Utah Big Game Range Trend Summaries 2018

Wildlife Management Units
22, 24, 25A, 25B, 25C, 27, 28, 29, 30
&
Southern Region Treated or Disturbed Summary

PUBLICATION NUMBER 19-15
REPORT FOR FEDERAL AID PROJECT W-82-R-63

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

UTAH BIG GAME RANGE TREND UNIT SUMMARIES
2018
WILDLIFE MANAGEMENT UNITS
22, 24, 25A, 25B, 25C, 27, 28, 29, 30
&
SOUTHERN REGION TREATED OR DISTURBED SUMMARY

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Cover Photo Credit

Hummingbird trumpet (*Epilobium canum*) by Jason Cox (2018)

Performance Report for Federal Aid Project W-82-R-63

Publication No. 19-15

UTAH DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife Resources
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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-63

Grant Title: Wildlife Habitat Research and Monitoring

Project Title: Wildlife Habitat Monitoring/Range Trend Studies

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

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

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

REMARKS

The work completed during the 2018 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Southern Region. Most trend studies surveyed in these management units were established in the 1980s and reread at 5-year intervals.

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

Bureau of Land Management
- Cedar City Field Office
- Grand Staircase-Escalante National Monument
- Kanab Field Office
- Fillmore Field Office
- Richfield Field Office
- St. George Field Office

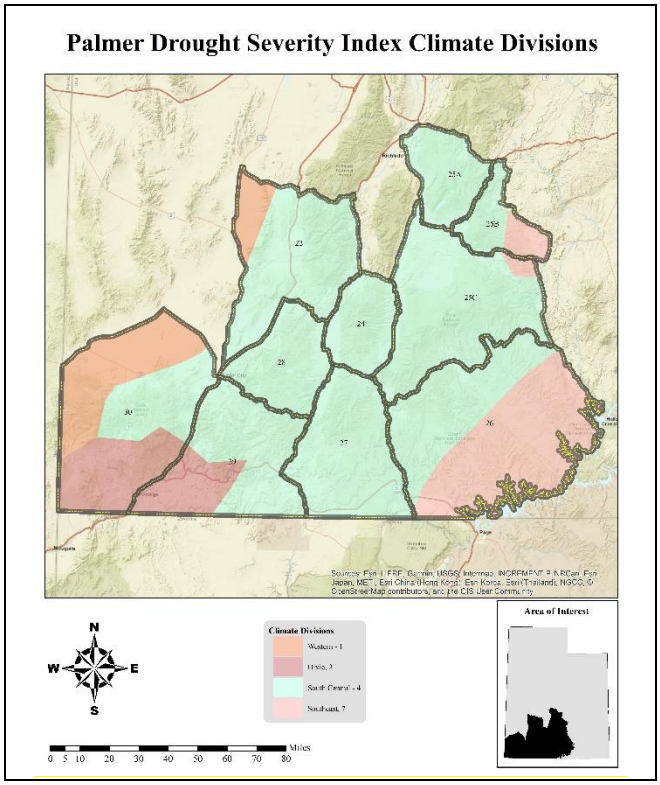
Dixie National Forest
- Cedar City Ranger District
- Escalante Ranger District
- Pine Valley Ranger District
- Powell Ranger District
- Teasdale Ranger District

Fishlake National Forest
- Beaver Ranger District
- Fillmore Ranger District
- Richfield Ranger District

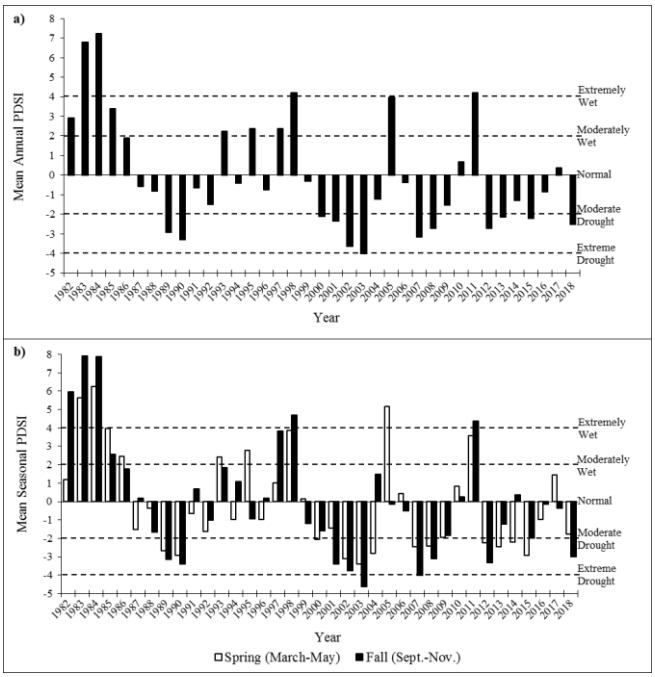
Private landowners were cooperative in allowing access to study sites located on their land.

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



Climate Data: The state of Utah is divided into seven climatic divisions for estimating the Palmer Drought Severity Index (PDSI) and the Southern region occurs within four of these divisions: Western (Division 1), Dixie (Division 2), South Central (Division 5), and Southeast (Division 7). 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 2018. The data reported in this summary covers the years over which these sites have been sampled (1982-2018). 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, 2019). In the figure below, graph "a" represents the mean annual PDSI for the Western division (Division 1) and graph "b" shows the mean PDSI by season, spring (March-May) and fall (Sept.-Nov.) for the Western division (Division 1) (Climate Prediction Center Internet Team, 2005).



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

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

LANDFIRE Existing Vegetation Coverage: The Existing Vegetation Cover (EVC) layer represents the vertically-projected percent cover of the live canopy layer for a 30-m grid cell. EVC is generated separately for tree, shrub, and herbaceous cover functional groups

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

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

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

Treatments/Restoration Work: There has been an active effort to address many of the limitations within each unit through the Watershed Restoration Initiative (WRI). This section outlines the work that has been done on the unit through WRI projects. A map of the projects that have occurred on the management unit through the WRI program and a map of the fire history from 2000-2018 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 (if available). 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, covers, and utilizations for shrubs and trees. Not all sites had shrubs or trees present: when this was the case, these graphs were included with no data displayed. The implied trend for the herbaceous understory was evaluated by comparing mean values of nested frequencies and covers from sample year to sample year. Occupancy trends of big game species are also discussed and were evaluated by comparing mean pellet group counts of individual species from sample year to sample year.

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

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

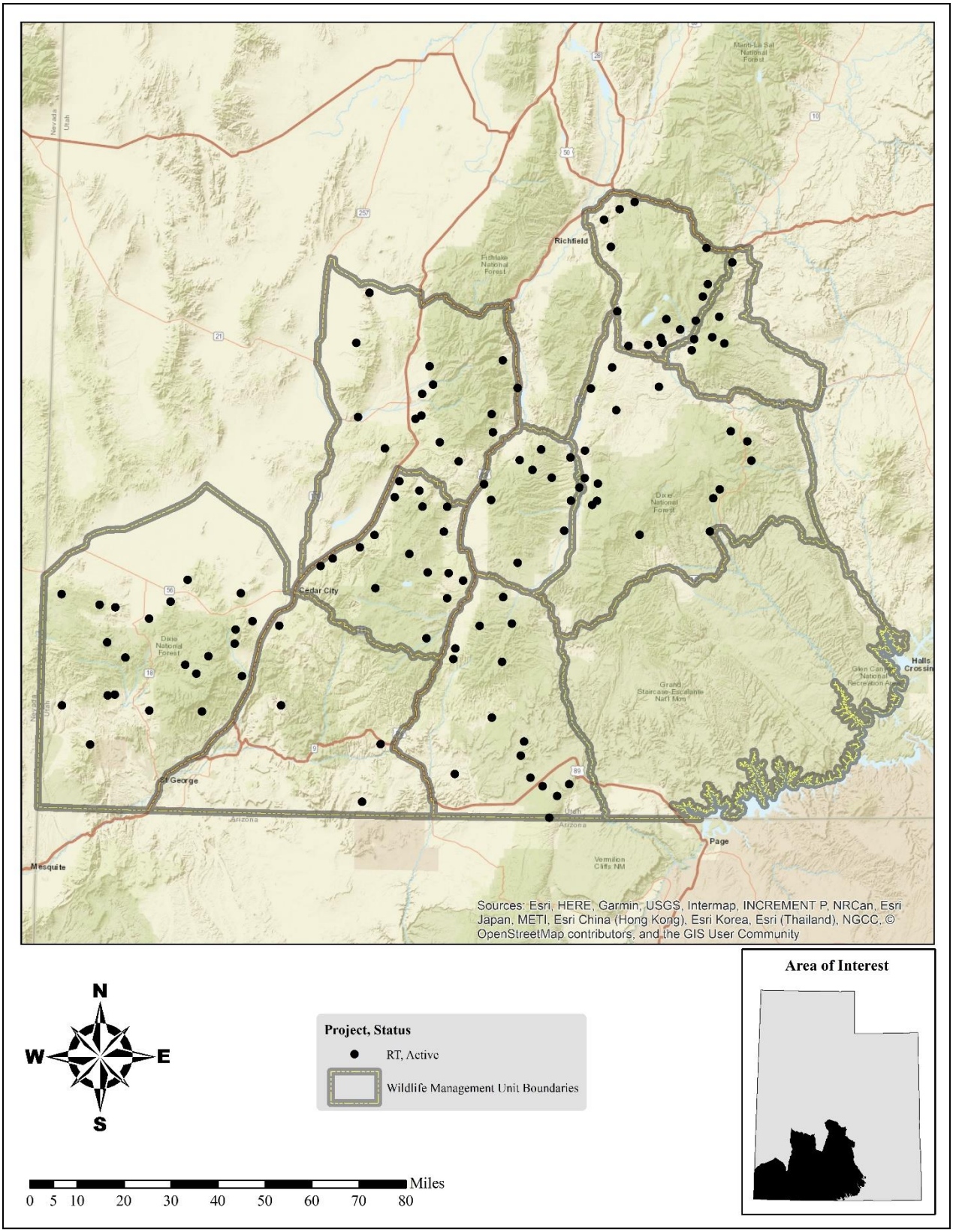
Deer Winter Range Condition Assessment: The desirable components index (DCI) for deer was created by Range Trend Program personnel as a tool to address condition and/or value of winter ranges for mule deer. This index is meant to be a companion to, and not a replacement for, the site-specific range trend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

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

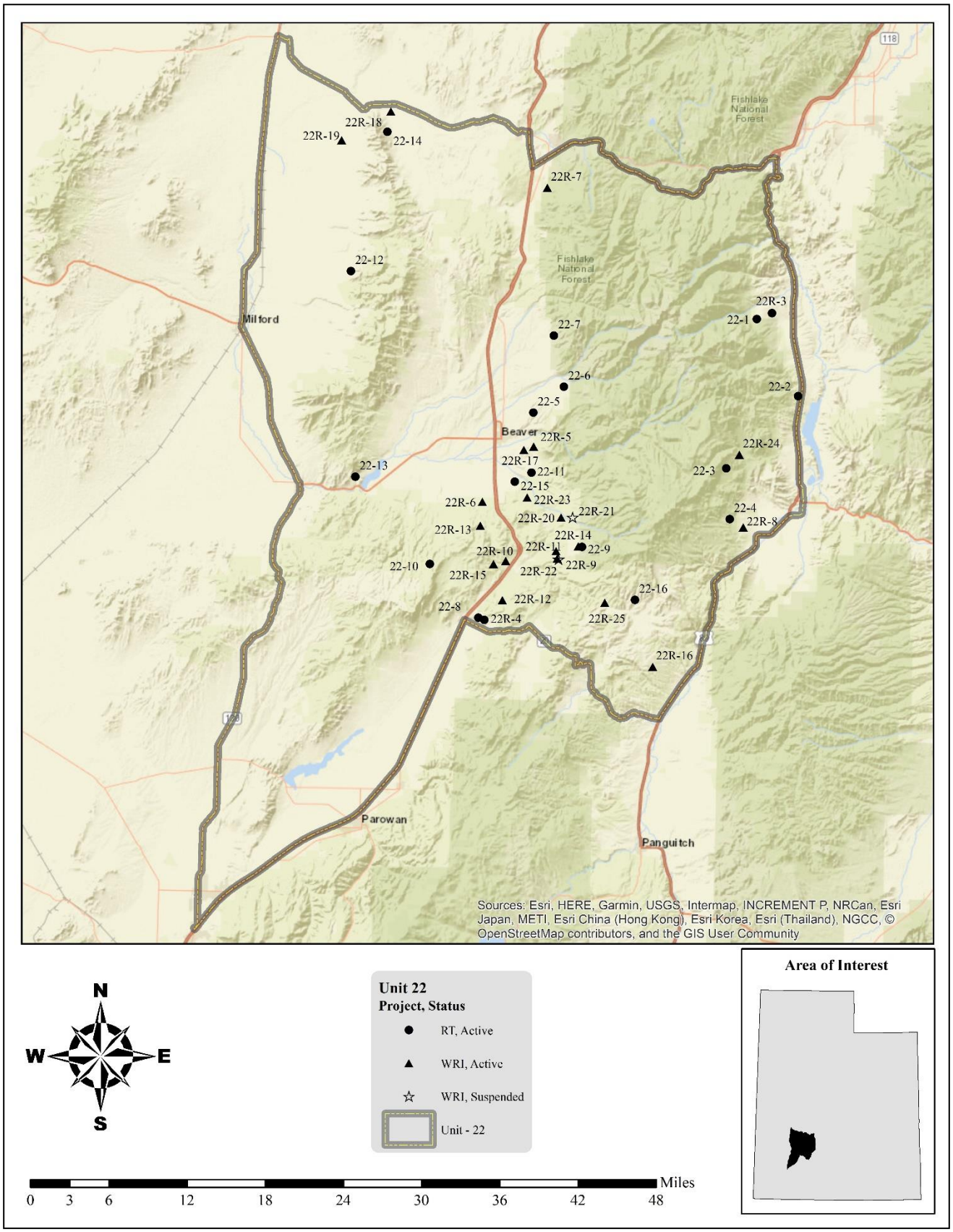
Changes in DCI over the sample years for both treated and untreated sites are included in the figures near the end of the summary. Care should be taken when interpreting these tables as the number of sites included in each year may vary. This could be misleading if the overall DCI seems to be improving,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

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

UNIT SUMMARIES



1. WILDLIFE MANAGEMENT UNIT 22 – BEAVER



WILDLIFE MANAGEMENT UNIT 22 – BEAVER

Boundary Description

Iron, Garfield, Piute, Beaver, and Millard counties - Boundary begins at SR-130 and I-15; north on SR-130 to SR-21; north on SR-21 to SR-257; north on SR-257 to Black Rock Road; east on Black Rock Road to I-15; south on I-15 to I-70; east on I-70 to US-89; south on US-89 to SR-20; west on SR-20 to I-15; south on I-15 to SR-130.

Management Unit Description

Geography

The Beaver wildlife management unit includes both the east and west slopes of the Tushar Mountains south of I-70. The unit also contains the Mineral Mountains south of Black Rock Road, a portion of Parowan Valley, and Fremont Wash. Delano Peak in the Tushar Mountains is the unit's highest point at an elevation of 12,173 feet. The lowest area in the unit is about 5,000 feet in the valley near Milford. The highest point in the Mineral Mountains is 9,578 feet on Granite Peak and Jack Henry Knoll at 8,668 feet is the highest area in the Black Mountains.

The east side of the Tushar Mountains is comprised of drainages which empty into the Sevier River. The major tributaries in the area are Deer Creek, Beaver Creek, Bullion Creek, Cottonwood Creek, Ten Mile Creek, City Creek, Birch Creek, Pine Creek and Chokecherry Creek. Between Circleville and Marysvale, a broad river valley with gradual slopes joins the steep mountain slopes and sheer cliffs of the Tushar Mountains. The portions north of Marysvale and south of Circleville (including Marysvale and Circleville Canyons) are composed of disjunctive pinyon-juniper canyons. Towns in this area include Sevier, Marysvale, Junction, and Circleville.

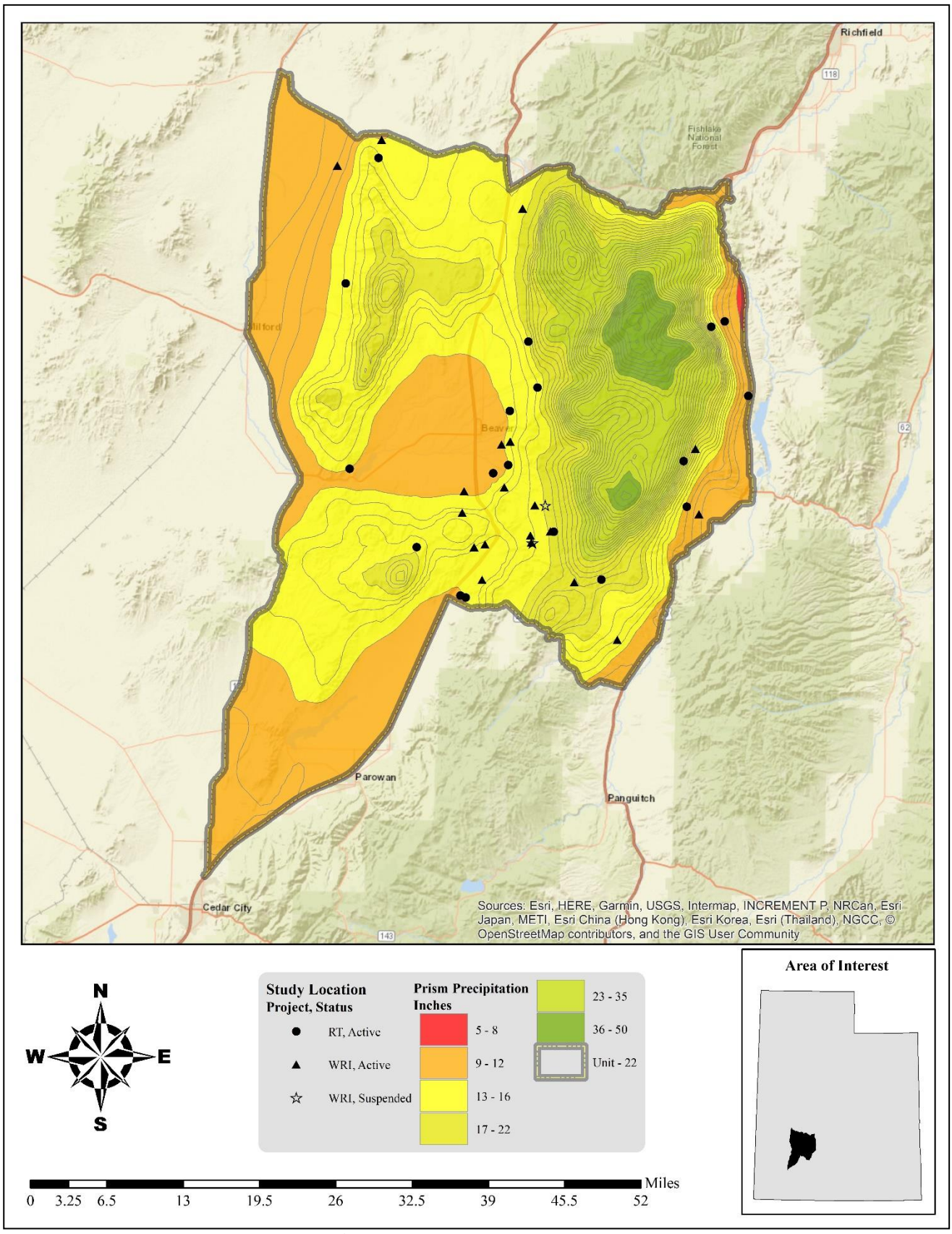
The west side of the Tushar Mountains is comprised of drainages which empty into the Beaver River. Major tributaries in the area are Indian Creek, North Creek, South Creek, and Merchant Creek. The low- to mid-elevation areas on the west side of the Tushar Mountains are composed of gradual sloping hills and flats that are transversed by I-15 north to south. On the west side of the wildlife unit, the Black Mountains and the Mineral Mountains are typical of the arid mountains of western Utah: neither support streams with permanent flows. Towns in this area include Beaver, Milford, and Minersville.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches near Marysvale to 43 inches on Mount Baldy. All of the Range Trend and WRI monitoring studies on the unit occur between 9 and 22 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 South Central division (Division 4).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 1.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 1.1b**) (Time Series Data, 2019).



Map 1.1: The 1981-2010 PRISM Precipitation Model for WMU 22, Beaver (PRISM Climate Group, Oregon State University, 2013).

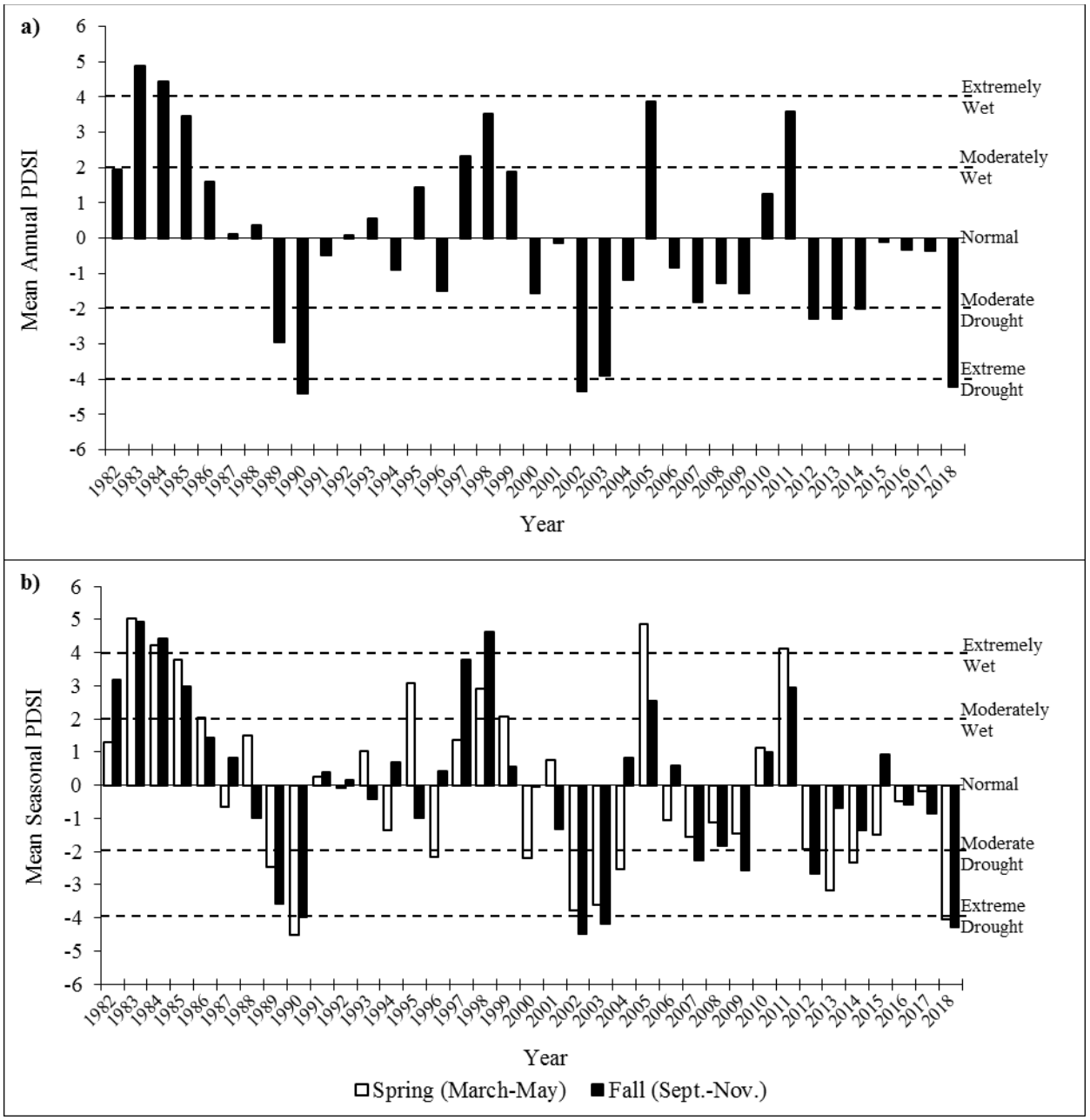


Figure 1.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

Big Game Habitat

There are an estimated 883,573 acres classified as deer range on Unit 22 with 34% classified as summer range and 66% considered to be winter range (**Table 1.1**, **Map 1.2**).

Land managed by the Bureau of Land Management comprises 68% of the winter range, 14% is administered by the United States Forest Service (USFS), 10% is privately owned, 7% is managed by the Utah School and Institutional Trust Lands Administration (SITLA), and less than 1% each is tribally owned or managed by the Utah Department of Transportation (UDOT), Utah State Parks (USP), or Utah Division of Wildlife Resources (UDWR) (**Table 1.2**, **Map 1.2**, **Map 1.6**). Of the elk winter range, 51% is administered by the BLM, 34% by the USFS, 8% is privately owned, 6% is managed by SITLA, 1% is administered by UDWR, and less than 1% is tribally owned (**Table 1.3**, **Map 1.3**, **Map 1.6**).

The Black and Mineral Mountains lack good summer range, but have vegetation similar to most deer wintering areas of southern Utah. Both the Black and Mineral Mountains have relatively steep, rugged slopes with areas of rocky outcrops. However, the Black Mountains are unlike the Mineral Mountains in that the top is dominated by gently rolling sagebrush hills and dry meadows.

The Tushar Mountains are more typical of the high elevation mountains of central and southern Utah and contain good summer range for deer and elk. The Tushars have many small lakes and perennial streams. The western slopes of the Tushar Mountains are more gradual and receive sufficient precipitation to create substantial summer range for deer. On the east side of the Tushar Mountains, the normal winter range boundaries range from 6,200 feet on the valley floor to 8,500 feet in the upper basins. Oak Basin often winters deer up to the 8,600-foot level. The upper limit along the steeper portions of the east face of Tushar Mountains is 7,200 feet. Winter deer concentrations are found on south and southeast facing slopes. Minor migrations from the summer ranges of units 23 - Monroe and 24 – Mt. Dutton onto unit 22 winter ranges occur each year, but the major movement is an elevation movement from summer to winter range within the unit.
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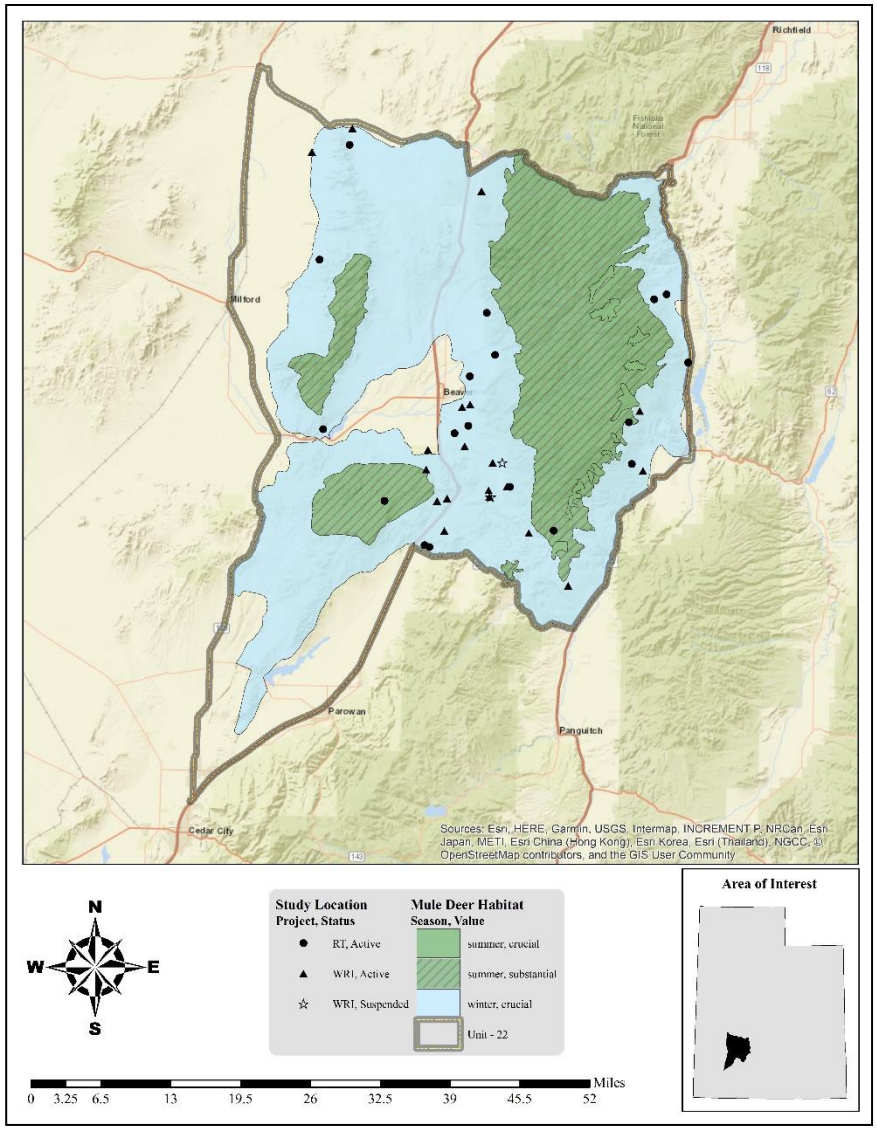
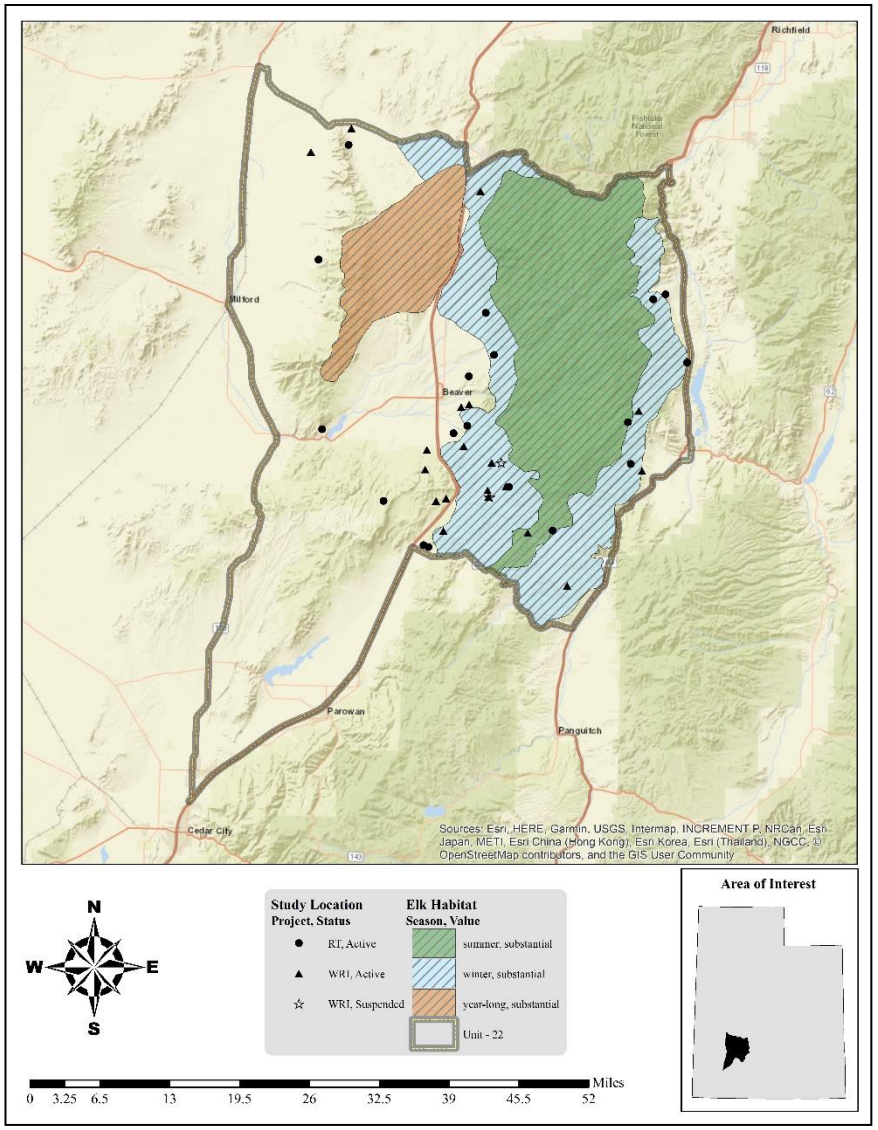
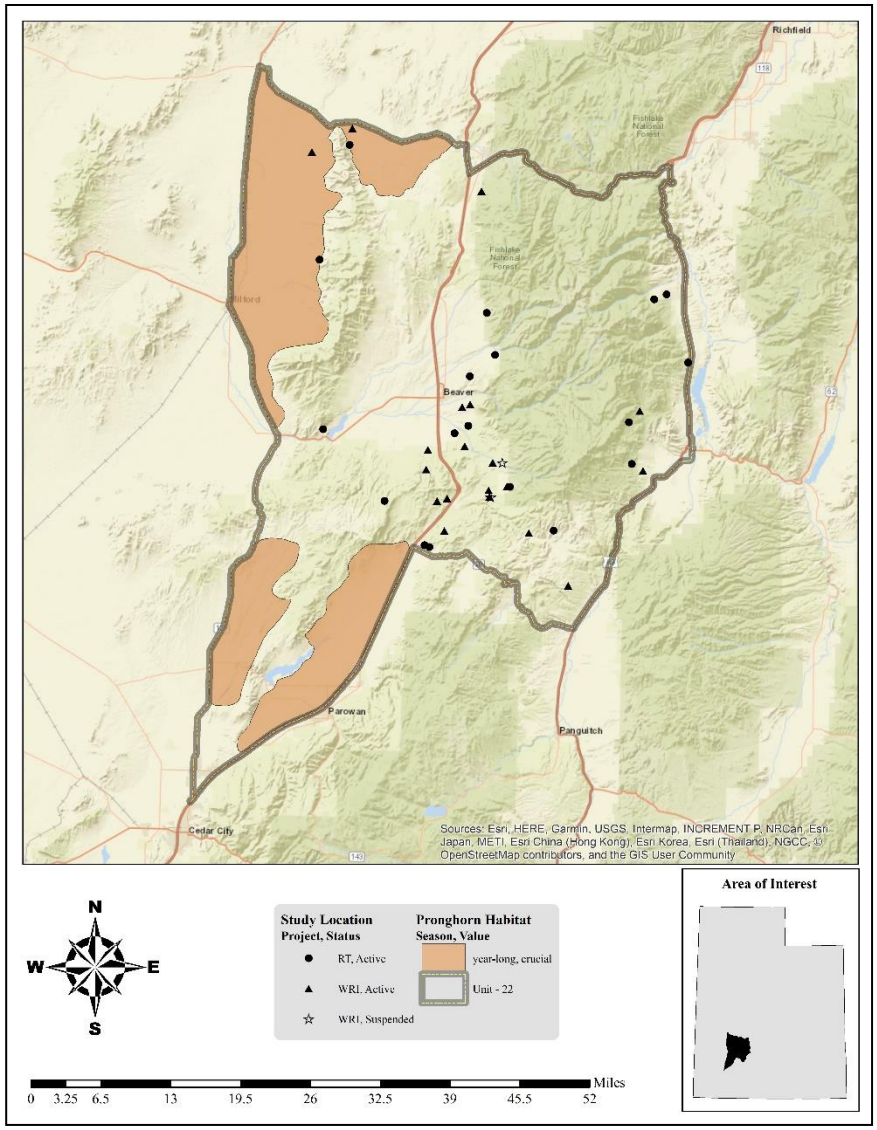


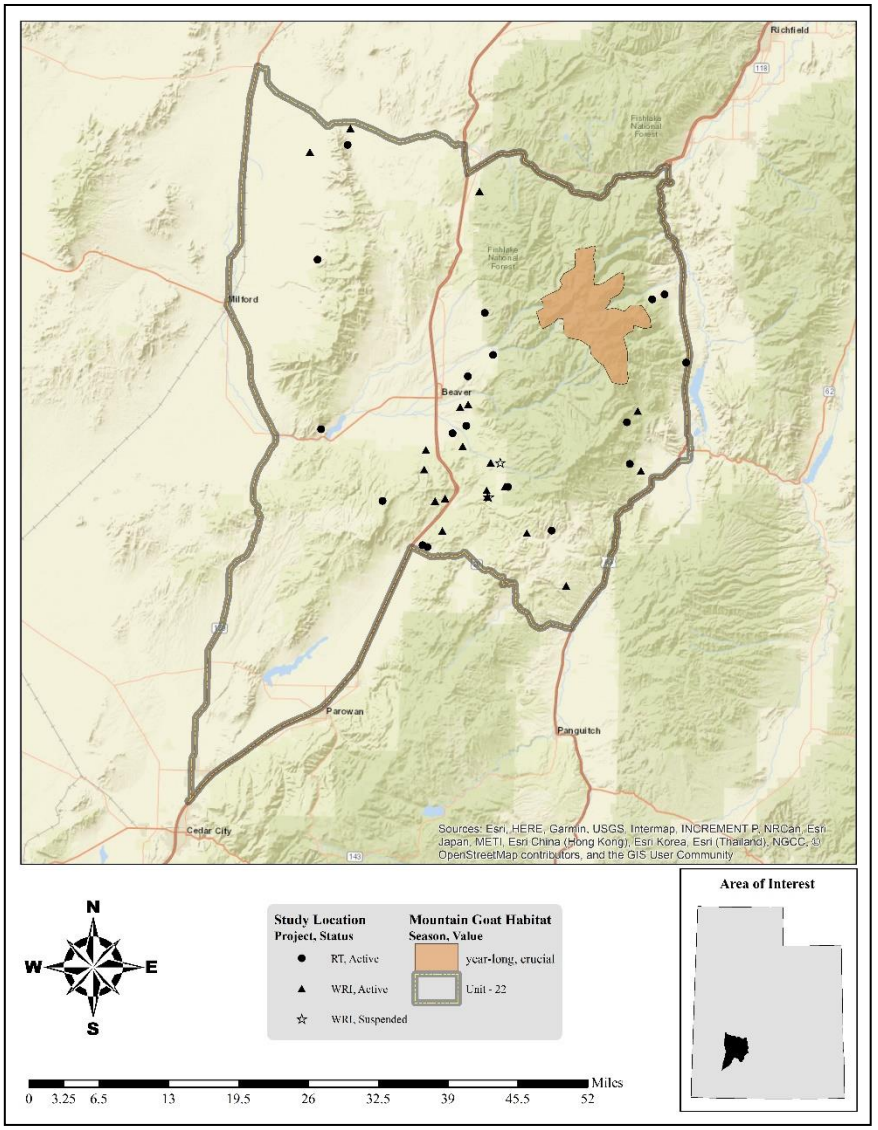
Map 1.2: Estimated mule deer habitat by season and value for WMU 22, Beaver.



Map 1.3: Estimated elk habitat by season and value for WMU 22, Beaver.



Map 1.4: Estimated pronghorn habitat by season and value for WMU 22, Beaver.



Map 1.5: Estimated mountain goat habitat by season and value for WMU 22, Beaver.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	299,704	34%	583,869	66%	0	0%
Elk	237,174	45%	207,178	40%	79,234	15%
Pronghorn	0	0%	0	0%	253,959	100%
Mountain Goat	0	0%	0	0%	37,013	100%

Table 1.1: Estimated mule deer, elk, pronghorn, and mountain goat habitat acreage by season for WMU 22, Beaver.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	66,681	22%	397,879	68%
Private	17,669	6%	57,792	10%
SITLA	7,431	2%	42,460	7%
Tribal	0	0%	247	<1%
USFS	207,921	69%	82,221	14%
UDOT	0	0%	2	<1%
USP	1	<1%	532	<1%
UDWR	0	0%	2,736	<1%
Total	299,704	**100%**	583,869	**100%**

Table 1.2: Estimated mule deer habitat acreage by season and ownership for WMU 22, Beaver.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	7,405	3%	104,723	51%	63,957	81%
Private	14,898	6%	17,245	8%	8,683	11%
SITLA	1,976	1%	12,895	6%	6,554	8%
Tribal	0	0%	247	<1%	0	0%
USFS	212,545	90%	70,560	34%	0	0%
USP	350	<1%	0	0%	0	0%
UDWR	0	0%	1,507	1%	40	<1%
Total	237,174	**100%**	207,178	**100%**	79,234	**100%**

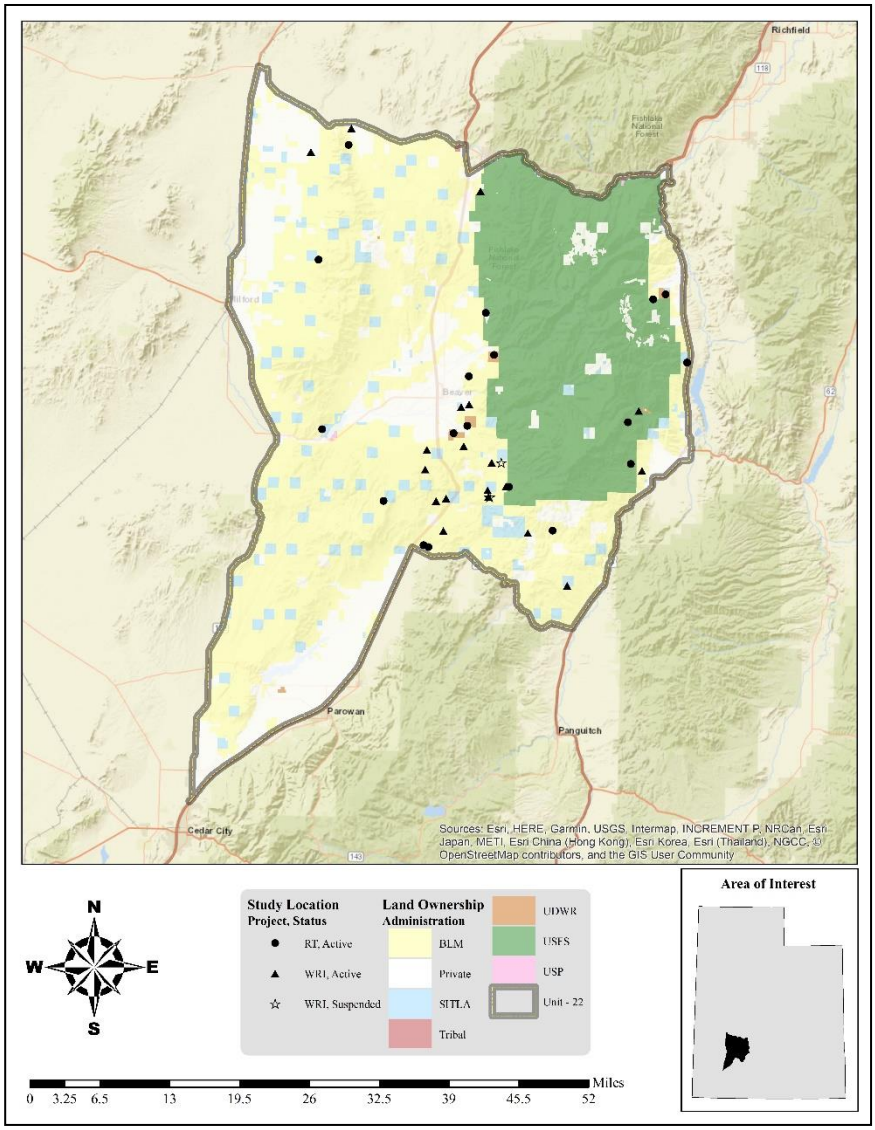
Table 1.3: Estimated elk habitat acreage by season and ownership for WMU 22, Beaver.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	133,811	53%
Private	105,101	41%
SITLA	14,861	6%
UDWR	186	<1%
Total	253,959	**100%**

Table 1.4: Estimated pronghorn habitat acreage by season and ownership for WMU 22, Beaver.

	Year Long Range	
Ownership	*Area (acres)*	*%*
Private	2,479	7%
SITLA	60	<1%
USFS	34,474	93%
Total	37,013	**100%**

Table 1.5: Estimated mountain goat habitat acreage by season and ownership for WMU 22, Beaver.



Map 1.6: Land ownership for WMU 22, Beaver.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	332,942	29.11%	
	Mountain Mahogany Woodland and Shrubland	48,610	4.25%	
	Spruce-Fir Forest and Woodland	26,619	2.33%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	19,493	1.70%	
	Juniper Woodland and Savanna	4,297	0.38%	
	Ponderosa Pine Forest, Woodland and Savanna	2,506	0.22%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	842	0.07%	
	Limber Pine Woodland	13	0.00%	
	Lodgepole Pine Forest and Woodland	3	0.00%	38.06%
Exotic Herbaceous	Introduced Annual Grassland	117,689	10.29%	
	Introduced Annual and Biennial Forbland	8,918	0.78%	
	Introduced Perennial Grassland and Forbland	1,656	0.14%	11.21%
Grassland	Grassland	37,338	3.26%	
	Alpine Dwarf-Shrubland, Fell-field and Meadow	16,708	1.46%	
	Dry Tundra	9	0.00%	4.73%
Shrubland	Big Sagebrush Shrubland and Steppe	119,949	10.49%	
	Desert Scrub	74,887	6.55%	
	Low Sagebrush Shrubland and Steppe	72,268	6.32%	
	Salt Desert Scrub	41,529	3.63%	
	Deciduous Shrubland	21,200	1.85%	
	Greasewood Shrubland	12,950	1.13%	
	Chaparral	3,031	0.26%	
	Other Shrubland	1,091	0.10%	30.33%
Other	Conifer-Hardwood	56,093	4.90%	
	Agricultural	37,388	3.27%	
	Developed	34,274	3.00%	
	Riparian	16,955	1.48%	
	Hardwood	16,132	1.41%	
	Sparsely Vegetated	8,813	0.77%	
	Barren	8,324	0.73%	
	Open Water	768	0.07%	
	Quarries-Strip Mines-Gravel Pits	519	0.05%	
	Snow-Ice	2	0.00%	15.67%
Total		1,143,816	100%	100%

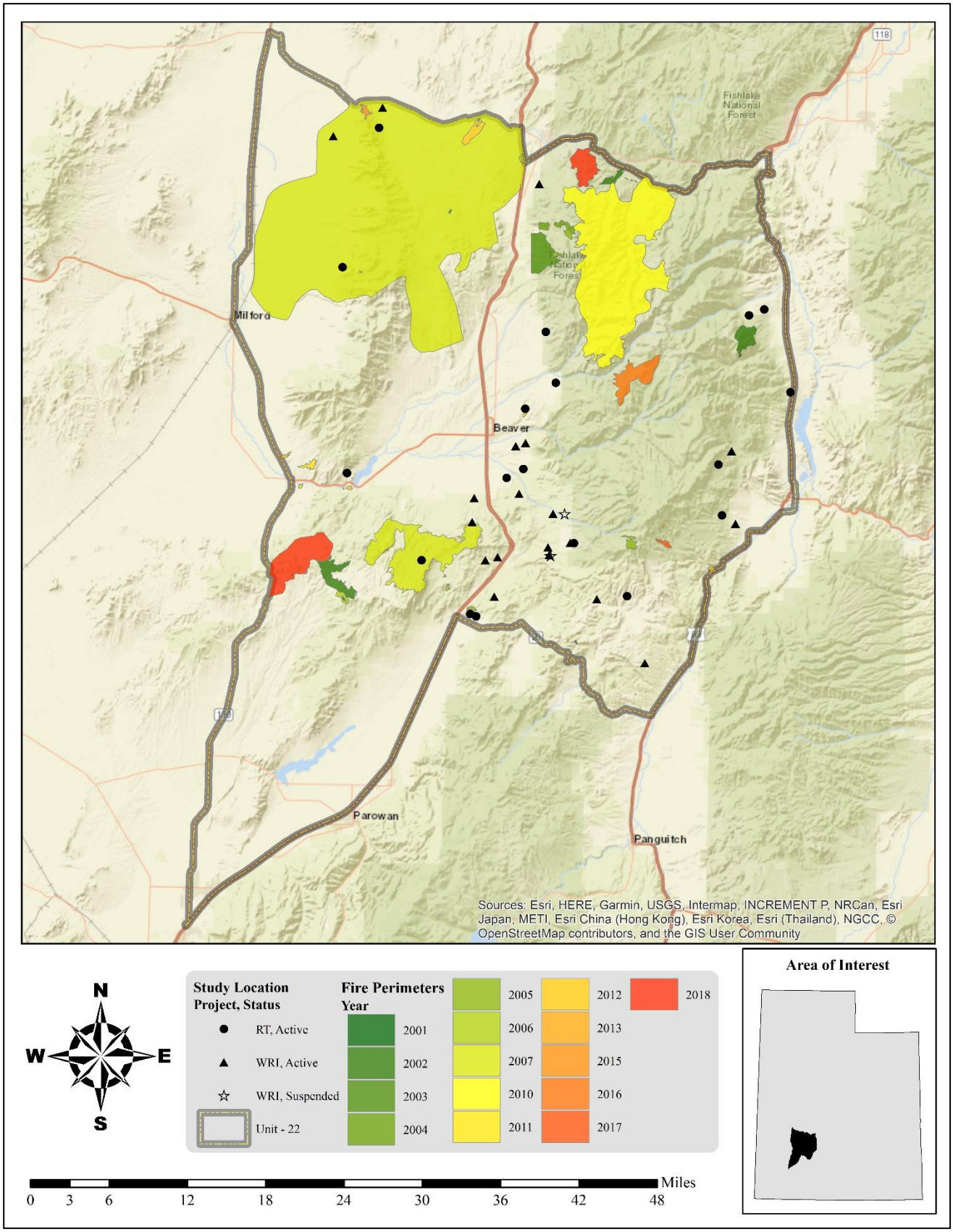
Table 1.6: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 22, Beaver.

Limiting Factors to Big Game Habitat

Historically, on the west side of the Tushar Mountains most of the use on the winter range was on the Black and Mineral Mountains: the winter ranges on these mountains were used quite extensively in the past by deer migrating from summer range on the Tushars. These migrations were essentially eliminated by the construction and fencing of I-15. Two underpasses and one overpass were constructed to aid deer in crossing I-15, but they have had limited success. Meanwhile, the winter range on the east side of I-15 must carry the burden. Still, there is ample range for deer in normal winters. Only in severe winters when the usable range is limited to the lowest areas near the freeway does winterkill become a substantial problem.

Wildfire has also had a considerable impact on the deer winter range in the unit, particularly in the northern portion of the unit. The Milford Flat fire of 2007 was the largest wildfire in Utah's recorded history at 356,665 acres, and burned most of the northern portions of the Mineral Mountains and much of the surrounding valleys and foothills. In 2007, the Greenville fire burned 14,716 acres on Black Mountain (**Map 1.7**). The Dog Valley fire of 1996 burned a portion on the northern end of WMU 22 and a large number of the southern portion of WMU 21 around the I-15 and I-70 Junction. All of these wildfires removed large expanses of important sagebrush and shrubland communities. While response to rehabilitation efforts and recovery has varied, available shrub forage remains greatly decreased from pre-fire levels. According to the According to the current LANDFIRE Existing Vegetation Coverage model, 10% of the unit is classified as introduced annual grassland. The abundance of the introduced annual species cheatgrass (*Bromus tectorum*), primarily within the lower elevation sagebrush communities, increases fuel loads and exacerbates the threat of catastrophic wildfires within the unit (Balch, D'Antonio, & Gómez-Dans, 2013).

Encroachment by pinyon-juniper woodland communities also poses a substantial threat to important sagebrush rangelands. Pinyon-juniper woodlands comprise 29% of the unit and dominate the vegetation coverage within the deer winter range on WMU 22 (**Table 1.6**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components, and therefore decreases available forage for wildlife (Miller, Svejcar, & Rose, 2000).



Map 1.7: Land coverage of fires by year from 2000-2018 for WMU 16A, Nebo (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

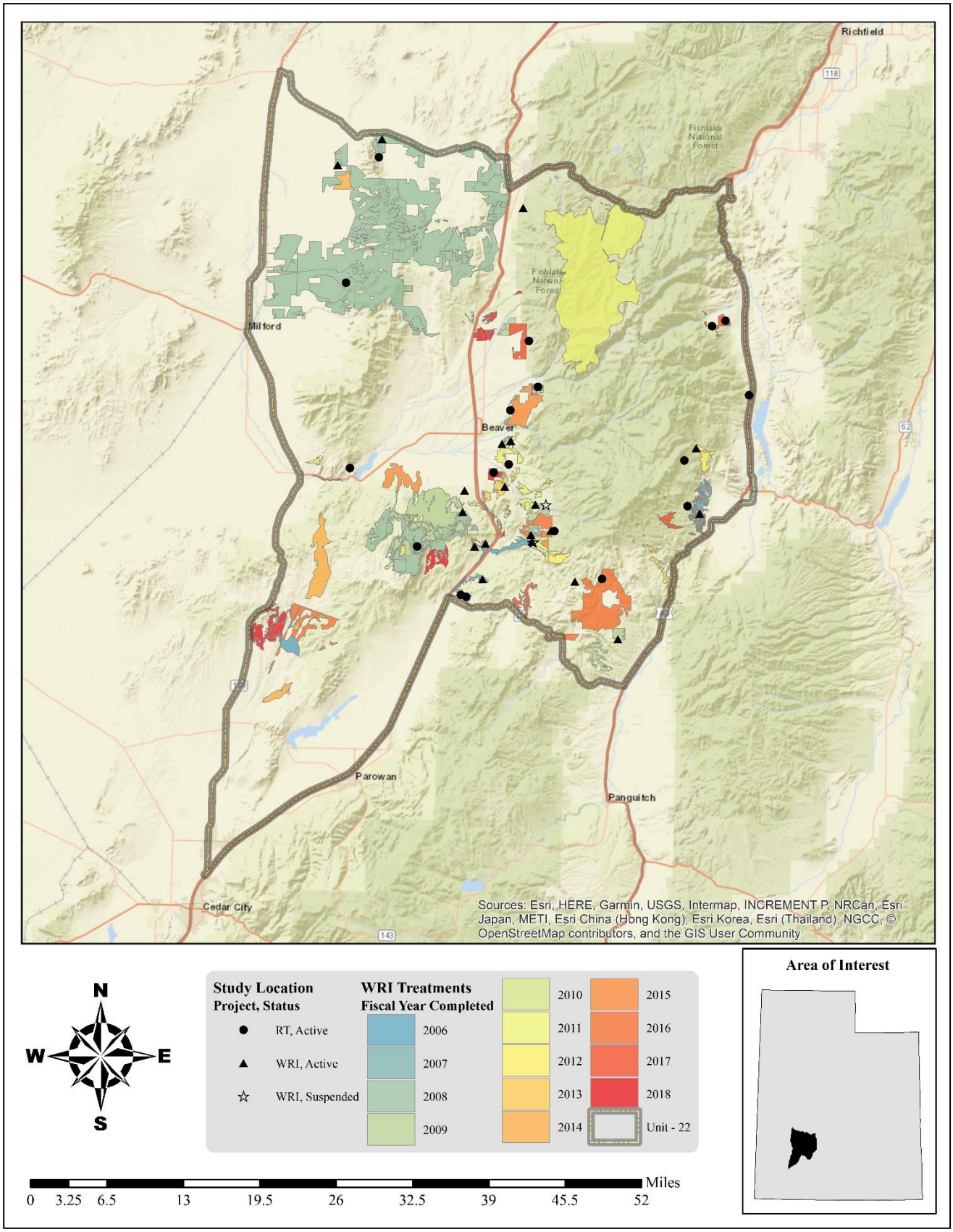
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 204,704 acres of land have been treated within the Beaver unit since the WRI was implemented in 2004 (**Map 1.8**). An additional 9,471 acres are pending completion, 15,217 acres are currently being treated, and treatments have been proposed for 25,438 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 254,829 acres for this unit (**Table 1.7**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

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

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**119,760**	**2,523**	**0**	**2,751**	**125,034**
Ely (One-Way)	109,199	2,523	0	0	111,722
Ely (Two-Way)	9,822	0	0	2,751	12,573
Smooth (One-Way)	740	0	0	0	740
Bullhog	**12,423**	**3,697**	**0**	**464**	**16,584**
Full Size	12,038	3,697	0	464	16,199
Skid Steer	385	0	0	0	385
Bulldozing	**36**	**0**	**0**	**0**	**36**
Tree Push	36	0	0	0	36
Chain Harrow	**514**	**1,091**	**0**	**0**	**1,605**
≤15 ft. (Two-Way)	93	1,091	0	0	1,184
>15 ft. (One-Way)	307	0	0	0	307
>15 ft. (Two-Way)	114	0	0	0	114
Disc	**158**	**0**	**0**	**0**	**158**
Off-Set (Two-Way)	158	0	0	0	158
Harrow	**4,380**	**0**	**0**	**69**	**4,449**
≤15 ft. (One-Way)	75	0	0	0	75
≤15 ft. (Two-Way)	2,269	0	0	69	2,337
>15 ft. (One-Way)	1,646	0	0	0	1,646
>15 ft. (Two-Way)	391	0	0	0	391
Herbicide Application	**1,481**	**0**	**0**	**0**	**1,481**
Aerial (Fixed-Wing)	1,481	0	0	0	1,481
Planting/Transplanting	**1,057**	**0**	**0**	**0**	**1,057**
Prescribed Fire	**0**	**0**	**9,471**	**79**	**9,550**
Seeding (Primary)	**168,983**	**1,364**	**0**	**969**	**171,316**
Broadcast (Aerial-Fixed Wing)	121,807	1,364	0	969	124,140
Drill (Rangeland)	46,016	0	0	0	46,016
Drill (Truax)	1,068	0	0	0	1,068
Ground (Mechanical Application)	92	0	0	0	92
Seeding (Secondary/Shrub)	**0**	**0**	**0**	**262**	**262**
Hand Seeding	0	0	0	262	262
Skid-Steer Mounted Tree Cutter	**1,750**	**0**	**0**	**0**	**1,750**
Hydraulic Brush Saw	1,750	0	0	0	1,750
Vegetation Removal/Hand Crew	**25,917**	**7,758**	**0**	**24,868**	**58,543**
Lop (No Scatter)	5,074	0	0	0	5,074
Lop & Scatter	20,838	7,758	0	24,868	53,464
Lop-Pile-Burn	5	0	0	0	5
Other	**852**	**0**	**0**	**0**	**852**
Road Decomissioning	852	0	0	0	852
Grand Total	**337,311**	**16,433**	**9,471**	**29,463**	**392,678**
*** Total Land Area Treated**	**204,704**	**15,217**	**9,471**	**25,438**	**254,829**

Table 1.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 22, Beaver. Data accessed on 02/18/2019. *Does not include overlapping treatments.



Map 1.8: WRI treatments by fiscal year completed for WMU 22, Beaver.

Range Trend Studies

Range Trend studies have been sampled within WMU 22 on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 1.8**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 1.9**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
22-01	Deer Flat	RT	Active	'85, '91, '98, '03, '08, '13, '18	Mountain Stony Loam (Mountain Big Sagebrush)
22-02	Piute Reservoir	RT	Active	'85, '91, '98, '03, '08, '13, '18	Semidesert Shallow Loam (Wyoming Big Sagebrush)
22-03	Oak Basin	RT	Active	'85, '91, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Mountain Big Sagebrush)
22-04	Wades Canyon	RT	Active	'85, '91, '98, '03, '08, '13, '18	Mountain Stony Loam (Mountain Big Sagebrush)
22-05	Bone Hollow	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
22-06	Beaver Table	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
22-07	Sheep Rock	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
22-08	Muley Point	RT	Suspended	'85, '91, '98, '03, '08, '13	Semidesert Loam (Wyoming Big Sagebrush)
22-09	Rocks Reseeding	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
22-10	Doubleup Hollow	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
22-11	B Hill	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
22-12	Big Cedar Cove	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Gravelly Loam (Mountain Big Sagebrush)
22-13	Minersville Reservoir	RT	Active	'85, '91, '98, '03, '08, '13, '18	Semidesert Loam (Wyoming Big Sagebrush)
22-14	Antelope Mountain	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
22-15	South Creek	RT	Active	'98, '03, '08, '13, '18	Semidesert Loam (Wyoming Big Sagebrush)
22-16	Brady Creek	RT	Active	'18	Upland Stony Loam (Mountain Big Sagebrush)
22R-03	Marysvale WMA	RT	Active	'98, '18	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
22R-04	Above Fremont Wash	RT	Active	'99, '03, '08, '13, '18	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
22R-05	Black Mountain	WRI	Active	'04, '07, '12, '16	Upland Loam (Wyoming Big Sagebrush)
22R-06	Greenville Bullhog	WRI	Active	'04, '07, '12, '16	Upland Loam (Wyoming Big Sagebrush)
22R-07	Sulphurdale	WRI	Active	'05, '08, '13, '17	Upland Loam (Mountain Big Sagebrush)
22R-08	P-Hill Dixie	WRI	Active	'05, '08, '13, '17	Semidesert Gravelly Loam (Mountain Big Sagebrush)
22R-09	South Beaver Dixie Reference	WRI	Suspended	'06	Not Verified
22R-10	South Beaver Bullhog	WRI	Active	'06, '10, '14, '18	Upland Loam (Mountain Big Sagebrush)
22R-11	South Beaver SITLA Chaining	WRI	Active	'07, '10, '14, '18	Upland Loam (Mountain Big Sagebrush)
22R-12	South Beaver Bullhog 2	WRI	Active	'07, '10, '15, '18	Upland Loam (Mountain Big Sagebrush)
22R-13	Greenville Bench Bullhog 2	WRI	Active	'07, '11, '15	Upland Loam (Mountain Big Sagebrush)
22R-14	South Beaver Rocky Wash	WRI	Active	'08, '11, '15	Upland Loam (Mountain Big Sagebrush)
22R-15	South Beaver Bullhog Year 4	WRI	Active	'08, '11, '15	Upland Loam (Mountain Big Sagebrush)
22R-16	Spry Sagebrush Restoration	WRI	Active	'08, '11, '15	Upland Stony Loam (Mountain Big Sagebrush)
22R-17	Beaver Easement Harrow	WRI	Active	'08, '11, '15	Upland Loam (Mountain Big Sagebrush)
22R-18	A&F Drill 1	WRI	Active	'08, '11, '17	Semidesert Loam (Wyoming Big Sagebrush)
22R-19	A&F Drill 2	WRI	Active	'08, '11, '17	Semidesert Loam (Wyoming Big Sagebrush)
22R-20	South Beaver Year 5	WRI	Active	'10, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
22R-21	South Beaver Year 5 Reference	WRI	Suspended	'10	Not Verified
22R-22	South Beaver Dixie	WRI	Active	'10, '14, '18	Upland Loam (Mountain Big Sagebrush)
22R-23	South Beaver Year 7	WRI	Active	'12, '15	Upland Gravelly Loam (Bonneville Big Sagebrush)
22R-24	City Creek	WRI	Active	'11, '14, '18	Mountain Stony Loam (Mountain Big Sagebrush)
22R-25	Fremont Pass	WRI	Active	'18	Upland Stony Loam (Black Sagebrush)

Table 1.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 22, Beaver.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
22-01	Deer Flat	Seed Unknown		1968		
		Chain Unknown		1968		
		Lop and Scatter	Deer Flat Lop and Scatter Project	May-June 2017	724	3775
22-03	Oak Basin	Seed Unknown		1965	600	
		Dixie Harrow		1965	600	
		Unknown				
		Wildfire		Between 1985 and 1991		
22-05	Bone Hollow	Aerial Before	Indian Creek	October 2014	3160	3001
		Two-Way Ely Chain	Indian Creek	November 2014-February 2015	2790	3001
22-06	Beaver Table	Seed Unknown		1957		
		Cable Unknown		1957		
		Lop and Scatter		Between 2003 and 2008		
22-07	Sheep Rock	Two-Way Chain		Fall 1981		
		Unknown				
		Seed Unknown		Fall 1981		
		Wildfire		Between 1981 and 1984		
		Bullhog		Between 2009 and 2011		
22-08	Muley Point	Wildfire	Lee's Wash	2005	195	
		Aerial After	Lee's Wash Reseeding	2005	193	
22-09	Rocks Reseeding	Dixie Harrow		1962		
		Unknown				
		Seed Unknown		1962		
		Lop and Scatter	South Beaver Lop and Scatter	2019	4657	4655
22-10	Doubleup Hollow	Wildfire	Greenville	May-July 2007	14716	
		Aerial After	Greenville Bench Aerial Seeding	December 2007-January 2008	11048	993
22-11	B Hill	Chain Unknown		1959		
		Aerial Unknown		1959		
22-12	Big Cedar Cove	Wildfire	Milford Flat	July 2007	356665	
		Aerial Before	Milford Flat Fire Rehabilitation and Contracting	Fall 2007	76454	1218
		One-Way Ely Chain	Milford Flat Fire Rehabilitation and Contracting	Fall 2007	76454	1218
		Aerial After	Milford Flat Fire Rehabilitation and Contracting	Fall 2007	76454	1218
22-13	Minersville Reservoir	Wildfire	Minersville	July 1998	4052	
		Aerial Before	Minersville Aerial Seeding	October 1998	1522	
		One-Way Smooth Chain	Minersville Fire Rehabilitation	October 1998	2626	
22-14	Antelope Mountain	Wildfire		1996		
		Chain Unknown		1996		
		Seed Unknown		1996		
		Wildfire	Milford Flat	July 2007	356665	
22-16	Brady Creek	Lop and Scatter	Dog Valley Hand Thinning	September-November 2015	9768	3265
22R-03	Marysvale WMA	Lop and Scatter	Deer Flat Lop and Scatter Project	May-June 2017	724	3775
22R-04	Above Fremont Wash	Lop and Scatter		Between 2008 and 2013		

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
22R-05	Black Mountain	Aerial	Black Mountain	September-December 2004		PDB
		Lop and Scatter		Between 2004 and 2007		
		Transplant	SR Shrub Seedlings Year 2	January-June 2007	238	469
		Broadcast Before	Beaver Easement Property Treatment	November 2008	205	1294
		Two-Way Dixie Harrow	Beaver Easement Property Treatment	September-December2008	205	1294
		Aerial After	Beaver Easement Property Treatment	January 2009	205	1294
22R-06	Greenville Bullhog	Bullhog	Greenville Bench	August-December 2004	1500	PDB
		Aerial After	Greenville Bench	November 2004	1500	PDB
		Truax Drill	Greenville Bench	November 2004	1500	PDB
		Lop and Scatter	Bone Hollow and Greenville Bench Project Maintenance	September-December 2018	3368	4513
22R-07	Sulphurdale	Chain Unknown	Pine Creek Chaining	1983-1984	2800	
		Seed Unknown	Pine Creek Chaining	1983-1984	2800	
		Lop and Scatter	Sulphurdale	Fall 2005		
22R-08	P-Hill Dixie	Two-Way Dixie Harrow	P-Hill One-way Harrow	October 2005-February 2006	1784	119
		Broadcast After	P-Hill One-way Harrow	October 2005-February 2006	1784	119
22R-09	South Beaver Dixie Reference	Two-Way Chain Unknown	Coyote Bench Seeding	July 1964-November 1965	2905	LTDL
		Aerial Unknown	Coyote Bench Seeding	July 1964-November 1965	2905	LTDL
		Aerial Before	South Beaver Vegetation Enhancement Year 6	November 2011	1506	1994
		Bullhog	South Beaver Vegetation Enhancement Year 6	November 2011-February 2012	1506	1994
		Lop and Scatter	Project Maintenance - South Beaver	September-October 2015	4251	3296
22R-10	South Beaver Bullhog	Aerial Before	South Beaver Vegetation Enhancement Yr 4	December 2008	1358	1224
		Bullhog	South Beaver Vegetation Enhancement Yr 4	Fall 2008-Summer 2009	1520	1224
		Lop and Scatter	Project Maintenance - South Beaver	September-October 2015	4251	3296
22R-11	South Beaver SITLA Chaining	Aerial Before	South Beaver SITLA vegetation enhancement	December 2008	402	918
		Dribbler	South Beaver SITLA vegetation enhancement	December 2008	402	918
		Two-Way Ely Chain	South Beaver SITLA vegetation enhancement	November-December 2008	402	918
		Lop (No Scatter)	Panguitch Creek/South Beaver Dedicated Hunter Habitat Projects maintenance	April-June 2011	402	1801
		Lop and Scatter	Project Maintenance - South Beaver	September-October 2015	4251	3296
22R-12	South Beaver Bullhog 2	Rangeland Drill	South Beaver Vegetation Enhancement Project Year 3	August 2007-March 2008	385	895
		Bullhog	South Beaver Vegetation Enhancement Project Year 3	August 2007-March 2008	385	895
		Aerial After	South Beaver Vegetation Enhancement Project Year 3	February-March 2008	385	895
22R-13	Greenville Bench Bullhog 2	Aerial Bullhog	Greenville Bench Aerial Seeding BLM Project	December 2007 2008 or 2009	11048	993 BLM
		Lop and Scatter	Bone Hollow and Greenville Bench Project Maintenance (Proposed)	2019	3368	4513
22R-14	South Beaver Rocky Wash	Aerial Before	South Beaver Vegetation Enchancement Yr 4	December 2008	1358	1224
		Bullhog	South Beaver Vegetation Enhancement Yr 4	July 2008-August 2009	1520	1224
		Lop and Scatter	Project Maintenance - South Beaver	September-October 2015	4251	3296
22R-15	South Beaver Bullhog Year 4	Aerial Before	South Beaver Vegetation Enhancement Yr 4	December 2008	1358	1224
		Bullhog	South Beaver Vegetation Enhancement Yr 4	July 2008-August 2009	1520	1224
		Lop and Scatter	Project Maintenance - South Beaver	September-October 2015	4251	3296

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
22R-16	Spry Sagebrush Restoration	Chain Unknown	Hawkins Wash Seeding	Fall 1966		
		Seed Unknown	Hawkins Wash Seeding	Fall 1996		
		Herbicide - Tebuthiuron	Hawkins Wash Seeding Maintenance	1992	640	LTDL
		Lop and Scatter	Spry Sagebrush Restoration	April-June 2009	1745	1173
22R-17	Beaver Easement	Aerial Unknown		Historic		
		Broadcast Before Harrow	Beaver Easement Property Treatment	November 2008-January 2009	205	1294
		Two-Way Dixie Harrow	Beaver Easement Property Treatment	September 2008-January 2009	205	1294
		Aerial After	Beaver Easement Property Treatment	January 2009	205	1294
22R-18	A&F Drill 1	Wildfire	Milford Flat	July 2007	356665	
		Rangeland Drill	Milford Flat Fire Rehabilitation - Missouri Flat	October 2007-February 2008	7925	1007
22R-19	A&F Drill 2	Wildfire	Milford Flat	July 2007	356665	
		Rangeland Drill	Milford Flat Fire Rehabilitation - JK	September-December 2007	520	1010
22R-20	South Beaver Year 5	Aerial Before	South Beaver Vegetation Enhancement Year 5	October 2010	1761	1711
		Bullhog	South Beaver Vegetation Enhancement Year 5	October 2010-January 2011	1761	1711
		Lop and Scatter	Project Maintenance - South Beaver Phase II (Proposed)	2019	6248	4831
22R-22	South Beaver Dixie	Two-Way Chain Unknown	Coyote Bench Seeding	July 1964-November 1965	2905	LTDL
		Aerial Unknown	Coyote Bench Seeding	July 1964-November 1965	2905	LTDL
		Broadcast Before	South Beaver Vegetation Enhancement Project Year 1	December 2005-March 2006	1646	104
		One-Way Dixie Harrow	South Beaver Vegetation Enhancement Project Year 1	December 2005-March 2006	1646	104
		Lop and Scatter	Project Maintenance - South Beaver Phase II (Proposed)	2019	6248	4831
22R-23	South Beaver Year 7	Aerial Before	South Beaver Vegetation Enhancement Year 7	September 2014	1366	2227
		Bullhog	South Beaver Vegetation Enhancement Year 7	August-November 2014	1366	2227
		Hand Crew	Project Maintenance - South Beaver Phase II (Proposed)	2019	6248	4831
22R-24	City Creek	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Bullhog	City Creek Sagebrush-steppe Enhancement Year 1	September 2011-June 2012	1080	1995
22R-25	Fremont Pass	Lop and Scatter	Little Bear Valley to Fremont Canyon Sagebrush Steppe Habitat Restoration (Proposed)	Fall 2018	2284	4402

Table 1.9: Range trend and WRI studies known disturbance history for WMU 22, Beaver. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are three studies [Deer Flat (22-01), Oak Basin (22-03), and Wades Canyon (22-04)] classified as Mountain (Big Sagebrush) ecological sites. The Deer Flat study site is located southwest of Marysvale up Bullion Canyon. The Oak Basin study site is located in the foothills northwest of Circleville. The Wades Canyon study site is situated in the foothills west of Circleville.

Shrubs/Trees: Preferred browse cover on these sites has increased slightly across sampling years (**Figure 1.2**). The dominant browse species are black sagebrush (*Artemisia nova*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*); the other preferred shrub that is present on these sites is Gambel oak (*Quercus gambelii*). Preferred browse density and age demographics have generally increased, with recent samplings showing less decadence and more recruitment of young (**Figure 1.5**). Browse utilization has remained stable with the exception of the 2003 sample year which showed high usage (**Figure 1.6**).

Tree cover on these sites decreased significantly between 2013 and 2018 with the lop and scatter treatment on Deer Flat likely being a significant factor for this decrease. Tree density has remained stable throughout sample years and did not change drastically with the treatment. (**Figure 1.3**, **Figure 1.4**).

Herbaceous Understory: The herbaceous understory for these sites has increased slightly through the years, with Oak Basin and Deer Flat being dominated by introduced perennial grasses. Annual grasses are rare, with low cover and frequency noted across the sample years. Nested frequency for perennial grasses and forbs has remained stable (**Figure 1.7**, **Figure 1.8**).

Occupancy: Pellet transect data shows that deer are the primary occupants and that pellet group abundance has varied from a low of 15 days use/acre in 2018 to a high of 117 days use/acre in 2003. Cattle have been present on these sites and average pellet group abundance has varied from 9 days use/acre in 2018 to a high of 29 days use/acre in 1998. Abundance of elk pellet groups has varied from 5 days use/acre in 1998 to 15 days use/acre in 2003 (**Figure 1.9**).

Upland (Big Sagebrush)

There are nine studies [Bone Hollow (22-05), Beaver Table (22-06), Sheep Rock (22-07), Rocks Reseeding (22-09), Doubleup Hollow (22-10), B Hill (22-11), Big Cedar Cove (22-12), Antelope Mountain (22-14), and Brady Creek (22-16)] that are classified as Upland (Big Sagebrush) ecological sites. Bone Hollow and Beaver Table are located northeast of Beaver along the foothills. Sheep Rock is situated east of I-15 at the foothills near Last Chance Bench. Rocks Reseeding can be found on Coyote Bench between the city of Beaver and Buckskin Valley. Doubleup Hollow is situated south of Greenville Bench near Little Valley. B Hill is located south of Beaver near Kane Canyon. Big Cedar Cove can be found in the Mineral Mountains northeast of Milford. Antelope Mountain is located at the northern end of the Mineral Mountains directly west of the junction of I-70 and I-15. Brady Creek is located at the north end of Dog Valley between US-89 and I-15.

Shrubs/Trees: Preferred browse cover on these sites has shown some fluctuations, with a decrease in 2008 attributed to fires on both Doubleup Hollow and Big Cedar Cove; besides this decrease, cover has remained stable. The primary species of preferred browse is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). However, lesser amounts of antelope bitterbrush (*Purshia tridentata*) are found on some sites (**Error! Reference source not found.**). Utilization has increased slightly through the years except in 2018, w hen a significant decrease was noted (**Figure 1.6**).

Tree cover on these sites is provided by both twoneedle pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Average cover has shown fluctuations, but a significant decrease in 2018 was driven by a treatment on the Bone Hollow study site (**Figure 1.3**). Density of trees has also decreased: Bone Hollow, Beaver Table and Sheep Rock were the primary drivers of this trend (**Figure 1.4**).

Herbaceous Understory: The understories of these studies are primarily comprised of perennial species, with a general increase in cover between 2008 and 2018. Annual grass cover has fluctuated between sample years, with a low of 0.5 percent in 2008 and a high of 6 percent in 1998 (**Figure 1.7**). The perennial grass cover for Sheep Rock, Rocks Reseeding, Doubleup Hollow, and B Hill is primarily contributed by introduced species; namely intermediate wheatgrass (*Thinopyrum, intermedium*) and smooth brome (*Bromus inermis*).

Occupancy: Pellet transect data shows that deer are the main occupants on these sites and that pellet group abundance has fluctuated from 15 days use/acre in 2013 to 45 days use/acre in 2008. Elk utilization has fluctuated from 0 days use/acre in 1998 to 3 days use/acre in 2008. Finally, pellet group abundance of cattle has varied from 6 days use/acre in 2008 to 17 days use/acre in 2003 (**Figure 1.9**).

Semidesert (Big Sagebrush)

There are three studies [Piute Reservoir (22-02), Minersville Reservoir (22-13), and South Creek (22-15)] that are classified as Semidesert (Big Sagebrush) ecological sites. Piute Reservoir is located on the west side of US-89 near the north end of Piute Reservoir. Minersville Reservoir is situated north of UT-21 in the Mineral Mountains near the west edge of Minersville Reservoir. The South Creek study site is located in the foothills west of I-15 near Beaver.

Shrubs/Trees: The primary browse species on these sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with lesser amounts of cover contributed by other species. The Minersville Reservoir site burned in 1998 and does not host significant populations of browse species. Overall, preferred browse cover has remained stable or increased slightly (**Figure 1.2**). Utilization of preferred browse has fluctuated over time, with the 1998 and 2018 sample years showing low utilization (**Figure 1.5**).

Trees sampled on these sites include both Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*). 2018 was the first year point-quarter data was taken on any site, but small amounts of trees have been noted in shrub density strips or quadrat cover on all sites (**Figure 1.3**, **Figure 1.4**). Overall tree presence is low across the three sites.

Herbaceous Understory: The herbaceous understories on these sites is primarily composed of both perennial and annual grasses with cover remaining steady. Annual grass cover and frequency has fluctuated over the study years. Native grass species contribute significant cover to most of the sites. Cheatgrass (*Bromus tectorum*) is present on all study sites, with cover fluctuating from year to year (**Figure 1.7**, **Figure 1.8**).

Occupancy: Pellet transect data shows that deer are the primary occupants on these study sites and that usage has varied from 20 days use/acre in 2018 to 57 days use/acre in 1998. Abundance of cattle pellet groups has fluctuated from 7 days use/acre in 2008 to a high of 17 days use/acre in 2018 (**Figure 1.9**).

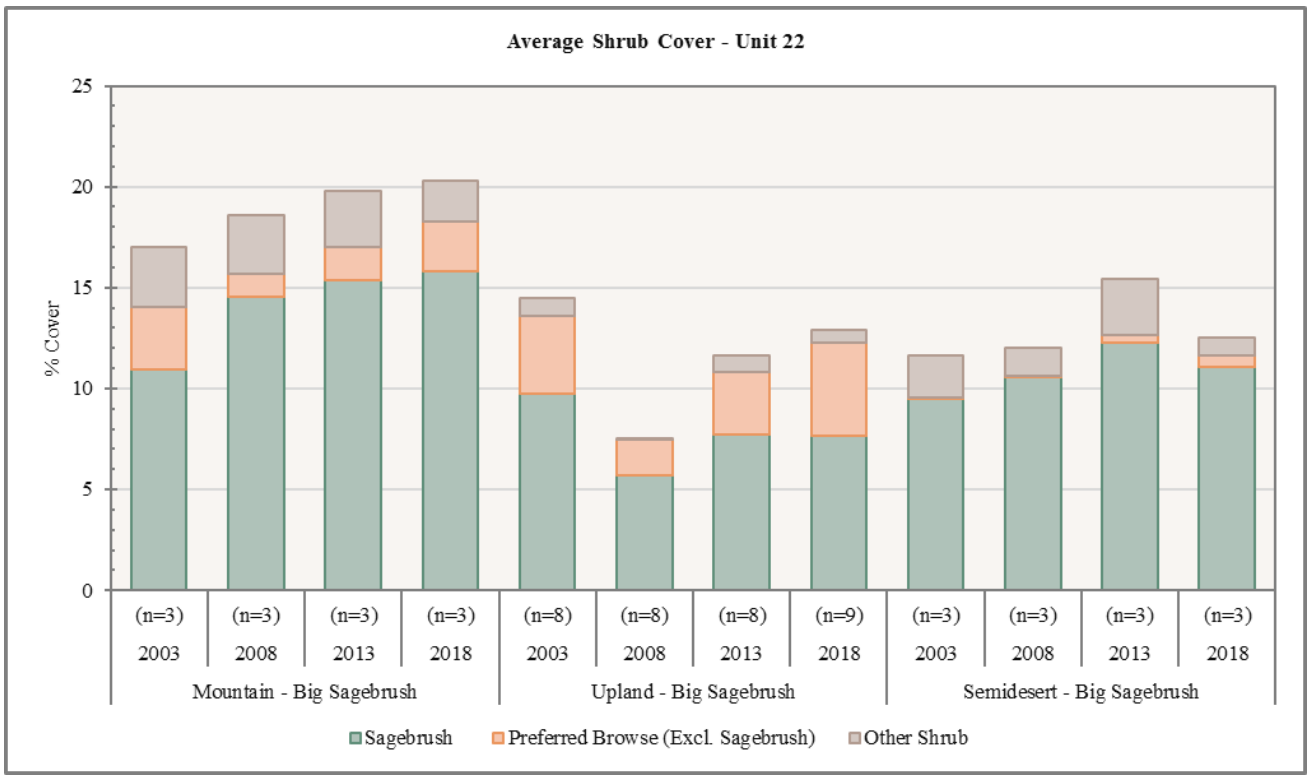


Figure 1.2: Average shrub cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

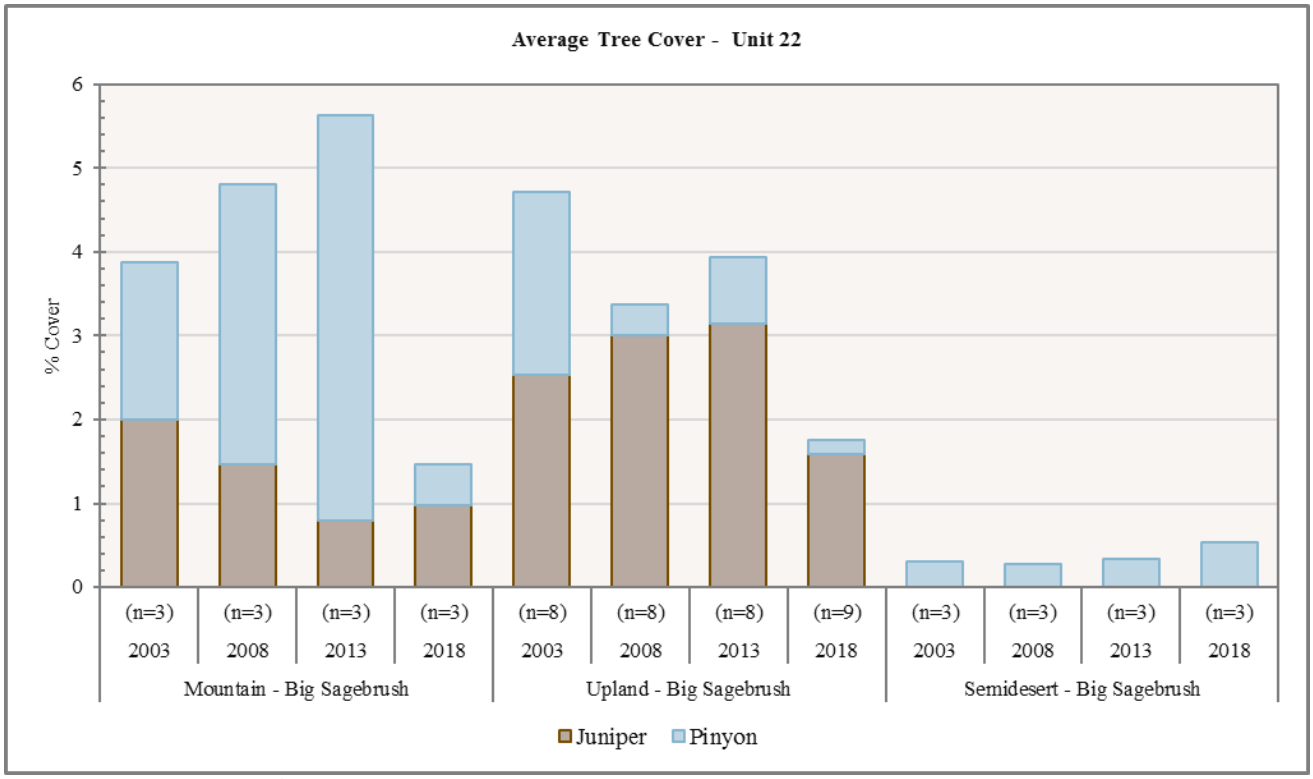


Figure 1.3: Average tree cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

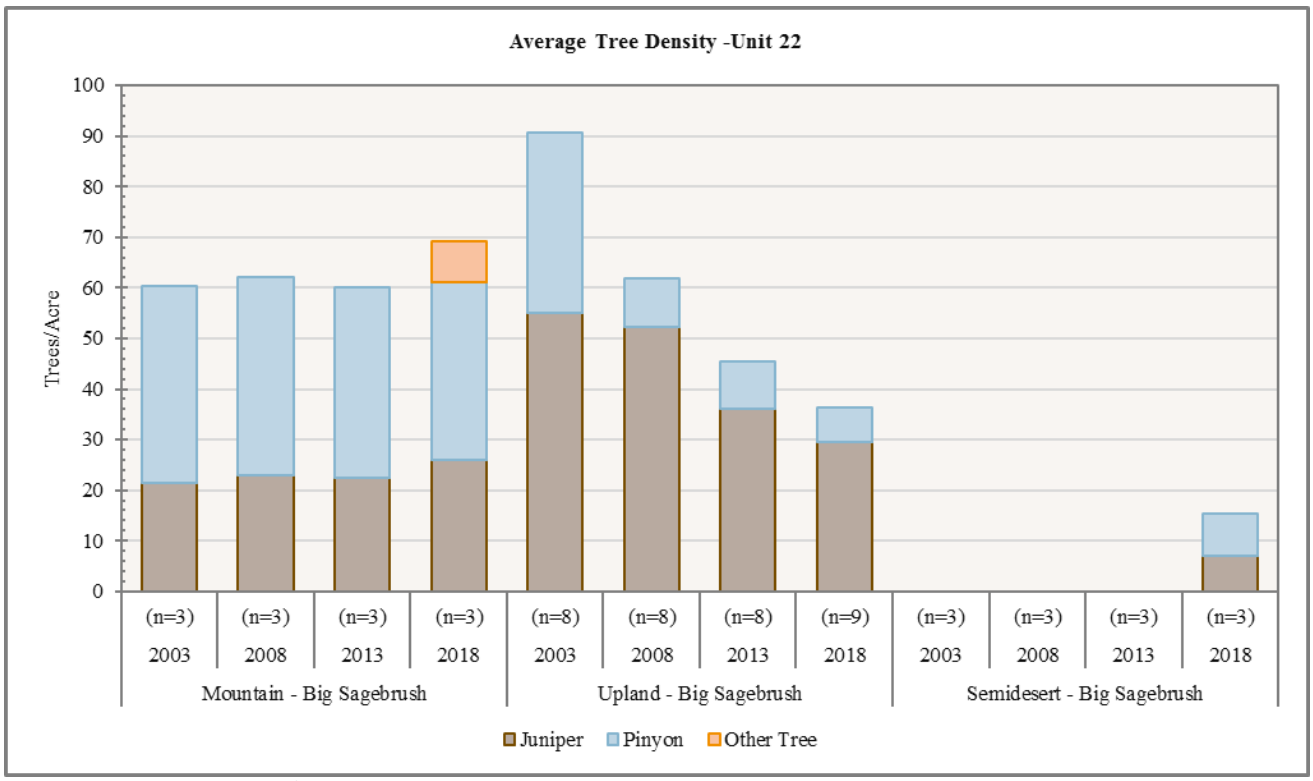


Figure 1.4: Average tree density for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

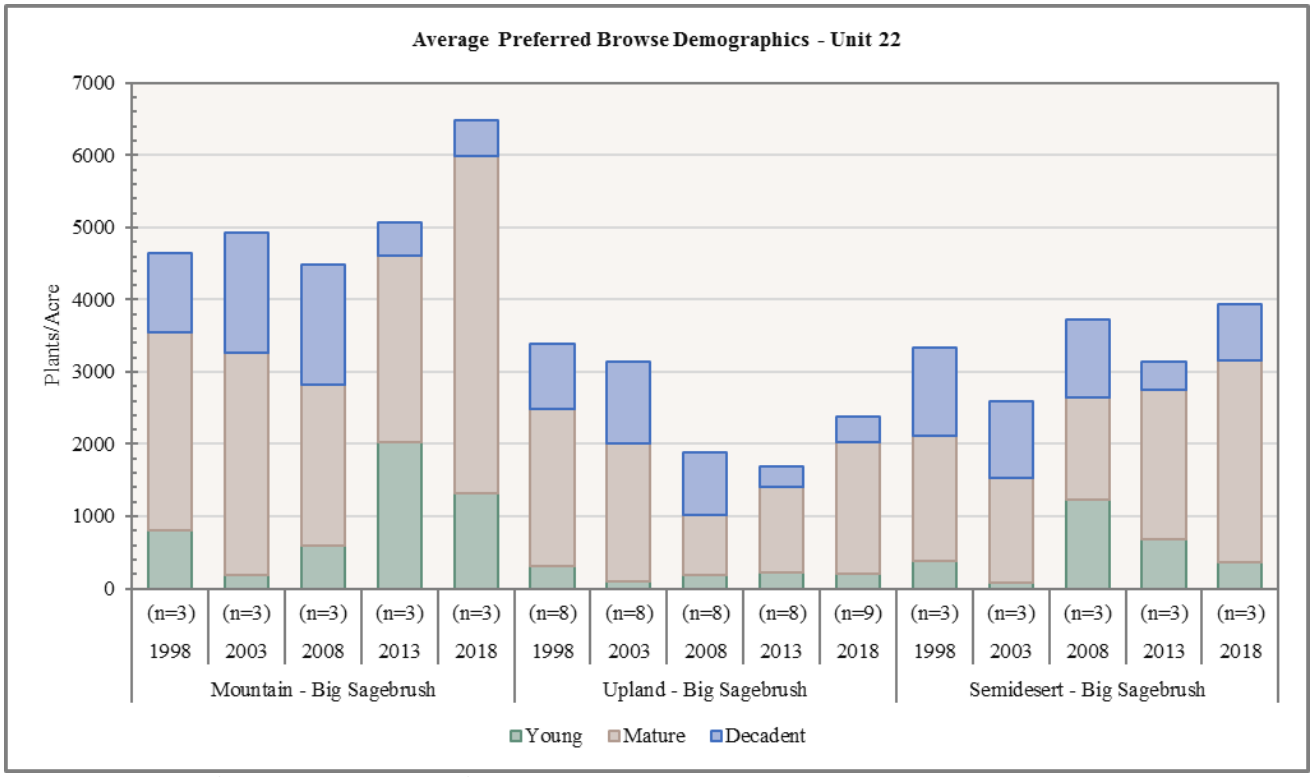


Figure 1.5: Average preferred browse demographics for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

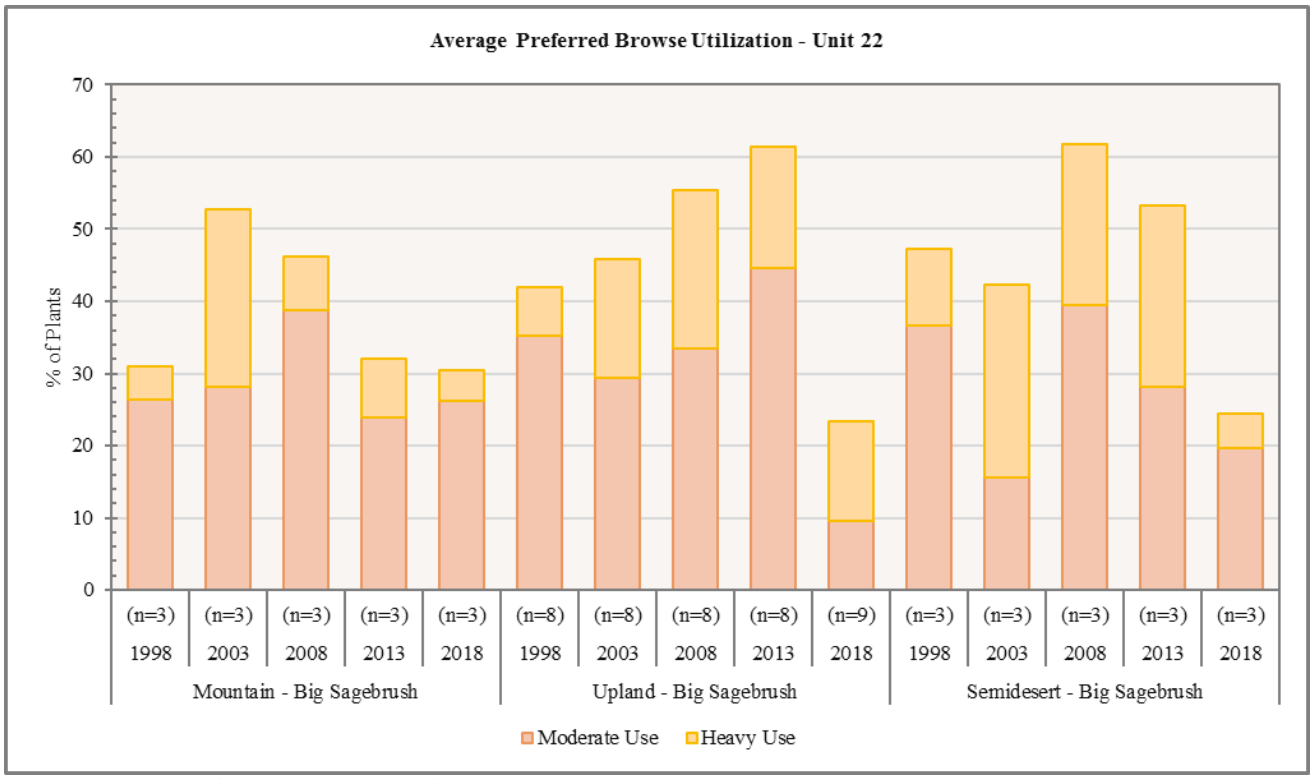


Figure 1.6: Average preferred browse utilization for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

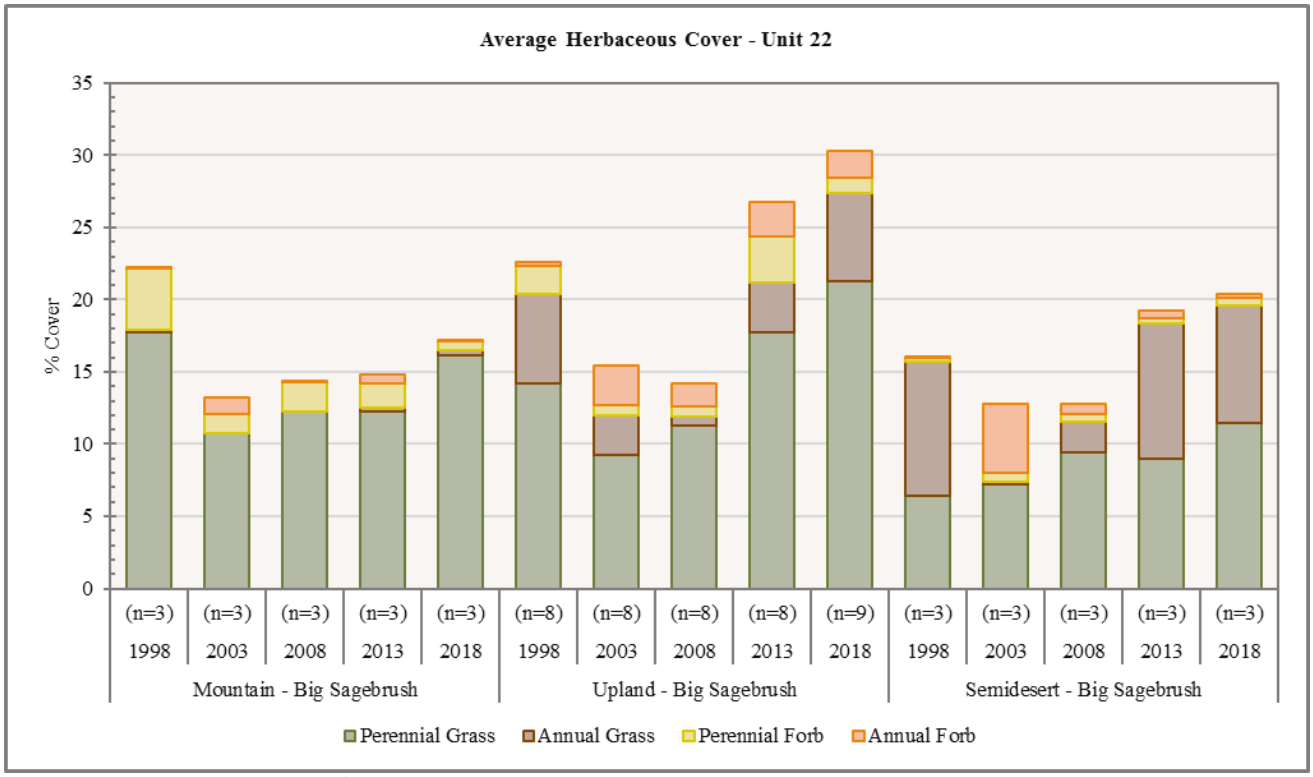


Figure 1.7: Average herbaceous cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

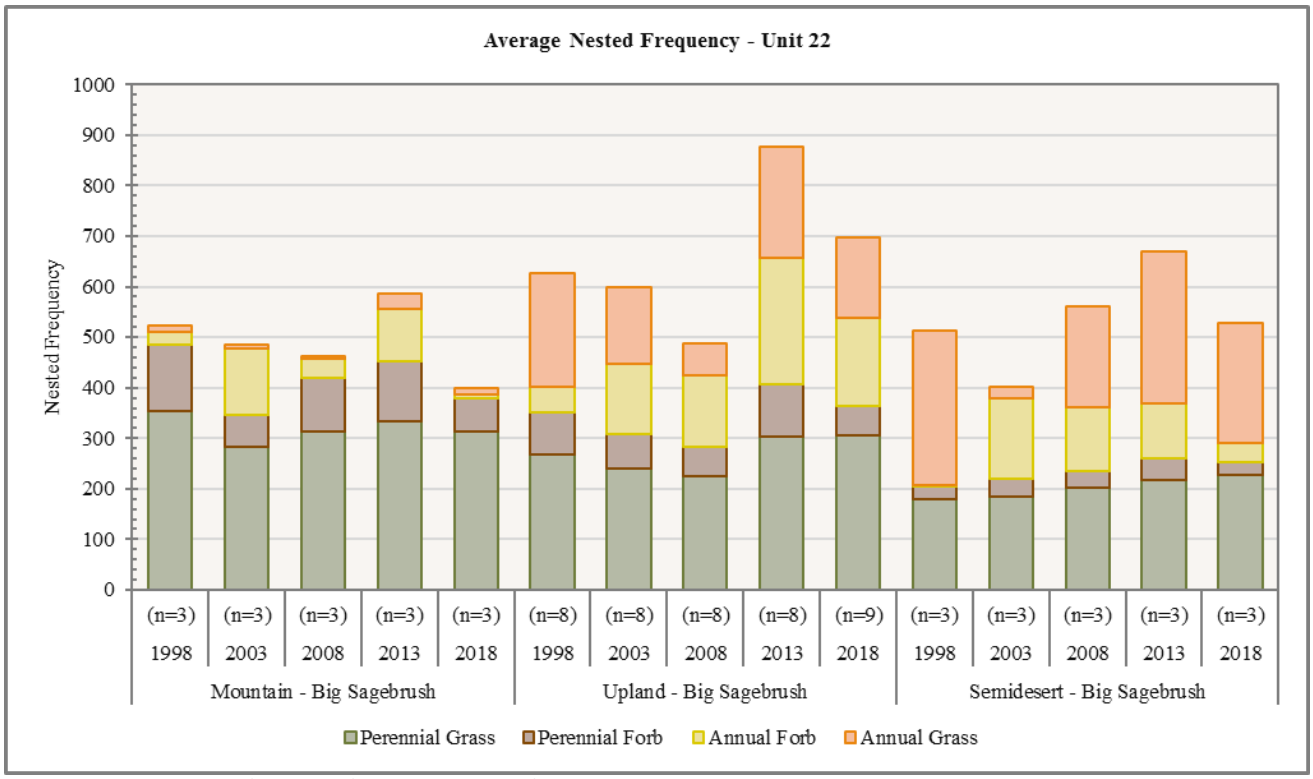


Figure 1.8: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver.

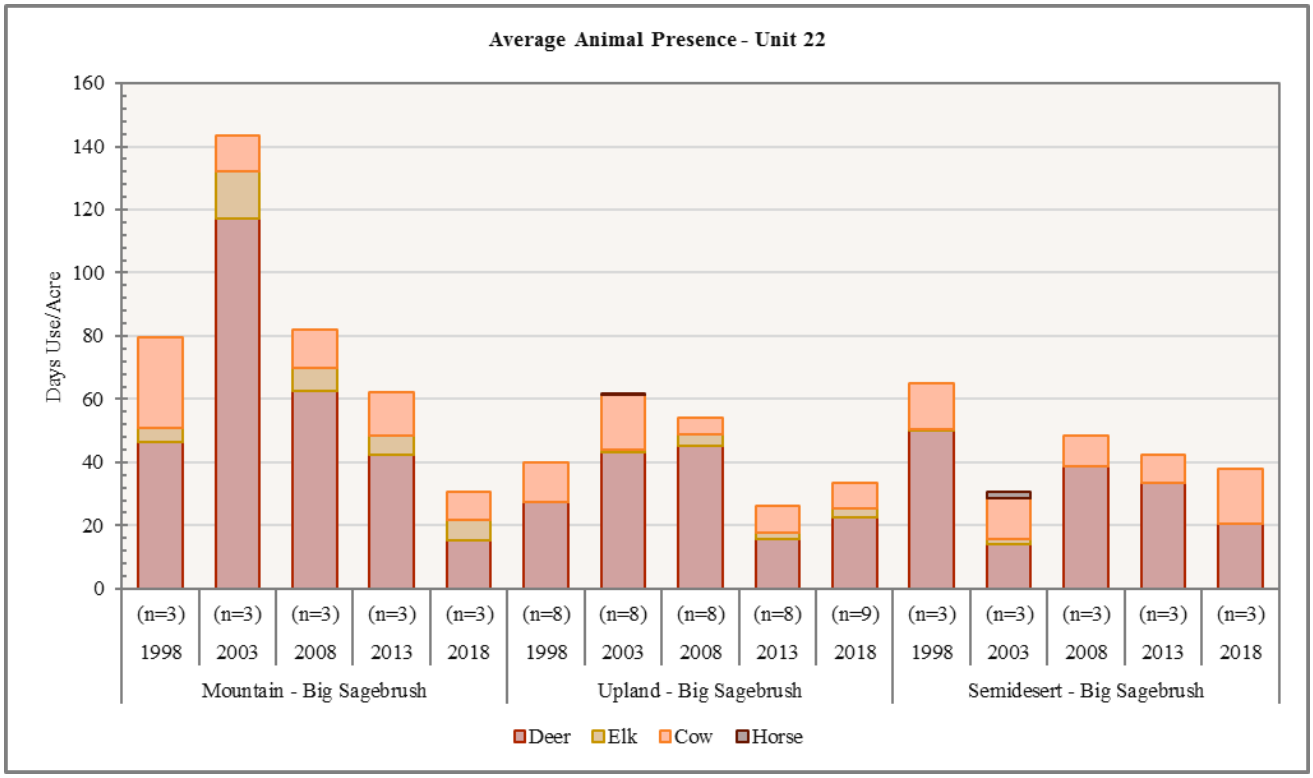
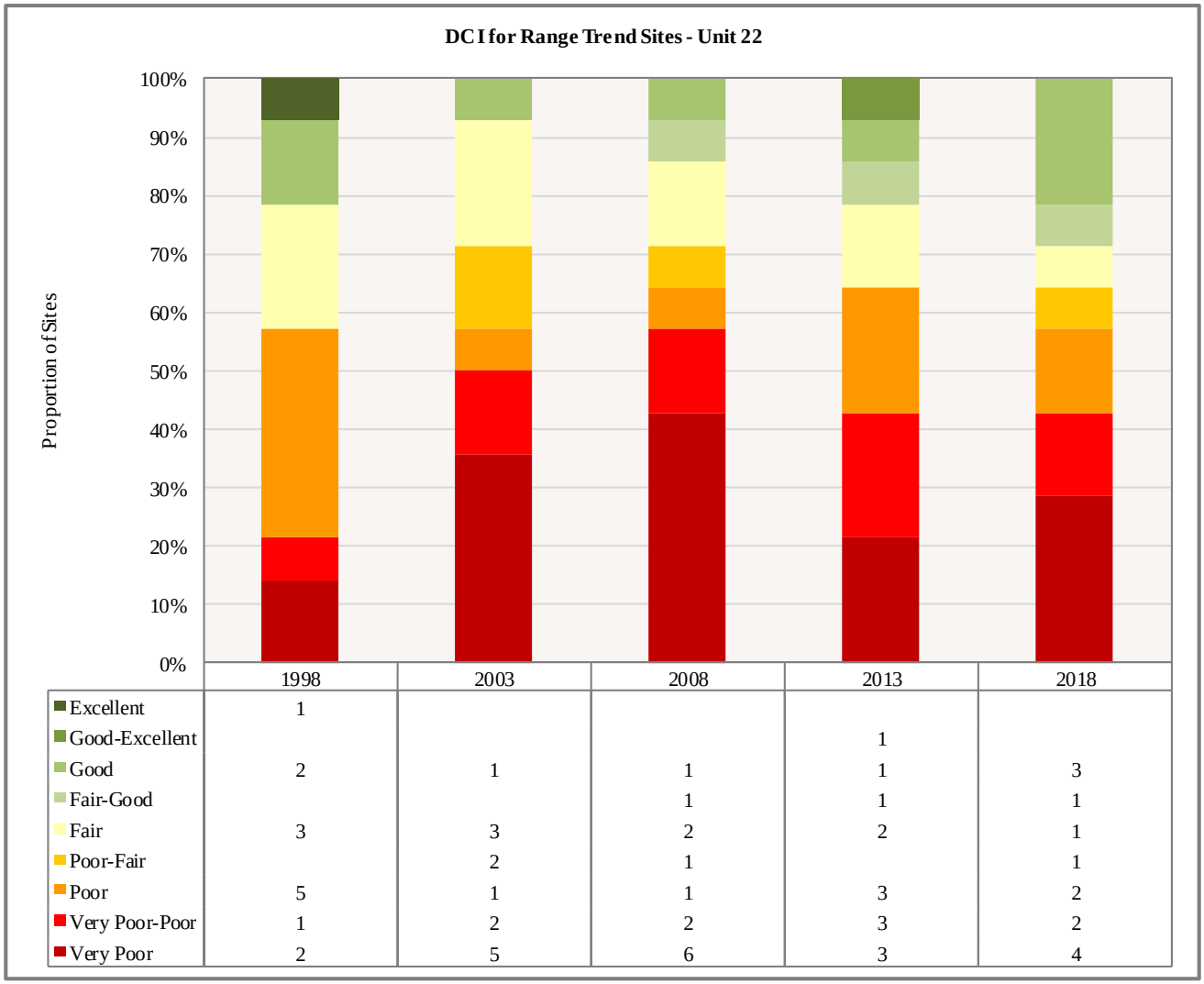


Figure 1.9: Average pellet transect data for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 22, Beaver. Upland - Big Sagebrush deer pellets include deer/sheep.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Beaver management unit has continually changed on the sites sampled since 1998; the active Range Tend sites within the unit are considered to be in very-poor to good condition as of the 2018 sample year (**Figure 1.10**, **Figure 1.10**). The sites considered to be in good condition are Deer Flat, Rocks Reseeding, and South Creek: high amounts of preferred browse and significant perennial grass cover contribute to the high rankings of these sites. The Marysvale WMA and Piute Reservoir site is considered to be in fair-good and fair condition, and the Beaver Table study is classified as being in poor-fair condition. The Wades Canyon and Minersville Reservoir studies were classified as being in poor condition. The Sheep Rock, B Hill, and Above Fremont Wash study sites are considered to be in very poor to poor condition. Finally, the sites considered to be in very poor condition are Bone Hollow, Big Cedar Cove, and Antelope Mountain. The lack of preferred browse and high annual grass cover are primary reasons that these sites were categorized as being in very poor condition.



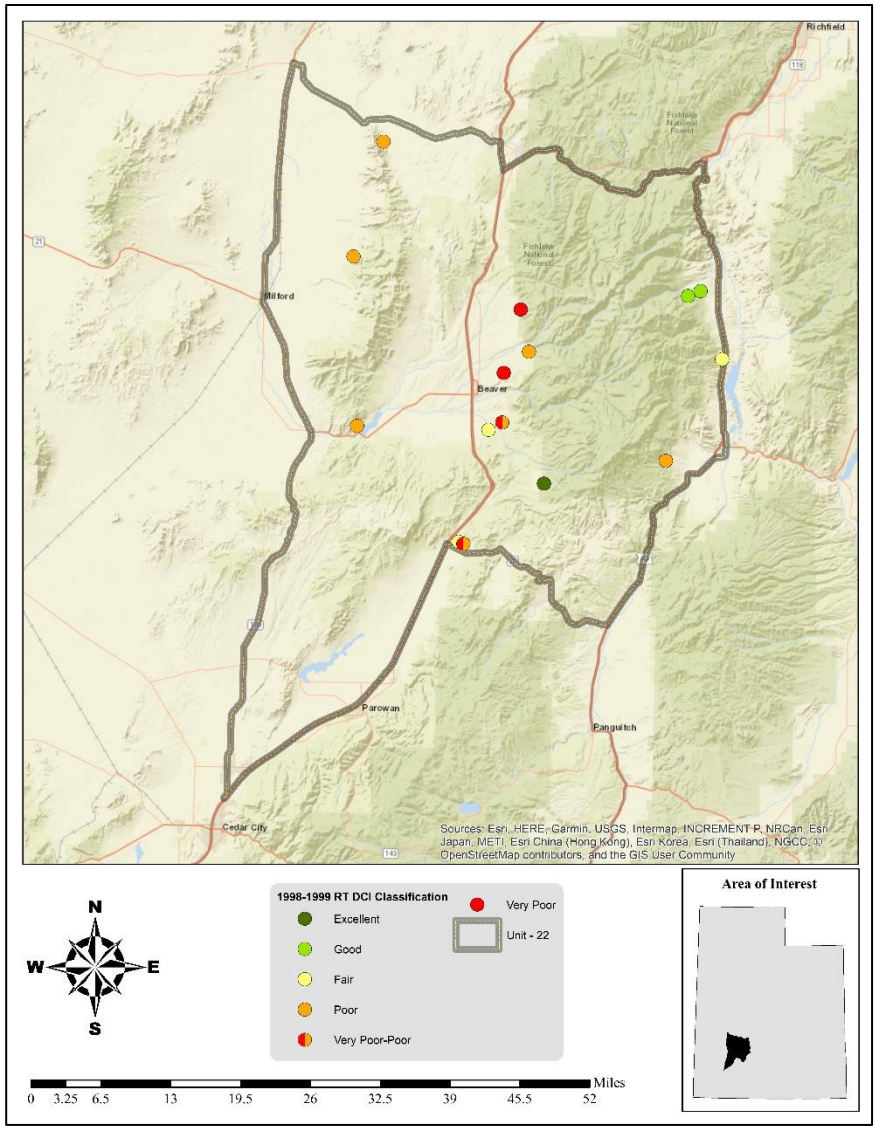
	1998	2003	2008	2013	2018
Excellent	1				
Good-Excellent				1	
Good	2	1	1	1	3
Fair-Good			1	1	1
Fair	3	3	2	2	1
Poor-Fair		2	1		1
Poor	5	1	1	3	2
Very Poor-Poor	1	2	2	3	2
Very Poor	2	5	6	3	4

Figure 1.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 22, Beaver.

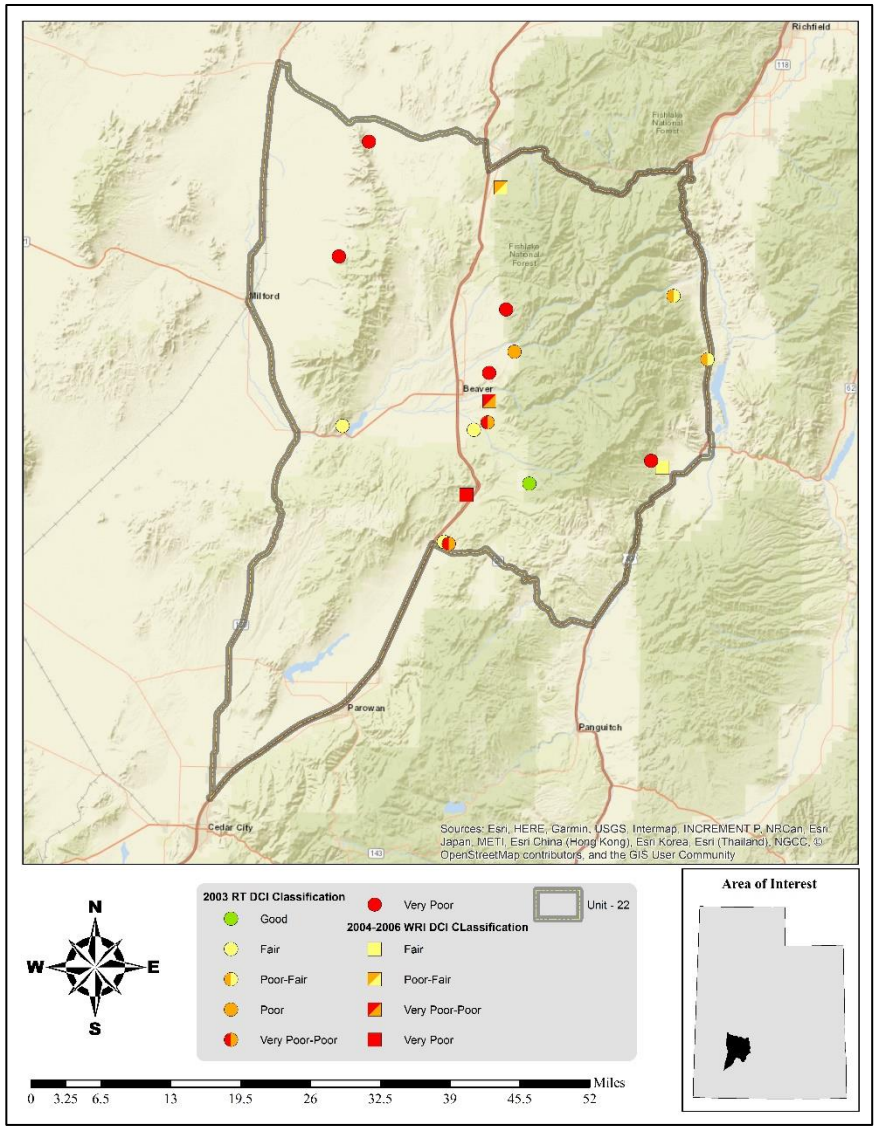
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22-01	1998	30	10.1	7	28	-0.4	3.7	0	**78.4**	**G**
22-01	2003	30	5	2.6	13.9	0	1.9	0	**53.4**	**P-F**
22-01	2008	29.2	2.3	5.5	24.2	0	5.5	0	**66.7**	**F**
22-01	2013	29	11.1	8.1	20.3	-0.4	1.5	0	**69.6**	**F-G**
22-01	2018	27.8	10.9	11.3	30	-0.8	1.1	0	**80.3**	**G**
22-02	1998	22.9	6.4	7	3.3	0	0.6	0	**40.2**	**F**
22-02	2003	22	3	0.7	0.9	0	0.1	0	**26.7**	**P-F**
22-02	2008	21.5	1.6	1.7	1	0	0.3	0	**26.1**	**P-F**
22-02	2013	24.9	10.3	2.8	3.2	0	0.2	0	**41.4**	**F**
22-02	2018	24.1	6.4	0.5	0.9	0	0.7	0	**32.7**	**F**
22-04	1998	14.1	-3.3	4.1	25.8	0	7.7	0	**48.4**	**P**
22-04	2003	7.8	0.8	2.4	10.7	0	1.1	0	**22.7**	**VP**
22-04	2008	11	-2.6	2.1	14.9	0	0.6	0	**25.9**	**VP**
22-04	2013	13.4	9.4	2.4	19.3	-0.1	2.1	0	**46.3**	**P**
22-04	2018	13.4	8.4	3.5	19.6	0	0.9	0	**45.7**	**P**
22-05	1998	21.6	4.6	2.2	9	-15.1	1.6	0	**23.9**	**VP**
22-05	2003	14.9	1.1	0	10	-2.1	0.6	0	**24.5**	**VP**
22-05	2008	12.4	-2.6	1.6	12.4	0	0.8	0	**24.5**	**VP**
22-05	2013	13.5	8.1	4.6	15.7	-3	1.7	0	**40.6**	**P**
22-05	2018	4.5	0	0	28.9	-6.2	3.6	0	**30.8**	**VP**
22-06	1998	21.9	3.4	4.3	14.8	-8.4	2.2	0	**38.2**	**P**
22-06	2003	27.8	5.9	0.1	6	-0.5	1.6	0	**41**	**P**
22-06	2008	30	0.9	1.4	6.7	-0.1	0.5	0	**39.4**	**P**
22-06	2013	30	9.5	3.5	8.3	-0.2	3.3	0	**54.5**	**F**
22-06	2018	30	8.5	2.8	8.3	-0.1	1.3	0	**50.8**	**P-F**
22-07	1998	2.6	0	0	30	-8.6	5.2	0	**29.2**	**VP**
22-07	2003	2.6	0	0	26.1	-1	4.1	0	**31.8**	**VP**
22-07	2008	2.4	0	0	30	-0.7	5.2	0	**36.9**	**VP-P**
22-07	2013	3.1	0	0	30	-1.5	2.6	0	**34.2**	**VP-P**
22-07	2018	4.2	0	0	30	-0.7	0.9	0	**34.4**	**VP-P**
22-08*	1998	18.3	3.9	5.7	9.1	-10	2.3	0	**29.3**	**F**
22-08*	2003	17.4	3.3	0.7	9.4	-3.4	1.6	0	**28.9**	**F**
22-08*	2008	1.3	0	0	1.7	-11.9	4.1	0	**-4.9**	**VP**
22-08*	2013	1.8	0	0	4.4	-18.5	4.9	0	**-7.4**	**VP**
22-09	1998	30	12.3	8.7	30	0	1.7	0	**82.7**	**E**
22-09	2003	30	4.2	4.5	30	0	0.6	0	**69.3**	**G**
22-09	2008	28.1	0.2	4.5	30	0	0.5	0	**63.3**	**F-G**
22-09	2013	30	11.4	7.4	30	0	1.3	0	**80.1**	**G-E**
22-09	2018	30	7.5	1.2	30	0	0.4	0	**69**	**G**
22-11	1998	3.8	0	0	30	-0.3	1.7	0	**35.2**	**VP-P**
22-11	2003	2.9	0	0	30	0	0.9	0	**33.8**	**VP-P**
22-11	2008	3	0	0	30	0	1.2	0	**34.2**	**VP-P**
22-11	2013	4	0	0	30	0	1.7	0	**35.7**	**VP-P**
22-11	2018	3.5	0	0	30	0	2.6	0	**36.1**	**VP-P**
22-12	1998	21.4	4.2	1.6	14.4	-3.4	1.7	0	**39.8**	**P**
22-12	2003	22.6	0.3	0.4	11	-3.4	1	0	**31.9**	**VP**
22-12	2008	0.2	0	0	7.8	-2.4	1	0	**6.5**	**VP**
22-12	2011	1.5	0	0	0	0	0	0	**1.5**	**VP**
22-12	2013	3	0	0	30	-6	1.8	0	**28.9**	**VP**
22-12	2018	3.4	0	0	19.9	-14.2	0.1	0	**9.1**	**VP**
22-13	1998	11	-0.3	2.5	14.2	-11.3	0	0	**16.1**	**P**
22-13	2003	0.3	0	0	27.4	-0.4	2.7	0	**30**	**F**
22-13	2008	0.1	0	0	30	-2	0.5	0	**28.6**	**F**
22-13	2013	1.4	0	0	30	-9.6	0.5	0	**22.3**	**P**
22-13	2018	2.4	0	0	30	-10.2	0.2	0	**22.4**	**P**
22-14	1998	0	0	0	30	-0.3	10	0	**39.7**	**P**
22-14	2003	0.4	0	0	23.9	-8.9	1.5	0	**16.8**	**VP**
22-14	2008	0.1	0	0	30	-0.7	1.4	0	**30.9**	**VP**
22-14	2013	0	0	0	30	-5.9	10	0	**34.1**	**VP-P**
22-14	2018	0.4	0	0	30	-18	0.8	0	**13.1**	**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
22-15	1998	11.1	5.2	6.9	21	-9.6	0.7	0	**35.4**	**F**
22-15	2003	13.5	2.2	3	15.1	0	0.9	0	**34.6**	**F**
22-15	2008	18.1	9.2	15	10.3	-2.7	2.2	0	**52.1**	**G**
22-15	2013	21.3	11.7	14.7	16	-11.4	1.3	0	**53.5**	**G**
22-15	2018	17.4	7	6.8	25.9	-8.1	2.3	0	**51.2**	**G**
22R-3	1998	8.1	12.3	15	26.3	-1.6	0.4	0	**60.4**	**G**
22R-3	2018	11.6	4.1	0.7	30	-2.3	1.1	0	**45.2**	**F-G**
22R-4	1999	4.7	0	0	16.8	-9.8	0.2	0	**11.9**	**VP-P**
22R-4	2003	10.3	6	0.7	9.8	-17.3	0.4	0	**9.9**	**VP-P**
22R-4	2008	5.9	0	0	8.9	-8.7	0.9	0	**6.9**	**VP**
22R-4	2013	4.9	0	0	13.9	-15.6	0.6	0	**3.7**	**VP**
22R-4	2018	3.8	0	0	12.1	-20	0	0	**-4.1**	**VP**

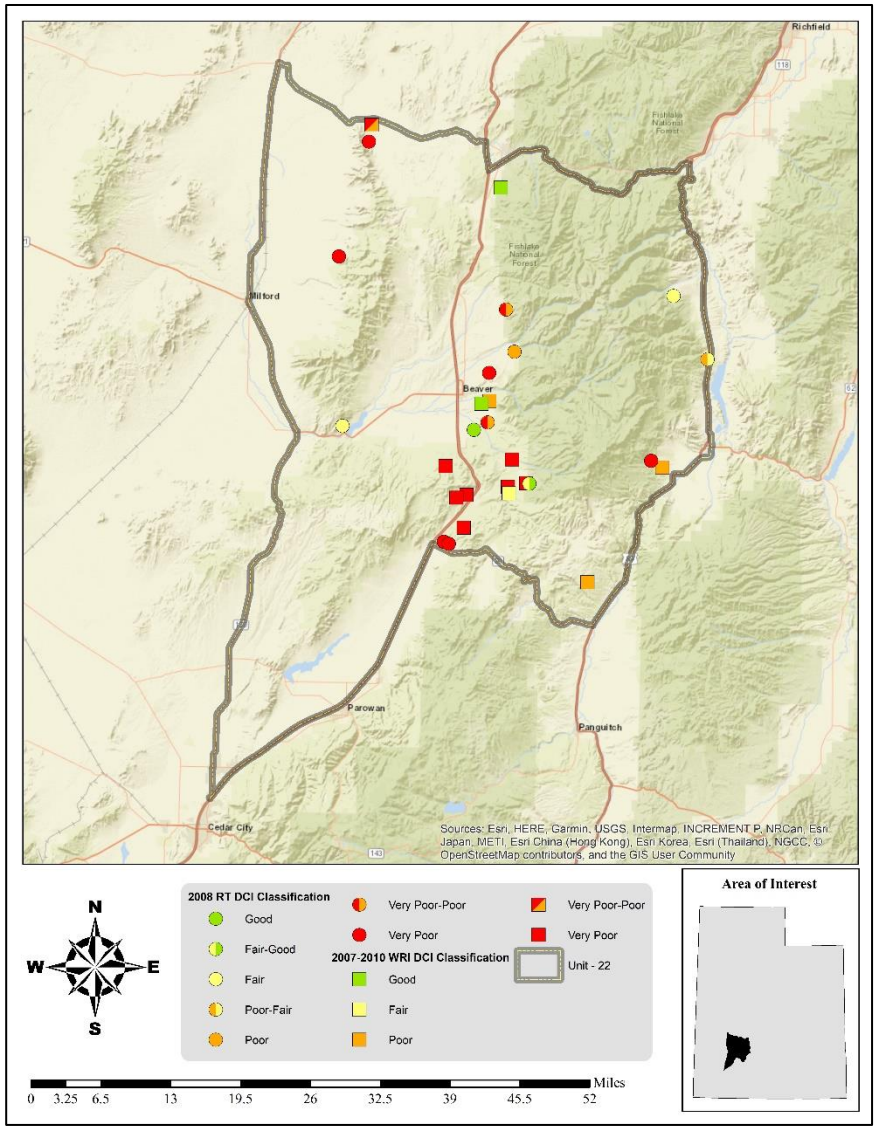
Table 1.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 22, Beaver.
VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



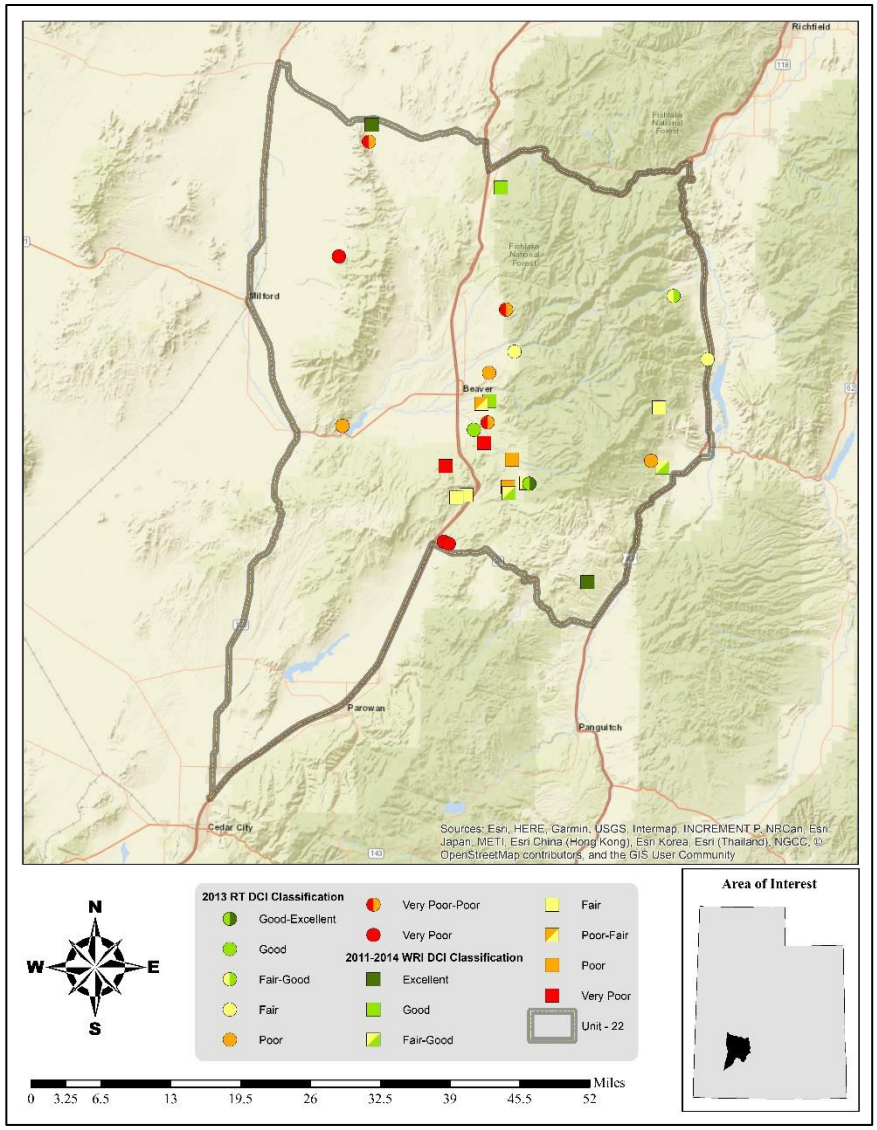
Map 1.9: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 22, Beaver.



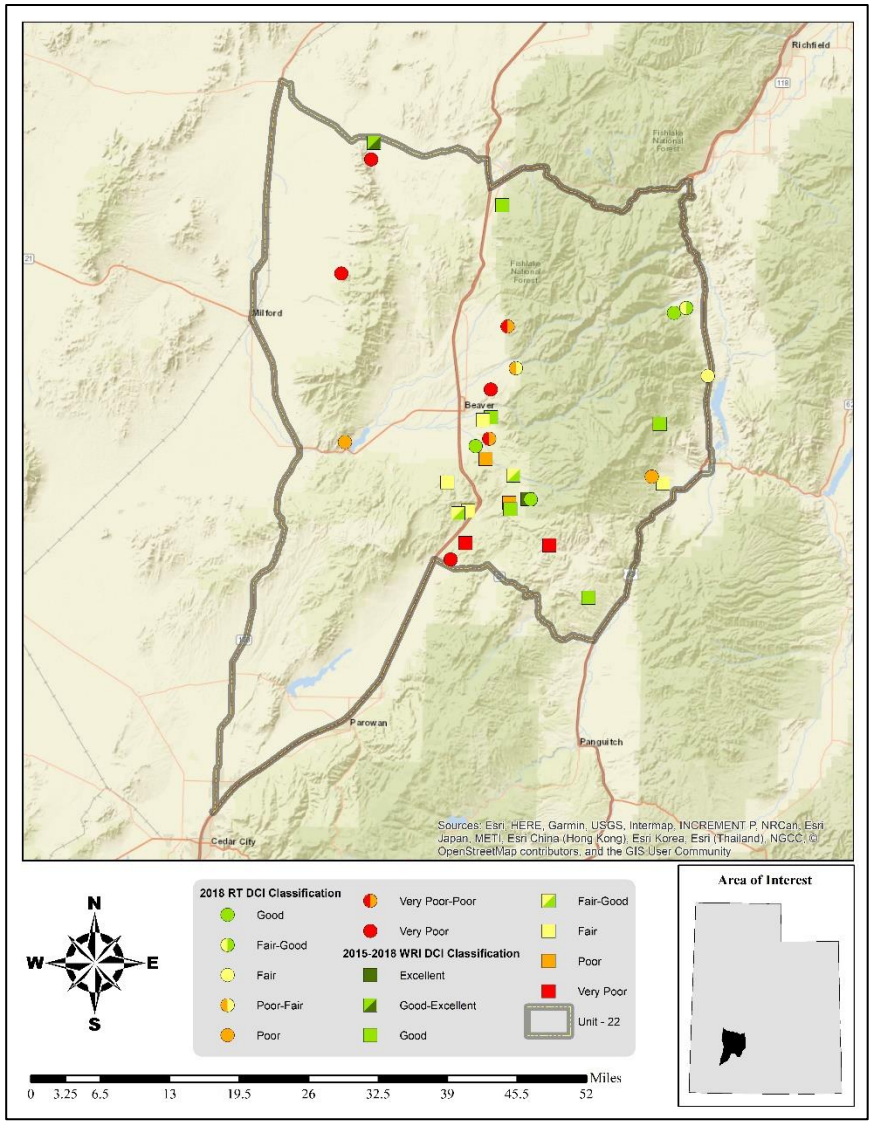
Map 1.10: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 22, Beaver.



Map 1.11: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 22, Beaver.



Map 1.12: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 22, Beaver.



Map 1.13: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 22, Beaver.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
22-01	Deer Flat	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-02	Piute Reservoir	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-03	Oak Basin	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-04	Wades Canyon	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
22-05	Bone Hollow	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-06	Beaver Table	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
22-07	Sheep Rock	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-09	Rocks Reseeding	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
22-10	Doubleup Hollow	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-11	B Hill	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-12	Big Cedar Cove	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
22-13	Minersville Reservoir	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Energy Development	Low	Fragmentation and degradation/loss of habitat
22-14	Antelope Mountain	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
22-15	South Creek	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22-16	Brady Creek	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-03	Marysvale	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-04	Above Fremont Wash	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-05	Black Mountain	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-06	Greenville Bullhog	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-07	Sulphurdale	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-08	P-Hill Dixie	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-10	South Beaver Bullhog	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-11	South Beaver SITLA Chaining	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-12	South Beaver Bullhog 2	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-13	Greenville Bench Bullhog 2	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
22R-14	South Beaver Rocky Wash	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-15	South Beaver Bullhog Year 4	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-16	Spry Sagebrush Restoration	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-17	Beaver Easement Harrow	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
22R-18	A&F Drill 1	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
22R-19	A&F Drill 2	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
22R-20	South Beaver Year 5	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-22	South Beaver Dixie	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-23	South Beaver Year 7	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
22R-24	City Creek	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
22R-25	Fremont Pass	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity

Table 1.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 22, Beaver. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Big Sagebrush)

The study sites within the Mountain (Big Sagebrush) ecological type vary in condition from poor to good for deer winter range in the Beaver management unit. The Oak Basin study is considered to be summer habitat, but it is on the edge of what is considered as winter range: it is likely used as transitional habitat or winter habitat in mild winter. The sagebrush communities support plant populations that provide winter forage for wildlife. Introduced perennial species are present on the Deer Flat and Oak Basin study sites in high amounts. Introduced annual grasses are present on all sites in low amounts. All of the sites are at a low to medium risk for conifer encroachment.

Areas with conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.) where and when feasible. Treatments to reduce undesirable grass species may be advisable on some locations to restore plant community diversity. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies that are considered to be Upland (Big Sagebrush) ecological sites vary in condition from very poor to good for deer winter range habitat on this management unit. The sagebrush communities provide cover and forage for wildlife in winter. Introduced annual grasses are present on all sites in varying amounts: these grasses can increase fuel loads and pose a risk for wildfire. Conifer encroachment is occurring on all sites except Big Cedar Cove and Brady Creek. Some sites have high amounts of introduced perennial grasses which can reduce understory diversity when present in significant amounts.

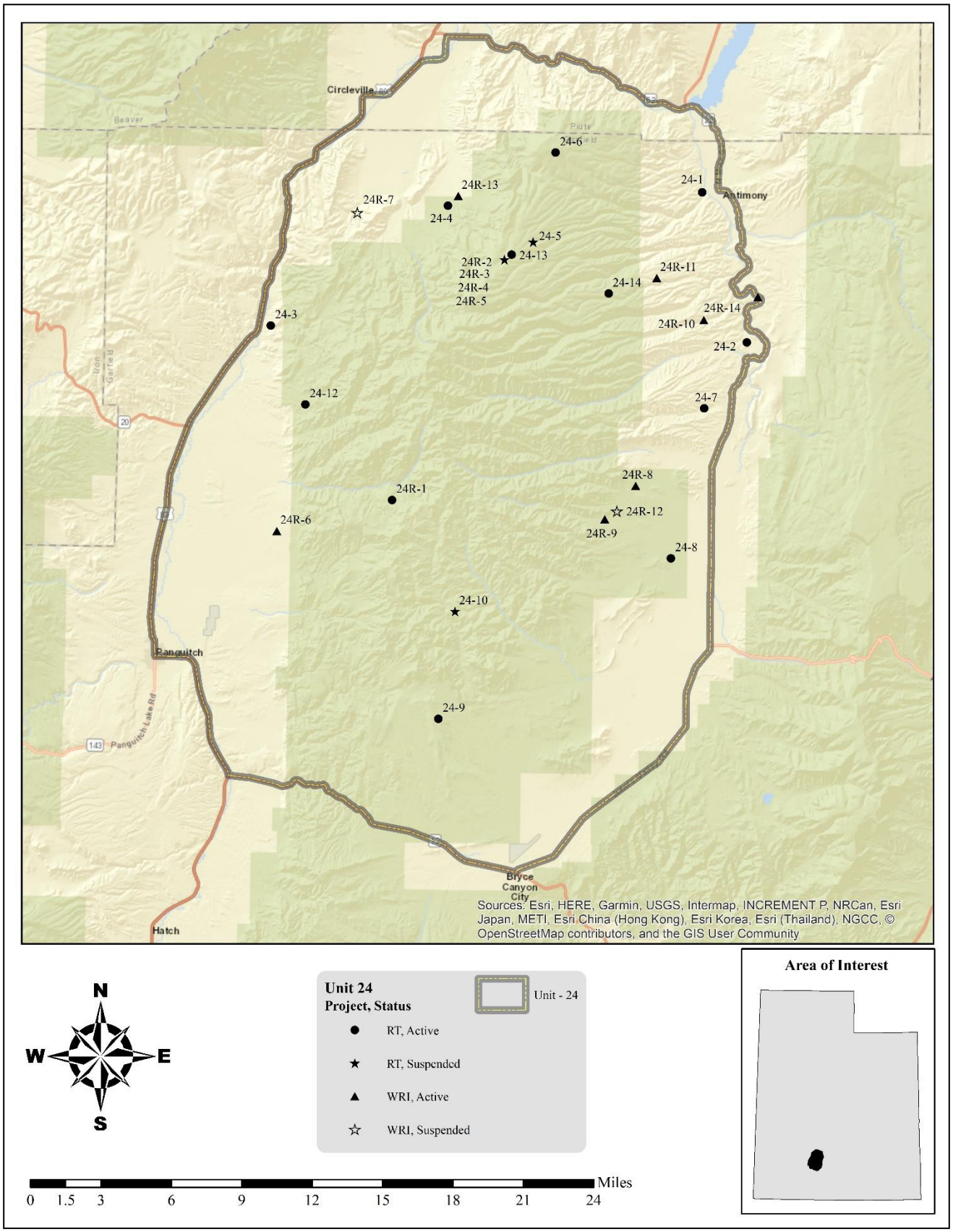
Treatments to reduce undesirable grasses may become necessary on some sites if high levels of these grasses persist. Areas with conifer encroachment should be treated (e.g. bullhog, chaining, lop and scatter, etc.) where and when appropriate. If reseeding is necessary to restore herbaceous communities,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

Semidesert (Big Sagebrush)

Studies that are considered to be Semidesert (Big Sagebrush) ecological sites vary in condition from poor to good for deer winter range habitat on this unit. These sagebrush communities support browse populations that provide good winter forage for wildlife, particularly deer. These communities have significant potential for invasion by annual grasses. Annual grasses, specifically cheatgrass (*Bromus tectorum*), can increase fuel loads and exacerbate the risk for wildfire. Except for the Minersville Reservoir study, the sites are in Phase I of conifer encroachment and are at risk for future encroachment. There is some energy development on some of the sites, but this consists of powerlines and associated disturbances.

Treatments to reduce annual grass might be necessary if high levels of these grasses become an issue in these communities. It is recommended that areas with significant conifer encroachment undergo a tree-removing treatment (e.g. bullhog, chaining, lop and scatter, etc.) where and when feasible. If reseeding is necessary to restore herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

2. WILDLIFE MANAGEMENT UNIT 24 – MT. DUTTON



WILDLIFE MANAGEMENT UNIT 24 – MT. DUTTON

Boundary Description

Iron, Garfield, Piute, Beaver, and Millard counties - Boundary begins at US-89 and SR-62; south on US-89 to SR-12; east on SR-12 to the Widtsoe-Antimony Road; north on the Widtsoe-Antimony Road to SR-22; north on SR-22 to SR-62; west on SR-62 to US-89.

Management Unit Description

Geography

The Mt. Dutton wildlife management unit includes both the east and west slopes of Mt. Dutton and Table Mountain, which is south of SR-62. The unit also contains the Sevier River Valley east of US-89, a portion of Panguitch East Bench, and John's Valley. Mt. Dutton, located near the center of the unit, is the unit's highest point at an elevation of 11,036 feet near the center of the unit. The lowest point in the unit is in the valley near Kingston with an elevation of about 6,000 feet. Towns in this area include Panguitch, Circleville, Kingston, and Antimony.

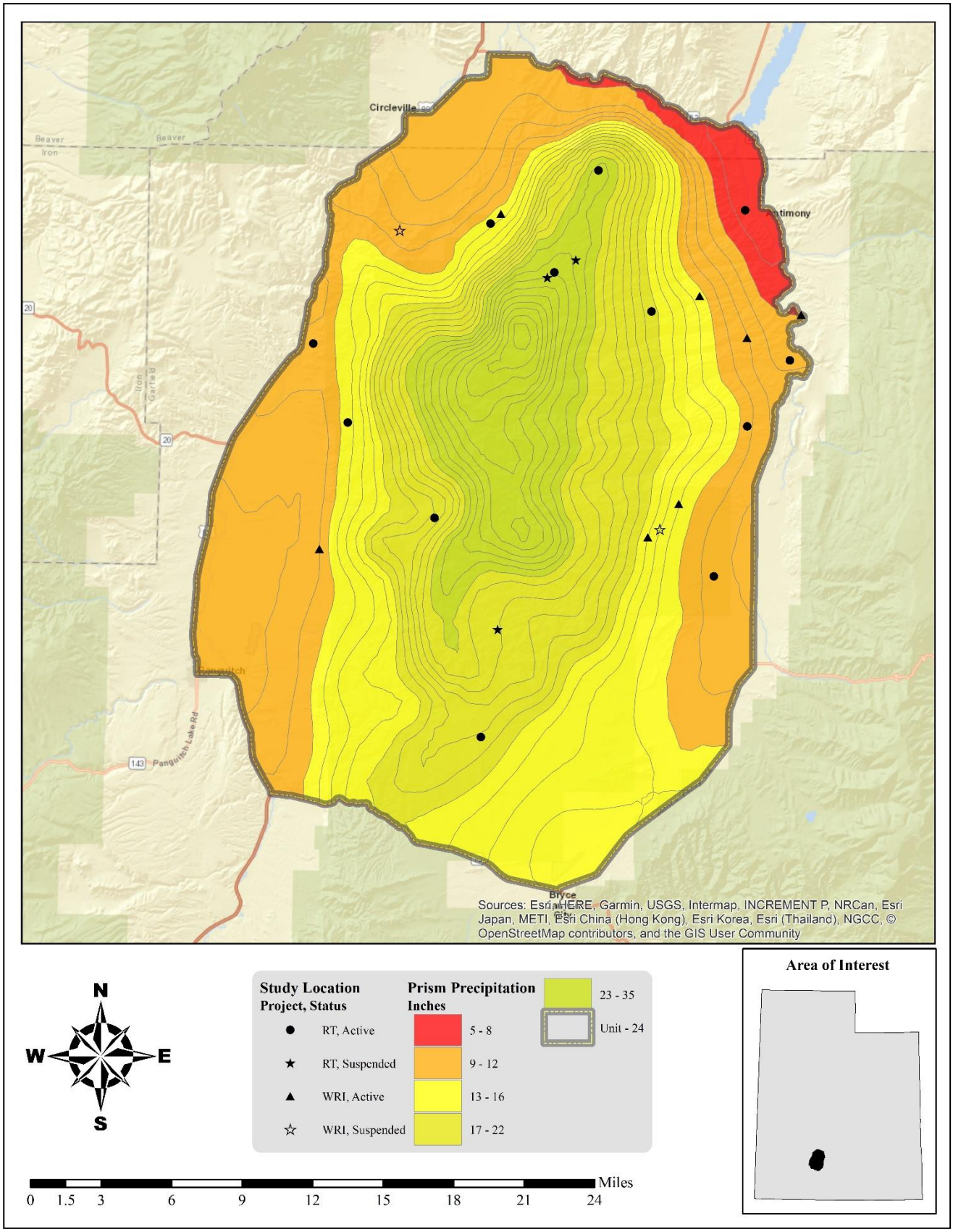
The east side of Mt. Dutton is comprised of many drainages which empty into the East Fork of the Sevier River. The major tributaries are Hoodle Creek, Forest Creek, Pine Creek, Deer Creek, Cow Creek, Cottonwood Creek, Rock Creek, North Fork Prospect Creek, and South Fork Prospect Creek. Drainages on the west side of Mt. Dutton empty into the Sevier River. The major tributaries are Sand Wash, Sanford Creek, Bull Rush Creek, and Lost Creek. East of Circleville lays Circle Valley with gradual slopes that join the steep mountain slopes and sheer cliffs of Table Mountain. The portions east and south Circleville are composed of disjunctive pinyon-juniper canyons.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches in the far northeast portion of the unit near Antimony to 32 inches on the peaks of Mt. Dutton. All of the Range Trend and WRI monitoring studies on the unit occur within 7-25 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 South Central division (Division 4).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 2.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 2.1b**) (Time Series Data, 2019).



Map 2.1: The 1981-2010 PRISM Precipitation Model for WMU 24, Mt. Dutton (PRISM Climate Group, Oregon State University, 2013).

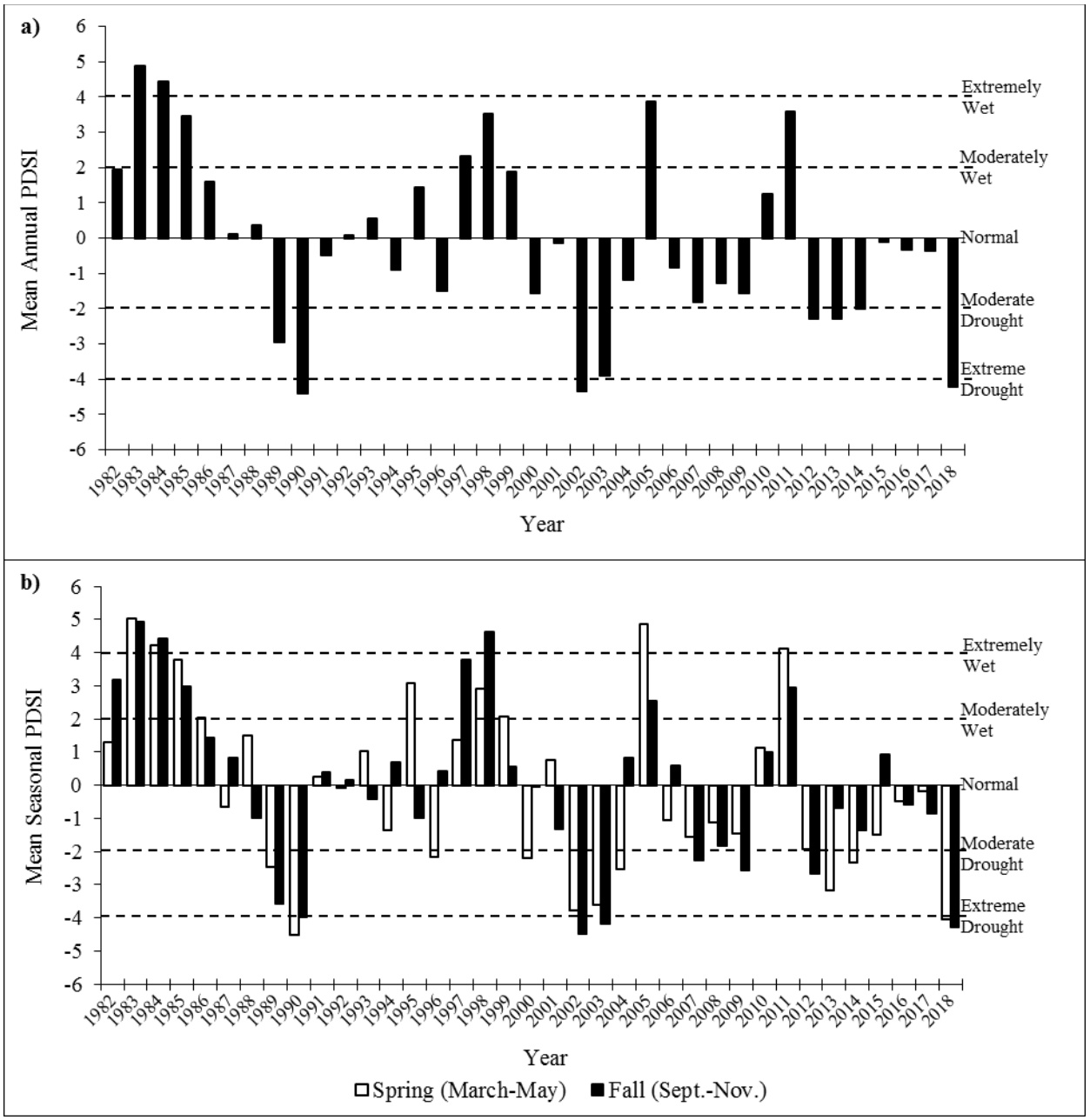


Figure 2.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

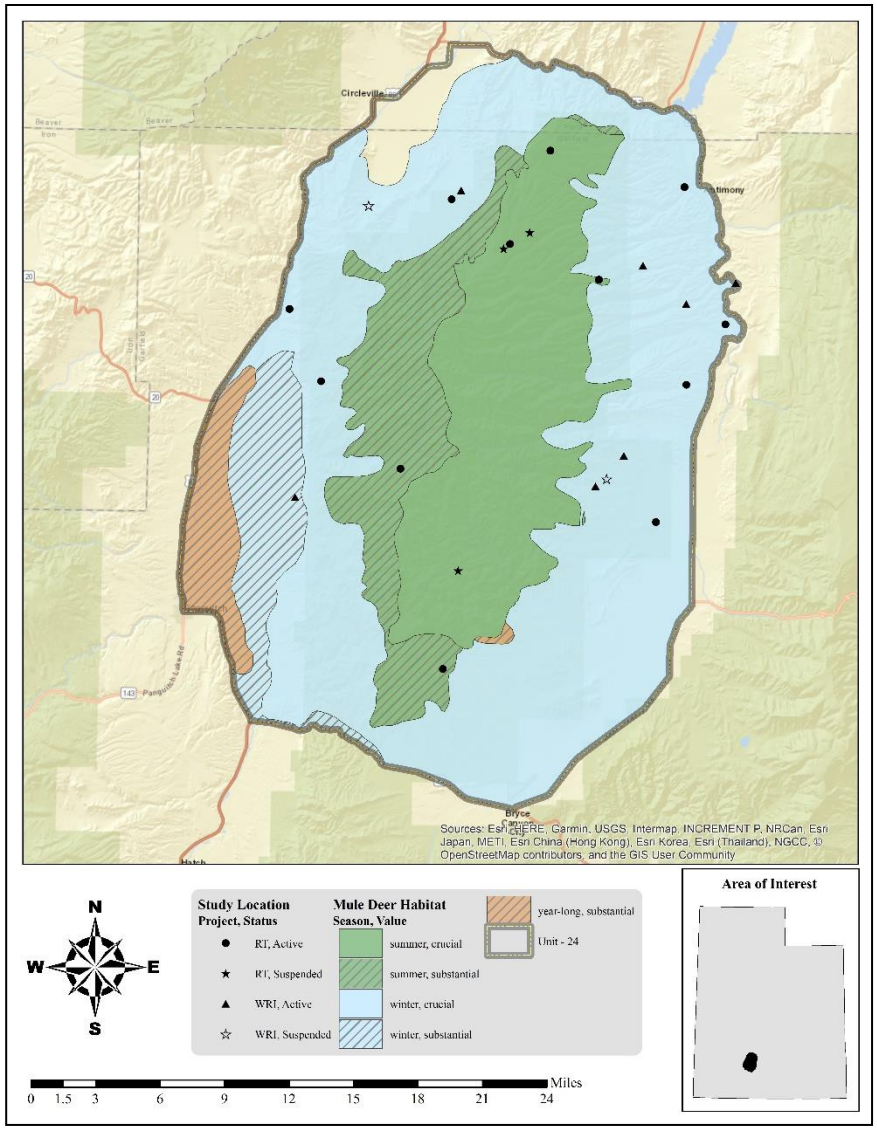
Big Game Habitat

There are an estimated 410,847 acres classified as deer range on Unit 24 with 62% classified as winter range, 34% as summer range, and 4% as year-long range (**Table 2.1**, **Map 2.2**). Land managed by the United States Forest Service (USFS) comprises 44% of the unit, 30% is administered by the Bureau of Land Management (BLM), 13% is managed by the School and Institutional Trust Lands Administration (SITLA), 11% is privately owned, and the Utah Department of Transportation (UDOT), Utah State Parks (USP), and the Utah Division of Wildlife Resources (UDWR) each manage less than 1% (**Table 2.2**, **Map 2.2**, **Map 2.6**). 45% of the elk winter range is administered by the USFS, 26% is managed by SITLA, the BLM manages 18%, 10% is privately owned, and UDOT manages less than 1% (**Table 2.3**

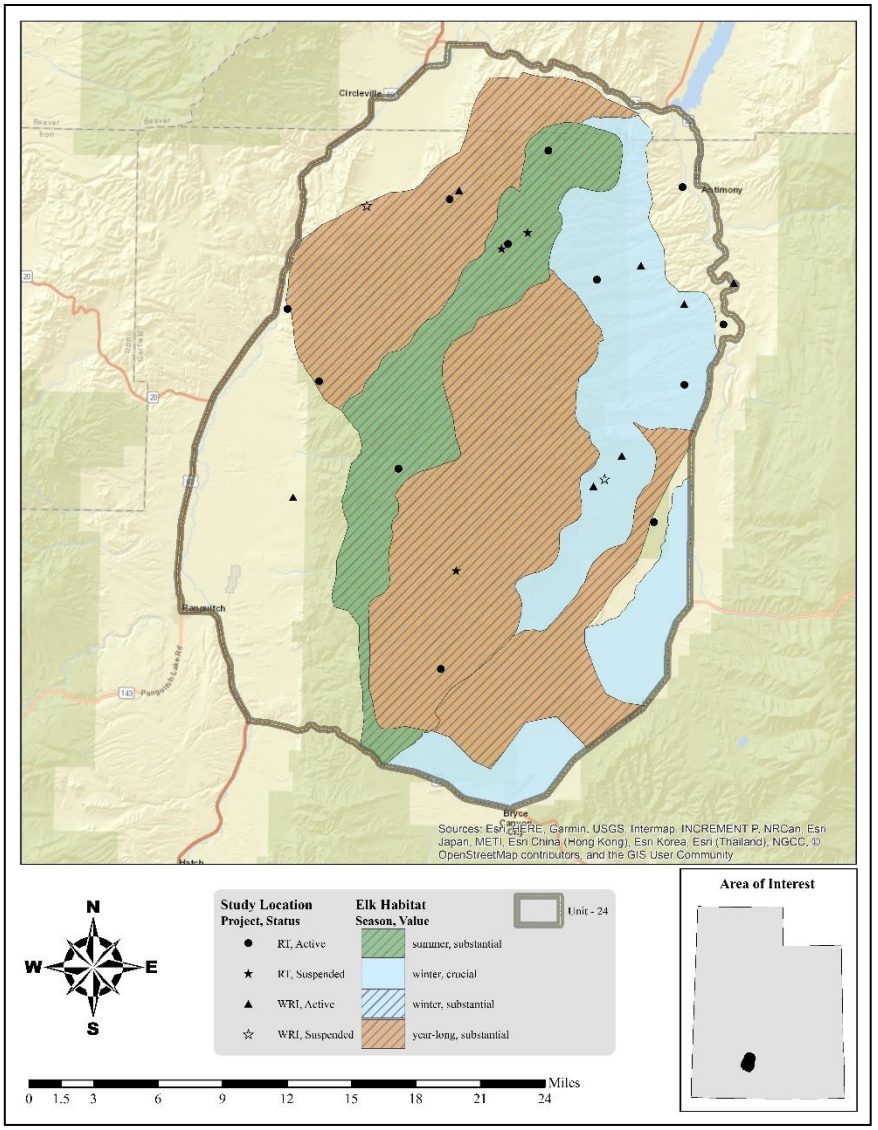
	Summer Range		**Winter Range**		**Year Long Range**	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	15,589	18%	14,573	9%
Private	0	0%	8,539	10%	2,781	2%
SITLA	0	0%	22,276	26%	7,586	5%
USFS	51,128	100%	38,155	45%	140,547	85%
UDOT	0	0%	4	<1%	0	0%
UDWR	0	0%	0	0%	4	<1%
Total	51,128	**100%**	84,562	**100%**	165,492	**100%**

Table 2.3, **Map 2.3**, **Map 2.6**).

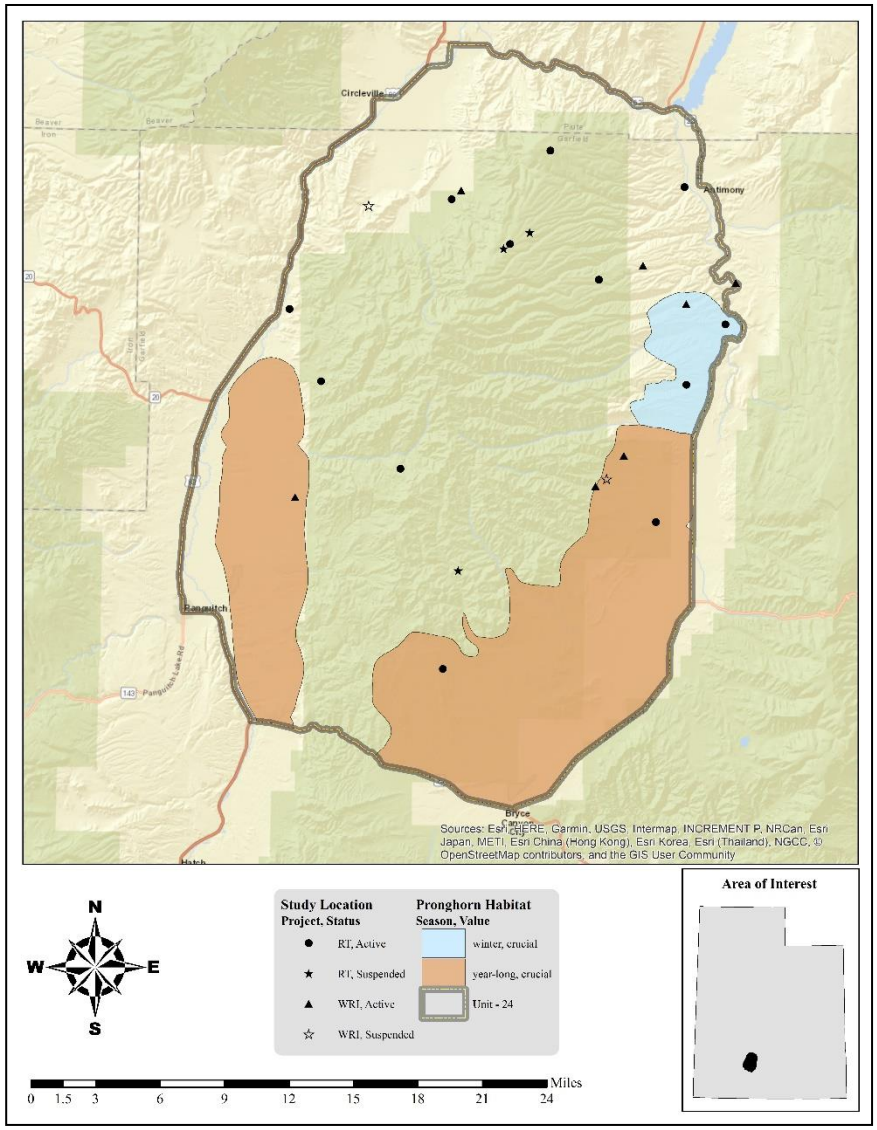
The wildlife unit encompasses Mt. Dutton with its surrounding foothills and valleys. Mt. Dutton is typical of the mesic, high mountain plateaus of southern Utah. Deer summer range is centrally located within the unit, while much of the winter range surrounds the high mountain plateaus of Mt. Dutton and Table Mountain (**Map 2.2**). Much of the elk range is considered year-long and centrally located on the plateaus and benches of Mt. Dutton and Table Mountain, while elk winter range is restricted to the higher benches and foothills on the eastern portion of the unit (**Map 2.3**).



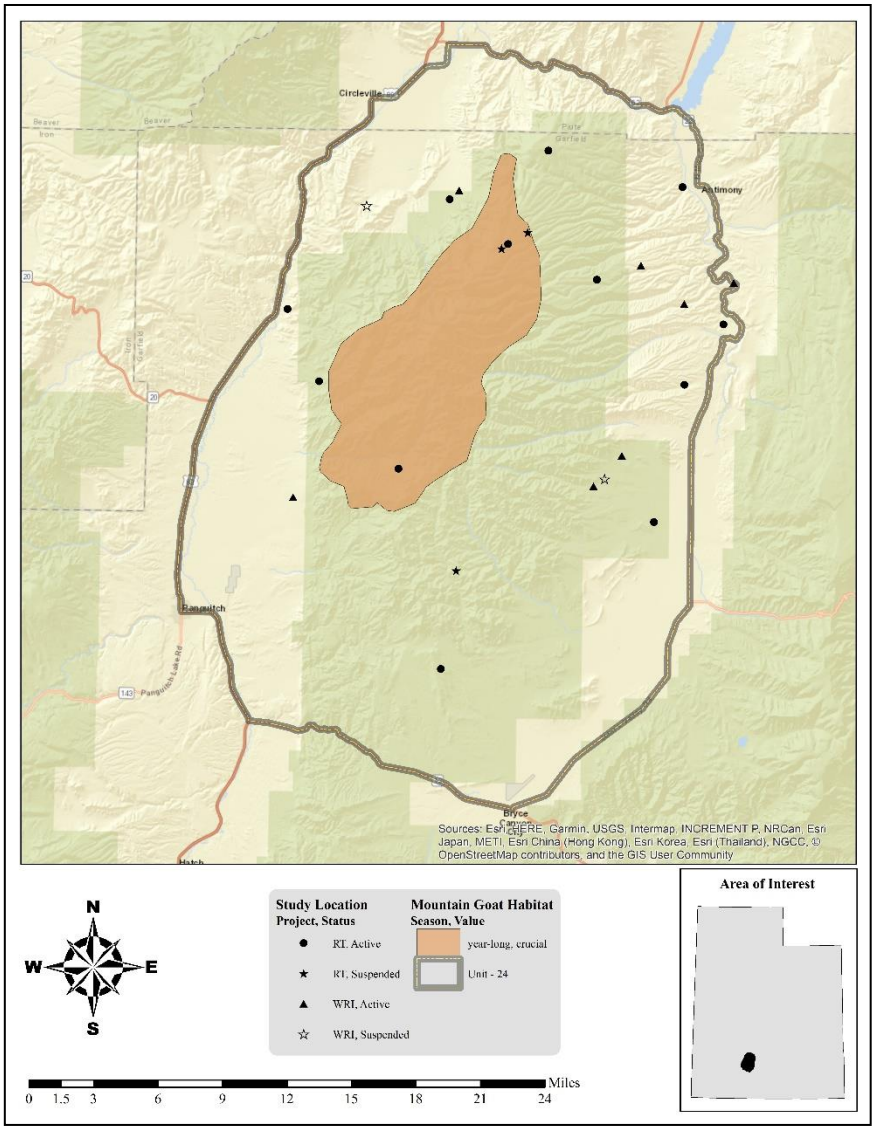
Map 2.2: Estimated mule deer habitat by season and value for WMU 24, Mt. Dutton.



Map 2.3: Estimated elk habitat by season and value for WMU 24, Mt. Dutton.



Map 2.4: Estimated pronghorn habitat by season and value for WMU 24, Mt. Dutton.



Map 2.5: Estimated mountain goat habitat by season and value for WMU 24, Mt. Dutton.

	Year Long Range		Summer Range		Winter Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	16,241	4%	139,230	34%	255,376	62%
Elk	165,492	55%	51,128	17%	84,562	28%
Pronghorn	123,875	91%	0	0%	12,747	9%
Mountain Goat	53,860	100%	0	0%	0	0%

Table 2.1: Estimated mule deer, elk, pronghorn, and mountain goat habitat acreage by season for WMU 24, Mt. Dutton.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	77,366	30%	1,054	6%
Private	0	0%	29,330	11%	14,617	90%
SITLA	18	<1%	34,328	13%	81	<1%
USFS	139,212	100%	113,609	44%	489	3%
UDOT	0	0%	4	<1%	0	0%
USP	0	0%	24	<1%	0	0%
UDWR	0	0%	716	<1%	0	0%
Total	139,230	**100%**	255,376	**100%**	16,241	**100%**

Table 2.2: Estimated mule deer habitat acreage by season and ownership for WMU 24, Mt. Dutton.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	15,589	18%	14,573	9%
Private	0	0%	8,539	10%	2,781	2%
SITLA	0	0%	22,276	26%	7,586	5%
USFS	51,128	100%	38,155	45%	140,547	85%
UDOT	0	0%	4	<1%	0	0%
UDWR	0	0%	0	0%	4	<1%
Total	51,128	**100%**	84,562	**100%**	165,492	**100%**

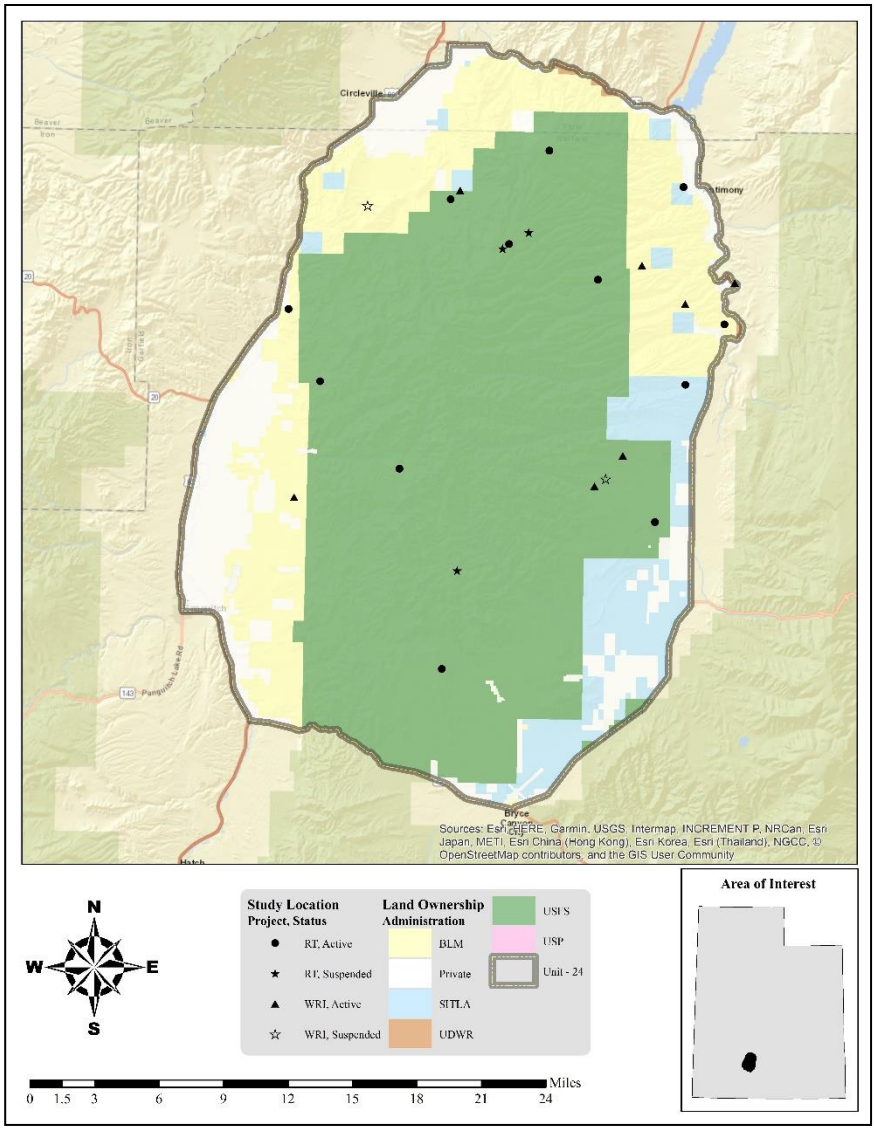
Table 2.3: Estimated elk habitat acreage by season and ownership for WMU 24, Mt. Dutton.

	Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	6,938	54%	22,319	18%
Private	332	3%	25,039	20%
SITLA	5,385	42%	23,067	19%
USFS	0	0%	53,446	43%
UDOT	0	0%	4	<1%
UDWR	92	1%	0	0%
Total	12,747	**100%**	123,875	**100%**

Table 2.4: Estimated pronghorn habitat acreage by season and ownership for WMU 24, Mt. Dutton.

	Year Long Range	
Ownership	*Area (acres)*	*%*
USFS	53,860	100%
Total	53,860	**100%**

Table 2.5: Estimated mountain goat habitat acreage by season and ownership for WMU 24, Mt. Dutton.



Map 2.6: Land ownership for WMU 24, Mt. Dutton.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	150,205	35.68%	
	Ponderosa Pine Forest, Woodland and Savanna	9,889	2.35%	
	Mountain Mahogany Woodland and Shrubland	9,046	2.15%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	7,082	1.68%	
	Spruce-Fir Forest and Woodland	5,822	1.38%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	3,060	0.73%	
	Limber Pine Woodland	1,335	0.32%	
	Lodgepole Pine Forest and Woodland	2	0.00%	
	Juniper Woodland and Savanna	1	0.00%	44.28%
Exotic Herbaceous	Introduced Annual Grassland	14,496	3.44%	3.44%
Grassland	Grassland	21,494	5.11%	
	Alpine Dwarf-Shrubland, Fell-field and Meadow	5,573	1.32%	
	Dry Tundra	6	0.00%	6.43%
Shrubland	Low Sagebrush Shrubland and Steppe	70,868	16.83%	
	Desert Scrub	13,800	3.28%	
	Big Sagebrush Shrubland and Steppe	12,430	2.95%	
	Chaparral	5,886	1.40%	
	Deciduous Shrubland	4,550	1.08%	
	Greasewood Shrubland	4,483	1.06%	
	Other Shrubland	2,296	0.55%	
	Salt Desert Scrub	1,345	0.32%	27.47%
Other	Conifer-Hardwood	23,289	5.53%	
	Hardwood	13,847	3.29%	
	Agricultural	12,307	2.92%	
	Developed	9,990	2.37%	
	Barren	7,378	1.75%	
	Sparsely Vegetated	5,615	1.33%	
	Riparian	4,858	1.15%	
	Quarries-Strip Mines-Gravel Pits	34	0.01%	
	Open Water	27	0.01%	
	Snow-Ice	6	0.00%	18.37%
Total		421,023	100%	100%

Table 2.6: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 24, Mt. Dutton.

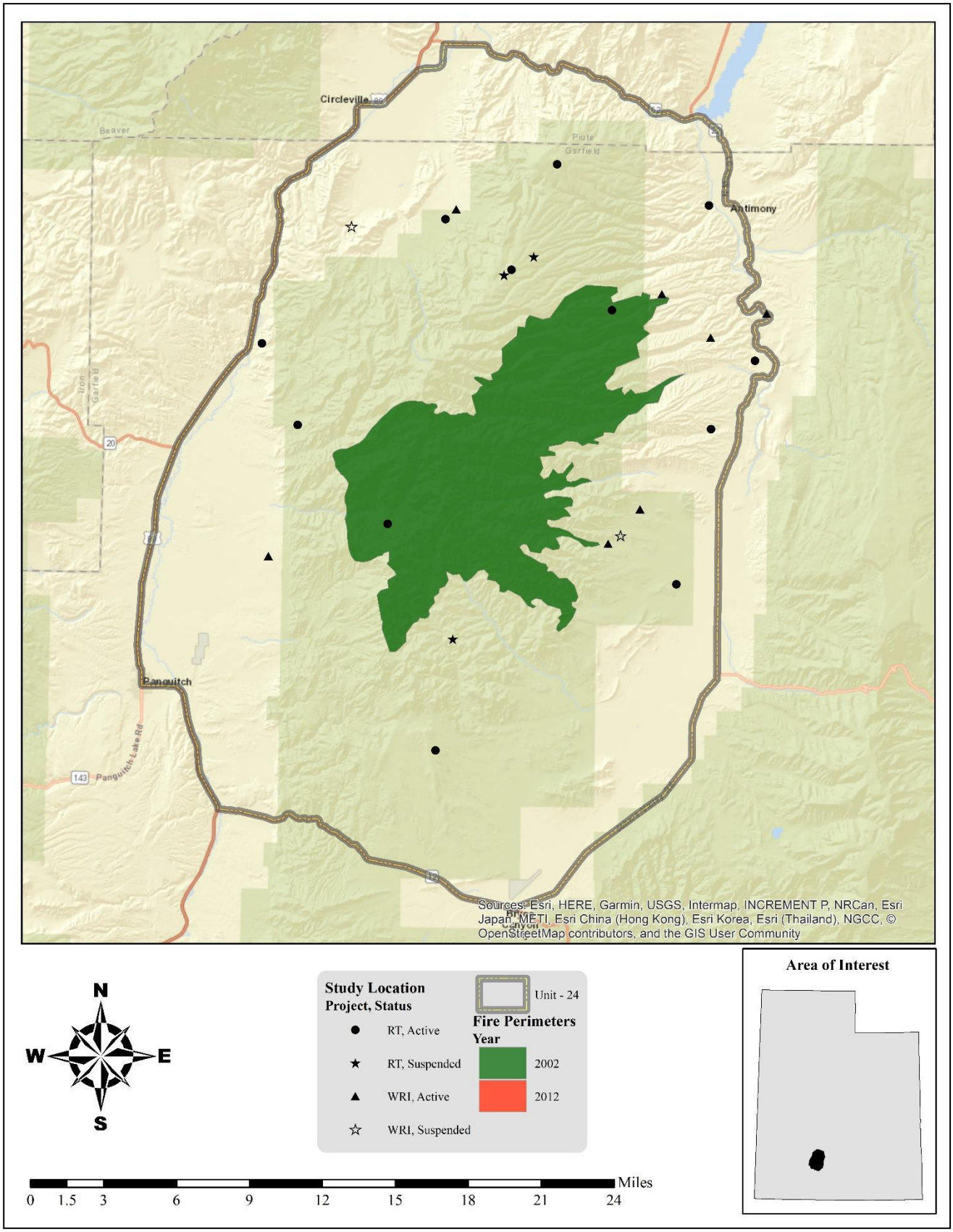
Limiting Factors to Big Game Habitat

Wildfire has had a substantial impact on the deer summer and winter ranges in this unit, particularly in the central portion. The Sanford fire of 2002 was a result of the loss of control of a prescribed fire and burned 60,740 acres, a significant portion of the central plateau and northeastern benches of Mt. Dutton (**Map 2.7**). The Sanford fire removed large expanses of important sagebrush and shrubland communities. While response to rehabilitation efforts and recovery has varied, available shrub forage on the winter range generally remains reduced from pre-fire levels. However, high mountain communities with mixed conifer and aspen have generally exhibited a reduction of conifer trees and rejuvenation of aspen clones. Due to the lack of range trend and watershed restoration monitoring sites within the burn area, it is difficult to assess vegetation trends and responses to the Sanford fire.

According to the current LANDFIRE Existing Vegetation Coverage model, nearly 36% of the unit is comprised of pinyon and juniper woodlands. While these woodlands provide valuable escape and thermal cover for wildlife, encroachment and invasion into historic shrublands reduces available browse and decreases the carrying capacity of the unit. Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components, therefore decreasing available forage for wildlife (Miller, Svejcar, & Rose, 2000).

Annual grasslands, primarily cheatgrass (*Bromus tectorum*), make up a minor proportion of the deer winter range according to the model (**Table 2.6**) and may exacerbate the risk of wildfire (Balch, D'Antonio, & Gómez-Dans, 2013). In addition, introduced perennial grass species such as crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Thinopyrum intermedium*), and smooth brome (*Bromus inermis*) are common on several of the study sites in the Mt. Dutton unit. These introduced grasses are often competitive

with other native perennial grass and forb species and could potentially limit more indigenous compositions within the unit's herbaceous communities.



Map 2.7: Land coverage of fires by year from 2000-2018 for WMU 24, Mt. Dutton (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

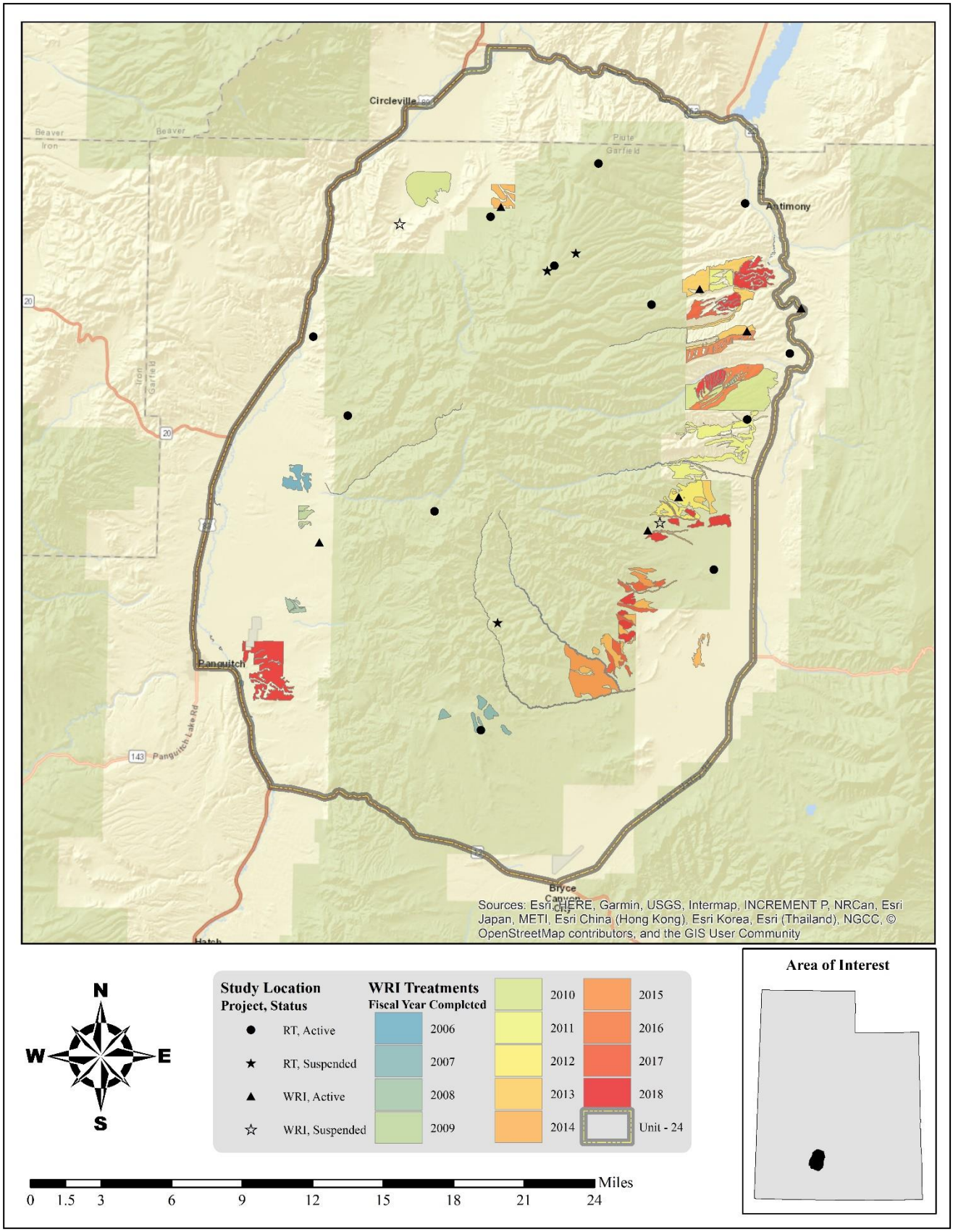
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 21,496 acres of land have been treated within the Mt. Dutton unit since the WRI was implemented in 2004 (**Map 2.8**). In addition, 736 acres are pending completion, 3,511 acres are currently being treated, and treatments have been proposed for 1,327 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 27,070 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.

The most common management practice in this unit is vegetation removal by hand (such as lop and scatter) to remove pinyon and juniper trees. Additional techniques to remove pinyon and juniper such as anchor chaining and bullhog treatments are also very common. Other management practices including (but not limited to) seeding species to augment the herbaceous understory, harrowing, mowing, and chain harrowing are all used across the unit (**Table 2.7**).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**6,255**	**0**	**586**	**0**	**6,841**
Ely (One-Way)	596	0	586	0	1,182
Ely (Two-Way)	5,659	0	0	0	5,659
Bullhog	**5,993**	**1,049**	**0**	**895**	**7,937**
Full size	4,730	1,049	0	895	5,779
Skid steer	1,264	0	0	0	1,264
Chain Harrow	**990**	**0**	**0**	**0**	**990**
≤15 ft. (One-Way)	990	0	0	0	990
Disc	**193**	**0**	**0**	**0**	**193**
Plow (One-Way)	193	0	0	0	193
Harrow	**1,423**	**0**	**150**	**0**	**1,573**
≤15 ft. (One-Way)	732	0	150	0	882
>15 ft. (One-Way)	692	0	0	0	692
Mowing	**24**	**0**	**0**	**0**	**24**
Other	24	0	0	0	24
Seeding (Primary)	**4,178**	**0**	**0**	**0**	**4,178**
Broadcast (Aerial-Fixed Wing)	220	0	0	0	220
Drill (Rangeland)	63	0	0	0	63
Ground (Mechanical Application)	3,895	0	0	0	3,895
Vegetation Removal/Hand Crew	**4,634**	**2,462**	**0**	**6,569**	**13,665**
Lop & Scatter	4,634	2,462	0	6,569	13,665
Other	**482**	**0**	**0**	**0**	**482**
Road Decommissioning	482	0	0	0	482
Grand Total	**24,172**	**3,511**	**736**	**7,464**	**35,883**
*** Total Land Area Treated**	**21,496**	**3,511**	**736**	**1,327**	**27,070**

Table 2.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 24, Mt. Dutton. Data accessed on 02/18/2019.
*Does not include overlapping treatments.



Map 2.8: WRI treatments by fiscal year completed for WMU 24, Mt. Dutton.

Range Trend Studies

Range Trend studies have been sampled within WMU 24 on a regular basis since 1987, 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 are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
24-01	North Pole Canyon	RT	Active	'87, '91, '97, '03, '08, '13, '18	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
24-02	Deer Creek Bench	RT	Active	'87, '91, '97, '03, '08, '13, '18	Semidesert Loam (Black Sagebrush)
24-03	North Bull Rush	RT	Active	'87, '91, '97, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24-04	Mud Spring Chaining	RT	Active	'87, '91, '97, '03, '08, '13, '18	Upland Stony Loam (Mountain Big Sagebrush)
24-05	Suicide	RT	Suspended	'87, '91, '92, '97	Not Verified
24-06	Table Mountain	RT	Active	'87, '91, '97, '03, '08, '13, '18	High Mountain Loam (Mountain Big Sagebrush)
24-07	Cow Creek	RT	Active	'87, '91, '97, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24-08	Prospect Seeding	RT	Active	'87, '91, '97, '03, '08, '13, '18	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
24-09	Mud Spring	RT	Active	'87, '91, '97, '03, '08, '13, '18	Upland Gravelly Loam (Black Sagebrush)
24-10	Barnhurst Ridge	RT	Suspended	'87, '91, '97	Not Verified
24-12	Marshall Basin	RT	Active	'87, '91, '97, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24-13	Jones Corral	RT	Active	'03, '08, '13, '18	High Mountain Loam (Mountain Big Sagebrush)
24-14	Pine Canyon	RT	Active	'13, '18	Mountain Windswept Ridge (Black Sagebrush)
24R-01	Sanford	RT	Active	'98, '03, '08, '13	High Mountain Loam (Aspen_
24R-02	Jones Corral Cattle Exclosure	RT	Suspended	'98	Not Verified
24R-03	Jones Corral Outside	RT	Suspended	'98	Not Verified
24R-04	Jones Corral Wildlife Exclosure	RT	Suspended	'98	Not Verified
24R-05	Jones Corral Total Exclosure	RT	Suspended	'98	Not Verified
24R-06	Panguitch East Bench Harrow	WRI	Active	'04, '07, '12, '16	Semidesert Loam (Wyoming Big Sagebrush)
24R-07	Horse Valley Burn	WRI	Suspended	'05	Not Verified
24R-08	Johns Valley	WRI	Active	'11, '15	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24R-09	Johns Valley 2	WRI	Active	'12, '15	Upland Loam (Basin Big Sagebrush)
24R-10	Antimony Lop and Scatter	WRI	Active	'12, '15	Upland Stony Loam (Mountain Big Sagebrush)
24R-11	Antimony PJ Reduction	WRI	Active	'12, '15, '18	Upland Stony Loam (Mountain Big Sagebrush)
24R-12	Johns Valley 3	WRI	Suspended	'13	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24R-13	Circleville	WRI	Active	'13, '16	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
24R-14	Black Canyon WMA	WRI	Active	'16	Upland - Interzonal Loamy Bottom (Basin Wildrye)

Table 2.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 24, Mt. Dutton.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
24-04	Mud Spring Chaining	Chain Unknown Seed Unknown Lop and Scatter		Historic Historic Between 2003 and 2008		
24-06	Table Mountain	Prescribed Fire		Prior to 1987		
24-07	Cow Creek	Disk Unknown Rangeland Drill Lop and Scatter	 Cow and Cottonwood Creek Lop and Scatter	Prior to 1987 Prior to 1987 November 2011	 2100	 1794
24-08	Prospect Seeding	Disk Unknown Seed Unknown		1968 1968		
24-09	Mud Spring	One-Way Dixie Harrow Seed Unknown Lop and Scatter	Sevier Plateau Dixie Harrow Sevier Plateau Dixie Harrow Powell - Mud Springs Phase I	Fall 2006 Fall 2006 2019	500 500 2462	461 461 4635
24-12	Marshall Basin	Chain Unknown Seed Unknown Wildfire		Fall 1984 Fall 1984 1996	900 900	
24R-01	Sanford	Wildfire	Sanford	April-July 2002	60740	
24R-02	Jones Corral Cattle Exc.	Wildfire		Mid-1990s		
24R-03	Jones Corral Outside	Wildfire		Mid-1990s		
24R-04	Jones Corral Wildlife Exc.	Wildfire		Mid-1990s		
24R-05	Jones Corral Total Exc.	Wildfire		Mid-1990s		
24R-06	Panguitch East Bench Harrow	Broadcast Before One-Way Dixie Harrow Aerial After	Panguitch East Bench Panguitch East Bench Panguitch East Bench	October 2004 October 2004 December 2004	300 300 300	PDB PDB PDB
24R-08	Johns Valley	Chain Unknown Seed Unknown Bullhog	 2012 John's Valley Sage-Steppe Restoration	Historic Historic January-July 2013	7685 7685 1236	 2055
24R-09	Johns Valley 2	Chain Unknown Seed Unknown Bullhog		Historic Historic 2012	7685 7685	
24R-10	Antimony Lop and Scatter	Lop and Scatter Prescribed Fire	Antimony Fuels Reduction and Habitat Improvement FY14 Antimony Fuels Reduction and Habitat Improvement FY14	November 2014-February 2015 November 2014-February 2015	587 736	2597 2597
24R-11	Antimony PJ Reduction	Aerial Before Bullhog	Antimony PJ Reduction and Riparian Improvement (Phase V) Antimony PJ Reduction and Riparian Improvement (Phase V)	Fall 2012 Fall 2012	1005 1005	2239 2239
24R-13	Circleville	Aerial Before Dribbler Before Two-Way Ely Chain Aerial After	Circleville Vegetation Enhancement Circleville Vegetation Enhancement Circleville Vegetation Enhancement Circleville Vegetation Enhancement	October 2013 October 2013 October 2013 February 2014	459 459 459 459	2706 2706 2706 2706
24R-14	Black Canyon WMA	Seed Unknown Herbicide - Tordon Mower	 Black Canyon WMA RabbitBrush Removal phase 2 Black Canyon WMA RabbitBrush Removal phase 2	Historic October-November 2016 October-November 2016	 24 24	 3069 3069

Table 2.9: Range trend and WRI studies known disturbance history for WMU 24, Mt. Dutton. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are two studies [Table Mountain (24-06) and Jones Corral (24-13)] that are classified as Mountain (Big Sagebrush) ecological sites. The Table Mountain site is located south of Kingston Canyon on Table Mountain. The Jones Corral site is situated south of Table Mountain up the Jones Corral Draw.

Shrubs/Trees: The dominant preferred browse species on these study sites has been a co-dominant mix of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), mountain snowberry (*Symphoricarpos oreophilus*), whisky currant (*Ribes cereum* var. *pedicellare*), and Wood's rose (*Rosa woodsii*). Most of the shrub cover is on the Table Mountain site, with Jones Corral having very little shrub cover present. A generally increasing trend for shrub cover is noted through the sample years (**Figure 2.2**). Shrub demographic data shows that most of the individuals are mature plants with moderate recruitment of young observed in 1997 and 2008 (**Figure 2.8**). Utilization of preferred browse has been low in all years except 2003 when overall usage was moderate (**Figure 2.10**).

No tree cover or density have been observed in any sample year on these study sites and will therefore not be discussed for this ecological type (**Figure 2.4**, **Figure 2.6**).

Herbaceous Understory: Total cover and frequency of the herbaceous understory has shown a generally increasing trend. Perennial grasses and forbs are co-dominant components across the sites, with Letterman's needlegrass (*Achnatherum lettermanii*), needle and thread (*Hesperostipa comata*), muttongrass (*Poa fendleriana*), and Sandberg bluegrass (*Poa secunda*) being the most common species. There are some introduced perennial grasses present, namely smooth brome (*Bromus inermis*), which is mostly found on the Jones Corral site. Perennial forbs have increased in cover and frequency with hollyleaf clover (*Trifolium gymnocarpon*) and silvery lupine (*Lupinus argenteus*) being the dominant species. Annual grasses and forbs do not provide significant amounts of cover on either site (**Figure 2.12**, **Figure 2.14**).

Occupancy: Average occupancy has shown fluctuations through the sample years, with the primary occupants varying between elk, deer and cattle. Deer occupancy has varied in mean abundance from 3 days use/acre in 2018 to 51 days use/acre in 2003. Elk pellet group abundance has ranged from 12 days use/acre in 2018 to 47 days use/acre in 2008. Cattle pellet groups have changed from 12 days use/acre in 2018 to 27 days use/acre in 2008 (**Figure 2.16**).

Mountain (Black Sagebrush)

There is one study site [Pine Canyon (24-14)] that is considered to be a Mountain (Black Sagebrush) ecological site: this site is located between Pole Canyon and Dry Hollow southwest of Antimony.

Shrubs/Trees: As the only site of this ecological type, this site is mostly composed of non-preferred shrub species and preferred browse is very minimal. Broom snakeweed (*Gutierrezia sarothrae*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* var. *viscidiflorus*) are the dominant shrub species sampled. Black sagebrush (*Artemisia nova*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) were both sampled, but in very small amounts (**Figure 2.2Error! Reference source not found.**). Shrub demographic data shows that the number of plants on the site is quite low and indicates a decreasing trend of utilization between 2013 and 2018 (**Figure 2.8**, **Figure 2.10**).

Trees are not present on this study sites and will therefore not be discussed for this ecological type (**Figure 2.4**, **Figure 2.6**).

Herbaceous Understory: The herbaceous understory of this site has been robust and diverse through the sample years. Most of the cover is provided by native species although some introduced species are present in small amounts. Blue grama (*Bouteloua gracilis*) and muttongrass (*Poa fendleriana*) are the dominant species on the site and provide significant amounts of cover. Cover increased in 2018, mostly due to perennial grasses; nested

frequency has remained stable. Perennial forbs have decreased slightly in nested frequency while annual forbs increased (**Figure 2.12**, **Figure 2.14**).

Occupancy: Average pellet transect data shows that elk were the primary occupants of the site in 2013 and were co-dominant occupants with cattle in 2018. Mean abundance of elk pellet groups showed a high of 26 days use/acre in 2013 and a low of 17 days use/acre in 2018. Cattle pellet group data showed a low of 9 days use/acre in 2013 and a high of 17 days use/acre in 2018. Deer have a low presence on this site, with a mean abundance of 1 days use/acre in 2013 and 0 days use/acre in 2018 (**Figure 2.16**).

Upland (Big Sagebrush)

There are four studies [North Bull Rush (24-03), Mud Spring Chaining (24-04), Cow Creek (24-07), and Marshall Basin (24-12)] that are classified as Upland (Big Sagebrush) ecological sites. The North Bull Rush site is located at the south end of Circleville Canyon off of US-89. The Mud Spring Chaining site is situated southeast of Circleville near Burnt Hollow. The Cow Creek site is located between the town of Antimony and John's Valley on the west side of John's Valley Road. Finally, Marshall Basin site can be found east of the junction between US-89 and UT-20 near Smith Canyon.

Shrubs/Trees: The dominant shrub species on these sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with cover showing a slight increase over the sample years (**Figure 2.2**). Preferred browse demographics display a stable population; the overall density is low but data indicates that the populations are mostly comprised of mature individuals. Recruitment of young is low (**Figure 2.8**). Utilization of preferred browse has shown fluctuations, with moderate use varying from a low of 23 percent in 2018 to a high of 47 percent in 1997 (**Figure 2.10**).

Tree cover and density have decreased through sample years; both Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*) are present on some of the sites. A lop and scatter treatment on the Mud Spring Chaining and Cow Creek sites contributed to the decreasing density and cover of trees (**Figure 2.4**, **Figure 2.6**).

Herbaceous Understory: Overall cover of the herbaceous understory has generally increased along with nested frequency. A majority of the understory is composed of perennial grasses, which are a mixture of both native and introduced species. Annual grasses are sparse and have not been sampled since 2008. Both annual and perennial forbs are also sparse across these sites (**Figure 2.12**, **Figure 2.14**).

Occupancy: Deer were the primary occupants in 2003 and 2008, but primary occupancy switched to elk in 2013 and 2018. Deer occupancy varied from a low of 9 days use/acre in 2013 to a high of 15 days use/acre in 2003. Elk pellet groups have had a mean abundance varying from 3 days use/acre in 2008 to 16 days use/acre in 2018. Cattle have been present on the site in all years, with a low of 3 days use/acre in 2018 to a high of 15 days use/acre in 2008 (**Figure 2.16**).

Upland (Black/Low Sagebrush)

One site [Mud Spring (24-09)] is classified as an Upland (Black/Low Sagebrush) ecological site. The Mud Spring study is situated roughly 8 miles northwest of Bryce Canyon City.

Shrubs/Trees: Sagebrush is the dominant browse species on this study site; black sagebrush (*Artemisia nova*) is the dominant sagebrush, but mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) is also present. Smaller amounts of longflower rabbitbrush (*Chrysothamnus depressus*) and antelope bitterbrush (*Purshia tridentata*) also compose a portion of the preferred browse species. Sagebrush and preferred browse species have shown an overall increase over sample years (**Figure 2.2**). Demographic data has shown a decrease in the numbers of sagebrush plants, but decadence has also decreased (**Figure 2.8**). Utilization increased dramatically in the 2008 and 2013 sample years, with around forty percent of plants showing moderate utilization. The 2018

sample year showed a significant decrease in the amount of moderate utilization from the previous years (**Figure 2.10**).

Trees have not maintained a significant presence on the site, with 2018 being the only year trees were sampled in density. Rocky Mountain juniper (*Juniperus scopulorum*) was the only species sampled, and density was observed at 7 trees per acre (**Figure 2.4**, **Figure 2.6**).

Herbaceous Understory: The herbaceous understory of this site is diverse and abundant with a generally increasing trend observed. Native species are the dominant components of this site. Perennial grasses have generally increased in cover, but frequency has remained stable. Perennial forbs are abundant with slight fluctuations in cover, but frequency has remained similar through the sample years. Annual grasses are not present and annual forbs make up a slight portion of the herbaceous community (**Figure 2.12**, **Figure 2.14**).

Occupancy: Average occupancy on these sites has exhibited fluctuations with a large decrease between 2003 and 2008, then increases in subsequent sample years. The primary occupants have varied between deer, elk and cattle. Deer and elk were co-dominant as primary occupants in 2003 and 2008, and elk and cattle were co-dominant as primary occupants in 2013. Deer were the sole primary occupants in 2018. Mean abundance of deer pellet groups has ranged from 3 days use/acre in 2013 to 36 days use/acre in 2018. Elk pellet groups have fluctuated in abundance between a low of 8 days use/acre in 2008 to a high of 32 days use/acre in 2003. Cattle pellet groups have ranged in mean abundance between 1 day use/acre in 2008 and 16 days use/acre in 2013 (**Figure 2.16**).

Semidesert (Big Sagebrush)

There are two study sites [North Pole Canyon (24-01) and Prospect Seeding (24-08)] that are classified as Semidesert (Big Sagebrush) ecological sites. The North Pole Canyon study site is located west of Antimony on the benches above the East Fork Sevier River. The Prospect Seeding site is located at the north end of John's Valley between Bryce Canyon City and Antimony.

Shrubs/Trees: These study sites are dominated by sagebrush as the preferred browse species with North Pole Canyon having mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Prospect Seeding having Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*). Other preferred browse species are not found in any abundance. Cover of sagebrush has generally increased, with a small decrease in 2018 (**Figure 2.3**). Composition of preferred browse has shown fluctuations with 2003 and 2008 having high levels of decadence. The 1997 and 2018 sample years showed good recruitment of young plants (**Figure 2.9**). Utilization has steadily increased, with 2013 showing nearly thirty percent of plants having heavy usage and thirty percent having moderate usage (**Figure 2.11**).

Trees are not present on these study sites and will therefore not be discussed for this ecological type (**Figure 2.5**, **Figure 2.7**).

Herbaceous Understory: These study sites have been dominated by perennial grasses with fluctuating cover; high amounts of cover were observed in 2008 and 2018. Introduced perennial species are dominant on Prospect Seeding and native species are dominant on North Pole Canyon (**Figure 2.13**). Nested frequency has shown slight increases through sample years. Perennial forbs have been sparse in all years. Annual forbs were common in 1997, but have not been sampled in abundance since that sample year (**Figure 2.15**).

Occupancy: Pellet transect data shows that overall occupancy of these sites has decreased over time and that cows have been the primary occupants in most sample years. Mean abundance of cow pellet groups has ranged from 40 days use/acre in 2008 to 4 days use/acre in 2018. Deer pellet groups have varied from a high of 24 days use/acre in 2003 to 5 days use/acre in 2013. Elk have had the least abundance varying from 7 days use/acre in 2003 to 0 days use/acre in 2013 (**Figure 2.17**).

Semidesert (Black/Low Sagebrush)

There is one study [Deer Creek Bench (24-02)] classified as a Semidesert (Black/Low Sagebrush) ecological site. The Deer Creek Bench site is located between John's Valley and Antimony west of the East Fork Sevier River.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) is the most dominant preferred browse species on this study site. Cover of black sagebrush has remained stable with a slight decrease observed in 2018 (**Figure 2.3**). Browse demographics have also remained stable with the majority of the plant population being composed of mature individuals (**Figure 2.9**). Preferred browse utilization has been stable with the exception of 2013 when utilization slightly increased (**Figure 2.11**).

Trees are not present on these study sites and will therefore not be discussed for this ecological type (**Figure 2.5**, **Figure 2.7**).

Herbaceous Understory: The understory on this study site is primarily composed of native species and has shown increases in all years. Perennial grasses are the dominant herbaceous component with needle and thread (*Hesperostipa comata*) and Indian ricegrass (*Achnatherum hymenoides*) as the dominant species. Annual grasses have been sampled on the site, although in low abundance. Perennial forb cover and frequency have displayed slight increases through the study years (**Figure 2.13**, **Figure 2.15**).

Occupancy: Average pellet transect data indicates that occupancy has remained stable over time with the exception of 2018, when presence decreased. The primary occupants have been deer in most sample years: mean abundance has ranged from a high of 74 days use/acre in 2013 to 6.7 days use/acre in 2018. Elk pellets have ranged from 1 days use per acre in 2008 to 0 days use/acre in all other years. Cow pellet groups have ranged from 4 days use/acre in 2013 to 8 days use/acre in 2003 and 2018 (**Figure 2.17**).

