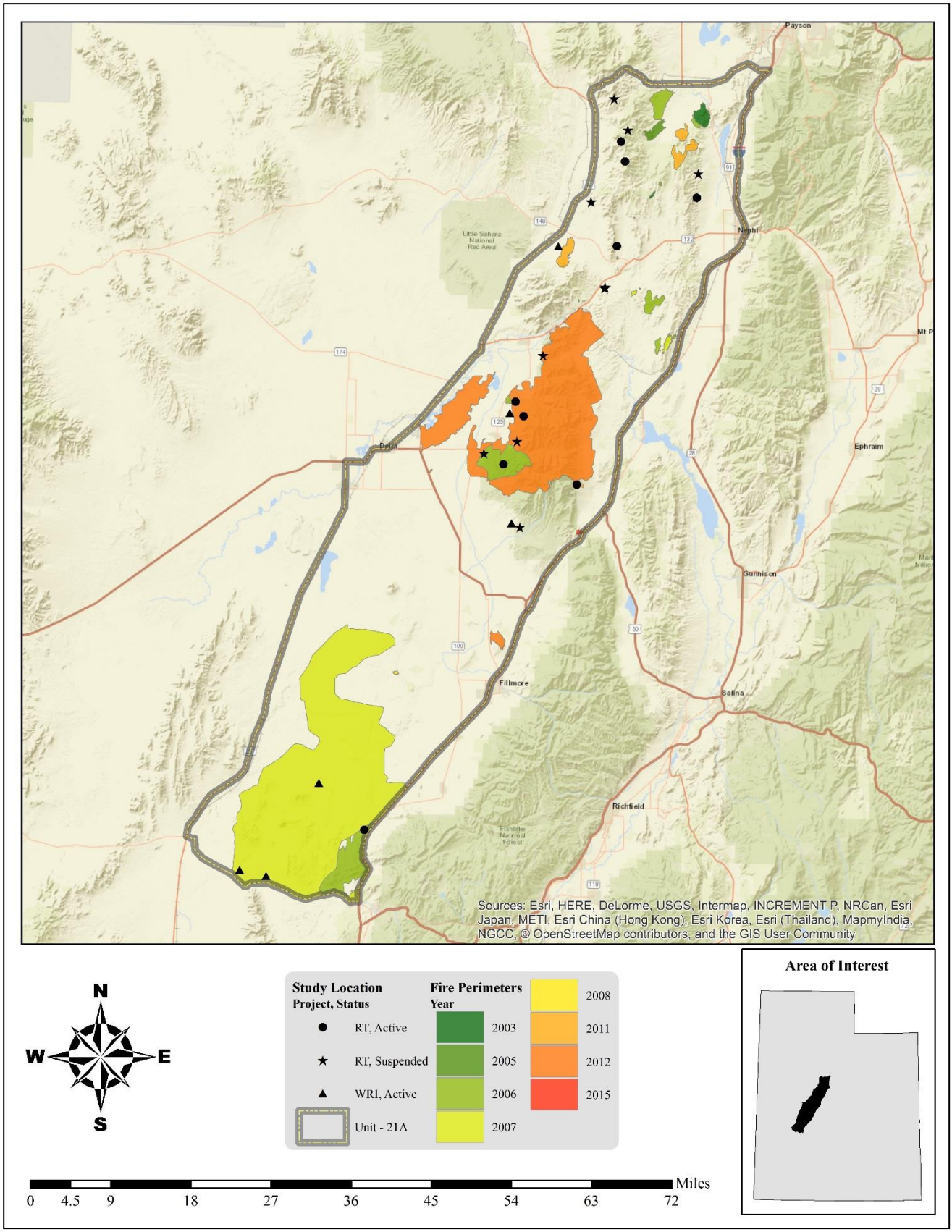
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	105,690	8.07%	
	Colorado Plateau Pinyon-Juniper Woodland	36,323	2.77%	
	Inter-Mountain Basins Juniper Savanna	7,680	0.59%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	5,339	0.41%	
	Abies concolor Forest Alliance	2,302	0.18%	
	Other Conifer	1,261	0.10%	12.10%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	353,363	26.97%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	36,217	2.76%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	13,399	1.02%	30.76%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	9,264	0.71%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	7,298	0.56%	
	Southern Rocky Mountain Montane-Subalpine Grassland	3,468	0.26%	
	Other Grassland	3	0.00%	1.53%
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	135,004	10.30%	
	Inter-Mountain Basins Greasewood Flat	132,847	10.14%	
	Inter-Mountain Basins Big Sagebrush Shrubland	122,877	9.38%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	33,640	2.57%	
	Great Basin Xeric Mixed Sagebrush Shrubland	32,815	2.50%	
	Inter-Mountain Basins Big Sagebrush Steppe	12,679	0.97%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	8,714	0.67%	
	Columbia Plateau Low Sagebrush Steppe	1,625	0.12%	
	Mojave Mid-Elevation Mixed Desert Scrub	1,344	0.10%	
	Quercus gambelii Shrubland Alliance	1,246	0.10%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	946	0.07%	
	Other Shrubland	709	0.05%	36.97%
Other	Agricultural	108,188	8.26%	
	Developed	57,741	4.41%	
	Barren	40,347	3.08%	
	Open Water	19,629	1.50%	
	Sparsely Vegetated	13,696	1.05%	
	Hardwood/Conifer Hardwood	2,860	0.22%	
	Riparian	1,186	0.09%	
	Quarries-Strip Mines-Gravel Pits	569	0.04%	18.64%
Total		1,310,270	100%	100%

Table 7.6: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 21A Fillmore - Oak Creek.

Limiting Factors to Big Game Habitat

Major human activities in the area include mining and grazing. Habitat degradation and loss, public land winter range availability, winter range forage condition, predation, and parasites and disease limit big game habitat in this unit. Encroachment by pinyon-juniper woodland communities poses a threat to important sagebrush rangelands. According to the current Landfire Existing Vegetation Coverage model, 12.10% of the Fillmore – Oak Creek unit is comprised of pinyon-juniper woodlands (**Table 7.6**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000).

This unit has been heavily impacted by fire and much of the winter range has seen a conversion of the browse component to annual and perennial grasses. With the large expanse of area affected by wildfires within this subunit, winter range is in poor condition across much of the unit (**Map 7.7**). Other limiting factors to big game include introduced exotic herbaceous species such as cheatgrass (*Bromus tectorum*). The current Landfire Existing Vegetation Coverage model indicates that 30.76% of the unit is comprised of exotic herbaceous species (**Table 7.6**). High amounts of cheatgrass increases the risk for severe wildfires occurrence (Balch, D'Antonio, & Gómez-Dans, 2013). The presence of the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) on many sites is another limiting factor to this unit. Once established, bulbous bluegrass populations persist and invade native plant communities (Kulmatiski, 2006), often leading to reduced understory productivity and species diversity. In addition, large wildfires that have occurred in this unit have resulted in a loss of big game habitat (**Map 7.7**). The Milford Flat fire burned a very large portion of the winter range west of I-15, and loss of this habitat may have consequences in the event of a very severe winter.



Map 7.7: Land coverage of fires by year from 2000-2018 for WMU 21A, Fillmore - Oak Creek (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

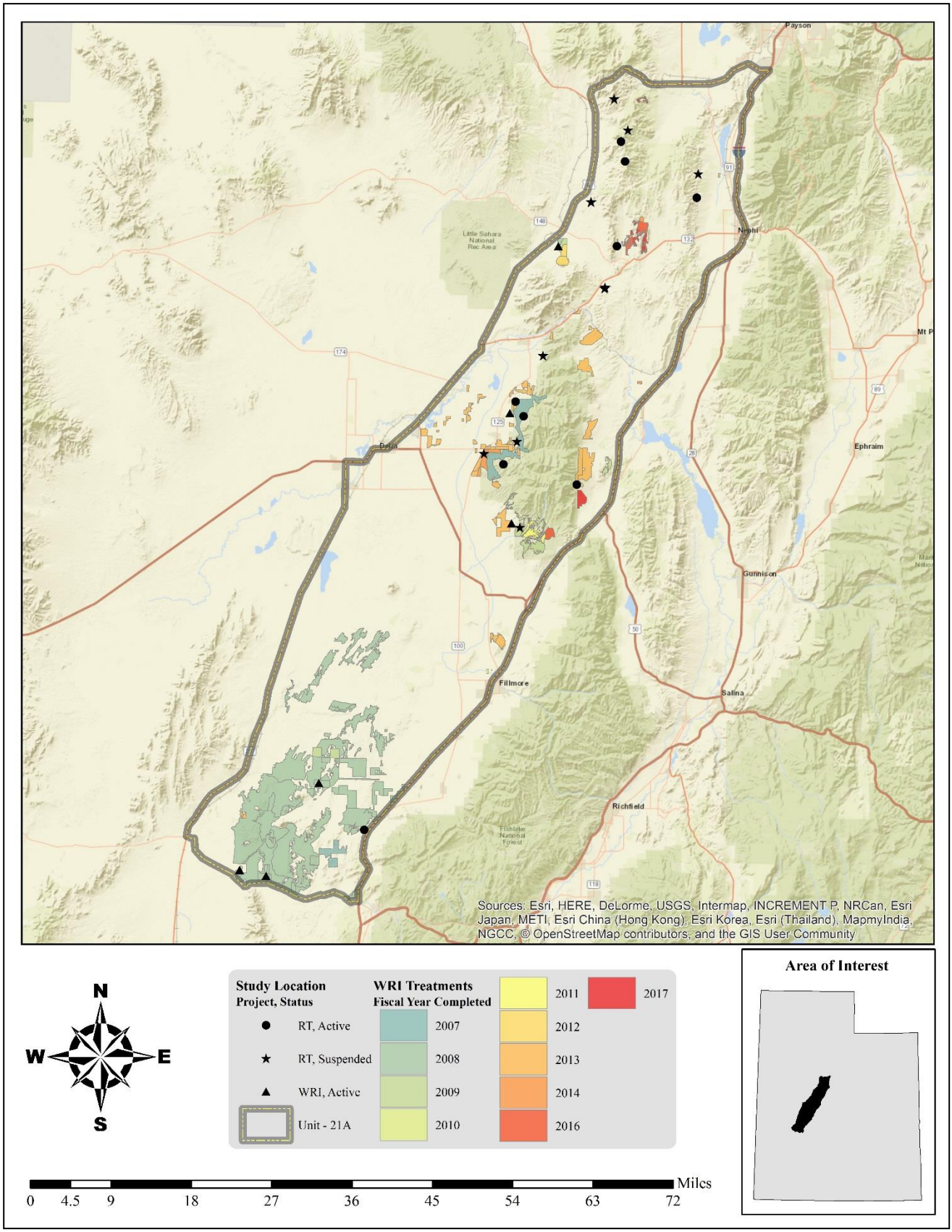
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 146,699 acres of land have been treated within the Oak Creek sub-unit since WRI was implemented in 2004 (**Map 7.8**). An additional 2,713 acres are currently being treated and treatments have been proposed for 4,495 acres. Treatments frequently overlap one another bringing the total treatment acres to 146,415 acres for this unit (**Table 7.7**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Anchor chaining to remove pinyon and juniper is the most common management practice in this unit. Seeding plants to augment the herbaceous understory is also very common and frequently occur together with chainings. Other management practices include (but are not limited to) bullhog and hand crew removal for pinyon-juniper trees, discing, grazing management/changes, greenstripping, harrow, herbicide application, land imprinter, and planting/transplanting(**Table 7.7**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**66,480**	**0**	**0**	**66,480**
Ely (One-Way)	64,161	0	0	64,161
Ely (Two-Way)	2,125	0	0	2,125
Smooth (Two-Way)	195	0	0	195
Bullhog	**6,112**	**1,498**	**3,451**	**11,060**
Full Size	900	1,498	0	2,398
Skid Steer	5,211	0	3,451	8,662
Disk	**1,295**	**0**	**0**	**1,295**
Plow (One-Way)	1,295	0	0	1,295
Grazing Management/Changes	**81**	**0**	**0**	**81**
Greenstripping	**1,785**	**0**	**0**	**1,785**
Harrow	**1,169**	**0**	**0**	**1,169**
≤ 15 ft. (One-Way)	494	0	0	494
> 15 ft. (One-Way)	675	0	0	675
Herbicide Application	**2,013**	**0**	**0**	**2,013**
Aerial (Fixed-Wing)	1,295	0	0	1,295
Aerial (Helicopter)	662	0	0	662
Ground	57	0	0	57
Land Imprinter	**837**	**0**	**0**	**837**
Planting/Transplanting	**69**	**0**	**0**	**69**
Other	69	0	0	69
Prescribed Fire	**3**	**0**	0	**3**
Seeding (Primary)	**58,675**	**1,215**	**0**	**59,890**
Broadcast (Aerial Fixed-Wing)	16,768	0	0	16,768
Broadcast (Aerial Helicopter)	813	0	0	813
Drill (Rangeland)	40,303	1,215	0	41,518
Drill (Truax)	234	0	0	234
Ground (Mechanical Application)	556	0	0	556
Seeding (Secondary/Shrub)	**3,572**	**0**	**0**	**3,572**
Broadcast (Aerial Fixed-Wing)	2,291	0	0	2,291
Hand Seeding	1,281	0	0	1,281
Vegetation Removal/Hand Crew	**4,609**	**0**	**1,044**	**5,653**
Lop and Scatter	3,995	0	1,044	5,039
Lop-Pile-Burn	615	0	0	615
Total Treatment Acres	**146,699**	**2,713**	**4,495**	**153,907**
***Total Land Area Treated**	**139,207**	**2,713**	**4,495**	**146,415**

Table 7.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 21A, Fillmore - Oak Creek. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 7.8: WRI treatments by fiscal year completed for WMU 21A, Fillmore - Oak Creek.

Range Trend Studies

Range Trend studies have been sampled within WMU 21A on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 7.8**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 7.9**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
21A-1	Long Canyon	RT	Suspended	'98, '03	Not Verified
21A-2	Lovell Hollow	RT	Suspended	'85, '91, '98, '03, '07, '12	Not Verified
21A-3	Cascade Spring	RT	Suspended	'85, '91, '98, '03, '07, '12	Not Verified
21A-4	Horse Hollow	RT	Active	'85, '91, '98, '03, '07, '12, '17	Upland Gravelly Loam (Wyoming Big Sagebrush)
21A-5	Wood Canyon	RT	Suspended	'98	Not Verified
21A-6	Bridge Canyon	RT	Active	'17	Upland Gravelly Loam (Wyoming Big Sagebrush)
21A-7	Rocky Ridge Canyon	RT	Active	'17	Mountain Stony Loam (Browse)
21A-8	Williams Canyon	RT	Active	'17	Upland Stony Loam (Mountain Big Sagebrush)
21A-10	Sioux Pass	RT	Suspended	'89, '97, '02	Not Verified
21A-11	Water Canyon	RT	Suspended	'89, '97	Not Verified
21A-12	Sunrise Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Shallow Loam (Low Sagebrush) and Mountain Loam (Mountain Big Sagebrush)
21A-13	Dennis Spring	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Mountain Big Sagebrush)
21A-16	Nephi Dump	RT	Active	'83, '89, '97, '02, '07, '12, '17	Upland Loam (Mountain Big Sagebrush)
21A-18	Furner Valley	RT	Active	'83, '89, '97, '02, '07, '12, '17	Mountain Loam (Browse)
21A-19	Paul Bunyan Burn	RT	Suspended	'98, '99, '02, '07	Not Verified
21A-20	Paul Bunyan Burn and Chain	RT	Suspended	'98, '99, '02, '07, '12	Upland Gravelly Loam (Wyoming Big Sagebrush)
21A-21	Leamington Burn and Chain	RT	Suspended	'97, '98, '99, '02, '07, '12	Upland Shallow Hardpan (Pinyon-Utah Juniper)
21A-22	Leamington Burn	RT	Suspended	'97, '98, '99, '02, '07	Not Verified
21A-23	Baker Canyon	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Loam (Wyoming Big Sagebrush)
21R-6	Anderson Dixie	WRI	Active	'07, '10, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
21R-8	A&F Aerial Seeding	WRI	Active	'08, '11, '17	Semidesert Loam (Wyoming Big Sagebrush)
21R-9	A&F Aerial Seeding 2	WRI	Active	'08, '11, '17	Semidesert Shallow Hardpan (Wyoming Big Sagebrush)
21R-10	A&F Drill 3	WRI	Active	'08, '11, '17	Desert Loam (Shadscale)
21R-15	Duggins Creek	WRI	Active	'12, '15	Upland Gravelly Loam (Wyoming Big Sagebrush)
21R-21	Gilson Mountain Sage-Grouse	WRI	Active	'08, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)

Table 7.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 21A, Fillmore - Oak Creek.

Study#	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
21A-13	Dennis Spring	Wildfire	Mona West	July 2001	33,852	
21A-18	Furner Valley	Mower or Aerator		Between 2002 and 2007		
21A-19	Paul Bunyan Burn	Wildfire Aerial	Leamington Burn Complex	1996 After Fire	138,340	
21A-20	Paul Bunyan Burn and Chain	Wildfire One-Way Ely Chain Aerial Before Dribbler	Leamington Burn Complex	1996 After Fire After Fire After Fire	138,340	
21A-21	Leamington Burn and Chain	Wildfire One-Way Ely Chain Aerial Before Dribbler	Leamington Burn Complex	1996 After Fire After Fire After Fire	138,340	
21A-22	Leamington Burn	Wildfire Aerial	Leamington Burn Complex	1996 After Fire	138,340	
21A-23	Baker Canyon	Plow Rangeland Drill Prescribed Fire	Horse Hollow Seeding Horse Hollow Seeding	1967 1967 Before 1991	2,200 2,200	
21R-6	Anderson Dixie	One-Way Dixie Harrow Aerial Before	D. Anderson Dixie Harrow D. Anderson Dixie Harrow	October 2007 October 2007	166 166	797 797
21R-8	A&F Aerial Seeding	Wildfire Rangeland Drill	Milford Flat Milford Flat Fire Rehabilitation - Missouri Flat	July 2007 October 2007	363,052 7,925	 1007
21R-9	A&F Aerial Seeding 2	Wildfire Aerial	Milford Flat Milford Flat Fire Rehabilitation - JK	July 2007 September 2007	363,052 265	 1010
21R-10	A&F Drill 3	Wildfire Rangeland Drill	Milford Flat Milford Flat Fire Rehabilitation - BG	July 2007 October 2007	363,052 2,896	 1006
21R-15	Duggins Creek	Chain Unknown Seed Unknown Lop and Scatter	 Whiskey Creek Lop n Scatter Project Phase I	Early 1980s Early 1980s Summer 2012	 1,902	 2197
21R-21	Gilson Mountain Sage-Grouse	Wildfire Herbicide - Plateau Rangeland Drill Rangeland Drill	 Gilson Mountain Sage-Grouse Habitat Improvement Gilson Mountain Sage-Grouse Habitat Improvement Gilson Mountain Sage-Grouse Habitat Improvement	1996 September 2008 November 2009 March 2009	 657 657 657	 1103 1103 1103

Table 7.9: Range trend and WRI studies known disturbance history for WMU 21A, Fillmore - Oak Creek.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are two studies [Sunrise Canyon (21A-12) and Dennis Spring (21A-13)] classified as Mountain (Big Sagebrush) ecological sites. The Sunrise Canyon study is located near Volcano Ridge in the East Tintic Mountains. The Dennis Spring study is located near Tintic Mountain in the East Tintic Mountains.

Shrubs/Trees: Preferred browse on the Mountain (Big Sagebrush) ecological sites is primarily composed of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) with other preferred browse species present in lower amounts. There has been a significant increase in the cover of sagebrush over time. Overall, preferred browse utilization has increased and a significant percentage of plants with heavy utilization were noted in 2012 (**Figure 7.4**, **Figure 7.8**). The average preferred browse demographic data shows that mature individuals make up a majority of the populations on these studies. In addition, the percentage of young plants has decreased since peaking in 2002 (**Figure 7.7**): this flush was primarily caused by the fire on the Dennis Spring site and resulting new shrub growth (**Table 7.9**).

Herbaceous Understory: The herbaceous understories of these sites are diverse and primarily composed of native species. Introduced perennial forage grasses provide some cover on the Dennis Spring study, although they are not dominant. The cover and frequency of both perennial grasses and forbs have generally shown an

increasing trend. Cover of annual grasses is low and therefore is not considered to be a high-level threat for these sites. (**Figure 7.9**, **Figure 7.10**).

Occupancy: The primary occupants on these sites are sheep. Sheep occupancy has varied from a low of 6 days use/acre in 2002 to a high of 46 days use/acre in 2007. Mean abundance of deer pellet groups ranges from 3 days use/acre in 2017 to 7 days use/acre in 2002. Finally, average elk pellet group abundance has been observed with a low of 0 days use/acre in 2002 and 2017 and a high of 3 days use/acre in 2007 (**Figure 7.11**).

Mountain (Browse)

There is one study [Rocky Ridge Canyon (21A-7)] classified as a Mountain (Browse) ecological site. This study is located in the Canyon Mountains south of Oak City.

Shrubs/Trees: The dominant browse species on this site are primarily alderleaf mountain mahogany (*Cercocarpus montanus*) and Gambel oak (*Quercus gambelii*). Utilization of preferred browse on this site is moderate overall, but a trend has not yet been set as the site was established in 2017 (**Figure 7.4**). The age demographic data of the browse species shows that the stand is almost entirely composed of mature individuals (**Figure 7.7**). Again, a trend is not yet available for demographic data due to the lack of sampling history.

Herbaceous Understory: Study site data shows that perennial grasses and forbs contribute significant cover in the herbaceous understory, but notable cover is also contributed by annual grasses (**Figure 7.9**). Most of the perennial grass cover is provided by bluebunch wheatgrass (*Pseudoroegneria spicata*). As this study site was established in 2017 and is the only site of this ecological type, a trend has not yet been established.

Occupancy: Average pellet group transect data shows that deer are the primary occupants of this study site. 2017 is the only sample year with data available, and that data shows the mean abundance of deer pellet groups to be 21 days use/acre and that of elk to be 2 days use/acre (**Figure 7.11**).

Upland (Big Sagebrush)

There are five studies [Horse Hollow (21A-4), Bridge Canyon (21A-6), Williams Canyon (21A-8), Nephi Dump (21A-16), and Furner Valley (21A-18)] that are classified as Upland (Big Sagebrush) ecological sites. The Horse Hollow and Bridge Canyon sites are located north of Oak City on the east slopes of the Canyon Mountains. The Williams Canyon site can be found at the base of the Canyon Mountains on the western side near Scipio. The Nephi Dump site is on Long Ridge on the foothills west of Nephi. The Furner Valley site is located at the southern edge of the East Tintic Mountains between the Tintic and Juab Valleys.

Shrubs/Trees: The browse species on these sites include Wyoming and mountain big sagebrush (*Artemisia tridentata* ssp. *wyomingensis* and *A. tridentata* ssp. *vaseyana*), Nevada jointfir (*Ephedra nevadensis*), and antelope bitterbrush (*Purshia tridentata*). The Bridge Canyon and Horse Hollow sites have been burned multiple times and therefore have very little browse cover. Across all the sites, preferred browse cover has increased overall and demographic data shows that the populations have generally been composed of mature individuals (**Figure 7.5**). Average preferred browse demographic data also indicates that recruitment of young plants has decreased over time, as has decadence (**Figure 7.7**). Preferred browse utilization has fluctuated with a decrease being observed in 2007; the percentage of heavy utilized plants has generally increased over the study years (**Figure 7.8**).

Tree cover on these sites has fluctuated from year to year, partially due to the addition of the Furner Valley and Nephi Dump sites. However, a slightly increasing trend was observed in tree cover prior to the addition of data from three studies in 2017.

Herbaceous Understory: The composition of the herbaceous understory varies depending on study site. Annual grass cover has fluctuated depending on study year but frequency has remained similar: it has been a co-dominant component in a number of sample years. The study sites driving this trend differ from year to year, but in 2017 it was largely driven by Williams Canyon and Horse Hollow. Perennial grass cover and frequency have remained similar over time. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) was first sampled in significant numbers in 2017: this is likely due to the addition of the Bridge Canyon and Williams Canyon study sites (**Figure 7.9**, **Figure 7.10**).

Occupancy: The primary occupants on these sites vary between sample years; deer, cattle and horses have all been primary occupants in different years. Average pellet transect data shows that mean abundance of deer pellet groups has varied between 2 days use/acre in 2012 and 23 days use/acre in 2002. Elk usage was only observed in 2017 with less than 1 day use/acre being recorded. Cattle pellet groups have had a mean abundance as low as 2 days/use per acre in 1998 and as high as 27 in 2012. Usage by horses was observed with a low of 0 days use/acre in 2017 and a high of 22 days use/acre in 2012. Sheep pellet groups were only reported in 2002 with 4 days use/acre (**Figure 7.11**).

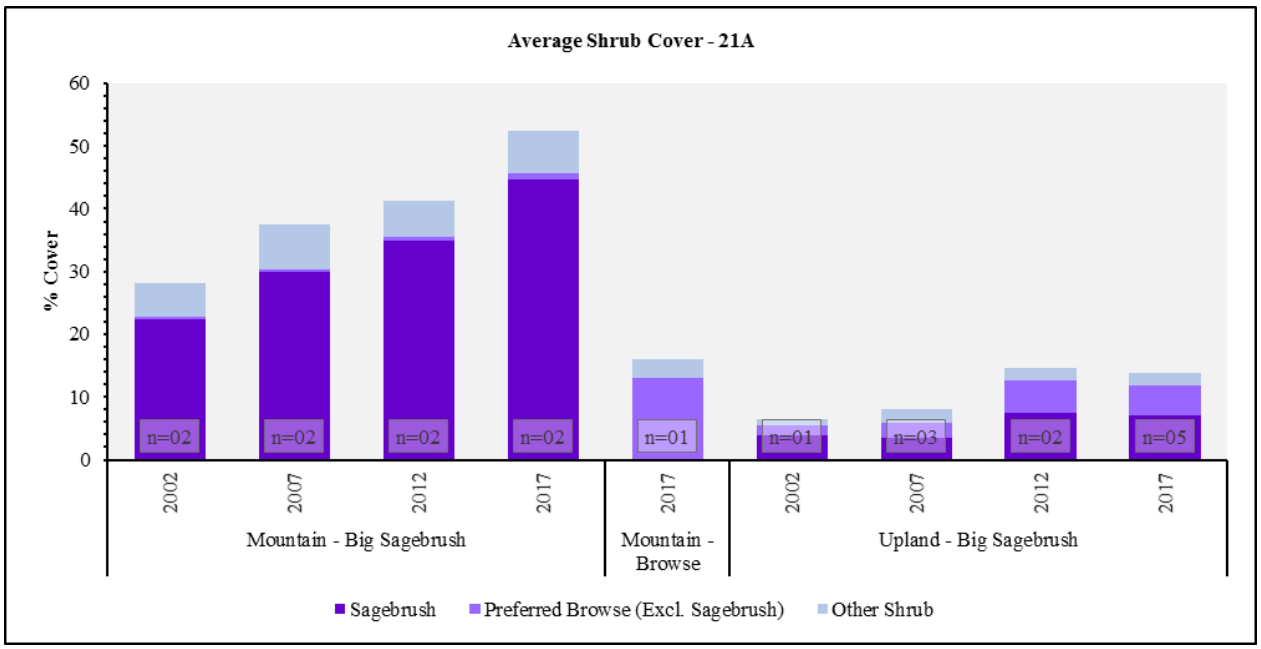


Figure 7.4: Average shrub cover for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

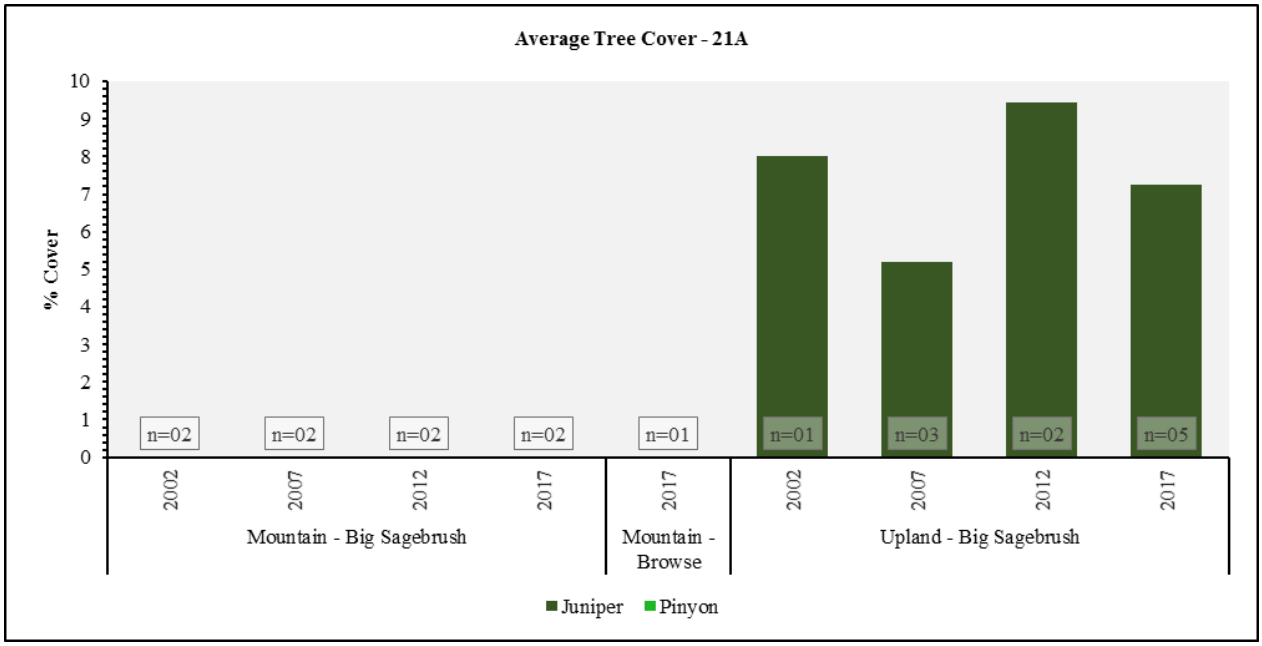


Figure 7.5: Average tree cover for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

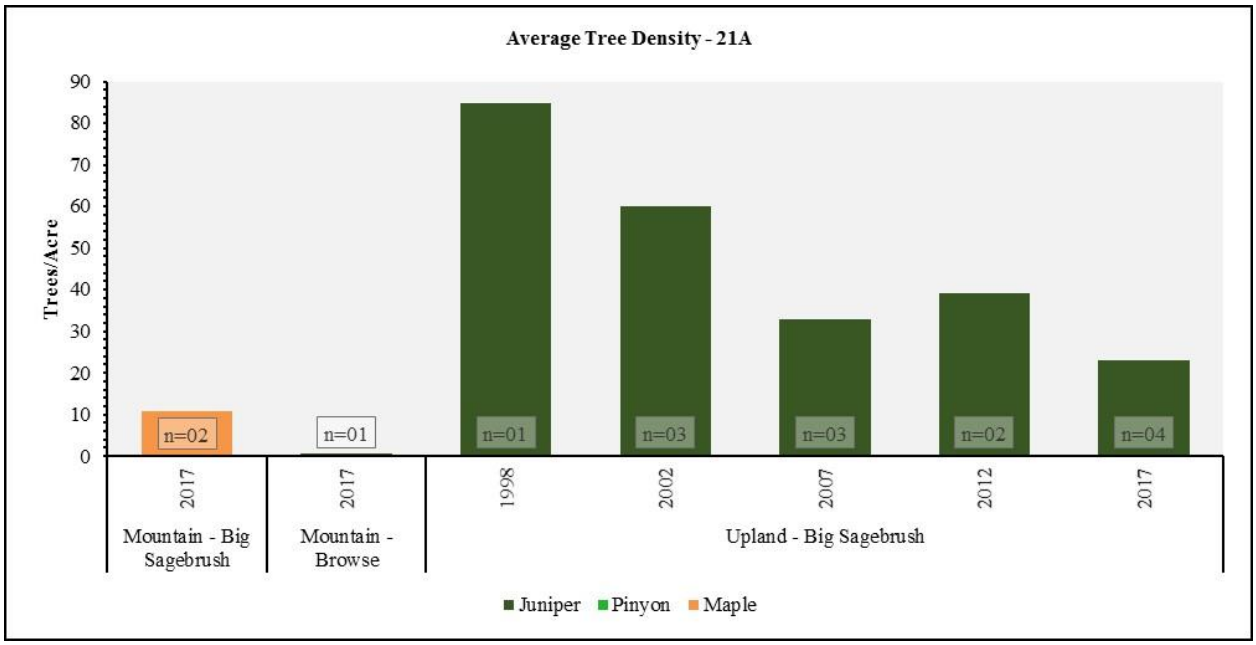


Figure 7.6: Average tree density for Mountain (ARTEM) and Mountain (ARNO) study sites in WMU 21A, Fillmore - Oak Creek.

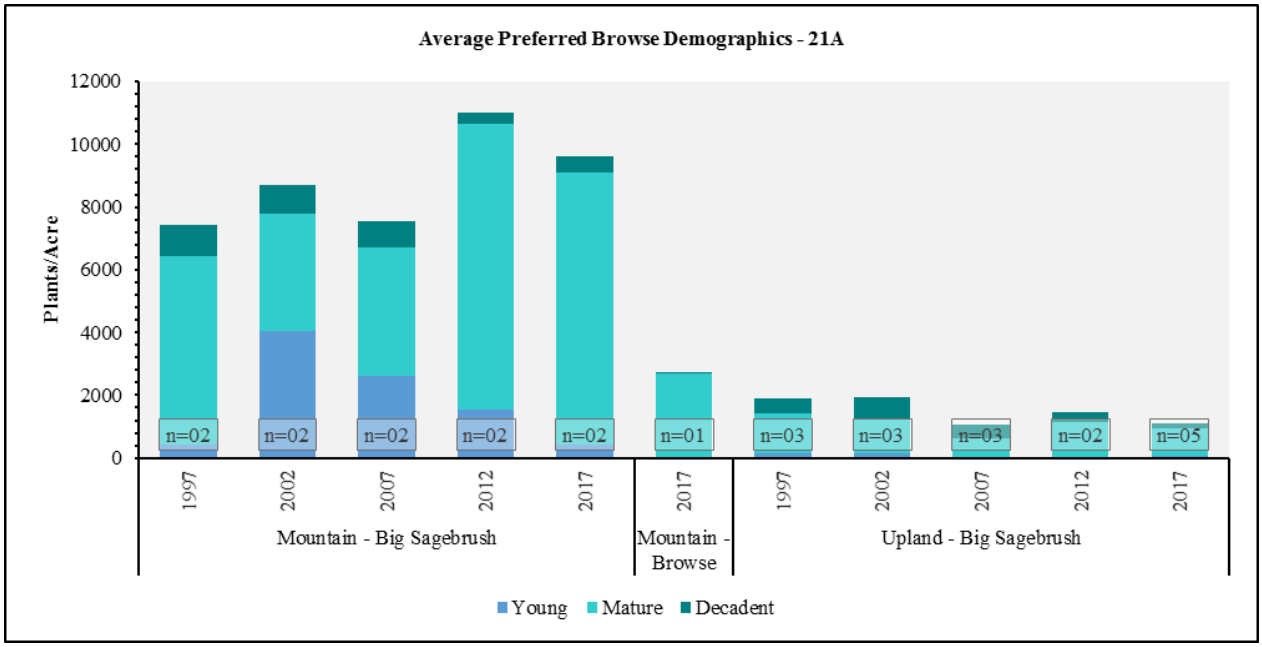


Figure 7.7: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

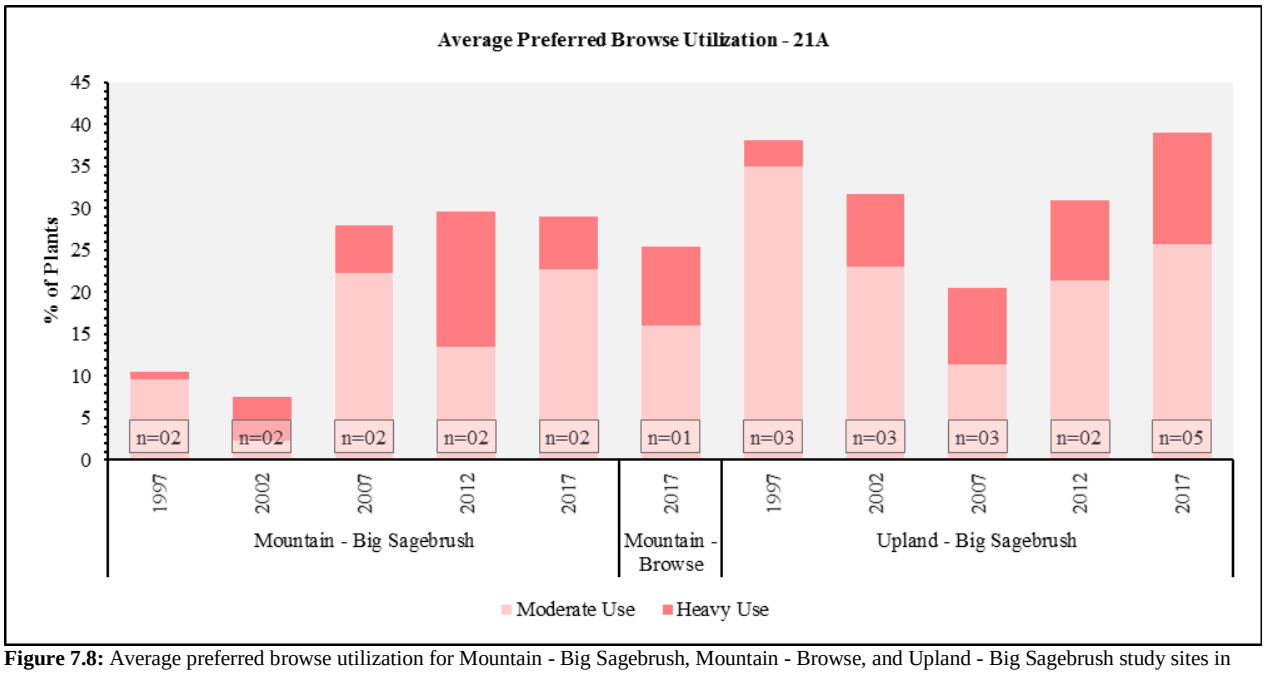


Figure 7.8: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

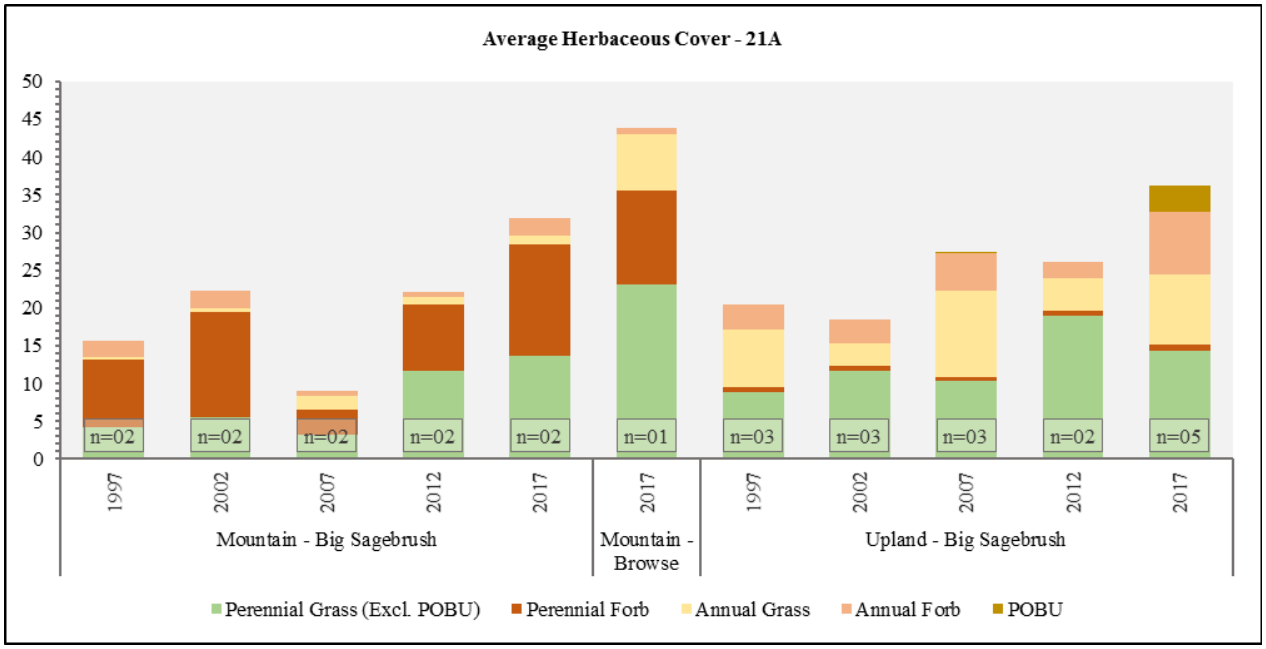


Figure 7.9: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

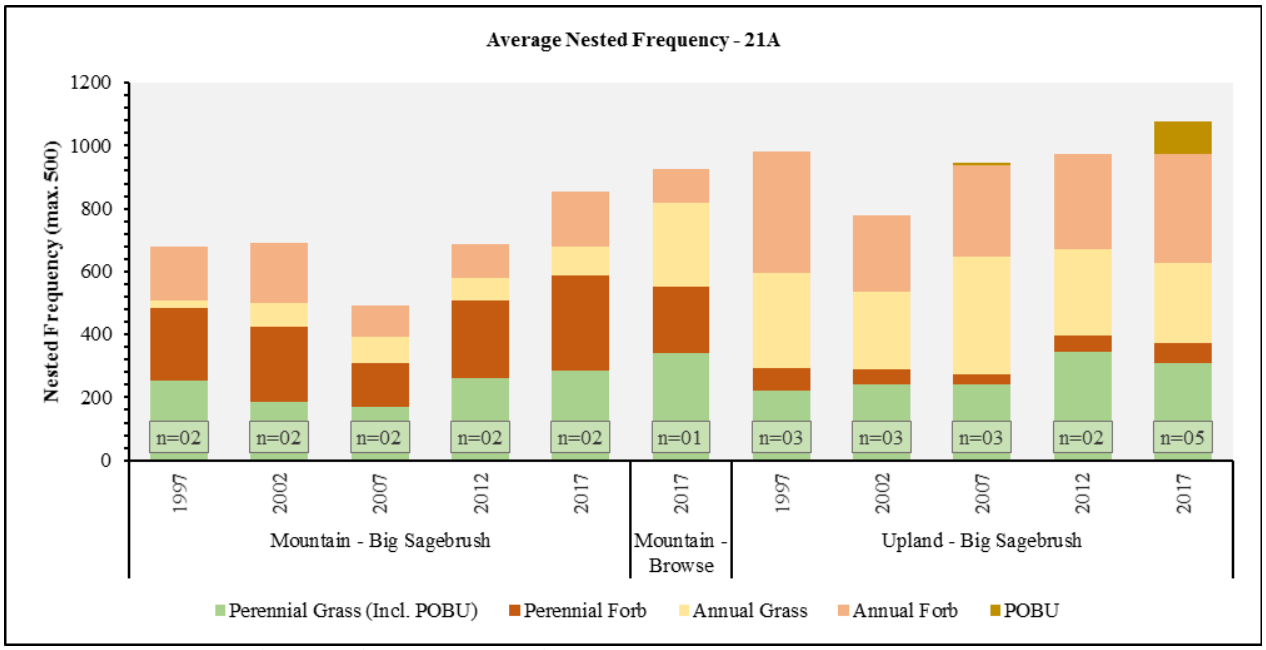


Figure 7.10: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Browse, and Upland - Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

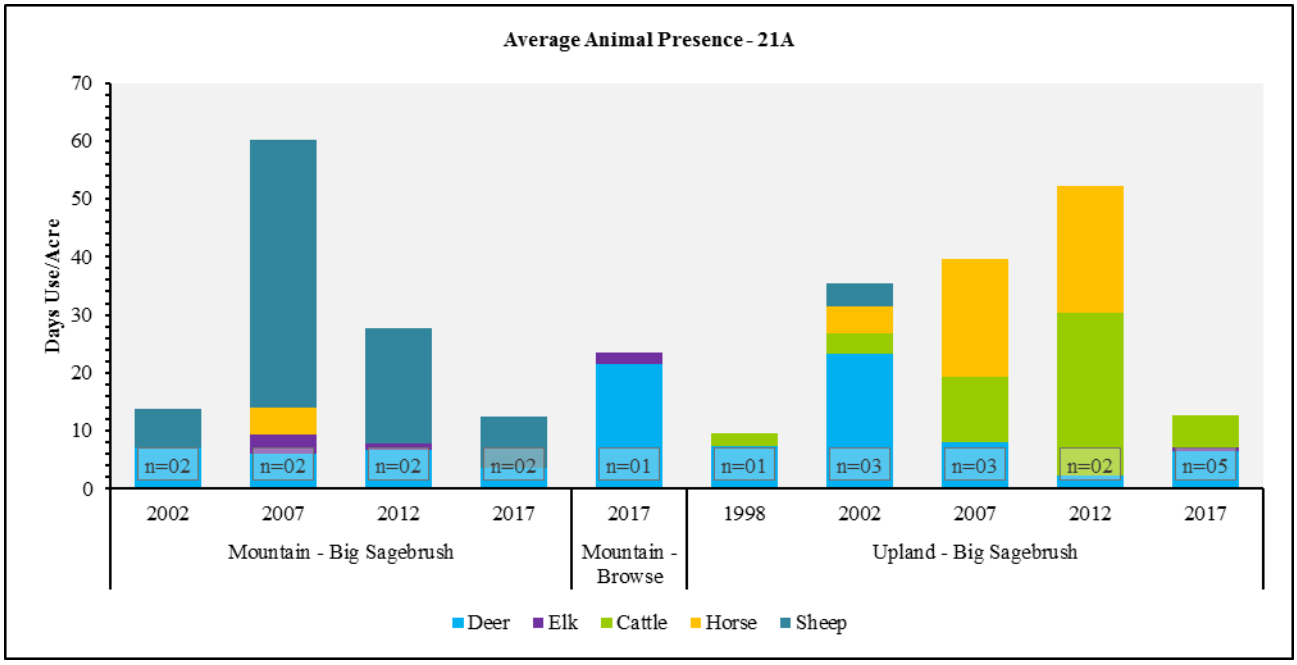
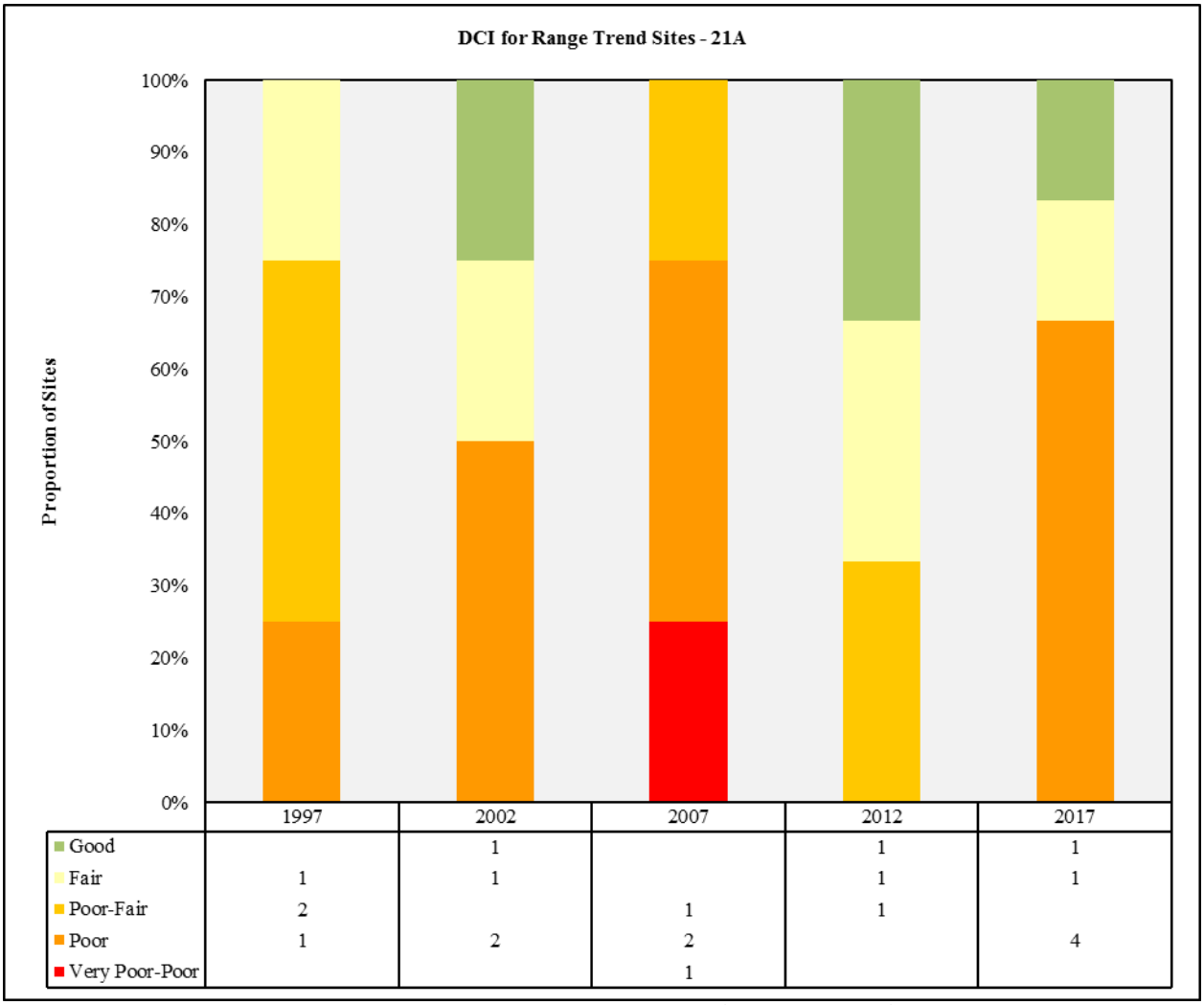


Figure 7.11: Average pellet transect data for Mountain – Big Sagebrush, Mountain – Browse, and Upland – Big Sagebrush study sites in WMU 21A, Fillmore - Oak Creek.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Fillmore - Oak Creek management unit has continually changed on the sites sampled since 1997. The active Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the 2017 sample year (**Figure 7.12**, **Table 7.10**). For the range trend sites, the Horse Hollow, Bridge Canyon, and Baker Canyon sites are considered to be in very poor condition. Furner Valley is considered to be in poor condition. Williams Canyon and Nephi Dump are considered to be in fair condition. Finally, Sunrise Canyon is classified as being in good condition. The treated sites have generally improved as time since treatment has increased. Anderson Dixie has improved from fair to fair-good and Duggins Creek improved from fair to good, but Gilson Mountain Sage-Grouse remained in very poor condition (**Figure 7.13**, **Table 7.11**). It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1997	2002	2007	2012	2017
Good		1		1	1
Fair	1	1		1	1
Poor-Fair	2		1	1	
Poor	1	2	2		4
Very Poor-Poor			1		

Figure 7.12: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 21A, Fillmore - Oak Creek.

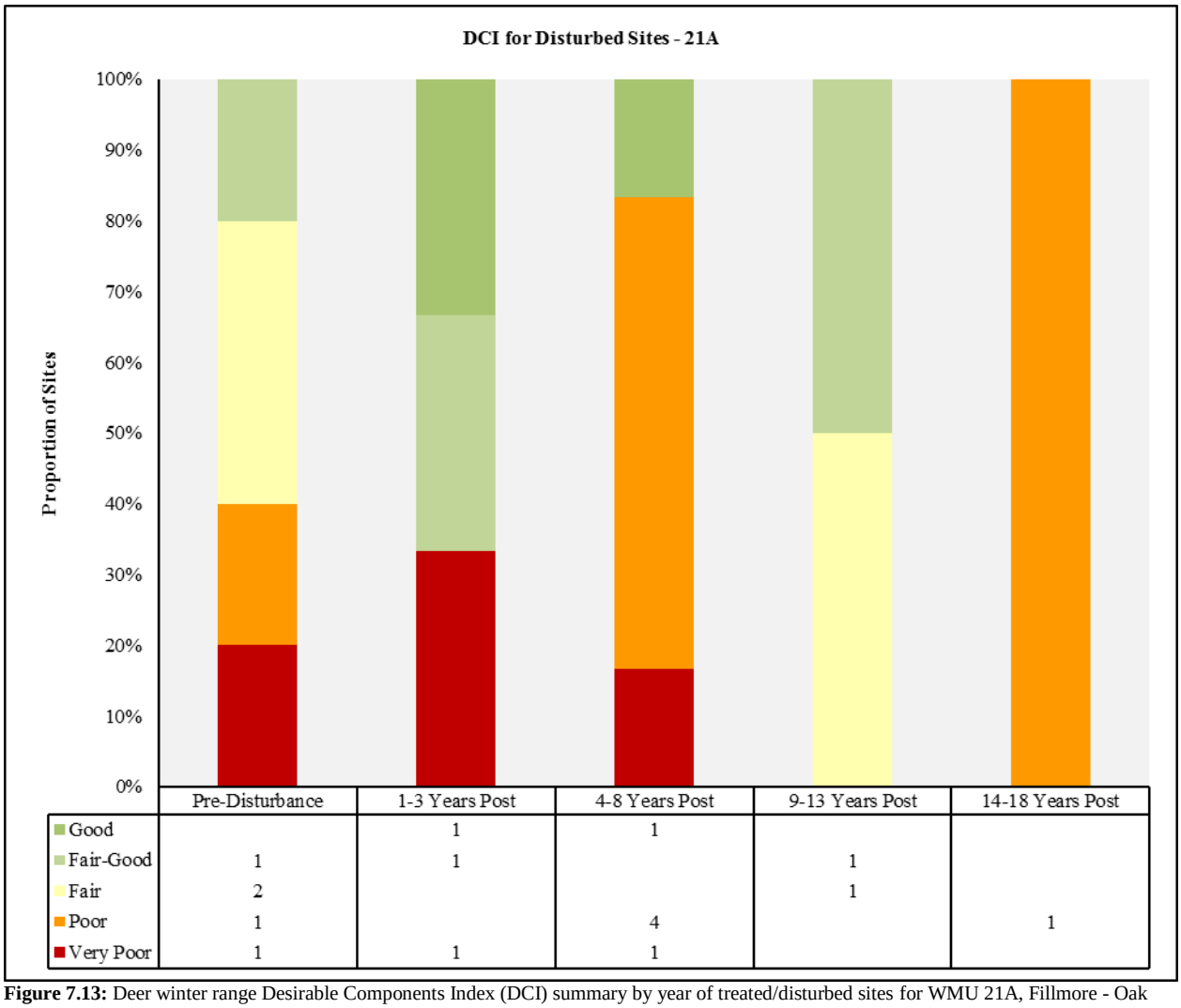


Figure 7.13: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 21A, Fillmore - Oak Creek.

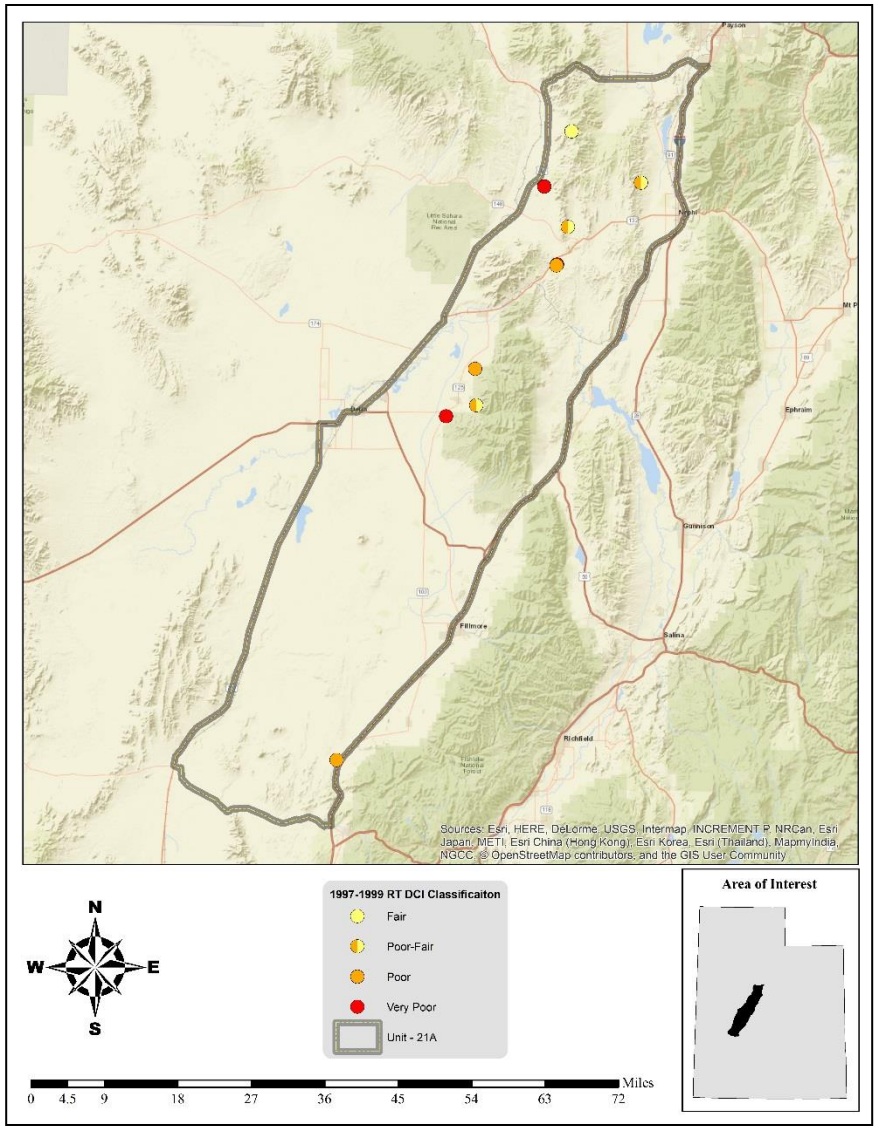
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21A-1*	1998	7.2	0.0	0.0	22.8	-3.2	5.2	0.0	**32.1**	**VP**
21A-1*	2003	11.4	1.0	0.0	26.8	-0.1	1.0	0.0	**40.1**	**P**
21A-2*	1998	2.8	0.0	0.0	9.6	-13.5	0.4	0.0	**-0.8**	**VP**
21A-2*	2003	0.8	0.0	0.0	12.0	-18.1	0.2	0.0	**-5.1**	**VP**
21A-3*	1998	0.0	0.0	0.0	30.0	-4.0	0.2	0.0	**26.2**	**P-F**
21A-3*	2003	0.0	0.0	0.0	30.0	-4.1	0.0	-2.0	**24.0**	**P-F**
21A-3*	2007	0.0	0.0	0.0	30.0	-18.2	0.4	-2.0	**10.3**	**VP-P**
21A-4	1997	3.8	0.0	0.0	6.0	-9.5	0.2	0.0	**0.5**	**VP**
21A-4	2002	7.0	-0.2	0.0	10.4	-2.6	0.2	0.0	**14.8**	**VP**
21A-4	2007	1.3	0.0	0.0	3.6	-10.4	0.0	0.0	**-5.5**	**VP**
21A-4	2017	2.5	0.0	0.0	19.2	-7.8	1.0	0.0	**14.9**	**VP**
21A-6	2017	0.0	0.0	0.0	30.0	-2.2	0.2	0.0	**28.0**	**VP**
21A-8	2017	30.0	11.5	1.0	27.8	-17.1	2.0	0.0	**55.1**	**F**
21A-10*	1997	30.0	10.5	0.8	8.0	-1.7	2.2	-2.0	**47.9**	**P**
21A-10*	2002	30.0	8.3	3.1	12.4	-0.9	1.8	0.0	**54.7**	**P-F**
21A-12	1997	30.0	9.1	3.0	11.8	0.0	10.0	-2.0	**61.9**	**F**
21A-12	2002	30.0	8.8	4.4	14.4	0.0	10.0	-2.0	**65.6**	**F**
21A-12	2007	30.0	6.8	4.2	5.4	0.0	9.2	0.0	**55.6**	**P-F**
21A-12	2012	30.0	12.7	8.9	19.0	-1.4	10.0	-2.0	**77.3**	**G**
21A-12	2017	30.0	12.3	4.5	30.0	-1.2	10.0	0.0	**85.6**	**G**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21A-16	1997	14.8	8.4	2.3	29.4	-3.5	0.4	0.0	**51.9**	**P-F**
21A-16	2002	11.1	1.8	0.5	30.0	-2.1	2.6	0.0	**43.9**	**P**
21A-16	2007	9.5	0.9	0.0	30.0	-7.9	2.2	0.0	**34.7**	**VP-P**
21A-16	2012	12.1	6.0	0.0	30.0	-1.8	1.8	0.0	**48.1**	**P-F**
21A-16	2017	10.6	10.2	4.0	30.0	-1.0	3.6	0.0	**57.5**	**F**
21A-18	1997	21.0	8.4	6.0	18.0	-4.0	3.6	-2.0	**51.0**	**P-F**
21A-18	2002	24.8	10.0	6.2	27.6	-1.8	1.6	0.0	**68.4**	**G**
21A-18	2007	12.9	9.9	1.6	23.2	-7.7	0.6	0.0	**40.4**	**P**
21A-18	2012	21.8	12.6	2.0	30.0	-4.8	0.8	0.0	**62.4**	**F**
21A-18	2017	22.7	8.8	1.6	14.4	-6.5	1.4	-2.0	**40.5**	**P**
21A-19*	1998	0.0	0.0	0.0	8.0	-9.4	1.2	-2.0	**-2.2**	**VP**
21A-19*	1999	0.0	0.0	0.0	9.2	-15.5	0.0	0.0	**-6.3**	**VP**
21A-19*	2002	0.0	0.0	0.0	23.0	-2.6	0.2	0.0	**20.6**	**VP**
21A-19*	2007	0.6	0.0	0.0	23.8	-1.4	0.4	0.0	**23.4**	**VP**
21A-20*	1998	0.8	0.0	0.0	29.0	-3.3	0.6	0.0	**27.1**	**VP**
21A-20*	1999	0.9	0.0	0.0	23.6	-4.1	0.2	0.0	**20.6**	**VP**
21A-20*	2002	0.6	0.0	0.0	30.0	-1.6	0.4	0.0	**29.5**	**VP**
21A-20*	2007	0.3	0.0	0.0	30.0	-1.7	0.4	0.0	**29.0**	**VP**
21A-20*	2012	4.6	0.0	0.0	30.0	-2.0	0.2	0.0	**32.9**	**VP**
21A-21*	1997	0.0	0.0	0.0	14.6	-1.1	2.0	-2.0	**13.6**	**VP**
21A-21*	1998	0.0	0.0	0.0	30.0	-7.4	2.4	0.0	**25.1**	**VP**
21A-21*	1999	0.0	0.0	0.0	25.8	-7.0	0.4	0.0	**19.2**	**VP**
21A-21*	2002	0.1	0.0	0.0	30.0	-3.5	0.6	0.0	**27.2**	**VP**
21A-21*	2007	0.1	0.0	0.0	30.0	-3.5	0.4	0.0	**23.1**	**VP**
21A-21*	2012	2.4	0.0	0.0	30.0	-1.1	0.6	-2.0	**29.9**	**VP**
21A-22*	1997	0.0	0.0	0.0	9.6	-1.8	3.6	0.0	**11.4**	**VP**
21A-22*	1998	0.0	0.0	0.0	21.0	-19.4	3.2	-2.0	**2.9**	**VP**
21A-22*	1999	0.5	0.0	0.0	19.2	-15.0	0.2	0.0	**4.9**	**VP**
21A-22*	2002	0.6	0.0	0.0	22.4	-3.5	0.2	-2.0	**17.8**	**VP**
21A-22*	2007	0.8	0.0	0.0	30.0	-3.2	0.2	0.0	**27.7**	**VP**
21A-23	1998	6.6	12.4	6.0	20.4	-4.9	10.0	0.0	**50.5**	**P-F**
21A-23	2003	6.4	9.2	15.0	26.4	-1.1	5.4	0.0	**61.3**	**F**
21A-23	2008	5.1	0.0	0.0	23.2	-1.9	4.4	0.0	**30.9**	**VP**
21A-23	2012	8.6	7.2	0.0	24.4	-4.1	4.4	0.0	**40.5**	**P**
21A-23	2017	7.1	9.8	5.9	13.0	-12.2	5.0	0.0	**28.6**	**VP**

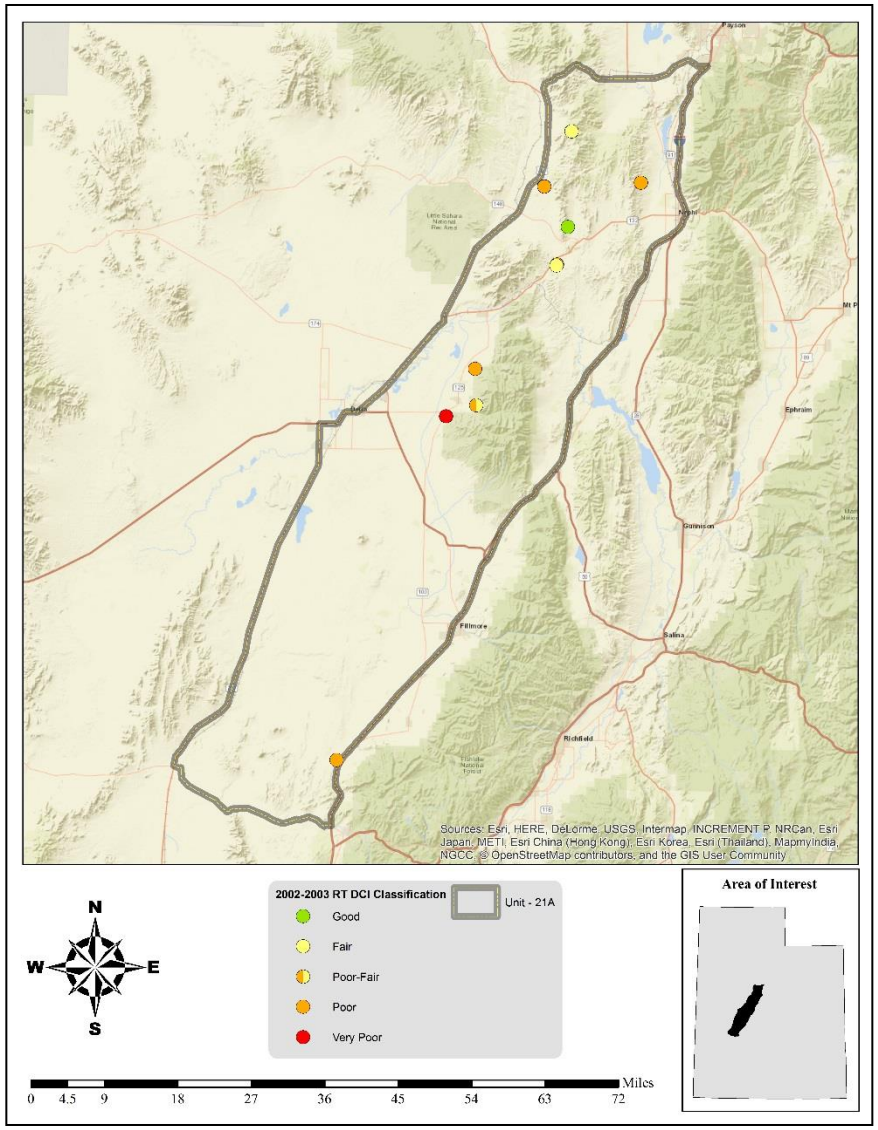
Table 7.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 21A, Fillmore - Oak Creek. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21R-6	2007	19.2	3.3	0.0	16.0	-11.8	0.4	0.0	**27.2**	**F**
21R-6	2010	21.8	13.0	4.0	14.4	-10.3	2.4	0.0	**45.3**	**F-G**
21R-6	2011	9.5	13.2	15.0	30.0	-13.9	1.6	0.0	**55.4**	**G**
21R-6	2016	10.5	12.9	3.0	21.6	-2.9	0.4	0.0	**45.5**	**F-G**
21R-15	2012	14.1	12.5	2.4	30.0	-5.2	0.0	0.0	**53.8**	**F**
21R-15	2015	19.4	14.0	5.6	30.0	-0.5	0.0	0.0	**68.5**	**G**
21R-21	2008	0.0	0.0	0.0	3.2	-4.9	0.2	0.0	**-1.5**	**VP**
21R-21	2011	0.8	0.0	0.0	7.8	-9.8	0.6	0.0	**-0.7**	**VP**
21R-21	2016	0.0	0.0	0.0	12.4	-20.0	1.2	0.0	**-6.4**	**VP**

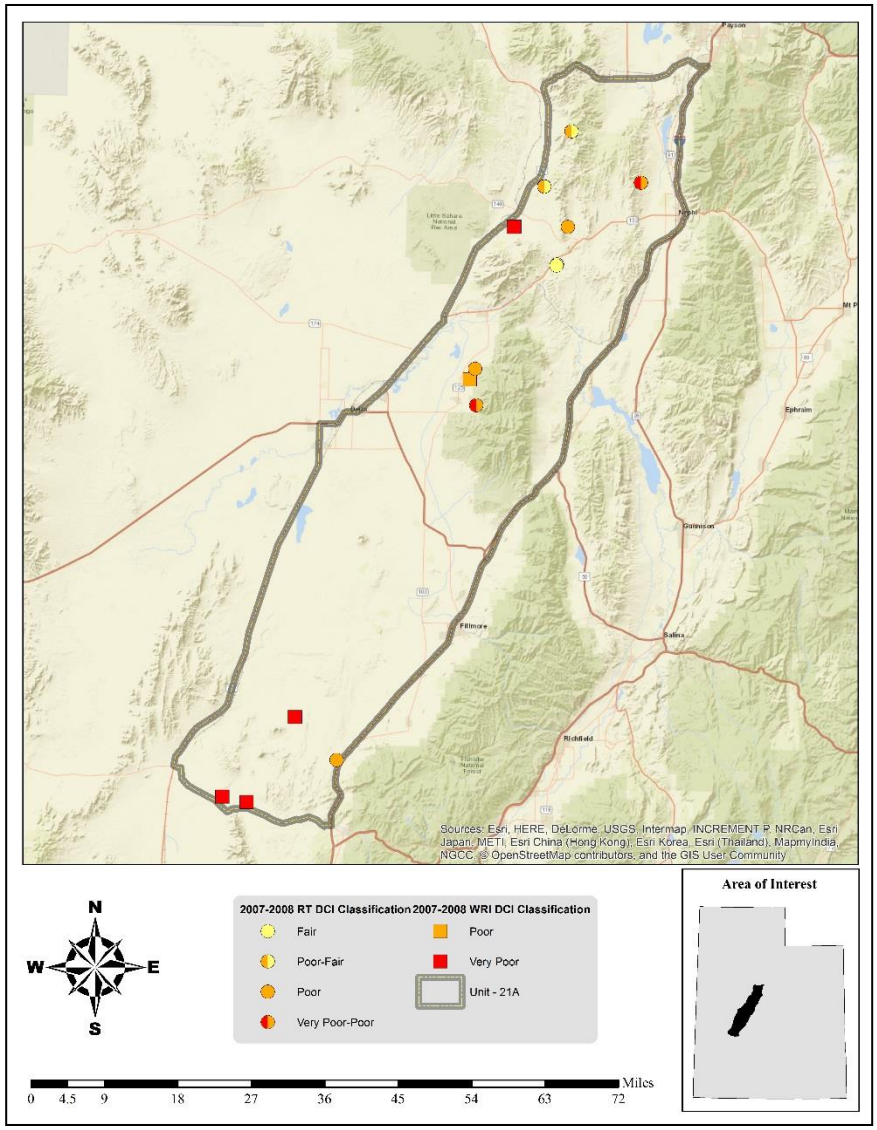
Table 7.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 21A, Fillmore - Oak Creek. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



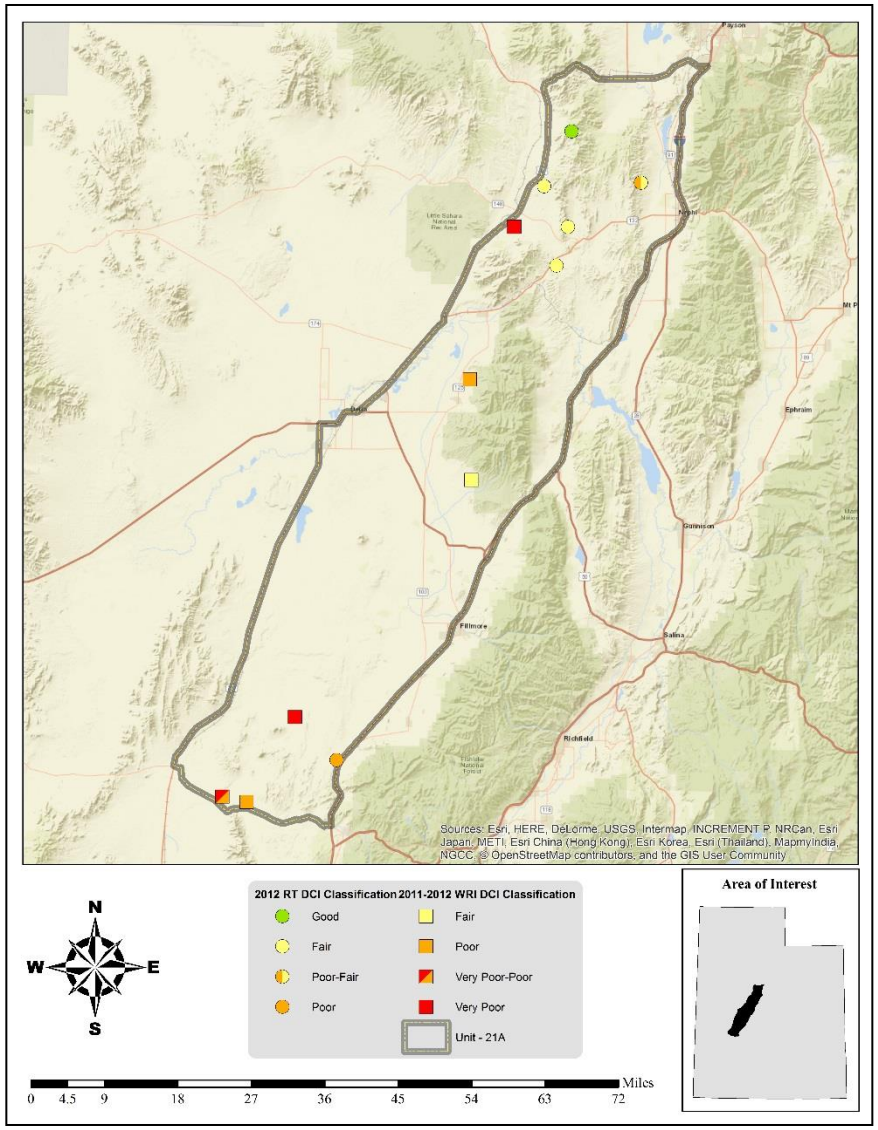
Map 7.9: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 21A, Fillmore - Oak Creek.



