UTAH BIG GAME RANGE TREND SUMMARIES 2016

WILDLIFE MANAGEMENT UNITS 1, 2, 3, 4, 5, 6, 7, 18A, 18B, & NORTHERN REGION TREATED OR DISTURBED SUMMARY

PUBLICATION NUMBER 17-08
REPORT FOR FEDERAL AID PROJECT W-82-R-60

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

UTAH BIG GAME RANGE TREND UNIT SUMMARIES
2016
WILDLIFE MANAGEMENT UNITS
1, 2, 3, 4, 5, 6, 7, 18A, 18B,
&
NORTHERN REGION TREATED OR DISTURBED SUMMARY

Written and Edited by

Ciaran Payne
Jason Cox
Luke McCarty

Tables, Maps, and Figures, prepared by

Ciaran Payne
Jason Cox
Luke McCarty

Data Collection by

Jason Cox
Jason Lane
Ciaran Payne
NiKelle Brown
Jess Batty
William Behling
Keghan Connor
Laura Jacobs
Thomas Jacques
Derek Hedges
Brett Howland
Evan Rees

Cover Photo Credit

Starveling milkvetch (*Astragalus jejunus*) by Jason Cox (2013)

Performance Report for Federal Aid Project W-82-R-61

Publication No. 17-08

UTAH DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife Resources
1594 West North Temple
Salt Lake City, Utah 84114

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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-61

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 CDs, 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 2016 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Northeastern 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

United States Forest Service

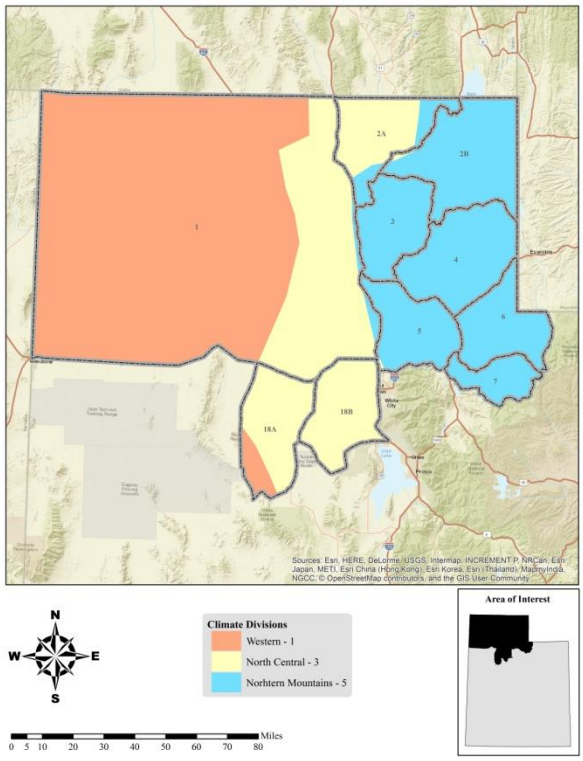
- Sawtooth National Forest
- Wasatch-Cache National Forest

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

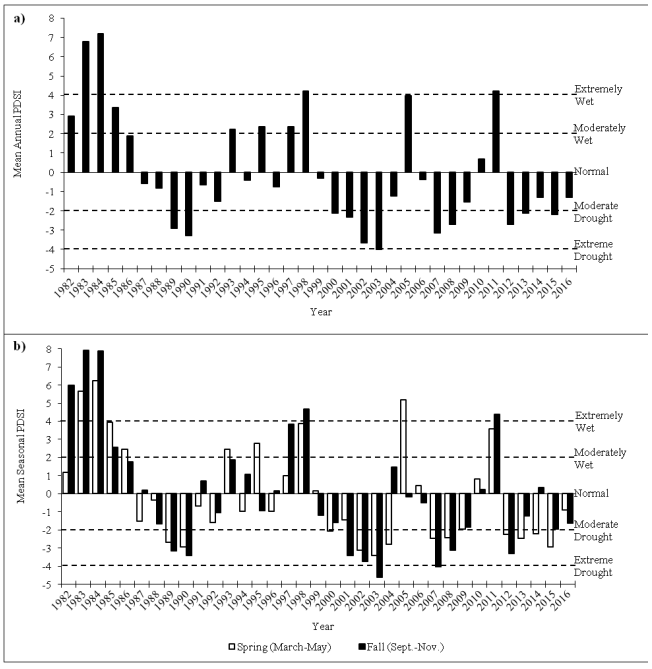
Palmer Drought Severity Index Climate Divisions



Climate Data: The state of Utah is divided into seven climatic divisions for estimating the Palmer Drought Severity Index (PDSI) and the northern region occurs within three of these divisions: Western (Division 1), North Central (Division 3), 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 2016. The data reported in this summary covers the years over which these sites have been sampled (1982-2016). 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, 2017).

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).

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.

Glossary of ESD Acronyms

ARTEM - Big sagebrush (*Artemisia tridentata*)
ARNO - Black sagebrush (*Artemisia nova*)
ARAR - Low sagebrush (*Artemisia arbuscula*)
QUGA - Gambel's oak (*Quercus gambelii*)
COMES - Cliffrose (*Purshia stansburiana*) synonym (*Cowania mexicana* ssp. *stanburiana*)
Browse - Mixed browse species
Shrub - Mixed shrub species

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.

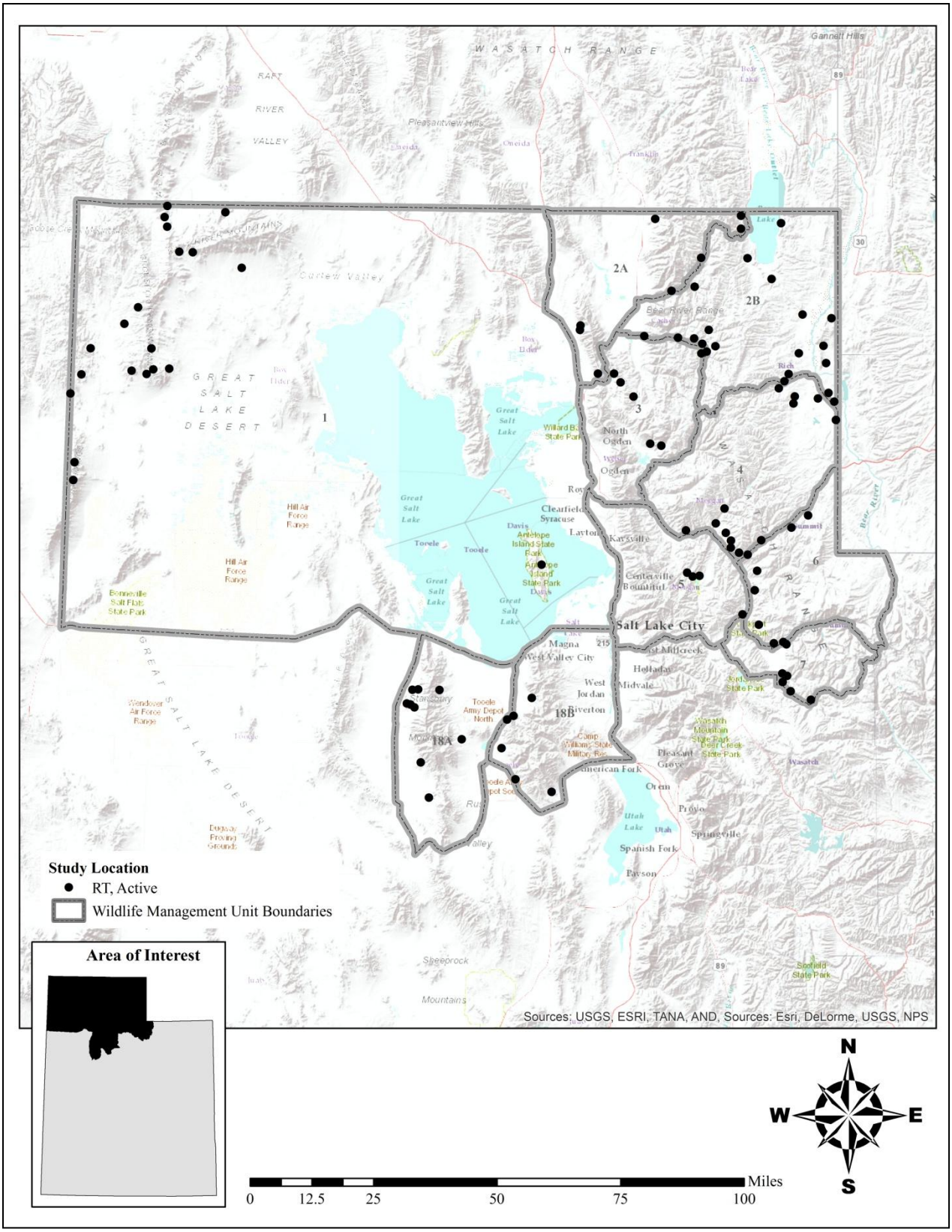
Deer Winter Range Condition Assessment: The desirable components index (DCI) for deer was created by Range Trend Program personnel as a tool to address condition and/or value of winter ranges for mule deer. This index is meant to be a companion to, and not a replacement for, the site-specific range trend 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.

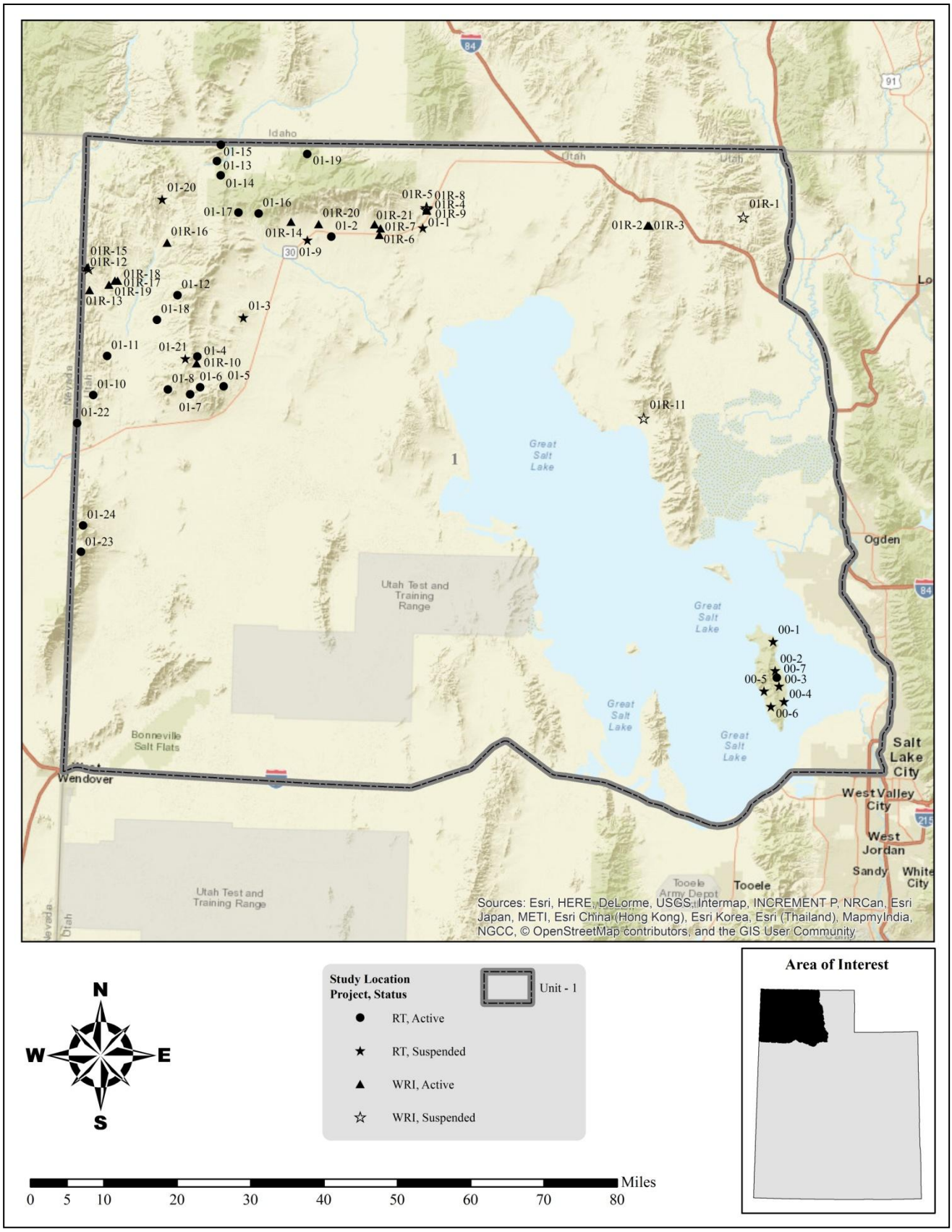
Changes in DCI over the sample years for both treated and untreated sites are included in the figures near the end of the summary. Care should be taken when interpreting these tables as the number of sites included in each year may vary. This could be misleading if the overall DCI seems to be improving, 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 1 – BOX ELDER



WILDLIFE MANAGEMENT UNIT 1 – BOX ELDER

Boundary Description

Box Elder, Tooele, Salt Lake, Davis, and Weber counties – Boundary begins at the Utah-Idaho state line and Interstate 15; west along this state line to the Utah-Nevada state line; south along this state line to Interstate 80; east on I-80 to I-15; north on I-15 to the Utah-Idaho state line.

Management Unit Description

Geography

The Box Elder Management Unit is one of the largest in the state, but big game range accounts for less than one-third of the unit. The Box Elder Subunit 1B (Promontory region) is located in the eastern portion of the WMU and consists primarily of private land that was considered unsuitable for permanent trend studies. The Pilot Mountain Subunit 1C is composed of the most southern portion of the unit and Pilot Mountain. Most of the permanent range trend studies have been established in the Raft River Subunit 1A, which is located in the western portion of WMU. The land area of this subunit is comprised mostly of the Raft River, Grouse Creek, and Goose Creek Mountains. A majority of the land in this Subunit is also privately owned, with 70% of what is considered "normal" winter range (King & Muir, 1971) arranged in a checkerboard pattern with public lands. Towns located within this area include Etna, Grouse Creek, Lynn, Yost, and Park Valley.

The Raft River Mountains run east-west, parallel to the Utah-Idaho border; slopes on this mountain range are moderately steep in the southern and eastern portions, and gentler to the north and west. The highest point is on Dunn Benchmark peak at the head of the Clear Creek drainage with an elevation of 9,925 feet. The Grouse Creek Mountains are relatively narrow and steep and run north-south; at 9,000 feet, Red Butte is the highest point in this mountain range. The topography of the Goose Creek Mountains is generally more nominal, with the highest point being 8,584 feet on Twin Peaks. Finally, the Dove Creek Mountains are rougher, but the terrain becomes gentler toward the Three Corners area.

Climate Data

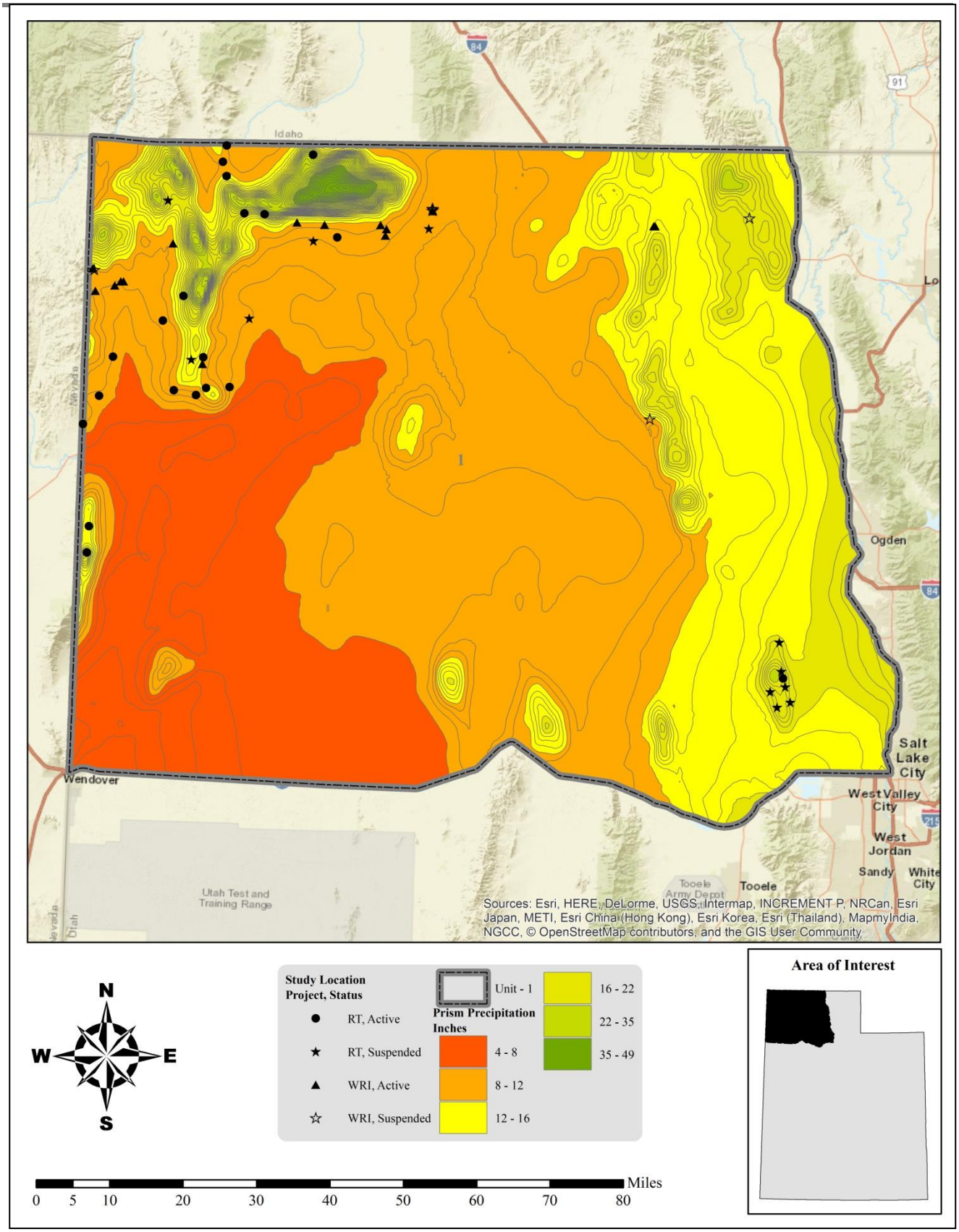
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 5 inches along portions of the Utah-Nevada border to 45 inches on the peaks of the Raft River Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 10-23 inches of precipitation (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 Western, North Central, and Northern Mountains divisions (Divisions 1, 3, and 5). 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 1.1a). 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 1.1b).

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, 1997-1998, 2005, and 2011 (Figure 1.2a). 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 1982-1986, 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 2.2b).

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 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, 2017).



Map 1.1: The 1981-2010 PRISM Precipitation Model for WMU 1, Box Elder (PRISM Climate Group, Oregon State University, 2013).

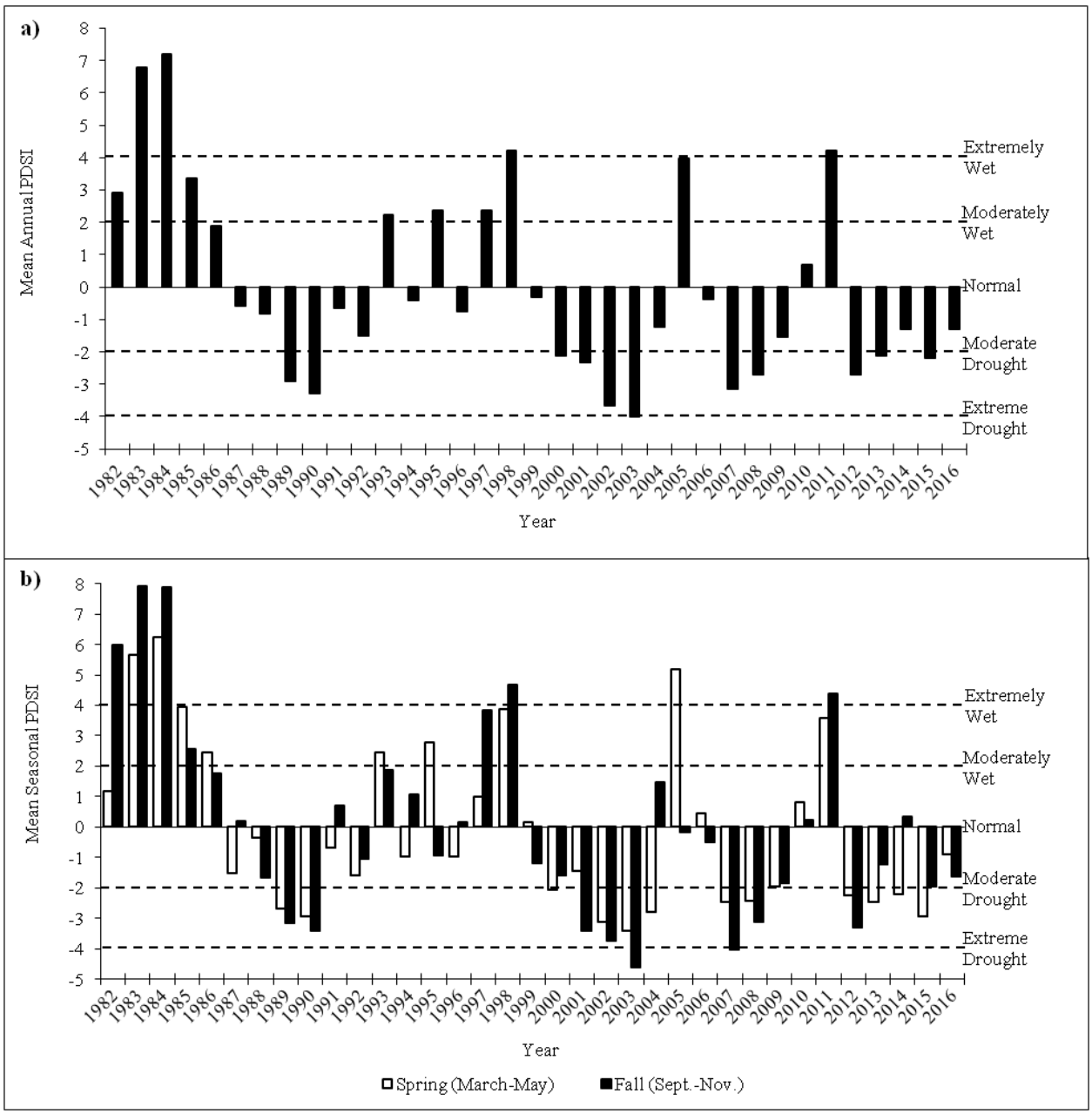


Figure 1.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

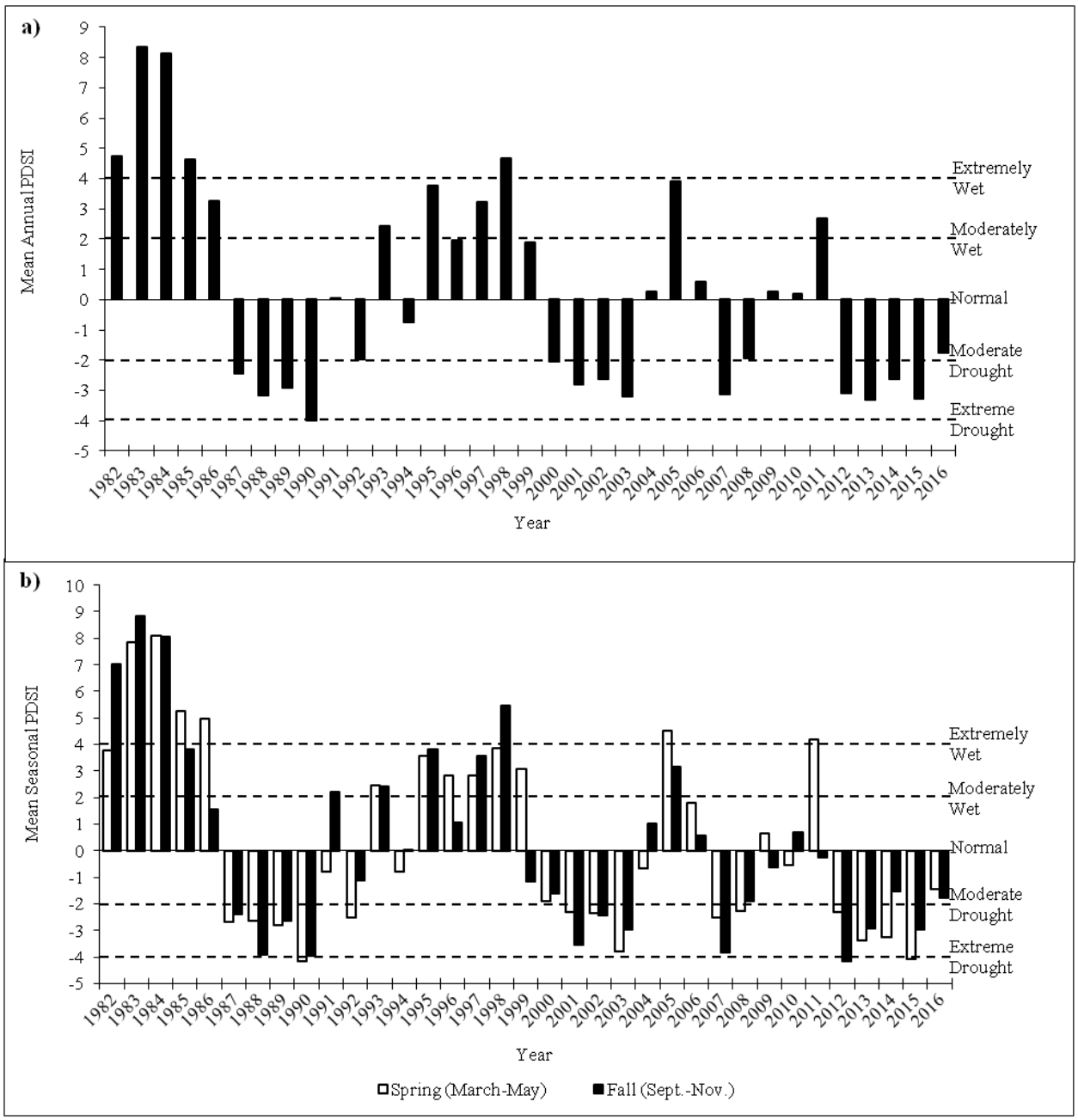


Figure 1.2: The 1982-2016 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

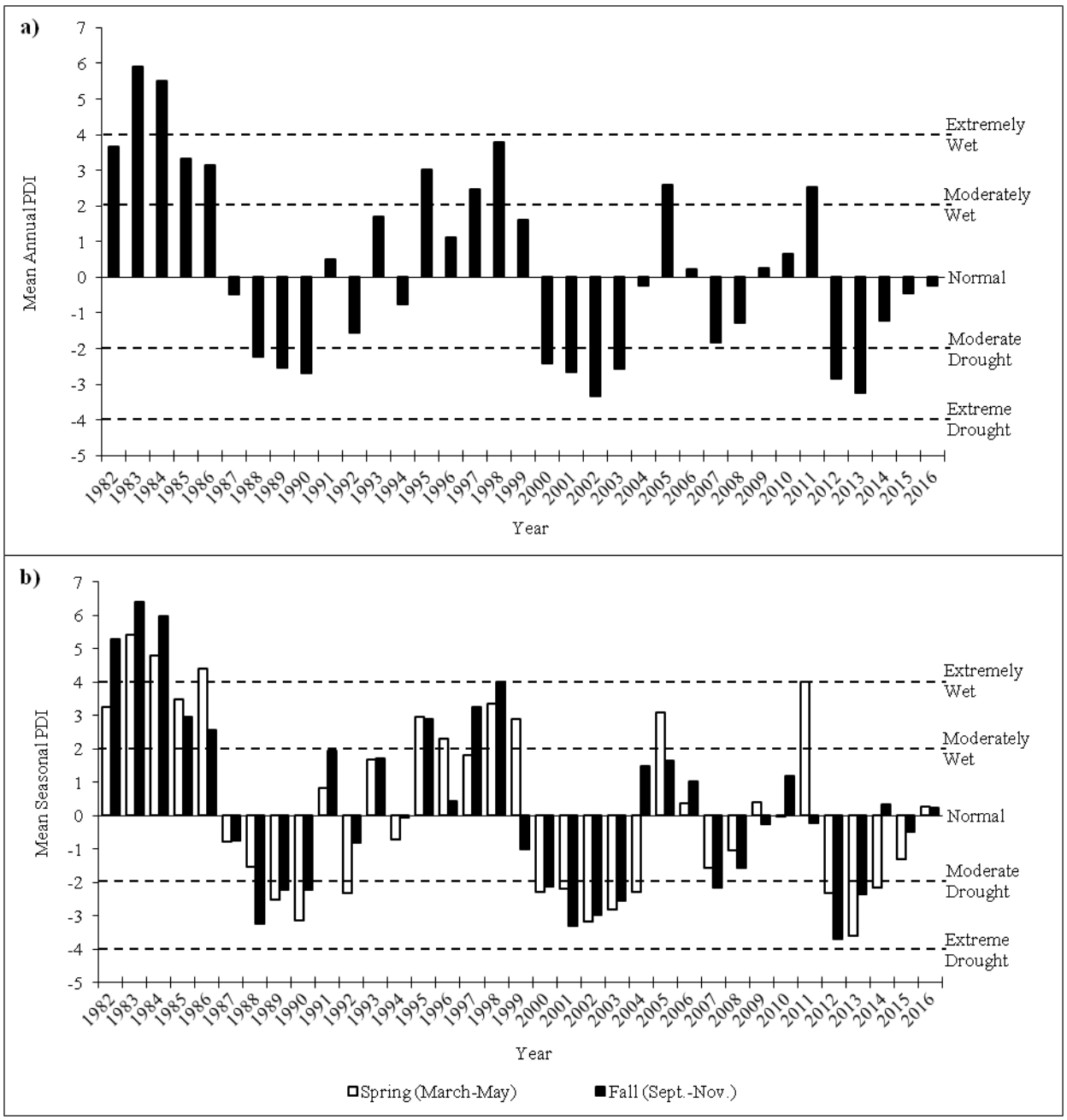


Figure 1.3: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

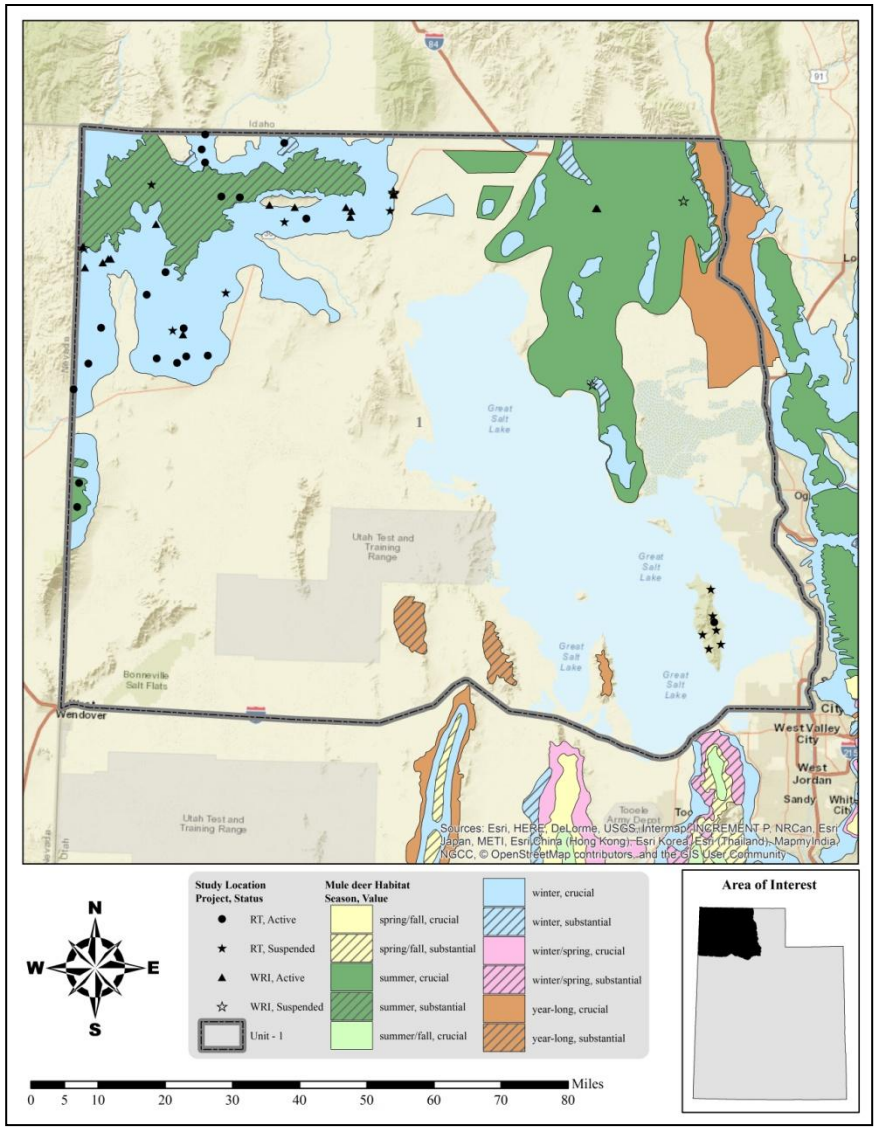
Big Game Habitat

There are an estimated 1,571,312 acres classified as deer range on Unit 1 with 41% classified as winter range, 48% as summer range, and 11% as year-long range (Table 1.1, Map 1.2). 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 1.2, Map 1.2, Map 1.8). Of the elk winter range, 48% is administered by the BLM, 31% is privately owned, the USFS manages 13%, and 8%

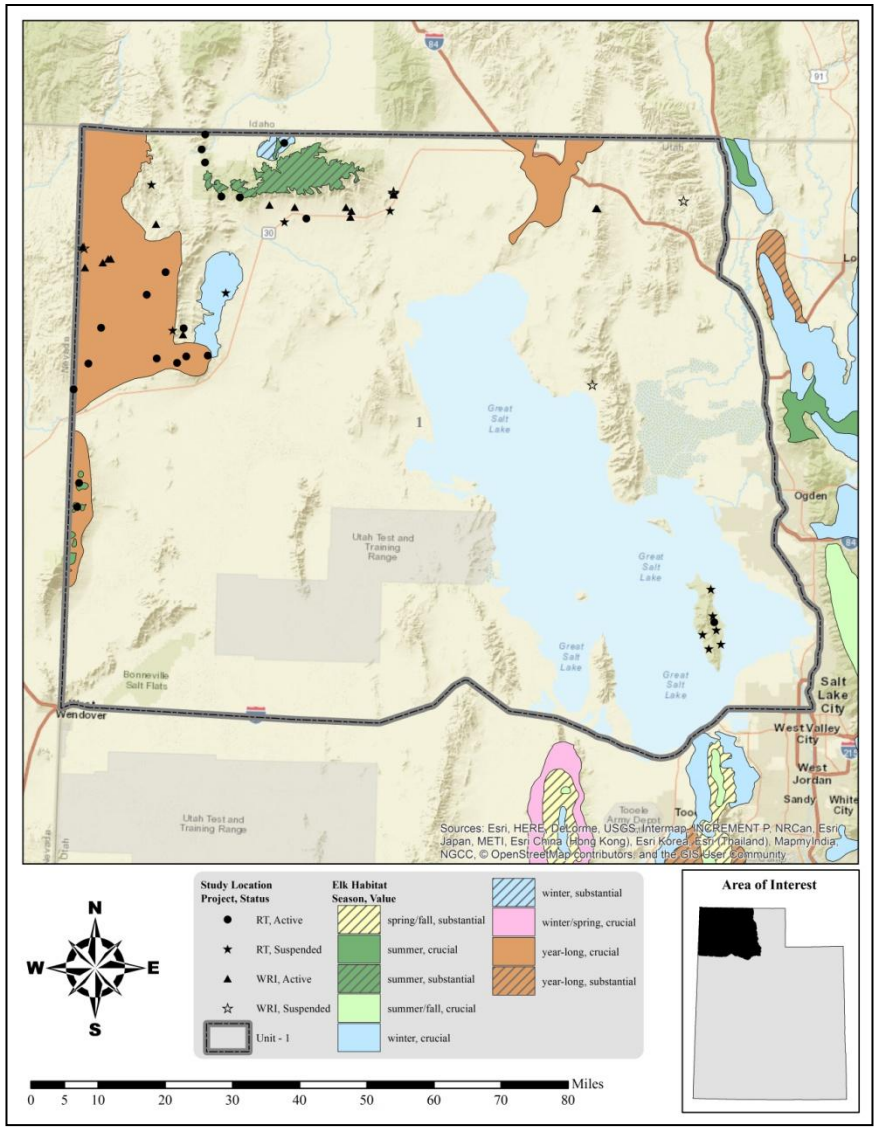
is managed by SITLA (Table 1.3, Map 1.3, Map 1.8). The unit presents several challenges to public land and wildlife managers. A majority of the summer range is on private land and hunting access is therefore limited.

Deer winter range mainly follows the foothills of the major mountain ranges within the unit; the upper limit of normal deer winter range varies from 6,000 to 8,000 feet based on the mountain range on which it occurs. The lower range of normal deer winter range typically follows Highway 30 from Curlew Junction to the Nevada border, with further deer winter range occurring in Nevada and Idaho. This unit has a unique situation during severe winters: the limits for severe deer winter range are not only lowered at the upper limit, but are also raised at the lower limit. This is because the low-growing vegetation at the lower limits of normal deer winter range is easily covered by heavy snowfall, making them unavailable for big game use (King & Muir, 1971).

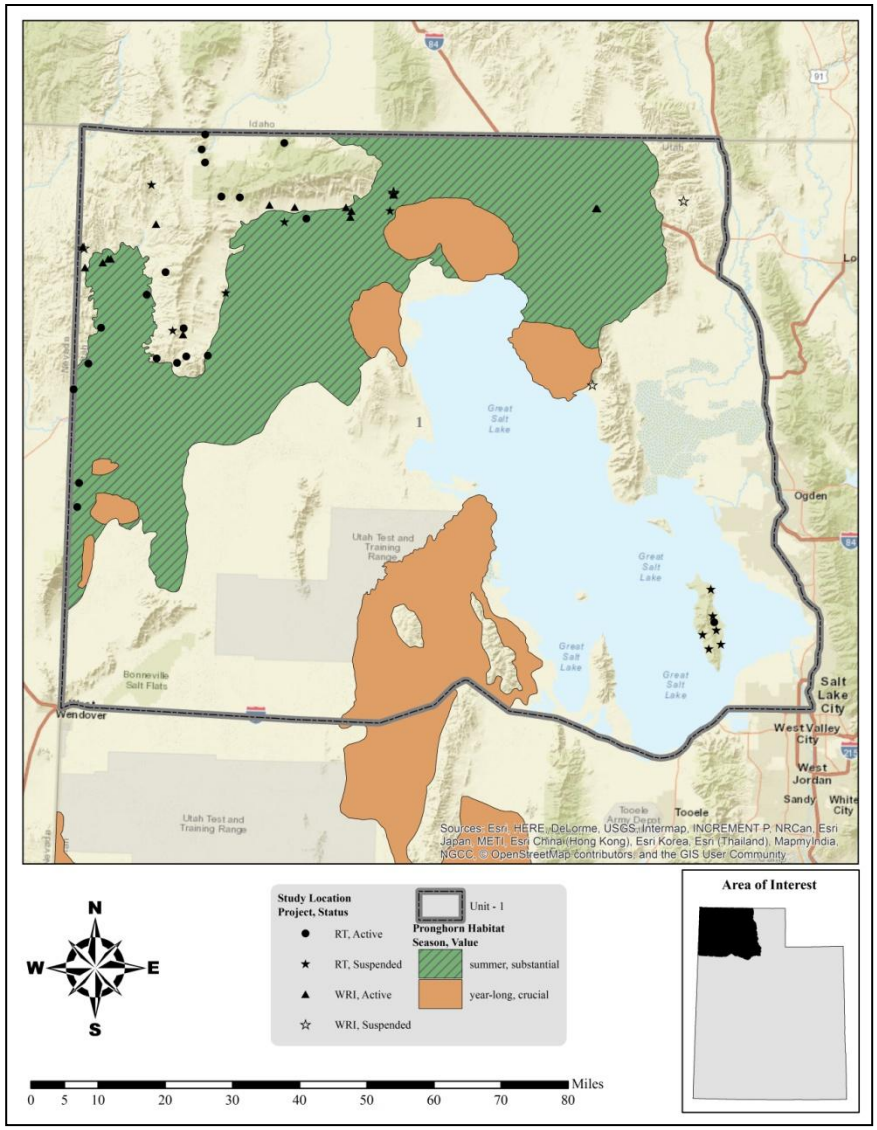
Sagebrush is a major vegetation component of both winter and summer ranges in this unit. Black sagebrush occupies ridge tops within the summer range and the upper reaches of the winter range; on summer range, black sagebrush communities have the highest abundance of grasses and forbs. Within the summer range, browse communities are dominated by curlleaf mountain mahogany in drier areas and by maple on more mesic sites; this type provides a good variety of spring-fall forage, yet comprises a very minor portion of the winter range. Sagebrush-juniper and juniper communities are present in the winter range; in these ecological types, juniper trees are more important for thermal cover than as forage. Although small amounts of the aspen-timber and forb-grass types are found along the upper edges of winter range, their primary value is as summer range (King & Muir, 1971).



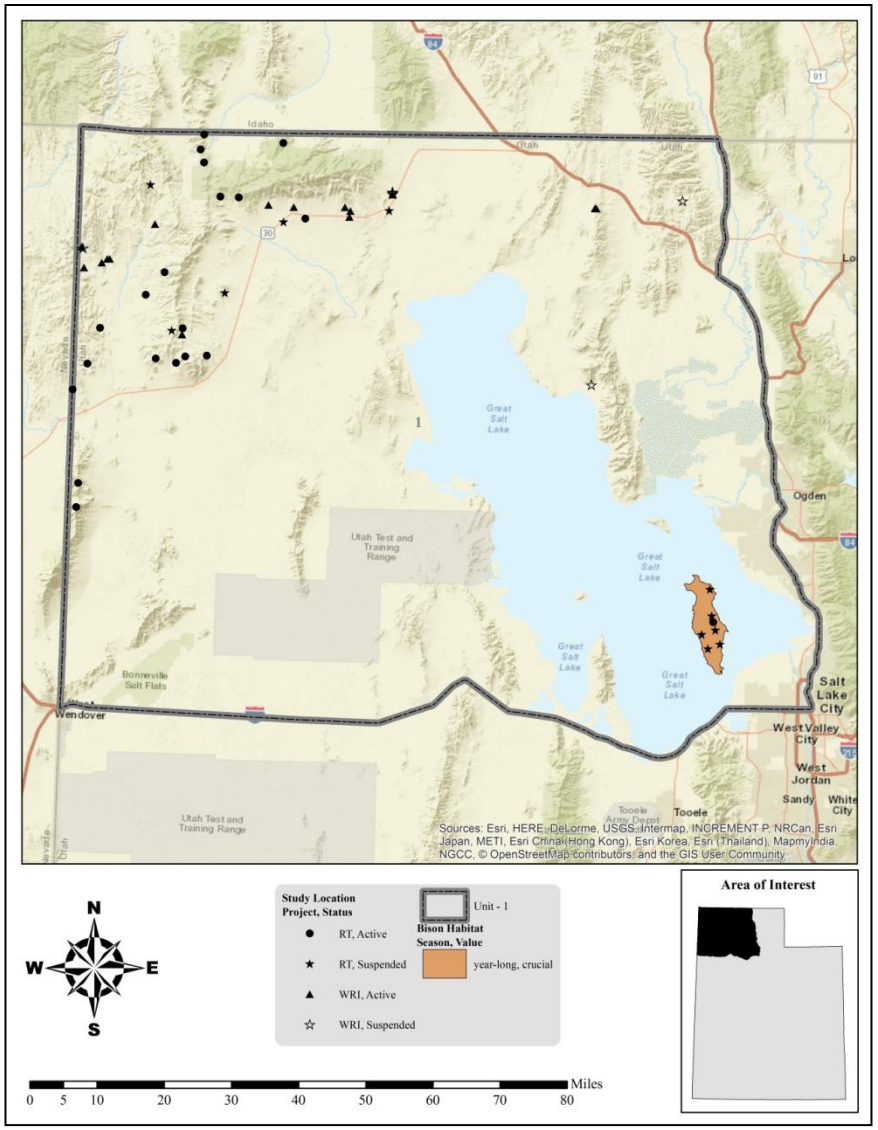
Map 1.2: Estimated mule deer habitat by season and value for WMU 1, Box Elder.



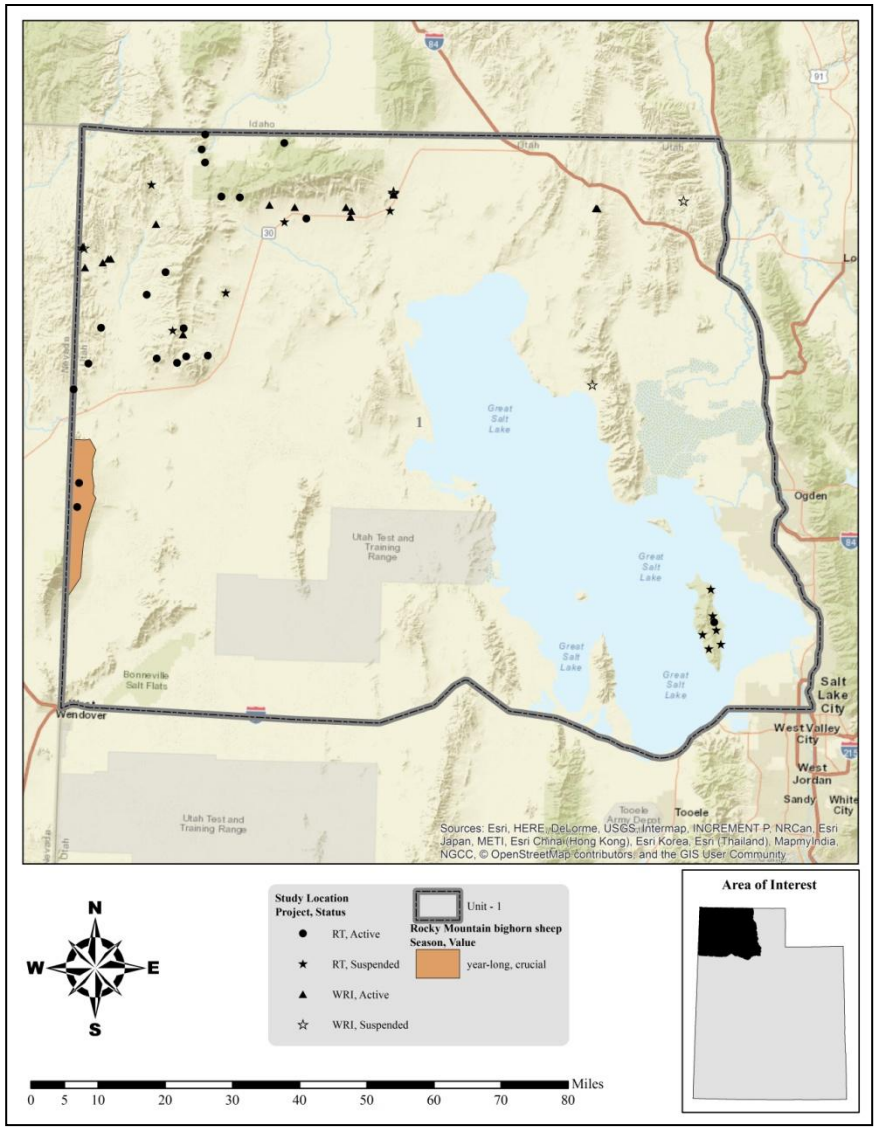
Map 1.3: Estimated elk habitat by season and value for WMU 1, Box Elder.



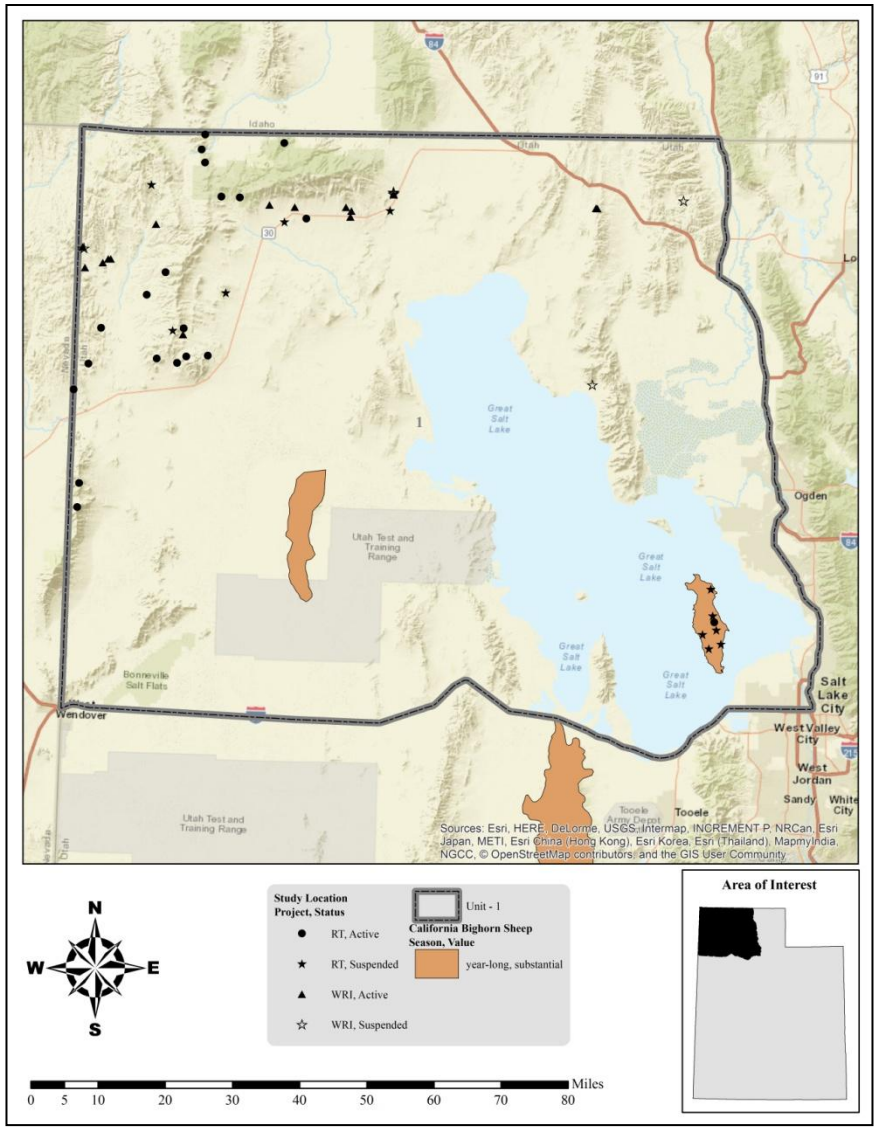
Map 1.4: Estimated pronghorn habitat by season and value for WMU 1, Box Elder.



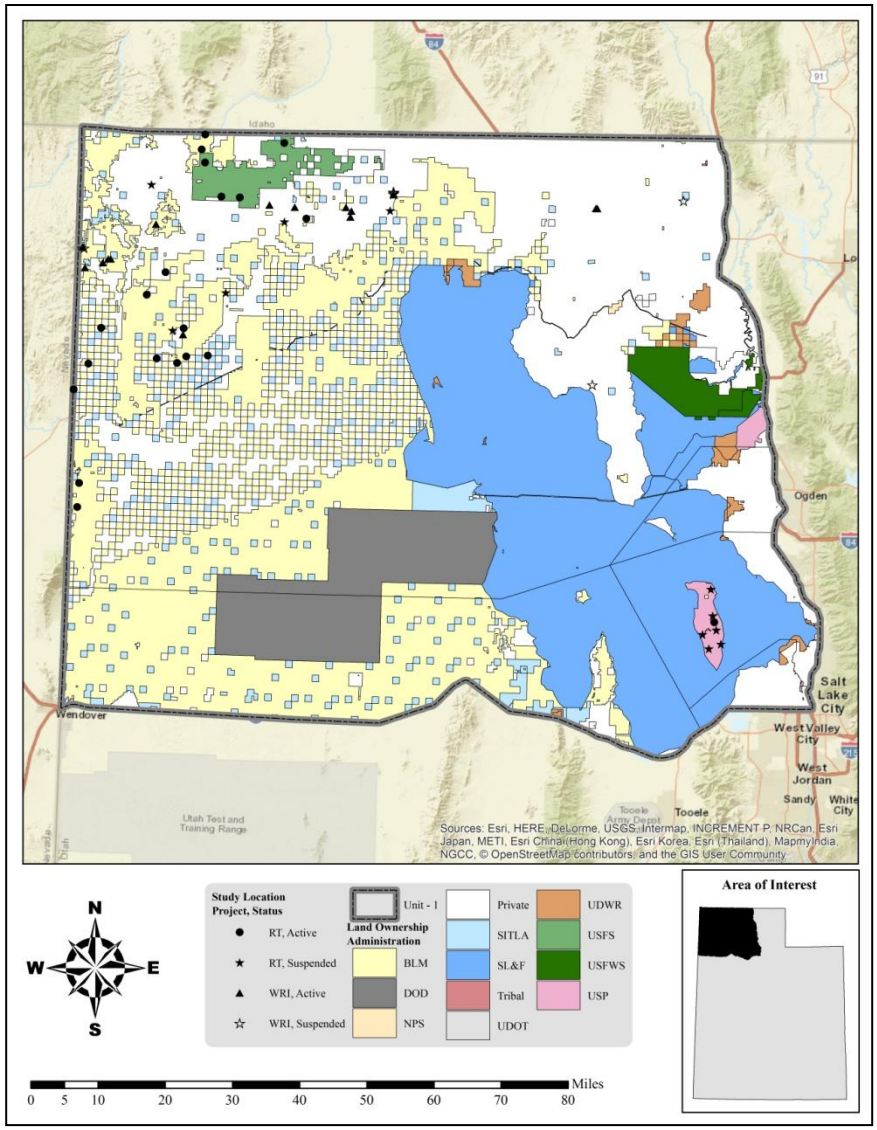
Map 1.5: Estimated bison habitat by season and value for WMU 1, Box Elder.



Map 1.6: Estimated Rocky Mountain bighorn sheep habitat by season and value for WMU 1, Box Elder.



Map 1.7: Estimated California bighorn sheep habitat by season and value for WMU 1, Box Elder.



Map 1.8: Land ownership for WMU 1, Box Elder.

	Year Long Range		Summer Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	164,237	11%	756,081	48%	650,994	41%
Elk	400,799	80%	55,404	11%	44,672	9%
Pronghorn	560,606	29%	1,379,293	71	0	0%
Bison	276,545	100%	0	0%	0	0%
CBS	68,665	100%	0	0%	0	0%
RMBS	41,919	100%	0	0%	0	0%

Table 1.1: Estimated mule deer, elk, pronghorn, bison, California Bighorn Sheep (CBS), and Rocky Mountain bighorn sheep (RMBS) habitat acreage by season for WMU 1, Box Elder.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	35,326	22%	53,227	7%	242,636	37%
Private	116,436	71%	639,819	85%	342,695	53%
SITLA	2,155	1%	13,282	2%	40,123	6%
Tribal	187	<1%	0	0%	0	0%
UDWR	5,313	3%	2	<1%	0	0%
USFS	0	0%	46,417	6%	25,521	4%
SL&F	3,429	2%	1,120	<1%	19	<1%
USFWS	1,391	1%	0	0%	0	0%
Total	164,237	**100%**	650,994	**100%**	756,081	**100%**

Table 1.2: Estimated mule deer habitat acreage by season and ownership for WMU 1, Box Elder.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	190,366	46%	5,531	10%	21,528	48%
Private	183,623	46%	18,375	33%	13,792	31%
SITLA	26,811	7%	1,497	3%	3,444	8%
USFS	0	0%	30,001	54%	5,907	13%
Total	400,799	**100%**	55,404	**100%**	44,672	**100%**

Table 1.3: Estimated elk habitat acreage by season and ownership for WMU 1, Box Elder.

	Year Long Range		Summer Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	268,671	48%	458,313	33%
Private	134,878	24%	840,355	61%
SITLA	49,470	9%	69,365	5%
DOD	98,289	18%	0	0%
UDWR	4,532	<1%	1,134	<1%
SL&F	4,572	<1%	7,823	<1%
UDOT	66	<1%	0	0%
NPS	127	<1%	2,088	<1%
USFS	0	0%	216	0%
Total	560,606	**100%**	1,379,293	**100%**

Table 1.4: Estimated pronghorn habitat acreage by season and ownership for WMU 1, Box Elder.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	280	1%
SL&F	3,287	12%
USP	24,088	87%
Total	27,655	**100%**

Table 1.5: Estimated bison habitat acreage by season and ownership for WMU 1, Box Elder.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	30,483	44%
Private	2,813	4%
SITLA	3,956	6%
DOD	4,055	6%
USP	24,279	35%
SL&F	3,079	5%
Total	68,665	**100%**

Table 1.6: Estimated California bighorn sheep habitat acreage by season and ownership for WMU 1, Box Elder.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	35,347	84%
Private	4,901	12%
SITLA	1,671	4%
Total	41,919	**100%**

Table 1.7: Estimated Rocky Mountain bighorn sheep habitat acreage by season and ownership for WMU 1, Box Elder.

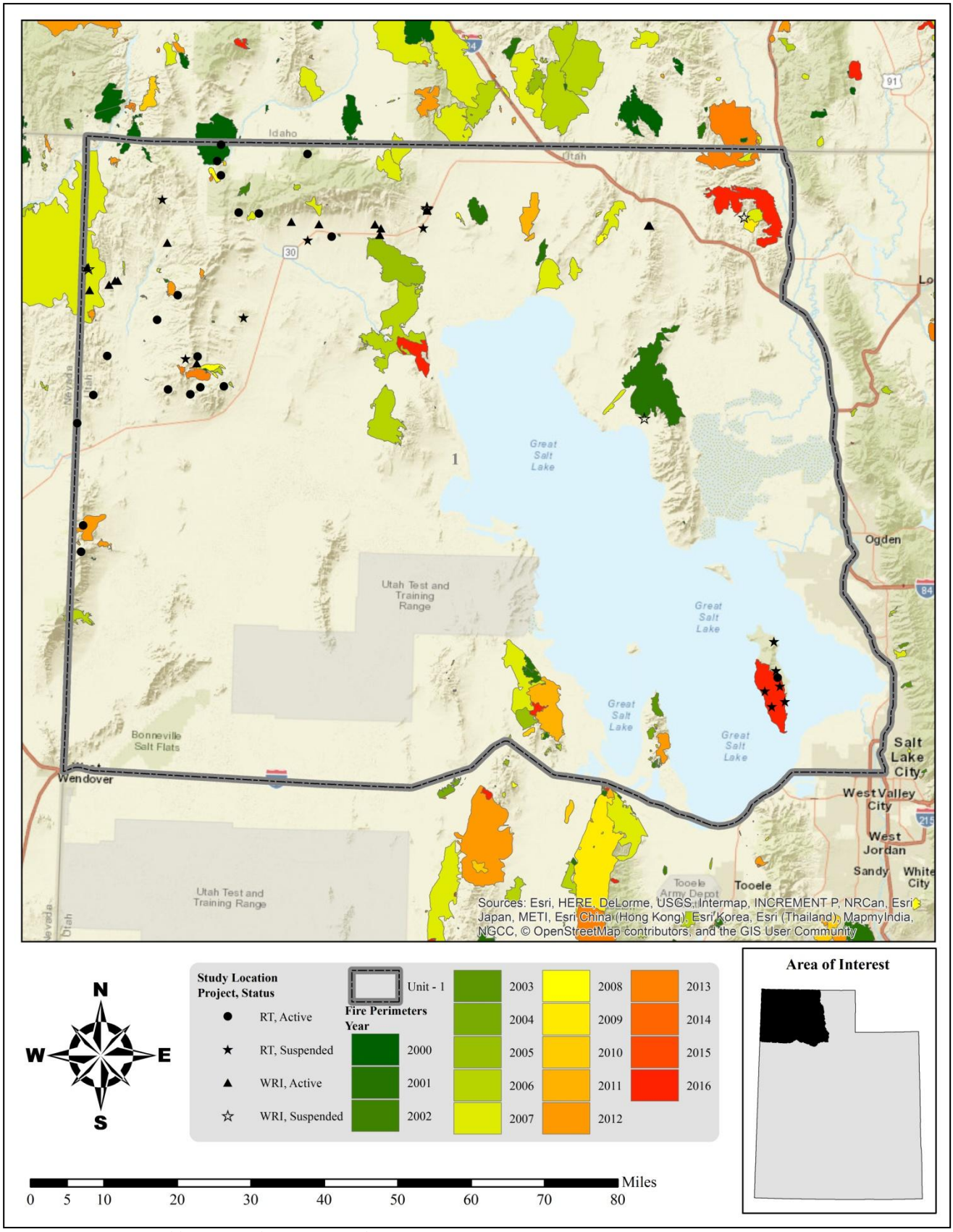
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	193,154	3.35%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	13,033	0.23%	
	Inter-Mountain Basins Juniper Savanna	11,174	0.19%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	9,111	0.16%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,153	0.02%	
	Other Conifer	448	0.01%	3.96%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	310,677	5.39%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	13,013	0.23%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	10,467	0.18%	5.80%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	26,104	0.45%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	15,138	0.26%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,350	0.02%	0.74%
Shrubland	Inter-Mountain Basins Mixed Salt Desert Scrub	671,178	11.64%	
	Inter-Mountain Basins Big Sagebrush Shrubland	538,551	9.34%	
	Great Basin Xeric Mixed Sagebrush Shrubland	287,336	4.98%	
	Inter-Mountain Basins Greasewood Flat	222,562	3.86%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	189,410	3.29%	
	Inter-Mountain Basins Big Sagebrush Steppe	72,513	1.26%	
	Sonora-Mojave Semi-Desert Chaparral	16,962	0.29%	
	Coleogyne ramosissima Shrubland Alliance	12,346	0.21%	
	Columbia Plateau Low Sagebrush Steppe	6,948	0.12%	
	Inter-Mountain Basins Montane Sagebrush Steppe	4,900	0.09%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	3,444	0.06%	
	Rocky Mountain Lower Montane-Foothill Shrubland	2,987	0.05%	
	Quercus gambelii Shrubland Alliance	2,535	0.04%	
	Other Shrubland	2,045	0.04%	35.28%
Other	Barren	1,319,834	22.90%	
	Open Water	1,269,641	22.02%	
	Agricultural	301,864	5.24%	
	Developed	200,907	3.49%	
	Sparsely Vegetated	15,409	0.27%	
	Hardwood	12,775	0.22%	
	Riparian	5,666	0.10%	54.23%
Total		5,764,634	100.00%	100%

Table 1.8: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 1, Box Elder.

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 current Landfire Existing Vegetation Coverage model, 3.35% of the Box Elder unit is comprised of pinyon-juniper woodlands, but in comparisons to sagebrush, pinyon-juniper woodlands comprise 16% (Table 1.8). 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, 5.8% of the unit is comprised of exotic herbaceous species (Table 1.8). 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 1.9).



Map 1.9: Land coverage of fires by year from 2000-2016 for WMU 1, Box Elder (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2017).

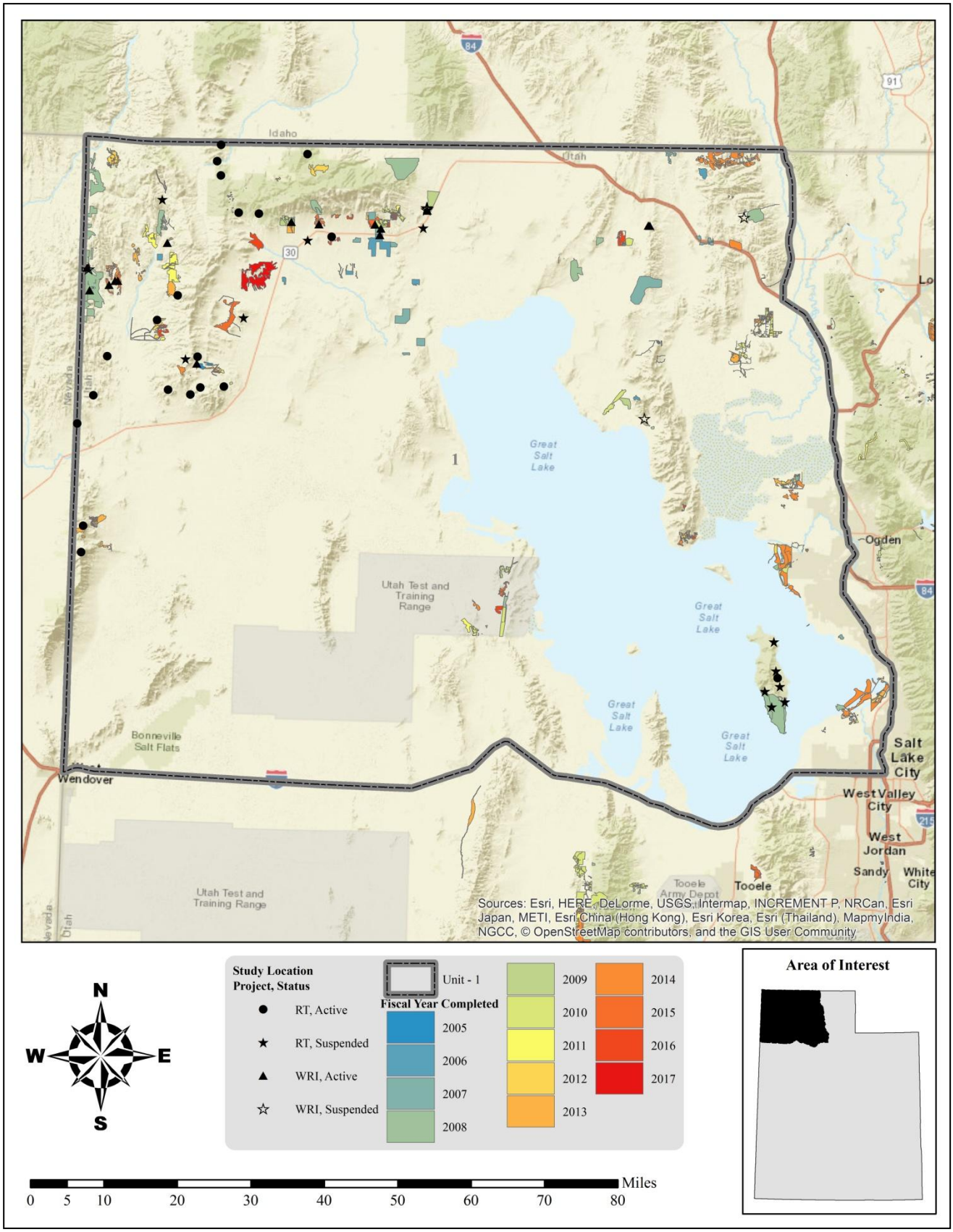
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 106,845 acres of land have been treated within the Box Elder unit since the WRI was implemented in 2004 (Map 1.10). An additional 23,756 acres are currently being treated and treatments have been proposed for 32,672 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 127,194 acres for this unit (Table 1.9). 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) grazing management and changes, bullhog and bulldozer use and hand crews to remove pinyon and juniper, herbicide application to remove weeds, prescribed fire, mowing, harrow, and other similar vegetation removal techniques (Table 1.9).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Aerator	**883**	**0**	**0**	**883**
Anchor Chain	**28,437**	**4,450**	**391**	**33,278**
Ely (One-Way)	17,485	0	0	17,485
Ely (Two-Way)	6,534	0	0	6,534
Smooth (One-Way)	3,673	4,450	391	8,514
Smooth (Two-Way)	745	0	0	745
Bulldozing	**1,595**	**0**	**0**	**1.595**
Tree Push	1,595	0	0	1,595
Bullhog	**10,401**	**9,713**	**3,958**	**24,072**
Chain Harrow	**927**	**62**	**101**	**1,090**
≤ 15 ft. (Two-Way)	927	0	101	1,028
> 15 ft. (Two-Way)	0	62	0	62
Disc	**11,143**	**156**	**0**	**11,300**
Grazing Management/Changes	**4,998**	**0**	**0**	**4,998**
Harrow	**543**	**241**	**0**	**784**
≤ 15 ft. (One-Way)	412	0	0	412
> 15 ft. (One-Way)	132	241	0	373
Herbicide Application	**37,343**	**0**	**0**	**37,343**
Aerial	32,157	0	0	32,157
Ground	4,004	0	0	4,004
Spot Treatment	1,181	0	0	1,181
Mowing	**1,364**	**0**	**0**	**1,364**
Other	1,364	0	0	1,364
Planting/Transplanting	**258**	**0**	**0**	**258**
Prescribed Fire	**1,868**	**0**	**0**	**1,868**
Seeding (Primary)	**23,850**	**6,961**	**0**	**30,810**
Broadcast (Aerial)	14,108	1,936	0	16,045
Drill (Rangeland)	7,507	5,024	0	12,532
Other	2,234	0	0	2,234
Seeding (Secondary/Shrub)	**452**	**0**	**0**	**452**
Broadcast (Aerial)	419	0	0	419
Drill (Rangeland)	33	0	0	33
Vegetation Removal/Hand Crew	**1,792**	**2,130**	**28,222**	**32,144**
Lop (No Scatter)	31	0	0	31
Lop & Scatter	1,761	2,130	28,222	32,113
Other	**1,342**	**42**	**0**	**1384**
Forestry practices	101	0	0	101
Greenstripping	1,240	42	0	1,283
Total Treatment Acres	**127,194**	**23,756**	**32,672**	**183,622**
***Total Land Area Treated**	**106,845**	**22,634**	**32,672**	**157,166**

Table 1.9: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 1, Box Elder. Data accessed on 02/09/2017.
*Does not include overlapping treatments.



Map 1.10: WRI treatments by fiscal year completed for WMU 1, Box Elder.

Range Trend Studies

Range Trend studies have been sampled within WMU 1 on a regular basis since 1984, with studies being added or suspended as was deemed necessary (Table 1.10). 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 1.11).

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
01-1	Kelton	RT	Suspended	'84, '90, '96, '01	Not Verified
01-2	Rosette	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
01-3	Rosebud Hills	RT	Suspended	'84, '90, '96, '01	Not Verified
01-4	Chokecherry Springs	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Browse)
01-5	Devils Playground	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semi-desert Gravelly Sandy Loam (Black Sagebrush)
01-6	Bovine Exclosure	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Browse)
01-7	South Side Emigrant Pass	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Shallow Loam (Black Sagebrush)
01-8	Mud Springs Basin	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Wyoming Big Sagebrush)
01-9	South West Rosette	RT	Suspended	'84, '90, '96, '01	Not Verified
01-10	Kilgore Basin	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Shallow Loam (Black Sagebrush)
01-11	Kimber Ranch	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Shallow Loam (Black Sagebrush)
01-12	Red Butte Exclosure	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Browse)
01-13	Raft River Narrows	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Gravelly Loam (Wyoming Big Sagebrush)
01-14	Broad Hollow	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Browse)
01-15	Cedar Hills	RT	Active	'90, '96, '01, '06, '11, '16	Upland Loam (Wyoming Big Sagebrush)
01-16	Nut Pine Hills	RT	Active	'96, '01, '06, '11, '16	Upland Loam (Browse)
01-17	Clarks Basin	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Shrub)
01-18	Bedke Spring	RT	Active	'96, '01, '06, '11, '16	Upland Loam (Wyoming Big Sagebrush)
01-19	Bally Mountain	RT	Active	'96, '01, '06, '11, '16	Mountain Shallow Gravelly Ridge (Black Sagebrush)
01-20	Cotton Thomas	RT	Suspended	'96	Not Verified
01-21	Keg Spring	RT	Suspended	'96, '01	Not Verified
01-22	Dake Pass	RT	Active	'96, '01, '06, '11, '16	Semidesert Shallow Loam (Black Sagebrush)
01-23	Patterson Pass	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountian Big Sagebrush)
01-24	Sheep Range Spring	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
01R-1	White's Valley	WRI	Suspended	'04	Not Verified
01R-2	Rattlesnake Fire Seeded	WRI	Active	'04, '07, '12	Not Verified
01R-3	Rattlesnake Burn	WRI	Active	'04, '07, '12	Not Verified
01R-4	Coldwater 1	WRI	Active	'05, '09, '13	Semidesert Gravelly Loam (Wyoming Big Sagebrush) North
01R-5	Coldwater 2 (Reference)	WRI	Suspended	'05, '09	Not Verified
1R-6	Hereford 1	WRI	Active	'05, '08, '13	Semidesert Loam (Wyoming Big Sagebrush)
01R-7	Hereford 2	WRI	Active	'05, '10, '13	Semidesert Shallow Loam (Black Sagebrush)
01R-8	Coldwater 3	WRI	Suspended	'05	Not Verified
01R-9	Coldwater 4	WRI	Suspended	'05	Not Verified
01R-10	Chokecherry	WRI	Active	'05, '08, '13	Upland Loam (Mountain Big Sagebrush)
01R-11	Lower Fort Ranch	WRI	Suspended	'07	Not Verified
01R-12	Dairy Valley GIP 1	WRI	Active	'08, '09, '11, '16	Upland Loam (Wyoming Big Sagebrush)
01R-13	Dairy Valley GIP 2	WRI	Active	'08, '09, '11, '16	Upland Loam (Wyoming Big Sagebrush)
01R-14	Morris GIP	WRI	Active	'08, '13	Upland Shallow Loam (Black Sagebrush)
01R-15	Dairy Valley GIP Reference	WRI	Suspended	'09	Not Verified
01R-16	Kimbell Creek	WRI	Active	'10, '13	Upland Loam (Basin Big Sagebrush)
01R-17	West Grouse Creek	WRI	Active	'13, '16	Upland Shallow Loam (Black Sagebrush)
01R-18	Buckskin Spring	WRI	Active	'14	Semidesert Loam (Wyoming Big Sagebrush)

Study #	Study Name	Project	Status	Year(s) sampled	Ecological Site Description
01R-19	Etna Reservoir	WRI	Active	'14	Semidesert Loam (Wyoming Big Sagebrush)
01R-20	Pine Creek	WRI	Active	'14	Upland Gravelly Loam (Bonneville Big Sagebrush)
01R-21	Indian Creek	WRI	Active	'14	Upland Stony Loam (Black Sagebrush)

Table 1.10: Range trend and WRI project studies monitoring history and ecological site potential for WMU 1, Box Elder.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
01-2	Rosette	Lop & Scatter	Park Valley PJ Treatment Project Phase 2	December 2015-March 2016	680	3400
01-4	Chokecherry Springs	Bullhog	Chokecherry Springs	March-June 2005	571	155
		Aerial Before	Chokecherry Springs	November 2004	571	155
01-5	Devils Playground	Chain Unknown		2014-2015		
01-8	Mud Springs Basin	Chain Unknown		2014-2015		
		Seed Unknown		2014-2015		
01-13	Raft River Narrows	Wildfire	City of Rocks	2000	17,573	
01-14	Broad Hollow	Wildfire		Prior to 1984		
		Wildfire		1996-2001		
01-15	Cedar Hills	Wildfire	City of Rocks	2000	17,573	
		Aerial Unknown		Fall 2000		
01-18	Bedke Spring	Bullhog	Grouse Creek Bullhog Phase 2	Winter 2012	1,031	1938
01-19	Bally Mountain	Prescribed Fire	Bally Mountain Prescribed Fire	Fall 2003		
01R-2	Rattlesnake Fire Seeded	Wildfire	Rattle Snake Fire	2003		PDB
		Rangeland Drill	Rattle Snake Fire	Fall 2003		PDB
01R-3	Rattlesnake Burn	Wildfire	Rattle Snake Fire	2003		PDB
01R-4	Coldwater 1	Prescribed Fire	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
		Herbicide - Plateau	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
		Rangeland Drill	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
01R-6	Hereford 1	Wildfire	Park Valley	July 2005	18,421	
		Rangeland Drill	Park Valley Burn Rehab	December 2005	3,152	348
		Aerial Unknown	Park Valley Burn Rehab	January 2006	3,152	348
01R-7	Hereford 2	Two-Way Ely Chain	Hereford Grazing Association	Fall 2005	600	250
		Rangeland Drill	Hereford Grazing Association	Fall 2005	1,240	250
		Aerial After	Hereford Grazing Association	January 2006	1,240	250
01R-8	Coldwater 3	Prescribed Fire	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
		Herbicide - Plateau	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
		Rangeland Drill	Coldwater Ranch-Dees Inc., M.O.	2007	3,000	163
01R-10	Chokecherry	Bullhog	Chokecherry Springs	March-June 2005	571	155
		Aerial Before	Chokecherry Springs	November 2004	571	155
01R-12	Dairy Valley GIP 1	Wildfire	Winecup Complex	2007	234,413	
		Aerial Before	Dairy Valley Fire Rehabilitation	December 2007	6,900	992
		One-Way Ely Chain	Dairy Valley Fire Rehabilitation	June 2008	2,700	992
01R-13	Dairy Valley GIP 2	Wildfire	Winecup Complex	2007	234,413	
		Aerial Before	Dairy Valley Fire Rehabilitation	December 2007	6,900	992
		One-Way Ely Chain	Dairy Valley Fire Rehabilitation	June 2008	2,700	992
01R-14	Morris GIP	Dozer Push	Morris Ranch	Fall 2008	798	1503
		Rangeland Drill	Morris Ranch	2009	798	1503
01R-16	Kimbell Creek	Broadcast Unknown	Kimball Creek Greater Sage Grouse Brood Rearing Habitat Enhancement	2010	106	1739
		One-Way Chain Harrow	Kimball Creek Greater Sage Grouse Brood Rearing Habitat Enhancement	2010	106	1739
01R-17	West Grouse Creek	Aerial Before	West Grouse Creek Bullhog Phase 2	October 2013	1,079	2574
		Bullhog	West Grouse Creek Bullhog Phase 2	October-December 2013	1,079	2574
01R-18	Buckskin Spring	Aerial Before	West Grouse Creek Bullhog Phase 3	2015	959	2900
		Bullhog	West Grouse Creek Bullhog Phase 3	2015	950	2900

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
01R-19	Etna Reservoir	Aerial Before	West Grouse Creek Bullhog Phase 3	2015	959	2900
		Bullhog	West Grouse Creek Bullhog Phase 3	2015	950	2900
01R-20	Pine Creek	Aerial Before	West Grouse Creek Bullhog Phase 3	2015	959	2900
		Bullhog	West Grouse Creek Bullhog Phase 3	2015	950	2900
01R-21	Indian Creek	Aerial Before	Park Valley PJ Treatment Project Phase 1	2015	1,471	2874
		Bullhog	Park Valley PJ Treatment Project Phase 1	2015	1,471	2874

Table 1.11: Range trend and WRI studies known disturbance history for WMU 1, Box Elder.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

There are three studies [Clarks Basin (01-17), Patterson Pass (01-23), and Sheep Range Spring (01-24)] classified as Mountain (Sagebrush) ecological sites. The Clarks Basin study is situated in Clarks Basin north of Clarks Basin Creek. Patterson Pass is located in the Pilot Mountains. The Sheep Range Spring study site is also located in the Pilot Mountains north of the Patterson Pass site and just southeast of Mineral Mountain.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the most dominant preferred browse species, although other browse such as black sagebrush (*A. nova*) contributes less cover. Average shrub cover has slightly increased overall; but cover of sagebrush has slightly decreased while that of other preferred browse and other shrubs has increased (Figure 1.4). Sagebrush demographic data shows that the community is comprised of mainly mature individuals. Although the average number of young plants increased in 2011 due to mountain big sagebrush on the Sheep Range Spring study, recruitment has slightly decreased overall (Figure 1.10). Sagebrush utilization has fluctuated from year to year, but has exhibited a general decrease. Mountain big sagebrush has consistently been the most used species on most study sites, and the degree of utilization has largely been none to light (Figure 1.13).

Trees contribute no cover on these study sites, but singleleaf pinyon (*Pinus monophylla*) was recorded on the Sheep Range Spring study site in low amounts in 2016 density measurements (Figure 1.7).

Herbaceous Understory: These study sites have rich and abundant herbaceous understories mainly dominated by perennial grasses and forbs. Perennial grass and forb cover has exhibited a general increase over the years, while frequency has remained fairly consistent. Native grass species have generally contributed a substantial amount of cover. Annual grass cover and frequency have increased over time: this trend was driven by the Sheep Range Spring study site in most sample years, although annual grass contributed the most cover on the Clarks Basin site in 2016. Annual forbs have slightly increased overall in cover while frequency has slightly decreased (Figure 1.16, Figure 1.18).

Occupancy: Average pellet transect data indicates that occupancy has decreased over the sample years and that primary occupants have been elk. Elk pellet groups have had a mean abundance ranging from 15 days use/acre in 2016 to 23 days use/acre in 2001. Mean abundance of deer pellet groups has ranged from 7 days use/acre in 2016 to 17 days use/acre in 2016. Finally, cattle use has been as low as 1 days use/acre in 2016 and as high as nearly 7 days use/acre in 2006 (Figure 1.20).

Mountain (Black Sagebrush)

There is one study [Bally Mountain (01-19)] that is classified as a Mountain (Black Sagebrush) ecological site; this study is located northeast of the town of Yost and just south of the Utah-Idaho border.

Shrubs/Trees: The primary browse species on this site is black sagebrush (*Artemisia nova*) which contributed the most cover in the 2006 and 2011 sample years; other preferred browse species such as mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) and slender buckwheat (*Eriogonum microthecum*) provide lesser amounts of cover. The cover of other shrub species has increased each study year, and broom snakeweed (*Gutierrezia sarothrae*) contributed the majority of the shrub cover in 2016 (Figure 1.4). Sagebrush demographic data indicates that mature individuals have comprised a majority of the population in all sample years except 2006, when decadent plants dominated, and 2016 when young plants were the major component. Sagebrush utilization has varied over time, but has decreased overall (Figure 1.10). Plants exhibited mainly moderate use in 1996 and 2011; usage has been mainly none to light in all other sample years (Figure 1.13).

Trees provide no cover on this study site, but 1996 and 2016 density measurements indicate that singleleaf pinyon (*Pinus monophylla*) has been present in low amounts (Figure 1.7).

Herbaceous Understory: This study site has remained dominated by perennial grasses and forbs in all study years. Cover and nested frequency for perennial grasses and forbs have increased overall, with bluebunch wheatgrass (*Pseudoroegneria spicata*) as the most abundant species in all years. Annual grass cover has remained minimal, with nested frequency increasing in greater amounts. Annual forbs have remained largely consistent in cover and frequency has increased slightly (Figure 1.16, Figure 1.18).

Occupancy: Pellet transect data shows that cattle have been the primary occupants of this site in most sample years, with the mean abundance of cattle pellet groups ranging from 0 days use/acre in 2006 to nearly 30 days use/acre in 2011. Deer pellet groups have had a mean abundance ranging from 0 days use/acre in 2016 to 6 days use/acre in 2001 (Figure 1.20).

Upland (Sagebrush)

Eight sites [Chokecherry Springs (01-4), Bovine Exclosure (01-6), Mud Springs Basin (01-8), Red Butte Exclosure (01-12), Raft River Narrows (01-13), Broad Hollow (01-14), Cedar Hills (01-15), and Bedke Spring (01-18)] are classified as Upland (Sagebrush) ecological sites. The Chokecherry Springs study site is located northeast of Rocky Pass Peak and west of State Road 30, while the Bovine Exclosure study is situated northwest of the Bovine Mountains off of Immigrant Trail Road. Mud Springs Basin is found southwest of Rocky Pass Peak and Mud Basin. The Red Butte Exclosure study is situated on the western slope of Red Butte mountain. The Raft River Narrows study is located just north of the Raft River and Valley Lynn Road, and the Broad Hollow site is about two miles south. Cedar Hills is found just south of the Utah-Idaho border and west of Lynn Road. Finally, the Bedke Spring study is found on the lower western slopes of the Grouse Creek Mountains.

Shrubs/Trees: Mountain and Wyoming big sagebrush (*Artemisia tridentata* ssp. *vaseyana, A. tridentata* ssp. *wyomingensis*) are the dominant browse species on all study sites. Cover of sagebrush has exhibited a marginal increase over the study years, while that of other preferred browse species has remained largely consistent. Cover of other shrub species has fluctuated, but has slightly decreased overall (Figure 1.4). Sagebrush populations have mainly been comprised of mature individuals. However, young plants were the largest demographic in 1996; most of these young individuals were found on the Raft River Narrows site (Figure 1.11). Utilization of sagebrush has decreased over the study years, with most plants exhibiting little to no use (Figure 1.14).

Tree cover on these study sites has increased each study year, and this trend is mainly driven by the Bovine Exclosure study (Figure 1.6). Density, however, has exhibited an overall decreasing trend: this could possibly be partially attributed to the difference in the number of studies sampled each year. In addition, the initial decrease in density from 1996-2001 is likely due to the exclusion of the Cedar Hills study in 2001 after a wildfire burned all the trees on the site (Figure 1.8).

Herbaceous Understory: The herbaceous understory of these sites are generally diverse and show an increasing trend. Perennial grass was the main component of the understory in 1996, 2006, and 2011, with a majority of the cover being contributed by native species on most sites. Although annual grass cover and frequency have varied, it was the dominant component of the understory in 2001 and 2016: this can be attributed to a number of sites including Chokecherry Springs, Mud Springs Basin, Red Butte Exclosure, Raft River Narrows, and Broad Hollow. Perennial and annual forb cover and frequency have also fluctuated, but are mostly consistent overall (Figure 1.16, Figure 1.18)

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 nearly 12 days use/acre in 2016 to almost 22 days use/acre in 2001. Elk pellet groups have had a mean abundance ranging from <1 days use/acre in 2001 to 2 days use/acre in 2016. Finally, the mean abundance of cattle pellet groups has been as low as 2 days use/acre in 2016 and as high as 12 days use/acre in 2006 (Figure 1.20).

Upland (Black Sagebrush)

There is one study [South Side Emigrant Pass (01-7)] that is classified as an Upland (Black Sagebrush) ecological site. South Side Emigrant Pass is found on the western slopes of the Bovine Mountains, southwest of the Bovine Exclosure study.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) is the dominant browse component on this site; other preferred browse species such as shadscale saltbush (*Atriplex confertifolia*) and green molly (*Bassia americana*) are also present, but contribute less cover. Total shrub cover has marginally decreased overall, although sagebrush cover has exhibited a slight increase (Figure 1.4). Average sagebrush demographics indicate that a majority of the population has been comprised of mature individuals, that decadence has exhibited an overall increase, and that recruitment of young has decreased (Figure 1.11). A majority of sagebrush plants were moderately or heavily browsed in 1996, but utilization has since decreased; a majority of plants have exhibited none to light use in 2011 and 2016 (Figure 1.14).

Trees have remained rare on this site and have not provided cover in any sample year. However, it is important to note that although point-quarter measurements were only taken in 2016, twoneedle pinyon (*Pinus edulis*) and/or Utah juniper (*Juniperus osteosperma*) have been recorded in shrub density strips in all years since 1996 (Figure 1.8).

Herbaceous Understory: Overall cover of the herbaceous understory has generally increased, but has been significantly less than that of other sites in this unit; frequency has exhibited a slight decrease. Perennial forbs and native perennial grasses have provided the most cover and have been the most abundant components in all study years. Cover of annual grasses and forbs has remained low (Figure 1.16, Figure 1.18).

Occupancy: Deer have been the primary occupants of this site in all years except 2001 in which elk had primarily been on the site; overall occupancy has decreased over time. Mean abundance of deer pellet groups has ranged from almost 5 days/acre in 2001 to nearly 27 days use/acre in 2006. Elk pellet groups have had a mean abundance ranging from 0 days use/acre in 2006, 2011, and 2016 to nearly 71 days use/acre in 2001. Mean abundance of cattle pellet groups has been as low as 0 days use/acre in 2001 and 2016 and as high as almost 4 days use/acre in 2011 (Figure 1.20).

Upland (Browse)

One study site [Nut Pine Hills (01-16)] is classified as an Upland (Browse) ecological site; this study is situated in Nut Pine Hills, east of the Clark Basin study.

Shrubs/Trees: The dominant browse species on this study site is antelope bitterbrush (*Purshia tridentata*) with other preferred browse species such as mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Utah

serviceberry (*Amelanchier utahensis*) present and providing less cover (Figure 1.4). Mature plants have dominated the sagebrush population in all study years, and the population has exhibited a general downwards trend over time. Sagebrush utilization has also decreased overall, with a majority of plants showing no to light use (Figure 1.11, Figure 1.14).

Tree cover has slightly increased overall; with Utah juniper (*Juniperus osteosperma*) contributing the most cover (Figure 1.6). Tree density has been increasing steadily each sample year since 2001, though density decreased substantially from 1996 to 2001 (Figure 1.8).

Herbaceous Understory: Cover of the herbaceous understory has varied from year to year, but has increased overall between 1996 and 2016; frequency has decreased a marginal amount. A diverse mix of perennial grasses and forbs has consistently been the dominant component of the understory and has mainly been comprised of native species. Annual grasses and forbs have remained rare throughout the study years (Figure 1.16, Figure 1.18).

Occupancy: Although presence has been variable over the study period, there has been a general decrease in total days use/acre. Deer have been the primary occupants in each study year, with mean abundance of pellet groups ranging from about 17 days use/acre in 2016 to 78 days use/acre in 2006. Elk pellet groups had a mean abundance ranging from 0 days use/acre in 2001, 2006, and 2016 to nearly 5 days use/acre in 2011. The mean abundance of cattle pellet groups has been as low as just under 3 days use/acre in 2011 and as high as just under 8 days use/acre in 2006 (Figure 1.20).

Semidesert (Sagebrush)

One study [Rosette (01-2)] is considered to be a Semidesert (Sagebrush) ecological site, and is located just outside the town of Rosette, south of State Route 30.

Shrubs/Trees: Shrub cover on this site has decreased from year to year. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) provides the most browse cover and other preferred browse is rare (Figure 1.5). Average sagebrush demographics show that mature plants have been the main component of the population in all study years except 1996, when young plants were the most prevalent; recruitment of young has decreased over time (Figure 1.12). Sagebrush utilization has varied, but the percentage of plants that are moderately or heavily browsed has decreased since 2011 – over 90% of plants exhibited little to no use in the most recent sample year (Figure 1.15).

Utah juniper (*Juniperus osteosperma*) contributed cover in 2006 and 2011, but provided no cover in 2016 due to a lop and scatter treatment. Density of trees has likewise exhibited an overall decrease (Figure 1.6, Figure 1.9).

Herbaceous Understory: Although native perennial grasses originally provided the most cover in the understory, annual grasses have increased and became dominant on the site in 2011. Total cover has been variable, but has increased overall. Average nested frequency of the understory as a whole has remained largely consistent with frequencies of individual components exhibiting slight fluctuations over time (Figure 1.17, Figure 1.19).

Occupancy: Average occupancy remained mostly consistent from 2001 to 2011, but decreased in 2016; deer have been the primary occupants in all years with mean abundance of pellet groups ranging from 14 days use/acre in 2016 to 26 days use/acre in 2001. Mean abundance of elk pellet groups has been as low as 0 days use/acre in 2001, 2006, and 2011, and as high as 0.7 days use/acre in 2016. Cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2001 to just over 2 days use/acre in 2016 (Figure 1.21).

Semidesert (Black Sagebrush)

Four study sites [Devils Playground (01-5), Kilgore Basin (01-10), Kimber Ranch (01-11), and Dake Pass (01-22)] are considered to be Semidesert (Black Sagebrush) ecological sites. The Devils Playground study is located northeast of the Bovine Mountains near the Devils Playground rock formation. Kilgore Basin is found west of Grouse Creek, and the Kimber Ranch site is situated west of North Etna Road and north of Toms Cabin Creek. Finally, the Dake Pass study is located north of State Route 30 very near to the Utah-Nevada border.

Shrubs/Trees: The dominant browse component on all sites is black sagebrush (*Artemisia nova*), although other preferred browse species such as Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) and shadscale saltbush (*Atriplex confertifolia*) often provide cover in lesser amounts. Cover of sagebrush and preferred browse has remained consistent, while that of other shrubs has slightly increased. This increase of other shrubs is likely partially due to the marked increase of yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* var. *stenophyllus*) on the Kilgore Basin site between 2011 and 2016 (Figure 1.5). According to the sagebush demographic data, mature plants make up most of the populations on these sites, followed by decadent and young individuals; density of all three age classes has decreased over time. Sagebrush utilization has fluctuated over time. Although a majority of sagebrush plants were moderately or heavily browsed in 1996, more than half of plants exhibited no to light utilization in 2001, 2006, 2011, and 2016 (Figure 1.12, Figure 1.15).

Utah juniper (*Juniperus osteosperma*) has provided fluctuating cover on these sites, but has generally decreased overall; this decrease is largely influenced by the Devils Playground study, in which cover was reduced by over 10% by a chaining project (Figure 1.6). Average density has also fluctuated with an overall

increase and both juniper and singleleaf pinyon (*Pinus monophylla*) have been recorded; this trend is mostly driven by the Devils Playground study and the Kimber Ranch site to a slightly lesser extent (Figure 1.9).

Herbaceous Understory: The average herbaceous understories of these studies has varied from year to year, but cover and frequency have increased overall. Composition has varied from year to year. Perennial grasses and forbs were the main components in 1996, 2011, and 2016, while annual grasses dominated in 2006; perennial and annual grasses were co-dominant in 2001. The large increase in annual grass cover in 2006 is likely due to the Dake Pass study, on which frequency and cover increased significantly between 2001 and 2006. Perennial grasses on these sites have been largely composed of native species (Figure 1.17, Figure 1.19).

Occupancy: Animal occupancy has generally increased, with deer being the main occupants in all study years. Mean abundance for deer pellet groups has been as low as 15.5 days/acre in 2001 and as high as nearly 24 days use/acre in 2016. Elk pellet groups have had a mean abundance ranging from almost 3 days use/acre in 2016 to 11 days use/acre in 2011. The mean abundance of cattle pellet groups has ranged from nearly 2 days use/acre in 2001 to 8 days use/acre in 2011. Finally, horse pellet groups have had a mean abundance as low as 0 days use/acre in 2001 and 2006 and as high as 0.3 days use/acre in 2011 and 2016 (Figure 1.21).

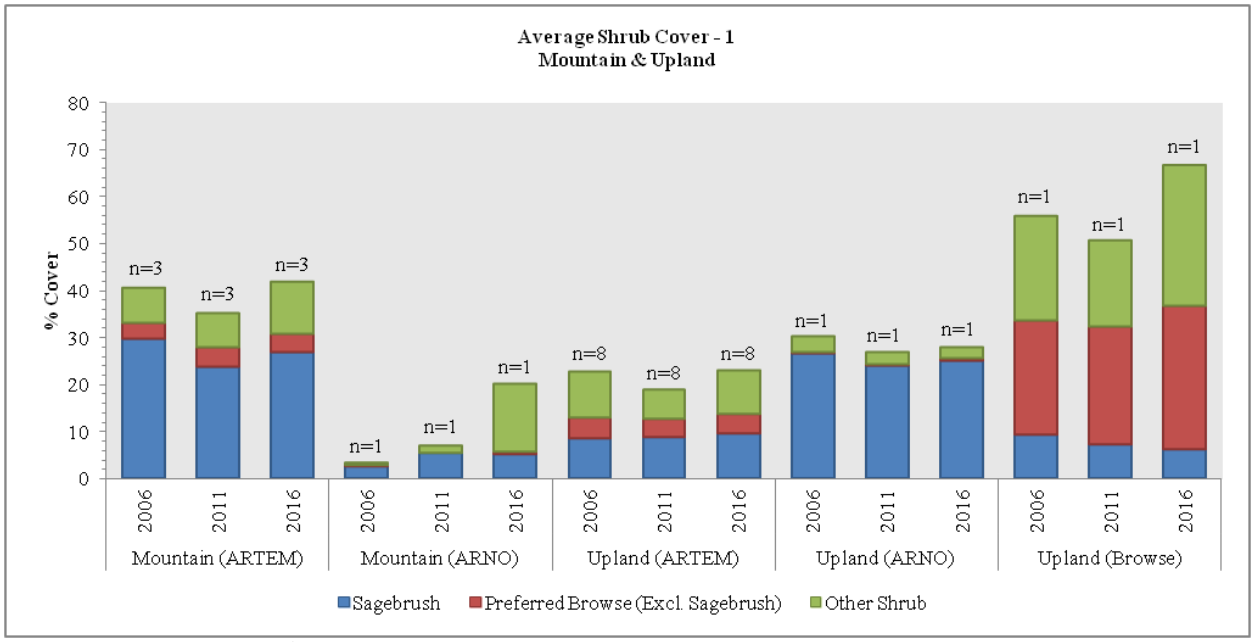


Figure 1.4: Average shrub cover for Mountain (ARTEM), Mountain (ARNO), Upland (ARTEM), Upland (ARNO), and Upland (Browse) study sites in WMU 1, Box Elder.

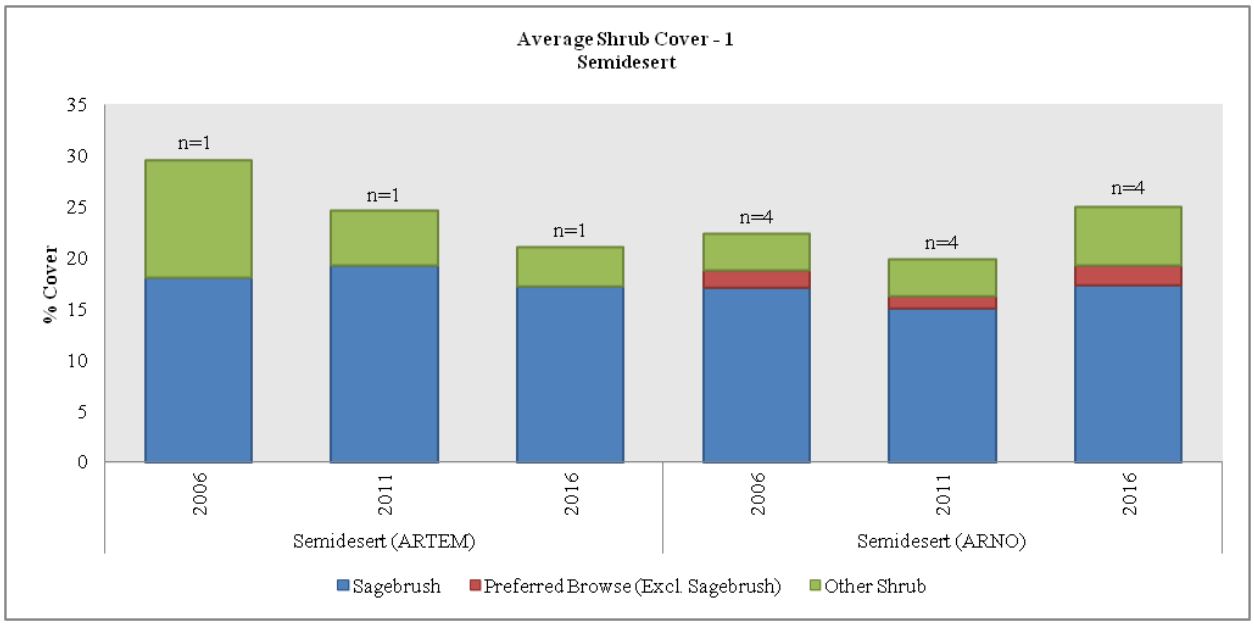


Figure 1.5: Average shrub cover for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

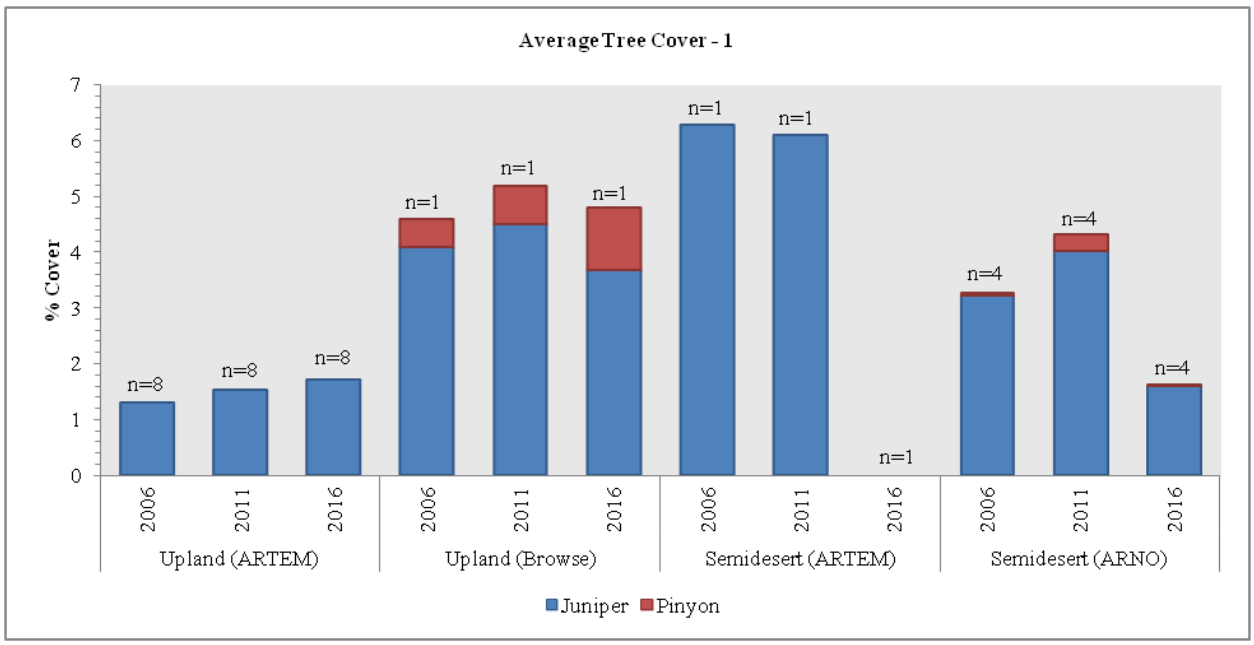


Figure 1.6: Average tree cover for Upland (ARTEM), Upland (Browse), Semidesert (ARTEM), and Semidesert (ARNO) study sites in WMU 1, Box Elder.

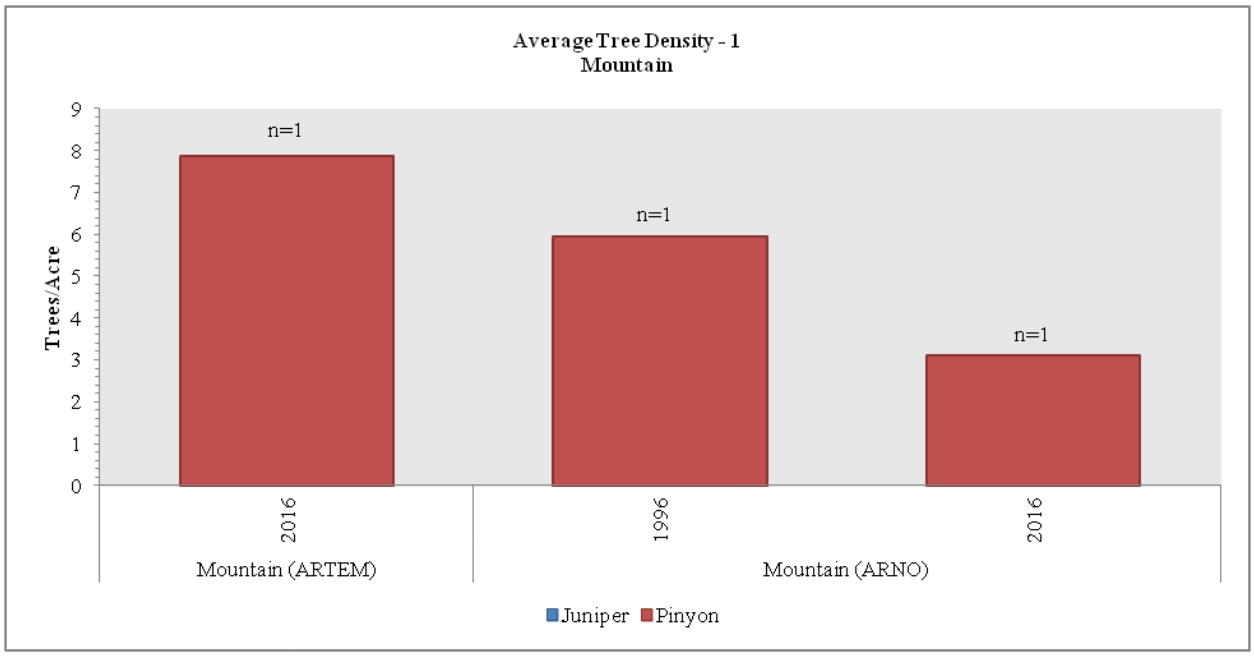


Figure 1.7: Average tree density for Mountain (ARTEM) and Mountain (ARNO) study sites in WMU 1, Box Elder.

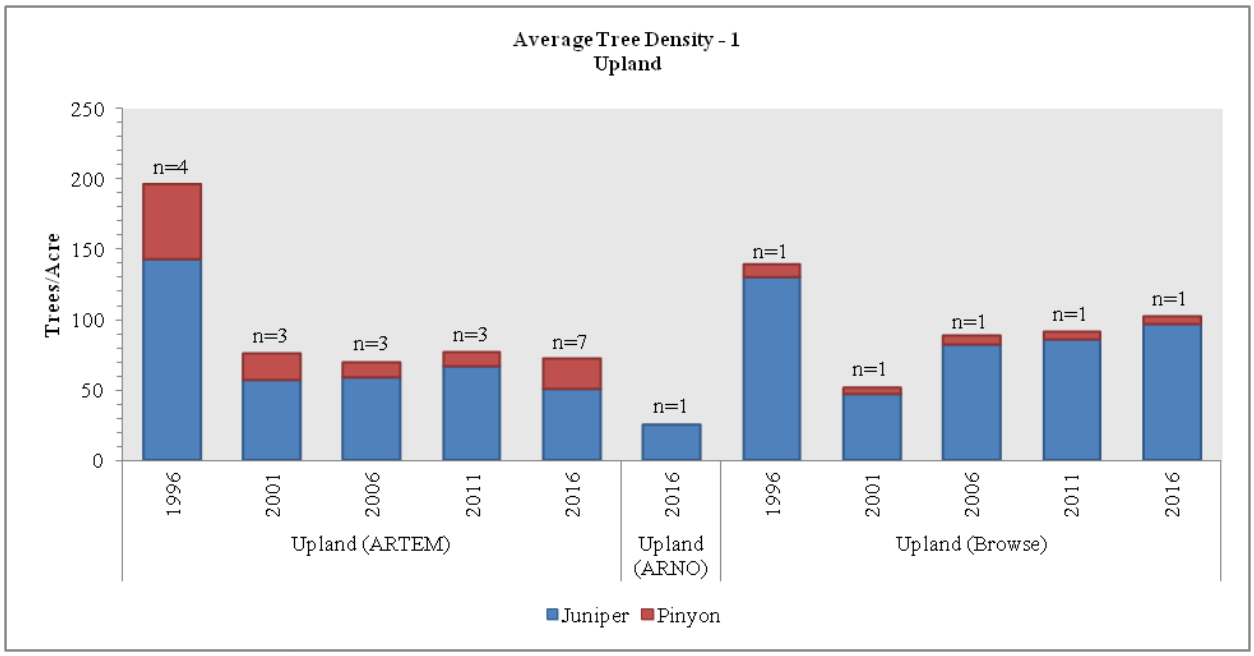


Figure 1.8: Average tree density for Upland (ARTEM), Upland (ARNO), and Upland (Browse) study sites in WMU 1, Box Elder.

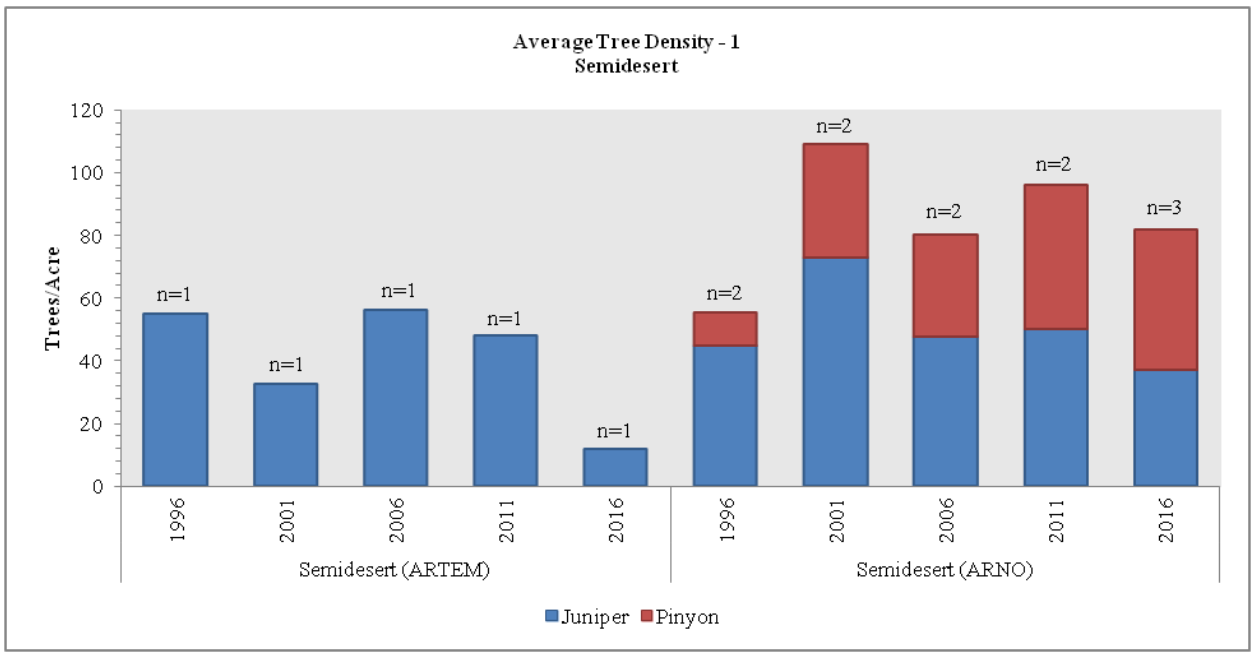


Figure 1.9: Average tree density for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

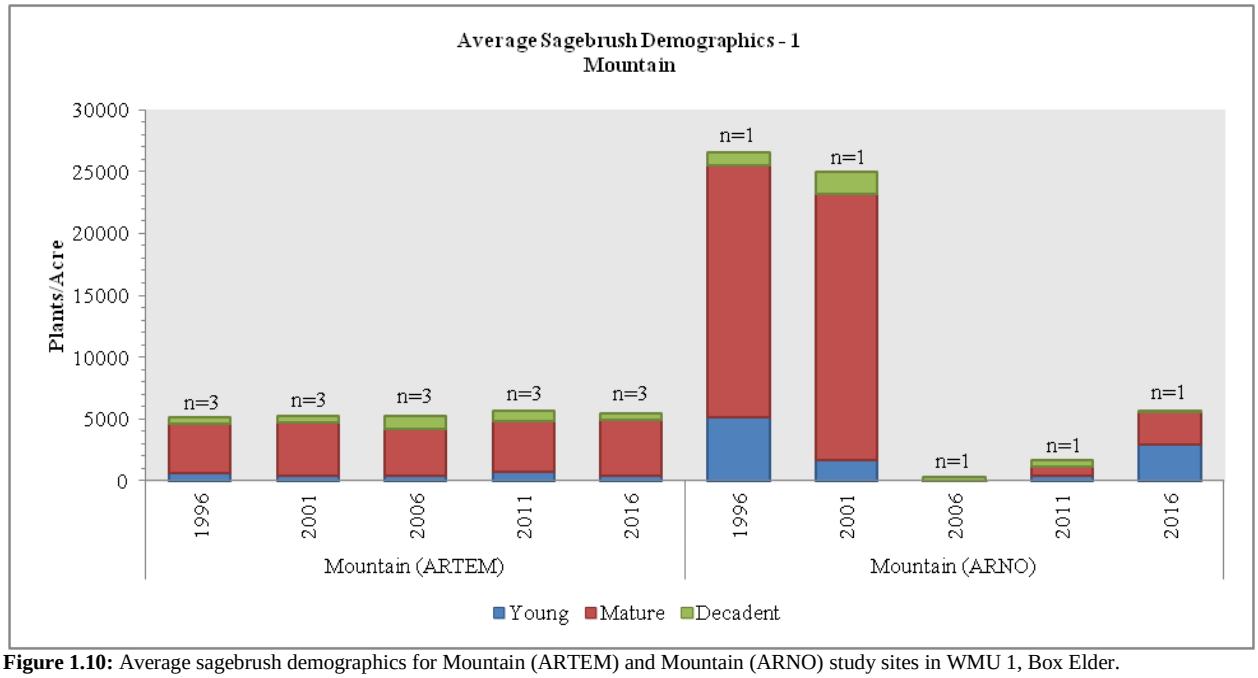


Figure 1.10: Average sagebrush demographics for Mountain (ARTEM) and Mountain (ARNO) study sites in WMU 1, Box Elder.

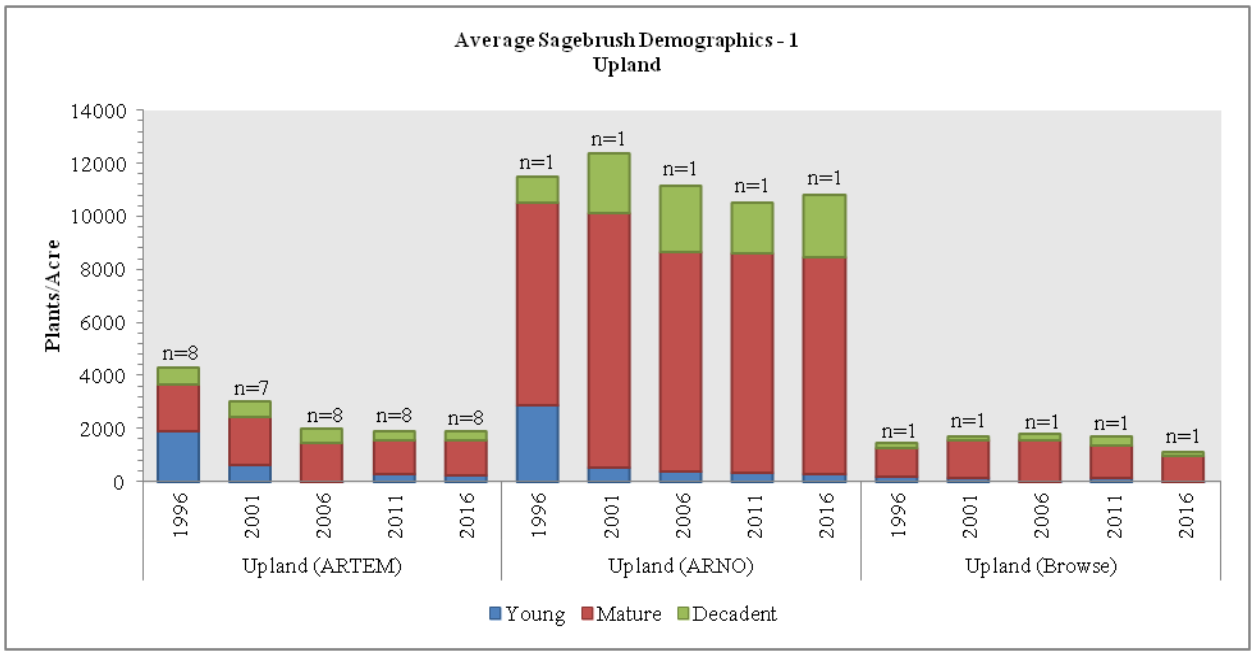


Figure 1.11: Average sagebrush demographics for Upland (ARTEM), Upland (ARNO), and Upland (Browse) study sites in WMU 1, Box Elder.

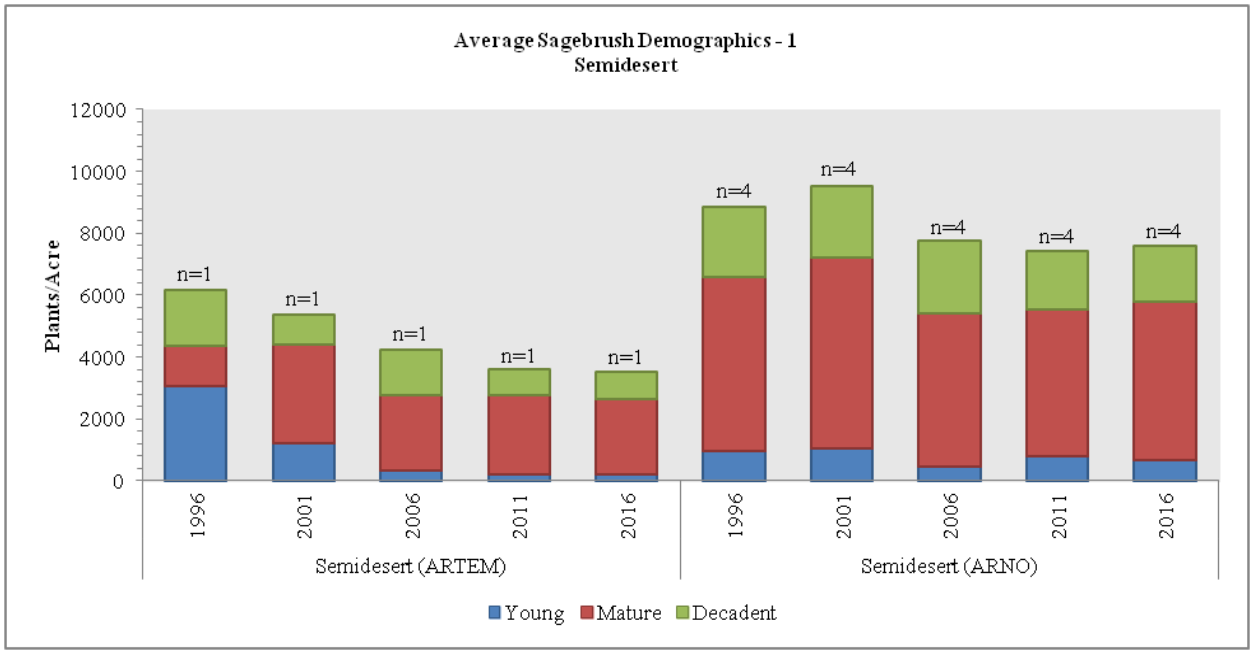


Figure 1.12: Average sagebrush demographics for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

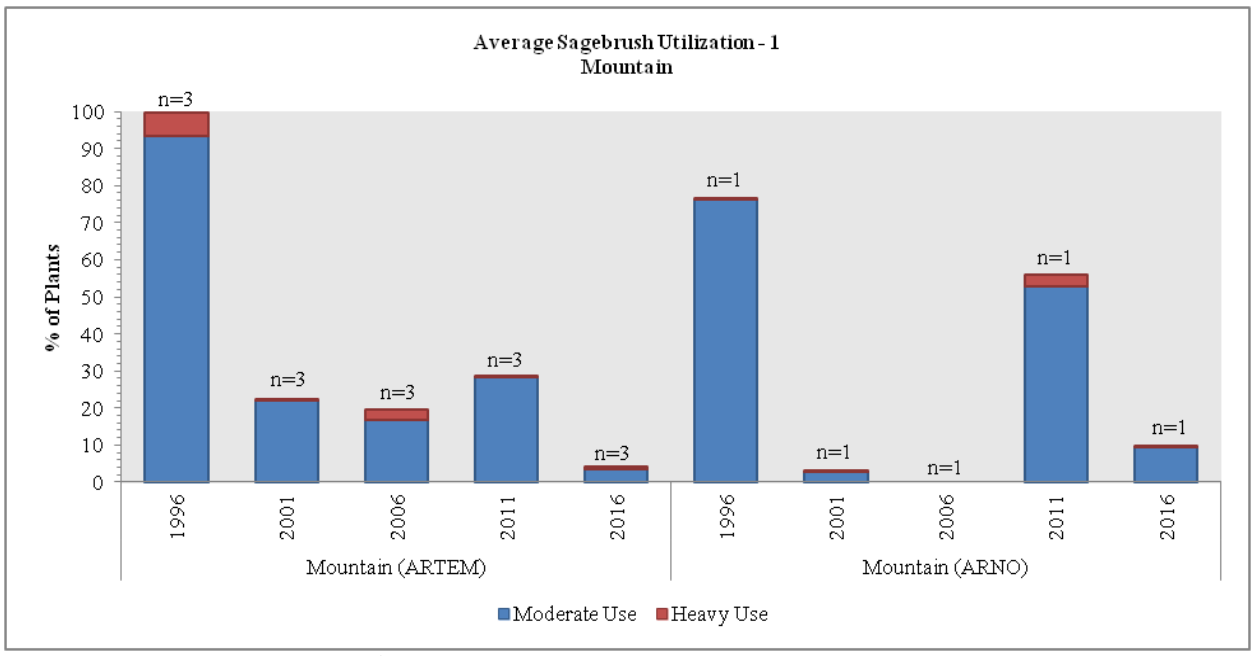


Figure 1.13: Average sagebrush utilization for Mountain (ARTEM) and Mountain (ARNO) study sites in WMU 1, Box Elder.

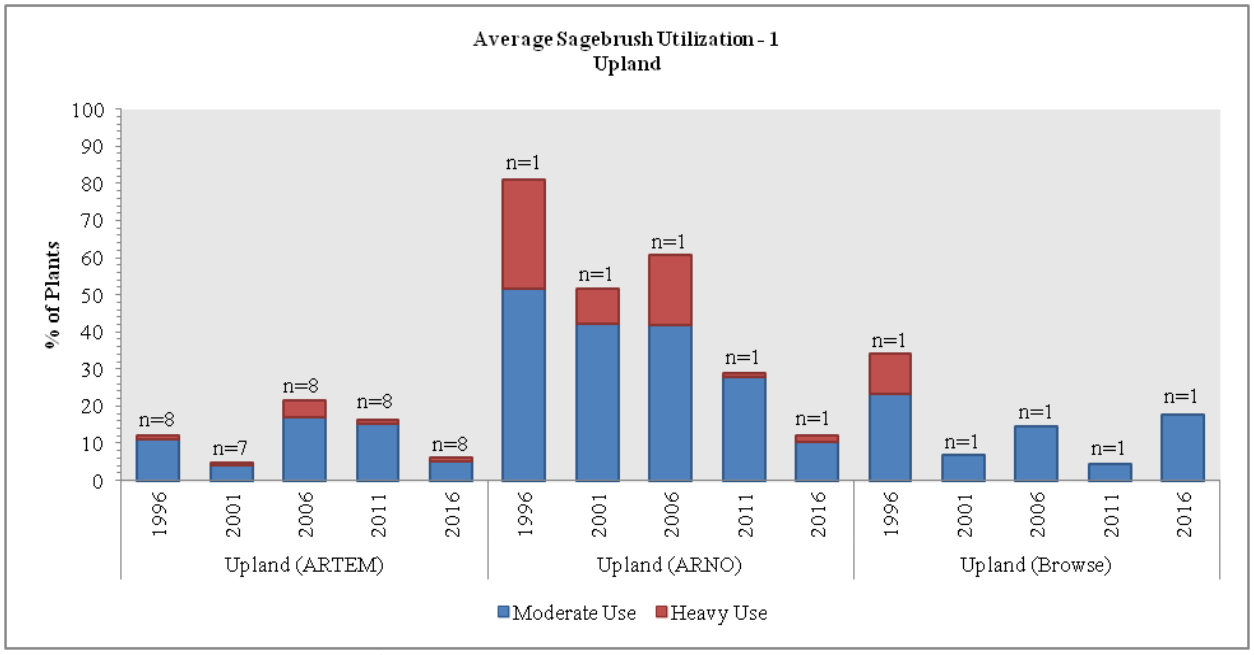


Figure 1.14: Average sagebrush utilization for Upland (ARTEM), Upland (ARNO), and Upland (Browse) study sites in WMU 1, Box Elder.

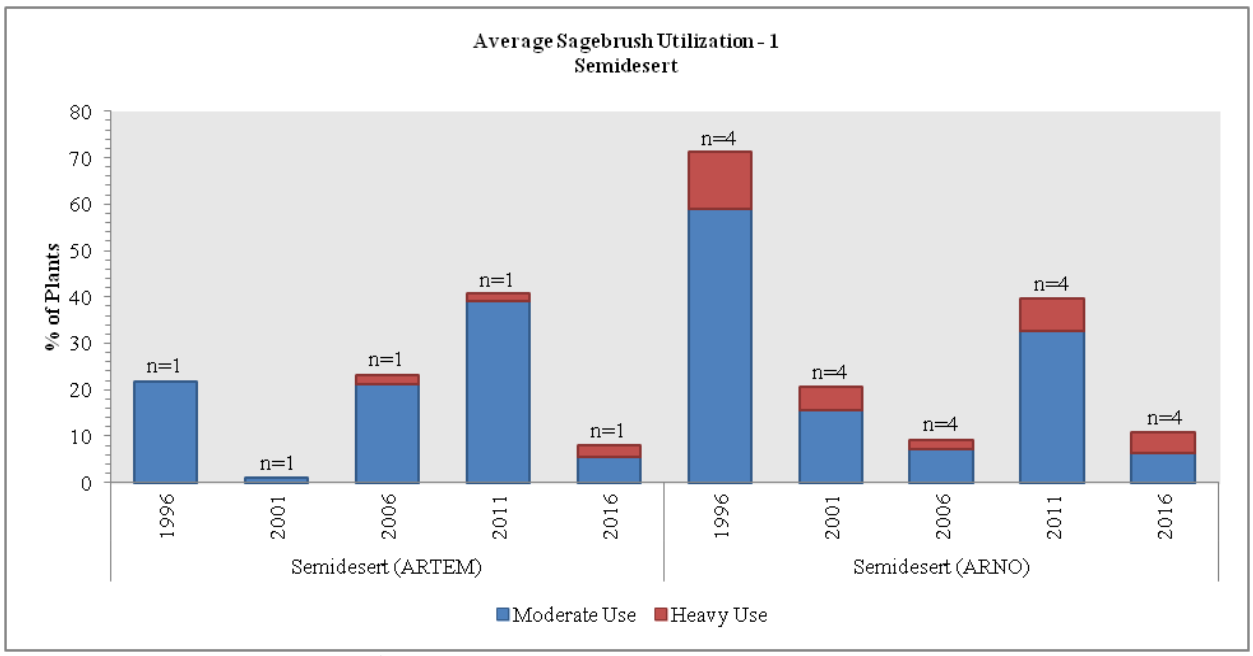


Figure 1.15: Average sagebrush utilization for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

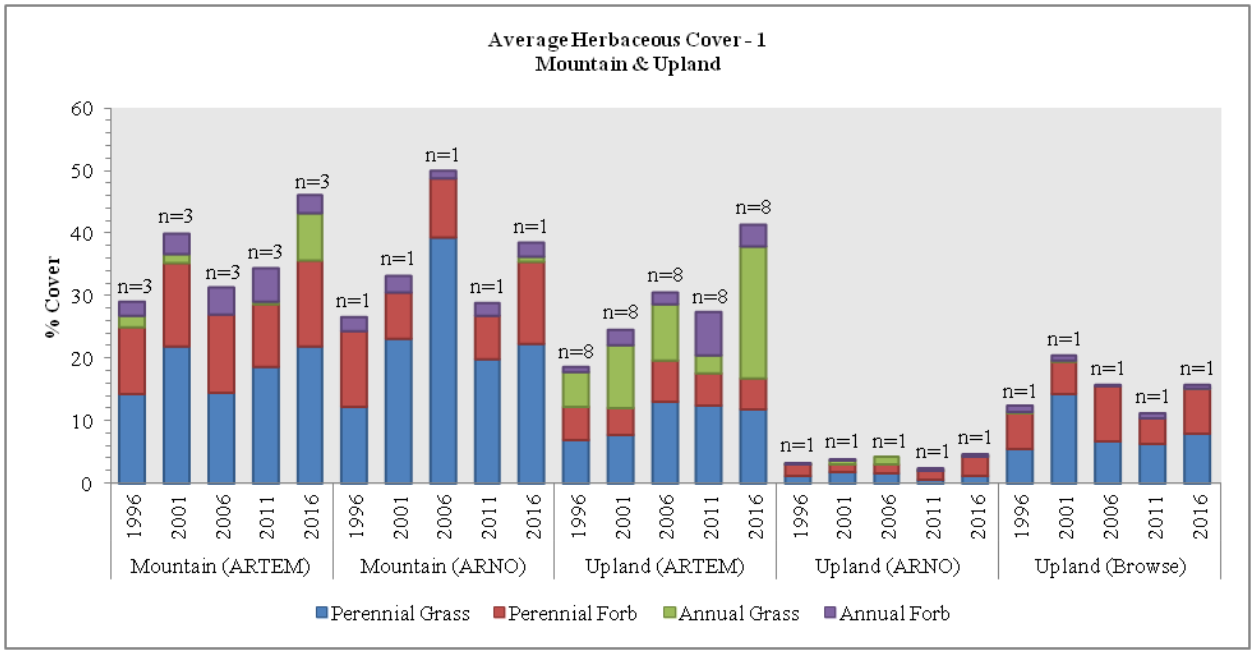


Figure 1.16: Average herbaceous cover for Mountain (ARTEM), Mountain (ARNO), Upland (ARTEM), and Upland (ARNO) study sites in WMU 1, Box Elder.

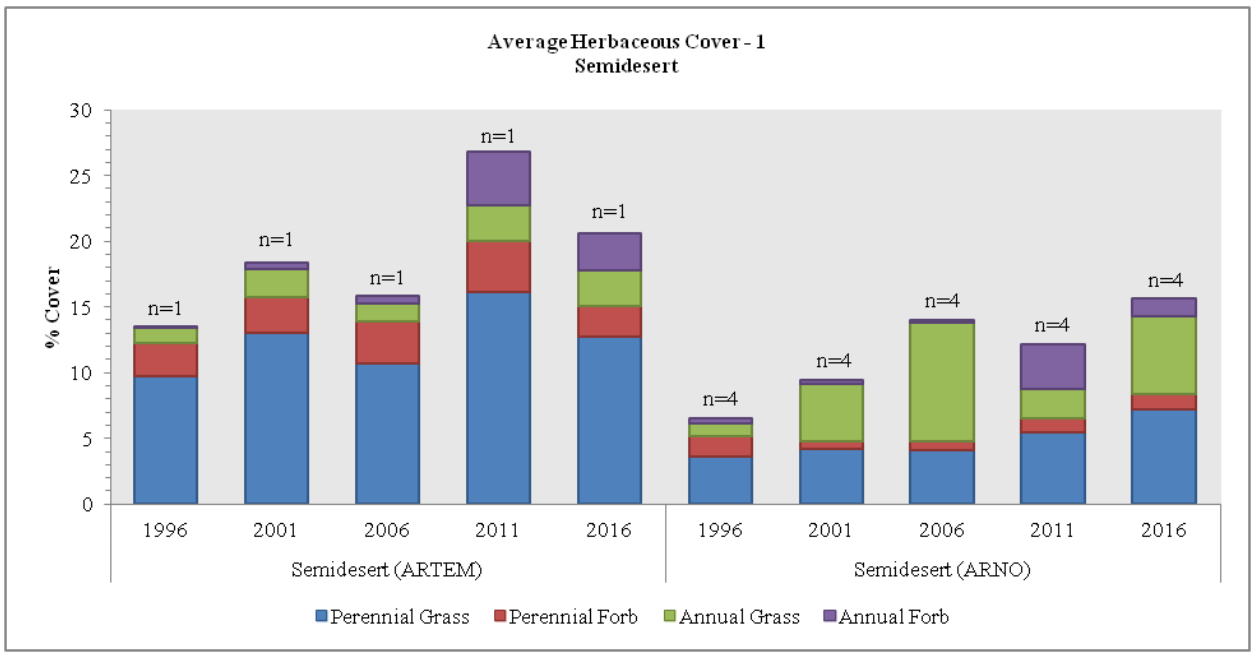


Figure 1.17: Average herbaceous cover for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

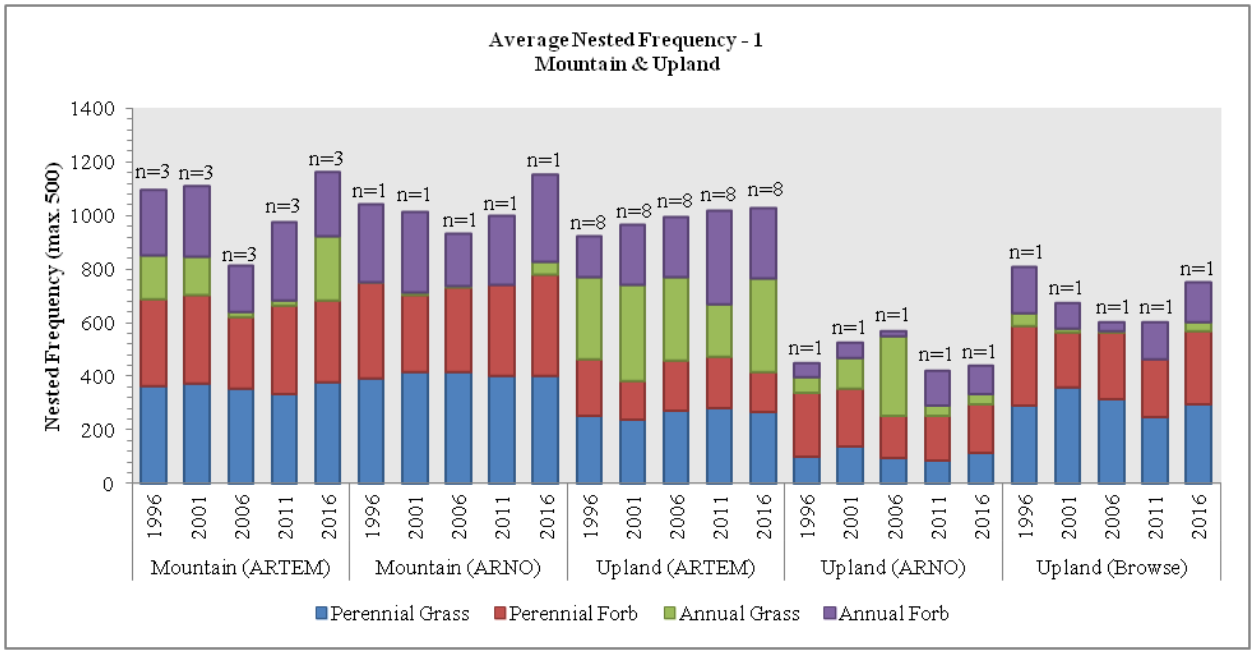


Figure 1.18: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (ARNO), Upland (ARTEM), and Upland (ARNO) study sites in WMU 1, Box Elder.

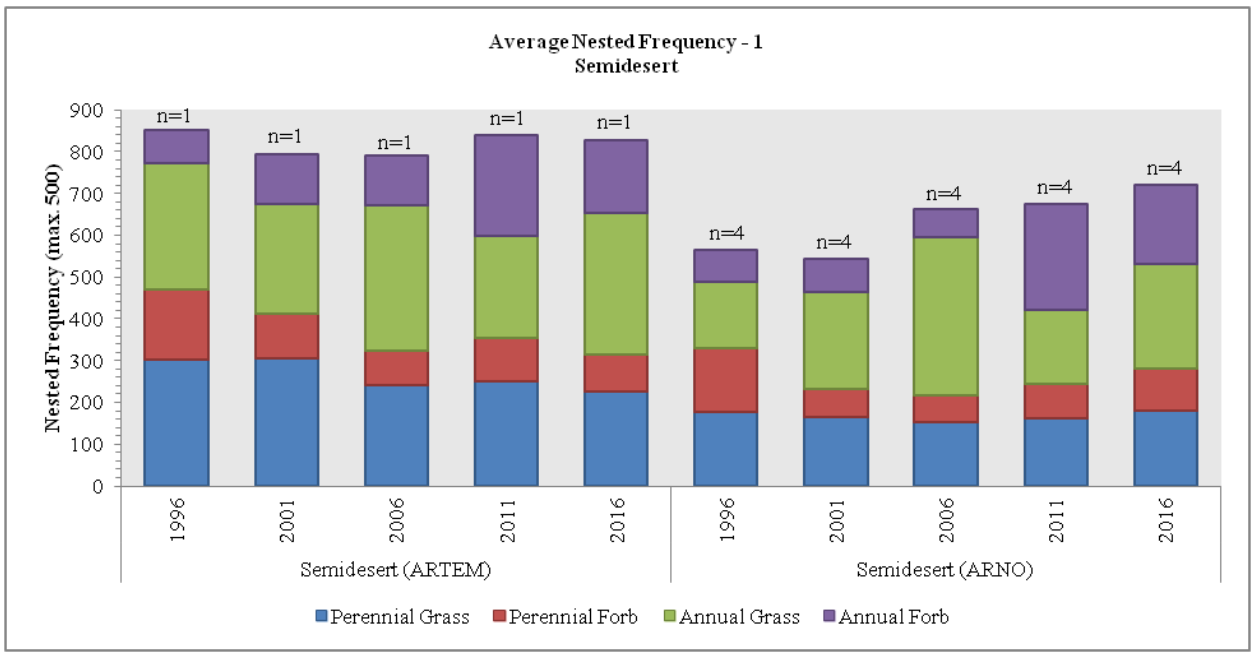


Figure 1.19: Average herbaceous nested frequency of herbaceous species for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

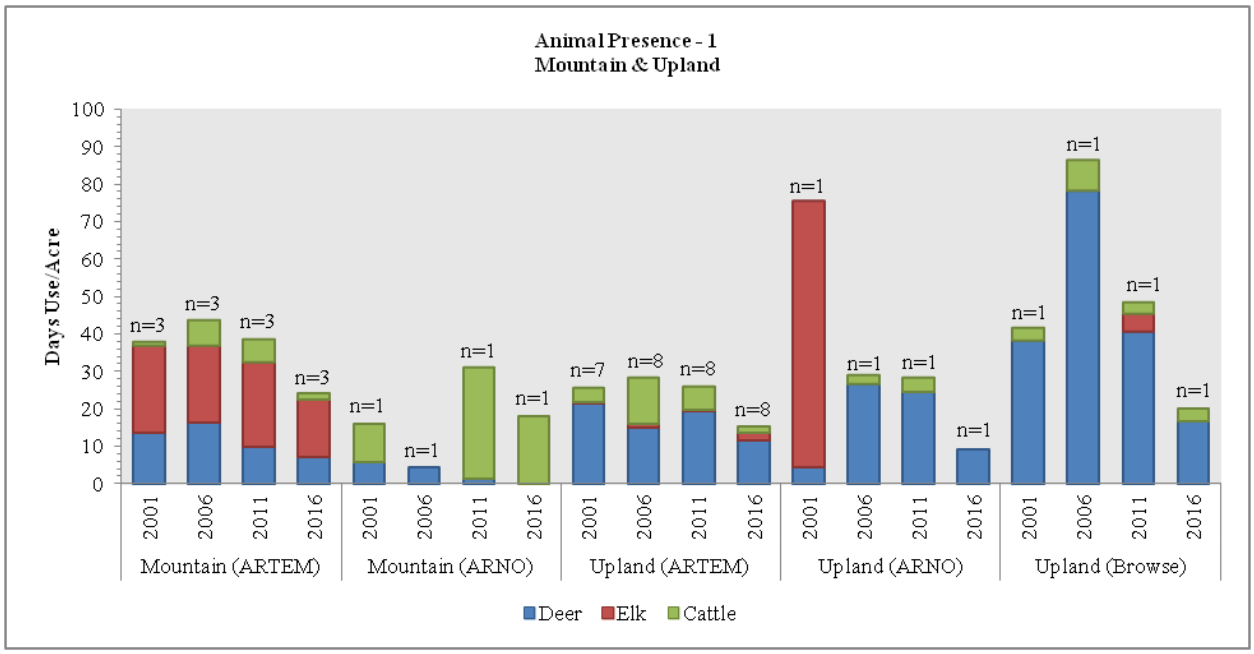


Figure 1.20: Average pellet transect data for Mountain (ARTEM), Mountain (ARNO), Upland (ARTEM), Upland (ARNO), and Upland (Browse) study sites in WMU 1, Box Elder.

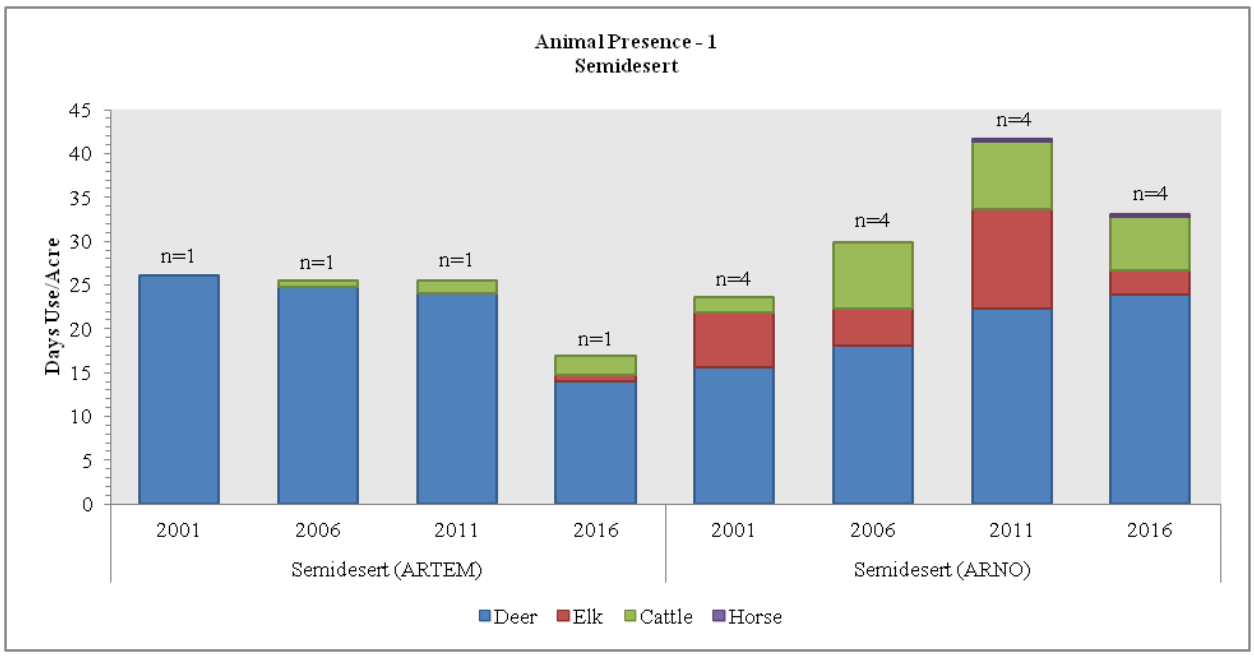
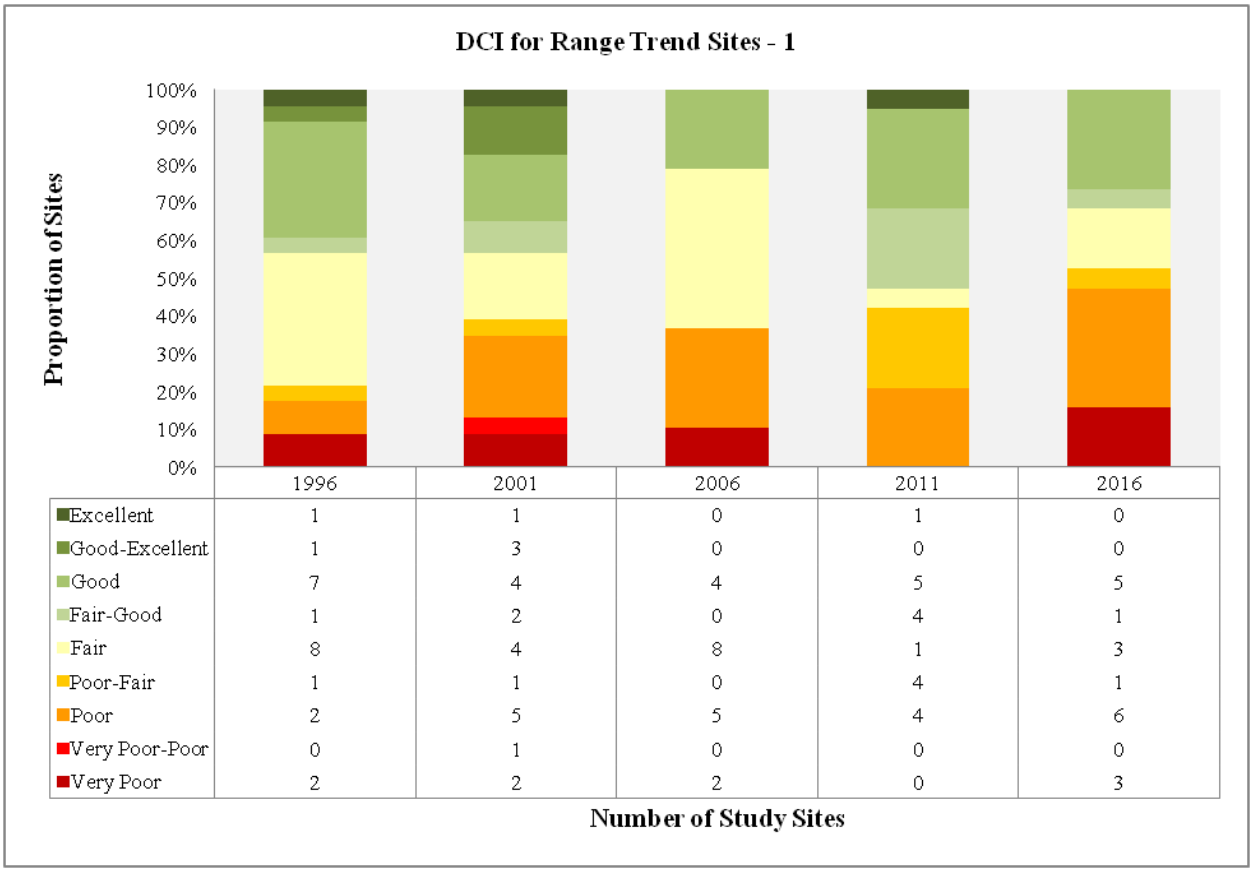


Figure 1.21: Average pellet transect data for Semidesert (ARTEM) and Semidesert (ARNO) study sites in WMU 1, Box Elder.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Box Elder 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 good-excellent condition as of the 2016 sample year (Figure 1.22, Map 1.15). Kilgore Basin, Nut Pine Hills, Clarks Basin, Dake Pass, and Patterson Pass have remained in good condition, while Sheep Range Spring is considered to be in fair-good condition. Rosette, Bovine Exclosure, and Kimber Ranch are in fair condition, and Devils Playground is in poor-fair condition. Chokecherry Springs, South Side Emigrant Pass, Broad Hollow, Cedar Hills, Bedke Spring, and Bally Mountain are in poor condition. Finally, the Mud Springs Basin, Red Butte Exclosure, and Raft River Narrow studies are considered to be in very poor condition generally due to the presence of annual grasses and lack of preferred browse cover. The treated sites have generally improved as time since treatment has increased (Figure 1.23); the exceptions to this are the Kimbell Creek study, which went from excellent to fair-good, the Dairy Valley GIP 2 study, which remained in very poor condition, and the Hereford 2 site which remained in fair condition. The Rosette, Chokecherry Springs, Devils Playground, Mud Springs Basin, Raft River Narrows, Broad Hollow, Cedar Hills, Bedke Spring, and Bally Mountain studies are also considered to be Range Trend sites and are discussed above. Buckskin Spring, Etna Reservoir, Pine Creek, and Indian Creek were all sampled prior to treatment and were in very poor to good condition. The Coldwater 1 study went from very poor to poor, Morris GIP went from very poor to good, Dairy Valley GIP 1 improved from fair-good to good, and the Hereford 1 study improved from good to excellent condition, (Map 1.15). It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1996	2001	2006	2011	2016
Excellent	1	1	0	1	0
Good-Excellent	1	3	0	0	0
Good	7	4	4	5	5
Fair-Good	1	2	0	4	1
Fair	8	4	8	1	3
Poor-Fair	1	1	0	4	1
Poor	2	5	5	4	6
Very Poor-Poor	0	1	0	0	0
Very Poor	2	2	2	0	3

Figure 1.22: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 1, Box Elder.

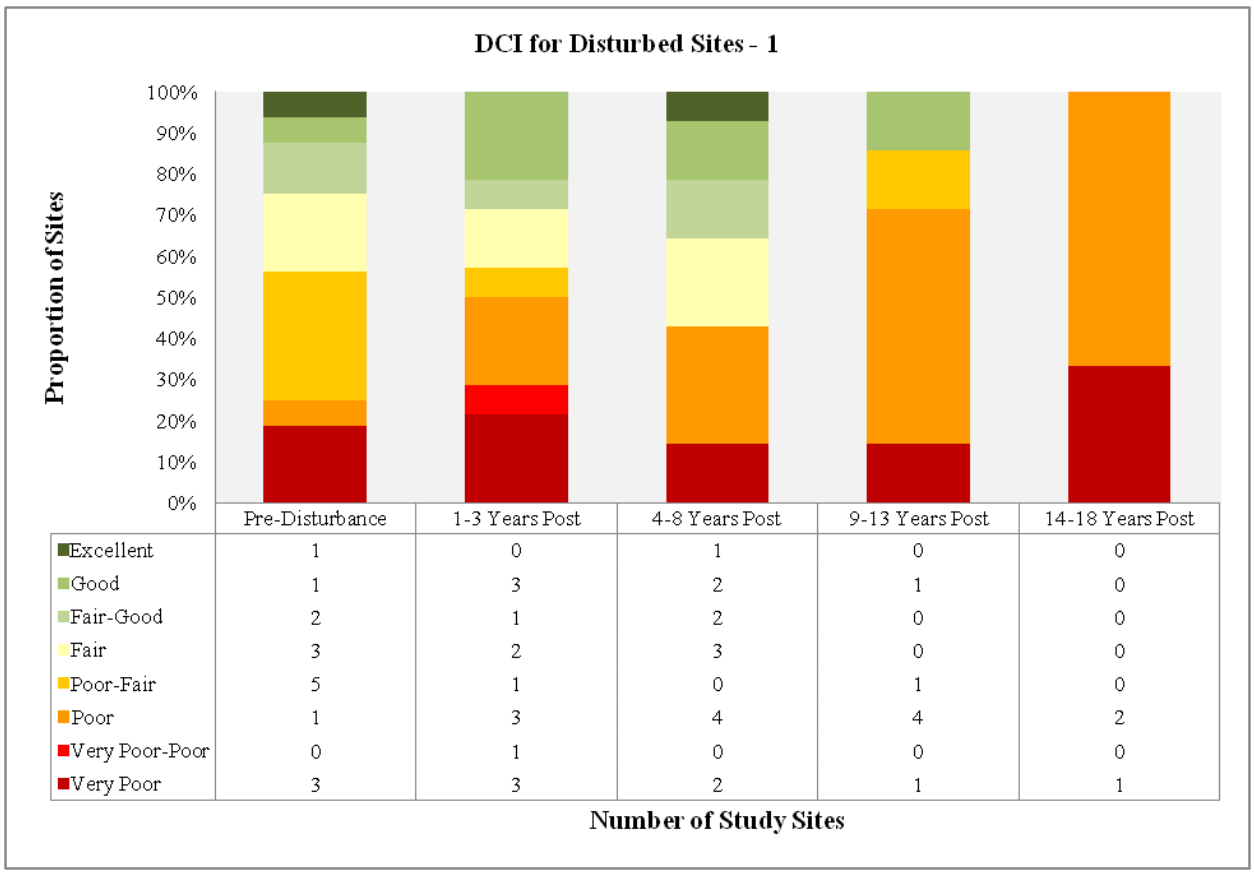


Figure 1.23: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 1, Box Elder.

