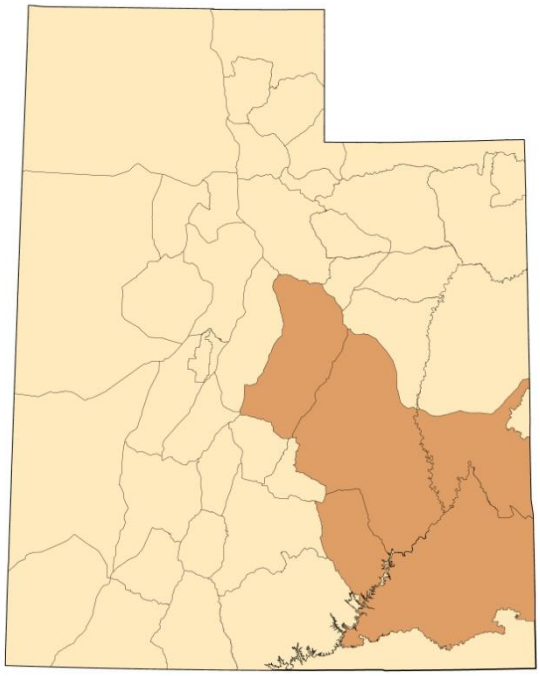
UTAH BIG GAME
RANGE TREND UNIT SUMMARIES
2014
Wildlife Management Units
13A, 14, 15, 16B/16C





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REPORT FOR FEDERAL AID PROJECT W-82-R-59

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Utah Big Game Range Trend Unit Summaries
2014
Wildlife Management Units
13A, 14, 15, 16B/16C

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Performance Report for Federal Aid Project W-82-R-59

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Reports for all regions, with accompanying photographs, are available online at http://dwrapps.utah.gov/rangetrend/rtstart.

PROGRAM NARRATIVE

State: UTAH

Project Number: W-82-R-59

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 to inform DWR biologists, public land managers, and private landowners of significant changes in plant community composition in these areas.

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

REMARKS

The work completed during the 2014 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 1980's 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
- Monticello Resource Area
- Moab Resource Area

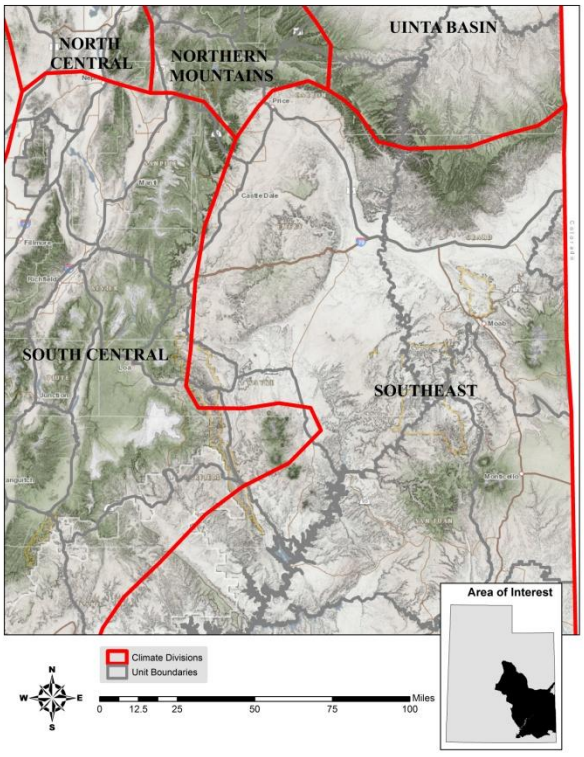
Manti-La Sal National Forest
- Ferron Ranger District
- Moab Ranger District
- Monitcello Ranger District
- Sanpete Ranger District