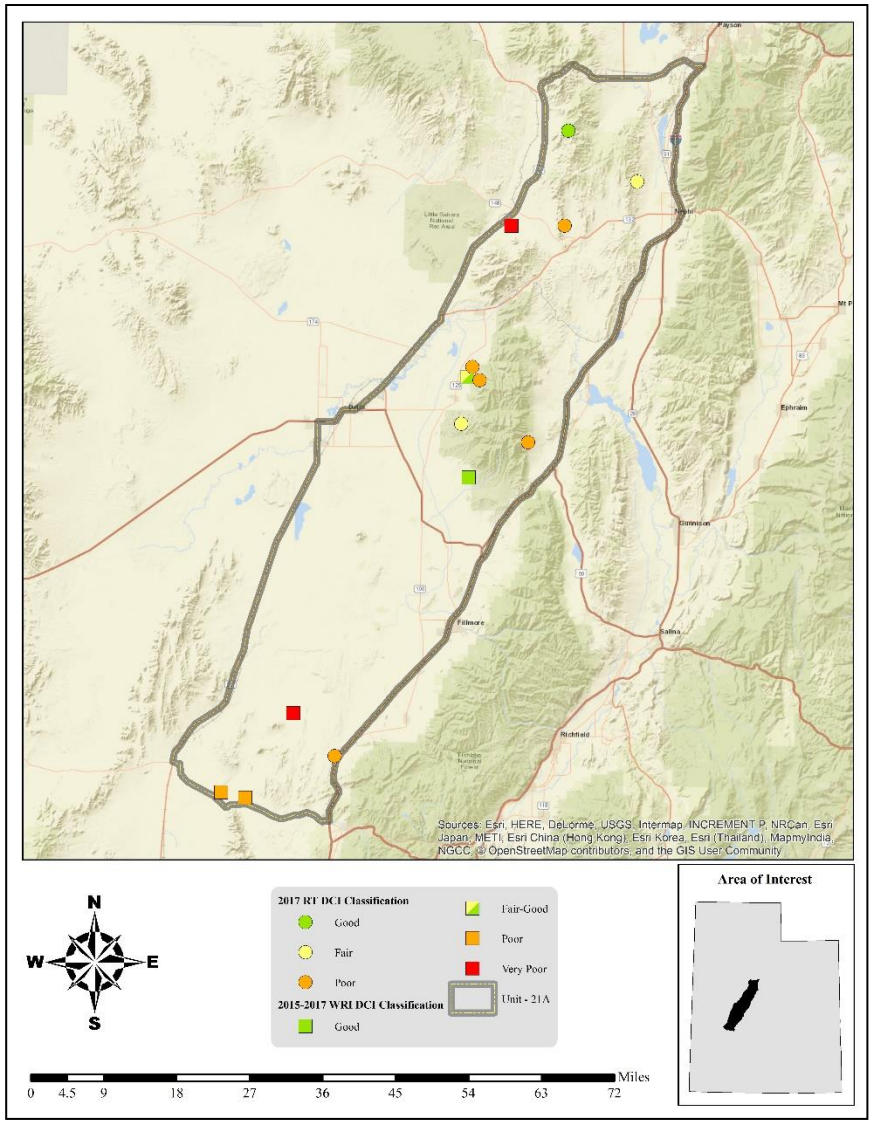
Map 7.10: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 21A, Fillmore - Oak Creek.



Map 7.11: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 21A, Fillmore - Oak Creek.



Map 7.12: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 21A, Fillmore - Oak Creek.



Map 7.13: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 21A, Fillmore - Oak Creek.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
21A-4	Horse Hollow	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21A-6	Bridge Canyon	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
21A-7	Rocky Ridge Canyon	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21A-8	Williams Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21A-12	Sunrise Canyon	Annual Grass	Medium	Increased Fire Potential
21A-13	Dennis Spring	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
21A-16	Nephi Dump	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
21A-18	Furner Valley	Annual Grass	Medium	Increased Fire Potential
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21A-23	Baker Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21R-2	Wide Canyon Bullhog	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
21R-8	A&F Aerial Seeding	Annual Grass	High	Increased Fire Potential
21R-9	A&F Aerial Seeding 2	Annual Grass	High	Increased Fire Potential
21R-10	A&F Drill 3	Annual Grass	High	Increased Fire Potential

Table 7.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 21A, Fillmore - Oak Creek. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are within the Mountain (Big Sagebrush) ecological type are considered to be in good condition for deer range on the unit. One of the sites (Dennis Spring) is considered to be summer range and was therefore not included in the Desirable Components Index. These ecological sites support robust sagebrush populations with small amounts of other browse species also present: these shrub communities provide plentiful browse for deer. Annual grasses are of moderate concern on these sites, particularly Sunrise Canyon. These grasses can change plant community dynamics and alter wildfire regime.

The primary threats to these studies are from herbaceous species. On sites with significant issues, treatments could be useful (where feasible) to restoring proper ecological function. Possible management tools that could help with these species include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Browse)

The only study located within the Mountain (Browse) ecological site is not considered to be in deer winter range and was therefore not rated by the Desirable Components Index criteria. This ecological type supports shrub and understory species that provide forage and browse for deer and other wildlife. Annual grasses are the highest level threat on this site as they can increase the fire return interval. Lesser threats are posed by introduced perennial grasses and pinyon-juniper encroachment. All of these threats are capable of altering the dynamics of the plant community, resulting in a less productive understory.

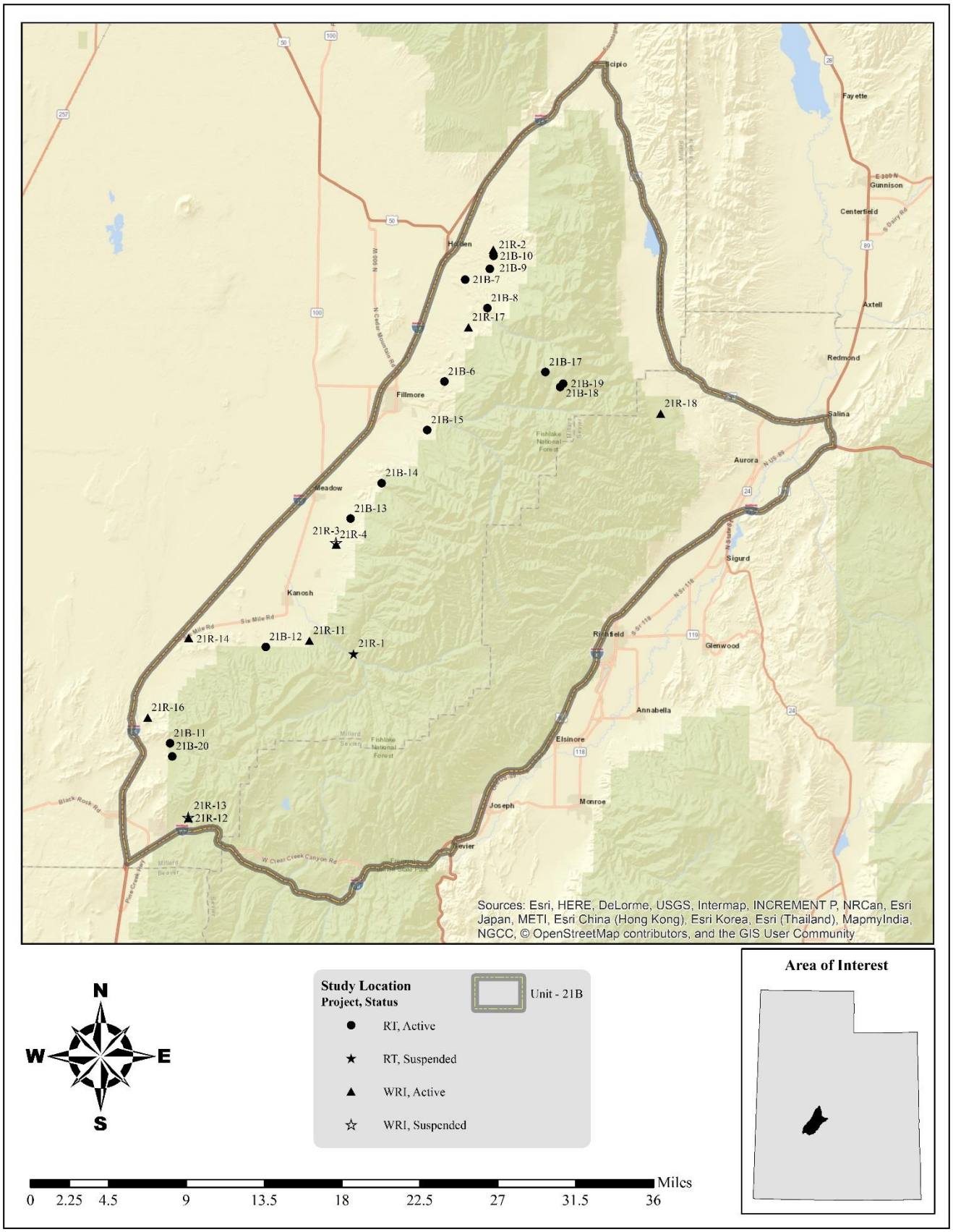
There is limited pinyon and juniper encroachment on this study site. It is recommended that when necessary, work to reduce these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin. On sites with significant cover from annual and perennial grasses, treatments that could be helpful to restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Upland (Big Sagebrush)

The Upland (Big Sagebrush) studies within this unit are considered to be in very poor to fair condition for deer winter range. Sites of this ecological type support sagebrush and other browse species that provide browse for wintering deer. Factors detrimental to the condition of the winter range include low preferred browse cover, high cover of annual grasses, and a lack of perennial grasses and forbs. Annual grasses pose the highest level threat on these sites, with pinyon juniper encroachment and introduced perennial grasses as lesser threats. Annual grasses can increase the fuel load and thereby increase the fire return interval. All of these threats can change the plant community dynamics and result in a less productive browse component and herbaceous understory.

There is pinyon and juniper encroachment occurring on these studies; it is recommended that in areas where it is necessary, work to reduce these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin. On sites with significant cover from annual and perennial grasses, treatments that could aid in restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. In addition, noxious weeds are present on the Furner Valley site. Areas within this unit that are infested with noxious weeds should be treated to prevent further spread of these undesirable species. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

8. WILDLIFE MANAGEMENT UNIT 21B – FILLMORE - PAHVANT



WILDLIFE MANAGEMENT UNIT 21B – FILLMORE - PAHVANT

Boundary Description

Millard and Sevier counties--Boundary begins at I-70 and I-15; north on I-15 to US-50 at Scipio; southeast on US-50 to I-70; southwest on I-70 to I-15. Excludes all CWMUs.

Management Unit Description

Geography

The Fillmore - Pahvant management unit sits in between the Sevier Desert and Central Valley. This unit consists of the Pahvant range and associated winter habitat areas surrounding it. Range trend studies are mostly on the western side of the mountain range in the winter range, with three high-elevation summer range sites located in the northern section of the unit.

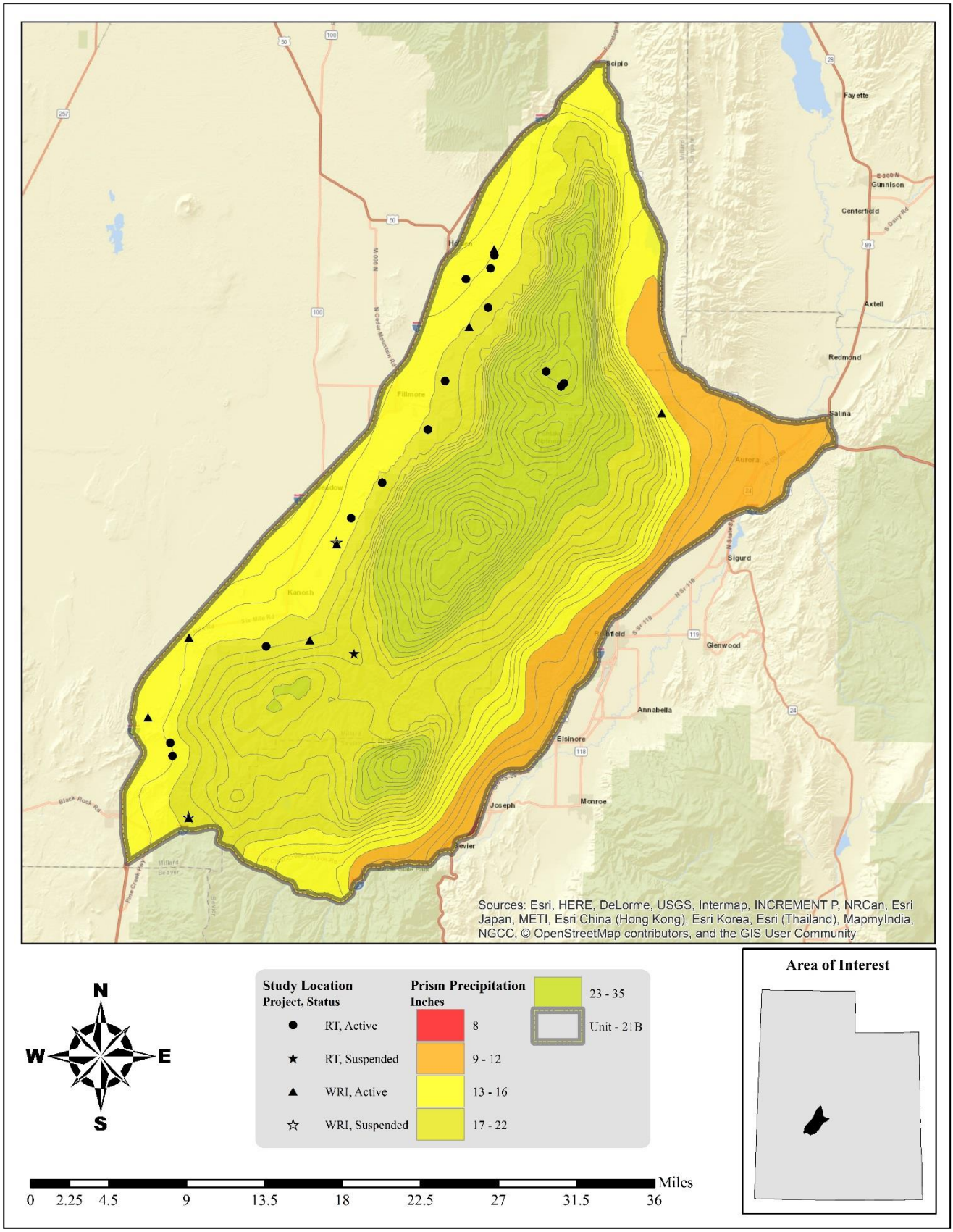
The Pahvant range is the primary geographic feature within the unit. This mountain range runs north and south, parallel with I-15. Mine Camp Peak is the tallest peak in the range at 10,225 feet tall. There are many wide and moderately-sloped canyons on both the eastern and western sides of the range. The range generally becomes lower in elevation towards the southern end of the unit with sagebrush flats and valleys as the main topography instead of high elevation peaks. Towns within this management unit include Kanosh, Fillmore, Meadow, and Aurora.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches in areas near Joseph up to 35 inches on the top of the Pahvani range. All of the Range Trend and WRI monitoring studies on the unit occur within 13-35 inches of precipitation (**Map 8.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the South-Central division (Division 4).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (Figure 8.1a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 8.1b**).



Map 8.1: The 1981-2010 PRISM Precipitation Model for WMU 21B, Fillmore - Pahvant (PRISM Climate Group, Oregon State University, 2013).

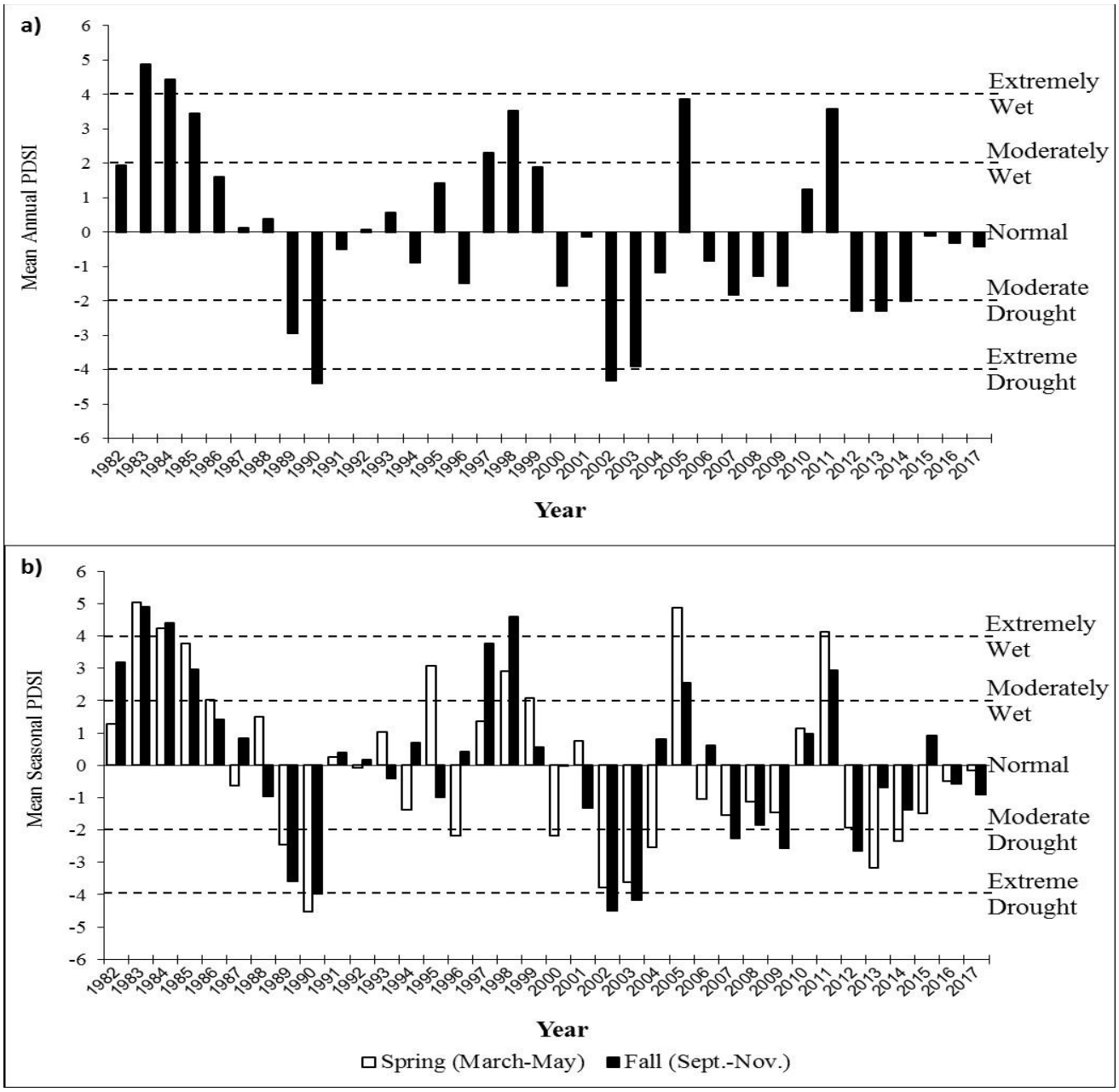


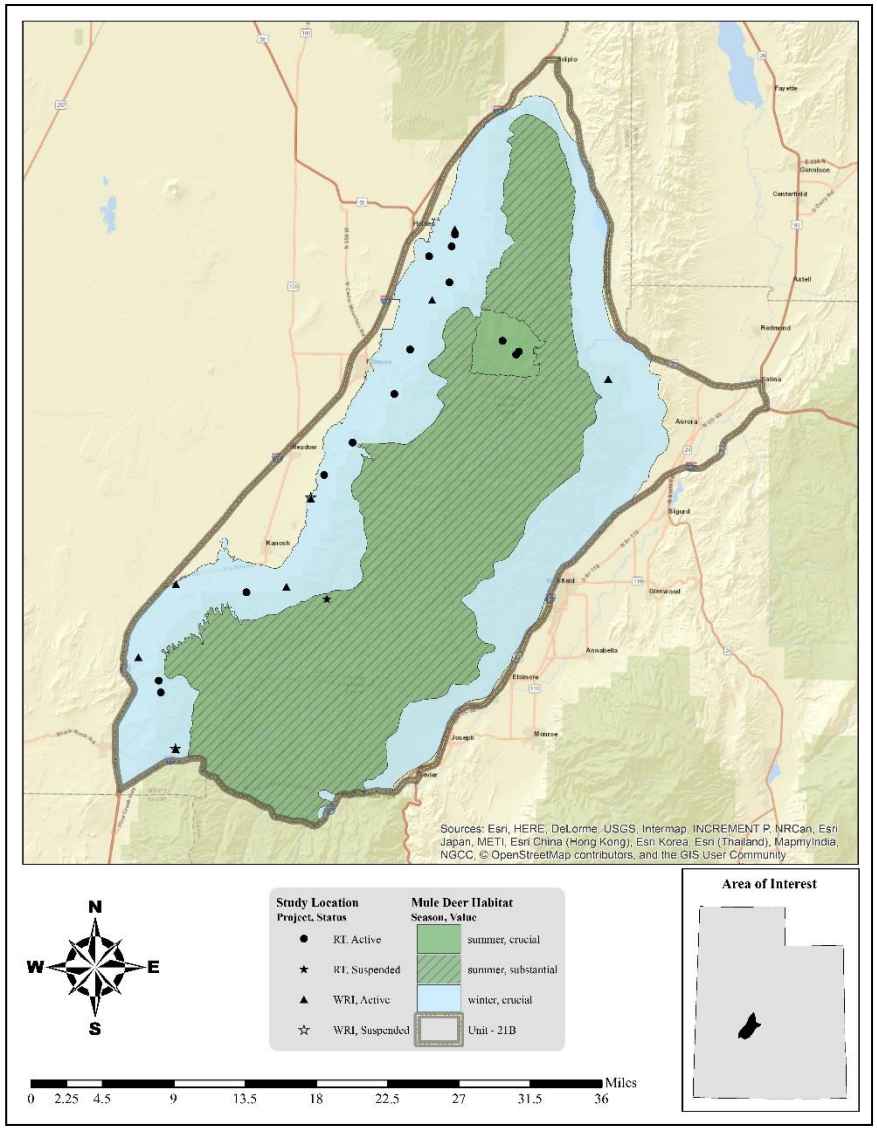
Figure 8.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 5). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018). .

Big Game Habitat

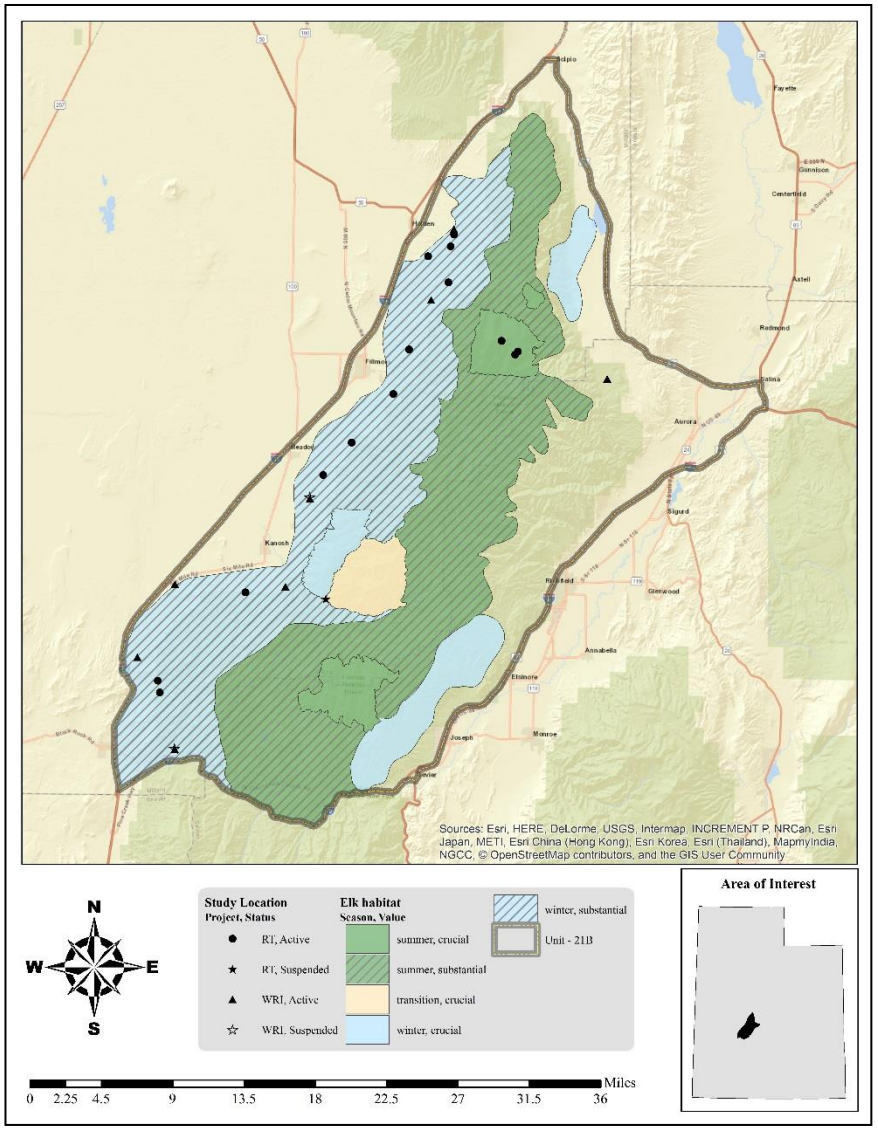
There are 480,510 acres estimated as mule deer range on Unit 21B with 44% designated as winter range and 56% classified as summer range (**Table 8.1**, **Map 8.2**). The United States Forest Service manages 51% of the winter range, 30% is privately owned, 10% is managed by the Bureau of Land Management, The Utah Division of Wildlife Resources (UDWR) manages 7%, the Utah School and Institutional Trust Lands Administration (SITLA) manages another 2%, Utah Department of Transportation (UDOT) and Utah State Parks (USP) manage <1%, and there is another <1% that is tribally owned. This unit has significant amounts of winter range that are privately owned, which can present management issues with crop depredation (**Table 8.2**, **Map 8.2**).

Deer winter range roughly follows the base of the Pahvant range at elevations between approximately 5100 and 7500 feet. It is bordered on the west by I-15, on the east by I-70, and on the north by US-50. There are still good amounts of winter habitat at the lower elevations of the unit. The Milford Flat fire burned significant areas of former winter range and I-15 acts as a barrier to migration into previously-used desert wintering areas.

Much of the winter range on this unit is host to shrub communities composed of a mix of Stansbury cliffrose, mountain big sagebrush, and other browse species. While many of the range trend sites show good populations of browse species, many of these sites have depleted understories with both cheatgrass and bulbous bluegrass being very common across the range. On the higher elevation summer sites, there are significant amounts of aspen-timber and subalpine meadow plant communities that are used for summer range.



Map 8.2: Estimated mule deer habitat by season and value for WMU 21B, Fillmore - Pahvant.



Map 8.3: Estimated elk habitat by season and value for WMU 21B, Fillmore - Pahvant.

	Summer Range		Transitional Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	268,650	0%	0	0%	211,860	5%
Elk	179,570	**100%**	12,002	**100%**	181,009	**100%**

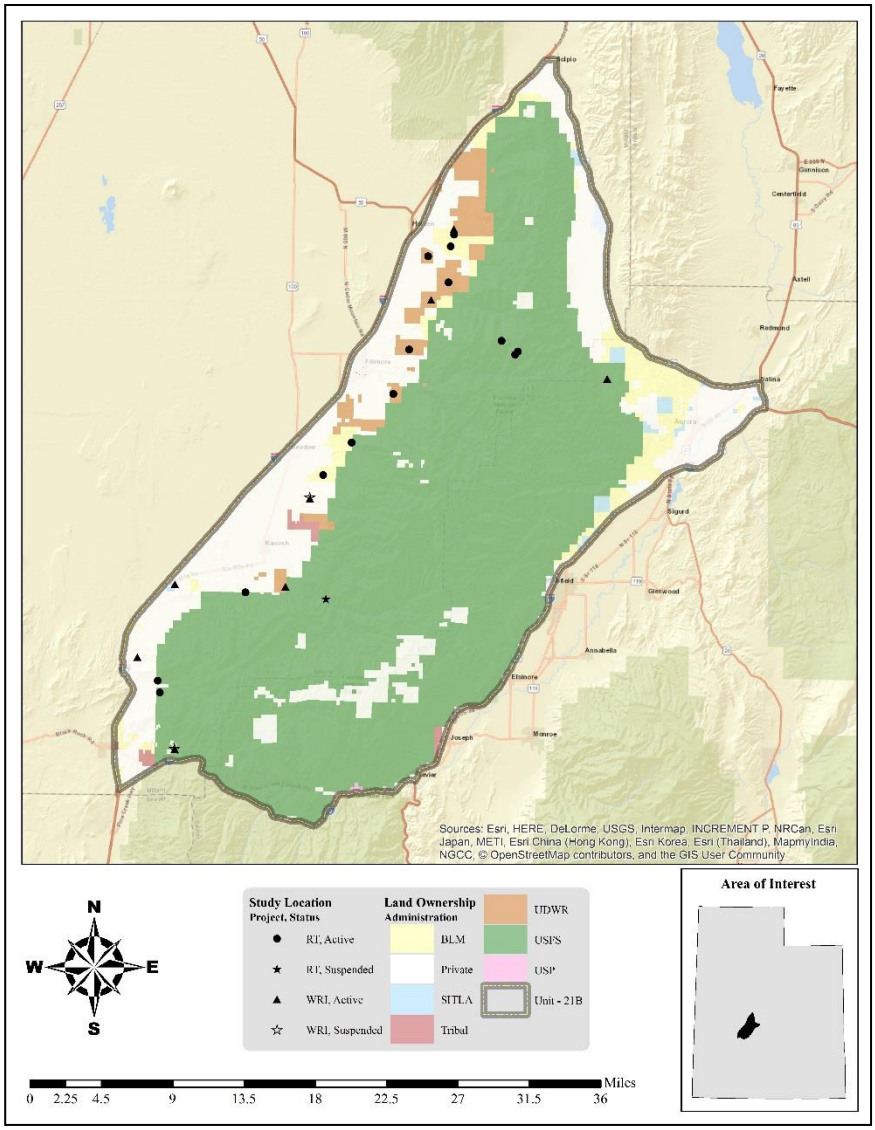
Table 8.1: Estimated mule deer and elk habitat acreage by season for WMU 21B, Fillmore - Pahvant.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0.3	<1%	20,355	10%
Private	14,811	6%	63,970	30%
SITLA	0	0%	3,484	2%
Tribal	0	0%	991	<1%
UDOT	0	0%	33	<1%
UDWR	0	0%	15,641	7%
USFS	253,529	94%	107,163	51%
USP	310	<1%	224	<1%
Total	268,650	**100%**	211,860	**100%**

Table 8.2: Estimated mule deer habitat acreage by season and ownership for WMU 21B, Fillmore - Pahvant.

	Summer Range		Transitional Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	0	0%	8,187	5%
Private	13,709	8%	0	0%	48,865	27%
SITLA	0	0%	0	0%	808	<1%
Tribal	0	0%	0	0%	596	<1%
UDWR	16	<1%	0	0%	13,344	7%
USFS	165,505	92%	12,002	100%	109,124	60%
USP	339	<1%	0	0%	85	<1%
Total	179,570	**100%**	12,002	**100%**	181,009	**100%**

Table 8.3: Estimated elk habitat acreage by season and ownership for WMU 21B, Fillmore - Pahvant.



Map 8.4: Land ownership for WMU 21B, Fillmore - Pahvant.

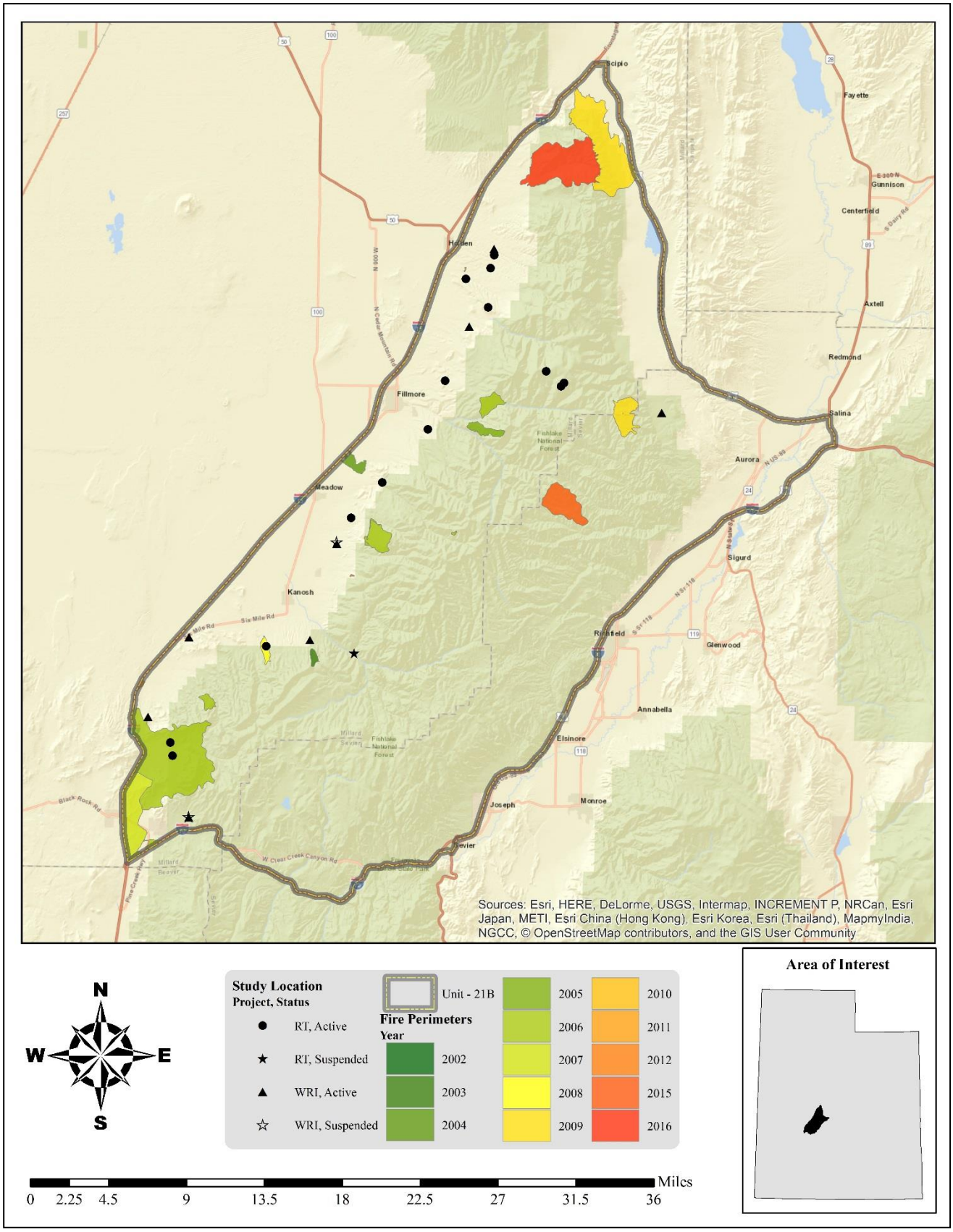
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Colorado Plateau Pinyon-Juniper Woodland	188,396	34.68%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	29,942	5.51%	
	Abies concolor Forest Alliance	17,966	3.31%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	13,022	2.40%	
	Great Basin Pinyon-Juniper Woodland	3,295	0.61%	
	Inter-Mountain Basins Juniper Savanna	2,797	0.51%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,099	0.20%	
	Other Conifer	1,218	0.22%	47.45%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	24,333	4.48%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	1,784	0.33%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	1,665	0.31%	5.11%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	4,379	0.81%	
	Inter-Mountain Basins Semi-Desert Grassland	2,205	0.41%	
	Southern Rocky Mountain Montane-Subalpine Grassland	883	0.16%	
	Other Grassland	14	0.00%	1.38%
Shrubland	Inter-Mountain Basins Semi-Desert Shrub-Steppe	57,482	10.58%	
	Inter-Mountain Basins Big Sagebrush Shrubland	26,091	4.80%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	26,086	4.80%	
	Quercus gambelii Shrubland Alliance	16,624	3.06%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	16,350	3.01%	
	Inter-Mountain Basins Greasewood Flat	6,423	1.18%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	6,146	1.13%	
	Inter-Mountain Basins Montane Sagebrush Steppe	4,192	0.77%	
	Rocky Mountain Lower Montane-Foothill Shrubland	3,523	0.65%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	2,139	0.39%	
	Great Basin Xeric Mixed Sagebrush Shrubland	1,477	0.27%	
	Arctostaphylos patula Shrubland Alliance	1,272	0.23%	
	Inter-Mountain Basins Big Sagebrush Steppe	1,082	0.20%	
	Coleogyne ramosissima Shrubland Alliance	776	0.14%	
	Other Shrubland	777	0.14%	31.38%
Other	Hardwood	21,789	4.01%	
	Agricultural	18,465	3.40%	
	Developed	16,146	2.97%	
	Conifer-Hardwood	9,353	1.72%	
	Sparsely Vegetated	6,456	1.19%	
	Riparian	5,142	0.95%	
	Barren	1,727	0.32%	
	Open Water	556	0.10%	
	Quarries-Strip Mines-Gravel Pits	109	0.02%	14.68%
Total		543,181	100%	100%

Table 8.4: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 21B, Fillmore - Pahvant.

Limiting Factors to Big Game Habitat

Major human activities in this area include agriculture, grazing, and mining. Some of the limiting factors to this unit include habitat fragmentation, habitat degradation and loss, and winter range conditions. Due to the amounts of cropland adjacent to winter ranges, there are issues with private land depredation. In addition, I-15 and I-70 are restrictive to the natural migration patterns and are barriers to movement in both winter and summer habitats. Pinyon-Juniper encroachment is a threat to the browse communities in the unit; according to the current Landfire Exisiting Vegetation Coverage model, 34.68% of the unit is composed of Pinyon-Juniper woodlands (**Table 8.4**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000).

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). The current Landfire Existing Vegetation Coverage model indicates that 4.48% of the unit is comprised of annual exotic herbaceous species (**Table 8.4**). Increased amounts of cheatgrass increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). The unit has had several large wildfires, resulting in loss of big game habitat (**Map 8.5**).The presence of bulbous bluegrass (*Poa bulbosa*) on many sites within this unit is also a limiting factor to this unit. Once established, bulbous bluegrass populations persist and invade native plant communities (Kulmatiski, 2006). The presence of this introduced grass often leads to reduced understory productivity and species diversity.



Map 8.5: Land coverage of fires by year from 2000-2018 for WMU 21B, Fillmore - Pahvant (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

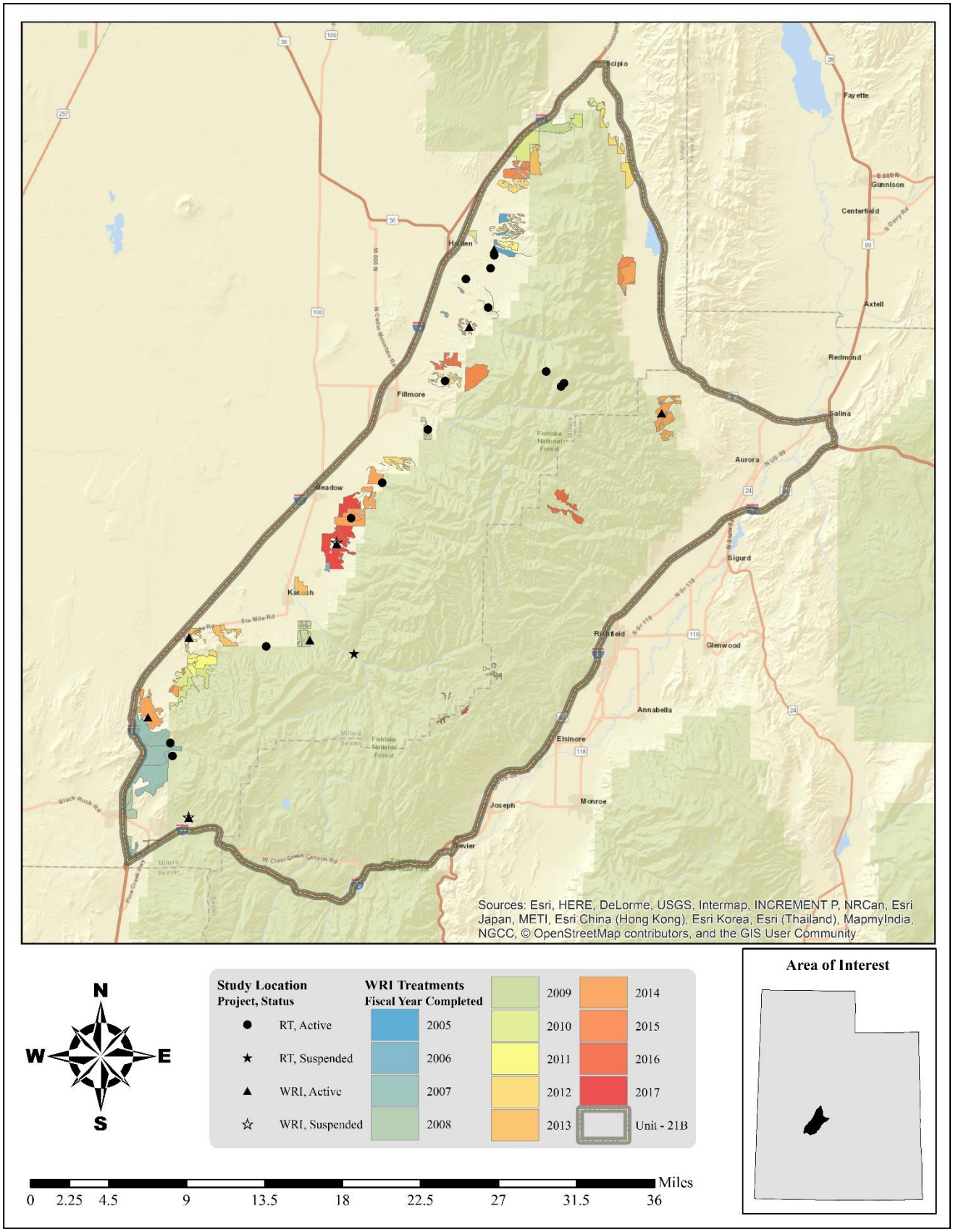
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 32,484 acres of land have been treated within the Fillmore – Pahvant unit since the WRI was implemented in 2004 (**Map 8.6**). An additional 7,956 acres are currently being treated and treatments have been proposed for 2,083 acres. Treatments frequently overlap one another bringing the total treatment acres to 38,126 acres for this unit (**Table 8.5**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but WRI projects comprise the majority of work done on deer winter ranges throughout the state of Utah.

Anchor chaining to remove pinyon and juniper is the most common management practice in this unit. Seeding plants to augment the herbaceous understory is also very common and frequently occurs together with chainings. Other management practices include (but are not limited to): bullhog and hand crew removal for pinyon-juniper trees, disking, harrow, herbicide application, and prescribed fire (**Table 8.5**).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**8,792**	**0**	**1,047**	**9,839**
Ely (One-Way)	3,031	0	471	3,501
Ely (Two-Way)	5,143	0	577	5,719
Smooth (One-Way)	618	0	0	618
Bullhog	**5,223**	**1,195**	**0**	**6,418**
Full Size	488	0	0	488
Skid Steer	4,735	1,195	0	5,930
Chain Harrow	**0**	**6,067**	**0**	**6,067**
> 15 ft. (Two-Way)	0	6,067	0	6,067
Disk	**72**	**0**	**0**	**72**
Off-Set (One-Way)	72	0	0	72
Harrow	**338**	**0**	**0**	**338**
> 15 ft. (One-Way)	338	0	0	338
Herbicide Application	**2,181**	**0**	**0**	**2,181**
Aerial (Fixed-Wing)	1,793	0	0	1,793
Aerial (Helicopter)	359	0	0	359
Ground	29	0	0	29
Prescribed Fire	**631**	**0**	**0**	**631**
Road Decommissioning	**62**	**0**	**0**	**62**
Road/Parking Area Improvements	**0**	**0**	**6**	**6**
Seeding (Primary)	**10,972**	**451**	**131**	**11,553**
Broadcast (Aerial-Fixed Wing)	8,949	0	0	8,949
Broadcast (Aerial-Helicopter)	651	0	0	651
Drill (Rangeland)	1,372	0	0	1,372
Ground (Mechanical Application)	0	451	131	581
Spring Development	**1**	**0**	**0**	**1**
Vegetation Removal/Hand Crew	**4,214**	**244**	**899**	**5,357**
Lop and Scatter	3,979	0	899	4,878
Lop-Pile-Burn	235	244	0	478
Total Treatment Acres	**32,484**	**7,956**	**2,083**	**42,524**
***Total Land Area Treated**	**28,525**	**7,518**	**2,083**	**38,126**

Table 8.5: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 21B, Fillmore – Pahvant. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 8.6: WRI treatments by fiscal year completed for WMU 21B, Fillmore - Pahvant.

Range Trend Studies

Range Trend studies have been sampled within WMU 21B on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 8.6**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 8.7**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
21B-6	M Hill	RT	Active	'85, '91, '98, '03, '08, '12, '17	Mountain Loam (Oak)
21B-7	Bennett Field	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Mountain Big Sagebrush)
21B-8	Smiths Ridge	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Mountain Big Sagebrush)
21B-9	Wide Canyon BLM	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Wyoming Big Sagebrush)
21B-10	Wide Canyon DWR	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Mountain Big Sagebrush)
21B-11	Dog Valley	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Mountain Big Sagebrush)
21B-12	Dameron Canyon	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
21B-13	Walker Creek	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Stony Loam (Mountain Big Sagebrush)
21B-14	Meadow Creek	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
21B-15	Fillmore Cemetery East	RT	Active	'85, '91, '98, '03, '08, '12, '17	Mountain Loam (Oak)
21B-17	Pioneer Peak	RT	Active	'97, '03, '12, '17	High Mountain Loam (Mountain Big Sagebrush)
21B-18	Teeples Ridge	RT	Active	'97, '03, '12, '17	High Mountain Loam (Mountain Big Sagebrush)
21B-19	Teeples Terrace	RT	Active	'97, '03, '12, '17	High Mountain Loam (Mountain Big Sagebrush)
21B-20	Dog Valley Creek	RT	Active	'17	Upland Loam (Mountain Big Sagebrush)
21R-1	Corn Creek	RT	Suspended	'97, '03, '12,	Mountain Shallow Loam (Mountain Big Sagebrush)
21R-2	Wide Canyon Bullhog	WRI	Active	'04, '08, '13, '17	Upland Loam (Wyoming Big Sagebrush)
21R-3	Dry Creek	WRI	Suspended	'04, '08	Not Verified
21R-4	Dry Creek Chaining	WRI	Active	'08, '09, '10, '15	Upland Stony Loam (Mountain Big Sagebrush)
21R-11	Kanosh Lop and Scatter	WRI	Active	'08, '11, '14	Not Verified
21R-12	Water Canyon	WRI	Active	'09, '12, '16	Upland Loam (Mountain Big Sagebrush)
21R-13	Water Canyon Reference	WRI	Suspended	'09	Not Verified
21R-14	Wide Mouth Canyon	WRI	Active	'11, '14	Upland Loam (Wyoming Big Sagebrush)
21R-16	Wide Mouth Canyon 2	WRI	Active	'13, '16	Upland Gravelly Loam (Wyoming Big Sagebrush)
21R-17	Pioneer Creek	WRI	Active	'13, '16	Mountain Loam (Oak)
21R-18	Ezra Flat	WRI	Active	'13, '16	Upland Shallow Hardpan (Black Sagebrush-Bluegrass)

Table 8.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 21B, Fillmore - Pahvant.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
21B-6	M Hill	Chain Unknown		Historic		
21B-7	Bennett Field	Chain Unknown		January 1958		
21B-8	Smiths Ridge	Chain Unknown		January 1950		
		Wildfire	Swains Fire	August 2000	7,898	
		Aerial	Fire Rehabilitation-Swains Fire Q-619	2001	1,000	
21B-9	Wide Canyon BLM	Two-Way Chain Unknown	Holden Seeding	July 1965	2,668	
		Aerial Before	Holden Seeding	July 1965	2,668	
		Bullhog	BLM Project	January 2006	1,500	
21B-10	Wide Canyon DWR	Chain Unknown		January 1950		
		Seed Unknown		January 1950		
		Chain Unknown		Between 1998 and 2003		
21B-11	Dog Valley	Wildfire	Dog Valley Peak	July 1996	217	
		Wildfire	Dog Valley	July 2006	28,664	
21B-12	Dameron Canyon	Chain Unknown		January 1985		
		Wildfire	Dry Wash	July 2008	324	
21B-13	Walker Creek	Push Lop and Scatter	Meadow Creek Seeding	August 1966 Between 1991 and 1998	270	
21B-14	Meadow Creek	Two-Way Chain Unknown	Meadow Creek Seeding	August 1966	1,770	
		Aerial Before	Meadow Creek Seeding	August 1966	1,770	
21B-15	Fillmore Cemetery East	Chain Unknown		January 1973		
		Seed Unknown		January 1973		
		One-Way Dixie Harrow	Fillmore WMA Juniper Thinning	November 2008	156	408
		Broadcast Before	Fillmore WMA Juniper Thinning	November 2008	156	408
21B-17	Pioneer Peak	Contour Trench		Historic		
		Seed Unknown		Historic		
21B-18	Teeples Ridge	Seed Unknown		Historic		
21B-19	Teeples Terrace	Contour Trench		Historic		
		Seed Unknown		Historic		
21R-1	Corn Creek	Wildfire	Adelaide	1996	15,706	
21R-2	Wide Canyon Bullhog	Seed Unknown		Historic		
		Chain Unknown		January 1955		
		Bullhog	Fillmore WMA Bullhog	March 2005	488	85
21R-4	Dry Creek Chaining	Two-Way Ely Chain	Dry Creek Chaining	Winter 2006-2007	847	86
		Aerial Before	Dry Creek Chaining	Winter 2006-2007	847	86
		Lop and Scatter	Dry Creek Meadow Canyon Phase II Restoration Project	September-October 2016	1,402	3699
21R-11	Kanosh Lop and Scatter	Chain Unknown		1960s		
		Seed Unknown		1960s		
		Lop and Scatter	Fillmore WMA Juniper Thinning	May 2008	575	408
21R-12	Water Canyon	Bullhog	Cancelled (Water Canyon Forage Enhancement WRI #1493)	Spring 2009		USFS
		Prescribed Fire		Fall 2012-Spring 2013		
21R-14	Wide Mouth Canyon	Two-Way Ely/Smooth Chain	Wide Mouth Canyon Chaining Phase III Project	Fall 2011	237	1972
		Herbicide-Plateau	Wide Mouth Canyon Chaining Phase III Project	Fall 2011	237	1972
		Aerial Before	Wide Mouth Canyon Chaining Phase III Project	Fall 2011	237	1972
		Dribbler	Wide Mouth Canyon Chaining Phase III Project	Fall 2011	237	1972
		Aerial After	Wide Mouth Canyon Chaining Phase III Project	February 2012	237	1972
21R-16	Wide Mouth Canyon 2	Two-Way Ely/Smooth Chain	Widemouth Canyon Chaining Phase V	September 2013	1,240	2727
		Aerial Before	Widemouth Canyon Chaining Phase V	September 2013	1,240	2727
		Aerial Before	Widemouth Canyon Chaining Phase V	September 2013	1,240	2727
		Dribbler	Widemouth Canyon Chaining Phase V	September 2013	1,240	2727

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
21R-17	Pioneer Creek	Two-Way Ely Chain	Pioneer WMA Bullhog	November 2013-March 2014	102	2665
		Aerial Before	Pioneer WMA Bullhog	November 2013	188	2665
21R-18	Ezra Flat	Chain Unknown		Historic	1,100	
		Bullhog	Ezra Flat Winter Range Restoration	November 2013	1,048	2623

Table 8.7: Range trend and WRI studies known disturbance history for WMU 21B, Fillmore - Pahvant.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are three studies [Pioneer Peak (21B-17), Teeples Ridge (21B-18), and Teeples Terrace (21B-19)] that are classified as Mountain (Big Sagebrush) ecological sites. The Pioneer Peak study is located on the east side of Pioneer Peak on the Pahvant Range. The Teeples Ridge and Teeples Terrace studies are located on Teeples Ridge in the Pahvant Range east of Fillmore.

Shrubs/Trees: The dominant browse species present on these study sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Browse cover data has shown a slight increase in cover over time (**Figure 8.2**). Average preferred browse demographic data indicates an increase in the percentage of young plants (**Figure 8.5**). The overall utilization of preferred browse species has been low, remaining under 5% in all sample years (**Figure 8.6**).

Trees contribute no cover or density on these sites and will therefore not be discussed in this section (**Figure 8.3**, **Figure 8.4**).

Herbaceous Understory: These sites have diverse and abundant herbaceous understories. Overall herbaceous cover has increased over time with frequency remaining stable. For perennial grasses, this increasing trend in cover is driven by smooth brome (*Bromus inermis*) on the Teeples Ridge and Teeples Terrace sites, but mountain brome (*Bromus marginatus*) is the primary driver on the Pioneer Peak study. Perennial forbs have exhibited a slight increase in both cover and frequency (**Figure 8.7**, **Figure 8.8**).

Occupancy: Average pellet transect data indicates that usage has decreased slightly in 2017 and that cattle and elk are the primary occupants on these study sites. Cattle usage has varied from a low of 4 days use/acre in 2017 to a high of 21 days use/acre in 2003. The mean abundance of elk pellet groups has been as low as 9 days use/acre in 2003 and as high as 23 days use/acre in 2012. Finally, deer pellet groups have had a mean abundance ranging from 0 days use/acre in 2017 to 2 days use/acre in 2012 (**Figure 8.9**).

Mountain (Oak)

There are two studies [M Hill (21B-6) and Fillmore Cemetery East (21B-15)] that are classified as Mountain (Oak) ecological sites. The M Hill study is located in the foothills east of Fillmore. Fillmore Cemetery East is located in the foothills southeast of Fillmore.

Shrubs/Trees: Browse species on these sites include alderleaf mountain mahogany (*Cercocarpus montanus*), Gambel oak (*Quercus gambelii*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and Stansbury cliffrose (*P. stansburiana*). Cover of sagebrush has exhibited a slight decrease, while cover of other preferred browse species has remained stable or slightly increased (**Figure 8.2**). Average preferred browse demographic data shows that the percentage of young plants in these shrub populations has increased and that of decadent individuals has decreased (**Figure 8.5**). Browse utilization has been low and decreasing in general with the exception of a small increase in 2017 (**Figure 8.6**).

Tree cover and density have shown a marginally increasing trend over time (**Figure 8.3**, **Figure 8.4**). The M Hill site is the primary driver of these trends, although trees are present on the Fillmore Cemetery East site in small numbers.

Herbaceous Understory: The herbaceous understory is mixed, with both introduced and native plant species present. Annual grasses and forbs have increased over time and dominate the understory; perennial grass cover has exhibited slight increases, but is still considered a minor component in comparison. The introduced perennial species bulbous bluegrass (*Poa bulbosa*) has increased in both cover and frequency over the sample years (**Figure 8.7**, **Figure 8.8**).

Occupancy: Pellet transect data indicates that overall animal presence has slightly decreased and that deer are the primary occupants with a high of 135 days use/acre in 2003 and a low of 32 days use/acre in 2017. Mean abundance of elk pellet groups has ranged from 1 days use/acre in 2017 to 4 days use/acre in 2003. Cattle usage has fluctuated with a low of 0 days use/acre in 2008, 2012, and 2017 and a high of 4 days use/acre in 1998 (**Figure 8.9**).

Upland (Big Sagebrush)

There are nine studies [Bennett Field (21B-7), Smiths Ridge (21B-8), Wide Canyon BLM (21B-9), Wide Canyon DWR (21B-10), Dog Valley (21B-11), Dameron Canyon (21B-12), Walker Creek (21B-13), Meadow Creek (21B-14), Dog Valley Creek (21B-20)] that are classified as Upland (Big Sagebrush) ecological sites. The Bennett Field study is located southeast of Holden. The Smiths Ridge study is located southeast of Holden near the base of Pioneer Canyon. The Wide Canyon BLM and Wide Canyon DWR sites are situated east of Holden on the flats near Wide Canyon. The Dog Valley and Dog Valley Creek sites can be found at the base of Dog Valley Mountain near I-15. The Dameron Canyon site is about two miles south of Kanosh, and the Walker Creek site is situated about two miles southeast of Meadow. Finally, the Meadow Creek study is located around 2.5 miles northeast of Meadow near Halfway Hill.

Shrubs/Trees: These sites are varied in shrub composition, but cover of browse species include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and Stansbury cliffrose (*P. stansburiana*). Cover of sagebrush and other preferred shrubs displayed a decrease in 2008 but has steadily increased in subsequent sample years (**Figure 8.2**). Average preferred browse demographics indicate an increase in recruitment of young plants in 2017, a trend primarily driven by the Dog Valley Creek site (**Figure 8.5**): this site was established in 2017 and displays high density of young plants. Average preferred browse utilization has fluctuated, with 2003 and 2012 showing increased overall utilization levels (**Figure 8.6**).

Tree cover on sites of this ecological type has shown a slight increase while density decreased significantly (**Figure 8.3 Figure 8.4**). This decrease is likely due to the addition of a new site that did not have trees present, thereby lowering the overall density.

Herbaceous Understory: The herbaceous understories of these sites are generally in poor condition. Annual grasses and the introduced perennial species bulbous bluegrass (*Poa bulbosa*) are noted as significant issues across the unit and there has been a steady increase in both cover and frequency of these species. Cover of perennial grasses has remained stable, while frequency has shown a slight decrease (**Figure 8.7**, **Figure 8.8**). Native species are present in the understories, though they are often rare in areas dominated by introduced species.

Occupancy: Average pellet transect data shows that overall animal presence has decreased and that deer are the primary occupants of these sites. Mean abundance of deer pellet groups has varied, with a low of 32 days use/acre in 2017 and a high of 135 days use/acre in 2003. Cattle usage has ranged from 3 days use/acre in 2003 to 10 days use/acre in 2017. Elk pellet groups have had a mean abundance as low as 1 days use/acre in 2003 and as high as 5 days use/acre in 1998 (**Figure 8.9**).

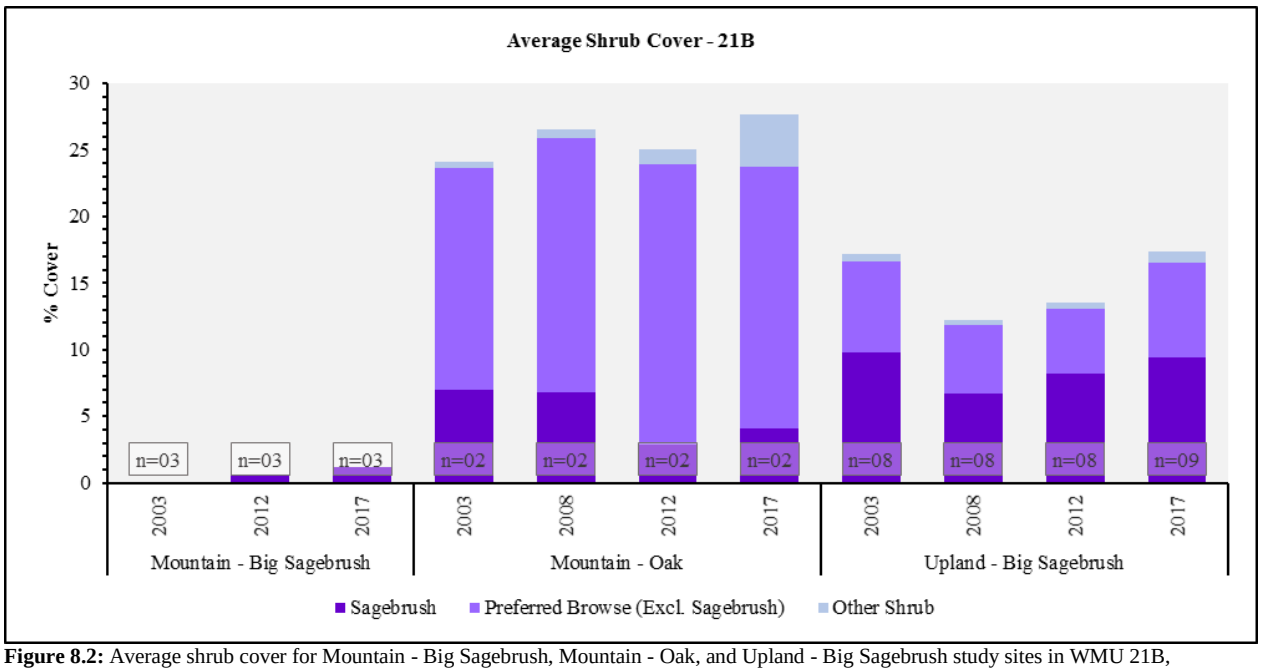


Figure 8.2: Average shrub cover for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

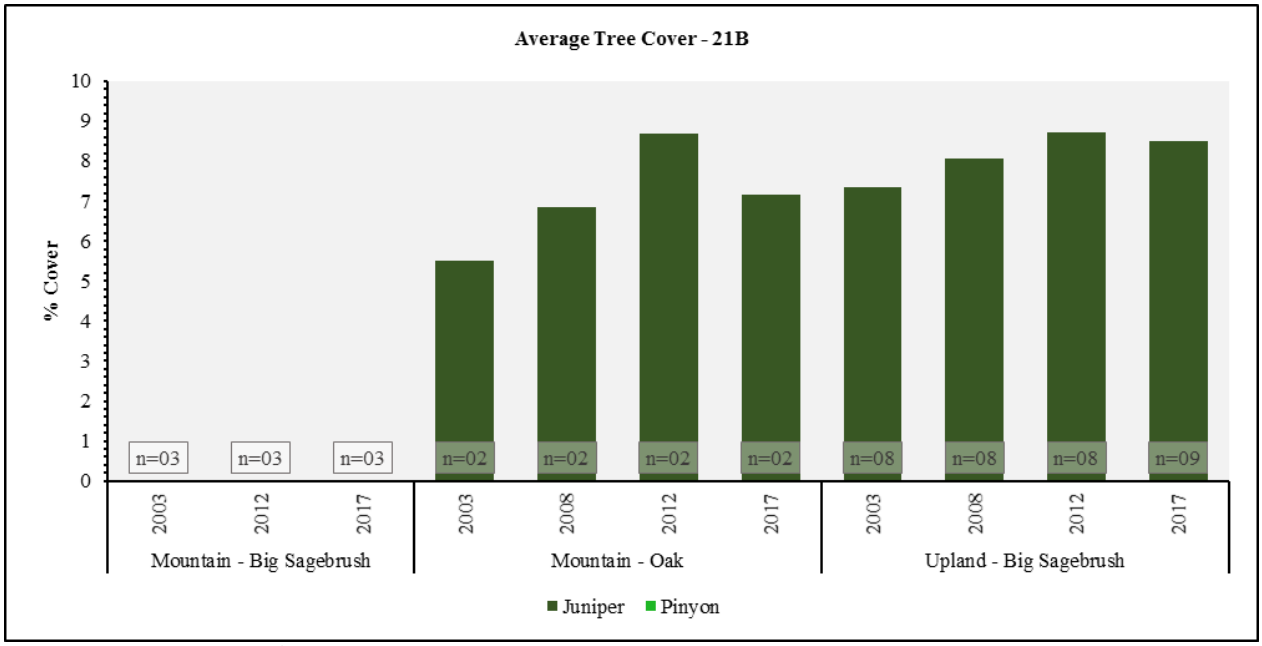


Figure 8.3: Average tree cover for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

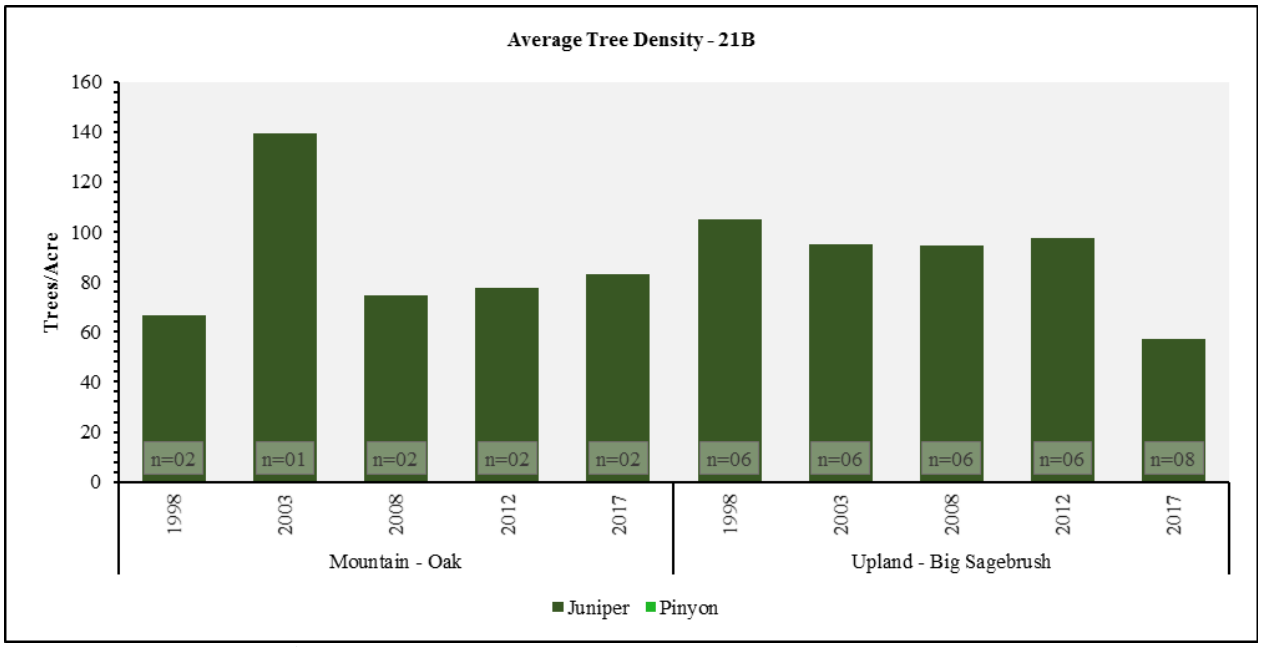


Figure 8.4: Average tree density for Mountain - Oak and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