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
01-1*	1996	2.9	8.4	15.0	0.3	-20.0	0.9	0.0	**7.5**	**VP**
01-1*	2001	2.4	6.1	11.0	0.3	-20.0	0.3	0.0	**0.0**	**VP**
01-2	1996	17.6	6.3	15.0	12.8	-2.4	3.4	0.0	**52.6**	**G**
01-2	2001	23.2	9.6	11.5	18.4	-2.7	3.7	0.0	**63.6**	**G-E**
01-2	2006	19.9	4.5	3.5	11.4	-4.0	1.9	0.0	**37.2**	**F**
01-2	2011	18.7	8.1	3.0	21.1	-8.3	3.8	0.0	**46.3**	**F-G**
01-2	2016	16.6	7.2	3.0	6.6	-6.9	3.4	0.0	**29.9**	**F**
01-3*	1996	25.5	10.2	7.3	1.7	-0.5	1.1	0.0	**45.3**	**F-G**
01-3*	2001	23.4	8.1	3.2	4.1	-2.3	0.2	0.0	**36.7**	**F**
01-4	1996	22.3	9.0	5.5	17.4	-4.7	10.0	0.0	**59.5**	**F**
01-4	2001	30.0	10.0	1.9	17.0	-17.6	10.0	0.0	**51.3**	**P-F**
01-4	2006	20.7	5.8	1.8	26.0	-2.3	10.0	0.0	**62.1**	**F**
01-4	2011	18.3	6.9	0.9	29.8	-2.1	10.0	0.0	**63.8**	**F-G**
01-4	2016	14.5	11.7	1.1	20.0	-14.7	10.0	-2.0	**40.7**	**P**
01-5	1996	15.2	7.4	3.3	10.5	-0.4	2.3	0.0	**38.3**	**F**
01-5	2001	17.1	6.4	1.0	15.8	-4.3	1.7	0.0	**37.6**	**F**
01-5	2006	18.3	5.5	0.9	10.9	-6.0	0.3	0.0	**29.9**	**F**
01-5	2011	14.0	3.6	2.8	21.3	-2.2	4.3	0.0	**43.8**	**F-G**
01-5	2016	10.8	8.3	2.4	13.4	-11.0	1.8	0.0	**25.6**	**P-F**
01-6	1996	9.9	8.5	7.8	23.4	-1.7	4.3	0.0	**52.3**	**F**
01-6	2001	11.1	7.5	2.8	24.4	-7.1	5.6	0.0	**44.2**	**P**
01-6	2006	14.1	6.0	2.6	25.7	-2.8	9.5	0.0	**55.0**	**F**
01-6	2011	13.3	10.9	5.7	30.0	-1.1	10.0	0.0	**68.8**	**G**
01-6	2016	13.2	8.7	2.2	24.6	-3.5	10.0	0.0	**55.1**	**F**

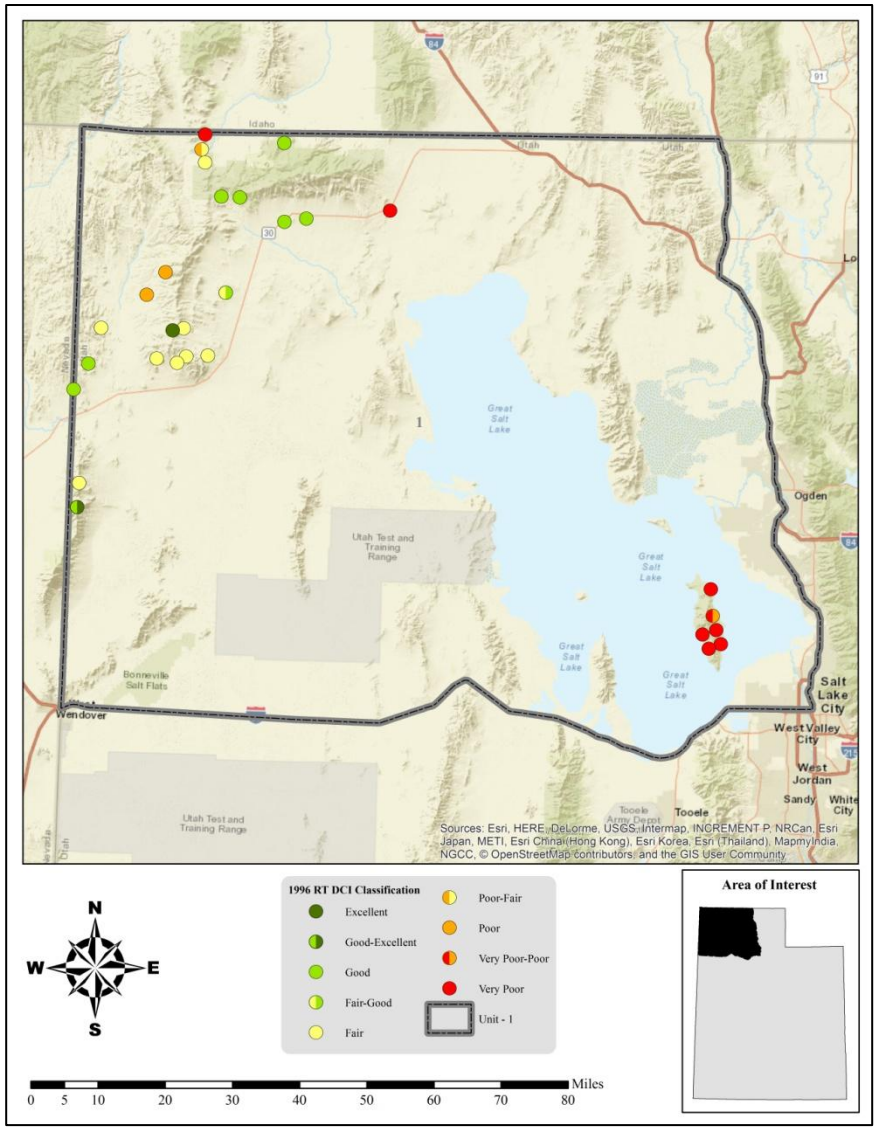
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
01-7	1996	23.3	12.4	12.1	2.7	-0.1	3.7	0.0	**54.0**	**F**
01-7	2001	25.2	9.2	3.1	3.9	-0.5	2.5	0.0	**45.2**	**P**
01-7	2006	30.0	8.6	2.0	3.7	-0.9	2.6	0.0	**46.0**	**P**
01-7	2011	27.8	9.4	1.5	1.4	-0.1	2.8	0.0	**42.9**	**P**
01-7	2016	26.5	8.6	1.5	2.8	-0.1	5.8	0.0	**45.0**	**P**
01-8	1996	16.5	6.0	5.7	29.2	-4.0	6.7	0.0	**60.0**	**F**
01-8	2001	19.1	8.8	1.6	21.1	-9.7	2.1	0.0	**42.9**	**P**
01-8	2006	10.9	5.8	0.7	24.8	-20.0	2.2	0.0	**24.5**	**VP**
01-8	2011	12.4	9.0	2.1	26.2	-1.4	3.2	0.0	**51.5**	**P-F**
01-8	2016	5.0	0.0	0.0	22.2	-20.0	5.8	0.0	**13.0**	**VP**
01-9*	1996	18.1	6.0	1.5	20.7	-0.1	3.2	0.0	**49.3**	**G**
01-9*	2001	28.0	5.7	3.0	27.6	-2.5	4.9	0.0	**66.7**	**G-E**
01-10	1996	30.0	7.6	6.2	3.3	-0.2	3.5	0.0	**50.4**	**G**
01-10	2001	26.8	8.4	5.1	1.9	-0.4	1.3	0.0	**43.2**	**F-G**
01-10	2006	29.0	6.3	2.6	2.5	-3.5	3.1	0.0	**40.1**	**F**
01-10	2011	25.4	7.5	7.6	3.8	-0.2	3.2	0.0	**47.3**	**G**
01-10	2016	25.2	7.2	6.0	8.0	-0.3	2.6	0.0	**48.7**	**G**
01-11	1996	20.0	10.3	7.3	3.4	-2.4	0.6	0.0	**39.3**	**F**
01-11	2001	20.2	8.0	8.0	2.5	-8.3	0.3	0.0	**30.6**	**F**
01-11	2006	18.0	5.8	3.9	8.1	-7.9	0.3	0.0	**28.2**	**F**
01-11	2011	17.1	8.9	2.3	5.0	-3.8	0.8	0.0	**30.3**	**F**
01-11	2016	14.8	7.3	1.4	7.6	-4.1	0.8	0.0	**27.9**	**F**
01-12	1996	22.6	9.9	5.9	10.9	-11.5	0.0	0.0	**37.9**	**P**
01-12	2001	26.9	5.3	3.3	11.1	-8.1	0.0	0.0	**38.4**	**P**
01-12	2006	23.9	11.2	2.0	9.6	-2.9	0.0	0.0	**43.8**	**P**
01-12	2011	15.0	11.6	7.8	16.3	-2.0	0.0	0.0	**48.6**	**P-F**
01-12	2016	14.6	12.2	9.7	3.4	-20.0	10.0	0.0	**29.9**	**VP**
01-13	1996	18.3	13.8	15.0	3.9	-2.7	1.8	0.0	**50.1**	**P-F**
01-13	2001	12.2	12.9	15.0	4.0	-9.8	0.3	0.0	**34.6**	**VP-P**
01-13	2006	11.3	9.6	4.0	12.1	-12.5	1.6	0.0	**26.2**	**VP**
01-13	2011	16.3	13.8	14.0	7.2	-5.6	0.4	0.0	**46.1**	**P**
01-13	2016	17.0	12.0	3.0	7.0	-14.0	0.8	0.0	**25.8**	**VP**
01-14	1996	21.2	13.9	7.2	13.0	-9.2	10.0	0.0	**56.0**	**F**
01-14	2001	17.6	12.2	10.0	30.0	-4.8	10.0	0.0	**74.9**	**G**
01-14	2006	21.2	9.8	2.9	22.2	-5.0	10.0	0.0	**61.0**	**F**
01-14	2011	16.4	11.6	1.4	15.9	-2.4	7.9	0.0	**50.9**	**P-F**
01-14	2016	20.1	12.9	3.4	13.6	-20.0	9.0	0.0	**39.1**	**P**
01-15	1996	1.3	0.0	0.0	11.0	0.0	10.0	0.0	**22.3**	**VP**
01-15	2001	0.0	0.0	0.0	8.4	0.0	1.0	0.0	**9.4**	**VP**
01-15	2006	1.3	0.0	0.0	30.0	-2.5	9.6	0.0	**38.3**	**P**
01-15	2011	0.3	0.0	0.0	30.0	0.0	9.0	0.0	**39.3**	**P**
01-15	2016	3.1	0.0	0.0	30.0	-0.1	7.6	0.0	**40.7**	**P**
01-16	1996	29.4	13.7	6.2	11.2	-0.1	10.0	0.0	**70.4**	**G**
01-16	2001	30.0	12.3	4.7	29.0	-0.1	10.0	0.0	**85.9**	**E**
01-16	2006	30.0	11.0	4.9	13.6	0.0	10.0	0.0	**69.5**	**G**
01-16	2011	30.0	12.8	4.6	12.8	0.0	9.4	0.0	**69.5**	**G**
01-16	2016	30.0	12.8	2.8	16.2	-0.1	10.0	0.0	**71.7**	**G**
01-17	1996	30.0	13.2	5.2	28.7	0.0	10.0	0.0	**87.1**	**G**
01-17	2001	30.0	12.6	5.8	30.0	0.0	10.0	0.0	**88.4**	**G-E**
01-17	2006	30.0	10.3	5.6	19.7	0.0	10.0	0.0	**75.6**	**G**
01-17	2011	29.1	10.3	4.1	30.0	0.0	10.0	0.0	**83.4**	**G**
01-17	2016	30.0	10.5	4.3	30.0	-10.4	10.0	-2.0	**72.3**	**G**
01-18	1996	11.0	6.9	4.0	11.0	-0.2	10.0	0.0	**42.7**	**P**
01-18	2001	9.9	6.0	10.1	13.1	-2.6	10.0	0.0	**46.5**	**P**
01-18	2006	8.6	5.6	4.2	17.1	-5.4	10.0	0.0	**40.1**	**P**
01-18	2011	8.1	8.2	3.2	23.2	-3.2	10.0	0.0	**49.4**	**P-F**
01-18	2016	6.0	8.6	5.7	22.2	-12.6	10.0	0.0	**39.9**	**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
01-19	1996	18.0	13.8	9.5	24.6	0.0	10.0	0.0	**75.9**	**G**
01-19	2001	22.2	12.9	3.5	30.0	0.0	10.0	0.0	**78.6**	**G**
01-19	2006	2.9	0.0	0.0	30.0	0.0	10.0	0.0	**42.9**	**P**
01-19	2011	2.1	0.0	0.0	30.0	0.0	10.0	0.0	**42.1**	**P**
01-19	2016	4.1	0.0	0.0	30.0	-0.6	10.0	0.0	**43.5**	**P**
01-21*	1996	30.0	11.6	10.8	21.5	-0.6	10.0	0.0	**83.4**	**E**
01-21*	2001	7.4	15.0	15.0	10.3	-0.3	10.0	0.0	**57.5**	**F**
01-22	1996	23.6	7.0	7.5	12.0	0.0	7.1	0.0	**57.2**	**G**
01-22	2001	20.4	7.5	7.8	17.0	-0.2	1.6	0.0	**54.1**	**G**
01-22	2006	19.8	8.1	4.7	12.8	-9.6	2.3	0.0	**38.0**	**F**
01-22	2011	16.8	9.1	6.2	13.4	-0.7	1.3	0.0	**46.1**	**F-G**
01-22	2016	16.3	10.8	4.7	28.4	-2.4	4.4	0.0	**62.2**	**G**
01-23	1996	30.0	11.2	7.8	30.0	0.0	10.0	0.0	**89.0**	**G-E**
01-23	2001	30.0	11.2	4.2	30.0	0.0	10.0	0.0	**85.4**	**G**
01-23	2006	30.0	8.9	1.9	30.0	0.0	10.0	0.0	**80.8**	**G**
01-23	2011	30.0	9.8	2.0	27.3	0.0	10.0	0.0	**79.2**	**G**
01-23	2016	30.0	12.8	1.5	30.0	0.0	10.0	0.0	**84.3**	**G**
01-24	1996	12.4	10.6	7.7	22.6	-4.1	10.0	0.0	**59.2**	**F**
01-24	2001	16.2	10.4	2.4	30.0	-3.1	10.0	0.0	**65.9**	**F-G**
01-24	2006	17.5	8.7	1.2	30.0	0.0	10.0	0.0	**67.4**	**G**
01-24	2011	23.4	11.9	12.6	30.0	-0.6	10.0	0.0	**87.3**	**E**
01-24	2016	18.8	13.8	5.1	25.6	-6.6	10.0	0.0	**66.7**	**F-G**

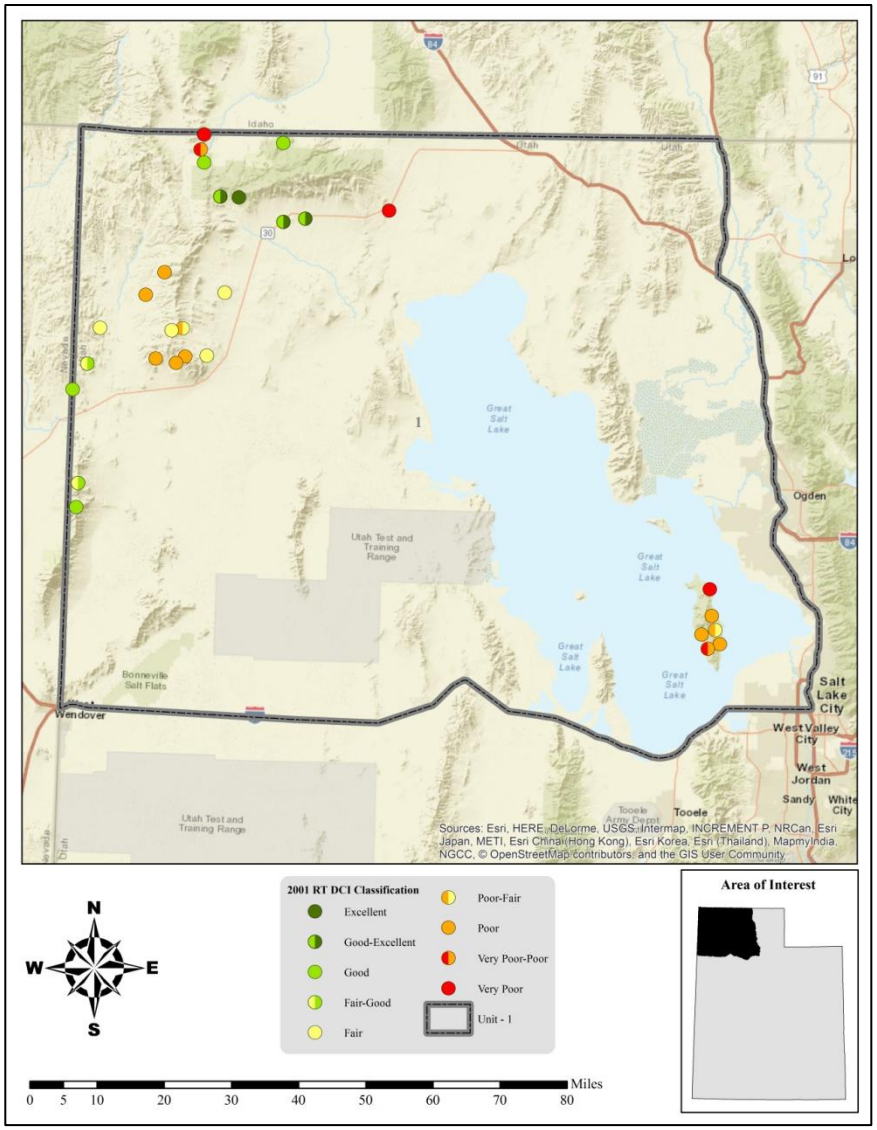
Table 1.12: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 1, Box Elder. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

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
01R-4	2005	0.3	0.0	0.0	3.8	-20.0	1.8	0.0	**-14.2**	**VP**
01R-4	2013	0.6	0.0	0.0	19.0	-6.0	2.6	0.0	**16.2**	**P**
01R-6	2005	18.0	4.2	2.5	15.2	-5.4	0.4	0.0	**34.9**	**F**
01R-6	2008	17.5	13.7	2.5	17.4	-0.8	2.2	0.0	**52.5**	**G**
01R-6	2013	26.1	14.9	15.0	20.6	-0.2	0.4	0.0	**76.8**	**E**
01R-7	2005	11.5	2.7	5.0	3.2	-1.1	2.2	0.0	**23.5**	**P-F**
01R-7	2010	8.7	14.6	5.2	4.6	-9.1	10.0	0.0	**34.0**	**F**
01R-7	2013	7.6	15.0	15.0	1.8	-2.9	3.4	0.0	**39.8**	**F**
01R-10	2005	27.1	7.0	2.7	24.0	-3.2	5.2	0.0	**62.8**	**F**
01R-10	2008	23.3	-4.2	0.9	15.6	-0.1	2.8	0.0	**38.3**	**P**
01R-10	2013	26.7	10.2	7.9	21.4	-0.8	3.2	0.0	**68.6**	**G**
01R-12	2008	4.9	5.7	9.5	15.2	-0.2	10.0	0.0	**45.1**	**P**
01R-12	2011	6.6	14.9	14.7	20.2	-0.1	10.0	0.0	**66.3**	**F-G**
01R-12	2016	22.2	14.6	8.4	29.2	-9.0	10.0	0.0	**75.4**	**G**
01R-13	2008	0.0	0.0	0.0	4.0	0.0	2.2	0.0	**6.2**	**VP**
01R-13	2011	0.0	0.0	0.0	17.6	-7.1	7.6	0.0	**18.1**	**VP**
01R-13	2016	0.4	10.0	0.0	30.0	-13.7	4.8	0.0	**31.5**	**VP**
01R-14	2008	3.9	0.0	0.0	5.4	-0.2	1.8	0.0	**10.9**	**VP**
01R-14	2013	13.0	15.0	15.0	23.6	-1.3	3.4	0.0	**68.7**	**G**
01R-16	2010	30.0	14.7	15.0	26.2	-0.5	5.8	0.0	**91.3**	**E**
01R-16	2013	26.9	13.2	8.5	8.8	-0.5	7.4	0.0	**64.4**	**F-G**
01R-17	2013	12.0	7.4	15.0	5.8	-0.1	2.0	0.0	**42.1**	**P**
01R-17	2016	16.0	12.1	11.7	26.6	-5.7	9.0	0.0	**69.7**	**G**
01R-18	2014	5.5	0.0	0.0	4.8	-0.1	6.8	0.0	**17.0**	**P**
01R-19	2014	7.6	10.4	15.0	7.2	0.0	9.2	0.0	**49.4**	**G**
01R-20	2014	0.0	0.0	0.0	16.6	-1.8	0.2	0.0	**15.0**	**VP**
01R-21	2014	6.6	9.9	9.0	6.0	-1.5	3.2	0.0	**33.2**	**VP-P**

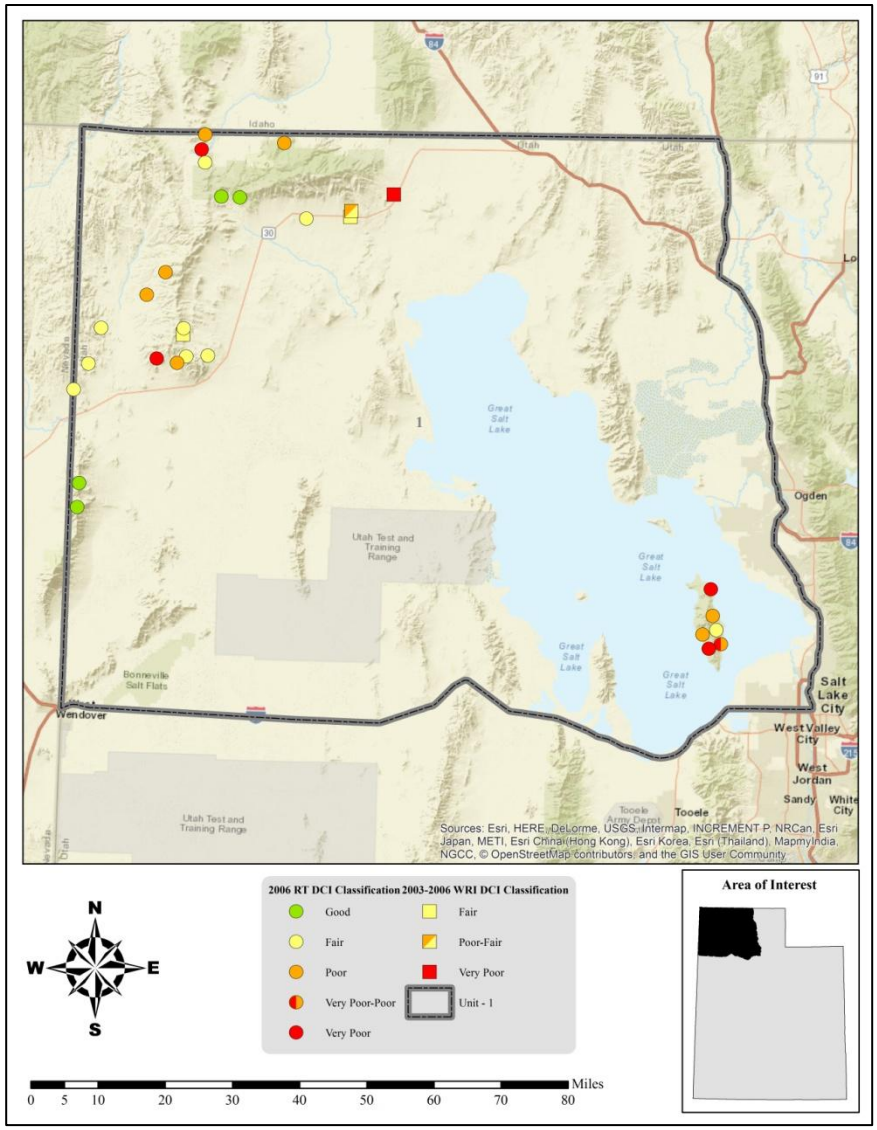
Table 1.13: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 1, Box Elder. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



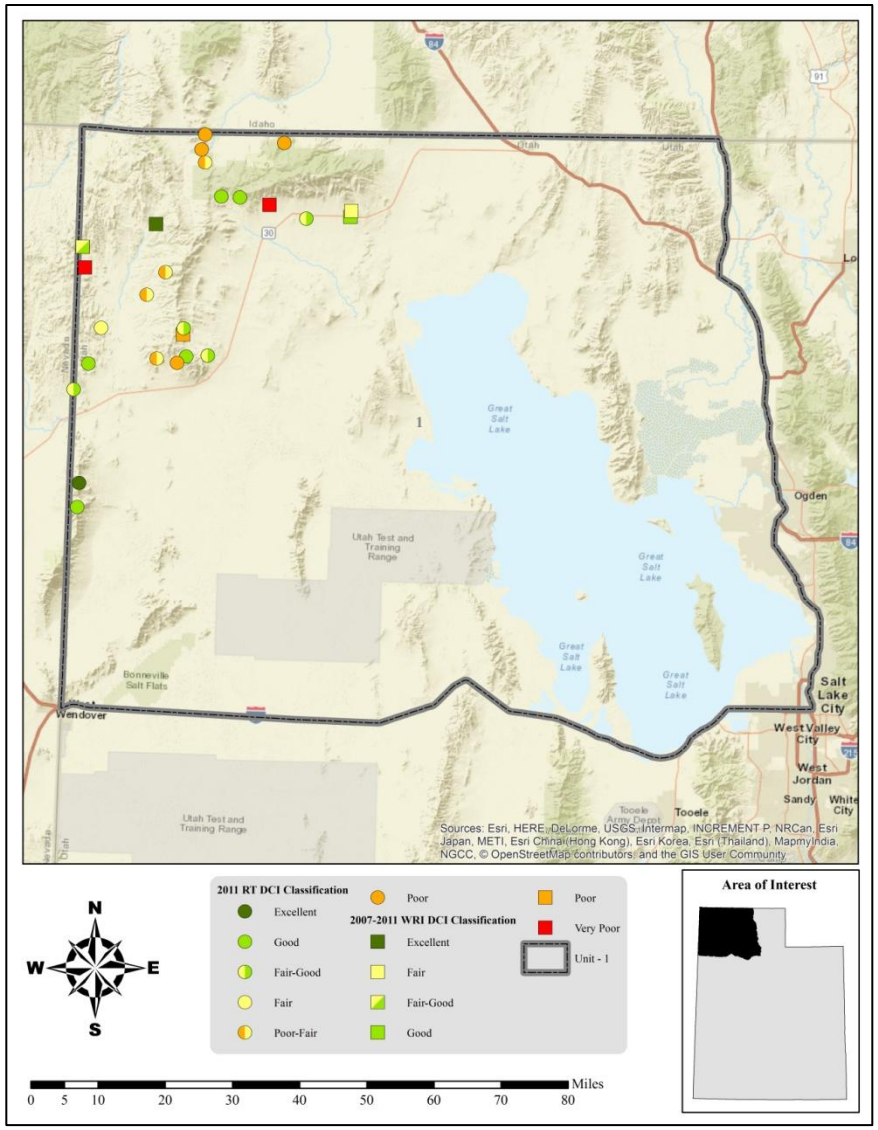
Map 1.11: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 1, Box Elder.



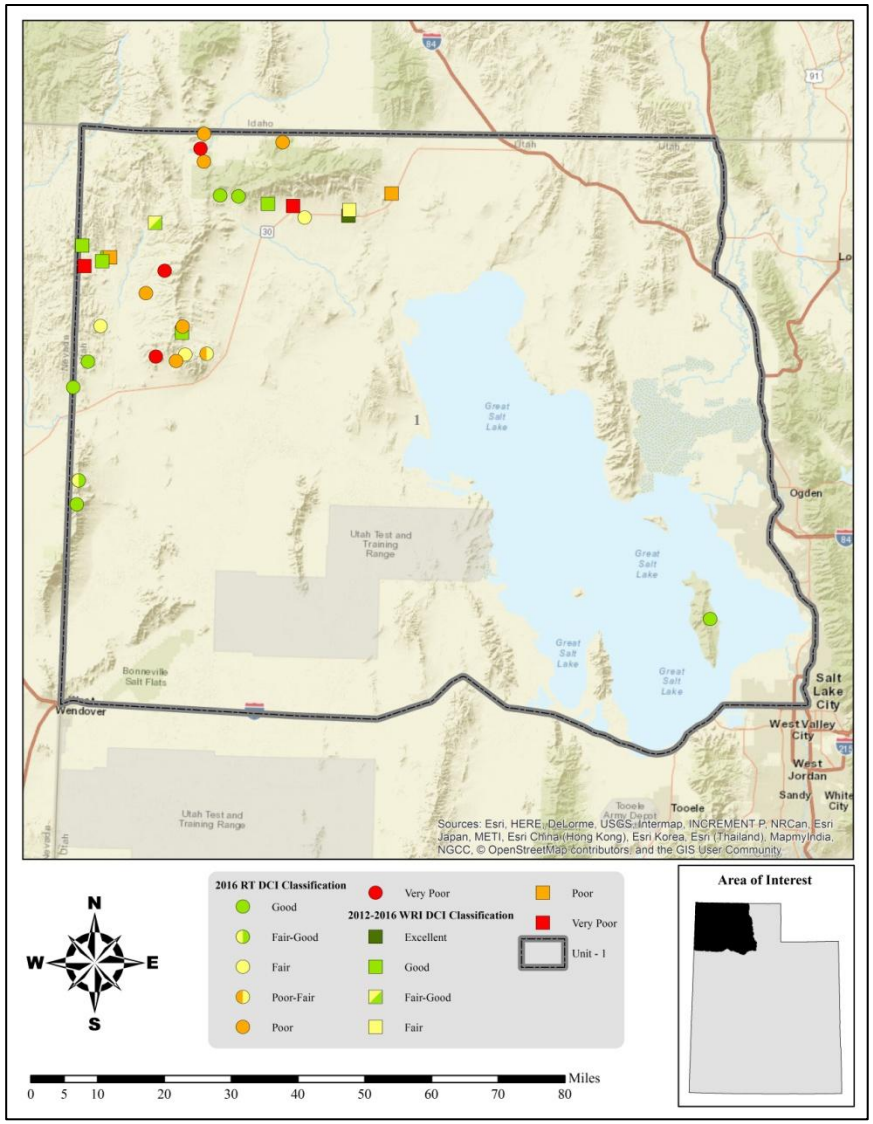
Map 1.12: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 1, Box Elder.



Map 1.13: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 1, Box Elder.



Map 1.14:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 1, Box Elder.



Map 1.15: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 1, Box Elder.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
01-2	Rosette	Annual Grass	Moderate	Increased Fire Potential
01-4	Chokecherry Springs	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-5	Devils Playground	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-6	Bovine Exclosure	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
01-7	South Side Emigrant Pass	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-8	Mud Springs Basin	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-10	Kilgore Basin	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-11	Kimber Ranch	Annual Grass	Moderate	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-12	Red Butte Exclosure	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-13	Raft River Narrows	Annual Grass	High	Increased Fire Potential
01-14	Broad Hollow	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-15	Cedar Hills	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
01-16	Nut Pine Hills	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-17	Clarks Basin	Annual Grass	High	Increased Fire Potential
01-18	Bedke Spring	Annual Grass	High	Increased Fire Potential
01-19	Bally Mountain	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01-22	Dake Pass	Annual Grass	Low	Increased Fire Potential
01-23	Patterson Pass	None Identified		
01-24	Sheep Range Spring	Annual Grass	Moderate	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-2	Rattlesnake Fire Seeded	None Identified		
01R-3	Rattlesnake Burn	None Identified		
01R-4	Coldwater 1	Annual Grass	Moderate	Increased Fire Potential
01R-6	Hereford 1	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-7	Hereford 2	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
01R-10	Chokecherry	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-12	Dairy Valley GIP 1	Annual Grass	High	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-13	Dairy Valley GIP 2	Annual Grass	High	Increased Fire Potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
01R-14	Morris GIP	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
01R-16	Kimbell Creek	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-17	West Grouse Creek	Annual Grass	Moderate	Increased Fire Potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
01R-18	Buckskin Spring	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
01R-19	Etna Reservoir	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
01R-20	Pine Creek	Annual Grass	Low	Increased Fire Potential
		PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
01R-21	Indian Creek	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor

Table 1.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 1, Box Elder. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The studies that are within the mountain (sagebrush) ecological sites are considered to generally be in good condition for deer summer range on the Box Elder Management Unit. These communities support good shrub populations that can provide valuable browse for wildlife. Although they are generally good, invasive grasses are a threat in the herbaceous understory. Clark's Basin is of particular concern for this threat. These species can shift the plant community dynamics, with annual grass monocultures and more frequent wildfires being a concern.

There is limited pinyon and juniper encroachment of these studies, with the Sheep Range Spring study being at a low risk of future pinyon juniper encroachment. 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 (Black Sagebrush)

The study that is within the mountain (black sagebrush) ecological site is generally considered to be in poor condition for deer winter range on the unit. These communities often support sagebrush populations that provide browse for wildlife. The herbaceous understory is in good condition, with only a small amount of cheatgrass being noted. 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 in the future 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 necessary on these communities. 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 (Sagebrush)

The studies within the mid elevation sagebrush communities are generally considered to be in very poor to fair condition for deer winter range. These community types support sagebrush, which provide browse for wildlife in winters. Several of the sites are currently at risk of conifer encroachment, which can reduce shrub and herbaceous understory productivity. There are currently introduced perennial grasses, specifically crested wheatgrass on the Cedar Hills site. While they provide forage, introduced perennial grasses can be aggressive and reduce the prevalence and abundance of other more desirable native grasses and forbs. Introduced annual grasses are a concern on many of these studies, specifically Chokecherry Springs, Mud Springs Basin, Red Butte Exclosure, Raft River Narrows, Broad Hollow, and Bedke Spring. Cheatgrass is the dominant grass species on many of these sites and increases the fuel loads, which in turn raises the risk of wildfire.

It is recommended that monitoring and work to reduce conifer encroachment continue in these communities. 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 would be given to native species when possible.

Upland Black Sagebrush

The study within the mid elevation black sagebrush community is considered to be in poor condition for deer winter habitat. The community type supports sagebrush, which can provide browse for wildlife in winters. The understory is in fair condition for this ecological type. While currently only in Phase I of conifer encroachment, the study is at risk for future encroachment which can reduce the shrub and herbaceous production.

While this particular study is only in Phase I of woodland succession, it may not represent the entire Upland (Black Sagebrush) ecological type. In areas where conifer encroachment is more advanced, it is recommended that work begin or continue to prevent future encroachment (e.g. bullhog, chaining, lop and scatter, etc.). 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 Browse

The study within the mid-elevation browse community is considered to be in good condition for deer summer range. The community type supports shrub species which provide browse for wildlife throughout the year. The understory of this study is in good condition, with perennial forbs and grasses being main components. This study is currently in Phase I of woodland succession, and is therefore at risk for future encroachment if not addressed.

It is recommended that areas with significant conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.). 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.

Semidesert Sagebrush

The study within the semi-desert sagebrush ecological site is generally considered to be in fair condition for deer winter range habitat on this unit. This community supports shrub populations that provide browse in winters for wildlife. This community does have the potential for invasion of annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and raise the potential for wildfire. This site is also in Phase I of conifer encroachment and is at risk for future encroachment if this is not addressed.

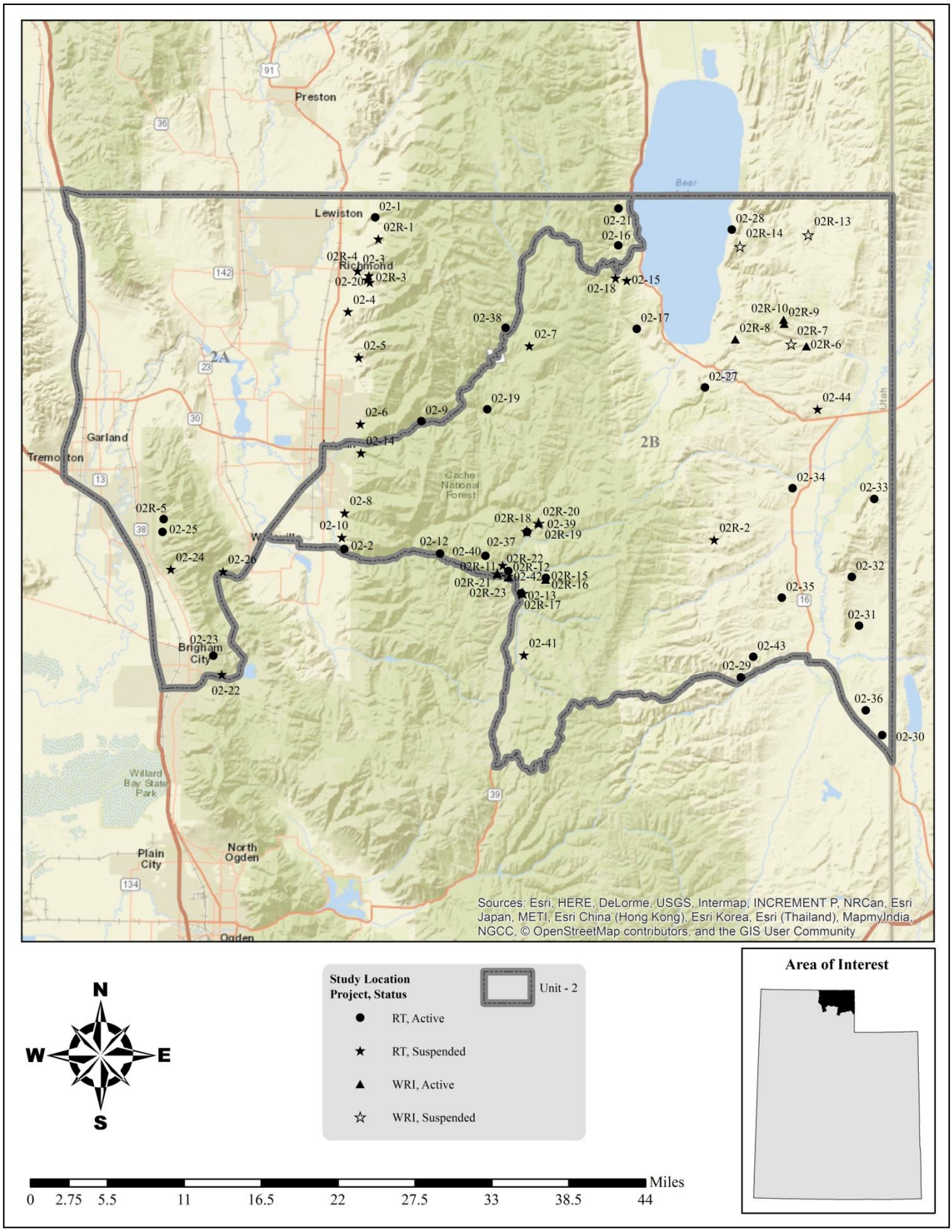
Treatments to reduce annual grass might be necessary if high levels of annual grass become an issue in this community. It is recommended that areas with significant conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.). If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Semidesert Black Sagebrush

The studies that are considered to be of this semi-desert black sagebrush ecological type are generally considered to be in poor-fair to good condition for deer winter and elk year-long habitat range. This community supports shrub populations that provide good browse in years that snow does not impede utilization. All of the sites except Kilgore Basin are at risk of annual grass invasion, with mainly cheatgrass sampled. The annual grasses can increase the fuel load and raise the potential for wildfire. All of the study sites except Dake Pass are in Phase I of woodland succession and are at risk for future encroachment if left untreated.

It is recommended that those areas with significant conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.). 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 2 – CACHE



WILDLIFE MANAGEMENT UNIT 2 – CACHE

Boundary Description

Cache, Rich, Weber, and Box Elder counties – Boundary begins at the Utah-Idaho state line and I-15; south on I-15 to US-91; northeast on US-91 to SR-101; east on SR-191 to Hardware Ranch and USFS Road 054 (Ant Flat); south on USFS 054 to SR-39; east on SR-39 to SR-16; southeast on SR-16 to the Utah-Wyoming state line; north along this state line to the Utah-Idaho state line; west along this state line to I-15.

Management Unit Description

Geography

The Cache Management Unit can be divided into three main areas, which are isolated from one another to some extent. The first area is comprised of the Wellsville Mountains and their northern extension, Clarkston Mountain. The eastern half, mostly agricultural land in Cache Valley, does not receive much use by wintering deer. The second area consists of Cache Valley with its summer range on the Cache National Forest to the east; big game summer in the forest and use the winter ranges in the canyons and upper benches of the valley. The third and final area is Rich County, which includes a vast area of private and public rangeland on the east side of the Cache National Forest, extending to the Wyoming state line. Prior to 1993, these three areas were managed as separate deer herd units, but these were combined in 1993 to make Wildlife Management Unit 2 and are now managed as sub-units.

The Wellsville Mountains have remained relatively inaccessible because of steep topography; rising abruptly from the valley floor, the ridge of these mountains reaches over 9,300 feet in elevation. The upper limit for normal winter range is generally 7,000 feet, but during severe winters, that upper limit decreases to about 6,000-6,500 feet; in some canyons, the upper limit drops to 6,000 feet and excludes the north slopes. Box Elder Canyon reaches a low limit at 5,400 feet with the lower limit following an elevation of 4,400 feet. Most deer summer on the east side of the Wellsville Mountains and migrate to the west side each fall for winter range. Coldwater Canyon is the most notable concentration area for deer, and there is some migration from the Mantua-Willard herd unit. Most of the deer that winter on Clarkston Mountain range also summer on the Caribou National Forest in Idaho.

The majority of the deer range (along with the largest deer herd) is within the Cache County portion of the unit; most of this herd summers at higher elevations in the Wasatch-Cache National Forest west of the Wasatch Range summit. Most of the winter range is also on Forest Service land. The south-facing slopes of Blacksmith Fork, Logan, Dry, Providence, and Millville canyons are all important wintering areas.

The Rich County portion of the Cache deer herd unit, located on the eastern face of the Wasatch Range, is topographically similar to the western face. However, the drainages of Swan Creek, Garden City Canyon, Jebo Canyon, Cottonwood Canyon, and Temple Canyon are not as deep as those on the western face. Elevation in this portion ranges from 5,900 feet at Bear Lake to 9,114 feet on Swan Peak. Randolph and Woodruff are the principal municipalities located in Rich County: these towns are located on a strip of private land along the Bear River. Much of the lower country is privately owned and is grazed or farmed. The upper limit of the winter range begins at about 8,000 feet at the Idaho border and gradually descends to 6,000 feet at Cottonwood Canyon; the lower limit generally follows the 6,000-foot contour.

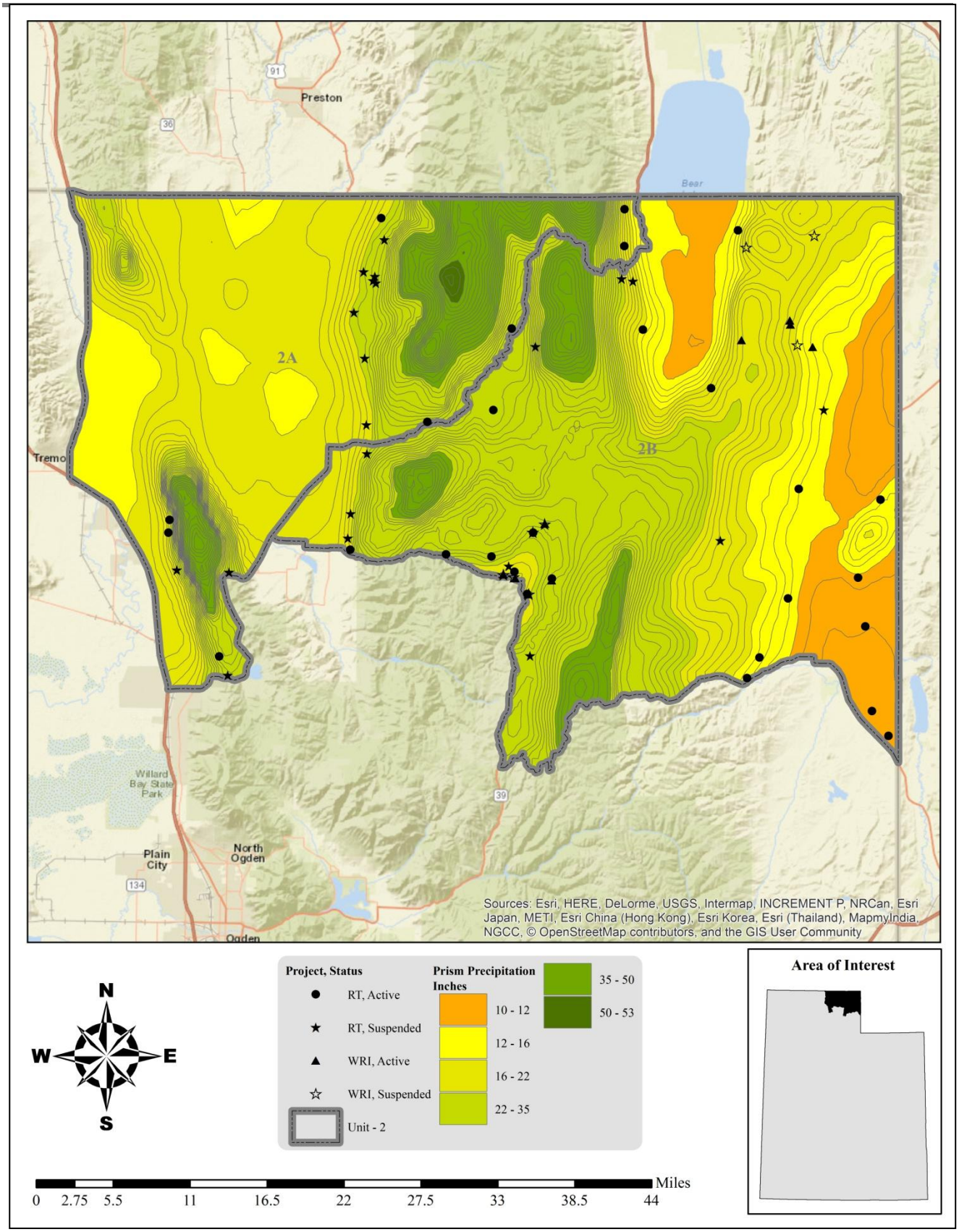
Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 10 inches along portions of the Utah-Wyoming border to 50 inches on the peaks of the Bear River Mountains. All

of the Range Trend and WRI monitoring studies on the unit occur within 10-26 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 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, 1997-1998, 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 1982-1986, 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, 2017).



Map 2.1: The 1981-2010 PRISM Precipitation Model for WMU 2, Cache (PRISM Climate Group, Oregon State University, 2013).

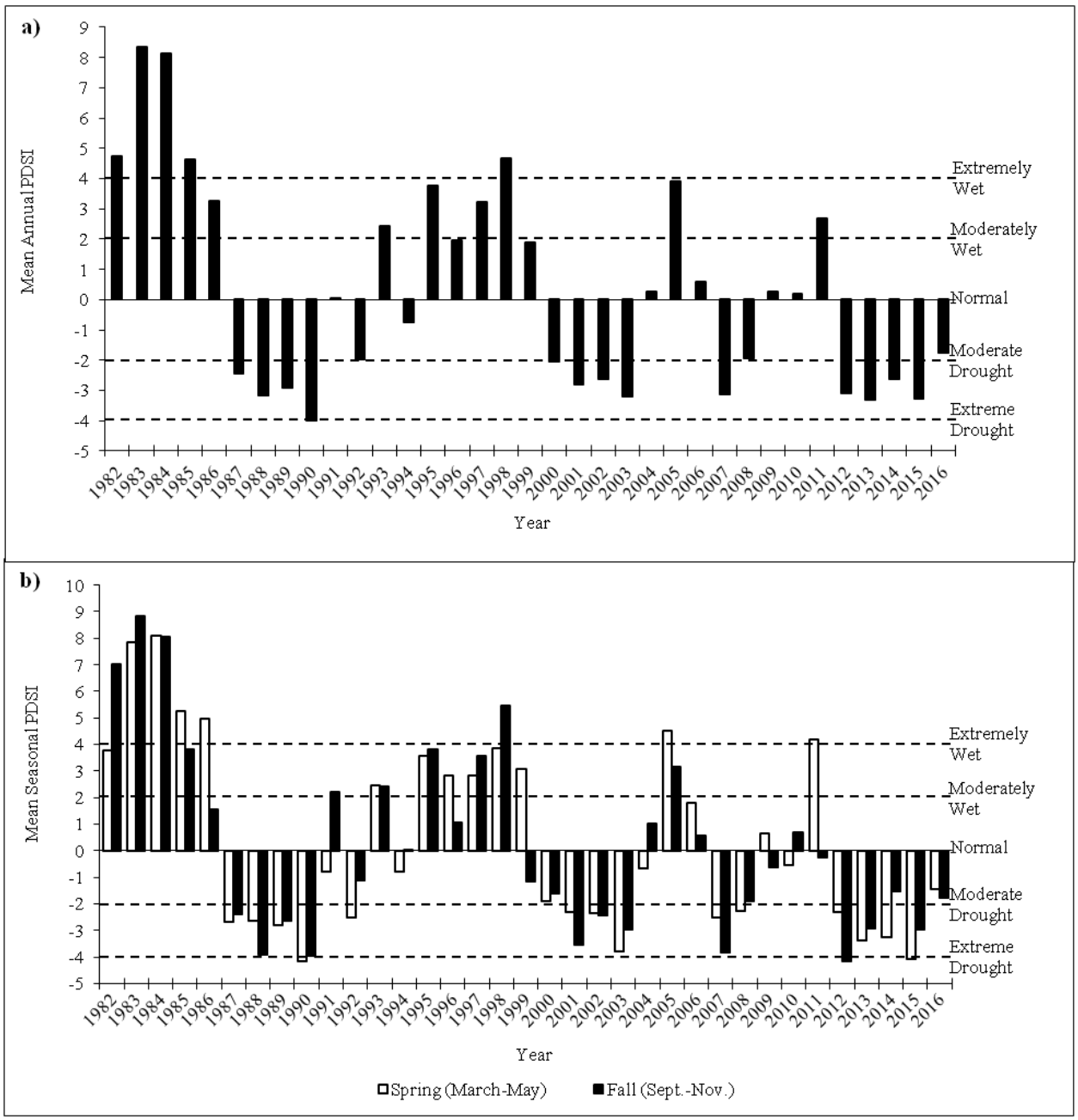


Figure 2.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

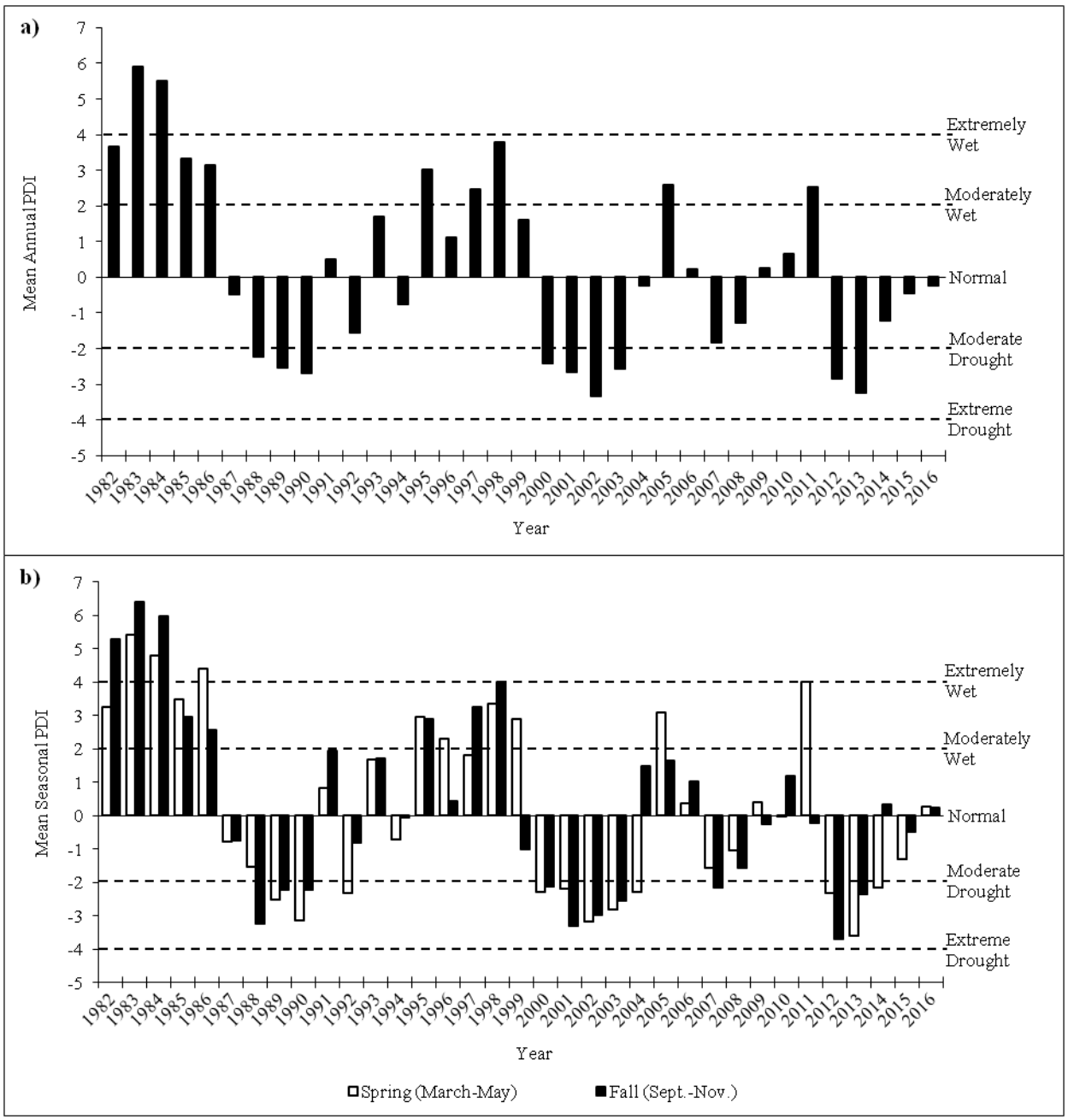
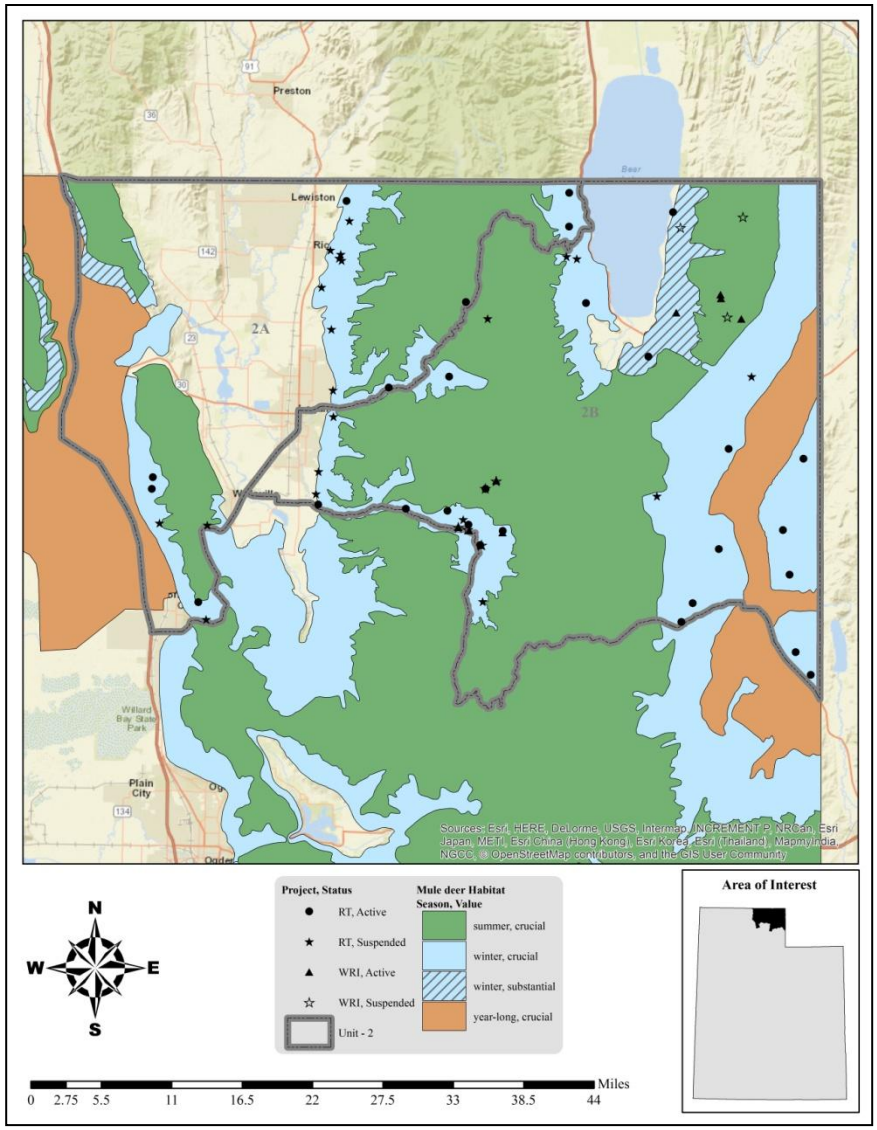


Figure 2.2: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

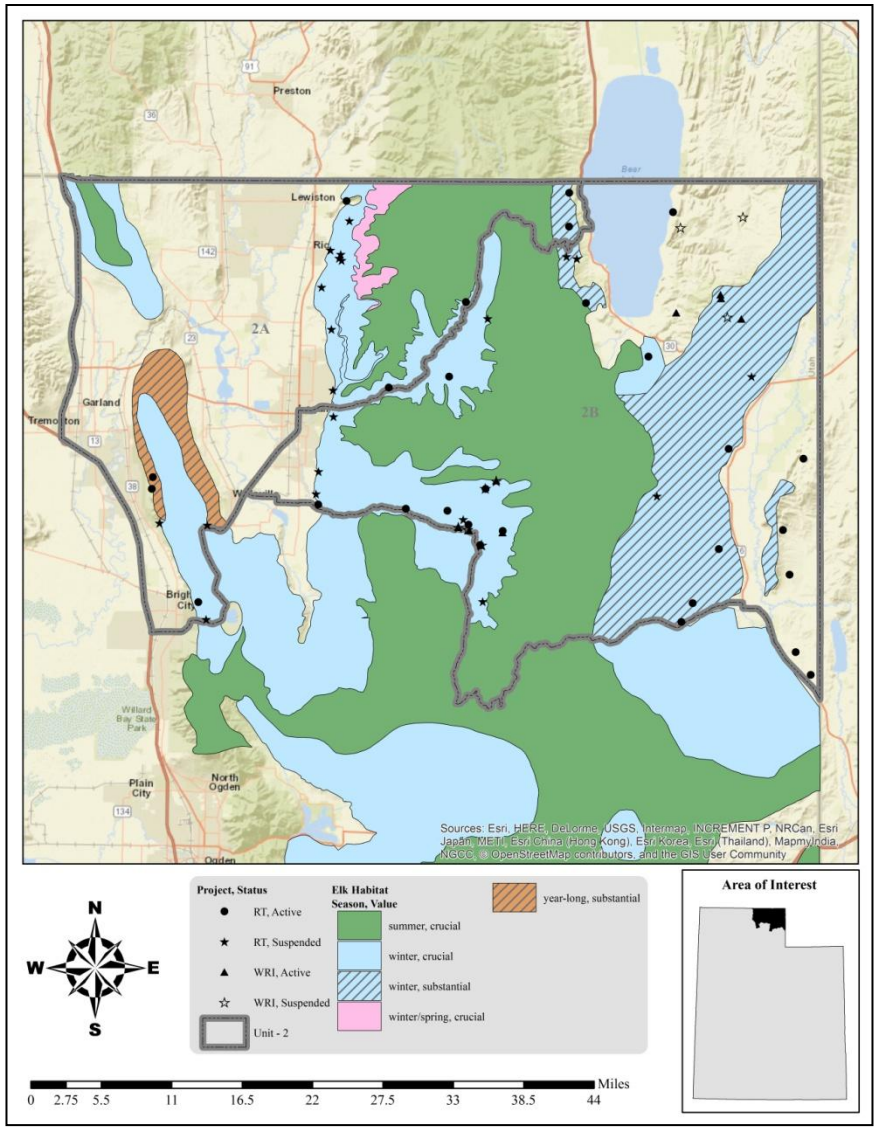
Big Game Habitat

Total mule deer range in this wildlife management unit is estimated at over 921,000 acres with 104,287 acres classified as year-long range, 321,678 acres classified as winter range, and 495,405 acres classified as summer range (Table 2.1, Map 2.2). Total elk range is estimated at just over 701,000 acres with 22,374 acres classified as year-long range, 356,052 acres of this classified as winter range, 312,553 acres classified as summer range, and 10,247 classified as winter/spring range (Table 2.1, Map 2.3).

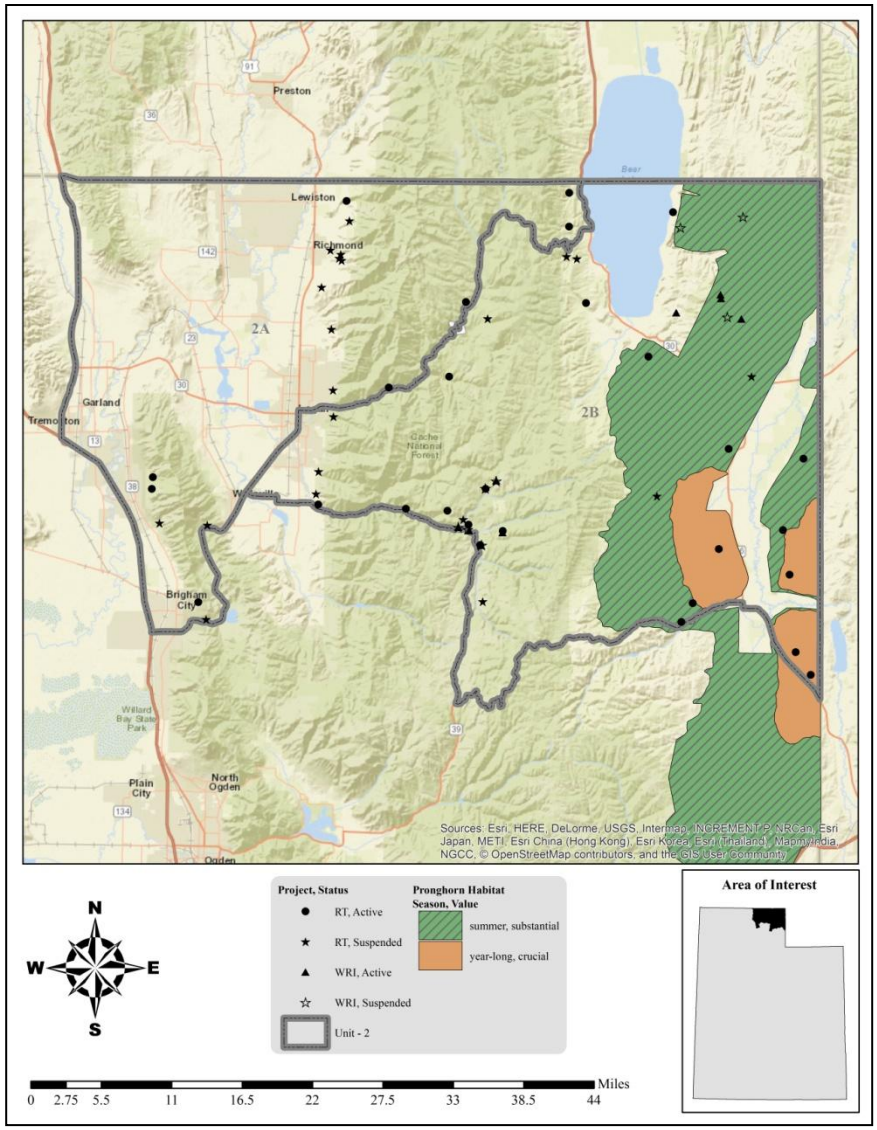
98% of mule deer year-long range is privately owned, 1% is administrated by Fire & State Lands (SL&F), and the Bureau of Land Management (BLM), Utah School and Institutional Trust Lands Administration (SITLA), and the Utah Division of Wildlife Resources (UDWR) manage the remaining 1%. Much of the summer range (57%) is located on US Forest Service (USFS) land, 27% is privately owned, 10% is administrated by the BLM, 5% is owned by SITLA, and 1% is on land belonging to UDWR. 41% of the winter range is managed by private landowners, 29% is owned by the BLM, 16% belongs to USFS, 8% is administrated by SITLA, 5% is owned by UDWR, and the remaining 1% is managed by Utah State Parks (USP) and SL&F (Table 2.2, Map 2.3, Map 2.6).



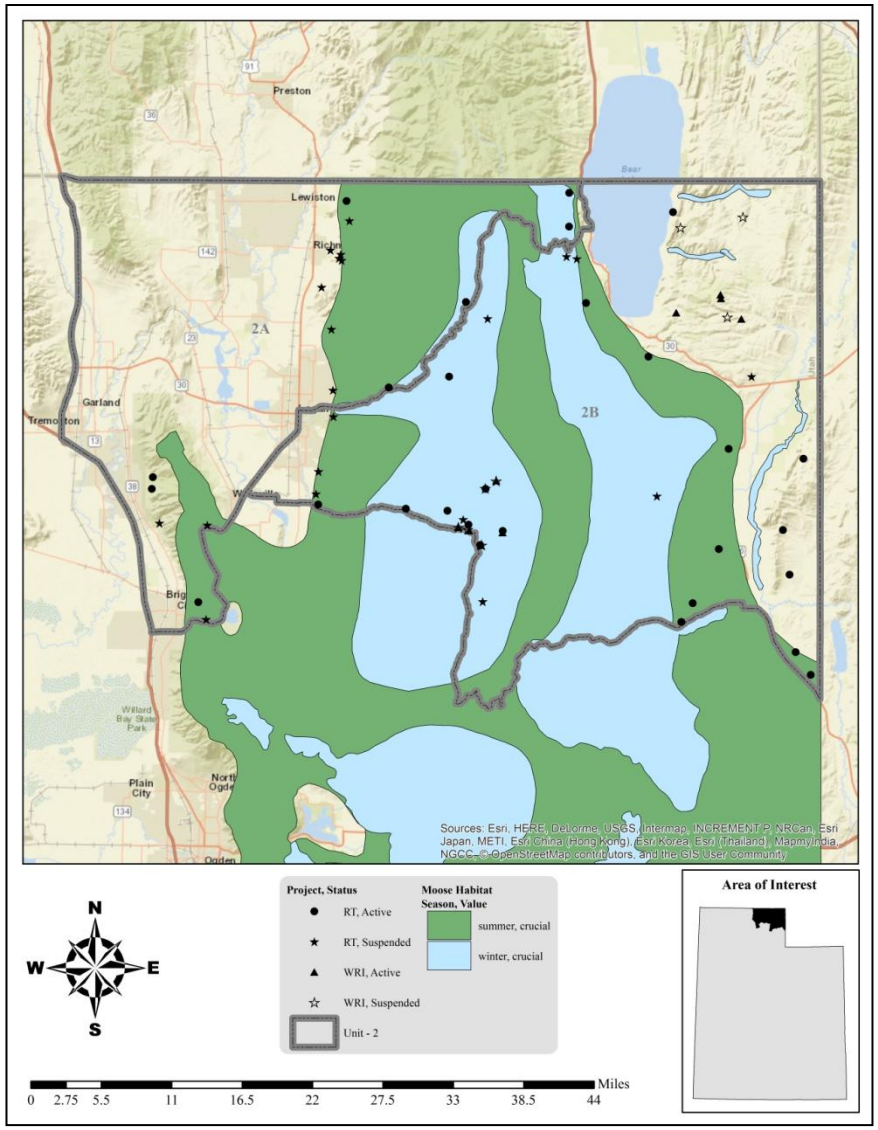
Map 2.2: Estimated mule deer habitat by season and value for WMU 2, Cache.



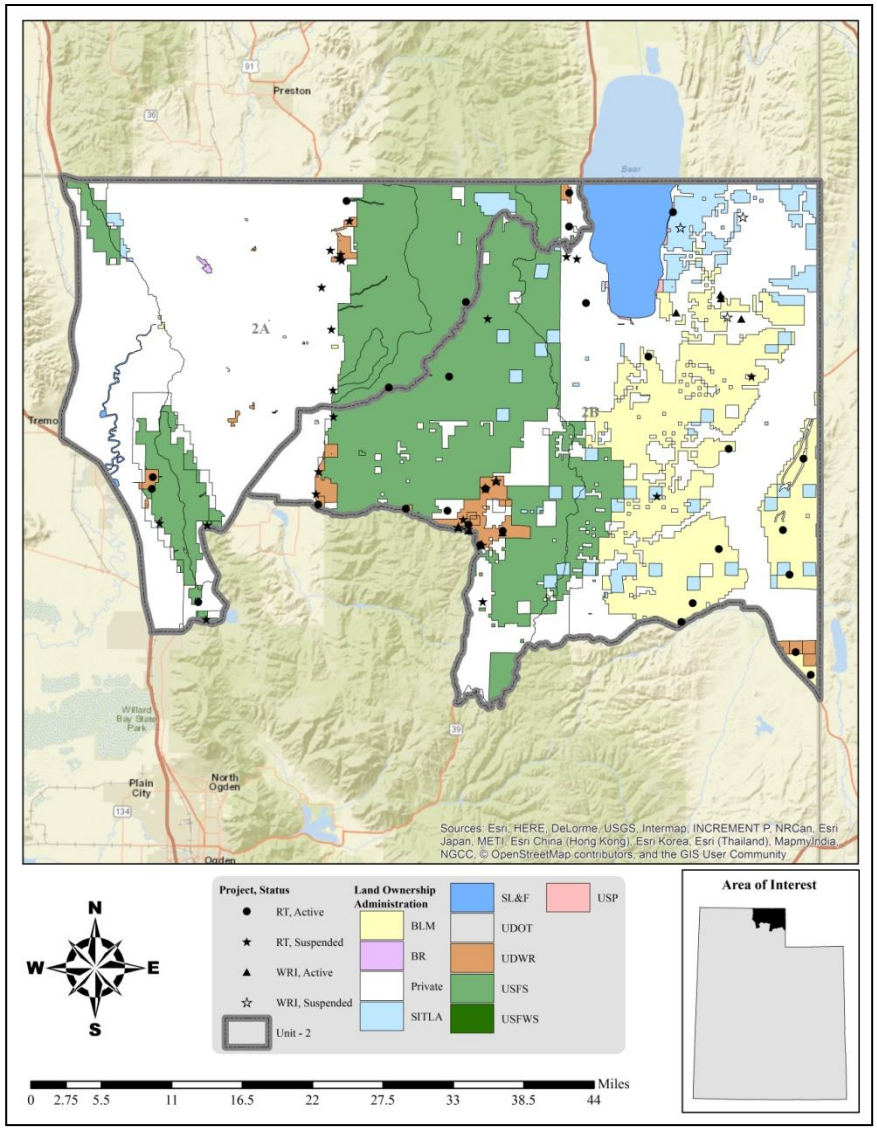
Map 2.3: Estimated elk habitat by season and value for WMU 2, Cache.



Map 2.4: Estimated pronghorn habitat by season and value for WMU 2, Cache.



Map 2.5: Estimated moose habitat by season and value for WMU 2, Cache.



Map 2.6: Land ownership for WMU 2, Cache.

	Year Long Range		Summer Range		Winter Range		Winter/Spring Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	104,287	11%	495,405	54%	321,678	35%	0	0%
Elk	22,374	3%	312,553	45%	356,052	51%	10,247	1%
Pronghorn	49,686	19%	215,342	81%	0	0%	0	0%
Moose	0	0%	323,012	53%	281,801	47%	0	0%

Table 2.1: Estimated mule deer, elk, pronghorn, and moose habitat acreage by season for WMU 2, Cache.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	504	<1%	48,987	10%	94,077	29%
Private	102,355	98%	135,843	27%	131,401	41%
SITLA	44	<1%	25,020	5%	27,043	8%
USP	0	0%	0	0%	305	<1%
UDWR	76	<1%	4,859	1%	15,175	5%
USFS	0	0%	280,697	57%	53,503	16%
SL&F	1,308	1%	0	0%	174	<1%
Total	104,287	**100%**	495,405	**100%**	321,678	**100%**

Table 2.2: Estimated mule deer habitat acreage by season and ownership for WMU 2, Cache.

	Year Long Range		Summer Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	16,532	5%
Private	15,417	69%	72,994	24%
SITLA	0	0%	13,434	4%
UDWR	629	3%	1,185	<1%
USFS	6,327	28%	208,408	67%
Total	22,374	**100%**	312,553	**100%**
	Winter Range		**Winter/Spring Range**	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	97,339	27%	0	0%
Private	116,679	33%	64	<1%
SITLA	18,895	5%	0	0%
UDWR	14,906	5%	39	<1%
USFS	108,233	30%	10,143	99%
Total	356,052	**100%**	10,247	**100%**

Table 2.3: Estimated elk habitat acreage by season and ownership for WMU 2, Cache.

	Year Long Range		Summer Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	31,346	63%	103,681	48%
Private	12,004	24%	81,017	38%
SITLA	3,438	7%	30,301	14%
USFS	0	0%	342	<1%
UDWR	2,897	6%	0	0%
Total	49,686	**100%**	215,342	**100%**

Table 2.4: Estimated pronghorn habitat acreage by season and ownership for WMU 2, Cache.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	44,761	14%	46,523	17%
Private	73,559	22%	87,628	31%
SITLA	10,837	3%	9,759	3%
USFS	187,708	58%	127,030	45%
UDWR	6,075	2%	10,861	4%
USP	24	<1%	0	0%
SL&F	49	<1%	0	0%
Total	323,012	**100%**	281,801	**100%**

Table 2.5: Estimated moose habitat acreage by season and acreage for WMU 2, Cache.

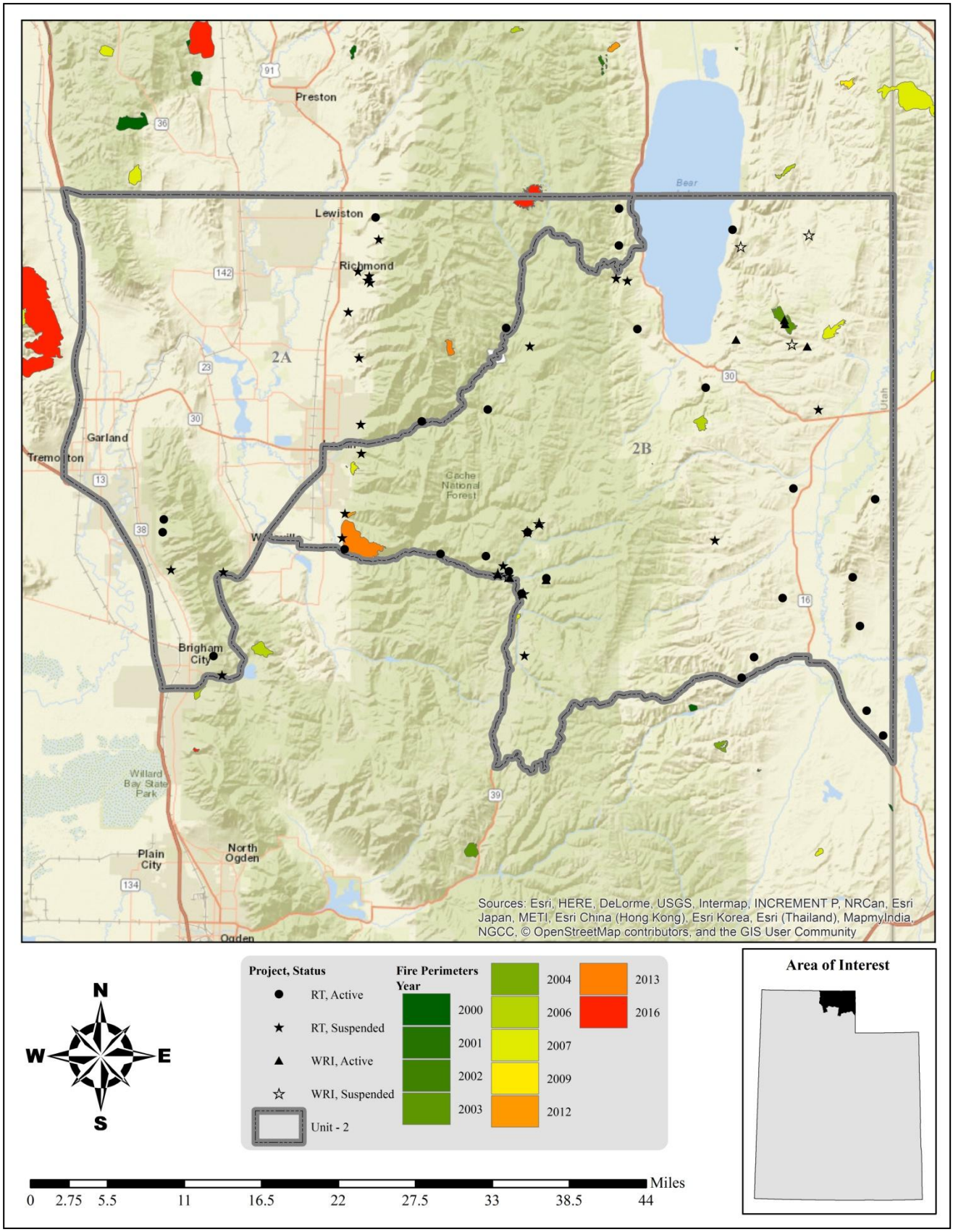
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Conifer-Hardwood	57,765	4.92%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	51,594	4.40%	
	Rocky Mountain Lodgepole Pine Forest	17,074	1.46%	
	Colorado Plateau Pinyon-Juniper Woodland	16,194	1.38%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	11,914	1.02%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	11,656	0.99%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	10,099	0.86%	
	Great Basin Pinyon-Juniper Woodland	4,355	0.37%	
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	4,047	0.34%	
	Other Conifer	2,022	0.17%	15.91%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	5,063	0.43%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	1,267	0.11%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	162	0.01%	0.55%
Exotic Tree-Shrub	Introduced Riparian Shrubland	77	0.01%	
	Introduced Riparian Forest and Woodland	2	0.00%	0.01%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	8,685	0.74%	
	Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	2,743	0.23%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,500	0.13%	
	Other Grassland	1,093	0.09%	1.19%
Shrubland	Artemisia tridentata ssp. vaseyana Shrubland Alliance	157,987	13.46%	
	Inter-Mountain Basins Big Sagebrush Shrubland	119,168	10.16%	
	Inter-Mountain Basins Montane Sagebrush Steppe	50,074	4.27%	
	Inter-Mountain Basins Big Sagebrush Steppe	30,843	2.63%	
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	19,773	1.69%	
	Rocky Mountain Lower Montane-Foothill Shrubland	17,133	1.46%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	14,008	1.19%	
	Great Basin Xeric Mixed Sagebrush Shrubland	5,253	0.45%	
	Inter-Mountain Basins Greasewood Flat	3,181	0.27%	
	Quercus gambelii Shrubland Alliance	2,633	0.22%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	1,308	0.11%	
	Other Shrubland	1,975	0.17%	36.08%
Other	Agricultural	249,253	21.24%	
	Hardwood	135,729	11.57%	
	Developed	91,108	7.76%	
	Open Water	41,919	3.57%	
	Riparian	16,977	1.45%	
	Sparsely Vegetated	4,318	0.37%	
	Barren	3,480	0.30%	
	Other	5	0.00%	46.26%
Total		1,173,437	100.00%	100%

Table 2.6: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 2, Cache.

Limiting Factors to Big Game Habitat

The south-facing slopes of Blacksmith Fork, Logan, Dry, Providence, and Millville canyons are all important wintering areas. The lower winter range limits are restricted by the towns and cities of Cove, Richmond, Smithfield, Hyde Park, North Logan, Logan, Providence, Millville, Nibley, and Hyrum; these limits also include the deer-proof fence above agricultural land between Hyrum and Logan. Between Hyde Park and the Idaho border, the lower third of the winter range is located on private land and is threatened by increased cultivation and subdivision developments.

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, 0.5% of the unit is comprised of exotic herbaceous species (Table 2.6); increased amounts of cheatgrass increases the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). The unit has had some wildfires that have resulted in big game habitat loss, mainly near Hyrum and the Millville face (Map 2.7).



Map 2.7: Land coverage of fires by year from 2000-2016 for WMU 2, Cache.

Treatments/Restoration Work

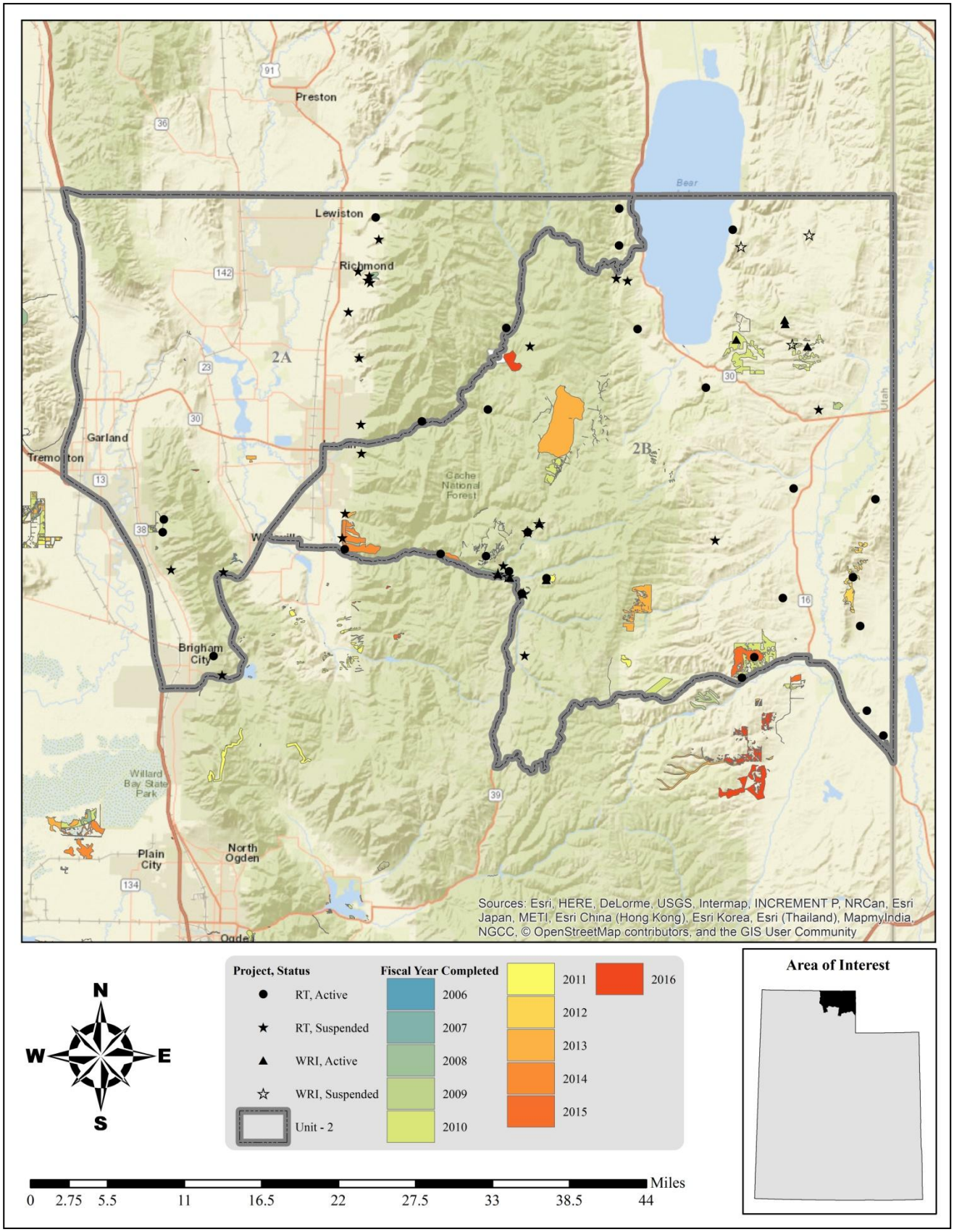
There has been some effort to address the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 21,880 acres of land have been treated within the Cache unit since the WRI was implemented in 2004 (Map 2.8). In addition, 20,561 acres are currently being treated and treatments have been proposed for 1,621 acres. Treatments frequently overlap one another bringing the total treatment acres to 23,457 acres for this unit (Table 2.7). 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.

Prescribed fire to reduce fuel loads and restore habitat functions is the most common management practice in this unit. Vegetation removal via hand crew is also very common. Other management practices include herbicide application to remove weeds, aerator use to improve the herbaceous understory, seeding desirable herbaceous species, harrow, bullhog (used to remove twoneedle pinyon and Utah juniper), and other similar vegetation removal techniques (Table 2.7).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Aerator	**2,834**	**0**	**0**	**2,834**
Anchor Chain	**207**	**0**	**0**	**207**
Ely (One-Way)	147	0	0	147
Ely (Two-Way)	60	0	0	60
Bullhog	**1,015**	**1,199**	**0**	**2,215**
Chain Harrow	**1,721**	**1,092**	**0**	**2,813**
> 15 ft. (Two-Way)	1,721	1,092	0	2,813
Disc	**41**	**0**	**0**	**41**
Harrow	**212**	**0**	**0**	**212**
≤15 ft. (One-Way)	16	0	0	16
≤ 15 ft. (Two-Way)	124	0	0	124
> 15 ft. (One-Way)	73	0	0	73
Herbicide Application	**3,156**	**0**	**0**	**3,156**
Aerial	2,794	0	0	2,794
Ground	362	0	0	362
Mowing	**76**	**0**	**0**	**76**
Other	76	0	0	76
Planting/Transplanting	**306**	**0**	**0**	**306**
Prescribed Fire	**6,562**	**14,100**	**0**	**20,662**
Seeding (Primary)	**2,299**	**0**	**0**	**2,299**
Broadcast (Aerial)	1,930	0	0	1,930
Drill (Rangeland	271	0	0	271
Other	99	0	0	99
Vegetation Removal/Hand Crew	**4,797**	**4,153**	**1,579**	**10,529**
Lop (No Scatter)	727	0	0	727
Lop & Scatter	4,036	4,153	1,579	9,767
Lop-Pile-Burn	34	0	0	34
Other	**230**	**17**	**42**	**290**
Forestry Practices	0	17	0	17
Greenstripping	19	0	0	19
Interseeding	8	0	0	8
Road Decommissioning	203	0	42	246
Total Treatment Acres	**23,457**	**20,561**	**1,621**	**45,639**
***Total Land Area Treated**	**21,880**	**20,558**	**1,613**	**42,981**

Table 2.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 2, Cache. Data accessed on 02/09/2017.

*Does not include overlapping treatments.



Map 2.8: WRI treatments by fiscal year completed for WMU 2, Cache.

Range Trend Studies

Range Trend studies have been sampled within WMU 2 on a regular basis since 1984, with studies being added or suspended as was deemed necessary (Table 2.8). 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 2.9).

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 by region.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
02-1	High Creek	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Mountain Big Sagebrush)
02-2	Mouth of Blacksmith Fork	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Mountain Big Sagebrush)
02-3	East of Richmond	RT	Suspended	'84	Not Verified
02-4	Crow Mountain	RT	Suspended	'84, '90, '96, '01	Not Verified
02-5	Smithfield Dry Canyon	RT	Suspended	'84, '90, '96	Not Verified
02-6	Green Canyon Exclosure	RT	Suspended	'84, '90, '96, '01	Not Verified
02-7	Spawn Creek	RT	Suspended	'84, '90, '96	Not Verified
02-8	Millville Canyon	RT	Suspended	'84, '90, '96	Not Verified
02-9	Beirdneau	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Antelope Bitterbrush)
02-10	Broad Hollow Flat	RT	Suspended	'84, '90, '96	Not Verified
02-12	Second Dam Blacksmith Fork	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Antelope Bitterbrush)
02-13	Hardware Plateau	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Very Steep Stony (Antelope Bitterbrush)
02-14	Dry Canyon	RT	Suspended	'84, '90, '96	Not Verified
02-15	Lower Hodges Canyon	RT	Suspended	'84, '90, '96, '01, '06	Not Verified
02-16	Garden City Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Shallow Loam (Curlleaf Mountain mahogany)
02-17	Meadowville	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
02-18	Upper Hodges Canyon	RT	Suspended	'84, '90, '96	Not Verified
02-19	Right Fork Logan Canyon	RT	Active	'90, '96, '01, '06, '11, '16	Mountain Stony Loam (Antelope Bitterbrush)
02-20	Richmond WMA	RT	Suspended	'90, '96, '01	Not Verified
02-21	Swan Creek	RT	Active	'90, '96, '01, '06, '11, '16	Mountain Shallow Loam (Curlleaf Mountain Mahogany)
02-22	Box Elder Canyon	RT	Suspended	'84, '90, '96	Not Verified
02-23	Flat Bottom Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Shallow Loam (Mountain Big Sagebrush)
02-24	Calls Fort Canyon	RT	Suspended	'84, '90, '96, '01	Not Verified
02-25	Mouth of Two Jump Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Gravelly Loam (Mountain Big Sagebrush)
02-26	Wellsville Canyon	RT	Suspended	'90, '96, '01	Not Verified
02-27	Laketown Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Browse)
02-28	North Eden	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland - Loamy 12-16
02-29	Woodruff Creek	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Wyoming Big Sagebrush)
02-30	State Line	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
02-31	South Crawford Mountains	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Shallow Loam (Wyoming Big Sagebrush)
02-32	Wood Pass	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semi-desert Loam (Wyoming Big Sagebrush)
02-33	Braizer Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Shallow Loam (Black Sagebrush)
02-34	Otter Creek	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
02-35	Higgins Hollow	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
02-36	Woodruff Co-op	RT	Active	'90, '96, '01, '06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
02-37	Rock Creek Riparian	RT	Suspended	'96, '06	Not Verified
02-38	Twin Creek	RT	Active	'96, '01, '06, '11, '16	High Mountain Loam (Mountain Big Sagebrush)
02-39	Pole Hollow Spring	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
02-40	Warrens Spring	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
02-41	Boundary Spring	RT	Suspended	'96, '01	Not Verified
02-42	Hardware Gravel Pit	RT	Active	'11, '16	Mountain Loam (Mountain Big Sagebrush)
02-43	Woodruff Longhill	RT	Active	'11, '16	Upland Loam (Bonneville Big Sagebrush)
02-44	Rich County Landfill	RT	Suspended	'84, '90	Not Verified
02R-1	Austin's Rock	RT	Suspended	'97	Not Verified
02R-2	Randolph Burn	RT	Suspended	'97	Not Verified
02R-3	Richmond WMA-Seeded	RT	Suspended	'98	Not Verified
02R-4	Richmond WMA-Native	RT	Suspended	'98	Not Verified
02R-5	Coldwater WMA	RT	Active	'98, '06, '11, '16	Mountain Gravelly Loam (Mountain Big Sagebrush)
02R-6	Duck Creek 3 Low	WRI	Active	'03, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
02R-7	Duck Creek 3 High	WRI	Suspended	'03	Not Verified
02R-8	Duck Creek 1	WRI	Active	'03, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
02R-9	Rabbit Creek Burn	WRI	Active	'04, '07, '12, '16	Mountain Loam (Mountain Big Sagebrush)
02R-10	Rabbit Creek Burn Seeded	WRI	Active	'04, '07, '12, '16	Mountain Loam (Mountain Big Sagebrush)
02R-11	Rattlesnake Knoll East	WRI	Active	'05, '13	Mountain Loam (Mountain Big Sagebrush)
02R-12	Rattlesnake Knoll West	WRI	Suspended	'09	Not Verified
02R-13	Black Mountain East	WRI	Suspended	'05	Not Verified
02R-14	Black Mountain West	WRI	Suspended	'05	Not Verified
02R-15	Curtis Ridge Control	RT	Active	'06, '11	Not Verified
02R-16	Curtis Ridge	WRI	Active	'06, '13	Mountain Shallow Loam (Low Sagebrush)
02R-17	Hardware Plateau Control	WRI	Suspended	'06, '07	Not Verified
02R-18	Pole Hollow Control	WRI	Suspended	'06	Not Verified
02R-19	Squaw Flat South	WRI	Suspended	'06	Not Verified
02R-20	Squaw Flat North	WRI	Active	'06, '13	Mountain Shallow Loam (Low Sagebrush)
02R-21	Hardware Plateau Grazed	WRI	Active	'07, '13	Mountain Shallow Loam (Mountain Big Sagebrush)
02R-22	Blacksmith Fork Control	WRI	Suspended	'07	Not Verified
02R-23	Blacksmith Fork Grazed	WRI	Active	'07, '13	Mountain Very Steep Stony Loam (Mountain Big Sagebrush)

Table 2.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 2, Cache.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
02-2	Mouth of Blacksmith Fork	Wildfire	Sleepy Hollow	2007	900	
		Herbicide - Plateau	Millville WMA Fire Rehabilitation Project	September 2007	792	972
		Aerial Unknown	Millville WMA Fire Rehabilitation Project	December 2007	792	972
		Transplant	Millville WMA Fire Rehabilitation Project	Spring 2008	792	972
		Wildfire	Millville	August 2013	2,864	
		Herbicide - Plateau	Millville WMA Fire Rehab	September 2013	410	2839
		Aerial Unknown	Millville WMA Fire Rehab	November 2013	410	2839
02-12	Second Dam Blacksmith Fork	Lop & Scatter	Blacksmith Fork Juniper Thinning and Shrub Restoration	October-November 2013	1,200	2697
02-32	Wood Pass	Bullhog	Crawford Mountain Bullhog	October 2011-August 2012	1,103	1936
02-34	Otter Creek	Herbicide		Prior to 1984		
		Rangeland Drill		Prior to 1984		
		Aerator/Seed		Spring 2004	355	
02-36	Woodruff Co-op	Seed Unknown		Historic		
		Disc	Woodruff Co-op WMA	2003	173	
		Rangeland Drill	Woodruff Co-op WMA	2003	173	
02-39	Pole Hollow Spring	Lop & Scatter	Hardware Plateau Lop and Scatter	2016?	2,143	3701
02-40	Warrens Spring	Lop & Scatter	Hardware Plateau Lop and Scatter	2016?	2,143	3701
02-43	Woodruff Longhill	Lop & Scatter	Woodruff Longhill Sagebrush Improvement	Fall 2009	3,069	1477
02R-3	Duck Creek 3 Low	Aerator/Seed	Duck Creek	2004	2,850	1321
02R-8	Duck Creek 1	Aerator/Seed	Duck Creek	2004	2,850	1321
02R-9	Rabbit Creek Burn	Wildfire	East Bear	Fall 2003	887	PDB

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
02R-10	Rabbit Creek Burn Seeded	Wildfire	East Bear	Fall 2003	887	PDB
		Rangeland Drill	Rabbit Creek	Fall 2003	500	PDB
02R-11	Rattlesnake Knoll East	Intensive Grazing	Hardware Grazing Project	2005		
02R-16	Curtis Ridge	Intensive Grazing	Hardware Grazing Project	2005		
02R-20	Squaw Flat North	Intensive Grazing	Hardware Grazing Project	2005		
02R-21	Hardware Plateau Grazed	Intensive Grazing	Hardware Grazing Project	2005		
02R-23	Blacksmith Fork Grazed	Intensive Grazing	Hardware Grazing Project	2005		
		Aerial Unknown		April 2007		

Table 2.9: Range trend and WRI studies known disturbance history for WMU 2, Cache.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

There are eight studies [Meadowville (02-17), Flat Bottom Canyon (02-23), Mouth of Two Jump Canyon (02-25), Twin Creek (02-38), Pole Hollow Spring (02-39), Warrens Spring (02-40), Hardware Gravel Pit (02-42), and Coldwater WMA (02R-5)] are considered to be Mountain (Sagebrush) ecological sites. The Meadowville study is located west of Bear Lake and north of Meadowville. Flat Bottom Canyon is found on the south-facing slope of Flat Bottom Canyon, and the Mouth of Two Jump Canyon site is situated at the mouth of Two Jump Canyon. The Twin Creek study is located north of US-89 in Logan Canyon near Twin Creek. Pole Hollow Spring is situated north of Rock Creek, and Warrens Spring is found in North Cottonwood Canyon, northeast of Warrens Hollow. The Hardware Gravel Pit study site is situated north of SR-101 in Blacksmith Fork Canyon. Finally, the Coldwater WMA study is located at the mouth of Coldwater Canyon.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species on all sites except for Meadowville, on which antelope bitterbrush (*Purshia tridentata*) contributes the most cover. Other preferred browse species that provide less cover include chokecherry (*Prunus virginiana*) and serviceberry (*Amelanchier* sp.). Cover of sagebrush has exhibited an overall increase over the study period, and has increased overall on all sites except Pole Hollow Spring (Figure 2.3). Average sagebrush demographic data indicates that a majority of the populations have been comprised of mature individuals in all study years and that decadent plants and recruitment of young have decreased overall (Figure 2.9). Average sagebrush utilization has exhibited a general decrease over time, with a majority of the plants showing no to light use in all years (Figure 2.11).

Tree cover has increased over time: this trend is driven by the Warrens Spring and Hardware Gravel Pit studies. Point-quarter data indicates that density has marginally decreased overall. However, it is important to note the difference in the number of studies sampled each year and keep in mind that the trends may be driven by separate sites from sample year to sample year (Figure 2.5, Figure 2.7).

Herbaceous Understory: The herbaceous understories of these studies are generally diverse and have shown an increasing trend. Perennial grasses and forbs have increased overall in both cover and frequency. While the perennial grass component on many studies includes native species like bluebunch wheatgrass (*Psuedoroegneria spicata*), the invasive species bulbous bluegrass (*Poa bulbosa*) has increased as well: this trend is driven by the Mouth of Two Jump Canyon and Twin Creek studies. Although average annual grass cover has decreased over the study years, species such as cheatgrass (*Bromus tectorum*) and field brome (*B. arvensis*) contribute a significant amount of cover on many study sites (Figure 2.13, Figure 2.15).

Occupancy: Average pellet transect data shows that overall animal occupancy has decreased over time and that deer have been the primary occupants in all sample years, with pellet groups having a mean abundance ranging from just under 12 days/use acre in 2016 to nearly 32 days use/acre in 2001. Mean abundance of elk pellet groups has been as low as 5 days use/acre in 2016 and as high as 11 days use/acre in 2001. Cattle pellet groups had a mean abundance ranging from almost 3 days use/acre in 2011 and 2016 to nearly 6 days use/acre in 2006. The mean abundance of horse pellet groups has ranged from 0 days use/acre in 2001, 2006, and 2016 to 0.6 days use/acre in 2011. Finally, moose pellet groups have had a mean abundance as low as 0 days use/acre in 2011 and 2016 and as high as 0.5 days use/acre in 2006 (Figure 2.17).

Mountain (Curlleaf Mountain Mahogany)

Two study sites [Garden City Canyon (02-16) and Swan Creek (02-21)] are classified as Mountain (Curlleaf Mountain Mahogany) ecological sites. The Garden City Canyon study is located on the south-facing slope of Garden City Canyon, west of Garden City. The Swan Creek study site is found east of Bear Lake on the Swan Creek WMA north of Swan Creek.

Shrubs/Trees: Overall shrub cover on study sites of this ecological type has increased over time. The dominant browse species on both of these studies is curlleaf mountain mahogany (*Cercocarpus ledifolius* var. *ledifolius*). Other preferred browse species such as sagebrush (*Artemisia* sp.) and Saskatoon serviceberry (*Amelanchier alnifolia*) are also present, but contribute less cover. Preferred browse as a whole has also exhibited an increasing trend: this is due to the Swan Creek study, as preferred browse cover has decreased on the Garden City Canyon site. Sagebrush cover has fluctuated from year to year, but has generally remained stable overall (Figure 2.3). Average sagebrush demographics indicate that mature individuals have been the main component on these sites in all sample years and that both decadent plants and recruitment of young have decreased (Figure 2.9). Sagebrush utilization has fluctuated over the study years, and most plants have shown little to no use in most sample years (Figure 2.11).

Average tree cover has been entirely contributed by juniper and has increased overall; this is due to the Garden City Canyon study as juniper contributes no cover on the Swan Creek site. Density of juniper has varied, but has been consistent in general. Point quarter data was also taken on curlleaf mountain mahogany in each sample year, and although it has fluctuated from year to year, density values have also remained fairly consistent overall (Figure 2.5, Figure 2.7).

Herbaceous Understory: The overall cover and nested frequency of the herbaceous understory have increased slightly over time. Perennial grasses have been the dominant component in most sample years and have largely been comprised of native species such as bluebunch wheatgrass (*Pseudoroegneria spicata*). However, annual grasses have also contributed a fair amount of cover. Average cover and frequency of the introduced perennial grass bulbous bluegrass (*Poa bulbosa*) have increased through the sample years; this increase is mainly due to the Swan Creek study (Figure 2.13, Figure 2.15).

Occupancy: Following an initial increase in the 2006 sample year, average animal occupancy has decreased each study year. Average pellet transect data indicates that deer have been the primary occupants in all sample years except 2006, when elk were the main occupants. Deer have had a mean abundance of pellet groups ranging from 31 days use/acre in 2016 to nearly 52 days use/acre in 2001. Mean abundance of elk pellet groups has been as low as 17 days use/acre in 2016 and as high as almost 74 days use/acre in 2006. Moose have also been present with a mean abundance of pellet groups ranging from 0 days use/acre in 2001 and 2011 to almost 1 days use/acre in 2006 and 2016 (Figure 2.17).

Mountain (Browse)

There are four studies [Beirdneau (02-9), Second Dam Blacksmith Fork (02-12), Hardware Plateau (02-13), and Right Fork Logan Canyon (02-19)] that are considered to be Mountain (Browse) ecological sites. Beirdneau is located on a south-facing slope north of US-89 and Beirdneau Campground, and the Second Dam Blacksmith Fork study is situated east of Hyrum City Park and north of SR-101 in Blacksmith Fork Canyon. Hardware Plateau is found on a steep slope in the hills south of Hardware Ranch. Finally, the Right Fork Logan Canyon study is located east of US-89 on the slopes above Maughan Hollow.

Shrubs/Trees: Antelope bitterbrush (*Purshia tridentata*) is the dominant browse species on all studies of this ecological type except for Hardware Plateau, where it is co-dominant with Saskatoon serviceberry (*Amelanchier alnifolia*). Other browse species such as mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are also present on many sites, though they provide less cover. Overall, average shrub cover has slightly increased over the sample years, with preferred browse other than sagebrush contributing a majority of this cover (Figure 2.3). Average sagebrush demographics indicate that mature individuals primarily comprise the populations on these study sites; both decadence and recruitment of young have decreased over the sample years (Figure 2.9). More than half of sagebrush plants exhibited moderate to heavy browsing in 1996, but utilization has decreased over time. In the most recent sample year (2016), approximately 21% of plants were heavily used, 11% were moderately used, and the remaining majority showed little to no use (Figure 2.11).

Average tree cover has increased over the sample years: this trend is entirely driven by the Beirdneau study. Point-quarter measurements were only recorded in 2016 on the Right Fork Logan Canyon and Beirdneau studies, but site reports indicate that Rocky Mountain juniper (*Juniperus scopulorum*) has been recorded in density strips on the Beirdneau site in the past (Figure 2.5, Figure 2.7).

Herbaceous Understory: The overall herbaceous understory has increased in both cover and frequency over the study years. Perennial and annual grasses have been the main components on these study sites; annual grasses have exhibited an overall increase in cover and perennial grass cover has decreased over time. Cover and frequency of the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) have remained fairly consistent, with most of the grass found on the Right Fork Logan Canyon study. Perennial and annual forb cover has increased overall, a trend that is largely driven by the Beirdneau and Right Fork Logan Canyon studies (Figure 2.13, Figure 2.15).

Occupancy: Average animal presence has decreased over time. Elk have been the primary occupants in all sample years, with average pellet group abundance ranging from 16.5 days use/acre in 2016 to nearly 51 days use/acre in 2006. The mean abundance of deer pellet groups has been as low as 5.5 days use/acre in 2016 and as high as 21 days use/acre in 2001. Cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2016 to almost 3 days use/acre in 2006. Finally, the mean abundance of horse pellet groups has been as low as 0 days use acre in 2001, 2006, and 2011, and as high as 0.6 days use/acre in 2016 (Figure 2.17).

Mountain (Shrub)

One study [Laketown Canyon (02-27)] is considered to be a Mountain (Shrub) ecological site. The Laketown Canyon study is located on the western facing slope of Laketown Canyon, south of the town of Laketown.

Shrubs/Trees: The dominant browse species on this study site are black sagebrush (*Artemisia nova*) and alderleaf mountain mahogany (*Cercocarpus montanus*); although many other browse species are present in lesser amounts. Overall average shrub cover has remained fairly consistent with other shrubs as the main component. Sagebrush cover has exhibited a marginal increase (Figure 2.3), and average demographic data shows that the population has been dominated by mature individuals in all sample years. Decadence of sagebrush has decreased and recruitment of young has increased over time (Figure 2.9). Average sagebrush utilization has decreased overall, and a majority of the plants showed signs of little to no browsing in each sample year (Figure 2.11).

Although not recorded in 2011, tree cover has remained consistent in general and has been entirely contributed by Utah juniper (*Juniperus osteosperma*); point quarter data shows that density has increased (Figure 2.5, Figure 2.7).

Herbaceous Understory: As a whole, the understory on this study site has increased in cover, with native perennial grasses as the main component in most sample years. Annual grass has increased over time and became dominant in the understory in 2016. Perennial forb cover and frequency have decreased while those of annual forbs have increased, mainly due to an increase of desert madwort (*Alyssum desertorum*) and common mullein (*Verbascum thapsus*) between 2011 and 2016 (Figure 2.13, Figure 2.15).

Occupancy: Average pellet transect data shows that overall occupancy has decreased over time. Deer have been the primary occupants in all sample years except 2006, when elk pellets were the most abundant. Mean abundance of deer pellet groups has ranged from almost 5 days use/acre in 2006 to 41.5 days use/acre in 2001. Elk pellet groups have had a mean abundance as low as 0 days use/acre in 2001 and 2006 and as high as almost 3 days use/acre in 2011 and 2016. The mean abundance of cattle pellet groups has been as low as 0 days use/acre in 2001 and 2011 and as high as 5 days use/acre in 2006. Finally, mean abundance of moose pellet groups has ranged from 0 days use/acre in 2001, 2011, and 2016 to nearly 2 days use/acre in 2006 (Figure 2.17).

Upland (Sagebrush)

Seven studies [High Creek (02-1), Mouth of Blacksmith Fork (02-2), North Eden (02-28), Woodruff Creek (02-29), Otter Creek (02-34), Higgins Hollow (02-35), and Woodruff Longhill (02-43)] are considered to be Upland (Sagebrush) ecological sites. The High Creek study site is located on a south-facing slope north of Prater Hollow and High Creek and east of US-91. The Mouth of Blacksmith Fork study is situated at the mouth of Blacksmith Fork Canyon, north of SR-101. North Eden is found on west-facing slope east of Bear Lake and North Cisco Road, and the Woodruff Creek study is situated east of Birch Creek Reservoirs above Woodruff Creek. The Otter Creek site is located north of the town of Randolph and east of the Bear River, while the Higgins Hollow study is found in Higgins Hollow. Finally, Woodruff Longhill is located south of Dry Basin Reservoir and north of Woodruff Creek.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the primary browse species on all sites except Mouth of Blacksmith Fork, which is dominated by forage kochia (*Bassia prostrata*), and Woodruff Creek, on which Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) is dominant. Other preferred browse is present on select sites in lesser amounts, and includes antelope bitterbrush (*Purshia tridentata*), black sagebrush (*A. nova*), and slender buckwheat (*Eriogonum microthecum*). The average cover of sagebrush, preferred browse, and other shrubs have exhibited a slight increase over the study period; the increase in sagebrush cover is likely driven by the Otter Creek and Higgins Hollow studies (Figure 2.4). Average sagebrush demographics indicate that mature plants comprise a majority of the populations on these studies, and that decadent individuals and the recruitment of young have increased over time. This increase in young plants is largely due to the Otter Creek study, which has had the highest density of young plants in most sample years (Figure 2.9). Average sagebrush utilization has exhibited an overall decrease over the study period, with a majority of plants displaying no to light use (Figure 2.12).

Tree cover on these study sites has increased each year since 2006, a trend which can be attributed to the North Eden and Woodruff Creek studies as line intercept cover of juniper (*Juniperus osteosperma*) was not recorded on any other site. Tree density has exhibited an overall decrease. However, it is important to note the difference in the number of studies sampled when analyzing this trend. Although increasing numbers of trees were recorded on the North Eden and Woodruff Creek sites in each sample year, addition of the Woodruff Longhill study in 2006 and High Creek in 2016 has suppressed the averages in these study years (Figure 2.6, Figure 2.8).

Herbaceous Understory: Although average herbaceous cover and frequency decreased between 2011 and 2016, it has exhibited an increase overall. A majority of the understory cover, however, has been contributed by annual grasses in most sample years: this trend is likely driven by the Mouth of Blacksmith Fork study, on which annual grasses had 40.3% cover in 2016. The perennial grass component on many sites is largely composed of species such as Sandberg bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Pseudoroegneria spicata*), but the introduced species bulbous bluegrass (*P. bulbosa*) has been present in fluctuating amounts in all study years on the High Creek and Mouth of Blacksmith Fork studies. Average cover and frequency of perennial and annual forbs have also exhibited an overall increase over the study period (Figure 2.14, Figure 2.16).

Occupancy: Overall, animal presence has decreased over the study period, and deer have been the primary occupants in all sample years with a mean abundance of pellet groups ranging from 25 days use/acre in 2011 to nearly 59 days use/acre in 2006. The mean abundance of elk pellet groups has been as low as 0 days use/acre in 2001 and as high as just over 3 days use/acre in 2011. Finally, cattle pellet groups have had a mean abundance ranging from 4.5 days use/acre in 2011 to 9 days use/acre in 2016 (Figure 2.18).

Upland (Black Sagebrush)

One study site [Braizer Canyon (02-33)] is classified as an Upland (Black Sagebrush) ecological site: this study site is located in the Crawford Mountains in Braizer Canyon.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) is the dominant browse species on this site, with other preferred species such as winterfat (*Krascheninnikovia lanata*) and slender buckwheat (*Eriogonum microthecum*) providing less cover; overall shrub cover has increased over the study years (Figure 2.4). According to average demographic data, sagebrush populations are mostly comprised of mature individuals though recruitment of young plants has increased overall (Figure 2.10). Sagebrush utilization on this site has generally decreased over time, with a majority of plants showing little to no use in all sample years (Figure 2.12).

Average tree cover has increased overall with Utah juniper (*Juniperus osteosperma*) providing all cover. Point-quarter data reveals that juniper density has also increased over the sample period (Figure 2.6, Figure 2.8).

Herbaceous Understory: The herbaceous understory on this site has exhibited an overall increase in both cover and frequency with native perennial grasses – mainly bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) – as the main component. Annual grasses have exhibited an increase in both cover and frequency, but have remained relatively rare in comparison to perennial grasses. Perennial forb cover has fluctuated, but remained consistent overall, and annual forbs have remained rare (Figure 2.14, Figure 2.16).

Occupancy: Average pellet transect data shows that animal occupancy has varied from year to year, but has decreased overall. Deer have been the primary occupants in all sample years with mean abundance of pellet groups ranging from 30 days use/acre in 2016 to 78 days use/acre in 2006. Mean abundance of elk pellet groups has been as low as 0 days use/acre in 2011 and 2016 and as high as 8 days use/acre in 2006. Cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2011 to over 4 days use/acre in 2006 (Figure 2.18).

Semidesert (Sagebrush)

There are four studies [State Line (02-30), South Crawford Mountains (02-31), Wood Pass (02-32), and Woodruff Co-op (02-36)] that are classified as Semidesert (Sagebrush) ecological sites. The State Line study is located at the intersection of two dirt roads near the Utah-Wyoming border, and the South Crawford Mountains site is situated just east of the southern portion of the Crawford Mountains. The Wood Pass study is found on the lower eastern slopes of the Crawford Mountains, south of Wood Pass. Woodruff Co-op is found on the Woodruff Co-op Wildlife-Livestock WMA near the Utah-Wyoming border.

Shrubs/Trees: The main browse species on a majority of sites is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), although fourwing saltbush (*Atriplex canescens*) contributes more cover on the Woodruff Co-op site. Total average shrub cover has increased each sample year: this increase is driven by the State Line and South Crawford Mountains studies, both of which had nearly 30% cover of Wyoming big sagebrush in 2016 (Figure 2.4). Average sagebrush demographics show that mature plants have been the most prominent age class in every sample year, and although low in comparison, recruitment of young has exhibited an overall increase (Figure 2.10). Average sagebrush utilization has increased over the sample years and nearly half of the plants showed moderate to heavy usage in 2016. This trend is driven by the Woodruff Co-op study, on which 81% of plants were moderately used, and the South Crawford study which had 69% of black sagebrush being moderately browsed (Figure 2.12).

Overall tree cover has decreased over the sample years, with the Wood Pass study being the only one to contribute tree cover. Density has fluctuated throughout the years, with Wood Pass again being the sole

contributor in every year except 1996, when Woodruff Co-op also contributed tree density (Figure 2.6, Figure 2.8).

Herbaceous Understory: The average cover and frequency of the understories of these sites has varied from year to year, but has displayed an increasing trend. Perennial grasses are, on average, the dominant herbaceous component and are largely comprised of species such as Sandberg bluegrass (*Poa secunda*), with the exception to this being the Woodruff Co-op study, which is dominated by crested wheatgrass (*Agropyron cristatum*). The average cover of annual grass has increased, but has remained relatively low overall (Figure 2.14, Figure 2.16).

Occupancy: Average pellet transect data shows that overall animal presence has increased over time and that deer were the primary occupants in all sample years except 2016, when most pellet groups were contributed by cattle. The mean abundance of deer pellet groups has been as low as nearly 17 days use/acre in 2006 and as high as almost 42 days use/acre in 2011. Elk have also been present on this site, with a mean abundance of pellet groups ranging from 0.3 days use/acre in 2016 to just over 13 days use/acre in 2006. Finally, the mean abundance of cow pellet groups has ranged from 2 days use/acre in 2011 to 27 days use/acre in 2016 (Figure 2.18).

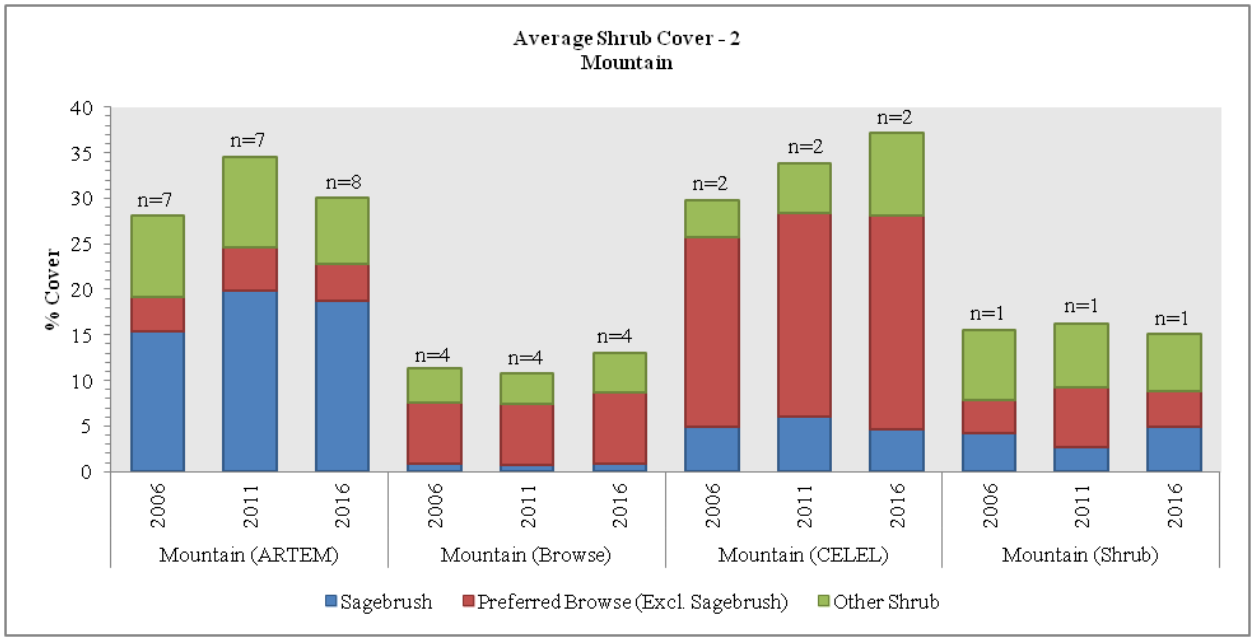


Figure 2.3: Average shrub cover for Mountain (ARTEM), Mountain (Browse), Mountain (CELEL), and Mountain (Shrub) study sites in WMU 2, Cache.

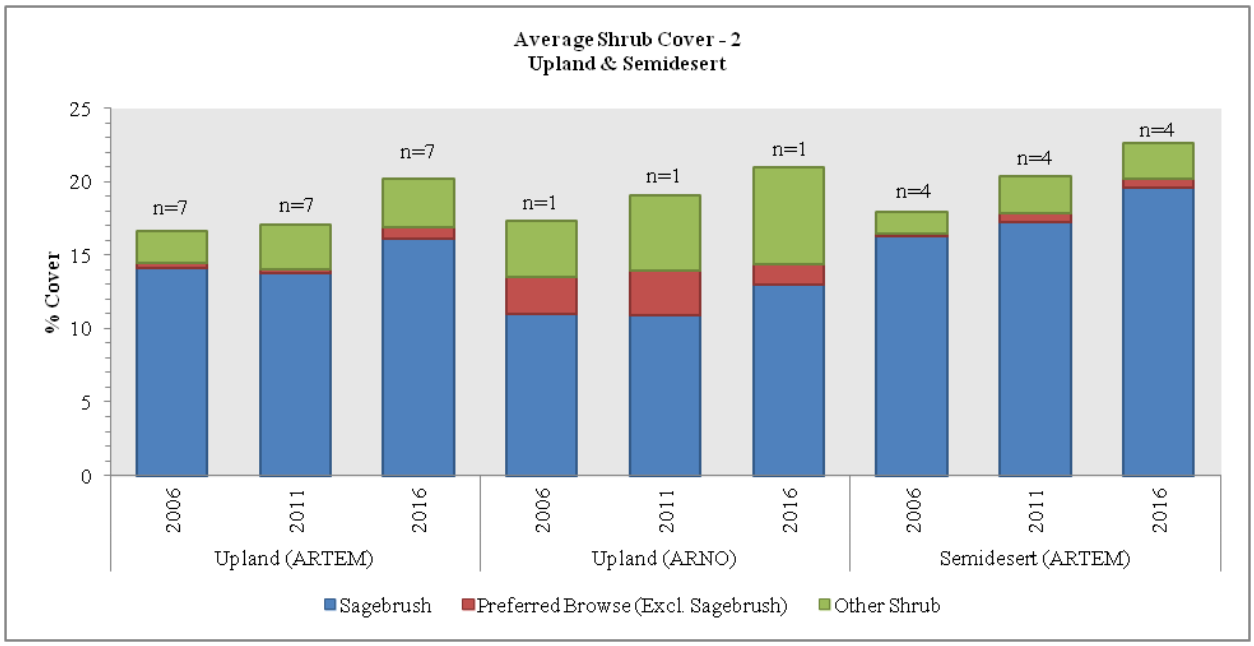


Figure 2.4: Average shrub cover for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

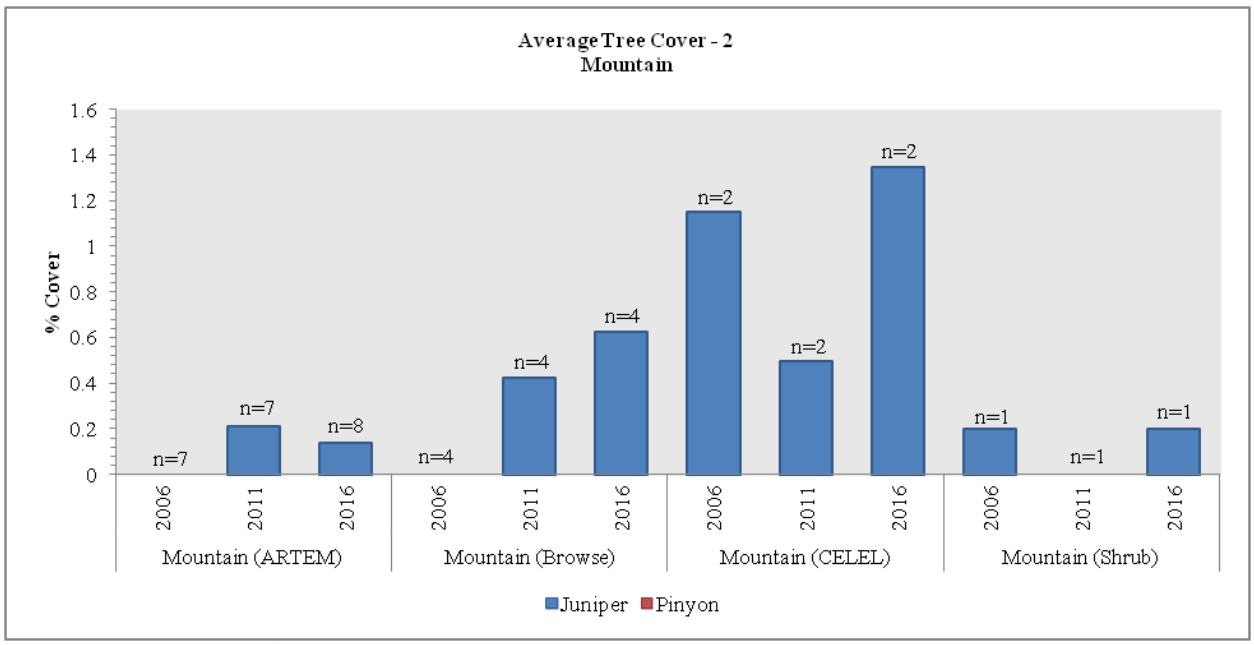


Figure 2.5: Average tree cover for Mountain (ARTEM), Mountain (Browse), Mountain (CELEL), and Mountain (Shrub) study sites in WMU 2, Cache.

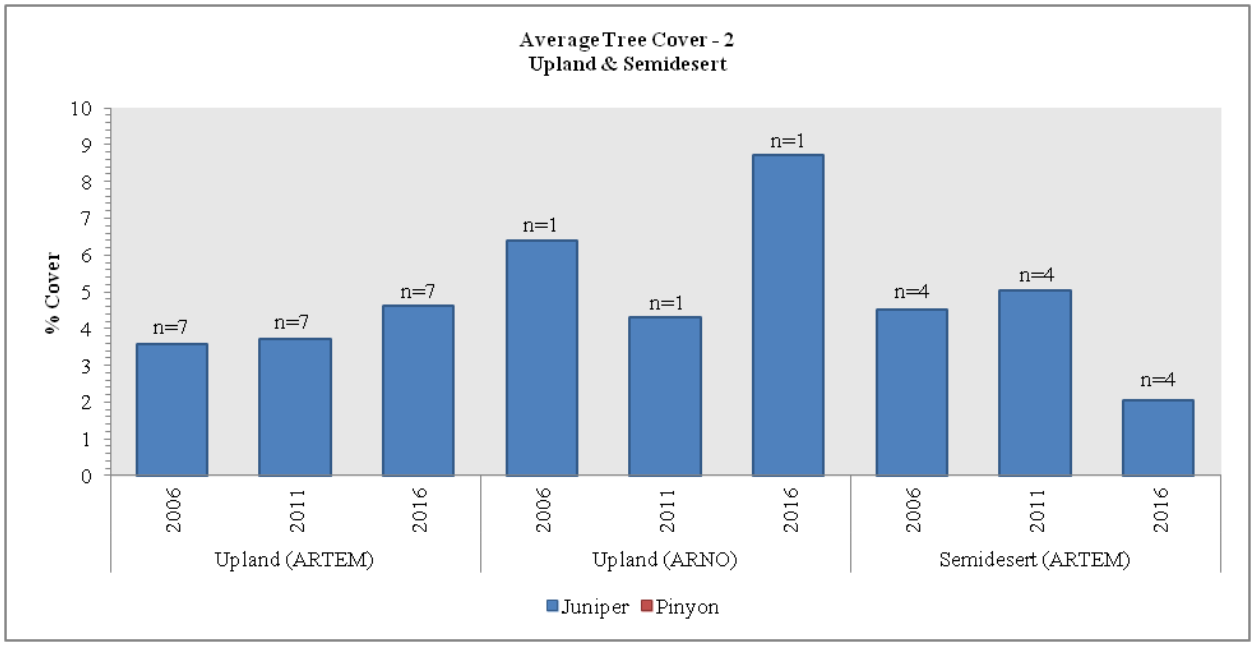


Figure 2.6: Average tree cover for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

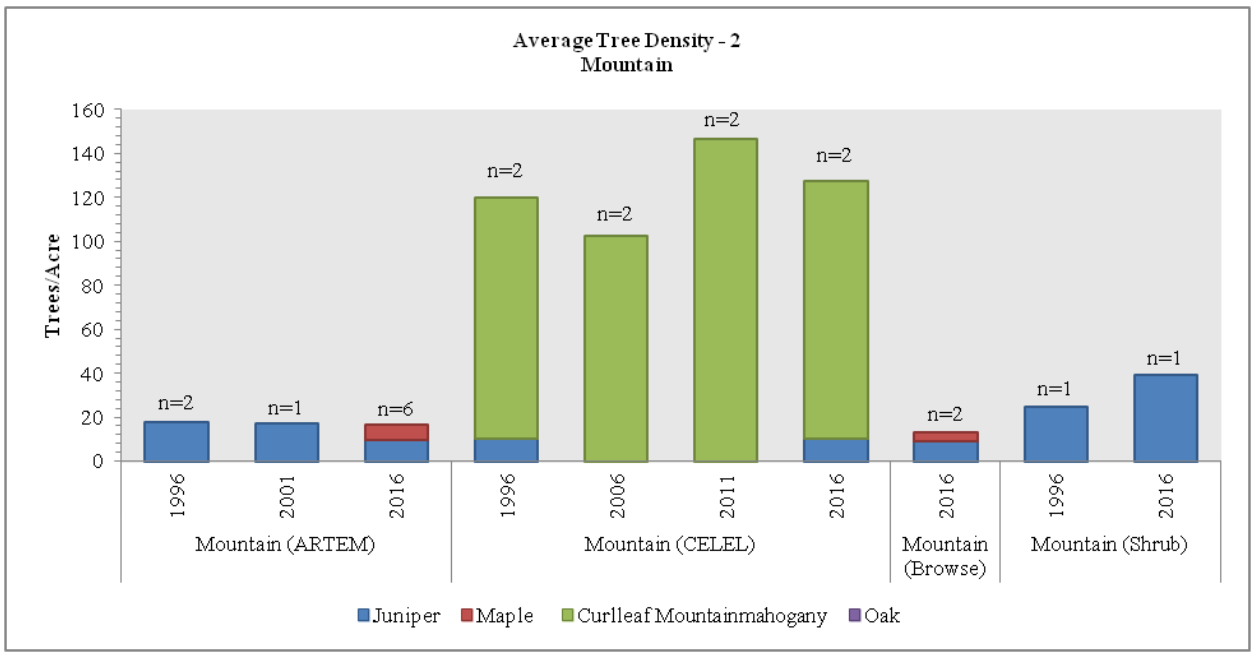


Figure 2.7: Average tree density for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

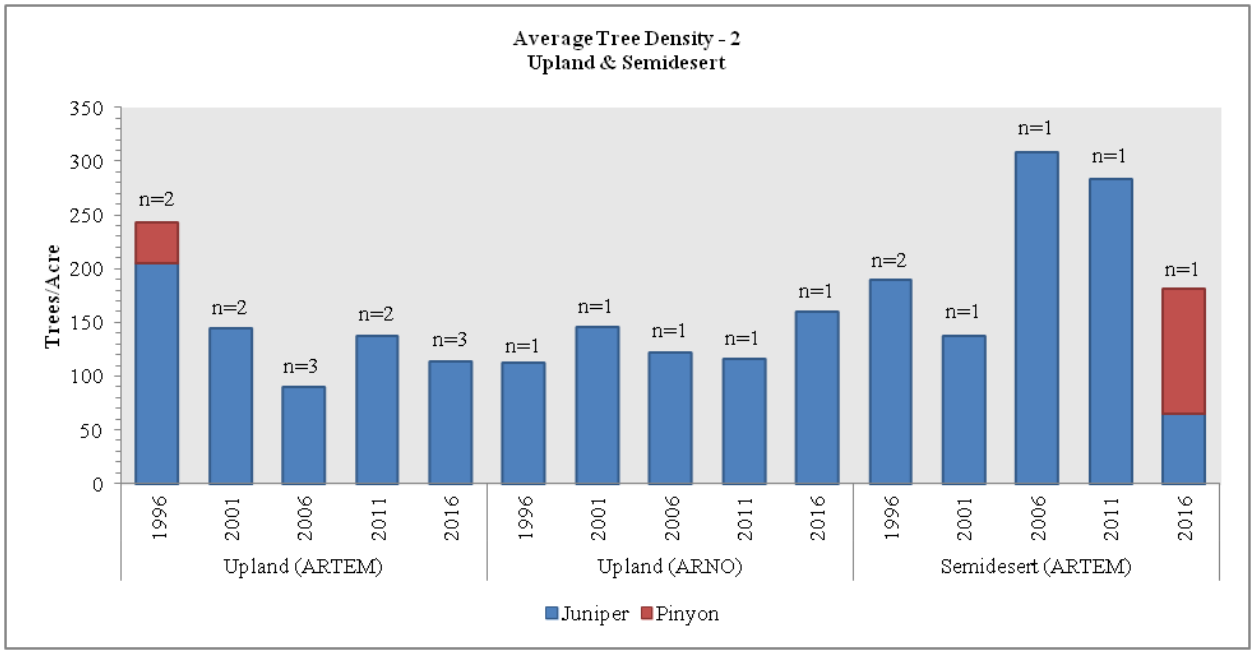


Figure 2.8: Average tree density for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

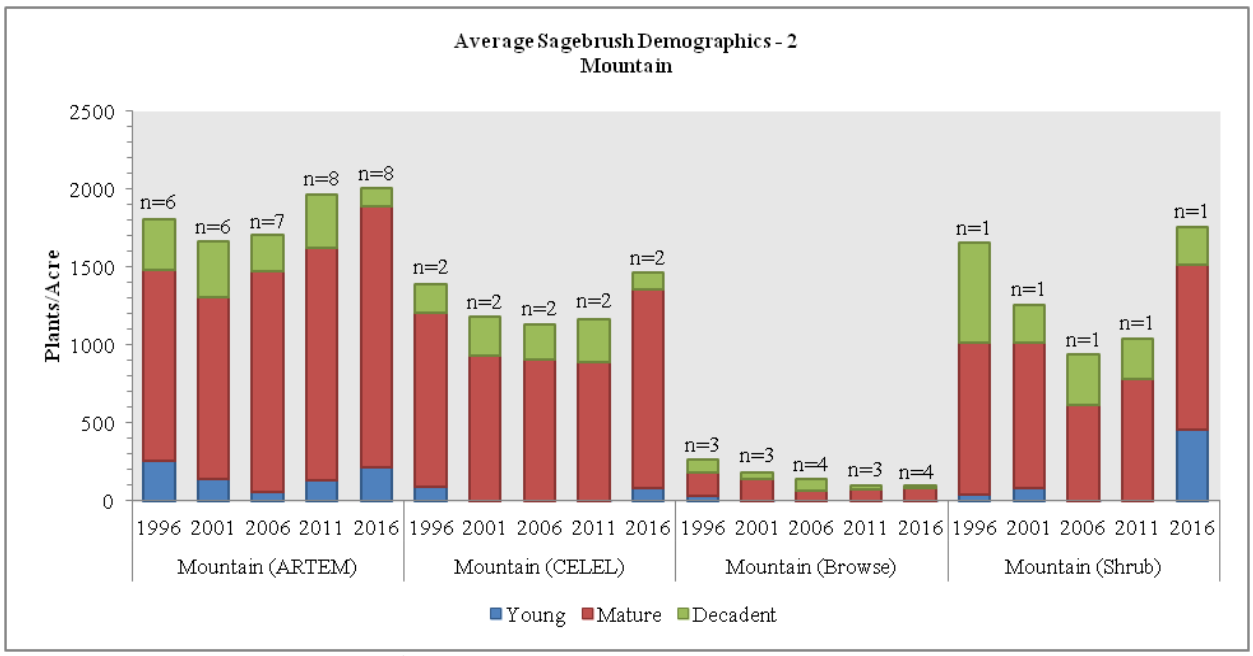


Figure 2.9: Average sagebrush demographics for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

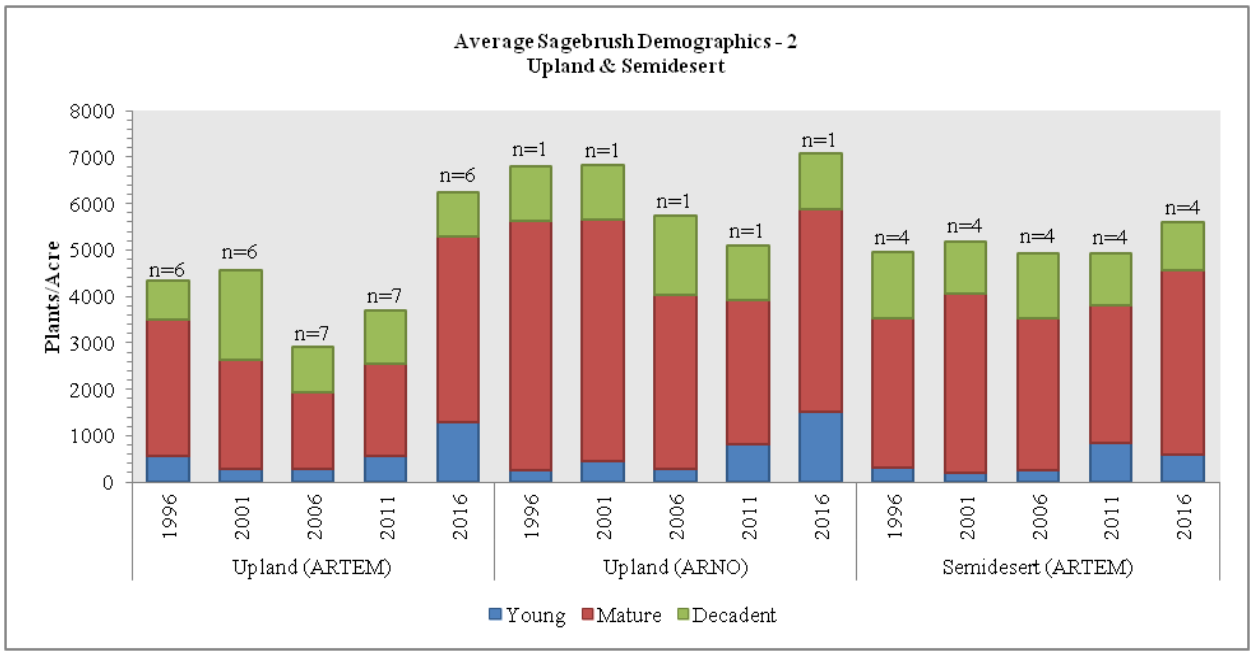


Figure 2.10: Average sagebrush demographics for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

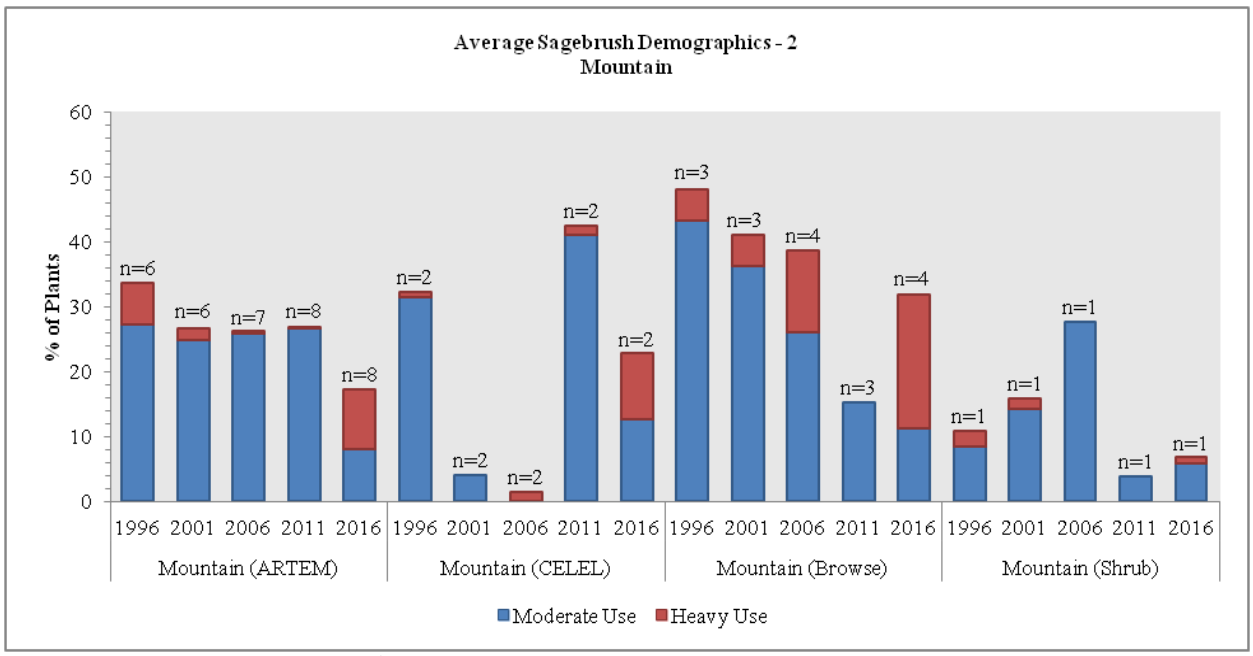


Figure 2.11: Average sagebrush utilization for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

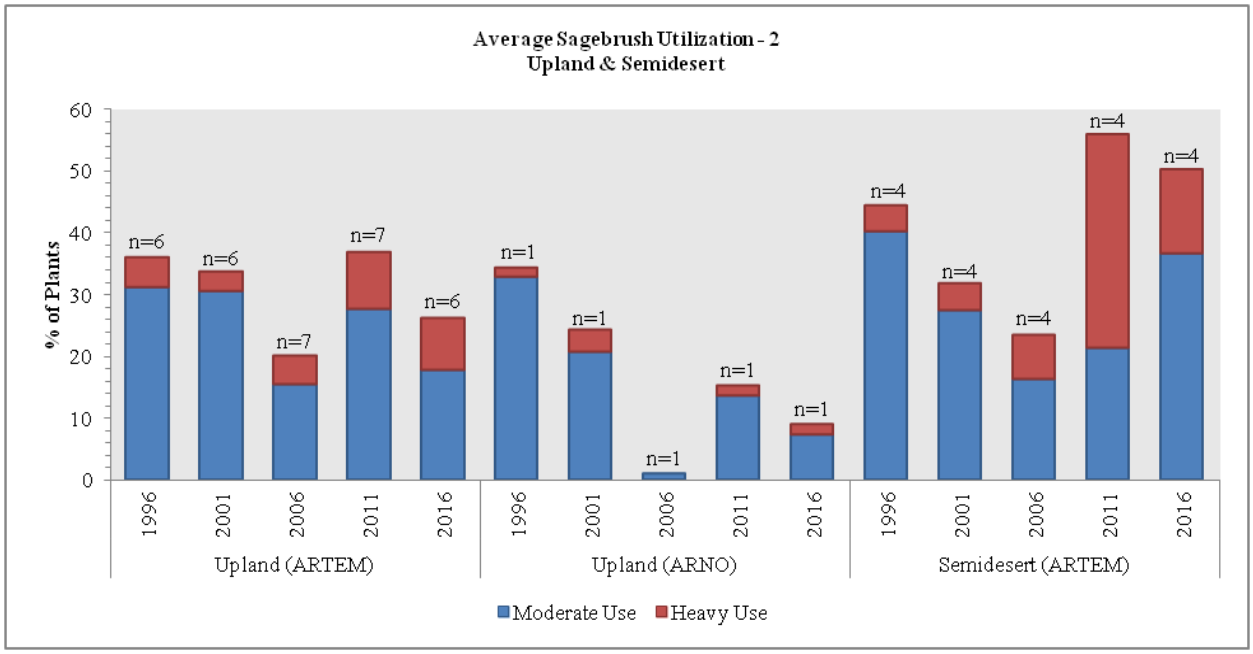


Figure 2.12: Average sagebrush utilization for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

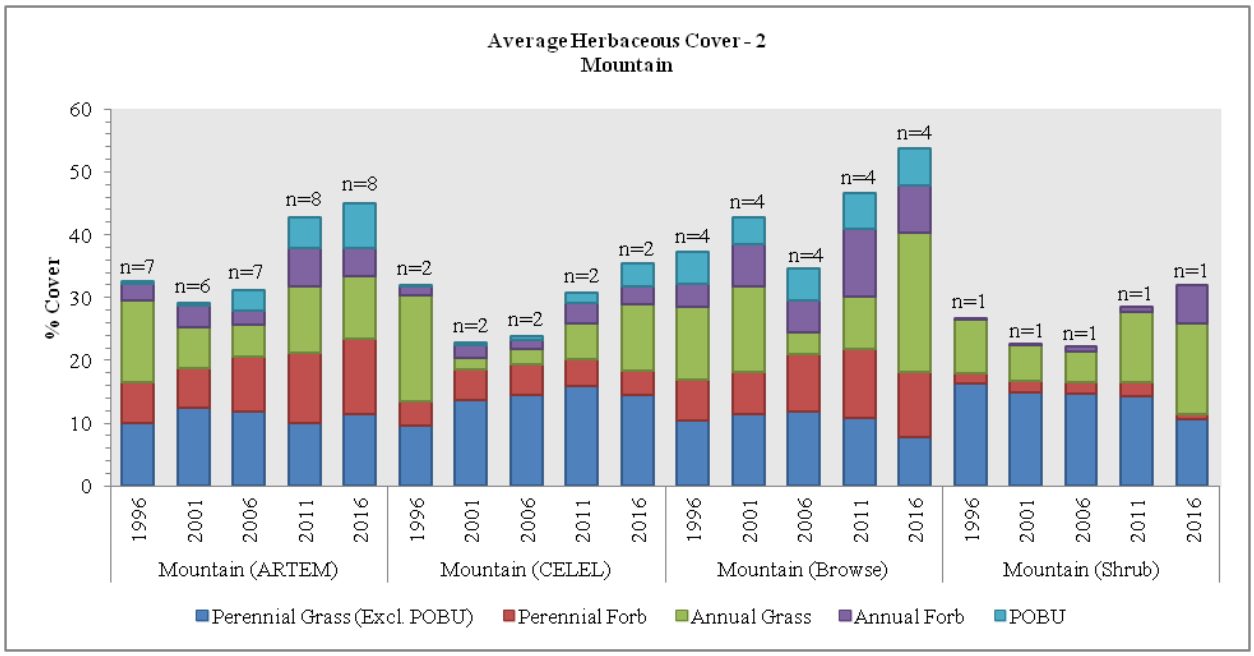


Figure 2.13: Average herbaceous cover for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

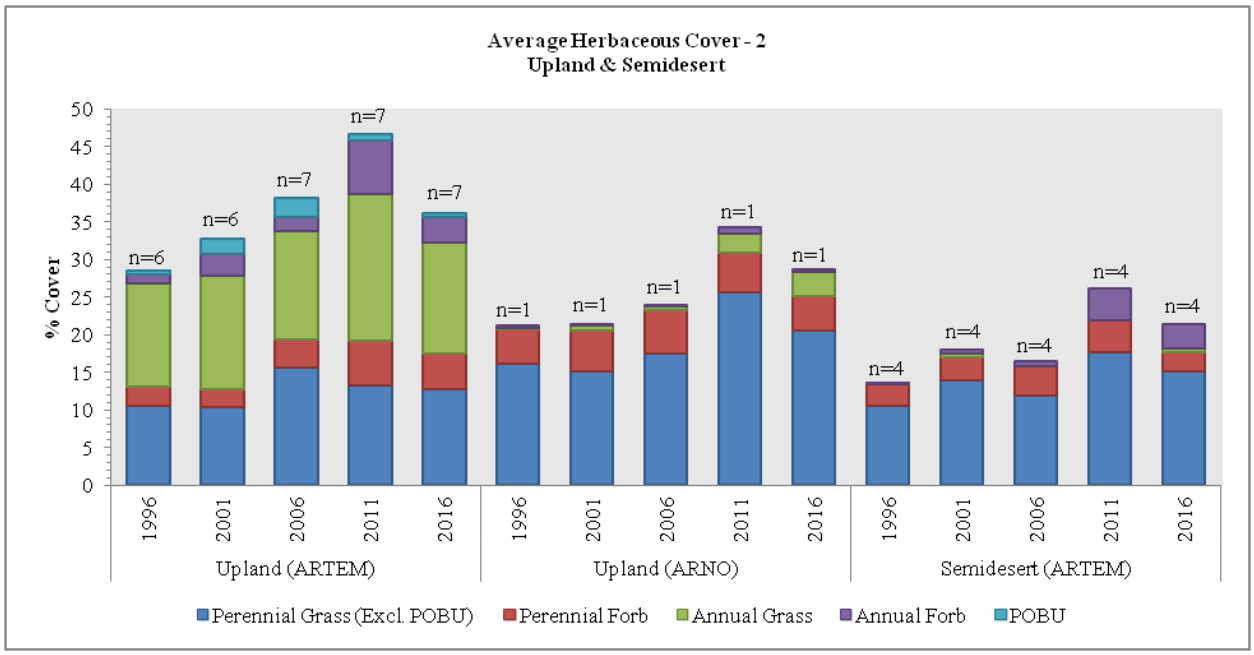


Figure 2.14: Average herbaceous cover for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

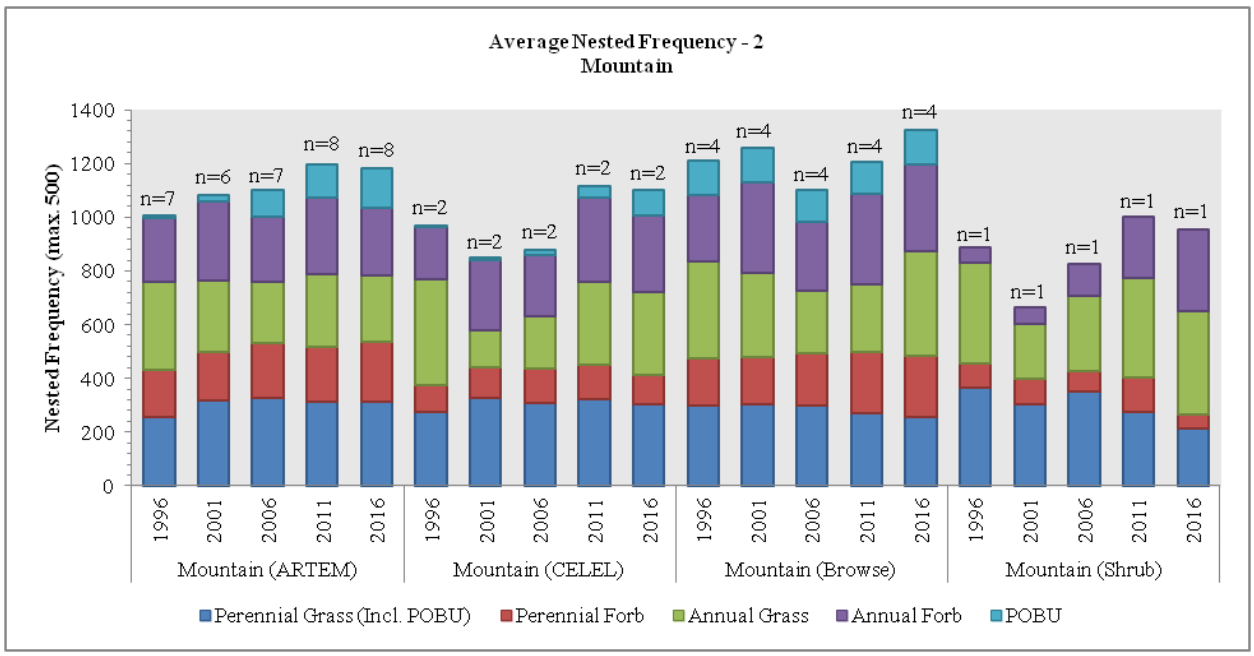


Figure 2.15: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

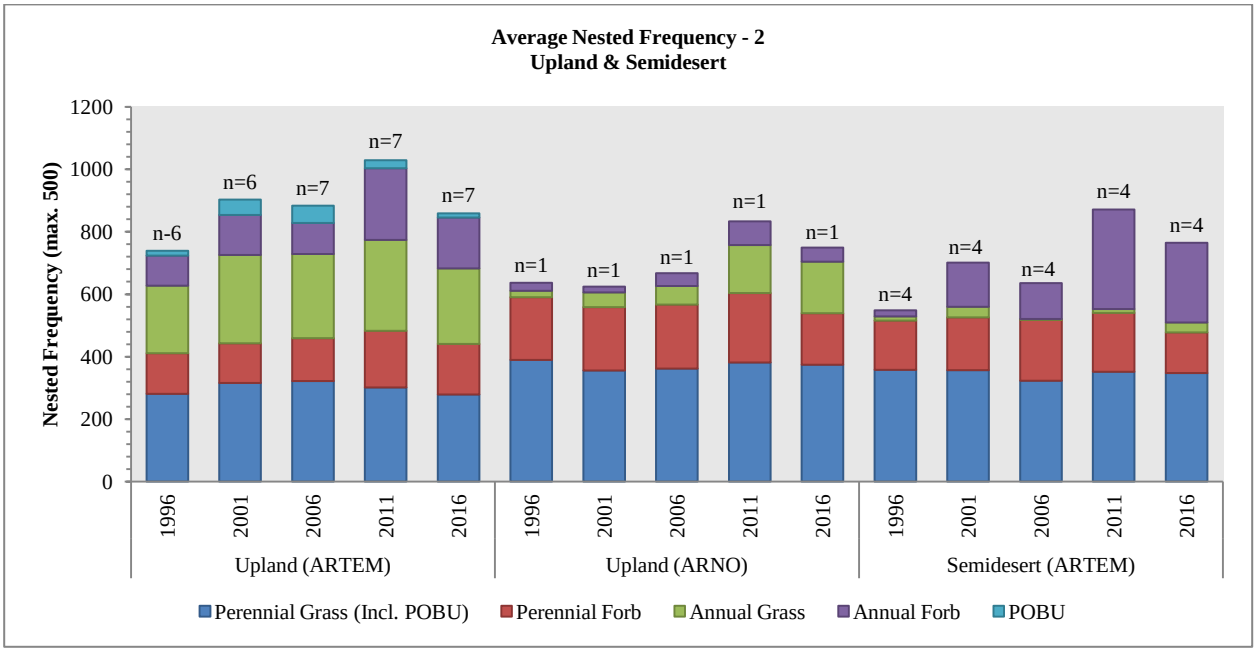


Figure 2.16: Average nested frequency of herbaceous species for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

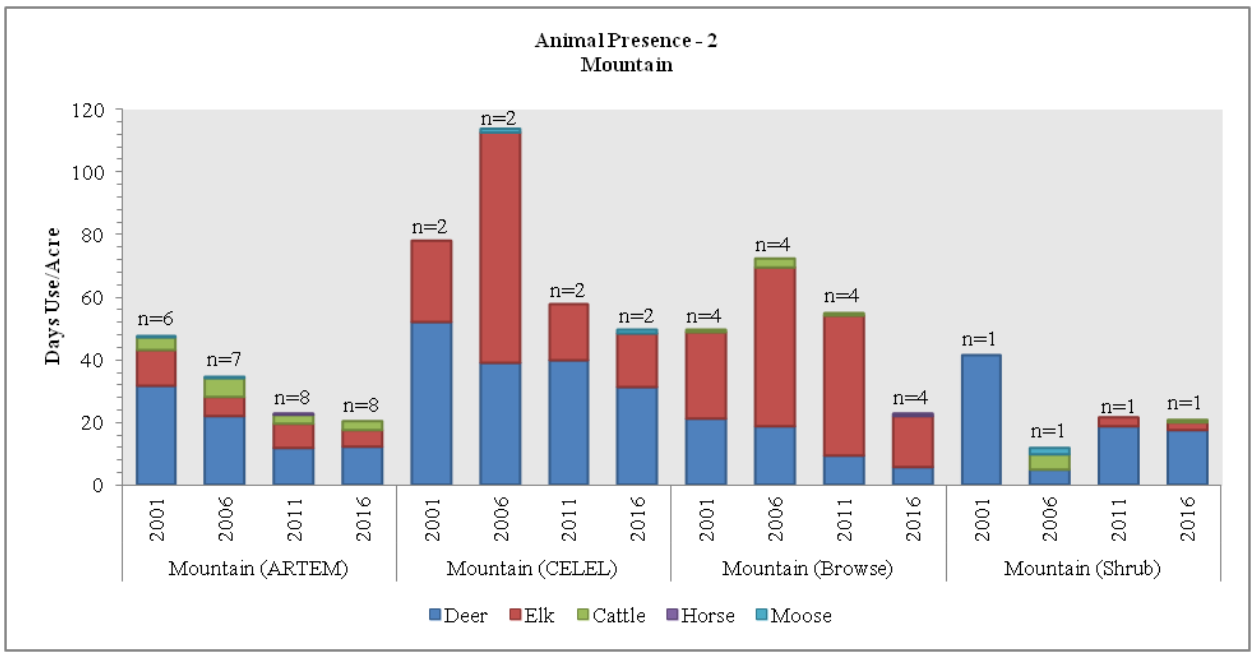


Figure 2.17: Average pellet transect data for Mountain (ARTEM), Mountain (CELEL), Mountain (Browse), and Mountain (Shrub) study sites in WMU 2, Cache.

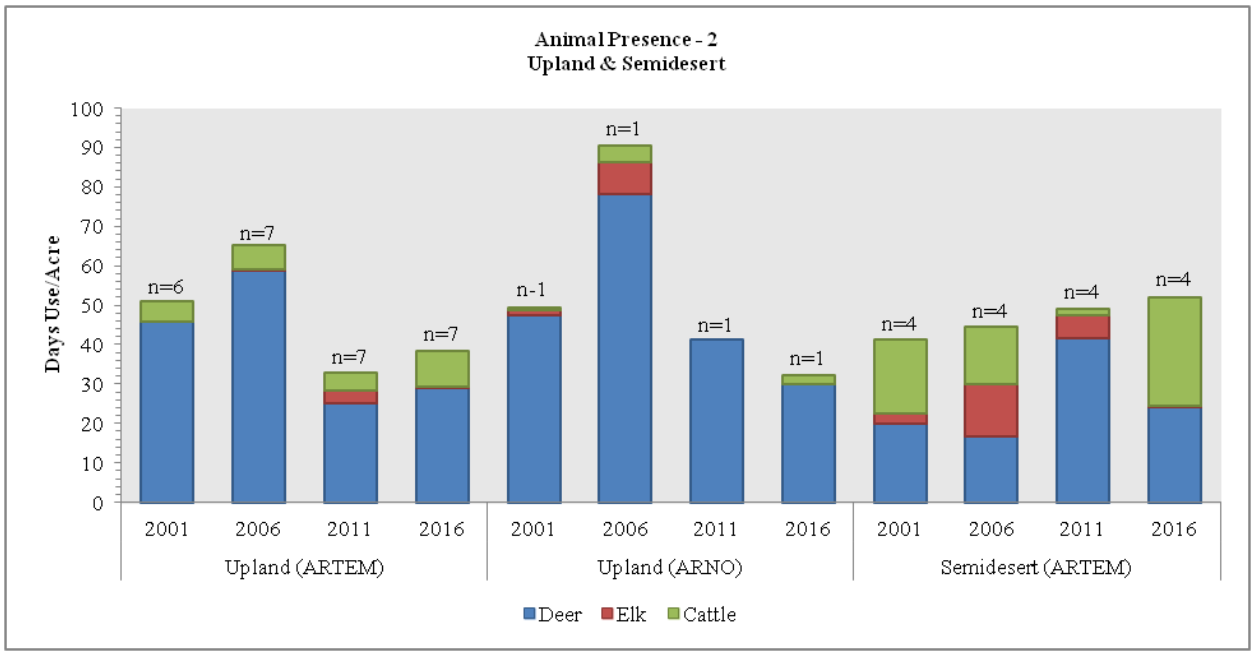
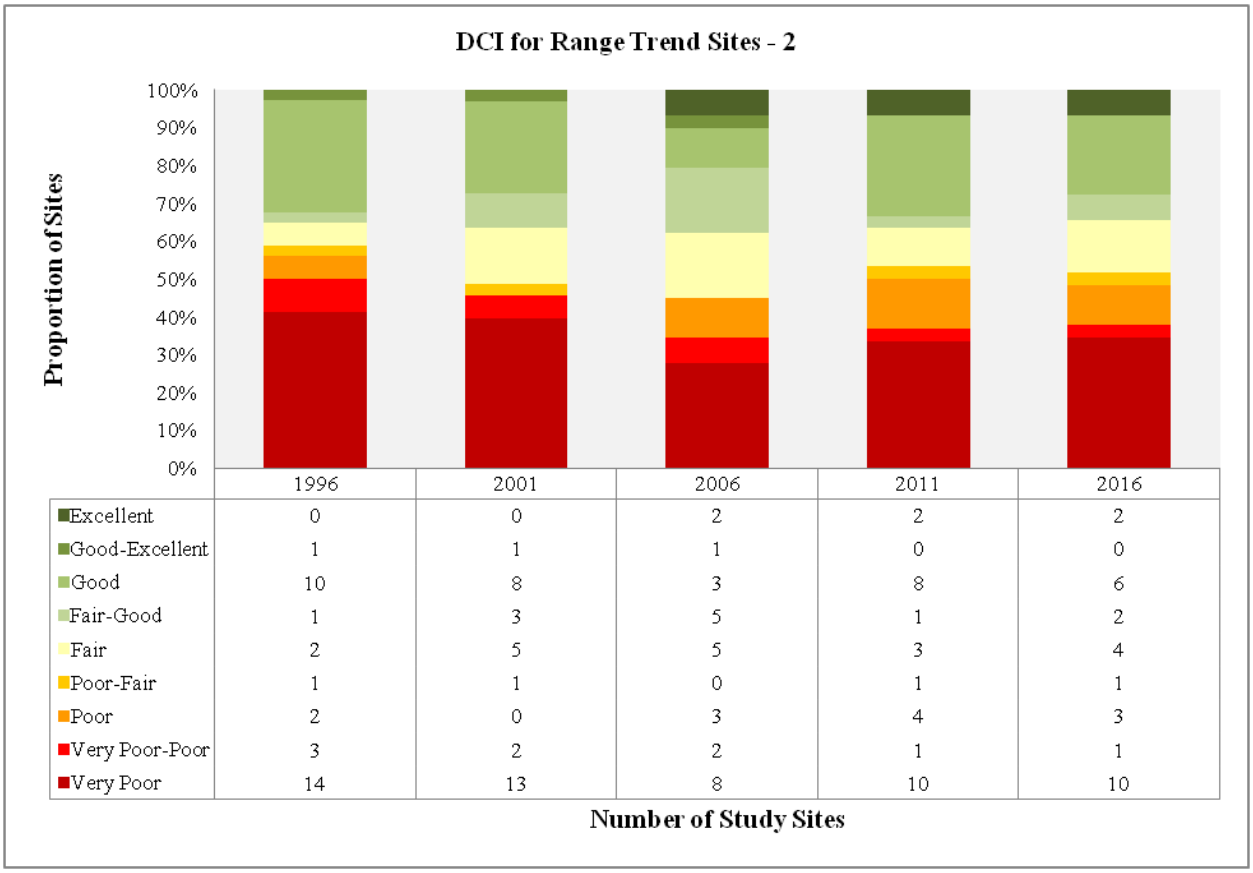


Figure 2.18: Average pellet transect data for Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) study sites in WMU 2, Cache.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Cache management unit has continually changed on the sites sampled since 1996. The Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2016 sample year (Figure 2.19, Table 2.10, Map 2.13). South Crawford Mountains remained in excellent condition, Twin Creek improved from good to excellent, Otter Creek went from excellent to good, and State Line, Braizer Canyon, Higgins Hollow, and Pole Hollow Spring remained in good condition. Wood Pass went from good to fair-good condition while Woodruff Longhill remained in fair-good condition, and North Eden and Woodruff Co-op remained in fair condition. Warrens Spring improved from poor to fair, Mouth of Two Jump Canyon remained in poor-fair condition, and Garden City Canyon, Woodruff Creek, and Coldwater WMA remained in poor condition. Finally, the High Creek, Mouth of Blacksmith Fork, Beirdneau, Second Dam Blacksmith Fork, Hardware Plateau, Meadowville, Right Fork Logan Canyon, Swan Creek, Flat Bottom Canyon, Laketown Canyon, and Hardware Gravel Pit studies are considered to be in very poor or very poor-poor condition generally due to the lack of browse cover and sagebrush diversity and/or the presence of annual grasses. The treated study sites range from very poor to good (Figure 2.20). The Mouth of Blacksmith Fork, Second Dam Blacksmith Fork, Wood Pass, Otter Creek, and Woodruff Co-op studies are also considered to be Range Trend sites and are discussed above. The treated sites have fluctuated as time since treatment has increased. Curtis Ridge Control went from excellent to good and Duck Creek 1 has remained in good condition. Curtis Ridge improved from fair-good to good, Rattlesnake Knoll East went from poor to very poor, and Hardware Plateau Grazed and Blacksmith Fork Grazed stayed in very poor condition (Map 2.13). It is possible given more time and continual monitoring that these sites might improve.



	1996	2001	2006	2011	2016
Excellent	0	0	2	2	2
Good-Excellent	1	1	1	0	0
Good	10	8	3	8	6
Fair-Good	1	3	5	1	2
Fair	2	5	5	3	4
Poor-Fair	1	1	0	1	1
Poor	2	0	3	4	3
Very Poor-Poor	3	2	2	1	1
Very Poor	14	13	8	10	10

Figure 2.19: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 2, Cache.

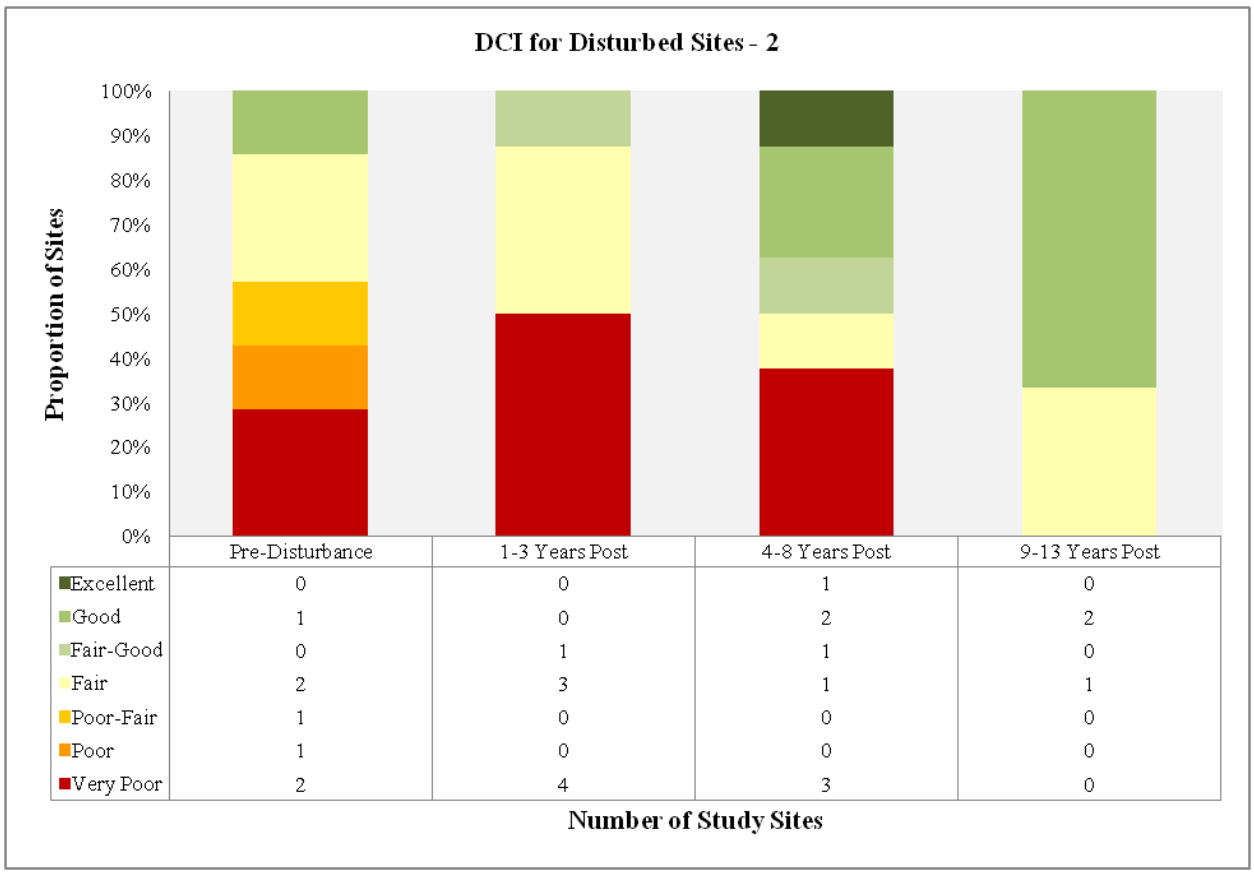


Figure 2.20: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 2, Cache.