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

RANGE TREND UNIT SUMMARY OVERVIEW

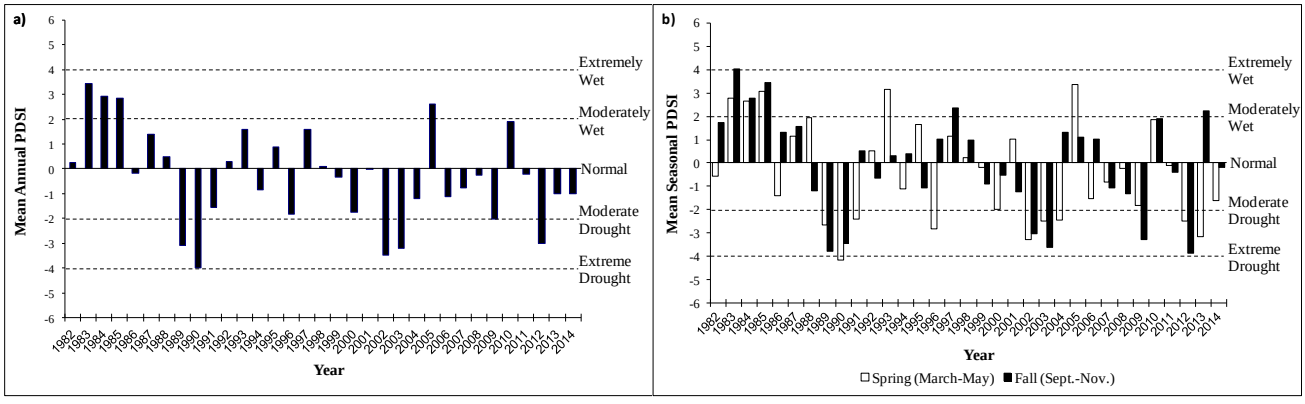
Boundary Description and Geography: Each unit summary includes the boundary description outlining the boundary for the unit. The geography section details the major features of the unit

Palmer Drought Severity Index Climate Divisions



Climate Data: The state of Utah is divided into seven climatic divisions for estimating the Palmer Drought Severity Index (PDSI) and the southeastern region occurs within three of these divisions; South Central (Division 4), Northern Mountains (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 2014. The data reported in this summary covers the years over which these sites have been sampled (1982-2014). 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 2014). In the figure below, graph "a" represents the mean annual PDSI for the south central region and graph "b" shows the mean PDSI by season, spring (March-May) and fall (Sept.-Nov.) for the south central region (Climate Prediction Center Internet Team, 2005).



Big Game Habitat: Big game habitat is discussed within each unit summary. This section is a general description of the big game habitat within the unit. Habitat maps for deer and elk show the seasonal ranges for year-long, winter, 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 both mule deer and elk to represent estimated habitat acreage by season and ownership. If there was not habitat for a specific season (summer, winter, 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. Percentage tree, shrub, and herbaceous canopy cover training data are generated using plot-level ground-based visual assessments. Once the training data are developed, relationships are then established separately for each functional group between the training data and combination of Landsat, elevation, and ancillary data. Each of the derived data layers (tree, shrub, herbaceous) has a potential range from 0-100 percent, which are merged into a single composite EVC layer (LANDFIRE).

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

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Shrubland	Inter-Mountain Basins Semi-Desert Shrub-Steppe	66,032.04	11.31%	
	Inter-Mountain Basins Big Sagebrush Shrubland	54,103.02	9.27%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	31,447.25	5.39%	
	Great Basin Xeric Mixed Sagebrush Shrubland	6,980.96	1.20%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	4,289.99	0.73%	
	Quercus gambelii Shrubland Alliance	3,983.31	0.68%	
	Inter-Mountain Basins Big Sagebrush Steppe	846.43	0.14%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	752.36	0.13%	
	Inter-Mountain Basins Montane Sagebrush Steppe	54.26	0.01%	
	Other Shrubland	4,973.86	0.85%	29.71%
Conifer	Colorado Plateau Pinyon-Juniper Woodland	268,993.04	46.07%	
	Great Basin Pinyon-Juniper Woodland	7,700.85	1.32%	
	Inter-Mountain Basins Juniper Savanna	3,750.68	0.64%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	14,289.29	2.45%	
	Other Conifer	3,477.81	0.60%	51.08%
Grassland	Native Grassland	10,451.42	1.79%	1.79%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	71,091.29	12.18%	
	Introduced Upland Vegetation-Annual and Biennial Forbland	1,114.2	0.19%	
	Introduced Upland Vegetation-Perennial Grassland and Forbland	921.16	0.16%	12.53%
Other	Hardwood	561.1	0.10%	
	Riparian	5,675.73	0.97%	
	Agricultural	6,633.14	1.14%	
	Developed	12,863.29	2.20%	
	Other	2,833.74	0.49%	4.89%
Total		583,820.2		

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 unit through the WRI program and a map of the fire history from 2000-2013 is available for each unit. A total amount of acres 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 1980's and have many years of data associated with them. A table details the year an individual study was established, whether it is active or suspended, and the ecological site description. Another table shows the disturbance history for those sites that have had a known disturbance that occurred on the site.