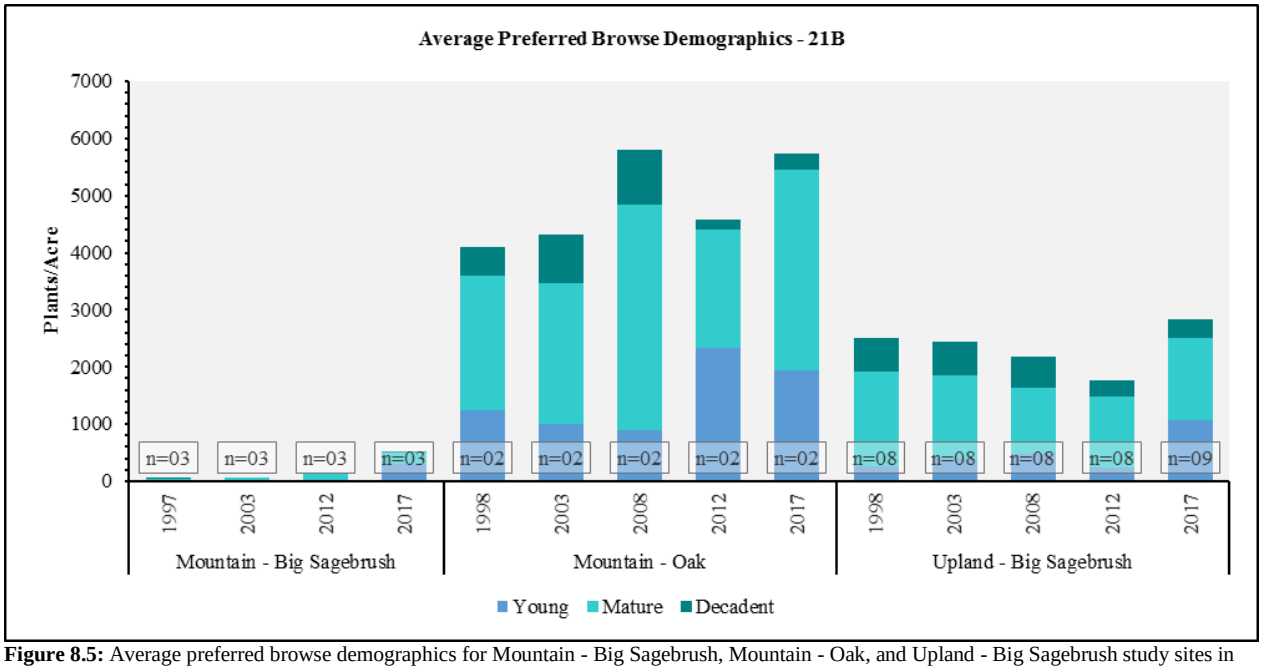


Figure 8.5: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

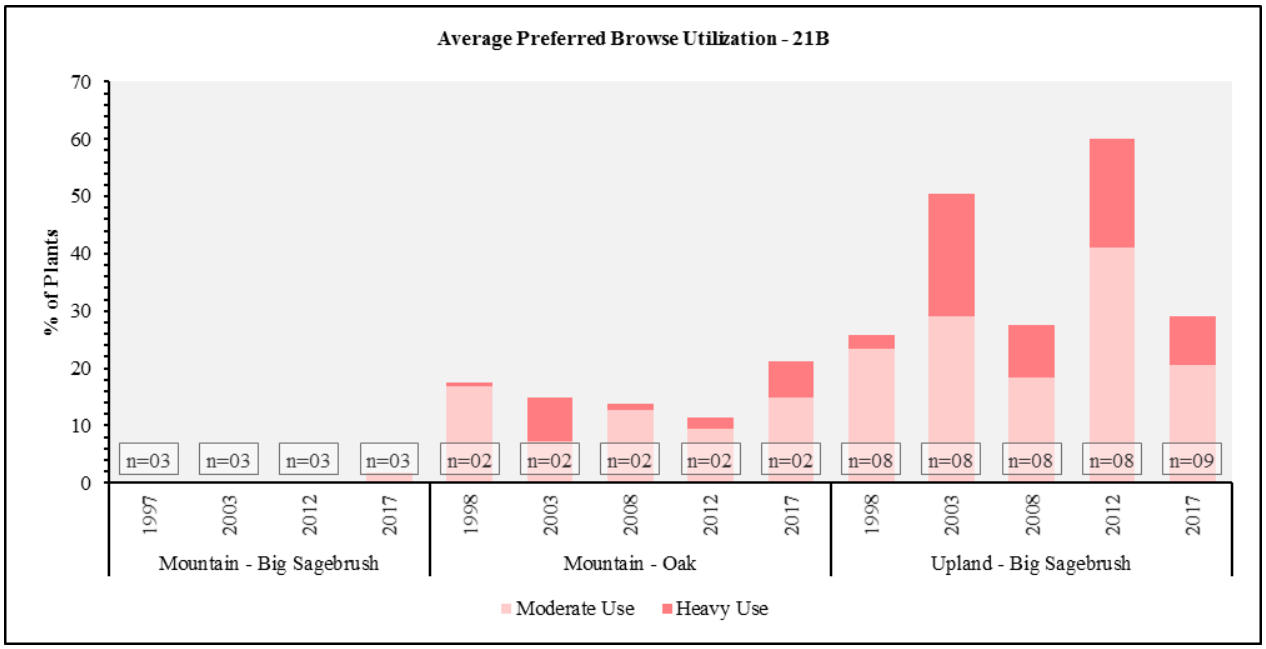


Figure 8.6: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

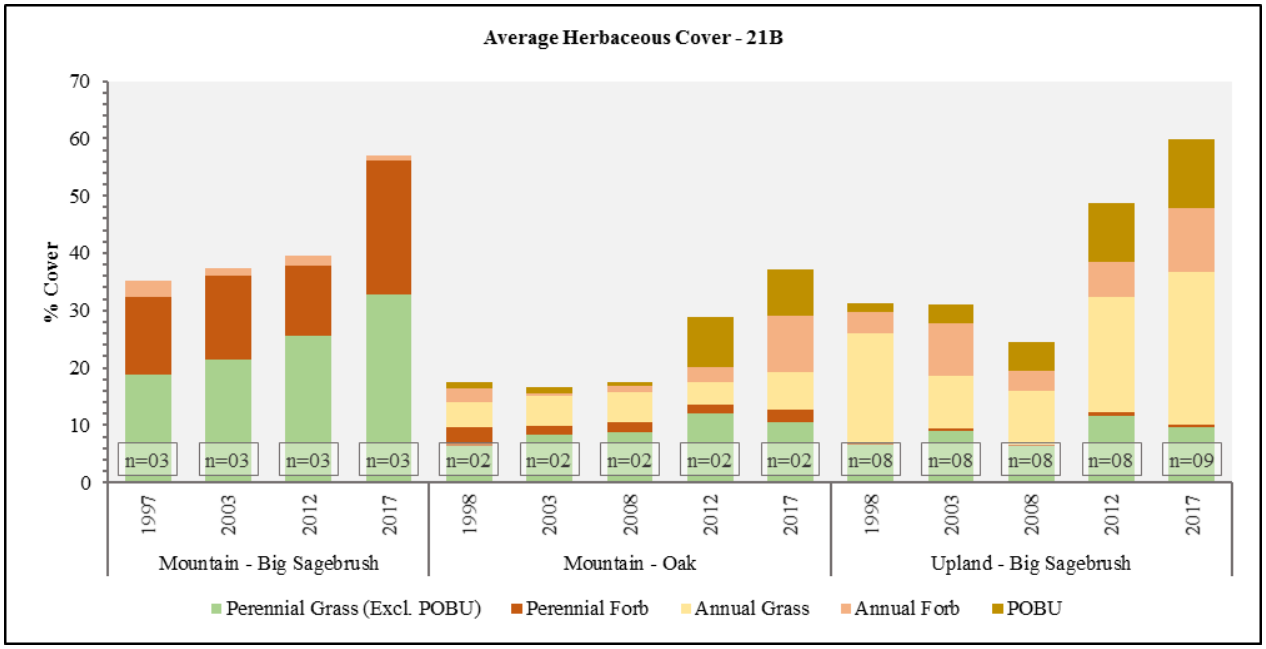


Figure 8.7: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

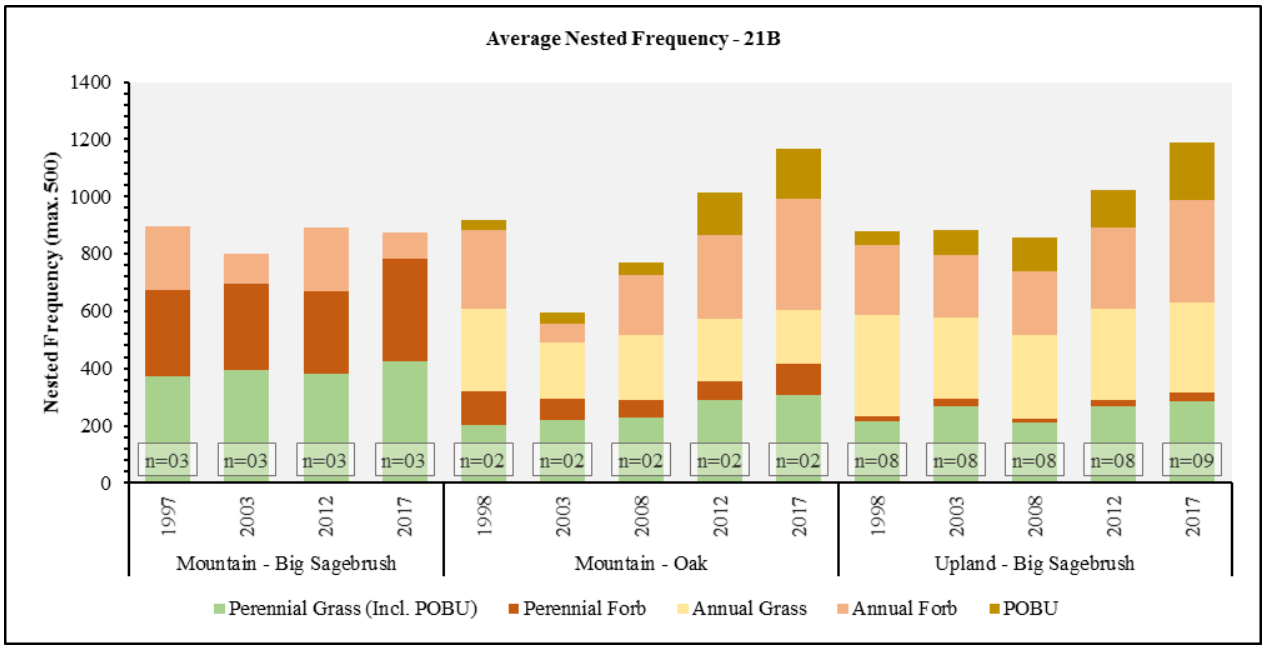


Figure 8.8: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

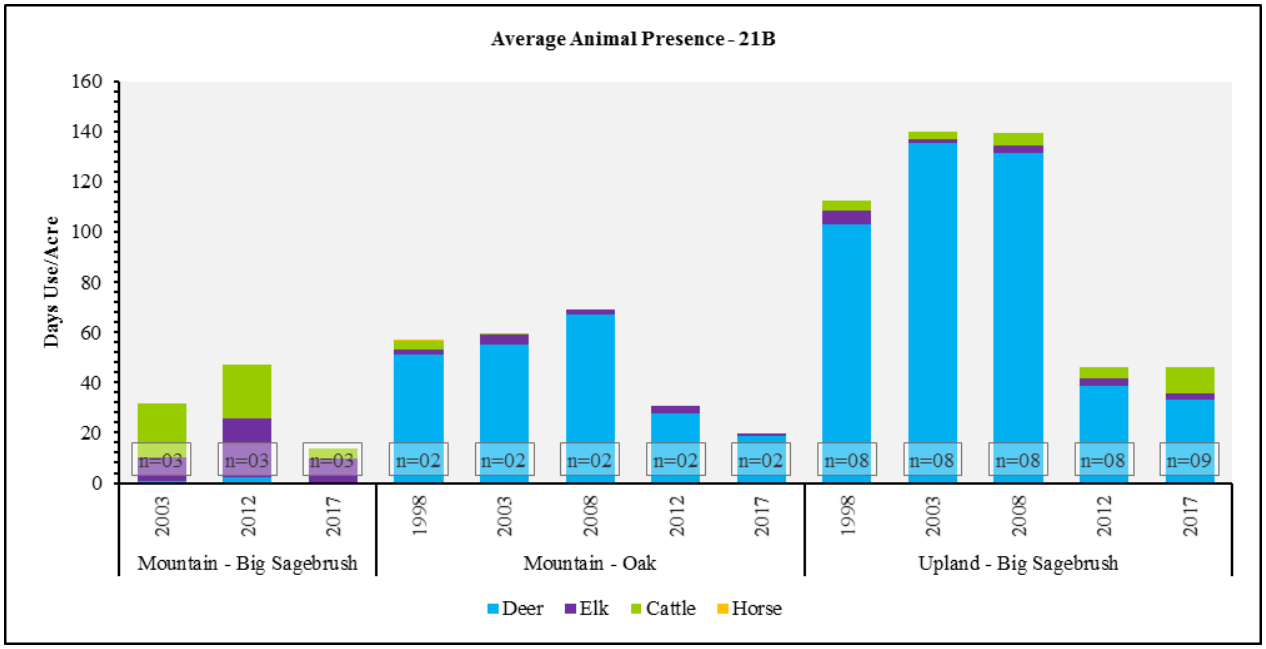
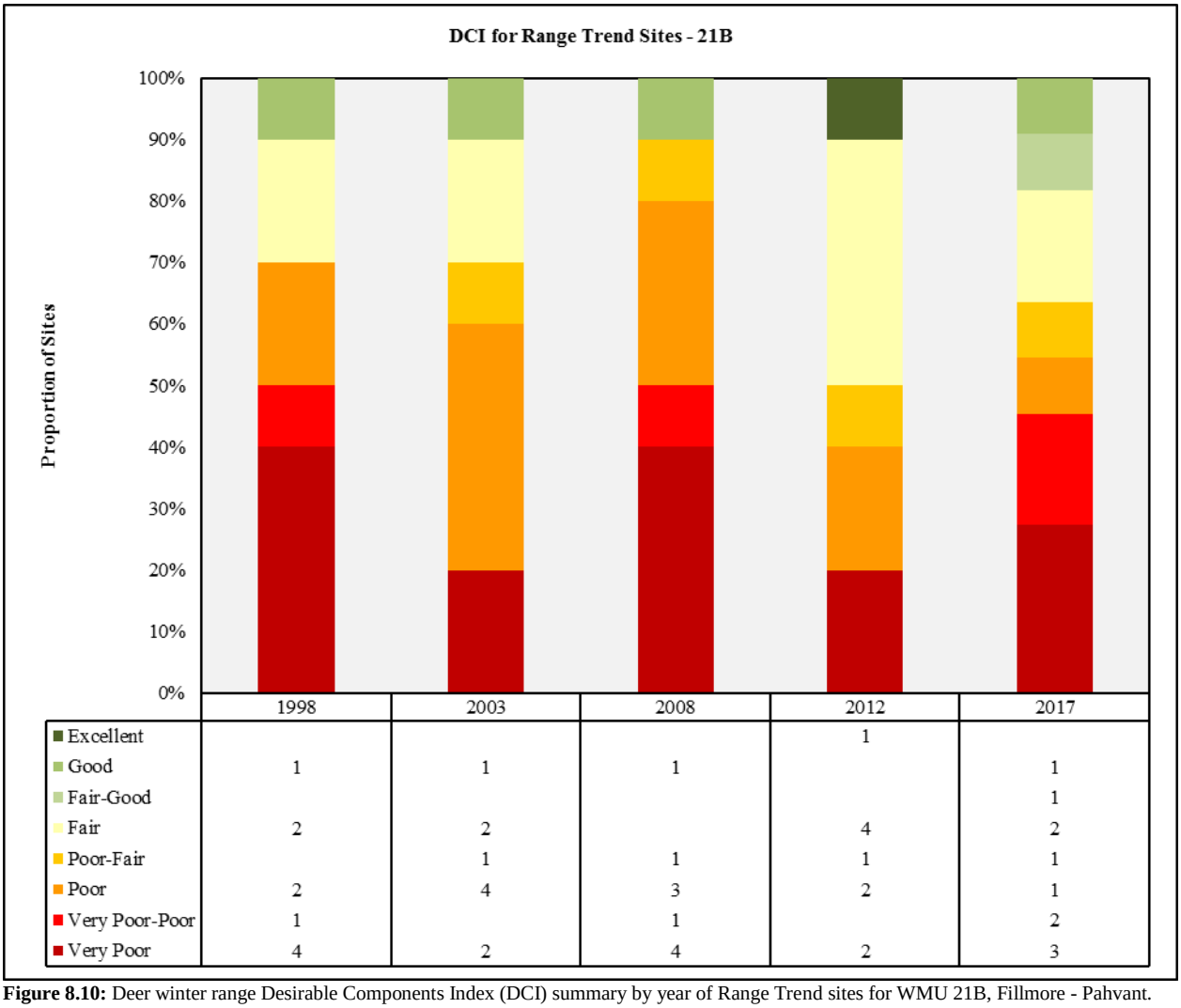


Figure 8.9: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Oak, and Upland - Big Sagebrush study sites in WMU 21B, Fillmore - Pahvant.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Fillmore - Pahvant management unit has continually changed on the sites sampled since 1998. The active Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the 2017 sample year (**Figure 8.10**, **Table 8.8**). M Hill has remained in good condition. Smiths Ridge improved from fair to fair-good. Wide Canyon DWR and Dog Valley Creek are considered to be in fair condition, and Fillmore Cemetery East went from fair to poor-fair condition. Wide Canyon BLM remained in poor condition. Walker Creek deteriorated from fair to very poor-poor condition. Bennett Field moved from poor-fair to very poor-poor condition. Meadow Creek went from poor to very poor condition. Finally Dog Valley and Dameron Canyon remained in very poor condition. (**Figure 8.11**, **Table 8.9**) The treated sites have generally shown an improvement or have remained in the same condition as time since treatment increased. The exception to this is Water Canyon, which moved from fair to very poor.



	1998	2003	2008	2012	2017
Excellent				1	
Good	1	1	1		1
Fair-Good					1
Fair	2	2		4	2
Poor-Fair		1	1	1	1
Poor	2	4	3	2	1
Very Poor-Poor	1		1		2
Very Poor	4	2	4	2	3

Figure 8.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 21B, Fillmore - Pahvant.

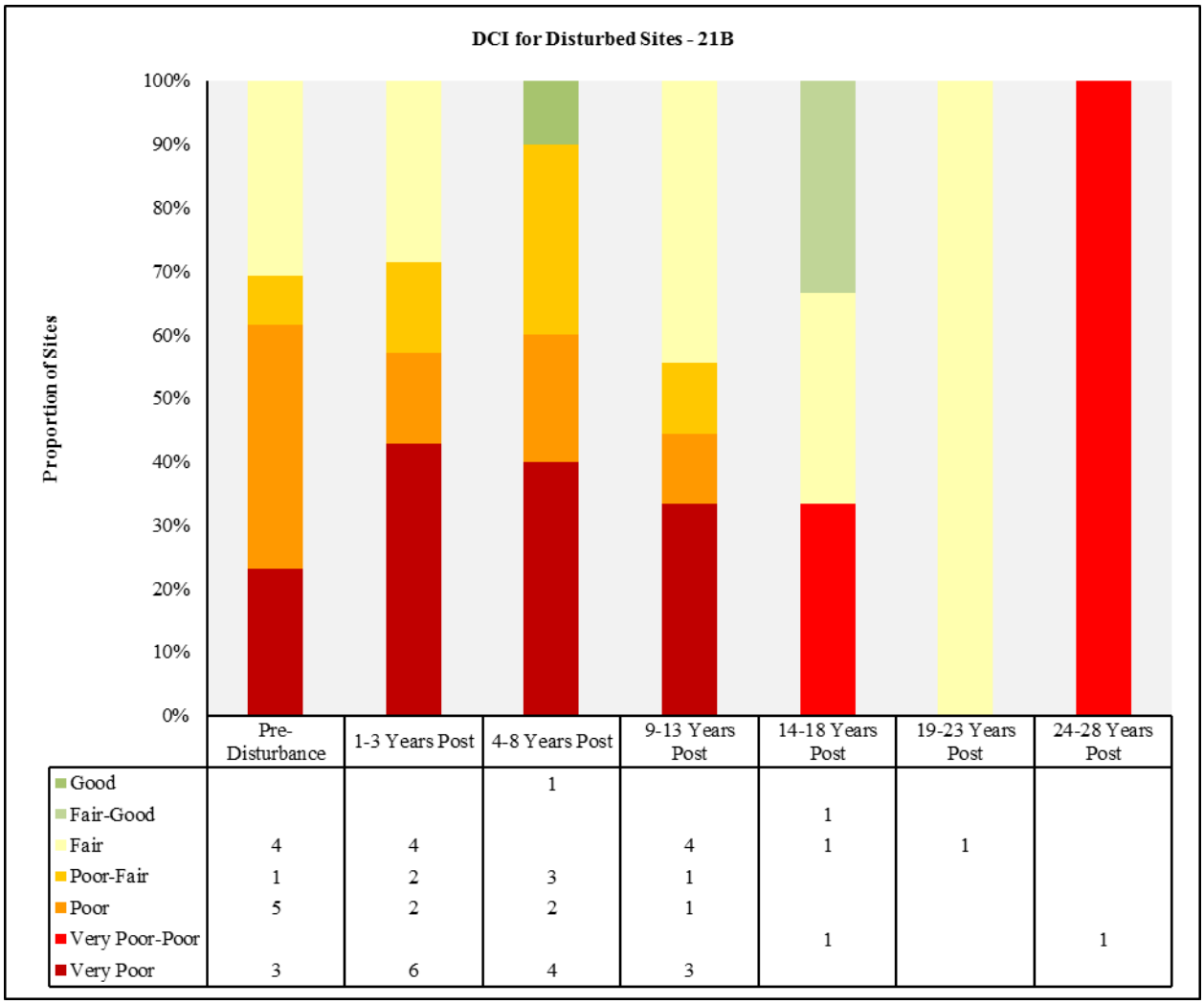


Figure 8.11: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 21B, Fillmore - Pahvant.

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21B-6	1998	17.7	12.7	15.0	18.6	-1.7	10.0	0.0	**72.3**	**G**
21B-6	2003	24.0	10.4	14.5	24.0	-0.1	4.6	0.0	**77.3**	**G**
21B-6	2008	23.5	11.5	6.1	26.4	-0.2	5.6	0.0	**72.9**	**G**
21B-6	2012	30.0	14.1	15.0	30.0	-0.2	4.4	0.0	**93.3**	**E**
21B-6	2017	24.4	14.0	15.0	30.0	-1.6	5.6	0.0	**87.5**	**G**
21B-7	1998	19.0	5.1	2.9	9.2	-20.0	1.4	0.0	**17.6**	**VP**
21B-7	2003	30.0	1.8	0.3	19.4	-9.8	1.2	0.0	**43.0**	**P**
21B-7	2008	27.8	-2.4	4.8	13.0	-11.0	0.0	0.0	**32.1**	**VP**
21B-7	2012	29.1	5.6	0.3	30.0	-16.5	0.6	0.0	**49.1**	**P-F**
21B-7	2017	27.6	3.2	2.0	16.2	-14.4	0.4	0.0	**35.0**	**VP-P**
21B-8	1998	28.8	13.7	5.0	17.0	-7.0	0.2	0.0	**57.8**	**F**
21B-8	2003	7.6	12.0	12.7	15.4	-8.9	3.4	0.0	**42.0**	**P**
21B-8	2008	9.7	10.1	15.0	18.0	-4.8	0.0	0.0	**48.0**	**P**
21B-8	2012	12.2	13.7	3.4	28.8	-2.0	0.8	0.0	**56.8**	**F**
21B-8	2017	17.8	12.4	8.5	27.0	-0.9	1.0	0.0	**65.8**	**F-G**

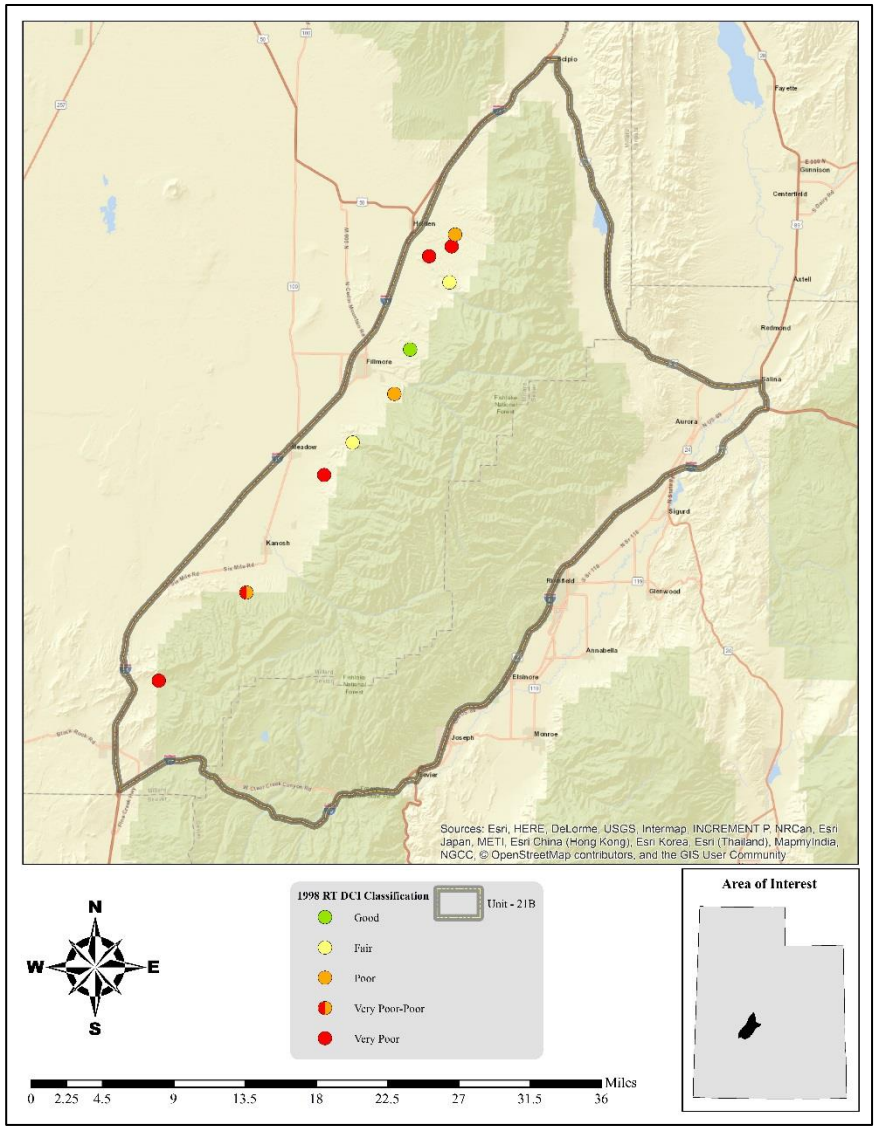
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21B-9	1998	18.2	10.1	8.9	5.2	-11.3	0.4	0.0	**31.5**	**VP**
21B-9	2003	30.0	11.4	0.7	15.0	-14.2	0.2	0.0	**43.1**	**P**
21B-9	2008	30.0	7.3	15.0	8.0	-13.1	0.0	0.0	**47.1**	**P**
21B-9	2012	23.3	10.5	5.1	23.6	-16.4	0.0	0.0	**46.1**	**P**
21B-9	2017	30.0	10.0	1.8	15.0	-20.0	0.4	0.0	**37.1**	**P**
21B-10	1998	13.4	-1.0	1.0	30.0	-0.2	0.4	0.0	**43.7**	**P**
21B-10	2003	15.3	5.6	1.4	30.0	-0.6	0.4	0.0	**52.1**	**F**
21B-10	2008	14.9	2.7	2.4	30.0	-0.8	0.2	0.0	**49.4**	**P-F**
21B-10	2012	13.6	7.8	5.0	30.0	-0.1	0.0	0.0	**56.3**	**F**
21B-10	2017	15.1	2.2	6.4	30.0	-0.5	0.4	0.0	**53.6**	**F**
21B-11	1998	0.0	0.0	0.0	2.8	-20.0	1.2	0.0	**-16.0**	**VP**
21B-11	2003	1.2	0.0	0.0	1.0	-6.5	0.0	-2.0	**-6.3**	**VP**
21B-11	2008	0.0	0.0	0.0	1.2	-15.5	0.2	-2.0	**-16.1**	**VP**
21B-11	2012	0.0	0.0	0.0	4.4	-20.0	0.2	-2.0	**-17.4**	**VP**
21B-11	2017	1.4	0.0	0.0	8.2	-20.0	0.4	-4.0	**-14.1**	**VP**
21B-12	1998	25.6	10.7	4.4	10.0	-14.9	0.2	0.0	**35.9**	**VP-P**
21B-12	2003	30.0	8.5	0.7	28.8	-6.2	0.0	0.0	**61.8**	**F**
21B-12	2008	0.0	0.0	0.0	1.0	0.0	0.0	0.0	**1.0**	**VP**
21B-12	2012	3.9	0.0	0.0	0.8	-20.0	4.4	0.0	**-11.0**	**VP**
21B-12	2017	29.7	15.0	2.3	1.2	-20.0	0.0	0.0	**28.1**	**VP**
21B-13	1998	30.0	10.2	1.8	7.4	-20.0	0.2	0.0	**29.6**	**VP**
21B-13	2003	30.0	4.5	0.8	20.8	-7.5	0.0	0.0	**48.7**	**P-F**
21B-13	2008	30.0	2.3	1.2	12.8	-10.1	0.6	0.0	**36.8**	**VP-P**
21B-13	2012	30.0	9.7	5.3	30.0	-14.8	0.2	0.0	**60.4**	**F**
21B-13	2017	30.0	6.1	2.0	17.2	-20.0	0.8	-2.0	**34.1**	**VP-P**
21B-14	1998	18.1	9.1	8.8	21.8	-2.0	0.4	0.0	**56.2**	**F**
21B-14	2003	13.6	0.0	2.9	11.2	-1.1	0.0	0.0	**26.6**	**VP**
21B-14	2008	9.9	3.2	8.9	12.0	-1.4	0.2	0.0	**32.7**	**VP**
21B-14	2012	11.0	6.8	7.0	23.2	-2.3	0.2	0.0	**45.8**	**P**
21B-14	2017	8.7	6.0	0.3	15.0	-0.8	0.2	0.0	**29.4**	**VP**
21B-15	1998	30.0	8.5	6.8	6.6	-5.1	0.8	0.0	**47.6**	**P**
21B-15	2003	30.0	8.0	4.3	9.6	-8.0	1.2	0.0	**45.1**	**P**
21B-15	2008	30.0	7.1	5.4	9.0	-7.4	1.4	0.0	**45.5**	**P**
21B-15	2012	24.1	13.9	15.0	10.2	-5.9	1.0	0.0	**58.2**	**F**
21B-15	2017	30.0	13.4	4.8	11.0	-8.1	3.0	0.0	**54.2**	**P-F**
21B-20	2017	21.4	15.0	15.0	29.4	-19.4	2.4	-2.0	**61.8**	**F**

Table 8.8: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 21B Fillmore - Pahvant. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

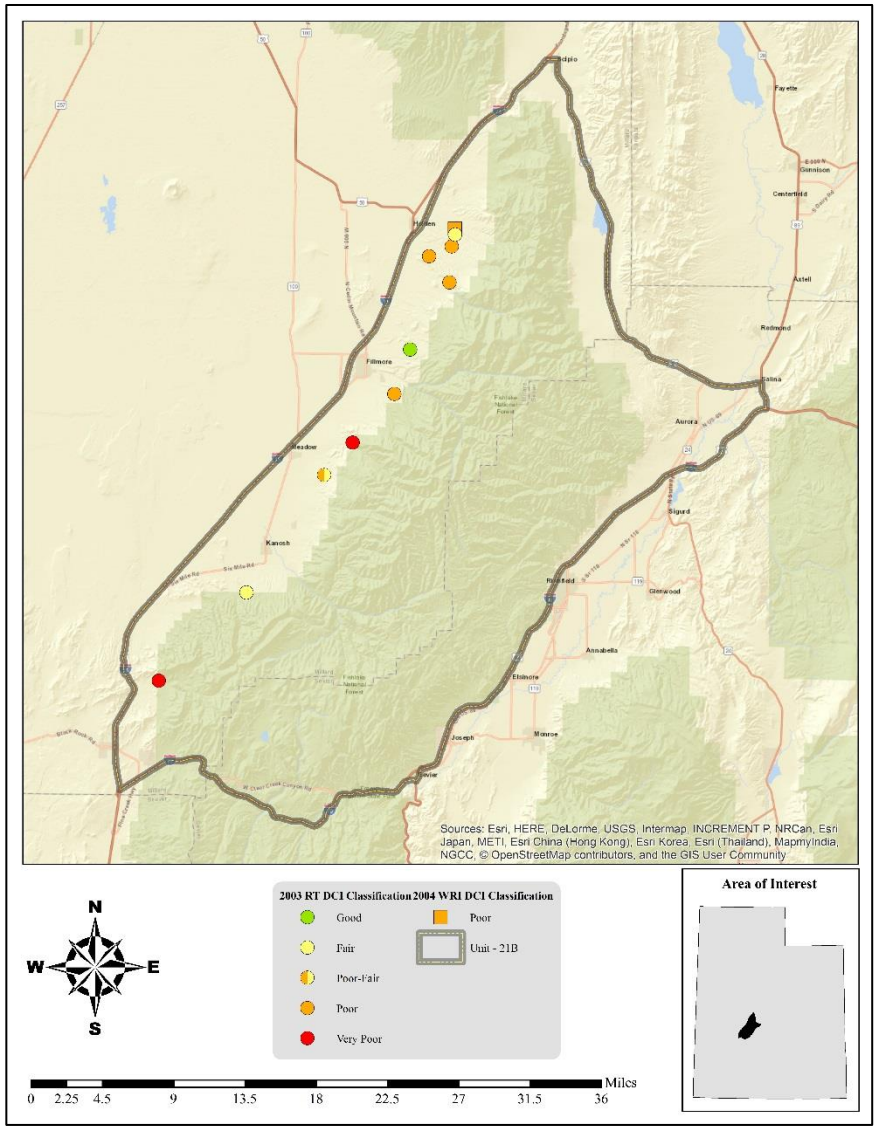
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21R-2	2004	13.6	9.5	5.5	12.6	-2.2	1.4	0.0	**40.4**	**P**
21R-2	2008	10.9	10.5	5.2	26.8	-3.4	1.8	-2.0	**49.8**	**P-F**
21R-2	2013	15.5	9.1	7.3	17.0	-0.6	3.4	0.0	**51.7**	**P-F**
21R-2	2017	13.6	10.8	5.1	20.2	-1.1	3.6	0.0	**52.1**	**F**
21R-3*	2004	0.6	0.0	0.0	3.2	-18.5	0.0	0.0	**-14.6**	**VP**
21R-3*	2008	0.0	0.0	0.0	2.8	-20.0	0.0	0.0	**-17.2**	**VP**
21R-4	2008	1.5	0.0	0.0	6.6	-20.0	8.8	0.0	**-3.1**	**VP**
21R-4	2010	3.6	0.0	0.0	6.0	-20.0	10.0	0.0	**-0.4**	**VP**
21R-4	2015	6.4	0.0	0.0	6.2	-10.1	4.6	0.0	**7.1**	**VP**
21R-11	2008	30.0	-1.3	0.3	14.4	-3.2	4.2	0.0	**44.5**	**P**
21R-11	2011	30.0	9.3	1.4	30.0	-11.7	2.6	0.0	**61.6**	**F**
21R-11	2014	30.0	12.1	2.6	27.0	-5.0	0.8	0.0	**67.6**	**G**
21R-12	2012	8.0	14.1	15.0	18.2	-8.5	10.0	0.0	**56.8**	**F**
21R-12	2016	1.4	0.0	0.0	30.0	-8.9	8.0	0.0	**30.5**	**VP**
21R-13*	2009	0.3	0.0	0.0	8.0	-0.2	0.4	0.0	**8.5**	**VP**
21R-14	2011	9.4	5.1	1.0	19.0	-20.0	0.4	0.0	**14.9**	**VP**
21R-14	2014	1.8	0.0	0.0	6.6	-20.0	0.4	0.0	**-11.3**	**VP**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21R-16	2013	6.3	0.0	0.0	7.0	-0.7	0.2	0.0	**12.9**	**VP**
21R-16	2016	2.2	0.0	0.0	30.0	-5.6	2.6	0.0	**29.2**	**VP**
21R-17	2013	30.0	14.8	15.0	3.4	-0.5	2.4	0.0	**65.1**	**F**
21R-17	2016	30.0	15.0	15.0	7.8	-7.6	1.8	0.0	**62.0**	**F**
21R-18	2013	27.3	10.7	6.4	1.4	-0.1	3.4	0.0	**49.0**	**P-F**
21R-18	2016	28.5	11.5	6.5	1.0	0.0	2.0	0.0	**49.6**	**P-F**

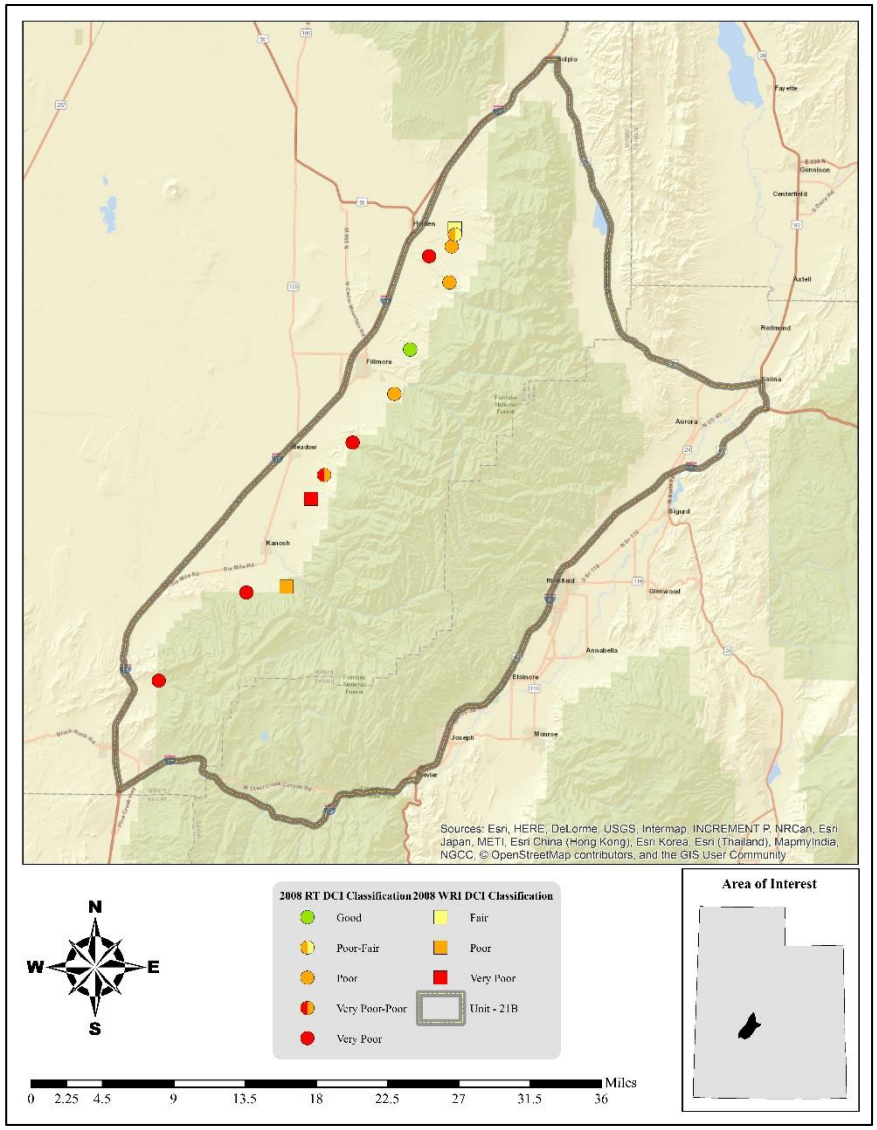
Table 8.9: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 21B Fillmore - Pahvant. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



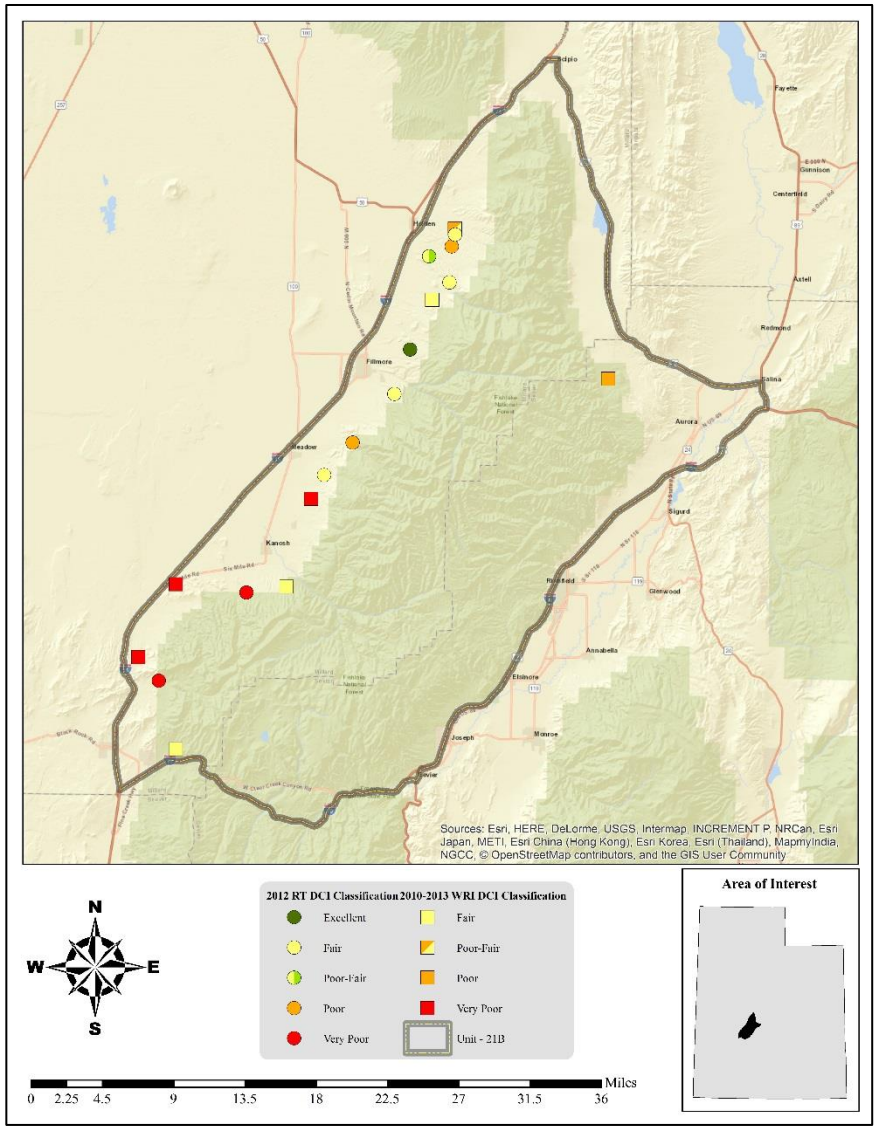
Map 8.7: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 21B, Fillmore - Pahvant.



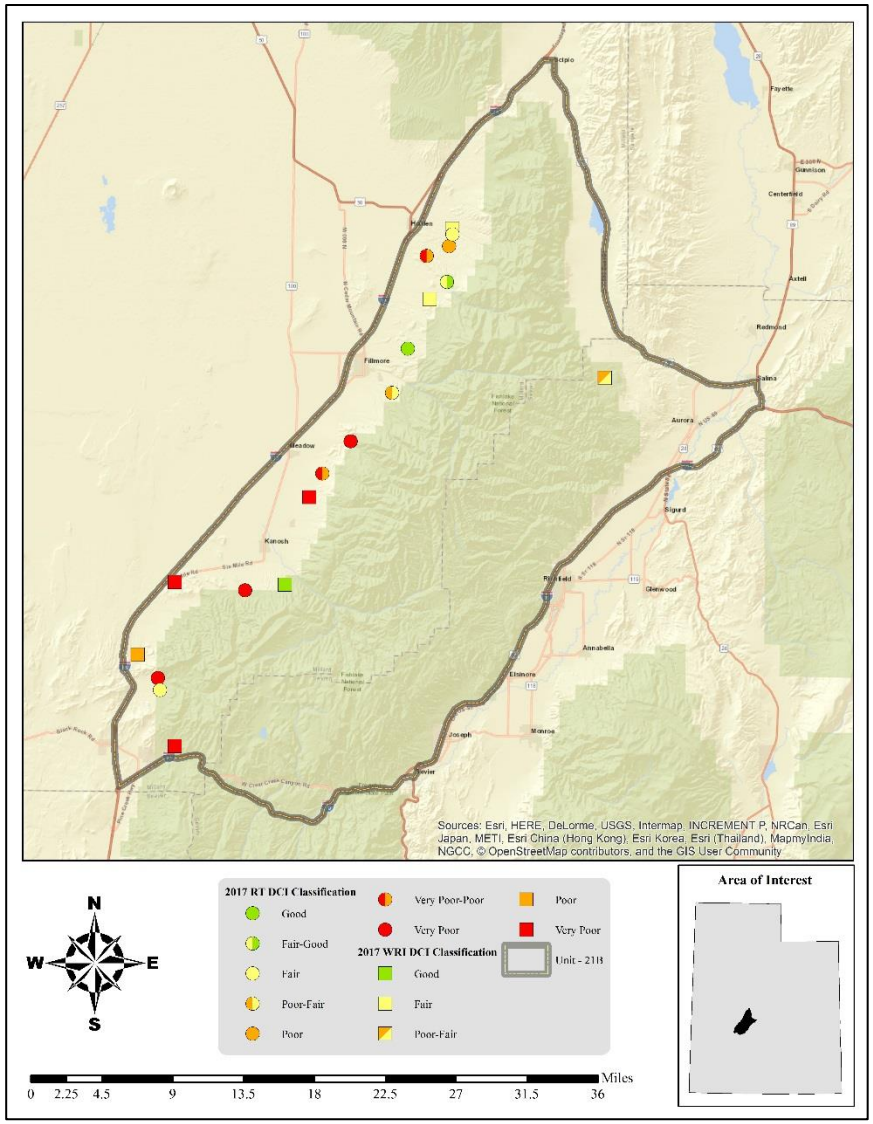
Map 8.8: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 21B, Fillmore - Pahvant.



Map 8.9: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 21B, Fillmore - Pahvant.



Map 8.10: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 21B, Fillmore - Pahvant.



Map 8.11: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 21B, Fillmore - Pahvant.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
21B-6	M Hill	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-7	Bennett Field	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-8	Smiths Ridge	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-9	Wide Canyon BLM	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-10	Wide Canyon DWR	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-11	Dog Valley	Annual Grass	High	Increased Fire Potential
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
21B-12	Dameron Canyon	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
21B-13	Walker Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-14	Meadow Creek	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
21B-15	Fillmore Cemetery East	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
21B-17	Pioneer Peak	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
21B-18	Teeples Ridge	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
21B-19	Teeples Terrace	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
21B-20	Dog Valley Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
21R-2	Wide Canyon Bullhog	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species

Table 8.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 21B, Fillmore - Pahvant. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are within the Mountain (Big Sagebrush) ecological type are not considered to be in deer winter range and therefore were not included in the Desirable Components Index. These sites are primarily high-elevation summer range sites and support robust understories that provide forage for summering animals. Teeples Terrace and Pioneer Peak had historical terracing treatments completed.

The main threat on these sites is introduced perennial grasses. When introduced perennial grasses become dominant in a system, they can reduce the biodiversity of the understory. Management of these rhizomatous introduced grasses can be difficult on these high-elevation sites. While they provide abundant forage, they can be detrimental to the overall biodiversity. Management options for introduced perennial grasses can include grazing management changes, prescribed burns, and if needed, herbicide treatments. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species.

Mountain (Oak)

The studies that are considered to be of the Mountain (Oak) ecological type are within deer winter range and are considered to be in condition varying from poor-fair to good. Annual grass cover is a threat on these sites because they increase fuel loads which in turn can lead to habitat-destroying wildfires. Little conifer encroachment was observed on both study sites, but this will likely increase in future years. This could lead to reduced herbaceous and shrub productivity. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) is present on both of the study sites within this ecological type, the presence of which often results in reduced understory diversity and productivity.

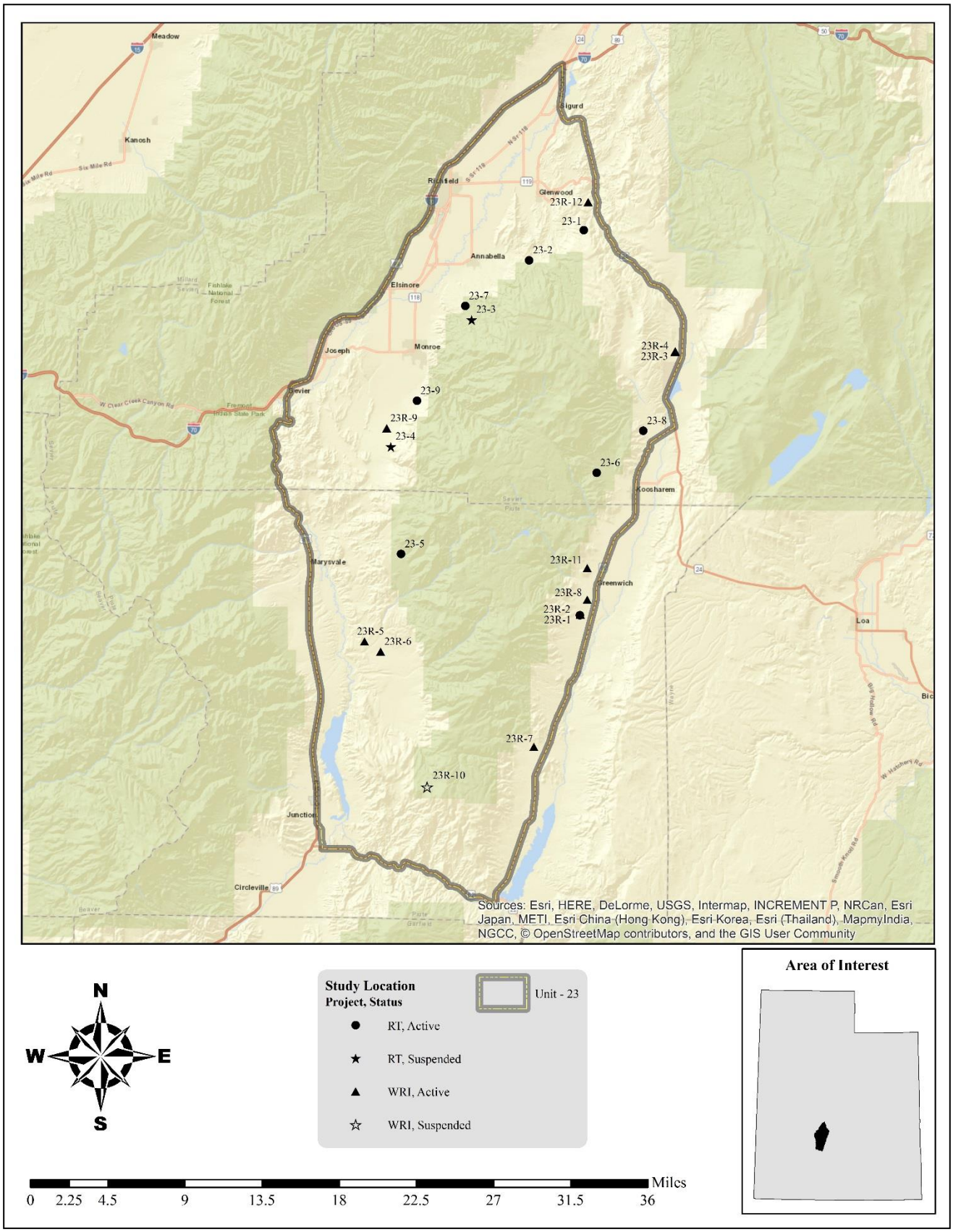
Management of conifer trees are recommended in areas where it would be beneficial and feasible; possible tree-removing methods include bullhog, chaining, and lop and scatter. Areas with significant annual grass invasion should be monitored and treated if these high cover values persist. In addition, bulbous bluegrass can be difficult to control, but efforts to reduce spread could prove beneficial for the herbaceous understories of these sites. Changes to grazing management or herbicides are potential options to treat these introduced grasses. In areas where reseeding is needed to restore herbaceous communities post treatment, seed selection should be done carefully and native species should be given preference.

Upland (Big Sagebrush)

The Upland (Big Sagebrush) study sites are located within deer winter range and are considered to be in conditions varying from very poor to fair-good. Annual grass cover is a threat for these sites as the high fuel loads they create can lead to destructive wildfires. Multiple sites have low to medium levels of conifer encroachment or infill, which is likely to increase in subsequent sampling years: this will likely lead to reduced herbaceous and shrub productivity. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) is present on all the study sites, except for Dog Valley, within this ecological type, the presence of which often results in reduced understory diversity and productivity. One site (Dog Valley) had noxious weeds present on the site in multiple years which can lead to reduced understory diversity.

Management of conifer trees would be recommended in areas where it would be both beneficial and feasible; possible tree-removing treatments include bullhog, chaining, and lop and scatter. Areas with significant annual grass presence should be monitored and treated if high cover values persist. Bulbous bluegrass can be difficult to control but efforts to reduce spread could provide benefits. For both of these grasses; changes to grazing management or herbicides are potential management options. In addition, areas with noxious weeds can be treated with herbicides where necessary and feasible. In areas where reseeding is needed to restore herbaceous communities, seed selection should be done carefully and native species should be given preference.

9. WILDLIFE MANAGEMENT UNIT 23 – MONROE



WILDLIFE MANAGEMENT UNIT 23 – MONROE

Boundary Description

Piute and Sevier counties - Boundary begins at I-70 and US-89 north of Sigurd; south on US-89 to SR24; south on SR-24 to SR-62; south and west on SR-62 to US-89; north on US-89 to I-70 near Sevier; north on I-70 to US-89 north of Sigurd.

Management Unit Description

Geography

The Monroe Management Unit is almost entirely considered as big game habitat, with the exception of the desert areas and some of the incorporated townships. A majority of this unit is publicly managed on both winter and summer ranges. The permanent range trend studies have been established on both sides of the Sevier Plateau in both Central Valley and the areas between Otter Creek Reservoir and Koosharem. Significant amounts of the winter range occur on publicly managed lands. Towns within this unit include Richfield, Monroe, Glenwood, Annabella, Koosharem, and Marysvale.

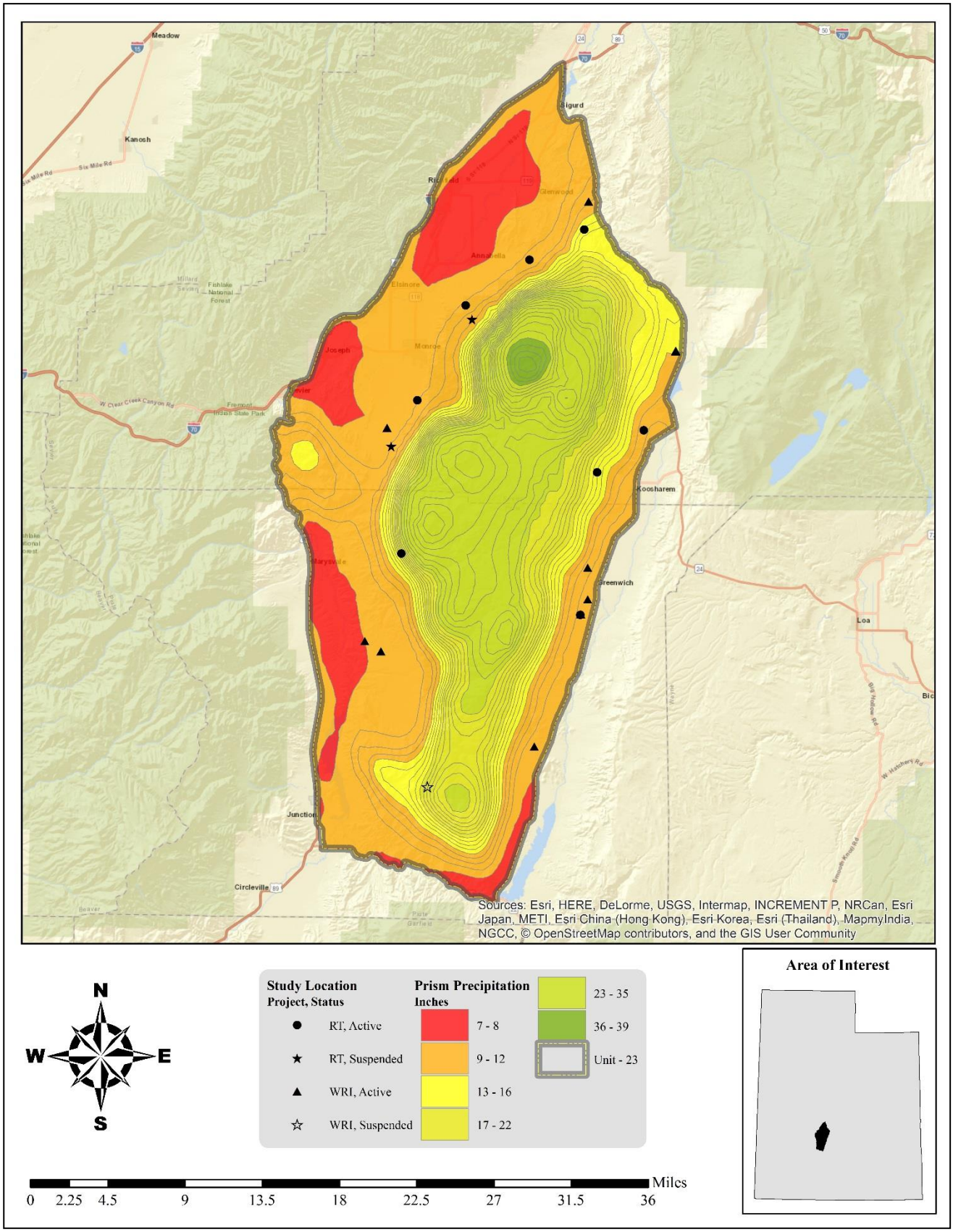
The primary geographic feature on this unit is the Sevier Plateau, with the highest point being Glenwood Mountain at 11,208 feet. The lowest part of the unit is in the Central Valley near Richfield at around 5,300 feet. The mountains are not particularly rough, with the large plateau averaging between 9,000 to 10,000 feet; a majority of the summer habitat for this unit exists on the plateau.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches in areas near Richfield, Joseph, and areas around Piute Reservoir up to 39 inches on Glenwood Mountain. All of the Range Trend and WRI monitoring studies on the unit occur within 9-22 inches of precipitation (**Map 9.1**) (PRISM Climate Group, Oregon State University, 2013).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit was compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the South Central division (Division 4).

The mean annual PDSI of the South-Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 9.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 9.1b**).



Map 9.1: The 1981-2010 PRISM Precipitation Model for WMU 23, Monroe (PRISM Climate Group, Oregon State University, 2013).

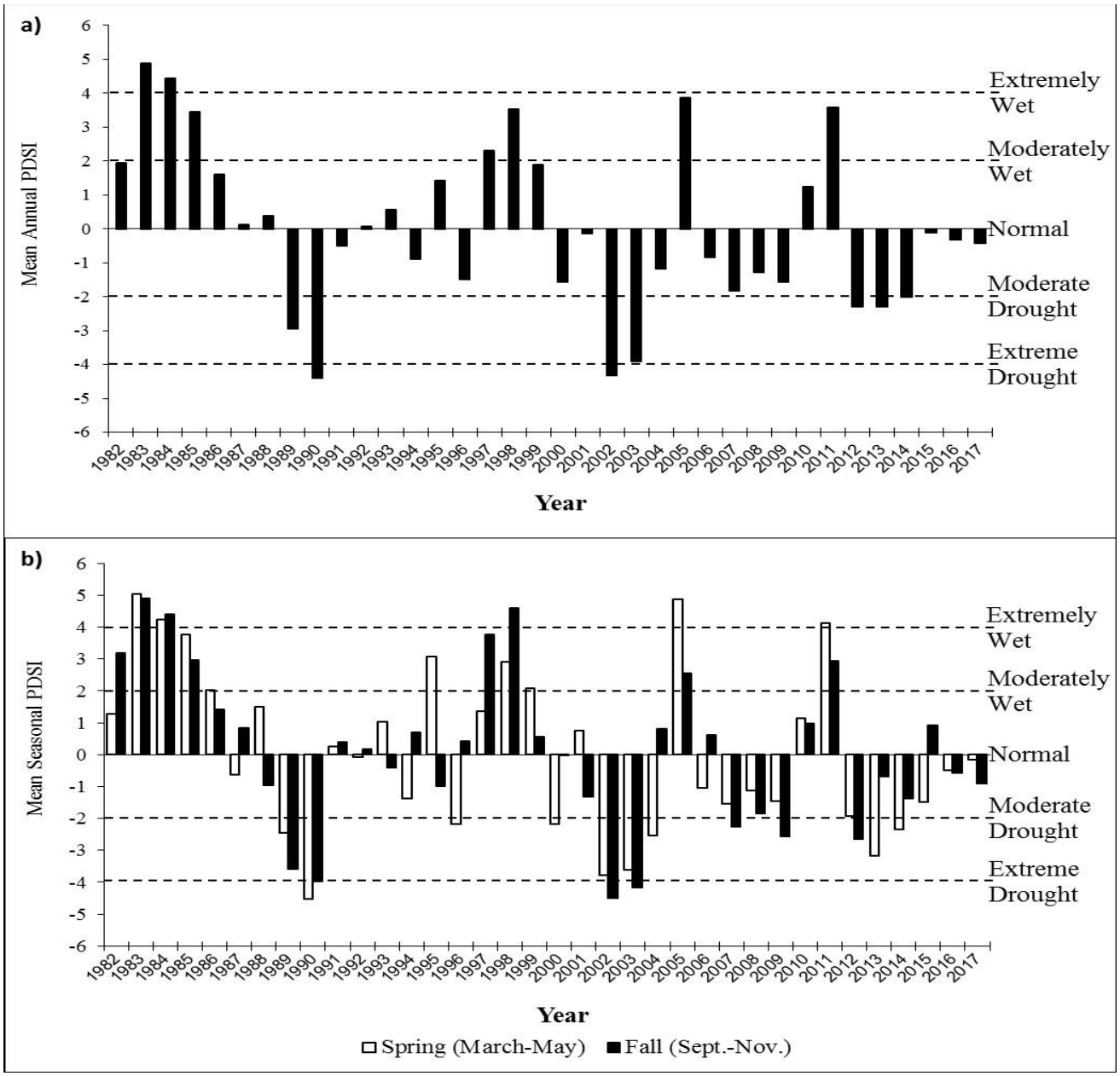


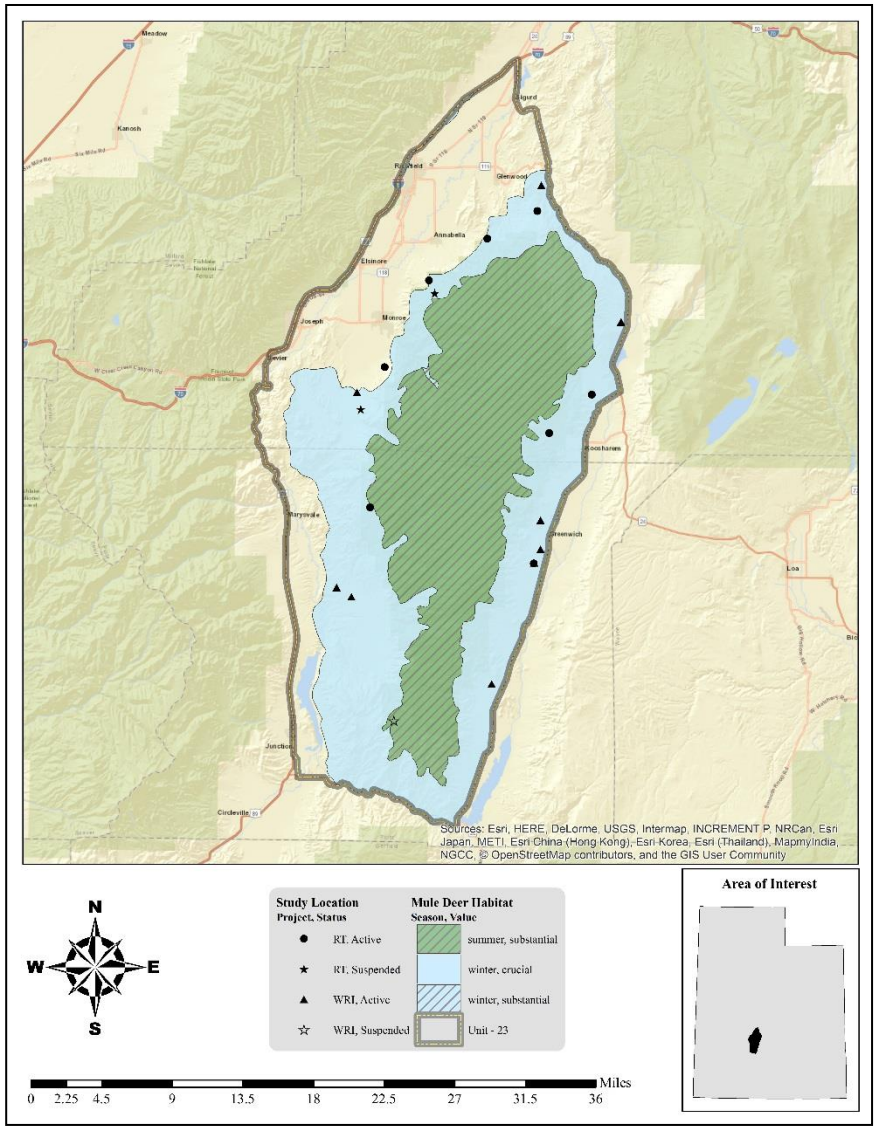
Figure 9.1: The 1982-2017 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2017. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2018).

Big Game Habitat

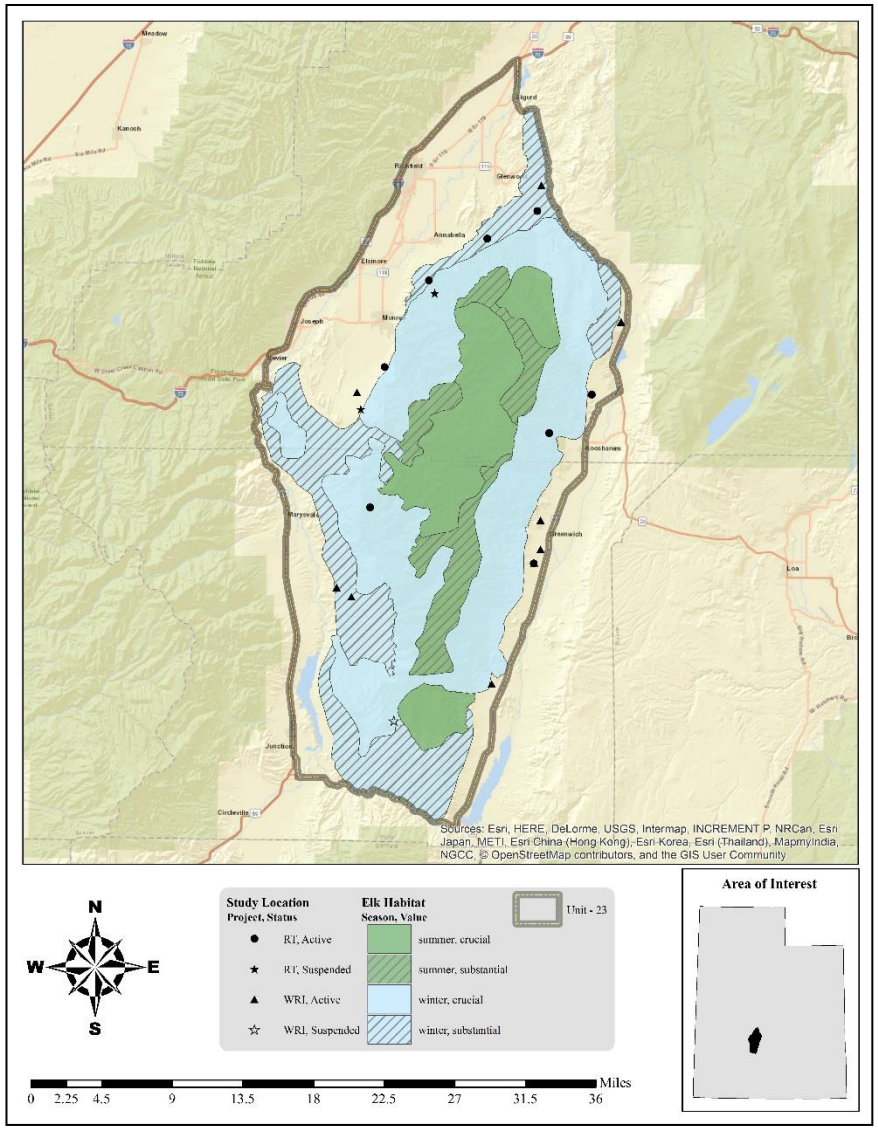
It is estimated that there are 326,742 acres that are classified as mule deer range on Unit 23. Of these acres, 46% is classified as summer range and 54% is classified as winter range (**Table 9.1**, **Map 9.2**). The Bureau of Land Management (BLM) manages 56% of the winter range, the United States Forest Service (USFS) manages 24% of the range, 8% is privately owned, School and Institutional Trust Lands Administration (SITLA) manages 8% of the winter range, Utah Division of Wildlife Resources (UDWR) manages 2%, Utah Department of Transportation manages <1%, and another <1% is tribally owned. The elk winter range has 44% managed by the BLM, 42% managed by the USFS, SITLA manages 7%, 6% is privately owned, 2% is managed by UDWR, and less than 1% is tribally owned. (**Table 9.3**, **Table 9.3**, **Map 9.4**). Most of the summer range for deer is on Forest Service land and provides good access for hunting.

Deer winter range is mostly located around the lower-elevation edges of the Sevier Plateau between 5,500 and 8,200 feet. The winter range is bounded on the lower edge by Highway 89 on the west and Highways 24 and 62 on the east. On the northern portion of the mountains, the winter range is limited in size and there is potential for conflicts with animals using agricultural areas in the winter because of the proximity to traditional winter ranges.

Significant amounts of the winter range consists of sagebrush, with smaller amounts being host to mixed mountain brush communities. Many of the sagebrush communities are composed of mountain big sagebrush. There are some issues with excessive decadence and mortality in some portions of this unit, particularly low precipitation areas. Significant amounts of pinyon-juniper are present at the lower elevations, which can pose a threat to the integrity and productivity of the sagebrush ecosystems. At the higher elevations, some of the aspen stands are being encroached by conifer trees, which can lower quality of the summer habitat.



Map 9.2: Estimated mule deer habitat by season and value for WMU 23, Monroe.



Map 9.3: Estimated elk habitat by season and value for WMU 23, Monroe.

	Summer Range		Winter Range		Year-Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	149,492	46%	177,251	54%	0	0%
Elk	86,847	29%	216,270	71%	0	0%
Moose	0	0%	0	0%	772	100%

Table 9.1: Estimated mule deer, elk, and moose habitat acreage by season for WMU 23, Monroe.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	8,749	6%	99,894	56%
Private	18,406	12%	14,401	8%
SITLA	2,620	2%	14,676	8%
Tribal	0	0%	720	<1%
UDOT	0	0%	71	<1%
UDWR	0	0%	4,143	2%
USFS	119,717	80%	43,346	24%
Total	149,492	**100%**	177,251	**100%**

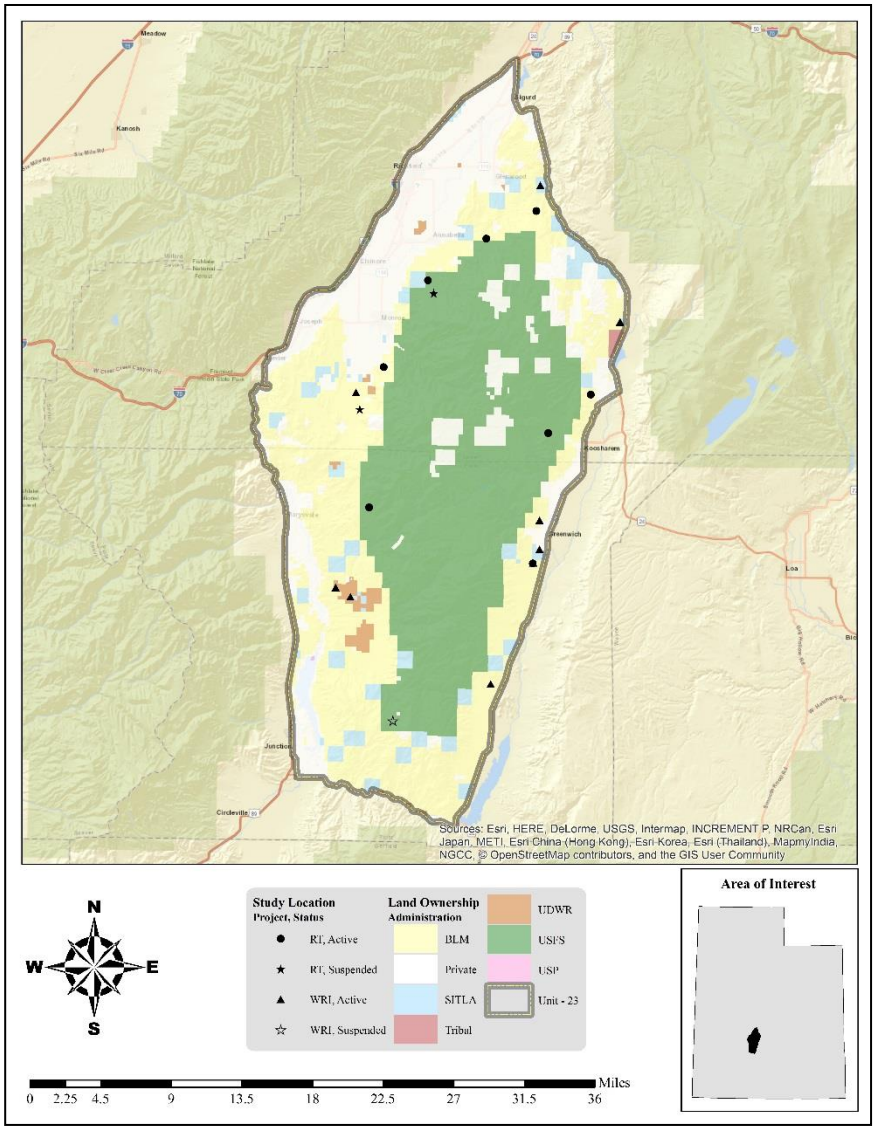
Table 9.2: Estimated mule deer habitat acreage by season and ownership for WMU 23, Monroe.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	800	1%	94,227	44%
Private	12,187	14%	13,068	6%
SITLA	1,045	1%	14,217	7%
Tribal	0	0%	107	<1%
UDWR	0	0%	4,158	2%
USFS	72,815	84%	90,492	42%
Total	86,847	**100%**	216,270	**100%**

Table 9.3: Estimated elk habitat acreage by season and ownership for WMU 23, Monroe.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	41	5%
Private	571	74%
SITLA	5	1%
USFS	155	20%
Total	772	**100%**

Table 9.4: Estimated moose habitat acreage by season and ownership for WMU 23, Monroe.



Map 9.4: Land ownership for WMU 23, Monroe.

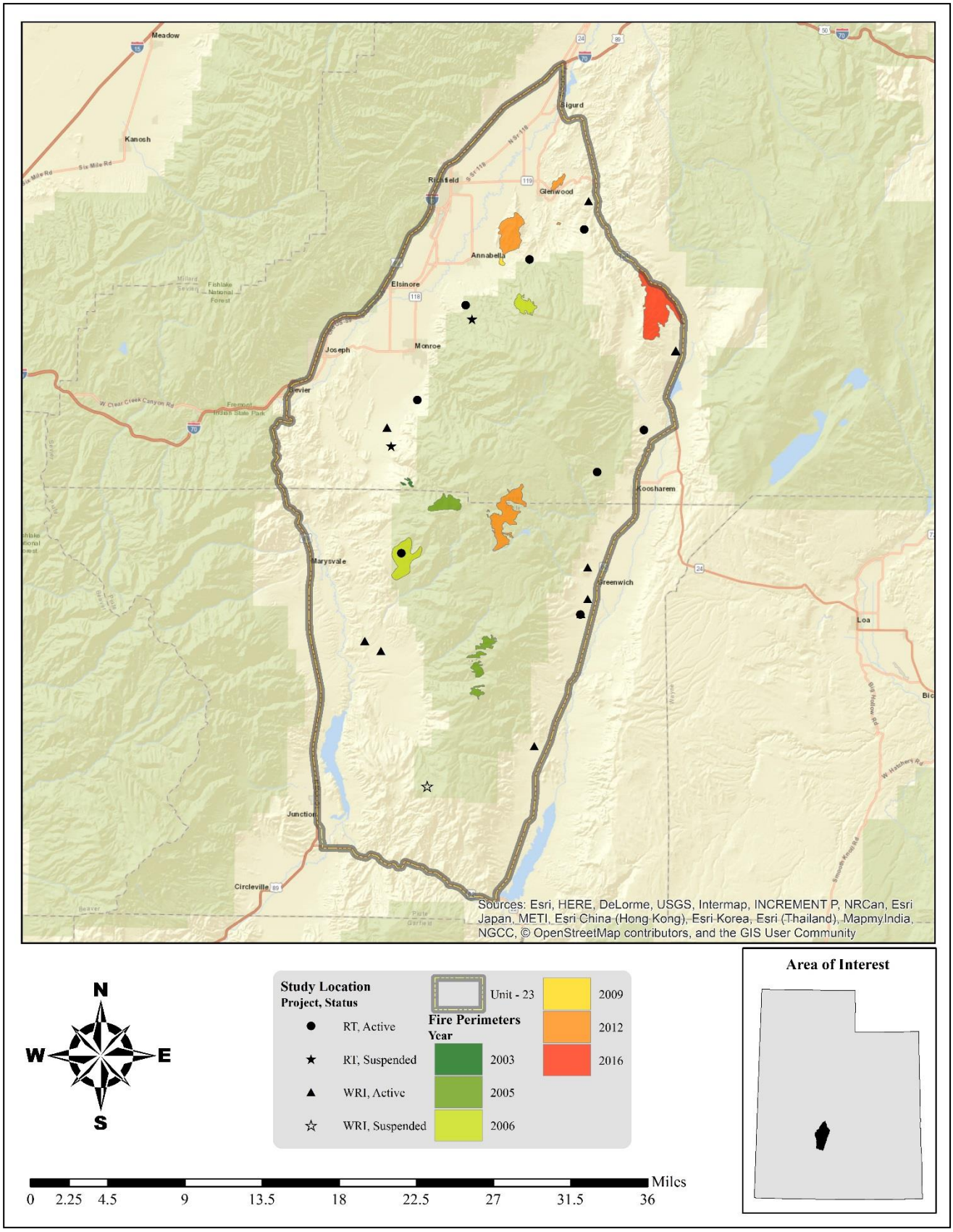
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Colorado Plateau Pinyon-Juniper Woodland	123,328	27.90%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	21,140	4.78%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	9,595	2.17%	
	Abies concolor Forest Alliance	3,492	0.79%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	3,451	0.78%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,235	0.28%	
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	748	0.17%	
	Other Conifer	146	0.03%	36.91%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	17,075	3.86%	3.86%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	3,136	0.71%	
	Southern Rocky Mountain Montane-Subalpine Grassland	834	0.19%	
	Inter-Mountain Basins Semi-Desert Grassland	663	0.15%	
	Other Grassland	34	0.01%	1.06%
Shrubland	Colorado Plateau Mixed Low Sagebrush Shrubland	34,548	7.82%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	27,158	6.14%	
	Inter-Mountain Basins Big Sagebrush Shrubland	15,754	3.56%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	13,524	3.06%	
	Inter-Mountain Basins Montane Sagebrush Steppe	12,178	2.76%	
	Inter-Mountain Basins Greasewood Flat	10,421	2.36%	
	Coleogyne ramosissima Shrubland Alliance	6,145	1.39%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	5,339	1.21%	
	Rocky Mountain Lower Montane-Foothill Shrubland	2,844	0.64%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	1,869	0.42%	
	Great Basin Semi-Desert Chaparral	941	0.21%	
	Quercus gambelii Shrubland Alliance	790	0.18%	
	Other Shrubland	64	0.01%	29.77%
Other	Barren	1,599	0.36%	
	Open Water	2,952	0.67%	
	Agricultural	33,936	7.68%	
	Developed	22,488	5.09%	
	Sparsely Vegetated	3,910	0.88%	
	Hardwood	22,936	5.19%	
	Conifer-Hardwood	29,399	6.65%	
	Snow-Ice	16	0.00%	
	Quarries-Strip Mines-Gravel Pits	256	0.06%	
	Riparian	8,070	1.83%	28.41%
Total		442,016	100%	100%

Table 9.5: Landfire existing vegetation coverage (LANDFIRE.US_140EVT, 2016) for WMU 23, Monroe.