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
02-1	1996	18.1	10.3	0.9	5.7	-20.0	2.9	0.0	**17.9**	**VP**
02-1	2001	18.2	9.0	0.5	3.2	-19.3	6.8	0.0	**18.3**	**VP**
02-1	2006	9.8	10.3	15.0	2.4	-14.0	10.0	-4.0	**29.5**	**VP**
02-1	2011	11.7	9.0	0.0	2.6	-8.7	10.0	-2.0	**22.5**	**VP**
02-1	2016	18.6	11.5	1.3	1.0	-11.5	8.6	-4.0	**25.4**	**VP**
02-2	1996	12.3	12.6	13.0	1.6	-20.0	10.0	-2.0	**27.5**	**VP**
02-2	2001	13.7	11.1	0.5	3.5	-20.0	6.9	-2.0	**13.7**	**VP**
02-2	2006	19.7	9.9	0.0	2.6	-20.0	8.1	-2.0	**18.3**	**VP**
02-2	2011	0.0	0.0	0.0	3.4	-20.0	10.0	-2.0	**-8.6**	**VP**
02-2	2016	3.3	0.0	0.0	5.4	-20.0	10.0	0.0	**-1.3**	**VP**
02-4*	1996	8.5	11.4	7.0	13.0	-20.0	10.0	-2.0	**27.9**	**VP**
02-4*	2001	6.8	3.3	0.0	12.7	-13.0	10.0	-2.0	**17.7**	**VP**
02-6*	1996	3.2	0.0	15.0	26.9	-20.0	10.0	-2.0	**33.1**	**VP-P**
02-6*	2001	13.1	13.5	13.8	30.0	-16.7	10.0	0.0	**63.8**	**F-G**
02-9	1996	16.1	12.6	0.6	6.2	-19.6	10.0	-2.0	**23.8**	**VP**
02-9	2001	11.6	8.3	1.6	6.9	-20.0	10.0	-2.0	**16.4**	**VP**
02-9	2006	10.8	8.2	0.0	7.7	-2.6	10.0	-2.0	**32.1**	**VP**
02-9	2011	8.3	7.5	0.0	4.9	-1.9	10.0	-2.0	**26.8**	**VP**
02-9	2016	11.4	5.2	0.0	13.4	-11.1	10.0	-4.0	**24.9**	**VP**
02-12	1996	7.0	0.0	0.0	20.6	-7.2	8.4	-2.0	**26.7**	**VP**
02-12	2001	4.5	0.0	0.0	19.1	-15.5	6.6	0.0	**14.7**	**VP**
02-12	2006	5.1	0.0	0.0	28.0	-6.5	10.0	-2.0	**34.7**	**VP**
02-12	2011	6.6	0.0	0.0	23.4	-19.6	8.8	-2.0	**17.2**	**VP**
02-12	2016	3.6	0.0	0.0	11.8	-20.0	5.8	0.0	**1.2**	**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
02-13	1996	3.2	0.0	0.0	30.0	-7.3	10.0	0.0	**35.9**	**VP**
02-13	2001	2.7	0.0	0.0	30.0	-4.5	10.0	-2.0	**36.2**	**VP**
02-13	2006	1.6	0.0	0.0	30.0	-0.8	10.0	-2.0	**38.8**	**VP-P**
02-13	2011	1.6	0.0	0.0	30.0	-3.3	10.0	-2.0	**36.3**	**VP**
02-13	2016	4.3	0.0	0.0	23.0	-18.3	10.0	0.0	**19.0**	**VP**
02-15*	1996	30.0	8.8	3.4	30.0	-12.3	6.7	0.0	**66.7**	**F-G**
02-15*	2001	30.0	6.7	2.0	30.0	-4.1	10.0	0.0	**74.6**	**G**
02-15*	2006	22.1	11.4	7.1	30.0	-2.5	10.0	0.0	**78.2**	**G-E**
02-16	1996	17.0	10.6	2.9	21.1	-15.1	1.6	0.0	**38.0**	**VP-P**
02-16	2001	17.2	9.2	1.8	30.0	-1.8	3.2	0.0	**59.5**	**F**
02-16	2006	14.2	7.8	0.0	29.8	-2.0	2.1	0.0	**51.9**	**P**
02-16	2011	12.9	7.6	1.3	30.0	-4.3	2.3	0.0	**49.8**	**P**
02-16	2016	11.5	13.0	1.6	30.0	-11.9	2.4	0.0	**46.6**	**P**
02-17	1996	7.5	0.0	0.0	23.8	-14.7	6.2	0.0	**22.7**	**VP**
02-17	2001	5.9	0.0	0.0	28.5	-5.1	7.6	0.0	**36.9**	**VP**
02-17	2006	4.2	0.0	0.0	30.0	-6.1	7.8	0.0	**35.8**	**VP**
02-17	2011	7.0	0.0	0.0	17.1	-17.5	6.0	0.0	**12.5**	**VP**
02-17	2016	13.0	15.0	4.2	18.0	-17.5	5.8	0.0	**38.6**	**VP-P**
02-19	1996	4.4	0.0	0.0	21.4	-1.0	10.0	0.0	**34.8**	**VP**
02-19	2001	5.7	0.0	0.0	13.0	-1.1	10.0	0.0	**27.6**	**VP**
02-19	2006	7.6	0.0	0.0	14.5	-0.5	10.0	-2.0	**29.7**	**VP**
02-19	2011	4.3	0.0	0.0	10.4	-0.4	10.0	0.0	**24.3**	**VP**
02-19	2016	5.7	0.0	0.0	12.8	-9.4	10.0	0.0	**19.1**	**VP**
02-20*	1996	0.1	0.0	7.5	0.5	-18.3	10.0	0.0	**-0.2**	**VP**
02-20*	2001	0.6	0.0	0.0	5.2	-11.5	10.0	0.0	**4.3**	**VP**
02-21	1996	9.2	0.0	0.0	16.9	-10.4	10.0	0.0	**25.7**	**VP**
02-21	2001	7.2	0.0	0.0	22.5	-1.0	10.0	0.0	**38.7**	**VP-P**
02-21	2006	6.2	0.0	0.0	28.3	-1.6	10.0	0.0	**42.9**	**P**
02-21	2011	6.1	0.0	0.0	29.7	-3.9	10.0	0.0	**41.9**	**VP-P**
02-21	2016	5.0	0.0	0.0	24.8	-4.0	10.0	0.0	**35.9**	**VP**
02-23	1996	0.2	0.0	0.0	12.5	-13.9	10.0	-2.0	**6.9**	**VP**
02-23	2001	0.0	0.0	0.0	22.7	-10.0	5.1	-2.0	**15.8**	**VP**
02-23	2006	0.0	0.0	0.0	24.7	-6.5	10.0	-2.0	**26.2**	**VP**
02-23	2011	0.2	0.0	0.0	27.8	-14.0	8.1	-2.0	**20.0**	**VP**
02-23	2016	1.0	0.0	0.0	30.0	-5.4	10.0	0.0	**35.6**	**VP**
02-24*	1996	1.4	0.0	15.0	19.5	-17.8	10.0	0.0	**28.1**	**VP**
02-24*	2001	12.3	12.6	3.0	17.1	-18.5	6.4	0.0	**32.8**	**VP**
02-25	1996	16.9	3.9	8.1	16.4	-20.0	10.0	0.0	**35.3**	**VP**
02-25	2001	9.4	-0.6	7.5	17.2	-12.9	10.0	0.0	**30.6**	**VP**
02-25	2006	9.4	8.6	2.7	17.2	-7.8	10.0	0.0	**40.1**	**VP-P**
02-25	2011	12.7	11.7	6.0	23.1	-5.8	10.0	-2.0	**55.8**	**P-F**
02-25	2016	15.3	14.4	2.0	16.2	-1.4	10.0	-2.0	**54.5**	**P-F**
02-26*	1996	10.7	13.5	12.5	30.0	-6.7	10.0	-2.0	**68.0**	**G**
02-26*	2001	16.6	12.0	2.5	30.0	-0.7	10.0	0.0	**70.4**	**G**
02-27	1996	6.2	0.0	0.0	30.0	-6.4	3.6	0.0	**33.5**	**VP**
02-27	2001	4.8	0.0	0.0	29.6	-4.3	3.6	0.0	**33.7**	**VP**
02-27	2006	6.0	0.0	0.0	29.5	-3.7	4.2	0.0	**36.1**	**VP**
02-27	2011	6.0	0.0	0.0	28.6	-8.4	4.5	0.0	**30.7**	**VP**
02-27	2016	5.5	0.0	0.0	21.0	-10.9	1.8	0.0	**17.5**	**VP**
02-28	1996	19.5	2.2	1.6	30.0	-3.2	1.8	0.0	**51.8**	**G**
02-28	2001	16.9	0.0	1.4	30.0	-1.6	2.7	0.0	**49.3**	**G**
02-28	2006	10.2	-2.3	8.7	30.0	-2.6	4.3	0.0	**48.3**	**G**
02-28	2011	5.9	-5.4	2.1	30.0	-4.9	8.4	0.0	**36.0**	**F**
02-28	2016	6.9	0.6	4.6	30.0	-13.6	4.6	0.0	**33.1**	**F**

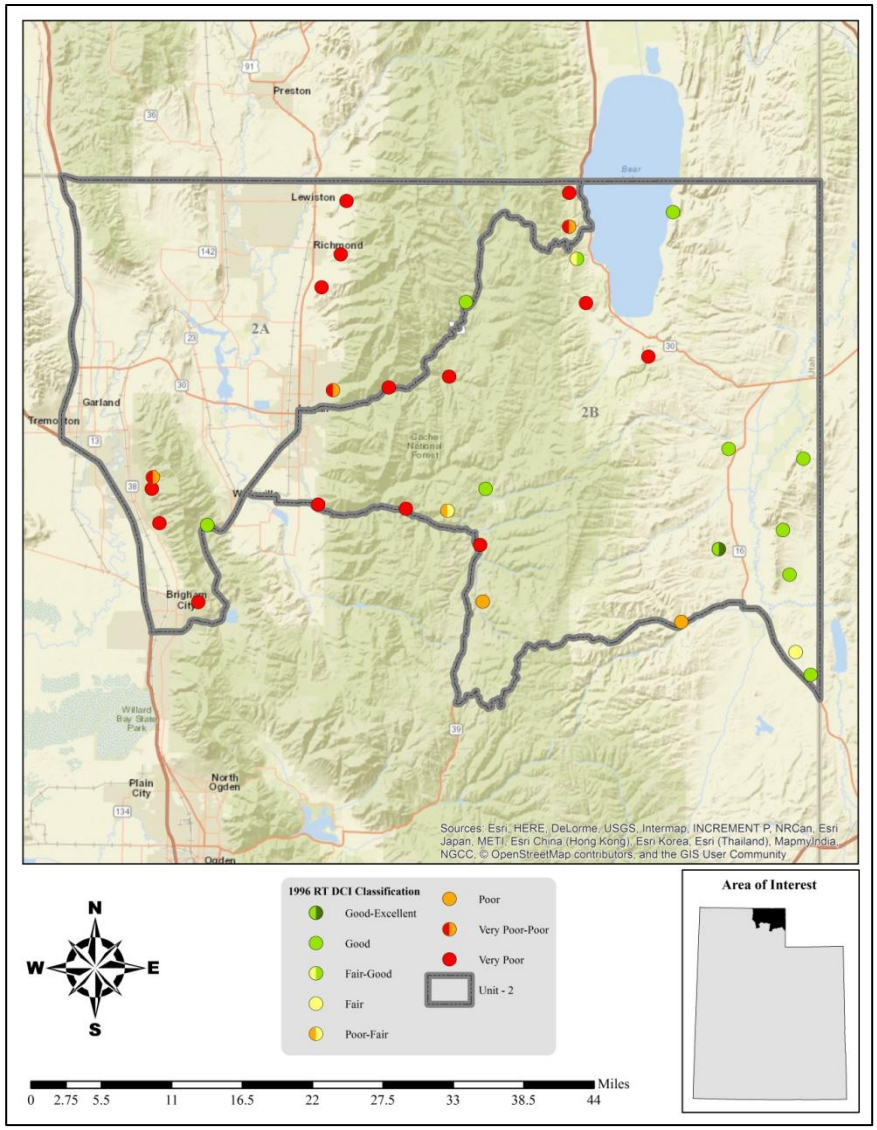
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02-29	1996	6.9	2.7	0.0	19.9	-0.1	8.2	0.0	**37.6**	**P**
02-29	2001	6.6	-2.1	3.5	21.5	0.0	6.7	0.0	**36.2**	**VP-P**
02-29	2006	5.7	-4.8	3.0	24.1	0.0	10.0	0.0	**38.0**	**P**
02-29	2011	4.6	-0.6	4.5	23.5	0.0	10.0	0.0	**41.9**	**P**
02-29	2016	5.9	0.0	0.0	25.6	-0.1	10.0	0.0	**41.4**	**P**
02-30	1996	29.2	5.4	1.0	9.5	0.0	6.2	0.0	**51.3**	**G**
02-30	2001	30.0	8.7	0.0	12.6	0.0	5.3	0.0	**56.6**	**G**
02-30	2006	27.5	6.0	2.0	10.1	0.0	0.0	0.0	**45.6**	**F-G**
02-30	2011	25.1	5.4	4.0	17.8	0.0	0.0	0.0	**52.2**	**G**
02-30	2016	25.5	7.8	6.0	14.6	-1.9	4.2	0.0	**56.2**	**G**
02-31	1996	21.0	6.2	2.9	16.1	0.0	7.2	0.0	**53.4**	**G**
02-31	2001	27.9	9.3	1.5	17.4	0.0	8.3	0.0	**64.5**	**G-E**
02-31	2006	24.9	8.4	1.9	22.7	0.0	10.0	0.0	**67.9**	**E**
02-31	2011	29.1	9.4	9.0	24.0	0.0	10.0	0.0	**81.4**	**E**
02-31	2016	26.6	9.1	4.2	25.4	-0.1	9.0	0.0	**74.3**	**E**
02-32	1996	16.8	6.8	7.1	11.7	-0.1	6.0	0.0	**48.3**	**G**
02-32	2001	17.3	7.1	3.9	16.9	-0.3	8.3	-2.0	**51.2**	**G**
02-32	2006	14.4	3.4	2.0	15.2	0.0	8.9	0.0	**43.9**	**F-G**
02-32	2011	16.1	9.2	13.5	14.0	0.0	6.2	0.0	**59.0**	**G**
02-32	2016	14.9	12.0	5.1	13.8	-1.1	6.0	-4.0	**46.7**	**F-G**
02-33	1996	16.1	10.4	1.8	30.0	-0.2	9.5	0.0	**67.6**	**G**
02-33	2001	19.2	10.9	3.0	30.0	-0.5	10.0	0.0	**72.7**	**G**
02-33	2006	14.2	7.5	2.6	30.0	-0.4	10.0	0.0	**63.8**	**F-G**
02-33	2011	17.0	9.2	7.6	30.0	-1.8	10.0	0.0	**72.0**	**G**
02-33	2016	14.3	10.2	9.9	30.0	-2.5	9.0	0.0	**70.8**	**G**
02-34	1996	20.3	12.3	7.9	30.0	0.0	2.7	0.0	**73.3**	**G**
02-34	2001	14.2	2.7	6.0	26.3	0.0	1.5	0.0	**50.8**	**P-F**
02-34	2006	11.4	8.7	3.5	30.0	0.0	8.2	0.0	**61.8**	**F**
02-34	2011	21.4	12.6	15.0	30.0	0.0	4.6	0.0	**83.6**	**E**
02-34	2016	19.1	13.5	15.0	25.6	0.0	4.4	0.0	**77.6**	**G**
02-35	1996	25.7	9.3	9.5	30.0	0.0	4.2	0.0	**78.7**	**G-E**
02-35	2001	30.0	0.6	1.0	30.0	0.0	4.4	0.0	**66.0**	**F-G**
02-35	2006	28.4	4.2	0.5	30.0	0.0	7.0	0.0	**70.2**	**G**
02-35	2011	30.0	4.5	1.0	30.0	0.0	10.0	0.0	**75.5**	**G**
02-35	2016	28.4	6.3	1.5	30.0	0.0	10.0	0.0	**76.2**	**G**
02-36	1996	1.1	0.0	0.0	30.0	0.0	2.4	0.0	**33.5**	**F**
02-36	2001	1.9	0.0	0.0	30.0	0.0	1.7	0.0	**33.6**	**F**
02-36	2006	1.1	0.0	0.0	30.0	0.0	3.7	0.0	**34.8**	**F**
02-36	2011	2.0	0.0	0.0	30.0	0.0	10.0	0.0	**42.0**	**F**
02-36	2016	4.4	0.0	0.0	30.0	0.0	1.0	0.0	**35.4**	**F**
02-38	1996	12.0	13.6	9.4	30.0	0.0	10.0	0.0	**75.0**	**G**
02-38	2001	18.3	11.7	1.8	30.0	0.0	10.0	0.0	**71.8**	**F-G**
02-38	2006	16.7	12.4	3.4	30.0	0.0	10.0	0.0	**72.4**	**G**
02-38	2011	17.5	9.7	6.6	30.0	0.0	10.0	0.0	**73.8**	**G**
02-38	2016	25.6	14.3	15.0	30.0	-0.8	10.0	0.0	**94.0**	**E**
02-39	1996	27.4	13.7	5.1	30.0	-3.1	10.0	0.0	**83.1**	**G**
02-39	2001	30.0	9.8	5.3	30.0	-0.2	10.0	0.0	**84.9**	**G**
02-39	2006	30.0	11.4	1.3	18.9	0.0	10.0	0.0	**71.6**	**F-G**
02-39	2011	30.0	12.2	5.5	30.0	-0.3	10.0	0.0	**87.4**	**G**
02-39	2016	30.0	14.1	3.9	25.6	0.0	10.0	0.0	**83.6**	**G**
02-40	1996	21.7	11.1	6.6	11.0	-4.5	9.6	-2.0	**53.5**	**P-F**
02-40	2001	29.9	10.7	2.5	10.1	-0.7	8.3	-2.0	**58.8**	**F**
02-40	2006	22.8	9.5	3.3	14.9	-0.7	10.0	0.0	**59.8**	**F**
02-40	2011	19.9	12.0	4.6	8.9	-1.3	10.0	-2.0	**52.1**	**P**
02-40	2016	28.0	10.3	2.4	15.8	-6.4	10.0	0.0	**60.2**	**F**
02-41*	1996	17.5	10.4	0.0	16.3	-10.5	10.0	0.0	**43.7**	**P**
02-41*	2001	18.9	10.8	3.9	25.4	-13.1	10.0	0.0	**55.9**	**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
02-42	2011	21.0	2.3	1.4	4.7	-19.1	10.0	0.0	**20.4**	**VP**
02-42	2016	27.2	13.6	3.4	3.6	-19.9	10.0	0.0	**37.9**	**VP**
02-43	2011	30.0	4.2	0.5	27.0	0.0	3.0	0.0	**64.8**	**F-G**
02-43	2016	22.6	9.6	2.0	30.0	0.0	2.2	0.0	**66.4**	**F-G**
02R-5	1998	23.0	13.0	3.4	5.5	-13.6	10.0	0.0	**41.2**	**VP-P**
02R-5	2006	30.0	11.2	0.0	16.8	-6.0	10.0	-2.0	**60.1**	**F**
02R-5	2011	30.0	10.9	0.5	1.7	-10.0	10.0	0.0	**43.1**	**P**
02R-5	2016	30.0	14.7	0.5	1.0	-9.5	10.0	0.0	**46.7**	**P**

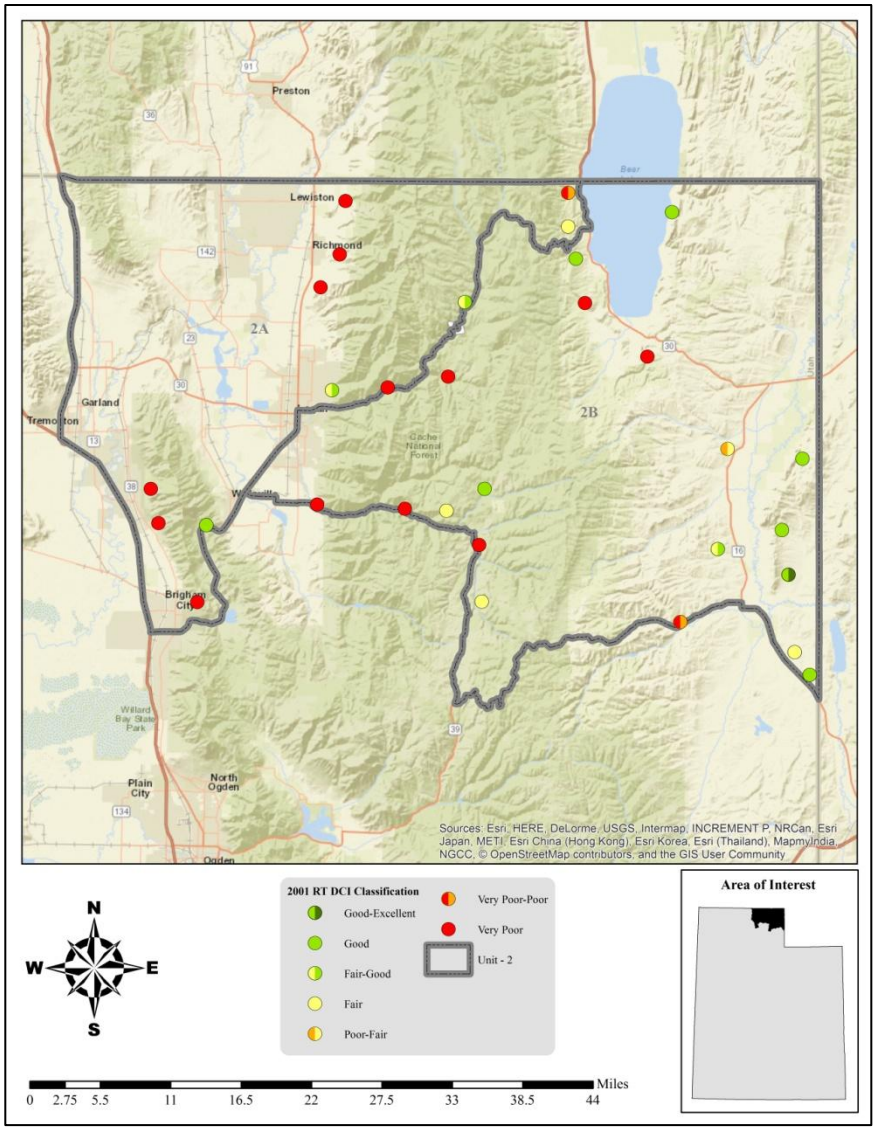
Table 2.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 2, Cache.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

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
02R-8	2003	30.0	5.7	0.0	19.2	0.0	10.0	0.0	**64.9**	**F**
02R-8	2006	11.5	8.1	0.0	30.0	0.0	10.0	0.0	**59.6**	**F**
02R-8	2011	23.5	11.1	0.0	30.0	0.0	10.0	0.0	**74.6**	**G**
02R-8	2016	29.7	14.4	0.0	30.0	0.0	10.0	0.0	**84.1**	**G**
02R-11	2005	10.3	14.8	0.1	21.4	-6.1	7.8	0.0	**48.3**	**P**
02R-11	2013	6.9	0.0	0.0	8.8	-7.9	10.0	0.0	**17.8**	**VP**
02R-16	2006	30.0	10.0	4.3	17.6	0.0	10.0	0.0	**71.9**	**F-G**
02R-16	2013	30.0	13.1	5.1	16.6	0.0	10.0	0.0	**74.8**	**G**
02R-21	2007	0.1	0.0	0.0	30.0	-1.9	4.0	0.0	**32.3**	**VP**
02R-21	2013	0.0	0.0	0.0	30.0	-1.1	6.2	0.0	**35.2**	**VP**
02R-23	2007	1.6	0.0	0.0	1.4	-2.7	5.0	0.0	**5.3**	**VP**
02R-23	2013	2.3	0.0	0.0	15.2	-18.0	9.6	0.0	**9.1**	**VP**
02R-15	2006	30.0	11.1	5.8	27.2	0.0	10.0	0.0	**84.0**	**E**
02R-15	2011	29.2	11.3	6.4	20.0	0.0	10.0	0.0	**76.9**	**G**

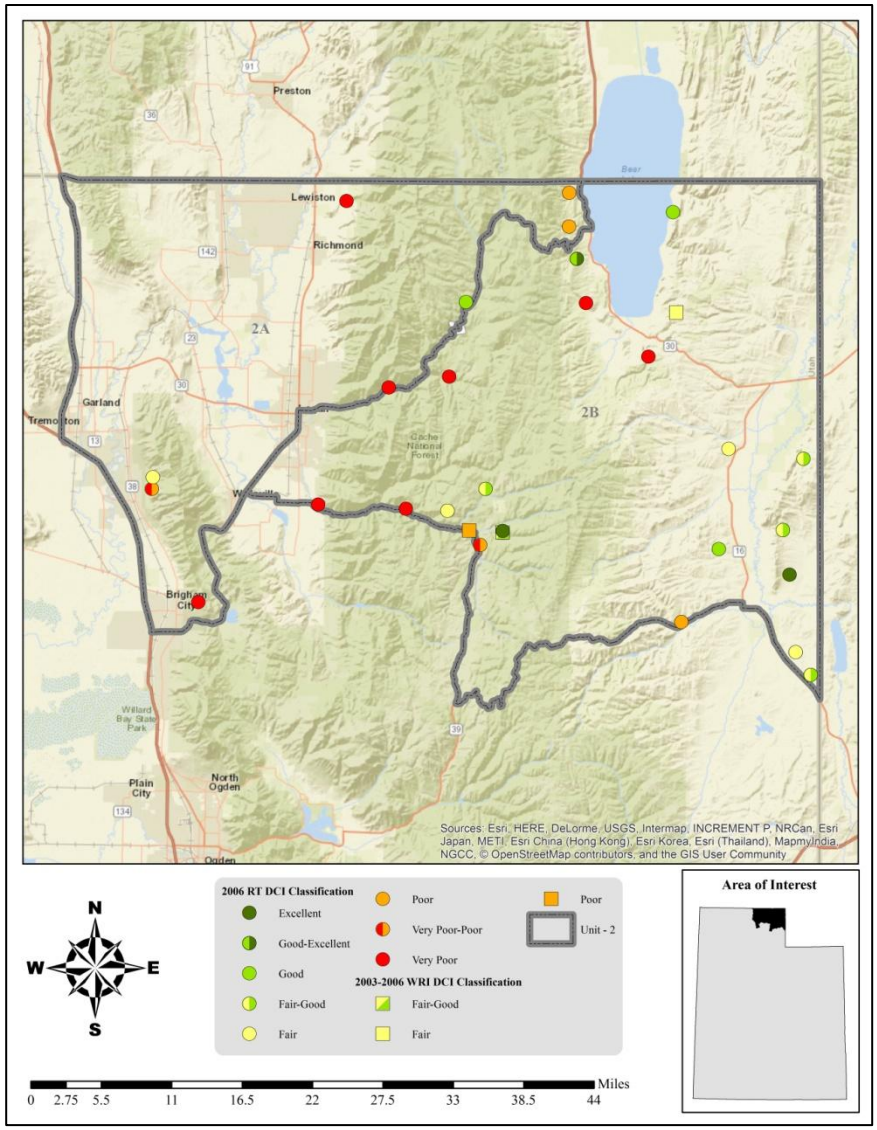
Table 2.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 2, Cache.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



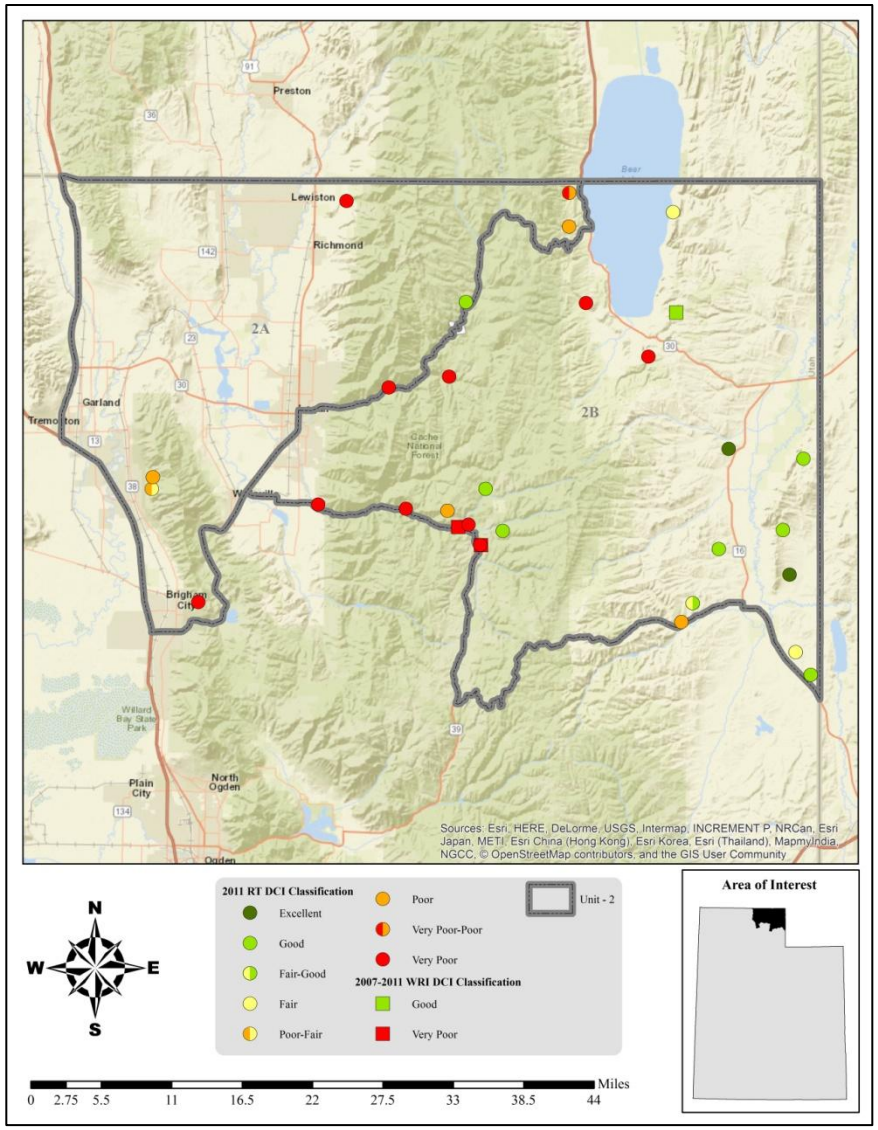
Map 2.9: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 2, Cache.



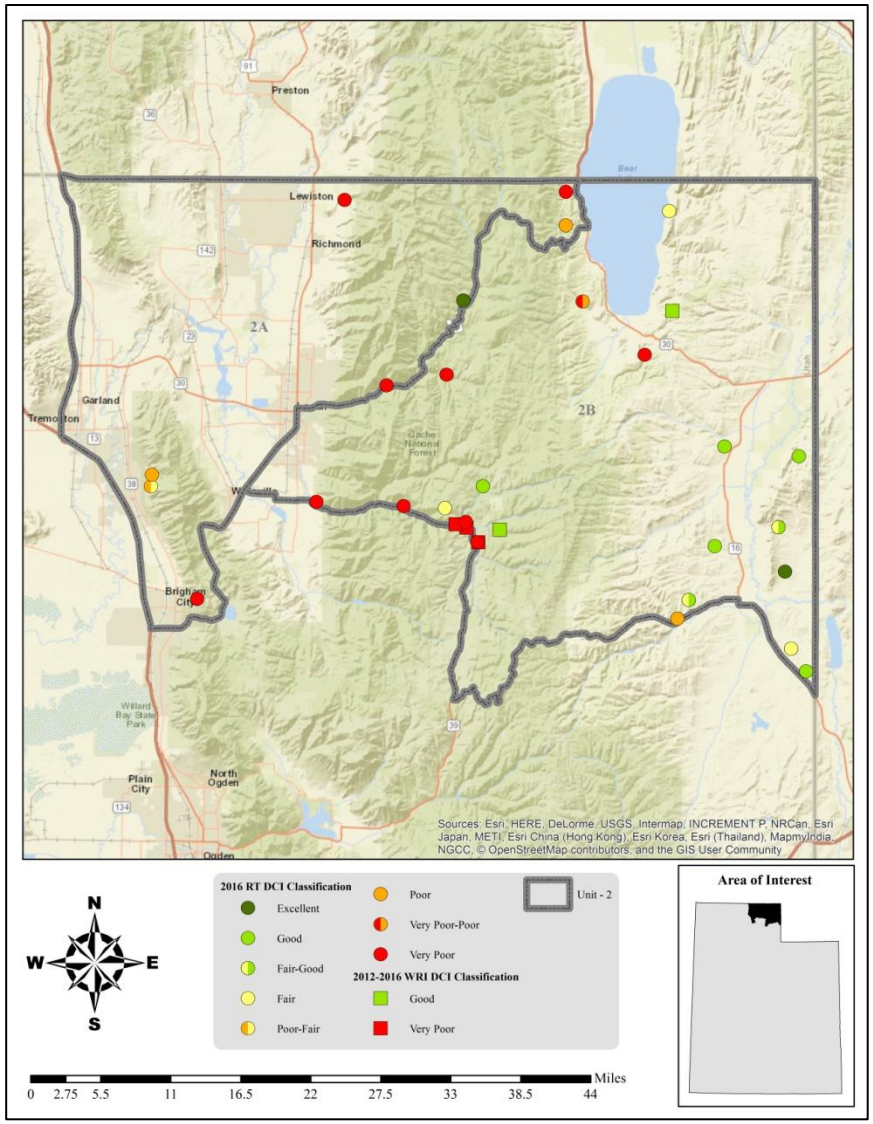
Map 2.10: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 2, Cache.



Map 2.11: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 2, Cache.



Map 2.12:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 2, Cache.



Map 2.13: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 2, Cache.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
02-1	High Creek	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
02-2	Mouth of Blacksmith Fork	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	High	Reduced diversity of desirable grass and forb species
02-9	Beirdneau	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
02-12	Second Dam Blacksmith Fork	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
02-13	Hardware Plateau	Annual Grass	High	Increased fire potential
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
02-16	Garden City 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
02-17	Meadowville	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
02-19	Right Fork Logan Canyon	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
02-21	Swan Creek	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
02-23	Flat Bottom Canyon	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
02-25	Mouth of Two Jump Canyon	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-27	Laketown Canyon	Annual Grass	High	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-28	North Eden	Annual Grass	High	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-29	Woodruff Creek	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
02-30	State Line	None Identified		
02-31	South Crawford Mountains	None Identified		
02-32	Wood Pass	Annual Grass	Low	Increased fire potential
		Noxious Weed Species	Moderate	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-33	Braizer Canyon	Annual Grass	Low	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-34	Otter Creek	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
02-35	Higgins Hollow	None Identified		
02-36	Woodruff Co-op	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
02-38	Twin Creek	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
02-39	Pole Hollow Spring	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-40	Warrens Spring	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-42	Hardware Gravel Pit	Annual Grass	High	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02-43	Woodruff Longhill	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
02R-5	Coldwater WMA	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
02R-6	Duck Creek 3 Low	None Identified		
02R-8	Duck Creek 1	None Identified		
02R-9	Rabbit Creek Burn	Annual Grass	Low	Increased fire potential
02R-10	Rabbit Creek Burn Seeded	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
02R-11	Rattlesnake Knoll East	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
02R-15	Curtis Ridge Control	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02R-16	Curtis Ridge	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
02R-20	Squaw Flat North	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02R-21	Hardware Plateau Grazed	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
02R-23	Blacksmith Fork Grazed	Annual Grass	High	Increased fire potential
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor

Table 2.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 2, Cache. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The study sites on the Cache management unit that are classified as high elevation Mountain (Sagebrush) sites range from very poor to excellent condition. This ecological type generally supports a varied community of sagebrush and other browse species for big game winter ranges. In addition, there are shrub, grass and forb communities for big game summer range. The understory condition varies greatly between study locations; perennial forbs and grasses are present and diverse on some studies such as Twin Creek, but there are several sites such as Meadowville and Mouth of Two Jump Canyon with high cover of invasive annual and perennial grasses. Conifer encroachment is also occurring on most studies, which may reduce the vigor and health of the shrub and herbaceous understory.

It is recommended that work to reduce conifer encroachment (bullhog, chaining, lop and scatter, etc) continue or begin in these communities. On some sites, management of annual grasses might be necessary through herbicide application. Introduced perennial grasses may also need management through changes in grazing or restoration of competitive native species. When reseeding, care should be taken in species selection and preference should be given to native species when possible.

Mountain (Curlleaf Mountain Mahogany)

This high elevation ecological type generally supports curlleaf mountain mahogany communities. The study sites located in the Cache management unit that are considered to be of this ecological type range from very poor to poor condition for winter range for deer. The site includes other browse species as well as some perennial grass and forb species. The understory on both sites has invasive perennial and annual grasses present: these species can be aggressive and reduce the abundance of more desirable native forbs and grasses. There is some conifer encroachment occurring which may reduce shrub and herbaceous understory as woodland succession continues.

It is recommended that management of the conifer encroachment (bullhog, chaining, lop and scatter, etc) continue or begin. On some of these communities, management of annual grasses may be necessary through herbicide application and establishment of competitive perennial native species. Introduced perennial grasses may also need management through establishment of competitive species. When reseeding, care should be taken in species selection and preference should be given to native species when possible.

Mountain (Browse)

The study sites that are classified as Mountain (Browse) ecological types are considered to be in very poor condition for deer winter range. These sites support some perennial grasses and forbs, but the herbaceous understory is generally dominated by introduced annual grasses which can reduce the abundance of more desirable native forbs and grasses. There are also some noxious weeds present in the understories of some studies. In addition, conifer communities are currently in Phase I succession on the Second Dam Blacksmith and Right Fork Logan Canyon study sites.

It is recommended that work to reduce encroachment of pinyon and juniper (bullhog, chaining, lop and scatter, etc) continue or begin. In some of these communities, management of annual grasses may be necessary with herbicide application and establishment of competitive perennial native species. On sites with noxious weeds, there are limited options to deal with Dyer's woad (*Isatis tinctoria*): the best treatment is to use integrated pest management in order to limit the plant. When reseeding the understory, care should be taken in species selection and preference should be given to native species when possible.

Mountain (Shrub)

This high elevation mountain ecological type generally supports shrub and perennial grass communities. The study site located in the Cache management unit that is classified as a Mountain (Shrub) ecological site is considered to be in very poor condition for deer winter range. The study site does have good cover from perennial grasses, but is limited in forbs. In addition, the site has been invaded by annual grasses, primarily cheatgrass, which increases the fuel loads and the risk of wildfire. Finally, this study site is at risk of pinyon-juniper encroachment, which can reduce understory shrub and herbaceous production.

It is recommended that management of the conifer community (bullhog, chaining, lop and scatter, etc) continue or begin. Management of annual grasses may be necessary through application of herbicide and establishment of competitive perennial native species. When reseeding, care should be taken in species selection and preference should be given to native species when possible.

Upland (Sagebrush)

The study sites that are designated as being of the Upland (Sagebrush) ecological type are considered to be in very poor to good condition for deer winter range on the Cache management unit. These communities support shrub populations that provide browse in winters. Annual grasses are a component of the understory on some of the study sites, and have the potential to increase fuel loads and exacerbate the risk of wildfire. Non-native perennial grasses are also a concern on several study sites. The noxious weed jointed goatgrass (*Aegilops cylindrica*) has invaded the High Creek site: this is a threat due to the grass outcompeting desirable native species. There is some conifer encroachment occurring, which may reduce shrub and herbaceous understory as the woodland succession continues.

It is recommended that work to reduce encroachment of pinyon and juniper (bullhog, chaining, lop and scatter, etc) continue or begin. When reseeding, care should be taken in species selection and preference should be given to native species when possible. Noxious weed control may be necessary on some sites and would include herbicide application and seeding to re-establish native perennial forbs and grass populations.

Upland (Black Sagebrush)

The study site that is considered to be of this mid elevation ecological type is considered to be in good condition for deer winter range on the Cache management unit. This community supports a population of black sagebrush and other browse species. Annual grasses are a component of this study site, and may increase fuel loads and the risk of wildfire. There is some conifer encroachment occurring, which may reduce the shrub and herbaceous understory as woodland succession communities.

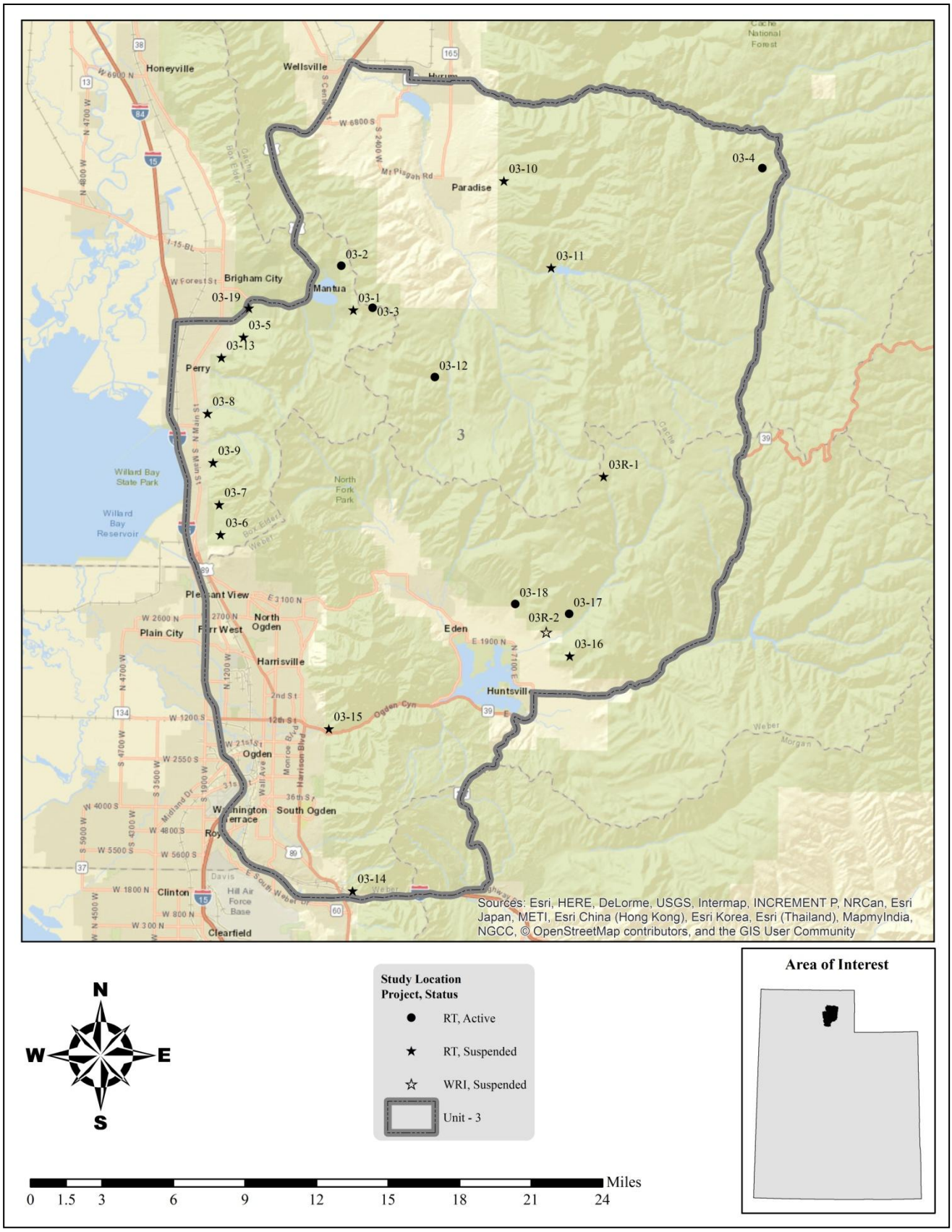
It is recommended that management of the conifer community (bullhog, chaining, lop and scatter, etc) continue or begin. When reseeding, care should be taken in species selection and preference should be given to native species when possible.

Semidesert (Sagebrush)

The study sites that are classified as Semidesert (Sagebrush) ecological types are considered to be in fair to excellent condition for deer winter range on the Cache management unit. The community supports a mix of sagebrush and other browse species that can provide valuable browse in winter. Introduced annual grasses have the potential to invade some study sites, which exacerbates the risk of wildfire due to increased fuel loads. In addition, introduced perennial grasses are present on the Woodruff Co-op site; while they do provide valuable forage, these grass species can compete with other more desirable native forbs and grasses. On Woods Pass, there is the noxious weed gypsyflower (*Cynoglossum officinale*) present. There is some conifer encroachment occurring, which may reduce the shrub and herbaceous understory as woodland succession continues.

It is recommended that management of the conifer community (bullhog, chaining, lop and scatter, etc) continue or begin. When reseeding, care should be taken in species selection and preference should be given to native species when possible. Noxious weed control might be necessary on some studies and would include herbicide treatment (if feasible) for the infestation. Finally, introduced annual grass control may be necessary on some studies and could include herbicide application and seeding.

3. WILDLIFE MANAGEMENT UNIT 3 – OGDEN



WILDLIFE MANAGEMENT UNIT 3 – OGDEN

Boundary Description

Weber, Box Elder, Cache, and Morgan Counties – Boundary begins at Hyrum and SR-101; east on SR-101 to Ant Flat Road (at Hardware Ranch); south on this road to SR-39; west and south on SR-39 to SR-167 (Trappers Loop Road); south on SR-167 to SR-30 at Mountain Green; west along SR-30 to Interstate 84; west on I-84 to Interstate 15; north on I-15 to US-191; east and north on US-91 to SR-101; east on SR-101 to Hyrum.

Management Unit Description

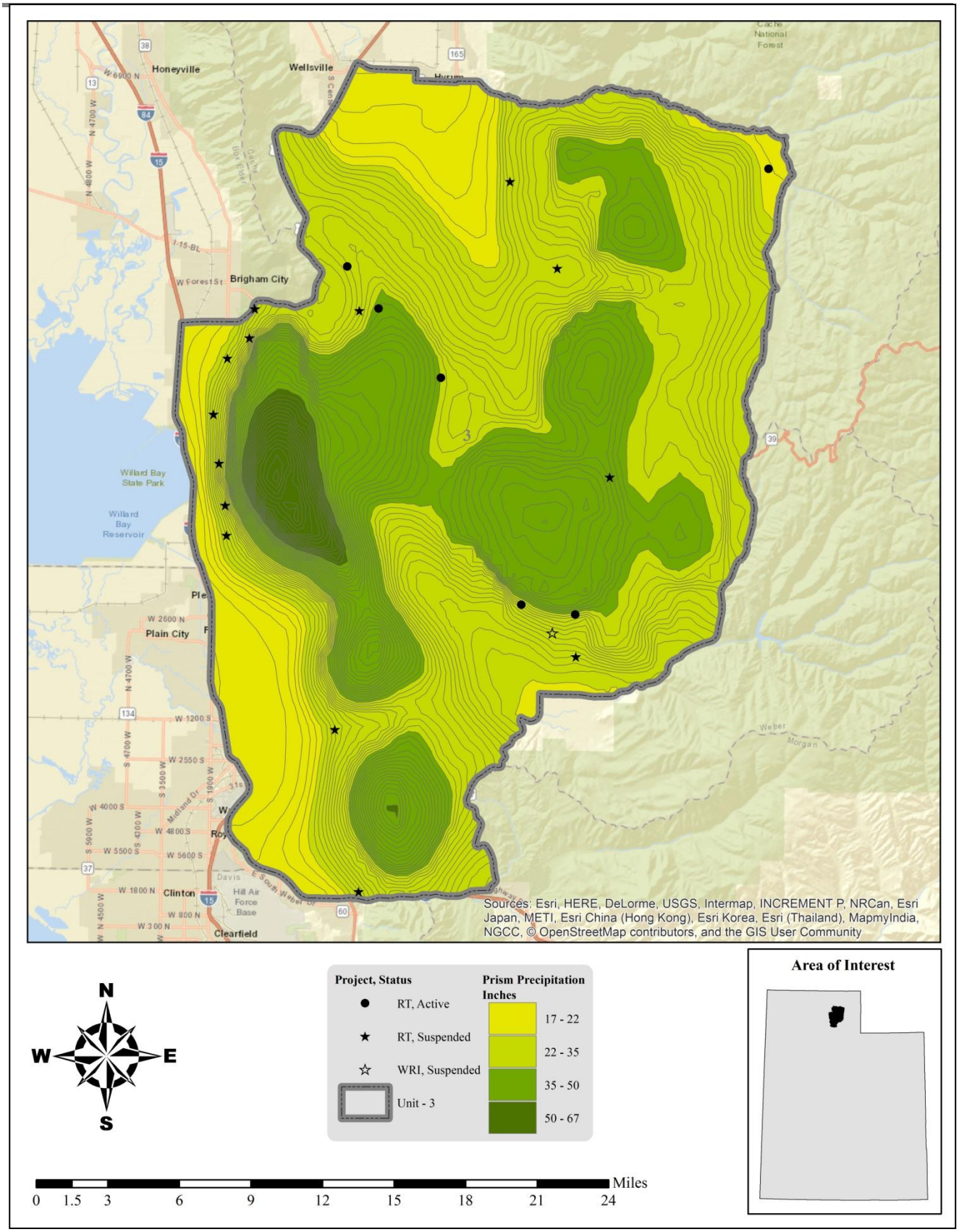
Geography

The Ogden Management Unit is located within Weber, Cache, Box Elder, and Morgan counties. Municipalities located within or along the unit boundaries include: Hyrum, Wellsville, Mantua, Perry, Willard, Ogden, Mountain Green, and Huntsville. The major drainages are the Little Bear River, Ogden River, and Box Elder Creek. Smaller drainages include Davenport Creek, Paradise Dry Canyon, Hyrum Dry Canyon, Hyrum Green Canyon, Perry Canyon, and Willard Canyon. The topography is steep and rough on the western face of the Wasatch Mountains above Willard, Perry, Ogden, and east of Avon and Paradise, and the topography is gentler in between. Elevation ranges from 4,400 feet near Willard to 9,764 feet on Willard Peak.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 17 inches on the southwestern edge near Ogden to 66 inches on Willard Peak. All of the Range Trend and WRI monitoring studies on the unit occur within 21-39 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 Northern Mountains division (Division 5). 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, 2017).



Map 3.1: The 1981-2010 PRISM Precipitation Model for WMU 3, Ogden (PRISM Climate Group, Oregon State University, 2013).

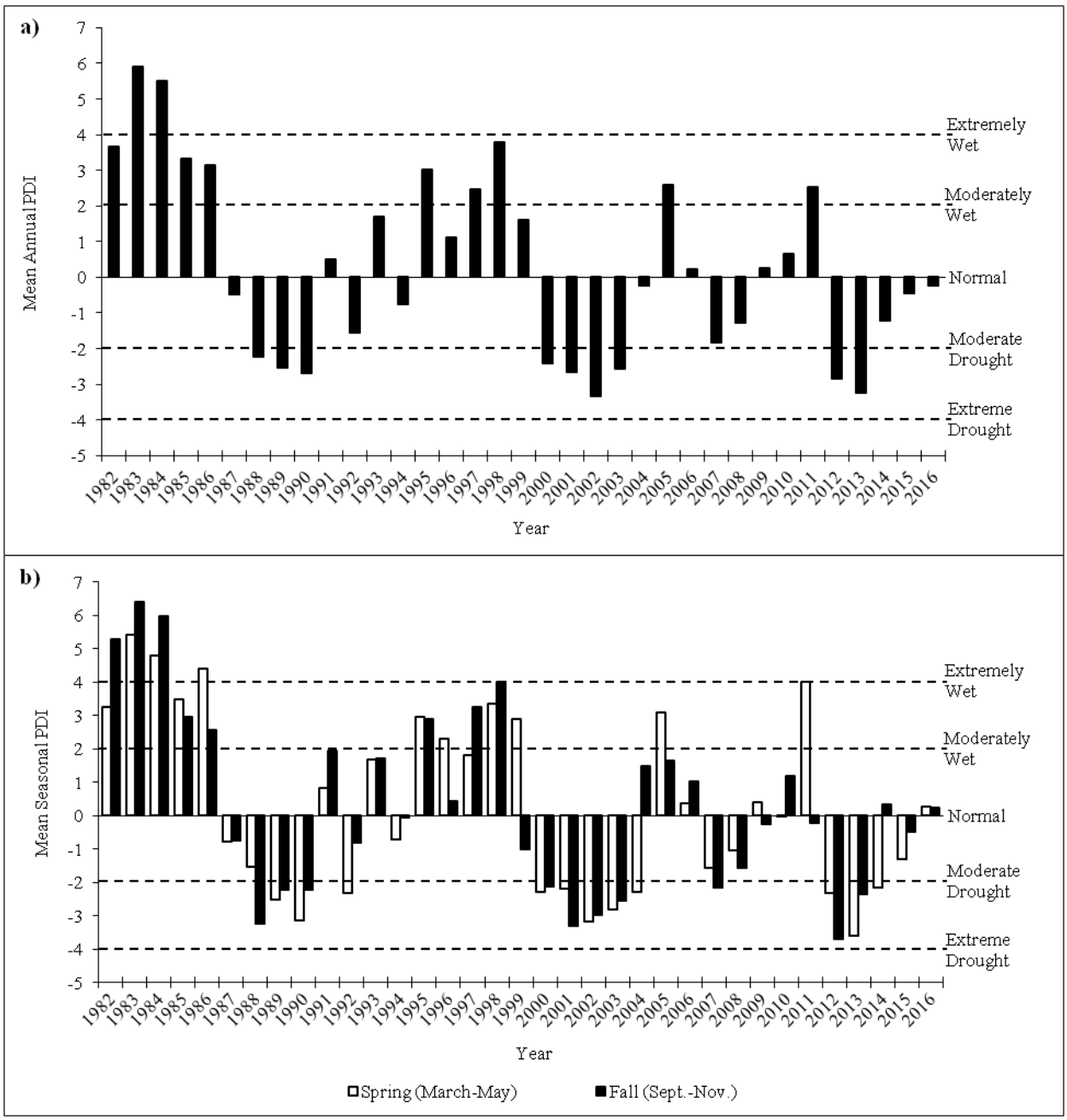
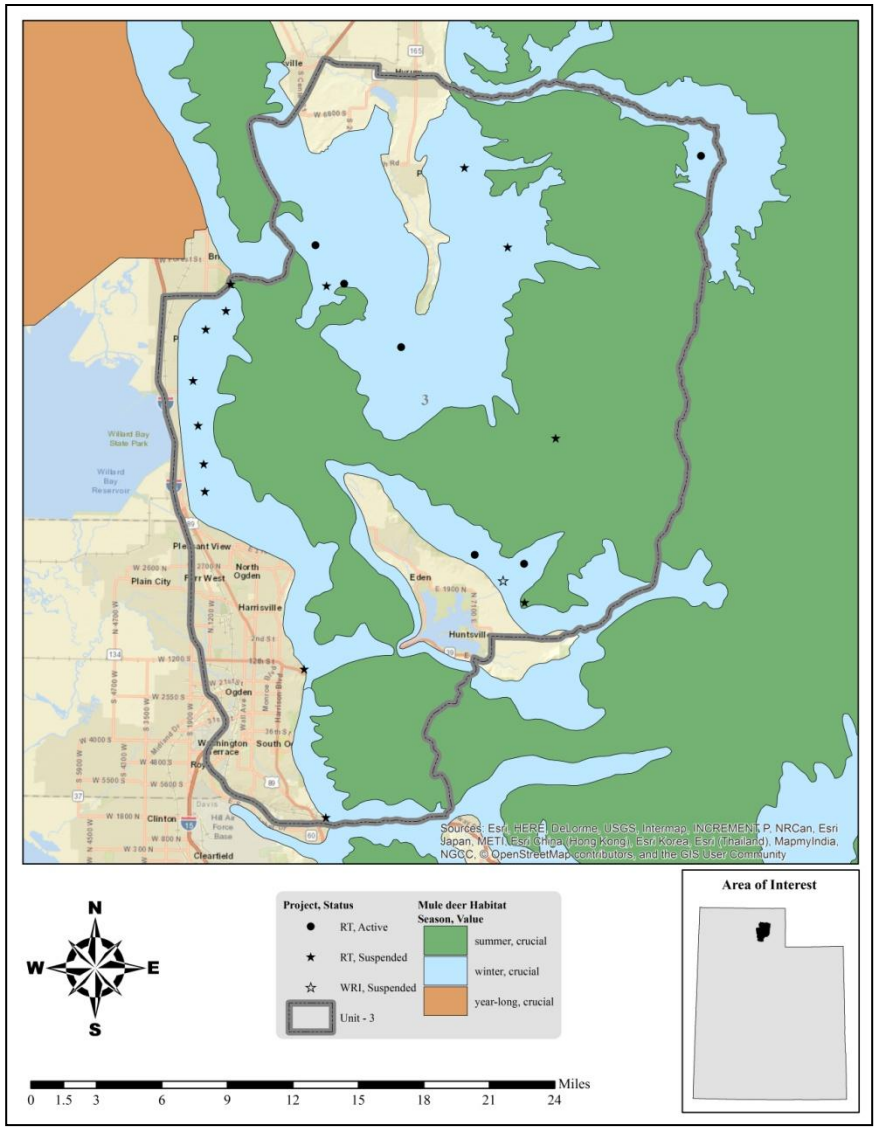


Figure 3.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

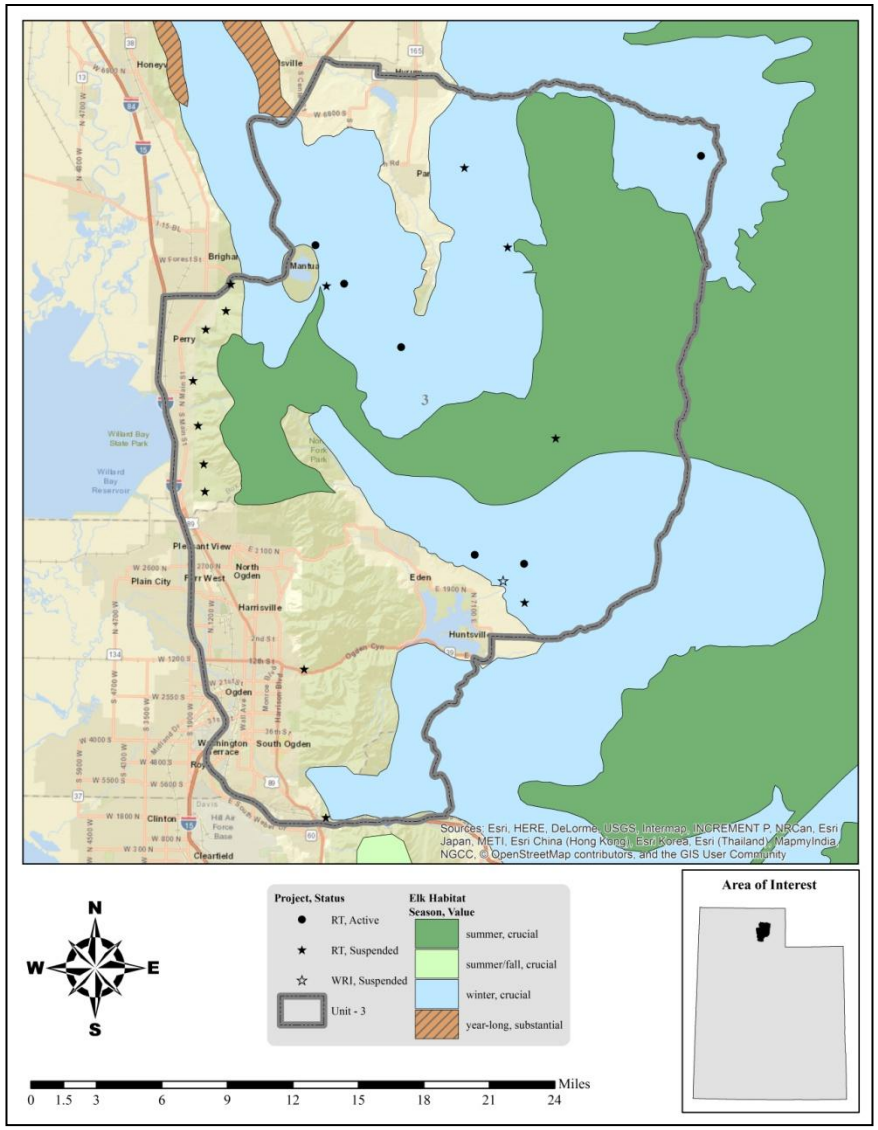
Big Game Habitat

There are approximately 140,000 acres in Unit 3 that are considered to be deer winter range and approximately 166,000 acres that are considered to be elk winter range (Table 3.1, Map 3.2, Map 3.3). 78% of deer winter range is privately owned, 16% is managed by the US Forest Service (USFS), 6% is administered by the Utah Division of Wildlife Resources (UDWR), and less than 1% is owned by Utah State Parks (USP). A majority (66%) of the summer range is also privately owned, 24% is managed by the USFS, 6% is administrated by UDWR, and the Utah School and Institutional Trust Lands Administration (SITLA) owns the remaining 4% (Table 3.2, Map 3.2, Map 3.5).

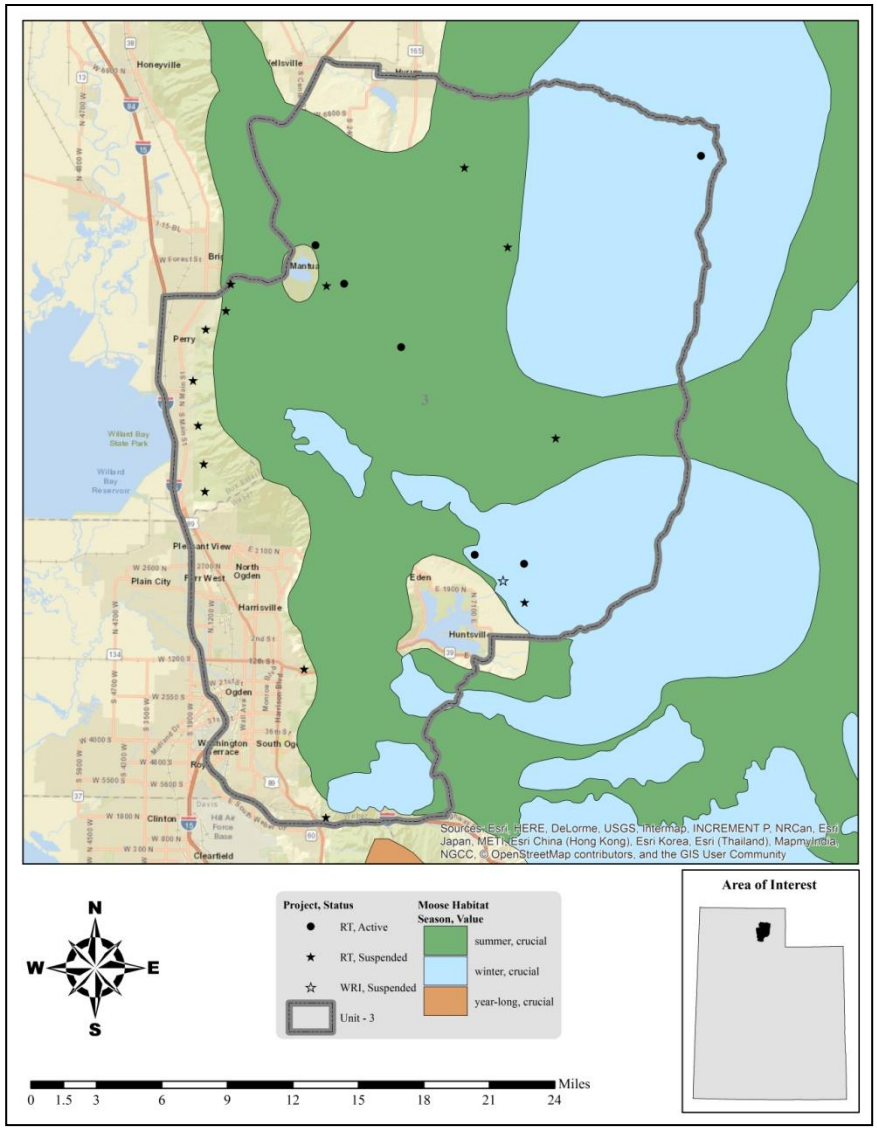
Deer wintering areas are found between 4,600 and 7,000 feet on the Wasatch face above Willard and Perry, between 5,100 and 7,000 feet north and east of Mantua Reservoir, from 5,600 to 7,000 feet in Threemile Canyon, and between 5,400 and 7,000 feet slopes on the southeast side of Cache Valley above Paradise and Avon. During severe winters, snow restricts deer use to Threemile Canyon, the East Fork of the Little Bear River, the area south of Porcupine Reservoir, Paradise Dry Canyon, Hyrum Dry Canyon, Perry Canyon, and the southeast corner of the unit south of Willard (King & Muir, 1971).



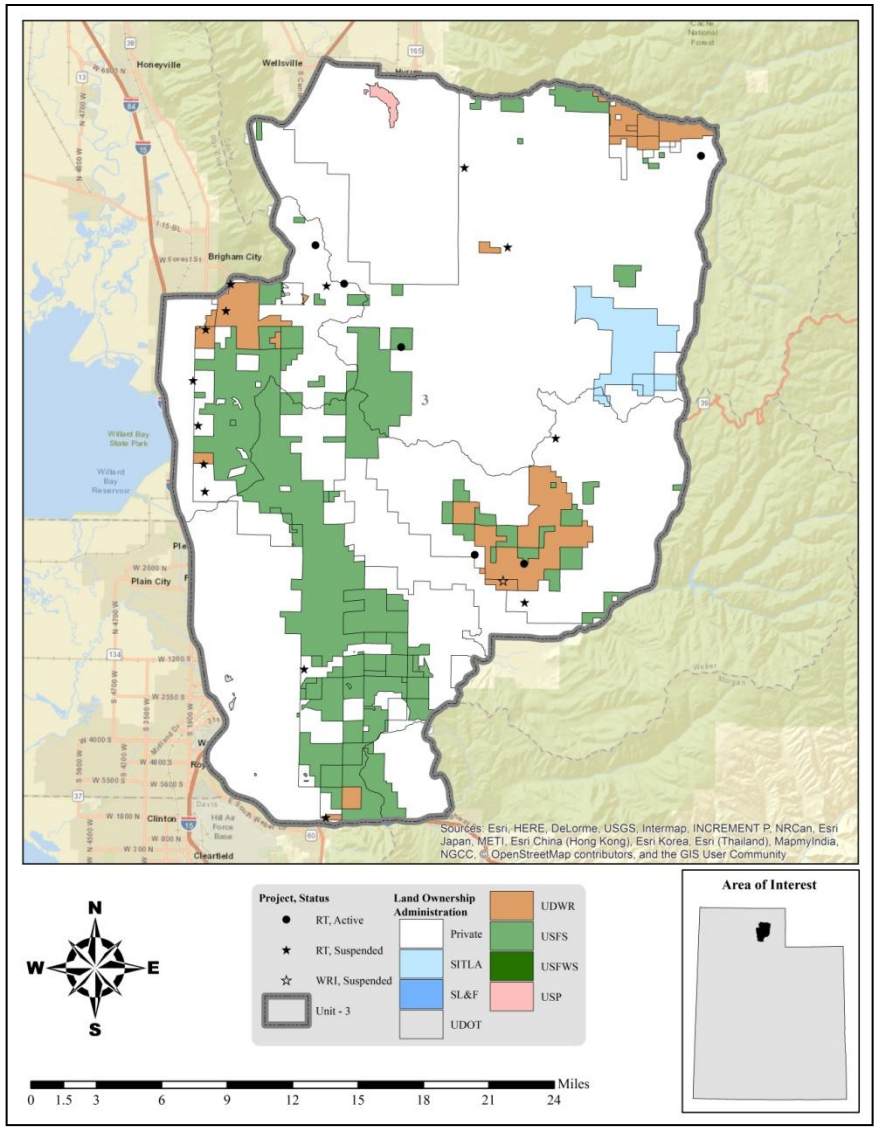
Map 3.2: Estimated mule deer habitat by season and value for WMU 3, Ogden.



Map 3.3: Estimated elk habitat by season and value for WMU 3, Ogden.



Map 3.4: Estimated moose habitat by season and value for WMU 3, Ogden.



Map 3.5: Land ownership for WMU 3, Ogden.

	Year Long Range		Summer Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	0	0%	193,624	58%	139,804	42%
Elk	8	<1%	104,543	39%	166,382	61%
Moose	0	0%	193,465	61%	123,410	39%

Table 3.1: Estimated mule deer, elk, and moose habitat acreage by season for WMU 3, Ogden.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
Private	127,632	66%	108,765	78%
SITLA	8,113	4%	0	0%
UDWR	10,871	6%	7,982	6%
USFS	47,008	24%	23,046	16%
USP	0	0%	11	<1%
Total	193,624	**100%**	139,804	**100%**

Table 3.2: Estimated mule deer habitat acreage by season and ownership for WMU 3, Ogden.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Private	8	100%	78,269	75%	128,178	77%
SITLA	0	0%	8,113	8%	0	0%
UDWR	0	0%	1,283	1%	15,013	9%
USFS	0	0%	16,877	16%	23,191	14%
Total	8	**100%**	104,543	**100%**	166,382	**100%**

Table 3.3: Estimated elk habitat acreage by season and ownership for WMU 3, Ogden.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
Private	139,209	72%	90,515	73%
SITLA	432	<1%	7,681	6%
UDWR	4,902	3%	12,648	11%
USFS	48,922	25%	12,566	10%
Total	193,465	**100%**	123,410	**100%**

Table 3.4: Estimated moose habitat acreage by season and ownership for WMU 3, Ogden.

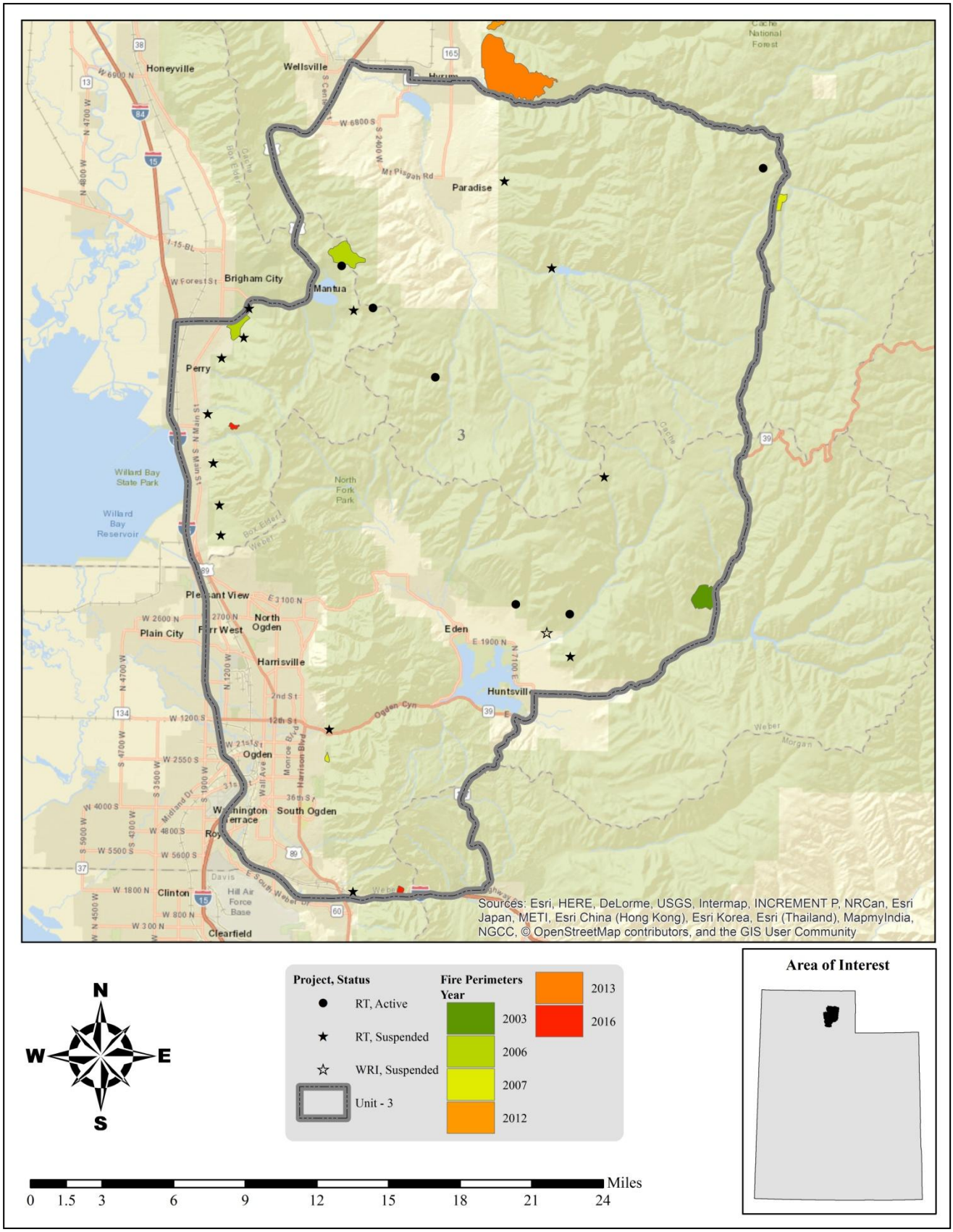
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	26,698	6.58%	
	Conifer-Hardwood	23,842	5.88%	
	Colorado Plateau Pinyon-Juniper Woodland	13,411	3.31%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	9,646	2.38%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	8,623	2.13%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,392	0.34%	
	Other Conifer	1,681	0.41%	21.03%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	1,306	0.32%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	1	0.00%	0.32%
Exotic Tree-Shrub	Introduced Riparian Shrubland	106	0.03%	0.03%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	12,124	2.99%	
	Southern Rocky Mountain Montane-Subalpine Grassland	918	0.23%	
	Inter-Mountain Basins Semi-Desert Grassland	602	0.15%	
	Rocky Mountain Alpine Dwarf-Shrubland	9	0.00%	3.37%
Shrubland	Artemisia tridentata ssp. vaseyana Shrubland Alliance	19,517	4.81%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	17,646	4.35%	
	Inter-Mountain Basins Montane Sagebrush Steppe	14,466	3.57%	
	Quercus gambelii Shrubland Alliance	11,890	2.93%	
	Rocky Mountain Lower Montane-Foothill Shrubland	10,439	2.57%	
	Inter-Mountain Basins Big Sagebrush Shrubland	9,826	2.42%	
	Great Basin Xeric Mixed Sagebrush Shrubland	1,201	0.30%	
	Other Shrubland	1,395	0.34%	21.30%
Other	Hardwood	119,170	29.39%	
	Developed	50,281	12.40%	
	Agricultural	37,561	9.26%	
	Riparian	3,950	0.97%	
	Open Water	3,363	0.83%	
	Sparsely Vegetated	2,734	0.67%	
	Barren	1,732	0.43%	53.95%
Total		405,529	100.00%	100%

Table 3.5: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 3, Ogden.

Limiting Factors to Big Game Habitat

Major human activities in the area include urbanization, grazing, and agriculture. Habitat degradation and loss, public land winter range availability, winter range forage condition, and landowner acceptance limit big game habitat in this unit.

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). Increased amounts of cheatgrass exacerbate the risk of catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). According to the current Landfire Existing Vegetation Coverage model, 0.32% of the unit is comprised of exotic herbaceous species (Table 3.5). Wildfires have occurred on this management unit, resulting in some loss of big game habitat (Map 3.6).



Map 3.6: Land coverage of fires by year from 2000-2016 for WMU 3, Ogden.

Treatments/Restoration Work

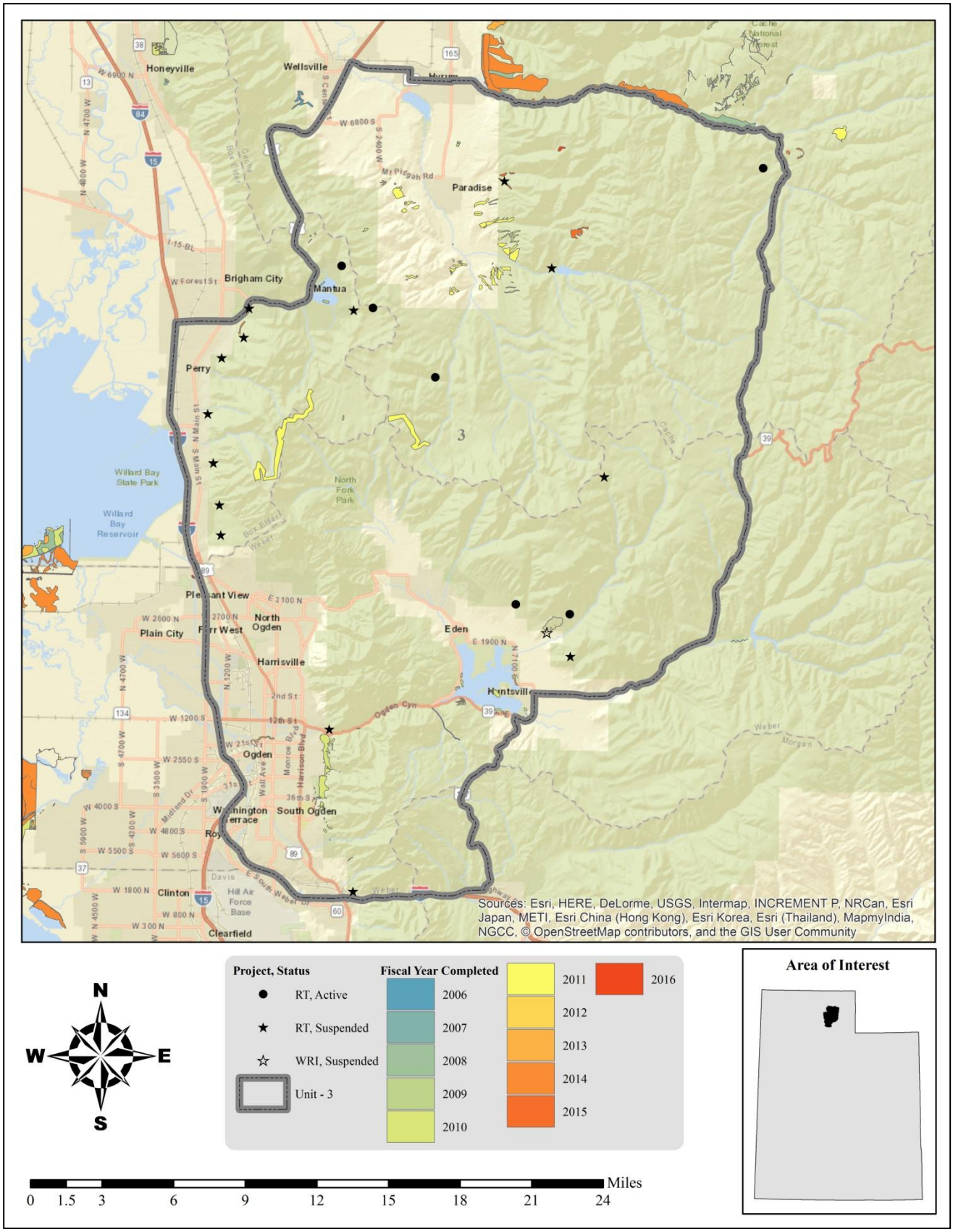
There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 1,785 acres of land have been treated within the Ogden unit since the WRI was implemented in 2004 (Map 3.8). In addition, 109 acres are currently undergoing treatment and treatment projects are proposed for 98 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 1,785 acres for this unit (Table 3.6). 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.

Herbicide application to remove unwanted vegetation is the most common management practice in this unit. Additional management practices include discing, seeding desirable herbaceous species, and other vegetation management techniques (Table 3.6).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Disc	**22**	**0**	**0**	**22**
Herbicide application	**1,555**	**0**	**0**	**1,555**
Aerial	923	0	0	923
Ground	632	0	0	632
Planting/Transplanting	**20**	**0**	**0**	**20**
Prescribed Fire	**0**	**98**	**0**	**98**
Seeding (Primary)	**12**	**0**	**0**	**12**
Drill (Rangeland)	12	0	0	12
Vegetation Removal/Hand Crew	**11**	**0**	**0**	**11**
Lop & Scatter	11	0	0	11
Other	**165**	**11**	**98**	**274**
Biological Control of Vegetation	5	0	0	5
Forestry practices	21	11	0	32
Greenstripping	138	0	0	138
Road Decommissioning	1	0	98	98
Total Treatment Acres	**1,785**	**109**	**98**	**1,991**
***Total Land Area Treated**	**1,785**	**107**	**98**	**1,987**

Table 3.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 3, Ogden. Data accessed on 02/09/2017.

*Does not include overlapping treatments.



Map 3.7: WRI treatments by fiscal year completed for WMU 3, Ogden.

Range Trend Studies

Range Trend studies have been sampled within WMU 3 on a regular basis since 1984, with studies being added or suspended as was deemed necessary (Table 3.7). 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 3.8).

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	Year(s) Sampled	Ecological Site Description
03-1	East Mantua	RT	Suspended	84, '90	Not Verified
03-2	NE Mantua Reservoir	RT	Active	84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Wyoming Big Sagebrush)
03-3	Clay Valley	RT	Active	84, '90, '96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
03-4	Anderson Ranch	RT	Active	84, '90, '96, '01, '06, '11, '16	Mountain Loam (Shrub)
03-5	Mathias Canyon	RT	Suspended	84, '90, '96	Not Verified
03-6	White's Orchard	RT	Suspended	84, '90, '96, '01	Not Verified
03-7	Mouth of Pearson's Canyon	RT	Suspended	84, '90, '96	Not Verified
03-8	Facer Canyon	RT	Suspended	84, '90, '96	Not Verified
03-9	Cook Canyon	RT	Suspended	84, '90, '96, '01	Not Verified
03-10	Hyrum Canyon	RT	Suspended	84, '90, '96	Not Verified
03-11	Porcupine Dam	RT	Suspended	84, '90	Not Verified
03-12	Threemile Canyon	RT	Active	84, '90, '96, '01, '06, '11, '16	Mountain Loam (Shrub)
03-13	Perry Basin	RT	Suspended	84, '90, '96	Not Verified
03-14	Uintah Junction	RT	Suspended	85, '90, '96	Not Verified
03-15	Odgen Canyon	RT	Suspended	85, '90, '96	Not Verified
03-16	Maple Canyon	RT	Suspended	85, '90, '96	Not Verified
03-17	Middle Fork	RT	Active	85, '90, '96, '01, '06, '11, '16	Mountain Shallow Loam (Low Sagebrush)
03-18	Geertsen Canyon	RT	Active	85, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Mountain Big Sagebrush)
03-19	Brigham Face	RT	Suspended	84, '90, '96	Not Verified
03R-1	Middle Fork Easement	RT	Suspended	99	Not Verified
03R-2	Middle Fork Spray	WRI	Suspended	06	Not Verified

Table 3.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 3, Ogden.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
03-2	NE Mantua Reservoir	Fire		Historic		
		Fire		2006-2011		
03-4	Anderson Ranch	Herbicide - 2, 4-D		June 2011		
03R-2	Middle Fork Spray	Broadcast Unknown	Middle Fork WMA Treatment	2008	5.8	1211

Table 3.8: Range trend and WRI studies known disturbance history for WMU 3, Ogden.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

Four study sites [Clay Valley (03-3), Anderson Ranch (03-4), Threemile Canyon (03-12), and Geertsen Canyon (03-18)] are classified as Mountain (Sagebrush) ecological sites. The Clay Valley study is located east of Mantua Reservoir and north of Clay Valley. Anderson Ranch is situated west of Ant Flat Road near Hardware Ranch, and the Threemile Canyon study is located on a south-facing slope above Threemile Creek. Finally, the Geertsen Canyon study is found on the southwest-facing lower slopes near Geertsen Canyon.

Shrubs/Trees: Total shrub cover has decreased over time, and preferred browse other than sagebrush was the primary component in the most recent sample year (2016). The dominant browse species on two studies, Clay Valley and Geertsen Canyon, is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), whereas the dominant species on the Anderson Ranch and Threemile Canyon studies is antelope bitterbrush (*Purshia tridentata*). The Anderson Ranch study is largely responsible for the decrease in sagebrush cover between 2011 and 2016; cover of mountain big sagebrush decreased from 8.8% to 0.2% (Figure 3.2). Average sagebrush demographics show that overall sagebrush density has decreased over time and that mature plants make up the majority of the population. Recruitment of young and density of decadent individuals has decreased overall (Figure 3.5). Average sagebrush utilization data shows that a majority of plants in all sample years have exhibited little to no use (Figure 3.6).

Average tree cover of juniper (*Juniperus* sp.) and bigtooth maple (*Acer grandidentatum*) has increased each study year: this is entirely due to the Clay Valley study as tree cover was not recorded on any other site of this ecological type (Figure 3.3). Point-quarter measurements of these species were only taken in 2016 with the values being attributed to the Clay Valley, Anderson Ranch, and Threemile Canyon studies (Figure 3.4).

Herbaceous Understory: The average herbaceous cover increased each sample year except between 2011 and 2016 when cover decreased; cover has increased and nested frequency has decreased overall. The dominant component of the understory has been the introduced grass species bulbous bluegrass (*Poa bulbosa*) in most sample years. Although all sites of this ecological type in this unit have had bulbous bluegrass present in each sample year, cover has been highest on the Geertsen Canyon study throughout most of the study period; average frequency has fluctuated, but has stayed fairly consistent overall. Cover of perennial forbs, annual forbs, and annual grasses has generally increased (Figure 3.7, Figure 3.8).

Occupancy: Average pellet transect data shows that overall occupancy has decreased and that deer have been the primary occupants in most sample years. Mean abundance of deer pellet groups has ranged from 12 days use/acre in 2011 to 65.5 days use/acre in 2001. Elk pellet groups have had a mean abundance as low as just over 11 days use/acre in 2006 and 2016 and as high as 16.5 days use/acre in 2011. Mean abundance of cattle pellet groups has been as low as nearly 2 days use/acre in 2001 and as high as over 5 days use/acre in 2016. Finally, horse pellet groups have had a mean abundance ranging from 0 days use/acre in 2006 and 2016 to just over 2 days use/acre in 2011 (Figure 3.9).

Mountain (Low Sagebrush)

There is one study [Middle Fork (03-17)] that is considered to be a Mountain (Low Sagebrush) ecological site; this study is situated on the south-facing slope north of Middle Fork Ogden River.

Shrubs/Trees: The primary browse species on this study site is low sagebrush (*Artemisia arbuscula*); other shrubs contribute less cover. Shrub cover has fluctuated from year to year, but has remained fairly consistent overall (Figure 3.2). Mature plants have comprised most of the sagebrush population on this site, and density of decadent individuals has exhibited a slight increase while recruitment of young plants has decreased (Figure 3.5). Average sagebrush utilization has varied, but a majority of plants have shown signs of little to no use in all sample years (Figure 3.6).

Tree cover on this site is contributed entirely by bigtooth maple (*Acer grandidentatum*) and has increased by a marginal amount overall (Figure 3.3). Although recorded in density strips, point-quarter data for bigtooth maple was only taken in 2016 (Figure 3.4).

Herbaceous Understory: The herbaceous understory on this site has fluctuated from year to year, with cover exhibiting a slight increase over time and frequency showing an overall decrease. The dominant component of the understory has been the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) in most sample years. Other perennial grasses include a number of introduced and native species with bluebunch

wheatgrass (*Pseudoroegneria spicata*) providing much of the cover. Perennial forb cover and frequency has fluctuated, while annual forbs have remained relatively rare (Figure 3.7, Figure 3.8)

Occupancy: According to average pellet transect data, animal occupancy has increased over the study period with deer being the primary occupants in all study years; mean abundance of deer pellet groups has been as low as 13 days use/acre in 2006 and as high as nearly 35 days use/acre in 2016. Elk have also been present on this site, with pellet groups having a mean abundance ranging from 7 days use/acre in 2001 to 20 days use/acre in 2016. Horse pellet groups have had a mean abundance ranging from 0 days use/acre in 200 and 2011 to 0.6 days use/acre in 2001 and 2016. Finally, the mean abundance of moose pellet groups has ranged from 0 days use/acre in 2001, 2006, and 2011 to almost 1 days use/acre in 2016 (Figure 3.9).

Upland (Sagebrush)

One study site [NE Mantua Reservoir (03-2)] is classified as an Upland (Sagebrush) ecological site. This study site is located northeast of Mantua Reservoir near Clappers Hollow.

Shrubs/Trees: The dominant browse species on this study site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), but other preferred browse species such as chokecherry (*Prunus virginiana*) are present to a lesser extent as well. The overall shrub cover has decreased due to a fire that burned the study site between 2006 and 2011. However, cover increased between 2011 and 2016, suggesting that the site may continue to recover in future sample years (Figure 3.2). Average sagebrush demographic data shows that a majority of plants were mature in most sample years; the exception to this was 2016, when young plants were the most common. No decadent plants have been recorded since 2006 (Figure 3.5). Most of the sagebrush plants were moderately or heavily used in 2001 and 2006, while a majority showed signs of little to no use in 1996, 2011, and 2016 (Figure 3.6).

Trees have not been recorded on this site in either cover or density measurements (Figure 3.3, Figure 3.4).

Herbaceous Understory: Both average cover and frequency of the herbaceous understory have exhibited a general increase over the study period. The dominant component has varied from year to year, although the cover of perennial and annual forbs and grasses has increased overall. This study site has been host to the noxious annual grass medusahead (*Teaniatherum caput-medusae*) in 2011 and 2006, and the introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) has been recorded in each sample year with fluctuating cover (Figure 3.7, Figure 3.8).

Occupancy: As might be expected, average pellet transect data indicates that animal occupancy has decreased following the burn. Deer were the primary occupants in 2001 and 2006, and mean pellet group abundance has ranged from 0.7 days use/acre in both 2011 and 2016 to almost 27 days use/acre in 2006. Elk were the primary occupants in 2011 and 2016, and mean abundance of pellet groups has been as low as 0 days use/acre in 2001 and 2006 and as high as nearly 3 days use/acre in 2011 (Figure 3.9).

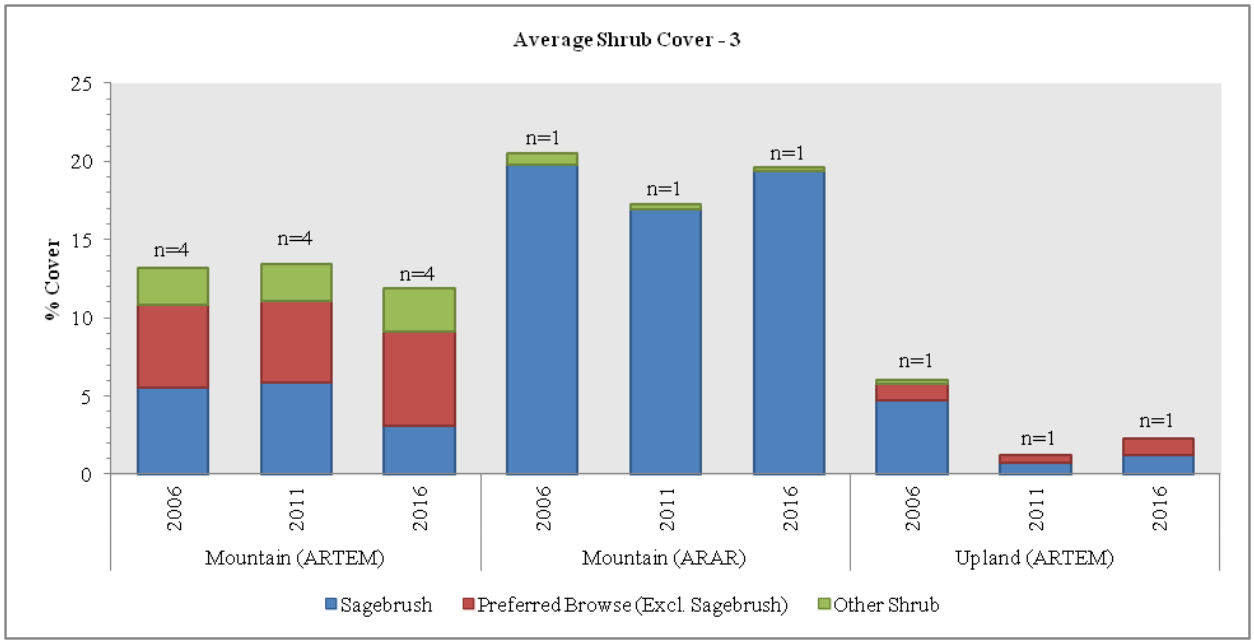


Figure 3.2: Average shrub cover for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

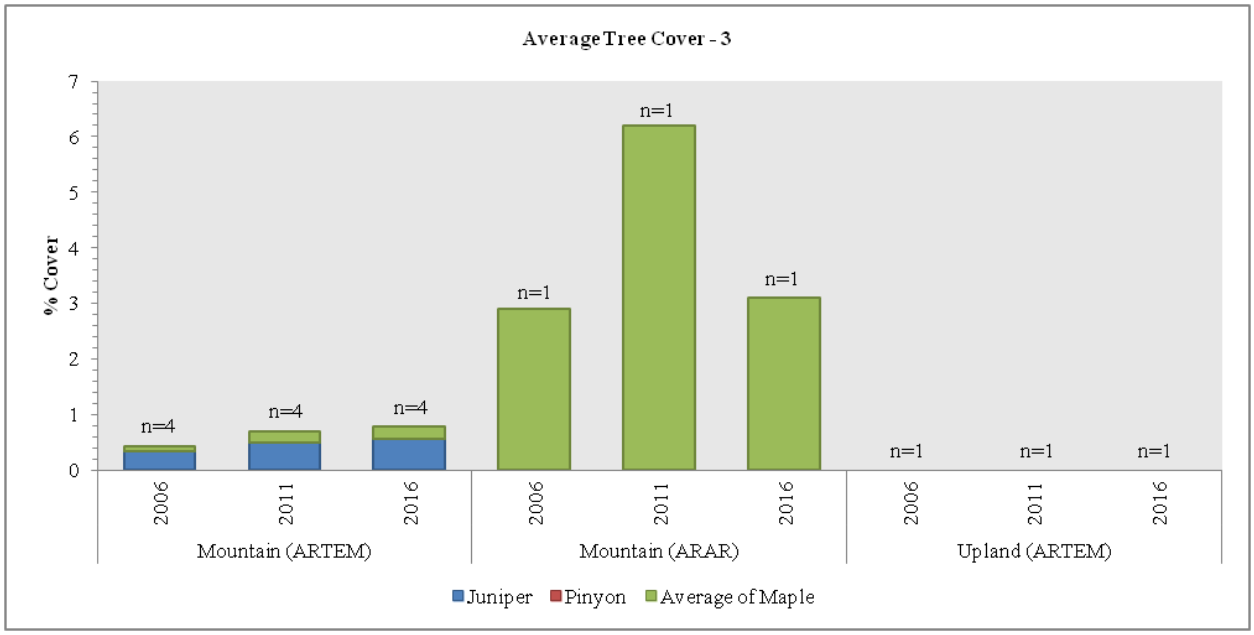


Figure 3.3: Average tree cover for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

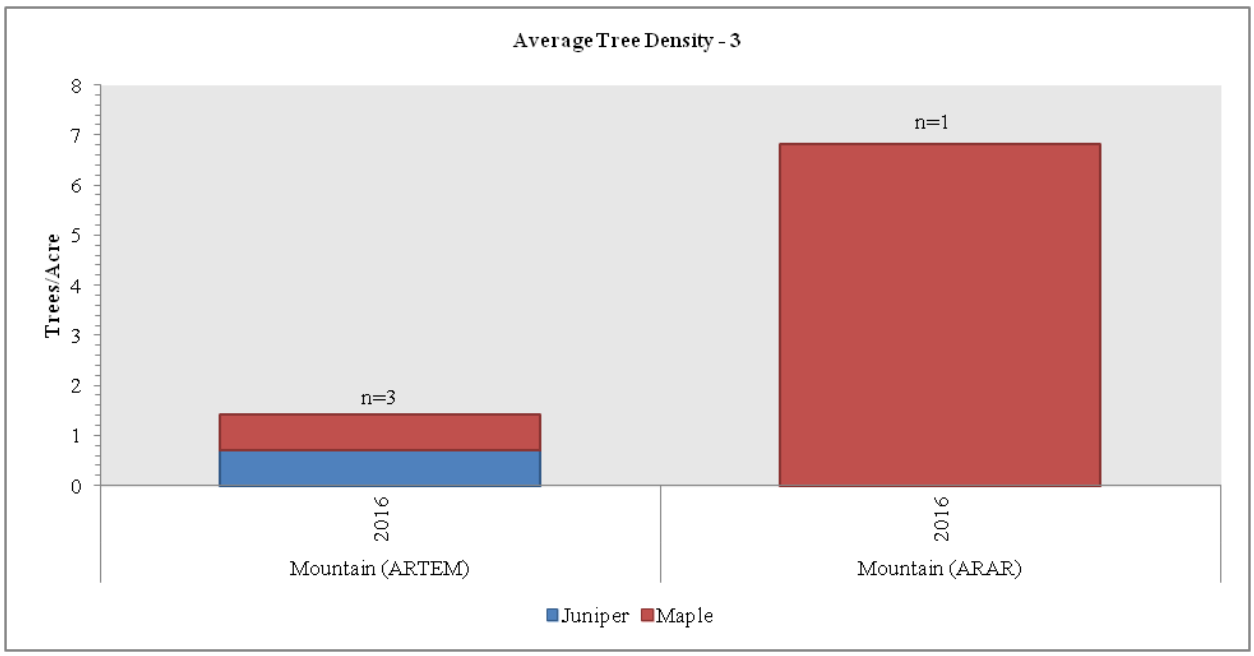


Figure 3.4: Average tree density for Mountain (ARTEM) and Mountain (ARAR) study sites in WMU 3, Ogden.

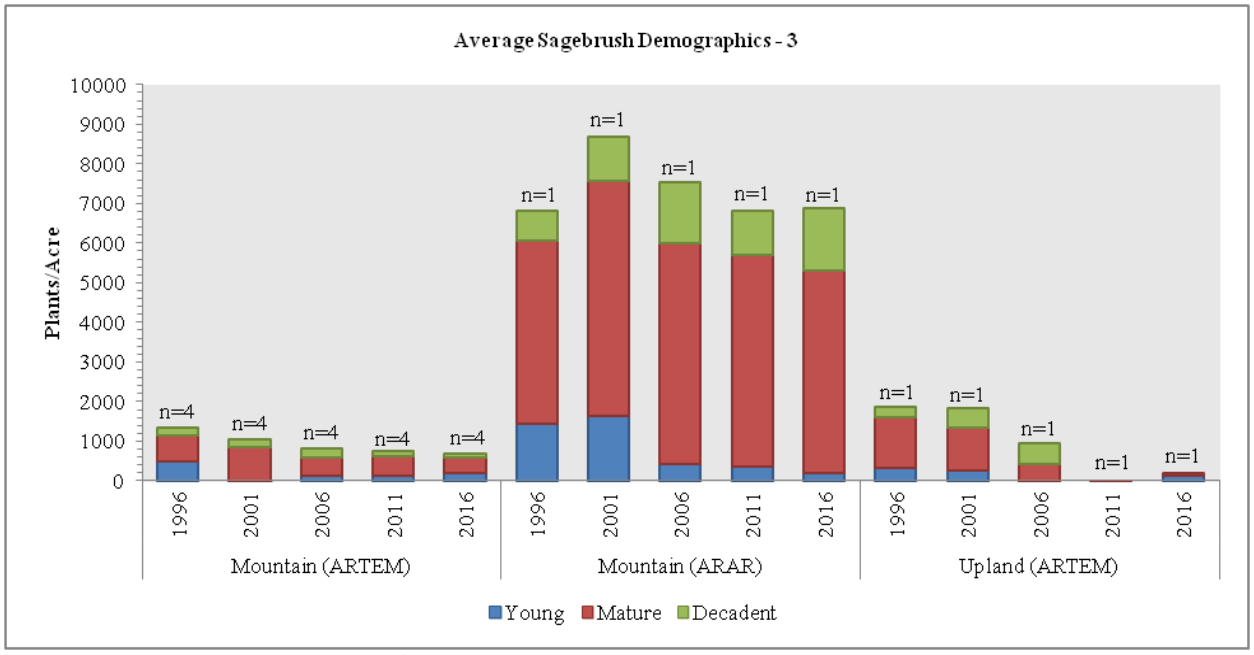


Figure 3.5: Average sagebrush demographics for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

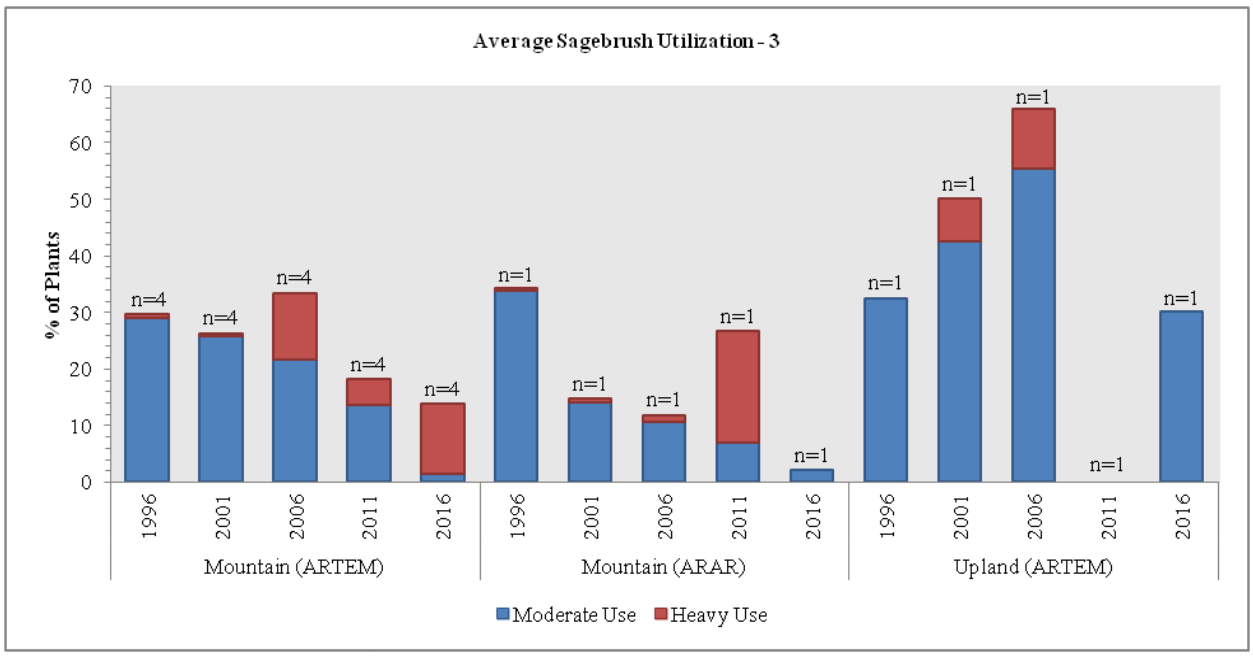


Figure 3.6: Average sagebrush utilization for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

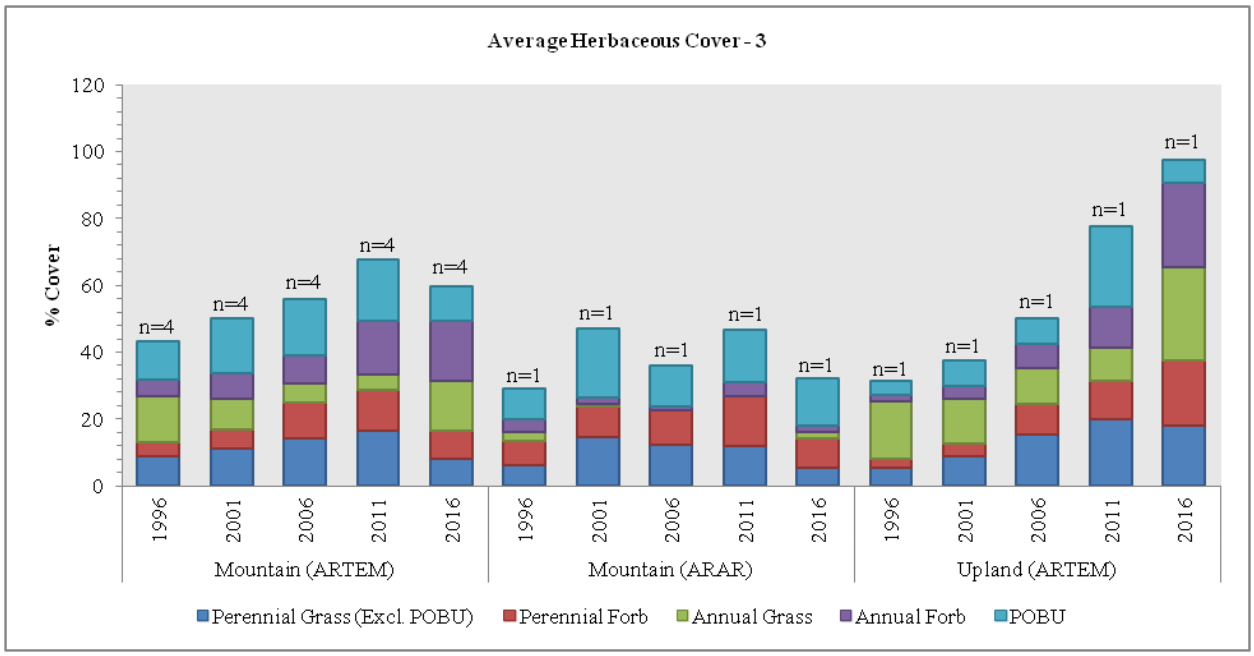


Figure 3.7: Average herbaceous cover for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

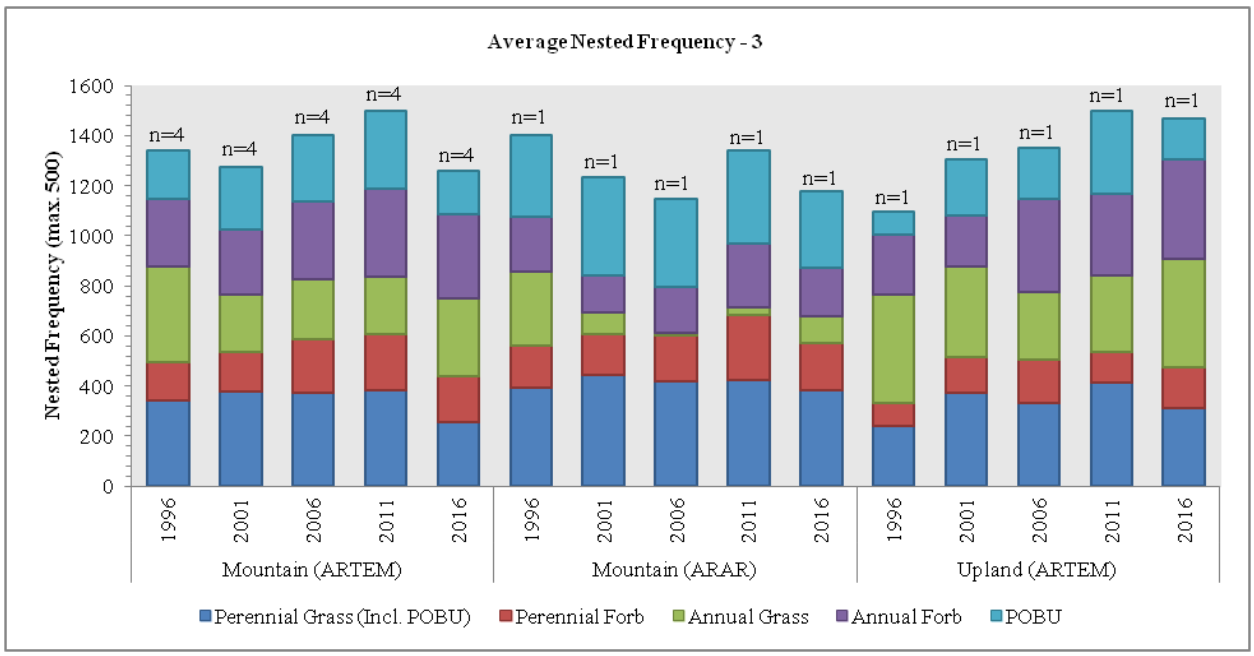


Figure 3.8: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

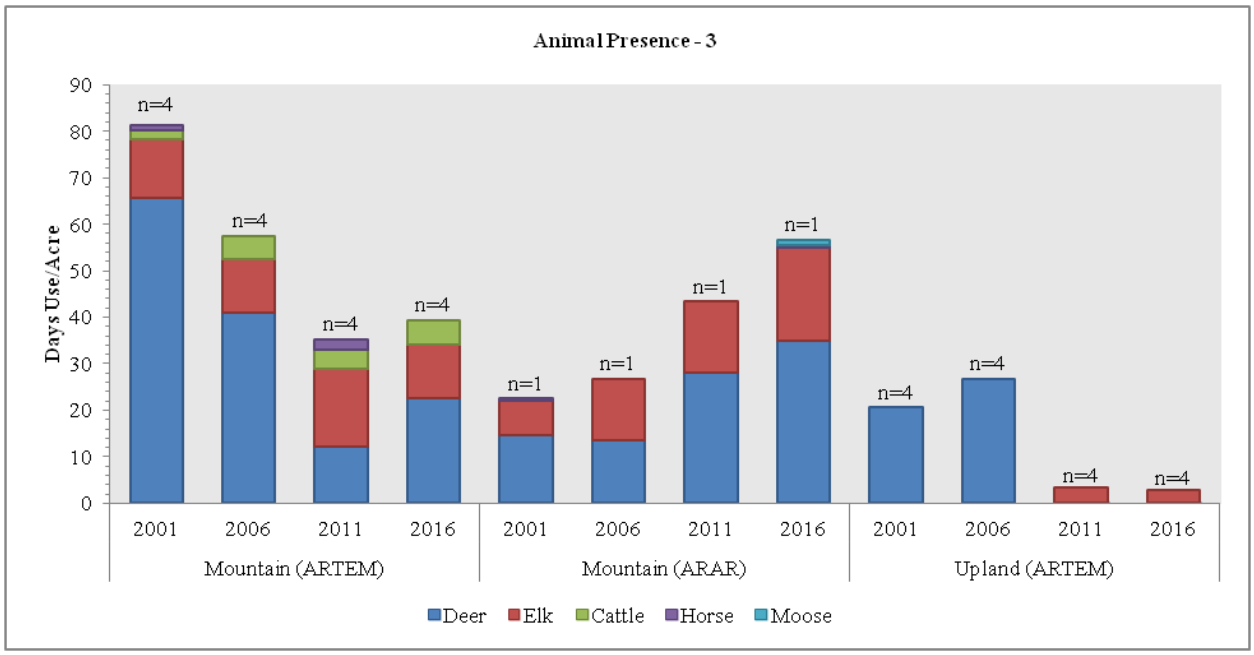
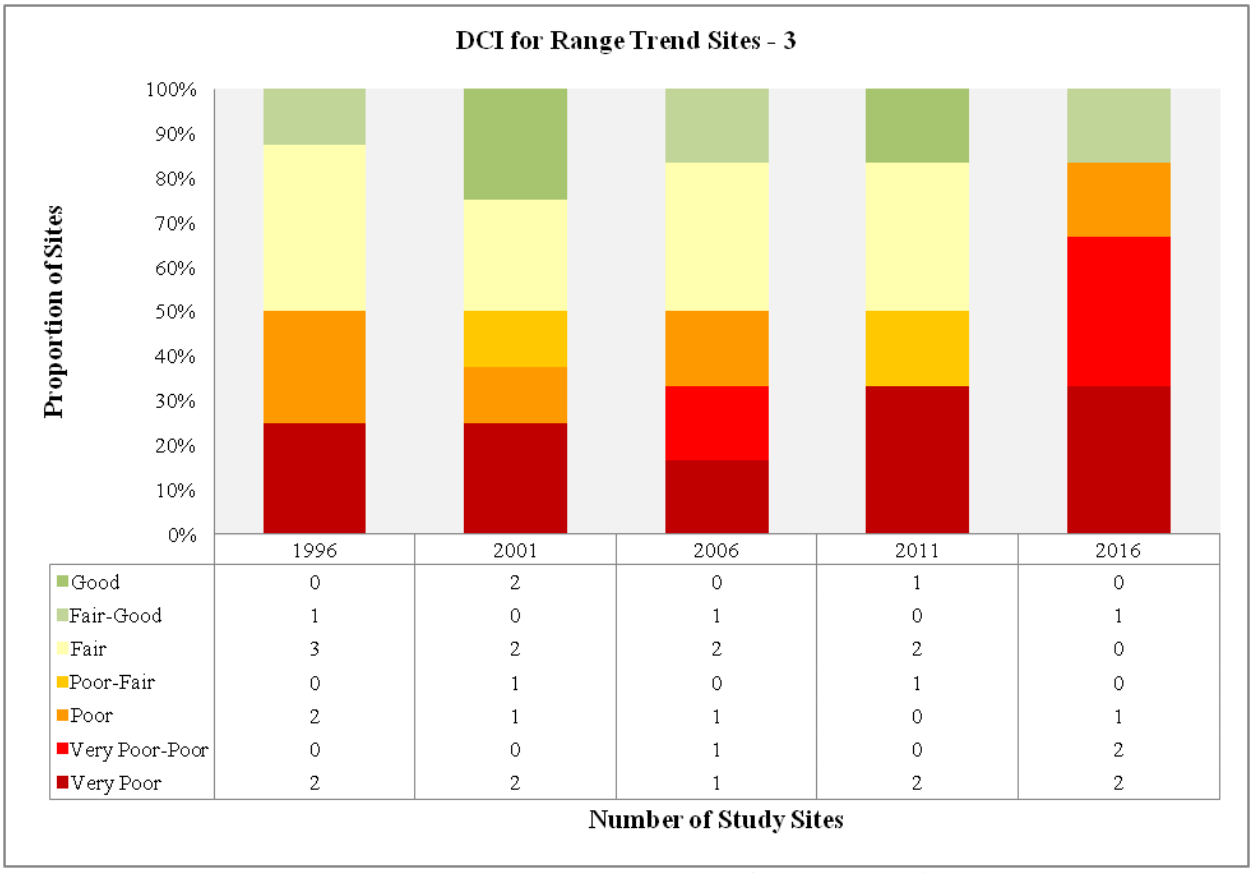


Figure 3.9: Average pellet transect data for Mountain (ARTEM), Mountain (ARAR), and Upland (ARTEM) study sites in WMU 3, Ogden.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Ogden management unit has continually changed on the sites sampled since 1996. The Range Trend sites sampled within the unit are considered to be in very poor to fair-good condition as of the 2016 sample year (Figure 3.10, Table 3.9, Map 3.12). Clay Valley went from good to fair-good condition and Middle Fork went from fair to poor condition. The NE Mantua Reservoir, Anderson Ranch, Threemile Canyon, and Geertsen Canyon studies are considered to be in very poor or very poor-poor condition generally due to the lack of browse cover, sagebrush diversity, and/or presence of annual grasses. The treated study sites range from very poor to very poor-poor (Figure 3.11). The treated study sites, NE Mantua Reservoir and Anderson Ranch, are also considered to be Range Trend sites and are therefore discussed above. Given more time and continual monitoring, it is possible that these sites might improve.



	1996	2001	2006	2011	2016
Good	0	2	0	1	0
Fair-Good	1	0	1	0	1
Fair	3	2	2	2	0
Poor-Fair	0	1	0	1	0
Poor	2	1	1	0	1
Very Poor-Poor	0	0	1	0	2
Very Poor	2	2	1	2	2

Figure 3.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 3, Ogden.

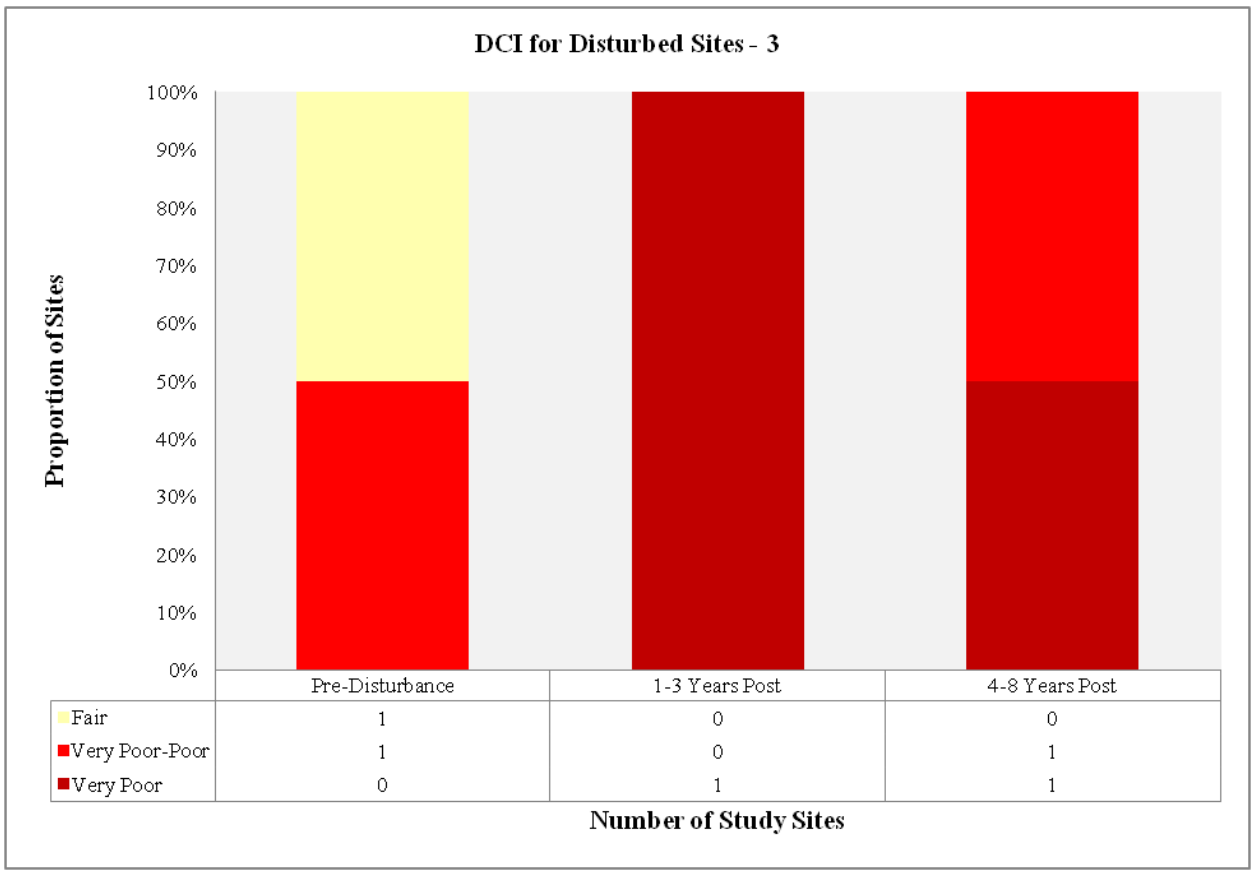
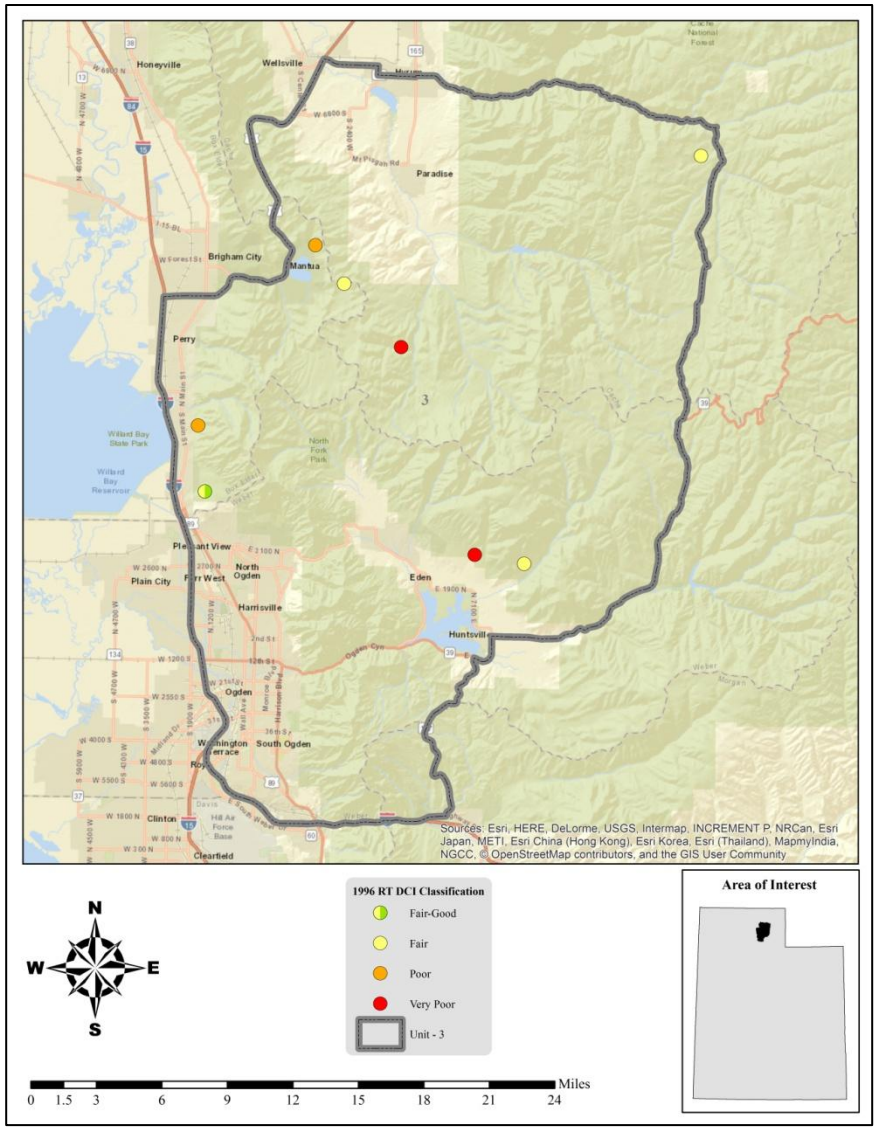


Figure 3.11: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 3, Ogden.

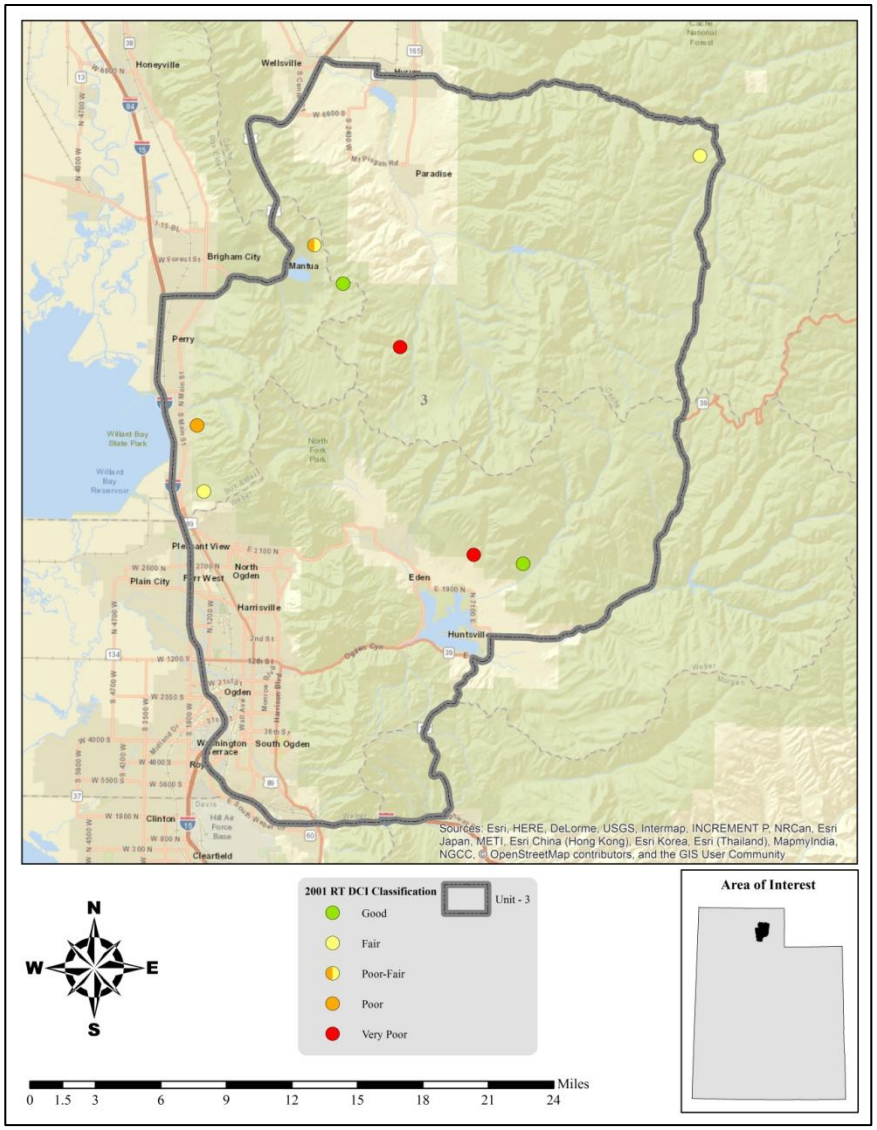
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
03-2	1996	21.4	11.0	8.2	10.6	-13.0	6.0	-2.0	**42.2**	**P**
03-2	2001	21.1	6.1	7.1	14.6	-8.3	10.0	-2.0	**48.5**	**P-F**
03-2	2006	5.7	0.0	0.0	30.0	-8.2	10.0	-2.0	**35.5**	**VP-P**
03-2	2011	0.7	0.0	0.0	30.0	-7.5	10.0	-4.0	**29.1**	**VP**
03-2	2016	1.9	0.0	0.0	21.4	-20.0	10.0	-4.0	**9.3**	**VP**
03-3	1996	20.8	9.6	11.5	24.3	-9.6	4.5	-2.0	**59.1**	**F**
03-3	2001	29.3	9.6	1.0	30.0	-1.1	10.0	-2.0	**76.8**	**G**
03-3	2006	12.5	8.1	10.0	30.0	-4.8	10.0	-2.0	**63.9**	**F**
03-3	2011	13.8	11.1	14.5	30.0	-3.2	10.0	-2.0	**74.1**	**G**
03-3	2016	12.5	12.6	15.0	30.0	-11.6	10.0	0.0	**68.6**	**F-G**
03-4	1996	10.5	15.0	7.4	30.0	-5.8	2.9	0.0	**59.9**	**F**
03-4	2001	14.2	11.3	6.5	30.0	-1.2	1.8	0.0	**62.6**	**F**
03-4	2006	15.5	10.2	8.1	30.0	-0.8	4.3	0.0	**67.3**	**F**
03-4	2011	12.6	6.5	2.5	30.0	-0.7	7.1	0.0	**58.0**	**F**
03-4	2016	9.0	5.1	0.0	20.8	-6.4	10.0	0.0	**38.5**	**VP-P**
03-6*	1996	24.2	10.8	7.0	29.5	-6.3	1.4	0.0	**66.6**	**F-G**
03-6*	2001	11.5	10.2	12.0	21.6	-4.0	4.7	0.0	**56.0**	**F**
03-9*	1996	28.7	12.3	7.0	7.9	-20.0	4.2	-2.0	**38.0**	**P**
03-9*	2001	27.6	6.3	2.0	20.6	-13.3	3.6	-2.0	**44.8**	**P**
03-12	1996	12.8	13.0	6.3	13.0	-19.8	9.2	-2.0	**32.5**	**VP**
03-12	2001	11.6	9.9	1.6	19.9	-20.0	10.0	-2.0	**31.0**	**VP**
03-12	2006	12.5	13.0	2.4	20.6	-7.8	10.0	-2.0	**48.7**	**P**
03-12	2011	15.2	14.9	1.8	21.6	-7.0	10.0	-2.0	**54.6**	**P-F**
03-12	2016	18.3	14.4	0.9	7.0	-8.3	10.0	-2.0	**40.4**	**VP-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
03-17	1996	16.6	12.1	9.9	12.7	-2.0	10.0	0.0	**59.2**	**F**
03-17	2001	16.7	11.2	9.7	28.8	-0.6	10.0	0.0	**75.9**	**G**
03-17	2006	18.3	8.7	3.0	24.7	0.0	10.0	0.0	**64.6**	**F-G**
03-17	2011	14.7	9.9	2.6	24.2	-0.1	10.0	0.0	**61.4**	**F**
03-17	2016	18.0	8.5	1.4	11.0	-1.4	10.0	0.0	**47.6**	**P**
03-18	1996	2.8	0.0	0.0	2.4	-6.2	10.0	-2.0	**7.0**	**VP**
03-18	2001	3.6	0.0	0.0	2.8	-2.6	10.0	0.0	**13.8**	**VP**
03-18	2006	2.4	0.0	0.0	4.2	-4.3	10.0	-2.0	**10.2**	**VP**
03-18	2011	3.7	0.0	0.0	5.4	-2.8	10.0	0.0	**16.3**	**VP**
03-18	2016	4.5	0.0	0.0	2.4	-18.1	10.0	0.0	**-1.2**	**VP**

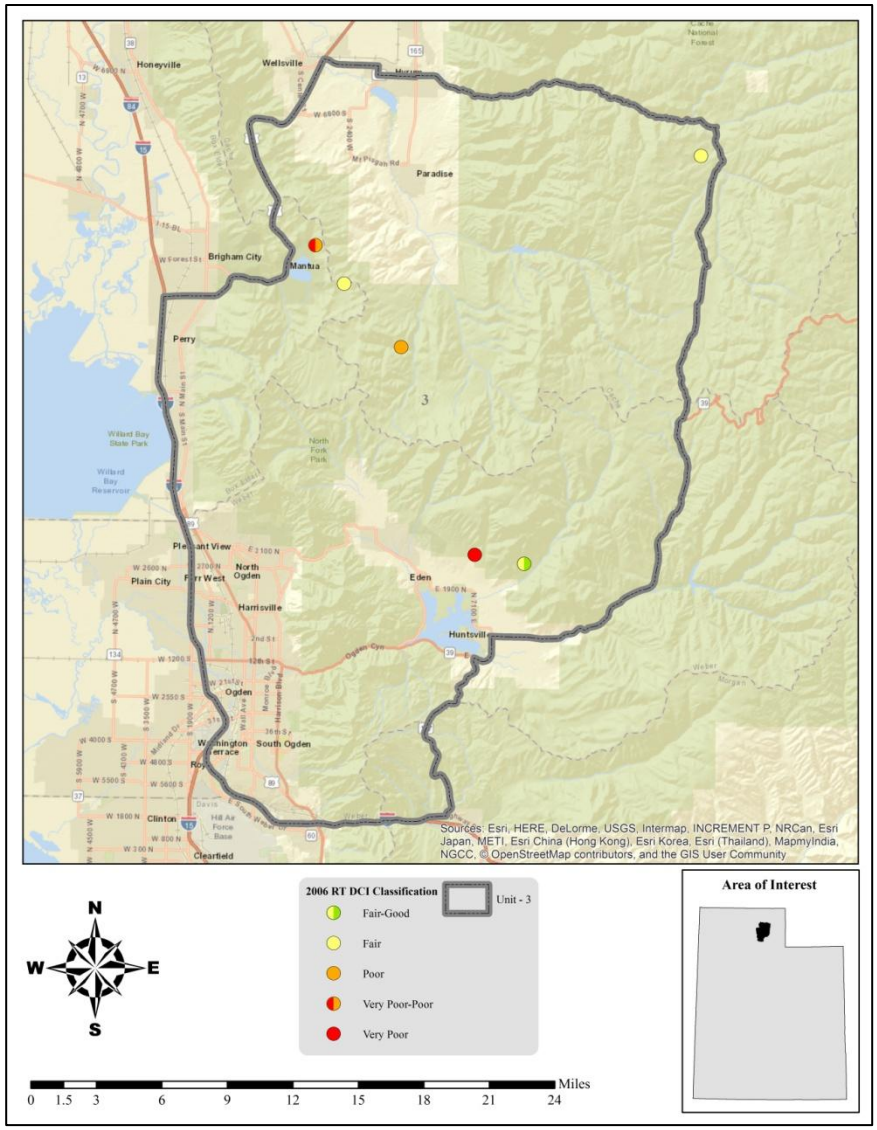
Table 3.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 3, Ogden. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



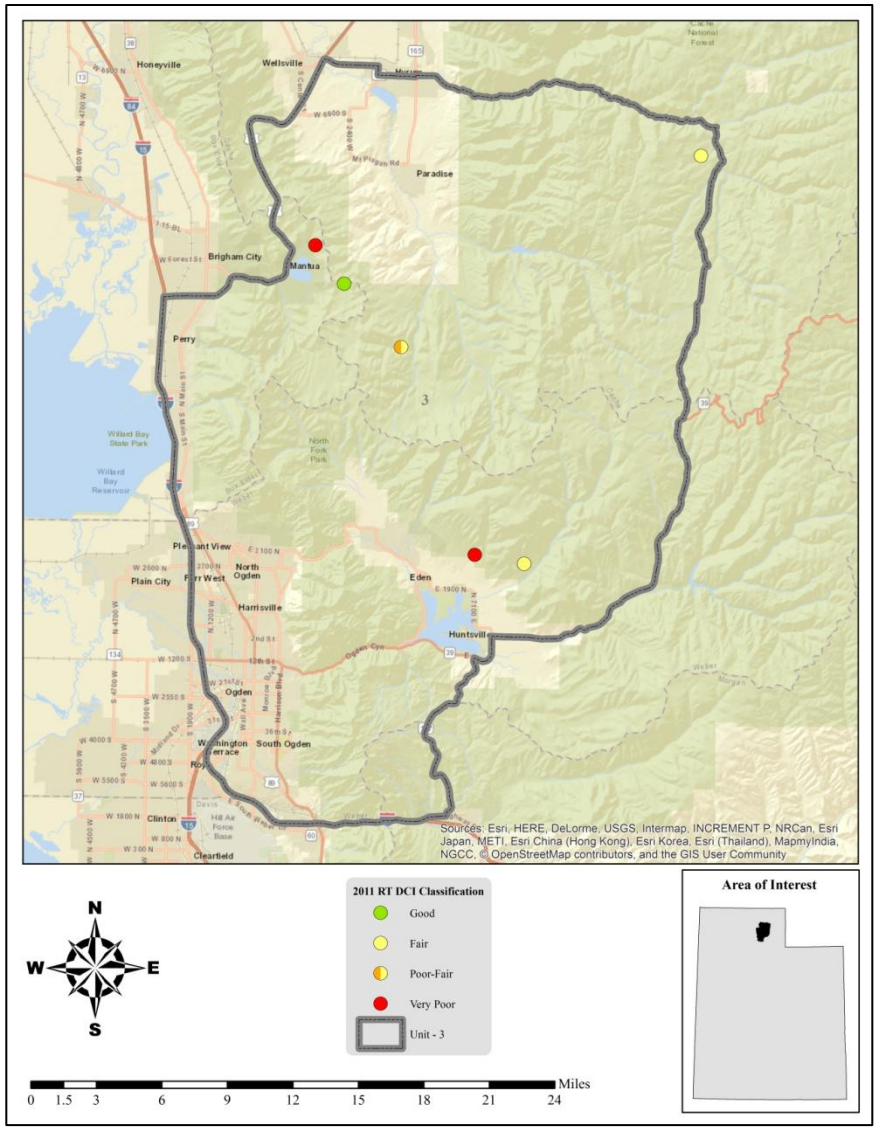
Map 3.8: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 3, Ogden.



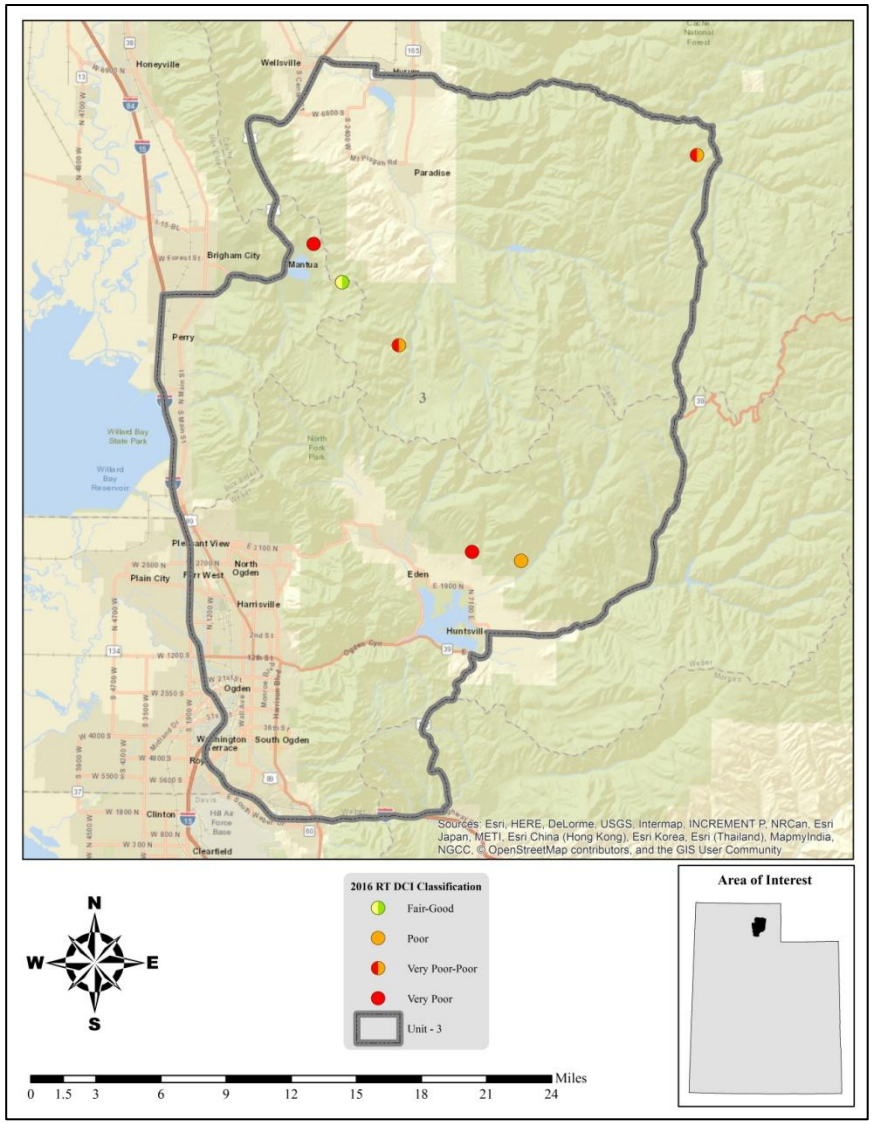
Map 3.9: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 3, Ogden.



Map 3.10: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 3, Ogden.



Map 3.11:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 3, Ogden.



Map 3.12: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 3, Ogden.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
03-2	NE Mantua Reservoir	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	High	Reduced diversity of desirable grass and forb species
03-3	Clay Valley	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
03-4	Anderson Ranch	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
03-12	Threemile Canyon	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	High	Reduced diversity of desirable grass and forb species
03-17	Middle Fork	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
03-18	Geertsen Canyon	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species

Table 3.9: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 3, Ogden. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The studies that are considered to be Mountain (Sagebrush) ecological sites support sagebrush communities and are generally considered to be in very poor to fair-good condition for deer winter habitat on the Ogden management unit. The herbaceous understories are generally fair in condition, but are susceptible to invasion by significant amounts of annual grasses. Increased amounts of cheatgrass can increase fuel loads and exacerbate the threat of wildfire. In addition, introduced perennial grasses are a dominant component on some study sites; while they do provide forage, these grass species can be aggressive at higher elevations and reduce the prevalence and abundance of other more desirable native grass and forb species. There are also noxious weeds present on some studies. Pinyon-juniper encroachment is also a concern on some study sites, and can reduce understory shrub and herbaceous health if not addressed.

Work to prevent further encroachment of pinyon and juniper (e.g. bullhog, chaining, lop and scatter, etc.) is recommended. Herbicide application may be needed to reduce annual grasses and noxious weeds. Finally, if reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native species when possible.

Mountain (Low Sagebrush)

The study site that is considered to be of this ecological type supports a population of little sagebrush and is generally considered to be in poor condition for deer winter range for the Ogden management unit. The herbaceous understory of this study is in fair condition, although there are significant amounts of introduced perennial grasses and some annual grasses. While introduced perennial grasses may provide forage, they can be aggressive at higher elevations and may reduce the prevalence and abundance of other more desirable native grass and forb species. Increased amounts of cheatgrass can increase fuel loads, therefore increasing the threat of wildfire.

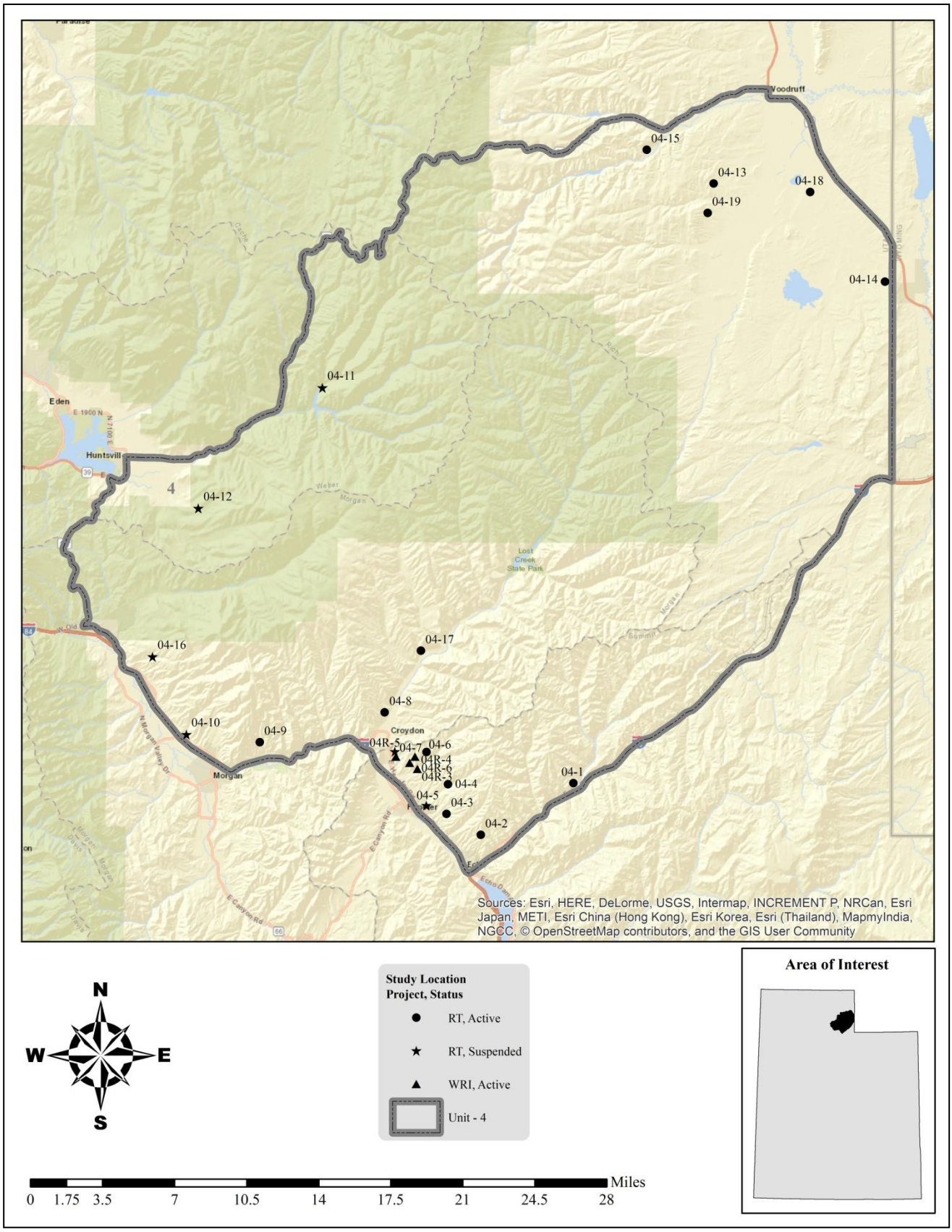
Herbicide application may be needed to reduce annual grasses and noxious weeds. When reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native species when possible.

Upland (Sagebrush)

The study that is considered to be an Upland (Sagebrush) ecological sites supports a population of sagebrush and perennial grasses and is generally considered to be in very poor condition for deer winter range within the Ogden management unit. Annual bromes and introduced perennial grasses dominate this site. Increased amounts of annual grass can increase fuel loads and exacerbate the risk of wildfire. Introduced perennial grasses can provide forage, but also have the potential to be aggressive and reduce the prevalence and abundance of other more desirable native grass and forb species.

When reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native species when possible. In addition, herbicide application may be necessary to reduce annual grass loads.

4. WILDLIFE MANAGEMENT UNIT 4 – MORGAN-SOUTH RICH



WILDLIFE MANAGEMENT UNIT 4 – MORGAN-SOUTH RICH

Boundary Description

Morgan, Rich, Summit, and Weber counties – Boundary begins at the junction of Interstate 80 and I-84 near Echo, Utah; northeast on I-80 to the Utah-Wyoming state line; north along this state line to SR-16; north on SR-16 to SR-39 near Woodruff; west along SR-39 to SR-167 (Trappers Loop Road); south on SR-167 to SR-30 at Mountain Green; west on SR-30 to I-84; east on I-84 to I-80 and the beginning point.

Management Unit Description

Geography

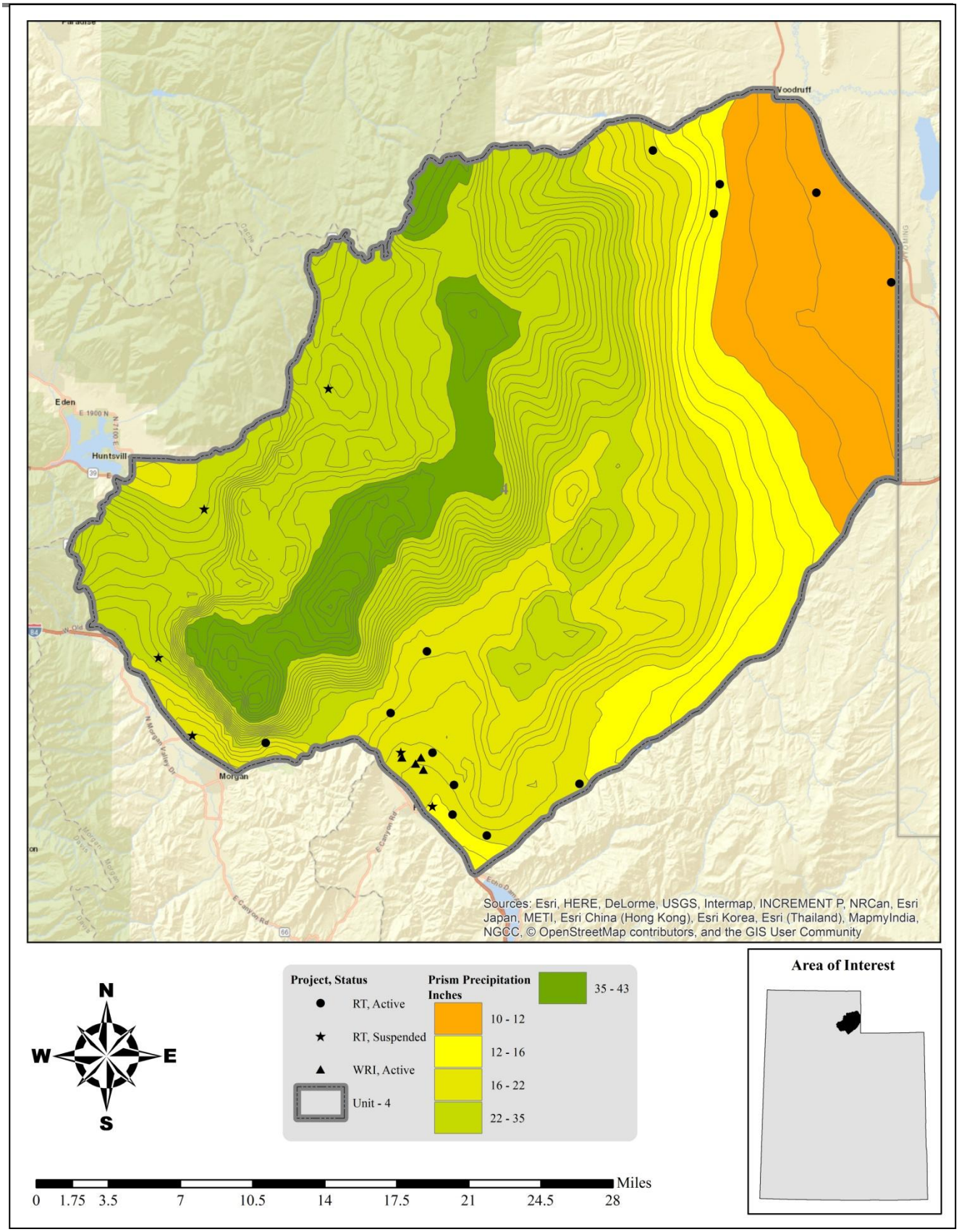
Management unit boundaries were changed in 1993 and the Morgan-South Rich Management Unit was created from parts of the old Units 5, 6, and 7. The new unit incorporates a section of Weber county southeast of Huntsville, the northern halves of Morgan and Summit counties, and the southern portion of Rich county southwest of Woodruff. Municipalities along the unit boundaries include Woodruff, Huntsville, Mountain Green, Croydon, and Echo.

Interstate 80 and I-84, which run through Echo Canyon and along the Weber River, form the unit's southern boundary; there are several towns along the highways. The majority of the Lost Creek bottoms surrounding the town of Croydon have been converted to alfalfa fields. Lost Creek Reservoir, managed by the Division of Parks and Recreation, is primitively developed and the road is not maintained in the winter. However, snowmobilers, winter fishermen, and other recreationists use the facilities during winter months. Two areas of land in the unit are managed by the Division of Wildlife Resources. The Round Valley WMA is north of I-84, just east of Morgan. The Henefer-Echo WMA is located east of Henefer and is managed primarily as a big game habitat.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 10 inches along portions of the Utah-Wyoming border to 41 inches on the mountain tops north of Morgan. All of the Range Trend and WRI monitoring studies on the unit occur within 10-21 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 Northern Mountains division (Division 5). 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 4.1a). 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 4.1b) (Time Series Data, 2017).



Map 4.1: The 1981-2010 PRISM Precipitation Model for WMU 4, Morgan- South (PRISM Climate Group, Oregon State University, 2013).

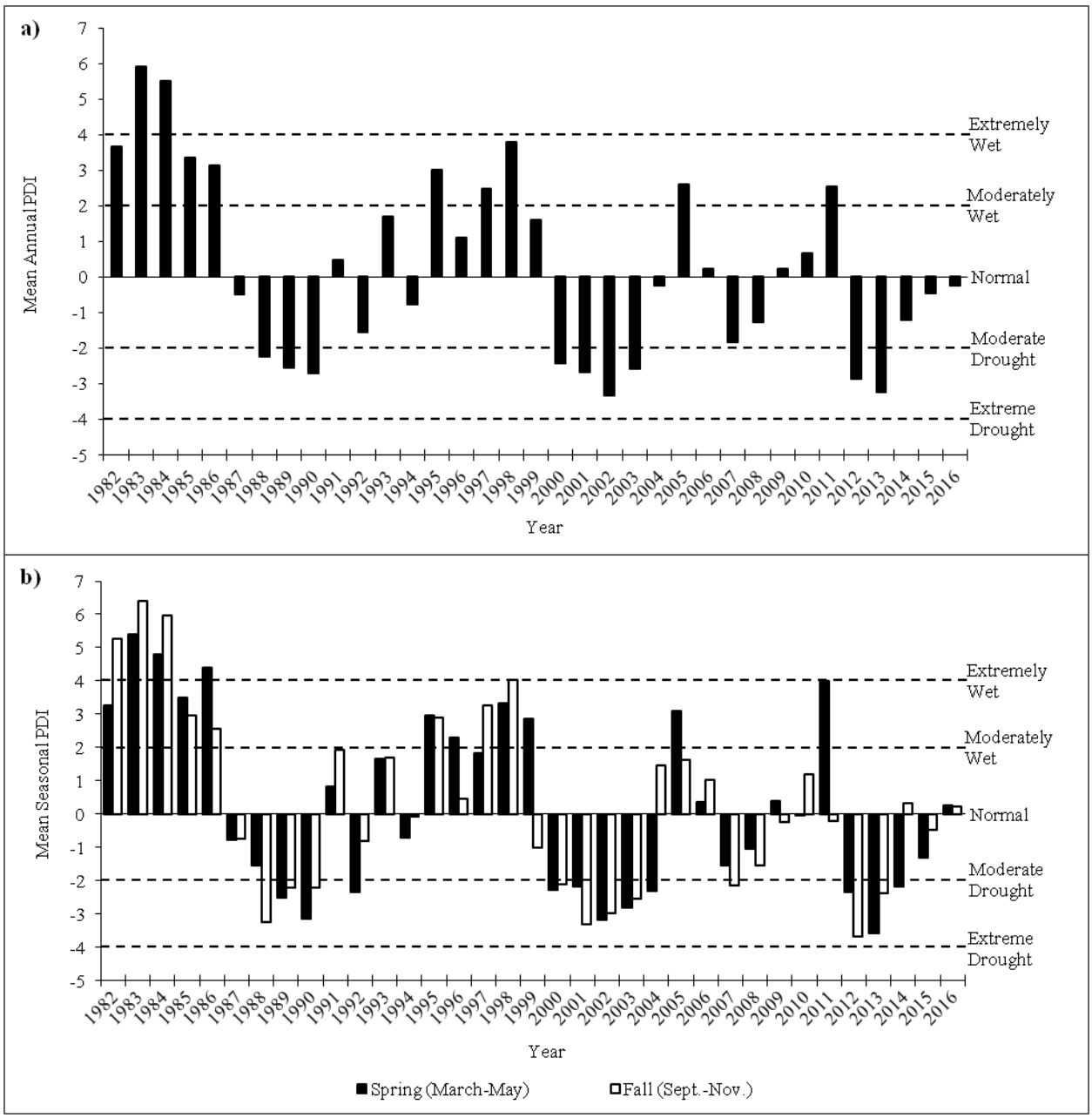


Figure 4.1: The 1982-2015 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2015. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

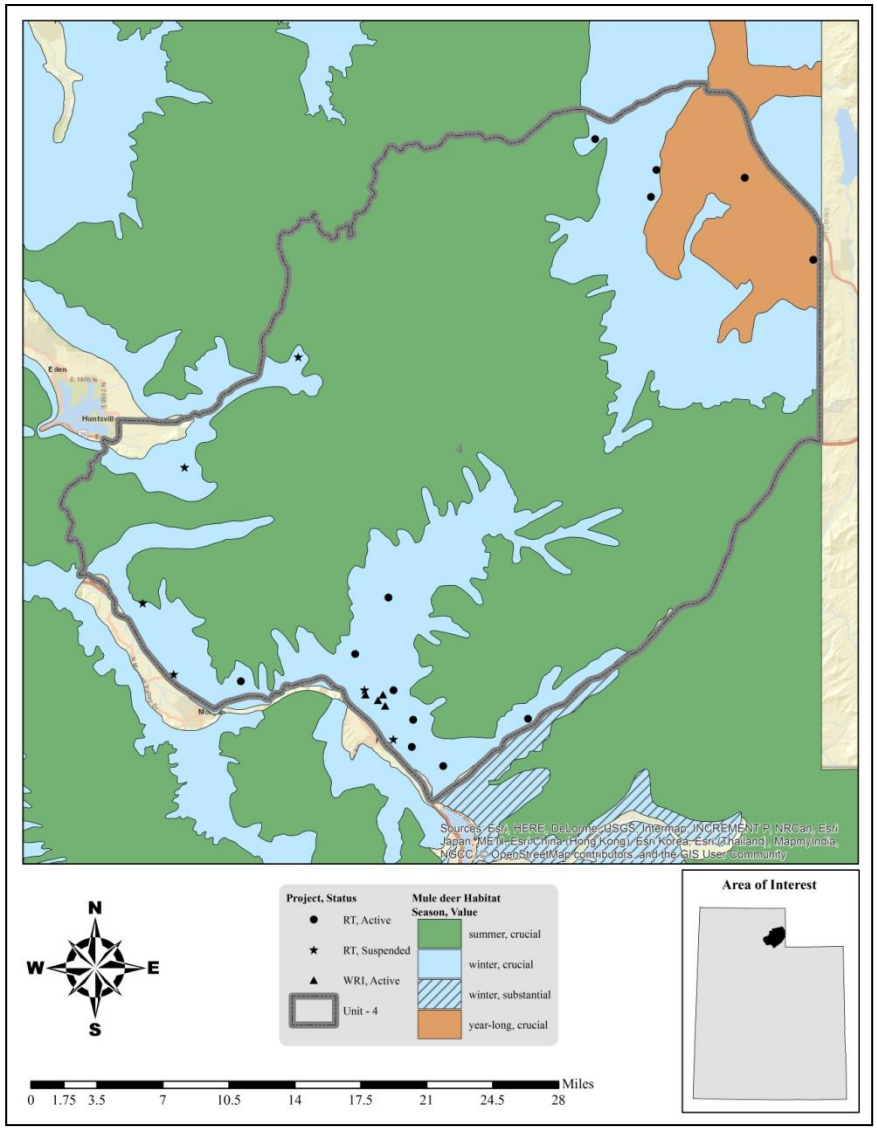
Big Game Habitat

The Morgan-South Rich unit contains over 587,000 acres of deer range with summer, winter, and year-long ranges making up 64%, 28%, and 8% of this area, respectively (Table 4.1, Map 4.2). Most (81%) of the year-long range in this unit occurs in land owned by private landowners, while 18% is managed by the Bureau of Land Management (BLM). The remaining 1% is administrated by the Utah School and Institutional Trust Lands Administration (SITLA) and the Utah Division of Wildlife Resources (UDWR). 81% of the winter range is also privately owned. 9% is administrated by the BLM, 7% is managed by UDWR, and SITLA, the US Forest Service (USFS), and Utah State Parks (USP) each own 1%. Finally, 88% of the summer range is privately owned, 8% is managed by the USFS, 2% is administrated by UDWR, 1% is owned by the BLM, and the remaining 1% is administrated by SITLA and USP (Table 4.2, Map 4.2, Map 4.6).

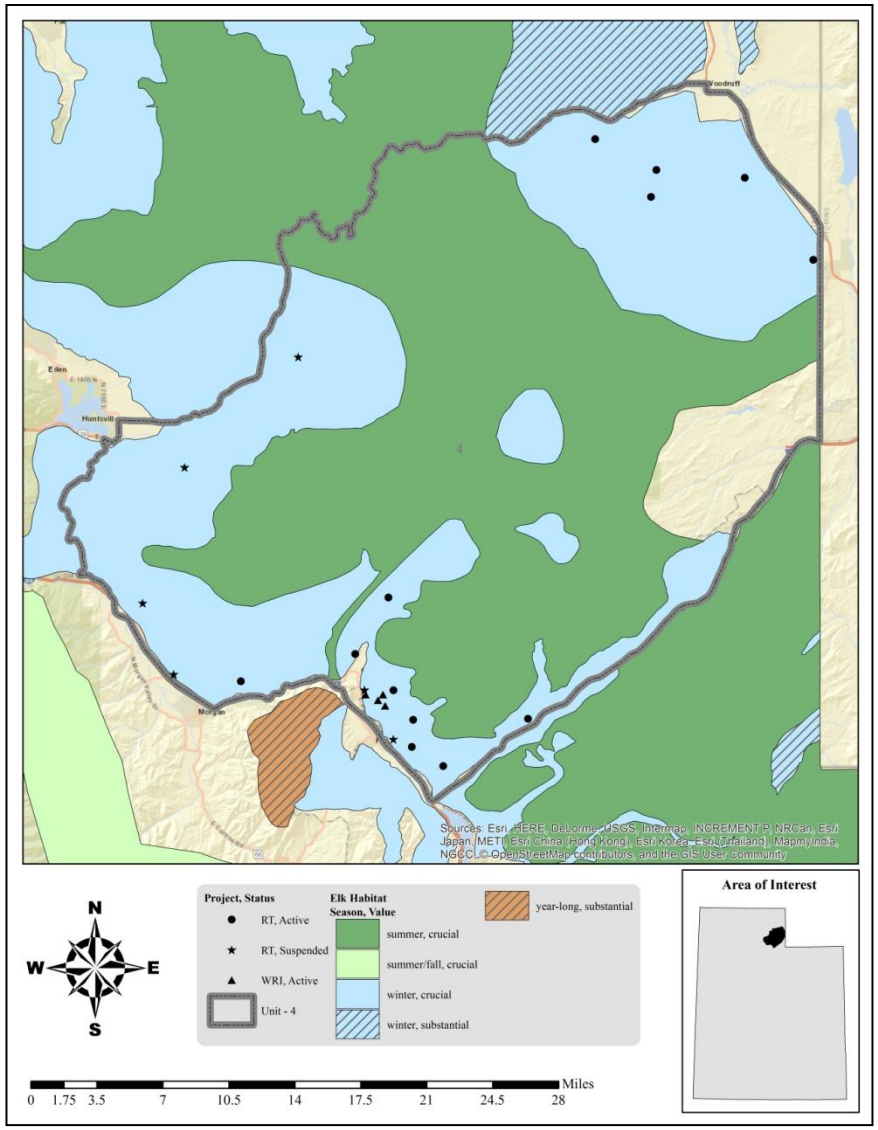
The Lost Creek, Weber River, and Echo Canyon areas are traditional deer wintering areas. There is considerable migration both from higher elevations in the unit and from other herd units to this area, especially during severe winters. The largest number of deer would likely come from the East Canyon Unit, where deer summer on the east side of the Wasatch Mountains; development in Morgan Valley is disrupting this migration route. Deer also come from the Ogden and Chalk Creek Units, which have adequate summer range, but limited winter range.

In severe winters, the area of available winter range is greatly reduced. The upper limit is 6,500 feet on most of the unit. The available acreage of all vegetation types (except agricultural land) is reduced during severe winters. All range trend studies in the unit were established on winter range; most studies sample crucial and/or heavily-used areas.

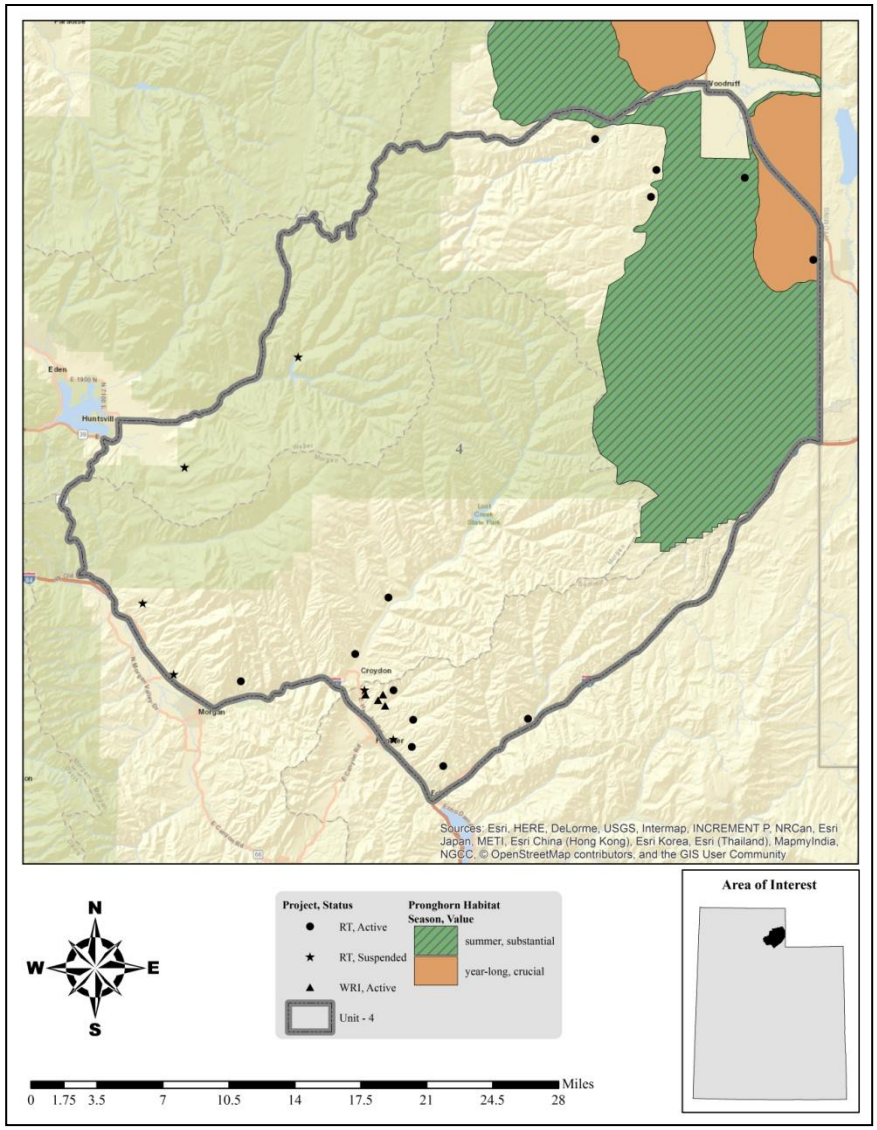
Earlier inventory studies described six vegetation types. The sagebrush type is most common and found over the whole area, forming part of a continuum (based on moisture conditions) between the mountain browse/sagebrush and mountain browse types. The lower elevation sagebrush and mountain browse/sagebrush types are productive and utilized heavily by deer, while the mountain browse type mainly provides cover and is unavailable in most winters. The other vegetation types occupy comparatively little land area, but have the potential to increase. Burns occur frequently in this unit and production of desirable species is generally very low unless the area is seeded. Deer use the burned areas infrequently, possibly because of lack of cover. A small population of mahogany is located in Cottonwood canyon and is important to wintering deer. Scattered stands of juniper are also important for providing thermal cover, but are of little forage value.



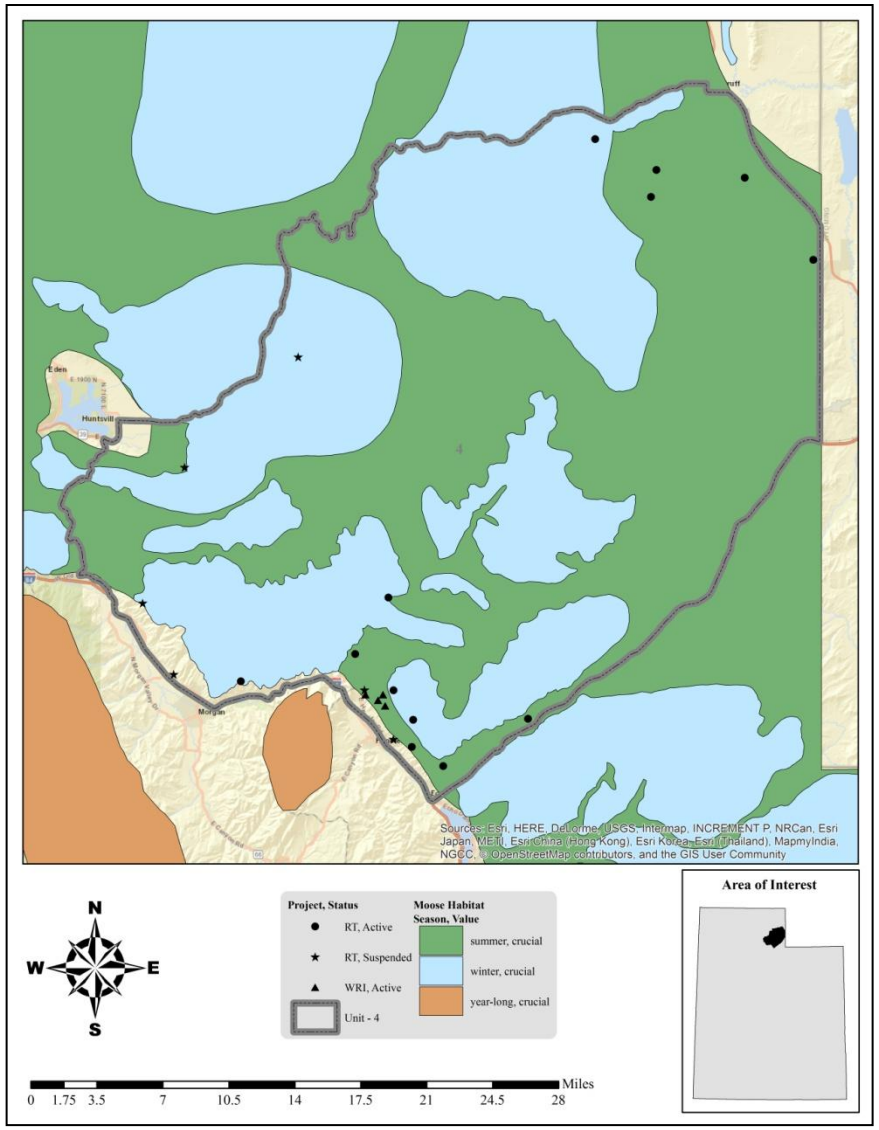
Map 4.2: Estimated mule deer habitat by season and value for WMU 4, Morgan-South Rich.