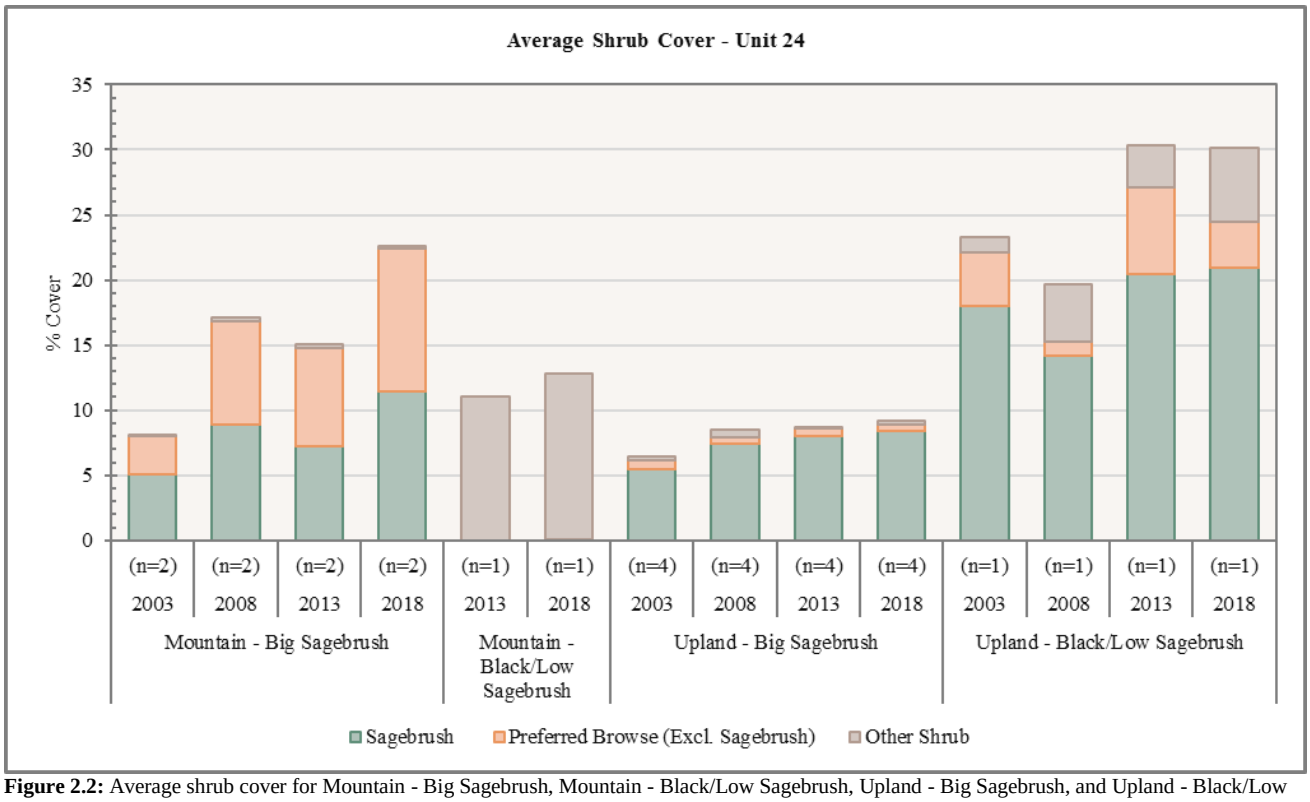


Figure 2.2: Average shrub cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

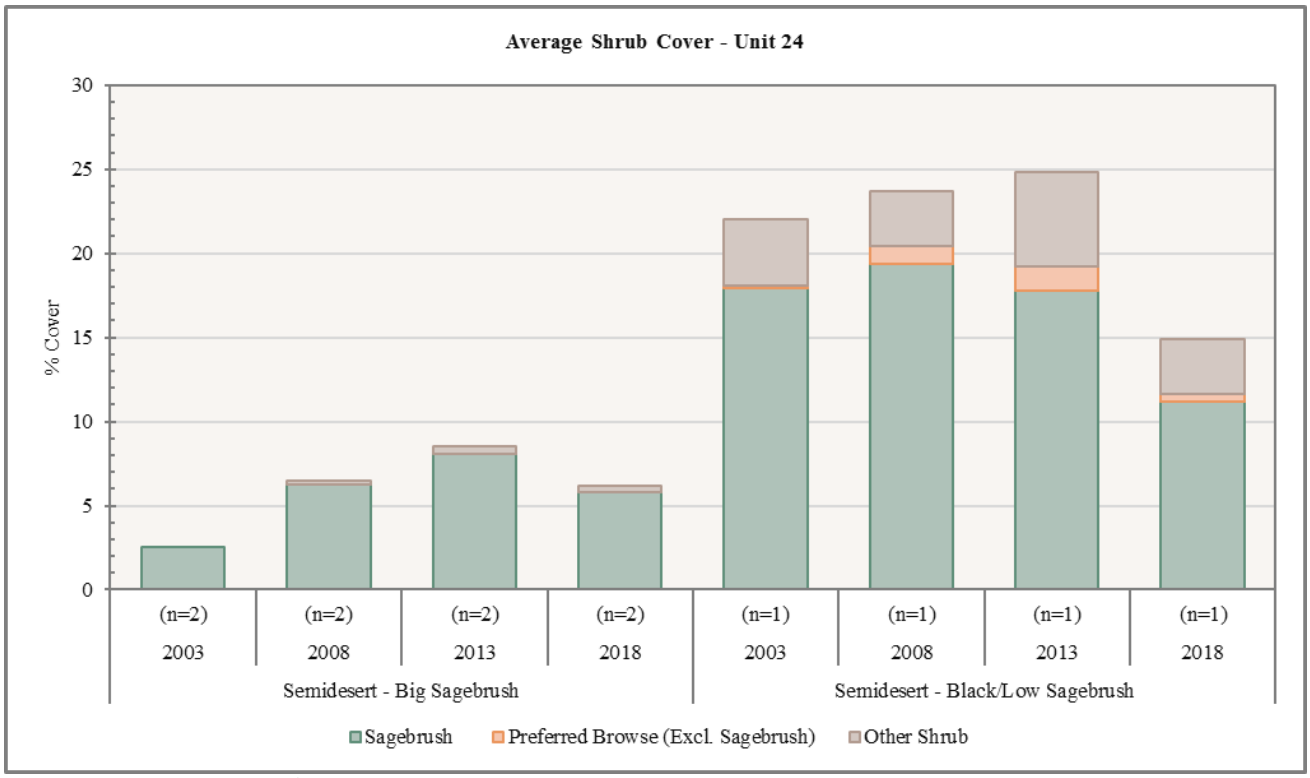


Figure 2.3: Average shrub cover for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

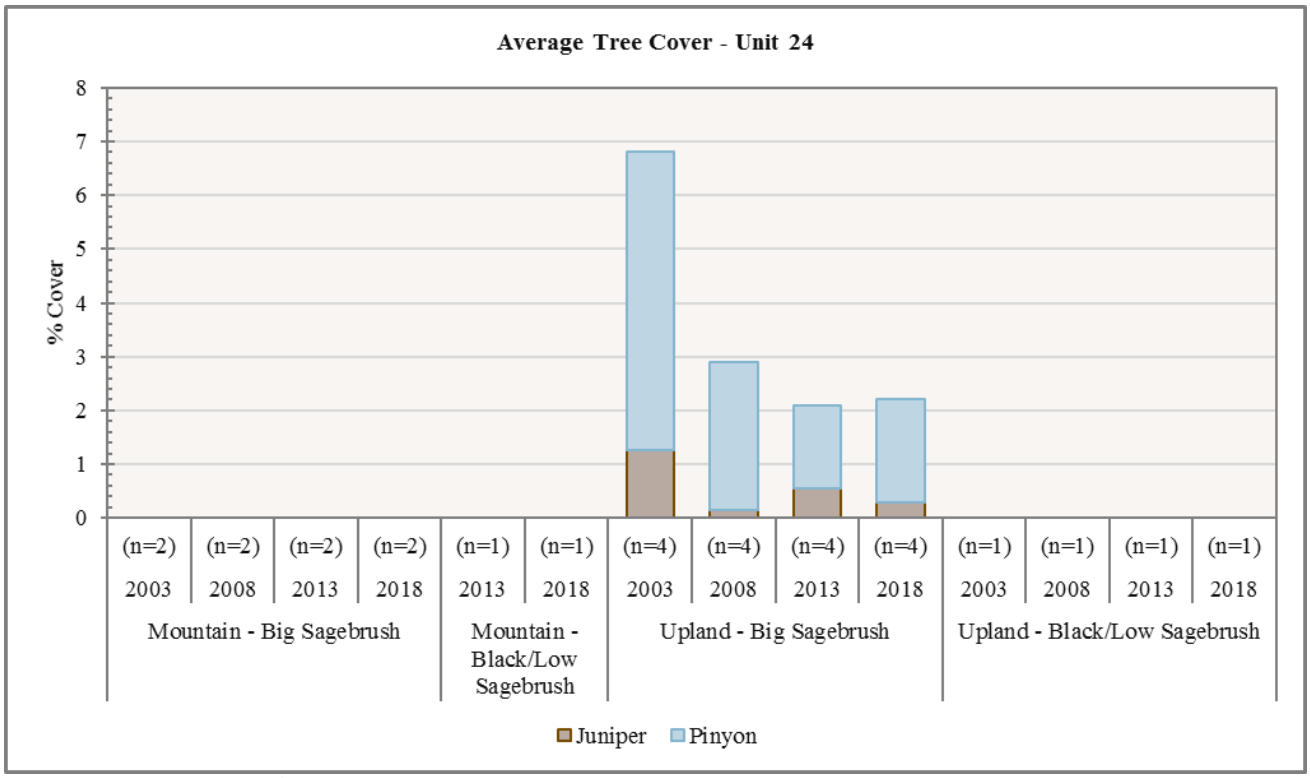


Figure 2.4: Average tree cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

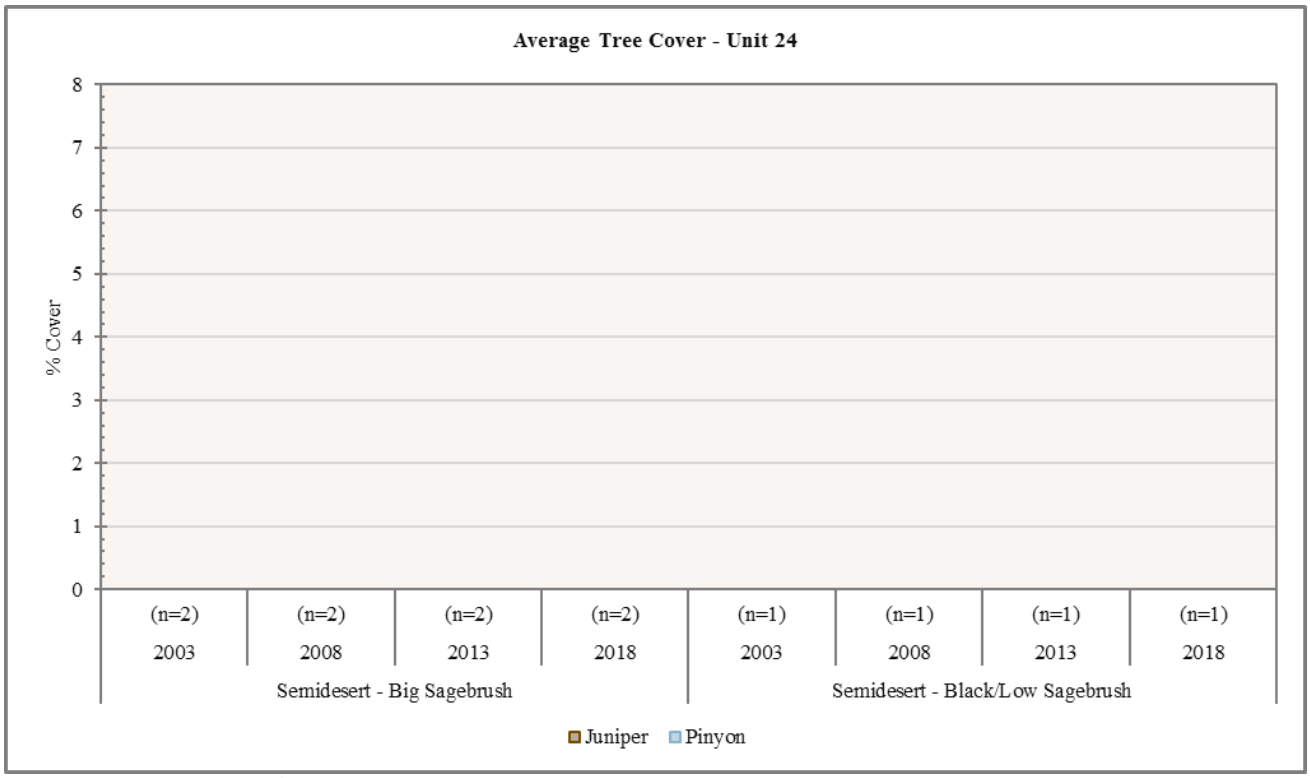


Figure 2.5: Average tree cover for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

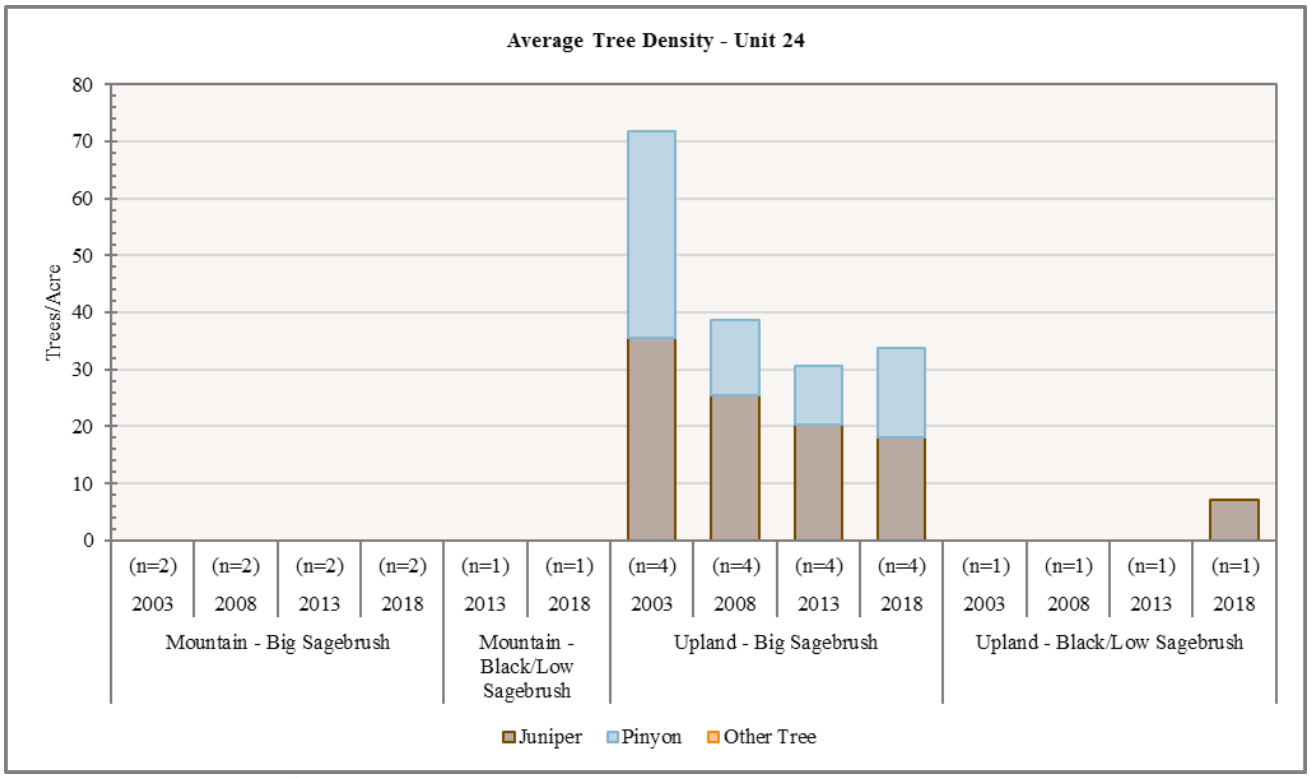


Figure 2.6: Average tree density for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

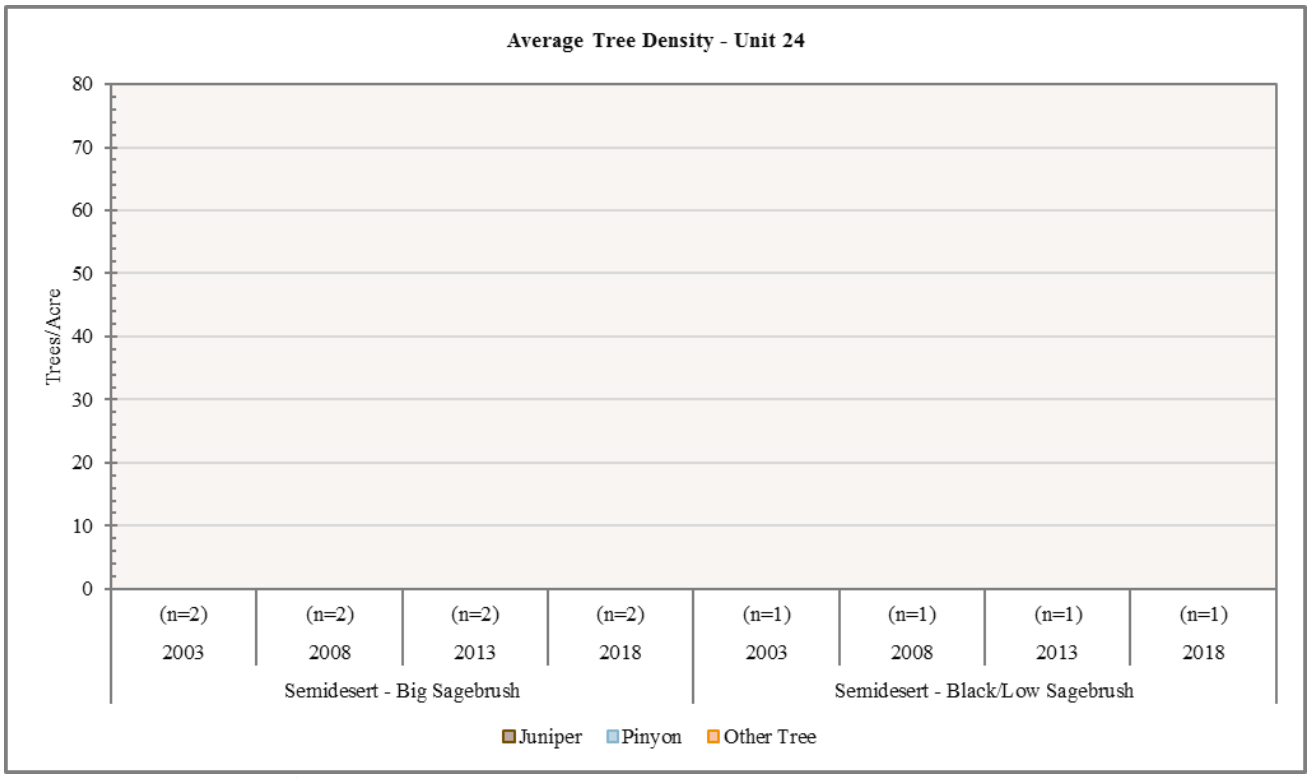


Figure 2.7: Average tree density for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

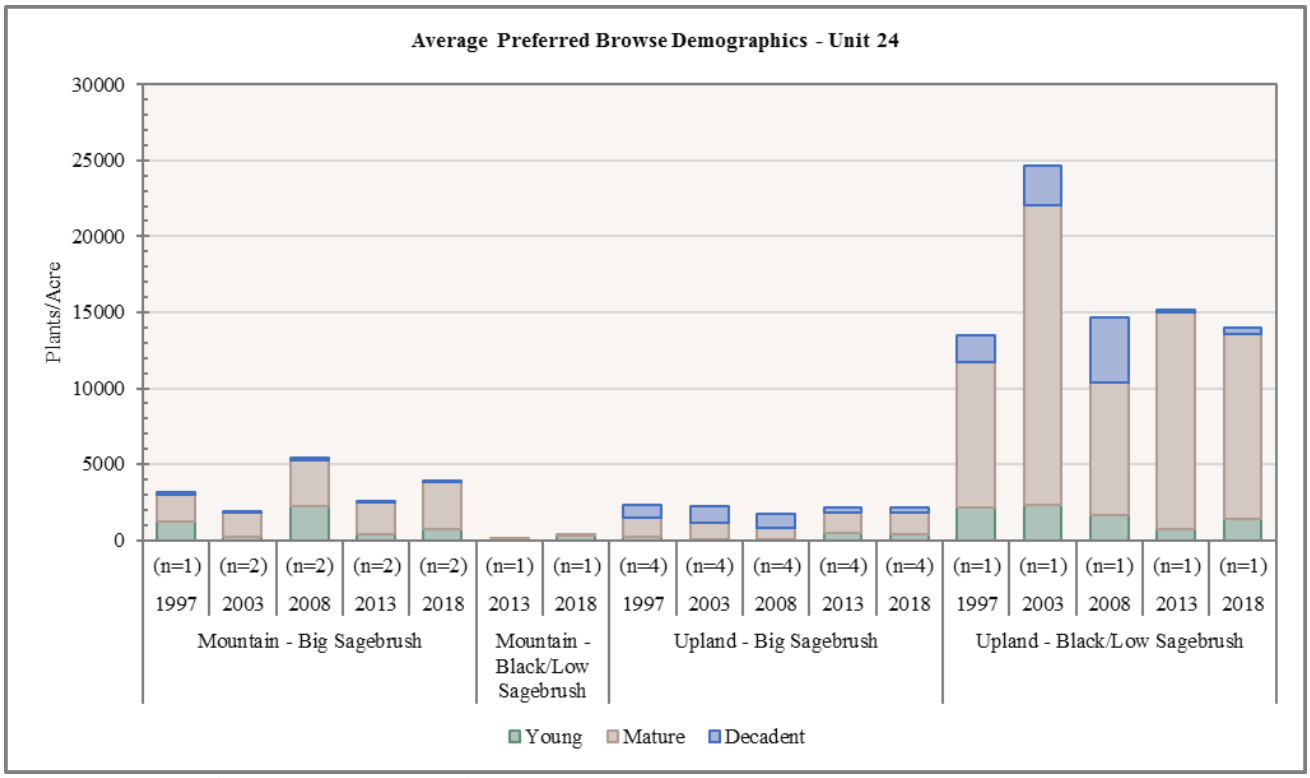


Figure 2.8: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

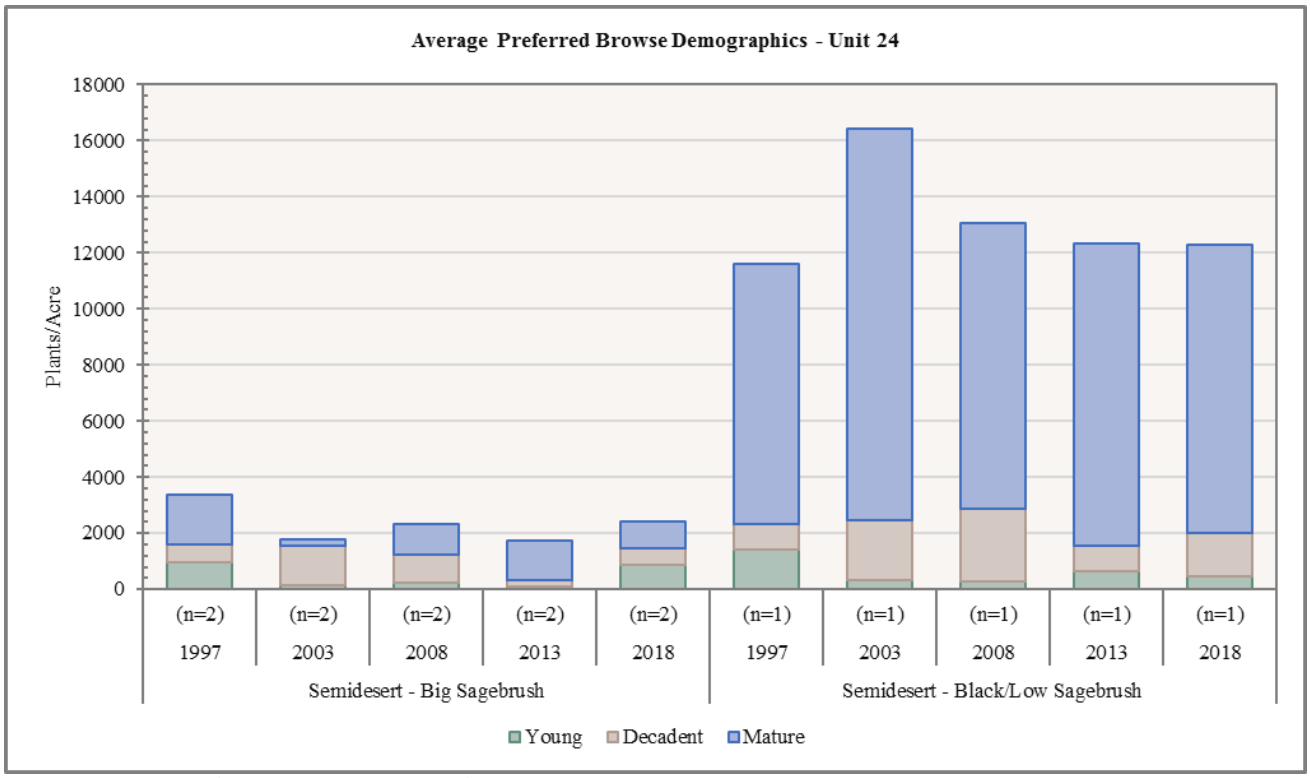


Figure 2.9: Average preferred browse demographics for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

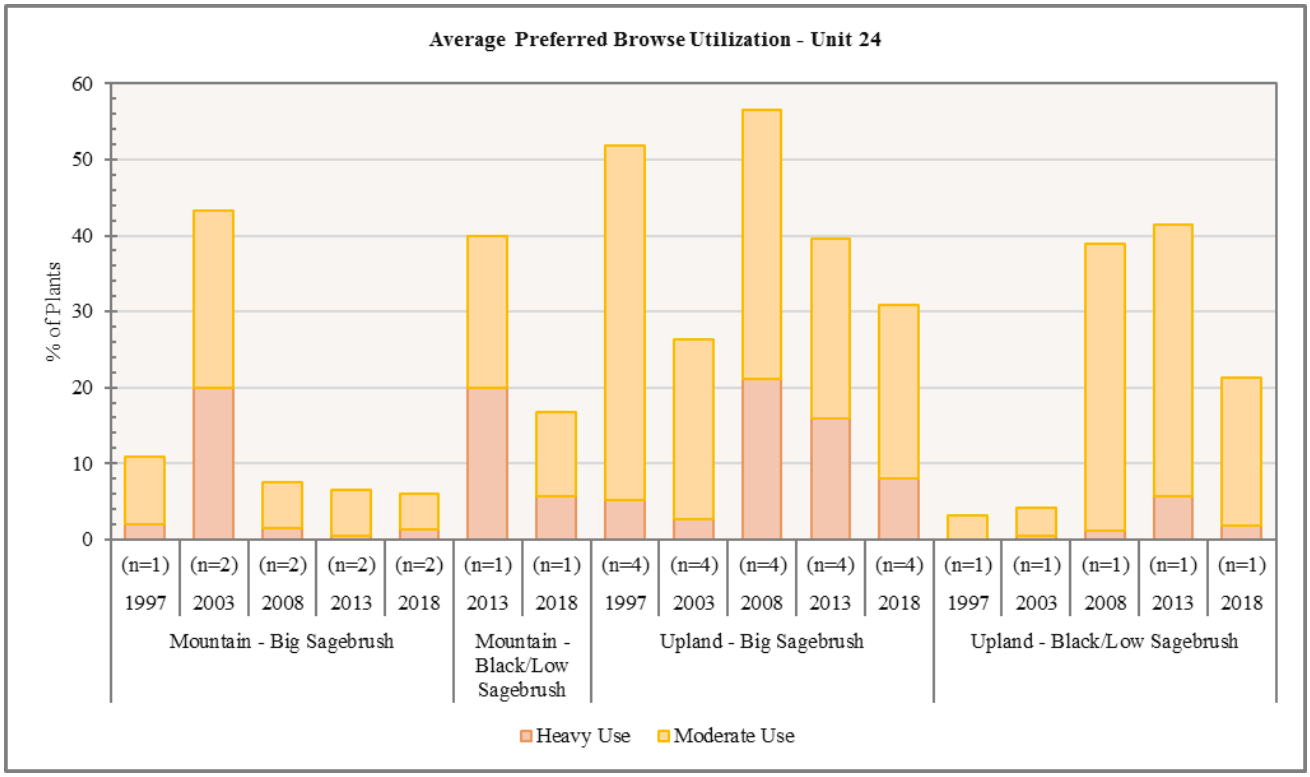


Figure 2.10: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

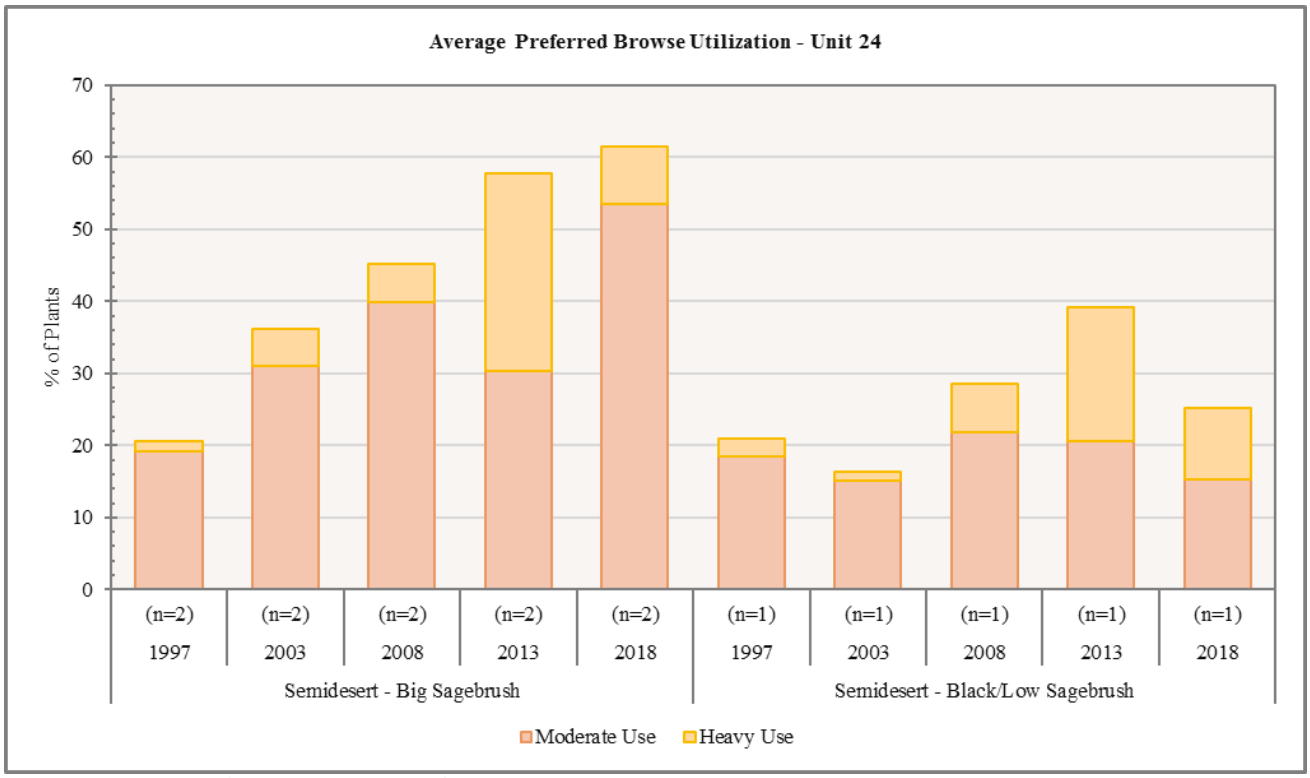


Figure 2.11: Average preferred browse utilization for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

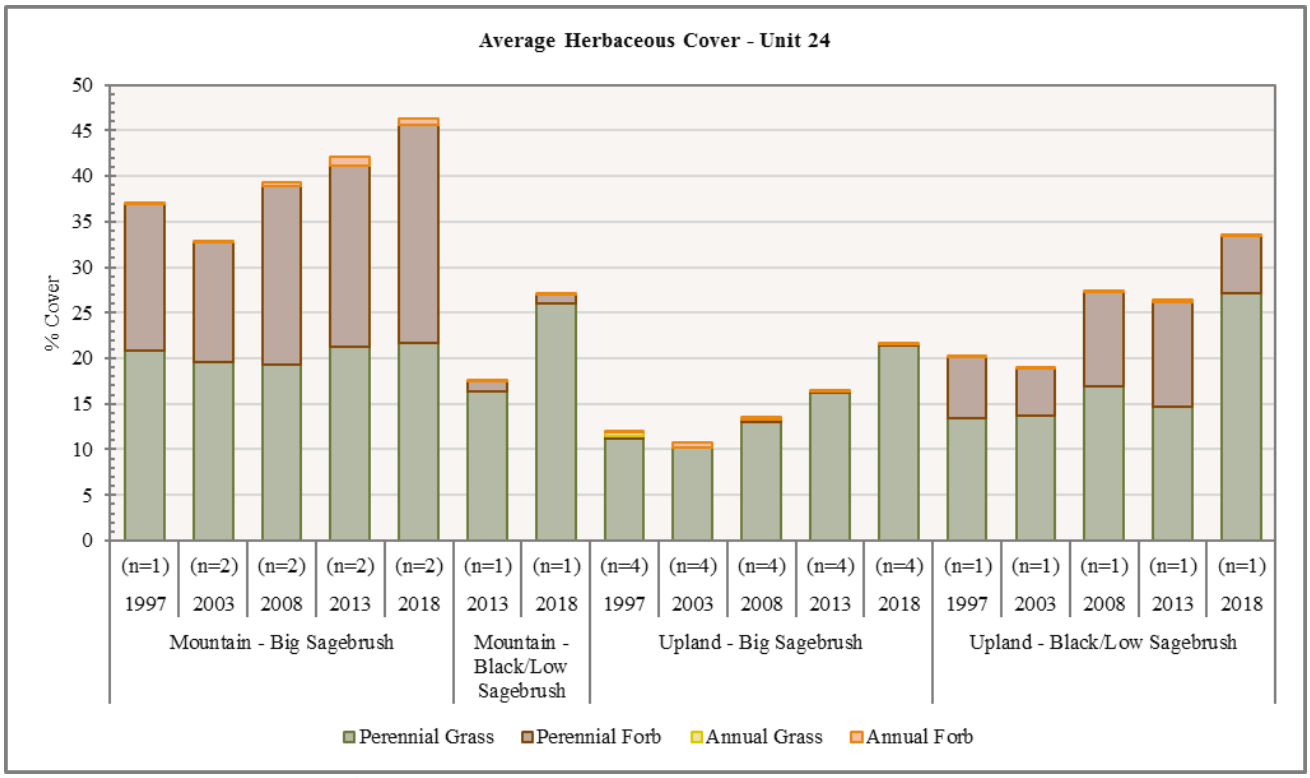


Figure 2.12: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton..

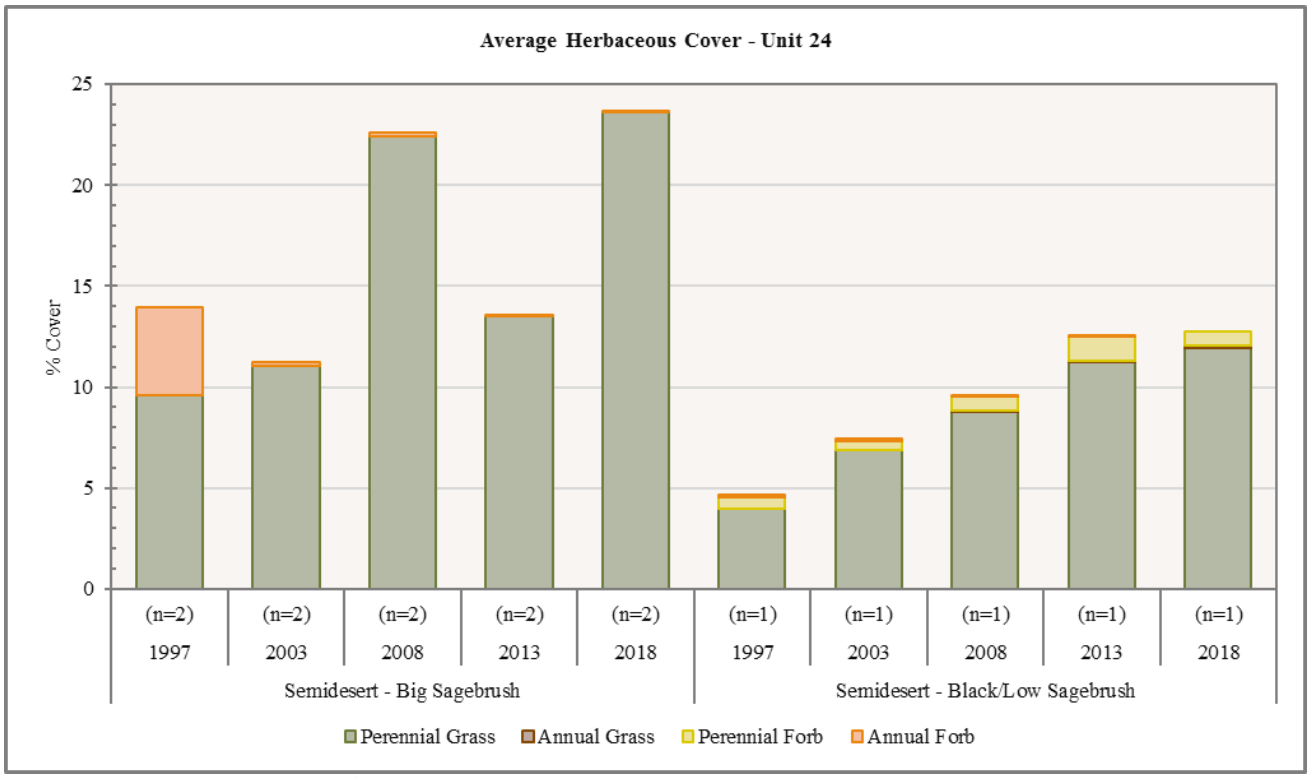


Figure 2.13: Average herbaceous cover for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

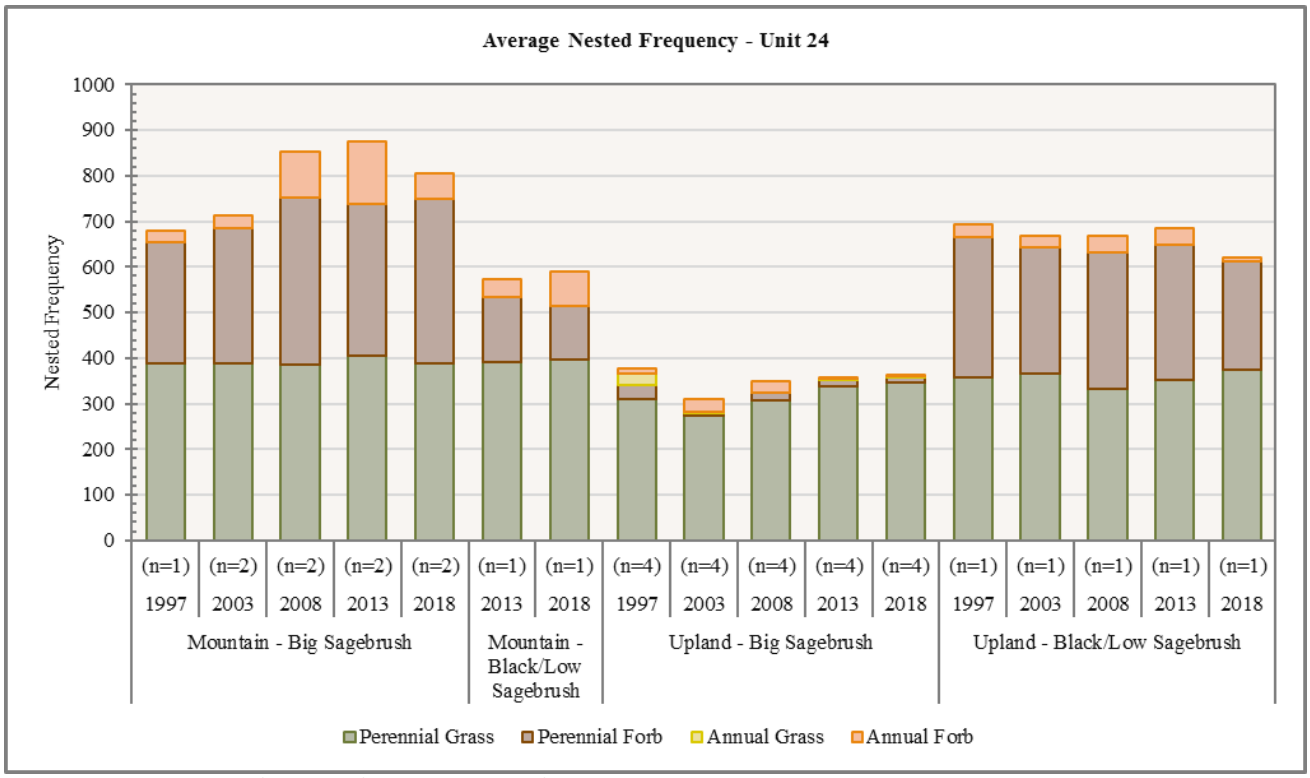


Figure 2.14: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

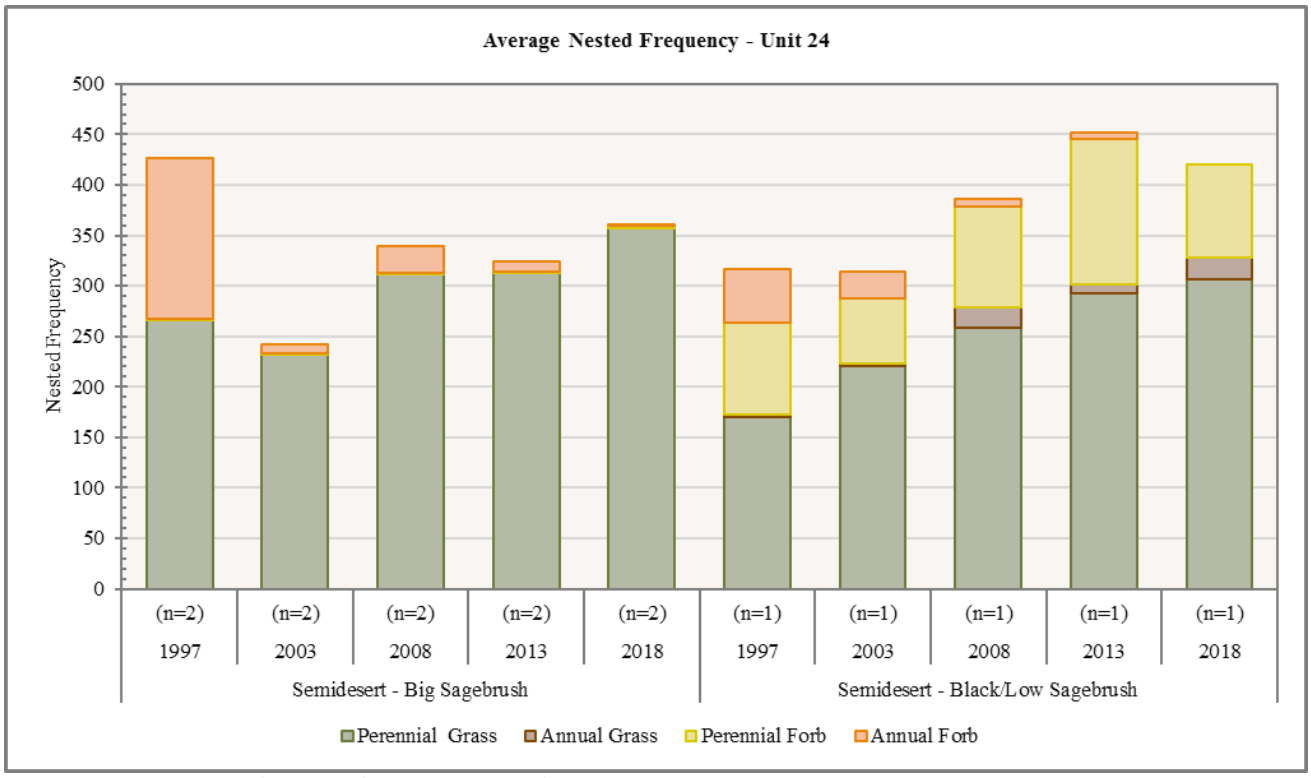


Figure 2.15: Average nested frequency of herbaceous species for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

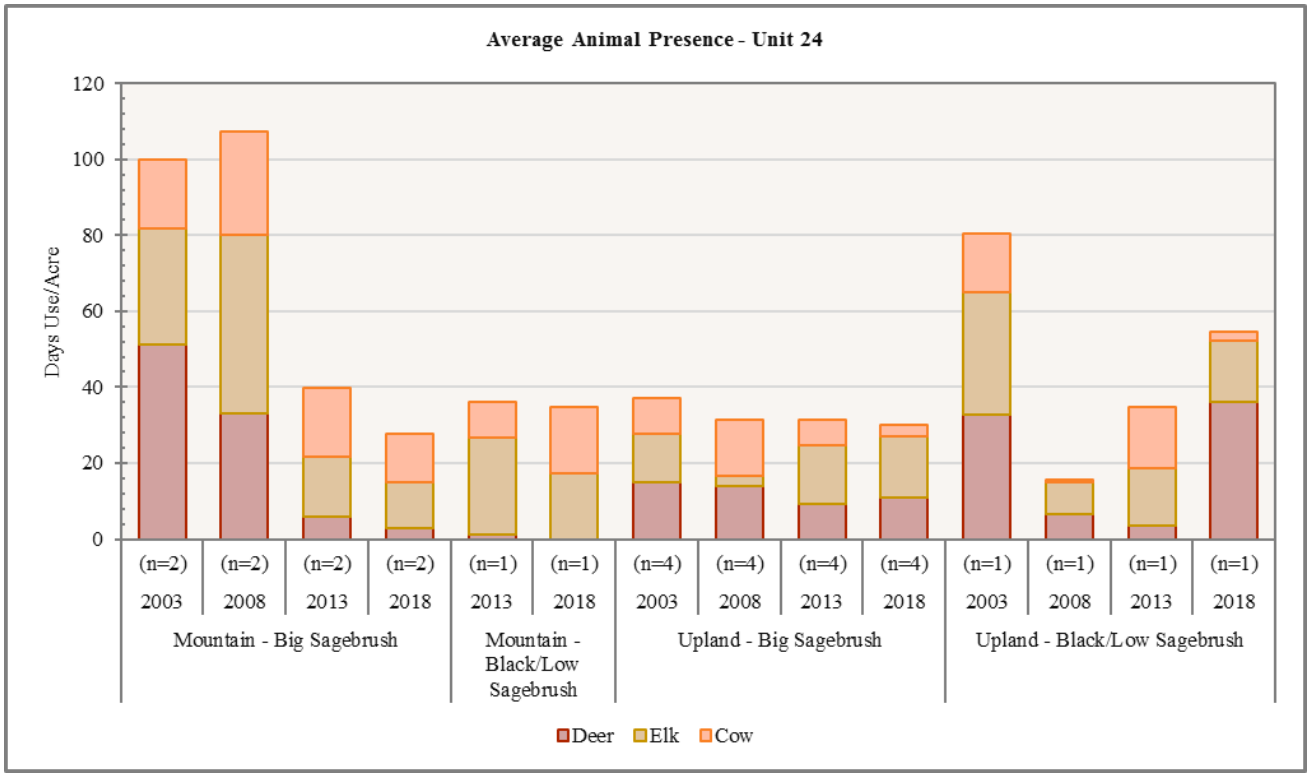


Figure 2.16: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton. Mountain - Big Sagebrush deer pellets include deer/sheep.

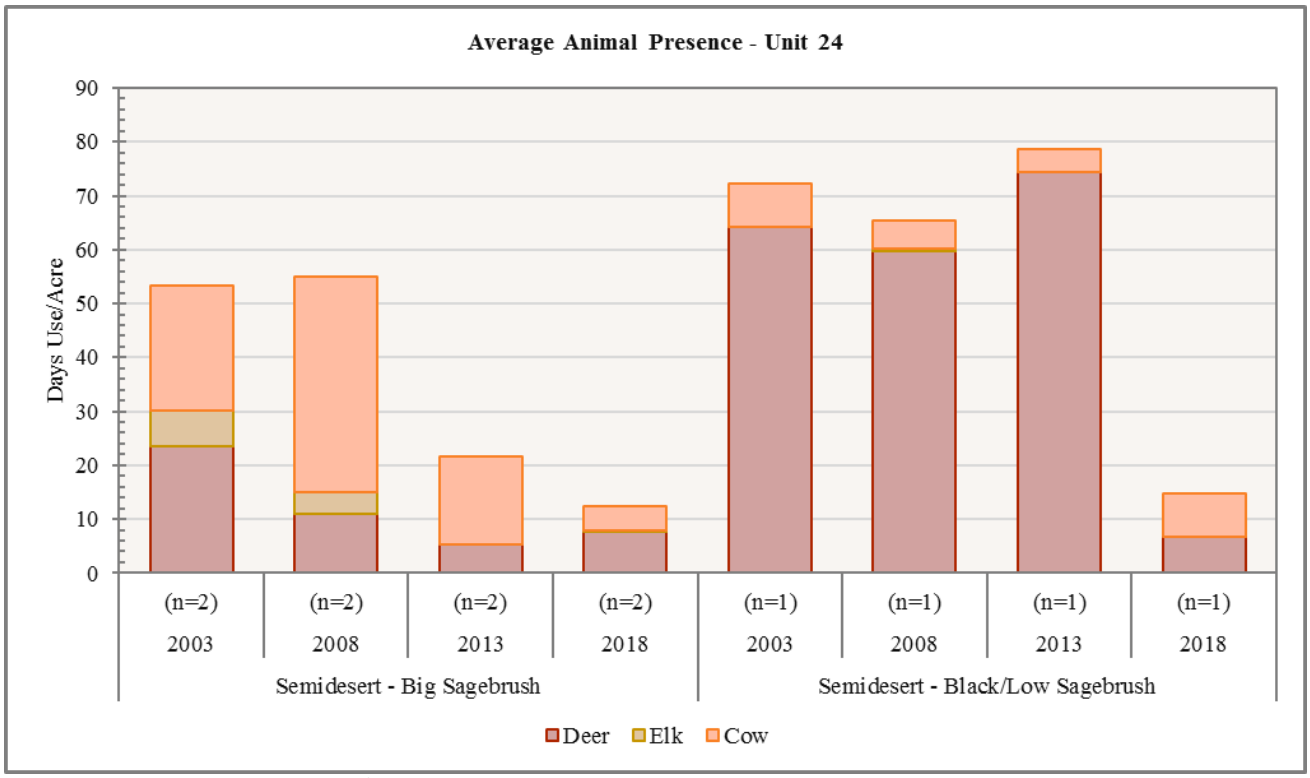


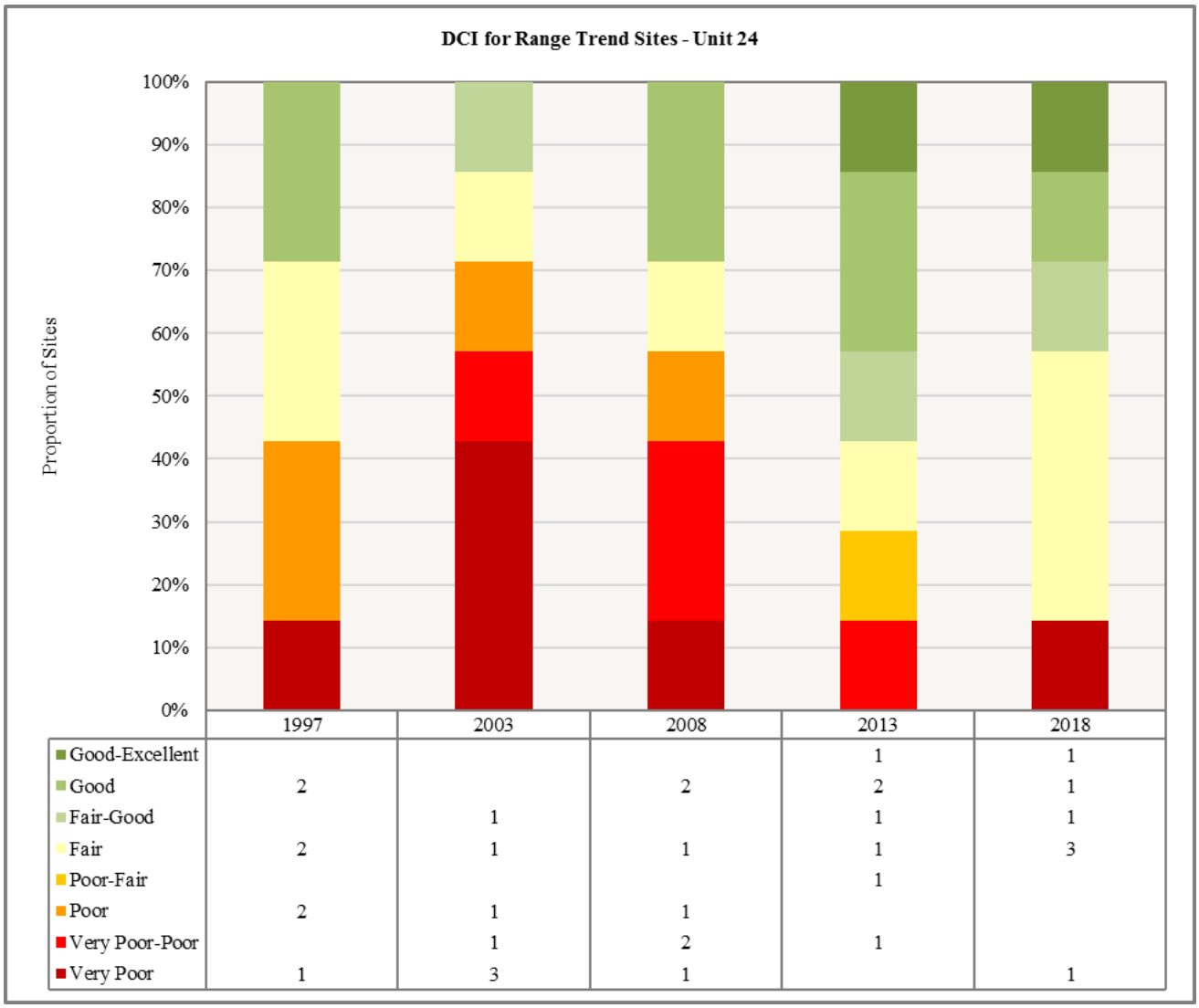
Figure 2.17: Average pellet transect data for Semidesert - Big Sagebrush and Semidesert - Black/Low Sagebrush study sites in WMU 24, Mt. Dutton.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Mt. Dutton management unit has fluctuated on the sites sampled since 1997. As of the 2018 sample year, the active Range Trend sites in the unit are considered to be in very poor to good-excellent condition (**Figure 2.18**,

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
24-01	1997	8	11.5	15	14	0	0	0	**48.6**	**G**
24-01	2003	6.3	0	0	30	0	0.1	0	**36.3**	**F**
24-01	2008	13.4	0.3	3.9	30	0	0	0	**47.5**	**G**
24-01	2013	16.9	10	3.8	30	0	0	0	**60.6**	**G**
24-01	2018	11.4	8.1	15	30	0	0	0	**64.5**	**G-E**
24-02	1997	22.1	10.7	6.4	7.9	0	1.1	0	**48.3**	**G**
24-02	2003	22.6	7.8	0.6	13.8	0	0.9	0	**45.6**	**F-G**
24-02	2008	25.5	3.9	1.8	17.6	0	1.4	0	**50.2**	**G**
24-02	2013	24	10.9	3.4	22.5	0	2.4	0	**63.3**	**G-E**
24-02	2018	14.5	8	3.5	23.9	-0.1	1.4	0	**51.2**	**G**
24-03	1997	17	0.6	1.5	20.4	0	0.1	0	**39.6**	**P**
24-03	2003	12.3	-1.2	0	24.3	0	0	0	**35.3**	**VP-P**
24-03	2008	11.9	-5.7	0.3	30	0	0	0	**36.5**	**VP-P**
24-03	2013	17.1	9.9	9.8	30	0	0	0	**66.8**	**F-G**
24-03	2018	15	8	9.2	30	0	0	0	**62.2**	**F**
24-04	1997	7.7	12.6	13.4	22.6	0	0.5	0	**56.9**	**F**
24-04	2003	6.4	6.2	8.2	16.6	0	0.1	0	**37.4**	**P**
24-04	2008	11.5	10.4	0	25.6	0	0.2	0	**47.7**	**P**
24-04	2013	12.5	13.7	7.3	27	0	0.4	0	**60.9**	**F**
24-04	2018	17.1	12	6.8	30	0	0.6	0	**66.5**	**F-G**
24-07	1997	8.2	4.8	4	22.9	0	1.4	0	**41.2**	**P**
24-07	2003	7.9	-2.8	0.5	24.7	0	0.1	0	**30.4**	**VP**
24-07	2008	13.6	-5.7	1.4	24.8	0	1.2	0	**35.3**	**VP-P**
24-07	2013	10.3	12	15	30	0	0.6	0	**67.9**	**G**
24-07	2018	10	11.9	8.6	30	0	1	0	**61.4**	**F**
24-08	1997	3.5	0	0	24.4	0	0	0	**27.9**	**F**
24-08	2003	0.1	0	0	7	0	0	0	**7.1**	**VP**
24-08	2008	2.3	0	0	30	0	0	0	**32.3**	**F**
24-08	2013	3.3	0	0	23.2	0	0	0	**26.5**	**P-F**
24-08	2018	3.1	0	0	30	0	0	0	**33.1**	**F**
24-12	1997	0.4	0	0	23.5	-1.1	0.1	0	**22.9**	**VP**
24-12	2003	4.3	0	0	16.1	0	0	0	**20.3**	**VP**
24-12	2008	2.6	0	0	17.1	0	0.5	0	**20.2**	**VP**
24-12	2013	2.9	0	0	30	0	0.2	0	**33**	**VP-P**
24-12	2018	2.5	0	0	30	0	0	0	**32.5**	**VP**

Table 2.10). The North Pole Canyon study is in good-excellent condition: perennial grass cover and some preferred browse cover are the reason that this site is in this condition. The Deer Creek Bench is considered to be in good condition. The one site in fair-good condition is the Mud Spring Chaining study. There are three sites classified as being in fair condition: these sites are North Bull Rush, Cow Creek and Prospect Seeding. Finally, there is only one site ranked as very poor which is the Marshall Basin study. Lack of preferred browse and very little perennial forb cover is the reason that this study is classified as being in very poor condition. DCI scores on the unit have generally increased over time.

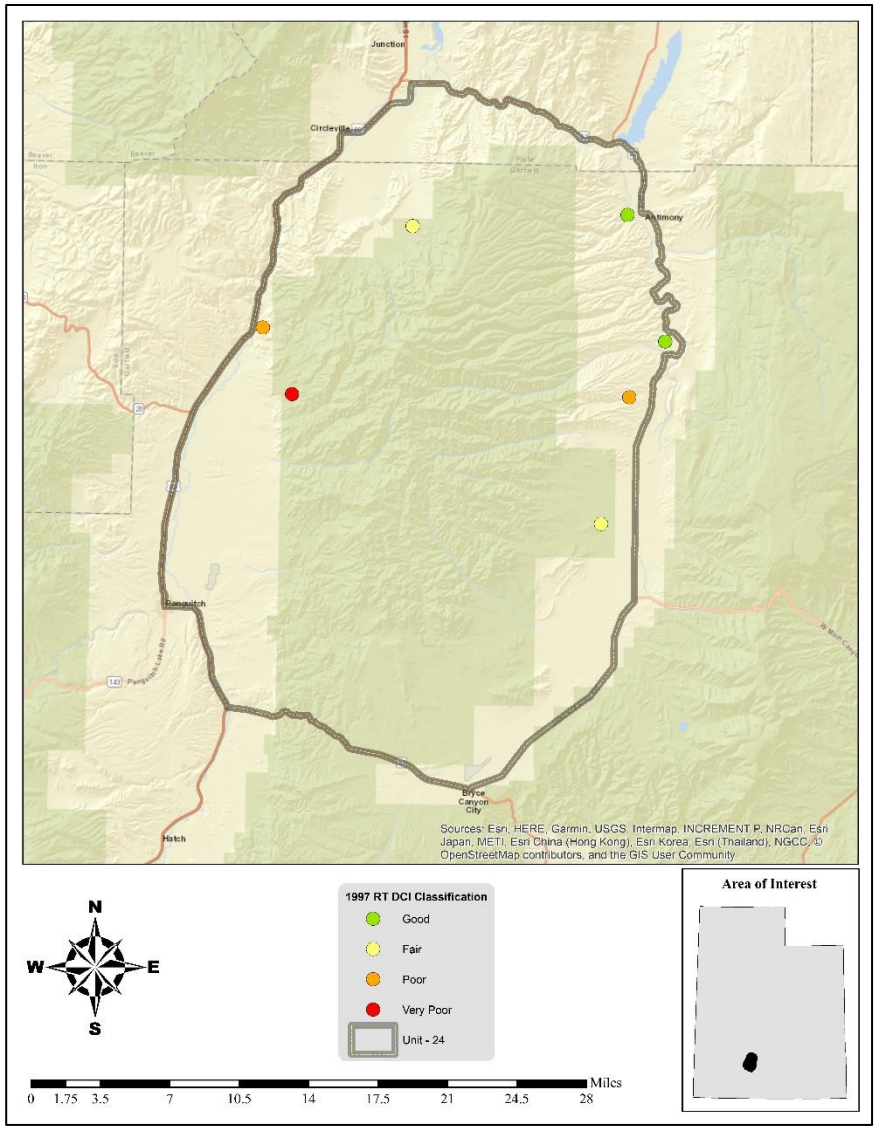


	1997	2003	2008	2013	2018
Good-Excellent				1	1
Good	2		2	2	1
Fair-Good		1		1	1
Fair	2	1	1	1	3
Poor-Fair				1	
Poor	2	1	1		
Very Poor-Poor		1	2	1	
Very Poor	1	3	1		1

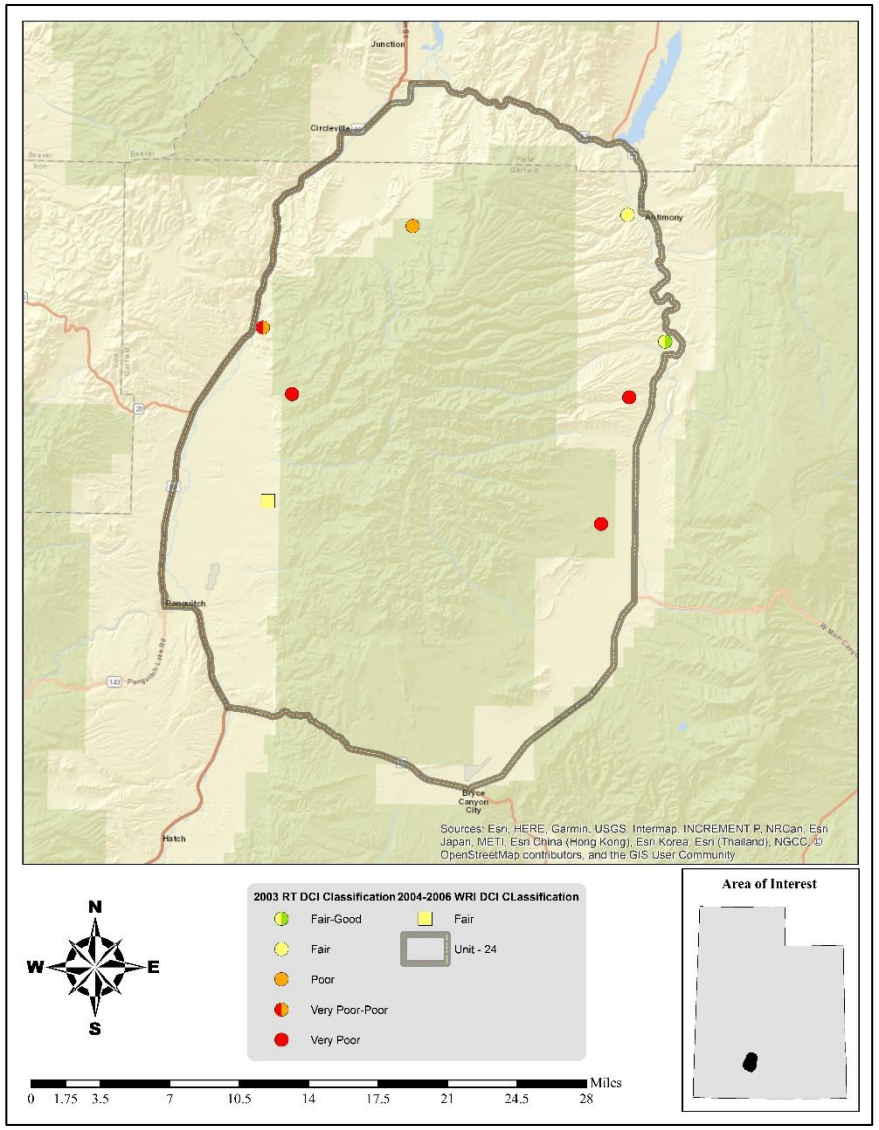
Figure 2.18: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 24, Mt. Dutton.

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
24-01	1997	8	11.5	15	14	0	0	0	**48.6**	**G**
24-01	2003	6.3	0	0	30	0	0.1	0	**36.3**	**F**
24-01	2008	13.4	0.3	3.9	30	0	0	0	**47.5**	**G**
24-01	2013	16.9	10	3.8	30	0	0	0	**60.6**	**G**
24-01	2018	11.4	8.1	15	30	0	0	0	**64.5**	**G-E**
24-02	1997	22.1	10.7	6.4	7.9	0	1.1	0	**48.3**	**G**
24-02	2003	22.6	7.8	0.6	13.8	0	0.9	0	**45.6**	**F-G**
24-02	2008	25.5	3.9	1.8	17.6	0	1.4	0	**50.2**	**G**
24-02	2013	24	10.9	3.4	22.5	0	2.4	0	**63.3**	**G-E**
24-02	2018	14.5	8	3.5	23.9	-0.1	1.4	0	**51.2**	**G**
24-03	1997	17	0.6	1.5	20.4	0	0.1	0	**39.6**	**P**
24-03	2003	12.3	-1.2	0	24.3	0	0	0	**35.3**	**VP-P**
24-03	2008	11.9	-5.7	0.3	30	0	0	0	**36.5**	**VP-P**
24-03	2013	17.1	9.9	9.8	30	0	0	0	**66.8**	**F-G**
24-03	2018	15	8	9.2	30	0	0	0	**62.2**	**F**
24-04	1997	7.7	12.6	13.4	22.6	0	0.5	0	**56.9**	**F**
24-04	2003	6.4	6.2	8.2	16.6	0	0.1	0	**37.4**	**P**
24-04	2008	11.5	10.4	0	25.6	0	0.2	0	**47.7**	**P**
24-04	2013	12.5	13.7	7.3	27	0	0.4	0	**60.9**	**F**
24-04	2018	17.1	12	6.8	30	0	0.6	0	**66.5**	**F-G**
24-07	1997	8.2	4.8	4	22.9	0	1.4	0	**41.2**	**P**
24-07	2003	7.9	-2.8	0.5	24.7	0	0.1	0	**30.4**	**VP**
24-07	2008	13.6	-5.7	1.4	24.8	0	1.2	0	**35.3**	**VP-P**
24-07	2013	10.3	12	15	30	0	0.6	0	**67.9**	**G**
24-07	2018	10	11.9	8.6	30	0	1	0	**61.4**	**F**
24-08	1997	3.5	0	0	24.4	0	0	0	**27.9**	**F**
24-08	2003	0.1	0	0	7	0	0	0	**7.1**	**VP**
24-08	2008	2.3	0	0	30	0	0	0	**32.3**	**F**
24-08	2013	3.3	0	0	23.2	0	0	0	**26.5**	**P-F**
24-08	2018	3.1	0	0	30	0	0	0	**33.1**	**F**
24-12	1997	0.4	0	0	23.5	-1.1	0.1	0	**22.9**	**VP**
24-12	2003	4.3	0	0	16.1	0	0	0	**20.3**	**VP**
24-12	2008	2.6	0	0	17.1	0	0.5	0	**20.2**	**VP**
24-12	2013	2.9	0	0	30	0	0.2	0	**33**	**VP-P**
24-12	2018	2.5	0	0	30	0	0	0	**32.5**	**VP**

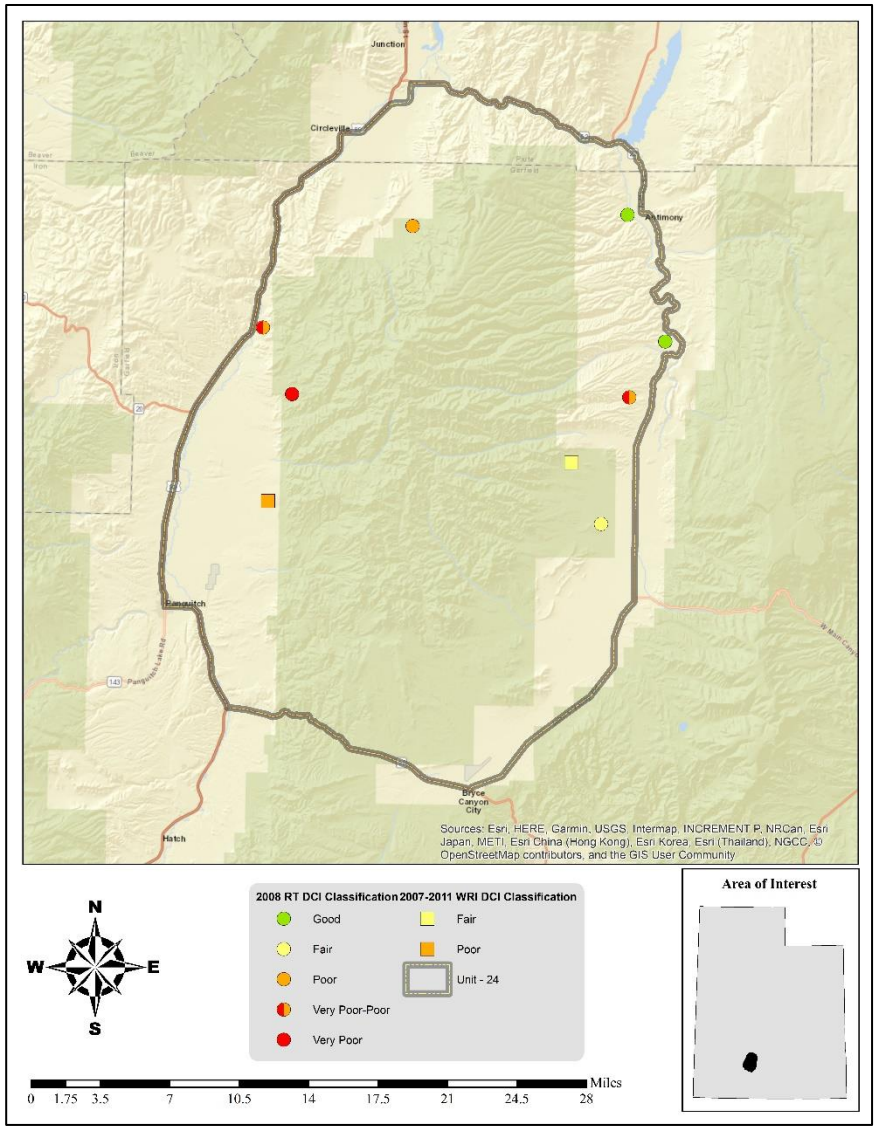
Table 2.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 24, Wasatch Mountains. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



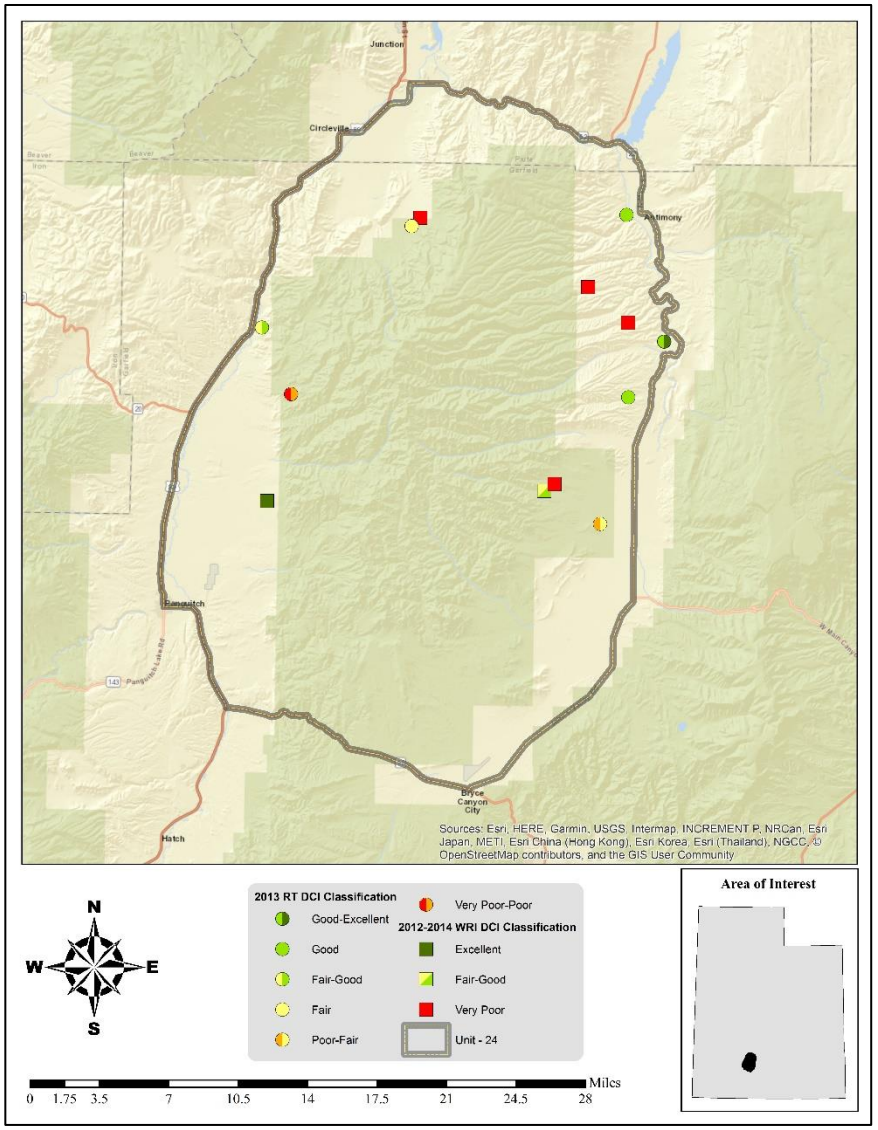
Map 2.9: 1997 Desirable Components Index (DCI) ranking distribution by study site for WMU 24., Mt. Dutton.



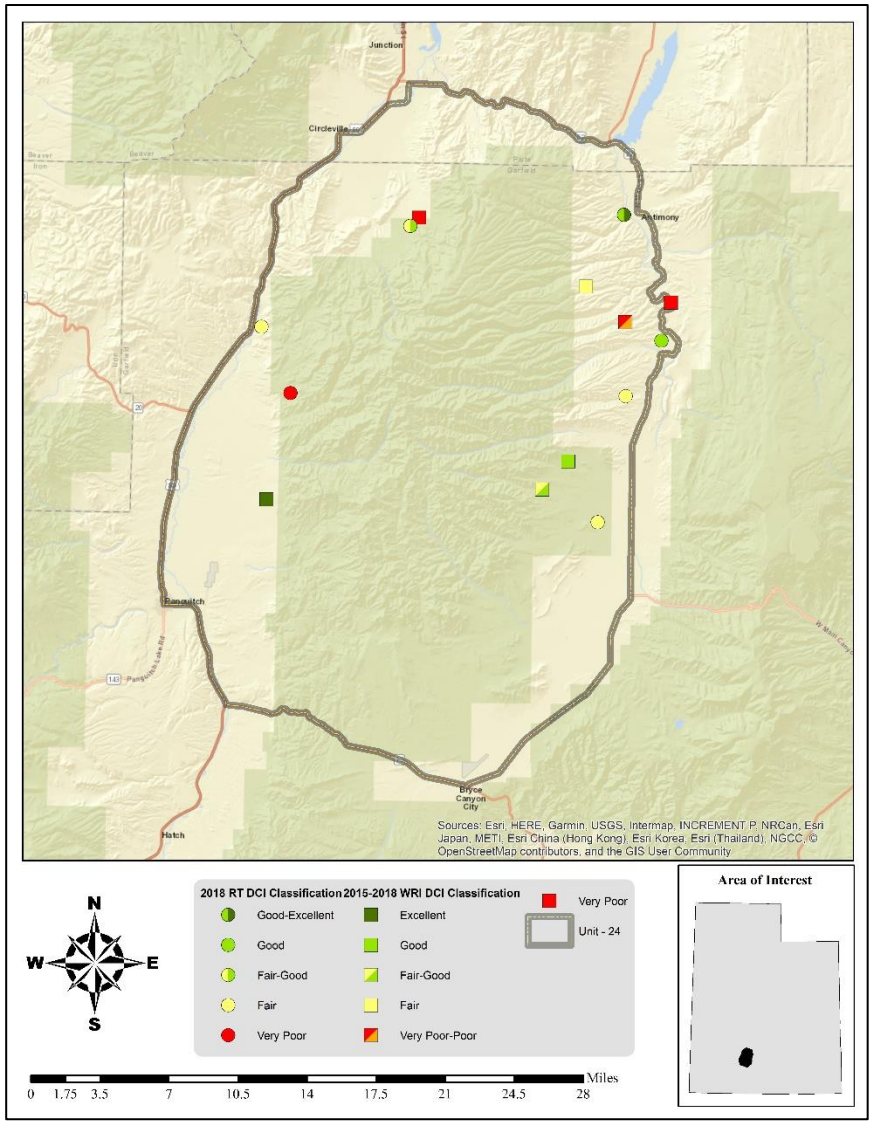
Map 2.10: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 24, Mt. Dutton.



Map 2.11: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 24, Mt. Dutton.



Map 2.12: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 24, Mt. Dutton.



Map 2.13: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 24, Mt. Dutton.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
24-01	North Pole Canyon	None Identified		
24-02	Deer Creek Bench	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
24-03	North Bull Rush	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
24-04	Mud Spring Chaining	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24-06	Table Mountain	None Identified		
24-07	Cow Creek	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24-08	Prospect Seeding	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
24-09	Mud Spring	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24-12	Marshall Basin	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24-13	Jones Corral	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
24-14	Pine Canyon	None Identified		
24R-01	Sanford	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Conifer Encroachment	Medium	Reduced understory shrub, aspen stand, and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-06	Panguitch East Bench Harrow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-08	Johns Valley	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-09	Johns Valley 2	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-10	Antimony Lop and Scatter	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
24R-11	Antimony PJ Reduction	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-13	Circleville	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
24R-14	Black Canyon WMA	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species

Table 2.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 24, Mt. Dutton. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are within the Mountain (Big Sagebrush) ecological type are considered to be deer and elk summer range within the Mount Dutton management unit. These communities support grass, forb, and shrub populations that provide valuable summer forage for wildlife. Introduced perennial grasses pose a moderate threat on the Jones Corral study site. These grasses can be aggressive at higher elevation and are capable of reducing the diversity and abundance of other more desirable native grass and forb species.

Treatments to reduce aggressive perennial grasses could eventually be needed in some areas if a lack of diversity in the plant community becomes a concern. 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 site that is considered to be of the Mountain (Black Sagebrush) ecological type range is considered to be deer summer range on this unit. This community type supports grass and forbs populations that provide forage for wildlife. No threats were found on this study site.

Upland (Big Sagebrush)

The studies within the Upland (Big Sagebrush) communities range from being in very poor to fair-good condition for deer winter range. Study sites of this ecological type support plant communities which provide valuable browse for wildlife in the winter months, primarily mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Annual grasses are present on the sites (except Mud Spring Chaining) in varying amounts and may be of concern because of the increased risk of wildfire. In addition, all sites except North Bull Rush are host to introduced perennial grasses. While they provide forage, introduced perennial grasses can be aggressive and reduce the prevalence and abundance of other more desirable native grasses and forbs. Conifer encroachment is occurring on all sites except for North Bull Rush and it is likely that these tree stands will progress through woodland succession without future treatment.

Treatment to reduce annual grasses may be necessary in some areas if cover increases significantly. Treatments for aggressive introduced perennial grasses could be needed to restore diversity on sites. In addition, sites with significant encroachment may require conifer-reducing treatments in the future (e.g. bullhog, chaining, lop and scatter, etc.) if density and cover increase. When reseeding is necessary to restore native species, care should be taken in species selection and preference given to native species when possible.

Upland (Black/Low Sagebrush)

The study that is classified as an Upland (Black/Low Sagebrush) ecological site is considered to be deer summer habitat within the Mt. Dutton management unit. This community type supports black sagebrush (*Artemisia nova*) as well as a diverse forb and grass understory which can provide forage and browse for wildlife. Conifer encroachment is occurring on the study site and it is likely that it will continue to progress through woodland succession without treatment.

Locations with significant encroachment may require conifer-reducing treatments in the future (e.g. bullhog, chaining, lop and scatter, etc.) if density and cover increase. If reseeding is needed to restore the herbaceous community on this study site specifically, care should be taken in seed selection and preference should be given to native species when possible.

Semidesert (Big Sagebrush)

The studies that are considered to be Semidesert (Big Sagebrush) are classified as being in fair to good-excellent condition for deer winter range. These sites supports shrub species, primarily mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), which provide browse for wildlife. Introduced perennial grasses are present on the Prospect Seeding site. Although they help provide competition against annual grasses, these grasses may have the potential to reduce the abundance of more desirable native grass and forb species.

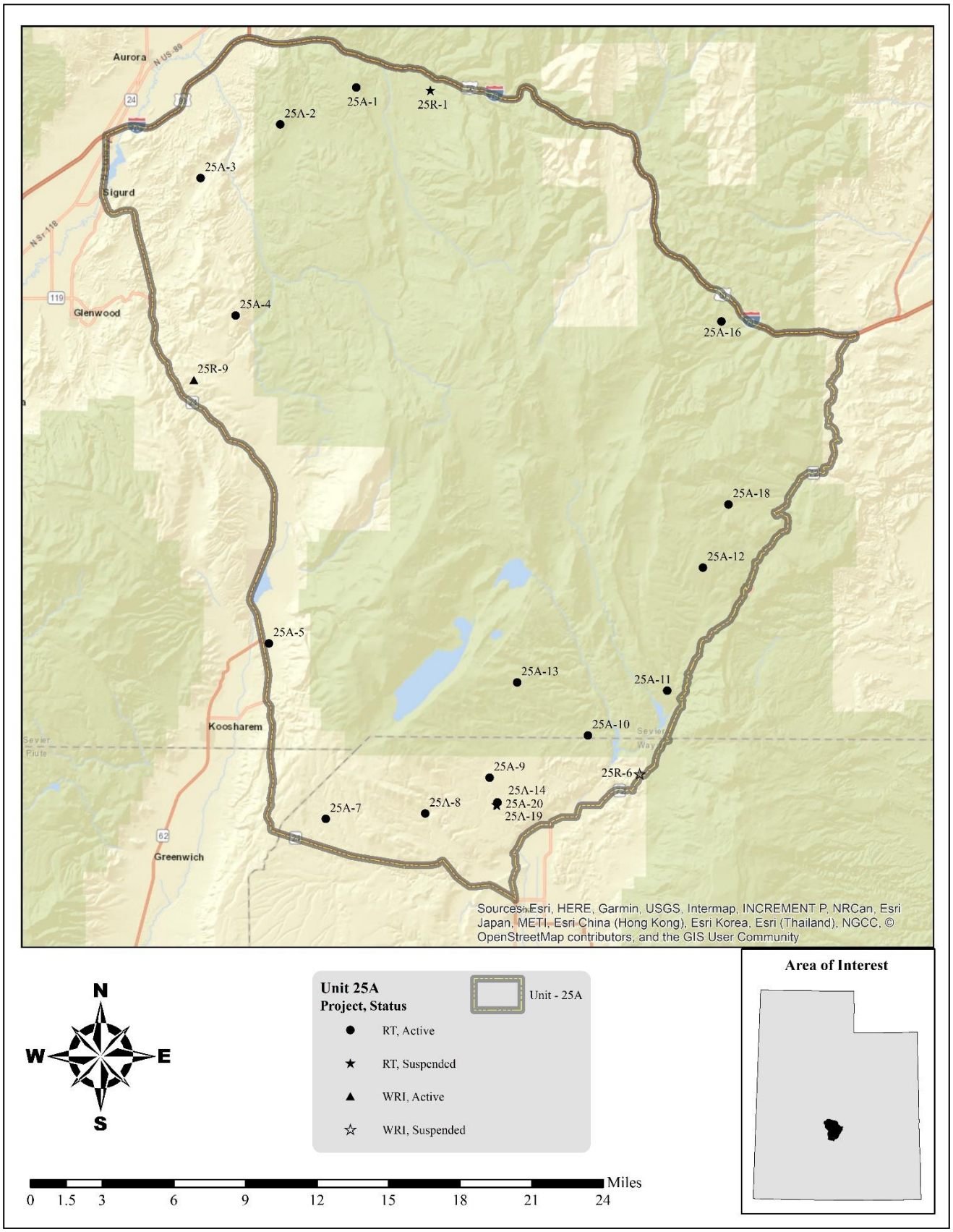
Treatments for aggressive introduced perennial grasses could be needed to restore diversity on these sites. When reseeding is necessary to restore native species, care should be taken in species selection and preference given to native species when possible.

Semidesert (Black/Low Sagebrush)

The study that is classified as a Semidesert (Black/Low Sagebrush) ecological site is considered to be in good condition for deer winter range habitat on this unit. This study site supports shrub populations that provide browse for wildlife in the winter months. Annual grasses have been observed on this site in low amounts: increased amounts of cheatgrass can increase fuel loads and raise the potential for wildfire.

Treatments to reduce annual grass might be necessary if higher levels of annual grasses occur in the future on this study site. If reseeding is necessary to restore the herbaceous community, care should be taken in seed selection and preference should be given to native species when possible.

3. WILDLIFE MANAGEMENT UNIT 25A – FISHLAKE PLATEAU



WILDLIFE MANAGEMENT UNIT 25A – FISHLAKE PLATEAU

Boundary Description

Sevier, Piute, and Wayne counties - Boundary begins at SR-24 and US-89 at Sigurd; south on SR-24 to SR-72 at Loa; north on SR-72 to I-70; west on I-70 to US-89; south on US-89 to SR-24.

Management Unit Description

Geography

The Fishlake Plateau Wildlife Management unit is part of the larger management unit 25 - Plateau. Unit 25 is divided into three sub-units: Fishlake Plateau (25A), Thousand Lakes Plateau (25B), and Boulder Plateau (25C).

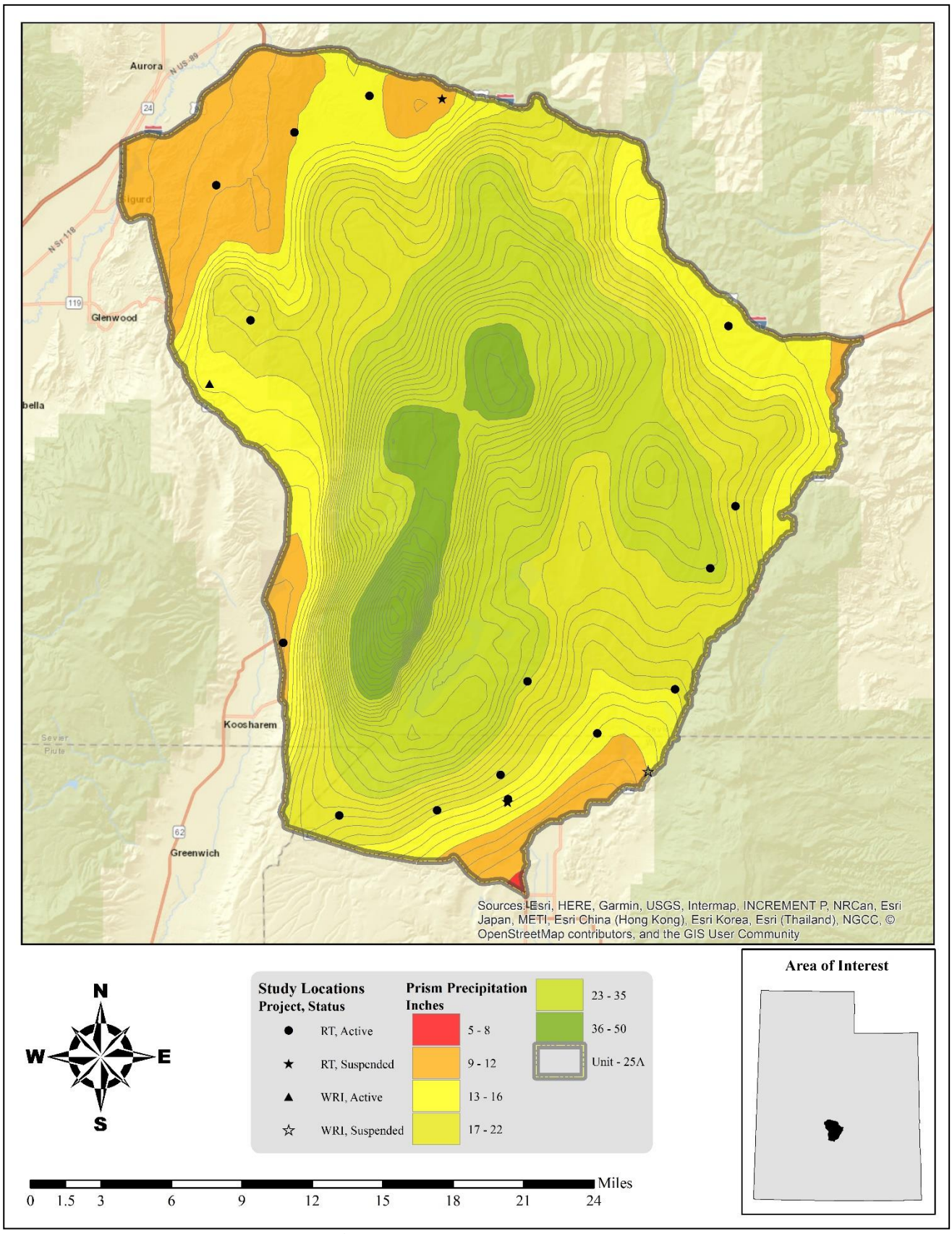
The Fishlake Plateau unit includes the Fish Lake Mountains and the associated drainages: Otter Creek to the west and the Fremont River with its major tributaries, 7-mile Creek and UM Creek to the east. Some steep, relatively rough areas exist in the drainage heads along the northwestern side, but most of the unit is an inclined, rolling plateau. Elevation ranges from 11,600 feet on the Fish Lake Hightop Plateau to 5,200 feet near Sigurd. Towns in this area include Fremont and Sigurd.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches in the southeast portion of the unit near Loa to 48 inches on the high-elevation peak of the Fish Lake Hightop Plateau. All of the Range Trend and WRI monitoring studies on the unit occur within 11-23 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 South Central division (Division 4).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 3.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 3.1b**) (Time Series Data, 2019).



Map 3.1: The 1981-2010 PRISM Precipitation Model for WMU 25A, Fishlake Plateau (PRISM Climate Group, Oregon State University, 2013).

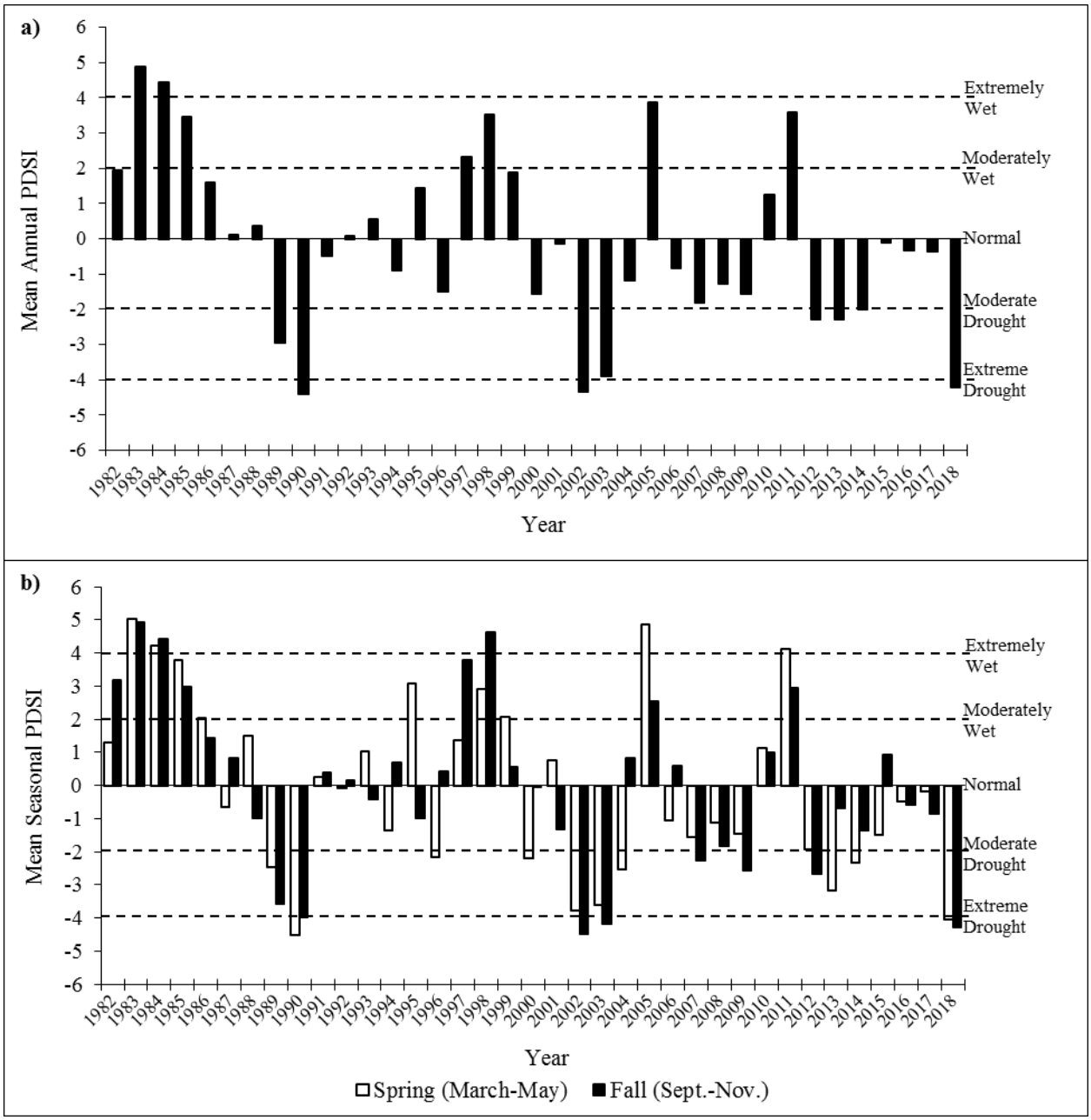
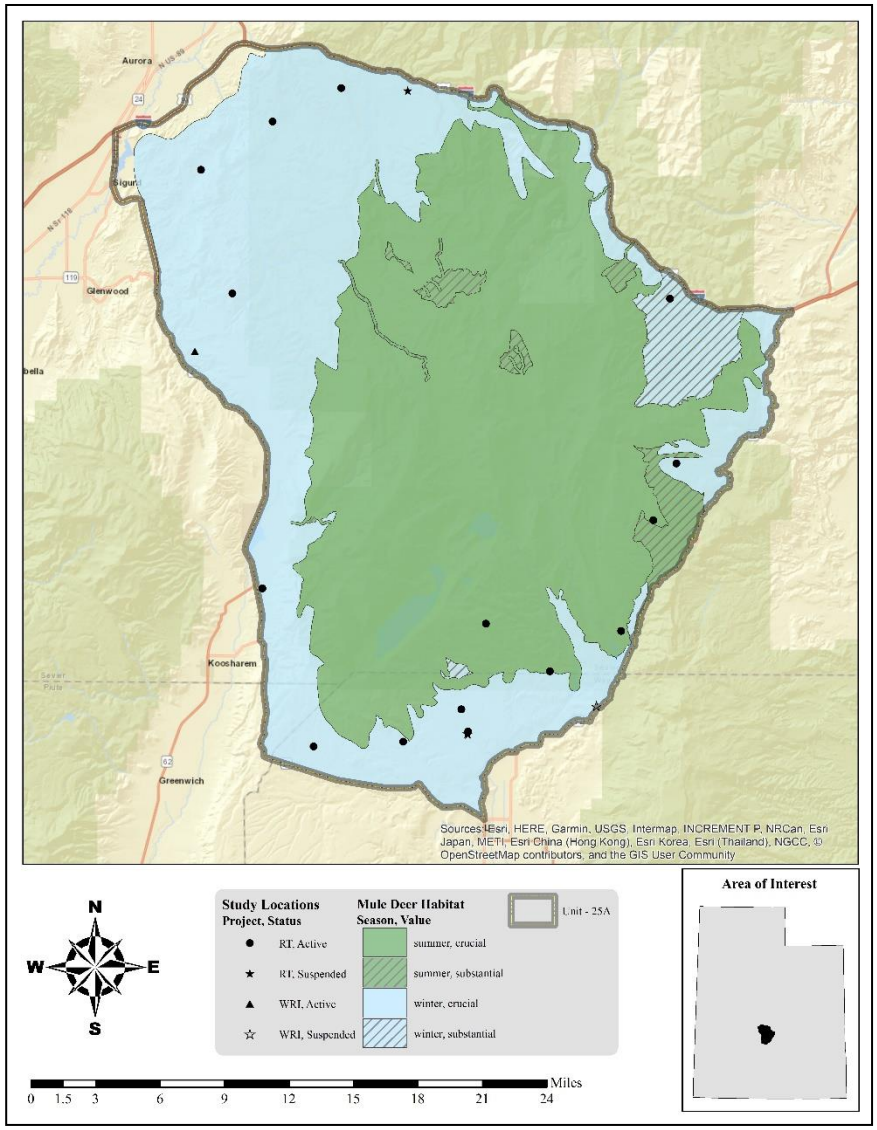


Figure 3.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

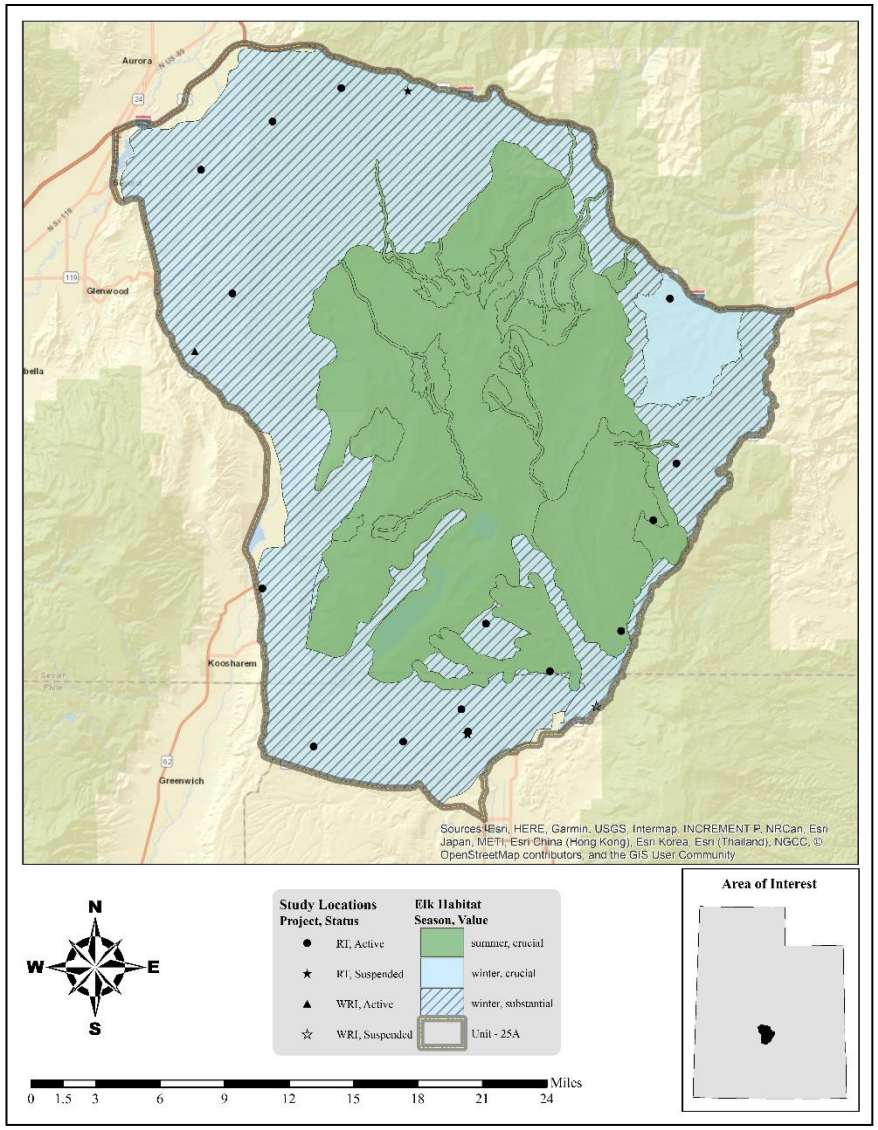
Big Game Habitat

An estimated 428,775 acres are classified as deer range on 25A with 44% classified as winter range and 56% as summer range (**Table 3.1**, **Map 3.2**). The United States Forest Service administers 47% of the winter range, 28% is managed by the Bureau of Land Management (BLM), 16% is privately held, 8% is managed by the School and Institutional Trust Lands Administration (SITLA), and the Paiute Indian Tribe of Utah, Utah Department of Transportation (UDOT), and Utah Division of Wildlife Resources (UDWR) each manage less than 1%. (**Table 3.2**, **Map 3.2**, **Map 3.6**). Of the elk winter range, 54% is managed by the USFS, 25% is administered by the BLM, 15% is privately held, 6% is managed by SITLA, and UDOT and UDWR each administer less than 1% (**Table 3.3**, **Map 3.3**, **Map 3.6**).

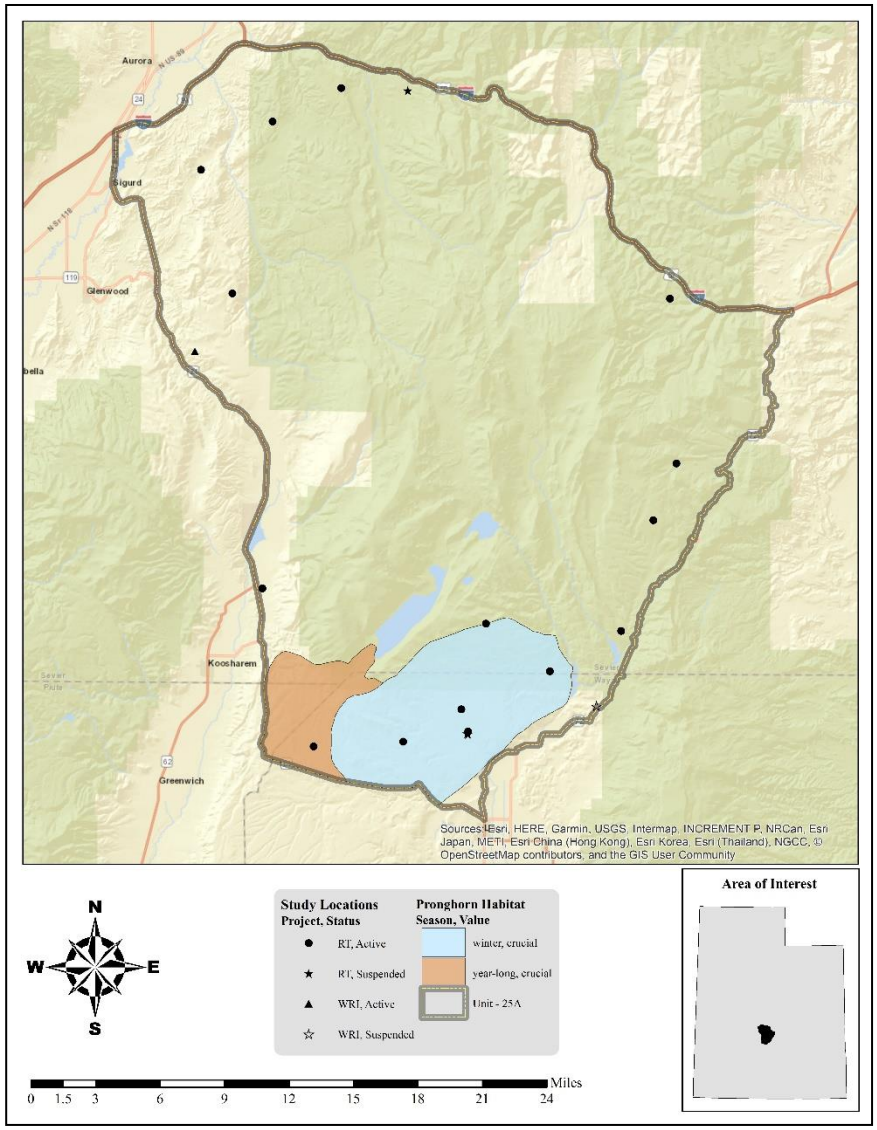
The northern two-thirds of the unit include the high elevation Fish Lake Mountains which constitute summer range for deer and elk. Winter range is primarily confined to the lower elevations of the northern third of the unit and the sagebrush benches on the west side above Highway 24. Antelope are also present and are normally found in the more open areas of the deer and elk winter range. Excessive accumulations of snow during severe winters confine deer below the 8,600-foot contour. Pinyon-juniper on both normal and severe wintering areas provide extremely important protective cover for elk and deer, while the closely associated sagebrush type produces the bulk of the required forage.



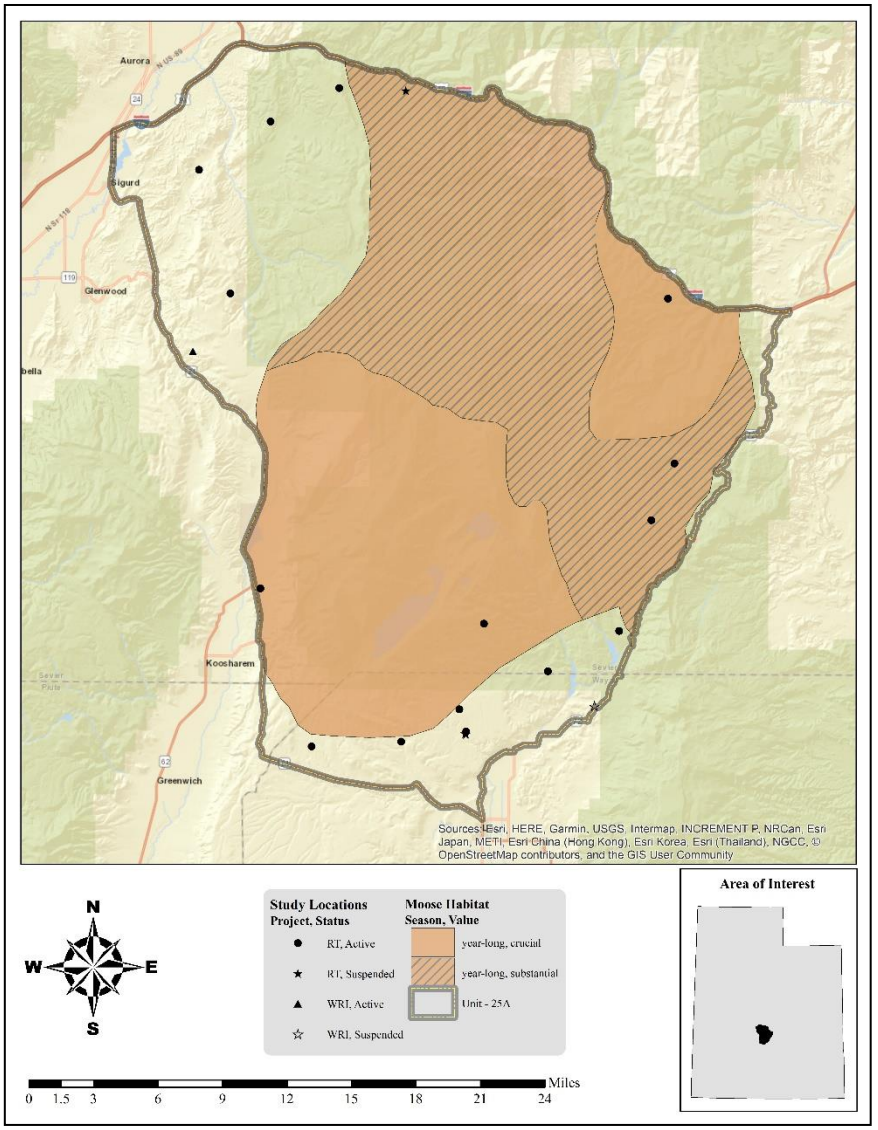
Map 3.2: Estimated mule deer habitat by season and value for WMU 25A, Fishlake Plateau.



Map 3.3: Estimated elk habitat by season and value for WMU 25A, Fishlake Plateau.



Map 3.4: Estimated pronghorn habitat by season and value for WMU 25A, Fishlake Plateau.



Map 3.5: Estimated moose habitat by season and value for WMU 25A, Fishlake Plateau.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	241,175	56%	187,580	44%	0	0%
Elk	187,492	44%	238,416	56%	0	0%
Pronghorn	0	0%	37,728	75%	12,855	25%
Moose	0	0%	0	0%	305,011	100%

Table 3.1: Estimated mule deer, elk, pronghorn, and moose habitat acreage by season for WMU 25A, Fishlake Plateau.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	5,507	2%	53,202	28%
Private	36,516	15%	30,398	16%
SITLA	63	<1%	14,838	8%
Tribal	0	0%	50	<1%
USFS	199,089	83%	88,983	47%
UDOT	0	0%	73	<1%
UDWR	0	0%	37	<1%
Total	241,175	**100%**	187,580	**100%**

Table 3.2: Estimated mule deer habitat acreage by season and ownership for WMU 25A, Fishlake Plateau.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	13	<1%	60,012	25%
Private	27,627	15%	35,404	15%
SITLA	0	0%	14,900	6%
USFS	159,853	85%	128,007	54%
UDOT	0	0%	73	<1%
UDWR	0	0%	19	<1%
Total	187,492	**100%**	238,416	**100%**

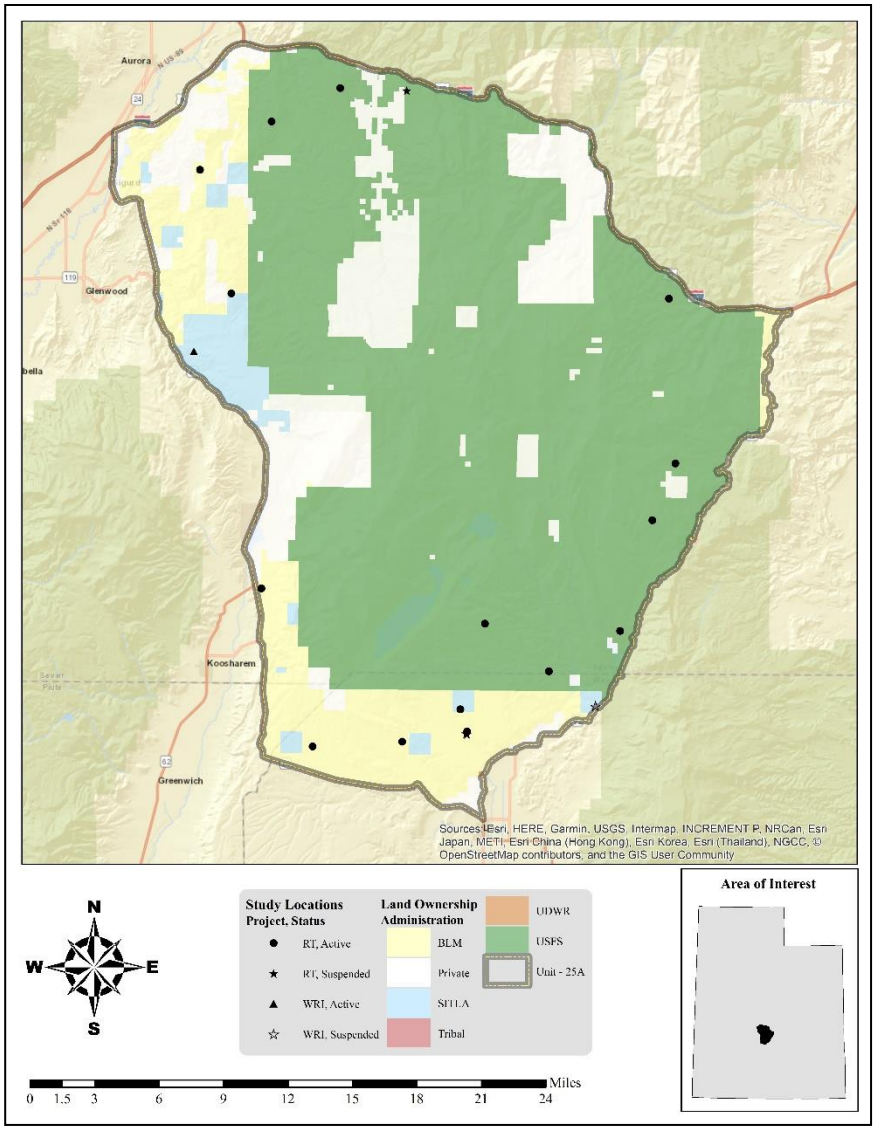
Table 3.3: Estimated elk habitat acreage by season and ownership for WMU 25A, Fishlake Plateau.

	Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	23,040	61%	8,791	68%
Private	110	<1%	1,213	9%
SITLA	1,286	3%	719	6%
USFS	13,292	35%	2,132	17%
UDWR	<1	<1%	0	0%
Total	37,728	**100%**	12,855	**100%**

Table 3.4: Estimated pronghorn habitat acreage by season and ownership for WMU 25A, Fishlake Plateau.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	15,930	5%
Private	53,293	17%
SITLA	1,788	1%
Tribal	50	<1%
USFS	233,930	77%
UDOT	20	<1%
Total	305,011	**100%**

Table 3.5: Estimated moose habitat acreage by season and ownership for WMU 25A, Fishlake Plateau.



Map 3.6: Land ownership for WMU 25A, Fishlake Plateau.

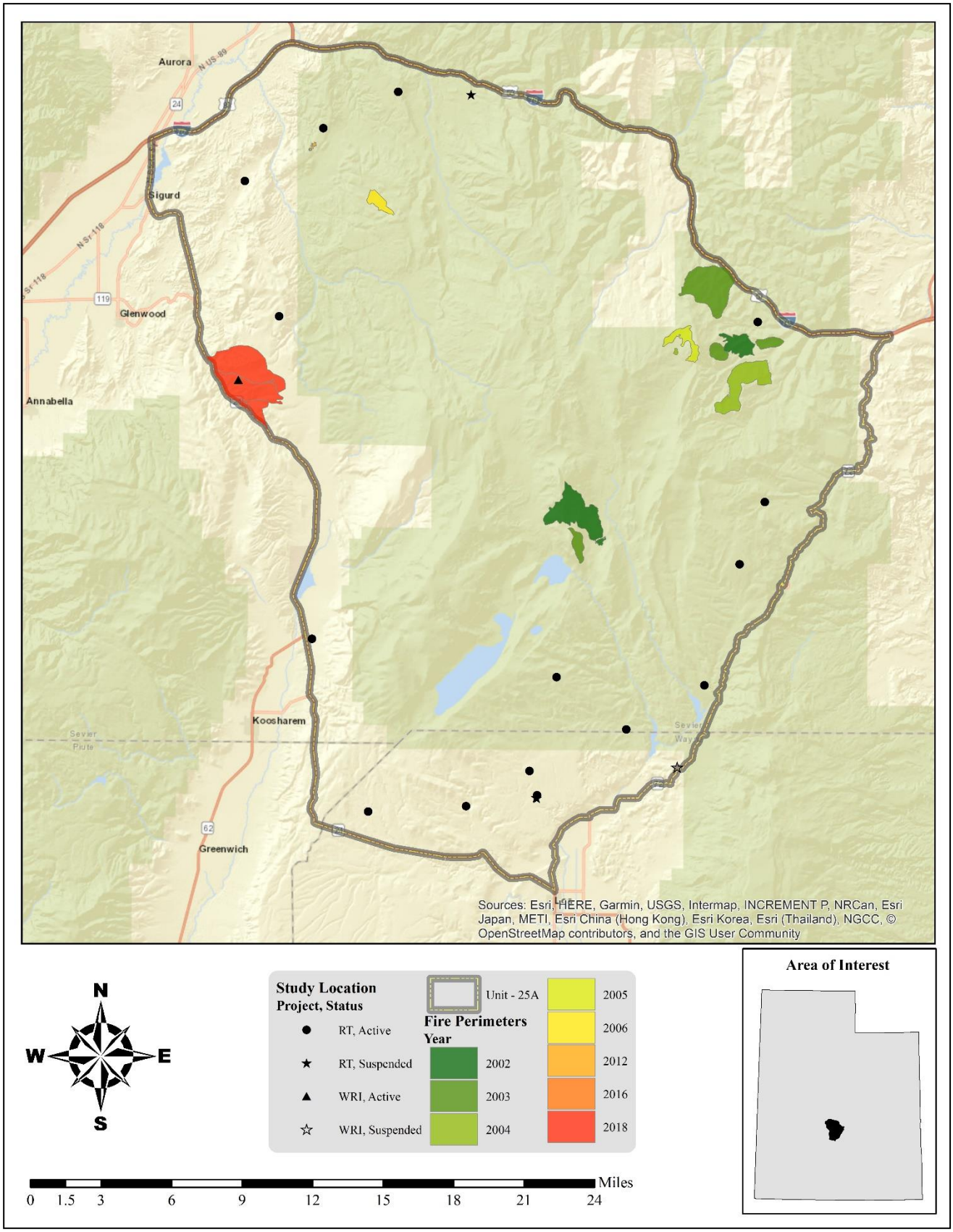
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	109,533	25.70%	
	Spruce-Fir Forest and Woodland	32,470	7.62%	
	Mountain Mahogany Woodland and Shrubland	14,788	3.47%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	5,458	1.28%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	700	0.16%	
	Ponderosa Pine Forest, Woodland and Savanna	374	0.09%	
	Limber Pine Woodland	165	0.04%	
	Lodgepole Pine Forest and Woodland	7	0.00%	38.36%
Exotic Herbaceous	Introduced Annual Grassland	6,801	1.60%	1.60%
Grassland	Alpine Dwarf-Shrubland, Fell-field and Meadow	9,376	2.20%	
	Grassland	5,171	1.21%	
	Dry Tundra	1	0.00%	3.41%
Shrubland	Low Sagebrush Shrubland and Steppe	50,970	11.96%	
	Big Sagebrush Shrubland and Steppe	29,365	6.89%	
	Deciduous Shrubland	11,467	2.69%	
	Desert Scrub	10,176	2.39%	
	Chaparral	1,455	0.34%	
	Salt Desert Scrub	1,354	0.32%	
	Greasewood Shrubland	1,276	0.30%	
	Other Shrubland	496	0.12%	25.00%
Other	Hardwood	62,146	14.58%	
	Conifer-Hardwood	43,498	10.21%	
	Sparsely Vegetated	9,174	2.15%	
	Developed	8,348	1.96%	
	Riparian	4,550	1.07%	
	Open Water	3,786	0.89%	
	Barren	2,249	0.53%	
	Agricultural	696	0.16%	
	Quarries-Strip Mines-Gravel Pits	347	0.08%	
	Snow-Ice	12	0.00%	31.63%
Total		426,209	100%	100%

Table 3.6: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 25A, Fishlake Plateau.

Limiting Factors to Big Game Habitat

According to the current LANDFIRE Existing Vegetation Coverage model, just over 25% of the unit is comprised of pinyon-juniper woodlands. While these woodlands provide valuable escape and thermal cover for wildlife, encroachment and invasion into historic shrublands reduces available browse (Miller, Svejcar, & Rose, 2000) and may thereby decrease the carrying capacity of the unit.

In addition, annual grasslands primarily composed of cheatgrass (*Bromus tectorum*) comprise a small proportion of the deer winter range and pose a minimal threat to the resilience of the plant communities on this unit (**Table 3.6**). Increased amounts of cheatgrass also increase fuel loads, potentially exacerbating the risk of catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 3.7: Land coverage of fires by year from 2000-2018 for WMU 25A, Fishlake Plateau (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

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 17,874 acres of land have been treated within the Fishlake Plateau unit since the WRI was implemented in 2004 (**Map 3.8**). An additional 18,960 are currently being treated and treatments are proposed for a further 2,318 acres. Treatments frequently overlap one another bringing the total completed treatment acres for this unit to 39,152 acres (

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,421**	**3,106**	**0**	**0**	**4,527**
Ely (One-Way)	526	3,106	0	0	3,632
Ely (Two-Way)	896	0	0	0	896
Bullhog	**574**	**2,033**	**0**	**754**	**3,361**
Full Size	0	0	0	754	754
Skid Steer	574	2,033	0	0	2,607
Chain Harrow	**3,337**	**0**	**0**	**62**	**3,399**
≤15 ft. (Two-Way)	0	0	0	62	62
>15 ft. (Two-Way)	3,337	0	0	0	3,337
Forestry Practices	**52**	**0**	**0**	**0**	**52**
Clearcutting	52	0	0	0	52
Harrow	**8,922**	**0**	**0**	**0**	**8,922**
≤15 ft. (Two-Way)	4,566	0	0	0	4,566
>15 ft. (One-Way)	112	0	0	0	112
>15 ft. (Two-Way)	4,244	0	0	0	4,244
Herbicide Application	**645**	**0**	**0**	**0**	**645**
Aerial (Fixed-Wing)	645	0	0	0	645
Mowing	**2,522**	**0**	**0**	**0**	**2,522**
Brush Hog	2522	0	0	0	2,522
Seeding (Primary)	**814**	**4,583**	**0**	**0**	**5,397**
Broadcast (Aerial-Fixed Wing)	789	4,583	0	0	5,372
Hand Seeding	26	0	0	0	26
Seeding (Secondary/Shrub)	**<1**	**0**	**0**	**0**	**<1**
Broadcast (Aerial-Fixed Wing)	<1	0	0	0	<1
Vegetation Removal/Hand Crew	**7,478**	**17,368**	**0**	**7,552**	**32,398**
Lop & Scatter	7,478	17,368	0	7,552	32,398
Other	**0**	**2**	**0**	**0**	**2**
Road Decommissioning	0	1	0	0	1
Road/Parking Area Improvements	0	1	0	0	1
Grand Total	**25,765**	**27,092**	**0**	**8,368**	**61,225**
*** Total Land Area Treated**	**17,874**	**18,960**	**0**	**2,318**	**39,152**

Table 3.7). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Manual vegetation removal (lop and scatter) to treat pinyon and juniper trees is the most common management practice by acreage. Harrow treatments are also common, as is seeding plants to augment the herbaceous understory. Other management practices include (but are not limited to): anchor chaining and bullhog treatments to remove pinyon and juniper, mowing, chain harrowing, and clearcutting (

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,421**	**3,106**	**0**	**0**	**4,527**
Ely (One-Way)	526	3,106	0	0	3,632
Ely (Two-Way)	896	0	0	0	896
Bullhog	**574**	**2,033**	**0**	**754**	**3,361**
Full Size	0	0	0	754	754
Skid Steer	574	2,033	0	0	2,607
Chain Harrow	**3,337**	**0**	**0**	**62**	**3,399**
≤15 ft. (Two-Way)	0	0	0	62	62
>15 ft. (Two-Way)	3,337	0	0	0	3,337
Forestry Practices	**52**	**0**	**0**	**0**	**52**
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Harrow	**8,922**	**0**	**0**	**0**	**8,922**
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Aerial (Fixed-Wing)	645	0	0	0	645
Mowing	**2,522**	**0**	**0**	**0**	**2,522**

Brush Hog	2522	0	0	0	2,522
Seeding (Primary)	**814**	**4,583**	**0**	**0**	**5,397**
Broadcast (Aerial-Fixed Wing)	789	4,583	0	0	5,372
Hand Seeding	26	0	0	0	26
Seeding (Secondary/Shrub)	**<1**	**0**	**0**	**0**	**<1**
Broadcast (Aerial-Fixed Wing)	<1	0	0	0	<1
Vegetation Removal/Hand Crew	**7,478**	**17,368**	**0**	**7,552**	**32,398**
Lop & Scatter	7,478	17,368	0	7,552	32,398
Other	**0**	**2**	**0**	**0**	**2**
Road Decommissioning	0	1	0	0	1
Road/Parking Area Improvements	0	1	0	0	1
Grand Total	**25,765**	**27,092**	**0**	**8,368**	**61,225**
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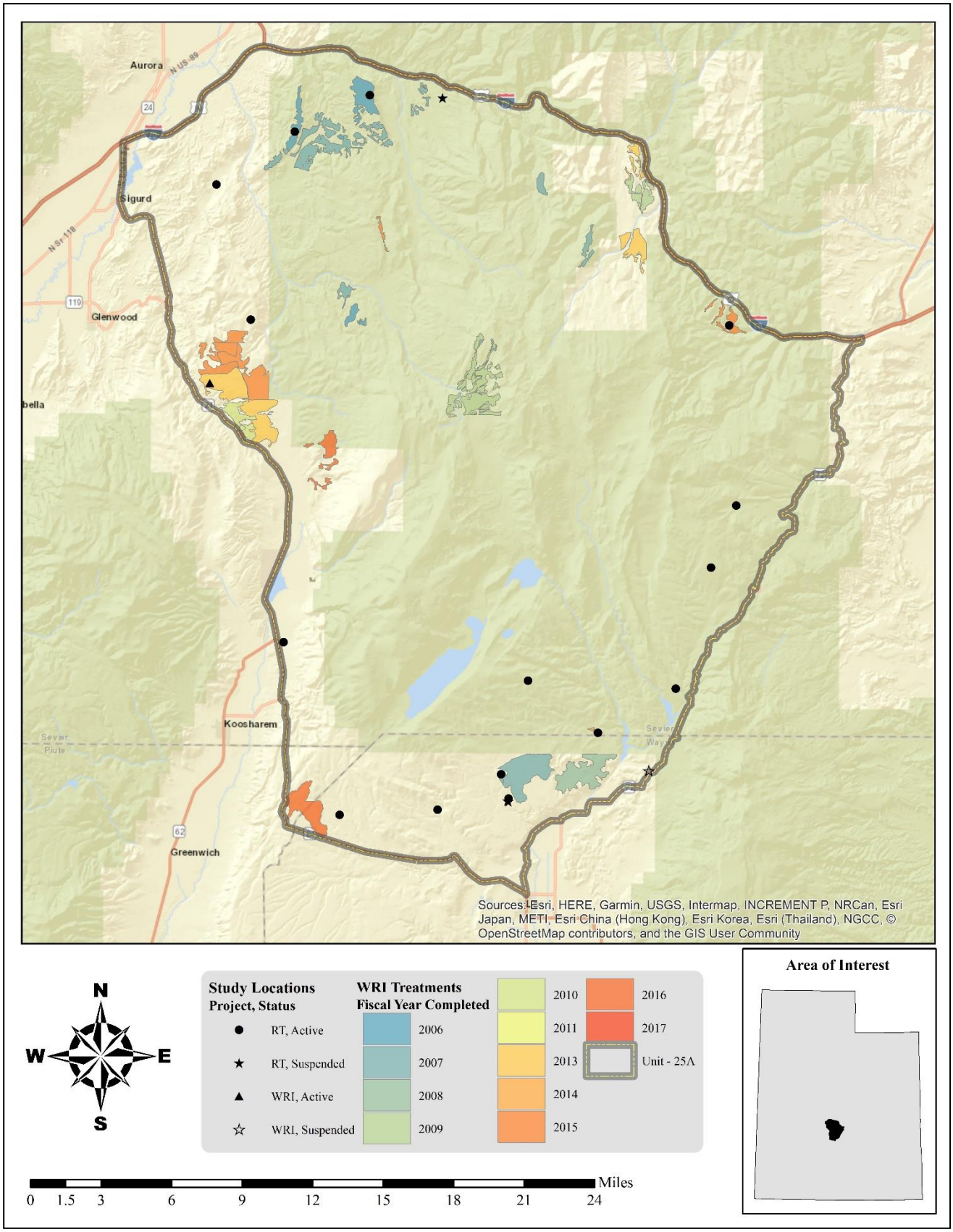
Other	**0**	**2**	**0**	**0**	**2**
Road Decommissioning	0	1	0	0	1
Road/Parking Area Improvements	0	1	0	0	1
Grand Total	**25,765**	**27,092**	**0**	**8,368**	**61,225**
*** Total Land Area Treated**	**17,874**	**18,960**	**0**	**2,318**	**39,152**

Table 3.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 25A, Fishlake Plateau. Data accessed on 02/18/2019. *Does not include overlapping treatments.



Map 3.8: WRI treatments by fiscal year completed for WMU 25A, Fishlake Plateau.

Range Trend Studies

Range Trend studies have been sampled within WMU 25A on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 3.8**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 3.9**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
25A-01	Triangle Mountain	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Black Sagebrush)
25A-02	Black Mountain	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Black Sagebrush)
25A-03	Sage Flat	RT	Active	'85, '91, '99, '04, '09, '13, '18	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
25A-04	Durfee Homestead	RT	Active	'85, '91, '99, '04, '09, '13, '18	Mountain Gravelly Loam (Mountain Big Sagebrush)
25A-05	Praetor Slope	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-07	Evans Reservoir	RT	Active	'85, '91, '99, '04, '09, '13, '18	Mountain Loam (Mountain Big Sagebrush)
25A-08	Lower Dog Flat	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-09	Row of Pines	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-10	Cedarless Flat	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-11	Forsyth Reservoir	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Black Sagebrush)
25A-12	East Tidwell	RT	Active	'91, '99, '04, '09, '13, '18	High Mountain Loam (Mountain Big Sagebrush)
25A-13	Ox Spring	RT	Active	'91, '99, '04, '09, '13, '18	High Mountain Loam (Mountain Big Sagebrush)
25A-14	Row of Pines Exclosure	RT	Active	'91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-16	Tommy Hollow	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25A-18	Elk Camp	RT	Active	'85, '91, '99, '04, '09, '13, '18	Mountain Stony Loam (Mountain Big Sagebrush)
25A-19	Row of Pines Livestock Exclosure	RT	Suspended	'99, '04, '09	Not Verified
25A-20	Row of Pines Total Exclosure	RT	Suspended	'99, '04, '09	Not Verified
25R-09	Sand Ledges	WRI	Active	'12, '16	Mountain Loam (Mountain Big Sagebrush)

Table 3.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 25A, Fishlake Plateau.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
25A-01	Triangle Mountain	Chain Unknown		1970		
		Seed Unknown		1970		
		Two-Way Dixie Harrow	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year 1	Fall 2005	4079	216
		Broadcast	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year 1	Fall 2005	1600	216
25A-02	Black Mountain	Chain Unknown		1984		
		Seed Unknown		1984		
		Bullhog		Between 1999 and 2004		
		Two-Way Dixie Harrow	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year 1	Fall 2005	4079	216
25A-04	Durfee Homestead	Chain Unknown		1983		
		Seed Unknown		1983		
		Prescribed Fire	Gypsum Sandledge Prescribed Fire	August-September 1985	1000	LTDL
		Aerial Unknown	Gypsum Sandledge Prescribed Fire	October 1985	1000	LTDL
25A-05	Praetor Slope	Chain Unknown	Praetor Slopes Reseeding	May 1963	1400	LTDL
		Rangeland Drill	Praetor Slopes Reseeding	Spring 1964	1400	LTDL
		Two-Way Dixie Harrow		2002	3000	PDB
		Seed Unknown		2002	3000	PDB

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
25A-07	Evans Reservoir	Two-Way Dixie Harrow		Fall 1999		PDB
		Seed Unknown		Fall 1999		PDB
25A-08	Lower Dog Flat	Chain Unknown		1980		
		Seed Unknown		1980		
		Broadcast Before	Seven Mile Dixie Harrow 2006	November-December 2006	4275	LTDL
		Two-Way Dixie Harrow	Seven Mile Dixie Harrow 2006	October-December 2006	4275	LTDL
		Aerial After	Seven Mile Dixie Harrow 2006	January 2007	2000	LTDL
25A-10	Cedarless Flat	Chain Unknown		1987		
		Seed Unknown		1987		
		Lop and Scatter	Mytoge-Tidwell Sage Grouse Habitat Improvement Phase 1 (Proposed)	August 2017-June 2018	8942	3995
25A-13	Ox Spring	Prescribed Fire		1989 or 1990		
25A-14	Row of Pines Exclosure	Two-Way Chain Unknown	Roe Pine Bench Chaining and Seeding 1983	August-November 1983	2345	LTDL
		Aerial Unknown	Roe Pine Bench Chaining and Seeding	August-November 1983	2345	LTDL
		Broadcast Before	Seven Mile Dixie Harrow 2006	November-December 2006	4275	LTDL
		Two-Way Dixie Harrow	Seven Mile Dixie Harrow 2006	October-December 2006	4275	LTDL
		Aerial After	Seven Mile Dixie Harrow 2006	January 2007	2000	LTDL
25A-18	Elk Camp	Prescribed Fire		1990		
25A-19	Row of Pines Livestock Exclosure	Two-Way Chain Unknown	Roe Pine Bench Chaining and Seeding 1983	August-November 1983	2345	LTDL
		Aerial Unknown	Roe Pine Bench Chaining and Seeding 1983	August-November 1983	2345	LTDL
25A-20	Row of Pines Total Exclosure	Two-Way Chain Unknown	Roe Pine Bench Chaining and Seeding 1983	August-November 1983	2345	LTDL
		Aerial Unknown	Roe Pine Bench Chaining and Seeding 1983	August-November 1983	2345	LTDL
25R-09	Sand Ledges	Chain Unknown	Sand Ledges Chaining 1983	July-November 1983	1980	LTDL
		Aerial Unknown	Sand Ledges Chaining 1983	July-November 1983	1980	LTDL
		Lop and Scatter	Sandledges Lop and Scatter Project Phase II	June 2013	2275	2334
		Wildfire	Willow Patch Fire	June-July 2018	4583	
		Aerial After	Willow Patch Fire Rehabilitation Project (Proposed)	Fall 2018	4583	4739
		Aerial After	Willow Patch Fire Rehabilitation Project (Proposed)	Winter 2018	4583	4739

Table 3.9: Range trend and WRI studies known disturbance history for WMU 25A, Fishlake Plateau. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are five studies [Durfee Homestead (25A-04), Evans Reservoir (25A-07), East Tidwell (25A-12), Ox Spring (25A-13), and Elk Camp (25A-18)] that are classified as Mountain (Big Sagebrush) ecological sites. The Durfee Homestead study site is about four miles east of State Route 24 (SR-24) on Cedar Mountain. The Evans Reservoir study is located south of Fish Lake between the south end of the lake and SR-24. The East Tidwell study is located on the Tidwell Slopes approximately five miles north of Forsyth Reservoir. The Ox Spring study can be found in the Mytoge Mountains approximately three miles east of Fish Lake. Finally, the Elk Camp study is located around five miles north of the Tidwell Slopes along South Last Chance Creek.

Shrubs/Trees: The dominant browse species on these sites is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Lesser amounts of other sagebrush such as prairie sagewort (*A. frigida*) and black sagebrush (*A. nova*) are also present. Sites with other browse present include species like mountain snowberry (*Symphoricarpos oreophilus*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), Woods' rose (*Rosa woodsii*) and others in varying amounts. Cover data shows an increasing trend of preferred browse species, driven mostly by larger numbers of sagebrush cover (**Figure 3.2**). Preferred browse demographics indicate that the populations are increasing and that the communities are mostly composed of

mature plants. Recruitment of young plants has been high in most years, with 2004 being the exception with low recruitment (**Figure 3.5**). Browse utilization has exhibited a decreasing trend with the exception of 2013, when nearly 50 percent of plants were either moderately or heavily browsed. However, less than 15 percent of plants were either moderately or heavily browsed in 2018, continuing the trend of decreased utilization (**Figure 3.6**).

Trees on the sites are a mixture of Rocky Mountain juniper (*Juniperus scopulorum*), Utah juniper (*J. osteosperma*), and twoneedle pinyon (*Pinus edulis*). In addition, quaking aspen (*Populus tremuloides*) was sampled for the first time in 2018 on the East Tidwell site. Tree density has shown an increasing trend (**Figure 3.4**). Cover of trees has fluctuated, but displays a generally increasing trend as well (**Figure 3.3**).

Herbaceous Understory: The herbaceous understories of these study sites are rich and abundant, and primarily composed of native species. Perennial grasses and forbs are the dominant components. Small amounts of annual forbs are present and the introduced annual grass cheatgrass (*Bromus tectorum*) is present in very low numbers on some of the study sites. Overall cover decreased through 2009, but an increasing trend has been observed in subsequent sample years (**Figure 3.7**). Frequency shows a similar decreasing trend to 2009 followed by an increasing trend through the most recent study year (**Figure 3.8**).

Occupancy: Average pellet transect data indicates an overall decreasing trend in animal presence. Elk have been the primary occupants on these sites except for 2009 when deer and elk were co-dominant. Usage for elk has varied from 55 days use/acre in 1999 to 30 days use/acre in 2018. Deer pellet group data shows that mean abundance has ranged from 5 days use/acre in 2013 to 46 days use/acre in 2009. Cattle are also present on the sites and mean abundance has fluctuated from 1 day use/acre in 2018 to 11 days use/acre in 1999 (**Figure 3.9**).

Upland (Big Sagebrush)

There are six studies [Praetor Slope (25A-05), Lower Dog Flat (25A-08), Row of Pines (25A-09), Cedarless Flat (25A-10), Row of Pines Exclosure (25A-14), and Tommy Hollow (25A-16)] that are classified as Upland (Big Sagebrush) ecological sites. The Praetor Slope site is located about one mile south of Koosharem Reservoir. The Lower Dog Flat study site can be found between Loa and Fish Lake near Black Ridge. Row of Pines is situated northwest of Fremont on the Row of Pines Bench. The Cedarless Flat site can be found about a mile west of Mill Meadow Reservoir. The Row of Pines Exclosure is also located northwest of Fremont on the Row of Pines Bench. Finally, the Tommy Hollow study site is located near the top of Emigrant Pass south of Interstate 70 (I-70).

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred browse species on these studies, with lesser amounts of black sagebrush (*A. nova*) present on some sites. Other preferred browse such as antelope bitterbrush (*Purshia tridentata*), Utah serviceberry (*Amelanchier utahensis*) and winterfat (*Krascheninnikovia lanata*) have also been present, but mostly on the Tommy Hollow study site. Overall cover has slightly increased through the sample years (**Figure 3.2**). Preferred browse demographics have indicated an increasing number of plants/acre, and a majority of individuals have been classified as mature. Recruitment of young plants has increased steadily through the study period (**Figure 3.5**). Preferred browse utilization has fluctuated, with 2013 showing almost 60 percent of the plants being moderately or heavily browsed. In 2018, about 20 percent of plants were either moderately or heavily hedged: this trend appeared to be consistent across study sites and not driven by a particular site (**Figure 3.6**).

Trees, particularly Utah juniper (*Juniperus osteosperma*), Rocky Mountain juniper (*J. scopulorum*) and twoneedle pinyon (*Pinus edulis*), provide cover on all of these sites. Both cover and density have increased significantly over time and it is likely that this trend will continue in the future (**Figure 3.3**, **Figure 3.4**).

Herbaceous Understory: The herbaceous understories of these study sites have been consistent throughout the study years, with small increases in cover and frequency in both 2013 and 2018. Perennial grasses are the dominant components of the understory; the most common grasses on the sites are muttongrass (*Poa*

fendleriana) and blue grama (*Bouteloua gracilis*). Perennial and annual forbs are present on the sites, but provide little cover overall (**Figure 3.7**, **Figure 3.8**).

Occupancy: Average pellet transect data indicates that the utilization of these sites has fluctuated, but has overall exhibited a slightly decreasing trend. Deer have been the primary occupants in years except for 1999 and 2009, in which they were co-dominant with elk for primary occupancy. Deer pellet data shows that presence on the sites has varied from nearly 15 days use/acre in 2013 to 32 days use/acre in 2004. Elk pellet group data has had a mean abundance ranging between 4 days use/acre in 2018 and 23 days use/acre in 2009. Finally, cattle have been present on the site in all years and occupancy has changed between 4 days use/acre in 2009 and 7 days use/acre in 1999 (**Figure 3.9**).

Upland (Black/Low Sagebrush)

There are three studies [Triangle Mountain (25A-01), Black Mountain (25A-02), and Forsyth Reservoir (25A-11)] classified as Upland (Black/Low Sagebrush) ecological sites. The Triangle Mountain site is located between Salina and Gooseberry Road south of I-70. The Black Mountain site is situated about 5 miles south of the town of Salina. The Forsyth Reservoir site can be found about one half mile north of Forsyth Reservoir near the Tidwell Slopes.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) is the dominant preferred browse species with lesser amounts of mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) being present as well. Average shrub cover has increased over time: 6 percent cover was noted in 2004 and increased to nearly 9 percent in 2018 (**Figure 3.2**). Shrub demographic data shows that the majority of individuals in these communities are mature plants, with good recruitment of young observed in all years except 2004 (**Figure 3.5**). Utilization of preferred browse has been relatively low with the exception of 2013 which showed that 45 percent of the plants had moderate use (**Figure 3.6**).

Tree cover and density have been observed on the sites in all years; a mixture of both twoneedle pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) has been noted on all of the sites. Both cover and density have shown increases through time (**Figure 3.3**, **Figure 3.4**).

Herbaceous Understory: The herbaceous understories of these study sites are mostly composed of perennial grasses. Both cover and frequency for perennial grasses have displayed a generally increasing trend with the exception of a slight decrease in 2018. The Black Mountain and Triangle Mountain sites are mostly composed of crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*), while the Forsyth Reservoir site is primarily blue grama (*Bouteloua gracilis*) and muttongrass (*Poa fendleriana*). Annual grasses are present, but overall cover is relatively low. Annual forbs have high frequency numbers but cover is low; frequency is mostly provided by the introduced species desert madwort (*Alyssum desertorum*) (**Figure 3.7**, **Figure 3.8**).

Occupancy: Pellet transect data shows that the occupancy has fluctuated between years, but the primary occupants of these sites are deer, elk and cattle. Deer usage has varied from 8 days use/acre in 2013 to 33 days use/acre in 1999. Average elk pellet group data shows that usage on the site has ranged from a low of 15 days use/acre in 2004 to a high of 50 days use/acre in 1999. Cattle pellet group data displays occupancy from 7 days use/acre in 2004 to 28 days use/acre in 2009 (**Figure 3.9**).

Semidesert (Big Sagebrush)

There is one study [Sage Flat (25A-03)] that is classified as a Semidesert (Big Sagebrush) ecological site. The Sage Flat study is located south of Salina in Sage Flat, between I-70 and SR-24.

Shrubs/Trees: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the only preferred browse species on this site and provides a significant amount of cover. The cover of sagebrush has displayed significant fluctuations between sample years, but has shown a mostly stable trend overall (**Figure 3.2**).

Preferred browse demographic data indicates that the numbers of sagebrush have steadily decreased. There has been a moderate amount of decadence noted in all sample years (**Figure 3.5**). Utilization of preferred browse has fluctuated significantly, with 74 percent of plants showing heavy utilization in 2004 and about 1 percent showing heavy utilization in 2013. Excluding these two extremes, usage has remained light to moderate (**Figure 3.6**).

Utah juniper (*Juniperus osteosperma*) is the tree species present on the site. Cover has not been sampled and density of trees was only sampled in 2018 (**Figure 3.3**, **Figure 3.4**).

Herbaceous Understory: The herbaceous understory of this site is primarily composed of annual grasses and forbs with a generally decreasing trend observed. Frequency of these components shows less fluctuation and has decreased only slightly. Perennial grasses are very rare and were not observed in sampling during 2009 or 2018. Introduced annual grasses and forbs are very common on the site. Annual grasses; namely cheatgrass (*Bromus tectorum*), have been dominant in all sample years (**Figure 3.7**, **Figure 3.8**).

Occupancy: The primary occupants of this site have been deer and mean pellet group abundance ranges from 12 days use/acre in both 2013 and 2018 to 261 days use/acre in the 2004 sample year. Cattle have been present in all years with mean abundance ranging from 4 days use/acre in 2004 to 9 days use/acre in 2018. Elk were present only in the 1999 and 2004 study years. The mean abundance of elk pellet groups has varied from 0 days use/acre in 2009, 2013 and 2018 to 4 days use/acre in 1999 (**Figure 3.9**).

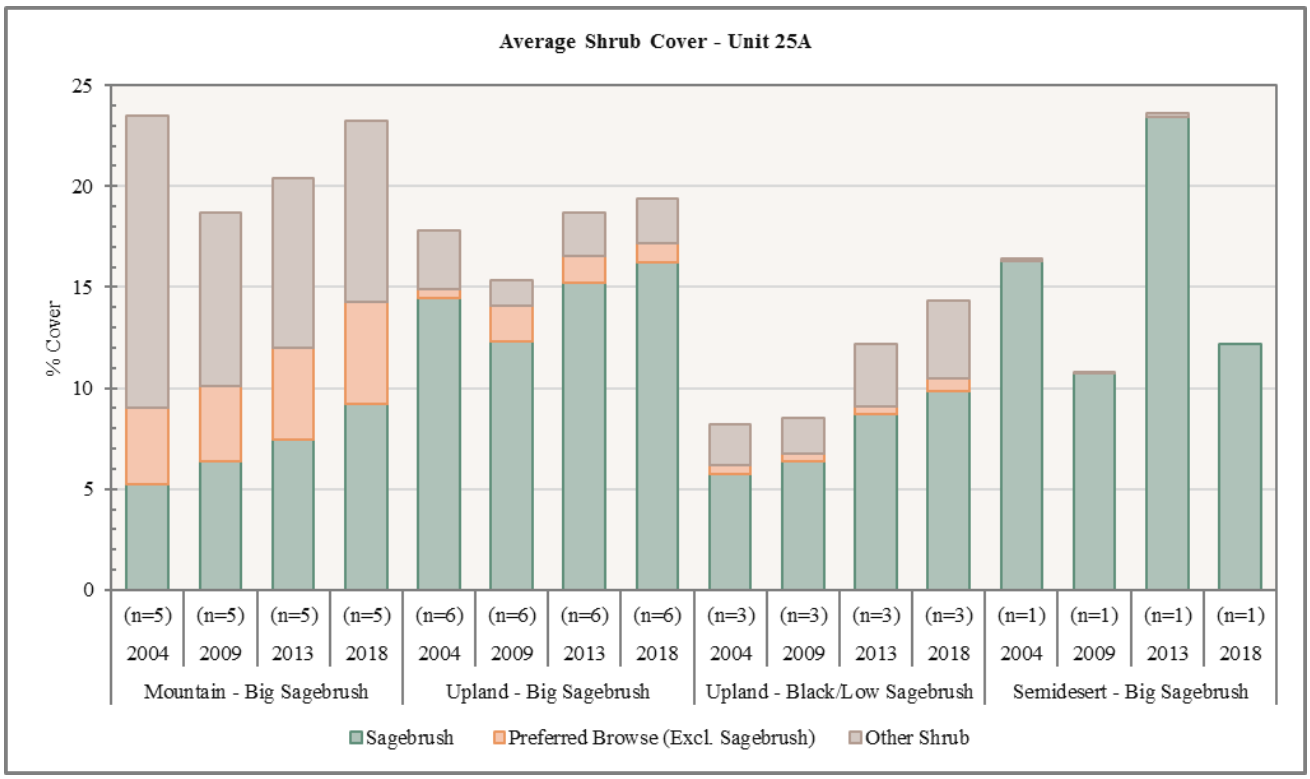


Figure 3.2: Average shrub cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

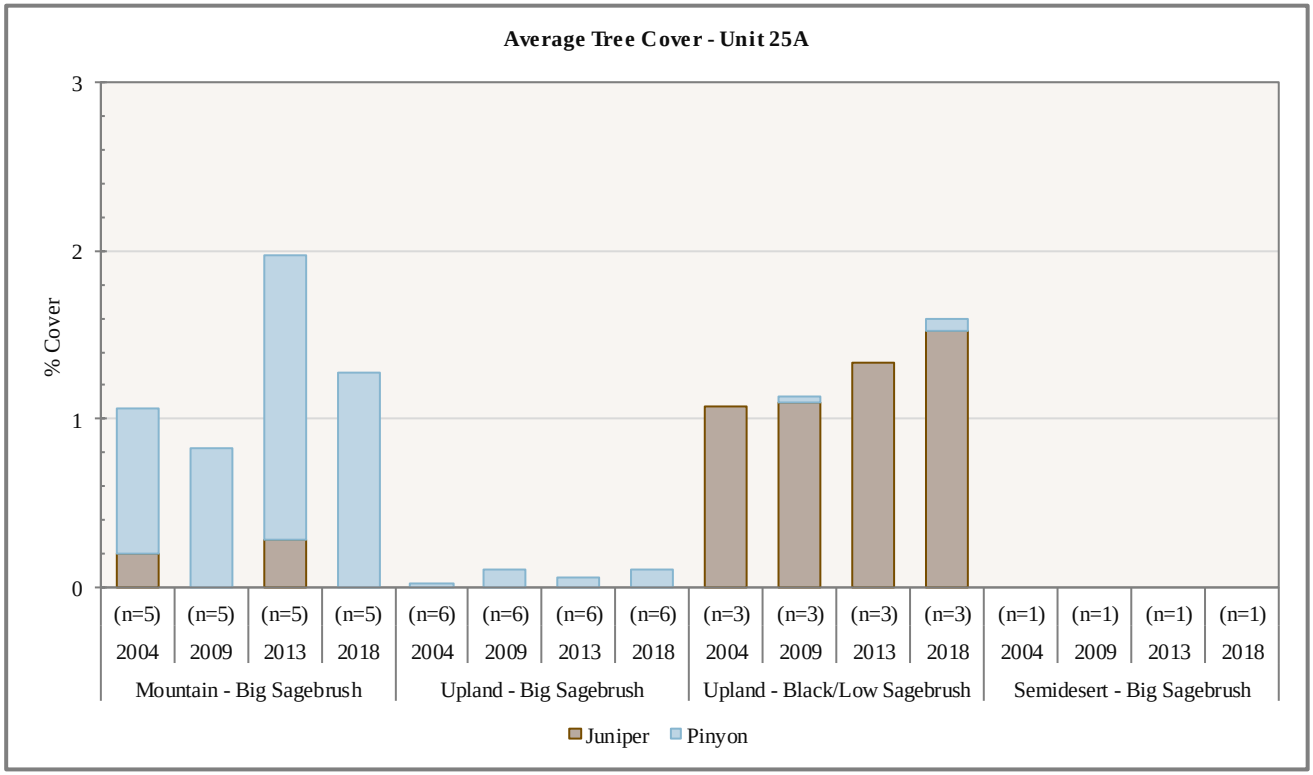


Figure 3.3: Average tree cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

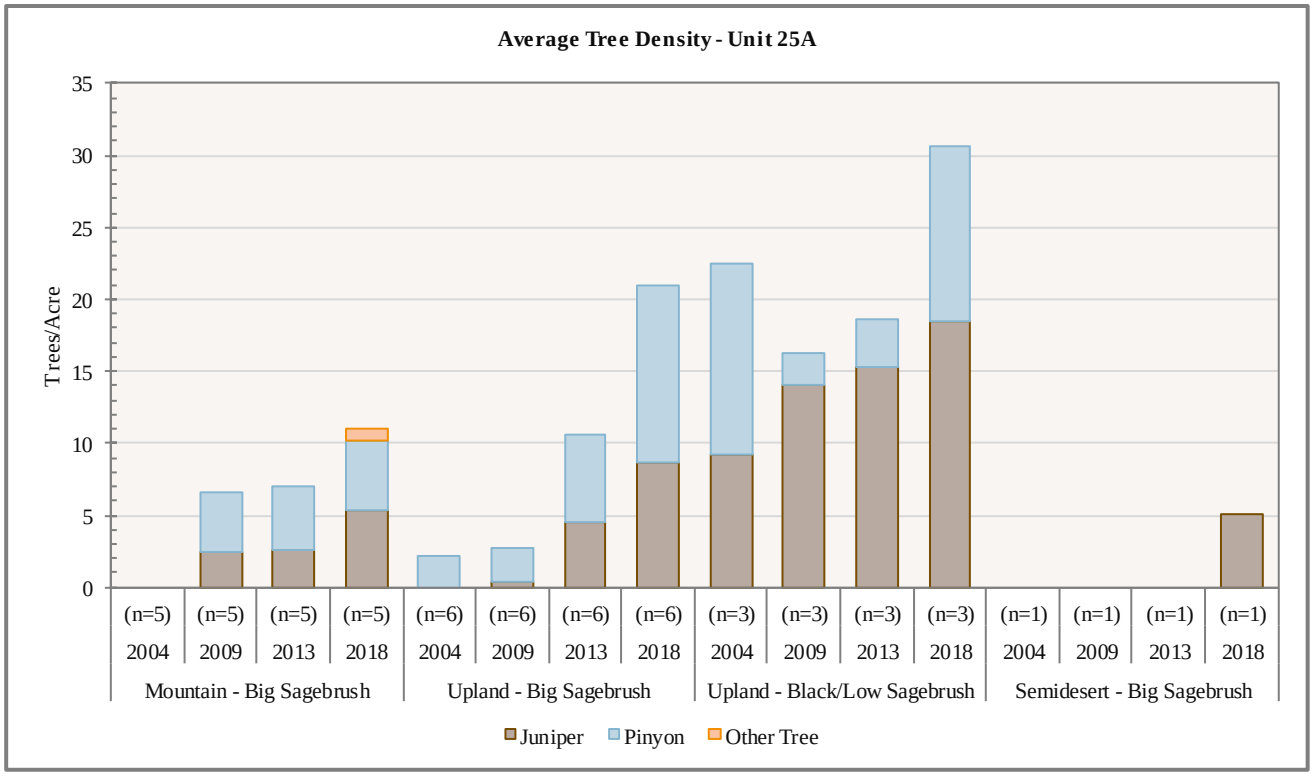


Figure 3.4: Average tree density for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

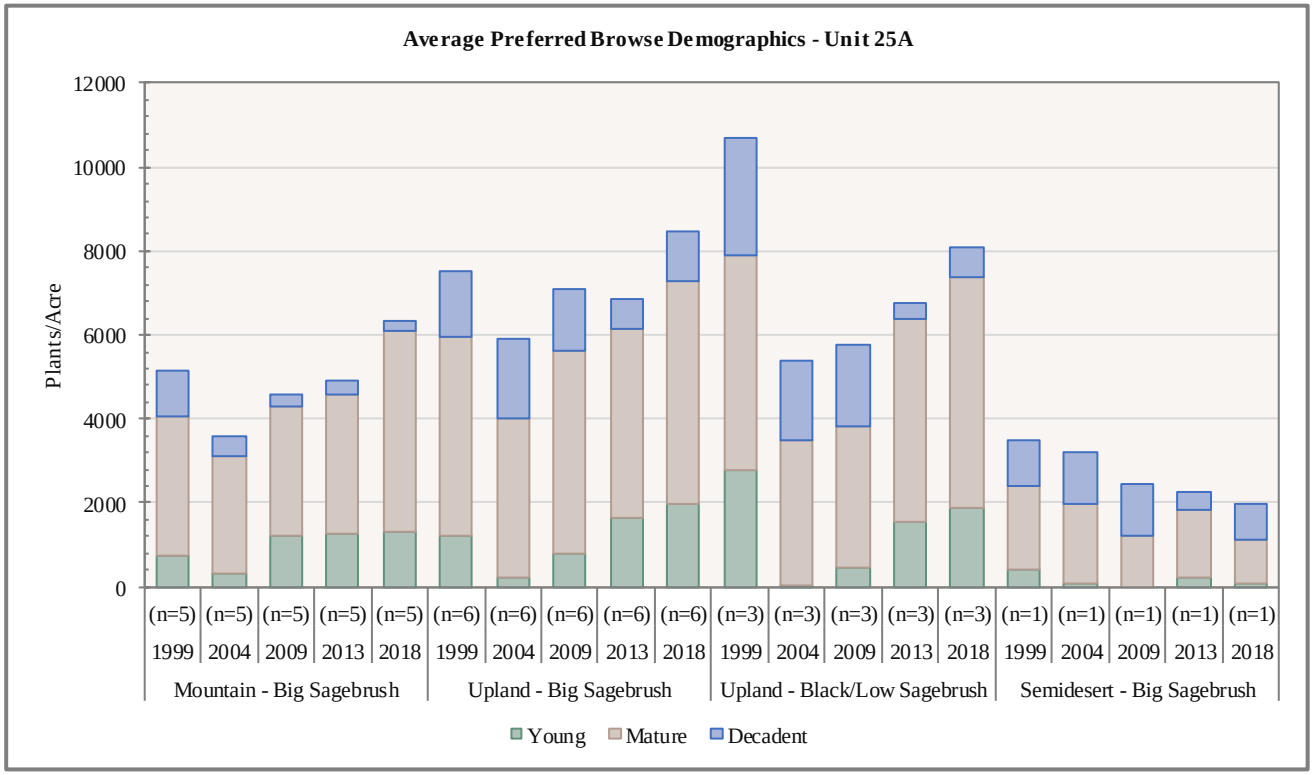


Figure 3.5: Average preferred browse demographics for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

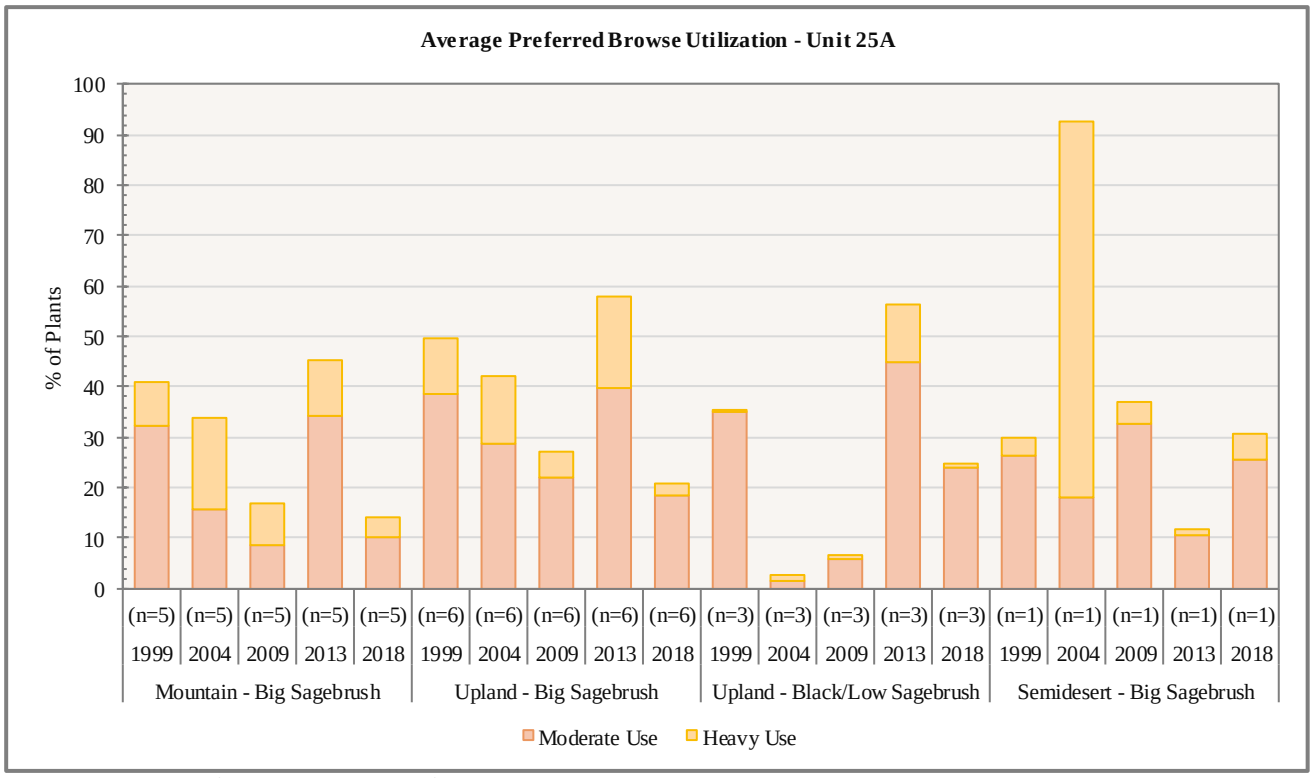


Figure 3.6: Average preferred browse utilization for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

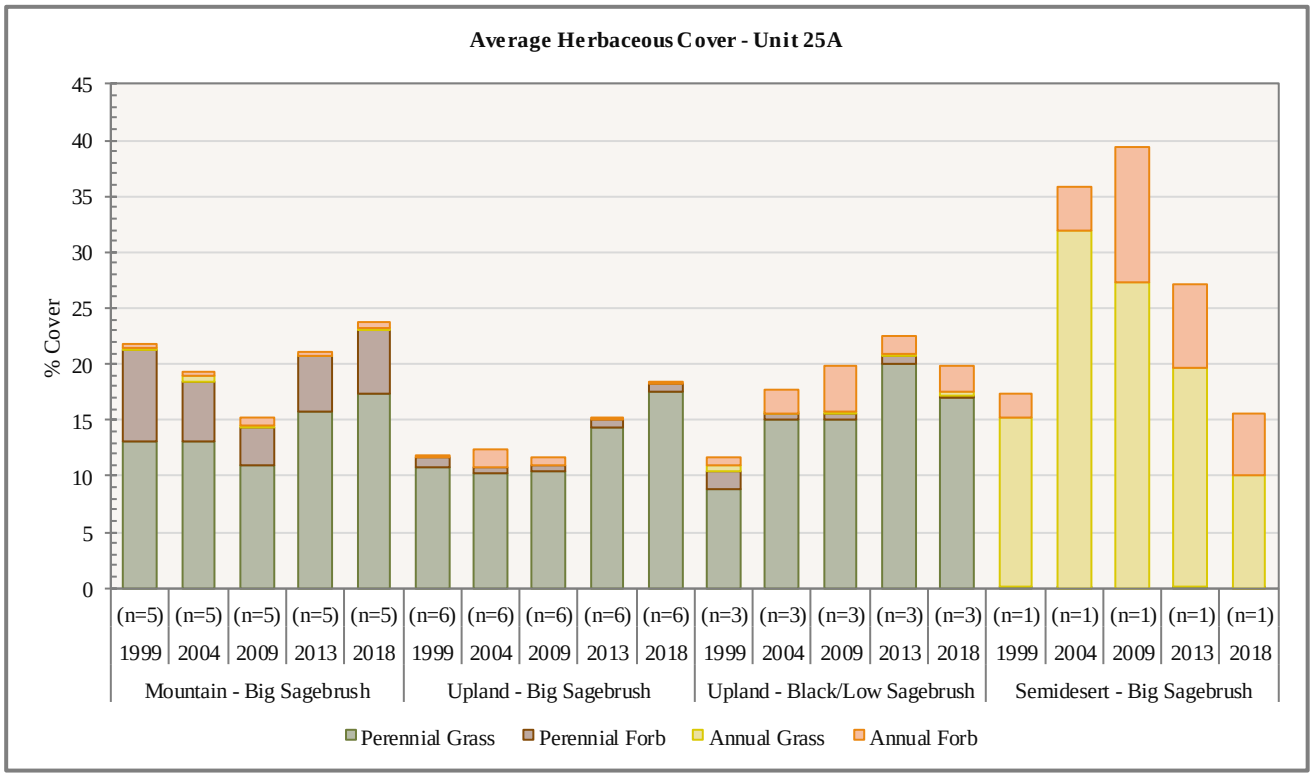


Figure 3.7: Average herbaceous cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

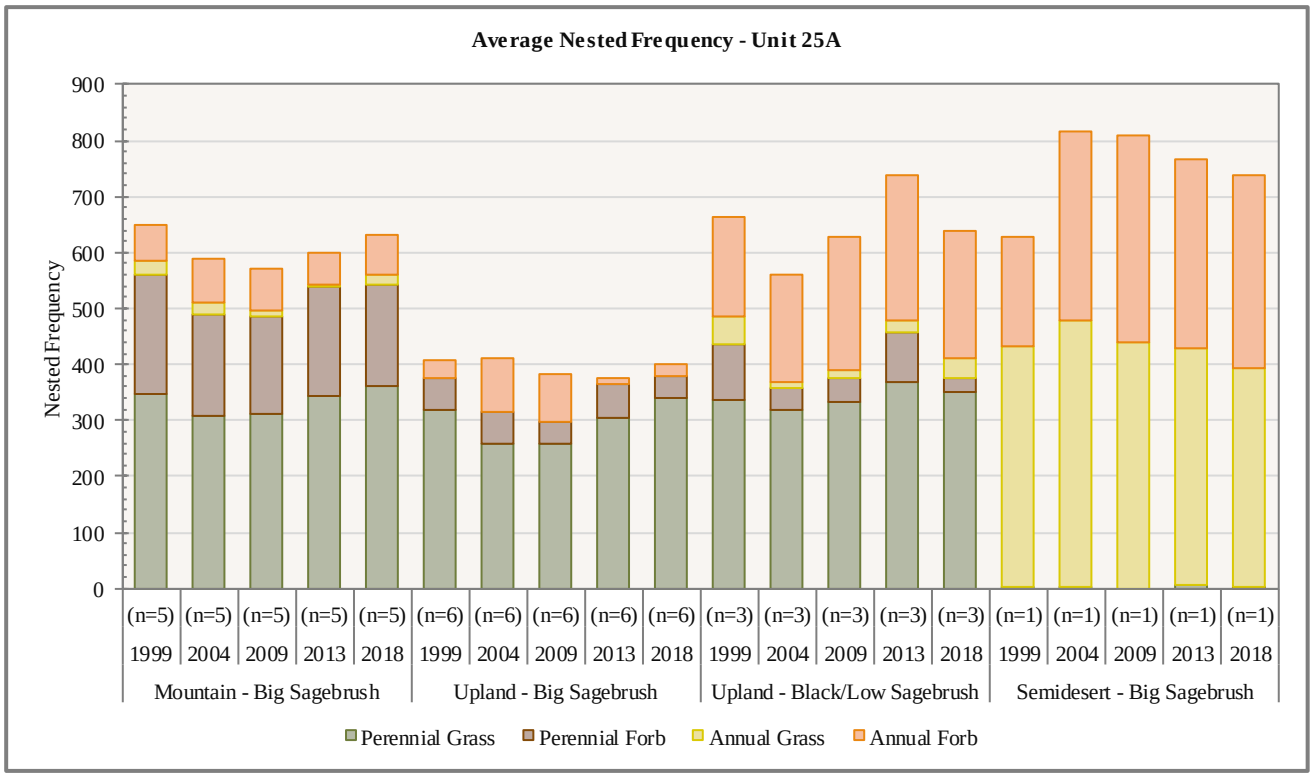


Figure 3.8: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau.

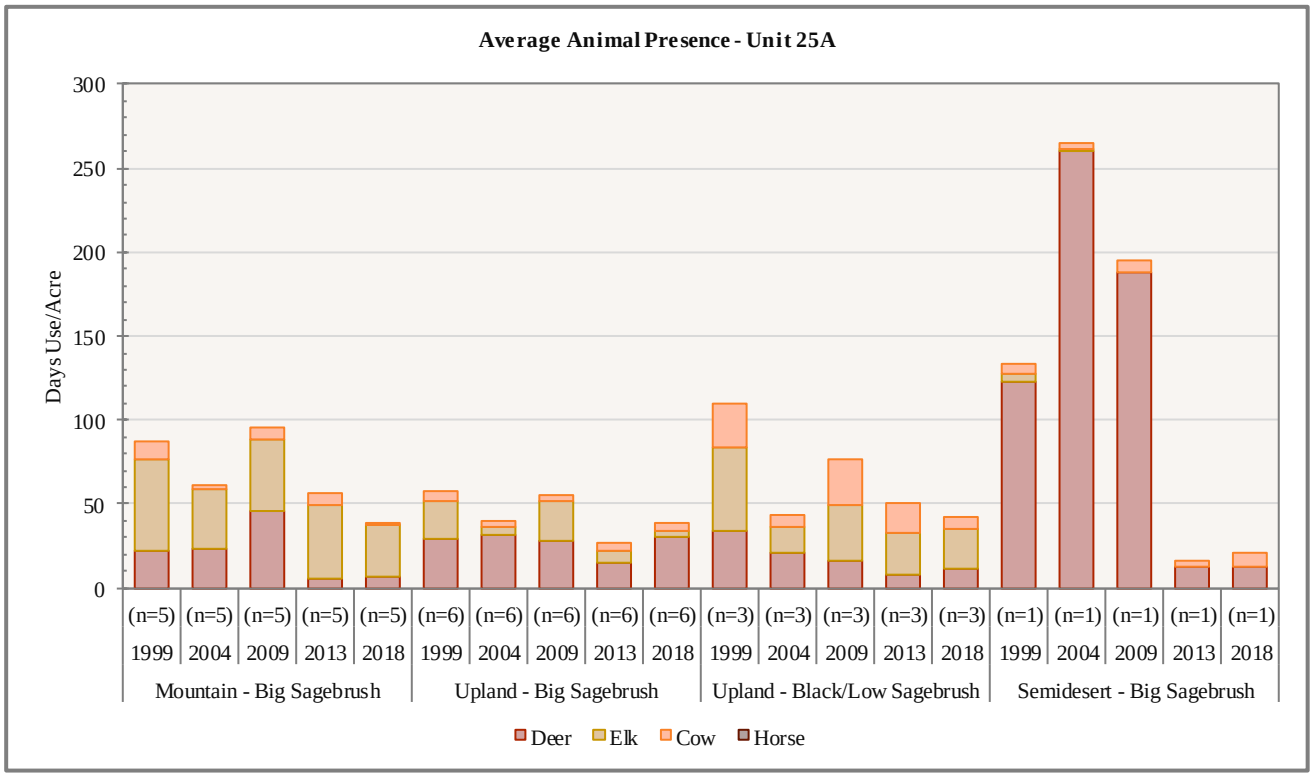
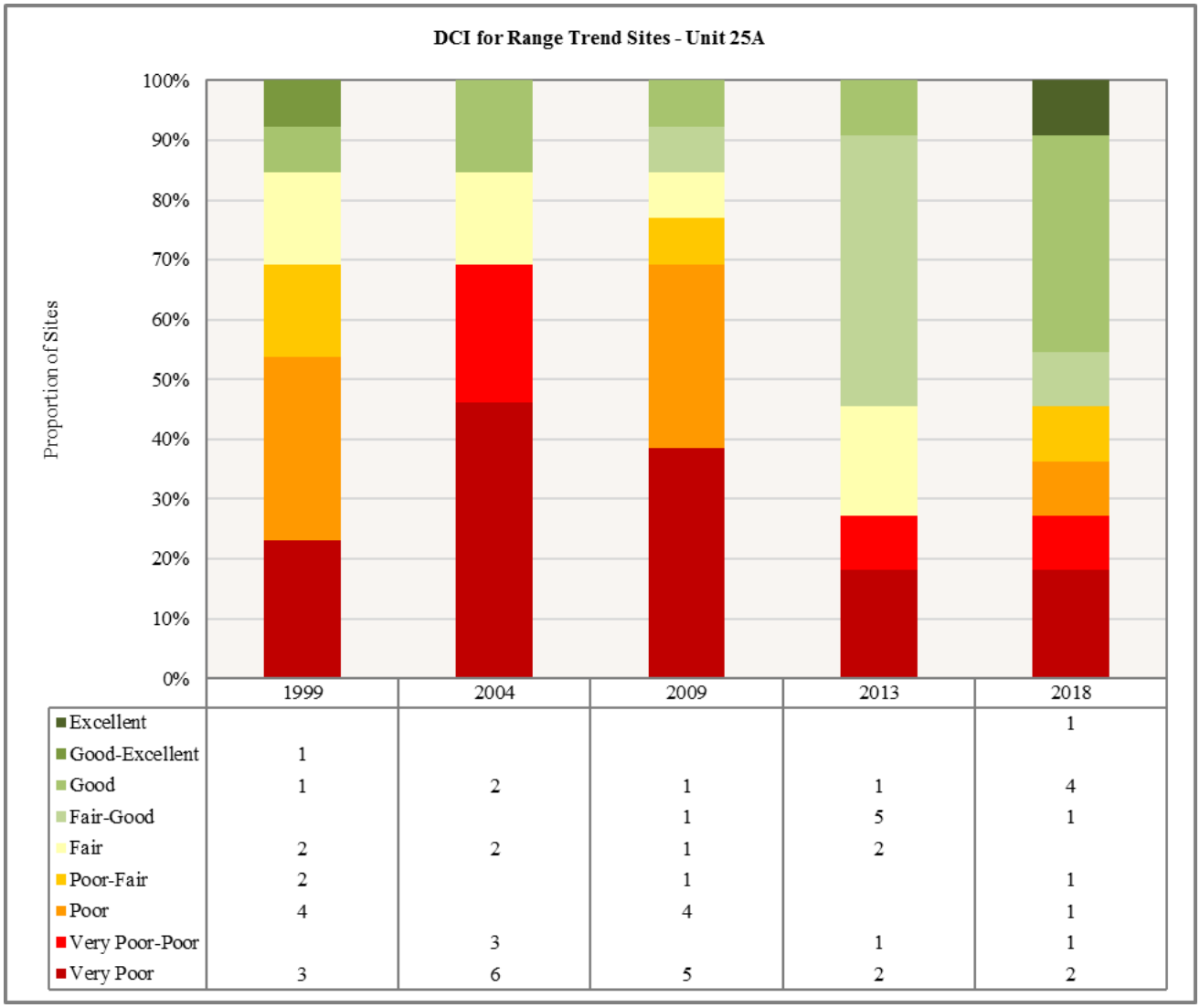


Figure 3.9: Average pellet transect data for Mountain - Big Sagebrush, Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Semidesert - Big Sagebrush study sites in WMU 25A, Fishlake Plateau. Mountain and Upland - Big Sagebrush deer pellets include deer/antelope.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Fishlake Plateau management unit has continually changed on the sites sampled since 1999. The active Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2018 sample year (**Figure 3.10**, **Table 3.10**). The Tommy Hollow study is considered to be in excellent condition, with high preferred browse cover and a robust understory contributing to this ranking. The four sites rated as being in good condition are Evans Reservoir, Lower Dog Flat, Row of Pines Exclosure, and Elk Camp. The one site in fair-good condition is the Row of Pines study. There is one study in poor-fair condition: the Durfee Homestead site. The Sage Flat study site is classified as being in poor condition. There is one study in very poor-poor condition: the Praetor Slope study. Finally, the two studies classified as being in very poor condition are Triangle Mountain and Black Mountain. Overall, the condition of the sites across the unit has slightly improved.



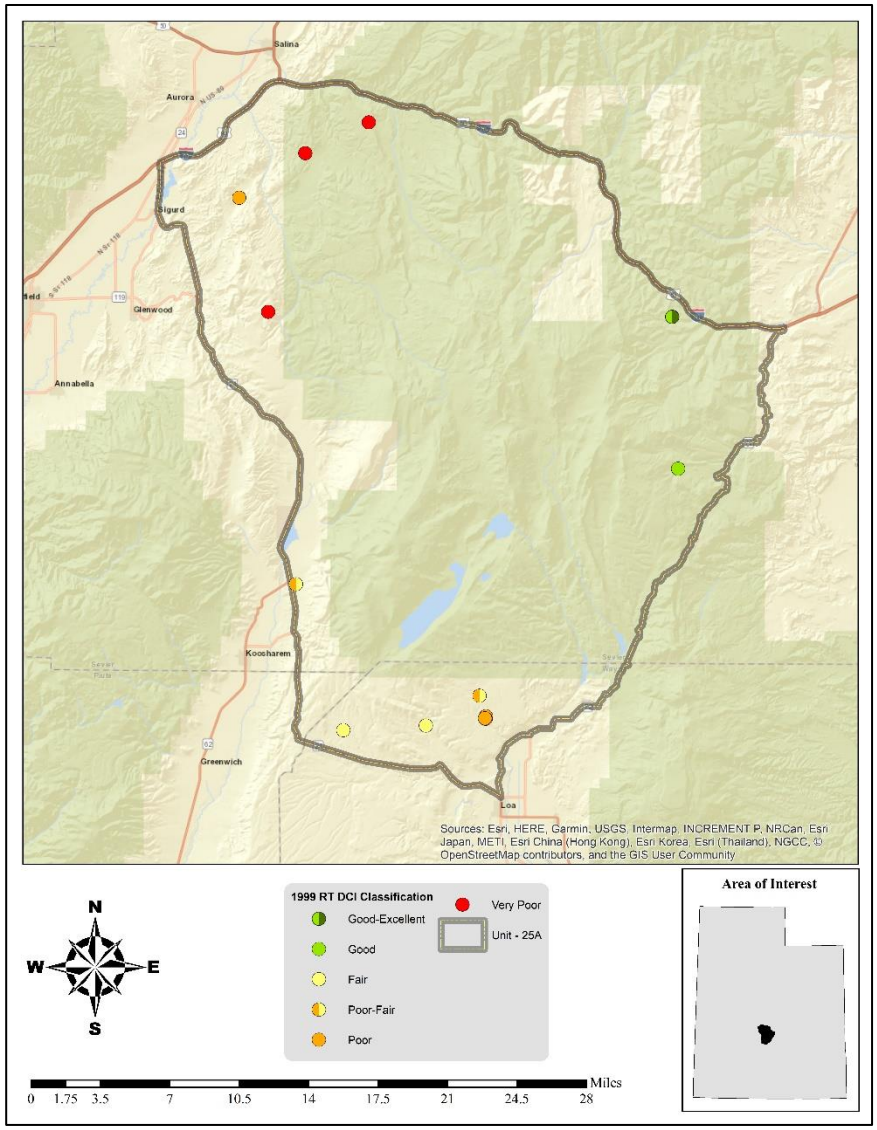
	1999	2004	2009	2013	2018
Excellent					1
Good-Excellent	1				
Good	1	2	1	1	4
Fair-Good			1	5	1
Fair	2	2	1	2	
Poor-Fair	2		1		1
Poor	4		4		1
Very Poor-Poor		3		1	1
Very Poor	3	6	5	2	2

Figure 3.10: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 25A, Fishlake Plateau.

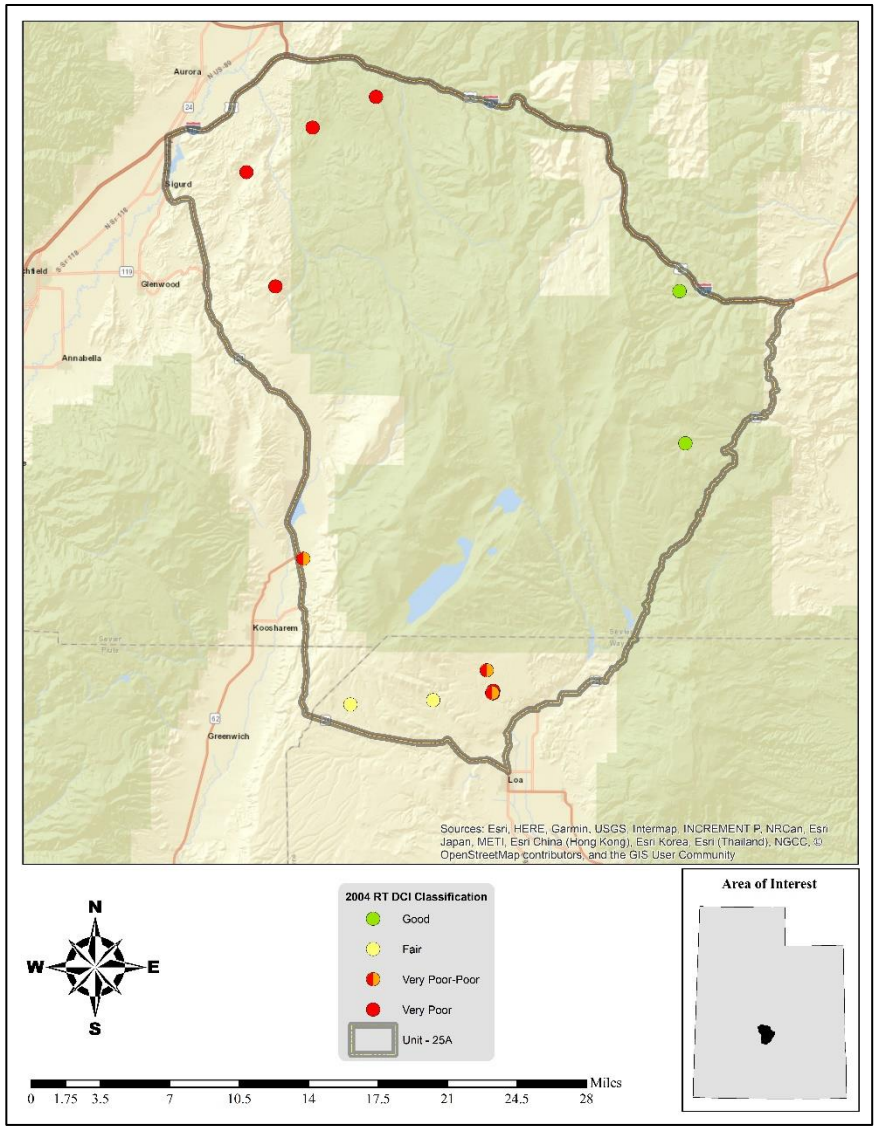
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
25A-01	1999	0	0	0	23.2	0	7.3	0	**30.5**	**VP**
25A-01	2004	1.1	0	0	30	-0.1	1.1	0	**32.1**	**VP**
25A-01	2009	1	0	0	30	0	2	0	**32.9**	**VP**
25A-01	2013	1.1	0	0	30	0	1.3	0	**32.4**	**VP**
25A-01	2018	0.8	0	0	30	-0.2	0.6	0	**31.2**	**VP**
25A-02	1999	2.1	0	0	16.1	-1	0.2	0	**17.5**	**VP**
25A-02	2004	1.9	0	0	24.5	-0.1	0	0	**26.2**	**VP**
25A-02	2009	1.4	0	0	21	-0.4	0.3	0	**22.3**	**VP**
25A-02	2013	2	0	0	30	-0.3	0.3	0	**32**	**VP**
25A-02	2018	2.5	0	0	22.8	-0.5	0	0	**24.9**	**VP**
25A-03	1999	18.5	5.7	5.7	0.4	-11.2	0	0	**19.1**	**P**
25A-03	2004	20.4	3.6	1.3	0.1	-20	0	0	**5.3**	**VP**
25A-03	2009	13.4	-0.2	0	0	-20	0	0	**-6.9**	**VP**
25A-03	2013	29.3	9.4	4.9	0.2	-14.6	0	0	**29.1**	**F**
25A-03	2018	15.3	2.5	2.1	0	-7.6	0	0	**12.2**	**P**
25A-04	1999	3.5	0	0	17.1	-0.7	5.5	0	**25.4**	**VP**
25A-04	2004	5.8	0	0	19.2	-1.9	5.3	0	**28.4**	**VP**
25A-04	2009	9.9	14.4	1	23.7	-0.7	5.5	0	**53.7**	**P-F**
25A-04	2013	11	15	4.9	30	-0.1	4.2	0	**65**	**F**
25A-04	2018	13.1	15	1.2	20.9	-0.5	5.5	0	**55.1**	**P-F**
25A-05	1999	15	5.9	0.7	30	0	0	0	**51.6**	**P-F**
25A-05	2004	0.4	0	0	30	0	3.8	0	**34.2**	**VP-P**
25A-05	2009	0.8	0	0	30	0	0.4	0	**31.1**	**VP**
25A-05	2013	3.9	0	0	30	0	1.2	0	**35.1**	**VP-P**
25A-05	2018	3.9	0	0	30	0	0.2	0	**34.1**	**VP-P**
25A-07	1999	20.8	0.3	4.1	26	0	10	0	**61.3**	**F**
25A-07	2004	11.1	8	3.3	30	0	6.8	0	**59.2**	**F**
25A-07	2009	11.8	7.1	4.5	30	0	5.5	0	**58.8**	**F**
25A-07	2013	12.5	11	8.9	30	0	7.6	0	**70**	**F-G**
25A-07	2018	15.9	14	14.2	30	0	10	0	**84.1**	**G**
25A-08	1999	22	10.4	6.2	17.4	0	0.5	0	**56.5**	**F**
25A-08	2004	26.9	8.7	1.7	15.7	0	0.1	0	**53**	**F**
25A-08	2009	19.8	9.8	0.8	8.8	0	0.1	0	**39.2**	**P**
25A-08	2013	26.1	12.5	15	11.6	0	0.1	0	**65.3**	**F-G**
25A-08	2018	24.1	10.4	15	26.9	0	0.1	0	**76.5**	**G**
25A-09	1999	30	2.9	2.9	11.2	0	1.1	0	**48.1**	**P-F**
25A-09	2004	26	0.6	0.8	5.8	0	0.5	0	**33.7**	**VP-P**
25A-09	2009	26	3.1	5.9	4.8	0	0.1	0	**39.9**	**P**
25A-09	2013	30	10.4	14.9	8.1	0	0.6	0	**63.9**	**F-G**
25A-09	2018	30	7.5	9	19.5	0	0.2	0	**66.1**	**F-G**
25A-14	1999	16.3	6.3	3.1	17.6	0	1.2	0	**44.5**	**P**
25A-14	2004	12	2.5	0.9	11.4	0	0.4	0	**27.1**	**VP**
25A-14	2009	5.4	0	0	20.6	0	0.1	0	**26**	**VP**
25A-14	2013	11.6	14.1	9.9	30	0	0.4	0	**65.9**	**F-G**
25A-14	2018	15	13.2	15	30	0	0	0	**73.3**	**G**
25A-16	1999	26.5	8.9	13.5	24.8	0	7.9	0	**81.6**	**G-E**
25A-16	2004	30	5.8	2.8	26.1	0	3	0	**67.7**	**G**
25A-16	2009	30	9.3	1.9	21.3	0	5.5	0	**68**	**G**
25A-16	2013	30	9.7	4.9	28.4	0	4.8	0	**77.8**	**G**
25A-16	2018	30	11.5	4.1	30	0	6.8	0	**82.4**	**E**
25A-18	1999	28.8	11.4	9.4	24	0	4.9	0	**78.4**	**G**
25A-18	2004	30	10.8	5	22.5	0	4.8	0	**73.1**	**G**
25A-18	2009	30	13.5	9.5	15.5	0	2.2	0	**70.7**	**F-G**
25A-18	2013	30	10	8.7	17.5	0	2.2	0	**68.4**	**F-G**
25A-18	2018	30	13.3	5	29.3	0	7.3	0	**84.9**	**G**
25A-19*	1999	10.2	6.9	1.3	20.6	0	0.6	0	**39.8**	**P**
25A-19*	2004	7.6	-5.6	1	15.9	0	0.5	0	**19.4**	**VP**
25A-19*	2009	11	5.3	0.5	21	0	0.2	0	**37.9**	**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
25A-20*	1999	17.3	6.9	2.6	18	0	1.9	0	**46.7**	**P**
25A-20*	2004	15.8	-0.5	2.5	16.7	0	0.4	0	**34.8**	**VP-P**
25A-20*	2009	17.5	3.9	0.7	21	0	0.3	0	**43.4**	**P**

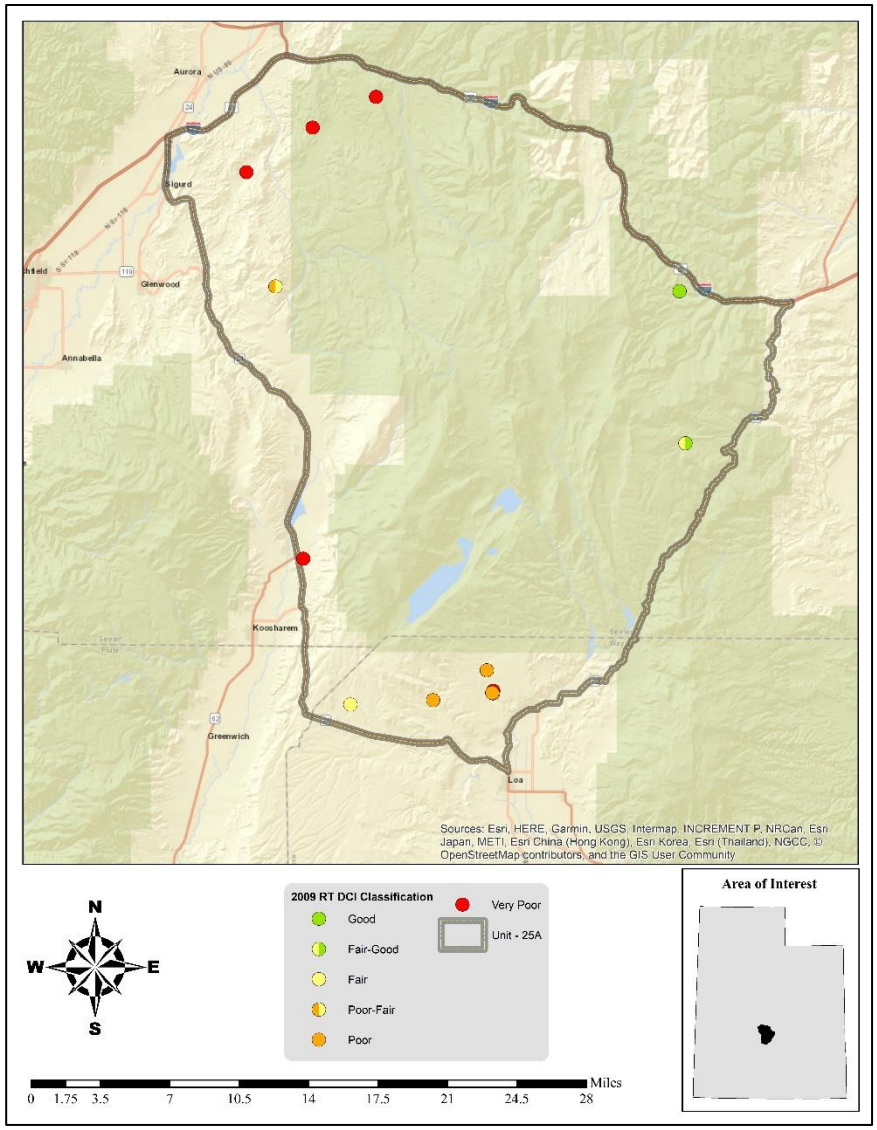
Table 3.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 25A, Fishlake Plateau. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



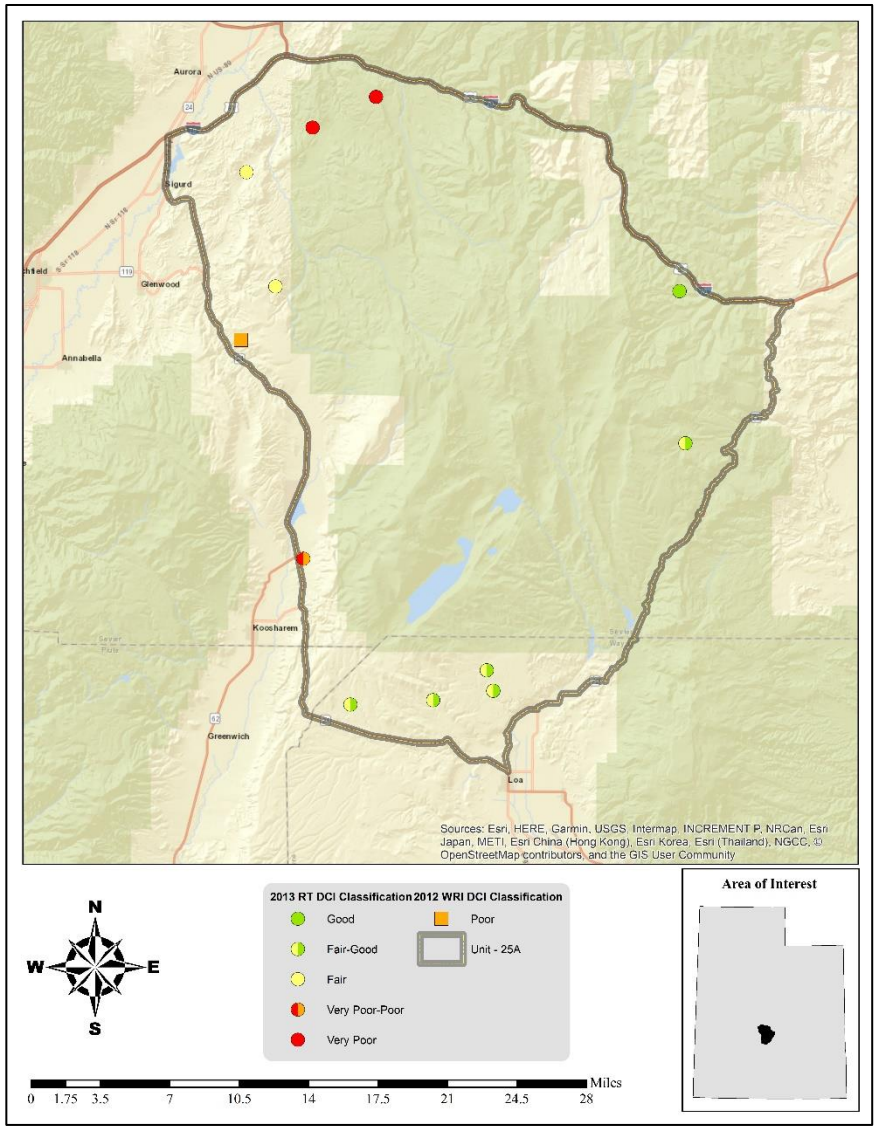
Map 3.9: 1999 Desirable Components Index (DCI) ranking distribution by study site for WMU 25A, Fishlake Plateau.



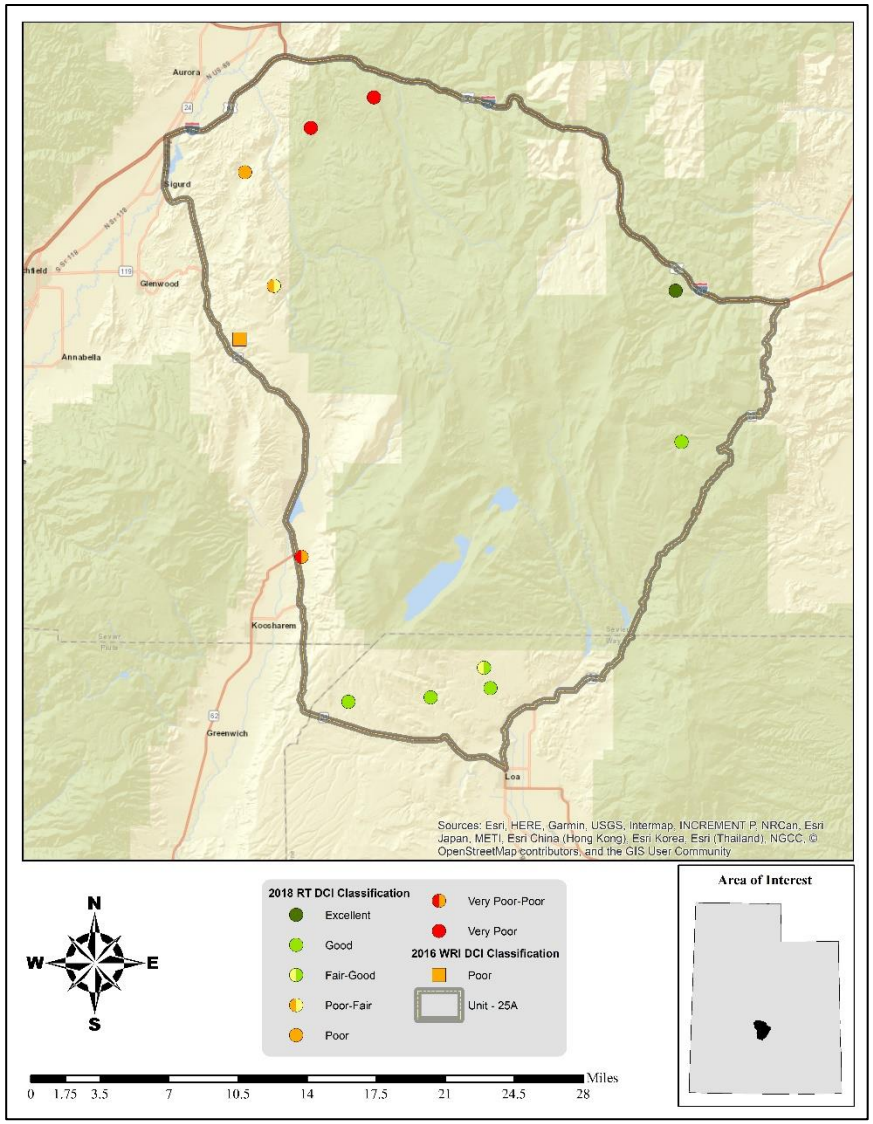
Map 3.10: 2004 Desirable Components Index (DCI) ranking distribution by study site for WMU 25A, Fishlake Plateau.



Map 3.11: 2009 Desirable Components Index (DCI) ranking distribution by study site for WMU 25A, Fishlake Plateau.



Map 3.12: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 25A, Fishlake Plateau.



Map 3.13: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 25A, Fishlake Plateau.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
25A-01	Triangle Mountain	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-02	Black Mountain	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Energy Development	High	Fragmentation and degradation/loss of habitat
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-08	Sage Flat	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-04	Durfee Homestead	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-05	Praetor Slope	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
25A-07	Evans Reservoir	None Identified		
25A-08	Lower Dog Flat	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-09	Row of Pines	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-10	Cedarless Flat	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-11	Forsyth Reservoir	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-12	East Tidwell	None Identified		
25A-13	Ox Spring	None Identified		
25A-14	Row of Pines Exclosure	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
25A-16	Tommy Hollow	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25A-18	Elk Camp	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25R-09	Sand Ledges	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor

Table 3.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 25A, Fishlake Plateau. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies within the Mountain (Big Sagebrush) ecological type are considered to be in poor-fair to good condition for deer winter range on the unit. These communities support sagebrush populations and robust understories that provide forage and browse to wildlife. Conifer encroachment has been observed on both the Elk Camp and Durfee Homestead studies: these sites are likely to progress through the phases of woodland succession. On the Durfee Homestead study, there are additional threats from annual grasses. While cover of these grasses is not high as of the 2018 sample year, it is possible that in the future they could become an issue. Introduced perennial grasses are also present on the Durfee Homestead study site: these grasses can contribute to a reduction in understory diversity.

Conifer-removing treatments (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in these communities when and where they are feasible. Treatments to reduce annual grasses or aggressive introduced perennial grasses would be advisable in areas where the ecological integrity is threatened. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies that are classified as Upland (Big Sagebrush) ecological sites are considered to be in very poor-poor to excellent condition for deer winter range within the Fishlake Plateau unit. The plant communities on these sites support sagebrush populations and robust understories that provide browse to wildlife. Conifer encroachment is present on all sites except for Praetor Slope and Row of Pines Exclosure; it is likely that trees will continue to encroach and reduce productivity on the sites where they are present. Annual grasses are

present on the Praetor Slope and Tommy Hollow studies, and there is potential for these annual grasses to increase and elevate the risk of wildfire. Introduced perennial grass species are present on the Praetor Slope, Cedarless Flat, Row of Pines Exclosure, and Tommy Hollow studies: these grasses can increase and reduce understory diversity, particularly in higher elevation locations.

Tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in these communities where and when feasible. Treatment to reduce annual grasses and aggressive perennial grass monocultures may be advisable in areas where ecological integrity is threatened. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Black/Low Sagebrush)

The studies within the Upland (Black/Low Sagebrush) ecological type are considered to be in very poor condition for deer winter range on this unit. The sagebrush communities on these sites support shrub populations that provide winter browse for wildlife. The understories for these sites are not particularly diverse with Triangle Mountain and Black Mountain having high cover of introduced perennial grasses.

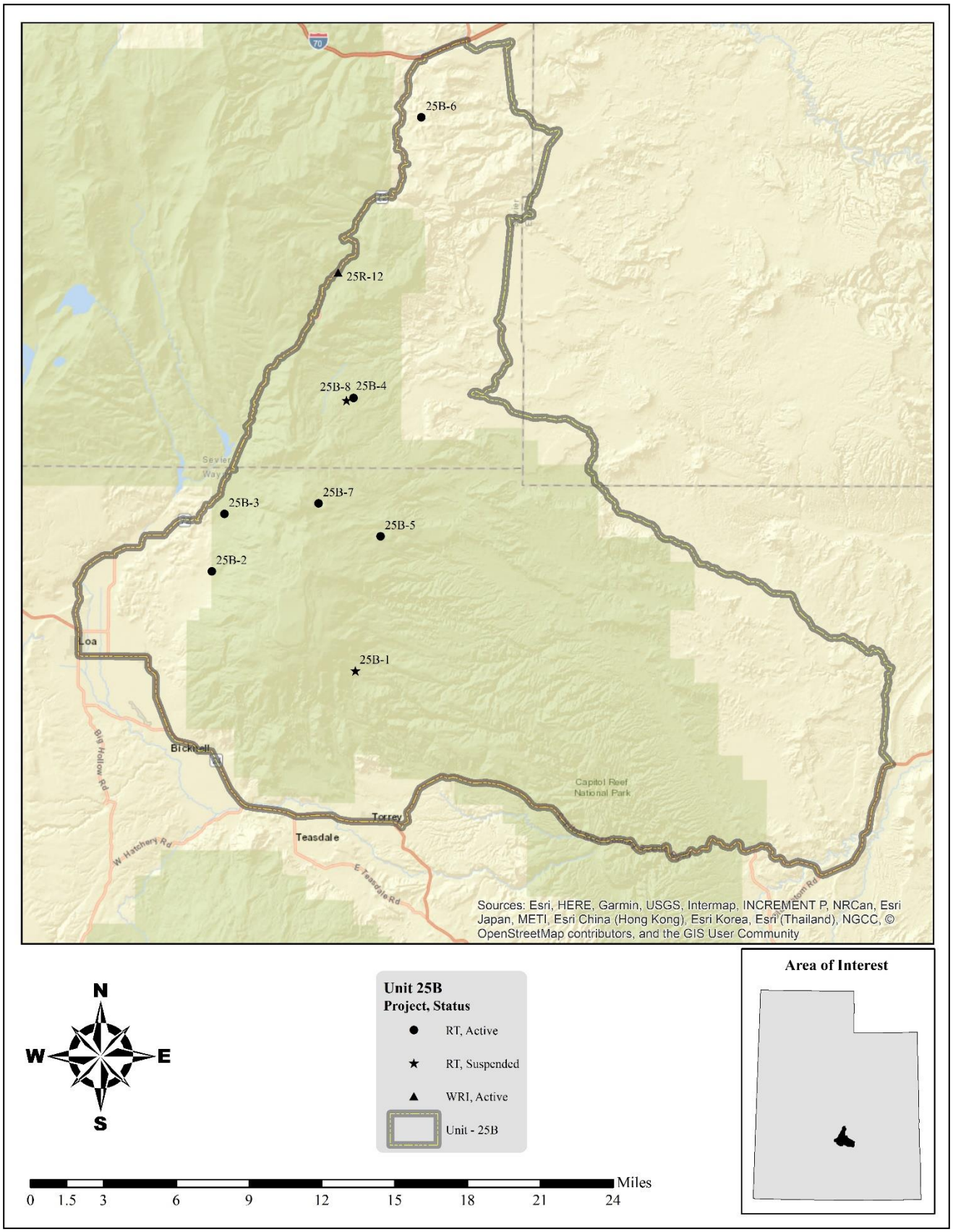
Conifer communities are present on these ecological sites with all sites being in Phase I of woodland succession. Treatments to reduce trees (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in areas where it is feasible in order to restore the browse and herbaceous communities. Treatments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

Semidesert (Big Sagebrush)

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

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

4. WILDLIFE MANAGEMENT UNIT 25B – THOUSAND LAKES PLATEAU



WILDLIFE MANAGEMENT UNIT 25B – THOUSAND LAKES PLATEAU

Boundary Description

Sevier and Wayne counties - Boundary begins at the junction of SR-24 and SR-72 at Loa; southeast on SR-24 to the Caineville Wash road; north on the Caineville Wash road to the junction of I-70 and SR-72; south on SR-72 to SR-24 at Loa.

Management Unit Description

Geography

The Thousand Lakes Plateau Wildlife Management unit is part of the larger management unit 25 - Plateau. Unit 25 is divided into three sub-units: Fishlake Plateau (25A), Thousand Lakes Plateau (25B), and Boulder Plateau (25C).

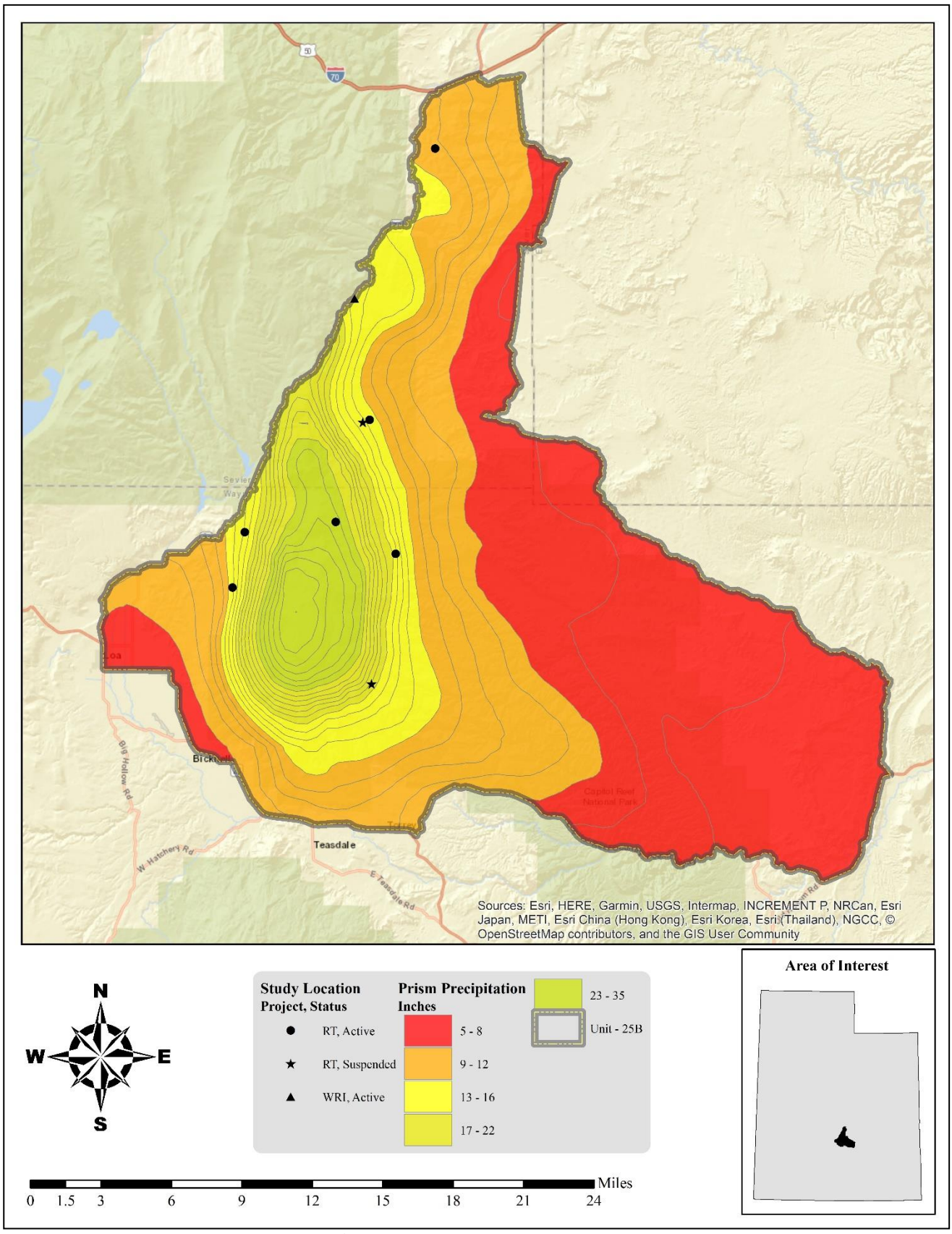
Management unit 25B was named after Thousand Lake Mountain, a lava-capped plateau with numerous small natural lakes. Thousand Lake Mountain reaches an elevation of 11,295 feet and overlooks Capital Reef National Park and the desert country east of the unit. At the extreme southeastern corner of the unit is Caineville, which is the lowest point in elevation in the herd unit at about 4,100 feet. The vegetation composition varies greatly throughout the unit with respect to topographical relief and elevation. The major towns in this unit are Fremont, Loa, Bicknell, and Caineville.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 6 inches on the lower east side of the unit to 29 inches on the peak of Thousand Lake Mountain. All of the Range Trend and WRI monitoring studies on the unit occur within 12-24 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 South Central division (Division 4).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 4.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 4.1b**) (Time Series Data, 2019).



Map 4.1: The 1981-2010 PRISM Precipitation Model for WMU 25B, Thousand Lakes Plateau (PRISM Climate Group, Oregon State University, 2013).

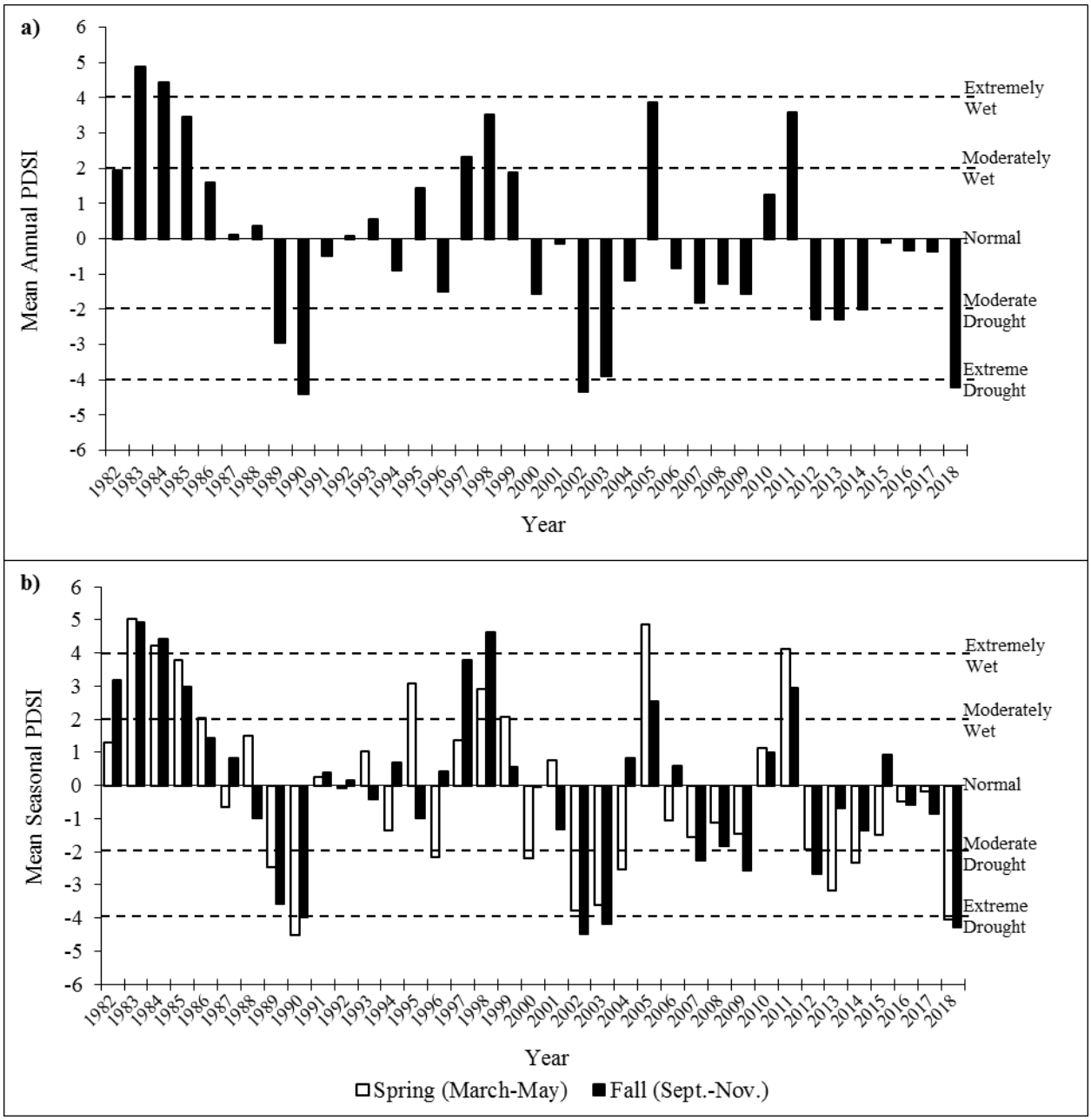
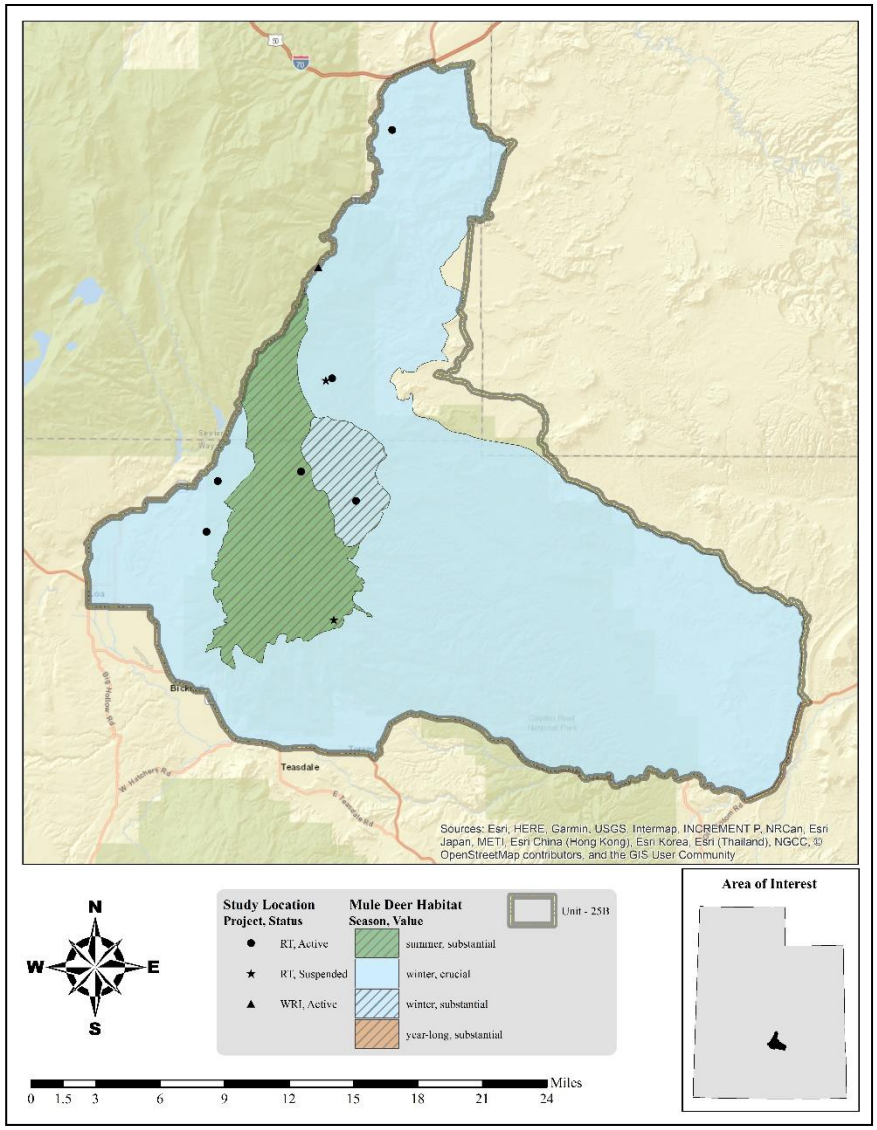


Figure 4.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

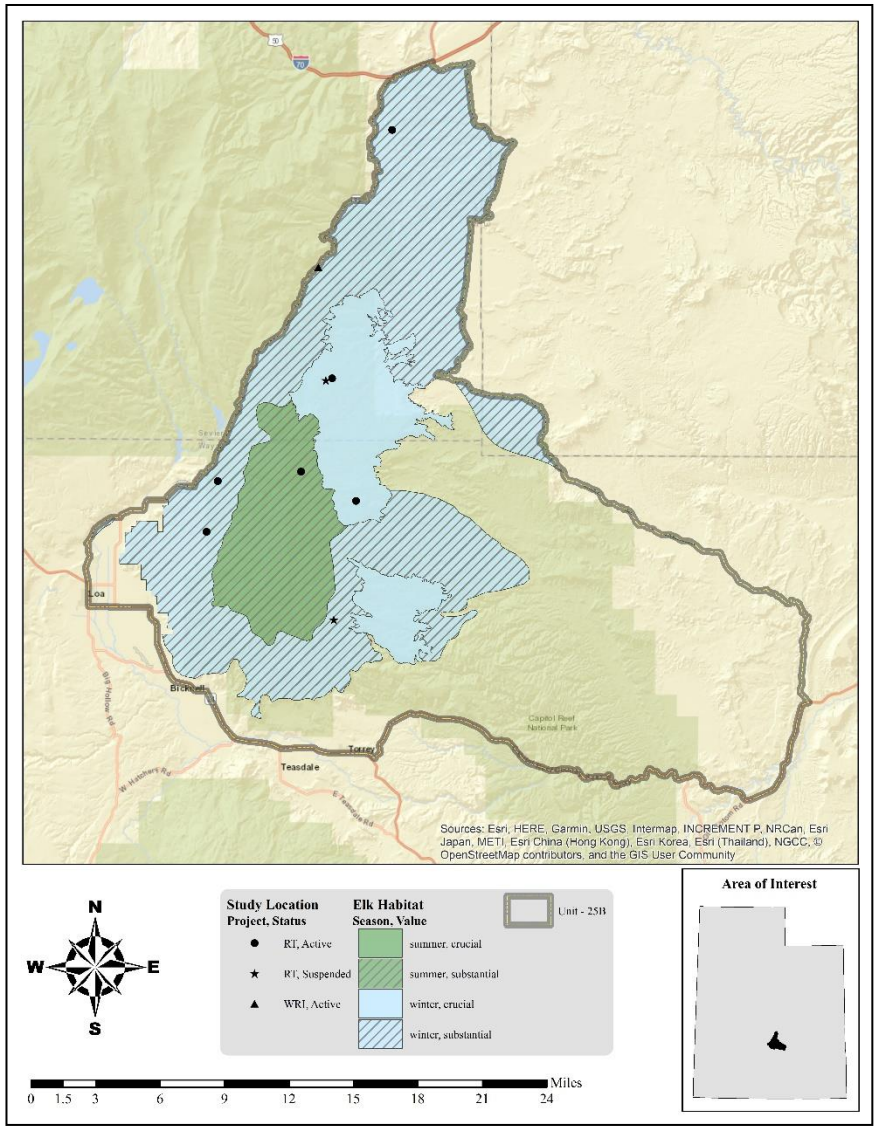
Big Game Habitat

There are an estimated 507,865 acres classified as deer range within Unit 25B with 88% classified as winter range, 12% as summer range, and less than 1% as year-long range (**Table 4.1**, **Map 4.2**). The National Park Service (NPS) administers 37% of the deer winter range, 30% is managed by the Bureau of Land Management (BLM), 24% is administered by the United States Forest Service (USFS), 6% is privately held, the School and Institutional Trust Lands Administration (SITLA) manages 3%, and the Utah Department of Transportation (UDOT) and Utah Division of Wildlife Resources (UDWR) each administer less than 1% (**Table 4.2**, **Map 4.2**, **Map 4.7**). Of the elk winter range, 44% is managed by the USFS, 32% is managed by the BLM, 17% is administered by the NPS, 4% is managed by SITLA, 3% is privately owned, and less than 1% is managed by UDOT (**Table 4.3**, **Map 4.3**, **Map 4.7**).

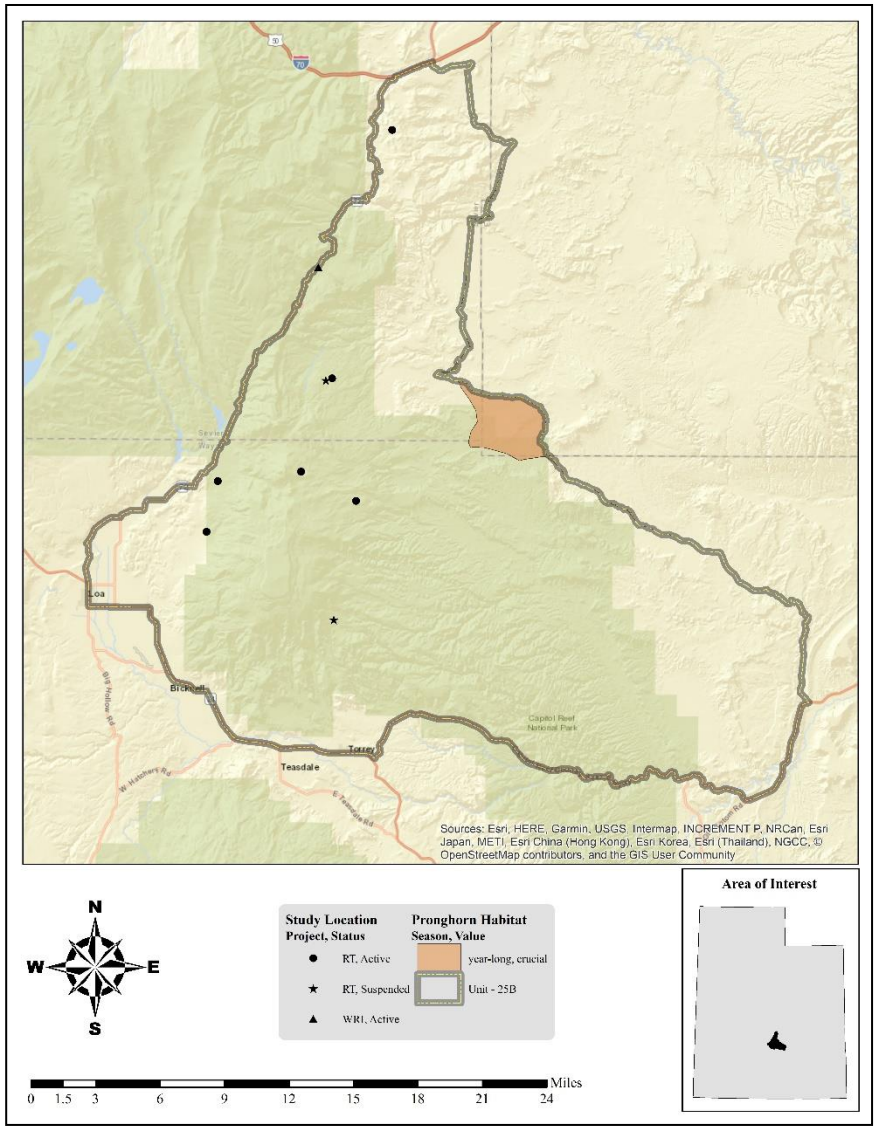
The winter range on this unit provides ample protective cover, large basins, draws, and open ridges. The upper limits of the normal winter range vary from 8,400 feet at the northern boundary to 9,000 feet on the south end of Thousand Lake Mountain. The lower normal winter range limit is between 6,000 and 7,400 feet in elevation. At present, the winter range appears ample to support the deer and elk from the Thousand Lakes unit and many wintering deer from the adjacent Fish Lake unit. Solomon Basin, Sage Flat, Horse Valley, Sand Flat, Paradise Flat, and Lyman Slopes are all winter concentration areas.