Limiting Factors to Big Game Habitat

There are a few factors that limit big game habitat in the Monroe unit. Pinyon-Juniper woodlands account for 27.9% of the Monroe unit (**Table 9.5**). Conifer encroachment into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000). An additional limiting factor is the encroachment of conifer into high elevation summer ranges; prescribed fires have been used to reduce conifer cover and to regenerate aspen stands in these ranges.

Other limiting factors to big game habitat include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). According to the current Landfire Existing Vegetation Coverage model, 3.86% of the unit is comprised of exotic herbaceous species (**Table 9.5**). Increased amounts of cheatgrass increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). The unit has had several wildfires, resulting in loss of big game habitat (**Map 9.5**). The Poverty Flat area suffered from a wildfire in 1997, and recovery of browse species has been slow. Some of the drier portions of the unit have experienced sagebrush die-off from drought, which is often also in severe winter habitat.



Map 9.5: Land coverage of fires by year from 2000-2018 for WMU 23, Monroe (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2018).

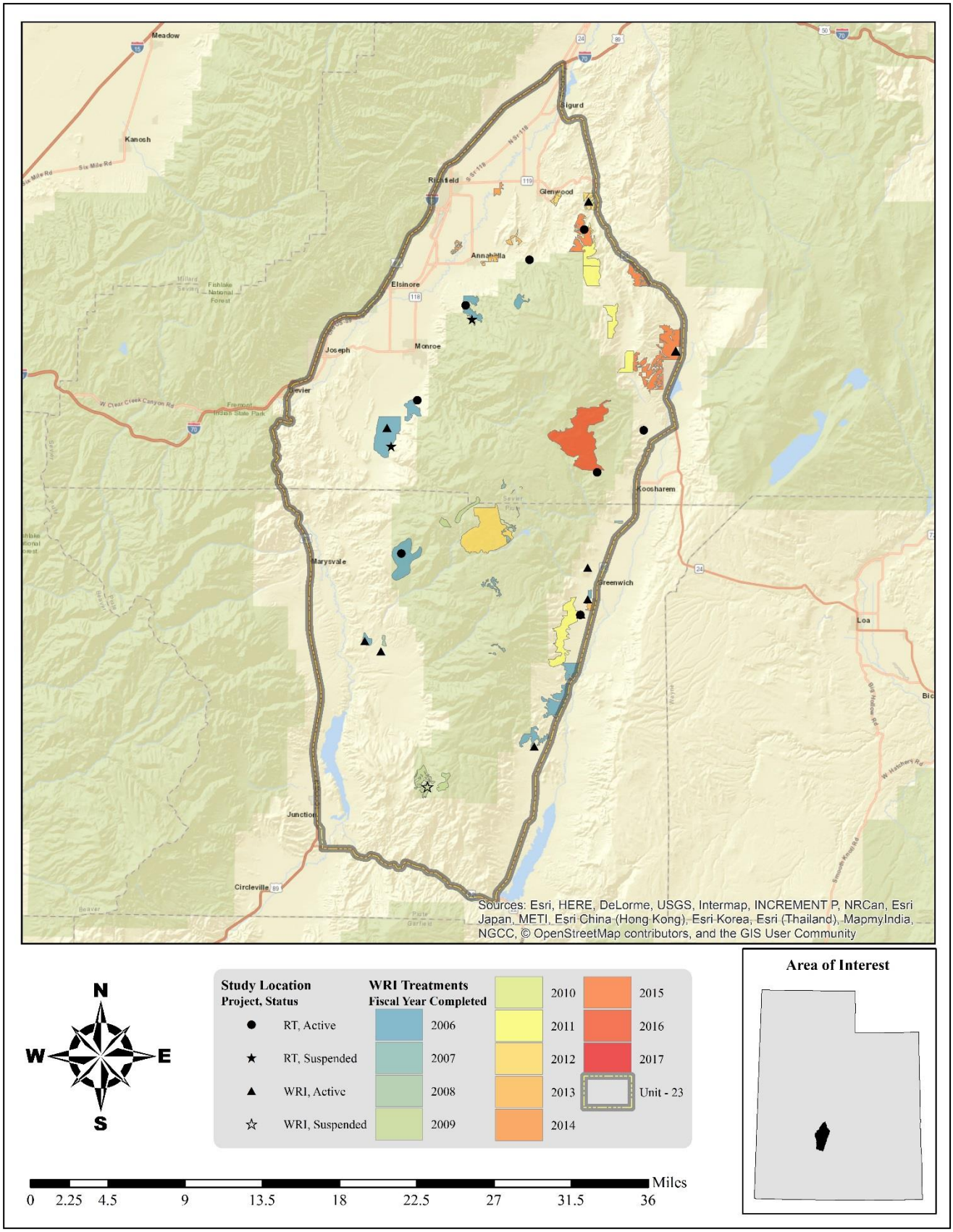
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 30,628 acres of land have been treated within the Monroe unit since the WRI was implemented in 2004 (**Map 9.6**). An additional 9,103 acres are currently being treated and treatments have been proposed for 8,092 acres. Treatments frequently overlap one another bringing the total treatment acres to 46,479 acres for this unit (**Table 9.6**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Prescribed fire is the most common management practice in this unit. Seeding to augment the herbaceous understory is also frequently used in the unit. In addition, tree removal through treatment methods such as anchor chaining, brush saws, and hand crews such as lop/scatter are frequently used. Other management practices include (but are not limited to) chain harrows, harrows, mowing, herbicide application, and forest thinning (**Table 9.6**).

Row Labels	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**3,674**	**3,548**	**2,414**	**9,635**
Ely (One-Way)	113	3,098	0	3,211
Ely (Two-Way)	3,560	450	2,414	6,424
Bullhog	**1,547**	**0**	**427**	**1,974**
Full Size	1,546	0	427	1,973
Skid Steer	1	0	0	1
Chain Harrow	**5,168**	**0**	**0**	**5,168**
> 15 ft. (One-Way)	5,168	0	0	5,168
Disk	**65**	**0**	**0**	**65**
Off-Set (Two-Way)	65	0	0	65
Forestry Practices	**0**	**2,513**	**1,364**	**3,876**
Thinning (Commercial)	0	0	707	707
Thinning (Non-Commercial)	0	2,513	657	3,170
Harrow	**5,316**	**0**	**0**	**5,316**
≤ 15 ft. (One-Way)	2,323	0	0	2,323
≤ 15 ft. (Two-Way)	2,067	0	0	2,067
> 15 ft. (One-Way)	749	0	0	749
> 15 ft. (Two-Way)	176	0	0	176
Herbicide Application	**438**	**122**	**0**	**560**
Aerial (Fixed-Wing)	303	0	0	303
Aerial (Helicopter)	0	122	0	122
Ground	134	0	0	134
Mowing	**654**	**0**	**78**	**732**
Brush Hog	654	0	78	732
Prescribed Fire	**7,690**	**2,563**	**3,572**	**13,825**
Seeding (Primary)	**2,105**	**0**	**151**	**2,256**
Broadcast (Aerial-Helicopter)	1,682	0	0	1,682
Drill (Rangeland)	270	0	151	421
Ground (Mechanical Application)	154	0	0	154
Skid-Steer Mounted Tree Cutter	**0**	**358**	**0**	**358**
Hydraulic Brush Saw	0	276	0	276
Hydraulic Shears	0	82	0	82
Vegetation Removal/Hand Crew	**3,973**	**0**	**86**	**4,059**
Lop (No Scatter)	822	0	0	822
Lop and Scatter	3,151	0	86	3,237
Total Treatment Acres	**30,628**	**9,103**	**8,092**	**47,823**
***Total Land Area Treated**	**29,284**	**9,103**	**8,092**	**46,479**

Table 9.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 23, Monroe. Data accessed on 02/09/2018. *Does not include overlapping treatments.



Map 9.6: WRI treatments by fiscal year completed for WMU 23, Monroe.

Range Trend Studies

Range Trend studies have been sampled within WMU 23 on a regular basis since 1985, with studies being added or suspended as was deemed necessary **(Table 9.7**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 9.8**).

Range Trend studies are summarized in this report by ecological site. Range Trend and WRI studies that have had a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type and are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
23-1	Bear Ridge	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Shallow Loam (Black Sagebrush)
23-2	Saul Meadow	RT	Active	'85, '91, '98, '03, '08, '12, '17	Upland Loam (Mountain Big Sagebrush)
23-3	Thompson Basin	RT	Suspended	'85, '91, '98, '03, '08, '12	Upland Stony Loam (Mountain Big Sagebrush)
23-4	Poverty Flat	RT	Suspended	'85, '91, '98, '03, '08, '12	Semidesert Gravelly Loam (Wyoming Big Sagebrush) South
23-5	Smith Canyon	RT	Active	'85, '91, '98, '03, '08, '12, '17	Mountain Loam (Mountain Big Sagebrush)
23-6	Koosharem Canyon	RT	Active	'85, '91, '98, '03, '08, '12, '17	Mountain Loam (Browse)
23-7	Thompson Creek	RT	Active	'17	Upland Loam (Mountain Big Sagebrush)
23-8	Burrville Cemetery	RT	Active	'17	Upland Loam (Mountain Big Sagebrush)
23-9	Corner Spring Canyon	RT	Active	'17	Semidesert Loam (Wyoming Big Sagebrush)
23R-1	Greenwich Disking	WRI	Active	'97, '03, '04, '08, '12	Semidesert Loam (Wyoming Big Sagebrush)
23R-2	Greenwich Native	RT	Active	'97, '03, '04, '08, '12, '17	Semidesert Loam (Wyoming Big Sagebrush)
23R-3	Plateau Harrow	WRI	Active	'99, '03, '08, '12	Upland Shallow Loam (Mountain Big Sagebrush)
23R-4	Plateau Native	WRI	Active	'99, '03, '12	Upland Shallow Loam (Mountain Big Sagebrush)
23R-5	Elbow Ranch 1	WRI	Active	'04, '12, '17	Semidesert Gravelly Loam (Wyoming Big Sagebrush) South
23R-6	Elbow Ranch 2	WRI	Active	'04, '12, '17	Semidesert Gravelly Loam (Wyoming Big Sagebrush) South
23R-7	South Narrows	WRI	Active	'04, '07, '12, '16	Semidesert Loam (Wyoming Big Sagebrush)
23R-8	Browns Canyon Drill	WRI	Active	'04, '07, '12, '16	Semidesert Loam (Wyoming Big Sagebrush)
23R-9	Poverty Dixie	WRI	Active	'05, '10, '13, '17	Semidesert Gravelly Loam (Wyoming Big Sagebrush) South
23R-10	Twin Peaks Dixie	WRI	Suspended	'06	Not Verified
23R-11	Box Creek Dixie	WRI	Active	'06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
23R-12	Glenwood Chaining	WRI	Active	'11, '14	Not Verified

Table 9.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 23, Monroe.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Size (acres)	WRI Project #
23-1	Bear Ridge	Two-Way Ely Chain	North Cove Vegetation Treatment	October 2010	3,000	1880
		Aerial Before	North Cove Vegetation Treatment	October 2010	1,500	1880
23-2	Saul Meadow	Lop and Scatter	Sauls Meadow Thinning	April 2003	331	
		Two-Way Unknown Chain	Maple Creek Seeding	May 1965	540	
		Broadcast Before	Maple Creek Seeding	May 1965	540	
		Aerial Before	Maple Creek Seeding	May 1965	540	
23-3	Thompson Basin	Wildfire		Historic		
23-4	Poverty Flat	Wildfire	Flat	1997		
		Seed Unknown		1997		
23-5	Smith Canyon	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Wildfire	Blackbird Mine WFU	June 2006	1,464	
		Aerial Unknown	Monroe Mountain Burn Stabilization	June 2006	1,468	598
23R-1	Greenwich Disking	Disk		Fall 1996		PDB
		Seed Unknown		Fall 1996		PDB
		One-Way Dixie Harrow	Narrows Project	November 2004	3,600	PDB
		Broadcast Before	Narrows Project	November 2004	3,600	PDB
23R-2	Greenwich Native	Two-Way Dixie Harrow	Narrows Project	November 2004	3,600	PDB
		Broadcast Before	Narrows Project	November 2004	3,600	PDB
23R-3	Plateau Harrow	Two-Way Dixie Harrow		1999		
		Seed Unknown		1999		
23R-5	Elbow Ranch 1	Cropland		Historic		
		One-Way Dixie Harrow	Elbow Ranch Drill	November 2005	170	2835
		Rangeland Drill	Elbow Ranch Drill	November 2005	170	2835
		Broadcast	Elbow Ranch Drill	November 2005	170	2835
		Rangeland Drill	Elbow Ranch Drill	November 2007	42	800
23R-6	Elbow Ranch 2	Cropland		Historic		
23R-7	South Narrows	Two-Way Dixie Harrow		1996		PDB
		Seed Unknown		1996		PDB
		Two-Way Dixie	South Narrows Dixie Harrow - West Side	Fall 2005	1,740	210
		Broadcast Before	South Narrows Dixie Harrow - West Side	Fall 2005	1,740	210
23R-8	Browns Canyon Drill	Disk Unknown		Fall 1996		PDB
		Seed Unknown		Fall 1996		PDB
		Truax Drill	Greenwich Disking	October 2003	275	PDB
		Aerial After	Greenwich Disking	December 2003	275	PDB
		Rangeland Drill	Grass Valley/Rocky Knoll Phase II	November 2013	172	2256
23R-9	Poverty Dixie	Wildfire	Flat	July 1997	5,425	
		Rangeland Drill	Flat Fire Rehabilitation	November 1997	3,400	
		Aerial	Flat Fire Rehabilitation	November 1997	3,000	
		Aerial	Flat Fire Rehabilitation	November 1997	400	
		One-Way Dixie Harrow	Poverty Flat	November 2005	2,108	139
		Broadcast Before	Poverty Flat	November 2005	2,108	139
23R-11	Box Creek Dixie	Two-Way Dixie Harrow	BLM Project	Fall 2006		BLM
		Broadcast Before	BLM Project	Fall 2006		BLM
		Aerial After	BLM Project	Fall 2006		BLM
23R-12	Glenwood Chaining	Two-Way Ely/Smooth Chain	Glenwood Habitat Enhancement	November 2011	303	1941
		Aerial Before	Glenwood Habitat Enhancement	November 2011	303	1941
		Dribbler	Glenwood Habitat Enhancement	November 2011	303	1941
		Aerial After	Glenwood Habitat Enhancement	February 2012	303	1941

Table 9.8: Range trend and WRI studies known disturbance history for WMU 23, Monroe.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There is one study [Smith Canyon (23-5)] that is classified as a Mountain (Big Sagebrush) ecological site. The Smith Canyon study is located approximately four miles east of Marysvale at the base of Marysvale Peak.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species present on this study site, although lesser amounts of antelope bitterbrush (*Purshia tridentata*) are present. Preferred browse cover on these sites has changed due to a fire that occurred on the site in 2006. Cover of preferred browse was minimal in 2008, but subsequent sample years have shown cover increasing back to the levels observed prior to fire. Utilization of preferred browse has remained low in the years following the fire (**Figure 9.2**). Average preferred browse demographics showed that prior to the fire, the browse community was dominated by decadent plants. Following the fire, young plants were the dominant age class in the plant community (**Figure 9.8**).

Herbaceous Understory: The herbaceous understory of this site is depauperate with annual grasses as the dominant component; perennial grasses and forbs are sparse. Cover and frequency of perennial species has decreased over time while that of annual grasses has increased (**Figure 9.12**, **Figure 9.14**). Because Smith Canyon is the only site providing the trend for this ecological type, it is likely that the fire affected the composition of the herbaceous understory.

Occupancy: Average pellet transect data shows a general decrease in animal presence on the site and that deer are the primary occupants of the site. Mean abundance of deer pellet groups has exhibited a low of 10 days use/acre in 2017 and a high of 139 days use/acre in 2003. Elk presence on the site has ranged from less than 1 days use/acre to 8 days use/acre in 2008. Finally, cattle pellet groups have had a mean abundance as low as 0 days use/acre in 2017 and as high as 18 days use/acre in 2012 (**Figure 9.16**).

Mountain (Browse)

There is one study [Koosharem Canyon (23-6)] classified as a Mountain (Browse) ecological site. This study site is located approximately 2.5 miles northwest of the town of Koosharem up Koosharem Canyon.

Shrubs/Trees: The Koosharem Canyon site is the only study in this unit that is considered to be of the Mountain (Browse) ecological type. On this site, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and alderleaf mountain mahogany (*Cercocarpus montanus*) are co-dominant browse species, although lesser amounts of preferred browse such as Gambel oak (*Quercus gambelii*), antelope bitterbrush (*Purshia tridentata*), and Utah serviceberry (*Amelanchier utahensis*) have also been observed. Preferred browse cover has varied overall. Sagebrush cover has remained consistent while that of other preferred browse has shown a slight decrease (**Figure 9.4**). Average demographics of preferred browse have remained consistent, with the stands being mostly composed of mature individuals; recruitment of young plants is low, but stable overall (**Figure 9.6**). Preferred browse utilization has increased over the study years with heavy utilization driving the upward trend (**Figure 9.10**).

Both Utah juniper (*Juniperus osteosperma*) and two-needle pinyon (*Pinus edulis*) are tree species present on this site. Tree cover and density have increased over time on this site (**Figure 9.4**, **Figure 9.6**).

Herbaceous Understory: The herbaceous understory of this ecological site is almost entirely composed of perennial grasses with smaller amounts of perennial forbs being sampled. Native species comprise a significant portion of the understory, and forbs are diverse although low in overall cover. Cover of perennial grasses has exhibited an increasing trend, with frequency remaining stable (**Figure 9.12**, **Figure 9.14**).

Occupancy: Pellet transect data shows a fluctuating but generally increasing trend in animal presence. Deer are the primary occupants of this study site, with mean pellet group abundance ranging from 62 days use/acre in 1998 to 230 days use/acre in 2017. Mean abundance of elk pellet groups has shown a low of less than 1 days

use/acre in 2017 and a high of 30 days use/acre in 1998. Finally, cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2017 to 5 days use/acre in 1998 (**Figure 9.16**).

Upland (Big Sagebrush)

There are three studies [Saul Meadow (23-2), Thompson Creek (23-7), and Burrville Cemetery (23-8)] that are classified as Upland (Big Sagebrush) ecological sites. The Saul Meadow site is located approximately 2.5 miles east of Annabella near Water Creek. Thompson Creek is situated around three miles south of Annabella up Thompson Basin Road. The Burrville Cemetery site can be found 0.5 miles north of Burrville on the foothills above town.

Shrubs/Trees: The primary browse species present on the Upland (Big Sagebrush) ecological sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Browse cover (mainly contributed by sagebrush) has remained stable overall, although an increase was exhibited in 2012 (**Figure 9.3**). Average preferred browse demographics show that the percentage of decadent plants has decreased over time (**Figure 9.9**). Preferred browse utilization has exhibited an overall increase, with 65% of plants being moderately to heavily used in 2017 (**Figure 9.11**).

The only tree species that has been sampled on these sites is Utah juniper (*Juniperus osteosperma*). Tree cover and density are low overall and there have not been any significant changes from year to year (**Figure 9.5**, **Figure 9.7**).

Herbaceous Understory: The herbaceous understories of these sites are not particularly diverse, with Thompson Creek and Saul Meadow being dominated by annual grass species. Cover and frequency provided by perennial grass species have shown slight increases over time, and annual grass species have also increased (**Figure 9.13**, **Figure 9.15**). The significant increase in cover of annual grasses during the 2017 sample year is driven by the addition of the Thompson Creek study, which is dominated by cheatgrass (*Bromus tectorum*).

Occupancy: Average pellet transect data indicates a general decrease in animal presence and that deer are the primary occupants of these sites. The mean abundance of deer pellet groups shows a low of 16 days use/acre in 2017 and a high of 54 days use/acre in 2003. Elk pellet groups have had a mean abundance ranging from 10 days use/acre in 2003 to 39 days use/acre in 2012. Mean abundance of cattle pellet groups displayed a low of 0 days use/acre in 2008 and 2012 and a high of 3 days use/acre in 1998 (**Figure 9.17**).

Upland (Black Sagebrush)

There is one study [Bear Ridge (23-1)] that is classified as an Upland (Black Sagebrush) ecological site. The Bear Ridge study site is located about three miles southeast of Glenwood.

Shrubs/Trees: Preferred browse species on this Upland (Black Sagebrush) ecological site include black sagebrush (*Artemisia nova*) and antelope bitterbrush (*Purshia tridentata*) as the dominant species, with lesser amounts of mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) being observed. Cover of preferred browse has fluctuated slightly over time but a moderate increase from previous years was displayed in 2017 (**Figure 9.5**). Prior to 2012, average preferred browse demographics showed high levels of decadence and decreasing numbers of preferred browse. The two subsequent sample years, however, showed increased recruitment of young and mature individuals (**Figure 9.9**). Utilization of preferred browse has fluctuated over time with the 2008 study year displaying utilization levels well above those exhibited in other years (**Figure 9.11**).

Trees sampled on this study site include Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*). Cover and density have been steadily decreasing: a 2010 chaining treatment and a lop and scatter project in 2016 are likely responsible for the decrease (**Figure 9.5**, **Figure 9.7**).

Herbaceous Understory: The herbaceous understory is generally in good condition, with perennial grasses and forbs being the dominant components. Perennial grasses and forbs have increased significantly in cover over

time; frequency has also increased, but to a lesser extent. Annual grasses are present in the understory, although not in high amounts (**Figure 9.13**, **Figure 9.15**). Native species comprise much of the understory. Some introduced species are also present, but not in significant amounts.

Occupancy: Pellet transect data indicates a general decrease in animal presence with deer being the primary occupants. Mean abundance of deer pellet groups varies from a low of 16 days use/acre in 2017 to a high of 54 days use/acre in 2003. Elk presence has been as low as 1 days use/acre in 2003 and 2008 and as high as 7 days use/acre in 1998. Finally, mean abundance of cattle pellet groups has ranged from 0 days use/acre in 1998, 2012, and 2017 to under 1 days use/acre in 2003 and 2008 (**Figure 9.17**).

Semidesert (Big Sagebrush)

There are two studies [Greenwich Native (23R-2) and Corner Spring Canyon (23-9)] that are considered to be Semidesert (Big Sagebrush) ecological sites. Greenwich Native is located approximately two miles south of Greenwich near the mouth of Browns Canyon. Corner Spring Canyon is located about two miles south of Monroe at the base of Monroe Mountain.

Shrubs/Trees: The primary preferred browse species on these Semidesert (Big Sagebrush) ecological sites is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). Cover has fluctuated, with a decrease in 2017 due in part to the addition of the Corner Spring Canyon study (**Figure 9.3**). Utilization of preferred browse has generally increased with the percentage of heavy utilization rising in each study year (**Figure 9.11**). Demographic data shows that the community is mostly composed of mature individuals with numbers of decadent plants generally decreasing (**Figure 9.9**).

Trees were observed on the newly established site in point-quarter measurements. Utah juniper (*Juniperus osteosperma*) was the only species sampled and density was low; no tree cover was recorded (**Figure 9.5**, **Figure 9.7**).

Herbaceous Understory: The herbaceous understories of these sites are mostly depleted with little cover provided by perennial species. Annual grass cover was nominal until 2017, when the additional study increased average annual grass cover significantly. Perennial grasses and forb cover is very low, but has remained stable over the sample years (**Figure 9.13**, **Figure 9.15**).

Occupancy: Pellet transect data for these sites has indicated an increase in animal presence and that the primary occupants are deer and elk. Mean abundance of deer pellet groups varied from 0 days use/acre in 2003 and 2008 to 41 days use/acre in 2017. The mean abundance of elk pellet groups has been as low as 1 days use/acre in 2003 and as high as 4 days use/acre in 2012. Finally, cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2003 to 4 days use/acre in 2012 (**Figure 9.17**).

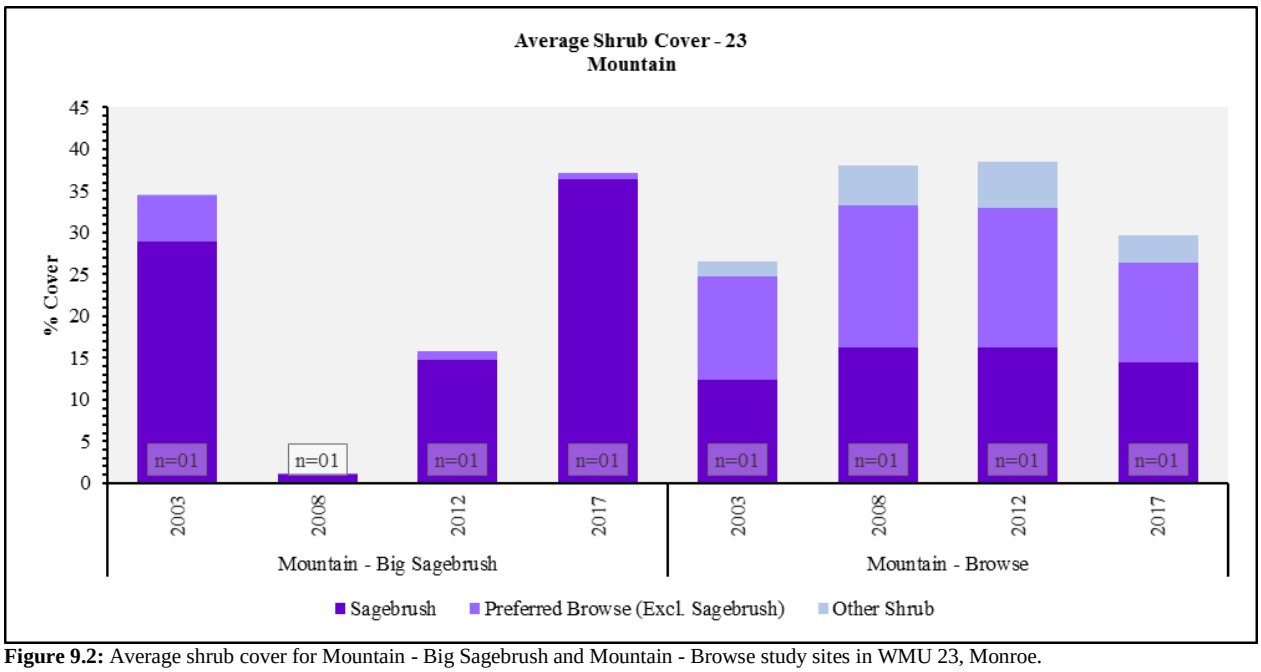


Figure 9.2: Average shrub cover for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

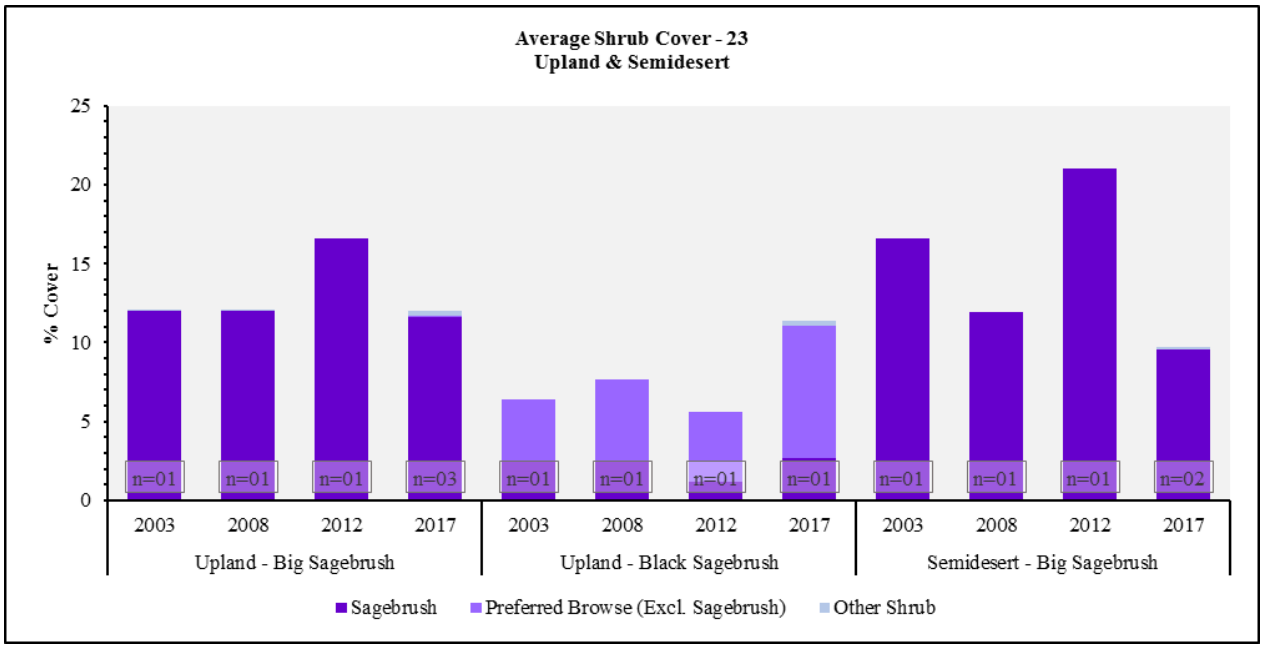


Figure 9.3: Average shrub cover for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

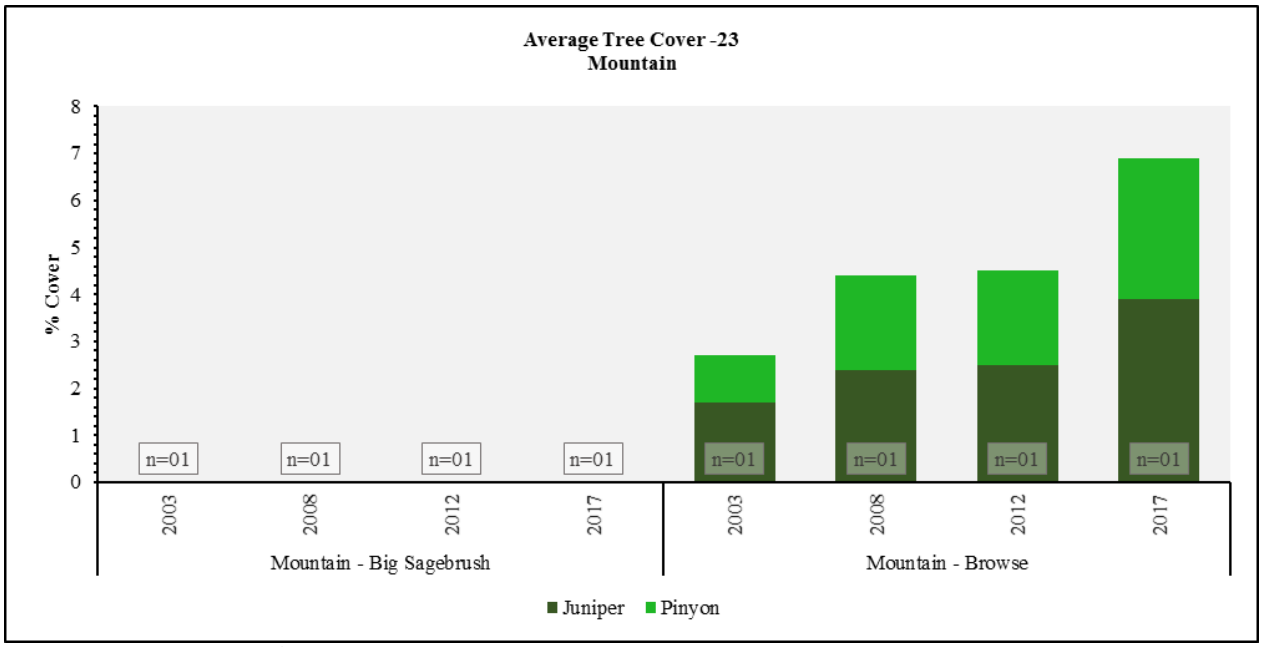


Figure 9.4: Average tree cover for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

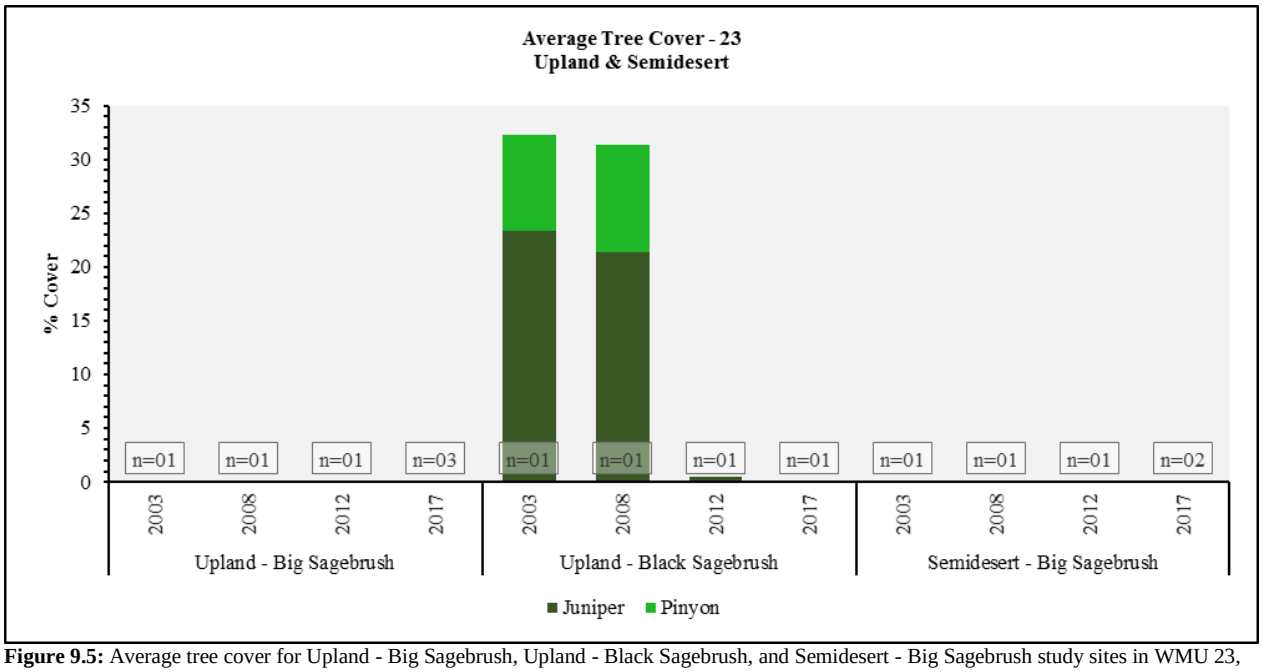


Figure 9.5: Average tree cover for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

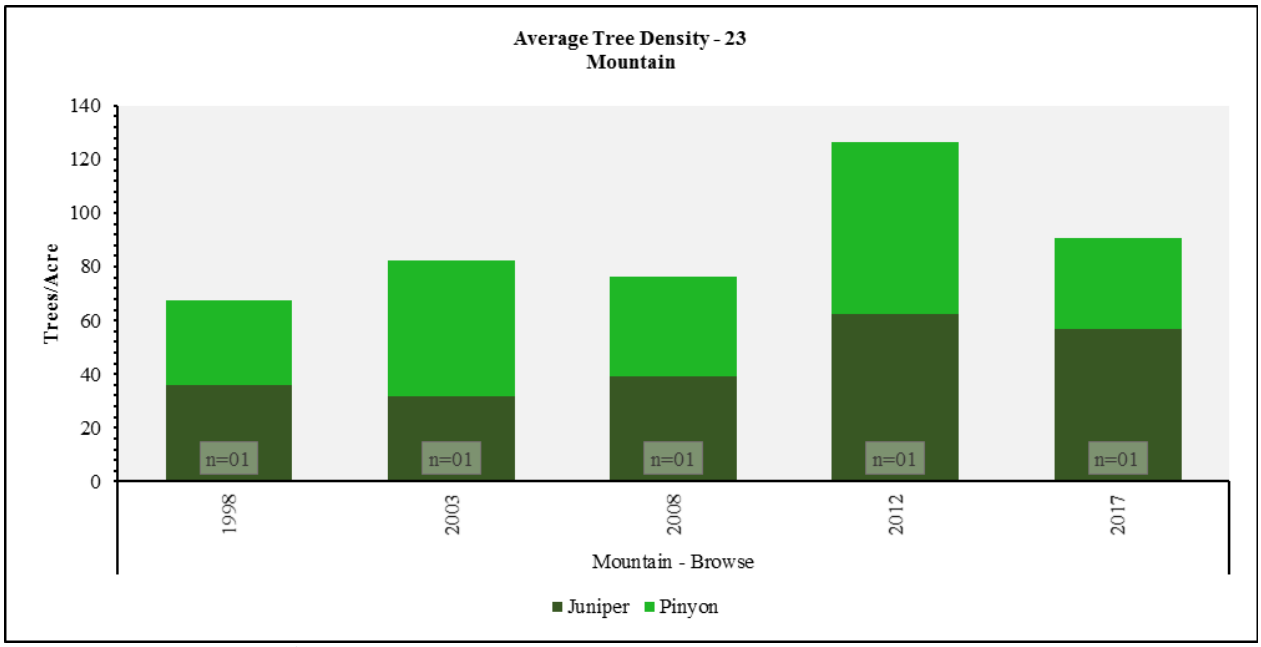


Figure 9.6: Average tree density for Mountain - Browse study sites in WMU 23, Monroe.

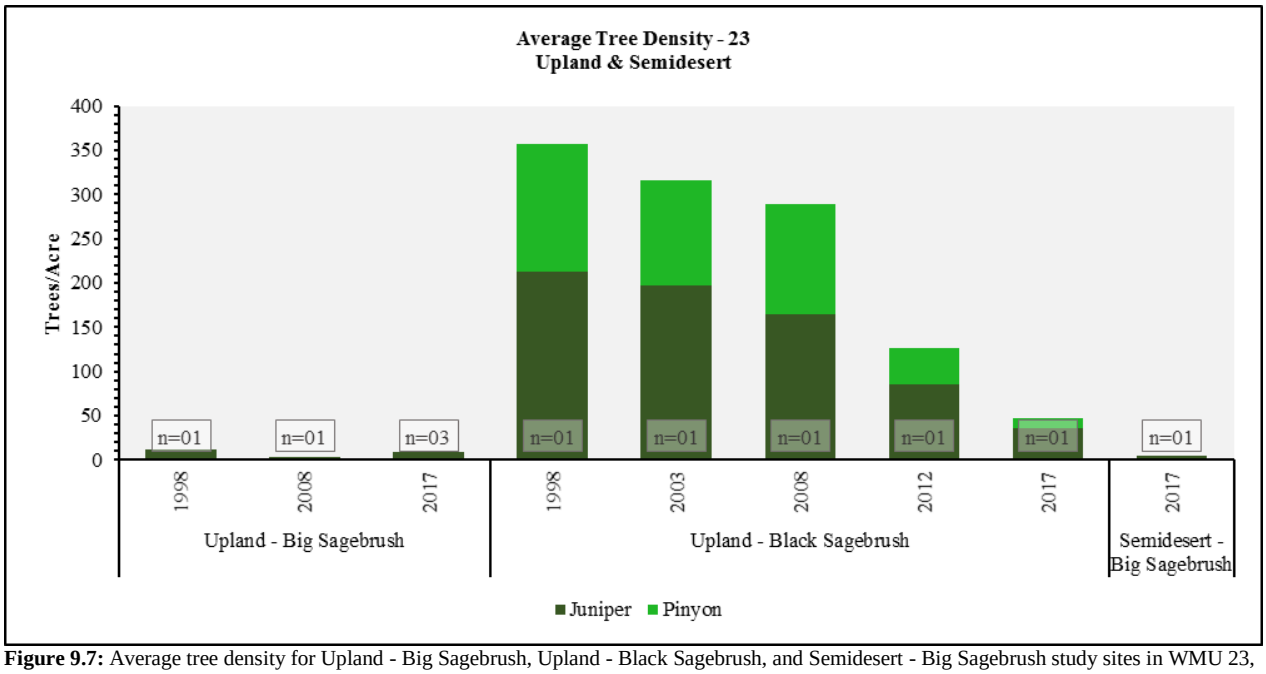


Figure 9.7: Average tree density for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

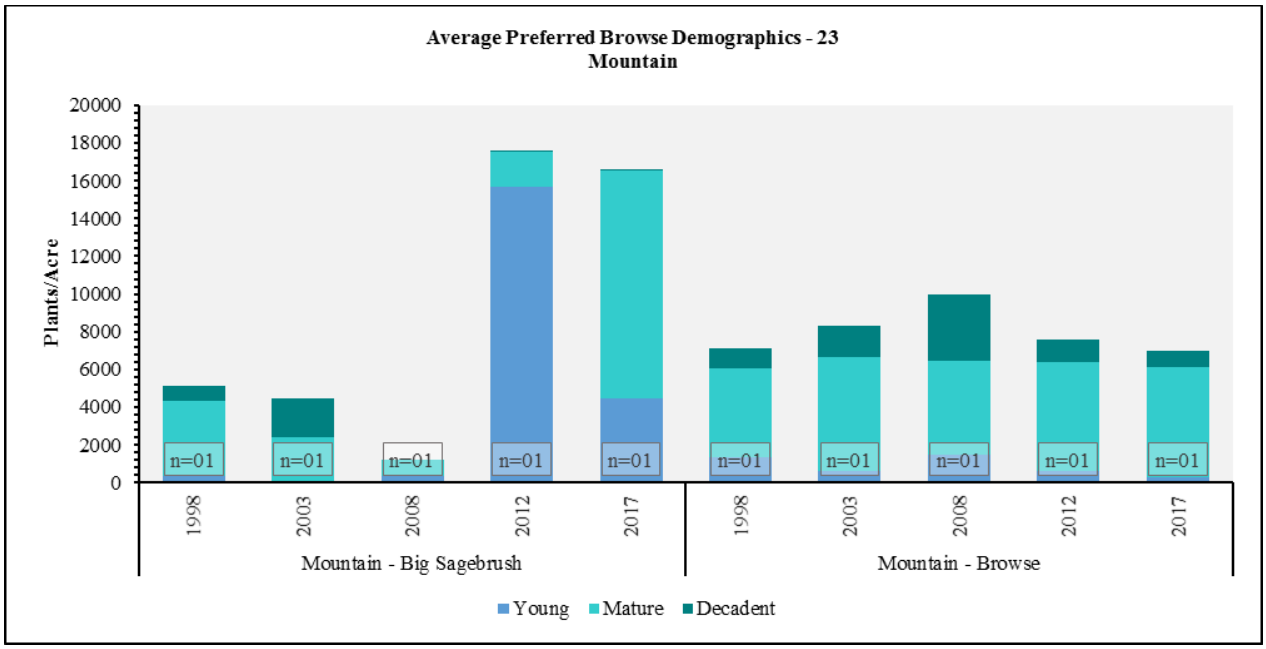


Figure 9.8: Average preferred browse demographics for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

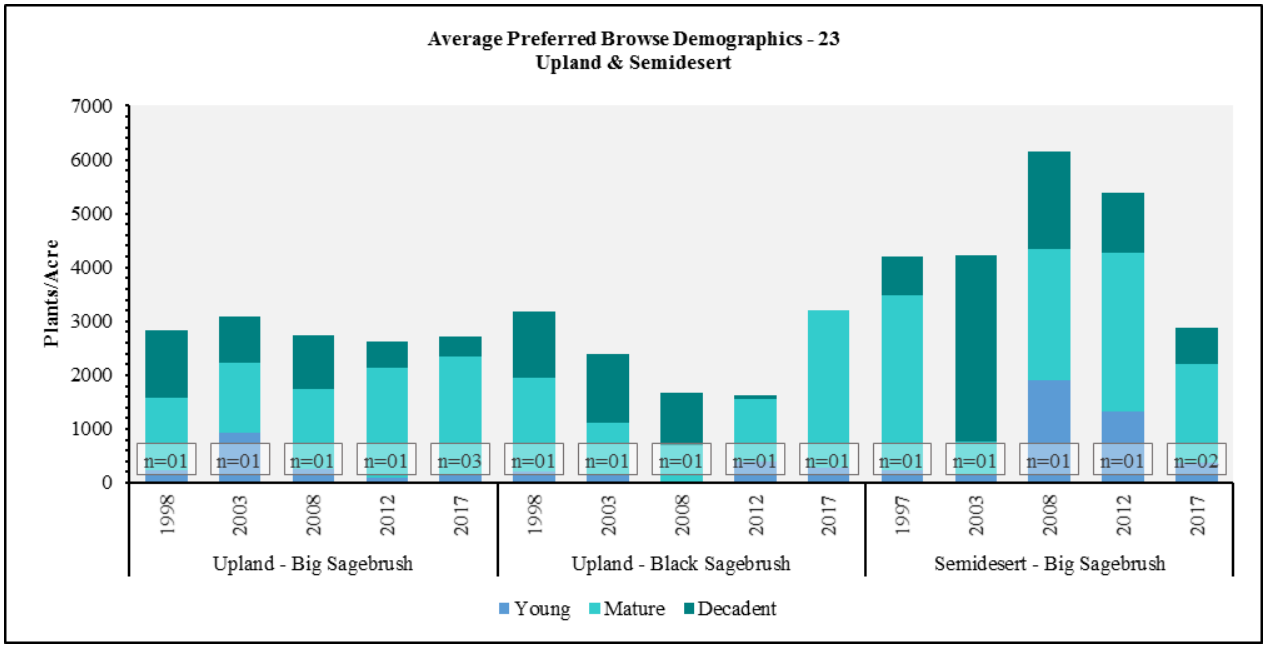


Figure 9.9: Average preferred browse demographics for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

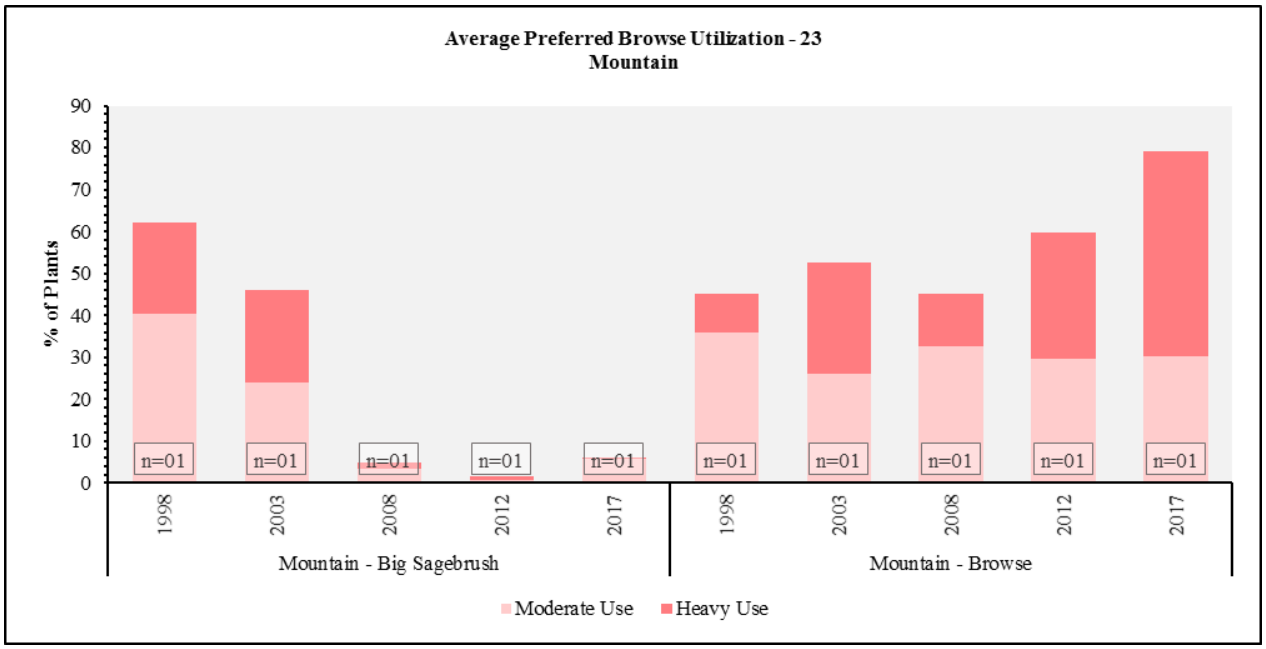


Figure 9.10: Average preferred browse utilization for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23. Monroe.

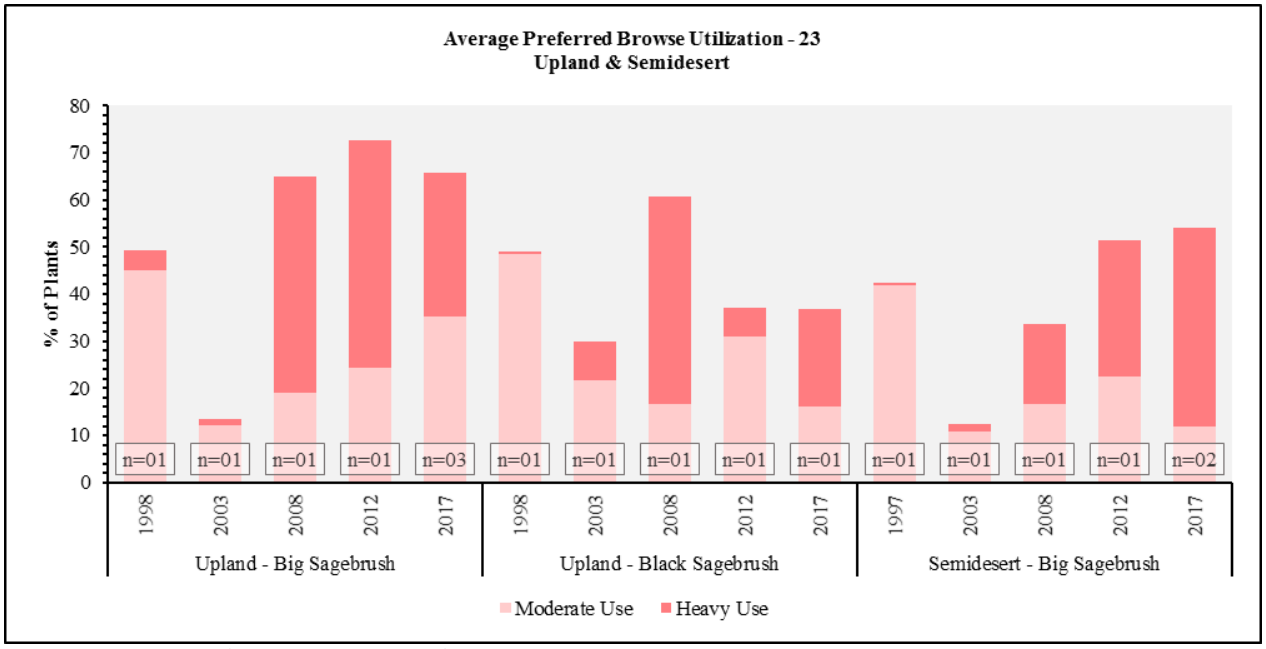


Figure 9.11: Average preferred browse utilization for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

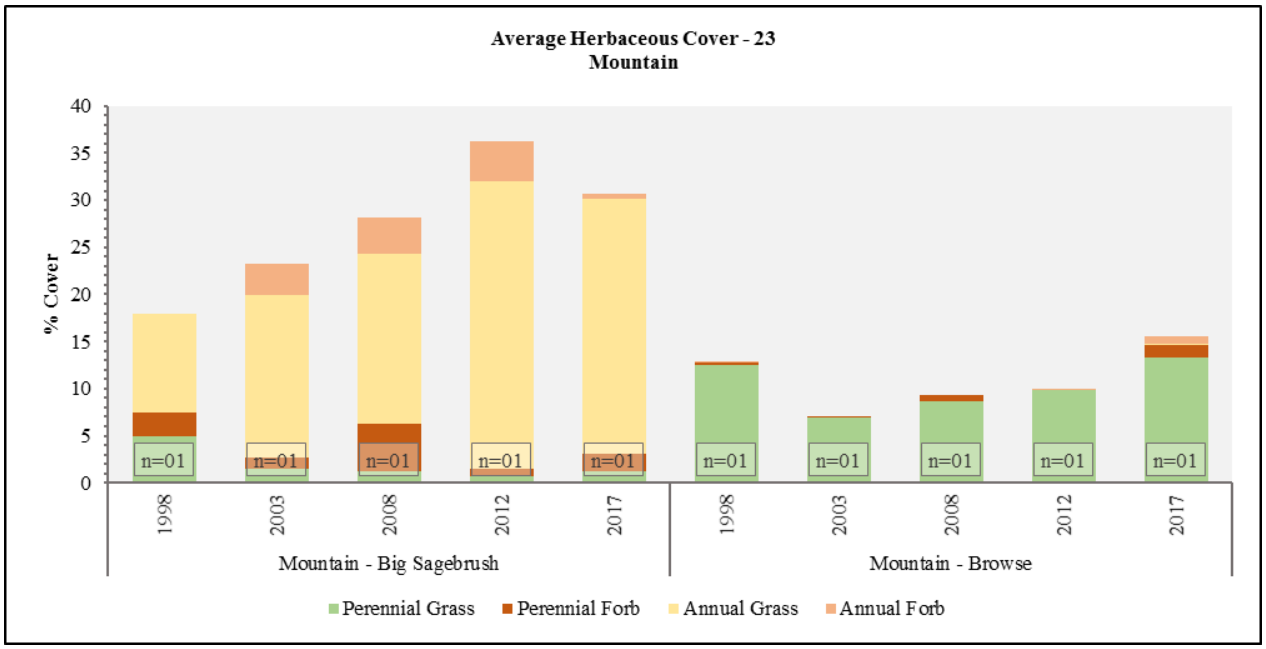


Figure 9.12: Average herbaceous cover for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

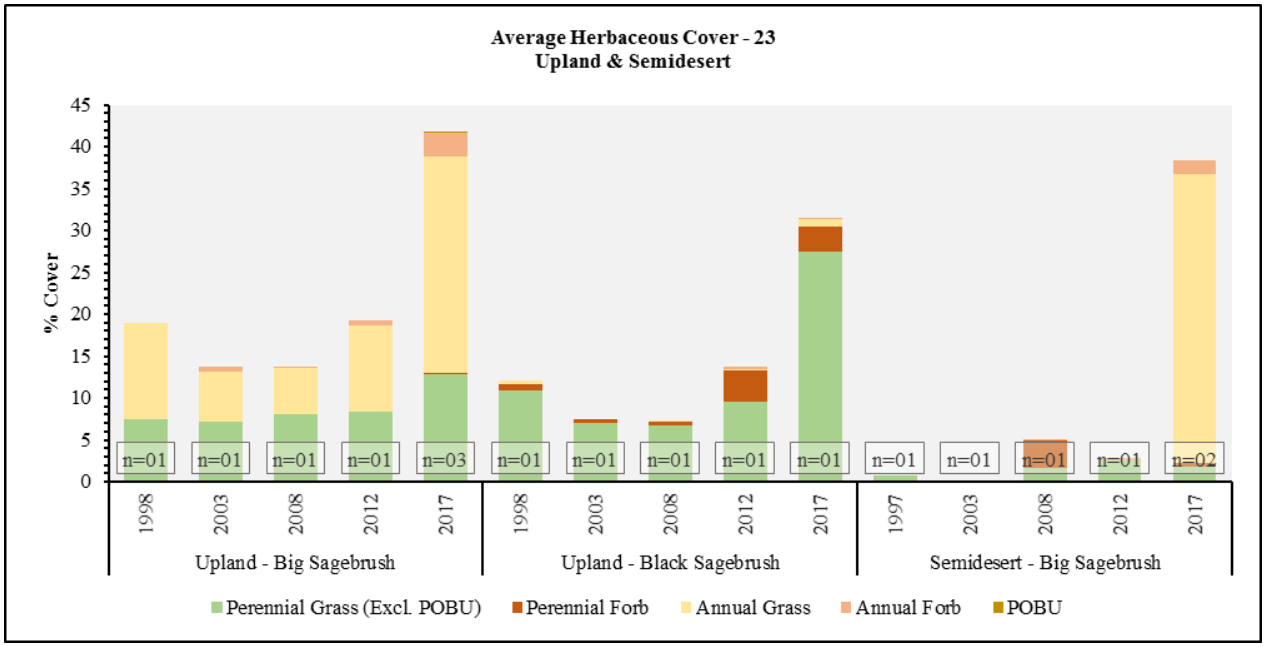


Figure 9.13: Average herbaceous cover for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

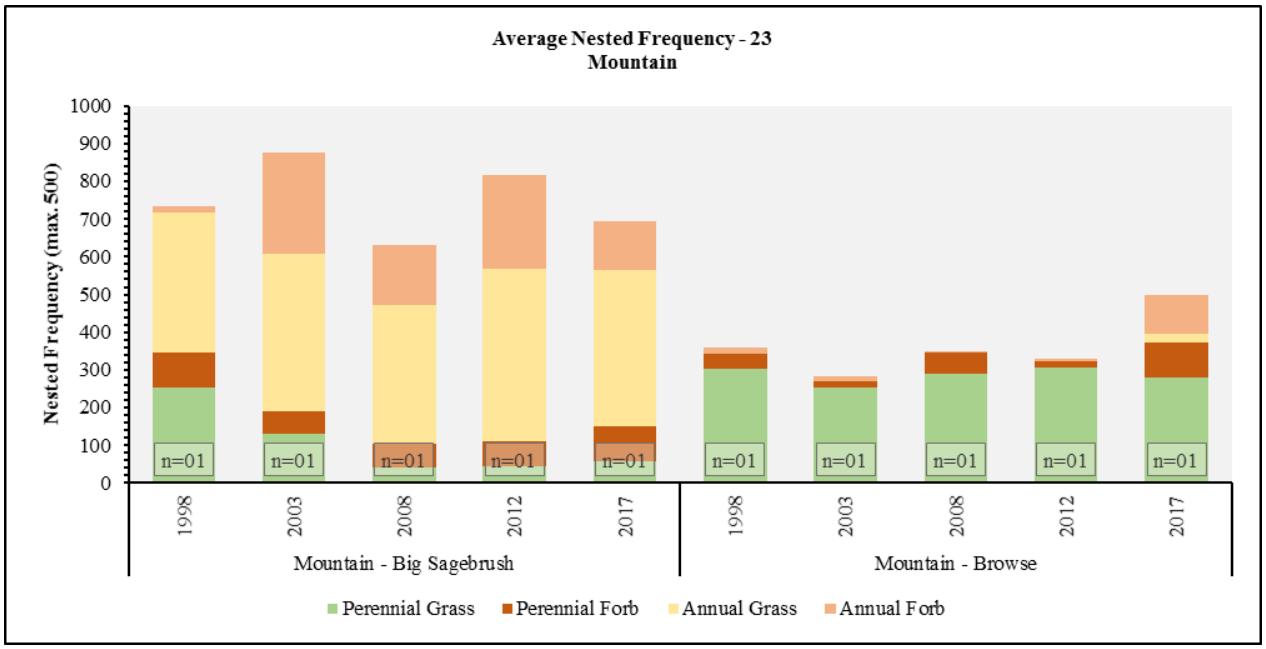


Figure 9.14: Average nested frequency of herbaceous species for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

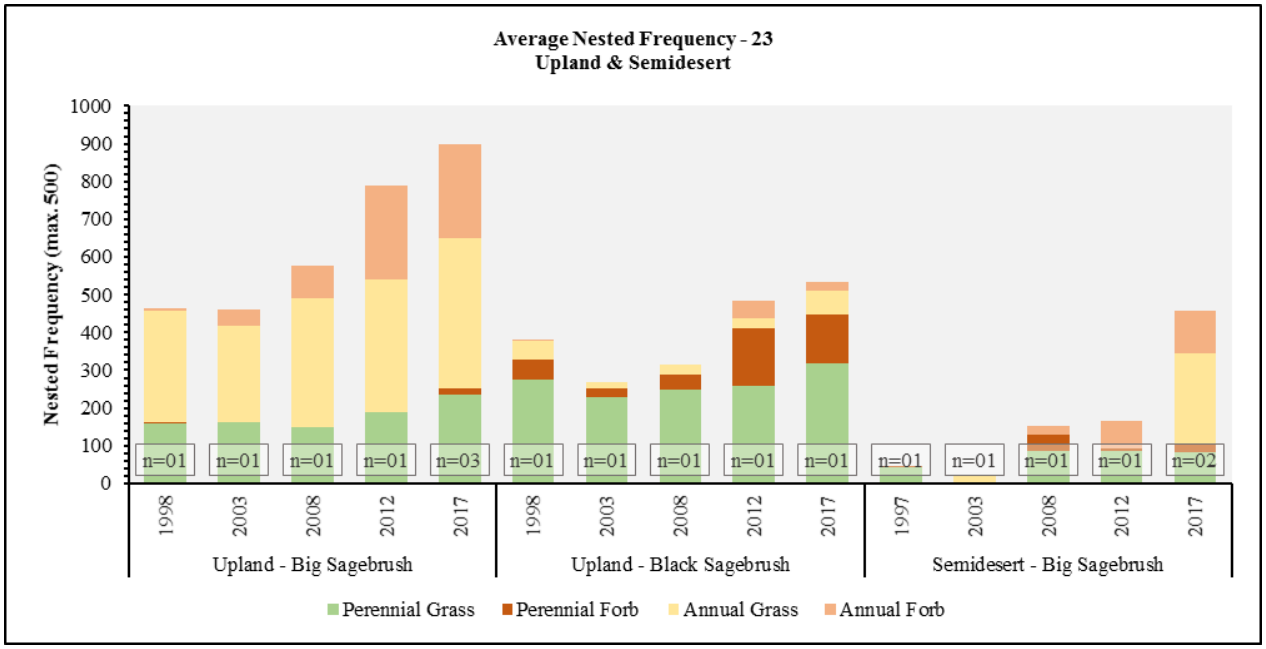


Figure 9.15: Average nested frequency of herbaceous species for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

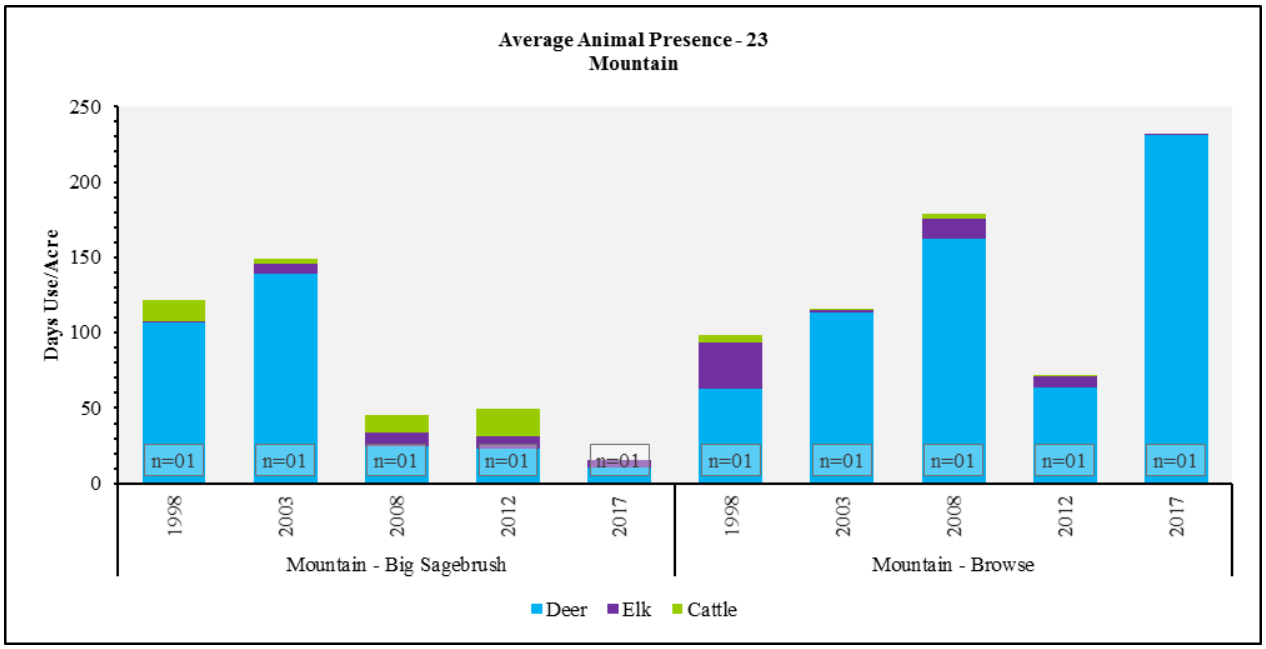


Figure 9.16: Average pellet transect data for Mountain - Big Sagebrush and Mountain - Browse study sites in WMU 23, Monroe.

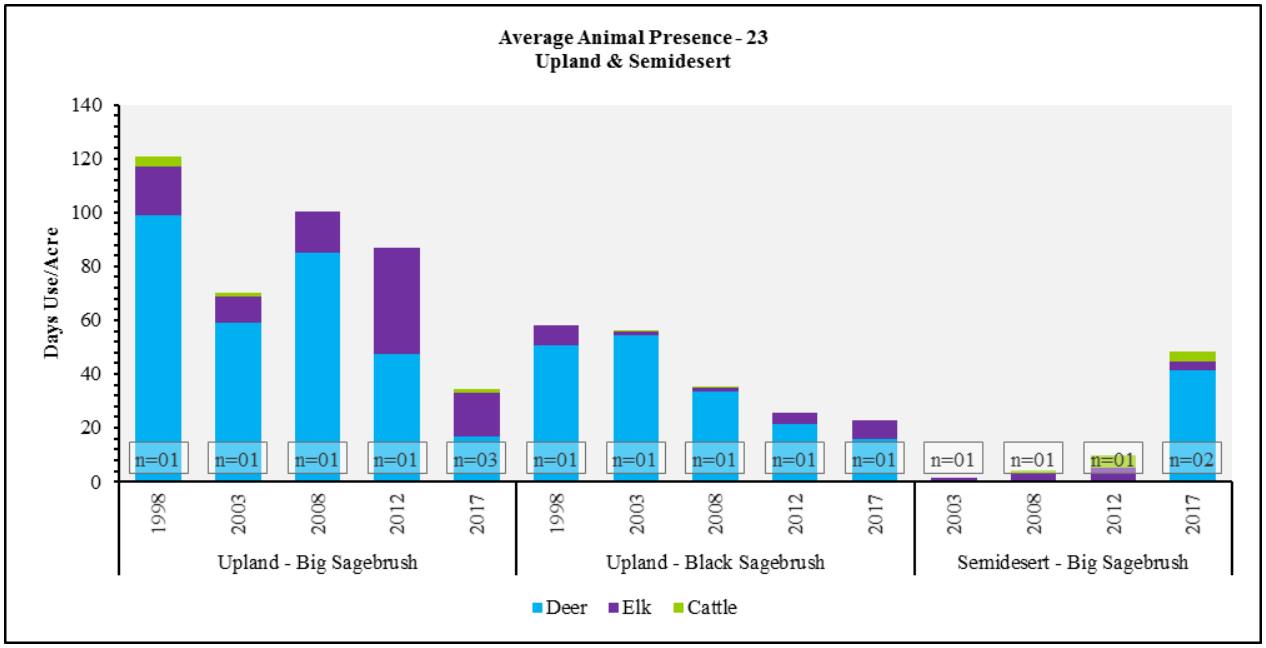
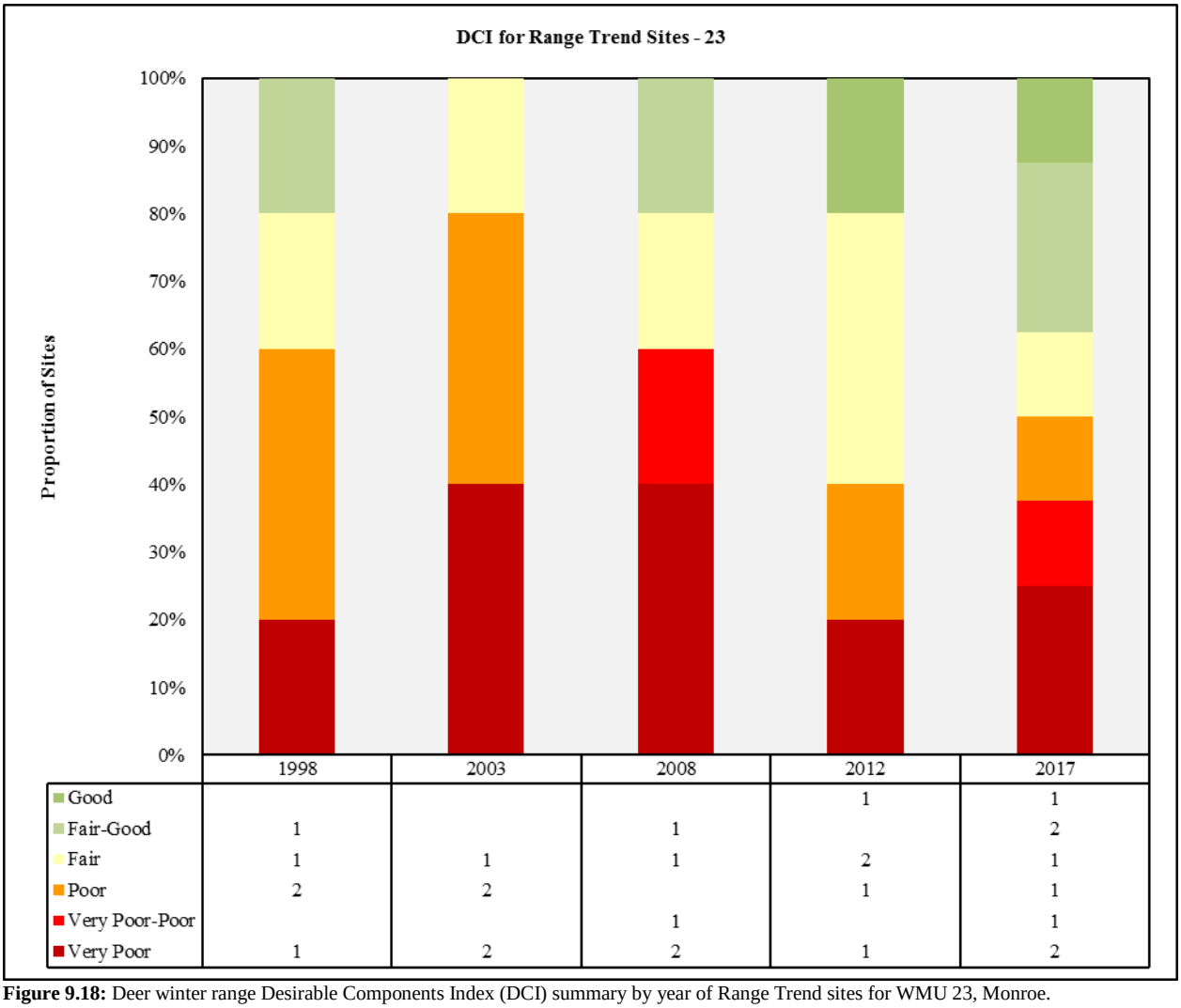


Figure 9.17: Average pellet transect data for Upland - Big Sagebrush, Upland - Black Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 23, Monroe.