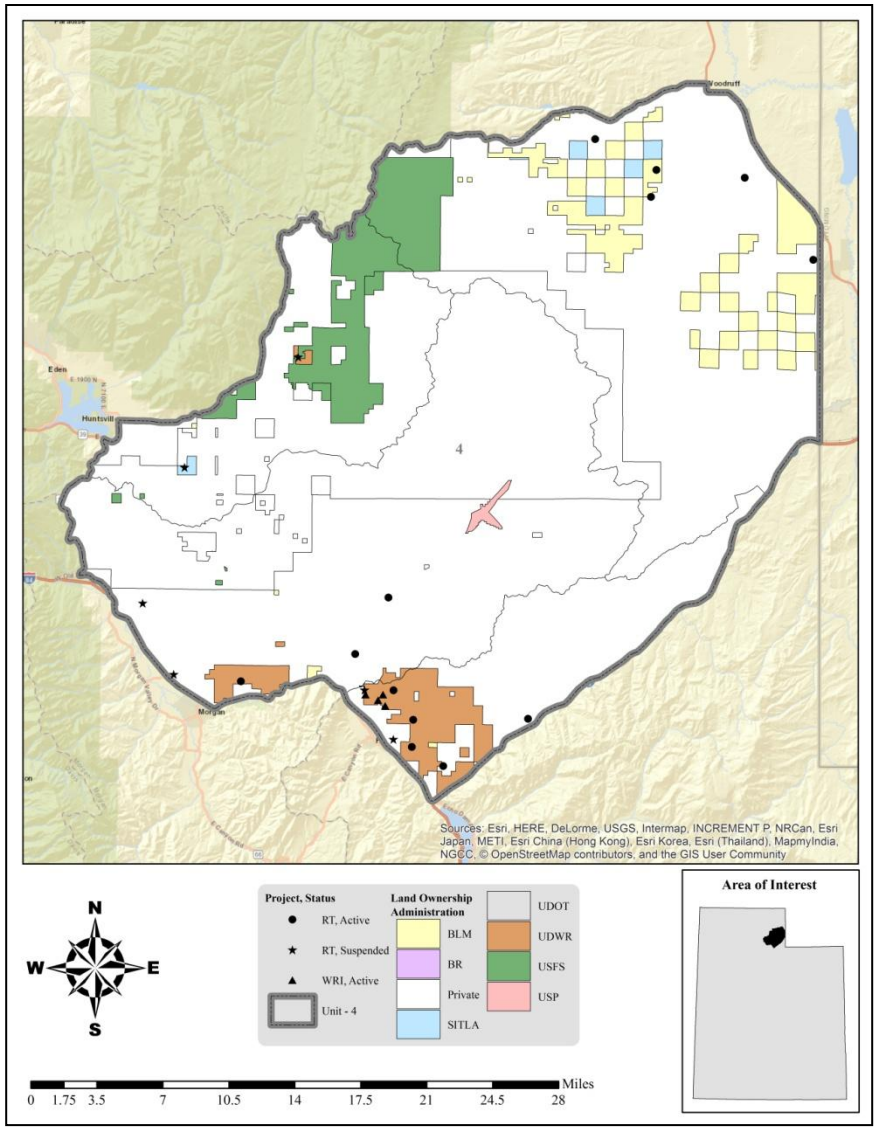
Map 4.3: Estimated elk habitat by season and value for WMU 4, Morgan-South Rich.



Map 4.4: Estimated pronghorn habitat by season and value for WMU 4, Morgan- South Rich.



Map 4.5: Estimated moose habitat by season and value for WMU 4, Morgan-South Rich.



Map 4.6: Land ownership for WMU 4, Morgan-South Rich.

	Year Long Range		Summer Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	44,395	8%	375,858	64%	167,709	28%
Elk	0	0%	298,299	54%	251,704	46%
Pronghorn	11,342	9%	117,695	91%	0	0%
Moose	0	0%	315,018	54%	264,688	46%

Table 4.1: Estimated mule deer, elk, pronghorn, and moose habitat acreage by season for WMU 4, Morgan-South Rich.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	8,309	18%	4,626	1%	15,663	9%
Private	36,047	81%	332,618	88%	134,932	81%
SITLA	32	<1%	745	<1%	2,293	1%
UDWR	6	<1%	6,035	2%	11,691	7%
USFS	0	0%	31,820	8%	2,070	1%
USP	0	0%	14	<1%	1,060	1%
Total	44,395	**100%**	375,858	**100%**	167,709	**100%**

Table 4.2: Estimated mule deer habitat acreage by season and ownership for WMU 4, Morgan-South Rich.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	5,012	2%	22,456	9%
Private	267,414	90%	199,383	79%
SITLA	0	0%	3,071	1%
UDWR	5,144	2%	12,559	5%
USFS	19,663	6%	14,227	6%
USP	1,066	<1%	7	<1%
Total	298,299	**100%**	251,704	**100%**

Table 4.3: Estimated elk habitat acreage by season and ownership for WMU 4, Morgan-South Rich.

	Year Long Range		Summer Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	4,888	43%	11,180	9%
Private	6,448	57%	106,515	91%
UDWR	6	<1%	0	0%
Total	11,342	**100%**	117,695	**100%**

Table 4.4: Estimated pronghorn habitat acreage by season and ownership for WMU 4, Morgan-South Rich.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	19,261	6%	9,177	3%
Private	280,257	89%	216,104	82%
SITLA	1,401	<1%	1,682	<1%
UDWR	6,161	2%	10,690	4%
USFS	7,142	2%	26,748	10%
UDOT	9	<1%	0	0%
USP	786	<1%	288	<1%
Total	315,018	**100%**	264,688	**100%**

Table 4.5: Estimated moose habitat acreage by season and ownership for WMU 4, Morgan-South Rich.

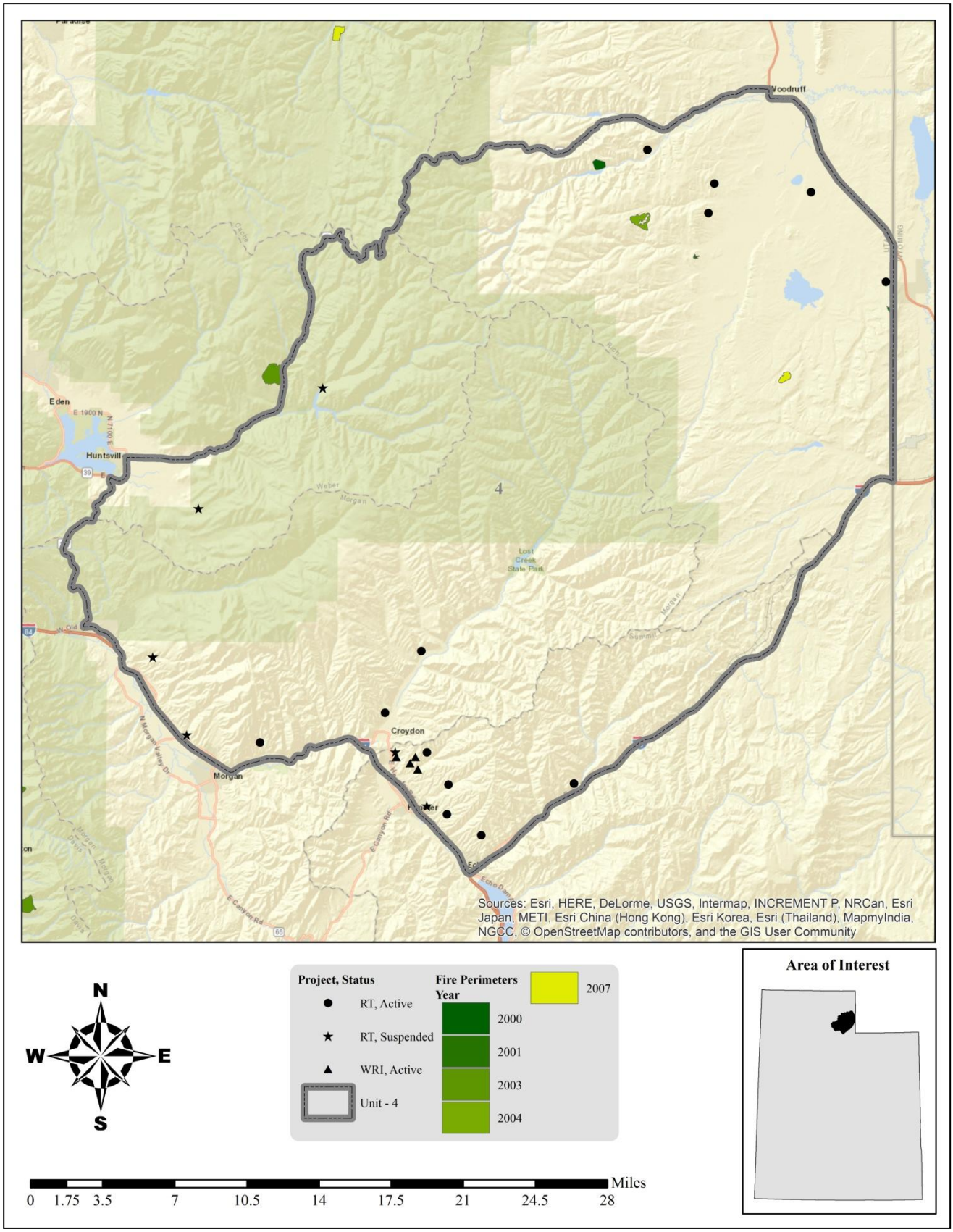
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Conifer-Hardwood	24,765	4.16%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	14,207	2.39%	
	Colorado Plateau Pinyon-Juniper Woodland	7,940	1.33%	
	Inter-Mountain Basin Curl-leaf Mountain Mahogany Woodland	5,427	0.91%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	2,777	0.47%	
	Rocky Mountain Lodgepole Pine Forest	2,398	0.40%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,617	0.27%	
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	1,117	0.19%	
	Other Conifer	339	0.06%	10.18%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	920	0.15%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	139	0.02%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	98	0.02%	0.19%
Exotic Tree-Shrub	Introduced Riparian Shrubland	9	0.00%	0.00%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	5,366	0.90%	
	Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	769	0.13%	
	Southern Rocky Mountain Montane-Subalpine Grassland	667	0.11%	
	Other Grassland	88	0.01%	1.16%
Shrubland	Artemisia tridentata ssp. vaseyana Shrubland Alliance	144,217	24.24%	
	Inter-Mountain Basins Big Sagebrush Shrubland	105,253	17.69%	
	Quercus gambelii Shrubland Alliance	21,364	3.59%	
	Inter-Mountain Basins Montane Sagebrush Steppe	14,059	2.36%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	13,436	2.26%	
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	10,011	1.68%	
	Inter-Mountain Basins Big Sagebrush Steppe	6,854	1.15%	
	Rocky Mountain Lower Montane-Foothill Shrubland	5,723	0.96%	
	Inter-Mountain Basins Greasewood Flat	1,945	0.33%	
	Inter-Mountain Basins Mat Saltbush Shrubland	926	0.16%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	487	0.08%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	337	0.06%	
	Other Shrubland	52	0.01%	54.57%
Other	Hardwood	156,348	26.28%	
	Agricultural	19,903	3.35%	
	Developed	11,950	2.01%	
	Riparian	9,595	1.61%	
	Open Water	1,923	0.32%	
	Sparsely Vegetated	1,364	0.23%	
	Barren	220	0.04%	
	Other	340	0.06%	33.89%
Total		594,952	100.00%	100.00%

Table 4.6: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 4, Morgan-South Rich.

Limiting Factors to Big Game Habitat

Major human activities in the area include urbanization, grazing, and agriculture. Habitat degradation and loss, public land winter range availability, winter range forage condition, and landowner acceptance limit big game habitat in this unit.

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). Increased amounts of cheatgrass exacerbate the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). According to the current Landfire Existing Vegetation Coverage model, 0.5% of the unit is comprised of exotic herbaceous species (Table 4.6).



Map 4.7: Land coverage of fires by year from 2000-2016 for WMU 4, Morgan-South Rich.

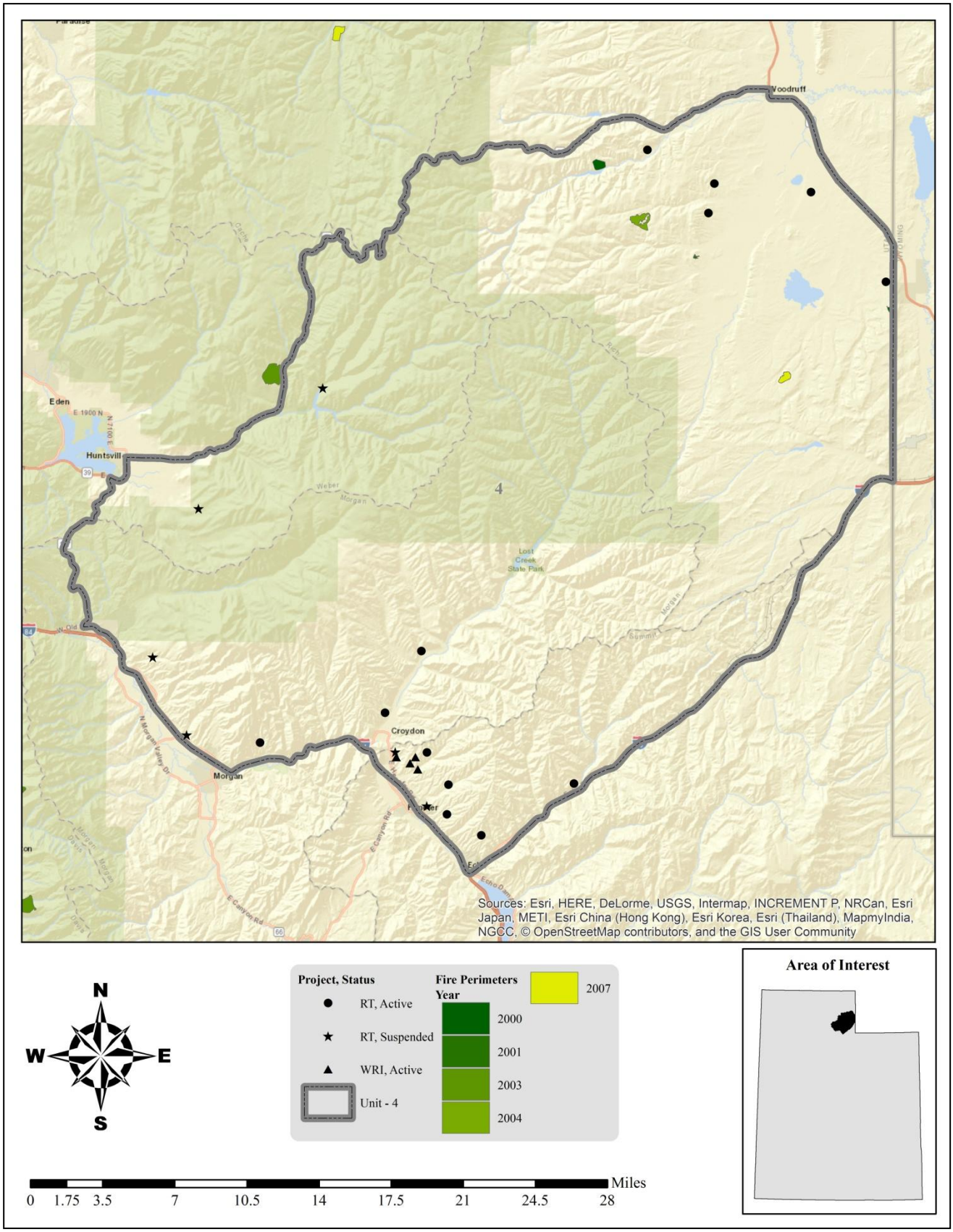
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 3,540 acres of land have been treated within the Morgan-South Rich unit since the WRI was implemented in 2004 (Map 4.8). An additional 322 acres are currently being treated and treatments have been proposed for 371 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 3,488 acres for this unit (Table 4.7). 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.

Vegetation removal via hand crew is the most common management practice in this unit. Harrow is also common. Other management practices include seeding desirable herbaceous species, anchor chain used to remove twoneedle pinyon and Utah juniper, discing, and other vegetation removal techniques (Table 4.7).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**263**	**0**	**0**	**263**
Ely (One-Way)	2	0	0	2
Ely (Two-Way)	261	0	0	261
Disc	**191**	**0**	**0**	**191**
Harrow	**640**	**0**	**0**	**640**
≤15 ft. (One-Way)	640	0	0	640
Planting/Transplanting	**17**	**0**	**371**	**388**
Seeding (Primary)	**567**	**322**	**0**	**889**
Broadcast (Aerial)	92	322	0	414
Drill (Rangeland)	357	0	0	357
Other	119	0	0	119
Vegetation Removal/Hand Crew	**1,809**	**0**	**0**	**1,809**
Lop & Scatter	1,809	0	0	1,809
Other	**53**	**0**	**0**	**53**
Greenstripping	53	0	0	53
Total Treatment Acres	**3,540**	**322**	**371**	**4,233**
***Total Land Area Treated**	**3,488**	**322**	**371**	**4,067**

Table 4.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 4, Morgan-South Rich. Data accessed on 02/09/2017. *Does not include overlapping treatments.



Map 4.8: WRI treatments by fiscal year completed for WMU 4, Morgan-South Rich.

Range Trend Studies

Range Trend studies have been sampled within WMU 4 on a regular basis since 1984, with studies being added or suspended as was deemed necessary (Table 4.8). 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 4.9).

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 by region.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
04-1	Heiner's Creek	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
04-2	Echo Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Wyoming Big Sagebrush)
04-3	Tank Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04-4	Owen's Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04-5	Owen's Canyon Bench	RT	Suspended	'84, '90	Not Verified
04-6	Harris Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Mountain Big Sagebrush)
04-7	Croyden Access Road	RT	Suspended	'84, '90	Not Verified
04-8	Shell Hollow	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04-9	Scott Rees Ranch	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Mountain Big Sagebrush)
04-10	Big Hollow	RT	Suspended	'84, '90	Not Verified
04-11	Causey Dam	RT	Suspended	'84, '90	Not Verified
04-12	Bennett Creek	RT	Suspended	'90, '96	Not Verified
04-13	Wheatgrass Hollow	RT	Active	'90, '96, '01, '06, '11, '16	Upland Gravelly Loam (Bonneville Big Sagebrush)
04-14	Chapman Canal	RT	Active	'84, '90, '96, '01, '06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
04-15	Woodruff Creek South	RT	Active	'96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04-16	Dry Hollow	RT	Suspended	'96, '01	Not Verified
04-17	Above Toon Ranch	RT	Active	'96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04-18	Deseret Main Gate	RT	Active	'97, '01, '06, '11, '16	Semidesert Loam (Wyoming Big Sagebrush)
04-19	Deseret Burn	RT	Active	'97, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04R-3	Claypit North Slope	WRI	Active	'06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04R-4	Claypit South Slope	WRI	Active	'06, '11, '16	Upland Stony Loam (Mountain Big Sagebrush)
04R-5	Crodon Cemetary	WRI	Active	'06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
04R-6	Harris Canyon Dixie	WRI	Active	'08	Not Verified

Table 4.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 4, Morgan-South Rich.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
04-1	Heiner's Creek	Wildfire		Prior to 1984		
04-2	Echo Canyon	Wildfire	Echo Road Shed	August 2016	317	
		Aerial After	Henefer Echo - Roadshed Fire, Rehab	November 2016	315	3895
04-3	Tank Canyon	Wildfire		1982		
		Seed Unknown		1982		
		Wildfire		1984-1990	40	
		Two-Way Ely Chain	Henefer Echo WMA Project	November-December 2008	261	1212
		Aerial After	Henefer Echo WMA Project	December 2008	261	1212
04-04	Owen's Canyon	Wildfire	Eagle Canyon	1999	3,744	
04-19	Deseret Burn	Wildfire	Wheat Grass	August 1996	630	
		Chain Unknown		Fall 1996		
		Aerial Unknown		Fall 1996		
		Dribbler		Fall 1996		
04R-3	Claypit North Slope	Aroga Moth	Aroga Moth Study	Approx. 2006		
04R-4	Claypit South Slope	Aroga Moth	Aroga Moth Study	Approx. 2006		
04R-5	Croydon Cemetery	Aroga Moth	Aroga Moth Study	Approx. 2006		
04R-6	Harris Canyon Dixie	Aroga Moth	Aroga Moth Study	Approx. 2006		
		Disc	Henefer-Echo WMA	2010	30	1471
		Rangeland Drill	Henefer-Echo WMA	2010	30	1471

Table 4.9: Range trend and WRI studies known disturbance history for WMU 4, Morgan-South Rich.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

One study [Heiner's Creek (04-1)] is considered to be a Mountain (Sagebrush) ecological site: this study is located in Echo Canyon north of Interstate 80.

Shrubs/Trees: The dominant browse species on this site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which has increased in cover each sample year; other preferred browse is less prevalent, but includes Saskatoon serviceberry (*Amelanchier alnifolia*), Woods' rose (*Rosa woodsii*), and antelope bitterbrush (*Purshia tridentata*) (Figure 4.2). Average sagebrush demographics show that mature plants have been the primary age class in all years except 2001, when young individuals dominated; recruitment of young has decreased since that sample year (Figure 4.5). Sagebrush on this site has been browsed in various amounts from year to year, but a majority of plants have exhibited little to no use in all sample years (Figure 4.6).

Trees are not present on this study site and therefore will not be discussed (Figure 4.3, Figure 4.4).

Herbaceous Understory: Average herbaceous cover and frequency has fluctuated over time, but has increased overall. Perennial grasses such as Sandberg bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) have dominated the understory in 1996-97, 2001, and 2006, and have been co-dominant with perennial forbs in 2011 and 2016. Annual grasses and forbs have also fluctuated, but have remained relatively rare throughout the study years (Figure 4.7, Figure 4.8).

Occupancy: Average pellet transect data indicates that animal occupancy on this site has decreased overall and that deer have been the primary occupants in all sample years with a mean abundance of pellet groups ranging from 18 days use/acre in 2011 to 45.5 days use/acre in 2006. Elk have also been present on this site, with a mean abundance of pellet groups as low as 2 days use/acre in 2001 and as high as 16 days use/acre in 2006. Mean abundance of cattle pellet groups has ranged from 1.5 days use/acre in 2016 to 7 days use/acre in 2011. Finally, mean abundance of horse pellet groups has been as low as 0 days use/acre in 2001, 2006, and 2011 and as high as over 2 days use/acre in 2016 (Figure 4.9).

Mountain (Oak)

One study site [Scott Rees Ranch (04-9)] is classified as a Mountain (Oak) ecological site. This study is situated north of Rees Ranch on the Morgan WMA.

Shrubs/Trees: Average shrub cover data shows that cover has slightly increased overall; almost all of this cover is contributed by Gambel oak (*Quercus gambelii*), although mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*) are present in much lower amounts (Figure 4.2). Mature sagebrush plants have made up a majority of the population in most sample years, and no young plants have been recorded in density measurements in any sample year (Figure 4.5). A majority of sagebrush plants have been moderately to heavily used in all study years except in 2001 when most plants showed signs of little to no use (Figure 4.6).

Although trees contribute no cover on this site, Utah juniper (*Juniperus osteosperma*) was recorded in point-quarter measurements in low amounts in 2016 (Figure 4.3, Figure 4.4).

Herbaceous Understory: The herbaceous understory of this site has, on average, increased in cover through the sample years and decreased in frequency. Annual grasses have been the dominant herbaceous component in all sample years except 2001 and 2006, when perennial grass and/or annual forbs contributed the most cover. Perennial forb cover has increased through the study years with arrowleaf balsamroot (*Balsamorhiza sagittata*) and white sagebrush (*Artemisia ludoviciana*) as the most prevalent species. The introduced perennial grass bulbous bluegrass (*Poa bulbosa*) has been observed in each sample year since 2001, but is not common (Figure 4.7, Figure 4.8).

Occupancy: Although pellet transect data indicates that occupancy increased between 2001 and 2006, it has decreased each sample year since then. Deer have been the primary occupants in 2001 and 2011, while elk pellets have been most prevalent in 2006 and 2016. Deer pellet groups have had a mean abundance ranging from almost 11 days use/acre in 2016 to 56 days use/acre in 2006. Mean abundance of elk pellet groups has been as low as 4 days use/acre in 2001 and as high as 58 days use/acre in 2006 (Figure 4.9).

Upland (Sagebrush)

Nine study sites [Echo Canyon (04-2), Tank Canyon (04-3), Owen's Canyon (04-4), Harris Canyon (04-6), Shell Hollow (04-8), Wheatgrass Hollow (04-13), Woodruff Creek South (04-15), Above Toon Ranch (04-17), and Deseret Burn (04-19)] are classified as Upland (Sagebrush) ecological sites. The Echo Canyon study is located northeast of the intersection of Interstates 84 and 80, above Echo Canyon Road. Tank Canyon is found on the ridge between Tank Canyon and Bald Rock Canyon, and the Owen's Canyon study site is situated on the slopes on the northwest side of Owen's Canyon. The Harris Canyon site is found on the northwest slopes of Harris Canyon. Shell Hollow is located on the slopes above Lost Creek near Shells Hollow, and the Wheatgrass Hollow study is situated north of Wheatgrass Hollow and southwest of Halfway Spring. The Woodruff Creek South study is located on a south-facing slope north of Woodruff Creek. The Above Toon Ranch study site is found on a southeast-facing slope above Lost Creek Road and Toon Ranch. Finally, the Deseret Burn study is located south of Wheatgrass Hollow.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) or Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) are the dominant preferred browse species on all studies except Owen's Canyon, on which forage kochia (*Bassia prostrata*) has contributed the most cover. The overall shrub cover has exhibited a marginal increase each study year. The general increase in sagebrush cover is likely driven by the Shell Hollow and Wheatgrass Hollow studies which exhibited the largest increases in sagebrush cover (Figure 4.2). Average sagebrush demographics show that mature plants have made up most of the populations on these sites in all sample years. The demographic data also indicates that the density of decadent individuals and recruitment of young has decreased over time (Figure 4.5). Average sagebrush use has increased throughout

the study period, although a majority of plants have shown signs of little to no use in most sample years; the exception to this is 2011 and 2016, when just over/under (respectively) half of the population was moderately or heavily hedged (Figure 4.6).

Tree cover on these sites is contributed by Utah juniper (*Juniperus osteosperma*) and has decreased over time: this trend is driven by the Woodruff Creek South study. Average tree density has increased overall, a trend that is also largely driven by the previously-mentioned study (Figure 4.3, Figure 4.4).

Herbaceous Understory: Average cover and frequency of the herbaceous understory on these sites has increased over time. Perennial grasses such as crested wheatgrass (*Agropyron cristatum*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) have been the dominant component in most sample years. Annual grass cover and frequency have varied from year to year, but have exhibited a general decrease. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*), however, has increased in both cover and frequency due to the Echo Canyon, Tank Canyon, and Owen's Canyon studies. Finally, perennial and annual forbs have exhibited an overall increase in cover over the study period (Figure 4.7, Figure 4.8).

Occupancy: Average pellet transect data shows that although animal occupancy has varied, it has decreased overall and that deer have been the primary occupants in all sample years. Mean abundance of deer pellet groups has ranged from 29 days use/acre in 2016 to 38 days use/acre in 2006. Elk pellet groups have had a mean abundance as low as 7.5 days use/acre in 2016 and as high as almost 29 days use/acre in 2006. Mean abundance of cattle pellet groups has ranged from nearly 11 days use/acre in 2001 to just under 20 days use/acre in 2006. Finally, horse pellet groups have had a mean abundance ranging from 0 days use/acre in 2006 and 2016 to almost 1 days use/acre in 2001 (Figure 4.9).

Semidesert (Sagebrush)

Two studies [Chapman Canal (04-14) and Deseret Main Gate (04-18)] are considered to be Semidesert (Sagebrush) ecological sites. The Chapman Canal study is located west of the Utah-Wyoming border and south of Chapman Canal, while Deseret Main Gate is situated north of Home Ranch Road and southeast of Blue Grass Pond.

Shrubs/Trees: The dominant browse species on these sites is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). Average shrub cover has increased over time, a trend which is driven by the Chapman Canal study by the overall increase of sagebrush and yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* var. *stenophyllus*) (Figure 4.2). Average sagebrush demographics indicate that mature plants have been the most abundant age class in all years except 2006, in which decadent individuals were dominant. Recruitment of young has fluctuated over the study years, but has exhibited a marginal increase overall (Figure 4.5). More than half of the sagebrush plants showed signs of moderate to heavy browsing in 1996-1997, while a majority of plants have been either not used or lightly used in other sample years (Figure 4.6).

Trees have not been observed in cover or point-quarter measurements in any sample year and will therefore not be discussed here (Figure 4.3, Figure 4.4).

Herbaceous Understory: The average cover and frequency of the herbaceous understories of these study sites have increased overall with perennial grasses as the dominant component. Although perennial grass cover has increased on both study sites, the general trend is likely driven by the Deseret Main Gate study which had 40.2% cover in 2016, much of which was contributed by crested wheatgrass (*Agropyron cristatum*). Annual grasses and forbs and perennial forbs have remained rare throughout the study years. Annual grass cover and frequency have been provided solely by the Chapman Canal study in all sample years (Figure 4.7, Figure 4.8).

Occupancy: Animal occupancy has fluctuated over the years, but has decreased overall according to average pellet transect data. Cattle have been the primary occupants in all years except 2006, when deer were the primary occupants. Deer pellet groups have had a mean abundance ranging from 11 days use/acre in 2016 to

almost 69 days use/acre in 2006. Mean abundance of elk pellet groups has been as low as nearly 5 days use/acre in 2016 and as high as 39 days use/acre in 2006. Finally, cattle pellet groups have had a mean abundance ranging from 23.5 days use/acre in 2006 to over 38 days use/acre in 2011 (Figure 4.9).

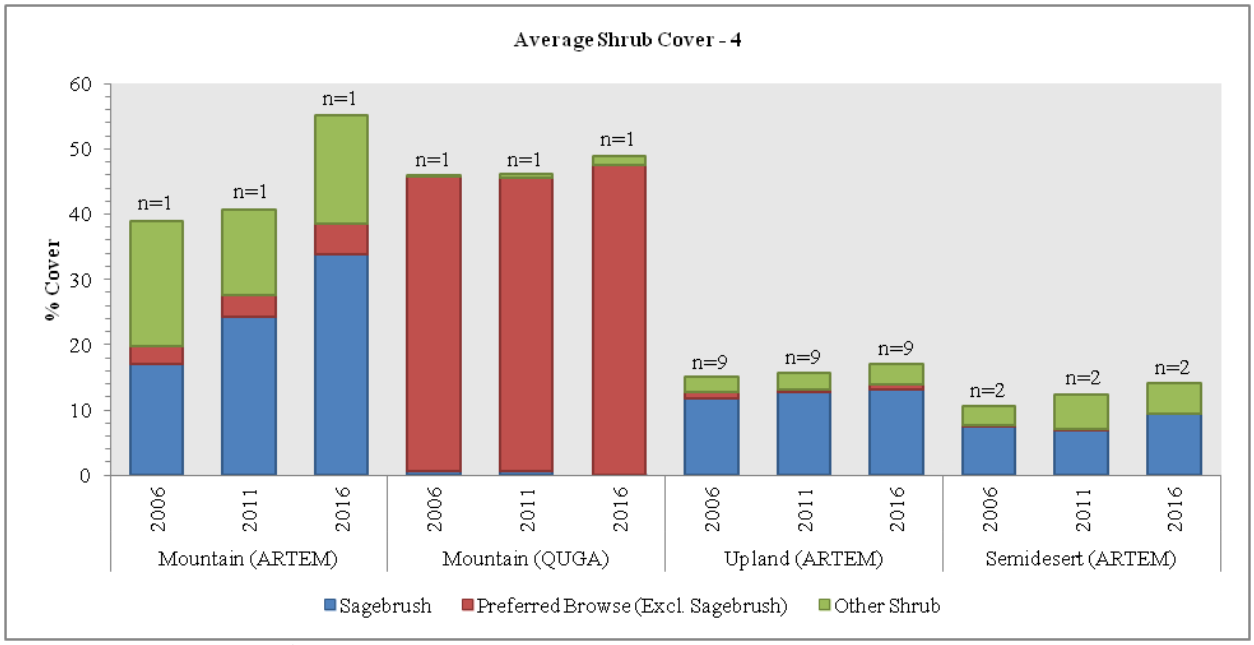


Figure 4.2: Average shrub cover for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

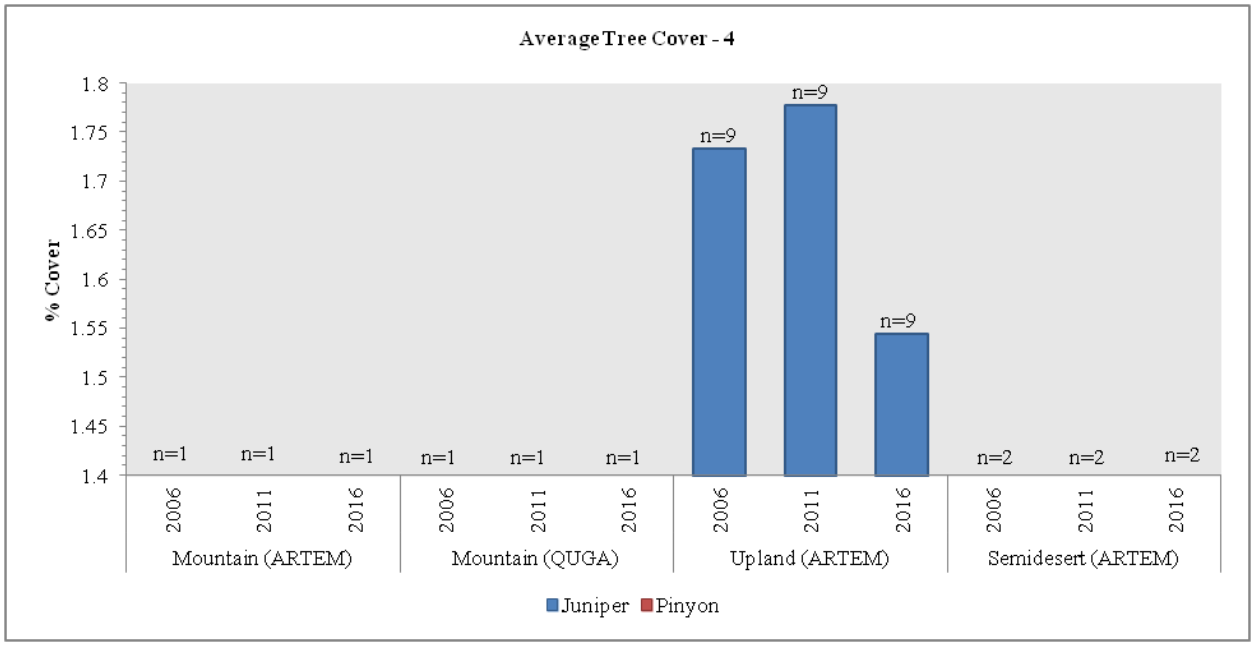


Figure 4.3: Average tree cover for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

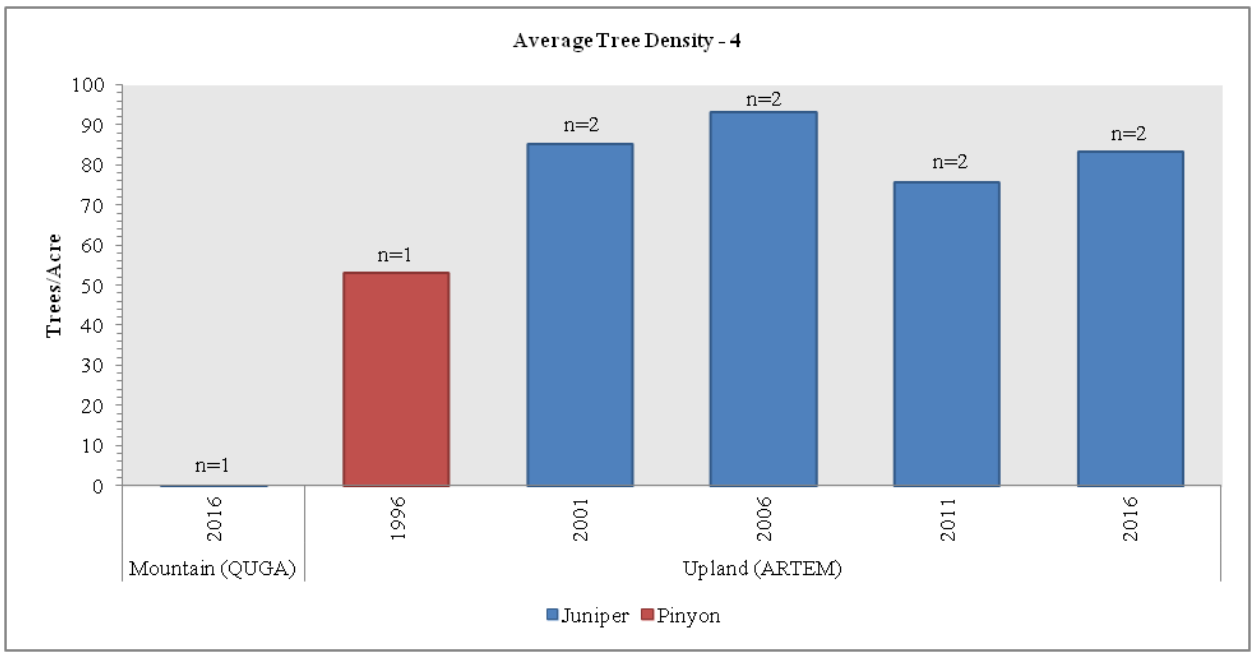


Figure 4.4: Average tree density for Mountain (QUGA) and Upland (ARTEM) study sites in WMU 4, Morgan-South Rich.

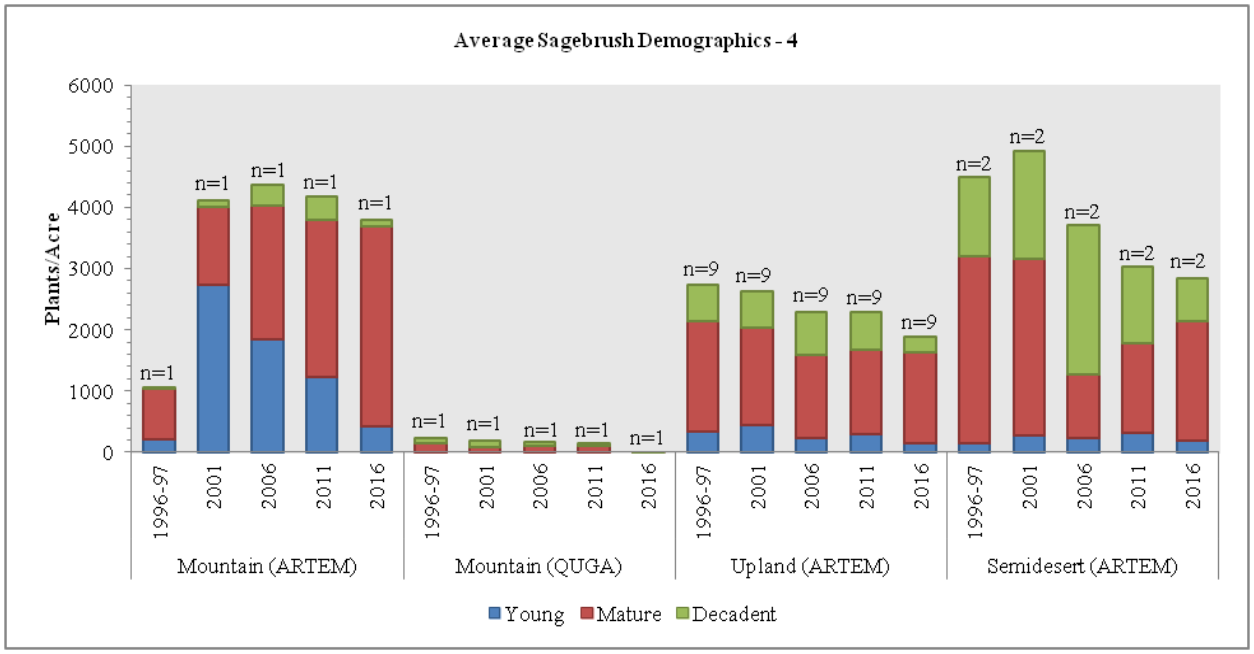


Figure 4.5: Average sagebrush demographics for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

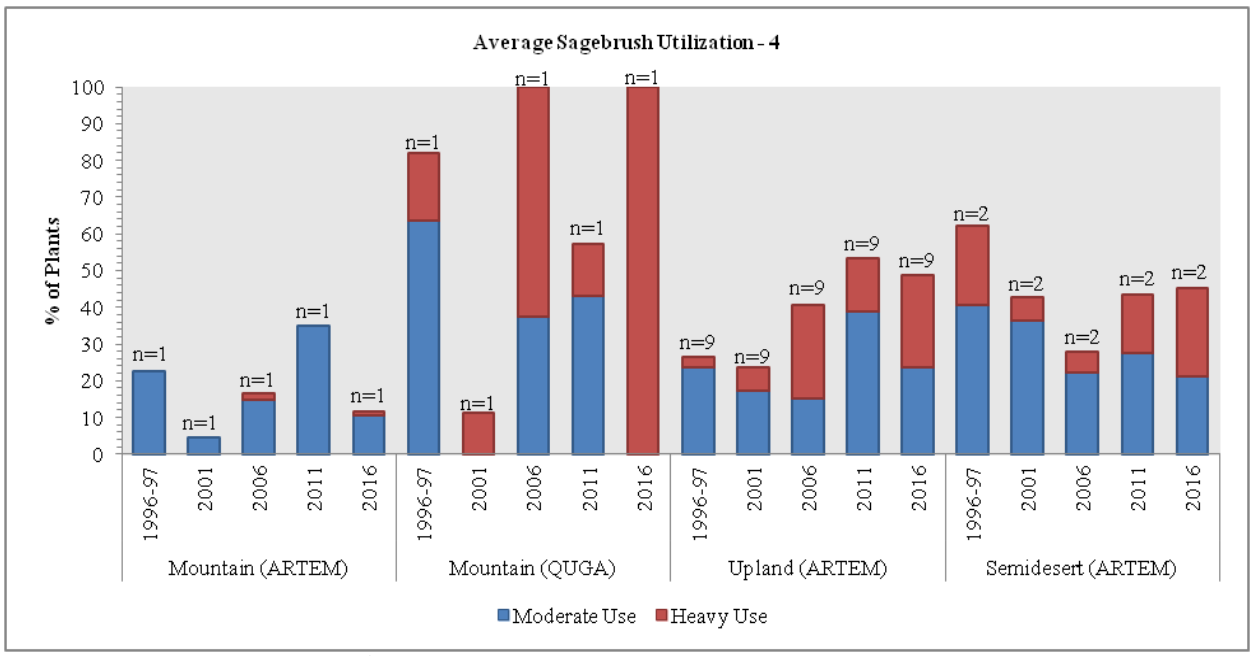


Figure 4.6: Average sagebrush utilization for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

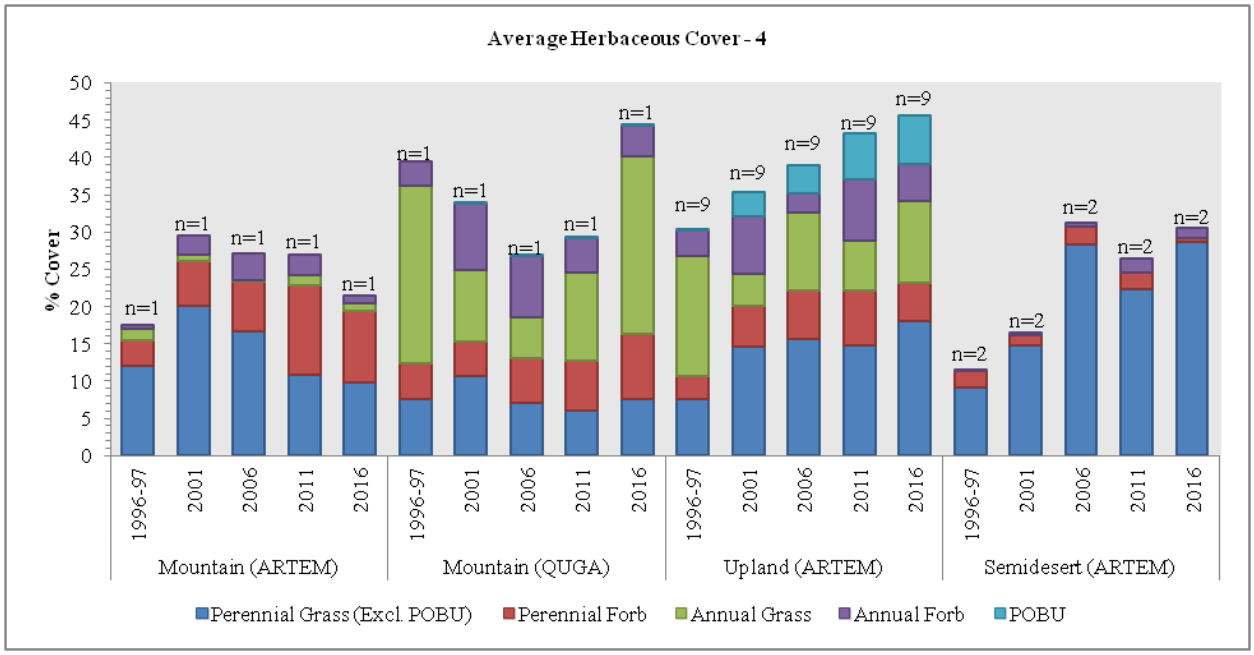


Figure 4.7: Average herbaceous cover for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

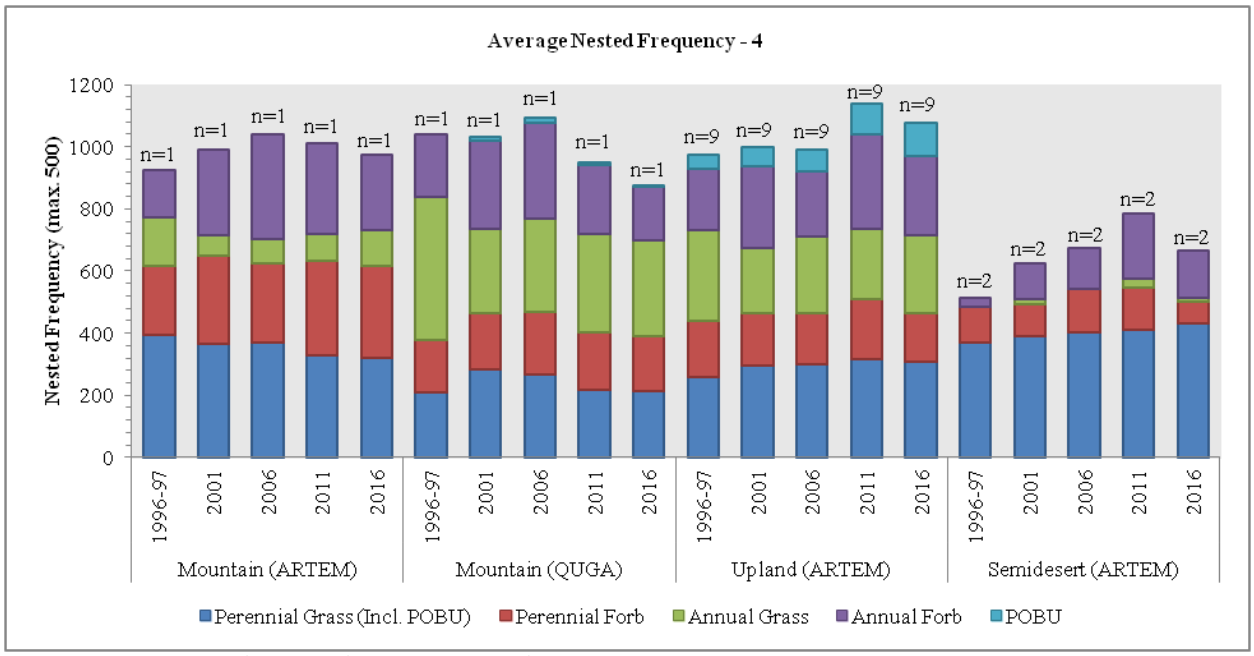


Figure 4.8: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

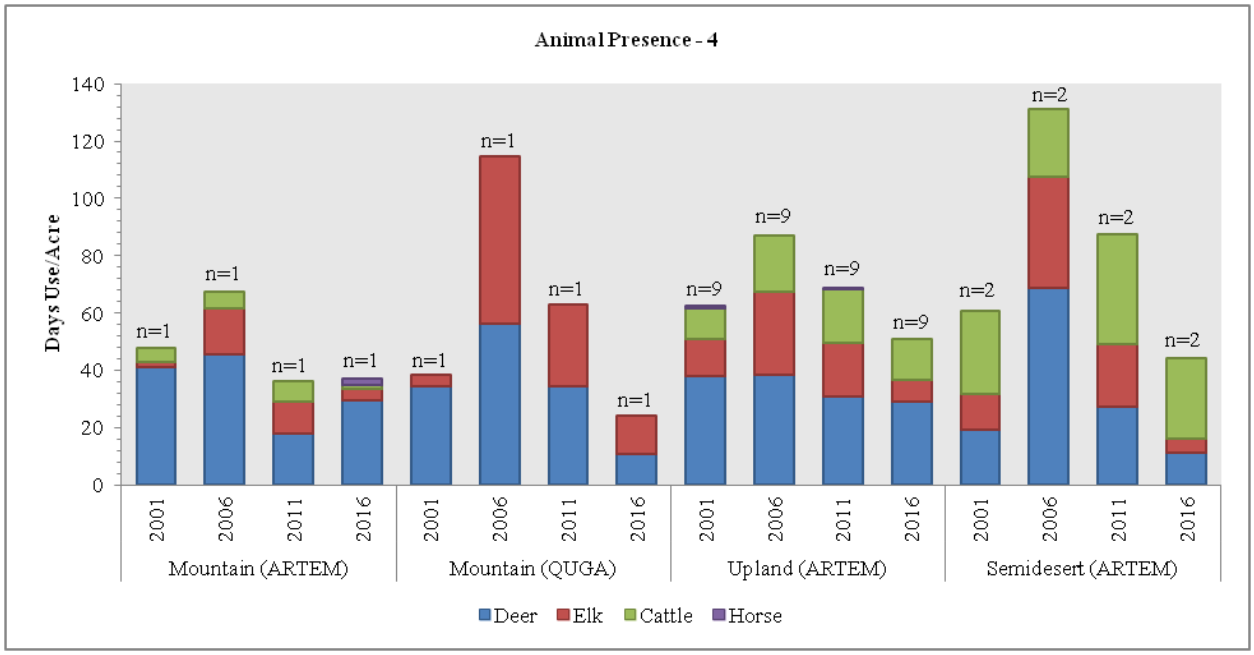
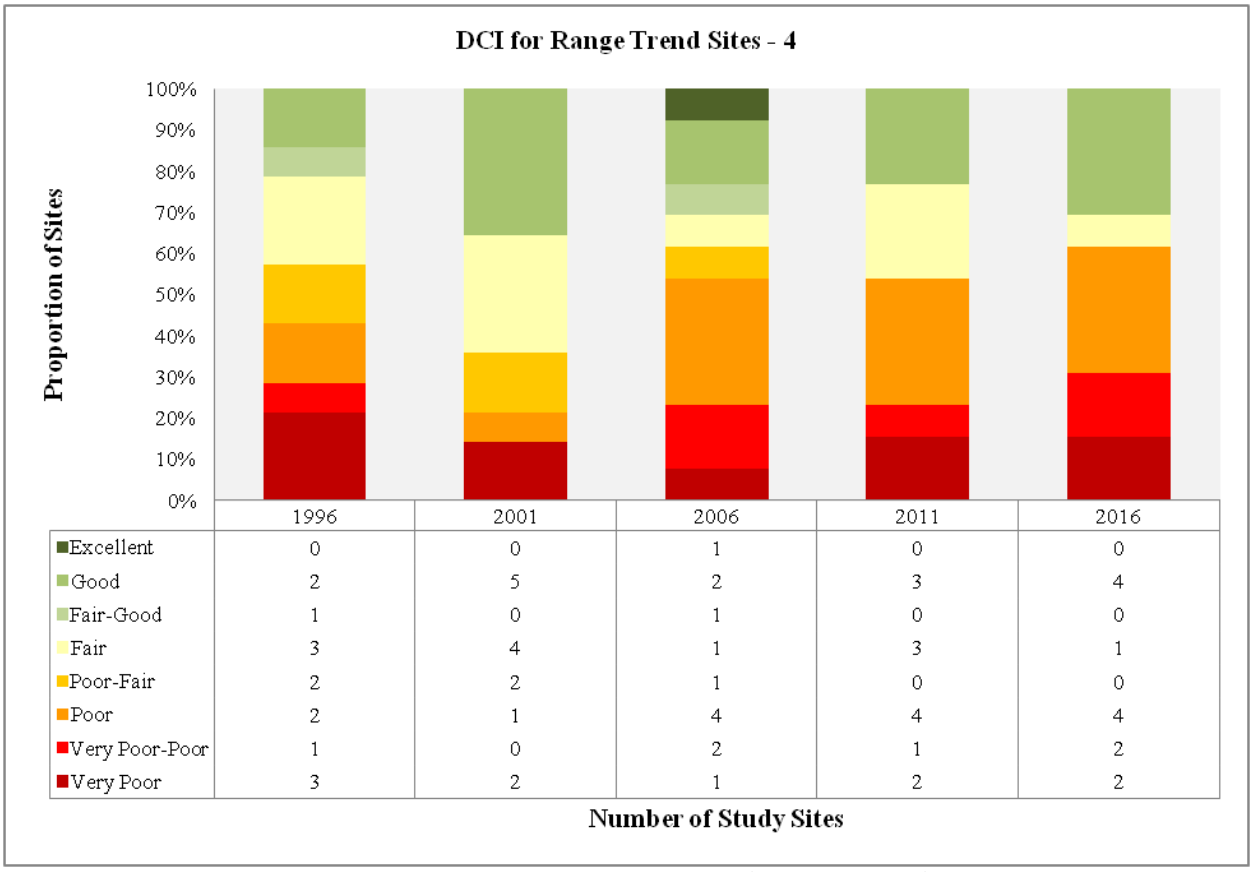


Figure 4.9: Average pellet transect data for Mountain (ARTEM), Mountain (QUGA), Upland (ARTEM), and Semidesert (ARTEM) study sites in WMU 4, Morgan-South Rich.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Morgan-South Rich management unit has continually changed on the sites sampled since 1996. The Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the 2016 sample year (Figure 4.10, Table 4.10, Map 4.13). Shell Hollow improved from very poor-poor to poor condition, Echo Canyon and Tank Canyon remained in poor condition, and Scott Rees Ranch and Wheatgrass Hollow improved from fair to good condition. Heiner's Creek and Chapman Canal remained in good condition, Deseret Main Gate went from good to fair condition, and Woodruff Creek South went from fair to poor. Finally, the Owen's Canyon, Deseret Burn, Harris Canyon, and Above Toon Ranch studies are considered to be in very poor-poor condition generally due to the lack of browse cover, sagebrush diversity, and the presence of annual grasses. The treated study sites range from very poor to good (Figure 4.11, Table 4.11). The treated sites have generally improved as time since treatment has increased; the exception to this is the Claypit South Slope study which has remained in very poor condition. Tank Canyon, Owen's Canyon, and Deseret Burn are also considered to be Range Trend sites and are discussed above. Harris Canyon Dixie was sampled prior to treatment and was in very poor condition. Claypit North Slope improved from fair-good to good and Croydon Cemetery remained in fair condition (Map 4.13). It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1996	2001	2006	2011	2016
Excellent	0	0	1	0	0
Good	2	5	2	3	4
Fair-Good	1	0	1	0	0
Fair	3	4	1	3	1
Poor-Fair	2	2	1	0	0
Poor	2	1	4	4	4
Very Poor-Poor	1	0	2	1	2
Very Poor	3	2	1	2	2

Figure 4.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 4, Morgan-South Rich.

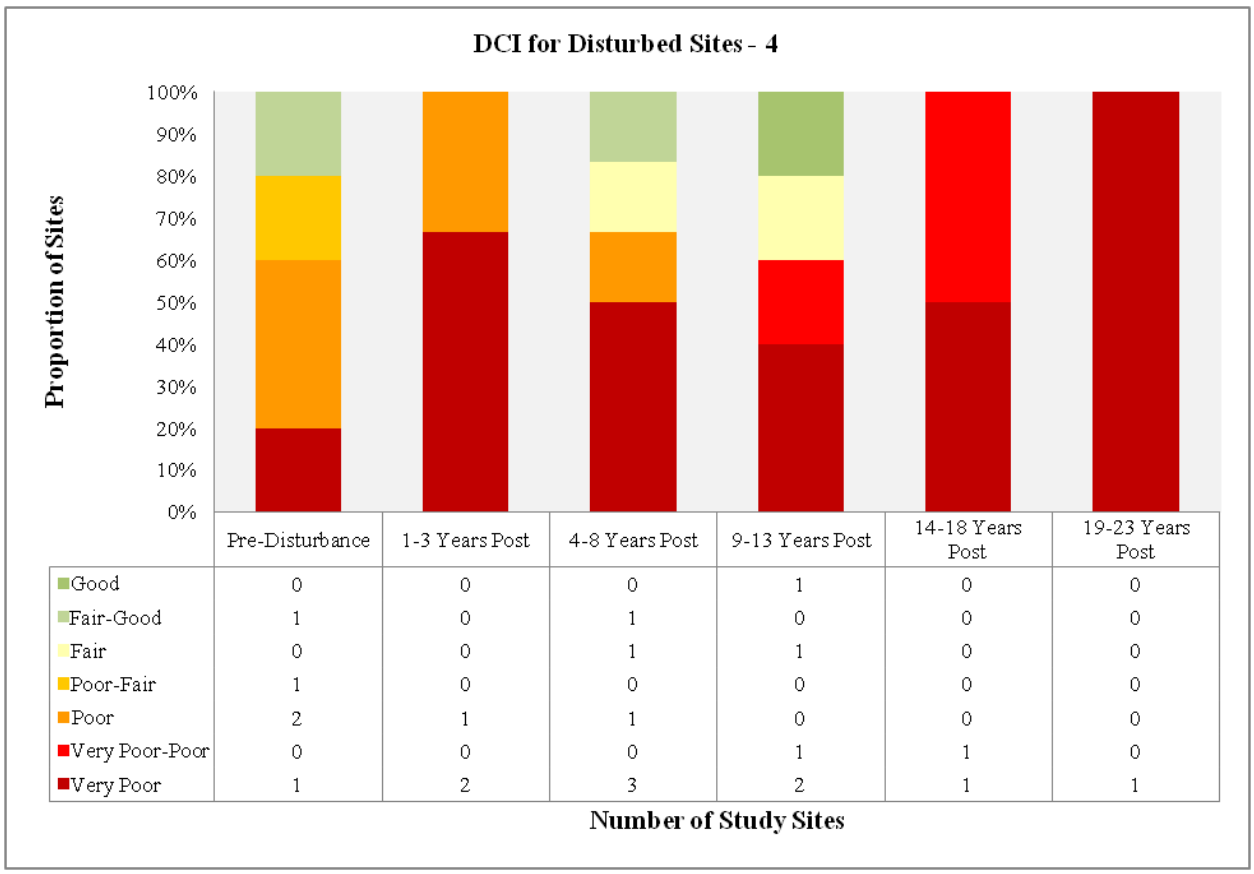


Figure 4.11: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 4, Morgan-South Rich.

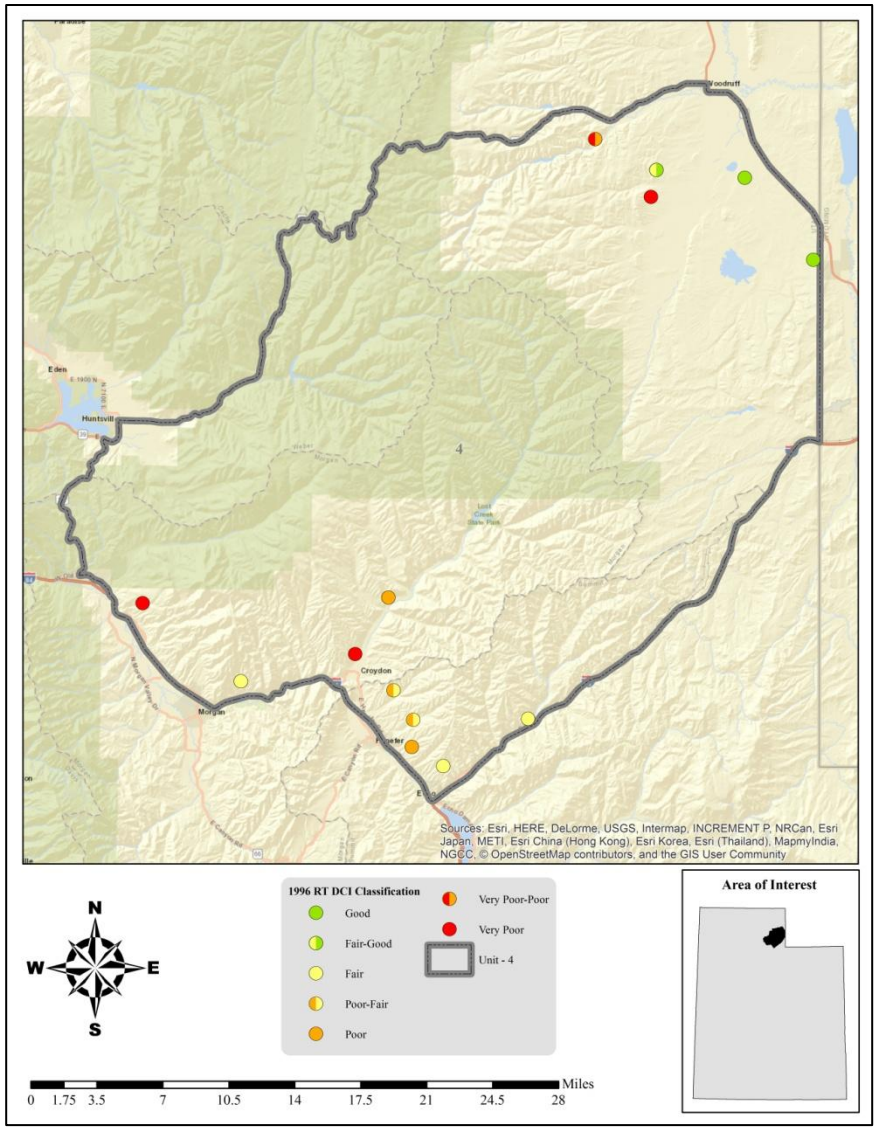
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
04-1	1996	9.5	13.1	10.6	24.2	-1.2	7.8	0.0	**63.9**	**F**
04-1	2001	14.5	14.3	15.0	30.0	-0.6	10.0	0.0	**83.2**	**G**
04-1	2006	25.9	13.0	15.0	30.0	-0.2	10.0	0.0	**93.7**	**E**
04-1	2011	30.0	12.6	14.3	21.5	-1.0	10.0	0.0	**87.4**	**G**
04-1	2016	30.0	14.2	7.8	19.6	-0.8	10.0	0.0	**80.9**	**G**
04-2	1996	17.9	9.3	8.0	19.0	-10.3	10.0	0.0	**53.9**	**F**
04-2	2001	18.8	5.7	0.0	30.0	-3.3	10.0	0.0	**61.2**	**F**
04-2	2006	12.0	0.6	0.5	30.0	-3.4	10.0	0.0	**49.7**	**P-F**
04-2	2011	5.3	0.0	0.0	26.5	-3.5	10.0	0.0	**38.3**	**P**
04-2	2016	6.0	0.0	0.0	30.0	-5.8	10.0	0.0	**40.2**	**P**
04-3	1996	1.5	0.0	0.0	30.0	-0.2	10.0	0.0	**41.3**	**P**
04-3	2001	1.9	0.0	0.0	30.0	0.0	10.0	0.0	**41.9**	**P**
04-3	2006	1.7	0.0	0.0	30.0	0.0	10.0	0.0	**41.7**	**P**
04-3	2011	1.9	0.0	0.0	30.0	0.0	10.0	0.0	**41.9**	**P**
04-3	2016	1.8	0.0	0.0	30.0	0.0	10.0	0.0	**41.8**	**P**
04-4	1996	25.9	8.2	4.6	23.3	-14.8	2.0	0.0	**49.1**	**P-F**
04-4	2001	0.5	0.0	0.0	30.0	-1.9	4.4	-2.0	**31.1**	**VP**
04-4	2006	2.0	0.0	0.0	30.0	-7.5	2.9	0.0	**27.4**	**VP**
04-4	2011	1.2	0.0	0.0	30.0	-5.3	2.2	0.0	**28.2**	**VP**
04-4	2016	3.2	0.0	0.0	30.0	-1.2	1.2	0.0	**33.2**	**VP-P**
04-6	1996	8.5	11.9	9.5	24.6	-7.2	4.2	-2.0	**49.4**	**P-F**
04-6	2001	16.9	7.1	3.3	27.2	-6.6	7.0	-2.0	**53.0**	**F**
04-6	2006	11.0	8.2	3.2	29.4	-13.9	10.0	-2.0	**45.9**	**P**
04-6	2011	6.8	4.9	4.4	25.2	-8.6	10.0	0.0	**42.6**	**P**
04-6	2016	5.6	0.0	0.0	30.0	-7.4	7.0	0.0	**35.3**	**VP-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
04-8	1996	30.0	8.0	4.0	3.8	-19.5	3.4	0.0	**29.7**	**VP**
04-8	2001	30.0	9.2	1.7	6.0	-1.6	5.8	0.0	**51.2**	**P-F**
04-8	2006	27.9	4.2	1.9	9.2	-19.4	10.0	0.0	**33.9**	**VP-P**
04-8	2011	26.5	5.6	0.0	5.0	-7.5	5.2	0.0	**34.9**	**VP-P**
04-8	2016	29.5	11.4	6.5	5.4	-11.6	3.4	0.0	**44.6**	**P**
04-9	1996	28.7	12.6	9.3	15.0	-18.3	10.0	0.0	**57.3**	**F**
04-9	2001	30.0	14.4	6.5	21.2	-9.9	10.0	0.0	**72.2**	**G**
04-9	2006	27.0	14.3	7.4	14.1	-5.8	10.0	0.0	**67.1**	**G**
04-9	2011	28.6	13.2	11.8	12.2	-14.6	7.2	0.0	**58.3**	**F**
04-9	2016	30.0	15.0	15.0	15.2	-17.8	10.0	0.0	**67.4**	**G**
04-13	1996	29.3	7.5	5.5	20.3	0.0	4.1	0.0	**66.6**	**F-G**
04-13	2001	30.0	8.1	11.5	20.6	-0.1	3.3	0.0	**73.4**	**G**
04-13	2006	30.0	5.7	6.0	23.8	-0.1	5.9	0.0	**71.3**	**G**
04-13	2011	28.7	7.8	4.5	16.2	-0.1	4.1	0.0	**61.2**	**F**
04-13	2016	30.0	11.4	3.0	18.8	-0.5	5.2	0.0	**67.9**	**G**
04-14	1996	18.8	5.8	1.2	12.9	0.0	8.9	0.0	**47.5**	**G**
04-14	2001	22.9	7.2	0.5	21.7	0.0	5.3	0.0	**57.6**	**G**
04-14	2006	12.9	-10.9	1.0	30.0	0.0	8.2	0.0	**41.2**	**F**
04-14	2011	10.7	0.5	5.1	26.0	0.0	8.1	0.0	**50.4**	**G**
04-14	2016	17.1	7.2	4.0	30.0	0.0	2.4	0.0	**60.7**	**G**
04-15	1996	13.5	5.1	9.0	18.6	-11.8	0.4	0.0	**34.8**	**VP-P**
04-15	2001	13.8	8.1	14.5	22.2	-1.2	0.6	0.0	**58.0**	**F**
04-15	2006	15.2	9.3	9.5	17.7	-5.8	1.6	0.0	**47.5**	**P**
04-15	2011	16.7	9.9	13.0	24.4	-8.7	1.4	0.0	**56.7**	**F**
04-15	2016	19.1	13.2	5.5	17.2	-17.5	0.8	0.0	**38.4**	**P**
04-16*	1996	17.6	13.0	4.0	1.0	-13.1	10.0	0.0	**32.4**	**VP**
04-16*	2001	22.4	11.8	9.1	4.8	-7.0	10.0	0.0	**51.1**	**P-F**
04-17	1996	30.0	12.0	3.5	6.3	-20.0	10.0	0.0	**41.8**	**P**
04-17	2001	30.0	8.7	3.5	12.0	-8.7	10.0	0.0	**55.5**	**F**
04-17	2006	30.0	4.8	2.0	14.1	-13.1	10.0	0.0	**47.8**	**P**
04-17	2011	23.7	2.1	0.0	11.9	-6.1	10.0	0.0	**41.6**	**P**
04-17	2016	27.1	6.3	0.0	7.4	-20.0	10.0	0.0	**30.8**	**VP**
04-18	1996	14.5	6.9	2.0	23.5	0.0	0.3	0.0	**47.2**	**G**
04-18	2001	14.5	2.1	4.0	30.0	0.0	0.4	0.0	**51.1**	**G**
04-18	2006	7.4	1.5	5.0	30.0	0.0	1.0	0.0	**45.0**	**F-G**
04-18	2011	6.1	5.7	5.0	30.0	0.0	0.7	0.0	**47.5**	**G**
04-18	2016	4.1	0.0	0.0	30.0	0.0	0.0	0.0	**34.1**	**F**
04-19	1996	0.1	0.0	0.0	20.2	-0.5	5.9	0.0	**25.7**	**VP**
04-19	2001	0.0	0.0	0.0	30.0	-4.7	3.2	0.0	**28.5**	**VP**
04-19	2006	0.4	0.0	0.0	30.0	-0.1	3.7	0.0	**34.0**	**VP-P**
04-19	2011	0.3	0.0	0.0	30.0	0.0	0.1	0.0	**30.3**	**VP**
04-19	2016	1.4	0.0	0.0	30.0	-16.3	1.2	0.0	**16.3**	**VP**

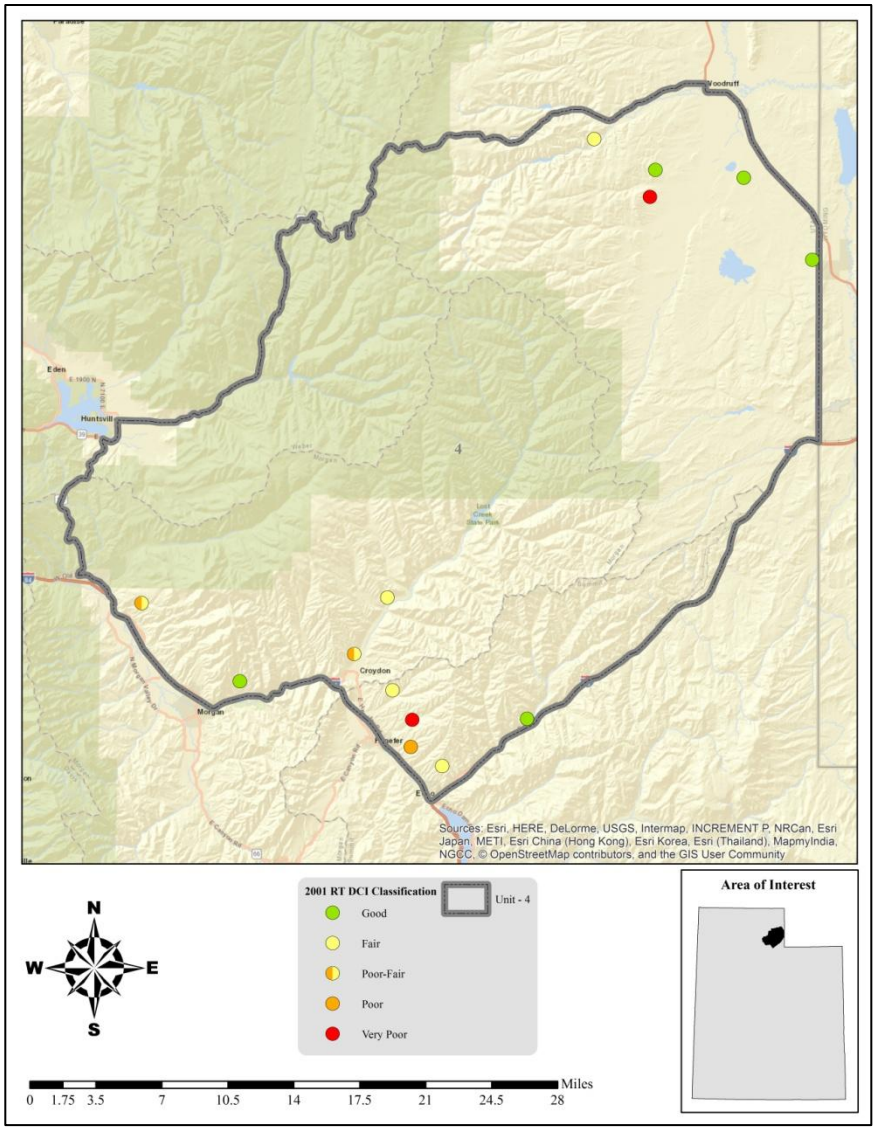
Table 4.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 4, Morgan-South Rich. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

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
04R-3	2006	18.5	5.5	3.1	30.0	0.0	7.6	0.0	**64.7**	**F-G**
04R-3	2011	22.4	2.1	1.6	30.0	-0.1	10.0	0.0	**66.0**	**F-G**
04R-3	2016	25.0	3.1	5.9	30.0	-2.4	10.0	0.0	**71.7**	**G**
04R-4	2006	7.4	1.6	1.9	28.6	-8.7	0.0	0.0	**30.7**	**VP**
04R-4	2011	6.5	3.8	1.5	30.0	-9.7	1.6	0.0	**33.8**	**VP**
04R-4	2016	8.3	2.1	0.0	30.0	-7.5	0.4	0.0	**33.3**	**VP**
04R-5	2006	19.6	-2.4	1.0	22.8	0.0	0.0	0.0	**41.0**	**P**
04R-5	2011	25.3	0.9	2.5	30.0	-0.2	0.2	0.0	**58.7**	**F**
04R-5	2016	30.0	0.6	4.0	25.0	0.0	0.0	0.0	**59.6**	**F**
04R-6	2008	8.0	-13.2	1.0	25.6	0.0	7.4	0.0	**28.8**	**VP**

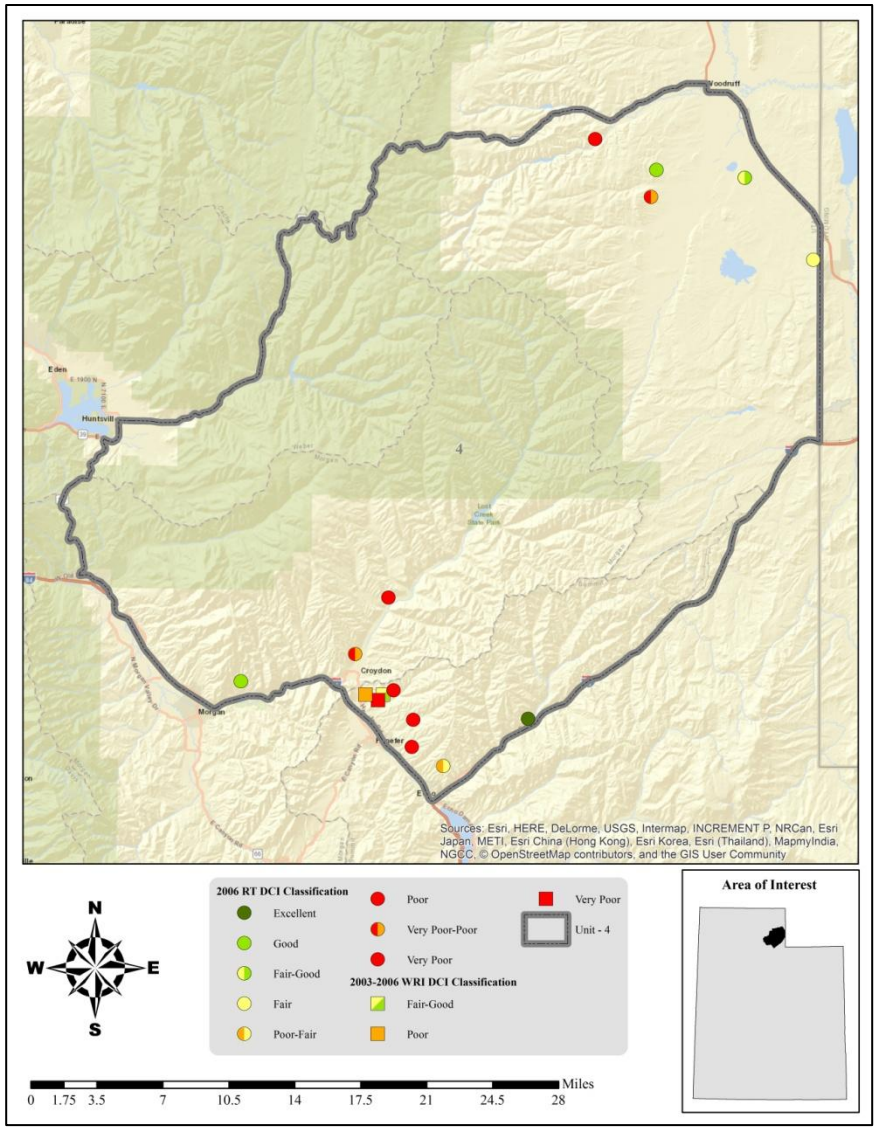
Table 4.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 4, Morgan-South Rich. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



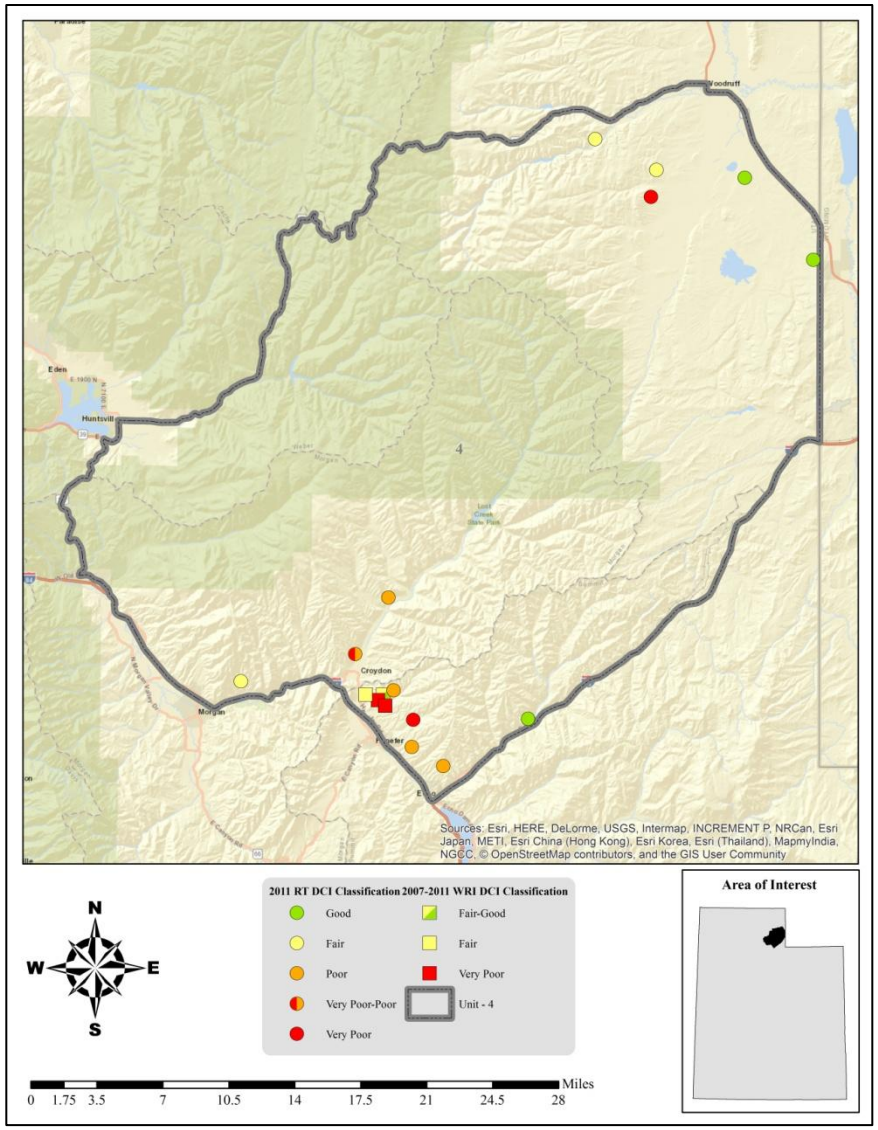
Map 4.9: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 4, Morgan-South Rich.



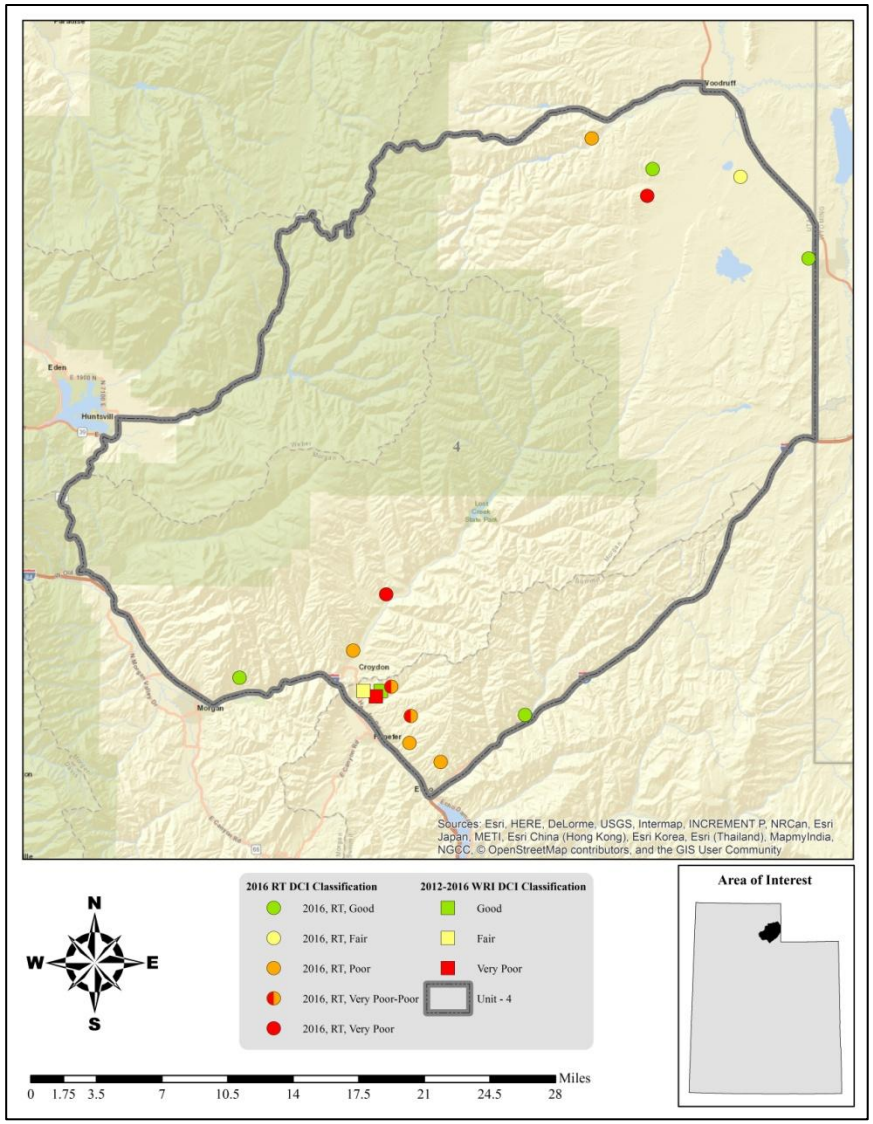
Map 4.10: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 4, Morgan South Rich.



Map 4.11: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 4, Morgan-South Rich.



Map 4.12:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 4, Morgan-South Rich.



Map 4.13: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 4, Morgan-South Rich.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
04-1	Heiner's Creek	Annual Grass	Low	Increased fire potential
04-2	Echo Canyon	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
04-3	Tank Canyon	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
04-4	Owen's Canyon	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
04-6	Harris Canyon	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
04-8	Shell Hollow	Annual Grass	High	Increased fire potential
04-9	Scott Rees Ranch	Annual Grass	High	Increased fire potential
04-13	Wheatgrass Hollow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
04-14	Chapman Canal	None Identified		
04-15	Woodruff Creek South	Annual Grass	High	Increased fire potential
		PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
04-17	Above Toon Ranch	Annual Grass	High	Increased fire potential
04-18	Deseret Main Gate	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
04-19	Deseret Burn	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
04R-3	Claypit North Slope	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
04R-4	Claypit South Slope	Annual Grass	High	Increased fire potential
04R-5	Croydon Cemetery	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
04R-6	Harris Canyon Dixie	Introduced Perennial Grass	High	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 4, Morgan-South Rich. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The study that is considered to be a Mountain (Sagebrush) ecological site supports a sagebrush community and is considered to be in good condition for deer winter range in this management unit. This community supports a variety of shrub species hat provide valuable browse for wildlife. The understory is generally in good condition, with perennial forbs and grasses as main components. However, there are some annual grasses present in the understory, which can increase fuel loads exacerbating the risk of wildfire and outcompete more desirable native species.

It is recommended that monitoring of this community continue. If reseeding is necessary to restore the herbaceous understory, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Oak)

The study that is considered to be of this ecological type supports a Gambel oak community and is considered to be in good condition for deer winter range. The understory is generally in good condition, although annual grasses are present in significant amounts; annual grasses can increase fuel loads and increase the risk of wildfire and have the potential to outcompete more desirable and native species.

It is recommended that monitoring of this community continue. 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 (Sagebrush)

The study sites that are classified as Upland (Sagebrush) ecological sites are generally considered to be in very poor to good condition for deer winter range. It is also within elk and moose winter range. Some of the studies have transitioned into a perennial grass state with a diverse understory. Woodruff Creek South and Wheatgrass Hollow are both at risk for conifer encroachment. Introduced perennial grasses such as bulbous bluegrass and intermediate wheatgrass are often present in the herbaceous understory and may compete with more desirable native species for resources. Annual grasses are also often present in the understory, and have the potential to increase fuel loads and exacerbate the risk of wildfire. In addition, the noxious weed species blueweed (*Echium vulgare*) is present on the Echo Canyon Study.

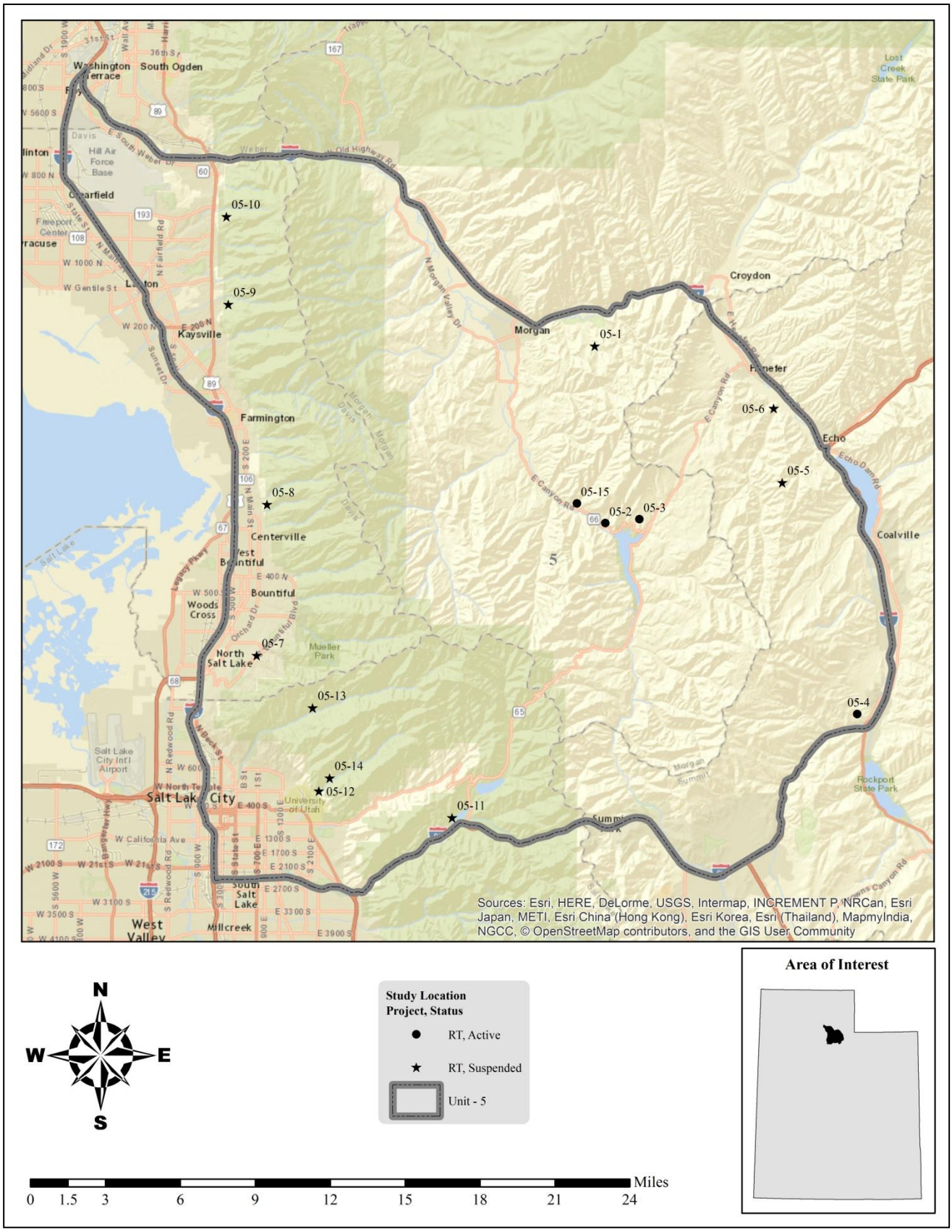
It is recommended that monitoring of this community continue. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible. Noxious weed control may be necessary and would include herbicide application (if feasible). It is recommended that work to reduce encroachment of pinyon and juniper (bullhog, chaining, lop and scatter, etc.) continue or begin on some study sites.

Semidesert (Sagebrush)

The sites classified as belonging to this lower elevation semidesert sagebrush ecological type are considered to be in fair to good condition for deer year-long range on the unit. These studies generally support sagebrush and perennial grass populations. The understory of these studies is dominated by western wheatgrass and crested wheatgrass: these and other introduced perennial grass species have the potential to be aggressive and may reduce the abundance of other native grass and forb species.

It is recommended that monitoring of this community continue. 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.

5. WILDLIFE MANAGEMENT UNIT 5 – EAST CANYON



WILDLIFE MANAGEMENT UNIT 5 – EAST CANYON

Boundary Description

Morgan, Summit, Salt Lake, and Davis counties – The boundary begins at the junction of Interstate 80 and I-84 (Echo Junction); south and west on I-80 to Interstate 15; north on I-15to I-84; east on I-84 to I-80.

Management Unit Description

Geography

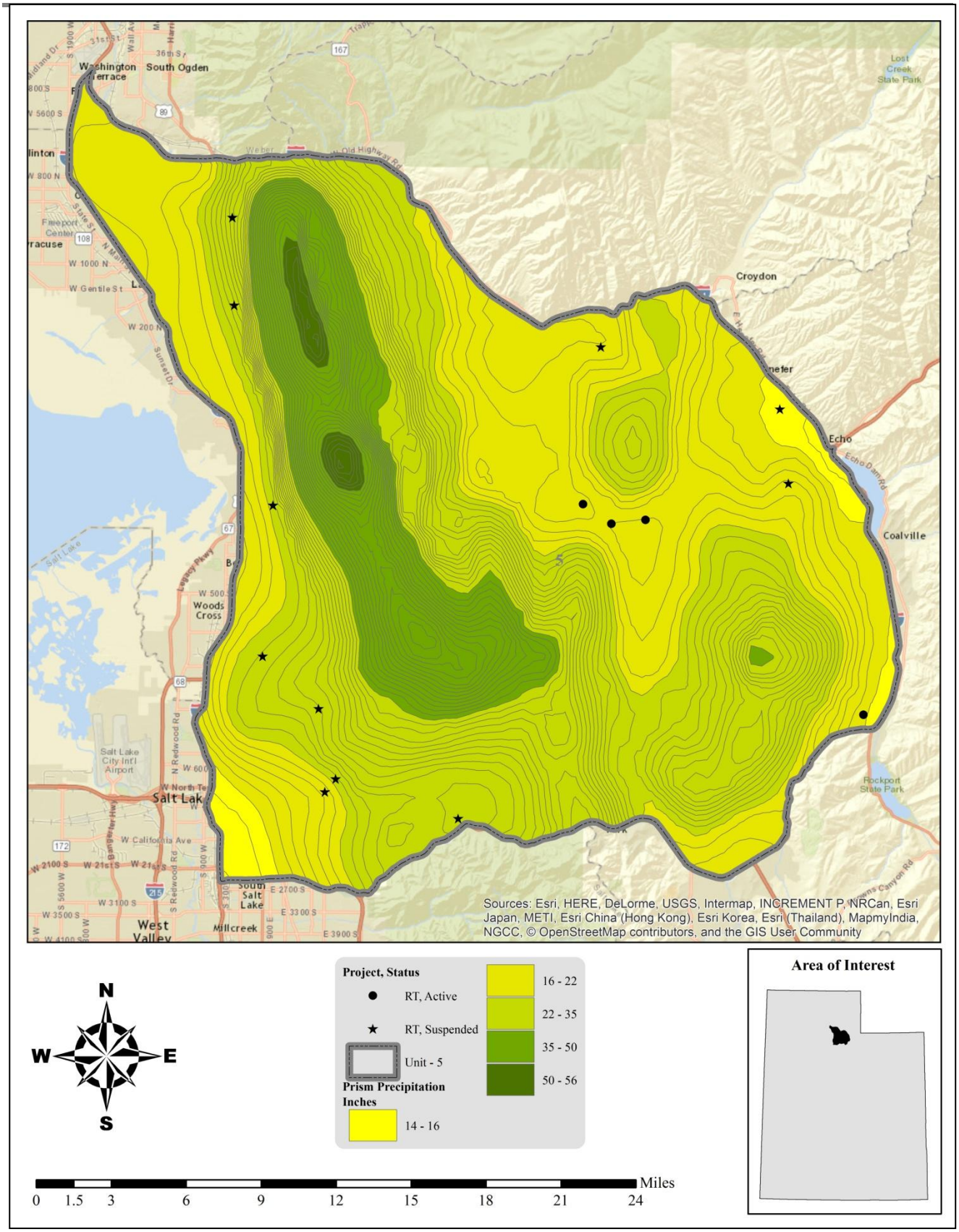
The East Canyon Management Unit is located mostly on the east side of the Wasatch Mountains. The topography varies across the unit, ranging from fairly deep canyons and steep slopes in the western portion to more gentle open slopes and fewer cliffs in the east. Most of the unit is drained by the Weber River; several creeks (including the East Canyon Creek) along the north and east edges of the unit drain directly into the river. East Canyon Reservoir is located approximately in the center of the unit. The highest elevations are along the western boundary on peaks of the Wasatch Range and reach above 9,500 feet. The lowest point is 4,800 feet in the northwestern corner where the Weber River flows out of the unit.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 14 inches on the extreme southwest corner to 55 inches on the peaks of the Sessions Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 9-23 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 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, 1997-1998, 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 1982-1986, 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, 2017).



Map 5.1: The 1981-2010 PRISM Precipitation Model for WMU 5, East Canyon (PRISM Climate Group, Oregon State University, 2013).

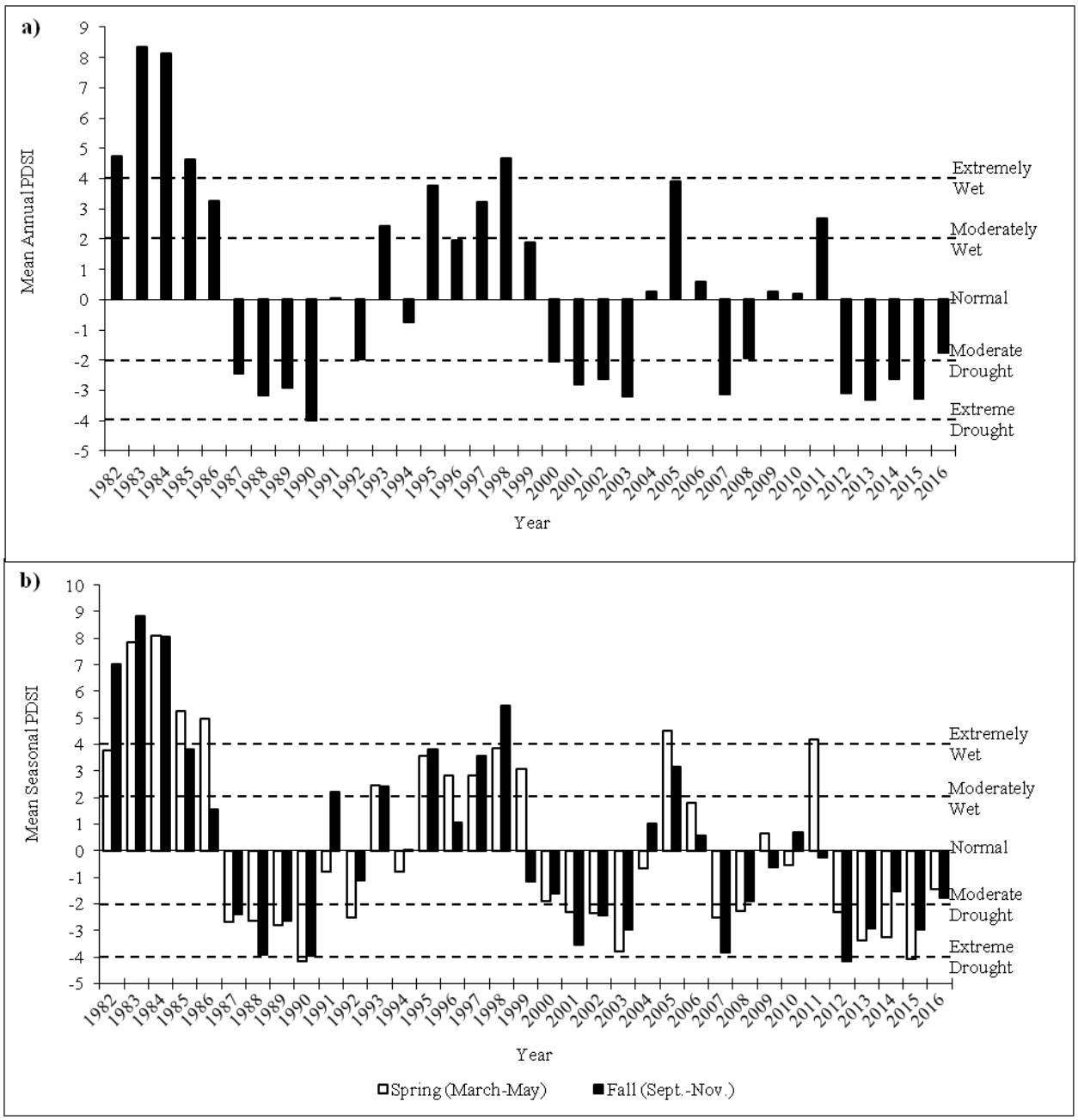


Figure 5.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

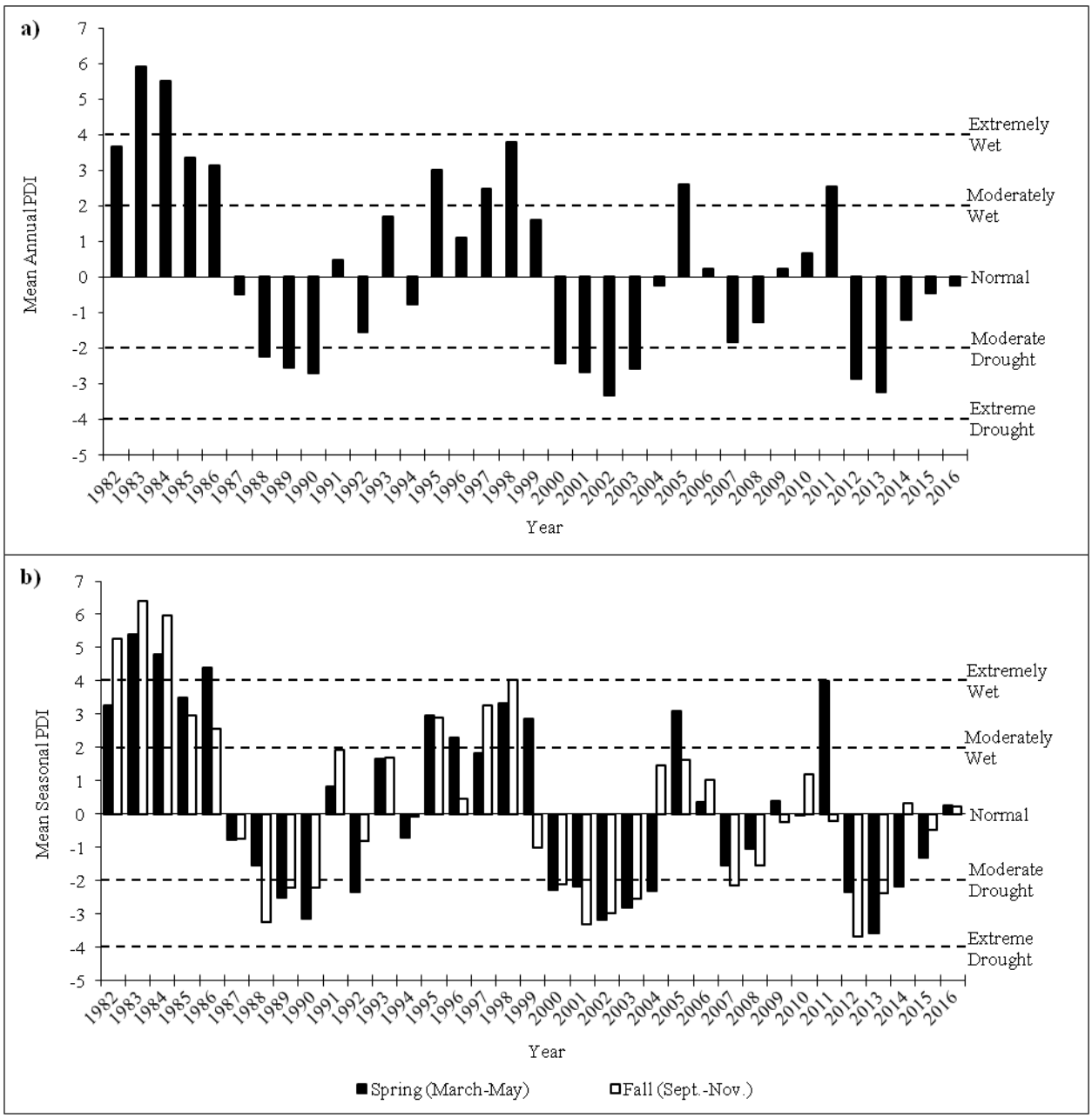


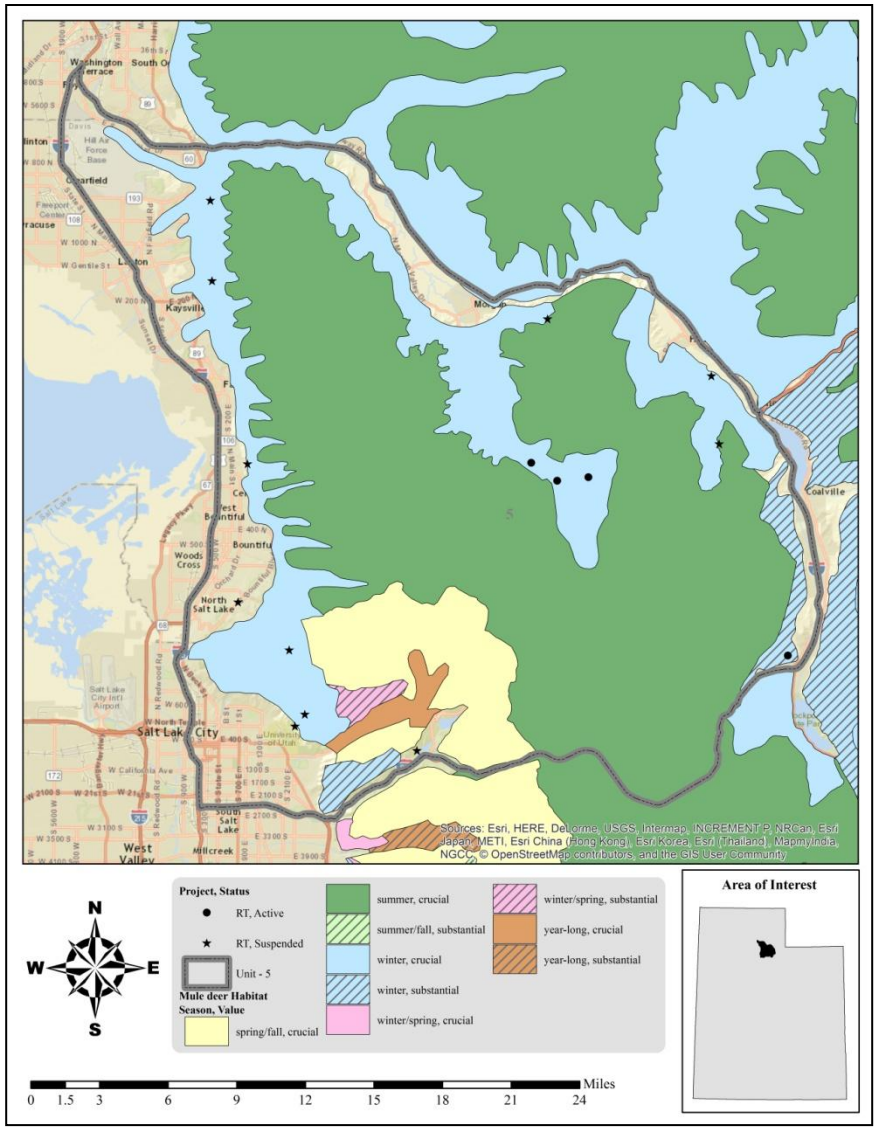
Figure 5.2: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

Big Game Habitat

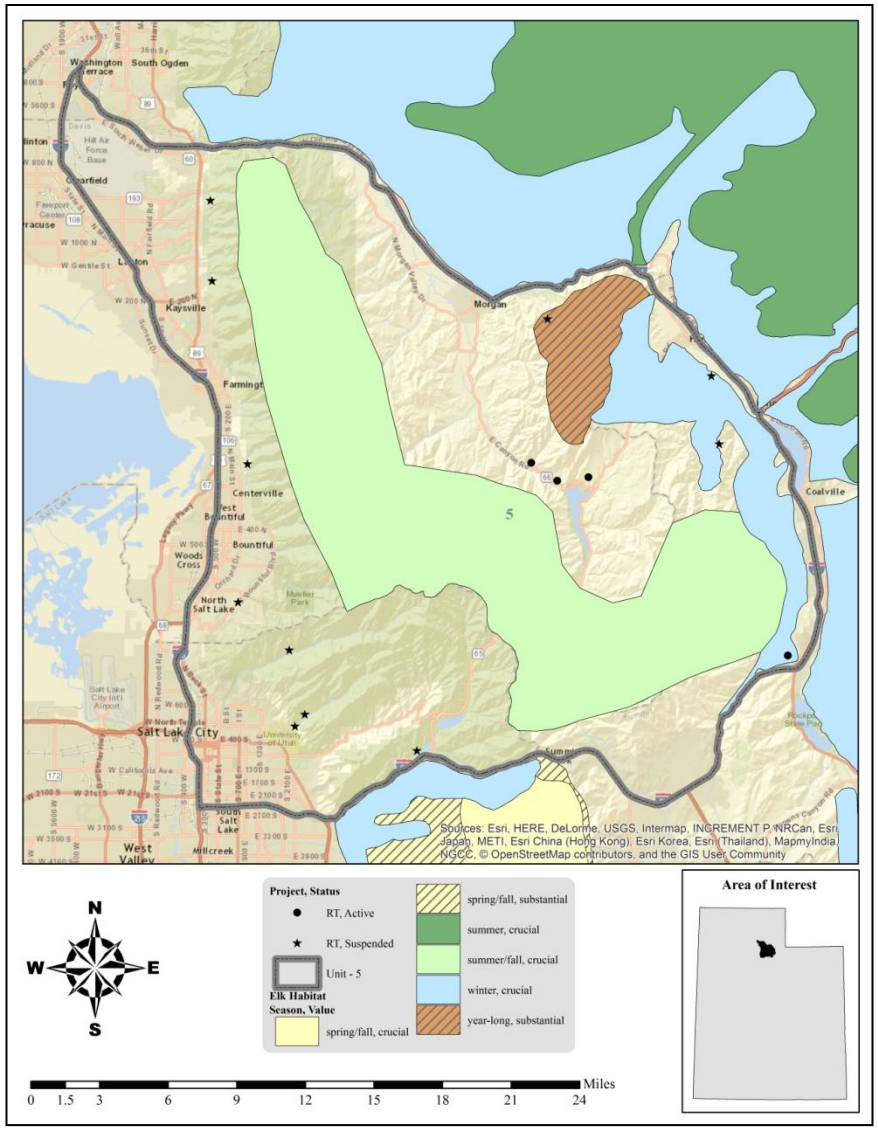
Total mule deer range in this wildlife management unit is estimated at over 330,000 acres with 4,076 acres classified as year-long range, 86,383 acres classified as winter range, 208,859 acres classified as summer range, 28,697 acres classified as spring/fall range, and 2,015 acres classified as winter/spring range. (Table 5.1, Map 5.2). Total elk range is estimated at just over 156,000 acres with 12,596 acres classified as year-long range, 24,749 acres of this classified as winter range, and 118,679 acres classified as summer/fall range (Table 5.1, Map 5.3).

86% of mule deer year-long range is privately owned and 14% is administrated by US Forest Service (USFS). Much of the summer range (81%) is also privately owned, 17% is managed by the USFS, 1% is administrated by the Utah Division of Wildlife Resources (UDWR), and the remaining 1% is owned by the Bureau of Land Management (BLM) and Utah State Parks (USP). Of the winter range, private landowners manage 74%, 23% is owned by USFS, 2% is administrated by UDWR, 1% is managed by USP, and the BLM, Bureau of Reclamation (BR), and Department of Defense (DOD) manage 1%. USFS manages a little over half (54%) of the winter/spring range and 46% is privately owned. Finally, 60% of the spring/fall range is privately owned, USFS administrates about 40%, and USP owns less than 1% (Table 5.2, Map 5.2, Map 5.5).

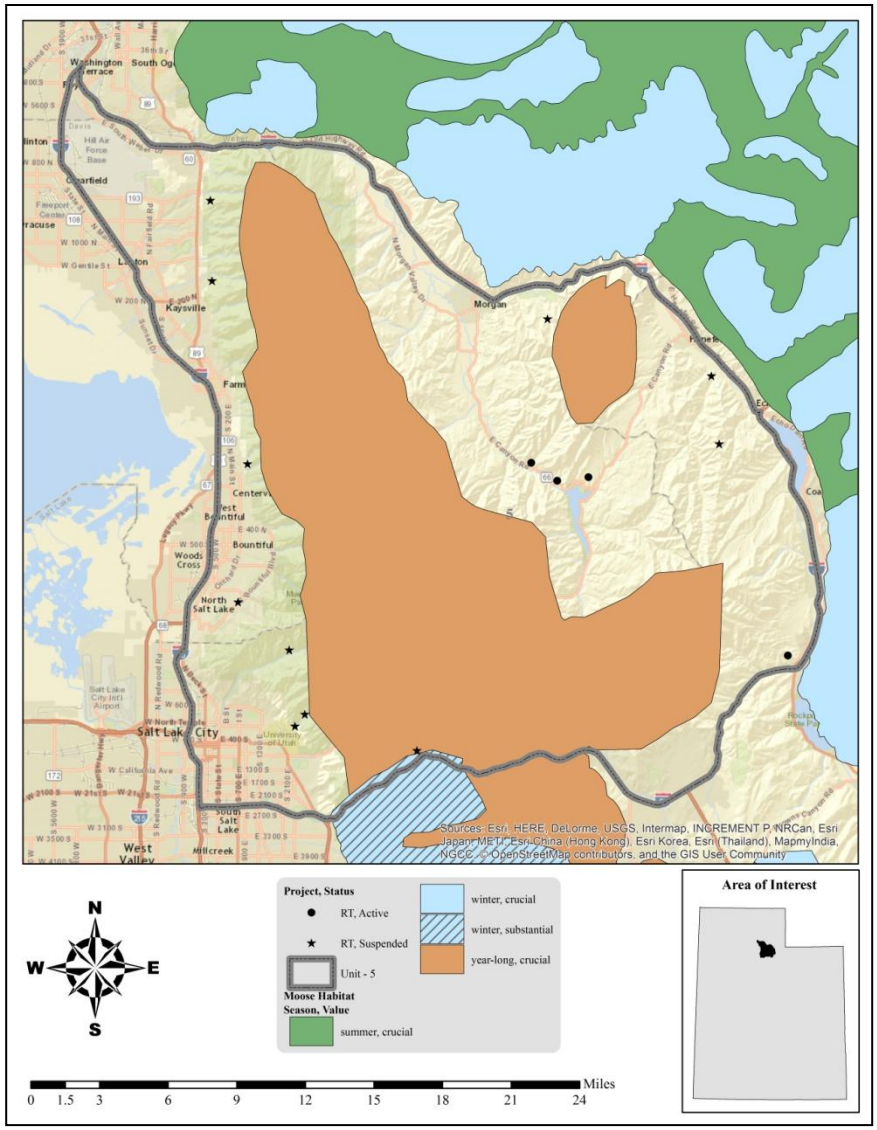
The upper limit of normal winter range is generally considered to be about 7,000 feet. Winter range is found in the major drainages and around East Canyon Reservoir. Most of the winter range is comprised of sagebrush range types. In the original inventory in 1972, King and Olson described almost three-quarters of the winter range as a mixture of black sagebrush on the ridge tops and big sagebrush down the slopes on the deeper soils; the sagebrush type has a good mix of browse species and can provide substantial forage for wintering deer. The browse type, which is 20% of the total range, is composed mainly of big sagebrush and Gambel oak. Other range types include agricultural lands and burns.



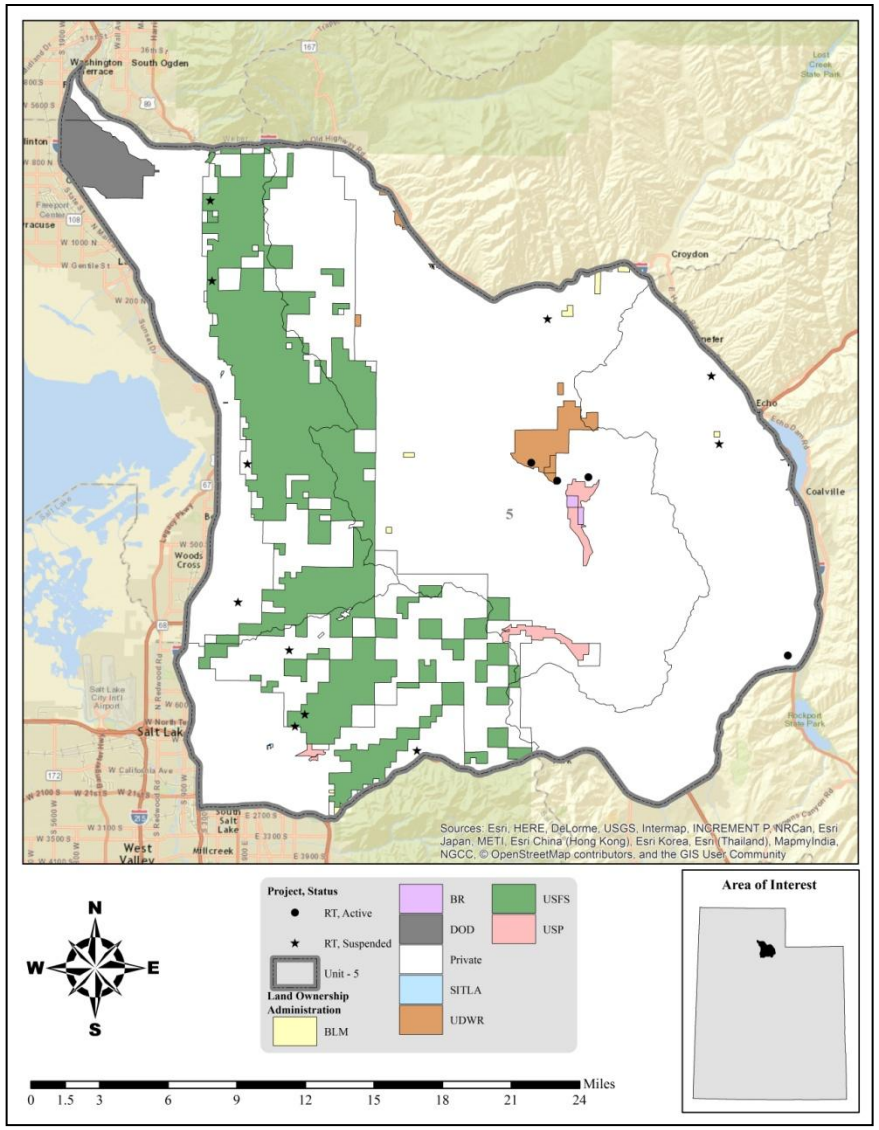
Map 5.2: Estimated mule deer habitat by season and value for WMU 5, East Canyon.



Map 5.3: Estimated elk habitat by season and value for WMU 5, East Canyon.



Map 5.4: Estimated moose habitat by season and value for WMU 5, East Canyon.



Map 5.5: Land ownership for WMU 5, East Canyon.

	Year Long Range		Summer Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	4,076	1%	208,859	63%	86,383	26%	2,015	<1%	28,697	9%
Elk	12,596	8%	0	0%	24,749	16%	0	0%	0	0%
Moose	171,844	99%	0	0%	1,448	1%	0	0%	0	0%

	Summer/Fall Range	
	Area (acres)	*%*
Mule Deer	0	0%
Elk	118,679	76%
Moose	0	0%

Table 5.1: Estimated mule deer, elk, and moose habitat acreage by season for WMU 5, East Canyon.

	Year Long Range		Summer Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	318	<1%	234	<1%	0	0%	0	0%
BR	0	0%	0	0%	293	<1%	0	0%	0	0%
Private	3,499	86%	168,771	81%	63,579	74%	918	46%	17,209	60%
UDWR	0	0%	2,283	1%	1,393	2%	0	0%	0	0%
USFS	577	14%	36,372	17%	19,551	23%	1,098	54%	11,486	40%
USP	0	0%	1,115	<1%	1,137	1%	0	0%	2	<1%
DOD	0	0%	0	0%	196	<1%	0	0%	0	0%
Total	4,076	**100%**	208,859	**100%**	86,383	**100%**	2,015	**100%**	28,697	**100%**

Table 5.2: Estimated mule deer habitat acreage by season and ownership for WMU 5, East Canyon.

	Year Long Range		Summer/Fall Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	198	1%	40	<1%	38	<1%
BR	0	0%	0	0%	16	<1%
Private	11,279	90%	86,189	73%	24,624	99%
UDWR	1,119	9%	79	<1%	72	<1%
USFS	0	0%	31,257	26%	0	0%
USP	0	0%	1,114	<1%	0	0%
Total	12,596	**100%**	118,679	**100%**	24,749	**100%**

Table 5.3: Estimated elk habitat acreage by season and land ownership for WMU 5, East Canyon.

	Year Long Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	325	<1%	70	5%
Private	117,996	69%	1,128	78%
UDWR	528	<1%	0	0%
USFS	51,879	30%	250	17%
USP	1,117	<1%	0	0%
Total	171,844	**100%**	1,448	**100%**

Table 5.4: Estimated moose habitat acreage by season and land ownership for WMU 5, East Canyon.

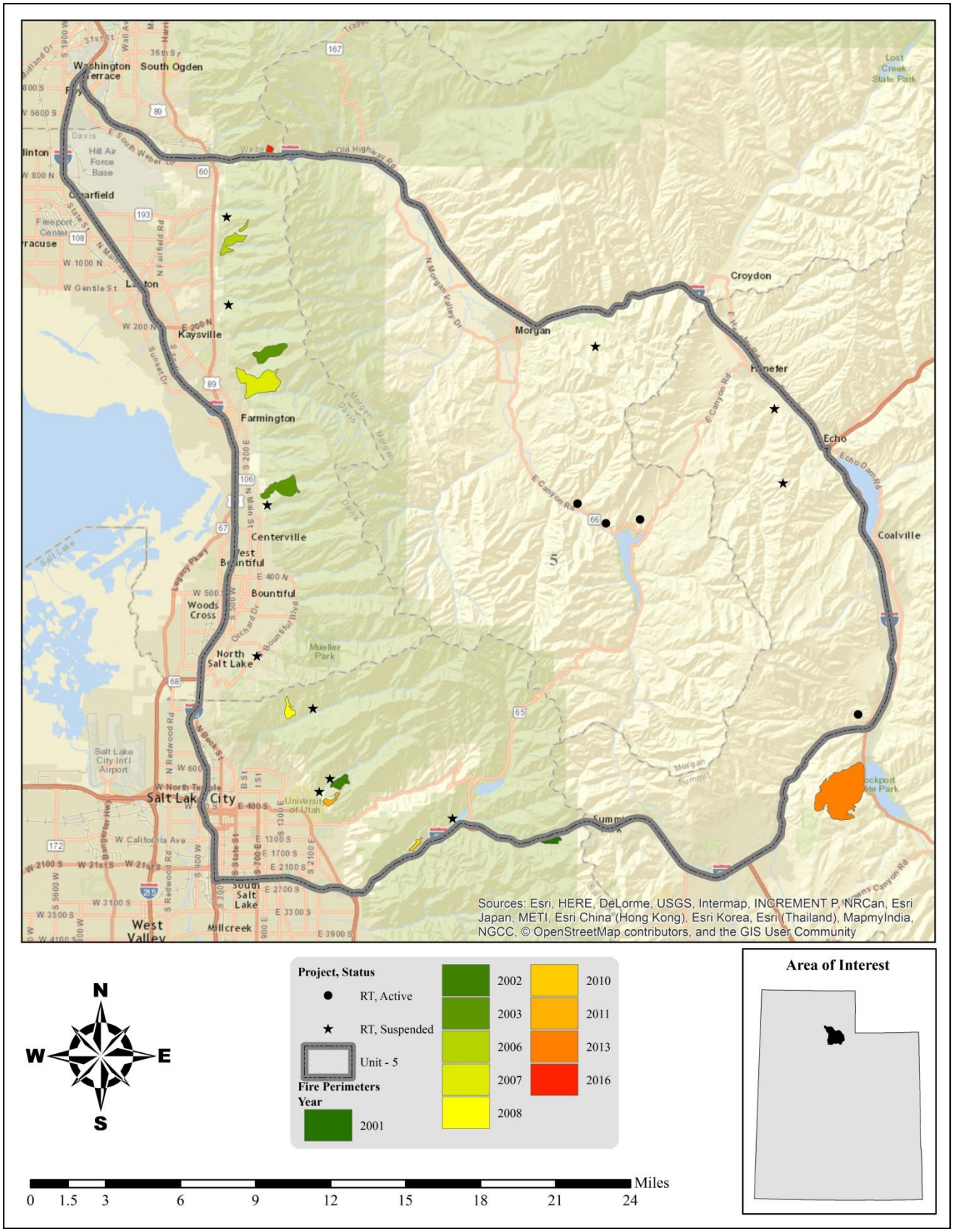
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	22,803	5.65%	
	Conifer-Hardwood	11,919	2.95%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	6,286	1.56%	
	Abies concolor Forest Alliance	3,953	0.98%	
	Colorado Plateau Pinyon-Juniper Woodland	2,458	0.61%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	2,105	0.52%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,414	0.35%	
	Great Basin Pinyon-Juniper Woodland	222	0.05%	
	Rocky Mountain Lodgepole Pine Forest	215	0.05%	
	Other Conifer	30	0.01%	12.73%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	616	0.15%	0.15%
Exotic Tree-Shrub	Introduced Riparian Shrubland	162	0.04%	0.04%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	7,563	1.87%	
	Inter-Mountain Basins Semi-Desert Grassland	455	0.11%	
	Southern Rocky Mountain Montane-Subalpine Grassland	386	0.10%	
	Rocky Mountain Alpine Dwarf-Shrubland	14	0.00%	2.08%
Shrubland	Quercus gambelii Shrubland Alliance	55,065	13.63%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	35,150	8.70%	
	Inter-Mountain Basins Big Sagebrush Shrubland	16,661	4.13%	
	Inter-Mountain Basins Montane Sagebrush Steppe	6,254	1.55%	
	Rocky Mountain Lower Montane-Foothill Shrubland	5,174	1.28%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	3,016	0.75%	
	Great Basin Xeric Mixed Sagebrush Shrubland	1,424	0.35%	
	Other Shrubland	711	0.18%	30.57%
Other	Hardwood	130,036	32.20%	
	Developed	63,303	15.67%	
	Agricultural	20,412	5.05%	
	Riparian	3,508	0.87%	
	Open Water	1,246	0.31%	
	Sparsely Vegetated	951	0.24%	
	Barren	281	0.07%	
	Other	104	0.03%	54.43%
Total		403,895	100.00	100%

Table 5.5: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 5, East Canyon.

Limiting Factors to Big Game Habitat

In recent years, urbanization and deer have led to conflicts and degradation of the winter range. All of the valleys have been developed for agriculture and housing. The major canyons (Weber, East, and Main Canyons) contain housing developments and high-use roads. The northern, eastern, and southern boundaries are formed by Interstates 80 and 84, while other more narrow and higher-elevation canyons have seasonal roads. Heavy deer and livestock use has resulted in downward trends on much of the range, with soil erosion, removal of perennial herbaceous cover, and heavy use of browse species as resource concerns. Harvesting depredated deer is difficult due to access restrictions on private land; reducing the deer herd to within the carrying capacity of the winter range must be done with the cooperation and support of local interest groups.

Other limiting factors to big game habitat include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). Increased amounts of cheatgrass exacerbate the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). Wildfires have occurred on this unit, resulting in loss of big game habitat mainly near the Wasatch Front (Map 5.6).



Map 5.6: Land coverage of fires by year from 2000-2016 for WMU 5, East Canyon.

Treatments/Restoration Work

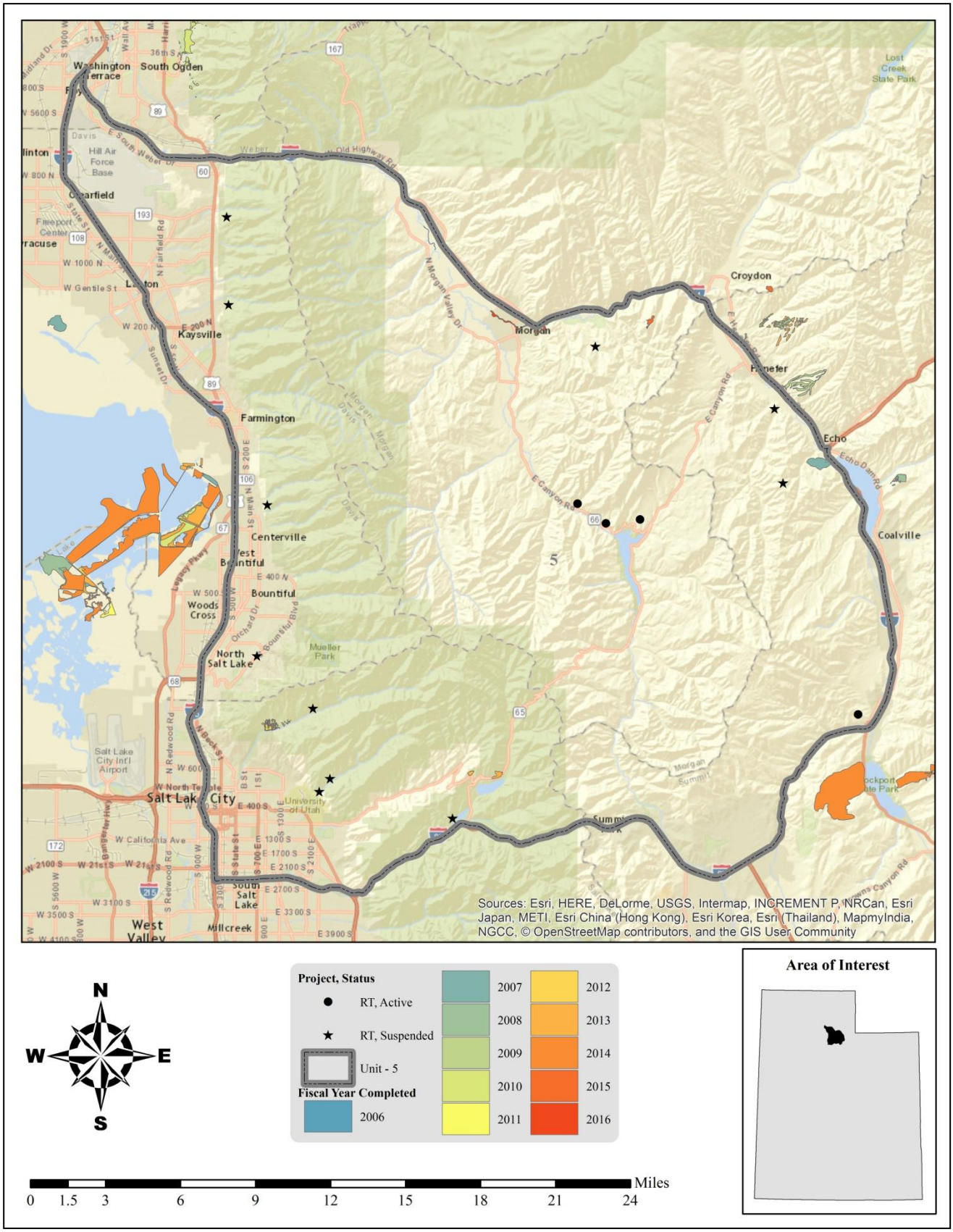
There have been efforts to address the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 399 acres of land have been treated within the East Canyon unit since the WRI was implemented in 2004 (Map 5.7). An additional 1,089 acres are currently being treated, and treatments are proposed for 184 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 515 acres for this unit (Table 5.7). 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 application to remove unwanted vegetation is the most common management practice in this unit. Discing is also very common, and other management practices include seeding desirable herbaceous species and biological control of vegetation (Table 5.7).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Disc	**191**	**0**	**0**	**191**
Herbicide Application	**231**	**1,089**	**184**	**1,504**
Aerial	40	0	0	40
Ground	53	0	0	53
Spot Treatment	137	1,089	184	1410
Seeding (Primary)	**35**	**0**	**0**	**35**
Drill (Rangeland)	35	0	0	35
Other	**59**	**0**	**0**	**59**
Biological Control of Vegetation	59	0	0	59
Total Treatment Acres	**515**	**1,089**	**184**	**1,788**
***Total Land Area Treated**	**399**	**1,089**	**184**	**1,376**

Table 5.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 5, East Canyon. Data accessed on 02/09/2017.

*Does not include overlapping treatments.



Map 5.7: WRI treatments by fiscal year completed for WMU 5, East Canyon.

Range Trend Studies

Range Trend studies have been sampled within WMU 5 on a regular basis since 1983, with studies being added or suspended as was deemed necessary (Table 5.8). 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 5.9).

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 by region.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
05-1	Geary Hollow	RT	Suspended	'84, '90, '96, '91	Not Verified
05-2	Tucson Hollow	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
05-3	East Canyon Reservoir	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
05-4	Wanship	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
05-5	Upper Franklin Canyon	RT	Suspended	'84, '90, '96	Not Verified
05-6	Franklin Canyon	RT	Suspended	'84, '90, '96	Not Verified
05-7	Baskin Spring	RT	Suspended	'84, '90, '96	Not Verified
05-8	Barnard Creek	RT	Suspended	'85, '90, '96, '01, '06, '11	Not Verified
05-9	Davis County Rifle Range	RT	Suspended	'85, '90, '01, '06	Not Verified
05-10	Junction 89-193	RT	Suspended	'85, '90	Not Verified
05-11	Mountain Dell Reservoir	RT	Suspended	'83, '90, '96	Not Verified
05-12	Fort Douglas	RT	Suspended	'83	Not Verified
05-13	City Creek Canyon	RT	Suspended	'83	Not Verified
05-14	Red Butte Canyon	RT	Suspended	'83	Not Verified
05-15	Red Rock Canyon	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)

Table 5.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 5, East Canyon.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
05-4	Wanship	Wildfire		1990-1995		
05-15	Red Rock Canyon	Wildfire		1992		
		Seed Unknown	Redrock Burn	1992		

Table 5.9: Range trend and WRI studies known disturbance history for WMU 5, East Canyon Reservoir.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

There are three study sites [Tucson Hollow (05-2), East Canyon Reservoir (05-3), and Red Rock Canyon (05-15)] that are classified as Mountain (Sagebrush) ecological sites. The Tucson Hollow site is located northeast of East Canyon Reservoir near East Canyon Creek. The East Canyon Reservoir site is situated about ½ mile north of East Canyon Reservoir. Red Rock Canyon is located about 1.5 miles northeast of East Canyon Reservoir along East Canyon Creek.

Shrubs/Trees: The main browse species on these sites is mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Other browse species are present, including antelope bitterbrush (*Purshia tridentata*). The cover of shrub species has decreased through time, with the decline of sagebrush being the primary contribution to the loss of cover (Figure 5.3). The sagebrush on these sites is generally composed of mature plants although decadence has increased slightly over time. Average sagebrush utilization has increased overall, but more than half of plants have shown signs of little to no use in all sample years (Figure 5.4).

Herbaceous Understory: The herbaceous understories of these sites are generally in fair condition with high amounts of cover across the sites. The non-native grasses cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*) provide significant amounts of cover, reducing the overall condition of these sites. On the Red Canyon study, crested wheatgrass (*Agropyron cristatum*) and cheatgrass are co-dominant. The East Canyon Reservoir site is dominated by cheatgrass and bulbous bluegrass. On Tucson Hollow, the grass cover is mainly composed of cheatgrass and field brome (*B. arvensis*). A mix of perennial forbs has been present in amounts ranging from 11 percent in 2001 to 8 percent in 2016. The cover of annual forbs has fluctuated from 8 percent in 2001 to 16 percent in 2016 (Figure 5.6, Figure 5.7).

Occupancy: Pellet group data shows fluctuations in usage from year to year. 2006 and 2016 show moderate use by cattle, while 2001 and 2011 show minimal cattle usage. This trend is primarily by the Red Canyon site, which has displayed 42 and 29 days use/acre of cattle usage in 2006 and 2016, respectively. Mule deer usage has declined since 2001, with a small increase occurring in 2016. Mean abundance of deer pellet groups has been as high as 56 days/acre in 2001 and as low as 21 days/acre in 2016. Usage of the sites by elk was minimal in 2001 with less than 1 day use/acre across the sites. Elk presence increased to 30 days use/acre in 2006, followed by 4 days use/acre in 2011, 2016 showed negligible use by elk at less than 1 day use/acre (Figure 5.8).

Upland (Sagebrush)

There is one study [Wanship (05-4)] that is classified as an Upland (Sagebrush) ecological site. The site is located north of I-80 near Rockport State Park.

Shrubs/Trees: This study site does not have a significant shrub population as there was a fire in the early 1990s that removed much of the sagebrush community. Forage kochia (*Bassia prostrata*) initially provided some cover after seeding but has decreased in recent years. The cover of sagebrush has been steadily decreasing over time and in 2016 it has become only a trace element of the species present on the site (Figure 5.4). There are other preferred browse species present on the site, but they have also decreased over time (Figure 5.3). Overall, this study site has transitioned to a perennial grass state from a sagebrush dominated plant community.

Herbaceous Understory: The herbaceous understory of this site of this site has increased over time. The most common component is the non-native species crested wheatgrass (*Agropyron cristatum*). There has also been an increase in the presence of the non-native bulbous bluegrass (*Poa bulbosa*). Perennial forbs are reasonably diverse, but remain a small component of the understory, while annual forbs provide the most forb cover with three percent cover in 2016 (Figure 5.6, Figure 5.7).

Occupancy: The average pellet transect data has shown fluctuations of animal usage between 2001 and 2016. The mean abundance of elk pellet groups has generally increased with 24 days use/acre in 2001 and 90 days use/acre in 2016. The mean abundance of mule deer pellet groups has decreased significantly: there were 64 days use/acre in 2001 and 15 days use/acre in 2016. There were cattle pellet groups observed on the site in the 2001 and 2006 samples on this site (Figure 5.8).

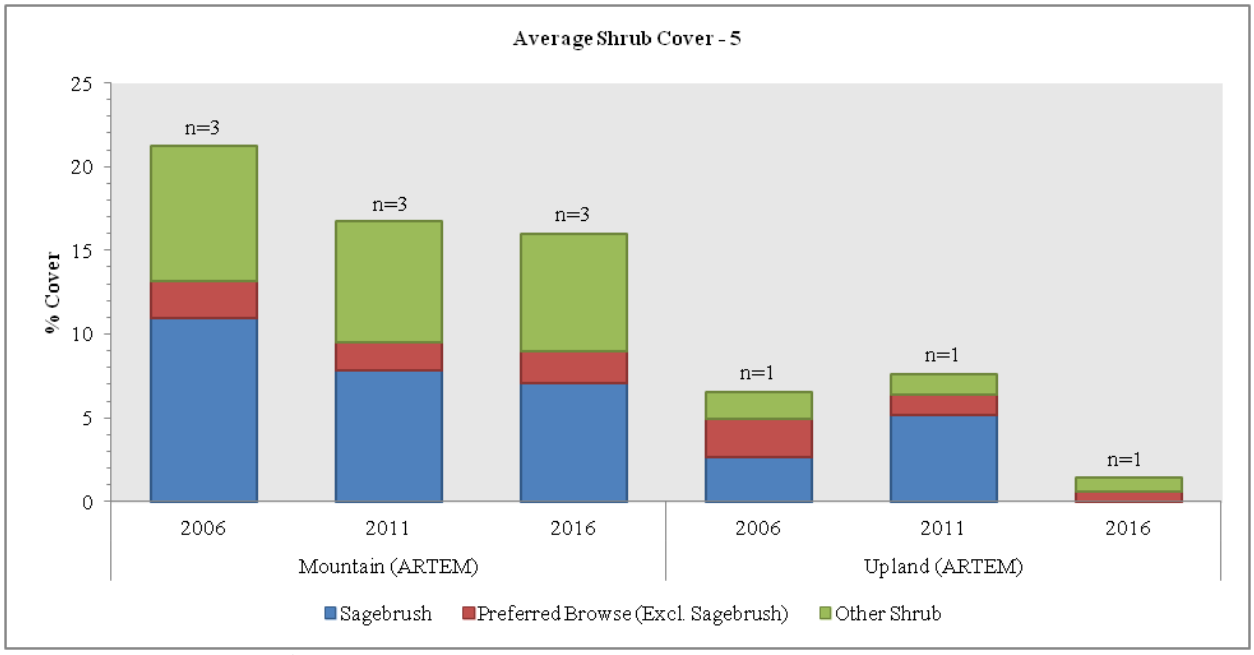


Figure 5.3: Average shrub cover for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

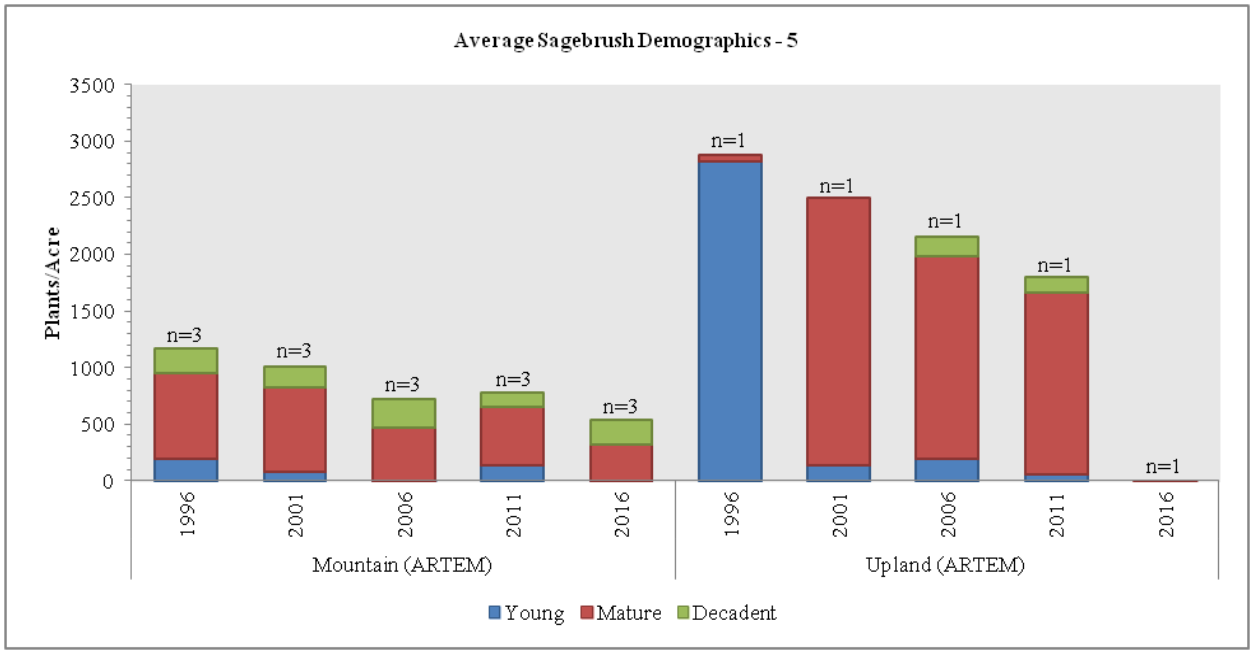


Figure 5.4: Average sagebrush demographics for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

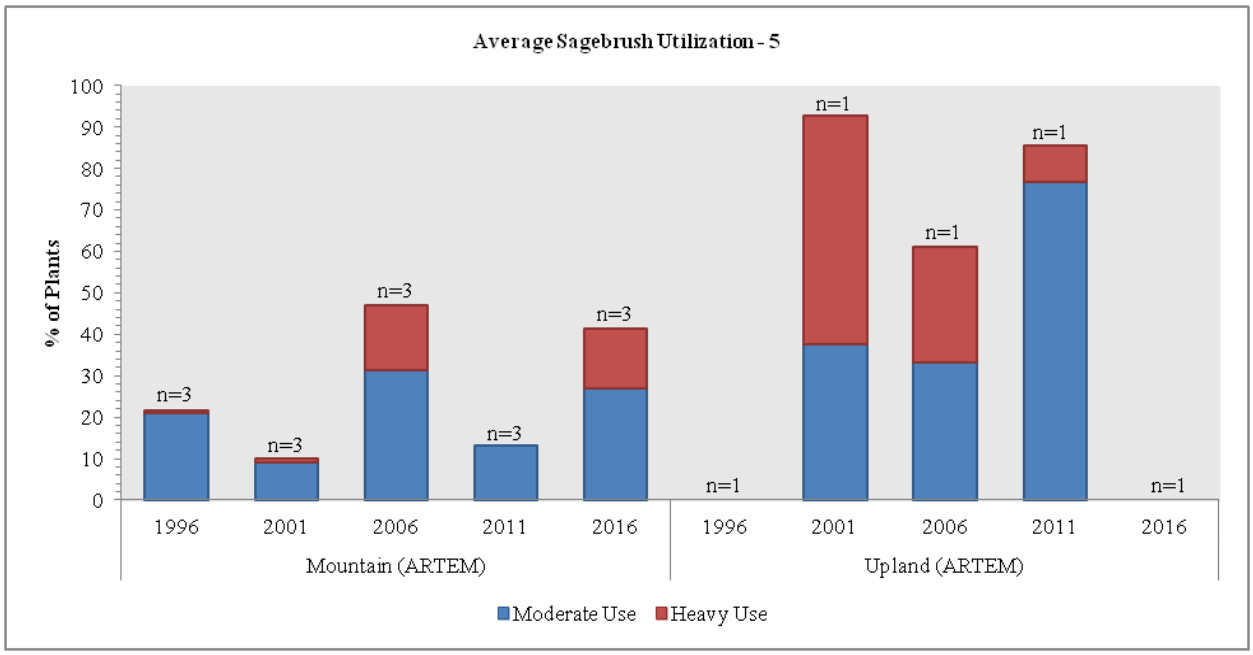


Figure 5.5: Average sagebrush utilization for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

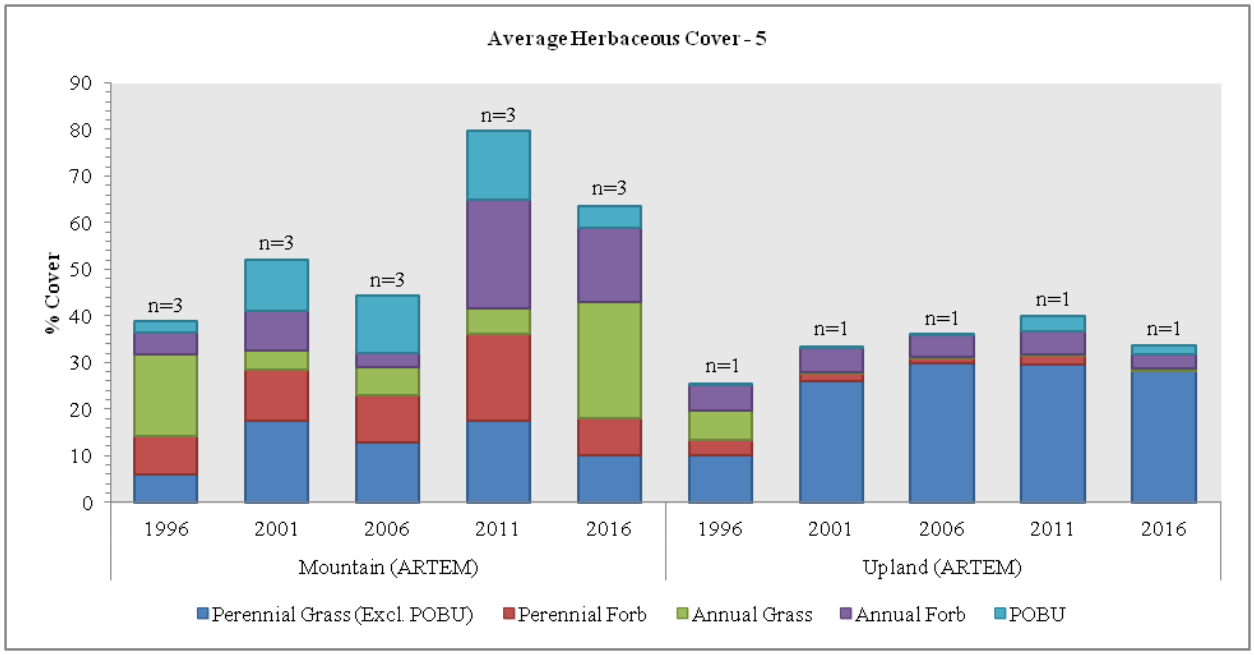


Figure 5.6: Average herbaceous cover for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

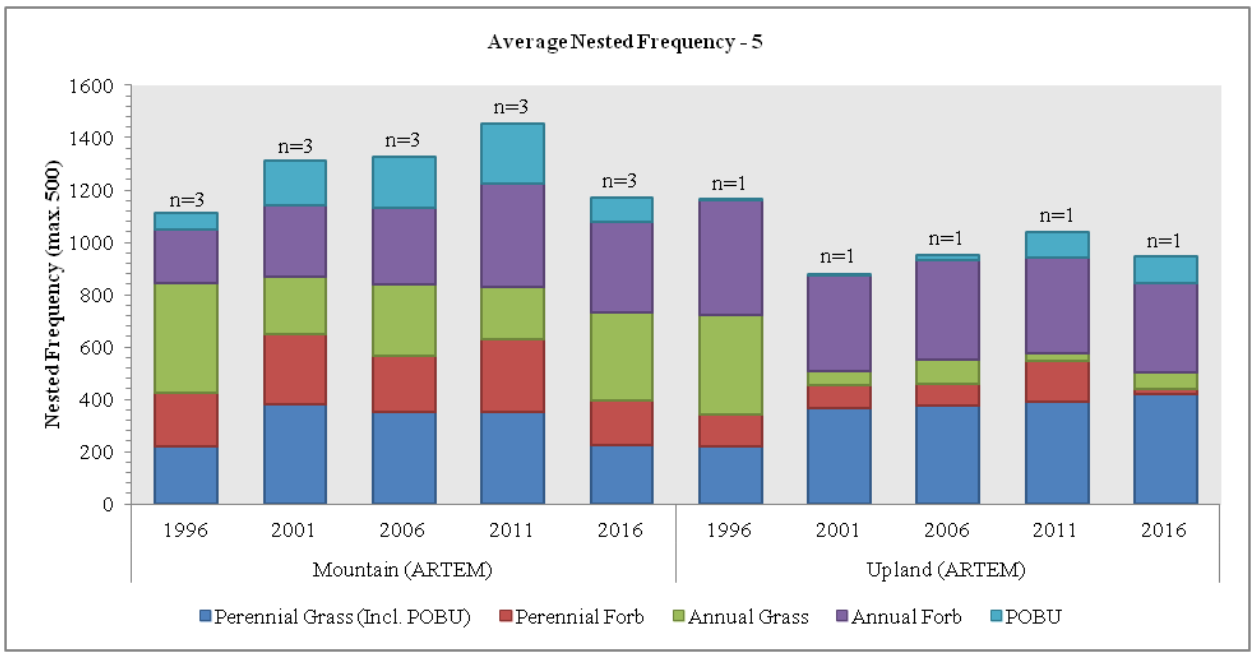


Figure 5.7: Average nested frequency of herbaceous species for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

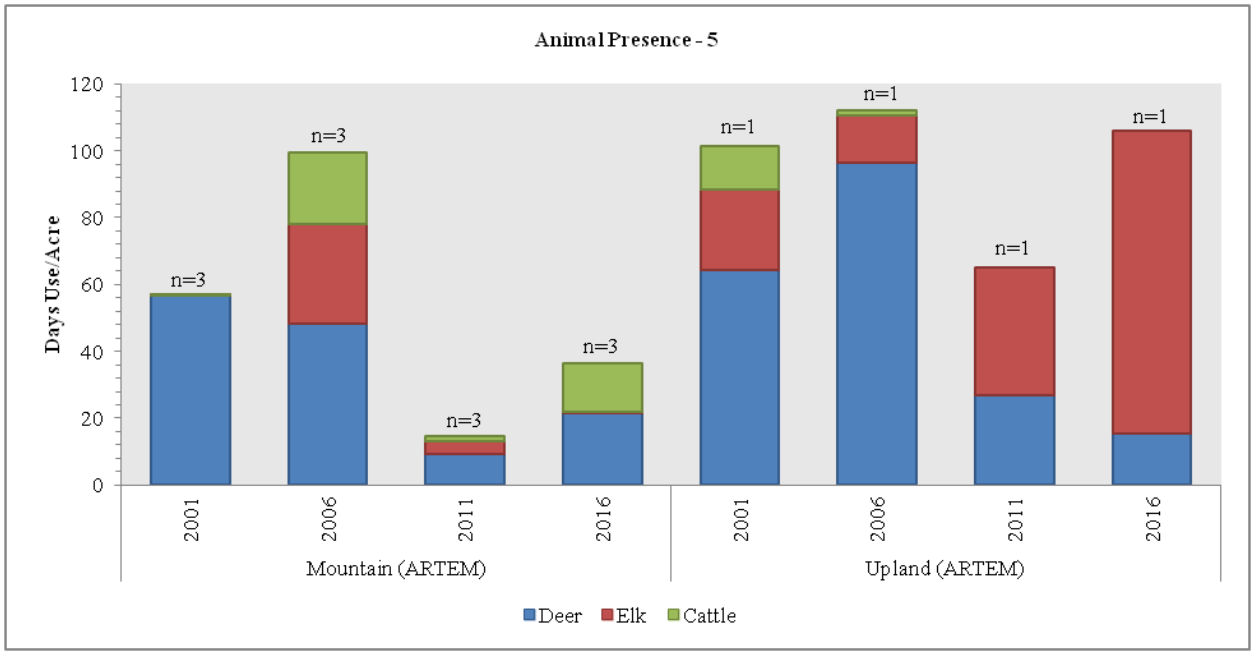


Figure 5.8: Average pellet transect data for Mountain (ARTEM) and Upland (ARTEM) study sites in WMU 5, East Canyon.

Deer Winter Range Condition Assessment

The condition of deer winter range within the East Canyon management unit has continually changed since 1996. The Range Trend sites sampled within the unit (Tucson Hollow, Red Rock Canyon, East Canyon Reservoir, and Wanship) are considered to be in very poor condition as of the 2016 sample year (Figure 5.9, Table 5.10, Map 5.12): this is generally due to the high levels of annual grass and lack of preferred browse cover. There are no treated sites in this management unit. It is possible that with time and continued monitoring these sites will improve.

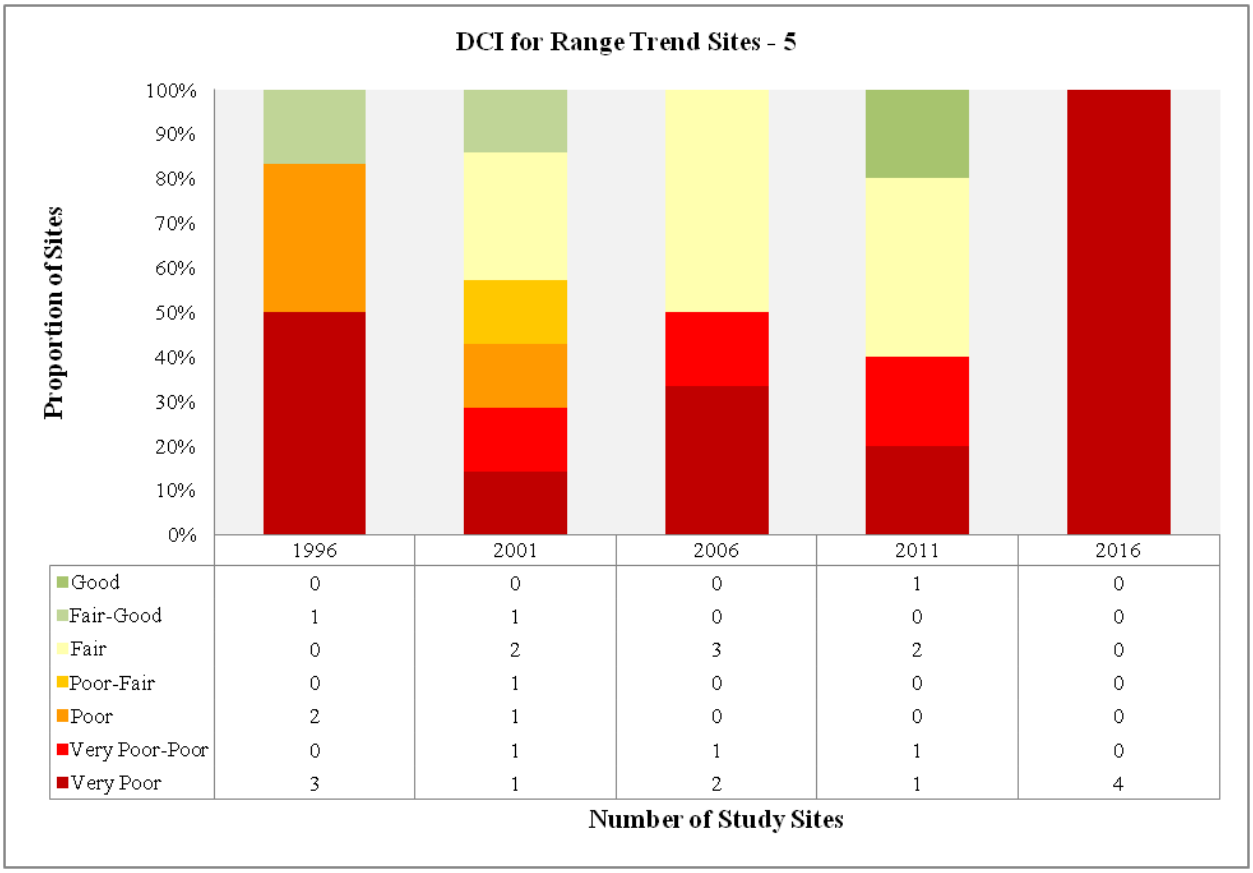
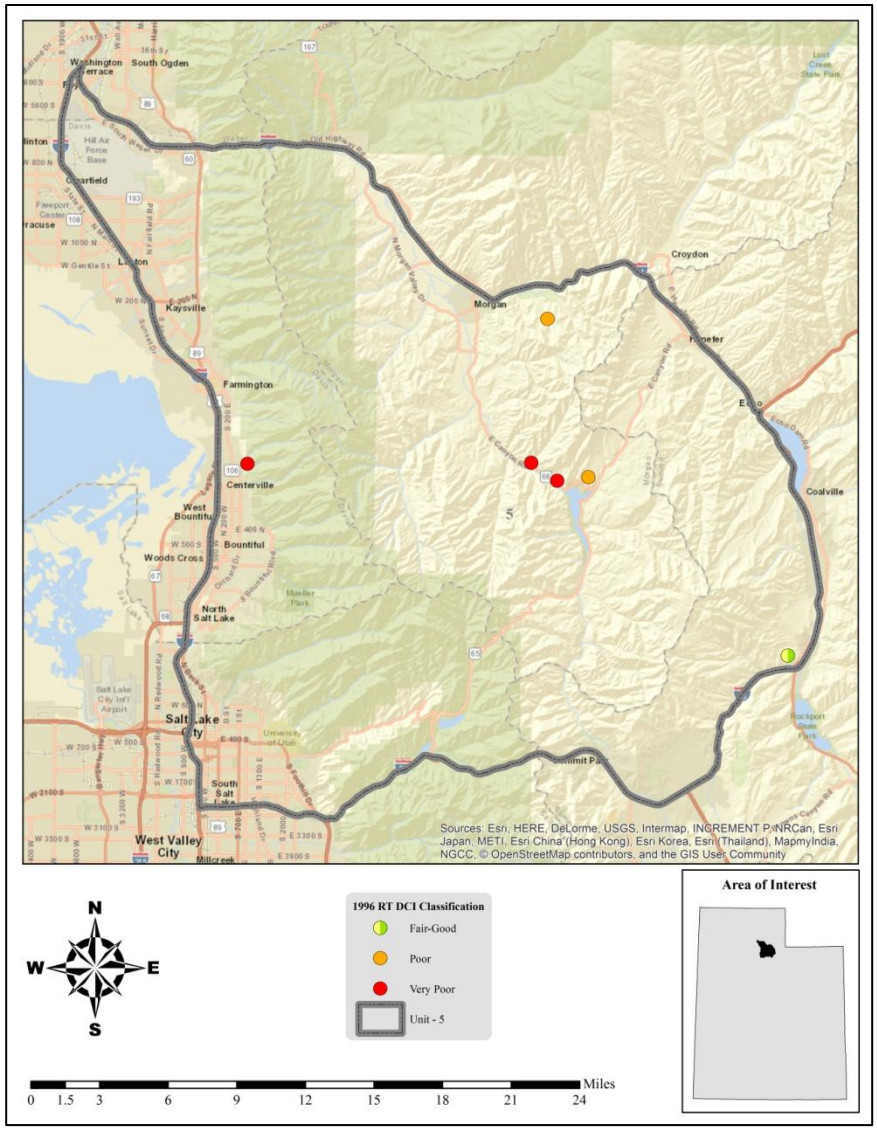


Figure 5.9: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 5, East Canyon.