Study Trend Summary (Undisturbed Sites): Sites that have not been disturbed since site establishment are considered undisturbed, though many of them have had historic disturbances. Trends were reported by grouping sites into an ecological site based on soil characteristics, elevation, precipitation, and dominant vegetation type. Trends for each individual ecological site were evaluated by analyzing directional shifts in mean densities and covers for shrubs and trees. Not all sites had shrubs or trees present. When this was the case, these graphs were omitted from the summary. The implied trend for the herbaceous understory was evaluated by comparing mean values of nested frequencies and covers from sample year to sample year. Occupancy trends of big game species are also discussed and were evaluated by comparing mean pellet group counts of individual species from sample year to sample year.

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

Study Trend Summary (Disturbed Sites): 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 1-5 years post treatment, 6-10 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.

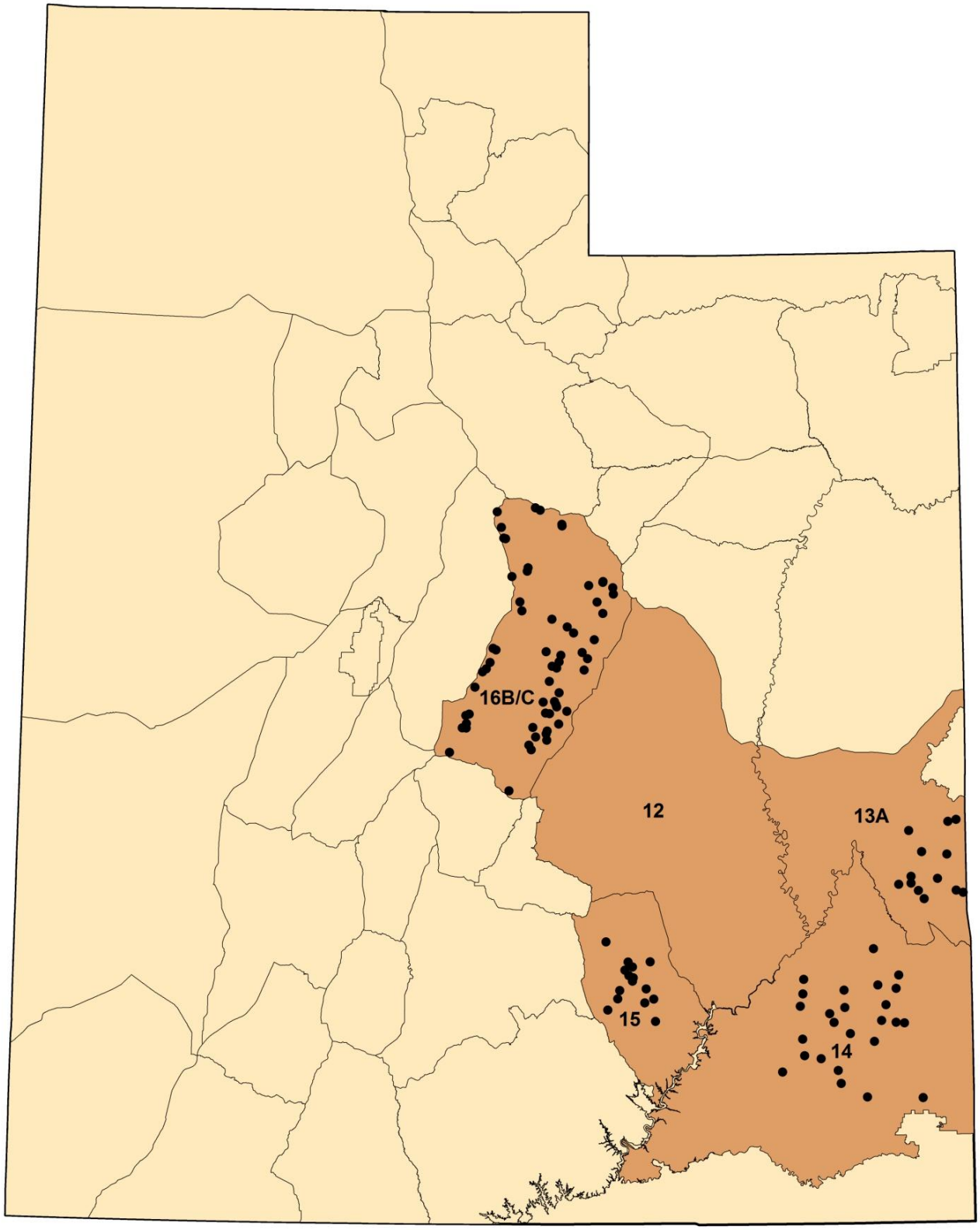
Deer Winter Range Condition Assessment: The desirable components index (DCI) for deer was created by Range Trend Program personnel as a tool to address condition and/or value of winter ranges for mule deer. This index is meant to be a companion to, not a replacement for, the site-specific range trend 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, shrub young recruitment, 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 into account factors such as soil stability, hydrologic function, and other environmental factors, it should not be used to assess a sites function and/or condition as typically used by federal land management agencies.