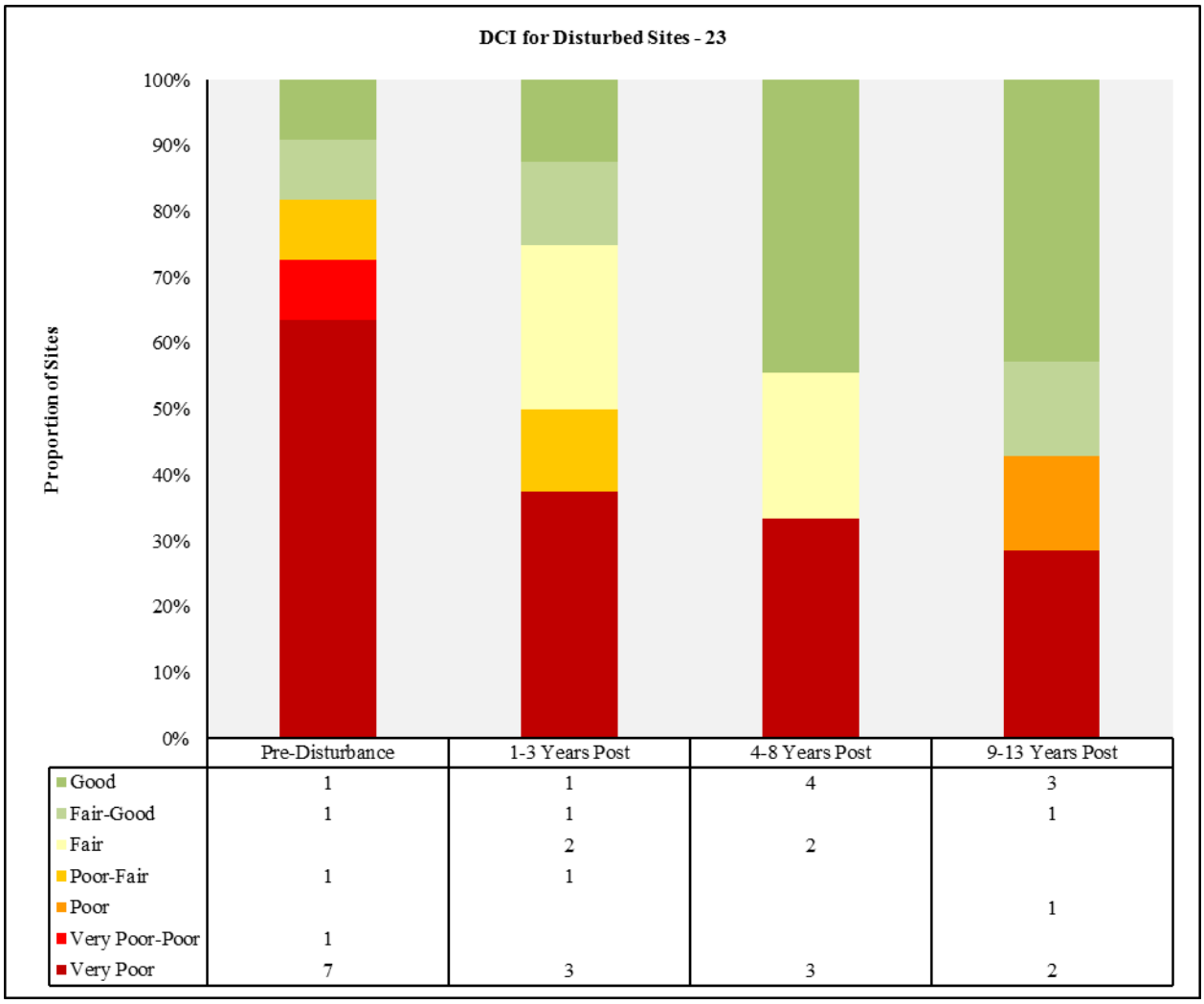
Deer Winter Range Condition Assessment

The condition of deer winter range within the Monroe management unit has continually changed on the sites sampled since 1998. The active Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the 2017 sample year (**Figure 9.18**, **Table 9.9**). Bear Ridge improved to good condition, and Koosharem Canyon improved to fair-good condition. The Burrville Cemetery study is considered to be in fair condition. Smith Canyon improved to poor condition. Thompson Creek was considered to be in very poor-poor condition. Saul Meadow and Corner Spring Canyon were considered as being in very poor condition. High annual grass cover, low perennial grass cover and lack of browse were contributing factors to the lower quality sites. The treated sites have generally shown improvement as time since treatment has increased (**Figure 9.19**). The exceptions to this are Elbow Ranch 1 and Glenwood Chaining which remained in very poor condition, Elbow Ranch 2 and Browns Canyon Drill which remained in good condition, and South Narrows which deteriorated from very poor-poor to very poor (**Table 9.10**). It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1998	2003	2008	2012	2017
Good				1	1
Fair-Good	1		1		2
Fair	1	1	1	2	1
Poor	2	2		1	1
Very Poor-Poor			1		1
Very Poor	1	2	2	1	2

Figure 9.18: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 23, Monroe.



	Pre-Disturbance	1-3 Years Post	4-8 Years Post	9-13 Years Post
Good	1	1	4	3
Fair-Good	1	1		1
Fair		2	2	
Poor-Fair	1	1		
Poor				1
Very Poor-Poor	1			
Very Poor	7	3	3	2

Figure 9.19: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 23, Monroe.

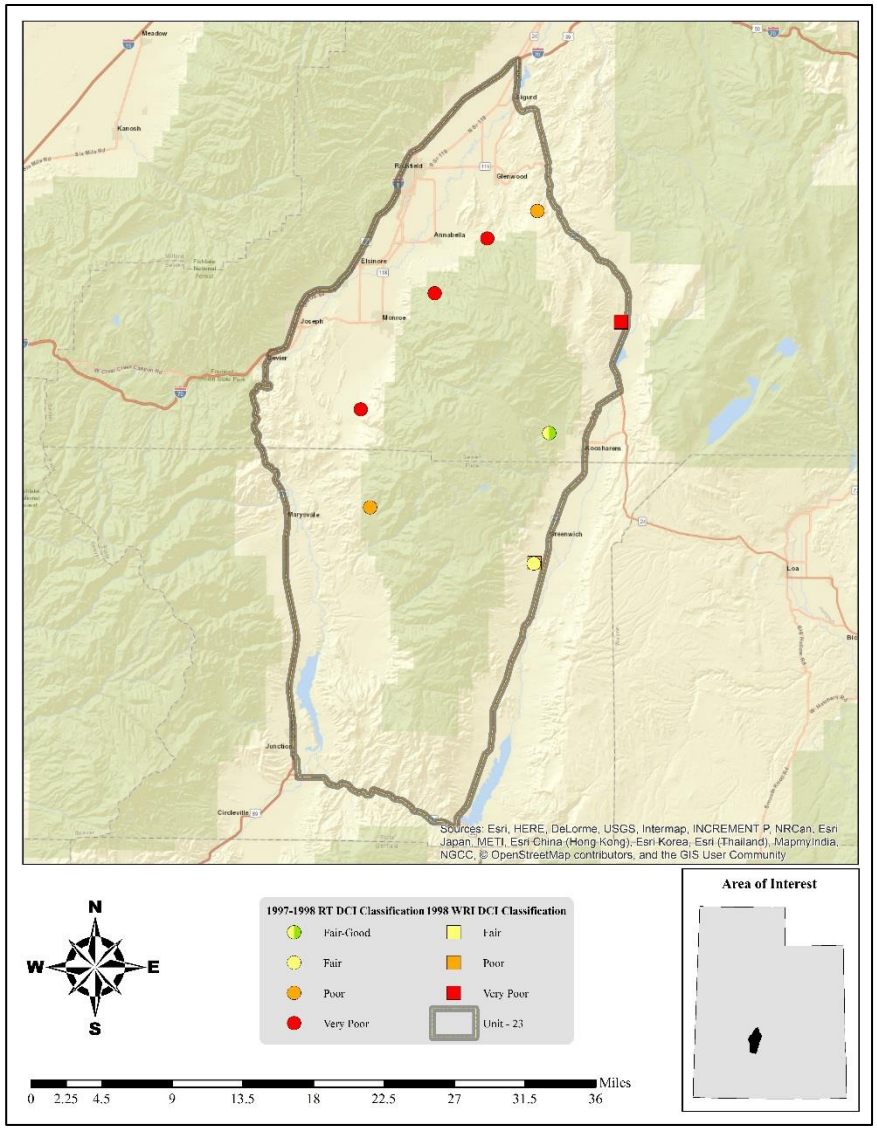
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
23-1	1998	10.7	4.8	3.3	21.8	-0.3	1.6	0.0	**41.9**	**P**
23-1	2003	9.0	4.0	2.5	14.0	0.0	0.8	0.0	**30.2**	**VP**
23-1	2008	10.9	4.8	0.0	13.4	-0.1	1.0	0.0	**30.0**	**VP**
23-1	2012	8.1	14.6	9.8	19.0	-0.1	7.6	0.0	**59.0**	**F**
23-1	2017	16.0	15.0	2.6	30.0	-0.6	6.2	0.0	**69.2**	**G**
23-2	1998	15.9	1.8	4.5	14.8	-8.7	0.0	0.0	**28.3**	**VP**
23-2	2003	15.0	6.6	15.0	14.4	-4.4	0.0	0.0	**46.6**	**P**
23-2	2008	15.0	3.9	5.0	16.0	-4.2	0.0	0.0	**35.7**	**VP-P**
23-2	2012	20.8	9.6	2.0	16.8	-7.7	0.0	0.0	**41.4**	**P**
23-2	2017	16.8	7.2	1.0	6.0	-20.0	0.0	0.0	**11.0**	**VP**
23-3*	1998	5.3	0.0	0.0	23.4	-0.2	2.6	0.0	**31.1**	**VP**
23-3*	2003	5.4	0.0	0.0	10.6	-0.2	3.8	0.0	**19.6**	**VP**
23-3*	2008	5.3	0.0	0.0	12.4	-0.2	2.4	0.0	**19.8**	**VP**
23-3*	2012	5.1	0.0	0.0	14.0	-0.3	2.6	0.0	**21.4**	**VP**
23-4*	1998	0.0	0.0	0.0	2.8	-6.8	2.2	0.0	**-1.8**	**VP**
23-4*	2003	3.1	0.0	0.0	8.0	-18.8	0.0	0.0	**-7.7**	**VP**
23-4*	2008	4.1	0.0	0.0	19.2	-10.7	0.0	0.0	**12.6**	**P**
23-4*	2012	7.9	13.6	14.6	18.2	-13.1	0.2	0.0	**41.3**	**F**
23-5	1998	30.0	10.2	3.2	10.0	-7.9	5.0	0.0	**50.5**	**P**
23-5	2003	30.0	1.9	0.4	3.0	-12.9	2.4	0.0	**24.8**	**VP**
23-5	2008	1.4	0.0	0.0	2.4	-13.5	10.0	0.0	**0.3**	**VP**
23-5	2012	19.9	15.0	15.0	1.4	-20.0	1.6	0.0	**32.9**	**VP**
23-5	2017	30.0	15.0	13.2	2.4	-20.0	3.8	0.0	**44.4**	**P**
23-6	1998	30.0	9.2	6.7	25.0	0.0	0.6	0.0	**71.4**	**F-G**
23-6	2003	30.0	9.1	4.0	13.8	0.0	0.2	0.0	**57.1**	**F**
23-6	2008	30.0	2.7	7.7	17.4	0.0	1.2	0.0	**59.0**	**F**
23-6	2012	30.0	10.6	4.5	19.6	0.0	0.2	0.0	**64.8**	**F**
23-6	2017	30.0	11.1	1.8	26.6	-0.2	2.6	0.0	**72.0**	**F-G**
23-7	2017	16.9	7.8	0.5	29.8	-20.0	0.2	0.0	**35.2**	**VP-P**
23-8	2017	10.2	14.4	5.0	30.0	-3.2	0.8	0.0	**57.2**	**F**
23-9	2017	3.0	0.0	0.0	2.0	-20.0	0.0	0.0	**-15.0**	**VP**
23R-2	1998	28.5	9.9	3.0	1.6	0.0	0.0	0.0	**43.0**	**F**
23R-2	2003	20.8	-9.6	2.0	0.2	0.0	0.0	0.0	**13.4**	**P**
23R-2	2004	26.8	-1.8	2.0	0.0	0.0	0.0	0.0	**27.0**	**P-F**
23R-2	2008	14.9	6.0	15.0	3.2	0.0	6.6	0.0	**45.7**	**F-G**
23R-2	2012	26.3	8.7	12.0	5.0	0.0	0.0	0.0	**52.0**	**G**
23R-2	2017	21.0	9.3	7.0	5.4	0.0	0.8	0.0	**43.5**	**F-G**

Table 9.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 23, Monroe.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

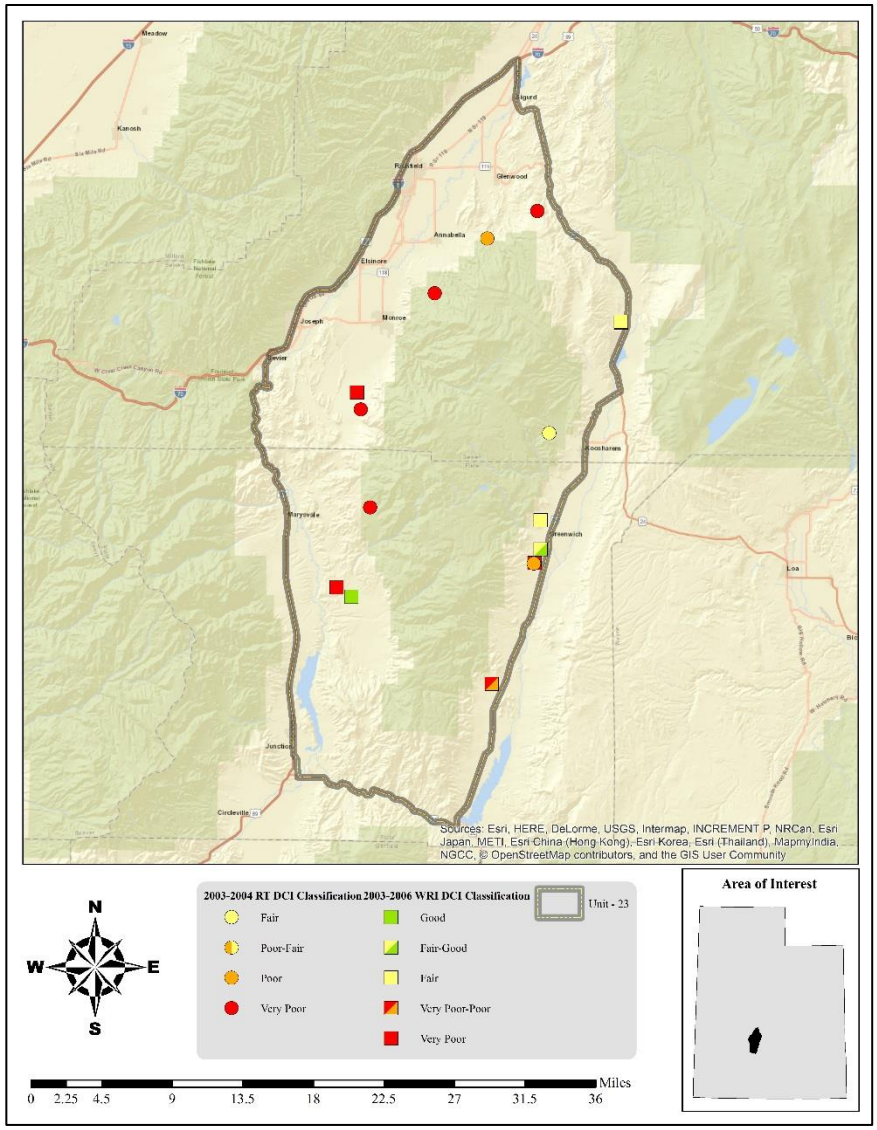
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
23R-1	1998	0.9	0.0	0.0	9.4	0.0	10.0	0.0	**20.3**	**P**
23R-1	2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**VP**
23R-1	2004	0.0	0.0	0.0	0.0	0.0	0.4	0.0	**0.4**	**VP**
23R-1	2008	0.0	0.0	0.0	15.0	0.0	8.4	0.0	**23.4**	**P-F**
23R-1	2012	5.0	0.0	0.0	21.4	0.0	0.4	0.0	**26.8**	**P-F**
23R-3	1999	4.6	0.0	0.0	16.4	-6.5	10.0	0.0	**24.6**	**VP**
23R-3	2003	6.3	9.9	4.5	30.0	-1.1	10.0	0.0	**59.6**	**F**
23R-3	2008	11.4	5.7	2.5	30.0	-1.1	10.0	0.0	**58.5**	**F**
23R-3	2012	13.6	14.1	15.0	30.0	-0.8	3.2	0.0	**75.2**	**G**
23R-4	1999	21.0	8.7	2.5	15.6	-2.0	10.0	0.0	**55.8**	**F**
23R-4	2003	29.4	6.9	0.0	17.8	-0.5	10.0	0.0	**63.6**	**F-G**
23R-4	2012	30.0	9.9	9.5	16.8	-2.3	7.0	0.0	**71.0**	**G**
23R-5	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**VP**
23R-5	2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**VP**
23R-5	2017	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**	**VP**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
23R-6	2004	17.6	15.0	12.5	2.2	0.0	5.2	-2.0	**50.5**	**G**
23R-6	2012	30.0	15.0	15.0	0.0	0.0	0.0	0.0	**60.0**	**G**
23R-6	2017	21.3	15.0	11.5	0.0	0.0	1.2	0.0	**49.0**	**G**
23R-7	2004	0.0	0.0	0.0	0.2	0.0	9.4	0.0	**9.6**	**VP-P**
23R-7	2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**VP**
23R-7	2012	0.3	0.0	0.0	1.0	0.0	1.6	0.0	**2.9**	**VP**
23R-7	2016	0.1	0.0	0.0	0.0	0.0	3.0	0.0	**3.1**	**VP**
23R-8	2004	30.0	15.0	0.5	0.0	0.0	2.6	0.0	**48.1**	**G**
23R-8	2007	24.8	15.0	15.0	0.0	0.0	0.4	0.0	**55.2**	**G**
23R-8	2012	30	15	15	1.8	0	0	0	**61.8**	**G**
23R-8	2016	30	15	0.5	1.8	0	1.2	0	**48.5**	**G**
23R-9	2005	2.9	0.0	0.0	13.6	-11.5	0.8	0.0	**5.9**	**VP**
23R-9	2010	16.8	15.0	5.3	22.4	-10.7	0.2	0.0	**49.0**	**G**
23R-9	2013	10.6	15.0	10.6	21.2	-11.5	0.0	0.0	**46.0**	**F-G**
23R-9	2017	14.2	14.8	15.0	25.4	-12.7	0.0	0.0	**56.7**	**G**
23R-11	2006	27.1	5.1	12.0	0.8	0.0	0.2	0.0	**45.2**	**F-G**
23R-11	2011	14.0	15.0	15.0	2.2	0.0	2.2	0.0	**48.4**	**G**
23R-11	2016	21.7	14.7	15.0	3.0	0.0	3.0	0.0	**57.4**	**G**
23R-12	2011	0.0	0.0	0.0	0.4	-0.9	0.2	0.0	**-0.3**	**VP**
23R-12	2014	0.1	0.0	0.0	11.0	-8.3	3.8	0.0	**6.6**	**VP**

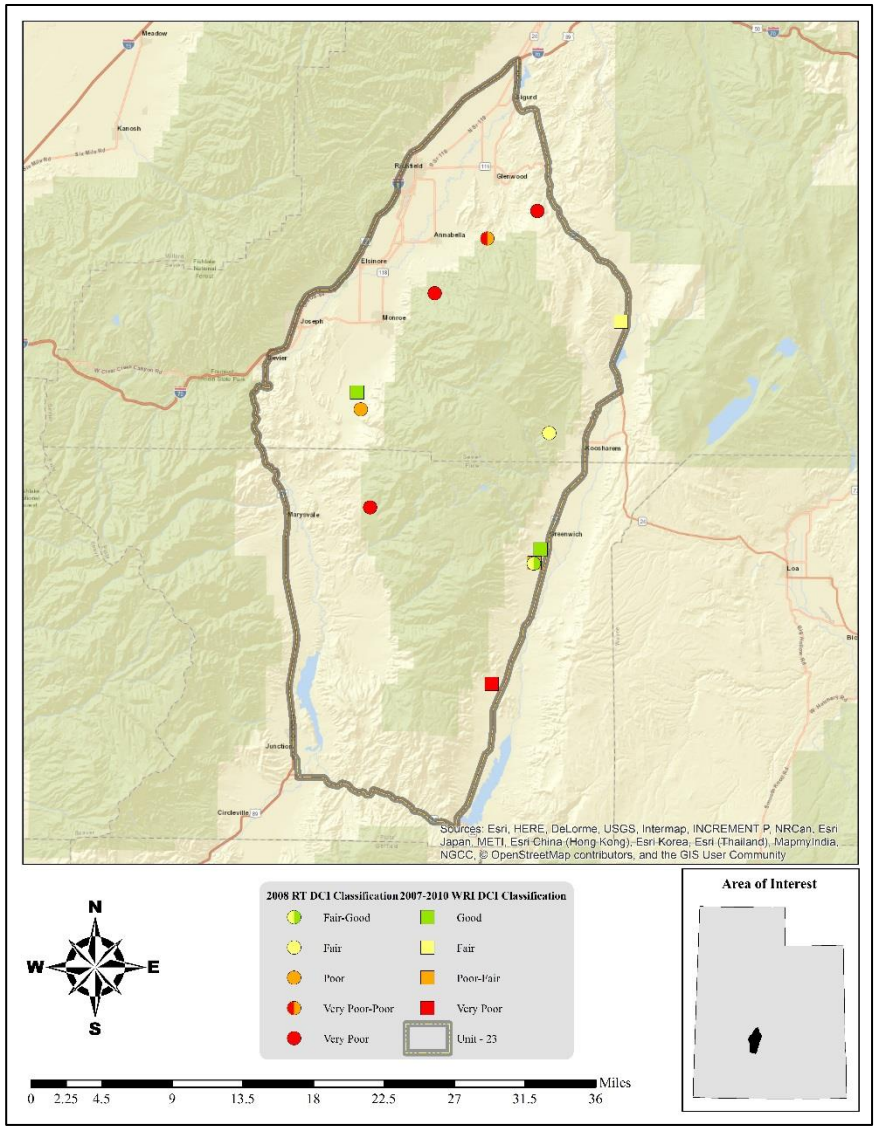
Table 9.10: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 23, Monroe.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



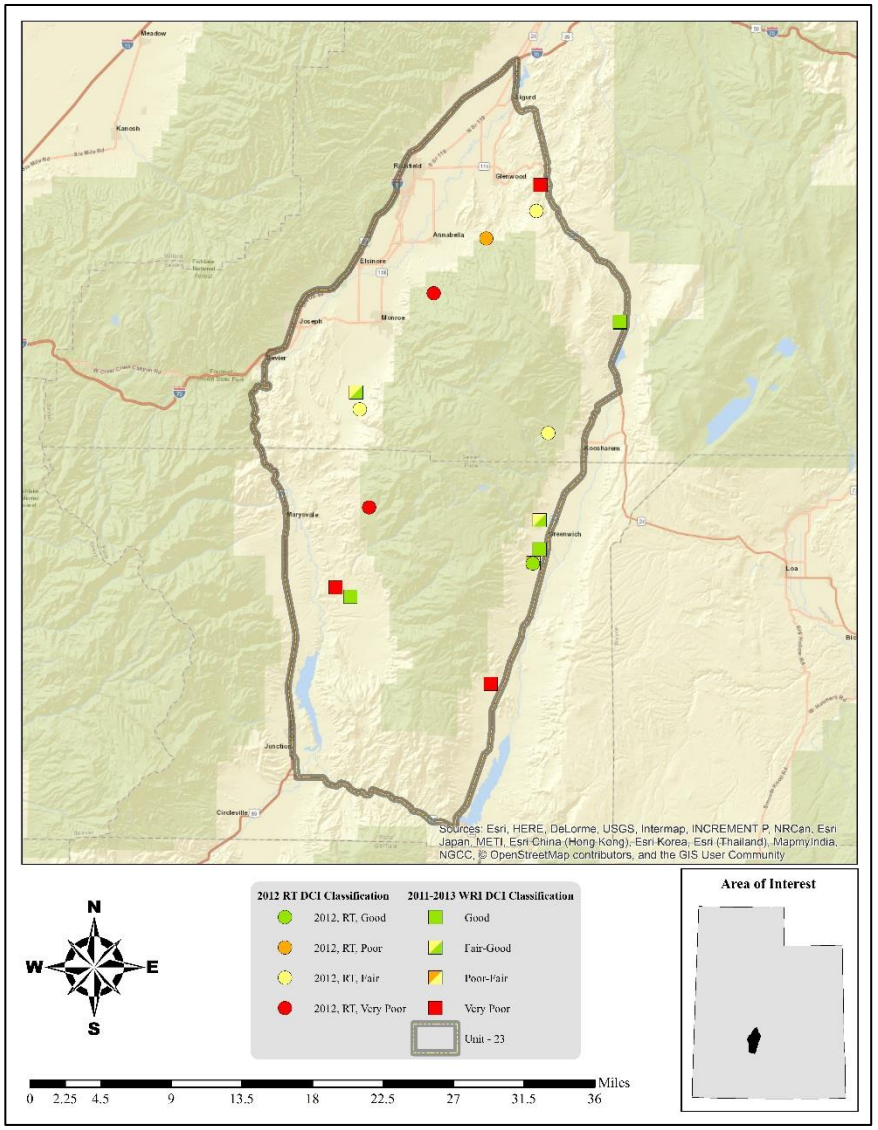
Map 9.7: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 23, Monroe.



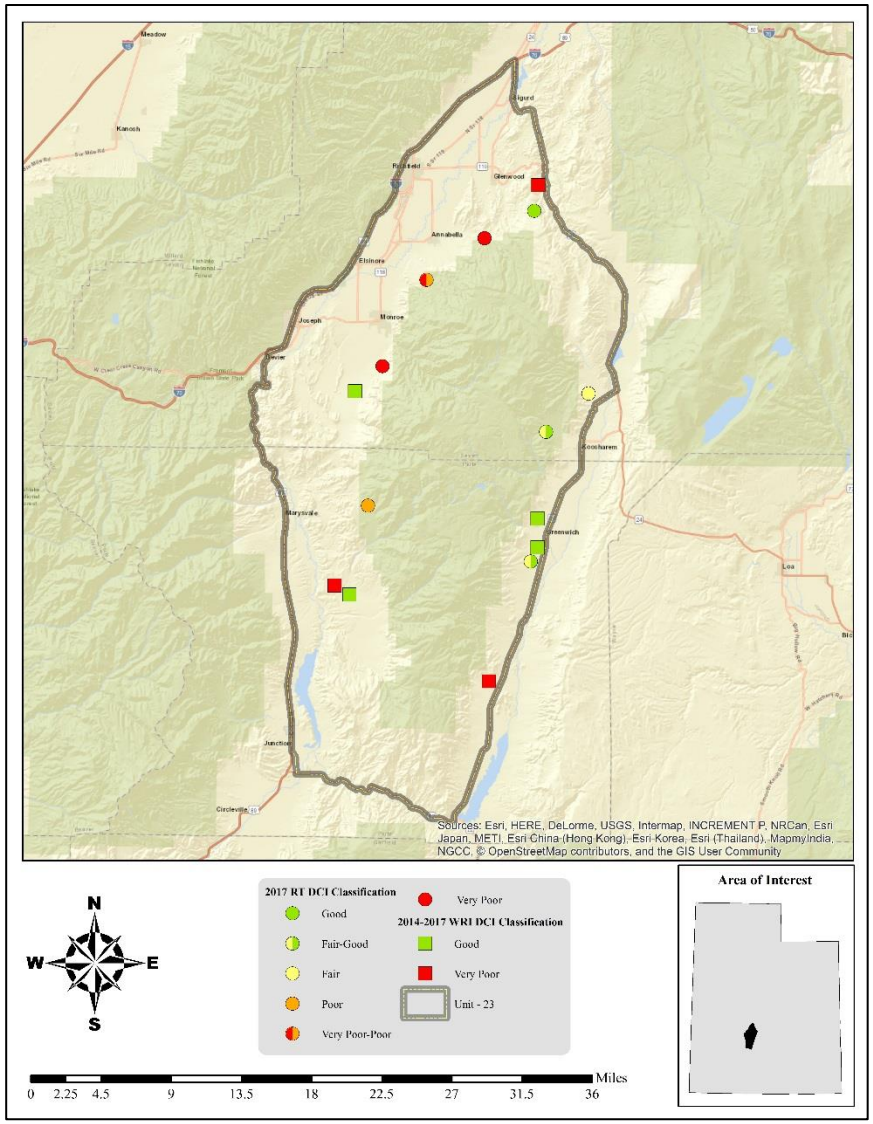
Map 9.8: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 23, Monroe.



Map 9.9: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 23, Monroe.



Map 9.10: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 23, Monroe.



Map 9.11: 2017 Desirable Components Index (DCI) ranking distribution by study site for WMU 23, Monroe.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
23-1	Bear Ridge	Annual Grass	Low	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
23-2	Saul Meadow	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
23-5	Smith Canyon	Annual Grass	High	Increased Fire Potential
23-6	Koosharem Canyon	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
23-7	Thompson Creek	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
23-8	Burrville Cemetery	Annual Grass	Medium	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
23-9	Corner Spring Canyon	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
23R-2	Greenwich Native	Annual Grass	Low	Increased Fire Potential
23R-5	Elbow Ranch 1	No threats identified		
23R-6	Elbow Ranch 2	No threats identified		
23R-9	Poverty Dixie	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species

Table 9.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 23, Monroe. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

Mountain (Big Sagebrush)

The study that is classified as a Mountain (Big Sagebrush) ecological site is considered to be in poor condition for deer winter range on the Monroe Unit. In general, these ecological communities support good shrub populations that can provide valuable browse for wildlife. Introduced annual grasses are a threat in the herbaceous understory of this study site: high cover of these grasses can change plant community dynamics and increase fuel loads. High fuel loads can lead to increased wildfire regimes.

Monitoring of areas with high cover of annual grasses is recommended, and if high levels remain consistent, treatments for their reduction may be needed. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and native species should be given preference when possible.

Mountain (Browse)

The study within the Mountain (Browse) ecological type is considered to be in fair-good condition for big game winter range on the Monroe Unit. Studies of this ecological type support robust shrub communities that provide browse for animals during the winter. Limited pinyon-juniper encroachment is occurring on the Koosharem Canyon site, which may lead to reduced understory and shrub vigor. Where necessary, treatments to reduce conifer encroachment (e.g. bullhog, chaining, lop and scatter, etc.) are recommended.

Annual grass contributes some cover on the Koosharem Canyon study site. These introduced annual species can shift the dynamics of the plant community and lead to less biodiversity. In addition, fuel loads are increased with high levels of annual grass, which in turn are associated with more frequent wildfires. If reseeding is necessary to restore herbaceous species after any treatments, care should be taken in species selection and preference should be given to native grass species when possible.

Upland (Big Sagebrush)

The studies that are classified as Upland (Big Sagebrush) ecological sites are considered to be in very poor to fair condition for deer winter range on the Monroe Management Unit. These communities support sagebrush populations which provide browse for wintering big game animals. The Thompson Creek and Saul Meadow studies have some pinyon-juniper encroachment and/or infill occurring, which can lead to reduced understory and shrub vigor. It is recommended that tree-removing disturbances (e.g. bullhog, chaining, lop and scatter,

etc.) take place in areas where conifer reduction would be feasible and beneficial. Care should be taken to select methods that will not increase annual grass cover.

In addition, large amounts of annual grasses have been observed on the Saul Meadow study, placing the site at an increased risk for wildfire. Other study sites within this ecological type have lesser but still significant cover of annual grasses; treatments to reduce these grasses may be needed in some areas. These sites are further threatened by the presence of introduced perennial grasses, as they can lead to reduced understory diversity and productivity. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Upland (Black Sagebrush)

The Upland (Black Sagebrush) ecological site is considered to be in good condition for deer winter range on the Monroe Management Unit. This community has robust mixed browse populations that support big game animals during winter months. Some pinyon-juniper infill is occurring on this study site which has the potential to lead to reduced understory and shrub productivity. Treating areas where conifer removal would be beneficial (e.g. bullhog, chaining, lop and scatter, etc.) is recommended. Care should be taken to select methods that will not increase annual grass cover.

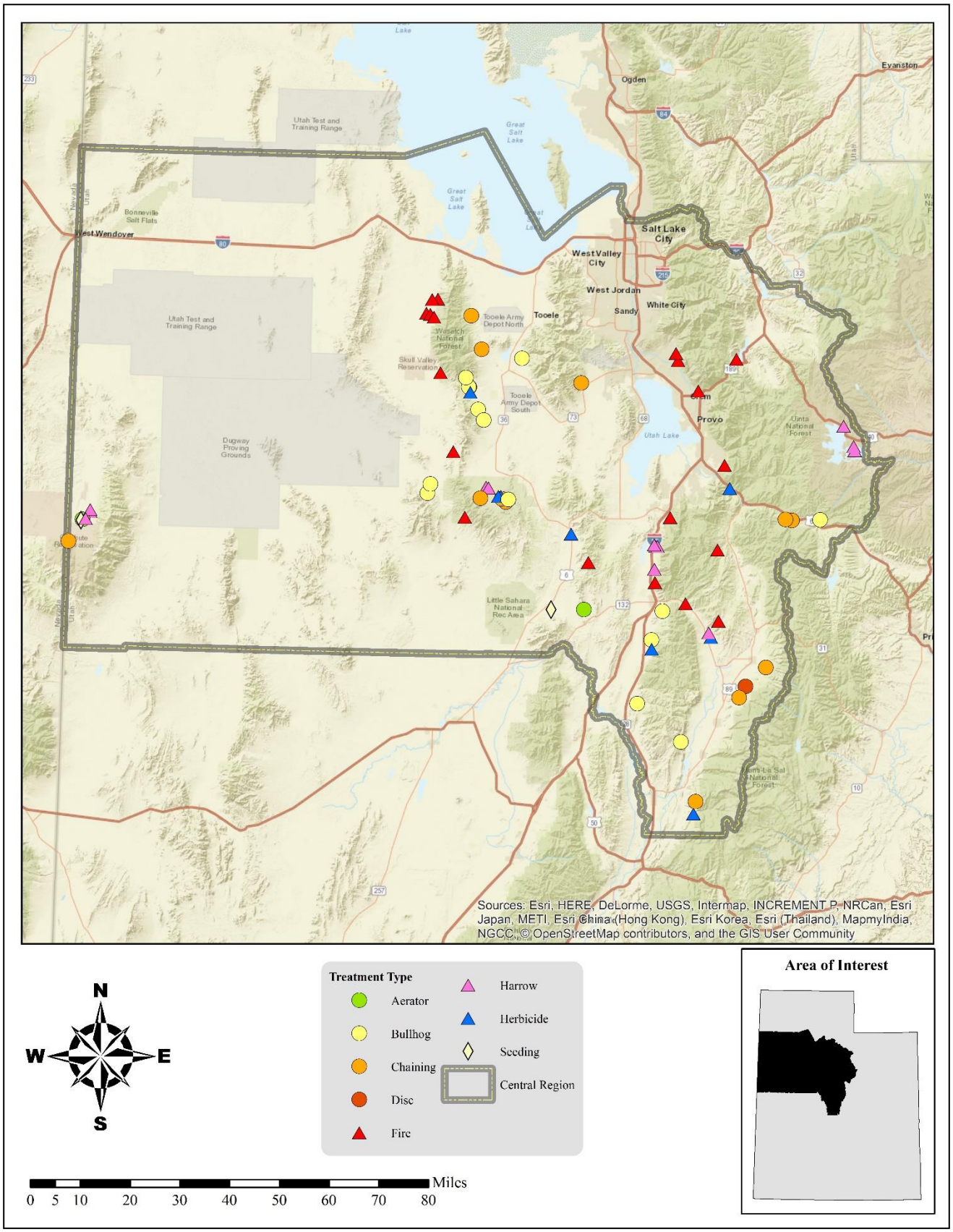
Annual and perennial grass species are present on the Bear Ridge study and are classified as low-level threats. Although cover of annual grasses is currently low, an increase in future years may exacerbate the risk of wildfire. In addition, introduced perennial grasses have the potential to lead to reduced understory diversity and productivity. If reseeding is necessary following treatments to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Semidesert (Big Sagebrush)

The studies classified as Semidesert (Big Sagebrush) ecological sites are considered to be in very poor to fair-good condition for deer winter range. The plant communities that are located within this ecological type support sagebrush that provides browse for wintering big game animals. Pinyon-juniper encroachment is occurring on the Corner Spring Canyon study site which may lead to reduced understory and shrub productivity. Tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in areas where they would be beneficial and appropriate. However, care should be taken to select methods that will not increase annual grass cover.

While the Greenwich Native site has low amounts of annual grass cover, they provide a majority of the herbaceous cover on the Corner Spring Canyon and could put these sites at risk for future wildfire. If reseeding is necessary following treatments to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

10. CENTRAL REGION – TREATED OR DISTURBED SUMMARY



Study Trend Summary (Treated/Disturbed Sites)

Aerator

Two study sites [Deep Creek Aerator (19R-2) and Furner Valley (21A-18)] have been treated with an aerator and are considered to be upland ecological sites. Deep Creek Aerator is located west of the Deep Creek Mountains in western Utah and just north of Lower Rocky Road. The Furner Valley site is located at the south edge of the East Tintic Mountains between the Tintic and Juab Valleys. The target of aerator treatments is usually to rejuvenate sagebrush cover in order to restore sagebrush health and herbaceous understory.

Shrubs/Trees: The dominant browse species differ between study sites; antelope bitterbrush (*Purshia tridentata*) contributes a majority of the browse cover on the Furner Valley site, while the Deep Creek Aerator study is mainly dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Cover of sagebrush exhibited an initial decrease in the first sample year after treatment, a trend which is driven solely by the Deep Creek Aerator study. One should note the differences in number of study sites (the 'n value') from year to year, as fluctuations in cover may not be driven by both studies. Overall shrub cover has increased steadily following the second post-treatment sampling. Most of the sagebrush cover has been provided by the Deep Creek Aerator study, while a majority of the preferred browse cover (excluding sagebrush) has been contributed by the Furner Valley study (**Figure 10.1**). The preferred browse population has been mainly comprised of mature individuals both pre- and post-treatment. Recruitment of young individuals exhibited an initial increase during the first post-treatment sampling, but decreased in subsequent sample years (**Figure 10.4**). Utilization of preferred browse has increased overall: again, these trends are in part driven by the differing number of studies from year to year (**Figure 10.5**).

Tree cover and density have been entirely contributed by the Furner Valley study. Although there was a noticeable increase between the third and fourth post-categories, it is partially due to the exclusion of the Deep Creek Aerator site in the fourth sampling average because of a lack of data. Density has remained largely stable overall (**Figure 10.2**, **Figure 10.3**).

Herbaceous Understory: Overall herbaceous cover has fluctuated following treatment. Cover and frequency decreased in the first post-treatment sample year: this is due lack of data for the Furner Valley study. Perennial and annual grasses have been co-dominant in many post-treatment sample years. Perennial and annual forbs have remained relatively rare in general. However, annual forbs exhibited a noticeable increase in both cover and frequency during the fourth post-treatment sampling: this increase can be entirely attributed to the Furner Valley study as there is not yet post-treatment category four data for the Deep Creek Aerator study (**Figure 10.6**, **Figure 10.7**).

Occupancy: Average pellet transect data indicates that the identity of the primary occupants has varied from year to year and that occupancy has fluctuated. Deer were the primary occupants prior to treatment and in the fourth post-treatment sampling, while deer/antelope were the sole occupants in the first sample year following treatment. Horse pellet groups were the most abundant 4-8 years after treatment, and cattle were the primary occupants during the third post-treatment sampling. As was discussed in previous sections, care should be taken when interpreting the relevant graph as the number of studies (the 'n value') varies from year to year (**Figure 10.8**).

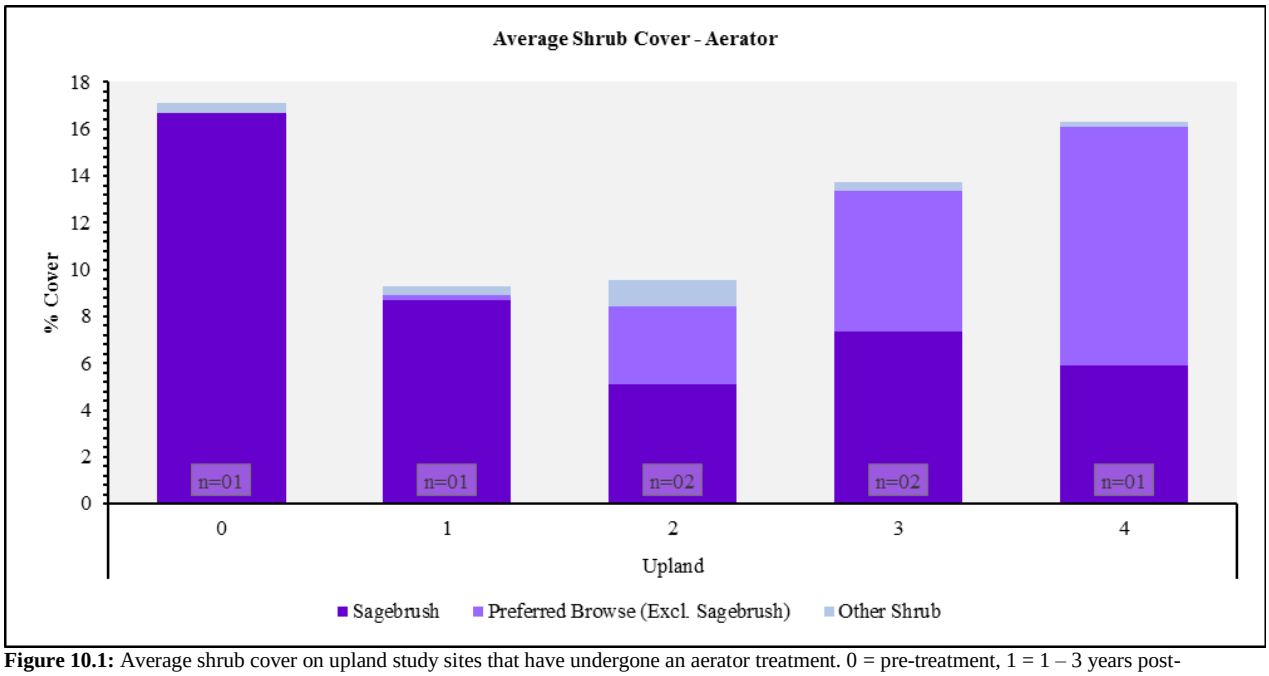


Figure 10.1: Average shrub cover on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

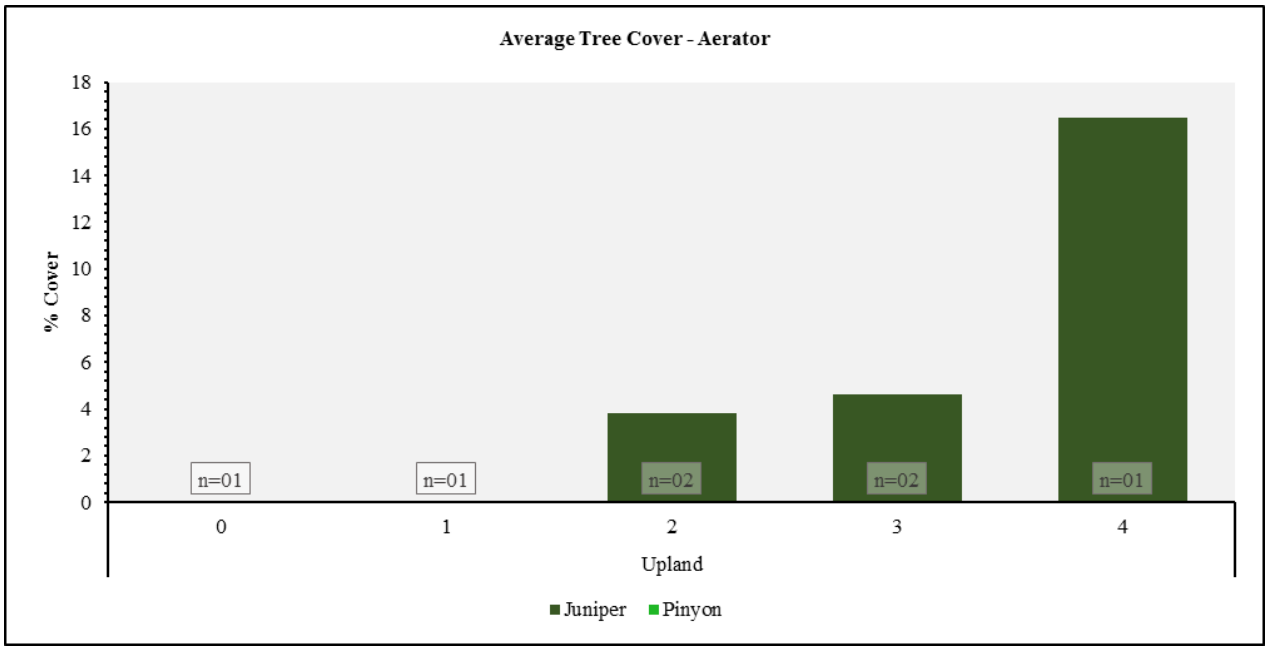


Figure 10.2: Average tree cover on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

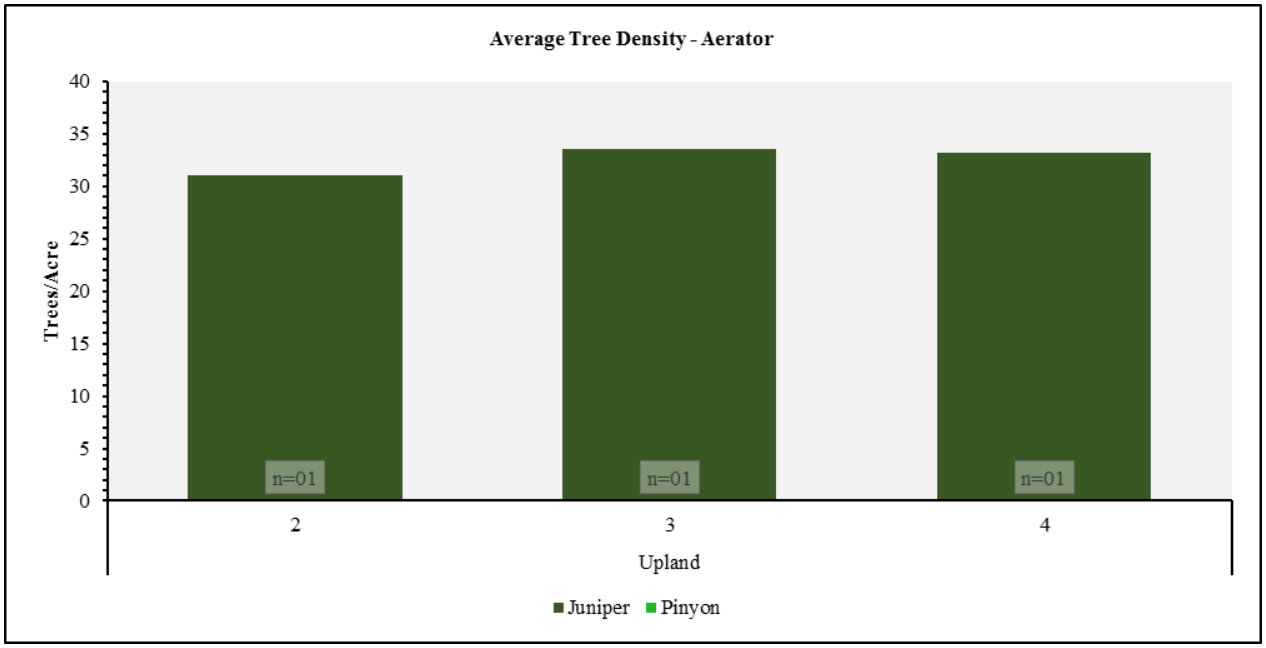


Figure 10.3: Average tree density on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

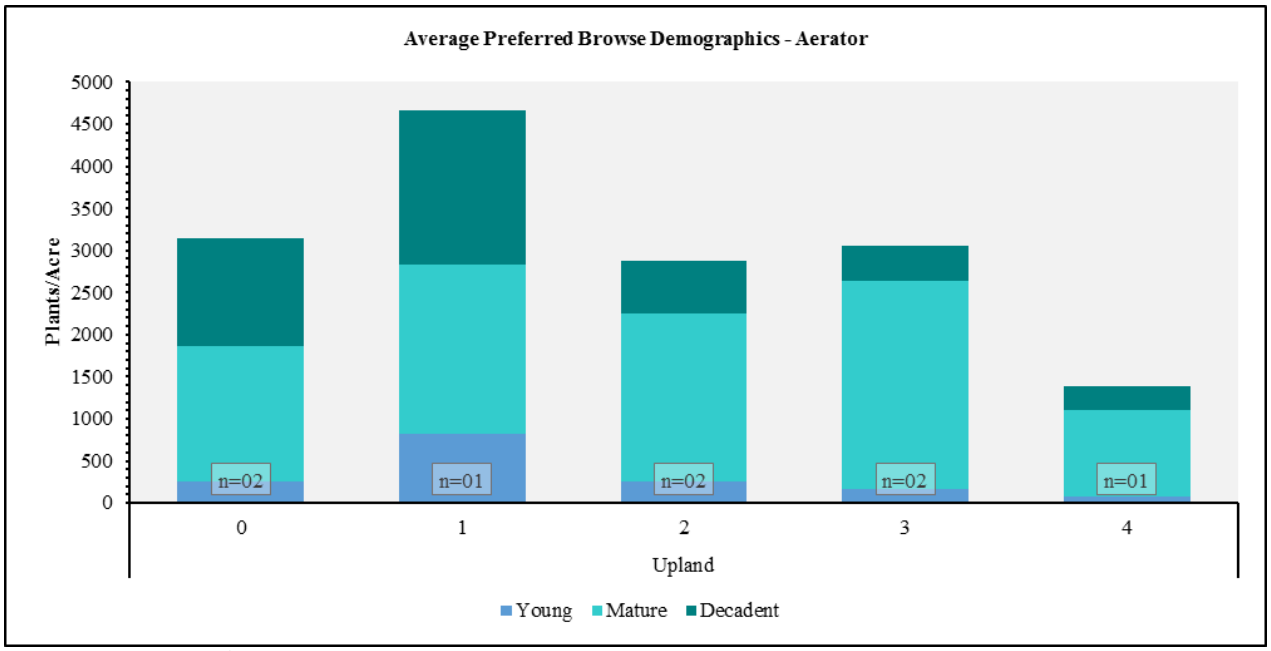


Figure 10.4: Average preferred browse demographics on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

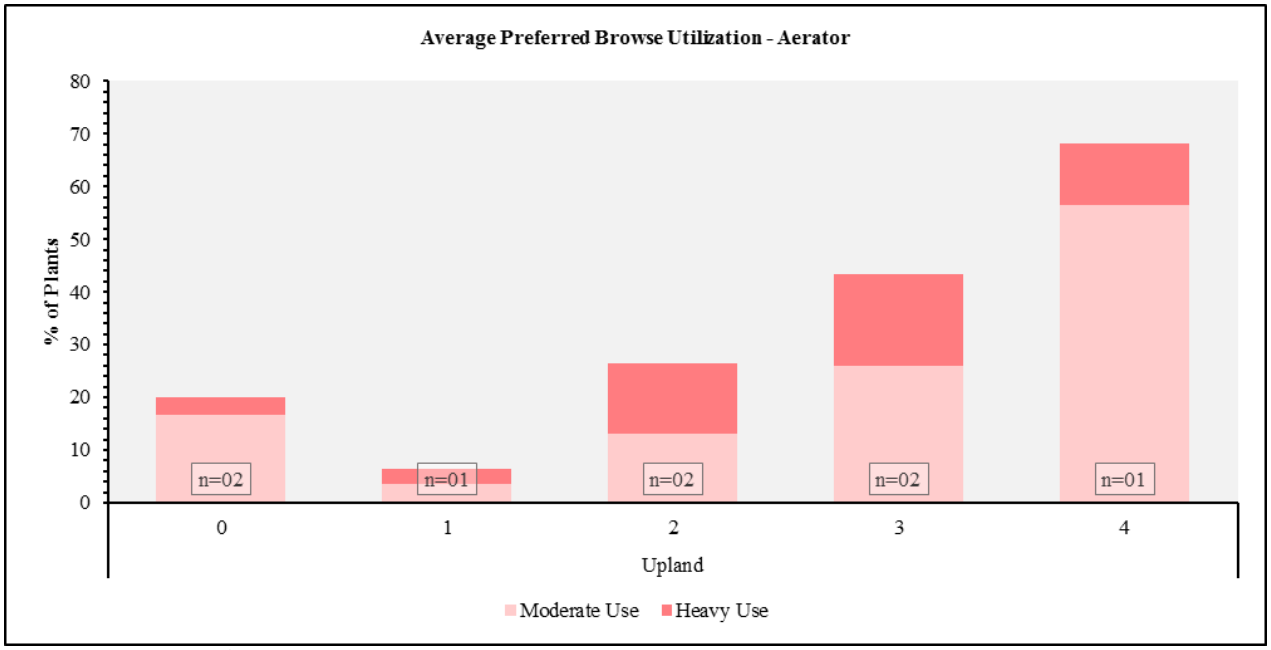


Figure 10.5: Average preferred browse utilization on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

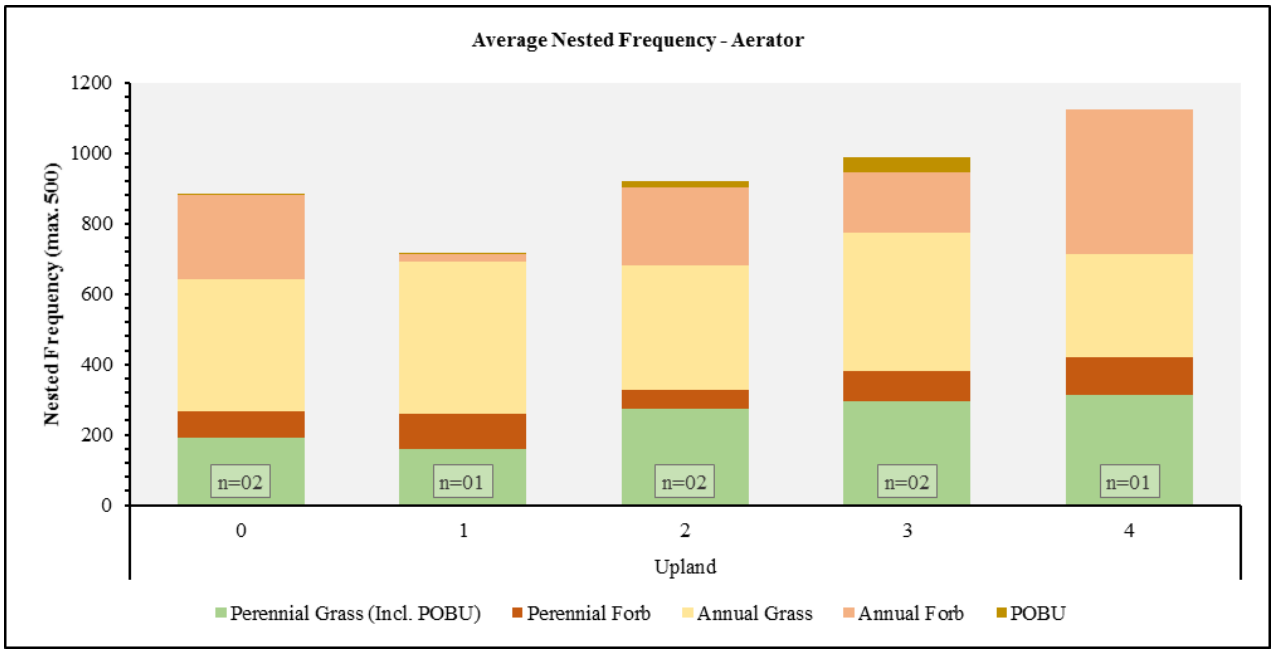


Figure 10.6: Average herbaceous cover on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

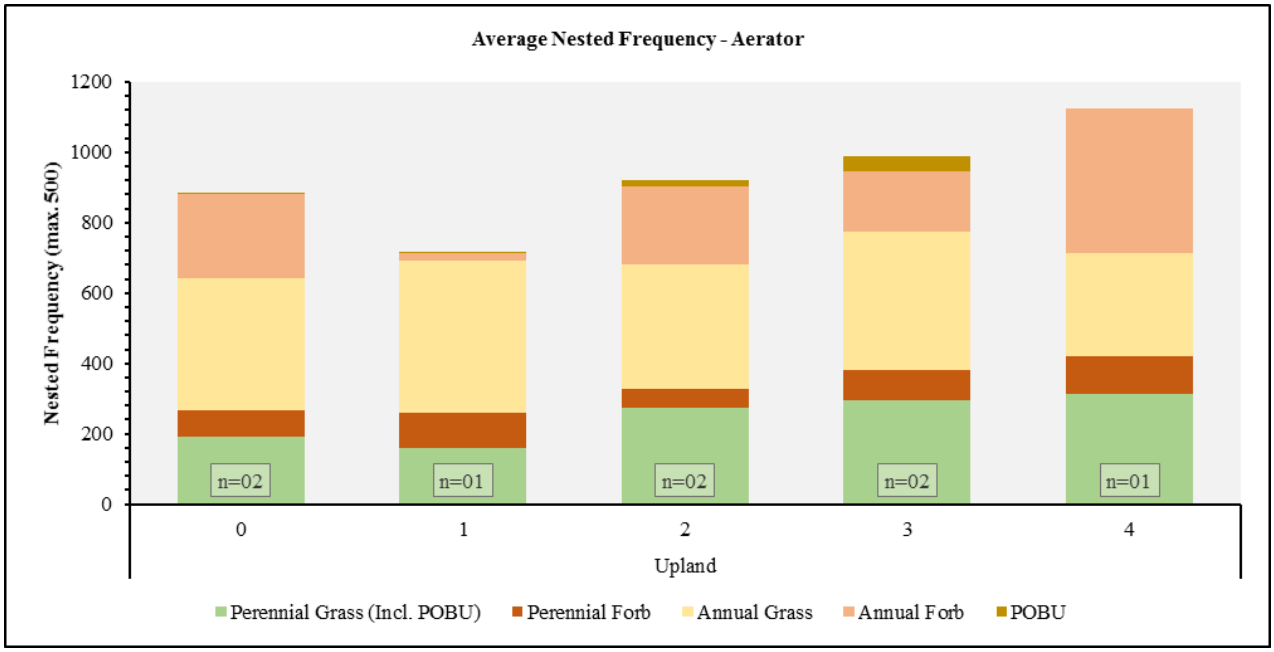


Figure 10.7: Average nested frequency of herbaceous species on upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

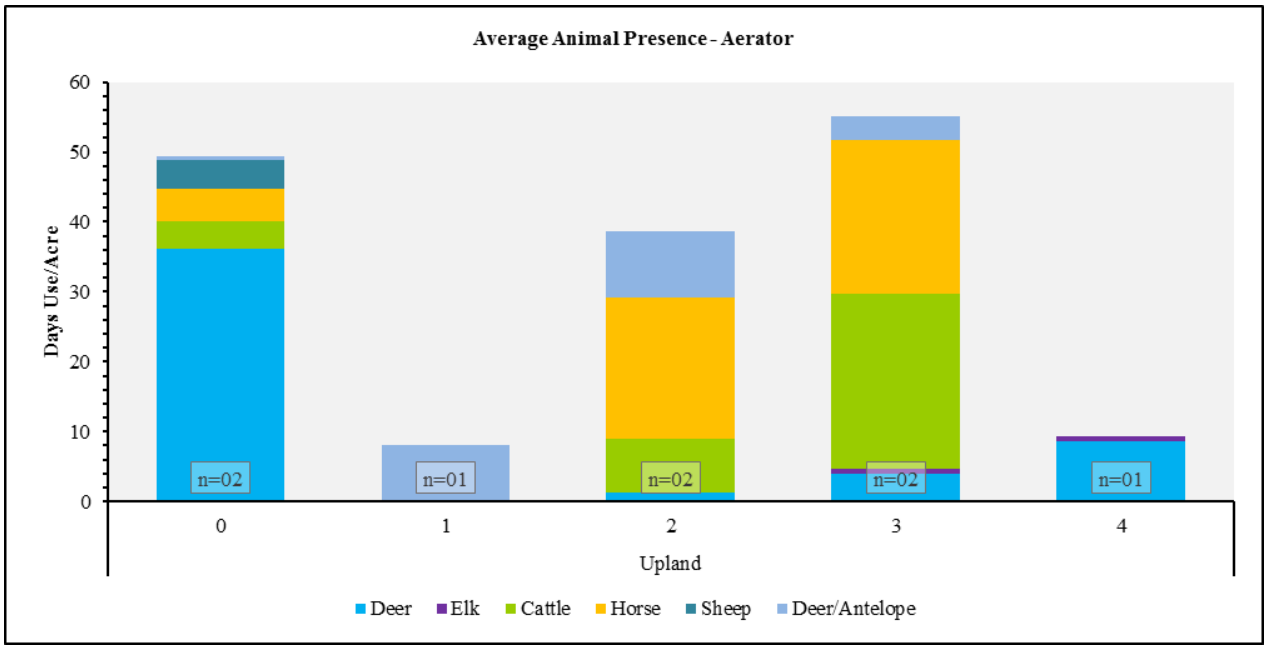


Figure 10.8: Average pellet transect data of upland study sites that have undergone an aerator treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 18 – 23 years post-treatment.

Bullhog

There are eighteen study sites that were treated with a bullhog during the report period. Of these studies, three [Triangle Ranch (16A-20), Starvation Mountain Brush (16B-9), and Big Hollow Bullhog (18R-4)] are considered to be mountain ecological sites and 15 [Flat Canyon (16A-19), Levan North (16A-22), Maple Canyon (16A-24), Dry Creek Chaining (16B-4), Hilltop (16B-11), Indian Creek Road (17-70), Hatch Ranch (18A-30), South of Soldier Canyon (18B-6), East Onaqui (18R-1), Clover Bullhog Drill (18R-2), Clover Bullhog Aerial (18R-3), East Faust Creek (18R-9), West Lee's Creek (19R-1), James Ranch Bullhog (19R-11), and East Vernon Bullhog (19R-22)] are considered to be upland ecological sites.

The Triangle Ranch study site is located in the foothills southeast of Nephi while Starvation Mountain Brush can be found south of US Highway 6 and east of Starvation Road. The Big Hollow Bullhog site can be found just west of Big Hollow on the eastern side of the Onaqui Mountains. The Flat Canyon study is located near the mouth of Flat Canyon and just east of Skinner Peaks, while Levan North is situated north of the town of Levan. The Maple Canyon site is located on the benches to the west of the town of Manti. The Dry Creek Chaining study site can be found on the foothills just north of Dry Creek and northeast of the community of Indianola, and the Hilltop study site is situated north of the city of Fairview and just east of US Route 89. Indian Creek Road is located just north of Indian Creek Road and northeast of the Tie Fork Rest Area. The Hatch Ranch site is located about 3.75 miles south of the town of Terra on the western side of the Onaqui Mountains. The South of Soldier Canyon study can be found slightly southwest of Soldier Canyon and south of the town of Stockton. East Onaqui is situated at the foot of the eastern slopes of the Onaqui Mountains. The Clover Bullhog Drill and Clover Bullhog Aerial studies are located on the eastern and western sides (respectively) of Leprechaun Road, north of Serviceberry Canyon. The East Faust Creek study can be found at the foot of the Onaqui Mountains and north of East Faust Canyon. West Lee's Creek is located at the base of the Simpson Mountains north of Erickson Pass, and the James Ranch Bullhog study can be found about two miles northeast of the West Lee's Creek site. Finally, the East Vernon Bullhog site is situated just north of Vernon Reservoir.

Shrubs/Trees: Overall cover on mountain ecological sites has exhibited an increase as time since treatment has increased, with sagebrush being the most abundant component in all sample years. This trend is partially due to a variation in number of study sites (the 'n value') in each sample year; for example, data for the third post-

treatment sample year is provided entirely by the Starvation Mountain Brush study. On upland study sites, shrub cover has fluctuated overall and has decreased each sample year following the first post-treatment reading: again, this is at least in part due to the differing number of study sites from year to year. Preferred browse other than sagebrush has provided significant cover in most sample years, largely due to the Flat Canyon, Dry Creek, and Hatch Ranch studies. Other shrub species have been present in varying amounts throughout the study period, but are typically a minor part of the shrub component (**Figure 10.9**). Overall density of preferred browse has increased on mountain study sites, with mature plants being the dominant demographic both prior to and after treatment. Upland study sites have exhibited fluctuating preferred browse populations with mature plants being the most abundant individuals each sample year. The overall density decreased between the second and third post-treatment sampling for the same reasons discussed above (**Figure 10.12**). Utilization of preferred browse on mountain ecological sites has increased, with 74% of plants exhibiting moderate to heavy use in the third post-treatment sample year. Upland utilization has fluctuated, but has mostly been light (**Figure 10.13**).

Tree cover and density has generally decreased on both mountain and upland study sites. The exception to this is the increase in density from pre-treatment levels to those of the most recent sample year on the mountain ecological site. This increase can be attributed entirely to the Big Hollow Bullhog study as it was the only one with data for the second post-treatment category; density on this site increased by 103 trees/acre between the first and second post-treatment samplings (**Figure 10.10**, **Figure 10.11**).

Herbaceous Understory: The herbaceous understory on mountain study sites has decreased in both cover and frequency on mountain sites, but has remained generally stable on upland study sites; it is important to notice the difference in the numbers of studies from sample year to sample year. The overall decrease on mountain sites is driven in part by diminished amounts of undesirable grasses such as bulbous bluegrass (*Poa bulbosa*) and annual species, which is in turn due to the difference in number of study sites: the studies with the most amounts of these species do not yet have data available for the third post-treatment category. Perennial grasses have contributed the most cover of any herbaceous component throughout the study years on both mountain and upland ecological sites. Upland study sites driving this trend vary, but in general, West Lee's Creek contributed the most cover prior to treatment and in the first sample year following treatment, while East Onaqui, Clover Bullhog Drill, and Clover Bullhog Aerial did so during the second and third post-treatment sample years. Perennial and annual forbs have provided relatively moderate amounts of cover in most years; frequency of perennial species has increased overall and that of annual species has exhibited an overall decrease (**Figure 10.14**, **Figure 10.15**).

Occupancy: Pellet group transect data indicates that although average animal presence has fluctuated, it has increased overall on both mountain and upland ecological site. This trend may be somewhat affected by the difference in study numbers as has been mentioned in previous sections, and it would be prudent to take note of this when interpreting the relevant graphs. Mountain study sites have had elk as the primary occupants in most study years except the first post-treatment sample year, in which deer pellet groups were the most abundant: These trends are driven by the Starvation Mountain Brush study. Deer have been the primary occupants on upland study sites in all sample years except the first post-treatment year, in which a majority of the pellet groups were provided by deer/antelope (all of which were observed on the West Lee's Creek study site) (**Figure 10.16**).