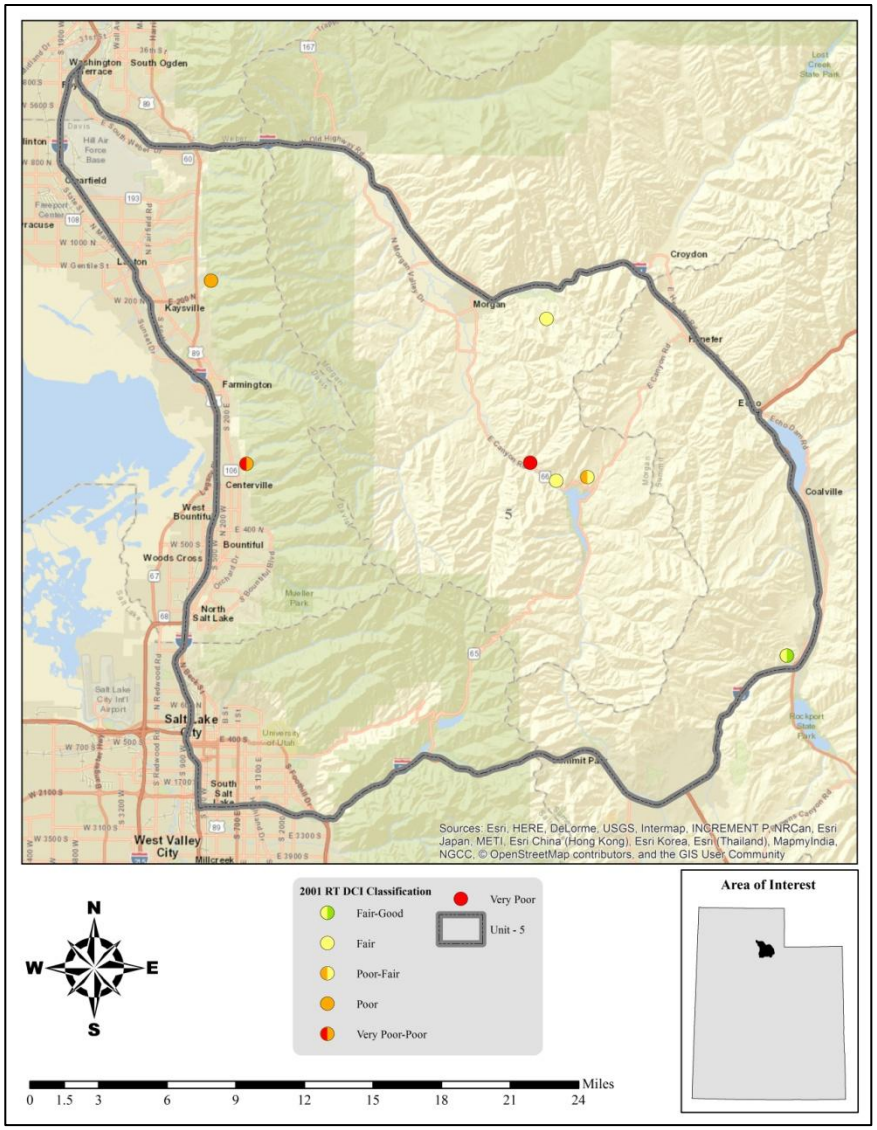
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
05-1*	1996	30.0	12.0	9.7	3.4	-20.0	5.1	0.0	**40.2**	**P**
05-1*	2001	25.1	12.7	1.6	9.8	-5.3	10.0	0.0	**53.8**	**F**
05-2	1996	15.4	11.3	2.6	9.0	-14.5	10.0	0.0	**33.8**	**VP**
05-2	2001	15.4	6.5	0.0	30.0	-2.1	10.0	0.0	**59.7**	**F**
05-2	2006	15.8	8.7	4.3	29.1	-7.6	10.0	0.0	**60.2**	**F**
05-2	2011	11.4	11.4	9.5	30.0	-7.6	10.0	0.0	**64.6**	**F**
05-2	2016	9.7	5.0	3.0	4.0	-20.0	10.0	0.0	**11.7**	**VP**
05-3	1996	21.6	9.6	6.4	10.9	-6.6	10.0	0.0	**51.8**	**P**
05-3	2001	25.6	8.2	2.7	15.8	-3.2	5.7	0.0	**54.7**	**P-F**
05-3	2006	18.7	-1.1	0.9	15.7	-1.9	8.4	0.0	**40.7**	**VP-P**
05-3	2011	19.0	10.3	6.2	30.0	-2.9	10.0	0.0	**72.6**	**G**
05-3	2016	11.1	-0.4	1.4	8.4	-13.3	7.8	0.0	**15.0**	**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
05-4	1996	12.8	15.0	15.0	20.4	-4.8	6.3	0.0	**64.8**	**F-G**
05-4	2001	8.9	15.0	6.0	30.0	-0.2	3.7	0.0	**63.4**	**F-G**
05-4	2006	5.6	13.7	6.1	30.0	-0.2	2.1	0.0	**57.4**	**F**
05-4	2011	6.3	13.0	2.0	30.0	-0.1	3.7	0.0	**55.1**	**F**
05-4	2016	0.3	0.0	0.0	30.0	-0.3	0.4	0.0	**30.4**	**VP**
05-8*	1996	24.5	13.4	0.2	3.4	-20.0	8.7	-4.0	**26.3**	**VP**
05-8*	2001	30.0	12.7	0.4	4.4	-20.0	10.0	-4.0	**33.4**	**VP-P**
05-8*	2006	30.0	13.3	0.0	4.9	-20.0	5.5	-4.0	**29.7**	**VP**
05-8*	2011	30.0	12.6	0.9	3.4	-20.0	10.0	-4.0	**32.9**	**VP**
05-9*	2001	30.0	12.8	1.1	7.5	-11.5	3.1	0.0	**42.9**	**P**
05-9*	2006	30.0	11.2	3.0	19.4	-13.1	8.4	-2.0	**57.0**	**F**
05-15	1996	0.1	0.0	0.0	25.2	-18.3	10.0	0.0	**17.0**	**VP**
05-15	2001	0.2	0.0	0.0	30.0	-3.6	10.0	0.0	**36.6**	**VP**
05-15	2006	0.6	0.0	0.0	30.0	-3.7	10.0	0.0	**36.8**	**VP**
05-15	2011	2.0	0.0	0.0	30.0	-2.0	10.0	0.0	**40.0**	**VP-P**
05-15	2016	1.6	3.0	0.0	30.0	-10.1	4.2	0.0	**28.8**	**VP**

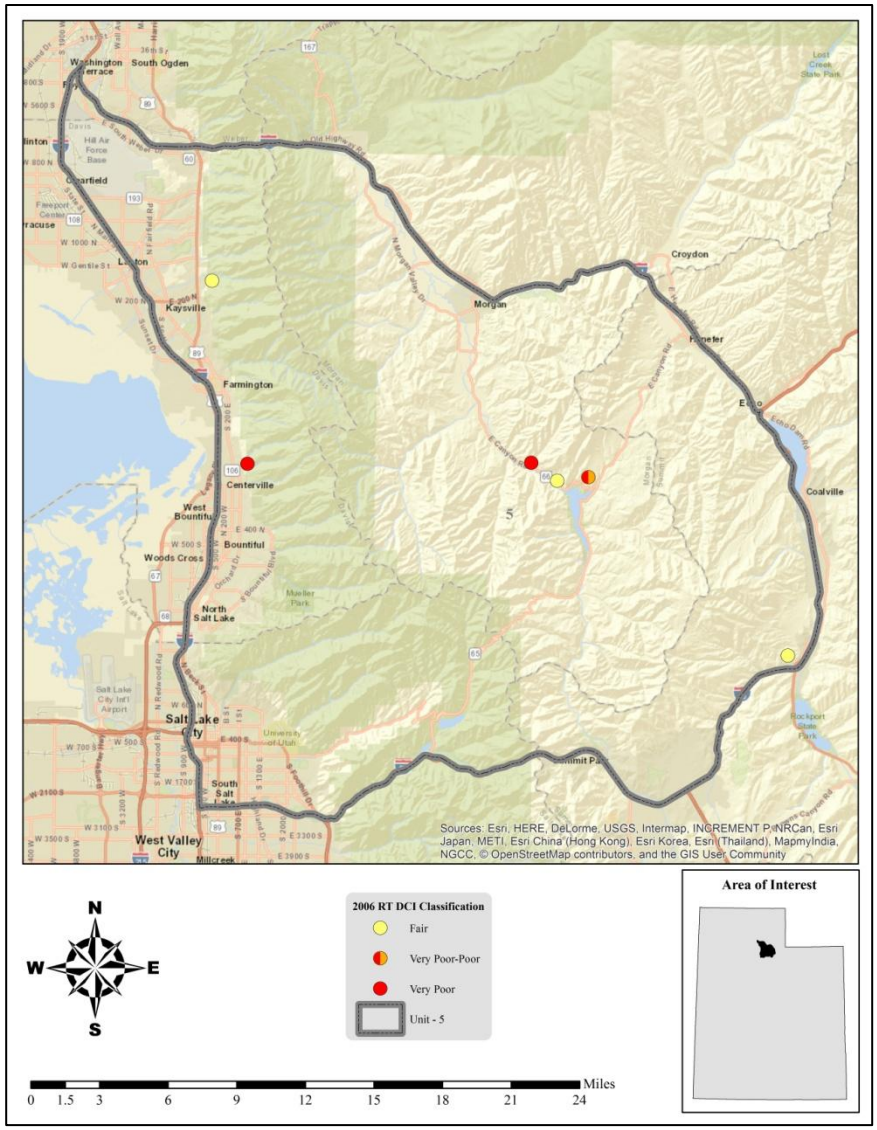
Table 5.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 5, East Canyon. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



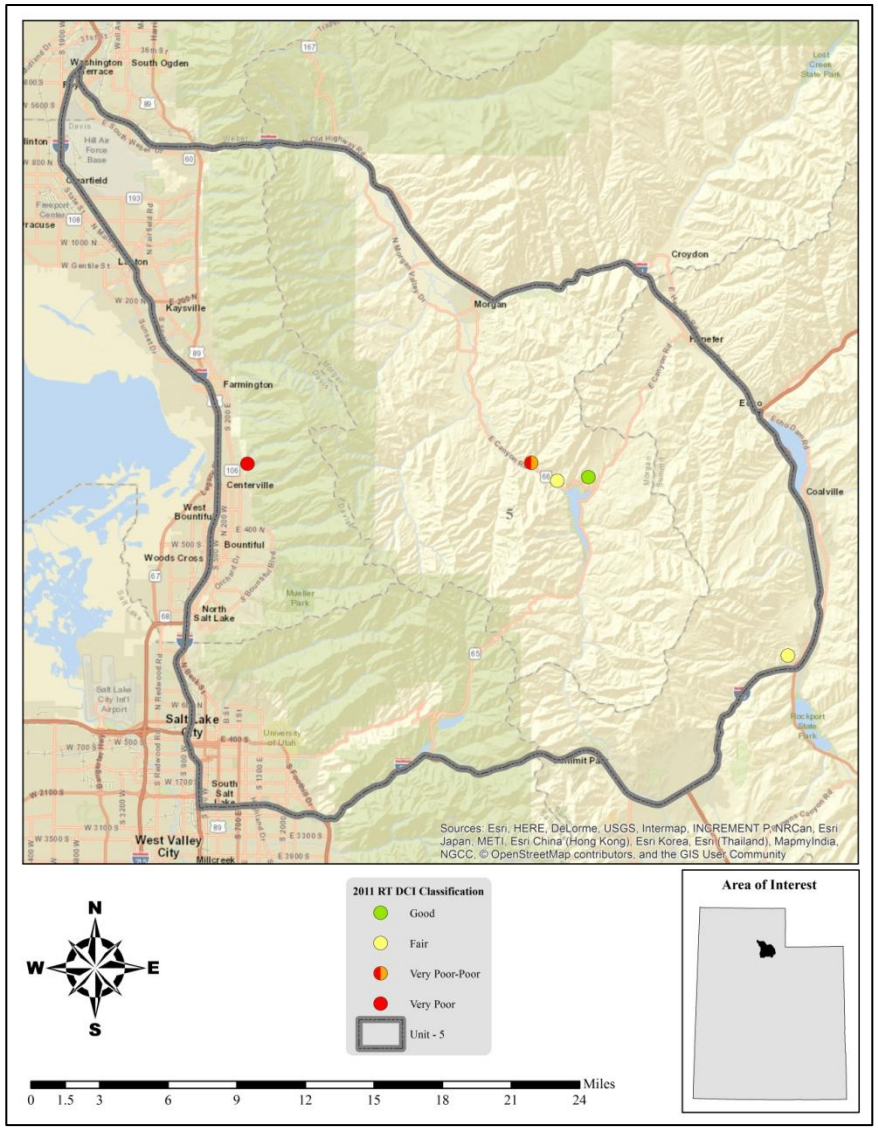
Map 5.8: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 5, East Canyon.



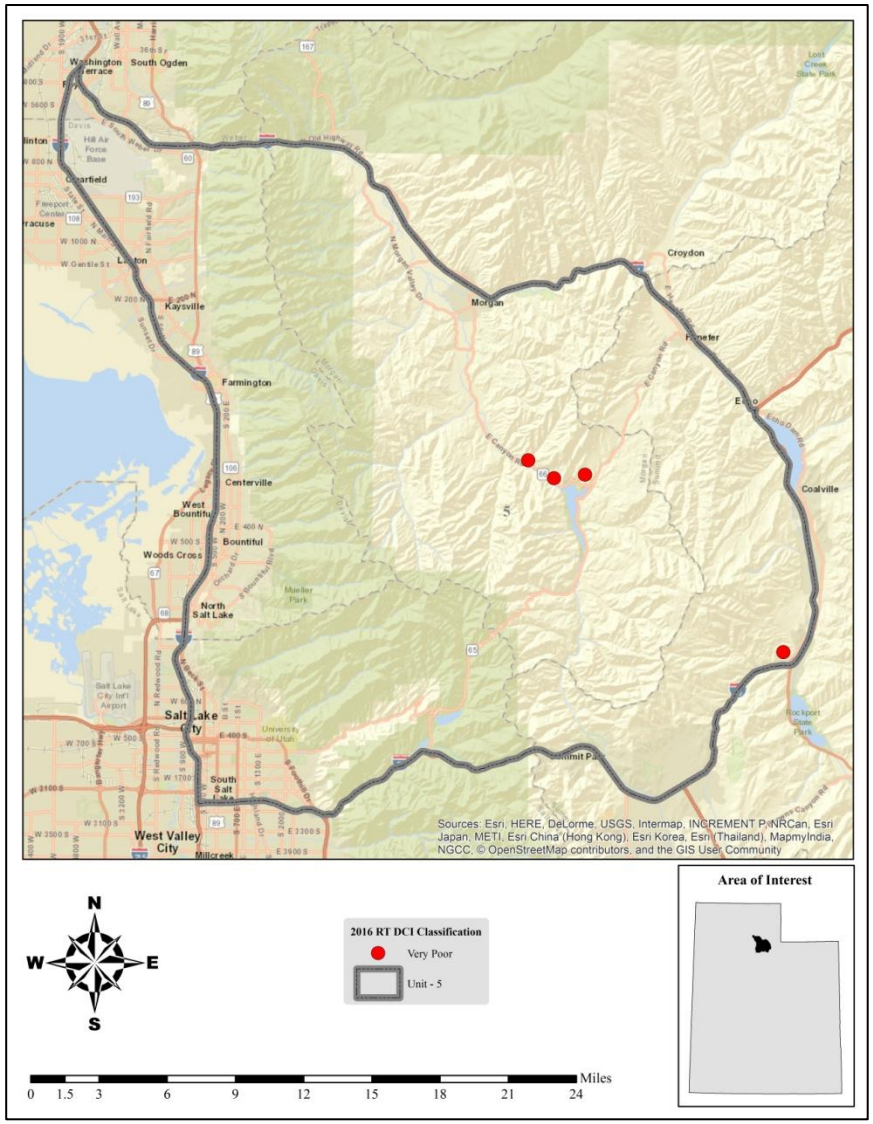
Map 5.9: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 5, East Canyon.



Map 5.10: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 5, East Canyon.



Map 5.11:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 5, East Canyon.



Map 5.12: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 5, East Canyon.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
05-2	Tucson Hollow	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
05-3	East Canyon Reservoir	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
05-4	Wanship	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
05-15	Red Rock Canyon	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species

Table 5.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 5, East Canyon. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The high elevation studies that are considered to be Mountain (Sagebrush) ecological sites support sagebrush populations that provide valuable browse for wildlife and are considered to be in very poor condition for deer winter range habitat on the East Canyon management unit. Although the herbaceous understories are abundant, annual grasses – namely cheatgrass – are present in amounts that pose a high-level threat to these study sites. Introduced perennial grass species are also present on these studies. Although these grasses can provide forage, they can often be aggressive at higher elevations and may reduce the prevalence and abundance of other more desirable native grass and forb species. Finally, noxious weed species on the Tucson Hollow study could compete with more desirable native grasses and forbs for resources.

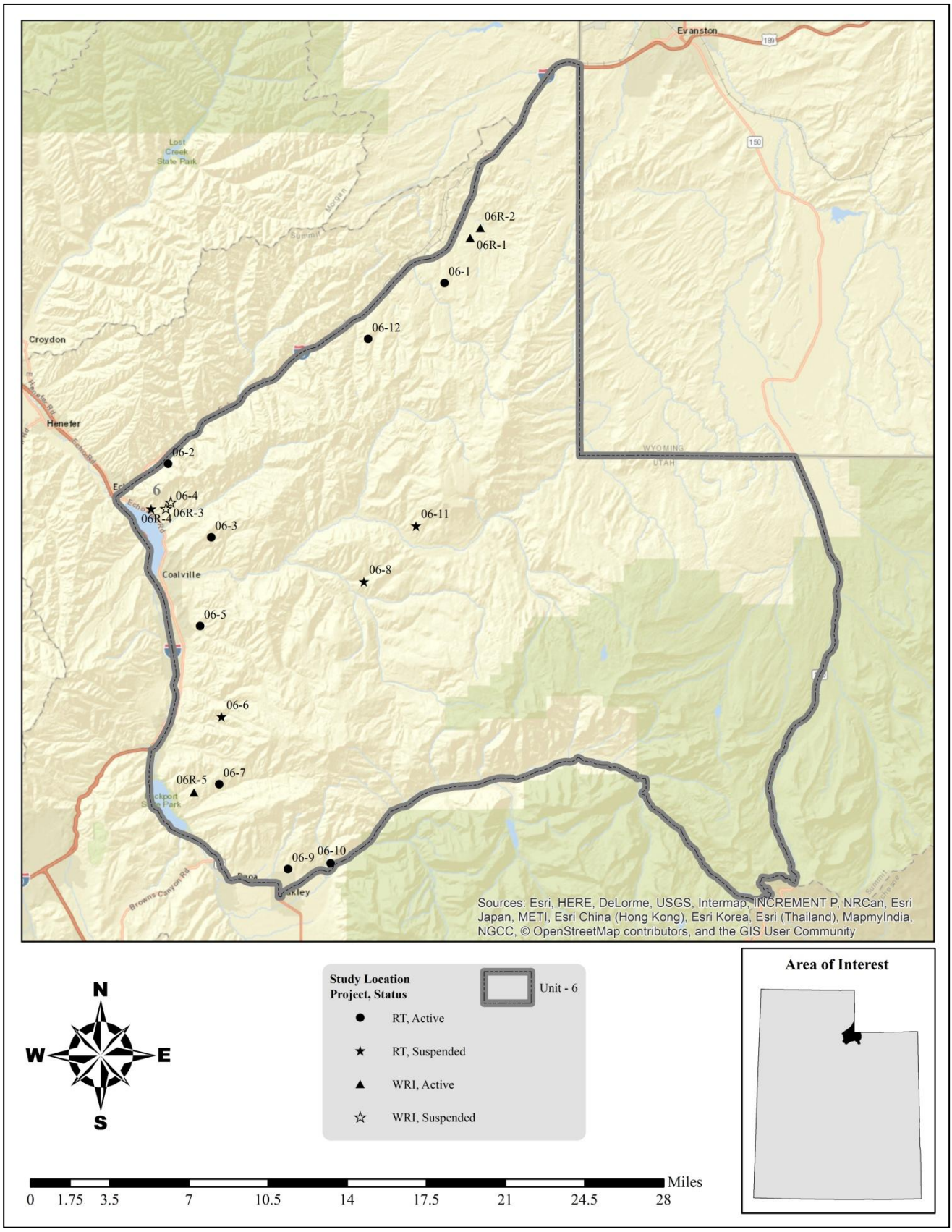
It is recommended that monitoring of this community continue. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible. Additional treatments such as herbicide application to reduce cheatgrass cover may be necessary in the future.

Upland (Sagebrush)

The mid elevation study site of this ecological type is considered to be in very poor condition for deer winter range habitat on this unit. A sagebrush community was supported in the past, but the site now hosts an abundant herbaceous understory. Introduced perennial grasses pose a high-level threat to this site, as they are often aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that monitoring of this community continue. If reseeding is necessary to restore herbaceous species, species should be selected with care with preference being given to native grass species when possible.

6. WILDLIFE MANAGEMENT UNIT 6 – CHALK CREEK



WILDLIFE MANAGEMENT UNIT 6 – CHALK CREEK

Boundary Description

Summit and Duchesne counties – Boundary begins at the junction of Interstates 84 and 80 near Echo; northeast on I-80 to the Utah-Wyoming state line; south and east along this state line to Highway SR-150; south on SR-150 to Pass Lake and the Weber River Trail; west to Holiday Park and Weber River Road; west on this road to Highway SR-32; north and west on SR-32 to I-80 and Wanship; north on I-80 to I-84 near Echo.

Management Unit Description

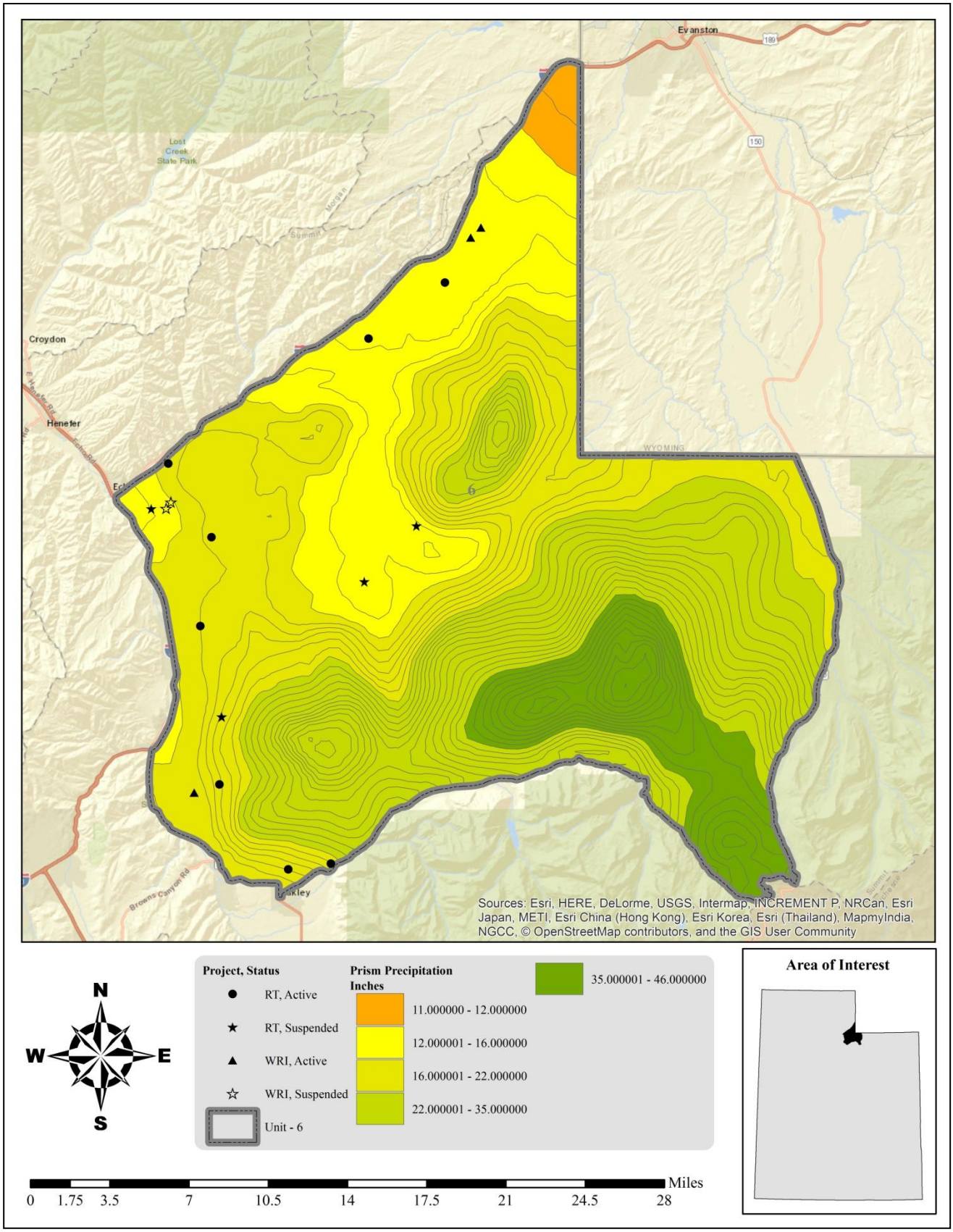
Geography

The topography of the Chalk Creek unit is influenced mainly by the Uinta Mountains to the east, with their drainages flowing through long, gradual slopes down into the Weber River Valley. Towns located in the valley along the Weber River include Oakley, Peoa, Wanship, Hoytsville, and Coalville. Echo and Rockport Reservoirs are located on the west side of the unit on the Weber River.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 11 inches along the northernmost portion of the unit near the Utah-Wyoming border to 45 inches on the peaks of the Uintas. All of the Range Trend and WRI monitoring studies on the unit occur within 14-21 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 Northern Mountains division (Division 5). 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, 2017).



Map 6.1: The 1981-2010 PRISM Precipitation Model for WMU 6, Chalk Creek (PRISM Climate Group, Oregon State University, 2013).

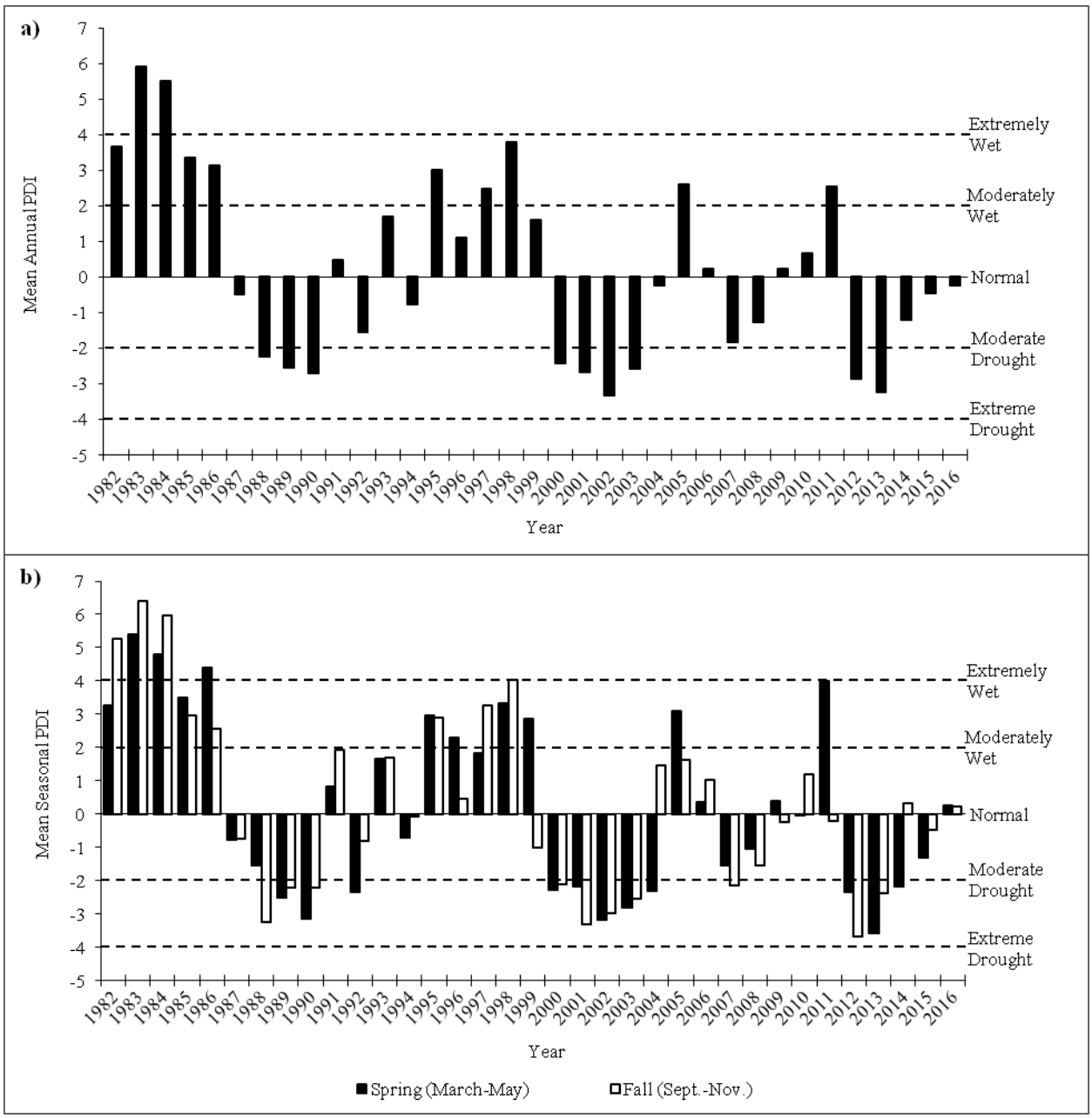
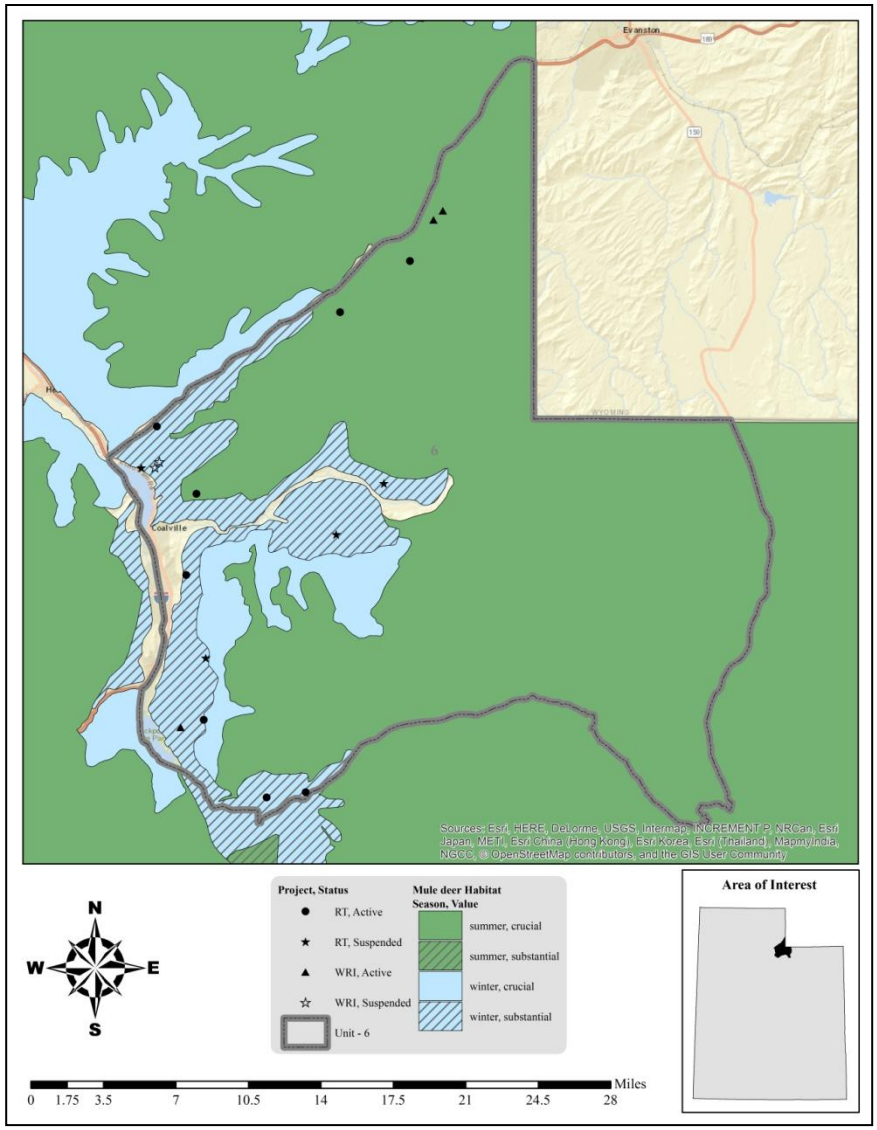


Figure 6.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

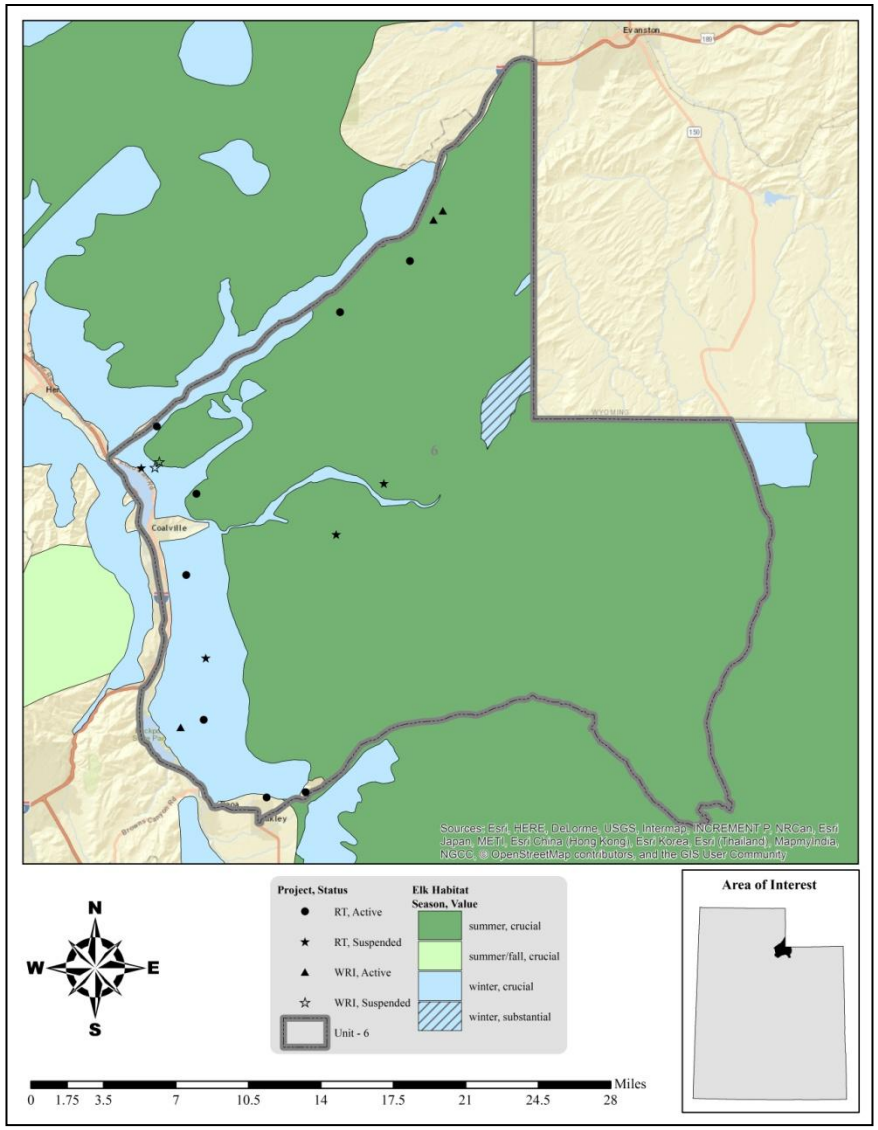
Big Game Habitat

There are just over 380,000 acres classified as deer range on Unit 6 with 74,467 acres classified as winter range and 306,362 acres classified as summer range (Table 6.l, Map 6.2). Privately owned land comprises 96% of the winter range, 3% is managed by the Utah Division of Wildlife Resources (UDWR), and the remaining 1% is administrated by the Bureau of Land Management (BLM), Bureau of Reclamation (BR), the Utah School and Institutional Trust Lands Administration (SITLA), the US Forest Service (USFS), Utah Department of Transportation (UDOT), and Utah State Parks (USP). 88% of the summer range is also privately owned, 11% is administrated by USFS, and UDWR, SITLA, and the BLM manage the remaining 1% (Table 6.2, Map 6.2, Map 6.5).

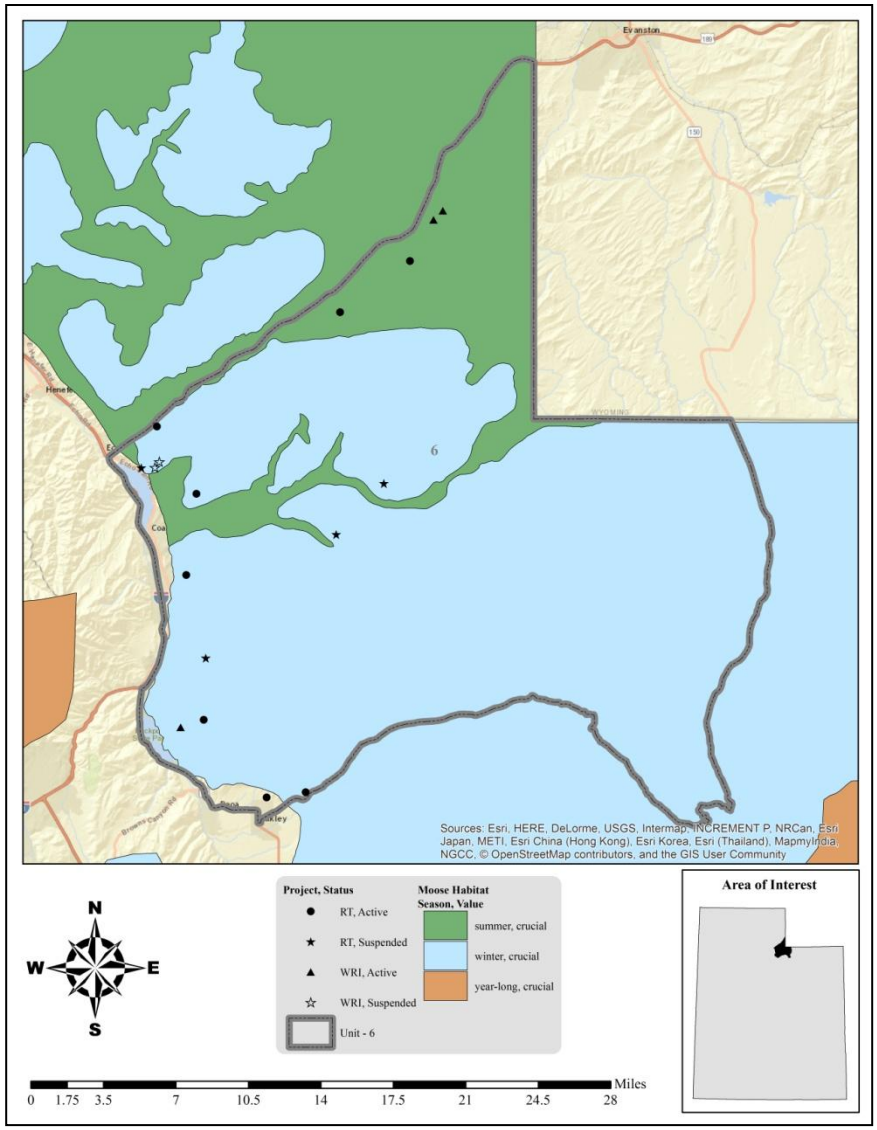
In the 1977 range inventory, the winter range was classified into 12 distinct vegetation types (Giunta, 1979); of these, seven of the larger, more important types were sampled. The sagebrush-grass and oak types were the most prevalent. The sagebrush-grass type is quite variable with basin big sagebrush, mountain big sagebrush, and Wyoming big sagebrush all occurring within the unit; this type is found on a variety of exposures, slopes, and elevations and is important on severe winter range. The oak brush type is the most productive type, but is largely unavailable in severe winters; this type intergrades with the sagebrush-grass and other types. Other important types include juniper, which is especially important for thermal cover, and mountain brush.



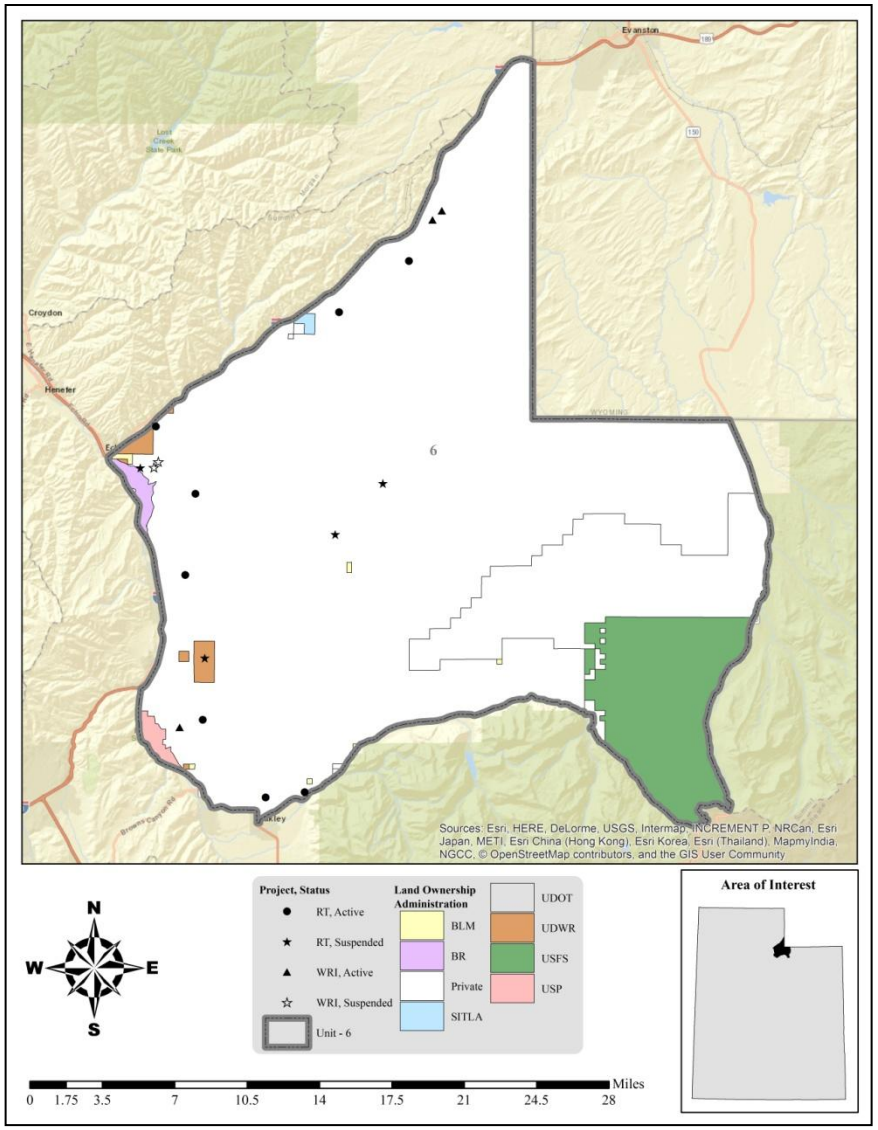
Map 6.2: Estimated mule deer habitat by season and value for WMU 6, Chalk Creek.



Map 6.3: Estimated elk habitat by season and value for WMU 6, Chalk Creek.



Map 6.4: Estimated moose habitat by season and value for WMU 6, Chalk Creek.



Map 6.5: Land ownership for WMU 6, Chalk Creek.

	Summer Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	306,362	80%	74,467	20%
Elk	334,704	87%	48,006	13%
Moose	73,452	19%	311,305	81%

Table 6.1: Estimated mule deer, elk, and moose habitat acreage by season for WMU 6, Chalk Creek.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	88	<1%	330	<1%
BR	0	0%	12	<1%
Private	272,085	88%	71,341	96%
SITLA	237	<1%	213	<1%
UDWR	16	<1%	2,412	3%
USFS	33,937	11%	14	<1%
UDOT	0	0%	1	<1%
USP	0	0%	144	<1%
Total	306,362	**100%**	74,467	**100%**

Table 6.2: Estimated mule deer habitat acreage by season and landownership for WMU 6, Chalk Creek.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	160	<1%	232	<1%
BR	0	0%	20	<1%
Private	300,155	89%	45,201	94%
SITLA	237	<1%	213	<1%
UDWR	216	<1%	2,211	5%
USFS	33,937	10%	0	0%
UDOT	0	0%	1	<1%
USP	0	0%	128	<1%
Total	334,704	**100%**	48,006	**100%**

Table 6.3: Estimated elk habitat acreage by season and land ownership for WMU 6, Chalk Creek.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	65	<1%	231	<1%
BR	38	<1%	0	0%
Private	72,593	99%	274,699	88%
SITLA	450	<1%	0	0%
UDWR	297	<1%	2,127	<1%
USFS	0	0%	33,951	11%
UDOT	9	<1%	0	0%
USP	0	0%	296	<1%
Total	73,452	**100%**	311,305	**100%**

Table 6.4: Estimated moose habitat acreage by season and land ownership for WMU 6, Chalk Creek.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Conifer-Hardwood	27,623	7.00%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	16,623	4.21%	
	Rocky Mountain Lodgepole Pine Forest	14,648	3.71%	
	Colorado Plateau Pinyon-Juniper Woodland	14,425	3.65%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	5,397	1.37%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	2,306	0.58%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	934	0.24%	
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	636	0.16%	
	Abies concolor Forest Alliance	411	0.10%	
	Other Conifer	58	0.01%	21.04%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	319	0.08%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	38	0.01%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	16	0.00%	0.09%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	5,864	1.49%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,562	0.40%	
	Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	258	0.07%	
	Inter-Mountain Basins Semi-Desert Grassland	167	0.04%	
	Other Grassland	50	0.01%	2.00%
Shrubland	Artemisia tridentata ssp. vaseyana Shrubland Alliance	68,212	17.28%	
	Quercus gambelii Shrubland Alliance	30,813	7.81%	
	Inter-Mountain Basins Big Sagebrush Shrubland	27,417	6.95%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	12,635	3.20%	
	Inter-Mountain Basins Montane Sagebrush Steppe	10,312	2.61%	
	Rocky Mountain Lower Montane-Foothill Shrubland	4,053	1.03%	
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	1,546	0.39%	
	Inter-Mountain Basins Big Sagebrush Steppe	1,525	0.39%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	194	0.05%	
	Other Shrubland	216	0.05%	39.75%
Other	Hardwood	119,553	30.29%	
	Developed	7,913	2.00%	
	Riparian	6,570	1.66%	
	Agricultural	4,988	1.26%	
	Open Water	2,832	0.72%	
	Sparsely Vegetated	2,325	0.59%	
	Barren	2,286	0.58%	
	Other	1	0.00%	37.11%
Total		394,726	100.00%	

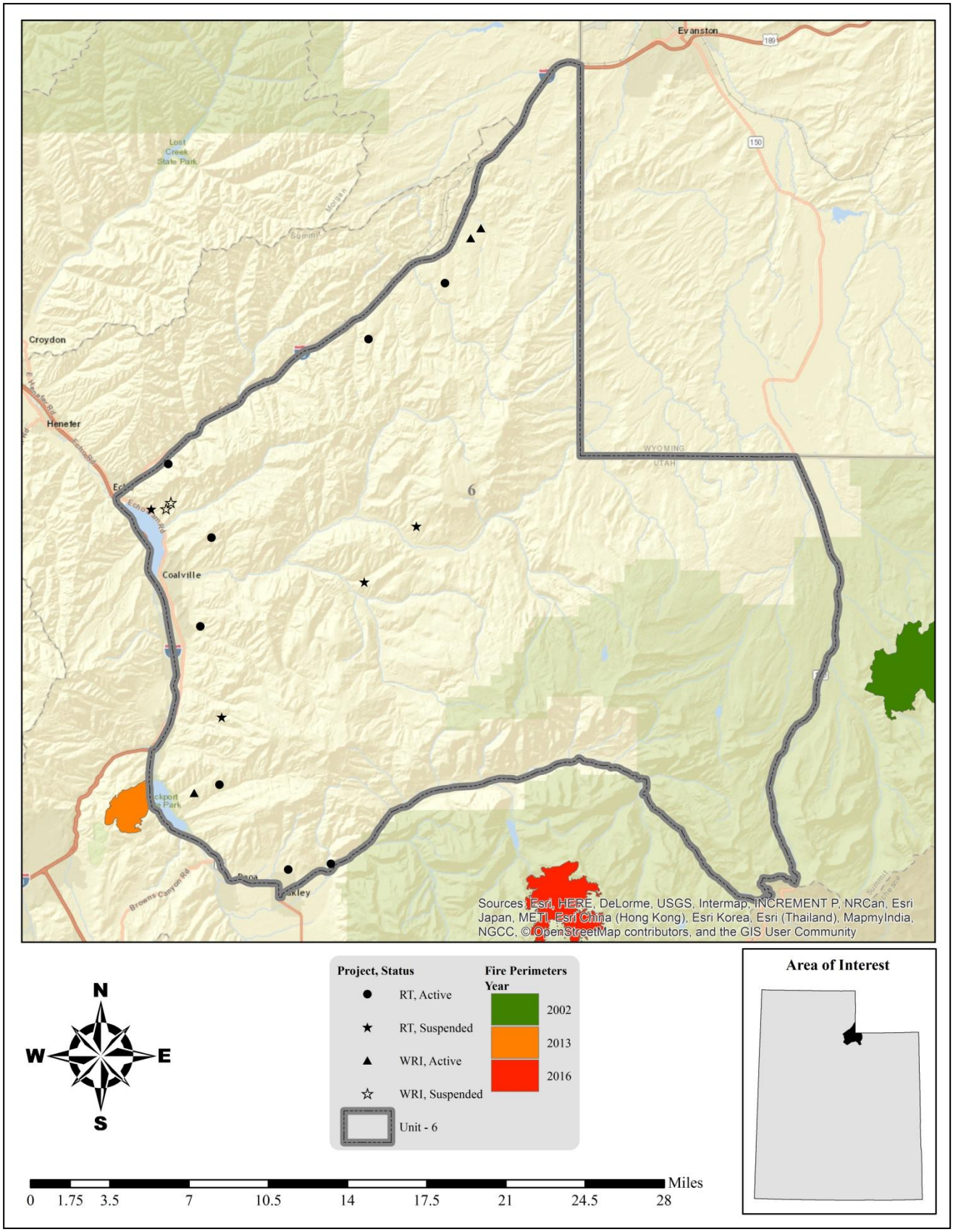
Table 6.5: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 6, Chalk Creek.

Limiting Factors to Big Game Habitat

Widespread private ownership has led to numerous management complications; unregulated development and loss of habitat are some of the biggest problems in this unit. The discovery, development, and removal of oil resources throughout the unit (especially the Chalk Creek area) has led to increased road and housing developments. Agricultural projects on crucial winter range also continue to increase wildlife depredation problems and further decrease the available big game range. The establishment of hunting clubs has led to access that is strictly restricted for trophy hunting in large areas of the unit. Private landowners are also less likely to undertake extensive rehabilitation projects to improve the value of the remaining range.

Echo and Rockport Reservoirs, located on the west side of the unit on the Weber River, are both significant barriers to big game movement. I-80 through Echo Canyon also discourages big game movement and many deer deaths occur there during winter and spring. In addition, fires have destroyed large tracts of important range. Because of this habitat loss, increasing numbers of mule deer, elk, and moose tend to concentrate in the lower areas on agricultural land and at mouths of canyons, especially during severe winters.

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). Increased amounts of cheatgrass increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 6.6: Land coverage of fires by year from 2000-2016 for WMU 6, Chalk Creek.

Treatments/Restoration Work

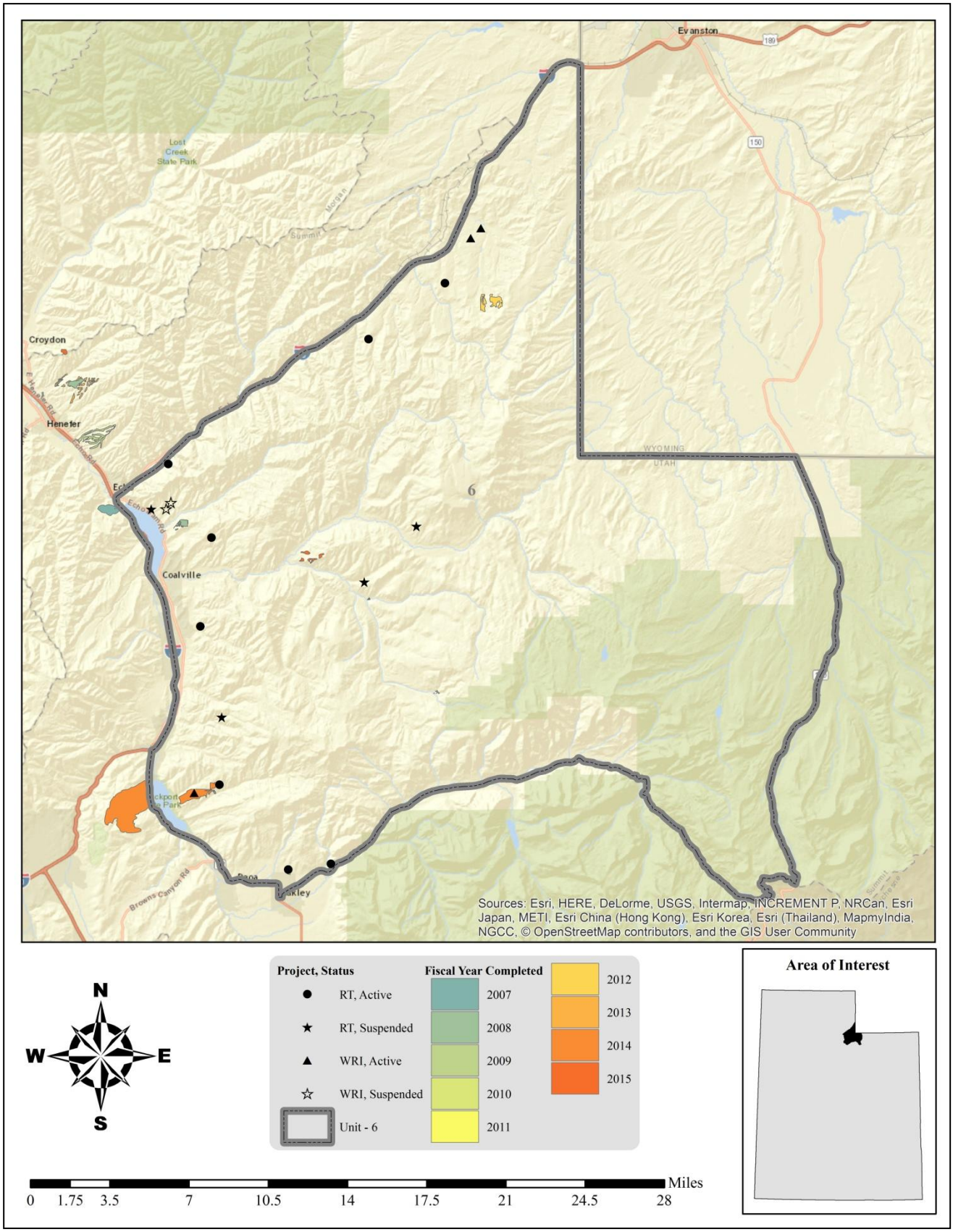
There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 709 acres of land have been treated within the Chalk Creek unit since the WRI was implemented in 2004 (Map 6.7); 1,168 acres are currently undergoing treatment projects. Treatments frequently overlap one another bringing the total completed treatment acres to 709 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 chain use to remove twoneedle pinyon and Utah juniper is the most common management practice in this unit. Other management practices include seeding desirable herbaceous species, harrow, hand crews, and other treatments (Table 6.6).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**354**	**0**	**0**	**354**
Ely (Two-Way)	354	0	0	354
Harrow	**75**	**0**	**0**	**75**
≤15 ft. (One-Way)	75	0	0	75
Planting/Transplanting		**171**	**0**	**171**
Prescribed Fire		**896**	**0**	**896**
Seeding (Primary)	**205**	**101**	**0**	**305**
Broadcast (Aerial)	3	0	0	3
Drill (Rangeland)		101	0	101
Other	202	**0**	**0**	202
Vegetation Removal/Hand Crew	**69**	**0**	**0**	**69**
Lop-Pile-Burn	69	0	0	69
Other	**7**	**0**	**0**	**7**
Interseeding	7	0	0	7
Total Treatment Acres	**709**	**1,168**	**0**	**1,877**
***Total Land Area Treated**	**709**	**1,168**	**0**	**1,877**

Table 6.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 6, Chalk Creek. Data accessed on 02/09/2017.

*Does not include overlapping treatments.



Map 6.7: WRI treatments by fiscal year completed for WMU 6, Chalk Creek.

Range Trend Studies

Range Trend studies have been sampled within WMU 6 on a regular basis since 1984, 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	Year(s) Sampled	Ecological Site Description
06-1	Anshutz Ranch	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
06-2	Echo Canyon Rest Area	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Shrub)
06-3	Spring Hollow Burn	RT	Active	'84, '90, '01, '06, '11, '16	Mountain Loam (Mountain Big Sagebrush)
06-4	Echo Reservoir	RT	Suspended	'84, '90, '96, '01, '06, '11	Not Verified
06-5	Spring Canyon	RT	Active	'96, '91, '06, '11	Not Verified
06-6	Hixon Canyon	RT	Suspended	'84, '90, '96, '06	Not Verified
06-7	Crandall Canyon	RT	Active	'84, '90, '96, '01, '06, '11	Not Verified
06-8	South Fork Chalk Creek	RT	Suspended	'90, '96	Not Verified
06-9	North Oakley Bench	RT	Active	'96, '01, '06, '11	Not Verified
06-10	Mahogany Hills	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Loam (Shrub)
06-11	Upper Chalk Creek	RT	Suspended	'84	Not Verified
06-12	Stag Canyon	RT	Active	'96, '01, '06, '11, '16	Upland Loam (Bonneville Big Sagebrush)
06R-1	Cache Cave 1	WRI	Active	'04, '07, '12	Not Verified
06R-2	Cache Cave 2	WRI	Active	'04, '07, '12	Not Verified
06R-3	Grassy Valley Disking	WRI	Suspended	'07	Not Verified
06R-4	Grassy Valley Chaining	WRI	Suspended	'07	Not Verified
06R-5	Lower Crandall Canyon	WRI	Active	'14	Mountain Loam (Mountain Big Sagebrush)

Table 6.7 Range trend and WRI project studies monitoring history and ecological site potential for WMU 6, Chalk Creek.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
06-2	Echo Canyon Rest Area	Wildfire		1999		
06-3	Spring Hollow Burn	Wildfire		Historic		
		Seed Unknown		Historic		
06-12	Stag Canyon	Wildfire		Historic		
06R-1	Cache Cave 1	Aerator/Seed	Cache Cave	2004	500	PDB
06R-2	Cache Cave 2	Aerator/Seed	Cache Cave	2004	500	PDB
06R-5	Lower Crandall Canyon	Two-Way Ely Chain	Crandall Canyon Juniper Thinning	2013	400	2360
		Aerial After	Crandall Canyon Juniper Thinning	2013	400	2360
		Drill	Crandall Canyon Juniper Thinning	2013		2360

Table 6.8: Range trend and WRI studies known disturbance history for WMU 6, Chalk Creek.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

There are two studies [Spring Hollow Burn (06-3) and Mahogany Hills (06-10)] that are classified as Mountain (Sagebrush) ecological sites. Spring Hollow Burn is 2.75 miles east of the town of Coalville. Mahogany Hills is 2.5 Miles northeast of the town of Oakley off Weber Canyon Road.

Shrubs/Trees: The primary browse species present are Saskatoon serviceberry (*Amelanchier alnifolia*), mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), and mountain snowberry (*Symphoricarpos oreophilus*). These species are primarily found on the Mahogany Hills site, while Spring Hollow Burn has few desirable shrubs present. The primary shrubs on Spring Hollow Burn are broom snakeweed (*Gutierrezia sarothrae*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus ssp. viscidiflorus*), with a small amount of Saskatoon serviceberry (*Amelanchier alnifolia*) present on the site. The cover for Spring Hollow Burn has remained stable over the study period, with the exception being a spike in the cover of broom snakeweed (*Gutierrezia sarothrae*) in 2016. For the Mahogany Hills site, the cover of preferred browse has generally remained stable (Figure 6.2). Average sagebrush demographics indicate that the population has been comprised of mainly mature individuals in most sample years and that recruitment of young has decreased (Figure 6.4). Average sagebrush utilization has been moderate in all sample years except 2016, when a majority of plants exhibited little to no use (Figure 6.5).

Herbaceous Understory: The perennial grass and forb components of these study sites have remained rich in diversity and high in cover. There are some native grasses, but much of the perennial grass cover is introduced species such as smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), bulbous bluegrass (*Poa bulbosa*), and intermediate wheatgrass (*Thinopyrum intermedium*). Annual grass and forb cover has remained low (Figure 6.6).

Occupancy: Average pellet group transect data indicates that overall utilization of the site has remained stable, while the species that use the site have fluctuated over the years. Mean abundance of deer pellet groups has varied from 5 days use/acre in 2001 to 19 days use/acre in 2016. Elk pellet groups have had a mean abundance ranging from 0 days use/acre in 2001 and 2016 to 38 days use/acre in 2006. Cattle have also been present on Spring Hollow Burn, with mean abundance of pellet groups varying from no use in 2001 to a high of 13 days use/acre in 2006 (Figure 6.8).

Mountain (Oak)

There is one study [Echo Canyon Rest Area (06-2)] that is classified as a Mountain (Oak)] ecological site. The Echo Canyon Rest Area site is located 2.75 miles northeast of the town of Echo on I-80.

Shrubs/Trees: The primary browse species on this site include antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), and mountain snowberry (*Symphoricarpos oreophilus*). There are lesser components of the shrub community that include Saskatoon serviceberry (*Amelanchier alnifolia*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*): these average less than 1 percent cover. Overall shrub cover has remained relatively stable through the sample years (Figure 6.2).

Herbaceous Understory: The herbaceous understory of the Echo Canyon Rest Area site is composed of a variety of perennial grasses and forbs. There is a small component of introduced annual forbs and grasses. Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) are the primary perennial native grasses on the site. There are many forbs present on the site, and many of them are native. American Vetch (*Vicia americana*) is the most common native forb with an average of 3.5 percent cover (Figure 6.6).

Occupancy: Average pellet group transect data shows variable but generally decreasing usage by both deer and elk on the site. Mule deer pellet groups have had a mean abundance as high as 27.5 days use/acre in 2006 and as low as 6.7 days use/acre in 2011. Mean abundance of elk pellet groups has ranged from 7.4 days use/acre in 2001 to 36.2 days use/acre in 2006. Finally, mean abundance of moose pellet groups was 0.5 days use/acre in 2006 (Figure 6.8).

Upland (Sagebrush)

There are two studies [Anshutz Ranch (06-1) and Stag Canyon (06-12)] classified as Upland (Sagebrush) ecological sites. Anshutz Ranch is located 1.5 miles south of I-80 off of Reese Creek. Stag Canyon is located 2 miles south of I-80 in Stag Canyon, which is off Robinson Creek.

Shrubs/Trees: Both of these sites are dominated by sagebrush species in the shrub overstory. Stag Canyon is dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), while the Anshutz Ranch site is dominated by a mix of mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) and little sagebrush (*A. arbuscula*). The cover percentage has remained stable, but recruitment of young plants has decreased over time (Figure 6.2, Figure 6.4). Utilization of sagebrush has fluctuated from year to year. In 2001, 2006, and 2011 a majority of plants were moderately to heavily used, while all plants exhibited little to no use in 1996 and 2016 (Figure 6.5).

Encroachment of conifers is contributed by the Stag Canyon study; trees are comprised of Utah juniper (*Juniperus osteosperma*). No tree cover has been recorded (Figure 6.3).

Herbaceous Understory: The herbaceous understories of the two sites is composed of a mix of perennial grasses and forbs. The most common perennial grasses include squirreltail (*Elymus elymoides*), thickspike wheatgrass (*Elymus lanceolatus*), needle and thread (*Hesperostipa comata*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). There is a moderate annual grass component present on both sites. Perennial grass and forb cover has remained stable through the sample years, with exceptionally high cover of both perennial forbs and grasses exhibited in 2011 (Figure 6.6). Nested frequency of the understory has increased overall (Figure 6.7).

Occupancy: Average pellet group transect data for both sites shows an increasing trend for mule deer and a decreasing trend in usage for elk over time on the two sites. Elk averaged 54 days use/acre in 2001 and decreased to 6 days use/acre in 2016. The mean abundance of deer usage for the sites was 9 days use/acre in 2001 which increased to nearly 37 days use/acre in 2016. Cattle pellet group mean abundance was 2.1 days use/acre across the two sites between 2001 and 2016. Thus, it appears that primary occupancy has varied between deer and elk between 2001 and 2016 (Figure 6.8).

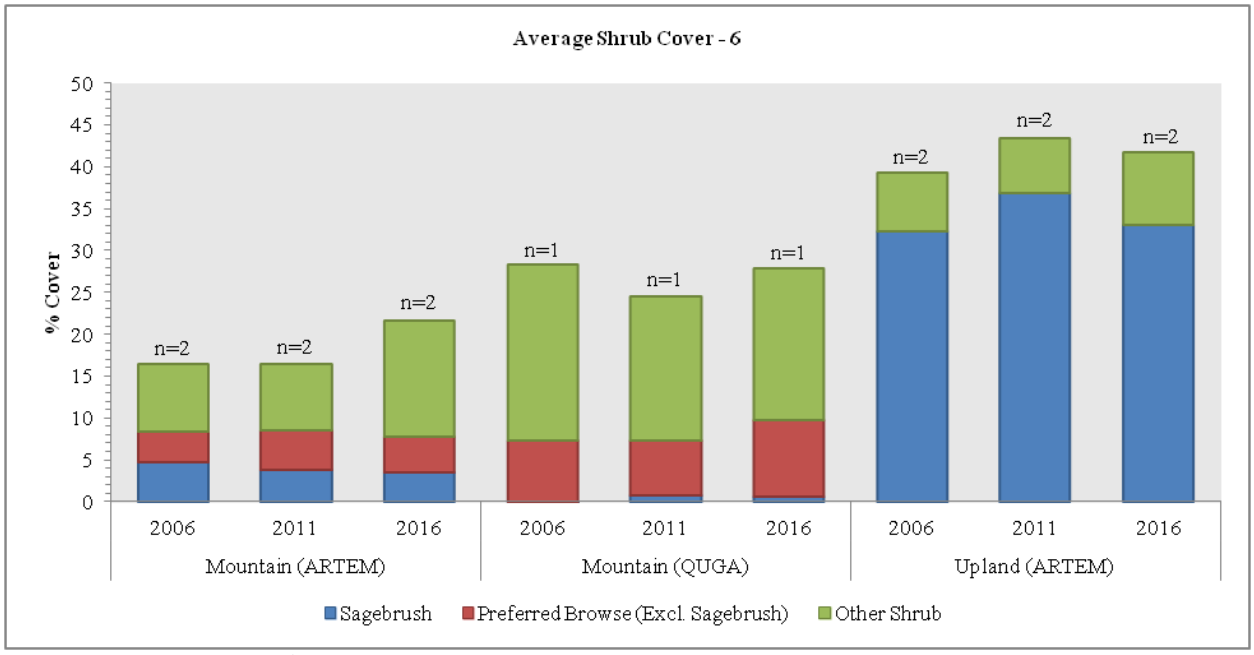


Figure 6.2: Average shrub cover for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

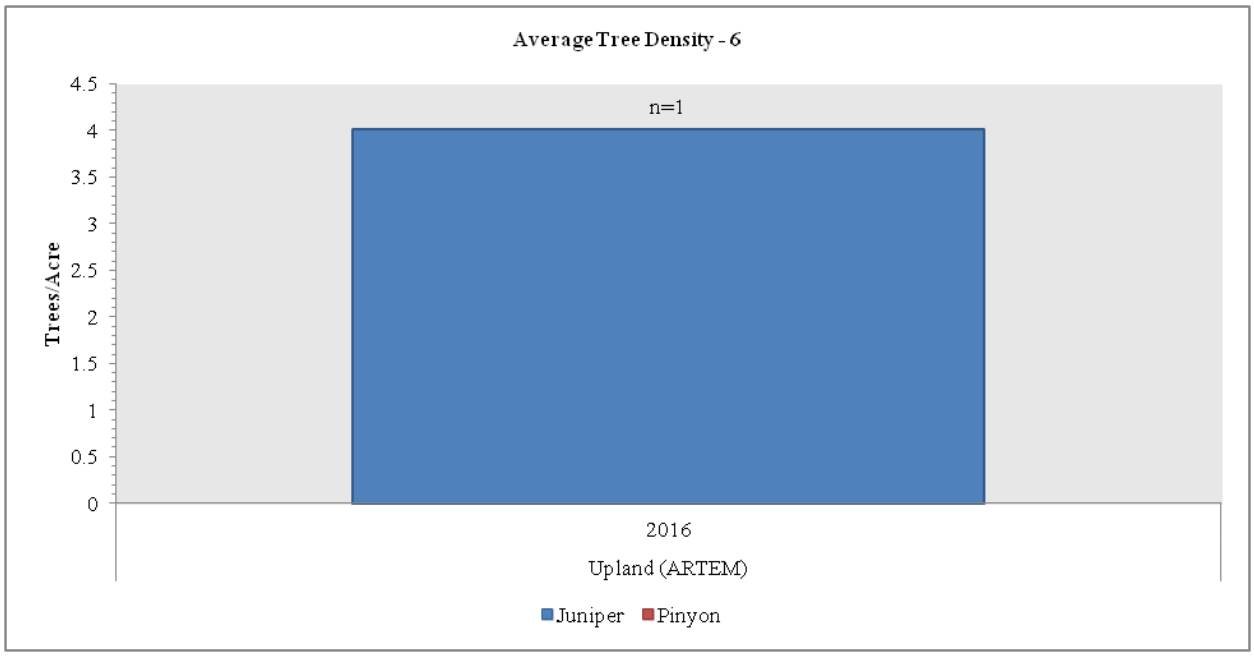


Figure 6.3: Average tree density for Upland (ARTEM) study sites in WMU 6, Chalk Creek.

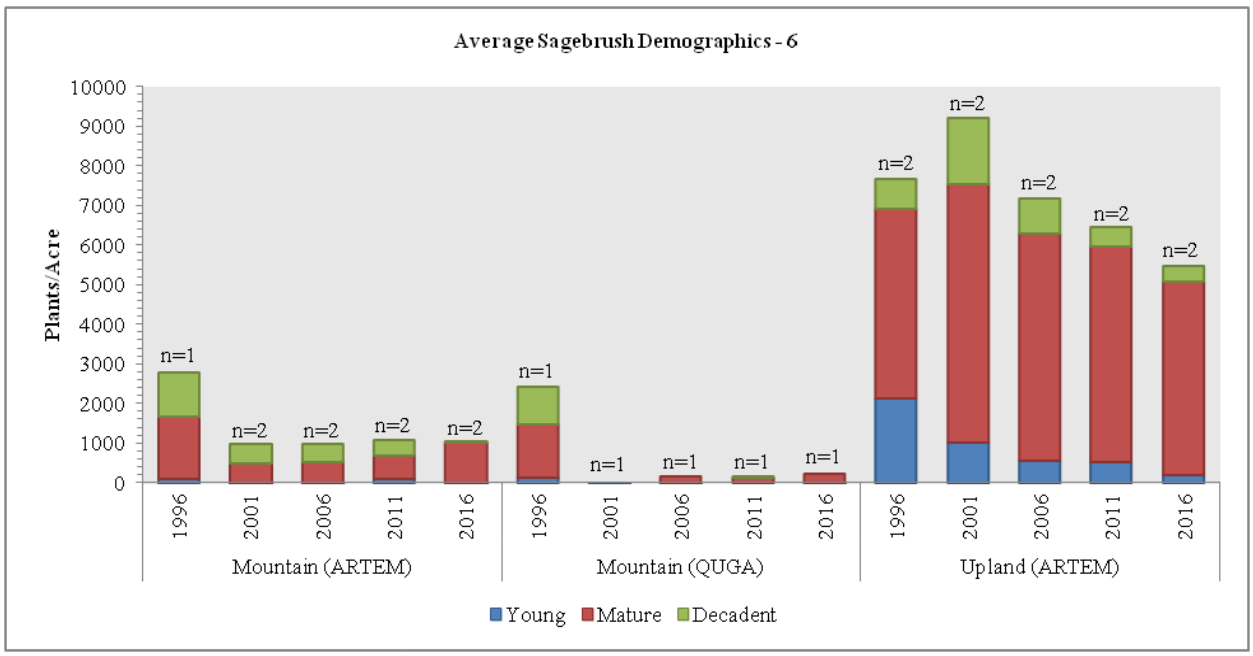


Figure 6.4: Average sagebrush demographics for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

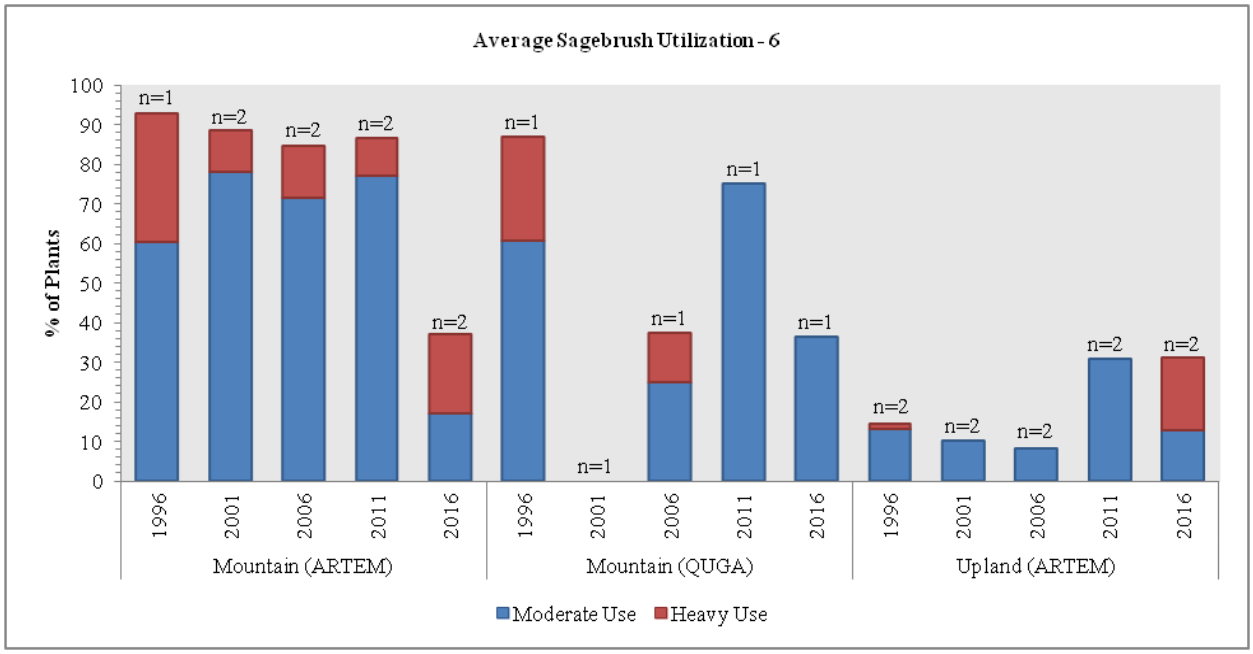


Figure 6.5: Average sagebrush utilization for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

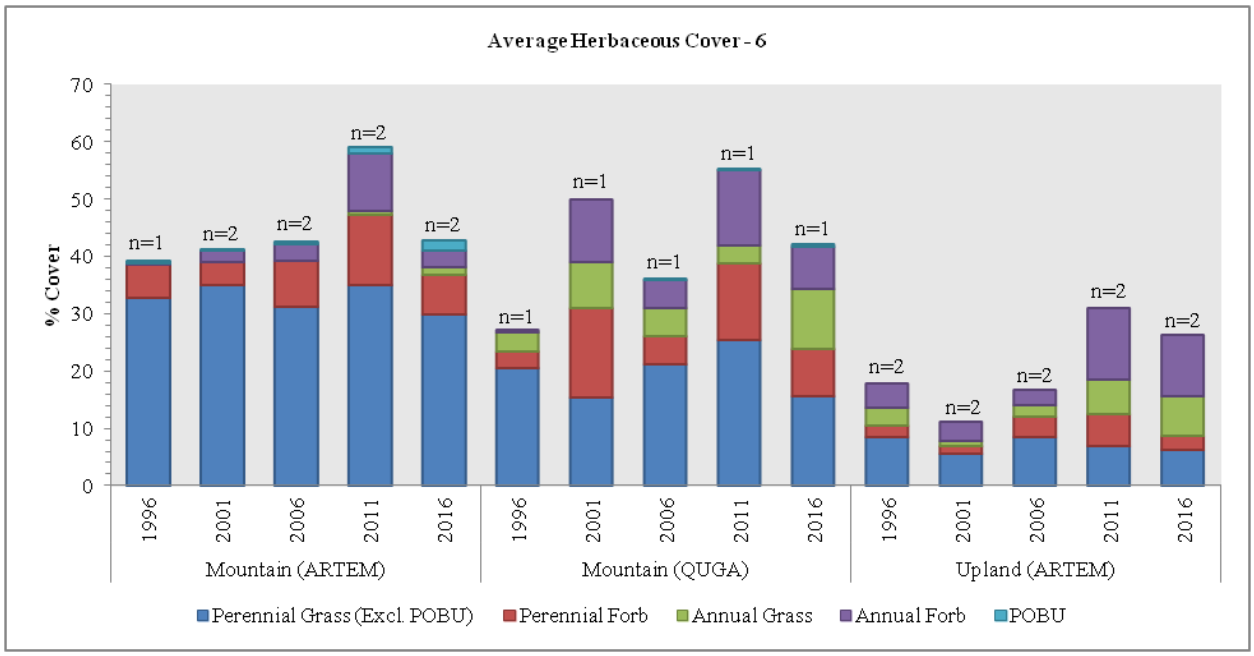


Figure 6.6: Average herbaceous cover for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

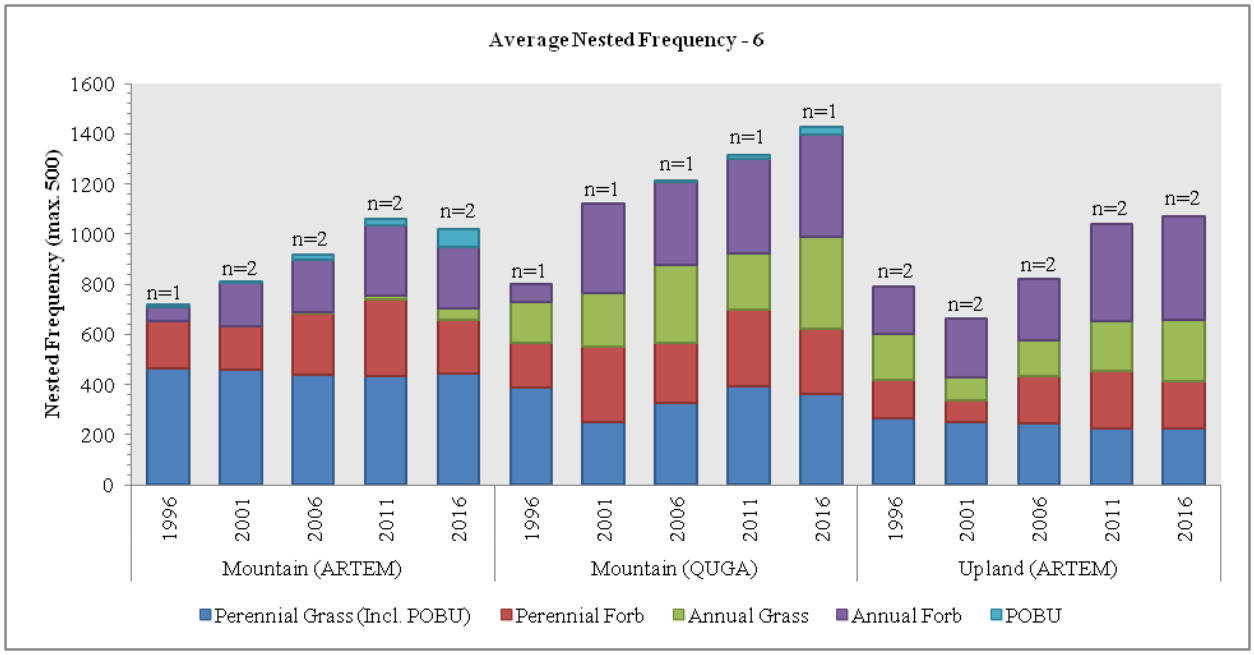


Figure 6.7: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

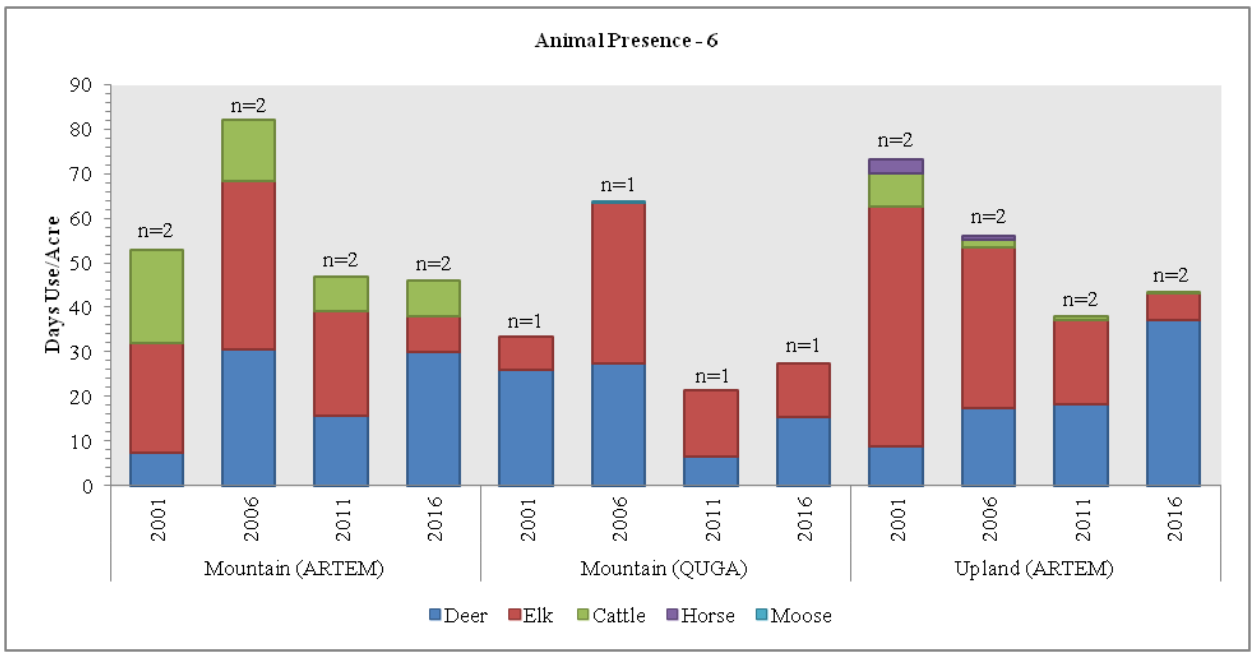
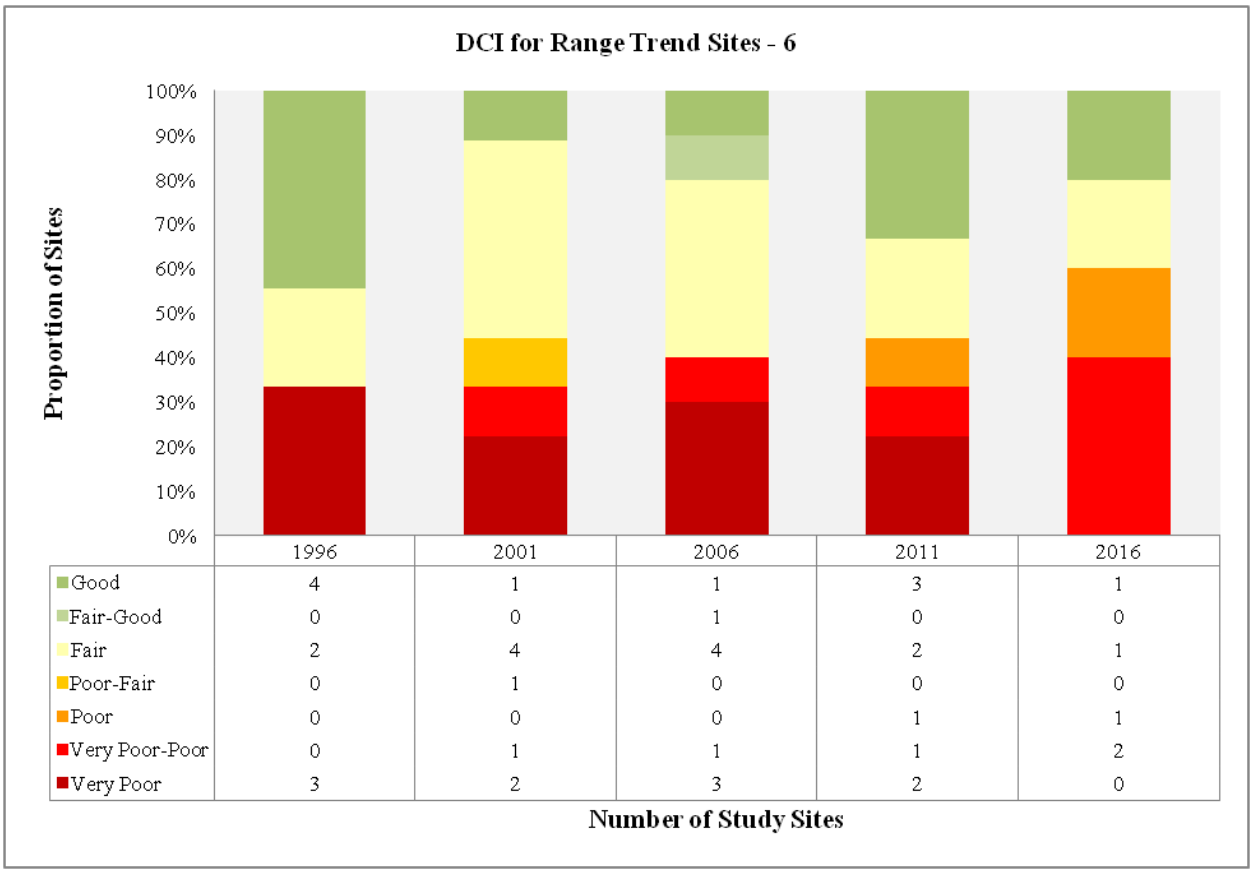


Figure 6.8: Average pellet transect data for Mountain (ARTEM), Mountain (QUGA), and Upland (ARTEM) study sites in WMU 6, Chalk Creek.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Chalk Creek management unit has continually changed on the sites sampled since 1996. The Range Trend sites sampled within the unit are considered to be in very poor to good condition as of the most recent sample years (Figure 6.9, Table 6.9, Map 6.12). Crandall Canyon, North Oakley Bench, and Mahogany Hills improved from fair or fair-good to good condition. Anshutz Ranch went from good to fair condition, and Stag Canyon remained in poor condition. The Echo Canyon Rest Area, Spring Hollow Burn, and Spring Canyon studies are considered to be in very poor or very poor-poor condition generally due to the lack of preferred browse cover and sagebrush diversity. The treated study sites range from very poor-poor to poor condition (Figure 6.10, Table 6.10 , Map 6.12); Echo Canyon Rest Area is also considered to be a Range Trend site and is therefore discussed above. Lower Crandall Canyon was not sampled prior to treatment, but is in very poor condition upon the first post-treatment sampling due to lack of preferred browse cover and sagebrush diversity. It is possible given more time and continual monitoring that these sites will (continue to) improve.



	1996	2001	2006	2011	2016
Good	4	1	1	3	1
Fair-Good	0	0	1	0	0
Fair	2	4	4	2	1
Poor-Fair	0	1	0	0	0
Poor	0	0	0	1	1
Very Poor-Poor	0	1	1	1	2
Very Poor	3	2	3	2	0

Figure 6.9: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 6, Chalk Creek.

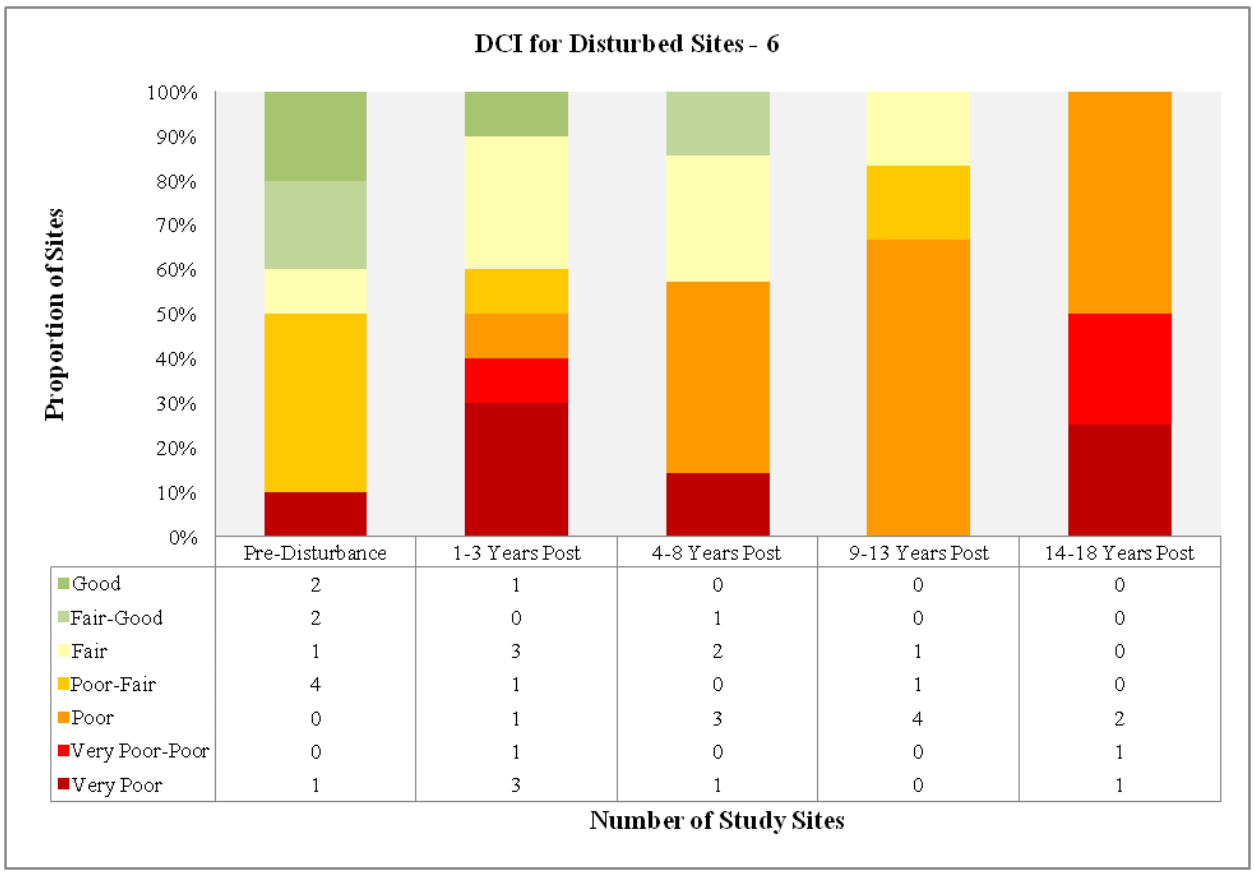


Figure 6.10: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 6, Chalk Creek.

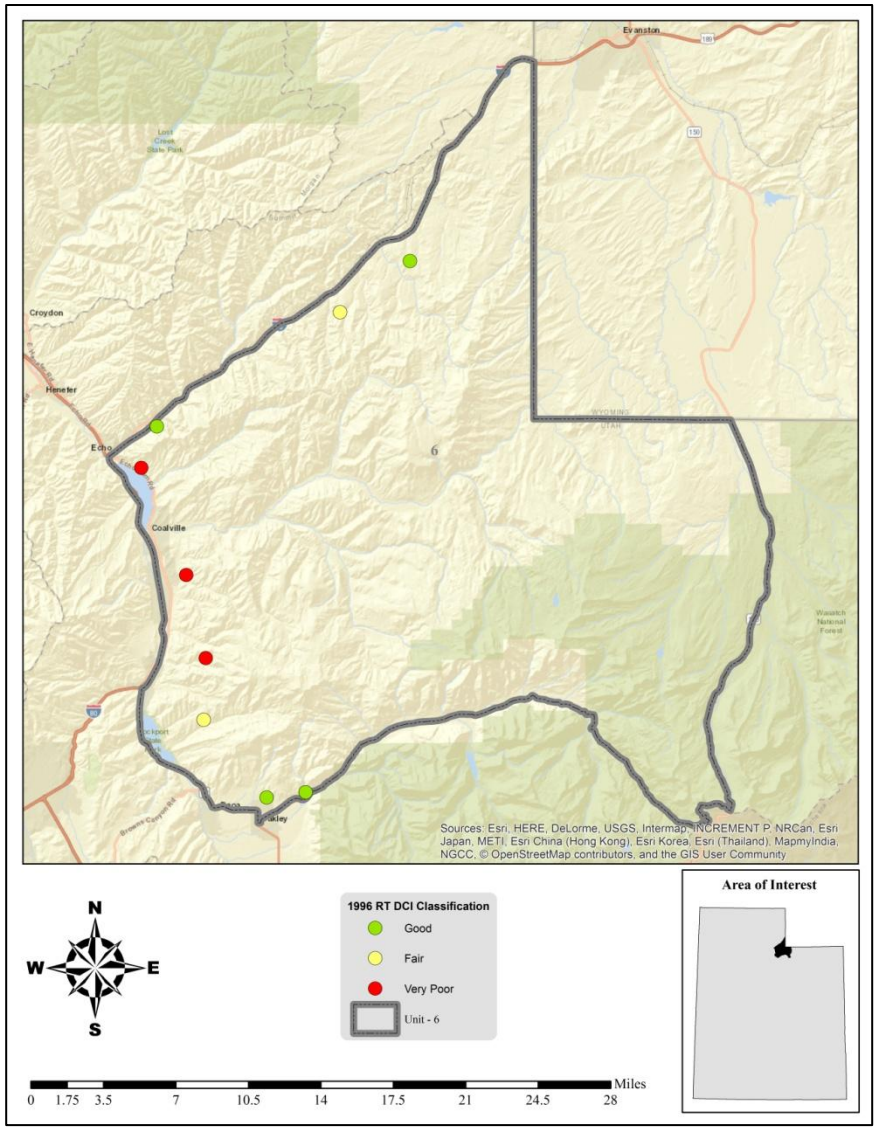
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
06-1	1996	30.0	10.5	2.9	22.2	-1.5	7.0	0.0	**71.1**	**G**
06-1	2001	30.0	7.4	1.2	11.3	-0.1	4.3	0.0	**54.2**	**F**
06-1	2006	30.0	10.4	1.5	21.8	-0.1	10.0	0.0	**73.6**	**G**
06-1	2011	30.0	12.8	3.7	17.6	-1.0	10.0	0.0	**73.0**	**G**
06-1	2016	30.0	12.7	2.0	12.8	-1.8	6.6	0.0	**62.3**	**F**
06-2	1996	25.7	7.4	6.9	30.0	-2.5	6.2	0.0	**73.7**	**G**
06-2	2001	6.5	7.1	15.0	30.0	-6.0	10.0	0.0	**62.7**	**F**
06-2	2006	7.8	12.9	4.6	30.0	-3.7	9.9	0.0	**61.4**	**F**
06-2	2011	6.7	13.1	5.9	30.0	-2.3	10.0	0.0	**63.4**	**F**
06-2	2016	6.5	0.0	0.0	30.0	-7.9	10.0	0.0	**38.7**	**VP-P**
06-3	2001	0.8	0.0	0.0	30.0	0.0	8.8	0.0	**39.7**	**VP-P**
06-3	2006	0.7	0.0	0.0	30.0	0.0	10.0	0.0	**40.7**	**VP-P**
06-3	2011	0.0	0.0	0.0	30.0	-0.5	10.0	0.0	**39.5**	**VP-P**
06-3	2016	0.0	0.0	0.0	30.0	-1.1	10.0	0.0	**39.0**	**VP-P**
06-4*	1996	0.0	0.0	0.0	17.6	-11.5	4.6	0.0	**10.7**	**VP**
06-4*	2001	0.0	0.0	0.0	30.0	-1.0	2.0	0.0	**31.0**	**VP**
06-4*	2006	0.0	0.0	0.0	25.7	-1.4	3.1	0.0	**27.4**	**VP**
06-4*	2011	0.0	0.0	0.0	27.0	-3.6	4.5	0.0	**27.9**	**VP**
06-5	1996	0.0	0.0	0.0	5.5	-2.1	2.3	0.0	**5.7**	**VP**
06-5	2001	0.0	0.0	0.0	9.7	-0.3	2.9	0.0	**12.3**	**VP**
06-5	2006	0.0	0.0	0.0	6.6	-0.5	3.6	0.0	**9.7**	**VP**
06-5	2011	0.0	0.0	0.0	10.0	-0.2	7.9	0.0	**17.7**	**VP**
06-6*	1996	4.8	0.0	0.0	10.8	-4.6	0.4	0.0	**11.4**	**VP**
06-6*	2006	8.1	0.0	0.0	22.9	-1.7	2.3	0.0	**31.6**	**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
06-7	1996	15.0	13.0	9.2	21.0	-0.2	4.4	0.0	**62.3**	**F**
06-7	2001	11.7	10.9	5.4	21.9	-0.2	5.4	0.0	**55.1**	**P-F**
06-7	2006	11.7	11.3	8.1	30.0	-0.1	3.2	0.0	**64.2**	**F**
06-7	2011	17.4	14.8	9.8	30.0	-2.1	8.4	0.0	**78.3**	**G**
06-9	1996	9.2	12.8	7.5	30.0	-0.2	8.6	0.0	**67.9**	**G**
06-9	2001	15.3	11.2	4.9	28.0	-0.1	9.6	0.0	**68.9**	**G**
06-9	2006	11.7	5.9	7.8	30.0	0.0	10.0	0.0	**65.3**	**F-G**
06-9	2011	16.5	12.3	4.9	30.0	-0.3	10.0	0.0	**73.4**	**G**
06-10	1996	30.0	5.4	1.4	30.0	0.0	10.0	0.0	**76.8**	**G**
06-10	2001	21.4	4.4	1.6	30.0	0.0	10.0	0.0	**67.4**	**F**
06-10	2006	20.2	4.0	3.5	30.0	0.0	10.0	0.0	**67.7**	**F**
06-10	2011	16.4	4.3	4.0	30.0	0.0	10.0	0.0	**64.6**	**F**
06-10	2016	19.6	14.3	9.2	30.0	0.0	10.0	0.0	**83.0**	**G**
06-12	1996	12.0	15.0	15.0	11.5	-3.3	10.0	0.0	**60.2**	**F**
06-12	2001	14.6	14.4	14.5	12.0	-1.4	2.7	0.0	**56.8**	**F**
06-12	2006	20.8	13.2	10.5	12.5	-3.0	4.5	0.0	**58.5**	**F**
06-12	2011	20.6	11.7	4.0	9.9	-8.3	8.9	0.0	**46.7**	**P**
06-12	2016	22.6	12.3	1.5	12.2	-8.4	3.4	0.0	**43.6**	**P**

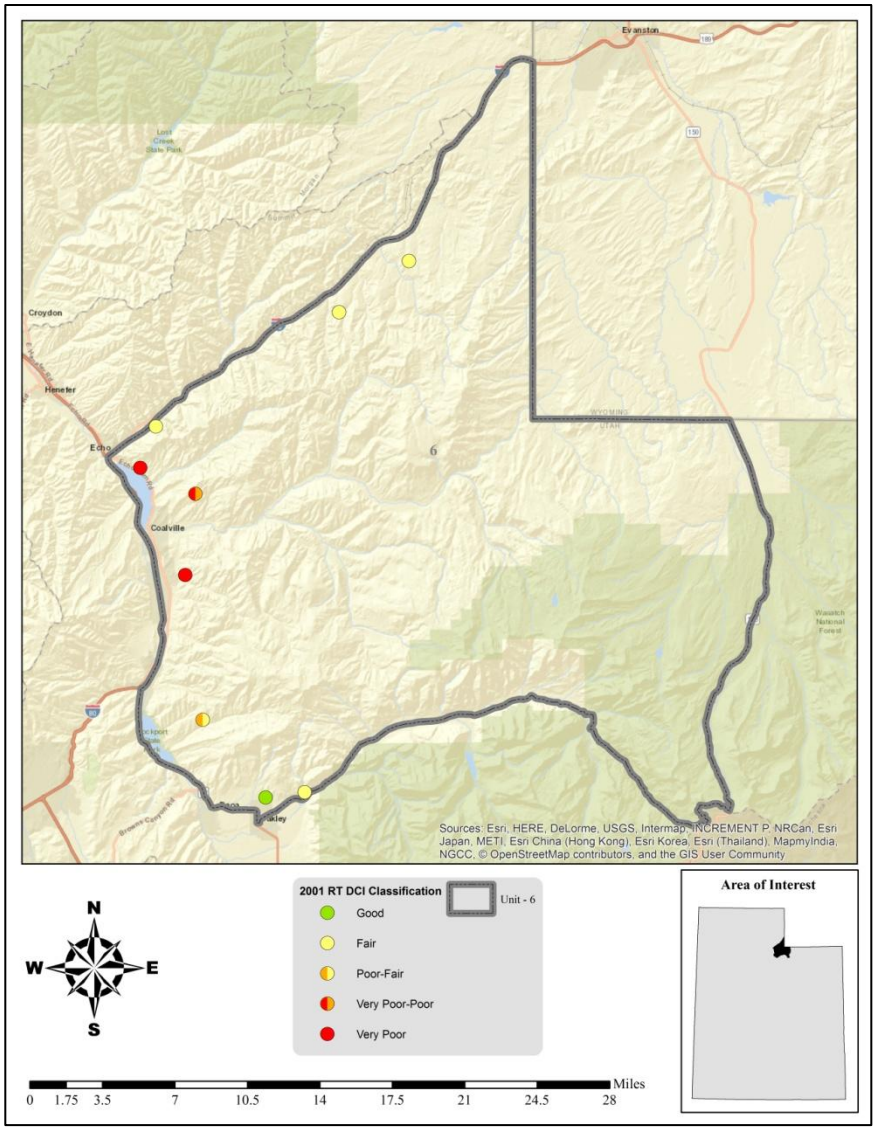
Table 6.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 6, Chalk Creek.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

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
06R-5	2014	1.2	0.0	0.0	14.4	0.0	3.2	0.0	**18.8**	**VP**

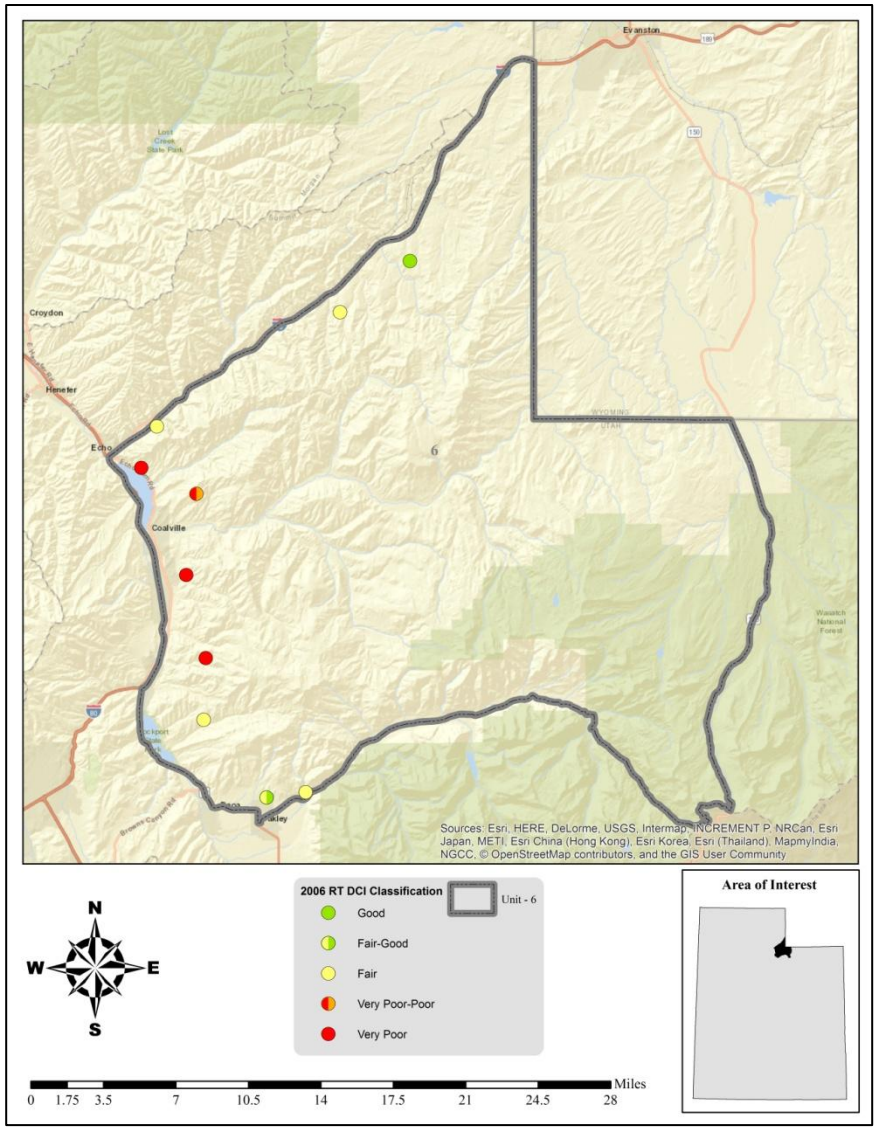
Table 6.10: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 6, Chalk Creek.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



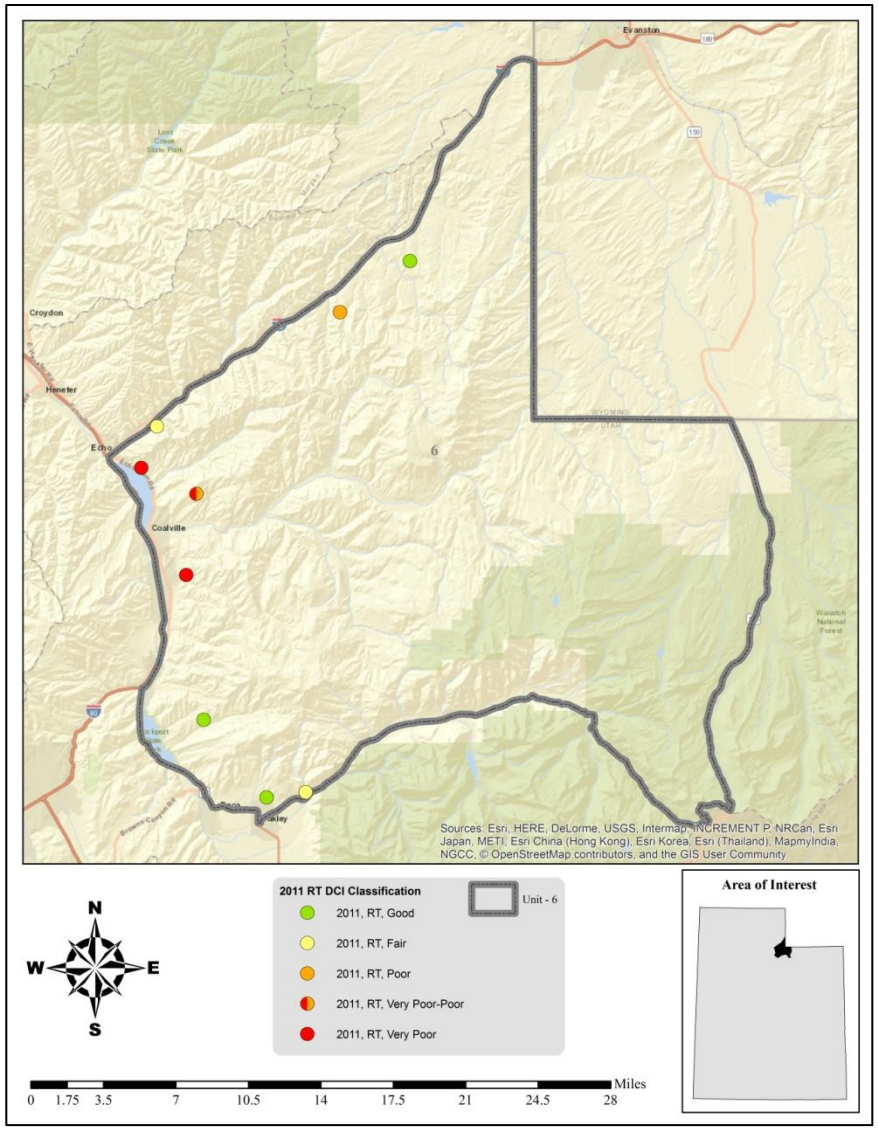
Map 6.8: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 6, Chalk Creek.



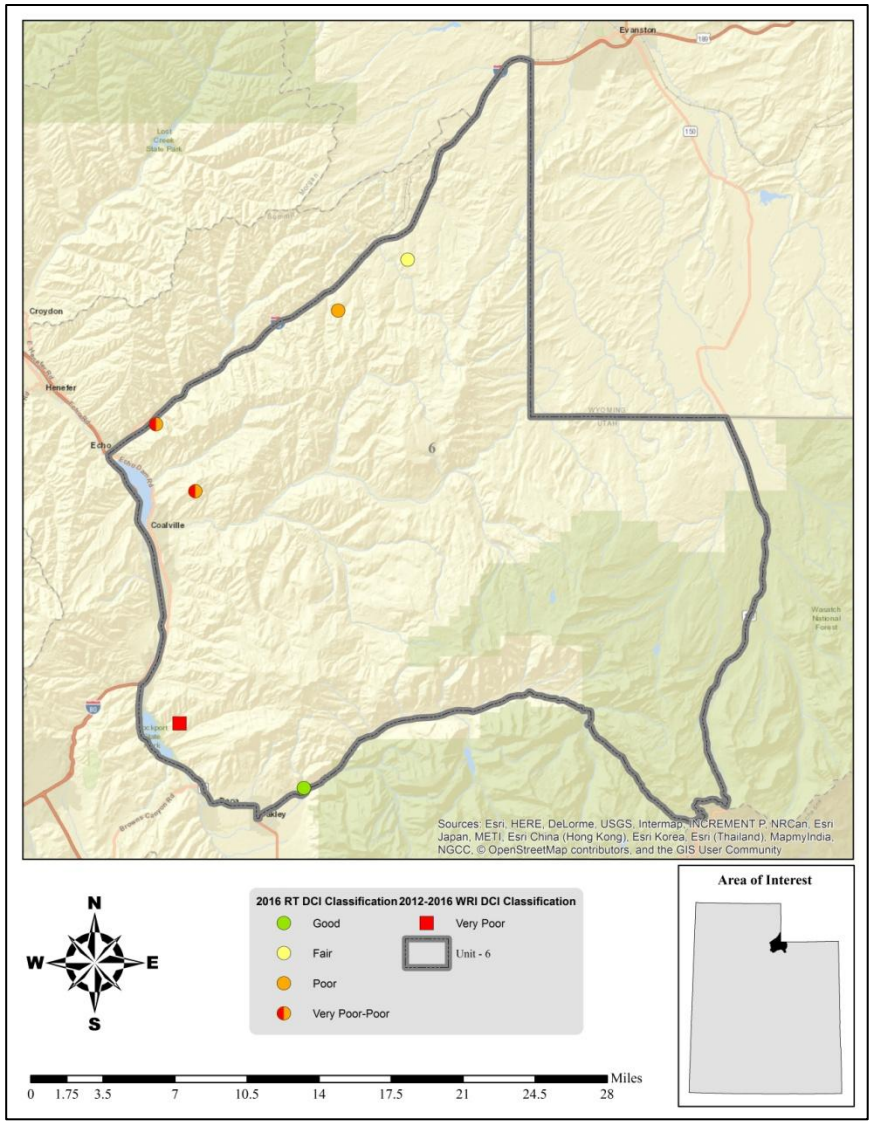
Map 6.9: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 6, Chalk Creek.



Map 6.10: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 6, Chalk Creek.



Map 6.11:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 6, Chalk Creek.



Map 6.12: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 6, Chalk Creek.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
06-1	Anshutz Ranch	Annual Grass	Low	Increased fire potential
06-2	Echo Canyon Rest Area	Annual Grass	High	Increased fire potential
06-3	Spring Hollow Burn	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
06-5	Spring Canyon	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
06-7	Crandall Canyon	Annual Grass	Low	Increased fire potential
		PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
06-9	North Oakley Bench	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
06-10	Mahogany Hills	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
06-12	Stag Canyon	Annual Grass	High	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
06R-1	Cache Cave 1	Annual Grass	Low	Increased fire potential
06R-2	Cache Cave 2	None Identified		
06R-5	Lower Crandall Canyon	PJ Encroachment	Low	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 6, Chalk Creek. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The high elevation study sites that are designated as being of the mountain (sagebrush) ecological site vary in condition. The Spring Hollow Burn study lacks a significant browse component and is classified as being in very poor-poor condition, while the Mahogany Hills study site hosts a community of sagebrush and other preferred browse species. While these studies have abundant herbaceous understories, they are dominated by introduced perennial grasses. Although they provide forage, introduced grass species are often aggressive at higher elevations and can reduce the abundance and diversity of other more desirable native grass and forb species.

It is recommended that monitoring of this community continue. 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. Treatment to reduce conifer may be necessary in the future.

Mountain (Oak)

This high elevation study site of this ecological type is in very poor-poor condition and supports a community of mixed browse species. Although the herbaceous understory is diverse and abundant, annual grasses (primarily cheatgrass) contribute a significant amount of cover. Increased cheatgrass cover can increase fuel loads and exacerbate the risk of wildfire.

Treatments such as herbicide application or seeding of native perennial grass species may be necessary to reduce the cover of cheatgrass on this study site.

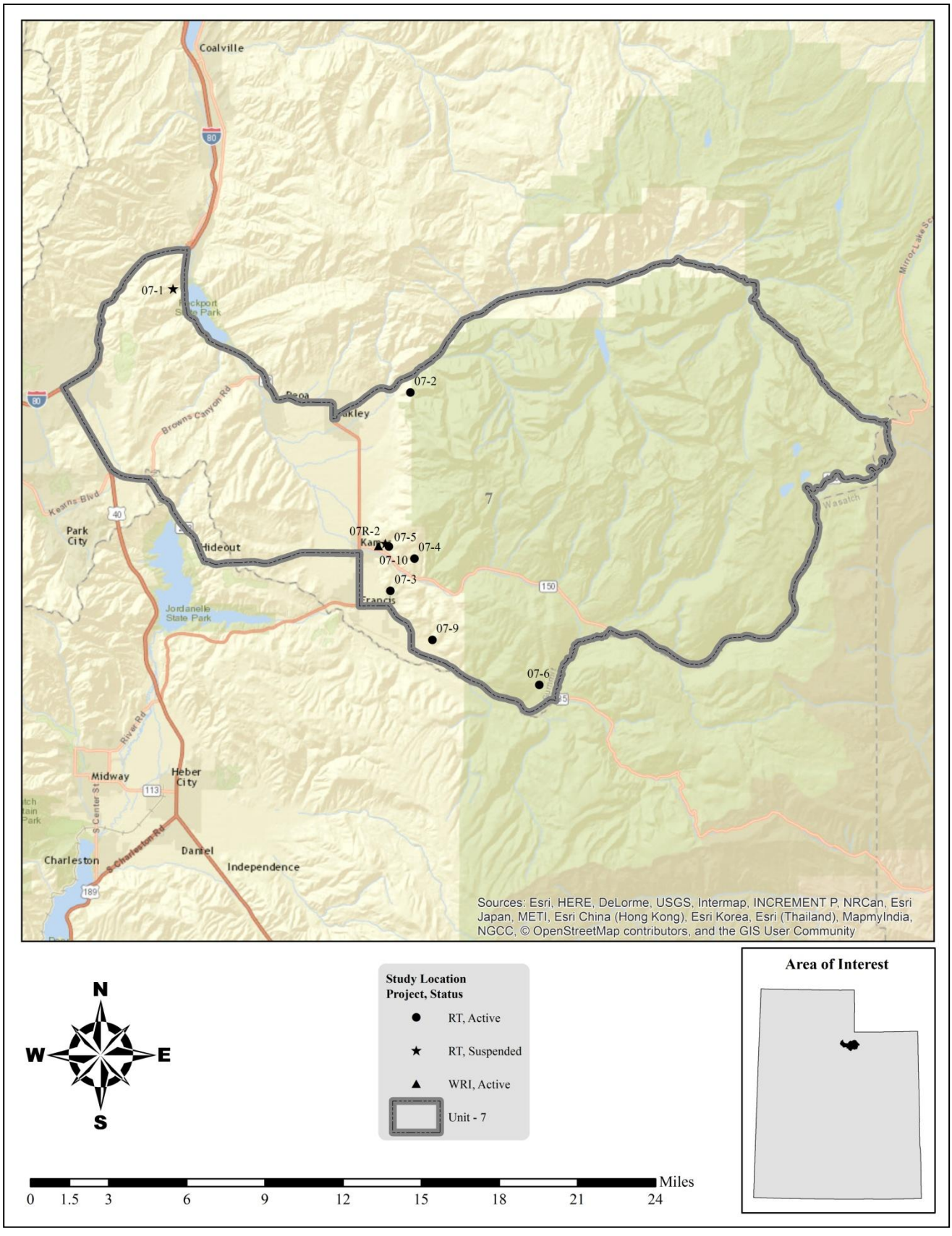
Upland (Sagebrush)

The mid elevation study sites of the Upland (Sagebrush) ecological type are considered to be in poor to fair condition for winter deer range habitat in the Chalk Creek management unit and are dominated by sagebrush populations that provide valuable browse. The annual grass species cheatgrass is present on these sites, increasing fuel loads and heightening the risk of wildfire. In addition, pinyon and juniper encroachment is a

concern on the Stag Canyon site as this encroachment has the potential to reduce understory shrub and herbaceous health.

It is recommended that monitoring of these study sites continue. Treatments to remove annual grasses may be needed. If/when necessary, work to reduce pinyon/juniper encroachment (e.g. bullhog, lop and scatter, chaining, etc.) should begin with care being taken to select methods that will not increase annual grass loads.

7. WILDLIFE MANAGEMENT UNIT 7 – KAMAS



WILDLIFE MANAGEMENT UNIT 7 – KAMAS

Boundary Description

Summit and Wasatch Counties – Boundary begins at the junction of I-80 and SR-32 (Wanship); south on SR-32 to the Weber Canyon Road at Oakley; east on this road to Holiday Park and the Weber River Trail; east on the Weber River Trail to SR-150 near Pass Lake; south on SR-150 to Soapstone Basin Road (USFS 037); south on this road to SR-35; west on SR-35 to Francis and SR-32; west on SR-32 to US-40 near Jordanelle; north on US-40 to I-80; north on I-80 to SR-32 and Wanship.

Management Unit Description

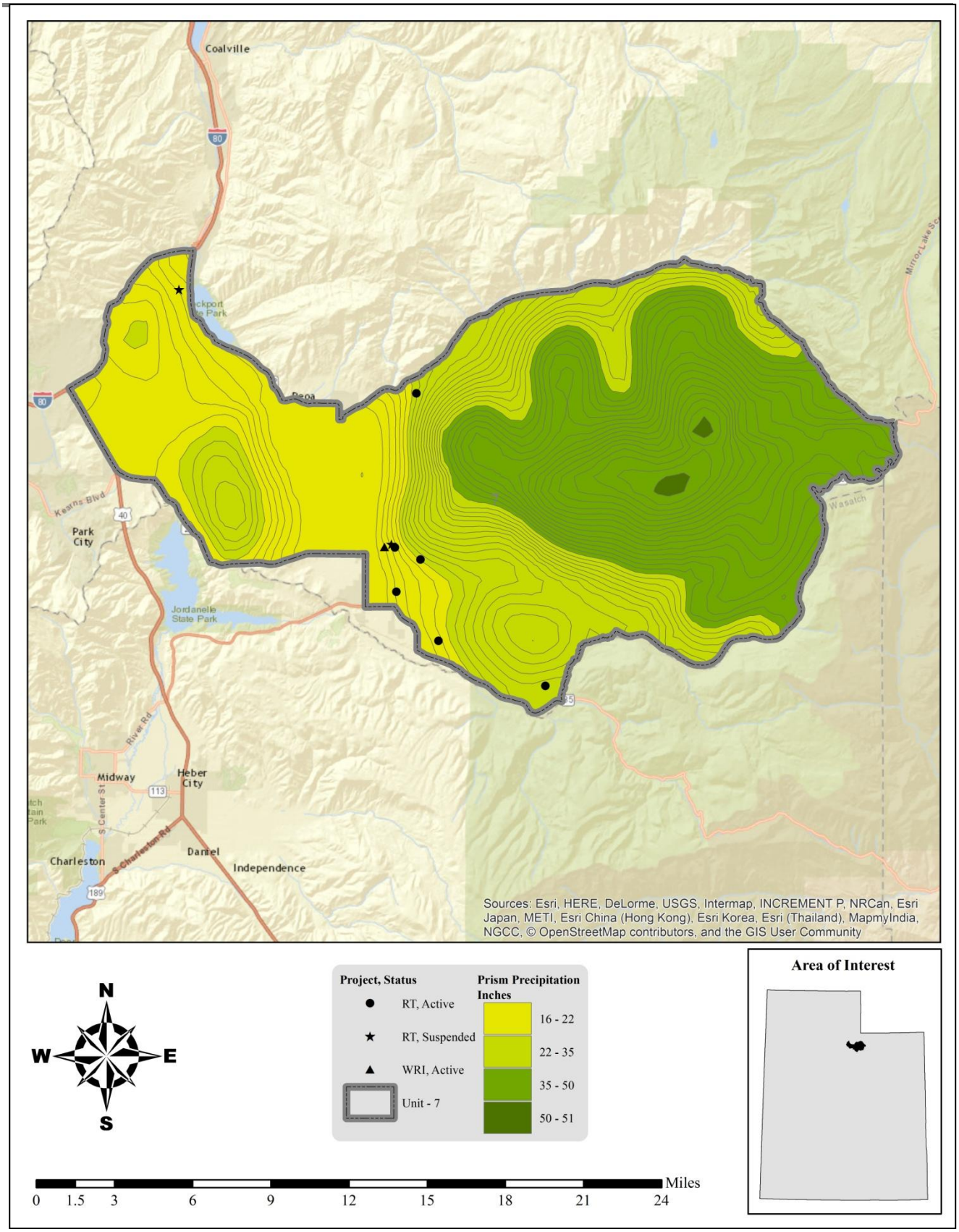
Geography

The Kamas management unit is located between the Uinta and Wasatch Mountains in the north-central part of the state. Boundary changes in 1985 reduced the total acreage and shifted a portion of the winter range north of the Weber River into the Chalk Creek management unit; there was another realignment of the herd unit boundaries again in 1996 and in 2004. The cities of Oakley, Kamas, and the town of Francis fall partially within the unit boundaries. The Uinta Mountains to the east contain the headwaters of the Weber and Provo Rivers, which flow west through the Rhodes and Heber Valleys.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 16 inches in the northernmost portion near Rockport State Park to 51 inches on the peaks of the Uintas. All of the Range Trend and WRI monitoring studies on the unit occur within 18-25 inches of precipitation (Map 7.1) (PRISM Climate Group, Oregon State University, 2013).

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, 2017).



Map 7.1: The 1981-2010 PRISM Precipitation Model for WMU 7, Kamas (PRISM Climate Group, Oregon State University, 2013).

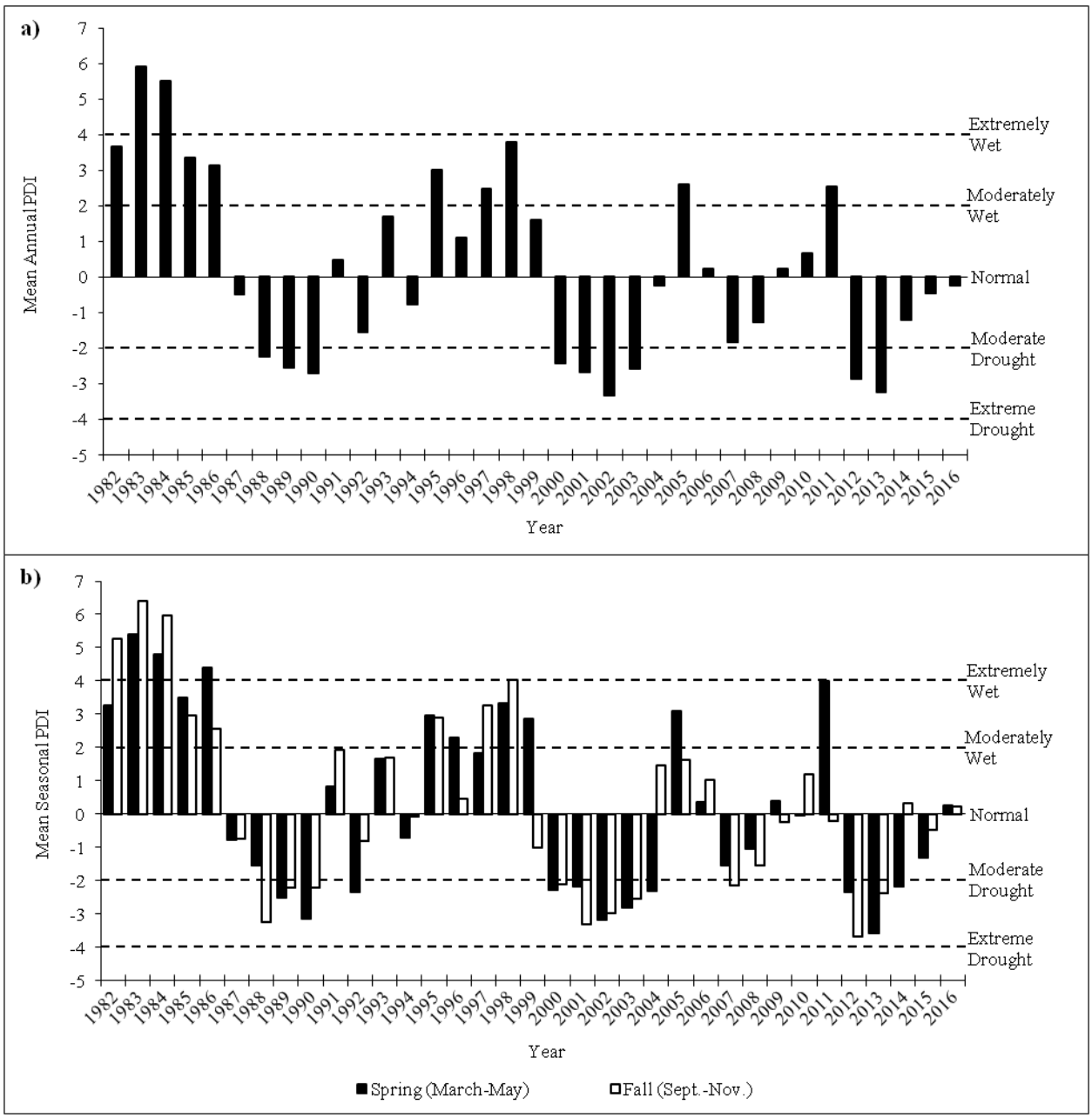


Figure7.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

Big Game Habitat

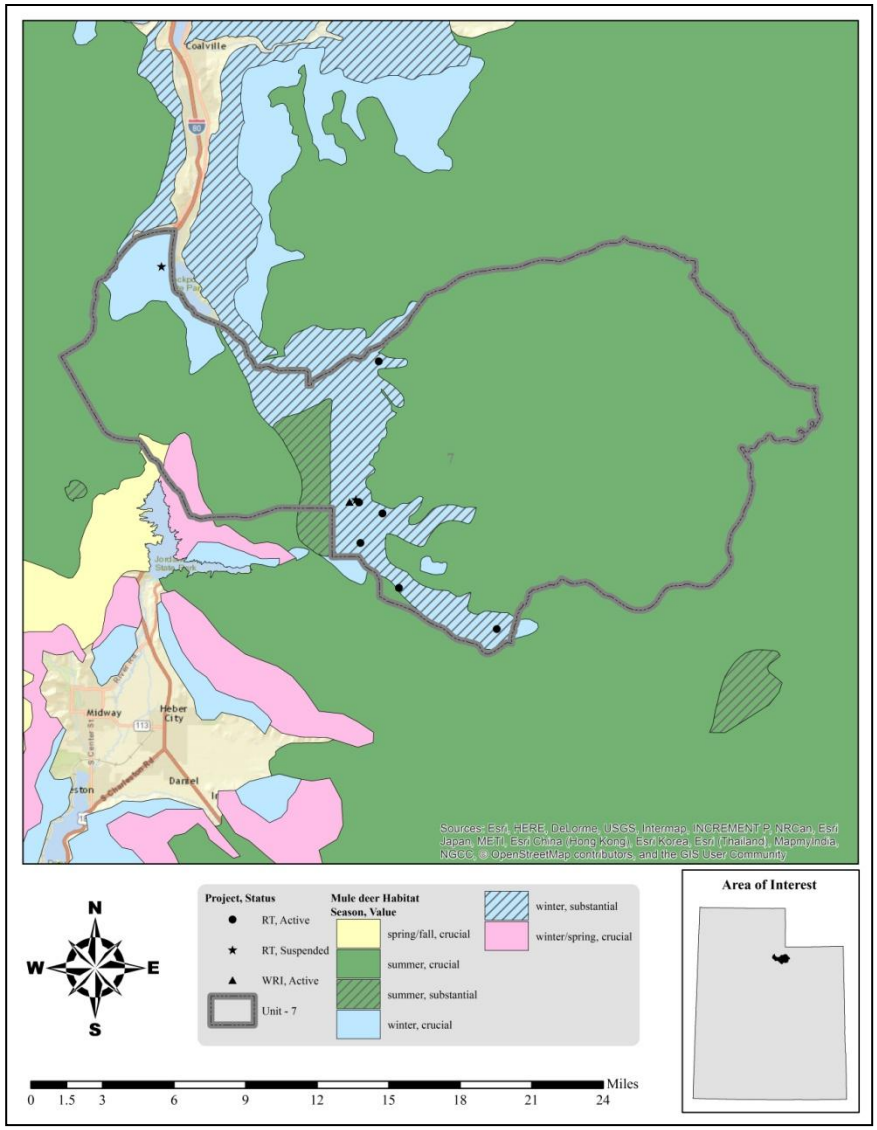
Total mule deer range in this wildlife management unit is estimated at over 199,000 acres with 165,422 acres classified as summer range, 31,197 acres classified as winter range, 2,363 acres classified as winter/spring range, and 552 acres classified as spring/fall range (Table 7.1, Map 7.2). Total elk range is estimated at just over 154,000 acres with 124,230 acres classified as summer range, 29,932 acres of this classified as winter range, and 422 acres classified as summer range, and 10,247 classified as winter/spring range (Table 7.1, Map 7.3).

76% of mule deer winter range is privately owned, 21% is administrated by the US Forest Service (USFS), 2% is owned by the Utah Division of Wildlife Resources (UDWR), and the remaining 1% is managed by the

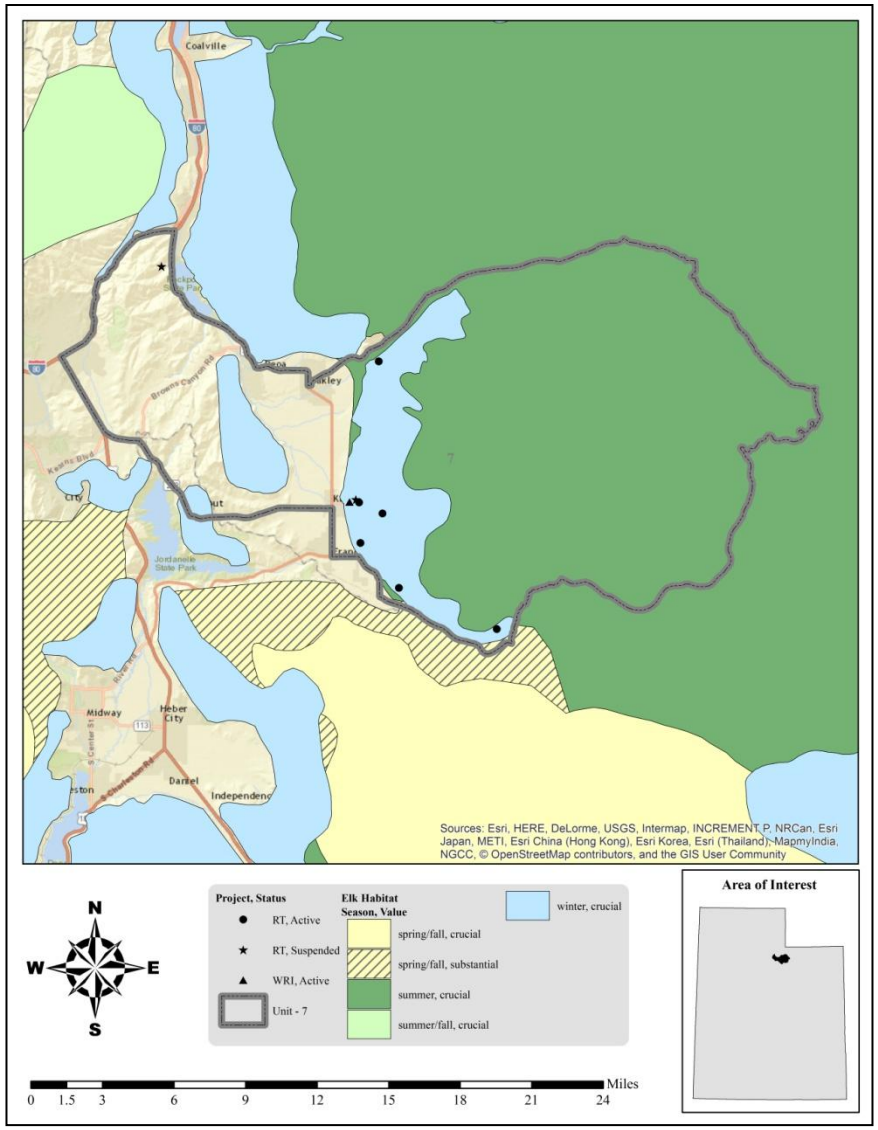
Bureau of Land Management (BLM), Utah School and Institutional Trust Lands Administration (SITLA), and Utah State Parks (USP). Much of the summer range (72%) is located on US Forest Service (USFS) land, 27% is privately owned, and 1% is managed by the BLM, SITLA, UDWR, and USP. All of the winter/spring range and spring/fall range is privately owned (Table 7.2, Map 7.2, Map 7.5).

Because of the varying topography, the deer winter range is separated into several distinct areas. The upper limits vary considerably, but lower limits generally follow the canyon bottoms, roads, and upper limits of cultivated lands. Wintering areas north of the Weber River (on the Kamas face, Beaver Creek, and the Provo River) have long been recognized as crucial to the deer herd on the western edge of the Uinta Mountains. However, there has been controversy regarding which deer use the Weber River winter range; data on migration patterns led to the boundary change which shifted this important winter range into the Chalk Creek Unit. An area south of Wanship that was surveyed as winter range in 1977 was not considered winter range on the 1984 herd unit map, but the area was sampled with study 7-1 in the past. For a complete description of all the winter range areas and vegetation types sampled, consult the 1977 Range Inventory (Giunta, 1979).

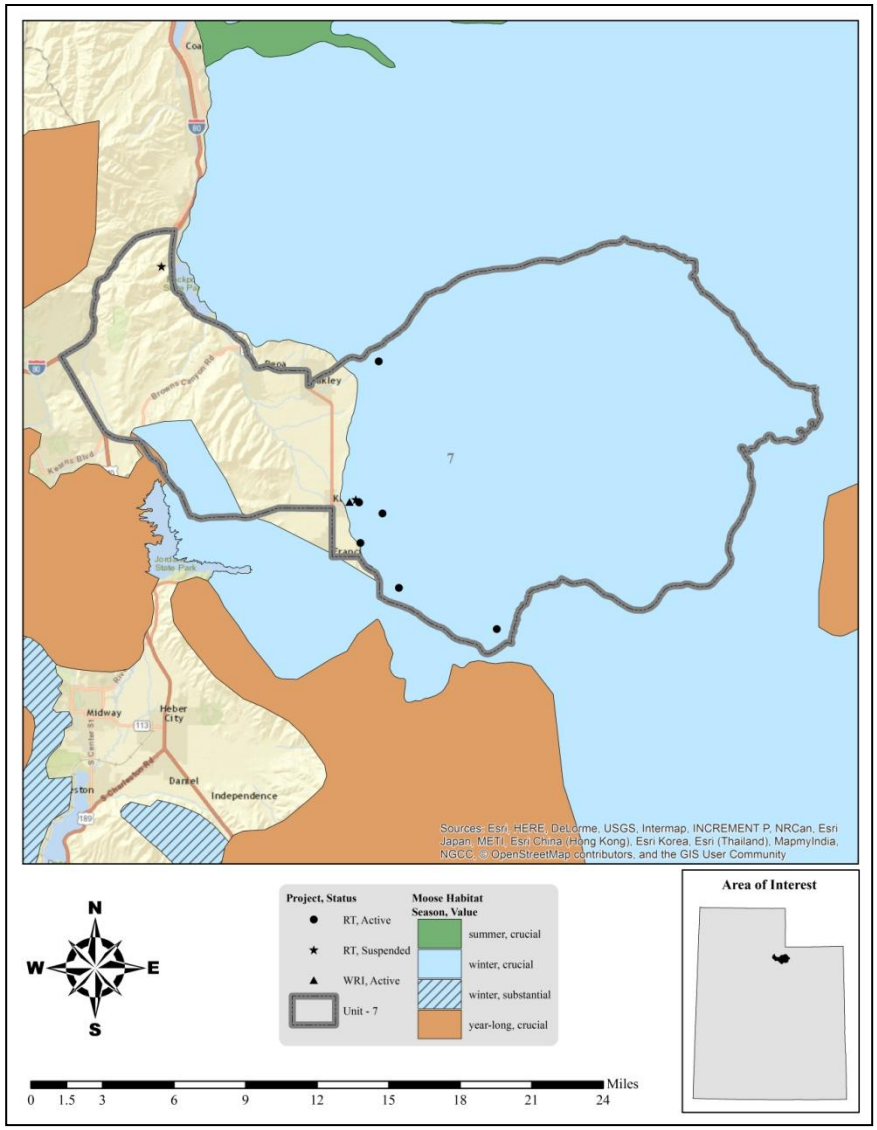
Fourteen different vegetation types were classified, but only nine of the more important types were sampled in the 1977 inventory. Of those, two emerge as the dominant and most valuable types. Together, the oakbrush and sagebrush-grass types occupied a majority of the normal winter range. The oakbrush type, dominated by Gambel oak (with big sagebrush, serviceberry, and snowberry as the subdominant associates) is often found at the more mesic, higher elevations; in 1977, the oakbrush range condition was generally considered satisfactory and exhibited light to moderate deer use. Sagebrush-grass, the second most abundant type, often occurs interspersed with the oak type and normally occupies the lower, especially crucial portions of the winter range. Much of the lower areas have been converted to cropland or are heavily grazed by livestock. Other important types include the rather depleted sagebrush type and a significant mountain brush stand on the south-facing slope of Pinyon Canyon.



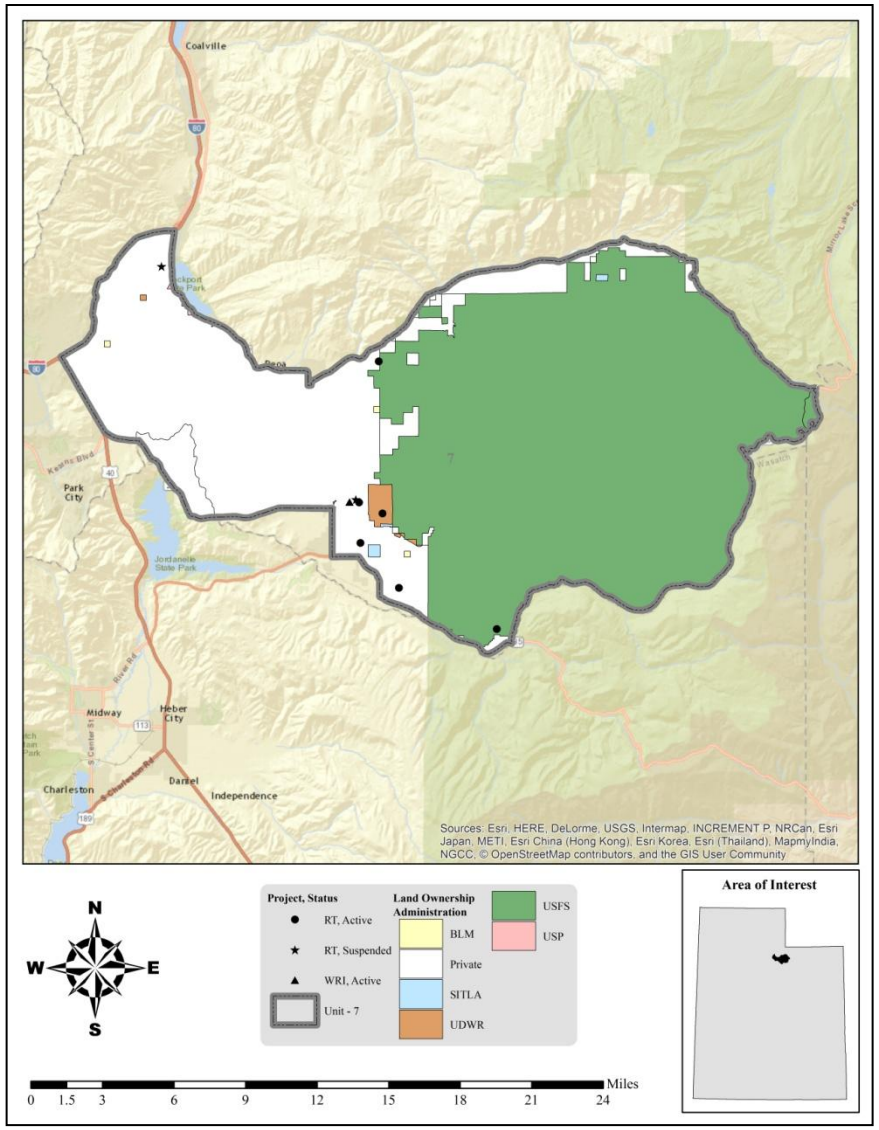
Map 7.2: Estimated mule deer habitat by season and value for WMU 7, Kamas.



Map 7.3: Estimated elk habitat by season and value for WMU 7, Kamas.



Map 7.4: Estimated moose habitat by season and value for WMU 7, Kamas.



Map 7.5: Land ownership for WMU 7, Kamas.

	Year Long Range		Summer Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	0	0%	165,422	83%	31,197	16%	2,363	1%	552	<1%
Elk	0	0%	124,230	80%	29,932	20%	0	0%	422	<1 %
Moose	363	<1%	0	0%	153,322	100%	0	0%	0	0%

Table 7.1: Estimated mule deer, elk, and moose habitat acreage by season for WMU 7, Kamas.

	Summer Range		Winter Range		Winter/Spring Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	81	<1%	41	<1%	0	0%	0	0%
Private	44,521	27%	23,559	76%	2,363	100%	552	100%
SITLA	81	<1%	199	<1%	0	0%	0	0%
UDWR	500	<1%	672	2%	0	0%	0	0%
USFS	120,237	72%	6,527	21%	0	0%	0	0%
USP	1	<1%	199	<1%	0	0%	0	0%
Total	165,422	**100%**	31,197	**100%**	2,363	**100%**	552	**100%**

Table 7.2: Estimated mule deer habitat acreage by season and land ownership for WMU 7, Kamas.

	Summer Range		Winter Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	<1	<1%	81	<1%	0	0%
Private	7,265	5%	18,686	62%	379	90%
SITLA	81	<1%	199	<1%	0	0%
USFS	116,883	94%	9,831	33%	43	10%
UDWR	<1	<1%	1,135	4%	0	0%
Total	124,230	**100%**	29,932	**100%**	422	**100%**

Table 7.3: Estimated elk habitat acreage by season and land ownership for WMU 7, Kamas.

	Year Long Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	81	<1%
Private	363	100%	25,066	16%
SITLA	0	0%	280	<1%
UDWR	0	0%	1,135	<1%
USFS	0	0%	126,760	83%
USP	0	0%	<1	<1%
Total	363	**100%**	153,322	**100%**

Table 7.4: Estimated moose habitat acreage by season and land ownership for WMU 7, Kamas.

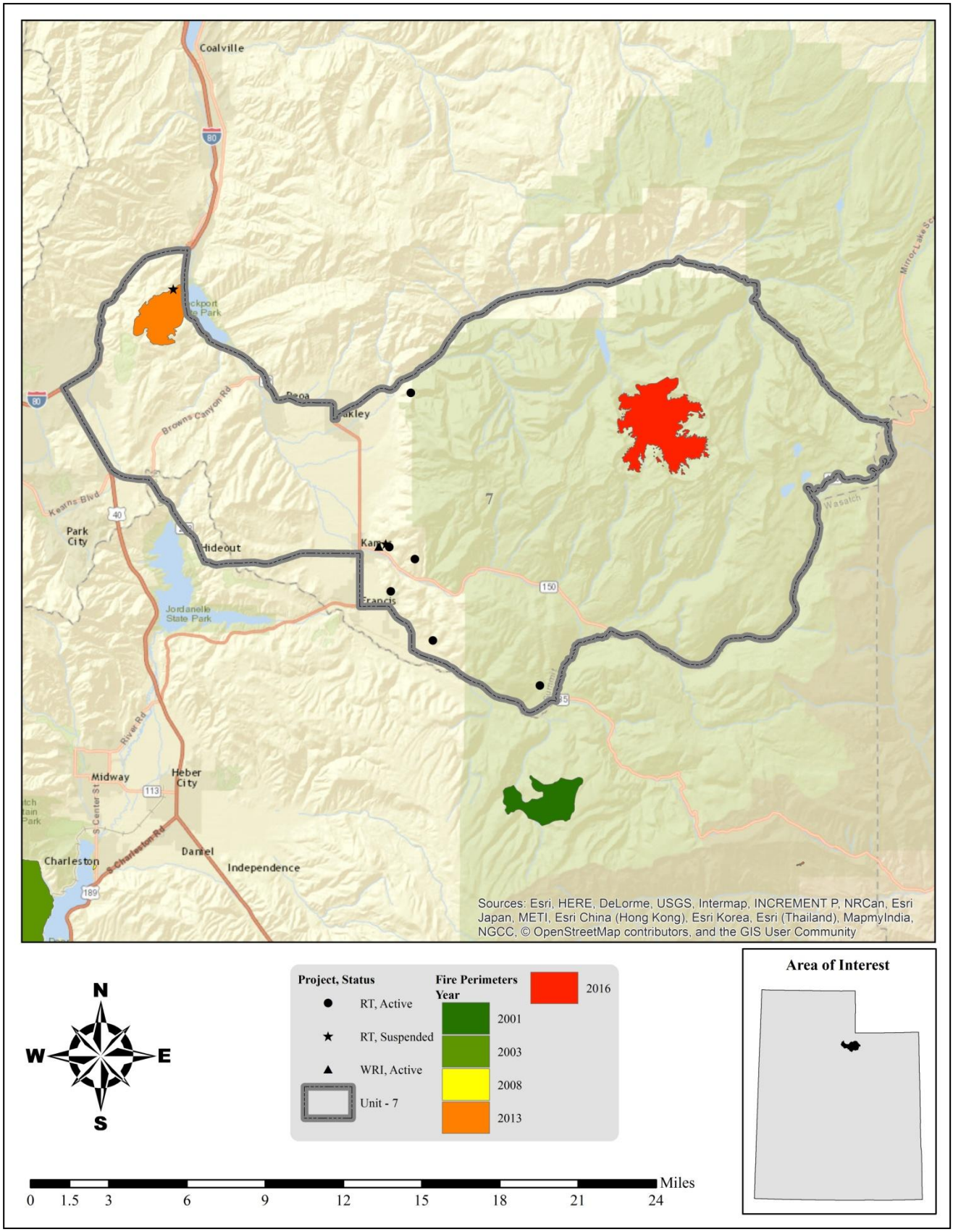
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	30,060	15.03%	
	Rocky Mountain Lodgepole Pine Forest	24,952	12.48%	
	Conifer-Hardwood	16,890	8.45%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	7,600	3.80%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	2,732	1.37%	
	Colorado Plateau Pinyon-Juniper Woodland	2,506	1.25%	
	Abies concolor Forest Alliance	1,702	0.85%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,108	0.55%	
	Other Conifer	47	0.02%	43.81%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	127	0.06%	0.06%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	3,003	1.50%	
	Southern Rocky Mountain Montane-Subalpine Grassland	600	0.30%	
	Other Grassland	113	0.06%	1.86%
Shrubland	Quercus gambelii Shrubland Alliance	15,679	7.84%	
	Inter-Mountain Basins Big Sagebrush Shrubland	9,635	4.82%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	6,640	3.32%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	6,203	3.10%	
	Inter-Mountain Basins Montane Sagebrush Steppe	2,593	1.30%	
	Rocky Mountain Lower Montane-Foothill Shrubland	1,821	0.91%	
	Other Shrubland	141	0.07%	21.36%
Other	Hardwood	37,974	18.99%	
	Agricultural	8,595	4.30%	
	Developed	7,446	3.72%	
	Barren	5,555	2.78%	
	Sparsely Vegetated	2,739	1.37%	
	Riparian	2,297	1.15%	
	Open Water	1,154	0.58%	
	Other	40	0.02%	32.91%
Total		199,952	100.00%	100%

Table 7.5: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 7, Kamas.

Limiting Factors to Big Game Habitat

The obvious limiting factor for big game in this management unit is the lack of adequate amounts of good quality winter range. The available range is reduced even further with severe winters; an example of this problem can be illustrated by the large winter deer losses which occurred during the winter of 1992-93. Furthermore, much of the lower winter range areas have been converted to cropland or are heavily grazed by livestock.

Other limiting factors to big game include introduced exotic herbaceous species, such as cheatgrass (*Bromus tectorum*). Increased amounts of cheatgrass increases the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 7.6: Land coverage of fires by year from 2000-2016 for WMU 7, Kamas.

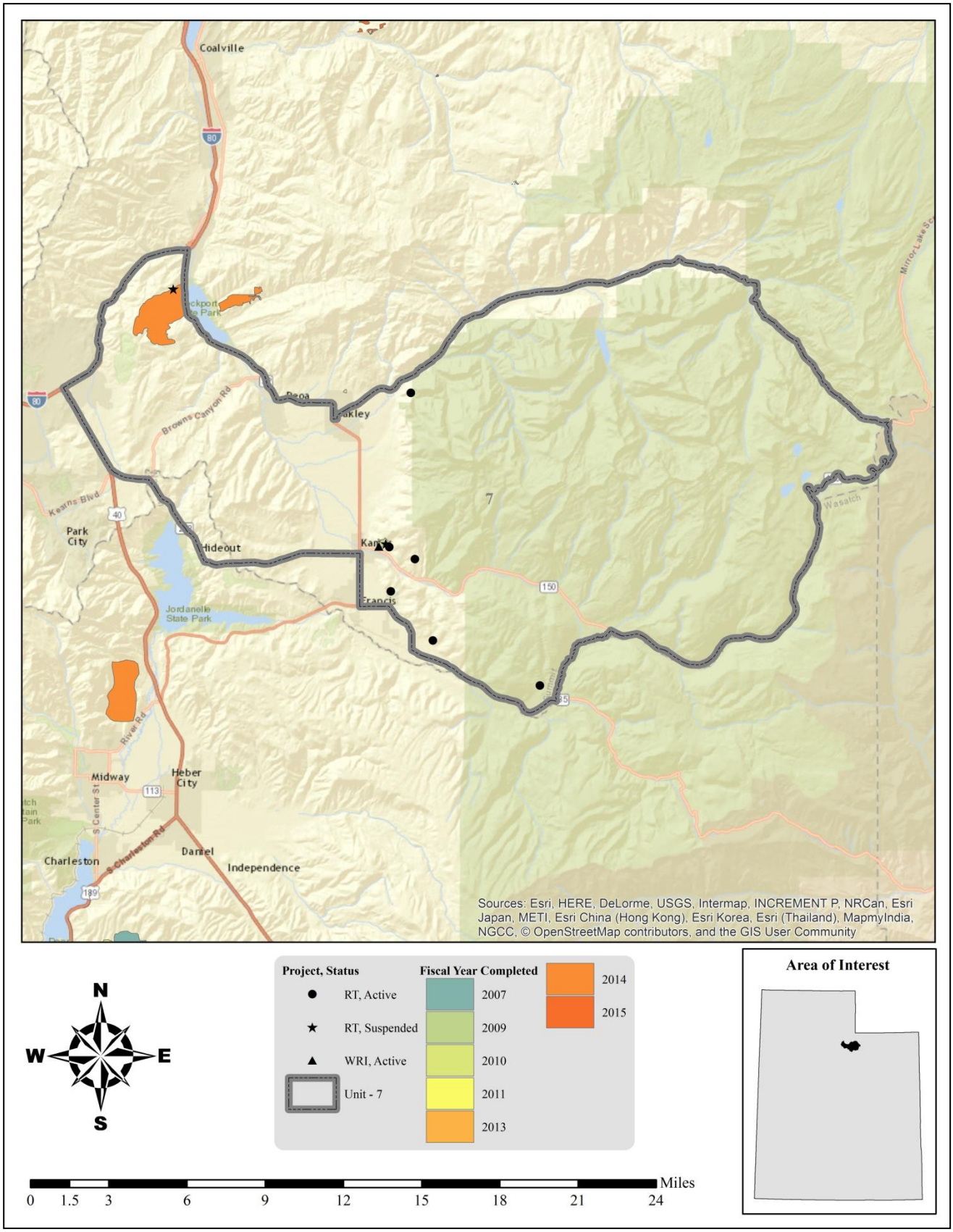
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 1,842 acres of land have been treated within the Kamas unit since the WRI was implemented in 2004 (Map 7.7); 625 acres are currently undergoing a treatment project, and projects are proposed for 82 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 1,842 acres for this unit (Table 7.6). 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.

Seeding to supplement the herbaceous understory is the most common management practice in this unit. Other management practices for completed, current, and proposed projects include bullhog use to remove twoneedle pinyon and Utah juniper, herbicide application to remove weeds, and vegetation removal by hand crews (Table 7.6).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Bullhog	**0**	**625**	**0**	**625**
Herbicide Application	**55**	**0**	**0**	**55**
Aerial	55	0	0	55
Seeding (Primary)	**1,787**	**0**	**0**	**1,787**
Broadcast (Aerial)	1,787	0	0	1,787
Vegetation Removal/Hand Crew	**0**	**0**	**82**	**82**
Lop-Pile-Burn	0	0	82	82
Total Treatment Acres	**1,842**	**625**	**82**	**2,549**
***Total Land Area Treated**	**1,842**	**625**	**82**	**2,549**

Table 7.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 7, Kamas. Data accessed on 02/09/2017. *Does not include overlapping treatments.



Map 7.7: WRI treatments by fiscal year completed for WMU 7, Kamas.

Range Trend Studies

Range Trend studies have been sampled within WMU 7 on a regular basis since 1984, with studies being added or suspended as was deemed necessary (Table 7.7). 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 7.8).

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	Year(s) Sampled	Ecological Site Description
07-1	Stevens Hollow	RT	Suspended	'84, '90, '96	Not Verified
07-2	Pinyon Canyon	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Browse)
07-3	Foothill Drive	RT	Active	'84, '90, '96, '01, '06, '11, '16	Upland Stony Loam (Mountain Big Sagebrush)
07-4	Above Samak	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Stony Loam (Gambel Oak)
07-5	Kamas Water Tanks	RT	Suspended	'84, '90, '96	Not Verified
07-6	Cedar Hollow	RT	Active	'84, '90, '96, '01, '06, '11, '16	Mountain Loam (Shrub)
07-7	Provo River Canyon	RT	Active	'84, '90, '96, '01, '07, '12	Not Verified
07-8	Hailstone	RT	Suspended	'84, '90, '96, '01	Not Verified
07-9	Above Woodland	RT	Active	'01, '06, '11, '16	Mountain Stony Loam (Browse)
07-10	Elder Hollow	RT	Active	'96, '01, '06, '11, '16	Mountain Loam (Shrub)
07R-1	West Hills WMA	RT	Suspended	'99	Not Verified
07R-2	Kamas SFH	WRI	Active	'06, '11	Not Verified

Table 7.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 7, Kamas.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
07-4	Above Samak	Wildfire		Early 1960s		
		Seed Unknown		Early 1960s		
07R-2	Kamas SFH	Herbicide	Kamas SFH Spray	September 2008	55	1195
		Aerial Unknown	Kamas SFH Spray	February 2009	55	1195

Table 7.8: Range trend and WRI studies known disturbance history for WMU 7, Kamas.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

There are two studies [Elder Hollow (07-10), Cedar Hollow (07-6)] that are classified as Mountain (Sagebrush) ecological sites. Cedar Hollow is located 5 miles east of Woodland above the Provo River. The Elder Hollow Study is located a half mile east of Kamas off of Highway 150.

Shrubs/Trees: The shrub component of these sites is composed of a mix of species, with the primary browse species being mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Other species are present in lesser amounts and include the preferred browse species Saskatoon serviceberry (*Amelanchier alnifolia*) and Antelope bitterbrush (*Purshia tridentata*); the Cedar Hollow site includes a significant component of Gambel Oak (*Quercus gambelii*) (Figure 7.2). Average sagebrush density has decreased overall, with mature plants as the primary age class in all sample years. Density of decadent individuals and recruitment of young have fluctuated, but have decreased overall (Figure 7.4). Average utilization of sagebrush has also decreased, with less than half of the populations showing signs of moderate to heavy use in 2001, 2006, 2011, and 2016 (Figure 7.5).

There is some conifer encroachment occurring on both these sites. Cover provided by trees is currently nominal, but there is potential for encroachment in the future.

Herbaceous Understory: These sites support a small but diverse understory of perennial grasses and forbs. Both sites contain the undesirable species cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*), with cover percentages averaging near 3 percent for each species. Cover of perennial forbs and grasses has remained steady throughout the study years (Figure 7.6). The nested frequency of perennial grasses has remained fairly constant, while that of perennial forbs has exhibited a marginal increase (Figure 7.7).

Occupancy: Average pellet transect data indicates that occupancy of the site has decreased through the sample years. Deer are the primary occupants, although cattle and elk pellet groups have been recorded in low quantities. Moose pellets were noted on Cedar Hollow with 1 day use/acre in 2001 and 0.5 days use/acre in 2016. Deer pellets had a mean abundance with a high of 68.3 days use/acre in 2006 and a low of 32.2 days use/acre in 2011; usage has remained comparatively low with 36.2 days use/acre estimated in 2016 (Figure 7.8).

Mountain (Shrub)

There are two studies [Pinyon Canyon (07-2) and Above Woodland (07-9)] that are classified as Mountain (Shrub) ecological sites. Pinyon Canyon is located a mile northeast of Oakley. The Above Woodland study is located in the hills directly north of Woodland on State Road 35.

Shrubs/Trees: The shrub overstory on this site includes mixed browse; cover is co-dominated by preferred browse species such as Saskatoon serviceberry (*Amelanchier alnifolia*), alderleaf mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is also a co-dominant species on both sites. The overall trend for browse has remained stable. Sagebrush cover has increased through time on the Pinyon Canyon site, but has decreased on the Above Woodland site. Despite the decreases, the density of decadent plants has decreased and that of young plants has increased on both sites (Figure 7.2, Figure 7.4). In addition, average sagebrush utilization data indicates that more than half of plants have showed signs of little to no use in all sample years (Figure 7.5).

Herbaceous Understory: The understories of these studies are composed of several perennial forbs and grasses. Cover of annual grasses and introduced annual forbs has either remained steady or increased. The cover of perennial grasses has generally decreased on both sites. Pinyon Canyon maintains dominated by a strong community of bluebunch wheatgrass (*Pseudoroegneria spicata*) with a lesser amount of cover contributed by annual bromes (*Bromus* sp.); Above Woodland is dominated by annual bromes (Figure 7.6).

Occupancy: These sites are primarily occupied by of elk according to average pellet transect data. Usage by deer has remained relatively low (but steady), varying between 6 days use/acre in 2006 and 12 days use/acre in 2011. Elk usage has fluctuated significantly over the years, ranging from 15 days use/acre in 2001 to 82 days use/acre in 2006. 2016 usage was comparatively moderate at 35 days use/acre (Figure 7.8).

Mountain (Oak)

There is one study [Above Samak (07-4)] that is classified as Mountain (Oak). The Above Samak study is located 2 miles east of Kamas in the Kamas WMA.

Shrubs/Trees: The shrub component of the Above Samak site is composed of a mix of preferred browse species including Saskatoon serviceberry (*Amelanchier alnifolia*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). There is also a significant mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) component available on this site. Average cover of sagebrush has decreased from 8.6 percent in 2011 to 5.2 percent in 2016. Gambel oak has increased from 6.9 percent in 2006 to 10.2 percent cover in 2016.

The overall cover of preferred browse has increased or remained steady through the study (Figure 7.2). Average sagebrush density has generally decreased, and most plants were considered to be mature in all sample years. Both decadence and recruitment of young have exhibited marginal increases over time (Figure 7.4). Although more than half of plants were moderately or heavily browsed in 1996 and 2001, but the majority has shown signs of little to no use in 2006, 2011, and 2016 (Figure 7.5).

Herbaceous Understory: The herbaceous understory of this site has generally increased over the study years. In 2011, bulbous bluegrass (*Poa bulbosa*) was recorded in significant amounts on the site for the first time; cover has remained around 2 percent in both 2011 and 2016. There is a diverse mix of perennial forbs on the site that has varied in cover from a low of 5.5 percent in 1996 to a high of 12.9 percent in 2011. Annual forbs have been present in amounts between 0.7 in 1996 to 4.6 percent in 2011.The herbaceous understory is dominated by the introduced perennial grasses crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), and intermediate wheatgrass (*Thinopyrum intermedium*). The native grasses muttongrass (*P. fendleriana*), bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) provide lesser amounts of cover (Figure 7.6). Overall frequency has increased over time (Figure 7.7).

Occupancy: Average pellet group transect data shows that the site is primarily used by deer and that cattle use fluctuates by year. Elk pellet groups were sampled from 2001 to 2011 but were not sampled in 2016. Mule deer have had a mean abundance of pellet as low as 20 days of use/acre in 2011 and as high as 46 days of use/acre in 2016. Cattle usage has varied, ranging from 6 days use/acre in 2011 to 31 days use/acre in 2016. Finally, the mean abundance of elk pellet groups has ranged from 0 days use/acre in 2016 to 23 days use/acre in 2001 (Figure 7.8).

Upland (Sagebrush)

There is one study [Foothill Drive (07-3)] that is classified as an Upland (Sagebrush) ecological site. The Foothill Drive site is located 2.25 miles south of Kamas near Foothill Drive.

Shrubs/Trees: The browse component on this study site is primarily composed of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Other preferred browse species are present, namely Saskatoon serviceberry (*Amelanchier alnifolia*) and Woods' rose (*Rosa woodsii*). Cover of sagebrush has remained relatively stable as has the cover of preferred browse. Cover of other shrubs has slightly increased through the sample years (Figure 7.2). Sagebrush recruitment has decreased slightly over time. Cover of other shrubs has slightly increased through the sample years (Figure 7.4). According to average sagebrush utilization data, more than half of plants have been moderately to heavily used in the three most recent sample years (Figure 7.5).

Herbaceous Understory: The herbaceous understory for graminoids is primarily composed of annuals, namely cheatgrass (*Bromus tectorum*) and field brome (*B. arvensis*). Native species include squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*), and bluebunch wheatgrass (*Pseudoroegneria spicata*); these native species are present in small amounts on the site. Nested frequency of annual grasses has shown a marginal increase, while that of perennial grasses has decreased. Perennial forb cover for the site has varied, with cover amounts ranging from 3.1 to 9.2 percent. Annual forb cover has ranged from 4.9 to 10.1 percent over time (Figure 7.6, Figure 7.7).

Occupancy: The average pellet transect data shows that deer are the primary occupants on this site. Additionally, the usage of the site by deer has decreased through the course of the study. There is a small amount of usage by domestic animals, as cattle had 3 days use/acre and horse pellet groups showed 2 days use/acre in 2016. The mean abundance of deer pellet groups has been as high as 68.3 days use/acre in 2006 and as low as 36.2 days use/acre in 2016 (Figure 7.8).