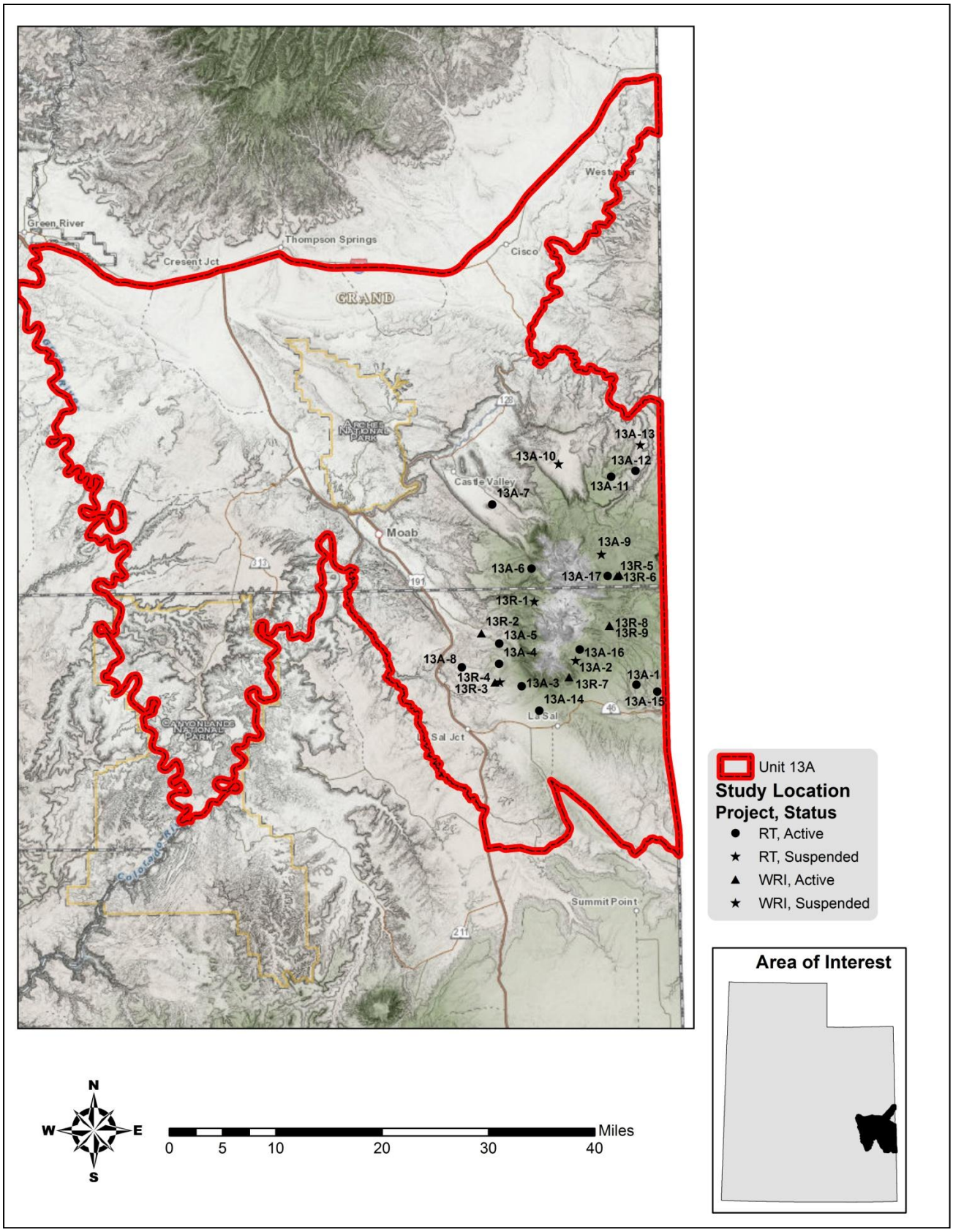
Changes in DCI over the sample years for both treated and untreated sites are included in the figures near the end of the summary. Care should be taken when interpreting these tables as the number of sites included in each year may vary. This could be misleading if the overall DCI seems to be improving 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, 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 13A – LA SAL MOUNTAINS