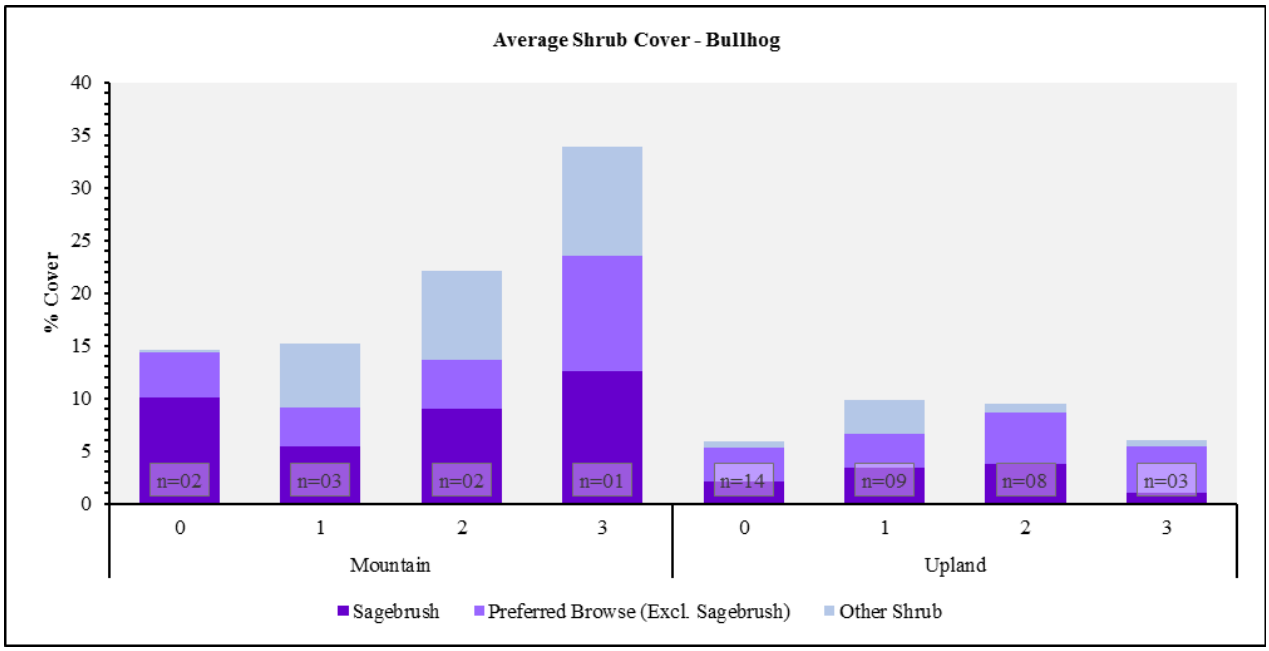


Figure 10.9: Average shrub cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

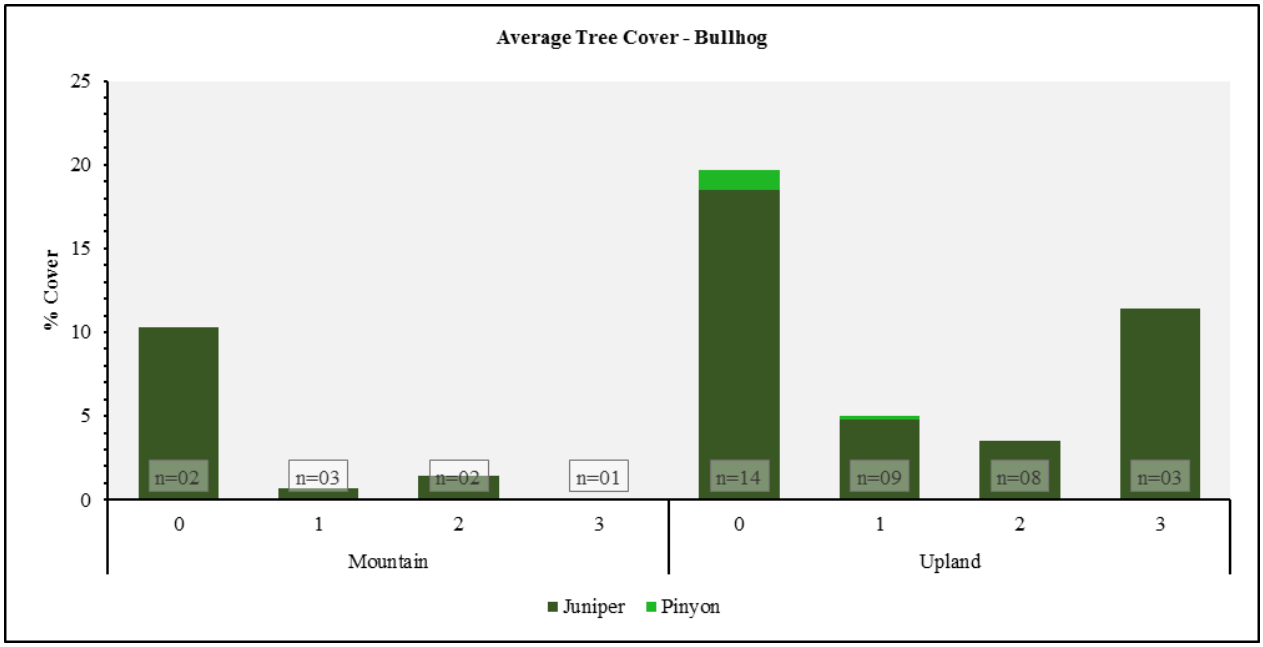


Figure 10.10: Average tree cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

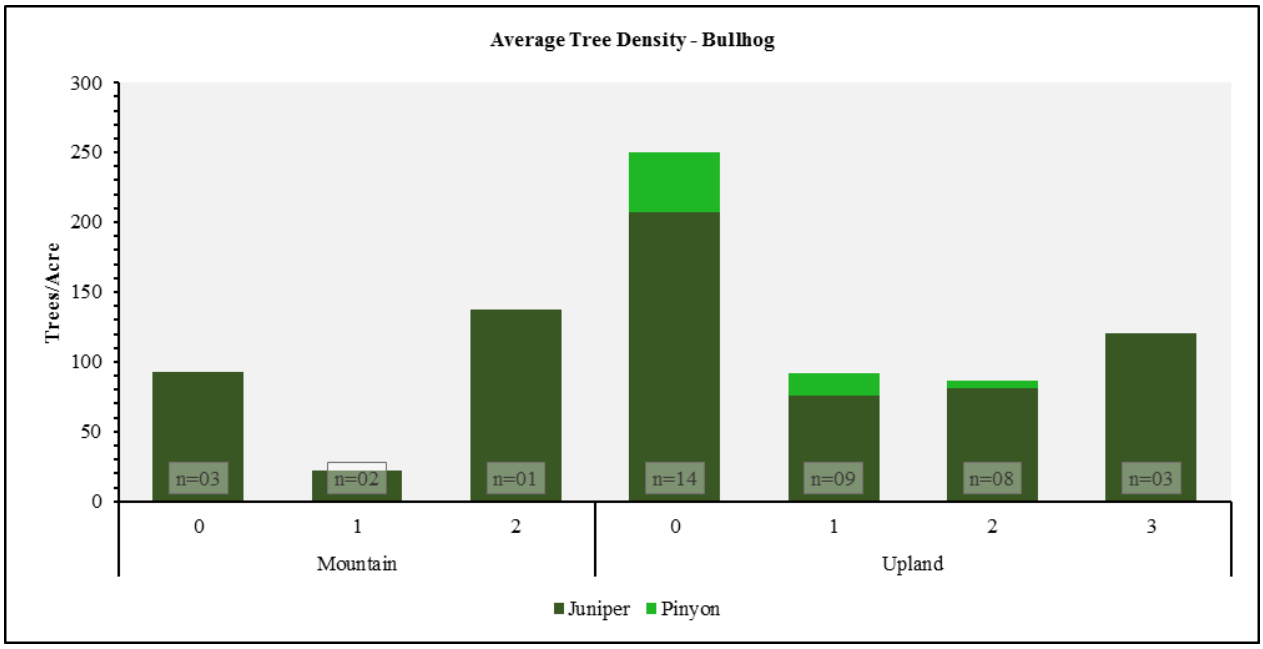


Figure 10.11: Average tree density on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

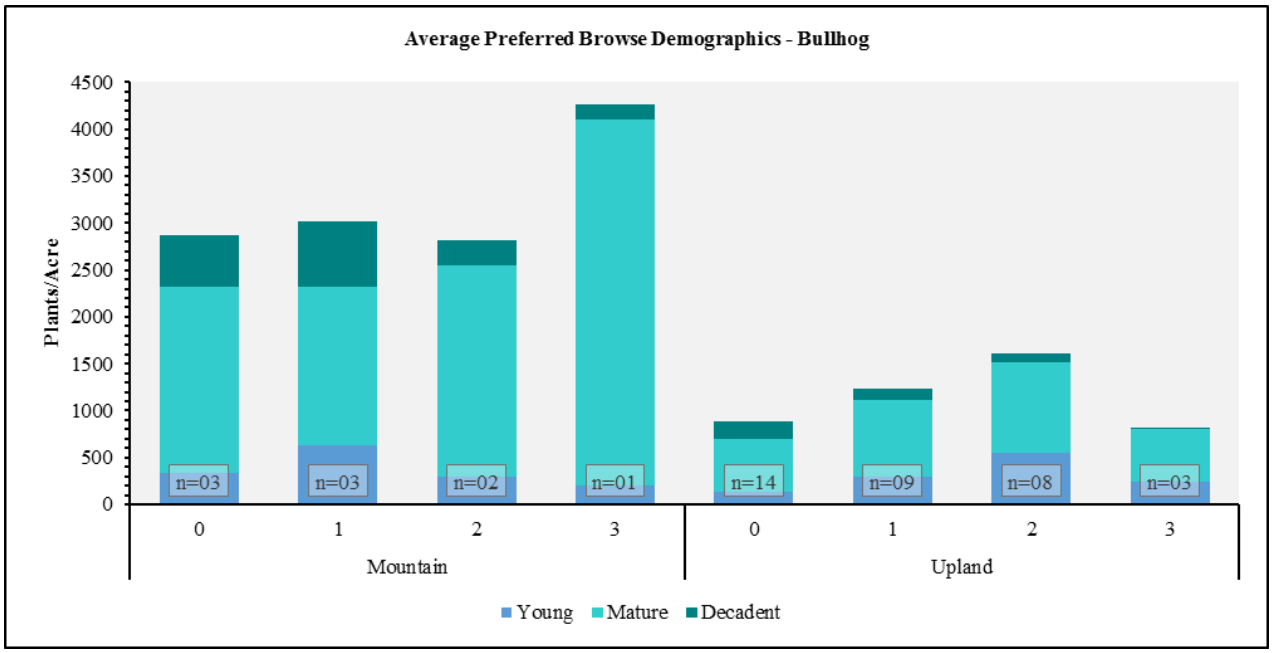


Figure 10.12: Average preferred browse demographics on mountain and upland study sites that have been treated with a bullhog.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

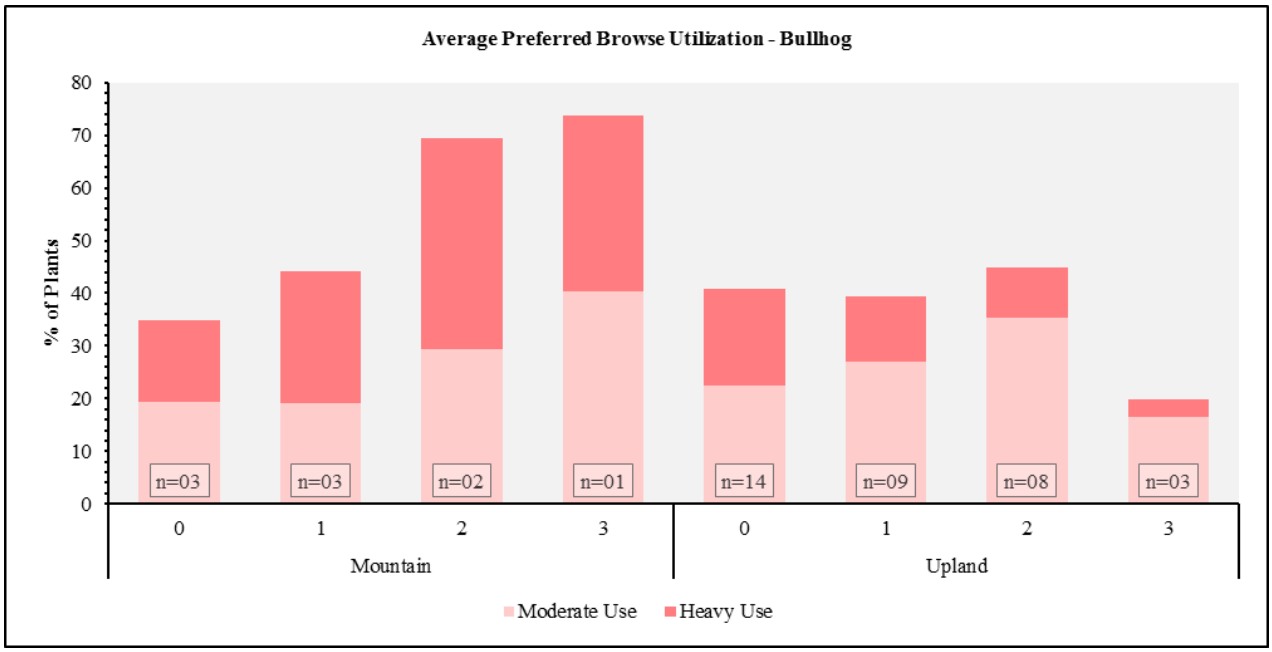


Figure 10.13: Average preferred browse utilization on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

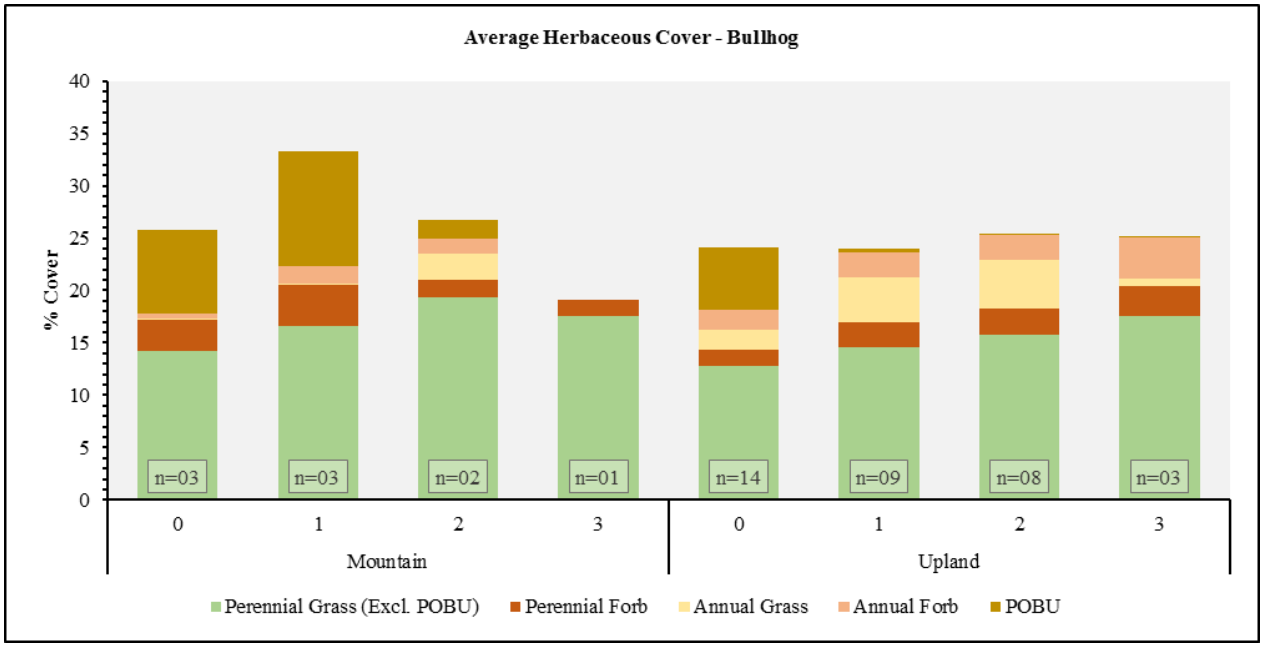


Figure 10.14: Average herbaceous cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

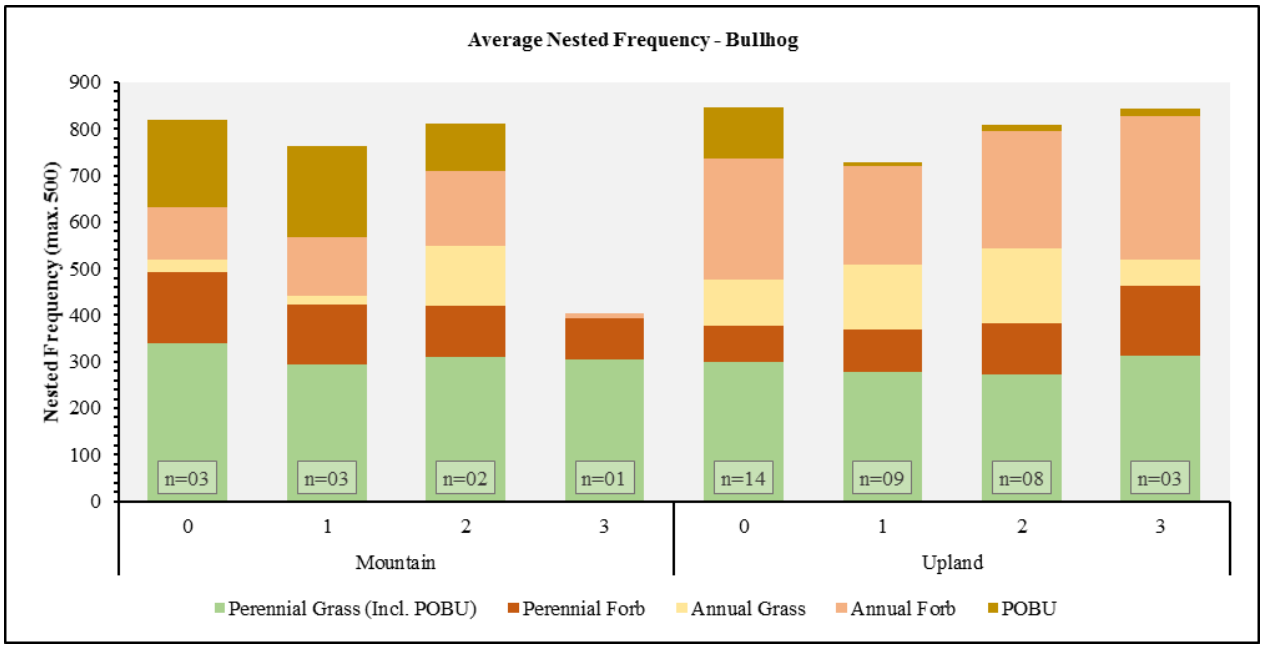


Figure 10.15: Average nested frequency of herbaceous species on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

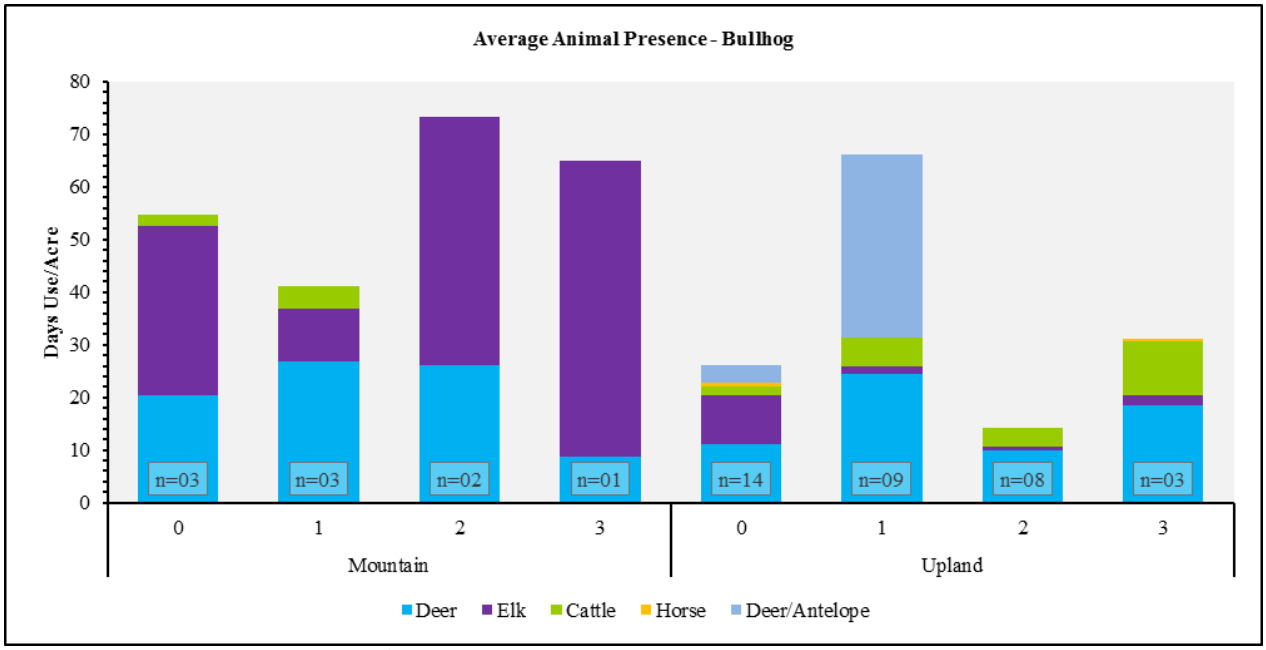


Figure 10.16: Average pellet transect data of mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Chaining

Fifteen study sites have undergone a chaining treatment during the study period. Of these, seven studies [Mill Fork (16B-6), Pole Canyon Oak (16C-9), Above South Hollow (16C-11), Pleasant Creek (16C-38), Mill Fork Chaining (16R-30), North Hollow (16R-48), and Bear Ranch (16R-50)] are considered to be mountain ecological sites and eight [Canal Canyon (16R-42), Dairy Fork 2 (16R-47), Grantsville Chaining (18R-7), Cedar Fort Bench (18R-10), Bennion Chaining (19R-4), Goshute Chaining (19R-5), Bennion Sagebrush Chaining (19R-7), and Lion Hill (19R-23)] are classified as upland ecological sites.

Mill Fork can be found on the lower north-facing slopes of Davis Hill and southeast of Mill Fork. The Pole Canyon Oak study site is situated west of the mouth of Pole Canyon, and the Above South Hollow study is found on the plateau above South Hollow Road. Pleasant Creek is situated south of East Pleasant Creek Road near the city of Mt. Pleasant. The Mill Fork Chaining site is located about 0.2 miles northwest of the Mill Fork study, and the North Hollow study is found in North Hollow near the town of Mayfield. Bear Ranch is south of the Pleasant Creek study. The Canal Canyon study is located west of the mouth of Canal Canyon and northeast of Pigeon Hollow. The Dairy Fork 2 site is situated south of Mill Fork in Spanish Fork Canyon. Grantsville Chaining can be found near the mouth of Coal Pit Canyon in the Stansbury Mountains, while the Cedar Fort Bench study site is situated north of the town of Cedar Fort. Bennion Chaining is located about 0.3 miles north of Vernon Reservoir, and the Goshute Chaining study can be found just east of the Utah-Nevada border on the Goshute Reservation. The Bennion Sagebrush Chaining site is situated on the west side of Vernon Reservoir Road north of Vernon Reservoir. Finally, the Lion Hill study is found south of North Oak Brush Creek at the foot of the Sheeprock Mountains.

Shrubs/Trees: Average total shrub cover has shown a decreasing overall trend for mountain ecological sites and a general increase for upland ecological sites. The dominant shrub component on a majority of the mountain study sites has been preferred browse (excluding sagebrush) in all sample years. Dominance has varied from year to year on upland study sites. Prior to treatment, sagebrush contributed the most cover of any browse species, a trend largely driven by the Goshute Chaining and Bennion Sagebrush Chaining studies. Cover of sagebrush and preferred browse decreased as of the first post-treatment sample year making other shrubs the dominant component, but increased and became co-dominant in the second sample year following treatment (**Figure 10.17**). Sagebrush populations on studies of both ecological types have been mainly comprised of mature individuals throughout the study period. Density, however, has exhibited an overall decrease on studies of the mountain ecological type; the increase in overall density in the first post-treatment sample year was largely due to the North Hollow study. No second post-treatment category data is available for North Hollow and it was therefore not included in the average: this may be a partial driver of the decrease between the first and second sample years following treatment. Density on upland study sites has increased each sample year following treatment. However, one should note the difference in the number of study sites between post-treatment categories two and three: this could partially account for the noticeable increase in these sample years (**Figure 10.20**). Utilization of sagebrush has generally increased as time since treatment has increased (**Figure 10.21**).

Average tree cover and density have generally decreased on both mountain and upland ecological sites. However, there was an increase in density each year following the first post-treatment sampling on study sites of both ecological types. For mountain sites, this increasing trend is likely due to the differing numbers of studies each sample year; the Pleasant Creek study provided all data for the first post-treatment sampling and was not included in the second post-treatment average. This could also be a partial driver on upland ecological sites along with the Goshute Chaining study, which had an increase of over 200 trees/acre between the second and third sample years following treatment (**Figure 10.18**, **Figure 10.19**).

Herbaceous Understory: Average herbaceous cover and frequency have increased overall on sites designated as mountain ecological sites with perennial grasses as the dominant component in each sample year. However, one should note the difference in number of study sites for each year. In addition, three of the four studies during the first post-treatment sampling are different than the ones sampled 4-8 years post-treatment. As such, post category one data for mountain sites may not be directly comparable to that provided for post category two. Cover and frequency of the herbaceous understory have also exhibited a general increase overall on upland study sites with perennial grasses as the dominant component. Cover and frequency of annual grasses as well as perennial and annual forbs have fluctuated from year to year on both mountain and upland ecological sites (**Figure 10.22**, **Figure 10.23**).

Occupancy: Animal pellet groups have exhibited a decrease on mountain ecological sites and an overall increase on upland ecological sites. Primary occupancy has varied from year to year on study sites of both ecological types. Deer were the main occupants on mountain sites prior to treatment and during the second

post-treatment sampling, whereas deer/sheep pellet groups were the most abundant in the first post-treatment sample year. On upland study sites, elk were the primary occupants pre-treatment and during the first post-treatment sampling, a trend driven by the Canal Canyon and Dairy Fork 2 studies. Cattle pellet groups were the most abundant during the second and third post-treatment sample years: this is mainly due to the East Hickman Canyon and Goshute Chaining study sites (**Figure 10.24**).

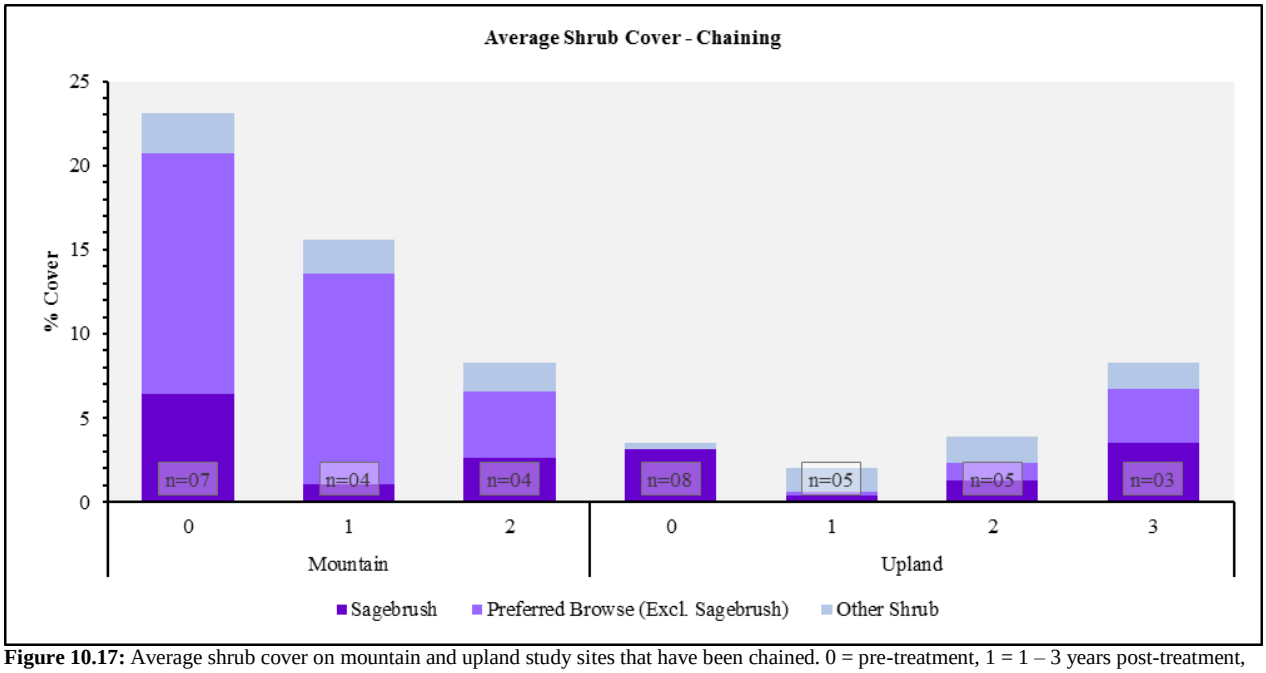


Figure 10.17: Average shrub cover on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

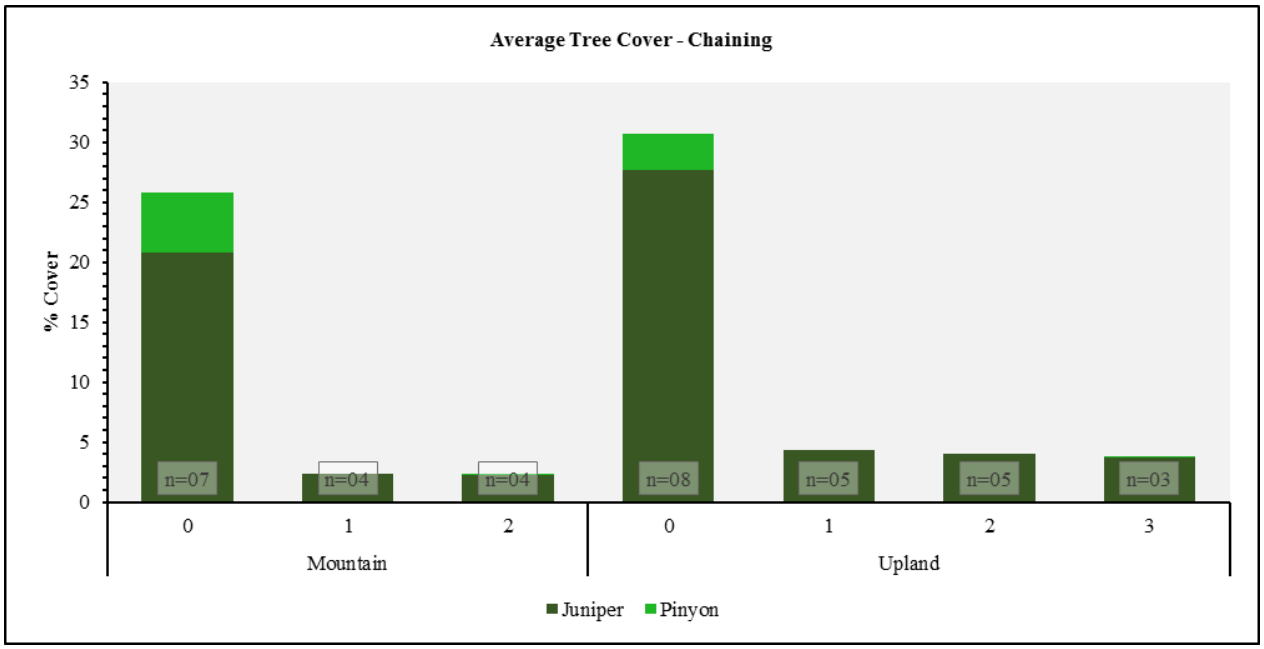


Figure 10.18: Average tree cover on mountain and upland study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

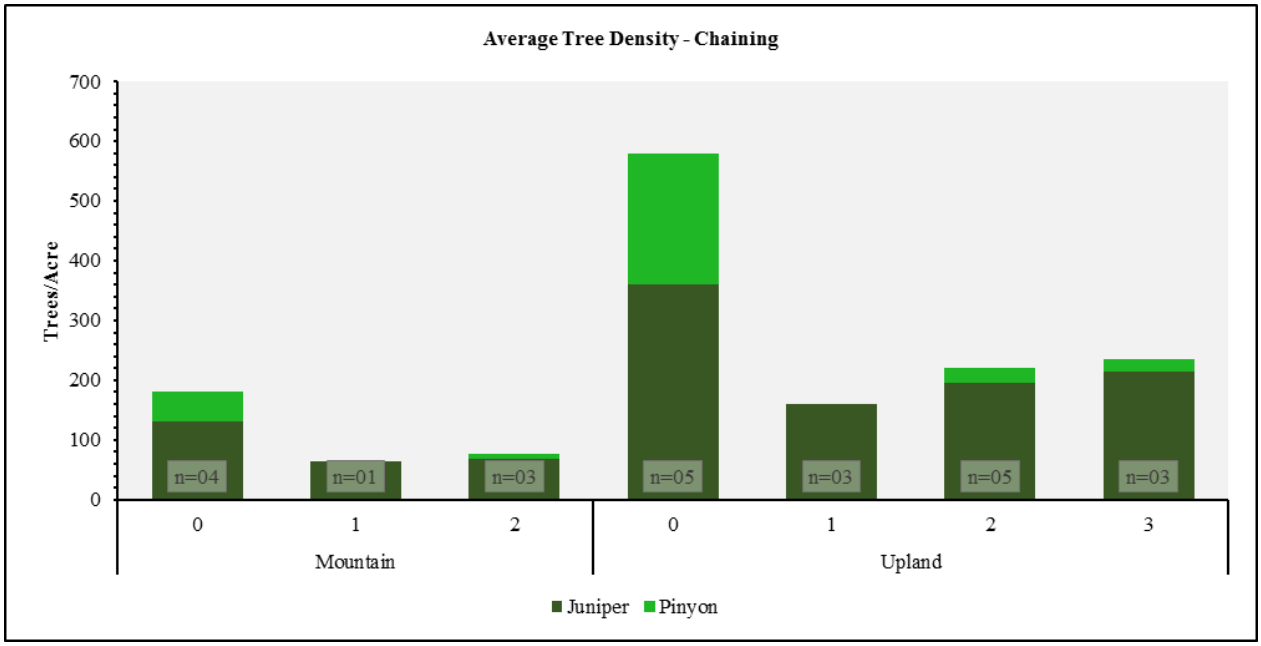


Figure 10.19: Average tree density on mountain and upland study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

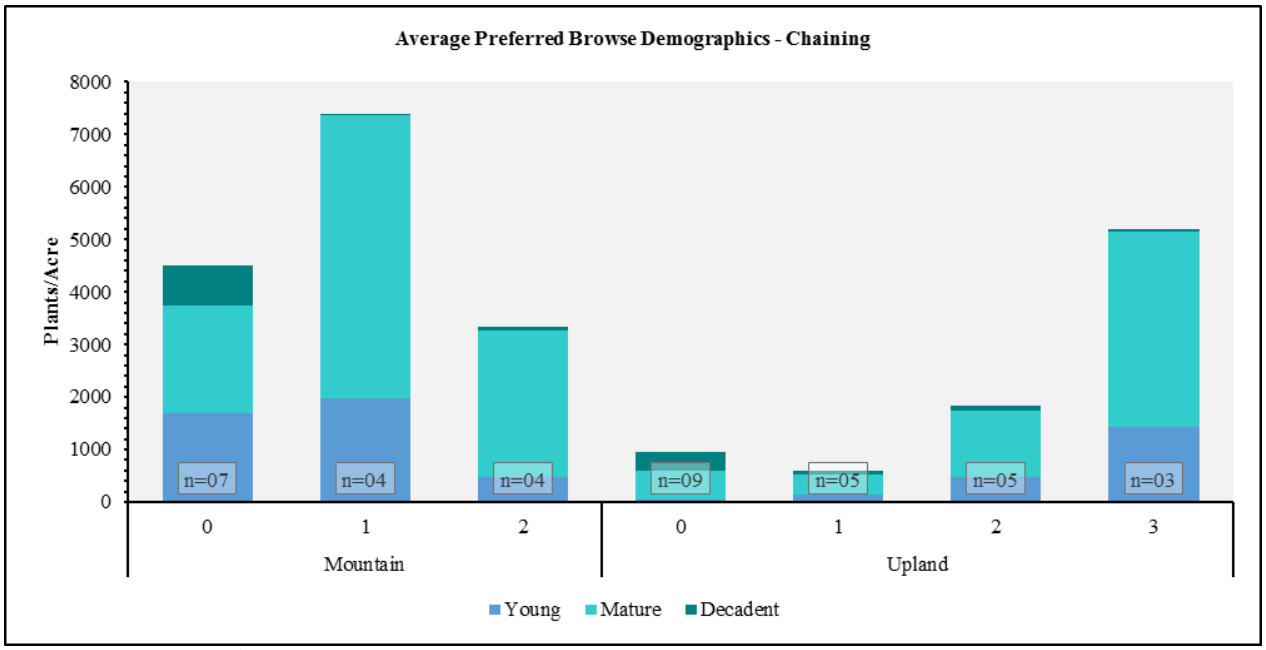


Figure 10.20: Average preferred browse demographics on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

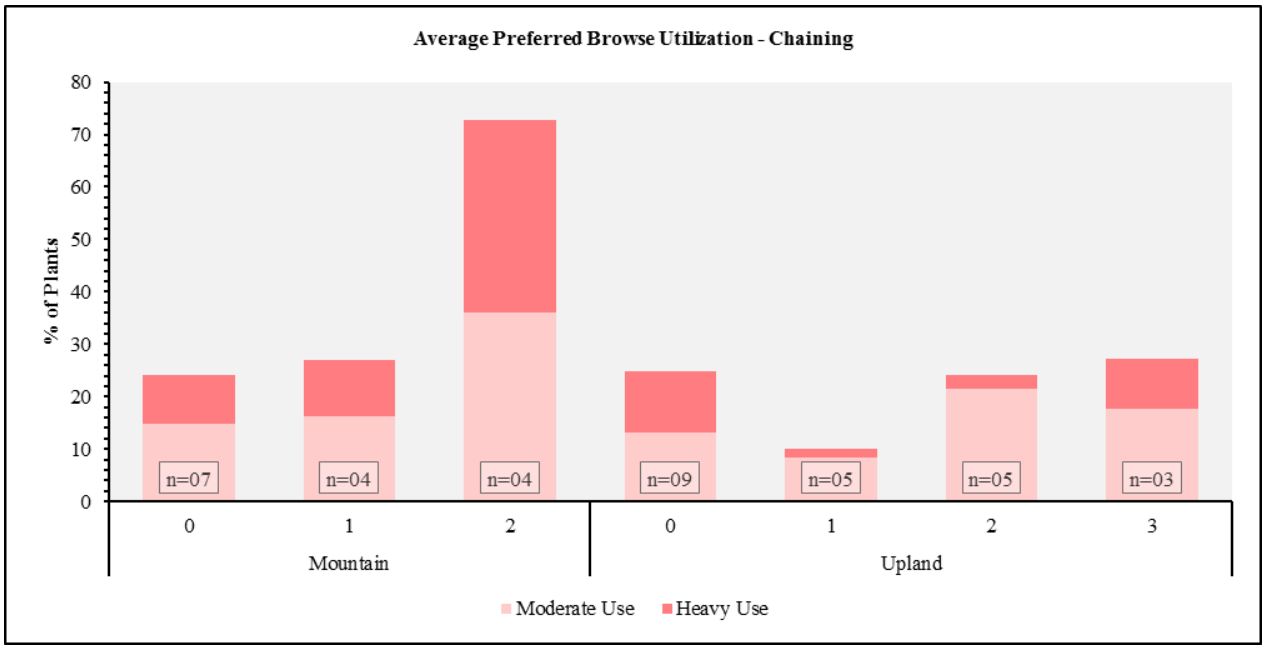


Figure 10.21: Average preferred browse utilization on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

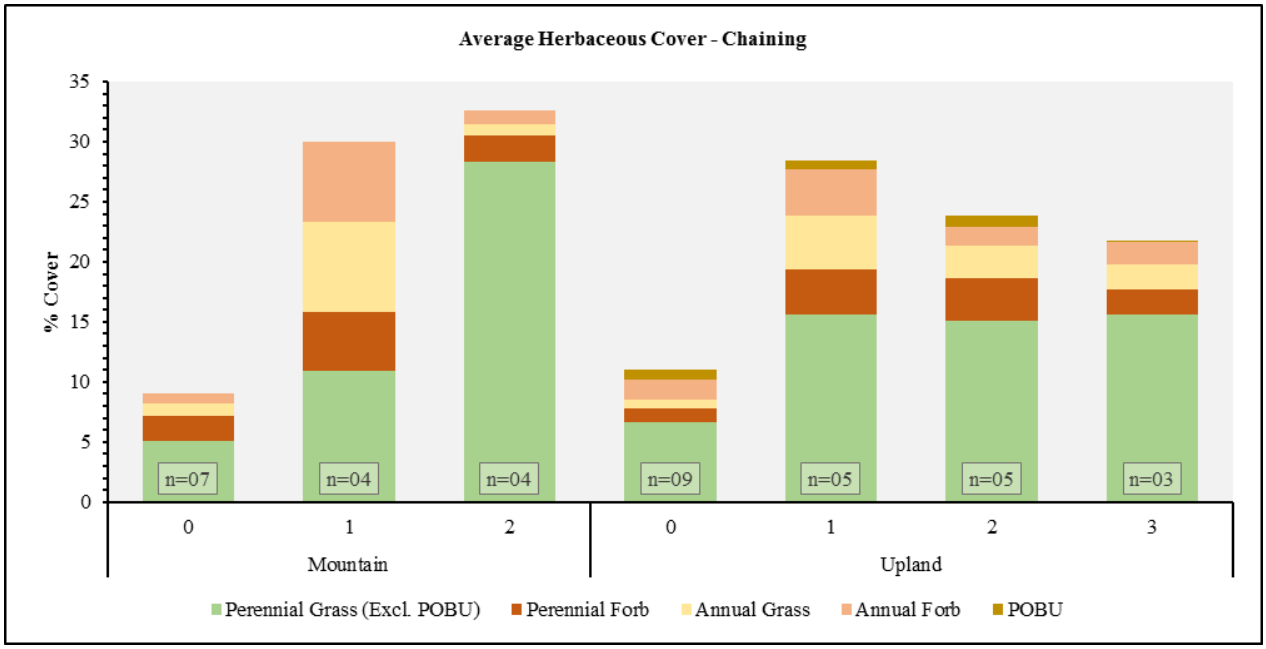


Figure 10.22: Average herbaceous cover on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

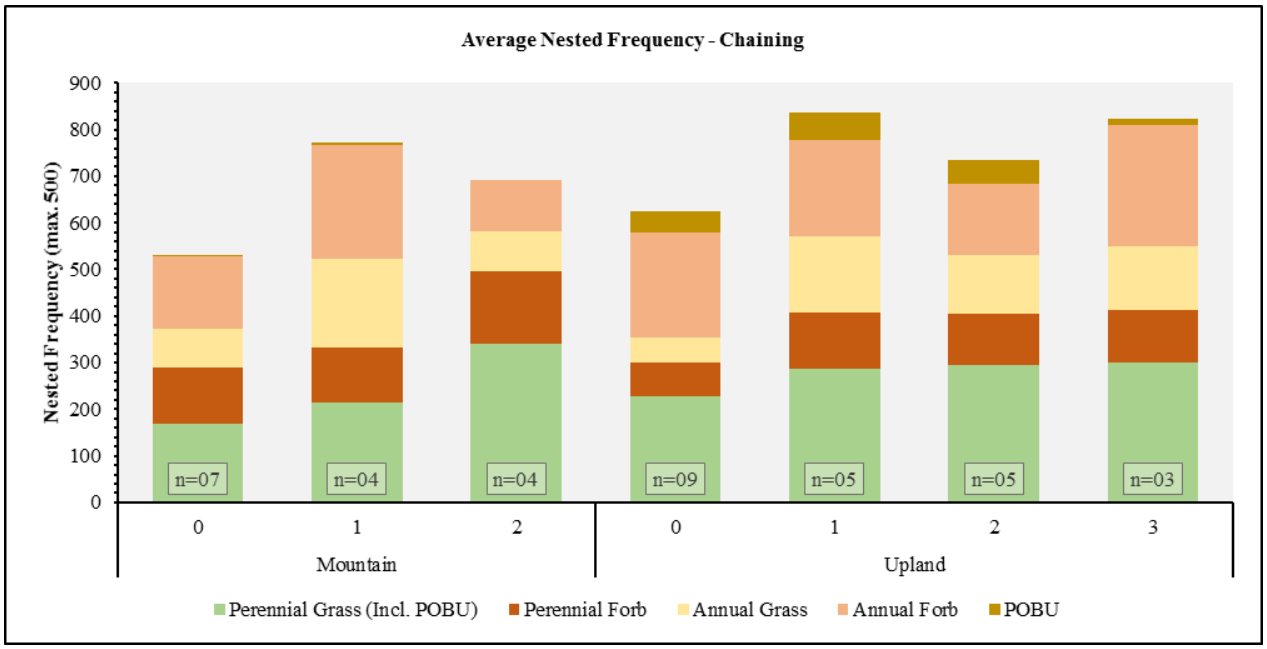


Figure 10.23: Average nested frequency of herbaceous species on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

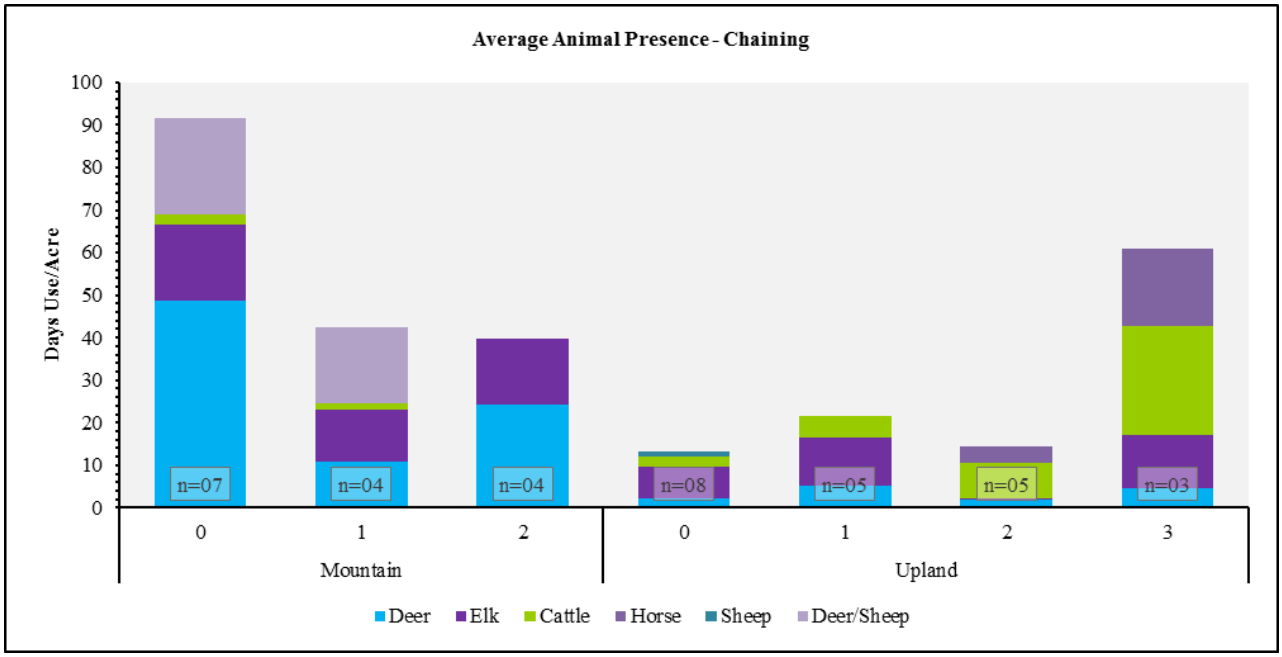


Figure 10.24: Average pellet transect data of mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Disking

One study site [Howerton's (16R-20)] has been disked during the study period: this study is considered to be an upland ecological site. Howerton's is situated just southeast of East 600 South in Spring City.

Shrubs/Trees: Average shrub cover, although minimal, has exhibited an overall increase on this upland study site and is contributed solely by forage kochia (*Bassia prostrata*) (**Figure 10.25**). Average preferred browse demographics indicate that both mature and young plants comprised a majority of the population during the

first post-treatment sample year. However, recruitment of young decreased and mature plants were the dominant age group during the second sampling following treatment (**Figure 10.27**). Utilization of preferred browse has increased after treatment, but a majority of the plants have exhibited no to light browsing in all sample years (**Figure 10.28**).

Tree cover has decreased significantly and was not recorded in the second post-treatment sample year. However, this decrease is likely not due to treatment, as tree cover was present both prior to treatment and during the first sample year post-treatment. Trees have not been recorded in point-quarter measurements in any sample year (**Figure 10.26**).

Herbaceous Understory The herbaceous understory has exhibited an overall decrease in cover and a marginal increase in frequency. However, the decrease in cover is due to diminished amounts of annual grasses and forbs between the first and second post-treatment samplings. Perennial grasses have increased in cover and frequency over the study years, although much of that is provided by introduced species such as crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*). The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has been observed on site following treatment, but in very small amounts. Finally, perennial forbs have decreased in cover and frequency from pre-treatment levels, most of which has been contributed by the noxious weed field bindweed (*Convolvulus arvensis*) in all sample years (**Figure 10.29**, **Figure 10.30**).

Occupancy: Pellet group abundance on this study site can be attributed to deer in all sample years and has increased over the study period (**Figure 10.31**).

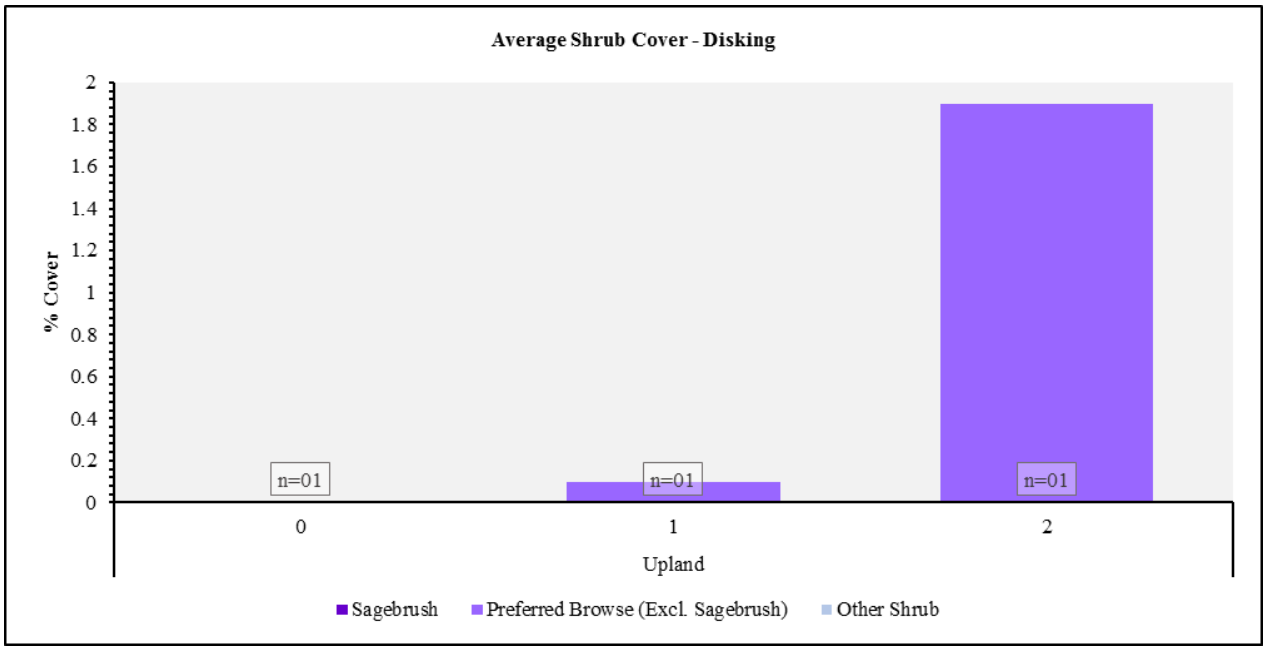


Figure 10.25: Average shrub cover on upland study sites that have been disked. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

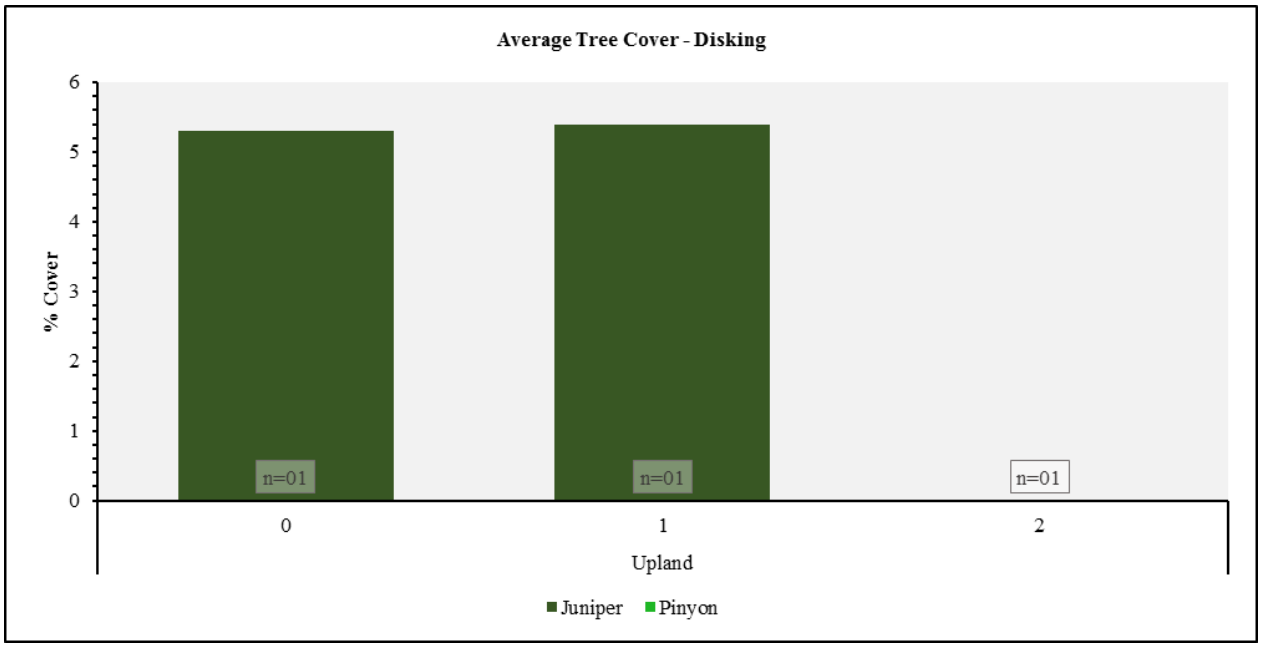


Figure 10.26: Average tree cover on upland study sites that have been disked. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

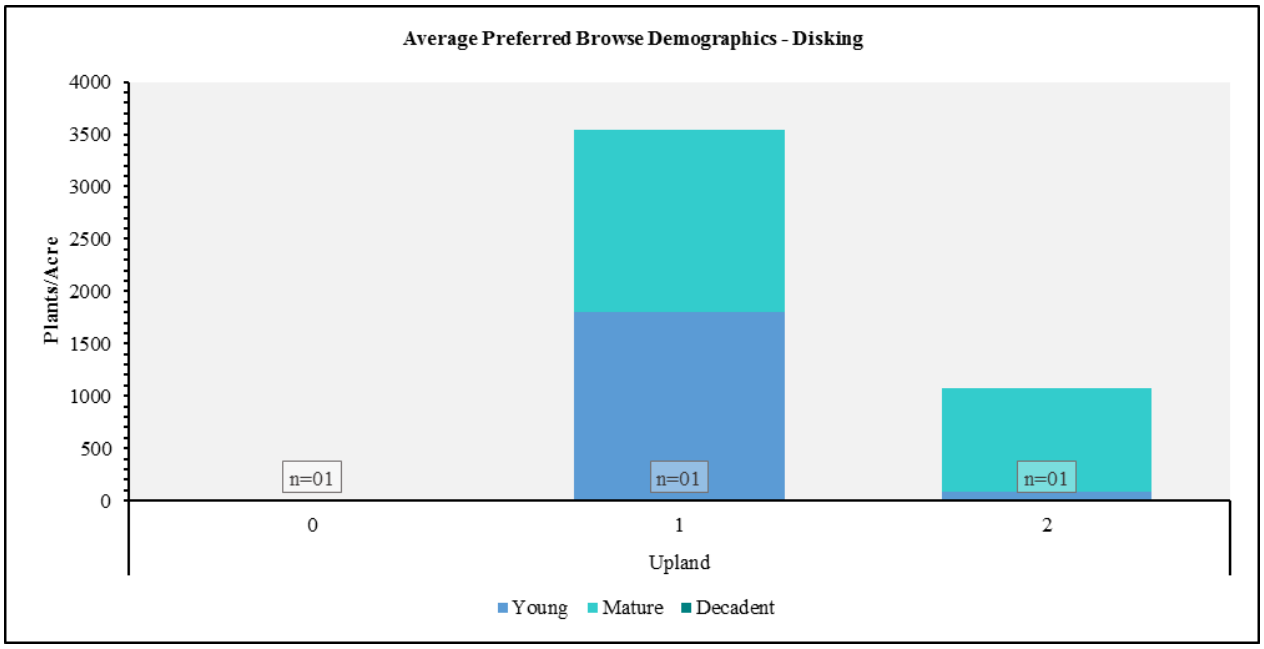


Figure 10.27: Average preferred browse demographics on upland study sites that have been disked. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

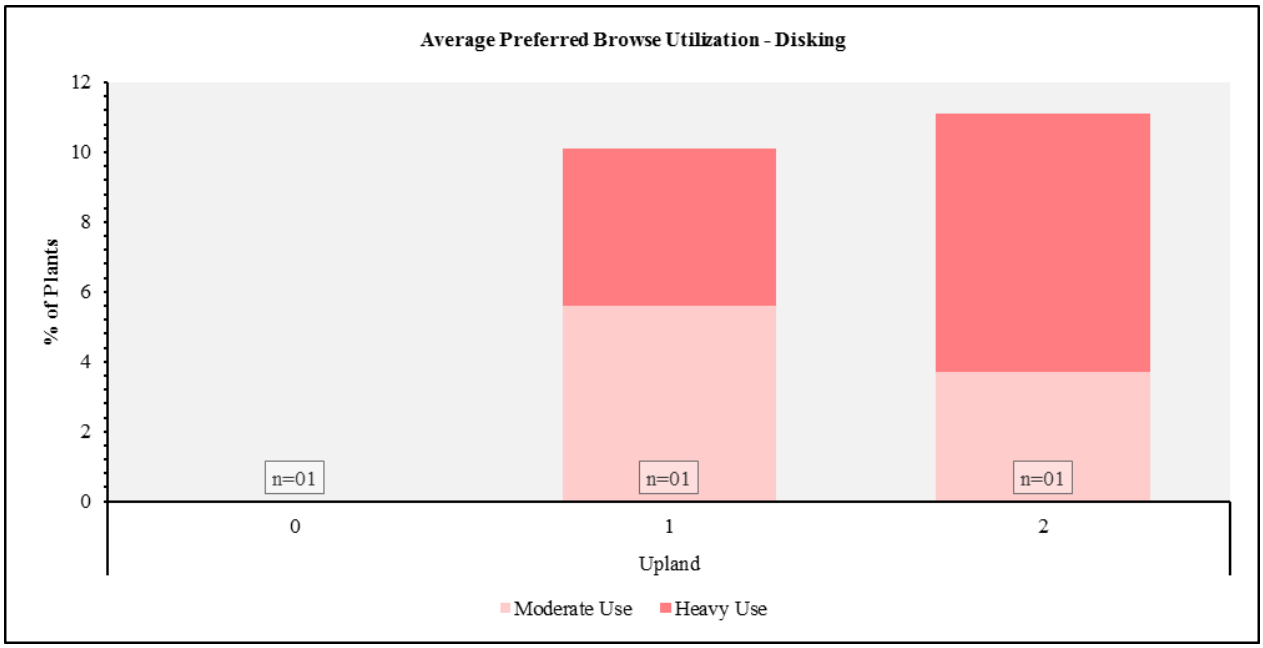


Figure 10.28: Average preferred browse utilization on upland study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

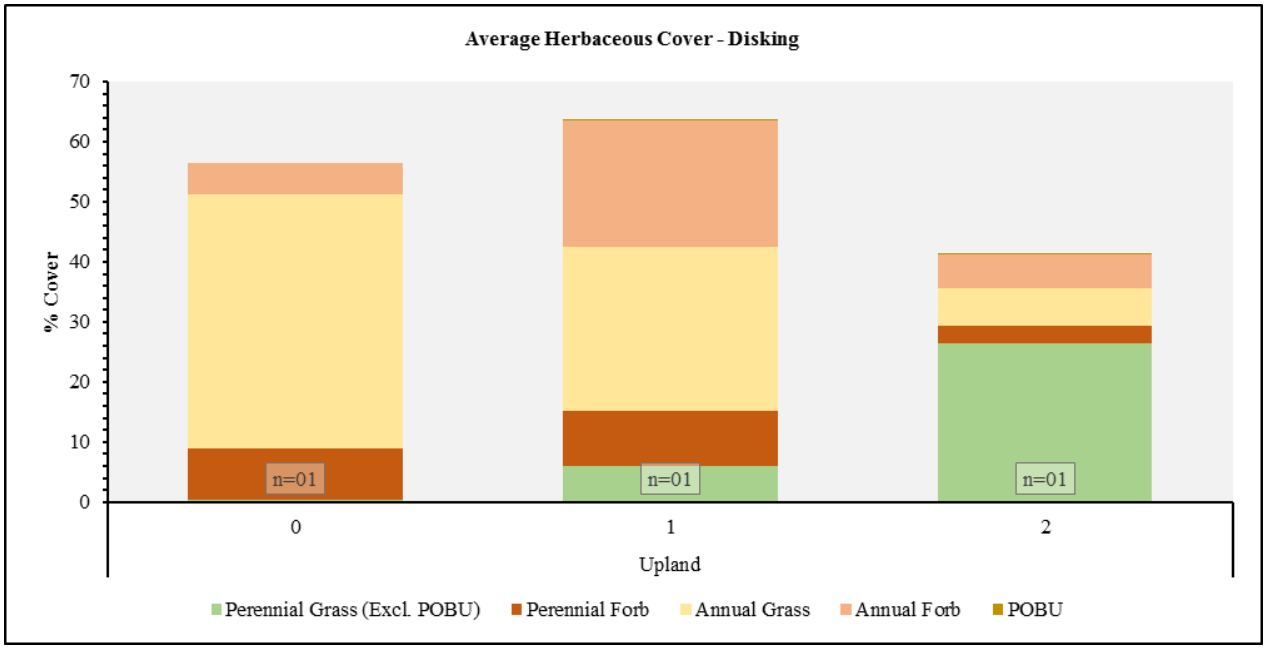


Figure 10.29: Average herbaceous cover on upland study sites that have been disked. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

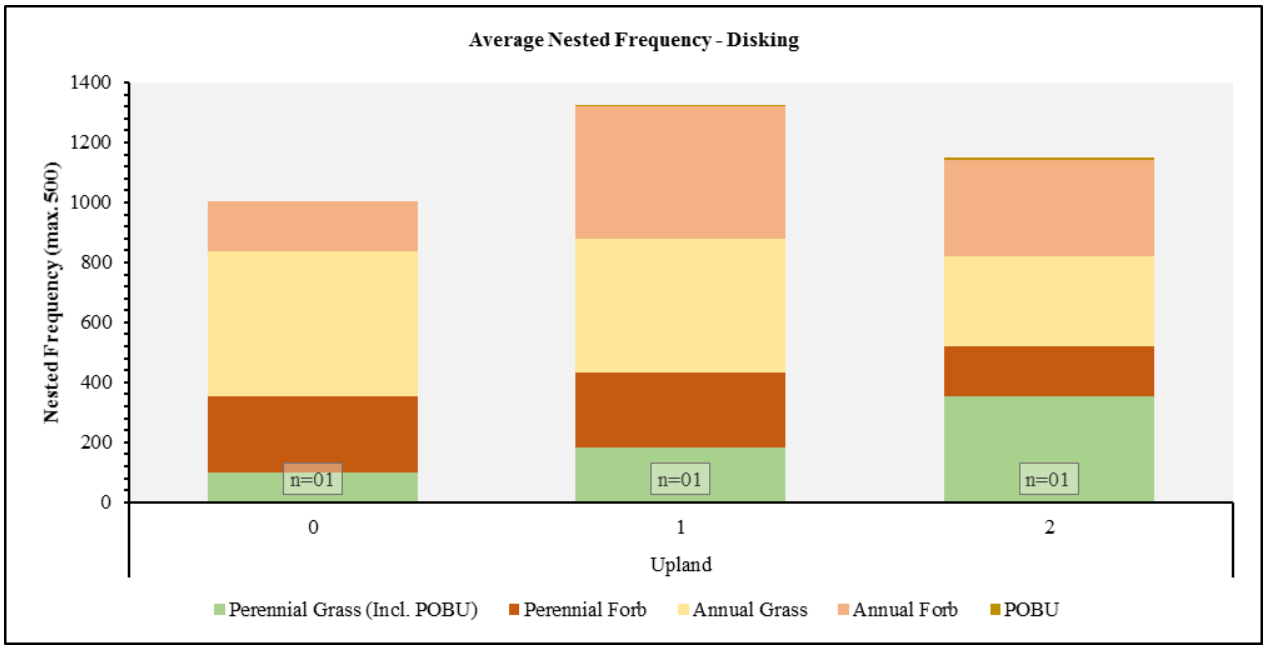


Figure 10.30: Average nested frequency of herbaceous species on upland study sites that have been disked. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

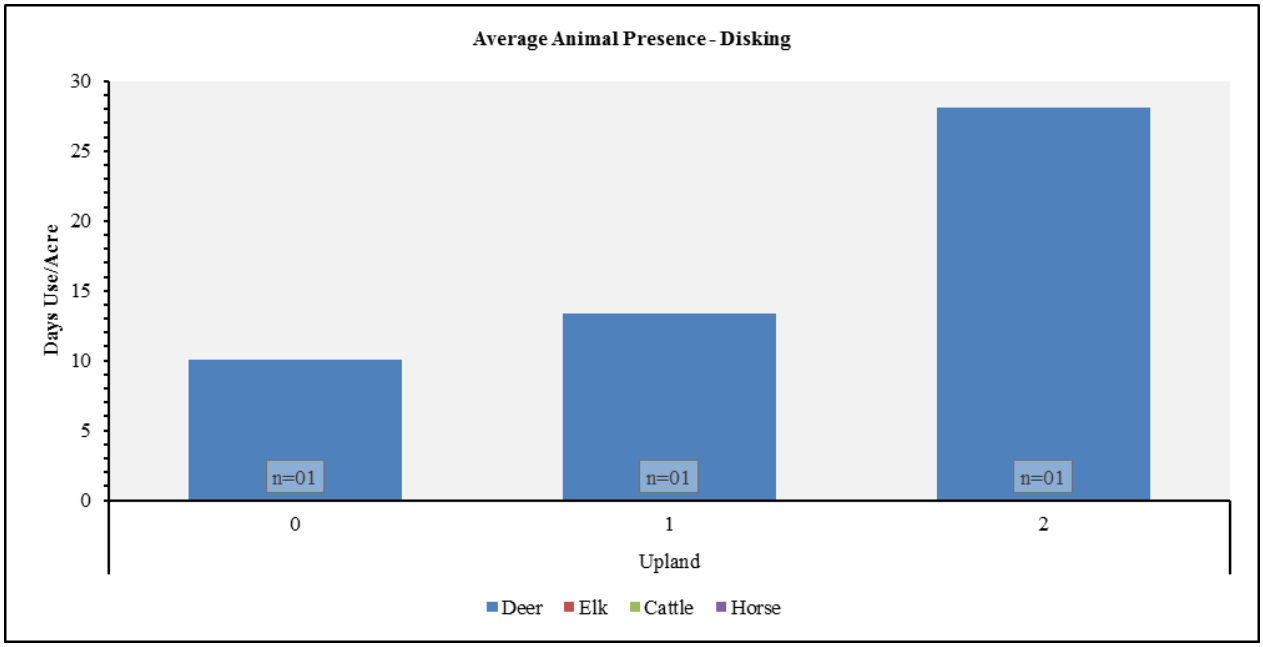


Figure 10.31: Average pellet transect data of upland study sites that have been disked. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

Fire Treated

Eleven study sites have been burned and have undergone a fire rehabilitation treatment. Five of these studies [Santaquin Bench (16A-2), Hop Creek Browse (16A-6), Big Hollow (16A-14), Orem Water Tank (17-26), and Maple Mountain Face (17-34)] are considered to be mountain ecological sites and six [Birch Creek (16A-9), South Palmer Point (18A-23), Salt Mountain Stock Pond (18A-24), Below Chokecherry Spring (18A-25), Salt Mountain (18A-26), and West Onaqui Bullhog (18R-8)] are classified as upland ecological sites.

The Santaquin Bench study site can be found on the benches south of Santaquin along I-15 and the Hop Creek Browse site is located on the north side of Nephi Canyon. Big Hollow is situated northeast of Fountain Green. Orem Water Tank is located on the slopes above Orem City, northeast of the water tanks and the Orem City Rifle Range. The Maple Mountain Face study can be found west of Middle Slide Canyon near the city of Mapleton. Birch Creek is east of I-15 near Nortonville and the South Palmer Point study is located one mile north of Delle Ranch. Below Chokecherry Spring is located 2.25 miles southeast of Salt Mountain up Chokecherry Canyon. The Salt Mountain study is located 0.5 miles southeast of Salt Mountain. Finally, West Onaqui Bullhog can be found north of Lookout Pass, just north of Dry Creek Road.

Shrubs/Trees: Both mountain and upland study sites have exhibited an overall decrease in shrub cover from pre-treatment levels. However, average cover has increased with time since the first post-treatment sampling; care should be taken when comparing sample years, as number of study sites (the 'n value') often differs between years and may affect the average values. Although sagebrush was the most abundant browse component prior to treatment on mountain ecological sites, other preferred browse species have contributed the most cover following the fires and subsequent remediation efforts: this trend is driven by the Santaquin Bench and Maple Mountain Face studies. The dominant browse component has also fluctuated on upland study sites. Sagebrush provided a majority of the cover prior to treatment on these sites, but other shrubs (mainly found on the Below Chokecherry Spring study) were dominant in the first and second post-treatment sample years. Preferred browse excluding sagebrush increased and contributed a majority of the cover in the third and fourth samplings after treatment. However, it is important to note that because most upland sites do not yet have data for these years, this increase is entirely due to the Birch Creek study (**Figure 10.32**).

On the mountain sites, preferred browse demographics indicate that overall density has increased following treatment and that mature plants have been the most abundant age group in most sample years; the exception to this is the first post-treatment sampling in which young plants were the most abundant, mainly due to recruitment on the Santaquin Bench and Orem Water Tank studies. Average preferred browse density on upland sites has decreased over time and mature plants have comprised a majority of the population in most sample years (**Figure 10.35**). Average preferred browse utilization has fluctuated over the study years. Mountain ecological sites have exhibited an overall decrease and less than half of the plants were moderately or heavily browsed in all sample years. Utilization has increased on the upland studies with more than 70% of plants showing moderate to heavy use in the third and fourth post-treatment samplings: this trend is mainly driven by the Birch Creek study (**Figure 10.36**).

Trees have not contributed cover on mountain or upland study sites in any post-treatment sample year (**Figure 10.33**). On mountain study sites, tree density exhibited a noticeable increase between the first and second post-treatment readings: this increase, however, is not a direct comparison between study sites. Big Hollow is the only site for which point quarter data is available for the first post-treatment sampling with all density being provided by juniper trees (*Juniperus* sp.). In contrast, Santaquin Bench is the only study with data available for post-treatment category two, and all density is contributed by Gambel oak (*Quercus gambelii*) (**Figure 10.34**).

Herbaceous Understory: For the mountain ecological sites, the herbaceous understory is primarily composed of perennial grasses and the introduced perennial grass bulbous bluegrass (*Poa bulbosa*); cover and frequency averages of bulbous bluegrass can largely be attributed to the Maple Mountain Face study. These sites have all behaved similarly to each other in response to disturbance. Immediately following the fire, cover and frequency of all herbaceous components decreased, but have increased in subsequent years. Annual grasses have contributed moderate amounts of cover in most sample years. Perennial forbs have fluctuated from year to year, but were co-dominant prior to treatment and during the fifth post-treatment sampling. Annual forb cover increased overall from the pre- to fifth post-treatment readings, although frequency exhibited a marginal decrease.

For the upland sites, the herbaceous understory was primarily composed of perennial grasses during the pre-treatment sampling and during the first and second sample years following treatment. Annual grasses contributed the most cover in the third and fourth post-treatment samplings: this is entirely due to the Birch

Creek study. Perennial and annual forbs have fluctuated in cover and frequency, but have generally been present in low to moderate levels in all sample years (**Figure 10.37**, **Figure 10.38**).

Occupancy: Average pellet group abundance on mountain and upland study sites has decreased overall and the primary occupants have been variable. On mountain study sites, deer were the primary occupants prior to treatment and in the fourth and fifth post-treatment sample years; the high amounts of deer pellet groups prior to treatment are due to the Hop Creek Browse study. Cattle were the primary occupants in the first post-treatment sampling. Elk pellet groups were the most abundant in the second and third sample years following treatment, a trend driven by the Orem Water Tank site.

Pellet transect data for the upland ecological type shows that pre-disturbance and in the second post-treatment sample year, cattle were the primary occupants: this is mainly due to the Salt Mountain Stock Pond and Below Chokecherry Spring studies. Average pellet group abundance was greatest for deer during the first and third readings after treatment, a trend driven by the Birch Creek study. Finally, elk provided the most pellet groups on average during the fourth post-treatment reading. Data for both post-treatment categories three and four is contributed entirely by the Birch Creek site and may therefore not be representative of the ecological type as a whole (**Figure 10.39**).

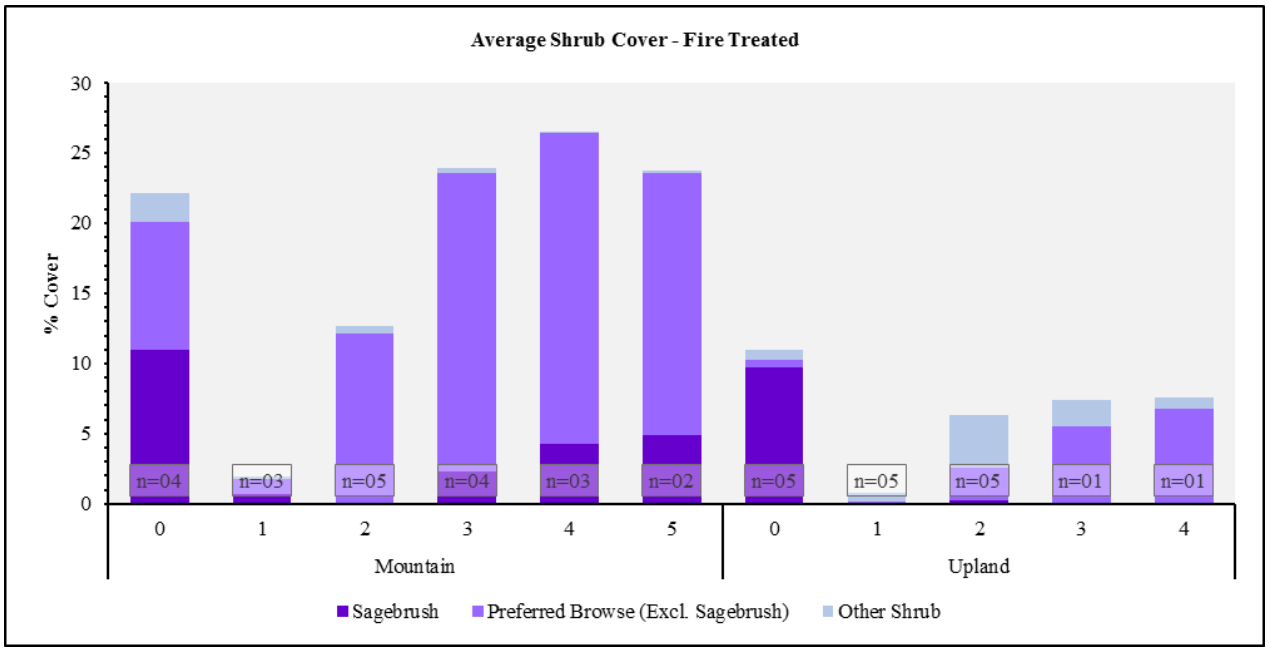


Figure 10.32: Average shrub cover on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

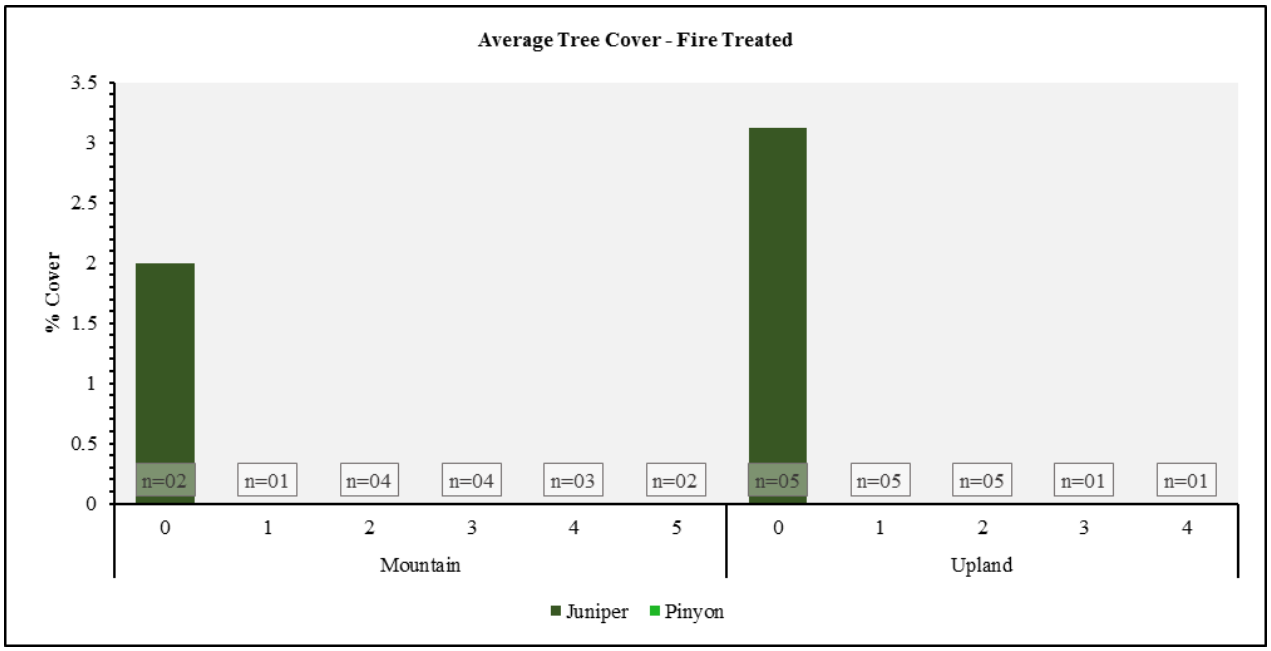


Figure 10.33: Average tree cover on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment; 4 = 14 – 18 years post-treatment; 5 = 19 – 23 years post-treatment.