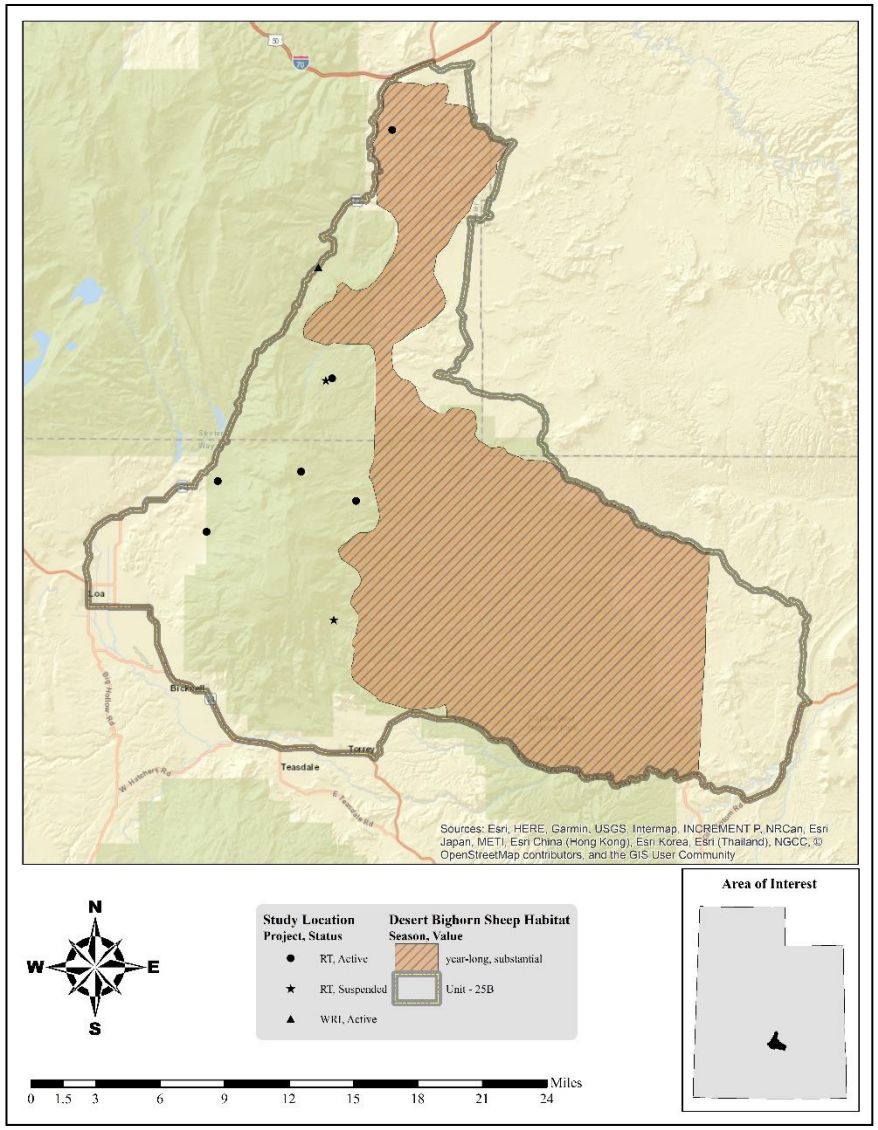
Map 4.2: Estimated mule deer habitat by season and value for WMU 25B, Thousand Lakes Plateau.



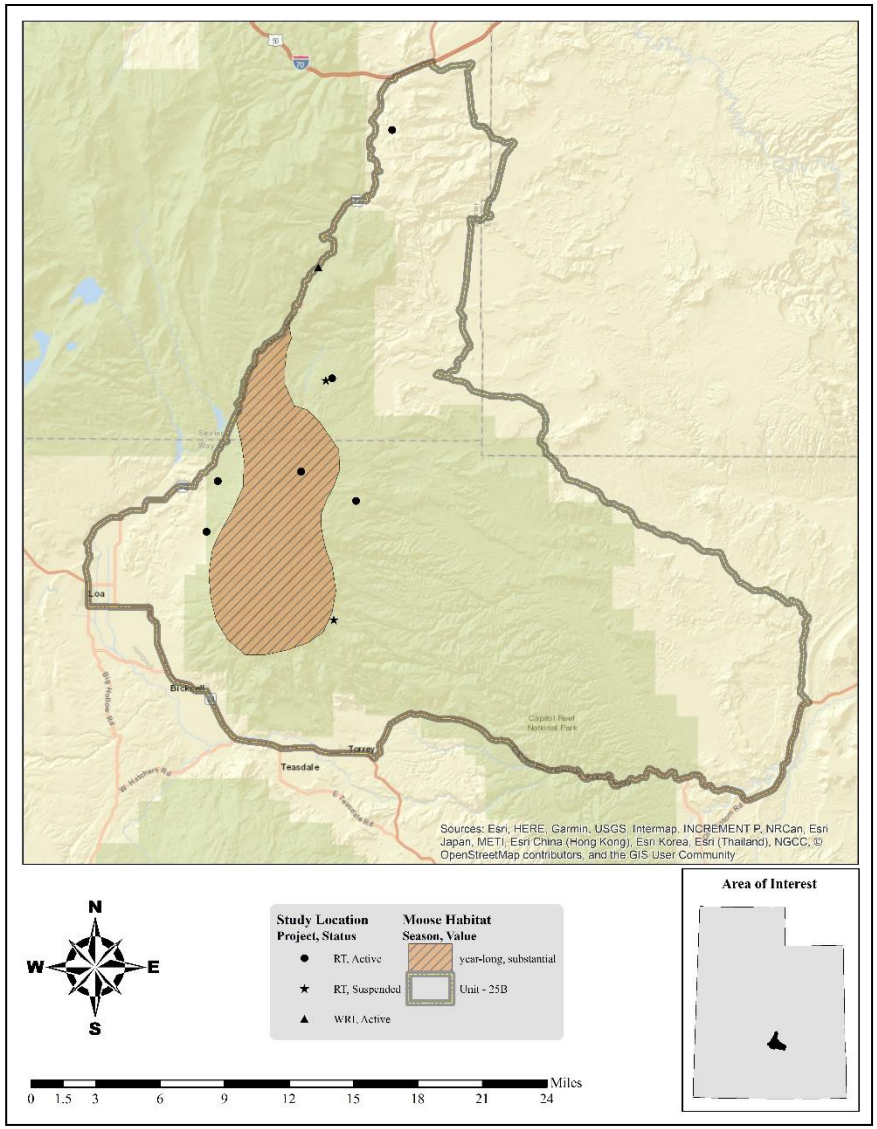
Map 4.3: Estimated elk habitat by season and value for WMU 25B, Thousand Lakes Plateau.



Map 4.4: Estimated pronghorn habitat by season and value for WMU 25B, Thousand Lakes Plateau.



Map 4.5: Estimated desert bighorn sheep habitat by season and value for WMU 25B, Thousand Lakes Plateau.



Map 4.6: Estimated moose habitat by season and value for WMU 25B, Thousand Lakes Plateau.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	39,302	12%	468,556	88%	7	<1%
Elk	28,620	16%	149,358	84%	0	0%
Pronghorn	0	0%	0	0%	5,927	100%
DBS	0	0%	0	0%	169,206	100%
Moose	0	0%	0	0%	37,688	100%

Table 4.1: Estimated mule deer, elk, pronghorn, desert bighorn sheep (DBS), and moose habitat acreage by season for WMU 25B, Thousand Lakes Plateau.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	82,605	30%	7	100%
Private	44	<1%	17,454	6%	0	0%
SITLA	0	0%	9,538	3%	0	0%
USFS	38,957	99%	65,687	24%	0	0%
UDOT	0	0%	30	<1%	0	0%
UDWR	0	0%	15	<1%	0	0%
NPS	301	1%	103,572	37%	0	0%
Total	39,302	**100%**	278,901	**100%**	7	**100%**

Table 4.2: Estimated mule deer habitat acreage by season and ownership for WMU 25B, Thousand Lakes Plateau.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	47,937	32%
Private	0	0%	4,892	3%
SITLA	0	0%	6,128	4%
USFS	28,620	100%	65,461	44%
UDOT	0	0%	10	<1%
NPS	0	0%	24,929	17%
Total	28,620	**100%**	149,358	**100%**

Table 4.3: Estimated elk habitat acreage by season and ownership for WMU 25B, Thousand Lakes Plateau.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	3,499	59%
Private	5	<1%
SITLA	30	<1%
NPS	2,394	40%
Total	5,927	**100%**

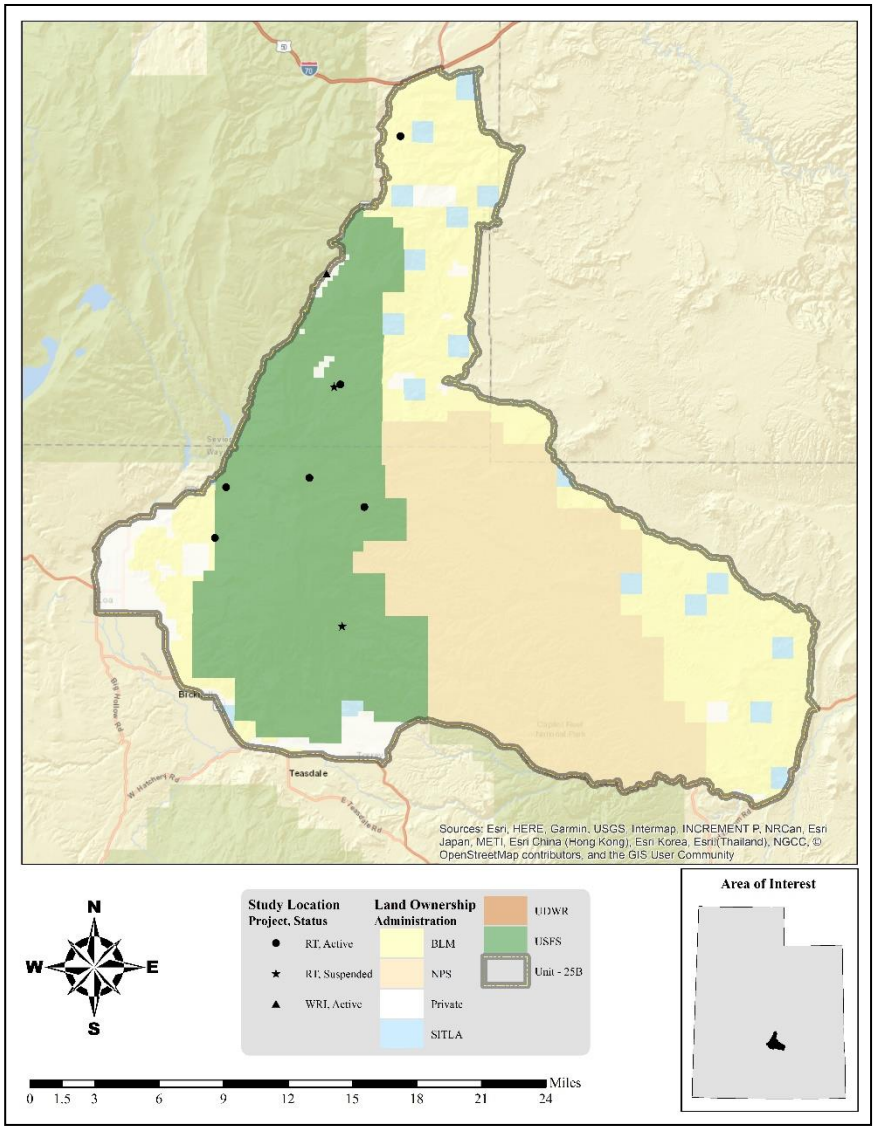
Table 4.4: Estimated pronghorn habitat acreage by season and ownership for WMU 25B, Thousand Lakes Plateau.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	41,355	24%
Private	1,762	1%
SITLA	5,827	3%
USFS	16,279	10%
NPS	103,983	61%
Total	169,206	**100%**

Table 4.5: Estimated desert bighorn sheep habitat acreage by season and ownership for WMU 25B, Thousand Lakes Plateau.

	Year Long Range	
Ownership	*Area (acres)*	*%*
USFS	37,688	100%
Total	37,688	**100%**

Table 4.6: Estimated moose habitat acreage by season and ownership for WMU 25B, Thousand Lakes Plateau.



Map 4.7: Land ownership for WMU 25B, Thousand Lakes Plateau.

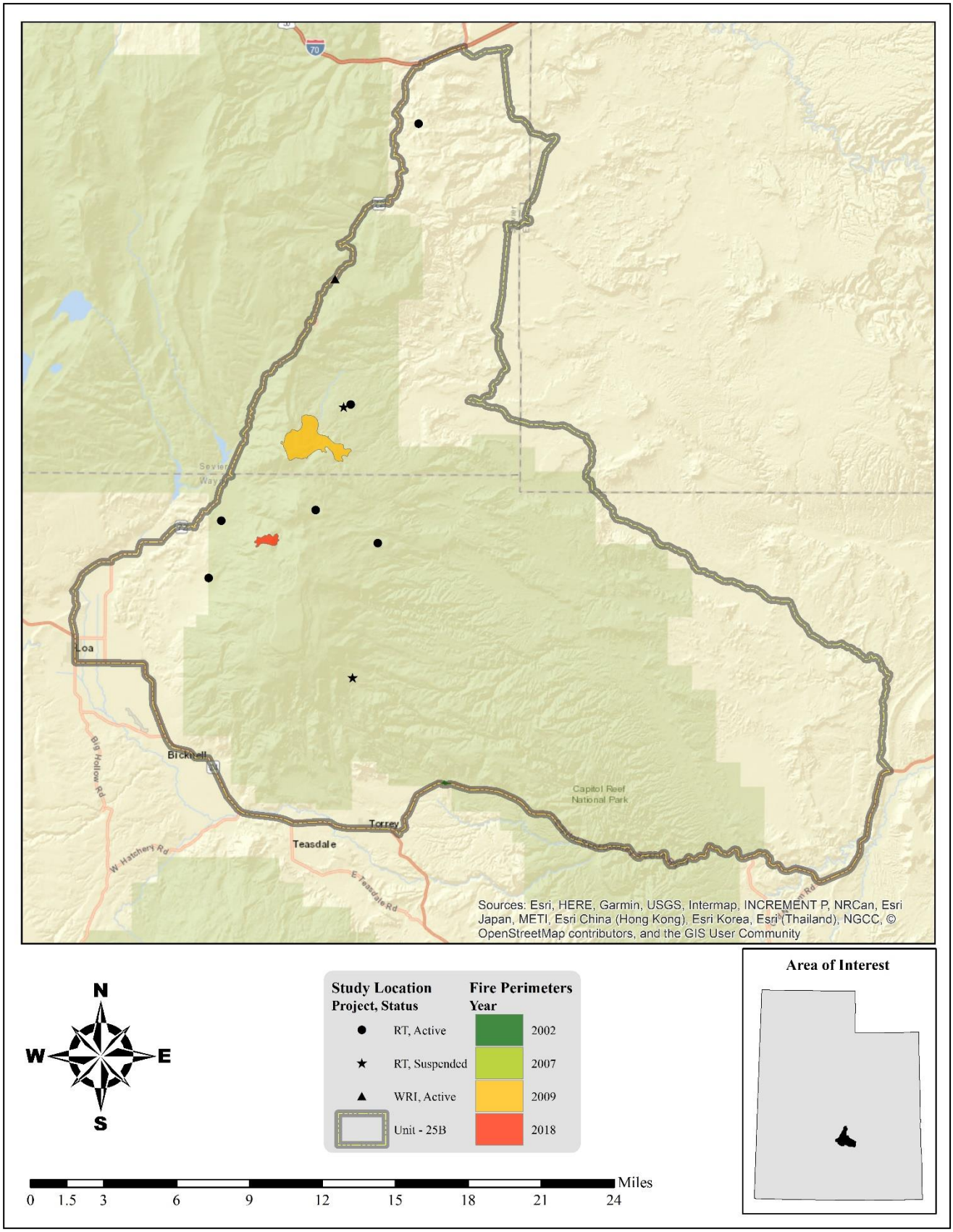
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	72,434	21.77%	
	Spruce-Fir Forest and Woodland	5,957	1.79%	
	Ponderosa Pine Forest, Woodland and Savanna	3,875	1.16%	
	Mountain Mahogany Woodland and Shrubland	1,362	0.41%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	1,153	0.35%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	923	0.28%	
	Limber Pine Woodland	3	0.00%	
	Lodgepole Pine Forest and Woodland	1	0.00%	
	Juniper Woodland and Savanna	0	0.00%	25.76%
Exotic Herbaceous	Introduced Annual Grassland	4,456	1.34%	1.34%
Exotic Tree-Shrub	Introduced Riparian Vegetation	452	0.14%	0.14%
Grassland	Grassland	6,643	2.00%	
	Alpine Dwarf-Shrubland, Fell-field and Meadow	1,223	0.37%	
	Dry Tundra	0	0.00%	2.36%
Shrubland	Salt Desert Scrub	37,045	11.13%	
	Big Sagebrush Shrubland and Steppe	32,653	9.81%	
	Low Sagebrush Shrubland and Steppe	12,030	3.62%	
	Sand Shrubland	8,927	2.68%	
	Desert Scrub	4,835	1.45%	
	Other Shrubland	2,685	0.81%	
	Greasewood Shrubland	1,707	0.51%	
	Chaparral	1,465	0.44%	
	Deciduous Shrubland	1,315	0.40%	30.86%
Other	Barren	55,133	16.57%	
	Sparsely Vegetated	43,759	13.15%	
	Conifer-Hardwood	13,658	4.11%	
	Hardwood	6,725	2.02%	
	Agricultural	4,961	1.49%	
	Developed	4,776	1.44%	
	Riparian	2,478	0.74%	
	Open Water	48	0.01%	
	Quarries-Strip Mines-Gravel Pits	18	0.01%	
	Snow-Ice	0	0.00%	39.54%
Total		332,700	100%	100%

Table 4.7: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 25B, Thousand Lakes Plateau.

Limiting Factors to Big Game Habitat

One major management concern in this unit is the condition of the summer range. As the snow begins to recede in the spring, deer seek green grasses and forbs, which are very scarce on the overgrazed spring ranges. At this time, the early green-up in the alfalfa and grain fields on private land near Loa, Fremont, Lyman and Torrey are very attractive to wildlife and depredation becomes problematic.

Other limiting factors to big game include the encroachment of pinyon and juniper trees. According to the current LANDFIRE Existing Vegetation Coverage model, pinyon-juniper woodlands comprise nearly 22% of the unit (**Table 4.7**). While these woodlands provide valuable escape and thermal cover for wildlife, encroachment and invasion into historic shrublands reduces available browse (Miller, Svejcar, & Rose, 2000), and may therefore influence the carrying capacity of the unit.



Map 4.8: Land coverage of fires by year from 2000-2018 for WMU 25B, Thousand Lakes Plateau (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

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 6,900 acres of land have been treated within the Thousand Lakes Plateau subunit since the WRI was implemented in 2004 (**Map 4.9**). An additional 1,905 acres are currently being treated and treatments have been proposed for 377 acres. Treatments frequently overlap one another bringing the total completed treatment acres to 9,182 acres for this unit (

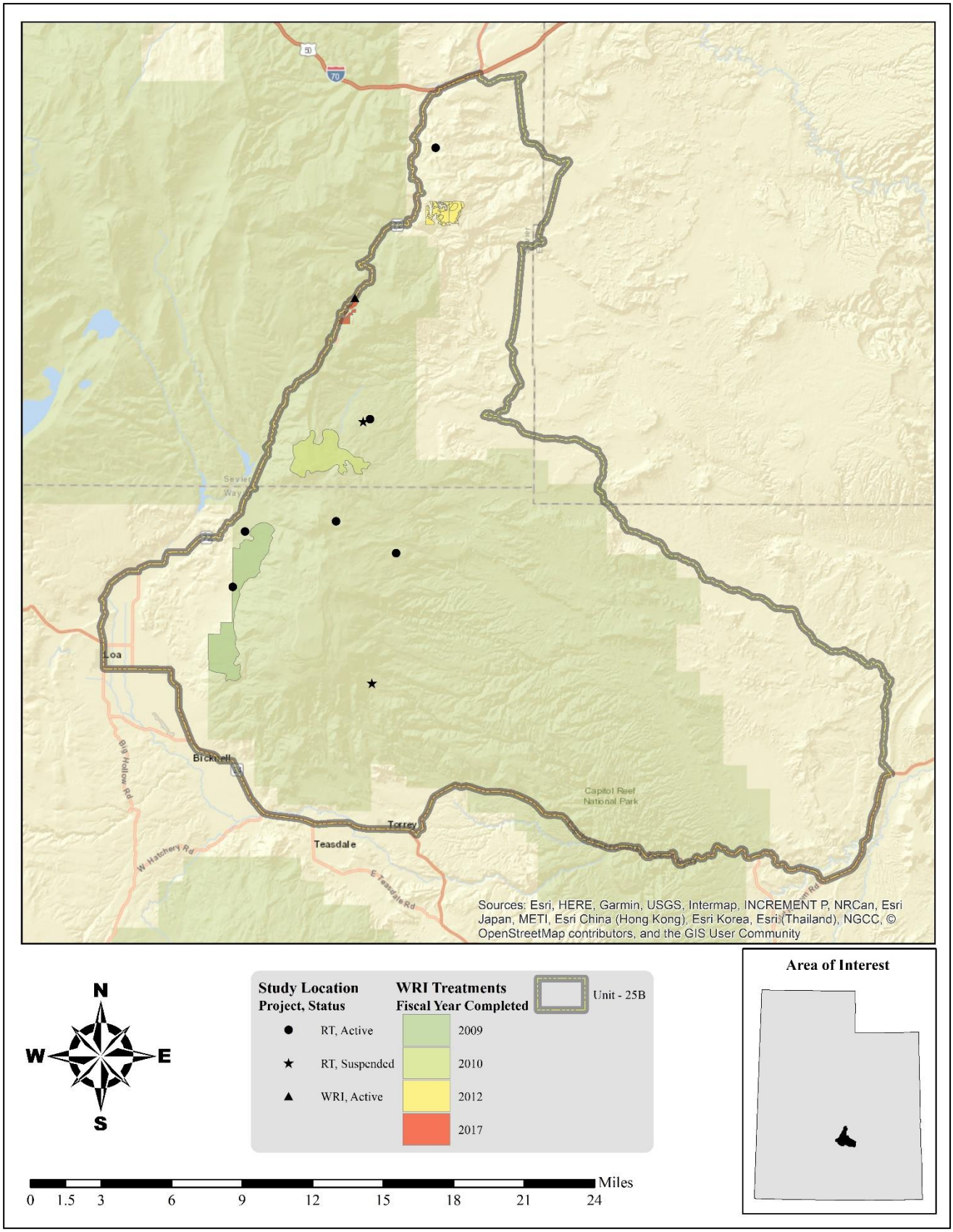
Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**539**	**0**	**0**	**0**	**539**
Ely (One-Way)	341	0	0	0	341
Ely (Two-Way)	198	0	0	0	198
Bullhog	**0**	**360**	**0**	**377**	**360**
Skid Steer	0	360	0	377	360
Mowing	**112**	**0**	**0**	**0**	**112**
Brush Hog	112	0	0	0	112
Seeding (Primary)	**2,590**	**0**	**0**	**0**	**2,590**
Broadcast (Aerial-Helicopter)	2,542	0	0	0	2,542
Drill (Rangeland)	48	0	0	0	48
Skid-Steer Mounted Tree Cutter	**3,569**	**0**	**0**	**0**	**3,569**
Hydraulic Brush Saw	3,569	0	0	0	3,569
Vegetation Removal/Hand Crew	**93**	**1,545**	**0**	**0**	**1,638**
Lop & Scatter	93	1,545	0	0	1,638
Grand Total	**6,903**	**1,905**	**0**	**377**	**9,185**
*** Total Land Area Treated**	**6,900**	**1,905**	**0**	**377**	**9,182**

Table 4.8). 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.

Skid-steer mounted tree cutting treatments are the most common treatment by acreage across the Thousand Lakes Plateau unit. Seeding plants to supplement the herbaceous understory is also common, as are manual vegetation removal techniques such as lop and scatter. Other treatments include anchor chaining, bullhog treatments, and mowing (**Table 4.8**).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**539**	**0**	**0**	**0**	**539**
Ely (One-Way)	341	0	0	0	341
Ely (Two-Way)	198	0	0	0	198
Bullhog	**0**	**360**	**0**	**377**	**360**
Skid Steer	0	360	0	377	360
Mowing	**112**	**0**	**0**	**0**	**112**
Brush Hog	112	0	0	0	112
Seeding (Primary)	**2,590**	**0**	**0**	**0**	**2,590**
Broadcast (Aerial-Helicopter)	2,542	0	0	0	2,542
Drill (Rangeland)	48	0	0	0	48
Skid-Steer Mounted Tree Cutter	**3,569**	**0**	**0**	**0**	**3,569**
Hydraulic Brush Saw	3,569	0	0	0	3,569
Vegetation Removal/Hand Crew	**93**	**1,545**	**0**	**0**	**1,638**
Lop & Scatter	93	1,545	0	0	1,638
Grand Total	**6,903**	**1,905**	**0**	**377**	**9,185**
*** Total Land Area Treated**	**6,900**	**1,905**	**0**	**377**	**9,182**

Table 4.8: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 25B, Thousand Lakes Plateau. Data accessed on 02/18/2019. *Does not include overlapping treatments.



Map 4.9: WRI treatments by fiscal year completed for WMU 25B, Thousand Lakes Plateau.

Range Trend Studies

Range Trend studies have been sampled within WMU 25B on a regular basis since 1985, with studies being added or suspended as was deemed necessary (**Table 4.9**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 4.10**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
25B-01	Thousand Lake	RT	Suspended	'85, '91, '99	Not Verified
25B-02	Horse Valley	RT	Active	'85, '91, '94, '99, '04, '09, '13, '18	Upland Stony Loam (Mountain Big Sagebrush)
25B-03	Sage Flat	RT	Active	'85, '91, '94, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25B-04	Solomon Basin	RT	Suspended	'94, '99, '04, '09, '13	Upland Loam (Black Sagebrush)
25B-05	Polk Creek	RT	Active	'85, '91, '94, '99, '04, '09, '13, '18	Mountain Stony Loam (Antelope Bitterbrush)
25B-06	Little Deer Peak	RT	Active	'85, '91, '99, '04, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25B-07	Hens Peak Aspen	RT	Active	'13, '18	High Mountain Stony Loam (Aspen)
25B-08	Morrell Pond	RT	Active	'18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25R-12	Paradise Valley	WRI	Active	'16	Semiwet Fresh Meadow

Table 4.9: Range trend and WRI project studies monitoring history and ecological site potential for WMU 25B, Thousand Lakes Plateau.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
25B-02	Horse Valley	Bullhog	Cedar Creek Winter Range Enhancement	Fall 2012	3569	818
25B-07	Hens Peak Aspen	Wildfire Seed Unknown	Hens Peak	July 1996 1996	630	
25R-12	Paradise Valley	Herbicide - Tordon 22K	Paradise Valley Restoration Project	October-December 2007	112	3794
		Mower	Paradise Valley Restoration Project	October-December 2017	112	3794

Table 4.10: Range trend and WRI studies known disturbance history for WMU 25B, Thousand Lakes Plateau. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Aspen)

There is one site [Hens Peak Aspen (25B-07)] that is classified as a Mountain (Aspen) ecological site. The Hens Peak Aspen site is located on the east slope of Hens Hole Peak near Thousand Lake Mountain.

Shrubs/Trees: The dominant browse species present on this site is mountain snowberry (*Symphoricarpos oreophilus*) with lesser amounts of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) also observed. Overall cover of preferred browse has been stable across the two sample years (**Figure 4.2**). Preferred browse demographic data shows that the community is composed of both young and mature individuals with very little decadence noted (**Figure 4.9**). Preferred browse utilization has been low overall in the years sampled (**Figure 4.10**).

Tree cover on this site has increased slightly. Most of the cover is provided by quaking aspen (*Populus tremuloides*), but a moderate amount of cover has been provided by conifer trees. Conifer cover has increased over the two study years (**Figure 4.5**). Both conifer and aspen density have increased in the two sample years (**Figure 4.7**).

Herbaceous Understory: The herbaceous understory of this site is diverse but not abundant and is co-dominated by both perennial grasses and perennial forbs. The most common grass is Kentucky bluegrass (*Poa pratensis*) and the most common forbs are trailing fleabane (*Erigeron flagellaris*) and common dandelion (*Taraxacum officinale*) (**Figure 4.11**, **Figure 4.12**).

Mountain (Shrub)

There is one study site [Polk Creek (25B-05)] that is classified as a Mountain (Shrub) ecological site. This study site is located northeast of Thousand Lake Mountain and west of the town of Fremont.

Shrubs/Trees: The shrub component on this site is comprised of a mixture of shrub species, but the dominant species is antelope bitterbrush (*Purshia tridentata*) with lesser amounts of black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), mountain snowberry (*Symphoricarpos oreophilus*) and longflower rabbitbrush (*Chrysothamnus depressus*). Cover of bitterbrush has decreased slightly through time while cover of other preferred browse has displayed a marginal increase (**Figure 4.3**). Shrub demographic data shows that the community is primarily composed of mature individuals; a moderate amount of decadence has been observed, but with a decreasing trend. Recruitment of young plants has been good, although it has decreased in the most recent years (**Figure 4.9**). Utilization data shows that usage is stable and has typically been light to moderate; the exception is 2013 when nearly half of the plants were either moderately or heavily hedged (**Figure 4.10**).

Tree cover on this site is provided by Utah juniper (*Juniperus osteosperma*), Rocky Mountain juniper (*J. scopulorum*), twoneedle pinyon (*Pinus edulis*), and ponderosa pine (*P. ponderosa*). Cover has showed an increasing trend over time, with most of the cover being provided by twoneedle pinyon (**Figure 4.6**). Tree density has increased significantly with pinyon and juniper trees driving this trend (**Figure 4.8**).

Herbaceous Understory: The herbaceous understory on this site is diverse and provides moderate cover, characteristics typical of higher precipitation browse sites. Perennial grasses are the dominant components of this site and most of the species are native. The herbaceous cover has fluctuated between sample years, with a decreasing trend observed between 1999 and 2009. From 2009 through the most recent sample year, an increasing trend of the understory was noted. Nested frequency has followed the trend of herbaceous cover with a corresponding decrease between 2004 and 2009 and an increase in nested frequency between the 2009 and 2018 sample years (**Figure 4.11**, **Figure 4.12**).

Occupancy: Average pellet transect data shows that the deer have been the primary occupants of these study sites and a generally decreasing occupancy trend has been noted. The mean pellet group abundance for deer has varied from a low of 20 days use/acre in 1999 to a high of 70 days use/acre in 2009. Elk usage has generally been low with 1 day use/acre in 1999 and 7 days use/acre being sampled in 2009. Mean abundance of cattle pellet groups has ranged from a low of less than 2 days use/acre in 2018 to a high of 9 days use/acre in 2013 (**Figure 4.13**).

Upland (Big Sagebrush)

There are four study sites [Horse Valley (25B-02), Sage Flat (25B-03), Little Deer Peak (25B-06), and Morrell Pond (25B-08)] that are classified as Upland (Big Sagebrush) ecological sites. The Horse Valley site is located approximately four miles east of Fremont, between the town and Thousand Lake Mountain. The Sage Flat study site is situated northeast of Fremont, approximately one mile east of SR-72. The Little Deer Peak site is located approximately 3 miles south of the I-70 and SR-72 junction, roughly ¾ mile east of SR-72. The Morrell Pond study site is located in Solomon Basin, roughly ¼ mile north of Morrell Pond.

Shrubs/Trees: The dominant browse species on the four sites is either Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) or mountain big sagebrush (*A. tridentata* ssp. *vaseyana*). However, there are small amounts of the other sagebrush species present, such as black sagebrush (*A. nova*) and prairie sagewort (*A. frigida*). The cover of preferred browse has remained relatively constant over the study years (**Figure 4.4**).

Shrub demographic data shows that the populations on these sites are primarily comprised of mature individuals with a moderate amount of decadent plants. Recruitment of young individuals has decreased through time (**Figure 4.9**). Utilization of preferred browse has typically been moderate with 2013 showing very high utilization. In that year, 41 percent of plants were used heavily and 48 percent of plants were moderately browsed (**Figure 4.10**).

Conifer trees are present on these sites, with twoneedle pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) as the sampled species. Tree cover on these sites has shown fluctuations but has generally increased, although some of this is due to the addition of the Morrell Pond study in 2018 (**Figure 4.6**). Tree density has shown a general increase as well, but as with cover, some of this can be attributed to the addition of the Morrell Pond study (**Figure 4.8**).

Herbaceous Understory: The herbaceous understories on these sites are relatively sparse, but typical of lower precipitation sagebrush sites. Perennial grasses are the dominant components, and on most of the sites are composed of native species. The herbaceous cover has fluctuated between sample years: a decreasing trend was noted between 1999 and 2009. Following 2009, an increasing trend of the understory through the current sample year was observed. Nested frequency has followed a similar trend to herbaceous cover with a small decrease between 2004 and 2009, then a corresponding increase in frequency between 2009 and 2018 (**Figure 4.11**, **Figure 4.12**).

Occupancy: Pellet transect data has shown that deer and elk are the primary occupants of these sites; animal presence has varied over the sample period. The mean abundance of deer pellet groups has shown usage varying from 5 days use/acre in 2004 and 2013 to 18 days use/acre in 1999. Elk usage has also fluctuated, with presence changing from 2 days use/acre in 2018 to 16 days use/acre in 1999. Cows have been present on these sites in all years in numbers varying between 1 day use/acre in 2009 and 2013 and 8 days use/acre in 1999 (**Figure 4.13**).

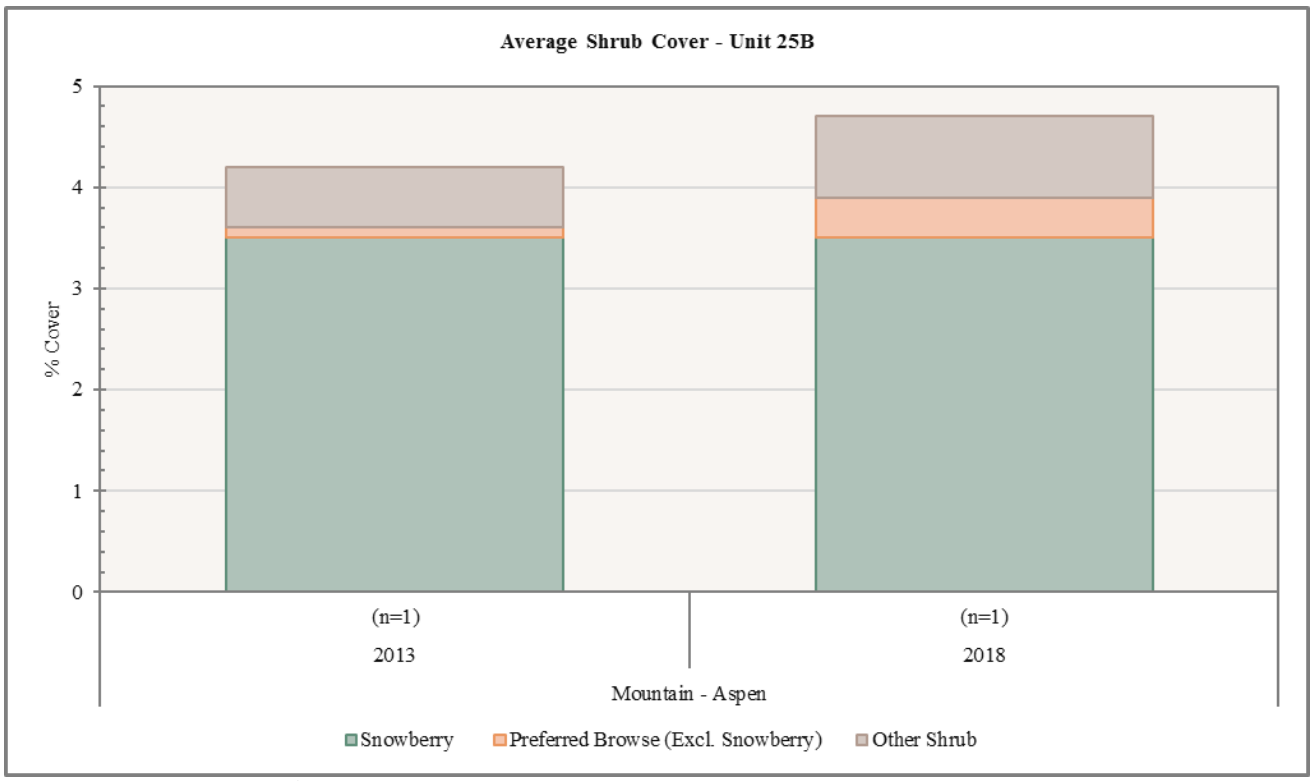


Figure 4.2: Average shrub cover for Mountain - Aspen study sites in WMU 25B, Thousand Lakes Plateau.

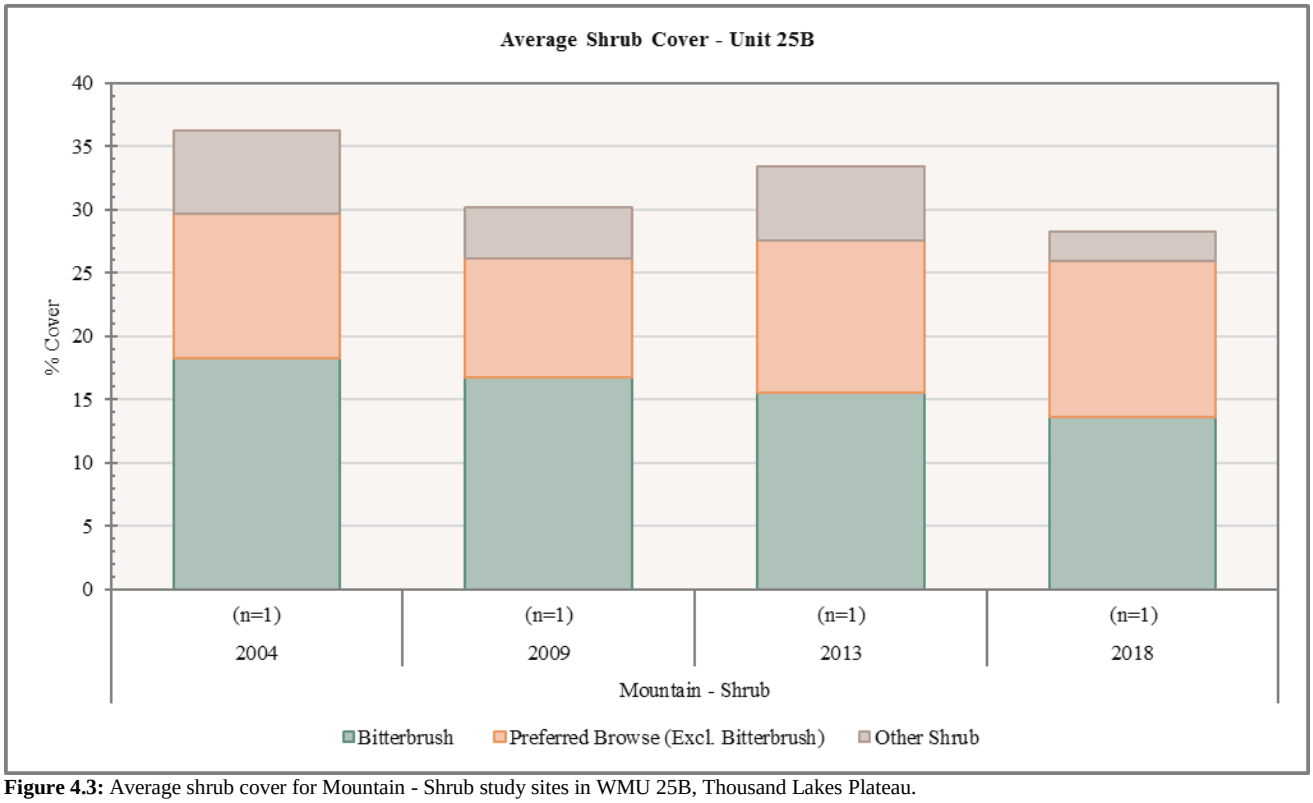


Figure 4.3: Average shrub cover for Mountain - Shrub study sites in WMU 25B, Thousand Lakes Plateau.

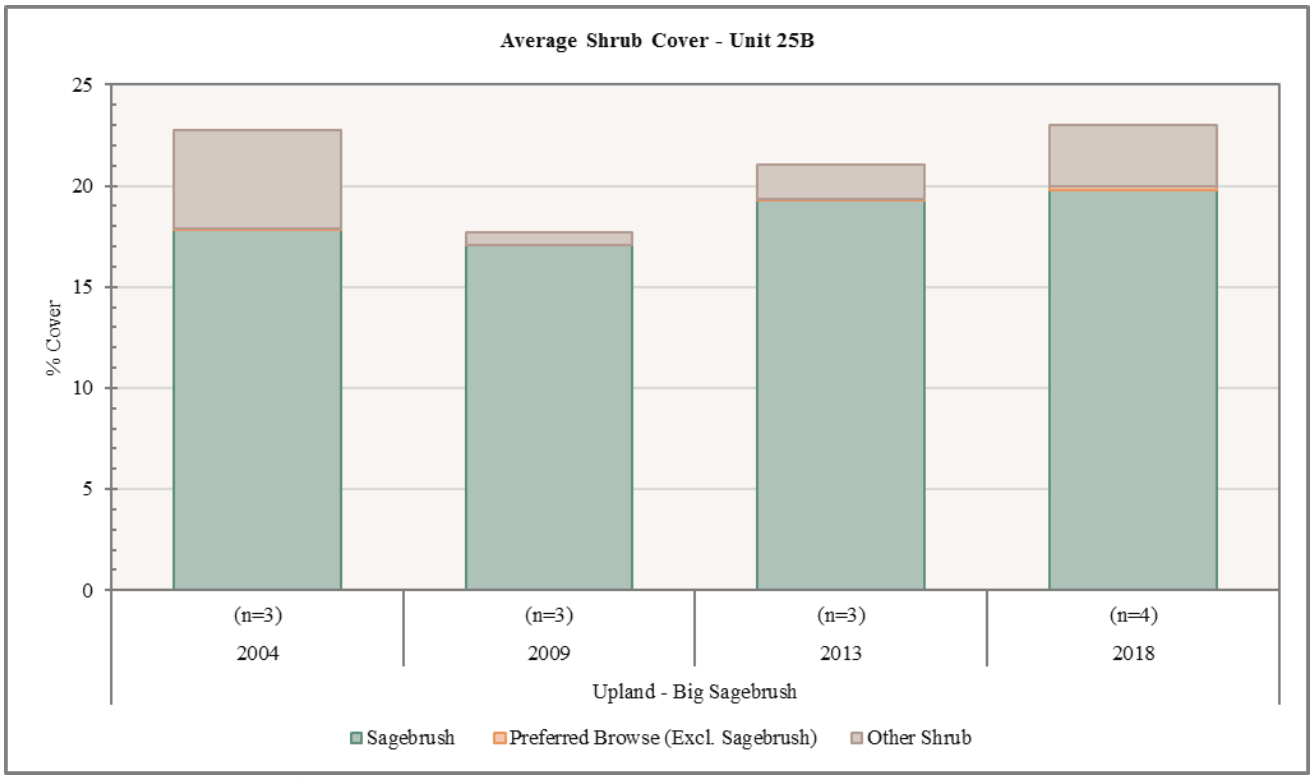


Figure 4.4: Average shrub cover for Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

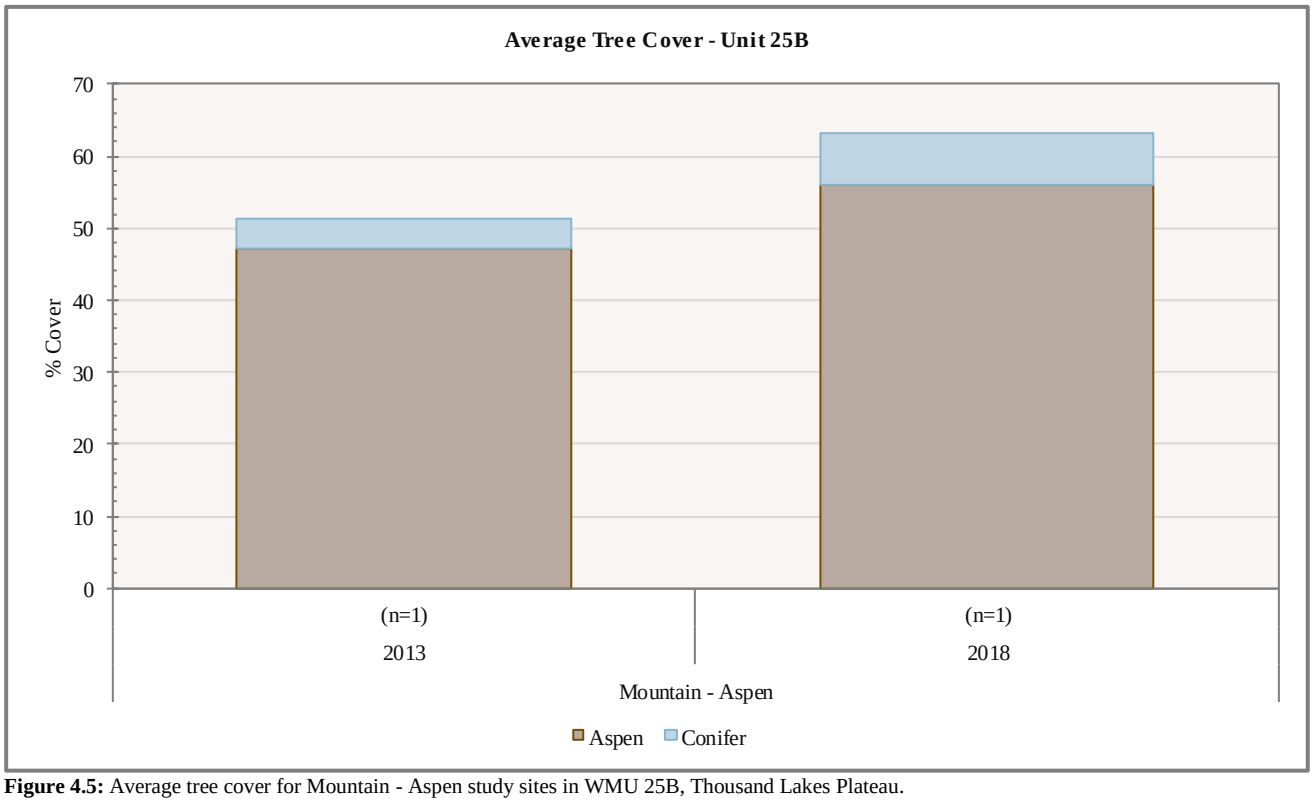


Figure 4.5: Average tree cover for Mountain - Aspen study sites in WMU 25B, Thousand Lakes Plateau.

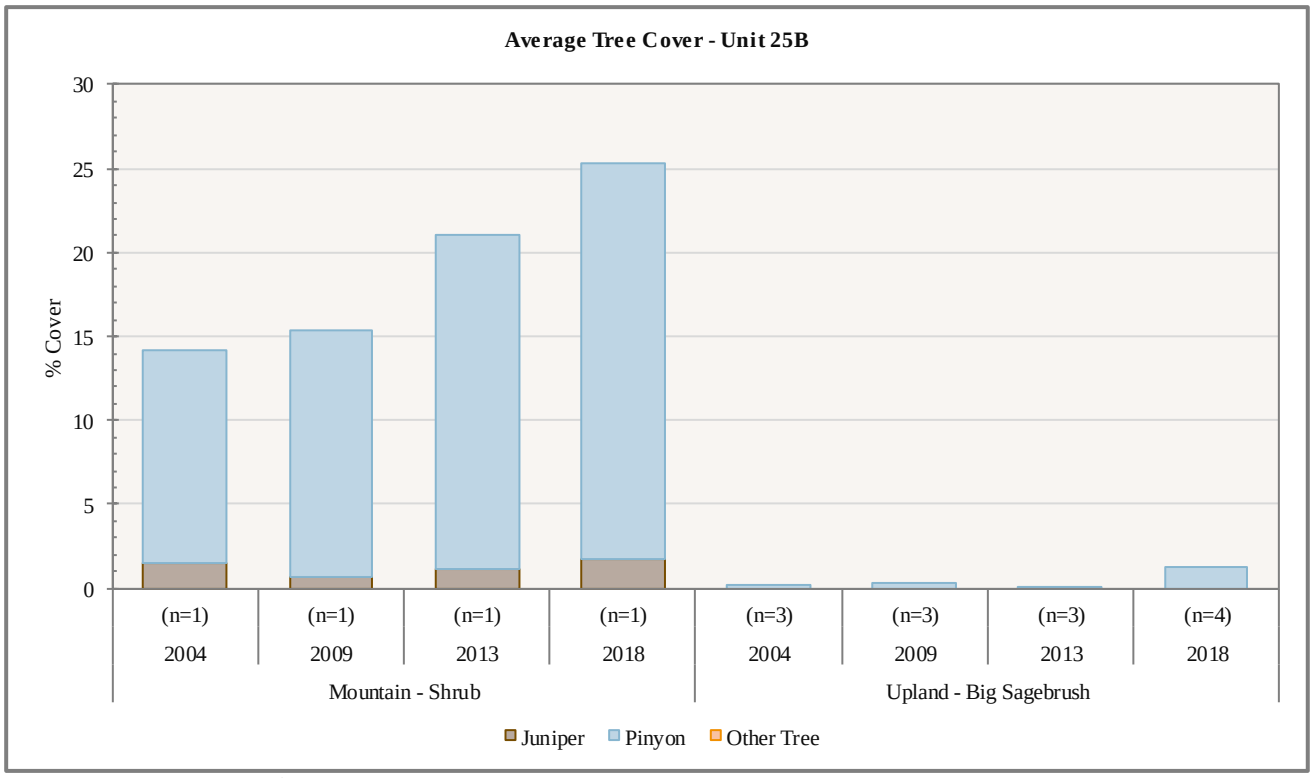


Figure 4.6: Average tree cover for Mountain - Shrub and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

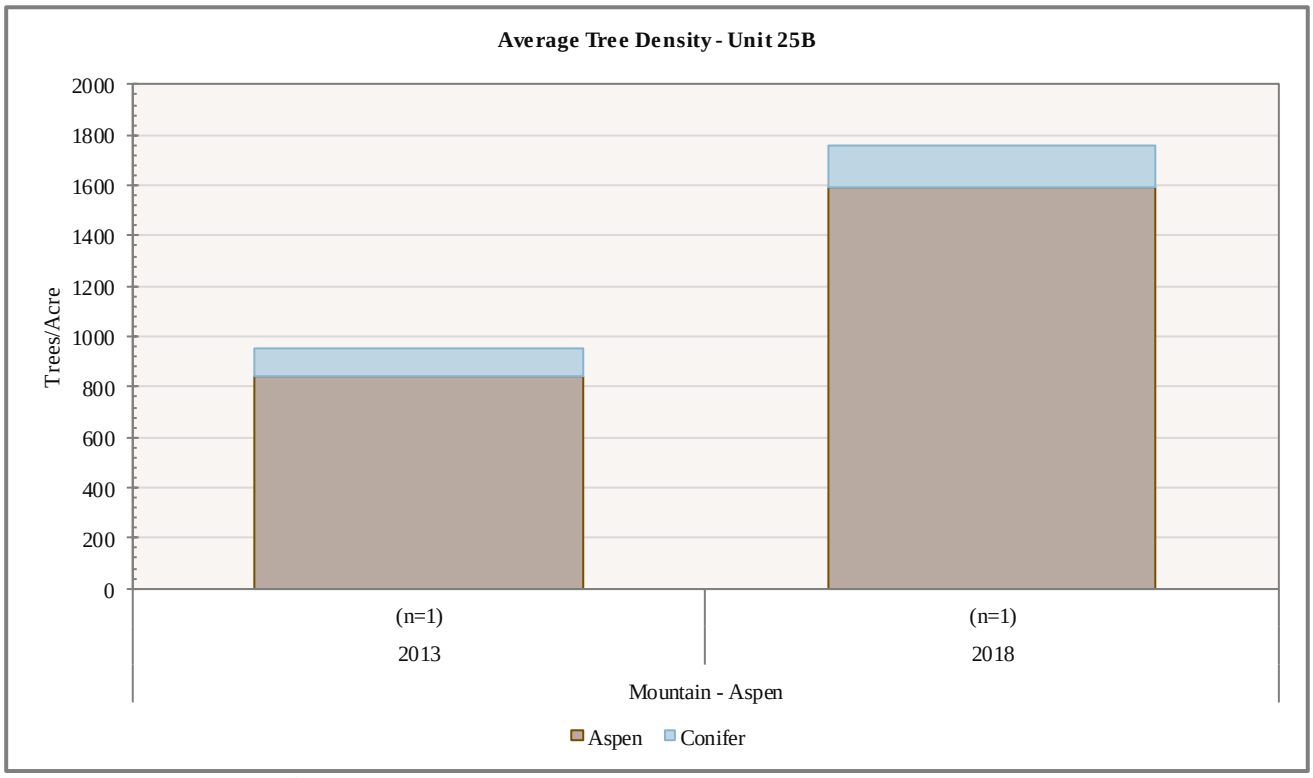


Figure 4.7: Average tree density for Mountain - Aspen study sites in WMU 25B, Thousand Lakes Plateau.

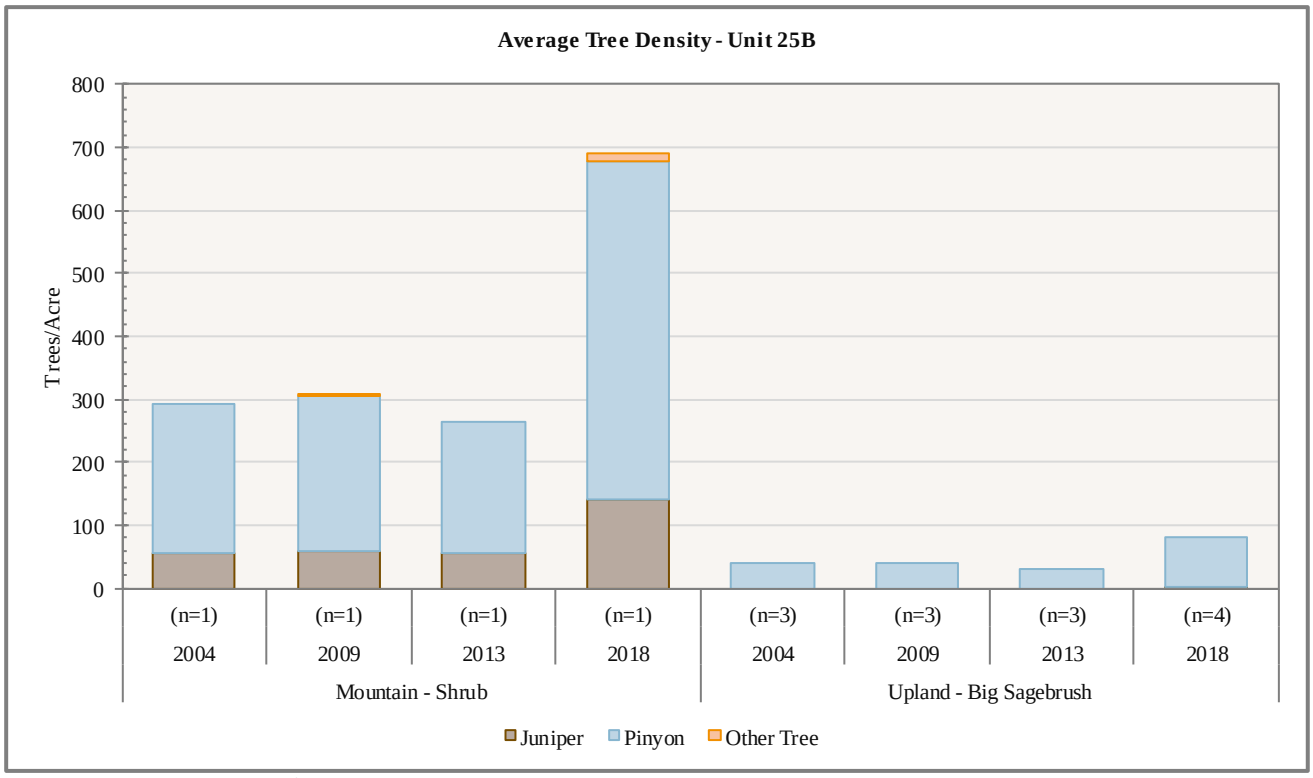


Figure 4.8: Average tree density for Mountain - Shrub and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

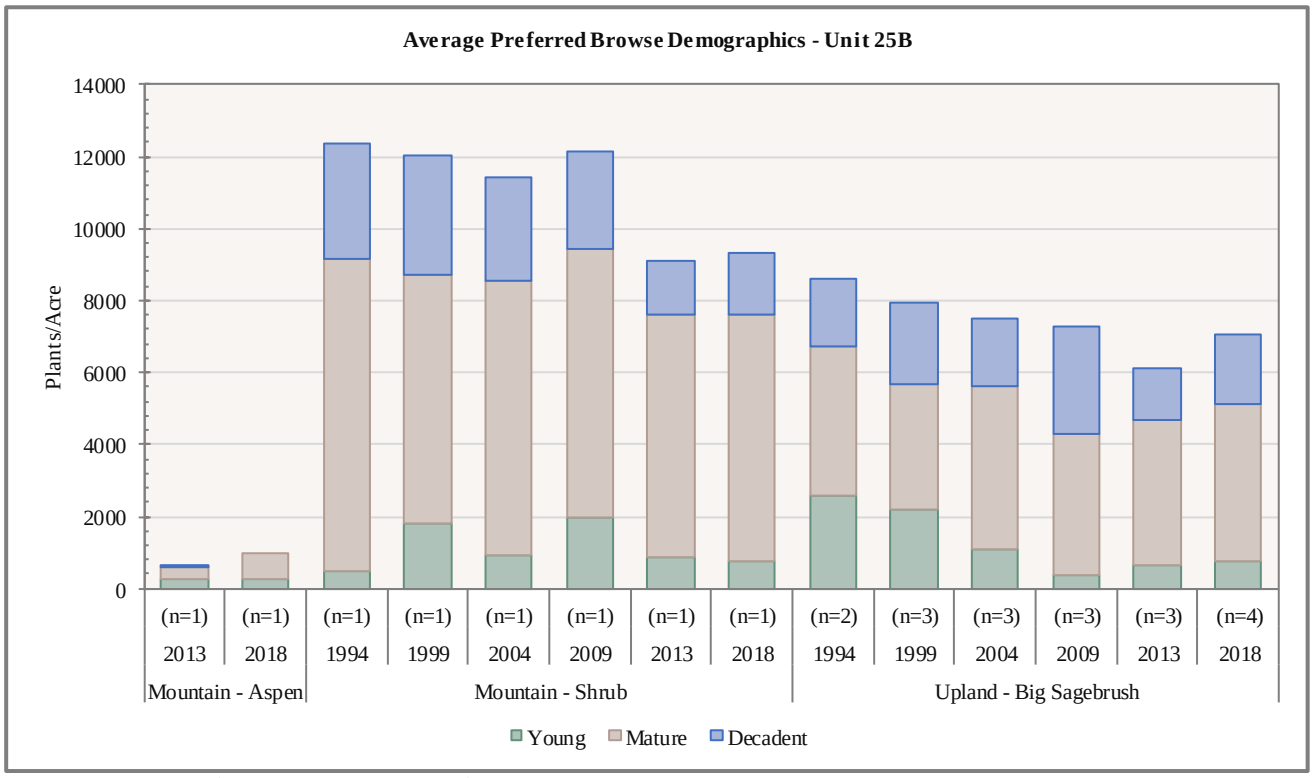


Figure 4.9: Average preferred browse demographics for Mountain - Aspen, Mountain - Shrub, and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

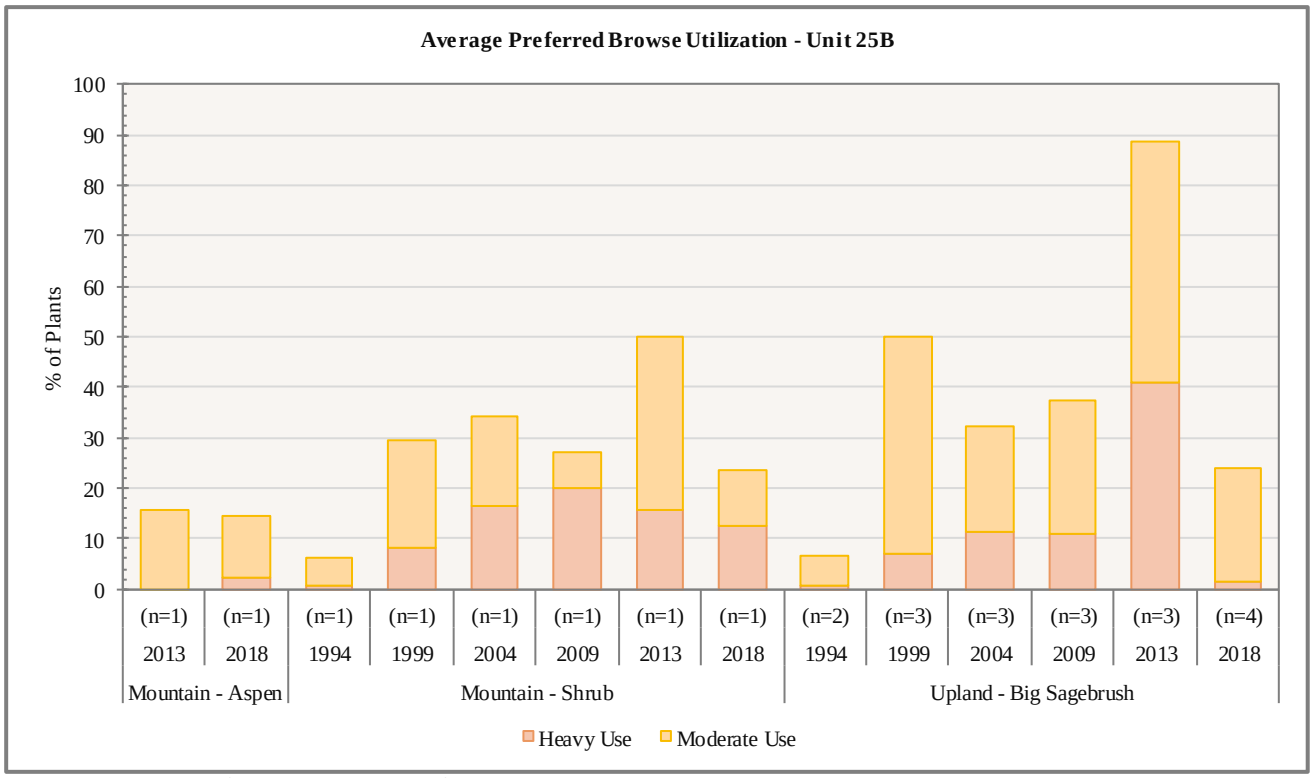


Figure 4.10: Average preferred browse utilization for Mountain - Aspen, Mountain - Shrub, and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

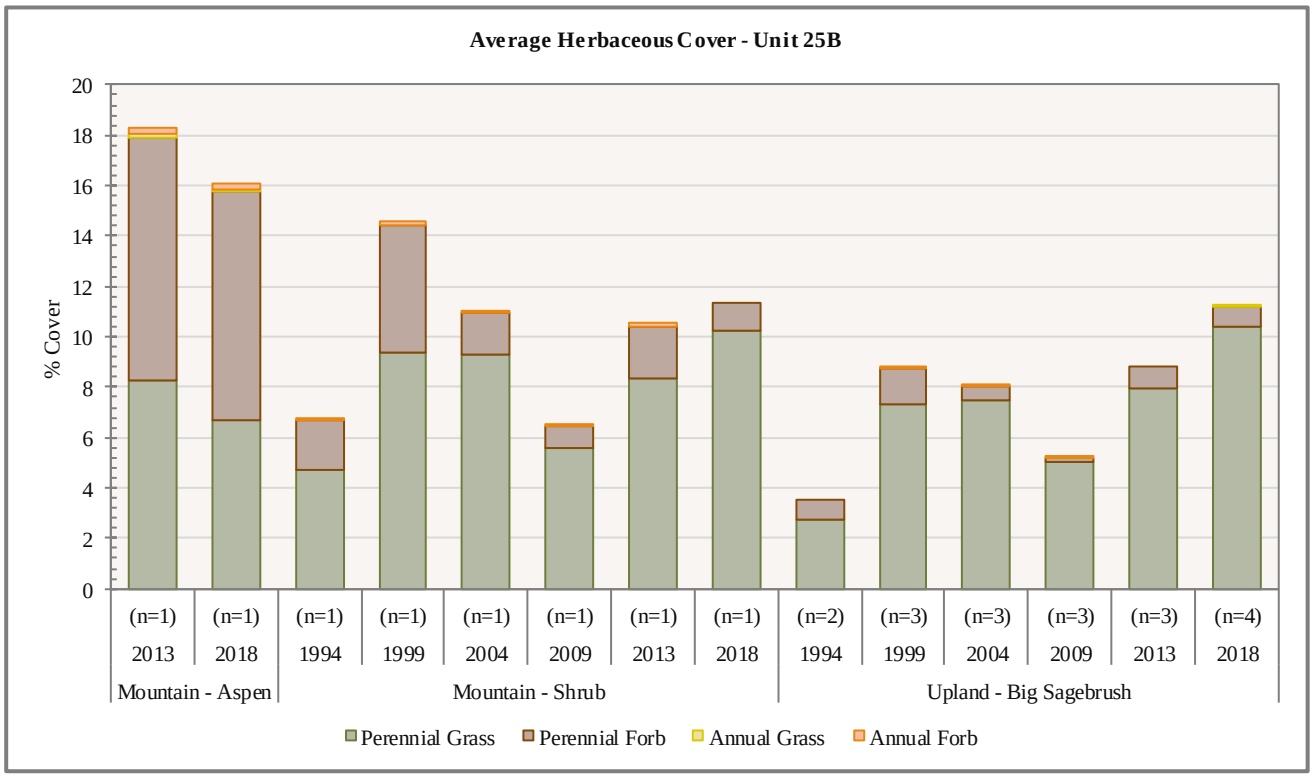


Figure 4.11: Average herbaceous cover for Mountain - Aspen, Mountain - Shrub, and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

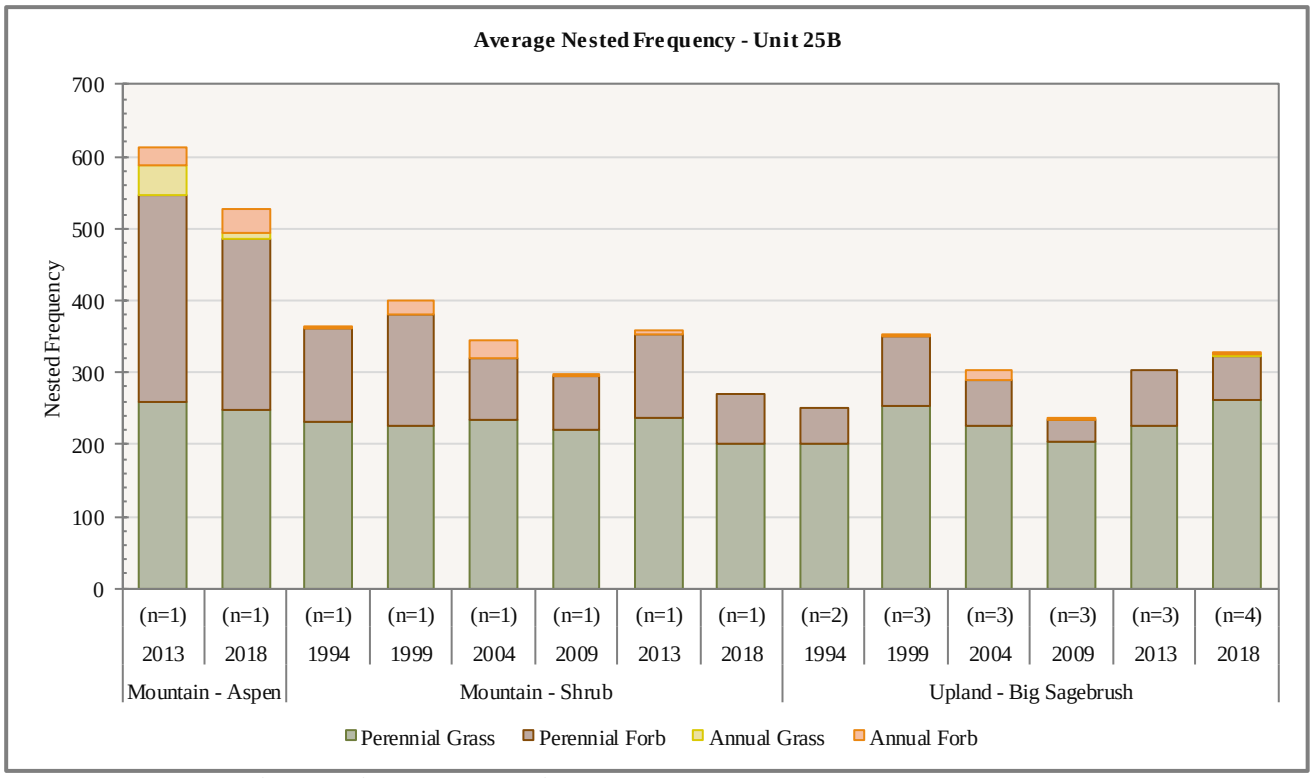


Figure 4.12: Average nested frequency of herbaceous species for Mountain - Aspen, Mountain - Shrub, and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

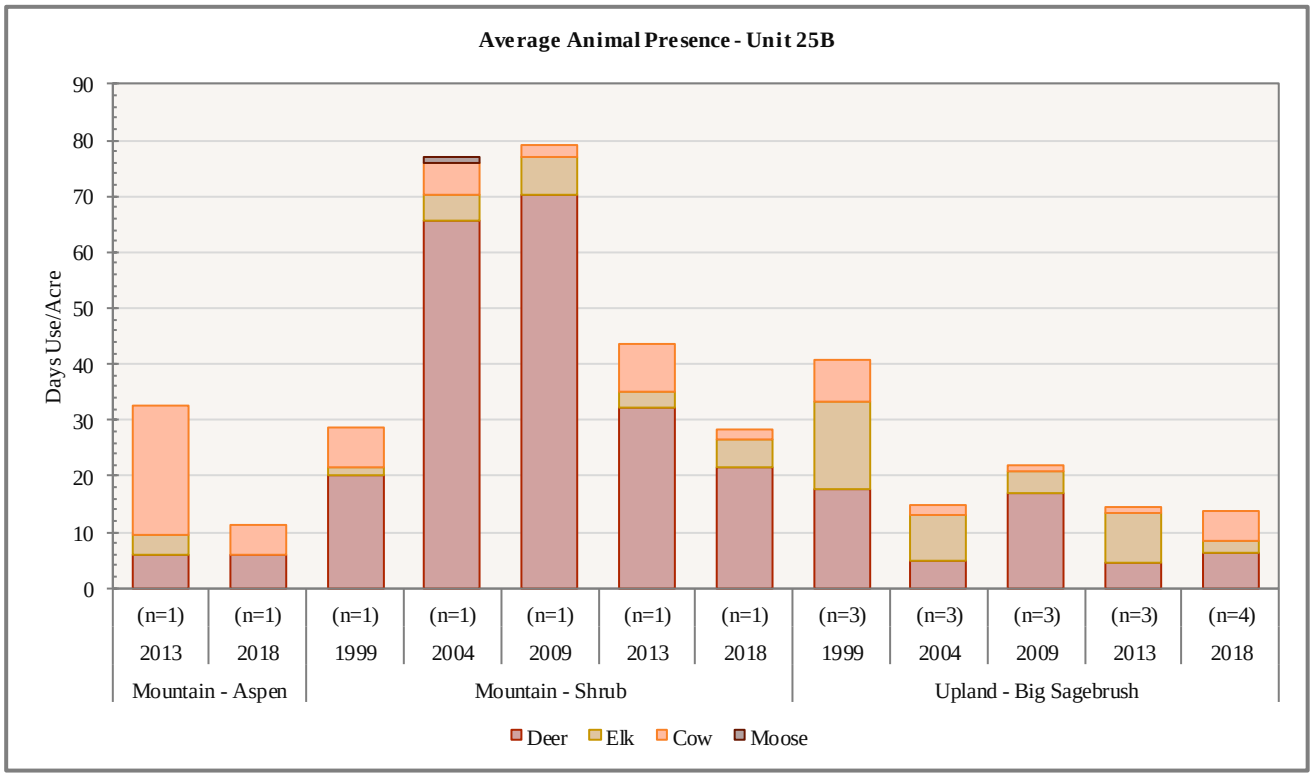


Figure 4.13: Average pellet transect data for Mountain - Aspen, Mountain - Shrub, and Upland - Big Sagebrush study sites in WMU 25B, Thousand Lakes Plateau.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Thousand Lakes Plateau management unit has fluctuated on the sites sampled since 1994. The active Range Trend sites sampled within the unit are considered to be in poor to fair condition as of the 2018 sample year (**Figure 4.14**, **Table 4.11**). The four studies considered to be in fair condition are Sage Flat, Polk Creek, Little Deer Peak, and Morrell Pond. The one site classified as being in poor condition is the Horse Valley study: a depauperate understory and lack of preferred browse young are the reasons that this site is considered to be in this condition.

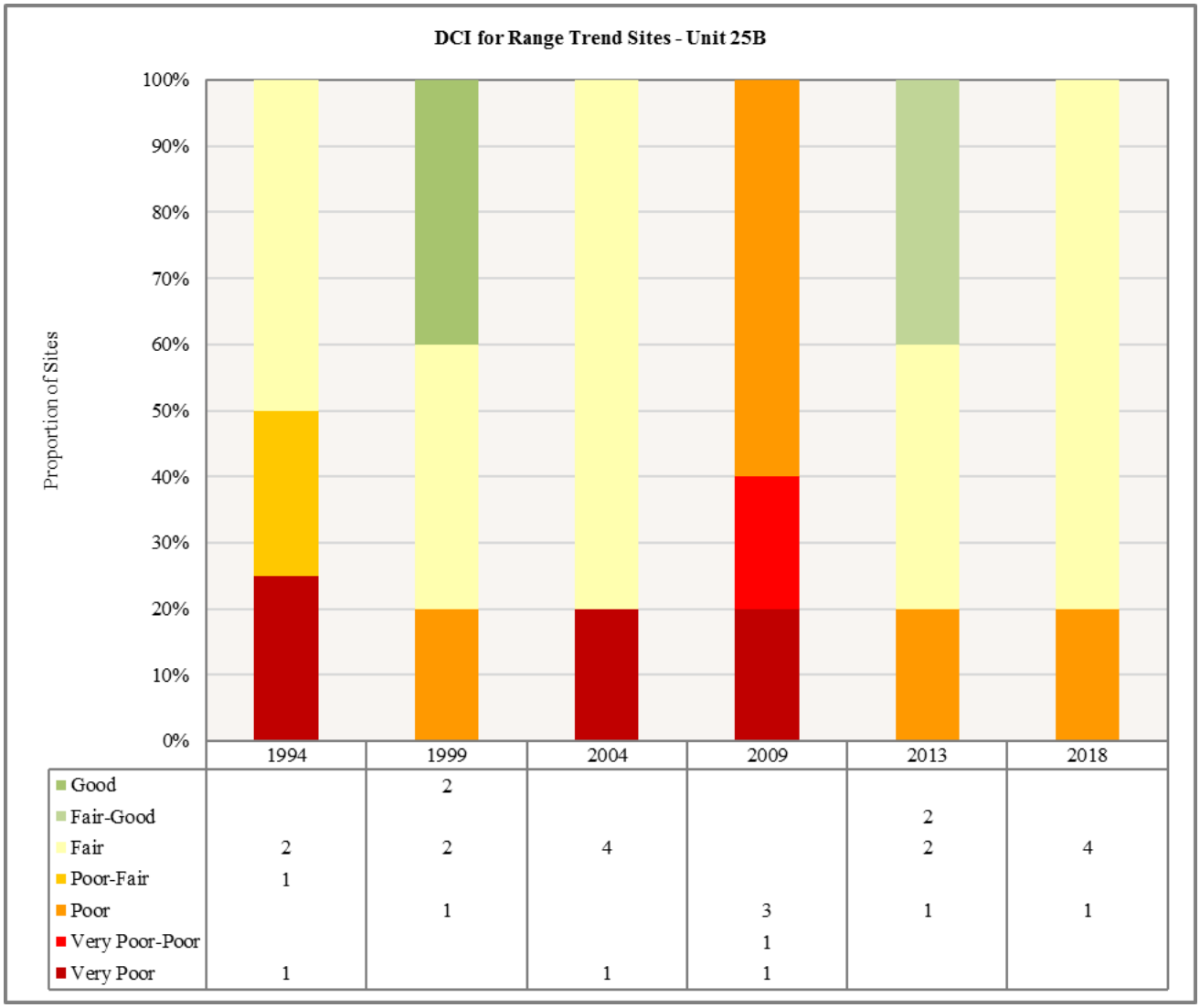
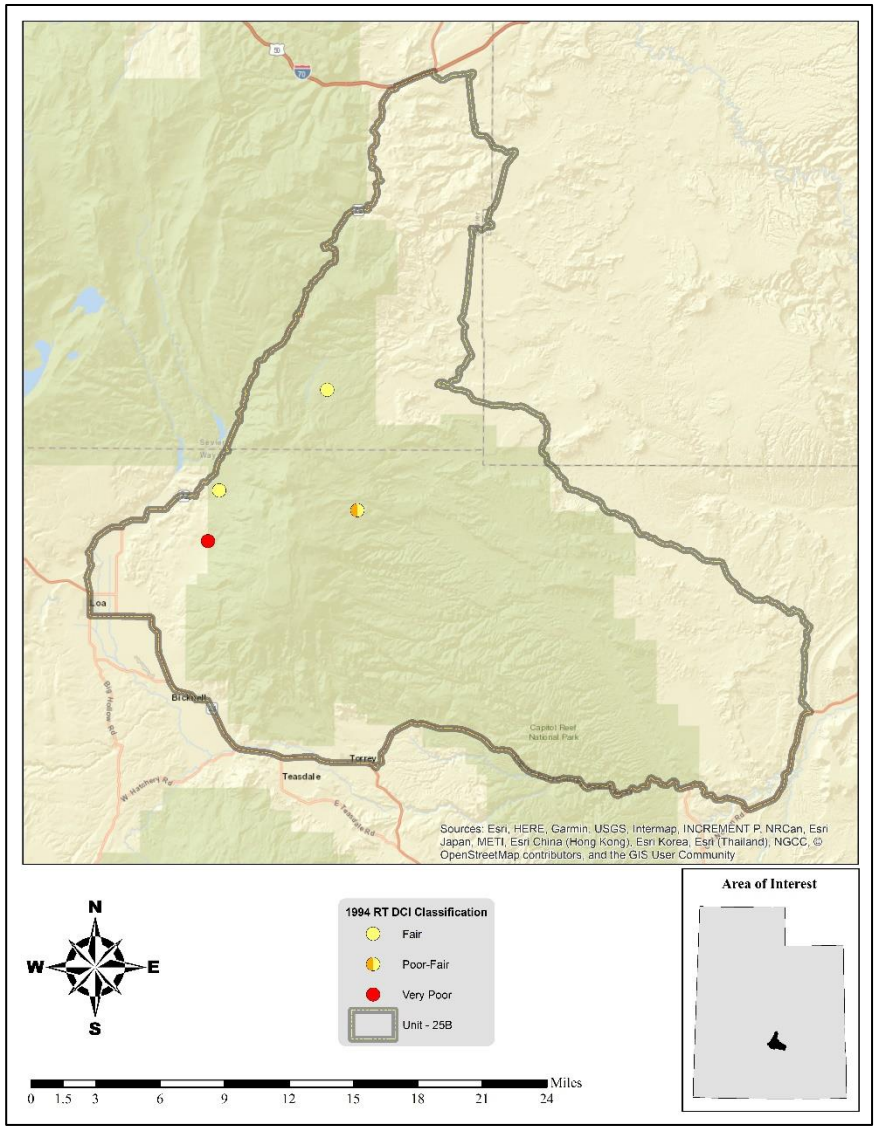


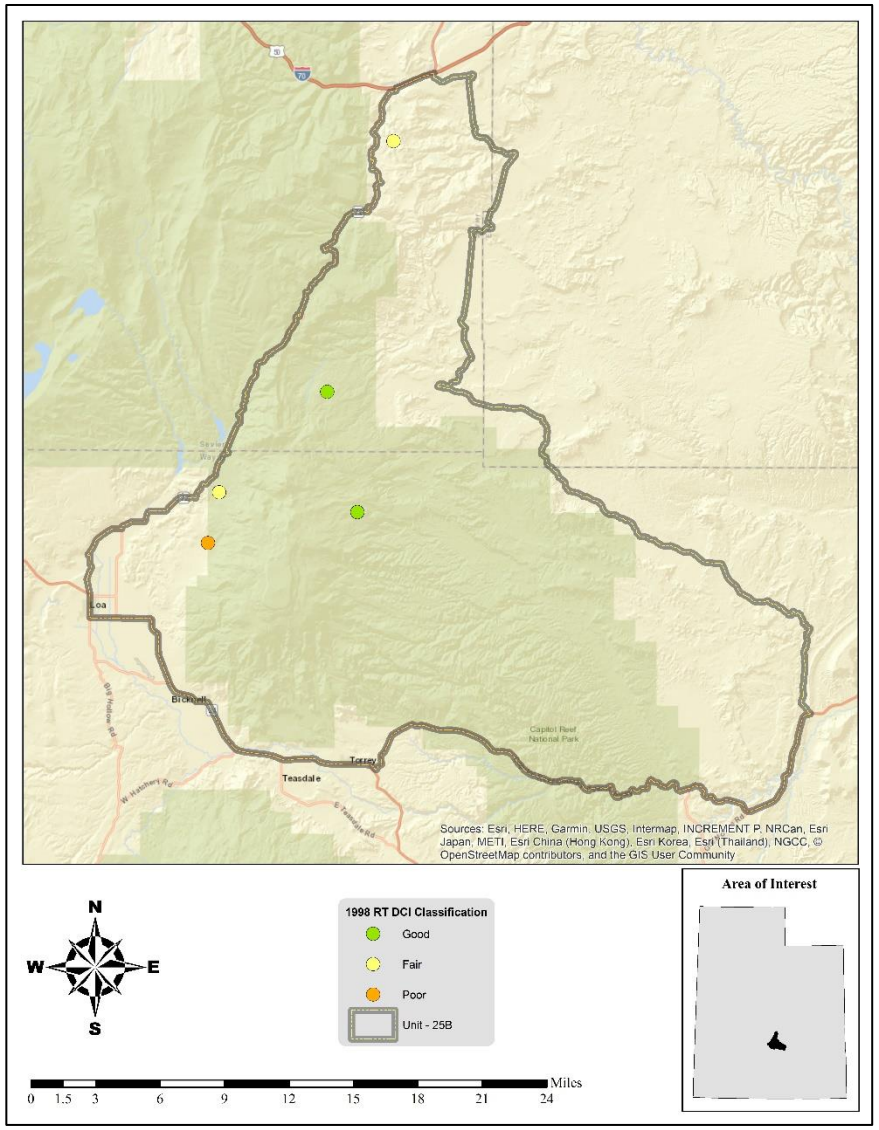
Figure 4.14: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 25B, Thousand Lakes Plateau.

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
25B-02	1994	18.8	2.2	1.3	3	0	2.5	0	**27.7**	**VP**
25B-02	1999	23.6	2.8	4.9	4.4	0	4.4	0	**40**	**P**
25B-02	2004	22.9	4	2.1	3.1	0	0.4	0	**32.4**	**VP**
25B-02	2009	25.5	-2.7	1	3.1	0	0.3	0	**27.2**	**VP**
25B-02	2013	27	3.6	2.5	3.8	0	2.8	0	**39.8**	**P**
25B-02	2018	28.1	4.9	1.5	6.5	0	2.7	0	**43.8**	**P**
25B-03	1994	26.8	10.2	15	8.1	0	0.5	0	**60.6**	**F**
25B-03	1999	26	8.1	15	6	0	0.7	0	**55.7**	**F**
25B-03	2004	25.5	9.1	13.2	5.5	0	0.4	0	**53.6**	**F**
25B-03	2009	26.9	7	3.2	4.8	0	0.4	0	**42.2**	**P**
25B-03	2013	27.9	9.1	4.7	13.1	0	0.8	0	**55.6**	**F**
25B-03	2018	30	6.7	6.5	9.6	0	1.4	0	**54.2**	**F**
25B-04*	1994	11.6	11.1	8.7	18.3	0	4	0	**53.6**	**F**
25B-04*	1999	17.8	10.9	6.8	23.3	0	8.8	0	**67.6**	**G**
25B-04*	2004	26.2	11.9	8.5	11.5	0	3.8	0	**61.9**	**F**
25B-04*	2009	17.6	9.3	9.6	9.9	0	1.5	0	**48**	**P**
25B-04*	2013	29.6	14	10.8	8.6	0	3.3	0	**66.2**	**F-G**
25B-05	1994	30	8.6	1.5	9.5	0	3.9	0	**53.4**	**P-F**
25B-05	1999	30	8.9	6.7	18.7	0	10	0	**74.2**	**G**
25B-05	2004	30	9	2.1	18.5	0	3.4	0	**63.1**	**F**
25B-05	2009	30	5.9	4.2	11.1	0	1.8	0	**52.9**	**P**
25B-05	2013	30	8.1	3.4	16.8	0	4	0	**62.2**	**F**
25B-05	2018	30	8	3.2	20.5	0	2.3	0	**63.9**	**F**
25B-06	1999	17.4	6	5.5	30	0	3.1	0	**61.9**	**F**
25B-06	2004	18.6	6.3	0.5	30	0	2.5	0	**57.9**	**F**
25B-06	2009	11.8	-2.1	1.6	22	0	0.3	0	**33.5**	**VP-P**
25B-06	2013	17.6	8.9	7.6	30	0	1.4	0	**65.5**	**F-G**
25B-06	2018	16.3	3.9	1.7	30	0	1.8	0	**53.6**	**F**
25B-08	2018	25.4	10.4	9.3	15	0	0.3	0	**60.2**	**F**

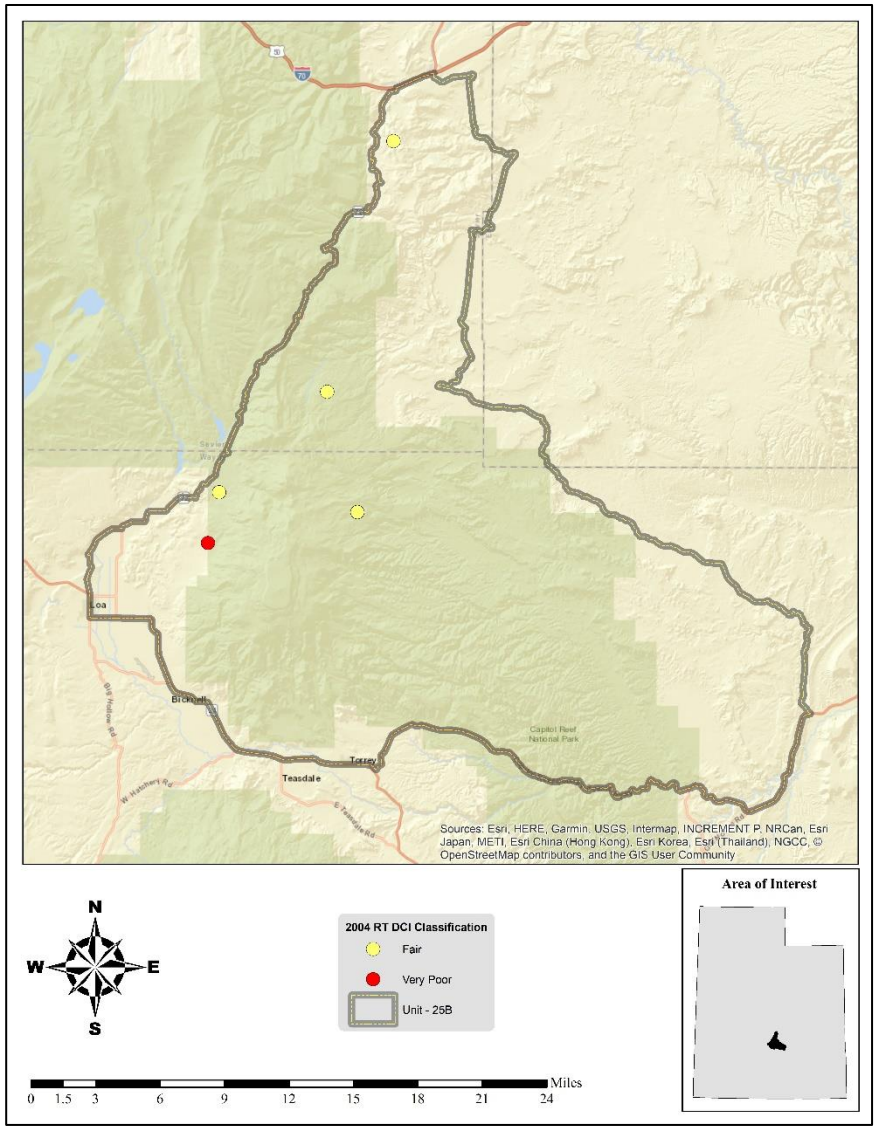
Table 4.11: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 25B, Thousand Lakes Plateau. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



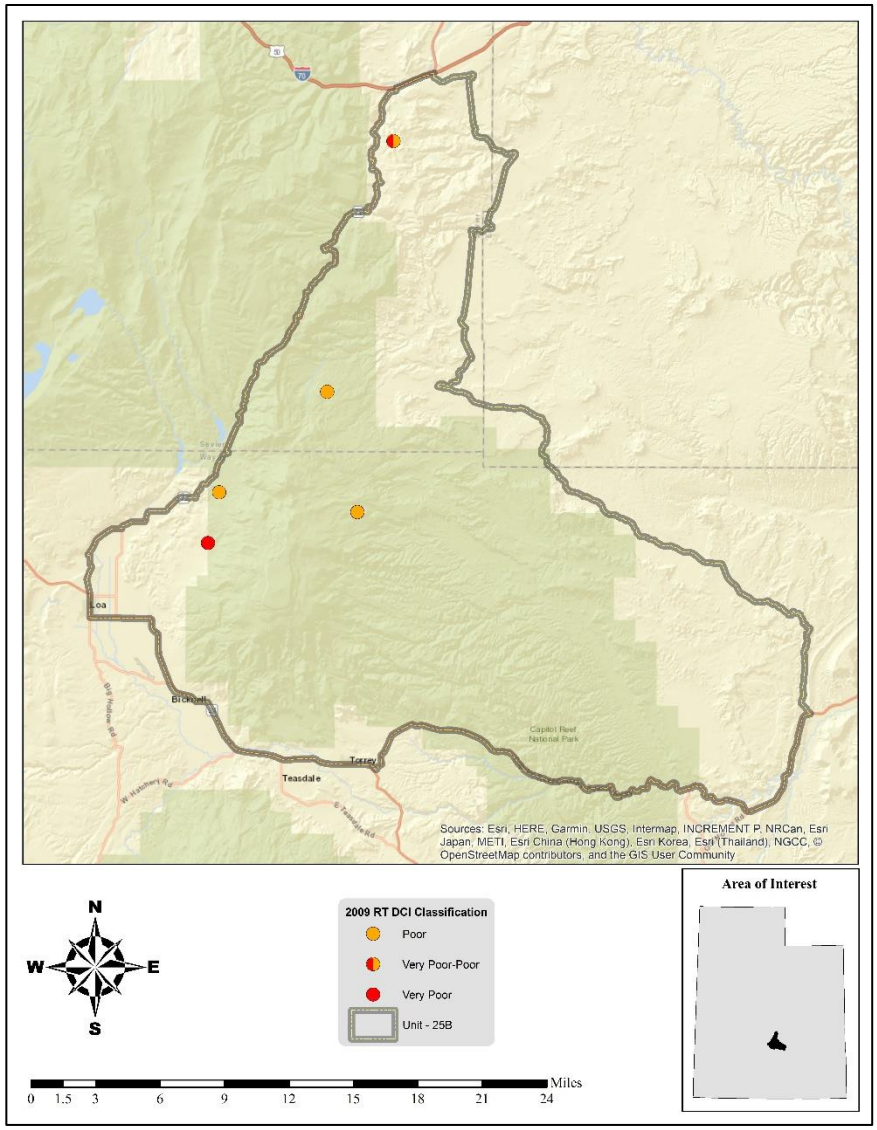
Map 4.10: 1994 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.



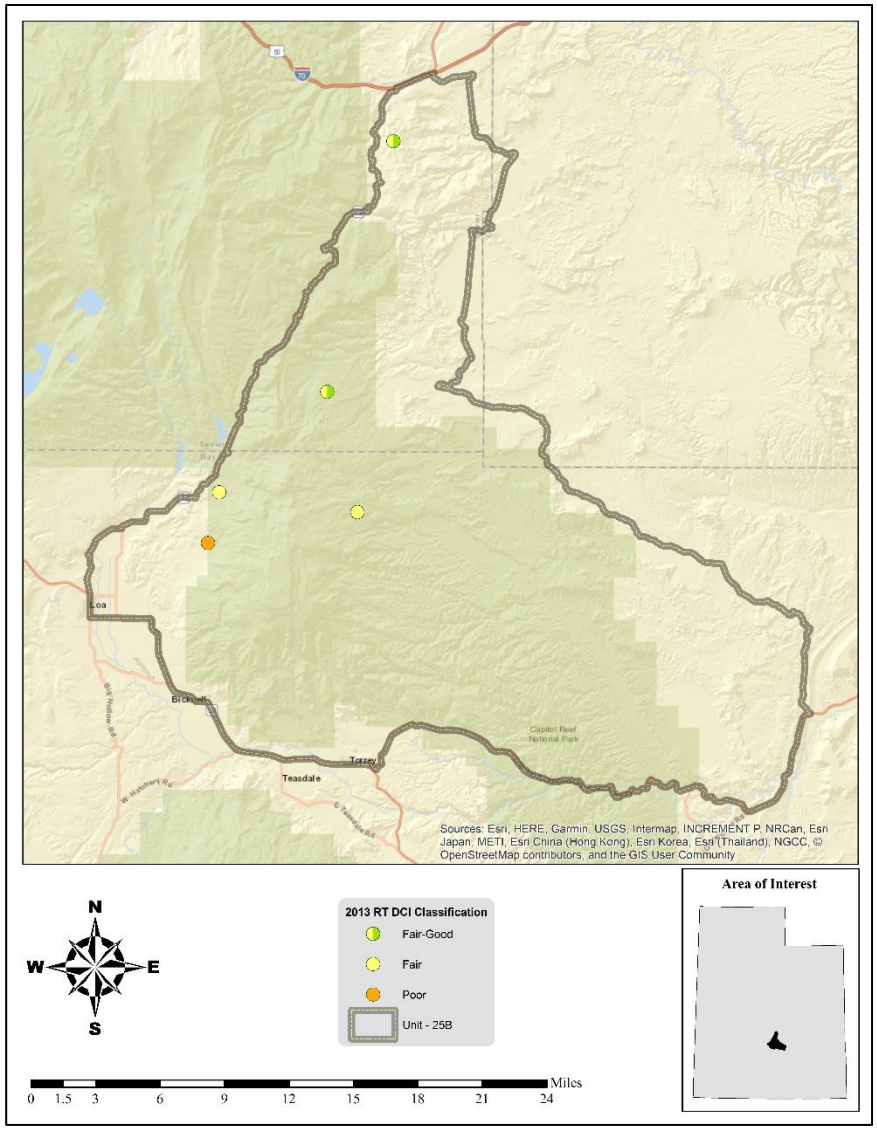
Map 4.11: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.



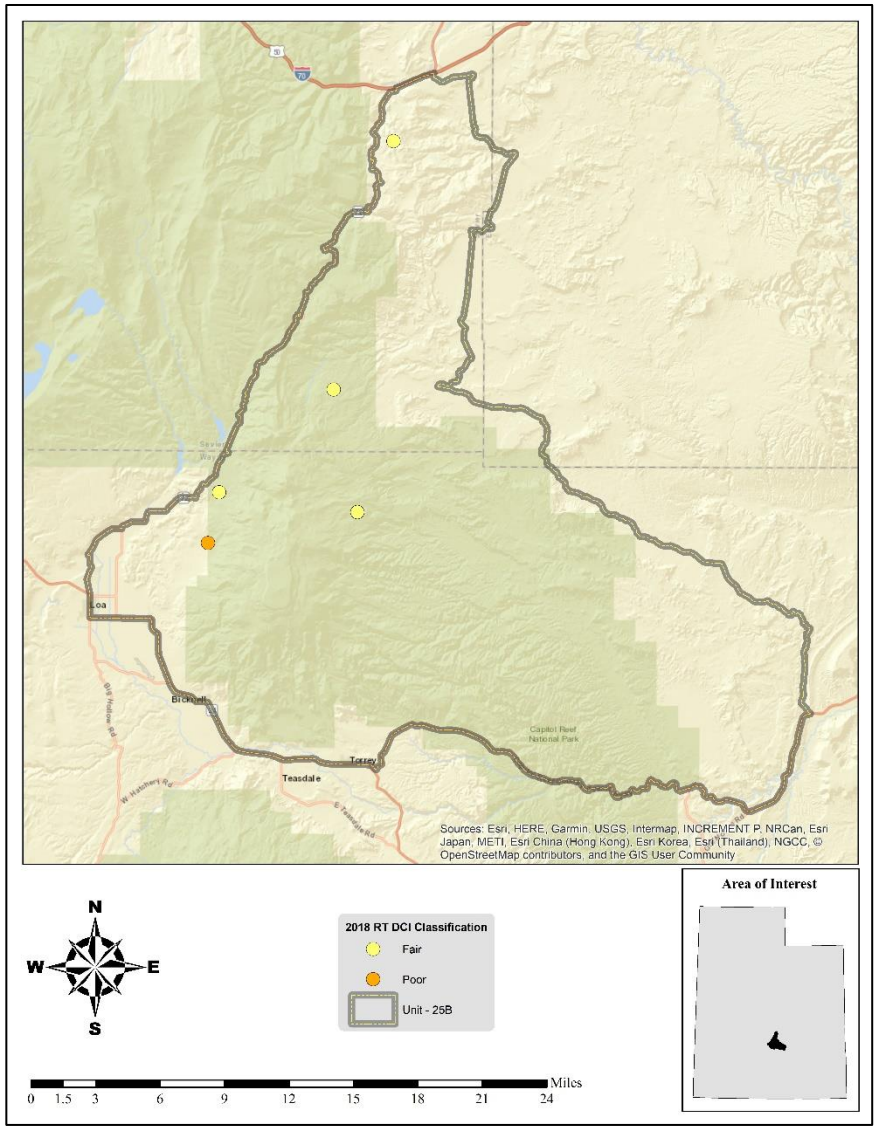
Map 4.12: 2004 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.



Map 4.13: 2009 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.



Map 4.14: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.



Map 4.15: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 25B, Thousand Lakes Plateau.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
25B-02	Horse Valley	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25B-03	Sage Flat	None Identified		
25B-05	Polk Creek	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
25B-06	Little Deer Peak	Introduced Perennial Grass PJ Encroachment	Low Low	Reduced diversity of desirable grass and forb species Reduced understory shrub and herbaceous vigor
25B-07	Hens Peak Aspen	Introduced Perennial Grass Annual Grass Conifer Encroachment	Medium Low Medium	Reduced diversity of desirable grass and forb species Increased fire potential and reduced herbaceous diversity Reduced understory shrub and aspen stand vigor, herbaceous vigor.
25B-08	Morrell Pond	Annual Grass PJ Encroachment	Low Low	Increased fire potential and reduced herbaceous diversity Reduced understory shrub and herbaceous vigor
25R-12	Paradise Valley	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species

Table 4.12: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 25B, Thousand Lakes Plateau. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Aspen)

The study considered to be of the Mountain (Aspen) ecological type supports aspen, mixed browse communities, and herbaceous understories that provide forage for deer and other game. Conifer encroachment is occurring on this site and will likely continue to occur in the future. The herbaceous understory of this site is moderately depleted but still provides some cover. Introduced perennial grasses are present: at higher elevations these can become aggressive and outcompete native species. There are some annual grasses present but they are not likely to pose a risk to the ecological integrity.

Areas in the aspen that show significant amounts conifer encroachment may be considered for a tree-removing treatment (e.g. bullhog, lop and scatter, etc.). This would likely help to restore vigor to the aspen community. Annual grass cover fluctuates but is generally low on these studies and treatments would likely not be beneficial. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Shrub)

The study that is classified as a Mountain (Shrub) ecological site supports mixed browse communities which provide feed for deer and elk during the winter months. The mixed browse community is in overall good condition. Conifer encroachment is occurring on the site sampled, but this may not be true for all areas within the mixed browse ecological type.

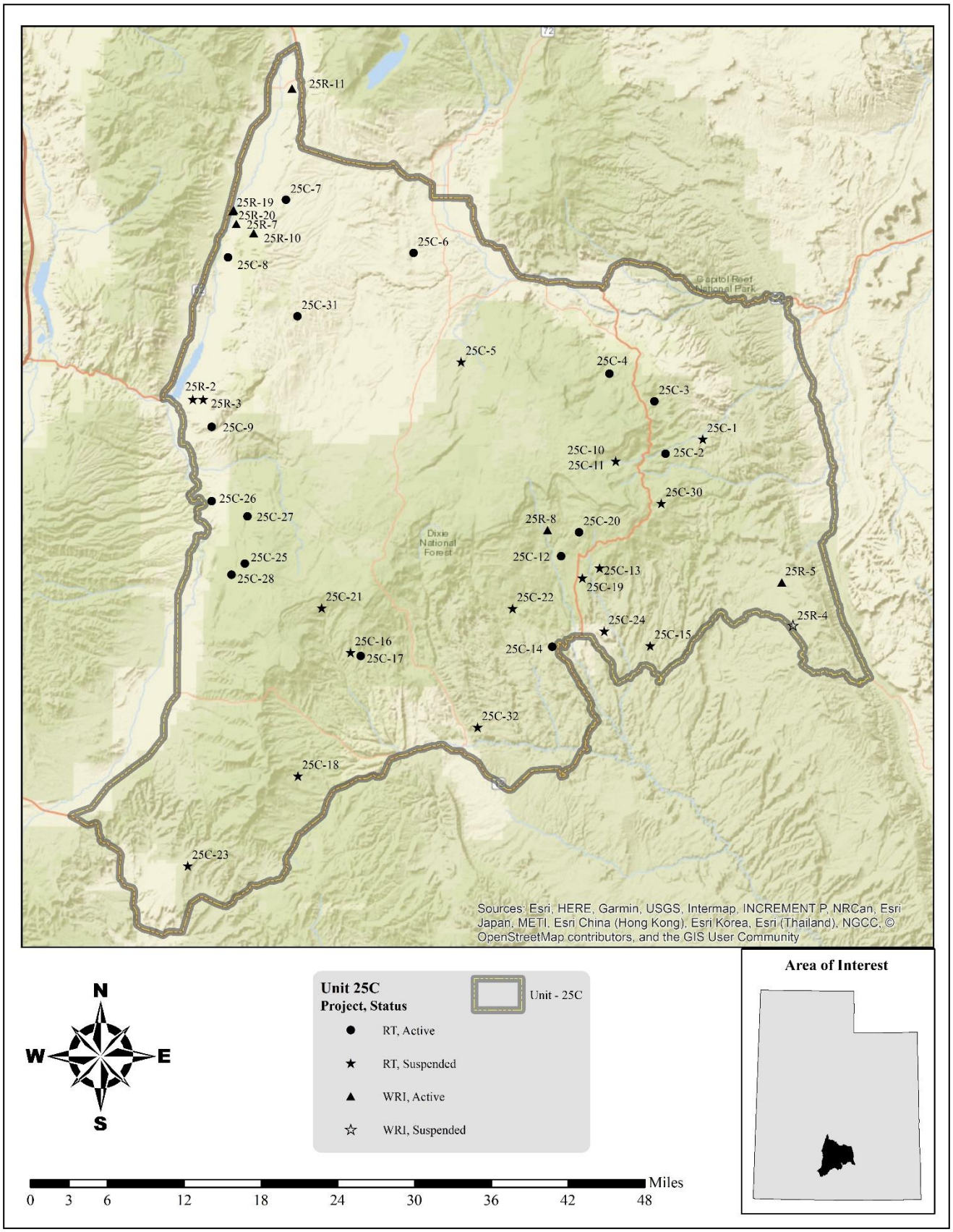
The primary threat on this ecological site is pinyon-juniper encroachment. Areas that have significant conifer encroachment might be considered for treatments (e.g. bullhog, chaining, lop and scatter, etc.). If reseeding is needed to restore the herbaceous communities in these areas, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies classified within the Upland (Big Sagebrush) ecological type support browse communities which provide browse and habitat for deer during the winter months. These sites range from being in poor to fair condition for deer winter range. The understories of these ecological types have varying cover of perennial grasses and forbs, but is generally low. The sagebrush communities are generally in good and stable condition. There is conifer encroachment occurring on some of the sites sampled: this encroachment is likely a threat in many other areas of this ecological type. Annual and introduced perennial grasses are present on some of the sites, high annual grass loads can raise the risk of wildfire while introduced perennial grasses can reduce the diversity of understory species.

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

5. WILDLIFE MANAGEMENT UNIT 25C – BOULDER PLATEAU



WILDLIFE MANAGEMENT UNIT 25C – BOULDER PLATEAU

Boundary Description

Sevier, Garfield, Piute, and Wayne counties – Boundary begins at SR-24 and SR-62 north of Koosharem; south on SR-24 to SR-62; south on SR-62 to SR-22; south on SR-22 to the Widtsoe-Antimony road; south on the Widstoe-Antimony road to SR-12; east on SR-12 to the Burr Trail at Boulder; east on the Burr Trail to Notom Road; north on Notom Road to SR-24; west on SR-24 to the junction of SR-24 and SR-62.

Management Unit Description

Geography

The Boulder Plateau Wildlife Management unit is part of the larger management unit 25 - Plateau. Unit 25 is divided into three sub-units: Fishlake Plateau (25A), Thousand Lakes Plateau (25B), and Boulder Plateau (25C).

The Boulder Plateau wildlife management unit includes the high country of the Aquarius Plateau, which is commonly known as Boulder Mountain. The unit also contains the slopes of the Aquarius Plateau, which slope down to the south and west through variable desert terrain that makes up a major portion of the winter range in Unit 25C. The Boulder Plateau Wildlife Management Unit also encloses areas to the north including Parker Mountain (Awapa Plateau), Boulder Mountain, Miners Mountain, and portions of the Waterpocket Fold and Capitol Reef National Park. Parker Mountain is an open rolling plateau with a maximum elevation of 9,600 feet and northeastern exposure. The Aquarius Plateau is a high, lava-capped mountain plateau rising to 11,322 feet in elevation on Boulder Mountain. Miners Mountain is a large anticline located in the northeast corner of the unit. The lowest points in the Boulder Plateau management unit are located in the far northeast portion with elevations of roughly 5,000 feet. A small section along the west side of Parker Mountain drains west into Otter Creek. The southern section of the unit drains to the south into the Escalante River, while the remainder of the unit drains to the north into the Fremont River.

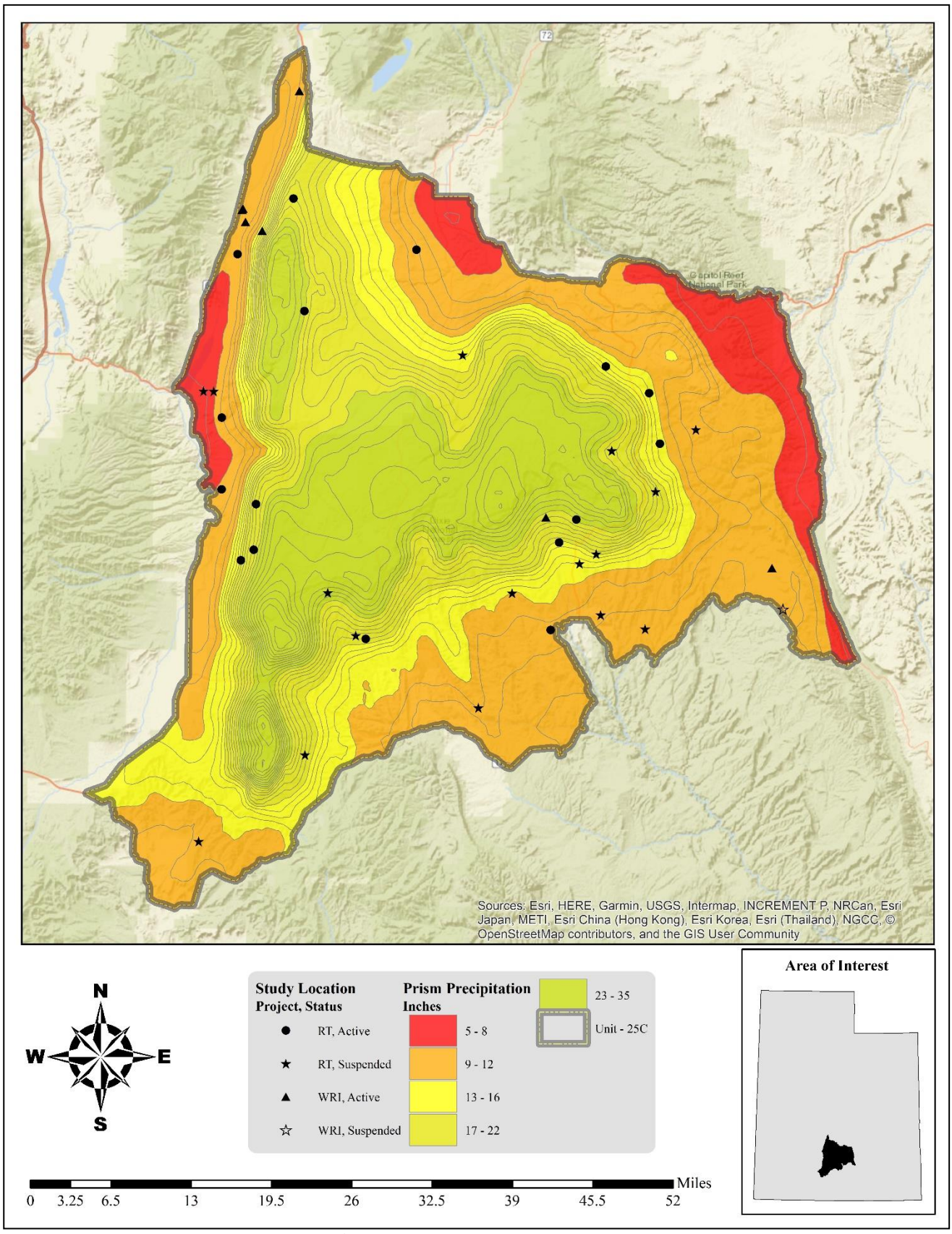
Municipalities located along the unit boundaries include Koosharem and Antimony on the west, Loa, Lyman, Bicknell, Teasdale, and Torrey on the north, and Escalante and Boulder on the south side.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches along the eastern portions the unit and in Rabbit Valley to 32 inches on Barney Top in the Escalante Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 9-23 inches of precipitation (**Map 5.1**) (PRISM Climate Group, Oregon State University, 2013).

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

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 5.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 5.1b**) (Time Series Data, 2019).



Map 5.1: The 1981-2010 PRISM Precipitation Model for WMU 25C, Boulder Plateau (PRISM Climate Group, Oregon State University, 2013).

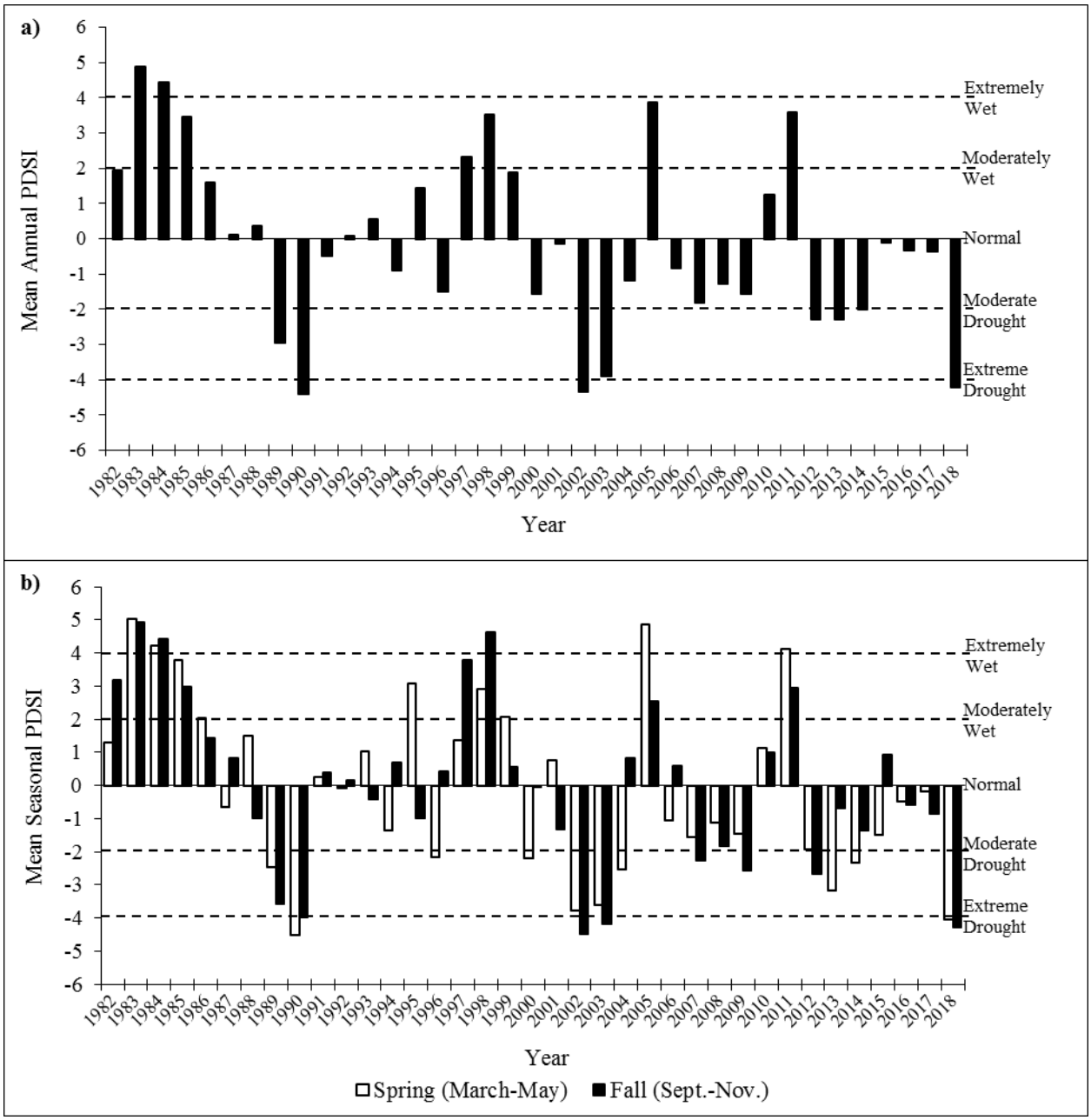


Figure 5.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

Big Game Habitat

An estimated 1,337,035 acres are classified as deer range within Unit 25C with 62% classified as winter range, 38% as summer range, and less than 1% as year-long range (**Table 5.1**, **Map 5.2**). 42% of mule deer winter range is managed by the Bureau of Land Management (BLM), 28% is administered by the United States Forest Service (USFS), 11% is managed by the National Park Service (NPS), 10% is managed by the Utah School and Institutional Trust Lands Administration (SITLA), 9% is privately held, and the Utah Department of Transportation (UDOT), Utah Division of Wildlife Resources (UDWR), and Utah State Parks (USP) each manage less than 1% (**Table 5.2**, **Map 5.2**, **Map 5.6**). Of the elk winter range, 40% is administered by the BLM, 39% is managed by the USFS, 14% is managed by SITLA, 4% is administered by the NPS, 3% is privately owned, and the UDOT, UDWR, and USP manage less than 1% each (**Table 5.3**, **Map 5.3**, **Map 5.6**).

The winter range is large enough to support all of the deer summering on the unit. With a few localized exceptions, it is in mostly good condition. Huff & Coles (1966) drew the upper limits of the winter range between 8,000 and 8,400 feet and the lower limits between 6,500 and 7,000 feet. The pinyon-juniper and sagebrush types with various combinations of the two dominate the winter range. South of Boulder Mountain, there is abundant winter range. However, much of the country is slickrock canyons and mesas that support few deer. Most wintering takes place on the lower slopes and at the base of the mountain. The upper limits of the normal winter range are uniform at 8,000 feet across the south slopes of the Boulder Mountain. Seven thousand feet is the usual upper limit during severe winter conditions. The lower limit for most wintering deer on the south side of the unit is Highway 12. On the west side of the Aquarius Plateau between Antimony and Widtsoe, winter range is more restricted. The mountain drops off steeply from Griffin Top to the river valley. Deer can typically utilize vegetation up to 9,000 feet during normal winters, but are limited to an upper limit of around 8,000 feet during severe winters. The lower boundary for severe winters is the bottom of the valley on the Sevier River, which is approximately 6,500 feet in elevation.

Summer range is limited to specific areas on Parker Mountain and Boulder Mountain. Boulder Mountain contains approximately 50,000 acres above 10,500 feet (Christensen & Bogedahl, 1983). This high summer range is unsuitable for fawning and receives only light deer use in late summer. Most fawning and summer use is concentrated underneath the lava rock rim where stands of aspen, fir, and spruce are interspersed with sage flats and meadows. Because of fire suppression, the trend is toward a denser spruce climax community. Logging and/or prescribed burns may help maintain this important habitat in a seral stage, which is more productive and more favorable to big game. Lower down the slopes, ponderosa pine (*Pinus ponderosa*) with its associated mountain brush understory receives limited summer use. Summer range on Parker Mountain is more limited to the higher southern end, where aspen stands in association with big sagebrush and antelope bitterbrush provide excellent fawning areas.
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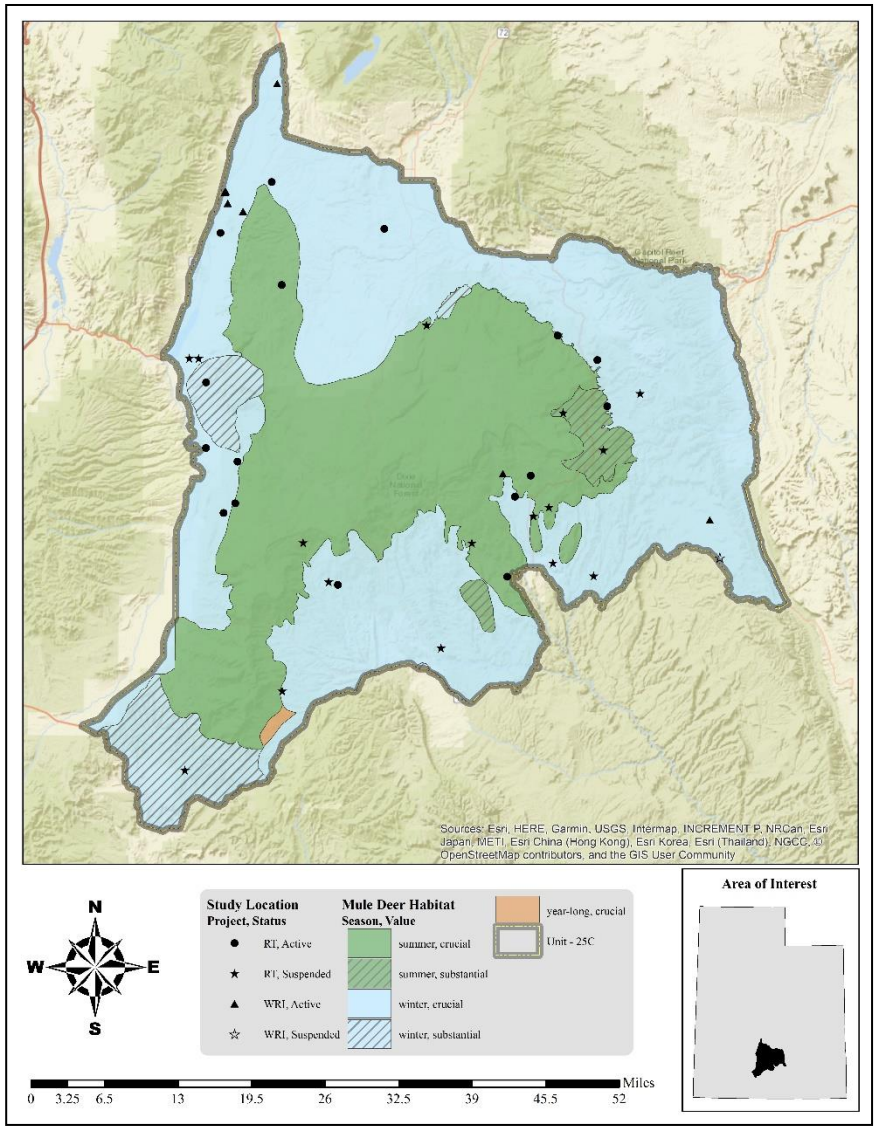
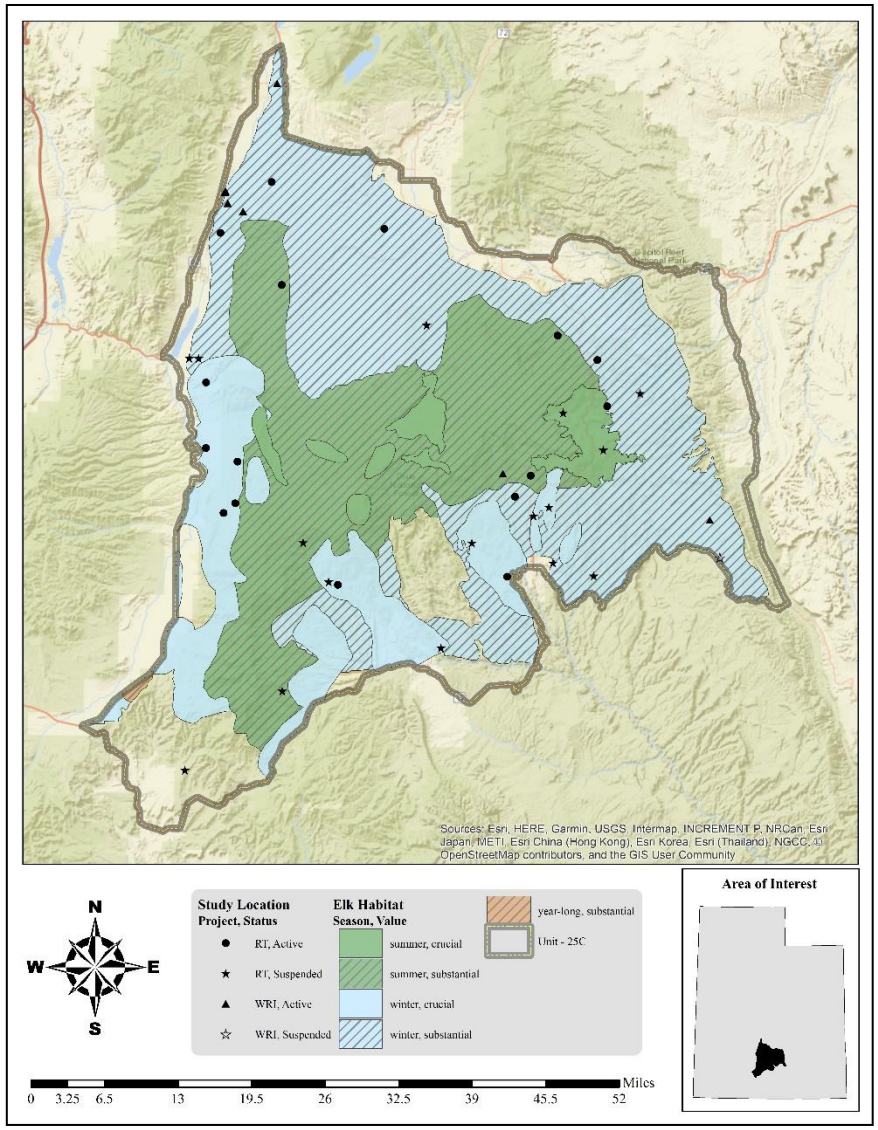
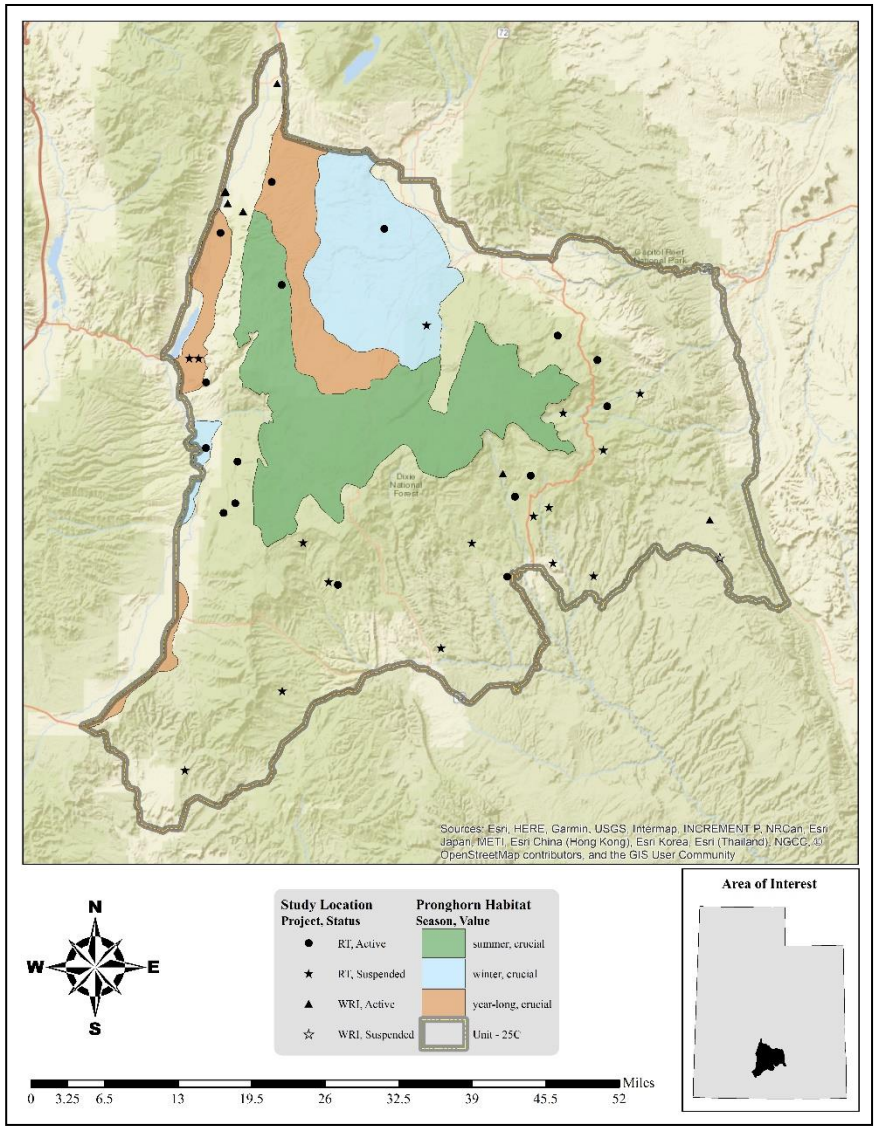


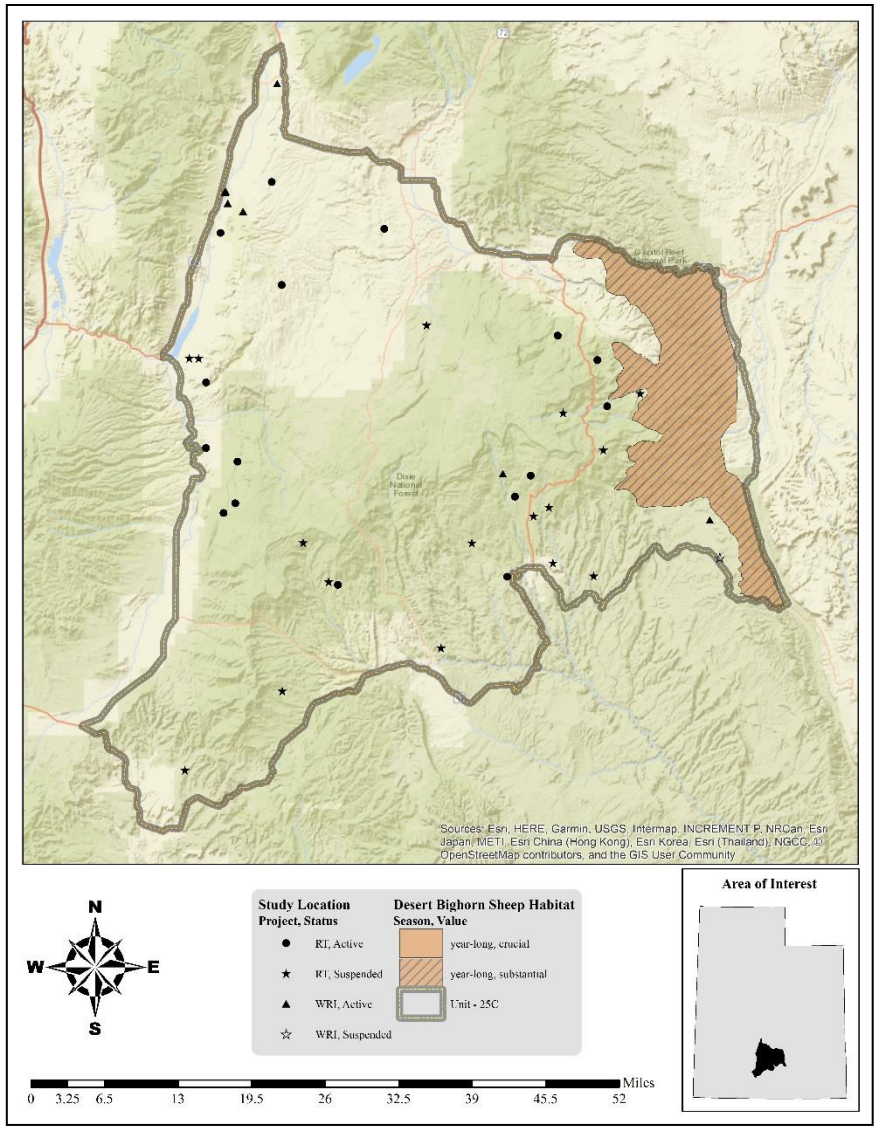
Map 5.2: Estimated mule deer habitat by season and value for WMU 25C, Boulder Plateau.



Map 5.3: Estimated elk habitat by season and value for WMU 25C, Boulder Plateau.



Map 5.4: Estimated pronghorn habitat by season and value for WMU 25C, Boulder Plateau.



Map 5.5: Estimated desert bighorn sheep habitat by season and value for WMU 25C, Boulder Plateau.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	505,941	38%	828,523	62%	2,571	<1%
Elk	393,991	37%	660,777	63%	1,695	<1%
Pronghorn	192,863	48%	117,409	29%	88,923	22%
DBS	0	0%	0	0%	135,315	100%

Table 5.1: Estimated mule deer, elk, pronghorn, and desert bighorn sheep (DBS) habitat acreage by season for WMU 25C, Boulder Plateau.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	21,870	4%	347,683	42%	0	0%
Private	2,634	1%	75,859	9%	10	<1%
SITLA	52,594	10%	84,317	10%	0	0%
USFS	428,843	85%	227,979	28%	2,561	100%
UDOT	0	0%	151	<1%	0	0%
USP	0	0%	1,391	<1%	0	0%
UDWR	0	0%	1,110	<1%	0	0%
NPS	0	0%	90,034	11%	0	0%
Total	505,941	**100%**	828,523	**100%**	2,571	**100%**

Table 5.2: Estimated mule deer habitat acreage by season and ownership for WMU 25C, Boulder Plateau.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	4,382	1%	265,000	40%	0	0%
Private	1,139	<1%	23,085	3%	5	<1%
SITLA	38,923	10%	89,513	14%	94	6%
USFS	349,547	89%	255,520	39%	1,596	94%
UDOT	0	0%	41	<1%	0	0%
USP	0	0%	1,329	<1%	0	0%
UDWR	0	0%	218	<1%	0	0%
NPS	0	0%	26,071	4%	0	0%
Total	393,991	**100%**	660,777	**100%**	1,695	**100%**

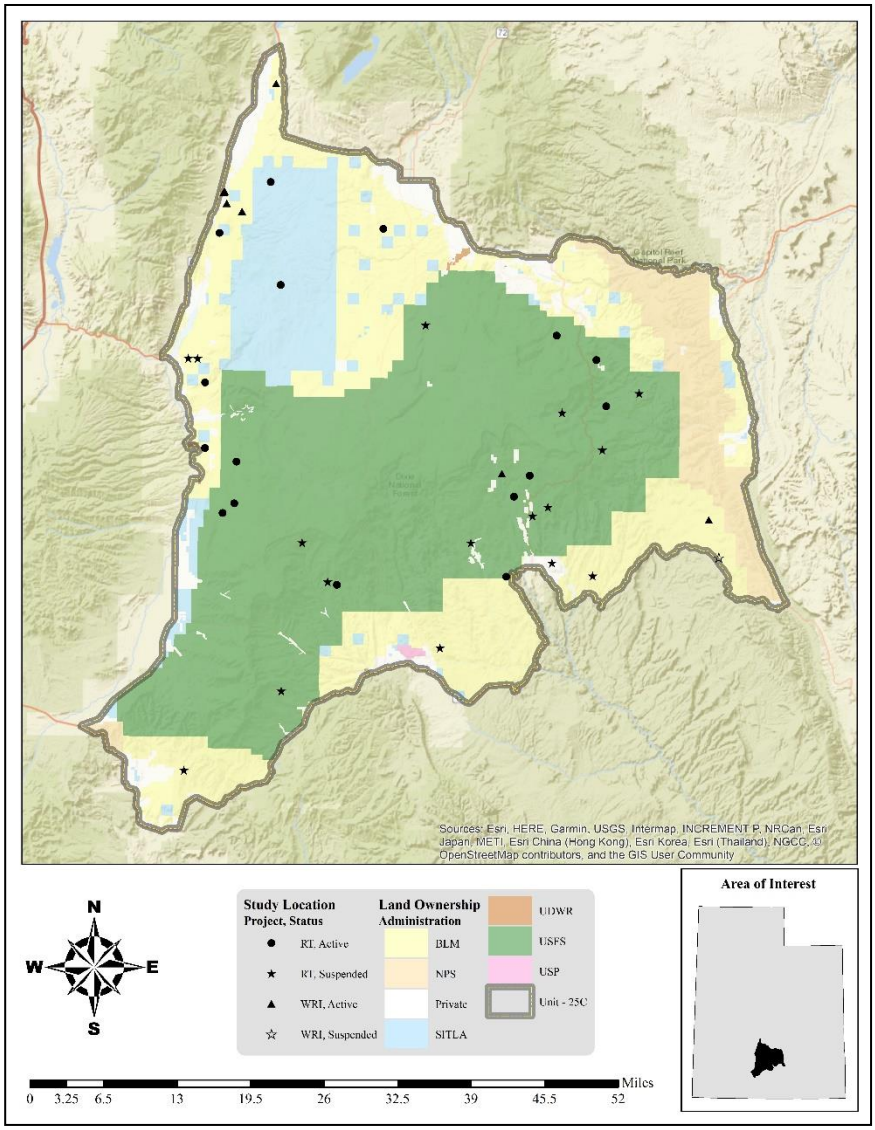
Table 5.3: Estimated elk habitat acreage by season and ownership for WMU 25C, Boulder Plateau.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	3,444	2%	72,716	62%	34,657	39%
Private	120	<1%	1,075	1%	5,054	6%
SITLA	36,026	19%	28,978	25%	46,275	52%
USFS	153,273	79%	14,331	12%	2,849	3%
UDWR	0	0%	309	<1%	0	0%
NPS	0	0%	0	0%	87	<1%
Total	192,863	**100%**	117,409	**100%**	88,923	**100%**

Table 5.4: Estimated pronghorn habitat acreage by season and ownership for WMU 25C, Boulder Plateau.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	17,973	13%
Private	2,074	2%
SITLA	2,195	2%
USFS	29,280	22%
NPS	83,793	62%
Total	135,315	**100%**

Table 5.5: Estimated desert bighorn sheep habitat acreage by season and ownership for WMU 25C, Boulder Plateau.



Map 5.6: Land ownership for WMU 25C, Boulder Plateau.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	360,119	26.89%	
	Spruce-Fir Forest and Woodland	103,800	7.75%	
	Ponderosa Pine Forest, Woodland and Savanna	58,966	4.40%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	17,206	1.28%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	11,848	0.88%	
	Mountain Mahogany Woodland and Shrubland	4,050	0.30%	
	Limber Pine Woodland	406	0.03%	
	Juniper Woodland and Savanna	5	0.00%	
	Lodgepole Pine Forest and Woodland	1	0.00%	41.55%
Exotic Herbaceous	Introduced Annual Grassland	12,100	0.90%	0.90%
Exotic Tree-Shrub	Introduced Riparian Vegetation	1,111	0.08%	0.08%
Grassland	Alpine Dwarf-Shrubland, Fell-field and Meadow	13,078	0.98%	
	Grassland	10,585	0.79%	
	Dry Tundra	13	0.00%	1.77%
Shrubland	Low Sagebrush Shrubland and Steppe	213,512	15.94%	
	Big Sagebrush Shrubland and Steppe	81,052	6.05%	
	Salt Desert Scrub	20,343	1.52%	
	Desert Scrub	18,679	1.39%	
	Other Shrubland	15,996	1.19%	
	Deciduous Shrubland	10,123	0.76%	
	Chaparral	6,478	0.48%	
	Greasewood Shrubland	4,742	0.35%	
	Sand Shrubland	4,668	0.35%	28.05%
Other	Barren	95,042	7.10%	
	Conifer-Hardwood	91,446	6.83%	
	Sparsely Vegetated	57,660	4.31%	
	Hardwood	57,260	4.28%	
	Developed	26,696	1.99%	
	Riparian	21,844	1.63%	
	Agricultural	16,972	1.27%	
	Open Water	3,371	0.25%	
	Quarries-Strip Mines-Gravel Pits	14	0.00%	27.65%
Total		1,339,186	100%	100%

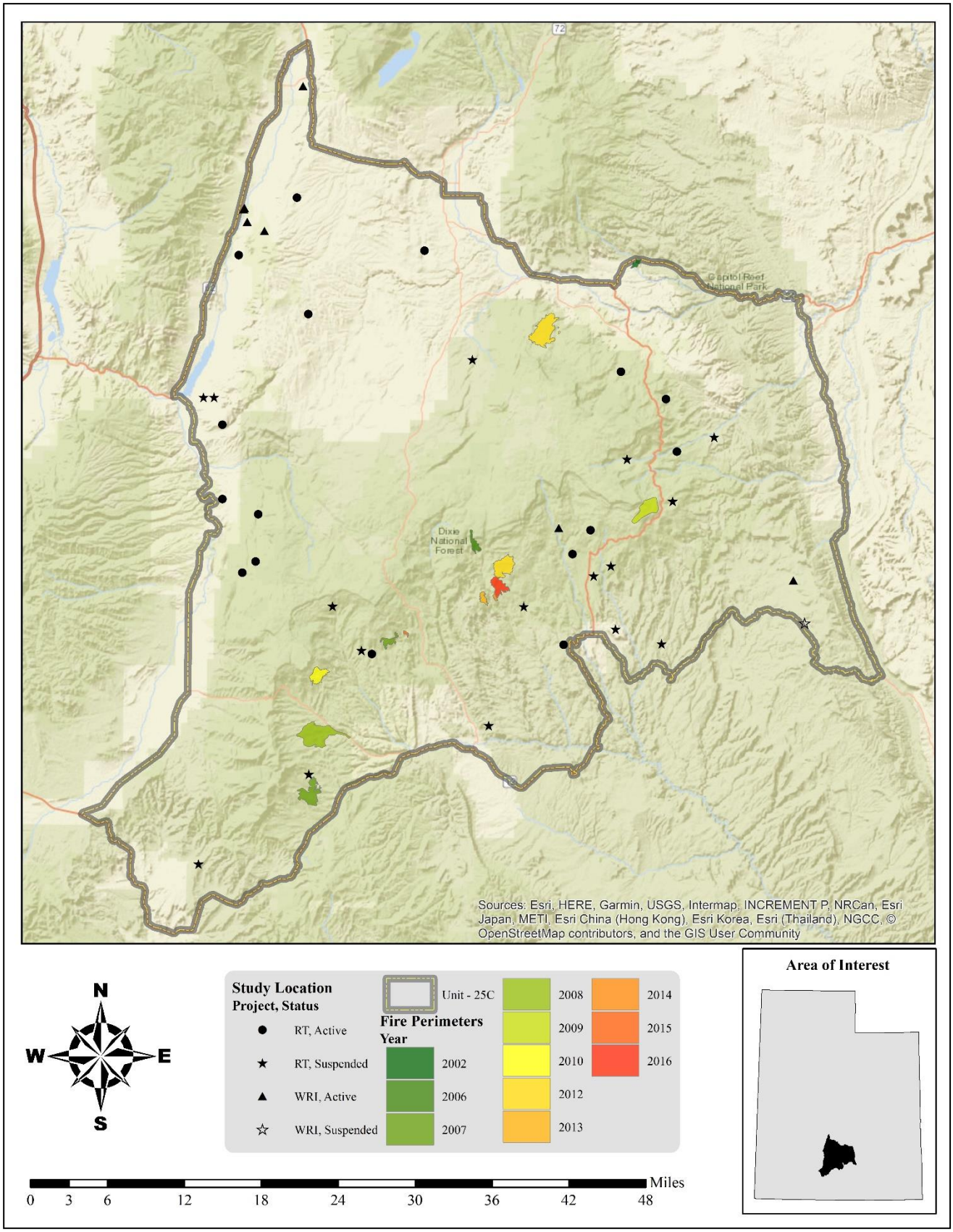
Table 5.6: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 25C, Boulder Plateau.

Limiting Factors to Big Game Habitat

The Boulder Plateau and the surrounding winter range have a wide variety of multiple uses that stem from a diverse range of landownership and land management principles. Private land practices mainly include ranching and alfalfa production, while state and federal land uses include livestock grazing, mineral and resource exploration and extraction, road building, OHV riding, camping, and wilderness designations. Many of the land uses within the unit can be harmonious with the management of big game habitat, but other land practices may negatively affect its management within the unit. There is ample range for deer in normal winters, and it is only in severe winters that the usable range may become limited. In addition, the potential to increase forage for wintering deer and elk is substantial and can be gained by the removal of encroached pinyon and juniper trees that are very pronounced along benches and flats of the Boulder Plateau.

The current LANDFIRE Existing Vegetation Coverage model shows that nearly 27% of this unit is comprised of pinyon and juniper stands (**Table 5.6**). While pinyon-juniper woodlands may provide valuable thermal cover, encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components, therefore decreasing the available forage for wildlife (Miller, Svejcar, & Rose, 2000).

Wildfire has not substantially impacted the deer winter range within this unit (**Map 5.7**). In addition, few of the range trend studies have captured wildfire events: as such, any responses to rehabilitation efforts or recovery of sagebrush communities within the fire perimeters since the year 2000 have not been evaluated.



Map 5.7: Land coverage of fires by year from 2000-2018 for WMU 25C, Boulder Plateau (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

Treatments/Restoration Work

There has been an active effort to address the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 16,400 acres of land have been treated within the Boulder Plateau subunit since the WRI was implemented in 2004 (**Map 5.8**). In addition, 564 acres are pending completion, 4,831 acres are currently being treated, and treatments are proposed for 1,020 acres. Treatments frequently overlap one another; bringing the total completed acres to 22,815 acres for this unit (

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,228**	**836**	**564**	**0**	**2,628**
Ely (Two-Way)	0	836	564	0	1,400
Smooth (Two-Way)	1,228	0	0	0	1,228
Bullhog	**2,109**	**1,656**	**0**	**0**	**3,765**
Full Size	1,271	1,656	0	0	2,927
Skid Steer	838	0	0	0	838
Forestry Practices	**0**	**1,842**	**0**	**184**	**2,026**
Coppice Cutting	0	350	0	0	350
Group Selection Cuts	0	171	0	0	171
Thinning (Commercial)	0	326	0	0	326
Thinning (Non-Commercial)	0	995	0	184	1,179
Harrow	**6,652**	**0**	**0**	**0**	**6,652**
≤15 ft. (One-Way)	1,418	0	0	0	1,418
≤15 ft. (Two-Way)	1,760	0	0	0	1,760
>15 ft. (One-Way)	1,056	0	0	0	1,056
>15 ft. (Two-Way)	2,418	0	0	0	2,418
Herbicide Application	**390**	**81**	**0**	**0**	**471**
Ground	390	81	0	0	471
Mowing	**349**	**0**	**0**	**0**	**349**
Brush Hog	74	0	0	0	74
Other	275	0	0	0	275
Prescribed Fire	**1,848**	**0**	**0**	**0**	**1,848**
Seeding (Primary)	**926**	**0**	**0**	**836**	**1,762**
Broadcast (Aerial-Fixed Wing)	0	0	0	836	836
Broadcast (Aerial-Helicopter)	727	0	0	0	727
Drill (Rangeland)	68	0	0	0	68
Ground (Mechanical application)	43	0	0	0	43
Hand Seeding	88	0	0	0	88
Vegetation Removal/Hand Crew	**5,192**	**416**	**0**	**0**	**5,608**
Lop & Scatter	4,200	416	0	0	4,616
Lop (No Scatter)	940	0	0	0	940
Lop-Pile-Burn	52	0	0	0	52
Other	**28**	**0**	**0**	**0**	**28**
Road Decommissioning	28	0	0	0	28
Grand Total	**18,722**	**4,831**	**564**	**1,020**	**24,573**
*** Total Land Area Treated**	**16,400**	**4,831**	**564**	**1,020**	**22,815**

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.

Harrow treatments to reduce shrub cover and increase understory diversity is the most common management practice in this unit, with manual vegetation removal (such as lop and scatter and lop-pile-burn) and bullhog treatments to remove pinyon and juniper also being common. Other common treatments on the Boulder Plateau unit include (but are not limited to): anchor chaining, forestry practices such as thinning and coppice cutting, seeding plants to augment the herbaceous understory, and prescribed fire (

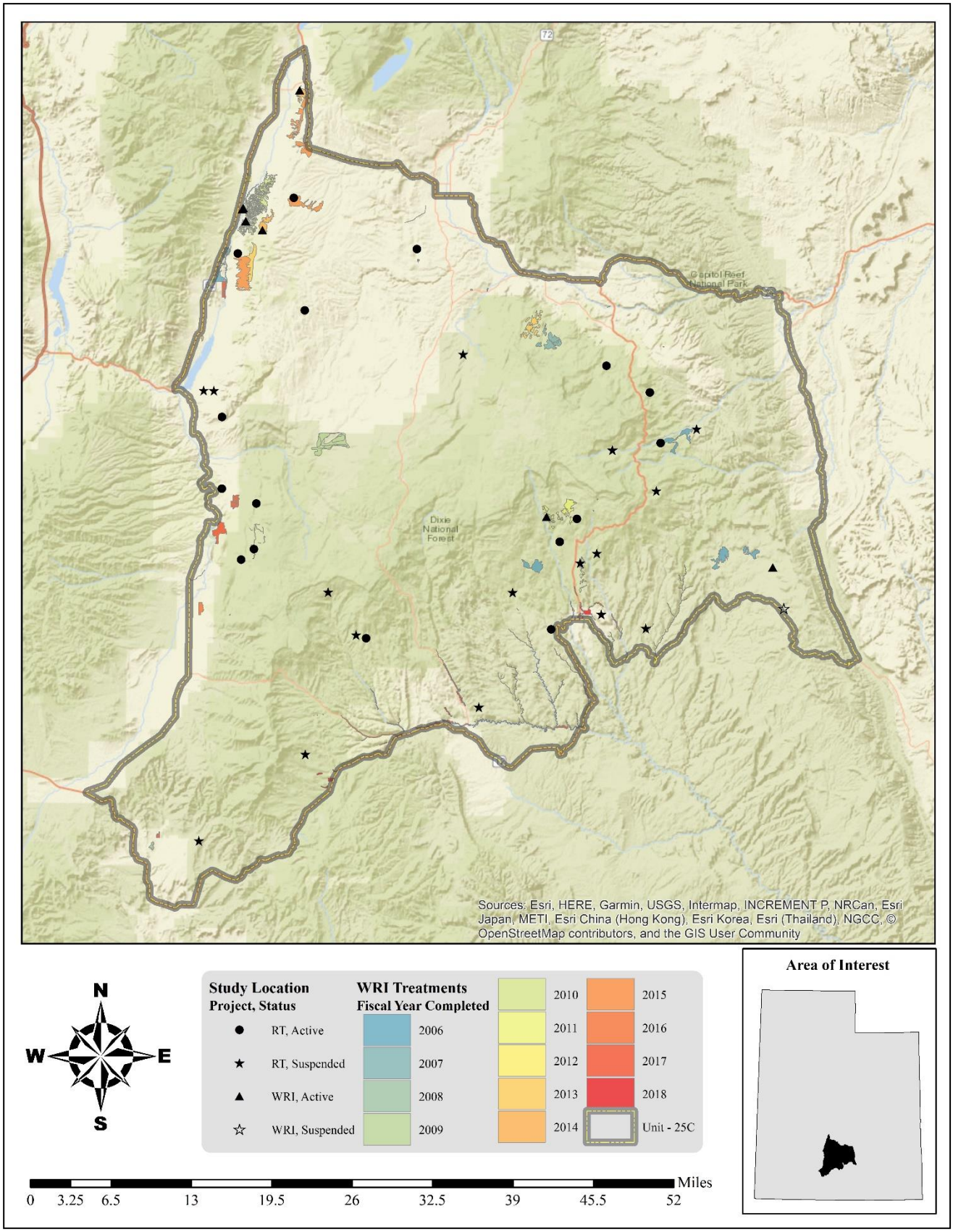
Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,228**	**836**	**564**	**0**	**2,628**
Ely (Two-Way)	0	836	564	0	1,400
Smooth (Two-Way)	1,228	0	0	0	1,228
Bullhog	**2,109**	**1,656**	**0**	**0**	**3,765**
Full Size	1,271	1,656	0	0	2,927
Skid Steer	838	0	0	0	838
Forestry Practices	**0**	**1,842**	**0**	**184**	**2,026**
Coppice Cutting	0	350	0	0	350
Group Selection Cuts	0	171	0	0	171
Thinning (Commercial)	0	326	0	0	326
Thinning (Non-Commercial)	0	995	0	184	1,179

Harrow	**6,652**	**0**	**0**	**0**	**6,652**
≤15 ft. (One-Way)	1,418	0	0	0	1,418
≤15 ft. (Two-Way)	1,760	0	0	0	1,760
>15 ft. (One-Way)	1,056	0	0	0	1,056
>15 ft. (Two-Way)	2,418	0	0	0	2,418
Herbicide Application	**390**	**81**	**0**	**0**	**471**
Ground	390	81	0	0	471
Mowing	**349**	**0**	**0**	**0**	**349**
Brush Hog	74	0	0	0	74
Other	275	0	0	0	275
Prescribed Fire	**1,848**	**0**	**0**	**0**	**1,848**
Seeding (Primary)	**926**	**0**	**0**	**836**	**1,762**
Broadcast (Aerial-Fixed Wing)	0	0	0	836	836
Broadcast (Aerial-Helicopter)	727	0	0	0	727
Drill (Rangeland)	68	0	0	0	68
Ground (Mechanical application)	43	0	0	0	43
Hand Seeding	88	0	0	0	88
Vegetation Removal/Hand Crew	**5,192**	**416**	**0**	**0**	**5,608**
Lop & Scatter	4,200	416	0	0	4,616
Lop (No Scatter)	940	0	0	0	940
Lop-Pile-Burn	52	0	0	0	52
Other	**28**	**0**	**0**	**0**	**28**
Road Decommissioning	28	0	0	0	28
Grand Total	**18,722**	**4,831**	**564**	**1,020**	**24,573**
*** Total Land Area Treated**	**16,400**	**4,831**	**564**	**1,020**	**22,815**

Table 5.7).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,228**	**836**	**564**	**0**	**2,628**
Ely (Two-Way)	0	836	564	0	1,400
Smooth (Two-Way)	1,228	0	0	0	1,228
Bullhog	**2,109**	**1,656**	**0**	**0**	**3,765**
Full Size	1,271	1,656	0	0	2,927
Skid Steer	838	0	0	0	838
Forestry Practices	**0**	**1,842**	**0**	**184**	**2,026**
Coppice Cutting	0	350	0	0	350
Group Selection Cuts	0	171	0	0	171
Thinning (Commercial)	0	326	0	0	326
Thinning (Non-Commercial)	0	995	0	184	1,179
Harrow	**6,652**	**0**	**0**	**0**	**6,652**
≤15 ft. (One-Way)	1,418	0	0	0	1,418
≤15 ft. (Two-Way)	1,760	0	0	0	1,760
>15 ft. (One-Way)	1,056	0	0	0	1,056
>15 ft. (Two-Way)	2,418	0	0	0	2,418
Herbicide Application	**390**	**81**	**0**	**0**	**471**
Ground	390	81	0	0	471
Mowing	**349**	**0**	**0**	**0**	**349**
Brush Hog	74	0	0	0	74
Other	275	0	0	0	275
Prescribed Fire	**1,848**	**0**	**0**	**0**	**1,848**
Seeding (Primary)	**926**	**0**	**0**	**836**	**1,762**
Broadcast (Aerial-Fixed Wing)	0	0	0	836	836
Broadcast (Aerial-Helicopter)	727	0	0	0	727
Drill (Rangeland)	68	0	0	0	68
Ground (Mechanical application)	43	0	0	0	43
Hand Seeding	88	0	0	0	88
Vegetation Removal/Hand Crew	**5,192**	**416**	**0**	**0**	**5,608**
Lop & Scatter	4,200	416	0	0	4,616
Lop (No Scatter)	940	0	0	0	940
Lop-Pile-Burn	52	0	0	0	52
Other	**28**	**0**	**0**	**0**	**28**
Road Decommissioning	28	0	0	0	28
Grand Total	**18,722**	**4,831**	**564**	**1,020**	**24,573**
*** Total Land Area Treated**	**16,400**	**4,831**	**564**	**1,020**	**22,815**

Table 5.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 25C, Boulder Plateau. Data accessed on 02/18/2019. *Does not include overlapping treatments.



Map 5.8: WRI treatments by fiscal year completed for WMU 25C, Boulder Plateau.

Range Trend Studies

Range Trend studies have been sampled within WMU 25C1 on a regular basis since 1985, 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 (**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 are summarized by region.

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
25C-01	Yergy	RT	Suspended	'85, '91, '94, '98, '03, '08	Not Verified
25C-02	Wildcat	RT	Active	'85, '91, '94, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25C-03	Happy Valley	RT	Active	'85, '91, '94, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Ponderosa Pine)
25C-04	North Slope	RT	Active	'85, '91, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Ponderosa Pine)
25C-05	Giles Hollow	RT	Suspended	'85, '91, '94, '98, '03	Not Verified
25C-06	Terza Flat	RT	Active	'85, '91, '94, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25C-07	Cedar Grove	RT	Active	'85, '91, '98, '03, '08, '13, '18	Upland Stony Loam (Black Sagebrush)
25C-08	South Narrows	RT	Active	'85, '91, '94, '98, '03, '08, '09, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
25C-09	Dry Wash	RT	Active	'85, '91, '94, '98, '03, '08, '13, '18	Upland Stony Loam (Mountain Big Sagebrush)
25C-10	Pleasant Creek Exclosure (In)	RT	Suspended	'91, '94, '98	Not Verified
25C-11	Pleasant Creek Exclosure (Out)	RT	Suspended	'91, '94, '98	Not Verified
25C-12	Nazer Draw	RT	Active	'87, '91, '94, '98, '03, '08, '13, '18	Mountain Shallow Loam (Ponderosa Pine)
25C-13	Short Neck	RT	Suspended	'87, '91, '94, '98, '03	Not Verified
25C-14	New Home Bench	RT	Active	'87, '91, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
25C-15	Steep Creek Bench	RT	Suspended	'87, '91, '94, '98, '03	Not Verified
25C-16	Whites Flat	RT	Suspended	'87, '91, '94, '98	Not Verified
25C-17	Varney-Griffin Chaining	RT	Active	'87, '91, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
25C-18	Allen Canyon	RT	Suspended	'87, '91, '98	Not Verified
25C-19	Rock Bench	RT	Suspended	'87, '91	Not Verified
25C-20	Baldys	RT	Active	'87, '91, '94, '98, '03, '08, '13, '18	High Mountain Loam (Aspen)
25C-21	Griffin	RT	Suspended	'87, '91, '94, '98	Not Verified
25C-22	Salt Gulch	RT	Suspended	'87, '91, '94, '98	Not Verified
25C-23	Coal Bench	RT	Suspended	'87, '91, '98, '03, '08	Not Verified
25C-24	Black Ridge	RT	Suspended	'87, '91, '98	Not Verified
25C-25	Center Creek	RT	Active	'87, '91, '94, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
25C-26	Black Canyon	RT	Active	'87, '91, '98, '03, '08, '13, '18	Upland Gravelly Loam (Black Sagebrush)
25C-27	Poison Creek Bench	RT	Active	'87, '91, '94, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Mountain Big Sagebrush)
25C-28	North Creek	RT	Active	'87, '91, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Mountain Big Sagebrush)
25C-30	Pole Corral Draw	RT	Suspended	'98	Not Verified
25C-31	Parker Mountain Aerator	RT	Active	'03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
25C-32	Antone Flat	RT	Suspended		Not Verified
25R-02	Lower Meadow Estates	RT	Suspended	'97, '03	Not Verified
25R-03	Upper Meadow Estates	RT	Suspended	'97, '03	Not Verified
25R-04	Onion Field	WRI	Suspended	'04	Not Verified
25R-05	Lamp Stand	WRI	Active	'04, '07, '12, '18	Semidesert Loam (Wyoming Big Sagebrush)
25R-07	North Narrows Dixie	WRI	Active	'08, '09, '10, '13, '17	Semidesert Loam (Wyoming Big Sagebrush)
25R-08	Sawmill Point Aspen	WRI	Active	'10, '13, '18	High Mountain Loam (Aspen)
25R-10	Parker Front	WRI	Active	'13, '16	Upland Stony Loam (Mountain Big Sagebrush)
25R-11	Brown Spring	WRI	Active	'13, '16	Upland Loam (Wyoming Big Sagebrush)
25R-19	Otter Creek	WRI	Active	'18	Semiwet Fresh Meadow
25R-20	Otter Creek 2	WRI	Active	'18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)

Table 5.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 25C, Boulder Plateau.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
25C-01	Yergy	Chain Unknown Seed Unknown One-Way Dixie Harrow Broadcast Unknown		1970 1970 Fall 2005 Fall 2005		
25C-02	Wildcat	Chain Unknown Seed Unknown Bullhog		1970 1970 Between 2003 and 2008		
25C-03	Happy Valley	Wildfire Seed Unknown		June 1984 1984		
25C-04	North Slope	Bullhog		Between 2016 and 2017		
25C-12	Nazer Draw	Seed Unknown		1955	1200	
25C-17	Varney-Griffin Chaining	Chain Unknown Seed Unknown Bullhog		1981 1981 Between 2003 and 2008	1100 1100	
25C-19	Rock Bench	Lop and Scatter Prescribed Fire Aerial After Bullhog	 Rock Bench Pinyon/Juniper and Brush Removal	1991 1991 1991 July 2009-May 2010	235 235 235 237	 1489
25C-23	Coal Bench	Two-Way Chain Unknown Aerial Unknown	Coal Bench Seeding 1966 Coal Bench Seeding 1966	June-December 1966 1966	3487	LTDL
25C-25	Center Creek	Seed Unknown Prescribed Fire		Historic 1984		
25C-27	Poison Creek Bench	Prescribed Fire		1994		
25C-28	North Creek	Wildfire		2002		
25C-31	Parker Mountain Aerator	Double Drum Aerator		2002		
25R-04	Onion Field	Plow Rangeland Drill	Onion Flat Seeding 1968 Onion Flat Seeding 1968	1968 1968	1200 1200	LTDL LTDL
25R-05	Lamp Stand	Chain Unknown Aerial Unknown Truax Drill	Lamp Stand Seeding Lamp Stand Seeding Circle Cliffs-Year 1	1970 1970 November 2004	650 650 1000	LTDL LTDL PDB
25R-07	North Narrows Dixie	Broadcast Before Two-Way Dixie Harrow Broadcast After	North Narrows Year 1 North Narrows Year 1 North Narrows Year 1	October 2008 October-December 2008 December 2008	1369 1369 1369	1155 1155 1155
25R-08	Sawmill Point Aspen	Lop (No Scatter)	Sawmill Point/Baldy's Ridge Aspen Improvement Stewardship	July 2010-June 2011	940	1691
25R-10	Parker Front	Aerial Before Two-Way Smooth Chain Aerial After	Parker Front PJ Removal Parker Front PJ Removal Parker Front PJ Removal	November 2013 October-November 2013 November 2013	1230 496 1230	2547 2547 2547
25R-11	Brown Spring	Aerial Before Bullhog	Parker Front PJ Removal Parker Front PJ Removal	November 2013 November 2013-January 2014	1230 404	2547 2547
25R-19	Otter Creek	Herbicide Unknown Seed Unknown	Otter Creek Stream Restoration Phase III Otter Creek Stream Restoration Phase III	Fall 2018 Fall 2018	81 81	4398 4398
25R-20	Otter Creek 2	Mower Herbicide Unknown	Otter Creek Stream Restoration Phase III Otter Creek Stream Restoration Phase III	Fall 2018 Fall 2018	81 81	4398 4398

Table 5.9: Range trend and WRI studies known disturbance history for WMU 25C, Boulder Plateau. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Aspen)

There is one study [Baldys (25C-20)] classified as a Mountain (Aspen) ecological site. The Baldys site is located up East Boulder Draw north of the powerhouse off of Highway 12 near Boulder.

Shrubs/Trees: Preferred browse cover on this site is primarily provided by mountain snowberry (*Symphoricarpos oreophilus*), although lesser amounts of Wood's rose (*Rosa woodsii*), Utah serviceberry (*Amelanchier utahensis*) and gooseberry currant (*Ribes montigenum*) are also present. Cover of preferred

browse species has remained stable with a slight increase noted through the years (**Figure 5.3**). Preferred browse utilization data shows that utilization of preferred browse is low, but has been on an increasing trend (**Figure 5.13**).

Tree cover has exhibited a slight decrease over time. Density of trees, however, has increased over time, and the age class has shifted toward an older age class of forest. Quaking aspen (*Populus tremuloides*) is the dominant tree species. Howeer, spruce (*Picea sp.*) and subalpine fir (*Abies lasiocarpa*) were sampled in 2018, indicating a potential for conifer encroachment on the site (**Figure 5.6**, **Figure 5.9**).

Herbaceous Understory: The understory of this ecological site has fluctuated, but has displayed a stable trend overall. In addition, the understory is diverse and abundant, characteristics typical of aspen ecological types. Frequency of perennial grasses and forbs has remained similar throughout the sample period. While this study is the only sample for the ecological type, the understory seems to be in good condition overall (**Figure 5.15**, **Figure 5.17**).

Occupancy: The pellet transect data for this site shows that the primary occupants are elk. Mean abundance of elk pellet groups has fluctuated with a low of 18 days use/acre in 2013 and a high of 45 days use/acre in 2008. Deer have also been present, and mean pellet group abundance has varied from 3 days use/acre in 2018 to 20 days use/acre in 2008. Finally, cattle pellets have been sampled in all years with mean abundance changing from a low of 2 days use/acre in 2013 to a high of 25 days use/acre in 2008 (**Figure 5.19**).

Mountain (Ponderosa Pine)

There are three studies [Happy Valley (25C-03), North Slope (25C-04), and Nazer Draw (25C-12)] that are classified as Mountain (Ponderosa Pine) ecological sites. The Happy Valley site is located near the Singletree Campground off of Highway 12. The North Slope study is found near Fish Creek between Grover and Blind Lake. The Nazer Draw study is located north of Boulder near the powerhouse off of Highway 12.

Shrubs/Trees: Antelope bitterbrush (*Purshia tridentata*) and black sagebrush (*Artemisia nova*) are the dominant browse species on the sites. However, lesser amounts of other preferred browse species are also present, including Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), and slender buckwheat (*Eriogonum microthecum*). Preferred shrub cover data shows that there have been some slight fluctuations between sample years, but the overall trend is stable (**Figure 5.4**). Shrub demographic data has displayed fluctuations in decadence and a generally decreasing, but still good amount of young recruitment (**Figure 5.11**). Utilization of browse species has been low in all years except 2013 in which moderate usage was noted (**Figure 5.13**).

Tree cover has exhibited a steadily increasing trend over time, with the majority of cover coming from ponderosa pine (*Pinus ponderosa*). However, twoneedle pinyon (*Pinus edulis*), Douglas fir (*Pseudotsuga menziesii*), Rocky Mountain juniper (*Juniperus scopulorum*), and Utah juniper (*Juniperus osteosperma*) also provide cover on these sites. Density of trees has shown an overall increase, with much of this coming from other tree species besides ponderosa pine (**Figure 5.7**, **Figure 5.10**).

Herbaceous Understory: The herbaceous understories of these sites are diverse and moderately abundant. Most of the cover is provided by perennial grass species; perennial grasses have increased slightly in cover while frequency has remained stable. Perennial forbs have decreased slightly in both cover and frequency. Annual grasses were only sampled in 1998 and 2003, and in very low amounts (**Figure 5.15**, **Figure 5.17**).

Occupancy: The pellet transect data for this ecological type shows that the primary occupants of these sites are deer and that presence has been on a decreasing trend. Mean abundance of deer pellet groups has fluctuated between sample years with a low of 19 days use/acre in 2012 and a high of 60 days use/acre in 2003. Elk have also been present in low numbers, with mean abundance of pellet groups fluctuating from 2 days use/acre in 2018 to 7 days use/acre in 2008. Pellet group data for cattle indicates that presence on this site has varied between a low of 3 days use/acre in 2018 and a high of 19 days use/acre in 1998 (**Figure 5.19**).

Mountain (Big Sagebrush)

There are five studies [Varney-Griffin Chaining (25C-17), Center Creek (25C-25), Poison Creek Bench (25C-27), North Creek (25C-28), and Parker Mountain Aerator (25C-31)] that are classified as a Mountain (Big Sagebrush) ecological sites. The Varney-Griffin Chaining is located in the Escalante Mountains to the east of North Creek. The Center Creek study is positioned approximately 5 miles southeast of Osiris. The Poison Creek Bench can be found approximately 4 miles east of the town of Osiris. The North Creek study site is situated north of North Creek which is located to the southeast of Osiris. Finally, the Parker Mountain Aerator study is placed on the Awapa Plateau to the east of Parker Mountain.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred browse species on these study sites. Other preferred browse species are also present and include antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*) and mountain snowberry (*Symphoricarpos oreophilus*). Preferred browse species, particularly sagebrush have shown significant increases in cover (**Figure 5.2**). Average preferred browse demographics show that the densities of preferred browse have increased markedly, with a significant amount considered to be young plants (**Figure 5.11**). Preferred browse utilization has fluctuated, but has remained low in general (**Figure 5.13**).

Tree cover decreased initially between 2003 and 2008 due to a lop and scatter treatment on the Varney-Griffin Chaining study. However, cover has increased in all subsequent sample years. Most cover can be attributed to twoneedle pinyon (*Pinus edulis*) with lesser amounts of Utah juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*J. scopulorum*) also present. Density of trees has increased as well (**Figure 5.5**, **Figure 5.8**).

Herbaceous Understory: The herbaceous understories of these study sites have fluctuated, but have remained stable overall. The grasses and forbs are diverse and moderately abundant. Perennial forbs have shown a slightly decreasing trend in both cover and nested frequency while perennial grasses have generally remained stable. Annual grasses were first sampled in 2003 and have increased in frequency significantly. Cover of annual grasses has also increased, but to a lesser extent (**Figure 5.15**, **Figure 5.17**).

Occupancy: Average pellet transect data indicates that the co-dominant occupants of these study sites are elk and cattle. Mean abundance of elk pellet groups has fluctuated between sample years with a low of 11 days use/acre in 2018 and a high of 20 days use/acre in 2013. The mean abundance of cattle pellet groups has varied from 10 days use/acre in 2018 to 21 days use/acre in 2008. Deer presence has changed from a high of 23 days use/acre in 1998 to a low of 9 days use/acre in 2018 (**Figure 5.19**).

Upland (Big Sagebrush)

There are five studies [Wildcat (25C-02), Terza Flat (25C-06), South Narrows (25C-08), Dry Wash (25C-09), and New Home Bench (25C-14)] that are considered to be classified as Upland (Big Sagebrush) ecological sites. The Wildcat study is located east of SR-12 near Sulfur Creek. The Terza Flat study site is placed about 4 miles south of Loa. The South Narrows study is situated roughly 8 miles north of Otter Creek Reservoir near SR-62. The Dry Wash study site can be found approximately 2 miles east of Antimony. The New Home Bench study is located to the west of Boulder near the Boulder landing strip.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred browse species on these sites. However, small amounts of other preferred browse species such as black sagebrush (*A. nova*) and fourwing saltbush (*Atriplex canescens*) are present as well. Cover of preferred browse has exhibited an overall increase over time (**Figure 5.2**). Preferred browse demographic data has shown a decreasing trend in the number of individuals along with decreased recruitment of young. Decadence has fluctuated between sample years (**Figure 5.12**). Utilization of preferred browse has increased and has been moderate to high throughout the study period with the exception of the 1994 sample year (**Figure 5.14**).

Tree cover and density have shown steady increases over time. Age class distribution has progressed as well, which indicates a shift in woodland progression (**Figure 5.5**, **Figure 5.8**). Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) are the most common species on the site, but ponderosa pine (*P. ponderosa*) has been sampled on the Wildcat site and has shown an increase through time.

Herbaceous Understory: The understories of these sites have exhibited fluctuations in herbaceous cover, while frequency has exhibited a slight decreasing trend. The understories are primarily composed of perennial grasses, with smaller amounts of annual and perennial forbs observed. Blue grama (*Bouteloua gracilis*) is the dominant perennial grass species; the sites are mostly composed of native species with some introduced species found in low amounts. Annual grasses have been present in all years, though with very little cover or frequency in most years. (**Figure 5.16**, **Figure 5.18**).

Occupancy: Pellet transect data for sites of this ecological type shows that the primary occupants are deer with elk being present in significant amounts as well. The mean abundance of deer pellet groups has varied from a low of 23 days use/acre in 2018 to a high of 59 days use/acre in 2008. Elk pellet groups have had a mean abundance ranging from 8 days use/acre in 2018 to 27 days use/acre in 2008. Cattle have been sampled in all years with a mean abundance varying from 4 days use/acre in 2013 to 10 days use/acre in 2018 (**Figure 5.20**).

Upland (Black/Low Sagebrush)

There are two studies [Cedar Grove (25C-07) and Black Canyon (25C-26)] classified as Upland (Black/Low Sagebrush) ecological sites. The Cedar Grove site is located on the Parker Mountain bench Southeast of Greenwich. The Black Canyon study site is situated north of Osiris on the benches to the east of the East Fork Sevier River.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) was the dominant preferred browse species sampled on these sites, but lesser amounts of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) were present as well. There have been fluctuations in cover but a generally increasing trend has been observed (**Figure 5.2**). Demographic data shows that the plant communities on these sites are primarily composed of mature individuals with a moderate amount of decadence being sampled. Recruitment of young has been low throughout the study period (**Figure 5.12**). The utilization of preferred browse has fluctuated significantly, 2003 and 2018 showed low usage while high amounts of utilization were observed in 2013 (**Figure 5.14**).

Tree cover has not been sampled on either site and density was only sampled in 2018, so a trend cannot be established for trees (**Figure 5.5**, **Figure 5.8**). The tree species sampled were Rocky Mountain juniper (*Juniperus scopulorum*) and twoneedle pinyon (*Pinus edulis*).

Herbaceous Understory: The understories of these sites are mostly composed of perennial grass species; muttongrass (*Poa fendleriana*) and blue grama (*Bouteloua gracilis*) are the dominant grass species sampled on the sites. Cover and frequency has shown slight fluctuations but has overall remained stable. Perennial forbs provide a moderate amount of cover and frequency (**Figure 5.16**, **Figure 5.18**).

Occupancy: Pellet transect data shows that the primary occupants of these sites are deer in most years, with the exception of 2003 when they were co-dominant with elk. The mean abundance of deer pellet groups has fluctuated between a low of 17 days use/acre in 2008 to a high of 30 days use/acre in 1998. Elk pellet groups have been sampled in varying abundance from 0 days use/acre in 2013 to 16 days use/acre in 1998. Cattle have been present in all years with mean abundance of pellet groups varying from 2 days use/acre in 2008 to 6 days use/acre in 2003 (**Figure 5.20**).

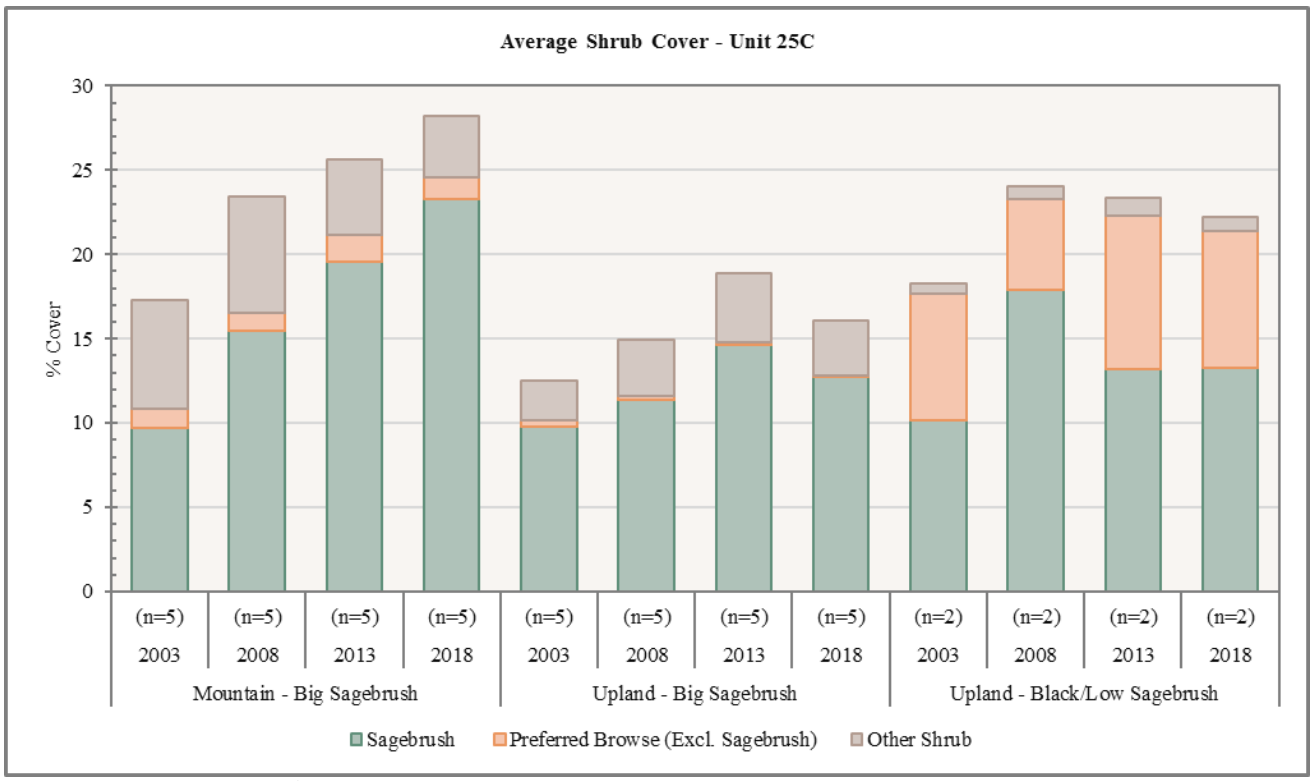


Figure 5.2: Average shrub cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

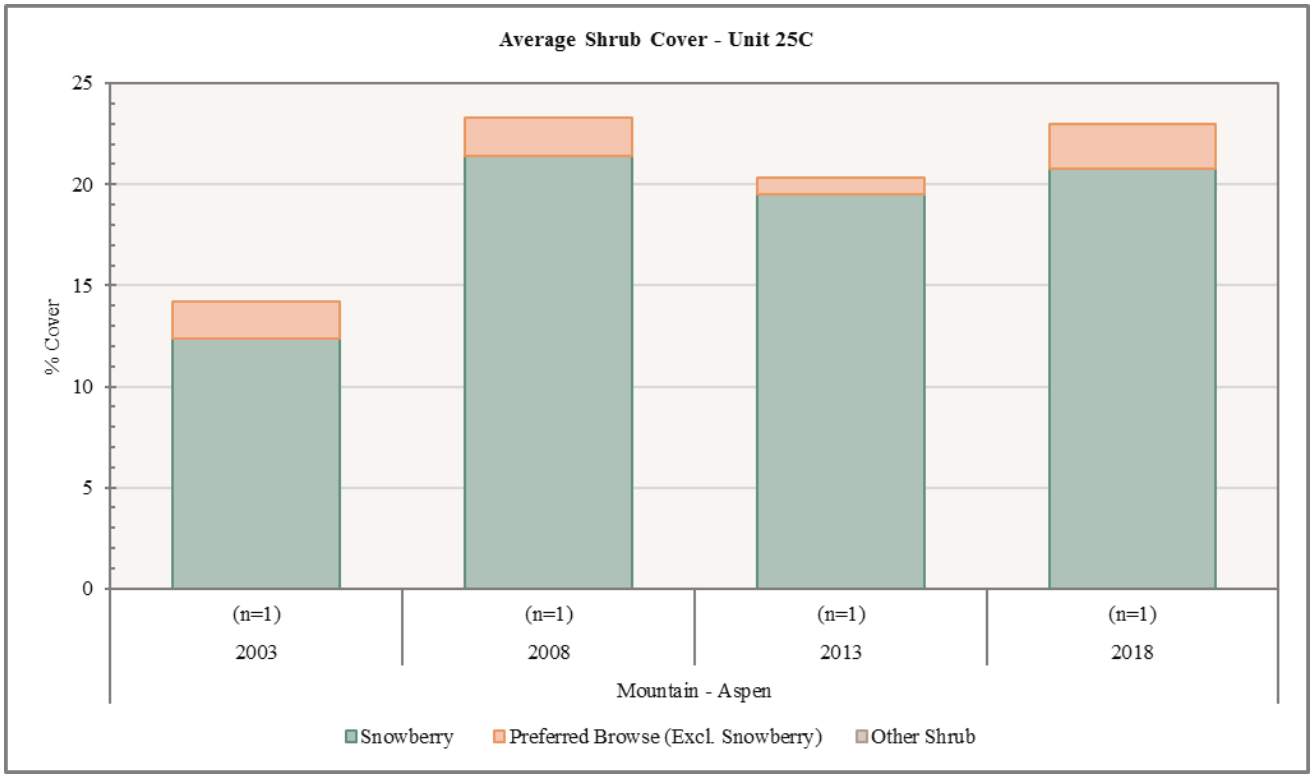


Figure 5.3: Average shrub cover for Mountain - Aspen study sites in WMU 25C, Boulder Plateau.

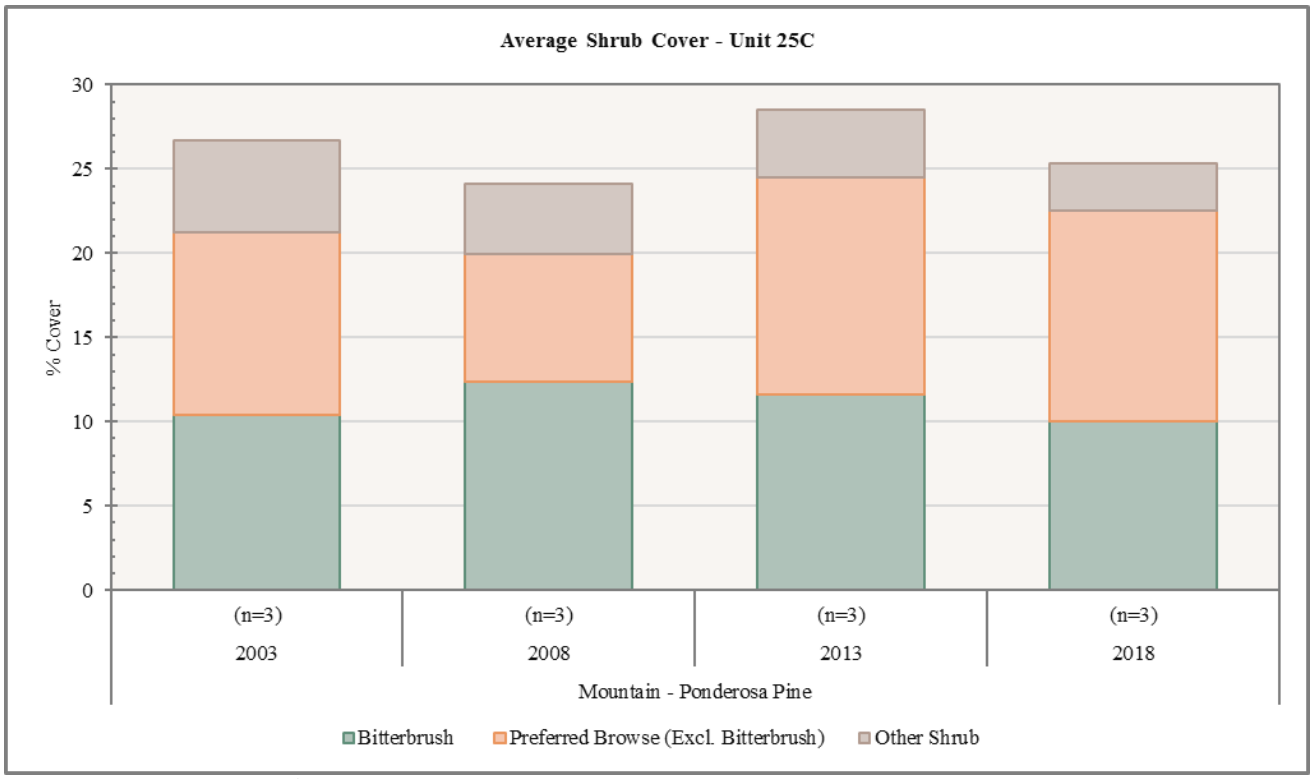


Figure 5.4: Average shrub cover for Mountain - Ponderosa Pine study sites in WMU 25C, Boulder Plateau.

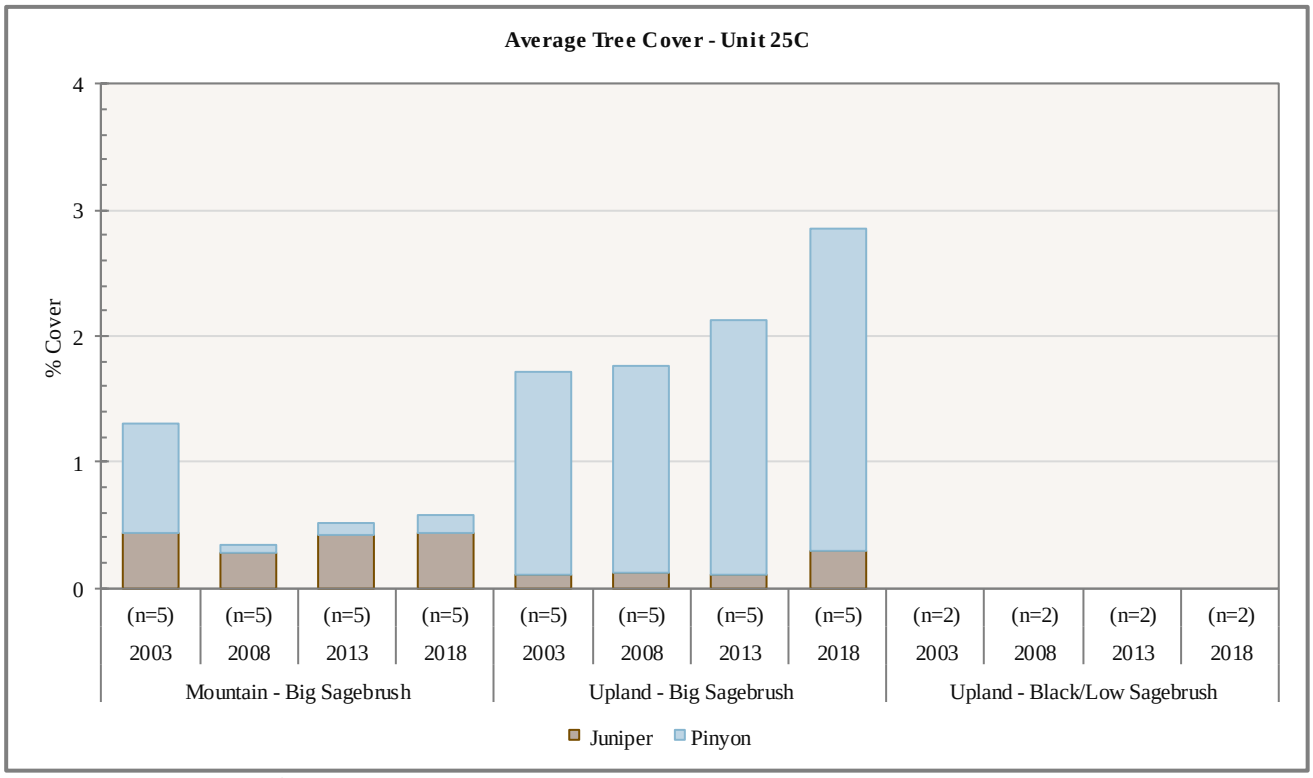


Figure 5.5: Average tree cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

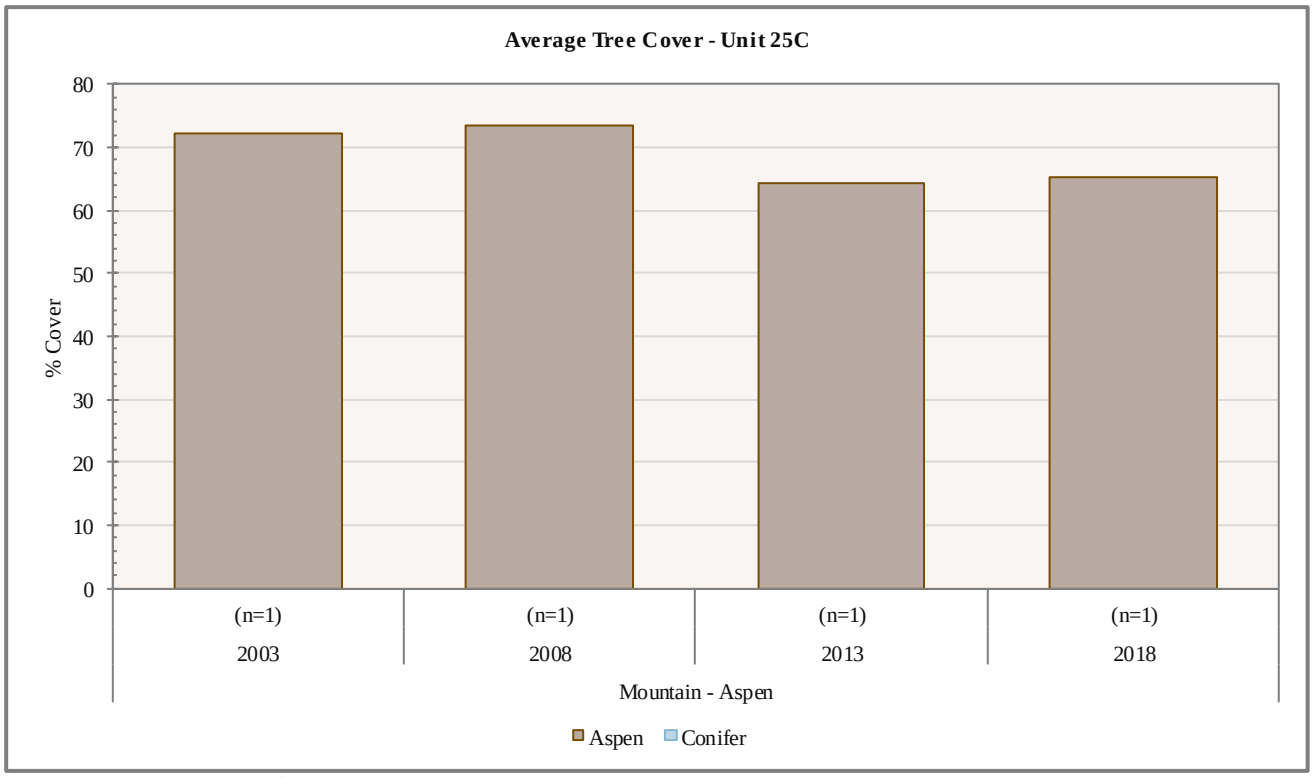


Figure 5.6: Average tree cover for Mountain - Aspen study sites in WMU 25C, Boulder Plateau.

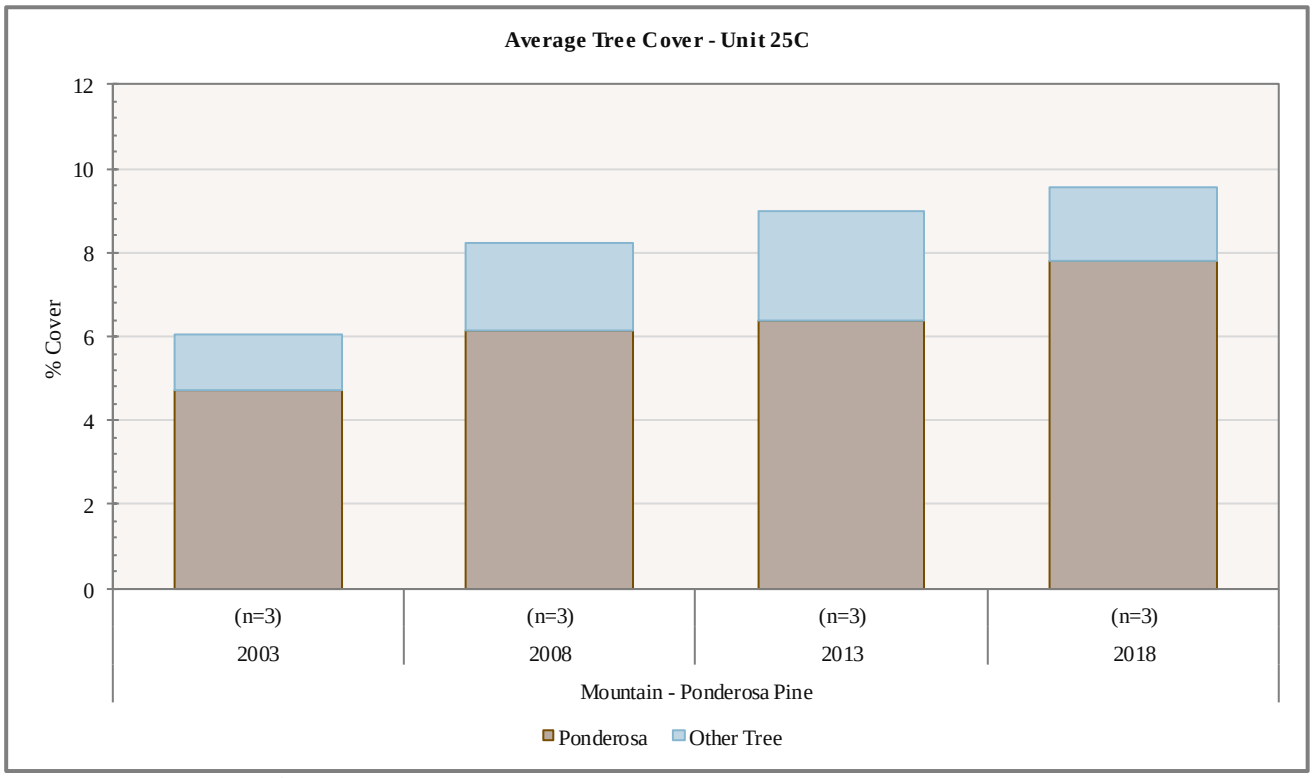


Figure 5.7: Average tree cover for Mountain - Ponderosa Pine study sites in WMU 25C, Boulder Plateau.

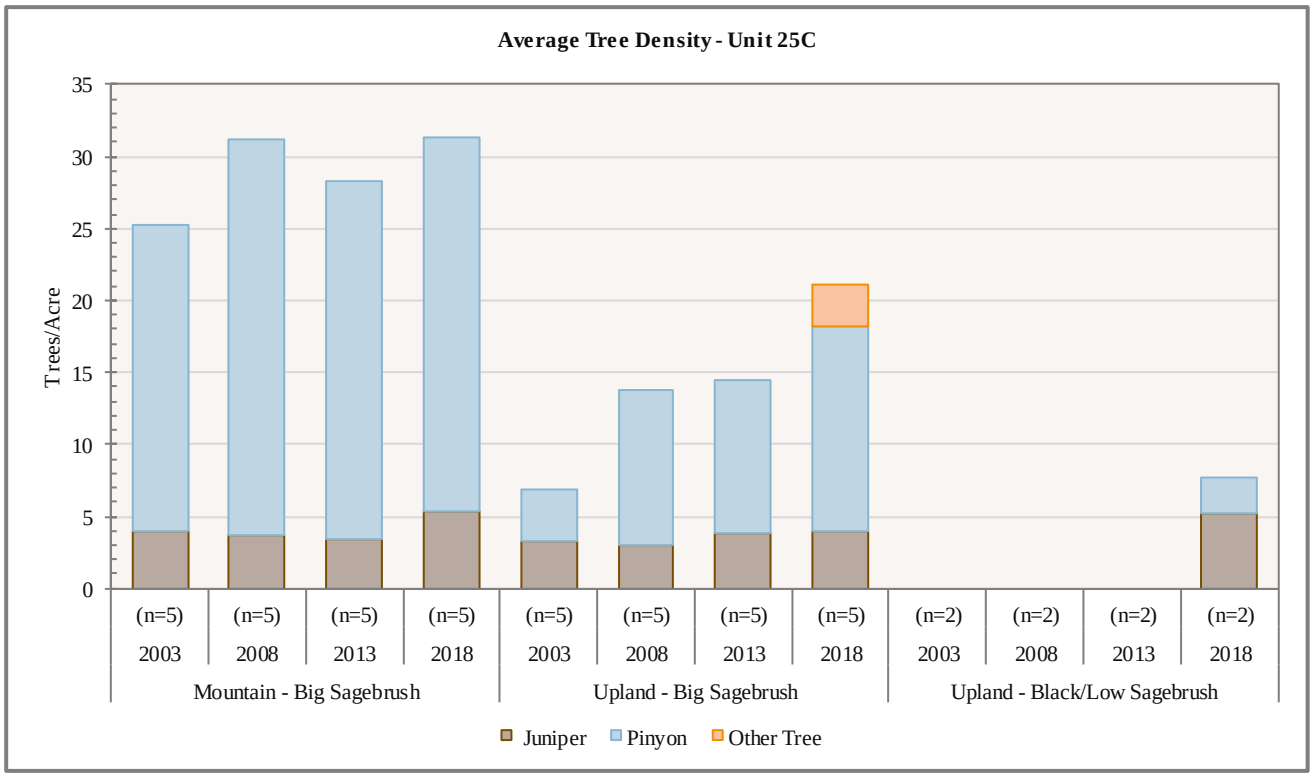


Figure 5.8: Average tree density for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

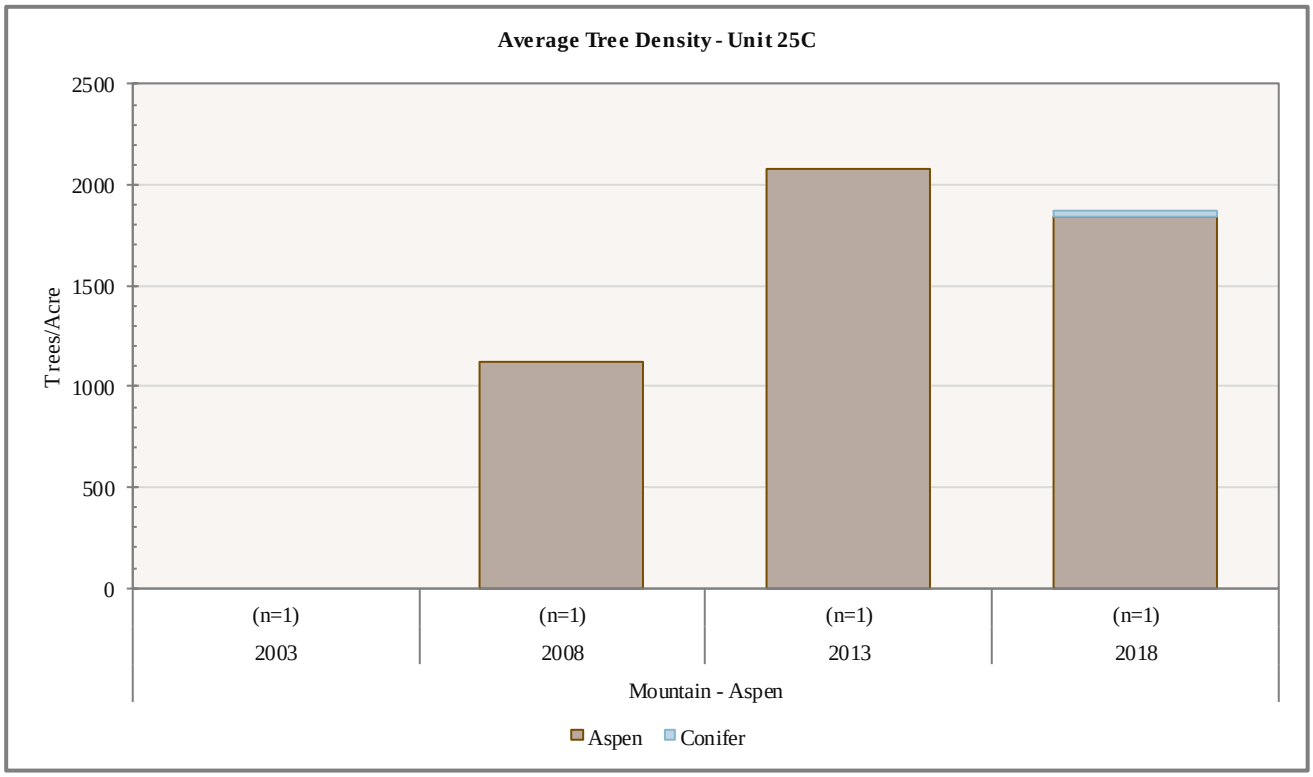


Figure 5.9: Average tree density for Mountain - Aspen study sites in WMU 25C, Boulder Plateau.

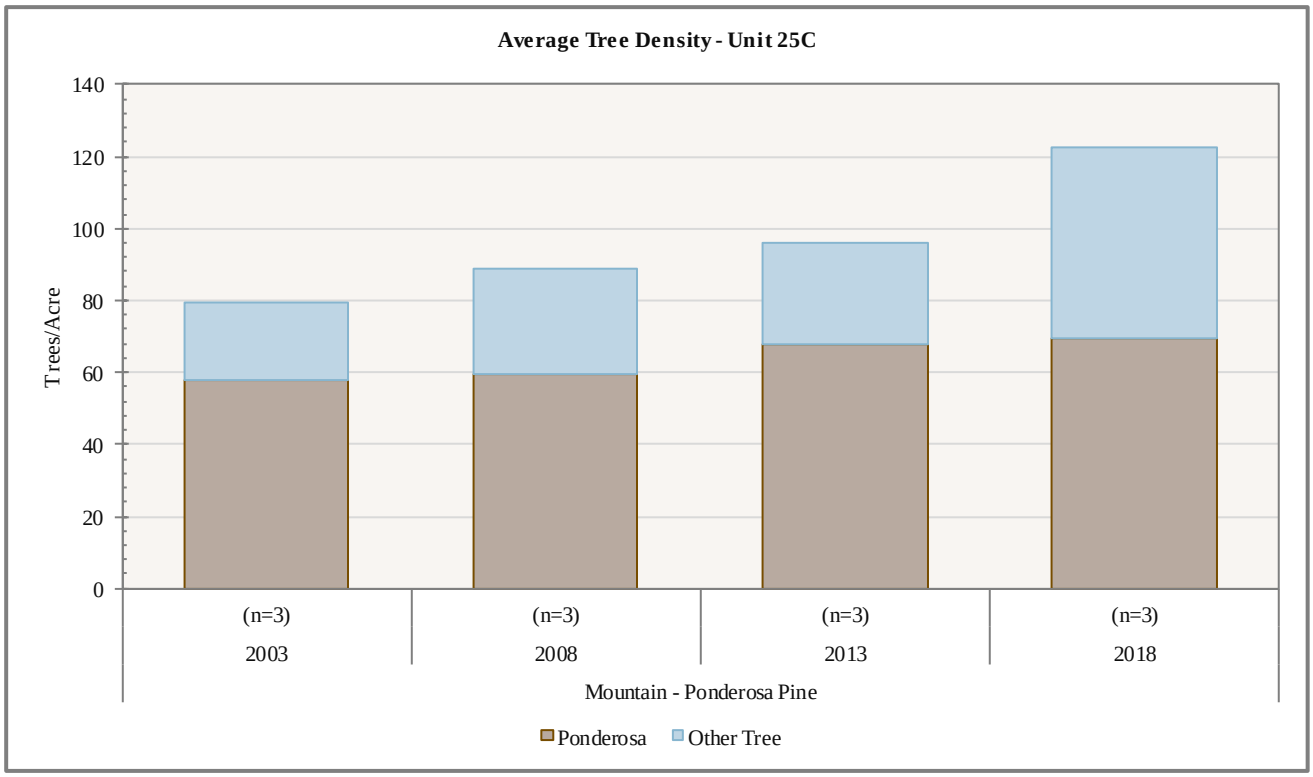


Figure 5.10: Average tree density for Mountain - Ponderosa Pine study sites in WMU 25C, Boulder Plateau.

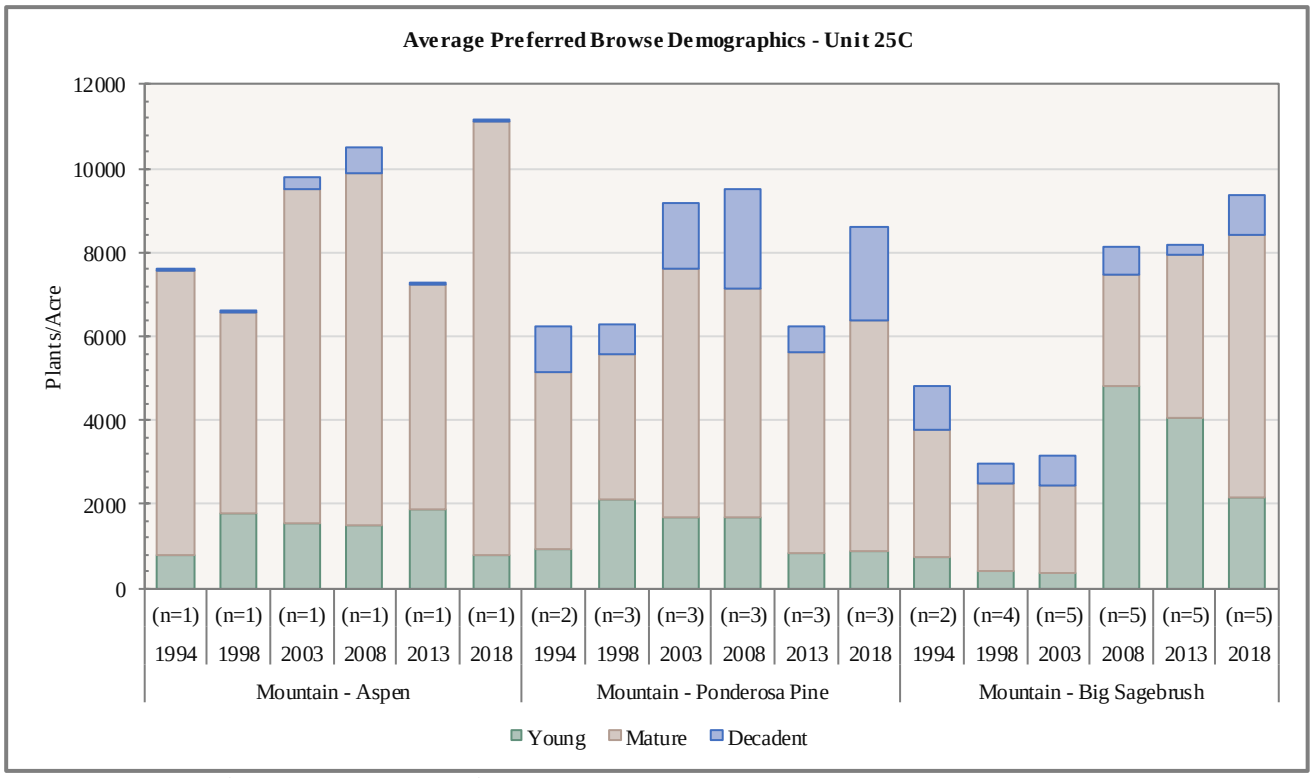


Figure 5.11: Average preferred browse demographics for Mountain - Aspen, Mountain - Ponderosa Pine, Mountain - Big Sagebrush study sites in WMU 25C, Boulder Plateau.

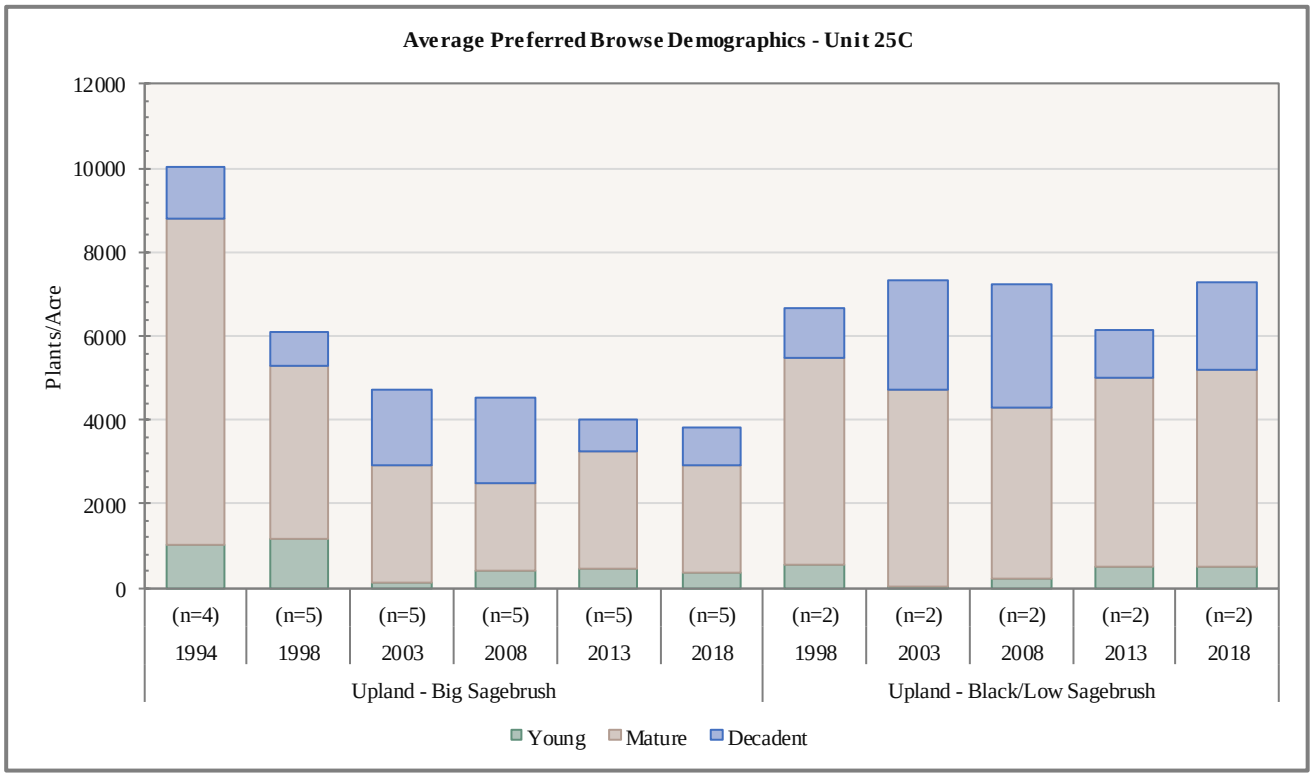


Figure 5.12: Average preferred browse demographics for Upland - Big Sagebrush and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

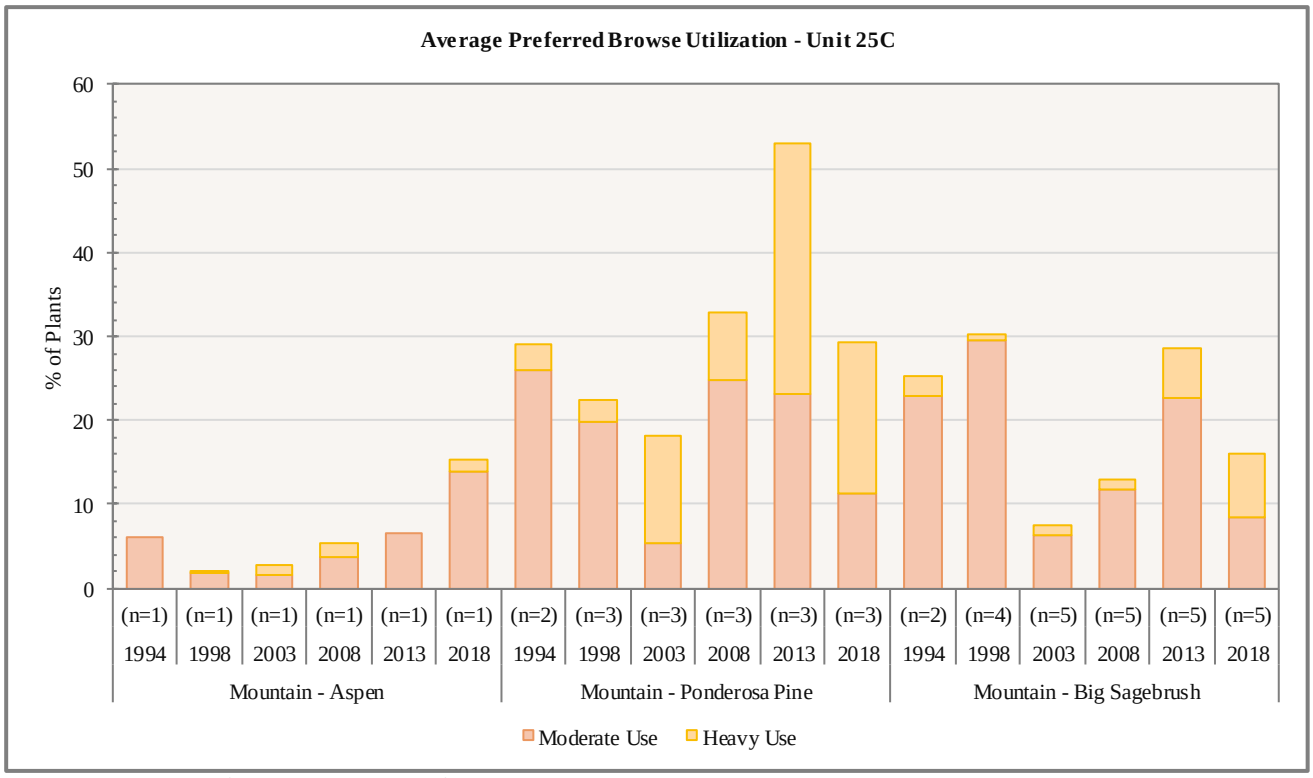


Figure 5.13: Average preferred browse utilization for Mountain - Aspen, Mountain - Ponderosa Pine, Mountain - Big Sagebrush study sites in WMU 25C, Boulder Plateau.