WILDLIFE MANAGEMENT UNIT 13A – LA SAL MOUNTAINS

Boundary Description

Grand and San Juan Counties - Boundary begins at I-70 and the Green River; south along the Green River to the Colorado River; north along this river to Kane Springs Creek; southeast along this creek to Hatch Wash; southeast along this wash to US-191; south on US-191 to Big Indian Road; east on this road to Lisbon Valley Road; east on this road to Island Mesa Road; east on this road to the Utah-Colorado state line; north on this state line to the Dolores River; northwest along this river to the Colorado River; northeast along this river to the Utah-Colorado state line; north on this state line to I-70; west on I-70 to the Green River.

Management Unit Description

Geography

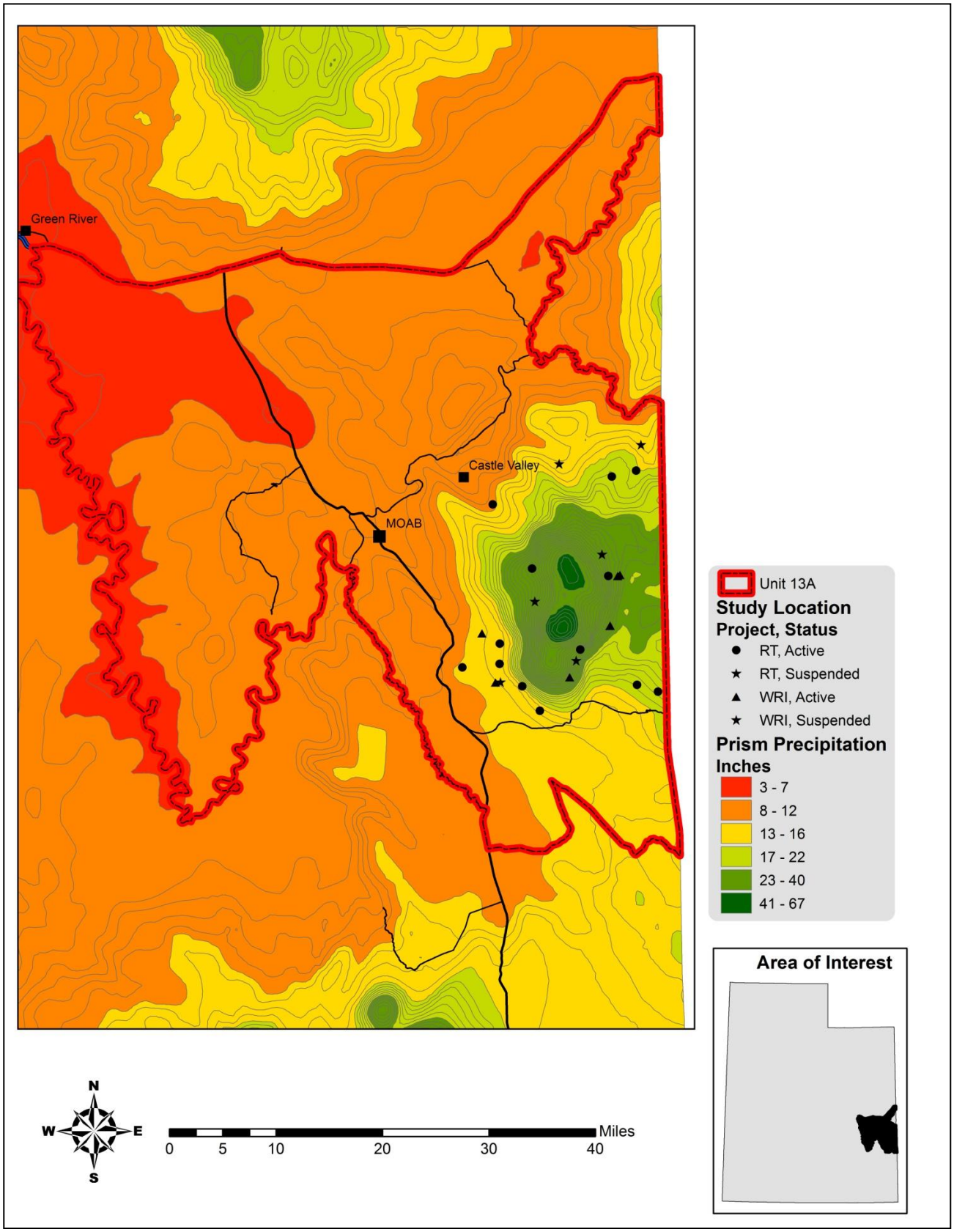
The La Sal Mountains wildlife management unit covers a vast and varied area including the section of the Colorado Plateau that falls between the Utah/Colorado boarder and the Green River. It also contains the Colorado River, La Sal mountain range, Arches National Park, and the north end of Canyonlands National Park. Mount Peale, the highest point of the La Sal Mountains, reaches 12,721ft. The lowest point is just less than 4,000ft along the Colorado River near Dead Horse Point State Park. Towns in this area include Moab, Castle Valley, La Sal, and Cisco.