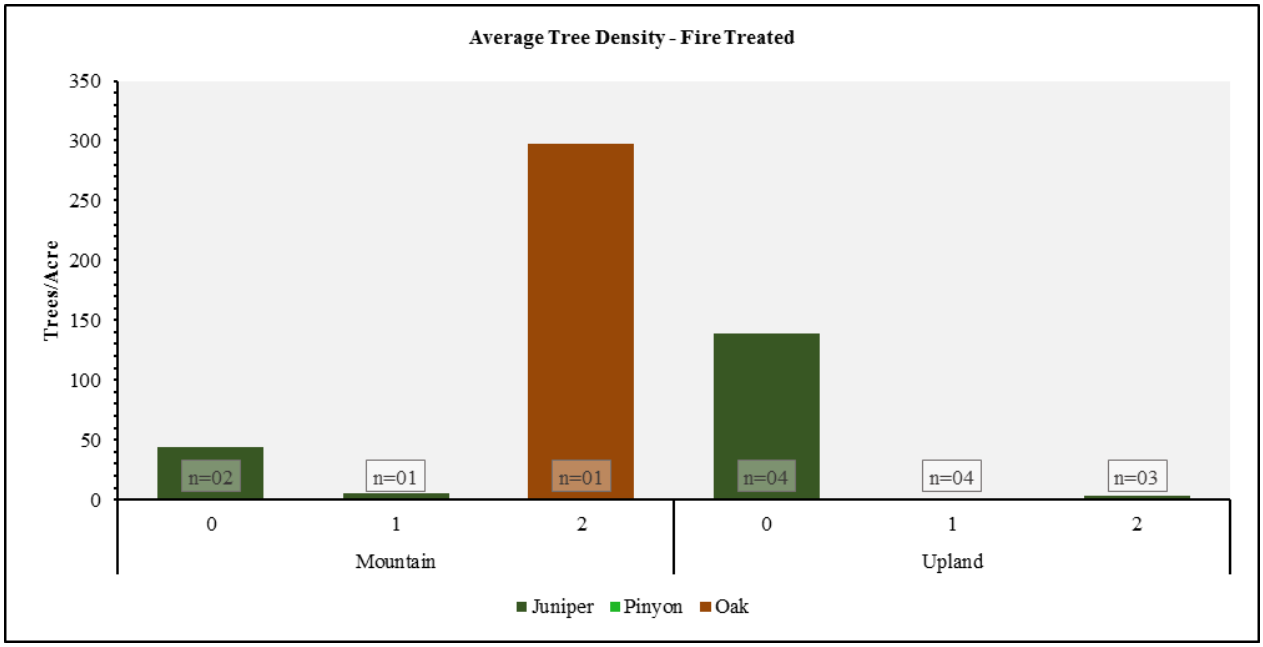


Figure 10.34: Average tree density on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

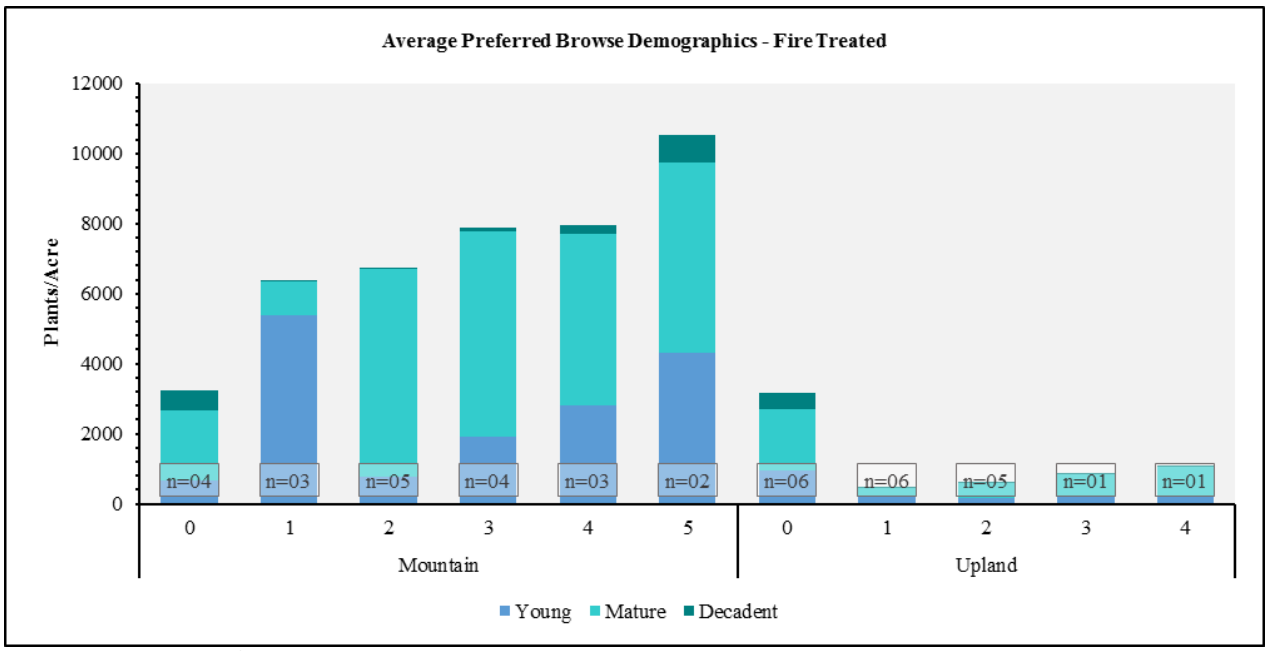


Figure 10.35: Average preferred browse demographics on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

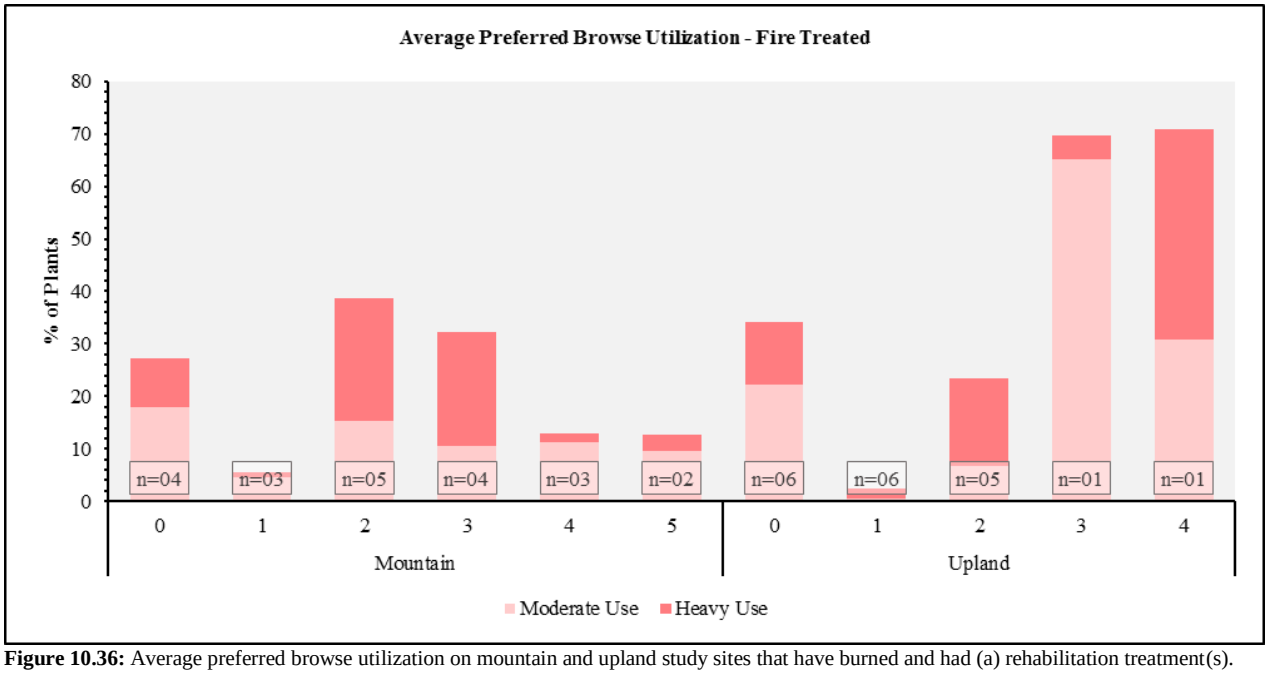


Figure 10.36: Average preferred browse utilization on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

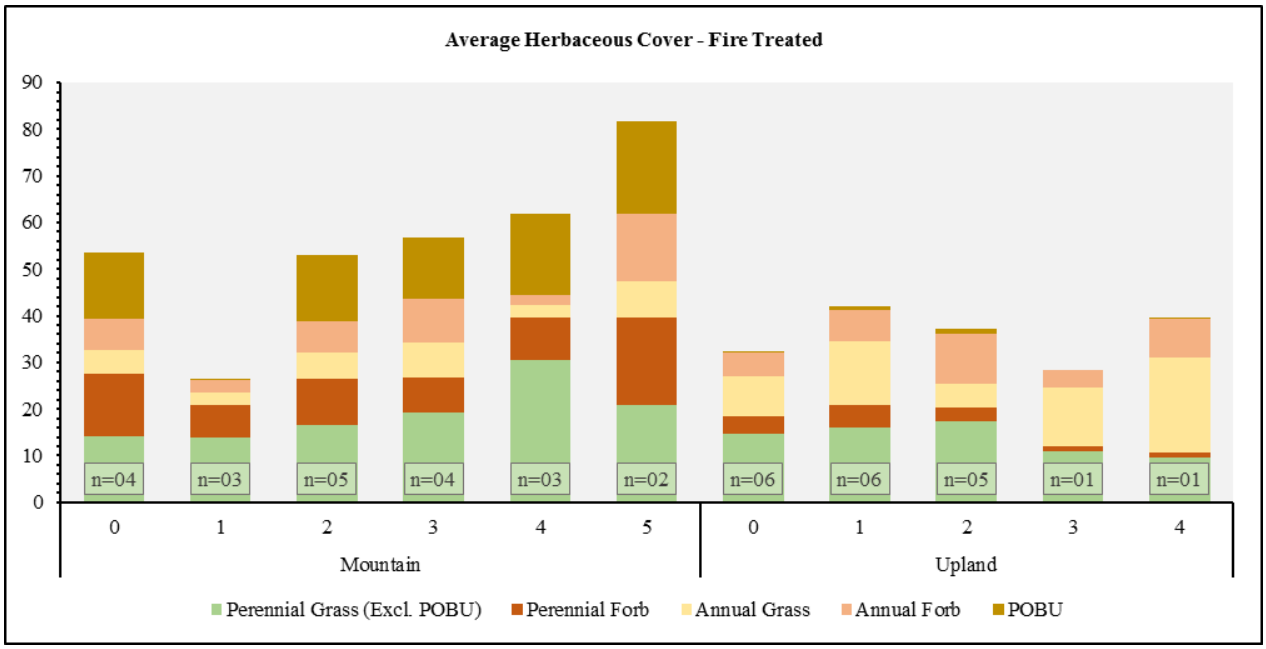


Figure 10.37: Average herbaceous cover on mountain and upland sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

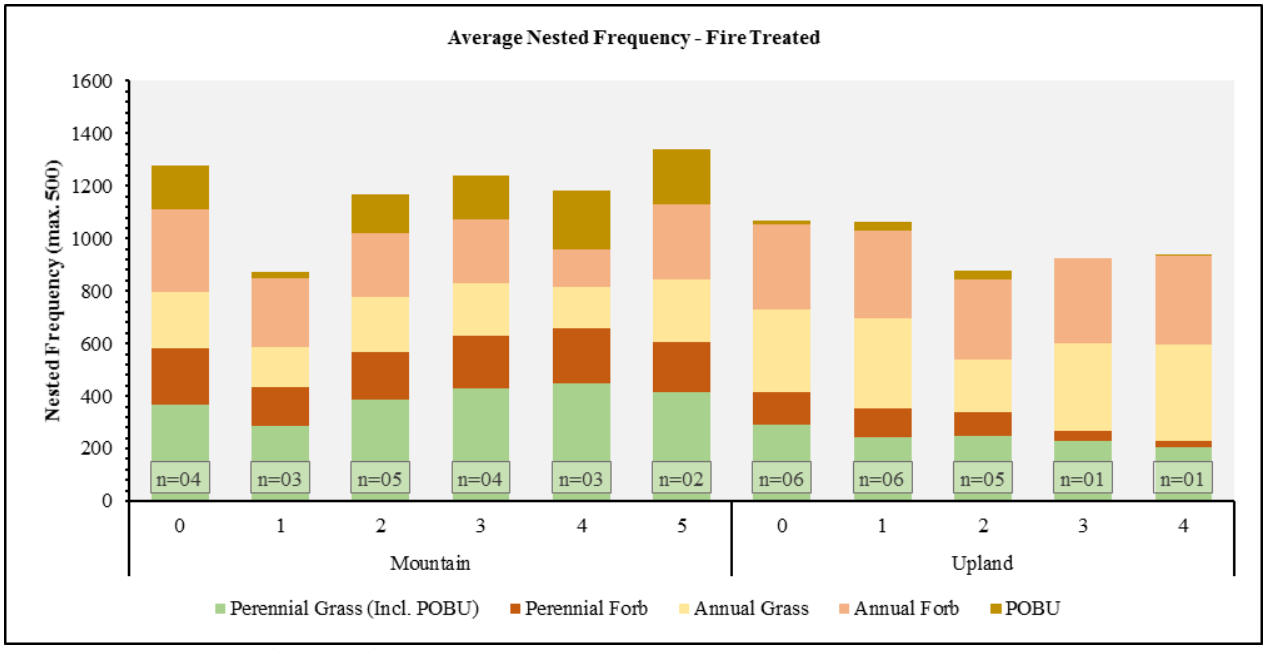


Figure 10.38: Average nested frequency of herbaceous species on mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

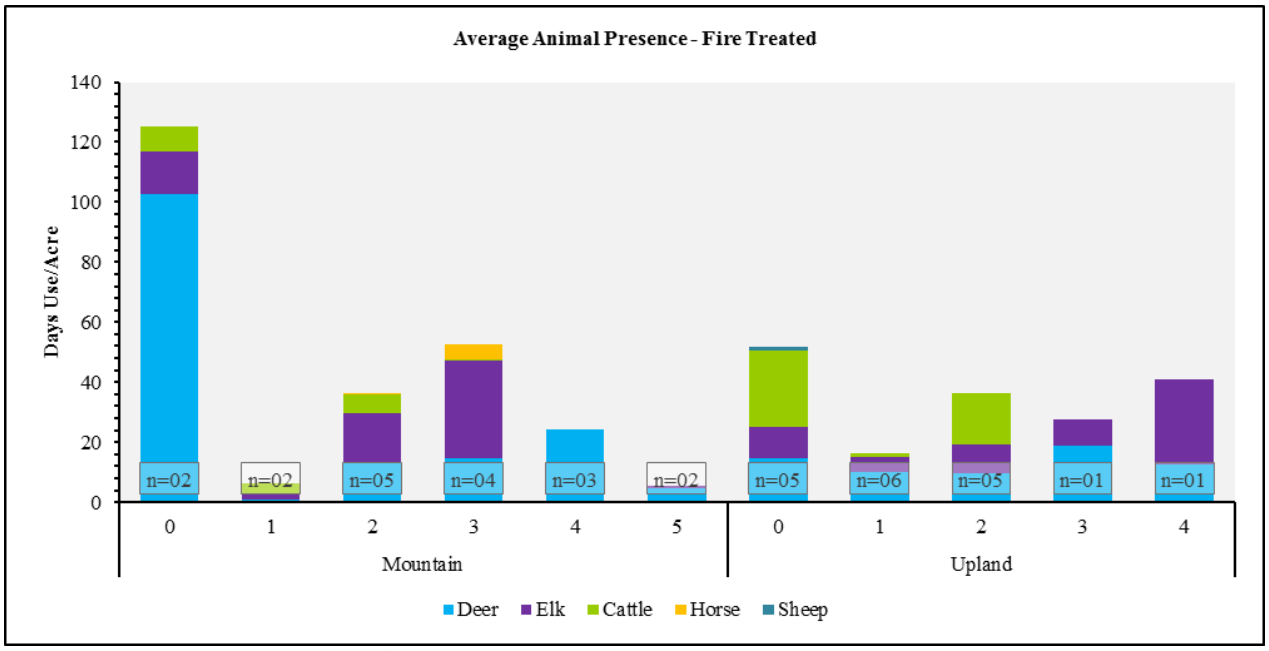


Figure 10.39: Average pellet transect data of mountain and upland study sites that have burned and had (a) rehabilitation treatment(s). 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment.

Fire Untreated

There are eight study sites that have burned and have not undergone a rehabilitation treatment. Of these, seven studies [Nebo Creek (16A-5), Hoovers Hollow (17-14), Heisetts Hollow (17-24), American Fork Canyon (17-61), South of Broons Canyon (18A-27), South Pine Canyon (19B-8), and Dennis Spring (21A-13)] are classified as mountain ecological sites, while one study [Deadman Canyon (18A-2)] is considered to be an upland ecological site.

Nebo Creek is located in the foothills west of US-89 near Indianola. The Hoovers Hollow study site is located on a slope just west of the southwest portion of Deer Creek Reservoir, while the Heisetts Hollow is situated north of Heisetts Hollow on the slopes facing the city of Cedar Hills. The American Fork Canyon study can be found on a bench which is at the mouth of American Fork Canyon and above a neighborhood which is in the city of Highland. South of Broons Canyon is situated 1.5 miles north of Delle Ranch up Round Canyon Road, and the South Pine Canyon study is in the Sheeprock Mountains south of Erickson Pass. The Dennis Spring study is located near Tintic Mountain in the East Tintic Mountains. Finally, Deadman Canyon is located about four miles north of the town of Terra, which is on SR-199.

Shrubs/Trees: The shrub component on the mountain study sites has been mainly comprised of big sagebrush (*Artemisia tridentata*) in most sample years. Other shrubs contributed a majority of the cover, however, in the first post-treatment sampling. Sagebrush cover has increased overall post-treatment, a trend mainly driven by the Dennis Spring and South Pine Canyon studies; one should also note the difference in study numbers (the 'n value') from year to year, keeping in mind that this trend may not be entirely representative of all mountain ecological sites. The single upland study site, Deadman Canyon, was dominated by preferred browse (excluding sagebrush) prior to treatment, but there was no cover of any shrub in the first post-treatment sampling (**Figure 10.40**). Preferred browse demographics indicate that overall density on mountain ecological sites has increased and that mature plants have comprised a majority of the populations in most sample years. Recruitment of young individuals has exhibited an overall increase from pre-treatment levels and young plants were the dominant demographic in the first sample year following treatment. Density has decreased on upland ecological sites, with mature plants as the most abundant age group prior to treatment and young plants dominating during the first post-treatment sample year (**Figure 10.43**). Browse utilization on mountain study

sites has fluctuated, but has exhibited an overall increase with nearly half of plants exhibiting moderate to heavy utilization in the sixth post-treatment sample year (again, one should note the difference in n values from year to year and keep the implications in mind). Utilization has also increased on the upland study site: the only plant sampled in the first year post-treatment was heavily used (**Figure 10.44**).

Tree cover and density have decreased significantly following treatment on both mountain and upland study sites. No cover was observed after the second post-treatment sampling on sites of either ecological type: on mountain studies, this is likely due to the exclusion of the Heisetts Hollow study from the average as there is not yet data available for the second and subsequent post-treatment categories. The only density observed during the fourth post-treatment sampling on mountain study sites was contributed by bigtooth maple (*Acer grandidentatum*) on the Dennis Spring study. Density has not been observed on upland studies following treatment (**Figure 10.41**, **Figure 10.42**).

Herbaceous Understory: The overall herbaceous understory for mountain study sites has decreased post-treatment in both cover and frequency, with annual grasses and forbs as the dominant components in most sample years. Perennial grasses and forbs have exhibited an overall decrease. The graph also indicates that the introduced perennial grass bulbous bluegrass (*Poa bulbosa*) has decreased in both cover and frequency. However, this decrease is likely due to the different number of studies being sampled each year: the only study with fifth and sixth post-treatment data is South Pine Canyon, a study on which bulbous bluegrass has never been observed. The herbaceous understory has increased in both cover and frequency on the upland study site. Although perennial grasses have increased marginally in cover, the overall herbaceous increase is mainly due to an increase in annual forbs and grasses. Bulbous bluegrass has decreased in cover, but frequency has remained consistent. Perennial forbs have remained rare (**Figure 10.45**, **Figure 10.46**).

Occupancy: Pellet group transect data indicates that pellet group abundance has decreased overall on mountain and upland study sites. Primary occupancy has varied from year to year on mountain sites. Deer have provided the most pellet groups prior to treatment and in the first, third, fifth, and sixth sample years following treatment. The primary occupants were cattle in the fourth post-treatment sample year, while sheep pellet groups were most abundant during the second sample year following treatment. Deer have been the primary occupants prior to treatment and in the first post-treatment sampling on upland study sites (**Figure 10.47**).

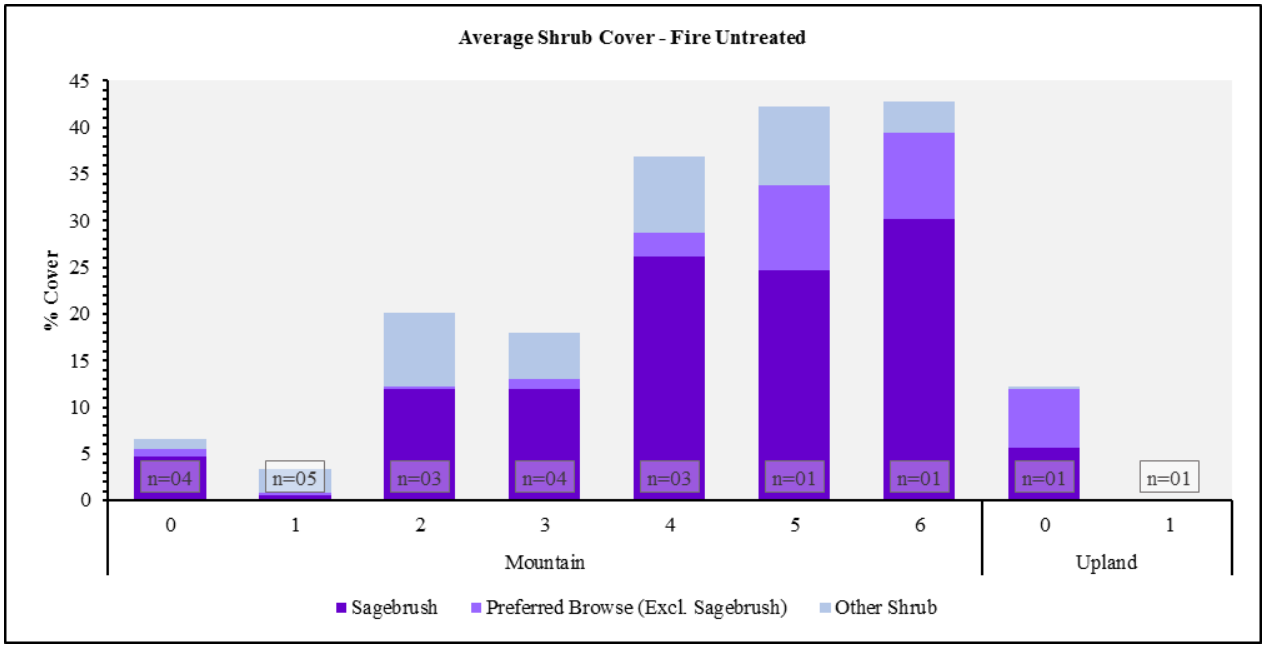


Figure 10.40: Average shrub cover on mountain and upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

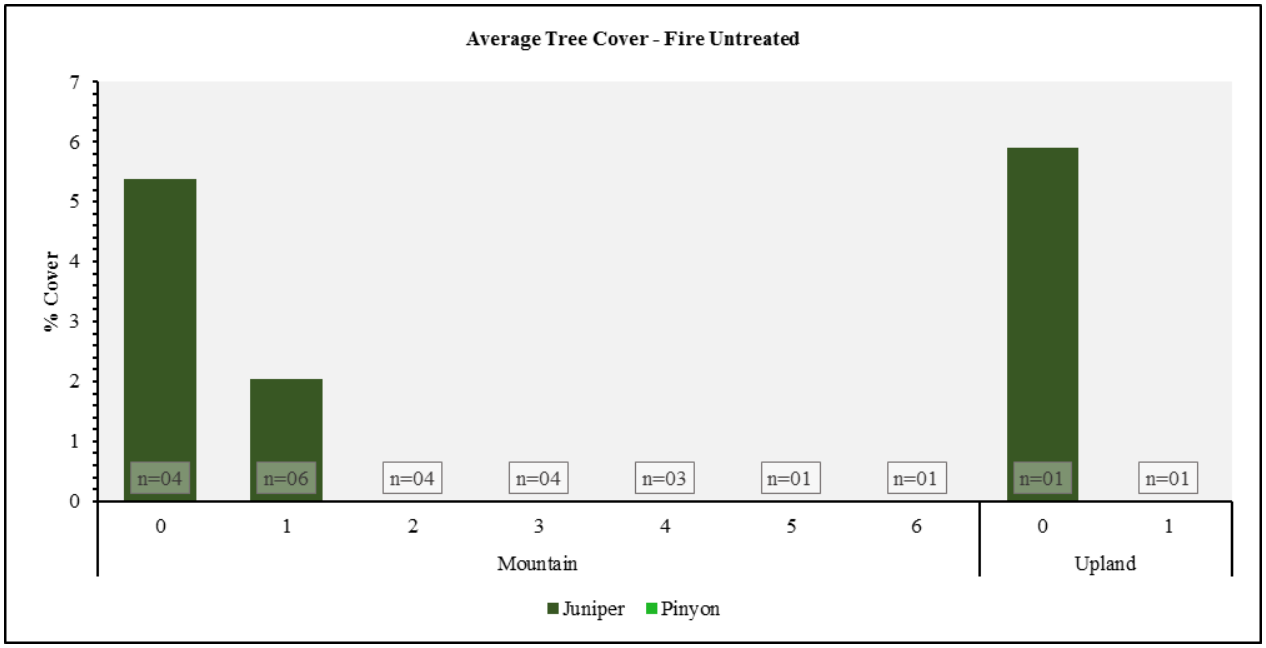


Figure 10.41: Average tree cover on upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

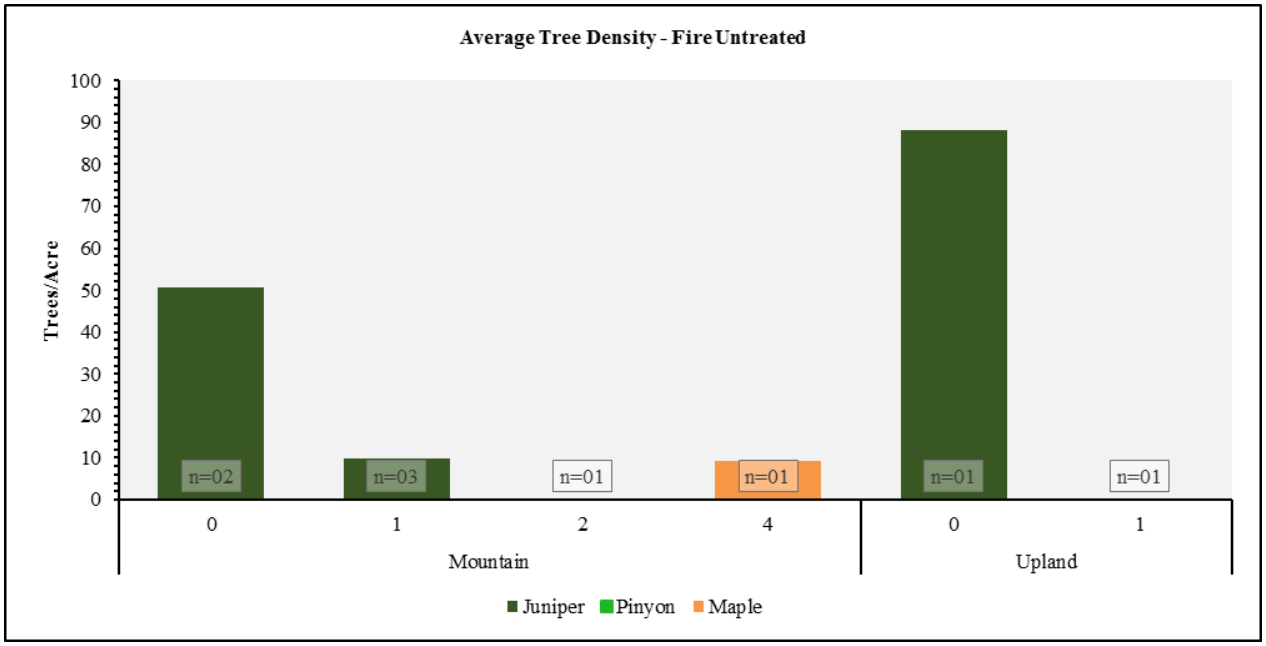


Figure 10.42: Average tree density on mountain upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

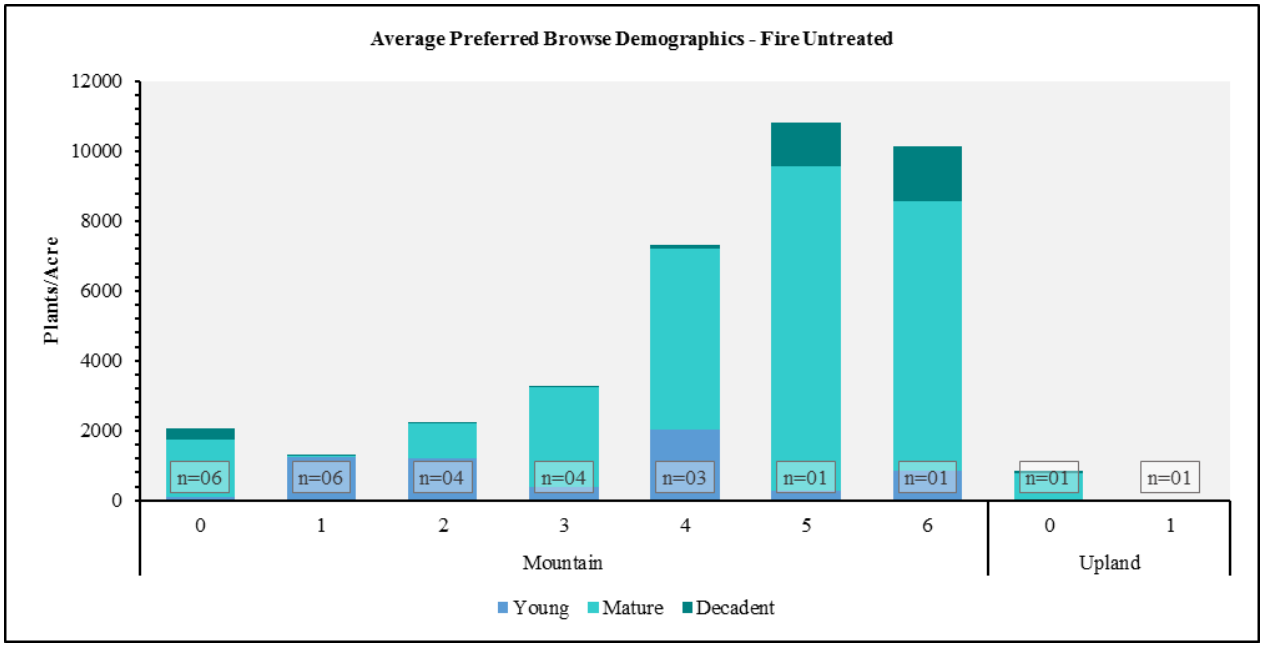


Figure 10.43: Average preferred browse demographics on mountain and upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

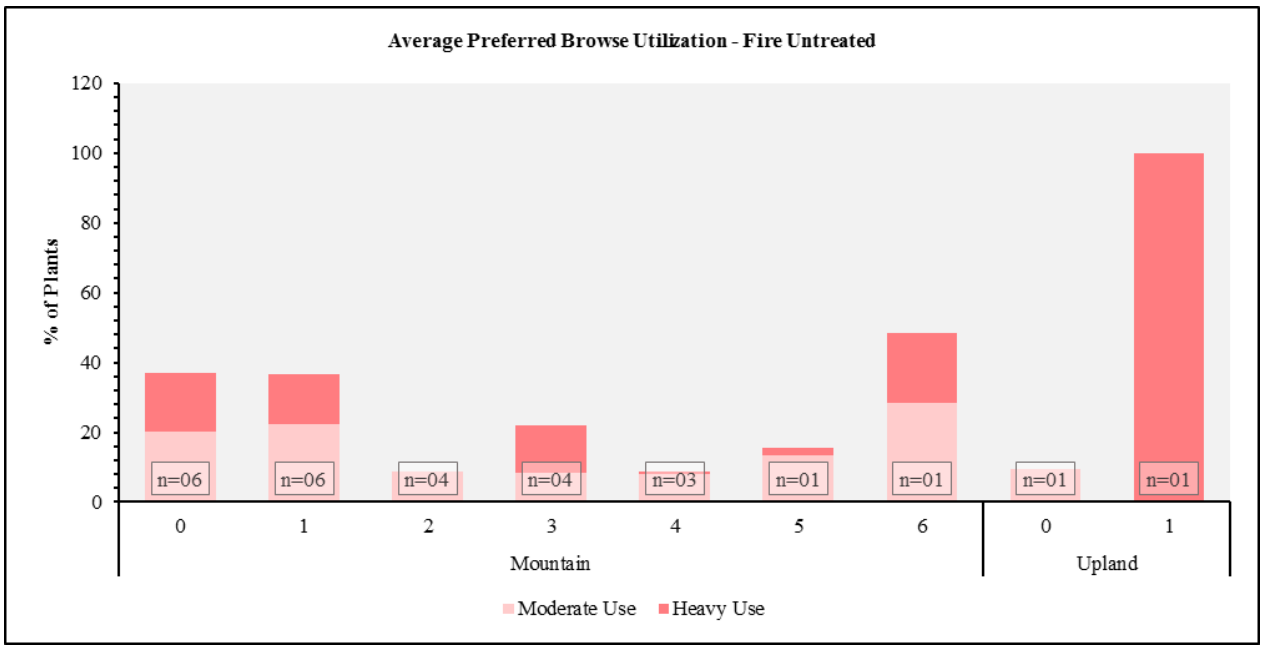


Figure 10.44: Average preferred browse utilization on mountain and upland study sites that have burned and had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

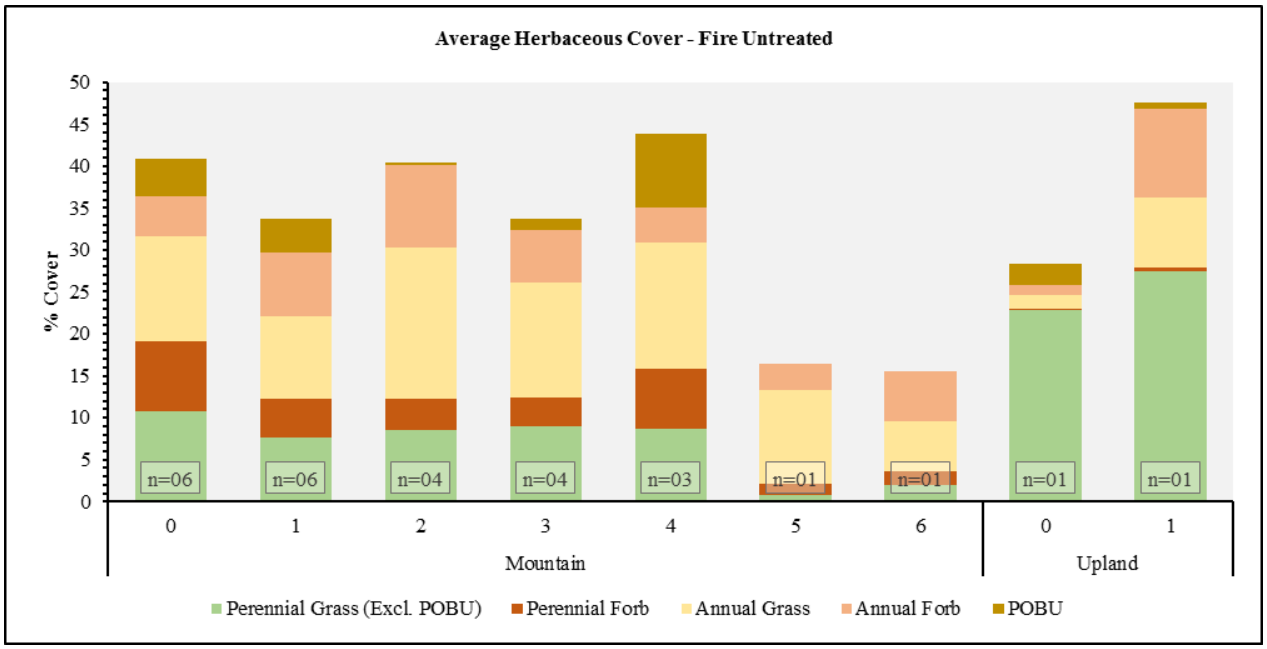


Figure 10.45: Average herbaceous cover on mountain and upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

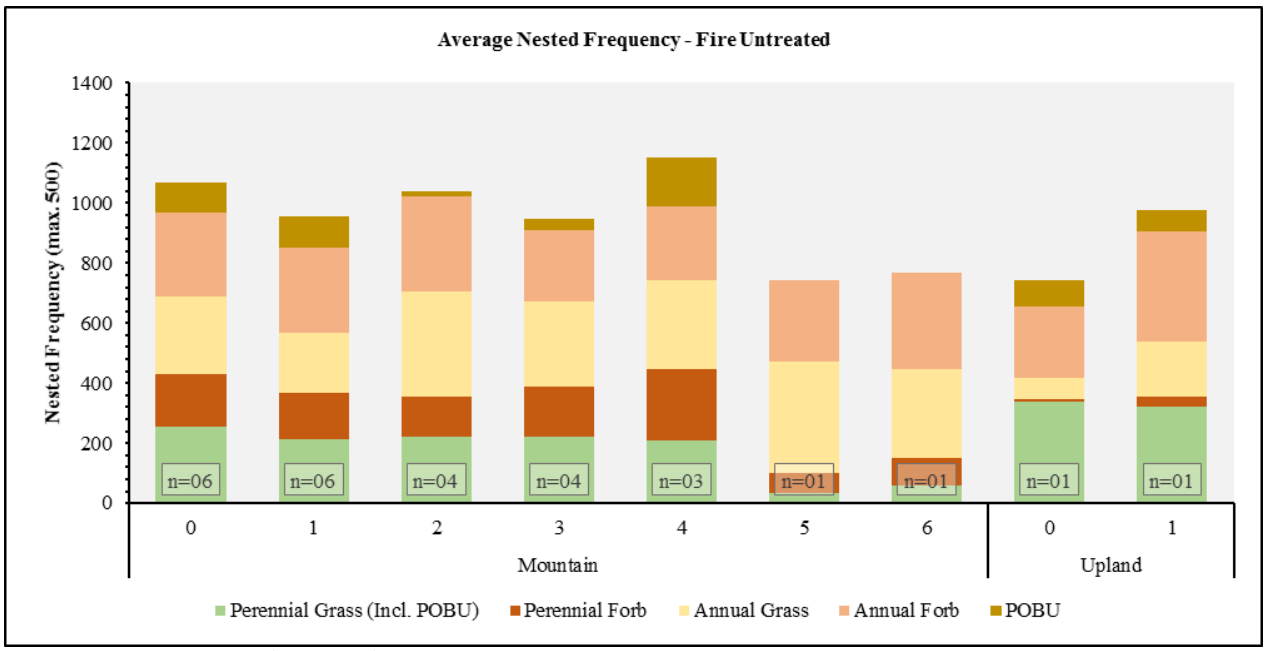


Figure 10.46: Average nested frequency of herbaceous species on mountain and upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

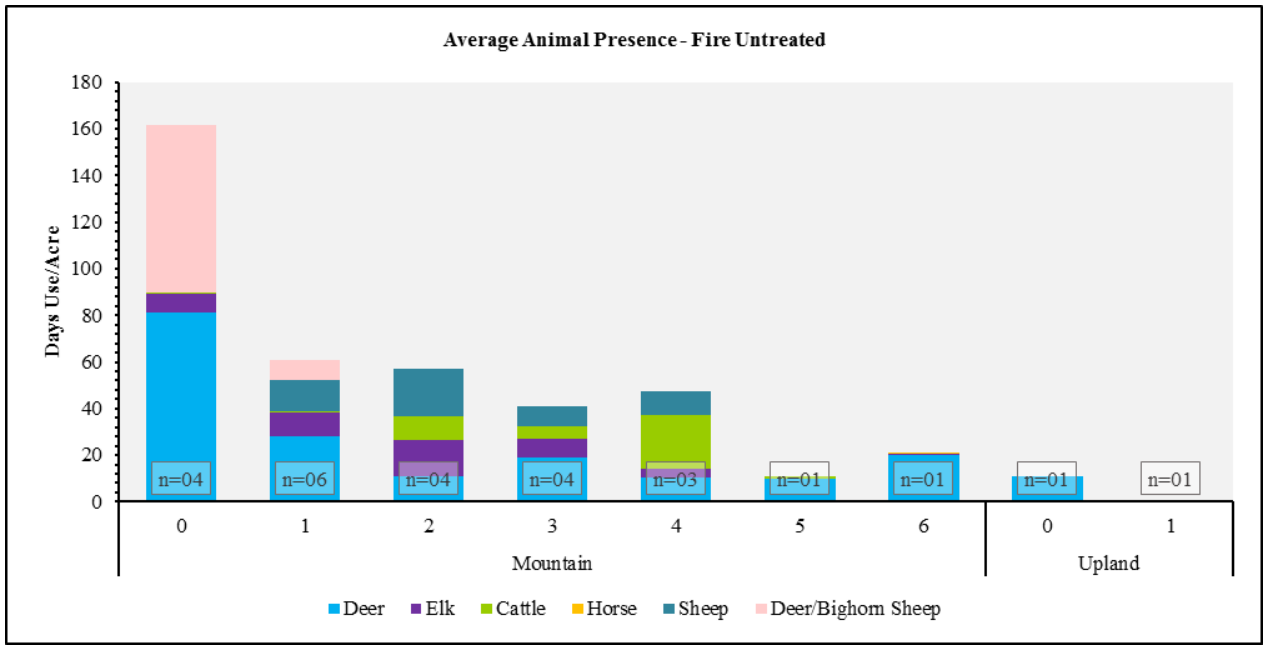


Figure 10.47: Average pellet data transect of mountain and upland study sites that have burned and have had no rehabilitation treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment, 5 = 19 – 23 years post-treatment, 6 = 24 – 28 years post-treatment.

Harrow

Fourteen study sites have been treated with a harrow over the study period. Three are considered to be mountain ecological sites [Strawberry Grouse 1 (17R-17), Trout Creek Dixie (17R-25), and Badger Hollow Harrow (17R-33)], ten are classified as upland ecological sites [Fountain Green Dixie and Plateau (16R-26) Willow Creek Dixie (16R-28), Mona Bench (16R-40), Mona Bench 2 (16R-41), North Canyon (16R-51), Ibapah Harrow (19A-11), Sage Valley Dixie (19R-6), Diagonal/Electric Harrow (19R-13), Ibapah Harrow (19R-14), and Benmore Harrow (19R-16)], and one is considered to be a semidesert ecological site [East Pasture Harrow (19R-20)].

The Strawberry Grouse 1 study is located just west of the Windy Ridge road near Strawberry Reservoir, while Trout Creek Dixie can be found just east of Trout Creek near US-40. The Badger Hollow Harrow study is situated north of Road Hollow near Strawberry Reservoir. Fountain Green Dixie and Plateau can be found east of the city of Fountain Green, and the Willow Creek Dixie site is situated east of the town of Mona and north of Willow Creek. The Mona Bench and Mona Bench 2 studies are found on the benches north of Mona. The North Canyon site can be found north of Mona and just east of I-15. Both Ibapah Harrow studies are located on either side of Durse Canyon Road near the foot of the Deep Creek Mountains. The Sage Valley Dixie site is located near Bankhead Road, northeast of Vernon Reservoir. Diagonal/Electric Harrow can be found west of Harker Road near the Sheeprock Mountains, while Benmore Harrow is found just east of Harker Road. Finally, East Pasture Harrow is located about 0.2 miles east of Horse Sense Road near the Deep Creek Mountains.

Shrubs/Trees: Sagebrush (*Artemisia sp.*) has been the dominant browse species on mountain study sites in all sample years; shrub cover decreased in the first post-treatment sample year, but started to recover in the second sample year following treatment. Shrub cover on upland study sites has been mainly contributed by sagebrush in all sample years. Overall cover amounts have fluctuated, with a significant decrease in the first post-treatment sampling and an increase in each subsequent sample year. As in previous sections, one should be aware of the differing n values between sample years: data for the third post-treatment category is provided by the Sage Valley Dixie and both Ibapah Harrow studies and may not be representative of all sites of this

ecological type. On the semidesert study site, sagebrush has also been the dominant browse component in all sample years and overall cover has decreased between the pre-treatment and second post-treatment sample years (**Figure 10.48**). Average preferred browse demographics indicate that both overall density and recruitment of young plants has increased on the mountain study sites and that mature plants have been the most prevalent demographic in all sample years. Overall density has also increased on upland study sites. Prior to treatment, decadent plants comprised a majority of the population, but mature plants have been the dominant demographic in all post-treatment years; recruitment of young has exhibited an overall increase. On the semidesert site, overall density and recruitment of young have also increased. Decadent individuals made up a majority of the population during the pre-treatment sampling, but mature plants dominated in the second post-treatment sample year (**Figure 10.49**). Preferred browse utilization has increased on mountain study sites, but decreased overall on upland and semidesert sites; more than half of all plants in all ecological types have exhibited no use or light use in all sample years (**Figure 10.50**).

Tree cover and density have not been observed on any study site and will therefore not be discussed in this section.

Herbaceous Understory: The herbaceous understory on mountain study sites has marginally decreased overall in both cover and frequency, with perennial grasses and forbs as the dominant components; annual grasses are not a concern on these sites. On upland study sites, there has been an overall increase in herbaceous cover and a slight increase in frequency. Annual grasses contributed the most cover prior to treatment and in the first reading post-treatment, largely due to the Mona Bench and Mona Bench 2 studies. Average perennial grass cover and frequency increased and surpassed that of annual grasses in the second and third sample years following treatment: this increase is due in part to the difference in study site numbers (the 'n value') from year to year. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has been observed in fluctuating amounts in each sample year, but was relatively rare during the third post-treatment sampling; again, this is partially due to the differing number of study sites. Cover of the herbaceous understory has slightly increased on the semidesert study site, and frequency has exhibited a marginal decrease. Annual grasses have been the dominant component on this site both prior to treatment and during the second post-treatment sample year (**Figure 10.51**, **Figure 10.52**).

Occupancy: Pellet group transect data indicates that overall pellet group abundance has decreased on the mountain, upland, and semidesert ecological sites. Elk were the primary occupants prior to treatment on the mountain study sites, while deer provided the most pellet groups during the first and second post-treatment sample years. On upland study sites, sheep pellet groups were most abundant in the pre-treatment and second post-treatment sample years, a trend driven by the Fountain Green Dixie and Plateau study. Deer and elk contributed the most pellet groups in the first-post treatment sample year, and cattle pellet groups were most abundant in the third year following treatment mainly due to the Sage Valley Dixie study site. Finally, cattle have been the primary occupants both prior to treatment and during the second post-treatment sampling on the semidesert study site (**Figure 10.53**).

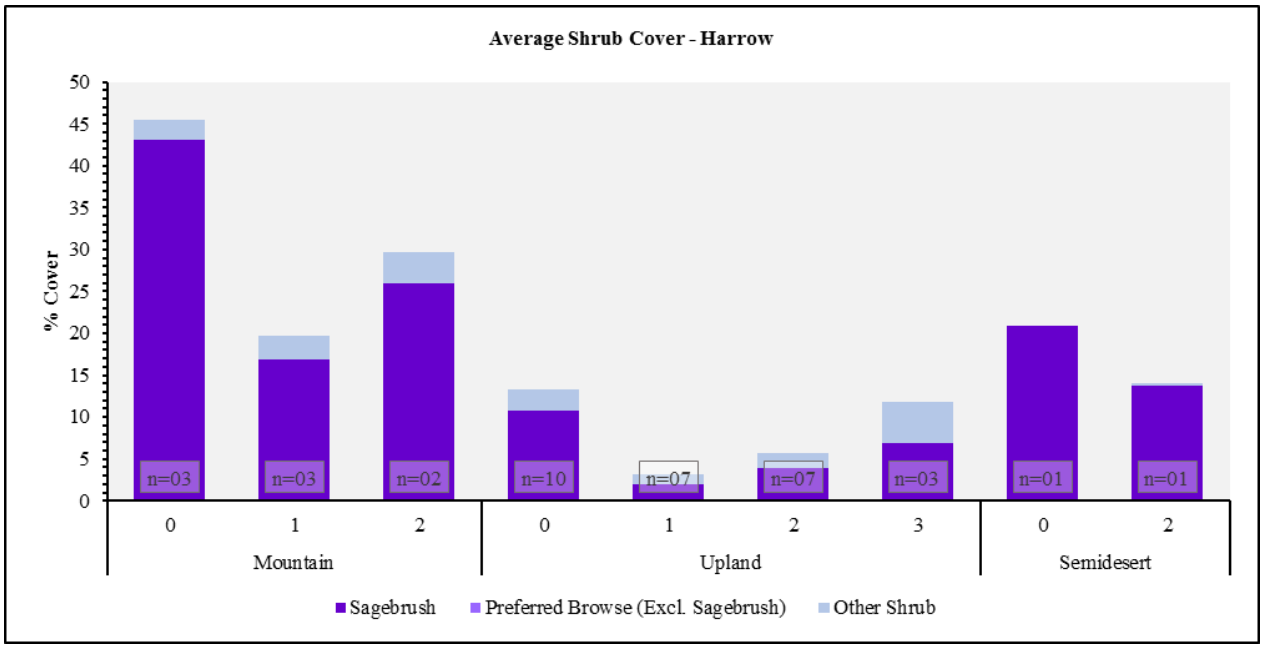


Figure 10.48: Average shrub cover on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

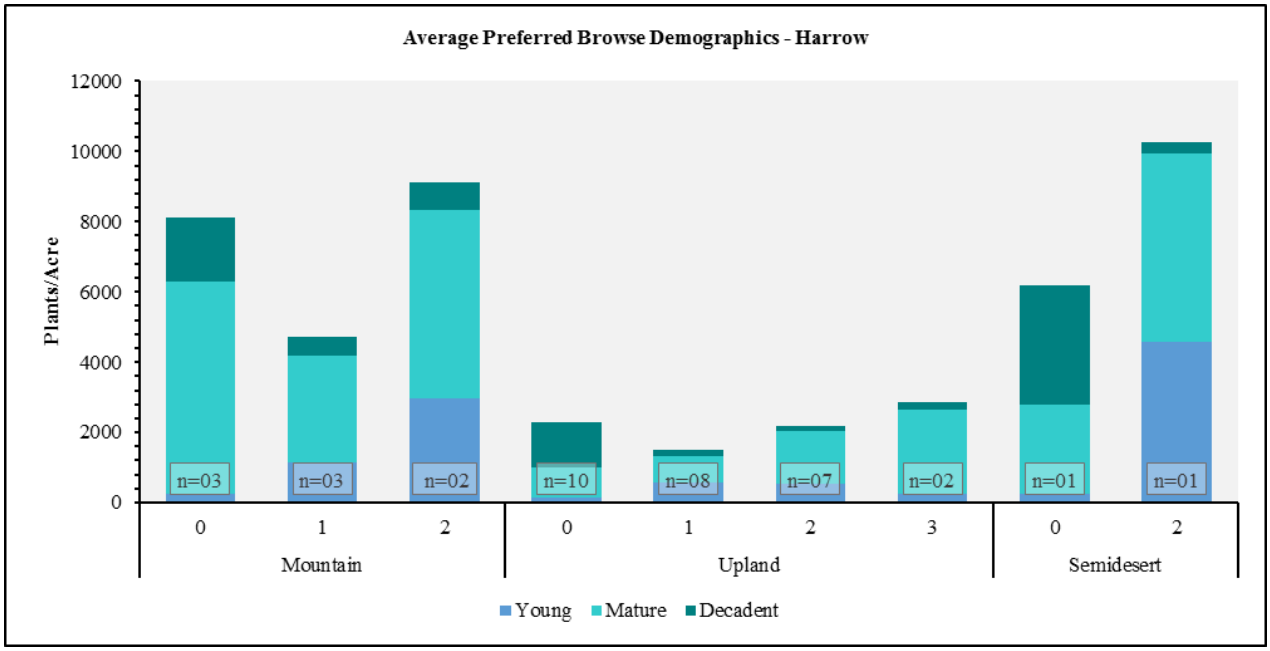


Figure 10.49: Average preferred browse demographics on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

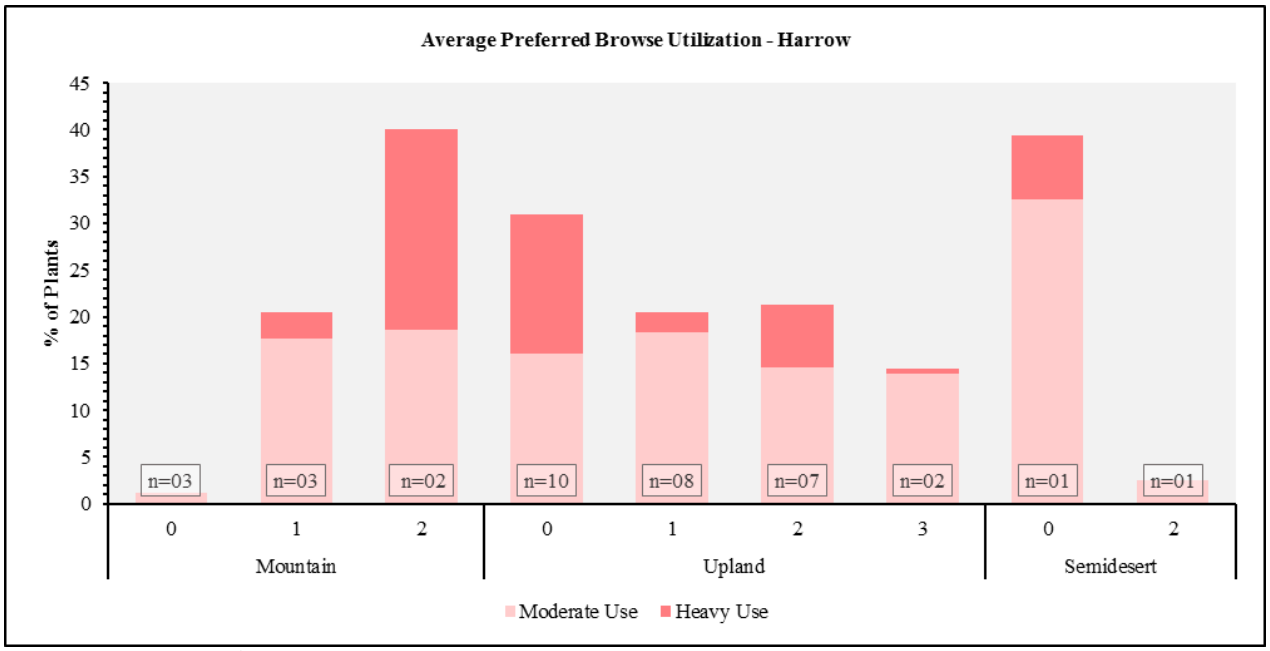


Figure 10.50: Average preferred browse utilization on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

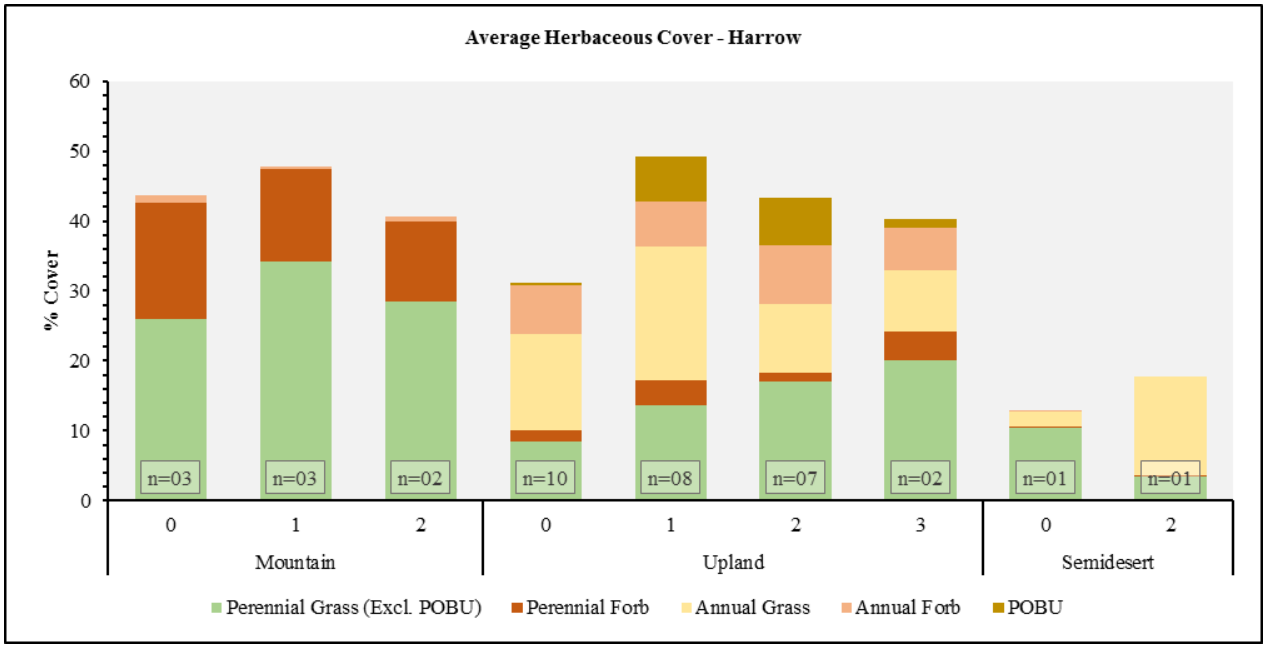


Figure 10.51: Average herbaceous cover on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

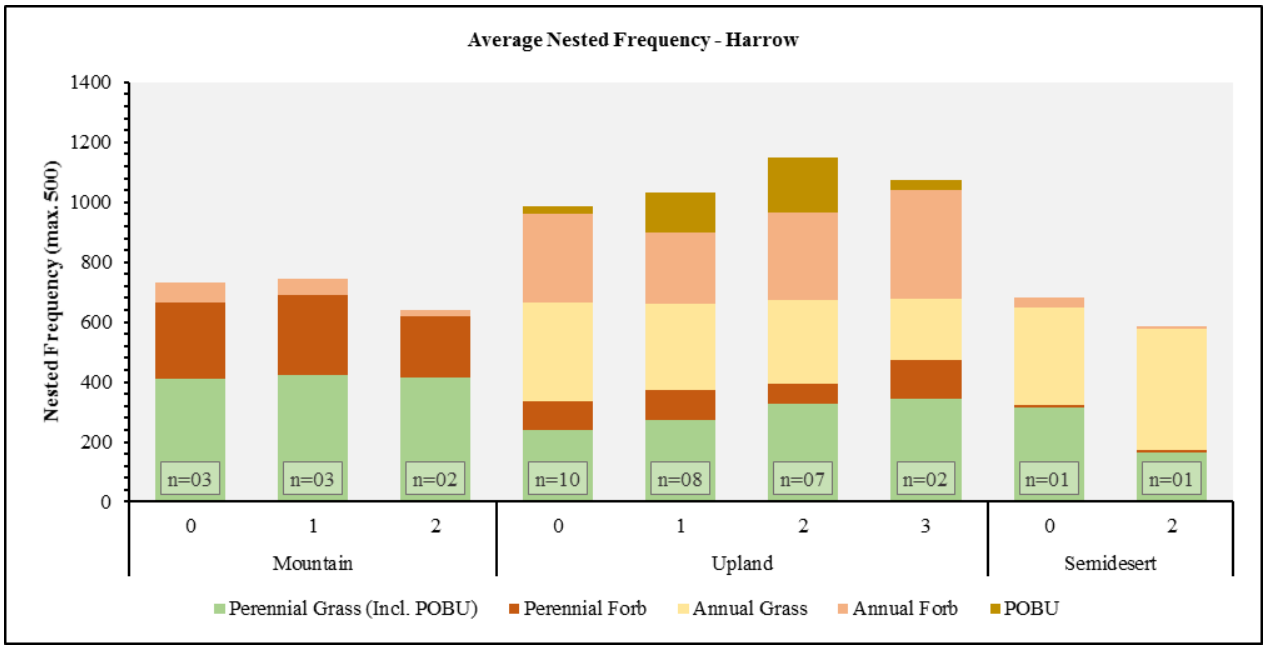


Figure 10.52: Average nested frequency of herbaceous species on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

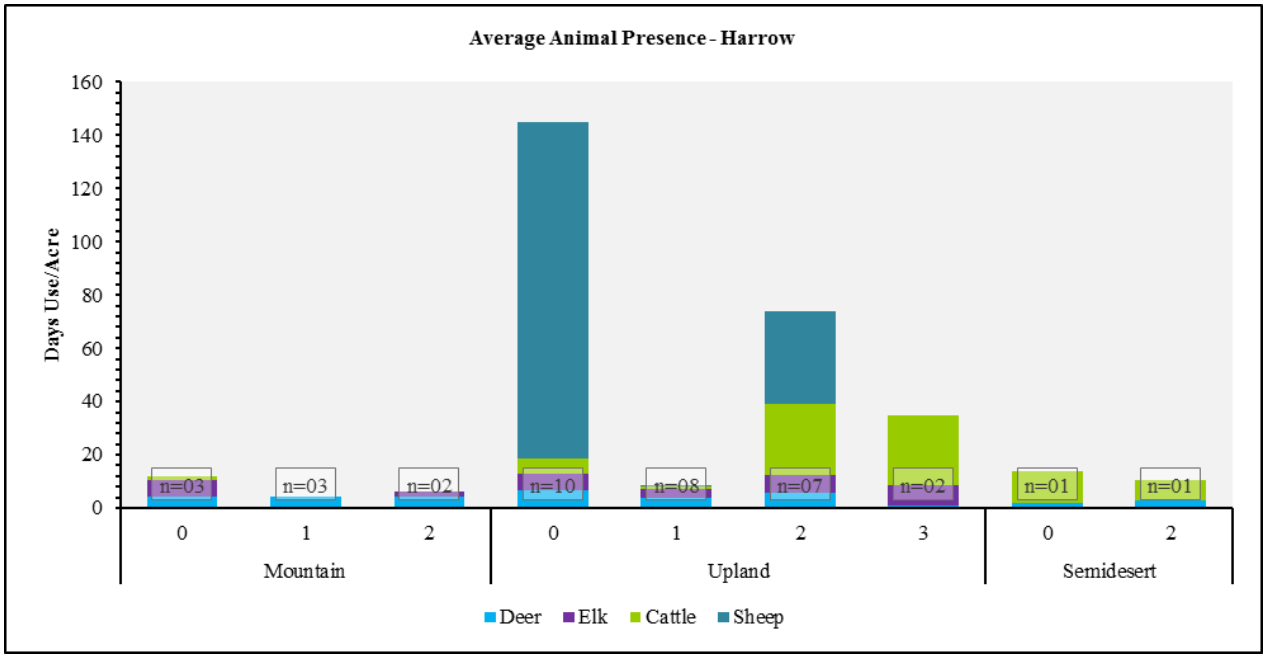


Figure 10.53: Average pellet transect data of mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Herbicide

Eight study sites have been treated with herbicide. Of these, one study [North Bench (17-45)] is classified as a mountain ecological site and seven study sites [Fountain Green Plateau (16A-23), Levan Spray and Drill (16R-22), 12 Mile Dixie (16R-24), Clover Creek Dry Farm (18R-6), Bennion Spike 1 (19R-8), Bennion Spike 2 (19R-9), and Tintic Knapweed Control (19R-10)] are considered to be upland ecological sites.

The North Bench study site is located on a bench between Joes Canyon and Sterling Hollow with Highway 6 to the east. The Fountain Green Plateau site is situated southeast of Fountain Green along the base of Cedar Hills, and the Levan Spray and Drill study can be found northeast of the town of Levan. 12 Mile Canyon is situated in South Hollow on the Twelve-Mile Wildlife Management Area, southeast of the town of Mayfield. The Clover Creek Dry Farm study is located just east of Leprechaun Road at the foot of the Onaqui Mountains. Both the Bennion Spike 1 and Bennion Spike 2 studies can be found along the north side of Green Jacket Road north of Vernon Reservoir. Finally, the Tintic Knapweed Control study is located just west of Highway 6 at the foot of the East Tintic Mountains.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) has been the dominant browse component on the mountain study site. Overall shrub cover on this site exhibited a decrease in the first sample year following treatment and an increase in the second sample year, resulting in a negligible increase overall. On upland study sites, sagebrush contributed the most cover in the pre-treatment and first post-treatment sample years, and was co-dominant with other shrubs in the second sampling following treatment. Average sagebrush cover decreased between the second and third post-treatment samplings. Other shrubs dominated during the third post-treatment reading (**Figure 10.54**). Overall density of preferred browse on mountain study sites has also exhibited a marginal increase, with mature plants comprising a majority of the population; recruitment of young has also increased overall. On upland study sites, density has shown a general decreasing trend. Mature plants were the dominant demographic in every year except the third post-treatment sampling, when decadent plants were most abundant. Recruitment of young on these study sites has also exhibited an overall increase (**Figure 10.57**). Average preferred browse utilization has decreased on the mountain study site, with no plants showing signs of moderate to heavy use in the second post-treatment sample year. On the upland study sites utilization has fluctuated, but has shown a slight overall decrease. Utilization data shows that over half of plants displayed little to no use in all sample years (**Figure 10.58**).

Tree cover was not recorded on the mountain study site, but decreased on upland study sites: this is likely not due to the herbicide treatment and is partially driven by the differing number of study sites each sample year (**Figure 10.55**). Density has increased between the pre-treatment and first post-treatment sample year on upland study sites. However, this trend is driven entirely by the Clover Creek Dry Farm study and is not representative of this ecological type as a whole (**Figure 10.56**).

Herbaceous Understory: On the mountain study sites, the herbaceous understory has increased in both cover and frequency. Perennial grasses and forbs have been the dominant components in most sample years and have both increased in cover. However, the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has also increased in cover and frequency and was co-dominant in the second post-treatment sample year. Annual grasses and forbs have remained relatively rare. The understory has also increased in both cover and frequency on upland study sites. However, this increase is largely due to an increase in annual grasses and forbs, a trend driven by the Fountain Green Plateau and 12 Mile Dixie studies. Perennial forbs have also increased in cover and frequency: this is mainly due to the Levan Spray and Drill study, on which the perennial noxious weed field bindweed (*Convolvulus arvensis*) provided a majority of the perennial forb cover in the third post-treatment sample year. Bulbous bluegrass has increased overall on these study sites, but remains rare in comparison to other herbaceous components (**Figure 10.59**, **Figure 10.60**).

Occupancy: Average pellet transect data indicates that animal occupancy has fluctuated from year to year, but has exhibited marginal variations when comparing pre-treatment and the latest post-treatment data on both mountain and upland study sites. Cattle have been the primary occupants of the mountain study site in all sample years. On upland study sites, deer/sheep were the primary occupants prior to treatment and during the second post-treatment sampling, a trend entirely driven by the Fountain Green Plateau study. Finally, cattle were the primary occupants on these study sites in the first and second sample years following treatment (**Figure 10.61**).

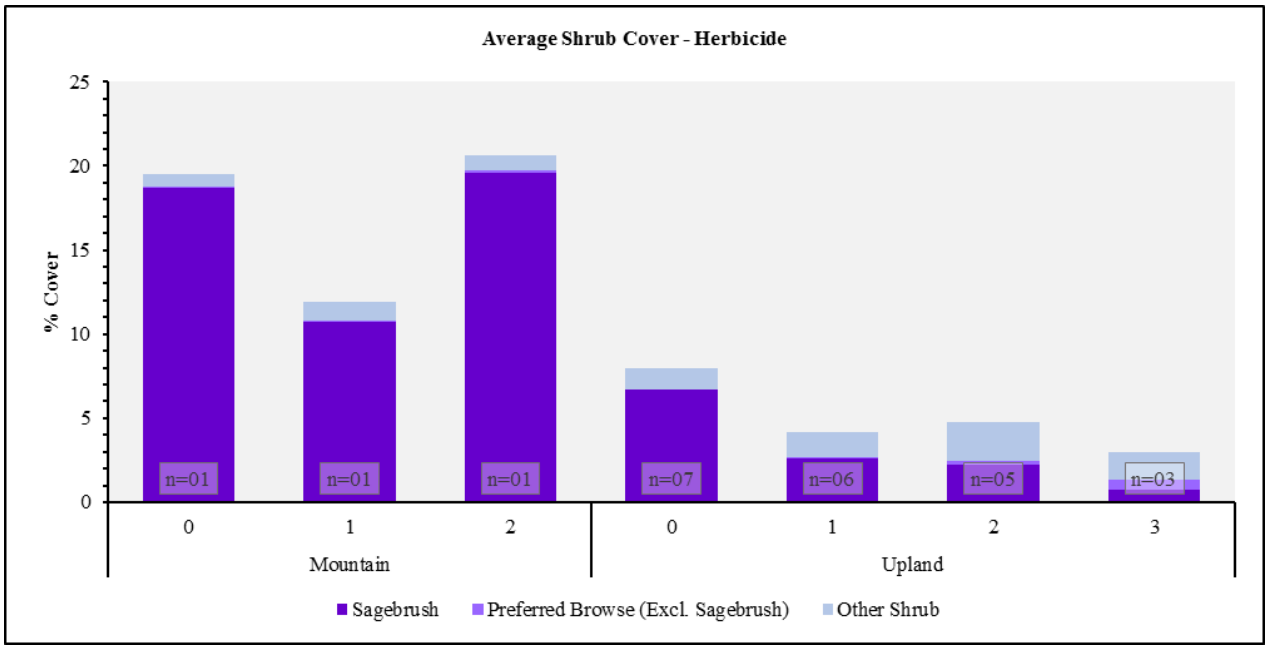


Figure 10.54: Average shrub cover on mountain upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

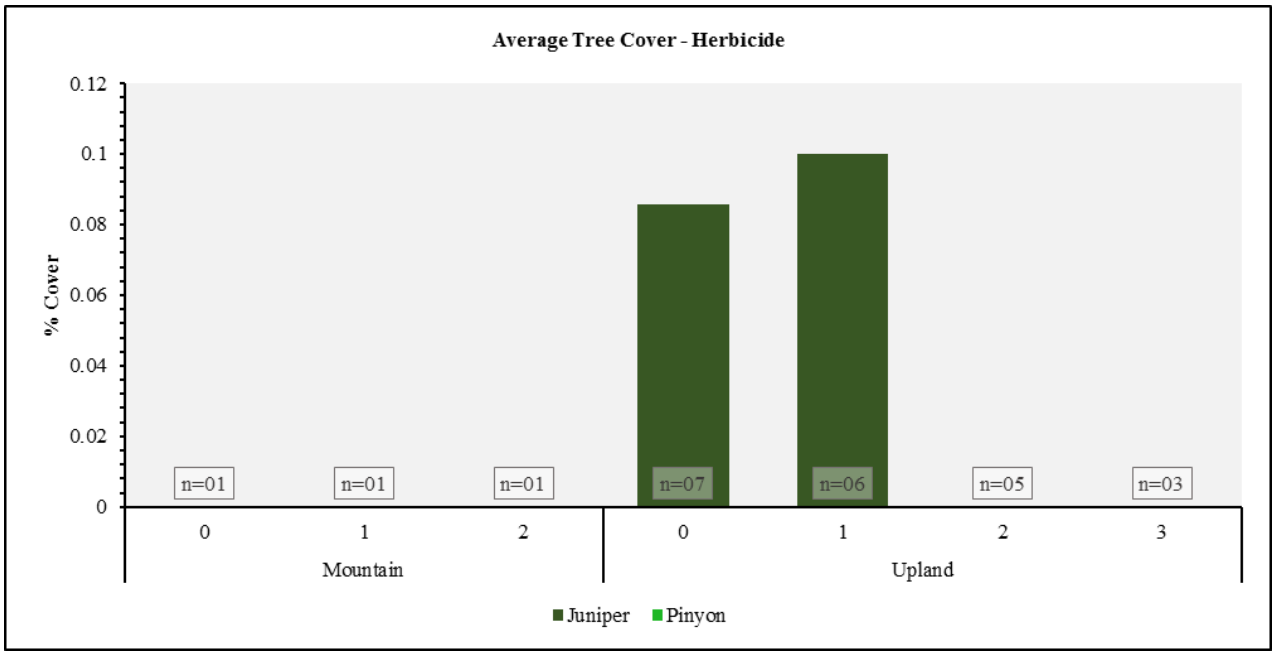


Figure 10.55: Average tree cover on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

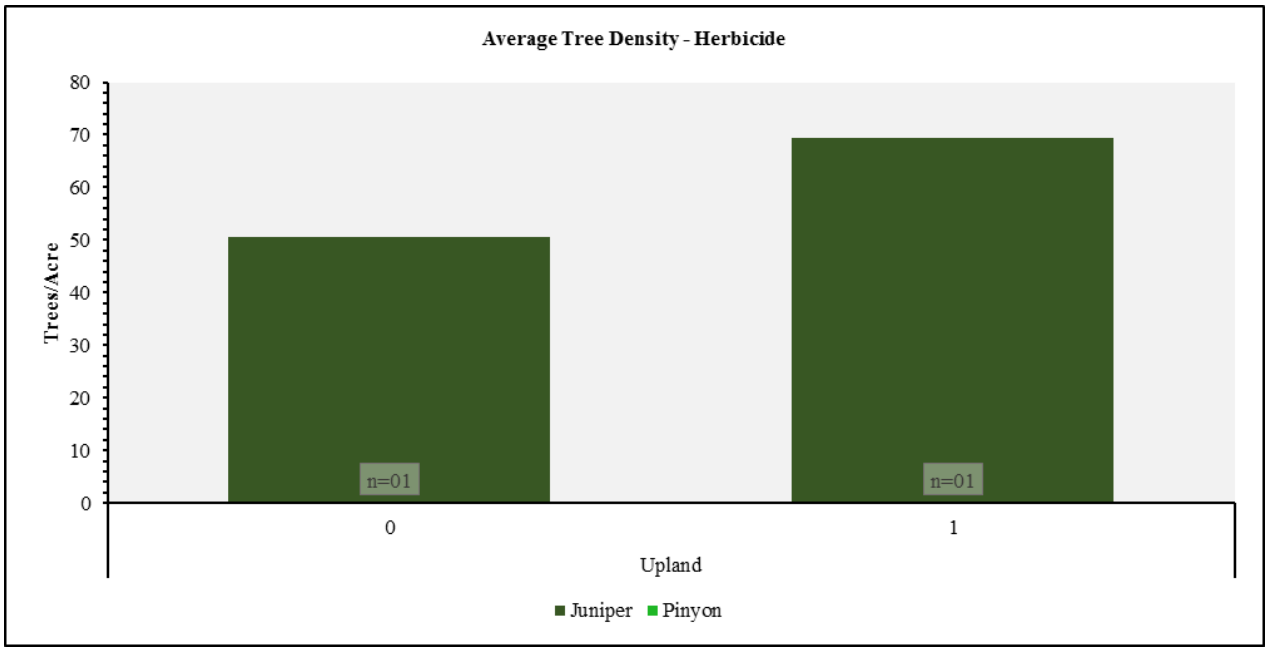


Figure 10.56: Average tree density on upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment.