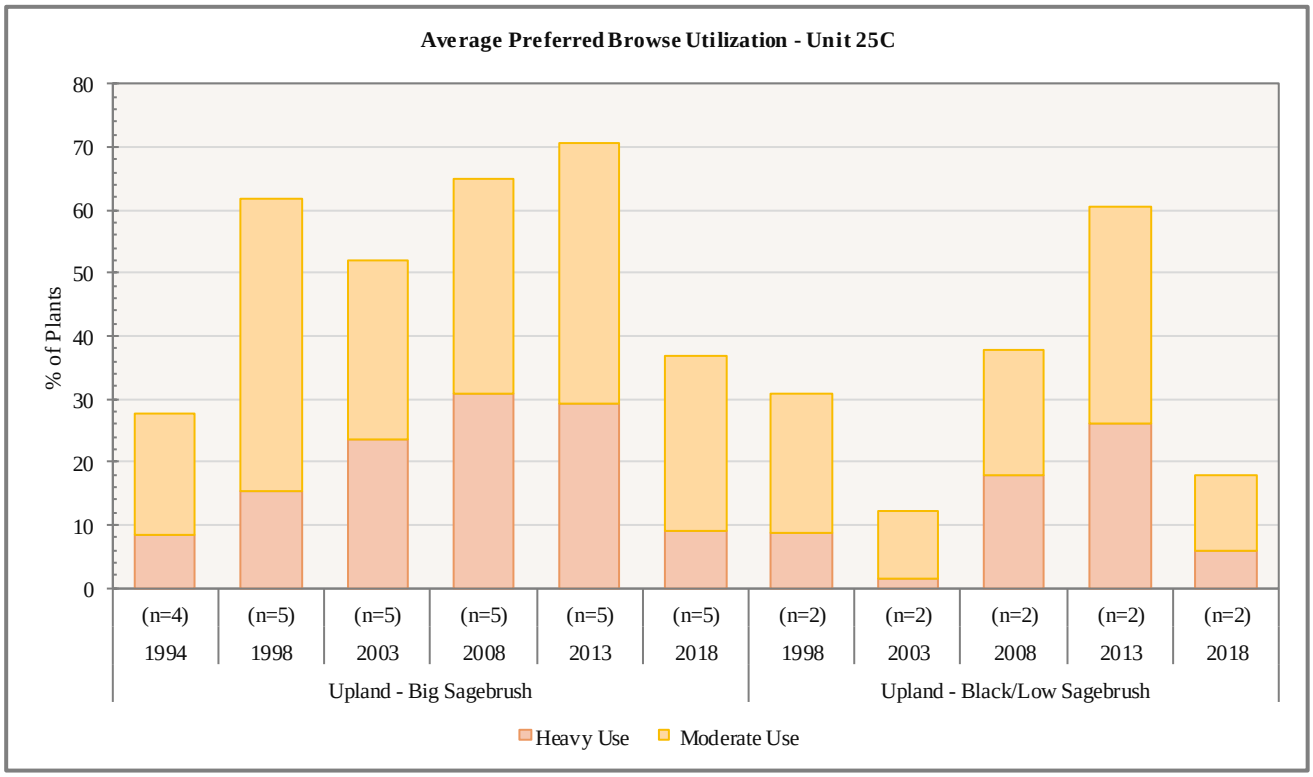


Figure 5.14: Average preferred browse utilization for Upland - Big Sagebrush and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

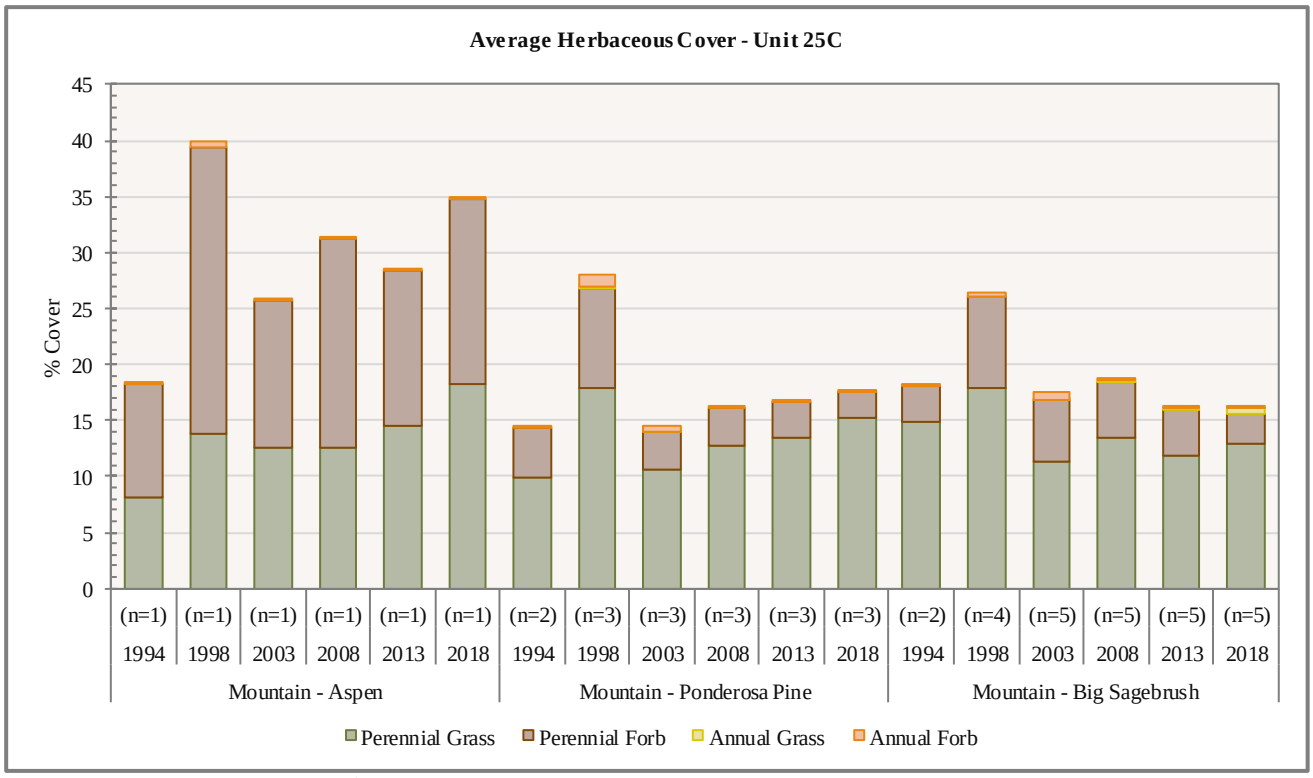


Figure 5.15: Average herbaceous cover for Mountain - Aspen, Mountain - Ponderosa Pine, Mountain - Big Sagebrush study sites in WMU 25C, Boulder Plateau.

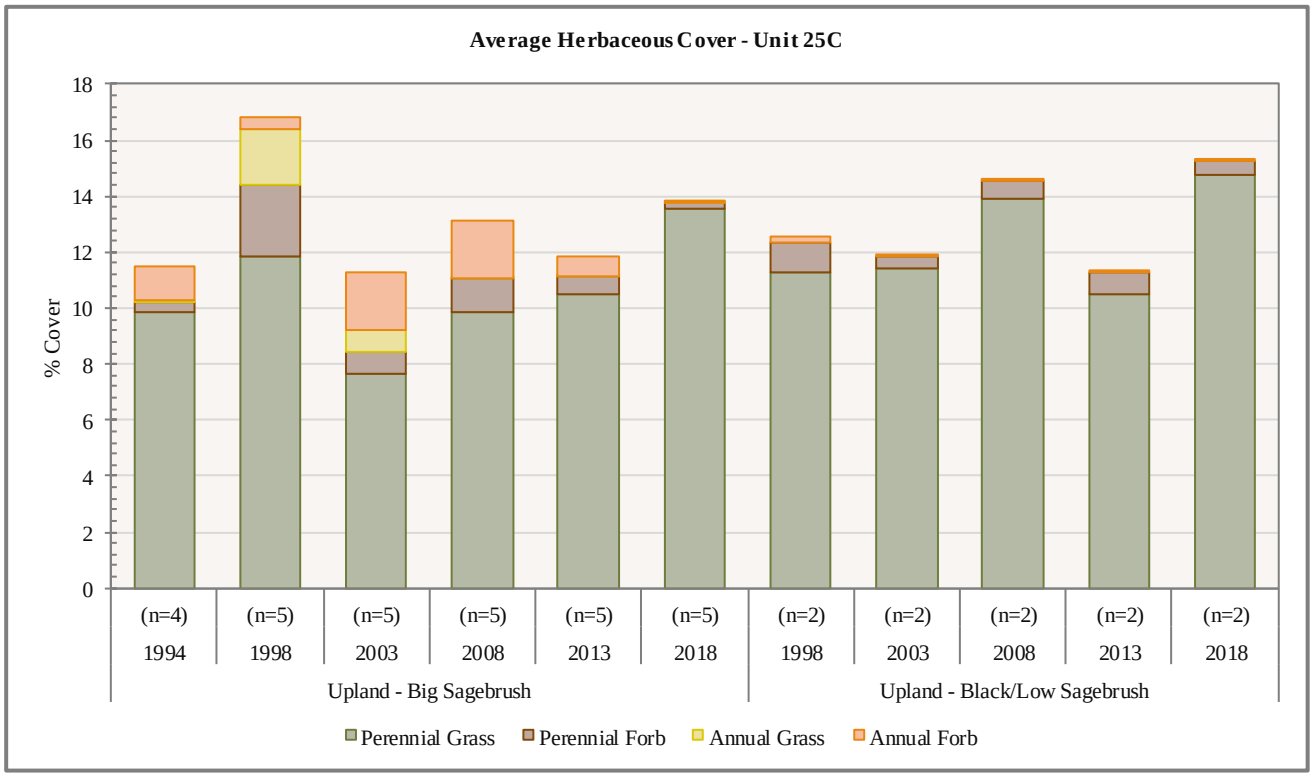


Figure 5.16: Average herbaceous cover for Upland - Big Sagebrush and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

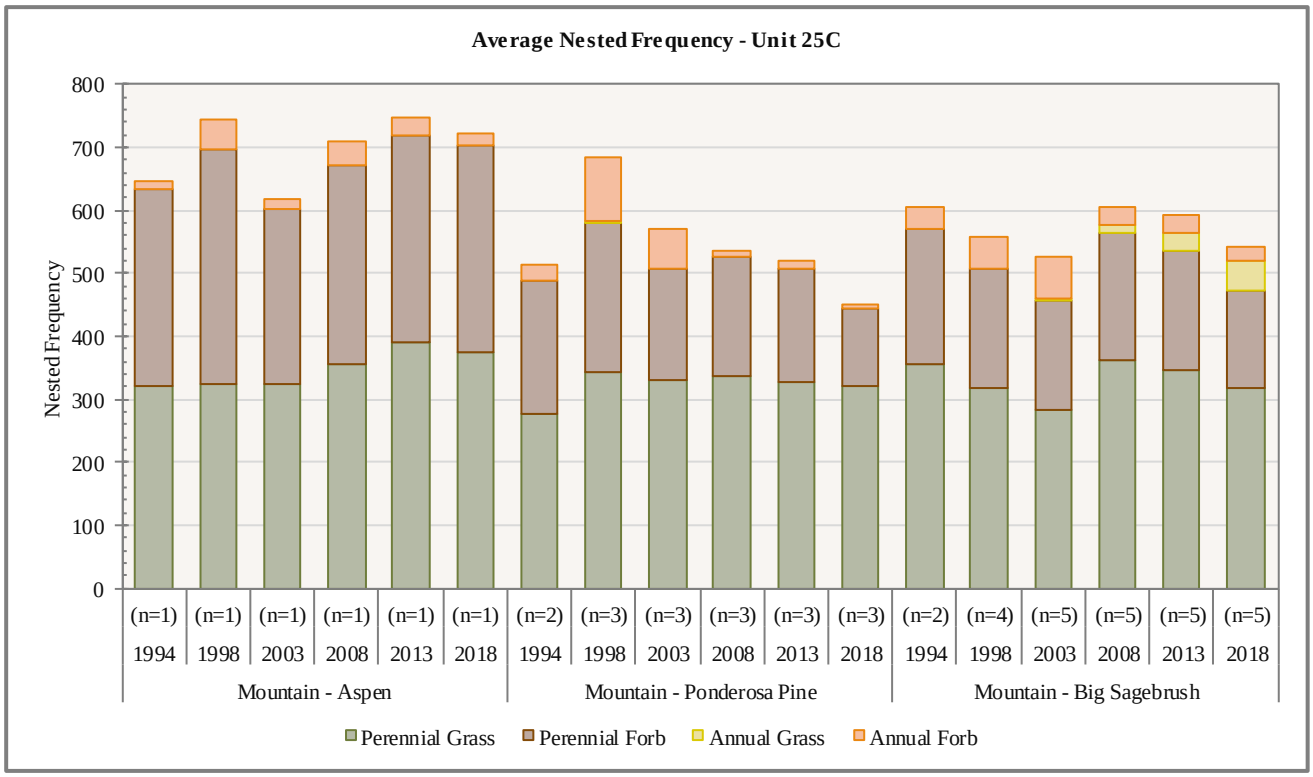


Figure 5.17: Average nested frequency of herbaceous species for Mountain - Aspen, Mountain - Ponderosa Pine, Mountain - Big Sagebrush study sites in WMU 25C, Boulder Plateau.

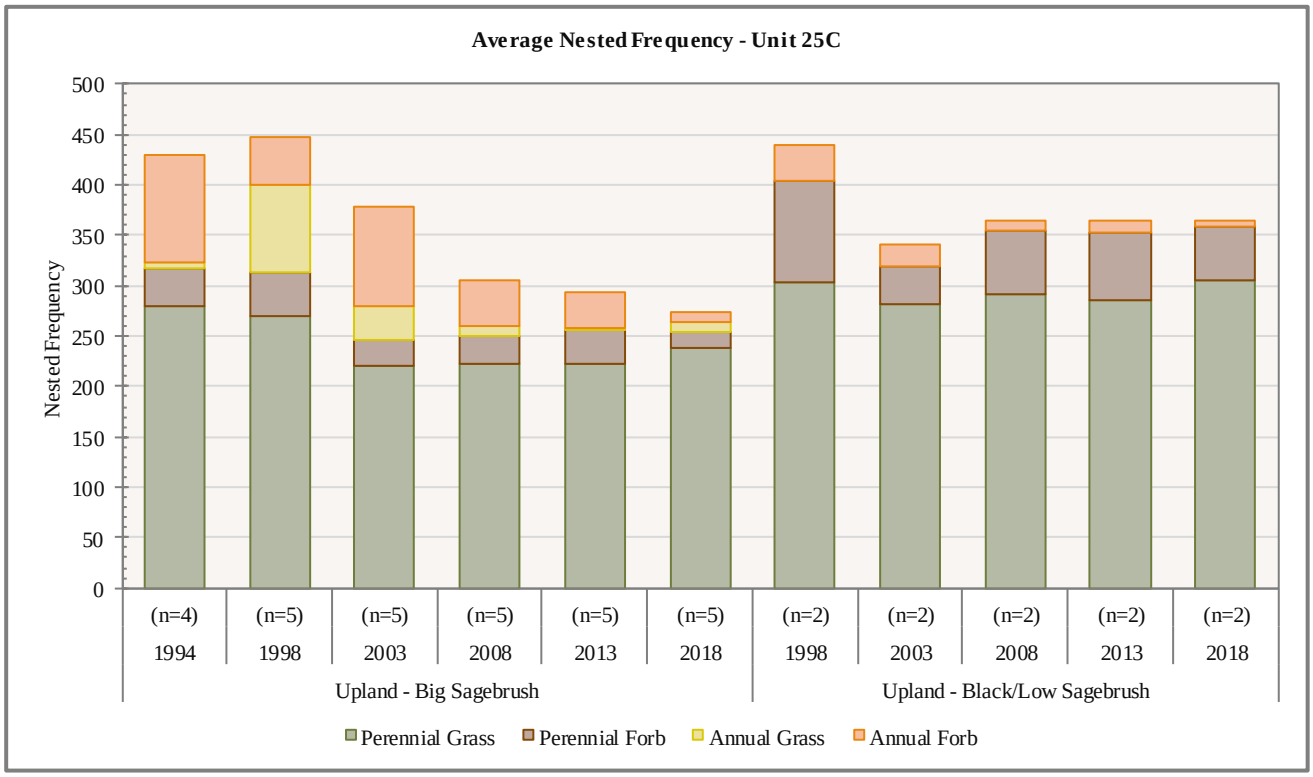


Figure 5.18: Average nested frequency of herbaceous for Upland - Big Sagebrush and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau.

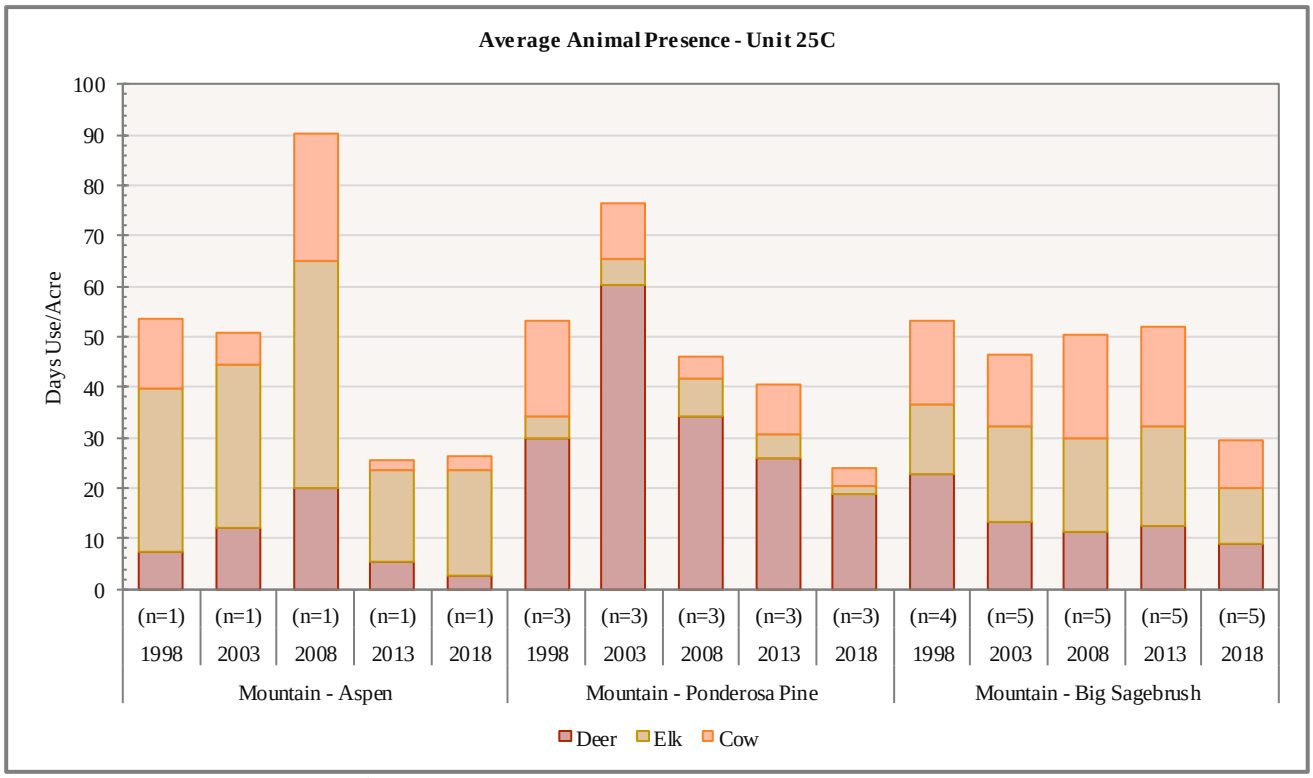


Figure 5.19: Average pellet transect data for Mountain - Aspen, Mountain - Ponderosa Pine, Mountain - Big Sagebrush study sites in WMU 25C, Boulder Plateau. Mountain - Big Sagebrush deer pellets include deer/antelope.

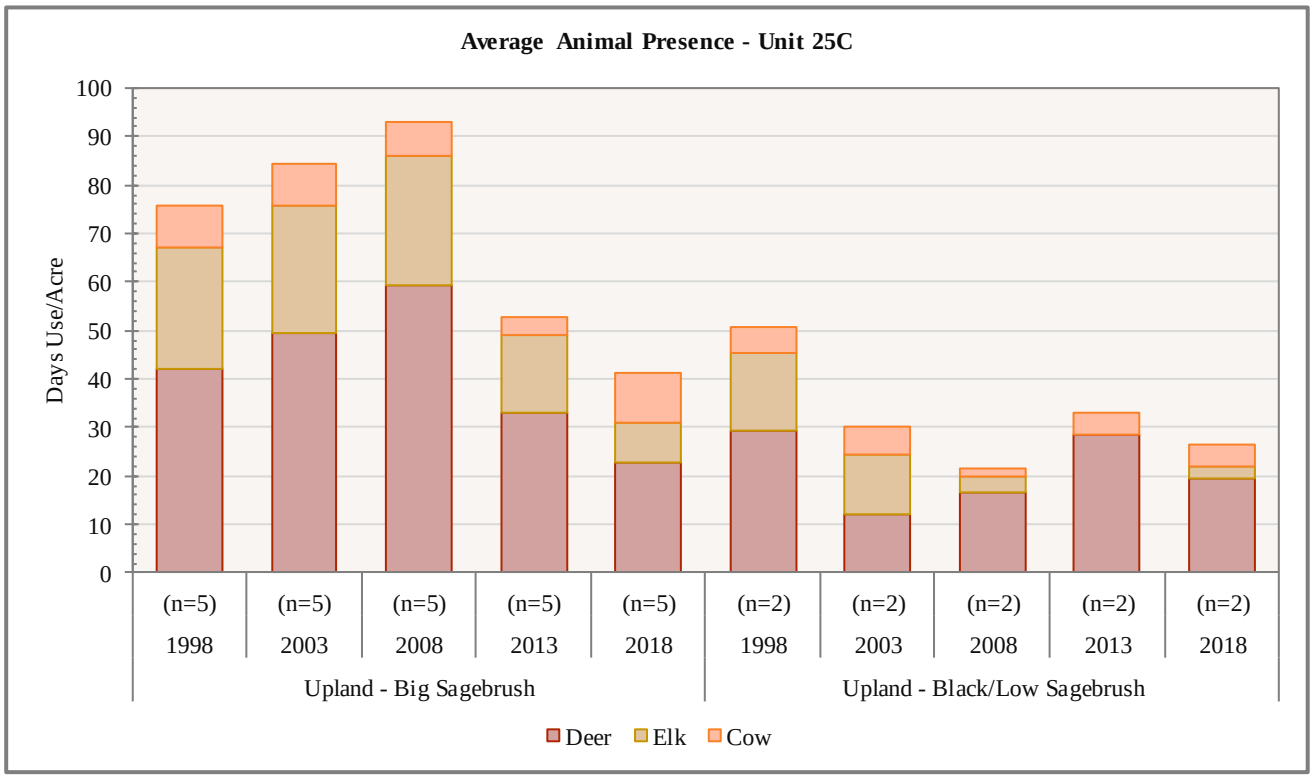
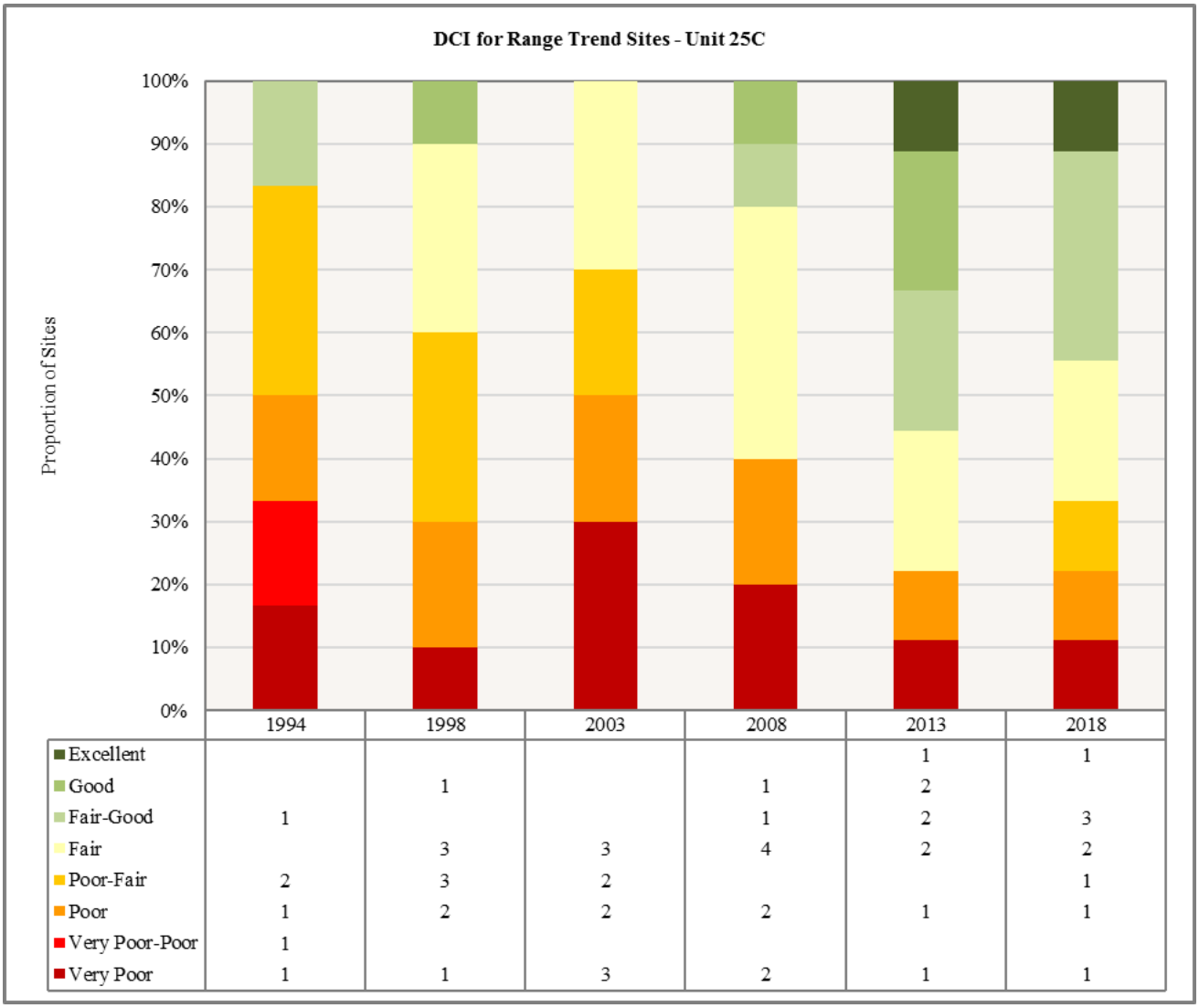


Figure 5.20: Average pellet transect data for Upland - Big Sagebrush and Upland - Black/Low Sagebrush study sites in WMU 25C, Boulder Plateau. Upland - Big Sagebrush and Upland - Black/Low Sagebrush deer pellets include deer/antelope.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Boulder Plateau management unit has shown variation on the sites sampled since 1994. The active Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2018 sample year (**Figure 5.21**, **Table 5.10**). The Poison Creek Bench study is the only site that is considered to be in excellent condition: high amounts of preferred browse as well as perennial grasses and forbs contribute to this ranking. There are three studies considered to be in fair-good condition, and these sites are Cedar Grove, Varney-Griffin Chaining, and Black Canyon. There are two studies classified as being in fair condition: Happy Valley and South Narrows. The site ranked as being in poor-fair condition is the North Creek study. There is one study in poor condition, and this study is the Dry Wash site. Finally, there is one study considered to be in very poor condition which is the Terza Flat study. This study is considered to be in this condition because of a lack of preferred browse as well as a lack of understory plants.

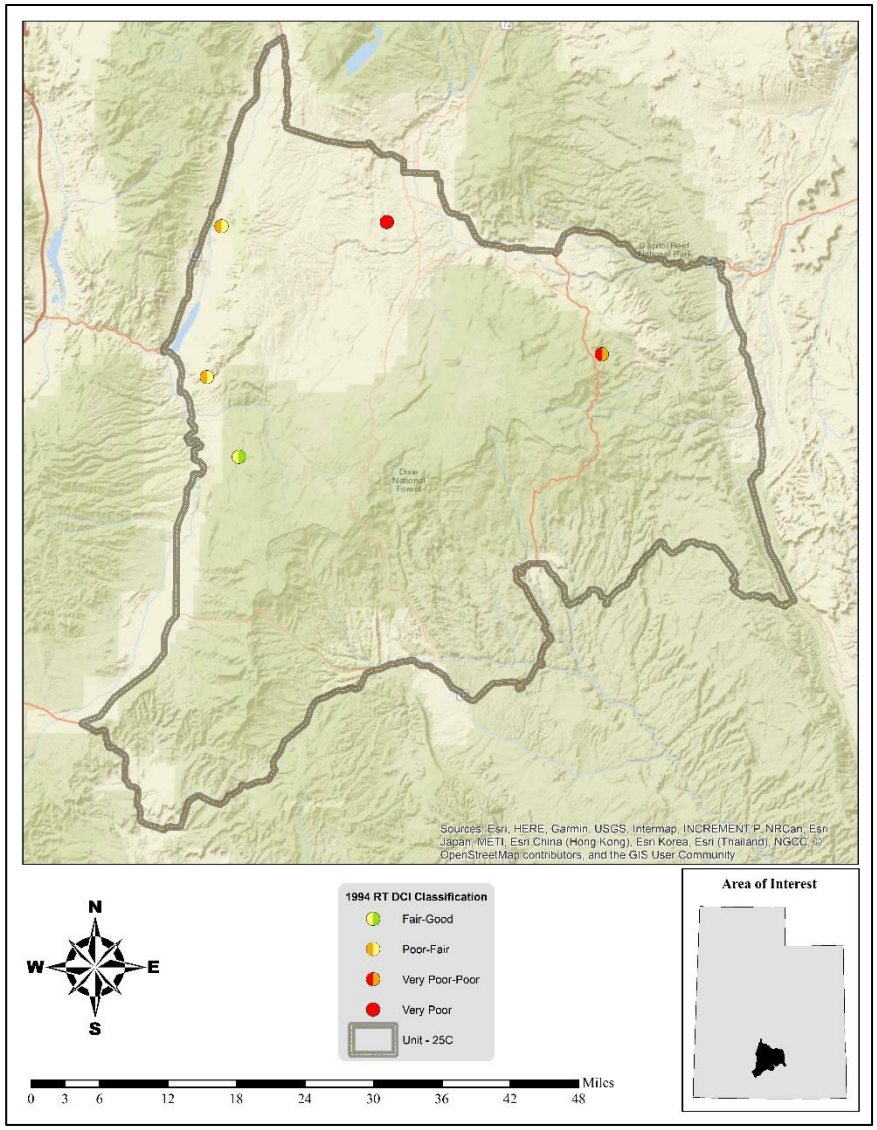


	1994	1998	2003	2008	2013	2018
Excellent					1	1
Good		1		1	2	
Fair-Good	1			1	2	3
Fair		3	3	4	2	2
Poor-Fair	2	3	2			1
Poor	1	2	2	2	1	1
Very Poor-Poor	1					
Very Poor	1	1	3	2	1	1

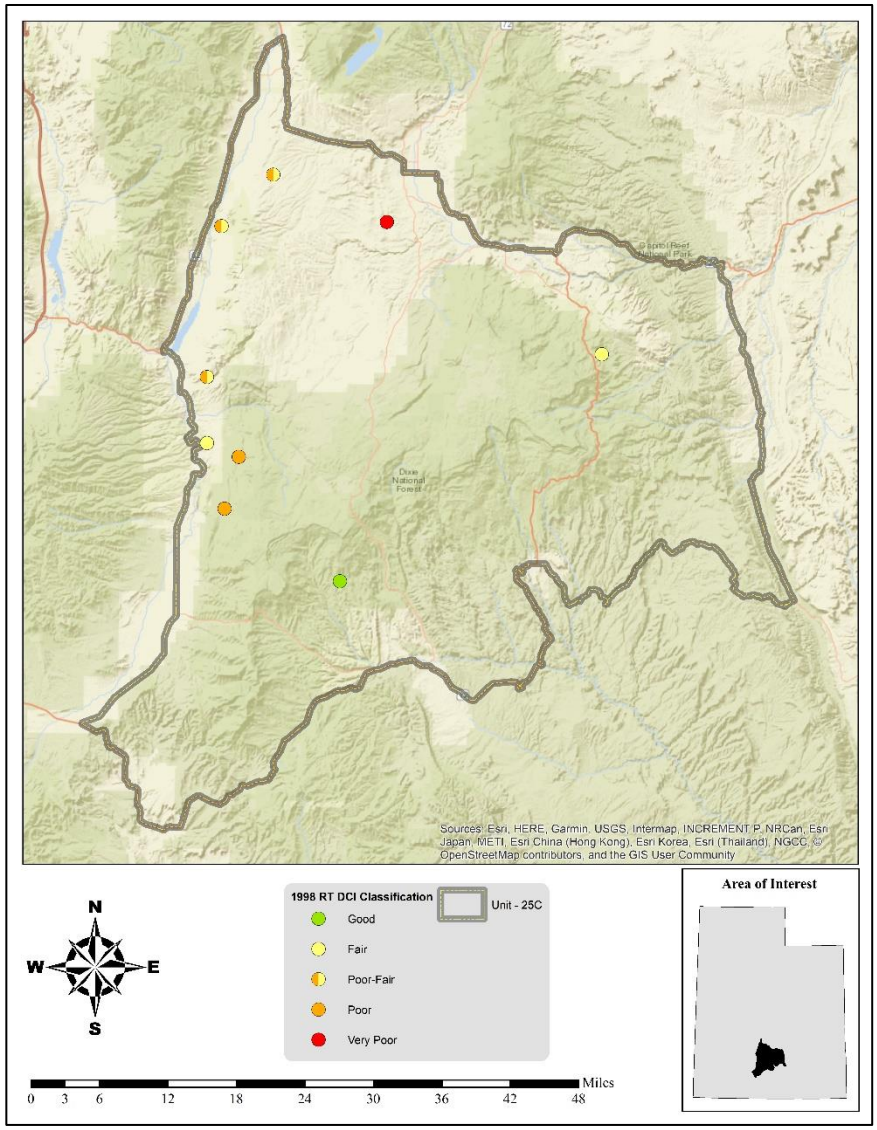
Figure 5.21: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 25C, Boulder Plateau.

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
25C-01*	1994	6.3	0	0	30	0	0.9	0	**37.2**	**P**
25C-01*	1998	9.2	9.6	7.4	30	0	0.6	0	**56.7**	**F**
25C-01*	2003	15.8	10.9	2.4	28.1	0	0.7	0	**57.9**	**F**
25C-01*	2008	7.8	10.3	6.4	30	0	1.6	0	**56**	**F**
25C-03	1994	6.2	0	0	22.6	0	10	0	**38.8**	**VP-P**
25C-03	1998	7.5	14.4	3.9	30	-0.3	10	0	**65.5**	**F**
25C-03	2003	11.5	13	2.8	24.7	0	8.3	0	**60.3**	**F**
25C-03	2008	14.6	13.3	4.2	23.8	0	4.8	0	**60.7**	**F**
25C-03	2013	16.3	14.5	9.5	25.9	0	6.2	0	**72.4**	**G**
25C-03	2018	14.8	5.4	8.4	24.5	0	4.2	0	**57.2**	**F**
25C-06	1994	2.5	0	0	0.9	0	0	0	**3.4**	**VP**
25C-06	1998	5.3	0	0	0.8	0	0	0	**6.1**	**VP**
25C-06	2003	3.6	0	0	0	0	0	0	**3.6**	**VP**
25C-06	2008	4.9	0	0	0	0	0	0	**4.9**	**VP**
25C-06	2013	6	0	0	0.1	0	0	0	**6.1**	**VP**
25C-06	2018	6.2	0	0	0.1	0	0	0	**6.3**	**VP**
25C-07	1998	18.8	6.2	1.8	20	0	3	0	**49.8**	**P-F**
25C-07	2003	25.8	3.2	0.3	17.7	0	1.8	0	**48.7**	**P-F**
25C-07	2008	29.1	-0.4	1.8	19.6	0	2.4	0	**52.5**	**F**
25C-07	2013	27.3	8.9	5.5	21.9	0	2.9	0	**66.5**	**F-G**
25C-07	2018	26.5	6.5	3.9	25.5	0	1.6	0	**64**	**F-G**
25C-08	1994	13.9	4.5	1.8	30	0	0.2	0	**50.4**	**P-F**
25C-08	1998	12.4	5.3	6.9	27.1	0	0.2	0	**51.9**	**P-F**
25C-08	2003	16.1	-1.8	0.5	27.1	0	0	0	**41.9**	**P**
25C-08	2008	19.8	-4.9	1	30	0	0	0	**45.9**	**P**
25C-08	2009	16.8	0	0	30	0	0	0	**46.8**	**P**
25C-08	2013	21.1	5.6	1.1	30	0	0.2	0	**58.1**	**F**
25C-08	2018	16.4	5.7	1.7	30	0	0.2	0	**53.9**	**F**
25C-09	1994	15.6	12	9.6	12.2	0	0.2	0	**49.4**	**P-F**
25C-09	1998	13.5	12.7	12.1	13.4	-0.9	0.2	0	**51**	**P-F**
25C-09	2003	11.3	4.7	2.9	10.4	-2.9	0.1	0	**26.4**	**VP**
25C-09	2008	12.3	1.6	1	13.7	-0.1	0	0	**28.6**	**VP**
25C-09	2013	16.1	10.2	2.5	16.4	0	0	0	**45.2**	**P**
25C-09	2018	12.4	6.7	2.1	21.1	0	0	0	**42.3**	**P**
25C-17	1998	11.1	13.1	9.8	30	0	9.9	0	**73.9**	**G**
25C-17	2003	17.2	11.2	2.6	10.8	0	9.4	0	**51.3**	**P**
25C-17	2008	11.7	9.2	15	20.5	0	4.3	0	**60.8**	**F**
25C-17	2013	20.5	14.8	15	17	0	1.2	0	**68.6**	**F-G**
25C-17	2018	20.1	14.7	4.9	27.8	0	1.8	0	**69.3**	**F-G**
25C-26	1998	14.6	11.6	5.7	25.1	0	1.3	0	**58.3**	**F**
25C-26	2003	18.5	3.6	0.1	27.9	0	0	0	**50.2**	**P-F**
25C-26	2008	29.1	5.6	1.6	30	0	0.1	0	**66.4**	**F-G**
25C-26	2013	28.5	9.7	2.3	20	0	0.2	0	**60.7**	**F**
25C-26	2018	27	5.8	1.6	30	0	0.2	0	**64.7**	**F-G**
25C-27	1994	30	6.4	7	20.4	0	6.4	0	**70.2**	**F-G**
25C-27	1998	3.4	0	0	30	0	10	0	**43.4**	**P**
25C-27	2003	11.8	12.3	1.1	30	0	9.9	0	**65.1**	**F**
25C-27	2008	18.8	12	15	30	0	6.4	0	**82.2**	**G**
25C-27	2013	26.5	15	15	29.4	0	7.4	0	**93.3**	**E**
25C-27	2018	30	13.7	15	30	0	4	0	**92.7**	**E**
25C-28	1998	30	10.2	2.7	1.5	0	1.5	0	**45.8**	**P**
25C-28	2003	7.9	6.3	4.6	3.9	-0.2	10	0	**32.5**	**VP**
25C-28	2008	13.5	8.9	10.6	14.5	-0.3	5.3	0	**52.5**	**P**
25C-28	2013	21.9	14.3	15	13.6	-0.9	10	0	**73.9**	**G**
25C-28	2018	26.7	11.6	10.3	4.7	-1.9	3.1	0	**54.5**	**P-F**

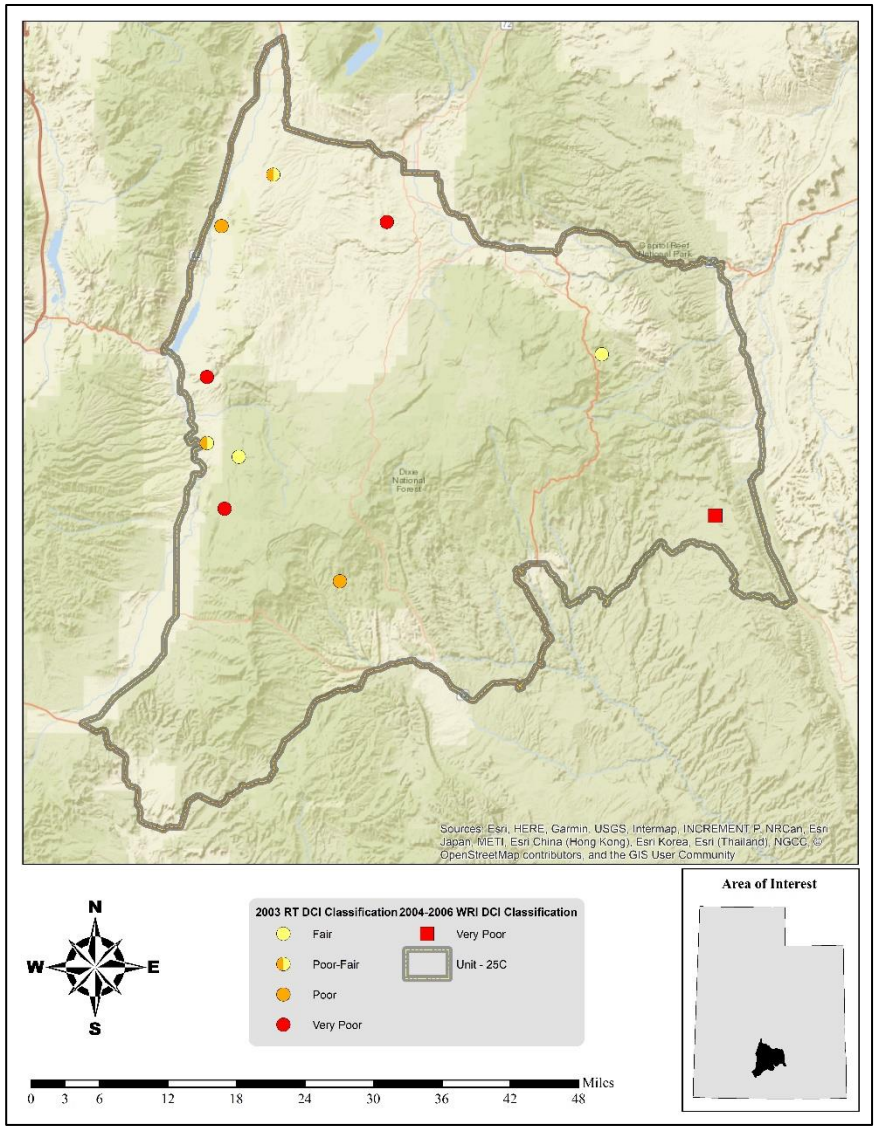
Table 5.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 25C, Boulder Plateau. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



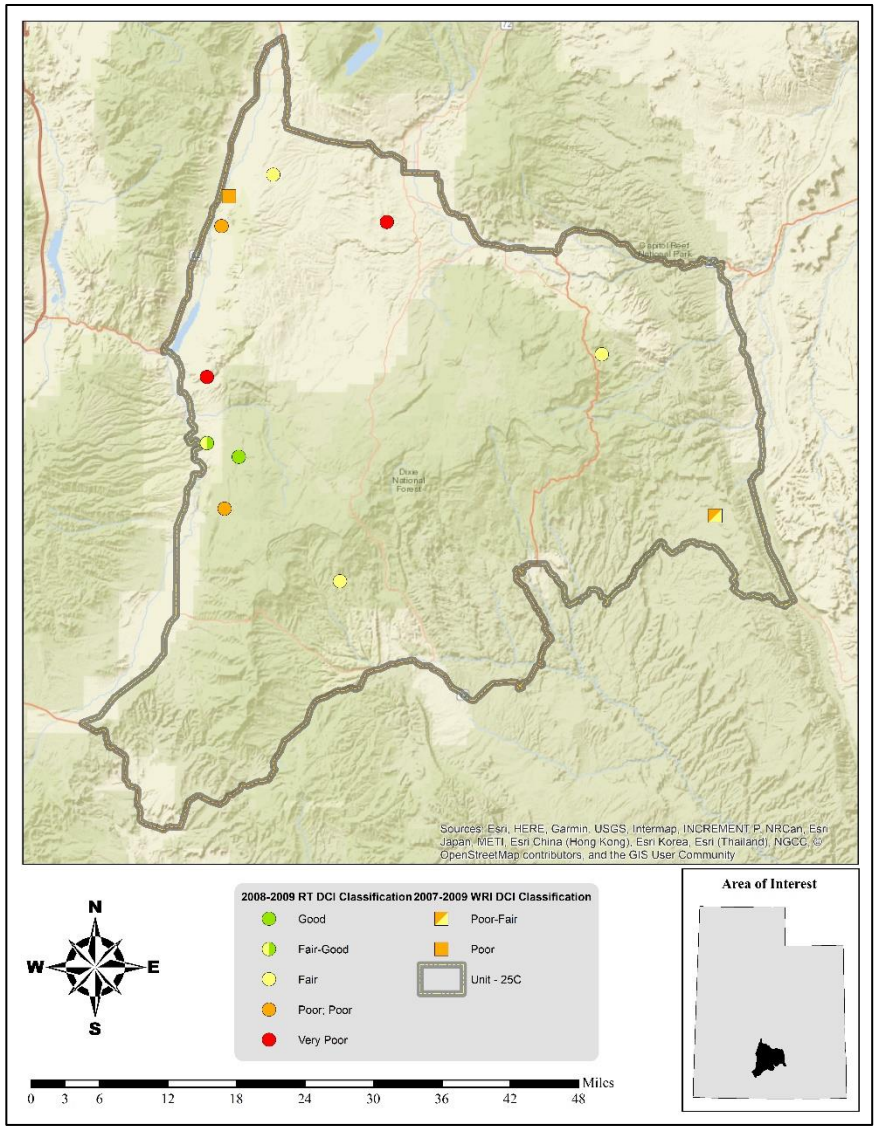
Map 5.9: 1994 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.



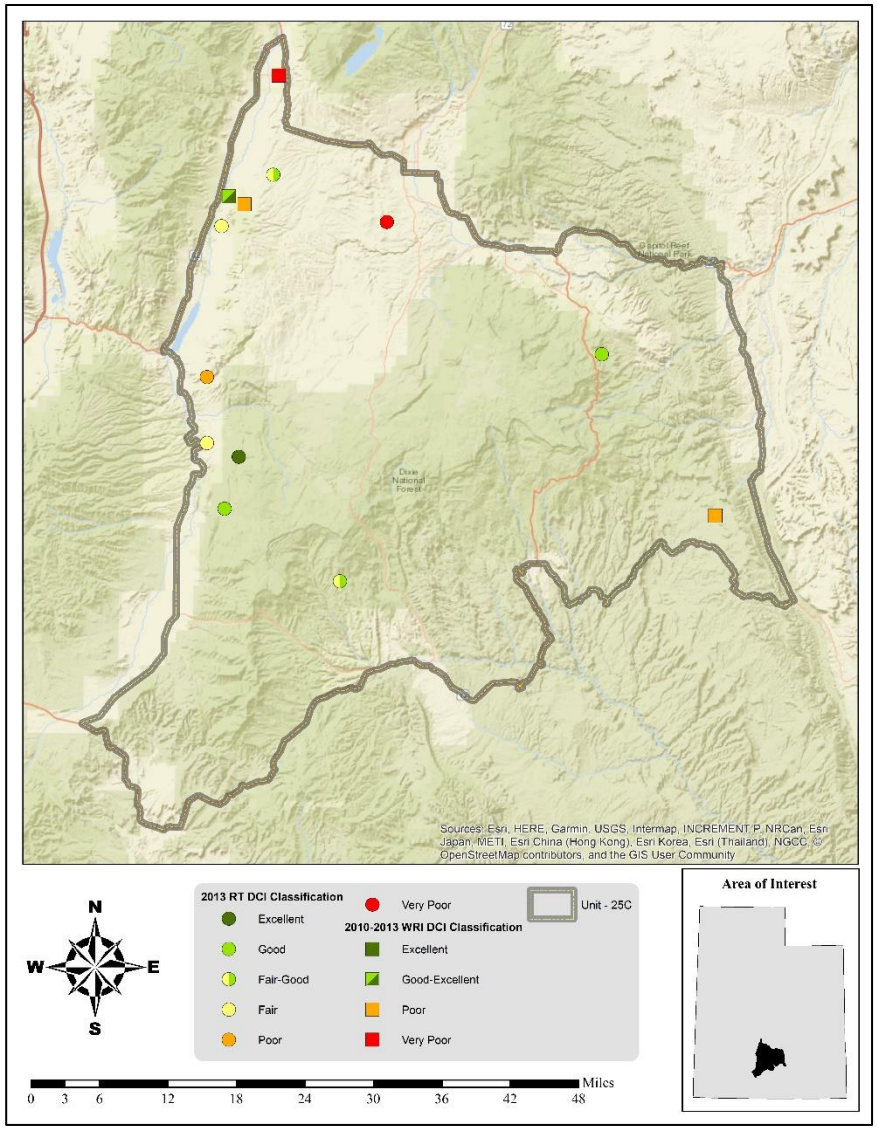
Map 5.10: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.



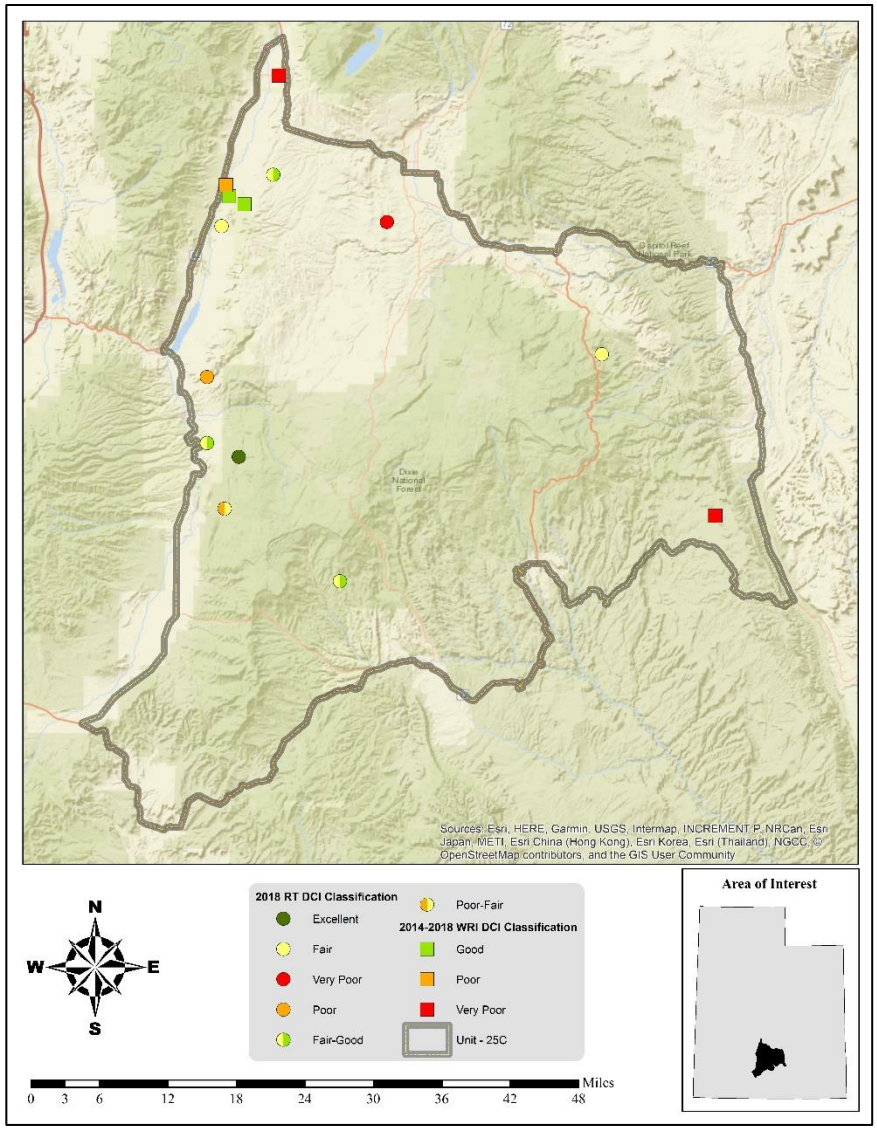
Map 5.11: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.



Map 5.12: 2008-2009 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.



Map 5.13: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.



Map 5.14: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 25C, Boulder Plateau.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
25C-02	Wildcat	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-03	Happy Valley	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-04	North Slope	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
25C-06	Terza Flat	None Identified		
25C-07	Cedar Grove	None Identified		
25C-08	South Narrows	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-09	Dry Wash	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-12	Nazer Draw	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-14	New Home Bench	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-17	Varney-Griffin	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
	Chaining	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-20	Baldys	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
25C-25	Center Creek	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
25C-26	Black Canyon	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-27	Poison Creek Bench	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25C-28	North Creek	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25R-05	Lamp Stand	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
25R-07	North Narrows Dixie	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
25R-08	Sawmill Point Aspen	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
25R-10	Parker Front	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25R-11	Brown Spring	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
25R-19	Otter Creek	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Energy Development	Low	Fragmentation and degradation/loss of habitat
25R-20	Otter Creek 2	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat

Table 5.11: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 25C, Boulder Plateau. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Aspen)

The study that is considered to be a Mountain (Aspen) ecological site is classified as summer range for deer and elk. This community supports browse and understory species for summering animals within the Boulder Plateau unit. Undesirable perennial grasses have increased steadily within the understory and are a threat to the resilience of the ecological system. These undesirable species can shift the dynamics of the plant community, with aggressive introduced perennial grasses having the potential to create monocultures and outcompete native species.

Treatments for perennial grass monocultures may be advisable in areas where ecological integrity is threatened. Herbicide treatments and grazing management changes are possible treatments for undesirable species in the herbaceous understory. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Ponderosa Pine)

The studies that are considered to be Mountain (Ponderosa Pine) ecological types are classified mostly as winter range for deer and elk, with the North Slope study being on the edge between winter and summer range. This community supports browse and understory species for winter and transition range deer and elk within the Boulder Plateau unit. Undesirable annual grasses are present on two of the sites and introduced perennial

grasses have been sampled within the understory on one site, these sites are a threat to the resilience of the ecological system. These undesirable species can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern. The introduced perennial grass species can create monocultures and outcompete native species. Conifer encroachment is occurring on the sites sampled, though this may not be true for all areas within the ponderosa pine ecological type.

It is recommended that treatments for conifer encroachment and infill (e.g. bullhog, chaining, lop and scatter, etc.) be implemented on areas where tree removal would be beneficial to the habitat. Treatments to reduce annual grasses or aggressive introduced perennial grasses would be advisable in areas where the ecological integrity is threatened. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Mountain (Big Sagebrush)

The studies that are considered to be Mountain (Big Sagebrush) ecological types are classified as winter range for deer and elk, the Parker Mountain Aerator is an exception to this as it is considered to be summer range for these animals. The community supports browse and understory species for wintering animals within the Boulder Plateau unit. Undesirable annual and perennial grasses have been sampled within the understory on some sites and pose a threat to the resilience of the ecological system where they are present. These undesirable species can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern. Conifer encroachment has been noted on the Varney-Griffin Chaining, Poison Creek Bench, and North Creek studies, these sites are likely to progress through woodland succession.

There is pinyon and juniper encroachment and infill occurring on these studies and encroachment is likely occurring in other areas within the unit. It is recommended that treatments (e.g. bullhog, chaining, lop and scatter, etc.) be implemented on areas where tree removal would be beneficial to the habitat. Treatments to reduce annual grasses or aggressive introduced perennial grasses would be advisable in areas where the ecological integrity is threatened. If reseeding is needed to restore the herbaceous communities on these sites, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies that are considered to be Upland (Big Sagebrush) ecological types are mostly classified as winter range for deer and elk, the Wildcat study is an exception as it is considered to be winter range for deer and elk. These studies are considered to be in very poor to fair condition for deer winter range. This community supports primarily big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) to provide browse for wintering deer within the Boulder Plateau unit. Undesirable annual grasses are present on all of the sites except for the Wildcat study. On the Wildcat site, introduced perennial grasses have been sampled within the understory. These undesirable species can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern. The introduced perennial grass species can create monocultures and outcompete native species. Conifer encroachment is occurring on the sites sampled and it is likely that it is the case for other areas in this ecological type.

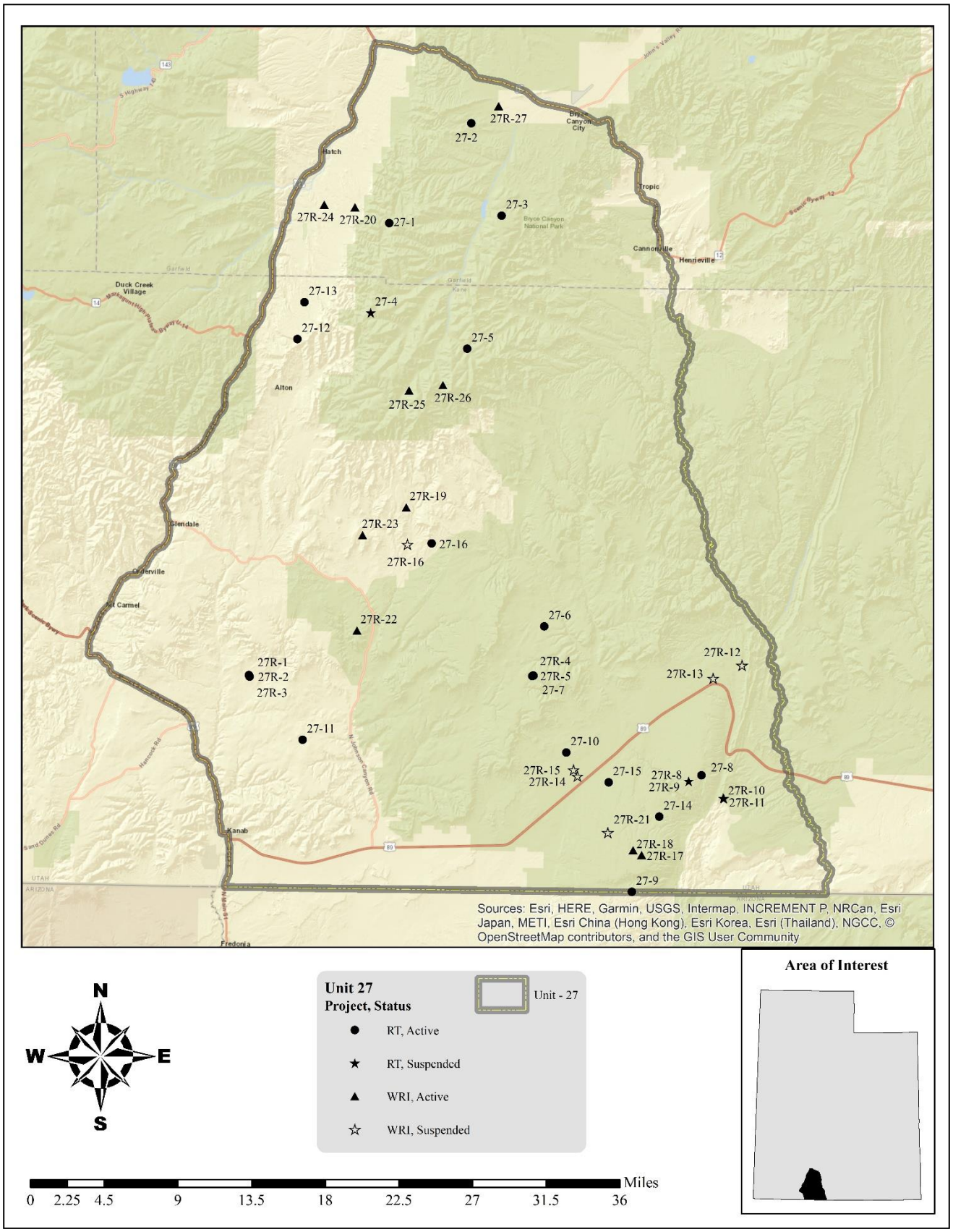
It is recommended that treatments (e.g. bullhog, chaining, lop and scatter, etc.) be implemented on areas where tree removal would be beneficial to the habitat. Treatments to reduce annual grasses or aggressive introduced perennial grasses would be advisable in areas where the ecological integrity is threatened. 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 (Black/Low Sagebrush)

The studies that are considered to be Upland (Black/Low Sagebrush) ecological types are classified as winter range for deer and are considered to be in fair-good condition for deer winter range. This community type supports primarily black sagebrush (*Artemisia nova*) and/or low sagebrush (*A. arbuscula*) which provide good

browse for wintering deer within the Boulder Plateau unit. No threats have been identified for the Cedar Grove site as of the most recent sampling. Conifer encroachment is occurring on the Black Canyon study, however, and it is likely that this is also the case for other areas in this ecological type. Although encroachment is low on this study site, it is recommended that treatments (e.g. bullhog, chaining, lop and scatter, etc.) possibly be implemented in the future on areas where tree removal would be beneficial to the habitat.

6. WILDLIFE MANAGEMENT UNIT 27 – PAUNSAUGUNT



WILDLIFE MANAGEMENT UNIT 27 – PAUNSAUGUNT

Boundary Description

Beaver, Iron and Millard counties -- Boundary begins at US-89A and the Utah-Arizona state line; north on US-89A to US-89; north on US-89 to SR-12; east on SR-12 to the Paria River; south along the Paria River to the Utah-Arizona state line; west along this state line to US-89A.

Management Unit Description

Geography

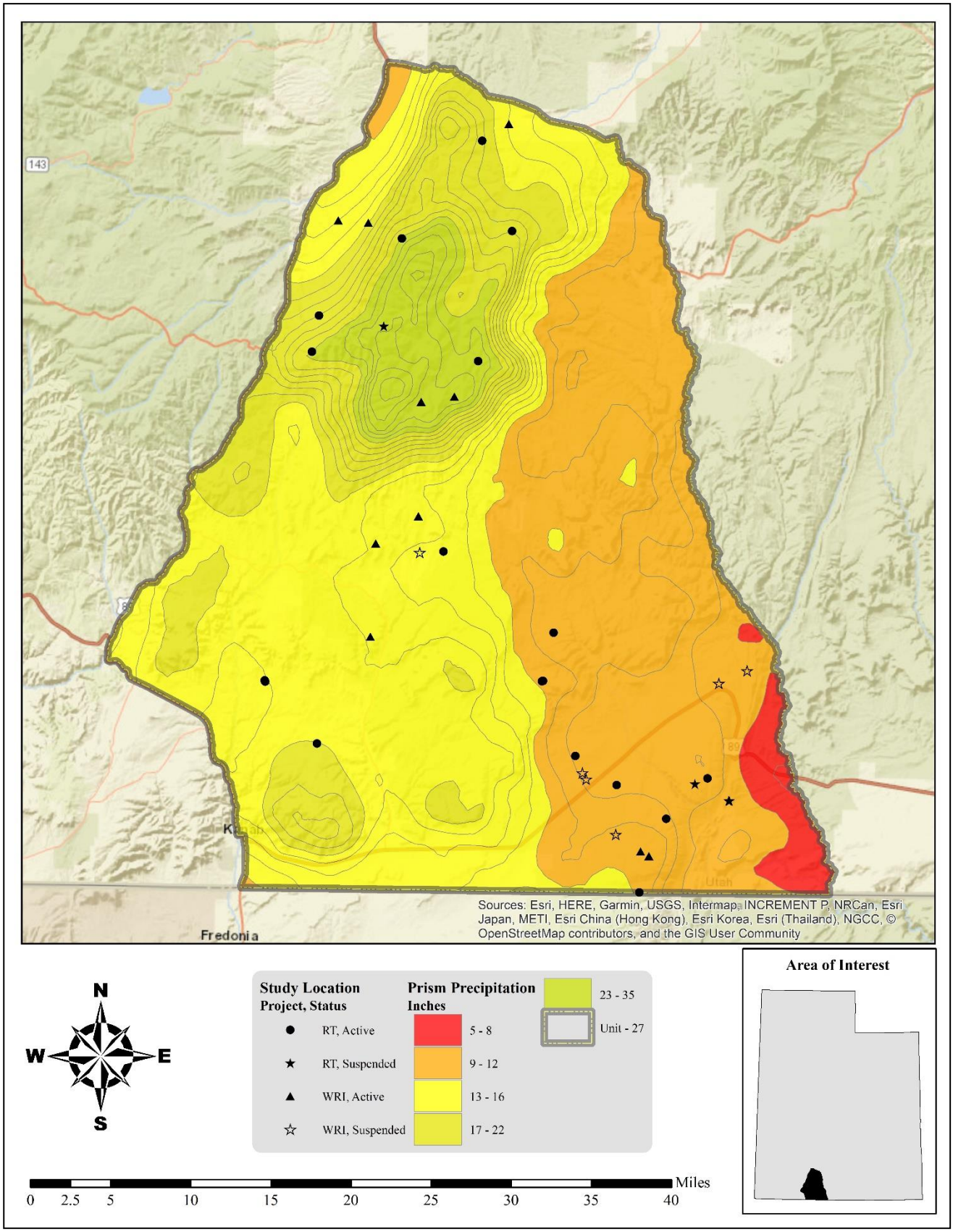
The Paunsaugunt wildlife management unit is located in south central Utah. It includes the Paunsaugunt Plateau in the northern part of the unit and the lower benches that stretch to the south, extending to the Utah and Arizona Border. The highest portion of the unit is Pink Cliff at 9,394 ft, which is found on the Paunsaugunt Plateau. The Paunsaugunt Plateau is mainly considered to be summer range. The Pink Cliffs of Bryce Canyon National Park and the Sunset Cliffs to the west delineate the southern rim of the Paunsaugunt Plateau. Terrain of the transitional and/or winter range is characterized by gently sloping terraces interspersed by extensive cliff formations. The Skutumpah Terrace lies between the Pink Cliffs and White Cliffs, and the Wygaret Terrace, Nephi Pasture, and No Man's Mesa lie between the White and Vermillion Cliffs. Buckskin Mountain is a lower elevation mountain that is located in the southeast portion of the unit. The bulk of the winter range is found on the Wygaret Terrace and Buckskin Mountain.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches in the southeastern portion of the unit to 28 inches on the high-elevation portion of the Paunsaugunt Plateau. All of the Range Trend and WRI monitoring studies on the unit occur between 10-25 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 South Central division (Division 4).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 6.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 6.1b**) (Time Series Data, 2019).



Map 6.1: The 1981-2010 PRISM Precipitation Model for WMU 27, Paunsaugunt (PRISM Climate Group, Oregon State University, 2013).

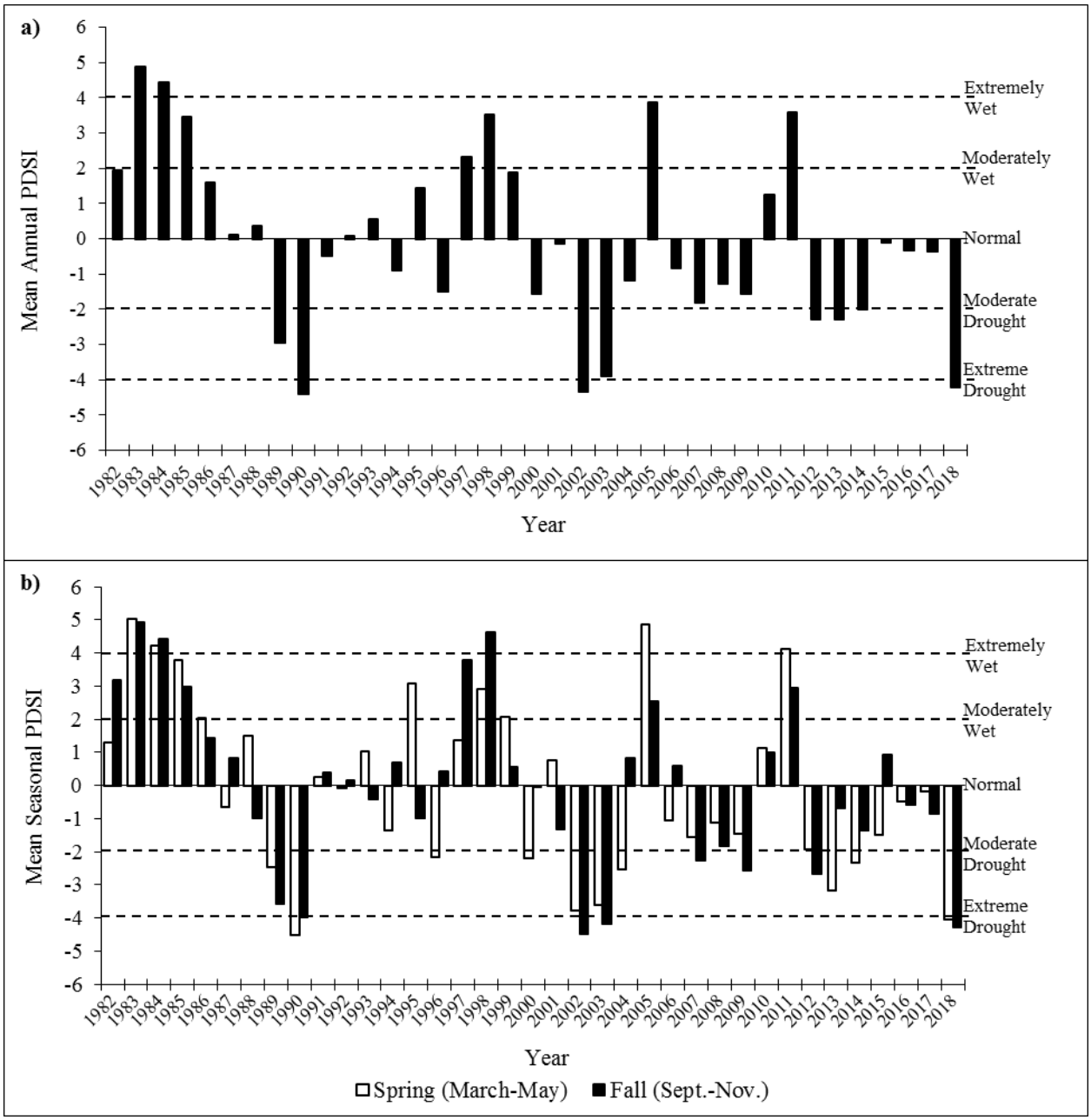


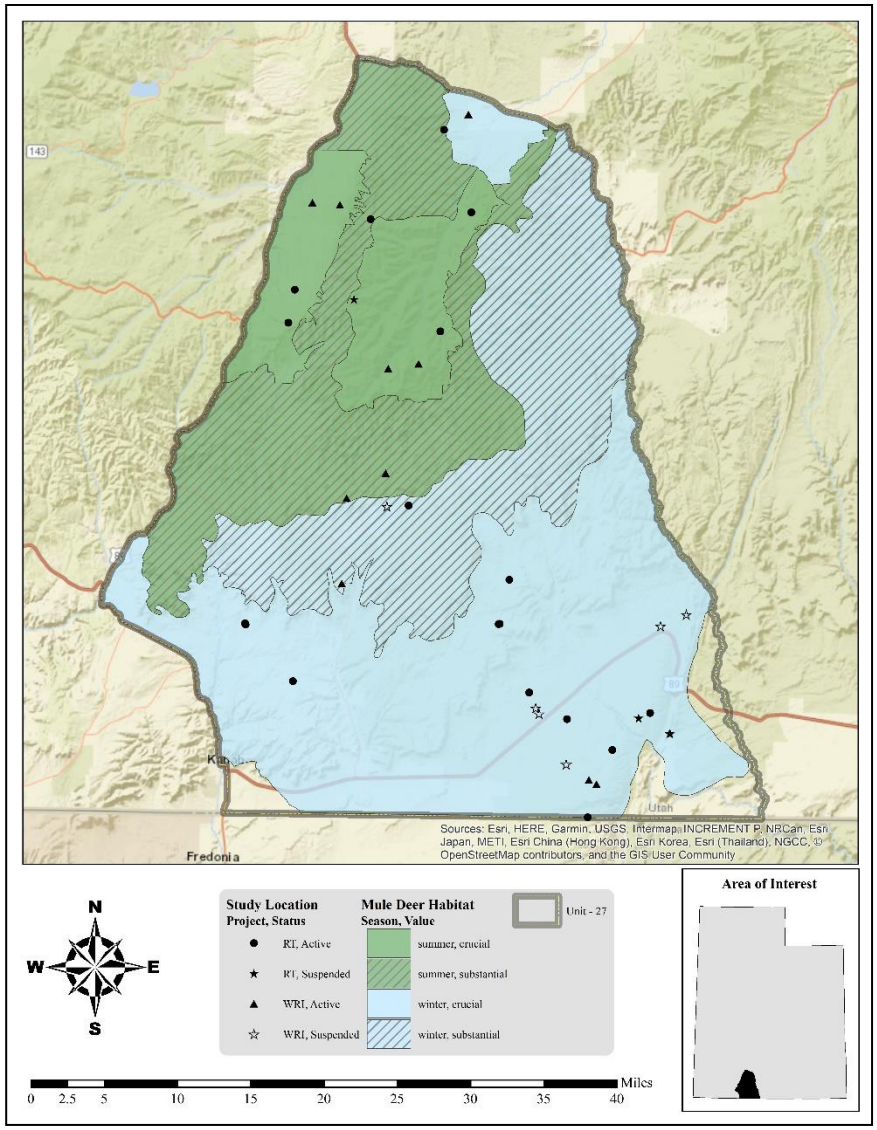
Figure 6.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

Big Game Habitat

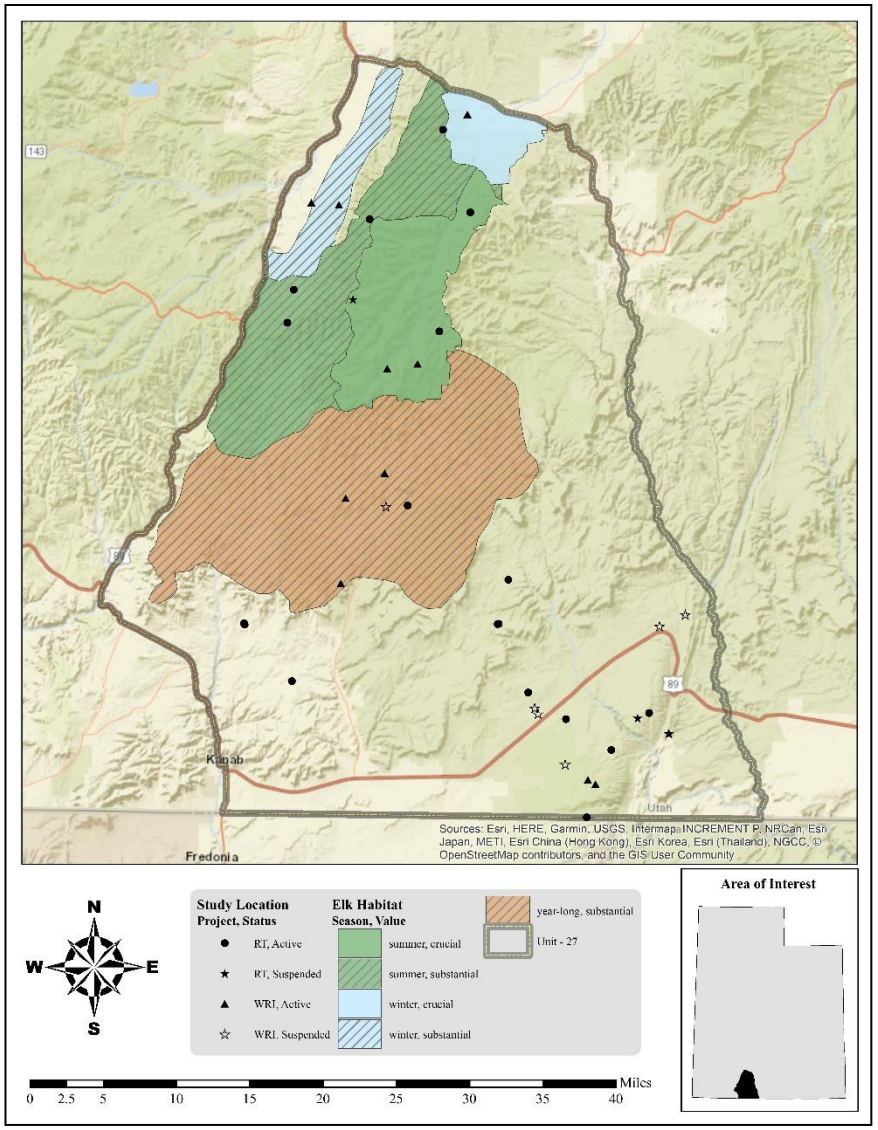
There are an estimated 921,870 acres classified as deer range on Unit 27 with 66% classified as winter range and 34% as summer range (**Table 6.1**, **Map 6.2**). Land administered by the Bureau of Land Management (BLM) comprises 83% of the winter range, 9% is privately owned, 3% is managed by the United States Forest Service (USFS), Utah School and Institutional Trust Lands Administration (SITLA) and the National Park Service (NPS) each administer 2%, and less than 1% is managed by the Utah Department of Transportation (UDOT) (**Table 6.2**, **Map 6.2**, **Map 6.6**). For the elk winter range, 37% is administered by the USFS, 34% is privately held, 22% is managed by SITLA, the BLM administers 7%, and the UDOT and NPS each manage less than 1% (**Table 6.3**, **Map 6.3**, **Map 6.6**).

The Paunsaugunt Plateau provides the bulk of the summer range in the unit with an average elevation of 9,000 feet. The key areas that have been identified on the summer range are the mixed mountain brush community in the upper reaches of Proctor Canyon, a high-elevation black sagebrush (*Artemisia nova*)-grass community between Ahlstrom Hollow and Johnson Bench, the ponderosa pine (*Pinus ponderosa*) type on Whiteman Bench, the conifer clear-cut with its associated aspen resurgence below the Sunset Cliffs near Sand Pass, and the grass meadow type in Podunk Creek.

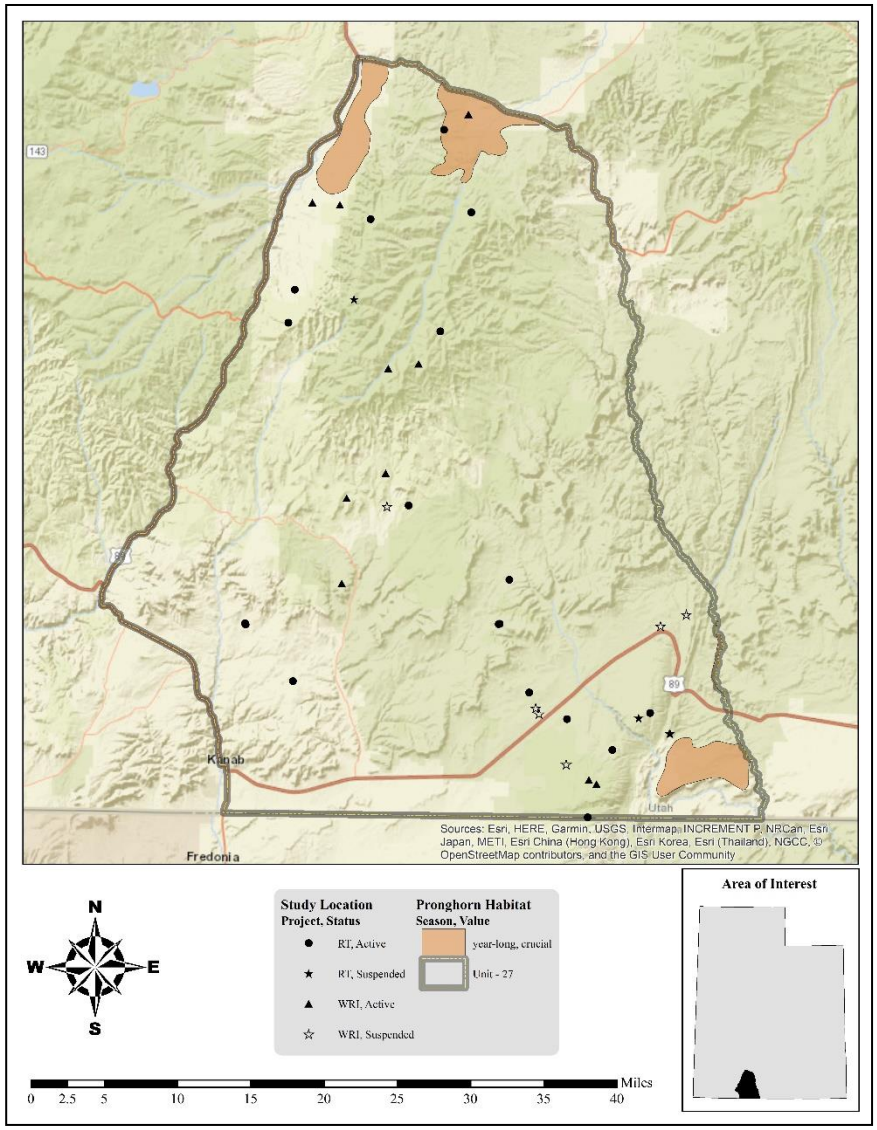
The southern rim of the plateau is delineated by the Pink Cliffs of Bryce Canyon National Park and the Sunset Cliffs to the west. Terrain of the transitional and/or winter range is characterized by gently sloping terraces interspersed by extensive cliff formations. The Skutumpah Terrace lies between the Pink Cliffs and White Cliffs; the Wygaret Terrace, Nephi Pasture, and No Man's Mesa lie between the White and Vermillion Cliffs. The bulk of the winter range is found on the Wygaret Terrace.



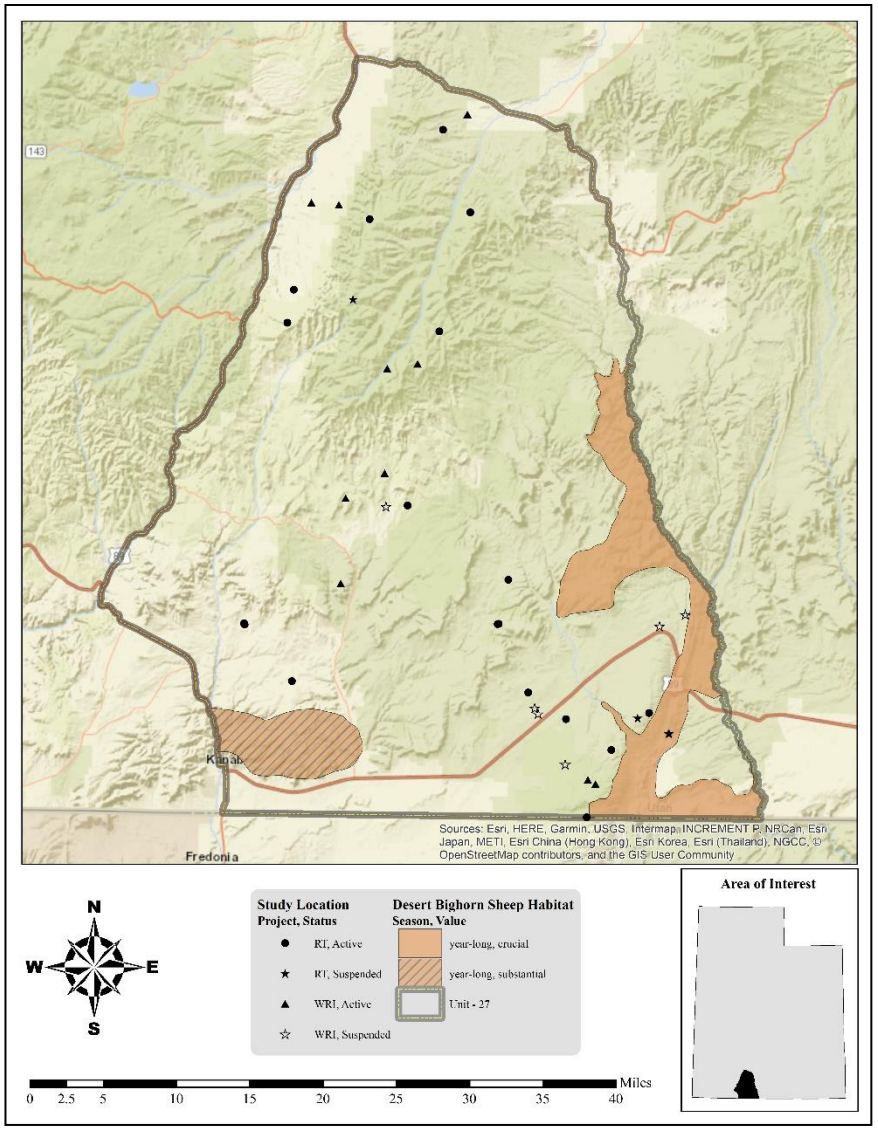
Map 6.2: Estimated mule deer habitat by season and value for WMU 27, Paunsaugunt.



Map 6.3: Estimated elk habitat by season and value for WMU 27, Paunsaugunt.



Map 6.4: Estimated pronghorn habitat by season and value for WMU 27, Paunsaugunt.



Map 6.5: Estimated desert bighorn sheep habitat by season and value for WMU 27, Paunsaugunt.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	312,882	34%	608,988	66%	0	0%
Elk	144,470	40%	38,480	11%	175,971	49%
Pronghorn	0	0%	0	0%	36,507	100%
DBS	0	0%	0	0%	98,520	100%

Table 6.1: Estimated mule deer, elk, pronghorn, and desert bighorn sheep (DBS) habitat acreage by season for WMU 27, Paunsaugunt.

	Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	76,326	24%	505,727	83%
Private	89,571	29%	55,634	9%
SITLA	17,369	6%	13,065	2%
USFS	112,049	36%	19,334	3%
UDOT	5	<1%	67	<1%
NPS	17,562	6%	15,160	2%
Total	312,882	**100%**	608,988	**100%**

Table 6.2: Estimated mule deer habitat acreage by season and ownership for WMU 27, Paunsaugunt.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	6,611	5%	2,696	7%	128,680	73%
Private	39,847	28%	12,959	34%	38,326	22%
SITLA	1,443	1%	8,490	22%	3,894	2%
USFS	91,710	63%	14,306	37%	3,761	2%
UDOT	0	0%	16	<1%	0	0%
NPS	4,858	3%	13	<1%	1,310	1%
Total	144,470	**100%**	38,480	**100%**	175,971	**100%**

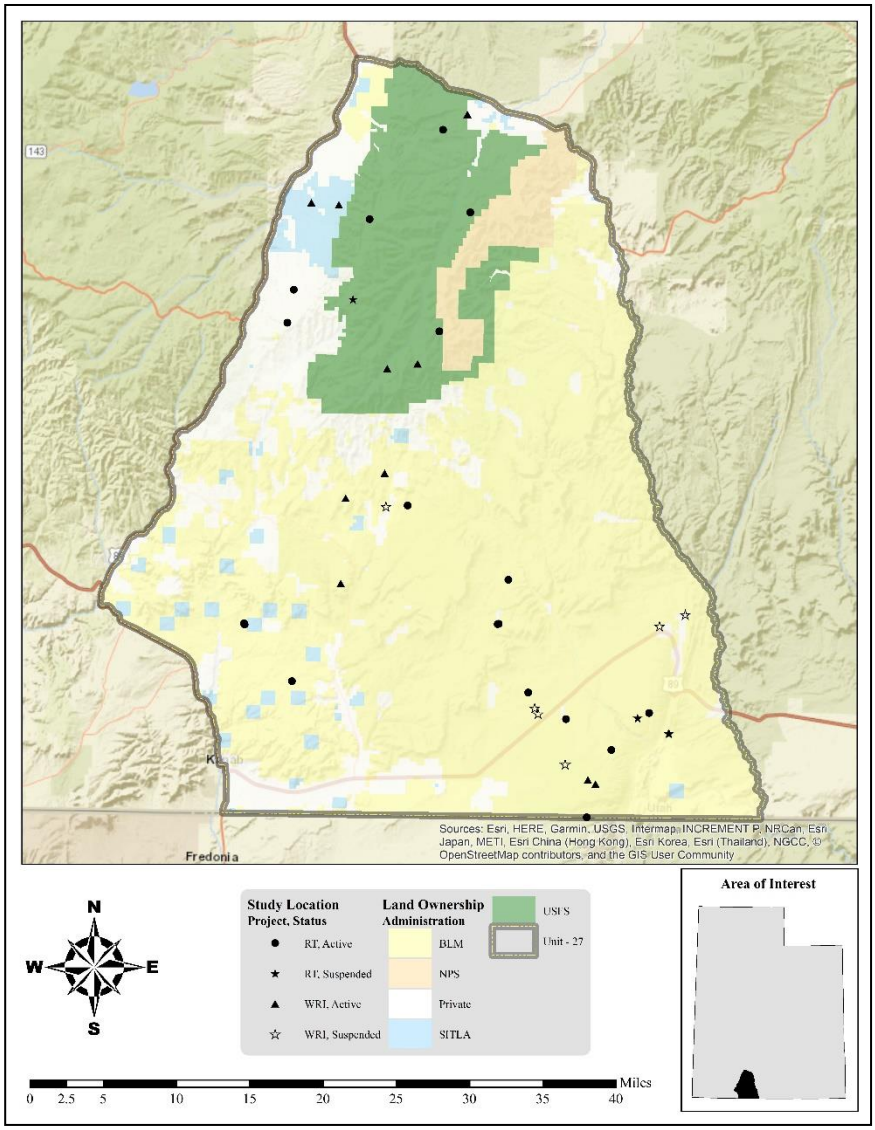
Table 6.3: Estimated elk habitat acreage by season and ownership for WMU 27, Paunsaugunt.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	15,071	41%
Private	9,263	25%
SITLA	2,470	7%
USFS	9,686	27%
UDOT	16	<1%
Total	36,507	**100%**

Table 6.4: Estimated pronghorn habitat acreage by season and ownership for WMU 27, Paunsaugunt.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	93,978	95%
Private	2,534	3%
SITLA	1,992	2%
UDOT	15	0%
Total	98,520	**100%**

Table 6.5: Estimated desert bighorn sheep habitat acreage by season and ownership for WMU 27, Paunsaugunt.



Map 6.6: Land ownership for WMU 27, Paunsaugunt.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	412,919	43.12%	
	Ponderosa Pine Forest, Woodland and Savanna	37,580	3.92%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	32,291	3.37%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	10,397	1.09%	
	Limber Pine Woodland	7,523	0.79%	
	Mountain Mahogany Woodland and Shrubland	2,927	0.31%	
	Spruce-Fir Forest and Woodland	243	0.03%	
	Juniper Woodland and Savanna	9	0.00%	52.62%
Exotic Herbaceous	Introduced Annual Grassland	14,731	1.54%	
	Introduced Perennial Grassland and Forbland	4	0.00%	1.54%
Exotic Tree-Shrub	Introduced Riparian Vegetation	9,095	0.95%	0.95%
Grassland	Grassland	8,852	0.92%	
	Alpine Dwarf-Shrubland, Fell-field and Meadow	4,375	0.46%	
	Grassland and Steppe	14	0.00%	
	Dry Tundra	0	0.00%	1.38%
Shrubland	Big Sagebrush Shrubland and Steppe	122,886	12.83%	
	Desert Scrub	32,030	3.34%	
	Salt Desert Scrub	25,676	2.68%	
	Other Shrubland	21,765	2.27%	
	Low Sagebrush Shrubland and Steppe	19,478	2.03%	
	Sand Shrubland	18,620	1.94%	
	Deciduous Shrubland	16,495	1.72%	
	Chaparral	14,154	1.48%	
	Greasewood Shrubland	5,552	0.58%	28.89%
Other	Barren	57,260	5.98%	
	Sparsely Vegetated	29,738	3.11%	
	Developed	15,173	1.58%	
	Riparian	15,022	1.57%	
	Conifer-Hardwood	11,941	1.25%	
	Hardwood	7,706	0.80%	
	Agricultural	2,753	0.29%	
	Open Water	288	0.03%	
	Quarries-Strip Mines-Gravel Pits	110	0.01%	14.62%
Total		957,607	100%	100%

Table 6.6: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 27, Paunsaugunt.

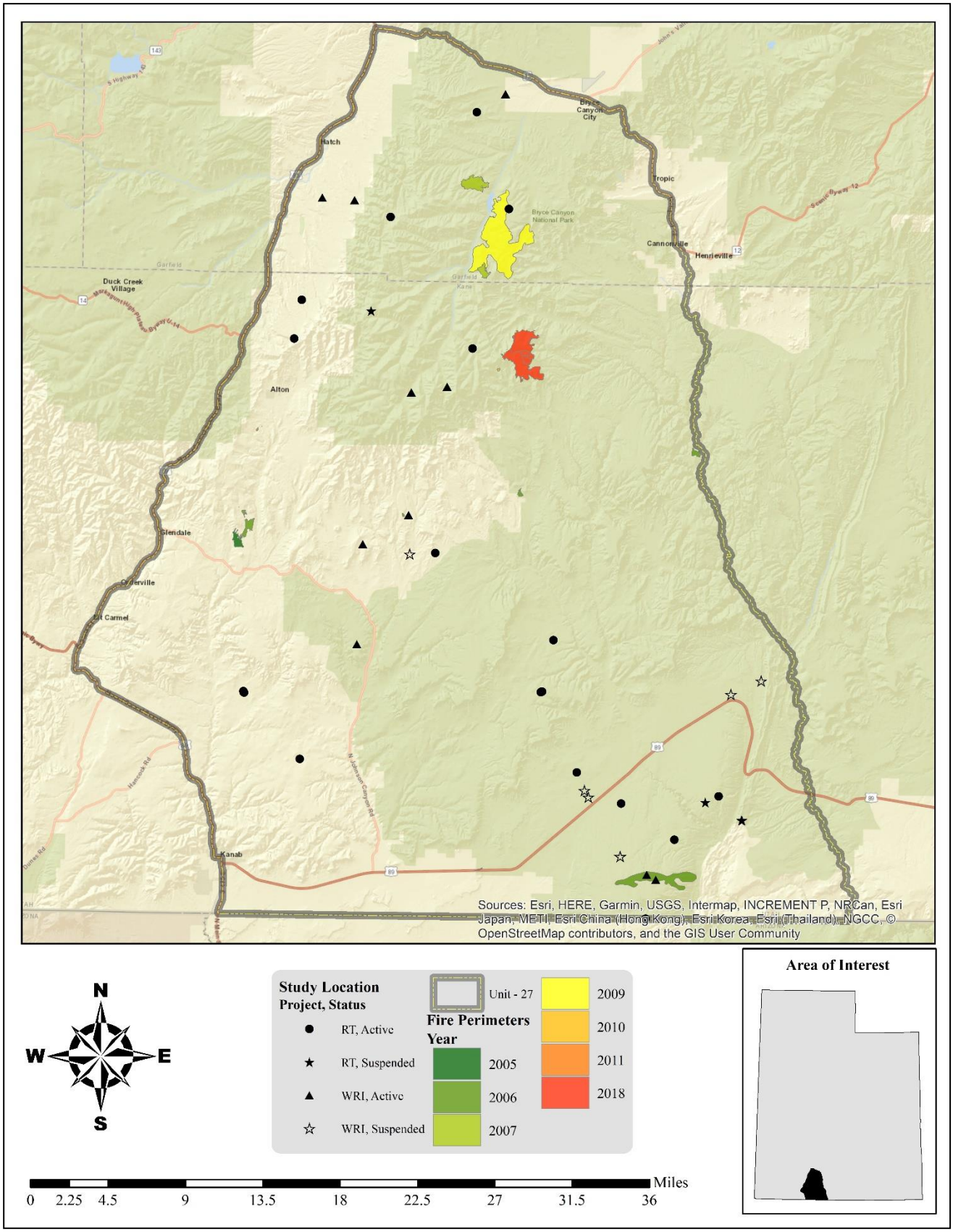
Limiting Factors to Big Game Habitat

The main habitat limitation found on the winter range of this unit is encroachment by pinyon and juniper trees, which poses a substantial threat to important sagebrush rangelands. According to the current LANDFIRE existing vegetation coverage model, pinyon-juniper woodlands comprise just over 43% of the unit (**Table 6.6**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components (Miller, Svejcar, & Rose, 2000), therefore decreasing available forage for wildlife.

The limiting factors on summer ranges on this unit include the encroachment of conifer trees and the presence of seeded non-native grass species. The Paunsaugunt Plateau exhibits encroachment of conifer into aspen communities as is illustrated by the Sieler Creek study (27R-25). This conifer encroachment has the potential to change the herbaceous and shrub components of the aspen community (Stam, Malechek, Bartos, Bowns, & Godfrey, 2008). The reduction of the herbaceous and shrub communities can have negative impacts on summering mule deer and elk. Many of the valleys along the East Fork of the Sevier River and its tributaries have been reseeded with potentially aggressive non-native grass species such as smooth brome (*Bromus inermis*) and intermediate wheatgrass (*Thinopyrum intermedium*) to reduce erosion and improve depleted rangeland condition. These grasses can be competitive, reduce the abundance of desirable forb and grass species, and limit the establishment of shrubs (Otfinowski, Kenkel, & Catling, 2006). The vegetation on the Podunk Creek (27-05) study site is an example of reduced herbaceous and shrub components due to the introduction of non-native perennial grasses.

Highway mortality is another limiting factor, and has been particularly pronounced east of Kanab along Highway 89. In 2013, a high fence and six deer underpasses were constructed to allow deer to pass through

and reduce highway mortality; highway mortality has decreased significantly following the construction of these crossings. Fencing may pose some barrier to deer migration to the wintering grounds. The other portion of Highway 89 north of Kanab also has areas of significant mortality.



Map 6.7: Land coverage of fires by year from 2000-2018 for WMU 27, Paunsaugunt (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

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 59,562 acres of land have been treated within the Paunsaugunt unit since the WRI was implemented in 2004 (**Map 6.8**). An additional 11,119 acres are currently being treated and treatments have been proposed for 12,537 acres. Treatments frequently overlap one another bringing the total treated land area to 100,931 acres for this unit (

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor chain	**12,312**	**1,566**	**0**	**0**	**13,878**
Ely (One-Way)	3,224	0	0	0	3,224
Ely (Two-Way)	8,790	1,566	0	0	10,356
Smooth (Two-Way)	298	0	0	0	298
Bulldozing	**911**	**0**	**0**	**0**	**911**
Tree Push	911	0	0	0	911
Bullhog	**16,299**	**1,910**	**620**	**2,848**	**21,677**
Full Size	13,679	1,910	620	2,848	19,057
Skid Steer	2,620	0	0	0	2,620
Chain Harrow	0	0	**0**	**152**	**152**
≤15 ft. (Two-Way)	0	0	0	152	152
Disc	**1,834**	**0**	**0**	**0**	**1,834**
Plow (One-Way)	1,038	0	0	0	1,038
Off-set (Two-Way)	796	0	0	0	796
Forestry Practices	**68**	**2,205**	**0**	**0**	**2,273**
Coppice Cutting	0	264	0	0	264
Group Selection Cuts	24	255	0	0	279
Thinning (Commercial)	44	260	0	0	304
Thinning (Non-Commercial)	0	1,426	0	0	1,426
Harrow	**4,100**	**0**	**0**	**628**	**4,728**
≤15 ft. (One-Way)	3,588	0	0	628	4,216
≤15 ft. (Two-Way)	512	0	0	0	512
Herbicide Application	**14**	**0**	**0**	**237**	**251**
Ground	14	0	0	0	14
Aerial (Fixed-Wing)	**0**	0	0	237	237
Mowing	**1,609**	**357**	**0**	**94**	**2,060**
Brush Hog	0	0	0	23	23
Other	1,609	357	0	71	2,037
Prescribed Fire	**1,477**	**0**	**0**	**0**	**1,477**
Seeding (Primary)	**3,854**	**1,554**	**0**	**0**	**5,408**
Broadcast (Aerial-Fixed Wing)	2,396	1,291	0	0	3,687
Drill (Rangeland)	1,219	0	0	0	1,219
Ground (Mechanical Application)	220	263	0	0	483
Hand Seeding	19	0	0	0	19
Seeding (Secondary/Shrub)	**1,248**	**0**	**0**	**1,353**	**2,601**
Broadcast (Aerial-Fixed Wing)	90	0	**0**	0	90
Ground (Mechanical Application)	1,158	0	0	0	1,158
Hand Seeding	0	0	0	1,353	1,353
Skid-Steer Mounted Tree Cutter	**1,018**	**0**	**0**	**0**	**1,018**
Hydraulic Shears	1,018	0	0	0	1,018
Vegetation Removal/Hand Crew	**25,962**	**3,764**	**0**	**7,793**	**37,519**
Lop & Scatter	25,320	3,764	0	7,793	36,877
Lop-Pile-Burn	642	0	0	0	642
Other	**482**	**0**	**0**	**0**	**482**
Road Decommissioning	482	0	0	0	482
Grand Total	**71,188**	**11,356**	**620**	**13,105**	**96,269**
*** Total Land Area Treated**	**59,562**	**11,119**	**620**	**13,089**	**84,390**

Table 6.7). 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.

The most common management practice in the Paunsaugunt unit is manual vegetation removal (such as lop and scatter and lop-pile-burn) to remove pinyon and juniper trees. Other tree-removing management techniques such as bullhog and anchor chaining are also very common. Additional management practices include (but are not limited to): seeding plants to augment the herbaceous understory, harrowing, seeding plants to enhance shrub communities, and forestry practices such as thinning and coppice cutting (

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage

Anchor chain	**12,312**	**1,566**	**0**	**0**	**13,878**
Ely (One-Way)	3,224	0	0	0	3,224
Ely (Two-Way)	8,790	1,566	0	0	10,356
Smooth (Two-Way)	298	0	0	0	298
Bulldozing	**911**	**0**	**0**	**0**	**911**
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Full Size	13,679	1,910	620	2,848	19,057
Skid Steer	2,620	0	0	0	2,620
Chain Harrow	0	0	**0**	**152**	**152**
≤15 ft. (Two-Way)	0	0	0	152	152
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Harrow	**4,100**	**0**	**0**	**628**	**4,728**
≤15 ft. (One-Way)	3,588	0	0	628	4,216
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Broadcast (Aerial-Fixed Wing)	90	0	**0**	0	90
Ground (Mechanical Application)	1,158	0	0	0	1,158
Hand Seeding	0	0	0	1,353	1,353
Skid-Steer Mounted Tree Cutter	**1,018**	**0**	**0**	**0**	**1,018**
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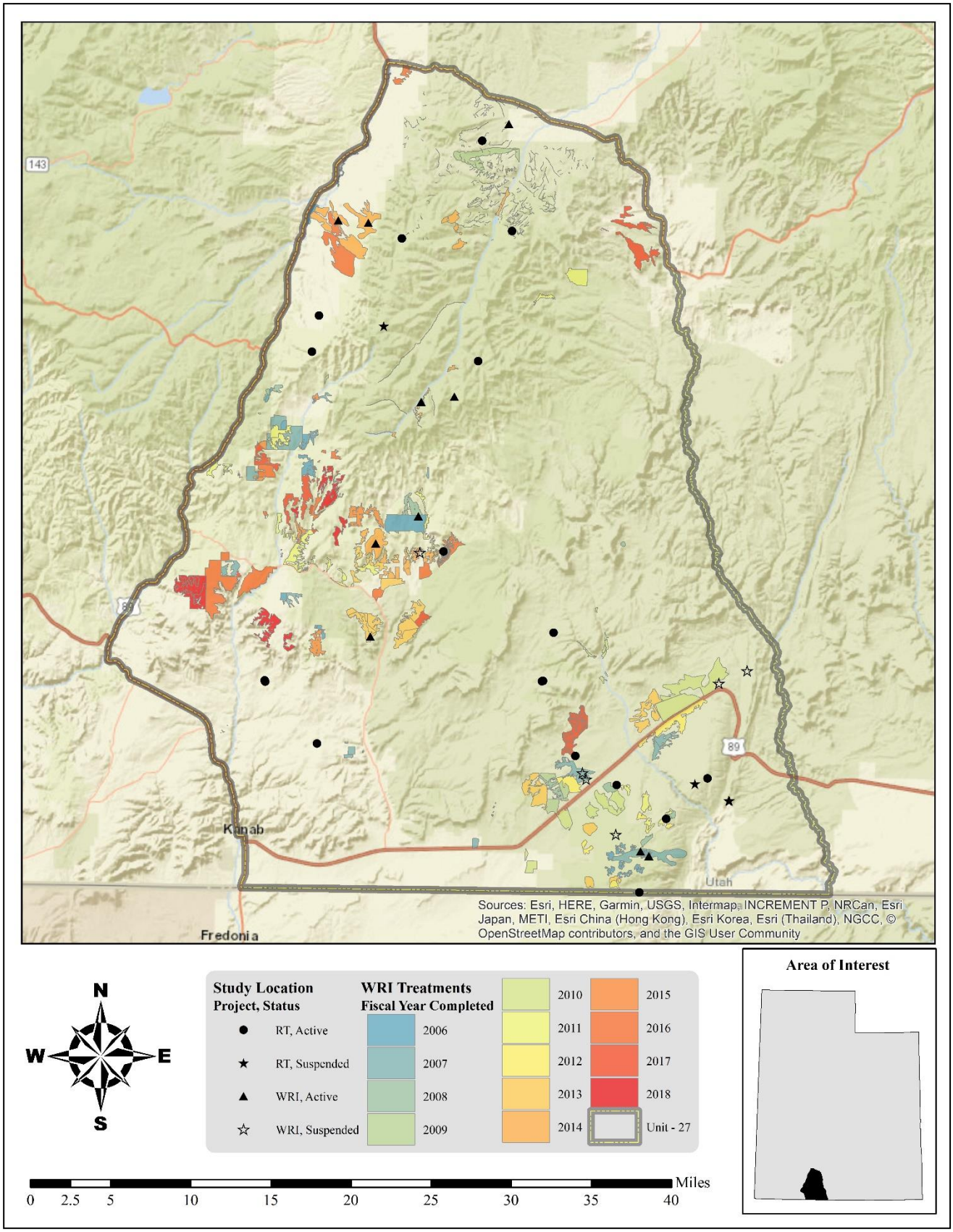
Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor chain	**12,312**	**1,566**	**0**	**0**	**13,878**
Ely (One-Way)	3,224	0	0	0	3,224
Ely (Two-Way)	8,790	1,566	0	0	10,356
Smooth (Two-Way)	298	0	0	0	298
Bulldozing	**911**	**0**	**0**	**0**	**911**
Tree Push	911	0	0	0	911
Bullhog	**16,299**	**1,910**	**620**	**2,848**	**21,677**
Full Size	13,679	1,910	620	2,848	19,057
Skid Steer	2,620	0	0	0	2,620
Chain Harrow	0	0	**0**	**152**	**152**
≤15 ft. (Two-Way)	0	0	0	152	152
Disc	**1,834**	**0**	**0**	**0**	**1,834**
Plow (One-Way)	1,038	0	0	0	1,038
Off-set (Two-Way)	796	0	0	0	796
Forestry Practices	**68**	**2,205**	**0**	**0**	**2,273**
Coppice Cutting	0	264	0	0	264
Group Selection Cuts	24	255	0	0	279
Thinning (Commercial)	44	260	0	0	304
Thinning (Non-Commercial)	0	1,426	0	0	1,426
Harrow	**4,100**	**0**	**0**	**628**	**4,728**
≤15 ft. (One-Way)	3,588	0	0	628	4,216

≤15 ft. (Two-Way)	512	0	0	0	512
Herbicide Application	**14**	**0**	**0**	**237**	**251**
Ground	14	0	0	0	14
Aerial (Fixed-Wing)	**0**	0	0	237	237
Mowing	**1,609**	**357**	**0**	**94**	**2,060**
Brush Hog	0	0	0	23	23
Other	1,609	357	0	71	2,037
Prescribed Fire	**1,477**	**0**	**0**	**0**	**1,477**
Seeding (Primary)	**3,854**	**1,554**	**0**	**0**	**5,408**
Broadcast (Aerial-Fixed Wing)	2,396	1,291	0	0	3,687
Drill (Rangeland)	1,219	0	0	0	1,219
Ground (Mechanical Application)	220	263	0	0	483
Hand Seeding	19	0	0	0	19
Seeding (Secondary/Shrub)	**1,248**	**0**	**0**	**1,353**	**2,601**
Broadcast (Aerial-Fixed Wing)	90	0	**0**	0	90
Ground (Mechanical Application)	1,158	0	0	0	1,158
Hand Seeding	0	0	0	1,353	1,353
Skid-Steer Mounted Tree Cutter	**1,018**	**0**	**0**	**0**	**1,018**
Hydraulic Shears	1,018	0	0	0	1,018
Vegetation Removal/Hand Crew	**25,962**	**3,764**	**0**	**7,793**	**37,519**
Lop & Scatter	25,320	3,764	0	7,793	36,877
Lop-Pile-Burn	642	0	0	0	642
Other	**482**	**0**	**0**	**0**	**482**
Road Decommissioning	482	0	0	0	482
Grand Total	**71,188**	**11,356**	**620**	**13,105**	**96,269**
*** Total Land Area Treated**	**59,562**	**11,119**	**620**	**13,089**	**84,390**

Table 6.7: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 27, Paunsaugunt. Data accessed on 02/18/2019.
*Does not include overlapping treatments.



Map 6.8: WRI treatments by fiscal year completed for WMU 27, Paunsaugunt.

Range Trend Studies

Range Trend studies have been sampled within WMU 27 on a regular basis since 1987, with studies being added or suspended as was deemed necessary (**Table 6.8**). 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 6.9**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
27-01	Proctor Canyon	RT	Active	'87, '92, '97, '03, '08, '13, '18	Mountain Loam (Browse)
27-02	Ahlstrom Hollow	RT	Active	'87, '92, '97, '03, '08, '13, '18	Mountain Loam (Black Sagebrush)
27-03	Whiteman Bench	RT	Active	'87, '92, '97, '03, '08, '13, '18	Mountain Shallow Loam (Ponderosa Pine)
27-04	Sand Pass	RT	Suspended	'87, '92, '97, '03	Not Verified
27-05	Podunk Creek	RT	Active	'87, '92, '97, '03, '08, '13, '18	High Mountain Loam (Mountain Big Sagebrush)
27-06	Nephi Pasture I	RT	Active	'87, '92, '97, '03, '08, '13, '18	Upland Sand (Mountain Big Sagebrush)
27-07	Nephi Pasture Exclosure Outside	RT	Active	'87, '92, '97, '98, '03, '08, '13, '18	Upland Sand (Mountain Big Sagebrush)
27-08	Fivemile Mountain	RT	Active	'87, '92, '97, '03, '08, '13, '18	Semidesert Shallow Loam (Black Sagebrush)
27-09	Buckskin Mountain	RT	Active	'97, '03, '08, '13, '18	Upland Shallow Loam (Cliffrose)
27-10	Telegraph Flat	RT	Active	'97, '03, '08, '13, '18	Semidesert Loam (Wyoming Big Sagebrush)
27-11	Crocodile	RT	Active	'97, '03, '08, '13, '18	Upland Sand (Mountain Big Sagebrush)
27-12	Moons Landing	RT	Active	'97, '03, '08, '13, '18	Mountain Stony Loam (Antelope Bitterbrush)
27-13	Heaton	RT	Active	'97, '03, '08, '13, '18	Mountain Loam (Black Sagebrush)
27-14	Mustang Pond South	RT	Active	'13, '18	Upland Shallow Loam (Cliffrose)
27-15	Jeppson Pond	RT	Active	'18	Upland Shallow Loam (Cliffrose)
27-16	Carly Knoll	RT	Active	'18	Upland Loam (Mountain Big Sagebrush)
27R-01	John R. Flat Total Exclosure	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
27R-02	John R. Flat Livestock Exclosure	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
27R-03	John R. Flat Exclosure Outside	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
27R-04	Nephi Pasture Total Exclosure	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
27R-05	Nephi Pasture Livestock Exclosure	RT	Active	'98, '03, '08, '13	Upland Sand (Mountain Big Sagebrush)
27R-08	Five Mile Mountain Outside	RT	Suspended	'98	Not Verified
27R-09	Five Mile Mountain Exclosure	RT	Suspended	'98	Not Verified
27R-10	Cockscomb Exclosure	RT	Suspended	'98	Not Verified
27R-11	Cockscomb Outside	RT	Suspended	'98	Not Verified
27R-12	Paria Road 1	WRI	Suspended	'04	Not Verified
27R-13	Paria Road 2	WRI	Suspended	'04	Not Verified
27R-14	Telegraph Flat 2	WRI	Suspended	'04	Not Verified
27R-15	Telegraph Flat 1	WRI	Suspended	'04	Not Verified
27R-16	Alton/Millcreek LS	WRI	Suspended	'05, '12	Not Verified
27R-17	Buckskin 2	WRI	Active	'05, '08, '13, '17	Upland Shallow Loam (Cliffrose)
27R-18	Buckskin 1	WRI	Active	'05, '08, '13, '17	Upland Shallow Loam (Cliffrose)
27R-19	Alton-Millcreek 2	WRI	Active	'07, '10, '14	Upland Loam (Black Sagebrush)
27R-20	Hatch Bench	WRI	Active	'12, '15	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
27R-21	Buckskin Lop and Scatter	WRI	Suspended	'12	Not Verified
27R-22	Pine Point Handthin	WRI	Active	'12, '15	Upland Loam (Mountain Big Sagebrush)
27R-23	UKC Thompson Creek	WRI	Active	'13, '16	Mountain Loam (Oak)
27R-24	Hatch Bench 2	WRI	Active	'13, '16	Upland Shallow Hardpan (Black Sagebrush-Bluegrass)
27R-25	Sieler Creek	WRI	Active	'13, '16	High Mountain Loam (Aspen)
27R-26	Crawford Creek	WRI	Active	'16	High Mountain Loam (Aspen)
27R-27	Johnson Bench	WRI	Active	'18	Upland Loam (Black Sagebrush)

Table 6.8: Range trend and WRI project studies monitoring history and ecological site potential for WMU 27, Paunsaugunt.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
27-03	Whiteman Bench	Logging/Clear-Cut		Historic		
27-02	Ahlstrom Hollow	Wildfire		Between 1997 and 2002		
27-05	Podunk Creek	Contour Trench Seed Unknown		1960s 1960s		
27-10	Telegraph Flat	Aerial Before Two-Way Chain Unknown Lop and Scatter Aerial Before Two-Way Ely Chain	Clay Hole Chaining Clay Hole Chaining Five Mile Mountain Habitat Restoration Phase III Jenny Clay Flex Harrow Jenny Clay Flex Harrow	1966 1966 Fall 2008-Spring 2009 December 2017-February 2018 December 2017-February 2018	1043 1342 1342	1169 3786 3786
27-11	Crocodile	Seed Unknown		1960s		
27-13	Heaton	Seed Unknown Double Drum Aerator Herbicide Unknown		Historic Between 1997 and 2003 Between 2003 and 2008		
27-14	Mustang Pond South	Lop and Scatter	Buckskin Lop and Scatter FY12	September-December 2011	604	2002
27-15	Jeppson Pond	Lop and Scatter	Buckskin Lop and Scatter	August-December 2008	500	823
27-16	Carly Knoll	Aerial Before Bullhog Aerial After	UKC - Carly Knoll/Mill Creek UKC - Carly Knoll/Mill Creek UKC - Carly Knoll/Mill Creek	Winter 2015-Spring 2016 Winter 2015-2016 Winter 2016	548 548 548	3279 3279 3279
27R-12	Paria Road 1	Broadcast Before Bullhog One-Way Chain Harrow	Cockscomb Vegetation Enhancement Project Cockscomb Vegetation Enhancement Project Cockscomb Vegetation Enhancement Project	February-March 2018 February-March 2018 February-March 2018	620 620 620	3737 3737 3737
27R-14	Telegraph Flat 2	Broadcast Before One-Way Dixie Harrow	Fivemile GSENM Habitat Restoration Complex Year 1 Fivemile GSENM Habitat Restoration Complex Year 1	December 2006-January 2007 December 2006-January 2007	1219 1219	124 124
27R-15	Telegraph Flat 1	Broadcast Before One-Way Dixie Harrow	Fivemile GSENM Habitat Restoration Complex Year 1 Fivemile GSENM Habitat Restoration Complex Year 1	December 2006-January 2007 December 2006-January 2007	1219 1219	124 124
27R-16	Alton/Millcreek LS	Seed Unknown Dozer Push		2009-2011 2009-2011		
27R-17	Buckskin 2	Lop and Scatter Aerial Unknown Wildfire One-Way Ely Chain Aerial Before Aerial After	Buckskin P-J Thinning 2005 Buckskin P-J Thinning 2005 Buckskin Lower Buckskin Telephone Wash Sagebrush Restoration Year 1 Lower Buckskin Telephone Wash Sagebrush Restoration Year 1 Lower Buckskin Telephone Wash Sagebrush Restoration Year 1	November 2005 November 2005 June 2006 November-December 2006 November 2006 February 2007	882 418 1437 1437 1437 1437	112 112 453 453 453
27R-18	Buckskin 1	Wildfire Aerial Before One-Way Ely Chain Aerial After	Buckskin Lower Buckskin Telephone Wash Sagebrush Restoration Year 1 Lower Buckskin Telephone Wash Sagebrush Restoration Year 1 Lower Buckskin Telephone Wash Sagebrush Restoration Year 1	June 2006 November 2006 November-December 2006 February 2007	1437 1437 1437 1437	 453 453 453
27R-19	Alton-Millcreek 2	Lop and Scatter Aerial Before Bullhog	Alton/Mill Creek Sagebrush Restoration - Year 1 Mill Creek Aerial Seeding Alton/Mill Creek Sagebrush Restoration - Year 3	December 2005-February 2006 October 2008 October 2008-February 2009	1630 912 912	188 1313 900

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
27R-20	Hatch Bench	Aerial Before	Hatch Bench Vegetation Enhancement Phase I	September 2012	1134	2069
		Dribbler	Hatch Bench Vegetation Enhancement Phase I	September 2012	1134	2069
		Two-Way Ely Chain	Hatch Bench Vegetation Enhancement Phase I	September-October 2012	1134	2069
		Aerial After	Hatch Bench Vegetation Enhancement Phase I	January 2013	1134	2069
		Lop and Scatter	Hatch Bench Vegetation Enhancement Phase II	July 2013-January 2015	2990	2690
27R-22	Pine Point Handthin	Aerial Before	Pine Point Handthin	November 2012	2525	2359
		Lop and Scatter	Pine Point Handthin	December 2012-May 2013	2525	2359
27R-23	UKC Thompson Creek	Aerial Before	UKC Thompson Creek	September 2014	959	2701
		Two-Way Ely Chain	UKC Thompson Creek	September-November 2014	959	2701
		Aerial After	UKC Thompson Creek	January 2015	959	2701
		Lop and Scatter	UKC - Spaniard Spring/Sink Valley Phase II	Fall 2018	931	4568
27R-24	Hatch Bench 2	Lop and Scatter	Hatch Bench Vegetation Enhancement Phase II	July 2013-January 2015	2990	2690
27R-25	Sieler Creek	Lop-Pile-Burn	Sieler Stewardship	August-September 2014	70	2716
		Logging/Clear-Cut	Sieler Stewardship	October 2014-June 2015	70	2716
27R-26	Crawford Creek	Group Selection Cut	Paunsaugunt boreal toad habitat improvement project	Fall 2016	28	3631
27R-27	Johnson Bench	Herbicide - Spike		2015	270	
		Broadcast Before	Johnson Bench UPD Habitat Enhancement Phase II	October 2018	263	4429
		One-Way Chain Harrow	Johnson Bench UPD Habitat Enhancement Phase II	October 2018	263	4429

Table 6.9: Range trend and WRI studies known disturbance history for WMU 27, Paunsaugunt. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Ponderosa Pine)

One study site [Whiteman Bench (27-03)] is classified as a Mountain (Ponderosa Pine) ecological site: this site is located on the benches east of and above Tropic Reservoir and Henderson Creek.

Shrubs/Trees: Preferred browse cover on this study site has remained largely consistent over the sample years, with most of the cover being contributed by longflower rabbitbrush (*Chrysothamnus depressus*) and antelope bitterbrush (*Purshia tridentata*) (**Figure 6.3**). The preferred browse demographic data shows that the density of plants has decreased overall, with the majority of the population being comprised of mature individuals in all years. Both decadence and recruitment of young plants have also decreased (**Figure 6.14**). Utilization of preferred browse has fluctuated, but less than 50% of plans were moderately or heavily browsed in all sample years (**Figure 6.17**).

Ponderosa pine (*Pinus ponderosa*) has provided all of the tree cover and density on this site, both of which have increased over time (**Figure 6.8**, **Figure 6.12**).

Herbaceous Understory: Perennial grasses and forbs have been the main components in the herbaceous understory throughout the duration of the study period. Muttongrass (*Poa fendleriana*) and rock goldenrod (*Petradoria pumila*) have contributed a majority of the cover in most samplings; overall cover has exhibited slight increases each sample year since 1997 (**Figure 6.20**). Frequency, however, has displayed a marginally decreasing trend over time (**Figure 6.23**).

Occupancy: Average pellet transect data has shown that overall animal presence on this study site has decreased. In addition, data indicates that the primary occupants of this study site have been deer in most sample years: the exception to this is 2008, in which elk were the main occupants. Mean abundance of deer

pellet groups has ranged from nearly 7 days use/acre in 2018 to 26 days use/acre in 2008. Elk pellet groups have had a mean abundance as low as under 1 days use/acre in 2013 and as high as nearly 30 days use/acre in 2008. Finally, mean abundance of cattle pellet groups has ranged from 0 days use/acre in 2003 to over 2 days use/acre in 2013 (**Figure 6.26**).

Mountain (Black/Low Sagebrush)

There are two studies [Ahlstrom Hollow (27-02) and Heaton (27-13)] that are considered to be Mountain (Black/Low Sagebrush) ecological sites. The Ahlstrom Hollow study is situated between Ahlstrom Hollow and SR-12. Heaton is located east of US-89 on Heaton Ranch.

Shrubs/Trees: The shrubs on these ecological sites are diverse and abundant with black sagebrush (*Artemisia nova*) providing a majority of the cover; sagebrush cover has remained stable over time. Other preferred browse cover has displayed an increasing trend that is mainly driven by antelope bitterbrush (*Purshia tridentata*) on the Heaton study. Cover of other shrubs has also increased, resulting in a generally increasing trend overall (**Figure 6.2**). Utilization of preferred browse has fluctuated, but under 30% of shrubs were lightly or heavily browsed in all sample years (**Figure 6.17**). Preferred browse demographics show that mature plants comprise the majority of the browse populations. Both density of young plants and decadence have decreased over the sample period (**Figure 6.14**).

Cover and density of Rocky Mountain juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*) have both increased over time. However, these trends are entirely driven by the Ahlstrom Hollow study, as trees have not been observed in cover or density data in any sample year on the Heaton study (**Figure 6.6, Figure 6.10**).

Herbaceous Understory: These sites support herbaceous communities that are primarily comprised of perennial grasses. Overall herbaceous cover has increased over time mainly due to increases in perennial grasses; in 2018, muttongrass (*Poa fendleriana*) provided the most perennial grass cover on both study sites. Perennial and annual forbs are also present, but have been minor components in the understories of both sites. Nested frequency of herbaceous species has decreased overall. This decreasing trend can be attributed to a decrease in the abundance of annual forbs over time. Annual grasses have been observed in the understories of these sites, but in very low amounts (**Figure 6.20**, **Figure 6.23**).

Occupancy: Animal presence on these study sites has fluctuated, but has generally remained stable overall. Average pellet transect data shows that the primary occupants of these study sites are cattle; mean abundance of cattle pellet groups has varied from 28 days use/acre in 2003 to nearly 65 days use/acre in 2008. Deer usage has also been variable with 21 days use/acre being noted in 2018 and 44 days use/acre observed in 2008. Mean abundance of elk pellet groups has been as low as 4 days use/acre in 2013 and as high as nearly 16 days use/acre in in 2003 (**Figure 6.26**).

Mountain (Shrub)

Two study sites [Proctor Canyon (27-01) and Moons Landing (27-12)] are classified as Mountain (Shrub) ecological sites. The Proctor Canyon study is located south of Proctor Canyon near the Sunset Cliffs, while the Moons Landing study is situated east of US-89 on Heaton Ranch.

Shrubs/Trees: Antelope bitterbrush (*Purshia tridentata*) contributes the most cover of any single shrub species on these study sites. However, other preferred browse species are numerous and have altogether provided nearly as much cover as bitterbrush over the sample years. Total average shrub cover has exhibited a generally increasing trend over time (**Figure 6.3**). Average density of preferred browse species exhibited an initial decrease between 1992 and 1997 due to the establishment of the Moons Landing study, but has since increased. Mature plants have made up a majority of the population in all sample years (**Figure 6.14**).Average preferred browse utilization has fluctuated from year to year, but has remained stable overall since 1997 (**Figure 6.17**).

Average tree cover has increased over time, a trend which is entirely driven by Rocky Mountain juniper (*Juniperus scopulorum*) on the Proctor Canyon study. However, photos and point-quarter density data show that trees are present on both study sites, and average density has exhibited an increase overall (**Figure 6.7**, **Figure 6.11**).

Herbaceous Understory: These study sites have remained dominated by a mixture of mainly native perennial grasses throughout the study period. Overall average herbaceous cover decreased between 1992 and 1997 due to the establishment of the Moons Landing site, but has increased in subsequent sample years (**Figure 6.20**). However, nested frequency has decreased (**Figure 6.23**): this trend is in part driven by a decrease in the annual forb species Douglas' knotweed (*Polygonum douglasii*) and pygmyflower rockcress (*Androsace septentrionalis*) on the Moons Landing study.

Occupancy: Average pellet transect data indicates that animal presence on these study sites exhibited an increase between 2003 and 2008, but has since decreased. This data also shows that deer are the primary occupants of these sites, with mean abundance of pellet groups ranging from 59 days use/acre in 2018 to 102.5 days use/acre in 2008. Mean abundance of elk pellet groups has been as low as 1 days use/acre in 2003 and as high as 6 days use/acre in 2008. Cattle have also been present, with a mean abundance of pellet groups ranging from 11 days use/acre in 2003 to just over 17 days use/acre in 2013 (**Figure 6.26**).

Semiwet (Fresh Meadow)

There is one study [Podunk Creek (27-05)] that is classified as an Upland (Big Sagebrush) ecological site. Podunk Creek is situated in a meadow near Podunk Creek, just west of the boundary with Bryce Canyon National Park.

Shrubs/Trees: Shrub cover on this study site is limited and contributed entirely by yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *lanceolatus* and *C. viscidiflorus* ssp. *viscidiflorus* var. *viscidiflorus*) and Parry's rabbitbrush (*Ericameria parryi* var. *parryi*) (**Figure 6.5**). As no preferred browse species have been observed in density or cover measurements, trends for average preferred browse utilization or demographics are not available for this study site (**Figure 6.16**, **Figure 6.19**).

Trends for tree cover and density are also unavailable as trees are absent on the Podunk Creek study (**Figure 6.9**, **Figure 6.13**).

Herbaceous Understory: The herbaceous understory of this study site has remained dominated by the seeded and introduced perennial grass species smooth brome (*Bromus inermis*). A number of other perennial grass species are also present, but contribute comparatively little cover. Overall herbaceous cover has fluctuated between sample years: perennial grasses have increased, while cover of perennial forbs has decreased (**Figure 6.22**) Nested frequency of herbaceous species has exhibited little variation over the study period (**Figure 6.25**). Without changes to management or additional disturbances, the understory of this site is likely to continue with this or a similar composition.

Occupancy: Average pellet transect data shows that overall animal presence has decreased over the study period. Cattle have been the primary occupants in all years, and mean abundance of pellet groups has ranged from 36 days use/acre in 2008 to nearly 72 days use/acre in 2003. Elk pellet groups have had a mean abundance of pellet groups as low as 0 days use/acre in 2013 and as high as nearly 11 days use/acre in 2008. Finally, mean abundance of deer pellet groups has ranged from 0 days use/acre in 2003 and 2018 to nearly 3 days use/acre in 2008 (**Figure 6.26**).

Upland (Big Sagebrush)

Five study sites [John R. Flat Exclosure Outside (27R-03), Nephi Pasture I (27-06), Nephi Pasture Exclosure Outside (27-07), Crocodile (27-11), and Carly Knoll (27-16)] are considered to be Upland (Big Sagebrush) ecological sites. The John R. Flat Exclosure Outside study is located north of Kanab on John R. Flat. The

Nephi Pasture study is situated north of US-89 on Nephi Pasture, and the Nephi Pasture Exclosure Outside can be found south of the Nephi Pasture study. Crocodile is located east of John R. Flat and just north of Wygaret Terrace. Finally, the Carly Knoll study can be found on the lower south-facing slopes of Carly Knoll.

Shrubs/Trees: Average shrub cover has exhibited an increase overall: this is likely due to both increases in cover on existing study sites and addition of new or reactivated studies. Sagebrush species (*Artemisia sp.*) contribute a significant amount of cover on these study sites. However, data shows that as a whole, other preferred browse species such as Utah serviceberry (*Amelanchier utahensis*) and antelope bitterbrush (*Purshia tridentata*) have provided a majority of the shrub cover throughout the sample period (**Figure 6.2**).

Preferred browse demographics indicate an overall decrease in total density, which may be due in part to a differing number of studies from year to year. Demographic data also shows that mature individuals have comprised a majority of the preferred browse populations in most sample years. In 2003 and 2008, however, decadent individuals were the most abundant of any age class (**Figure 6.15**). Average preferred browse utilization has fluctuated from sample year to sample year; over 50% of plants were moderately and/or heavily browsed in 1997 and 2013, while a majority of plants exhibited little or no use in other sample years (**Figure 6.18**).

Average tree cover has increased overall with most of the cover being contributed by Utah juniper (*Juniperus osteosperma*); Nephi Pasture I has had the most juniper cover of any study of this ecological type in most sample years (**Figure 6.6**). Average tree density has also exhibited an overall increase. Furthermore, the density increase between 2013 and 2018 can likely be attributed to the addition of the John R. Flat Exclosure Outside and Carly Knoll studies (**Figure 6.10**).

Herbaceous Understory: Perennial grasses have comprised a majority of the herbaceous understory of these sites throughout the sample period. Overall herbaceous cover has increased over time. Much of this overall increase is likely due to an increase in perennial forbs on the Nephi Pasture I, Nephi Pasture Exclosure Outside, and Carly Knoll studies (**Figure 6.21**). Average nested frequency has fluctuated, but has exhibited a general decrease overall: this can largely be attributed to a decreased abundance of annual forbs (**Figure 6.24**).

Occupancy: Pellet transect data shows that animal presence has varied over the sample years: this may be in part due to the differing number of studies from year to year. Deer have been the primary occupants in all sample years, having a mean abundance ranging from nearly 40 days use/acre in 2013 to 63 days use/acre in 2003. Elk have also been present, with a mean abundance varying from 0 days use/acre in 2003, 2008, and 2013 to 1 days use/acre in 2018. Finally, the mean abundance of cattle pellet groups has been as low as 2 days use/acre in 2018 and as high as 11 days use/acre in 2003 (**Figure 6.27**).

Upland (Cliffrose)

There are four studies [Buckskin Mountain (27-09), Telegraph Flat (27-10), Mustang Pond South (27-14), and Jeppson Pond (27-15)] that are classified as Upland (Cliffrose) ecological sites. Buckskin Mountain is located on the Utah-Arizona border on Buckskin Mountain; part of the transect lies in Arizona. The Telegraph Flat study can be found just south of the Vermilion Cliffs on Telegraph Flat. Mustang Pond South is situated on Buckskin Mountain, south of Kaibab Gulch. Jeppson Pond is located on south of U.S. Route 89 and just north of Buckskin Mountain.

Shrubs/Trees: Average cover of shrubs on these study sites increased from 2003 to 2013, but decreased in 2018. This recent decrease can largely be attributed to a decrease in sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and cliffrose (*Purshia stansburiana*) due to a chaining and seeding treatment on the Telegraph Flat study. Cliffrose has contributed a moderate amount of cover throughout the study period. However, other preferred browse such as sagebrush (*A. sp.*) has provided a majority of the shrub cover in all sample years (**Figure 6.4**). Average demographic data indicates that mature plants have comprised most of the preferred browse populations in a majority of the study years. Decadent individuals, however, were the most prevalent in 2008, a trend that is driven by the Buckskin Mountain study. Density of preferred browse has decreased

overall (**Figure 6.15**). Average preferred browse utilization has fluctuated, with the percentage of plants heavily or moderately browsed being as low as 36% in 2003 and as high as 71.5% in 2008 (**Figure 6.18**).

Utah juniper (*Juniperus osteosperma*) has contributed most of the tree cover in all sample years. Average tree cover has exhibited an overall decrease, in part due to treatments on Telegraph Flat and the addition of the Mustang Pond South and Jeppson Pond studies (**Figure 6.7**). However, density has increased, largely due to the establishment of additional studies (**Figure 6.11**).

Herbaceous Understory: Annual grasses, mainly the introduced species cheatgrass (*Bromus tectorum*), have dominated the herbaceous understories of these sites: this trend is primarily driven by the Buckskin Mountain study. Perennial grasses and perennial and annual forbs have been comparatively minor understory components throughout the study years. Average nested frequency and cover have decreased overall (**Figure 6.21**, **Figure 6.24**).

Occupancy: Average animal presence data indicates that occupancy has decreased over time and that deer are the primary occupants on these sites. Mean abundance of deer pellet groups has ranged from nearly 38 days use/acre in 2018 to nearly 67 days use/acre in 2008. Cattle have also been present, with mean pellet group abundance as low as 1 days use/acre in 2018 and as high as 10.5 days use/acre in 2003. Elk are the only other occupants of these sites, with a mean abundance of pellet groups ranging from 0 days use/acre in 2013 and 2018 to 0.3 days use/acre in 2003 and 2008 (**Figure 6.27**).

Semidesert (Black/Low Sagebrush)

One study site [Fivemile Mountain (27-08)] is considered to be of the Semidesert (Black/Low Sagebrush) ecological type. The Fivemile Mountain study is located south of US-89 on Fivemile Mountain.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) contributes a vast majority of the shrub cover on this study site and has increased over time. Preferred browse species other than sagebrush provide no cover, and little cover is contributed by other shrubs (**Figure 6.2**). According to average preferred browse demographic data, mature plants have been the main population demographic in most sample years. However, decadent individuals comprised a majority of the population in 2003 and 2008. Recruitment of young has exhibited an overall decrease (**Figure 6.15**). Average utilization of preferred browse has varied, with the percentage of plants that were moderately to heavily browsed being over 50% in 2008 and 2013 and under 35% in all other years (**Figure 6.18**).

Utah juniper (*Juniperus osteosperma*) is present on this site. Cover has remained low and has shown a marginal decrease overall (**Figure 6.6**). Tree density, however, has displayed a general increase (**Figure 6.10**).

Herbaceous Understory: The herbaceous understory has remained moderately diverse and mainly comprised of a mixture of perennial grass species, primarily blue grama (*Bouteloua gracilis*) and needle and thread (*Hesperostipa comata*). In addition, the understory has exhibited a very slight increase in overall cover. However, cover has been under 10% in most sample years: the exception to this is 2003, when there was an increase in annual grasses and forbs (**Figure 6.21**). Nested frequency has decreased overall, a trend that can be attributed to a decrease in annual grasses and forbs (**Figure 6.24**).

Occupancy: Average pellet transect data indicates that animal occupancy has generally decreased and that deer have been the primary occupants in all sample years. Mean abundance of deer pellet groups has been as low as 9 days use/acre in 2018 and as high as nearly 35 days use/acre in 2008. Cattle pellet groups have had a mean abundance ranging from nearly 4 days use/acre in 2013 to nearly 9 days use/acre in 2018 (**Figure 6.27**).

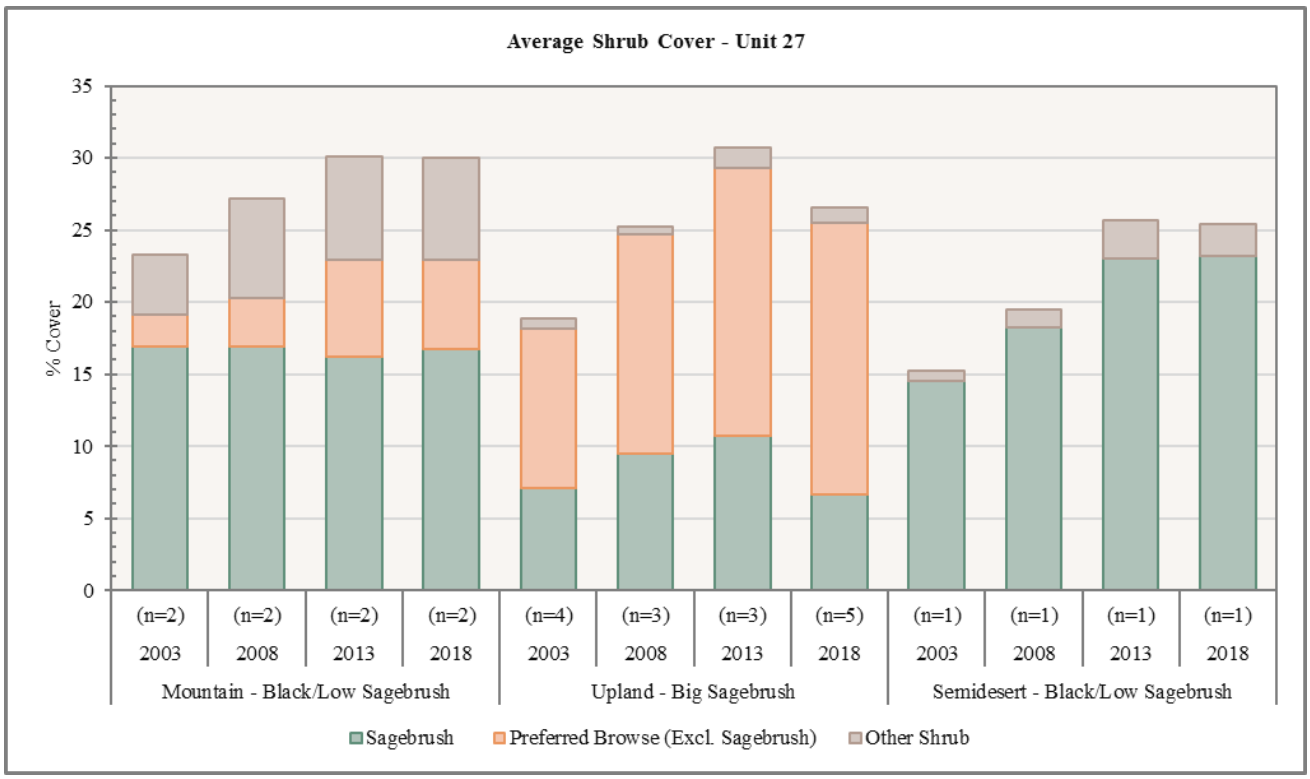


Figure 6.2: Average shrub cover for Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Semidesert - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

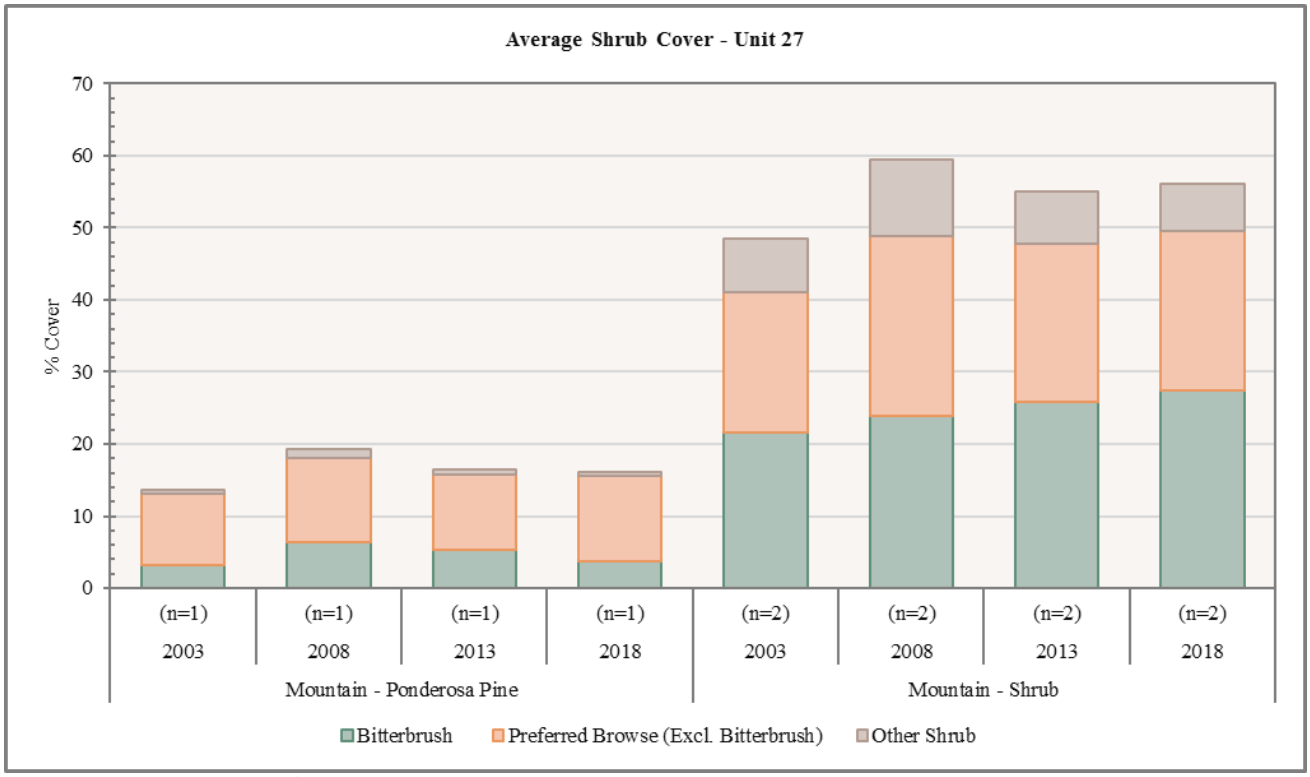


Figure 6.3: Average shrub cover for Mountain - Ponderosa Pine and Mountain - Shrub study sites in WMU 27, Paunsaugunt.

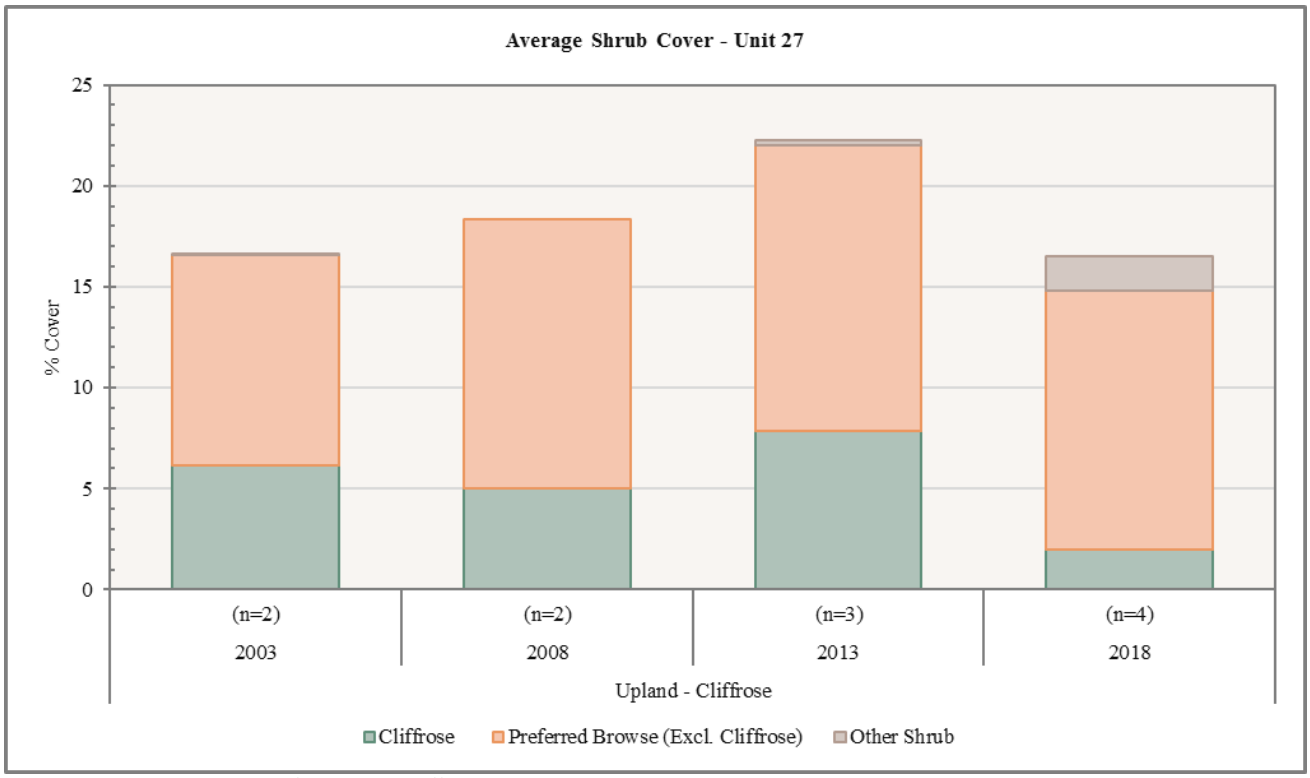


Figure 6.4: Average shrub cover for Upland - Cliffrose study sites in WMU 27, Paunsaugunt.

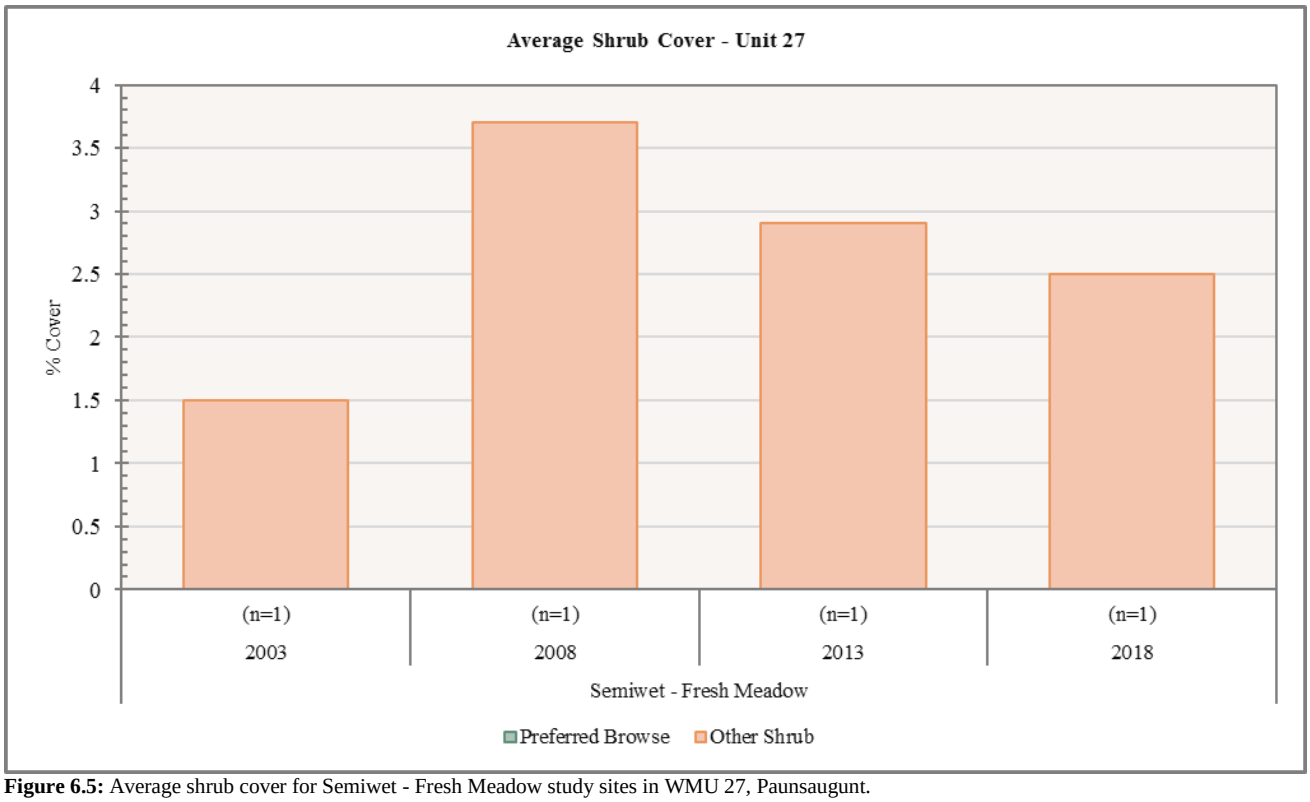


Figure 6.5: Average shrub cover for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

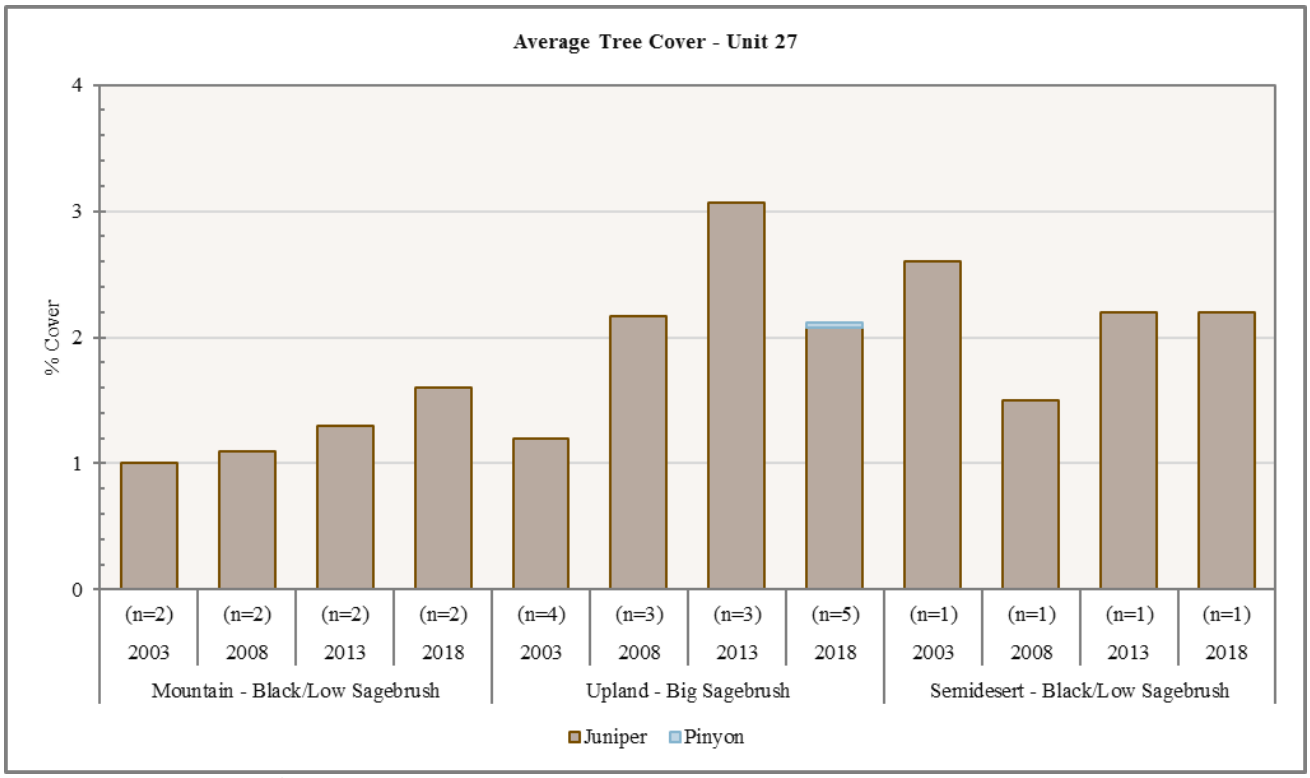


Figure 6.6: Average tree cover for Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Semidesert - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

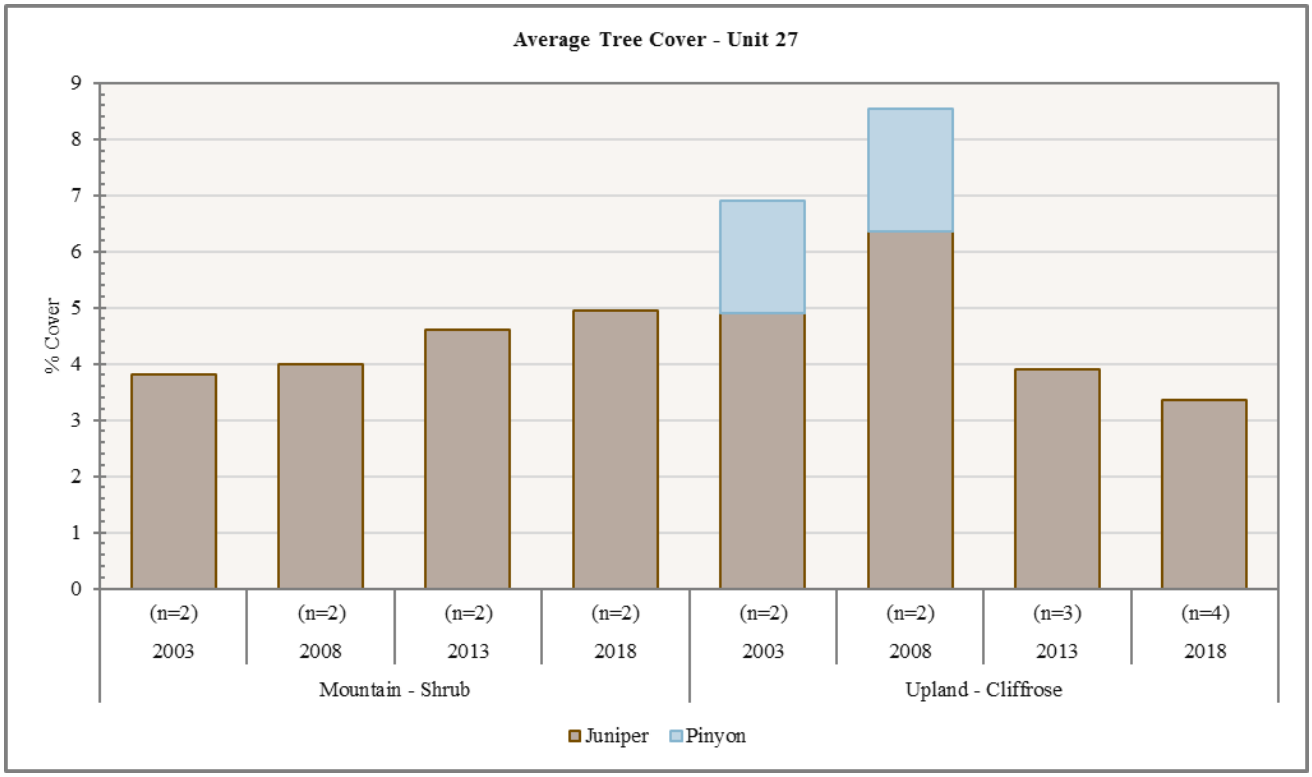


Figure 6.7: Average tree cover for Mountain - Shrub and Upland - Cliffrose study sites in WMU 27, Paunsaugunt.

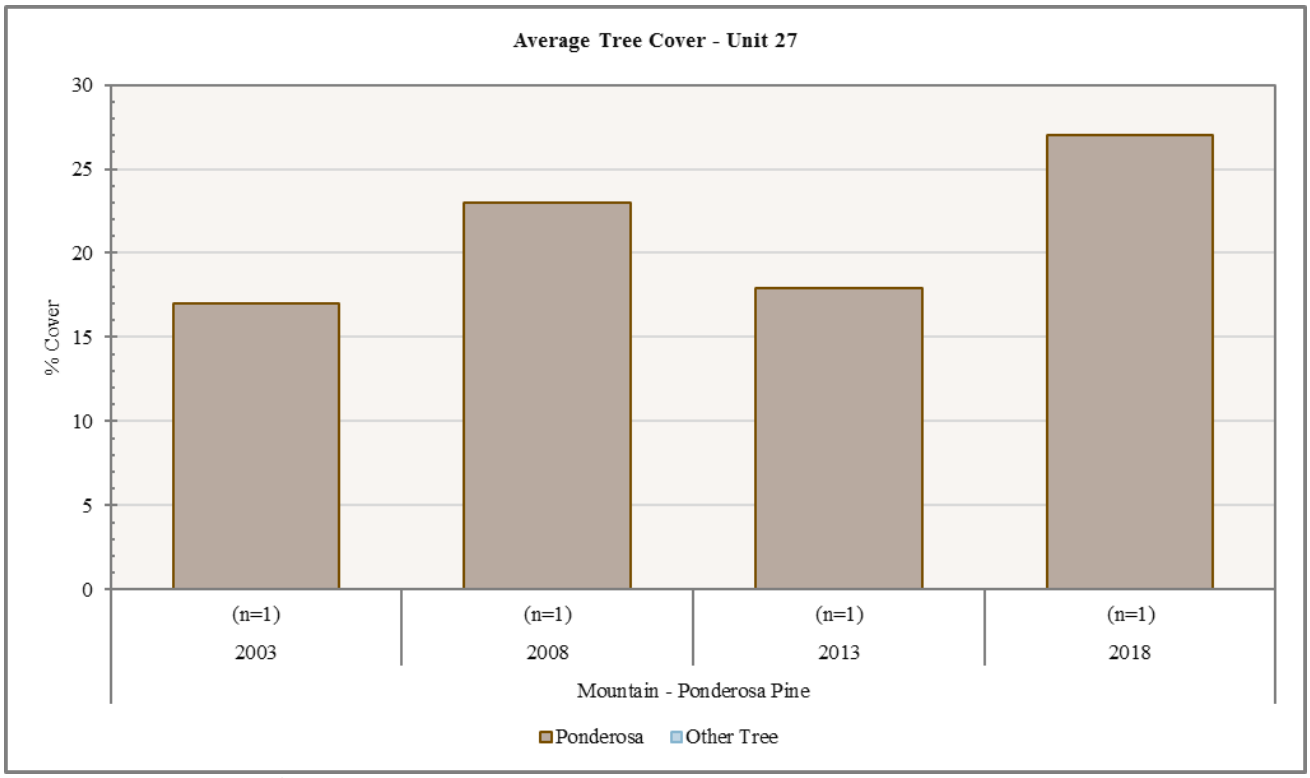


Figure 6.8: Average tree cover for Mountain - Ponderosa Pine study sites in WMU 27, Paunsaugunt.

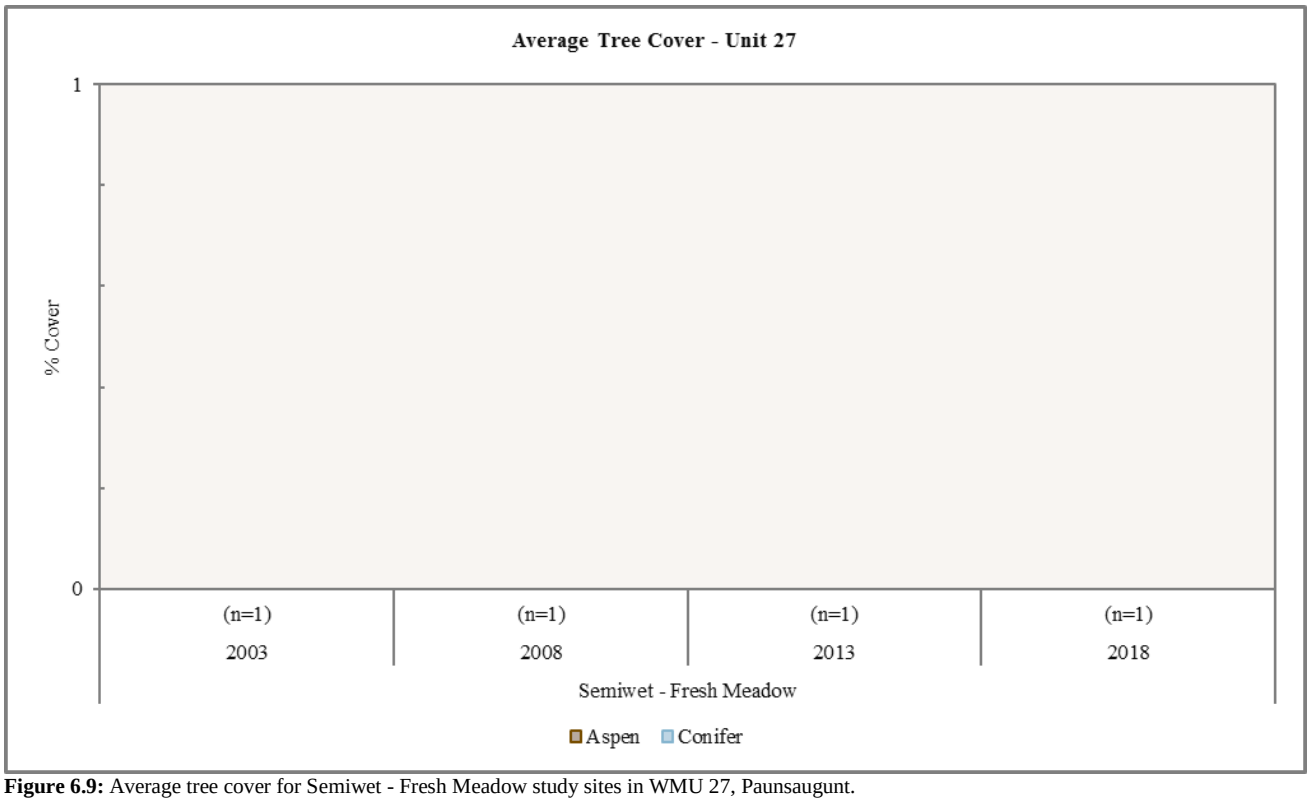


Figure 6.9: Average tree cover for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

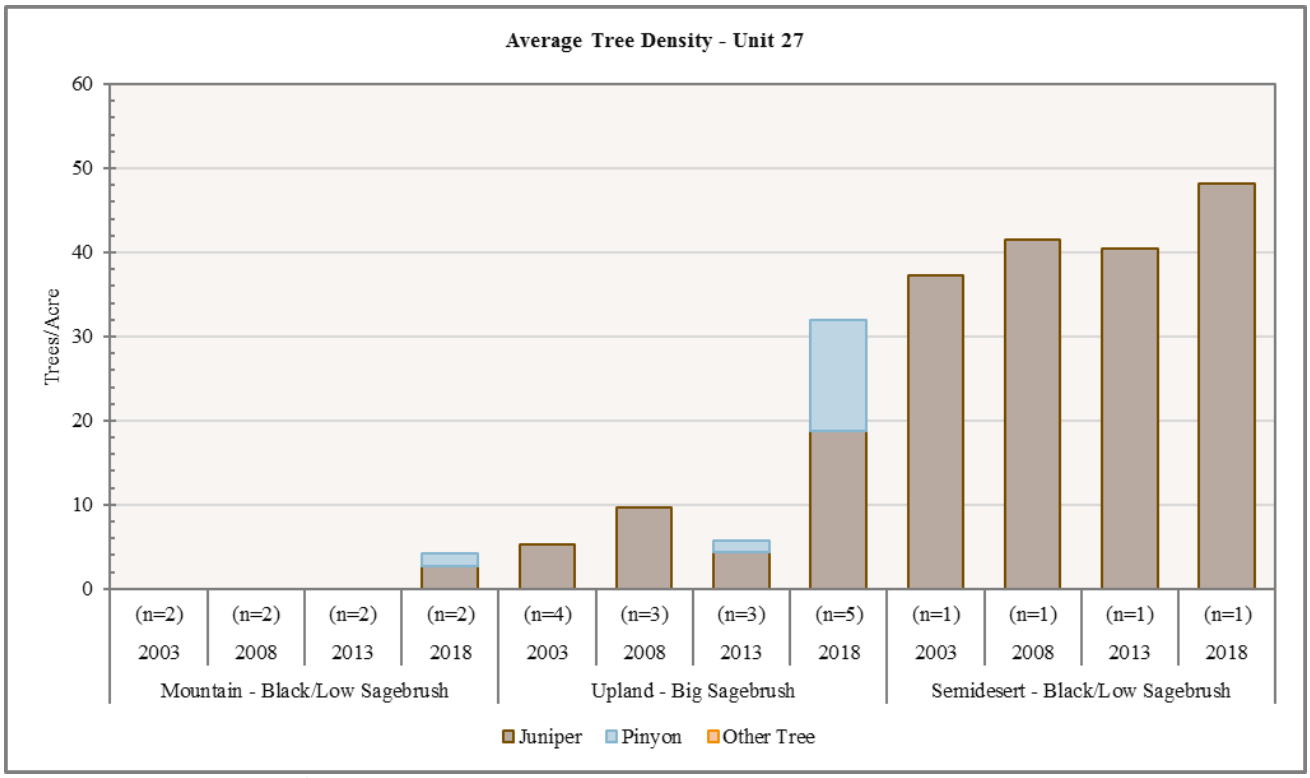


Figure 6.10: Average tree density for Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Semidesert - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

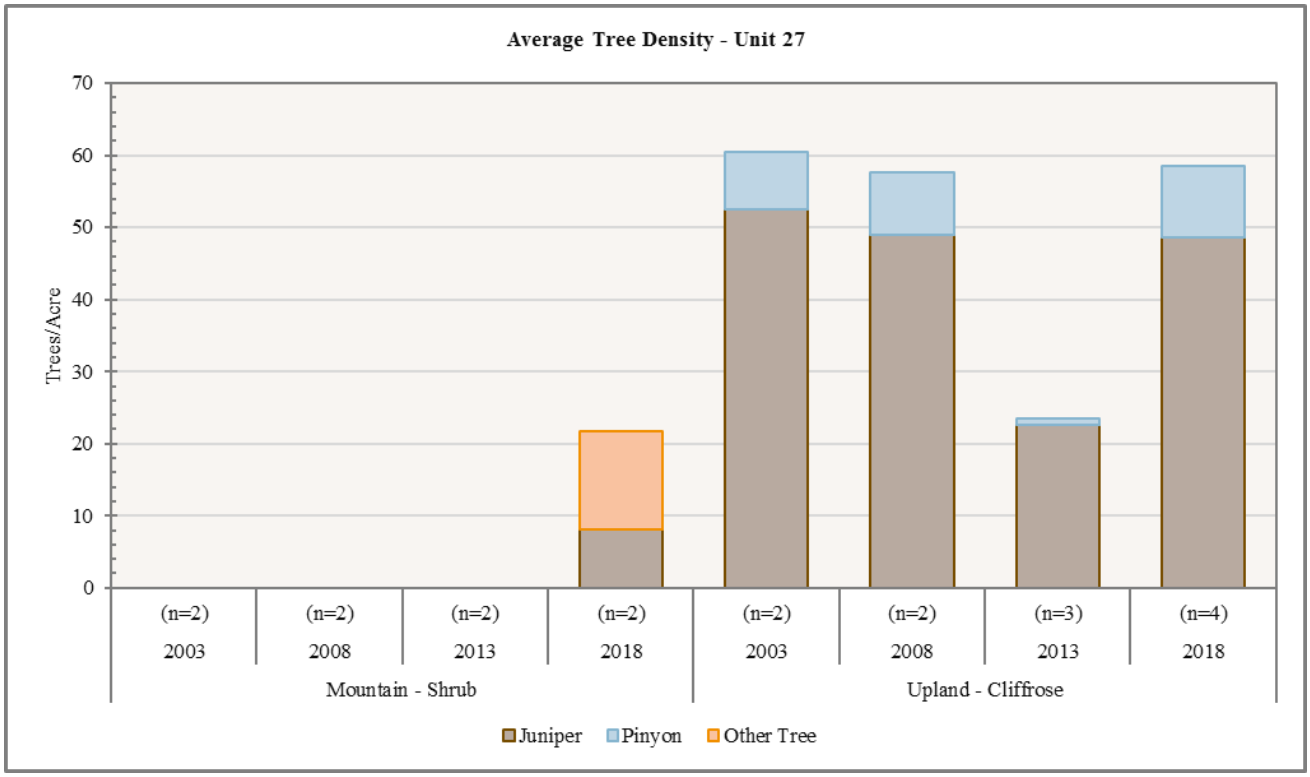


Figure 6.11: Average tree density for Mountain - Shrub and Upland - Cliffrose study sites in WMU 27, Paunsaugunt.

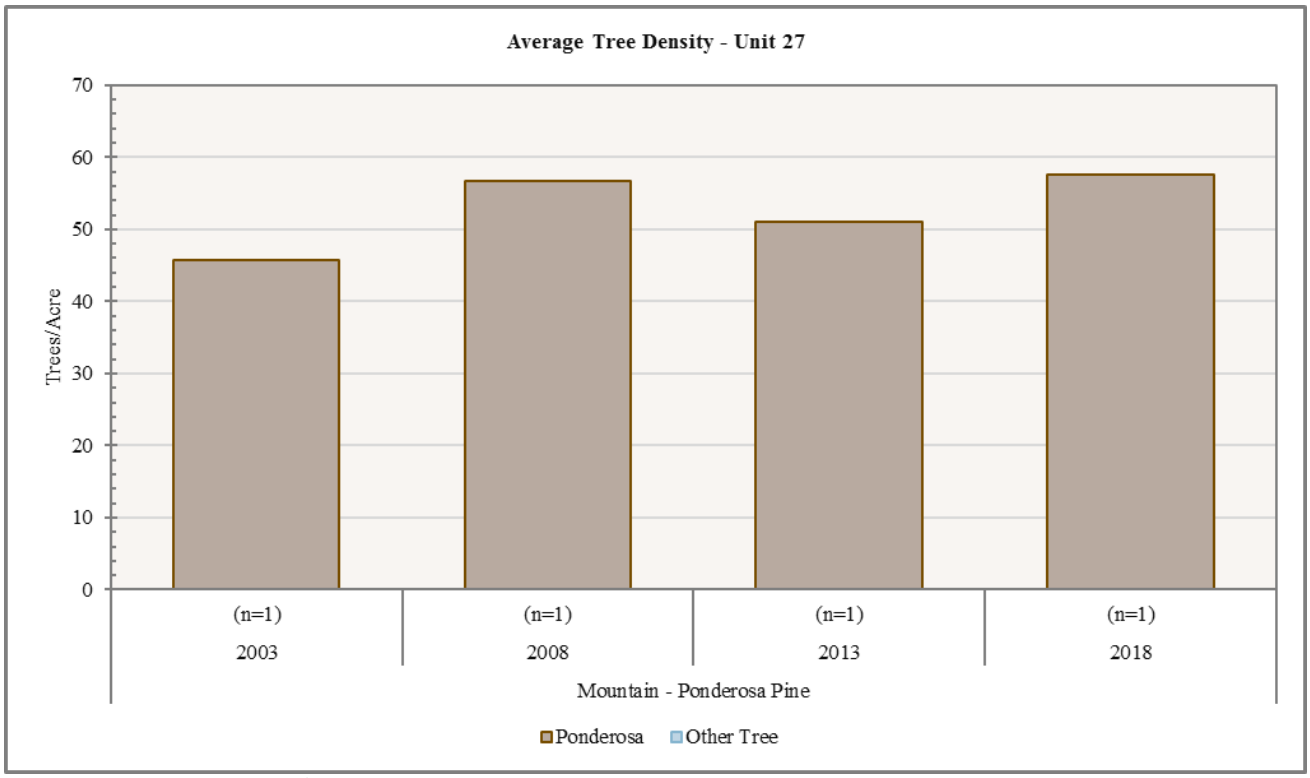


Figure 6.12: Average tree density for Mountain - Ponderosa Pine study sites in WMU 27, Paunsaugunt.

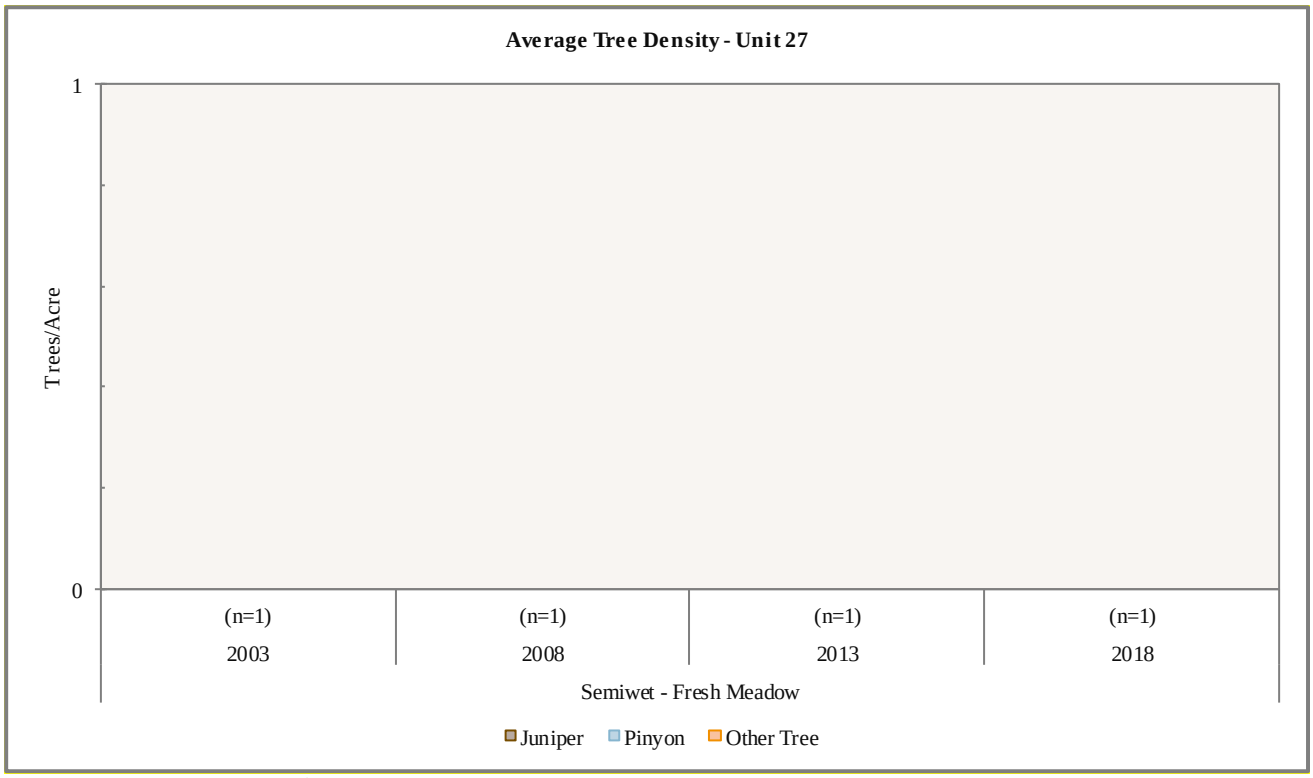


Figure 6.13: Average tree density for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

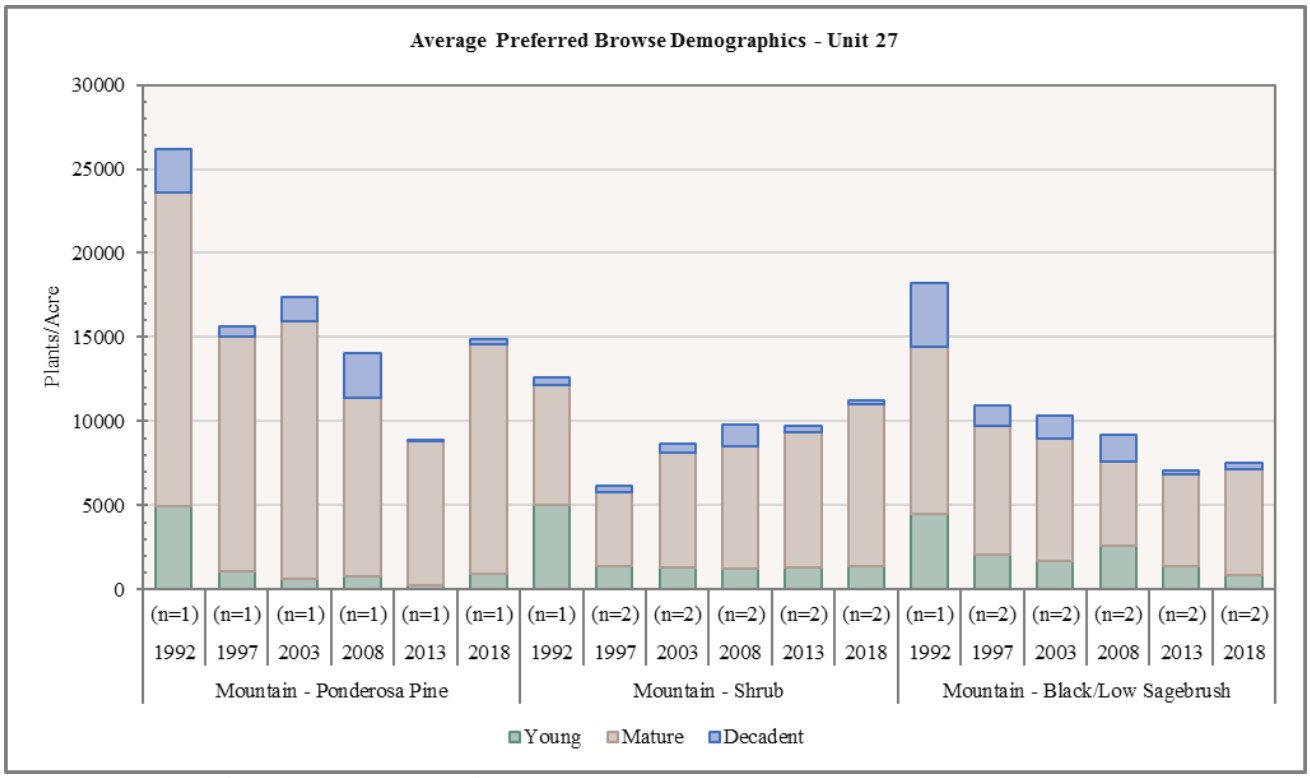


Figure 6.14: Average preferred browse demographics for Mountain - Ponderosa, Mountain - Shrub, and Mountain - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

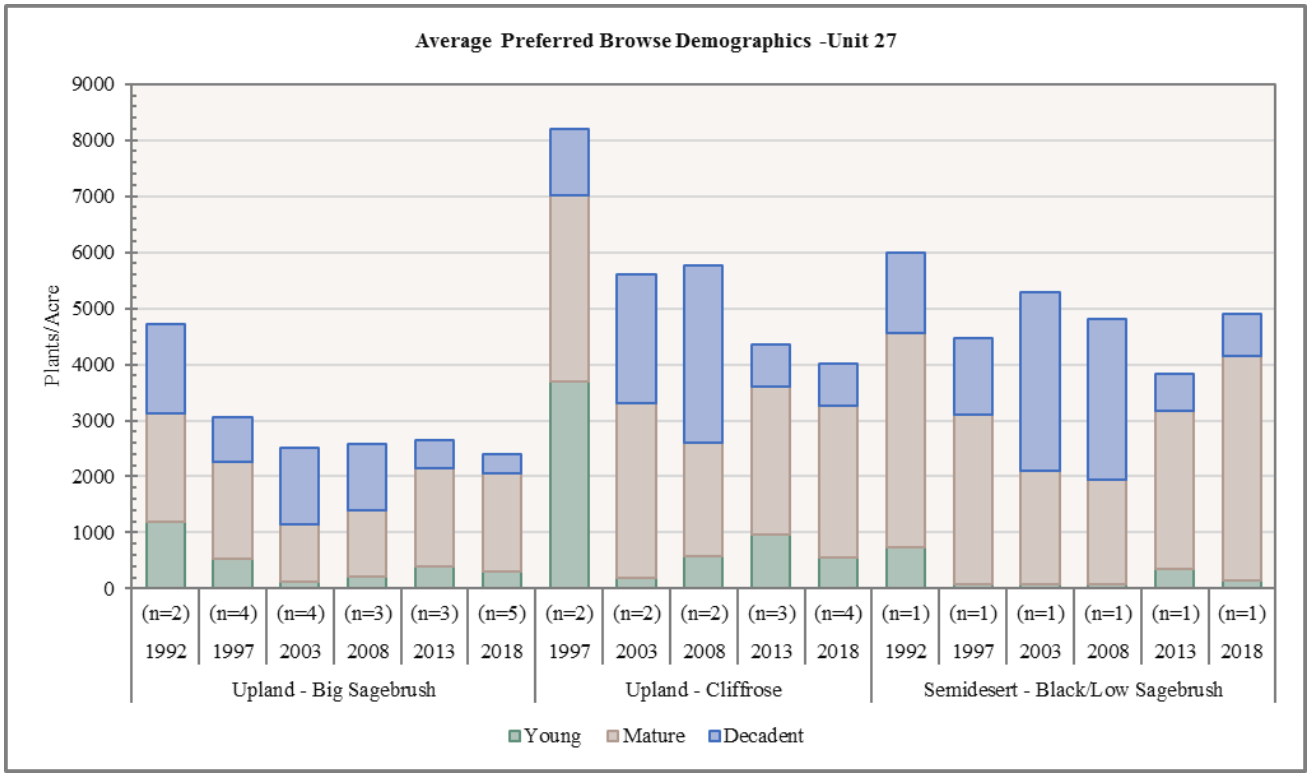


Figure 6.15: Average preferred browse demographics for Upland - Big Sagebrush, Upland Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 27, Paunsaugunt.

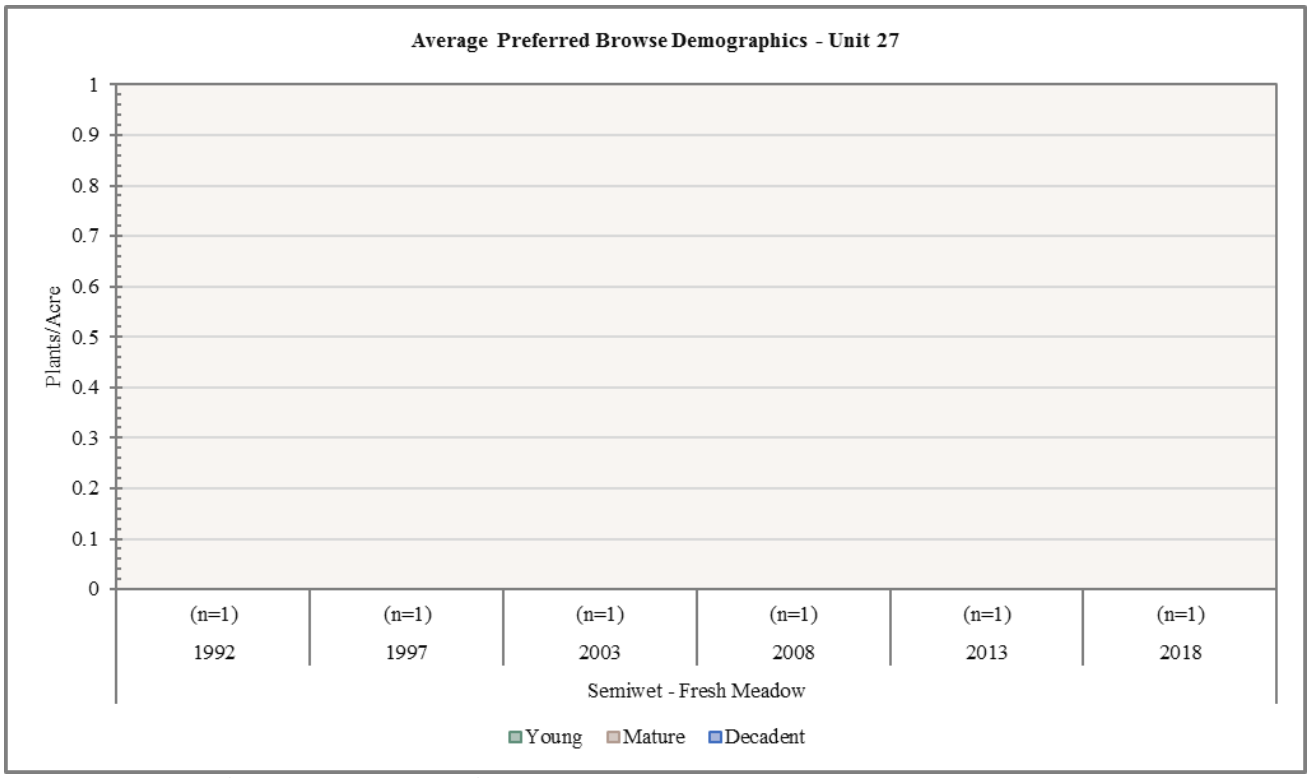


Figure 6.16: Average preferred browse demographics for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

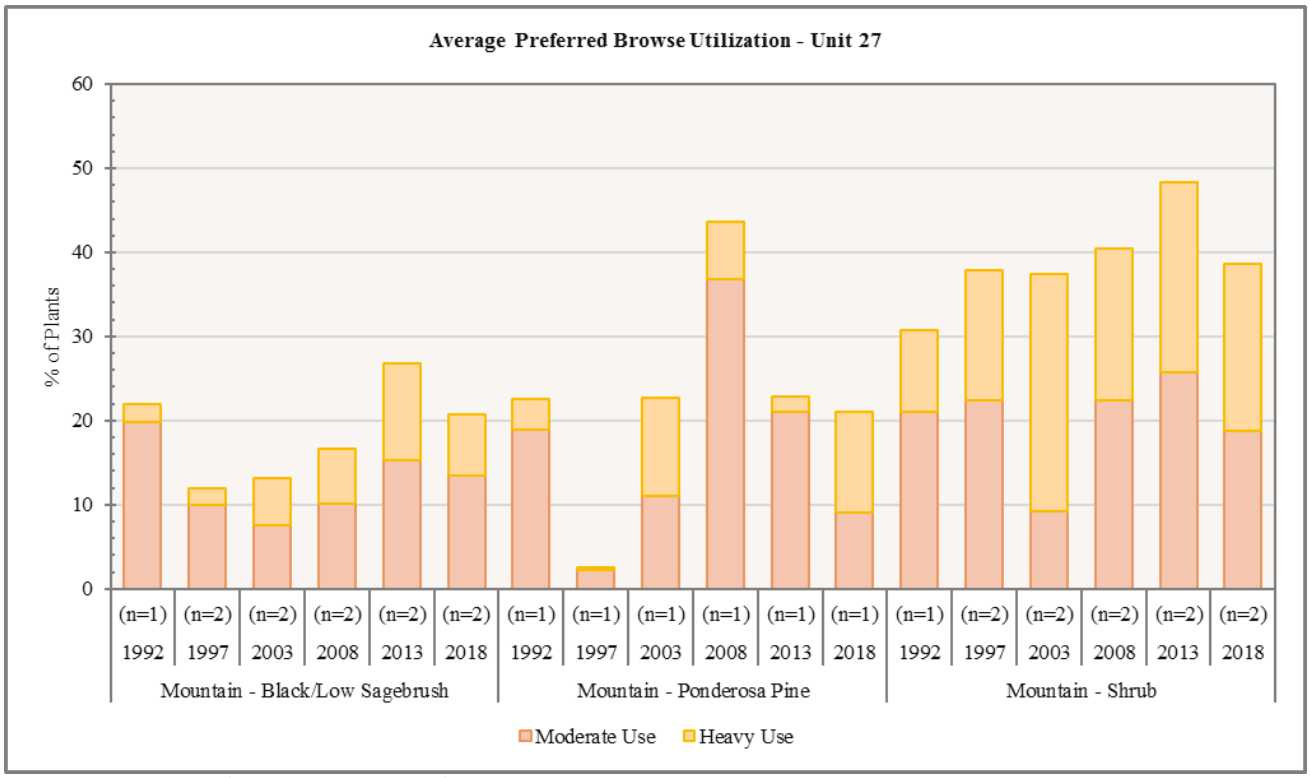


Figure 6.17: Average preferred browse utilization for Mountain - Ponderosa, Mountain - Shrub, and Mountain - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

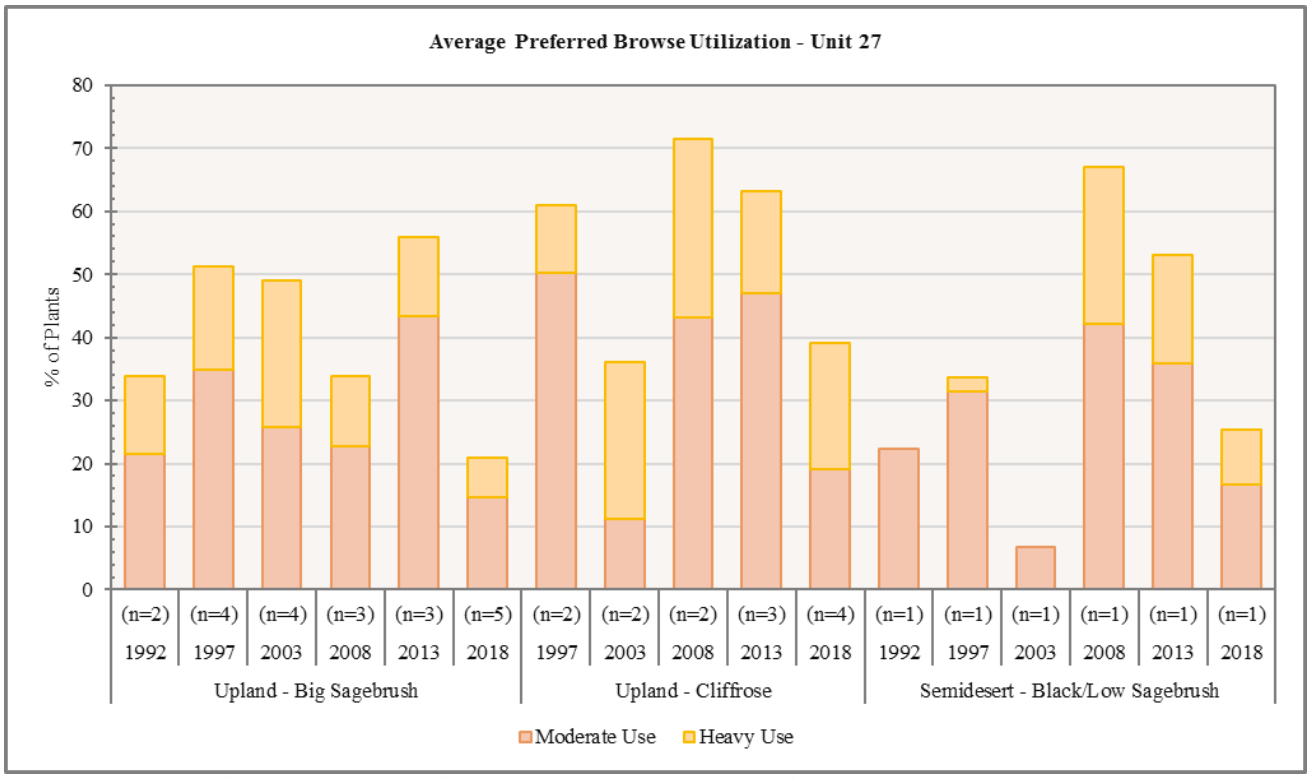


Figure 6.18: Average preferred browse utilization for Upland - Big Sagebrush, Upland Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 27, Paunsaugunt.

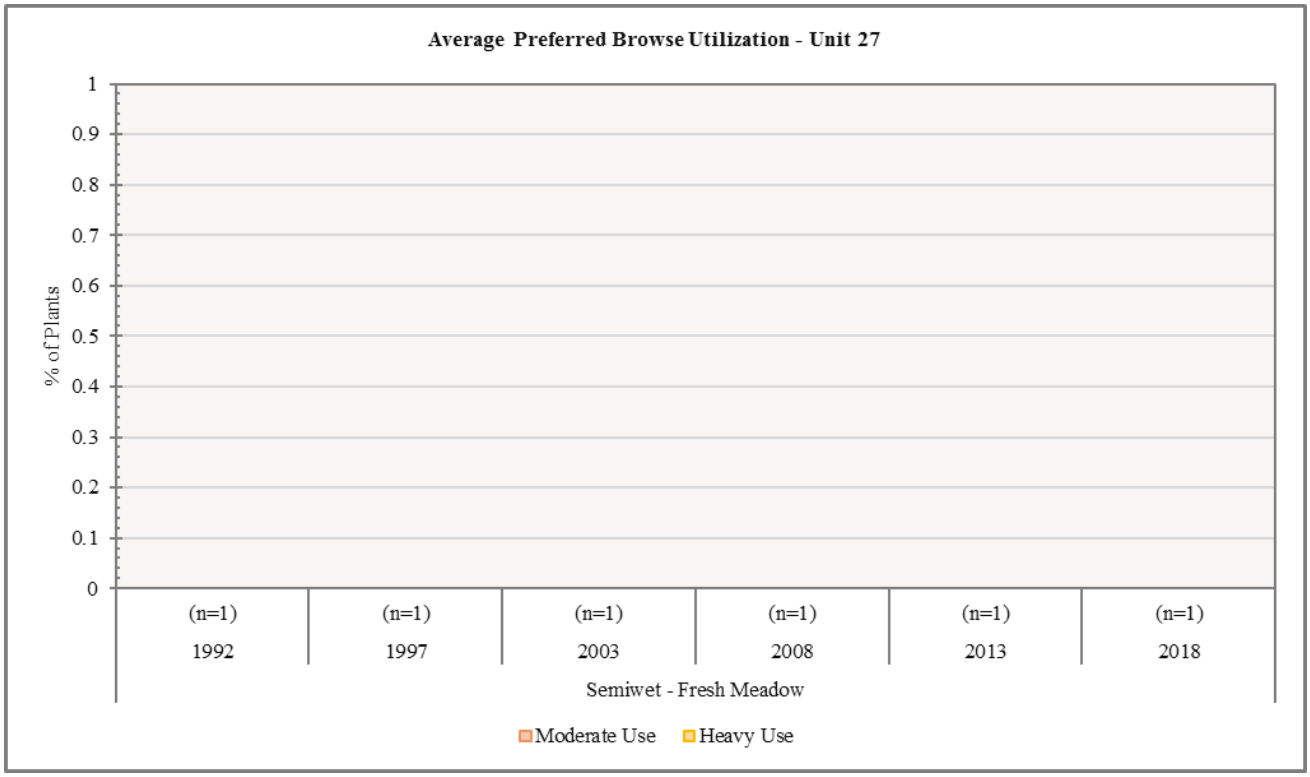


Figure 6.19: Average preferred browse utilization for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

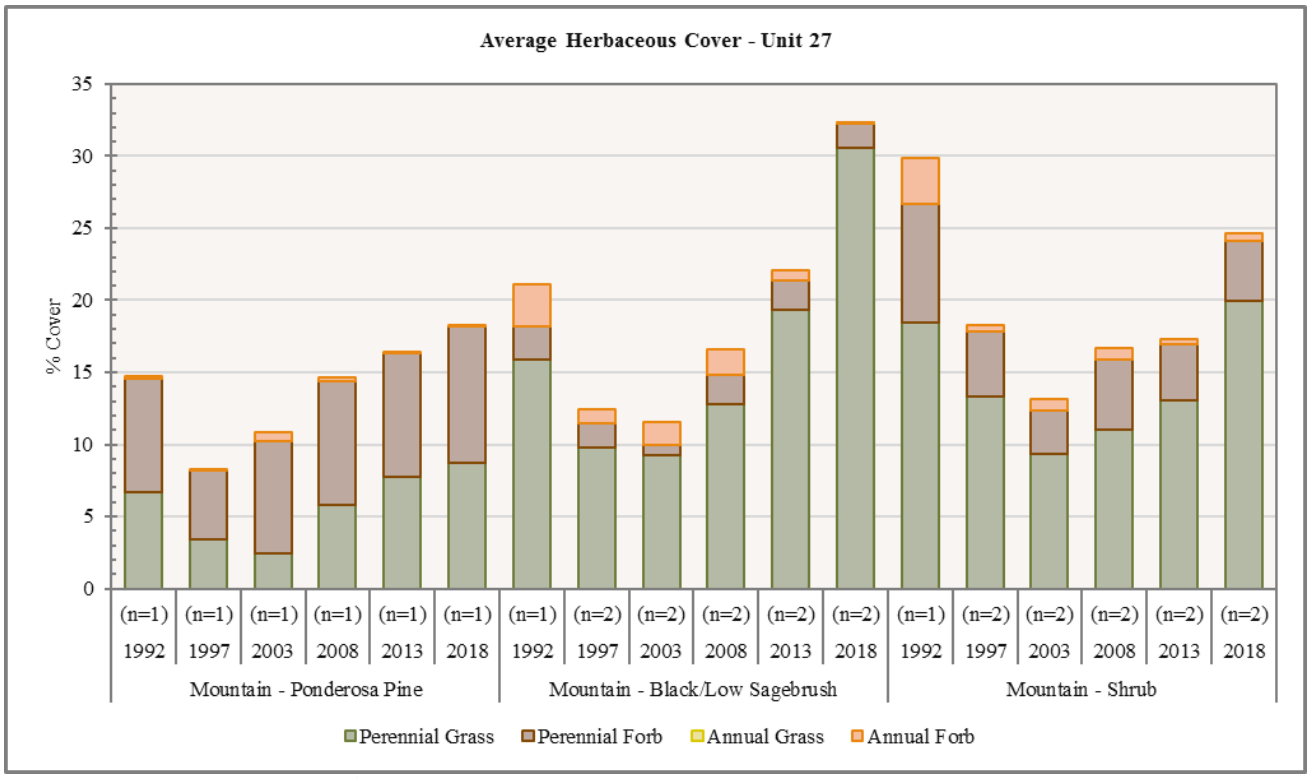


Figure 6.20: Average herbaceous cover for Mountain - Ponderosa, Mountain - Shrub, and Mountain - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

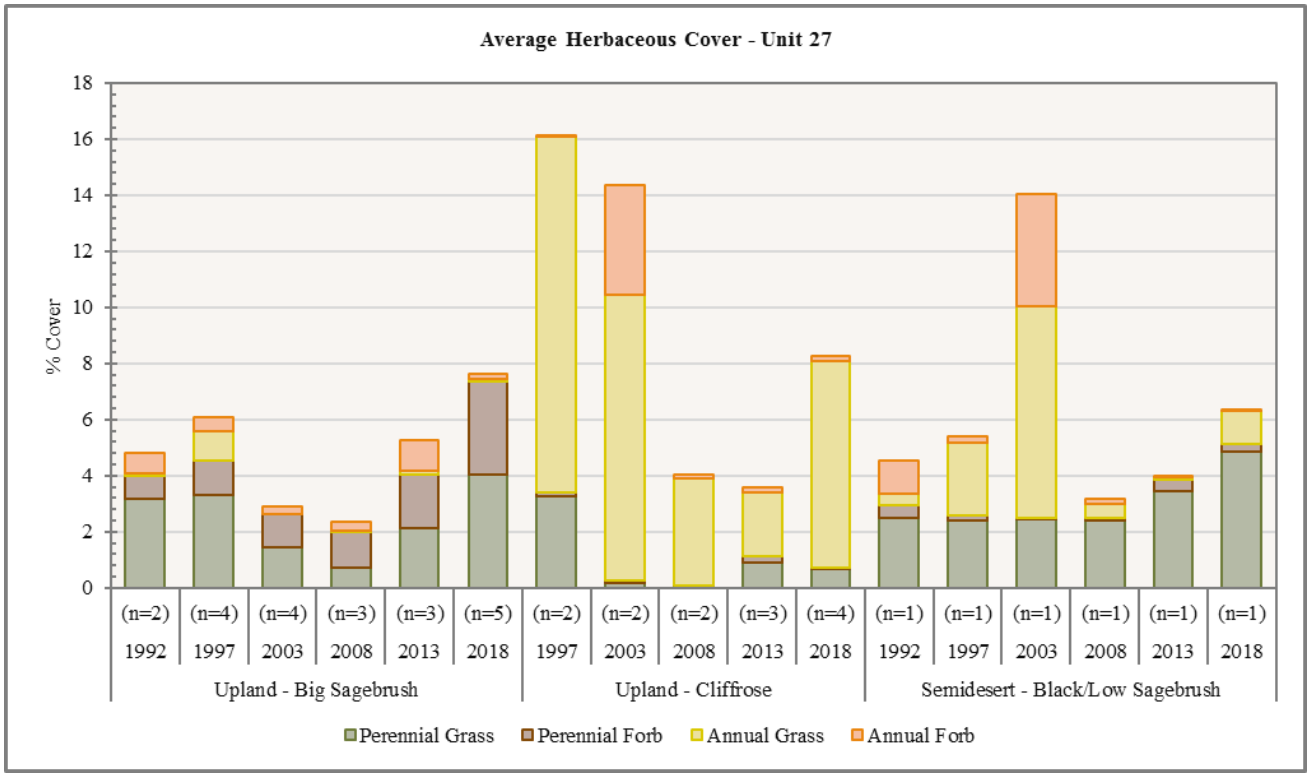


Figure 6.21: Average herbaceous cover for Upland - Big Sagebrush, Upland Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 27, Paunsaugunt.

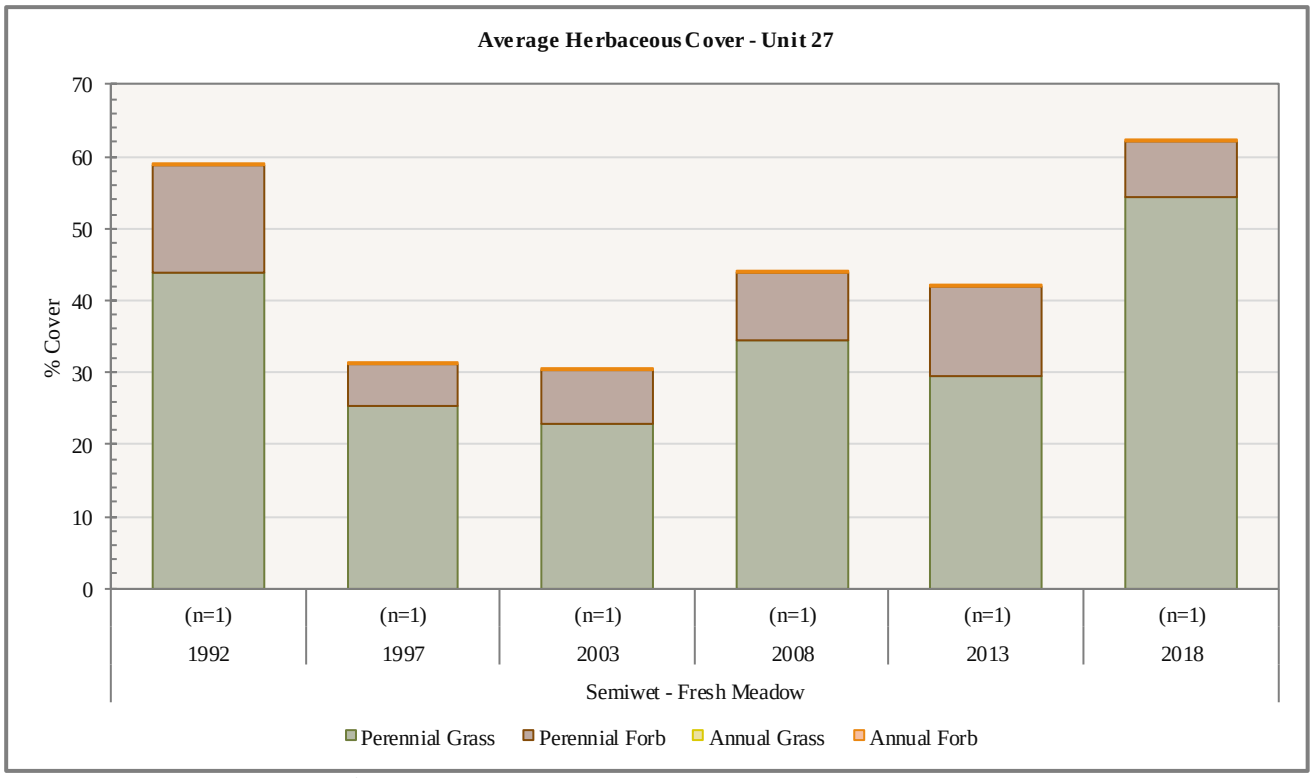


Figure 6.22: Average herbaceous cover for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

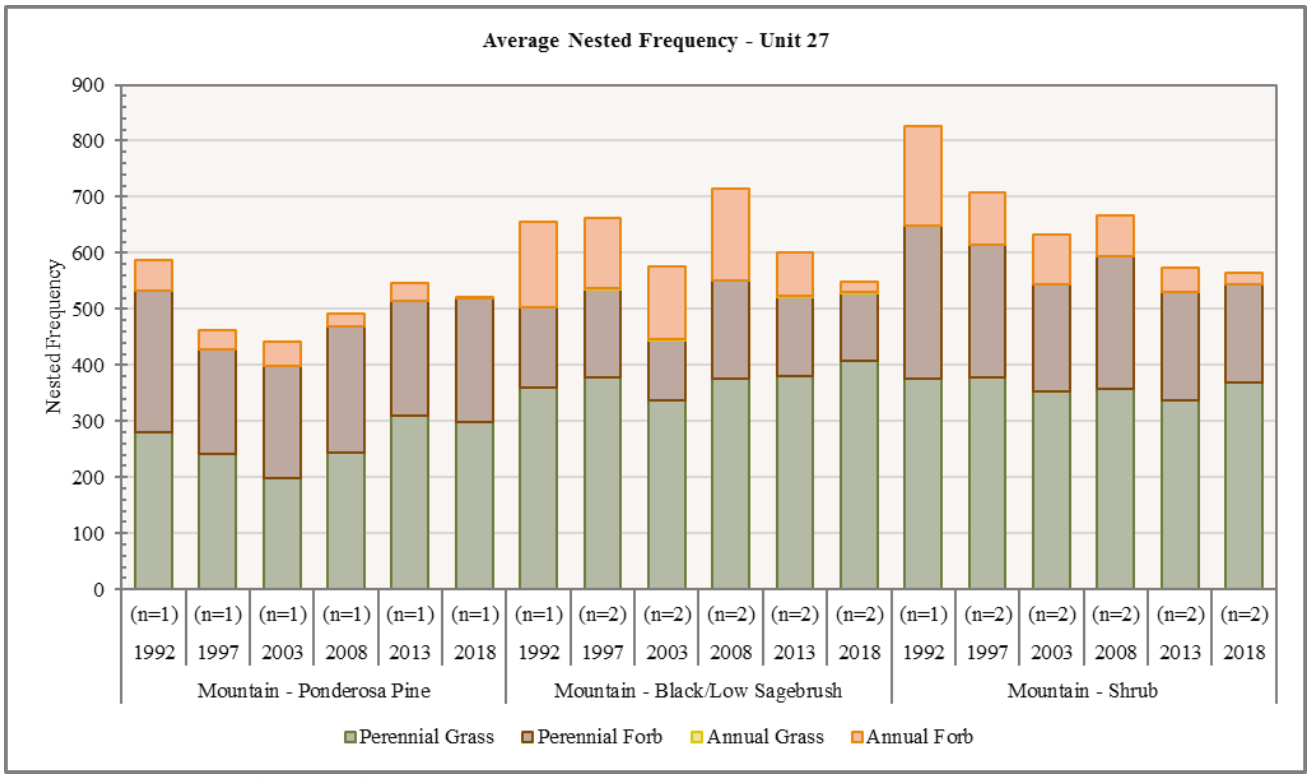


Figure 6.23: Average nested frequency of herbaceous species for Mountain - Ponderosa, Mountain - Shrub, and Mountain - Black/Low Sagebrush study sites in WMU 27, Paunsaugunt.

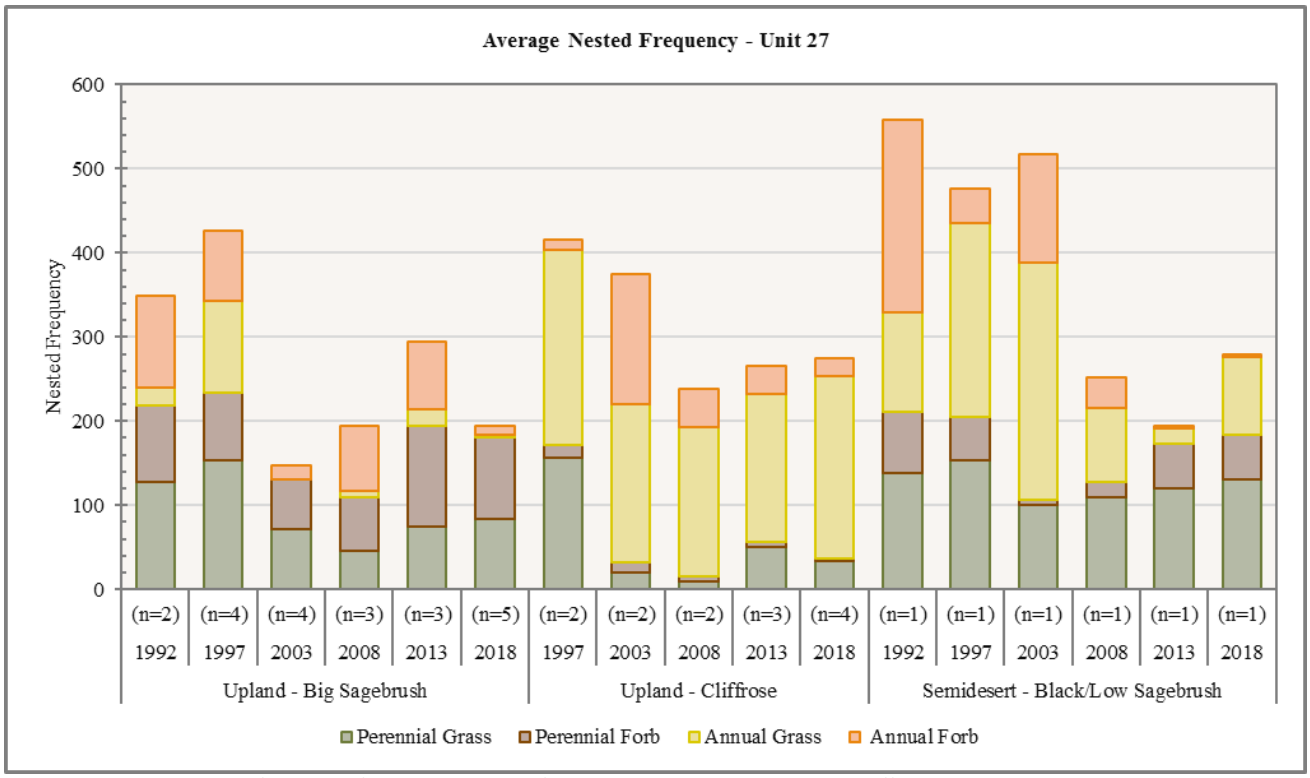


Figure 6.24: Average nested frequency of herbaceous species for Upland - Big Sagebrush, Upland Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 27, Paunsaugunt.