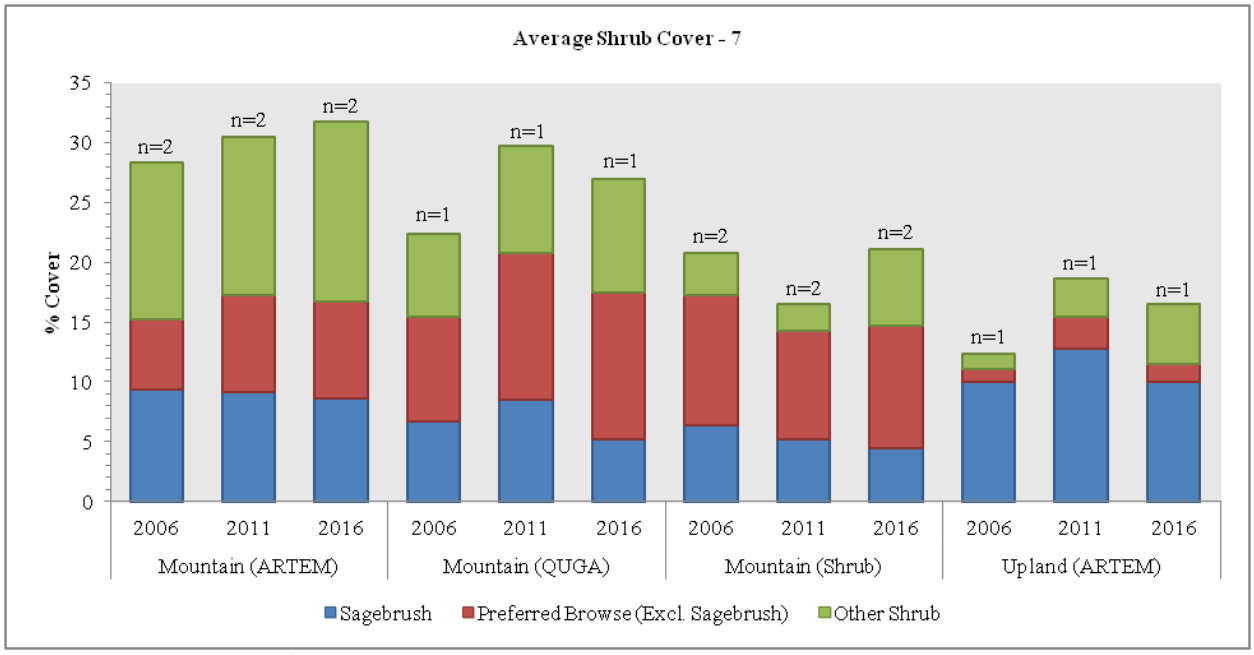


Figure 7.2: Average shrub cover for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

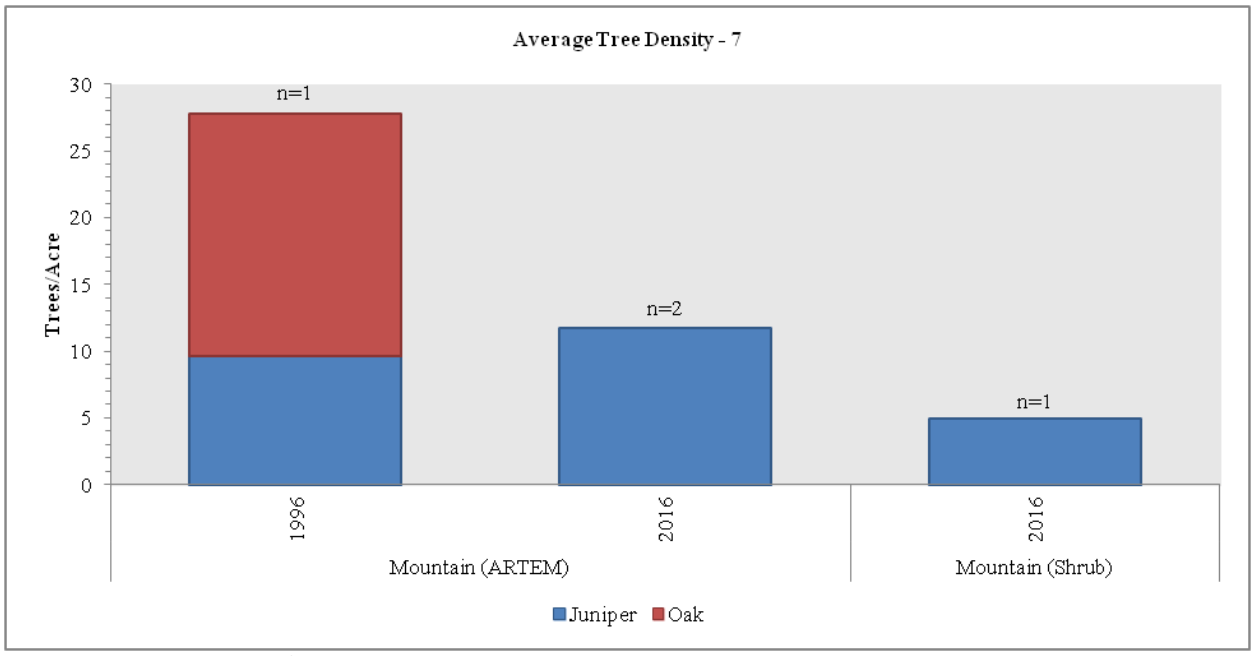


Figure 7.3: Average tree density for Mountain (ARTEM) and Mountain (Shrub) study sites in WMU 7, Kamas.

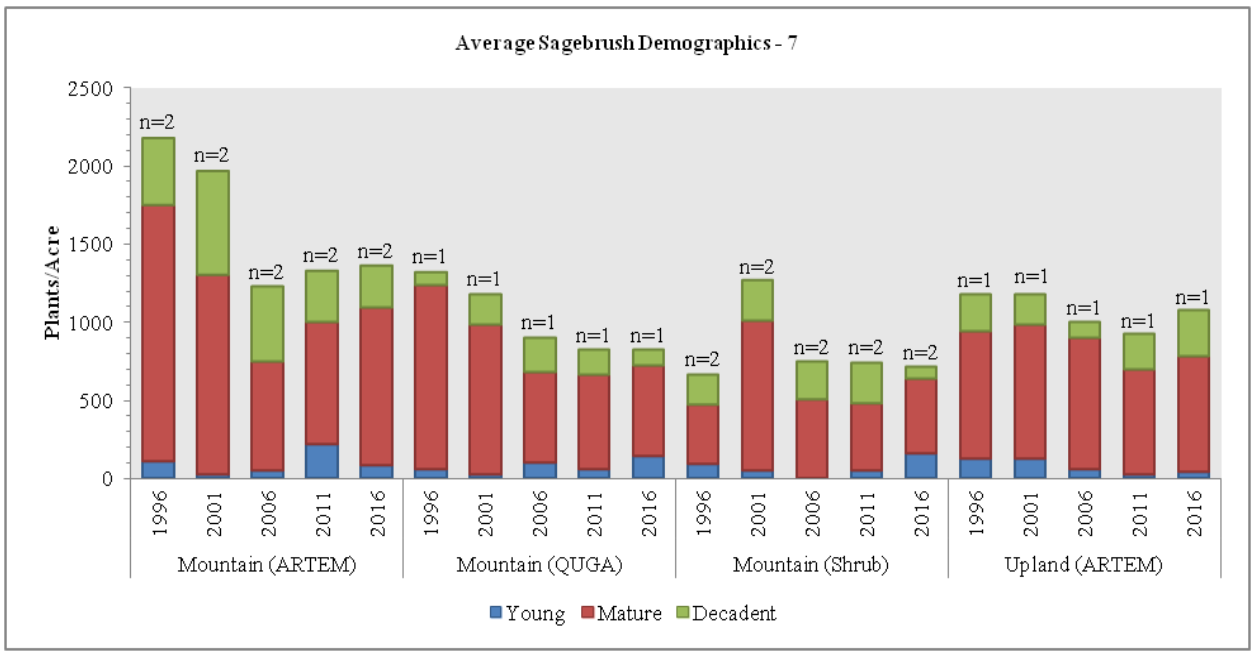


Figure 7.4: Average sagebrush demographics for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

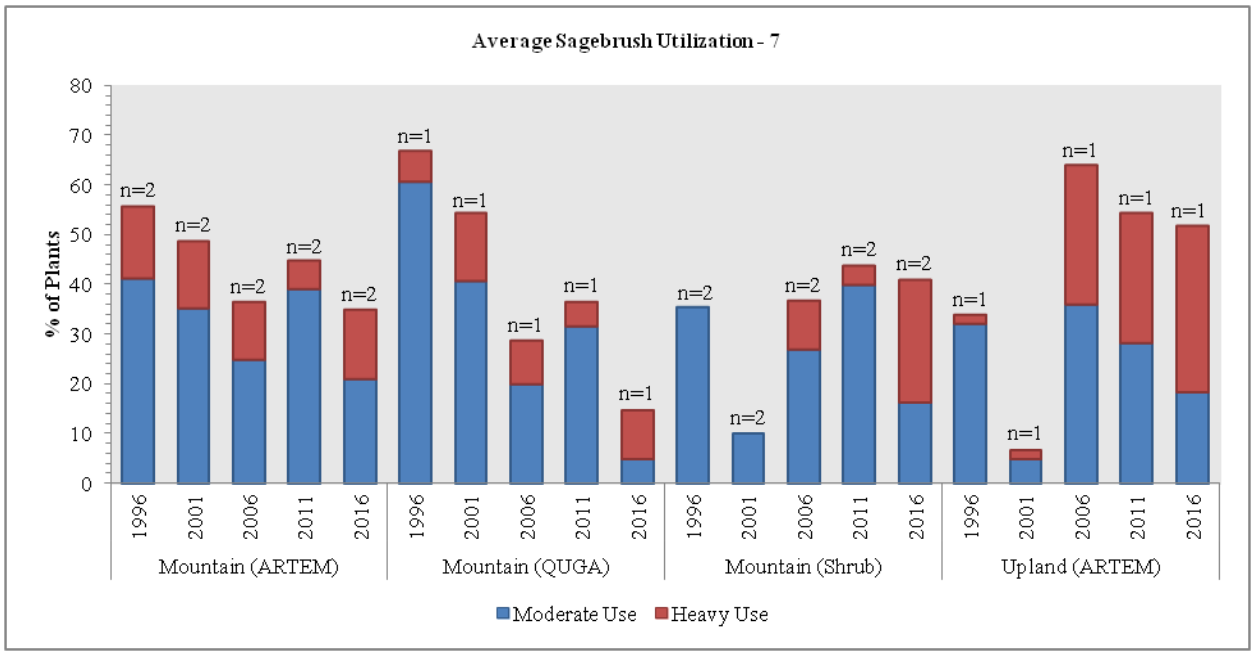


Figure 7.5: Average sagebrush utilization for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

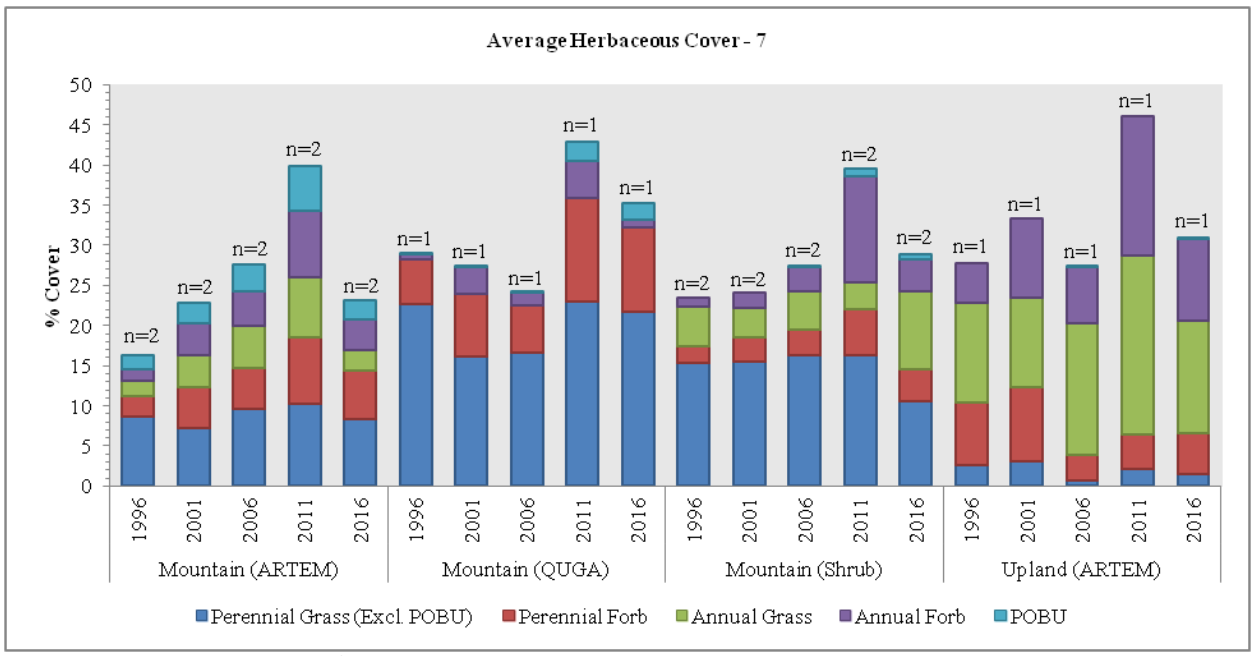


Figure 7.6: Average herbaceous cover for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

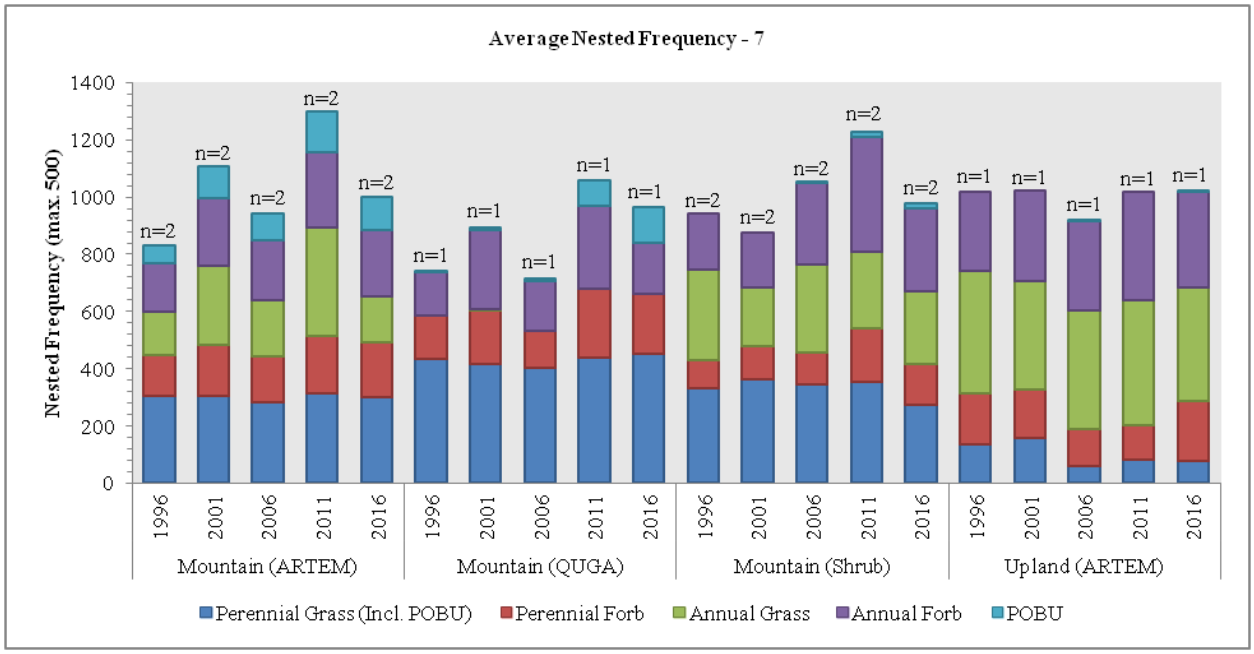


Figure 7.7: Average nested frequency of herbaceous species for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

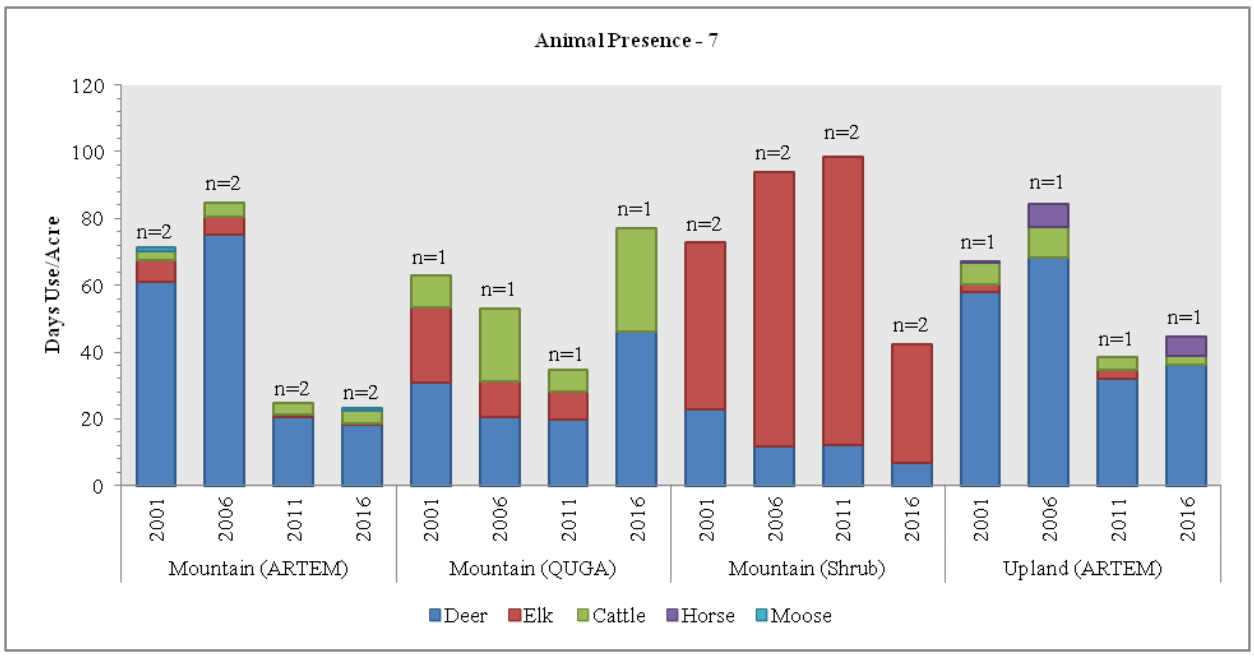
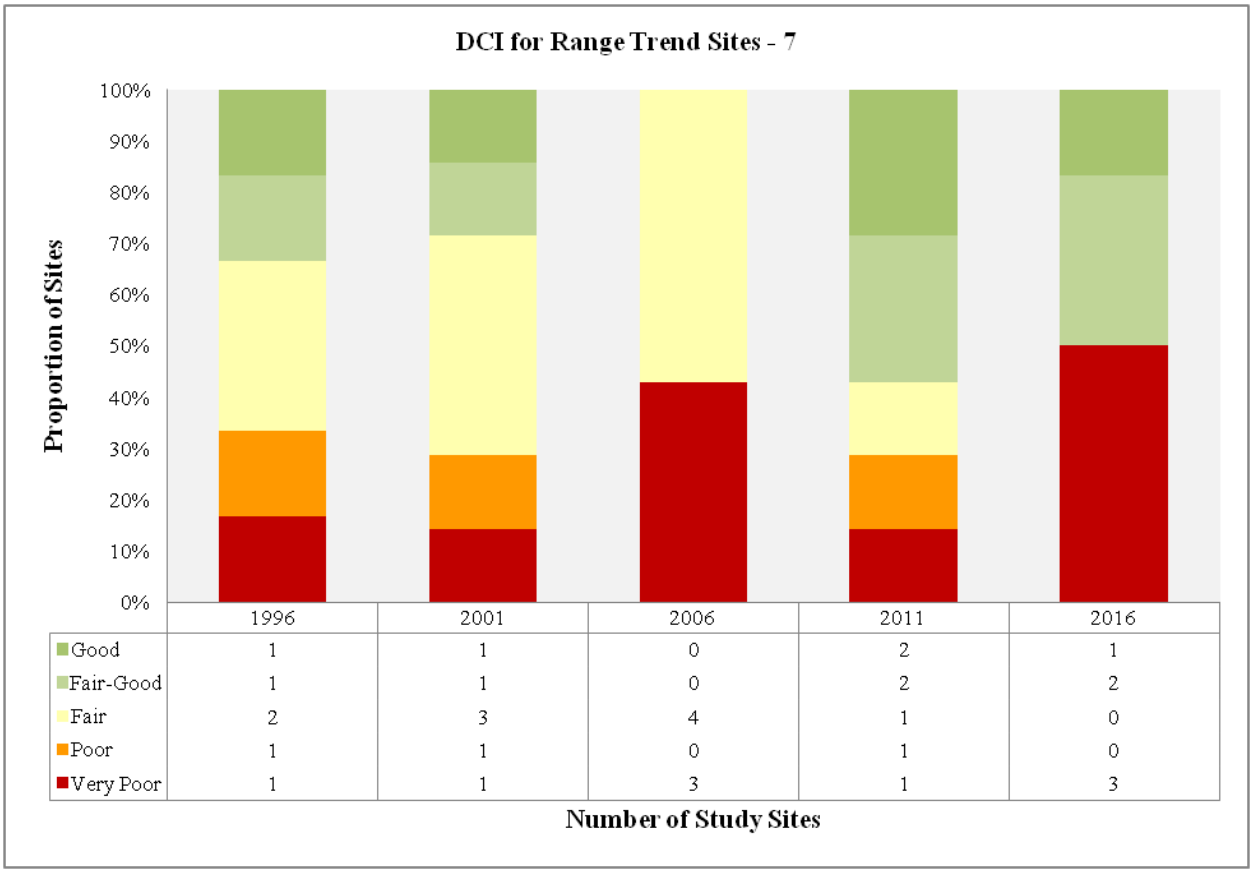


Figure 7.8: Average pellet transect data for Mountain (ARTEM), Mountain (QUGA), Mountain (Shrub), and Upland (ARTEM) study sites in WMU 7, Kamas.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Kamas management unit has changed on sites sampled since 1996. The Range Trend sites that were sampled vary in condition from very poor to good as of the 2016 sample year. No sites were in poor or fair condition. (Figure 7.9, Table 7.9, Map 7.12). Pinyon Canyon improved from fair-good to good condition, while Above Samak and Cedar Hollow deteriorated from good to fair-good condition. Above Woodland went from fair to very poor condition and Elder Hollow went from poor to very poor condition, generally due to increases in annual grasses and noxious weeds as well as reductions in preferred browse cover. Foothill Drive remained very poor due to annual grasses and low preferred browse cover. The only disturbed site in this unit is the Above Samak study, which is also considered to be a Range Trend site and is therefore discussed above (Figure 7.10, Map 7.12).



	1996	2001	2006	2011	2016
Good	1	1	0	2	1
Fair-Good	1	1	0	2	2
Fair	2	3	4	1	0
Poor	1	1	0	1	0
Very Poor	1	1	3	1	3

Figure 7.9: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 7, Kamas.

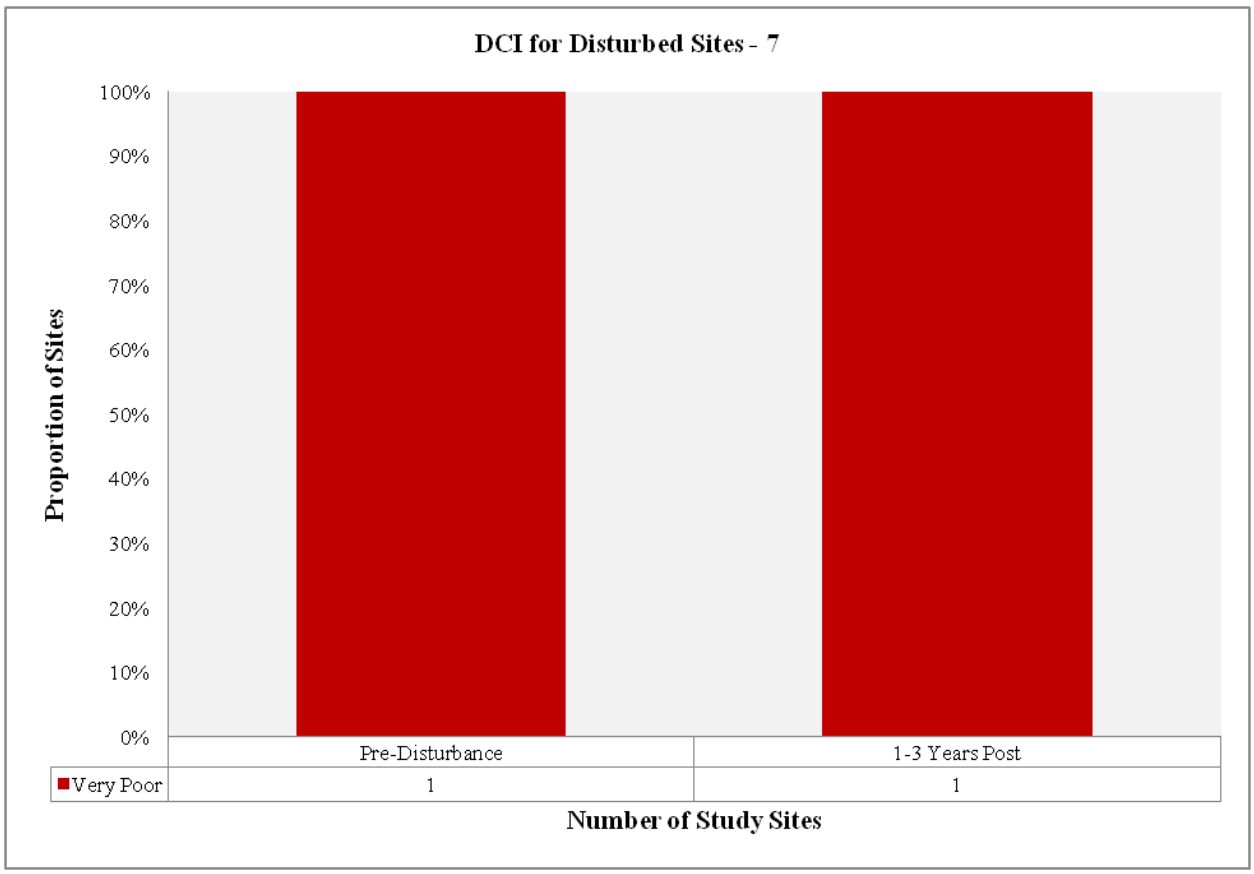
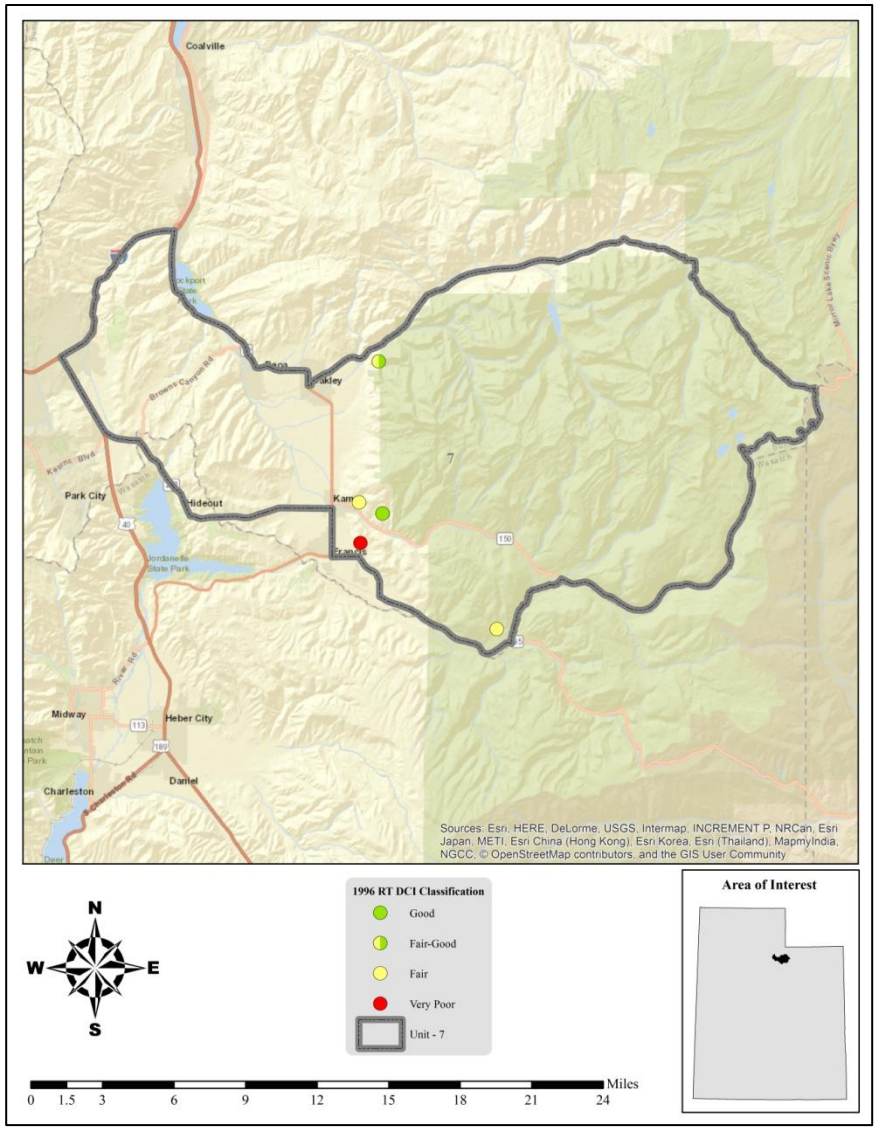


Figure 7.10: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 7, Kamas.

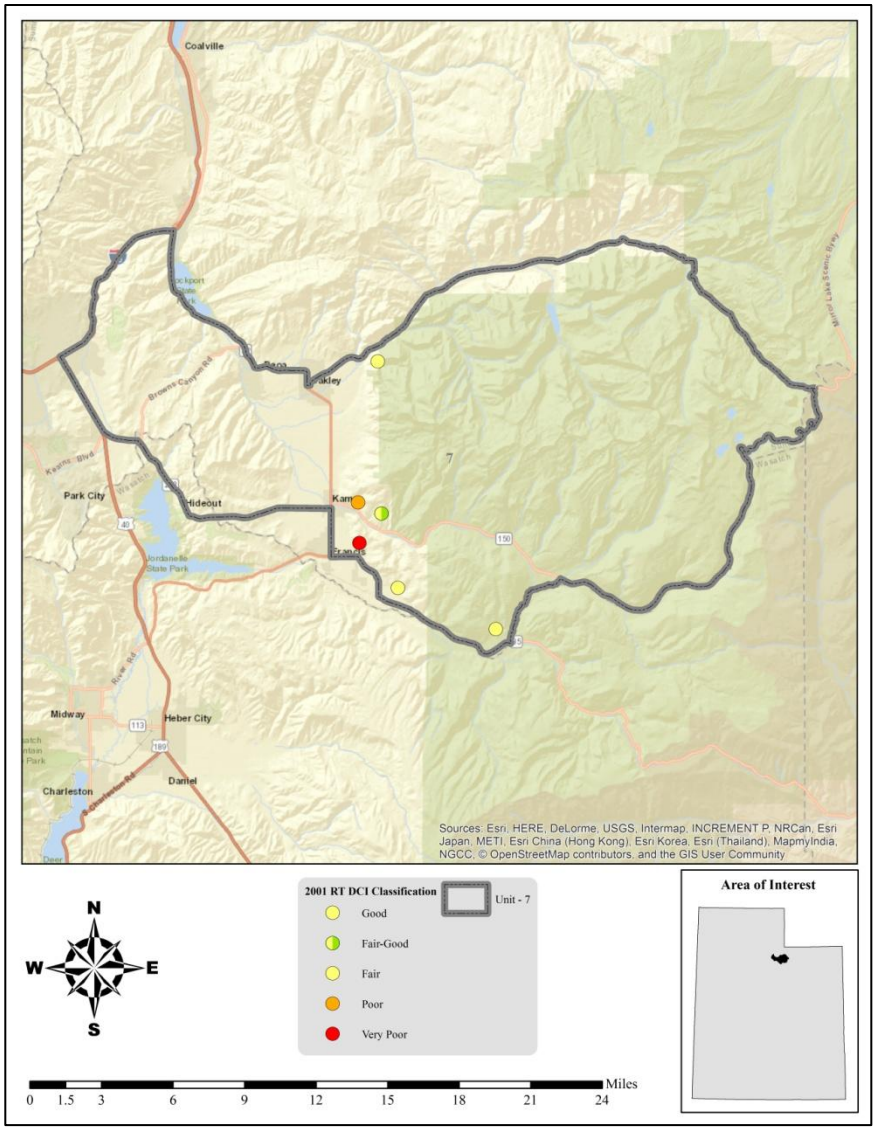
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
07-2	1996	11.0	13.8	14.9	30.0	-4.9	4.7	0.0	**69.6**	**F-G**
07-2	2001	13.1	12.1	6.1	30.0	-4.2	7.6	0.0	**64.7**	**F**
07-2	2006	12.9	10.2	5.4	30.0	-3.0	7.5	0.0	**63.0**	**F**
07-2	2011	14.0	9.9	8.4	29.7	-1.4	10.0	0.0	**70.5**	**F-G**
07-2	2016	16.9	14.2	12.2	30.0	-1.8	10.0	0.0	**81.5**	**G**
07-3	1996	8.2	9.7	6.5	5.2	-9.4	10.0	0.0	**30.3**	**VP**
07-3	2001	10.4	10.4	4.5	6.0	-8.4	10.0	0.0	**32.8**	**VP**
07-3	2006	12.2	12.3	3.8	1.5	-12.5	6.5	0.0	**23.8**	**VP**
07-3	2011	12.8	9.0	0.8	4.2	-16.9	10.0	0.0	**20.0**	**VP**
07-3	2016	12.9	8.1	2.1	3.0	-10.5	10.0	-2.0	**23.7**	**VP**
07-4	1996	13.6	13.0	9.9	30.0	0.0	10.0	0.0	**76.5**	**G**
07-4	2001	15.6	10.1	4.7	30.0	0.0	10.0	0.0	**70.4**	**F-G**
07-4	2006	12.6	8.2	7.1	30.0	0.0	10.0	0.0	**67.9**	**F**
07-4	2011	12.8	11.7	8.8	30.0	0.0	10.0	0.0	**73.2**	**G**
07-4	2016	10.9	13.4	7.5	30.0	0.0	10.0	0.0	**71.8**	**F-G**
07-6	1996	16.4	11.3	3.2	22.4	0.0	4.8	0.0	**58.2**	**F**
07-6	2001	18.9	9.1	1.2	21.6	0.0	10.0	0.0	**60.7**	**F**
07-6	2006	17.4	8.2	1.9	27.8	0.0	10.0	0.0	**65.2**	**F**
07-6	2011	15.4	13.4	3.6	30.0	0.0	10.0	0.0	**72.4**	**G**
07-6	2016	15.9	15.0	0.0	29.4	-0.1	10.0	0.0	**70.2**	**F-G**
07-7	1996	30.0	5.9	1.9	13.4	-5.6	0.5	0.0	**46.2**	**P**
07-7	2001	30.0	5.7	0.9	18.0	-1.1	7.6	0.0	**61.1**	**F**
07-7	2006	19.3	0.7	1.0	16.2	-13.4	1.3	0.0	**24.9**	**VP**
07-7	2011	22.2	3.0	0.0	30.0	-4.9	0.3	0.0	**50.6**	**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
07-9	2001	30.0	10.0	3.5	29.6	-1.2	6.4	0.0	**78.3**	**G**
07-9	2006	25.9	6.9	3.2	25.1	-4.3	6.7	0.0	**63.5**	**F**
07-9	2011	20.3	8.5	2.6	30.0	-3.5	10.0	0.0	**67.8**	**F**
07-9	2016	12.7	13.0	6.4	8.8	-12.8	4.4	0.0	**32.6**	**VP**
07-10	1996	30.0	9.5	3.0	12.2	-2.9	6.3	0.0	**58.2**	**F**
07-10	2001	26.8	4.9	1.2	7.4	-3.0	10.0	-2.0	**45.4**	**P**
07-10	2006	16.2	5.5	2.6	10.6	-7.8	9.1	0.0	**36.2**	**VP**
07-10	2011	16.0	7.0	8.4	10.5	-5.9	9.0	0.0	**45.0**	**P**
07-10	2016	15.4	8.9	3.7	3.8	-3.6	3.4	-2.0	**29.6**	**VP**

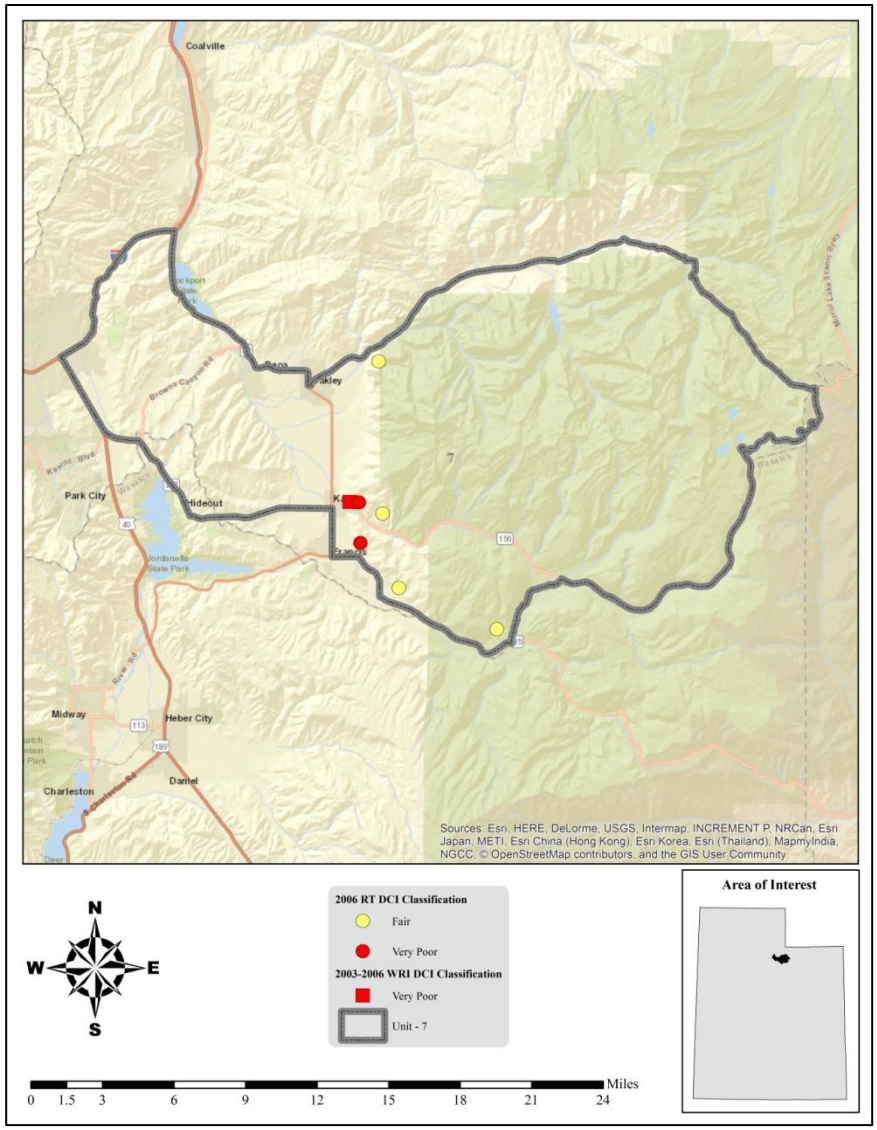
Table 7.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 7, Kamas.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



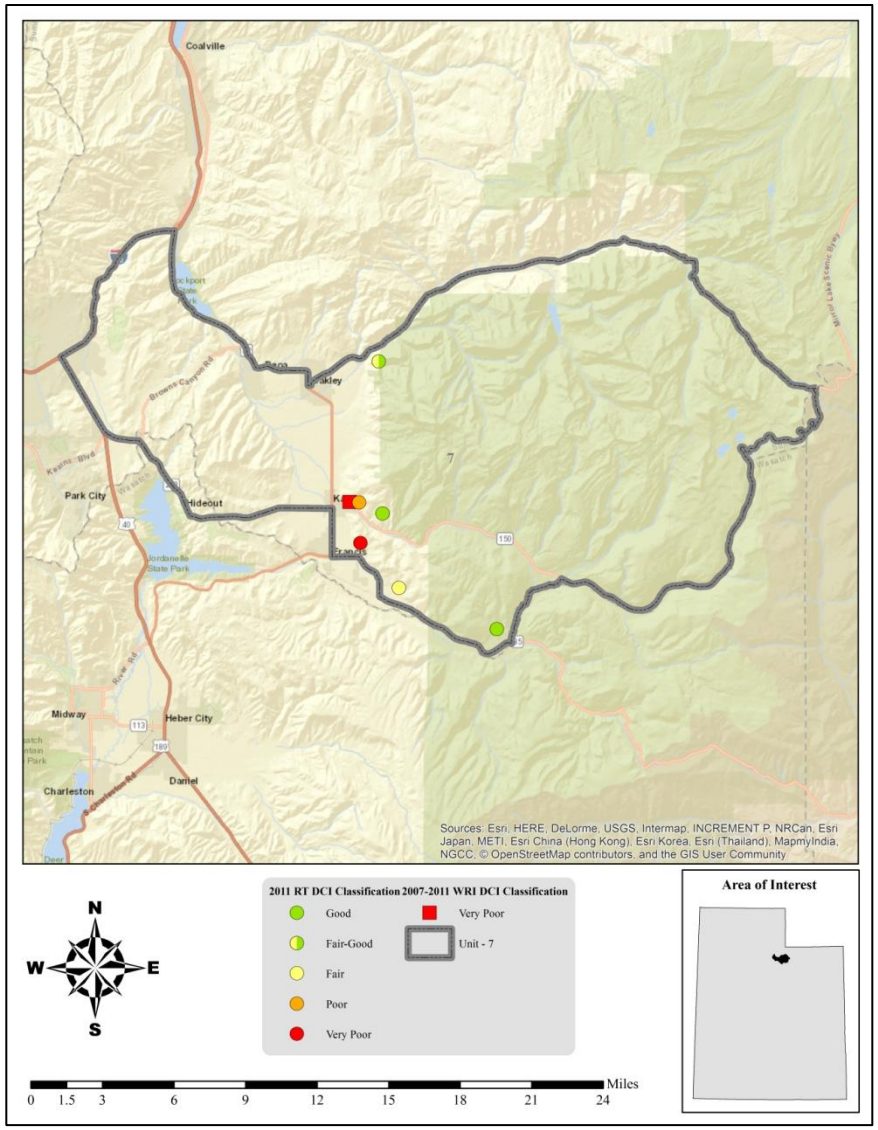
Map 7.8: 1996 Desirable Components Index (DCI) ranking distribution by study site for WMU 7, Kamas.



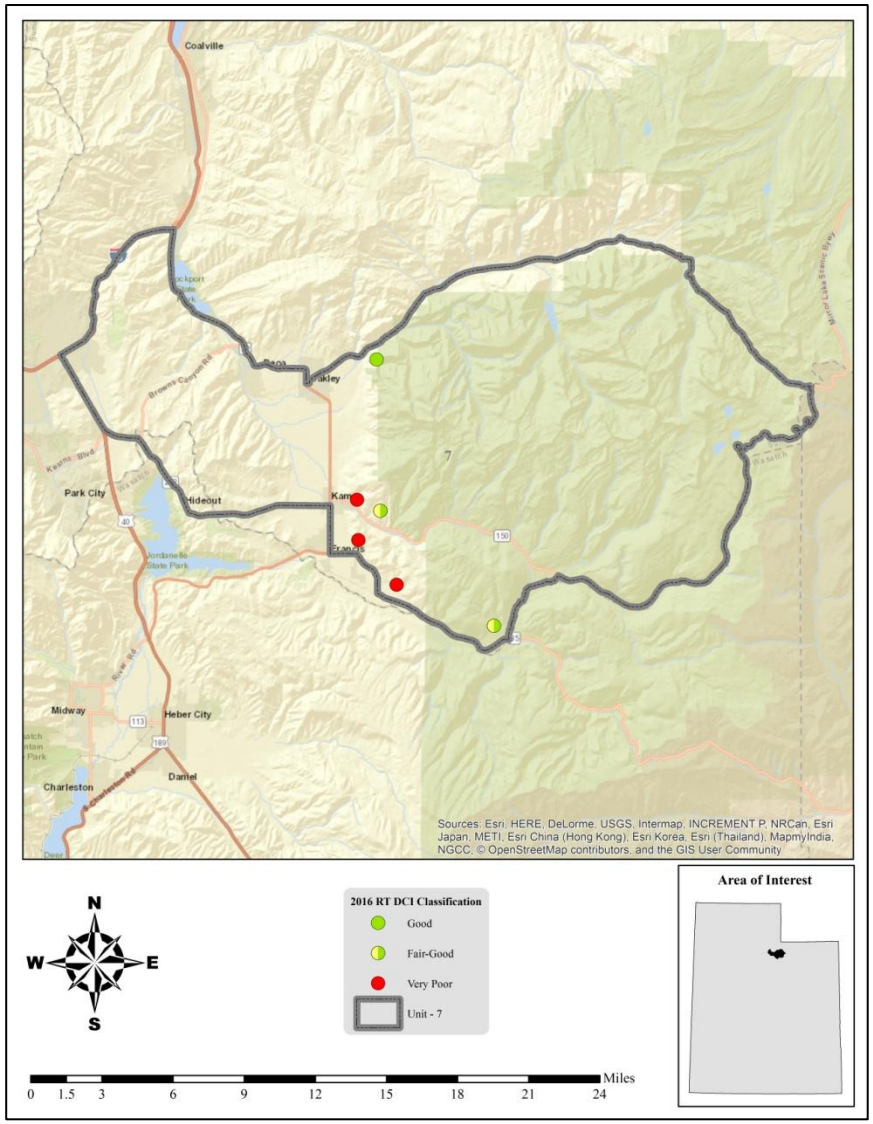
Map 7.9: 2001 Desirable Components Index (DCI) ranking distribution by study site for WMU 7, Kamas.



Map 7.10: 2006 Desirable Components Index (DCI) ranking distribution by study site for WMU 7, Kamas.



Map 7.11:2011 Desirable Components Index (DCI) ranking distribution by study site for WMU 7, Kamas.



Map 7.12: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 7, Kamas.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
07-2	Pinyon Canyon	Annual Grass	Low	Increased fire potential
07-3	Foothill Drive	Annual Grass	High	Increased fire potential
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
07-4	Above Samak	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
07-6	Cedar Hollow	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
07-7	Provo River Canyon	Annual Grass	Moderate	Increased fire potential
07-9	Above Woodland	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
07-10	Elder Hollow	Annual Grass	Low	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
07R-2	Kamas SFH	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species

Table 7.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 7, Kamas. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Shrub)

These high elevation study sites that are considered to be Mountain (Shrub) ecological sites support mixed browse and sagebrush communities and are generally considered to be in very poor to fair condition for deer winter range habitat on the Kamas management unit. Annual grasses (mainly cheatgrass) are present in the understories of both sites: these grasses can increase fuel loads and exacerbate the risk of wildfire. In addition, introduced perennial grass species are present on the Above Woodland study, and can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that monitoring of this community continue. 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. Treatment to reduce annual grasses may also be necessary on these study sites.

Mountain (Sagebrush)

The high elevation study sites that are classified as Mountain (Sagebrush) ecological sites support sagebrush communities and are considered to be in very poor to fair-good condition for deer winter range on the Kamas management unit. Introduced perennial grasses are a low-level threat on these studies, as they have the potential to be aggressive and can reduce understory diversity. In addition, pinyon and juniper encroachment is a potential threat – shrub and herbaceous health can be reduced as woodland succession progresses. Annual grasses, namely cheatgrass, are present on the Elder Hollow study: increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire in the affected areas. Finally, noxious weeds are also a low-level threat on the Elder Hollow site as they can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that monitoring of this community continue. Work to reduce pinyon-juniper encroachment (lop and scatter, bullhog, chaining, etc.) may be necessary in the future. Treatment to reduce annual grasses

may also be needed on these study sites. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass and forbs species when possible.

Mountain (Oak)

This high elevation study site of the Mountain (Oak) ecological type supports a mixed browse community dominated by Gambel oak and is considered to be in fair-good condition for deer winter range on this unit. Although the herbaceous understory on this study site is plentiful, it is mainly composed of introduced perennial grasses. These grass species provide forage, but can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable grass and forb species.

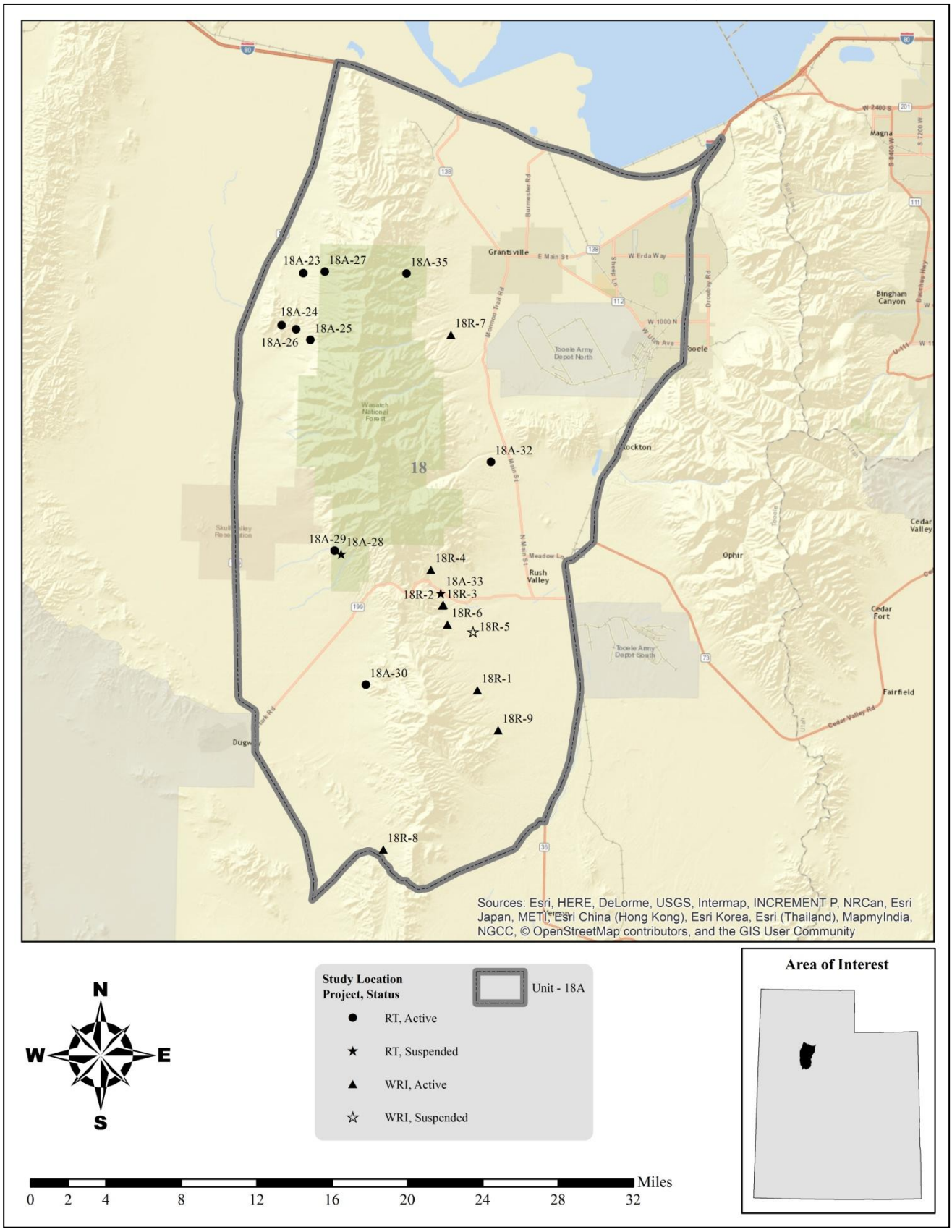
Should reseeding be necessary to restore the understory, species should be selected carefully with native grass and forb species being given preference when possible and appropriate.

Upland (Sagebrush)

The mid elevation study site that is classified as an Upland (Sagebrush) ecological site is dominated by sagebrush, which provides valuable browse for wildlife; this study site is considered to be in very poor condition. The annual grass cheatgrass dominates the herbaceous understory, increasing fuel loads and exacerbating the risk of catastrophic fire. Noxious weed species are also present, and can reduce the prevalence and abundance of more preferable grass and forb species.

Treatments such as herbicide application may be needed to reduce annual grass cover. Reseeding may also be necessary to restore the herbaceous understory, with preference being given to native grass and forb species when appropriate.

8. WILDLIFE MANAGEMENT UNIT 18A – STANSBURY OQUIRRH-STANSBURY



WILDLIFE MANAGEMENT UNIT 18A – STANSBURY OQUIRRH-STANSBURY

Boundary Description

Tooele county – Boundary begins at Lake Point Junction on I-80; south on the Tooele/Salt Lake County boundary to Middle Canyon Road; west on Middle Canyon Road to SR-36; south on SR-36 to Pony Express Road located just south of Faust; west on this road to the Skull Valley-Dugway-Timpie Road; north on this road to I-80 at Rowley Junction; east on I-80 to Lake Point Junction and beginning point.

Management Unit Description

Geography

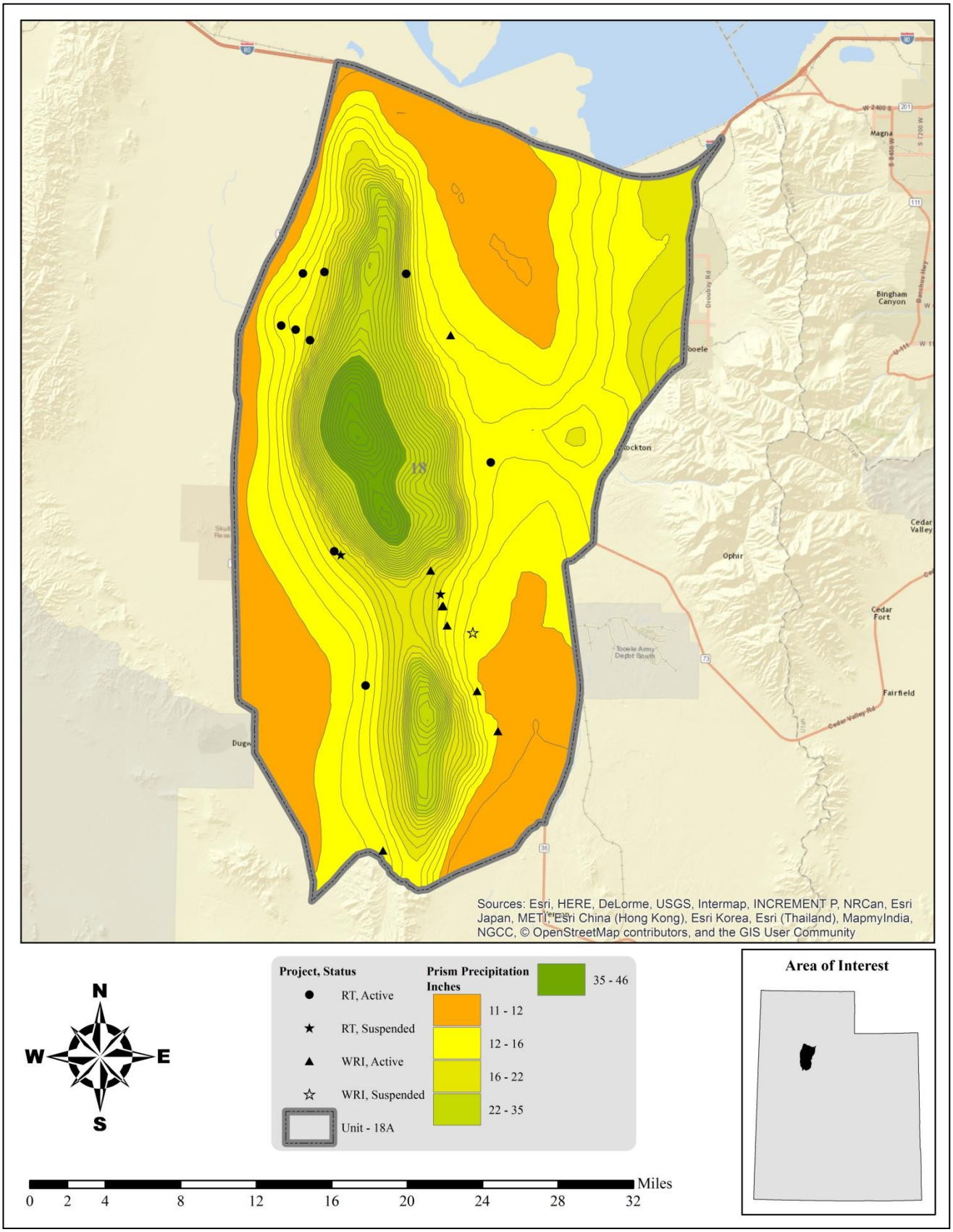
The Stansbury Oquirrh-Stanbury is situated in the eastern portion of Tooele County. This unit encompasses the Stansbury Mountains, bounded by Skull Valley and Cedar Mountains to the west, the Great Salt Lake to the north, and the Oquirrh Mountains in the east. Drainages include Hickman Creek, which drains East Hickman Canyon, East Faust Creek, which drains East Faust Canyon, and numerous others. Elevation ranges from just over 4,000 feet near the Great Salt Lake to over 10,000 feet on the peaks of the Stansbury Mountains. Communities within the unit include (but are not limited to) portions of Tooele and Stockton, Grantsville, and Rush Valley.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 11 inches along portions near the Great Salt Lake and Onaqui Mountains to 45 inches on the peaks of the Stansbury Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 12-19 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 Western and North Central divisions (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 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, 2001-2003, 2007-2008, and 2012; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (Figure 8.1b).

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, 1997-1998, 2005, and 2011 (Figure 8.2a). 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 1982-1986, 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 8.2b) (Time Series Data, 2017).



Map 8.1: The 1981-2010 PRISM Precipitation Model for WMU 18A, Stansbury Oquirrh-Stansbury (PRISM Climate Group, Oregon State University, 2013).

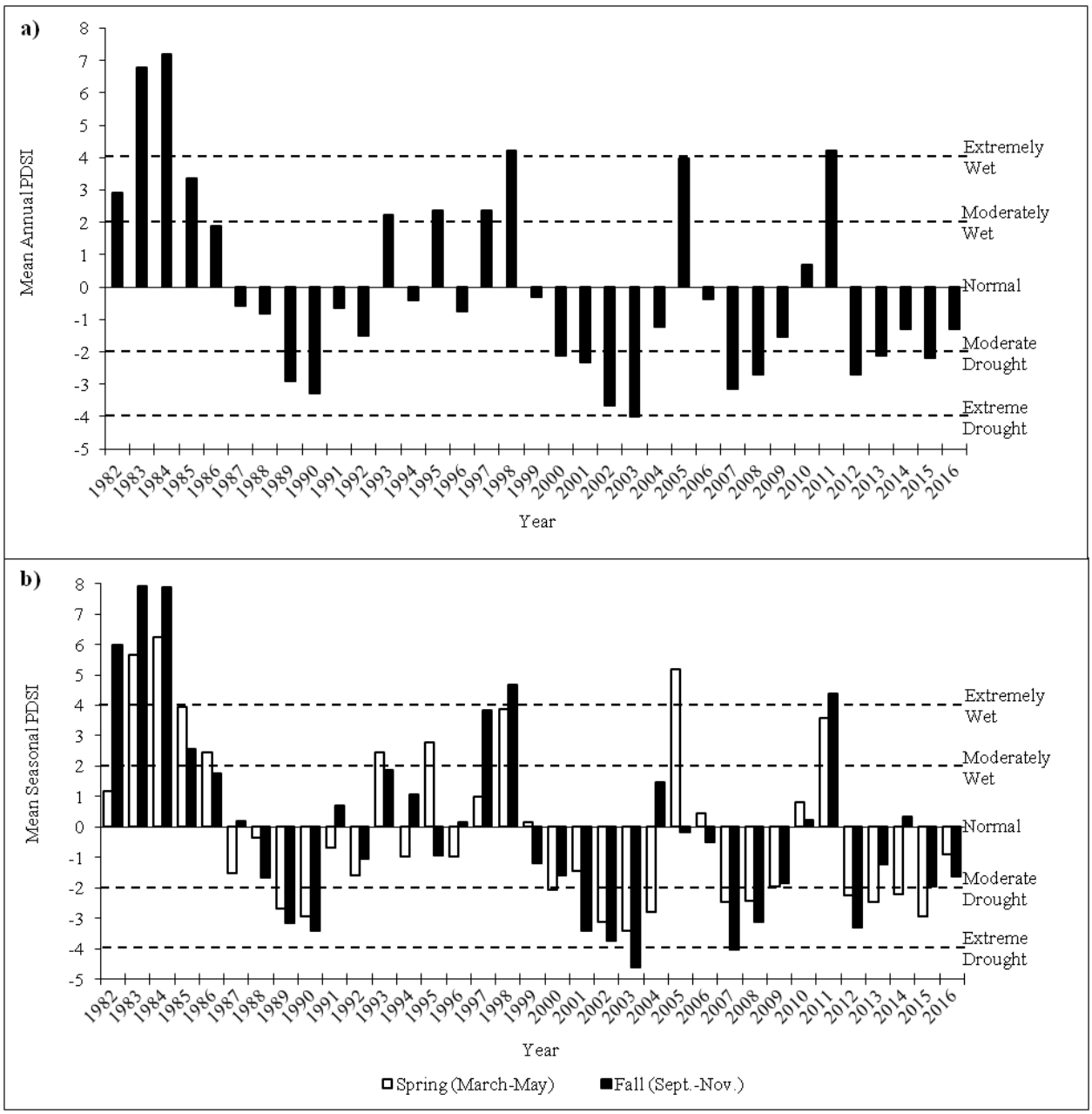


Figure 8.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

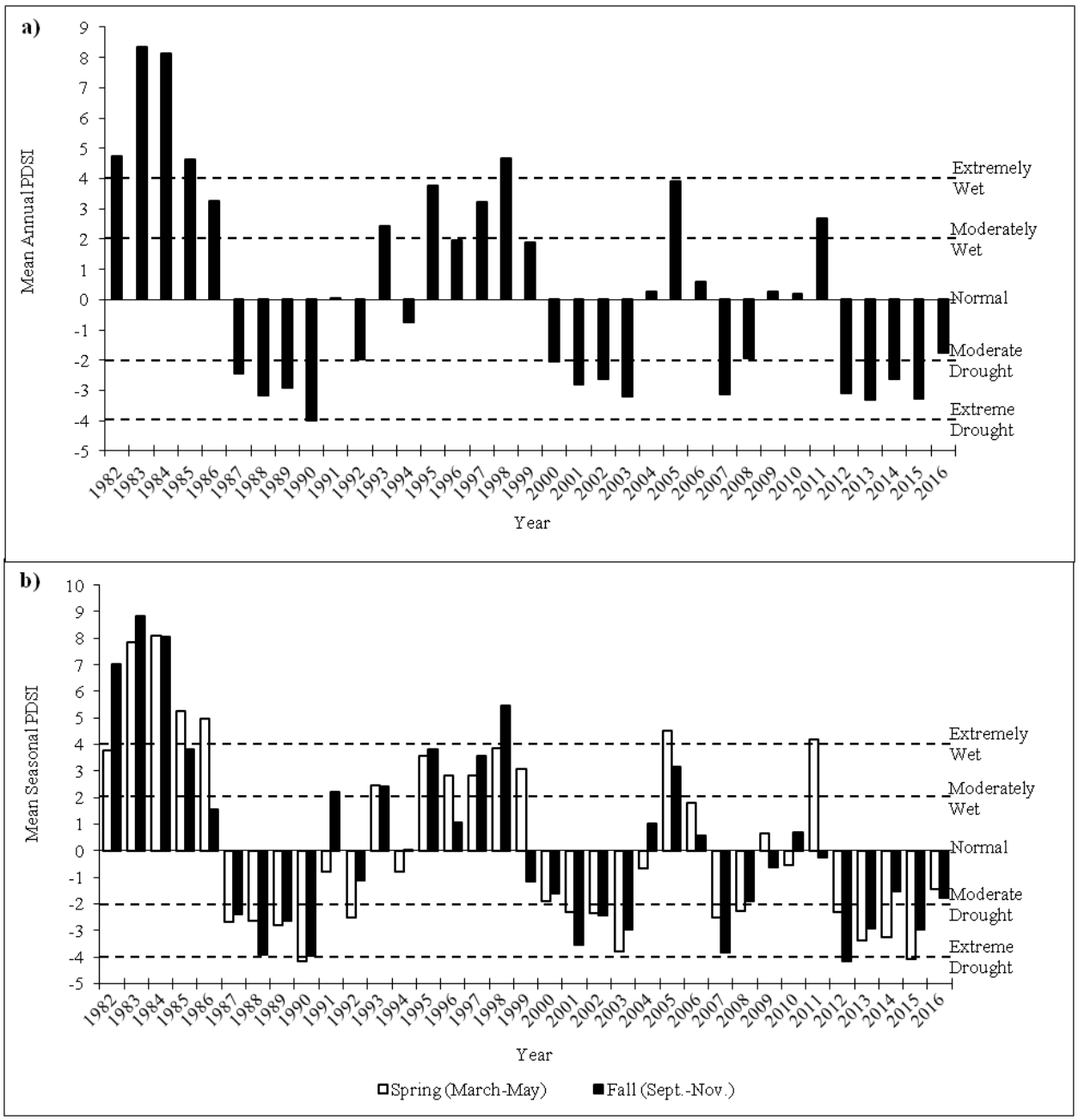
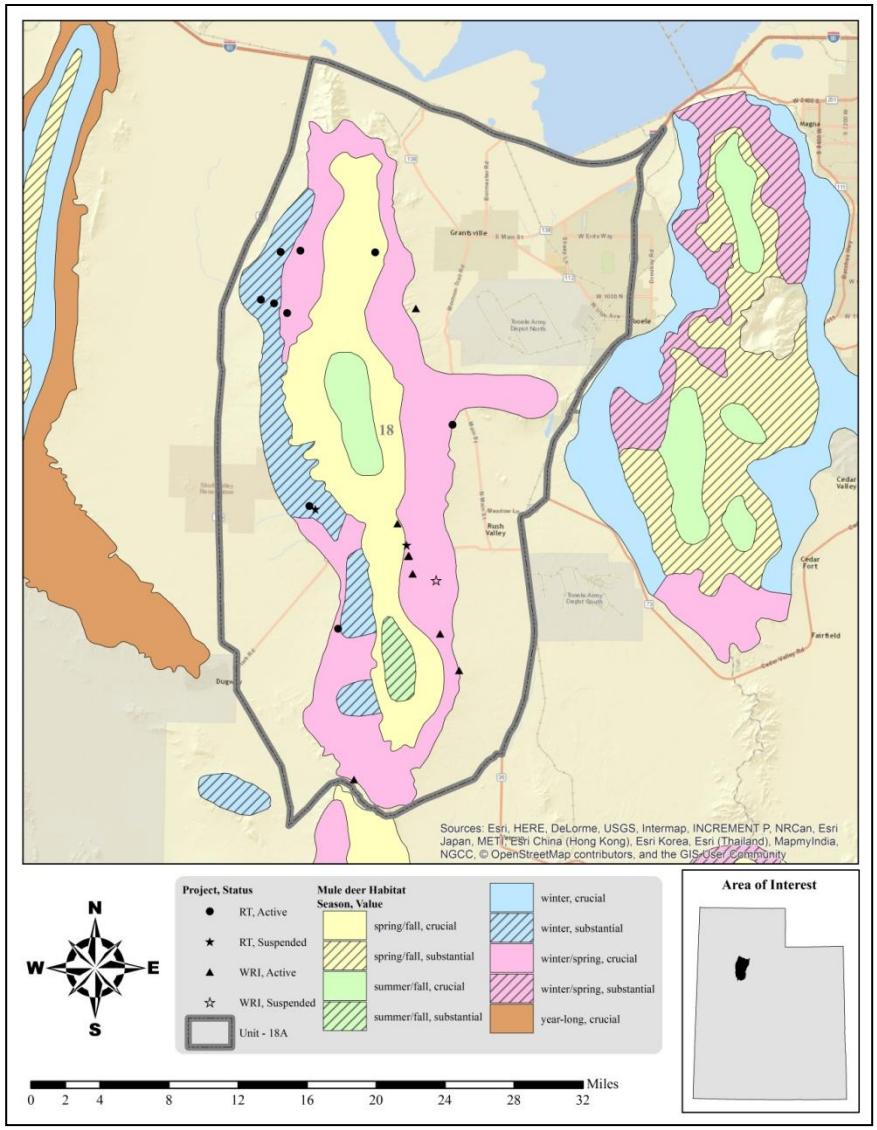


Figure 8.2: The 1982-2016 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

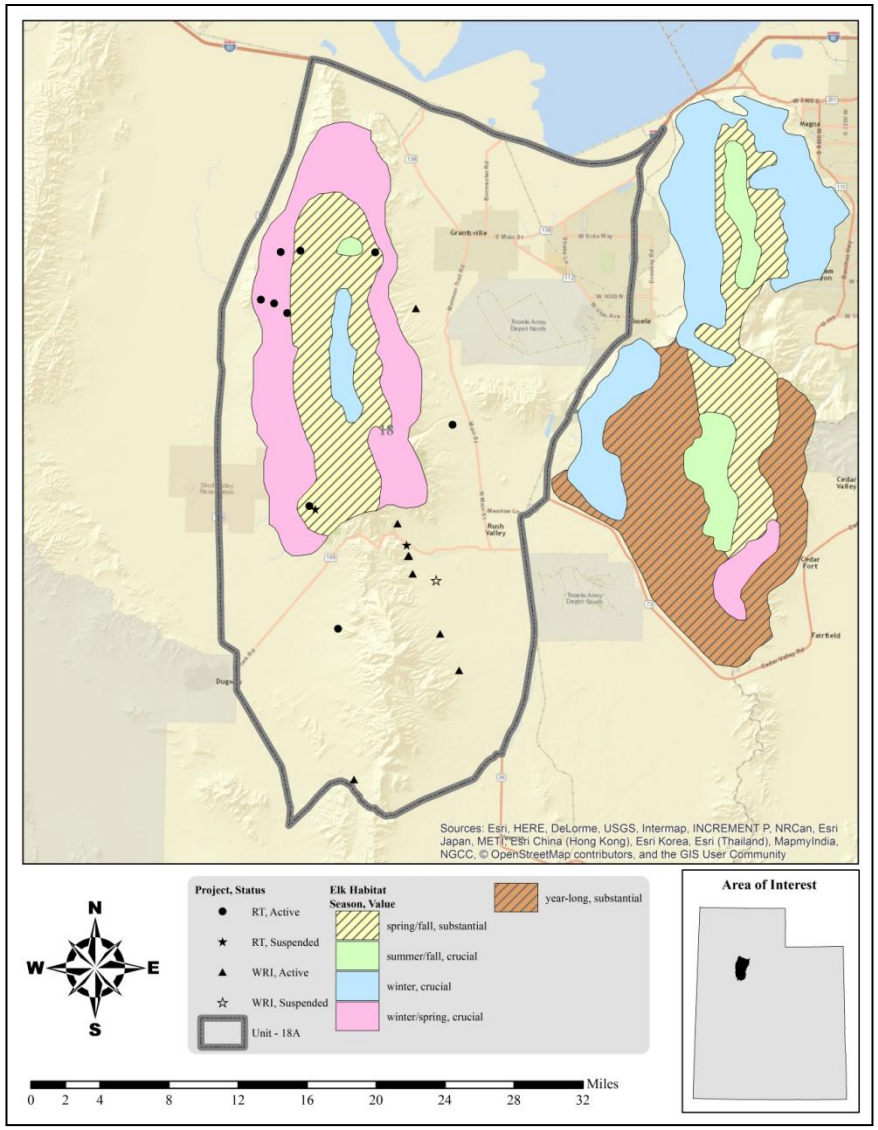
Big Game Habitat

There are estimated to be over 206,000 acres classified as deer range on Unit 18A with 46% classified as winter/spring range, 32% as spring/fall range, 15% as winter range, and 7% is classified as summer/fall range (Table 8.1). Bureau of Land Management (BLM)-managed land comprises 40% of the winter/spring range, 34% is privately owned, 15% is tribal-owned land, and the Utah School and Institutional Trust Lands Administration (SITLA) administrates 11%. 59% of spring/fall range is owned by the US Forest Service (USFS), 34% is managed by the BLM, 4% is privately owned, SITLA administrates 3%, and less than 1% is tribal-owned. The BLM administrates 57% of the winter range, 17% is owned by USFS, private landowners manage 14%, 10% is tribal-owned, and 2% is administrated by SITLA. Finally, 68% of the summer/fall range

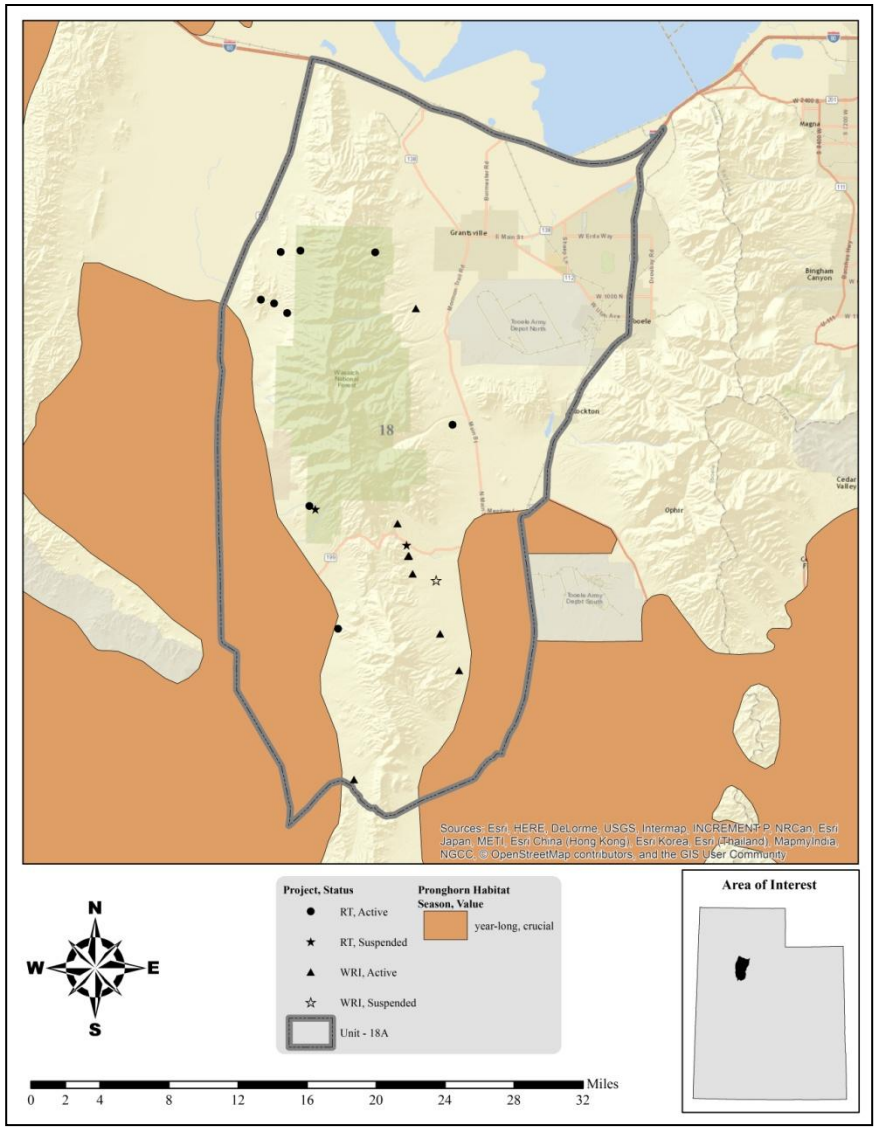
is owned by USFS, the BLM administrates 23%, 5% is managed by SITLA, and 4% is privately owned (Table 8.2).



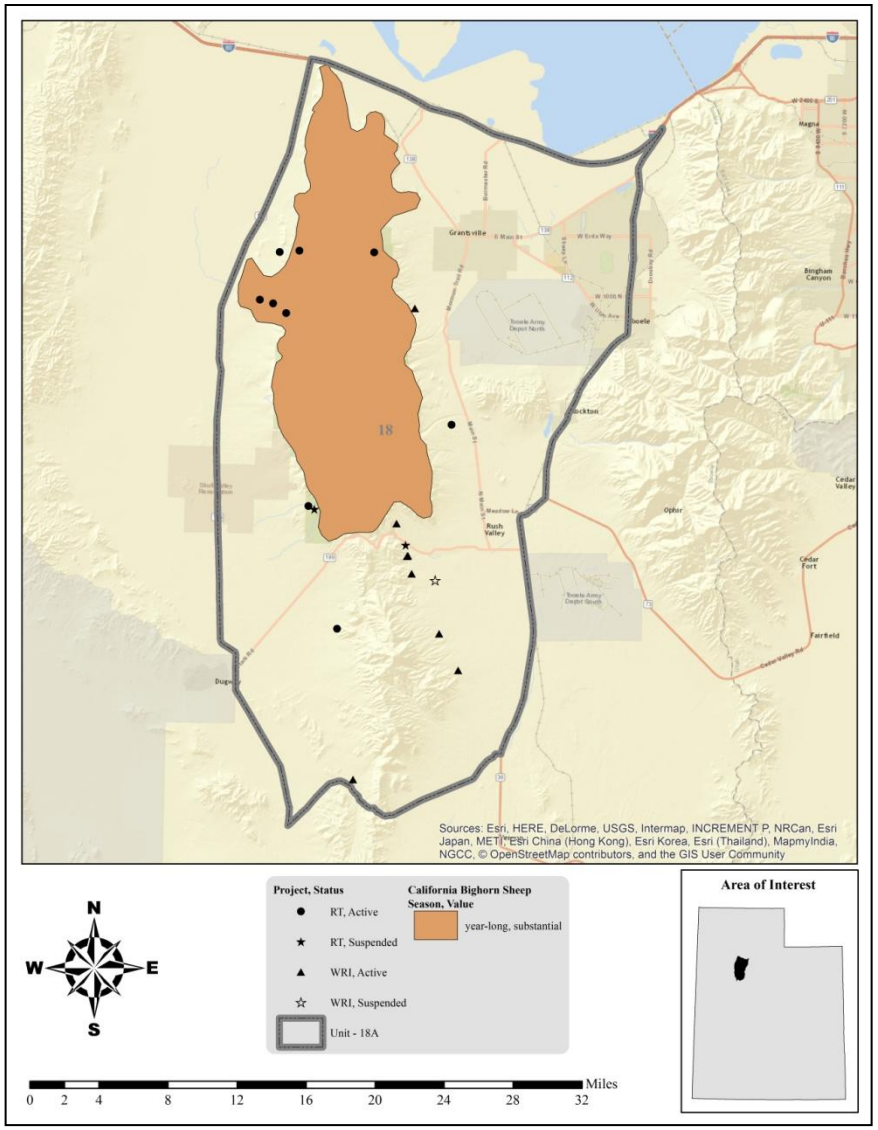
Map 8.2: Estimated mule deer habitat by season and value for WMU 18A, Stansbury Oquirrh-Stansbury.



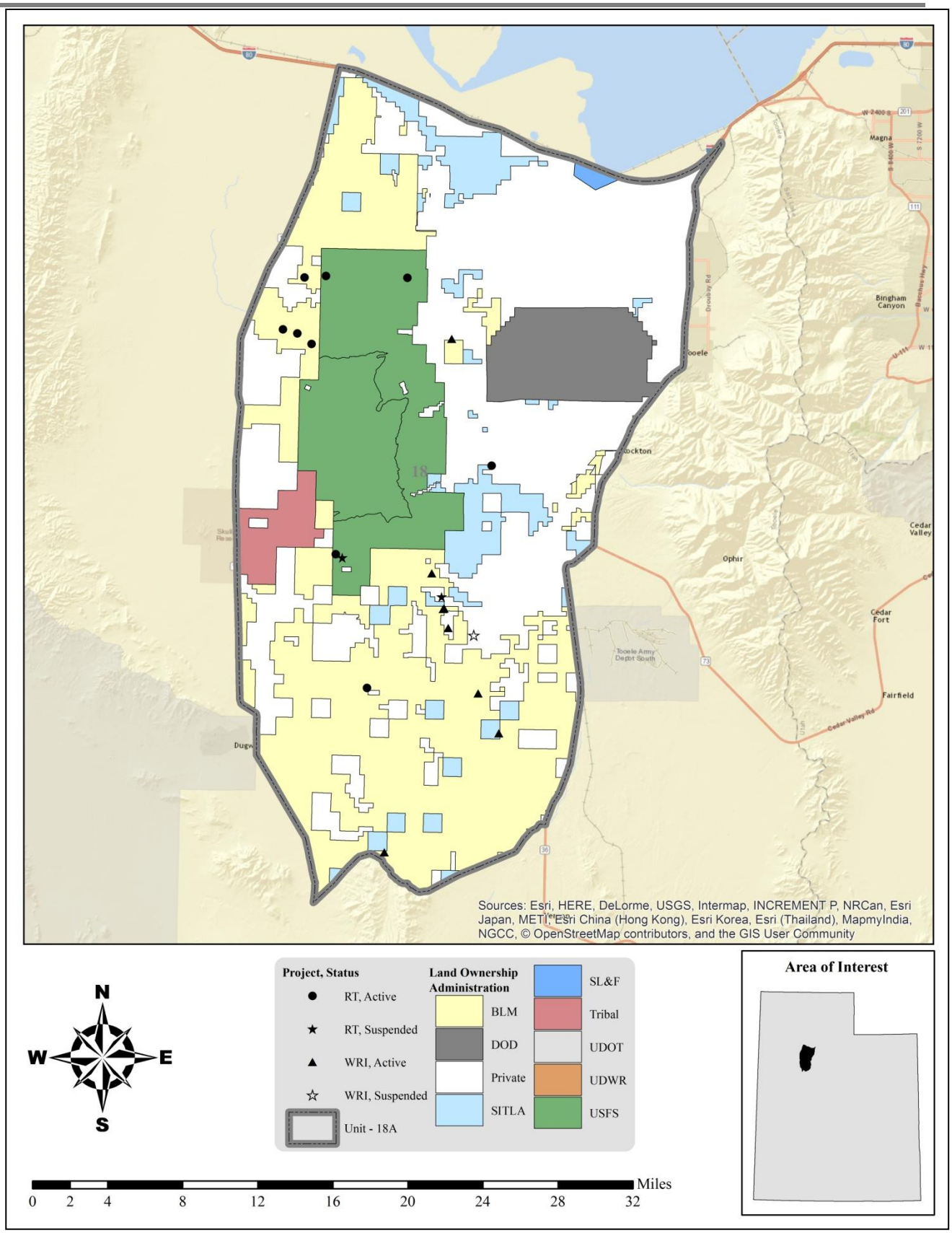
Map 8.3: Estimated elk habitat by season and value for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.4: Estimated pronghorn habitat by season and value for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.5: Estimated California bighorn sheep habitat by season and value for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.6: Land ownership for WMU 18A, Stansbury Oquirrh-Stansbury.

	Year Long Range		Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	0	0%	30,976	15%	95,499	46%	66,131	32%	14,206	7%
Elk	0	0%	5,695	5%	60,791	53%	48,215	42%	807	<1%
CBS	107,967	100%	0	0%	0	0%	0	0%	0	0%
Pronghorn	105,366	100%	0	0%	0	0%	0	0%	0	0%

Table 8.1: Estimated mule deer, elk, California bighorn sheep (CBS), and Pronghorn habitat acreage by season for WMU 18A, Stansbury Oquirrh-Stansbury.

	Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	17,739	57%	37,653	40%	22,570	34%	3,298	23%
Private	4,272	14%	32,443	34%	3,015	4%	607	4%
SITLA	487	2%	10,730	11%	1,766	3%	695	5%
Tribal	3,078	10%	14,673	15%	30	<1%	0	0%
USFS	5,399	17%	0	0%	38,750	59%	9,607	68%
USP	0	0%	0	0%	0	0%	0	0%
Total	30,976	**100%**	95,499	**100%**	66,131	**100%**	14,206	**100%**

Table 8.2: Estimated mule deer habitat acreage by season and land ownership for WMU 18A, Stansbury Oquirrh-Stansbury.

	Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	24,424	40%	6,054	13%	0	0%
Private	0	0%	10,617	17%	402	<1%	0	0%
SITLA	0	0%	2,748	5%	0	0%	0	0%
Tribal	0	0%	3,653	6%	0	0%	0	0%
USFS	5,695	100%	19,349	32%	41,759	87%	807	100%
Total	5,695	**100%**	60,791	**100%**	48,215	**100%**	807	**100%**

Table 8.3: Estimated elk habitat acreage by season and land ownership for WMU 18A, Stansbury Oquirrh-Stansbury.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	57,523	55%
Private	40,204	38%
SITLA	977	<1%
Tribal	6,584	6%
UDOT	10	<1%
UDWR	60	<1%
DOD	8	<1%
Total	105,366	**100%**

Table 8.4: Estimated pronghorn habitat acreage by season and land ownership for WMU 18A, Stansbury Oquirrh-Stansbury.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	27,618	26%
Private	10,203	9%
SITLA	4,180	4%
Tribal	186	<1%
USFS	65,780	61%
Total	107,967	**100%**

Table 8.5: Estimated California bighorn sheep habitat acreage by season and land ownership for WMU 18A, Stansbury Oquirrh-Stansbury.

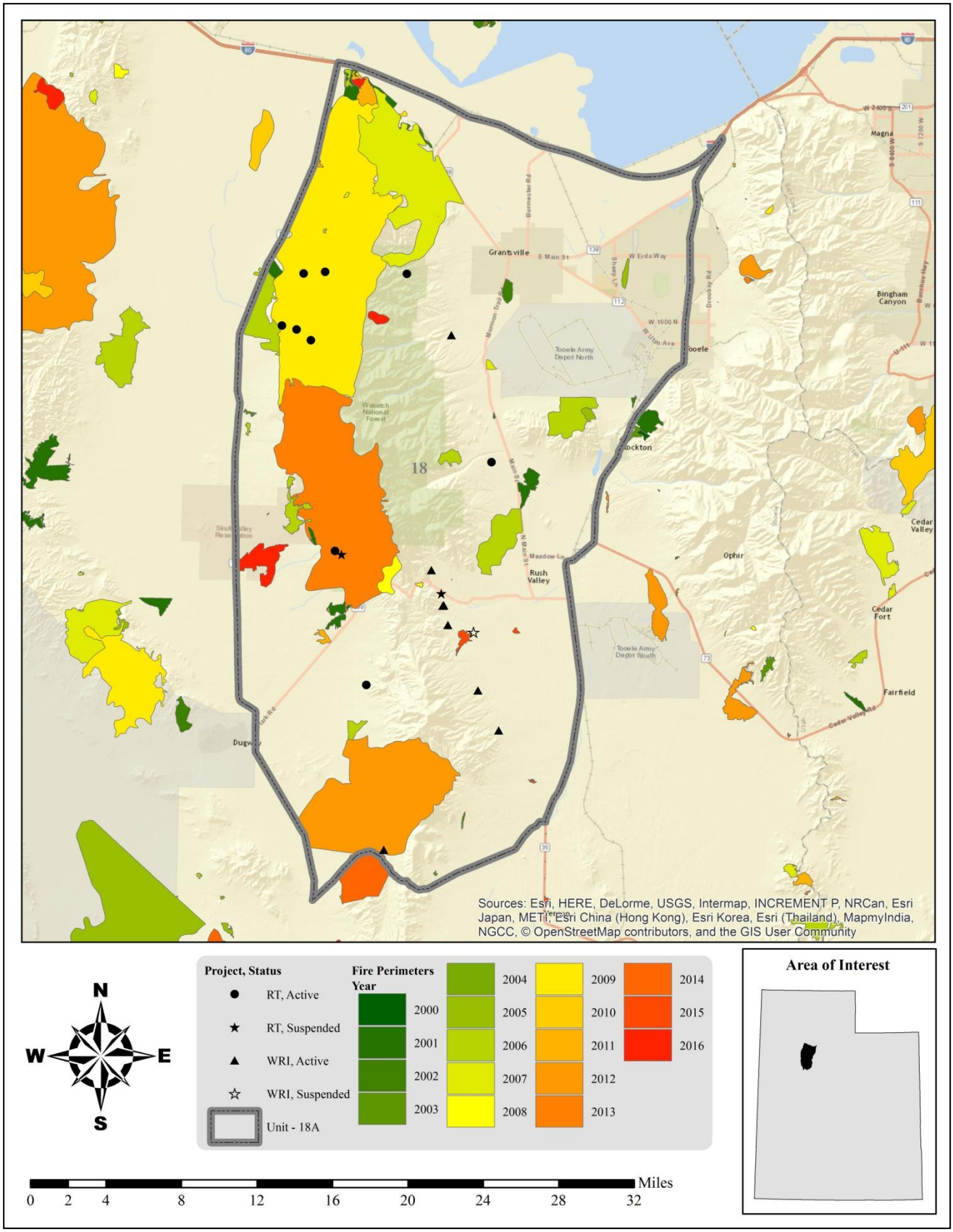
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	108,722	22.61%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	13,912	2.89%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	4,962	1.03%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	2,507	0.52%	
	Inter-Mountain Basins Juniper Savanna	2,029	0.42%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,579	0.33%	
	Conifer-Hardwood	929	0.19%	
	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	665	0.14%	
	Abies concolor Forest Alliance	193	0.04%	
	Southern Rocky Mountain Ponderosa Pine Woodland	0	0.00%	28.18%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	98,195	20.42%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	1,571	0.33%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	520	0.11%	20.86%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	11,617	2.42%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	3,863	0.80%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,791	0.37%	3.59%
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	58,659	12.20%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	18,808	3.91%	
	Inter-Mountain Basins Greasewood Flat	17,667	3.67%	
	Great Basin Xeric Mixed Sagebrush Shrubland	14,844	3.09%	
	Inter-Mountain Basins Big Sagebrush Steppe	11,501	2.39%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	9,556	1.99%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	2,774	0.58%	
	Coleogyne ramosissima Shrubland Alliance	2,643	0.55%	
	Sonora-Mojave Semi-Desert Chaparral	1,943	0.40%	
	Rocky Mountain Lower Montane-Foothill Shrubland	1,514	0.31%	
	Inter-Mountain Basins Montane Sagebrush Steppe	1,122	0.23%	
	Columbia Plateau Low Sagebrush Steppe	327	0.07%	
	Quercus gambelii Shrubland Alliance	125	0.03%	
	Other Shrubland	243	0.05%	29.48%
Other	Developed	33,590	6.99%	
	Agricultural	22,732	4.73%	
	Barren	13,126	2.73%	
	Hardwood	8,633	1.80%	
	Open Water	5,329	1.11%	
	Riparian	1,393	0.29%	
	Sparsely Vegetated	715	0.15%	
	Other	530	0.11%	17.90%
Total		480,829	100.00%	

Table 8.6: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 18A, Stansbury Oquirrh-Stansbury.

Limiting Factors to Big Game Habitat

Limiting factors to big game habitat in this unit include habitat degradation and loss, summer range availability, and winter range forage condition. Encroachment by pinyon-juniper woodland communities poses a substantial threat to important sagebrush rangelands. According to current Landfire Existing Vegetation Coverage models, nearly 23% of the Stansbury Oquirrh-Stansbury unit is comprised of pinyon-juniper woodlands (Table 8.6). 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).

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, 20.9% of the unit is comprised of exotic herbaceous species. Increased amounts of cheatgrass increases the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). The unit has had several large wildfires, resulting in loss of habitat for big game (Map 8.7).



Map 8.7: Land coverage of fires by year from 2000-2016 for WMU 18A, Stansbury Oquirrh-Stansbury.

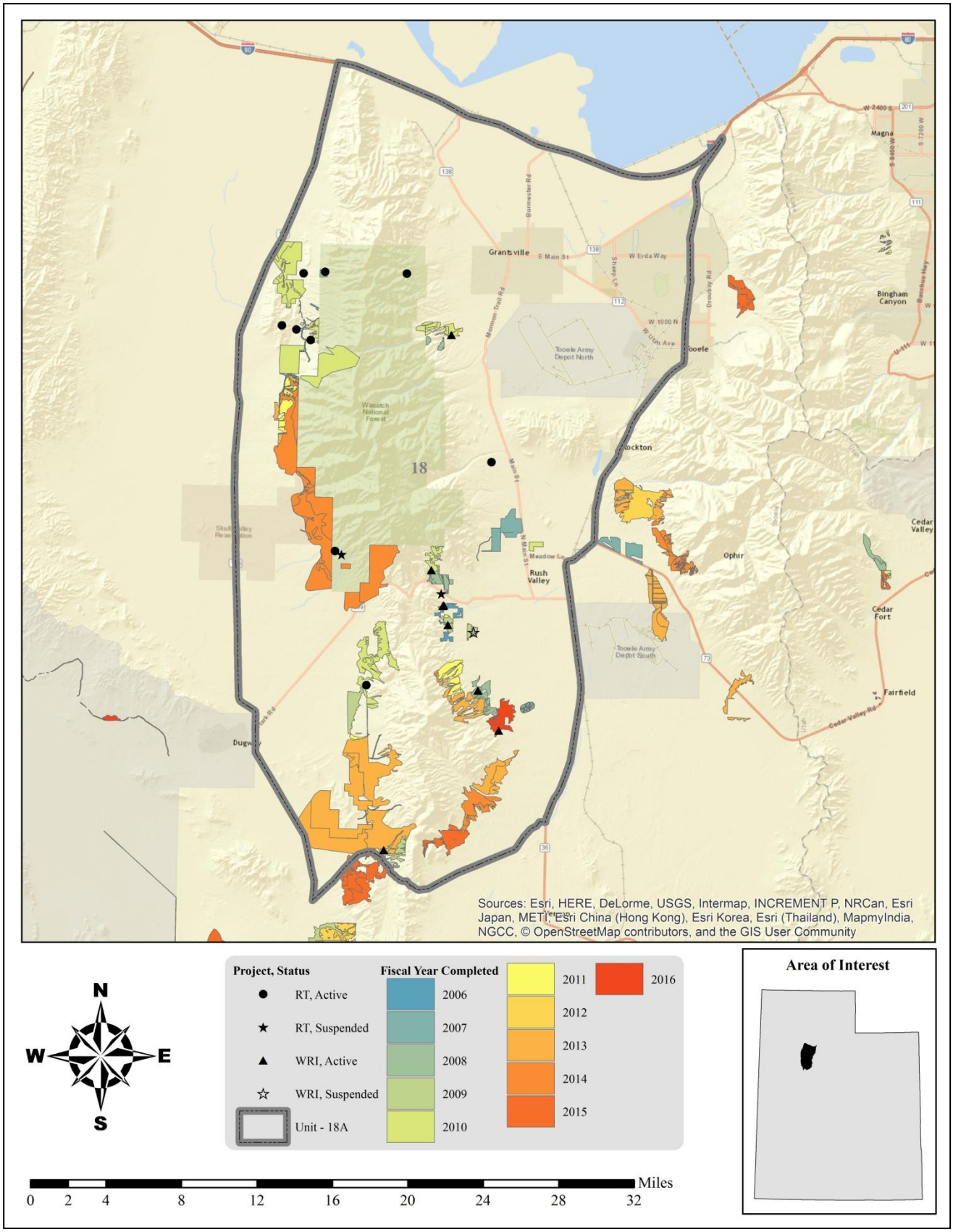
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 41,491 acres of land have been treated within the Stansbury Oquirrh-Stansbury unit since the WRI was implemented in 2004 (Map 8.8); 1,013 acres are currently being treated, and treatment projects are proposed for 3,284 units. Treatments frequently overlap one another bringing the total completed treatment acres to 43,630 acres for this unit (Table 8.7). 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 twoneedle pinyon and Utah juniper is the most common management practice in this unit. Bullhog use is also very common. Other management practices include (but are not limited to) seeding desirable herbaceous species, herbicide application to remove weeds, harrow, and seeding of shrub species (Table 8.7).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**14,510**	**0**	**0**	**14,510**
Ely (One-Way)	14,020	0	0	14,020
Ely (Two-Way)	194	0	0	194
Smooth (Two-Way)	297	0	0	297
Bullhog	**11,623**	**248**	**8**	**11,879**
Chain Harrow	**0**	**0**	**926**	**926**
> 15 ft. (Two-Way)	0	0	926	926
Harrow	**159**	**0**	**0**	**159**
≤15 ft. (One-Way)	42	0	0	42
≤15 ft. (Two-Way)	117	0	0	117
Herbicide Application	**3,971**	**0**	**0**	**3,971**
Aerial	3,971	0	0	3,971
Seeding (Primary)	**10,066**	**0**	**0**	**10,066**
Broadcast (Aerial)	7,435	0	0	7,435
Drill (Rangeland)	2,577	0	0	2,577
Drill (Truax)	53	0	0	53
Seeding (Secondary/Shrub)	**1,230**	**0**	**0**	**1,230**
Broadcast (Aerial)	1,027	0	0	1,027
Other	203	0	0	203
Vegetation Removal/Hand Crew	**2,051**	**764**	**2,350**	**5,166**
Lop (No Scatter)	90	0	2,056	2,146
Lop & Scatter	886	764	294	1,944
Lop-Pile-Burn	1,075	0	0	1,075
Other	**21**	**0**	**0**	**21**
Greenstripping	21	0	0	21
Total Treatment Acres	**43,630**	**1,013**	**3,284**	**47,927**
***Total Land Area Treated**	**41,491**	**1,013**	**3,284**	**45,403**

Table 8.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 18A, Stansbury Oquirrh-Stansbury. Data accessed on 02/09/2017. *Does not include overlapping treatments.



Map 8.8: WRI treatments by fiscal year completed for WMU 18A, Stansbury Oquirrh-Stansbury.

Range Trend Studies

Range Trend studies have been sampled within WMU 18A on a regular basis since 1983, with studies being added or suspended as was deemed necessary (Table 8.8). 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 8.9).

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
18A-23	South Palmer Point	RT	Active	'83, '89, '97, '02, '04, '07, '12, '16	Upland Loam (Wyoming Big Sagebrush)
18A-24	Salt Mountain Stock Pond	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Loam (Mountain Big Sagebrush)
18A-25	Below Chokecherry Spring	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Loam (Mountain Big Sagebrush)
18A-26	Salt Mountain	RT	Active	'83, '89, '02, '07, '12, '16	Upland Stony Loam (Mountain Big Sagebrush)
18A-27	South of Broons Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '16	Mountain Stony Loam (Antelope Bitterbrush)
18A-28	Condie Meadows	RT	Suspended	'83, '89, '97	Not Verified
18A-29	Deadman Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Gravelly Loam (Wyoming Big Sagebrush)
18A-30	Hatch Ranch	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Gravelly Loam (Wyoming Big Sagebrush)
18A-32	East Hickman Canyon	RT	Active	'97, '02, '07, '12	Not Verified
18A-33	Clover Creek	RT	Suspended	'97	Not Verified
18A-35	Magpie Canyon	RT	Active	'12, '16	Mountain Stony Loam (Antelope Bitterbrush)
18R-1	East Onaqui	WRI	Active	'04, '13, '16	Upland Loam (Mountain Big Sagebrush)
18R-2	Clover Bullhog Drill	WRI	Active	'05, '08, '12	Not Verified
18R-3	Clover Bullhog Aerial	WRI	Active	'05, '08, '12	Not Verified
18R-4	Big Hollow Bullhog	WRI	Active	'06, '10, '14	Not Verified
18R-5	Clover Creek Chaining	WRI	Suspended	'07, '10	Not Verified
18R-6	Clover Creek Dry Farm	WRI	Active	'07, '10, '14	Not Verified
18R-7	Grantsville Chaining	WRI	Active	'08, '11, '15	Upland Loam (Wyoming Big Sagebrush)
18R-8	West Onaqui Bullhog	WRI	Active	'08, '11, '15	Upland Shallow Loam (Black Sagebrush)
18R-9	East Faust Creek	WRI	Active	'15	Upland Shallow Loam (Mountain Big Sagebrush)

Table 8.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 18A, Stansbury Oquirrh-Stansbury.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
18A-23	South Palmer Point	Aerial Before	Round Canyon	November 2004	780	
		Bullhog	Round Canyon	November 2004	780	
		Wildfire	Big Pole	August 2009	44470	
		Aerial Before	BLM-ESR	Fall 2009	9500	
		One-Way Ely Chain	BLM-ESR	Fall 2009	9500	
		Aerial After	BLM-ESR	Fall 2009	4900	
18A-24	Salt Mountain Stock Pond	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Wildfire	Big Pole	August 2009	44470	
		Aerial Before	BLM-ESR	Fall 2009	9500	
		One-Way Ely Chain	BLM-ESR	Fall 2009	9500	
		Aerial After	BLM-ESR	Fall 2009	4900	
18A-25	Below Chokecherry Spring	Wildfire	Big Pole	August 2009	44470	
		Aerial Before	BLM-ESR	Fall 2009	9500	
		One-Way Ely Chain	BLM-ESR	Fall 2009	9500	
		Aerial After	BLM-ESR	Fall 2009	4900	
18A-26	Salt Mountain	Wildfire	Big Pole	August 2009	44470	
		Aerial Unknown	BLM-ESR	Fall 2009	9500	
		Aerial Unknown	BLM-ESR	Fall 2009	4900	
18A-27	South of Broons Canyon	Prescribed Fire	Stansbury Juniper Prescribed Burn and Mechanical Treatment	September 2007	80	727
		Wildfire	Big Pole	August 2009	44470	
18A-29	Deadman Canyon	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Wildfire	Patch	2013		
18A-30	Hatch Ranch	Bullhog	Terra East Juniper Thinning-Phase 2	October 2009-February 2010	2190	1362
18A-32	East Hickman Canyon	Chain Unknown		1999		
		Seed Unknown		1999		
18R-1	East Onaqui	Aerial Before	East Onaqui Juniper Thinning and Seeding - Year 1	2007	332	353
		Bullhog	East Onaqui Juniper Thinning and Seeding - Year 1	2007	418	353
18R-2	Clover Bullhog Drill	Bullhog	Clover Creek Juniper Thinning and Seeding - Year 2	Fall 2005	420	30
		Rangeland Drill	Clover Creek Juniper Thinning and Seeding - Year 2	Fall 2005	27	30
		Aerial After	Clover Creek Juniper Thinning and Seeding - Year 2	January 2006	420	30
18R-3	Clover Bullhog Aerial	Aerial Before	Clover Creek Juniper Thinning and Seeding - Year 2	Fall 2005	400	30
		Bullhog	Clover Creek Juniper Thinning and Seeding - Year 2	Fall 2005	420	30
		Aerial After	Clover Creek Juniper Thinning and Seeding - Year 2	January 2006	400	30
18R-4	Big Hollow Bullhog	Bullhog	Big Hollow Bullhog - Phase 2	Summer 2010	220	1380
18R-5	Clover Creek Chaining	Aerial Before	Clover Creek Habitat Enhancement	March 2007	408	712
		Two-Way Smooth Chain	Clover Creek Habitat Enhancement	Fall 2007-April 2008	168	712
18R-6	Clover Creek Dry Farm	Agriculture		Historic		
		Aerial Before	Clover Creek Habitat Enhancement	October 2008	408	712
		Two-Way Smooth Chain	Clover Creek Habitat Enhancement	September-November 2008	193	712
		Herbicide - Plateau	Clover Creek Plateau	September 2010	220	1613

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
18R-7	Grantsville Chaining	Aerial Before	Grantsville Chaining	October 2008	304	1117
		Two-Way Ely/Smooth Chain	Grantsville Chaining	October 2008	304	1117
		Dribbler	Grantsville Chaining	October 2008	304	1117
		Lop & Scatter	Grantsville Habitat and Grazing Improvement Project	2016	765	3663
18R-8	West Onaqui Bullhog	Bullhog	West Onaqui Bullhog Phase III	Spring 2009	512	1133
		Wildfire	Faust Fire	August 2012	22045	
		Herbicide - Plateau	Faust Fire ESR	September 2012	779	2484
		Aerial Before	Faust Fire ESR	December 2012	4532	2484
		One-Way Ely Chain	Faust Fire ESR	March-April 2013	4068	2484
18R-9	East Faust Creek	Aerial Before	Onaqui East Bench Bullhog Phase 3	October 2015	191	3249
		Bullhog	Onaqui East Bench Bullhog Phase 3	October 2015-March 2016	191	3249

Table 8.9: Range trend and WRI studies known disturbance history for WMU 18A, Stansbury Oquirrh-Stansbury

Study Trend Summary (Range Trend)

Mountain (Browse)

There are two studies [South of Broons Canyon (18A-27, Magpie Canyon 18A-35] that are classified as Mountain (Browse) ecological sites. South of Broons Canyon is located 1.5 miles north of Delle Ranch up Round Canyon Road. Magpie Canyon is located 6 miles west of Grantsville up Magpie Canyon.

Shrubs/Trees: The co-dominant browse species on these study sites are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*), with Utah serviceberry (*Amelanchier utahensis*) present as a minor component. South of Broons Canyon burned completely in 2009, which removed the shrub component completely; prior to the burn, the shrub community on the site was composed of these species. The fire accounts for the precipitous decrease in shrub cover in the combined cover between the years 2007 and 2012 (Figure 8.3). The density of sagebrush plants has decreased over time while average utilization has exhibited an overall increase (Figure 8.6, Figure 8.7).

The tree cover on South of Broons Canyon burned off in the 2009 fire and reduced the overall tree cover. The tree cover is contributed by Utah Juniper (*Juniperus osteosperma*). Few trees are present on the Magpie Canyon site (Figure 8.4).

Herbaceous Understory: These study sites are not particularly diverse, with high amounts of annual grass cover. The perennial grass and forbs components are limited. Cheatgrass (*Bromus tectorum*) is the dominant grass on the sites with bluebunch wheatgrass (*Pseudoroegneria spicata*) as the most prevalent perennial grass species. Annual grass cover on the sites has averaged 21 percent. Perennial forb cover has decreased through the study years, while annual forb cover has increased (Figure 8.8). Overall nested frequency has decreased for all components except bulbous bluegrass (*Poa bulbosa*) and annual forbs (Figure 8.9).

Occupancy: The primary occupants on these sites have been mule deer, with lesser utilization on both sites by elk and cattle. Deer pellet groups had a mean abundance ranging from 0 to 79 days use/acre. Elk pellet groups ranged from 0 to 6 days use/acre. Cattle usage varied from 0 to 8 days use/acre. Magpie Canyon has shown usage by cattle in both sample years, while South of Broons Canyon has only shown cattle usage in one year (Figure 8.10).

Upland (Sagebrush)

Four studies [South Palmer Point (18A-23), Salt Mountain Stock Pond (18A-24), Below Chokecherry Spring (18A-25), and Salt Mountain (18A-26)] are classified as Upland (Sagebrush) ecological sites. South Palmer

Point is located 1 mile north of Delle Ranch. Salt Mountain Stock Pond is located 2 miles south of Delle Ranch on Spring Pond Road. 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.

Shrubs/Trees: All of these studies were affected by the Big Pole fire in 2009, which removed burned most of the shrub component for all four studies. The dominant shrub species on these sites is broom snakeweed (*Gutierrezia sarothrae*), with cover averaging 2.3 percent in 2016. There are small amounts of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and rubber rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa* var. *speciosa*) still found on South Palmer Point and Below Chokecherry Spring (Figure 8.3). Both density and utilization of sagebrush have decreased overall (Figure 8.6, Figure 8.7).

While there was some Utah Juniper (*Juniperus osteosperma*) present on the Salt Mountain, South Palmer Point, and Salt Mountain Stock Pond studies, it was all removed in the 2009 fire (Figure 8.4).

Herbaceous Understory: While diversity of the herbaceous understories of these sites is relatively low, there are comparatively high levels of perennial grasses. The cover of annual grass has been high in multiple sample years, but abruptly decreased in 2016. The perennial grasses include crested wheatgrass (*Agropyron cristatum*) as a dominant component, which limits the diversity to some extent. Other perennial grasses found include bluebunch wheatgrass (*Pseudoroegneria spicata*), slender wheatgrass (*Elymus trachycaulus*), and western wheatgrass (*Pascopyrum smithii*). Overall, perennial grass cover has remained steady or increased. There is relatively low cover of perennial forbs overall, with the cover averaging 3.7 percent across the sample years (Figure 8.8).

Occupancy: The primary occupants of these study sites are deer and cattle. Most of the cattle usage is on the Below Chokecherry Spring and Salt Mountain Stock Pond studies. Deer usage appears to be relatively evenly distributed across all areas. Elk sign was noted on Below Chokecherry Spring, Salt Mountain, and Salt Mountain Stock Pond only in 2007. The usage of elk between sites in 2007 varied between 3.3 days use/acre on Salt Mountain to 21 days use/acre on Below Chokecherry Spring. Mean abundance of deer pellet groups has varied from 0.25 days use/acre in 2016 to 34 days use /acre in 2002. Cattle pellet group mean abundance has ranged from 1 day use/acre in 2012 to 19 days use/acre in 2007 (Figure 8.10).

Upland (Stansbury Cliffrose)

There are two studies [Deadman Canyon (18A-29), Hatch Ranch (18A-30)] that are classified as Upland (Stansbury Cliffrose) ecological sites. Deadman Canyon is located about 4 miles north of the town of Terra, which is on SR 199. Hatch Ranch is located about 3.75 miles south of the town of Terra.

Shrubs/Trees: The two studies have different vegetative characteristics, since Deadman Canyon burned in 2013, significantly reducing the shrub community. The Hatch Ranch study is dominated by Stansbury cliffrose (*Purshia stansburiana*) with Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) providing additional cover, but in significantly less amounts; cover of Stansbury cliffrose has generally increased as has the cover of Wyoming big sagebrush. The Deadman Canyon site did not have any shrubs present in cover for 2016 (Figure 8.3). The sagebrush populations on these studies have mainly been composed of mature individuals and have decreased in density over time (Figure 8.6). Average sagebrush utilization has fluctuated, but more than half of plants have shown signs of little to no use in all sample years (Figure 8.7).

Conifers, specifically Utah juniper (*Juniperus osteosperma*) are the dominant trees on the site. Their cover and density has remained stable, with a decrease in cover noted in 2016: this can likely be attributed to the fire (Figure 8.4, Figure 8.5).

Herbaceous Understory: The herbaceous understories of these sites are composed of a mix of annual and perennial grasses, with very few perennial forbs present. Cheatgrass (*Bromus tectorum*) and red brome (*B.*

rubens) are the most common annual grasses on both sites. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is the major component of the understory of the Deadman Canyon study, and is present in smaller amounts at the Hatch Ranch study. Deadman Canyon is in a perennial grassland state and mostly composed of bluebunch wheatgrass with little cover attributed to shrubs. Annual forb cover has fluctuated throughout the study, and has made up a significant part of the understory in some years (Figure 8.8). Average overall nested frequency has increased over time, a trend that is driven by an increase in annual grasses and forbs (Figure 8.9).

Occupancy: The primary occupants on both studies are mule deer, with elk and cattle only present in some years. The mean abundance of deer pellet groups has varied from 4 days use/acre in 2012 to 44 days use/acre in 2002; the number of deer pellet groups has generally decreased over time. Cattle pellet groups were only sampled in 2016 with a mean abundance of 5.7 days use/acre and were only noted on the Hatch Ranch study. Elk were noted on Deadman Canyon in 2007 and Hatch Ranch in 2016; in 2007, the mean abundance was 0.6 days use/acre and in 2016 the mean abundance was1.3 days use/acre (Figure 8.10).

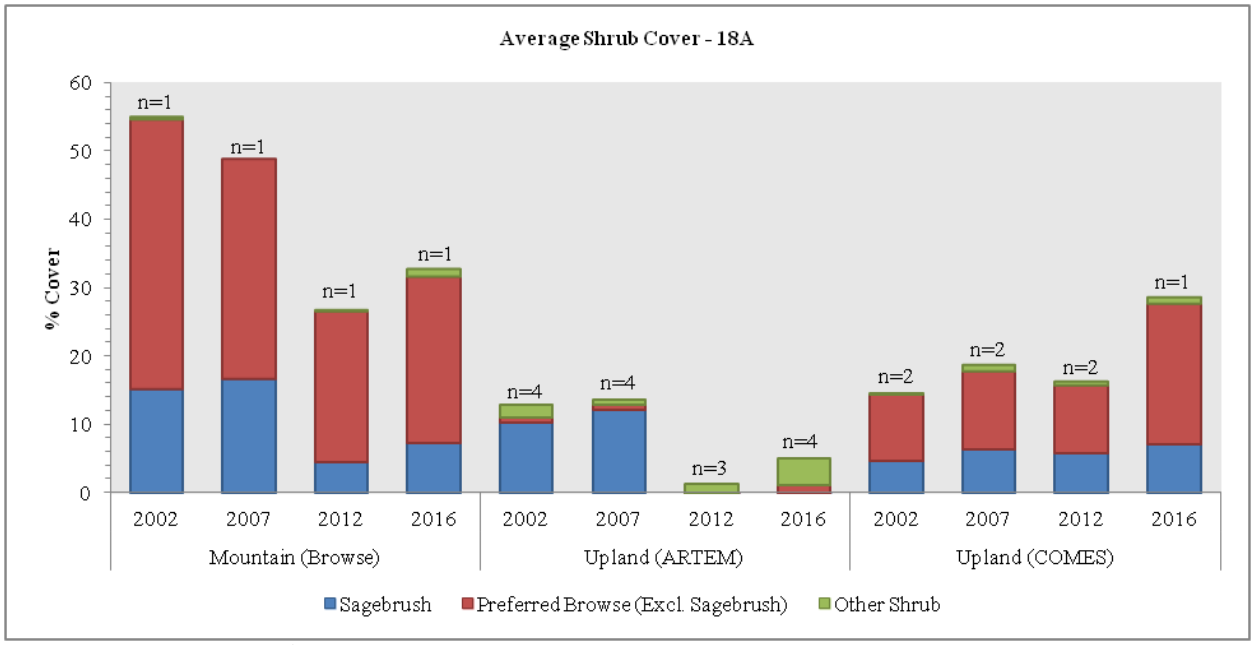


Figure 8.3: Average shrub cover for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

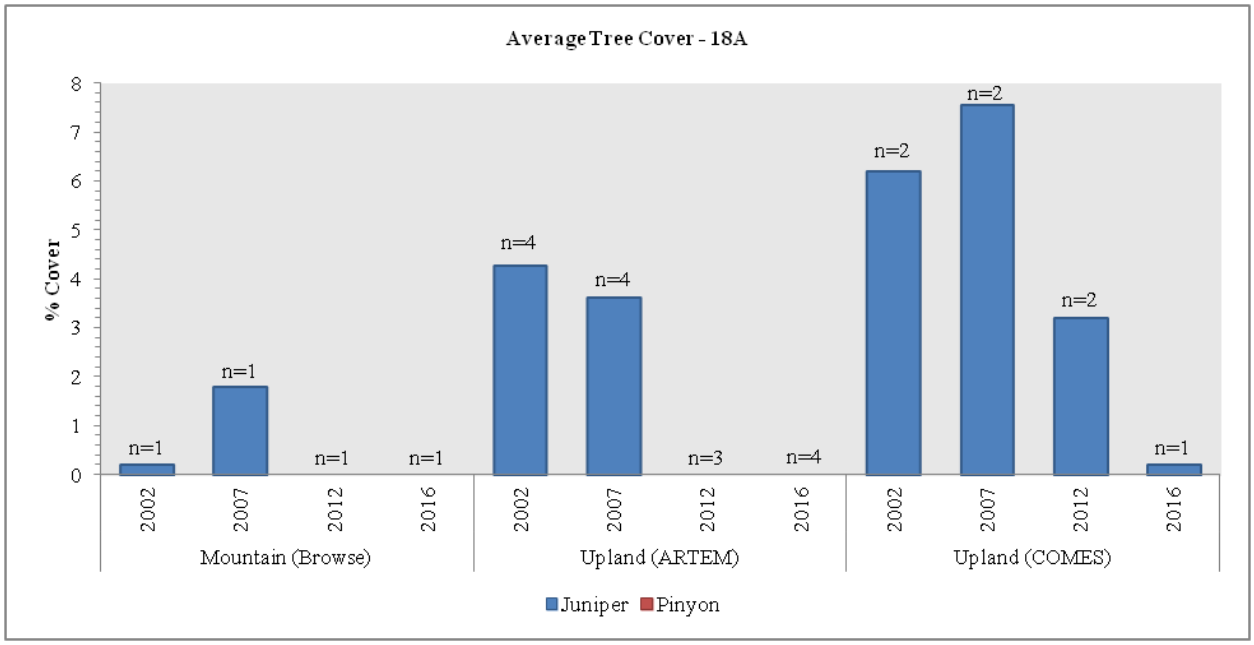


Figure 8.4: Average tree cover for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

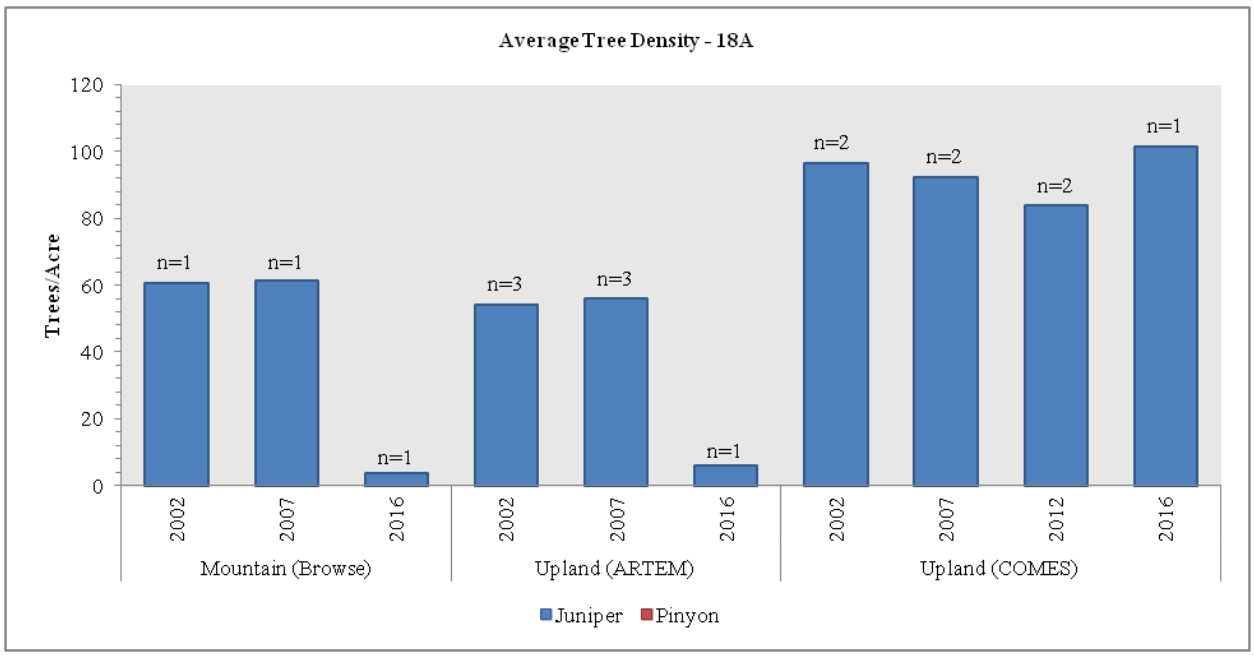


Figure 8.5: Average tree density for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

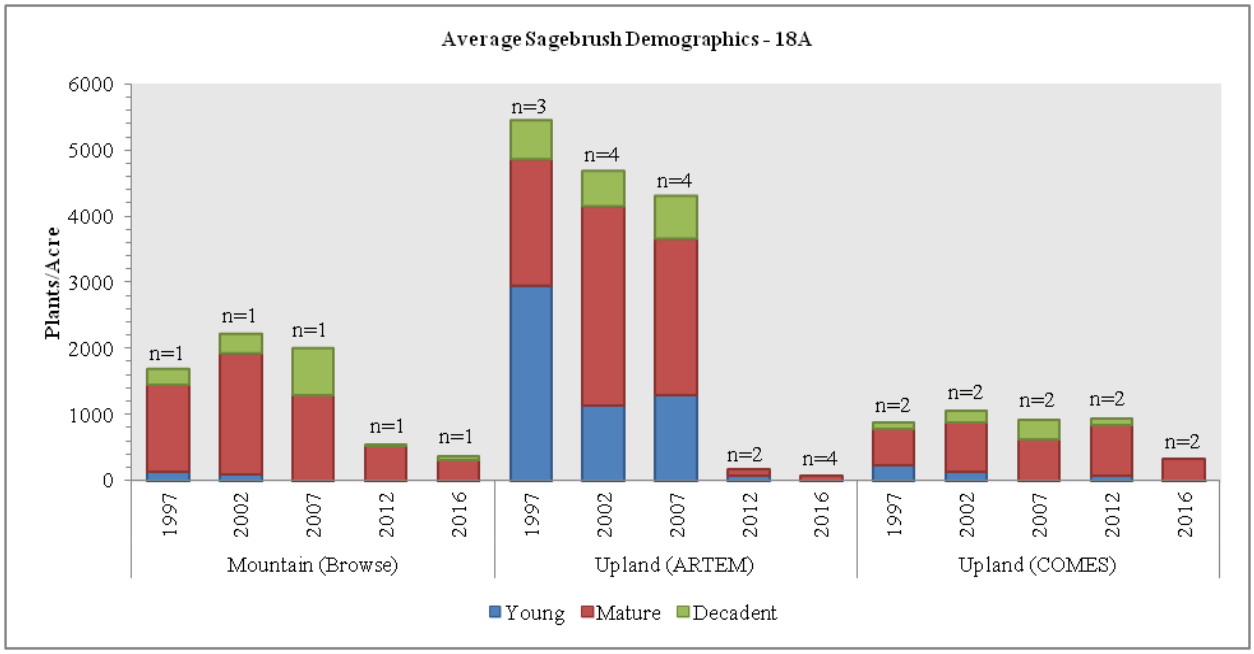


Figure 8.6: Average sagebrush demographics for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

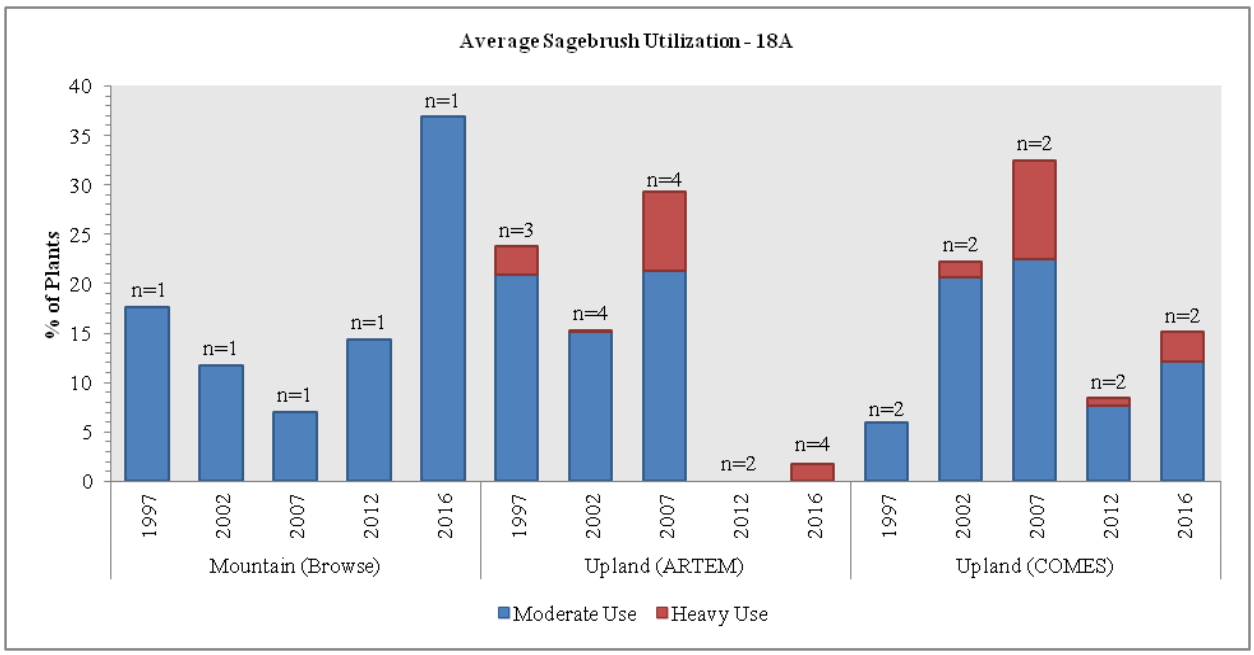


Figure 8.7: Average sagebrush utilization for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

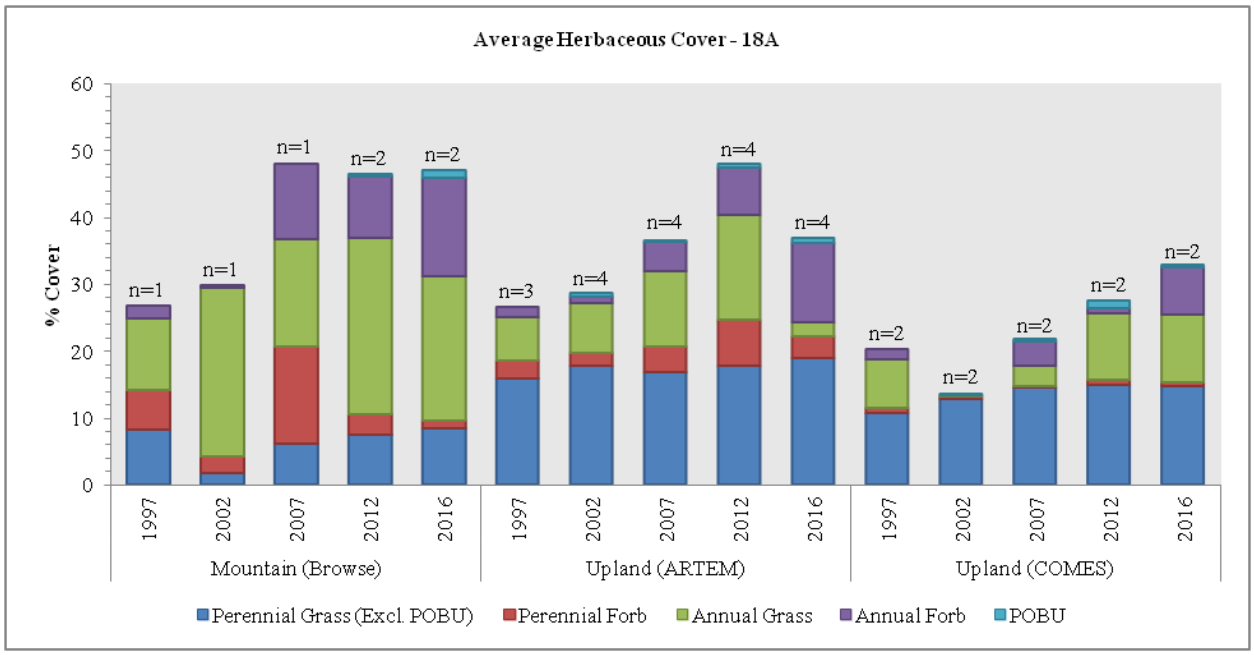


Figure 8.8: Average herbaceous cover for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

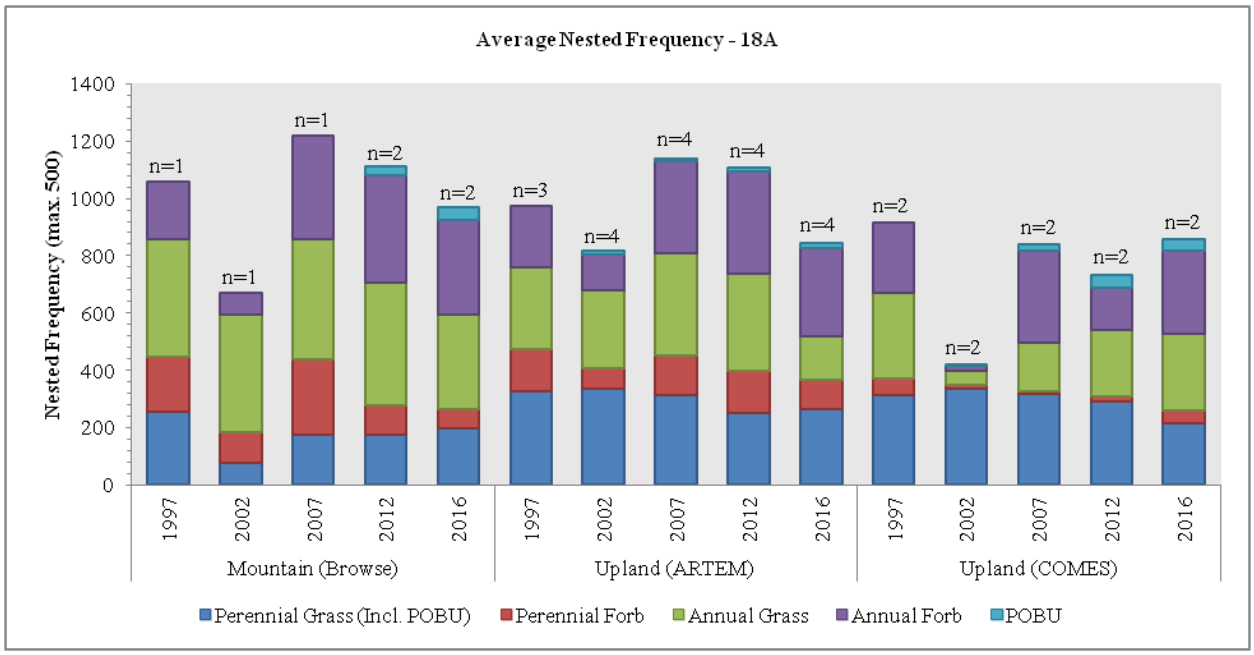


Figure 8.9: Average nested frequency of herbaceous species for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

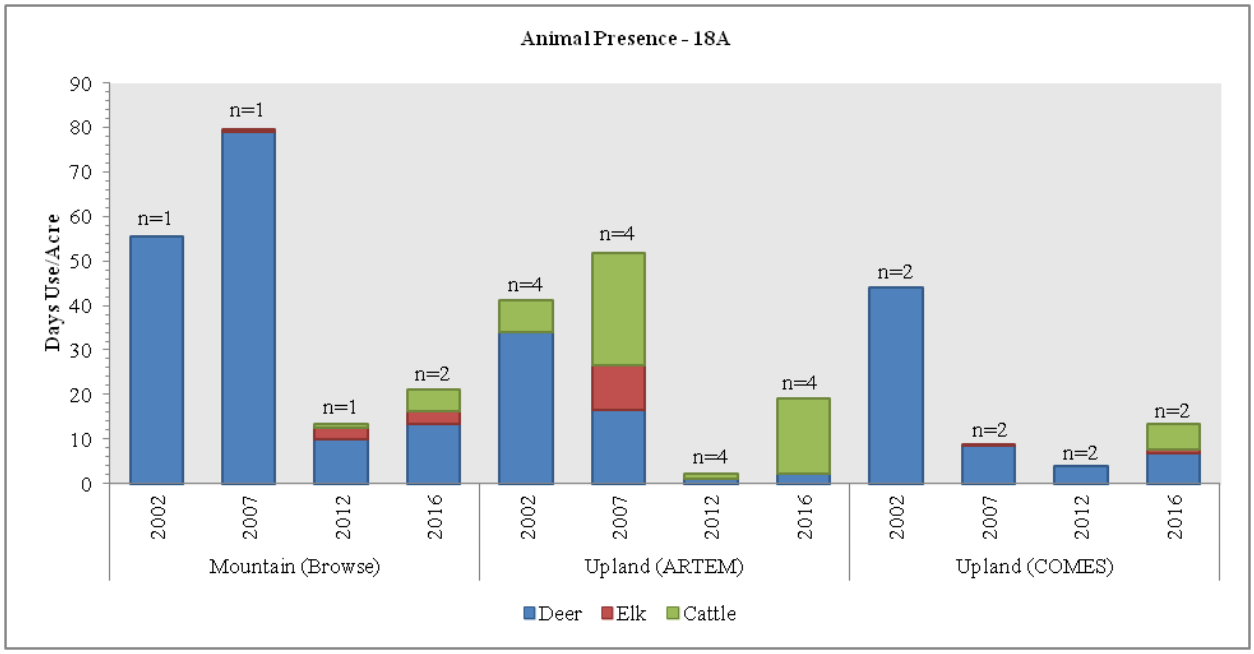
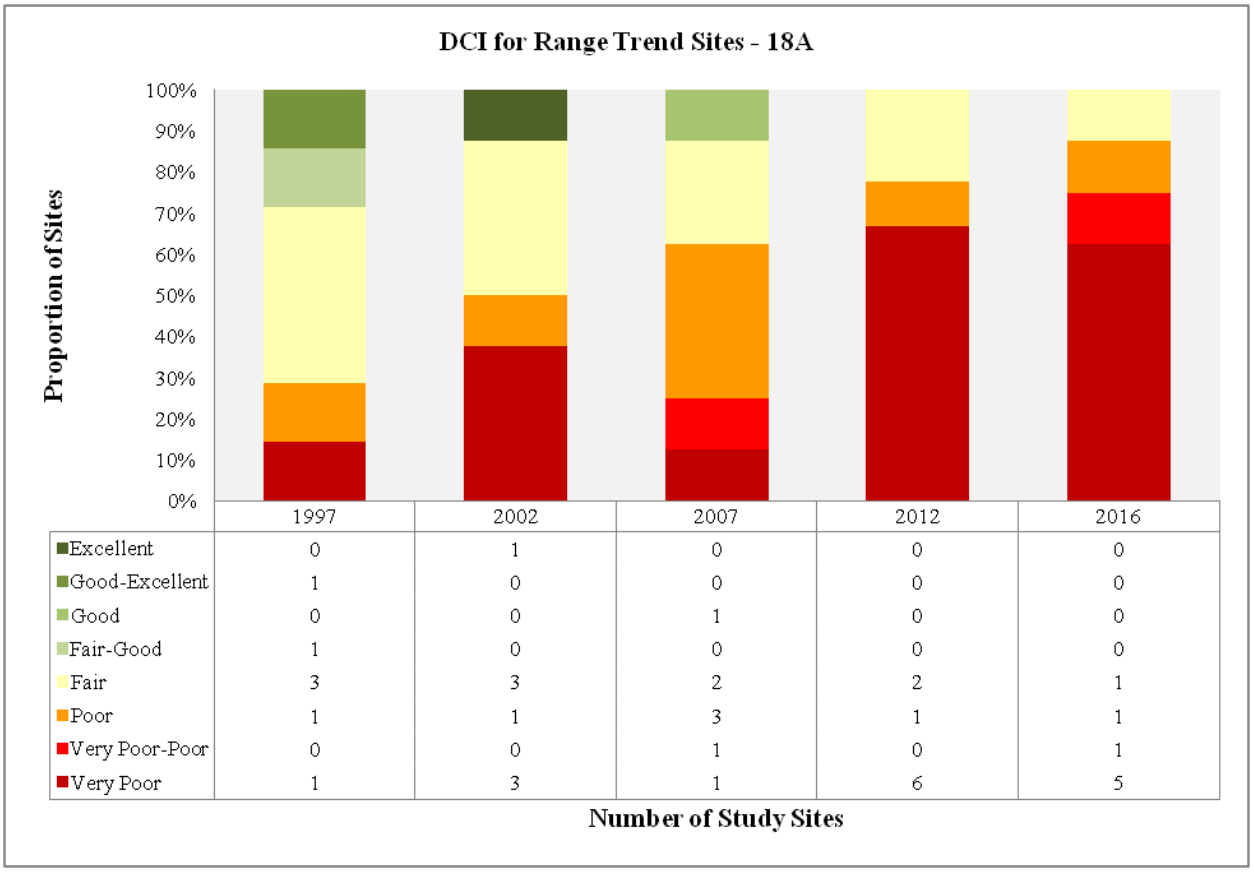


Figure 8.10: Average pellet transect data for Mountain (Browse), Upland (ARTEM), and Upland (COMES) study sites in WMU 18A, Stansbury Oquirrh-Stansbury.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Stansbury Oquirrh-Stansbury management unit has continually changed on the sites sampled since 1997. The Range Trend sites sampled within the unit are considered to be in very poor to fair condition as of the most recent sample year (Figure 8.11, Map 8.13). Below Chokecherry Spring improved from very poor to poor condition and Magpie Canyon remained in fair condition. The South Palmer Point, Salt Mountain Stock Pond, Salt Mountain, South of Broons Canyon, Deadman Canyon, Hatch Ranch, and East Hickman Canyon studies are considered to be in very poor or very poor-poor condition generally due to the lack of browse cover and sagebrush diversity. The disturbed study sites range from very poor to poor (Figure 8.12); all of these studies – South Palmer Point, Salt Mountain Stock Pond, Below Chokecherry Spring, Salt Mountain, South of Broons Canyon, Deadman Canyon, and Hatch Ranch – are also considered to be Range Trend sites and are therefore discussed above. It is possible given more time, continual monitoring, and further rehabilitation when necessary that these sites will improve.



	1997	2002	2007	2012	2016
Excellent	0	1	0	0	0
Good-Excellent	1	0	0	0	0
Good	0	0	1	0	0
Fair-Good	1	0	0	0	0
Fair	3	3	2	2	1
Poor	1	1	3	1	1
Very Poor-Poor	0	0	1	0	1
Very Poor	1	3	1	6	5

Figure 8.11: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 18A, Stansbury Oquirrh-Stansbury.

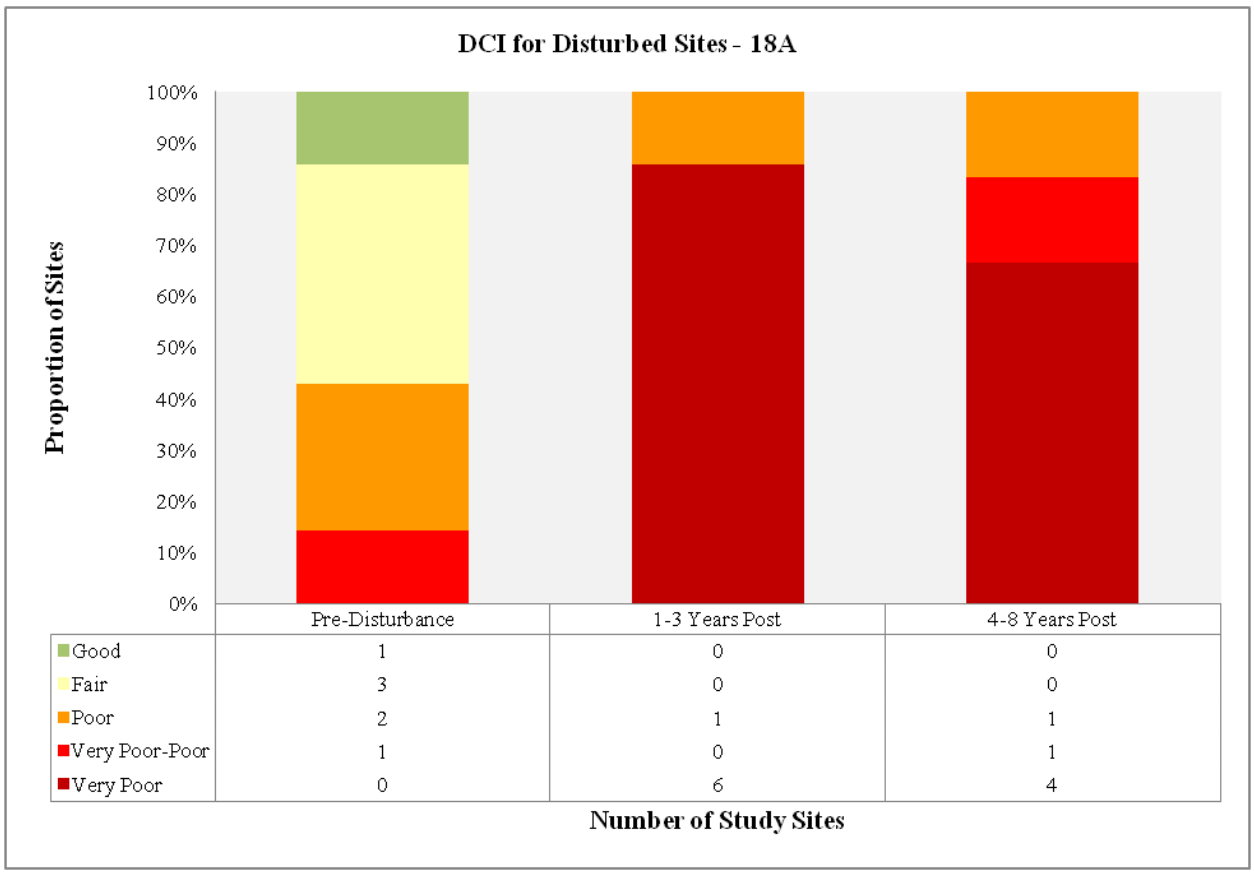


Figure 8.12: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 18A, Stansbury Oquirrh-Stansbury.

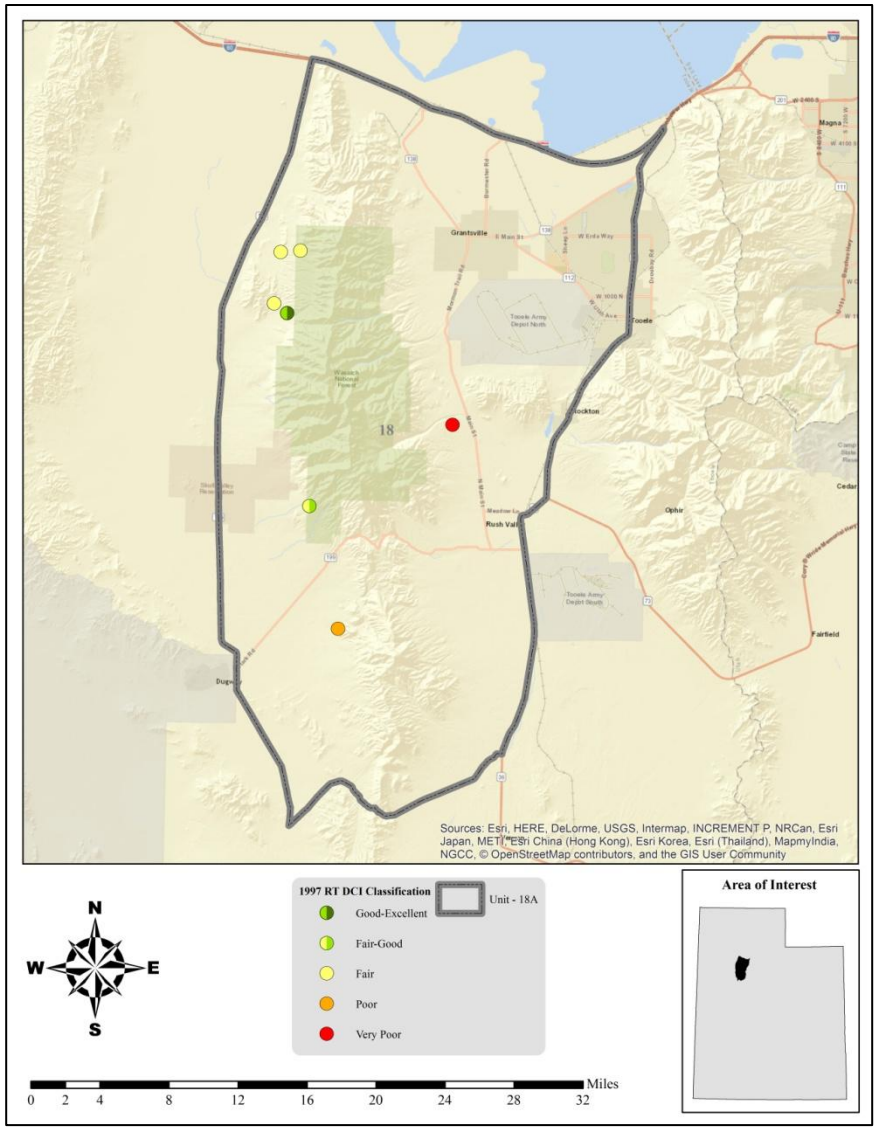
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
18A-23	1997	14.8	9.0	15.0	17.1	-6.5	4.4	0.0	**53.8**	**F**
18A-23	2002	11.9	9.3	15.0	18.6	-9.6	0.9	0.0	**46.1**	**P**
18A-23	2007	14.4	12.6	15.0	17.6	-13.7	9.1	0.0	**55.1**	**F**
18A-23	2012	0.7	0.0	0.0	10.6	-12.7	10.0	-2.0	**6.5**	**VP**
18A-23	2016	2.0	0.0	0.0	10.6	-0.6	5.2	-2.0	**15.2**	**VP**
18A-24	1997	12.0	5.1	9.0	30.0	-1.4	1.7	0.0	**56.4**	**F**
18A-24	2002	10.1	5.7	11.0	30.0	-1.7	0.1	0.0	**55.2**	**F**
18A-24	2007	9.7	4.5	3.5	30.0	-3.5	8.7	0.0	**52.9**	**F**
18A-24	2012	0.0	0.0	0.0	30.0	-2.7	4.0	0.0	**31.3**	**VP**
18A-24	2016	0.0	0.0	0.0	30.0	-0.2	4.0	0.0	**33.9**	**VP-P**
18A-25	1997	19.6	14.1	15.0	30.0	-7.0	10.0	0.0	**81.7**	**G-E**
18A-25	2002	23.2	13.6	13.4	30.0	-5.0	10.0	0.0	**85.1**	**E**
18A-25	2007	24.5	9.9	1.0	30.0	-3.1	10.0	0.0	**72.3**	**G**
18A-25	2012	0.2	0.0	0.0	30.0	-12.0	10.0	0.0	**28.2**	**VP**
18A-25	2016	1.6	0.0	0.0	30.0	-4.4	10.0	0.0	**37.2**	**P**
18A-26	2002	4.8	0.0	0.0	23.9	-6.4	0.0	0.0	**22.2**	**VP**
18A-26	2007	6.9	12.7	7.7	23.2	-13.7	0.0	0.0	**36.8**	**VP-P**
18A-26	2012	0.0	0.0	0.0	20.3	-19.7	3.8	0.0	**4.4**	**VP**
18A-26	2016	0.0	0.0	0.0	27.6	-1.6	5.6	0.0	**31.6**	**VP**
18A-27	1997	30.0	13.5	2.4	16.4	-8.1	10.0	0.0	**64.1**	**F**
18A-27	2002	30.0	11.9	1.0	3.4	-19.1	5.1	0.0	**32.4**	**VP**
18A-27	2007	30.0	9.4	0.8	12.4	-12.0	10.0	0.0	**50.5**	**P**
18A-27	2012	0.0	0.0	0.0	6.4	-20.0	9.0	0.0	**-4.6**	**VP**
18A-27	2016	0.0	0.0	0.0	8.0	-20.0	0.6	0.0	**-11.4**	**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
18A-29	1997	10.8	14.6	13.6	30.0	-4.7	2.0	0.0	**66.2**	**F-G**
18A-29	2002	10.4	13.3	3.6	30.0	0.0	0.0	0.0	**57.2**	**F**
18A-29	2007	8.3	2.3	0.0	30.0	-1.3	0.4	0.0	**39.7**	**P**
18A-29	2012	11.0	11.6	4.3	30.0	-1.3	0.4	0.0	**56.0**	**F**
18A-29	2016	0.0	0.0	0.0	30.0	-6.2	1.0	0.0	**24.8**	**VP**
18A-30	1997	17.9	10.8	9.1	12.2	-6.1	0.9	0.0	**44.8**	**P**
18A-30	2002	22.2	11.9	6.0	15.2	-0.3	0.7	0.0	**55.6**	**F**
18A-30	2007	18.7	9.9	2.0	17.5	-3.3	0.3	0.0	**45.1**	**P**
18A-30	2012	17.8	11.0	6.8	14.3	-13.9	2.2	0.0	**38.1**	**P**
18A-30	2016	17.3	12.2	4.5	4.2	-9.2	0.8	0.0	**29.9**	**VP**
18A-32	1997	0.2	0.0	0.0	15.4	-0.1	1.2	0.0	**16.8**	**VP**
18A-32	2002	0.0	0.0	0.0	30.0	-0.6	1.3	0.0	**30.8**	**VP**
18A-32	2007	0.1	0.0	0.0	30.0	-0.3	0.7	0.0	**30.5**	**VP**
18A-32	2012	0.1	0.0	0.0	30.0	0.0	0.7	0.0	**30.8**	**VP**
18A-35	2012	30.0	13.2	0.6	23.4	-9.9	7.1	-2.0	**62.3**	**F**
18A-35	2016	25.8	12.9	1.8	25.6	-8.7	4.4	-2.0	**59.8**	**F**

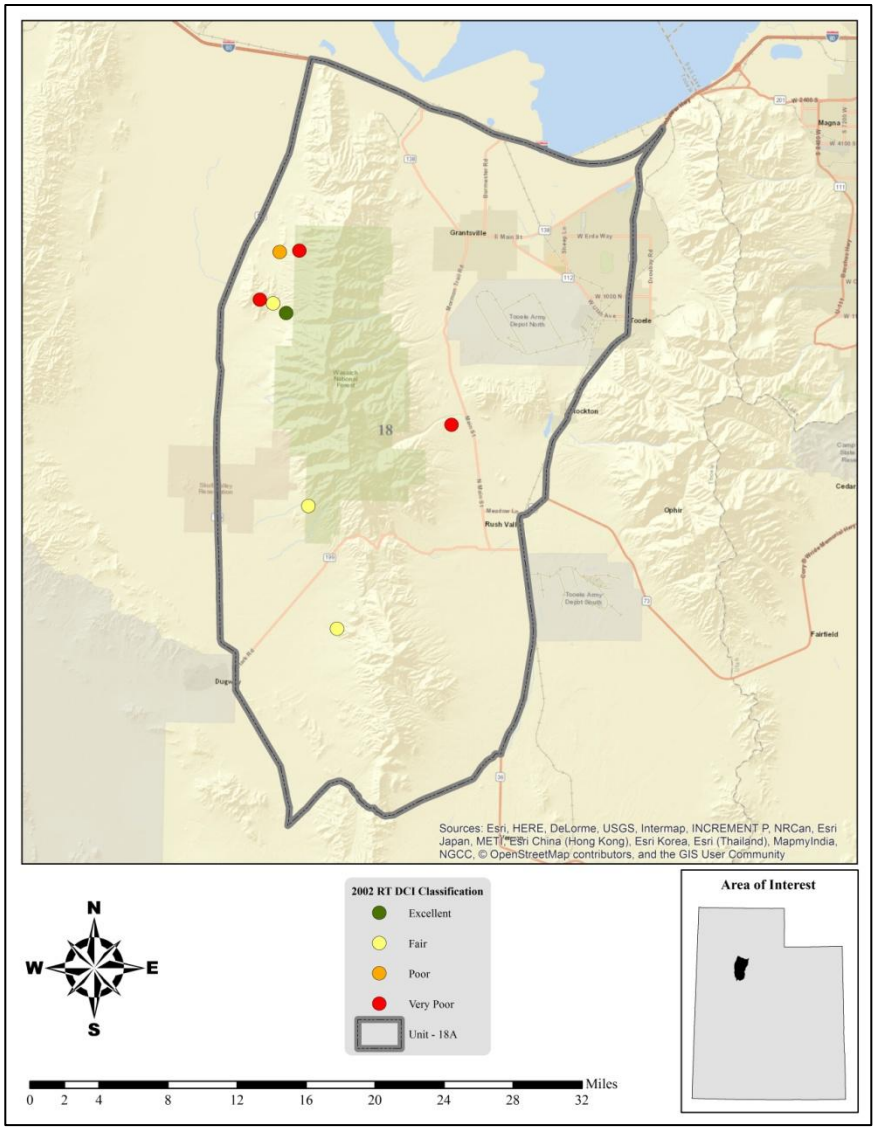
Table 8.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 18A, Stansbury Oquirrh-Stansbury. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

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
18R-1	2004	1.5	0.0	0.0	11.6	0.0	0.8	0.0	**13.9**	**VP**
18R-1	2013	2.6	0.0	0.0	30.0	-1.0	4.8	0.0	**36.4**	**VP-P**
18R-1	2016	9.6	15.0	10.2	30.0	-1.4	4.6	0.0	**68.0**	**G**
18R-2	2005	0.5	0.0	0.0	15.6	-0.1	0.8	0.0	**16.8**	**VP**
18R-2	2008	1.3	0.0	0.0	27.6	0.0	4.6	0.0	**33.5**	**VP-P**
18R-2	2012	1.9	0.0	0.0	30.0	-0.3	5.6	0.0	**37.2**	**P**
18R-3	2005	2.7	0.0	0.0	24.2	-0.1	1.2	0.0	**28.0**	**VP**
18R-3	2008	0.8	0.0	0.0	28.0	-0.1	2.2	0.0	**30.9**	**VP**
18R-3	2012	3.6	0.0	0.0	30.0	-0.1	3.6	0.0	**37.1**	**P**
18R-4	2006	21.6	7.7	1.0	21.6	-0.2	3.0	0.0	**54.7**	**F**
18R-4	2010	8.4	10.1	4.4	19.6	-0.2	4.2	0.0	**46.5**	**P**
18R-4	2014	17.3	14.4	4.7	30.0	-3.2	1.8	0.0	**65.0**	**F-G**
18R-6	2007	16.2	-5.4	2.1	3.2	-2.1	0.6	0.0	**14.7**	**VP**
18R-6	2010	9.8	12.9	6.5	16.6	-20.0	1.6	0.0	**27.4**	**VP**
18R-6	2014	14.8	13.5	1.0	30.0	-3.8	3.8	0.0	**59.3**	**F**
18R-7	2008	0.2	0.0	0.0	6.7	-0.2	0.2	0.0	**6.9**	**VP**
18R-7	2011	0.0	0.0	0.0	26.8	-1.8	10.0	0.0	**34.9**	**VP-P**
18R-7	2015	0.0	0.0	0.0	30.0	0.0	5.3	0.0	**35.3**	**VP-P**
18R-8	2008	0.0	0.0	0.0	6.4	0.0	0.9	0.0	**7.2**	**VP**
18R-8	2011	0.0	0.0	0.0	28.0	-0.4	10.0	0.0	**37.6**	**P**
18R-8	2015	0.0	0.0	0.0	30.0	-5.8	2.1	0.0	**26.3**	**VP**
18R-9	2015	0.0	0.0	0.0	18.8	-1.4	2.8	0.0	**20.3**	**VP**

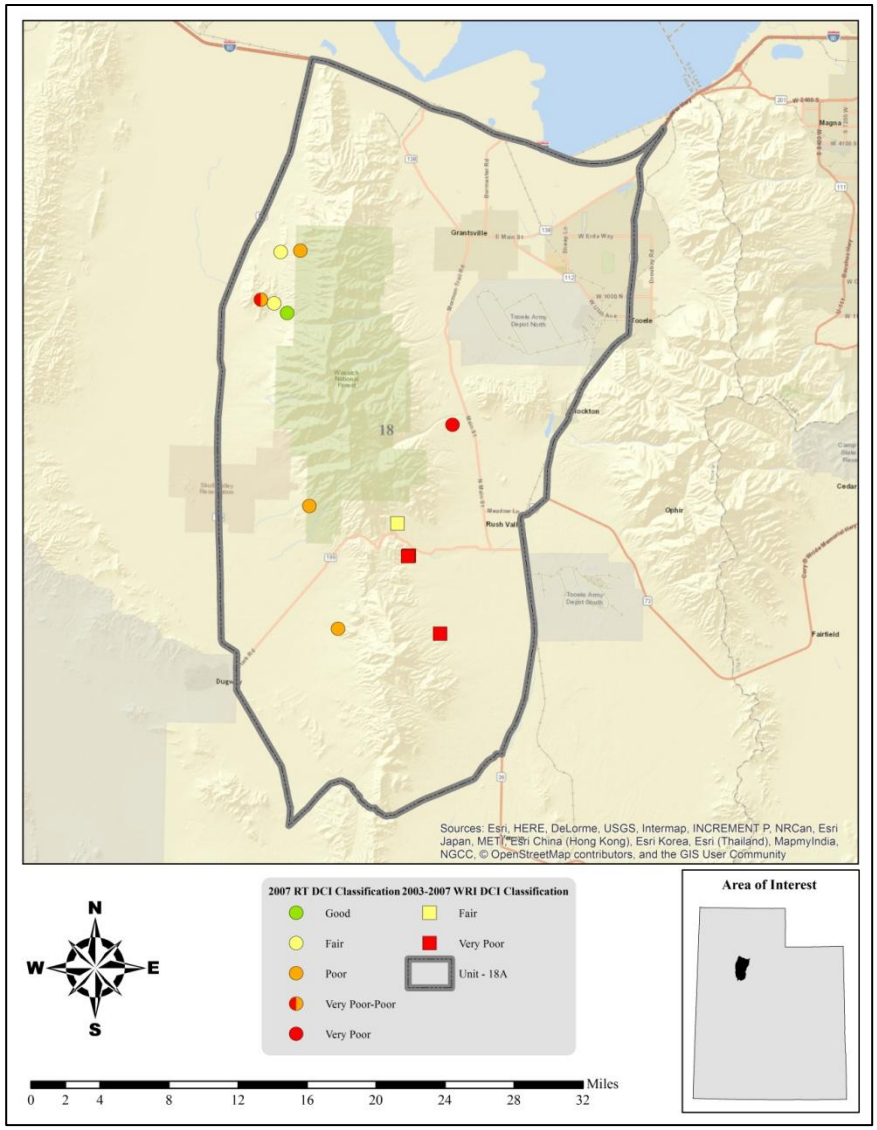
Table 8.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 18A, Stansbury Oquirrh-Stansbury. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



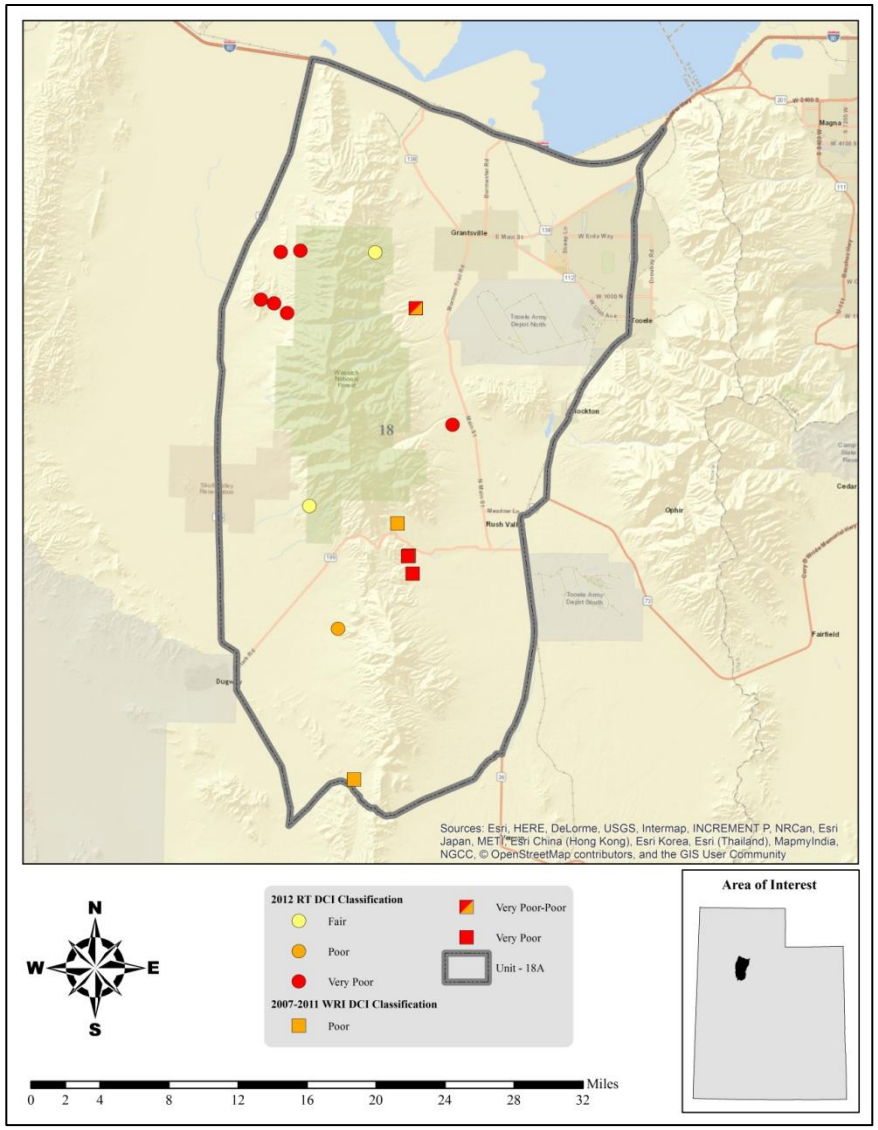
Map 8.9: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 18A, Stansbury Oquirrh-Stansbury.