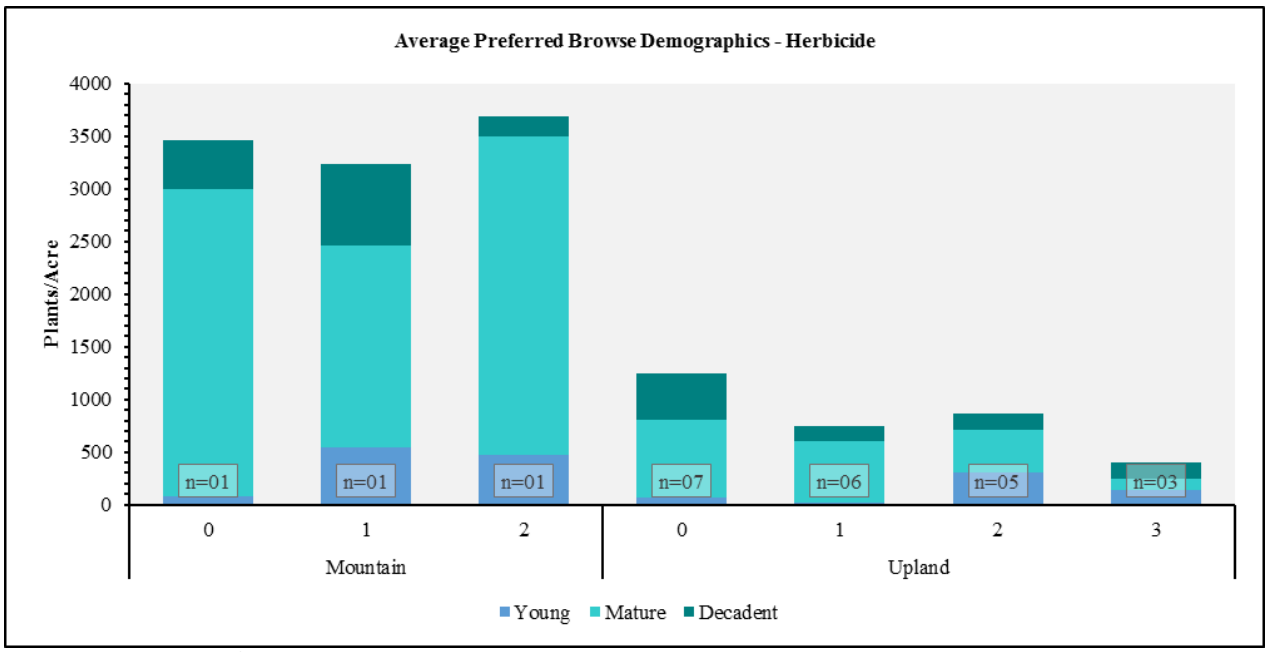


Figure 10.57: Average preferred browse demographics on mountain and upland study sites that have been treated with herbicide.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

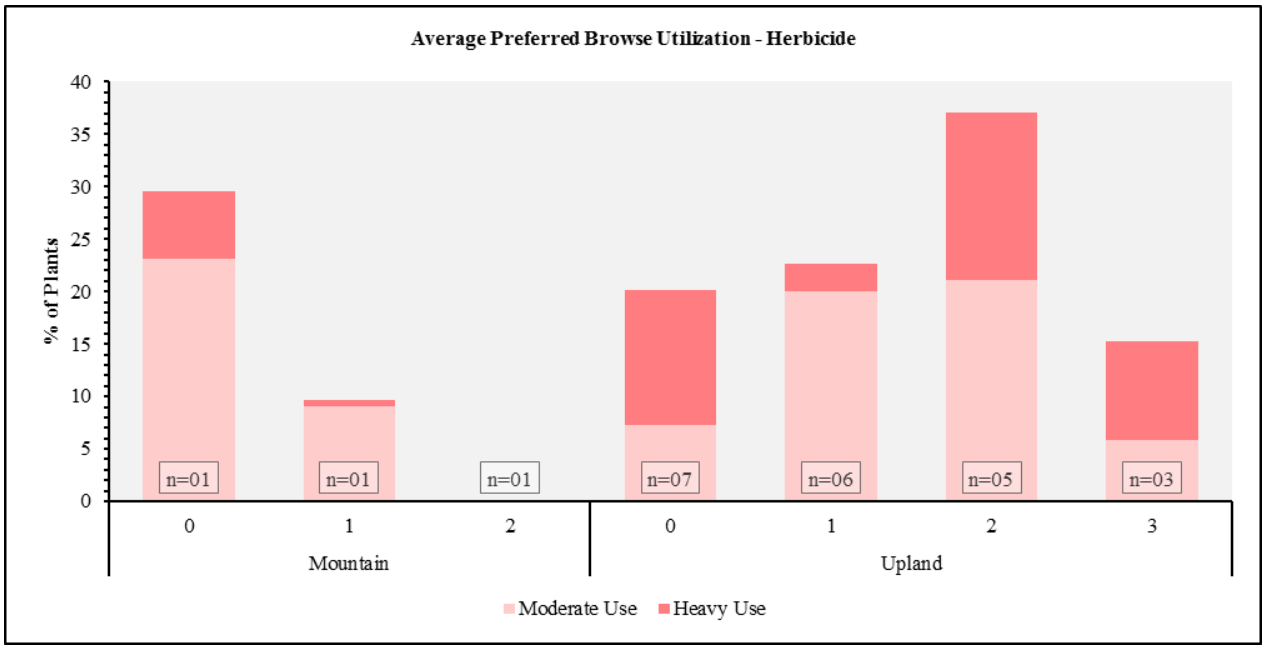


Figure 10.58: Average preferred browse utilization on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

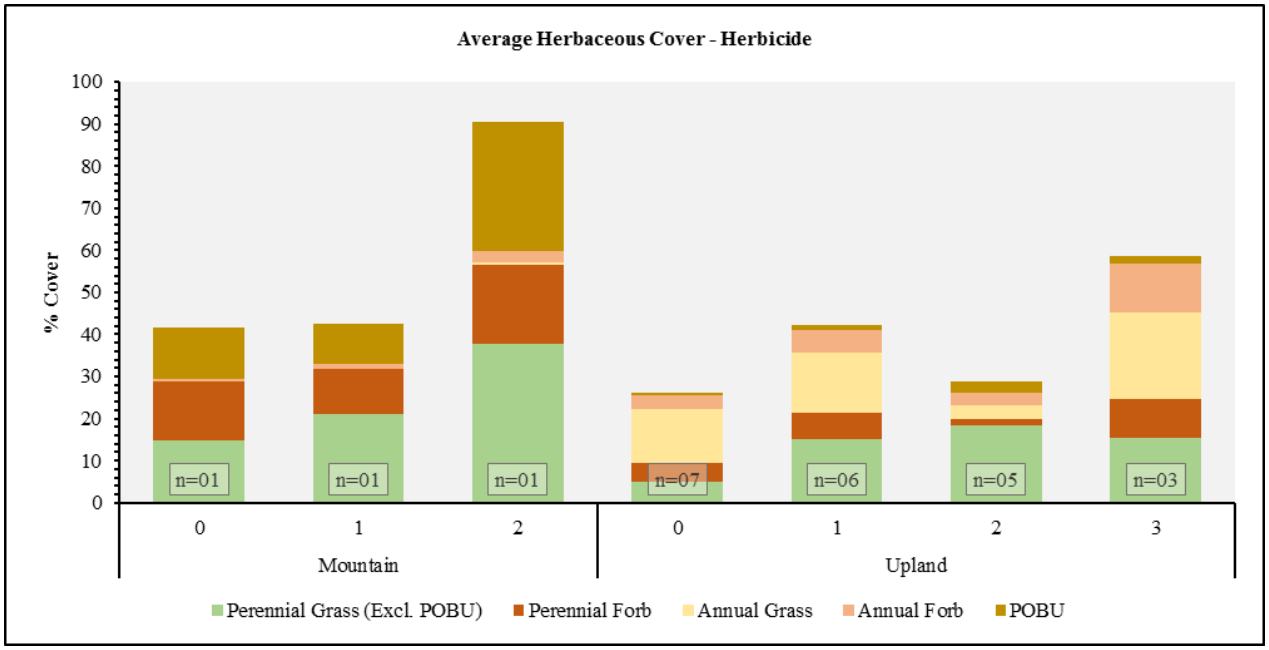


Figure 10.59: Average herbaceous cover on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

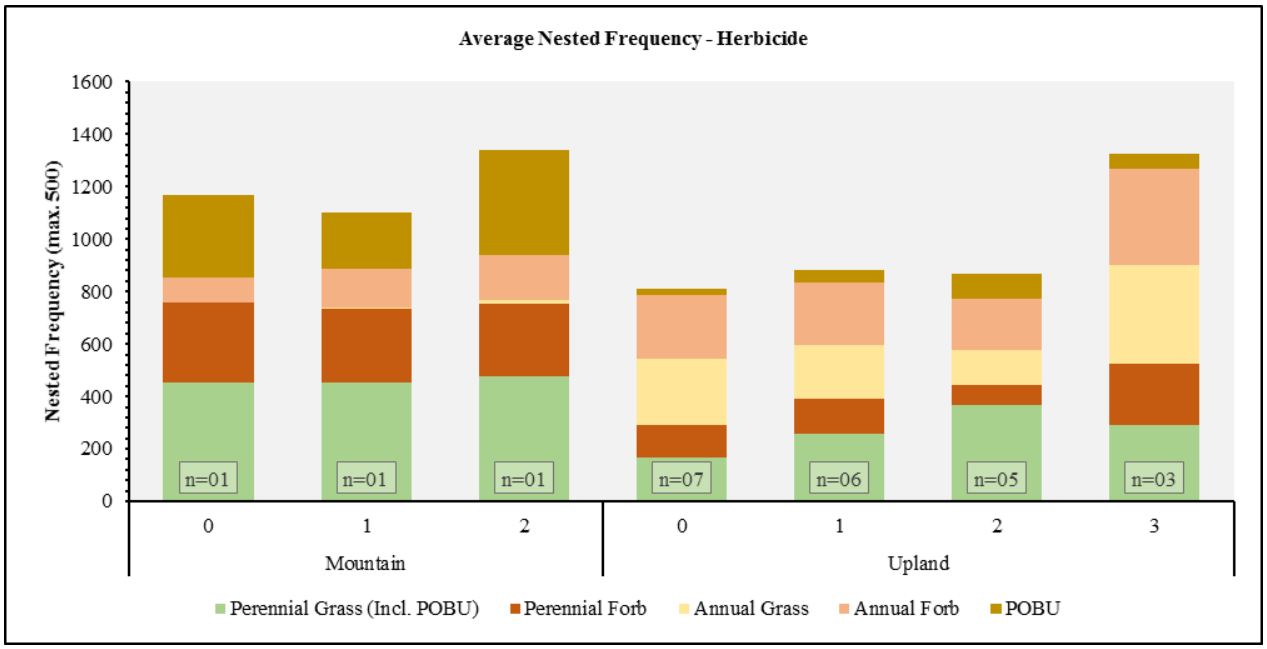


Figure 10.60: Average nested frequency of herbaceous species on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

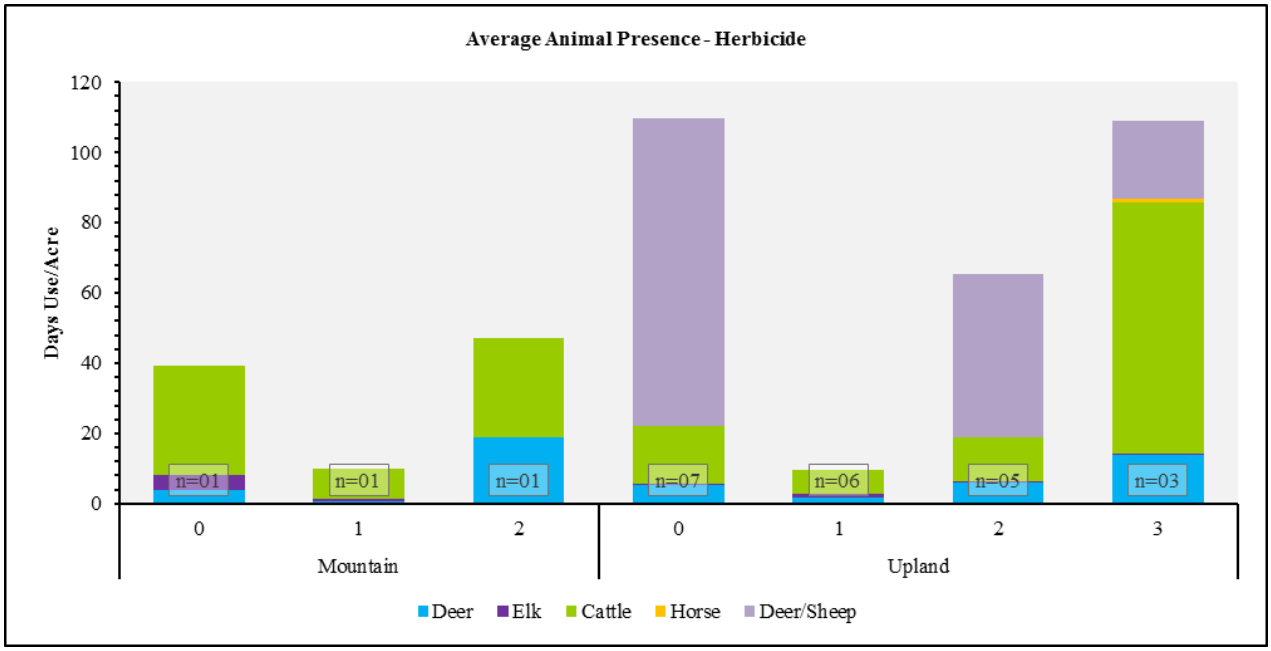


Figure 10.61: Average pellet transect data of mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Lop & Scatter

Ten studies [Manti Face Chaining (16C-1), Willow Creek (16C-2), North Manti Face (16C-3), Cane Valley (16C-5), Black Hill (16C-6), Mayfield Mountain Face (16C-7), Pole Canyon Chaining (16C-8), Tank Hollow (17-42), Lower Tank Hollow (17-46), West Government Creek (19B-5)] have been treated with lop and scatter treatments over the study period. The Manti Face Chaining site is located northeast of Manti on the Manti Face WMA property. Willow Creek is located on the lower face of Bald Mountain south of Ephraim. North Manti Face is on Willow Creek Road at the north end of the Manti Face WMA. The Cane Valley site is located east

of Ephraim along the foothills. The Black Hill site is situated northeast of Ephraim on the Black Hill WMA. The Mayfield Mountain Face study site is located southeast of Mayfield near South Hollow. The Pole Canyon Chaining site can be found at the south end of the Arapien Valley near Pole Canyon. Tank Hollow and Lower Tank Hollow are up the Knoll Hollow draw north of US-6. West Government Creek is situated on Erickson Pass on the west side of the Sheeprock Mountains.

Shrubs/Trees: The dominant browse species on these sites vary, but include sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and alderleaf mountain mahogany (*Cercocarpus montanus*). Shrub cover has generally increased following treatment, with the exception being post-treatment category three on the upland ecological sites. This precipitous decrease is likely due to the change in the 'n value' which indicates the number of study sites included in each year's average (**Figure 10.62**). Following treatment, preferred browse demographics have displayed a slight increase in young plants (**Figure 10.65**). Preferred browse utilization has shown fluctuations between sample years, but use has remained similar overall (**Figure 10.66**).

Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*) are the tree species that are present on these sites. Tree cover and density have decreased on both ecological sites following treatment (**Figure 10.63**, **Figure 10.64**).

Herbaceous Understory: The herbaceous cover has increased on these sites following treatment, with perennial grasses being the most common vegetation component. Perennial grasses have increased in cover but frequency has been stable: these cover increases can be partially attributed to the introduced perennial grasses crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*). Perennial forb cover has remained similar or increased slightly. Finally, annual grasses and forbs have shown increases in both cover and frequency on the upland sites (**Figure 10.67**, **Figure 10.68**).

Occupancy: Pellet group transect data shows that in most years the primary occupants of these studies have been deer. Deer and elk were the primary occupants of the mountain ecological site during the pre-treatment sample year. The overall animal pellet data shows decreases in days use/acre on both ecological sites. Deer usage has increased slightly on mountain ecological sites, while the mean abundance of elk and cattle pellets has decreased (**Figure 10.69**).

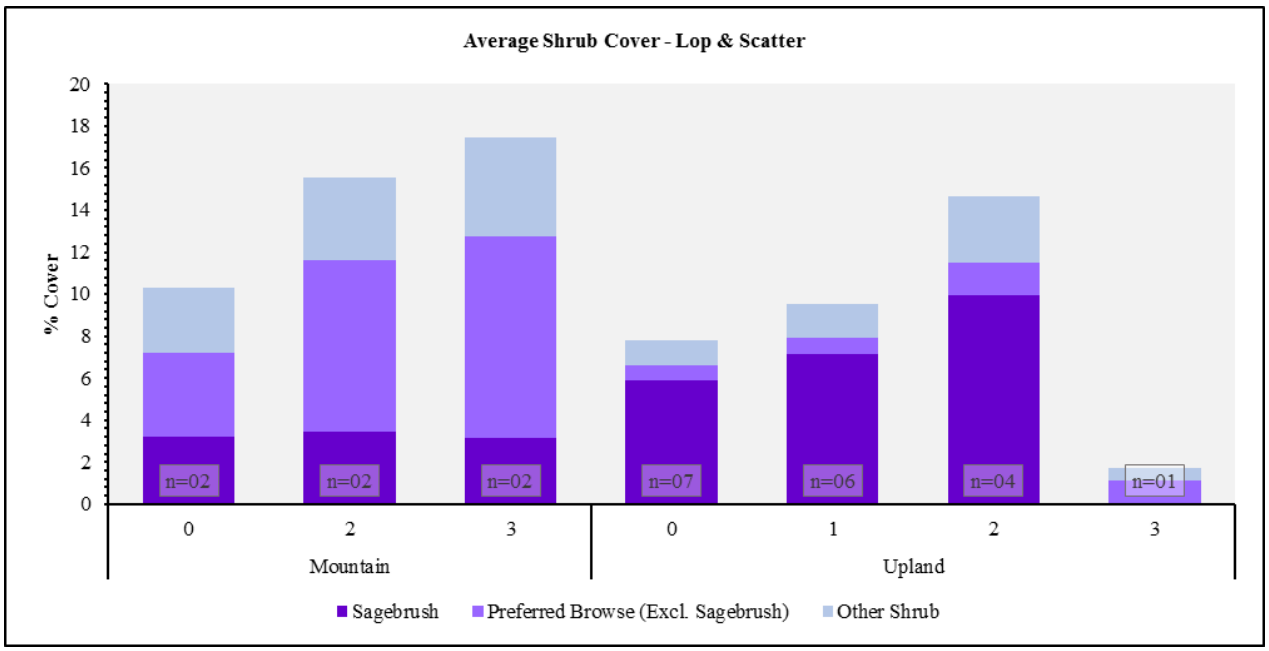


Figure 10.62: Average shrub cover on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

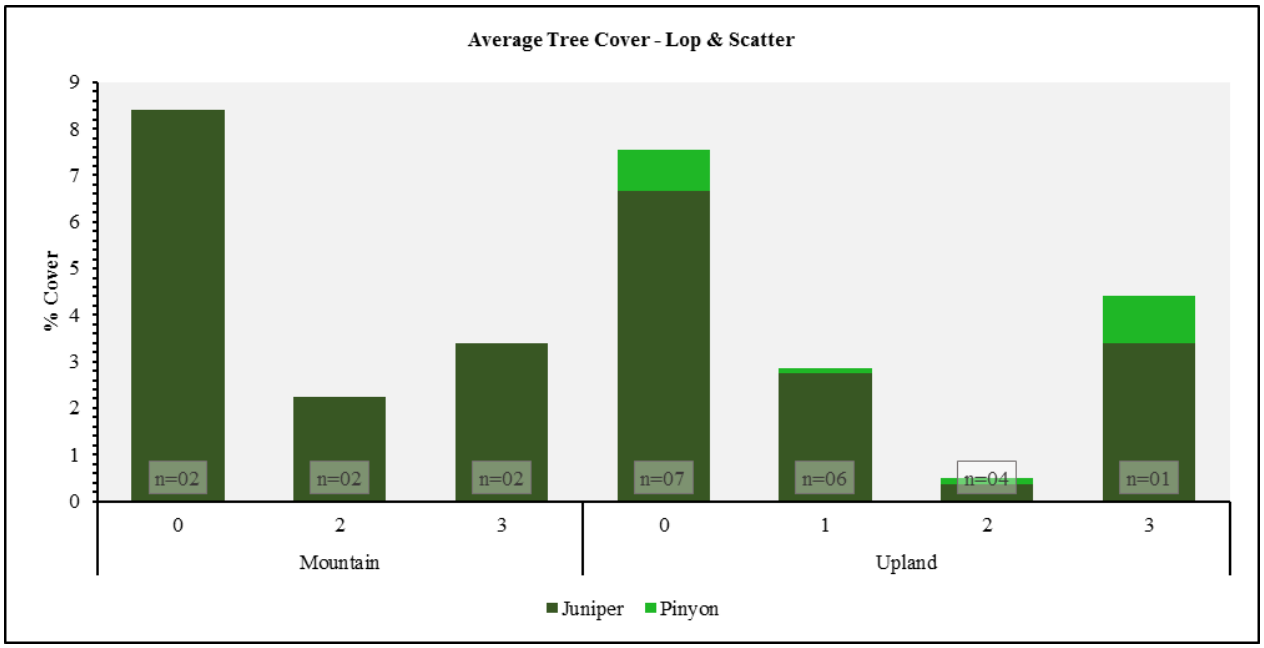


Figure 10.63: Average tree cover on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

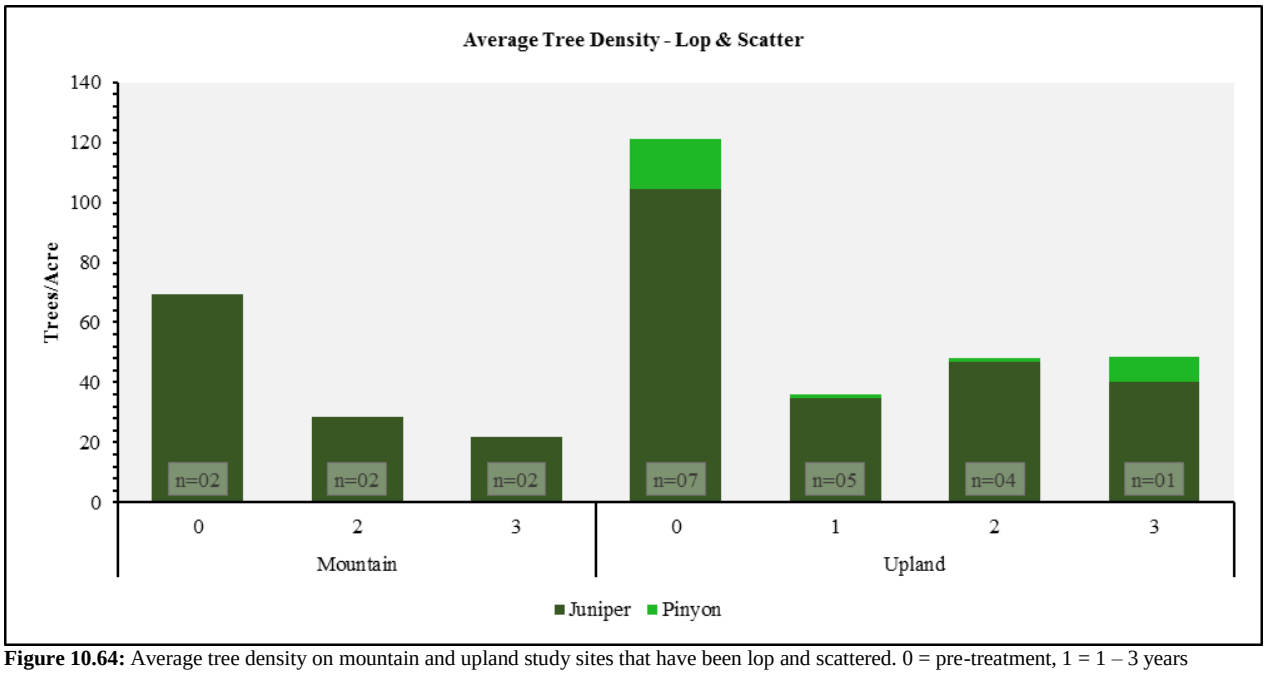


Figure 10.64: Average tree density on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

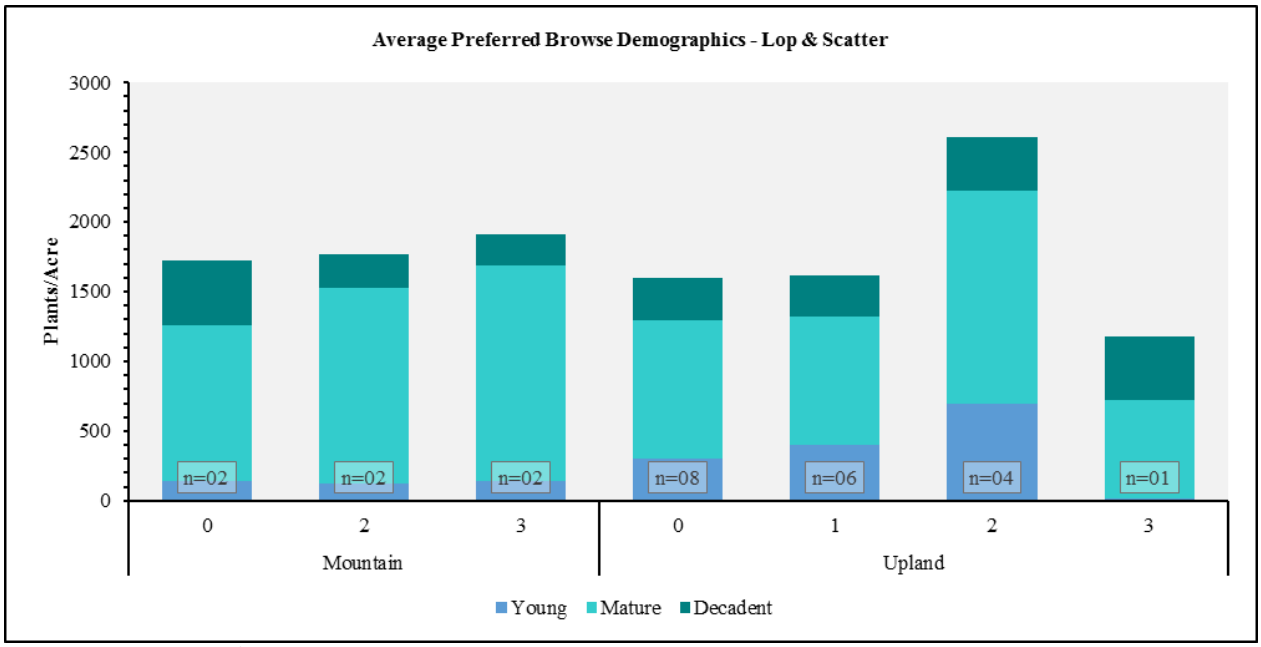


Figure 10.65: Average preferred browse demographics on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

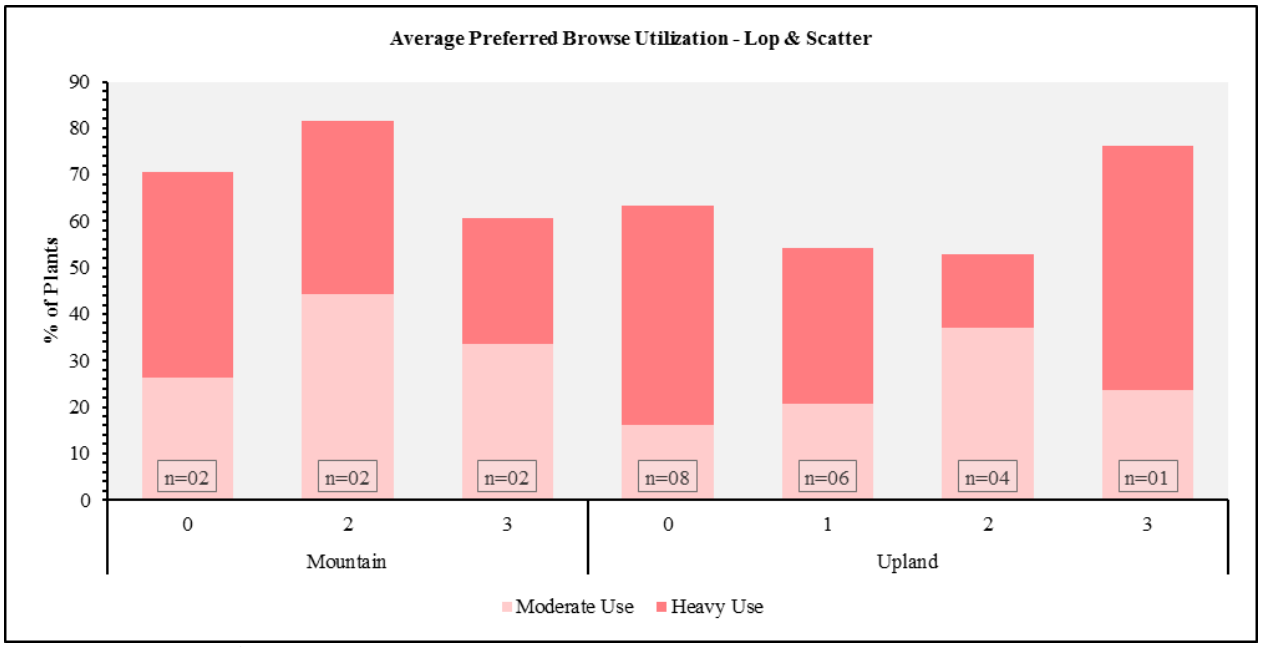


Figure 10.66: Average preferred browse utilization on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

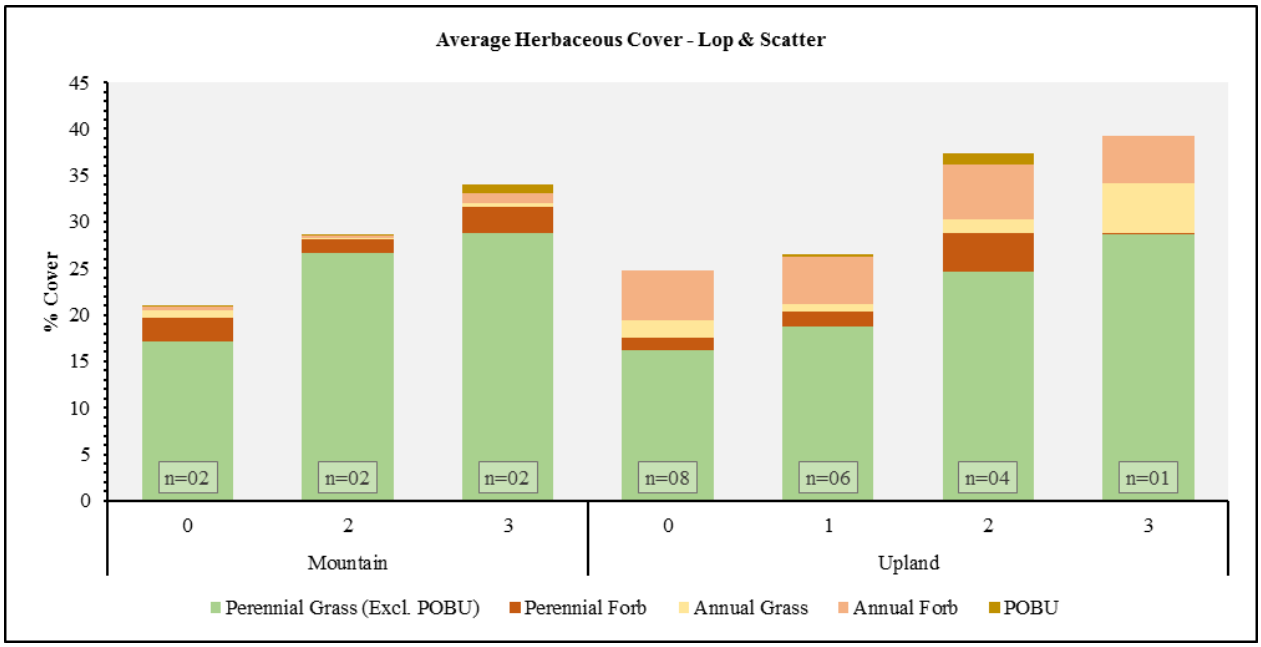


Figure 10.67: Average herbaceous cover on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

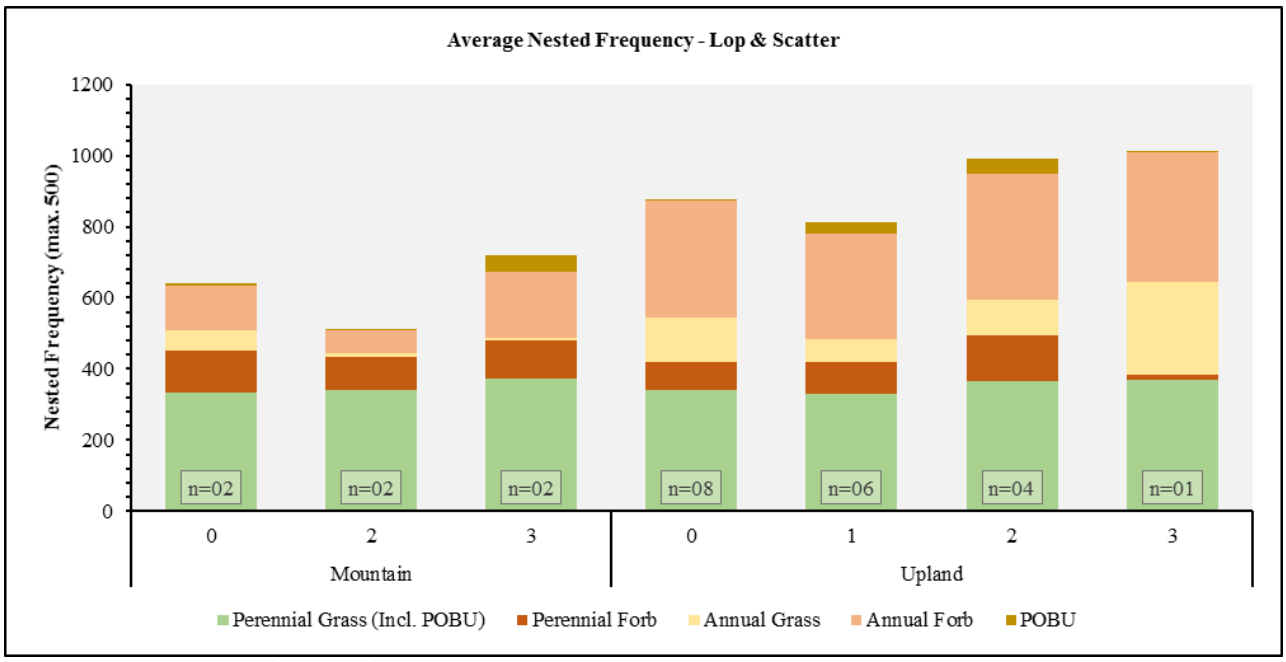


Figure 10.68: Average nested frequency of herbaceous species on mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

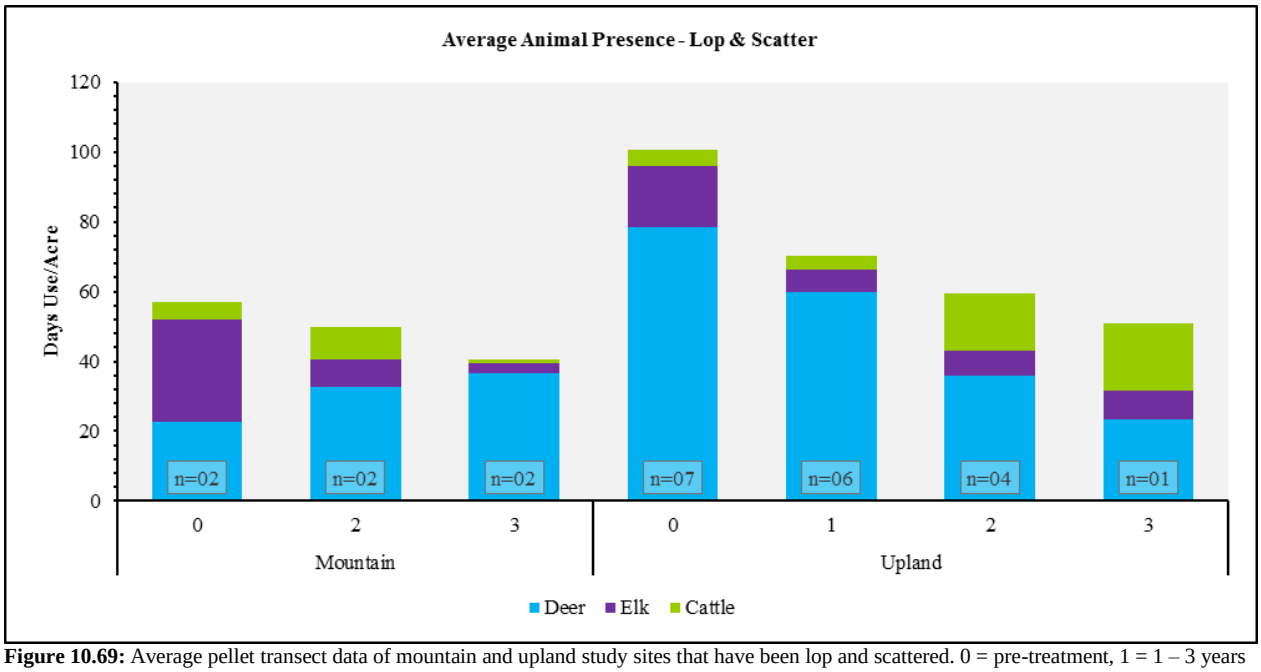


Figure 10.69: Average pellet transect data of mountain and upland study sites that have been lop and scattered. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Mow

Two study sites [Road Hollow (17R-19) and Badger Hollow Mow (17R-31)] have undergone a mowing treatment over the study period and they are considered to be Mountain (Big Sagebrush) ecological sites. The Road Hollow and Badger Hollow Mow sites are located above the bays on the east side of Strawberry Reservoir.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) are the dominant browse species on these sites. The overall cover of shrub species decreased in the first year post-

treatment, while the second year following treatment showed an increasing trend (**Figure 10.70**). Recruitment of young increased slightly following treatment but decreased in the second sampling post treatment (**Figure 10.71**). Utilization of sagebrush remained stable immediately following treatment, but increased significantly in the second sampling following treatment (**Figure 10.72**).

Herbaceous Understory: The herbaceous understory has shown slight decreases in the years following treatment. Frequency of all vegetation types has decreased slightly over time (**Figure 10.74**). Cover of perennial forbs has also shown decreases across all years. Perennial grass cover has remained similar throughout the sample years with a slight increase observed in the first sample year post-treatment (**Figure 10.73**, **Figure 10.74**).

Occupancy: Average pellet transect data indicates that deer and elk are the primary occupants on these sites in pre-treatment sample years. The first and second readings post-treatment indicated that deer were the sole occupants of the site. Overall, the mean abundance of pellet groups decreased in the first sampling post-treatment, but increased in the second (**Figure 10.75**).

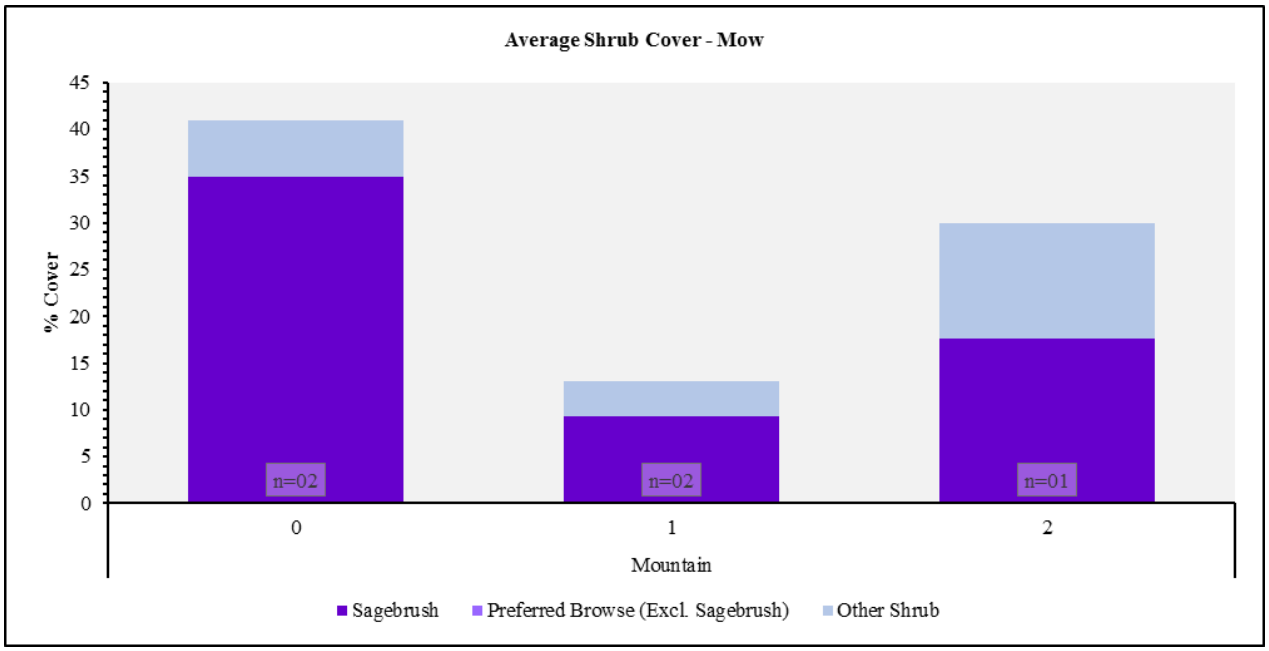


Figure 10.70: Average shrub cover on mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

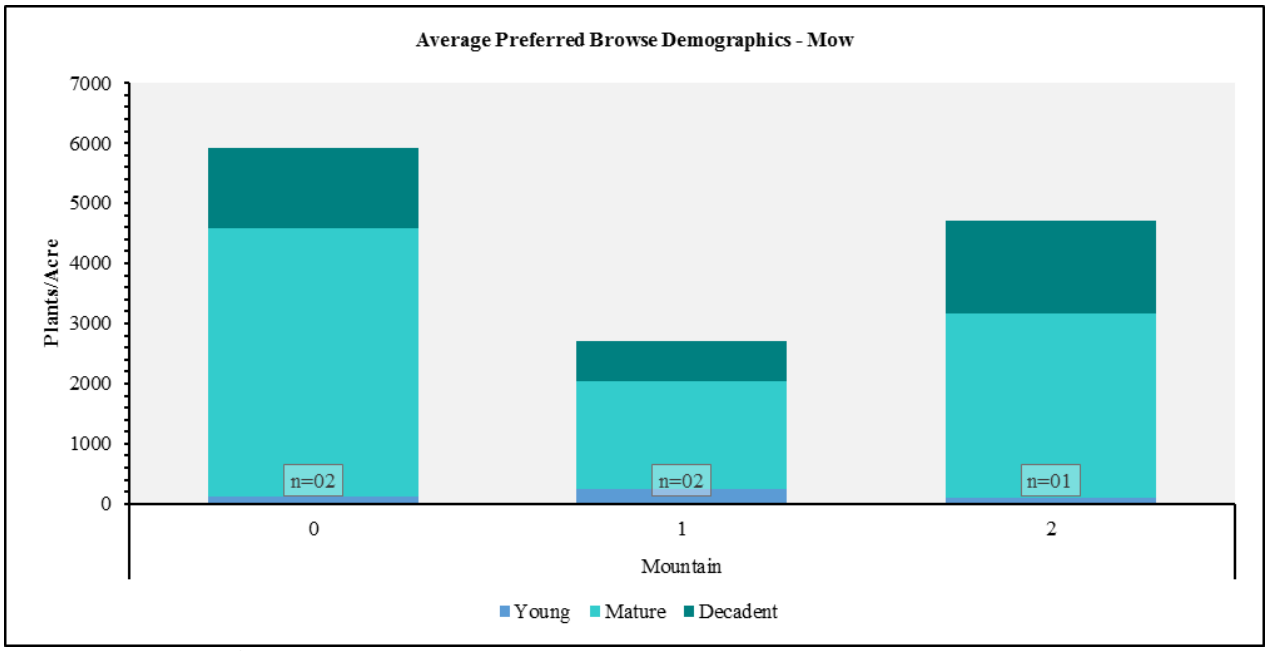


Figure 10.71: Average preferred browse demographics on mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

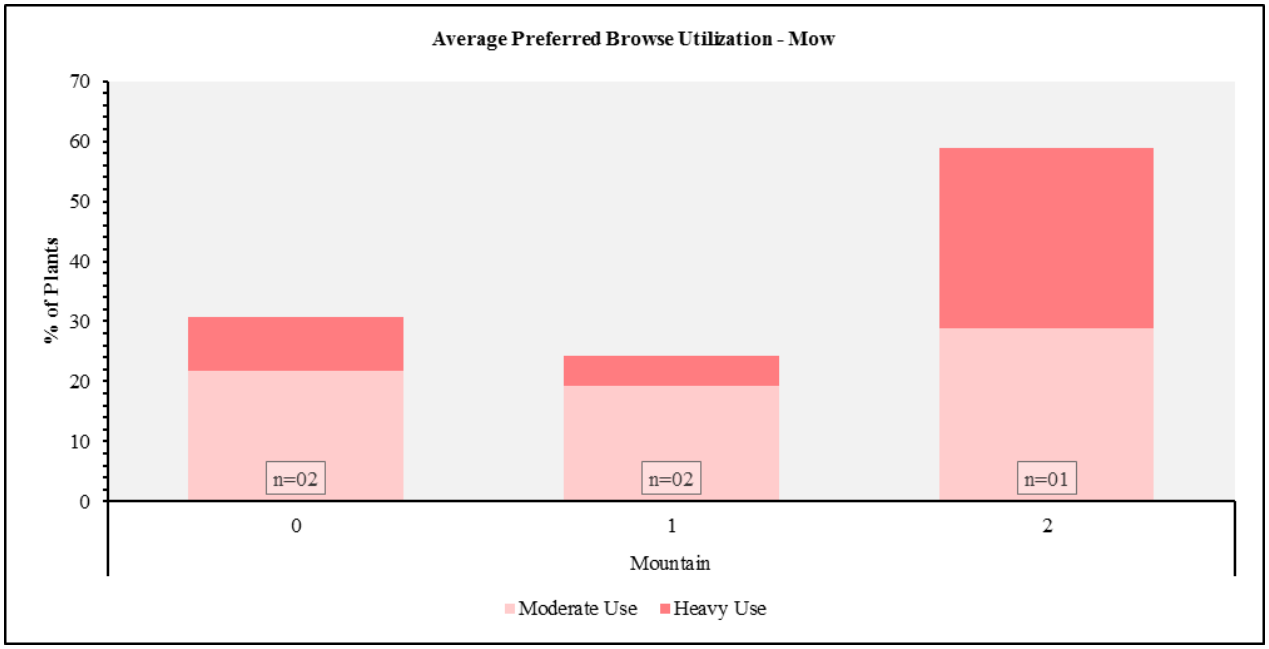


Figure 10.72: Average preferred browse utilization on mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

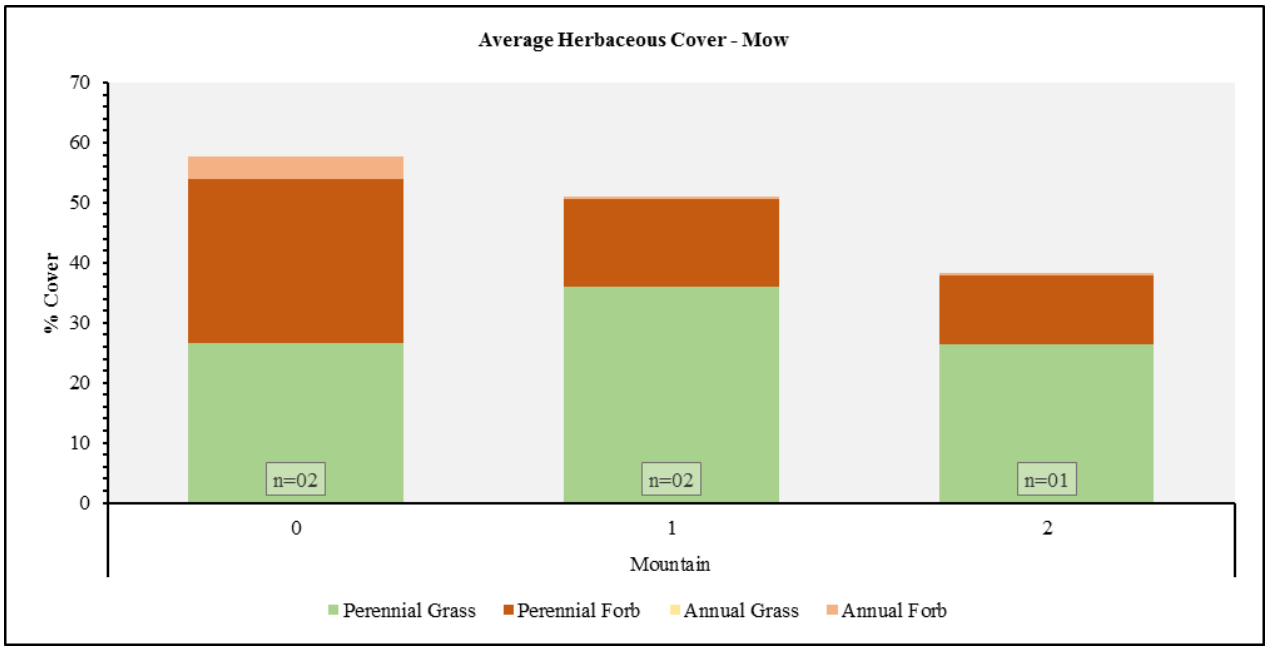


Figure 10.73: Average herbaceous cover on mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

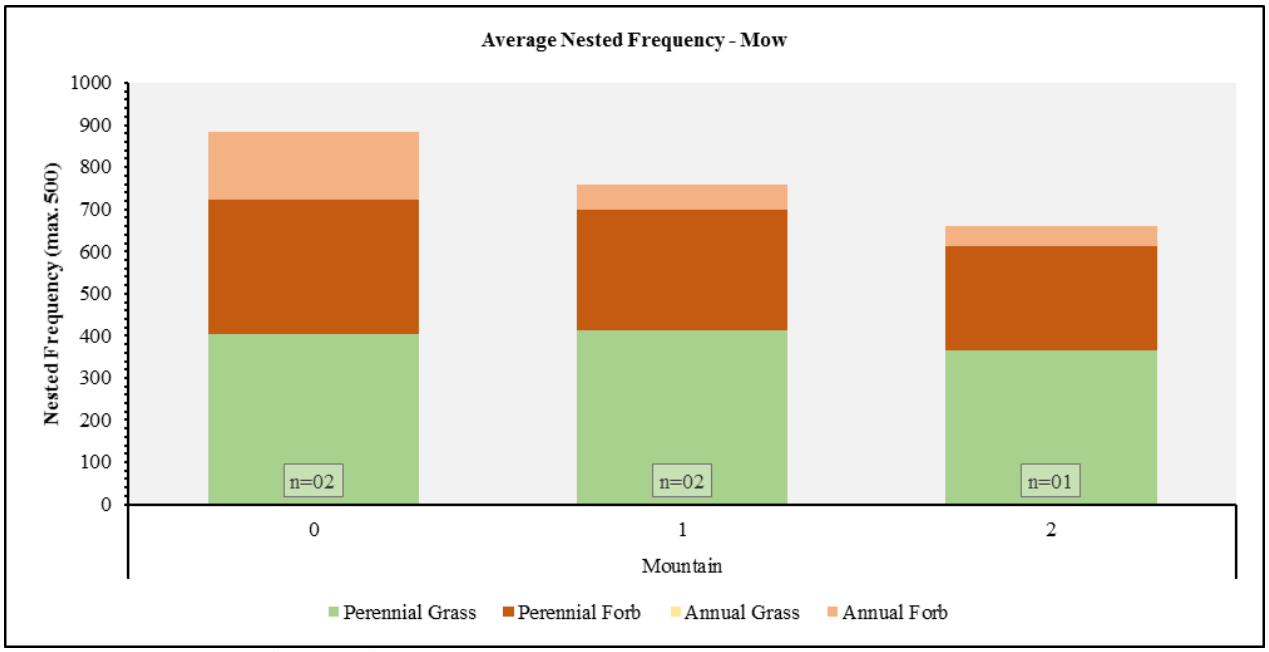


Figure 10.74: Average nested frequency of herbaceous species on mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

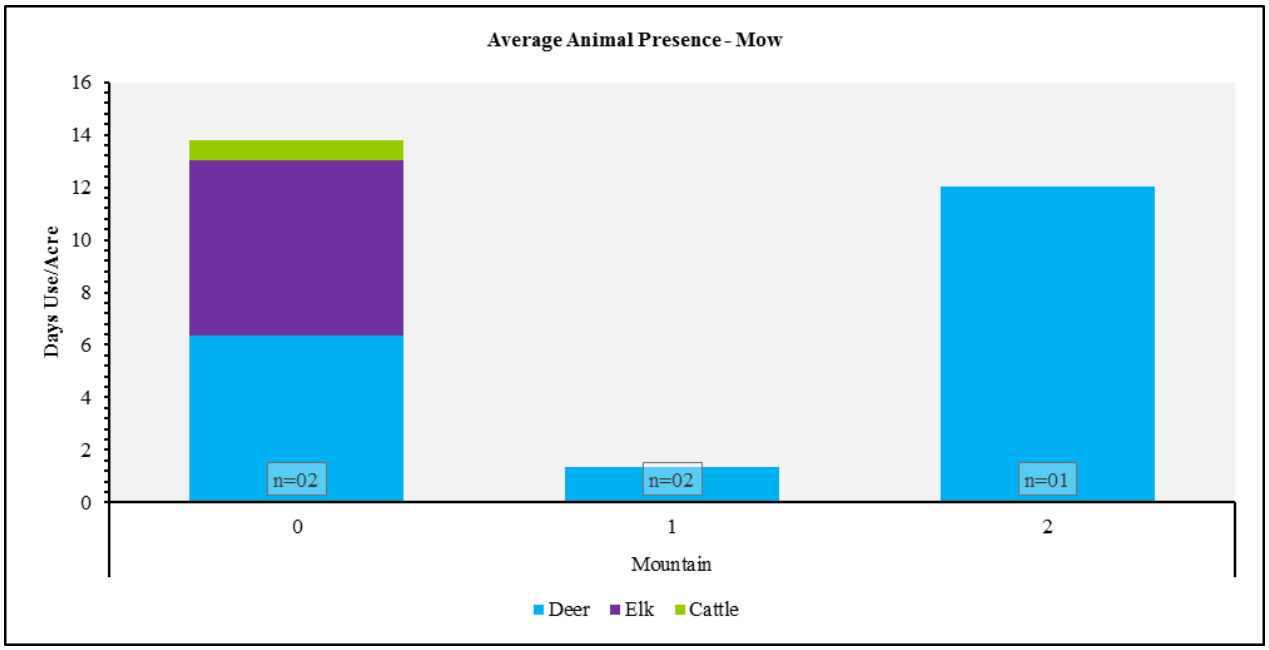


Figure 10.75: Average pellet transect data of mountain study sites that have been treated with a brush mower. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment.

Seeding

Two study sites [Deep Creek Drill (19R-3) and Gilson Mountain Sage-grouse (21R-21)] have undergone a seeding treatment over the study period. Deep Creek Drill is classified as an upland study site and the Gilson Mountain Sage-Grouse is considered to be a semidesert ecological site. The Deep Creek Drill site is located near Fifteenmile Creek south of Ibapah. The Gilson Mountain Sage-Grouse site is located north of the Gilson Mountains near US-6.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and forage kochia (*Bassia prostrata*) are the dominant browse species on these sites. Shrub cover on the upland sites decreased in the first year following treatment but then showed steady increases in the second and third years; shrub cover on the semidesert site is nominal (**Figure 10.76**). On the upland site, recruitment of young has increased following treatment, while the number of decadent plants has decreased (**Figure 10.77**). Utilization of preferred browse on upland sites has fluctuated with an overall decrease being observed (**Figure 10.78**).

Herbaceous Understory: The overall herbaceous understory has generally increased on sites of both ecological types. The upland site is primarily composed of perennial grasses, but has also shown increases of the introduced perennial species bulbous bluegrass (*Poa bulbosa*). The semidesert site is primarily composed of annual grasses and forbs, and has shown significant increases in the cover of annual grasses (**Figure 10.79**, **Figure 10.80**).

Occupancy: Average pellet transect data shows that cattle are the primary occupants of the upland and semidesert ecological sites and that deer were the primary occupants of the upland site during the first and second samplings post-treatment. The upland site showed decreased utilization during post-treatment years one and two, but increased in year three. The semidesert site had decreased occupancy in year one, but increased in year two (**Figure 10.81**).

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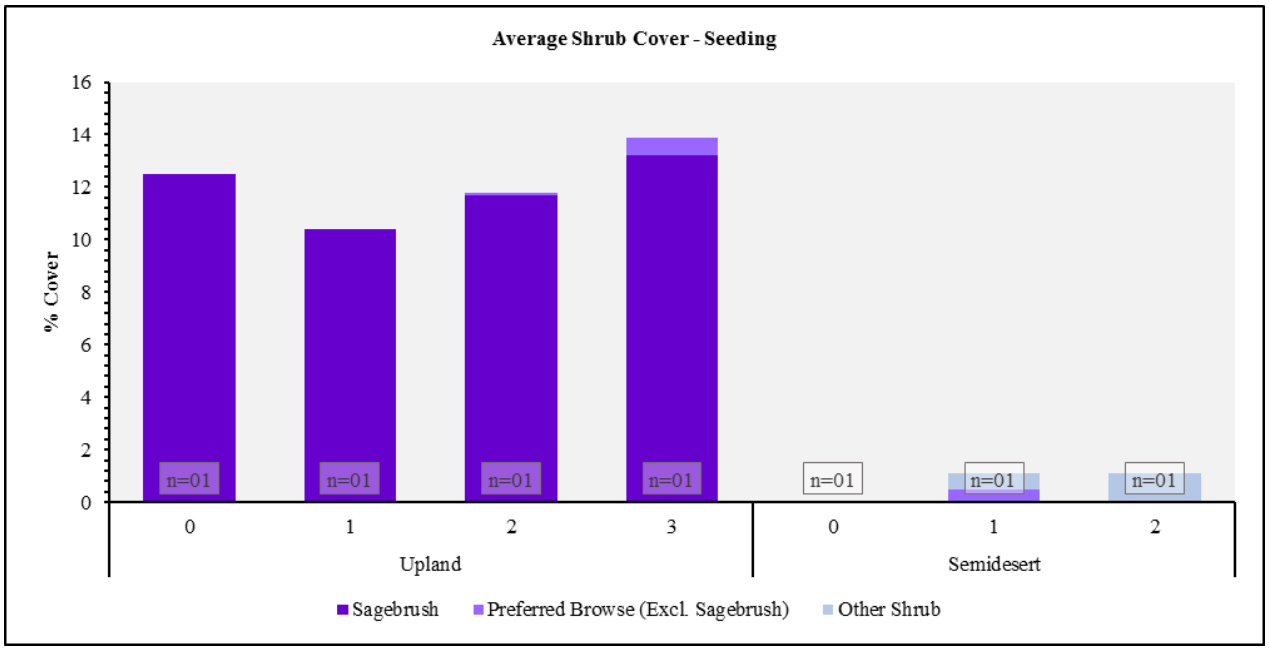

Figure 10.76: Average shrub cover of upland and semidesert study sites that have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

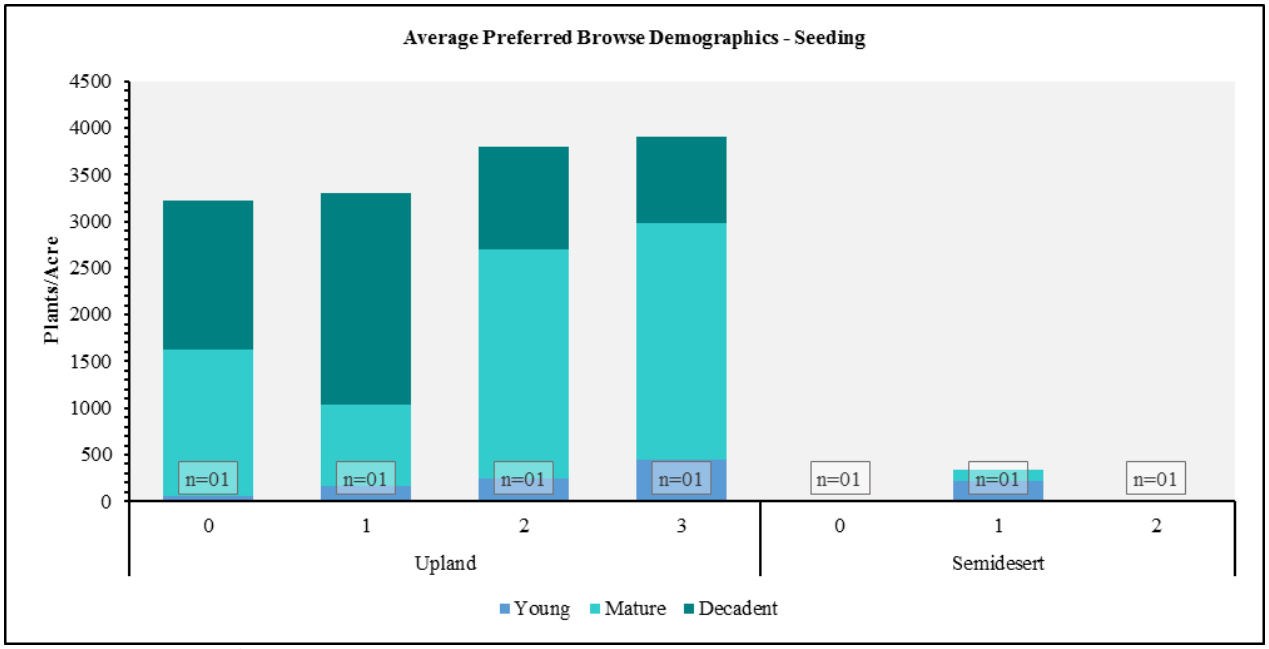

Figure 10.77: Average preferred browse demographics on upland and semidesert study sites that have seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

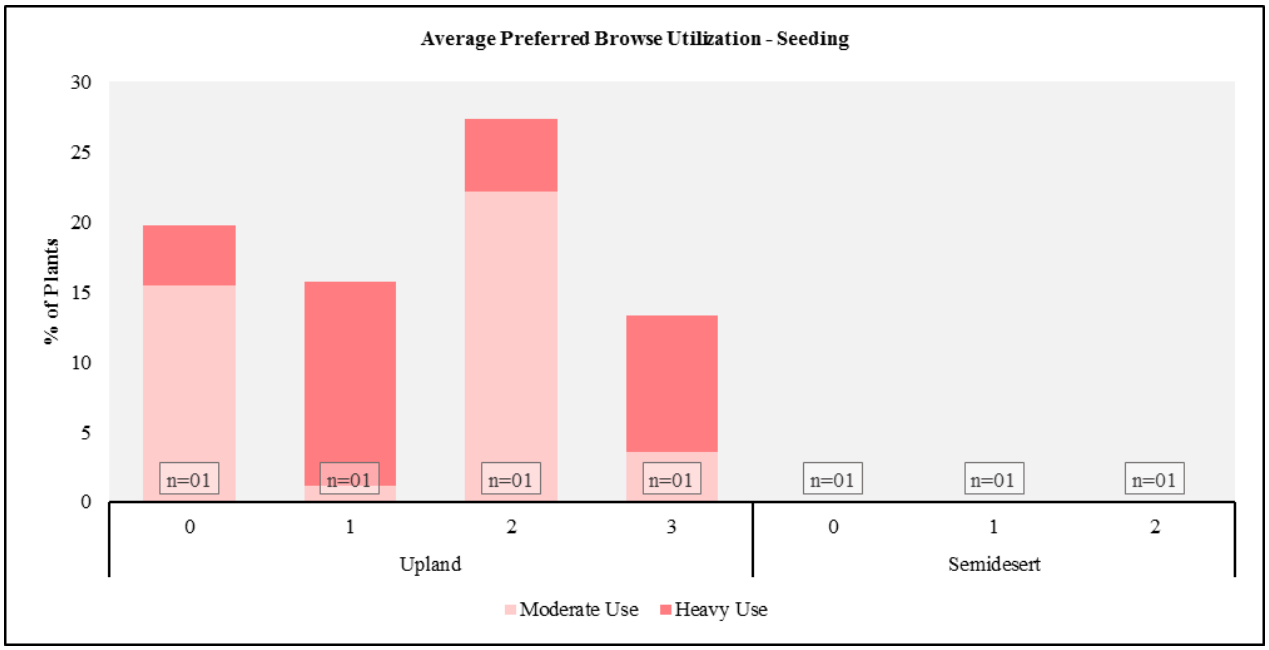

Figure 10.78: Average preferred browse utilization on upland and semidesert study sites that have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

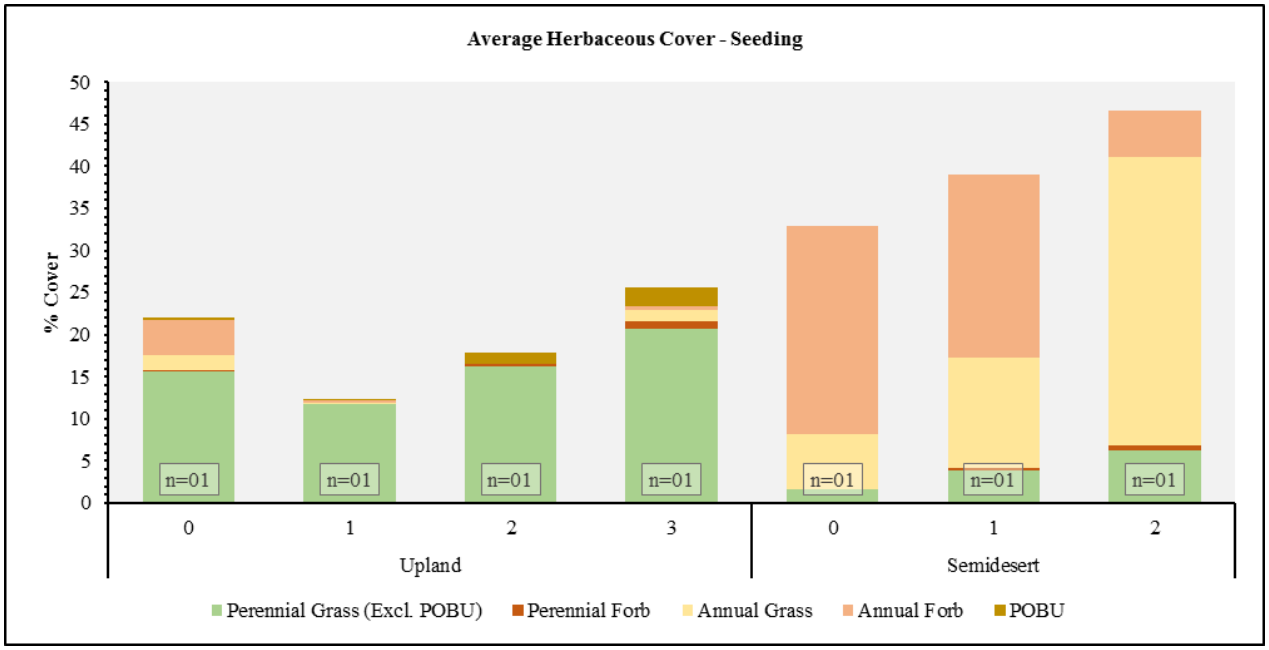

Figure 10.79: Average herbaceous cover on upland and semidesert study sites that have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

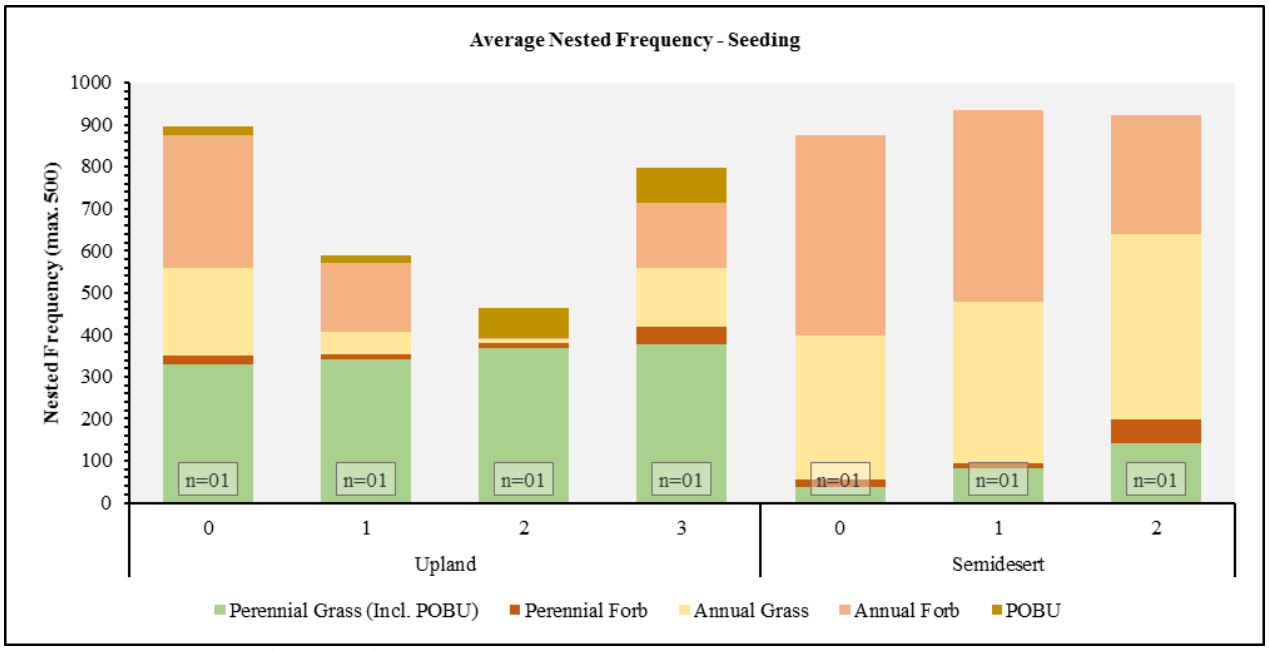

Figure 10.80: Average nested frequency of herbaceous species on upland and semidesert study sites that have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

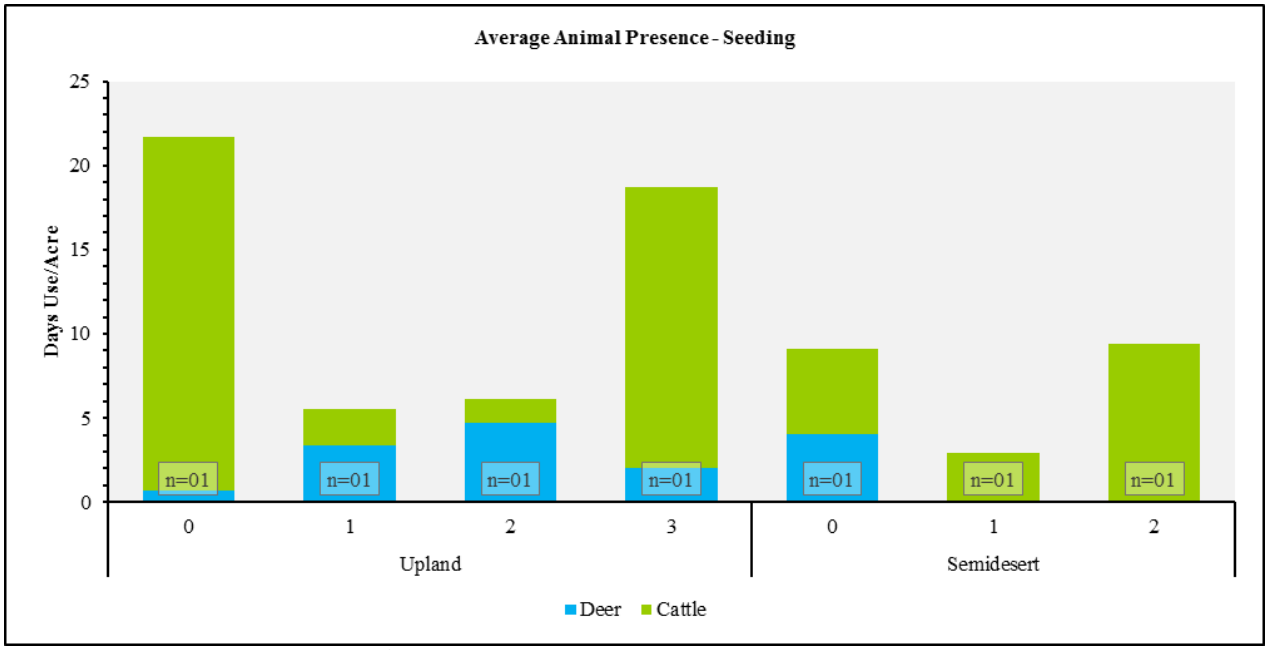

Figure 10.81: Average pellet transect data of upland and semidesert study sites that have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

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