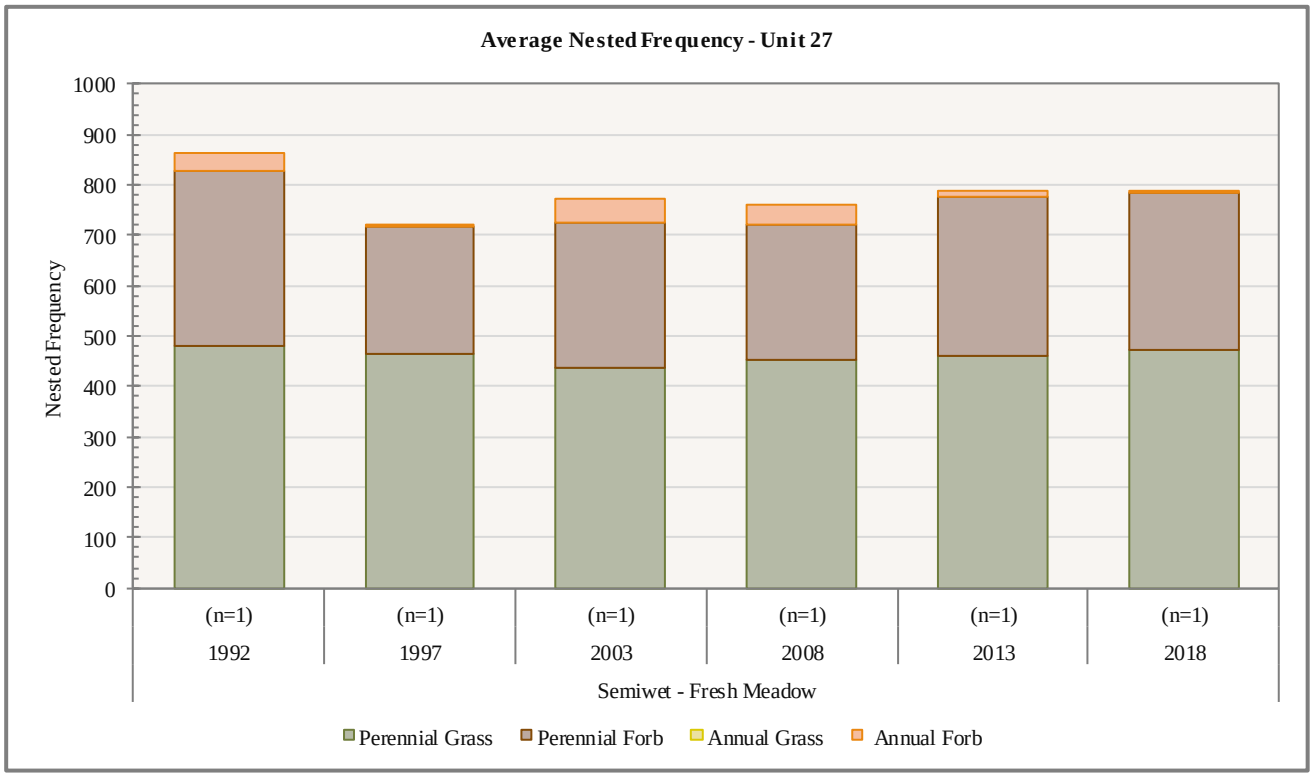


Figure 6.25: Average nested frequency of herbaceous species for Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

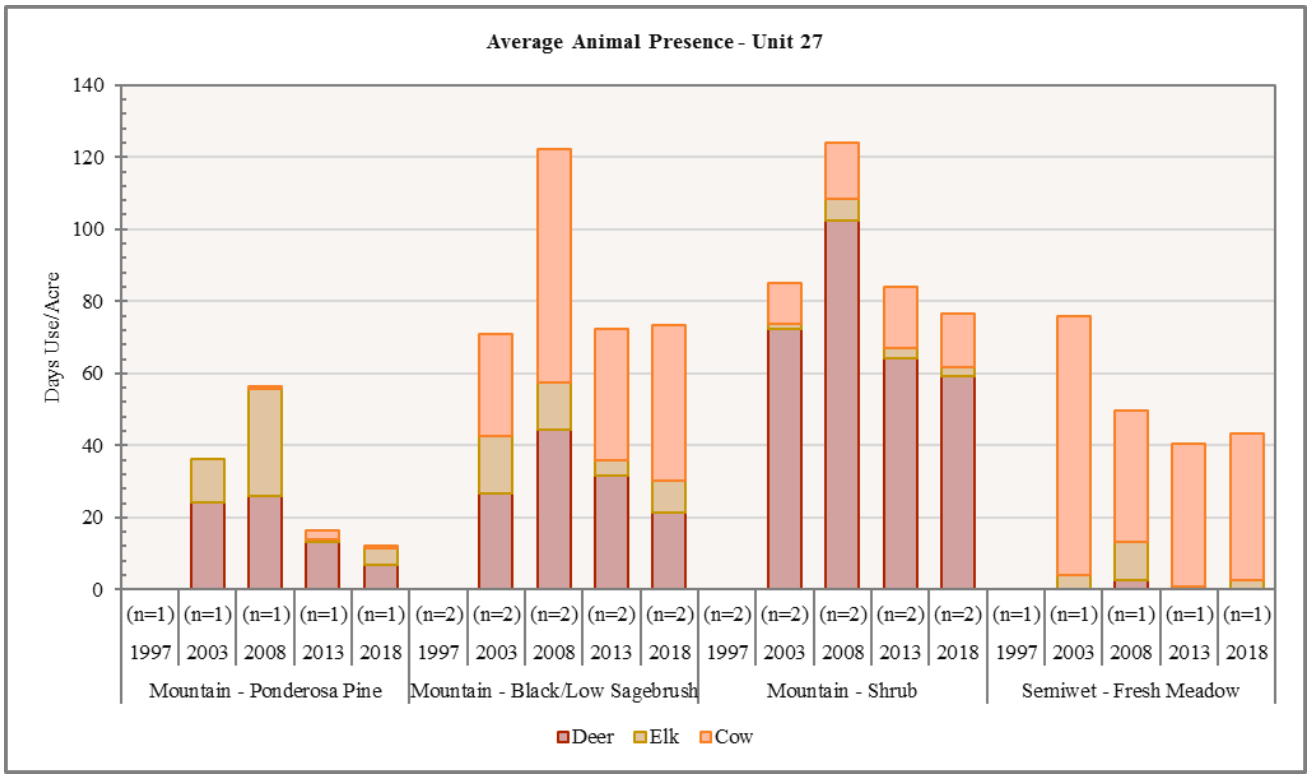


Figure 6.26: Average pellet transect for Mountain - Ponderosa, Mountain - Shrub, Mountain - Black/Low Sagebrush, and Semiwet - Fresh Meadow study sites in WMU 27, Paunsaugunt.

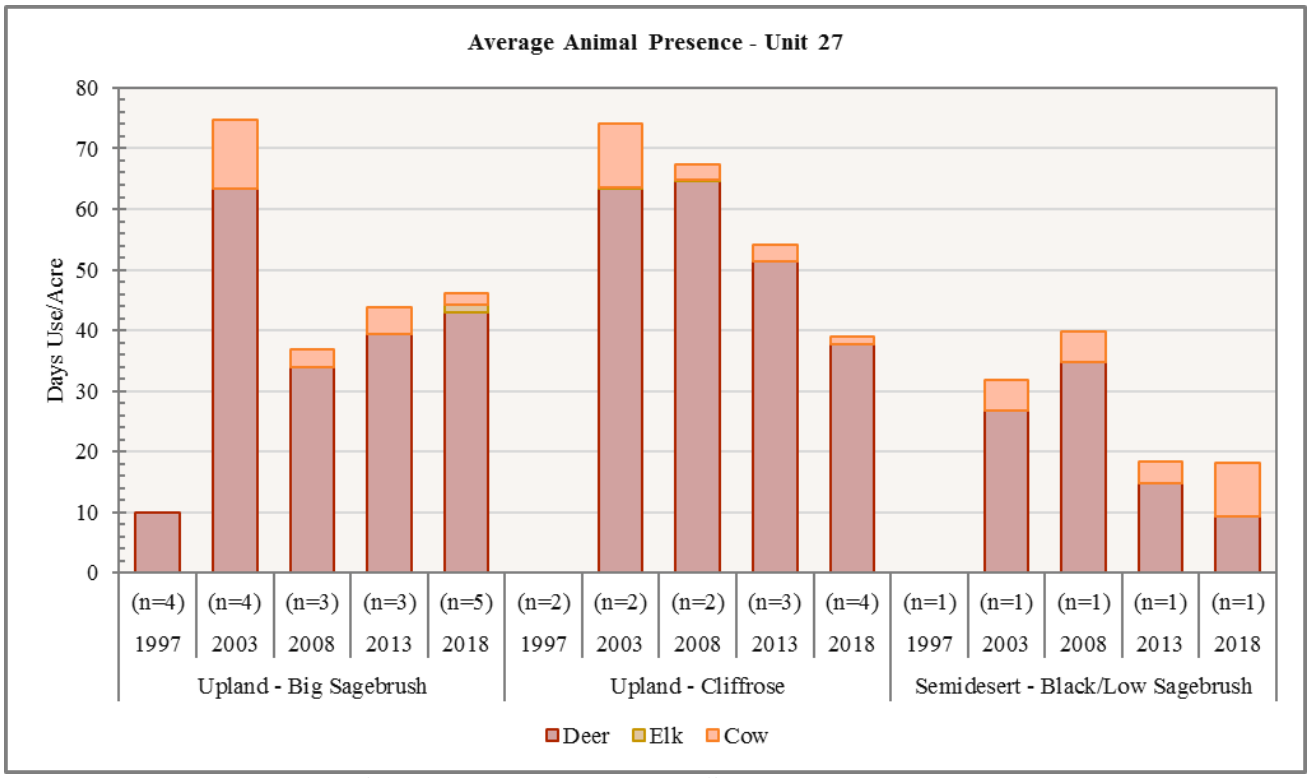
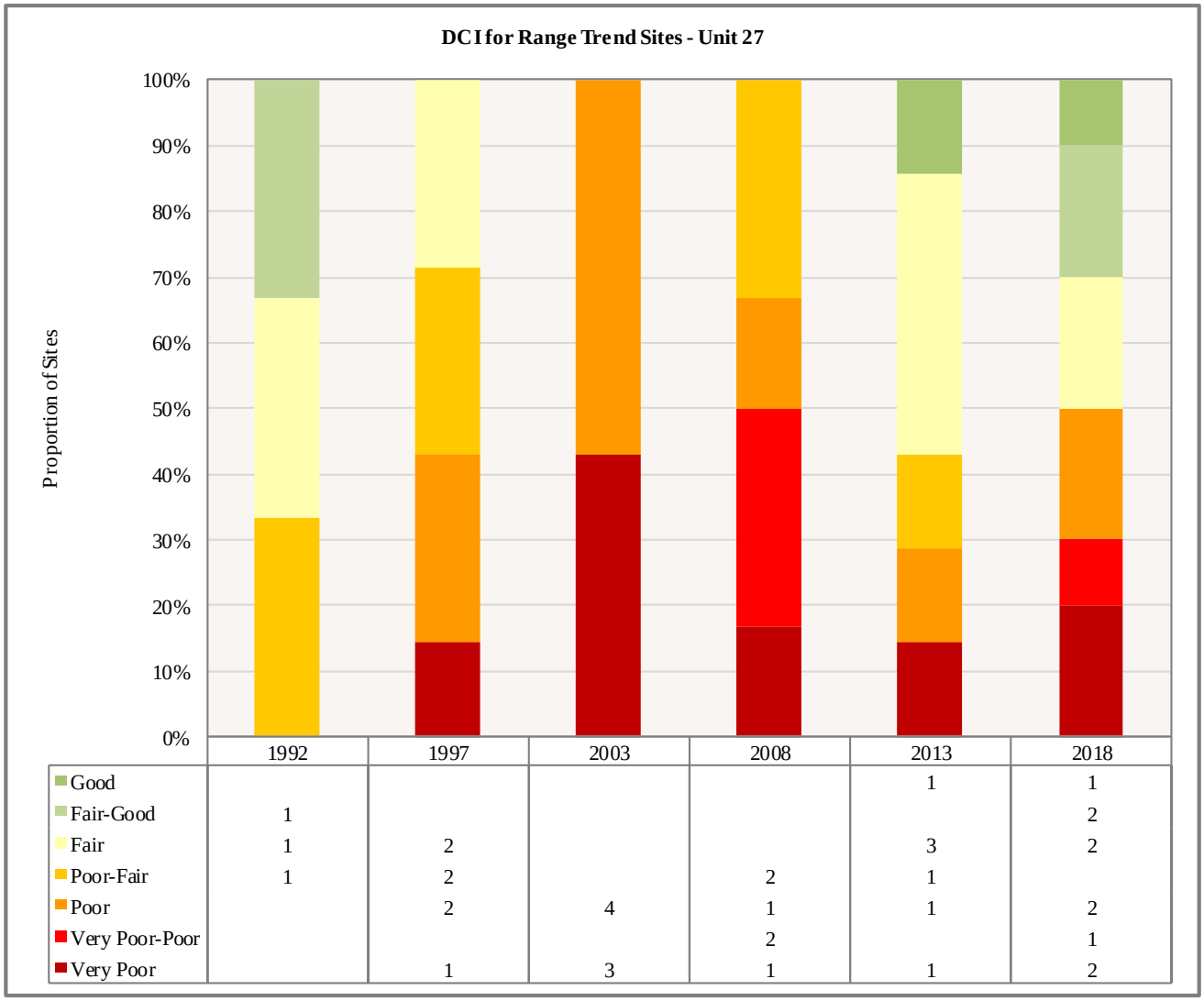


Figure 6.27: Average pellet transect data for Upland - Big Sagebrush, Upland Cliffrose, and Semidesert - Black Sagebrush study sites in WMU 27, Paunsaugunt.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Paunsaugunt management unit has fluctuated on the sites sampled since 1992. The active Range Trend sites sampled within the unit are considered to be in conditions varying from very poor to good condition as of the 2018 sample year (**Figure 6.28**, **Table 6.10**). The sole study site that is considered to be in good condition is the Fivemile Mountain study. There are two studies in fair-good condition: the Nephi Pasture I study and the Carly Knoll site. Another two studies are considered to be in fair condition, and these sites are the Nephi Pasture Exclosure Outside and Crocodile studies. In poor condition are the Jeppson Pond and John R. Flat Exclosure Outside studies. The Mustang Pond South study site falls in the very poor-poor condition category. Finally, the Buckskin Mountain and Telegraph Flat studies are considered to be in very poor condition, primarily due to significant amounts of annual grasses and few perennial species in the understory on the Buckskin Mountain site. The Telegraph Flat study is lacking in both understory vigor as well as preferred browse cover.

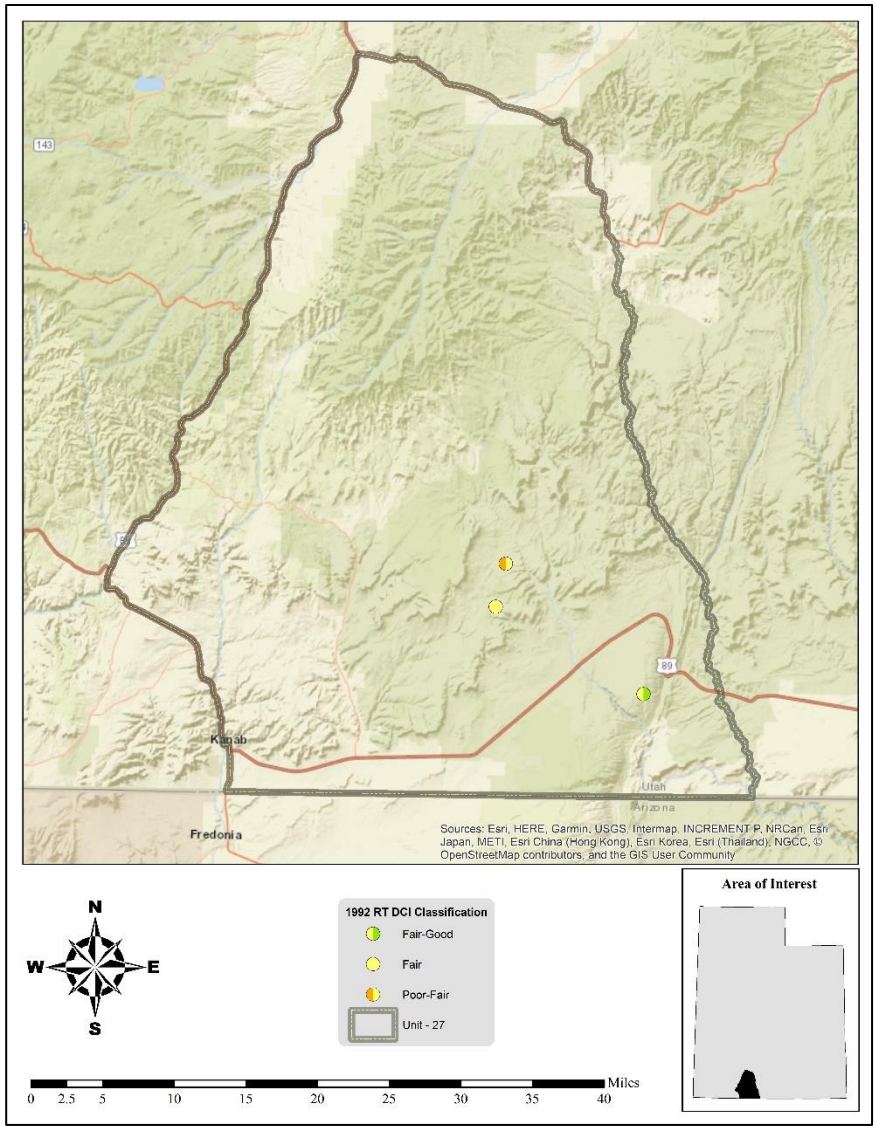


	1992	1997	2003	2008	2013	2018
Good					1	1
Fair-Good	1					2
Fair	1	2			3	2
Poor-Fair	1	2		2	1	
Poor		2	4	1	1	2
Very Poor-Poor				2		1
Very Poor		1	3	1	1	2

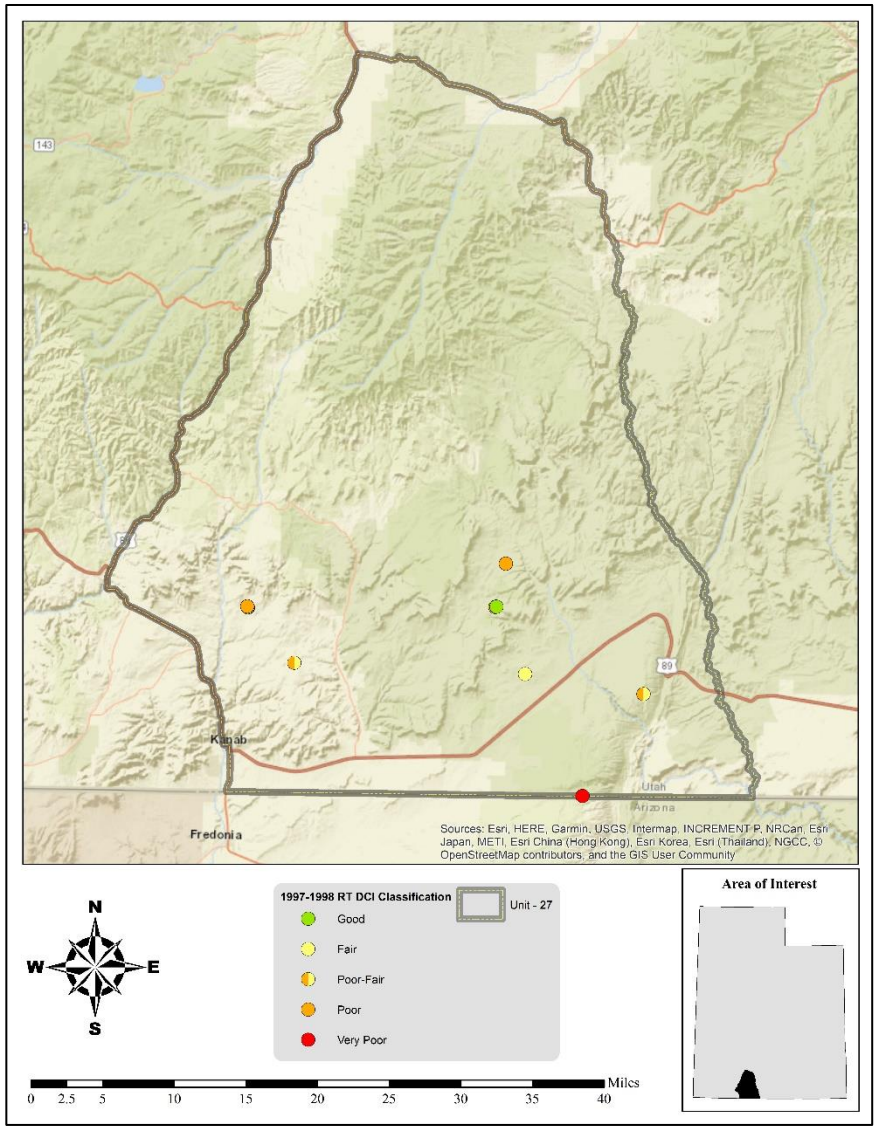
Figure 6.28: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 27, Paunsaugunt.

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
27-06	1992	30	2.1	9.5	8.8	0	1.1	0	**51.6**	**P-F**
27-06	1997	24.8	4.5	5.3	8.3	-1	2.8	0	**44.7**	**P**
27-06	2003	29.8	3.9	0	1.4	0	4.7	0	**39.8**	**P**
27-06	2008	30	4.6	10.3	2.3	0	1.6	0	**48.8**	**P-F**
27-06	2013	30	10	14.1	5.7	-0.2	2.6	0	**62.2**	**F**
27-06	2018	30	10.8	9.6	8.2	0	7.3	0	**65.9**	**F-G**
27-07	1992	30	8.3	15	3.9	-0.1	2.2	0	**59.3**	**F**
27-07	1997	28.9	9.2	9.6	3.7	-2	4.3	0	**53.7**	**F**
27-07	1998	20.3	9	7.8	4	-3.8	3.3	0	**40.5**	**P**
27-07	2003	30	3.4	4.6	0.8	0	3.1	0	**41.9**	**P**
27-07	2008	30	3.9	4.2	0.1	0	6	0	**44.2**	**P**
27-07	2013	30	12.2	9.4	0.7	0	6.9	0	**59.2**	**F**
27-07	2018	30	12.7	1.7	0.1	0	9.4	0	**54**	**F**
27-08	1992	28	7.8	6.2	4.9	-0.3	1	-2	**45.6**	**F-G**
27-08	1997	16.1	5.8	0.9	4.8	-1.9	0.4	0	**26.1**	**P-F**
27-08	2003	18.1	-3.2	0.8	4.9	-5.6	0.2	0	**15**	**P**
27-08	2008	22.8	-2.9	0.9	4.8	-0.4	0.1	0	**25.3**	**P-F**
27-08	2013	28.8	9.7	4.5	6.9	-0.1	0.8	0	**50.6**	**G**
27-08	2018	29	10.5	1.5	9.7	-0.9	0.6	0	**50.2**	**G**
27-09	1997	25	6.7	9.6	0.7	-19	0.1	0	**23.1**	**VP**
27-09	2003	21.7	6.2	3.8	0.1	-15.3	0	0	**16.6**	**VP**
27-09	2008	17.4	-7.2	2	0.1	-5.7	0	0	**6.6**	**VP**
27-09	2013	30	7.6	4	1.8	-2.3	0.4	0	**41.5**	**P**
27-09	2018	24.2	6.9	3.8	0.9	-11.7	0	0	**24.2**	**VP**
27-10	1997	17.3	12.2	15	12.3	0	0.5	0	**57.2**	**F**
27-10	2003	22.9	3.9	3.2	0.6	0	0.2	0	**30.7**	**VP**
27-10	2008	30	-1.1	5.5	0.2	0	0.1	0	**34.7**	**VP-P**
27-10	2013	30	10.3	13.3	0.5	0	0.1	0	**54.1**	**F**
27-10	2018	2.3	0	0	0	0	0.1	0	**2.3**	**VP**
27-11	1997	19.2	12.7	9.9	8.2	-0.1	0.3	0	**50.1**	**P-F**
27-11	2003	30	1.9	3.7	5	0	1	0	**41.7**	**P**
27-11	2008	30	0.7	3	2	0	0.1	0	**35.7**	**VP-P**
27-11	2013	30	8.7	2.4	6.3	-0.1	2.1	0	**49.3**	**P-F**
27-11	2018	30	8.8	3.8	13.3	0	0.7	0	**56.5**	**F**
27-14	2013	11.6	7.2	6.3	3.1	-2.8	1	0	**26.4**	**VP**
27-14	2018	21.2	11	9.7	4.4	-9.8	0.1	0	**36.7**	**VP-P**
27-15	2018	28.2	10	4.7	0.1	-0.6	0	0	**42.4**	**P**
27-16	2018	30	14.9	5.2	4.2	-0.2	10	0	**64.1**	**F-G**
27R-3	1998	8.8	5.7	14	6.4	0	2.3	0	**37.2**	**P**
27R-3	2003	7	2.7	3.4	4.4	0	0.5	0	**18.1**	**VP**
27R-3	2018	13.5	13.1	0	14.4	0	3.3	0	**44.2**	**P**

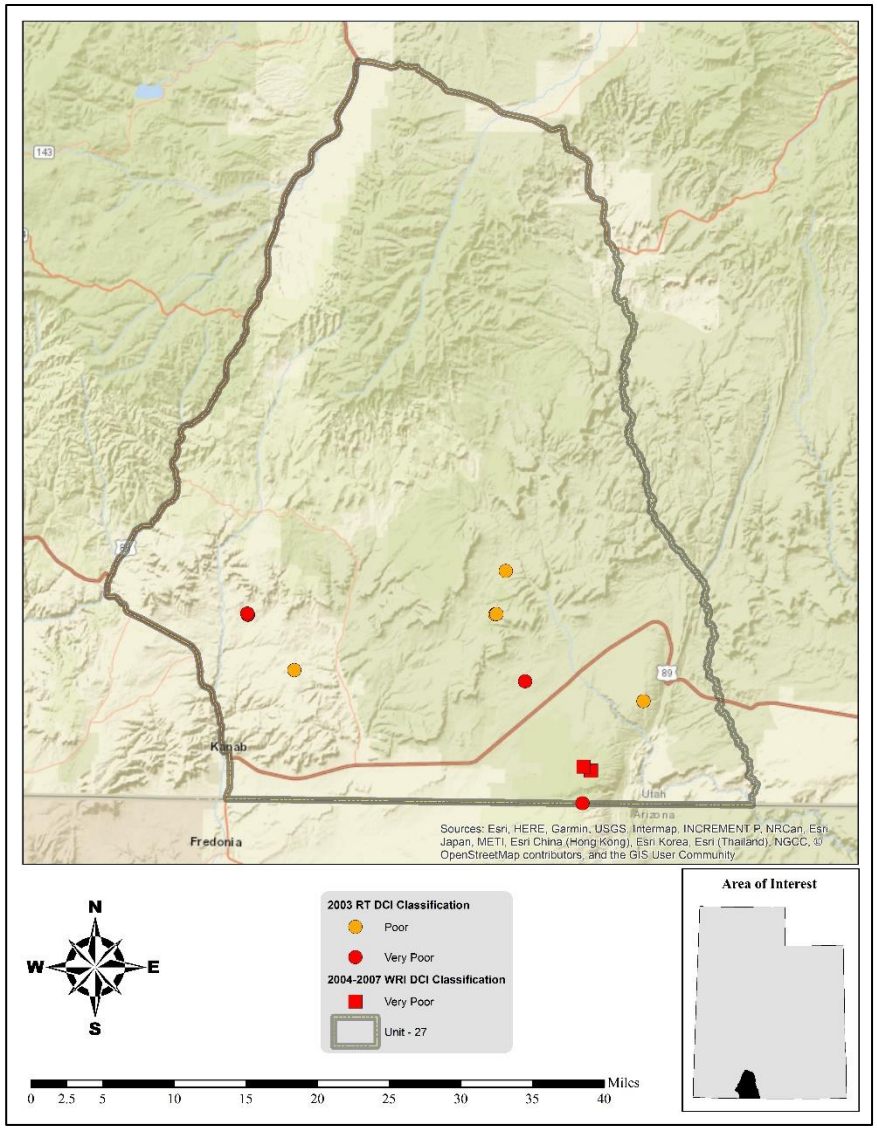
Table 6.10: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 27, Paunsaugunt. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



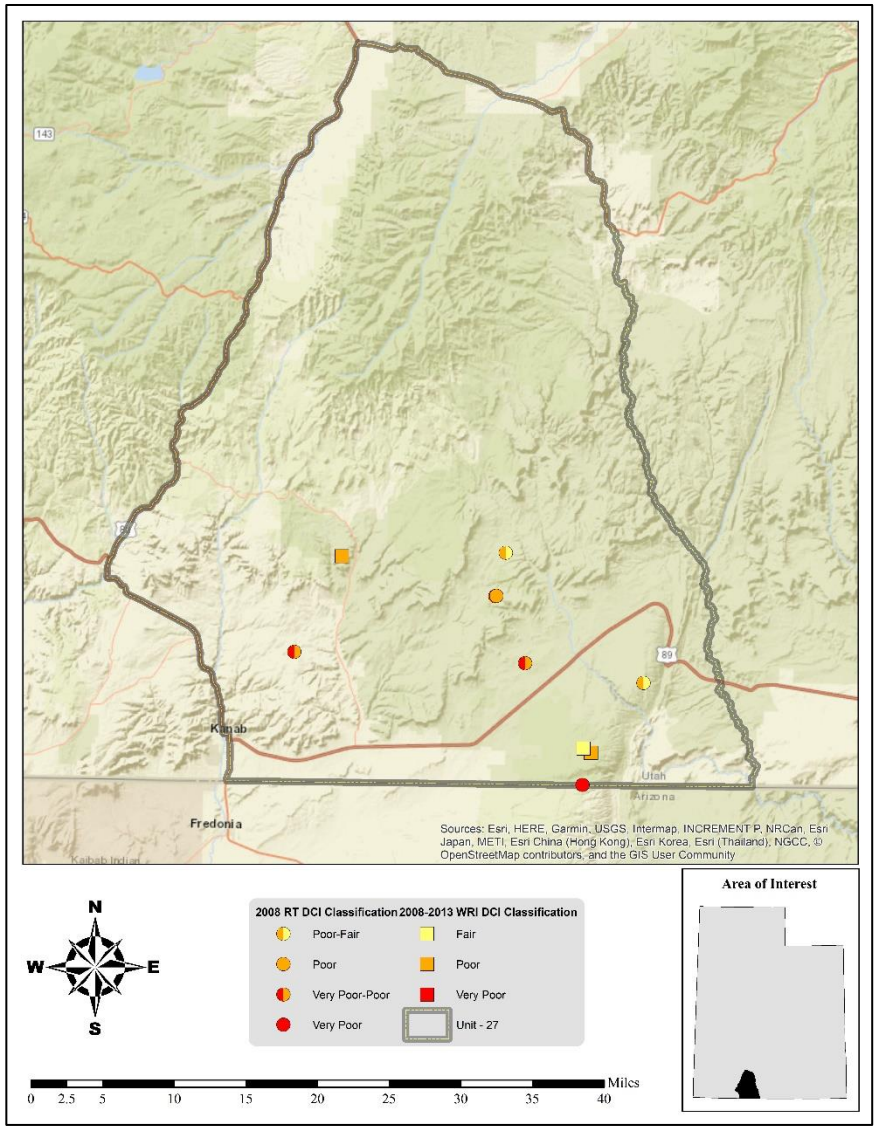
Map 6.9: 1992 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.



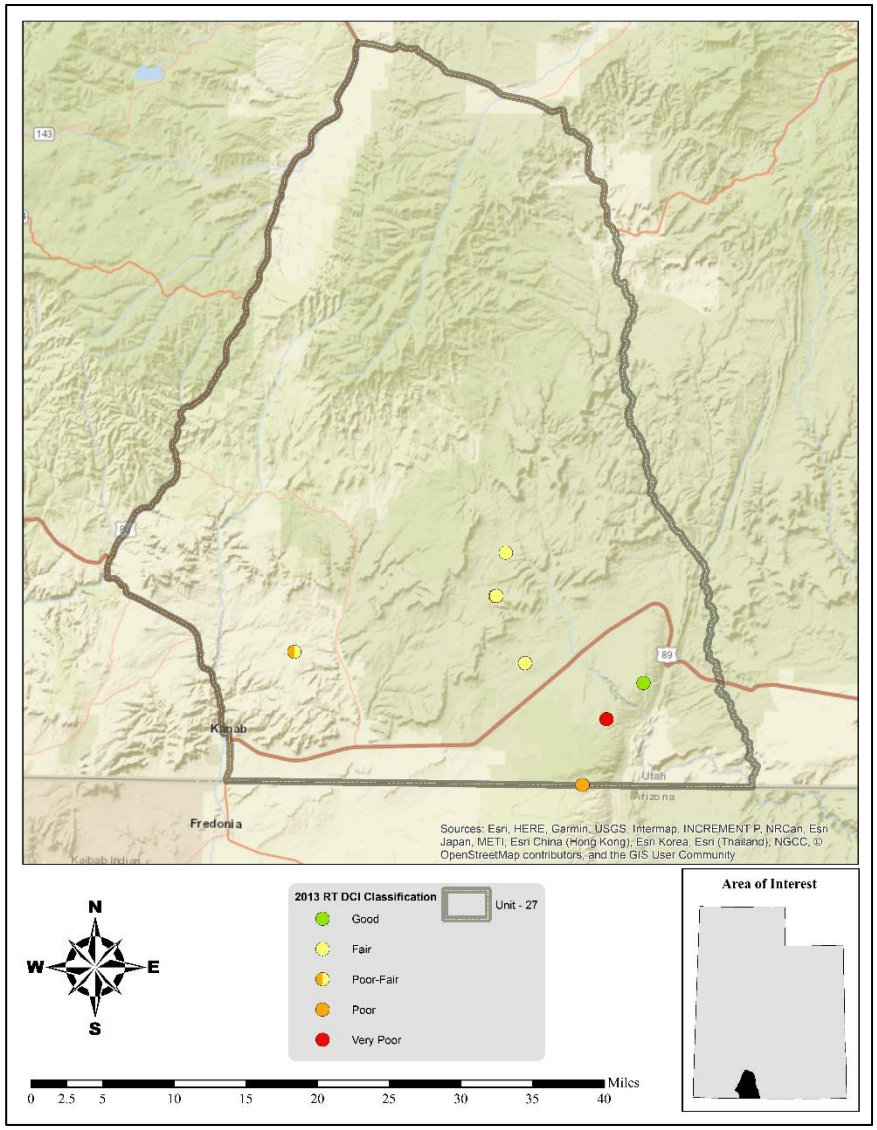
Map 6.10: 1997-1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.



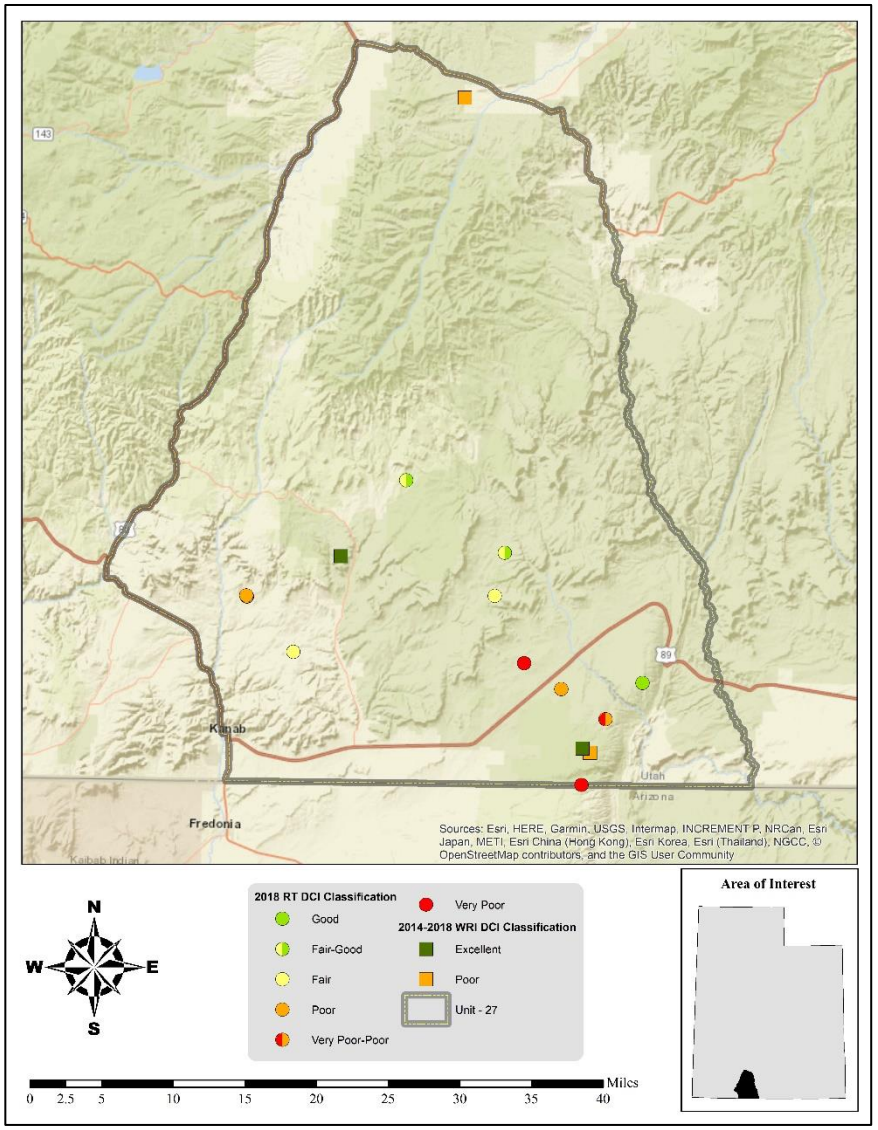
Map 6.11: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.



Map 6.12: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.



Map 6.13: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.



Map 6.14: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 27, Paunsaugunt.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
27-01	Proctor Canyon	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-02	Ahlstrom Hollow	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Energy Development	Low	Fragmentation and degradation/loss of habitat
27-03	Whiteman Bench	None Identified		
27-05	Podunk Creek	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
27-06	Nephi Pasture 1	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
27-07	Nephi Pasture Exclosure Outside	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-08	Fivemile Mountain	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-09	Buckskin Mountain	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
27-10	Telegraph Flat	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-11	Crocodile	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-12	Moons Landing	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-13	Heaton	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
27-14	Mustang Pond South	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-15	Jeppson Pond	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27-16	Carly Knoll	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-01	John R. Flat Total Exclosure	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-02	John R. Flat Livestock Exclosure	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-03	John R. Flat Exclosure Outside	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
27R-04	Nephi Pasture Total Exclosure	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
27R-05	Nephi Pasture Livestock Exclosure	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
27R-17	Buckskin 2	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-18	Buckskin 1	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-19	Alton-Millcreek 2	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-20	Hatch Bench	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-22	Pine Point Handthin	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-23	UKC Thompson Creek	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-24	Hatch Bench 2	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
27R-25	Sieler Creek	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Conifer Encroachment	Low	Reduced understory shrub, aspen stand, and herbaceous vigor
27R-26	Crawford Creek	Conifer Encroachment	High	Reduced understory shrub, aspen stand, and herbaceous vigor
27R-27	Johnson Bench	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		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 27, Paunsaugunt. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Ponderosa Pine)

The study that is considered to be of the Mountain (Ponderosa Pine) ecological type is classified as deer and elk summer range within this management unit. These communities are host to robust understories and shrub populations that can support deer and elk during the summer season. No threats were noted on this study site.

If reseeding is ever necessary to restore herbaceous communities in areas of this ecological type, care should be taken in seed selection and preference should be given to native species whenever this is possible.

Mountain (Black/Low Sagebrush)

All of the studies of the Mountain (Black/Low Sagebrush) ecological type are considered to be summer range. These communities support robust herbaceous communities and mixed browse that provide varied feed for summering animals within the Paunsaugunt unit. Conifer communities are present on the Ahlstrom Hollow study and the site is currently considered to be in Phase I of woodland succession. In addition, annual grasses are present on both sites: these grasses can increase fuel loads and raise the risk of wildfire.

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

Mountain (Shrub)

The two Mountain (Shrub) ecological sites are considered to be summer habitat for deer and elk on this unit. This community type generally supports shrubs and a robust herbaceous understory to provide a variety of feed for summering big game. As the Desirable Components Index is based on mule deer winter range, it is not used for these sites. Perennial grasses and forbs provided good cover on these studies. Some annual and introduced perennial grasses were sampled on the Proctor Canyon study. Pinyon-juniper communities are present on the Ahlstrom Hollow site and are currently considered to be in Phase I of woodland succession.

In areas with conifer encroachment or infill, a tree-removing disturbance is recommended (e.g. bullhog, chaining, lop and scatter, etc.) where it would be beneficial. Areas with high cover of annual grasses or introduced perennial grasses should be monitored and if these levels are sustained, treatments would be advisable to reduce these species. Possible annual grass-reducing treatments include changes in grazing management and herbicide treatments, among others. 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.

Semiwet (Fresh Meadow)

The study considered to be of the Semiwet (Fresh Meadow) ecological type is considered to be summer habitat for both elk and deer. A robust understory providing forage for summering big game animals is typical of this ecological type. However, introduced perennial grass species are present and have the potential to reduce understory diversity, particularly in high-elevation sites such as this.

Areas with high cover of introduced perennial grasses should be monitored and if these levels are sustained, treatments to reduce these species are advisable. If reseeding occurs, preference should be given to native species when possible.

Upland (Big Sagebrush)

The studies of the Upland (Big Sagebrush) ecological type are considered to be deer winter range. These studies in the Paunsaugunt management unit host browse communities that support deer populations over the winter. Pinyon-juniper communities are present on all of the sites and are currently considered to be in Phase I to Phase II of woodland succession. Introduced perennial grasses have been sampled on the Carly Knoll study: these grasses can lead to reduced understory diversity. In addition, annual grasses have been present on some of the sites. These grasses pose a threat to the resilience of the ecological system as they can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern.

It is recommended that treatments for pinyon-juniper (e.g. bullhog, chaining, lop and scatter, etc.) be implemented in areas where it would be beneficial to the habitat. Treatments to reduce annual grasses or aggressive introduced perennial grasses are advisable in areas where the ecological integrity is threatened. If reseeding is needed to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species when possible.

Upland (Cliffrose)

The sites classified as Upland (Cliffrose) ecological types are considered to be deer winter range and support browse populations that provide good browse for wintering deer herds. Pinyon-juniper communities are present on all of the sites. Tree stands on these studies are currently considered to be in Phase I and some are transitioning to Phase II of woodland succession. Annual grasses have been present on all of the sites in moderate amounts. These annual grass species pose a threat to the resilience of the ecological system as they can shift the dynamics of the plant community, with annual grass monocultures and more frequent wildfires being a concern.

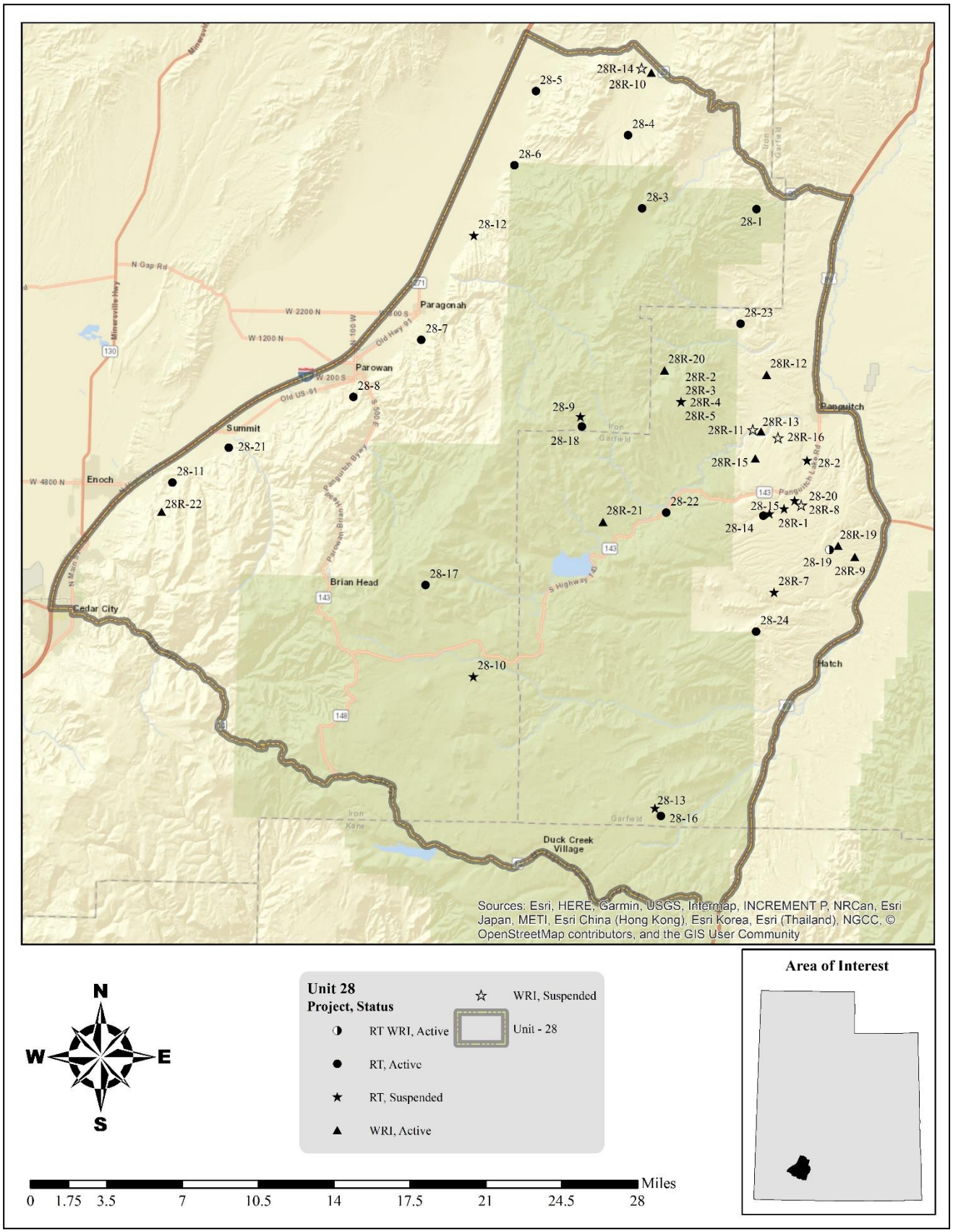
Treatments for pinyon-juniper (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in areas where it would be beneficial to the habitat. For the herbaceous understory, herbicide treatments and grazing management changes are possible treatments for the undesirable graminoid species. If reseeding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

Semidesert (Black/Low Sagebrush)

This site classified as a Semidesert (Black/Low Sagebrush) ecological site hosts plant communities that provide cover and forage for wintering deer herds. Undesirable annual grasses have been present within the herbaceous community. These annual grass species pose a threat to the resilience of the ecological system as they can shift the dynamics of the plant community, with monocultures and more frequent wildfires being a concern. Pinyon juniper communities are present on this site and are currently considered to be in Phase I of woodland succession; other areas in this ecological type likely have encroachment occurring as well.

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

7. WILDLIFE MANAGEMENT UNIT 28 – PANGUITCH LAKE



WILDLIFE MANAGEMENT UNIT 28 – PANGUITCH LAKE

Boundary Description

Garfield, Iron, and Kane counties - Boundary begins at SR-14 and US-89; north on US-89 to SR-20; west on SR-20 to I-15; south on I-15 to SR-14; east on SR-14 to US-89.

Management Unit Description

Geography

The Panguitch Lake wildlife management unit includes the section of the Colorado Plateau that falls between I-15 and US-89. The unit also contains the Markagunt Plateau, Cedar Breaks National Monument, Upper Bear Valley, Buckskin Valley, and Grass Valley. Brian Head Peak, the highest point of the Markagunt Plateau, reaches an elevation of 11,307ft. The lowest point is about 5,700ft and occurs along I-15. Towns in this area include Parowan, Paragonah, Panguitch, and Hatch.

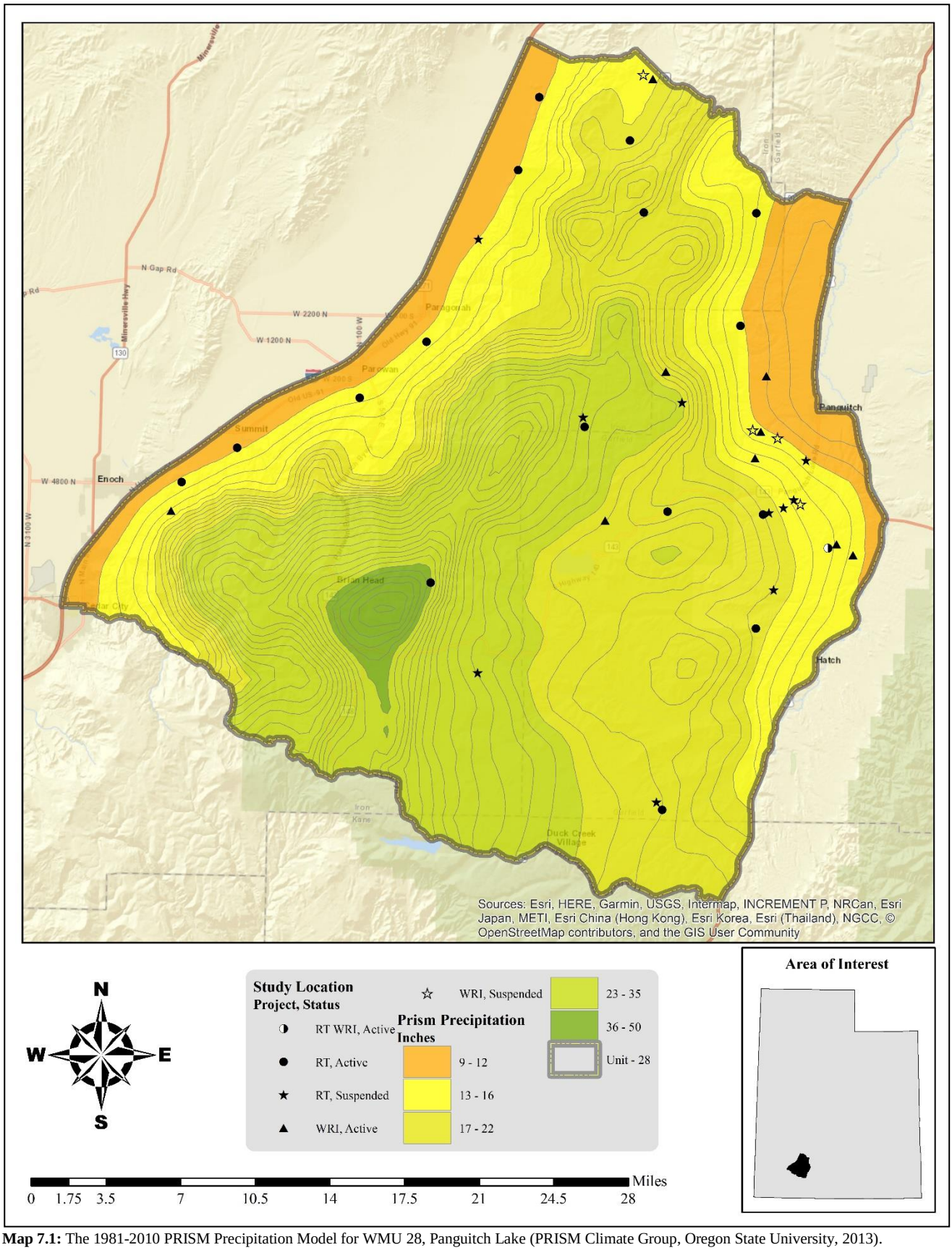
The Cedar Breaks National Monument area serves as the headwaters of the Mammoth Creek tributary of the Sevier River. Panguitch Creek flows into Panguitch Lake, which also feeds into the Sevier River. This management unit also includes Three Creeks Drainage, Buckskin Wash, Bear Creek, and Rattlesnake and Ashdown Creeks, which flow through the Ashdown Gorge Wilderness area.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 10 inches in the far northeastern portion of the unit near Panguitch to 41 inches on the high-elevation peak of Brian Head. All of the Range Trend and WRI monitoring studies in the unit occur within 12-36 inches of precipitation (**Map 7.1**) (PRISM Climate Group, Oregon State University, 2013).

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

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 7.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 7.1b**) (Time Series Data, 2019).



Map 7.1: The 1981-2010 PRISM Precipitation Model for WMU 28, Panguitch Lake (PRISM Climate Group, Oregon State University, 2013).

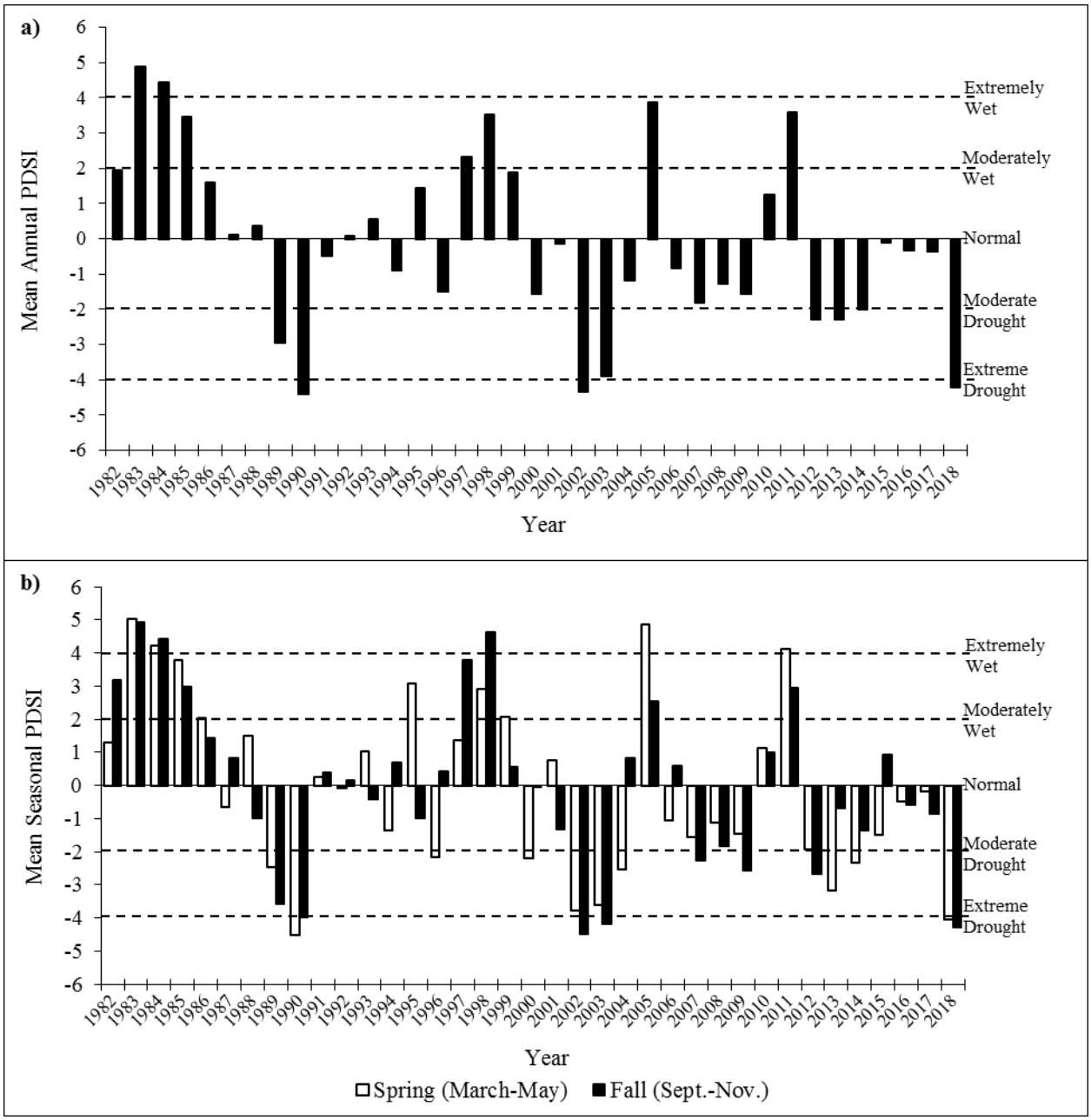


Figure 7.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

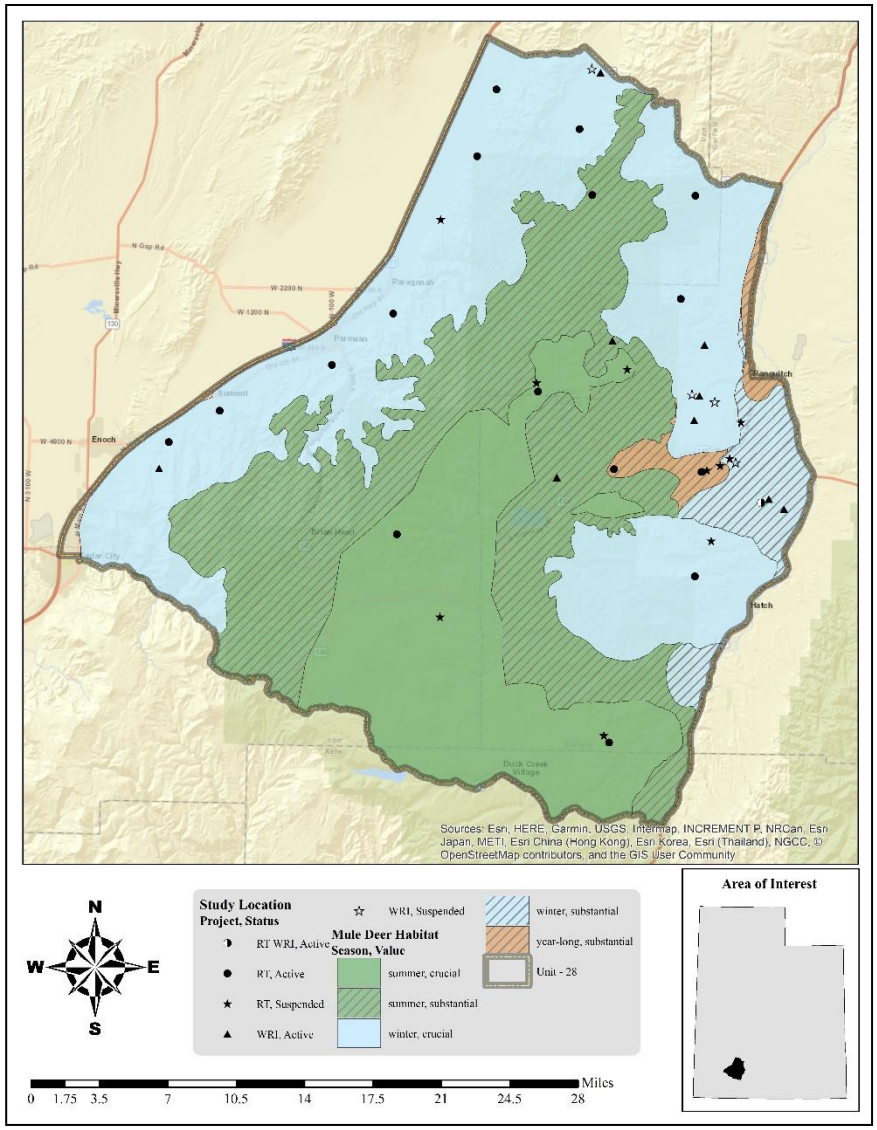
Big Game Habitat

An estimated 561,639 acres are considered to be mule deer winter range within Unit 28, with 54% classified as summer range, 44% as winter range, and 2% as year-long range (**Table 7.1**, **Map.7.2**). 46% of the deer winter range is managed by the Bureau of Land Management (BLM), private land owners and the United States Forest Service (USFS) each administer 23%, and the Utah School and Institutional Trust Lands Administration (SITLA) and Utah Division of Wildlife Resources (UDWR) manage 4% each (**Table 7.2**, **Map.7.2**, **Map 7.5**). Of the elk winter range, 43% is managed by the BLM, 39% is administered by the USFS, 11% is privately owned, the UDWR administers 4%, and SITLA manages the remaining 2% (**Table 7.3**, **Map 7.3**, **Map 7.5**).

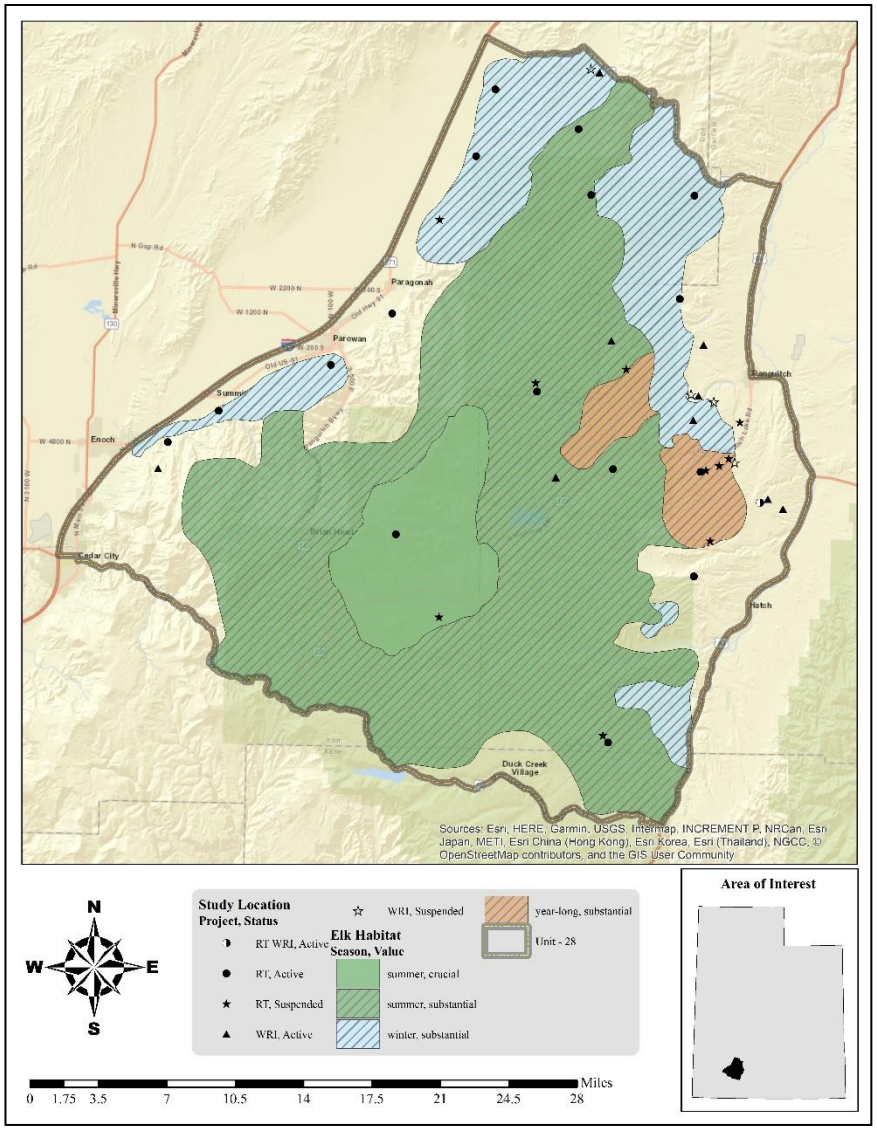
The winter range on the eastern portion of the unit is higher in elevation and experiences colder temperatures than on the Parowan side, and consequently, far fewer deer winter on the Panguitch side. Key areas that were identified on the winter range on the eastern side of the unit include the following: pinyon-juniper (*Pinus sp.* and *Juniperus sp.*) woodlands south of Panguitch, seeded range at the north end of Upper Bear Valley, the mixed brush type in Buckskin Valley, and the pinyon-juniper chaining in the Three Creeks drainage. These study sites range in elevation from 7,100 to 7,600 feet and represent key areas within the limits of normal winter range on the east side. The only severe winter range available on the unit is located on the pinyon-juniper slopes below the Hurricane Cliffs and on the sagebrush flats that extend from the slopes to I-15. During severe winters the deer on this herd unit are packed into the narrow area between the cliffs and I-15. Habitat availability is effectively reduced by 80% during these severe winters.

The key areas that were identified by the local interagency committee for this unit include the Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) type west of Swayback Knoll, a Wyoming big sagebrush type in the mouth of Cottonwood Creek, a pinyon-juniper chaining east of Paragonah, a large sagebrush/pinyon-juniper ecotone in Grass Valley south of Parowan, and a mountain big sagebrush (*A. tridentata* ssp. *vaseyana*)/pinyon-juniper ecotone in Elliker Basin. The importance of each of these areas for deer has increased over the years as sagebrush flats have been converted into agricultural lands.

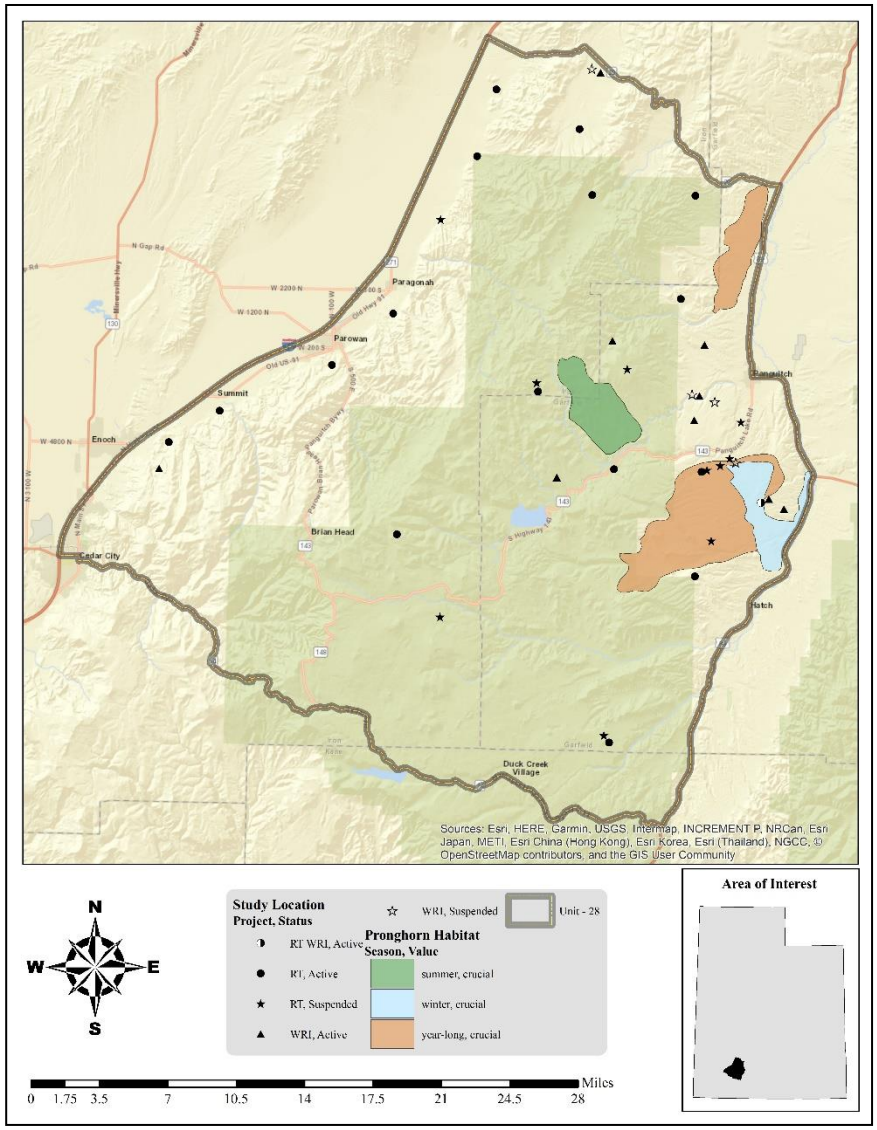
Summer range is not considered to be a limiting factor for this deer herd. Summer range on the northern portion of the unit generally lies between 8,000 and 9,000 feet and consists largely of gentle rolling terrain. Summer ranges on the south side of the unit reach elevations of over 10,000 feet bordering Cedar Breaks National Monument.



Map.7.2: Estimated mule deer habitat by season and value for WMU 28, Panguitch Lake.



Map 7.3: Estimated elk habitat by season and value for WMU 28, Panguitch Lake.



Map 7.4: Estimated pronghorn habitat by season and value for WMU 28, Panguitch Lake.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	305,263	54%	246,419	44%	9,957	2%
Elk	311,273	74%	86,302	21%	21,165	5%
Pronghorn	278,673	15%	221,282	12%	1,330,110	73%

Table 7.1: Estimated mule deer, elk, and pronghorn habitat acreage by season for WMU 28, Panguitch Lake.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	8,660	3%	114,028	46%	3,478	35%
Private	55,040	18%	56,232	23%	3,543	36%
SITLA	1,684	1%	10,484	4%	139	1%
USFS	233,446	76%	56,536	23%	2,797	28%
UDOT	4	<1%	0	0%	0	0%
UDWR	434	<1%	9,140	4%	0	0%
NPS	5,995	2%	0	0%	0	0%
Total	305,263	**100%**	246,419	**100%**	9,957	**100%**

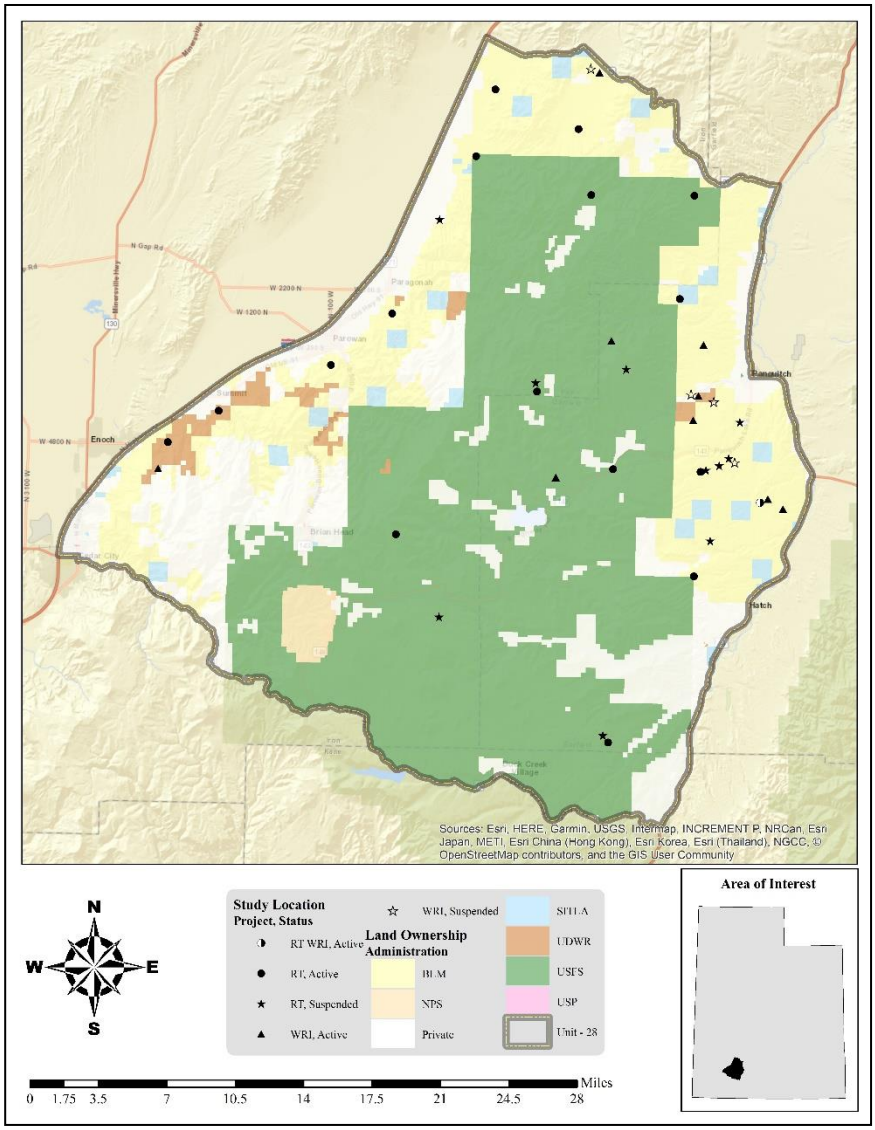
Table 7.2: Estimated mule deer habitat acreage by season and ownership for WMU 28, Panguitch Lake.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	14,482	5%	37,180	43%	9,306	44%
Private	56,125	18%	9,679	11%	457	2%
SITLA	2,179	1%	1,942	2%	1,782	8%
USFS	231,233	74%	33,641	39%	9,620	45%
UDOT	4	<1%	0	0%	0	0%
UDWR	1,255	<1%	3,861	4%	0	0%
NPS	5,995	2%	0	0%	0	0%
Total	311,273	**100%**	86,302	**100%**	21,165	**100%**

Table 7.3: Estimated elk habitat acreage by season and ownership for WMU 28, Panguitch Lake.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	187,939	85%	1,181,126	89%
Private	1,371	<1%	31,256	14%	34,205	3%
SITLA	0	0%	2,087	1%	3,413	<1%
USFS	277,302	100%	0	0%	111,366	8%
Total	278,673	**100%**	221,282	**100%**	1,330,110	**100%**

Table 7.4: Estimated pronghorn habitat acreage by season and ownership for WMU 28, Panguitch Lake.



Map 7.5: Land ownership for WMU 28, Panguitch Lake.

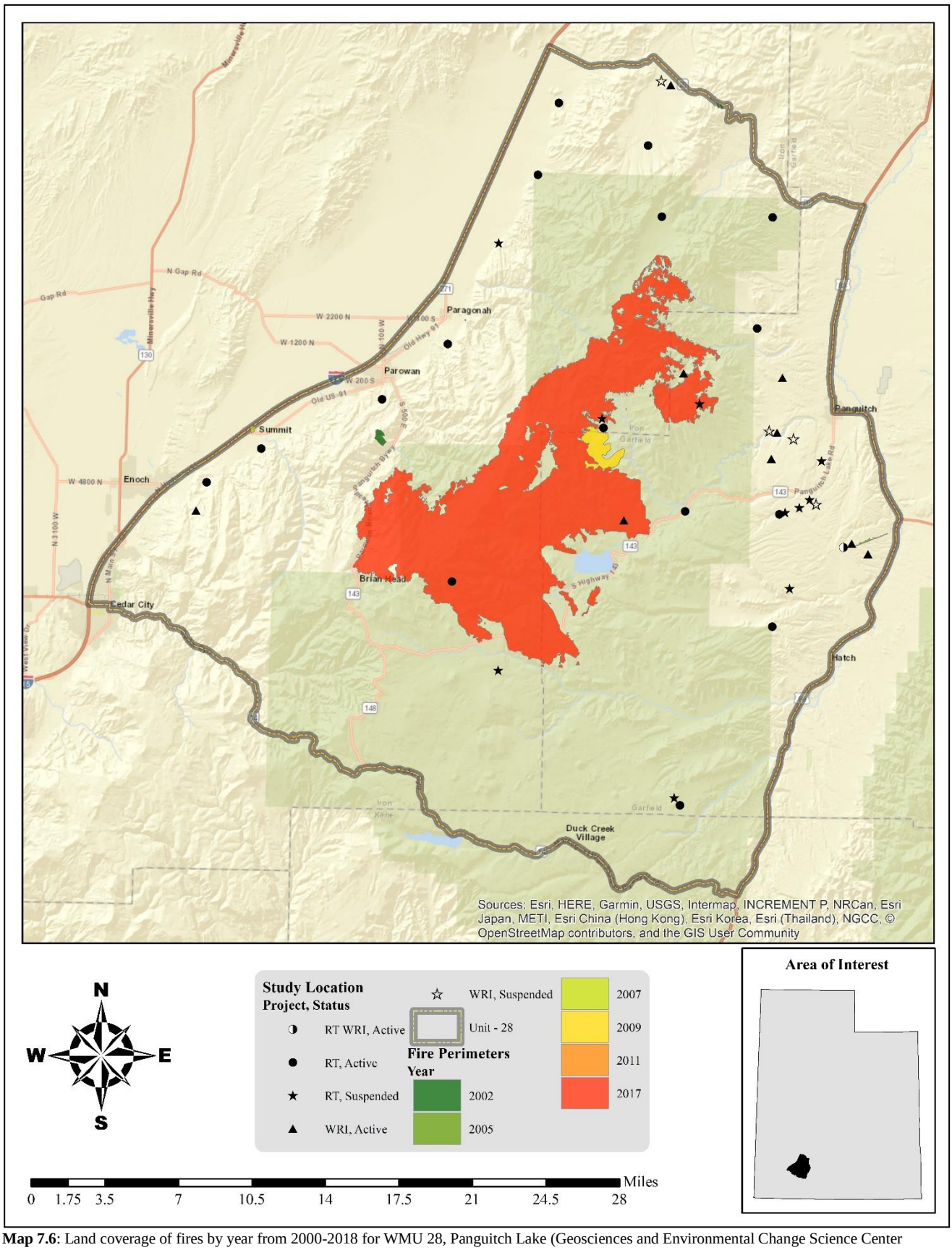
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	164,042	29.02%	
	Ponderosa Pine Forest, Woodland and Savanna	43,325	7.67%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	38,154	6.75%	
	Mountain Mahogany Woodland and Shrubland	17,998	3.18%	
	Spruce-Fir Forest and Woodland	16,605	2.94%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	2,708	0.48%	
	Juniper Woodland and Savanna	481	0.09%	
	Lodgepole Pine Forest and Woodland	319	0.06%	
	Limber Pine Woodland	307	0.05%	50.24%
Exotic Herbaceous	Introduced Annual Grassland	6,754	1.19%	
	Introduced Perennial Grassland and Forbland	697	0.12%	
	Introduced Annual and Biennial Forbland	337	0.06%	1.38%
Grassland	Alpine Dwarf-Shrubland, Fell-field and Meadow	7,175	1.27%	
	Grassland	2,777	0.49%	
	Dry Tundra	18	0.00%	1.76%
Shrubland	Low Sagebrush Shrubland and Steppe	37,478	6.63%	
	Big Sagebrush Shrubland and Steppe	23,274	4.12%	
	Desert Scrub	17,057	3.02%	
	Deciduous Shrubland	16,088	2.85%	
	Chaparral	11,794	2.09%	
	Greasewood Shrubland	559	0.10%	
	Salt Desert Scrub	378	0.07%	
	Other Shrubland	96	0.02%	18.88%
Other	Conifer-Hardwood	72,173	12.77%	
	Hardwood	26,573	4.70%	
	Developed	18,957	3.35%	
	Barren	15,160	2.68%	
	Riparian	8,832	1.56%	
	Agricultural	7,344	1.30%	
	Sparsely Vegetated	6,436	1.14%	
	Open Water	1,301	0.23%	
	Quarries-Strip Mines-Gravel Pits	23	0.00%	27.74%
Total		565,218	100%	100%

Table 7.5: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 28, Panguitch Lake.

Limiting Factors to Big Game Habitat

Many sagebrush flats have been converted to sprinkler-irrigated agricultural lands; mainly from UT-20 to Parowan. Due to depredation problems, deer fences were constructed around many of these fields. In addition, the deer-proof fence along the I-15 corridor severely limits the winter range available to deer on the west side of the freeway. Urbanization of former winter range is continuing, especially in the Fiddler's Canyon area north of Cedar City. Of particular concern is the fact that much of the severe winter range from U-20 to Cedar City is privately owned; additional habitat losses are to be expected on these privately owned land parcels. In June-July of 2017, the Brian Head wildfire burned approximately 71,692 acres on the unit (**Map 7.6**). Although some sagebrush and mountain brush communities were burned, a majority of the affected area was dominated by quaking aspen (*Populus tremuloides*) and conifer plant communities.

The current LANDFIRE Existing Vegetation Coverage model shows that 29% of Unit 28 is comprised of pinyon-juniper stands (**Table 7.5**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components (Miller, Svejcar, & Rose, 2000), therefore decreasing available forage for wildlife.



Map 7.6: Land coverage of fires by year from 2000-2018 for WMU 28, Panguitch Lake (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

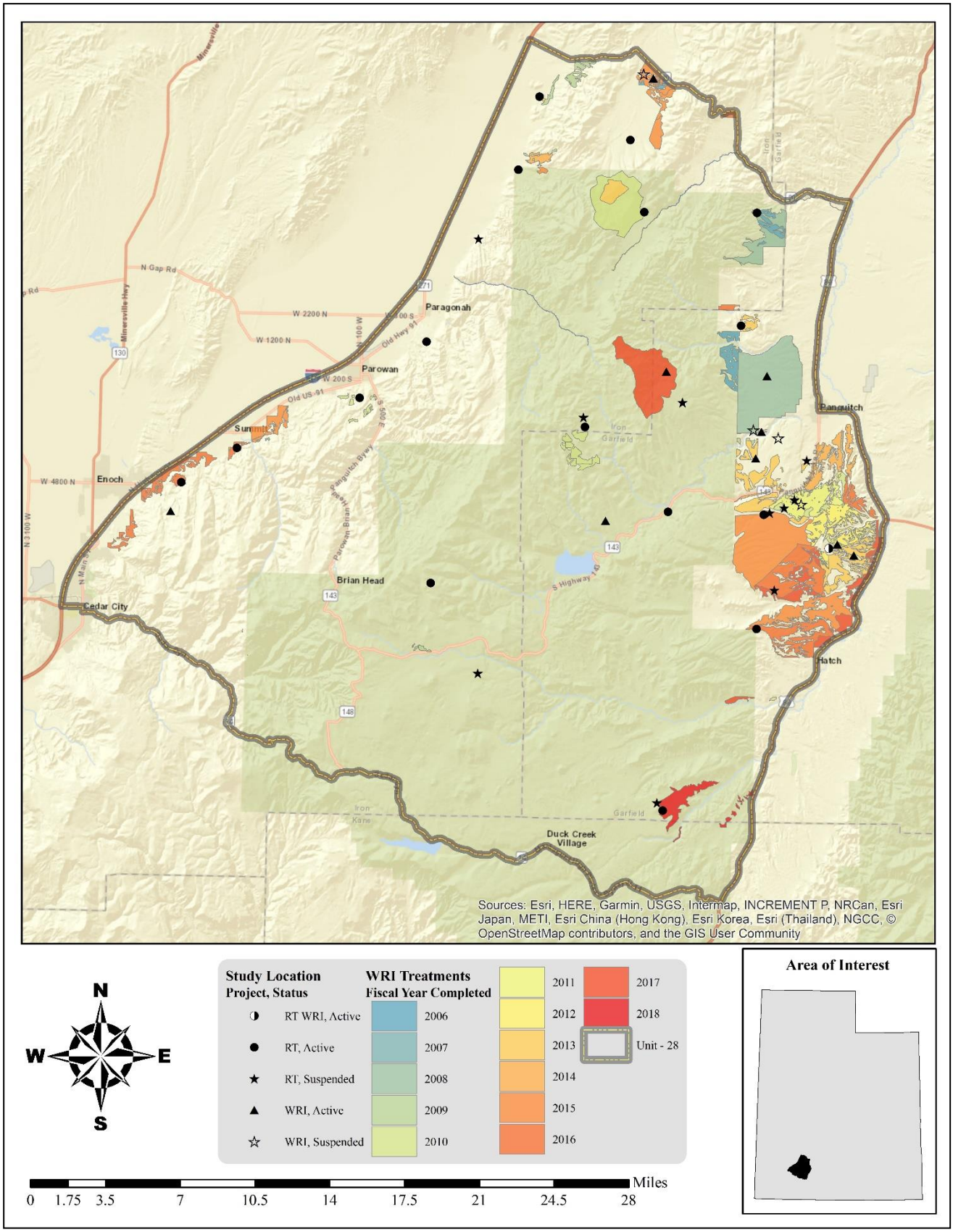
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 43,308 acres of land have been treated within the Panguitch Lake subunit since WRI was implemented in 2004 (**Map 7.7**). An additional 11,480 acres are currently being treated, 14,776 acres are pending completion, and treatments have been proposed for 4,912 acres. Treatments frequently overlap one another bringing the total treatment acres to 74,476 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.

Manual vegetation removal such as lop and scatter treatments to remove trees is the most common management practice in the Panguitch Lake unit. Bullhog projects to remove pinyon and juniper and seeding projects to augment the herbaceous understory are also very common. Other management practices include (but are not limited to): prescribed fires, anchor chaining to remove trees, harrow treatments, and mowing (**Table 7.6**).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**608**	**2,080**	**0**	**0**	**2,688**
Ely (One-Way)	332	0	0	0	332
Ely (Two-Way)	276	2,080	0	0	2356
Bullhog	**15,738**	**2,085**	**0**	**1,690**	**19,513**
Full size	14,083	1,928	0	1,690	17,701
Skid steer	1,655	157	0	0	1,812
Forestry practices	**0**	**0**	**0**	**193**	**193**
Thinning (commercial)	0	0	0	193	193
Harrow	**1,380**	**0**	**0**	**0**	**1,380**
≤15 ft. (One-Way)	456	0	0	0	456
≤15 ft. (Two-Way)	270	0	0	0	270
> 15 ft. (One-Way)	572	0	0	0	572
> 15 ft. (Two-Way)	82	0	0	0	82
Mowing	**1,238**	**0**	**0**	**0**	**1,238**
Brush Hog	1,112	0	0	0	1,112
Other	126	0	0	0	126
Prescribed Fire	**3,528**	**0**	**0**	**0**	**3,528**
Pile Burn	3,528	0	0	0	3,528
Seeding (Primary)	**1,925**	**0**	**15,265**	**213**	**17,403**
Broadcast (Aerial-Fixed Wing)	1,103	0	15,265	213	16,581
Broadcast (Aerial-Helicopter)	301	0	0	0	301
Drill (Rangeland)	21	0	0	0	21
Ground (Mechanical Application)	457	0	0	0	457
Hand Seeding	43	0	0	0	43
Seeding (Secondary/Shrub)	**344**	**0**	**0**	**68**	**412**
Hand Seeding	344	0	0	68	412
Vegetation Removal/Hand Crew	**24,091**	**7,288**	**0**	**2,760**	**34,139**
Lop & Scatter	23,990	7,183	0	1,906	33,079
Lop-Pile-Burn	101	105	0	854	1,060
Other	**0**	**28**	**0**	**0**	**28**
Road Decommissioning	0	28	0	0	28
Grand Total	**48,852**	**11,480**	**15,265**	**4,924**	**80,521**
*** Total Land Area Treated**	**43,308**	**11,480**	**14,776**	**4,912**	**74,476**

Table 7.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 28, Panguitch Lake. Data accessed on 02/18/2019.
*Does not include overlapping treatments.



Map 7.7: WRI treatments by fiscal year completed for WMU 28, Panguitch Lake.

Range Trend Studies

Range Trend studies have been sampled within WMU 28 on a regular basis since 1987, 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	Years Sampled	Ecological Site Description
28-01	Three Creeks	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Stony Loam (Mountain Big Sagebrush)
28-02	Panguitch	RT	Suspended	'87, '92, '98	Not Verified
28-03	Bear Valley	RT	Active	'87, '92, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
28-04	Buckskin Valley	RT	Active	'87, '92, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
28-05	Swayback Knoll	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
28-06	Cottonwood	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
28-07	Paragonah	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Stony Loam (Black Sagebrush)
28-08	Grass Valley	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
28-09	Little Valley	RT	Suspended	'87, '92, '98	Not Verified
28-10	Red Desert	RT	Suspended	'87, '92, '98	Not Verified
28-11	Elliker Basin	RT	Active	'87, '92, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
28-12	Hurricane Cliffs	RT	Suspended	'87	Not Verified
28-13	Asay Knoll	RT	Suspended	'92, '98	Not Verified
28-14	Sheep Hollow West	RT	Active	'98, '03, '08, '13, '18	Mountain Loam (Black Sagebrush)
28-15	Sheep Hollow East	RT	Suspended	'98, '03, '08, '13	Upland Clay (Black Sagebrush)
28-16	Asay Bench	RT	Active	'03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
28-17	Sidney Valley	RT	Active	'03, '08, '13, '18	Subalpine Loam (Geranium)
28-18	Shakespeare Hollow	RT	Active	'03, '08, '13, '18	High Mountain Loam (Silver Sagebrush)
28-19	DD Hollow	RT/WRI	Active	'03, '11, '18	Upland Gravelly Loam (Black Sagebrush)
28-20	South Canyon	RT	Suspended	'03	Not Verified
28-21	South Summit WMA	RT	Active	'08, '13, '18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
28-22	Haycock Mountain	RT	Active	'13, '18	Mountain Loam (Mountain Big Sagebrush)
28-23	Threemile Creek	RT	Active	'13, '16, '18	Upland Stony Loam (Black Sagebrush)
28-24	Above Limerock Canyon	RT	Active	'18	Mountain Stony Loam (Antelope Bitterbrush)
28R-01	Panguitch III	RT	Suspended	'98	Not Verified
28R-02	Five Mile Ridge Cattle Exclosure	RT	Suspended	'98	Not Verified
28R-03	Five Mile Ridge Outside	RT	Suspended	'98	Not Verified
28R-04	Five Mile Ridge Wildlife Exclosure	RT	Suspended	'98	Not Verified
28R-05	Five Mile Ridge Total Exclosure	RT	Suspended	'98	Not Verified
28R-07	Sage Hen Hollow	RT	Suspended	'00, '01	Not Verified
28R-08	South Canyon Burn 1	WRI	Suspended	'05	Not Verified
28R-09	South Canyon 2	WRI	Active	'05, '12, '16	Upland Gravelly Loam (Black Sagebrush)
28R-10	Buckskin Valley Highway 20	WRI	Active	'05, '08, '09, '13, '17	Upland (Mountain Big Sagebrush-Indian Ricegrass)
28R-11	Five Mile Hollow	WRI	Suspended	'05	Not Verified
28R-12	Fivemile 2	WRI	Active	'07, '11, '15	Upland Loam (Black Sagebrush)
28R-13	Panguitch Creek	WRI	Active	'08, '11, '15	Upland (Mountain Big Sagebrush-Indian Ricegrass)
28R-14	Buckskin Valley Highway 20 Reference	WRI	Suspended	'09	Not Verified
28R-15	Panguitch Creek WMA	WRI	Active	'09, '10, '13, '17	Upland Shallow Hardpan (Black Sagebrush-Bluegrass)
28R-16	Panguitch Creek WMA Reference	WRI	Suspended	'09	Not Verified
28R-19	South Canyon	WRI	Active	'11, '14, '18	Upland Loam (Black Sagebrush)

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
28R-20	Indian Hollow	WRI	Active	'18	Mountain Shallow Loam (Ponderosa Pine)
28R-21	Williams Hollow	WRI	Active	'18	Mountain Stony Loam (Antelope Bitterbrush)
28R-22	Above Elliker Basin	WRI	Active	'18	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)

Table 7.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 28, Panguitch Lake.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
28-03	Bear Valley	Chain Unknown Seed Unknown		Historic Historic		
28-04	Buckskin Valley	Lop and Scatter	Little Bear Valley to Fremont Canyon Sagebrush Steppe Habitat Restoration (Proposed)	2018	4095	4402
28-05	Swayback Knoll	Wildfire Broadcast After Browse Seed Planter	Laub Laub and Cotton Fire Rehab Laub and Cotton Fire Rehab	Summer 2012 August-September 2012 August-September 2012	40 43 43	 2469 2469
28-06	Cottonwood	Chain Unknown Seed Unknown		1970 1970		
28-07	Paragonah	Chain Unknown Seed Unknown Lop and Scatter Lop and Scatter		Historic Historic Between 1998 and 2003 Between 2008 and 2013		
28-08	Grass Valley	Chain Unknown Seed Unknown Lop and Scatter		Mid-1960s Mid-1960s Between 1998 and 2003		
28R-01	Panguitch III	Aerial Before Bullhog Lop and Scatter	South Canyon South Canyon South Canyon (Sunset Cliffs) (Proposed)	October 2010 December 2010-April 2011 2019	1749 1749 1749	1716 1716 4488
28R-02	Five Mile Ridge Cattle Exc.	Wildfire Aerial After	Brian Head Brian Head Fire Rehabilitation	June-July 2017 September-October 2017	71693 6882	 4358
28R-03	Five Mile Ridge Outside	Wildfire Aerial After	Brian Head Brian Head Fire Rehabilitation	June-July 2017 September-October 2017	71693 6882	 4358
28R-04	Five Mile Ridge Wildlife Exc.	Wildfire Aerial After	Brian Head Brian Head Fire Rehabilitation	June-July 2017 September-October 2017	71693 6882	 4358
28R-05	Five Mile Ridge Total Exc.	Wildfire Aerial After	Brian Head Brian Head Fire Rehabilitation	June-July 2017 September-October 2017	71693 6882	 4358
28R-07	Sage Hen Hollow	Lop and Scatter	South Canyon (Limestone)	October 2015-January 2016	1694	3264
28R-08	South Canyon Burn 1	Aerial Before Bullhog Lop and Scatter	South Canyon South Canyon South Canyon (Sunset Cliffs) (Proposed)	October 2010 December 2010-April 2011 2019	1749 1749 1749	1716 1716 4488
28R-09	South Canyon 2	Aerial Before Bullhog	South Canyon (Hillsdale) South Canyon (Hillsdale)	September 2012 October 2012-February 2013	2279 2279	2311 2311
28R-10	Buckskin Valley Highway 20	Seed Unknown Broadcast Before Two-Way Dixie Harrow	Middle Buckskin Seeding Buckskin Valley Hwy 20 Buckskin Valley Hwy 20	Historic September 2005 September 2005	 270 270	 242 242
28R-11	Five Mile Hollow	Lop and Scatter	Fivemile Hollow Sagebrush Restoration - Year 3	November 2008-May 2009	6465	901
28R-12	Fivemile 2	Lop and Scatter	Fivemile Hollow Sagebrush Restoration - Year 3	November 2008-May 2009	6465	901
28R-13	Panguitch Creek	Aerial Before Bullhog	Panguitch Creek WMA PJ Thinning Panguitch Creek WMA PJ Thinning	November 2008 Spring 2009	383 28	1206 1206

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
28R-15	Panguitch Creek WMA	Aerial Before	Panguitch Creek WMA PJ Thinning	November 2008	383	1206
		Two-Way Ely Chain	Panguitch Creek WMA PJ Thinning	November 2008	383	1206
		Dribbler	Panguitch Creek WMA PJ Thinning	November 2008	383	1206
		Lop and Scatter	Annual Habitat Restoration Project Maintenance	August 2013	1274	1998
28R-19	South Canyon	Aerial Before	South Canyon Year 2	October 2011	1901	2027
		Bullhog	South Canyon Year 2	October 2011-January 2012	1901	2027
28R-20	Indian Hollow	Lop and Pile	Brian Head Fire Rehabilitation Phase II	Fall 2017	157	4532
		Prescribed Fire	Brian Head Fire Rehabilitation Phase II (Proposed)	Fall 2018	157	4532
28R-21	Williams Hollow	Wildfire	Brian Head	June 2017	71693	
		Aerial Before	Brian Head Fire Rehabilitation Phase II (Proposed)	Fall 2018	2080	4532
		Two-Way Ely Chain	Brian Head Fire Rehabilitation Phase II (Proposed)	Fall 2018	2080	4532
28R-22	Above Elliker Basin	Aerial Before	Parowan Front Mastication (Proposed)	Fall 2019	1725	4544
		Bullhog	Parowan Front Mastication (Proposed)	Fall 2019	1725	4544

Table 7.8: Range trend and WRI studies known disturbance history for WMU 28, Panguitch Lake. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Subalpine (Geranium)

One study site [Sidney Valley (28-17)] is classified as a Subalpine (Geranium) ecological site: this study is located near Sidney Valley on the Markagunt Plateau.

Shrubs/Trees: Shrubs and trees are not present on the Sidney Valley site and will therefore not be discussed in this section (**Figure 7.5**, **Figure 7.8**, **Figure 7.11**, **Figure 7.13**, **Figure 7.15**).

Herbaceous Understory: This site has remained dominated by a robust herbaceous understory since study establishment in 2003. Average nested frequency and cover data display overall increases of the understory. Perennial grasses have been a co-dominant site component over the study period, consisting of mainly native species such as mountain muhly (*Muhlenbergia montana*), Columbia needlegrass (*Achnatherum nelsonii*), Letterman's needlegrass (*A. lettermanii*), and slender wheatgrass (*Elymus trachycaulus*). Native perennial forbs have also been co-dominant with common dandelion (*Taraxacum officinale*) and common yarrow (*Achillea millefolium*) providing the most cover (**Figure 7.17**, **Figure 7.19**).

Occupancy: Average animal presence has decreased over time, with elk being the primary occupants in all study years. Mean abundance of elk pellet groups has ranged from nearly 33 days use/acre in 2018 to almost 135 days use/acre in 2008. Deer have also been present with mean pellet group abundance as low as 0 days use/acre in 2018 and as high as nearly 27 days use/acre in 2003. Finally, cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2003, 2008, and 2018 to 4 days use/acre in 2013 (**Figure 7.21**).

Mountain (Big Sagebrush)

One study [Bear Valley (28-03)] is considered to be a Mountain (Big Sagebrush) ecological site. The Bear Valley study is situated in North Swale on the perimeter of Bear Valley, south of SR-20.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) has contributed a majority of the shrub cover on this study site in all years; other preferred browse species are rare. Total average shrub cover has exhibited an overall increase (**Figure 7.2**). Average preferred browse demographics indicate that overall density has increased over time. The dominant age class among the browse population, however, has fluctuated: mature plants were dominant in 1992, 2003, and 2008, while young individuals were the most abundant in 1998 and 2013 (**Figure 7.12**). Average preferred browse utilization has decreased over time, with less than 50% of plants being moderately to heavily used since 1998 (**Figure 7.14**).

Trees have not been observed in cover or point-quarter density data and will not be discussed in this section (**Figure 7.6**, **Figure 7.9**).

Herbaceous Understory: The seeded introduced perennial grass species crested wheatgrass (*Agropyron cristatum*) has contributed a majority of the herbaceous cover in all sample years. The introduced annual grass species cheatgrass (*Bromus tectorum*) has also been observed since 1998, but with low cover. Annual and perennial forbs are diverse, but have remained a minor understory component (**Figure 7.16**, **Figure 7.18**).

Occupancy: Average pellet transect data indicates that animal occupancy has decreased overall. Cattle have been the primary occupants in all sample years, with mean abundance of pellet groups ranging from 11 days use/acre in 2008 to just over 65 days use/acre in 1998. Elk have also been observed, with a mean abundance of pellet groups as low as 0 days use/acre in 2003 and as high as nearly 11 days use/acre in 2013. In addition, mean abundance of deer pellet groups has fluctuated between 2 days use/acre in 2013 and nearly 19 days use/acre in 1998 (**Figure 7.20**).

Mountain (Black/Low Sagebrush)

One study [Sheep Hollow West (28-14)] is classified as a Mountain (Black/Low Sagebrush) ecological site. The Sheep Hollow West study is located in Sheep Hollow, west of the junction of US-89 and SR-12.

Shrubs/Trees: Black sagebrush (*Artemisia nova*) has contributed most of the shrub cover on this site, although antelope bitterbrush (*Purshia tridentata*) has also been present to a lesser extent. Overall shrub cover increased steadily from 2003 to 2013, but decreased between 2013 and 2018 (**Figure 7.2**). Average density of preferred browse has exhibited slight fluctuations from year to year, but has remained stable overall. Mature individuals have comprised a majority of the plant populations in all sample years, and decadence has decreased (**Figure 7.12**). Average preferred browse utilization has decreased over the study period: less than 45% of plants showed moderate to heavy utilization in all sample years since 1998 (**Figure 7.14**).

Tree cover has not been observed on this site in any sample year (**Figure 7.6**). However, point-quarter data shows that both Rocky Mountain juniper (*Juniperus scopulorum*) and twoneedle pinyon (*Pinus edulis*) were observed in 2018 (**Figure 7.9**).

Herbaceous Understory: The herbaceous understory of this site has remained plentiful and dominated by perennial grasses throughout the study period. The native perennial grass species muttongrass (*Poa fendleriana*) has contributed a majority of the cover of any single grass species in all sample years, but a diverse mixture of other native and introduced species are also present. Overall herbaceous cover has increased over time, but frequency has slightly decreased: this is mainly due to a decrease in the abundance of perennial forbs (**Figure 7.16**, **Figure 7.18**).

Occupancy: Average pellet transect data indicates that overall animal occupancy has decreased over the study years. Deer and/or antelope have been the primary occupants throughout the study period, with a mean pellet group abundance ranging from just over 5 days use/acre in 2013 to 32 days use/acre in 2003. Elk have also been present, with average pellet group abundance as low as 0 days use/acre in 2018 and as high as over 7 days use/acre in 1998. Finally, cattle pellet groups have had a mean abundance ranging from 0 days use/acre in 2013 and 2018 to nearly 12 days use/acre in 1998 (**Figure 7.20**).

Mountain (Shrub)

There are four studies [Buckskin Valley (28-04), Asay Bench (28-16), Haycock Mountain (28-22), and Above Limerock Canyon (28-24)] that are classified as Mountain (Shrub) ecological sites. The Buckskin Mountain study is situated south of SR-20 in Buckskin Valley. The Asay Bench site is located on Asay Bench, just east of Asay Knoll. Haycock Mountain is located northeast of Panguitch Lake on the north-facing slopes of Haycock Mountain. The Above Limerock Canyon study site is found near Limestone Creek, west of the town of Hatch.

Shrubs/Trees: These study sites generally support stands of antelope bitterbrush (*Purshia tridentata*) and other preferred browse such as sagebrush (*Artemisia sp.*). Average cover data indicates that overall shrub cover has exhibited small fluctuations: this may be due in part to the addition of new study sites in 2013 and 2018 (number of studies is indicated by the "n value" in corresponding figures). Despite these fluctuations, however, cover has remained fairly stable overall. In addition, preferred browse other than bitterbrush has contributed a majority of the cover on these sites throughout the duration of the study period (**Figure 7.3**). According to average preferred browse demographics, mature individuals have made up a majority of these plant populations in all sample years. Overall density has decreased, but again, this can be partially attributed to the differing number of studies from year to year (**Figure 7.13**). Utilization has also decreased; in 2018, 31% of plants on average were moderately to heavily browsed (**Figure 7.15**).

Average tree cover on these sites has remained low over the sample period, and is mainly contributed by Rocky Mountain juniper (*Juniperus scopulorum*) on the Buckskin Valley study (**Figure 7.7**). Tree density has increased on average. However, it would be prudent to consider that this density increase could be due to point-quarter data only being sampled in 2018 (**Figure 7.10**).

Herbaceous Understory: On average, perennial grasses have contributed the most herbaceous cover in almost all sample years. The exception to this is 1998: the only site sampled that year (Buckskin Valley) was dominated by a mixture of perennial forbs and annual grasses and forbs (**Figure 7.17**). Nested frequencies of annual and perennial forbs have driven an overall decreasing trend while perennial grass frequency has remained fairly stable. As with trends mentioned in the previous section, these trends are likely due in part to the addition of new sample sites (**Figure 7.19**).

Occupancy: Average pellet transect data shows that animal occupancy exhibited an increase between 1998 and 2013, but decreased between 2013 and 2018. Deer and/or sheep have been the primary occupants in all sample years, with a mean pellet group abundance ranging from 38.5 days use/acre in 2018 to nearly 52 days use/acre in 2008 and 2013. Mean pellet group abundance of elk has been as low as 0 days use/acre in 1998 and as high as just over 23 days use/acre in 2013. Finally, cattle pellet groups have had a mean abundance ranging from 4 days use/acre in 2003 to almost 9 days use/acre in 2008 (**Figure 7.21**).

Mountain (Silver Sagebrush)

One study site [Shakespeare Hollow (28-18)] is considered to be a Mountain (Silver Sagebrush) ecological site. This study site is located in Shakespeare Hollow, north of Panguitch Lake.

Shrubs/Trees: Silver sagebrush (*Artemisia cana*) and antelope bitterbrush (*Purshia tridentata*) have contributed a majority of the browse cover over the study period. Preferred browse species other than sagebrush and bitterbrush have been observed, but in very low amounts (**Figure 7.4**). Average preferred browse demographics show that density has exhibited slight fluctuations from year to year, but has remained fairly stable overall. Demographic data also indicates that mature individuals have comprised most of the browse population in all sample years (**Figure 7.13**). Average utilization of preferred browse has also fluctuated. However, over half of the browse population has been moderately to heavily used in all sample years with 2003 displaying particularly heavy utilization (**Figure 7.15**).

Trees have not been observed in cover or point-quarter data, and will therefore not be discussed in this section (**Figure 7.8**, **Figure 7.11**).

Herbaceous Understory: Overall cover of the herbaceous understory has exhibited an increase over time. Perennial grasses have contributed a majority of the herbaceous cover on this study site throughout the study period. Perennial forbs, particularly western aster (*Symphyotrichum ascendens*) and fleabane (*Erigeron flagellaris* and *E. pumilus*), have also increased in cover over time. Annual forbs have remained a minor component of the understory and annual grasses have not been observed in any sample year. Nested frequency of herbaceous species has fluctuated, but has also exhibited a general increase (**Figure 7.17**, **Figure 7.19**).

Occupancy: Animal presence on this site has displayed a steadily decreasing trend throughout the study period. Primary occupancy has fluctuated: deer pellet groups were most abundant in 2008 and 2018, but elk were the main occupants in 2003 and 2013. Mean abundance of deer pellet groups has varied from 9 days use/acre in 2013 to over 23 days use/acre in 2008. Elk pellet groups have had a mean abundance as low as 4 days use/acre in 2008 and as high as 24 days use/acre in 2003. Cattle have also been present, with mean pellet group abundance ranging from 5 days use/acre in 2013 to nearly 12 days use/acre in 2008 (**Figure 7.21**).

Upland (Big Sagebrush)

Six study sites [Three Creeks (28-01), Swayback Knoll (28-05), Cottonwood (28-06), Grass Valley (28-08), Elliker Basin (28-11), and South Summit WMA (28-21)] are considered to be Upland (Big Sagebrush) ecological sites. The Three Creeks study is situated west of Bear Valley Junction and near Three Creeks Spring. The Swayback Knoll site is located just south of Swayback Knoll below the Hurricane Cliffs. Cottonwood can be found north of Paragonah at the mouth of Cottonwood Canyon, and the Grass Valley study is located south of Parowan in Grass Valley. The Elliker Basin study site is situated southeast of I-15 in Elliker Basin. Finally, South Summit WMA can be found just south of the town of Summit on the Parowan Front Wildlife Management Area.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) contributes a majority of the shrub cover on these study sites, and average shrub cover in general has remained stable over the sample years. Other shrubs and preferred browse species other than sagebrush contribute little cover (**Figure 7.2**). Average preferred browse demographics indicate that density has steadily decreased over time. Demographic data also shows that mature individuals have comprised a majority of the browse populations and that recruitment of young and decadence have decreased overall (**Figure 7.12**). Average utilization of preferred browse has fluctuated over time. In most sample years, at least 60% of the plants have been moderately to heavily browsed. However, only 44% of plants were moderately to heavily used in 1998 and 25% of plants exhibited that utilization in 2018 (**Figure 7.14**).

Tree cover has not been observed since 2003, when twoneedle pinyon (*Pinus edulis*) was observed on the Three Creeks study site (**Figure 7.6**). However, average tree density data indicates that both twoneedle pinyon and Utah juniper (*Juniperus osteosperma*) have been present in each sample year. However, all of the density prior to 2018 is contributed by the Three Creeks and Grass Valley studies; point-quarter data for Elliker Basin, Cottonwood, and South Summit WMA is only available for 2018 (**Figure 7.9**).

Herbaceous Understory: Since 2013, perennial grasses have dominated the understories of these study sites. Prior to 2013, however, perennial and annual grasses were co-dominant components: much of that annual grass cover can be attributed to the introduced species cheatgrass (*Bromus tectorum*) on the Elliker Basin and Cottonwood studies. The introduced perennial grass species bulbous bluegrass (*Poa bulbosa*) is present in all years in the average cover and nested frequency data with an increasing trend. Bulbous bluegrass has been observed on the Grass Valley, Elliker Basin, and South Summit WMA studies, but the increasing trend is largely driven by the Grass Valley site. Forbs have generally remained rare when compared to grasses (**Figure 7.16**, **Figure 7.18**).

Occupancy: Average pellet transect data shows that animal occupancy increased between 1998 and 2008, but has steadily decreased since that time. These study sites have been primarily occupied by deer in all sample years. Mean abundance of deer pellet groups has ranged from just under 20 days use/acre in 2018 to 87 days use/acre in 2008. Cattle have also been present, with mean pellet group abundance fluctuating between just under 4 days use/acre in 2018 and 11.5 days use/acre in 1998. Mean abundance of elk pellet groups has been as low as nearly 2 days use/acre in 2013 and 2018 and as high as just over 4 days use/acre in 2008. Finally, horse pellet groups had a mean abundance ranging from 0 days use/acre in 2003, 2008, 2013, and 2018 to 0.1 days use/acre in 1998 (**Figure 7.20**).

Upland (Black/Low Sagebrush)

Three studies [Paragonah (28-07), DD Hollow (28-19), and Threemile Creek (28-23)] are classified as Upland (Black/Low Sagebrush) ecological sites. The Paragonah study is located south of the town of Paragonah and in between the mouths of Water and Order Canyons. DD Hollow is situated west of the community of Hillsdale near DD Hollow. Finally, the Threemile Creek study can be found northwest of the city of Panguitch near Threemile Creek.

Shrubs/Trees: Average shrub cover on these study sites has exhibited an overall increase, mainly due to black sagebrush (*Artemisia nova*); mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) is also present on all three study sites to a lesser extent. Other preferred browse and other shrubs have also been observed, but have contributed less cover (**Figure 7.2**). Average preferred browse demographics indicate that despite fluctuations from year to year due to differing numbers of studies, density has increased overall. The data also shows that mature individuals have comprised a majority of the plant populations in most study years: the exception to this is 2008 when young plants were the main demographic, a trend largely driven by the DD Hollow study (**Figure 7.12**). Average utilization of preferred browse has fluctuated. Less than 20% of plants exhibited moderate to heavy use in 1198, 2003, 2008, and 2018. In 1992 and 2013, however, over 50% were moderately to heavily browsed (**Figure 7.14**).

Juniper species (*Juniperus sp.*) and twoneedle pinyon (*Pinus edulis*) have been present on all three study sites. Average tree cover has decreased overall (**Figure 7.6**). This decrease in cover is driven by the Paragonah study, which was lop and scattered between 1998 and 2003 and again between 2008 and 2013. The DD Hollow study also drives this trend, having undergone bullhog treatments in 2003 and 2012. These studies also drove a decrease in tree density decreased between 2003 and 2008. However, density has increased steadily since then (**Figure 7.9**): this is likely in part due to the addition of the Threemile Creek study in 2013.

Herbaceous Understory: Native and/or introduced perennial grasses have contributed a majority of the herbaceous cover on these studies in all sample years. Perennial forbs and annual grasses and forbs are present, but have provided much less cover (**Figure 7.16**). Average nested frequency values have varied from year to year; fluctuations of the introduced annual grass species cheatgrass (*Bromus tectorum*) are almost entirely due to the Paragonah study (**Figure 7.18**).

Occupancy: Animal occupancy has exhibited a slight decrease over the study years according to average pellet transect data, with deer as the primary occupants in all study years. Mean abundance of deer pellet groups has been as low as 9 days use/acre in 2013 and as high as just over 23 days use/acre in 1998. Cattle have also been present, with a mean abundance ranging from 0 days use/acre in 1998 and 2003 to nearly 3 days use/acre in 2018. Finally, mean abundance of elk pellet groups has been as low as 0 days use/acre in 1998, 2003, and 2008, and as high as 0.7 days use/acre in 2013 (**Figure 7.20**).

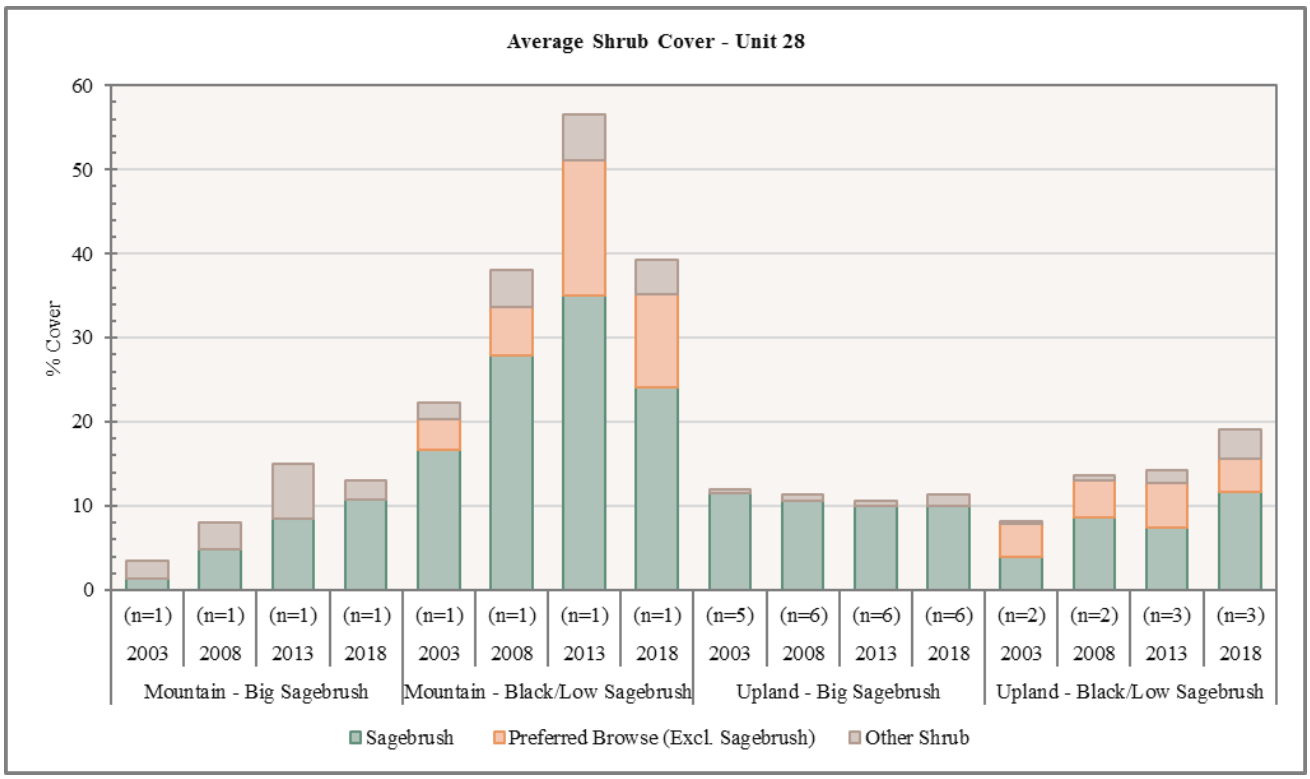


Figure 7.2: Average shrub cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

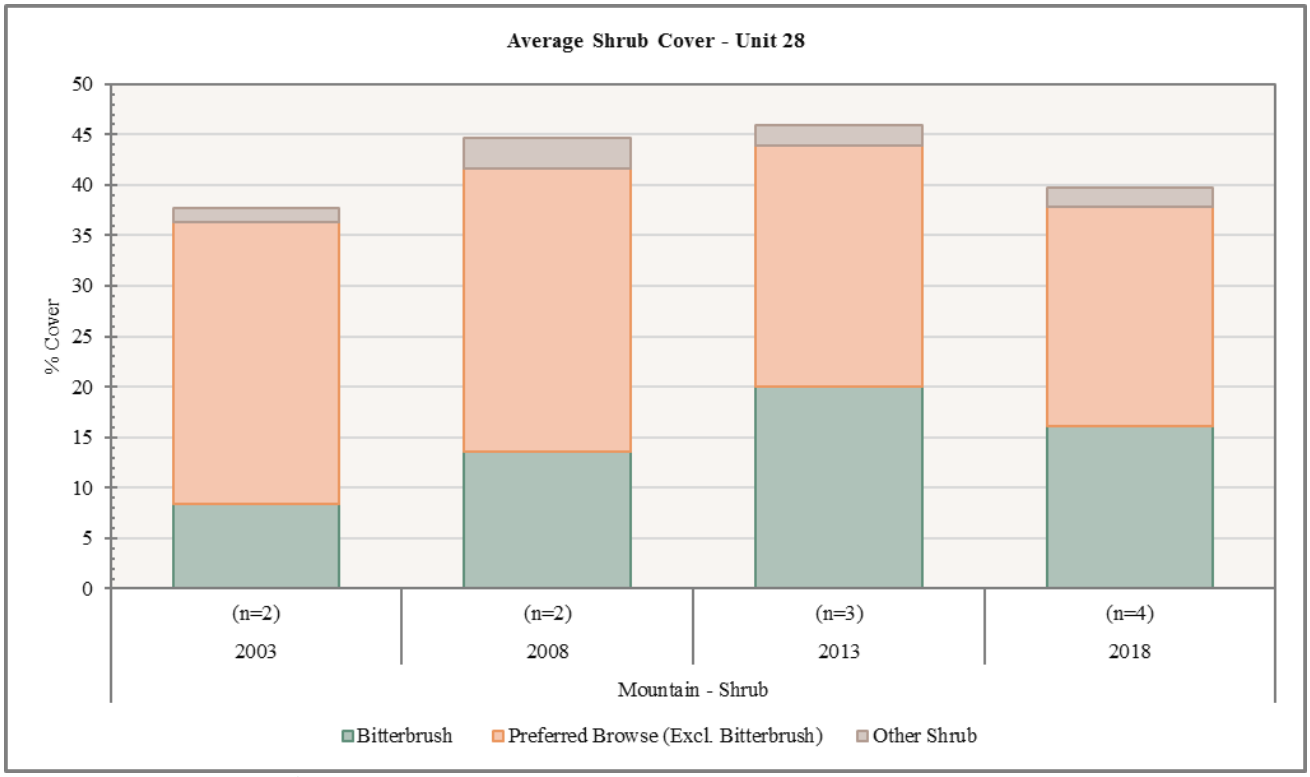


Figure 7.3: Average shrub cover for Mountain - Shrub study sites in WMU 28, Panguitch Lake.

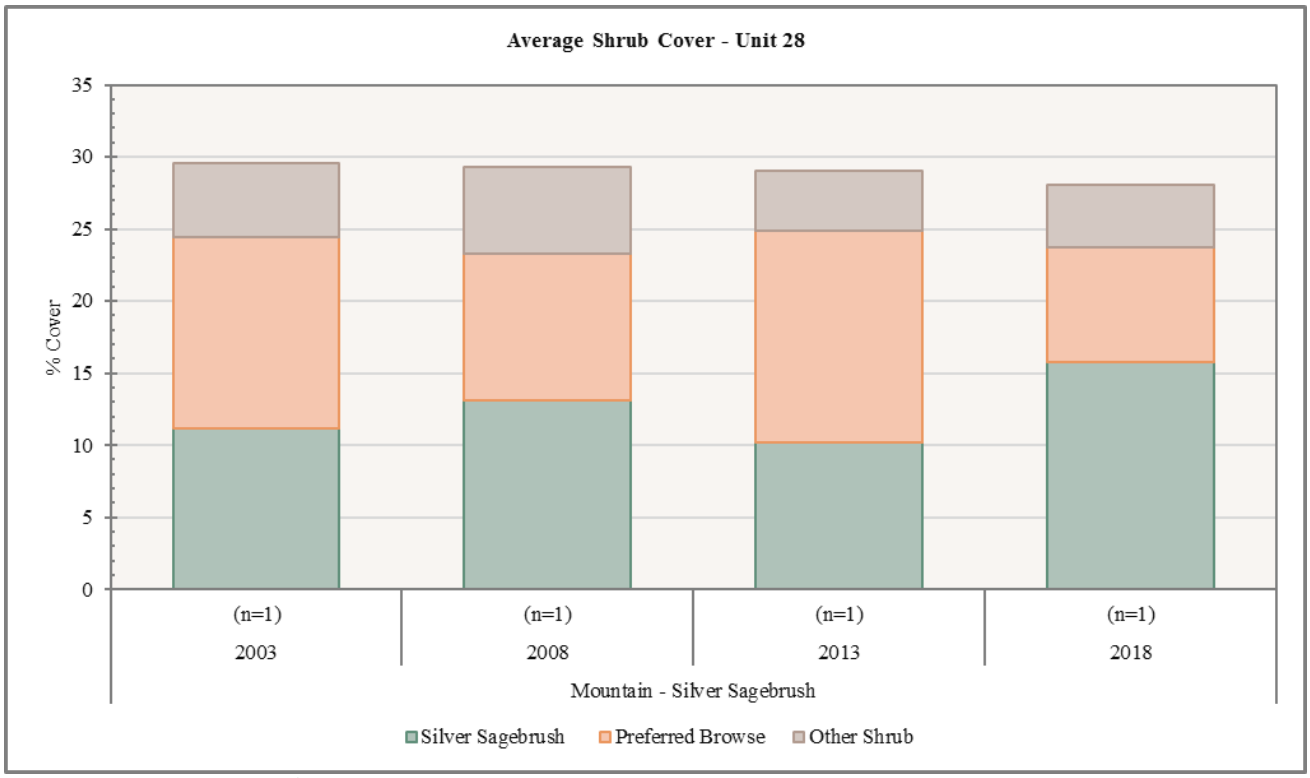


Figure 7.4: Average shrub cover for Mountain - Silver Sagebrush study sites in WMU 28, Panguitch Lake.

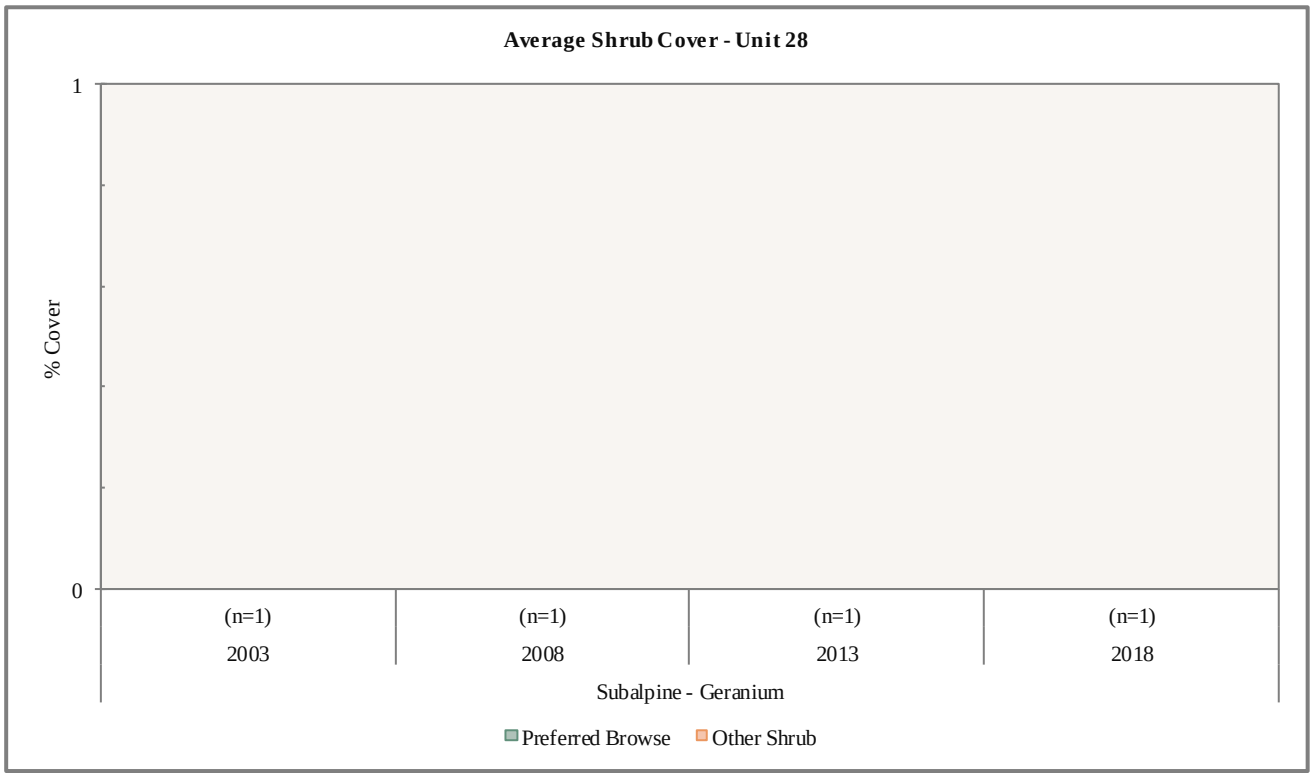


Figure 7.5: Average shrub cover for Subalpine - Geranium study sites in WMU 28, Panguitch Lake.

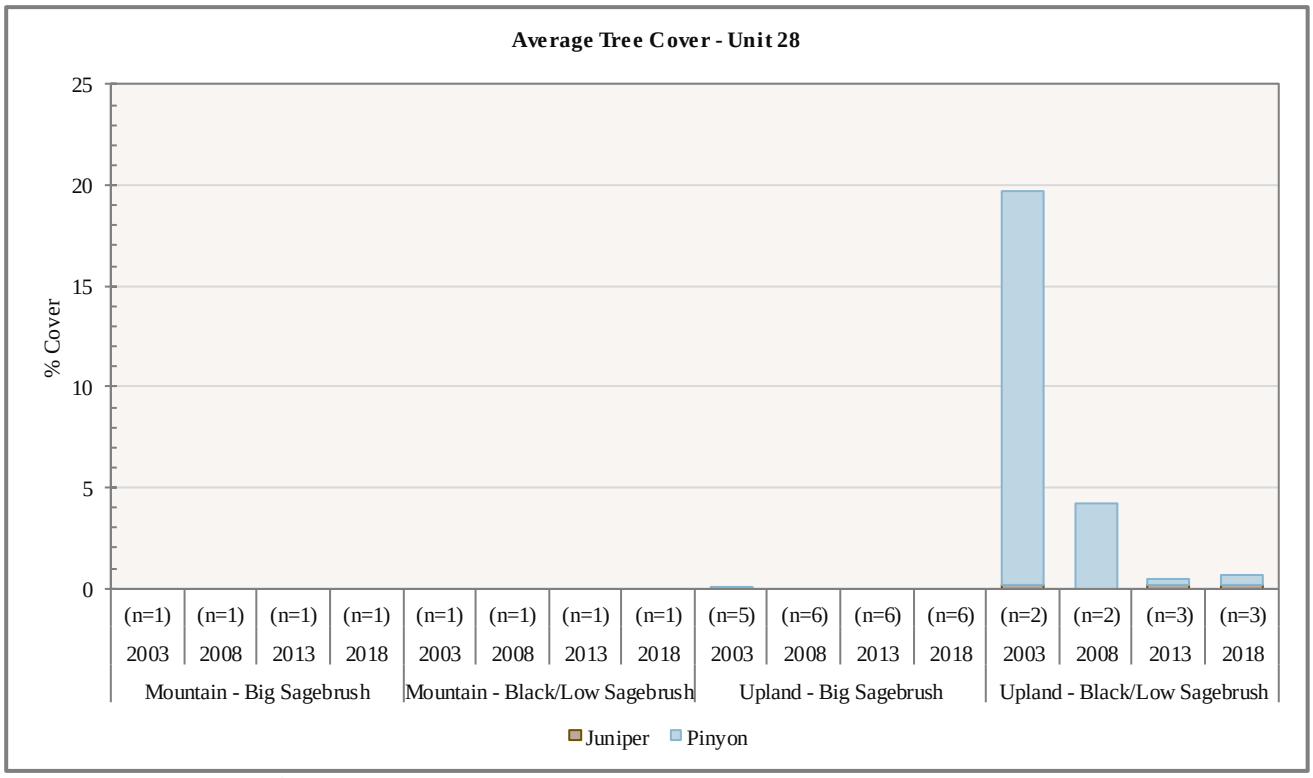


Figure 7.6: Average tree cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

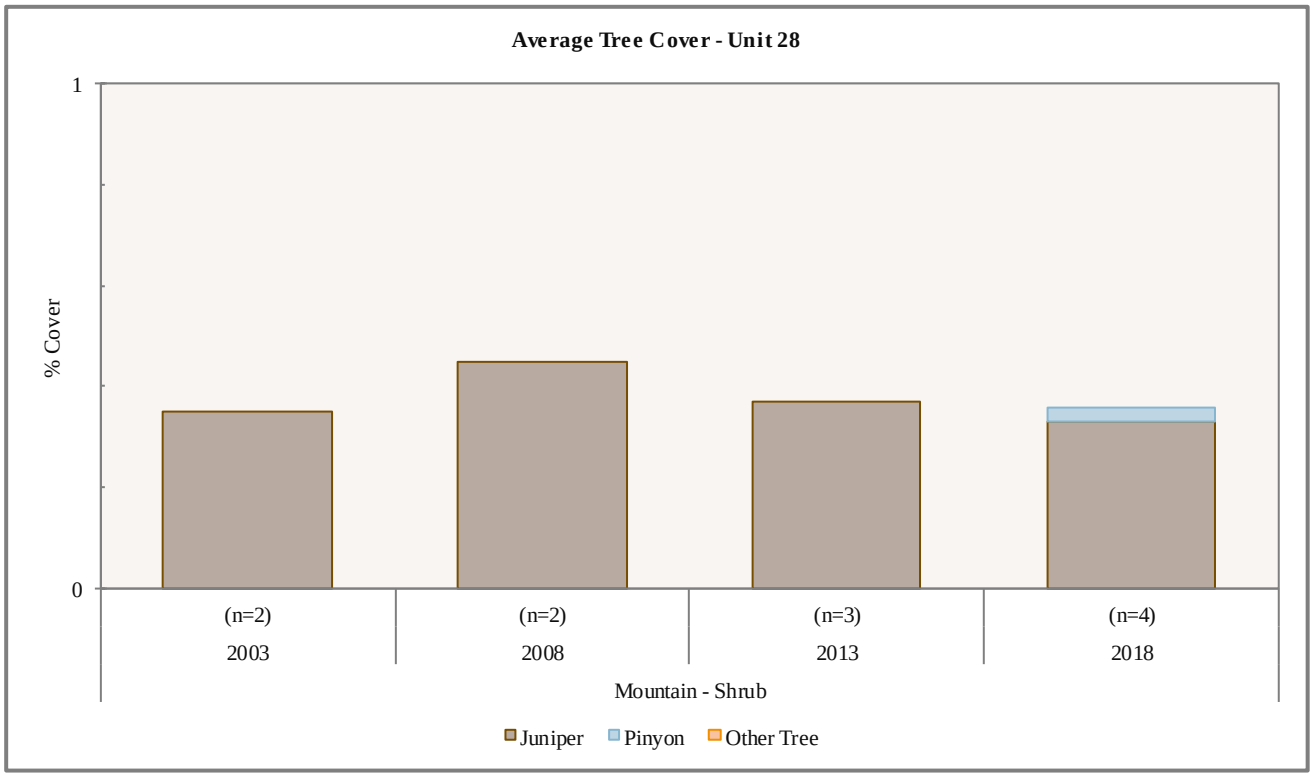


Figure 7.7: Average tree cover for Mountain - Shrub study sites in WMU 28, Panguitch Lake.

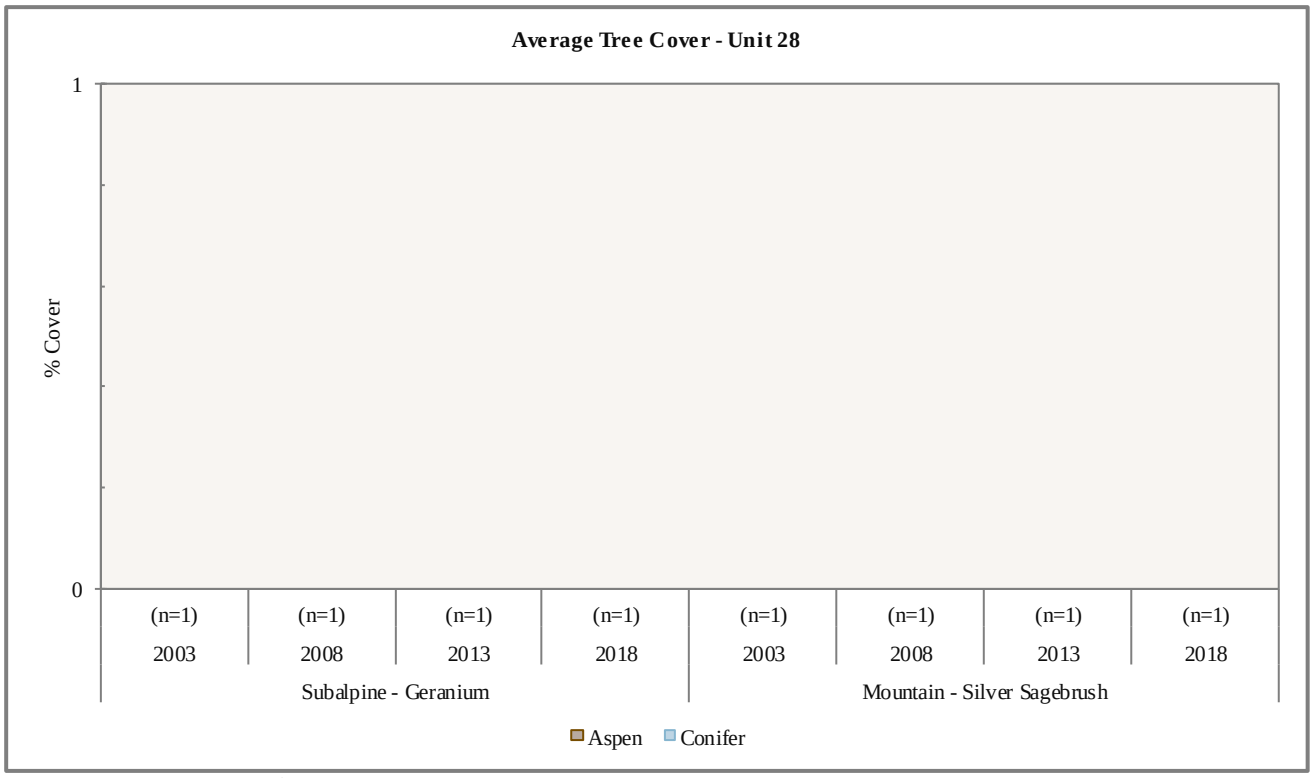


Figure 7.8: Average tree cover for Subalpine - Geranium and Mountain - Silver Sagebrush study sites in WMU 28, Panguitch Lake.

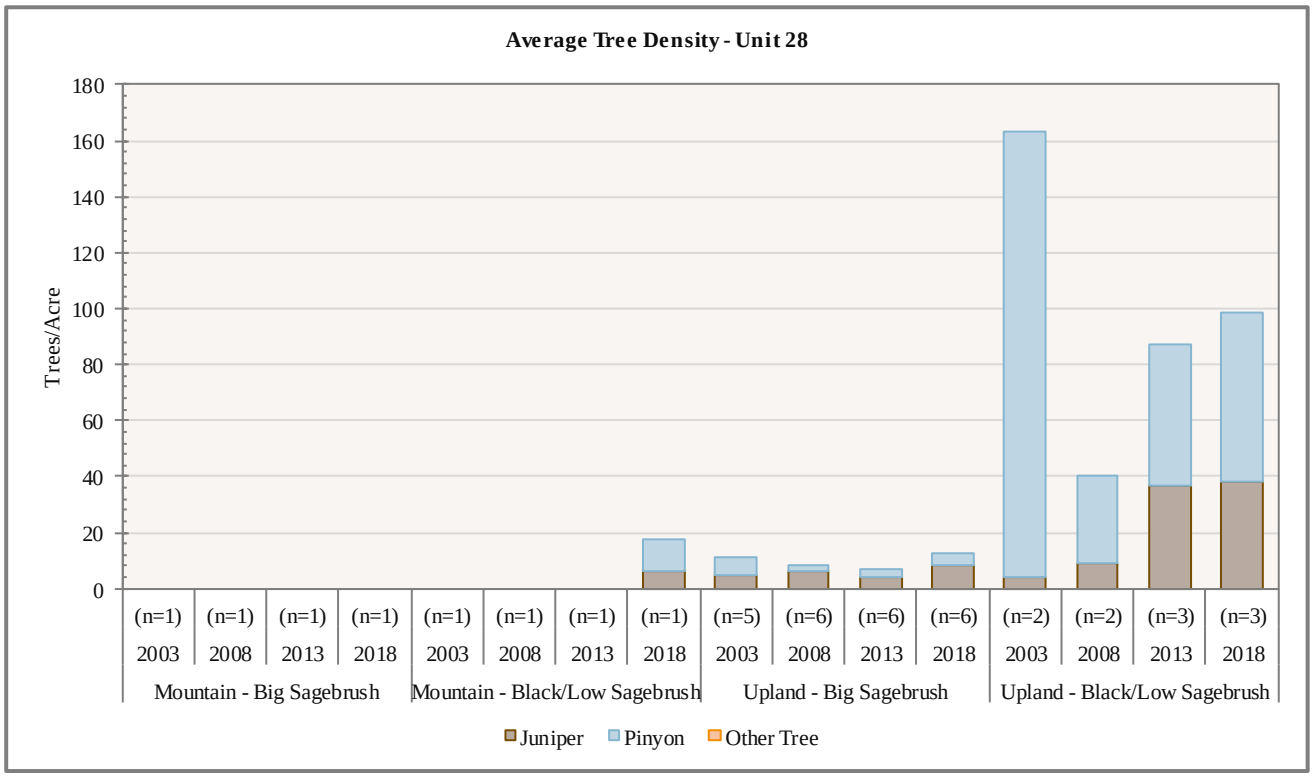


Figure 7.9: Average tree density for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

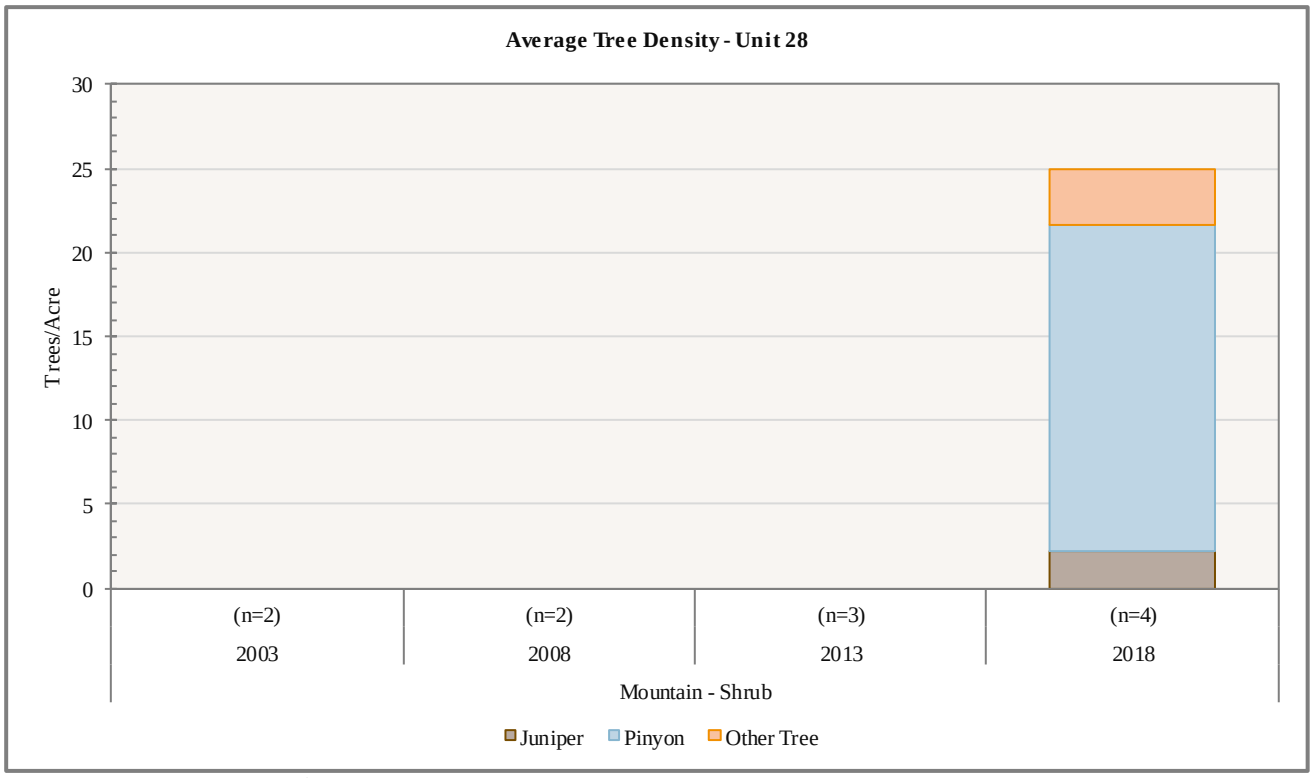


Figure 7.10: Average tree density for Mountain - Shrub study sites in WMU 28, Panguitch Lake.

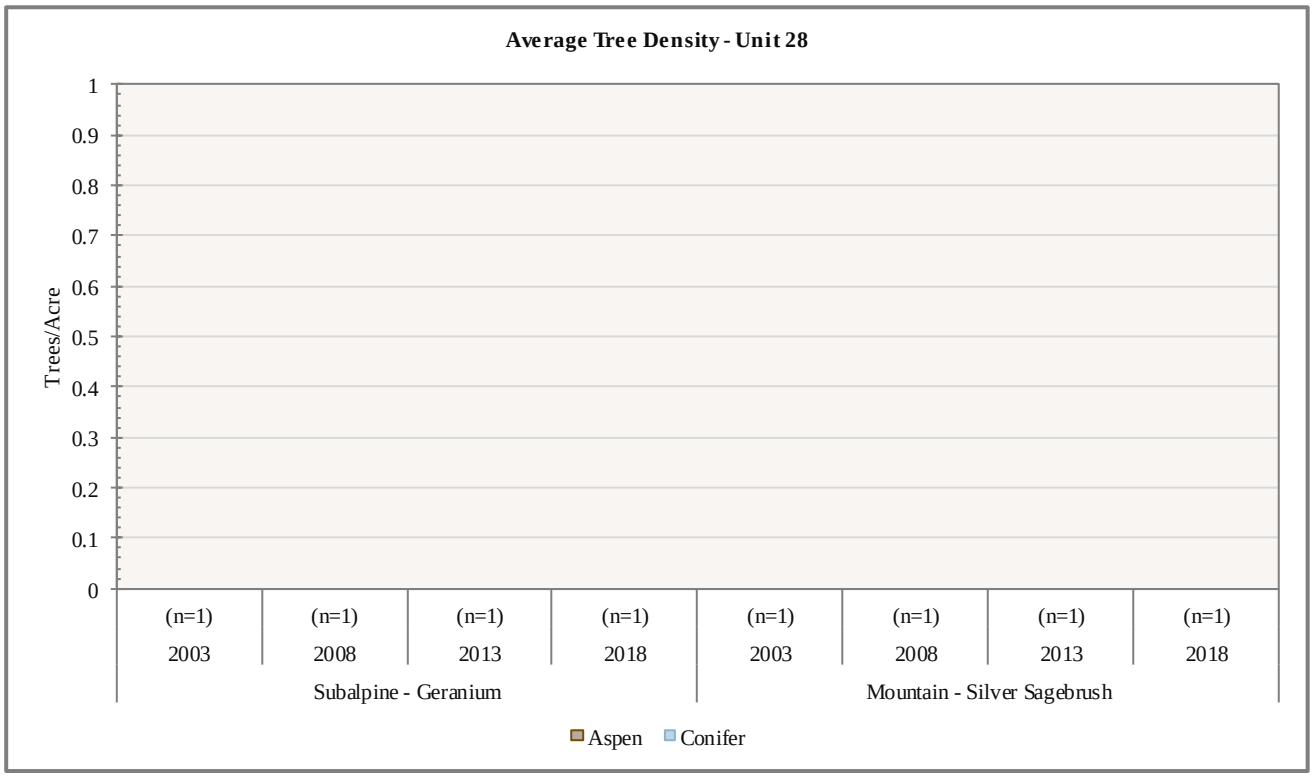


Figure 7.11: Average tree density for Subalpine - Geranium and Mountain - Silver Sagebrush study sites in WMU 28, Panguitch Lake.

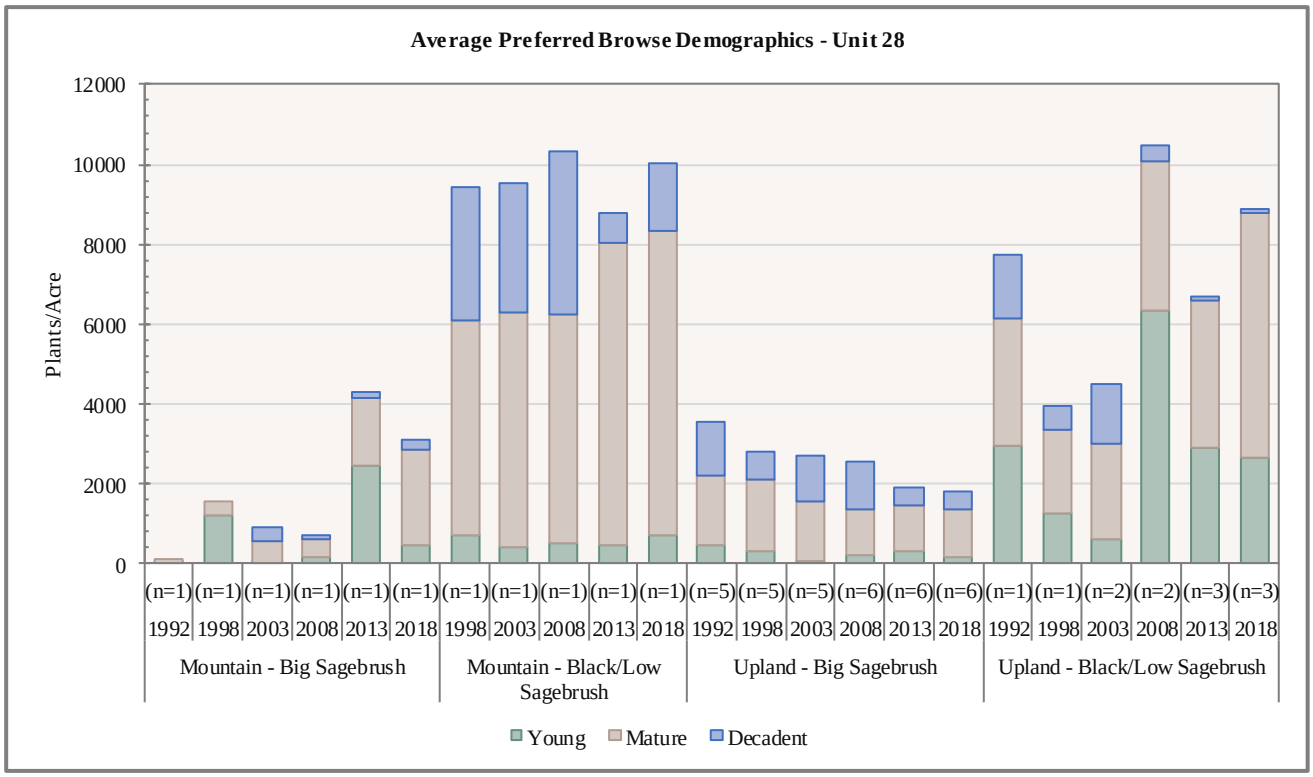


Figure 7.12: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

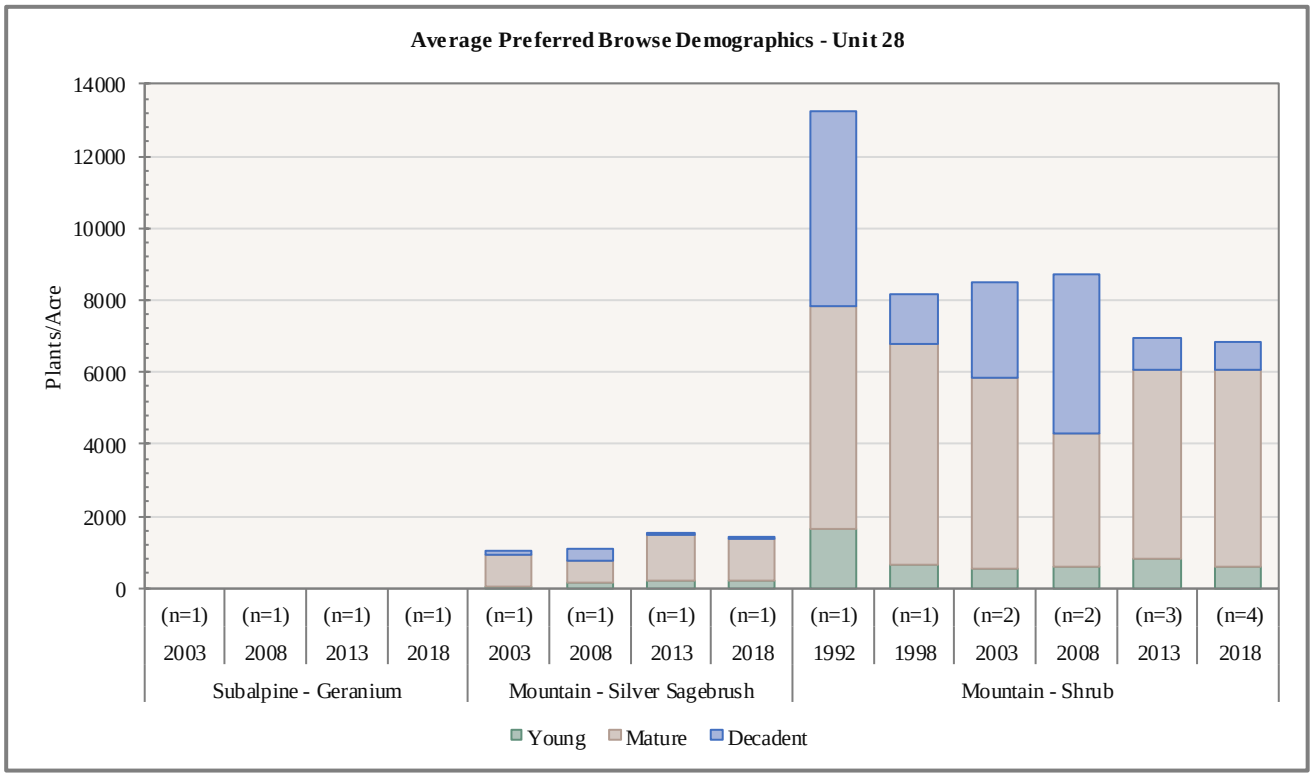


Figure 7.13: Average preferred browse demographics for Subalpine - Geranium, Mountain - Silver Sagebrush, and Mountain - Shrub study sites in WMU 28, Panguitch Lake.

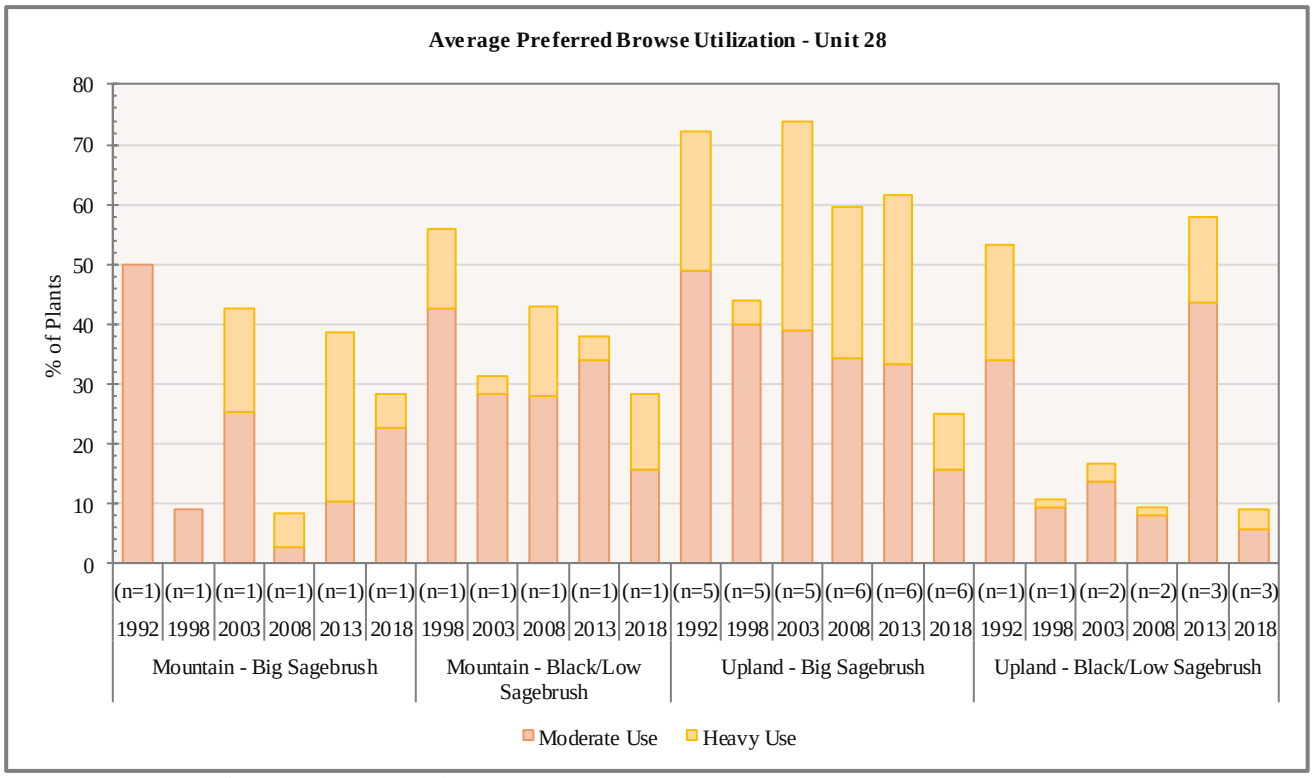


Figure 7.14: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

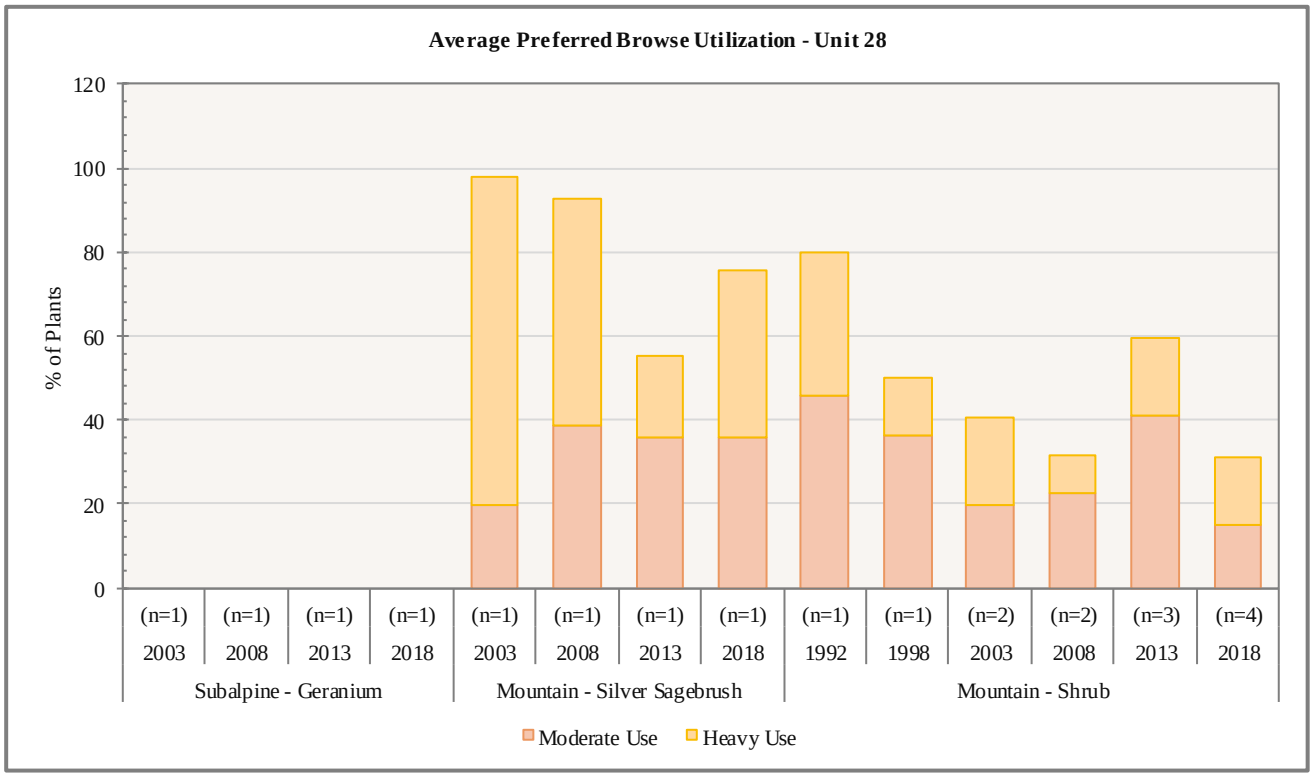


Figure 7.15: Average preferred browse utilization for Subalpine - Geranium, Mountain - Silver Sagebrush, and Mountain - Shrub study sites in WMU 28, Panguitch Lake.

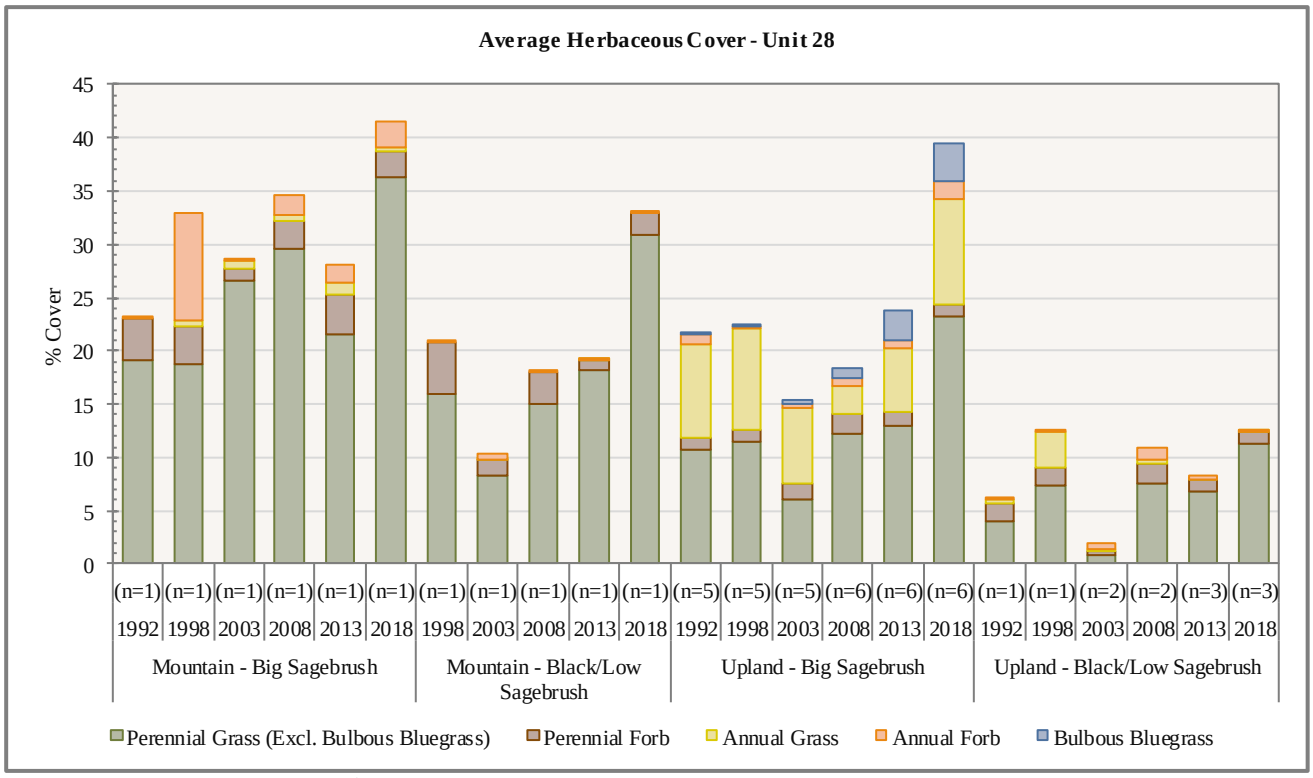


Figure 7.16: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

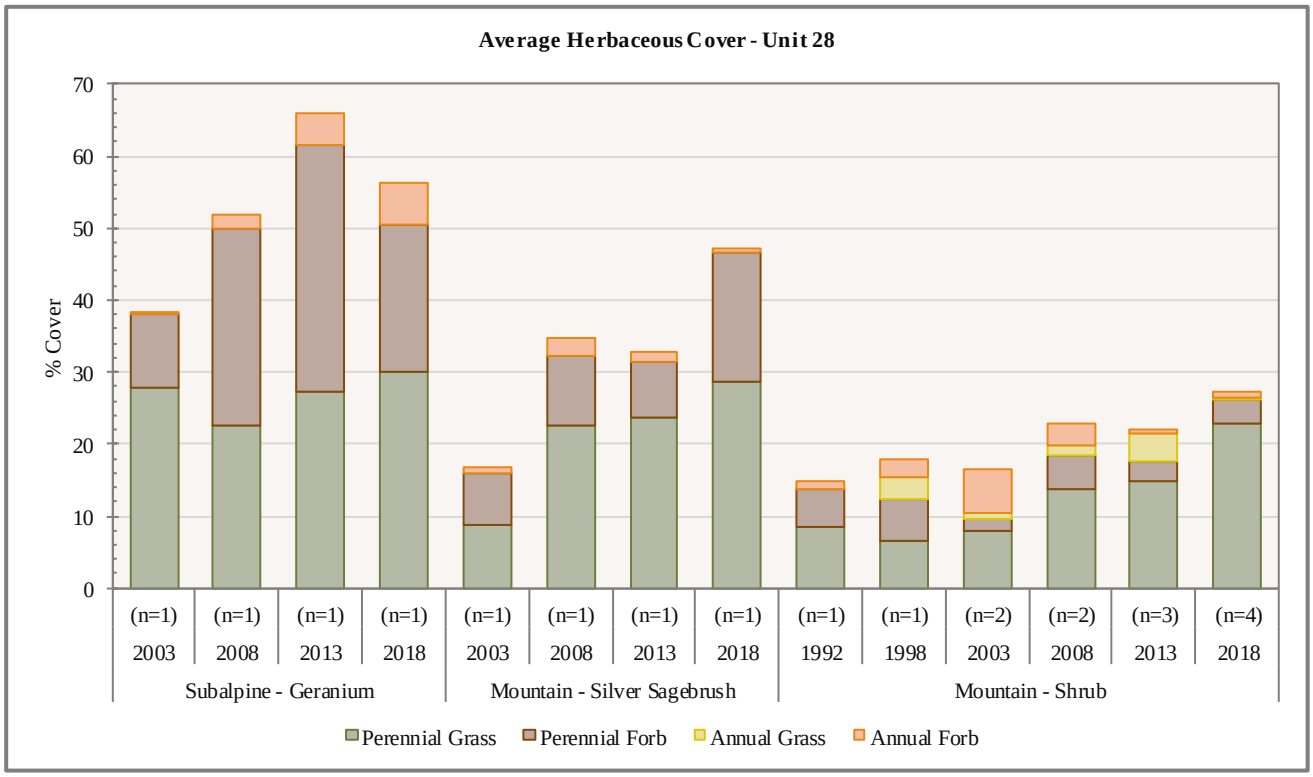


Figure 7.17: Average herbaceous cover for Subalpine - Geranium, Mountain - Silver Sagebrush, and Mountain - Shrub study sites in WMU 28, Panguitch Lake.

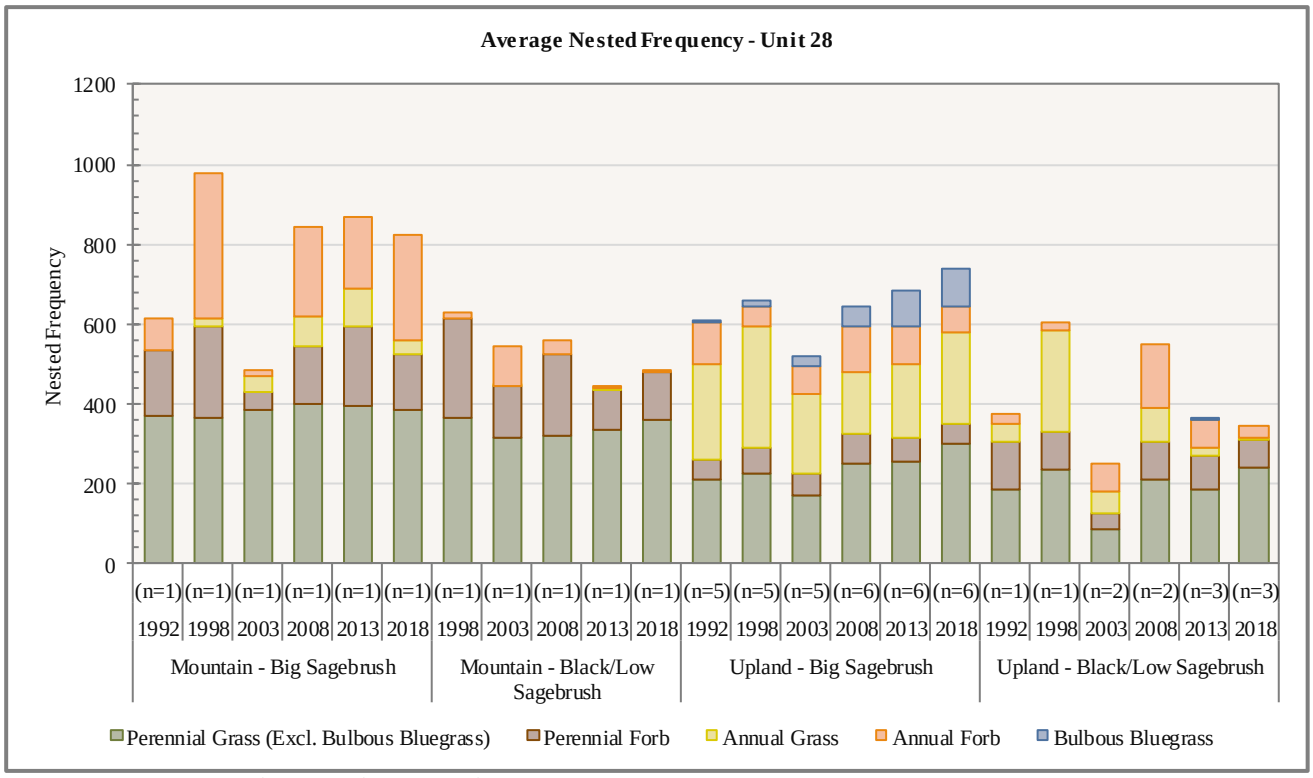


Figure 7.18: Average nested frequency of herbaceous for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake.

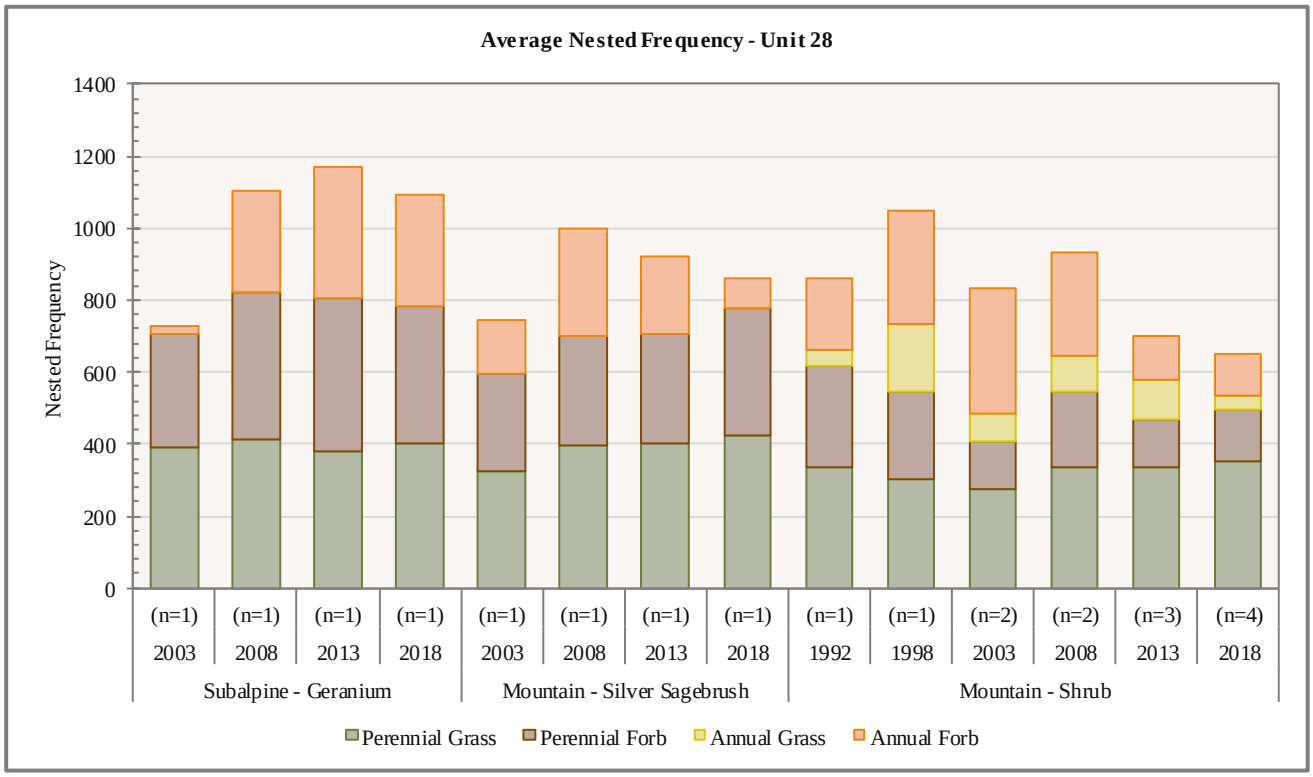


Figure 7.19: Average nested frequency of herbaceous for Subalpine - Geranium, Mountain - Silver Sagebrush, and Mountain - Shrub study sites in WMU 28, Panguitch Lake.

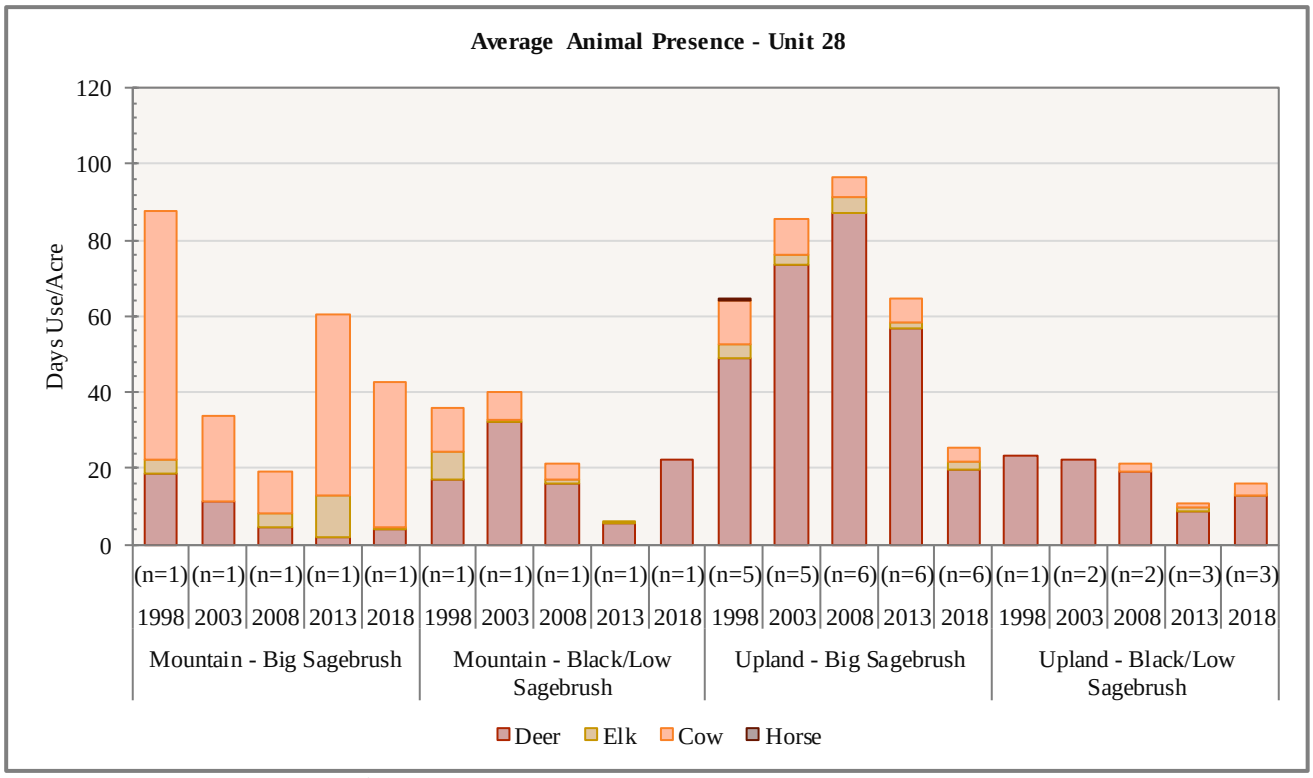


Figure 7.20: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Black/Low Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 28, Panguitch Lake. Mountain - Black/Low Sagebrush deer pellets include deer/antelope.

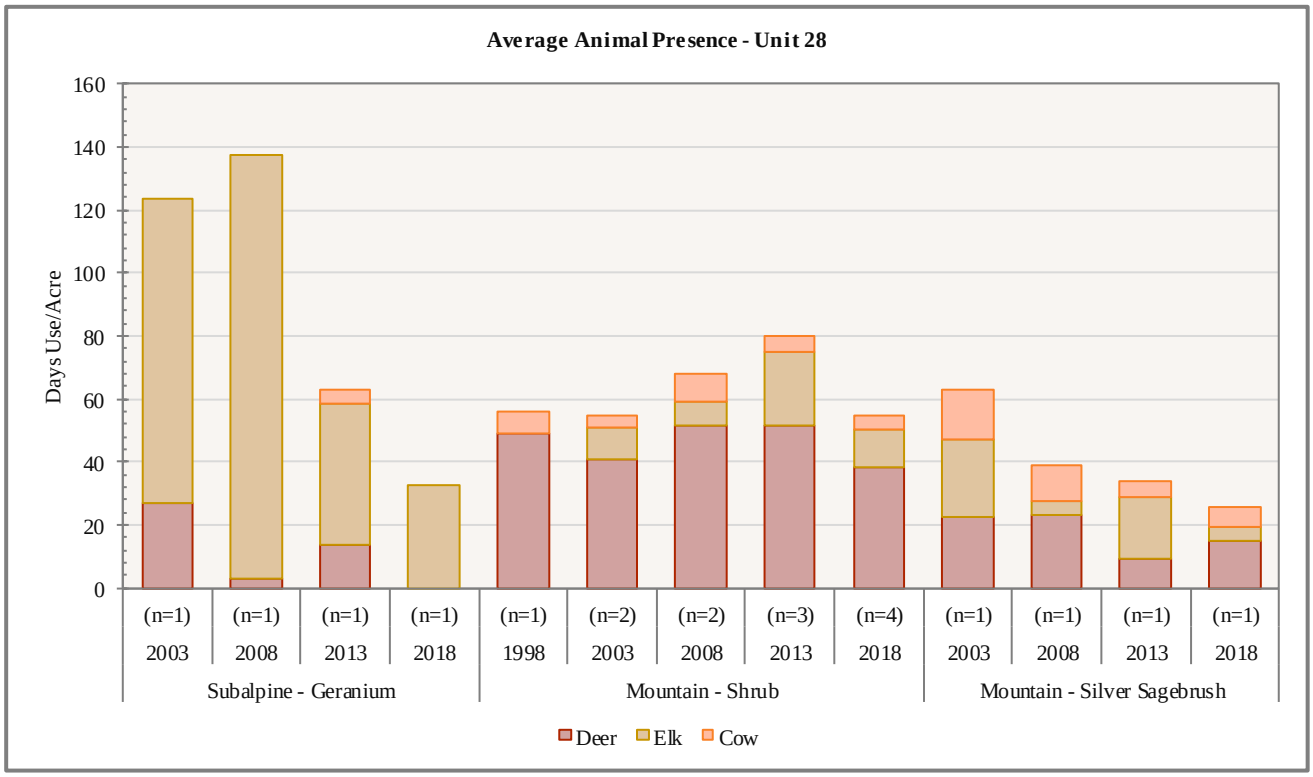


Figure 7.21: Average pellet transect data for Subalpine - Geranium, Mountain - Silver Sagebrush, and Mountain - Shrub study sites in WMU 28, Panguitch Lake. Mountain - Shrub deer pellets include deer/sheep.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Panguitch Lake management unit has changed on the sites sampled since 1992. The active Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2018 sample year (**Figure 7.22**,

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
28-01	1992	8.7	11.3	15	30	0	5.9	0	**70.9**	**G**
28-01	1998	10.5	14.5	14.6	30	0	6	0	**75.6**	**G**
28-01	2003	6.3	0	0	10	0	6.1	0	**22.4**	**VP**
28-01	2008	10.3	13.2	15	28.9	0	5.1	0	**72.3**	**G**
28-01	2013	15.1	13.8	9	30	0	4.1	0	**72.1**	**G**
28-01	2018	17.2	12.7	4.5	30	0	1.8	0	**66.2**	**F-G**
28-04	1992	30	1.7	5.1	16.9	-0.1	10	0	**63.6**	**F**
28-04	1998	30	9.6	3.8	12.9	-2.2	10	0	**64.1**	**F**
28-04	2003	30	3.2	1.2	5.3	-1.2	5.7	0	**44.2**	**P**
28-04	2008	30	2.1	1.9	12.8	-2	10	0	**54.8**	**P-F**
28-04	2013	30	8.8	3.2	12.1	-8.9	10	0	**55.2**	**P-F**
28-04	2018	30	11.3	2	20.1	-0.9	10	0	**72.5**	**G**
28-05	1992	13.8	6.3	8	6.3	-0.9	0.1	0	**33.6**	**VP-P**
28-05	1998	15.5	8.3	5.9	6.8	-14.6	0.2	0	**22.1**	**VP**
28-05	2003	20.4	5.2	2.1	6.4	-1.7	0	0	**32.4**	**VP**
28-05	2008	13.9	-0.4	3.3	9.6	-1.7	0.3	0	**24.9**	**VP**
28-05	2013	1	0	0	3.8	-15	0.5	0	**-9.7**	**VP**
28-05	2018	0.3	0	0	18.9	-16.9	0	0	**2.3**	**VP**
28-06	1992	12.3	10.3	3.2	10.2	-6.1	5.2	0	**35.1**	**VP-P**
28-06	1998	9.4	6.2	3.2	13.8	-13.4	4.6	0	**23.8**	**VP**
28-06	2003	10.3	0.2	0.6	6.9	-0.3	8.8	0	**26.5**	**VP**
28-06	2008	10.9	3.2	2.6	9.7	-9	10	0	**27.4**	**VP**
28-06	2013	10.4	8	0	10.8	-11.3	10	0	**27.8**	**VP**
28-06	2018	9.8	4.5	1.8	30	-13.6	9.9	0	**42.3**	**P**
28-07	1992	11.2	9.9	15	7.9	-0.2	3.6	0	**47.3**	**P**
28-07	1998	12.2	11.7	15	14.9	-2.6	3.1	0	**54.3**	**F**
28-07	2003	9.4	9.4	11.5	2.1	-0.3	1.7	0	**33.8**	**VP-P**
28-07	2008	7	12.1	15	18.6	-0.8	4.8	0	**56.8**	**F**
28-07	2013	20.3	14.4	15	11.3	-0.1	5.2	0	**66.1**	**F-G**
28-07	2018	22.6	14.4	6	17.1	0	5.5	0	**65.5**	**F-G**
28-08	1992	20.6	-3.1	3.3	30	-1.7	0	0	**49.1**	**P-F**
28-08	1998	17	4.8	4.6	30	-1.6	0.2	0	**54.9**	**F**
28-08	2003	16	0.9	1.2	24.4	-4.3	0.1	0	**38.3**	**P**
28-08	2008	15.6	0.2	1.9	30	-0.1	0.2	0	**47.8**	**P**
28-08	2013	17.6	1.3	2.9	30	0	0.1	0	**51.9**	**P-F**
28-08	2018	15.5	3.4	2	30	-0.9	0.1	0	**50**	**P-F**
28-11	1992	29.7	-0.2	2.9	9.8	-20	0.1	0	**22.4**	**VP**
28-11	1998	29	7.5	1.9	15.3	-6	0.7	0	**48.4**	**P-F**
28-11	2003	19	-2.1	0.8	12	-20	0	0	**9.7**	**VP**
28-11	2008	15	-4.2	1.4	24.8	-0.2	0.4	0	**37.2**	**P**
28-11	2013	15.4	6.8	15	30	-0.3	0.4	0	**67.2**	**G**
28-11	2018	17.5	9.3	11.6	30	-12.7	0.3	0	**56**	**F**
28-14	1998	24.1	6.2	4.5	30	0	9.6	0	**74.3**	**G**
28-14	2003	26.3	4.6	2.4	16.8	0	2.9	0	**52.9**	**P**
28-14	2008	30	3.4	2.8	30	0	6	0	**72.1**	**G**
28-14	2013	30	12.9	3.7	30	0	2.2	0	**78.8**	**G**
28-14	2018	30	10.2	5.8	30	0	4	0	**80**	**G**
28-15*	1998	30	7.8	2.3	15.5	0	5.3	0	**60.9**	**F**
28-15*	2003	30	8	2	4.6	0	2.4	0	**46.9**	**P**
28-15*	2008	30	1.7	5.5	14.3	0	6.9	0	**58.3**	**F**
28-15*	2013	30	11.5	3	21.8	0	3.1	0	**69.3**	**G**
28-19	2003	9.8	2.8	3.8	1.1	0	0	0	**17.6**	**VP**
28-19	2008	26.7	13.8	15	11.9	0	2	-2	**67.4**	**G**
28-19	2013	27.5	14.8	15	26.2	0	1.6	0	**85.1**	**E**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
28-19	2018	30	14.9	15	26.9	0	1	0	**87.8**	**E**
28-21	2008	14	-2.7	1.5	30	-0.7	0	0	**42.1**	**P**
28-21	2013	15.8	7.8	1.8	30	-0.1	0.3	0	**55.5**	**F**
28-21	2018	14.9	9.9	2.9	30	-0.9	0.7	0	**57.4**	**F**
28-22	2013	30	11.2	5.6	30	0	1.5	0	**78.3**	**G**
28-22	2018	30	7.6	3.2	30	0	3.4	0	**74.3**	**G**
28-23	2013	0.3	0	0	3.1	0	0.4	0	**3.8**	**VP**
28-23	2016	0.4	0	0	25.9	-0.2	0.3	0	**26.4**	**VP**
28-23	2018	1	0	0	23.9	0	0.1	0	**25**	**VP**
28-24	2018	30	13.4	5.3	30	0	0.3	0	**79.1**	**G**

Table 7.9). For the range trend sites, the DD Hollow study was the only one classified as being in excellent condition. There were four studies classified as being in good condition: these were Buckskin Valley, Sheep Hollow West, Haycock Mountain, and Above Limerock Canyon. The two sites considered to be in fair-good condition were Three Creeks and Paragonah. There were two sites considered to be in fair condition, and these sites were Elliker Basin and South Summit WMA. The Grass Valley site is considered to be in poor-fair condition. The Cottonwood study is classified as being in poor condition. Finally, the two studies in very poor condition are Swayback Knoll and Threemile Creek.

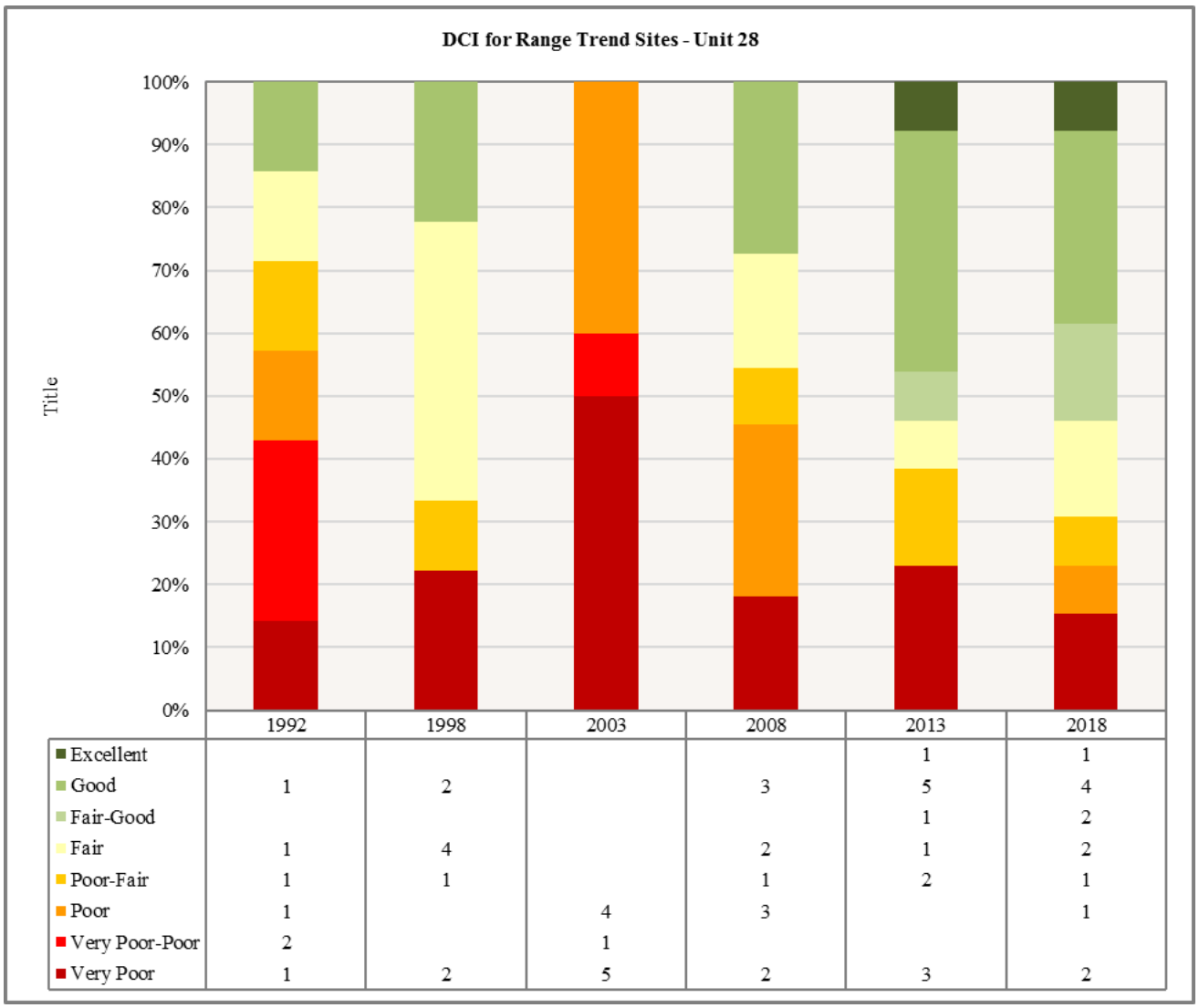
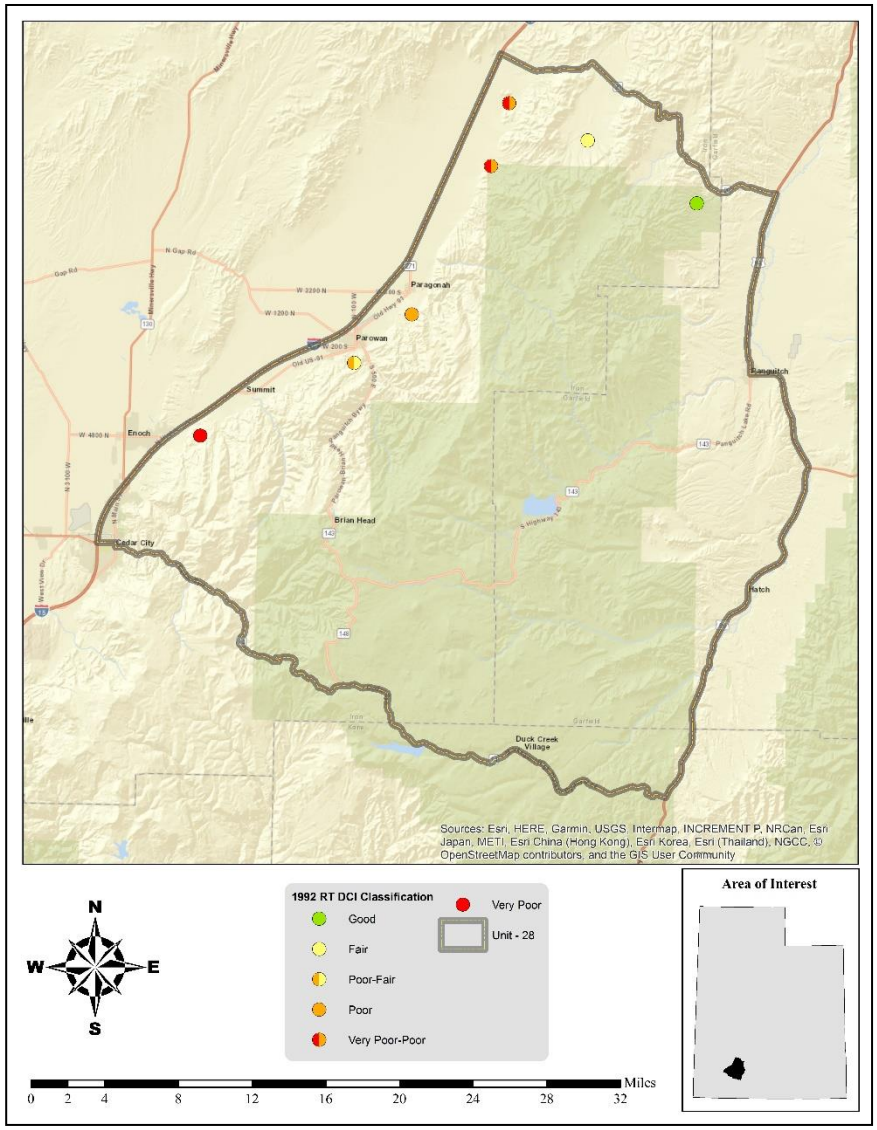


Figure 7.22: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 28, Panguitch Lake.

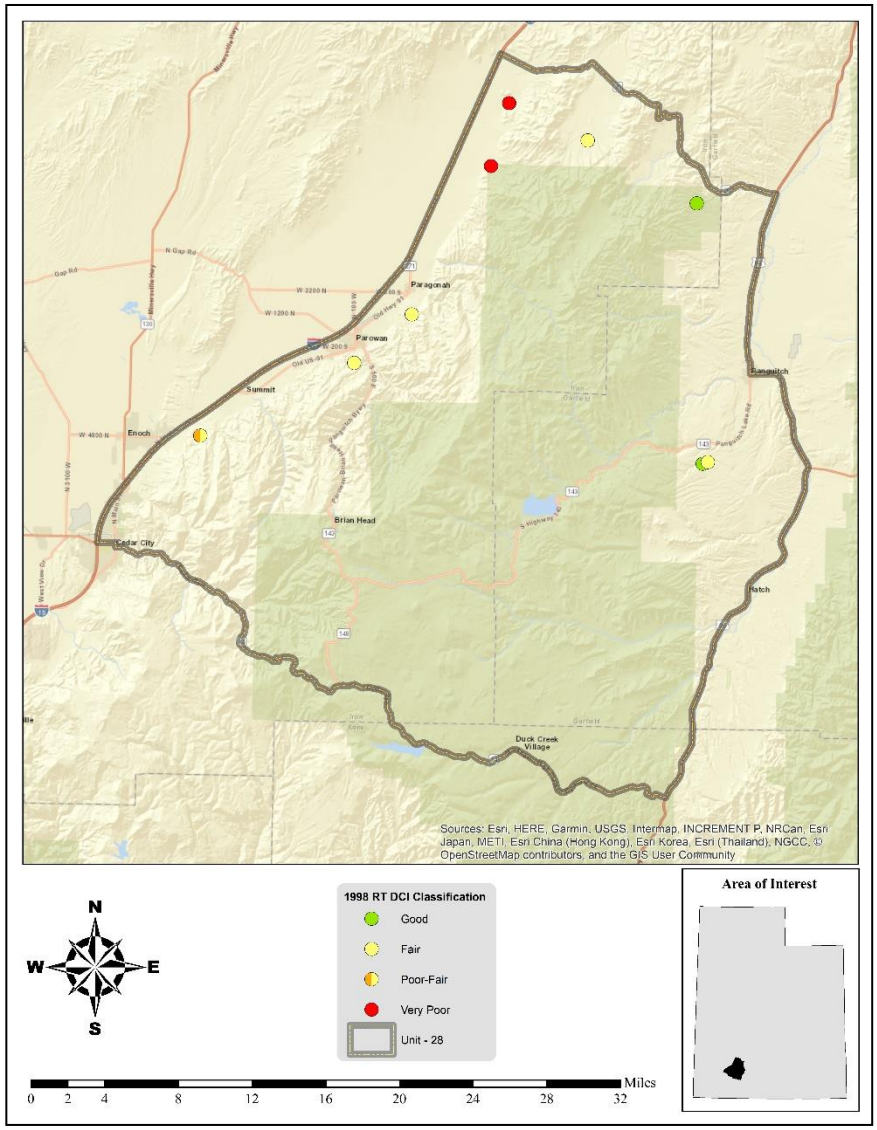
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
28-01	1992	8.7	11.3	15	30	0	5.9	0	**70.9**	**G**
28-01	1998	10.5	14.5	14.6	30	0	6	0	**75.6**	**G**
28-01	2003	6.3	0	0	10	0	6.1	0	**22.4**	**VP**
28-01	2008	10.3	13.2	15	28.9	0	5.1	0	**72.3**	**G**
28-01	2013	15.1	13.8	9	30	0	4.1	0	**72.1**	**G**
28-01	2018	17.2	12.7	4.5	30	0	1.8	0	**66.2**	**F-G**
28-04	1992	30	1.7	5.1	16.9	-0.1	10	0	**63.6**	**F**
28-04	1998	30	9.6	3.8	12.9	-2.2	10	0	**64.1**	**F**
28-04	2003	30	3.2	1.2	5.3	-1.2	5.7	0	**44.2**	**P**
28-04	2008	30	2.1	1.9	12.8	-2	10	0	**54.8**	**P-F**
28-04	2013	30	8.8	3.2	12.1	-8.9	10	0	**55.2**	**P-F**
28-04	2018	30	11.3	2	20.1	-0.9	10	0	**72.5**	**G**
28-05	1992	13.8	6.3	8	6.3	-0.9	0.1	0	**33.6**	**VP-P**
28-05	1998	15.5	8.3	5.9	6.8	-14.6	0.2	0	**22.1**	**VP**
28-05	2003	20.4	5.2	2.1	6.4	-1.7	0	0	**32.4**	**VP**
28-05	2008	13.9	-0.4	3.3	9.6	-1.7	0.3	0	**24.9**	**VP**
28-05	2013	1	0	0	3.8	-15	0.5	0	**-9.7**	**VP**
28-05	2018	0.3	0	0	18.9	-16.9	0	0	**2.3**	**VP**
28-06	1992	12.3	10.3	3.2	10.2	-6.1	5.2	0	**35.1**	**VP-P**
28-06	1998	9.4	6.2	3.2	13.8	-13.4	4.6	0	**23.8**	**VP**
28-06	2003	10.3	0.2	0.6	6.9	-0.3	8.8	0	**26.5**	**VP**
28-06	2008	10.9	3.2	2.6	9.7	-9	10	0	**27.4**	**VP**
28-06	2013	10.4	8	0	10.8	-11.3	10	0	**27.8**	**VP**
28-06	2018	9.8	4.5	1.8	30	-13.6	9.9	0	**42.3**	**P**
28-07	1992	11.2	9.9	15	7.9	-0.2	3.6	0	**47.3**	**P**
28-07	1998	12.2	11.7	15	14.9	-2.6	3.1	0	**54.3**	**F**
28-07	2003	9.4	9.4	11.5	2.1	-0.3	1.7	0	**33.8**	**VP-P**
28-07	2008	7	12.1	15	18.6	-0.8	4.8	0	**56.8**	**F**
28-07	2013	20.3	14.4	15	11.3	-0.1	5.2	0	**66.1**	**F-G**
28-07	2018	22.6	14.4	6	17.1	0	5.5	0	**65.5**	**F-G**
28-08	1992	20.6	-3.1	3.3	30	-1.7	0	0	**49.1**	**P-F**
28-08	1998	17	4.8	4.6	30	-1.6	0.2	0	**54.9**	**F**
28-08	2003	16	0.9	1.2	24.4	-4.3	0.1	0	**38.3**	**P**
28-08	2008	15.6	0.2	1.9	30	-0.1	0.2	0	**47.8**	**P**
28-08	2013	17.6	1.3	2.9	30	0	0.1	0	**51.9**	**P-F**
28-08	2018	15.5	3.4	2	30	-0.9	0.1	0	**50**	**P-F**
28-11	1992	29.7	-0.2	2.9	9.8	-20	0.1	0	**22.4**	**VP**
28-11	1998	29	7.5	1.9	15.3	-6	0.7	0	**48.4**	**P-F**
28-11	2003	19	-2.1	0.8	12	-20	0	0	**9.7**	**VP**
28-11	2008	15	-4.2	1.4	24.8	-0.2	0.4	0	**37.2**	**P**
28-11	2013	15.4	6.8	15	30	-0.3	0.4	0	**67.2**	**G**
28-11	2018	17.5	9.3	11.6	30	-12.7	0.3	0	**56**	**F**
28-14	1998	24.1	6.2	4.5	30	0	9.6	0	**74.3**	**G**
28-14	2003	26.3	4.6	2.4	16.8	0	2.9	0	**52.9**	**P**
28-14	2008	30	3.4	2.8	30	0	6	0	**72.1**	**G**
28-14	2013	30	12.9	3.7	30	0	2.2	0	**78.8**	**G**
28-14	2018	30	10.2	5.8	30	0	4	0	**80**	**G**
28-15*	1998	30	7.8	2.3	15.5	0	5.3	0	**60.9**	**F**
28-15*	2003	30	8	2	4.6	0	2.4	0	**46.9**	**P**
28-15*	2008	30	1.7	5.5	14.3	0	6.9	0	**58.3**	**F**
28-15*	2013	30	11.5	3	21.8	0	3.1	0	**69.3**	**G**
28-19	2003	9.8	2.8	3.8	1.1	0	0	0	**17.6**	**VP**
28-19	2008	26.7	13.8	15	11.9	0	2	-2	**67.4**	**G**
28-19	2013	27.5	14.8	15	26.2	0	1.6	0	**85.1**	**E**
28-19	2018	30	14.9	15	26.9	0	1	0	**87.8**	**E**
28-21	2008	14	-2.7	1.5	30	-0.7	0	0	**42.1**	**P**
28-21	2013	15.8	7.8	1.8	30	-0.1	0.3	0	**55.5**	**F**
28-21	2018	14.9	9.9	2.9	30	-0.9	0.7	0	**57.4**	**F**
28-22	2013	30	11.2	5.6	30	0	1.5	0	**78.3**	**G**
28-22	2018	30	7.6	3.2	30	0	3.4	0	**74.3**	**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
28-23	2013	0.3	0	0	3.1	0	0.4	0	**3.8**	**VP**
28-23	2016	0.4	0	0	25.9	-0.2	0.3	0	**26.4**	**VP**
28-23	2018	1	0	0	23.9	0	0.1	0	**25**	**VP**
28-24	2018	30	13.4	5.3	30	0	0.3	0	**79.1**	**G**

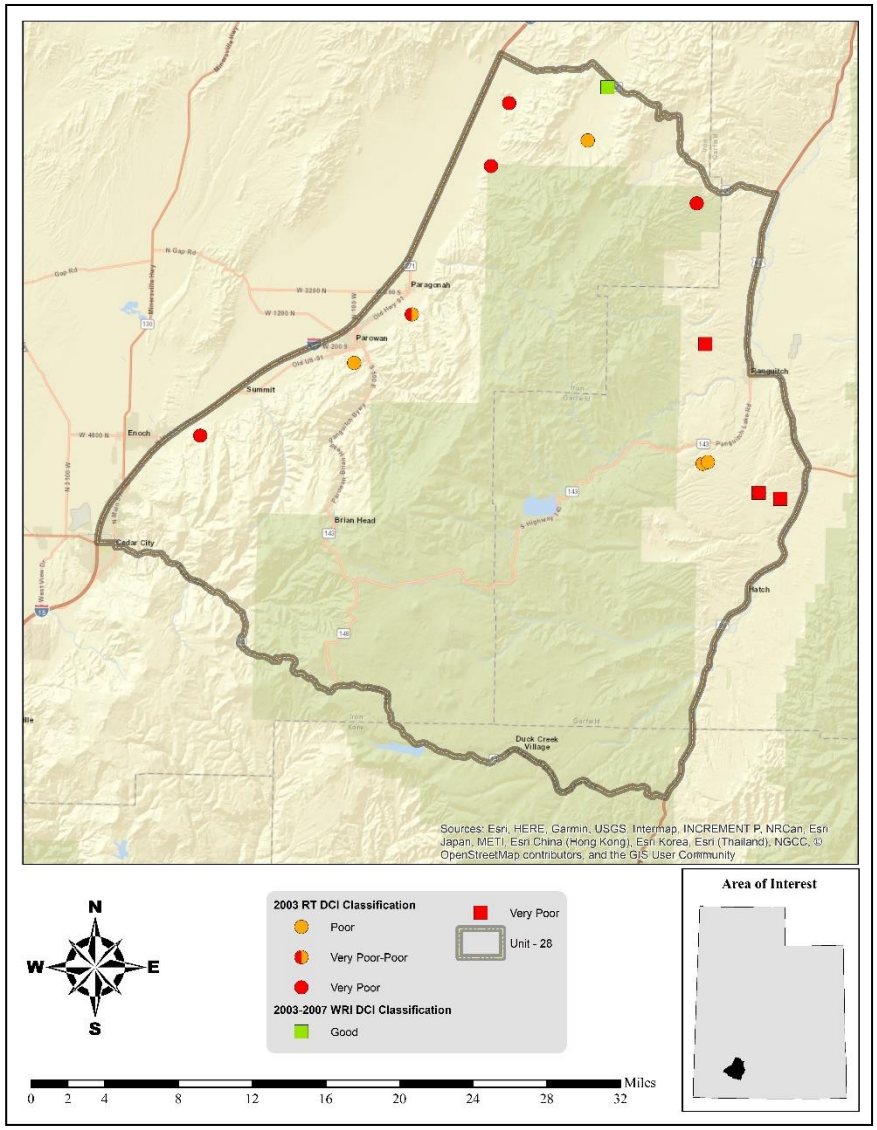
Table 7.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 28, Panguitch Lake. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



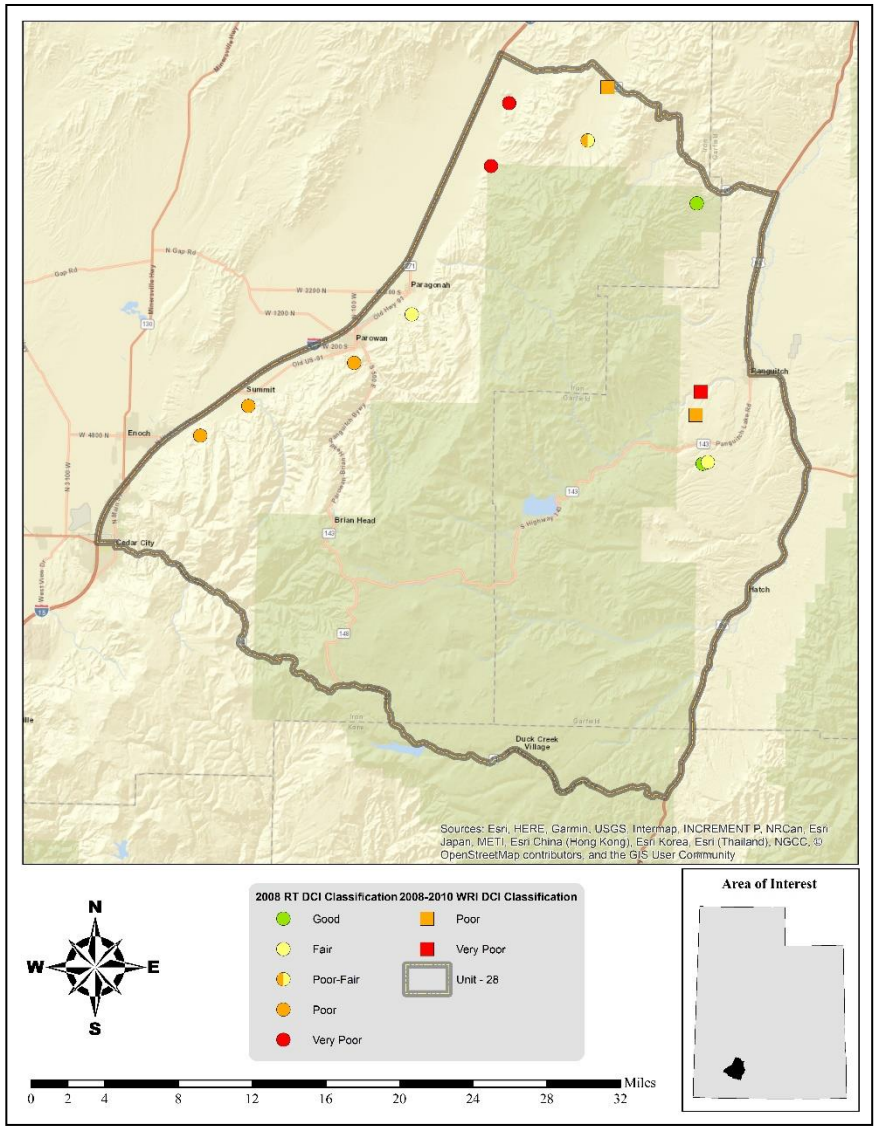
Map 7.8: 1992 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.



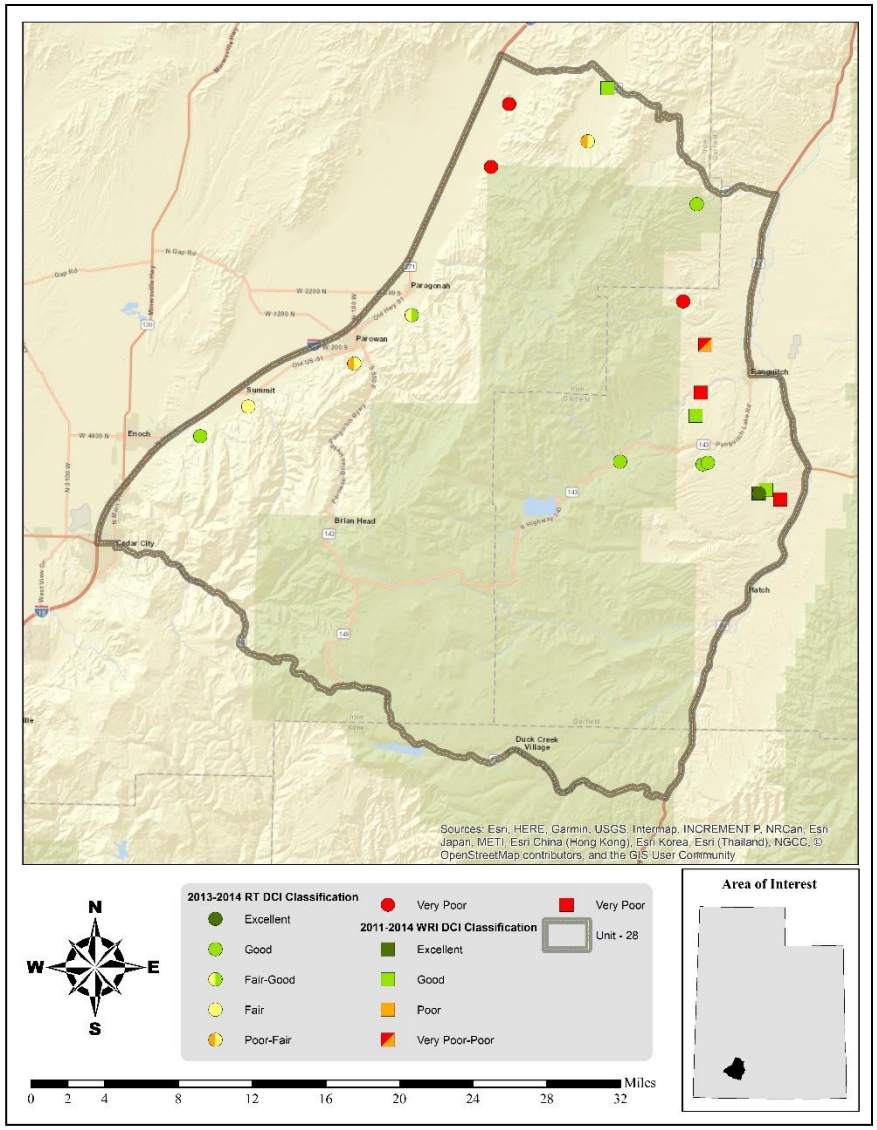
Map 7.9: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.



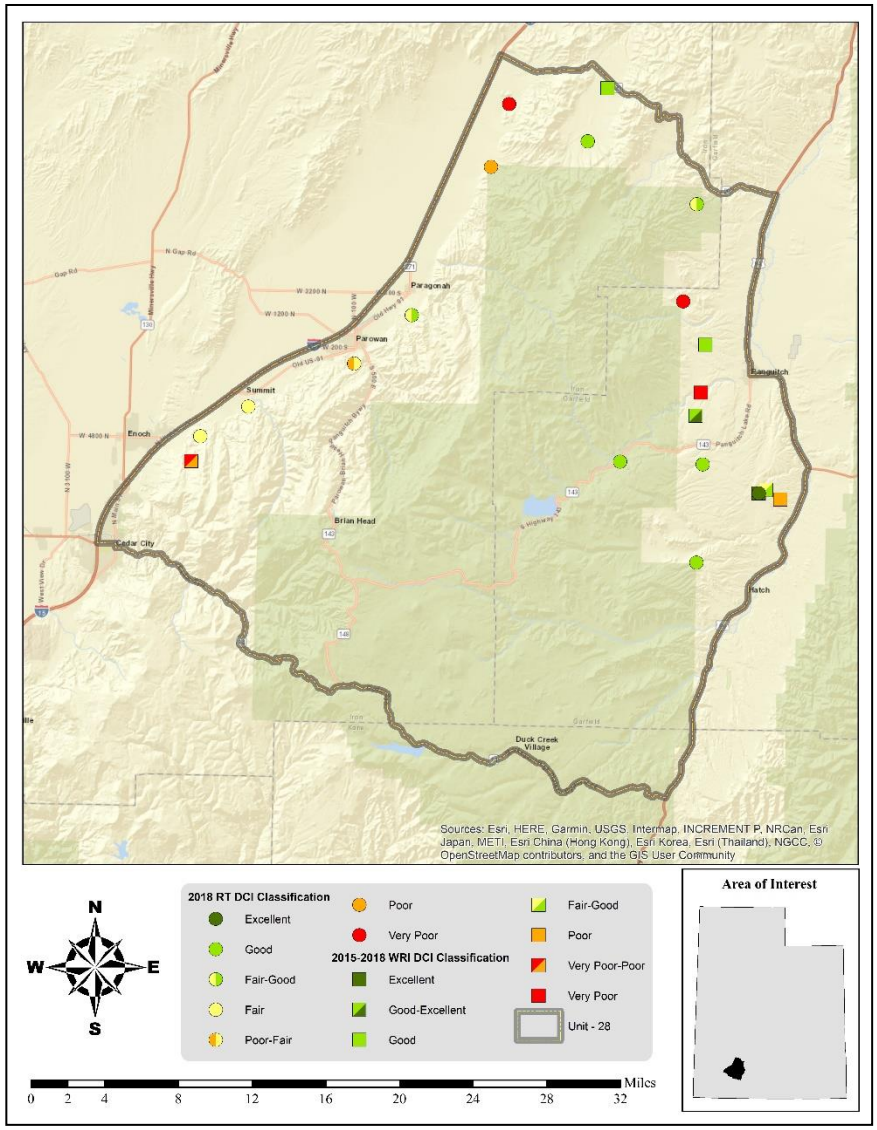
Map 7.10: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.



Map 7.11: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.



Map 7.12: 2013-2014 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.



Map 7.13: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 28, Panguitch Lake.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
28-01	Three Creeks	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-03	Bear Valley	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
28-04	Buckskin Valley	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-05	Swayback Knoll	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
28-06	Cottonwood	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-07	Paragonah	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-08	Grass Valley	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-11	Elliker Basin	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-14	Sheep Hollow West	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-16	Asay Bench	None Identified		
28-17	Sidney Valley	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
28-18	Shakespeare Hollow	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
28-19	DD Hollow	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
		Energy Development	Low	Fragmentation and degradation/loss of habitat
28-21	South Summit WMA	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-22	Haycock Mountain	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-23	Threemile Creek	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28-24	Above Limerock Canyon	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-09	South Canyon 2	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-10	Buckskin Valley Highway 20	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-12	Fivemile 2	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-13	Panguitch Creek	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
28R-15	Panguitch Creek WMA	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-19	South Canyon	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-20	Indian Hollow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
28R-21	Williams Hollow	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
28R-22	Above Elliker Basin	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity

Table 7.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 28, Panguitch Lake. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Subalpine (Geranium)

The study site that is classified as a Subalpine (Geranium) ecological site, Sidney Valley (28-17), is generally considered to be in good condition for big game summer range in the Panguitch Lake unit. This high-elevation

meadow supports a robust herbaceous component that may provide good forage for wildlife during the summer months. The primary threat to this study site is posed by introduced perennial grasses. Although the threat these grasses pose is low as of the most recent sample year, they can be aggressive at higher elevations and outcompete native forbs and grasses. This can lead to reduction in understory herbaceous diversity and productivity. It is recommended that monitoring continue for this site. If these grasses increase in the future, treatment may be beneficial. Possible management practices that could help with these species include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Big Sagebrush)

The only study that is considered to be within the Mountain (Big Sagebrush) ecological type is not considered to be in deer winter range and was therefore not rated by the Desirable Components Index criteria. This ecological type supports sagebrush and understory species that provide forage and browse for deer and other wildlife. Introduced perennial grasses, particularly crested wheatgrass, are the most immediate threat on this site. These grasses can be aggressive at higher elevation and outcompete native species for resources, leading to reduced understory diversity and productivity. A lesser threat is posed by annual grasses, which may elevate fuel loads and alter the fire regime if they increase in the future.