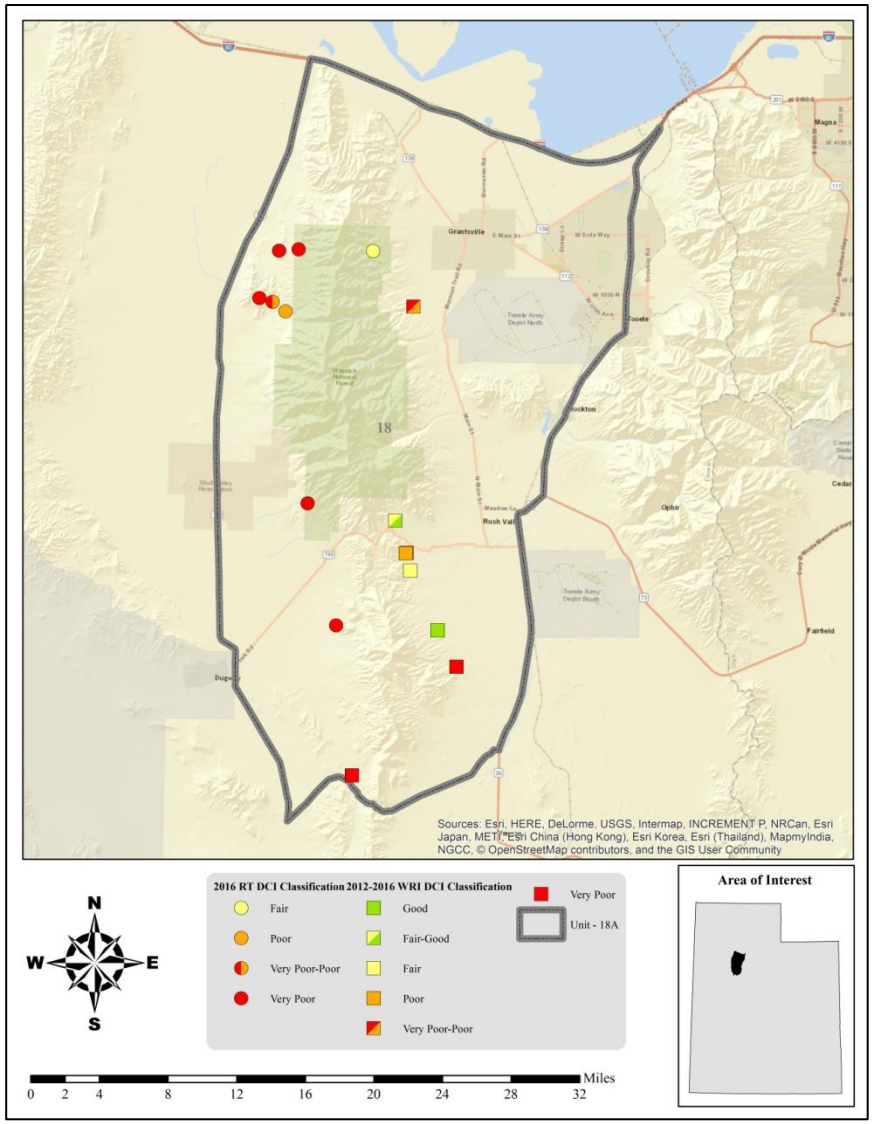
Map 8.10: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.11: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.12:2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 18A, Stansbury Oquirrh-Stansbury.



Map 8.13: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 18A, Stansbury Oquirrh-Stansbury.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
18A-23	South Palmer Point	Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
18A-24	Salt Mountain Stock Pond	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
18A-25	Below Chokecherry Spring	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
18A-26	Salt Mountain	Annual Grass	Low	Increased fire potential
18A-27	South of Broons Canyon	Annual Grass	High	Increased fire potential
18A-29	Deadman Canyon	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
18A-30	Hatch Ranch	Annual Grass	High	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18A-32	East Hickman Canyon	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18A-35	Magpie Canyon	Annual Grass	High	Increased fire potential
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18R-1	East Onaqui	Annual Grass	Low	Increased fire potential
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18R-2	Clover Bullhog Drill	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
18R-3	Clover Bullhog Aerial	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
18R-4	Big Hollow Bullhog	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
18R-6	Clover Creek Dry Farm	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18R-7	Grantsville Chaining	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18R-8	West Onaqui Bullhog	Annual Grass	Moderate	Increased fire potential
18R-9	East Faust Creek	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor

Table 8.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 18A, Stansbury Oquirrh-Stansbury. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Browse)

The high elevation mountain study sites of this ecological type support or used to support mountain browse communities and are generally considered to be in poor to fair condition for deer winter range habitat on the Stansbury Oquirrh-Stansbury management unit. Although a browse component is present on the Magpie Canyon study, a fire on the South of Broons Canyon study removed the shrub overstory. Annual grasses are present in significant amounts on these sites, increasing fuel loads and heightening the potential for (additional) wildfire(s). In addition, noxious weed species and introduced perennial grasses are present in the understory of the Magpie Canyon study and have the potential to reduce the prevalence and abundance of other more desirable grass and forb species. Conifer encroachment is another concern on this site: if tree cover and density increase in the future, understory shrub and herbaceous health could be threatened.

It is recommended that monitoring of this community continue. Treatments to reduce annual grass loads may be necessary. 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. Treatment to reduce conifer may be necessary in the future using methods that will not increase annual grass cover.

Upland (Sagebrush)

The mid elevation study sites classified as being of the Upland (Sagebrush) ecological type are considered to be in very poor to poor condition. Prior to burning in the Big Pole fire in 2009, these sites supported sagebrush

communities that provided valuable browse during the winter: much of the shrub cover was removed during the burn. Annual grasses – namely cheatgrass – are of some concern on the Below Chokecherry Spring and Salt Mountain studies, the presence of which can increase fuel loads and exacerbate the risk of wildfire. In addition, introduced perennial grasses are present on the Salt Mountain Stock Pond and Below Chokecherry Spring studies. Although these grasses can provide valuable forage, they can often be aggressive at higher elevations and outcompete more desirable herbaceous species. Finally, noxious weed species are a concern on the South Palmer Point study site, as they can also be aggressive and reduce the prevalence and abundance of other more desirable grass and forb species.

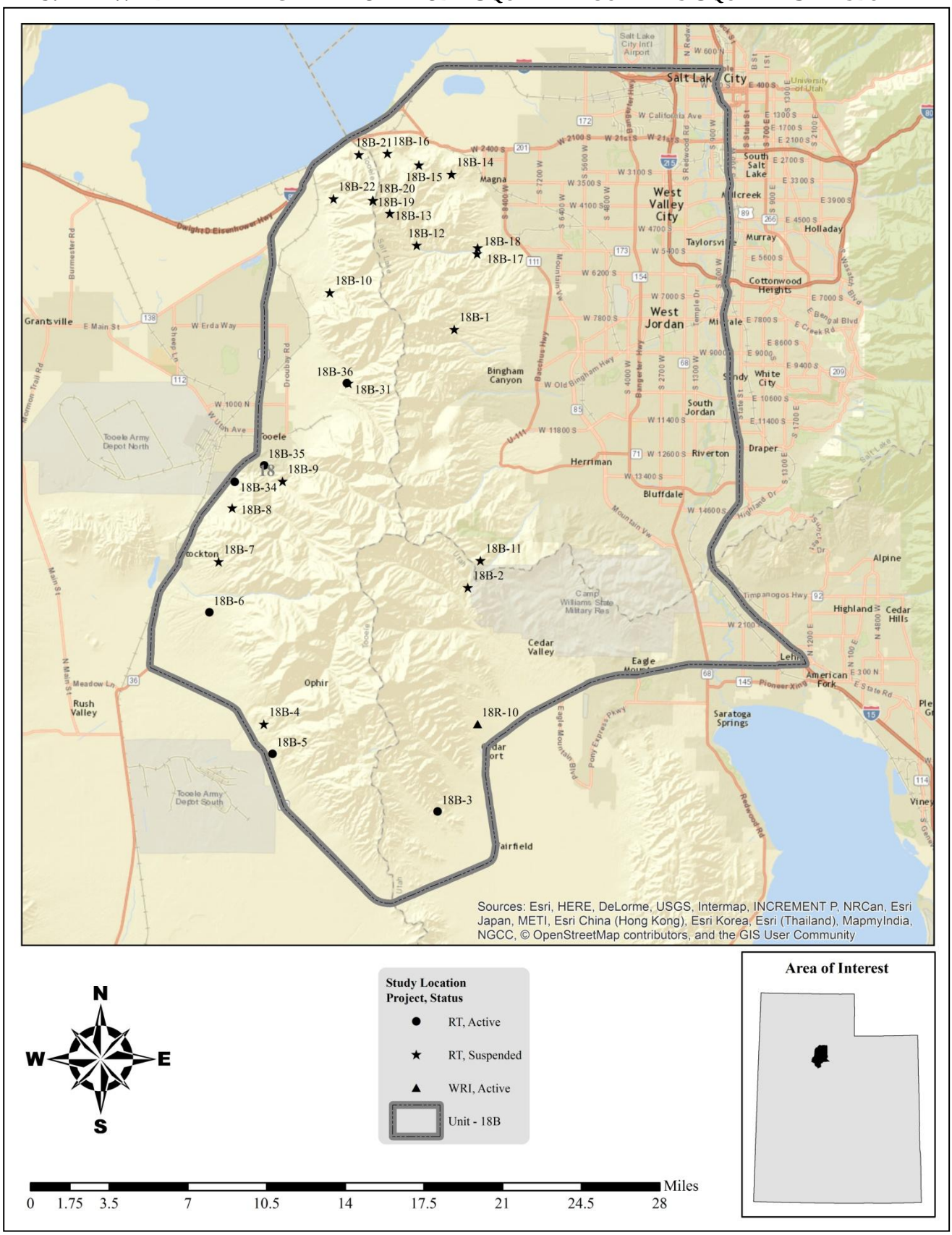
It is recommended that monitoring of these study sites continue. Treatments to reduce annual grass loads may be needed in the future. If reseeding is deemed necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native species whenever possible.

Upland (Stansbury Cliffrose)

The mid elevation study sites of the Upland (Stansbury Cliffrose) ecological type are generally considered to be in very poor condition. These studies support or supported shrub communities that provide(d) valuable browse for wildlife. Annual grasses, primarily cheatgrass and/or red brome, are of moderate to high concern on these sites, as they increase fuel loads and exacerbate the risk of wildfire. The herbaceous understory of the Deadman Canyon study also contains introduced perennial grasses, which have the potential to be aggressive and reduce the prevalence and abundance of other, more desirable native grass and forb species. Finally, the Hatch Ranch study has the potential to be encroached by pinyon and juniper trees, which may reduce understory shrub and herbaceous health if not addressed.

It is suggested that monitoring of these communities continue. Treatments to reduce annual grass cover may be required in the future. When/if necessary, further work to prevent and/or reduce infilling by pinyon and juniper (e.g. bullhog, chaining, lop and scatter, etc.) should begin on the Hatch Ranch study; treatment methods should be selected with caution so as not to increase annual grass loads. Finally, if reseeding is necessary to restore understory health, care should be taken in species selection and preference should be given to native species when possible.

9. WILDLIFE MANAGEMENT UNIT 18B – OQUIRRH MOUNTAINS OQUIRRH-STANSBURY



WILDLIFE MANAGEMENT UNIT 18B – OQUIRRH MOUNTAINS OQUIRRH-STANSBURY

Boundary Description

Salt Lake, Utah, and Tooele counties – Boundary begins at the junction of Interstate-15 and I-80 in Salt Lake City; south on I-15 to SR-73; west on SR-73 to SR-36; north on SR-36 to Middle Canyon Road; east on Middle Canyon Road to the Tooele-Salt Lake county boundary; north along the Tooele-Salt Lake county boundary (Oquirrh Mountains ridge line) to Lake Point and I-80; east on I-80 to I-15 and beginning point.

Management Unit Description

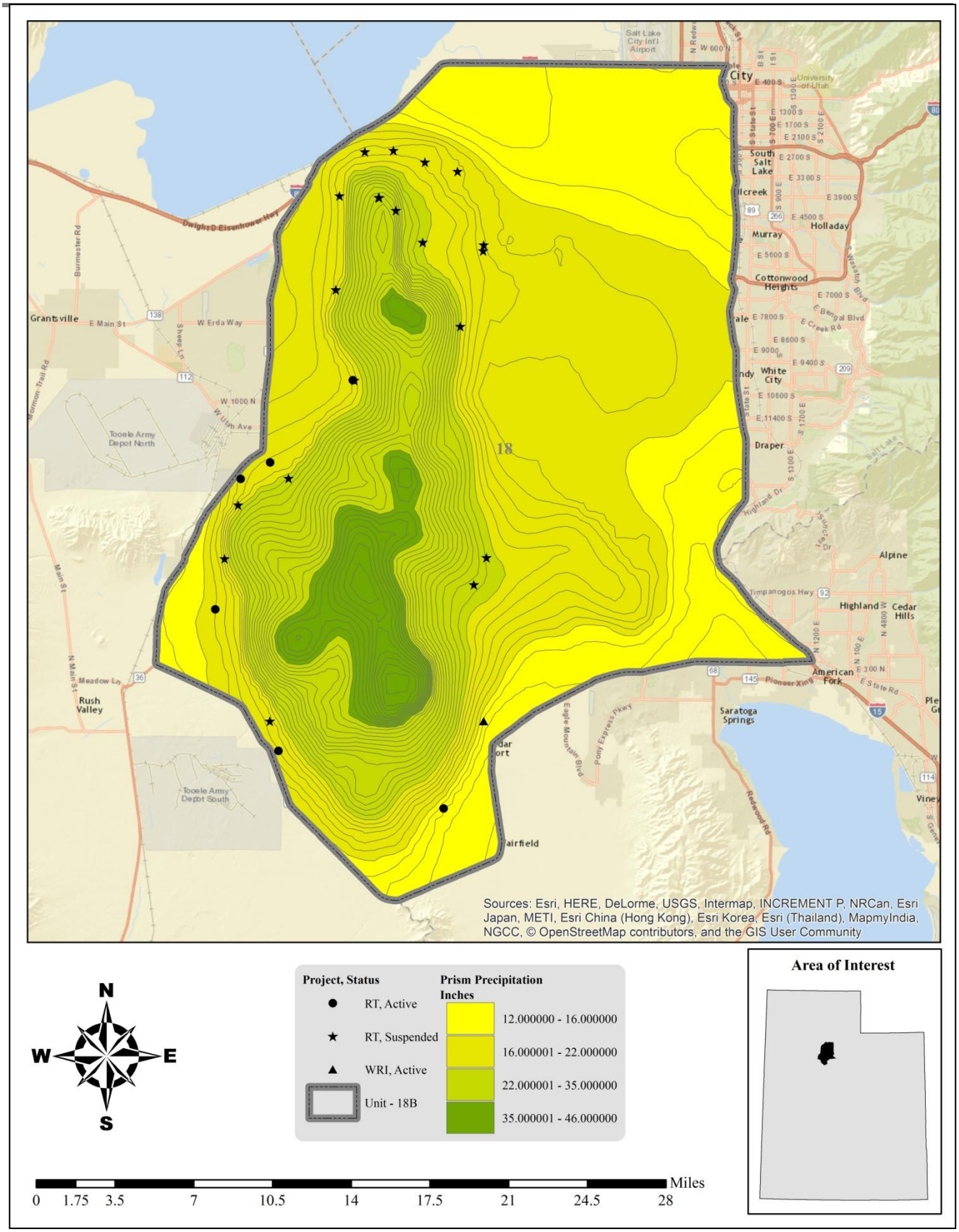
Geography

The Oquirrh Mountains Oquirrh-Stanbury management contains the easternmost portion of Tooele county, the western half of Salt Lake county, and the northwest corner of Utah county. This unit encompasses the Oquirrh Mountains, with Tooele Valley to the west, the Great Salt Lake to the north, the Wasatch Mountains in the east, and Utah Lake and the Lake Mountains to the south. Major drainages include, but are not limited to, Soldier Creek, Ophir Creek, and West Canyon Wash. Elevation ranges from just over 4,000 feet near Salt Lake City and the surrounding area to over 10,000 feet on the peaks of the Oquirrh Mountains. Communities within the unit are numerous and include, among others, Cedar Fort and portions of Tooele, Stockton, Lehi, and Salt Lake City.

Climate Data

The 30 year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 12 inches near Fairfield to 46 inches on the southern peaks of the Oquirrh Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 15-23 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 North Central division (Division 3). 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, 1997-1998, 2005, and 2011 (Figure 9.1a). 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 1982-1986, 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 9.1b) (Time Series Data, 2017).



Map 9.1: The 1981-2010 PRISM Precipitation Model for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury (PRISM Climate Group, Oregon State University, 2013).

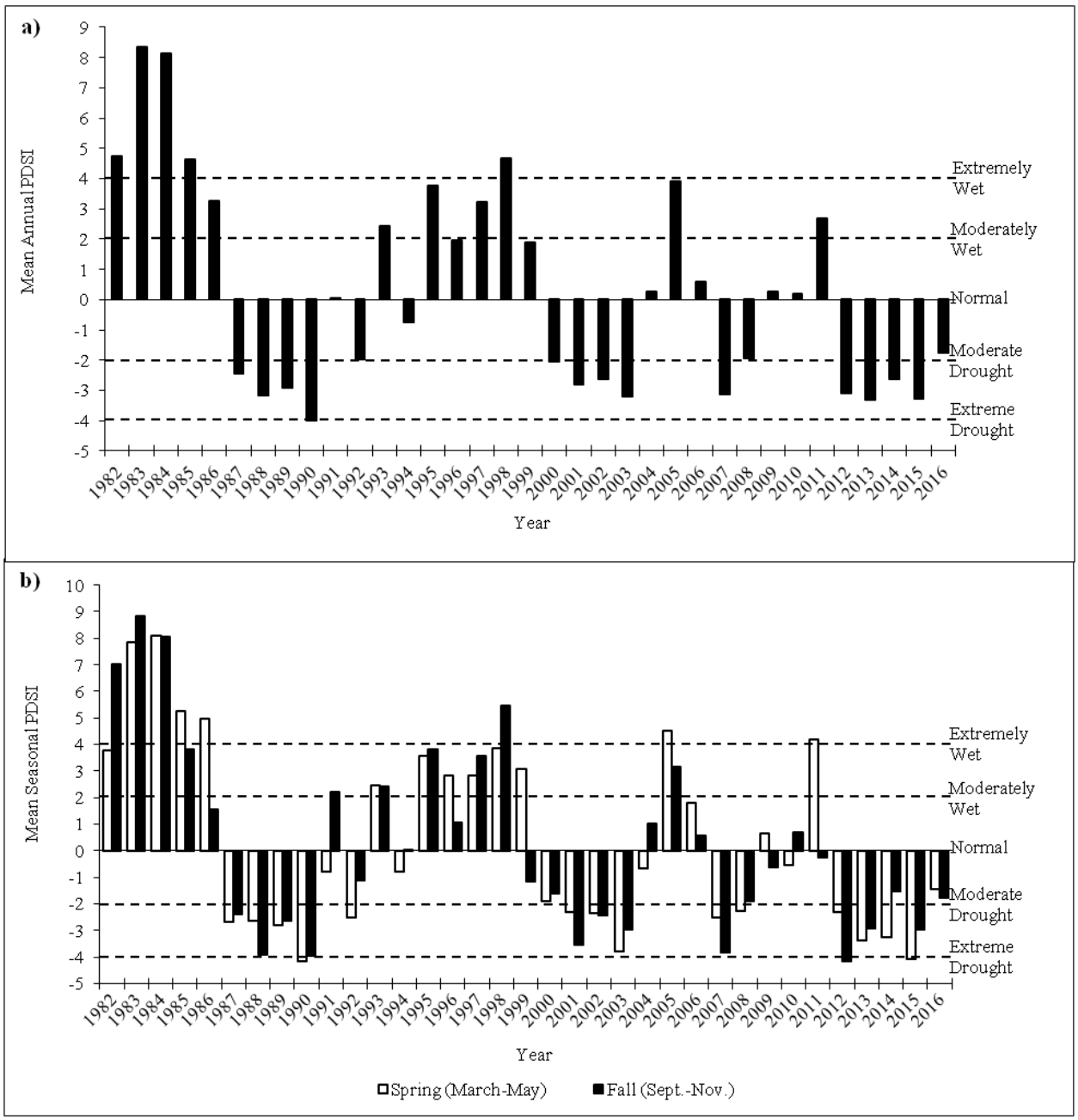
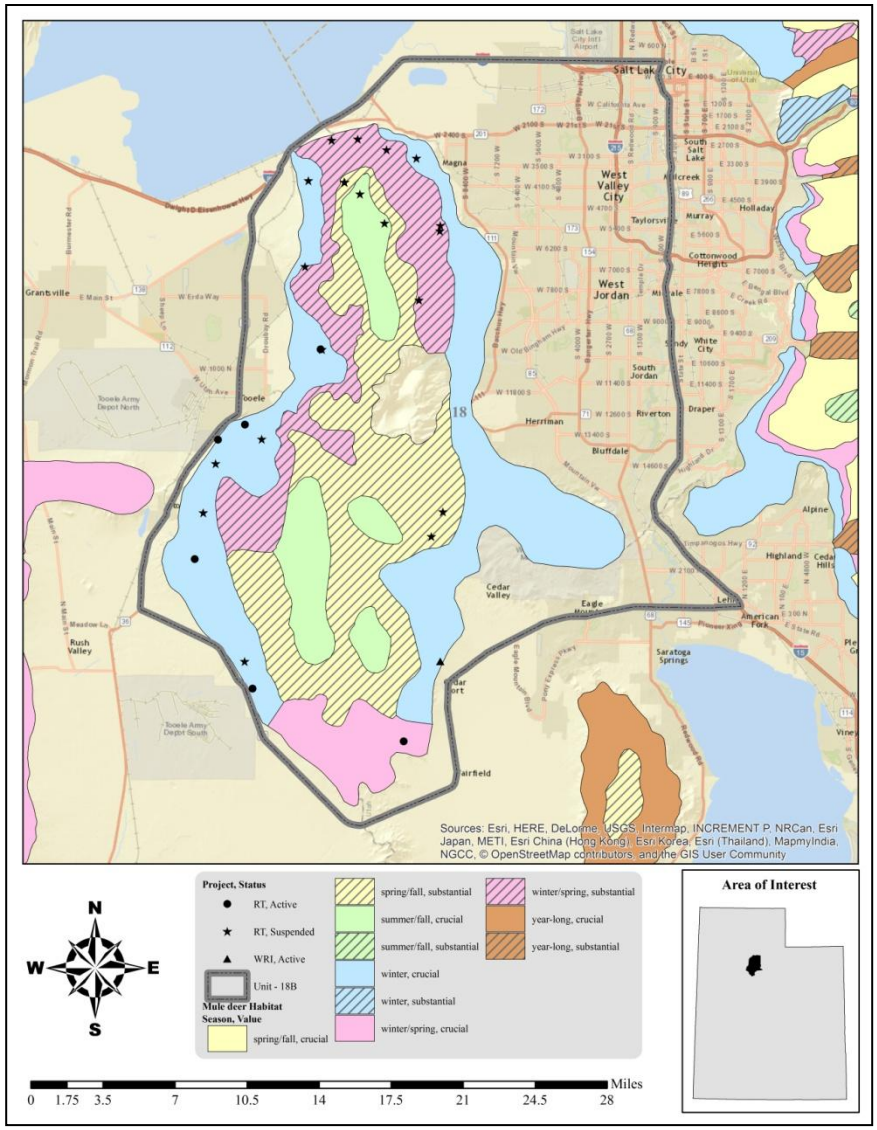


Figure9.1: The 1982-2016 Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2016. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 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. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2017).

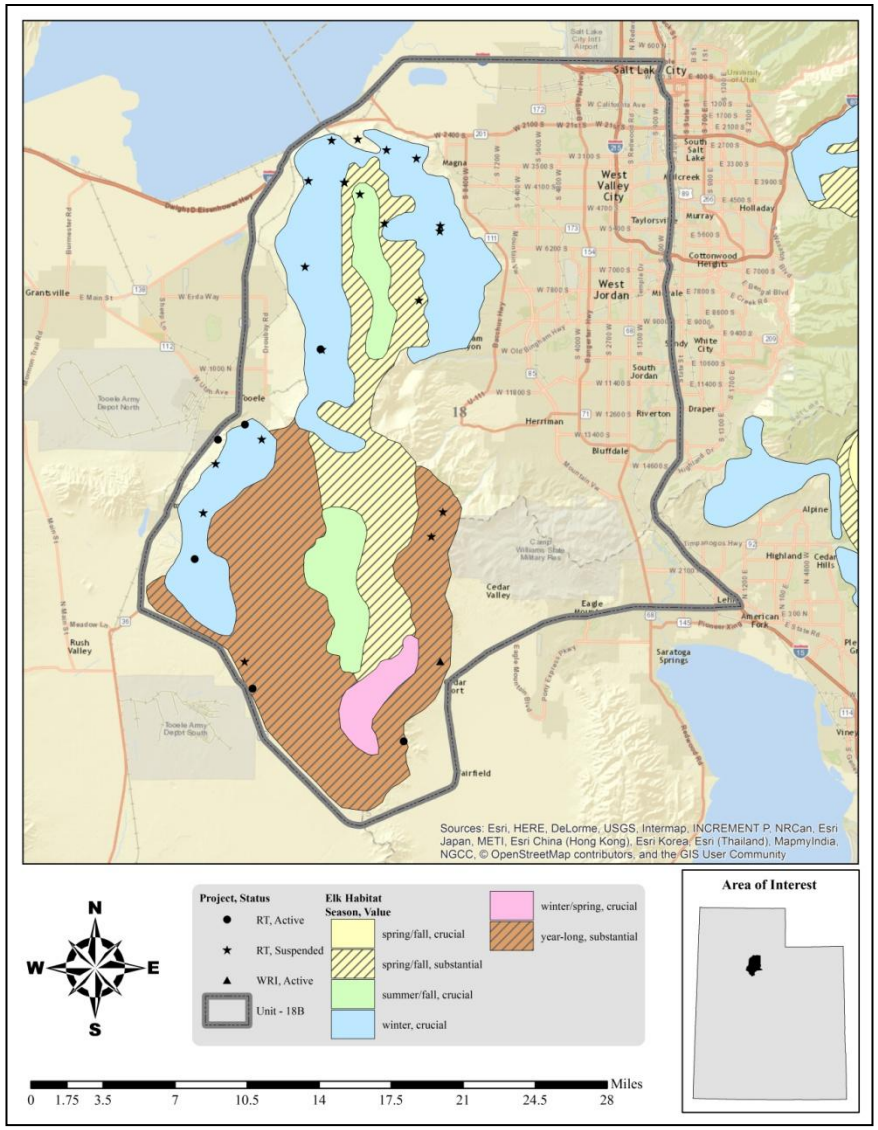
Big Game Habitat

There are an estimated 216,000 acres classified as deer range on Unit 18B with 79,776 acres classified as winter range, 63,834 acres as spring/fall range, 49,291 as winter/spring range, and 24,007 acres as summer/fall range (Table 9.1, Map 9.2). Privately owned land comprises 56% of the winter range, the Bureau of Land Management (BLM) administrates 20%, 15 % is managed by the Department of Defense (DOD), the Utah School and Institutional Trust Lands Administration (SITLA) administrates 9%, and less than 1% is owned by Fire & State Lands (SL&F). Of the spring/fall range, 70% is managed by private landowners, 25% by the BLM, 3% is owned by SITLA, and 2% is administrated by the DOD. 57% of the winter/spring range is privately owned, the BLM manages 39%, 4% is owned by SITLA, and less than 1% is administrated by

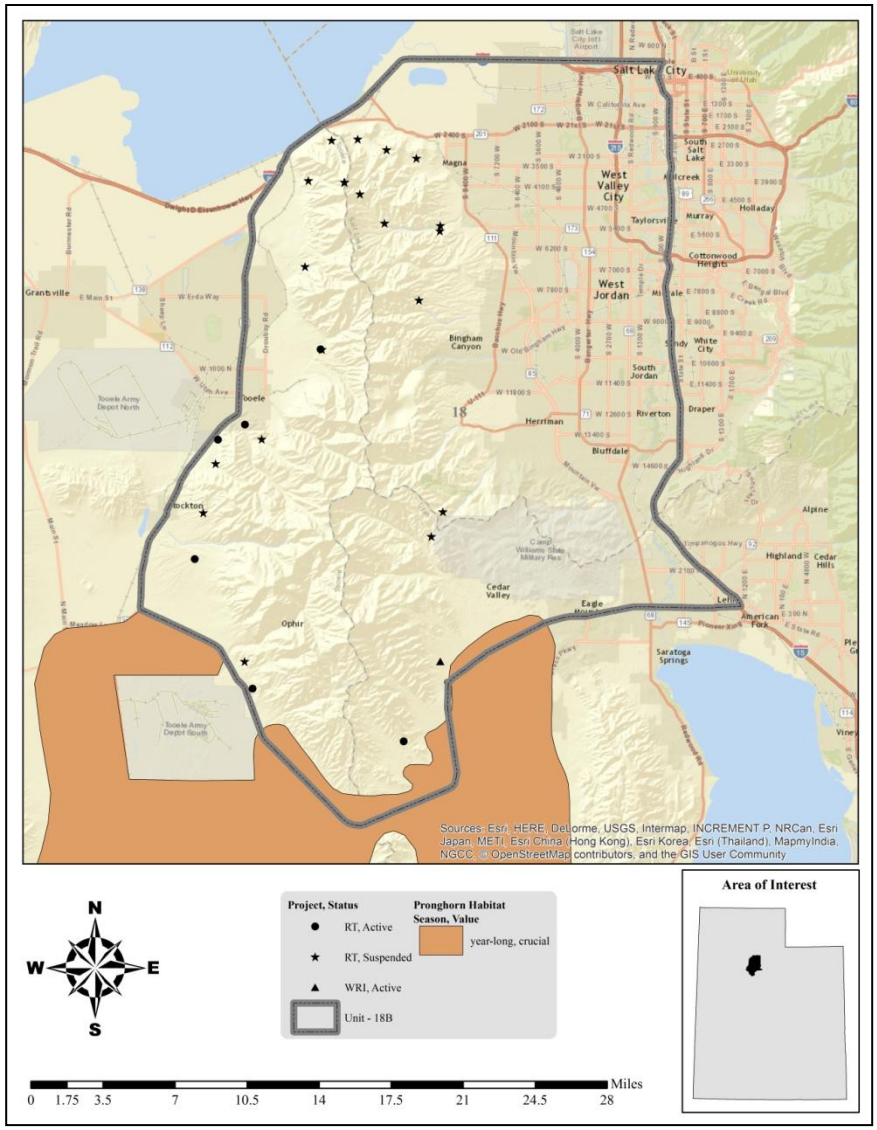
SL&F. Finally, most (79%) of the summer/fall range is also privately owned, 19% is administrated by the BLM, and 2% is managed by SITLA (Table 9.2, Map 9.2, Map 9.5).



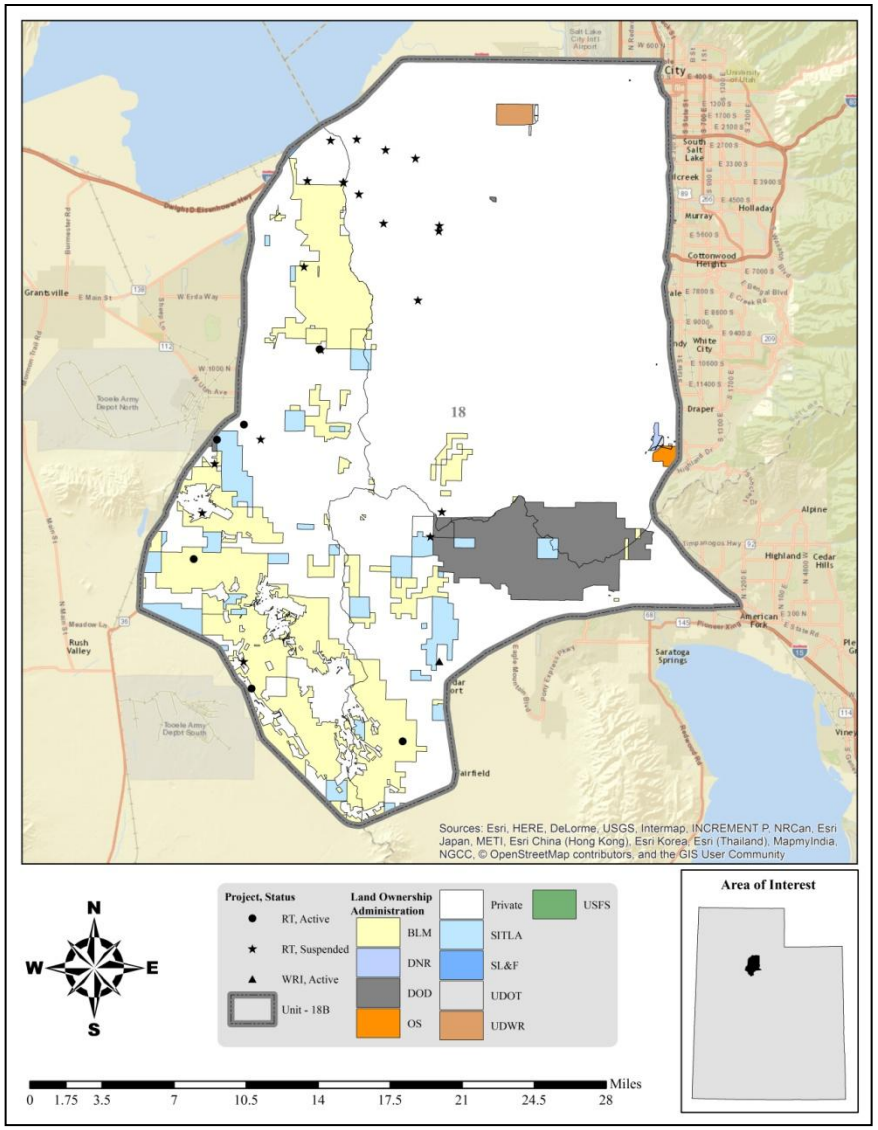
Map 9.2: Estimated mule deer habitat by season and value for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.3: Estimated elk habitat by season and value for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.4: Estimated pronghorn habitat by season and value for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.5: Land ownership for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

	Year Long Range		Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
	Area (acres)	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	0	0%	79,776	37%	49,291	23%	63,834	29%	24,007	11%
Elk	66,819	36%	57,985	32%	5,949	3%	36,592	20%	16,709	9%
Pronghorn	11,653	100%	0	0%	0	0%	0	0%	0	0%

Table 9.1: Estimated mule deer, elk, and pronghorn habitat acreage by season for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

	Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	16,140	20%	19,043	39%	16,081	25%	4,605	19%
Private	44,424	56%	28,297	57%	44,678	70%	18,903	79%
SITLA	7,136	9%	1,925	4%	2,153	3%	498	2%
DOD	12,053	15%	0	0%	922	2%	0	0%
SL&F	23	<1%	25	<1%	0	0%	0	0%
Total	79,776	**100%**	49,291	**100%**	63,834	**100%**	24,007	**100%**

Table 9.2: Estimated mule deer habitat acreage by season and land ownership for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

	Year Long Range		Winter Range		Winter/Spring Range		Spring/Fall Range		Summer/Fall Range	
	Area (acres)	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	26,463	40%	18,093	31%	2,320	39%	5,334	15%	2,388	14%
Private	32,469	49%	37,042	64%	3,348	56%	30,449	83%	13,546	81%
SITLA	6,542	9%	2,850	5%	281	5%	809	2%	774	5%
DOD	1,346	2%	0	0%	0	0%	0	0%	0	0%
Total	66,819	**100%**	57,985	**100%**	5,949	**100%**	36,592	**100%**	16,709	**100%**

Table 9.3: Estimated elk habitat acreage by season and land ownership for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	2,891	25%
Private	8,219	70%
SITLA	543	5%
UDOT	<1	<1%
Total	11,653	**100%**

Table 9.4: Estimated pronghorn habitat acreage by season and land ownership for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

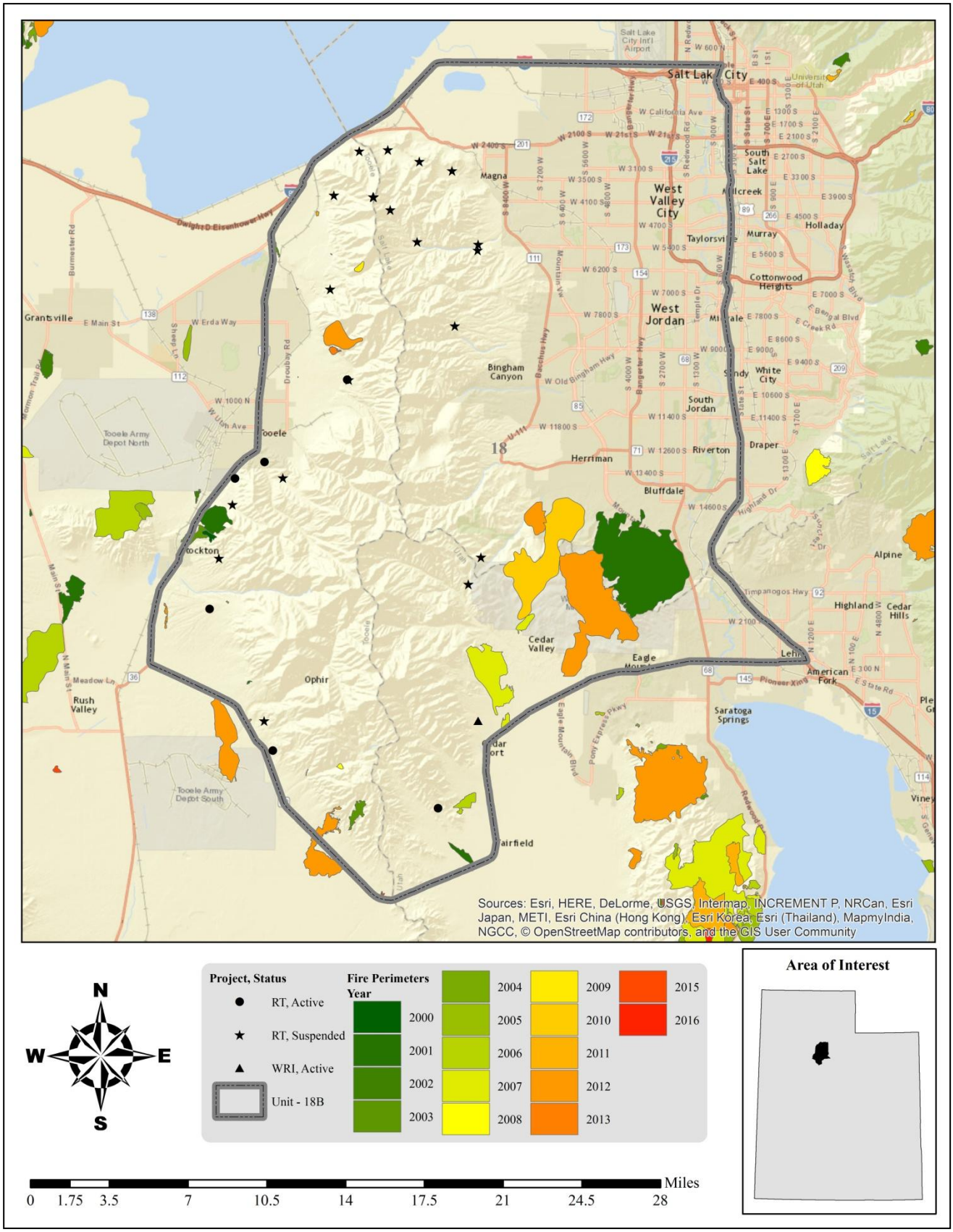
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Great Basin Pinyon-Juniper Woodland	41,468	9.69%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	15,797	3.69%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	10,182	2.38%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	2,394	0.56%	
	Inter-Mountain Basins Juniper Savanna	497	0.12%	
	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	205	0.05%	
	Other Conifer	117	0.03%	16.51%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	17,898	4.18%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	221	0.05%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	55	0.01%	4.25%
Grassland	Rocky Mountain Subalpine-Montane Mesic Meadow	2,738	0.64%	
	Inter-Mountain Basins Semi-Desert Grassland	2,544	0.59%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,254	0.29%	1.53%
Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	29,980	7.01%	
	Quercus gambelii Shrubland Alliance	24,415	5.71%	
	Great Basin Xeric Mixed Sagebrush Shrubland	16,326	3.81%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	7,111	1.66%	
	Inter-Mountain Basins Big Sagebrush Steppe	4,841	1.13%	
	Sonora-Mojave Semi-Desert Chaparral	4,010	0.94%	
	Coleogyne ramosissima Shrubland Alliance	3,375	0.79%	
	Inter-Mountain Basins Greasewood Flat	3,235	0.76%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	1,790	0.42%	
	Inter-Mountain Basins Montane Sagebrush Steppe	1,409	0.33%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	1,361	0.32%	
	Columbia Plateau Low Sagebrush Steppe	724	0.17%	
	Great Basin Semi-Desert Chaparral	394	0.09%	
	Columbia Plateau Steppe and Grassland	311	0.07%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	247	0.06%	
	Mojave Mid-Elevation Mixed Desert Scrub	143	0.03%	
	Other Shrubland	124	0.03%	23.32%
Other	Developed	119,262	27.87%	
	Hardwood	47,005	10.98%	
	Agricultural	45,591	10.65%	
	Quarries-Strip Mines-Gravel Pits	8,186	1.91%	
	Open Water	6,446	1.51%	
	Barren	4,151	0.97%	
	Riparian	1,328	0.31%	
	Sparsely Vegetated	820	0.19%	54.40%
Total		427,952	100.00%	100%

Table 9.5: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Limiting Factors to Big Game Habitat

Major human activities in the area include mining; the Bingham Canyon Open Pit Copper Mine is located on the eastern face of the Oquirrh Mountains. Limiting factors to big game habitat in this unit include habitat degradation and loss, summer range availability, and winter range forage condition. According to current Landfire Existing Vegetation Coverage models, 9.69% of the Oquirrh Mountains Oquirrh-Stansbury unit is comprised of pinyon-juniper woodlands (Table 9.5). 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, 5.8% of the unit is comprised of exotic herbaceous species. 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 habitat for big game (Map 9.6).



Map 9.6: Land coverage of fires by year from 2000-2016 for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

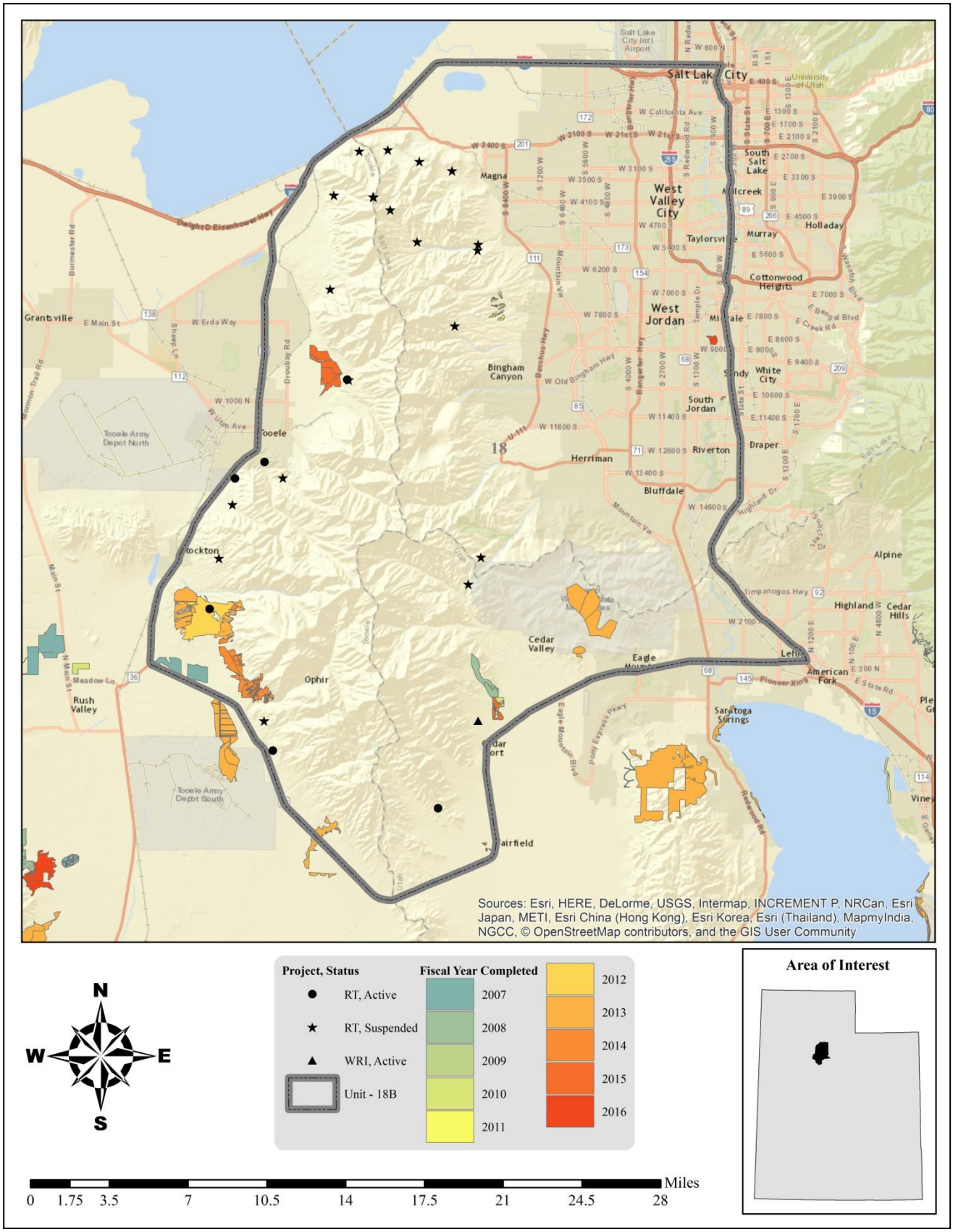
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 8,429 acres of land have been treated within the Oquirrh Mountains Oquirrh-Stansbury unit since the WRI was implemented in 2004 (Map 9.7). Treatments frequently overlap one another bringing the total completed treatment acres to 8,542 acres for this unit (Table 6.8). 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 use to remove twoneedle pinyon and Utah juniper is the most common management practice in this unit. Seeding to supplement the herbaceous understory and herbicide application to remove weeds are also very common. Other management practices include anchor chaining and hand crews to remove pinyon and juniper, seeding desirable shrub species, and other similar vegetation removal techniques (Table 9.6).

Type	Completed Acreage	Current Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**140**	**1,028**	**0**	**1,168**
Ely (One-Way)	140	0	0	140
Ely (Two-Way)	0	1,028	0	1,028
Bullhog	**3,109**	**0**	**0**	**3,109**
Disc	**838**	**0**	**0**	**838**
Herbicide Application	**1,444**	**0**	**802**	**2,246**
Aerial	1,229	0	802	2,032
Ground	215	0	0	215
Planting/Transplanting	**17**	**0**	**7**	**25**
Seeding (Primary)	**2,629**	**0**	**0**	**2,629**
Broadcast (Aerial)	2,100	0	**0**	2,100
Drill (Rangeland)	397	0	0	397
Other	132	0	0	132
Vegetation Removal/Hand Crew	**334**	**0**	**0**	**334**
Lop (No Scatter)	13	0	0	13
Lop & Scatter	321	0	0	321
Other	**30**	**0**	**0**	**30**
Interseeding	30	0	0	30
Total Treatment Acres	**8,542**	**1,028**	**810**	**10,379**
***Total Land Area Treated**	**8,429**	**1,028**	**810**	**9,542**

Table 9.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury. Data accessed on 02/09/2017. *Does not include overlapping treatments.



Map 9.7: WRI treatments by fiscal year completed for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Range Trend Studies

Range Trend studies have been sampled within WMU 18B on a regular basis since 1983, 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	Year(s) Sampled	Ecological Site Description
18B-1	Barney Canyon	RT	Suspended	'83	Not Verified
18B-2	City Canyon	RT	Suspended	'83	Not Verified
18B-3	Manning Canyon	RT	Active	'83, '90, '97, '02, '07, '12, '16	Upland Stony Loam (Wyoming Big Sagebrush)
18B-4	Silverado Canyon	RT	Suspended	'83, '89, '97	Not Verified
18B-5	Big Dip Gulch	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Shallow Loam (Black Sagebrush)
18B-6	South of Soldier Canyon	RT	Active	'83, '89, '97, '02, '07, '12, '16	Upland Loam (Mountain Big Sagebrush)
18B-7	Calumet Mine	RT	Suspended	'83, '89, '97	Not Verified
18B-8	Silcox Canyon	RT	Suspended	'83, '89	Not Verified
18B-9	Left Fork Settlement Canyon	RT	Suspended	'83, '89, '97	Not Verified
18B-10	Bates Canyon	RT	Suspended	'83, '89, '97	Not Verified
18B-11	Rose Canyon	RT	Suspended	'83	Not Verified
18B-12	Coon Canyon	RT	Suspended	'83, '90	Not Verified
18B-13	Kessler Peak	RT	Suspended	'90	Not Verified
18B-14	Little Valley	RT	Suspended	'90, '97	Not Verified
18B-15	Upper Kessler	RT	Suspended	'90, '97, '02, '08	Not Verified
18B-16	Smelter	RT	Suspended	'90	Not Verified
18B-17	Deadman	RT	Suspended	'90	Not Verified
18B-18	Hogback	RT	Suspended	'90	Not Verified
18B-19	Black Rock West	RT	Suspended	'90, '97	Not Verified
18B-20	Black Rock East	RT	Suspended	'90, '97, '02, '07	Not Verified
18B-21	Black Rock Canyon	RT	Suspended	'90, '97	Not Verified
18B-22	Rodgers Canyon	RT	Suspended	'90, '97	Not Verified
18B-31	Carr Fork	RT	Suspended	'97, '02, '07, '12	Not Verified
18B-34	Three O'Clock	RT	Active	'02, '07, '12, '16	Upland Stony Loam (Mountain Big Sagebrush)
18B-35	Settlement Canyon Reservoir	RT	Active	'02, '07, '12, '16	Upland Stony Loam (Mountain Big Sagebrush)
18B-36	Carr Fork 2	RT	Active	'12, '16	Mountain Loam (Mountain Big Sagebrush)
18R-10	Cedar Fort Bench	WRI	Active	'16	Upland Stony Loam (Wyoming Big Sagebrush)

Table 9.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
18B-6	South of Soldier Canyon	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Bullhog	Stockton Bullhog	Spring 2012	1,561	1929
		Transplant	Stockton Bullhog			1929
18B-34	Three O'Clock	Wildfire		Late 1980s		
18B-36	Carr Fork 2	Disc		Fall 1986-Spring 1987		
		Rangeland Drill		Fall 1986-Spring 1987		
		Transplant		2002		
18R-10	Cedar Fort Bench	Aerial Before	Cedar Fort Chaining	October 2016	1,028	3662
		Two-Way Ely Chain	Cedar Fort Chaining	October-December 2016	1,028	3662
		Dribbler After	Cedar Fort Chaining	October-December 2016	1,028	3662
		Aerial After	Cedar Fort Chaining	December 2016	1,028	3662

Table 9.8: Range trend and WRI studies known disturbance history for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Study Trend Summary (Range Trend)

Mountain (Sagebrush)

One study site [Carr Fork 2 (18B-36)] is classified as a Mountain (Sagebrush) ecological site: this study site is located north of Pine Creek and west of Leavetts Canyon.

Shrubs/Trees: Antelope bitterbrush is the sole browse species present on this study site and cover decreased from 26% to 19% between the 2012 and 2016 sample years (Figure 9.2). Sagebrush and trees have not been recorded on this site and will therefore not be discussed in this section (Figure 9.3, Figure 9.4, Figure 9.5, Figure 9.6).

Herbaceous Understory: The herbaceous understory on this study has fluctuated in quantity and composition in each sample year. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) was the dominant component in 2012, but has since decreased in cover and frequency. Other perennial grasses and forbs were co-dominant in 2016. However, much of the cover was contributed by introduced grass species, such as intermediate wheatgrass (*Thinopyrum intermedium*) and orchardgrass (*Dactylis glomerata*), and forbs that are considered to be noxious weeds such as whitetop (*Cardaria draba*) and field bindweed (*Convolvulus arvensis*) (Figure 9.7, Figure 9.8).

Occupancy: Average pellet transect data indicates that animal occupancy has decreased over the sample years; no pellet groups were recorded in transect data in 2016. Deer, however, were the sole occupants in 2012 with a mean abundance of pellet groups of nearly 13 days use/acre (Figure 9.9).

Upland (Sagebrush)

Four studies [Manning Canyon (18B-3), South of Soldier Canyon (18B-6), Three O'Clock (18B-34), and Settlement Canyon Reservoir (18B-35)] are considered to be Upland (Sagebrush) ecological sites. The Manning Canyon study is located in Manning Canyon, west of State Route 73. South of Soldier Canyon is situated south of Soldier Canyon and Soldier Creek, while Three O'Clock is found south of Tooele. Finally, the Settlement Canyon Reservoir study is located on a slope just northeast of Settlement Canyon Reservoir.

Shrubs/Trees: The primary browse species on these study sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*); the exception to this is the Manning Canyon study, which is dominated by Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*). Other browse species such as mormon tea (*Ephedra viridis*) and rubber rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa* var. *speciosa*) are present on certain sites to a lesser extent. Shrub cover has exhibited an overall increase, and the increase between 2002 and 2007 is at least in

part due to the addition of line intercept measurements for the Three O'Clock study (Figure 9.2). Average sagebrush demographics indicate that mature plants have comprised a majority of the populations on these sites in all sample years, and that decadence has increased and recruitment of young has decreased overall (Figure 9.5). Average sagebrush utilization has fluctuated from year to year, but has increased overall, with over half of plants being moderately or heavily browsed in 2002, 2007, 2012, and 2016; a majority of the sagebrush showed signs of little to no use in 1997 (Figure 9.6).

Tree cover has increased overall while density has decreased, with Utah juniper (*Juniperus osteosperma*) as the most abundant tree species. These trends are entirely driven by the Manning Canyon and South of Soldier Canyon studies, as no trees were recorded on Three O'Clock or Settlement Canyon Reservoir in any sample year (Figure 9.3, Figure 9.4).

Herbaceous Understory: The herbaceous understories of these studies have exhibited overall increases in both cover and frequency; the increase between 1997 and 2002 is at least in part due to the addition of the Three O'Clock and Settlement Canyon Reservoir studies. Perennial grasses have contributed the most cover of any single understory component in most sample years, and have generally been composed of native species such as bluebunch wheatgrass (*Pseudoroegneria spicata*). The cover of the introduced perennial grass bulbous bluegrass (*Poa bulbosa*) has fluctuated over time, and it was the dominant herbaceous component in 2002: this trend is entirely due to the Three O'Clock and Settlement Canyon Reservoir studies (Figure 9.7, Figure 9.8).

Occupancy: Average pellet transect data indicates that animal occupancy has fluctuated over time, but has decreased overall. Deer have been the primary occupants in all sample years, with pellet groups having a mean abundance ranging from 17 days use/acre in 2012 to 60 days use/acre in 2007. Elk have also occupied this study site, with mean abundance of pellet groups as low as 1 days use/acre in 2012 and as high as 21 days use/acre in 2007. Mean abundance of cattle pellet groups has ranged from 0 days use/acre in 2012 to 6.5 days use/acre in 2002. Finally, horse pellet groups have had a mean abundance ranging from 0 days use/acre in 2002 and 2016 to 3 days use/acre in 2007 (Figure 9.9).

Upland (Black Sagebrush)

One study [Big Dip Gulch (18B-5)] is classified as an Upland (Black Sagebrush) ecological site; this study site is located north of West Dip Gulch and just east of State Route 73.

Shrubs/Trees: The primary browse species on this study site is black sagebrush (*Artemisia nova*) which has increased in cover over the years; no other preferred browse species are present (Figure 9.2). Mature sagebrush plants have been the primary component of the sagebrush population in all sample years according to average demographic data. Sagebrush decadence has varied, but has increased overall while recruitment of young has decreased (Figure 9.5). Average utilization of sagebrush has also varied throughout the study years, although a significant majority of plants showed signs of moderate to heavy browsing in 2012 and 2016; more than half were lightly hedged or not used in all other sample years (Figure 9.6).

Both tree cover and density were not recorded in 2012, but have since increased with Utah juniper (*Juniperus osteosperma*) as the most abundant tree species, although singleleaf pinyon (*Pinus monophylla*) has also been present (Figure 9.3, Figure 9.4).

Herbaceous Understory: Perennial grasses such as Sandberg bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) contribute the most cover of any herbaceous component and have increased overall; nested frequency has fluctuated, but has been fairly consistent overall. Although cover has remained low, frequency values reveal that annual grasses and forbs have also been abundant in fluctuating amounts from year to year. Perennial forbs have remained rare (Figure 9.7, Figure 9.8).

Occupancy: Animal occupancy has fluctuated over time with a slight long-term increase; deer have been the sole occupants in all sample years with mean abundance of pellet groups ranging from 25 days use/acre in 2012 to 62 days use/acre in 2007 (Figure 9.9).

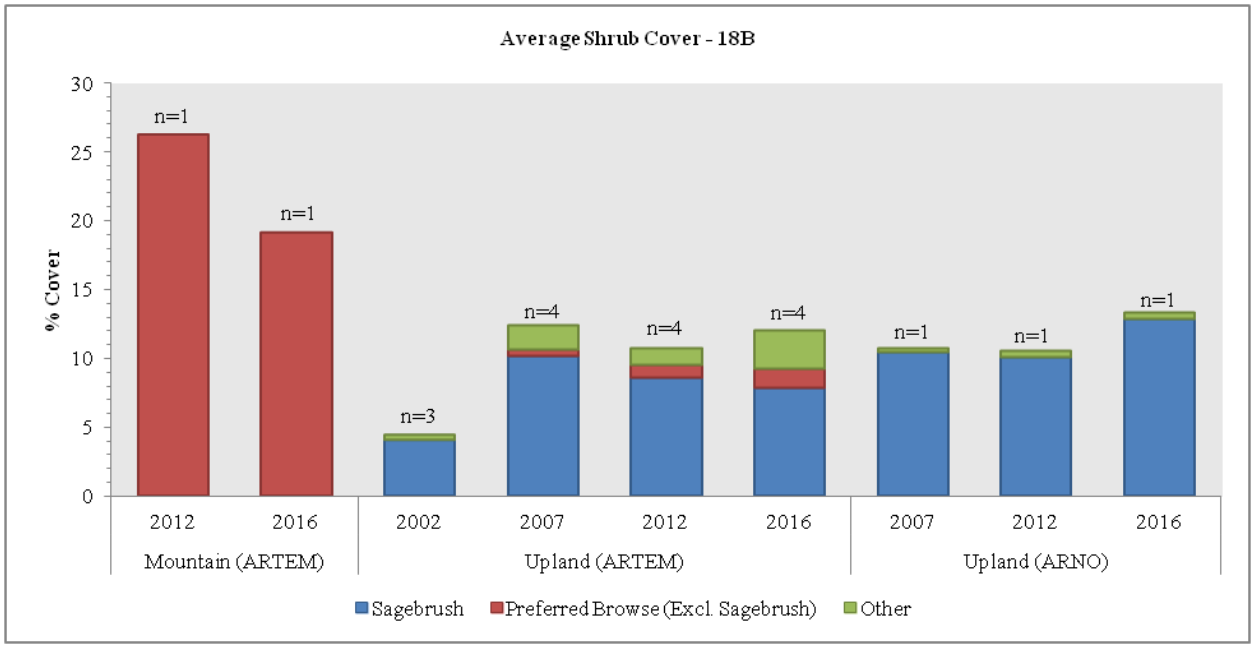


Figure 9.2: Average shrub cover for Mountain (ARTEM), Upland (ARTEM), and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

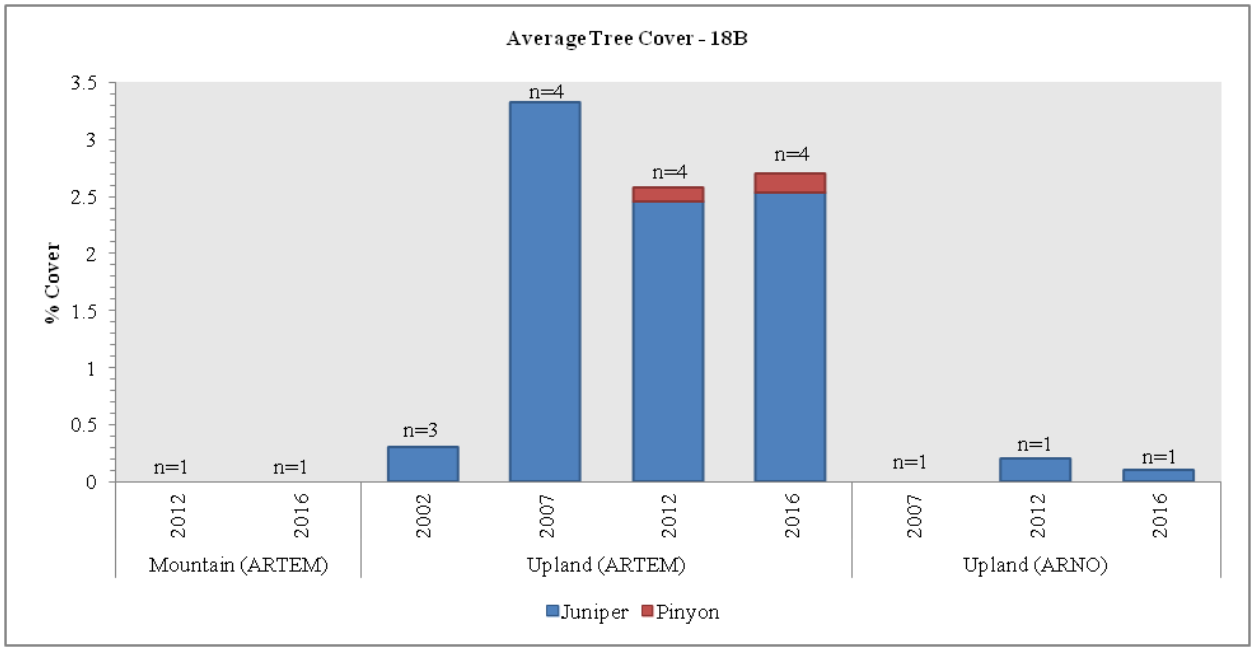


Figure 9.3: Average tree cover for Mountain (ARTEM), Upland (ARTEM), and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

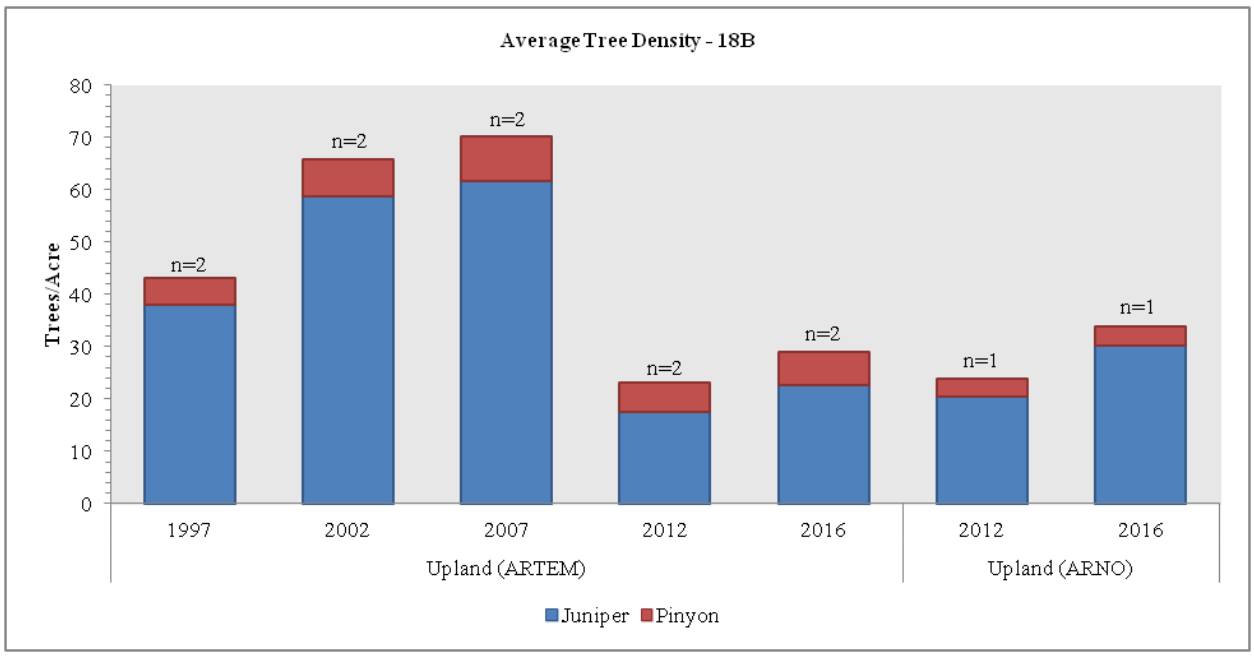


Figure 9.4: Average tree density for Upland (ARTEM) and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

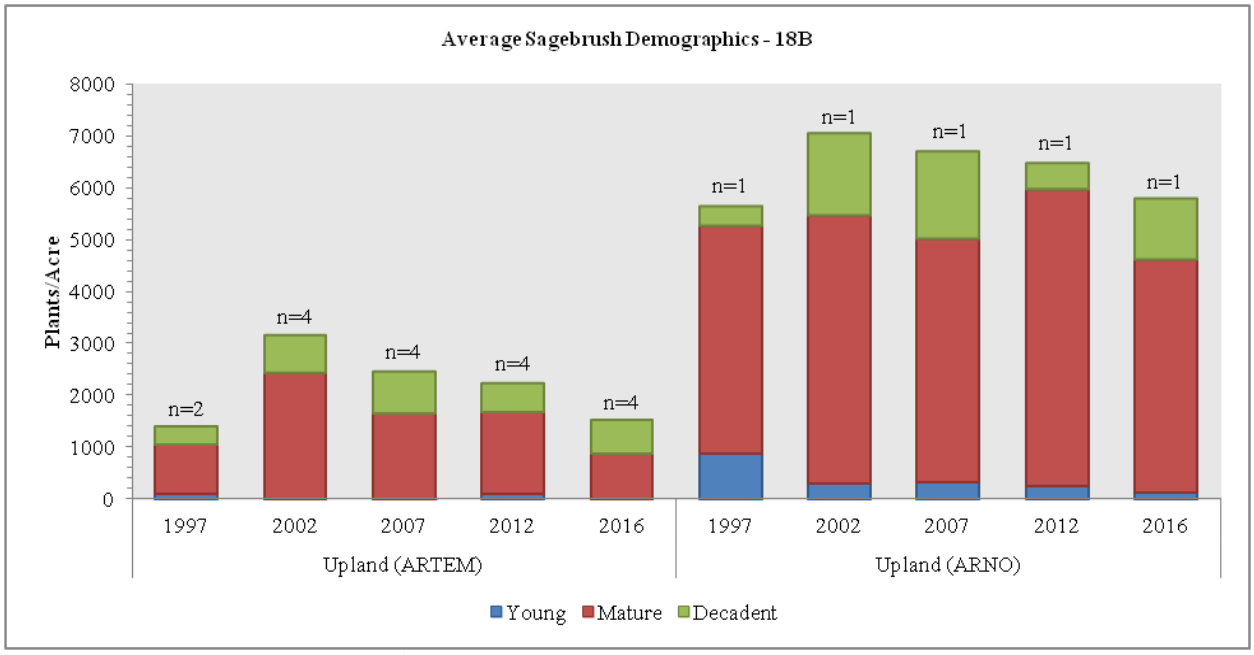


Figure 9.5: Average sagebrush demographics for Upland (ARTEM) and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

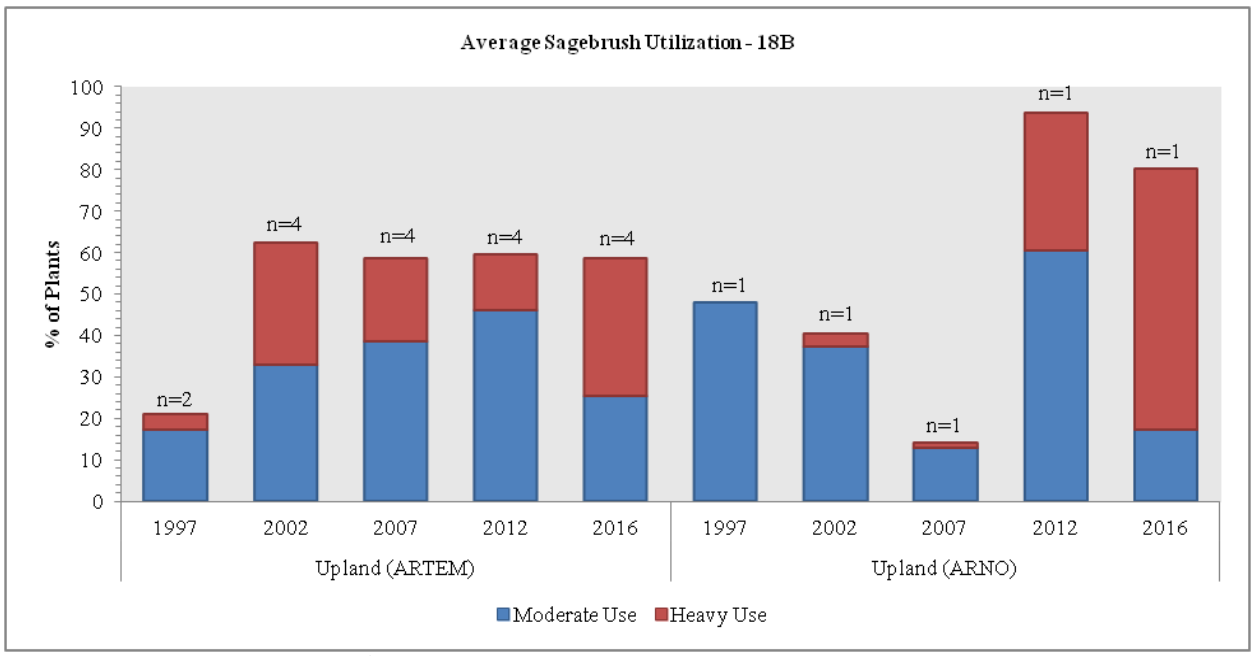


Figure 9.6: Average sagebrush utilization for Upland (ARTEM) and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

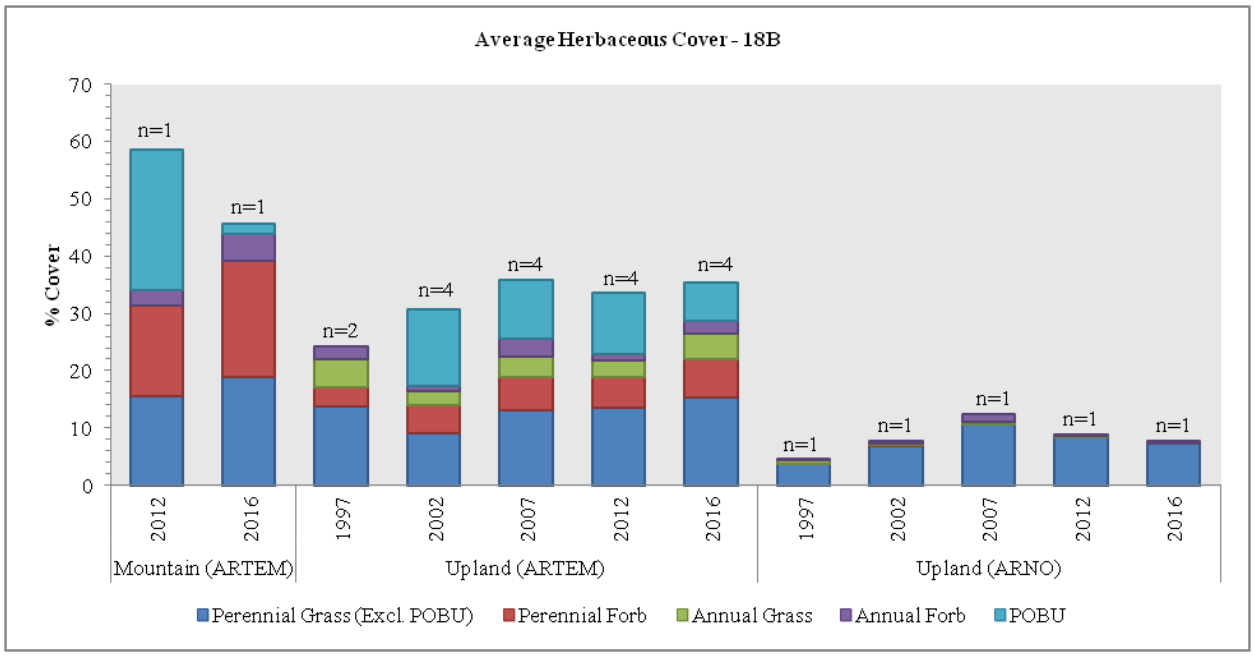


Figure 9.7: Average herbaceous cover for Mountain (ARTEM), Upland (ARTEM), and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

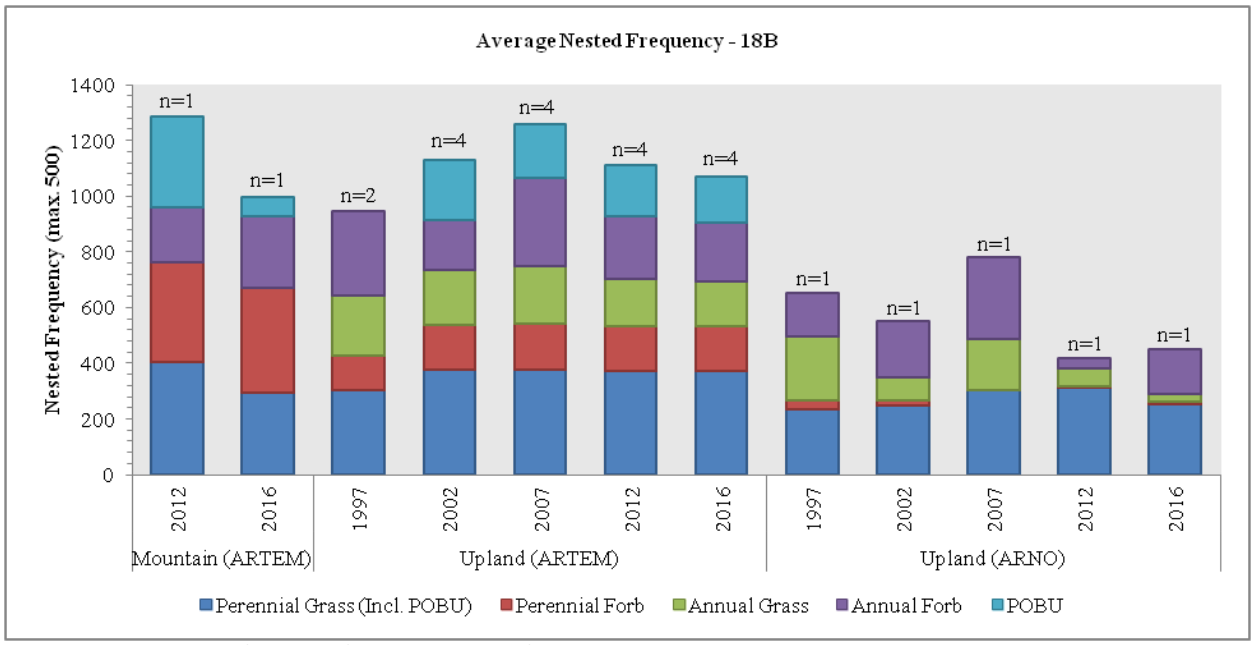


Figure 9.8: Average nested frequency of herbaceous species for Mountain (ARTEM), Upland (ARTEM), and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

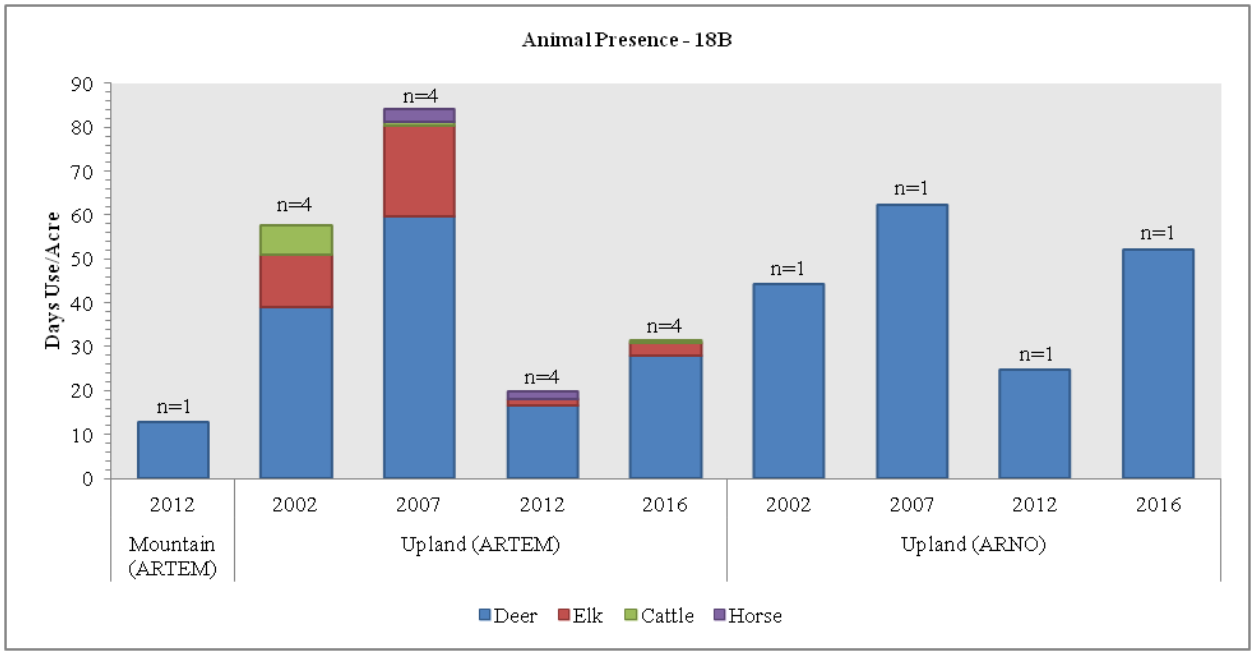
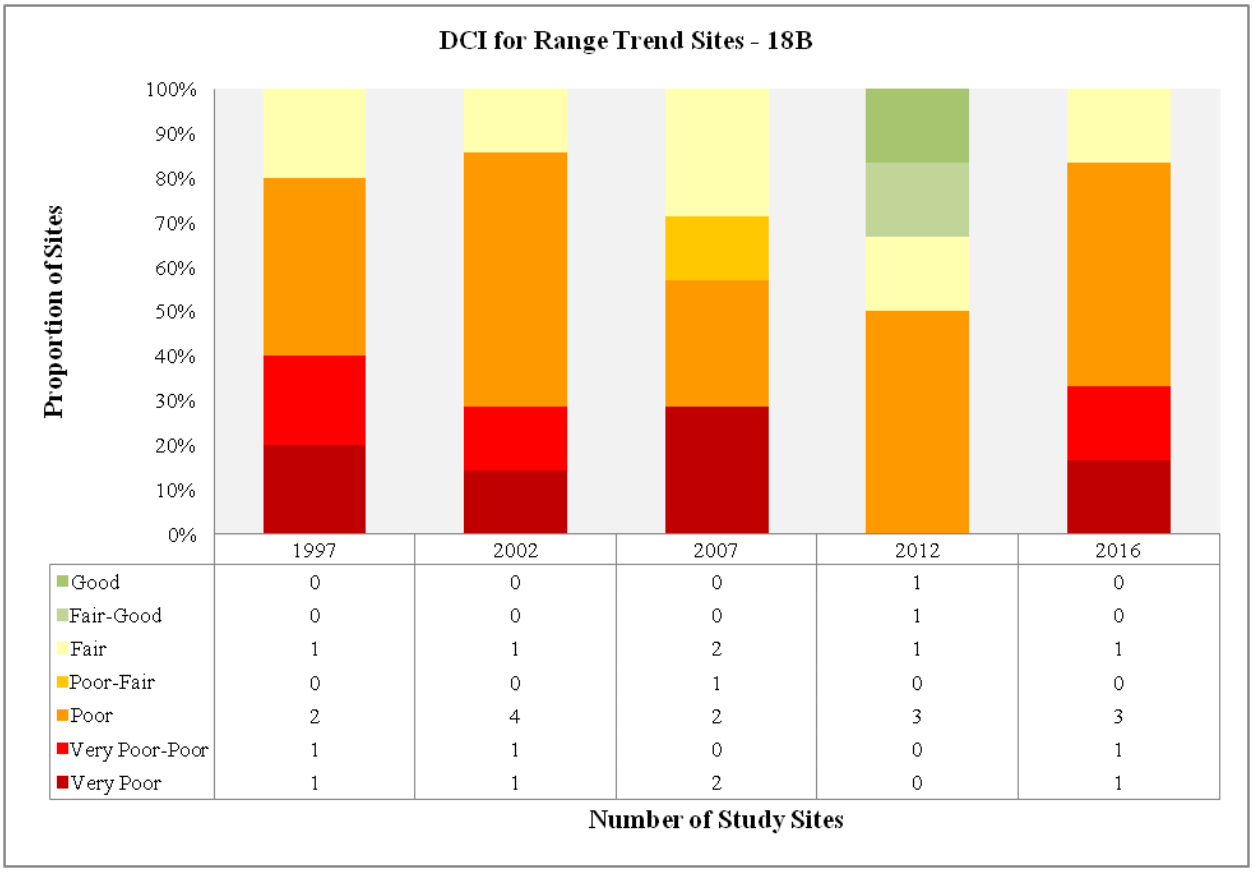


Figure 9.9: Average pellet transect data for Mountain (ARTEM), Upland (ARTEM), and Upland (ARNO) study sites in WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Oquirrh Mountains Oquirrh-Stansbury management unit has continually changed on the sites sampled since 1997. The Range Trend sites sampled within the unit are considered to be in very poor to fair condition as of the 2016 sample year (Figure 9.10, Table 9.9, Map 9.12). Carr Fork 2 went from good to fair condition, Manning Canyon deteriorated from fair to poor, Big Dip Gulch and South of Soldier Canyon remained in poor condition. The Three O'Clock and Settlement Canyon Reservoir studies are considered to be in very poor and very poor-poor condition (respectively) generally due to the lack of browse cover and sagebrush diversity. The treated study site, South of Soldier Canyon, is in poor condition (Figure 9.11): this study is also considered to be a Range Trend site and is therefore discussed above. (Map 9.12). It is possible given more time and continual monitoring that these sites might improve.



	1997	2002	2007	2012	2016
Good	0	0	0	1	0
Fair-Good	0	0	0	1	0
Fair	1	1	2	1	1
Poor-Fair	0	0	1	0	0
Poor	2	4	2	3	3
Very Poor-Poor	1	1	0	0	1
Very Poor	1	1	2	0	1

Figure 9.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

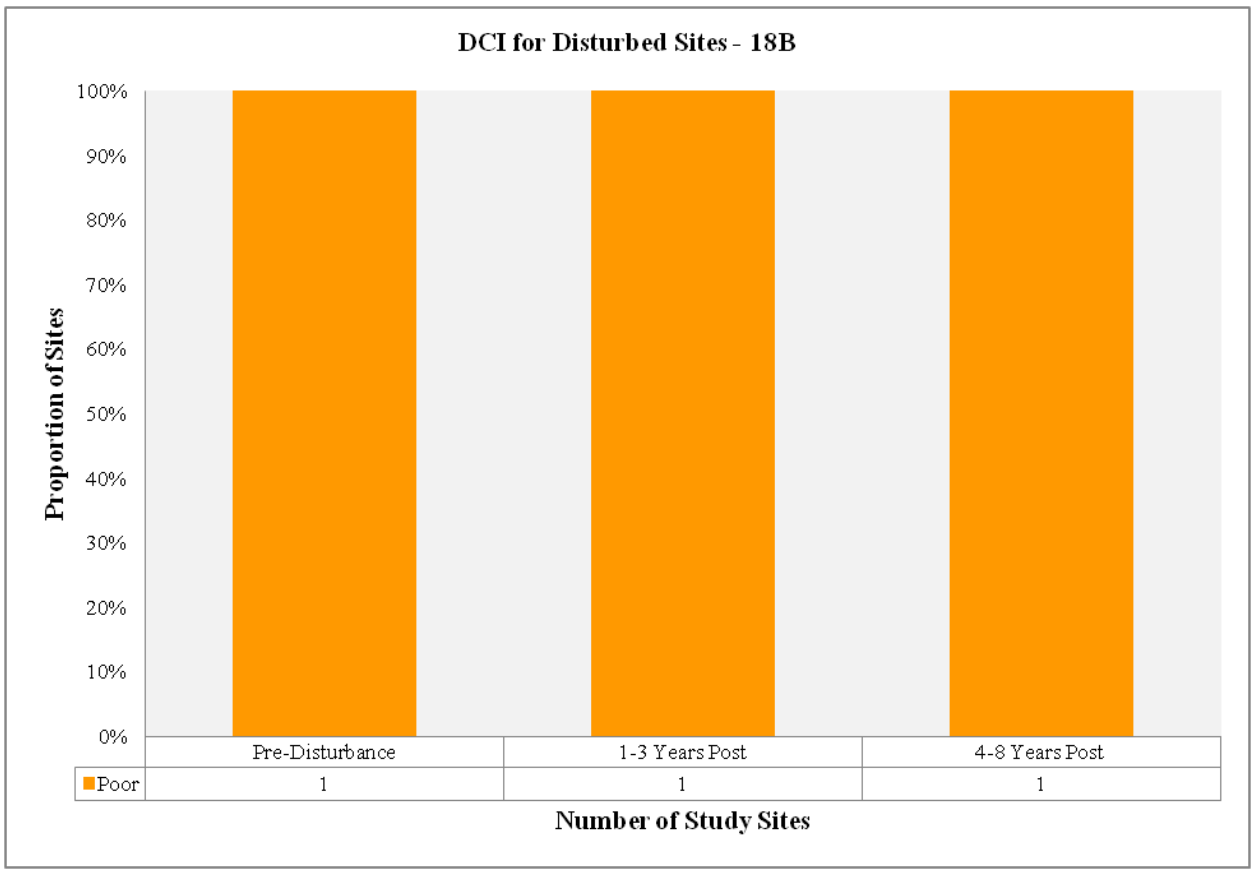


Figure 9.11: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

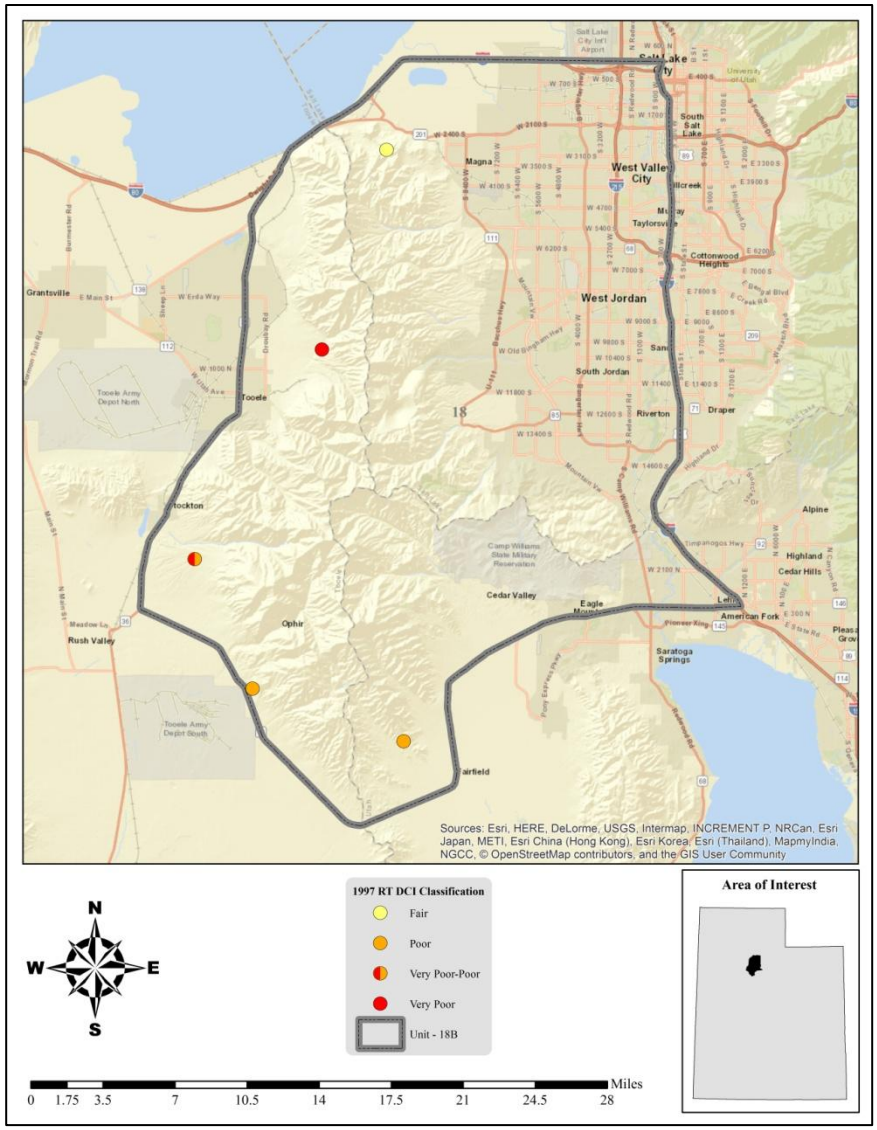
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
18B-3	1997	10.7	6.6	0.9	30.0	-5.0	3.5	0.0	**46.7**	**P**
18B-3	2002	11.1	1.1	1.3	23.5	-3.7	2.1	0.0	**35.4**	**VP-P**
18B-3	2007	8.3	2.3	5.4	21.5	-6.8	0.8	0.0	**31.6**	**VP**
18B-3	2012	12.4	9.5	8.7	29.5	-5.7	1.7	0.0	**56.2**	**F**
18B-3	2016	10.3	3.0	0.8	30.0	-2.5	1.6	0.0	**43.2**	**P**
18B-5	1997	9.6	12.9	8.0	7.6	-0.4	0.1	0.0	**37.8**	**P**
18B-5	2002	12.2	8.4	2.5	14.0	-0.2	0.2	0.0	**37.1**	**P**
18B-5	2007	12.9	7.5	2.5	21.2	-0.5	0.0	0.0	**43.6**	**P**
18B-5	2012	15.2	12.6	2.0	17.1	-0.1	0.0	0.0	**46.8**	**P**
18B-5	2016	12.9	9.0	1.0	14.6	-0.1	0.0	0.0	**37.4**	**P**
18B-6	1997	2.9	0.0	0.0	24.8	-2.4	9.8	0.0	**35.0**	**VP-P**
18B-6	2002	2.4	0.0	0.0	29.4	-1.3	9.7	0.0	**40.2**	**P**
18B-6	2007	3.5	0.0	0.0	30.0	-1.2	10.0	0.0	**42.3**	**P**
18B-6	2012	1.2	0.0	0.0	30.0	-0.1	7.4	0.0	**38.5**	**P**
18B-6	2016	2.3	0.0	0.0	30.0	-1.7	10.0	0.0	**40.5**	**P**
18B-15*	1997	0.0	0.0	0.0	30.0	-0.3	7.1	0.0	**36.8**	**F**
18B-15*	2002	0.0	0.0	0.0	30.0	-0.3	5.1	-2.0	**32.9**	**F**
18B-15*	2007	0.0	0.0	0.0	30.0	-0.7	10.0	-2.0	**37.3**	**F**
18B-31*	1997	0.0	0.0	0.0	0.0	-2.3	10.0	-6.0	**1.7**	**VP**
18B-31*	2002	0.3	0.0	0.0	7.7	-1.4	10.0	-6.0	**10.5**	**VP**
18B-31*	2007	4.3	0.0	0.0	12.7	0.0	10.0	-4.0	**23.0**	**VP**
18B-34	2002	18.1	12.9	0.5	4.2	-0.7	7.4	0.0	**42.3**	**P**
18B-34	2007	21.2	7.8	1.0	22.1	-0.7	9.7	0.0	**61.1**	**F**
18B-34	2012	17.8	8.1	2.0	27.4	-1.8	10.0	0.0	**63.5**	**F-G**
18B-34	2016	10.8	-1.2	0.5	20.4	-5.0	8.6	-4.0	**30.1**	**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
18B-35	2002	15.4	3.6	1.5	17.3	-1.3	10.0	-2.0	**44.4**	**P**
18B-35	2007	12.6	3.0	2.0	25.4	-2.1	10.0	-2.0	**48.8**	**P-F**
18B-35	2012	10.7	6.0	1.5	19.5	-1.5	10.0	-2.0	**44.2**	**P**
18B-35	2016	6.3	3.0	1.0	18.2	-4.0	10.0	0.0	**34.5**	**VP-P**
18B-36	2012	26.8	12.9	3.5	30.0	0.0	10.0	-6.0	**77.2**	**G**
18B-36	2016	14.6	3.9	5.5	30.0	0.0	10.0	-6.0	**58.0**	**F**

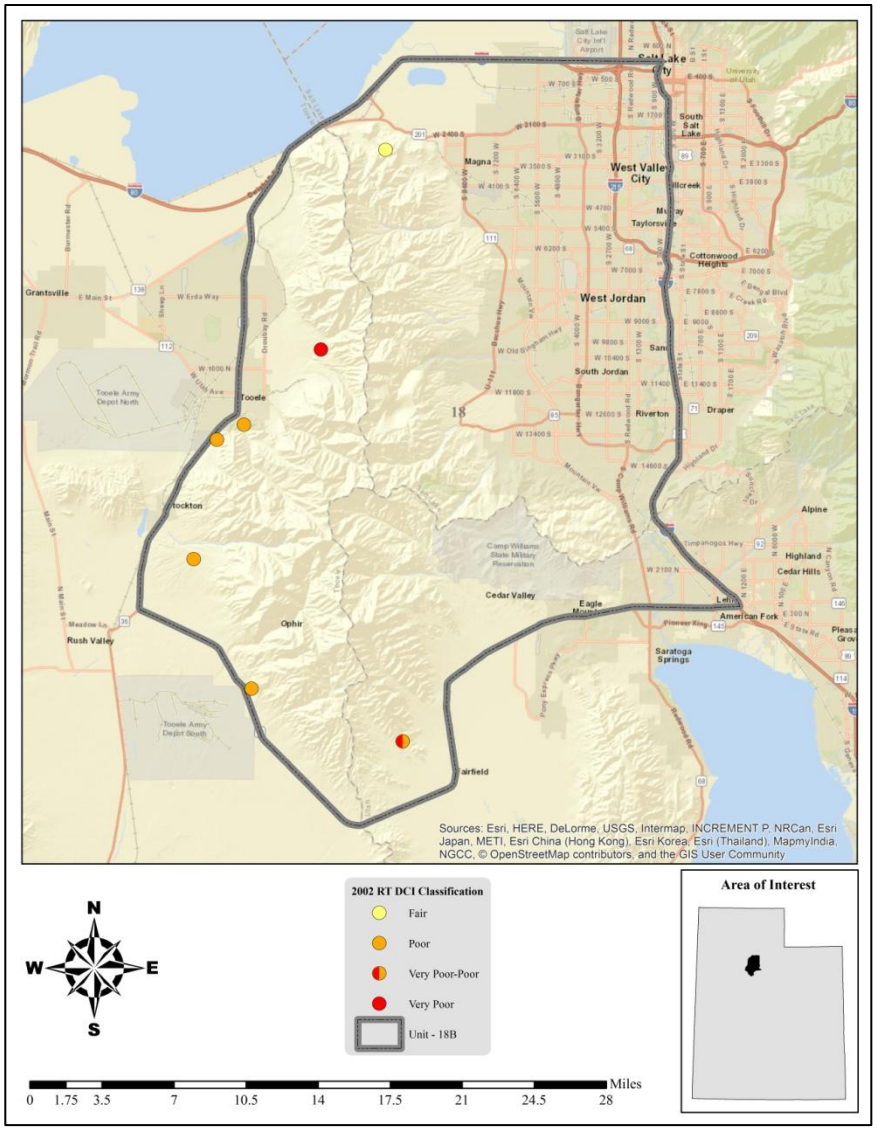
Table 9.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.

Study Name	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
18R-10	2016	0.30	0.00	0.00	0.80	-0.08	0.60	0.00	**1.63**	**VP**

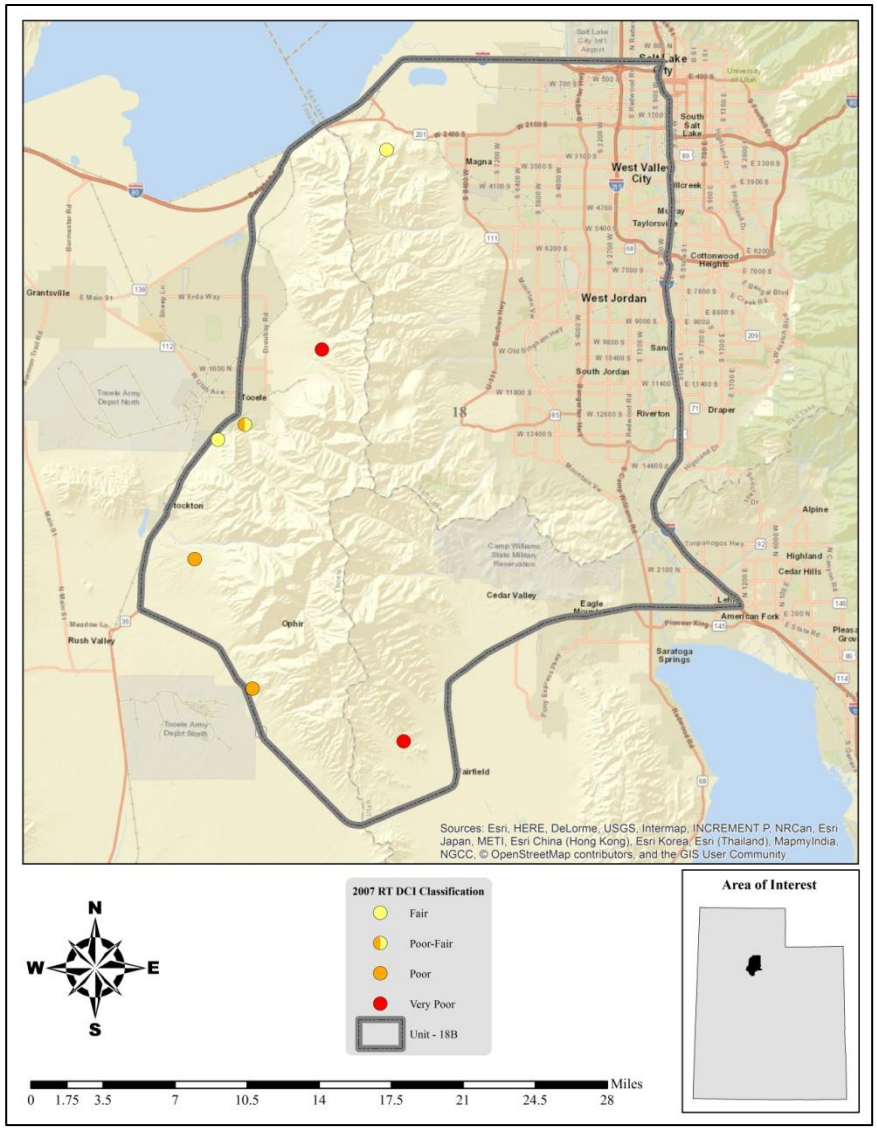
Table 8.11: Deer winter range Desirable Components Index (DCI) information by site number of WRI study sites for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent.



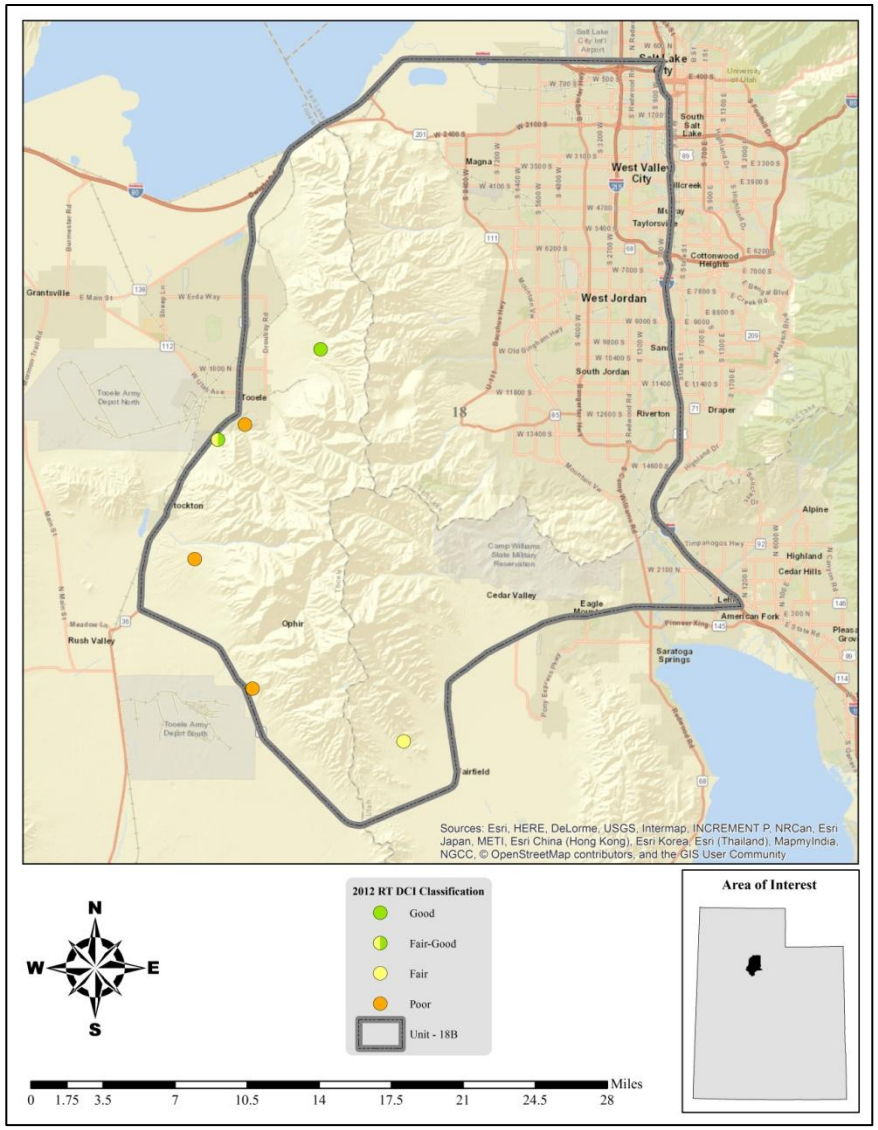
Map 9.8: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



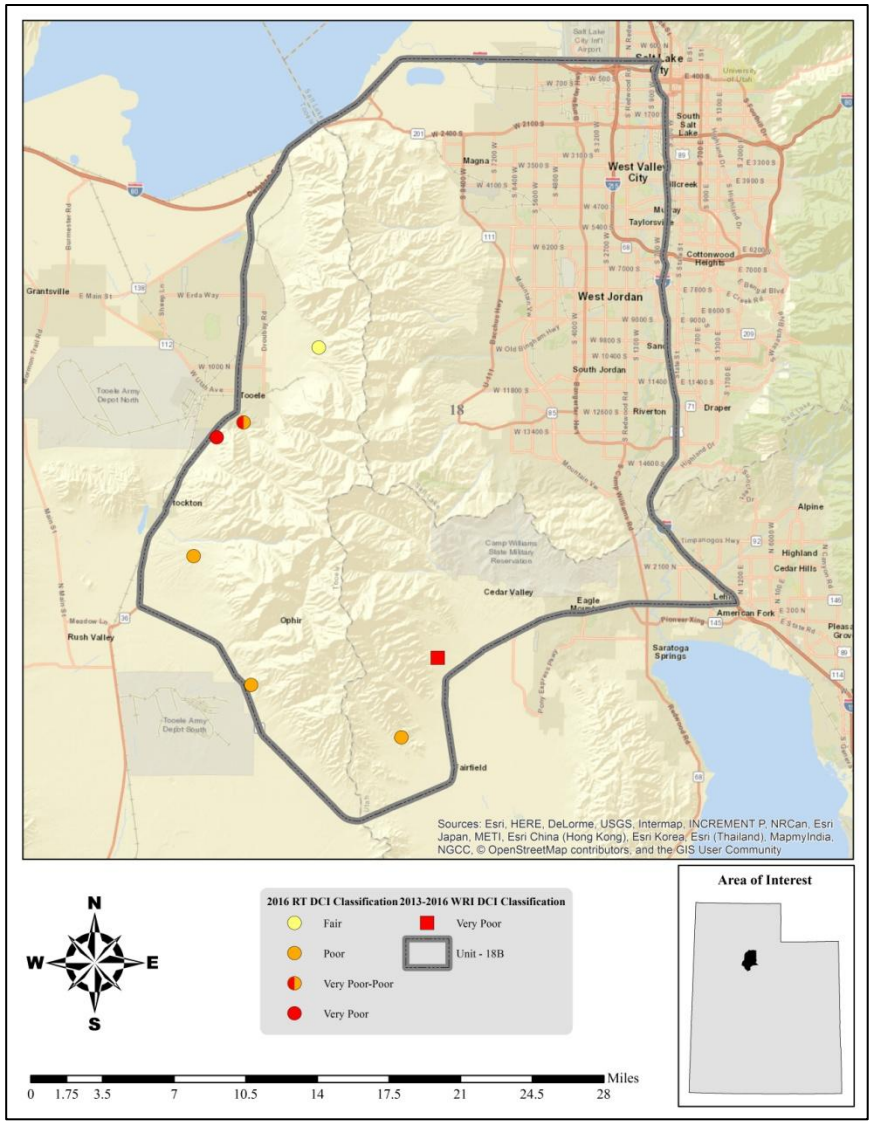
Map 9.9: 2002 Desirable Components Index (DCI) ranking distribution by study site for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.10: 2007 Desirable Components Index (DCI) ranking distribution by study site for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.11: 2012 Desirable Components Index (DCI) ranking distribution by study site for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.



Map 9.12: 2016 Desirable Components Index (DCI) ranking distribution by study site for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
18B-3	Manning Canyon	Annual Grass	Low	Increased fire potential
		PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
18B-5	Big Dip Gulch	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
18B-6	South of Soldier Canyon	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
18B-34	Three O'Clock	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	Low	Reduced diversity of desirable grass and forb species
18B-35	Settlement Canyon Reservoir	Annual Grass	Moderate	Increased fire potential
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
18B-36	Carr Fork 2	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weed Species	High	Reduced diversity of desirable grass and forb species
18R-10	Cedar Fort Bench	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor

Table 9.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 18B, Oquirrh Mountains Oquirrh-Stansbury. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

Mountain (Sagebrush)

The high elevation study site that is considered to be of the Mountain (Sagebrush) ecological type is considered to be in fair condition for deer winter range on this management unit and supports a robust bitterbrush community that may provide browse for wildlife. Both introduced perennial grasses and noxious weed species pose a significant threat to this community, as they have the potential to be aggressive and can reduce the prevalence and abundance of other more desirable native grass and forb species.

Monitoring of this community should continue. When reseeding is necessary to restore the herbaceous understory, preference should be given to native grasses and forbs when possible and caution should be taken in species selection.

Upland (Sagebrush)

These mid elevation study sites that are classified under this ecological type are considered to be in very poor to poor condition for deer winter range habitat on the Oquirrh Mountains Oquirrh-Stansbury management unit. These communities support robust sagebrush populations that provide valuable browse in mild to moderate winters. Annual grasses (primarily cheatgrass) are of concern on these study sites, as their presence can increase fuel loads and exacerbate the potential for wildfire occurrence. Introduced perennial grass species are also potential threats on the South of Soldier Canyon, Three O'Clock, and Settlement Canyon Reservoir studies as they can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species. In addition, noxious weed species are present on the Three O'Clock study and may reduce understory diversity. Pinyon and juniper encroachment is a concern on the Manning Canyon and South of Soldier Canyon sites: these trees may compete with understory species for resources.

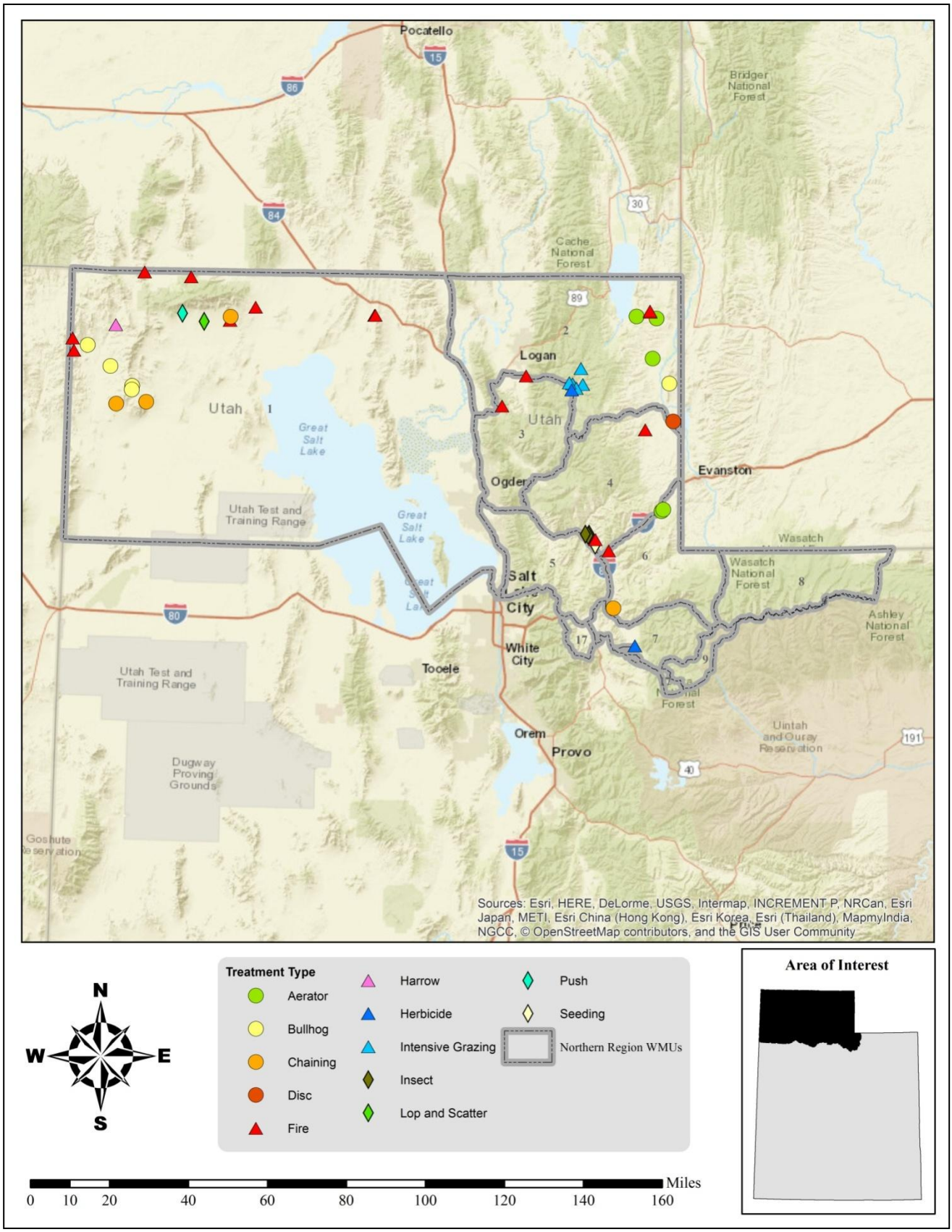
It is recommended that monitoring of these communities continue. Treatments to reduce annual grasses may be necessary on some sites. If reseeding is needed to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible. Treatment to reduce pinyon and juniper on some sites may be necessary in the future.

Upland (Black Sagebrush)

This mid elevation study site that is classified as an Upland (Black Sagebrush) ecological site is in poor condition for deer winter range on the Oquirrh Mountains Oquirrh-Stansbury management unit. A robust black sagebrush population is present on this study site and provides browse in moderate winters when snowpack is not persistent. Pinyon and juniper encroachment is a low-level potential threat and may threaten understory shrub and herbaceous health in the future.

When necessary, work to prevent further pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should begin in this community.

10. NORTHERN REGION - TREATED OR DISTURBED SUMMARY



Study Trend Summary (Treated/Disturbed Sites)

Lop and Scatter

One study site [Rosette (01-2)] in this region has undergone a lop and scatter treatment and is considered to be a semidesert ecological site. This study is located just outside the town of Rosette, south of State Route 30.

Shrubs/Trees: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse species on this site. Sagebrush cover has slightly decreased following treatment (Figure 10.1). The sagebrush population has been mainly comprised of mature individuals both pre- and post-treatment, and recruitment of young individuals has remained fairly stable (Figure 10.4). Average sagebrush utilization has decreased overall with almost all plants showing signs of little to no use (Figure 10.5). Tree cover and density have decreased following treatment (Figure 10.2, Figure 10.3).

Herbaceous Understory: Overall herbaceous cover has decreased following treatment. Perennial and annual grasses co-dominated the understory during the pre-treatment sampling. Cover and frequency of perennial grasses decreased following treatment, and annual grasses contributed a majority of the cover in the most recent sample year (Figure 10.5, Figure 10.6).

Occupancy: Pellet group transect data indicates that deer/pronghorn are the primary occupants on this study site. Abundance of pellet groups has decreased following treatment (Figure 10.7).

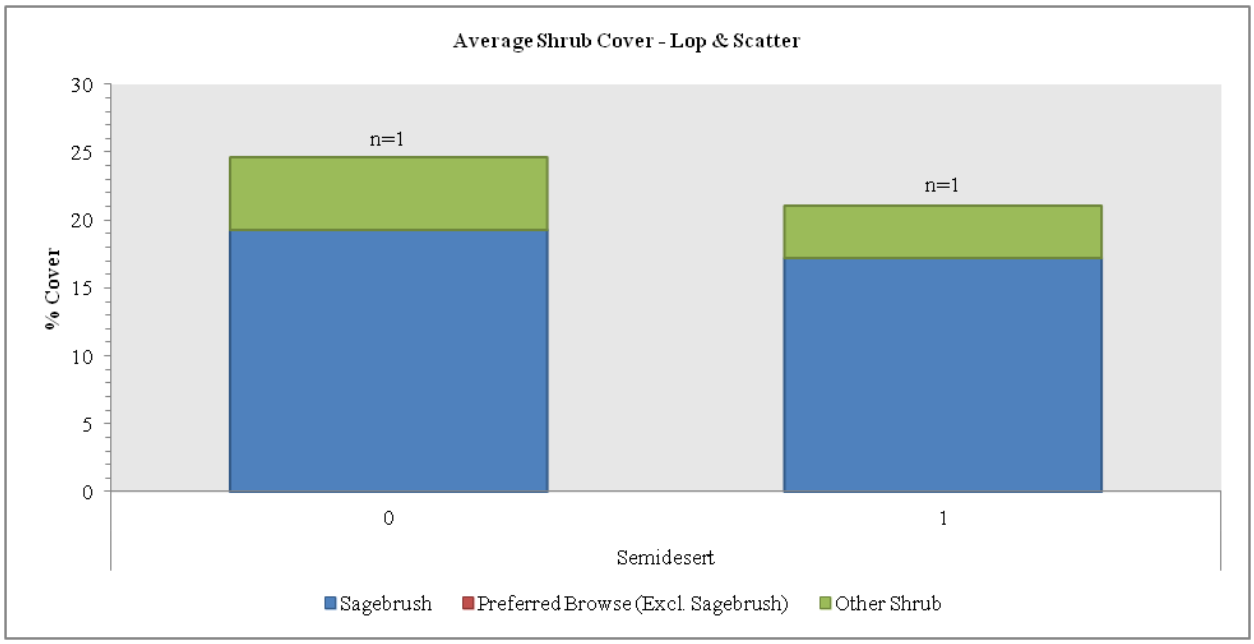


Figure 10.1: Average shrub cover of semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

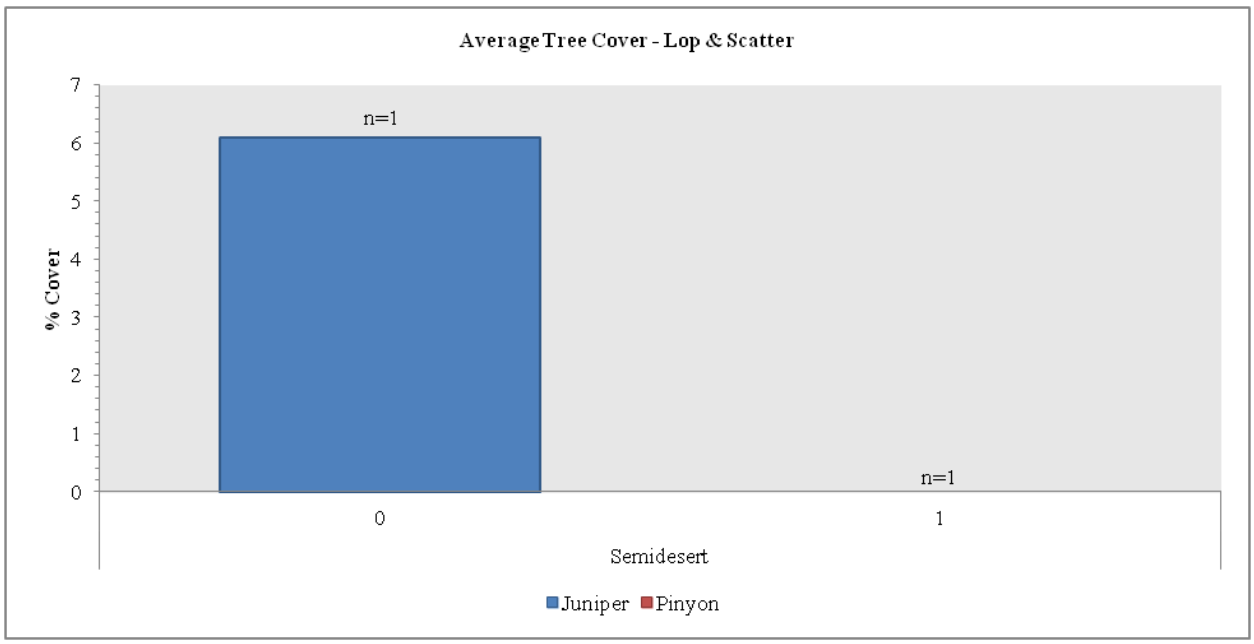


Figure 10.2: Average tree cover of semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

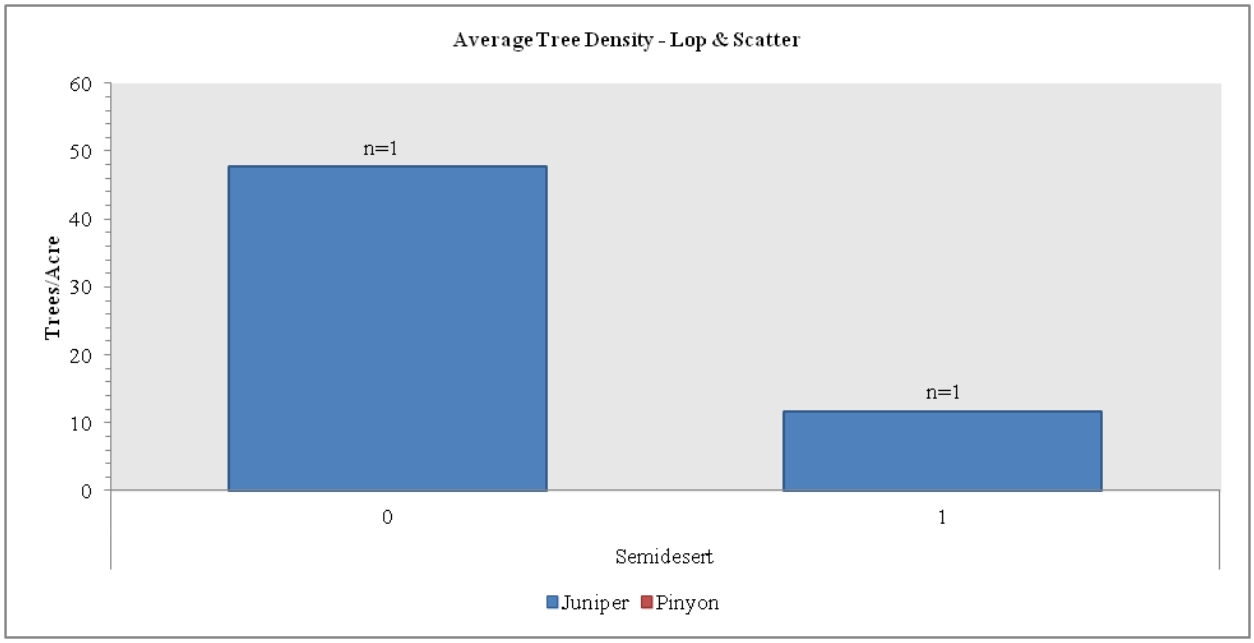


Figure 10.3: Average tree cover of semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

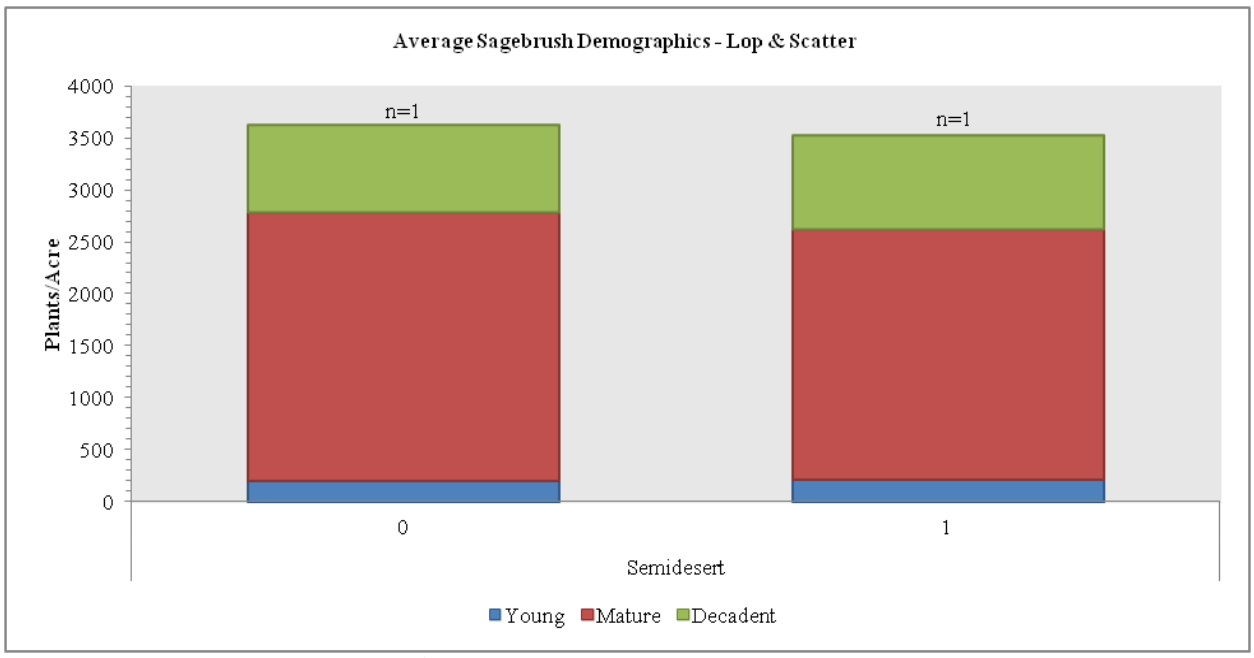


Figure 10.4: Average sagebrush demographics of semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

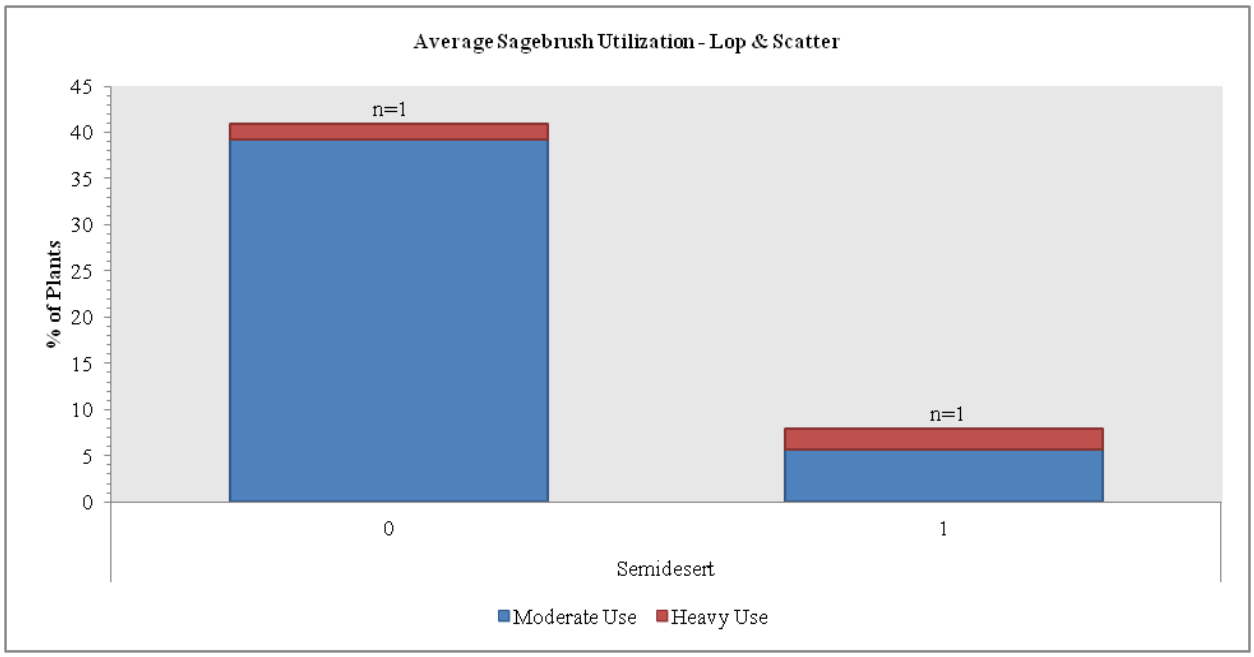


Figure 10.5: Average sagebrush utilization on semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

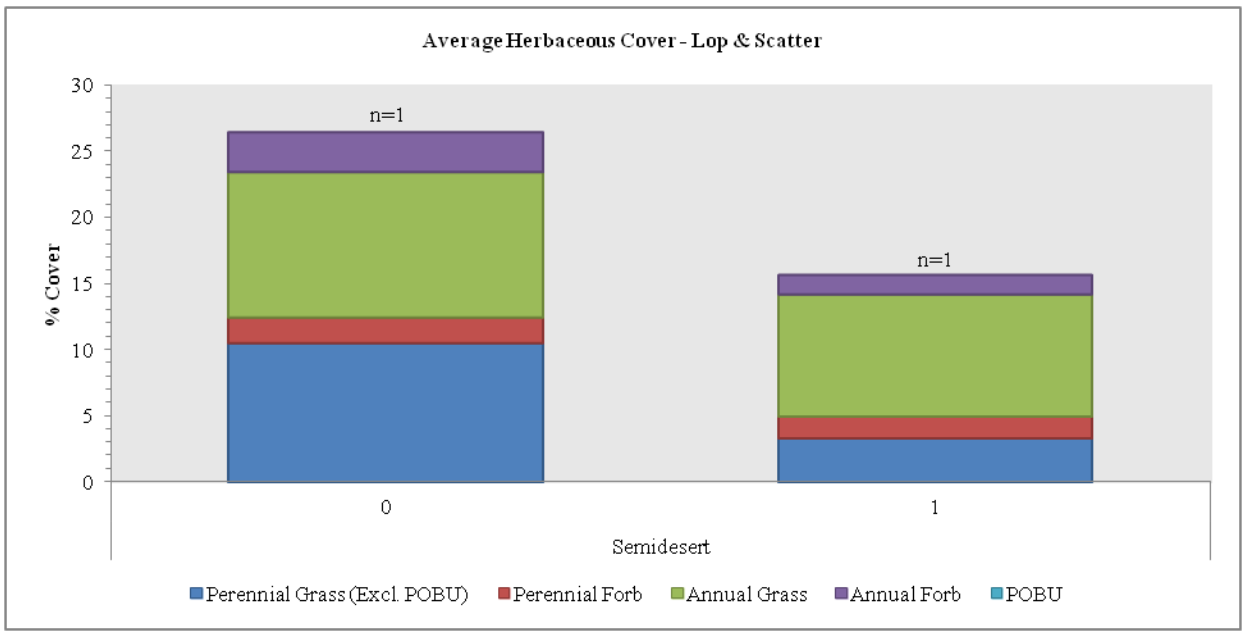


Figure 10.5: Average herbaceous cover of Semidesert (ARTEM) study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

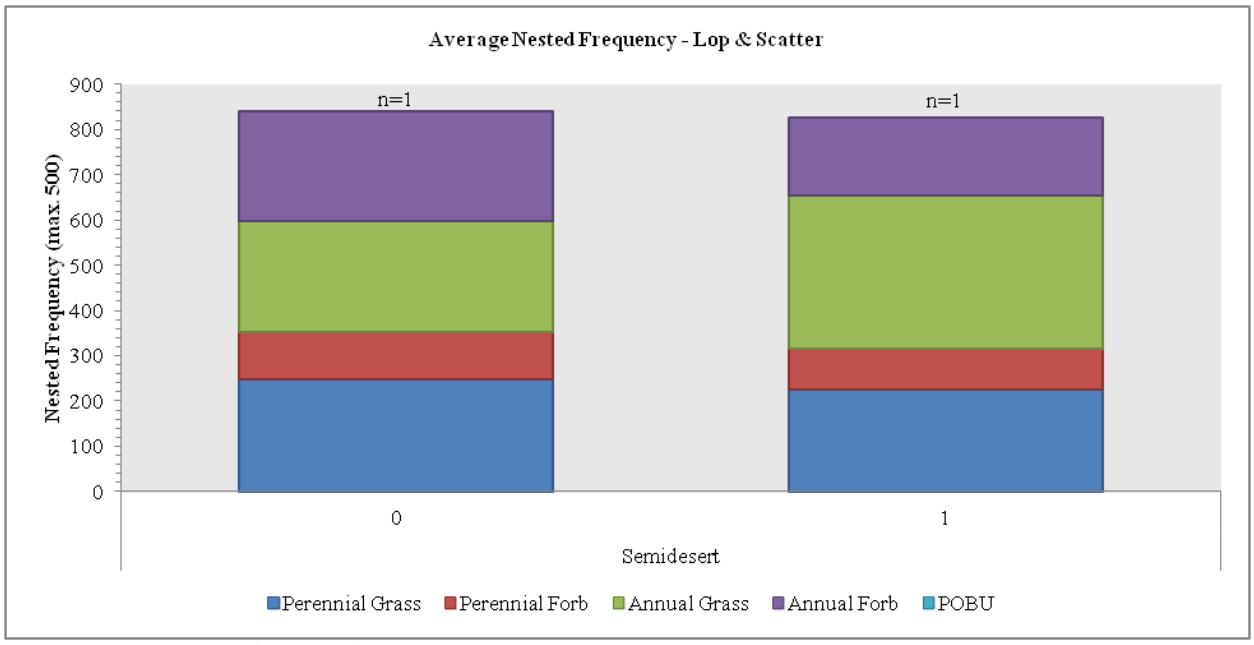


Figure 10.6: Average nested frequency of herbaceous species on semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment; 1 = 1 – 3years post-treatment.

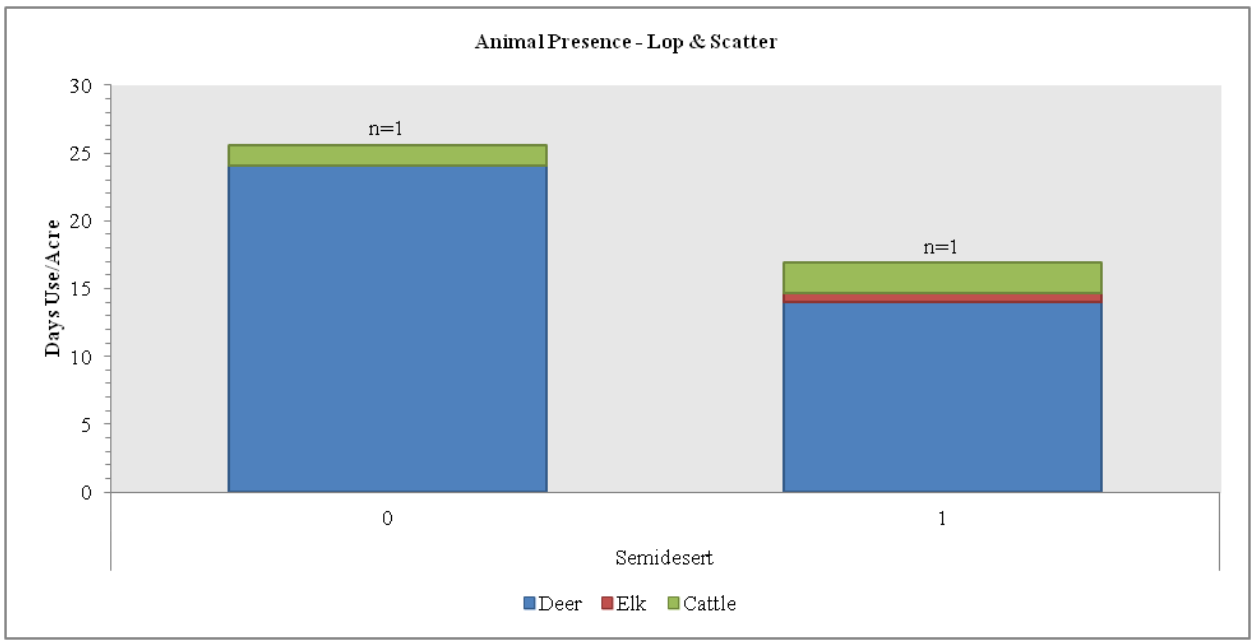


Figure 10.7: Average pellet transect data of Semidesert (ARTEM) study sites that have undergone a lop and scatter treatment.
0 = pre-treatment; 1 = 1 – 3 years post-treatment.

Aerator

There are five study sites that were treated with an aerator during the report period. Of these studies, one [Duck Creek 1 (02R-8)] is considered to be a mountain ecological site and four [Otter Creek (02-34), Duck Creek 3 Low (02R-6), Cache Cave 1 (06R-1), and Cache Cave 2 (06R-2)] are considered to be upland ecological sites. The Otter Creek site is located north of the town of Randolph and east of the Bear River. Duck Creek 3 Low is situated west of Sixmile Reservoir and south of Sixmile Creek, while Duck Creek 1 is found approximately two miles east of the southeastern portion of Bear Lake. Finally, the Cache Cave 1 study is situated between Interstate 80 and Cache Cave Creek, and the Cache Cave 2 study site is located just south of Ball and Moore Reservoir. The target of aerator treatments is usually to rejuvenate sagebrush cover in order to restore sagebrush health and herbaceous understory.

Shrubs/Trees: The primary browse on these study sites in all study years has been either mountain or basin big sagebrush (*Artemisia tridentata* ssp. *vaseyana* or *A. tridentata* ssp. *tridentata*). Sagebrush cover decreased on mountain and upland sites in the first sample year following treatment, but has since increased with time since treatment. Other shrub species have been present in varying amounts throughout the study period, but have contributed less cover in most sample years (Figure 10.8). Although density of sagebrush plants initially decreased following treatment, it has increased with time. Moreover, changes in demographics of the sagebrush population have been positive with decadence decreasing and recruitment of young increasing. A majority of the individuals were considered to be mature in all sample years; the exception to this is the third post-treatment sampling on upland sites, when young plants were the most abundant component (Figure 10.9). Utilization of sagebrush has fluctuated, but mostly has been light to moderate (Figure 10.10). It is expected that with the improved recruitment and health of the sagebrush following treatment that sagebrush density will continue to increase on these study sites.

Herbaceous Understory: The herbaceous understory on both mountain and upland study sites has fluctuated, but increased overall; it is important to notice the difference in the numbers of studies between the second and third post-treatment samplings. The upland ecological sites have been dominated by perennial grasses in all study years, with cover and frequency generally increasing as the time since treatment increases. The mountain ecological site, Duck Creek 1, has also had a large perennial grass component that has been supplemented by perennial forbs. Annual grasses have been recorded on all sites in at least one sample year, but have generally

remained rare; the trend of annual grass cover and frequency is largely driven by the Cache Cave 1 study. Finally, annual forbs have increased overall on the mountain ecological site, and have exhibited a general decrease on the upland sites (Figure 10.11, Figure 10.12).

Occupancy: Pellet group transect data indicates that cattle have predominantly occupied the mountain ecological site. Upland ecological sites have been primarily occupied by deer/sheep throughout the study years, except during the most recent sampling in which cattle were the primary occupants. Many of the deer/sheep pellet groups were recorded on the Cache Cave 1 and 2 sites, which are not included in the average of the most recent sample year (Figure 10.13).

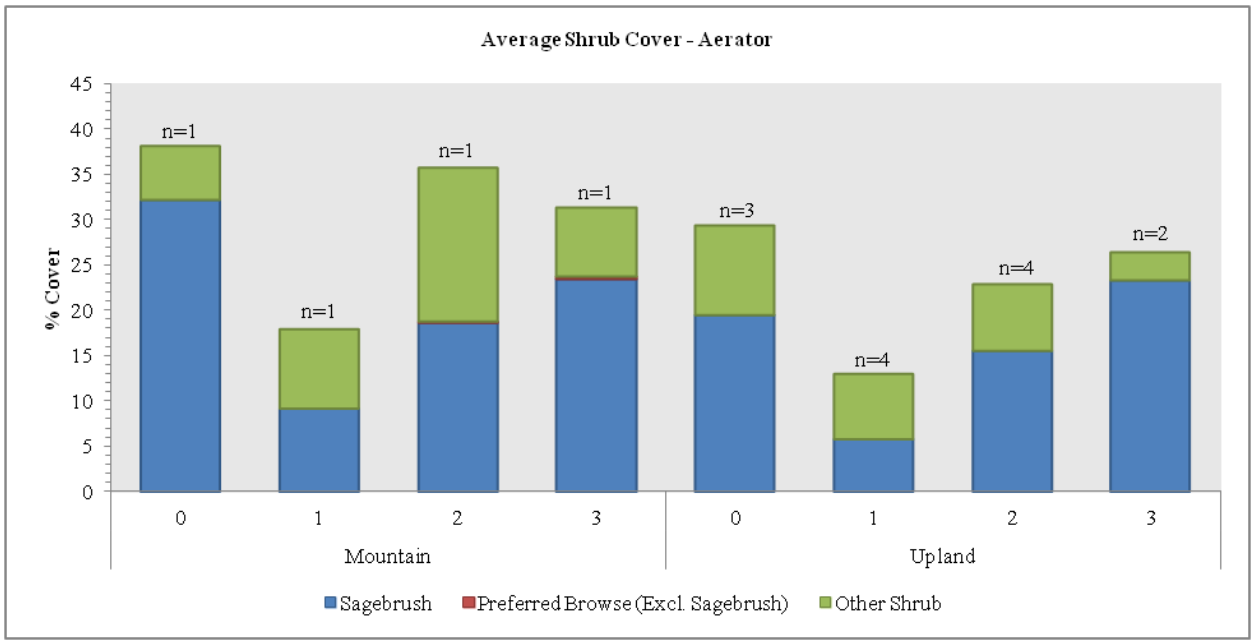


Figure 10.8: Average shrub cover of mountain and upland study sites that have been treated with an aerator. 0 = pre-treatment; 1 = 1 – 3years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

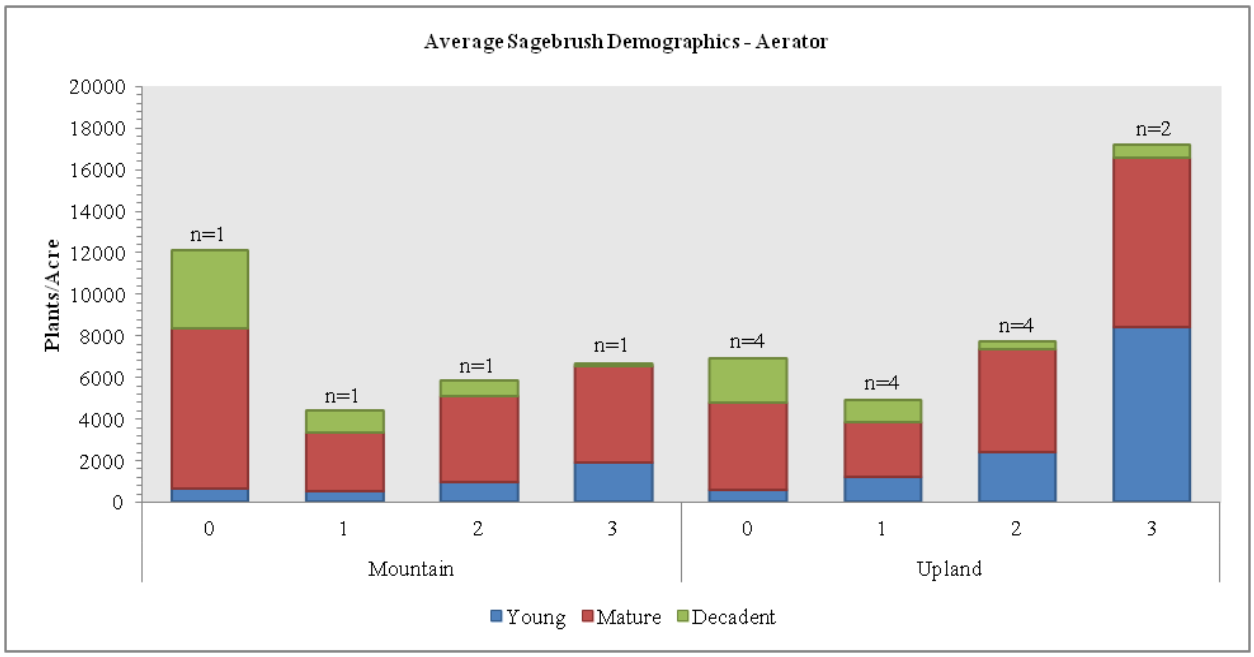


Figure10.9: Average sagebrush demographics of mountain and upland study sites that have been treated with an aerator. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

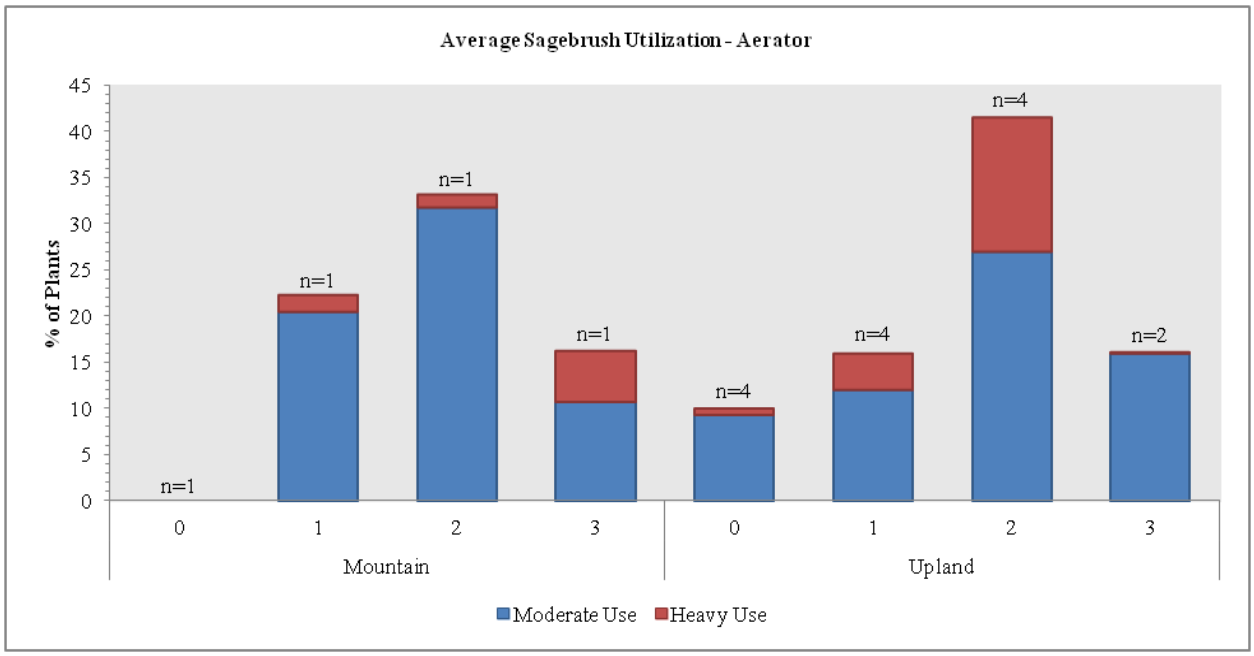


Figure10.10: Average sagebrush utilization on mountain and upland study sites that have been treated with an aerator.
0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

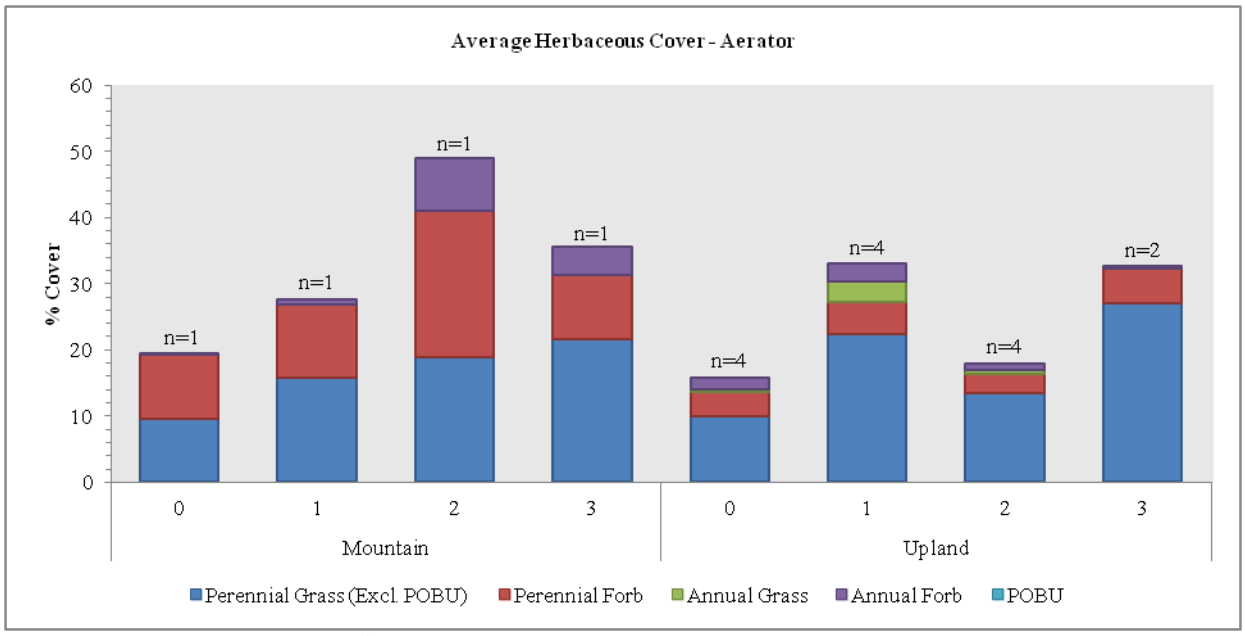


Figure10.11: Average herbaceous cover of mountain and upland study sites that have been treated with an aerator.
0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

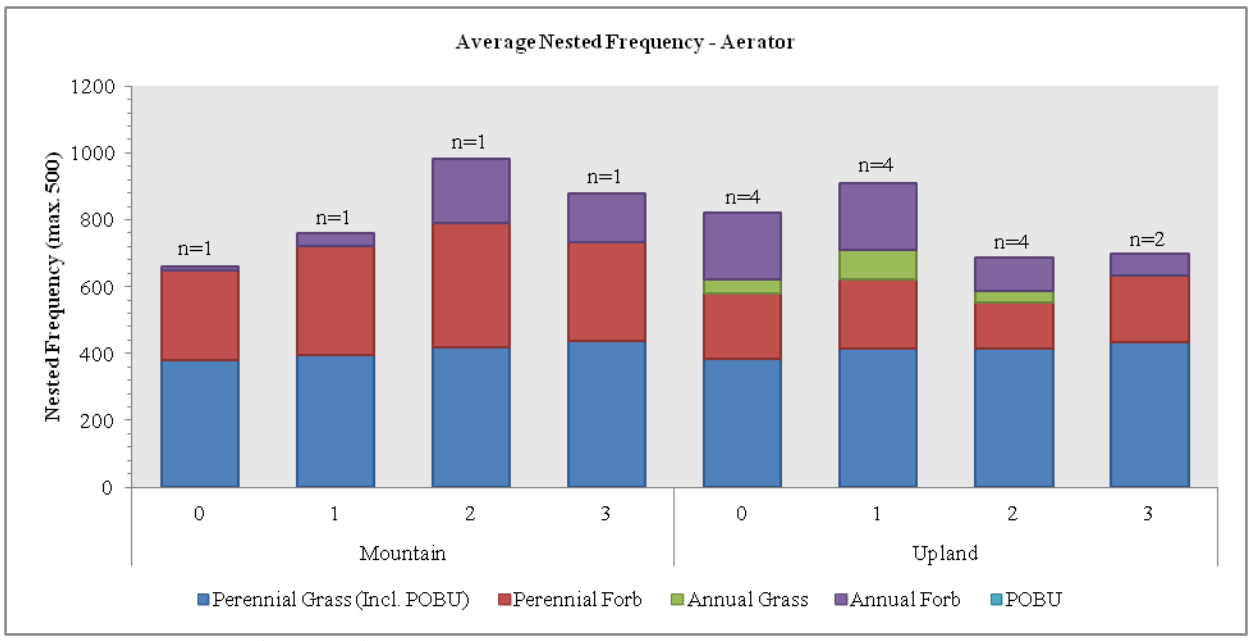


Figure10.12: Average nested frequency of herbaceous species on mountain and upland study sites that have been treated with an aerator. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

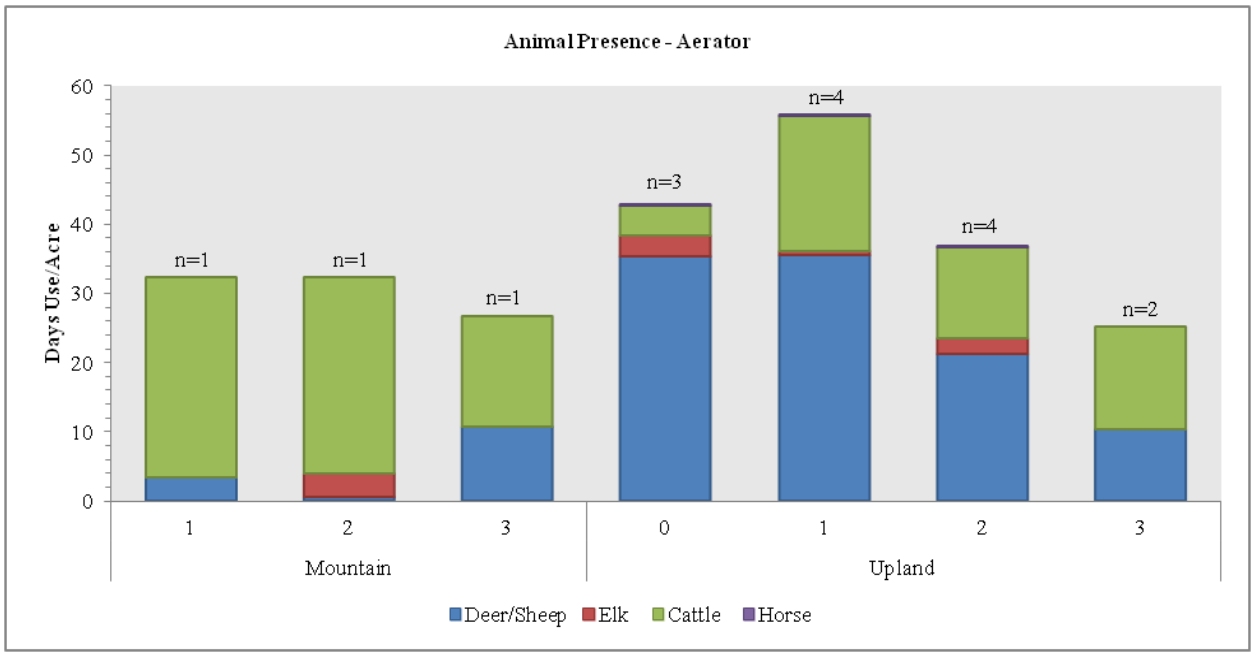


Figure 10.13: Average pellet transect data of mountain and upland study sites that have been treated with an aerator. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

Bullhog

Five study sites have been treated with a bullhog during the study period. Of these, four are classified as upland ecological sites [Chokecherry Springs (01-4), Bedke Spring (01-18), West Grouse Creek (01R-17), and Chokecherry (01R-10)] and one as a semidesert ecological type [Wood Pass (02-32)].

The Chokecherry Springs study site is located northeast of Rocky Pass Peak and west of State Road 30, while the Bedke Spring study is found on the lower western slopes of the Grouse Creek Mountains. West Grouse Creek is situated northeast of Etna Reservoir. The Chokecherry site is located east of Chokecherry Spring and

just south of Keg Springs Road. Finally, the Wood Pass study is found on the lower eastern slopes of the Crawford Mountains, south of Wood Pass.

Shrubs/Trees: Average total shrub cover has shown an increasing overall trend for upland ecological sites and a marginal general increase for semidesert ecological sites. The dominant shrub component has been sagebrush in all sample years on the semidesert ecological site and in most years on upland sites. However, other preferred browse contributed the most cover for upland sites in the most recent sample year. As only one study site has undergone a third post-treatment sampling, this trend is driven by the Chokecherry Springs study on which antelope bitterbrush (*Purshia tridentata*) is the most prevalent shrub (Figure 10.14). Sagebrush populations on studies of both ecological types have been mainly comprised of mature individuals throughout the study period, and recruitment of young plants has decreased in the years following treatment (Figure 10.16). Utilization of sagebrush has fluctuated on upland and semidesert sites, although more than three-quarters of plants showed signs of little to no use in all sample years (Figure 10.17).

Average tree cover and density have generally decreased on both mountain and upland ecological sites. However, there was an increase in density on upland ecological sites from four to eight years post-treatment to nine to thirteen years post-treatment. This increasing trend is driven by the Chokecherry Springs study, which exhibited an increase of 126 trees/acre between samplings (Figure 10.14, Figure 10.15).

Herbaceous Understory: Average herbaceous cover and frequency have increased overall on sites designated as upland ecological sites, while cover has marginally increased and frequency has remained fairly consistent on studies of the semidesert type. The most dominant herbaceous component has been perennial grasses during both sample years on the semidesert study site. Although perennial grasses have contributed about 10% cover in all years on upland sites, annual grasses were the dominant component in the third sample year following treatment. As the Chokecherry Springs study was the only study included in this sample year, it is the sole driver of this trend. Annual and perennial forbs have provided some cover over the study period for studies of both ecological types, but the exact amount has fluctuated from year to year (Figure 10.18, Figure 10.19).

Occupancy: Animal pellet groups have exhibited a marginal increase on upland ecological sites and a slight decrease on the semidesert site. Deer have been the primary occupants in all sample years on studies of both ecological types, and were the sole occupants on upland studies in the third post-treatment sampling. Again, this trend is solely due to the Chokecherry Springs study (Figure 10.20).