The Colorado and Green Rivers are carved into the Colorado Plateau. These rivers and their tributaries have shaped this region. The Green and Colorado rivers converge within Canyonlands National Park.

Climate Data

The 30 year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches along the Green River to 41 inches on the peaks of the La Sal Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 12-31 inches of precipitation (Map 1.1).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Southeast division (Division 7). The mean annual PDSI of the Southeast division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, 2009, and 2012. The mean annual PDSI displayed years of moderate to extreme wet years from 1983-1985 and 2005 (Figure 1.1a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1991, 1996, 2002-2004, and 2012-2013; and displayed years of moderate to extreme wet years in 1983-1985, 1993, and 2005. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2009 and 2012; and displayed years of moderate to extreme wet years in 1983-1985, 1997, and 2011 (Figure 1.1b) (Time Series Data, 2015).



Map 1.1: The 1981-2010 PRISM Precipitation Model for WMU 13A, La Sal Mountains (PRISM Climate Group, Oregon State University, 2013).

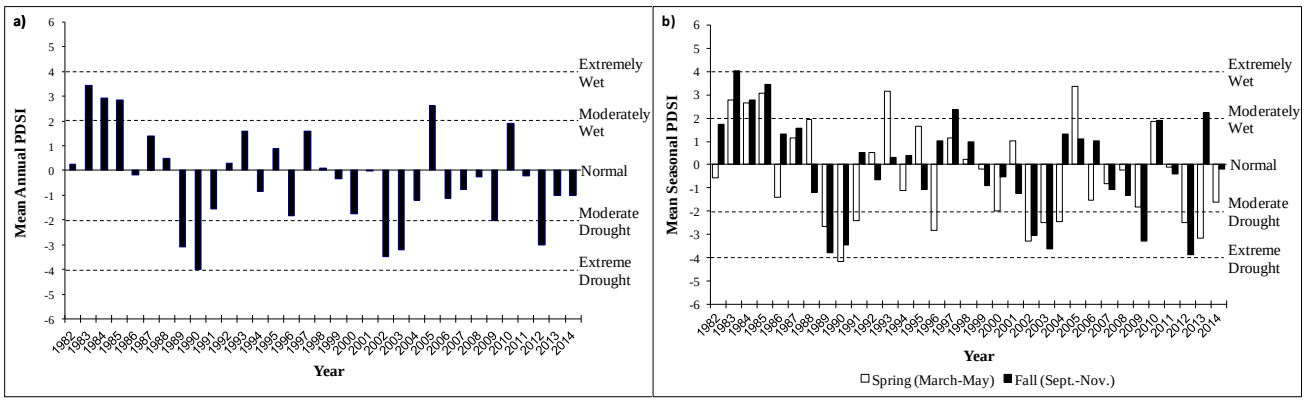


Figure 1.1: The 1982-2014 Palmer Drought Severity Index (PDSI) for the Southeast division (Division 7). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.).