Treatments that could be helpful to restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Black/Low Sagebrush)

The study that is classified as a Mountain (Black/Low Sagebrush) ecological type is considered to be in good condition for mule deer winter range on this management unit. This ecological type supports sagebrush and understory species that provide forage and browse for wintering deer and other wildlife. Introduced perennial grasses pose a low-level threat to the plant community on this site. At higher elevations, these grasses can be aggressive and outcompete native species for resources, leading to reduced understory diversity and productivity. An additional threat is posed by annual grasses, which may elevate fuel loads and alter the fire regime if they increase in the future. Treatments that could be helpful to restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Pinyon and juniper encroachment is also occurring on this study site. Although trees currently pose a low-level threat, continued encroachment could lead to reduced understory and shrub health. It is recommended that monitoring of this study site continue. In areas where and when it is necessary, work to reduce these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin.

Mountain (Shrub)

The studies that are classified as Mountain (Shrub) ecological sites are considered to be in good condition for deer winter range in the Panguitch Lake management unit. However, the Asay Bench study is not considered to be within deer winter range and was therefore not rated by the DCI criteria. In addition, no threats were identified for the Asay Bench study. Introduced perennial grasses pose a low to medium-level threat on all other sites, however. These introduced species have the potential to be aggressive at higher elevations and may lead to reduced understory diversity and productivity. Encroachment of pinyon and juniper is an additional low-level threat. If the tree communities on these studies continue to progress in woodland succession, they may lead to reduced understory and shrub vigor. Tree-removing disturbances such as chaining, lop and scatter, etc. may be beneficial in future sample years, but care should be taken so that annual grasses do not increase following treatment.

Annual grasses are a high-level threat on the Buckskin Valley site and a low-level threat on the Haycock Mountain study. High amounts of annual grasses can alter the plant community dynamics, increase fuel loads, and potentially exacerbate the risk of wildfire. Should reseeding be necessary to restore the understory, species selection should occur under great care with preference given to native species when possible.

Mountain (Silver Sagebrush)

The Shakespeare Hollow study is classified as a Mountain (Big Sagebrush) ecological site. This study is not considered to be within deer winter range and was therefore not rated by the DCI criteria. Introduced perennial grasses pose a medium-level threat on this site. These introduced species have the potential to be aggressive at higher elevations and may lead to reduced understory diversity and productivity. Should reseeding be necessary to restore the understory, species selection should occur under great care with preference given to native species when possible. No other threats have been identified for sites of this ecological type at this time.

Upland (Big Sagebrush)

The Upland (Big Sagebrush) studies within this unit are considered to be in very poor to fair-good condition for deer winter range. Sites of this ecological type support sagebrush and other browse species that provide browse for wintering deer. Annual grasses pose a low to high-level threat on these studies, and increased amounts of these grasses can increase the fuel load and thereby increase the fire return interval. Introduced perennial grasses also threaten many of these studies. These introduced perennial grasses have the potential to outcompete native herbaceous species for resources and may lead to decreased understory diversity and productivity. All of these threats can change the plant community dynamics and result in a less productive browse component and herbaceous understory. On sites with significant cover from annual and perennial grasses, treatments that could aid in restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. 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.

In addition, pinyon and juniper encroachment is occurring on some of these studies. Although trees currently pose a low-level threat on all sites where they are present, continued encroachment could lead to reduced understory and shrub health. It is recommended that in areas where and when it is necessary, work to reduce these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin.

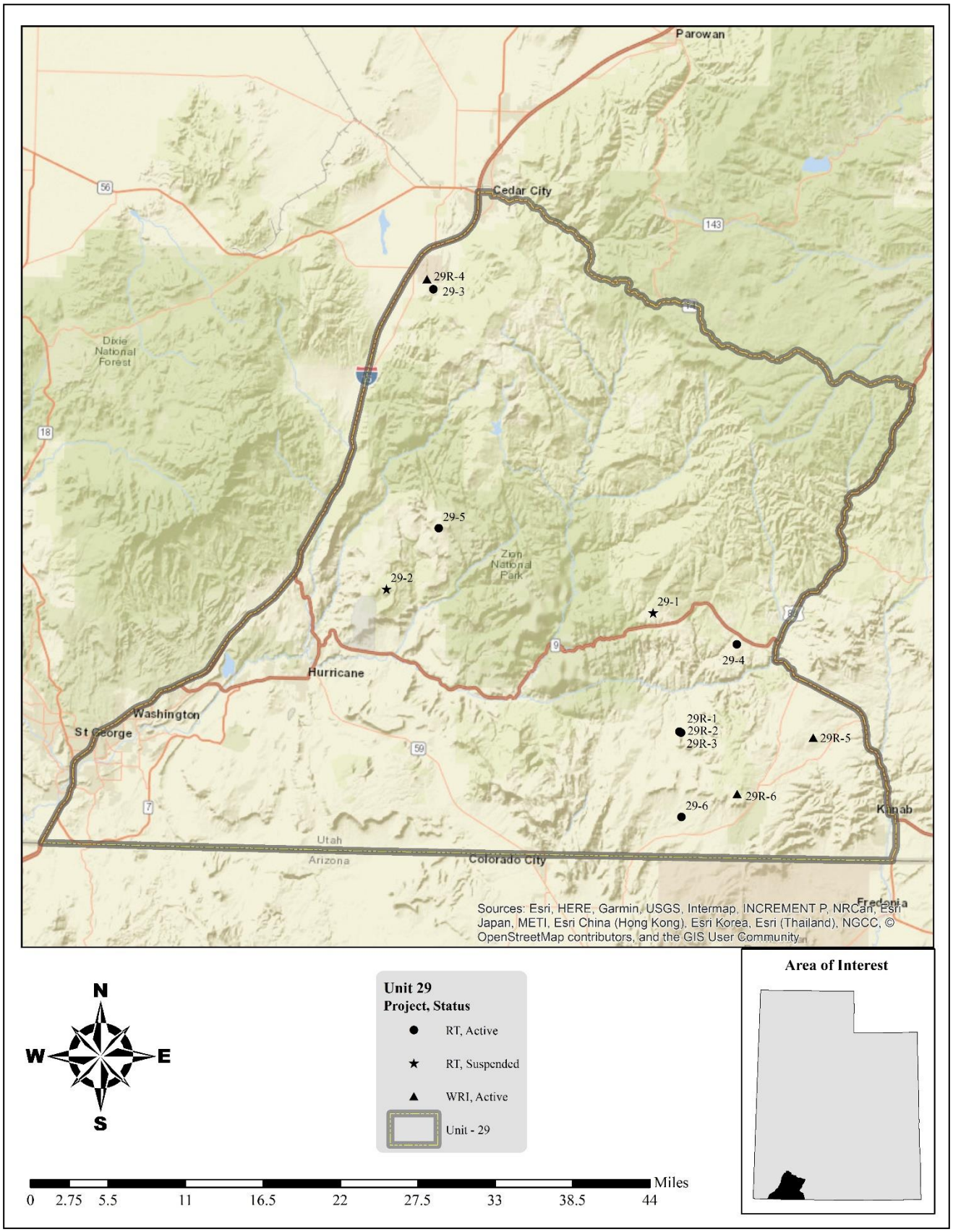
Upland (Black/Low Sagebrush)

The Upland (Black/Low Sagebrush) studies within this unit are considered to be in very poor to excellent condition for deer winter range. More specifically, the Paragonah study is in fair-good condition, DD Hollow is excellent, and Threemile Creek is in very poor condition. Sites of this ecological type generally support sagebrush and other browse species that provide browse for wintering deer. Annual grasses pose a low to medium-level threat on these studies, and increased amounts of these grasses can increase the fuel load and thereby increase the fire return interval. In addition, pinyon and juniper encroachment is occurring on these studies. Although trees currently pose a low-level threat, continued encroachment could lead to reduced shrub and understory health. It is recommended that in areas where and when it is necessary, work to reduce these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin.

Introduced perennial grasses are an immediate threat on the DD Hollow study. These introduced perennial grasses have the potential to outcompete native herbaceous species for resources and may lead to decreased understory diversity and productivity. Noxious weeds have also been observed on this site in past sample years, and can be aggressive and reduce understory diversity. The DD Hollow study is also at low risk for energy development as powerlines and substations are in the vicinity of the site. Further energy development has the potential to fragment and degrade wildlife habitat. All of these threats can alter the plant community dynamics, resulting in less productive browse and herbaceous components. On sites with significant cover from annual and perennial grasses, treatments that could aid in restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore

herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

8. WILDLIFE MANAGEMENT UNIT 29 – ZION



WILDLIFE MANAGEMENT UNIT 29 – ZION

Boundary Description

Iron, Kane, and Washington counties – Boundary begins at I-15 and the Utah-Arizona state line; north on I-15 to SR-14; east on SR-14 to US-89; south on US-89 to US-89A; south on US-89A to the Utah-Arizona state line; west on the Utah-Arizona state line to I-15.

Management Unit Description

Geography

The Zion wildlife management unit includes the southern portion of the Markagunt Plateau. The unit also contains Pine Spring Knoll, Kolob Peak, and Little Creek Mountain. Pine Knoll, located in the northeastern part of the unit, is the highest point with an elevation of 10,000 feet. In contrast, the lowest point in the unit has an elevation of about 2,500 feet and is located east of St. George. Zion National Park is also included in the unit; the highest point in the park is Horse Ranch Mountain with an elevation of 8,726 feet, and the lowest point is Coalpits Wash at 3,666 feet. The park occurs at the junction of the Mojave Desert, Colorado Plateau, and Great Basin, giving it a unique assembly of flora and fauna in addition to a variety of geographical configurations such as canyons, buttes, mesas, natural arches, and monoliths. Towns in this unit include Kanarraville, Hurricane, Springdale, Rockville, Mt. Carmel, and the cities of St. George and Cedar City on the unit boundaries.

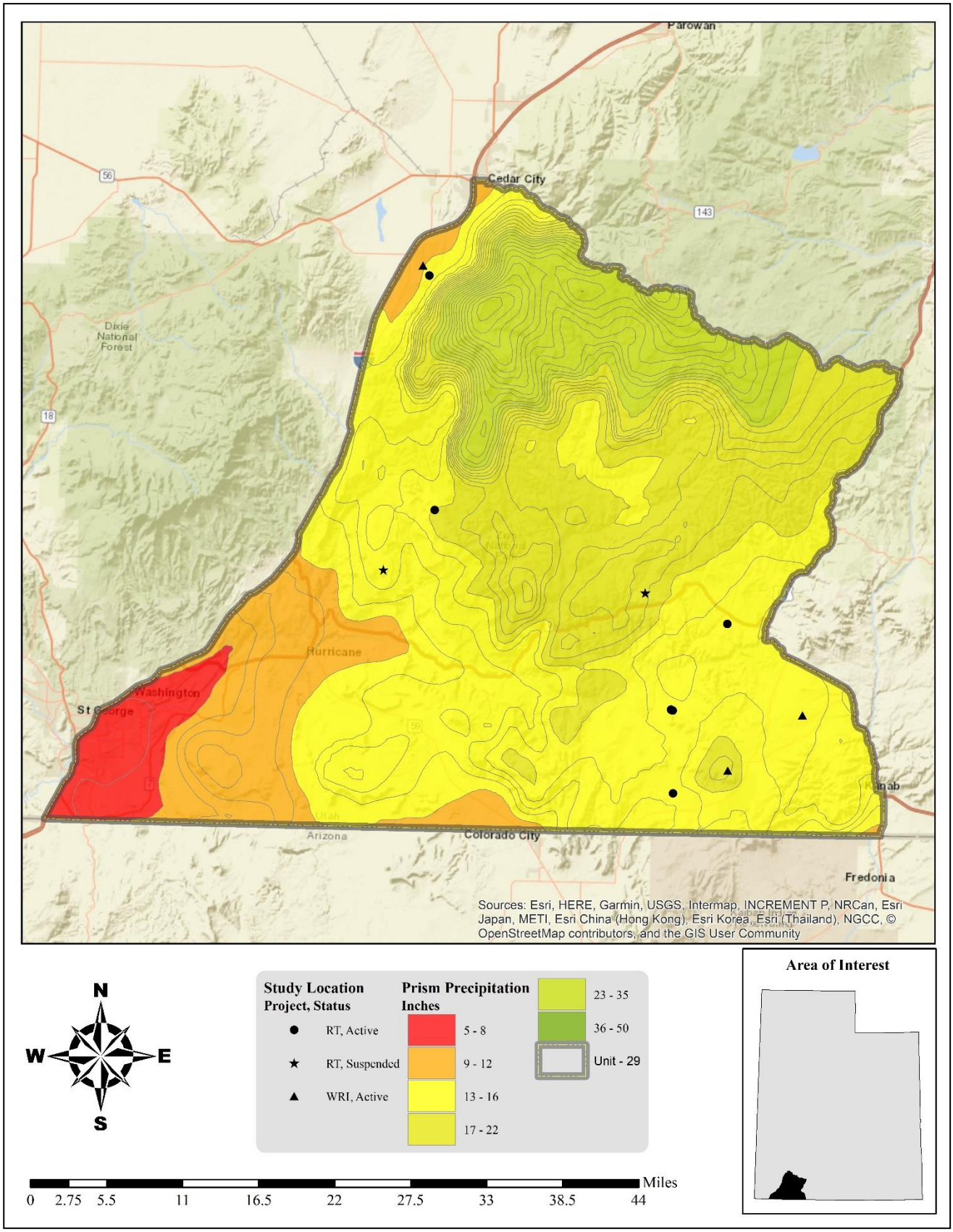
A number of streams are located within this unit, including La Verkin Creek, Muddy Creek, Blue Creek, Crystal Creek, and Deep Creek: most of these are tributaries of the Virgin River. The Virgin River itself is formed by the confluence of the North Fork Virgin and East Fork Virgin just outside of Zion National Park near the town of Springdale. Navajo Lake and Kolob Reservoir are also found within the Zion management unit.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches in the southwest portion of the unit near St. George to 36 inches near Midway Valley. All of the Range Trend and WRI monitoring studies on the unit occur within 12-18 inches of precipitation (**Map 8.1**) (PRISM Climate Group, Oregon State University, 2013).

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

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 8.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 8.1b**) (Time Series Data, 2019).



Map 8.1: The 1981-2010 PRISM Precipitation Model for WMU 29, Zion (PRISM Climate Group, Oregon State University, 2013).

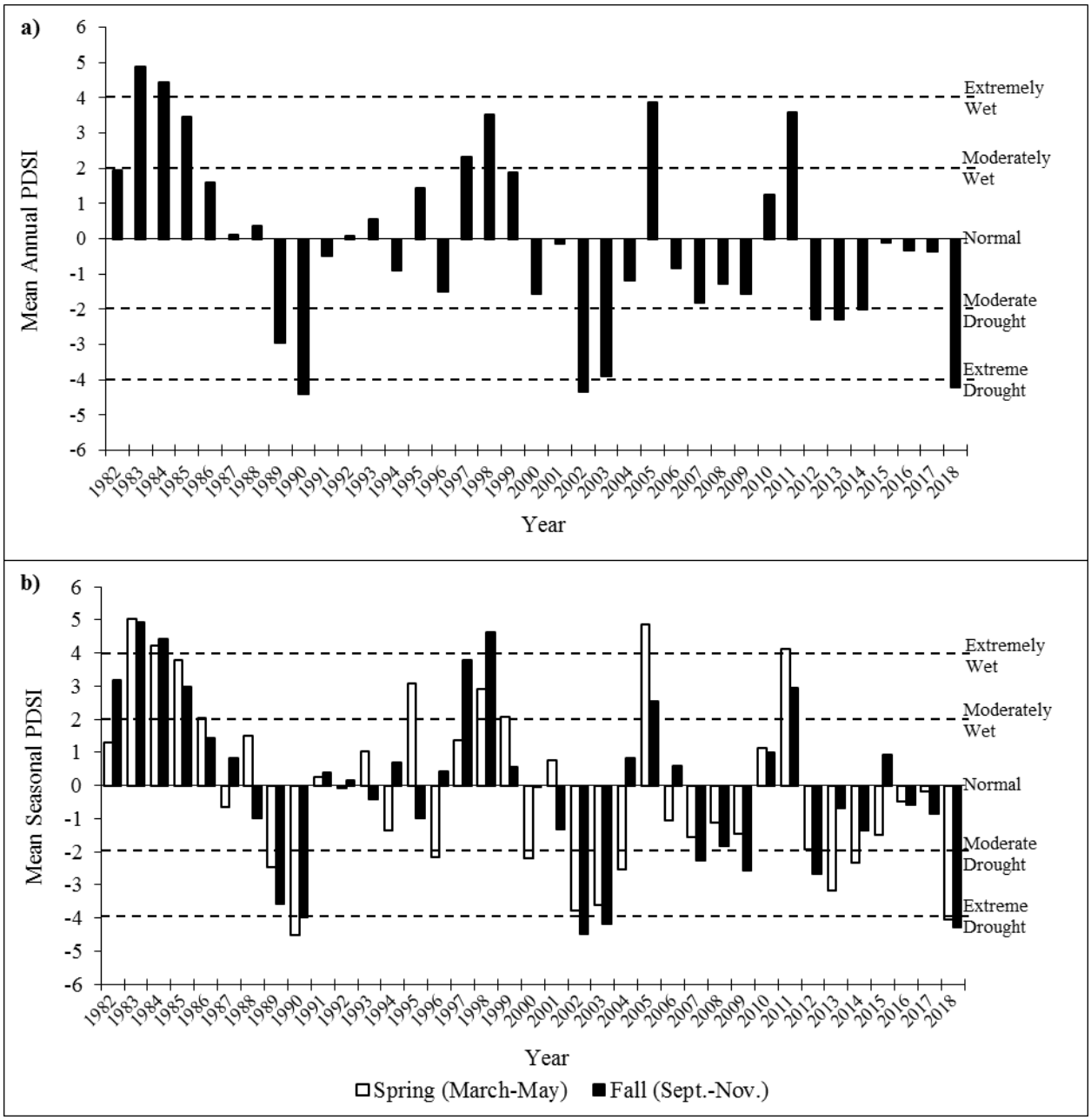
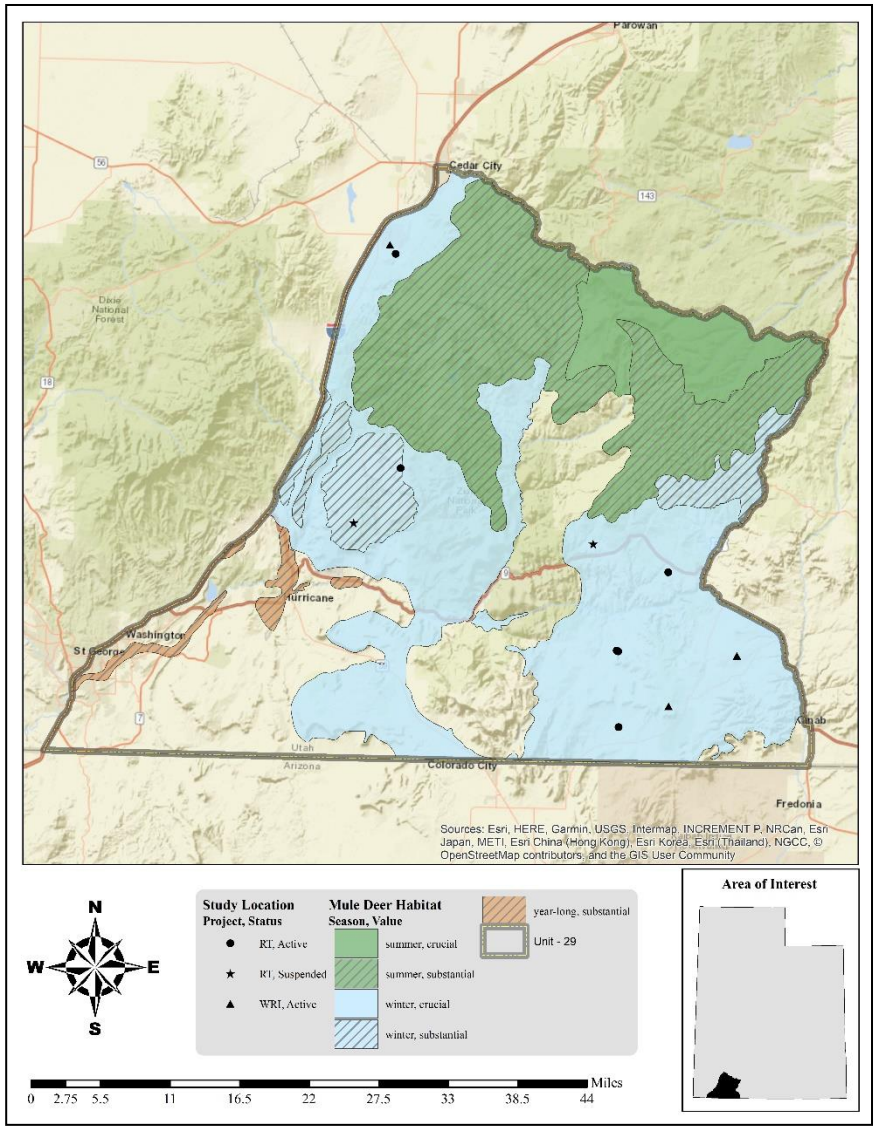


Figure 8.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019). .

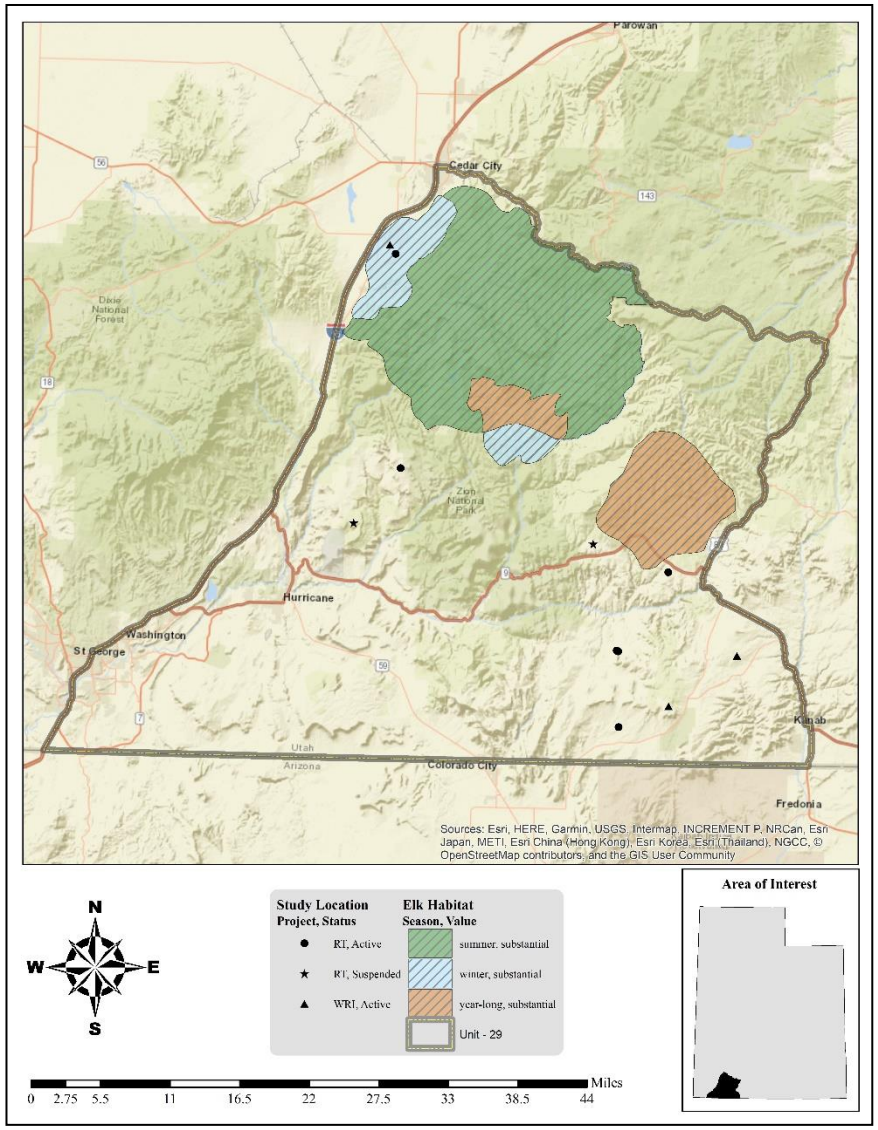
Big Game Habitat

There are 786,474 acres estimated as mule deer range on Unit 29 with 60% designated as winter range, 38% classified as summer range, and 2% as year-long range (**Table 8.1**, **Map.8.2**). The Bureau of Land Management (BLM) manages 57% of the winter range, 19% is privately owned, 15% is administered by the National Park Service (NPS), the Utah School and Institutional Trust Lands Administration (SITLA) manages another 2%, Utah State Parks administers 1%, and less than 1% each is tribally owned or administered by the United States Forest Service (USFS) or the Utah Department of Transportation (UDOT) (**Table 8.2**, **Map.8.2**, **Map 8.5**). Of the elk winter range, 48% is managed by the BLM, 20% is privately owned, 18% is administered by the NPS, 7% is tribally owned, and 7% is managed by SITLA (**Table 8.3**, **Map 8.3**, **Map 8.5**).

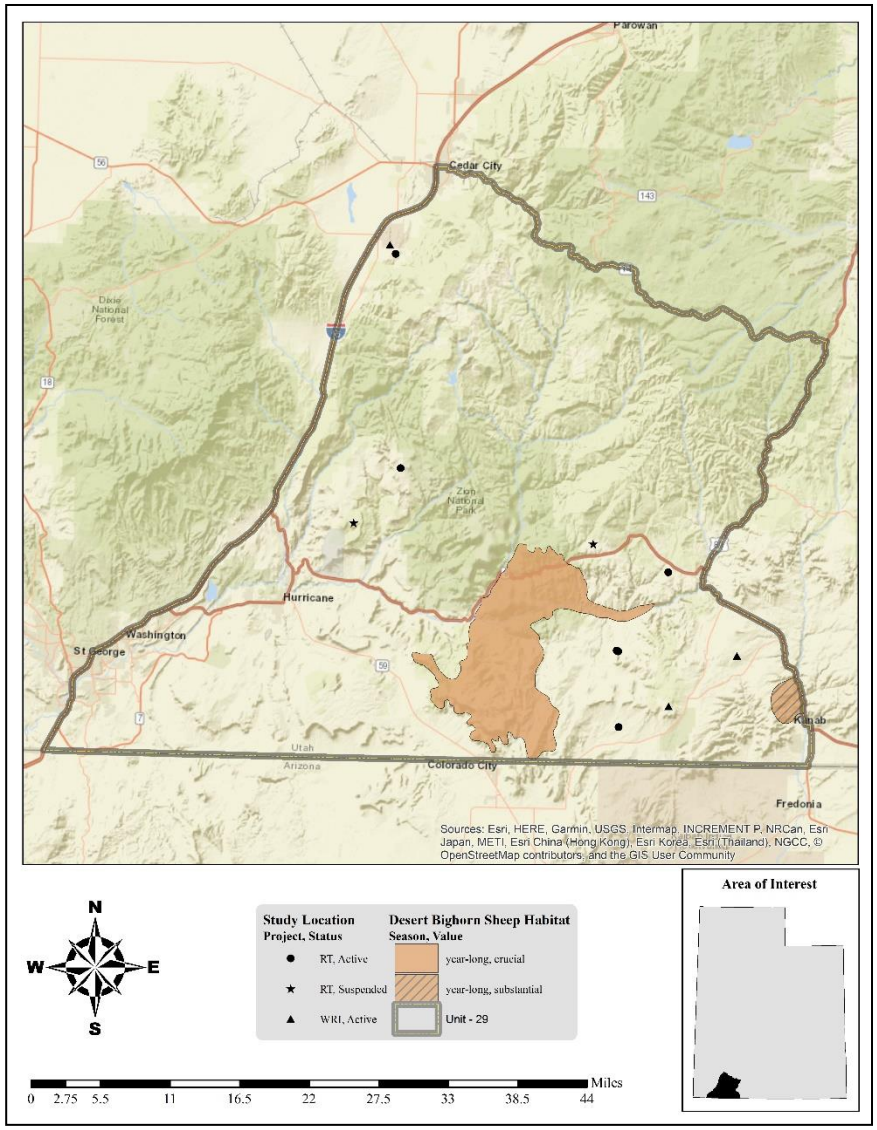
Most of the summer range is found in the northern part of the unit, which includes the southern end of the Markagunt Plateau. Unlike the majority of the wildlife management units in the state, most of the summer range in the Zion unit occurs on private land with increased summer home development becoming more of a management problem. The Forest Service and Zion National Park administrate the remaining summer range. Winter range predominately occurs on BLM land, but Zion National Park and private land make up a minor portion.



Map.8.2: Estimated mule deer habitat by season and value for WMU 29, Zion.



Map 8.3: Estimated elk habitat by season and value for WMU 29, Zion.



Map.8.4: Estimated desert bighorn sheep habitat by season and value for WMU 29, Zion.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	302,412	38%	468,556	60%	15,506	2%
Elk	169,979	65%	30,616	12%	62,809	24%
DBS	0	0%	0	0%	74,601	100%

Table 8.1: Estimated mule deer, elk, and desert bighorn sheep (DBS) habitat acreage by season for WMU 29, Zion.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	17,863	6%	267,506	57%	1,272	8%
Private	181,407	60%	89,374	19%	14,183	91%
SITLA	7,054	2%	36,071	8%	51	<1%
Tribal	0	0%	2,294	<1%	0	0%
USFS	60,579	20%	1,276	<1%	0	0%
UDOT	0	0%	79	<1%	0	0%
USP	0	0%	3,727	1%	0	0%
NPS	35,509	12%	68,229	15%	0	0%
Total	302,412	**100%**	468,556	**100%**	15,506	**100%**

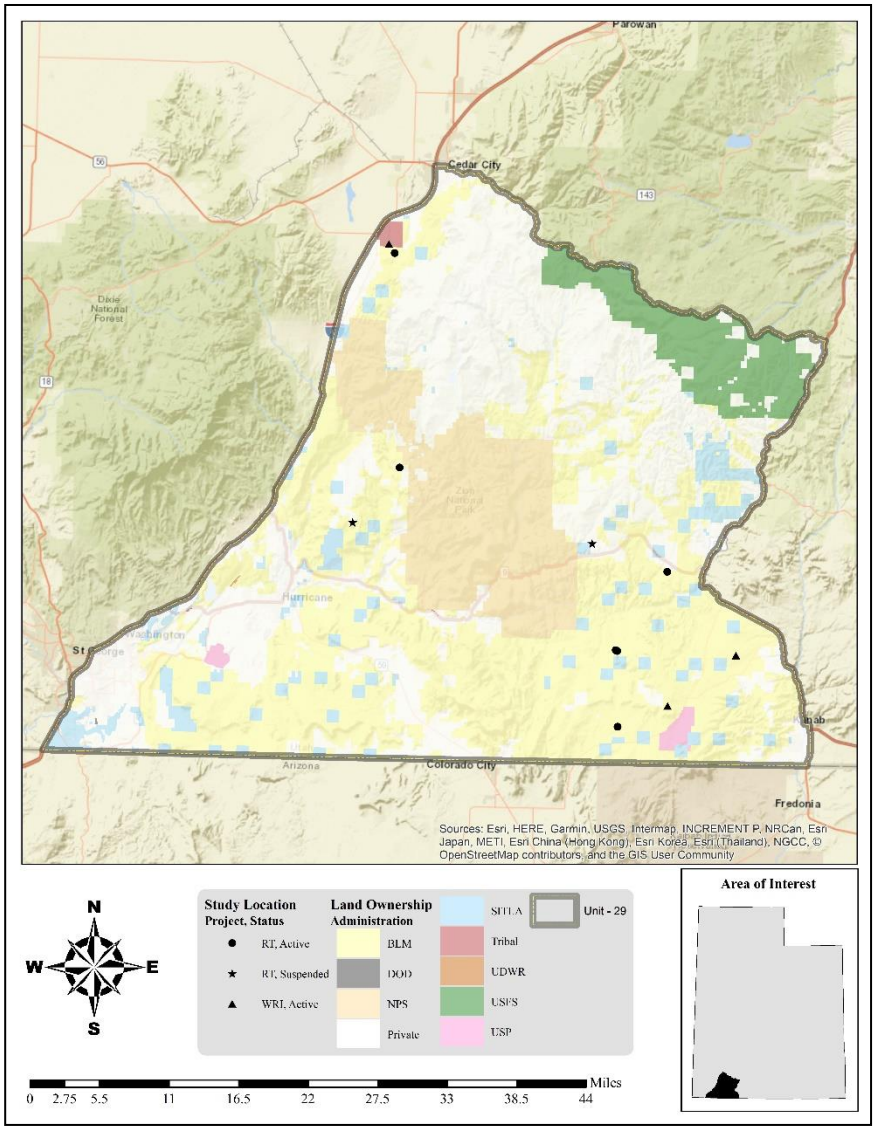
Table 8.2: Estimated mule deer habitat acreage by season and ownership for WMU 29, Zion.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	12,939	8%	14,611	48%	21,860	35%
Private	134,078	79%	6,245	20%	33,441	53%
SITLA	1,651	1%	2,067	7%	7,300	12%
Tribal	0	0%	2,088	7%	0	0%
USFS	12,529	7%	0	0%	0	0%
UDOT	0	0%	0	0%	23	<1%
NPS	8,783	5%	5,604	18%	184	<1%
Total	169,979	**100%**	30,616	**100%**	62,809	**100%**

Table 8.3: Estimated elk habitat acreage by season and ownership for WMU 29, Zion.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	48,102	64%
Private	3,048	4%
SITLA	27	0%
UDOT	3	0%
NPS	23,420	31%
Total	74,601	**100%**

Table 8.4: Estimated desert bighorn sheep habitat acreage by season and ownership for WMU 29, Zion.



Map 8.5: Land ownership for WMU 29, Zion.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	361,452	32.76%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	33,992	3.08%	
	Ponderosa Pine Forest, Woodland and Savanna	29,778	2.70%	
	Mountain Mahogany Woodland and Shrubland	18,371	1.66%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	3,566	0.32%	
	Spruce-Fir Forest and Woodland	2,725	0.25%	
	Limber Pine Woodland	1,865	0.17%	
	Juniper Woodland and Savanna	68	0.01%	
	Lodgepole Pine Forest and Woodland	5	0.00%	40.95%
Exotic Herbaceous	Introduced Annual Grassland	30,500	2.76%	
	Introduced Perennial Grassland and Forbland	394	0.04%	
	Introduced Annual and Biennial Forbland	193	0.02%	2.82%
Exotic Tree-Shrub	Introduced Riparian Vegetation	2,011	0.18%	0.18%
Grassland	Alpine Dwarf-Shrubland, Fell-field and Meadow	16,672	1.51%	
	Grassland	11,547	1.05%	
	Grassland and Steppe	92	0.01%	
	Dry Tundra	0	0.00%	2.57%
Shrubland	Desert Scrub	68,172	6.18%	
	Deciduous Shrubland	65,539	5.94%	
	Creosotebush Desert Scrub	53,155	4.82%	
	Big Sagebrush Shrubland and Steppe	52,432	4.75%	
	Chaparral	47,517	4.31%	
	Blackbrush Shrubland	40,213	3.64%	
	Sand Shrubland	11,057	1.00%	
	Salt Desert Scrub	9,062	0.82%	
	Low Sagebrush Shrubland and Steppe	6,053	0.55%	32.12%
Other	Barren	51,650	4.68%	
	Hardwood	43,652	3.96%	
	Sparsely Vegetated	40,427	3.66%	
	Developed	37,860	3.43%	
	Conifer-Hardwood	34,847	3.16%	
	Riparian	19,182	1.74%	
	Agricultural	6,275	0.57%	
	Open Water	1,680	0.15%	
	Quarries-Strip Mines-Gravel Pits	178	0.02%	21.37%
Total		1,103,437	100%	100%

Table 8.5: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 29, Zion.

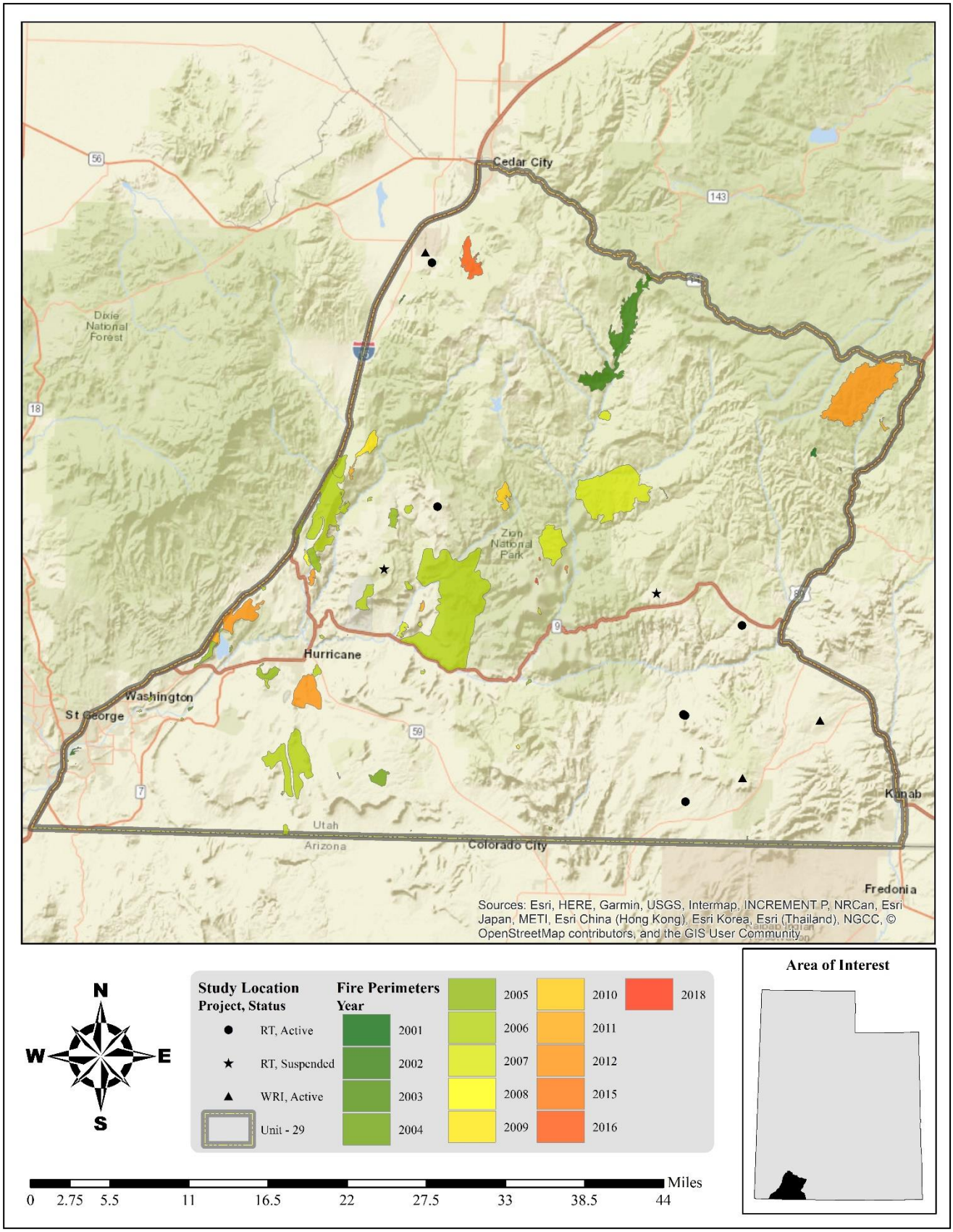
Limiting Factors to Big Game Habitat

Winter range is a limiting factor on the west side of the Zion Unit from Cedar City south to Toquerville where it is adjacent to I-15. In addition, the majority of the summer range occurs on private land with increased summer home development becoming more of a management problem.

Wildfire has also had an impact on the deer winter range in this unit. The Kolob fire of 2006 was the largest wildfire in the unit at 17,631 acres, and burned almost entirely within the western boundary of Zion National Park. The Ranch fire of 2006 burned 6,108 acres of deer winter range on the western side of the unit near Pintura. The Shingle fire of 2012 and Big Wash fire of 2002 burned several thousand acres each of deer summer range in the northern portion of the unit. Other large fires have occurred within the unit boundaries, but did not occur on deer habitat. Most recent fires burned less than 1,000 acres and have had negligible impact on deer winter range (**Map 8.6**).

According to the LANDFIRE Existing Vegetation Coverage model, nearly 33% of the unit is comprised of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodlands (**Table 8.5**). While these woodlands provide valuable escape and thermal cover for wildlife, encroachment and invasion of pinyon-juniper woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, therefore decreasing available wildlife forage (Miller, Svejcar, & Rose, 2000).

Annual grasslands, primarily cheatgrass (*Bromus tectorum*), comprise a small proportion of the unit and pose a minimal threat by increasing fuel loads and decreasing ecological resilience (**Table 8.5**).



Map 8.6: Land coverage of fires by year from 2000-2018 for WMU 29, Zion (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

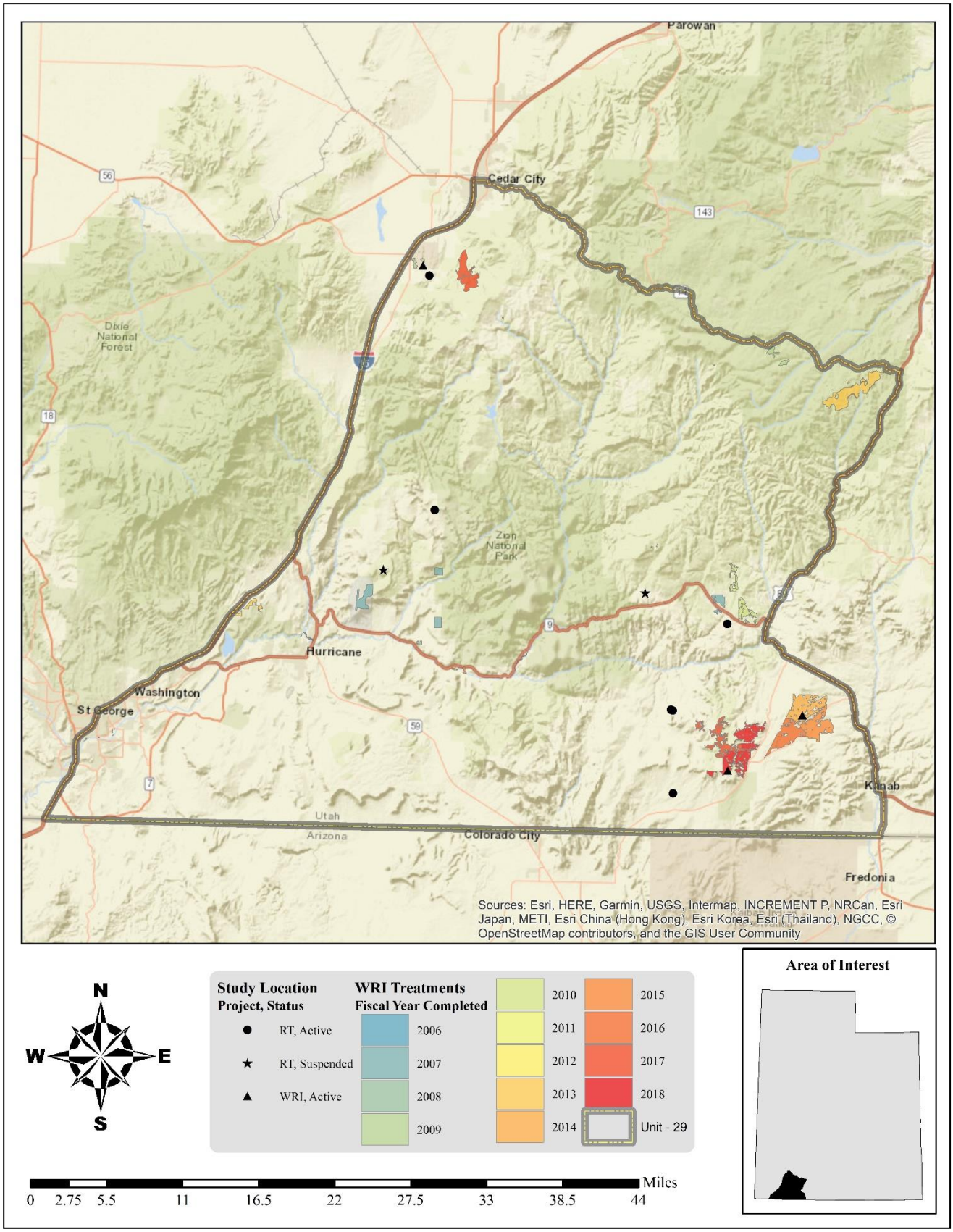
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 17,538 acres of land have been treated within the Zion unit since the WRI was implemented in 2004 (**Map 8.7**). In addition, 2,078 acres are currently being treated and treatments have been proposed for 6,770 acres. Treatments frequently overlap one another bringing the total treatment acres to 26,386 acres for this unit (**Table 8.6**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but WRI projects comprise the majority of work done on deer winter ranges throughout the state of Utah.

The most common management practice in this unit is the use of bullhog treatments to remove pinyon and juniper trees. Seeding plants to augment the herbaceous understory is also very common and frequently occurs together with other treatments. Other management practices include (but are not limited to): anchor chaining and manual vegetation removal techniques to remove trees, forestry practices such as thinning, discing, and prescribed fire (**Table 8.6**).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**1,341**	**0**	**0**	**1,075**	**2,416**
Ely (Two-Way)	1,341	0	0	1,075	2,416
Bulldozing	**53**	**0**	**0**	**0**	**53**
Tree Push	53	0	0	0	53
Bullhog	**10,042**	**2,262**	**0**	**2,496**	**14,800**
Full Size	9,892	2,262	0	2,496	14,650
Skid Steer	150	0	0	0	150
Disc	**349**	**0**	**0**	**0**	**349**
Plow (One-Way)	341	0	0	0	341
Off-Set (Two-Way)	8	0	0	0	8
Forestry Practices	**0**	**0**	**0**	**664**	**664**
Thinning (Commercial)	0	0	0	664	664
Harrow	**45**	**0**	**0**	**0**	**45**
≤15 ft. (One-Way)	45	0	0	0	45
Herbicide Application	**37**	**0**	**0**	**0**	**37**
Spot Treatment	37	0	0	0	37
Planting/Transplanting	**449**	**0**	**0**	**0**	**449**
Prescribed Fire	**298**	**0**	**0**	**0**	**298**
Seeding (Primary)	**5,310**	**21**	**0**	**2,077**	**7,408**
Broadcast (Aerial-Fixed Wing)	4,248	0	0	2,077	6,325
Broadcast (Aerial-Helicopter)	1,046	0	0	0	1,046
Hand Seeding	16	0	0	0	16
Ground (Mechanical Application)	0	21	0	0	21
Seeding (Secondary/Shrub)	**14**	**0**	**0**	**0**	**14**
Hand Seeding	14	0	0	0	14
Vegetation Removal/Hand Crew	**2,803**	**0**	**0**	**2,618**	**5,421**
Lop & Scatter	2,803	0	0	1,764	4,567
Lop-Pile-Burn	0	0	0	854	854
Grand Total	**20,741**	**2,283**	**0**	**8,930**	**31,954**
*** Total Land Area Treated**	**17,538**	**2,078**	**0**	**6,770**	**26,386**

Table 8.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 29, Zion. Data accessed on 02/18/2019. *Does not include overlapping treatments.



Map 8.7: WRI treatments by fiscal year completed for WMU 29, Zion.

Range Trend Studies

Range Trend studies have been sampled within WMU 29 on a regular basis since 1987, with studies being added or suspended as was deemed necessary (**Table 8.7**). 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 8.8**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
29-01	Wilson Ranch	RT	Suspended	'87, '92, '98	Not Verified
29-02	Smith's Mesa	RT	Suspended	'98, '03, '08	Not Verified
29-03	North Hills	RT	Active	'98, '03, '08, '13, '18	Mountain Loam (Browse)
29-04	Barracks Chaining	RT	Active	'03, '08, '13, '18	Mountain Loam (Browse)
29-05	Kolob Terrace	RT	Active	'13, '18	Upland Sand (Mountain Big Sagebrush)
29-06	Elephant Butte	RT	Active	'13, '18	Upland Sand (Mountain Big Sagebrush)
29R-01	Elephant Gap Total Exclosure	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
29R-02	Elephant Gap Livestock Exclosure	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
29R-03	Elephant Gap Exclosure Outside	RT	Active	'98, '03, '08, '18	Upland Sand (Mountain Big Sagebrush)
29R-4	North Hills Bullhog	WRI	Active	'08, '11	Upland Shallow Hardpan (Pinyon-Utah Juniper)
29R-5	Yellow Jacket	WRI	Active	'13, '16	Upland Sand (Mountain Big Sagebrush)
29R-6	Block Mesas	WRI	Active	'17	Mountain Sand (Ponderosa Pine)

Table 8.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 29, Zion.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
29-03	North Hills	Chain Unknown Seed Unknown Lop and Scatter		1967 1967 Between 2008 and 2013		
29-04	Barracks Chaining	Chain Unknown Seed Unknown Lop and Scatter		Historic Historic Between 2013 and 2018		
29R-04	North Hills Bullhog	Aerial Before	North Hills Seeding 1967	August-November 1967	1500	LTDL
		Two-Way Chain Unknown	North Hills Seeding 1967	August-November 1967	1500	LTDL
		Aerial Before	North Hills Thinning	September 2008	150	1190
		Bullhog	North Hills Thinning	October-November 2008	150	1190
29R-05	Yellow Jacket	Aerial Before	Yellowjacket (Kinnickinnic)	January 2014	2147	2687
		Bullhog	Yellowjacket (Kinnickinnic)	2014	2147	2687
29R-06	Block Mesas	Aerial Before	Yellow Jacket (Buck Pasture)	November 2017	3500	3977
		Bullhog	Yellow Jacket (Buck Pasture)	January-March 2018	1599	3977

Table 8.8: Range trend and WRI studies known disturbance history for WMU 29, Zion. PDB = Pre-Database; LTDL = Land Treatment Digital Library (Pilliod & Welty, 2019).

Study Trend Summary (Range Trend)

Mountain (Browse)

There are two studies [North Hills (29-03) and Barracks Chaining (29-04)] that are classified as Mountain (Browse) ecological sites. The North Hills study is located in North Hills, south of Cedar City. Barracks Chaining can be found west of Mt. Carmel Junction near Mineral Gulch.

Shrubs/Trees: Data for total average shrub cover indicates that preferred browse species other than Utah serviceberry (*Amelanchier utahensis*) and mountain mahogany (*Cercocarpus sp.*) contribute a majority of the cover for this ecological type. More specifically, other preferred browse species on these sites include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*), among others. Total shrub cover has increased over time (**Figure 8.2**). Average preferred browse demographics show that density has decreased overall. However, the initial decrease between 1998 and 2003 can largely be attributed to the establishment of the Barracks Chaining study; density actually increased in subsequent sample years. In addition, most of the browse populations on these sites have been comprised of mature individuals and decadence has decreased (**Figure 8.6**). Preferred browse has exhibited fluctuations in average utilization. Overall, there has been a decreasing trend in the percentage of plants that are moderately to heavily browsed (**Figure 8.7**).

Tree cover displayed an increasing trend from 2003 to 2013, but no cover was observed in 2018 (**Figure 8.4**). This trend is entirely driven by the Barracks Chaining site, which underwent a lop and scatter treatment between 2013 and 2018. Tree density has also decreased: again, this trend is largely driven by the Barracks Chaining site (**Figure 8.5**).

Herbaceous Understory: Seeded and introduced perennial grasses such as crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Thinopyrum intermedium*) have dominated the understories of these sites throughout the study period. Perennial forbs have also been a notable component particularly on the Barracks Chaining study, but have decreased in recent years. Annual grasses have been observed throughout the study period in low amounts. Total herbaceous cover has decreased overall. Average nested frequency has displayed slight to moderate fluctuations over the study period (**Figure 8.8**, **Figure 8.9**).

Occupancy: Average pellet transect data indicates that overall occupancy has decreased over time. Deer have been the primary occupants of these sites in all sample years, with mean pellet group abundance ranging from nearly 42 days use/acre in 2018 to over 103 days use/acre in 1998. Mean abundance of elk pellet groups has been as low as 0 days use/acre in 2013 and as high as 6 days use/acre in 1998. Cattle have also been present with a mean pellet group abundance ranging from 2.5 days use/acre in 2018 to over 17 days use/acre in 2008. Finally, horse pellet groups have been observed with a mean abundance fluctuating between 0 days use/acre in 1998, 2003, 2008, and 2018 and 0.3 days use/acre in 2013 (**Figure 8.10**).

Upland (Big Sagebrush)

Three study sites [Kolob Terrace (29-05), Elephant Butte (29-06), and Elephant Gap Exclosure Outside (29R-03)] are considered to be Upland (Big Sagebrush) ecological sites. Kolob Terrace is located on the Lower Kolob Plateau near the western border of Zion National Park. The Elephant Gap study site is situated just south of Elephant Gap. Finally, the Elephant Gap Exclosure Outside study is found just north of Harris Mountain in Elephant Cove.

Shrubs/Trees: Only one study site (Elephant Gap Exclosure Outside) was sampled in 2003 and 2008. As such, mormon tea (*Ephedra viridis*) was the dominant browse species during the initial two samplings. In 2013, the Kolob Terrace and Elephant Butte were established while the Elephant Gap Exclosure Outside study was not sampled; big sagebrush (*Artemisia tridentata*) provided the most cover overall. All three sample sites were read in 2018 and big sagebrush remained as the dominant browse species. Total average shrub cover decreased between 2013 and 2018 due to the inclusion of the Elephant Gap Exclosure Outside study in 2018 (**Figure 8.3**).

Average preferred browse demographics indicate that density has fluctuated, but has exhibited an overall decrease. Again, this decrease is likely in part due to the differing number of studies from year to year. Demographic data also indicates that mature individuals have comprised a majority of the plant populations in all sample years and that decadence has decreased (**Figure 8.6**). According to average preferred browse utilization data, the percentage of plants that have been moderately to heavily browsed has fluctuated, but has

also decreased over time. Again, these decreases in density and utilization may be due in part to the differing number of studies from year to year (**Figure 8.7**).

Utah juniper (*Juniperus osteosperma*) contributes a majority of the tree cover on these sites and has been observed on the Elephant Butte and Elephant Gap Exclosure Outside studies. Overall tree cover has displayed marginal fluctuations over time (**Figure 8.4**). Tree density, however, has shown a decreasing trend (**Figure 8.5**).

Herbaceous Understory: Annual forbs contributed the most herbaceous cover in 1998, a trend that is entirely due to the Elephant Gap Exclosure Outside study. Annual forb cover decreased in subsequent sample years while that of perennial forbs increased; perennial forbs have been the dominant herbaceous component since 2003. Annual grasses have fluctuated and have mainly been observed on the Kolob Terrace and Elephant Gap Exclosure Outside studies. Overall average herbaceous cover and frequency have decreased over time (**Figure 8.8**, **Figure 8.9**). As stated in the previous section, it would be prudent to consider the differing number of studies from year to year when reviewing this data.

Occupancy: Average pellet transect data indicates that overall occupancy has fluctuated over time. Pellet group abundance decreased between 1998 and 2008, a trend entirely driven by the Elephant Gap Exclosure Outside studies. Occupancy has since increased due to the inclusion of the Elephant Butte and Kolob Terrace studies. Deer have been the primary occupants on these sites in all sample years, with a mean pellet group abundance ranging from 46 days use/acre in 2003 to 99 days use/acre in 2013. Cattle have had a mean pellet group abundance as low as 0 days use/acre in 1998 and as high as over 4 days use/acre in 2003 (**Figure 8.10**).

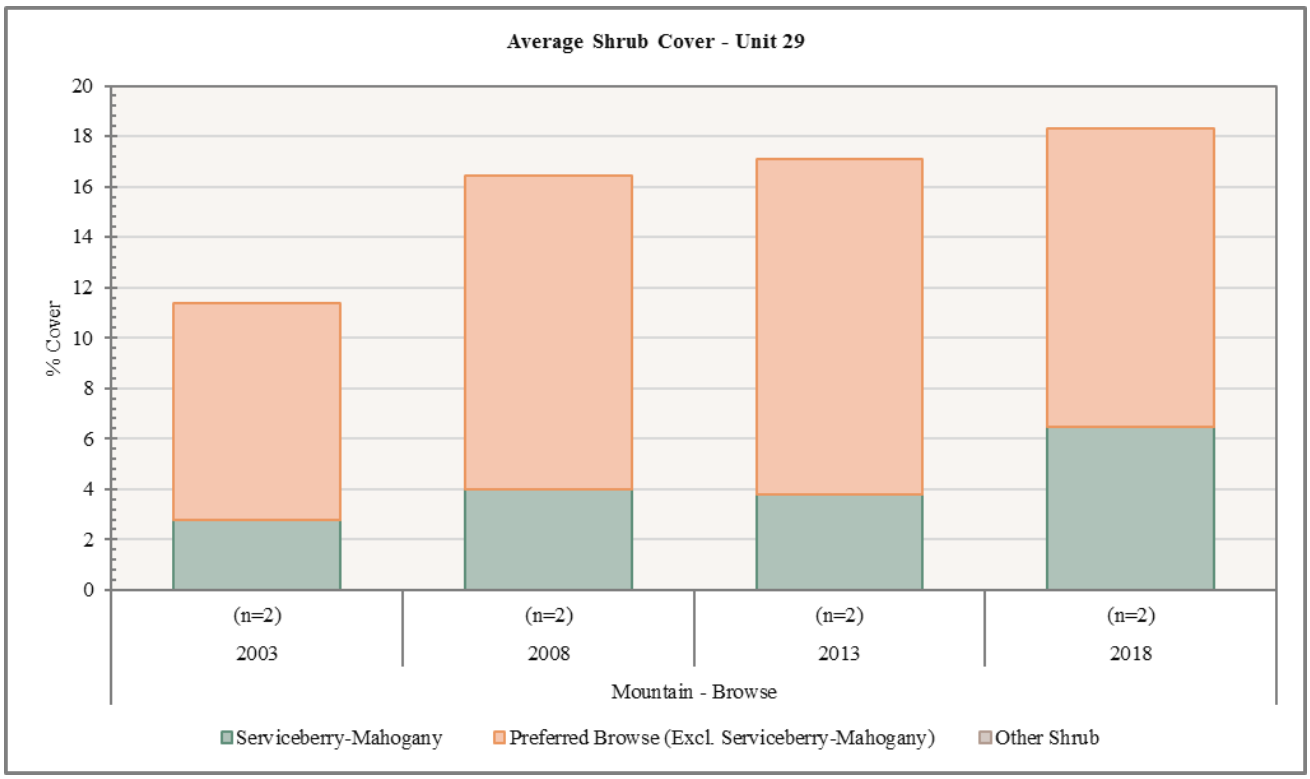


Figure 8.2: Average shrub cover for Mountain -Browse study sites in WMU 29, Zion.

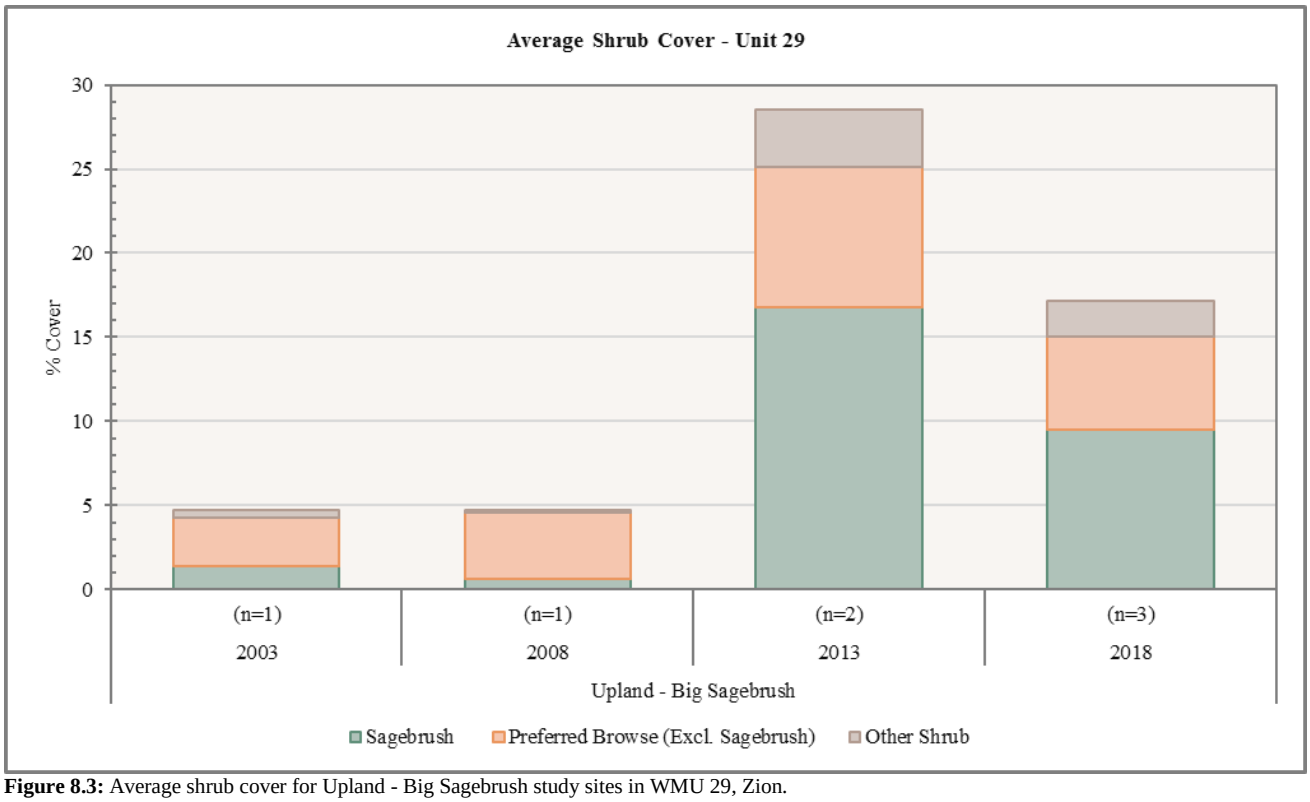


Figure 8.3: Average shrub cover for Upland - Big Sagebrush study sites in WMU 29, Zion.

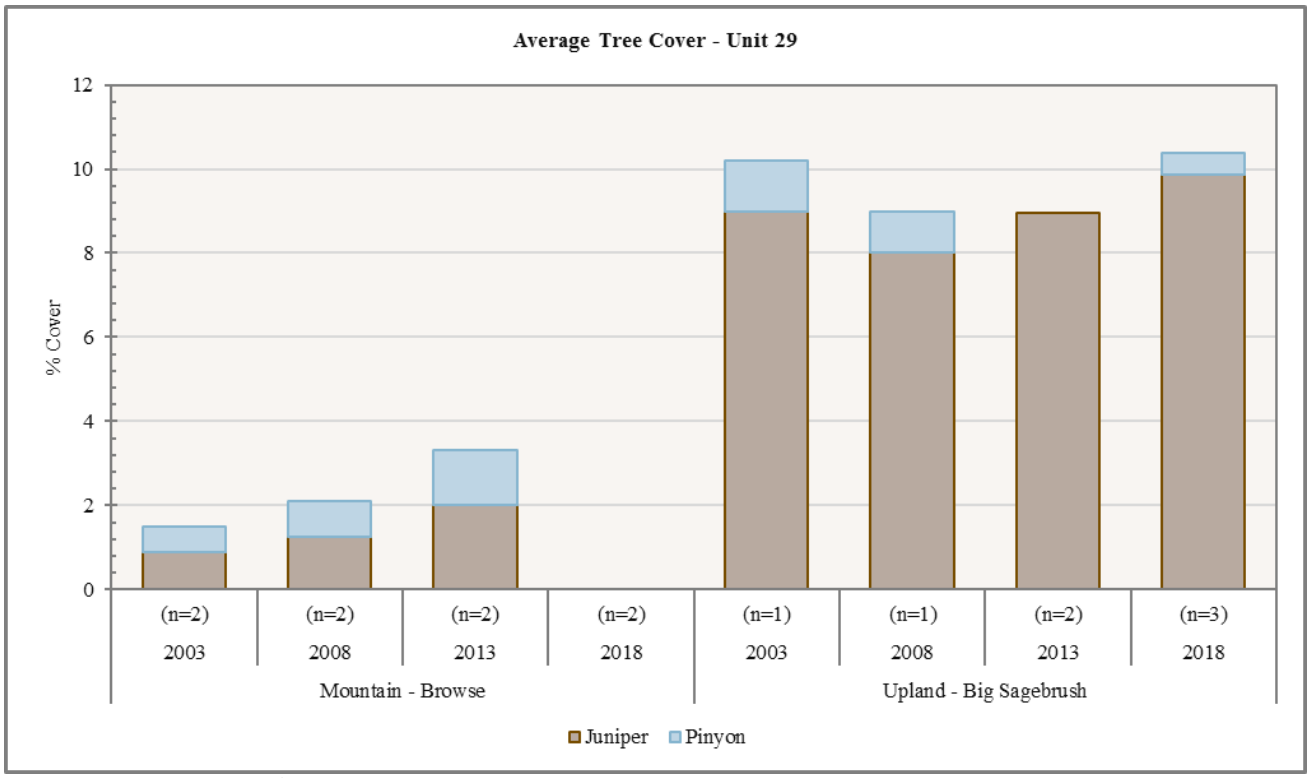


Figure 8.4: Average tree cover for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

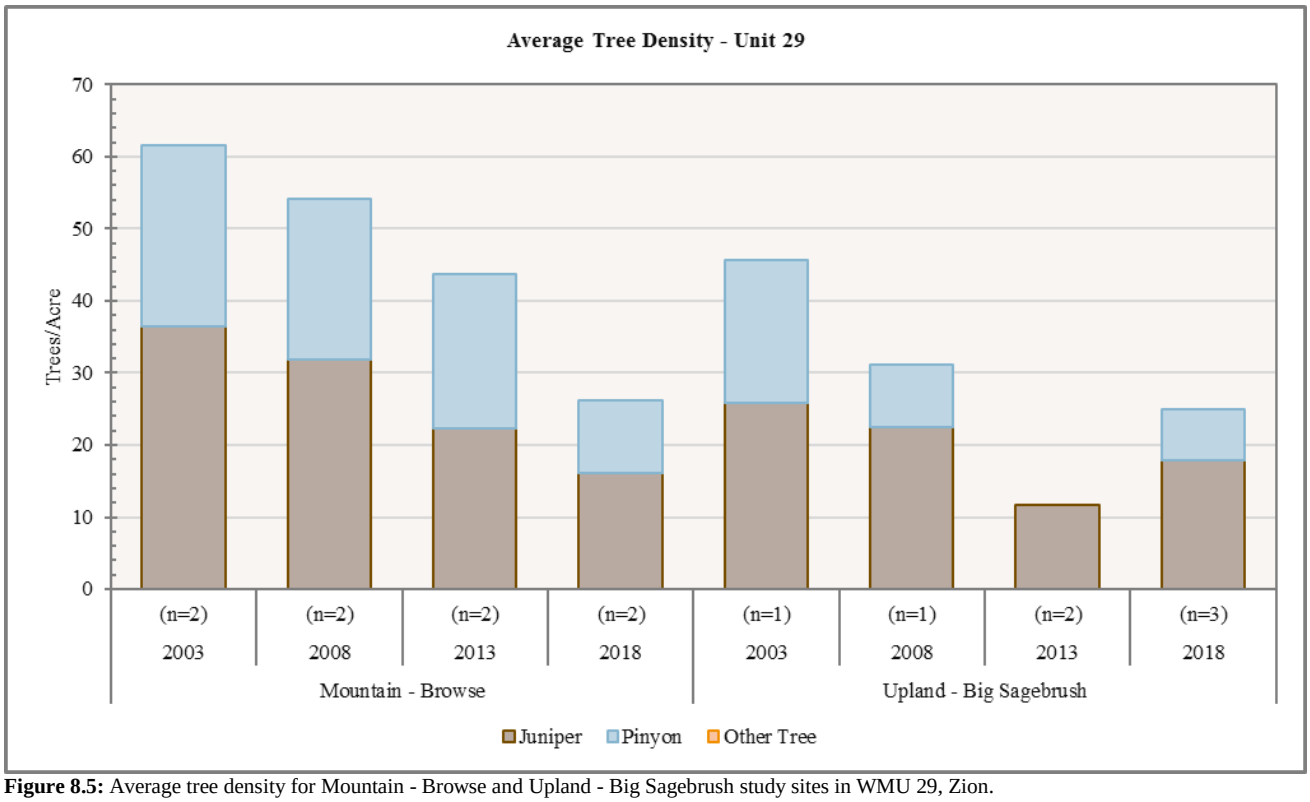


Figure 8.5: Average tree density for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

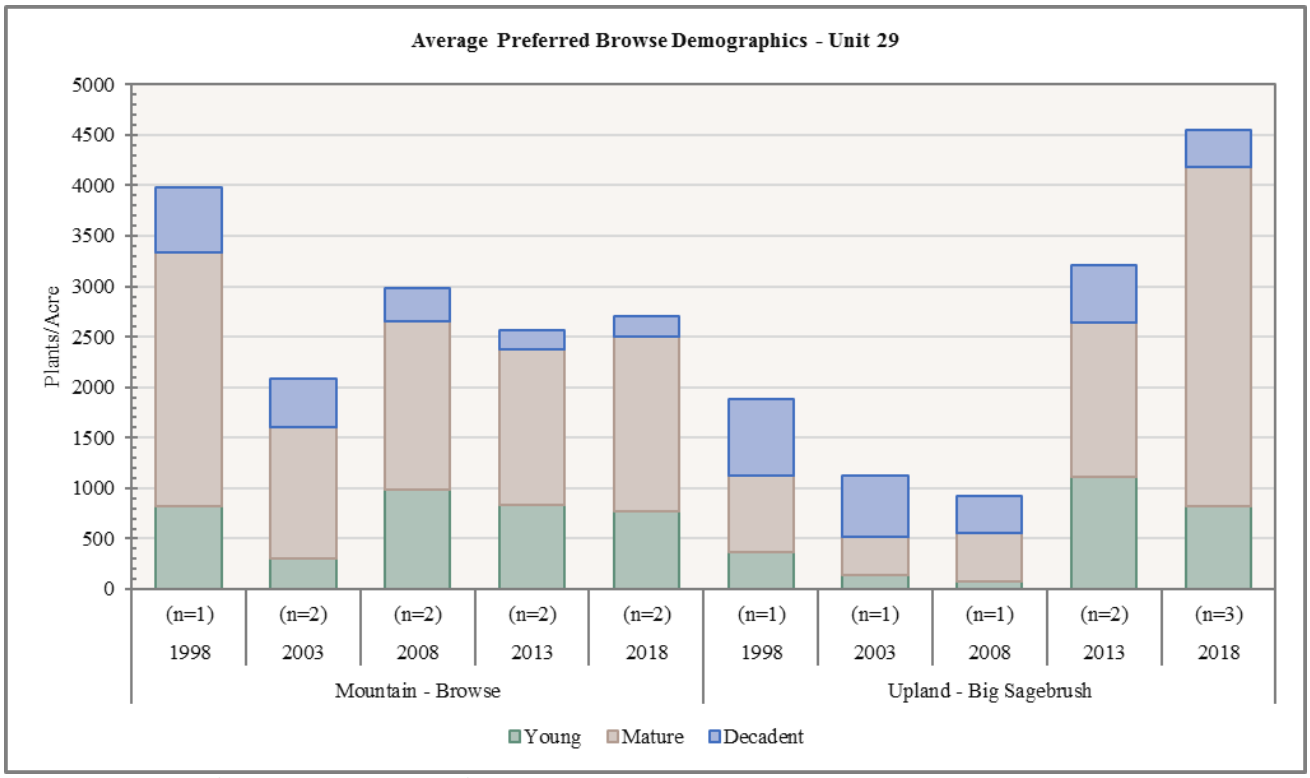


Figure 8.6: Average preferred browse demographics for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

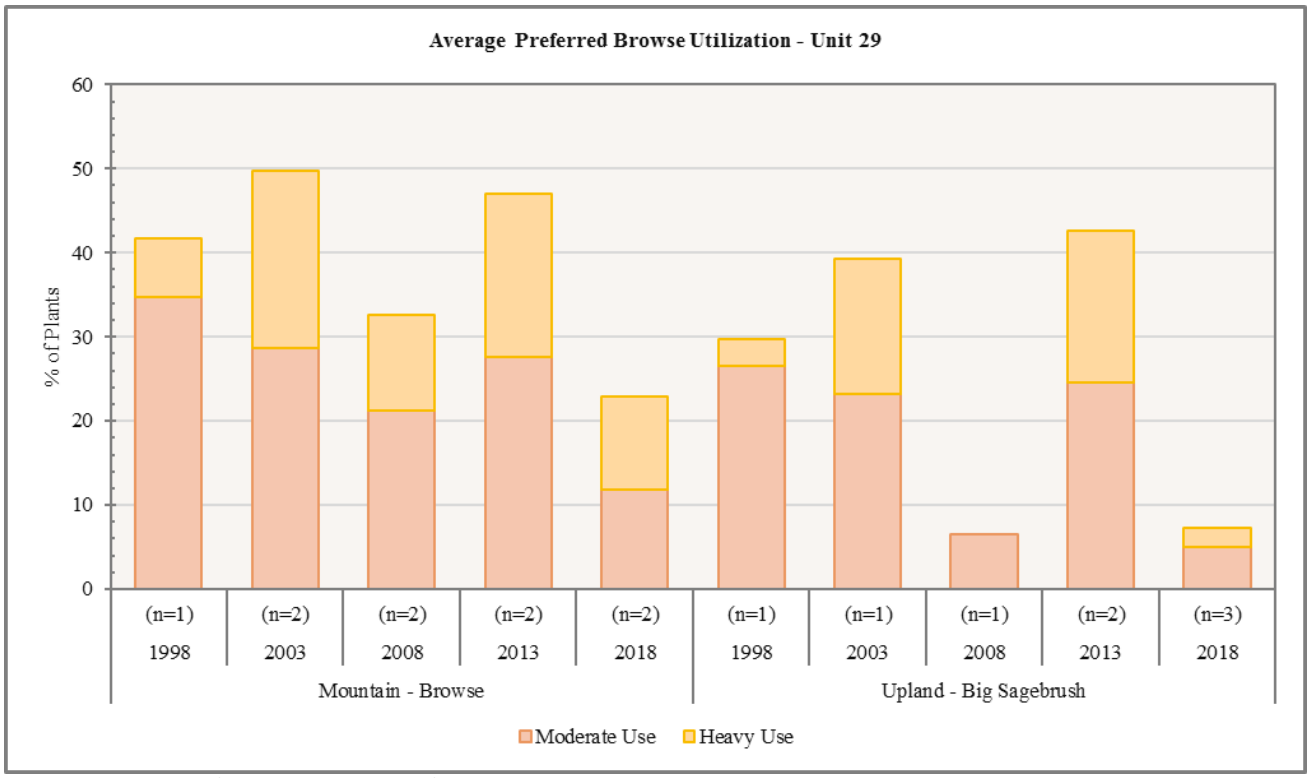


Figure 8.7: Average preferred browse utilization for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

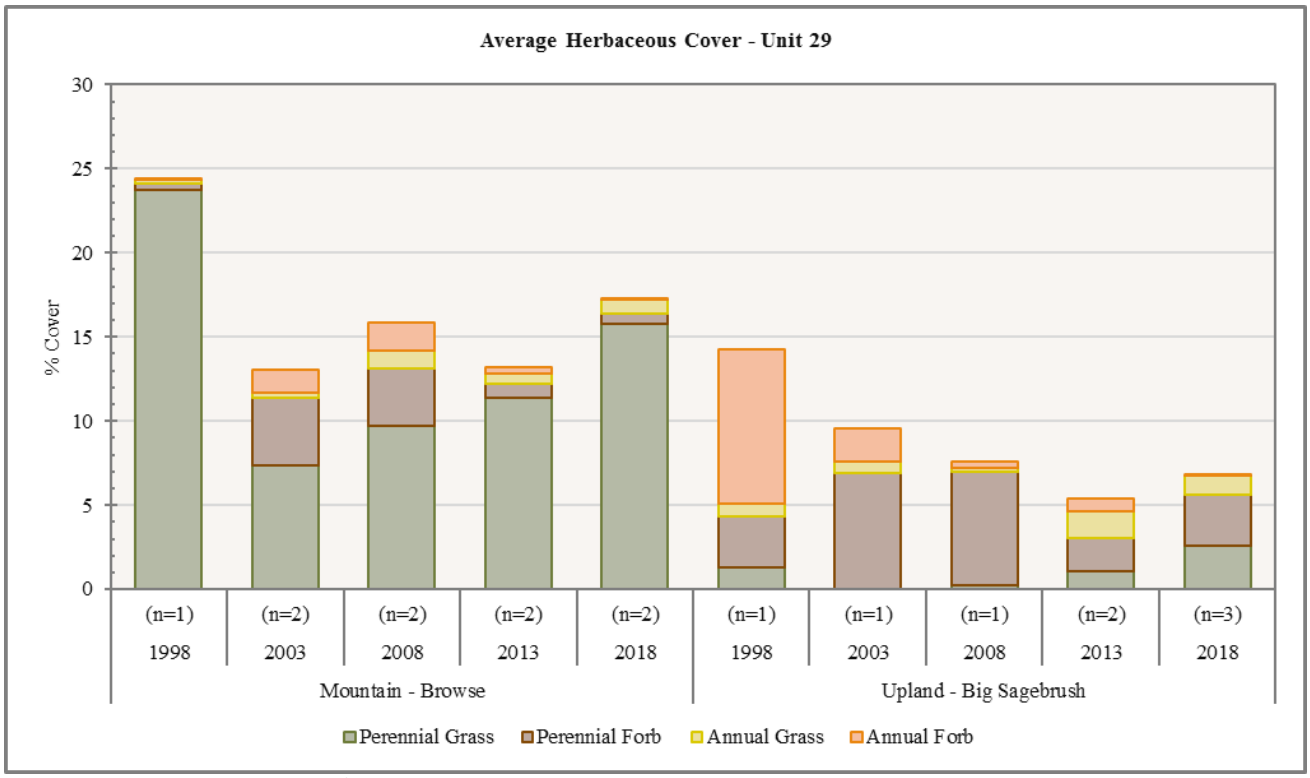


Figure 8.8: Average herbaceous cover for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

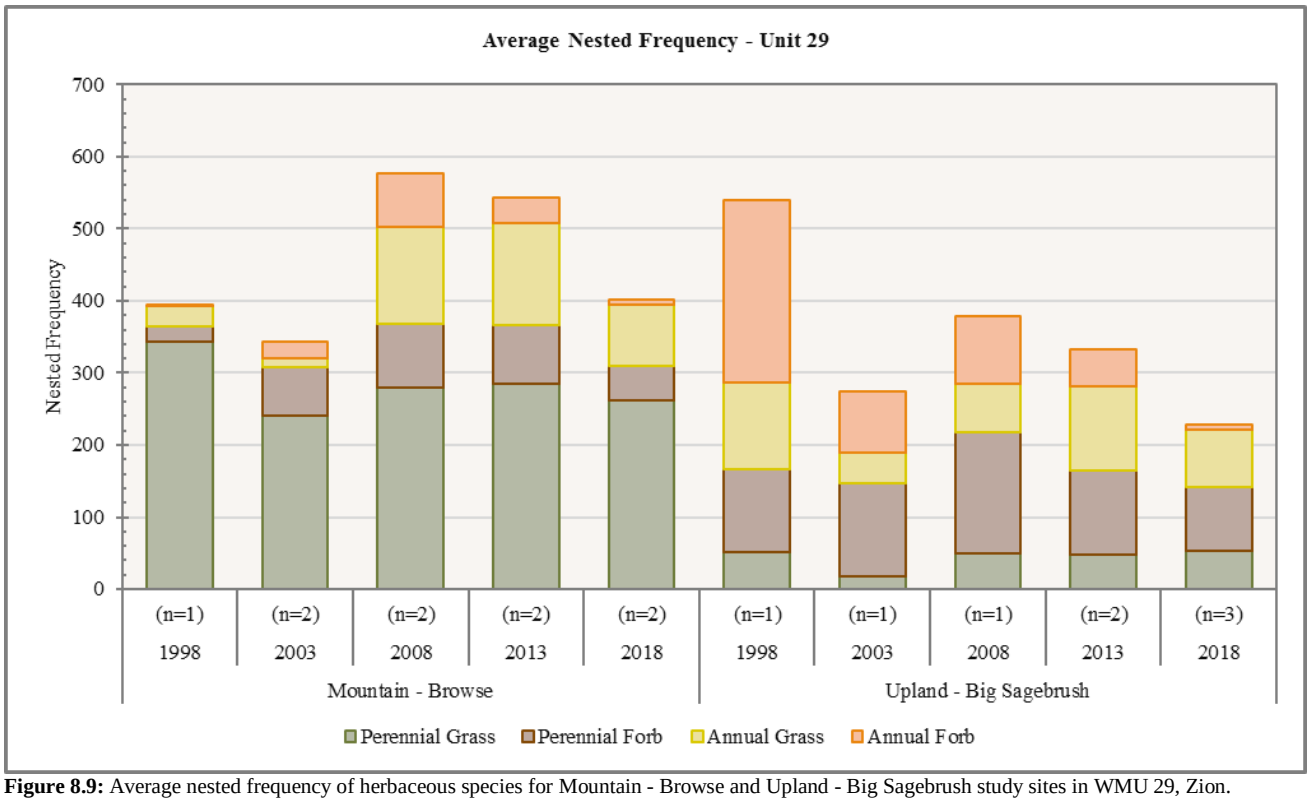


Figure 8.9: Average nested frequency of herbaceous species for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

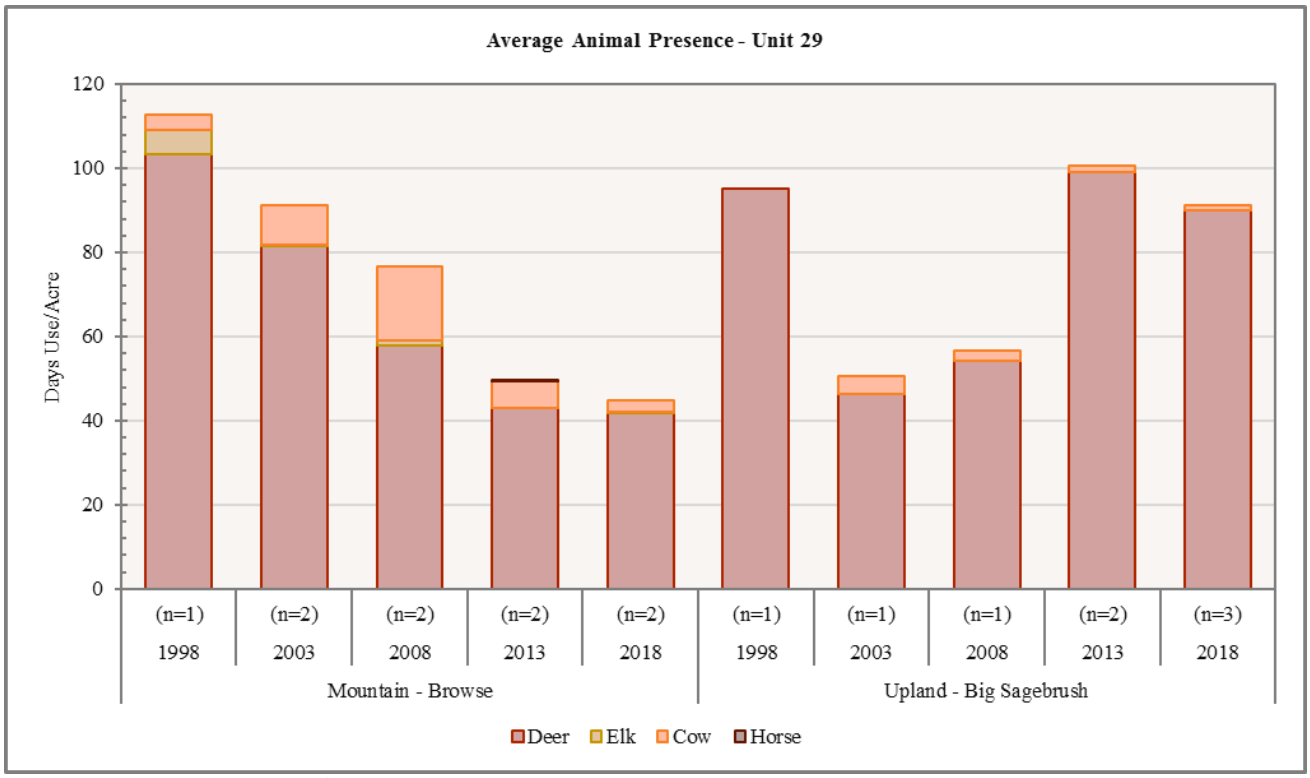


Figure 8.10: Average pellet transect for Mountain - Browse and Upland - Big Sagebrush study sites in WMU 29, Zion.

Deer Winter Range Condition Assessment

The condition of deer winter range within the Zion management unit has shown changes on the sites sampled since 1998. The active Range Trend sites sampled within the unit are considered to be in very poor to fair-good condition as of the 2018 sample year (**Figure 8.11**, **Table 8.9**). The North Hills and Barracks Chaining studies have remained in fair-good condition. The Kolob Terrace study has stayed in fair condition. The Elephant Gap Exclosure Outside and Elephant Butte studies have remained in poor to very poor condition.

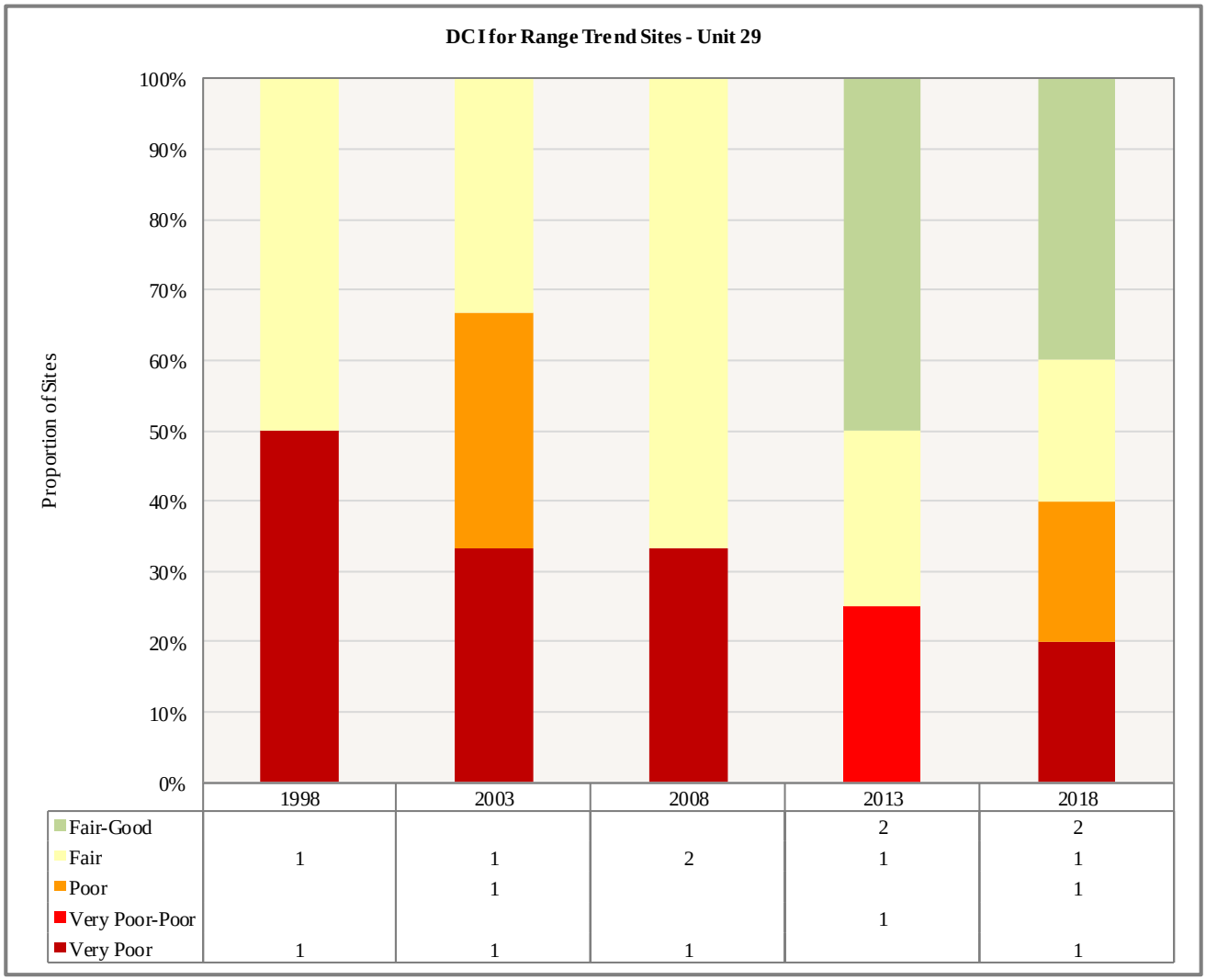
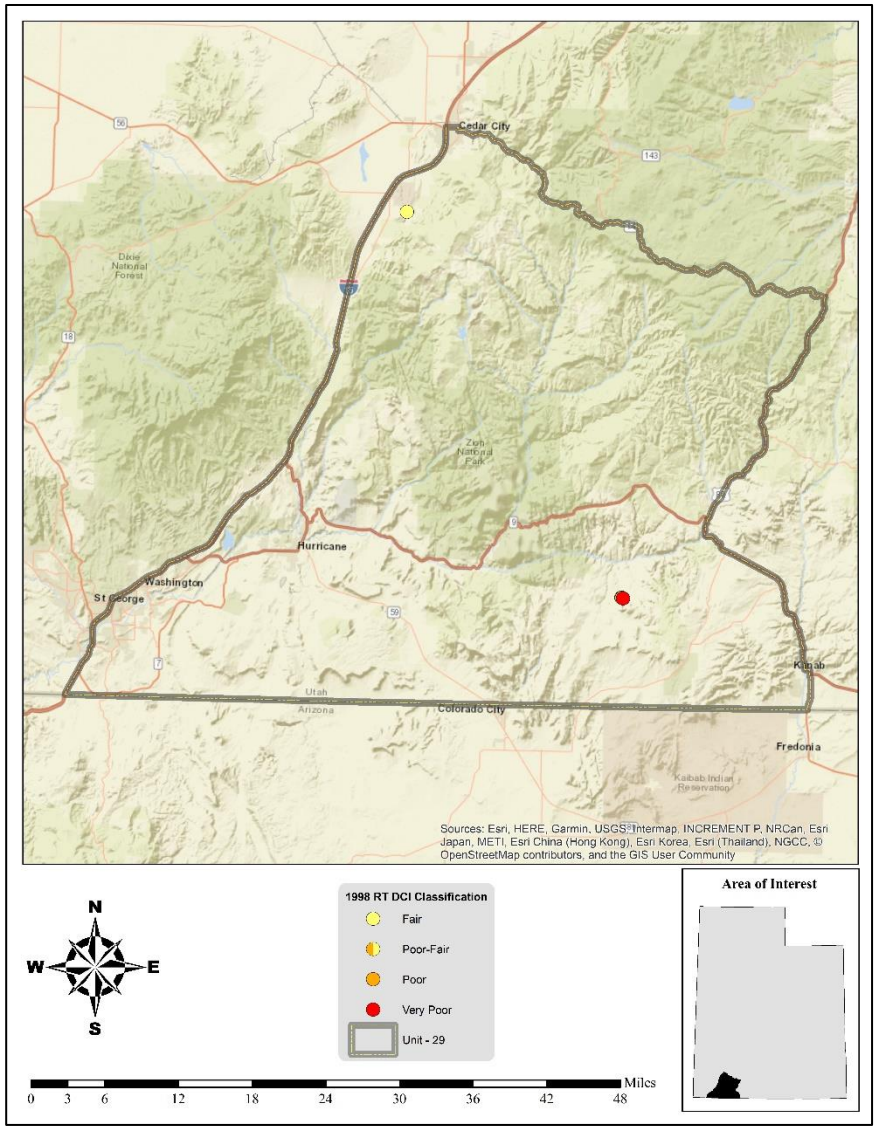


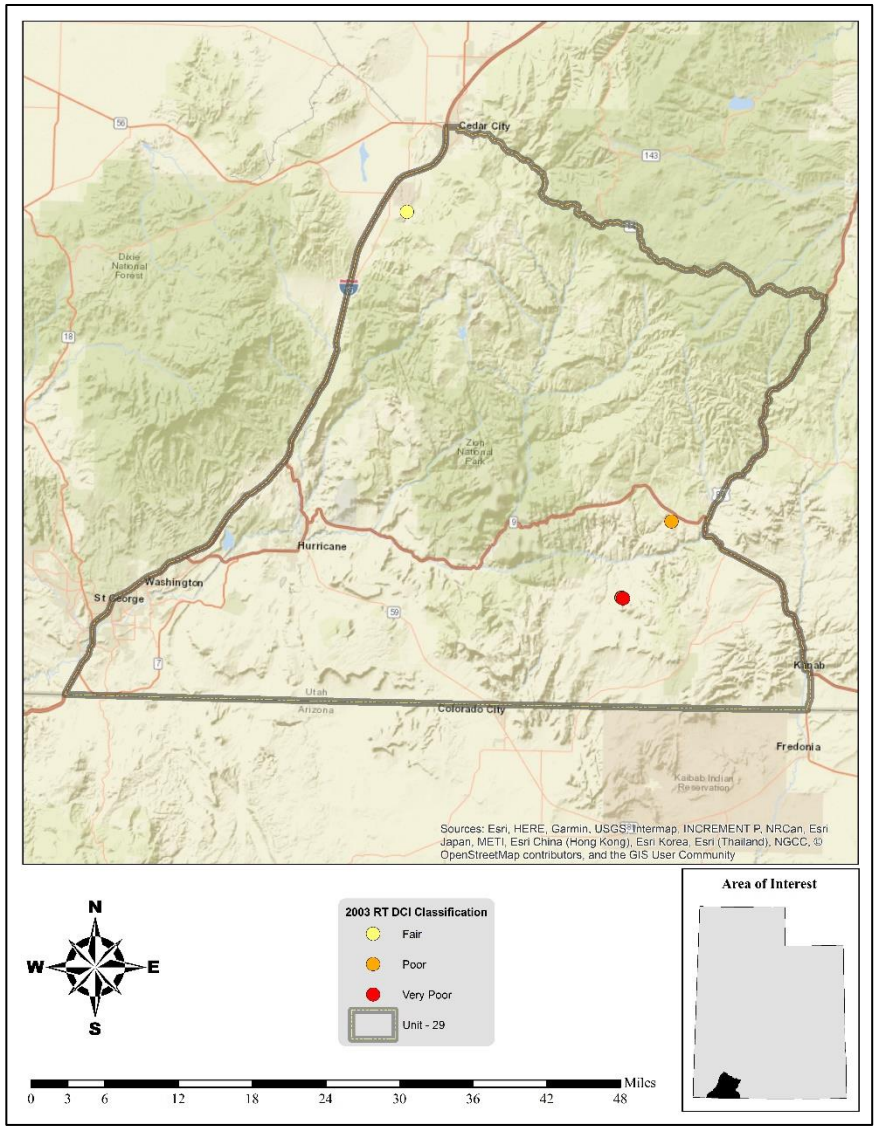
Figure 8.11: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 29, Zion.

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
29-03	1998	22.2	7.9	6.6	30	-0.2	0.7	0	**67.2**	**F**
29-03	2003	20.9	7.9	9.1	18.4	0	1	0	**57.2**	**F**
29-03	2008	30	11.5	13.9	10.9	-0.5	0.2	0	**66**	**F**
29-03	2013	27.2	12.8	15	16.2	-0.7	0.3	0	**70.7**	**F-G**
29-03	2018	30	13.3	15	10.8	-0.5	0.5	0	**69**	**F-G**
29-04	2003	8.8	7.7	5.3	11.1	-0.4	10	0	**42.5**	**P**
29-04	2008	11.6	8	8.2	27.9	-1	10	0	**64.6**	**F**
29-04	2013	16.5	14.7	5.6	29.3	-0.2	2.9	0	**68.8**	**F-G**
29-04	2018	14.3	12.8	11.7	30	-0.8	1.8	0	**69.8**	**F-G**
29-05	2013	30	8.1	13.8	2.6	-2.4	4.7	0	**56.7**	**F**
29-05	2018	30	11.4	6.7	7.6	-2.5	6.1	0	**59.4**	**F**
29-06	2013	13.6	11	4.4	1.7	0	3.1	0	**33.8**	**VP-P**
29-06	2018	10	8.9	4.7	5.1	0	2.6	0	**31.3**	**VP**
29R-3	1998	8.3	3.3	10.2	2.5	-0.6	6.1	0	29.9	VP
29R-3	2003	5.4	0	0	0.1	-0.5	10	0	14.9	VP
29R-3	2008	5.8	0	0	0.4	-0.2	10	0	16	VP
29R-3	2018	9.4	12.7	4.1	2.9	-0.1	9.4	0	38.5	P

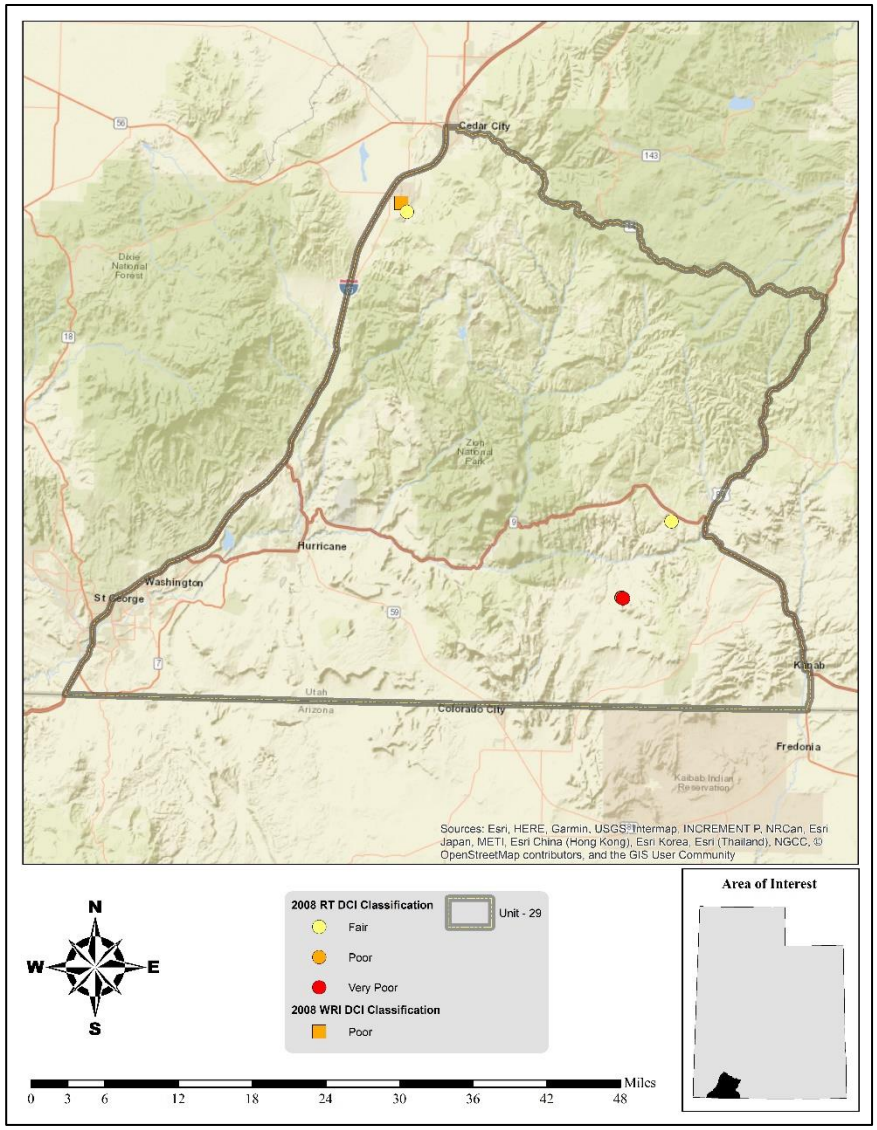
Table 8.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 29, Zion. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



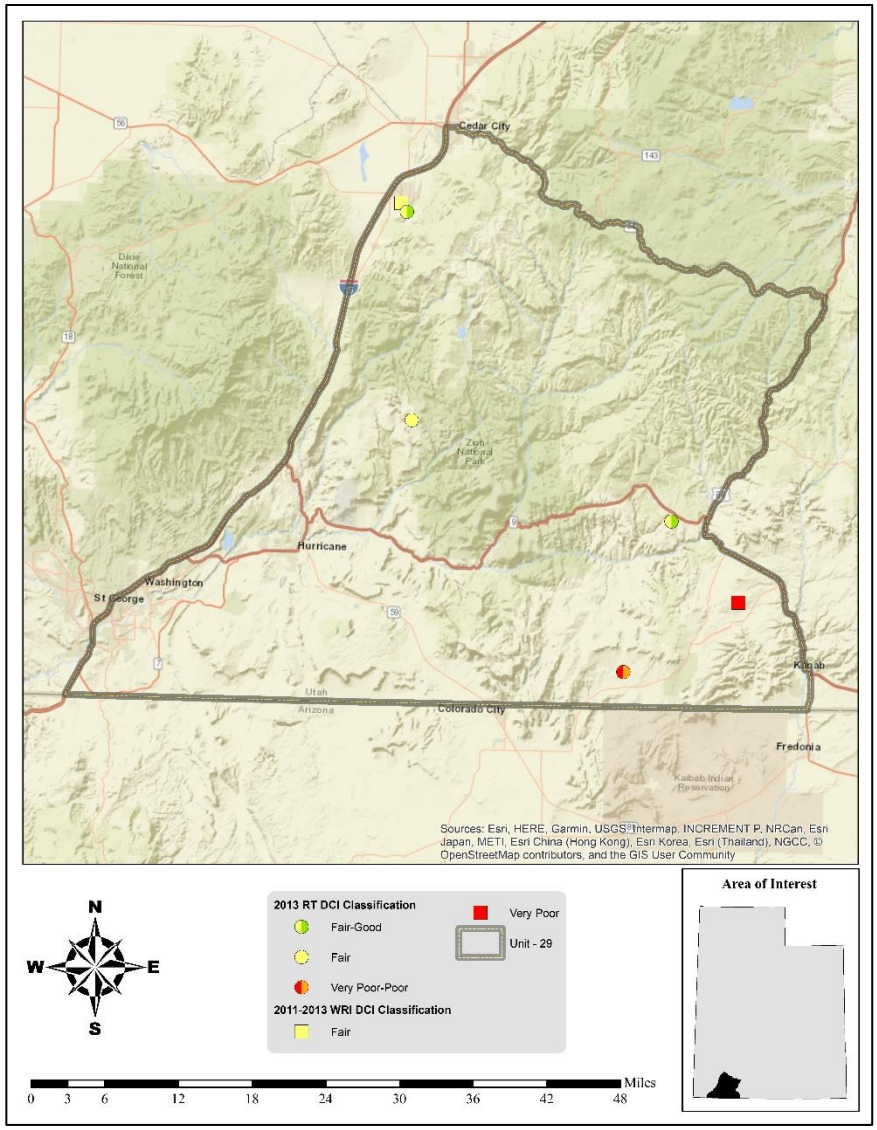
Map 8.8: 1998 Desirable Components Index (DCI) ranking distribution by study site for WMU 29, Zion.



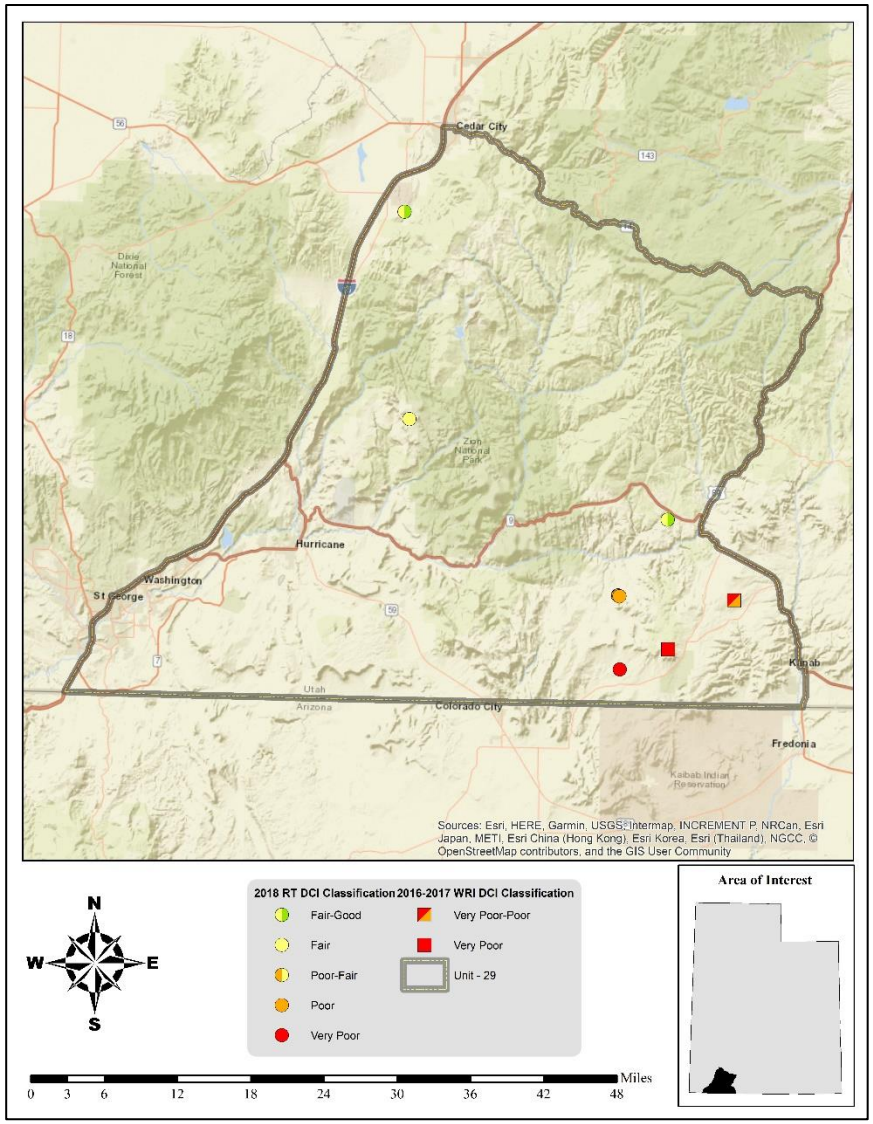
Map 8.9: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 29, Zion.



Map 8.10: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 29, Zion.



Map 8.11: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 29, Zion.



Map 8.12: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 29, Zion.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
29-03	North Hills	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
29-04	Barracks Chaining	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
29-05	Kolob Terrace	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
29-06	Elephant Butte	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
29R-01	Elephant Gap Total Exclosure	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
29R-02	Elephant Gap Livestock Exclosure	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
29R-03	Elephant Gap Exclosure Outside	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
29R-04	North Hills Bullhog	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
29R-05	Yellow Jacket	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
29R-06	Block Mesas	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity

Table 8.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 29, Zion. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Browse)

The studies that are within the Mountain (Browse) ecological type are considered to be in deer winter range and conditions on both sites are found to be fair to good. These sites are upper-elevation winter range sites and support mixed browse communities that provide browse for wintering animals. Annual grasses are a threat on these sites because they increase fuel loads which in turn can lead to habitat-destroying wildfires. Aggressive introduced perennial species are present and may present a significant threat to these sites, as they can reduce understory diversity by outcompeting more desirable native species. Conifer encroachment has been observed on both sites and these tree communities are likely to continue moving through the phases of woodland succession in future years.

When introduced perennial grasses become dominant in a system, they can reduce the biodiversity of the understory. Management of these rhizomatous introduced grasses can be difficult on these high-elevation sites. While they provide abundant forage, they can be detrimental to the overall biodiversity. Management options for introduced perennial grasses can include grazing management changes, prescribed burns, and if needed, herbicide treatments. Management of conifer trees is recommended in areas where it would be beneficial and feasible; possible tree-removing methods include bullhog, chaining, and lop and scatter. Areas with significant annual grass invasion should be monitored and treated if these high cover values persist. If reseeding is necessary to restore herbaceous communities, care should be taken in seed selection and preference should be given to native species.

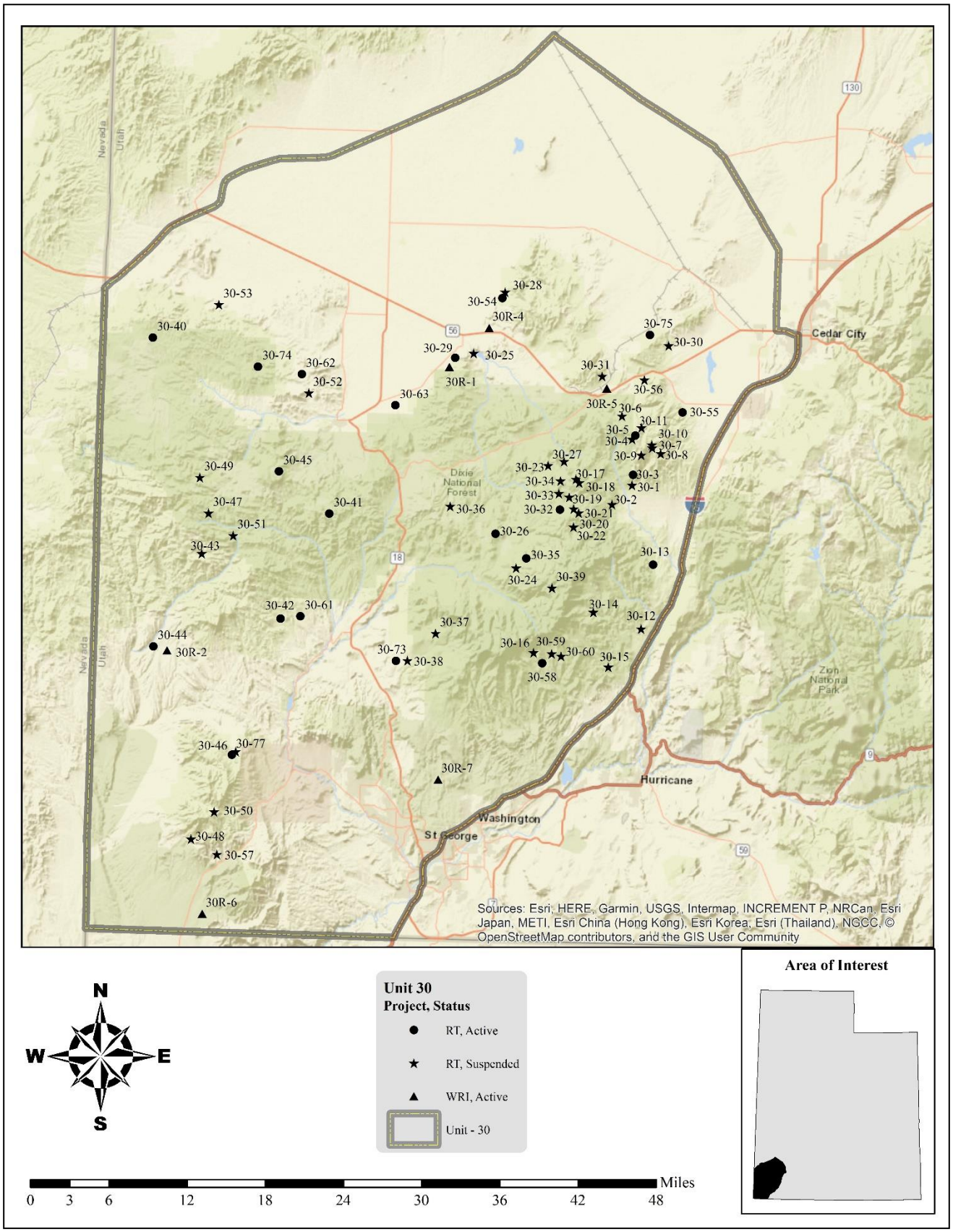
Upland (Big Sagebrush)

The studies that are considered to be of the Upland (Big Sagebrush) ecological type are within deer winter range and are considered to be in condition varying from very poor to fair. Annual grass cover has been observed on the Kolob Terrace site: these grasses pose a threat because they increase fuel loads which can lead to an increased wildfire regime. Conifer encroachment was also observed on both study sites and this will likely increase in future years.

Although pinyon and juniper presence is currently limited on these study sites, further tree encroachment could lead to reduced herbaceous and shrub productivity. It is recommended that when necessary, work to reduce

these tree species (e.g. bullhog, chaining, lop and scatter, etc.) should begin in areas where it would be beneficial to wildlife habitat. On sites with significant cover from annual grasses, treatments that could be helpful to restoring proper ecological function include changes to grazing, herbicide treatment, and other cultural control methods. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

9. WILDLIFE MANAGEMENT UNIT 30 – PINE VALLEY



WILDLIFE MANAGEMENT UNIT 30 – PINE VALLEY

Boundary Description

Iron and Washington counties - Boundary begins at I-15 and the Utah-Arizona state line; north on I-15 to SR-56; west on SR-56 to Lund Highway; northwest along Lund Highway to the Union Pacific railroad tracks at Lund; southwest on the Union Pacific railroad tracks to the Utah-Nevada state line; south on the Utah-Nevada state line to the Utah-Arizona state line; west on this state line to I-15.

Management Unit Description

Geography

The Pine Valley wildlife management unit is located in the southwest corner of Utah. The unit includes three physiographic regions: the Mojave Desert, Great Basin, and Colorado Plateau. The Mojave Desert is situated in the southern portion of the WMU. The Great Basin is located in the central and northern sections of the unit. Finally, the eastern section of the unit, mainly the Pine Valley Mountains and Harmony Mountains, are on the western edge of the Colorado Plateau. These three physiographic regions are host to a diverse array of vegetation and transitional communities that are important areas for wildlife.

The Pine Valley unit includes several mountain ranges, including the Pine Valley Mountain Range, Cove Mountain, Atchison Mountain, the Harmony Mountains, McFarlane Mountain, the Bull Valley Mountains, Mineral Mountain, the Beaver Dam Mountains, Bull Mountain, the Antelope Range, Iron Mountain, Swett Hills, and Eightmile Hills.

Climate Data

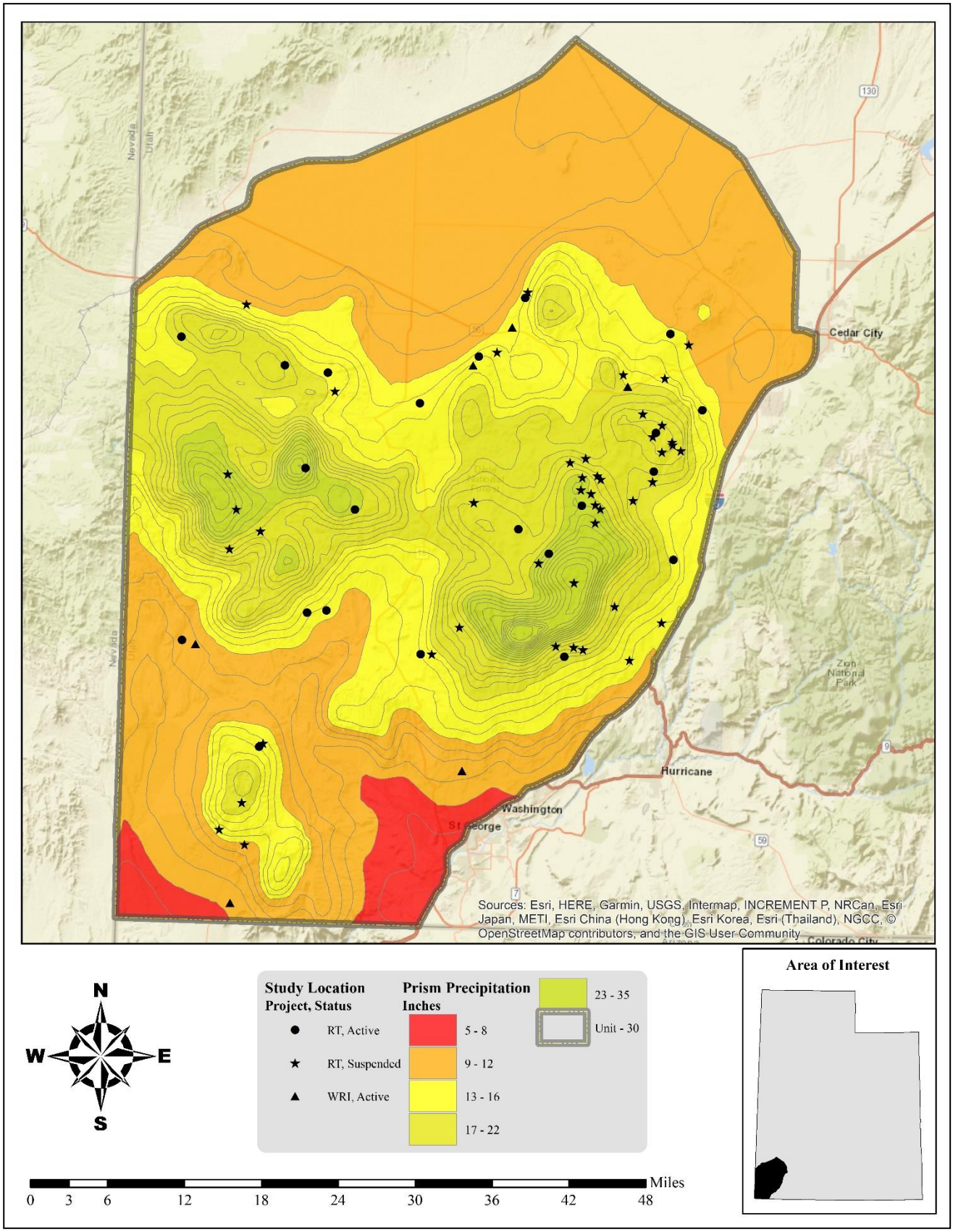
The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches in the far southeastern and southwestern portions of the unit up to 35 inches on the high-elevation peaks of the Pine Valley Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 9-28 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 Western, Dixie, and South Central divisions (Divisions 1,2, and 4).

The mean annual PDSI of the Western division displayed years of moderate to extreme drought from 1989-1990, 2000-2003, 2007-2008, 2012-2013, 2015, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1982-1985, 1993, 1995, 1997-1998, 2005, and 2011 (**Figure 9.1a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 2000, 2002-2004, 2007-2008, and 2012-2015; moderately to extremely wet years were displayed in 1983-1986, 1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2001-2003, 2007-2008, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, and 2011 (**Figure 9.1b**).

The Dixie division had a mean annual PDSI displaying years of moderate to extreme drought from 1989-1990, 1996, 1999-2000, 2002-2003, 2006-2007, 2009, 2013, and 2018. The mean annual PDSI displayed moderately to extremely wet years in 1983, 1998, and 2005 (**Figure 9.2a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought from 1989-1990, 1996, 1999-2000, 2002-2004, 2007, 2012-2014, and 2018; moderately to extremely wet years were displayed in 1983, 1992-1993, 1995, 1998, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 1999, 2001-2003, 2006-2009, and 2018; moderately to extremely wet years were displayed in 1983 and 1997-1998 (**Figure 9.2b**).

The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990. 2002-2003, 2012-2014, and 2018. The mean annual PDSI displayed moderately to extremely wet years from 1983-1985, 1997-1998, 2005, and 2011 (**Figure 9.3a**). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1996, 2000, 2002-2004, 2013-2015, and 2018. Moderately to extremely wet years for this time period were displayed in 1983-1986, 1995, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009, 2012, and 2018; moderately to extremely wet years were displayed in 1982-1985, 1997-1998, 2005, and 2011 (**Figure 9.3b**).



Map 9.1: The 1981-2010 PRISM Precipitation Model for WMU 30, Pine Valley (PRISM Climate Group, Oregon State University, 2013).

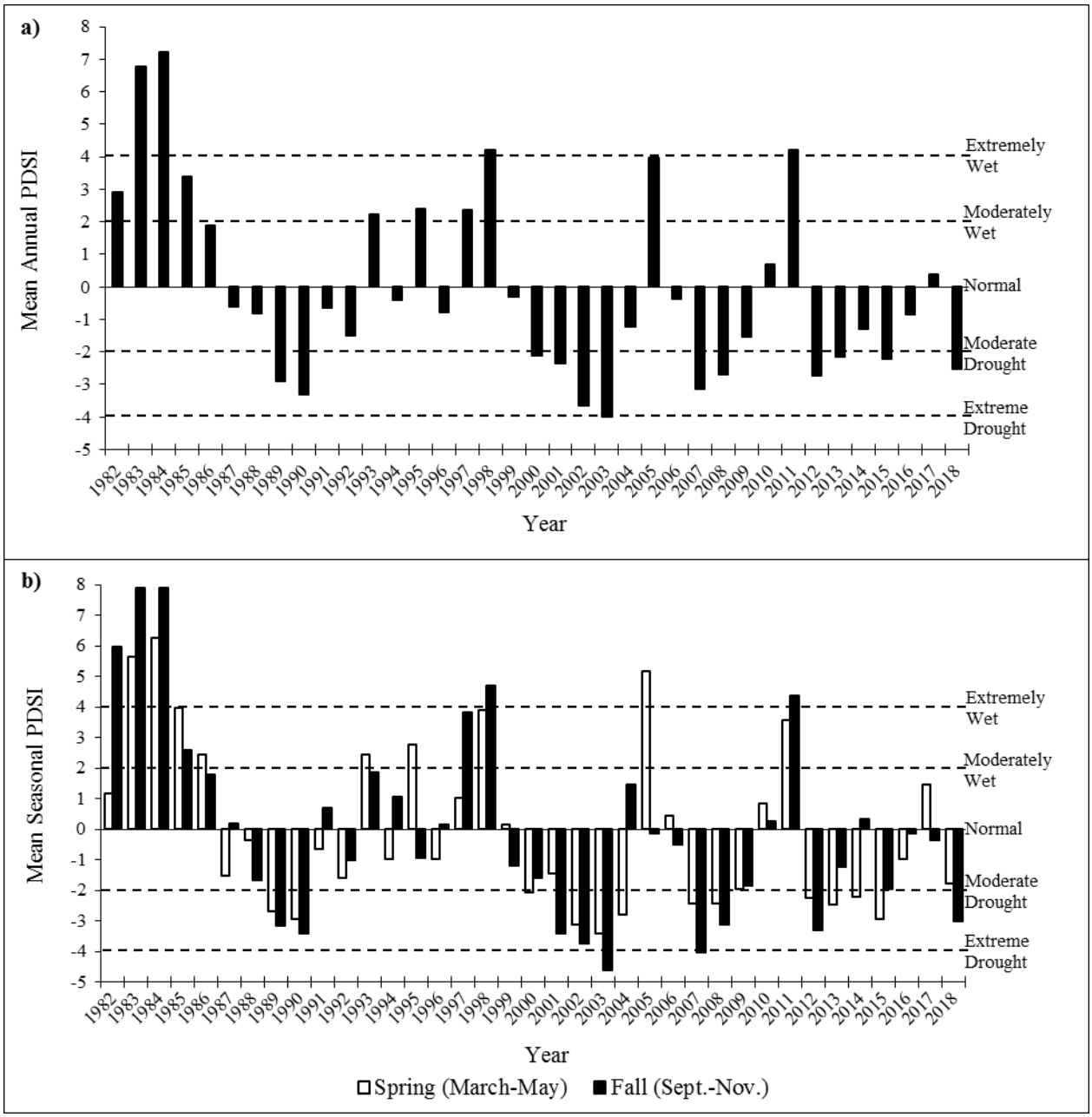


Figure 9.1: The 1982-2018 Palmer Drought Severity Index (PDSI) for the Western division (Division 1). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

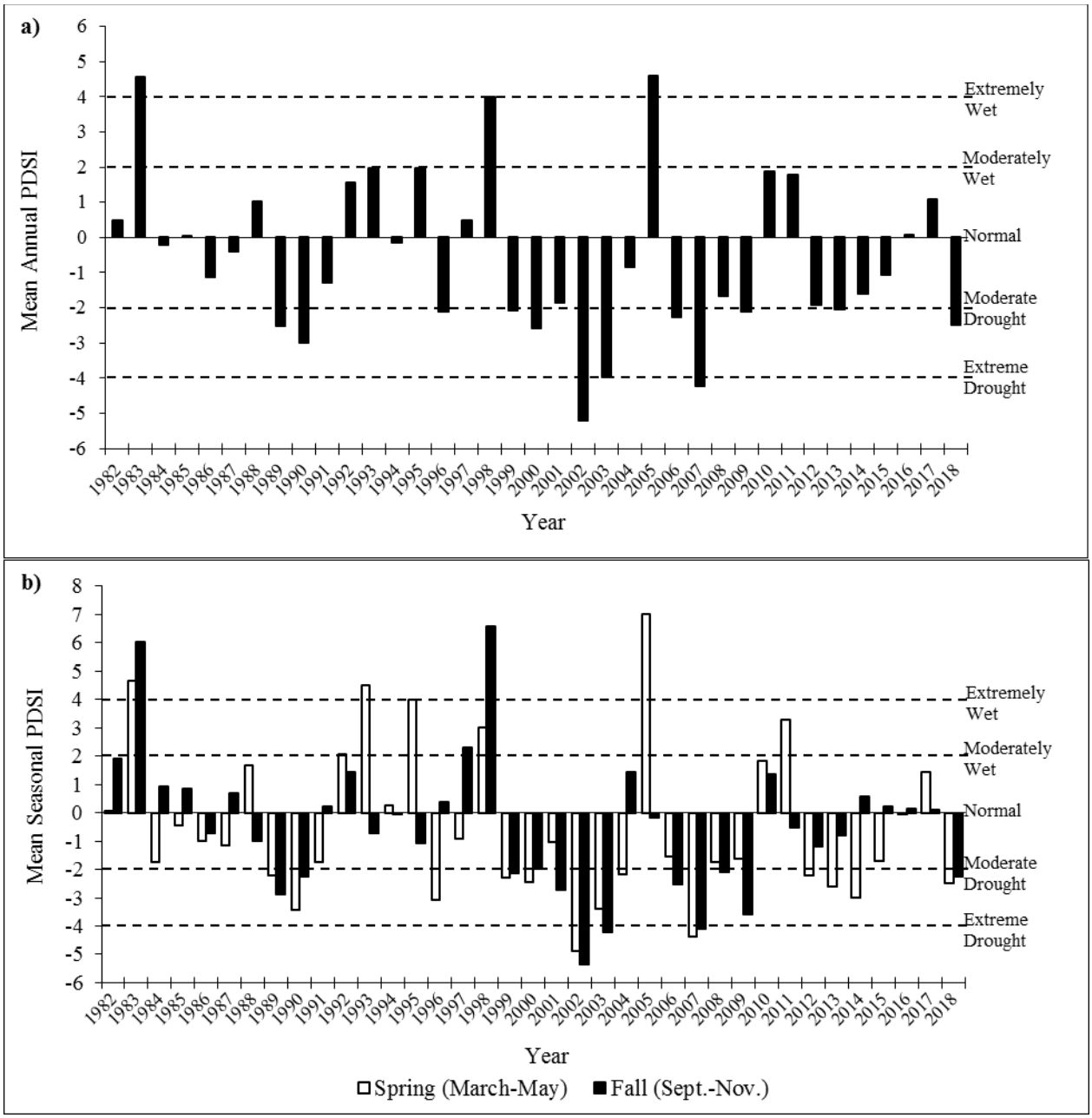


Figure 9.2: The 1982-2018 Palmer Drought Severity Index (PDSI) for the Dixie division (Division 2). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

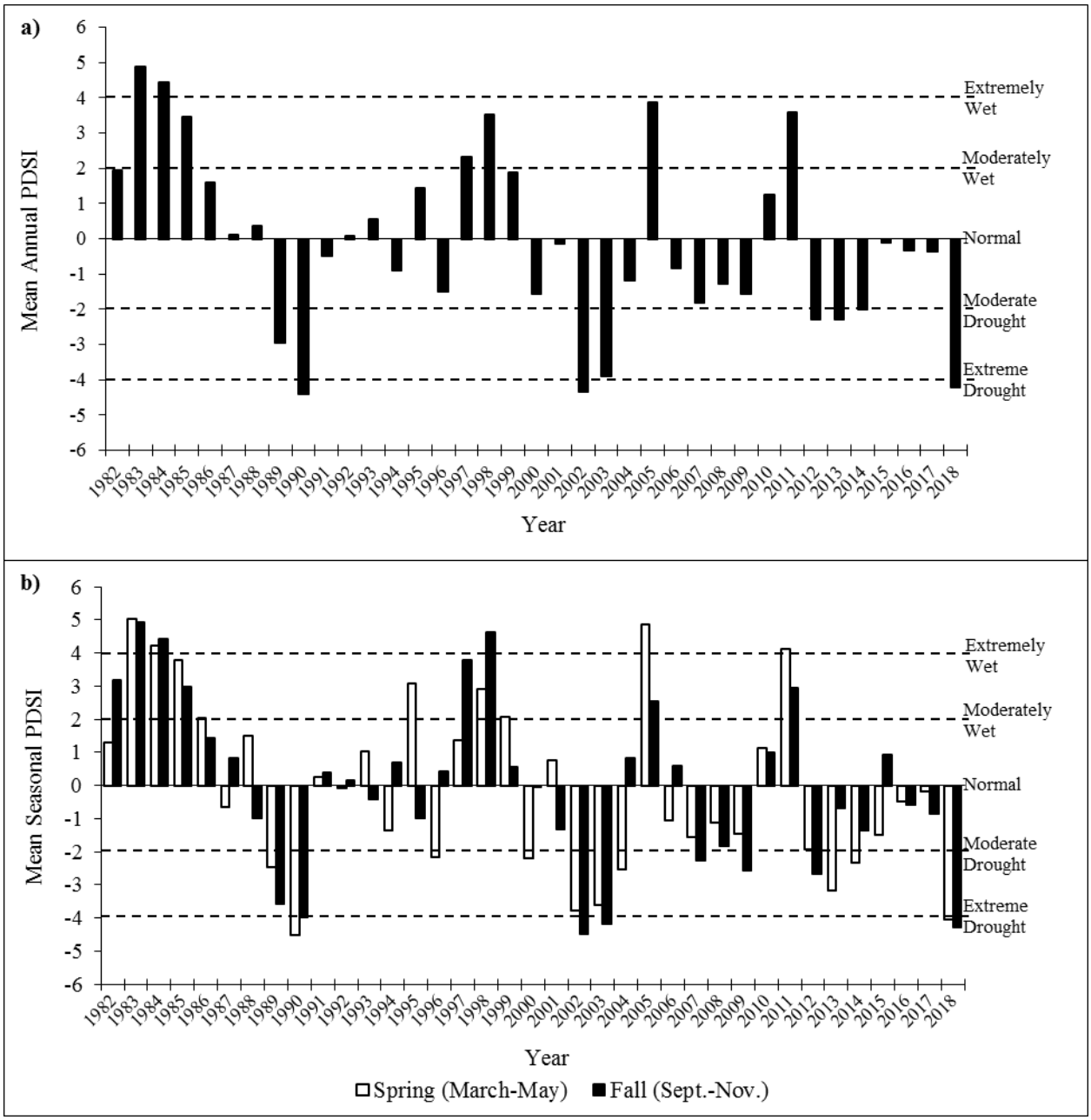


Figure 9.3: The 1982-2018 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2018. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought. a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2019).

Big Game Habitat

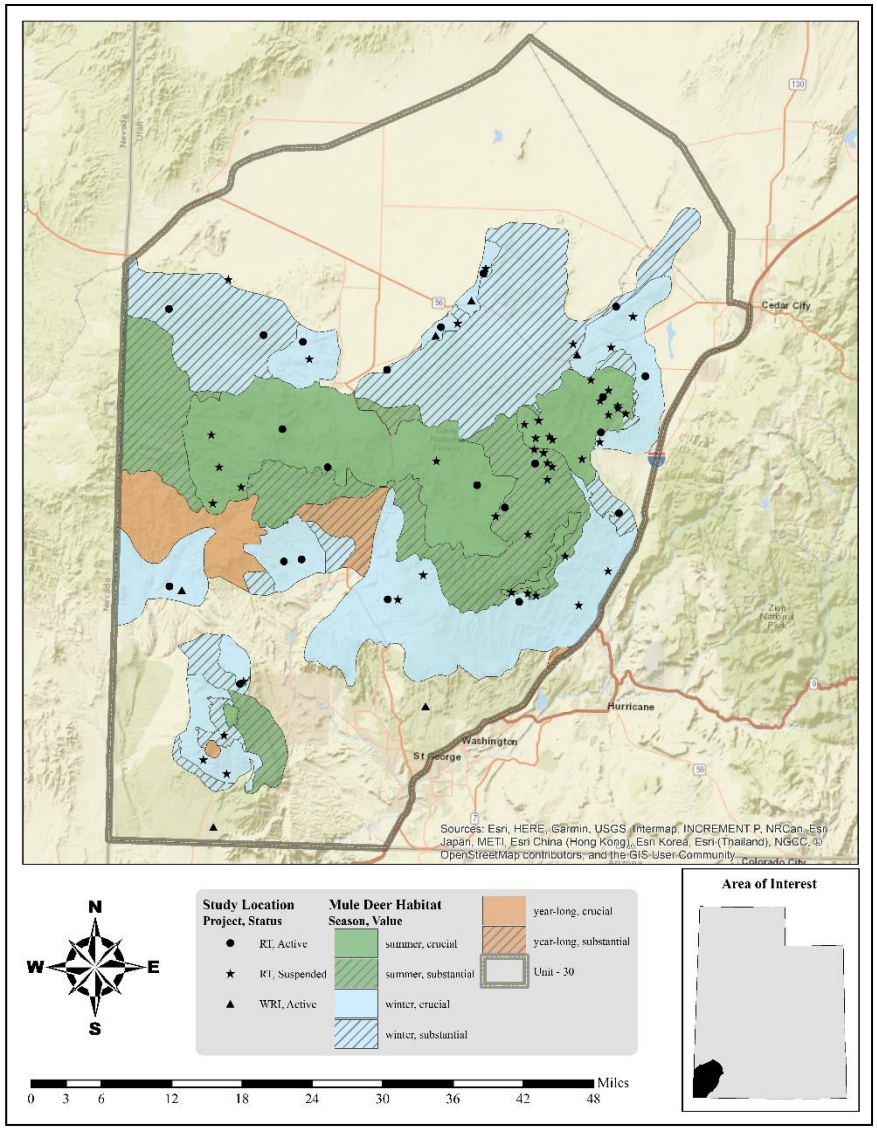
It is estimated that there are 867,240 acres that are classified as mule deer range on Unit 30. Of these acres, 54% is classified as winter range, 39% as summer range, and 7% is considered to be year-long range (**Table 9.1**, **Map 9.2**). The Bureau of Land Management (BLM) manages 46% of the winter range, the United States Forest Service (USFS) manages 37%, 13% is privately owned, the School and Institutional Trust Lands Administration (SITLA) manages 4% of the winter range, and the Paiute Indian Tribe of Utah and Utah State Parks (USP) each administer less than 1% (**Table 9.2**, **Map 9.2**, **Map 9.5**).

Crucial summer range is confined to elevations above 6,000 to 6,500 feet on the New Harmony and Pine Valley Mountains. The summer range consists of dense conifers with a few aspen (*Populus tremuloides*)

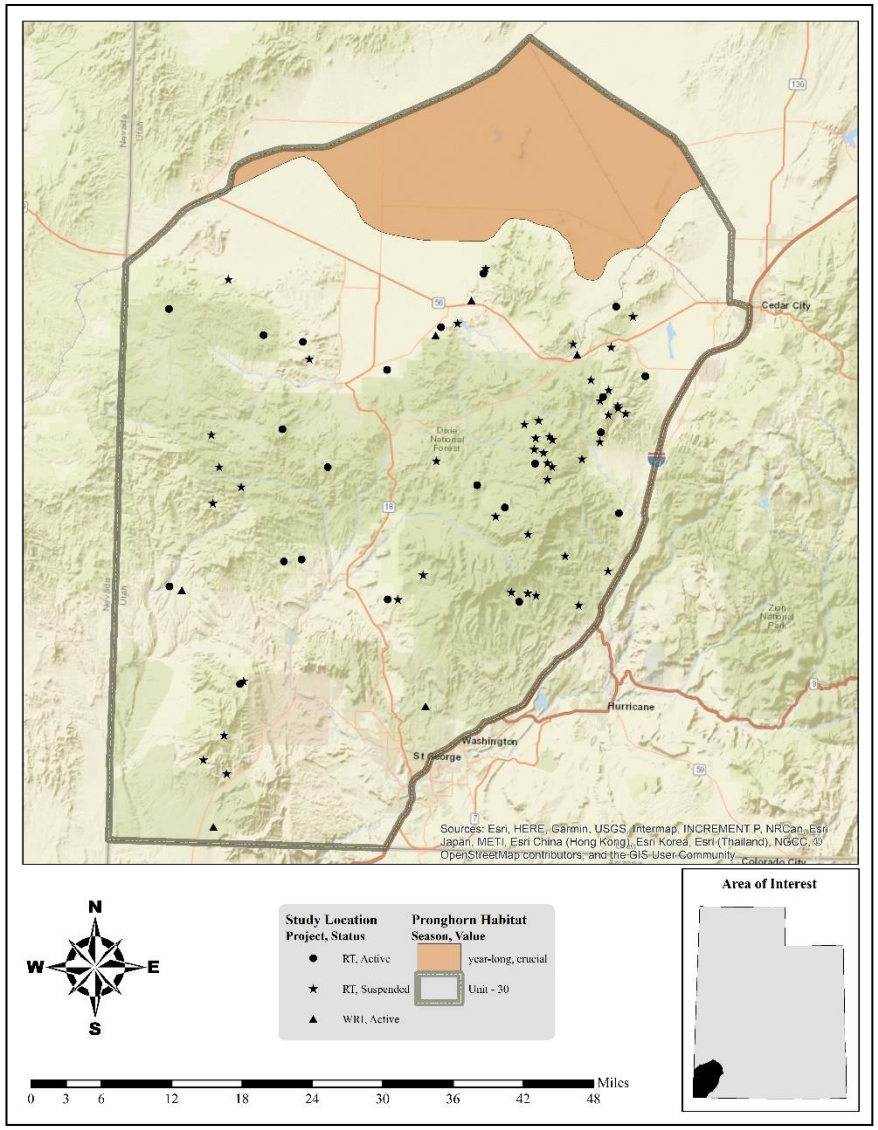
clones and dry meadows at higher elevations and mixed oak (*Quercus sp.*) brush, mountain brush, southern desert shrub, and sagebrush (*Artemisia sp.*)-grass at lower elevations. Part of the summer range is within the officially designated wilderness area. Vegetation of the Harmony Mountains and lower slopes of Pine Valley is principally dominated by oak brush and mountain brush. Aspen and conifer are common on the higher portions of the Pine Valley Mountains, but much less prevalent on the Harmony Mountains. Sagebrush-grasslands and meadows can be found at the summit of the Harmony Mountains: these areas are important for deer during a short period in the summer months, but have been heavily impacted by cattle. Many similar sagebrush grasslands and meadows also occur on the northern end of the Pine Valley Mountains. Summer deer concentrations are primarily on Harmony Mountain and the north end of the Pine Valley Mountains. Relatively few deer summer south of Big Point within Unit 30.

Herd Unit 30 winter range varies greatly depending upon elevation. North of the Great Basin-Colorado River divide, pinyon-juniper and sagebrush-grass predominate. South of the divide, pinyon-juniper is still prevalent but there are increasing amounts of desert shrublands dominated by shrub liveoak (*Q. turbinella*) and other browse species not often found in the northern portion. Both areas possess important acreages of seeded range, most notably east of Pinto at Page Ranch, Woolsey Ranch, New Harmony and Pintura Bench: deer tend to congregate in these areas, especially the latter three. Additional winter range in the Pine Valley unit can be found south of Pintura, but currently supports few deer. Winter range is extensive, but not uniformly utilized. Important critical winter concentration areas include the area east of Central, the lower Pinto Creek drainage, the Antelope Range, Iron Mountain, the Shoal Creek drainage, Moody Creek, Tobin Bench, and the middle portion of the East Fork of Beaver Dam Wash. Only during the most severe winters do deer utilize the lower portions of the winter range, especially the Mojave Desert areas. During the spring, summer, and fall, crucial concentration areas include the higher elevations of the Bull Valley Mountains, Lost Peak, Maple Ridge, the slopes surrounding Pine Valley Reservoir, the meadows of the Whipple Valley area, and Flattop Mountains.

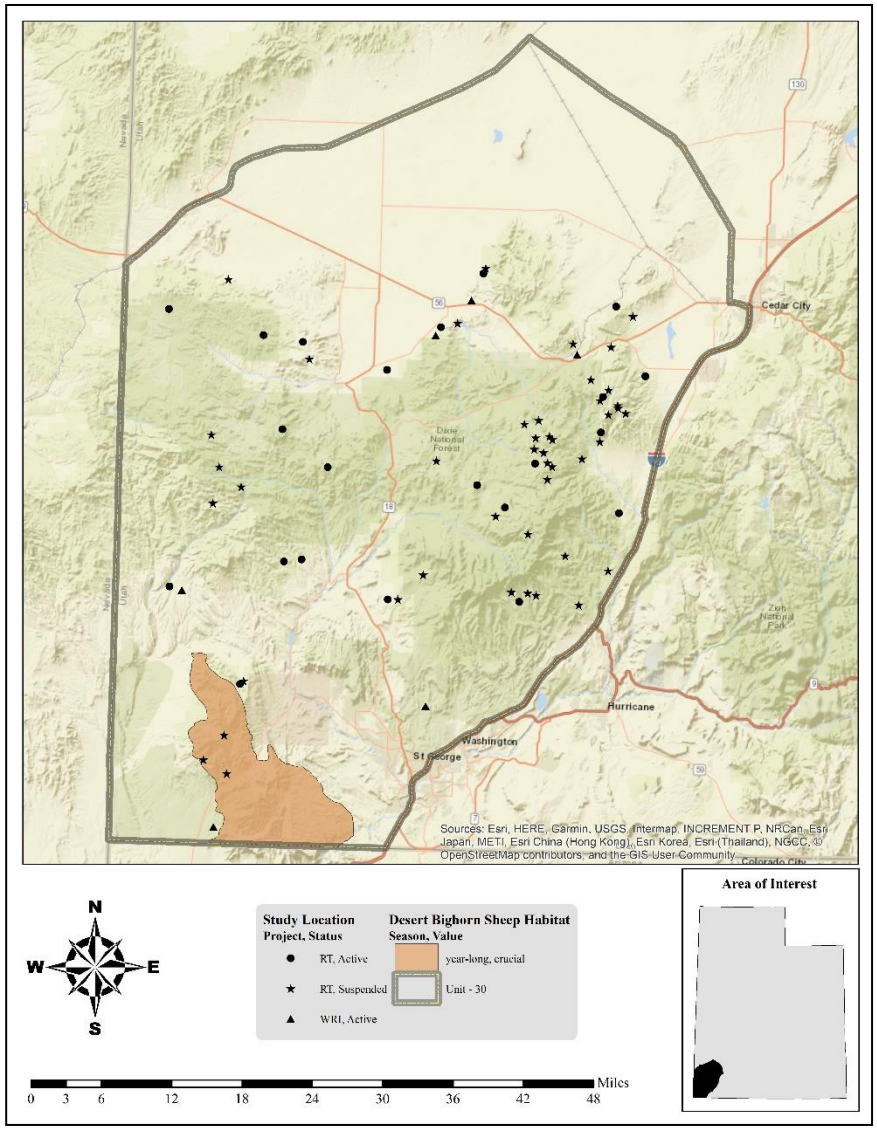
A comprehensive study conducted by the Southern Region of the Division of Wildlife Resources on deer population dynamics and habitat use has contributed greatly to understanding of this herd unit. This study was especially helpful in identifying crucial areas for trend studies. For example, it is now evident that fawning and fawn rearing habitat are very critical for deer herd success in this unit. Accordingly, studies have been established at known fawning areas. In addition, winter range is now better defined and critical areas have been identified, with studies also sampling these areas.



Map 9.2: Estimated mule deer habitat by season and value for WMU 30, Pine Valley.



Map 9.3: Estimated pronghorn habitat by season and value for WMU 30, Pine Valley.



Map 9.4: Estimated desert bighorn sheep habitat by season and value for WMU 30, Pine Valley.

	Summer Range		Winter Range		Year Long Range	
Species	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
Mule Deer	339,842	39%	466,939	54%	60,459	7%
Pronghorn	0	0%	0	0%	237,141	100%
DBS	0	0%	0	0%	67,730	100%

Table 9.1: Estimated mule deer, pronghorn, and desert bighorn sheep (DBS) habitat acreage by season for WMU 30, Pine Valley.

	Summer Range		Winter Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	37,274	11%	213,208	46%	43,300	72%
Private	17,516	5%	61,398	13%	3,515	6%
SITLA	1,338	<1%	20,951	4%	818	1%
Tribal	6,487	2%	141	<1%	0	0%
USFS	277,228	82%	170,923	37%	12,827	21%
USP	0	0%	318	<1%	0	0%
Total	339,842	**100%**	466,939	**100%**	60,459	**100%**

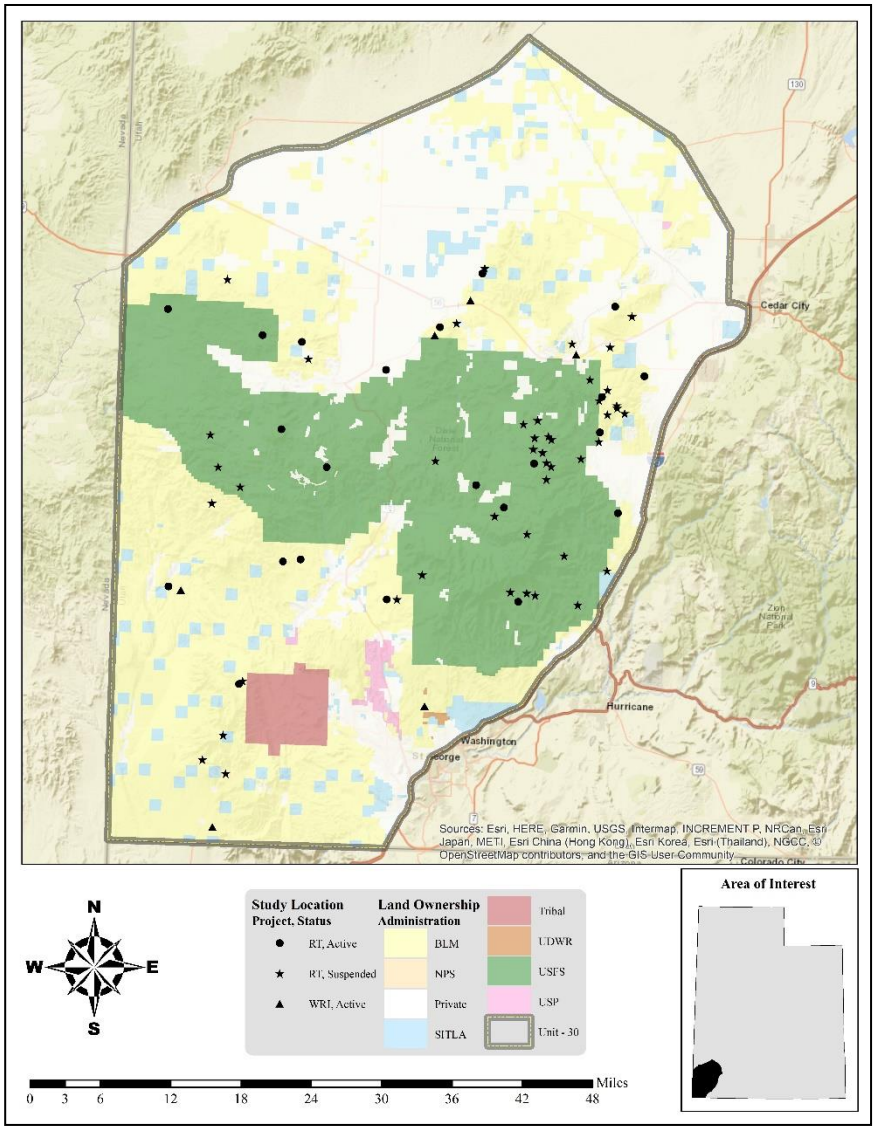
Table 9.2: Estimated mule deer habitat acreage by season and ownership for WMU 30, Pine Valley.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	66,945	28%
Private	153,302	65%
SITLA	16,894	7%
Total	237,141	**100%**

Table 9.3: Estimated pronghorn habitat acreage by season and ownership for WMU 30, Pine Valley.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	60,568	89%
Private	838	1%
SITLA	5,753	8%
Tribal	571	1%
Total	67,730	**100%**

Table 9.4: Estimated desert bighorn sheep habitat acreage by season and ownership for WMU 30, Pine Valley.



Map 9.5: Land ownership for WMU 30, Pine Valley.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Conifer	Pinyon-Juniper Woodland	494,923	29.71%	
	Mountain Mahogany Woodland and Shrubland	43,203	2.59%	
	Douglas-fir-Grand Fir-White Fir Forest and Woodland	11,563	0.69%	
	Ponderosa Pine Forest, Woodland and Savanna	6,410	0.38%	
	Spruce-Fir Forest and Woodland	2,198	0.13%	
	Juniper Woodland and Savanna	1,789	0.11%	
	Douglas-fir-Ponderosa Pine-Lodgepole Pine Forest and Woodland	997	0.06%	
	Limber Pine Woodland	513	0.03%	33.71%
Exotic Herbaceous	Introduced Annual Grassland	199,899	12.00%	
	Introduced Annual and Biennial Forbland	35,352	2.12%	
	Introduced Perennial Grassland and Forbland	2,845	0.17%	14.29%
Exotic Tree-Shrub	Introduced Riparian Vegetation	1,537	0.09%	0.09%
Grassland	Grassland	18,342	1.10%	
	Alpine Dwarf-Shrubland, Fell-field and Meadow	11,813	0.71%	1.81%
Shrubland	Big Sagebrush Shrubland and Steppe	233,853	14.04%	
	Salt Desert Scrub	111,365	6.68%	
	Desert Scrub	91,279	5.48%	
	Greasewood Shrubland	73,695	4.42%	
	Low Sagebrush Shrubland and Steppe	50,359	3.02%	
	Creosotebush Desert Scrub	38,619	2.32%	
	Deciduous Shrubland	22,702	1.36%	
	Blackbrush Shrubland	22,584	1.36%	
	Chaparral	10,754	0.65%	
	Sand Shrubland	24	0.00%	
	Grassland and Steppe	1	0.00%	39.33%
Other	Agricultural	43,976	2.64%	
	Developed	41,491	2.49%	
	Riparian	31,474	1.89%	
	Sparsely Vegetated	28,911	1.74%	
	Hardwood	11,456	0.69%	
	Conifer-Hardwood	11,331	0.68%	
	Barren	5,625	0.34%	
	Quarries-Strip Mines-Gravel Pits	4,212	0.25%	
	Open Water	900	0.05%	10.77%
Total		1,665,994	100%	100%

Table 9.5: LANDFIRE Existing Vegetation Coverage (LANDFIRE.US_140EVT, 2019) for WMU 30, Pine Valley.

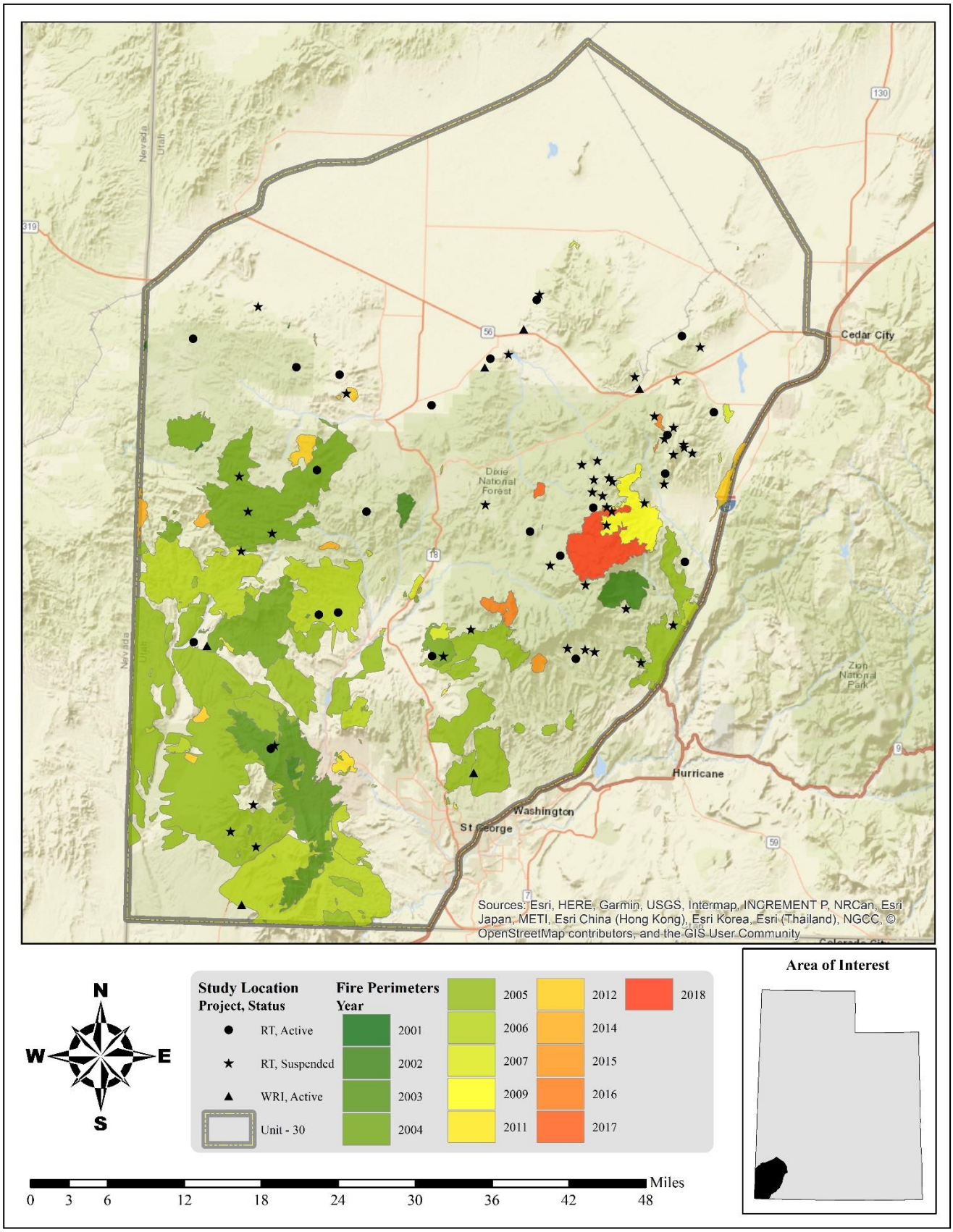
Limiting Factors to Big Game Habitat

Mortality of deer has been significant along I-15, SR-56, and SR-18. Deer-proof fencing has been erected along I-15, impeding deer movement; fencing may pose some barrier to deer migration to the wintering grounds.

Wildfire has had a significant impact on deer habitat in the southern and western portions of this unit in recent years (**Map 9.6**). These wildfires have removed large expanses of important sagebrush and shrubland communities. While response to rehabilitation efforts has varied, available shrub forage remains highly reduced from pre-2000 levels.

In addition to wildfire, severe flooding in January 2005 likely impacted deer habitat that drastically altered riparian communities along Moody Wash, Mogatsu Creek, Beaver Dam Wash, Santa Clara River, Virgin River, and neighboring drainages. Results of these events will likely impact deer use of these areas for several years.

The current LANDFIRE Existing Vegetation Coverage model shows that nearly 30% of Unit 30 is comprised of pinyon-juniper stands (**Table 9.5**). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease the sagebrush and herbaceous components (Miller, Svejcar, & Rose, 2000), therefore decreasing available forage for wildlife. Other limiting factors to big game habitat include introduced annual grasses such as cheatgrass (*Bromus tectorum*). The LANDFIRE model shows that 12% of the unit is comprised of introduced annual grasslands (**Table 9.5**). Increased amounts of cheatgrass may increase the risk for catastrophic wildfire (Balch, D'Antonio, & Gómez-Dans, 2013).



Map 9.6: Land coverage of fires by year from 2000-2019 for WMU 30, Pine Valley (Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets, 2019).

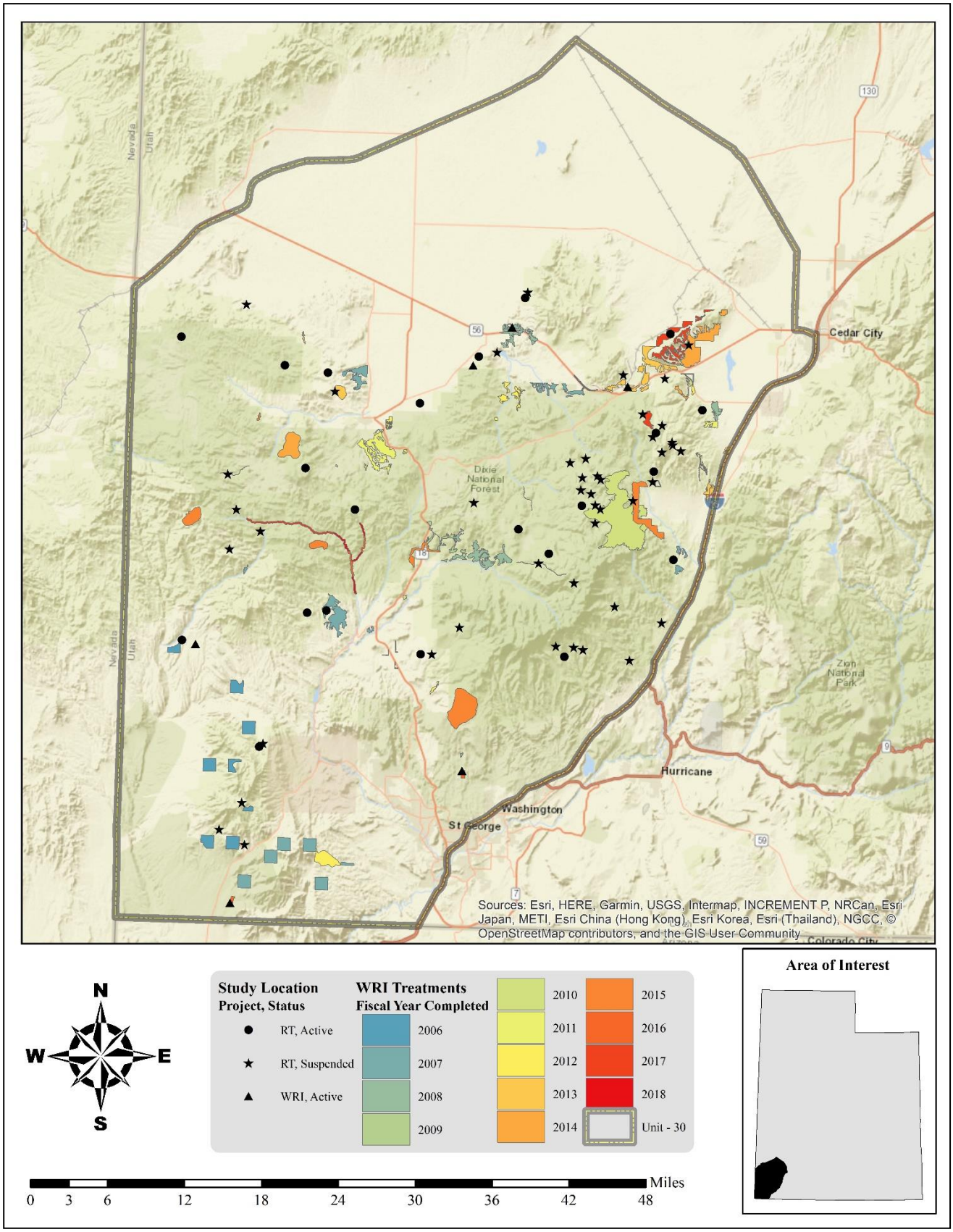
Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 45,861 acres of land have been treated within the Pine Valley unit since the WRI was implemented in 2004 (**Map 9.7**). An additional 1,113 acres are currently being treated and treatments have been proposed for 6,173 acres. Treatments frequently overlap one another bringing the total treatment acres to 53,147 acres for this unit (**Table 9.6**). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the state of Utah.

Seeding plant species to supplement the herbaceous understory is the most common management practice in this unit and often occurs along with other treatment types. Bullhog treatments and manual vegetation removal techniques (such as lop and scatter) to remove pinyon and juniper trees are also frequently used in the unit. Other management practices include (but are not limited to): seeding plants to enhance the shrub component, anchor chaining to remove trees, harrowing, and herbicide application (**Table 9.6**).

Type	Completed Acreage	Current Acreage	Pending Completed Acreage	Proposed Acreage	Total Acreage
Anchor Chain	**3,758**	**0**	**0**	**0**	**3,758**
Ely (One-Way)	1,123	0	0	0	123
Ely (Two-Way)	2,635	0	0	0	2,635
Bulldozing	**40**	**0**	0	**0**	**40**
Tree Push	40	0	0	0	40
Bullhog	**9,270**	**47**	**0**	**5,319**	**14,636**
Full Size	4,200	0	0	3,008	7,208
Skid Steer	5,070	47	0	2,311	7,428
Chain Harrow	**0**	**0**	**0**	**14**	**14**
>15 ft. (Two-Way)	0	0	0	14	14
Harrow	**774**	**0**	**0**	**0**	**774**
≤15 ft. (One-Way)	774	0	0	0	774
Herbicide application	**749**	**0**	**0**	**0**	**749**
Aerial (Fixed-Wing)	131	0	0	0	131
Aerial (Helicopter)	644	0	0	0	644
Planting/Transplanting	**200**	**0**	**0**	**0**	**200**
Seeding (Primary)	**29,083**	**0**	**0**	**0**	**29,083**
Broadcast (Aerial-Fixed Wing)	15,914	0	0	0	15,914
Broadcast (Aerial-Helicopter)	10,210	0	0	0	10,210
Drill (Rangeland)	123	0	0	0	123
Ground (Mechanical Application)	2,836	0	0	0	2,836
Seeding (Secondary/Shrub)	**3,601**	**300**	**0**	**0**	**3,901**
Broadcast (Aerial-Fixed wing)	108	0	0	0	108
Broadcast (Aerial-Helicopter)	508	300	0	0	508
Hand Seeding	2,985	0	0	0	2,985
Vegetation Removal/Hand Crew	**3,656**	**841**	**0**	**1,764**	**6,261**
Lop & Scatter	3,656	841	0	1,764	6,261
Other	**275**	**0**	**0**	**0**	**275**
Greenstripping	264	0	0	0	264
Road Decommissioning	11	0	0	0	11
Grand Total	**51,406**	**1,235**	**0**	**7,097**	**59,691**
*** Total Land Area Treated**	**45,861**	**1,113**	**0**	**6,173**	**53,147**

Table 9.6: WRI treatment action size (acres) for completed, current, and proposed projects for WMU 30, Pine Valley. Data accessed on 02/18/2019.
*Does not include overlapping treatments.



Map 9.7: WRI treatments by fiscal year completed for WMU 30, Pine Valley.

Range Trend Studies

Range Trend studies have been sampled within WMU 30 on a regular basis since 1982, with studies being added or suspended as was deemed necessary **(Table 9.7**). Due to changes in sampling methodologies, only data collected following the 1992 sample year is included in this summary. Monitoring studies of WRI projects began in 2004; when possible WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (**Table 9.8**).

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

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
30-01	Lower Broad Hollow	RT	Suspended	'82	Not Verified
30-02	Comanche Creek Ditch	RT	Suspended	'82, '92	Not Verified
30-03	Upper Broad Hollow	RT	Active	'82, '92, '98, '03, '08, '13, '18	Upland Stony Loam (Shrub Liveoak)
30-04	Rock Spring	RT	Suspended	'82	Not Verified
30-05	Harmony Mountain Summit	RT	Active	'82, '92, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
30-06	Upper Duncan Canyon	RT	Suspended	'82	Not Verified
30-07	Bumblebee Spring	RT	Suspended	'82	Not Verified
30-08	Upper Groves Spring	RT	Suspended	'82	Not Verified
30-09	Upper Lime Spring	RT	Suspended	'82, '92, '98, '03	Not Verified
30-10	Upper Bumblebee Spring	RT	Suspended	'82, '92	Not Verified
30-11	Quichapa Canyon	RT	Suspended	'82	Not Verified
30-12	Pintura Bench	RT	Suspended	'82, '92, '98	Not Verified
30-13	Black Ridge	RT	Active	'82, '92, '98, '03, '08, '13, '18	Upland Stony Loam (Mountain Big Sagebrush)
30-14	Browse	RT	Suspended	'82	Not Verified
30-15	Wet Sandy Trail	RT	Suspended	'82	Not Verified
30-16	Upper Leeds Creek	RT	Suspended	'82, '86, '87, '92	Not Verified
30-17	Upper Grants Spring	RT	Suspended	'82	Not Verified
30-18	Grants Ranch Trail	RT	Suspended	'82, '92	Not Verified
30-19	Big Water Reservoir	RT	Suspended	'82, '92	Not Verified
30-20	Upper Lone Pine Reservoir	RT	Suspended	'82	Not Verified
30-21	Upper Comanche Canyon	RT	Suspended	'82, '92	Not Verified
30-22	Sheep Pens	RT	Suspended	'82	Not Verified
30-23	Grants Ranch	RT	Suspended	'82	Not Verified
30-24	Water Canyon	RT	Suspended	'82	Not Verified
30-25	New Castle Reservoir	RT	Suspended	'82, '92	Not Verified
30-26	Grassy Flat Ridge	RT	Active	'82, '92, '98, '03, '08, '13, '18	Mountain Stony Loam (Browse)
30-27	Paradise	RT	Suspended	'82, '92	Not Verified
30-28	Bullion Canyon	RT	Suspended	'82	Not Verified
30-29	Southwest of Newcastle	RT	Active	'82, '92, '98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
30-30	Swett Hills	RT	Suspended	'82, '92	Not Verified
30-31	Oak Spring	RT	Suspended	'82, '92	Not Verified
30-32	Whiterocks Reservoir	RT	Active	'82, '92, '18	Mountain Stony Loam (Mountain Big Sagebrush)
30-33	South Side Rencher Peak	RT	Suspended	'82	Not Verified
30-34	West of Long Flat	RT	Suspended	'82, '92	Not Verified
30-35	Deep Canyon	RT	Active	'82, '92, '98, '03, '08, '18	Mountain Shallow Loam (Curlleaf Mountain Mahogany)
30-36	Atchison Mountain	RT	Suspended	'82, '92	Not Verified
30-37	Truman Bench	RT	Suspended	'82, '92, '98	Not Verified
30-38	Wide Canyon	RT	Suspended	'82, '92, '98, '03, '08	Not Verified
30-39	West Valley	RT	Suspended	'82, '92	Not Verified
30-40	Telegraph Draw	RT	Active	'82, '92, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Mountain Big Sagebrush)
30-41	Joe Spring	RT	Active	'82, '92, '98, '03, '08, '13, '18	Mountain Loam (Browse)
30-42	Grapevine Spring	RT	Active	'82, '92, '98, '03, '08, '13, '18	Upland Stony Loam (Shrub Liveoak)
30-43	Dagget Flat	RT	Suspended	'82	Not Verified
30-44	Motoqua	RT	Active	'82, '92, '18	Semidesert Shallow Hardpan (Blackbrush)
30-45	Flat Top Mountain	RT	Active	'82, '98, '03, '08, '13, '18	Mountain Gravelly Loam (Oak)
30-46	Pahcoon Bench	RT	Suspended	'82, '92, '98, '03, '08, '13, '18	Not Verified
30-47	Lost Peak	RT	Suspended	'82, '98	Not Verified
30-48	Welcome Springs	RT	Suspended	'82	Not Verified
30-49	Rattlesnake Spring	RT	Suspended	'82, '92	Not Verified

Study #	Study Name	Project	Status	Years Sampled	Ecological Site Description
30-50	Hell Hole Pass	RT	Suspended	'82	Not Verified
30-51	Pinnacles	RT	Suspended	'82, '92	Not Verified
30-52	Northwest of Enterprise	RT	Suspended	'82, '92, '98, '03, '08, '13	Semidesert Loam (Wyoming Big Sagebrush)
30-53	Sevy Hollow	RT	Suspended	'82, '98	Not Verified
30-54	Bullion Canyon	RT	Active	'98, '03, '08, '13, '18	Upland Stony Loam (Black Sagebrush)
30-55	Quichapa Canyon	RT	Active	'98, '03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
30-56	Woolsey Reseed	RT	Suspended	'98, '03, '08, '13	Upland Gravelly Loam (Bonneville Big Sagebrush)
30-57	Summit Spring	RT	Suspended	'98, '03, '08, '13	Not Verified
30-58	Spirit Creek South Burned	RT	Active	'86, '87, '92, '98, '03, '08, '13, '18	Mountain Loam (Mountain Big Sagebrush)
30-59	Upper Horse Creek	RT	Suspended	'86, '87, '92, '98, '03	Not Verified
30-60	Jones Hollow	RT	Suspended	'86, '87, '92, '98, '03	Not Verified
30-61	Tobin Bench	RT	Active	'03, '08, '13, '18	Semidesert Gravelly Loam (Desert Bitterbrush)
30-62	North Hills	RT	Active	'03, '08, '13, '18	Upland Gravelly Loam (Mountain Big Sagebrush)
30-63	Holt Canyon	RT	Active	'03, '08, '13, '18	Upland Loam (Mountain Big Sagebrush)
30-64	Horse Creek	RT	Suspended	'87	Not Verified
30-65	Spirit Creek South Unburned	RT	Suspended	'87	Not Verified
30-66	Jones Hollow II	RT	Suspended	'87	Not Verified
30-67	North Horse Creek	RT	Suspended	'87	Not Verified
30-68	Wet Sandy North	RT	Suspended	'87	Not Verified
30-69	Wet Sandy South	RT	Suspended	'87	Not Verified
30-70	Oak Grove	RT	Suspended	'87	Not Verified
30-71	Pig Creek	RT	Suspended	'87	Not Verified
30-72	Spirit Creek	RT	Suspended	'87	Not Verified
30-73	Wide Canyon 2	RT	Active	'13, '18	Upland Shallow Loam (Mountain Big Sagebrush)
30-74	Pinion Park	RT	Active	'18	Upland Gravelly Loam (Mountain Big Sagebrush)
30-75	Swett Hills North	RT	Active	'18	Upland Gravelly Loam (Wyoming Big Sagebrush)
30-77	Pahcoon Bench West	RT	Active	'18	Upland Gravelly Loam (Mountain Big Sagebrush)
30R-01	Newcastle Bullhog	WRI	Active	'04, '07, '12, '17	Upland Loam (Wyoming Big Sagebrush)
30R-02	Square Fire Rehab	WRI	Active	'06, '11, '17	Semidesert Shallow Hardpan (Blackbrush)
30R-04	North New Castle	WRI	Active	'08, '11, '15	Upland Loam (Wyoming Big Sagebrush)
30R-05	Duncan Creek/Hwy 56	WRI	Active	'12, '15	Upland Loam (Shrub)
30R-06	Tabeau Peak	WRI	Active	'16	Desert Loam (Creosotebush)
30R-07	Middletown Wash	WRI	Active	'16	Semidesert Shallow Hardpan (Blackbrush)

Table 9.7: Range trend and WRI project studies monitoring history and ecological site potential for WMU 30, Pine Valley.

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
30-02	Comanche Creek Ditch	Aerial Before	New Harmony/Central Fuelbreak Improvement Phase II	December 2014	2252	2988
30-13	Black Ridge	Chain Unknown Seed Unknown Dozer Push		Historic Historic Between 2013 and 2018		
30-15	Wet Sandy Trail	Wildfire	Jones	July 2004	702	
30-20	Upper Lone Pine Reservoir	Wildfire Aerial After	Mill Flat Mill Flat BAER Vegetation Stabilization	July 2009 November 2009	12607 8893	 1604
30-21	Upper Comanche Canyon	Wildfire	Mill Flat	July 2009	12607	
30-22	Sheep Pens	Wildfire	Mill Flat	July 2009	12607	
30-26	Grassy Flat Ridge	Seed Unknown		Historic		
30-29	Southwest of Newcastle	Lop and Scatter		Between 2003 and 2008		
30-30	Swett Hills	Two-Way Ely Chain Aerial After	Duncan Creek Phase II Vegetation Enhancement Duncan Creek Phase II Vegetation Enhancement	October 2014-February 2015 October 2014-February 2015	2925 2925	2704 2704
30-38	Wide Canyon	Wildfire Aerial After	Dameron Complex	2004 Winter 2004-2005	10027	
30-40	Telegraph Draw	Chain Unknown Seed Unknown		Historic Historic		
30-42	Grapevine Spring	Aerial Before Chain Unknown Wildfire Aerial After	Tobin Wash Seeding Tobin Wash Seeding Bull Complex Bull Complex Fire ESR	July-December 1965 July-December 1965 2006 2006-2007	1925 1925 41500 29532	LTDL LTDL LTDL LTDL
30-43	Dagget Flat	Wildfire	Bull Complex	2006	41500	

Study #	Study Name	Type	Disturbance Name (If Available)	Date	Acres	WRI Project #
30-45	Flat Top Mountain	Wildfire	Hawkins	2004	35427	
30-46	Pahcoon Bench	Chain Unknown		1979		
		Seed Unknown		1979		
		Wildfire	Pahcoon	1998	6363	
		Seed Unknown		1998		
		Wildfire	Apex	2003	29933	
30-47	Lost Peak	Wildfire	Hawkins	2004	35427	
30-48	Welcome Springs	Wildfire	West Side Complex	2005	68418	
30-49	Rattlesnake Spring	Wildfire	Hawkins	2004	35427	
30-51	Pinnacles	Wildfire	Hawkins	2004	35427	
30-52	Northwest of Enterprise	Wildfire	Barn	1998	1815	
		Aerial After		1998		
30-56	Woolsey Reseed	Chain Unknown	Woolsey Ranch Seeding	Historic	1600	
		Seed Unknown	Woolsey Ranch Seeding	Historic	1500	
		Lop and Scatter	Woolsey/Vandenburg Fuels Reduction	May-June 2004	312	
30-57	Summit Spring	Wildfire	Westside Complex	2005	68418	
		Aerial After		Winter 2005-2006		
30-58	Spirit Creek South Burned	Wildfire		June 1986		
		Seed Unknown		July 1986		
30-59	Upper Horse Creek	Wildfire	Oak Grove	1986		
30-60	Jones Hollow	Wildfire	Oak Grove	1986		
30-61	Tobin Bench	Wildfire	Bull Complex	2006	41500	
		Aerial After		2007	1000	
30-75	Swett Hills North	Aerial Before	Duncan Creek - Final Phase	Fall 2016	998	3563
		Bullhog	Duncan Creek - Final Phase	October 2016-May 2017	998	3563
30-77	Pahcoon Bench West	Wildfire	Apex	June 2003	29933	
		Aerial After		2003		
		Wildfire	West Mountain	August 2012	2456	
		Aerial After		2012		
30R-01	Newcastle Bullhog	Bullhog		October 2004	900	PDB
30R-02	Square Fire Rehab	Aerial Before	Aerial Seeding	October-December 1981	1450	
		One-Way Chain Unknown	Soil Disturbance: Chaining	October-December 1981	660	
		Dribbler	Ground Seeding: Dribble	October-December 1981	660	
		Wildfire	Square	2004	17146	
		Aerial Before	Square Fire Rehab	Fall 2004	6287	PDB
		One-Way Chain Unknown	Square Fire Rehab	Fall 2004		PDB
		Aerial After	Square Fire Rehab	February 2005	3000	PDB
30R-04	North New Castle	Aerial Before	North Newcastle	October 2008	870	446
		Bullhog	North Newcastle	December 2008-January 2009	870	446
		Lop and Scatter	Enterprise/Hwy 56 Project Maintenance	August-December 2015	1323	3431
30R-05	Duncan Creek/Hwy 56	Aerial Unknown	Duncan Creek/Hwy 56 Interface - Phase 1	Winter 2012-2013	2146	2303
		Bullhog	Duncan Creek/Hwy 56 Interface - Phase 1	Winter 2012-2013	2146	2303
30R-06	Tabeau Peak	Wildfire	Jarvis	June 2006	50702	
		Transplant	Desert Tortoise Habitat Restoration in Burned Areas within two National Conservation Areas in SW Utah	November 2016-Fall 2017	200	3284
30R-07	Middletown Wash	Wildfire	Plateau	June 2005	2986	
		Wildfire	Mill Creek	July 2005	7888	
		Transplant	Desert Tortoise Habitat Restoration in Burned Areas within two National Conservation Areas in SW Utah	November 2016-Fall 2017	200	3284

Table 9.8: Range trend and WRI studies known disturbance history for WMU 30, Pine Valley. PDB = Pre-Database; LTDL = Land Treatment Digital Library.

Study Trend Summary (Range Trend)

Mountain (Big Sagebrush)

There are four studies [Harmony Mountain Summit (30-05), Whiterocks Reservoir (30-32), Telegraph Draw (30-40), and Spirit Creek South Burned (30-58)] that are classified as Mountain (Big Sagebrush) ecological sites. The Harmony Mountain Summit study site is located approximately 8 miles north of New Harmony on Harmony Mountain. The Whiterocks Reservoir site can be found in the Pine Valley Mountains northeast of Grass Valley. The Telegraph Draw study is situated approximately three miles east of the Nevada border north of Crestline Road near Enterprise. The Spirit Creek South Burned study location is located around 10 miles northwest of Leeds in the Pine Valley Mountains.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species present on all study sites except for the Spirit Creek South Burned study. On the Spirit Creek South Burned site, Gambel oak (*Quercus gambelii*) is the dominant browse species. Cover of sagebrush has displayed a generally increasing trend while other preferred browse cover has remained stable (**Figure 9.4**). Preferred browse demographic data shows that the community is primarily composed of mature individuals. Decadence has remained low, except for 2008 in which there was moderate amount of decadence. Recruitment of young has been stable with moderate amounts of young plants sampled in most years (**Figure 9.17**). Utilization of preferred browse has consistently remained low in all sample years (**Figure 9.20**).

Tree cover for these sites is provided by Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*). In 2003, quaking aspen (*Populus tremuloides*) was sampled on the Harmony Mountain Summit study site. An overall increasing trend has been noted for tree cover (**Figure 9.11**). Density of trees has remained stable across the sample years (**Figure 9.14**).

Herbaceous Understory: The herbaceous understories of these sites are mostly abundant and moderately diverse. The higher elevation sites display more diversity in the forb and grass components; the Spirit Creek South Burned study is dominated by introduced perennial grasses. Cover has shown an increasing trend over time and frequency has also increased, but to a lesser degree. Perennial grasses have provided the majority of the increasing herbaceous cover, although annual grasses have also been present on the sites in small amounts. Perennial and annual forbs are present on these studies in moderate amounts (**Figure 9.23**, **Figure 9.26**).

Occupancy: Average pellet transect data shows a general decrease in animal presence on these sites and that deer are the primary occupants. Mean abundance of deer pellet groups has varied from 18 days use/acre in 2013 to 69 days use/acre in 2008. Cattle presence on the site has varied from 7 days use/acre in 2018 to nearly 11 days use/acre in 2003. Elk usage on the site has been low with less than 1 day use/acre noted only in the 2008 and 2018 sample years. Horse usage across the sites has been observed in all years, ranging from 1 day use/acre noted in 2018 and 4 days use/acre being sampled in 1998 (**Figure 9.29**).

Mountain (Browse)

There is one study [Grassy Flat Ridge (30-26)] that is classified as a Mountain (Browse) ecological site. The Grassy Flat Ridge study is located in between Grassy Flat and Grass Valley.

Shrubs/Trees: This study site has a mix of browse species present but the dominant species is little sagebrush (*Artemisia arbuscula*). Other browse species present include Utah serviceberry (*Amelanchier utahensis*), Gambel oak (*Quercus gambelii*), antelope bitterbrush (*Purshia tridentata*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), and alderleaf mountain mahogany (*C. montanus*). Cover of preferred browse has increased slightly over the sample years (**Figure 9.5**). Preferred browse demographic data displays a generally decreasing trend for recruitment of young, though numbers are still good. Decadence has been low in most years except for 2008 in which moderate amounts were noted (**Figure 9.17**). Utilization has increased slightly through time but has remained relatively low. The 2018 year had the highest amount of heavy use observed with nearly 20 percent of plants being heavily browsed (**Figure 9.20**).

Twoneedle pinyon (*Pinus edulis*) is the only tree that has been sampled on the site. Cover has increased steadily in all sample years (**Figure 9.11**). However, point quarter data is only available for 2018 so a trend for tree density cannot be established at this time (**Figure 9.14**).

Herbaceous Understory: The herbaceous understory of this site is diverse and abundant. Cover of species has shown fluctuations while frequency has been more stable. Perennial grasses have shown an overall increasing trend. Introduced perennial grass species are present, including intermediate wheatgrass (*Thinopyrum intermedium*) and bulbous bluegrass (*Poa bulbosa*). Bulbous bluegrass has fluctuated in cover, but has been present in most sample years. Perennial forbs provide moderate cover, but have displayed a generally decreasing trend (**Figure 9.23**, **Figure 9.26**).

Occupancy: Average pellet transect data shows fluctuations in animal presence between sample years. Deer have been the primary occupants of the site in all years with mean abundance varying from a low of 8 days use/acre in 2013 to a high of 70 days use/acre in 2008. Elk were sampled only in 2008 with a presence of 33 days use/acre. Cattle presence on the site has fluctuated with no pellet groups sampled in 1998 and 2013 varying to a high of 9 days use/acre in 2008 (**Figure 9.29**).

Mountain (Curlleaf Mountain Mahogany)

There is one study [Deep Canyon (30-35)] that is classified as a Mountain (Curlleaf Mountain Mahogany) ecological site. The Deep Canyon study is located southeast of Grass Valley, between the valley floor and Gardner Peak.

Shrubs/Trees: The dominant browse species on the site is curl-leaf mountain mahogany (*Cercocarpus ledifolius*). Other preferred browse species are also present, including Gambel oak (*Quercus gambelii*), slender buckwheat (*Eriogonum microthecum*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and Utah serviceberry (*Amelanchier utahensis*). Browse cover on this site showed a slight decrease in 2018 (**Figure 9.6**). Browse demographics show that the community is mostly composed of mature individuals. Recruitment of young has been good in most years. Decadence has been low with the exception of 2008 when it was considered to be moderate (**Figure 9.17**). Preferred browse utilization has been low in most years except in 2008 when moderate utilization was observed overall (**Figure 9.20**).

Both twoneedle pinyon (*Pinus edulis*) and other trees have been observed on this site with cover increasing each sample year (**Figure 9.11**). However, point quarter data is only available for 2018 so a trend for tree density cannot be established at this time (**Figure 9.14**).

Herbaceous Understory: The herbaceous component of this site is diverse and abundant with perennial grasses and forbs making up the majority of the understory. Cover of perennial herbaceous species has shown an overall increase. Nested frequency has increased slightly, but remained relatively stable overall. Annual grasses have been sampled in low abundance throughout the sample years. Annual forbs have decreased in cover, but nested frequency has been stable. With the exception of cheatgrass (*Bromus tectorum*), the understory is composed almost entirely of native species (**Figure 9.23**, **Figure 9.26**).

Occupancy: Pellet transect data has shown that deer are the predominant occupants of the site and that presence has fluctuated significantly. Deer were the sole occupants on the site in 2018 and the mean abundance of deer pellet groups has changed from 17 days use/acre in 2018 to 75 days use/acre in 2003. Cattle have also been present on this site and occupancy has varied from 0 days use/acre in 2018 to 4 days use/acre in 2003 (**Figure 9.29**).

Mountain (Oak)

There are two studies [Joe Spring (30-41) and Flat Top Mountain (30-45)] classified as Mountain (Oak) ecological sites. The Joe Spring study is located in the Black Hills near Ox Valley. The Flat Top Mountain site is situated on Flat Top Mountain approximately seven miles southwest of Enterprise.

Shrubs/Trees: Gambel oak (*Quercus gambelii*) is the dominant browse species on the Flat Top Mountain study and is co-dominant with mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) on the Joe Spring study. Lesser amounts of other preferred browse such as Utah serviceberry (*Amelanchier utahensis*), mountain snowberry (*Symphoricarpos oreophilus*), currant (*Ribes sp.*) and black sagebrush (*Artemisia nova*) have been observed on these sites as well. Preferred browse cover showed a decrease in the 2008 sample year due to the Hawkins fire that occurred on the Flat Top Mountain site. However, subsequent years have shown the return of preferred browse species (**Figure 9.7**). Average preferred browse demographics show that the community is mostly composed of mature plants. Decadence has been low in all years except for 2008, in which there were high amounts of decadent plants. Recruitment of young has been good in all sample years (**Figure 9.17**). Utilization of preferred browse has been moderate in all years except for 2008 in which utilization was low (**Figure 9.20**).

Trees have not been observed on these study sites and therefore will not be discussed in this section (**Figure 9.11**, **Figure 9.14**).

Herbaceous Understory: The herbaceous understory of these sites are robust and abundant with perennial forbs as the dominant vegetation component in most sample years. Annual grasses have been present on the sites in moderate abundance with a generally decreasing trend observed. Perennial grasses have fluctuated in cover, but nested frequency has shown an increasing trend. Muttongrass (*Poa fendleriana*) is the dominant grass species sampled on both sites (**Figure 9.23**, **Figure 9.26**).

Occupancy: Average pellet transect data shows a stable trend in animal usage on these sites and that deer are the primary occupants. Mean abundance of deer pellet groups has exhibited a low of 37 days use/acre in 2013 to a high of 50 days use/acre in 2003. Cattle pellet groups had a mean abundance varying from 0 days use/acre in 2013 to 9 days use/acre in 2008 (**Figure 9.29**).

Upland (Big Sagebrush)

There are eight studies [Southwest of Newcastle (30-29), Quichapa Canyon (30-55), North Hills (30-62), Holt Canyon (30-63), Wide Canyon 2 (30-73), Pinion Park (30-74), Swett Hills North (30-75), and Pahcoon Bench West (30-77)] that are classified as Upland (Big Sagebrush) ecological sites. The Southwest of Newcastle site is located in the foothills off of Bench Road which is southwest of Newcastle. Quichapa Canyon is placed off of Bumblebee Road southwest of Cedar City. The North Hills study site is situated in the hills to the south of Hamiltons Fort. Holt Canyon is located south of Bench Road between Enterprise and Newcastle. Wide Canyon 2 can be found approximately 2 miles east of Dammeron Valley. The Pinion Park study is approximately 10 miles northeast of Enterprise. The Swett Hills North study is located about 12 miles west of Cedar City in the Swett Hills. The Pahcoon Bench West study is placed approximately 8 miles west of Shivwits.

Shrubs/Trees: The dominant preferred browse species on these Upland (Big Sagebrush) ecological sites have been either mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) or Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*). Lesser amounts of other browse are present depending on the site. These other preferred browse species include narrowleaf yerba santa (*Eriodictyon angustifolium*), desert almond (*Prunus fasciculata*), Stansbury cliffrose (*Purshia stansburiana*), antelope bitterbrush (*P. tridentata*), Gambel oak (*Quercus gambelii*) and Utah serviceberry (*Amelanchier utahensis*). Cover of preferred browse has generally increased; the slight decrease in 2018 is likely due to the addition of three new study sites (**Figure 9.4**). Preferred browse demographic data shows that the community is primarily composed of mature individuals and that decadence has generally decreased (**Figure 9.18**). Utilization has displayed significant fluctuations, but 1998 and 2003 showed high utilization of preferred browse (**Figure 9.21**).

Trees sampled on this study site include Utah juniper (*Juniperus osteosperma*), singleleaf pinyon (*Pinus monophylla*), and twoneedle pinyon (*P. edulis*). Tree cover measurements showed a decreasing trend until 2018, when cover increased significantly. Density measurements also indicated a decreasing trend until 2018

when the density increased. These increases observed in 2018 are due to the addition of new sites with moderate amounts of tree cover (**Figure 9.12**, **Figure 9.15**).

Herbaceous Understory: The herbaceous understories of these sites are in varied conditions. Most of the sites are dominated by a mixture of perennial and annual grasses. Perennial grasses have fluctuated slightly, but are mostly stable. Annual grasses have had consistent values except for in 2003, when cover and frequency were low. Perennial and annual forbs are sparse and provide little cover. Most of the sites are dominated by native species except for the Swett Hills North site on which crested wheatgrass (*Agropyron cristatum*) is the co-dominant species (**Figure 9.24**, **Figure 9.27**).

Occupancy: Pellet transect data indicates a fluctuating trend in animal presence and that deer are the primary occupants of these sites. Deer presence has varied from a low of 23 days use/acre in 2013 to a high of 57 days use/acre in 1998. Elk pellets were sampled only in 2008 and 2018 with a mean abundance of less than 1 days use/acre. Cattle utilization of sites has varied, ranging in mean abundance from 0 days use/acre in 1998 to over 4 days use/acre in 2018. Horses have used the sites in low amounts, ranging from 0 days use/acre in 1998 and 2013 to 0.8 days use/acre in 2018 (**Figure 9.30**).

Upland (Black/Low Sagebrush)

There are two studies [Bullion Canyon (30-54) and Black Ridge (30-13)] that are classified as Upland (Black/Low Sagebrush) ecological sites. The Bullion Canyon study site is located approximately 4 miles northeast of Newcastle. The Black Ridge study is situated approximately 2 miles west of Ash Creek Reservoir, which is off of I-15 south of Kanarraville.

Shrubs/Trees: The primary browse species present on these Upland (Black/Low Sagebrush) ecological sites are black sagebrush (*Artemisia nova*) and little sagebrush (*A. arbuscula*). Other preferred browse species are present and include Utah serviceberry (*Amelanchier utahensis*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), Sonoran scrub oak (*Q. turbinella*), and Nevada jointfir (*Ephedra nevadensis*). Sagebrush cover has increased slightly over the study years (**Figure 9.4**). Preferred browse demographic data shows that the communities are primarily comprised of mature individuals with a moderate but decreasing amount of decadence; the number of young plants has fluctuated (**Figure 9.18**). Preferred browse utilization has fluctuated with 1998 and 2008 showing high amounts of use (**Figure 9.21**).

The tree species that have been sampled on these sites are Utah juniper (*Juniperus osteosperma*) and twoneedle pinyon (*Pinus edulis*). Tree cover is only provided by juniper and has increased in all sample years (**Figure 9.12**). Tree density is primarily provided by juniper but some pinyon has been sampled as well; an increasing trend is noted for density of tree species (**Figure 9.15**).

Herbaceous Understory: The herbaceous understory of the Bullion Canyon site is rather sparse and non-diverse, while the Black Ridge site is more diverse though still fairly sparse. Perennial grasses have been the dominant component in all years except 1998. Annual grasses have been present, but have not been a major component of these understories except in 1998 when they provided nearly 7 percent cover. Perennial forbs are present in the understories but do not provide significant cover (**Figure 9.24**, **Figure 9.27**).

Occupancy: Average pellet transect data indicates fluctuations in animal presence and that deer are the primary occupants of these sites. The mean abundance of deer pellet groups shows a low of 7 days use/acre in 2013 and a high of 47 days use/acre in 2008. Cow pellet groups have had a mean abundance ranging from 0 days use/acre in 2013 to 4 days use/acre in 2018. Horse pellet groups were only sampled in 2018, but data showed a presence of 1 days use/acre in that year (**Figure 9.30**).

Upland (Shrub Liveoak)

There are two studies [Upper Broad Hollow (30-03) and Grapevine Spring (30-42)] that are considered to be Upland (Shrub Liveoak) ecological sites. Upper Broad Hollow is located about 3 miles due north of the town of New Harmony. Grapevine Spring can be found approximately 5 miles west of the town of Veyo.

Shrubs/Trees: The preferred browse component on these Upland (Shrub Liveoak) ecological sites is a mixture of browse species. On the Upper Broad Hollow Site, Utah serviceberry (*Amelanchier utahensis*) is the dominant browse. On the Grapevine Spring site, Sonoran scrub oak (*Quercus turbinella*) is the dominant preferred browse species. Cover of both Sonoran scrub oak (shrub liveoak) and other preferred browse has generally increased except for the 2008 sample year where cover decreased due to the Bull Complex Fire in 2005 (**Figure 9.8**). Demographic data shows that these communities are mostly composed of mature individuals and an increasing amount of young plants has also been noted (**Figure 9.18**). Utilization of preferred browse has fluctuated, with the 2008 sample year showing lower utilization. In general, a lower trend has been observed for browse utilization (**Figure 9.21**).

Trees have been present on both sites, but the Grapevine Spring site has not had tree cover observed following the fire. Overall, however, an increasing trend has been noted from 2008 onwards (**Figure 9.12**). Tree density decreased significantly between 2003 and 2008, but has been increasing in years following that sample year (**Figure 9.15**).

Herbaceous Understory: The herbaceous understory of the Grapevine Spring site is depleted while the understory of the Upper Broad Hollow study is more diverse and abundant. Annual grass cover has been nominal in most years except for 1998 in which there was over 5 percent cover. Perennial forbs have fluctuated, but have showed moderate cover on average. Perennial grass cover along with nested frequency has increased slightly after an initial decrease between 1998 and 2003 (**Figure 9.24**, **Figure 9.27**).

Occupancy: Pellet transect data for these sites has shown an overall decreasing trend in animal presence and that the primary occupants are deer. Mean abundance of deer pellet groups has varied from 19 days use/acre in 2018 to 80 days use/acre in 2008. Cows have been present on the sites in low numbers, with presence ranging from 0 days use/acre in 2003 and 2018 to nearly 2 days use/acre in 2008 (**Figure 9.30**).

Semidesert (Desert Bitterbrush)

There is one study [Tobin Bench (30-61)] classified as a Semidesert (Desert Bitterbrush) ecological site. This site is located approximately 5 miles west of Veyo on Tobin Bench.

Shrubs/Trees: The Tobin Bench study site is the only study that is considered to be of the Semidesert (Desert Bitterbrush) ecological type in this unit. On this site, desert bitterbrush (*Purshia glandulosa*) is the primary browse species, but Sonoran scrub oak (*Quercus turbinella*) is also present in low amounts. Preferred browse cover decreased between 2003 and 2008 due to a wildfire, but has increased in subsequent years (**Figure 9.9**). Browse demographics show that the community is primarily composed of mature individuals (**Figure 9.19**). Utilization of preferred browse has fluctuated due to changes in the community after the fires; the 2003 sample year showed moderate utilization with nearly 50 percent of the plants either moderately or heavily browsed (**Figure 9.22**).

Trees are not present on this study site and will therefore not be discussed for this ecological type (**Figure 9.13**, **Figure 9.16**).

Herbaceous Understory: The herbaceous understory of this ecological site is depauperate, but consistent with dry semidesert sites. The understory was primarily composed of annual forbs between 2008 and 2018, which increased dramatically following the fire. Prior to the fire, perennial forbs were the main herbaceous component sampled. Perennial forbs have decreased in dominance but still comprise a small portion of the

understory. Annual grasses increased significantly in frequency numbers over time, but provided only a minimal amount of cover (**Figure 9.25**, **Figure 9.28**).

Occupancy: Pellet transect data indicates high initial animal presence which has decreased following the fire. Deer have been the primary occupants, but elk and cows were sampled during one year each. Mean pellet abundance for deer ranged from 226 days use/acre in 2003 and 21 days use/acre in 2013. Elk pellet groups were sampled only in 2008 with 1 days use/acre. Cattle pellet groups were only sampled in 2018 with a presence of 2 days use/acre (**Figure 9.31**).

Semidesert (Blackbrush)

There is one study [Motoqua (30-44)] that is classified as a Semidesert (Blackbrush) ecological site. The Motoqua study is located east of Beaver Dam Wash near Square Top Mountain.

Shrubs/Trees: Blackbrush (*Coleogyne ramosissima*) is the dominant browse species present on this study site, with lesser amounts of mixed desert browse species such as desert almond (*Prunus fasciculata*), desert bitterbrush (*Purshia glandulosa*), and ephedra (*Ephedra sp*.) also being sampled. This is the first sample year for a site of this ecological type, so a trend over time is not yet available. The site provides significant cover of preferred browse and will likely continue to do so in the future (**Figure 9.10**). Shrub demographic data shows that the community is primarily composed of mature individuals, but a small amount of decadence was noted (**Figure 9.19**). Utilization of preferred browse was low for this sample year (**Figure 9.22**).

Trees are not present on this study site and will therefore not be discussed for this ecological type (**Figure 9.13**, **Figure 9.16**).

Herbaceous Understory: The herbaceous understory of this site is depauperate and annual grasses are the dominant component; a sparse understory is usually typical of low precipitation desert sites. Annual grasses were the most common vegetation type with both red brome (*Bromus rubens*) and cheatgrass (*B. tectorum*) being sampled. No perennial grasses were observed .There is not yet an established trend for the herbaceous understory since this is the first year of sampling for this ecological type (**Figure 9.25**, **Figure 9.28**).

Occupancy: Average pellet transect data shows that deer are the sole occupants of the site. Mean abundance of deer pellet groups was 46 days use/acre in 2018 (**Figure 9.31**).

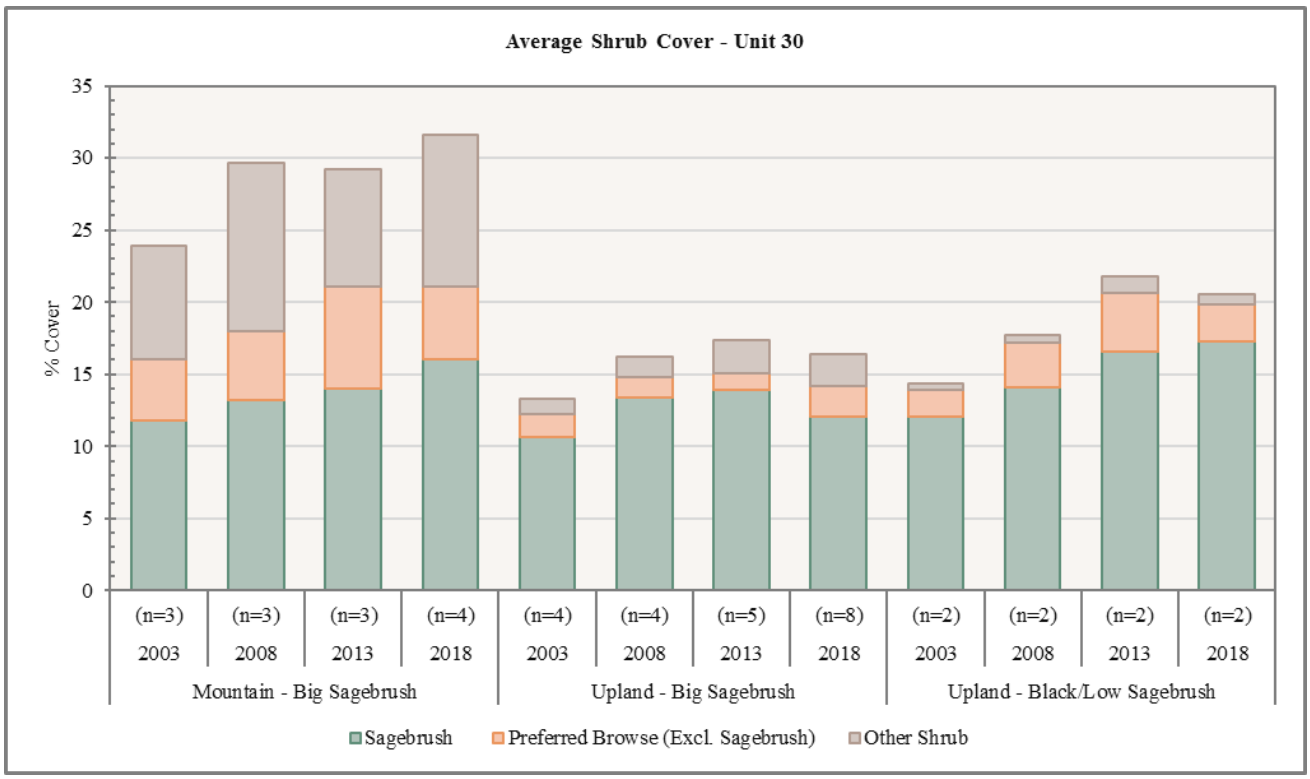


Figure 9.4: Average shrub cover for Mountain - Big Sagebrush, Upland - Big Sagebrush, and Upland - Black/Low Sagebrush study sites in WMU 30, Pine Valley.

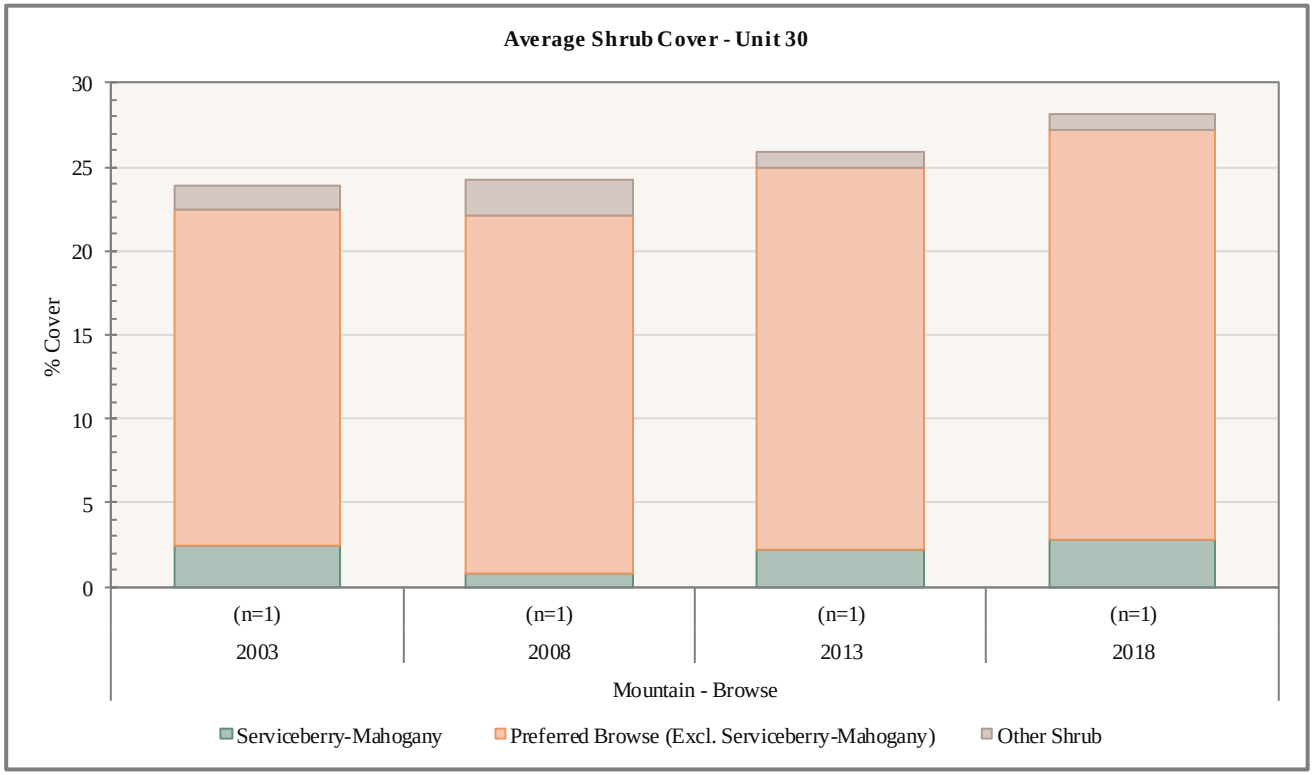


Figure 9.5: Average shrub cover for Mountain - Browse study sites in WMU 30, Pine Valley.

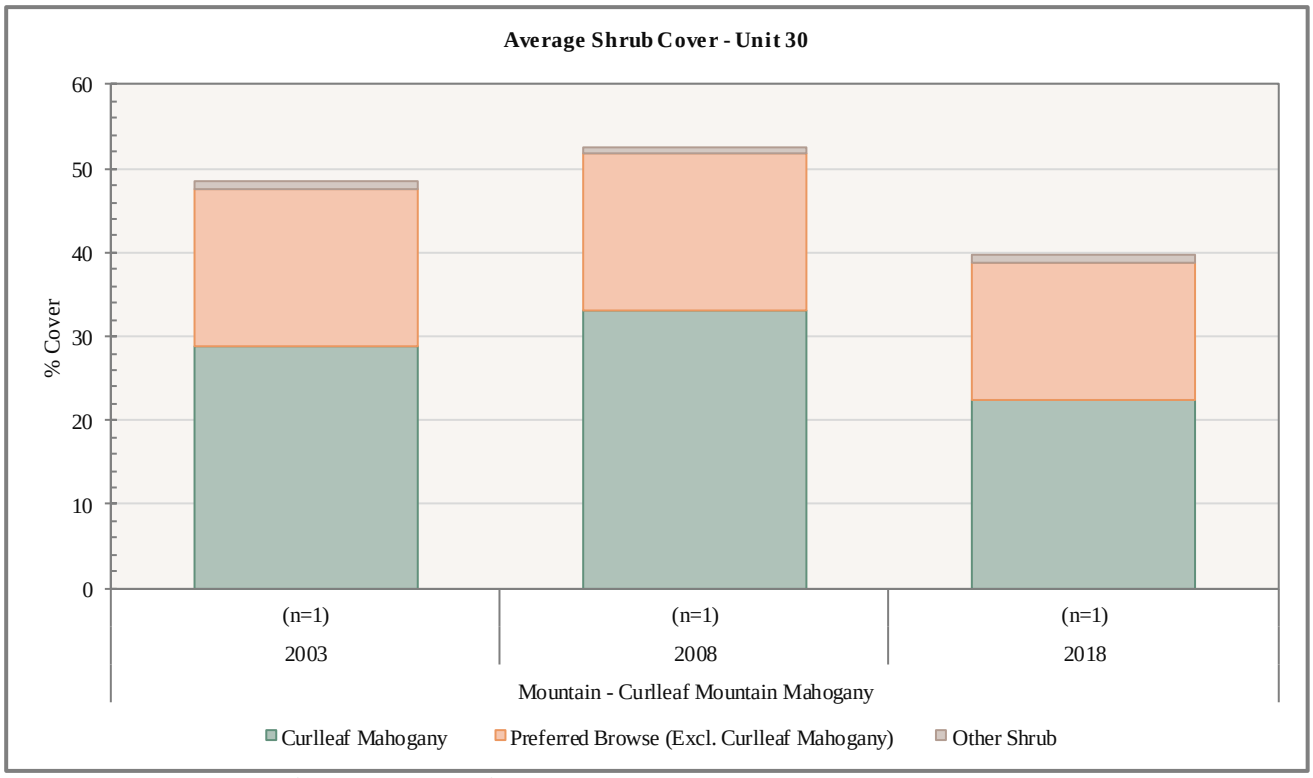


Figure 9.6: Average shrub cover for Mountain - Curlleaf Mountain Mahogany study sites in WMU 30, Pine Valley.

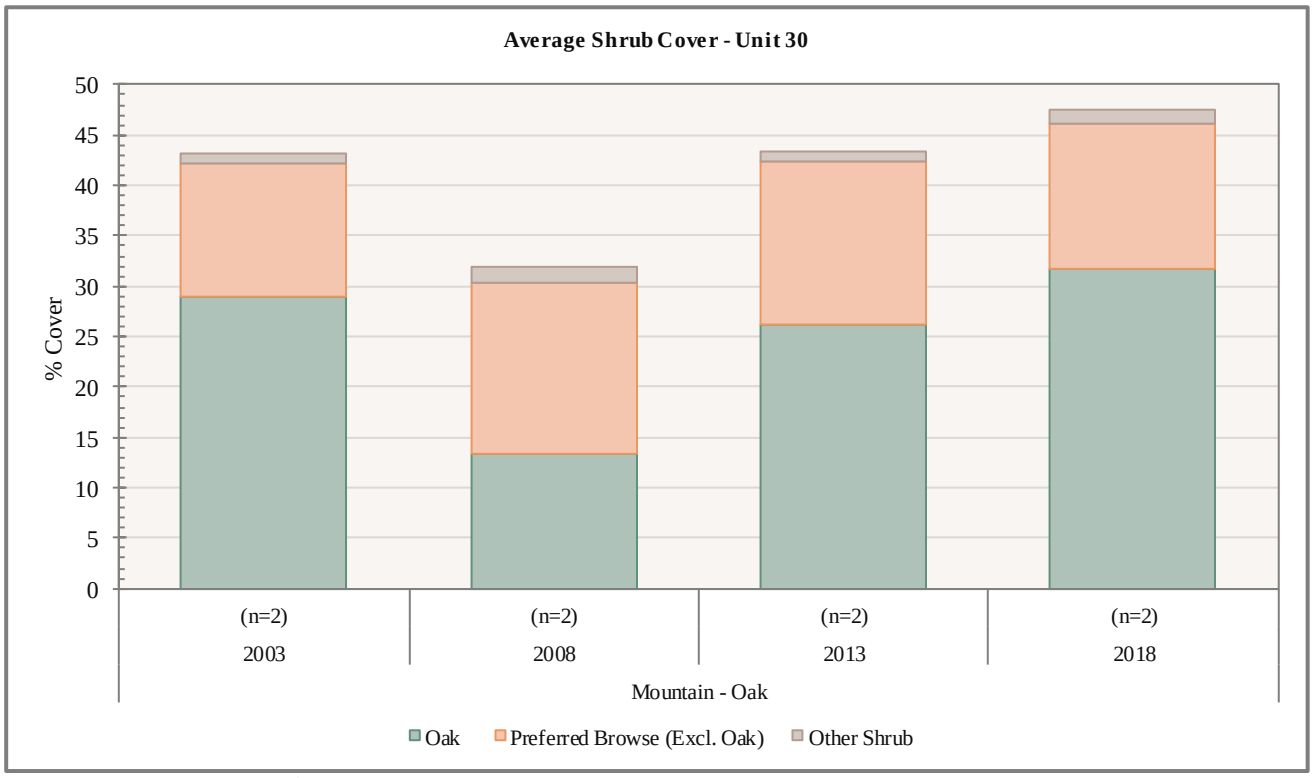


Figure 9.7: Average shrub cover for Mountain - Oak study sites in WMU 30, Pine Valley.