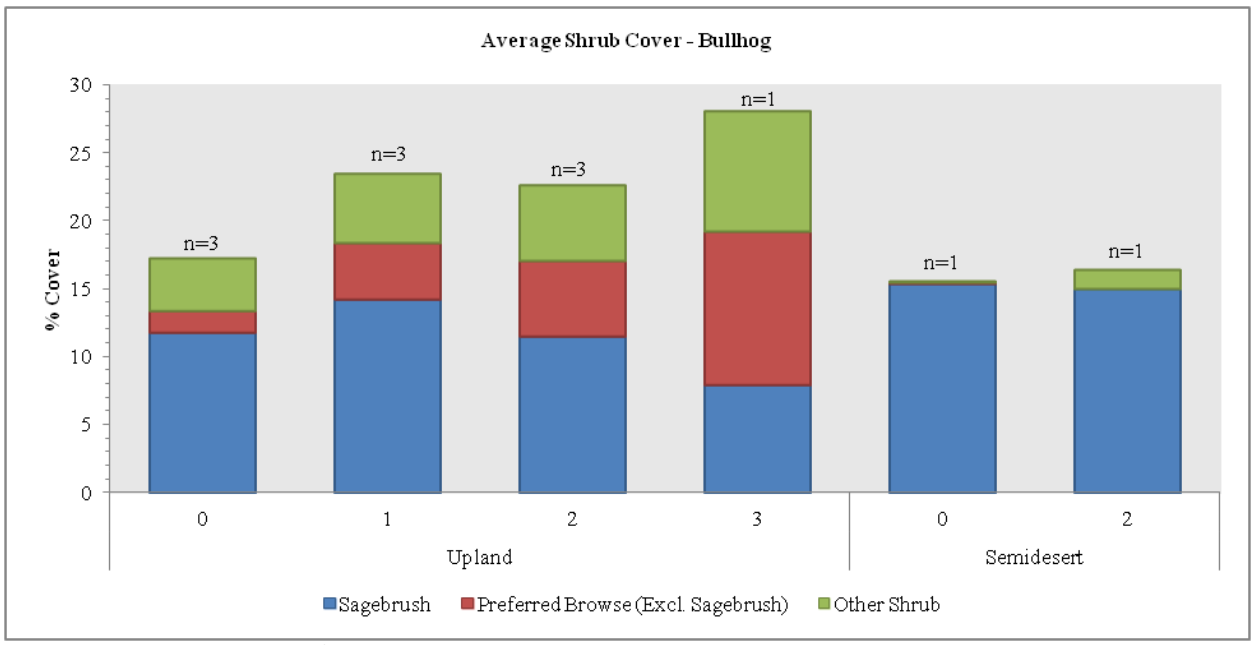


Figure 10.14: Average shrub cover of upland and semidesert study sites that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

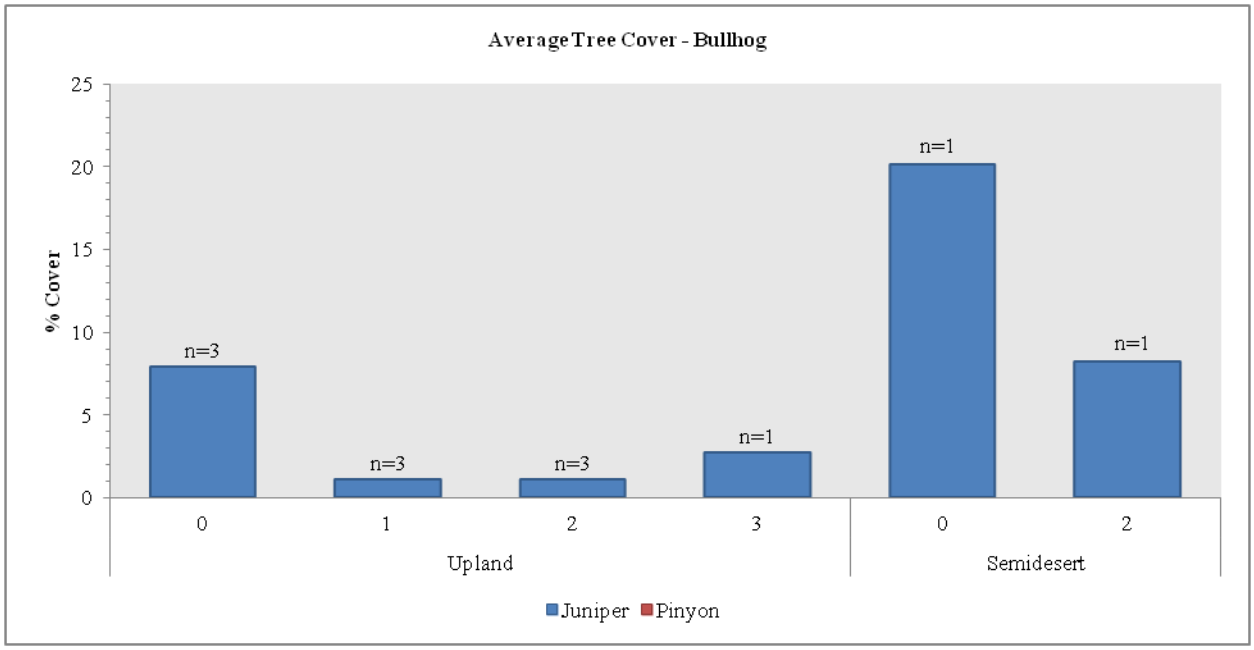


Figure 10.14: Average tree cover of Upland study sites that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

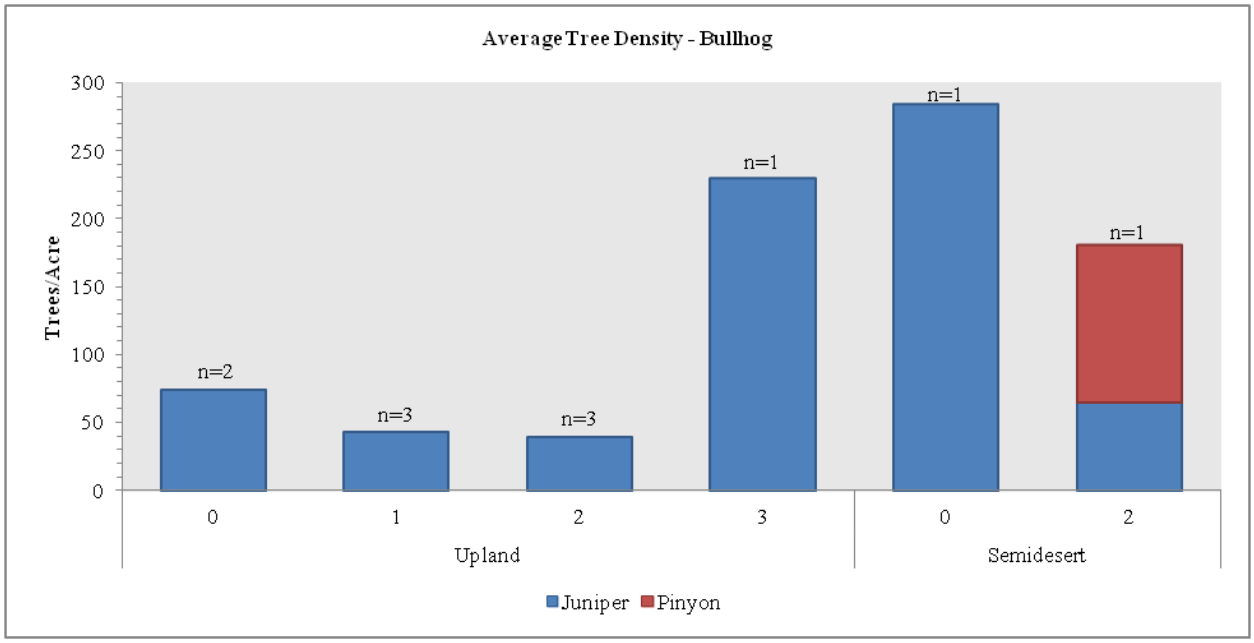


Figure 10.15: Average tree density of upland and semidesert study sites that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

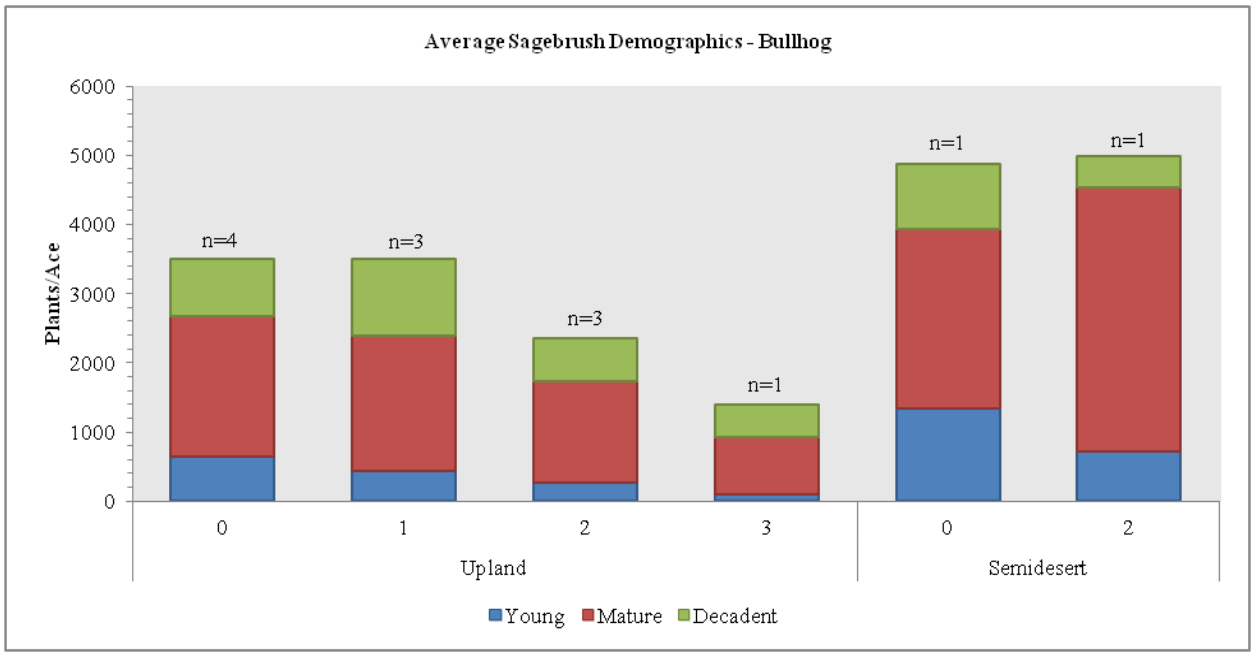


Figure 10.16: Average sagebrush demographics of upland and semidesert study sites that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

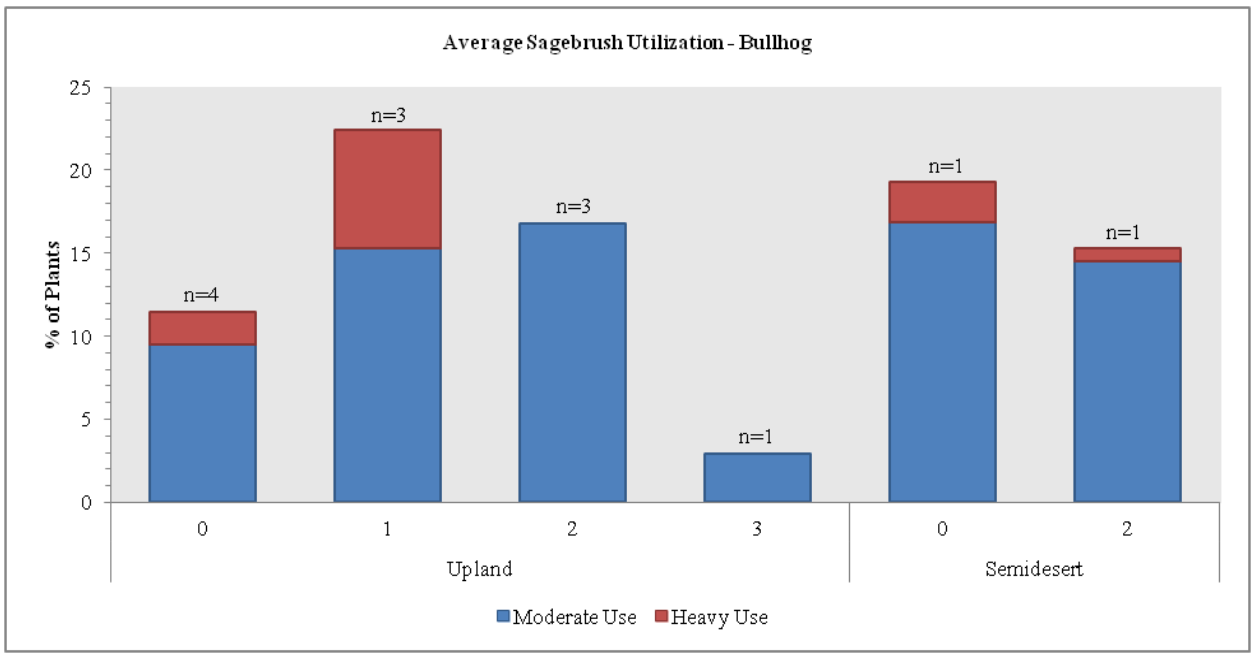


Figure 10.17: Average sagebrush utilization on upland and semidesert study sites that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

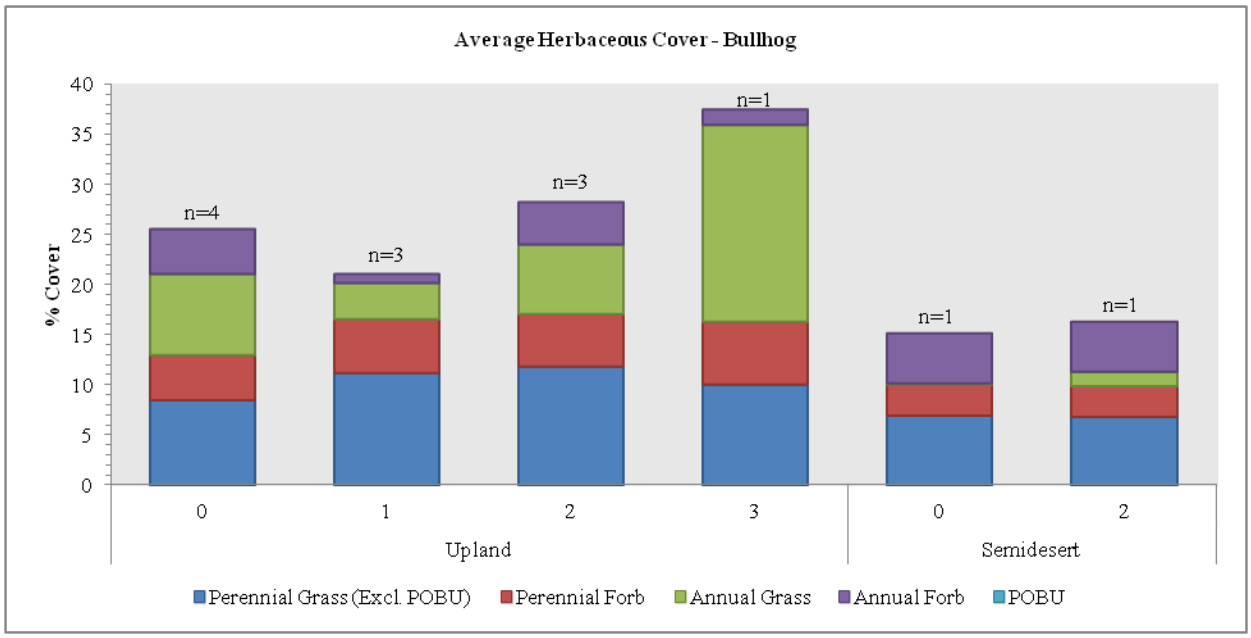


Figure 10.18: Average herbaceous cover of upland and semidesert study sites that have been bullhogged. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

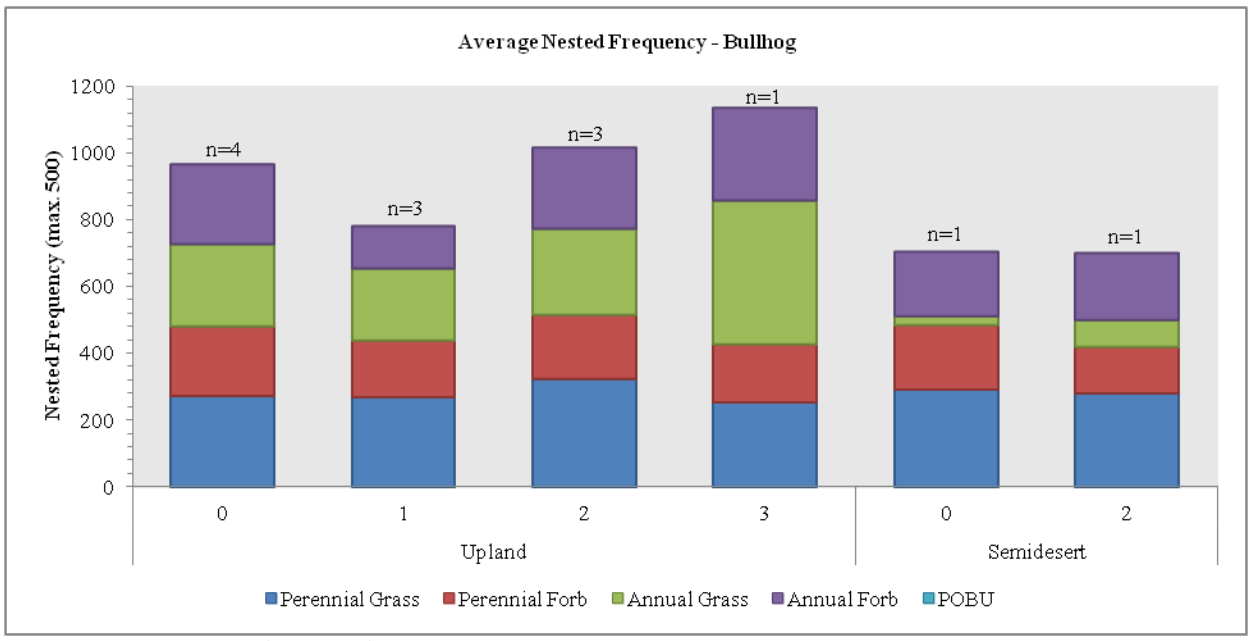


Figure 10.19: Average nested frequency of herbaceous species on upland and semidesert study sites that have been bullhogged. 0 = pre-treatment, 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

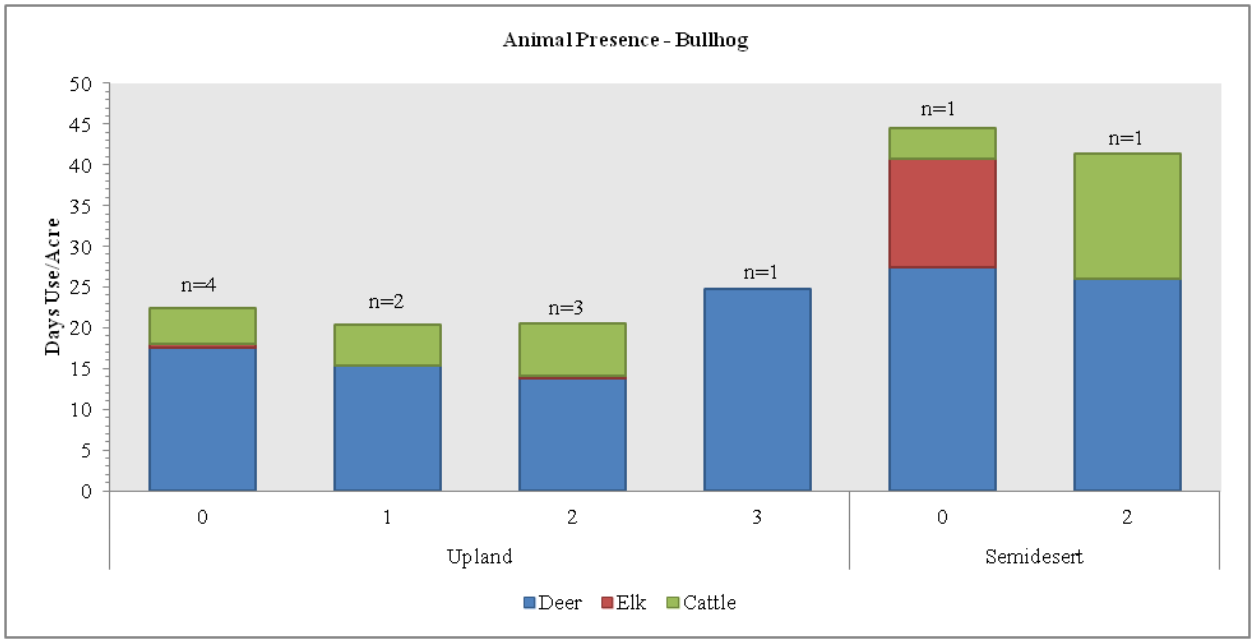


Figure 10.20: Average pellet transect data of Upland (ARTEM), Upland (ARNO), and Semidesert (ARTEM) that have been bullhogged. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment; 3 = 9 – 13 years post-treatment.

Chaining

Four study sites have been chained during the study period. One study [Lower Crandall Canyon (06R-5)] is considered to be a mountain ecological site, one [Mud Springs Basin (01-8)] is classified as an upland ecological site, and two [Devils Playground (01-5) and Hereford 2 (01R-7)] are considered to be semidesert ecological sites.

The Lower Crandall Canyon study is located north of Crandall Canyon and east of Rockport Lake. Mud Springs Basin is found southwest of Rocky Pass Peak and Mud Basin, while the Devils Playground study is situated northeast of the Bovine Mountains near the Devils Playground rock formation. The Hereford 2 study is located east of Park Valley, just north of Indian Creek Road.

Shrubs/Trees: Average shrub cover has exhibited an overall decrease on upland and semidesert ecological sites. Pre-treatment data is not available for the mountain ecological study site: this site only has data for the one post-treatment sampling so a trend cannot be extrapolated from the data and will therefore not be discussed. Average sagebrush demographics indicate that mature plants have comprised a majority of the populations on both upland and semidesert study sites in most sample years. The exception to this is the third post-treatment sampling on the semidesert ecological site, when young plants were the most abundant age class (Figure 10.24). Utilization of sagebrush has remained low, with most plants showing signs of little to no use in each sample year (Figure 10.25).

The tree cover on the study sites has decreased significantly post-treatment, on the semidesert sites the tree cover has gradually been increasing in the post-treatment samples. The tree density chart does not accurately represent the data since tree density was not recorded pre-treatment or in the first post-treatment sampling for the Hereford 2 study, and inclusion of this site into the second and third post-treatment categories may influence how the data is displayed (Figure 10.22, Figure 10.33).

Herbaceous Understory The herbaceous understory has exhibited an overall decrease in perennial grass cover and an overall increase of annual grasses and forbs following treatment. Since the mountain site does not have pre-treatment data, it cannot be determined how the treatment has affected the understory. However, annual grasses were not present in the post-treatment sampling on the mountain site. On the upland sites, perennial grass cover decreased and annual grass cover and frequency dramatically increased. Annual and perennial forbs increased slightly post-treatment. On the semidesert site, a similar trend is occurring, as the cover of perennial grasses decreased and that of annual grasses increased; however, annual grass cover decreased between the second and third post-treatment samplings. Perennial grasses and forbs are rare as of the third post-treatment sample year. Annual forbs initially decreased, but have increased in subsequent samplings (Figure 10.26, Figure 10.27).

Occupancy The primary occupants for the mountain ecological site are deer. The upland site shows the primary occupants being deer before treatment, then deer and elk showing equal usage in post-treatment pellet group transects. On the semidesert sites both before and after treatment, cattle are the primary occupants of the Hereford 2 site while mule deer are the primary occupants for Devils Playground. Data for only one sample year is available for the mountain ecological site so occupancy over time cannot be analyzed. On the upland site, animal occupancy declined post-treatment. On the semidesert site, animal occupancy remained stable until the second and third post-treatment samplings in which occupancy declined and elk were sampled for the first time on the site (Figure 10.28).

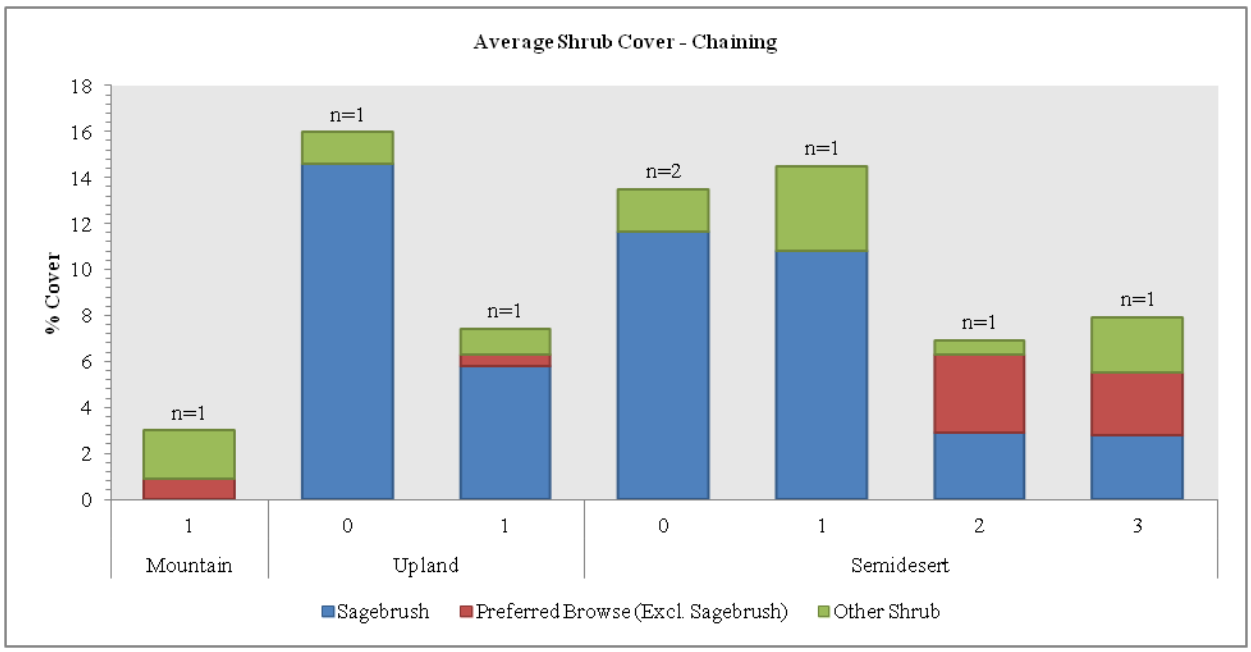


Figure 10.21: Average shrub cover of mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

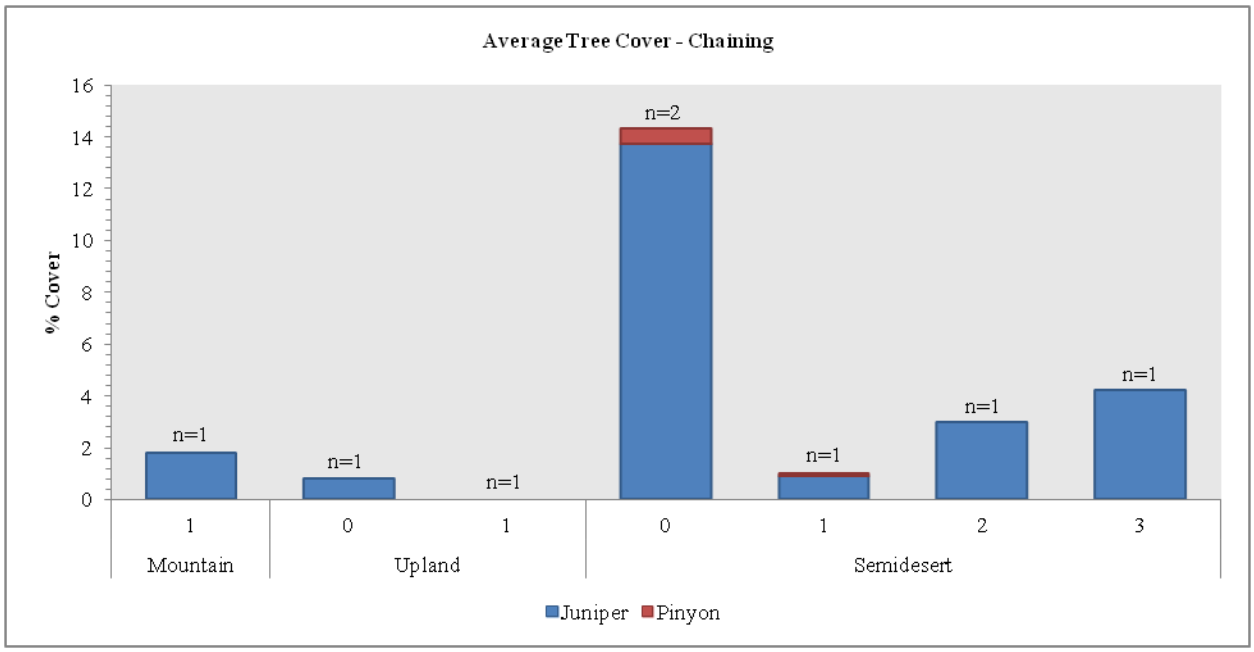


Figure 10.22: Average tree cover of mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

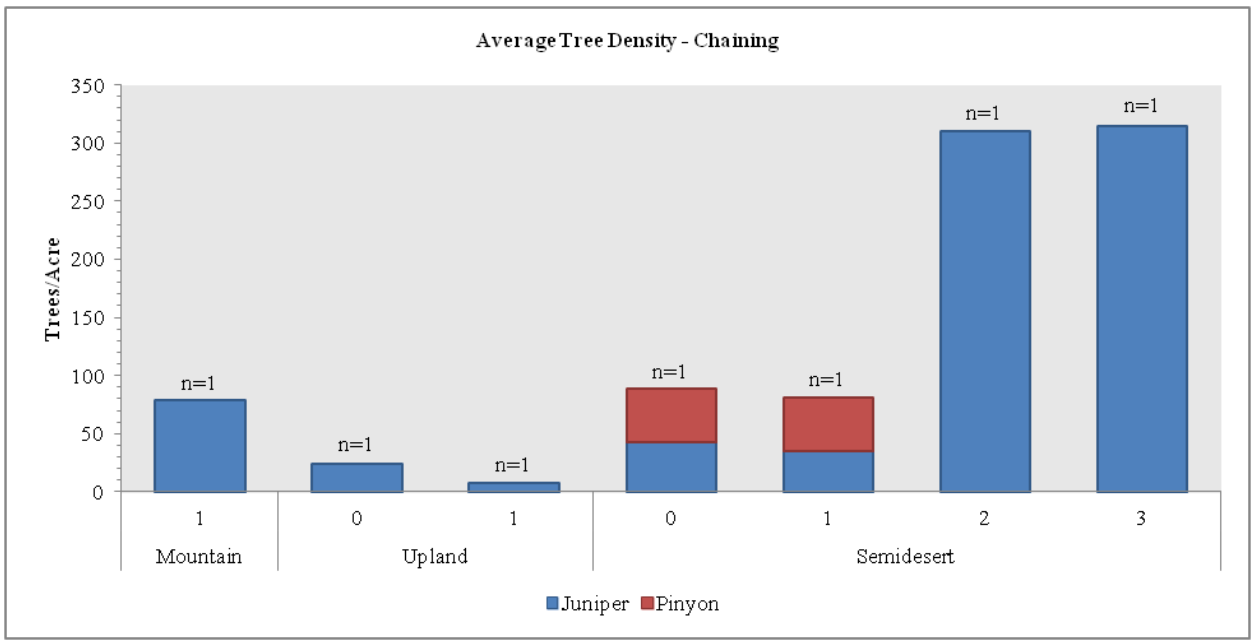


Figure 10.23: Average tree density of mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

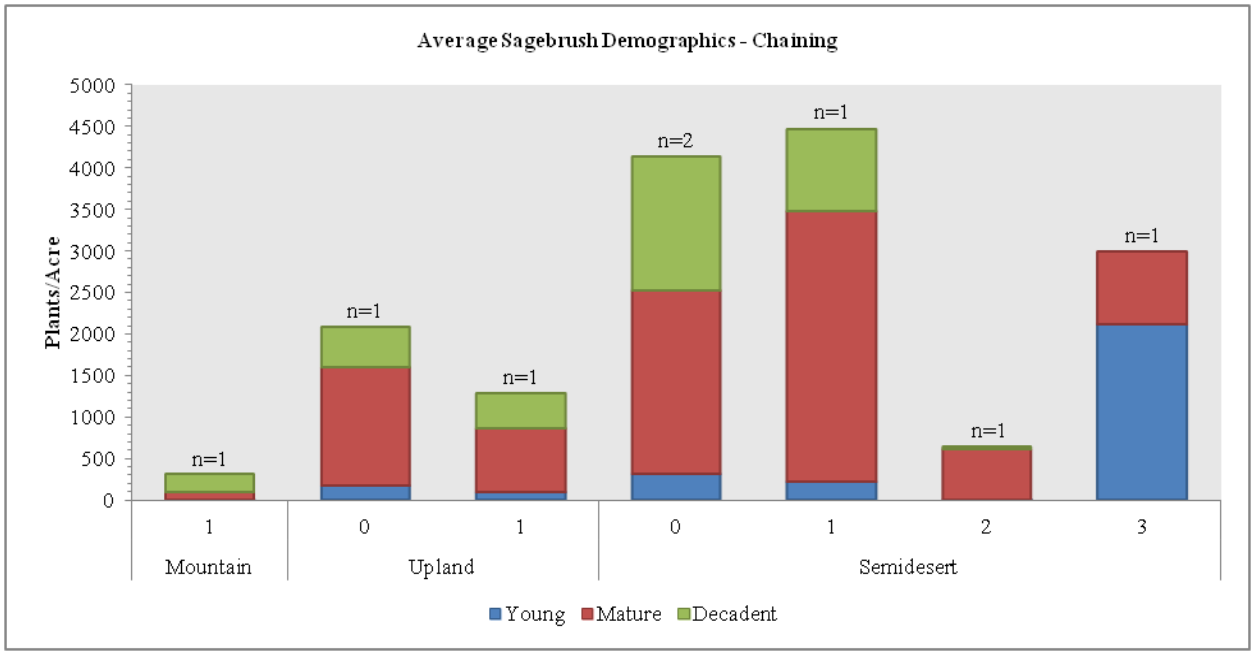


Figure 10.24: Average sagebrush demographics of mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

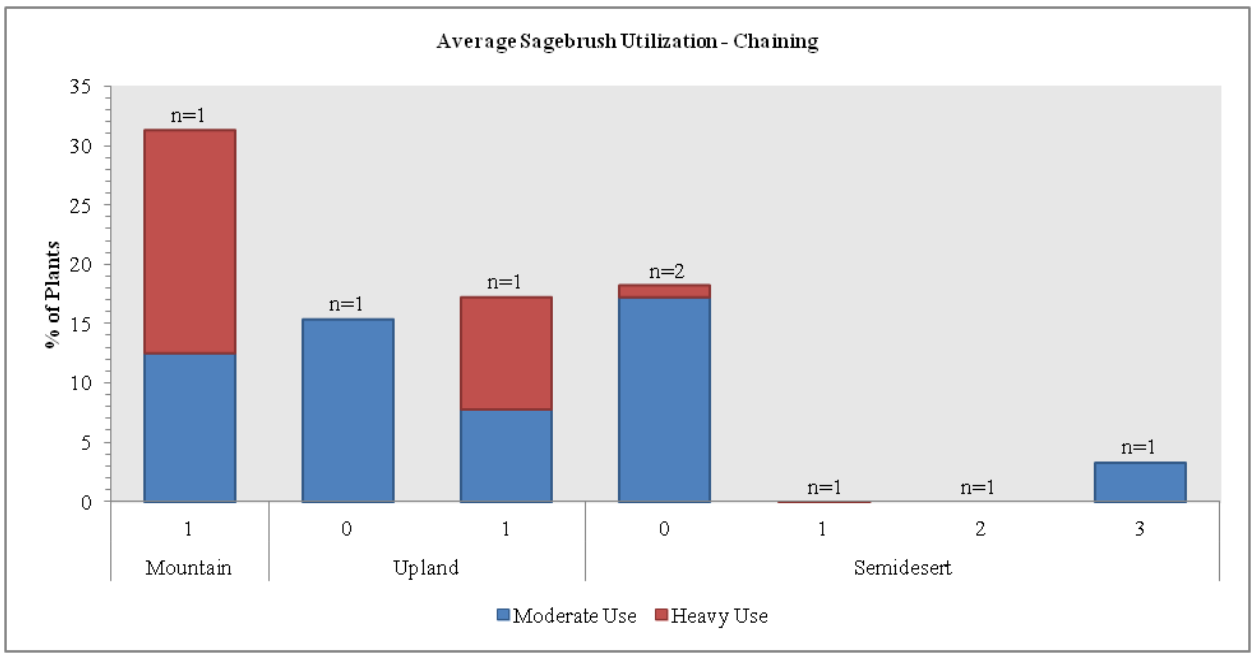


Figure 10.25: Average sagebrush utilization on mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

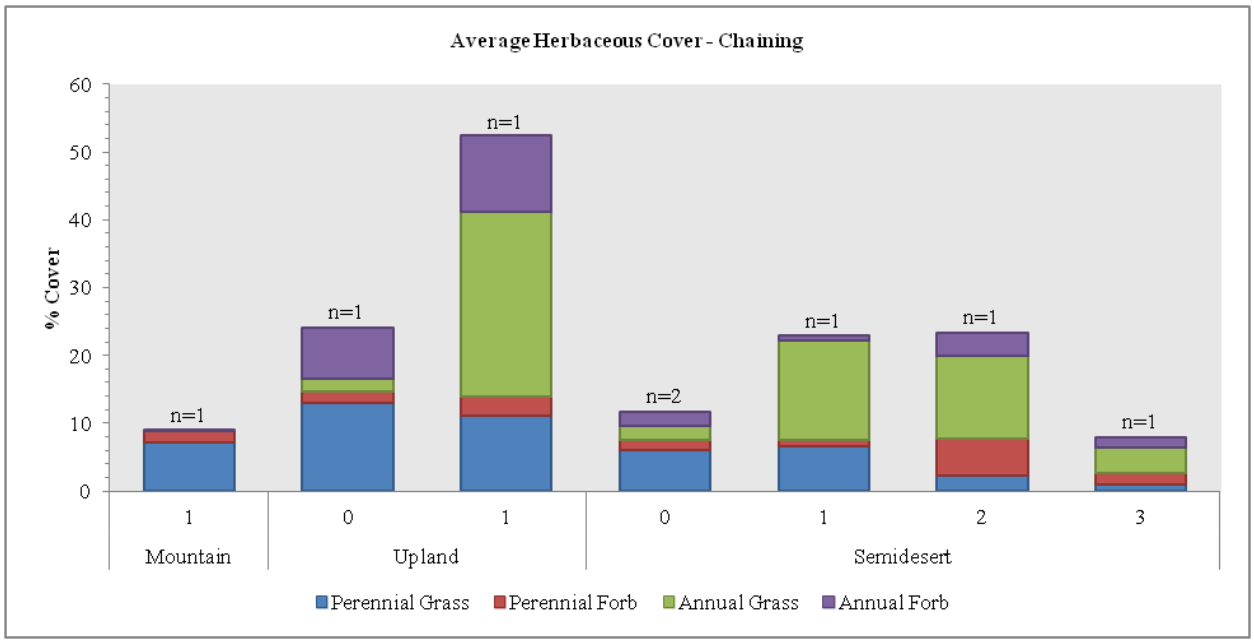


Figure 10.26: Average herbaceous cover of mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

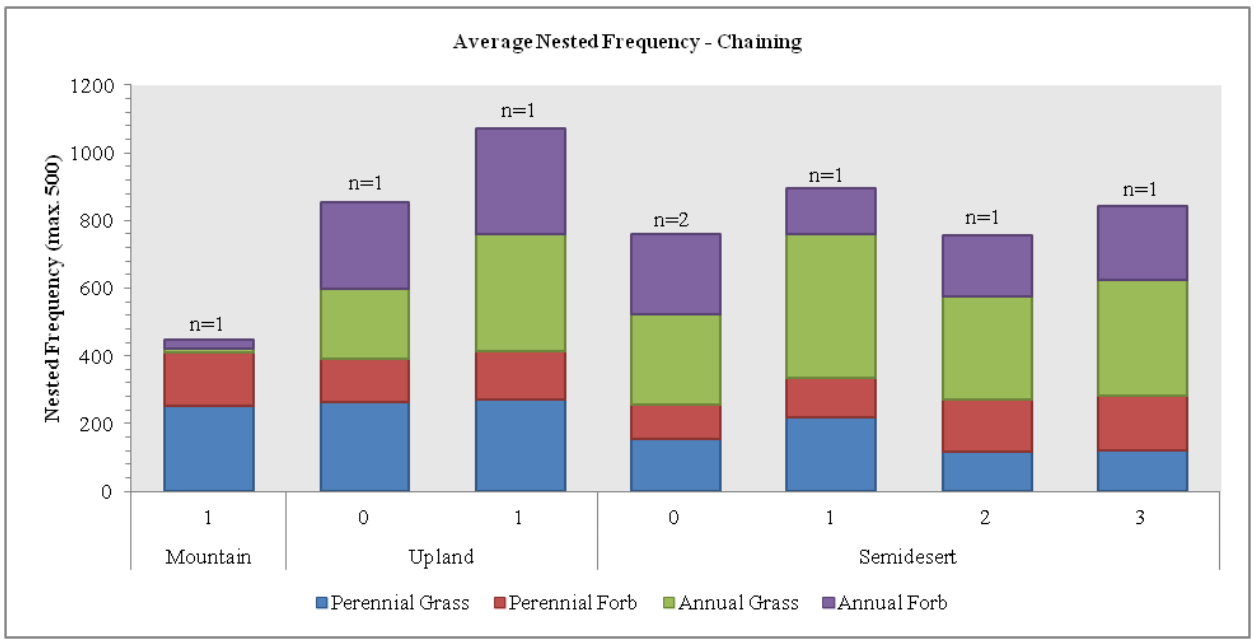


Figure 10.27: Average nested frequency of herbaceous species on mountain, upland, and semidesert study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

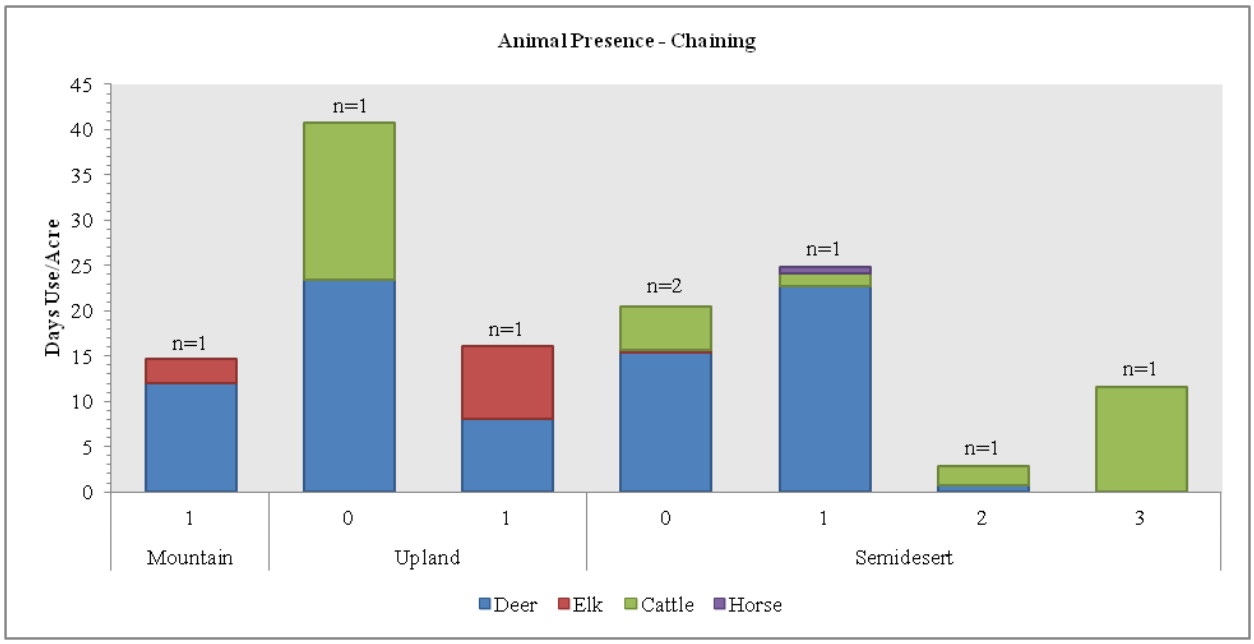


Figure 10.28: Average pellet transect data of Mountain (ARTEM), Upland (ARTEM), and Semidesert (ARNO) study sites that have been chained. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

Fire

Thirteen study sites have been burned in this region. Four studies are considered to be mountain ecological sites [Bally Mountain (01-19), Rabbit Creek Burn (02R-9), Rabbit Creek Burn Seeded (02R-10), Echo Canyon Rest Area (06-2)], eight are classified as upland ecological sites [Cedar Hills (01-15), Rattlesnake Fire Seeded (01R-2), Rattlesnake Burn (01R-3), Dairy Valley GIP 1 (01R-12), Dairy Valley GIP 2 (01R-13), Mouth of Blacksmith Fork (02-2), NE Mantua Reservoir (03-2), Owen's Canyon (04-4), and Deseret Burn (04-19)], and two are considered to be semidesert ecological sites [Coldwater 1 (01R-4) and Hereford 1 (01R-6)].

The Bally Mountain study is located northeast of the town of Yost and just south of the Utah-Idaho border. Rabbit Creek Burn and Rabbit Creek Burn Seeded are situated west of North Fork Sixmile Creek. The Echo Canyon Rest Area study is found 2.75 miles northeast of the town of Echo on Interstate 80, and Cedar Hills is situated just south of the Utah-Idaho border and west of Lynn Road. Rattlesnake Fire Seeded and Rattlesnake Burn are located south of I-84 on either side of 21480 West Road. The Dairy Valley GIP 1 study is found about 0.6 miles east of the Utah-Nevada border, while Dairy Valley GIP 2 is found south of Camp Creek. Mouth of Blacksmith Fork is situated at the mouth of Blacksmith Fork Canyon, north of State Route 101. The NE Mantua Reservoir study is located northeast of Mantua Reservoir near Clappers Hollow. The Owen's Canyon study site is found on the slopes on the northwest side of Owen's Canyon, while Deseret Burn is situated south of Wheatgrass Hollow. The Coldwater 1 site is northeast of Black Butte and north of US 30. Finally, the Hereford 1 study site is located just south of US 30, east of Park Valley.

Shrubs/Trees: The overstories of the mountain ecological sites are primarily composed of shrubs other than sagebrush and other preferred browse. Cover of sagebrush and preferred browse has remained low but has steadily increased in the years following disturbance. On the mountain sites, the cover of other shrubs has become the dominant component of the overstory: these include primarily rubber rabbitbrush (*Ericameria nauseosa*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), and broom snakeweed (*Gutierrezia sarothrae*). Average sagebrush utilization indicates that less than 50% of plants showed signs of moderate to heavy browsing in all sample years (Figure 10.33).

There are some trees present only on the Bally Mountain site, but density levels have decreased following the burn (Figure 10.31).

Trends concerning shrubs are very similar across all of the upland ecological sites. Post-fire, the cover of sagebrush decreased significantly and other shrubs such as yellow rabbitbrush became the dominant shrub type. Some sites such as Dairy Valley GIP 1 and Cedar Hills show good recruitment of sagebrush between 10-15 years post fire, while others such as Mouth of Blacksmith Fork show very little recruitment at nearly 10 years following the fire (Figure 10.32). Average utilization of sagebrush has varied throughout the years, but has increased overall. The significant increase between the fourth and fifth post-disturbance samplings is likely due to the difference in number of study sites and is driven by the Deseret Burn study (Figure 10.33).

Dairy Valley GIP 1 and Dairy Valley GIP 2 are the only upland study sites showing the presence of conifers. Dairy Valley GIP 1 has shown an increase in juniper trees following the fire in 2007 and chaining in 2008 (Figure 10.30, Figure 10.31).

The semidesert study sites are primarily composed of preferred browse species other than sagebrush, namely forage kochia (*Bassia prostrata*), that have been planted following fires. The cover of sagebrush has increased slightly on the Hereford 1 study site following the fire. Post-fire, the decadence of the remaining sagebrush decreased significantly (Figure 10.32). Average sagebrush utilization has increased following the fire(s), with nearly 39% of plants being moderately or heavily hedged as of the second post-disturbance sampling: this trend is mainly driven by the Hereford 1 study (Figure 10.33).

For the semidesert sites, only the Hereford 1 site had any tree cover historically. Following the fire, there was no tree cover sampled in either of the following sample years (Figure 10.29, Figure 10.31, Figure 10.32).

Herbaceous Understory: For the mountain ecological sites, the herbaceous understory is primarily composed of perennial grasses and forbs. These sites have all behaved similarly to each other in response to disturbance. Immediately following the fire, the cover and frequency of perennial grasses has decreased but recovered in subsequent years. The cover and frequency of perennial forbs increased slightly post-fire. Annual grasses have remained a small part of the understory, even following the fire. Annual forbs increased slightly in the years following the fire. Most of the perennial grass cover on the study sites is provided by Sandberg bluegrass (*Poa secunda*), thickspike wheatgrass (*Elymus lanceolatus*), and bluebunch wheatgrass (*Pseudoroegneria spicata*) (Figure 10.34).

For the upland sites, the herbaceous understory is primarily composed of perennial grasses with a mixture of annual grasses, annual forbs and perennial forbs present in varying amounts. The annual grasses have decreased successively in the years post-disturbance with the highest amount noted in the pre-disturbance data. Annual forbs generally increased following the fire. Perennial forb cover initially remained generally steady, but began to diminish 9-13 years post-disturbance. It should be noted that there is a difference in n values between pre-disturbance data and data collected 19-23 years post-disturbance, and that this trend may not be representative of the ecological type as a whole (Figure 10.34).

Semidesert ecological sites were mostly dominated by annual grasses pre-disturbance, followed by annual forbs and perennial grasses in the post-disturbance samplings. Perennial grasses increased in cover and frequency post-disturbance on both study sites. Perennial forbs have remained a small component of the understory. Annual forbs decreased to a small percent of cover in data collected 4-8 years post-disturbance. Post-disturbance, annual grasses have remained a component of the understory but are no longer dominant (Figure 10.34).

Occupancy: Average pellet group abundance on mountain, upland and semidesert ecological sites has decreased at the first post-disturbance sampling and the occupants have been varied. In subsequent sample years, the pellet group abundance has either returned to or increased above the pre-disturbance numbers. Cattle are the primary occupants on all mountain ecological sites except for the Echo Canyon site where mule deer are the primary occupants. Deer utilization remains similar throughout all sample years; cattle usage decreased significantly in data collected 1-3 years post-disturbance. Cattle usage increased significantly in subsequent sample years to roughly twice the pre-disturbance usage on mountain ecological sites.

Pellet transect data for the upland ecological type shows that pre-disturbance, mule deer were the primary occupants for all sites except for Dairy Valley GIP 1 and Dairy Valley GIP 2, where cattle pellet groups are the most abundant. Post-burn, cattle are the primary occupants for all sites except for Rattlesnake Fire Seeded, Rattlesnake Burn, and NE Mantua Reservoir where mule deer are the primary occupants. Owen's Canyon is also an exception, with elk as the primary occupants immediately following the burn. The post-burn occupancy trend remains similar in subsequent sample years across the sites.

The semidesert ecological site pellet group abundance data shows cattle as the primary occupants for the Coldwater 1 site and mule deer as primary occupants for Hereford 1 prior to disturbance. Post-disturbance, cattle have been the dominant species for both sites (Figure 10.36).

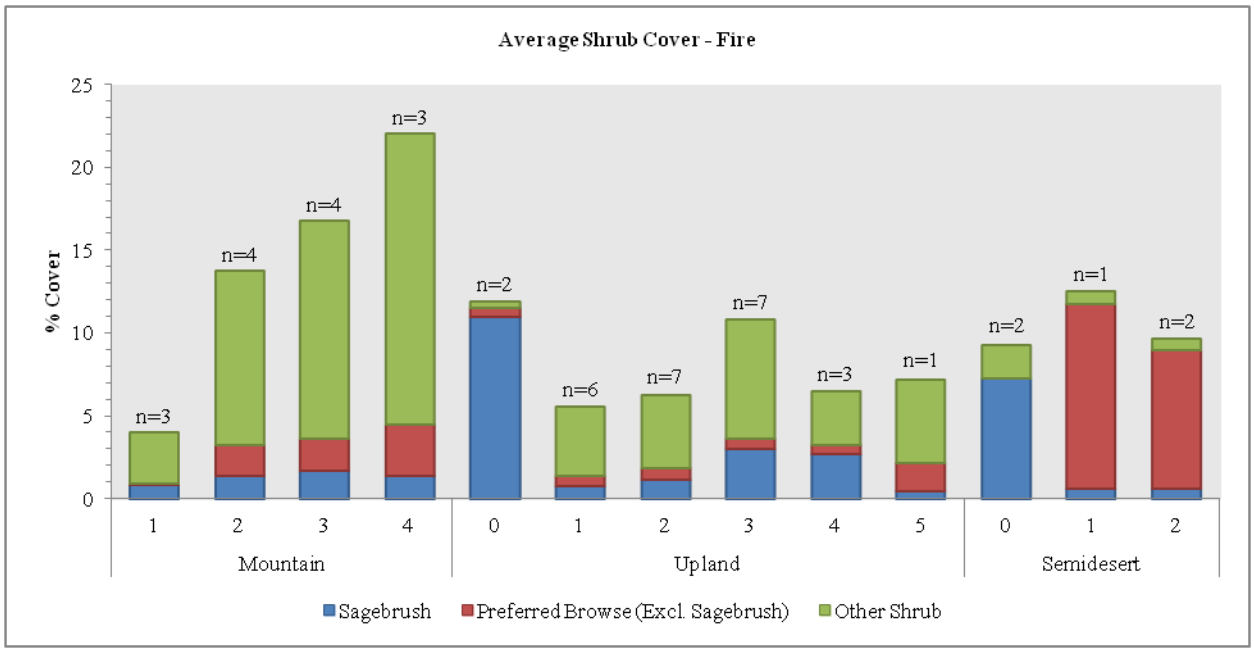


Figure 10.29: Average shrub cover of mountain, upland, and semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

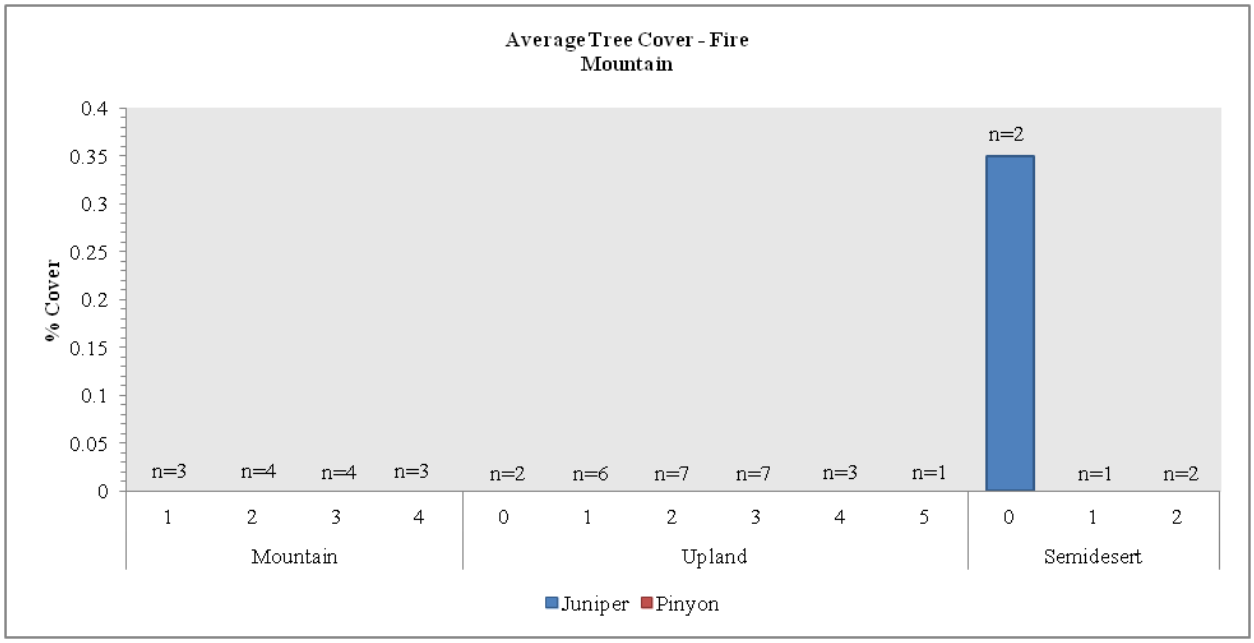


Figure 10.30: Average tree cover of mountain, upland, and semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

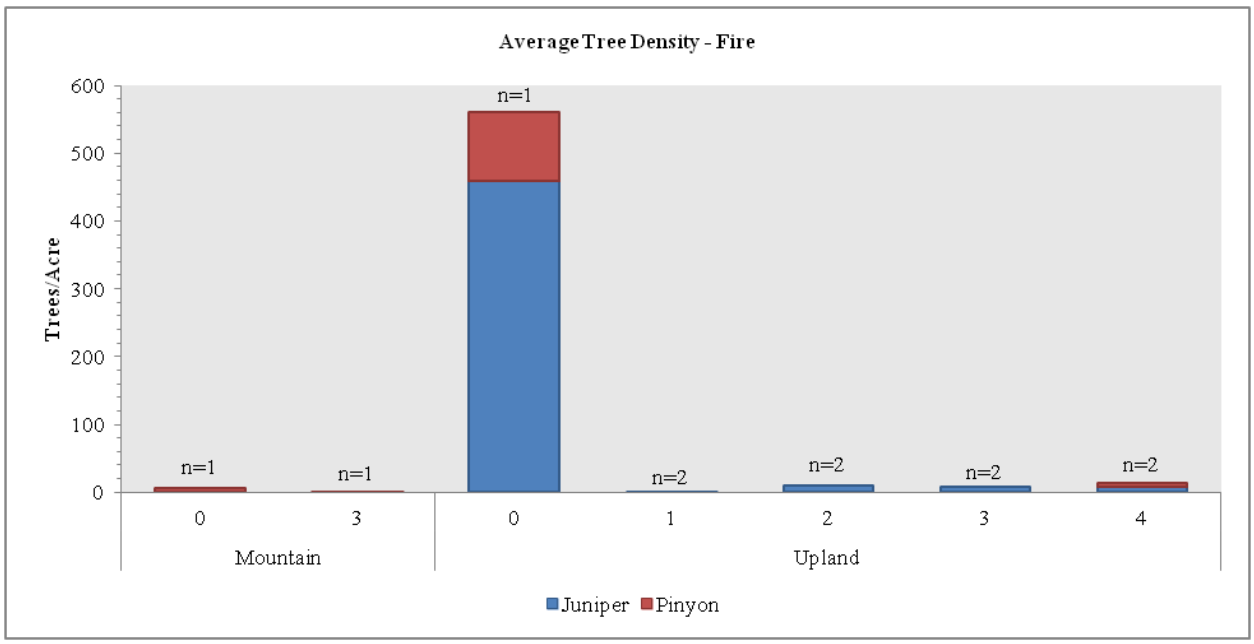


Figure 10.31: Average tree density of mountain and upland study sites that have been burned.
0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance.

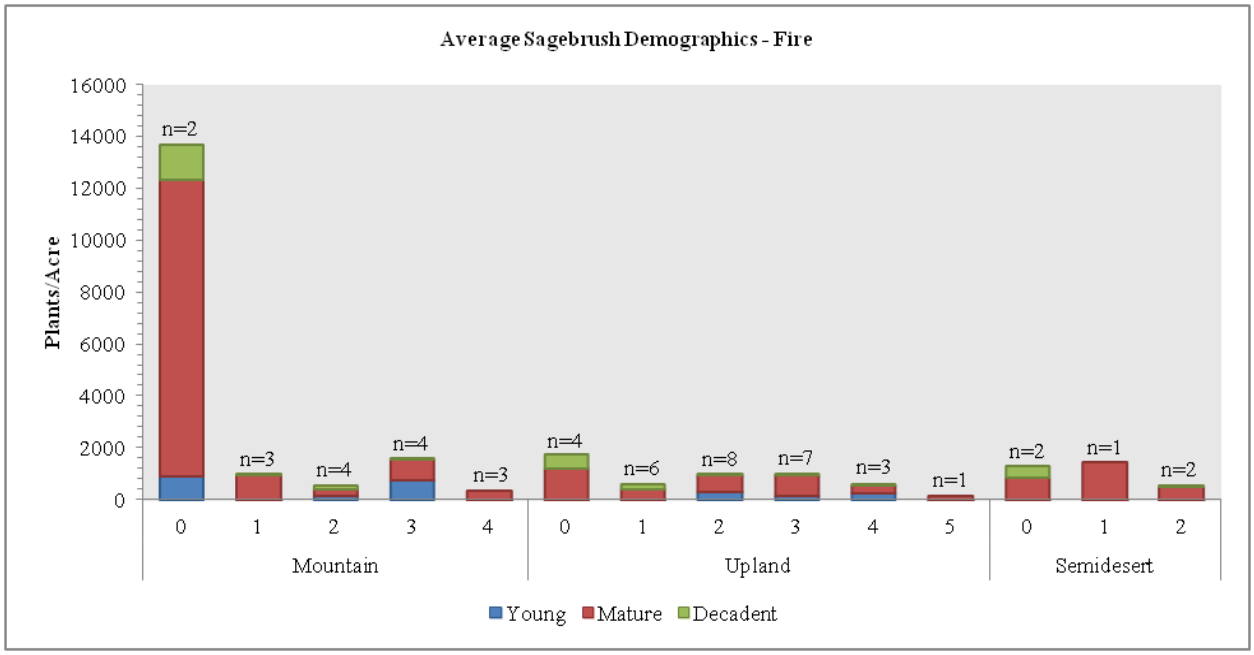


Figure 10.32: Average sagebrush demographics of mountain, upland, semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance.

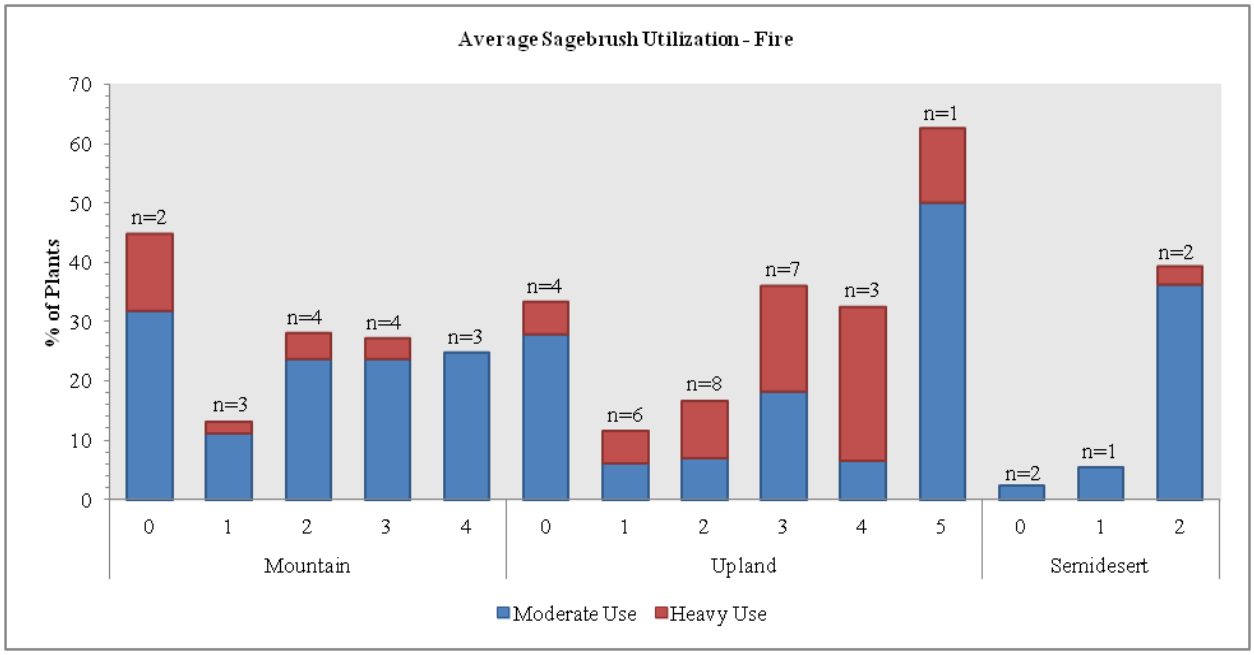


Figure 10.33: Average sagebrush utilization on mountain, upland, and semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

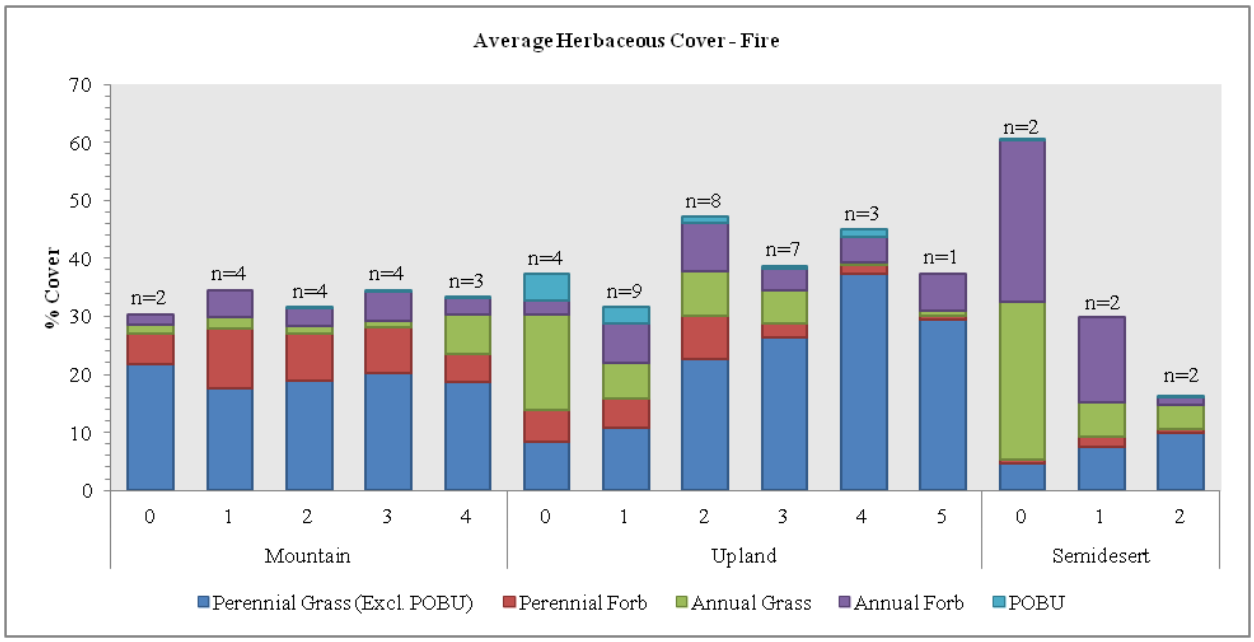


Figure 10.34: Average herbaceous cover of Mountain (ARTEM), Mountain (ARNO), and Mountain (QUGA) study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

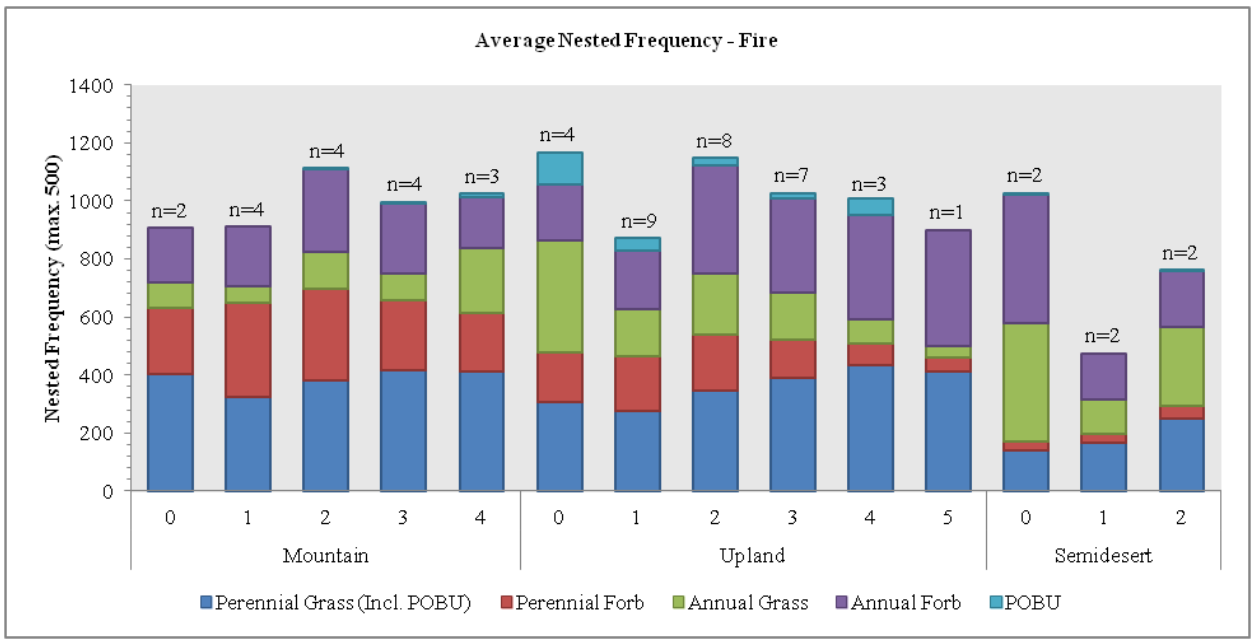


Figure 10.35: Average nested frequency of herbaceous species on mountain, upland, and semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

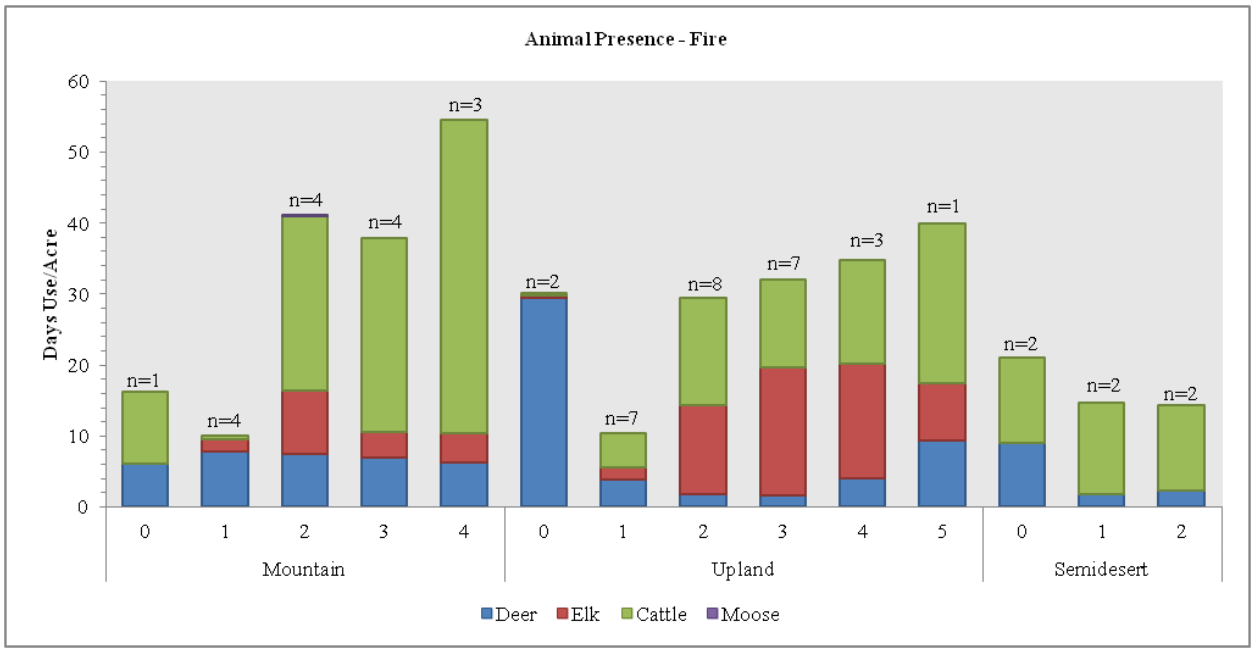


Figure 10.36: Average pellet transect data of mountain, upland, and semidesert study sites that have been burned. 0 = pre-disturbance; 1 = 1 – 3 years post-disturbance; 2 = 4 – 8 years post-disturbance, 3 = 9 – 13 years post-disturbance; 4 = 14 – 18 years post-disturbance; 5 = 19 – 23 years post-disturbance.

Harrow

There is one study site [Kimbell Creek (01R-16)] that has been treated with a harrow. Kimbell Creek is classified as an upland ecological site and is located between Cotton Creek and Kimbell Creek, east of North 75600 West Road.

Shrubs/Trees: The shrub components on this site are a mix of little sagebrush (*Artemisia arbuscula*), basin big sagebrush (*A. tridentata* ssp. *tridentata*), and smaller amounts of both yellow and rubber rabbitbrush (*Chrysothamnus viscidiflorus* and *Ericameria nauseosa*). The overall sagebrush cover has decreased post-treatment, but cover of little sagebrush did increase between pre-treatment and post-treatment (Figure 10.37). The recruitment of young sagebrush has declined post-treatment and decadence has slightly increased (Figure 10.40). Although average sagebrush utilization decreased between the pre and post-treatment samplings, a majority of plants have shown signs of little to no use in both sample years (Figure 10.41).

The cover and density of Utah juniper (*Juniperus osteosperma*) has declined significantly after treatment (Figure 10.38, Figure 10.39).

Herbaceous Understory: The overall herbaceous cover for this study site has decreased post-treatment. Perennial grasses are the dominant vegetative component. The primary vegetative component that declined post-treatment was perennial grasses. Annual grasses and forbs remained stable in cover, but are relatively rare overall. Perennial forbs are generally common and showed a slight increase in cover post-treatment (Figure 10.42).

Occupancy: Pellet group transect data indicates that cattle are the primary occupants of this study site. Elk and deer are also present on the site. Both cattle and deer pellet groups increased post-treatment, while elk pellet groups were not sampled post-treatment (Figure 10.44).

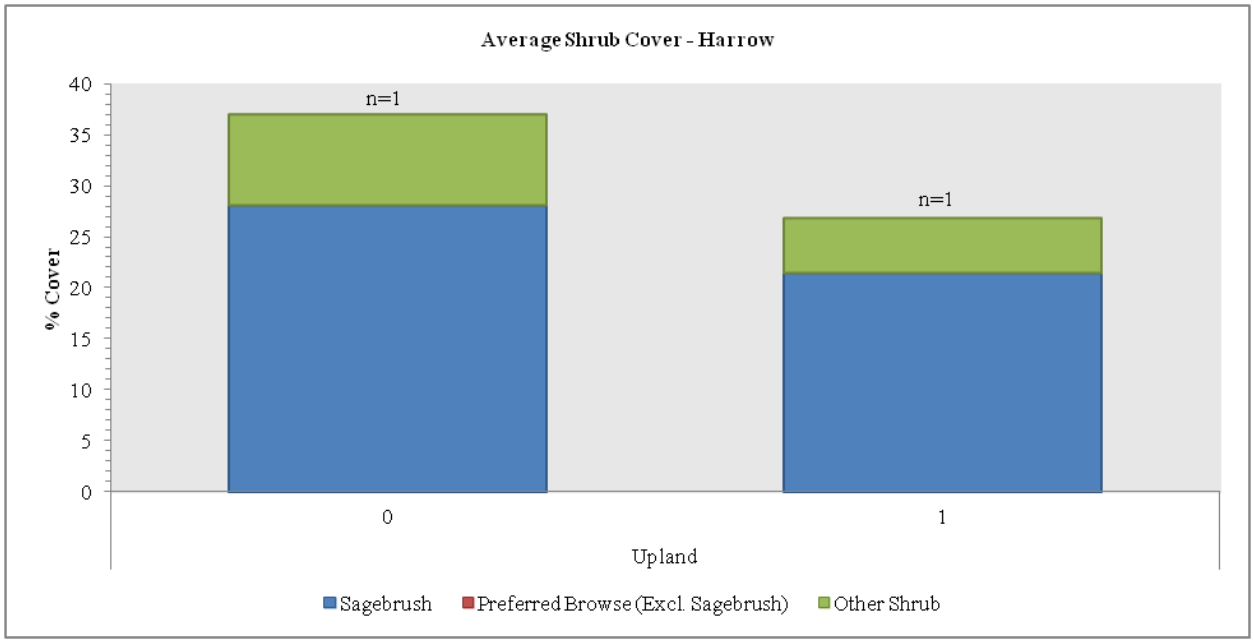


Figure 10.37: Average shrub cover of upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

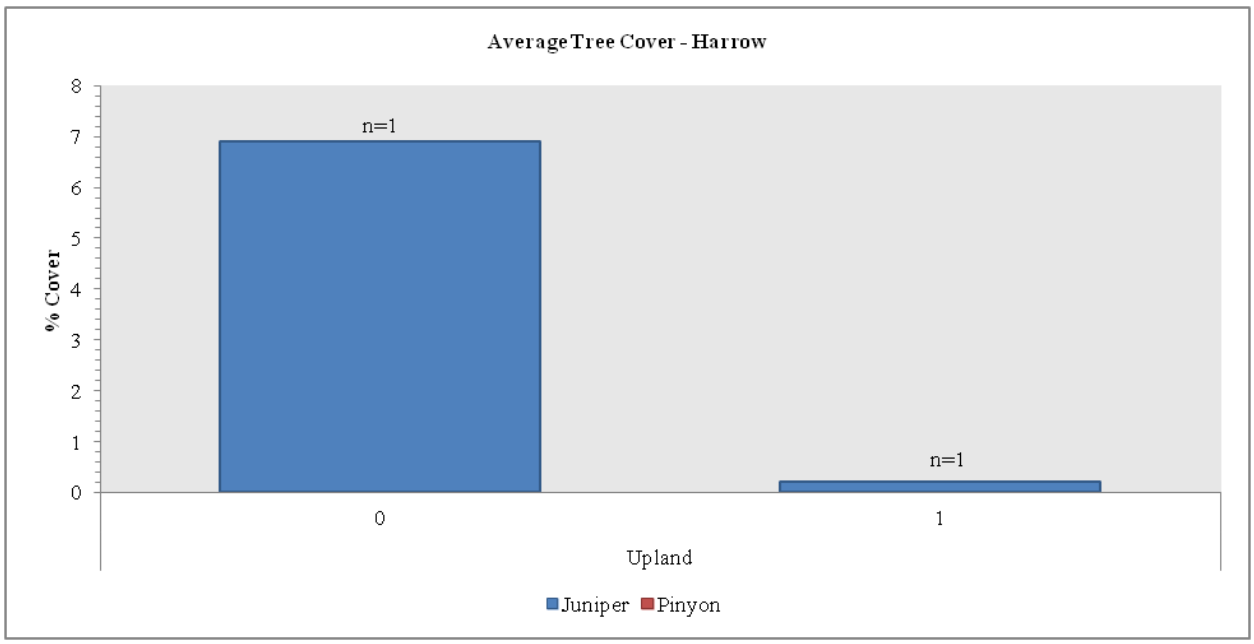


Figure 10.38: Average tree cover of upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

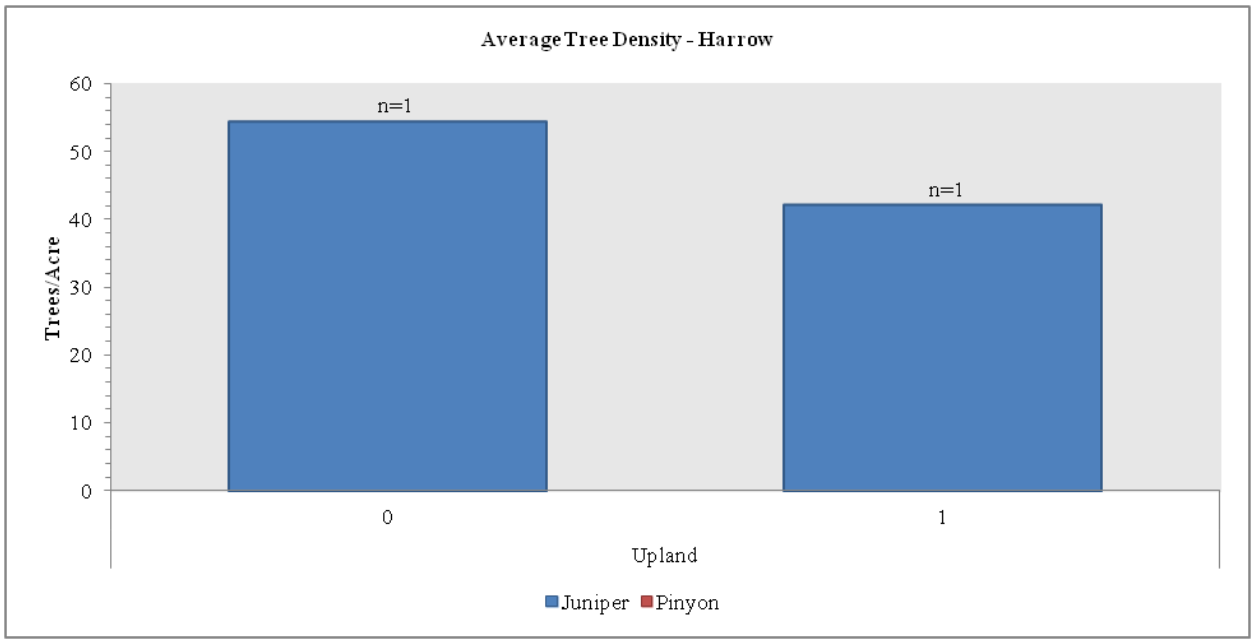


Figure 10.39: Average tree density of upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

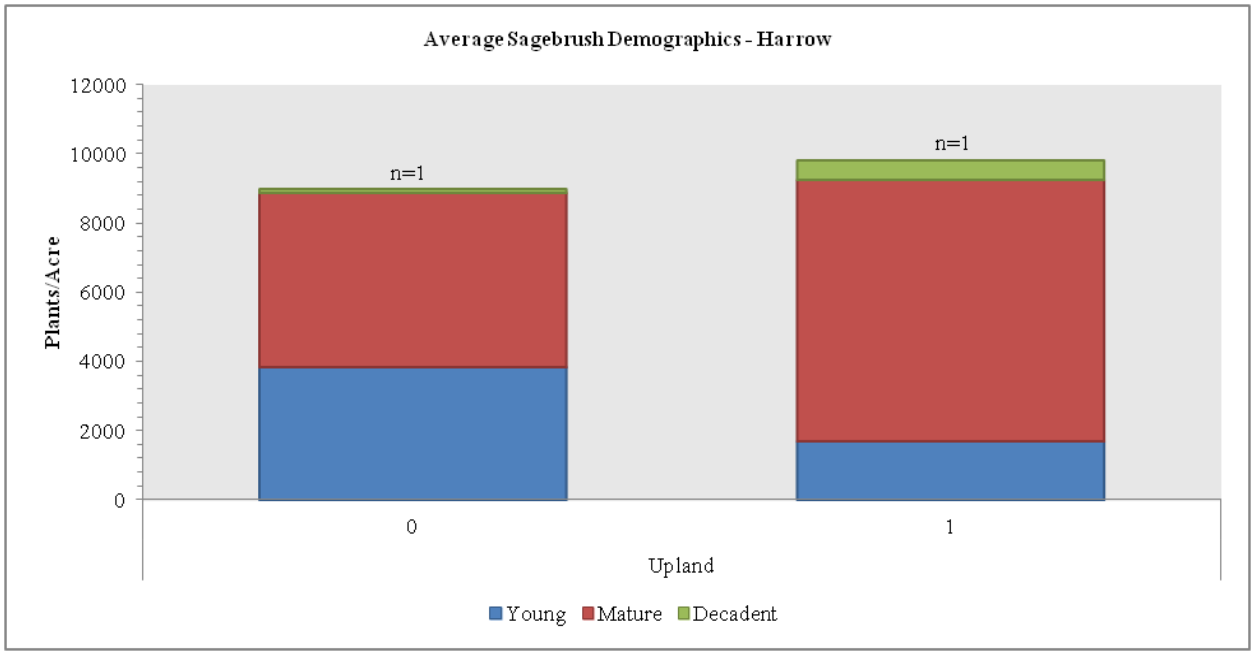


Figure 10.40: Average sagebrush demographics of upland study sites that have been harrowed. 0 = pre-treatment, 1 = 1 – 3 years post-treatment.

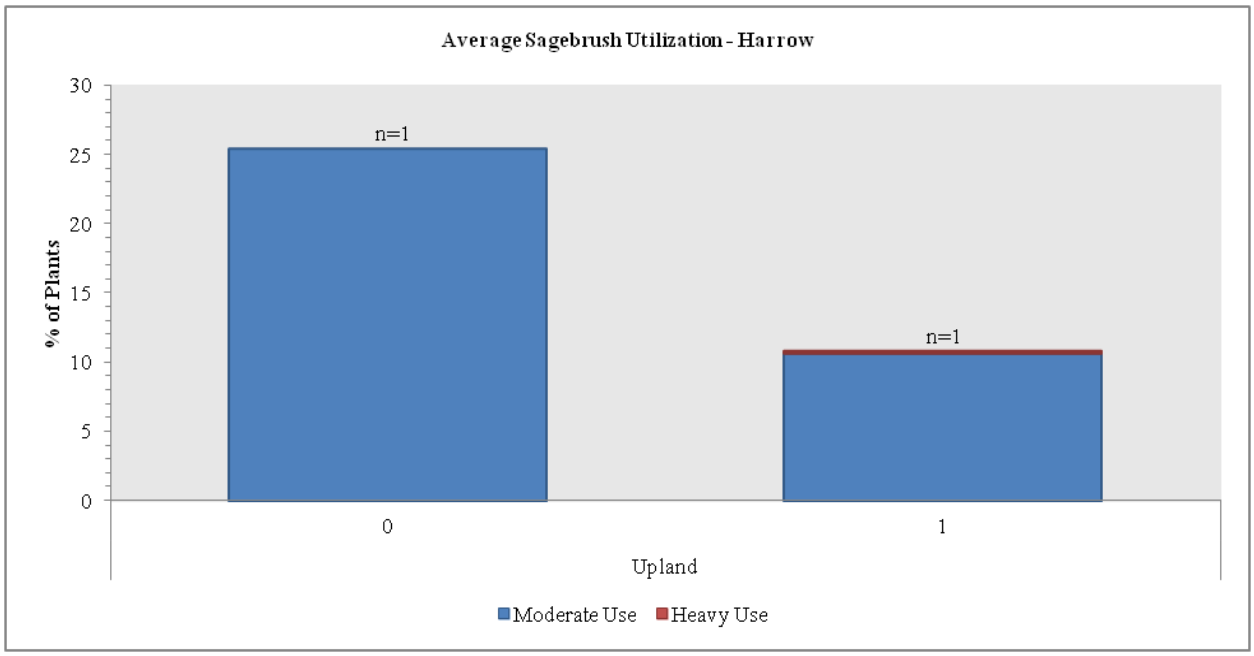


Figure 10.41: Average sagebrush utilization on upland study sites that have been harrowed. 0 = pre-treatment, 1 = 1 – 3 years post-treatment.

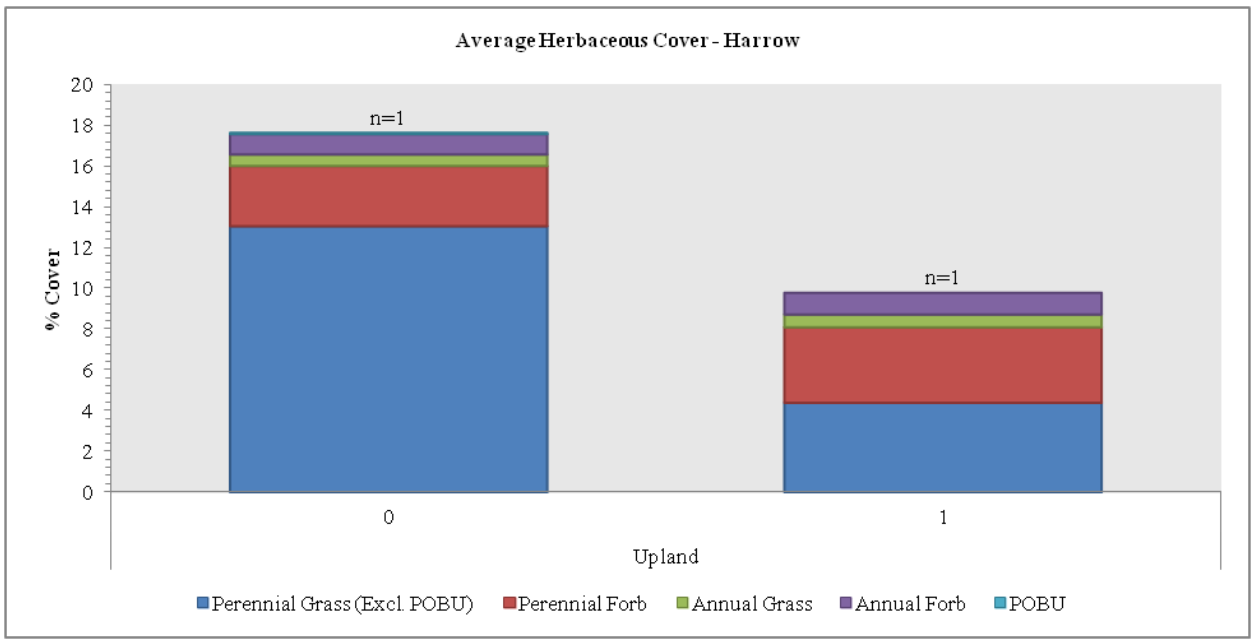


Figure 10.42 Average herbaceous cover of upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

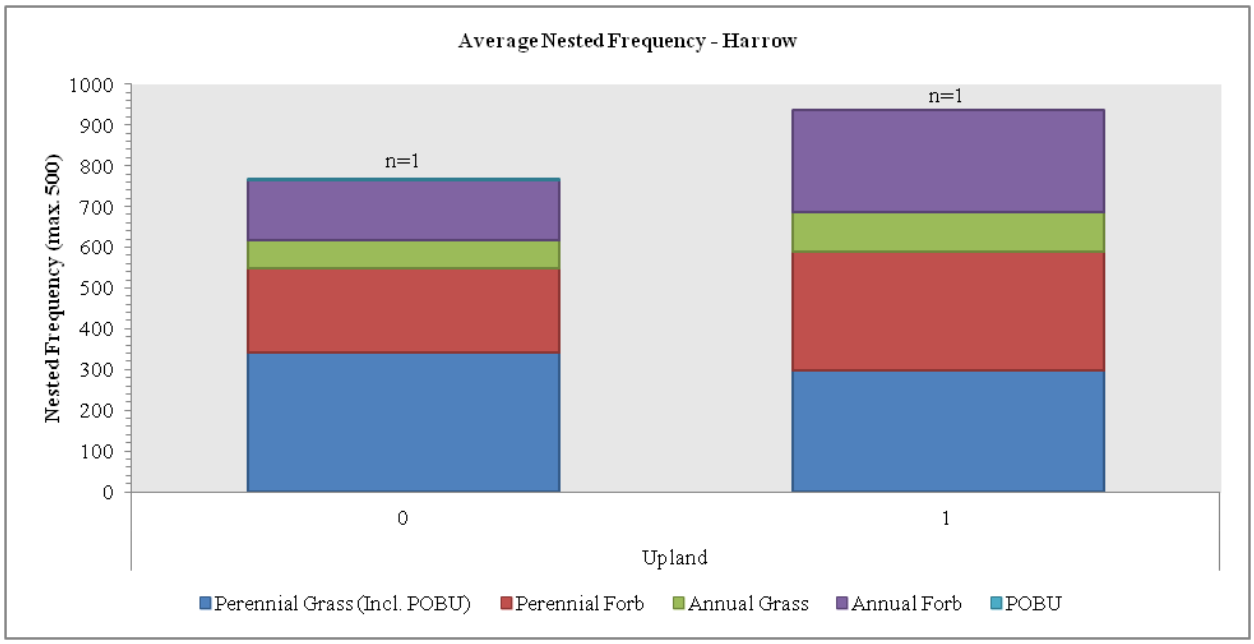


Figure 10.43 Average nested frequency of herbaceous species on upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

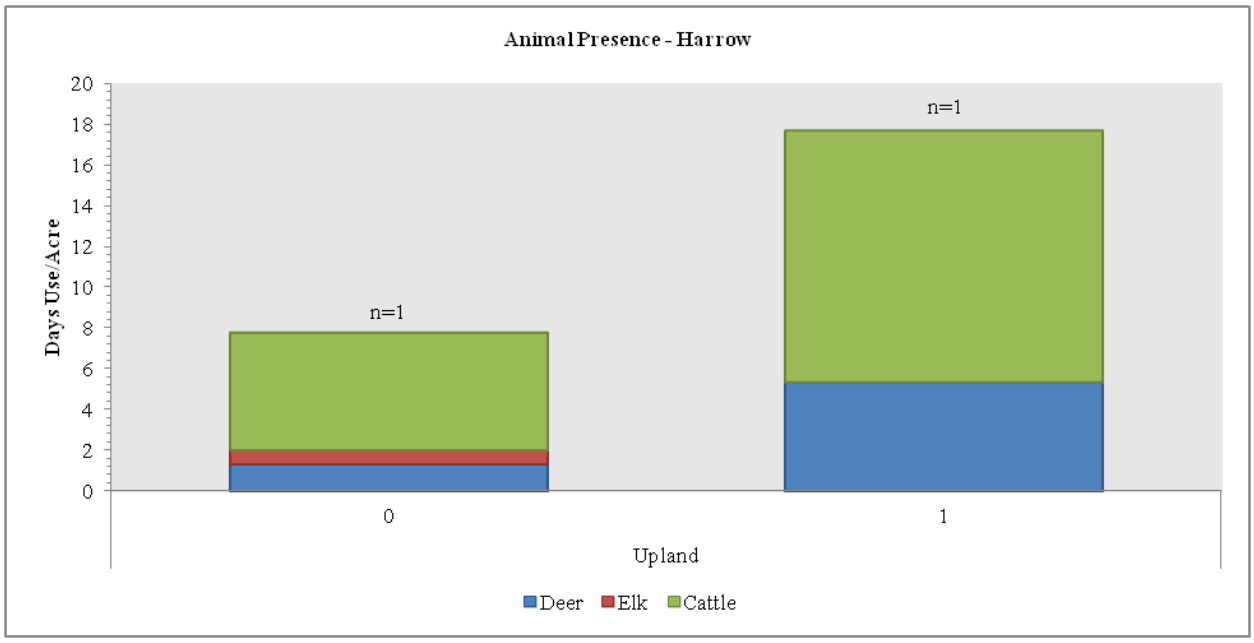


Figure 10.44: Average pellet data transect of upland study sites that have been harrowed. 0 = pre-treatment; 1 = 1 – 3 years post-treatment.

Herbicide

Two study sites have been treated with herbicide over the study period. One is considered to be a mountain ecological site [Anderson Ranch (03-4)] and one is classified as an upland ecological site [Kamas SFH (07R-2)]. Anderson Ranch is situated west of Ant Flat Road near Hardware Ranch, and the Kamas SFH study is located on a south-facing slope just east of the town of Kamas.

Shrubs/Trees: The browse species on these sites include sagebrush (*Artemisia tridentata*) and other browse species. The browse cover has generally decreased in post-treatment sample years. Much of the decrease in cover is due to the Anderson Ranch study; this site was treated with 2,4-D which killed much of the browse present on the site except for antelope bitterbrush (*Purshia tridentata*). The Kamas SFH site has remained stable in shrub cover (Figure 10.45). Average sagebrush demographics indicate that, pre-treatment, mature individuals comprised a majority of the population on the mountain ecological site, that recruitment of young has decreased, and that young plants were the sole demographic in the most recent sample year. The upland ecological site sagebrush population has been comprised of only mature plants in both sample years (Figure 10.46). Sagebrush use on the mountain site has decreased, while all plants on the upland ecological site have been moderately browsed in both sample years (Figure 10.47).

Tree cover is only present on the Kamas SFH site, with one Utah juniper tree present on the site. This data was only recorded in 2016, so an overall trend of conifers in the treatment area cannot be extrapolated.

Herbaceous Understory: The herbaceous cover has changed in composition post-treatment. Perennial grasses on the mountain site have decreased post-treatment, while annual grasses and forbs have increased. The cover of bulbous bluegrass (*Poa bulbosa*) and perennial forbs has remained stable on the mountain ecological site as well. On the upland site, the cover remained generally unaffected but there was a small decrease in the cover of perennial forbs. Bulbous bluegrass is common and increased slightly after treatment, while perennial forbs are quite common and decreased slightly. The cover of perennial grasses is rare. Annual grasses and forbs are generally common and cover has remained fundamentally unchanged (Figure 10.48).

Occupancy: Pellet group transect data indicates that deer are the primary occupants of the upland site, while elk are the primary occupants of the mountain site. Overall usage of the study sites has generally decreased,

except for the upland ecological site which decreased in both elk and deer occupation but had more cattle occupation (Figure 10.50).

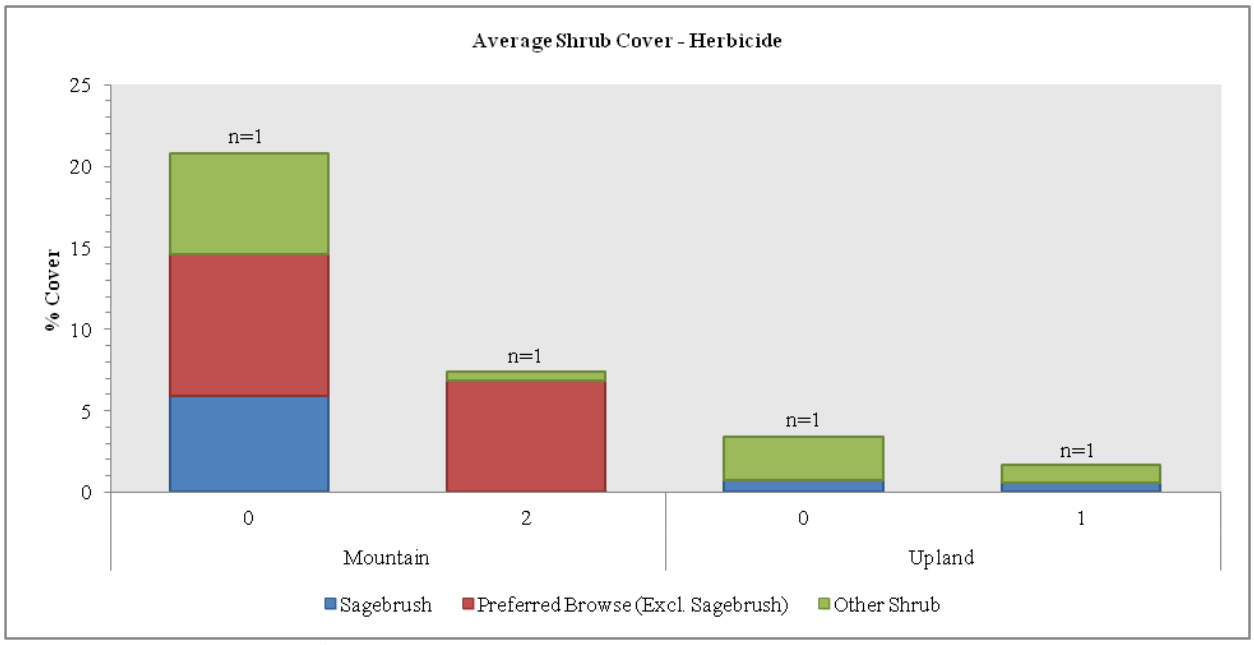


Figure 10.45: Average shrub cover of mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

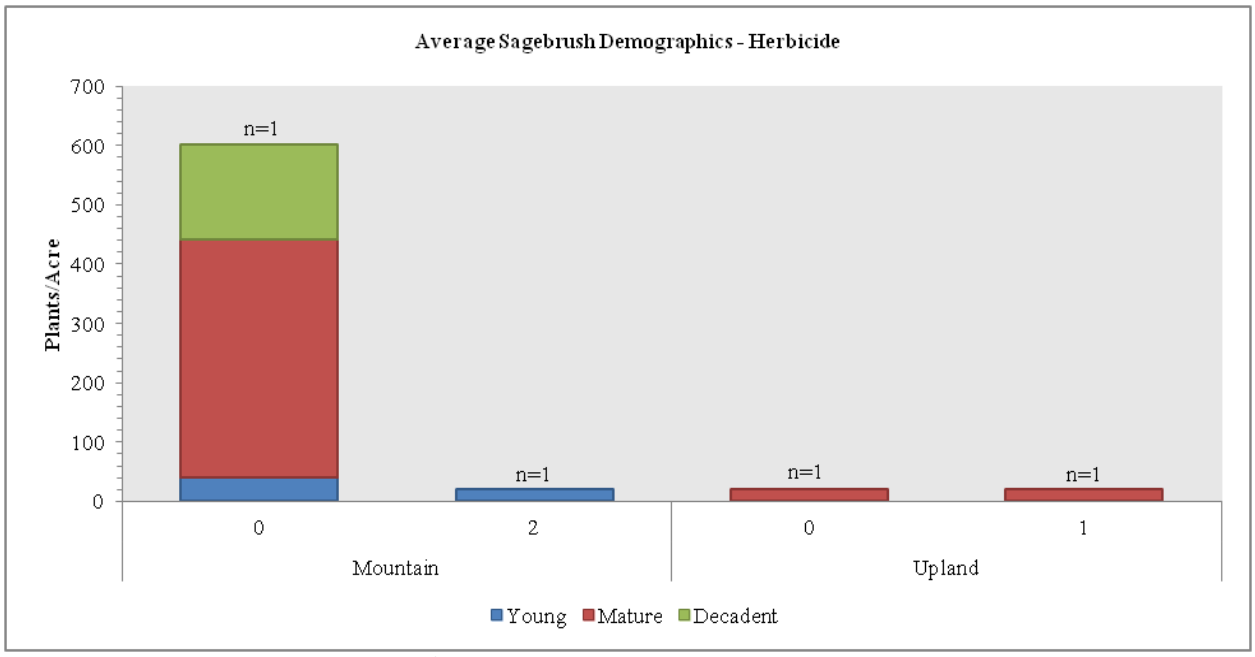


Figure 10.46: Average sagebrush demographics of mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

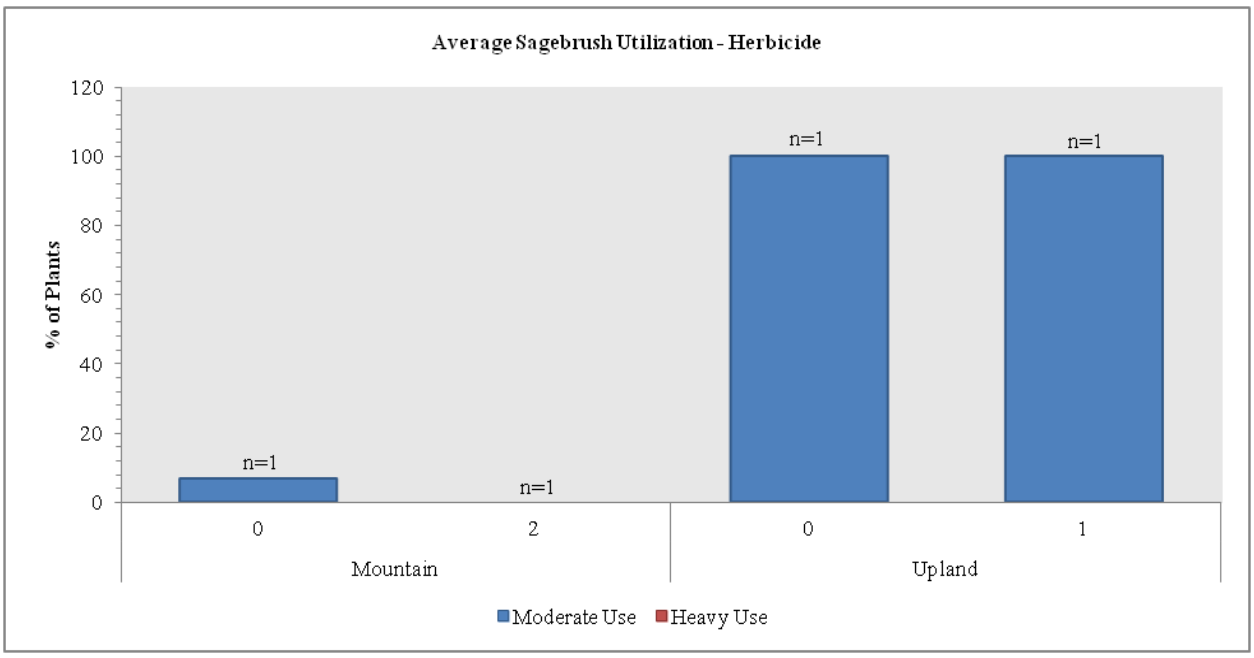


Figure 10.47: Average sagebrush utilization on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

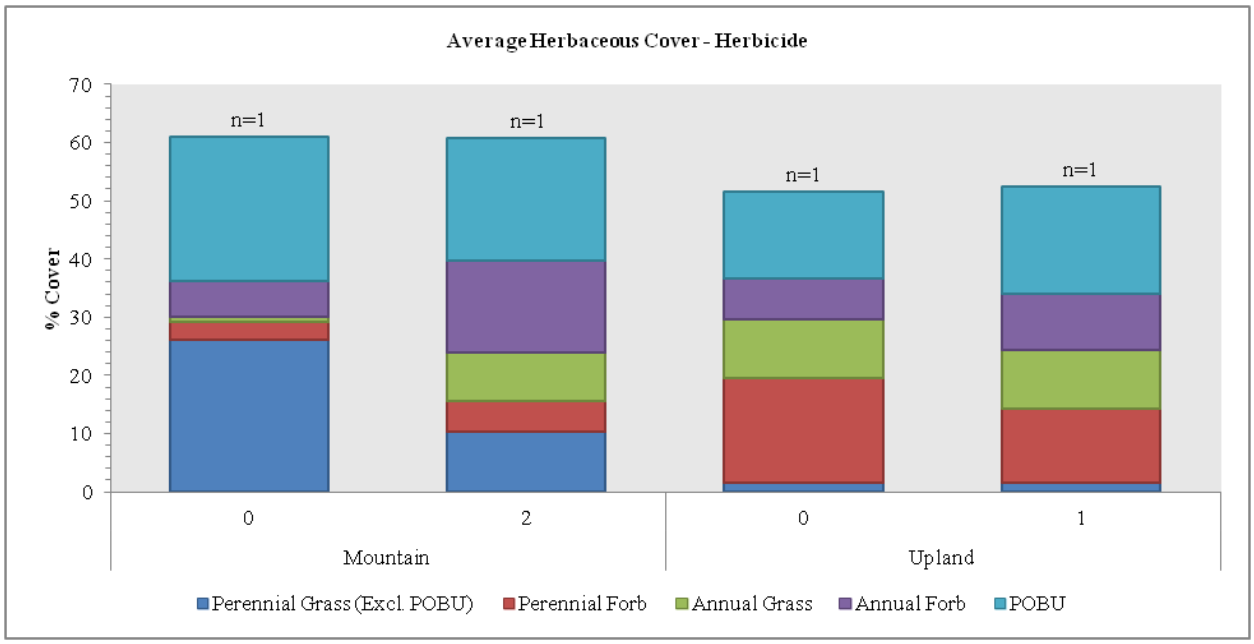


Figure 10.48 Average herbaceous cover of mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

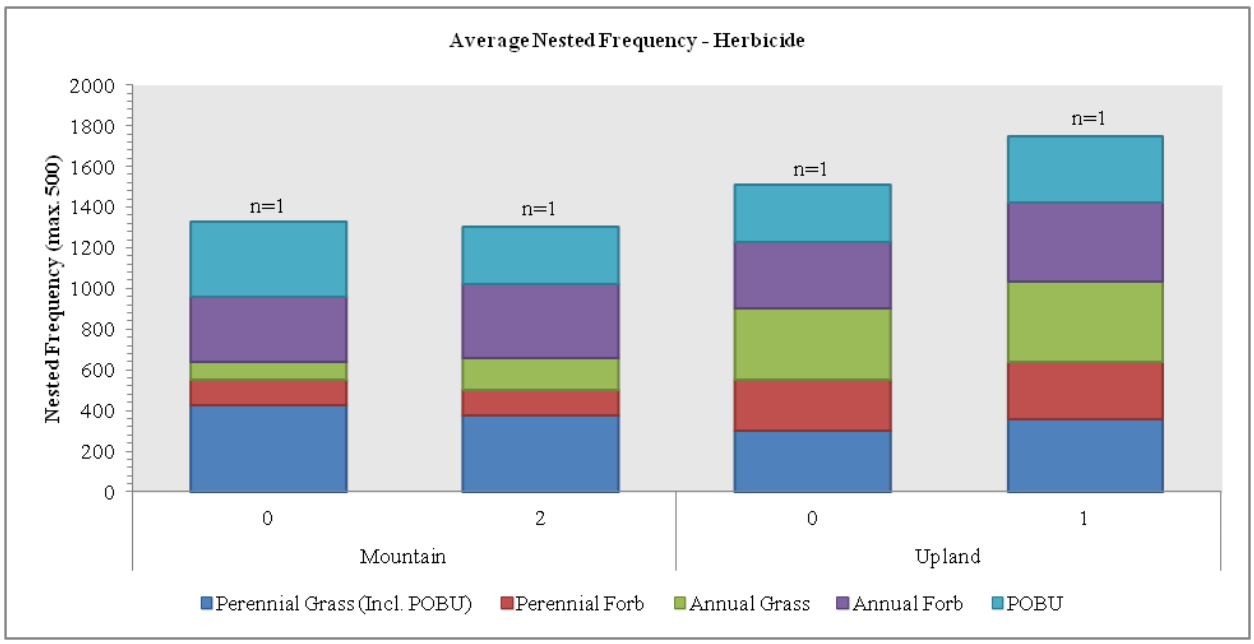


Figure 10.49 Average nested frequency of herbaceous species on mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

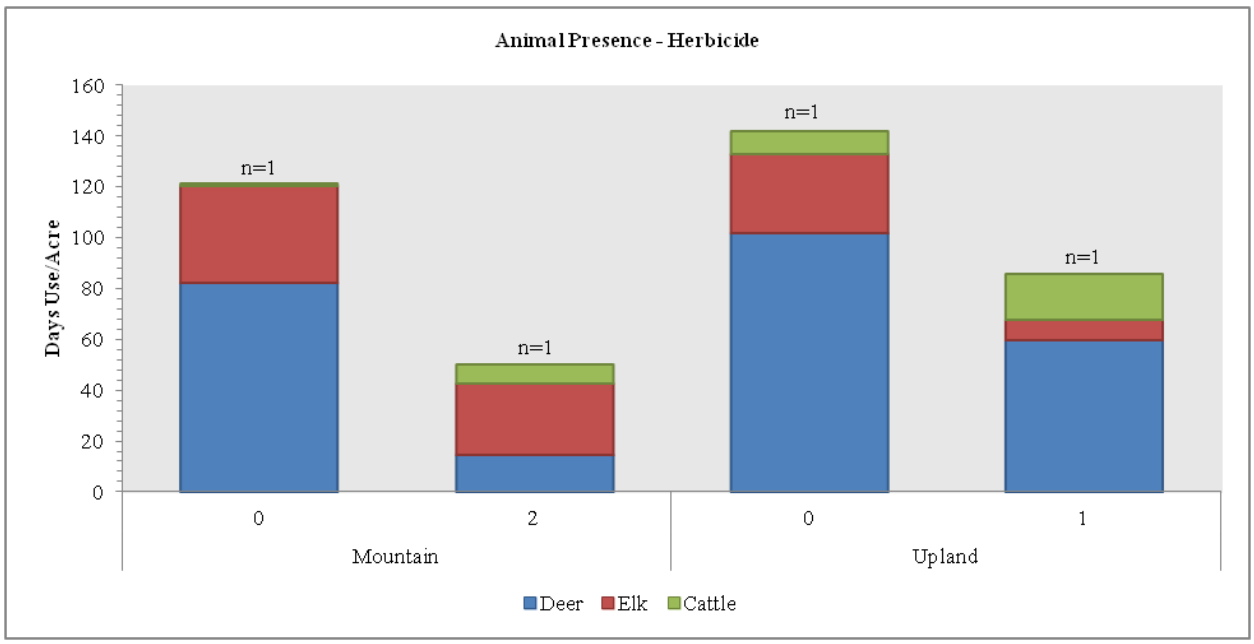


Figure 10.50: Average pellet transect data for mountain and upland study sites that have been treated with herbicide. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

Insect

Three study sites [Claypit North Slope (04R-3), Claypit South Slope (04R-4), and Croydon Cemetery (04R-5)] have been disturbed by insects and are considered to be upland ecological sites. The Claypit North Slope and Claypit South Slope studies are located on the southwest-facing slopes north of Harris Canyon, while Croydon Cemetery is situated east of East Henefer Road.

Shrubs/Trees: Sagebrush species are the dominant browse component on the study sites that have been infested by the sagebrush defoliator moth. The line intercept cover of sagebrush has steadily increased in the years following infestation across the sites (Figure 10.51). The density of sagebrush plants decreased following the infestation, with a slight recovery occurring at the third post-infestation sample year. Recruitment of young individuals has remained generally low, with increased recruitment occurring during the third sampling post-infestation (Figure 10.52). Average sagebrush utilization has exhibited a marginal decrease overall, with over half of plants showing signs of little to no use in all of the sample years (Figure 10.53).

There are no trees present on any of the study sites and therefore tree cover and density trends will not be discussed.

Herbaceous Understory: The cover of perennial forbs increased significantly following the disturbance, while the cover of annual grasses decreased. Perennial grass cover remained stable across all sample years. Both of the upland loam study sites have crested wheatgrass (*Agropyron cristatum*) as the dominant grass species, while the upland stony loam study site is dominated by western wheatgrass (*Pascopyrum smithii*). Annual forbs have increased in the years following infestation (Figure 10.54).

Occupancy: Average pellet transect data indicates that deer are the primary occupants of these study sites. Elk and cattle have also been present on these sites. Animal occupancy has decreased following infestation, with the exception of cattle, which has generally remained consistent through the sample years (Figure 10.56).

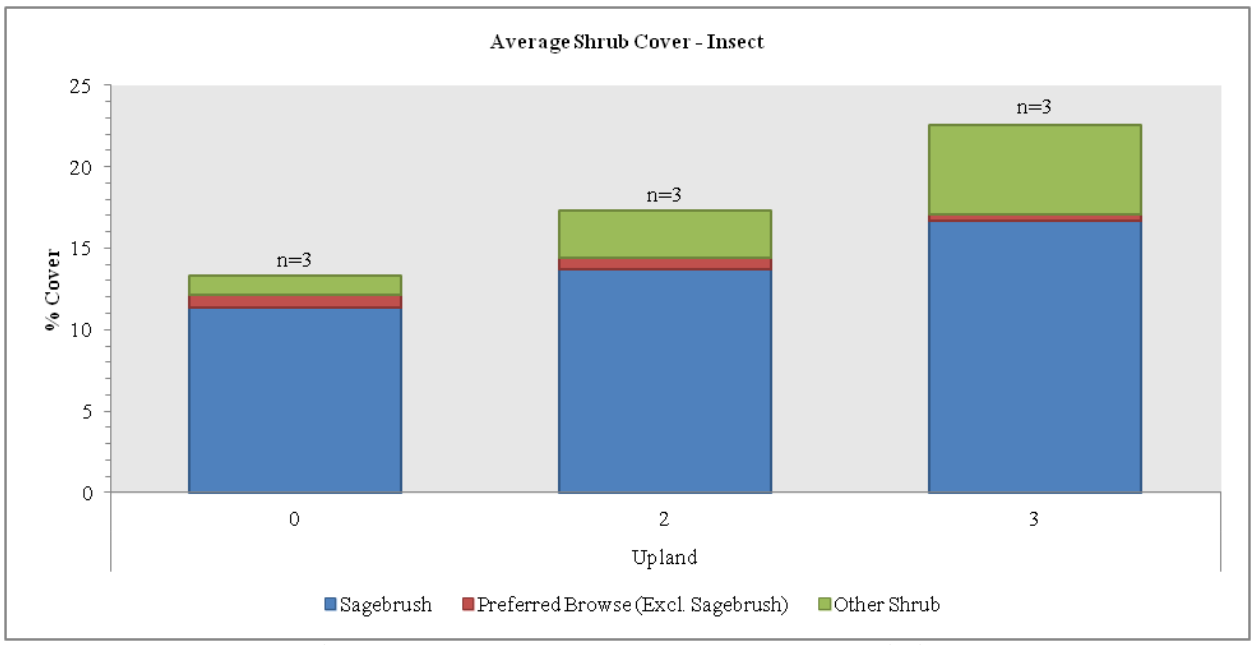


Figure 10.51: Average shrub cover of upland study sites that have been disturbed by insects. 0 = year of Infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

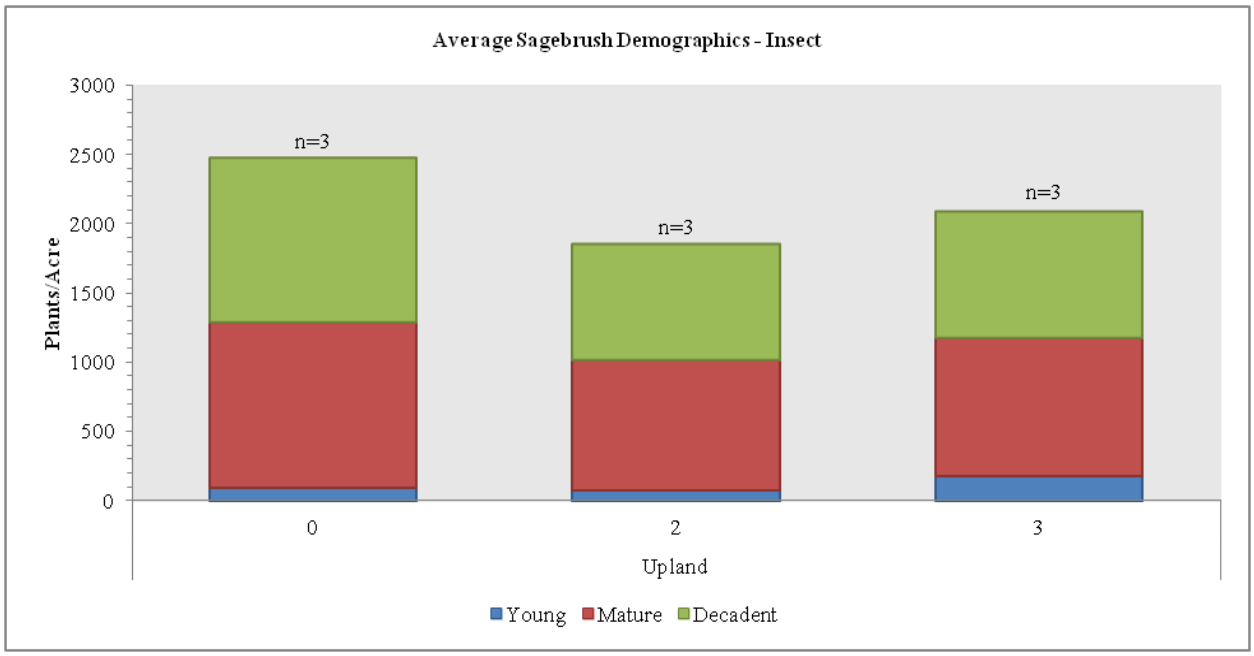


Figure 10.52: Average sagebrush demographics of upland study sites that have been disturbed by insects. 0 = year of infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

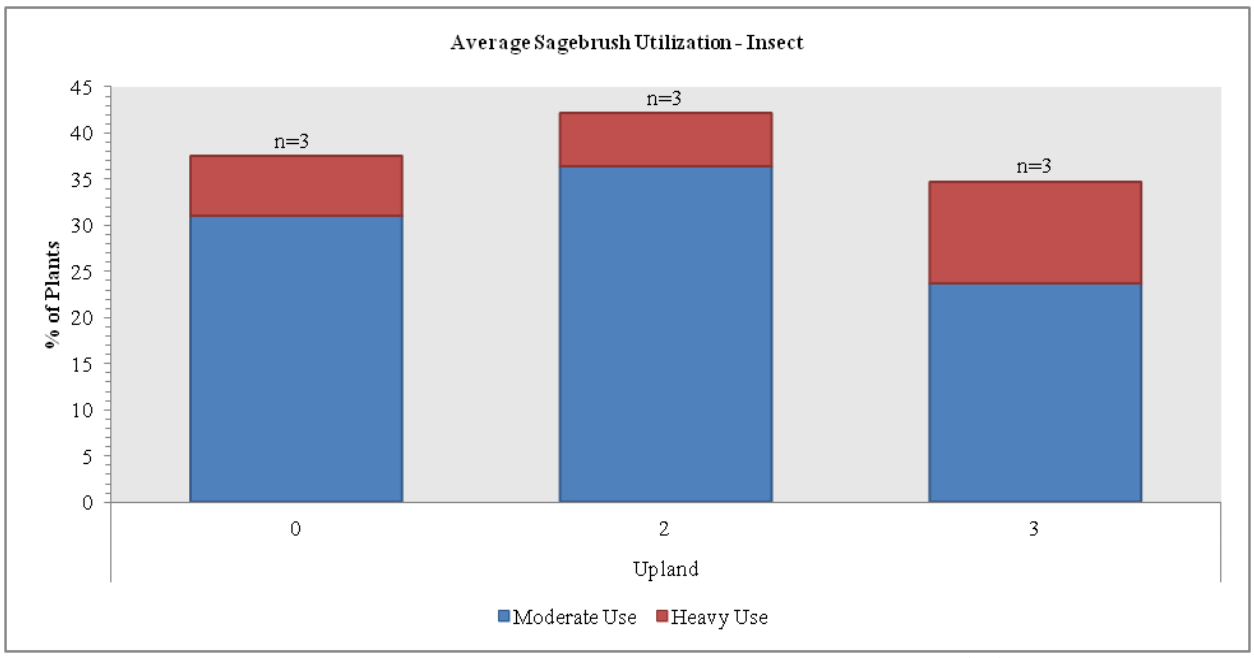


Figure 10.53: Average sagebrush utilization on upland study sites that have been disturbed by insects. 0 = year of infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

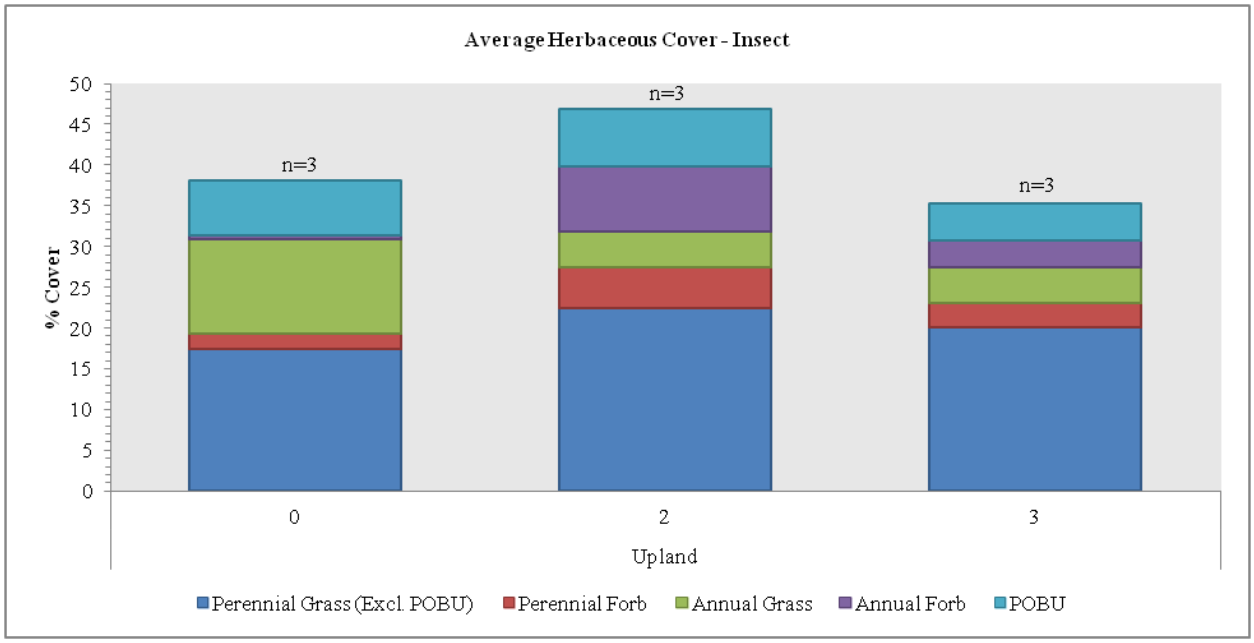


Figure 10.54: Average herbaceous cover of upland study sites that have been disturbed by insects. 0 = year of infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

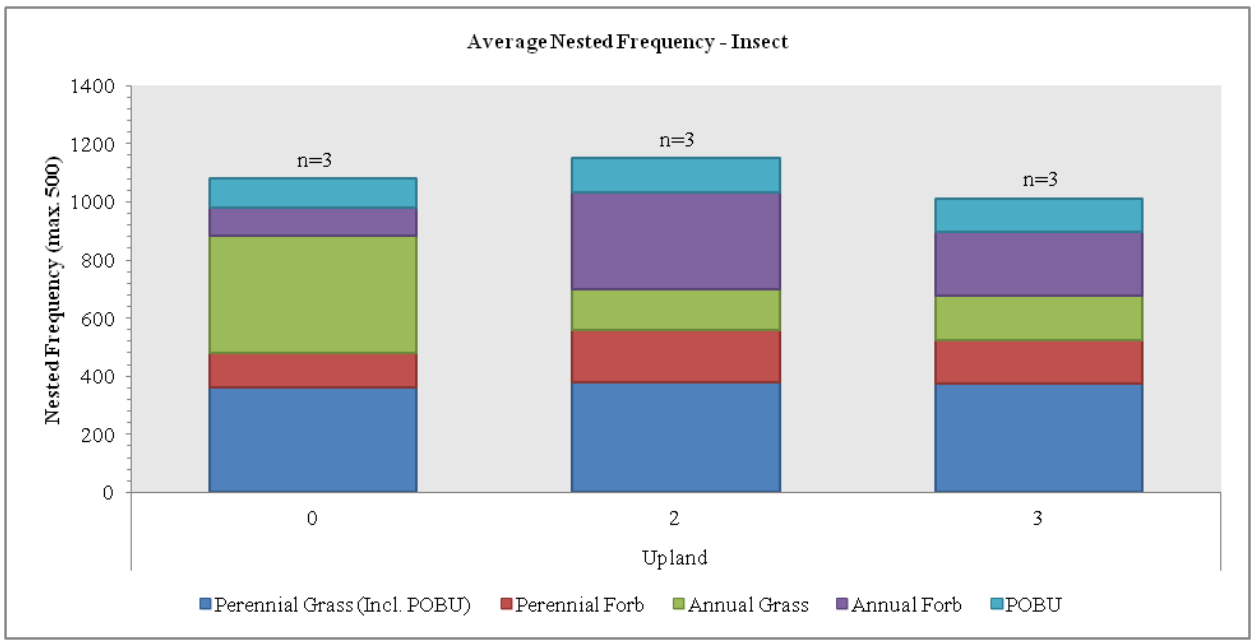


Figure 10.55: Average nested frequency of herbaceous species on upland study sites that have been disturbed by insects. 0 = year of infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

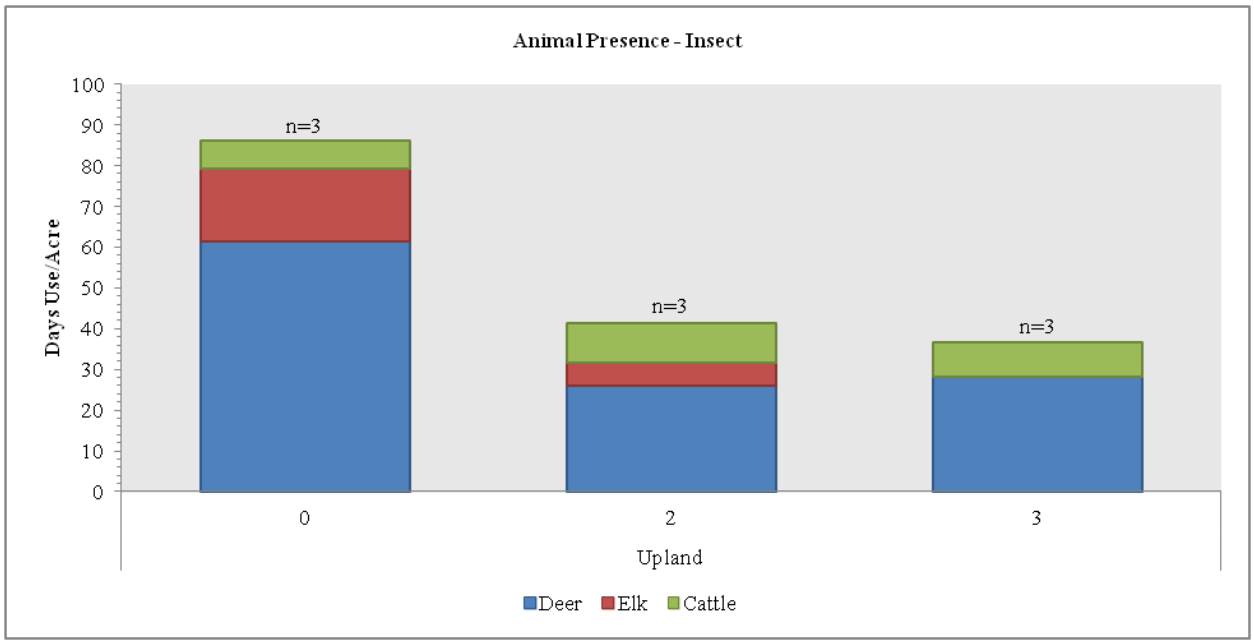


Figure 10.56: Average pellet transect data of upland study sites that have been disturbed by insects. 0 = year of infestation; 1 = 1 – 3 years post-infestation; 2 = 4 – 8 years post-infestation; 3 = 9 – 13 years post-infestation.

Push

One study [Morris GIP (01R-14)] has been treated with a bulldozer push over the study period. This study is considered to be an upland ecological site and is located west of the town of Rosette and east of Black Hills.

Shrubs/Trees: Sagebrush is the dominant browse component of the study site. Overall, sagebrush cover has increased following the treatment; as well as other browse species, namely forage kochia (*Bassia prostrata*) (Figure 10.57). The recruitment of young sagebrush plants has also increased post-treatment while average utilization has decreased (Figure 10.61).

The average tree cover and density for this study site has decreased significantly following treatment (Figure 10.58, Figure 10.59).

Herbaceous Understory: The herbaceous cover of the site has increased for this site post-treatment, with most of the cover consisting of perennial grasses. Perennial grasses showed an increase in cover, which can be partially attributed to the introduced perennial grasses: crested wheatgrass (*Agropyron cristatum*), Siberian wheatgrass (*A. fragile*), and intermediate wheatgrass (*Thinopyrum intermedium*). Perennial forbs exhibited a small increase post-treatment. Annual grasses did increase significantly following the treatment on the study site. Annual forbs have contributed a relatively small amount of cover both before and after treatment (Figure 10.62).

Occupancy: Pellet group transect data indicates that the primary occupants on this study site are cattle, with mule deer also present to a lesser extent on the study site. The pre-treatment study did not find any pellet groups in the transect survey, but this increased in the post-treatment sampling to 20.3 days use/acre for cattle and 4 days use/acre for deer (Figure 10.64).

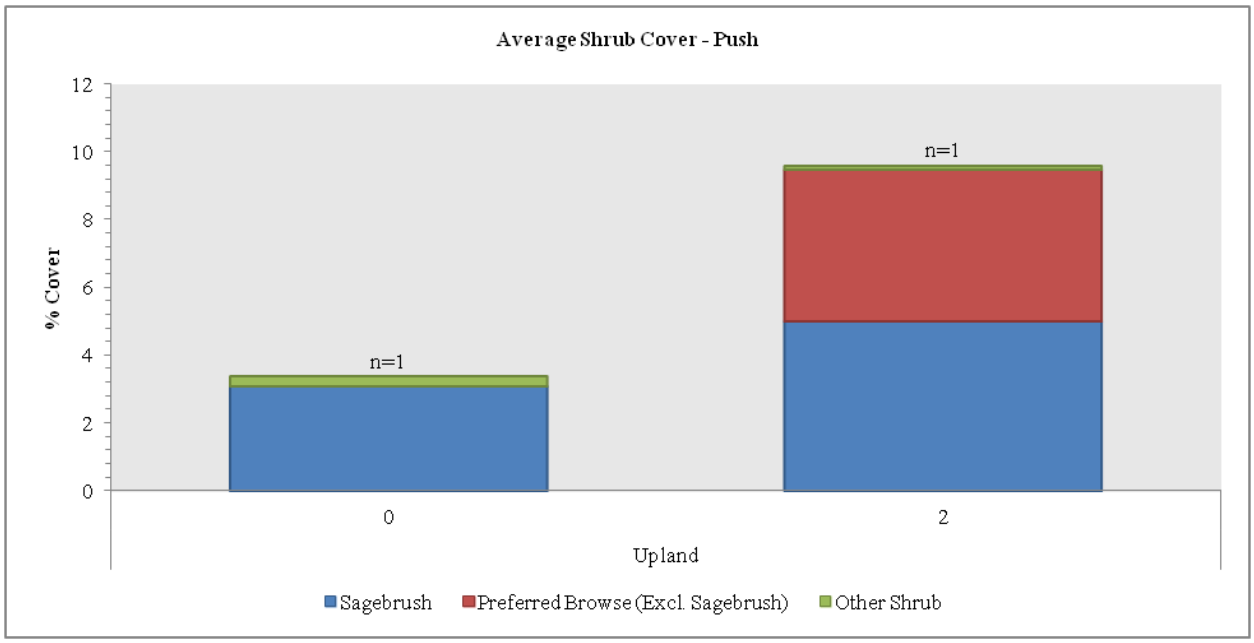


Figure 10.57: Average shrub cover of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

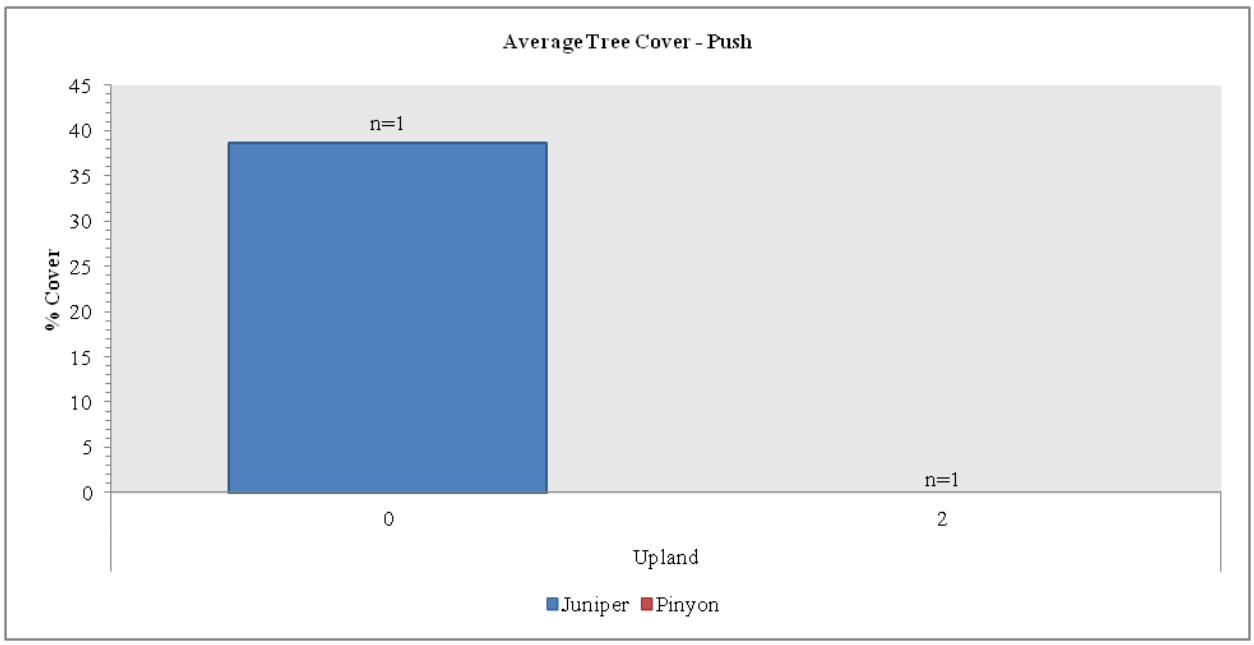


Figure 10.58: Average tree cover of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

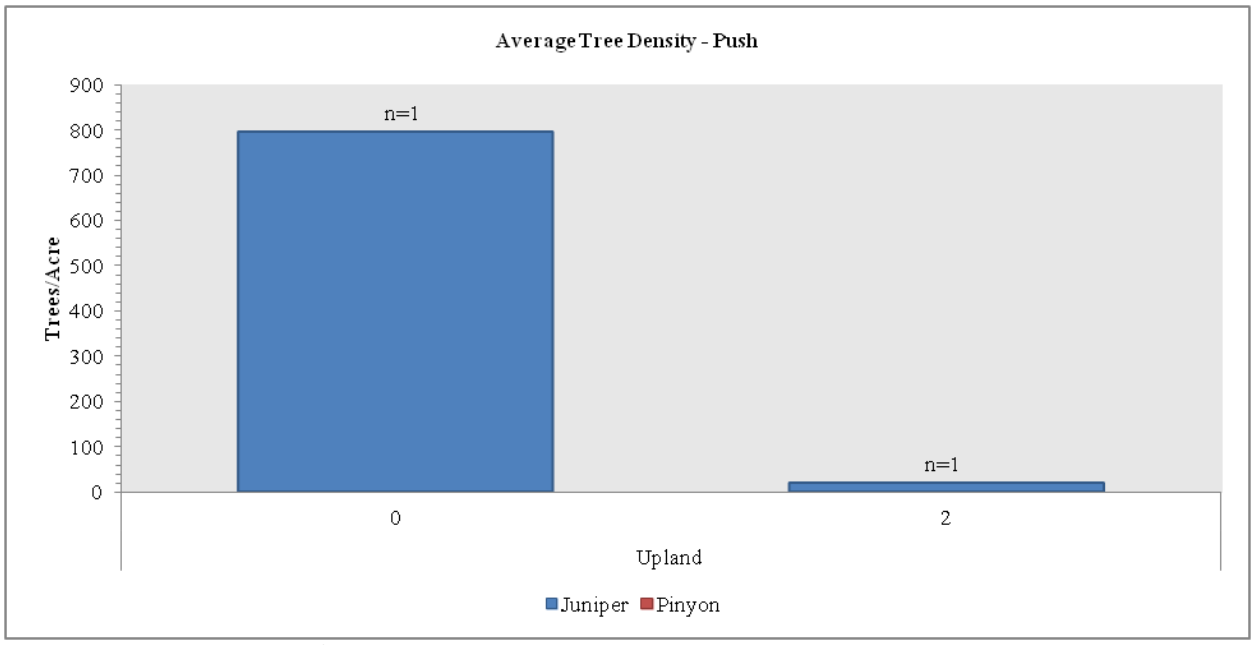


Figure 10.59: Average tree density of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

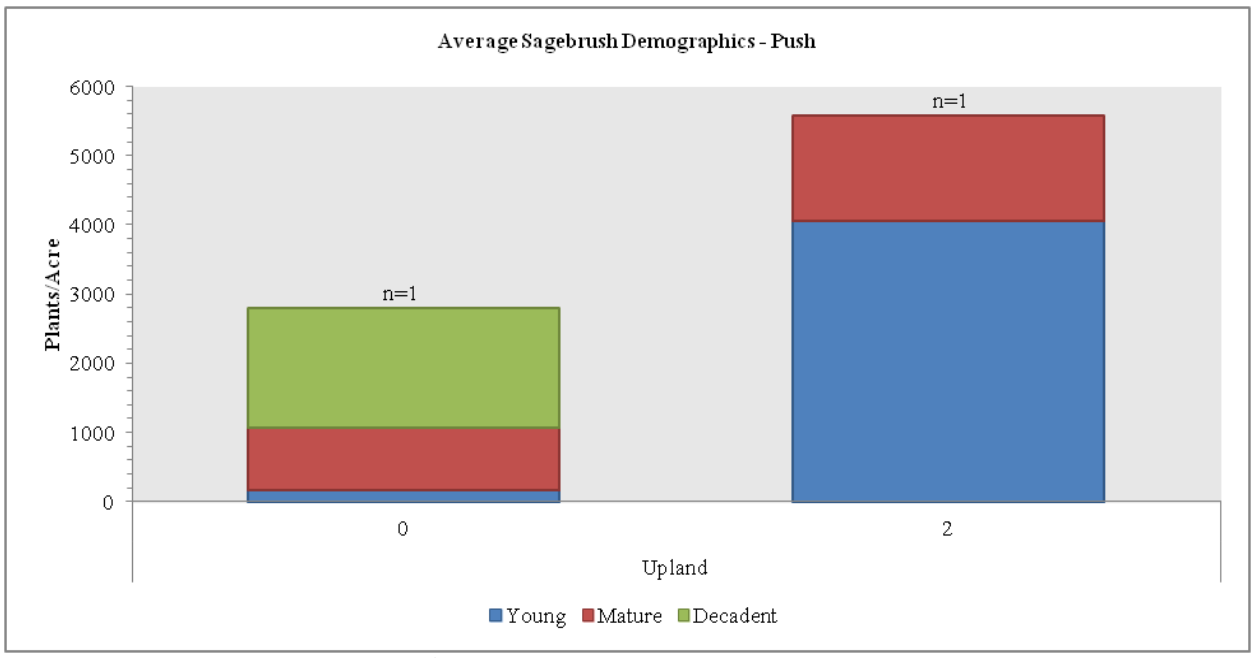


Figure 10.60: Average sagebrush demographics of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

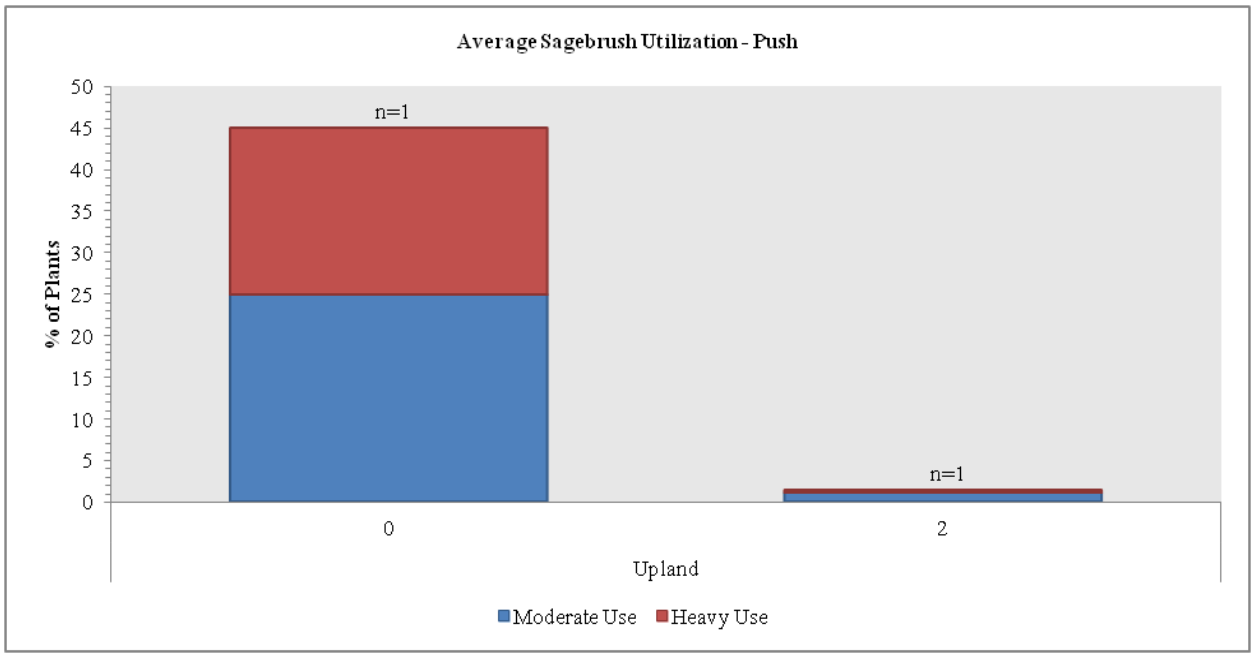


Figure 10.61: Average sagebrush utilization on upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

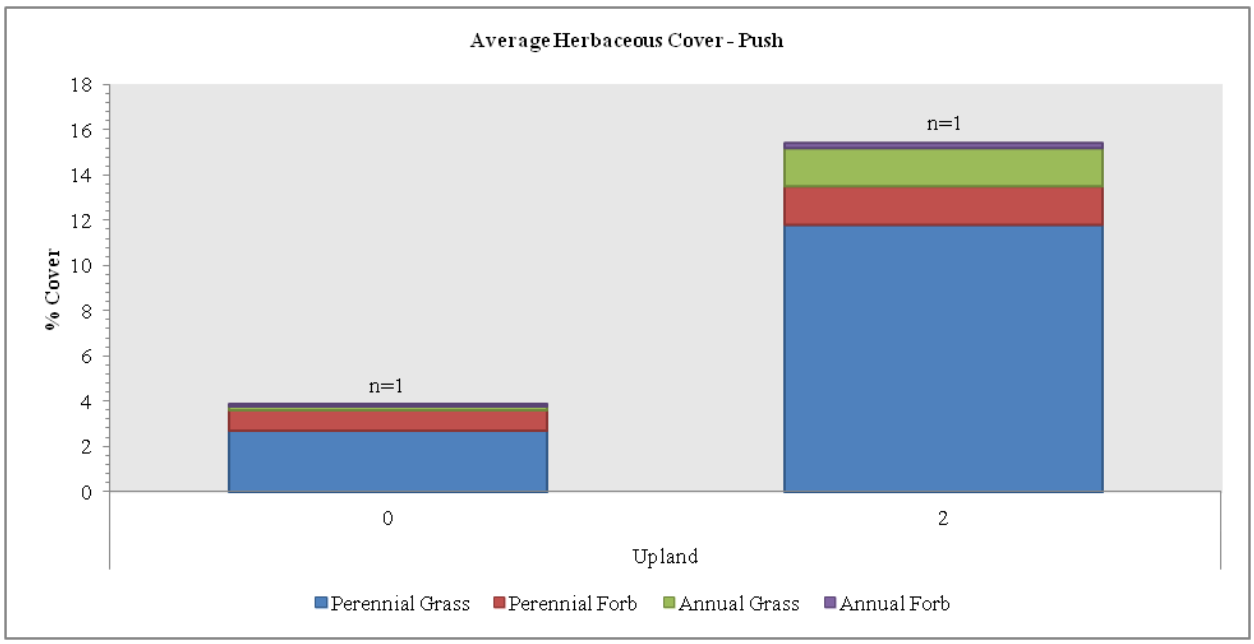


Figure 10.62: Average herbaceous cover of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

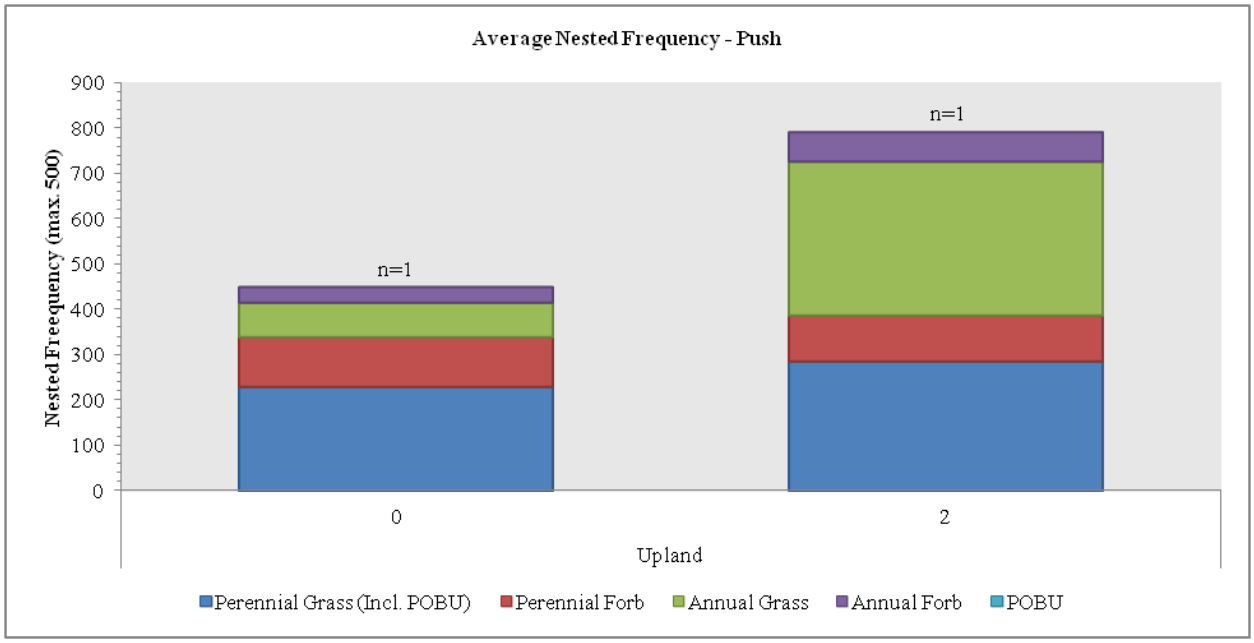


Figure 10.63: Average nested frequency of herbaceous species on upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

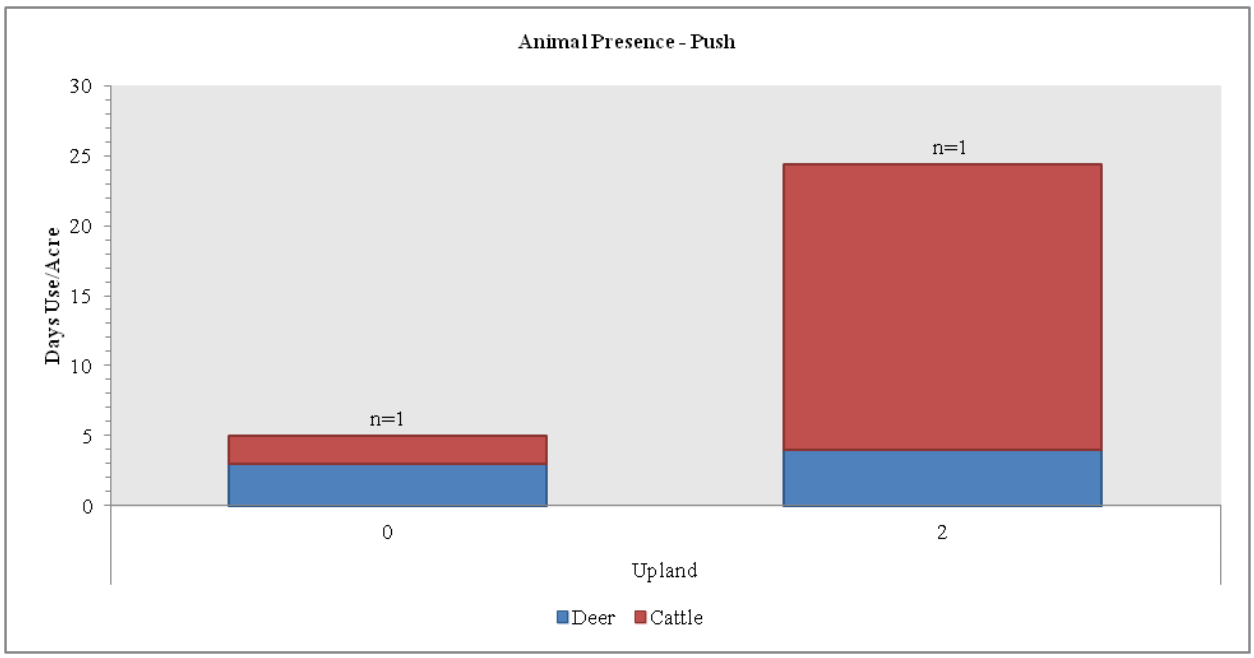


Figure 10.64: Average pellet transect data of upland study sites that have been treated with a bulldozer push. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

Disc

One study site [Woodruff Co-op (02-36)] has undergone a discing treatment over the study period and is considered to be a semidesert ecological site. This study site is found on the Woodruff Co-op Wildlife-Livestock WMA near the Utah-Wyoming border.

Shrubs/Trees: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and fourwing saltbush (*Atriplex canescens*) are the dominant browse components on this site. The cover of shrub species has steadily increased post-treatment. Fourwing saltbush was seeded and has increased on the site following treatment; sagebrush cover has also exhibited a slight increase in the years following treatment (Figure 10.65). Recruitment of young sagebrush plants increased immediately after treatment, but declined in the most recent sample year (Figure 10.66). Utilization of sagebrush has also increased in the years following treatment (Figure 10.67).

Herbaceous Understory: Herbaceous cover has remained relatively stable throughout the study years, with a slight decrease in the first post-treatment sampling. The majority of herbaceous cover has been provided by perennial grasses and the cover has remained stable. Perennial forbs have fluctuated slightly in their cover values. Although nested frequency values have fluctuated, annual forbs and grasses have remained rare (Figure 10.68, Figure 10.69).

Occupancy: Average pellet transect data indicates that cattle are the primary occupants on the site in pre-treatment, the first, and the third reading post-treatment. The second reading post-treatment indicated that deer were the sole occupants of the site. Overall, the mean abundance of pellet groups has decreased in the first two samplings post-treatment, but then increased in the third (Figure 10.70).

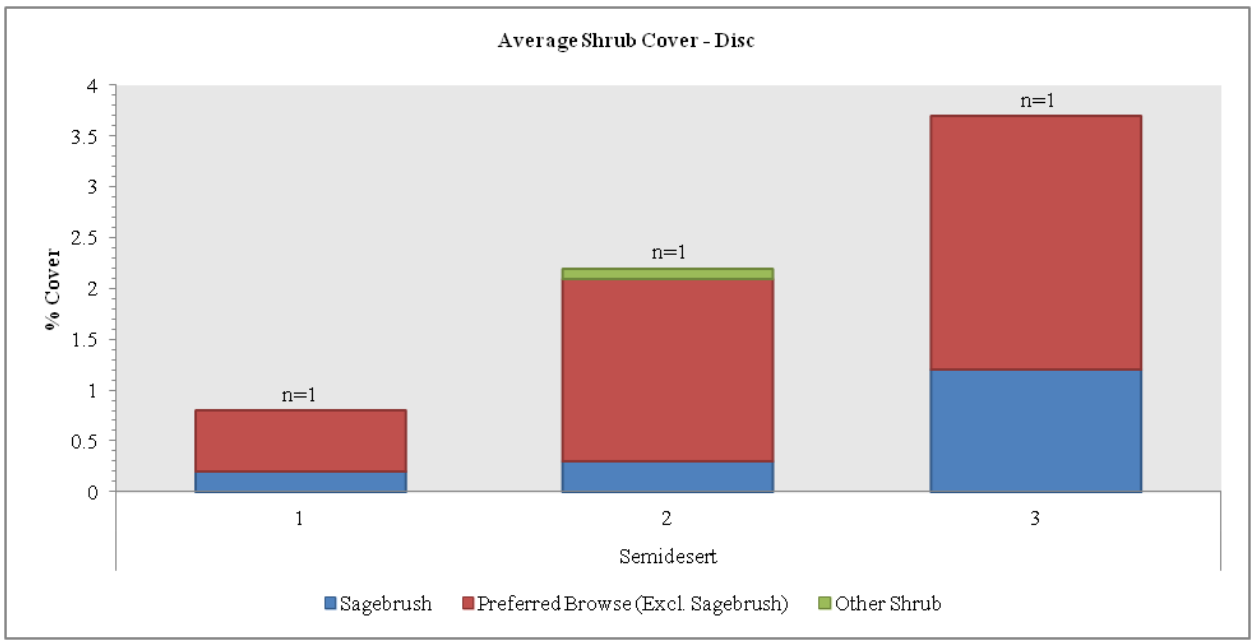


Figure 10.65: Average shrub cover of semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

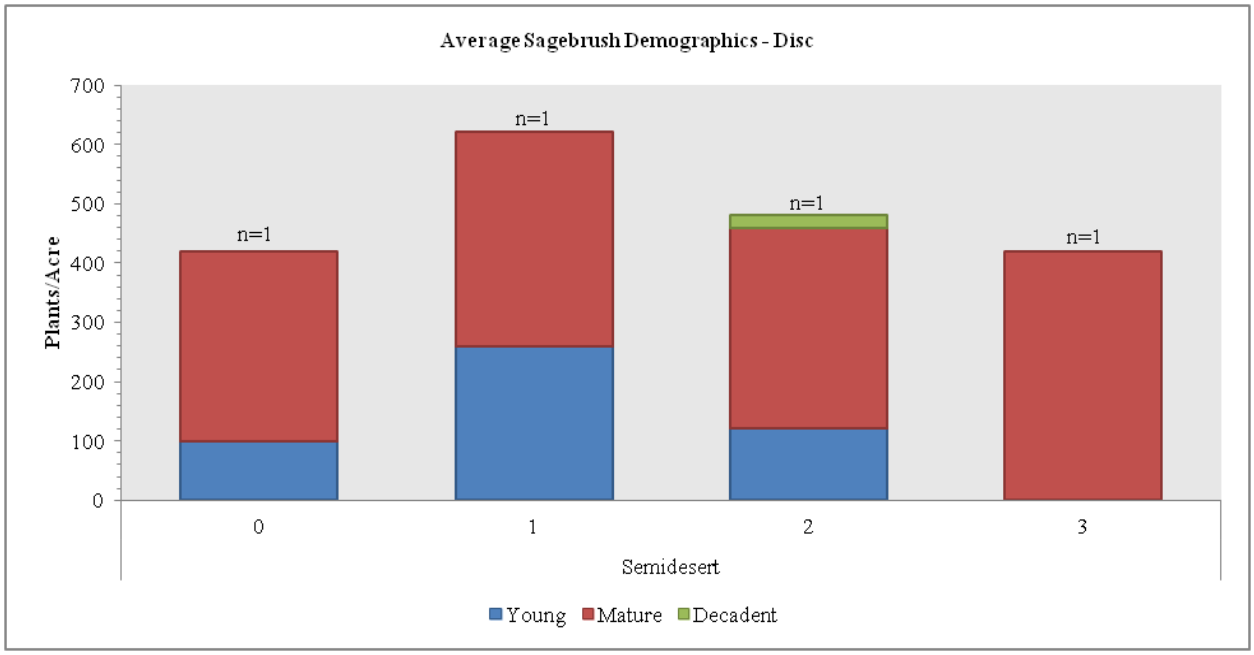


Figure 10.66: Average sagebrush demographics of semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

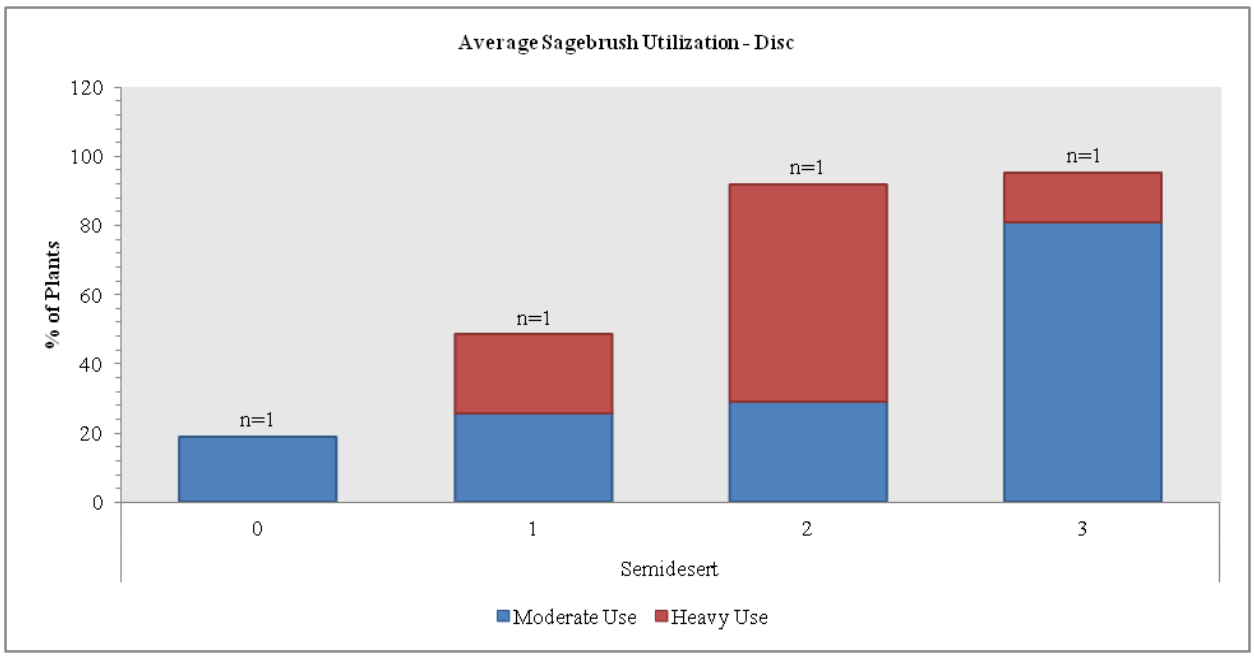


Figure 10.67: Average sagebrush utilization on semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

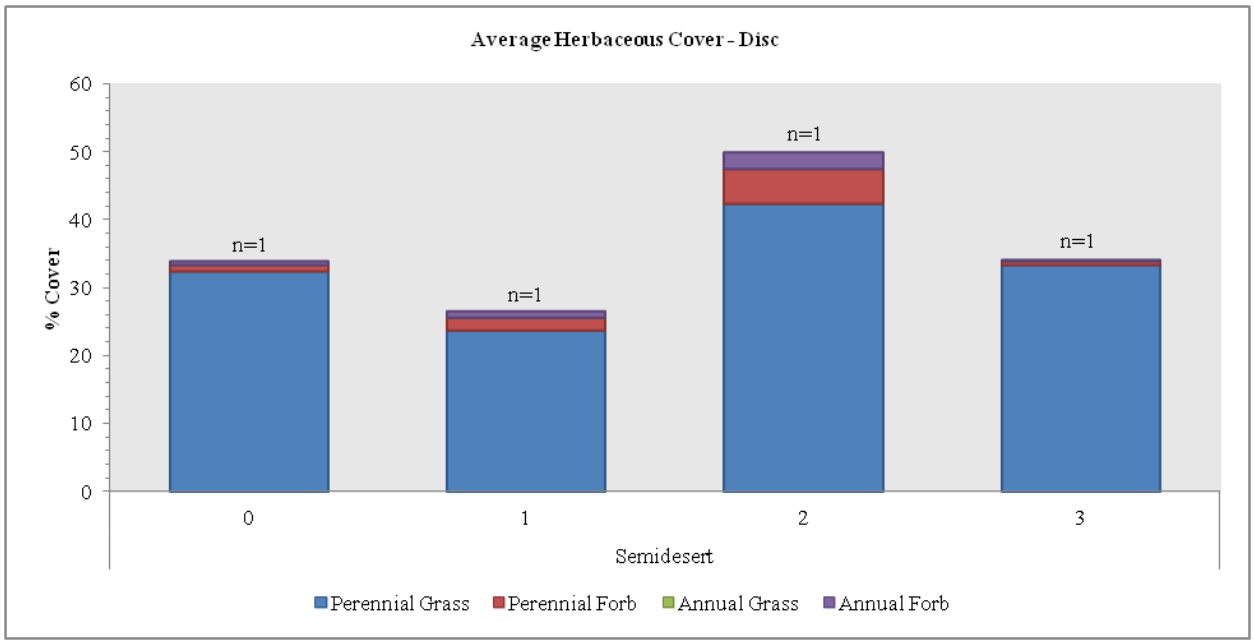


Figure 10.68: Average herbaceous cover of semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

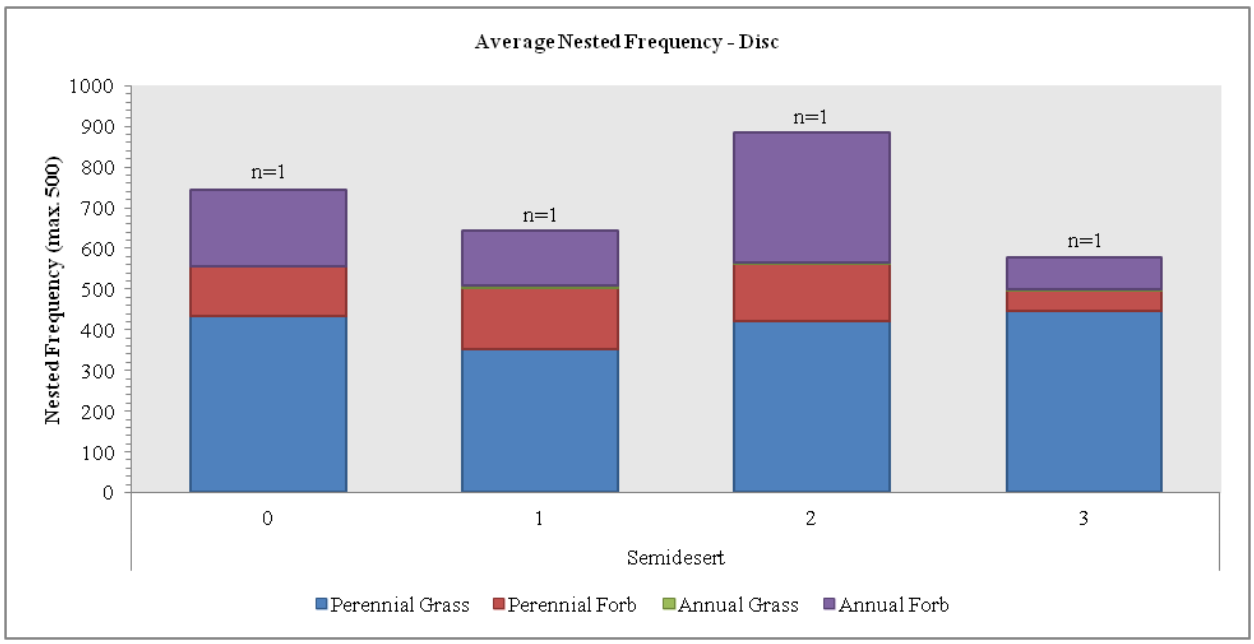


Figure 10.69: Average nested frequency of herbaceous species on semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

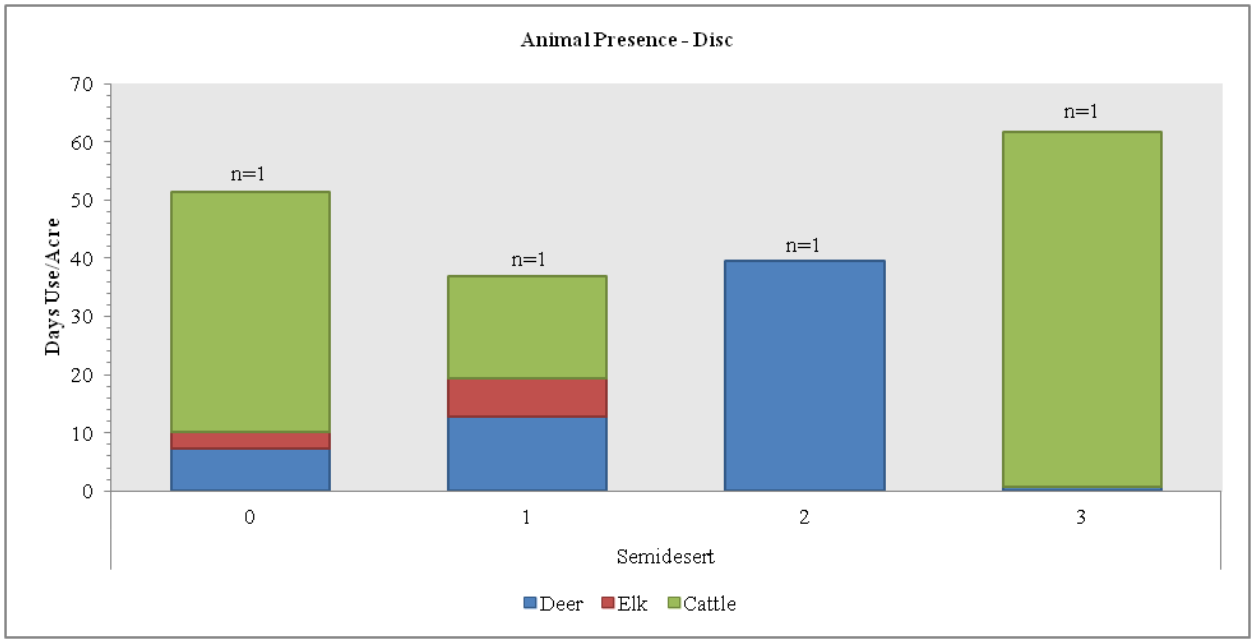


Figure 10.70: Average pellet transect data of semidesert study sites that have undergone a discing treatment. 0 = pre-treatment; 1 = 1 – 3 years post-treatment; 2 = 4 – 8 years post-treatment.

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