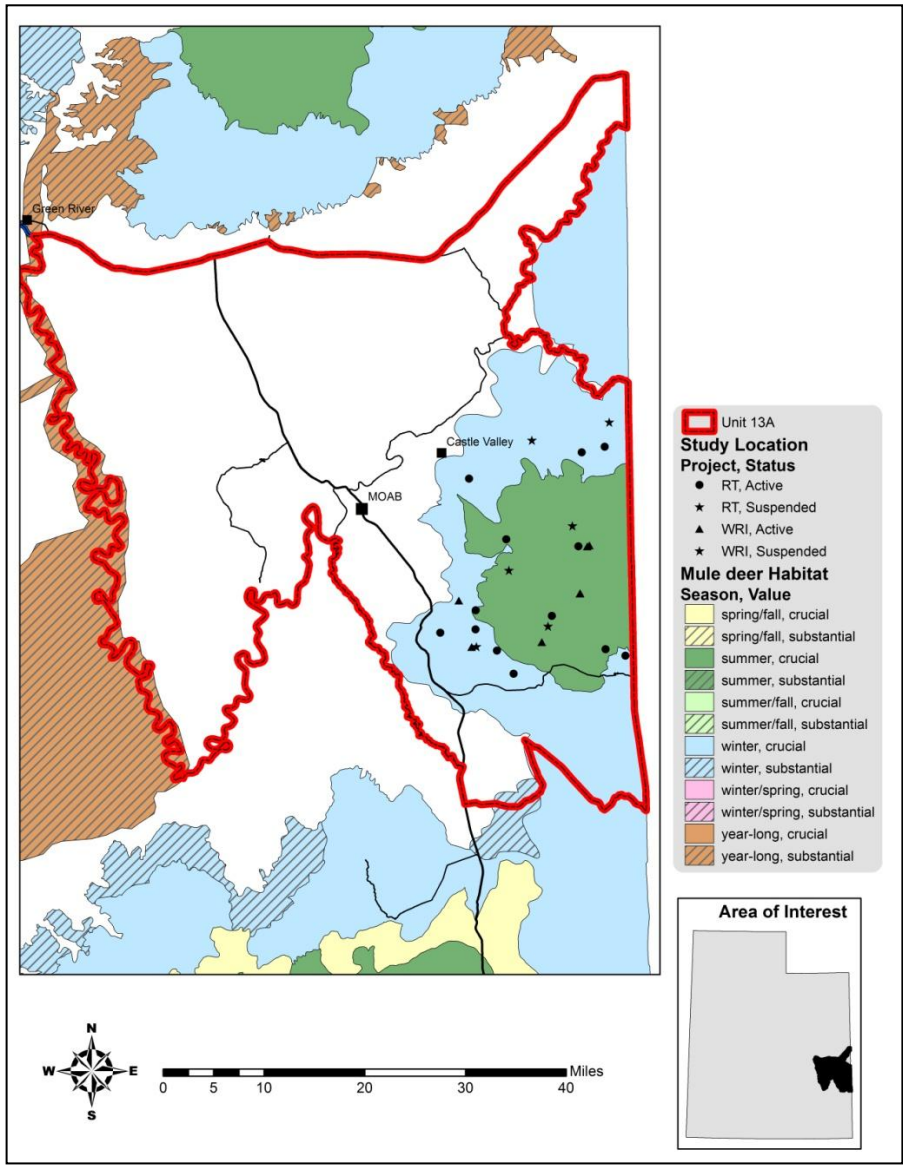
Big Game Habitat

Total mule deer range in the wildlife management unit is estimated at 517,777 acres with 44,007 acres classified as year-long range, 291,743 acres of this classified as winter range, and 182,027 acres classified as summer range (Table 1.2 and Map 1.2). Total elk range is estimated at 291,452 acres with 22,645 acres of this being classified as year-long range, 143,711 as winter range 113,382 as summer range, and 11,714 as spring/fall range (Table 1.3 and Map 1.3). Most of the big game year-long range in this unit is located on BLM or NPS managed lands. Minor portions of the year-long range in the unit occur on private holdings, Utah State School Trust Lands, and Division of Natural Resources management areas.