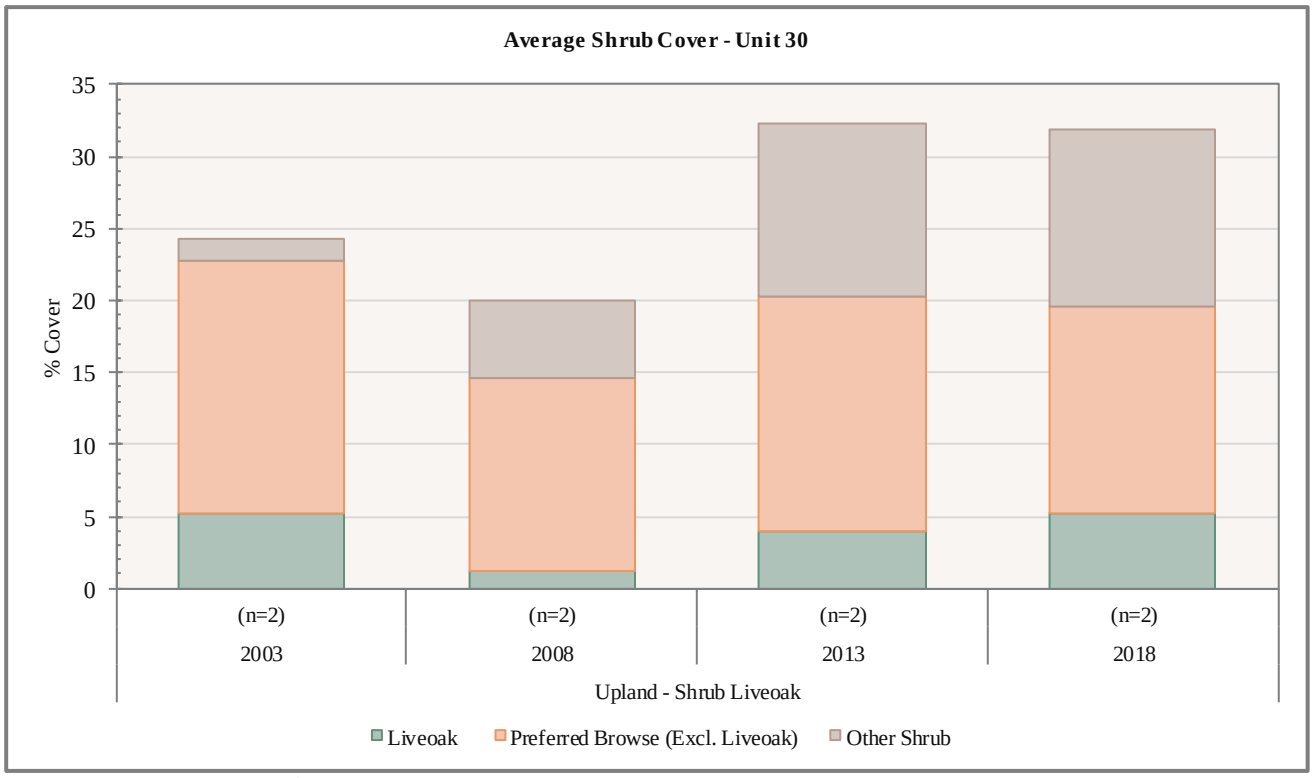


Figure 9.8: Average shrub cover for Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

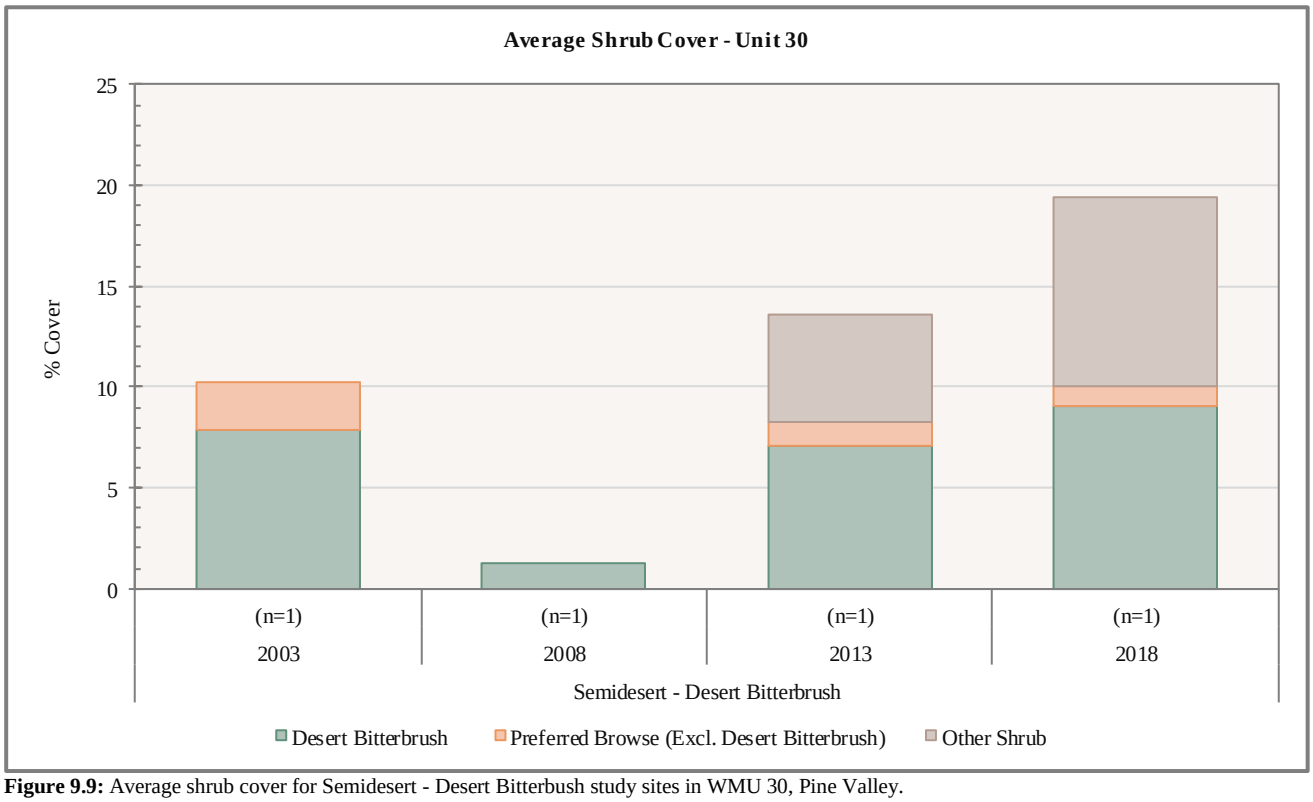


Figure 9.9: Average shrub cover for Semidesert - Desert Bitterbush study sites in WMU 30, Pine Valley.

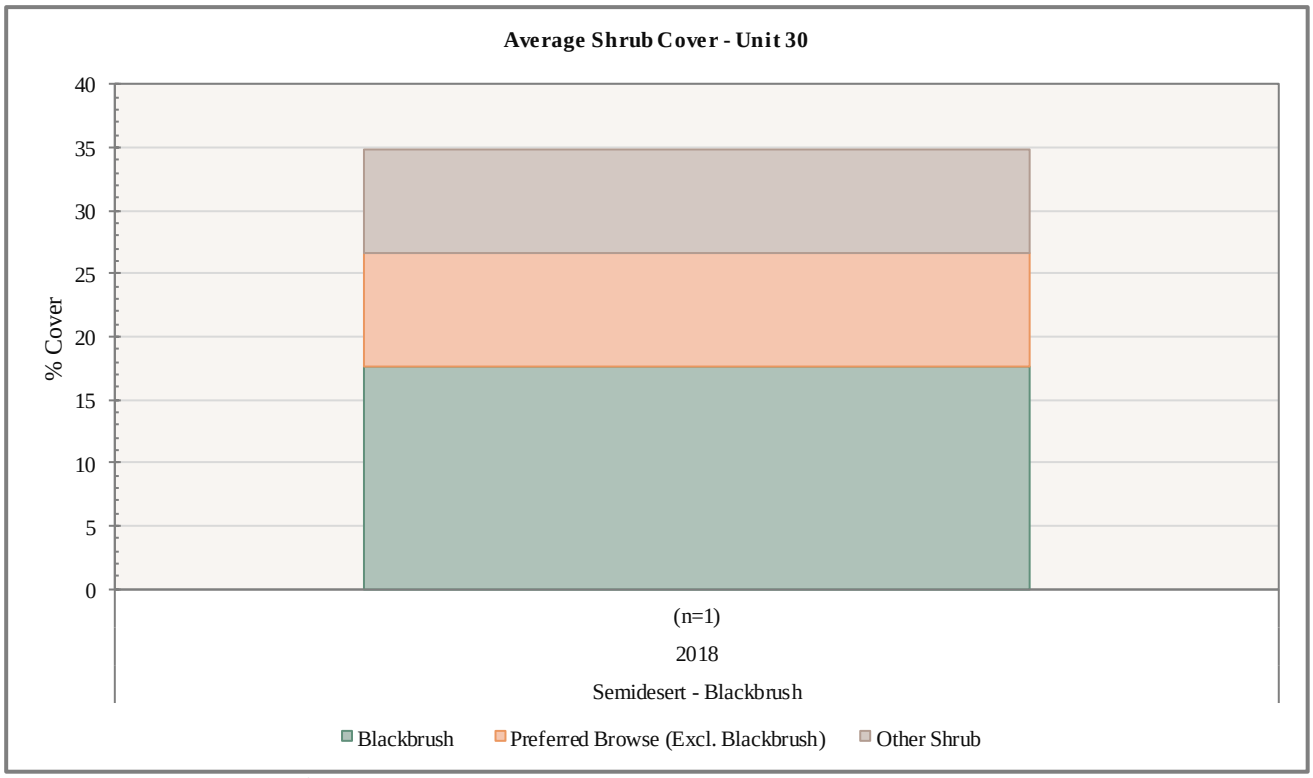


Figure 9.10: Average shrub cover for Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

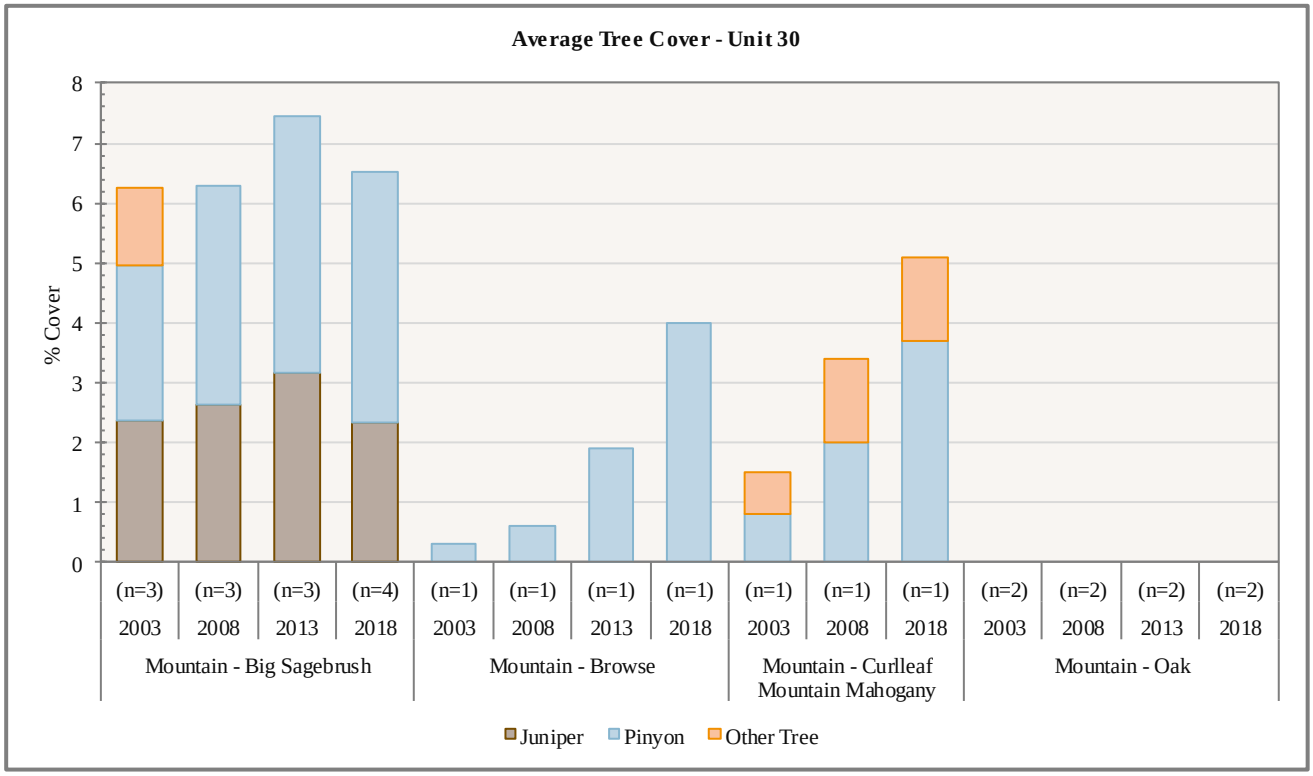


Figure 9.11: Average tree cover for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

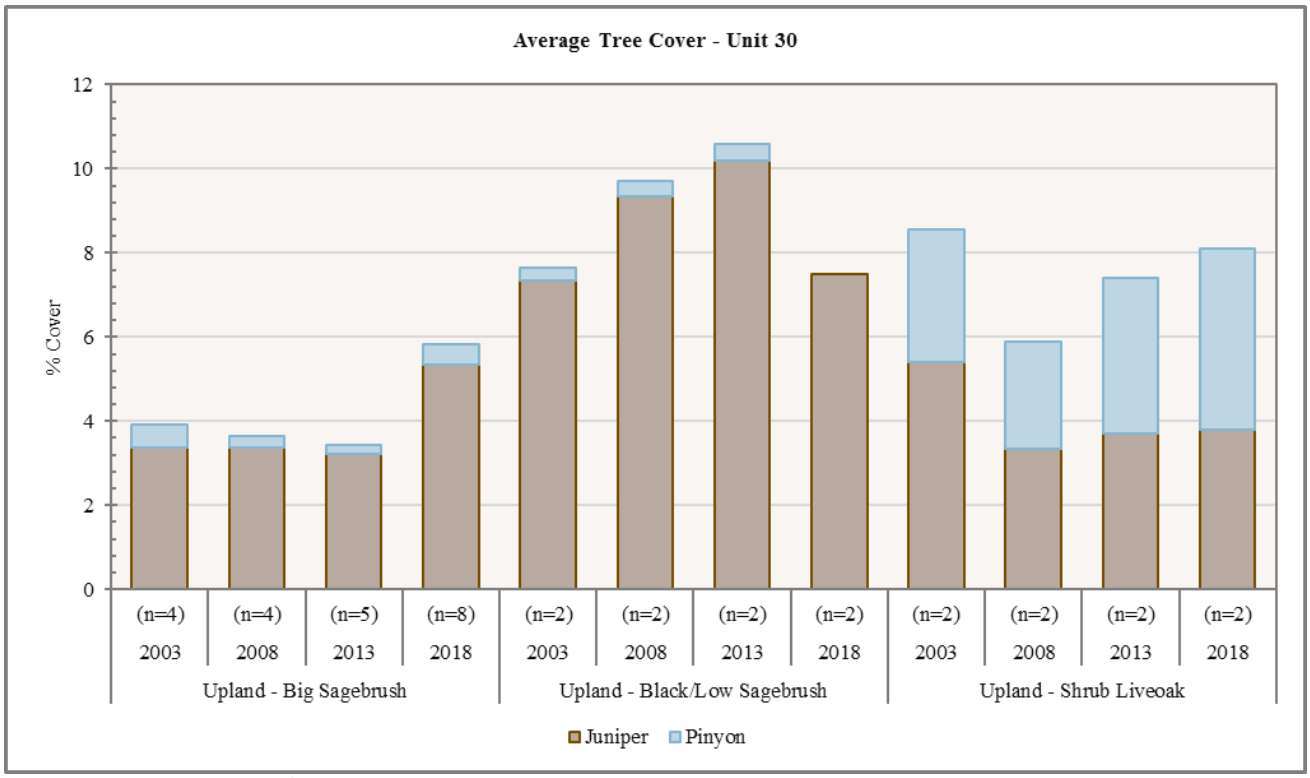


Figure 9.12: Average tree cover for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

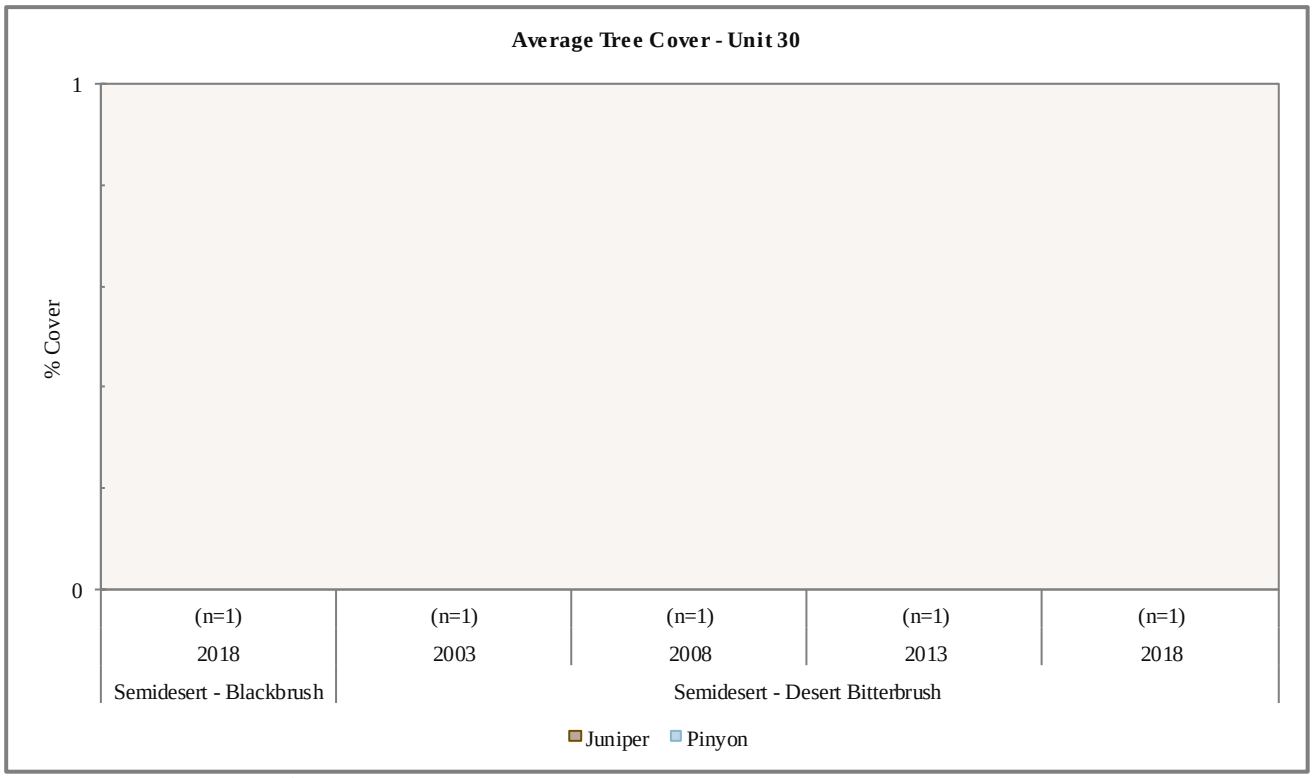


Figure 9.13: Average tree cover for Semidesert - Desert Bitterbrush and Semidesert - Blackbrushstudy sites in WMU 30, Pine Valley.

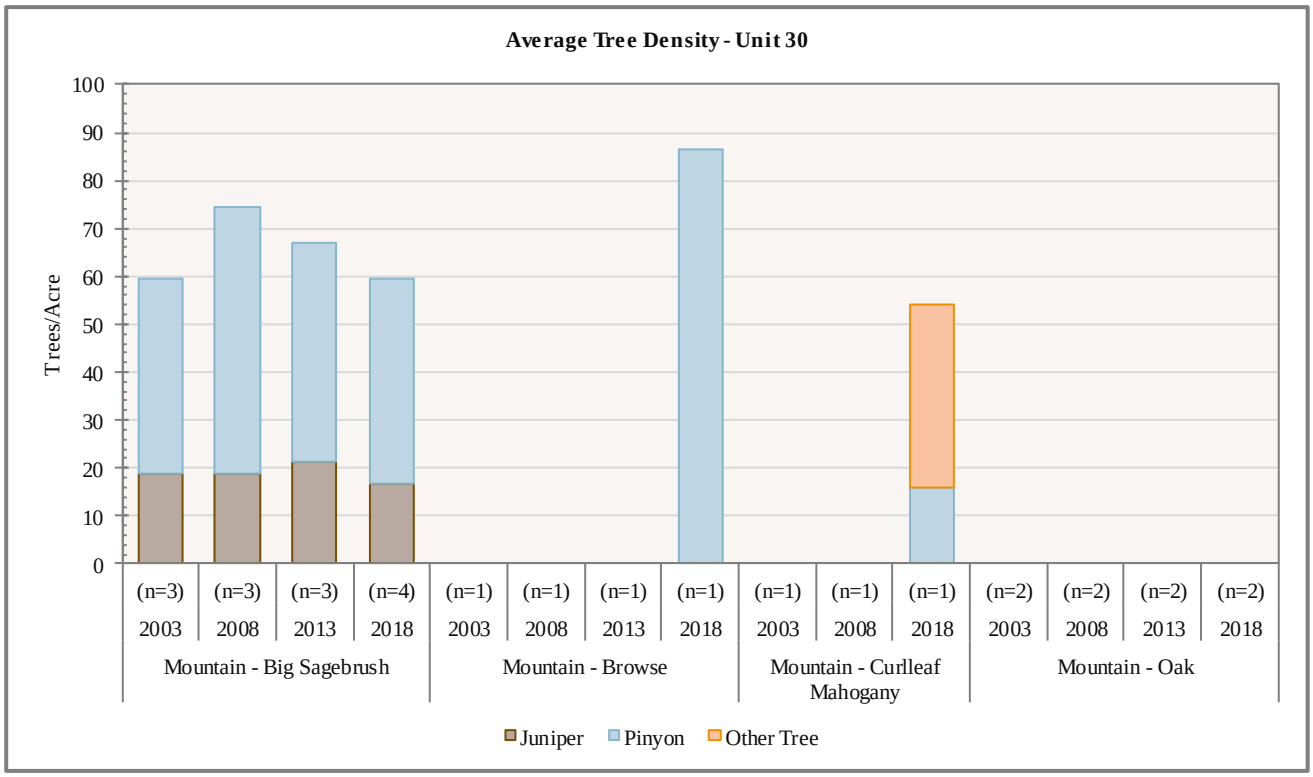


Figure 9.14: Average tree density for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

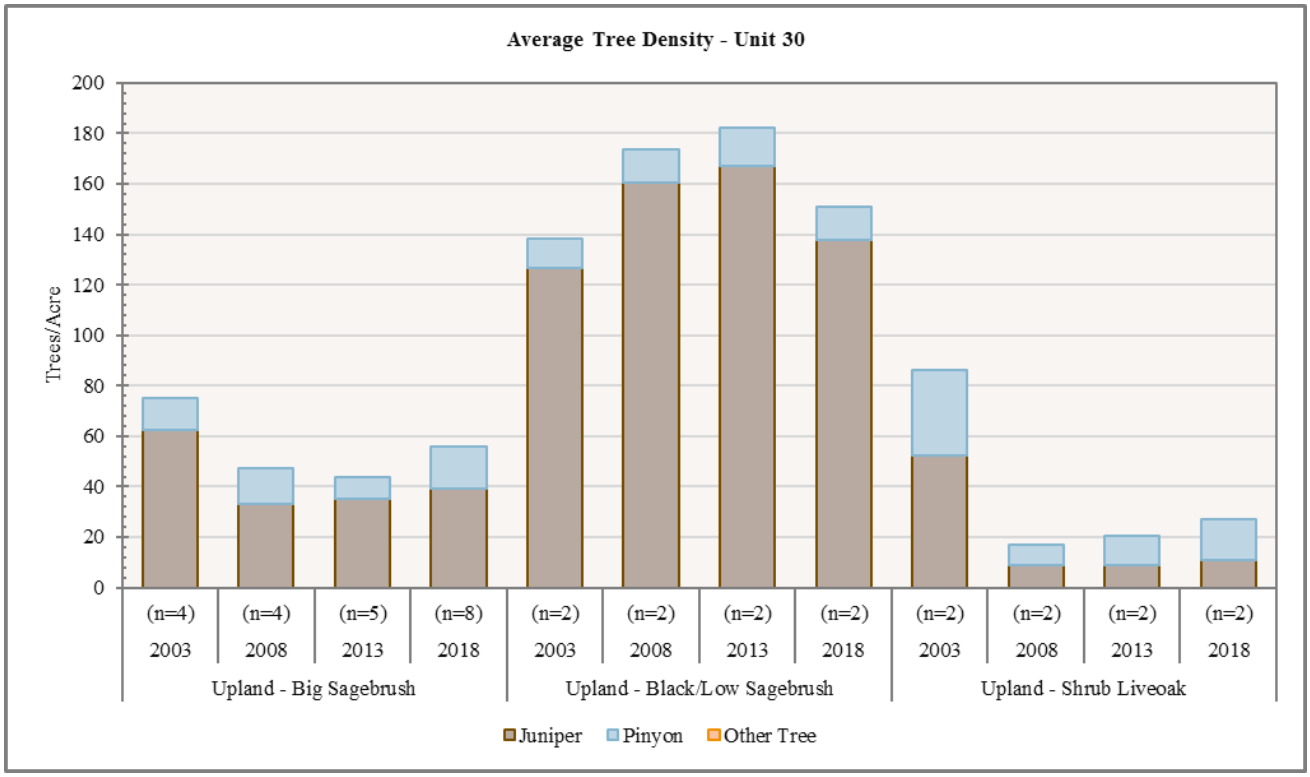


Figure 9.15: Average tree density for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

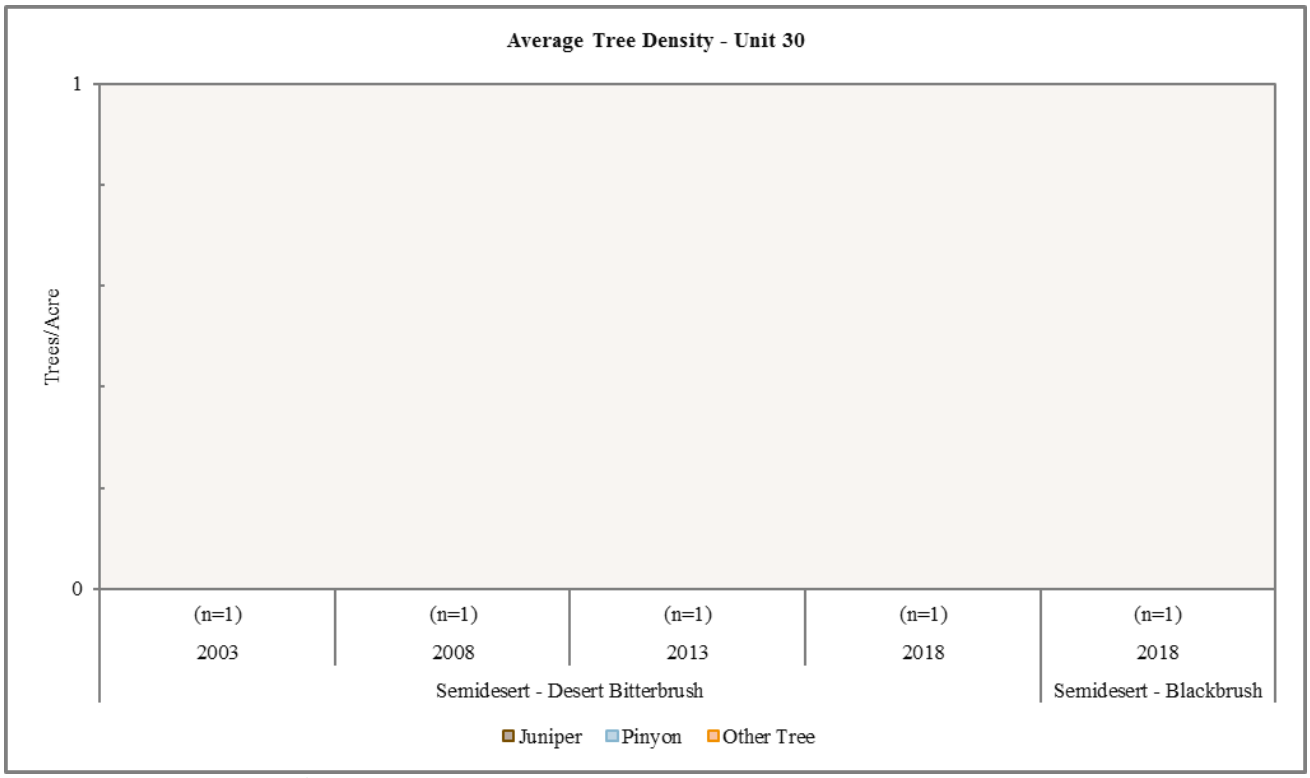


Figure 9.16: Average tree density for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

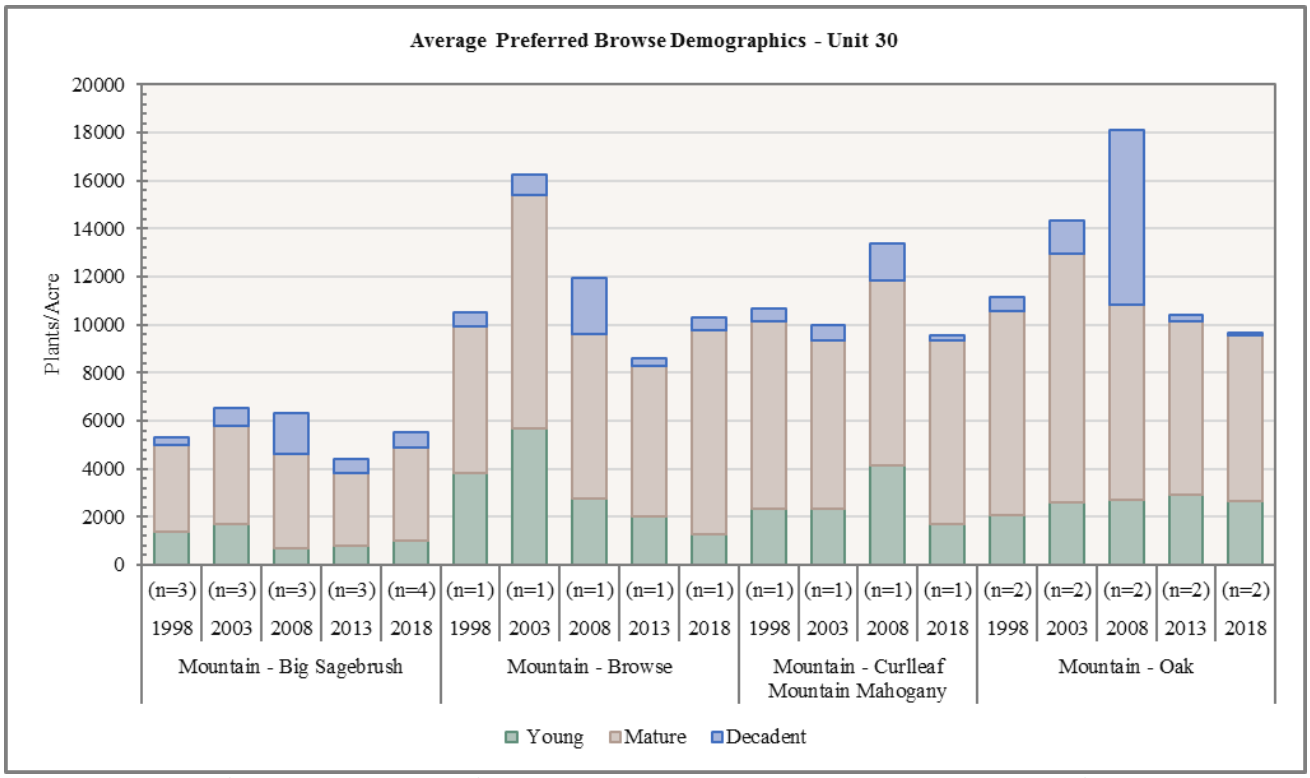


Figure 9.17: Average preferred browse demographics for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

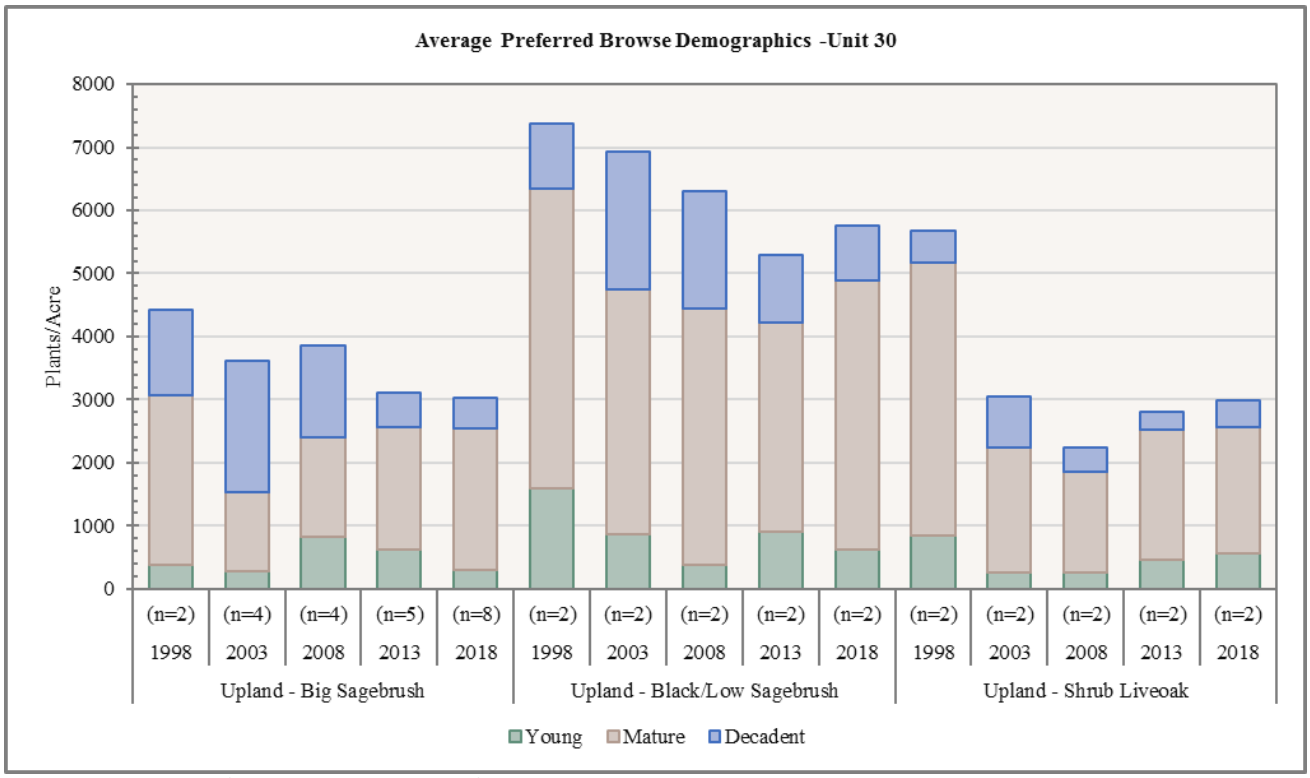


Figure 9.18: Average preferred browse demographics for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

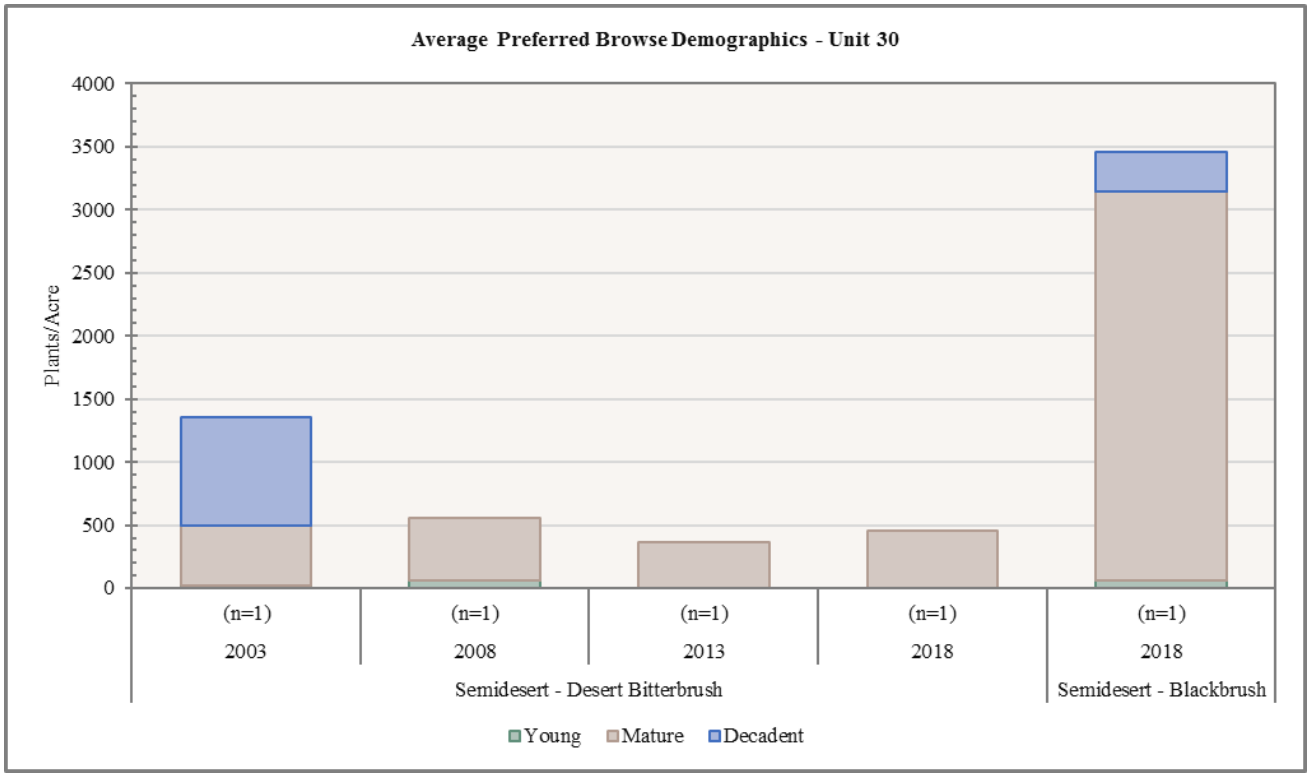


Figure 9.19: Average preferred browse demographics for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

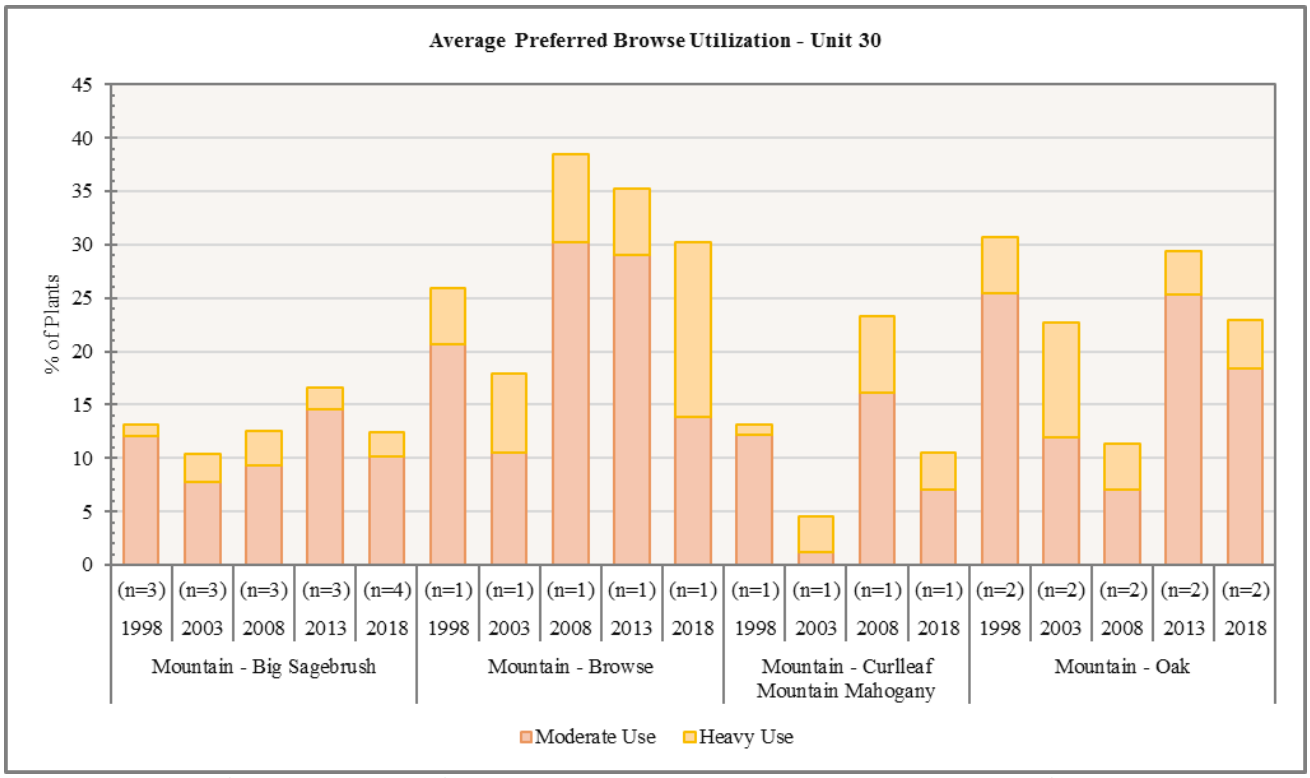


Figure 9.20: Average preferred browse utilization for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

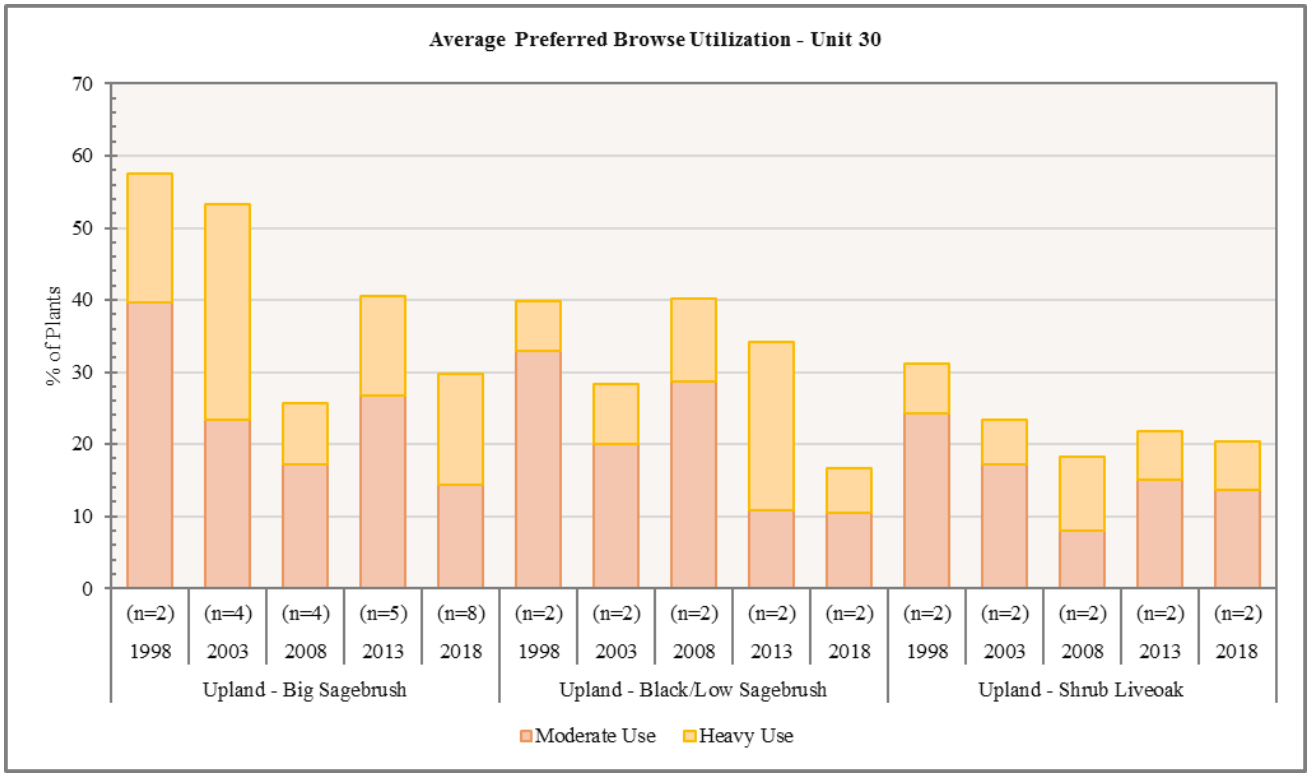


Figure 9.21: Average preferred browse utilization for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

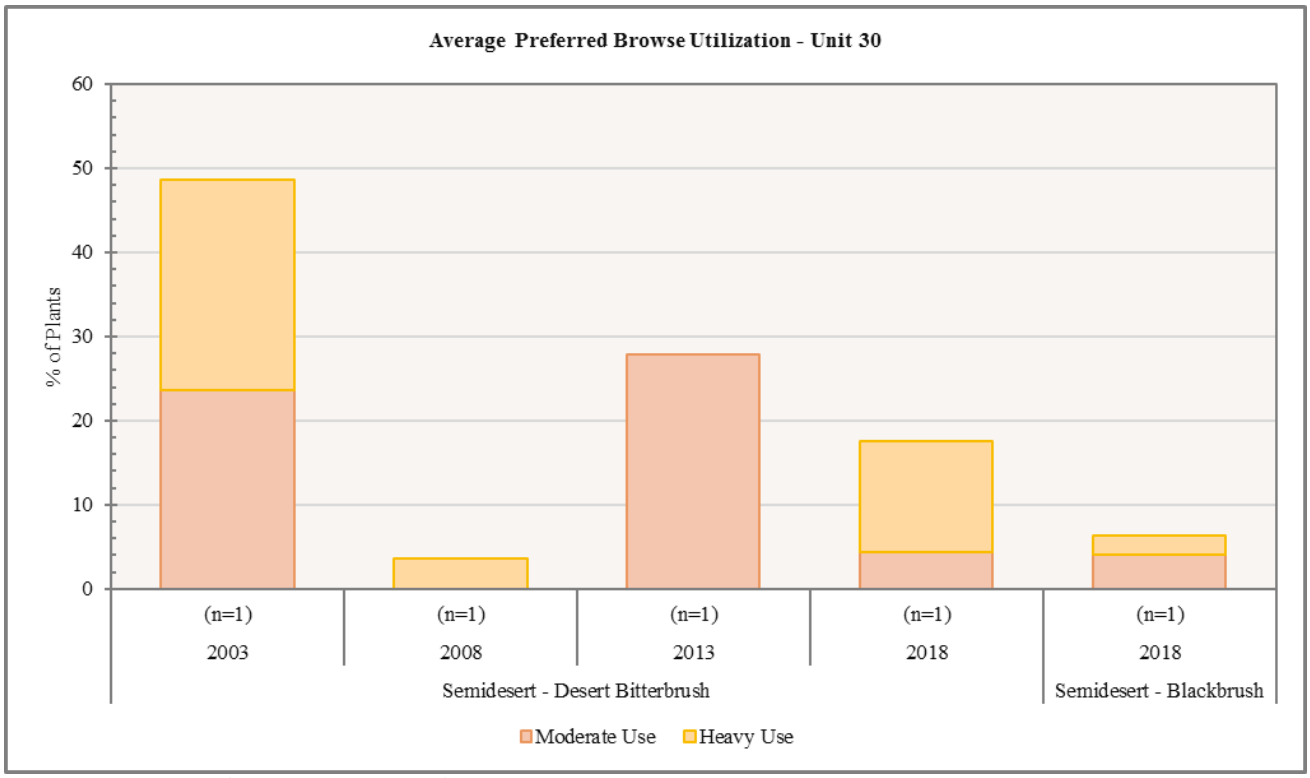


Figure 9.22: Average preferred browse utilization for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

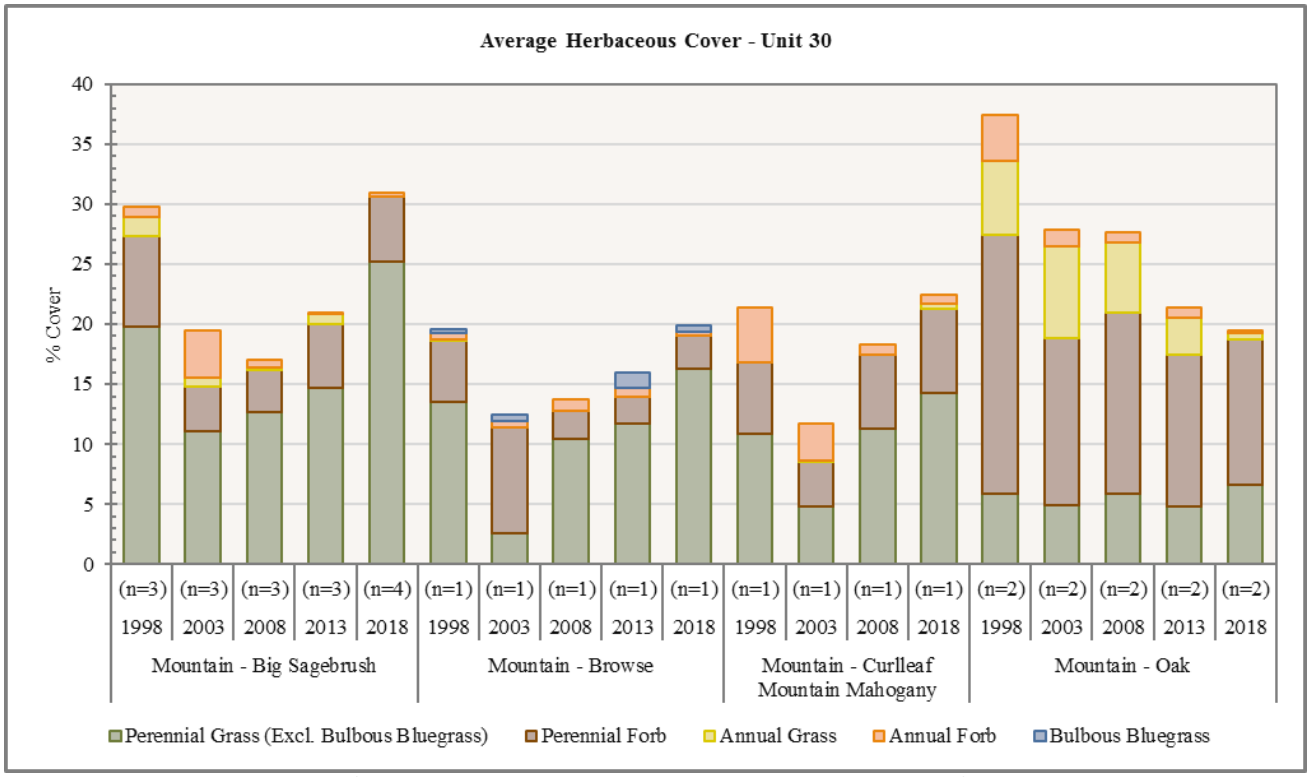


Figure 9.23: Average herbaceous cover for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

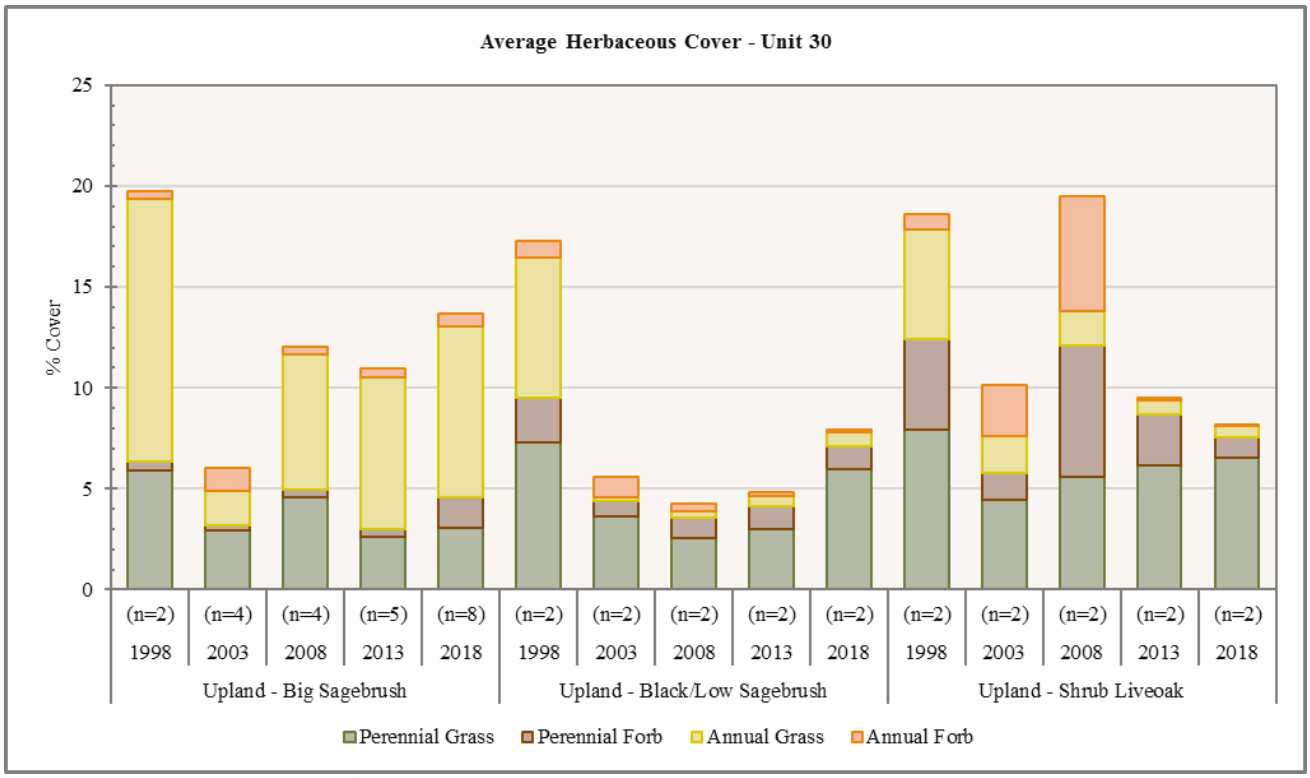


Figure 9.24: Average herbaceous cover for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

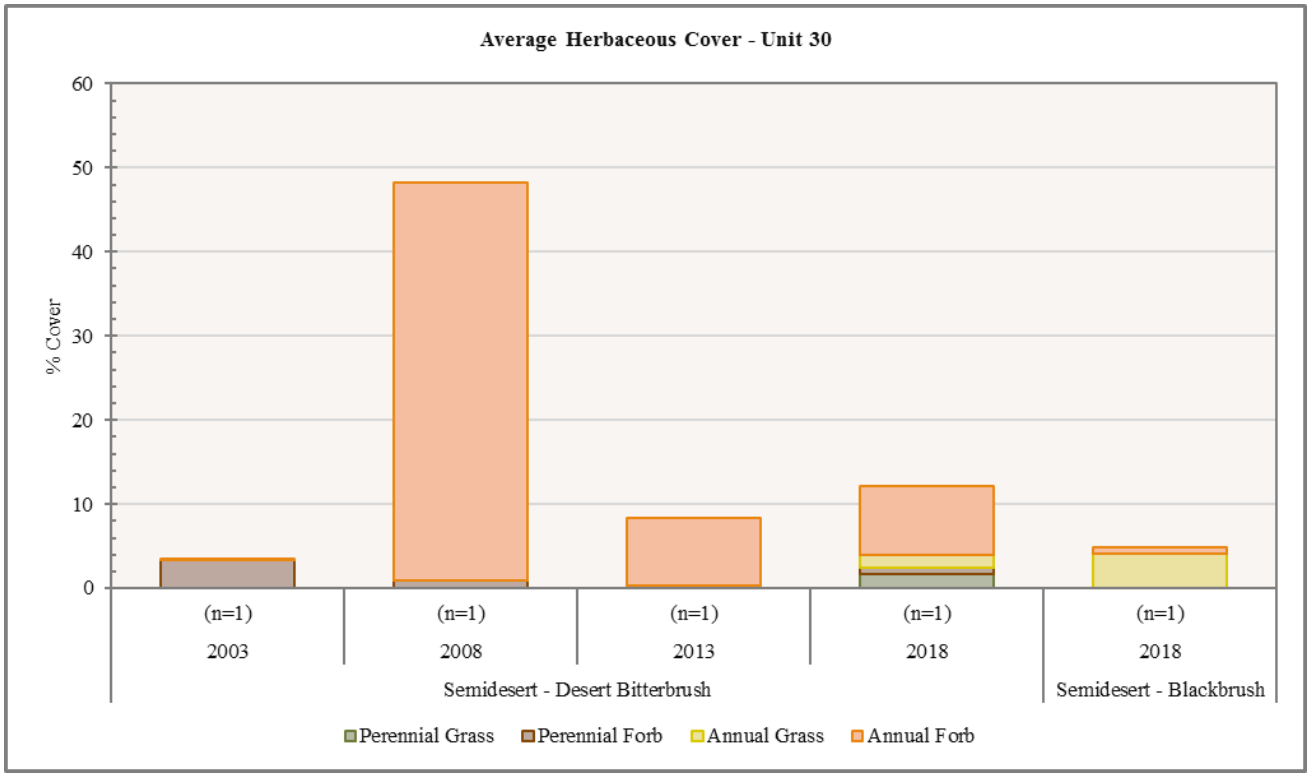


Figure 9.25: Average herbaceous cover for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

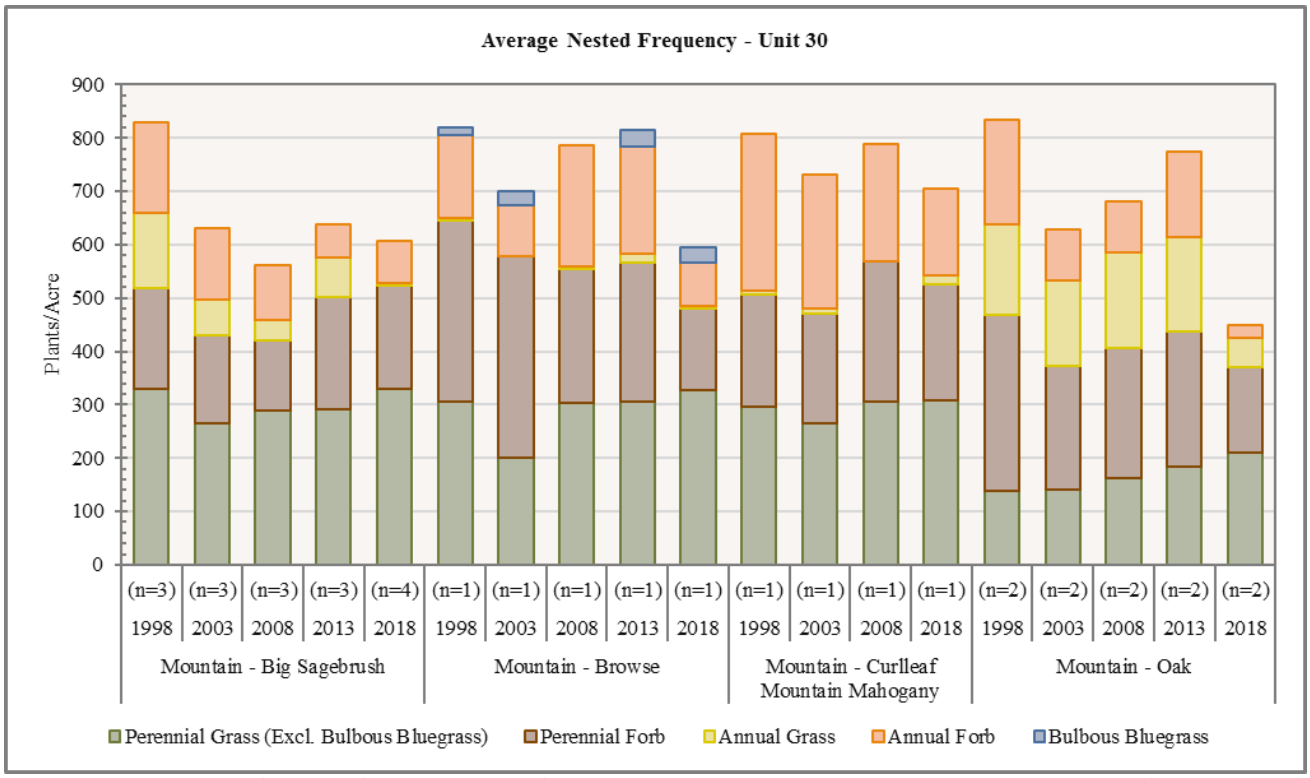


Figure 9.26: Average nested frequency of herbaceous species for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

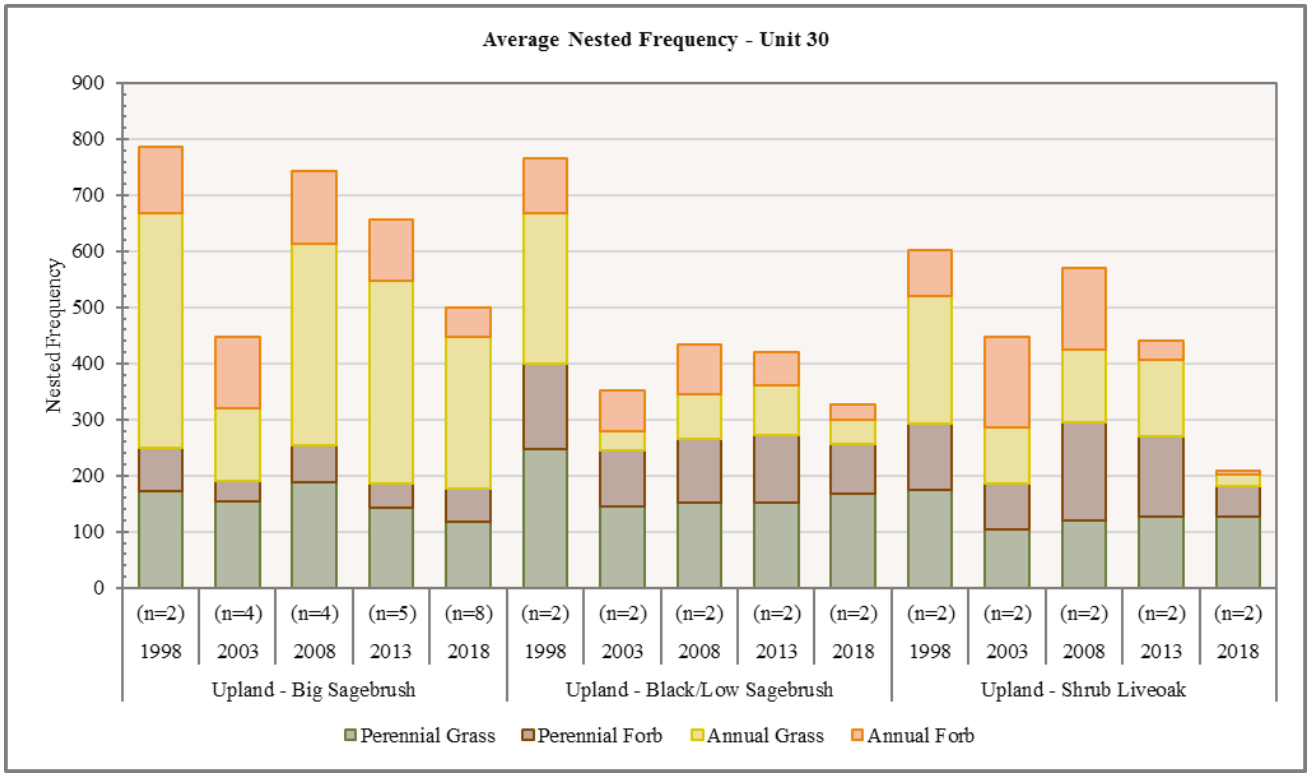


Figure 9.27: Average nested frequency of herbaceous species for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, Upland - Shrub Liveoak study sites in WMU 30, Pine Valley.

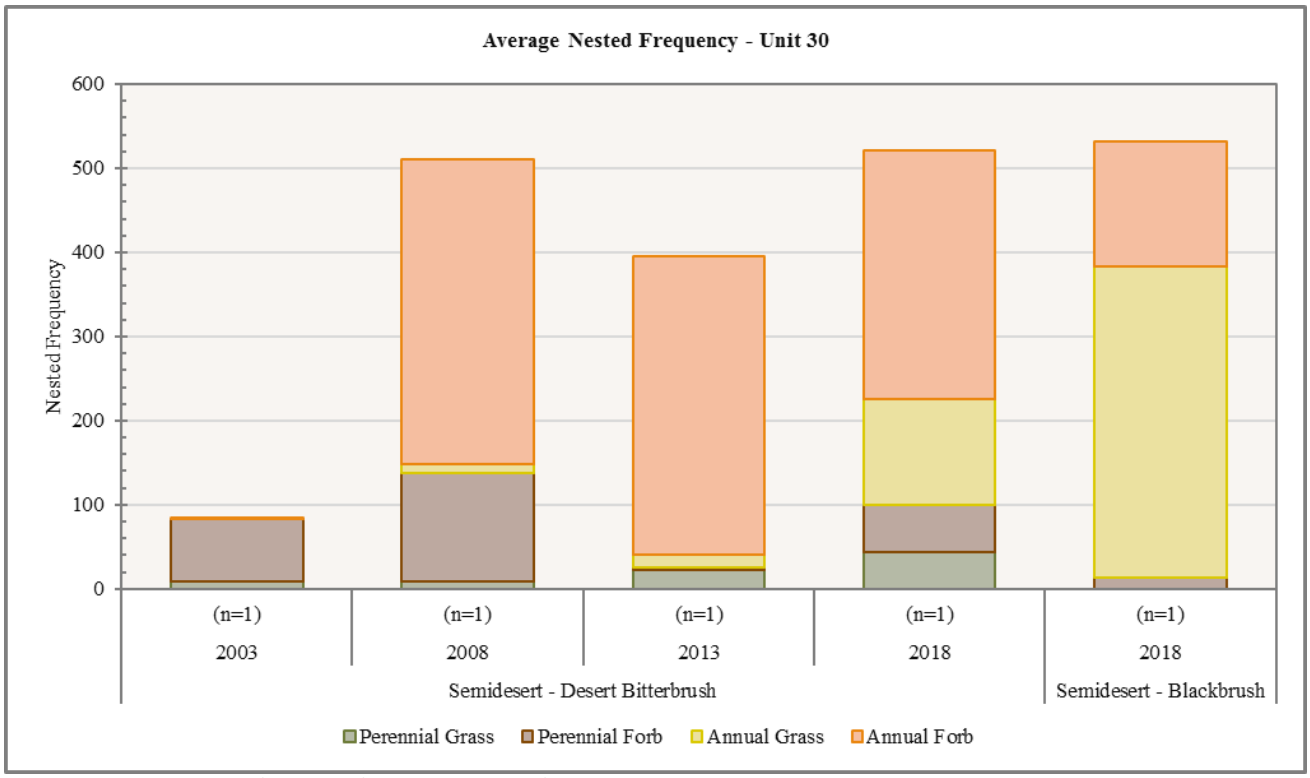


Figure 9.28: Average nested frequency of herbaceous species for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

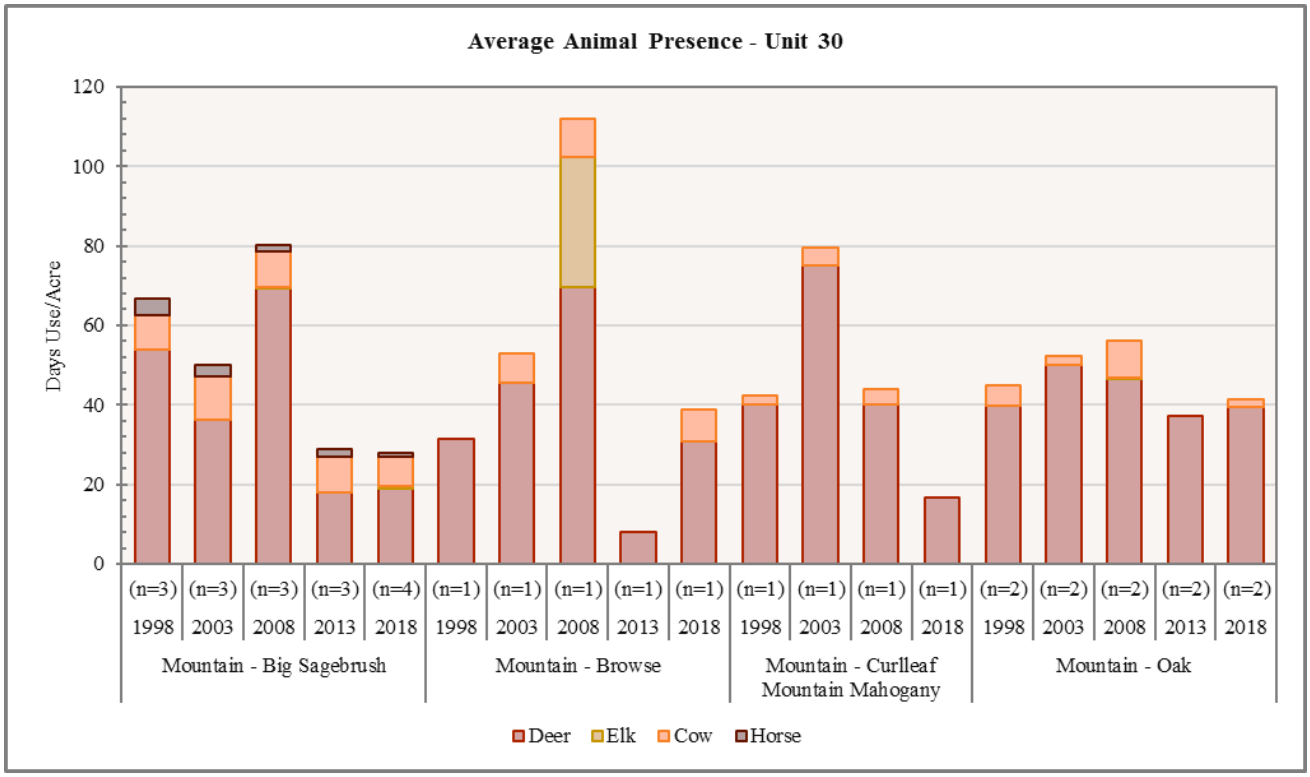


Figure 9.29: Average pellet transect data for Mountain - Big Sagebrush, Mountain - Browse, Mountain - Curlleaf Mountain Mahogany, and Mountain - Oak study sites in WMU 30, Pine Valley.

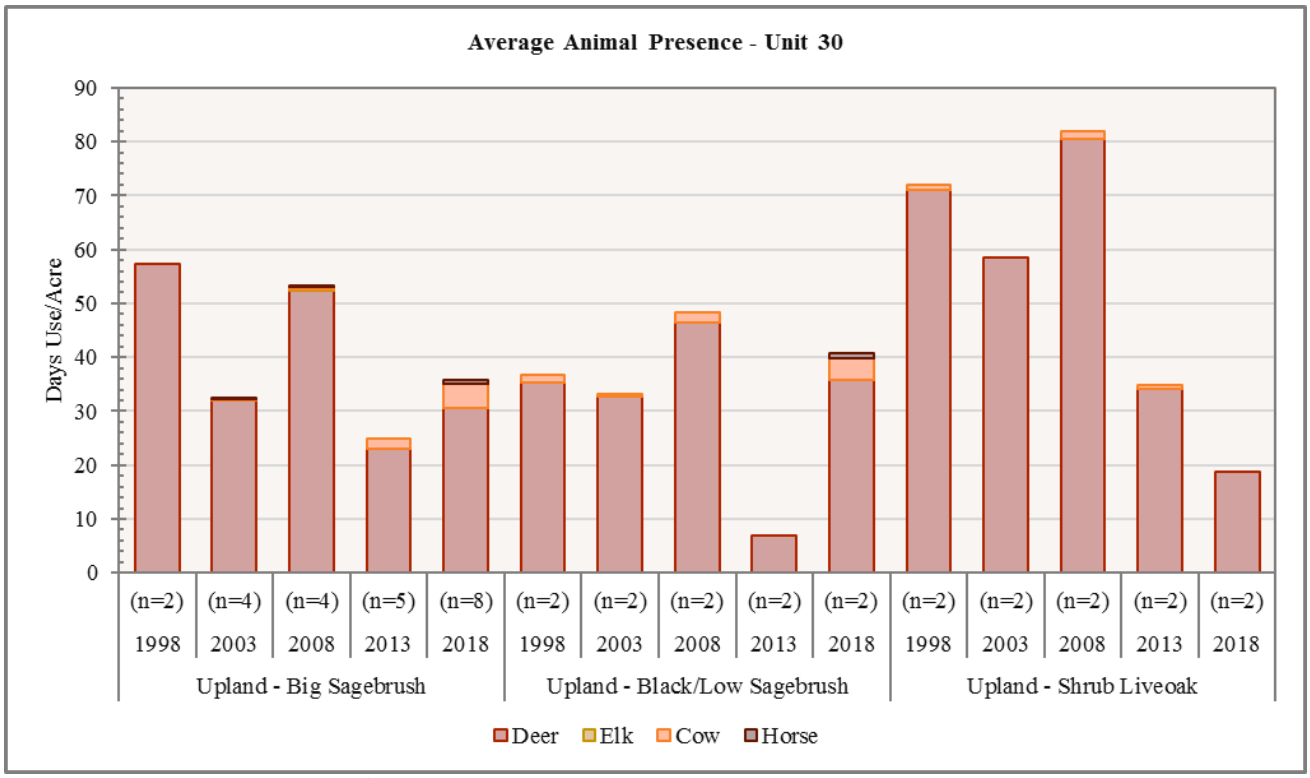


Figure 9.30: Average pellet transect data for Upland - Big Sagebrush, Upland - Black/Low Sagebrush, and Upland - Shrub Liveoak study sites in WMU 30, Pine Valley. Upland - Big Sagebrush deer pellets include deer/sheep.

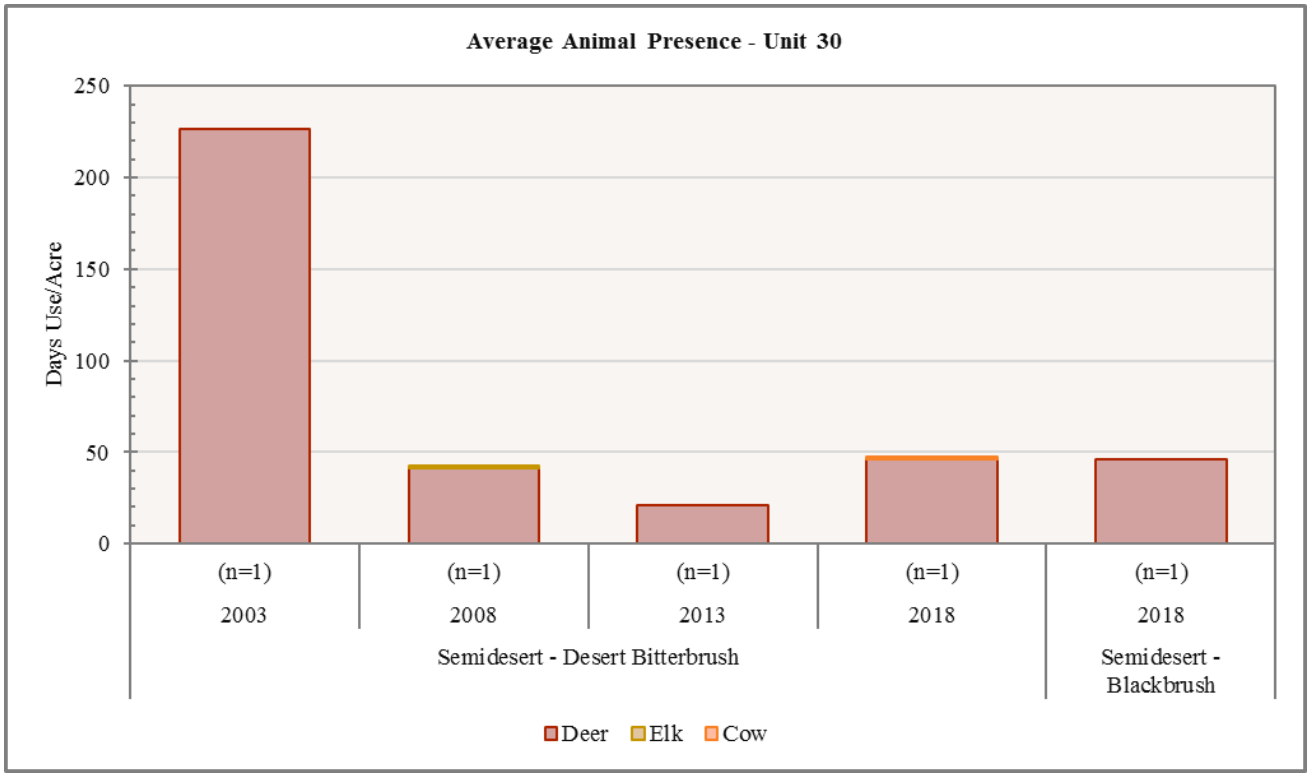


Figure 9.31: Average pellet transect data for Semidesert - Desert Bitterbrush and Semidesert - Blackbrush study sites in WMU 30, Pine Valley.

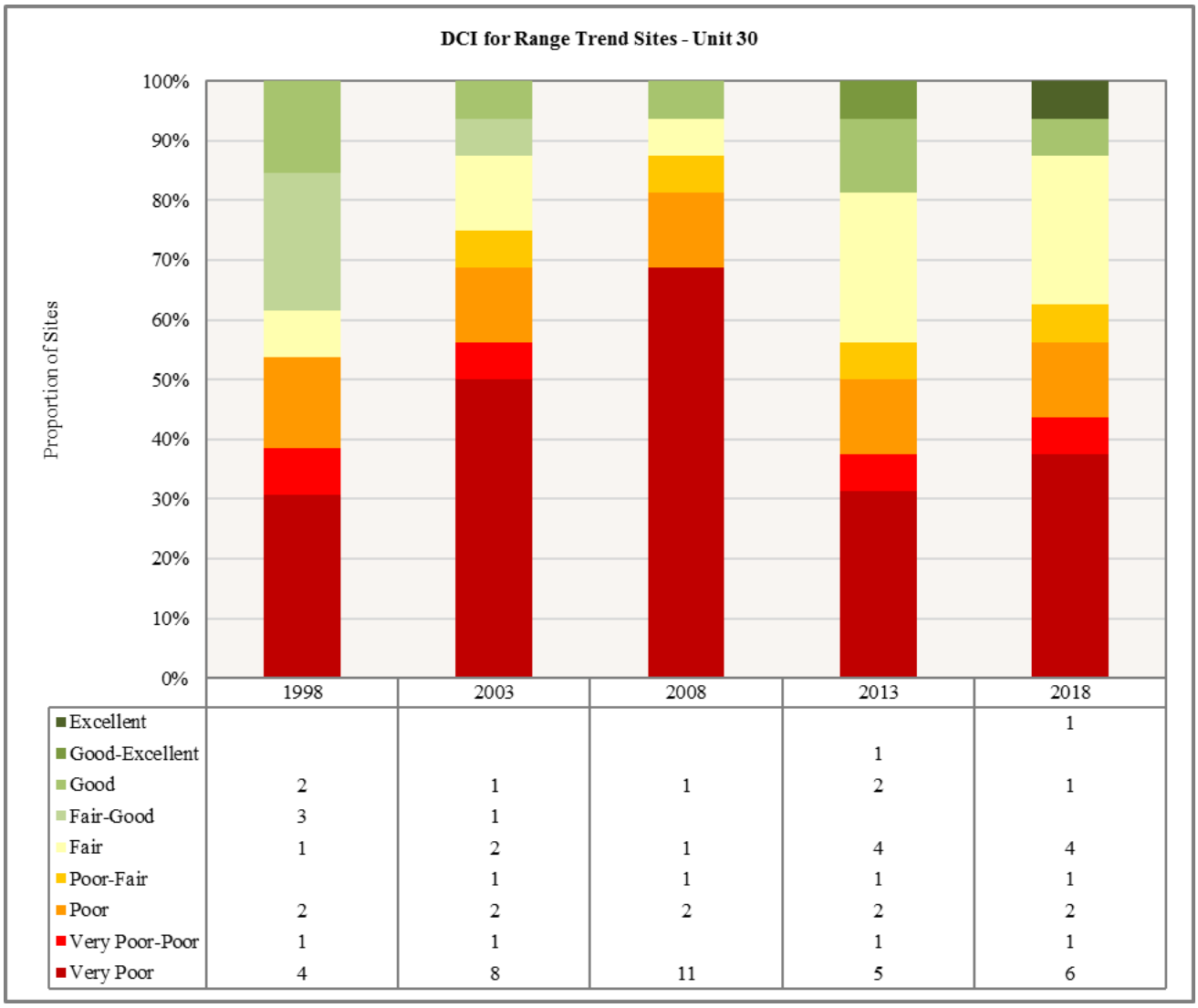
Deer Winter Range Condition Assessment

The condition of deer winter range within the Pine Valley management unit has continually changed on the sites sampled since 1998. The active Range Trend sites sampled within the unit are considered to be in very poor to excellent condition as of the 2018 sample year (**Figure 9.32**,

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
30-03	1998	30	11.1	7.2	29.4	-7.1	7.1	0	**77.7**	**G**
30-03	2003	30	11.4	9.1	17.7	-2	3.8	0	**69.9**	**G**
30-03	2008	30	8.9	7.1	22.1	-1.2	3.3	0	**70.2**	**G**
30-03	2013	30	13.1	9.2	24.6	-0.8	4	0	**80.2**	**G-E**
30-03	2018	30	12.9	11.7	26.1	-0.8	3.4	0	**83.3**	**E**
30-13	1998	22.2	12.3	14.3	21.3	-1	7.6	0	**76.6**	**G**
30-13	2003	24.8	10.2	8	8.2	-0.2	2	0	**53**	**F**
30-13	2008	29.6	10.1	3.6	3.3	0	2.1	0	**48.6**	**P-F**
30-13	2013	30	10.7	11.7	5.2	-0.1	3.6	0	**61**	**F**
30-13	2018	30	13.1	7.3	8	0	3.7	-2	**60.2**	**F**
30-29	1998	14.4	5.1	1.1	18	-14.3	0.9	0	**25.2**	**VP**
30-29	2003	2	0	0	10.3	-0.1	0.3	0	**12.6**	**VP**
30-29	2008	9.1	-1.6	7.3	16.6	-4.1	0.7	0	**28**	**VP**
30-29	2013	13.6	10.7	7.1	8.3	-12.4	0.5	0	**27.7**	**VP**
30-29	2018	11.3	11.8	0.9	6.7	-13.2	0.1	0	**17.6**	**VP**
30-38*	1998	12.9	10.6	6.5	0.4	-17.2	0.2	0	**13.3**	**VP**
30-38*	2003	15.4	6.7	3	0.1	-9.7	0.4	0	**15.8**	**VP**
30-38*	2008	0.5	0	0	2.5	-6.5	10	0	**6.5**	**VP**
30-40	1998	24.4	13.8	12.6	4.6	-1.9	10	0	**63.6**	**F**
30-40	2003	30	9.9	10	1.1	-0.3	5.8	0	**56.5**	**P-F**
30-40	2008	30	3.9	5.9	2.7	-0.1	5.5	0	**48**	**P**
30-40	2013	30	10.9	6.9	2.1	-1.7	7.2	0	**55.3**	**P-F**
30-40	2018	30	6.7	2.5	1	0	4	0	**44.1**	**P**
30-42	1998	30	14.4	8.6	2.4	-1.1	10	0	**64.3**	**F-G**
30-42	2003	25.1	8.1	2	0.1	-0.8	1.6	0	**36**	**VP-P**
30-42	2008	3.1	0	0	0.3	-1.4	10	0	**12**	**VP**
30-42	2013	8.2	14.5	9.4	0.1	-0.2	6	0	**38**	**P**
30-42	2018	12.7	11.5	4.2	0	0	0.7	0	**29.1**	**VP**
30-44	2018	29.6	12.7	0.8	0	-3	0	0	**40.1**	**F**
30-46*	1998	10.8	11.9	0.7	6.3	-20	0.2	0	**9.9**	**VP**
30-46*	2003	1.9	0	0	0.4	-11.8	2	0	**-7.6**	**VP**
30-46*	2008	2.7	0	0	0.8	-4.8	5.5	0	**4.2**	**VP**
30-46*	2013	4.1	0	0	5.3	-10.1	5.4	0	**4.7**	**VP**
30-52*	1998	12.1	1.3	4.4	29.5	-2.6	1.3	0	**46**	**F-G**
30-52*	2003	3.2	0	0	22.5	-0.1	1.8	0	**27.3**	**F**
30-52*	2008	2.6	0	0	16.7	-18.1	2.3	0	**3.4**	**VP**
30-52*	2013	8.4	15	15	17	-10.7	5.1	0	**49.8**	**G**
30-54	1998	25.6	9.4	6.3	7.8	-9.4	1.4	0	**41.1**	**P**
30-54	2003	10.1	-1.3	3.3	6.4	0	1.1	0	**19.6**	**VP**
30-54	2008	13.8	3.4	0.5	6.9	-0.4	2.1	0	**26.2**	**VP**
30-54	2013	13.9	6.9	1.8	7	-0.6	0.9	0	**29.8**	**VP**
30-54	2018	14.3	6	0.3	15.8	-1	0.9	0	**36.3**	**VP-P**
30-55	1998	17.1	2.3	6.2	5.6	-5.3	0.8	0	**26.6**	**VP**
30-55	2003	15.8	2.6	9.3	2.4	-0.7	0.6	0	**30.1**	**VP**
30-55	2008	19	8.7	15	5.3	-1.8	0.9	0	**47.1**	**P**
30-55	2013	19.4	11.9	15	6.1	-0.7	1.8	0	**53.6**	**F**
30-55	2018	22.1	11.1	11.7	6.6	0	0.4	0	**51.8**	**P-F**
30-56*	1998	4	0	0	30	-0.6	1.7	0	**35.1**	**VP-P**
30-56*	2003	1.6	0	0	22.7	0	1.3	0	**25.6**	**VP**
30-56*	2008	1.9	0	0	30	-0.3	0.7	0	**32.4**	**VP**
30-56*	2013	3.7	0	0	30	0	0.8	0	**34.5**	**VP-P**
30-57*	1998	15.4	14.8	3.2	0	-16.4	0.1	0	**17.2**	**P**
30-57*	2003	16.7	8.2	0.3	0.5	-10.4	0.9	0	**16.2**	**P**
30-57*	2008	3.2	0	0	0.2	-1.4	1	0	**3**	**VP**

Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
30-57*	2013	8.4	15	15	2.6	-7.2	2.6	0	**36.4**	**F**
30-58	1998	5.7	12.2	14.5	30	-1.7	10	0	**70.7**	**F-G**
30-58	2003	6.8	10.7	14.3	30	-1.3	8.3	0	**68.7**	**F-G**
30-58	2008	12.1	10.8	5.7	30	-0.2	6.3	0	**64.7**	**F**
30-58	2013	17.7	12.4	15	30	-0.2	10	0	**84.9**	**G**
30-58	2018	19.6	12.8	15	30	0	0.6	0	**78**	**G**
30-61	2003	14.4	0.4	1.5	0.1	0	6.5	0	**22.9**	**P**
30-61	2008	2	0	0	0.1	0	1.6	0	**3.7**	**VP**
30-61	2013	11.9	15	0	0.5	0	0	0	**27.4**	**F**
30-61	2018	14.6	15	0	3.5	-1.1	1.4	0	**33.3**	**F**
30-62	2003	21.5	1.3	1	4	-3.5	0.6	0	**24.9**	**VP**
30-62	2008	23.7	2.7	0	12	-9.3	0.3	0	**29.4**	**VP**
30-62	2013	23.8	5.4	0.4	4.6	-3.2	0.2	0	**31.2**	**VP**
30-62	2018	29.5	8.8	0	6.2	-2.8	0	0	**41.8**	**P**
30-63	2003	23.1	-1.2	1.6	6.9	-0.8	0.6	0	**30.2**	**VP**
30-63	2008	23.1	-2.9	0	3	-5	1.1	0	**19.4**	**VP**
30-63	2013	28.5	10	1.8	5.8	-4.4	0.3	0	**42**	**P**
30-63	2018	30	6.3	4.2	6.9	-15.4	0.9	0	**32.9**	**VP**
30-73	2013	9.5	9.6	8	1.4	-7.5	0.8	0	**21.8**	**VP**
30-73	2018	9.3	8.8	2.5	2.7	-11.3	0.7	0	**12.5**	**VP**
30-74	2018	15.9	3.2	2	0.7	-0.4	8.8	0	**30.1**	**VP**
30-75	2018	3.6	0	0	16.7	-4.1	2.4	0	**18.7**	**VP**
30-77	2018	22.5	15	8.2	2.9	-3.6	10	0	**55**	**F**

Table 9.9). The Upper Broad Hollow study improved to excellent condition, and the Spirit Creek South Burned study stayed in good condition. There were four studies considered to be in fair condition, and these are Black Ridge, Motoqua, Tobin Bench, and Pahcoon Bench West. The Quichapa Canyon study was considered to be in poor-fair condition. The Telegraph Draw and North Hills studies were classified as being in poor condition. The Bullion Canyon study site was considered to be in very poor-poor condition. A total of six studies were classified as being in very poor condition: Southwest of Newcastle, Grapevine Spring, Holt Canyon, Wide Canyon 2, Pinion Park and Swett Hills North. These sites were considered very poor due to lack of preferred browse, lack of perennial vegetation cover, and high loads of annual grass.



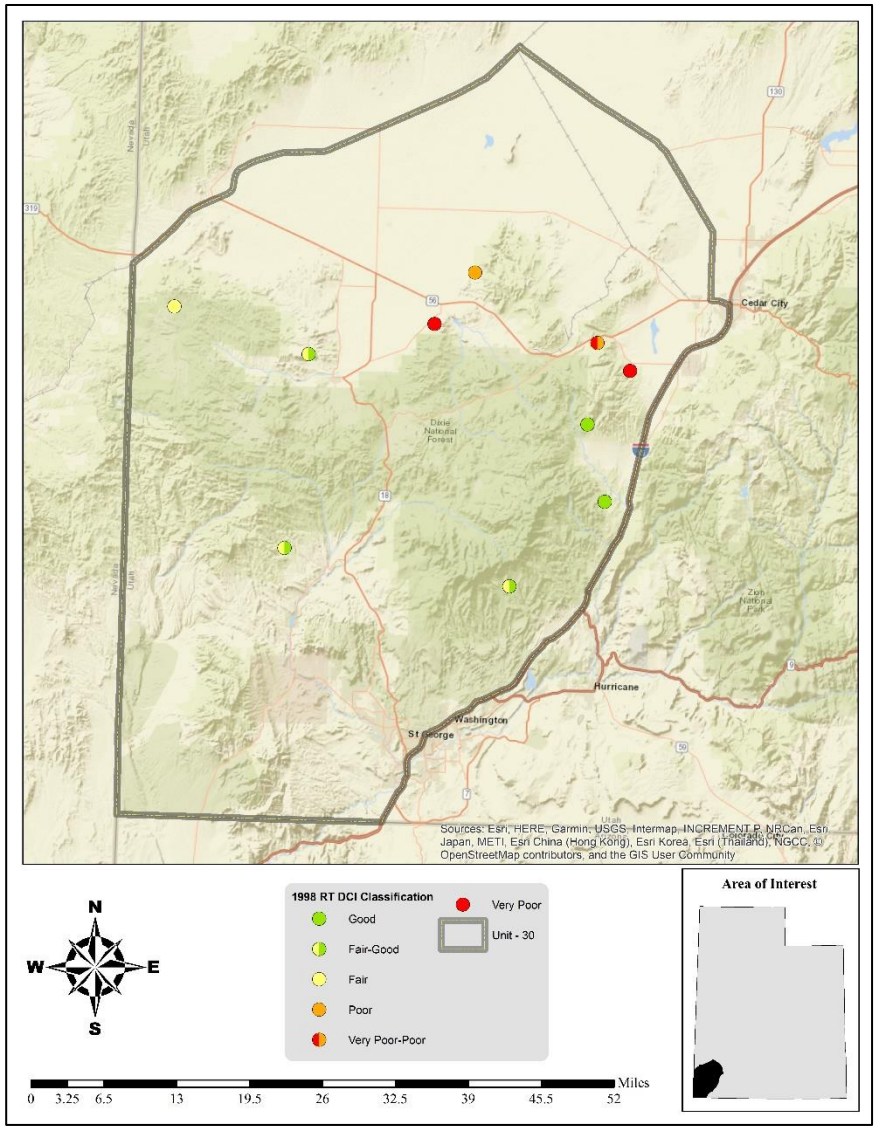
	1998	2003	2008	2013	2018
Excellent					1
Good-Excellent				1	
Good	2	1	1	2	1
Fair-Good	3	1			
Fair	1	2	1	4	4
Poor-Fair		1	1	1	1
Poor	2	2	2	2	2
Very Poor-Poor	1	1		1	1
Very Poor	4	8	11	5	6

Figure 9.32: Deer winter range Desirable Components Index (DCI) summary by year of Range Trend sites for WMU 30, Pine Valley.

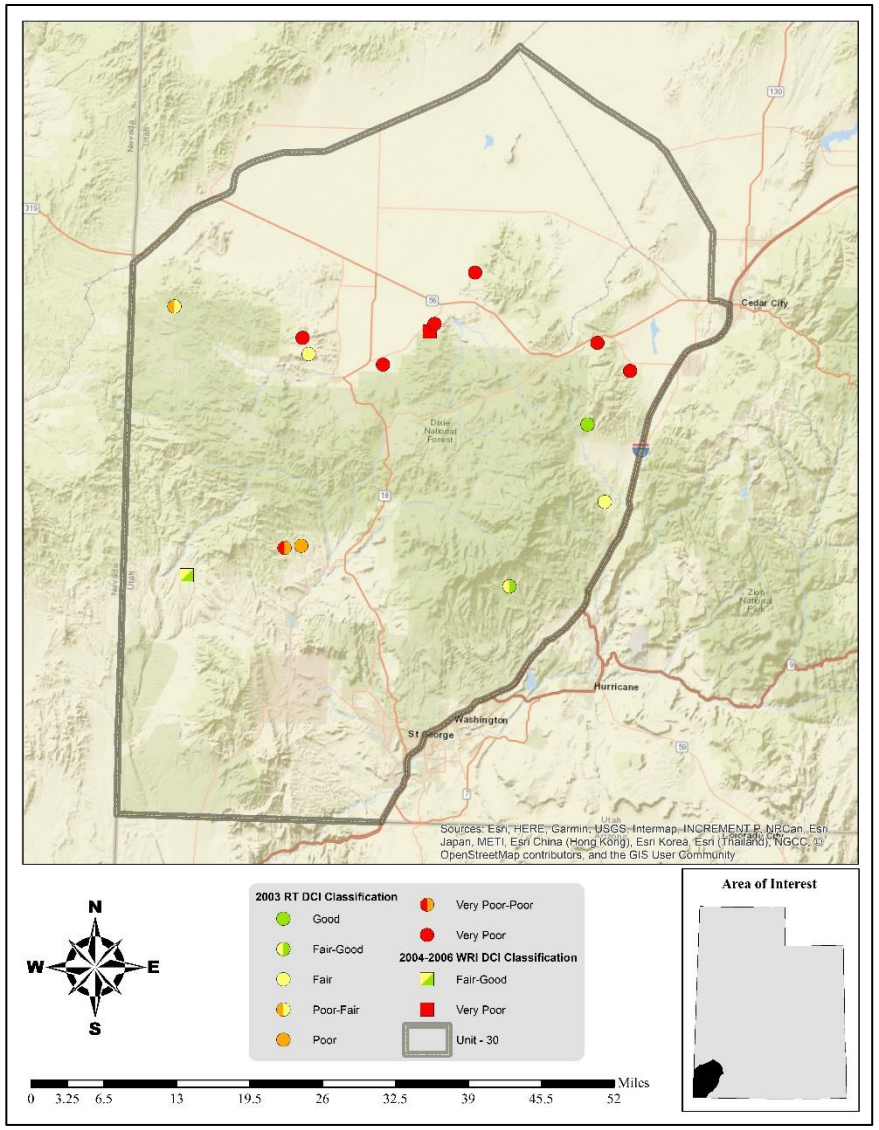
Study Number	Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
30-03	1998	30	11.1	7.2	29.4	-7.1	7.1	0	**77.7**	**G**
30-03	2003	30	11.4	9.1	17.7	-2	3.8	0	**69.9**	**G**
30-03	2008	30	8.9	7.1	22.1	-1.2	3.3	0	**70.2**	**G**
30-03	2013	30	13.1	9.2	24.6	-0.8	4	0	**80.2**	**G-E**
30-03	2018	30	12.9	11.7	26.1	-0.8	3.4	0	**83.3**	**E**
30-13	1998	22.2	12.3	14.3	21.3	-1	7.6	0	**76.6**	**G**
30-13	2003	24.8	10.2	8	8.2	-0.2	2	0	**53**	**F**
30-13	2008	29.6	10.1	3.6	3.3	0	2.1	0	**48.6**	**P-F**
30-13	2013	30	10.7	11.7	5.2	-0.1	3.6	0	**61**	**F**
30-13	2018	30	13.1	7.3	8	0	3.7	-2	**60.2**	**F**
30-29	1998	14.4	5.1	1.1	18	-14.3	0.9	0	**25.2**	**VP**
30-29	2003	2	0	0	10.3	-0.1	0.3	0	**12.6**	**VP**
30-29	2008	9.1	-1.6	7.3	16.6	-4.1	0.7	0	**28**	**VP**
30-29	2013	13.6	10.7	7.1	8.3	-12.4	0.5	0	**27.7**	**VP**
30-29	2018	11.3	11.8	0.9	6.7	-13.2	0.1	0	**17.6**	**VP**
30-38*	1998	12.9	10.6	6.5	0.4	-17.2	0.2	0	**13.3**	**VP**
30-38*	2003	15.4	6.7	3	0.1	-9.7	0.4	0	**15.8**	**VP**
30-38*	2008	0.5	0	0	2.5	-6.5	10	0	**6.5**	**VP**
30-40	1998	24.4	13.8	12.6	4.6	-1.9	10	0	**63.6**	**F**
30-40	2003	30	9.9	10	1.1	-0.3	5.8	0	**56.5**	**P-F**
30-40	2008	30	3.9	5.9	2.7	-0.1	5.5	0	**48**	**P**
30-40	2013	30	10.9	6.9	2.1	-1.7	7.2	0	**55.3**	**P-F**
30-40	2018	30	6.7	2.5	1	0	4	0	**44.1**	**P**
30-42	1998	30	14.4	8.6	2.4	-1.1	10	0	**64.3**	**F-G**
30-42	2003	25.1	8.1	2	0.1	-0.8	1.6	0	**36**	**VP-P**
30-42	2008	3.1	0	0	0.3	-1.4	10	0	**12**	**VP**
30-42	2013	8.2	14.5	9.4	0.1	-0.2	6	0	**38**	**P**
30-42	2018	12.7	11.5	4.2	0	0	0.7	0	**29.1**	**VP**
30-44	2018	29.6	12.7	0.8	0	-3	0	0	**40.1**	**F**
30-46*	1998	10.8	11.9	0.7	6.3	-20	0.2	0	**9.9**	**VP**
30-46*	2003	1.9	0	0	0.4	-11.8	2	0	**-7.6**	**VP**
30-46*	2008	2.7	0	0	0.8	-4.8	5.5	0	**4.2**	**VP**
30-46*	2013	4.1	0	0	5.3	-10.1	5.4	0	**4.7**	**VP**
30-52*	1998	12.1	1.3	4.4	29.5	-2.6	1.3	0	**46**	**F-G**
30-52*	2003	3.2	0	0	22.5	-0.1	1.8	0	**27.3**	**F**
30-52*	2008	2.6	0	0	16.7	-18.1	2.3	0	**3.4**	**VP**
30-52*	2013	8.4	15	15	17	-10.7	5.1	0	**49.8**	**G**
30-54	1998	25.6	9.4	6.3	7.8	-9.4	1.4	0	**41.1**	**P**
30-54	2003	10.1	-1.3	3.3	6.4	0	1.1	0	**19.6**	**VP**
30-54	2008	13.8	3.4	0.5	6.9	-0.4	2.1	0	**26.2**	**VP**
30-54	2013	13.9	6.9	1.8	7	-0.6	0.9	0	**29.8**	**VP**
30-54	2018	14.3	6	0.3	15.8	-1	0.9	0	**36.3**	**VP-P**
30-55	1998	17.1	2.3	6.2	5.6	-5.3	0.8	0	**26.6**	**VP**
30-55	2003	15.8	2.6	9.3	2.4	-0.7	0.6	0	**30.1**	**VP**
30-55	2008	19	8.7	15	5.3	-1.8	0.9	0	**47.1**	**P**
30-55	2013	19.4	11.9	15	6.1	-0.7	1.8	0	**53.6**	**F**
30-55	2018	22.1	11.1	11.7	6.6	0	0.4	0	**51.8**	**P-F**
30-56*	1998	4	0	0	30	-0.6	1.7	0	**35.1**	**VP-P**
30-56*	2003	1.6	0	0	22.7	0	1.3	0	**25.6**	**VP**
30-56*	2008	1.9	0	0	30	-0.3	0.7	0	**32.4**	**VP**
30-56*	2013	3.7	0	0	30	0	0.8	0	**34.5**	**VP-P**
30-57*	1998	15.4	14.8	3.2	0	-16.4	0.1	0	**17.2**	**P**
30-57*	2003	16.7	8.2	0.3	0.5	-10.4	0.9	0	**16.2**	**P**
30-57*	2008	3.2	0	0	0.2	-1.4	1	0	**3**	**VP**
30-57*	2013	8.4	15	15	2.6	-7.2	2.6	0	**36.4**	**F**
30-58	1998	5.7	12.2	14.5	30	-1.7	10	0	**70.7**	**F-G**
30-58	2003	6.8	10.7	14.3	30	-1.3	8.3	0	**68.7**	**F-G**
30-58	2008	12.1	10.8	5.7	30	-0.2	6.3	0	**64.7**	**F**
30-58	2013	17.7	12.4	15	30	-0.2	10	0	**84.9**	**G**
30-58	2018	19.6	12.8	15	30	0	0.6	0	**78**	**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
30-61	2003	14.4	0.4	1.5	0.1	0	6.5	0	**22.9**	**P**
30-61	2008	2	0	0	0.1	0	1.6	0	**3.7**	**VP**
30-61	2013	11.9	15	0	0.5	0	0	0	**27.4**	**F**
30-61	2018	14.6	15	0	3.5	-1.1	1.4	0	**33.3**	**F**
30-62	2003	21.5	1.3	1	4	-3.5	0.6	0	**24.9**	**VP**
30-62	2008	23.7	2.7	0	12	-9.3	0.3	0	**29.4**	**VP**
30-62	2013	23.8	5.4	0.4	4.6	-3.2	0.2	0	**31.2**	**VP**
30-62	2018	29.5	8.8	0	6.2	-2.8	0	0	**41.8**	**P**
30-63	2003	23.1	-1.2	1.6	6.9	-0.8	0.6	0	**30.2**	**VP**
30-63	2008	23.1	-2.9	0	3	-5	1.1	0	**19.4**	**VP**
30-63	2013	28.5	10	1.8	5.8	-4.4	0.3	0	**42**	**P**
30-63	2018	30	6.3	4.2	6.9	-15.4	0.9	0	**32.9**	**VP**
30-73	2013	9.5	9.6	8	1.4	-7.5	0.8	0	**21.8**	**VP**
30-73	2018	9.3	8.8	2.5	2.7	-11.3	0.7	0	**12.5**	**VP**
30-74	2018	15.9	3.2	2	0.7	-0.4	8.8	0	**30.1**	**VP**
30-75	2018	3.6	0	0	16.7	-4.1	2.4	0	**18.7**	**VP**
30-77	2018	22.5	15	8.2	2.9	-3.6	10	0	**55**	**F**

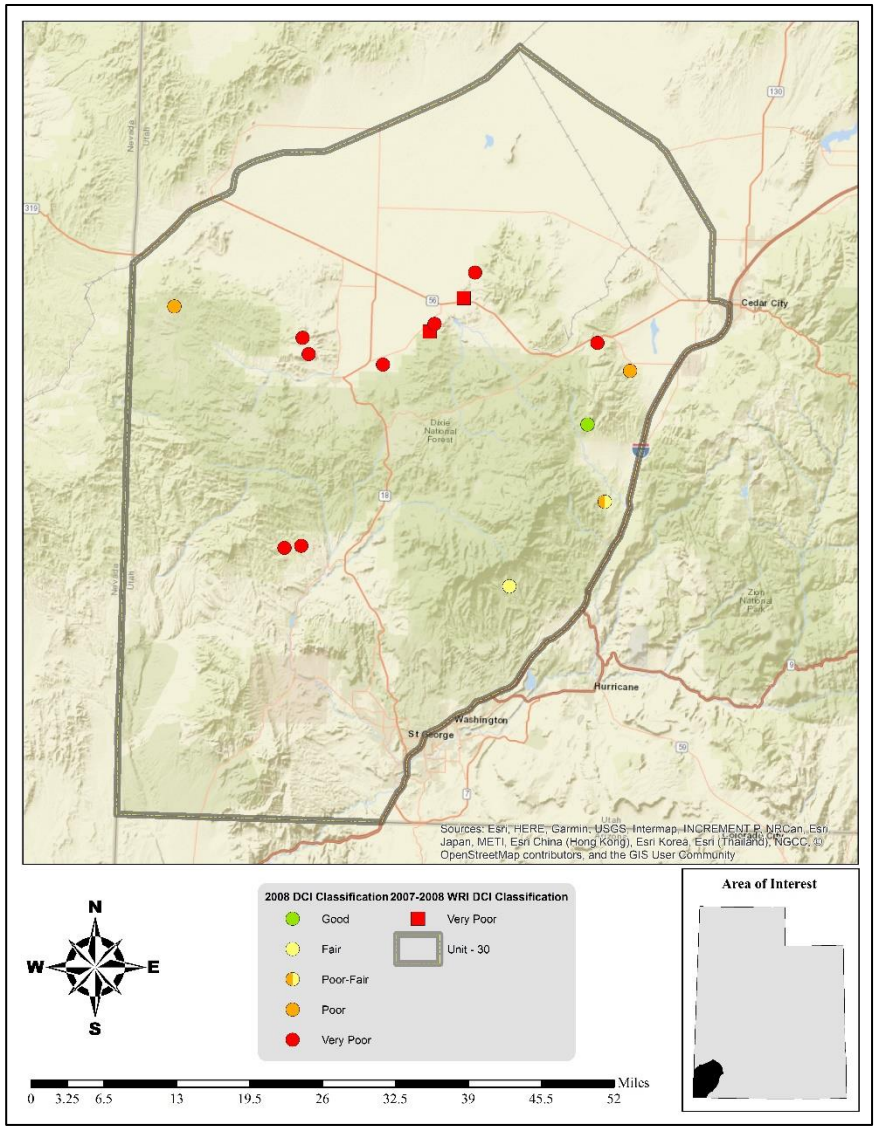
Table 9.9: Deer winter range Desirable Components Index (DCI) information by site number of Range Trend studies for WMU 30, Pine Valley. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. *Studies with an asterisk have been suspended.



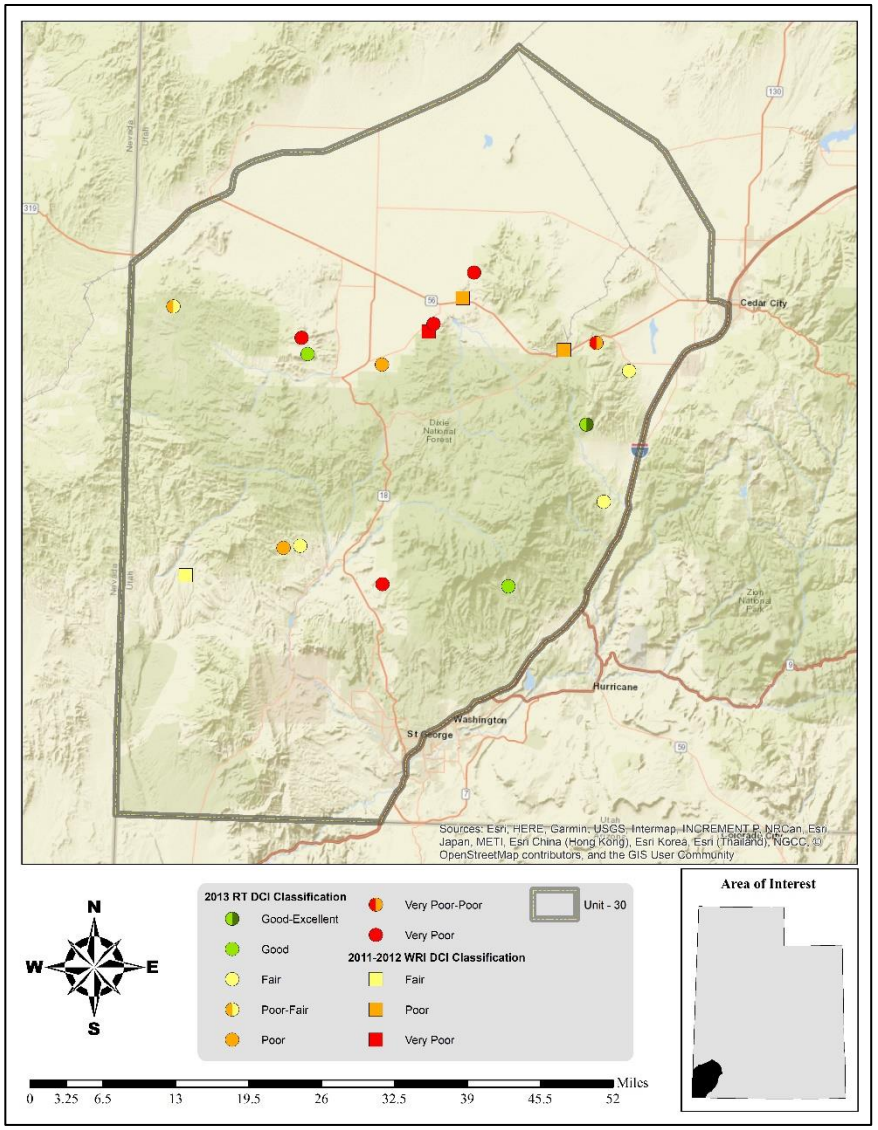
Map 9.8: 1998 Desirable Components Index (DCI) ranking distribution by study site for 30, Pine Valley.



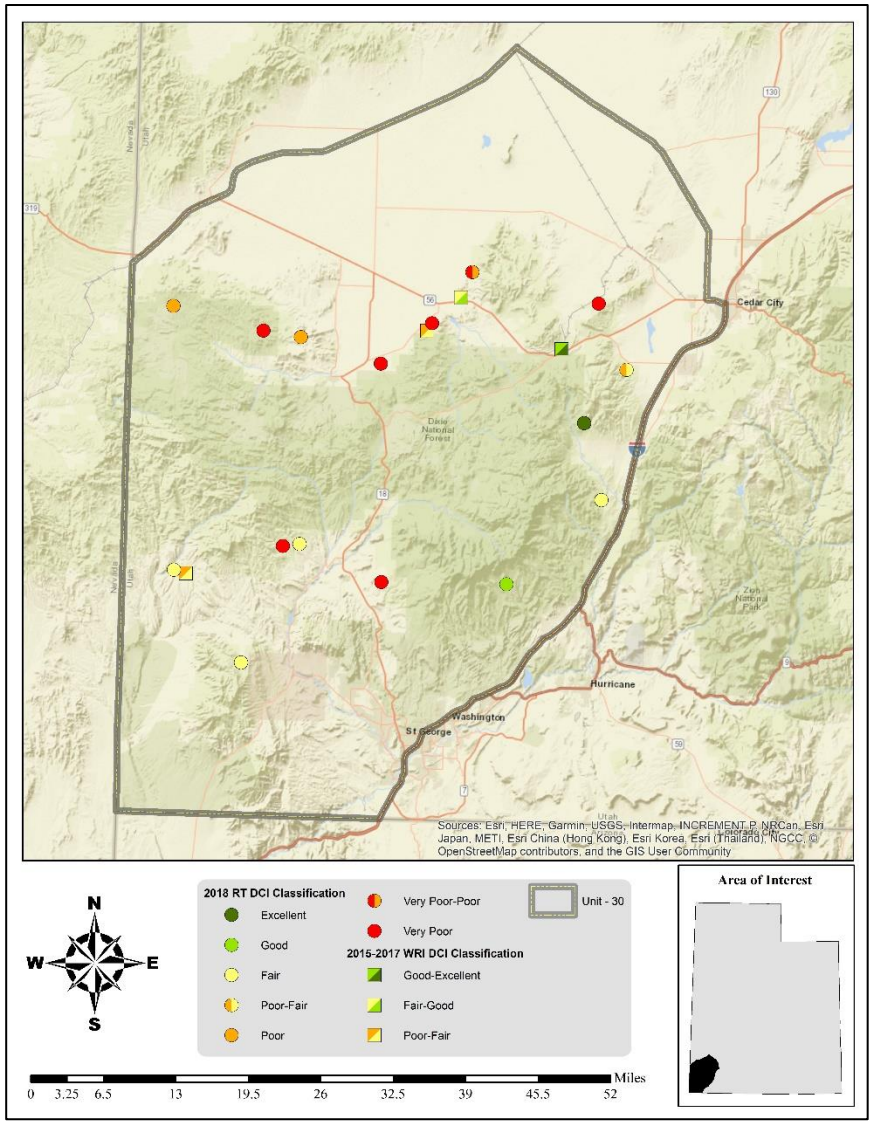
Map 9.9: 2003 Desirable Components Index (DCI) ranking distribution by study site for WMU 30, Pine Valley.



Map 9.10: 2008 Desirable Components Index (DCI) ranking distribution by study site for WMU 30, Pine Valley.



Map 9.11: 2013 Desirable Components Index (DCI) ranking distribution by study site for WMU 30, Pine Valley.



Map 9.12: 2018 Desirable Components Index (DCI) ranking distribution by study site for WMU 30, Pine Valley.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
30-03	Upper Broad Hollow	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
30-05	Harmony Mountain Summit	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-13	Black Ridge	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-26	Grassy Flat Ridge	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-29	Southwest of Newcastle	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-32	Whiterocks Reservoir	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
30-35	Deep Canyon	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-40	Telegraph Draw	PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-41	Joe Spring	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
30-42	Grapevine Spring	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-44	Motoqua	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-45	Flat Top Mountain	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
30-54	Bullion Canyon	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
30-55	Quichapa Canyon	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
30-58	Spirit Creek South Burned	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-61	Tobin Bench	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-62	North Hills	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-63	Holt Canyon	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-73	Wide Canyon 2	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Medium	Reduced understory shrub and herbaceous vigor
30-74	Pinion Park	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30-75	Swett Hills North	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
		Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30-77	Pahcoon Bench West	Annual Grass	Medium	Increased fire potential and reduced herbaceous diversity
30R-01	Newcastle Bullhog	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30R-02	Square Fire Rehab	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Noxious Weeds	Low	Reduced diversity of desirable grass and forb species
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30R-04	North New Castle	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30R-05	Duncan Creek/Hwy 56	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species
		Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
30R-06	Tabeau Peak	Annual Grass	Low	Increased fire potential and reduced herbaceous diversity
30R-07	Middletown Wash	Annual Grass	High	Increased fire potential and reduced herbaceous diversity
		Energy Development	Low	Fragmentation and degradation/loss of habitat

Table 9.10: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 30, Pine Valley. All assessments are based off of the most current sample date for each study site. Criteria for evaluating limiting factors is available in **APPENDIX A - Threat Assessment**.

Discussion and Recommendations

Mountain (Big Sagebrush)

The studies that are classified as a Mountain (Big Sagebrush) ecological site are considered to be in poor to good condition for deer winter range on the Pine Valley Unit. In general, these ecological communities support

good shrub populations that can provide valuable browse for wildlife. Introduced perennial grasses are present on some of these study sites, and can lead to reduced understory diversity and productivity. Introduced annual grasses are also present in low amounts. Should these annual grasses increase in the future, they may change plant community dynamics and increase fuel loads. High fuel loads can lead to increased wildfire regimes. Monitoring of areas with introduced perennial and annual grasses is recommended. If these grasses increase consistently, treatments for their reduction may be needed. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and native species should be given preference when possible.

The Telegraph Draw and Spirit Creek South Burned studies have some pinyon-juniper encroachment occurring, which has the potential for reduced understory and shrub vigor. It is recommended that tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) take place in areas where conifer reduction would be feasible and beneficial. Care should be taken to select methods that will not increase annual grass cover.

Mountain (Browse)

The study within the Mountain (Browse) ecological type is considered to be in fair condition for big game summer range on this unit. This study supports a robust shrub community that may provide valuable forage for wildlife. Limited pinyon-juniper encroachment is occurring on this study and may eventually lead to reduced understory and shrub vigor. Treatments to reduce conifer encroachment (e.g. bullhog, chaining, lop and scatter, etc.) may be needed in the future.

Introduced perennial grasses are present in moderate amounts on this study site. High levels of these introduced grasses may lead to reduced understory diversity and productivity. In addition, annual grass contributes a low amount of cover on this site. Should introduced annual species increase in the future, they have the potential to shift the dynamics of the plant community and lead to less biodiversity. In addition, fuel loads are increased with high levels of annual grass, which in turn are associated with more frequent wildfires. If reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Mountain (Curlleaf Mountain Mahogany)

The study that is classified as a Mountain (Curlleaf Mountain Mahogany) ecological site supports shrub populations which provide browse for summering big game animals. Introduced annual grasses are present in low amounts. Should future increases occur, higher amounts of annual grasses have the potential to increase fuel loads and exacerbate the risk of wildfire. This site is further threatened by the presence of introduced perennial grasses. Although the threat they pose is currently low, these introduced grasses can lead to diminished understory productivity and diversity if they increase in the future. 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.

Conifer encroachment is also occurring on this study site in low amounts. Although tree density is low as of 2018, tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) may be appropriate if conifers increase in the future. Care should be taken to select methods that will not increase annual grass cover.

Mountain (Oak)

These Mountain (Oak) ecological sites are considered to be in good condition for deer summer range on the Pine Valley Management Unit. Annual grasses have been observed in varying amounts on these sites. Increased levels of annual grasses may exacerbate fuel loads, which in turn have the potential to increase fire intervals. It is recommended that monitoring of these studies continue; if these grasses are observed in consistently high amounts in the future, treatment(s) to restore the herbaceous understory may be necessary. In addition, noxious weeds have been observed in the past on the Flat Top Mountain study. Although their

presence was not noted in 2013 or 2018, these noxious weeds may have the potential to outcompete native herbaceous species if they increase in future sample years.

Upland (Big Sagebrush)

The studies classified as Upland (Big Sagebrush) ecological sites are considered to be in very poor to fair condition for deer winter range on this management unit. The plant communities that are considered to be of this ecological type support sagebrush that provides browse for wintering big game animals. Annual grasses are present on many of these study sites in high amounts. Increased levels of annual grasses can exacerbate fuel loads and may alter the fire regime. Introduced perennial grasses pose a high-level risk on the Pahcoon Bench West study: high amounts of these grasses may lead to reduced understory diversity and productivity. It is recommended that monitoring of these studies continue; if these grasses are observed in consistently high amounts in the future, treatment(s) to restore the herbaceous understory 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.

Pinyon-juniper encroachment is also occurring on most of these study sites and may lead to reduced understory and shrub productivity. Tree-removing disturbances (e.g. bullhog, chaining, lop and scatter, etc.) are recommended in areas where they would be beneficial and appropriate. However, care should be taken to select methods that will not increase annual grass cover.

Upland (Black/Low Sagebrush)

These lower elevation Upland (Black/Low Sagebrush) ecological sites are classified as being in very poor-poor to fair condition for deer winter range on this management unit. These sites support robust sagebrush populations that provide valuable forage for wintering big game. Pinyon and juniper encroachment pose medium-level threats to these study sites, as they have the potential to reduce understory and shrub productivity as encroachment progresses. When and where appropriate, tree-removing disturbances such as bullhog and chaining may be beneficial.

Annual grasses are also present on these studies, posing a low-risk threat on the Black Ridge site and a high-risk threat on the Bullion Canyon study. High amounts of annual grasses can increase fuel loads and can potentially exacerbate the risk for wildfire. Monitoring should continue on these study sites and treatment may be necessary if high amounts of annual grasses persist in the future.

Upland (Shrub Liveoak)

The studies classified as Upland (Shrub Liveoak) ecological sites are considered to be within very poor to excellent condition for deer winter range within the Pine Valley Management Unit. More specifically, Upper Broad Hollow (30-03) is in excellent condition, while Grapevine Spring (30-42) is considered to be in very poor condition. Annual grasses pose a high-risk threat on the Upper Broad Hollow study and a low threat on the Grapevine Spring study site. Increased amounts of these grasses elevate fuel loads and may exacerbate the risk of catastrophic wildfire. If consistently high levels of annual grasses are observed in future sample years, treatment may be necessary to restore the herbaceous understory.

Encroachment of pinyon and juniper trees is an additional threat to both of these sites. Although the risk posed is currently ranked as medium, there may be potential for further encroachment in the future. As these pinyon-juniper woodlands progress in the phases of woodland succession, they have the potential to reduce the health and productivity of the understory and shrub components. Tree-removing disturbances (e.g. lop and scatter, bullhog, chaining, etc.) may be advisable in appropriate areas.

Semidesert (Desert Bitterbrush)

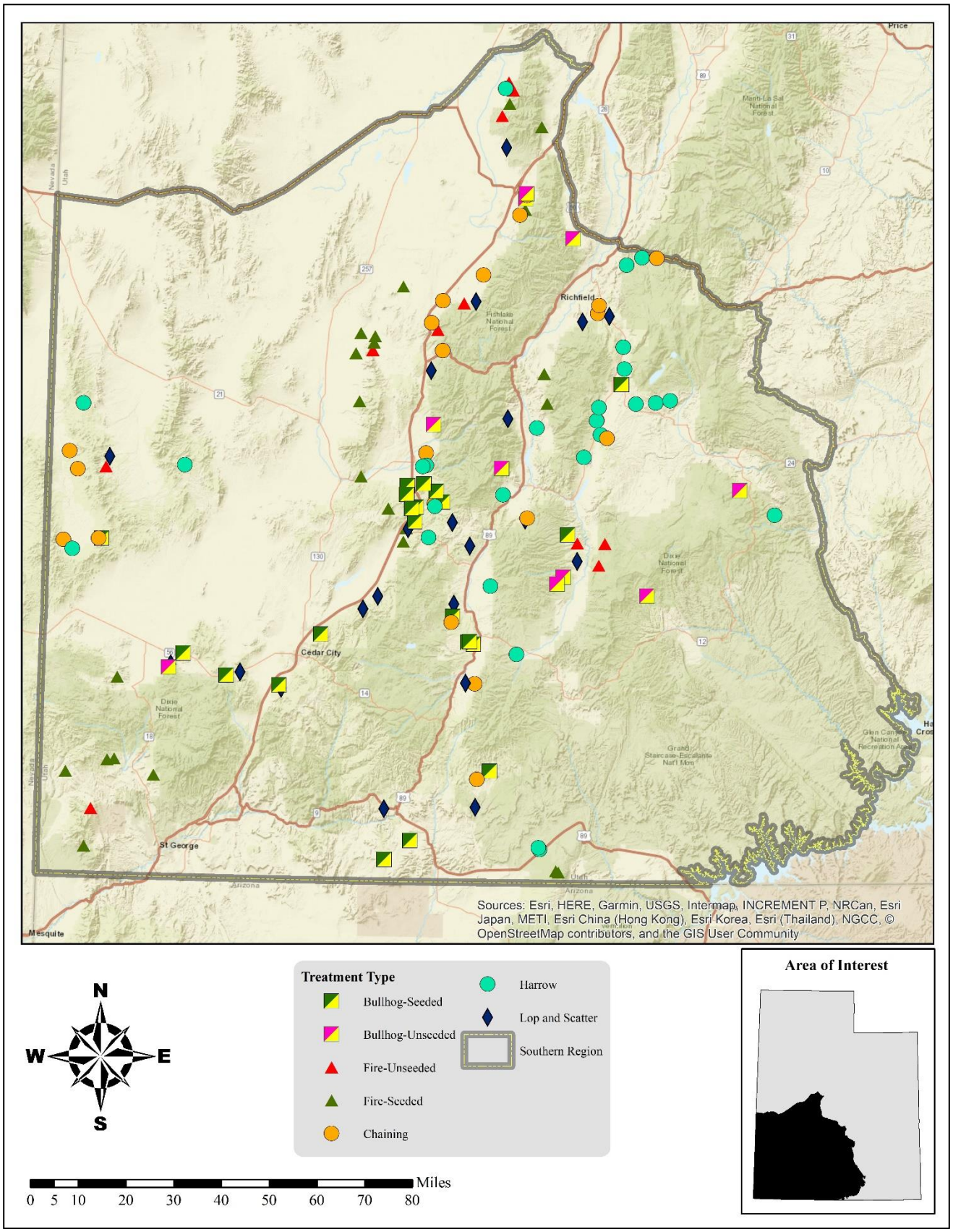
Tobin Bench (30-61), the study classified as a Semidesert (Desert Bitterbrush) ecological site, is classified as being in fair condition for mule deer winter range in this unit. This study supports shrub communities that provide valuable browse for wildlife. The existing herbaceous understory on this site is fairly degraded, and most of the graminoid cover is provided by the introduced perennial species crested wheatgrass (*Agropyron cristatum*) and annual species cheatgrass (*Bromus tectorum*). Introduced perennial grasses have the potential to outcompete native species for resources, therefore causing decreased understory diversity and productivity. In sufficient amounts, annual grasses can change plant community dynamics and increase fuel loads. High fuel loads, in turn, have the potential to alter wildfire regimes. If these grasses increase consistently, treatments for their reduction may be needed. Should reseeding be necessary to restore herbaceous species, care should be taken in species selection and native species should be given preference when possible.

Semidesert (Blackbrush)

The Motoqua (30-44) study site is considered to be a Semidesert (Blackbrush) ecological site and is classified as being in fair condition for deer winter range in this management unit. The shrub component on this site provides valuable browse for wildlife. Annual grasses are abundant on this site; increased annual grass levels can increase fuel loads and exacerbate the risk of wildfire. It is recommended that monitoring continue. If these grasses persist, treatments to restore the herbaceous understory may be beneficial.

Juniper encroachment is occurring on this study site. Although the study site is only in Phase I of woodland succession, tree-removing disturbances (bullhog, lop and scatter, chaining, etc.) may be beneficial. Over time, continued tree encroachment can lead to reduced understory and shrub productivity.

10. SOUTHERN REGION – TREATED OR DISTURBED SUMMARY



Study Trend Summary (Treated/Disturbed Sites)

Bullhog (Seeded)

There are 21 study sites that were treated with a bullhog during the report period. All of these studies [Spanish George Spring (20R-07), Greenville Bullhog (22R-06), South Beaver Bullhog (22R-10), South Beaver Bullhog 2 (22R-12), Greenville Bench Bullhog 2 (22R-13), South Beaver Rocky Wash (22R-14). South Beaver Bullhog Year 4 (22R-15), South Beaver Year 5 (22R-20), South Beaver Year 7 (22R-23), Antimony PJ Reduction (24R-11), Brown Spring (25R-11), Alton-Millcreek 2 (27R-19), DD Hollow (28-19), South Canyon 2 (28R-09), Panguitch Creek (28R-13), South Canyon (28R-19), Above Elliker Basin (28R-22), North Hills Bullhog (29R-04), Yellow Jacket (29R-05), North New Castle (30R-04), and Duncan Creek/Hwy 56 (30R-05)] are considered to be upland ecological sites.

The Spanish George Spring study site is located near Spanish George Spring in Hamlin Valley. The Greenville Bullhog site can be found just south of Beaver. The South Beaver Bullhog and South Beaver Bullhog 2 studies are situated near I-15 and Fremont Wash: South Beaver Bullhog is west of I-15 and South Beaver Bullhog 2 is east of I-15. Greenville Bench Bullhog 2 can be found south of Beaver, near Sand Hollow in the South Hills. The South Beaver Rocky Wash study site is situated east of I-15 on Coyote Bench, and the South Beaver Bullhog Year 4 study is found south of Beaver and west of I-15. South Beaver Year 5 is located just south of South Creek on Coyote Bench. South Beaver Year 7 lies between Boulder Canyon and Jockeys Canyon. The Antimony PJ Reduction site is located north of North Fork Pine Creek and West of Black Canyon.

The Brown Spring study is located slightly east of the town of Koosharem, while Alton-Millcreek 2 is found near the confluence of Mill Creek and Skutumpah Creek. DD Hollow is situated west of Hillsdale near a power substation, the South Canyon study can be found about 0.3 miles northeast of the DD Hollow study, and South Canyon 2 is situated between the two. The Panguitch Creek study is situated southwest of the city of Panguitch. The Above Elliker Basin site can be found in the mountains above Elliker Basin. North Hills Bullhog is located in North Hills, just south of Cedar City. Yellow Jacket is situated east of Yellowjacket Canyon and Block Mesas. The North New Castle study site can be found northwest of the town of Newcastle. Finally, Duncan Creek/Hwy 56 is situated just east of Iron Mountain near Duncan Creek and Highway 56.

Shrubs/Trees: Average shrub cover on these ecological sites has fluctuated, but has remained fairly stable overall. Preferred browse has been the most abundant component in all sample years and has exhibited a marginal decrease, while other shrubs have increased over time. These trends are partially due to a variation in number of study sites (the ‘n value’) in each sample year. For example, most of the preferred browse cover for the pre-treatment and first and second post-treatment samplings is contributed by the DD Hollow, North Hills Bullhog, and South Beaver Rocky Wash studies. However, these studies do not have data for the third post-treatment samplings, and the studies that do have data for this sampling (Greenville Bullhog, South Beaver Bullhog, and South Beaver Bullhog 2) contribute comparatively little preferred browse cover and slightly higher other shrub cover (**Figure 10.1**). Overall density of preferred browse has increased over time, with mature plants being the dominant demographic both prior to and after treatment (**Figure 10.4**). Utilization of preferred browse has fluctuated, but has remained fairly stable overall. However, a decrease was noted between the first and second post-treatment sample years and is at least partially driven by the DD Hollow and South Canyon studies (**Figure 10.5Figure 10.5**).

Tree cover has exhibited a marked decrease over time. In addition to trees removed by treatment, this decrease may also be partially due to the different number of studies each year (**Figure 10.2**). Tree density has also decreased overall, although a slight increase was observed between the first and second samplings following treatment. Again, although this increase can likely be somewhat attributed to differences in ‘n’ values, it is largely driven by the South Beaver Year 5 and South Beaver Rocky Wash (**Figure 10.3**).

Herbaceous Understory: The herbaceous understories have increased overall in cover and frequency, although composition has fluctuated. Perennial grasses have dominated the understories prior to treatment and during the second post-treatment sampling. During the first sample year following treatment, however, the understories of these studies were dominated by a mixture of perennial and annual forbs and grasses. Again, it is important to notice the difference in the numbers of studies from sample year to sample year when analyzing this data. The studies driving these herbaceous trends vary. In general, much of the annual grass and forb cover during the first post-treatment sampling was contributed by the North Hills Bullhog, Greenville Bullhog, and Greenville Bench Bullhog 2 studies. In contrast, many of the sites had over 10% perennial grass cover, driving the overall perennial grass increase during the second post-treatment sample year (**Figure 10.6**, **Figure 10.7**).

Occupancy: Pellet group transect data indicates that overall average animal presence has increased over time. Deer have been the primary occupants in all sample years. However, mean pellet group abundance of deer has decreased each year while that of cattle has increased over the same time period. Generally speaking, mean abundance of deer pellet groups has ranged from 9 days use/acre during the second sample year following treatment to just over 12 days use/acre prior to treatment. Elk pellet groups have had a mean abundance ranging from 1 days use/acre before treatment to nearly 3 days use/acre during the first and second post-treatment samplings. Finally, cattle pellet groups have had a mean abundance as low as 1 days use/acre prior to treatment and as high as nearly 7 days use/acre in the second sample year after treatment (**Figure 10.8**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have been bullhogged and seeded has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to excellent condition, with most studies improving or remaining stable. Spanish George Spring, South Beaver Bullhog 2, Brown Spring, and Panguitch Creek are in very poor condition as of the most recent sample year. Yellow Jacket improved from very poor to very poor-poor, Above Elliker Basin remained in very poor-poor, and South Canyon 2 and South Beaver Year 7 improved from very poor to poor condition. The Greenville Bench Bullhog 2 study improved from very poor to fair condition, and North Hills Bullhog went from poor to fair. South Beaver Year 5 and North New Castle improved from poor to fair-good, and Duncan Creek/Hwy 56 went from poor to good-excellent. Studies that remained in fair condition include South Beaver Bullhog and Antimony PJ Reduction. South Beaver Bullhog Year 4 improved from fair to fair-good. South Beaver Rocky Wash went from fair-good to excellent, and DD Hollow remained in excellent condition. Finally, South Canyon was the only study that deteriorated from good to fair-good condition (**Figure 10.9**, **Table 10.1**).

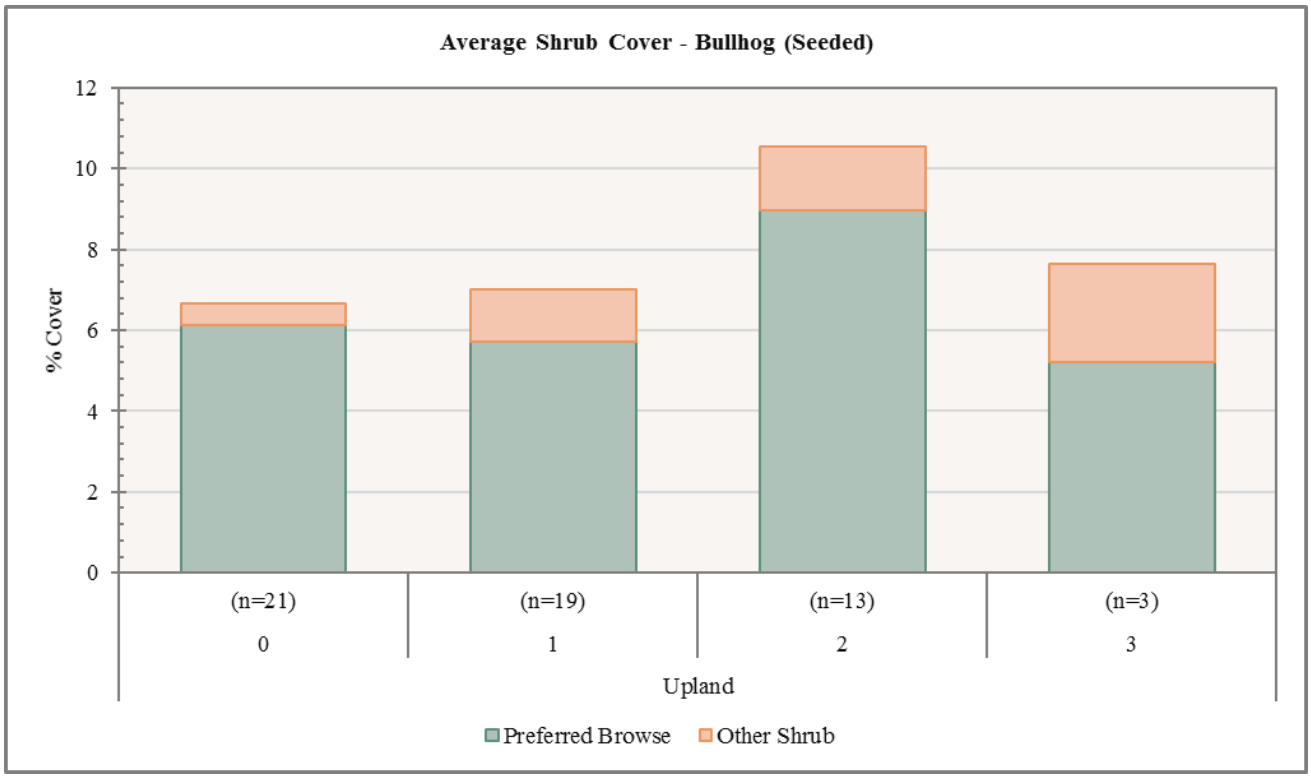


Figure 10.1: Average shrub cover on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

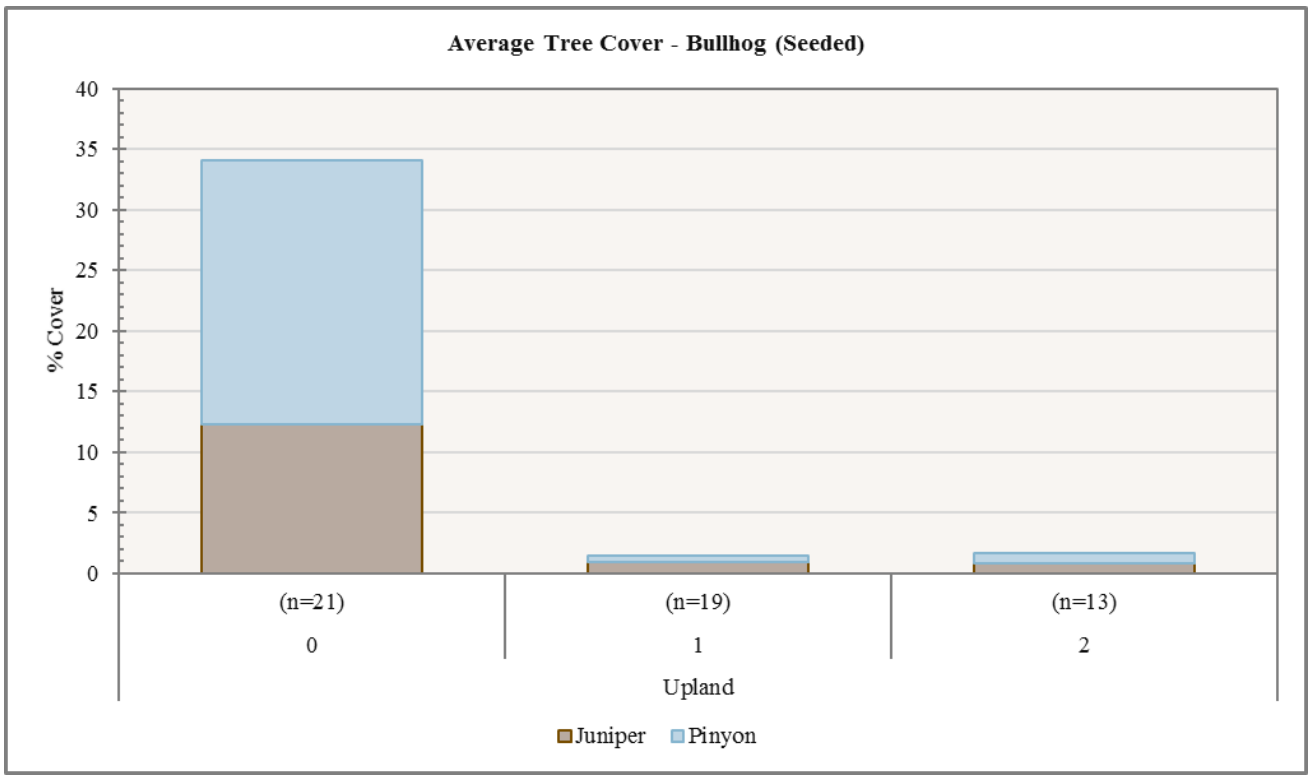


Figure 10.2: Average tree cover on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

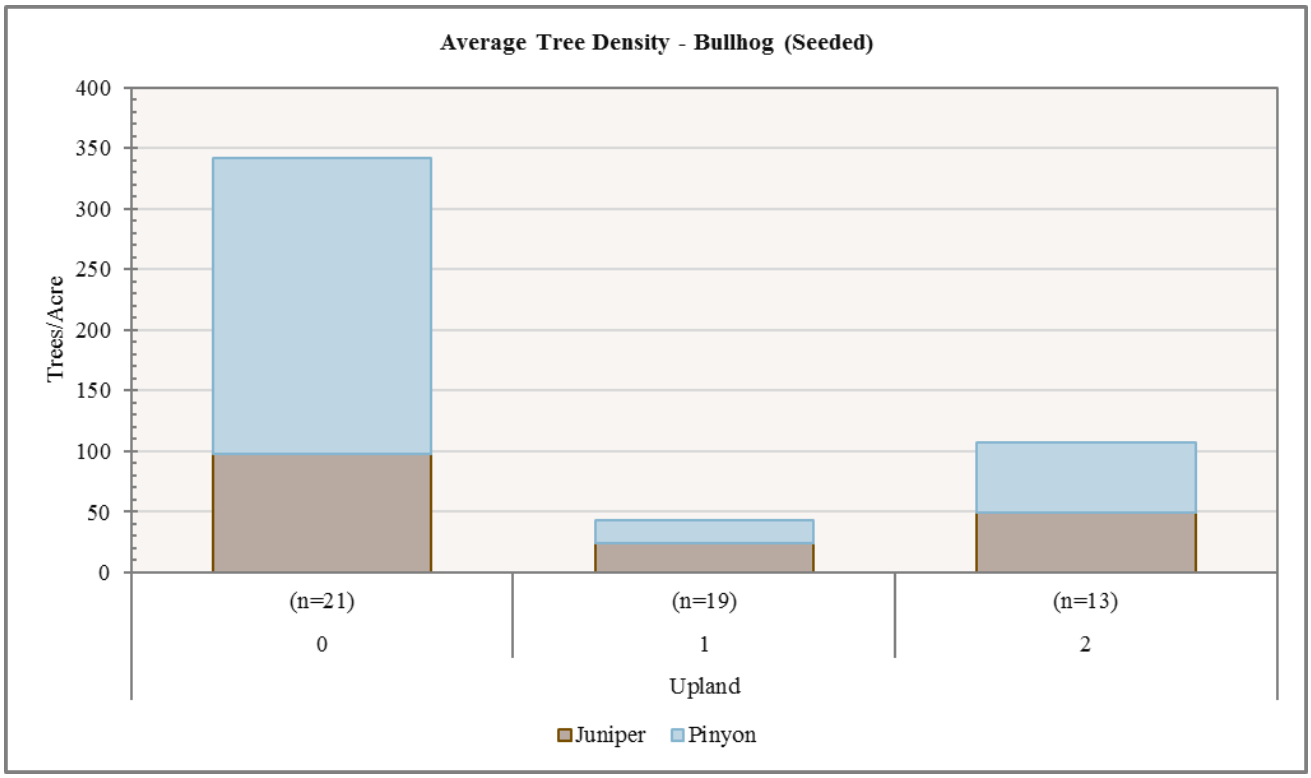


Figure 10.3: Average tree density on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

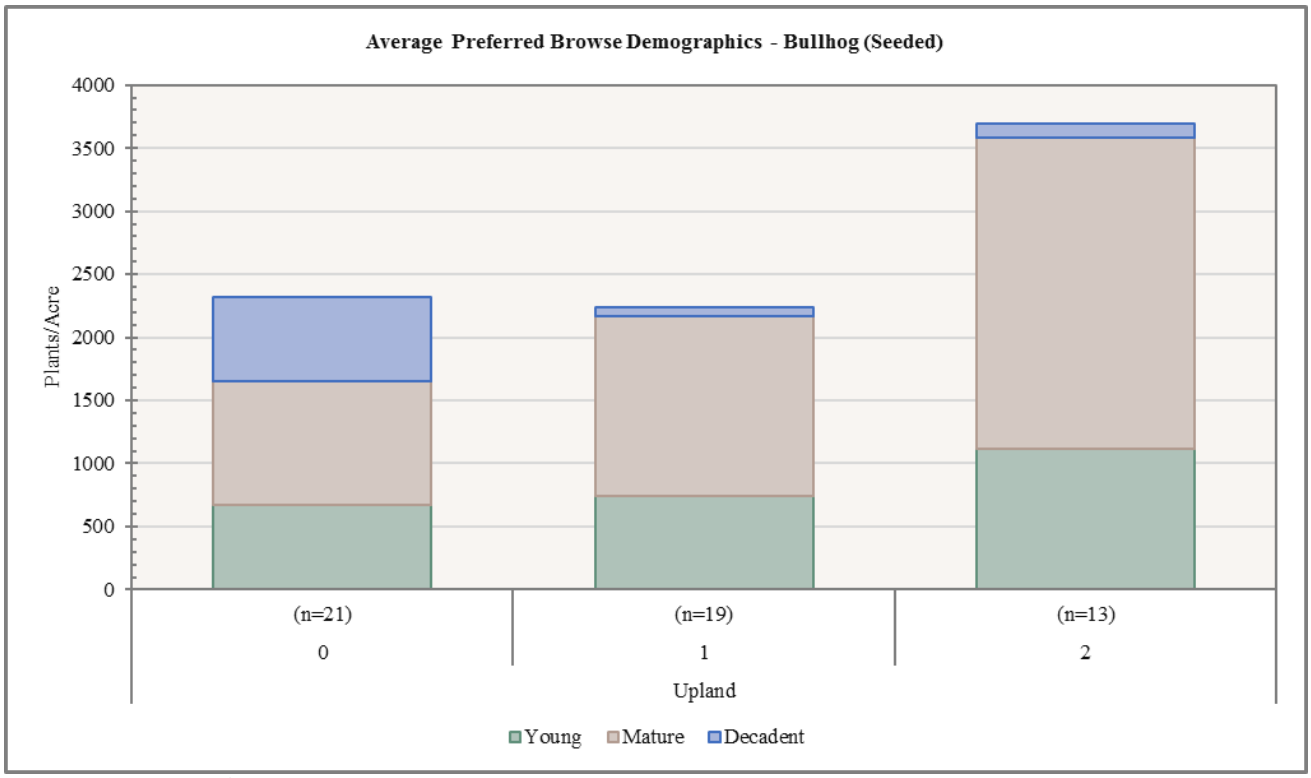


Figure 10.4: Average preferred browse demographics on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

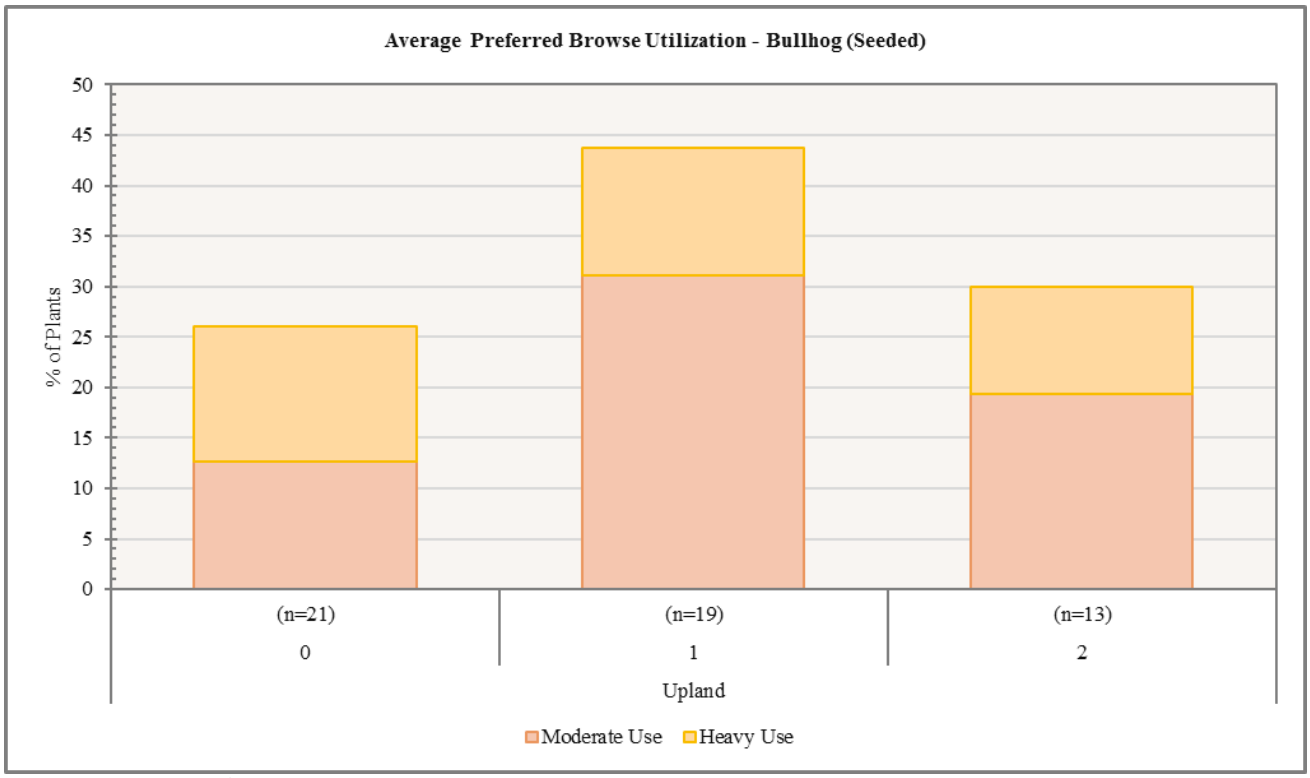


Figure 10.5: Average preferred browse utilization on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

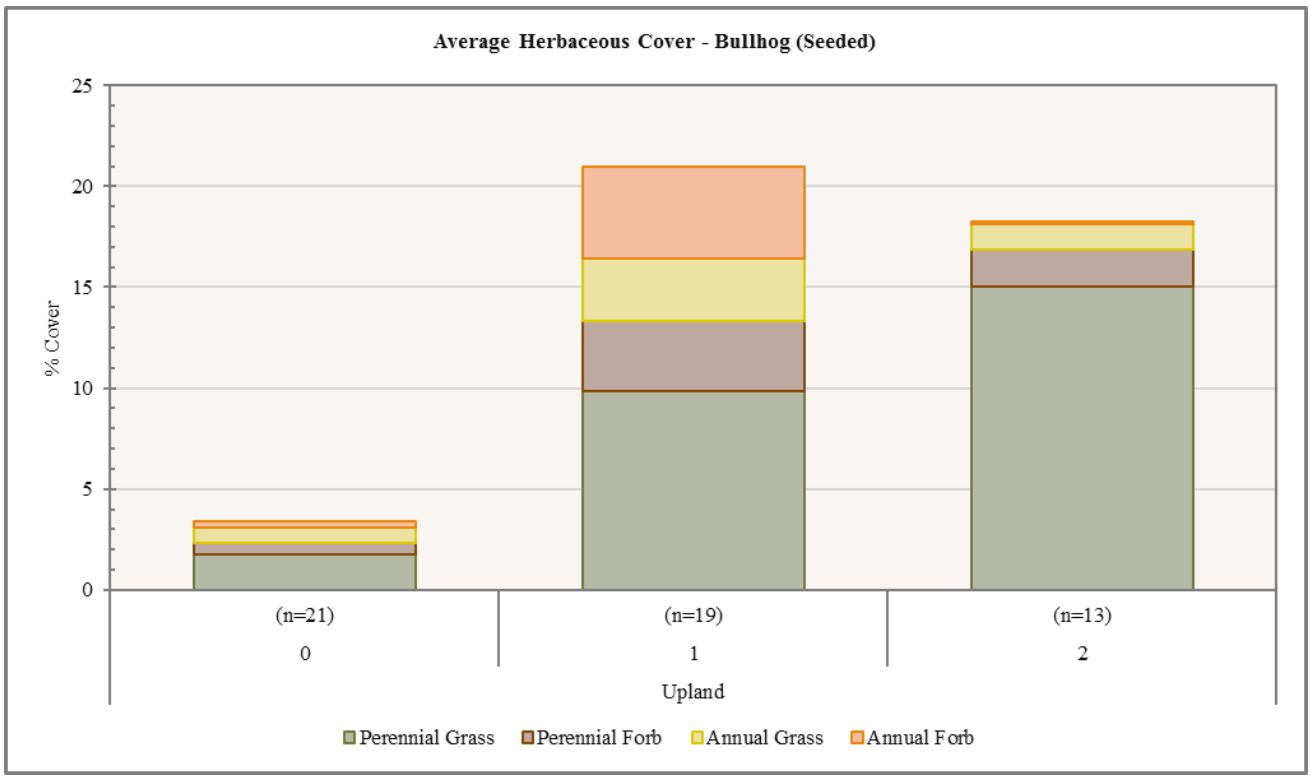


Figure 10.6: Average herbaceous cover on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

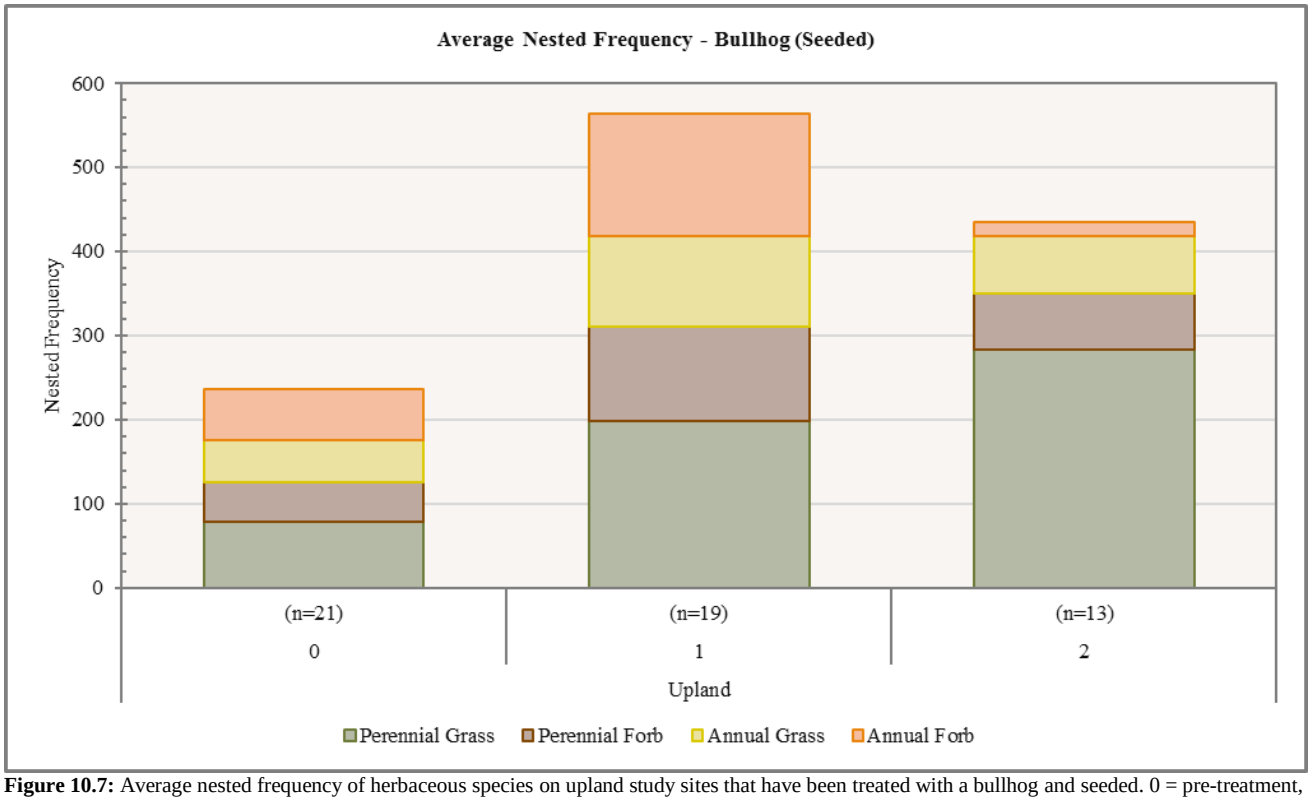


Figure 10.7: Average nested frequency of herbaceous species on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

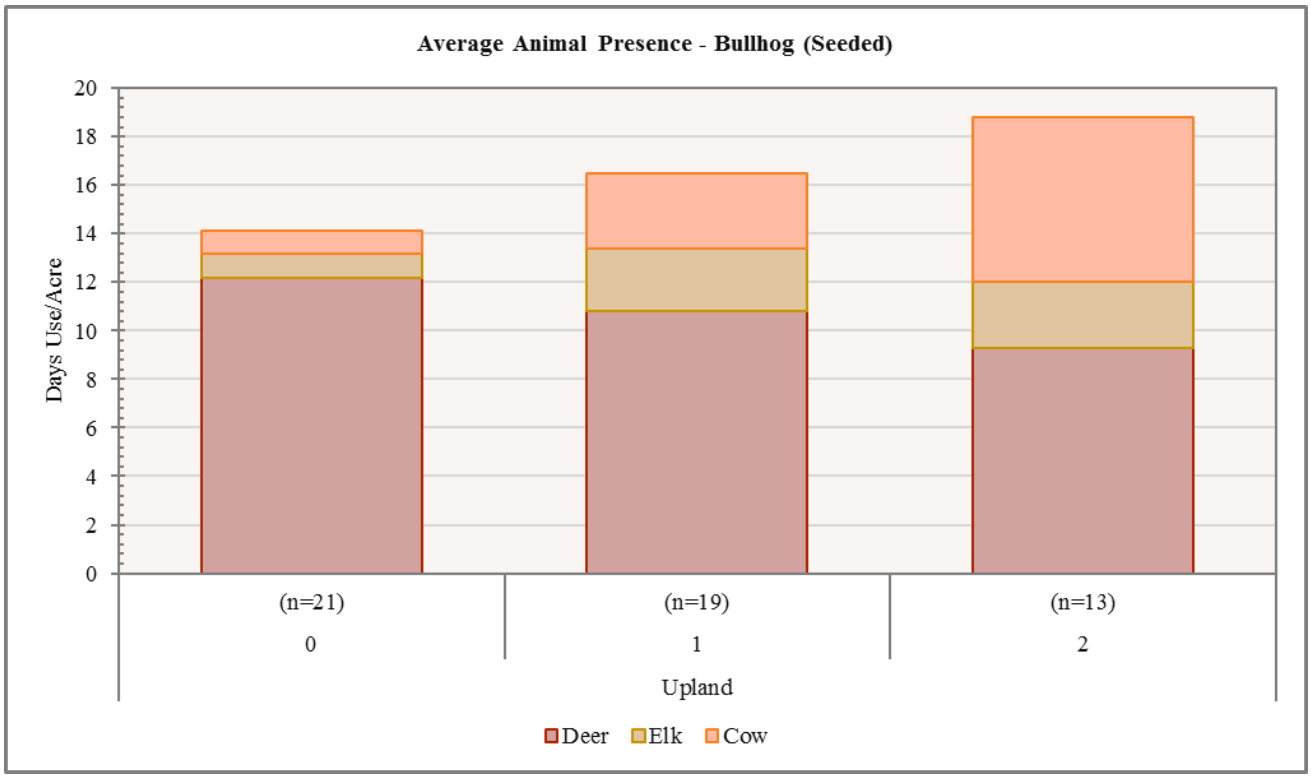


Figure 10.8: Average pellet transect data on upland study sites that have been treated with a bullhog and seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment. Upland deer pellets include deer/antelope.

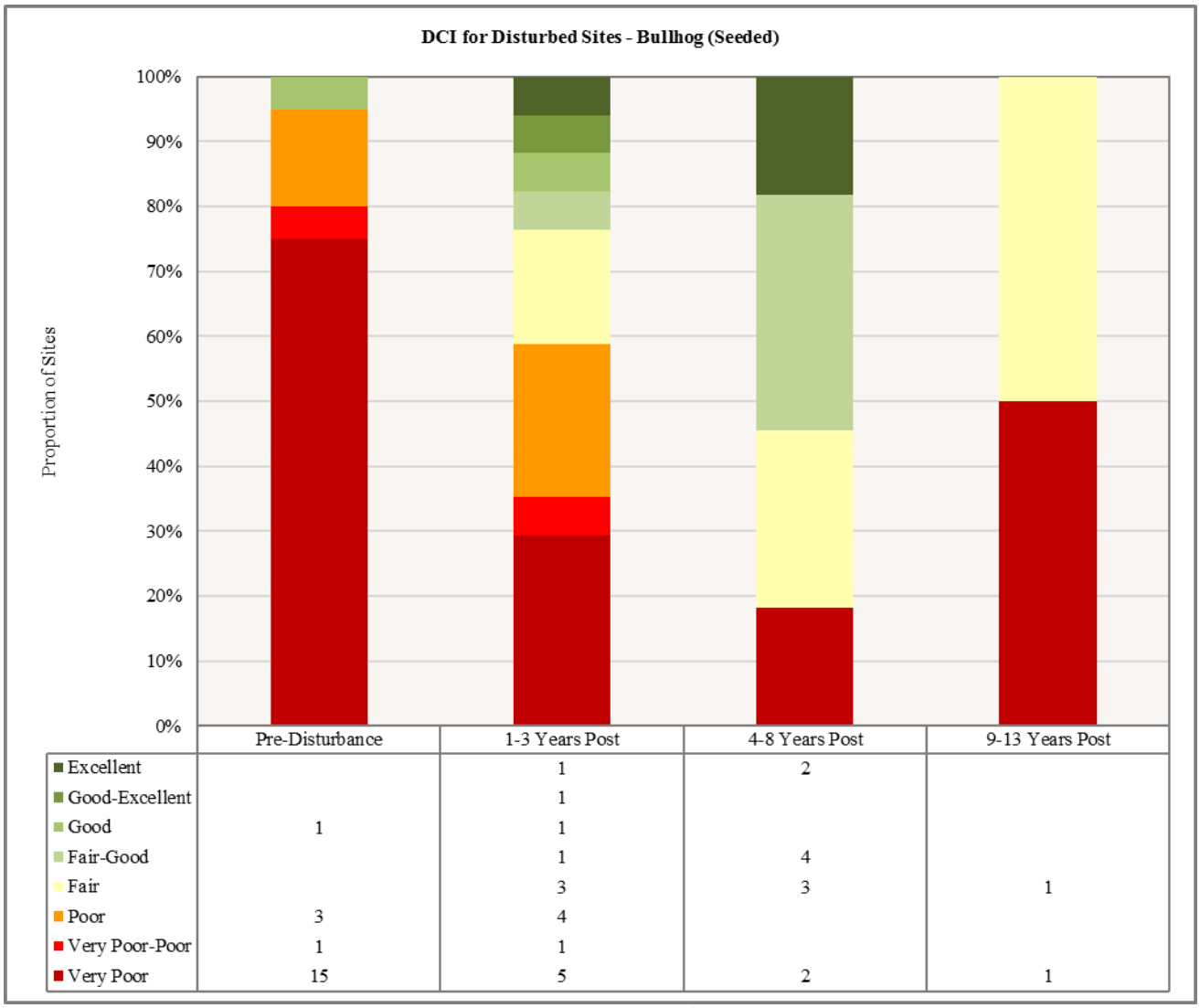


Figure 10.9: Deer winter range Desirable Components Index (DCI) summary by year of sites that have been treated with a bullhog and seeded.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20R-07	0	0.5	0	0	2.8	-0.1	0.4	0	**3.6**	**VP**
22R-10	0	10	2.8	2.5	2.5	-9.6	0.1	0	**8.2**	**VP**
22R-10	1	4.4	0	0	5.8	-1.2	0.2	0	**9.2**	**VP**
22R-10	2	8.1	14.7	4	30	-1.3	0.2	0	**55.6**	**F**
22R-10	3	9.4	11	3.3	30	-0.5	1	0	**54.2**	**F**
22R-12	0	0.3	0	0	0.2	-0.6	0.4	0	**0.2**	**VP**
22R-12	1	0	0	0	0.5	-4	7.5	0	**4**	**VP**
22R-12	2	0.1	0	0	17.6	-3	6.3	0	**21**	**VP**
22R-12	3	0.1	0	0	19.6	-3.8	3.8	0	**19.7**	**VP**
22R-13	0	4.6	0	0	0.2	0	0.2	0	**4.9**	**VP**
22R-13	1	5.5	0	0	14.5	-5.8	3.2	0	**17.4**	**VP**
22R-13	2	10.3	14.4	6.8	30	-0.8	0.7	0	**61.4**	**F**
22R-14	0	16	-3.1	1.9	12.7	-0.2	2.1	0	**29.4**	**VP**
22R-14	1	12.9	12.5	8.6	30	-5.2	6	0	**64.7**	**F-G**
22R-14	2	29	13.1	9.6	30	-0.3	4.2	0	**85.5**	**E**
22R-15	0	10.8	-7.2	2.2	0.3	0	1.6	0	**7.6**	**VP**
22R-15	1	8.3	13.4	7.5	14.1	-0.6	9.9	0	**52.5**	**F**
22R-15	2	10.9	6.3	9.8	28.6	-0.8	10	0	**64.8**	**F-G**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22R-20	0	4.4	0	0	3.1	-0.5	2.4	0	**9.3**	**VP**
22R-20	1	3.1	0	0	26.3	-0.1	9.4	0	**38.8**	**P**
22R-20	2	10.5	14.2	5.4	30	0	3.1	0	**63.2**	**F-G**
22R-23	0	7.6	0.4	3	0.7	-0.1	1.3	0	**13**	**VP**
22R-23	1	8.3	9.4	4.4	6.9	0	10	0	**38.9**	**P**
24R-11	0	11.7	4.8	3.3	3.8	0	0.2	0	**23.7**	**VP**
24R-11	1	8.1	15	2.7	28.4	0	4.6	0	**58.8**	**F**
24R-11	2	8.5	14.2	2.5	30	0	0.9	0	**56.2**	**F**
25R-11	0	3	0	0	0	0	0	0	**3**	**VP**
25R-11	1	3.8	0	0	0.8	0	10	0	**14.6**	**VP**
28-19	0	26.7	13.8	15	11.9	0	2	-2	**67.4**	**G**
28-19	1	27.5	14.8	15	26.2	0	1.6	0	**85.1**	**E**
28-19	2	30	14.9	15	26.9	0	1	0	**87.8**	**E**
28R-09	0	2.8	0	0	6.7	0	0.4	0	**9.9**	**VP**
28R-09	1	3.9	0	0	30	0	3.4	0	**37.3**	**P**
28R-13	0	1	0	0	0	0	0.2	0	**1.2**	**VP**
28R-13	1	2.9	0	0	2	0	10	0	**14.9**	**VP**
28R-13	2	4.6	0	0	7	0	1.2	0	**12.8**	**VP**
28R-19	0	13.1	8	15	2.8	0	0.9	0	**39.8**	**P**
28R-19	1	11.3	14.6	15	30	0	5	0	**75.9**	**G**
28R-19	2	10.3	14.5	11.1	30	0	0.7	0	**66.5**	**F-G**
28R-22	0	9.7	11.6	15	0.1	0	0.5	0	**36.8**	**VP-P**
29R-04	0	19.1	9.8	6.2	5.9	-0.6	0.2	0	**40.5**	**P**
29R-04	1	18.5	15	9	28.3	-12.6	1.6	0	**59.8**	**F**
29R-05	0	5.8	0	0	11.5	-0.1	2.4	0	**19.6**	**VP**
29R-05	1	2.8	0	0	25.9	-0.1	5.2	0	**33.8**	**VP-P**
29R-06	0	3.3	0	0	11.3	-1.6	6.3	0	**19.4**	**VP**
30R-04	0	5.8	0	0	10	-0.3	1.4	0	**16.9**	**VP**
30R-04	1	8.1	14.1	6.4	12.9	-6.6	4.2	0	**39.3**	**P**
30R-04	2	12	12.1	6.1	30	-1	5.7	0	**64.9**	**F-G**
30R-05	0	12.6	12.1	9.9	0	0	3.2	0	**37.7**	**P**
30R-05	1	9.5	15	15	30	-1.4	10	0	**78.1**	**G-E**

Table 10.1: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have been treated with a bullhog and seeded. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

Bullhog (Unseeded)

There are 10 study sites that were treated with a bullhog and not seeded during the report period. Of these studies, seven [Sheep Rock (22-07), Wide Canyon BLM (21B-09), Wide Canyon Bullhog (21R-02), Ezra Flat (21R-18), Johns Valley (24R-08), Johns Valley 2 (24R-09), and Newcastle Bullhog (30R-01)] are classified as upland ecological sites and three [City Creek (22R-24), North Slope (25C-04), and Varney-Griffin Chaining (25C-17)] are considered to be mountain ecological sites.

The Wide Canyon BLM study site is situated near Maple Hollow, southeast of the town of Holden. Wide Canyon Bullhog is located about one mile north of the Wide Canyon BLM site. Ezra Flat is situated north of Ezras Flat and Frogs Flat. The Sheep Rock study site can be found near Last Chance Bench north of Beaver, and City Creek is located west of the town of Junction. The Johns Valley and Johns Valley 2 are situated in the western portion of Johns Valley. North Slope can be found northeast of Boulder Mountain and Hickman Pasture, and the Varney-Griffin Chaining site is located near Whites Cove in the Escalante Mountains. Finally, the Newcastle Bullhog study is situated southwest of the town of Newcastle.

Shrubs/Trees: Preferred browse species have provided most of the cover in all sample years on mountain ecological sites. Shrub cover has fluctuated, with an initial decrease in the first sample year following

treatment and increases after that. Variation in number of study sites (the 'n value') in each sample year likely influences these trends; for example, data for the third post-treatment sample year is provided entirely by the Varney-Griffin Chaining study. On upland study sites, shrub cover has remained fairly stable overall, but has fluctuated from between sample years: again, this is at least in part due to the differing number of study sites from year to year. Other shrub species have been present in varying amounts throughout the study period, but are typically a minor part of the shrub component (**Figure 10.10**). Overall density of preferred browse has steadily increased on mountain study sites, with Varney-Griffin Chaining providing all of the data in the third post-treatment sampling. Mature plants have been the dominant demographic in most sample years. However, young plants comprised a majority of the populations during the second post-treatment sampling: this increase in young plants can again be largely attributed to the Varney-Griffin Chaining study. Upland study sites have fluctuated slightly from year to year, but have remained largely consistent overall (**Figure 10.13**). Average utilization of preferred browse on mountain ecological sites has increased overall. A marked decrease in utilization was observed during the second post treatment sampling. However, nearly 50% of plants were moderately to heavily used in the third sample year following treatment. Again, these trends are mostly driven by the Varney-Griffin Chaining study (**Figure 10.14**).

As is expected on sites treated with a bullhog, both tree cover and density decreased in the first sample year following treatment. Both upland and mountain ecological sites have displayed slight increases in the second and third post-treatment sample years (**Figure 10.11**, **Figure 10.12**).

Herbaceous Understory: The herbaceous understory on mountain study sites has exhibited minor fluctuations in both cover and frequency on mountain sites, but has remained generally stable. Again, trends for the third post-treatment sampling are entirely driven by the Varney-Griffin Chaining study. Perennial grasses have contributed the most cover of any herbaceous component on mountain ecological sites. Native species provide much of this perennial grass cover on the City Creek and North Slope studies. However, the introduced species crested wheatgrass (*Agropyron cristatum*) provides the most cover of any single species on the Varney-Griffin Chaining study. Composition of the understories on upland ecological sites has fluctuated. Perennial grasses contributed the most cover on prior to and in the first sample year following treatment, while annual and perennial grasses were co-dominant in the second post-treatment year, and annual grasses dominated in the third post-treatment sample year. This increasing trend in annual grasses is likely driven in part by variations in study number (**Figure 10.15**, **Figure 10.16**).

Occupancy: Pellet group transect data indicates that average animal presence has decreased overall on both mountain and upland ecological sites. On mountain ecological sites, elk have been the primary occupants: mean abundance of elk pellet groups has ranged from nearly 15 days use/acre in the first post treatment sample year to 33.5 days use/acre during the third sampling following treatment. Deer have also been present, with a mean pellet group abundance as low as just over 1 days use/acre in the first sample year following treatment and as high as nearly 23 days use/acre prior to treatment. Finally, cattle had a mean pellet group abundance ranging from 0 days use/acre in the third post-treatment sample year to nearly 7 days use/acre prior to treatment (**Figure 10.17**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have been treated has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to good condition, with all studies improving or remaining stable. The Sheep Rock study remained in very poor-poor condition, while Newcastle Bullhog improved from very poor to poor-fair. Wide Canyon BLM remained in poor condition. The Wide Canyon and Ezra Flat studies remained in poor-fair condition, while Johns Valley 2 and Varney-Griffin Chaining remained in fair-good condition. Finally, the City Creek and Johns Valley studies improved from fair to good condition (**Figure 10.18**, **Table 10.2**).

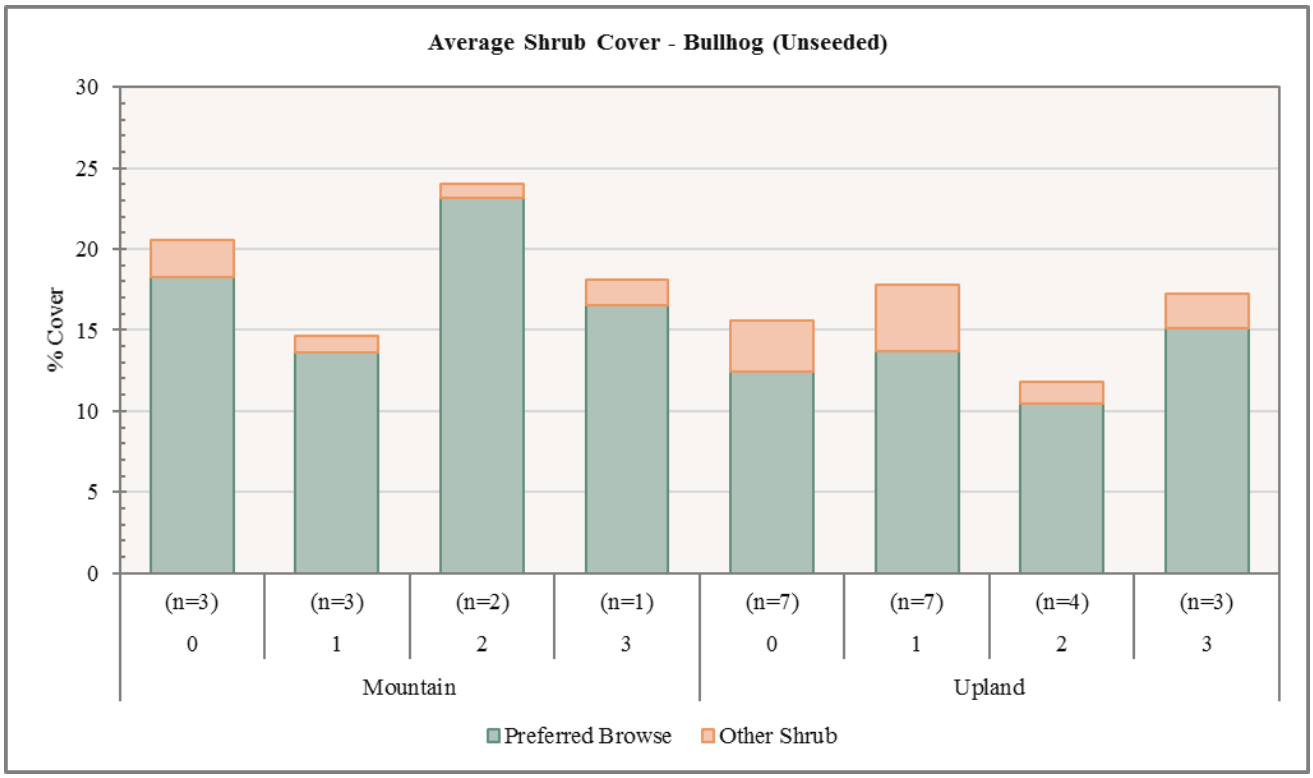


Figure 10.10: Average shrub cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

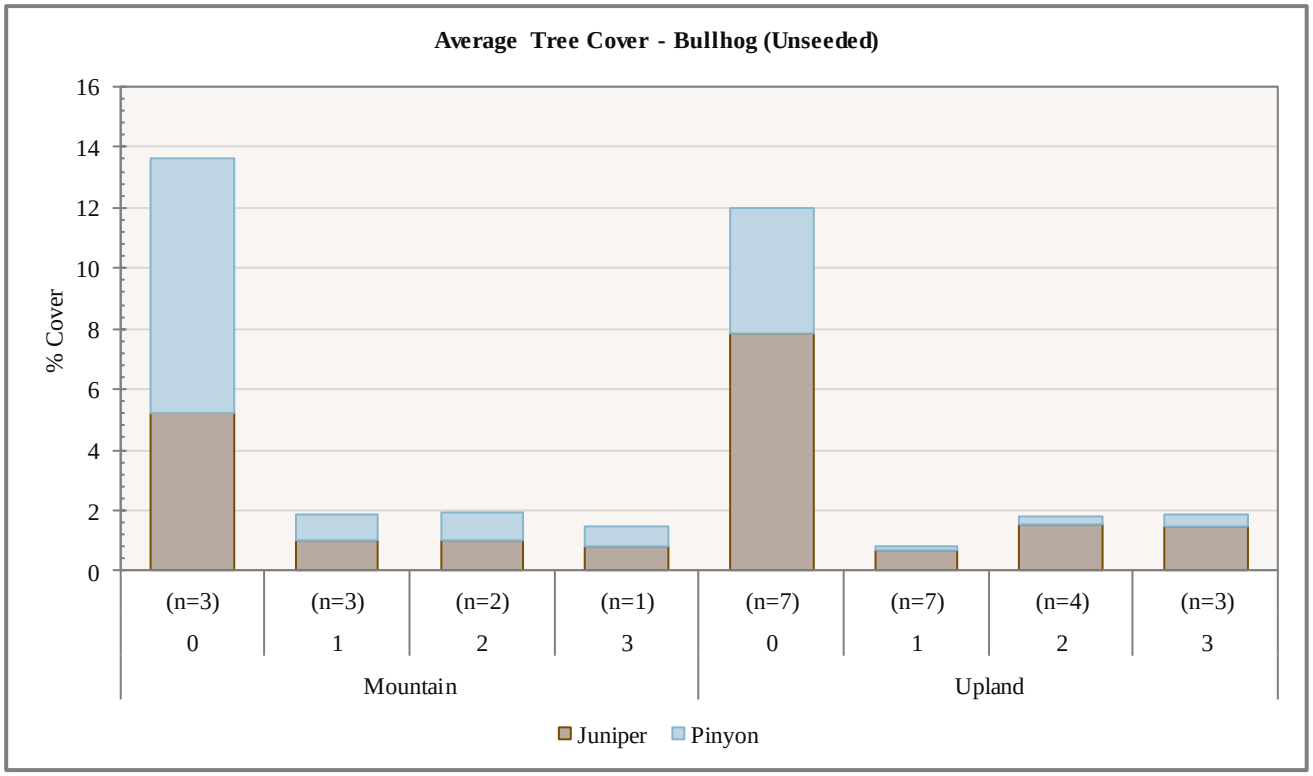


Figure 10.11: Average tree cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

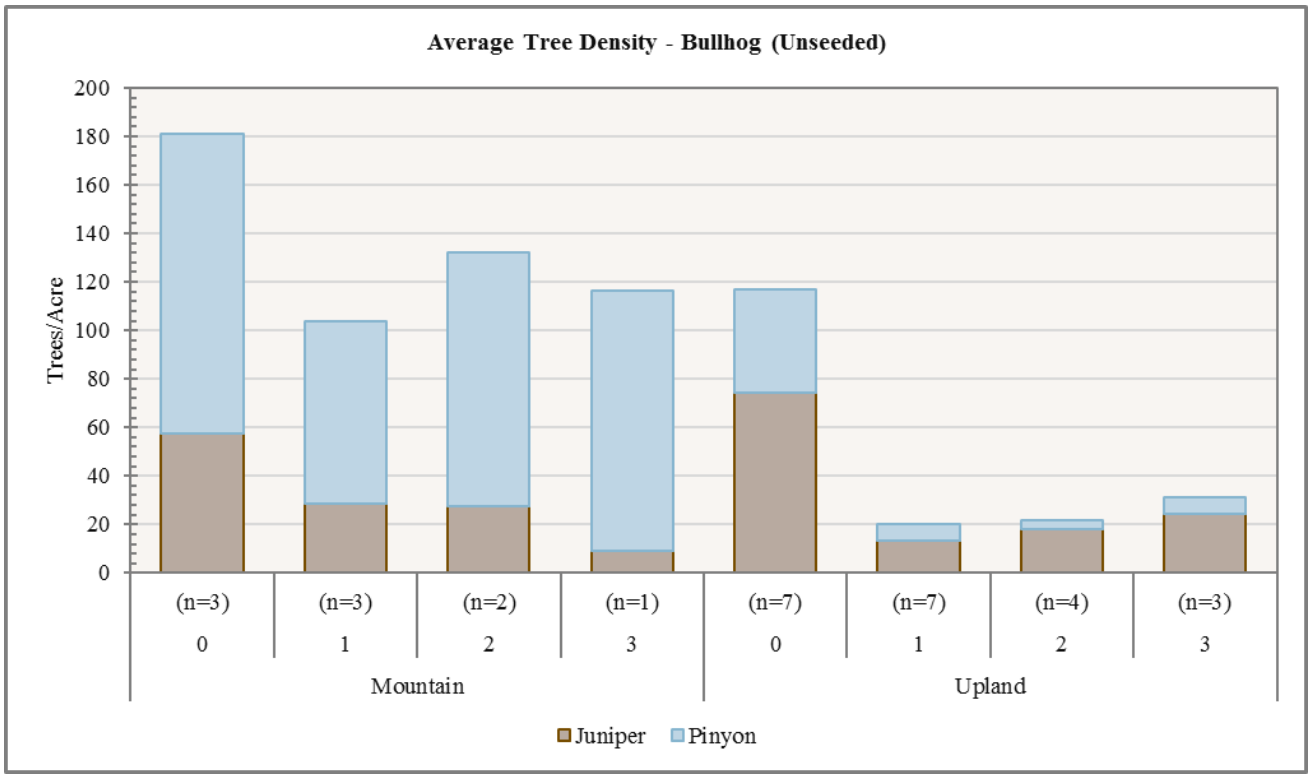


Figure 10.12: Average tree density on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

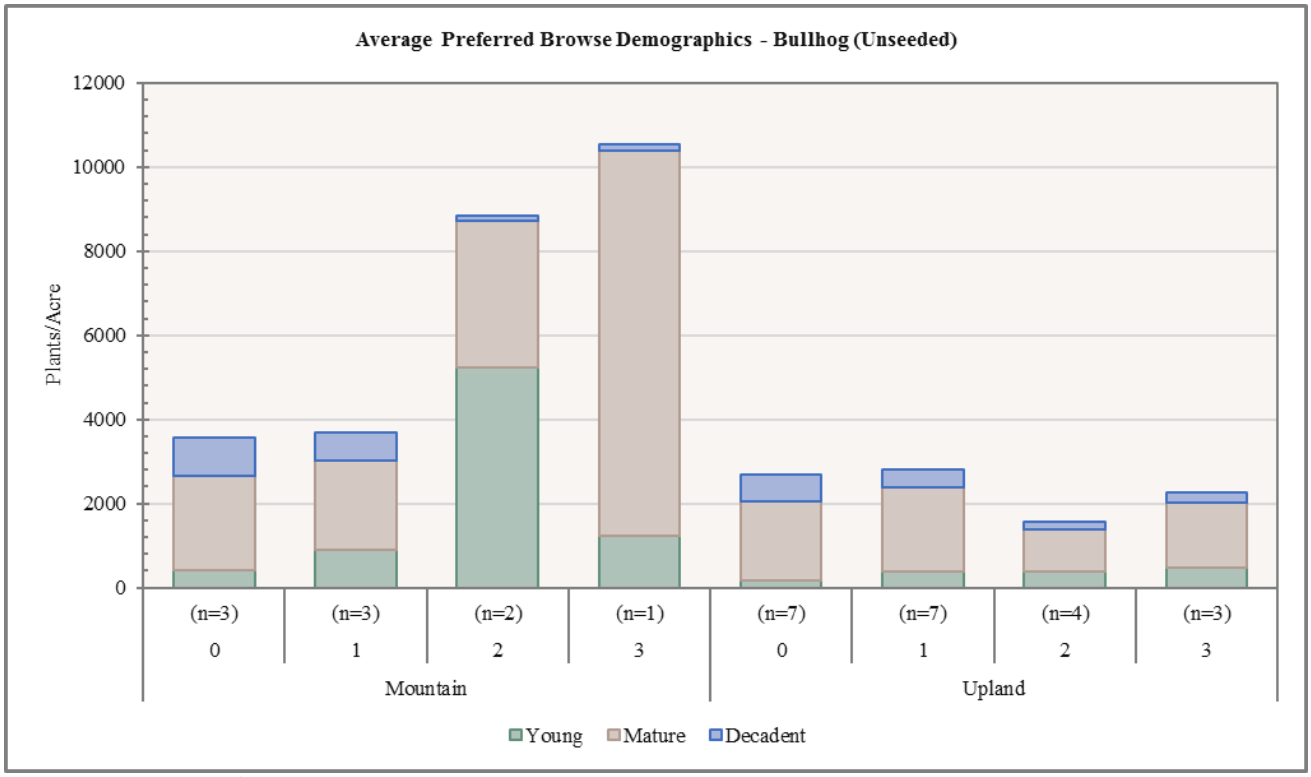


Figure 10.13: Average preferred browse demographics on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

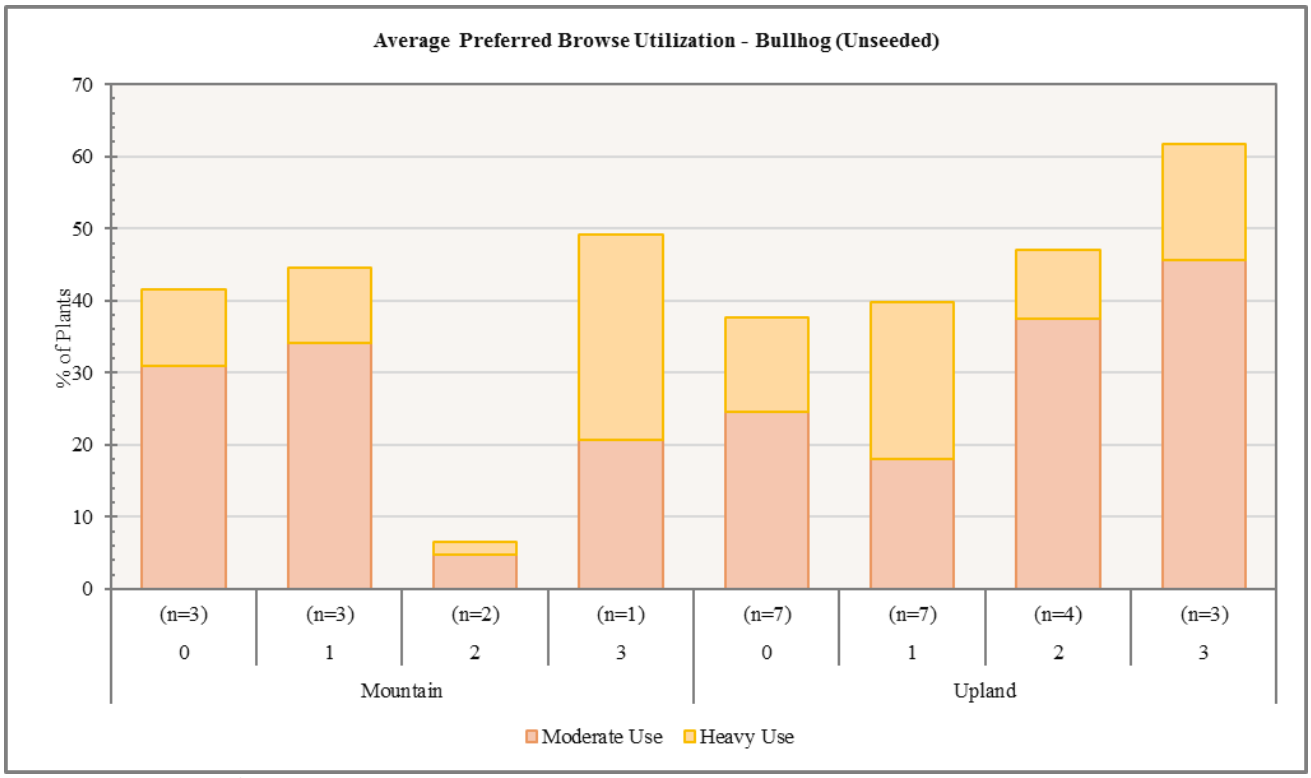


Figure 10.14: Average preferred browse utilization on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

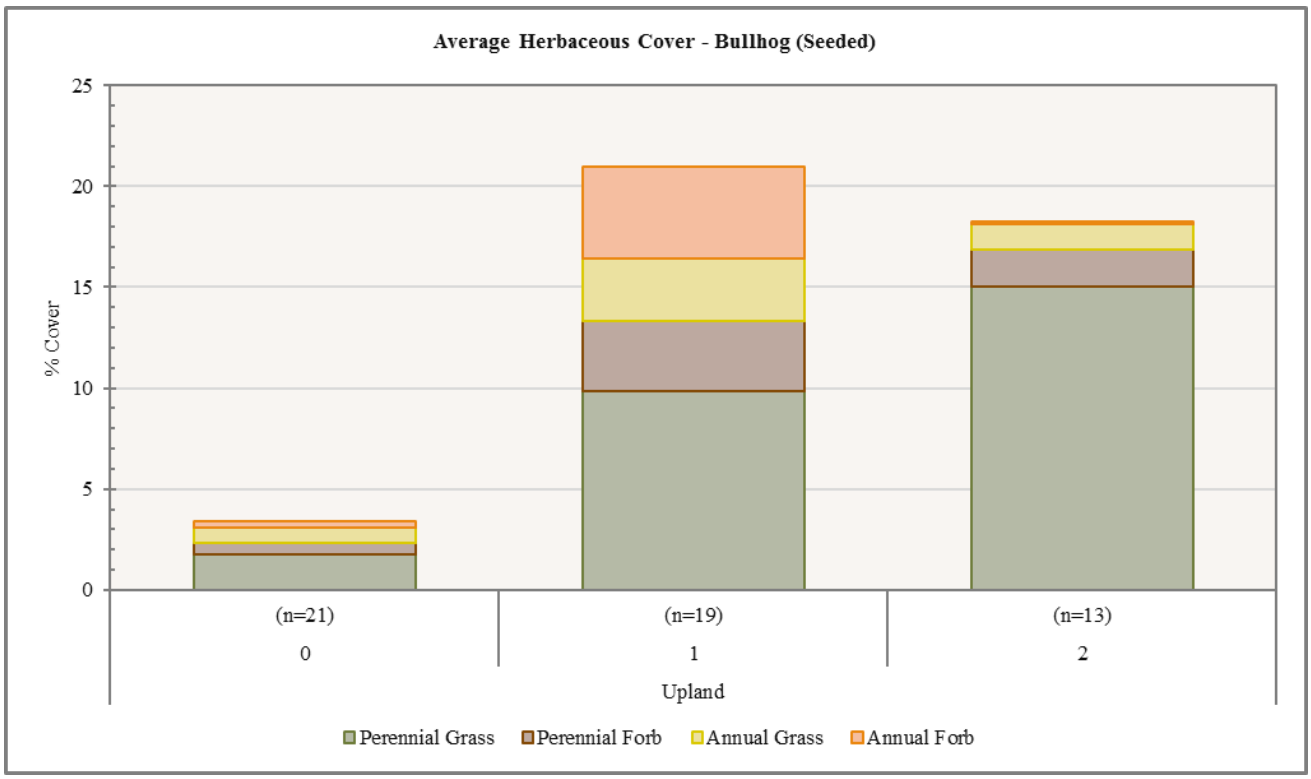


Figure 10.15: Average herbaceous cover on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

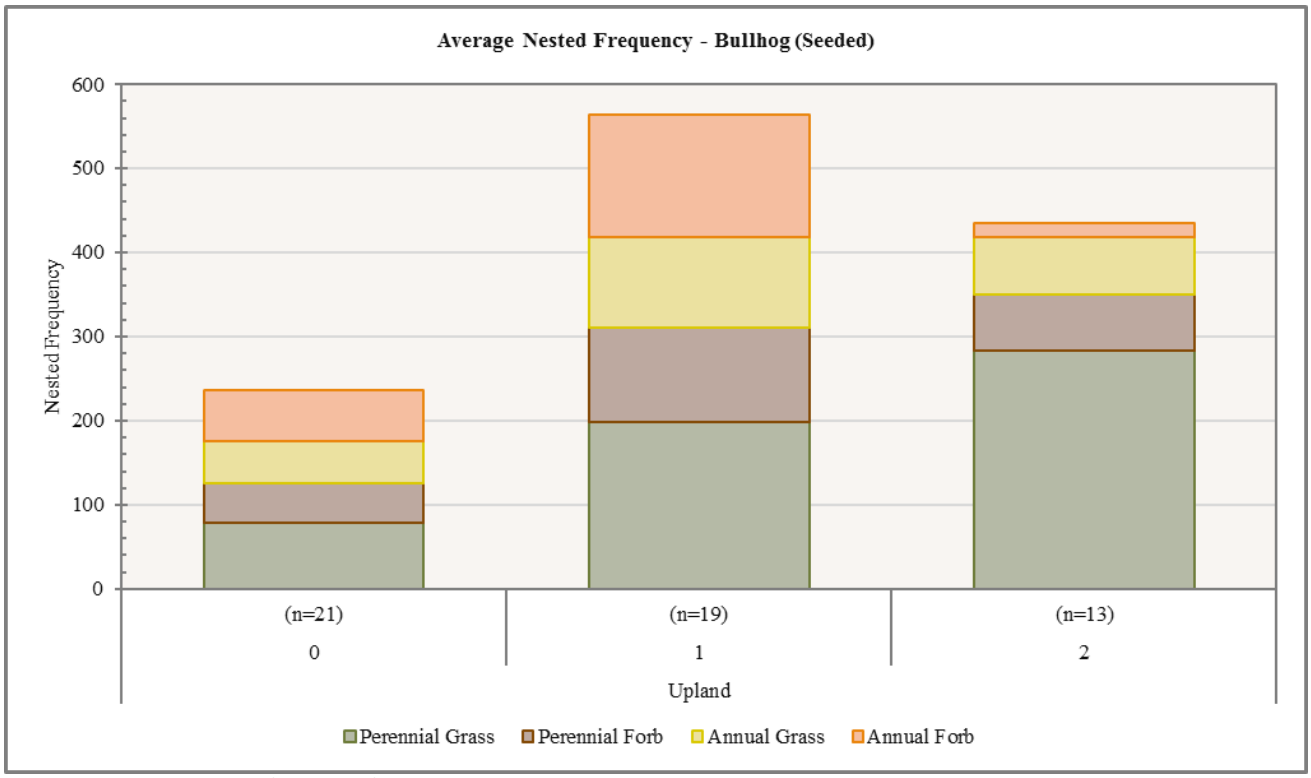


Figure 10.16: Average nested frequency of herbaceous species on mountain and upland study sites that have been treated with a bullhog. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

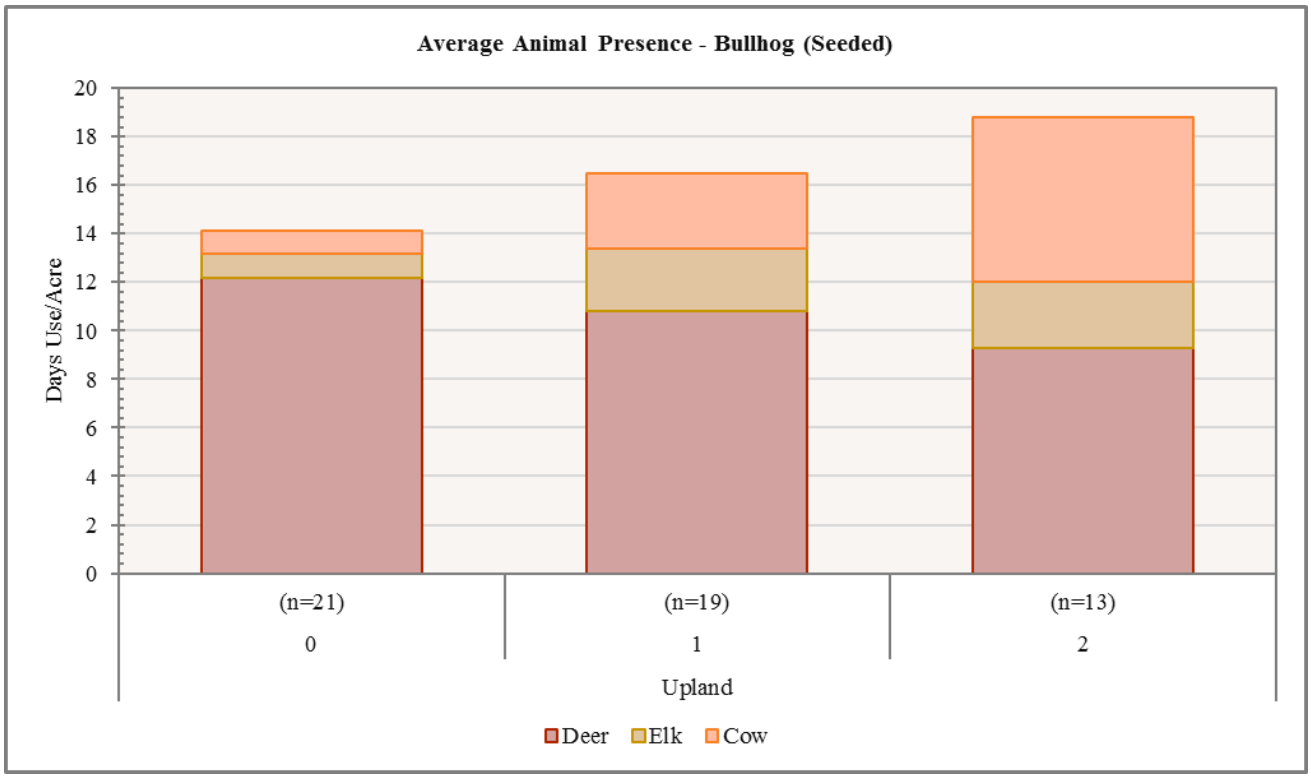


Figure 10.17: Average pellet transect data on mountain and upland study sites that have been treated with a bullhog, 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment. Upland deer pellets include deer/antelope.

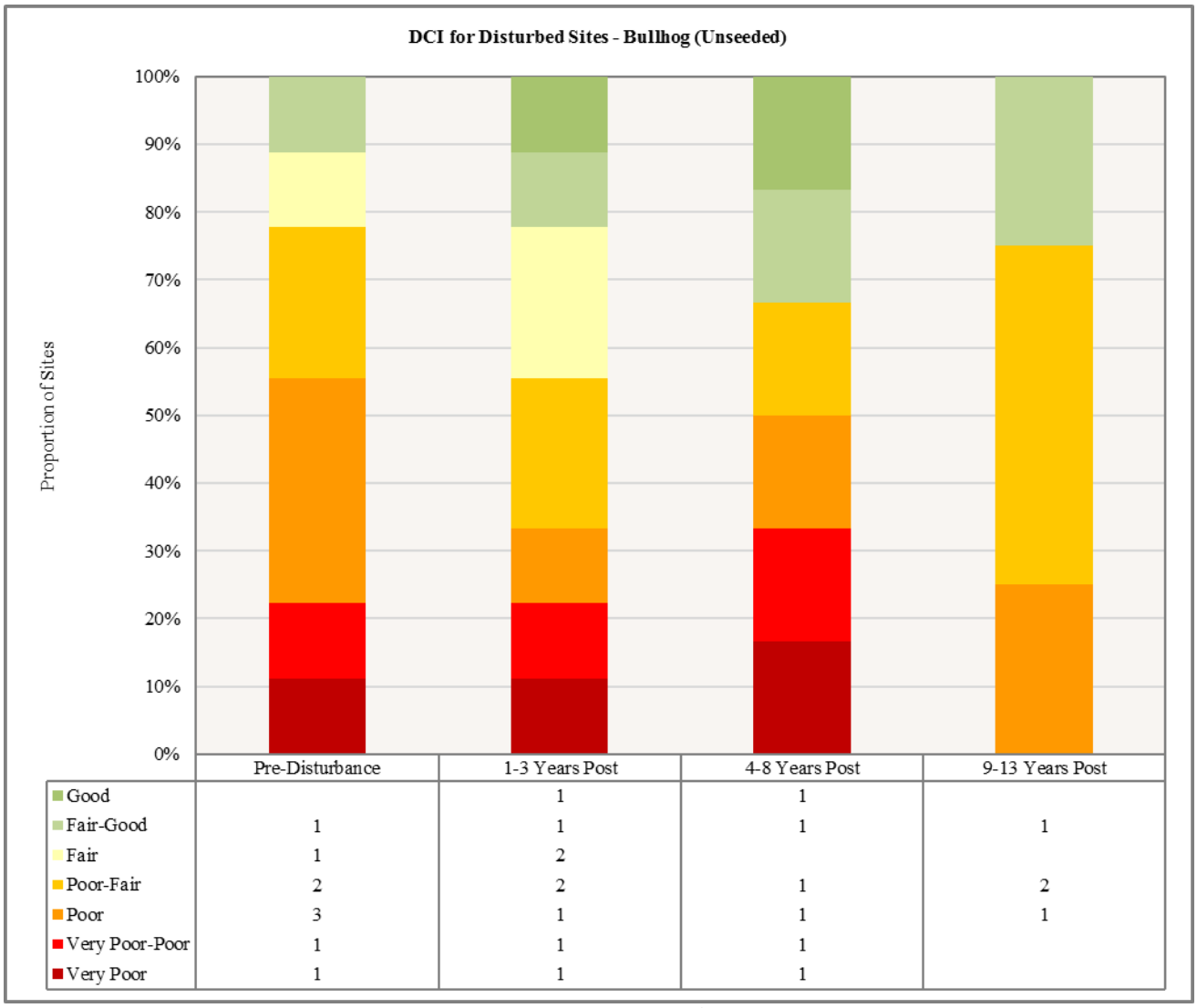


Figure 10.18: Deer winter range Desirable Components Index (DCI) summary by year of sites that have been treated with a bullhog.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21B-09	0	30	11.4	0.7	15	-14.2	0.3	0	**43.2**	**P**
21B-09	1	30	7.3	15	8.1	-13.1	0	0	**47.3**	**P**
21B-09	2	23.3	10.4	5.1	23.5	-16.3	0.1	0	**46.1**	**P**
21B-09	3	30	10	1.8	15	-20	0.4	0	**37.1**	**P**
21R-02	0	13.6	9.5	5.5	12.7	-2.2	1.3	0	**40.5**	**P**
21R-02	1	10.9	10.6	5.2	26.8	-3.4	1.8	-2	**49.9**	**P-F**
21R-02	2	15.5	9.1	7.2	17	-0.6	3.4	0	**51.7**	**P-F**
21R-02	3	13.6	10.9	4.9	20.2	-1.1	3.5	0	**52**	**P-F**
21R-18	0	27.3	10.6	6.4	1.4	0	3.5	0	**49**	**P-F**
21R-18	1	28.5	11.6	6.5	1	0	2	0	**49.5**	**P-F**
22-07	0	2.4	0	0	30	-0.7	5.2	0	**36.9**	**VP-P**
22-07	1	3.1	0	0	30	-1.5	2.6	0	**34.2**	**VP-P**
22-07	2	4.2	0	0	30	-0.7	0.9	0	**34.4**	**VP-P**
22R-24	0	30	5.9	5.6	11	0	1.4	0	**53.9**	**P-F**
22R-24	1	18.2	12.7	8.7	25.6	-1	1.3	0	**65.5**	**F**
22R-24	2	30	14.3	5.9	30	0	0.9	0	**81.1**	**G**
24R-08	0	19.8	5.7	2.6	26.5	0	3.4	0	**58**	**F**
24R-08	1	24	12.8	6.1	30	0	1.6	0	**74.4**	**G**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
24R-09	0	14	12.4	1.9	29.9	0	7.8	0	**65.9**	**F-G**
24R-09	1	15.6	10.1	3	30	0	5.3	0	**64**	**F-G**
25C-17	0	17.2	11.2	2.6	10.8	0	9.4	0	**51.3**	**P**
25C-17	1	11.7	9.2	15	20.5	0	4.3	0	**60.8**	**F**
25C-17	2	20.5	14.8	15	17	0	1.2	0	**68.6**	**F-G**
25C-17	3	20.1	14.7	4.9	27.8	0	1.8	0	**69.3**	**F-G**
30R-01	0	5.7	0	0	11.1	-0.1	0.1	0	**16.7**	**VP**
30R-01	1	11.1	8.1	5.9	17.6	-12.2	1.2	0	**31.7**	**VP**
30R-01	2	11.7	13.1	15	8.8	-20	1	0	**29.5**	**VP**
30R-01	3	16	12.3	15	10.6	-3.9	0.5	0	**50.5**	**P-F**

Table 10.2: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have been treated with a bullhog. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

Chaining

Sixteen study sites have undergone a chaining treatment during the study period. Of these studies, two [Pioneer Creek (21R-17) and UKC Thompson Creek (27R-23)] are considered to be mountain ecological sites and 14 [Bone Hollow (22-05), Bear Ridge (23-01), Bowler Chaining (20R-03), Salt Cabin (20R-05), Spanish George Spring 2 (20R-08), Miners Cabin Wash (20R-09), Wide Canyon DWR (21B-10), Wide Mouth Canyon (21R-14), Wide Mouth Canyon 2 (21R-16), South Beaver SITLA Chaining (22R-11), Glenwood Chaining (23R-12), Circleville (24R-13), Parker Front (25R-10), and Hatch Bench (27R-20)] are classified as mountain ecological sites.

The Bowler Chaining study site can be found near Pine Creek in the southern end of Hamlin Valley. Salt Cabin is also found in Hamlin Valley and is near Salt Cabin Spring Wash. The Spanish George Spring 2 study is in the southern end of Hamlin Valley near Spanish George Spring, and Miners Cabin Wash is further north in the valley near Miners Cabin Wash. Wide Canyon DWR is located east of the town of Holden near the mouth of Wide Canyon, and the Wide Mouth Canyon study is situated southeast of the town of Kanosh near I-15. Wide Mouth Canyon 2 is near Baker Canyon in the Pahvant Range. The Pioneer Creek study is situated just south of Pioneer Creek which is northeast of the town of Fillmore. Bone Hollow can be found on the Table Grounds near Bone Hollow, and South Beaver SITLA Chaining is on Coyote Bench south of the city of Beaver. On Bear Ridge near Kings Meadow Canyon is the Bear Ridge study, and the Glenwood Chaining study can be found just to the north in Kings Meadow Canyon. Circleville is located southwest of the town of Circleville. The Parker Front study is situated on the lower west-facing slopes of Parker Mountain, and the Hatch Bench study can be found on the benches southwest of the town of Hatch. Finally, the UKC Thompson Creek study site located southwest of Bald Knoll on the Skutumpah Terrace.

Shrubs/Trees: Average shrub cover displayed a decrease on mountain study sites in the first year following treatment. A majority of the shrub cover is contributed by Gambel oak (*Quercus gambelii*) on the Pioneer Creek study: cover of oak decreased on this site in the first post-treatment sample year, driving the overall trend for this ecological type. On upland sites, average total shrub cover has displayed minor increases over time: this trend can largely be attributed to increasing cover on many of the studies as well as the differing number of studies each sample year (**Figure 10.19**). Average preferred browse demographics indicate that browse density has increased on mountain study sites following treatment. Mature plants comprised a majority of the plant populations on these sites prior to treatment, but young plants were most abundant following treatment; both Pioneer Creek and UKC Thompson Creek exhibited increases in young plants. Density on upland study sites has increased each sample year following treatment, and mature plants have been the most abundant demographic in most sample years. The exception to this is the third sample year following treatment, in which young and mature plants were co-dominant: this increase in young plants can mostly be attributed to the Bowler Chaining and Panguitch Creek WMA Studies (**Figure 10.22**). Mean utilization of

preferred browse species on mountain study sites has increased following treatment, but has remained low overall. Utilization on upland sites has fluctuated, but exhibited a general decrease from pre-treatment levels; on average, approximately 25% of plants were moderately to heavily browsed in the third sample year following treatment (**Figure 10.23**).

Average tree cover and density have generally decreased on both mountain and upland ecological sites following treatment. Juniper (*Juniperus sp.*) and pinyon (*Pinus sp.*) were co-dominant on these studies prior to treatment, but juniper has provided most of the density and cover in post-treatment years. On upland study sites, most of the tree cover was contributed by the Salt Cabin and Wide Canyon DWR studies during the third sample year following treatment. This is not indicative of an absence of trees on other study sites, however; closer analysis of density data on a site level reveals that trees were present on a majority of the upland studies during the same year (**Figure 10.20**, **Figure 10.21**).

Herbaceous Understory: Average herbaceous cover and frequency have increased overall on both mountain and upland study sites. Mountain sites have had understories that are fairly heterogeneous, being composed of a mixture of annual and perennial forbs and grasses. On upland study sites, however, perennial grasses have contributed most of the herbaceous cover throughout the study period. During the first post-treatment sample year, however, a mixture of perennial forbs and annual forbs and grasses provided most of the understory cover. Most of the annual grass cover that year was contributed by the Wide Mouth Canyon and Dry Creek Chaining studies (**Figure 10.24**, **Figure 10.25**).

Occupancy: Average animal presence has exhibited an increase on mountain study sites. Deer have been the primary occupants in all sample years, with a mean pellet group abundance of 7 days use/acre before treatment and 11 days use/acre in the first sampling after treatment. Mean abundance of elk pellet groups was 3 days use/acre prior to treatment and 6 days use/acre after treatment. Mean abundance of cattle pellet groups was 2 days use/acre before the chaining treatment and less than 1 days use/acre in the first sample year afterwards.

Average animal presence has also increased overall on upland study sites; the marked increase during the second post-treatment year is entirely due to the Wide Canyon DWR study. Deer have been the primary occupants throughout the study period, with a mean abundance ranging from 17 days use/acre prior to treatment to 49 days use/acre in the second sample year following treatment. Elk pellet groups have had a mean abundance as low as 2 days use/acre in the first post-treatment year and as high as 8 days use/acre during the second sampling after treatment. Cattle have also been present, with average pellet group abundance fluctuating between 1 days use/acre prior to treatment and 5 days use/acre in the first post-treatment sampling. Finally, mean abundance of horse pellet groups has ranged from 0 days use/acre during the first sample year following treatment to 3 days use/acre in the third post-treatment year (**Figure 10.26**).

Deer Winter Range Condition Assessment: Over the sample period, the condition of deer winter range on sites that have undergone a harrow treatment has continually changed. These sites within the Southern Region are considered to be within very poor to good-excellent condition, with most studies remaining stable or exhibiting minor fluctuations. The Spanish George Spring 2, Miners Cabin Wash, Dry Creek Chaining, Wide Mouth Canyon, Wide Mouth Canyon 2, Glenwood Chaining, and Circleville studies have remained in very poor condition. Bone Hollow improved from very poor to poor, and South Beaver SITLA Chaining remained in poor condition. The Wide Canyon DWR and Pioneer Creek studies remained in fair condition, while Salt Cabin improved from poor to fair-good. Bear Ridge improved from fair to good condition, Parker Front went from poor to good, and Bowler Chaining improved from poor to good-excellent condition (**Figure 10.27**, **Table 10.3**).

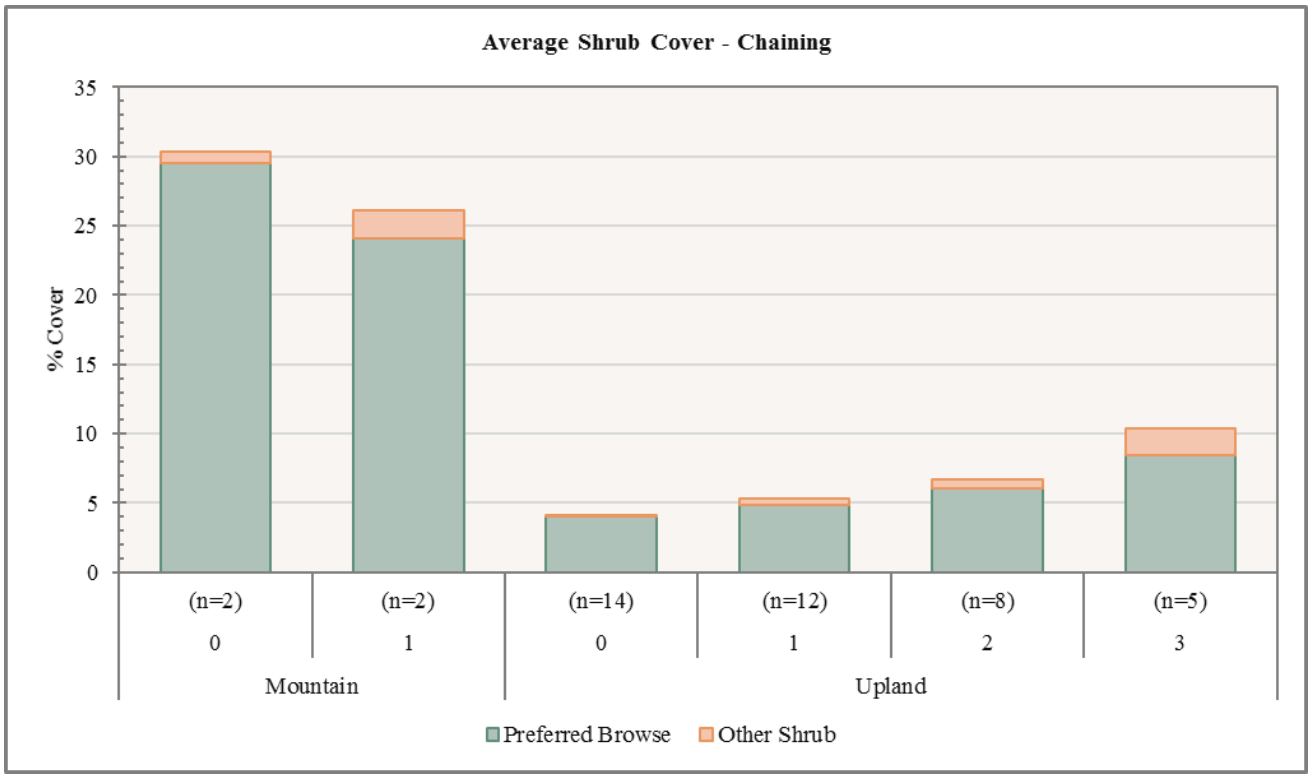


Figure 10.19: Average shrub cover on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

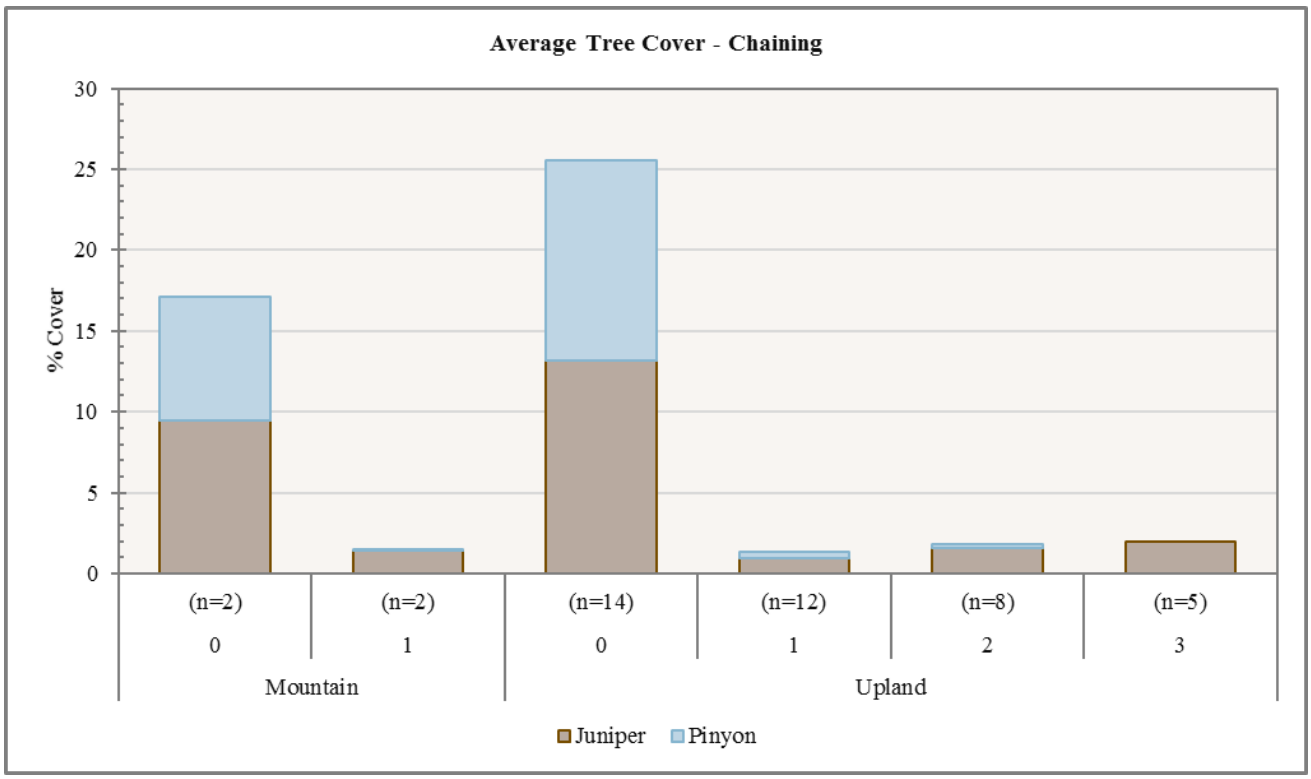


Figure 10.20: Average tree cover on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

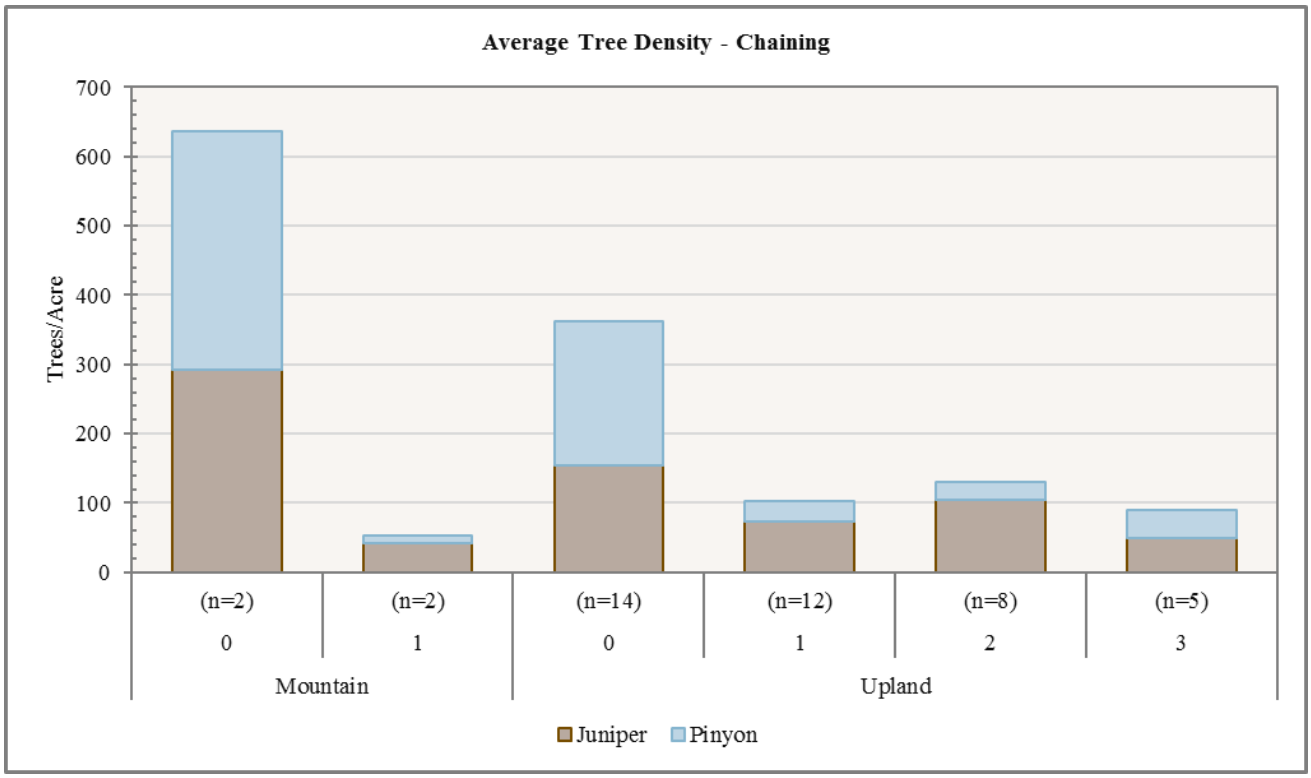


Figure 10.21: Average tree density on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

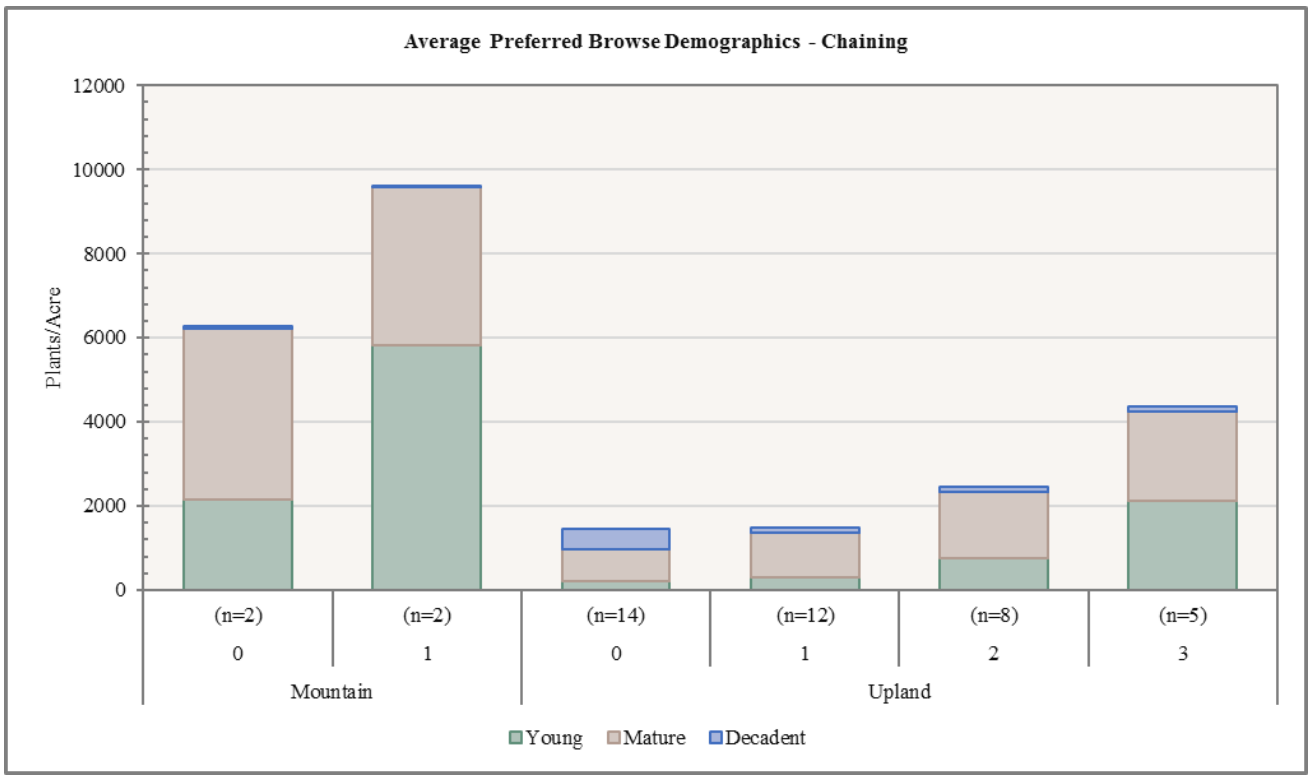


Figure 10.22: Average preferred browse demographics on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

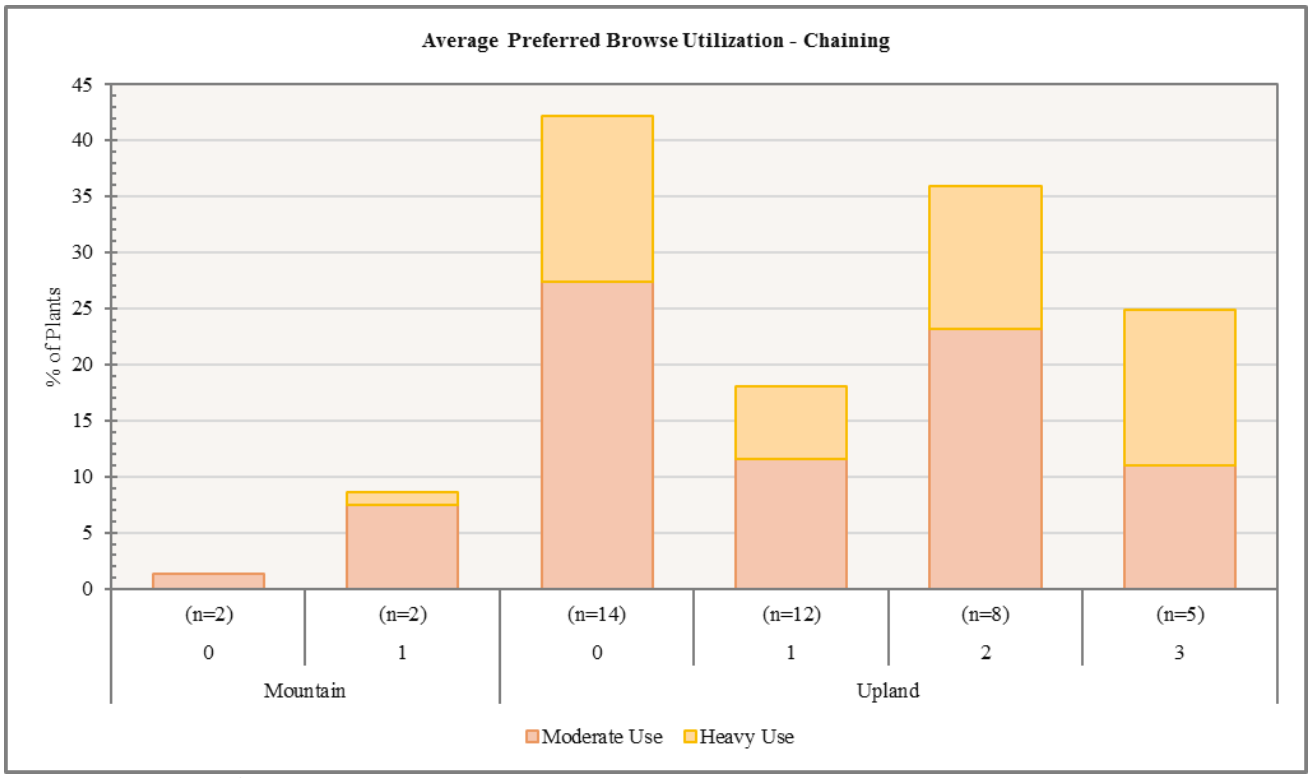


Figure 10.23: Average preferred browse utilization on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

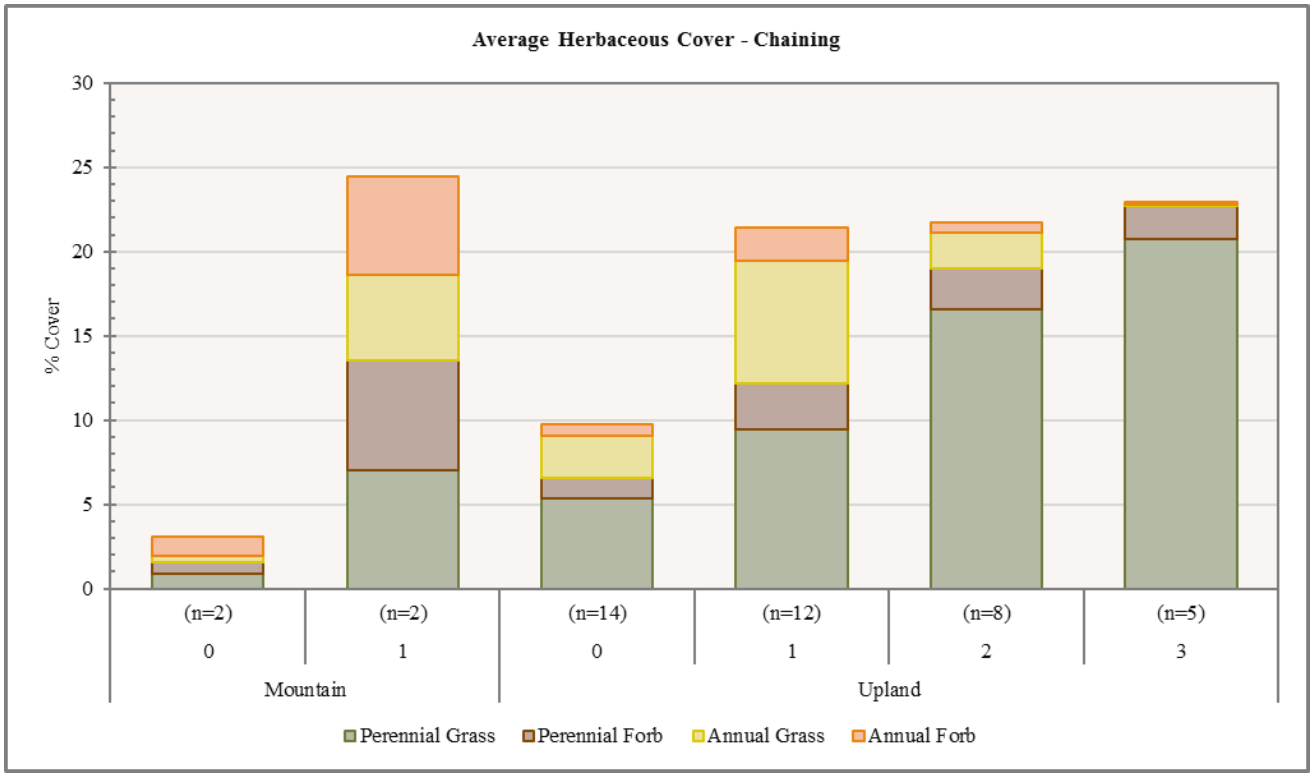


Figure 10.24: Average herbaceous cover on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

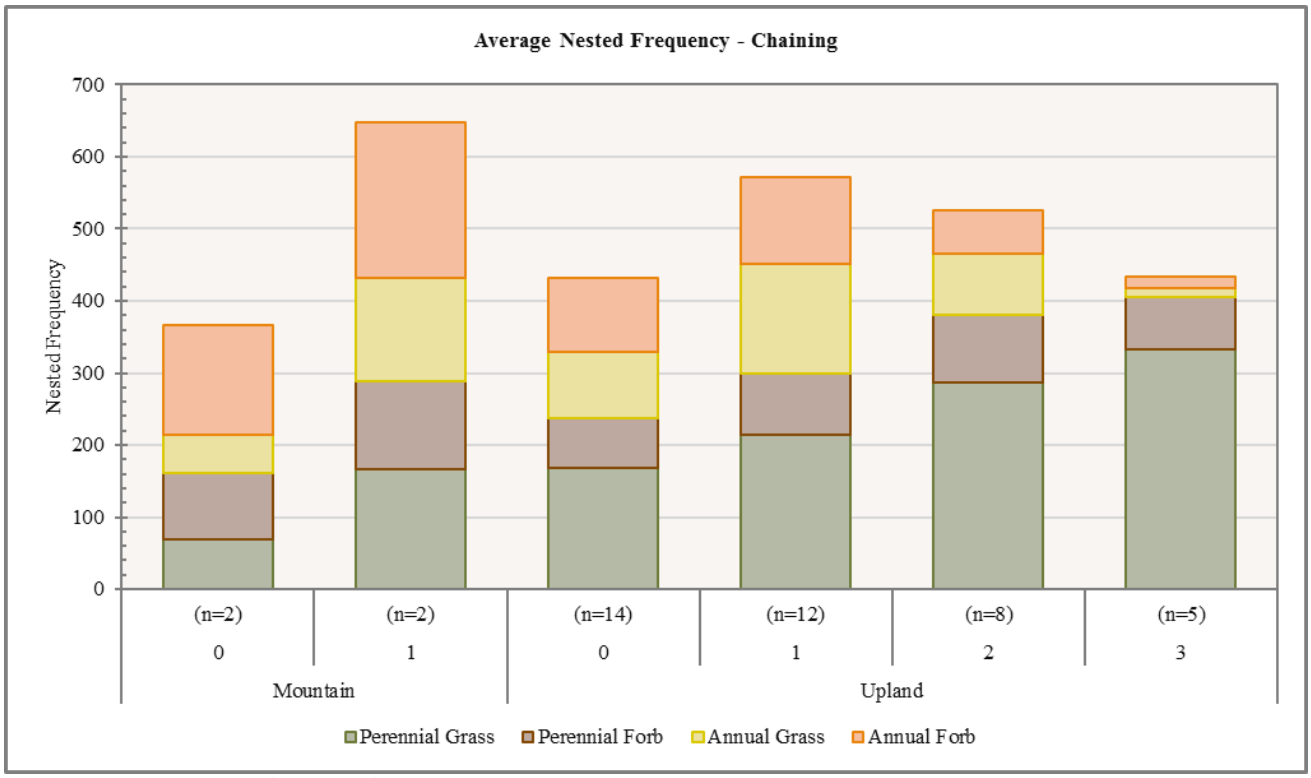


Figure 10.25: Average nested frequency of herbaceous species on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

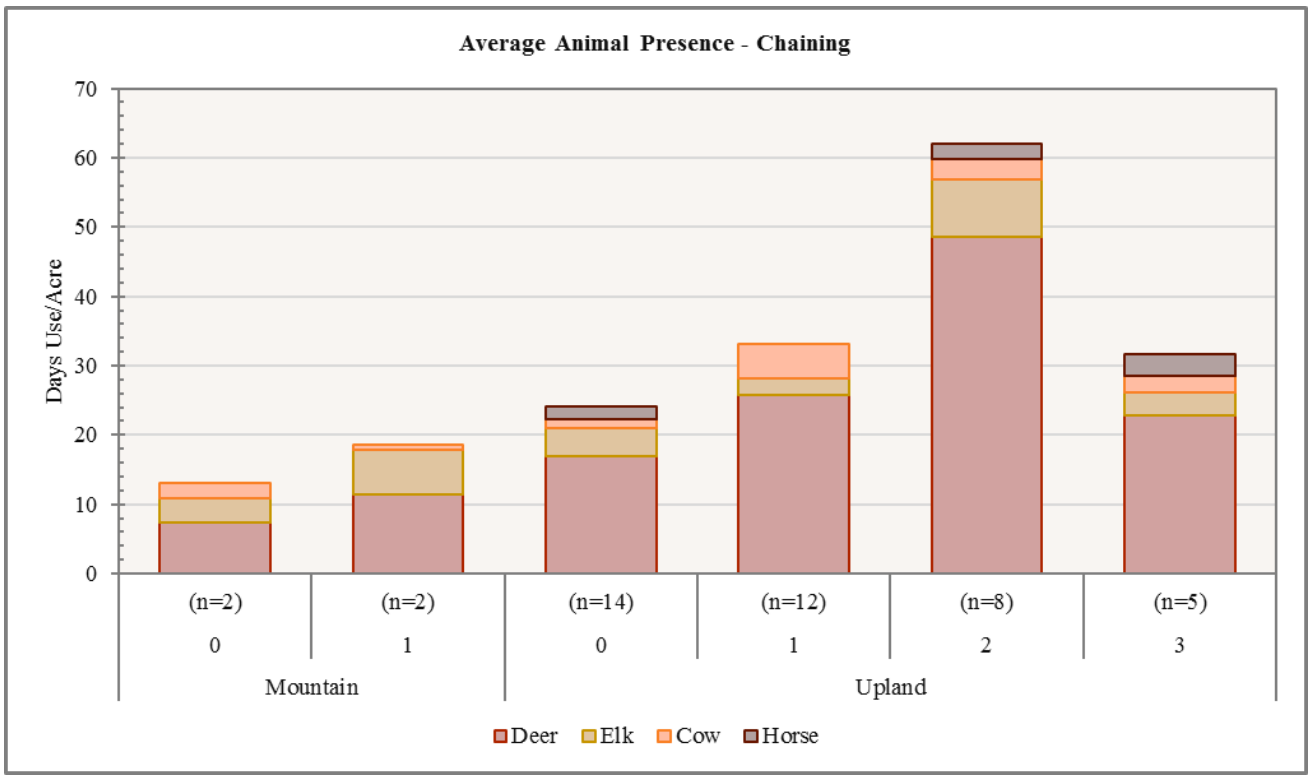


Figure 10.26: Average pellet transect data on mountain and upland study sites that have been chained. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

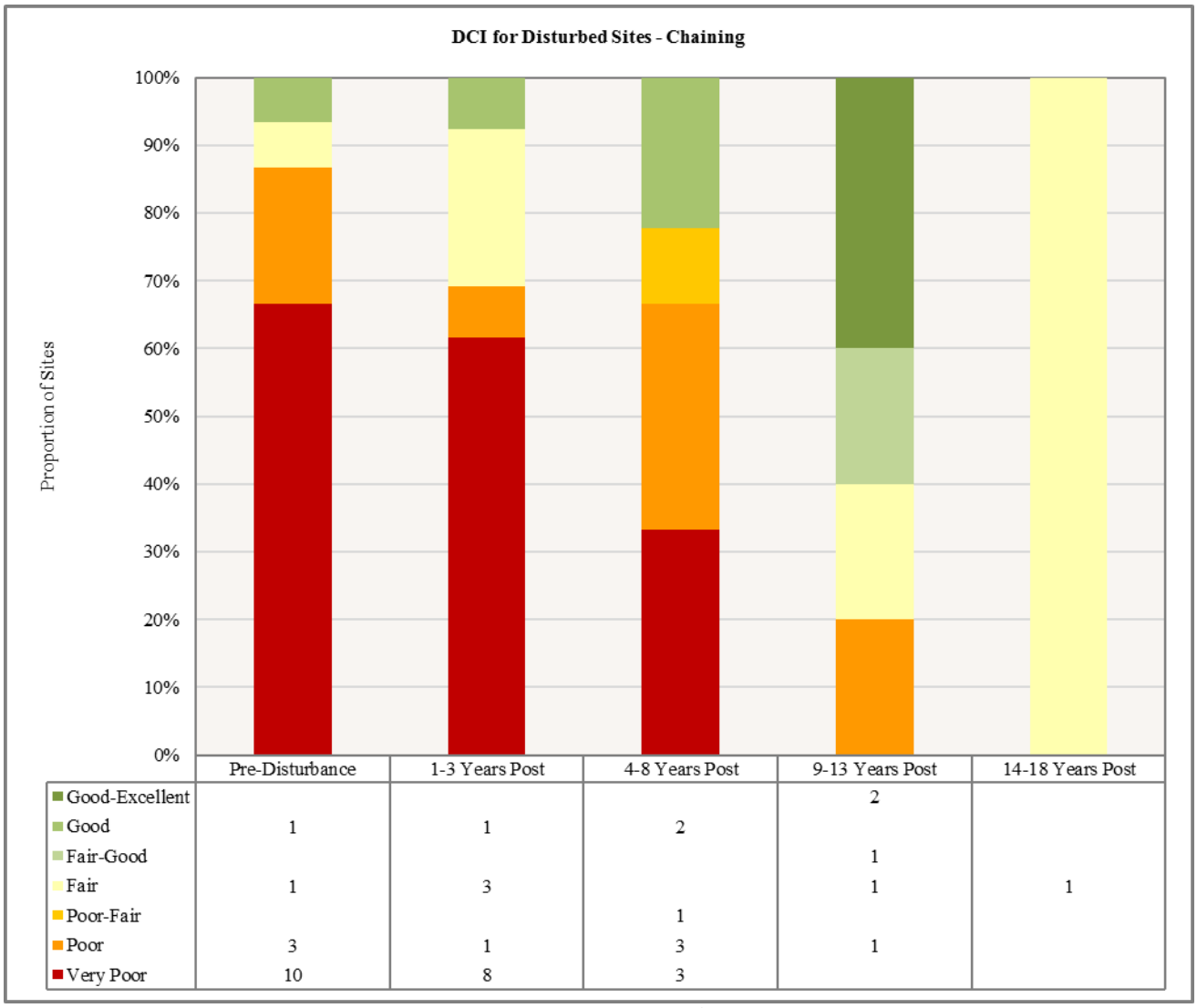


Figure 10.27: Deer winter range Desirable Components Index (DCI) summary by year of sites that have been chained.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20R-03	0	1.5	0	0	6.6	0	10	0	**18.1**	**VP**
20R-03	2	5.4	0	0	26.2	-0.1	10	0	**41.5**	**P**
20R-03	3	9.5	15	15	30	0	8.7	0	**78.2**	**G-E**
20R-05	0	7.1	13.1	15	30	-0.1	3	0	**68.1**	**G**
20R-05	2	5	0	0	30	-0.5	4.2	0	**38.7**	**P**
20R-05	3	8.6	15	9.2	29.4	-0.1	2.1	0	**64.3**	**F-G**
20R-08	0	0	0	0	0.3	0	0.1	0	**0.4**	**VP**
20R-09	0	4	0	0	2.6	0	6.2	0	**12.8**	**VP**
21B-10	0	13.4	-1	0.9	30	-0.1	0.4	0	**43.6**	**P**
21B-10	1	15.3	5.7	1.5	30	-0.6	0.5	0	**52.2**	**F**
21B-10	2	14.9	2.6	2.5	30	-0.9	0.1	0	**49.3**	**P-F**
21B-10	3	13.6	7.7	4.8	30	0	0.1	0	**56.2**	**F**
21B-10	4	15.1	2.3	6.5	30	-0.5	0.4	0	**53.8**	**F**
21R-04	1	1.5	0	0	6.7	-20	8.7	0	**-3.1**	**VP**
21R-04	2	6.4	0	0	6.3	-10	4.7	0	**7.3**	**VP**
21R-14	0	9.4	5	1.2	19	-20	0.4	0	**15**	**VP**
21R-14	1	1.8	0	0	6.6	-20	0.4	0	**-11.3**	**VP**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21R-16	0	6.3	0	0	7	-0.7	0.2	0	**12.9**	**VP**
21R-16	1	2.2	0	0	30	-5.6	2.5	0	**29.1**	**VP**
21R-17	0	30	14.8	15	3.5	-0.6	2.4	0	**65.2**	**F**
21R-17	1	30	14.9	15	7.9	-7.6	1.8	0	**62**	**F**
22-05	0	13.5	8.1	4.6	15.7	-3	1.7	0	**40.6**	**P**
22-05	1	4.5	0	0	28.9	-6.2	3.6	0	**30.8**	**VP**
22R-11	0	2.9	0	0	7.1	0	7.2	0	**17.2**	**VP**
22R-11	1	2	0	0	5.5	0	10	0	**17.5**	**VP**
22R-11	2	3.5	0	0	30	-0.1	4.5	0	**37.9**	**P**
22R-11	3	5.4	0	0	30	0	6.5	0	**41.8**	**P**
23-01	0	10.9	4.8	0	13.4	-0.1	0.9	0	**30.1**	**VP**
23-01	1	8.1	14.6	9.9	19.6	-0.1	7.5	0	**59.7**	**F**
23-01	2	16	15	2.5	30	-0.6	6.3	0	**69.1**	**G**
23R-12	0	0	0	0	0.4	-0.9	0.2	0	**-0.2**	**VP**
23R-12	1	0.1	0	0	10.9	-8.3	3.8	0	**6.5**	**VP**
23R-12	2	0.2	0	0	30	-1	2	0	**31.2**	**VP**
23R-13	0	1.4	0	0	3.5	0	0.4	0	**5.3**	**VP**
23R-13	1	0.3	0	0	25.1	0	4	0	**29.3**	**VP**
25R-01*	0	0	0	0	2.3	-1.2	1.2	0	**2.3**	**VP**
25R-01*	1	0	0	0	17.2	-0.6	10	0	**26.5**	**VP**
25R-01*	2	0	0	0	17.2	-0.5	8.8	0	**25.4**	**VP**
25R-10	0	14.8	6.7	11.1	10	0	0.7	0	**43.2**	**P**
25R-10	1	23.3	14.6	11.7	23.2	-0.1	1.6	0	**74.4**	**G**
28R-15	1	13.1	13.9	4.5	8	0	3	0	**42.4**	**P**
28R-15	2	12.6	14.3	15	29.4	0	1.8	0	**73.1**	**G**
28R-15	3	16.8	14.5	15	30	0	2.4	0	**78.6**	**G-E**

Table 10.3: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have been chained. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

Fire (Seeded)

Fourteen study sites have been burned and have been subsequently seeded. One of these study sites [Smith Canyon (23-05)] is considered to be a mountain ecological site, eight [Williams Canyon (21A-08), Smiths Ridge (21B-08), Doubleup Hollow (22-10), Big Cedar Cove (22-12), Buckskin 2 (27R-17), Buckskin 1 (27R-18), Swayback Knoll (28-05), and Grapevine Spring (30-42)] are classified as upland ecological sites, four [A&F Aerial Seeding (21R-08), A&F Aerial Seeding 2 (21R-09), Minersville Reservoir (22-13), and Tobin Bench (30-61)] are classified as semidesert ecological sites, and one [A&F Drill 3 (21R-10)] is considered to be a desert ecological site.

The Williams Canyon site is situated at the mouth of John Williams Canyon in Scipio Valley. Smiths Ridge is located southwest of the town of Holden near Pioneer Canyon. The A&F Aerial Seeding study is situated north of Antelope Mountain and Black Rock Road. The A&F Aerial Seeding 2 site is about two miles west of the A&F Aerial Seeding study. A&F Drill 3 can be found on Clear Spot Flat, west of Black Point, and the Doubleup Hollow study is located at the head of Doubleup Hollow, south of the city of Beaver. Big Cedar Cove can be found on the west side of the Mineral Mountains near Big Cedar Cove. The Minersville Reservoir study is located just west of Minersville Reservoir, and Smith Canyon is situated east of the town of Marysvale near the mouth of Smith Canyon. The Buckskin 2 study can be found on Buckskin Mountain, north of Pine Hollow Canyon; the Buckskin 1 study is just northwest of Buckskin 2. Swayback Knoll is located in Parowan Valley, south of Swayback Knoll. Finally, the Tobin Bench study can be found west of the town of Veyo on Tobin Bench.

Shrubs/Trees: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) provides nearly all of the cover on the mountain study site, Smith Canyon. Cover decreased during the first sample year following the burn, but has since recovered, surpassing pre-treatment levels. Upland study sites also exhibited an initial decrease in average shrub cover and increases in subsequent sample years; as of the third post-treatment sample year, total cover is nearly equal that of pre-treatment levels. However, composition has changed, with preferred browse providing less cover than it did prior to the burn and remediation efforts. Other shrubs have increased in cover, a trend mainly driven by the Grapevine Spring study. In addition, both preferred browse and other shrubs have displayed increases in cover over time on semidesert study sites. Forage kochia (*Bassia prostrata*) provides all of the shrub cover on the desert study site and has also increased over time (**Figure 10.28**).

Average preferred browse demographics indicate that density on study sites of all ecological types has increased over time. Dominant age classes of the plants, however, has fluctuated. Mature plants comprised a majority of the browse population on the mountain site prior to treatment and in the first and third post-treatment sample years. However, young plants were the most abundant age class in the second sampling following treatment. On upland study sites, mature plants have been the dominant component of the browse populations. Furthermore, the marked increase in the densities of young and mature plants between the first and second post-treatment samplings on these sites can largely be attributed to the Buckskin 2 study. Mature plants have also comprised a majority of the populations on semidesert sites in most sample years. However, a notable increase in density of young was observed in the first post-treatment sampling: this is mainly driven by the inclusion of the Square Fire Rehab study, which does not have pre-treatment data. On the semidesert site, young plants were the most abundant prior to and in the first year following treatment, while mature individuals dominated in the second sampling after the remediation efforts (**Figure 10.31**).

Mean preferred browse utilization has decreased overall on the mountain study, with 6% of plants displaying moderate to heavy utilization in the third post-treatment year. Upland sites exhibited an initial post-treatment increase in utilization that has since decreased. Use on semidesert study sites, however, has increased overall from pre-treatment levels: this is due in part to increased use on the A&F Drill 2 site. Finally, average utilization on the desert study site has increased overtime. However, use on this site remains low as of the third post-treatment sample year, when nearly 4% of plants were moderately used (**Figure 10.32**).

Trees only contribute cover on study sites of the upland ecological type. Cover of pinyon (*Pinus sp.*) and juniper (*Juniperus sp.*) initially decreased following treatment, but exhibited marginal increases in subsequent sample years. However, tree cover remains low as of the third post-treatment sampling (**Figure 10.29**). Tree density has also decreased on upland study sites following treatment, although there was a marginal increase between the second and third post-treatment samplings. In addition, juniper was observed in point-quarter data on semidesert sites for the first time in the third post-treatment sample year: this is entirely due to the Square Fire Rehab study. On mountain and desert sites, however, tree density has not been observed in any sample year (**Figure 10.30**).

Herbaceous Understory: The herbaceous understory of the mountain study site is primarily composed of the introduced annual grass cheatgrass (*Bromus tectorum*), the cover of which has increased after the fire. Overall nested frequency has decreased over time on this site, largely due to annual forbs. Cover of the herbaceous understory has also increased on upland study sites. The dominant herbaceous component on these sites has varied between perennial grasses, annual grasses, and a mixture of the two; perennial grasses provided the most cover in the third post-treatment sample year. As on the mountain site, however, frequency has also exhibited an overall decrease. These sites have all behaved similarly to each other in response to disturbance. Immediately following the fire, cover and frequency of all herbaceous components decreased, but have increased in subsequent years. Annual grasses have contributed moderate amounts of cover in most sample years. Perennial forbs have fluctuated from year to year, but were co-dominant prior to treatment and during the fifth post-treatment sampling. Annual forb cover increased overall from the pre- to fifth post-treatment readings, although frequency exhibited a marginal decrease. The understory on semidesert sites has increased in both cover and frequency, with annual forbs and grasses as the dominant herbaceous component in all sample years. Finally, the desert study site has exhibited marked increases in herbaceous cover and abundance

following treatment. However, much of this herbaceous vegetation is composed of weedy species such cheatgrass, desert madwort (*Alyssum desertorum*), and prickly Russian thistle (*Salsola tragus*) (**Figure 10.33**, **Figure 10.34**).

Occupancy: Average pellet transect data indicates that animal presence has exhibited an overall decrease on study sites of all ecological types. On the mountain site, deer have been the primary occupants with a mean abundance of pellet groups ranging from nearly 11 days use/acre in the third post-treatment sampling to 139 days use/acre prior to treatment. Mean abundance of elk pellet groups has been as low as almost 5 days use/acre in the third sample year after treatment and as high as nearly 9 days use/acre in the first post-treatment sample year. Cattle have also been present, and mean abundance of pellet groups has varied between 0 days use/acre in the third post-treatment year to 18 days use/acre in the second sample year after the fire and seeding.

Deer have also been the primary occupants in all study years on upland study sites. Mean abundance of deer pellet groups has fluctuated between 22 days use/acre in the first and third sample years after treatment to 40.5 days use/acre in the second post-treatment year. Elk pellet groups have had a mean abundance as low as 0.5 days use/acre in the second sample year after the fire and seeding and as high as 16 days use/acre prior to treatment. Average abundance of cattle pellet groups has ranged from 1.5 days use/acre before treatment to nearly 10 days use/acre in the second sampling after treatment.

Deer were the primary occupants on semidesert study sites before treatment and in the first and third sample years afterwards, while cattle pellet groups were most abundant in the second post-treatment sample year. Mean abundance of deer pellet groups has ranged from just over 4 days use/acre in the second post-treatment sampling to 72 days use/acre prior to treatment. Elk pellet groups were not observed before or in the second and third sample years after treatment, but mean abundance was 0.2 days use/acre in the first post-treatment year. Mean abundance of cattle pellet groups has fluctuated between nearly 1 days use/acre before the fire and seeding and nearly 10 days use/acre in the second sample year after treatment.

Finally, cattle have been the primary occupants of the desert study site in all sample years, with a mean abundance ranging from 0 days use/acre before treatment to 13 days use/acre in the second sample year following treatment. Neither deer nor elk pellets have been observed on this site throughout the duration of the study (**Figure 10.35**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have burned and have been seeded has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to excellent condition, with most studies remaining stable or exhibiting minor fluctuations. The Big Cedar Cove and Swayback Knoll studies remained in very poor condition, while the Grapevine Spring study went from poor to very poor. Minersville Reservoir and Buckskin 2 stayed in poor condition, and Smith Canyon improved from very poor to poor. The Tobin Bench and Williams Canyon study remained in fair condition. Square Fire Rehab deteriorated slightly from fair to poor-fair, Smiths Ridge improved from fair to fair-good, and Buckskin 1 improved from fair to excellent condition. Finally, A&F Drill 1 went from excellent to good condition (**Figure 10.36**, **Table 10.4**)

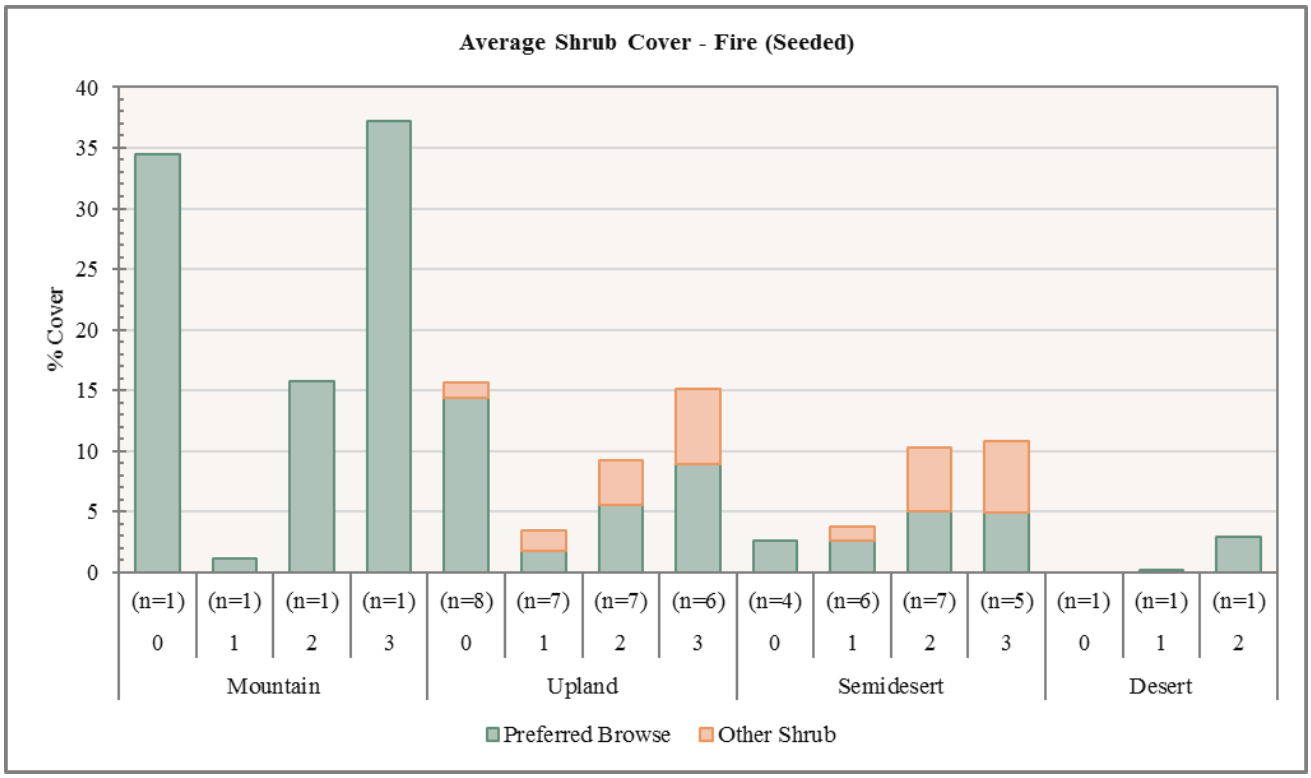


Figure 10.28: Average shrub cover on mountain, upland, semidesert, and desert study sites that have burned and have been seeded.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

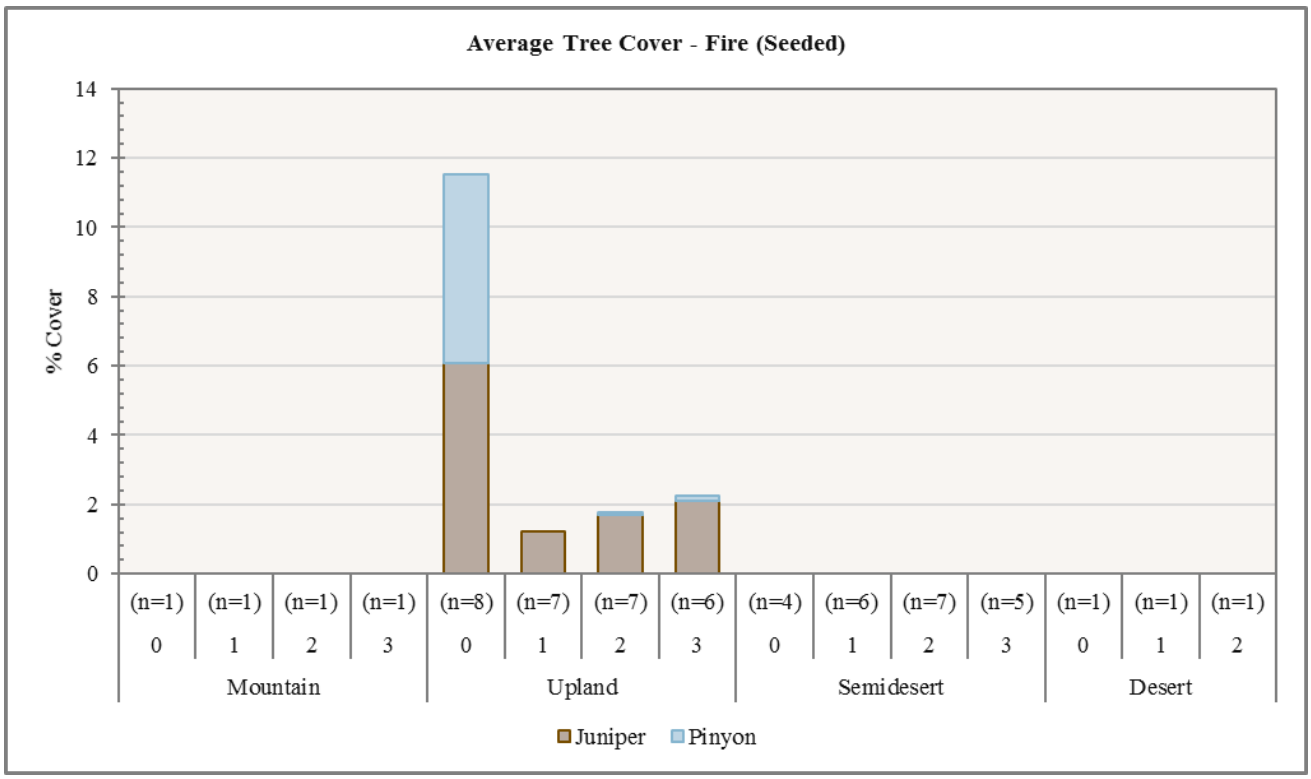


Figure 10.29: Average tree cover on mountain, upland, semidesert, and desert study sites that have burned and have been seeded.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

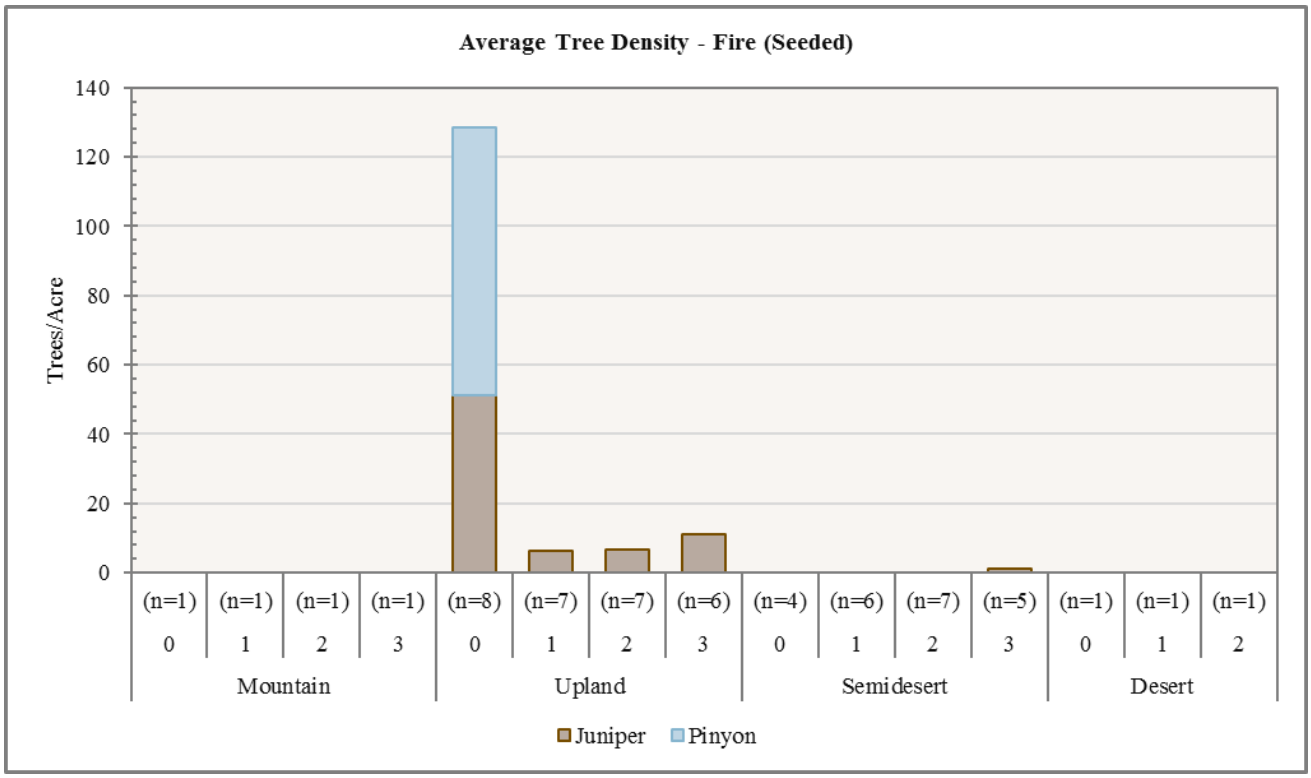


Figure 10.30: Average tree density on mountain, upland, semidesert, and desert study sites that have burned and have been seeded.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

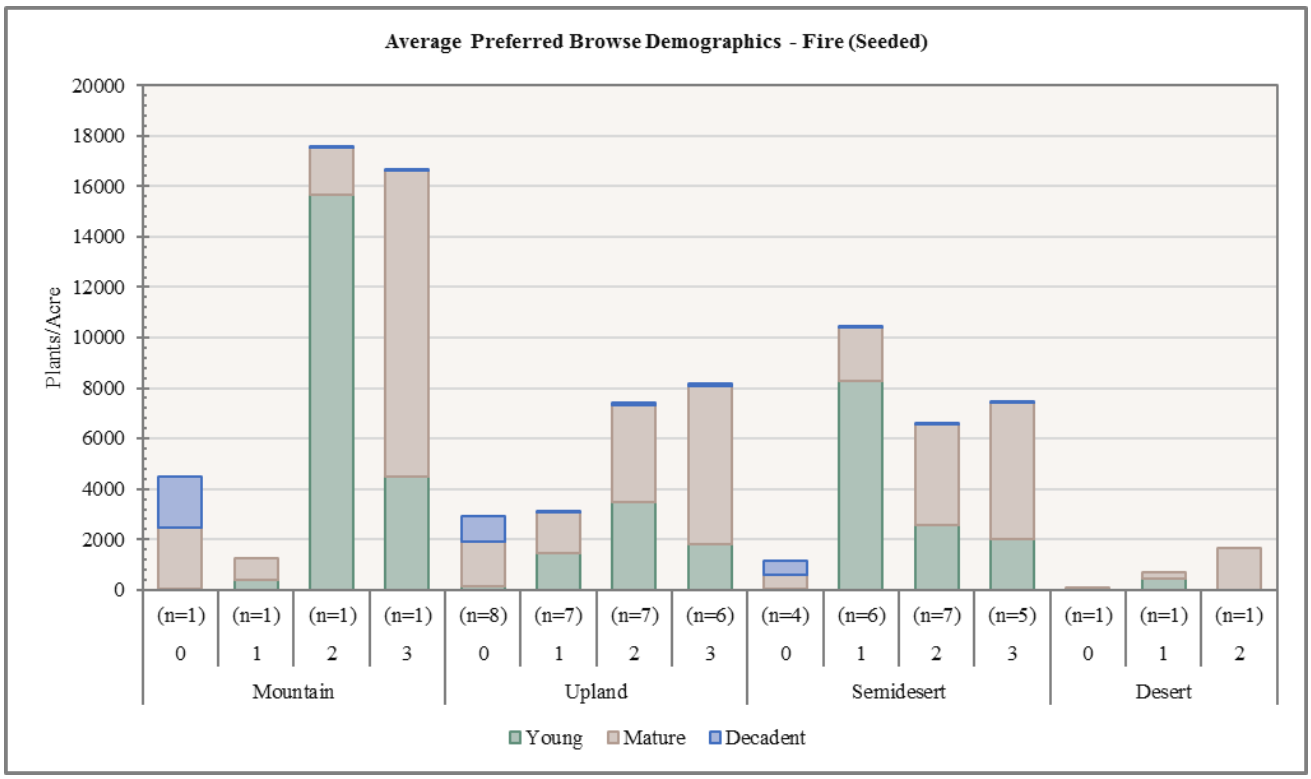


Figure 10.31: Average preferred browse demographics on mountain, upland, semidesert, and desert study sites that have burned and have been seeded.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

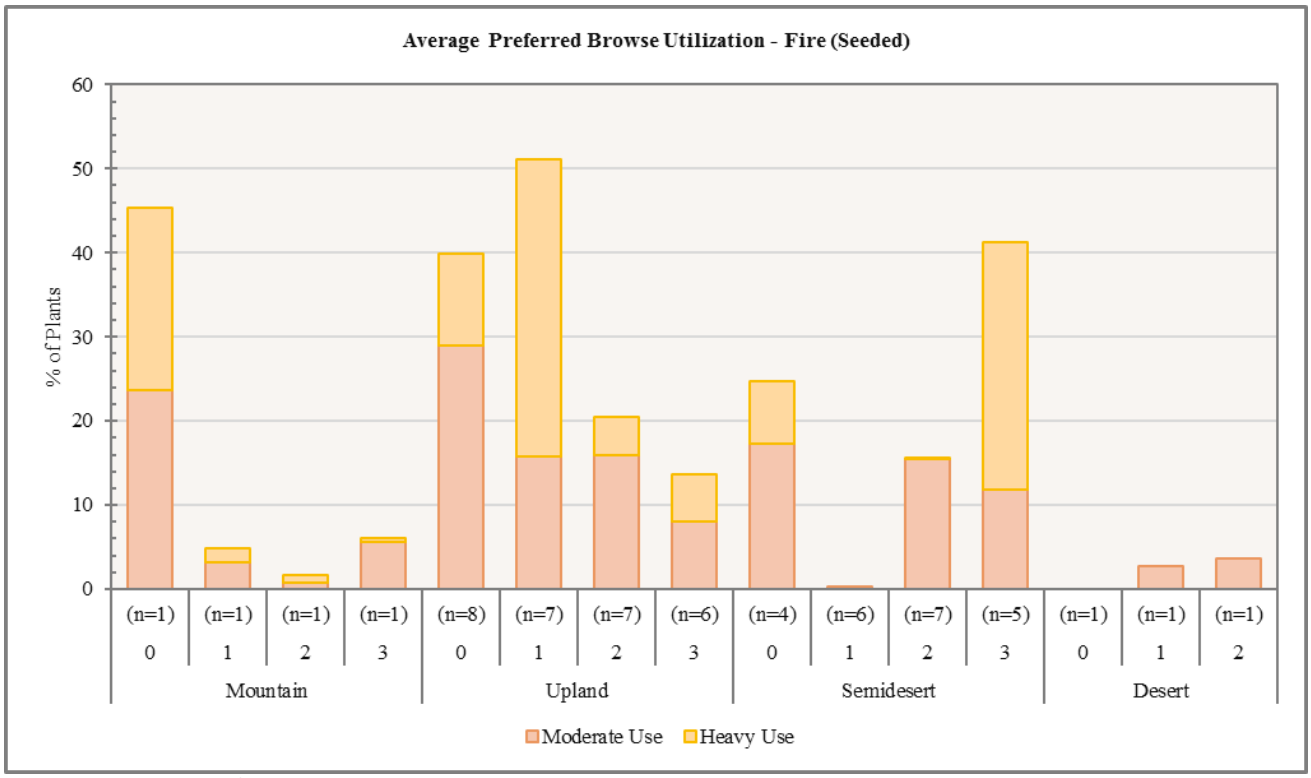


Figure 10.32: Average preferred browse utilization on mountain, upland, semidesert, and desert study sites that have burned and have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

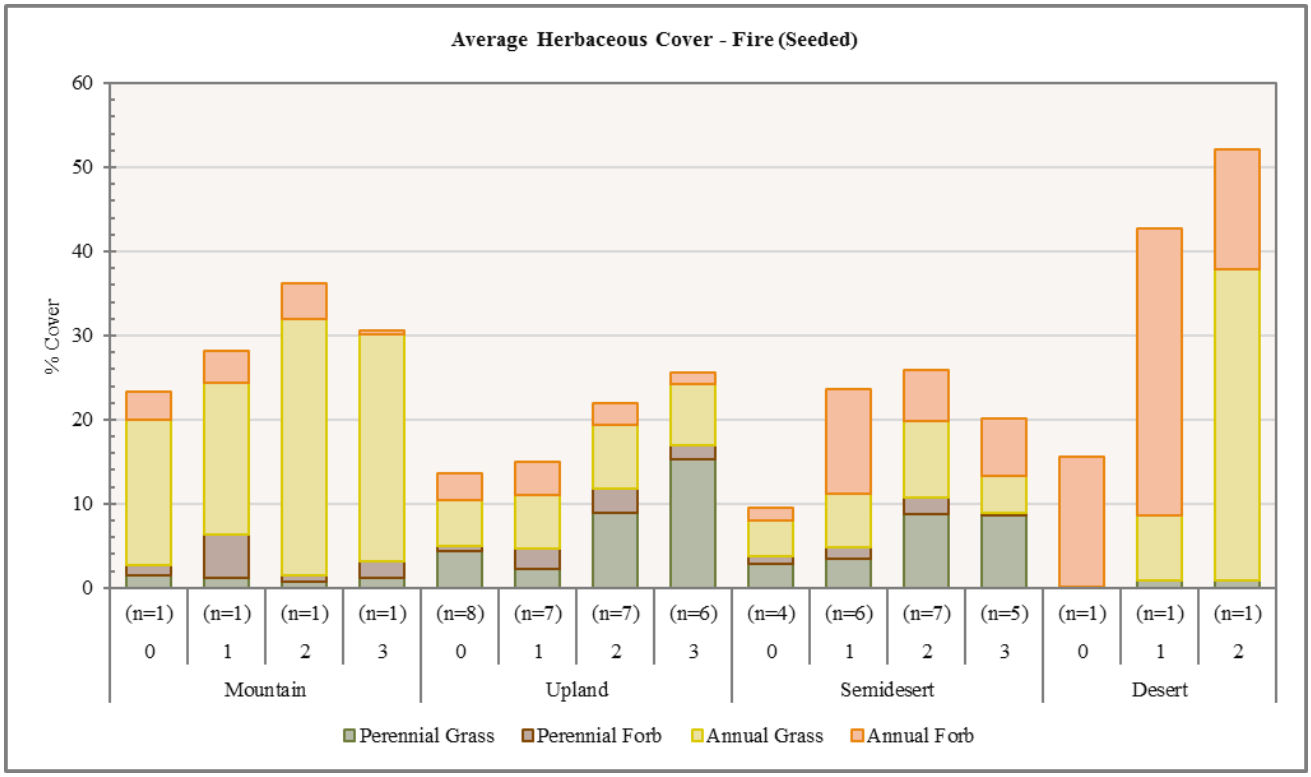


Figure 10.33: Average herbaceous cover on mountain, upland, semidesert, and desert study sites that have burned and have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

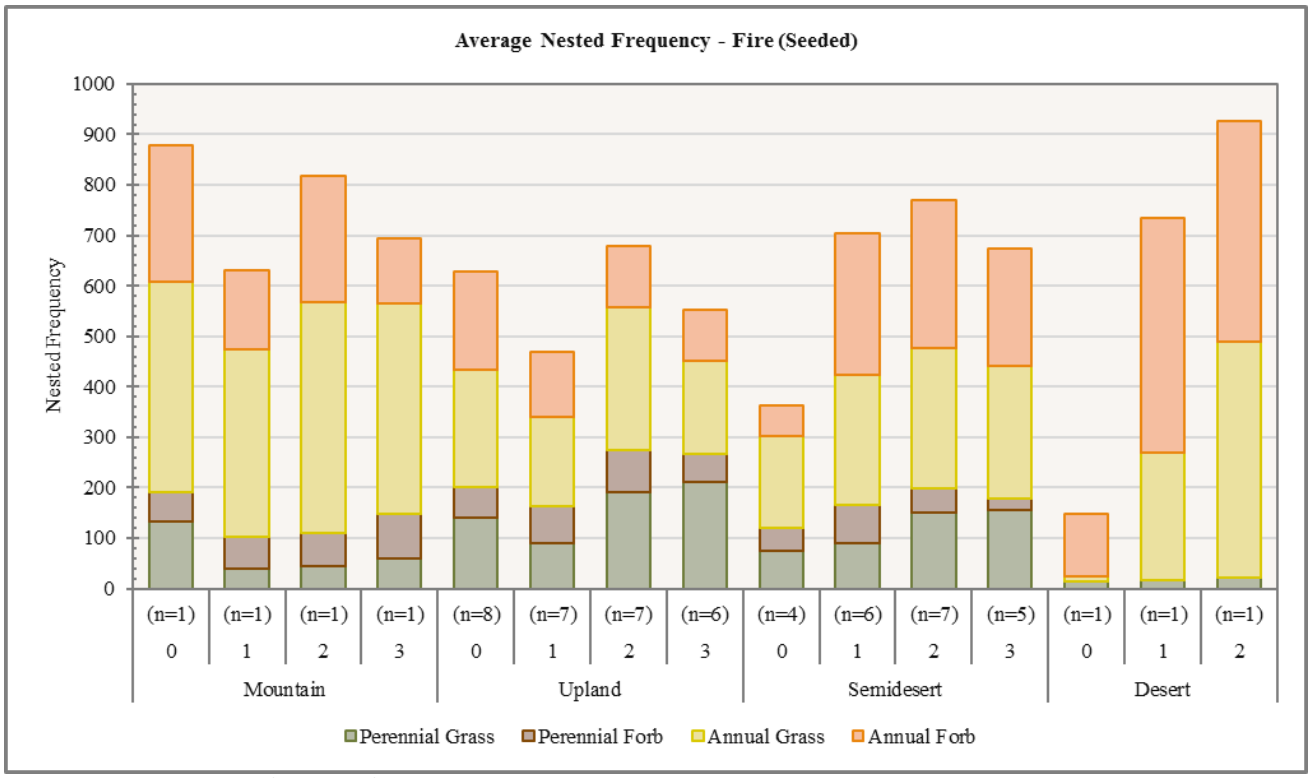


Figure 10.34: Average nested frequency of herbaceous species on mountain, upland, semidesert, and desert study sites that have burned and have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

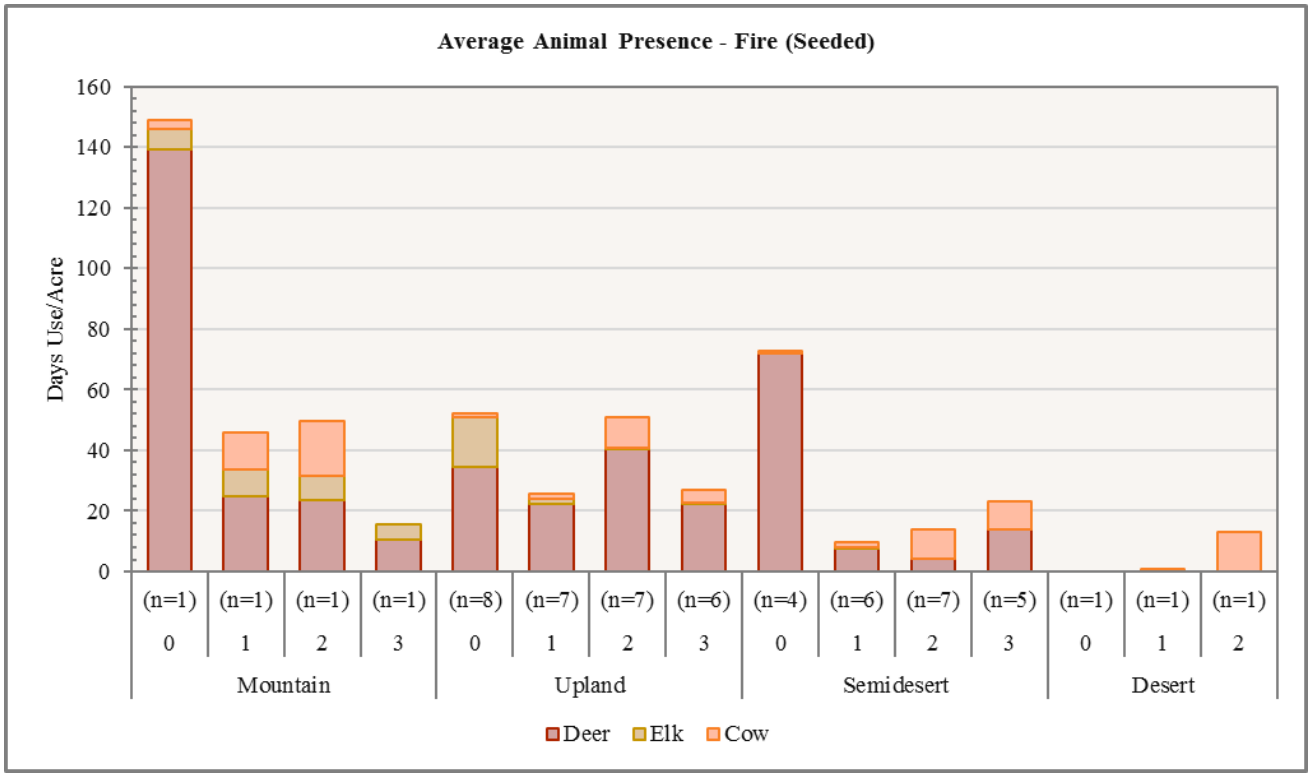


Figure 10.35: Average pellet transect data on mountain, upland, semidesert, and desert study sites that have burned and have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment. Upland deer pellets include deer/antelope.

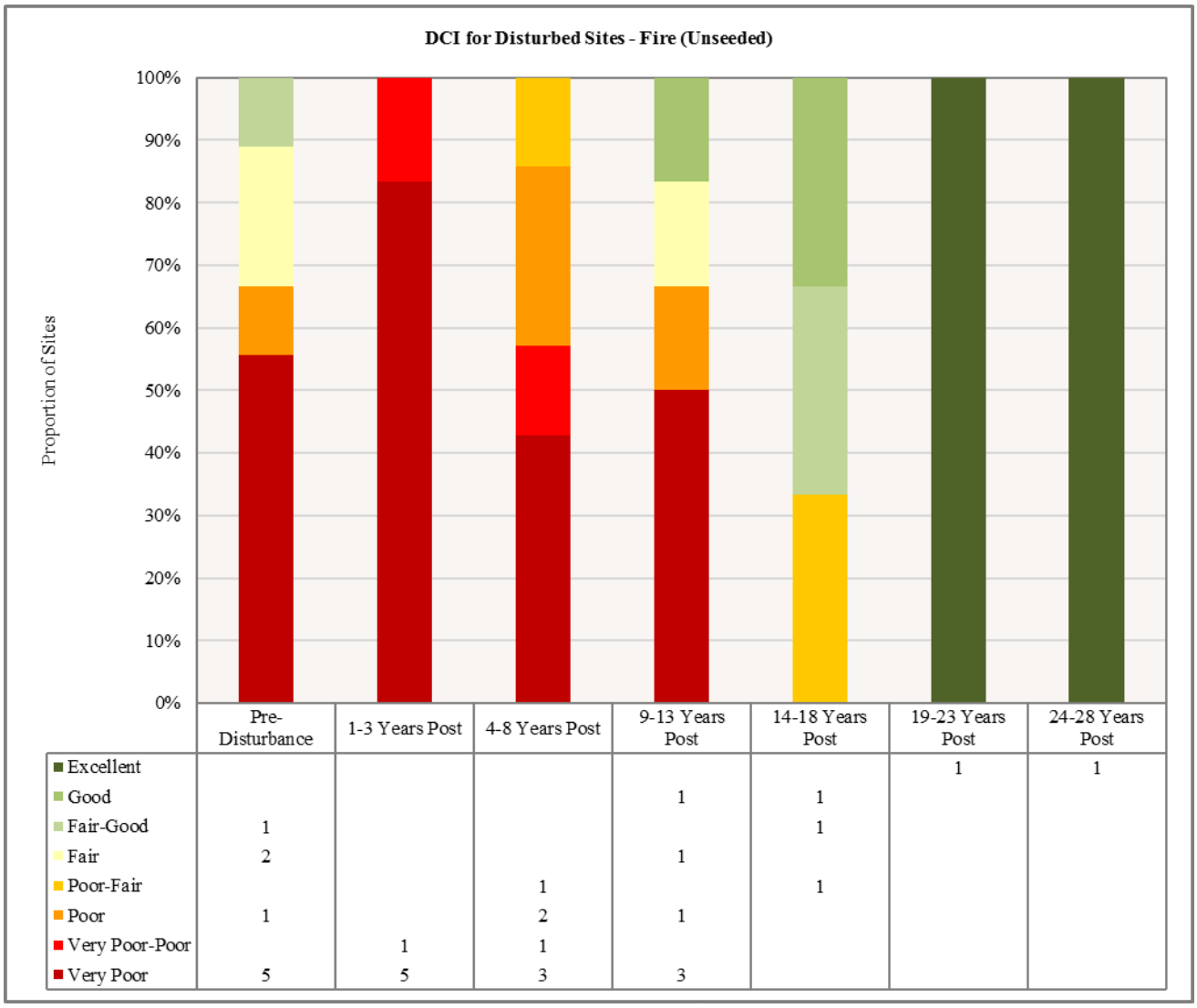


Figure 10.36: Deer winter range Desirable Components Index (DCI) summary by year of sites that have burned and have been seeded.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
21A-03*	0	0	0	0	30	-4.1	0	-2	**24**	**VP**
21A-03*	1	0	0	0	30	-18.1	0.5	-2	**10.3**	**VP**
21A-08	0	30	11.5	0.9	27.8	-17.1	2	0	**55**	**F**
21B-08	0	28.8	13.4	5.1	17.1	-7	0.3	0	**57.7**	**F**
21B-08	1	7.6	11.9	12.7	15.4	-8.9	3.5	0	**42.1**	**P**
21B-08	2	9.7	10.1	15	18.1	-4.8	0	0	**48**	**P**
21B-08	3	12.2	13.7	3.4	28.8	-2	0.9	0	**56.9**	**F**
21B-08	4	17.8	12.5	8.3	27	-0.9	1	0	**65.7**	**F-G**
22-08*	0	17.4	3.3	0.7	9.4	-3.4	1.6	0	**28.9**	**F**
22-08*	1	1.3	0	0	1.7	-11.9	4.1	0	**-4.9**	**VP**
22-08*	2	1.8	0	0	4.4	-18.5	4.9	0	**-7.4**	**VP**
22-12	0	22.6	0.3	0.4	11	-3.4	1	0	**31.9**	**VP**
22-12	1	0.2	0	0	7.8	-2.4	1	0	**6.5**	**VP**
22-12	2	3	0	0	30	-6	1.8	0	**28.9**	**VP**
22-12	3	3.4	0	0	19.9	-14.2	0.1	0	**9.1**	**VP**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22-13	0	11	-0.3	2.5	14.2	-11.3	0	0	**16.1**	**P**
22-13	2	0.3	0	0	27.4	-0.4	2.7	0	**30**	**F**
22-13	3	0.1	0	0	30	-2	0.5	0	**28.6**	**F**
22-13	4	1.4	0	0	30	-9.6	0.5	0	**22.3**	**P**
22-13	5	2.4	0	0	30	-10.2	0.2	0	**22.4**	**P**
22R-18	1	1.2	0	0	8.8	-0.8	0.5	0	**9.7**	**VP-P**
22R-18	2	15.7	14.6	15	30	-4.7	1	0	**71.6**	**E**
22R-18	3	13.4	15	14.5	27	-4.9	0.2	0	**65.1**	**G**
23-04*	1	0	0	0	2.9	-6.7	2.1	0	**-1.7**	**VP**
23-04*	2	3.1	0	0	8	-18.8	0	0	**-7.8**	**VP**
23-04*	3	4.1	0	0	19.1	-10.7	0	0	**12.5**	**P**
23-04*	4	7.9	13.6	14.6	18.1	-13.2	0.1	0	**41.2**	**F**
23-05	0	30	1.9	0.3	3	-12.9	2.4	0	**24.6**	**VP**
23-05	1	1.4	0	0	2.4	-13.5	10	0	**0.3**	**VP**
23-05	2	19.9	15	15	1.4	-20	1.5	0	**32.9**	**VP**
23-05	3	30	15	13.4	2.4	-20	3.8	0	**44.6**	**P**
27R-17	0	4.6	0	0	0.1	-1.2	1.9	0	**5.3**	**VP**
27R-17	1	3.2	0	0	0.1	-0.1	0.3	0	**3.3**	**VP**
27R-17	2	20	15	15	0.6	-7.1	1.8	0	**45.3**	**P**
27R-17	3	20.9	14.9	15	2.2	-14.9	3.8	0	**42**	**P**
27R-18	0	1.5	0	0	0.6	-0.9	3.5	0	**4.6**	**VP**
27R-18	1	2.2	0	0	3.4	-6.2	5.5	0	**5**	**VP**
27R-18	2	10	15	15	15.4	-0.4	4.7	0	**59.7**	**F**
27R-18	3	19.9	14.7	13.9	30	-1.4	10	0	**87.1**	**E**
28-05	0	13.9	-0.4	3.3	9.6	-1.7	0.3	0	**24.9**	**VP**
28-05	1	1	0	0	3.8	-15	0.5	0	**-9.7**	**VP**
28-05	2	0.3	0	0	18.9	-16.9	0	0	**2.3**	**VP**
30-38*	0	15.4	6.7	3	0.1	-9.7	0.4	0	**15.8**	**VP**
30-38*	1	0.5	0	0	2.5	-6.5	10	0	**6.5**	**VP**
30-42	0	25.1	8.1	2	0.1	-0.8	1.6	0	**36**	**VP-P**
30-42	1	3.1	0	0	0.3	-1.4	10	0	**12**	**VP**
30-42	2	8.2	14.5	9.4	0.1	-0.2	6	0	**38**	**P**
30-42	3	12.7	11.5	4.2	0	0	0.7	0	**29.1**	**VP**
30-52*	0	12.1	1.3	4.4	29.5	-2.6	1.3	0	**46**	**F-G**
30-52*	1	3.2	0	0	22.5	-0.1	1.8	0	**27.3**	**F**
30-52*	2	2.6	0	0	16.7	-18.1	2.3	0	**3.4**	**VP**
30-52*	3	8.4	15	15	17	-10.7	5.1	0	**49.8**	**G**
30-57*	0	16.7	8.2	0.3	0.5	-10.4	0.9	0	**16.2**	**P**
30-57*	1	3.2	0	0	0.2	-1.4	1	0	**3**	**VP**
30-57*	2	8.4	15	15	2.6	-7.2	2.6	0	**36.4**	**F**
30-61	0	14.4	0.4	1.5	0.1	0	6.5	0	**22.9**	**P**
30-61	1	2	0	0	0.1	0	1.6	0	**3.7**	**VP**
30-61	2	11.9	15	0	0.5	0	0	0	**27.4**	**F**
30-61	3	14.6	15	0	3.5	-1.1	1.4	0	**33.3**	**F**
30R-02	1	18.6	15	15	0.4	-5.5	2.1	-2	**43.6**	**F-G**
30R-02	2	22	15	4.8	1.5	-3.8	3.4	0	**42.8**	**F**
30R-02	3	7.4	12.9	3.4	3.8	-3.2	0.6	0	**24.9**	**P-F**

Table 10.4: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have burned and have been seeded. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

Fire (Unseeded)

There are 11 study sites that have burned and have not been seeded afterwards. Of these, four studies [South Spring (20-07), Rocky Ridge Canyon (21A-07), Poison Creek Bench (25C-27), and North Creek (25C-28)] are classified as mountain ecological sites and seven studies [Horse Hollow (21A-04), Bridge Canyon (21A-06),

Dog Valley (21B-11), Dameron Canyon (21B-12), Water Canyon (21R-12), Antelope Mountain (22-14), and Antimony Lop and Scatter (24R-10) are considered to be upland ecological sites.

The South Spring study site is located just south of Indian Creek in the Indian Peak mountain range, while Horse Hollow can be found north of Oak City and just south of Horse Hollow. Bridge Canyon is situated at the mouth of Bridge Canyon which is also north of Oak City. Rocky Ridge Canyon can be found just south of Oak City at the head of Rocky Ridge Canyon. The Dog Valley study site is situated south of the town of Kanosh in Dog Valley. Dameron Canyon is also south of Kanosh and east of the mouth of Dameron Canyon. The Water Canyon study is located in the Pavant Range, just east of Cove Fort. The Antelope Mountain study site can be found on the lower east-facing slopes of Antelope Mountain. Antimony Lop and Scatter is situated west of Black Canyon in Dry Hollow. The Poison Creek Bench study is located east of Black Canyon on Poison Creek Bench. Finally, the North Creek study is also east of Black Canyon, near North Creek Draw.

Shrubs/Trees: The shrub component on most of the mountain study sites has been mainly comprised of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Other preferred browse species are present on these sites, but have generally contributed less cover. One should note the differing number of studies from year to year and consider the possible effects of this on the overall average. For example, all desirable browse cover prior to treatment is provided by the Rocky Ridge Canyon study, a study for which no post-treatment data is available. Overall shrub cover has increased each year following treatment due to increases in cover of both preferred browse and other shrubs. On upland sites, average shrub cover exhibited an initial decrease in the first sample year following treatment, but has since recovered beyond pre-treatment levels; preferred browse has provided much of the shrub cover in most sample years. This recovery can partially be attributed to the Dameron Canyon study, which had over 29% preferred browse cover in the third sample year following treatment. Difference in study numbers from year to year is also a likely driver of this trend (**Figure 10.37**).

Average preferred browse demographics indicate that numbers of both mountain and upland study sites initially decreased following treatment, but have steadily increased in each following year. Mature plants have comprised a majority of the preferred browse populations in all study years on studies of both ecological types. In addition, data for mountain study sites displays increased recruitment of young following treatment (**Figure 10.40**). Mean utilization of preferred browse has decreased overall on mountain and upland study sites, with less than 10% of plants being moderately to heavily browsed in the third post-treatment sample year (**Figure 10.41**).

Tree cover on mountain study sites has increased from pre-treatment levels, but has remained generally stable since the first post-treatment sample year: this trend is entirely driven by Rocky Mountain juniper (*Juniperus scopulorum*) on the North Creek study. Average density data indicates that density of twoneedle pinyon (*Pinus edulis*) and Rocky Mountain juniper have also increased from pre-treatment levels, a trend also driven by the North Creek study. Both tree density and cover have exhibited general decreases on upland study sites; trees have been observed on the Horse Hollow, Dog Valley, Dameron Canyon, Water Canyon, and Antimony Lop and Scatter studies. Although the cover and density values are low as of the third post-treatment sampling, the continued presence of trees on many of these studies indicates that there may be potential for infilling over time (**Figure 10.38**, **Figure 10.39**).

Herbaceous Understory: The overall herbaceous understory for mountain study sites has displayed fluctuations in cover and frequency from year to year, but has generally remained stable overall. Perennial grasses have been the dominant herbaceous component in most sample years. The exception to this is the first post-treatment sample year, in which perennial forbs were most abundant. This increase in perennial forbs is likely due in part to silvery lupine (*Lupinus argenteus*) on the South Spring study and the differing number of studies from year to year. Annual grasses on these mountain sites have slightly increased over time, but have generally been present to a lesser extent than perennial grasses. On upland study sites, however, annual grasses have dominated the herbaceous understory in most sample years and have increased in cover over time. For example, annual grasses contributed 24%, 49.5%, and 64% cover on the Antelope Mountain, Dog Valley, and Dameron Canyon studies, respectively, in the third post-treatment year. However, one must also take into

account the differing number of study sites each year; the three studies previously mentioned are the only studies for which data is available for the third sampling following treatment (**Figure 10.42**, **Figure 10.43**).

Occupancy: Pellet group transect data indicates that pellet group abundance has increased overall on mountain study sites. Primary occupancy has varied from year to year on mountain sites. Deer have provided the most pellet groups prior to treatment, elk were the primary occupants in the second and third post-treatment years, and cattle groups were most abundant of any species in the fourth sampling after treatment. Mean abundance of deer pellet groups on these sites has ranged from 10 days use/acre before treatment and in the third post-treatment year to just over 13 days use/acre in the second sample year after treatment. Elk pellet groups have had a mean abundance as low as under 1 days use/acre prior to treatment and as high as nearly 45 days use/acre in the first post-treatment sampling. Mean abundance of cattle pellet groups has fluctuated between 0 days use/acre before fire and 14.5 days use/acre in the third sample year after treatment. Horse pellet groups have also been observed, with a mean abundance ranging from 0 days use/acre before and in the first sampling after treatment to 5 days use/acre in the second and fourth post-treatment samplings.

Average pellet group abundance has increased overall on upland sites. Deer have been the primary occupants in all study years except the second post-treatment sampling, in which cattle pellet groups were most abundant. Mean abundance of deer pellet groups has ranged from 5.5 days use/acre in the second post-treatment sampling to 52 days use/acre prior to treatment; pre-treatment abundance can largely be attributed to the Dog Valley and Dameron Canyon studies. Elk pellet groups have had a mean abundance fluctuating between under 1 days use/acre before and in the second and third samplings after treatment and 2 days use/acre in the first post-treatment sample year. Mean abundance of cattle pellet groups has been as low as 6 days use/acre in the second and third sample years after treatment and as high as 8 days use/acre prior to treatment (**Figure 10.44**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have burned has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to excellent condition, with most studies remaining stable or exhibiting minor fluctuations. The Horse Hollow, Bridge Canyon, Dog Valley, and Dameron Canyon studies remained in very poor condition, Antelope Mountain went from very poor-poor to very poor, and Water Canyon deteriorated from fair to very poor. North Creek went from good to poor-fair, while South Spring improved from poor to fair-good condition. Finally, the Poison Creek Bench study site remained in excellent condition (**Figure 10.45**, **Table 10.5**)

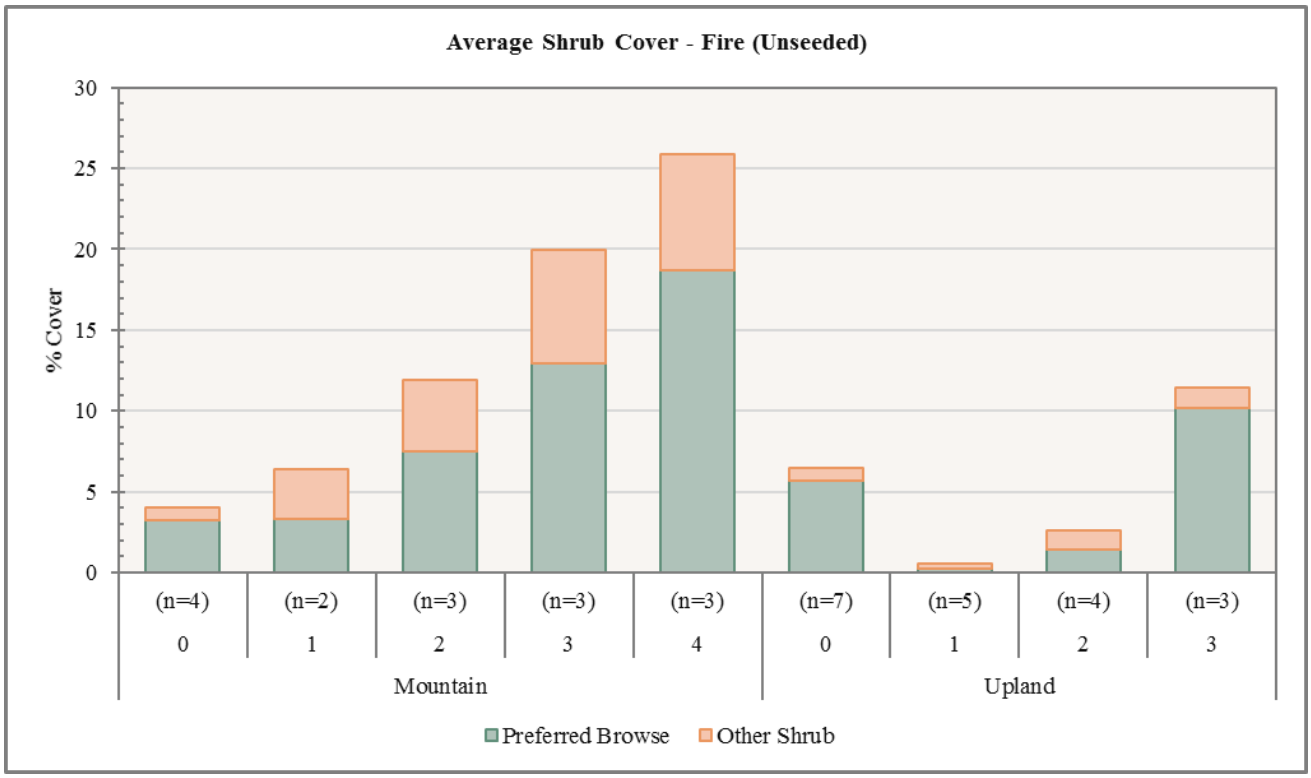


Figure 10.37: Average shrub cover on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

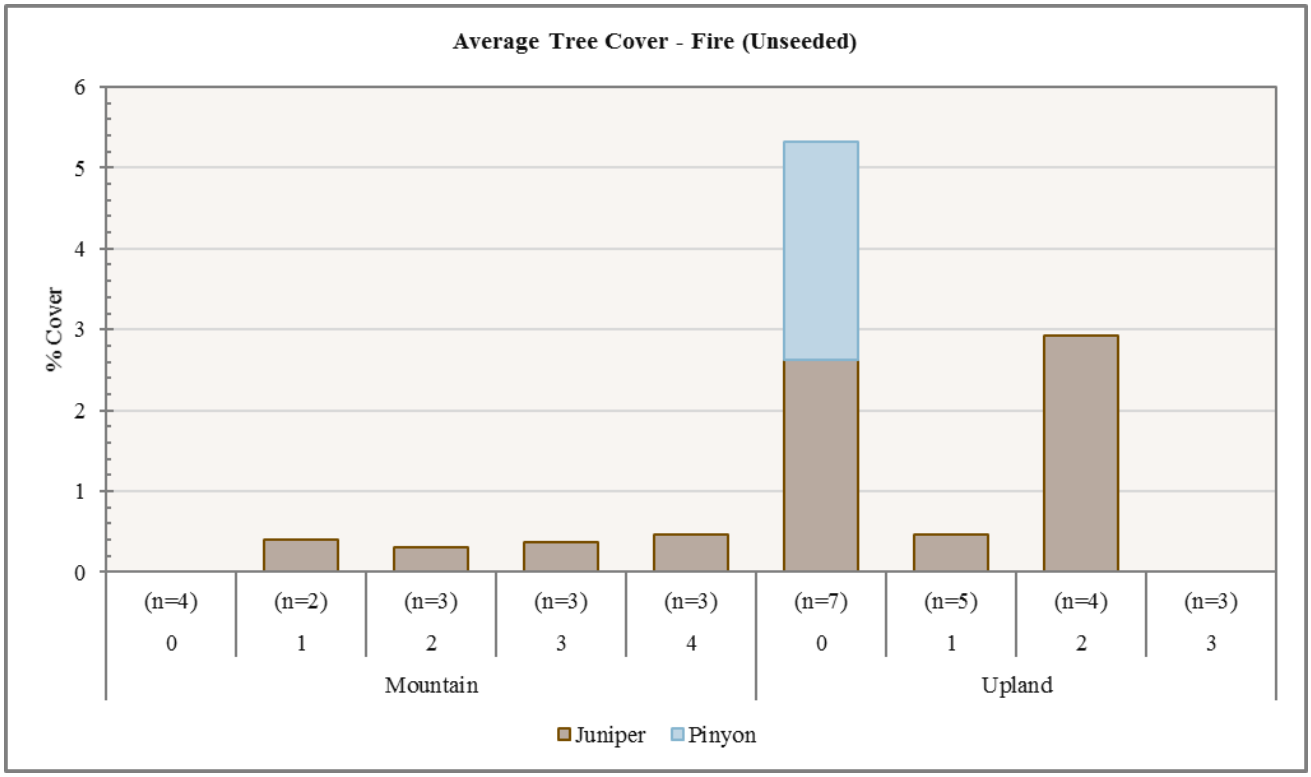


Figure 10.38: Average tree cover on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

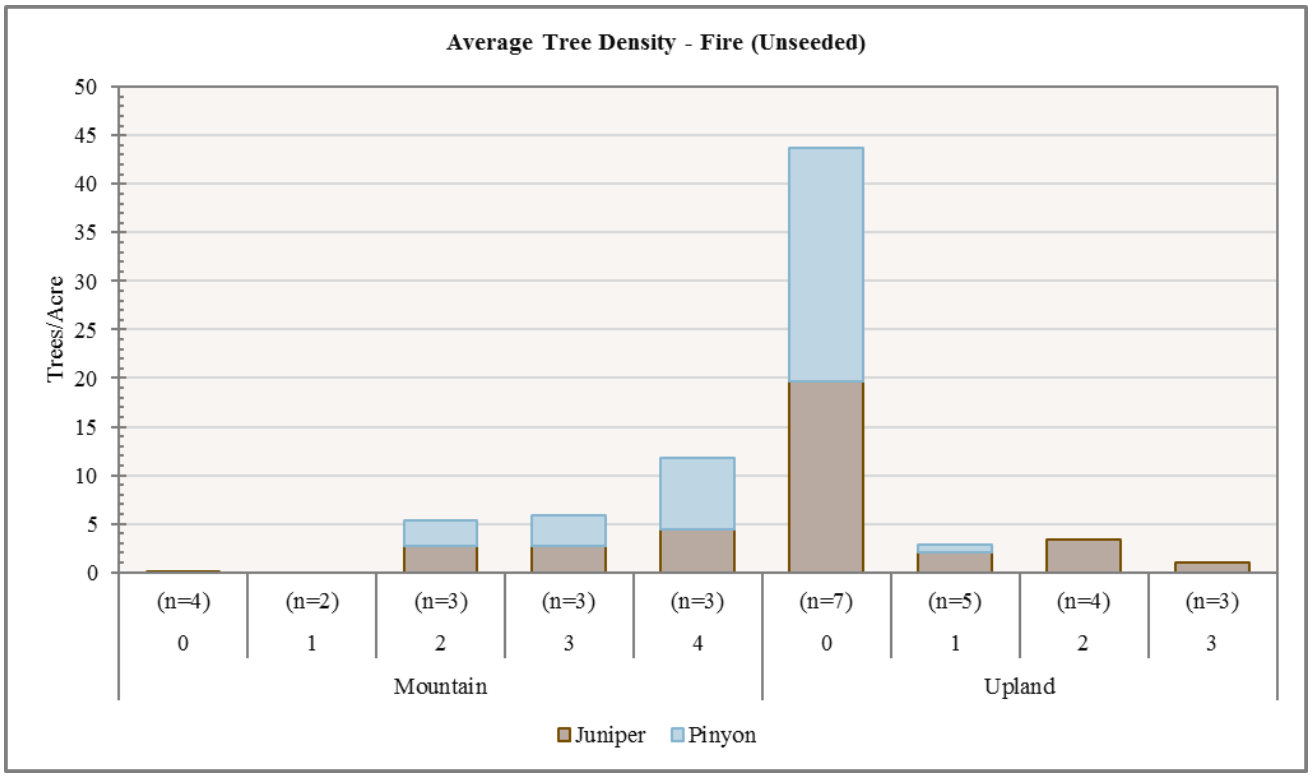


Figure 10.39: Average tree density on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

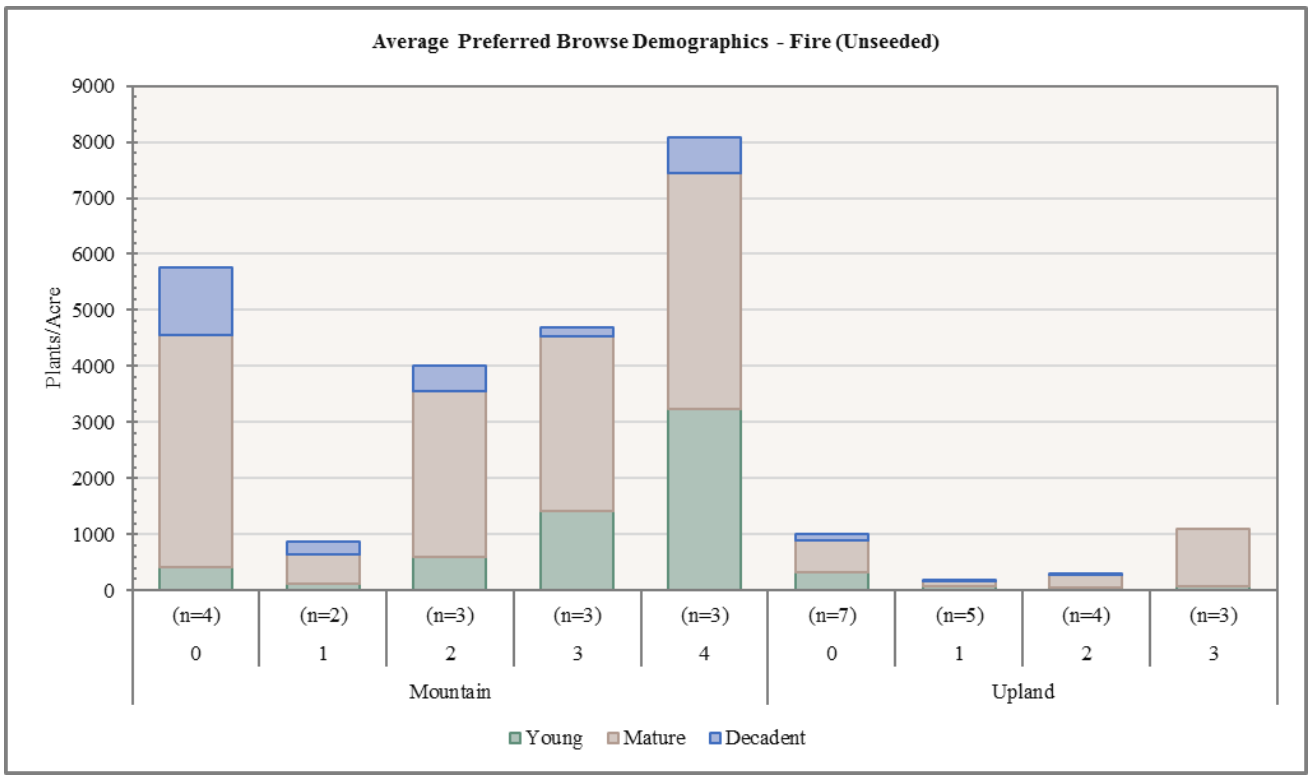


Figure 10.40: Average preferred browse demographics on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

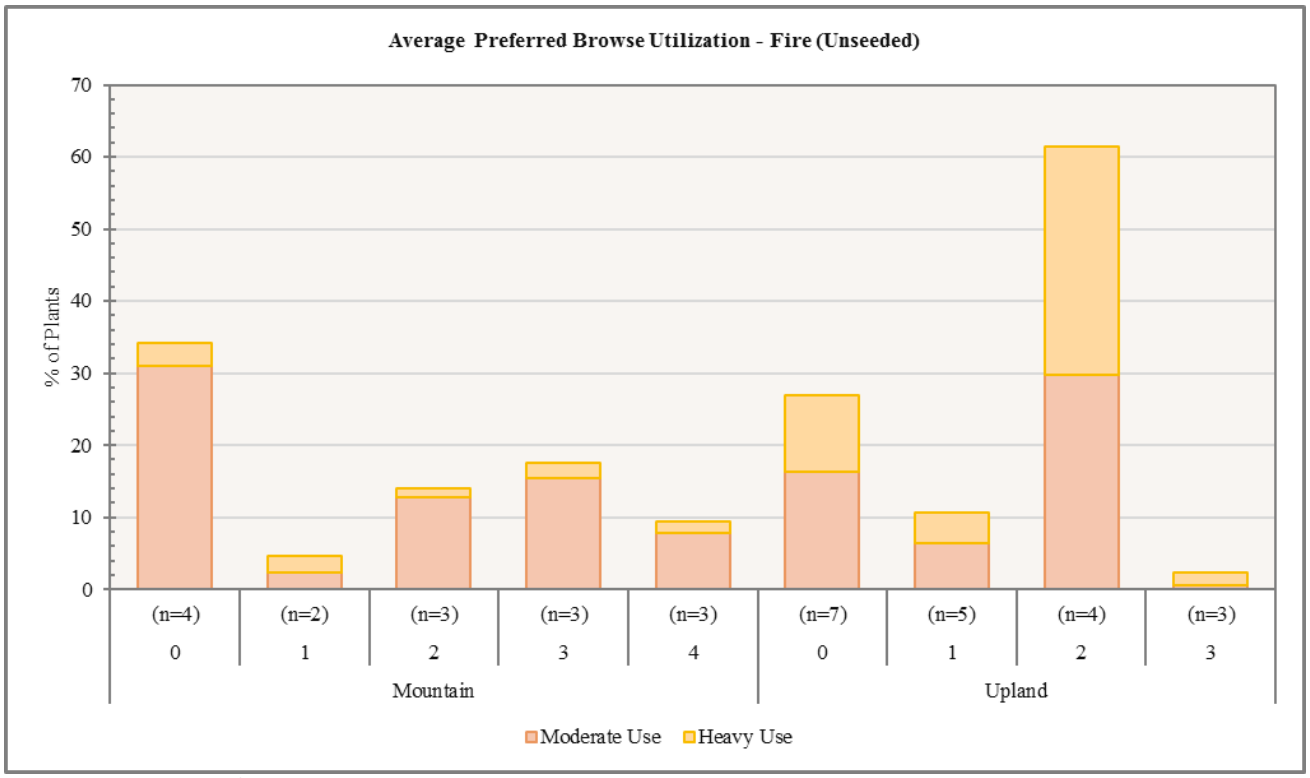


Figure 10.41: Average preferred browse utilization on mountain and upland study sites that have burned and have been seeded. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

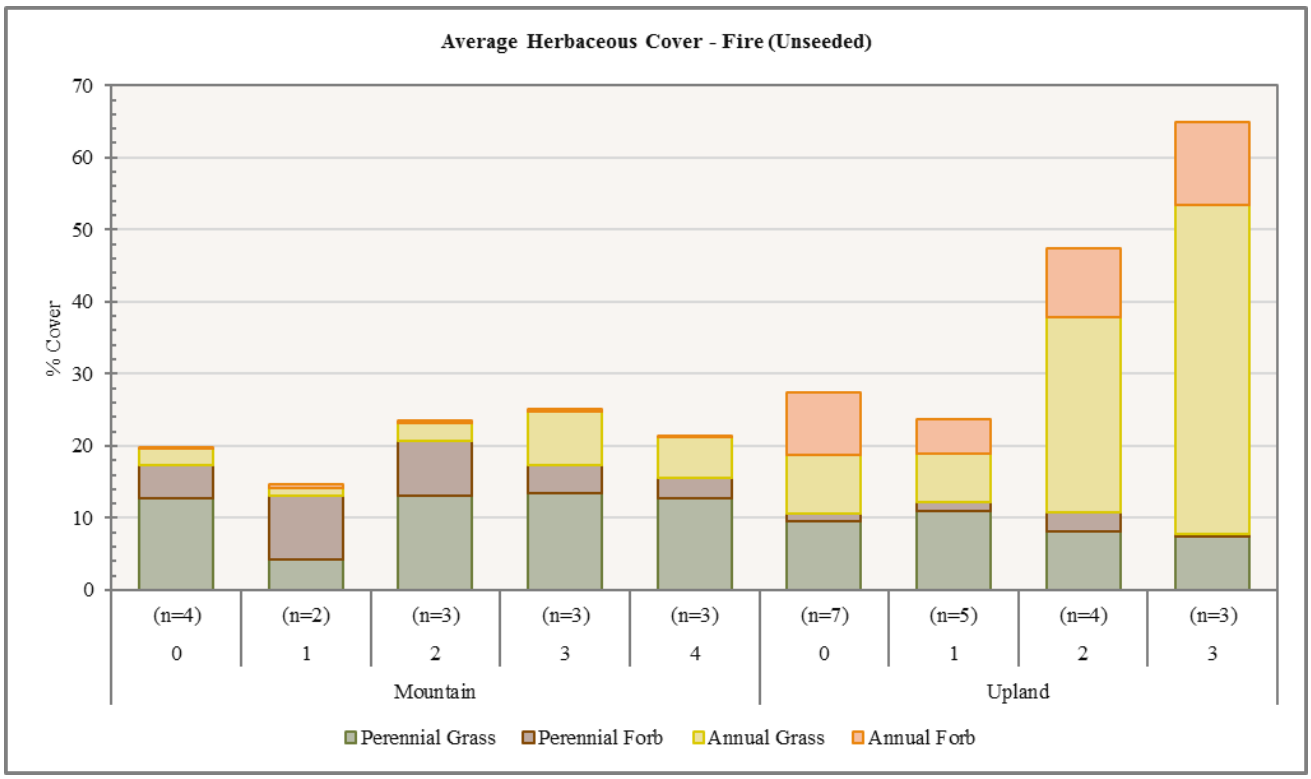


Figure 10.42: Average herbaceous cover on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

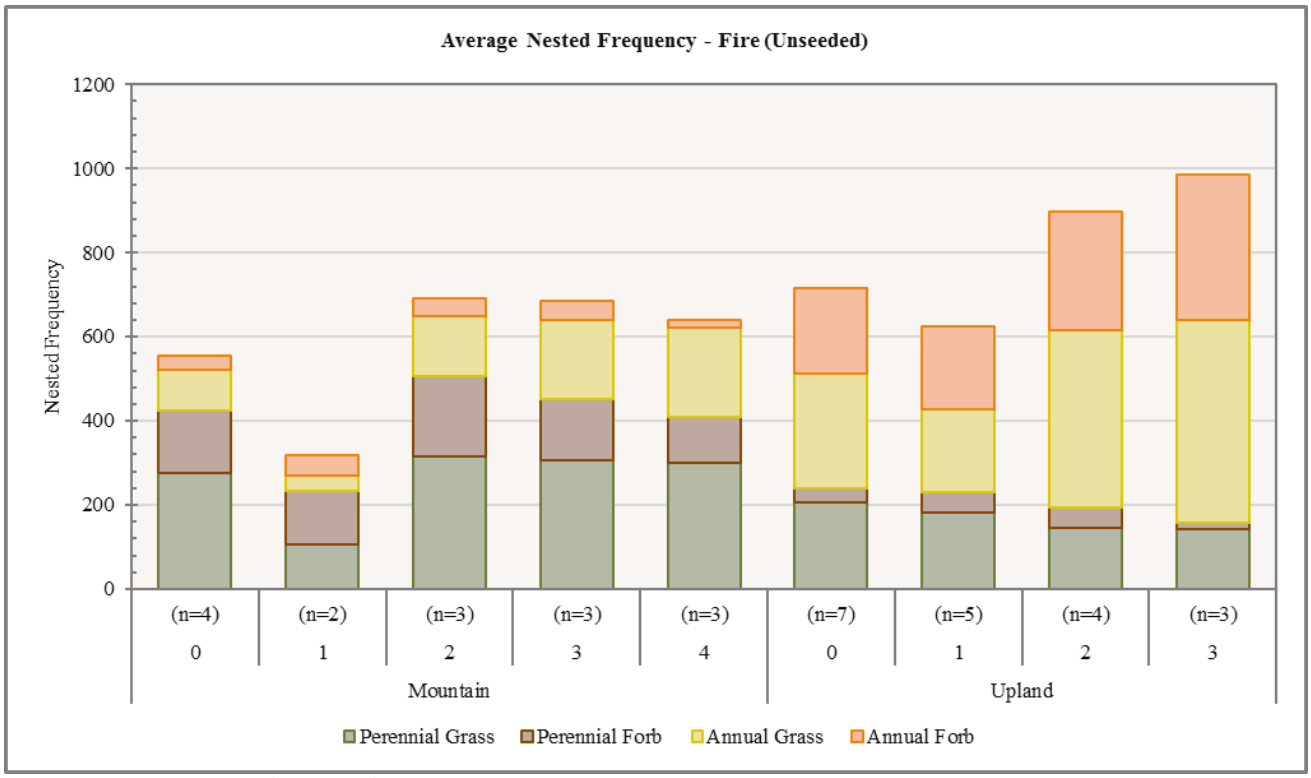


Figure 10.43: Average nested frequency of herbaceous species on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 4 – 18 years post-treatment.

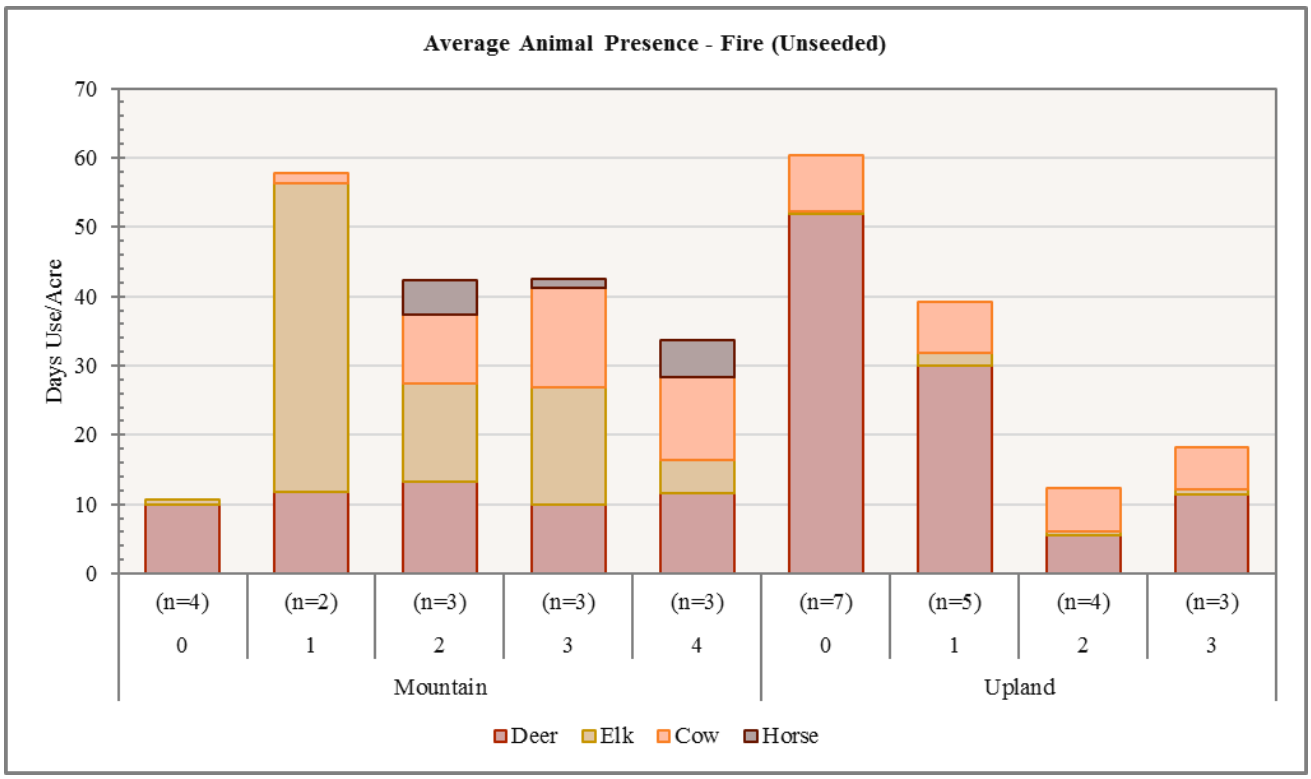


Figure 10.44: Average pellet transect data on mountain and upland study sites that have burned. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.

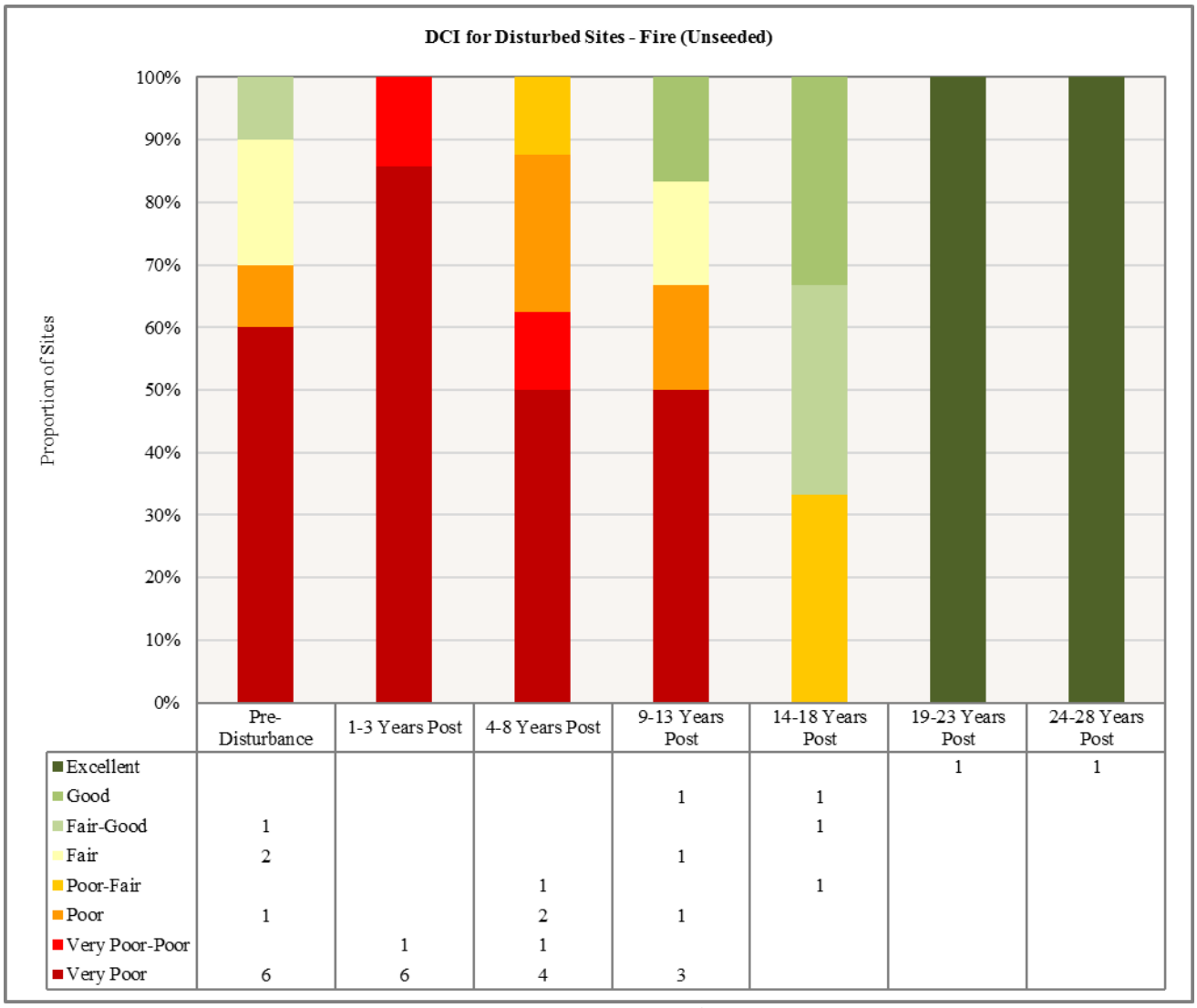


Figure 10.45: Deer winter range Desirable Components Index (DCI) summary by year of sites that have burned.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20-07	0	17.1	6.2	0.5	30	-0.9	5.2	0	**58.1**	**F**
20-07	1	0.4	0	0	13	-1.4	10	0	**22**	**VP**
20-07	2	14.5	14.3	2.9	18.1	-5.1	10	0	**54.7**	**P-F**
20-07	3	14.9	14.1	8.9	18.3	-15.5	3.5	0	**44.2**	**P**
20-07	4	25	12.6	6.7	29	-10.7	7.6	0	**70.1**	**F-G**
21A-04	0	1.3	0	0	3.6	-10.3	0.1	0	**-5.4**	**VP**
21A-04	2	2.5	0	0	19.3	-7.8	1	0	**14.9**	**VP**
21A-06	0	0	0	0	30	-2.2	0.1	0	**27.9**	**VP**
21B-11	0	1.2	0	0	0.9	-6.5	0.1	-2	**-6.4**	**VP**
21B-11	1	0	0	0	1.3	-15.4	0.2	-2	**-16**	**VP**
21B-11	2	0	0	0	4.3	-20	0.3	-2	**-17.4**	**VP**
21B-11	3	1.4	0	0	8.1	-20	0.3	-4	**-14.2**	**VP**
21B-12	0	30	8.5	0.5	28.9	-6.2	0	0	**61.7**	**F**
21B-12	1	0	0	0	1	0	0	0	**1**	**VP**
21B-12	2	3.9	0	0	0.8	-20	4.4	0	**-11**	**VP**
21B-12	3	29.7	15	2.2	1.3	-20	0.1	0	**28.2**	**VP**
21R-12	0	8	14.1	15	18.3	-8.4	10	0	**57**	**F**
21R-12	1	1.4	0	0	30	-8.8	8.1	0	**30.6**	**VP**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22-14	0	0.4	0	0	23.9	-8.9	1.5	0	**16.8**	**VP**
22-14	1	0.1	0	0	30	-0.7	1.4	0	**30.9**	**VP**
22-14	2	0	0	0	30	-5.9	10	0	**34.1**	**VP-P**
22-14	3	0.4	0	0	30	-18	0.8	0	**13.1**	**VP**
24R-10	0	2.1	0	0	9	0	1.3	0	**12.4**	**VP**
24R-10	1	0.2	0	0	30	0	3.2	0	**33.3**	**VP-P**
25C-27	0	30	6.4	7	20.4	0	6.4	0	**70.2**	**F-G**
25C-27	2	3.4	0	0	30	0	10	0	**43.4**	**P**
25C-27	3	11.8	12.3	1.1	30	0	9.9	0	**65.1**	**F**
25C-27	4	18.8	12	15	30	0	6.4	0	**82.2**	**G**
25C-27	5	26.5	15	15	29.4	0	7.4	0	**93.3**	**E**
25C-27	6	30	13.7	15	30	0	4	0	**92.7**	**E**
25C-28	0	30	10.2	2.7	1.5	0	1.5	0	**45.8**	**P**
25C-28	1	7.9	6.3	4.6	3.9	-0.2	10	0	**32.5**	**VP**
25C-28	2	13.5	8.9	10.6	14.5	-0.3	5.3	0	**52.5**	**P**
25C-28	3	21.9	14.3	15	13.6	-0.9	10	0	**73.9**	**G**
25C-28	4	26.7	11.6	10.3	4.7	-1.9	3.1	0	**54.5**	**P-F**
30-46*	0	1.9	0	0	0.4	-11.8	2	0	**-7.6**	**VP**
30-46*	1	2.7	0	0	0.8	-4.8	5.5	0	**4.2**	**VP**
30-46*	2	4.1	0	0	5.3	-10.1	5.4	0	**4.7**	**VP**

Table 10.5: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have burned. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment, 4 = 14 – 18 years post-treatment.
*Studies with an asterisk have been suspended.

Harrow

Twenty three study sites have been treated with a harrow over the study period. Two study sites [Mountain Home Seeding (20-03) and Evans Reservoir (25A-07)] are classified as mountain ecological sites, 12 [Blawn Wash Dixie (20R-04), Hamlin Valley Harrow (20R-06), Black Mountain (22R-05), Beaver Easement Harrow (22R-17), Plateau Harrow (23R-03), Triangle Mountain (25A-01), Black Mountain (25A-02), Praetor Slope (25A-05), Lower Dog Flat (25A-08), Row of Pines Exclosure (25A-14), Johnson Bench (27R-27), and Buckskin Valley Highway 20 (28R-10)] are considered to be upland ecological sites, and 9 studies [Anderson Dixie (21R-06), P-Hill Dixie (22R-08), Greenwich Disking (23R-01), Greenwich Native (23R-02), Elbow Ranch 1 (23R-05), South Narrows (23R-07), Box Creek Dixie (23R-11), Panguitch East Bench Harrow (24R-06), and North Narrows Dixie (25R-07)] are semidesert ecological sites.

The Mountain Home Seeding study can be found near Spike Hollow in the Mountain Home Range, and Blawn Wash Dixie is located near Blawn Wash Spring in the Wah Wah Mountains. Hamlin Valley Harrow is situated in the southern portion of Hamlin Valley. The Anderson Dixie study is located northeast of Oak City, near Horse Hollow. Black Mountain (22R-05) can be found at the foot of Black Mountain, southeast of the city of Beaver. The P-Hill Dixie site is situated just west of the city of Circleville, and Beaver Easement Harrow is southeast of Beaver. The Greenwich Native and Greenwich Disking studies are located in Grass Valley and southwest of the town of Greenwich. North of Koosharem Reservoir in Plateau Valley is the Plateau Harrow study site. Elbow Ranch 1 is found northeast of Piute Reservoir near Elbow Ranch. The South Narrows study is situated north of Otter Creek Reservoir in Grass Valley. Box Creek Dixie can also be found in Grass Valley, just northwest of Greenwich. The Panguitch East Bench Harrow site is located on the benches northeast of the city of Panguitch. The Triangle Mountain study is situated on Triangle Mountain which is southeast of the city of Salina. Black Mountain (25A-02) can be found on Black Mountain, west of Triangle Mountain. The Praetor Slope study is located on the Praetor Slopes, south of Koosharem Reservoir. Evans Reservoir can be found near Deadman Hollow south of Fish Lake, and the Lower Dog Flat site is situated on the lower portion of Dog Flat. Row of Pines Exclosure can be found on Row of Pines Bench, northwest of the town of Fremont. The North Narrows Dixie study is found in Grass Valley below Parker Mountain. The Johnson Bench study is

located on Johnson Bench which is on the Paunsaugunt Plateau. Finally, the Buckskin Valley Highway 20 site is situated in Buckskin Valley south of SR-20.

Shrubs/Trees: A majority of the preferred browse cover on the mountain ecological sites is provided by sagebrush species (*Artemisia sp.*). Overall average shrub cover has increased each sample year following treatment. Sagebrush species also contribute a majority of the preferred browse cover on upland study sites. Average overall shrub cover on these studies exhibited an initial decrease in the first post-treatment sample year. However, cover has increased each sample year since that time: the third post-treatment sample year displayed cover amounts nearly equivalent to those exhibited prior to treatment. This increasing trend is possibly driven in part by the Plateau Harrow study, which had no desirable browse cover prior to treatment, but increased to nearly 11% by the third sampling following treatment. Furthermore, one should consider that the differing number of studies from year to year may influence the average data. On semidesert studies, sagebrush species also contribute the most preferred browse cover. Average preferred browse cover data displays an initial decrease in the first sampling after treatment. However, cover has generally increased on these study sites in subsequent years, a trend which will likely continue as time elapses (**Figure 10.46**).

Average preferred browse demographics indicate that mountain study sites exhibited an initial decrease in preferred browse density post-treatment, but have recovered since that time; upland and semidesert study sites have followed the same general trend. Furthermore, marked increase in density on semidesert study sites between the first and second post-treatment sample years can largely be attributed to the Panguitch East Bench Harrow and North Narrows Dixie studies. Demographics also show that mature individuals have comprised a majority of the plant populations on mountain, upland, and semidesert sites in nearly all study years: however, some years do not follow this trend. Prior to treatment, young, mature, and decadent plants were co-dominant in the browse component on mountain study sites. On semidesert sites, young plants were the most abundant of any demographic during the second post-treatment sample year (**Figure 10.49**). Average preferred browse utilization on mountain and upland study sites decreased during the first post-treatment year, but has since increased. It is noted that overall use has increased on semidesert study sites. As of the third post-treatment sample year, approximately 25% of browse on mountain study sites exhibited moderate to heavy use, 36% on upland studies, and 32% on semidesert studies (**Figure 10.50**).

Tree cover has not been observed on mountain study sites, although average density indicates pinyon (*Pinus sp.*) and juniper (*Juniperus sp.*) are present in low amounts on the Mountain Home Seeding study. Overall cover on upland study sites remains low, but trees have increased in cover each year. This increase in cover is largely due to the Triangle Mountain and Black Mountain studies. Blawn Wash Dixie is largely responsible for the increase between the second and third sample years following treatment. On upland study sites, tree cover increased in between the pre-treatment and first post-treatment sample years, but was not observed in subsequent years: this trend can be entirely attributed to the Anderson Dixie study. Overall tree density on these sites has remained low, and trees have only been observed on Anderson Dixie and P-Hill Dixie (**Figure 10.56**, **Figure 10.57**).

Herbaceous Understory: The herbaceous understory on mountain study sites has marginally decreased overall in cover, but has increased in frequency; perennial grasses are the dominant herbaceous component on these sites. On upland study sites, there has been an overall increase in herbaceous cover. Nested frequency on upland studies has fluctuated, but displays an overall stable trend when comparing pre-treatment data to that of the third post-treatment sampling. Perennial grasses also comprise much of the understory on these studies; annual grasses have been present in moderate amounts over the study period, but have decreased as of the most recent sample year. Average herbaceous cover has remained fairly stable on semidesert sites, and frequency has exhibited a marginal increase. Annual forbs and grasses dominate the understories on sites of this ecological type. Elbow Ranch 1 and South Narrows in particular have exhibited consistently elevated annual forb cover and frequency. Annual grass trends are mainly driven by the Anderson Dixie, P-Hill Dixie, and North Narrows Dixie studies (**Figure 10.51**, **Figure 10.52**).

Occupancy: On mountain study sites, average pellet transect data indicates that animal presence has fluctuated from year to year, but slightly increased overall. Elk have been the primary occupants in all sample years except the third year following treatment, when deer were the primary occupants. Mean abundance of elk pellet groups has fluctuated between nearly 18 days use/acre in the third post-treatment sample year and almost 52 days use/acre in the first year following treatment. Deer pellet groups have had a mean abundance as low as nearly 5 days use/acre in the first sample year after treatment and as high as 48 days use/acre in the third post-treatment sample year. Horses have also been present, with pellet group mean abundance ranging from 7 days use/acre in the third sampling following treatment to 43.5 days use/acre in the first post-treatment year.

Overall animal presence has decreased slightly on upland studies while primary occupancy has varied. Deer were the main occupants in the pre- and first post-treatment sample years, while the primary occupants during the second sampling following treatment were elk. Cattle were the primary occupants in the third post-treatment sample year. Deer pellet groups have had a mean abundance ranging from 5 days use/acre in the second post-treatment year to nearly 23 days use/acre prior to treatment. Mean elk pellet group abundance has been as low as nearly 4 days use/acre before treatment and as high as 13 days use/acre in the second sampling after treatment. Cattle pellet group abundance has had an average fluctuating between 10 days use/acre pre-treatment to over 12 days use/acre in the first post-treatment sample year. Finally, mean abundance of horse pellet groups has ranged from 0 days use/acre in the first sample year after treatment to nearly 1 days use/acre before treatment.

Average animal presence has also decreased overall on semidesert study sites. Deer were the primary occupants in all sample years, with mean abundance of pellet groups ranging from 5 days use/acre in the third post-treatment sampling to 14 days use/acre prior to treatment. Elk pellet groups have had an average abundance fluctuating between 1 days use/acre in the first sample year after treatment and 2.5 days use/acre in the second post-treatment year. Mean abundance of cattle pellet groups has been as low as under 1 days use/acre in the first post-treatment year to over 4 days use/acre in the second sampling following treatment. Finally, horse pellet groups have had an average abundance ranging from 0 days use acre in the pre-treatment and first and third post-treatment samplings to 0.1 days use/acre in the second (**Figure 10.53**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have undergone a harrow treatment has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to good condition, with most studies remaining stable or exhibiting minor fluctuations. The Elbow Ranch 1, South Narrows, Triangle Mountain, and Black Mountain (25A-02) studies have remained in very poor condition, while Praetor Slope has remained in very poor-poor condition. Johnson Bench is in poor condition, and Hamlin Valley Harrow improved from poor to good. The Beaver Easement Harrow site went from poor-fair to fair condition, while Greenwich Disking remained in poor-fair and Mountain Home Seeding went from fair to poor-fair. Conditions of P-Hill Dixie and Plateau Harrow slightly deteriorated, going from fair-good to fair and good to fair, respectively. The Blawn Wash Dixie study remained in fair condition, Anderson Dixie in fair-good, and the Greenwich Native site went from good to fair-good. The South Beaver Dixie, Evans Reservoir, Lower Dog Flat, and Row of Pines Exclosure study sites all improved from fair-good to good. Black Mountain (22R-05), Box Creek Dixie, and Buckskin Valley Highway 20 remained in good condition, and North Narrows Dixie deteriorated slightly from good-excellent to good. Finally, the Panguitch East Bench Harrow site remained in excellent condition (**Figure 10.54**, **Table 10.6**).

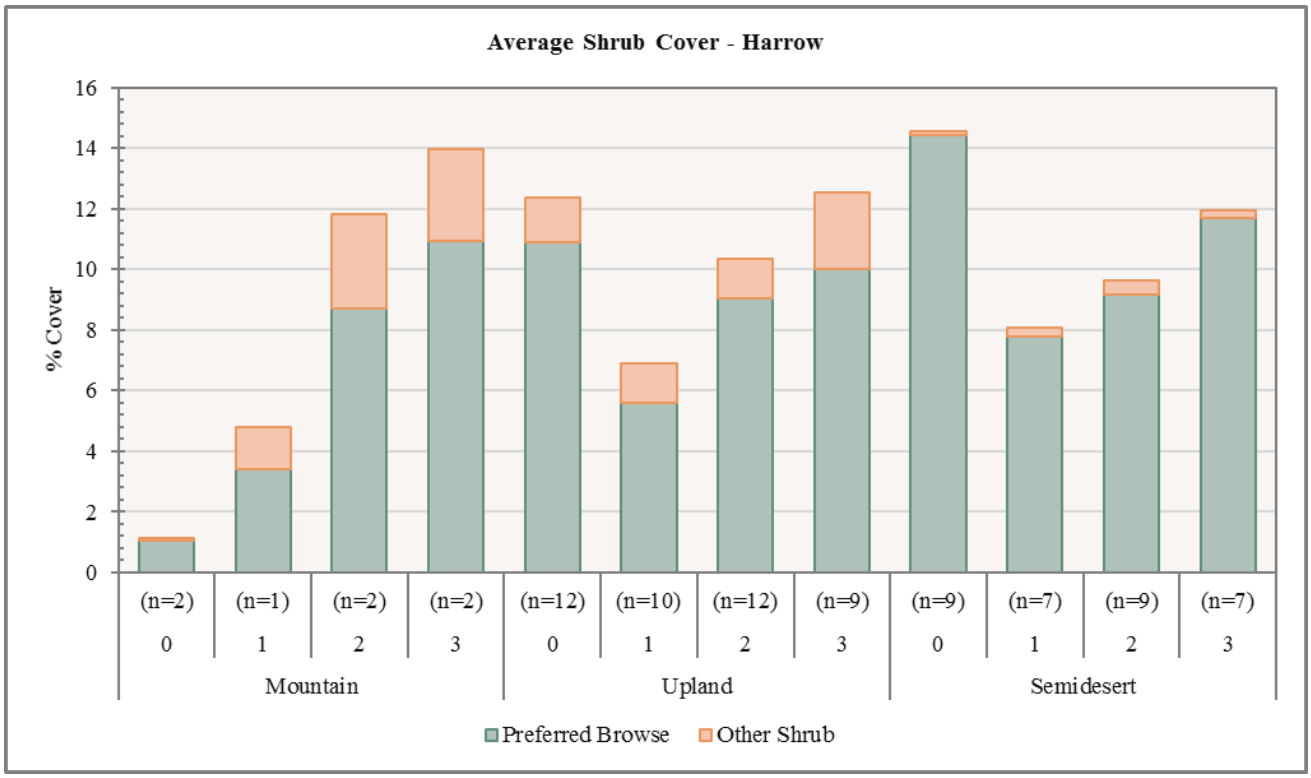


Figure 10.46: Average shrub cover on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

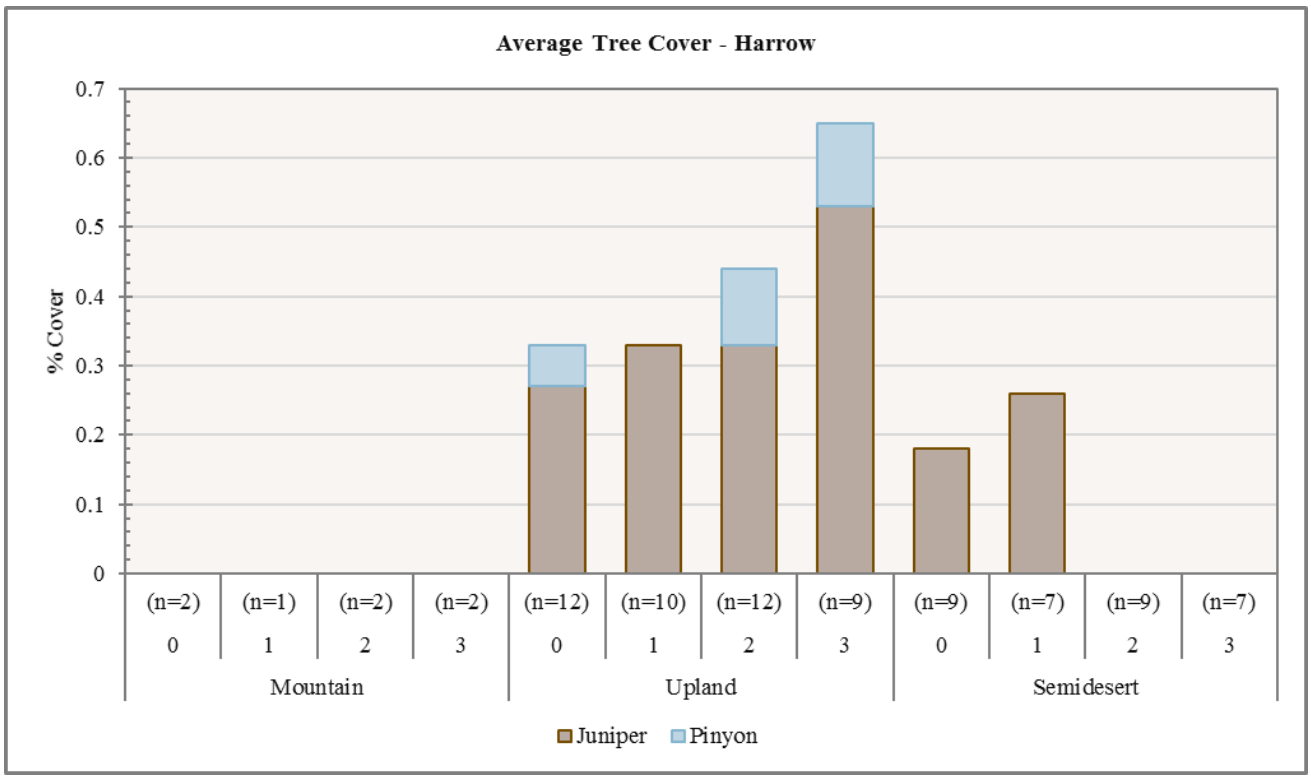


Figure 10.47: Average tree cover on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

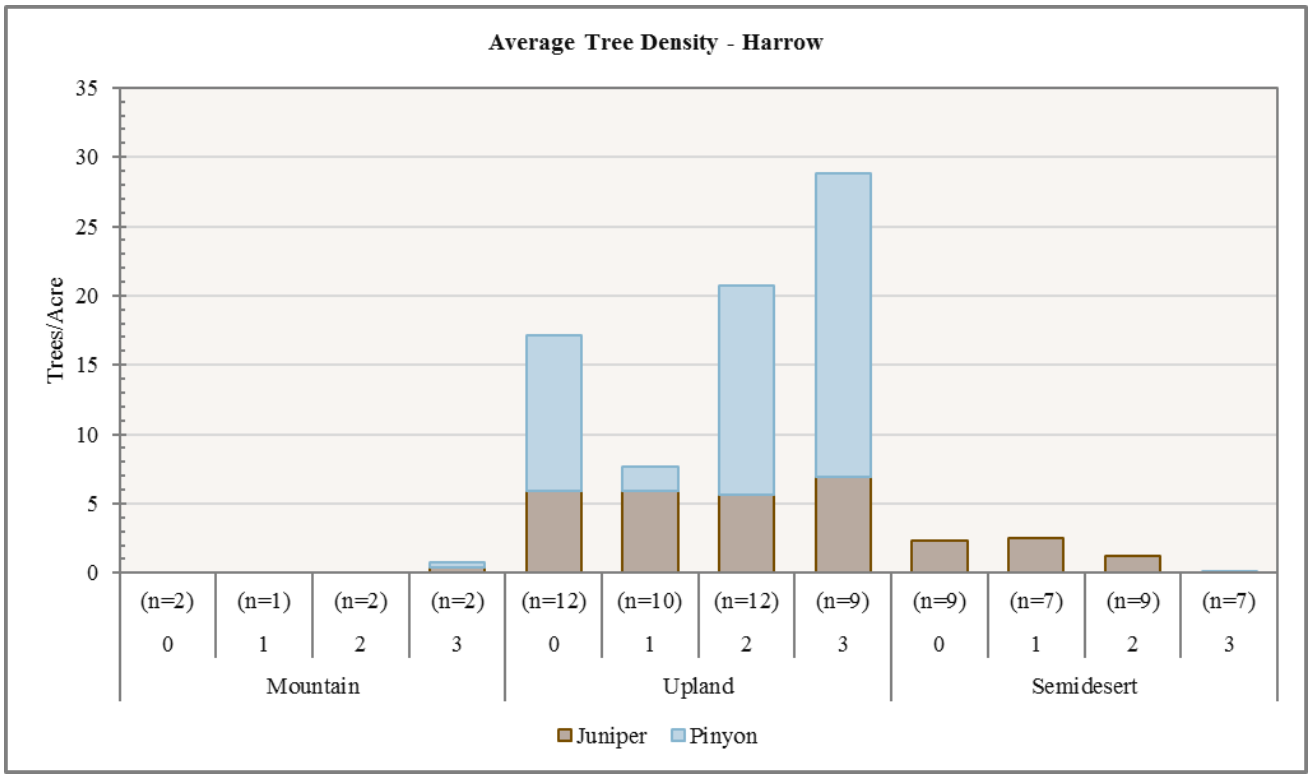


Figure 10.48: Average tree density on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

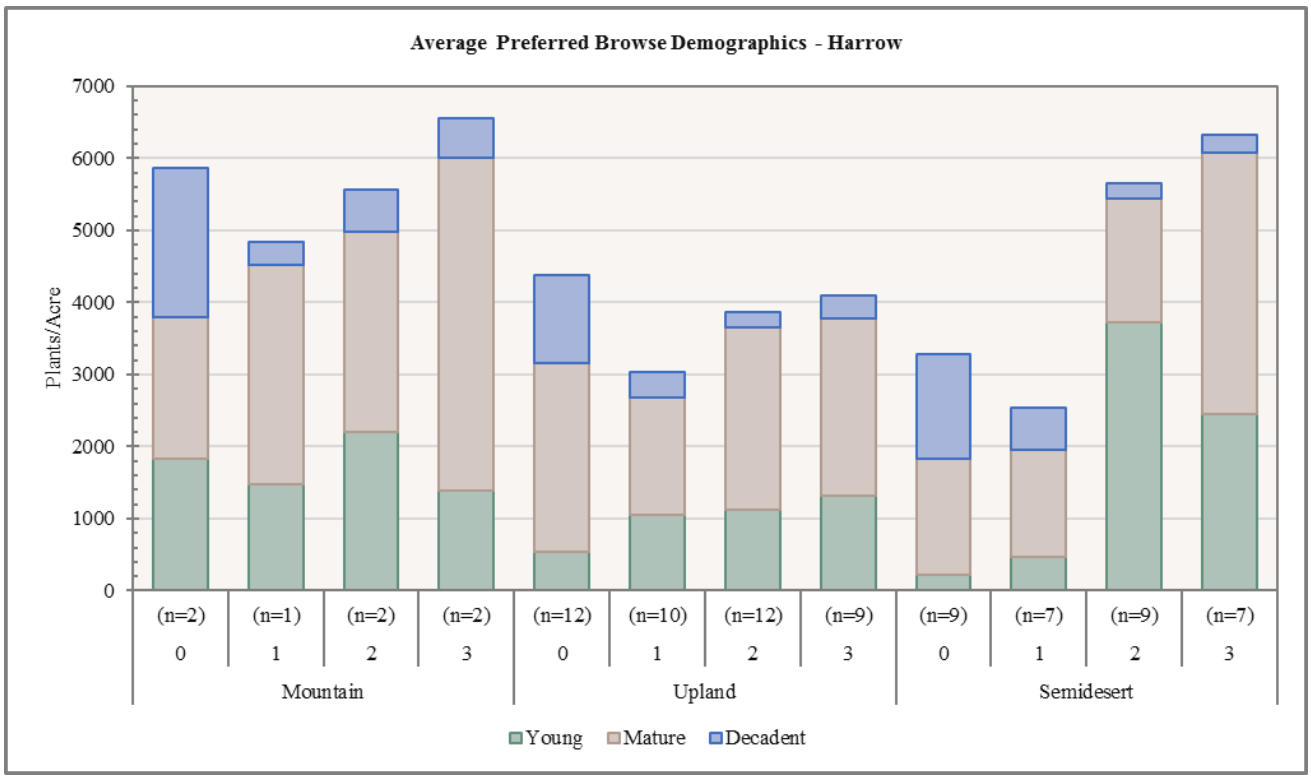


Figure 10.49: Average preferred browse demographics on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

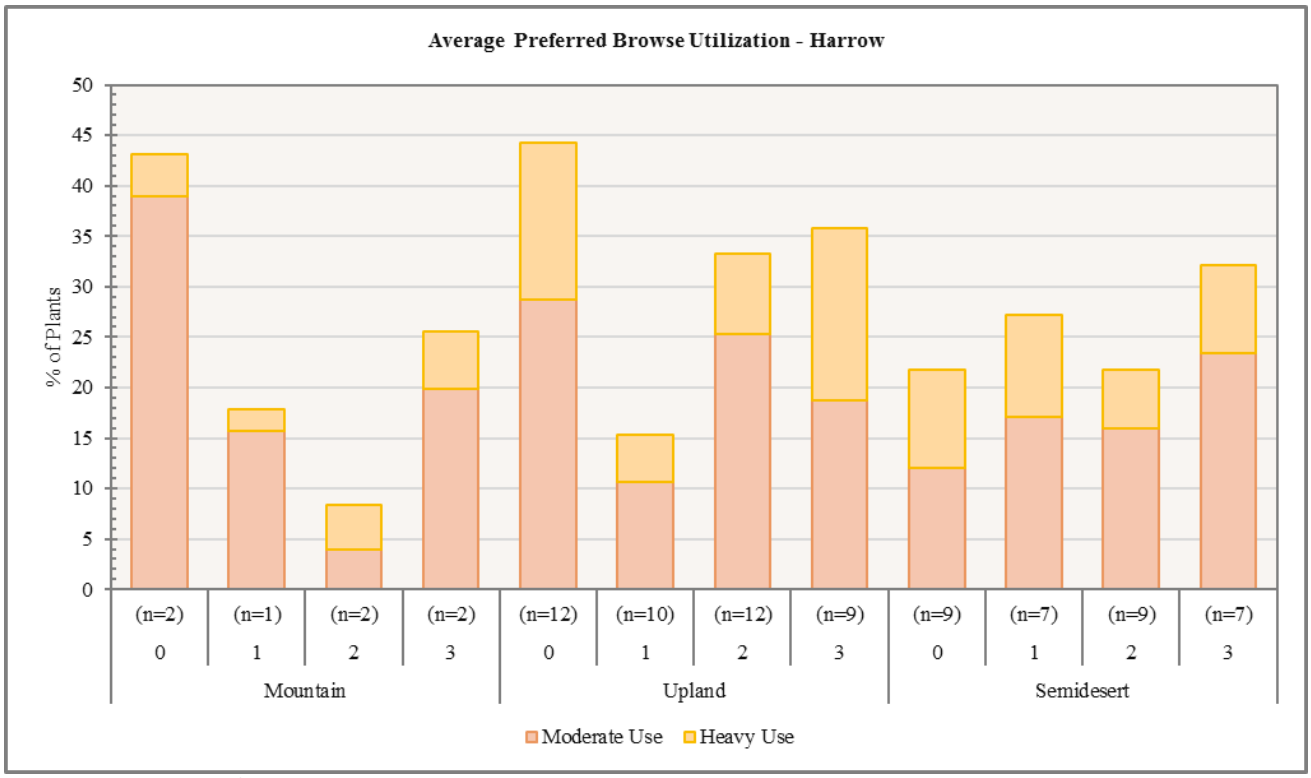


Figure 10.50: Average preferred browse utilization on mountain, upland, and semidesert study sites that have undergone a harrow treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

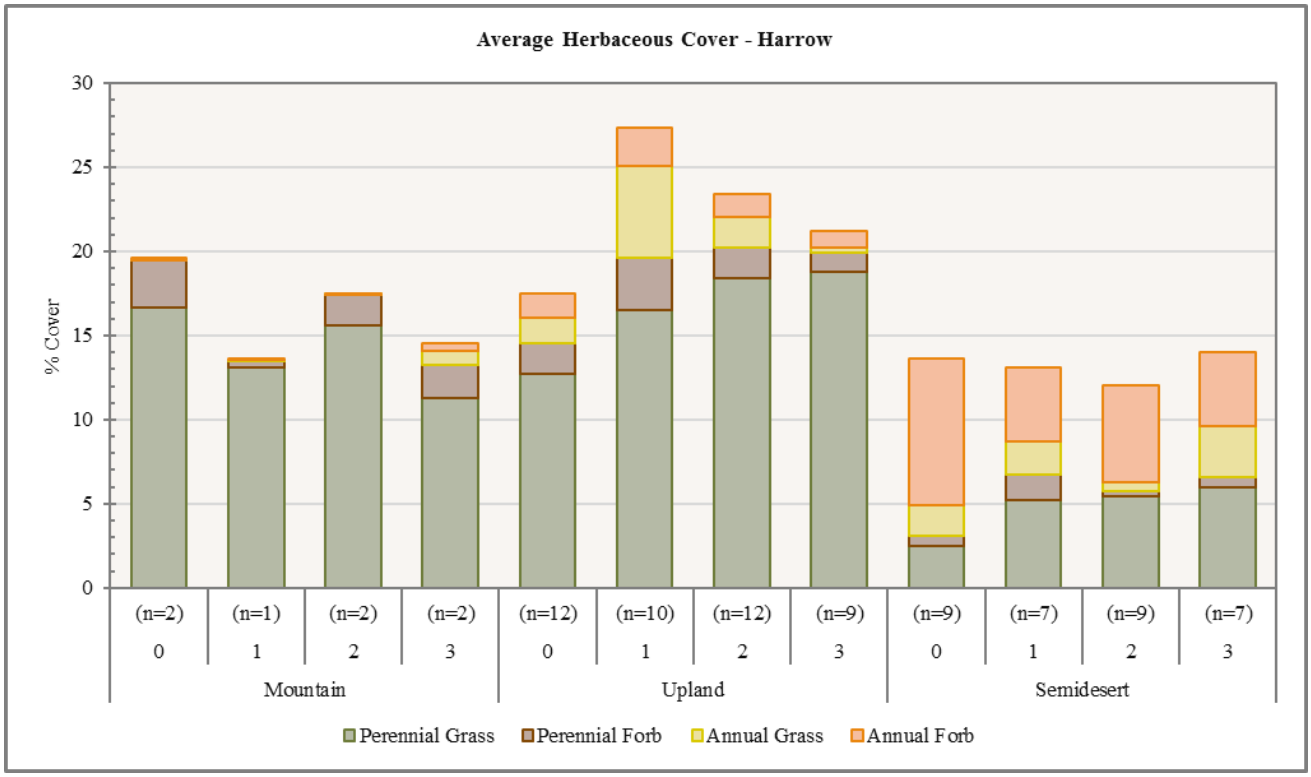


Figure 10.51: Average herbaceous cover on mountain, upland, and semidesert study sites that have undergone a harrow treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

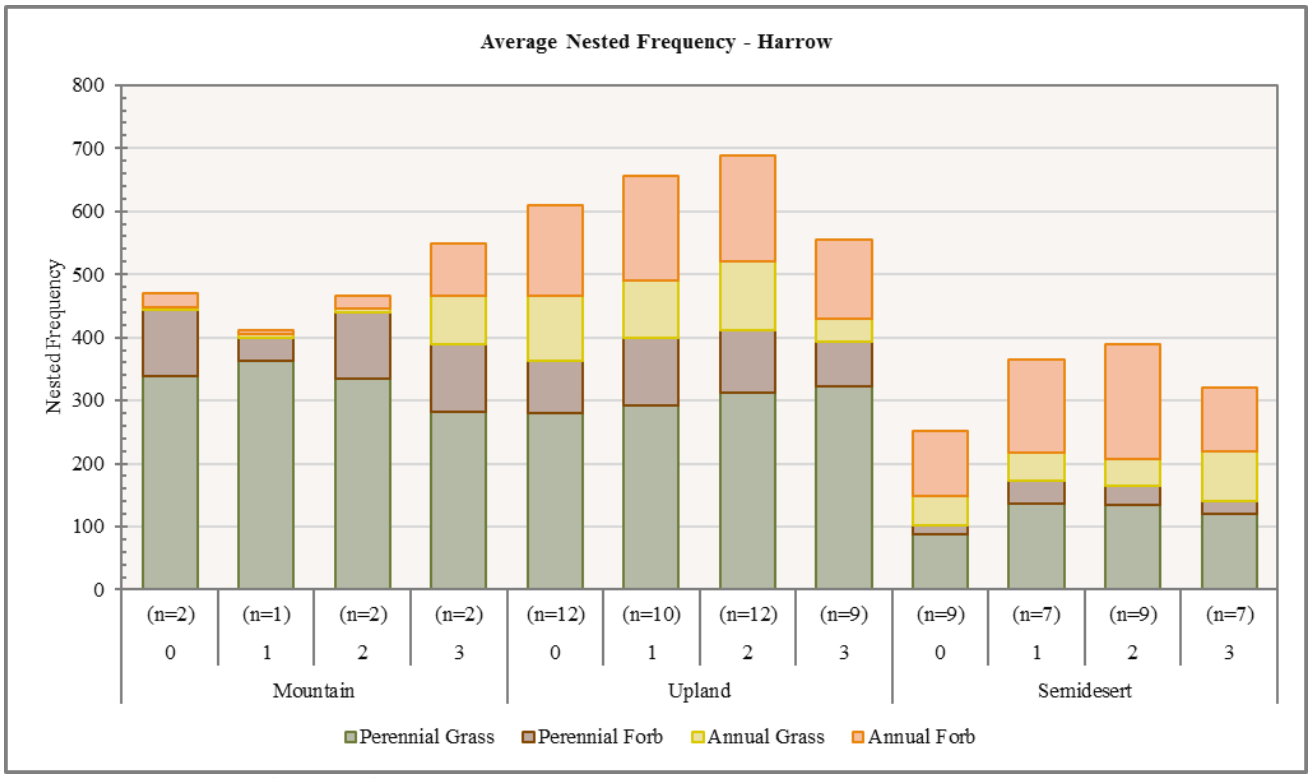


Figure 10.52: Average nested frequency of herbaceous species on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

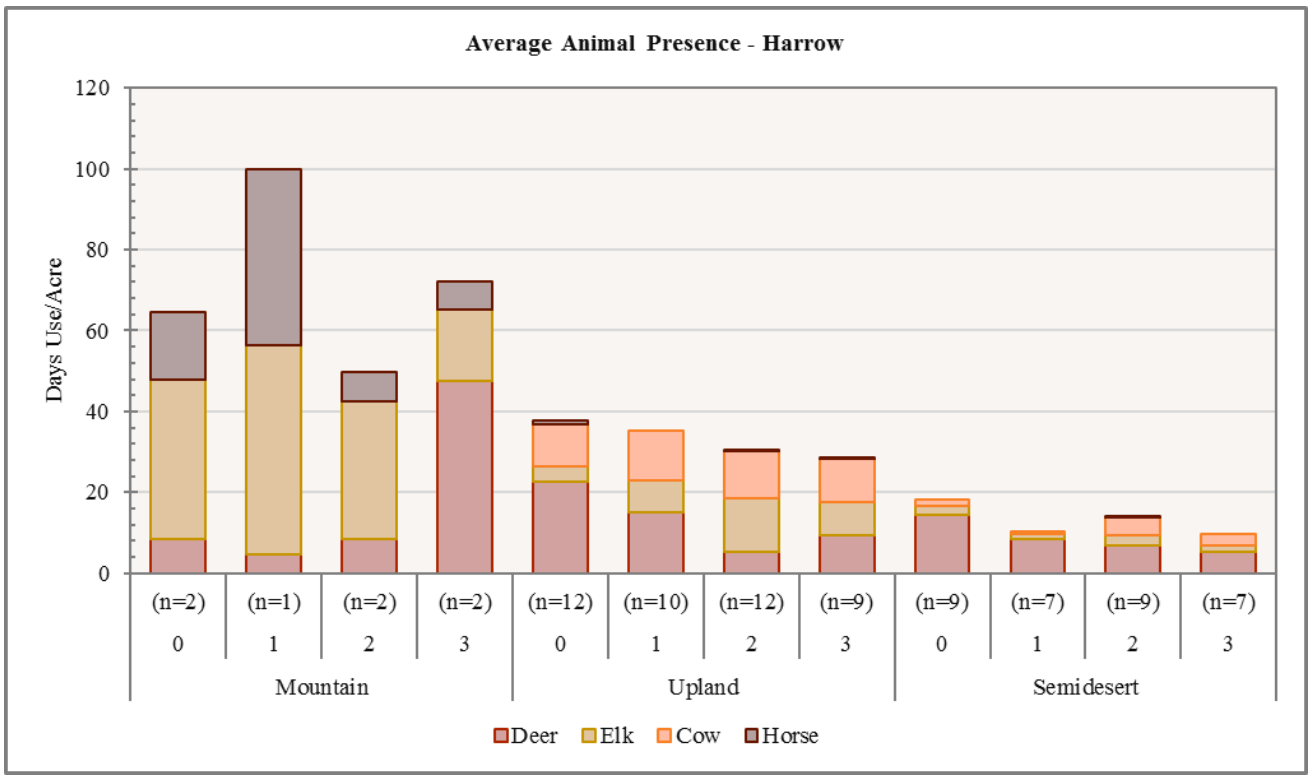


Figure 10.53: Average pellet transect data on mountain, upland, and semidesert study sites that have undergone a harrow treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment. Mountain, upland, and semidesert deer pellets include deer/antelope.

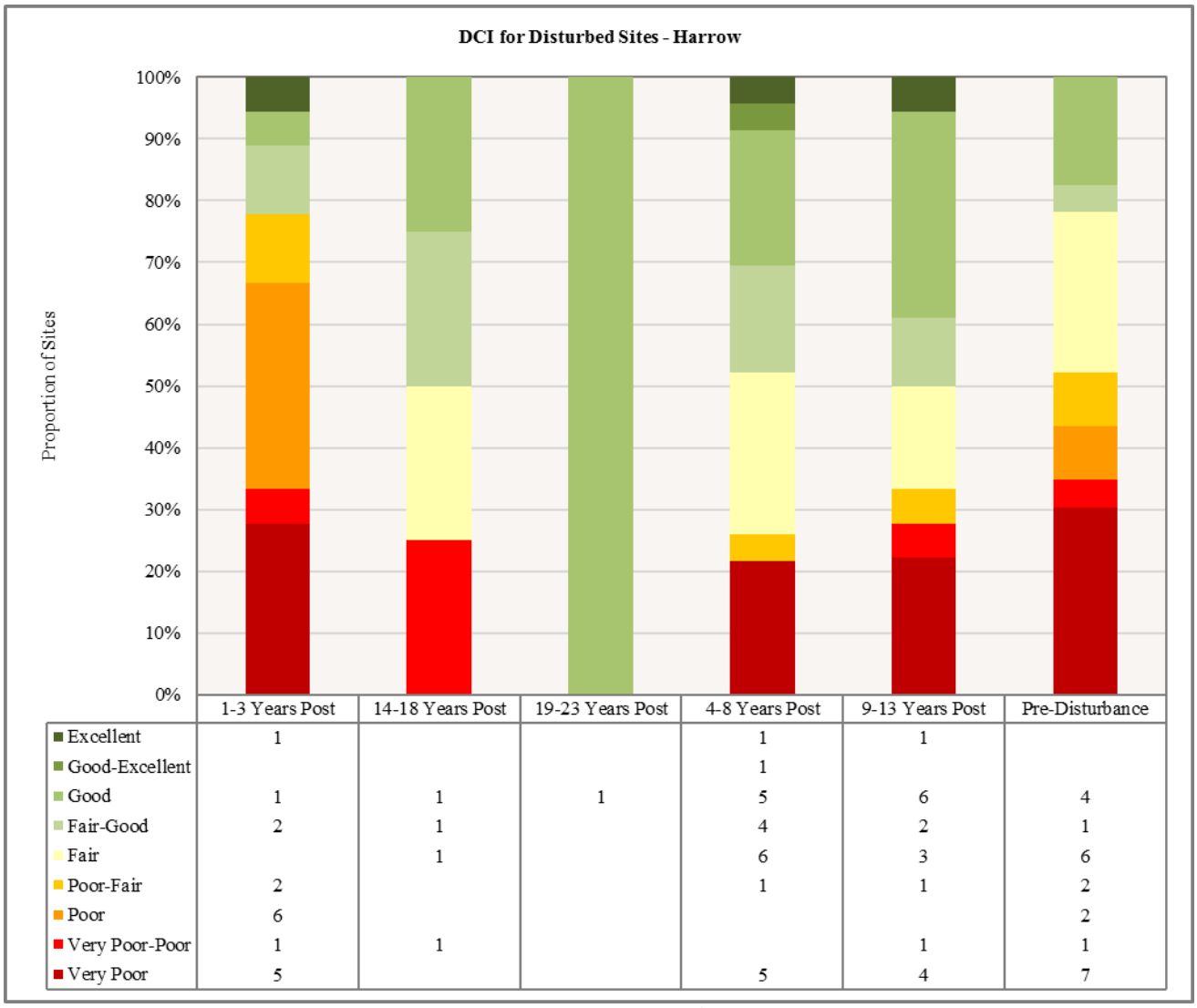


Figure 10.54: Deer winter range Desirable Components Index (DCI) summary by year of sites that have undergone a harrow treatment.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20-03	0	2.6	0	0	30	0	0.6	0	**33.2**	**VP**
20-03	1	4.3	0	0	26.3	0	0.7	0	**31.2**	**VP**
20-03	2	10.6	12.5	15	24.5	0	0.5	0	**63.1**	**F**
20-03	3	15.6	14.7	14.3	9.3	-1.3	2.3	0	**54.9**	**P-F**
20R-04	0	30	5.5	0.9	19.5	-2.7	0.3	0	**53.5**	**F**
20R-04	2	29.4	14.1	5.3	8.9	-7.4	2.6	0	**52.8**	**F**
20R-04	3	30	13.5	1.5	11.1	-0.5	1.1	0	**56.7**	**F**
20R-06	0	14.9	11.2	15	23	0	3.2	0	**67.2**	**G**
20R-06	1	2.9	0	0	30	-0.2	10	0	**42.7**	**P**
20R-06	2	6.5	14.9	15	30	0	4	0	**70.4**	**G**
21R-06	0	19.2	3.5	0	16	-11.8	0.3	0	**27.2**	**F**
21R-06	1	21.8	12.9	4.1	14.5	-10.3	2.4	0	**45.4**	**F-G**
21R-06	2	10.5	12.8	3.1	21.5	-3	0.3	0	**45.3**	**F-G**
22R-05	0	21.6	4.7	0	10.2	-1.7	2.3	0	**37.2**	**P**
22R-05	1	22.3	11.2	15	25.9	-3.3	6.2	0	**77.2**	**G**
22R-05	2	20.6	11.6	7.1	27.1	-0.6	8.2	0	**74.1**	**G**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22R-08	0	30	2.3	0	0.2	0	0.2	0	**32.7**	**F**
22R-08	1	10	-0.6	2.9	0.3	0	0	0	**12.6**	**P**
22R-08	2	15.1	13.5	15	0.3	-0.2	0.1	0	**43.8**	**F-G**
22R-08	3	17	12.3	15	1.6	-11.8	1.3	0	**35.4**	**F**
22R-17	0	19.1	8.4	15	23.5	-2.5	8.1	0	**71.5**	**G**
22R-17	1	6.8	13.3	15	23.8	-20	10	0	**48.8**	**P-F**
22R-17	2	8.9	11.9	13.5	30	-5.6	3.3	0	**62**	**F**
22R-22	2	10.1	12.2	4.3	27.9	-1.2	6.3	0	**59.6**	**F**
22R-22	3	11.4	12.2	6	30	-0.1	5.2	0	**64.6**	**F-G**
22R-22	4	13.3	11.9	7.4	30	0	8.8	0	**71.3**	**G**
23R-01	0	0	0	0	0	0	0.5	0	**0.5**	**VP**
23R-01	1	0	0	0	15.1	0	8.4	0	**23.5**	**P-F**
23R-01	2	5	0	0	21.5	0	0.4	0	**26.9**	**P-F**
23R-02	0	26.8	-2	1.9	0.1	0	0	0	**26.8**	**P-F**
23R-02	1	14.9	6.2	15	3.2	0	6.5	0	**45.7**	**F-G**
23R-02	2	26.3	8.8	12.2	5	0	0.1	0	**52.3**	**G**
23R-02	3	21	9.2	6.9	5.4	0	0.8	0	**43.3**	**F-G**
23R-03	0	4.6	0	0	16.4	-6.5	10	0	**24.5**	**VP**
23R-03	1	6.3	0	0	30	-1	10	0	**45.2**	**P**
23R-03	2	11.4	5.7	2.4	30	-1.1	10	0	**58.4**	**F**
23R-03	3	13.6	14.1	15	30	-0.8	3.2	0	**75.1**	**G**
23R-03	4	13.5	8.8	6.3	30	-2.2	1.9	0	**58.2**	**F**
23R-05	0	0	0	0	0	0	0	0	**0**	**VP**
23R-05	2	0	0	0	0	0	0	0	**0**	**VP**
23R-05	3	0.2	0	0	0	0	0	0	**0.2**	**VP**
23R-07	0	0	0	0	0.2	0	9.5	0	**9.7**	**VP-P**
23R-07	1	0	0	0	0	0	0.1	0	**0.1**	**VP**
23R-07	2	0.3	0	0	1.1	0	1.6	0	**3**	**VP**
23R-07	3	0.1	0	0	0.1	0	2.9	0	**3.1**	**VP**
23R-11	0	27.1	5.2	12.2	0.7	0	0.1	0	**45.4**	**F-G**
23R-11	2	14	15	15	2.3	0	2.1	0	**48.4**	**G**
23R-11	3	21.7	14.7	15	3	0	2.9	0	**57.3**	**G**
24R-06	0	24.4	1.5	3.6	10.7	0	0.1	0	**40.2**	**F**
24R-06	1	5.9	0	0	12.8	0	0.1	0	**18.7**	**P**
24R-06	2	19.9	14.8	15	21.5	0	0.2	0	**71.3**	**E**
24R-06	3	28.5	14.8	15	30	0	0	0	**88.3**	**E**
25A-01	0	1.1	0	0	30	-0.1	1.1	0	**32.1**	**VP**
25A-01	1	1	0	0	30	0	2	0	**32.9**	**VP**
25A-01	2	1.1	0	0	30	0	1.3	0	**32.4**	**VP**
25A-01	3	0.8	0	0	30	-0.2	0.6	0	**31.2**	**VP**
25A-02	0	1.9	0	0	24.5	-0.1	0	0	**26.2**	**VP**
25A-02	1	1.4	0	0	21	-0.4	0.3	0	**22.3**	**VP**
25A-02	2	2	0	0	30	-0.3	0.3	0	**32**	**VP**
25A-02	3	2.5	0	0	22.8	-0.5	0	0	**24.9**	**VP**
25A-05	0	15	5.9	0.7	30	0	0	0	**51.6**	**P-F**
25A-05	1	0.4	0	0	30	0	3.8	0	**34.2**	**VP-P**
25A-05	2	0.8	0	0	30	0	0.4	0	**31.1**	**VP**
25A-05	3	3.9	0	0	30	0	1.2	0	**35.1**	**VP-P**
25A-05	4	3.9	0	0	30	0	0.2	0	**34.1**	**VP-P**
25A-07	0	20.8	0.3	4.1	26	0	10	0	**61.3**	**F**
25A-07	2	11.1	8	3.3	30	0	6.8	0	**59.2**	**F**
25A-07	3	11.8	7.1	4.5	30	0	5.5	0	**58.8**	**F**
25A-07	4	12.5	11	8.9	30	0	7.6	0	**70**	**F-G**
25A-07	5	15.9	14	14.2	30	0	10	0	**84.1**	**G**
25A-08	0	26.9	8.7	1.7	15.7	0	0.1	0	**53**	**F**
25A-08	1	19.8	9.8	0.8	8.8	0	0.1	0	**39.2**	**P**
25A-08	2	26.1	12.5	15	11.6	0	0.1	0	**65.3**	**F-G**
25A-08	3	24.1	10.4	15	26.9	0	0.1	0	**76.5**	**G**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
25A-14	0	12	2.5	0.9	11.4	0	0.4	0	**27.1**	**VP**
25A-14	1	5.4	0	0	20.6	0	0.1	0	**26**	**VP**
25A-14	2	11.6	14.1	9.9	30	0	0.4	0	**65.9**	**F-G**
25A-14	3	15	13.2	15	30	0	0	0	**73.3**	**G**
25C-01*	0	15.8	10.9	2.4	28.1	0	0.7	0	**57.9**	**F**
25C-01*	1	7.8	10.3	6.4	30	0	1.6	0	**56**	**F**
25R-07	0	28.4	1.1	3	17.1	0	0.7	0	**50.2**	**G**
25R-07	1	16.6	12.2	8.6	27.2	0	4	0	**68.5**	**E**
25R-07	2	12.6	12.9	14.2	25	-0.3	0.1	0	**64.5**	**G-E**
25R-07	3	14.4	13.6	8.7	30	-4.3	0.1	0	**62.5**	**G**
27R-14*	0	0.4	0	0	0.4	0	3.2	0	**4**	**VP**
27R-15*	0	9.9	7.1	4.6	0.8	0	5.2	0	**27.5**	**VP**
27R-27	0	3.5	0	0	30	0	6.6	0	**40.1**	**P**
28R-10	0	25.6	9	2.9	29.9	0	3	0	**70.4**	**G**
28R-10	1	4.1	0	0	30	0	5.3	0	**39.4**	**P**
28R-10	2	7.6	14	15	30	0	6.7	0	**73.3**	**G**
28R-10	3	7.4	13.7	15	30	0	9.1	0	**75.1**	**G**

Table 10.6: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have undergone a harrow treatment. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

Lop & Scatter

Twenty study sites have undergone a lop and scatter treatment during the study period. Of these studies, four [Deer Flat (22-01), Sand Ledges (25R-09), North Hills (29-03), and Barracks Chaining (29-04)] are classified as mountain ecological sites, 15 [Lower Indian Peak (20-02), Kanosh Lop and Scatter (21R-11), Duggins Creek (21R-15), Sulphurdale (22R-07), Spry Sagebrush Restoration (22R-16), Fremont Pass (22R-25), Saul Meadow (23-02), Mud Spring Chaining (24-04), Cow Creek (24-07), Pine Point Handthin (27R-22), Hatch Bench 2 (27R-24), Paragonah (28-07), Grass Valley (28-08), Fivemile 2 (28R-12), and Southwest of Newcastle (30-29)] are considered to be upland ecological sites and one [Above Fremont Wash (22R-04)] is classified as a semidesert ecological site.

The Lower Indian Peak study site is located just east of Indian Peak, while Kanosh Lop and Scatter is south of the town of Kanosh. The Duggins Creek study is located near Duggins Creek just southeast of Blue Mountain. Above Fremont Wash is situated above Fremont Wash near the junction of I-15 and SR-20. Deer Flat can be found southwest of the town of Marysvale on Deer Flat. The Sulphurdale study is situated near Sulphur Creek near the community of Sulphurdale, and the Spry Sagebrush Restoration site is located just north of Dog Valley Road and south of Spry. Fremont Pass can be found in Fremont Canyon. The Saul Meadow study is situated southeast of the city of Richfield near Saul Meadow. Mud Spring Chaining is located south of Circleville near the Circleville study, and Cow Creek is just south of Black Canyon near Cow Creek. Sand Ledges is situated near Kings Meadow Canyon on the Sevier Plateau. The Pine Point Handthin study can be found on Lone Pine Point on the Skutumpah Terrace, and Hatch Bench 2 is situated on the benches south of Hatch. The Paragonah study site is south of the town of Paragonah, while the Grass Valley study is located in Grass Valley south of the city of Parowan. Fivemile 2 can be found northwest of Panguitch. The North Hills study is located on the North Hills southwest of Cedar City, and Barracks Chaining is situated west of the town of Mount Carmel Junction. Finally, the Southwest of Newcastle study is located southwest of the town of Newcastle.

Shrubs/Trees: Mountain ecological sites have exhibited an overall increasing trend. However, when considering these analyses, it is important to note the differing number of studies from year to year and consider their effect on these vegetation trends. Closer review of the data indicates that the increase in preferred browse cover between the first and second post-treatment samplings is entirely driven by the North

Hills study. Average shrub cover on upland ecological sites has increased overall following treatment. Many of the studies had preferred browse cover of nearly 10% or more during the first and second samplings following treatment. However, the Kanosh Lop and Scatter study contributed the most preferred browse cover of any single site during these years: a majority of this cover was provided by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*). Most study sites in the third sample year following treatment contributed over 10% preferred browse cover. However, average shrub cover exhibited a very slight decrease from the second post-treatment sample year. This decrease is possibly due in part to the exclusion of the Kanosh Lop and Scatter study, which has no data for the third post-treatment category. The semidesert study site has displayed decreases in preferred browse cover and increases in that of other shrubs; overall cover has remained stable (**Figure 10.55**).

Average preferred browse demographics for mountain ecological sites indicate that density of preferred browse has increased over time and that mature individuals have comprised a majority of the population. Again, the increase between the first and second post-treatment years is solely driven by the North Hills study. Upland and semidesert sites have exhibited an overall decrease in density. Mature plants have made up a majority of the populations on these sites. The exception to this is on the semidesert study prior to treatment, when young plants were the most abundant (**Figure 10.58**). Mean utilization of preferred browse has decreased on mountain sites. On upland sites, utilization has increased overall with nearly 60% of plants being moderately to heavily browsed in the third post-treatment sample year; the increase between the second and third categories is likely due in part to the differing 'n' values. Finally, utilization has exhibited a marked increase following treatment: nearly 90% of plants exhibited moderate to heavy use in the first and second post-treatment sample years (**Figure 10.59**).

Average cover of pinyon (*Pinus sp.*) and juniper (*Juniperus osteosperma*) trees has decreased following treatment on mountain, upland, and semidesert sites. Mean tree density has also decreased on mountain and upland sites. Density has remained fairly stable on the semidesert study, although composition has shifted: only juniper was observed prior to treatment, but pinyon became co-dominant in the second post-treatment sampling (**Figure 10.56**, **Figure 10.57**).

Herbaceous Understory: Perennial grasses have contributed the most average herbaceous cover on mountain ecological sites in all sample years. Although overall cover increased initially following treatment, it decreased between the first and second post-treatment years. This decrease is mostly due to the difference in number of study sites, as North Hills is the only study with data for the second sample year following treatment. Increases in annual and perennial grasses on upland study sites have driven an overall increasing trend in herbaceous cover. Annual grasses likely exhibited increasing cover between the second and third post-treatment samplings due to the differing number of study sites; the Saul Meadow and Southwest of Newcastle studies contributed most of the annual grass cover in the most recent sampling. On the semidesert site, cover has increased overall while frequency has largely remained stable. In addition, the understory on this site has remained dominated by cheatgrass (*Bromus tectorum*) in all sample years (**Figure 10.60**, **Figure 10.61**).

Occupancy: According to average pellet group data, animal presence on mountain sites has fluctuated, but has marginally increased overall. Deer have been the primary occupants on these sites in all years, with mean abundance of pellet groups as low as just over 21 days use/acre in the first post-treatment sampling and as high as 69 days use/acre in the third post-treatment sample year. Mean abundance of elk pellet groups has ranged from 0 days use/acre in the most recent sample year to nearly 9 days use/acre in the first post-treatment sampling. Cattle have also been present, with a mean abundance of pellet groups fluctuating between 0 days use/acre in the third sampling following treatment and nearly 7 days use/acre prior to treatment.

Average animal presence on upland study sites has remained stable throughout the sample period. Deer have also been the primary occupants of these sites in all sample years, with mean pellet group abundance ranging from nearly 37 days use/acre in the third post-treatment sample year to just over 44 days use/acre during the second sampling after treatment. Mean abundance of elk pellet groups has fluctuated between nearly 4 days use/acre prior to treatment and almost 11 days use/acre in the third post-treatment sampling. Cattle pellet

groups have had a mean abundance as low as just over 2 days use/acre in the second post-treatment year and as high as nearly 5 days use/acre prior to treatment.

The semidesert study site has displayed a decrease in average animal presence. Deer are the primary occupants of this site, with abundance of pellet groups ranging from nearly 49 days use/acre in the second sample year after treatment to 117 days use/acre before treatment. Cattle pellet groups have had a mean abundance ranging from nearly 4 days use/acre prior to treatment to 9 days use/acre in the first post-treatment sample year. Elk have not been observed in any year (**Figure 10.62**).

Deer Winter Range Condition Assessment: The condition of deer winter range on sites that have undergone a lop and scatter treatment has continually changed over the sample period. These sites within the Southern Region are considered to be within very poor to excellent condition, with most studies improving or remaining stable. The Above Fremont Wash, Fremont Pass, and Southwest of Newcastle studies remained in very poor condition, and Fivemile 2 went from very poor-poor to good condition. The Sand Ledges and Grass Valley sites remained in poor condition. Lower Indian Peaks went from poor to fair while the Pine Point Handthin study improved from poor to excellent. The Kanosh Lop and Scatter and Duggins Creek studies improved from fair to good. Paragonah, North Hills, and Barracks Chaining stayed in fair-good condition, and Mud Spring improved from fair to fair-good. The Deer Flat study improved from fair-good, and Sulphurdale remained in good condition. Three study sites had a decreasing score: Spry Sagebrush Restoration decreased from excellent to good, and Saul Meadow deteriorated from poor to very poor condition. Finally, the Cow Creek study went from good to fair condition (**Figure 10.63**, **Table 10.7**).

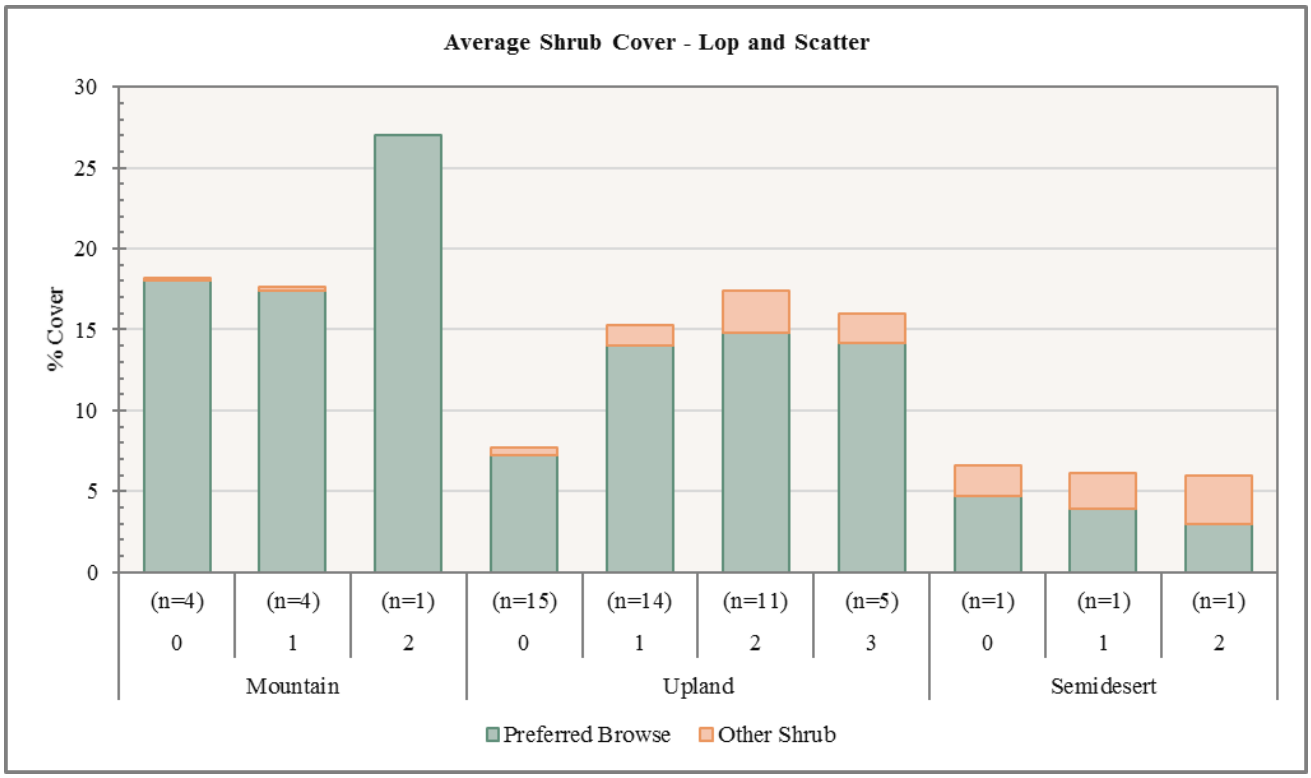


Figure 10.55: Average shrub cover on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

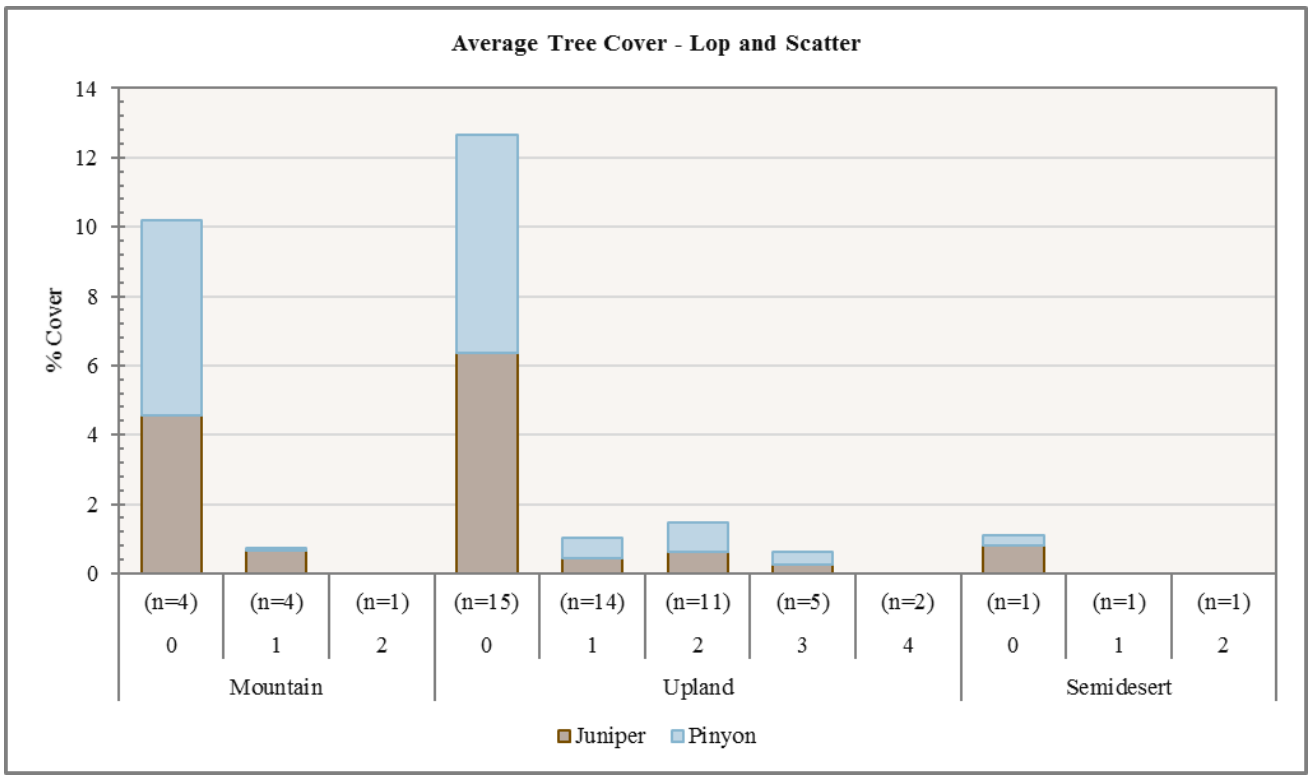


Figure 10.56: Average tree cover on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

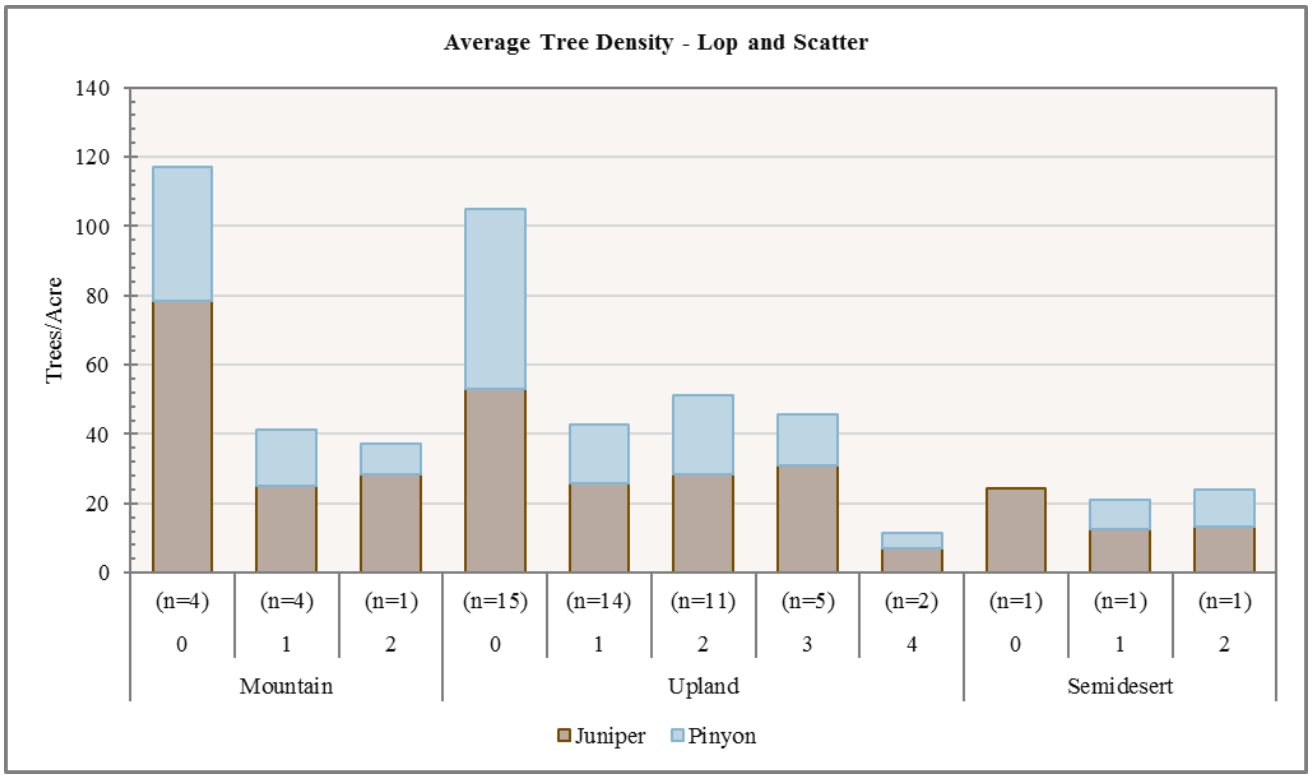


Figure 10.57: Average tree density on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

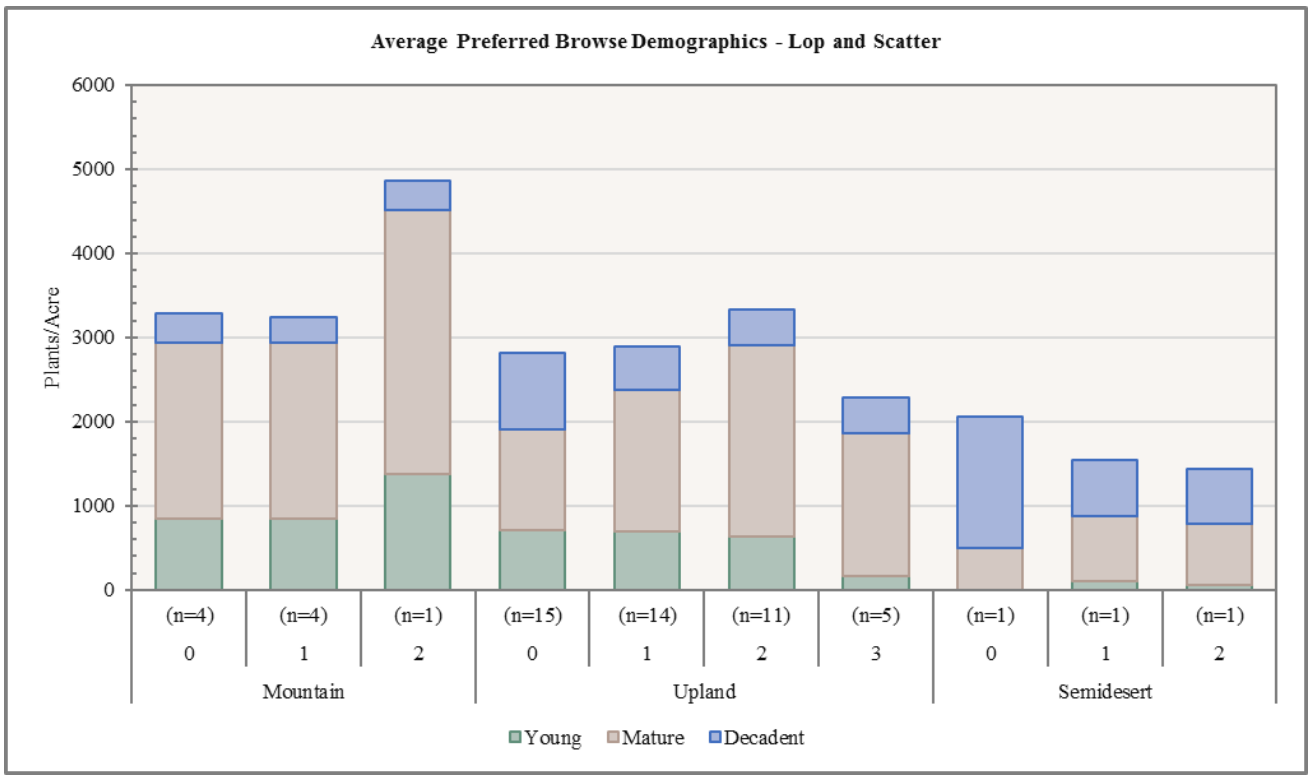


Figure 10.58: Average preferred browse demographics on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment.
0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

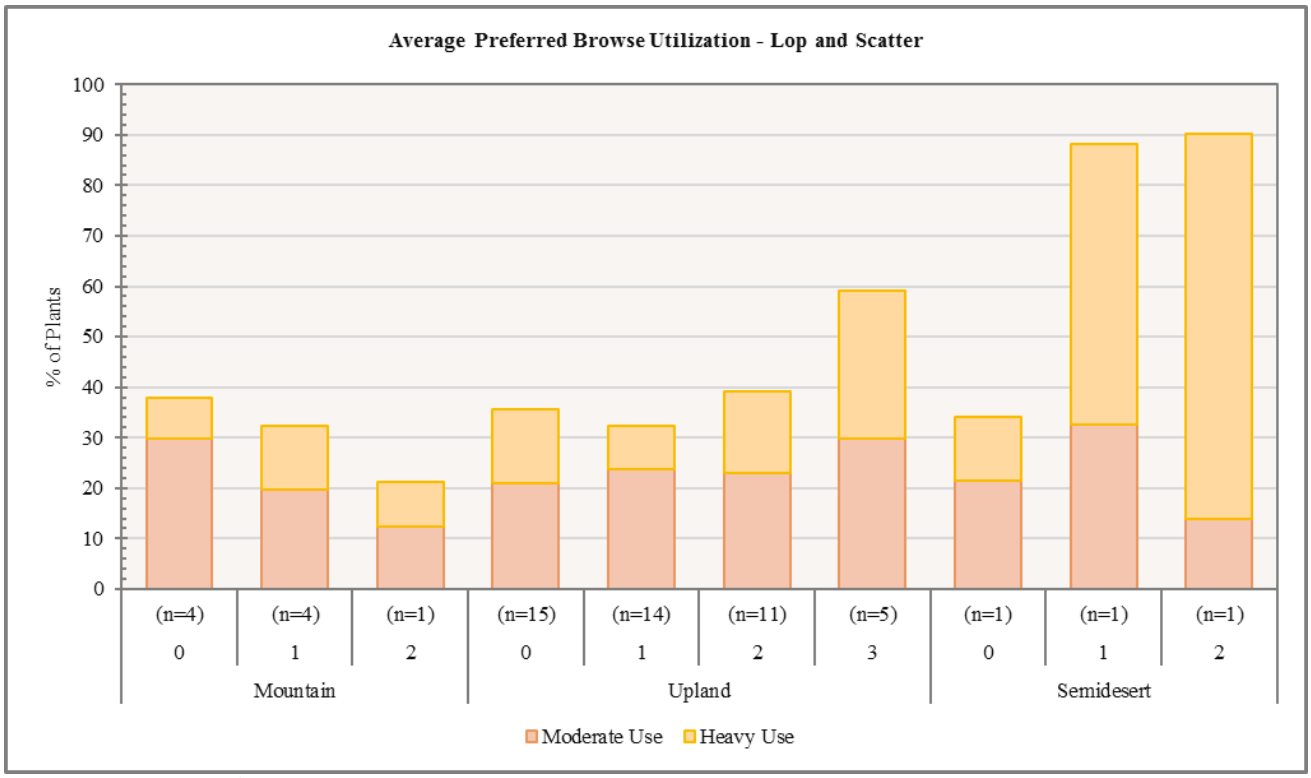


Figure 10.59: Average preferred browse utilization on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

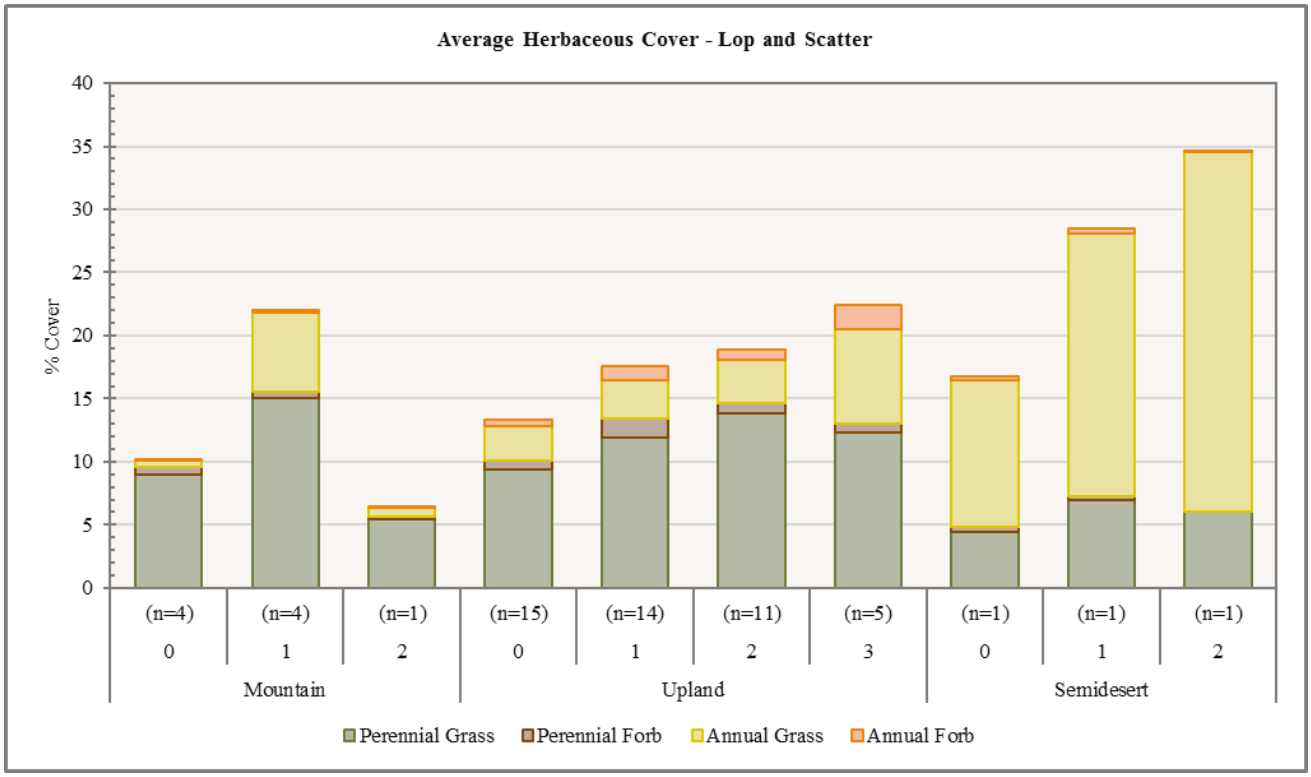


Figure 10.60: Average herbaceous cover on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

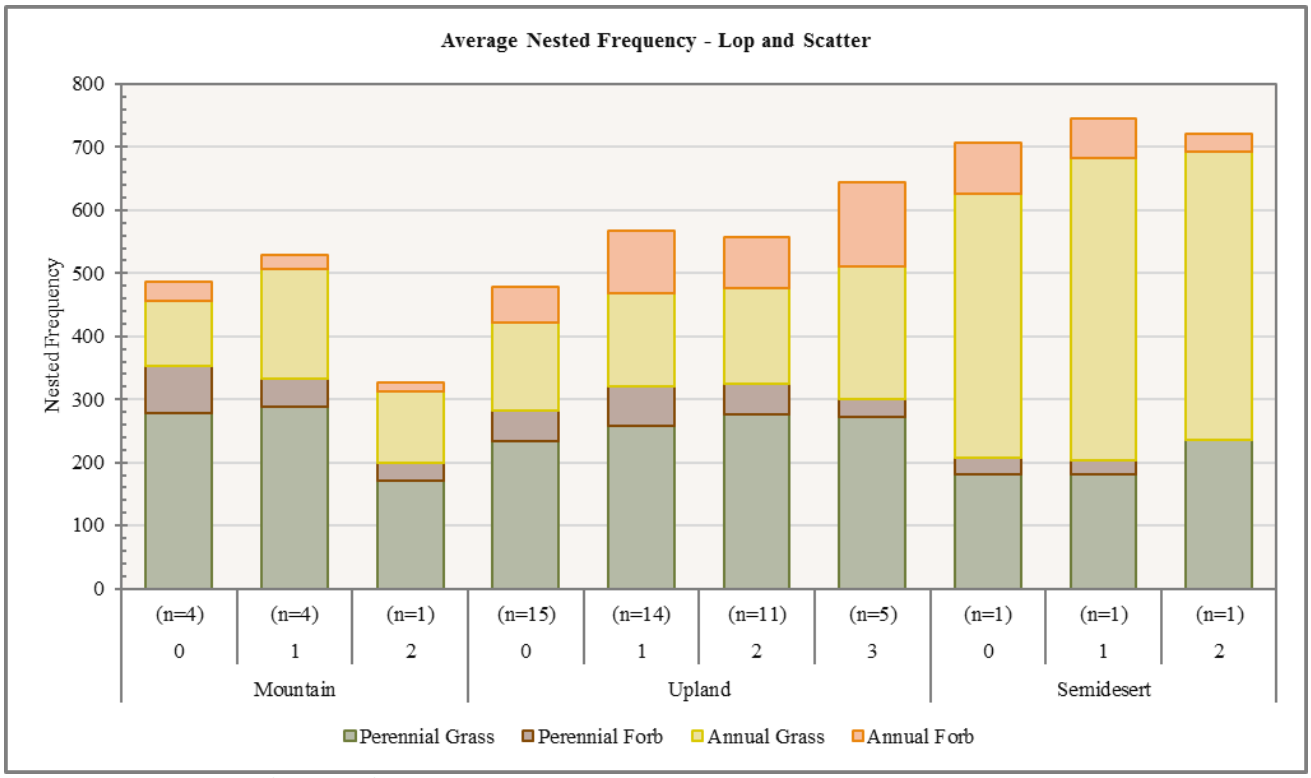


Figure 10.61: Average nested frequency of herbaceous species on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

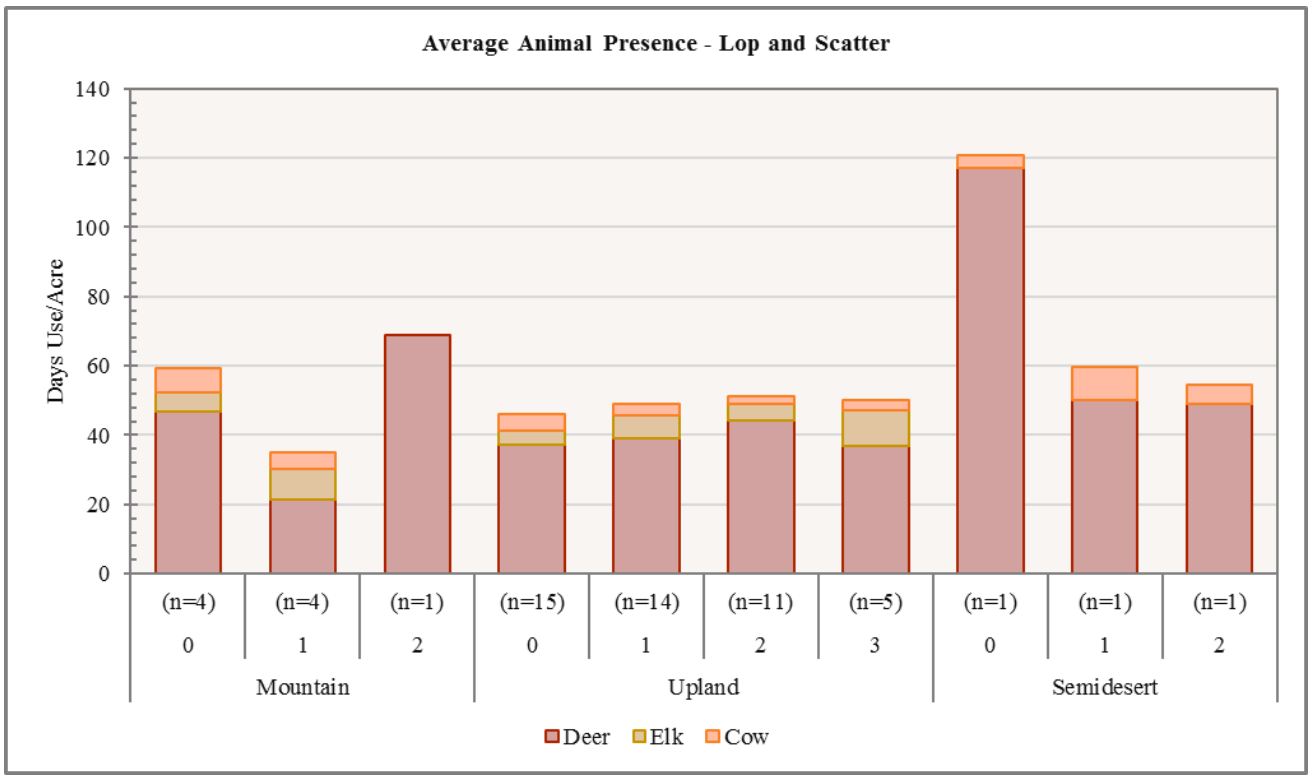


Figure 10.62: Average pellet transect data on mountain, upland, and semidesert study sites that have undergone a lop and scatter treatment. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.

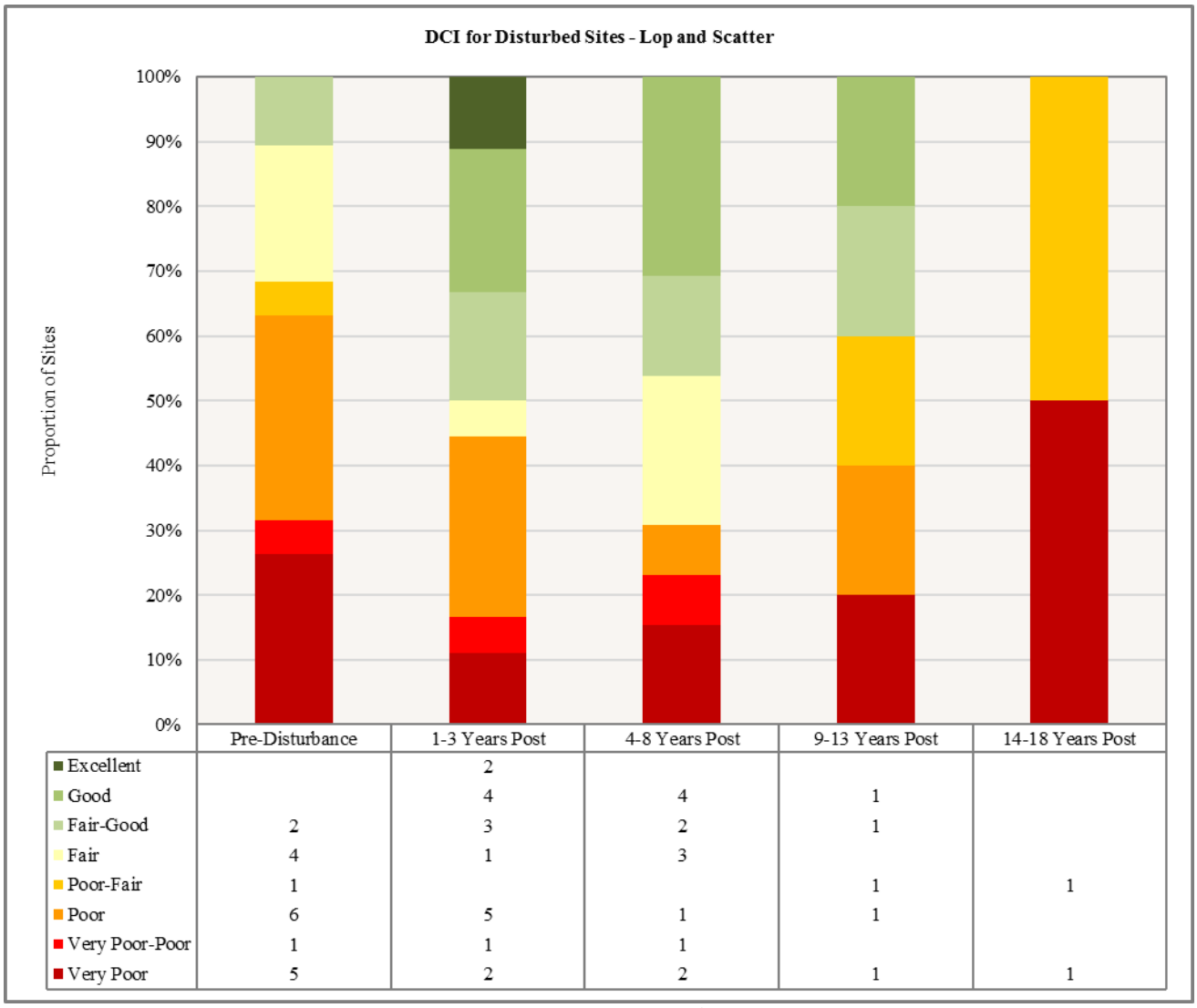


Figure 10.63: Deer winter range Desirable Components Index (DCI) summary by year of sites that have undergone a lop and scatter treatment.

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
20-02	0	8.6	8.3	6	22.8	-1	0.4	0	**45.1**	**P**
20-02	1	7.7	7.8	2.4	29.6	-1.9	0.2	0	**45.8**	**P**
20-02	2	9.9	13.4	3.8	28.9	-4	0.5	0	**52.6**	**F**
21R-11	0	30	-1.9	0.3	14.3	-3.2	4.3	0	**43.9**	**P**
21R-11	1	30	9.3	1.3	30	-11.7	2.8	0	**61.6**	**F**
21R-11	2	30	12.2	2.7	27.2	-5	0.7	0	**67.8**	**G**
21R-15	0	14.1	12.5	2.5	30	-5.1	0	0	**53.9**	**F**
21R-15	1	19.4	14	5.5	30	-0.4	0	0	**68.5**	**G**
22-01	0	29	11.1	8.1	20.3	-0.4	1.5	0	**69.6**	**F-G**
22-01	1	27.8	10.9	11.3	30	-0.8	1.1	0	**80.3**	**G**
22R-04	0	5.9	0	0	8.9	-8.7	0.9	0	**6.9**	**VP**
22R-04	1	4.9	0	0	13.9	-15.6	0.6	0	**3.7**	**VP**
22R-04	2	3.8	0	0	12.1	-20	0	0	**-4.1**	**VP**
22R-07	0	11.9	13.6	9.5	15	-6	6.6	0	**50.6**	**P**
22R-07	1	13.3	13.7	10.9	26.9	-5.1	8.1	0	**67.8**	**G**
22R-07	2	21.6	14.7	14.3	23.5	-3.2	6.9	0	**77.7**	**G**
22R-07	3	24	14	8.5	30	-7.1	6.5	0	**75.7**	**G**

Study Number	Post Category	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
22R-16	0	12.3	4.1	0.6	27.4	0	1	0	**45.3**	**P**
22R-16	1	20.7	14.4	15	30	0	1.9	0	**82**	**E**
22R-16	2	23.4	11.1	9.5	30	0	1.8	0	**75.7**	**G**
22R-25	0	0.9	0	0	13.9	-0.1	0.5	0	**15.3**	**VP**
23-02	0	15.9	1.7	4.3	14.9	-8.7	0	0	**28.1**	**VP**
23-02	1	15	6.6	15	14.3	-4.4	0	0	**46.5**	**P**
23-02	2	15	4.1	4.8	16	-4.2	0	0	**35.6**	**VP-P**
23-02	3	20.8	9.5	1.9	16.9	-7.7	0	0	**41.3**	**P**
23-02	4	16.8	7.3	0.9	6.1	-20	0	0	**11**	**VP**
24-04	0	6.4	6.2	8.2	16.6	0	0.1	0	**37.4**	**P**
24-04	1	11.5	10.4	0	25.6	0	0.2	0	**47.7**	**P**
24-04	2	12.5	13.7	7.3	27	0	0.4	0	**60.9**	**F**
24-04	3	17.1	12	6.8	30	0	0.6	0	**66.5**	**F-G**
24-07	0	13.6	-5.7	1.4	24.8	0	1.2	0	**35.3**	**VP-P**
24-07	1	10.3	12	15	30	0	0.6	0	**67.9**	**G**
24-07	2	10	11.9	8.6	30	0	1	0	**61.4**	**F**
25R-09	0	14.2	9.9	10.1	11.1	-0.7	0.3	0	**44.9**	**P**
25R-09	1	21.8	15	9.2	21.2	-16.6	0.1	0	**50.6**	**P**
27R-22	0	8.1	14.6	15	4.9	-4.1	0.9	0	**39.5**	**P**
27R-22	1	20.9	13.7	15	24.5	-0.5	10	0	**83.7**	**E**
28-07	0	7	12.1	15	18.6	-0.8	4.8	0	**56.8**	**F**
28-07	1	20.3	14.4	15	11.3	-0.1	5.2	0	**66.1**	**F-G**
28-07	2	22.6	14.4	6	17.1	0	5.5	0	**65.5**	**F-G**
28-08	0	17	4.8	4.6	30	-1.6	0.2	0	**54.9**	**F**
28-08	1	16	0.9	1.2	24.4	-4.3	0.1	0	**38.3**	**P**
28-08	2	15.6	0.2	1.9	30	-0.1	0.2	0	**47.8**	**P**
28-08	3	17.6	1.3	2.9	30	0	0.1	0	**51.9**	**P**
28-08	4	15.5	3.4	2	30	-0.9	0.1	0	**50**	**P**
28R-12	0	7.9	-1.1	1.3	10.3	0	0	0	**18.4**	**VP**
28R-12	1	11.8	5.6	7.3	11.8	0	0.5	0	**36.9**	**VP-P**
28R-12	2	17.4	13.4	15	30	0	0	0	**75.8**	**G**
29-03	0	30	11.5	13.9	10.9	-0.5	0.2	0	**66**	**F**
29-03	1	27.2	12.8	15	16.2	-0.7	0.3	0	**70.7**	**F-G**
29-03	2	30	13.3	15	10.8	-0.5	0.5	0	**69**	**F-G**
29-04	0	16.5	14.7	5.6	29.3	-0.2	2.9	0	**68.8**	**F-G**
29-04	1	14.3	12.8	11.7	30	-0.8	1.8	0	**69.8**	**F-G**
30-29	0	2	0	0	10.3	-0.1	0.3	0	**12.6**	**VP**
30-29	1	9.1	-1.6	7.3	16.6	-4.1	0.7	0	**28**	**VP**
30-29	2	13.6	10.7	7.1	8.3	-12.4	0.5	0	**27.7**	**VP**
30-29	3	11.3	11.8	0.9	6.7	-13.2	0.1	0	**17.6**	**VP**
30-56*	0	1.6	0	0	22.7	0	1.3	0	**25.6**	**VP**
30-56*	1	1.9	0	0	30	-0.3	0.7	0	**32.4**	**VP**
30-56*	2	3.7	0	0	30	0	0.8	0	**34.5**	**VP-P**

Table 10.7: Deer winter range Desirable Components Index (DCI) information by site number of study sites that have undergone a lop and scatter treatment. VP = Very Poor, P = Poor, F = Fair, G = Good, E = Excellent. 0 = pre-treatment, 1 = 1 – 3 years post-treatment, 2 = 4 – 8 years post-treatment, 3 = 9 – 13 years post-treatment.
*Studies with an asterisk have been suspended.

REFERENCES

Balch, J. K., D'Antonio, B. A., & Gómez-Dans, C. M. (2013). Introduced annual grass increases regional fire activity across the arid western USA (1980–2009). *Global Change Biology, 19*(1), 173-183.

Christensen, B. E., & Bogedahl, L. C. (1983). *Draft deer herd unit 51A management plan.* Salt Lake City, Utah: Utah Dept. of Natural Resources, Division of Wildlife Resources.

Climate Prediction Center Internet Team. (2005). *Climate Prediction Center*. Retrieved February 12, 2019, from National Weather Service: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/wpdanote.shtml

Geosciences and Environmental Change Science Center (GECSC) Outgoing Datasets. (2019). *US Historic Fire Perimeters*. U.S. Department of the Interior, Geological Survey. Retrieved January 3, 2018, from http://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/

Huff, C. L., & Bowns, J. E. (1965). *Utah Big Game Range Inventory 1963-1964.* Publication No. 65-1: Utah Department of Fish and Game (now Utah Division of Wildlife Resources).

Huff, C. L., & Coles, F. H. (1966). *Utah big game range inventory, 1965-66* (Vols. Publ. No. 66-3). Salt Lake City, Utah: Utah Department of Fish and Game (now Utah Division of Wildlife Resources).

Kulmatiski, A. (2006). Exotic plants establish persistent communities. *Plant Ecology*.

LANDFIRE. (n.d.). *LANDFIRE*. Retrieved February 25, 2019, from LANDFIRE: http://www.landfire.gov/

LANDFIRE.US_140EVT. (2018). *LANDFIRE Existing Vegetation Type*. Sioux Falls, SD, US: Wildland Fire Science, Earth Resources Observation and Science Center, U.S. Geological Survey. Retrieved January 16, 2019, from http://landfire.cr.usgs.gov/viewer/

Miller, R. F., Svejcar, T. J., & Rose, J. A. (2000). Impacts of western juniper on plant community composition and structure. *Journal of Range Management*, 574-585.

Otfinowski, R., Kenkel, N. C., & Catling, P. M. (2006). The Biology of Canadian Weeds. 134. Bromus inermis Leyss. *Canadian Journal of Plant Science, 87*(1), 183-198.

Pilliod, D., & Welty, J. (2019). *Land Treatment Digital Library: U.S. Geological Survey Data Series 806.* Retrieved from http://pubs.er.usgs.gov/publication/ds806

PRISM Climate Group, Oregon State University. (2013). *1981-2010 Climatology Normals*. Retrieved from http://prism.oregonstate.edu

Stam, B. R., Malechek, J. C., Bartos, D. L., Bowns, J. E., & Godfrey, E. B. (2008). Effect of Conifer Encroachment into Aspen Stands on Understory Biomass. *Rangeland ecology & Management, 61*(1), 93-97.

Time Series Data. (2019). *National Oceanic and Atmospheric Administration Earth System Research Laboratory Physical Science Division*. Retrieved February 12, 2019, from http://www.esrl.noaa.gov/psd/data/timeseries/

APPENDIX A - THREAT ASSESSMENT

Annual Grass:

Species: *Bromus tectorum, B. rubens, Taeniatherum caput-medusae*

Low: If present, automatically a threat. Present-3% in ANY sample year.*
Medium: 3-7% cover in ANY sample year.*
High: >7% cover in ANY sample year.*

Potential impact*:* Increased fire potential and reduced herbaceous diversity.

*The study sites are not monitored yearly, so it cannot be said with absolute confidence that the seedbank has been depleted even if cover was low in the most sample year. As such, one should err on the side of what has already occurred and what is therefore possible.

Introduced Perennial Grasses:

Species: *Thinopyrum intermedium, Bromus inermis, Agropyron cristatum, Poa pratensis, Psathrostachys juncea*

Low: 1% of actual cover has to be contributed by a single species AND ratio to total perennial grass cover has to be up to 20%.
Medium: 20-50% of total perennial grass cover is contributed by introduced species.
High: >50% of total perennial grass cover is contributed by introduced species.

Potential Impact: Reduced diversity of desirable grass and forb species.

Noxious Weeds:

Low: If present, automatically a threat. Present-1% in ANY sample year.*
Medium: 1-5% cover in ANY sample year.*
High: >5% cover in ANY sample year. *

Potential Impact: Reduced diversity of desirable grass and forb species.

*The study sites are not monitored yearly, so it cannot be said with absolute confidence that the seedbank has been depleted even if cover was low in the most sample year. As such, one should err on the side of what has already occurred and what is therefore possible.

PJ Encroachment:

Species: *Juniperus osteosperma, J. scopulorum, Pinus edulis, P. monophylla*

Low: Phase I.
Medium: Phase I transitioning to Phase II or Phase II.
High: Phase II transitioning to Phase III or Phase III.

Potential Impact: Reduced understory shrub and herbaceous vigor.

Conifer Encroachment (Aspen):

Species: All conifer species

Low: Conifer present or near site. Present-<1%
Medium: Conifer >1% but not co-dominant.
High: Conifers co-dominant.

Potential Impact: Reduced understory shrub, aspen stand, and herbaceous vigor.

Urban Development:

Low: On private or SITLA property that may be developed in the future AND near a community (ex: house or building nearby).
Medium: Development occurring nearby including road improvements and new roads.
High: Development occurring within one mile of the study site.

Potential Impact: Fragmentation and loss of habitat.

Energy Development:

Low: Must meet one of the following:

a.) Site located in a known oil and/or gas reserve (ex: sites near Price, Book Cliffs, etc.).
b.) Site is in the vicinity of a wind or solar farm AND could reasonably be developed in the future (ex: Milford Flat).
c.) Site is adjacent to powerline.

Medium: Site located in a known oil and/or gas reserve with road developments/improvements occurring in the area.

NOTE: No 'medium' option applicable for powerlines or wind or solar farms.

High: Must meet one of the following:

a.) Oil and gas developments are active within one mile of the study site.
b.) Site is in immediate vicinity of/adjacent to solar or wind farm.
c.) Powerline is actually on site.

Potential Impact: Fragmentation and loss of habitat.