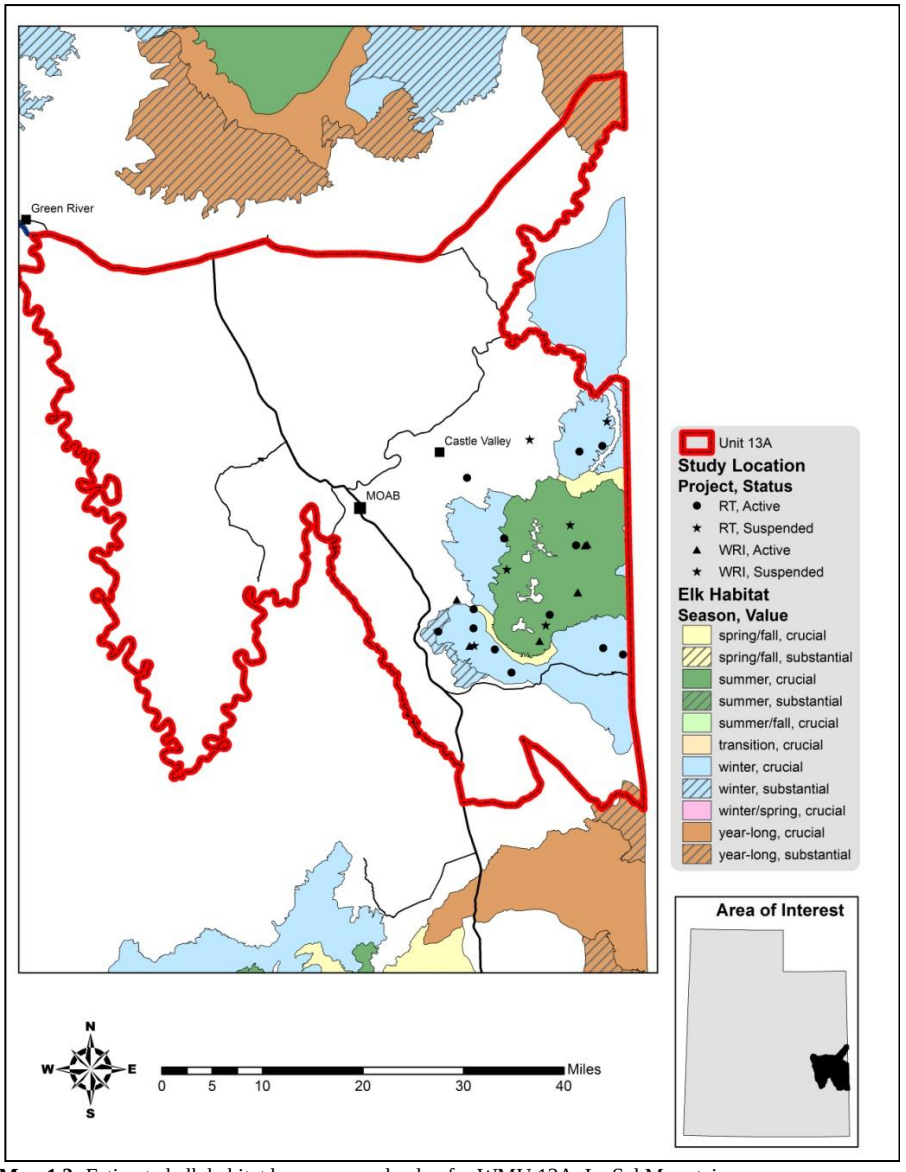
According to Landfire Existing Vegetation Coverage models, shrublands comprise more than 57% of the unit. Over half of the shrubland consists of the blackbrush (*Coleogyne ramosissima*) shrub alliance, which is a key browse species for mule deer, though much of this is not considered habitat for mule deer. Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodlands and annual grasslands comprise a small portion of the unit and pose a minimal threat for habitat loss. Other coverage types contribute a minimal proportion of the unit (Table 1.4).

The predominant vegetation in the northern and western portions of the unit is a desert shrub type, which receives little use by deer or elk. This lower country is inhabited mostly by desert bighorn sheep and antelope. The deer and elk range is centered on and around the La Sal Mountains. The 12,000 foot talus peaks are bare, however; the mountains level off at 8,000 feet to form a plateau, and then slope gently down to the desert below at about 4,000 feet. Deer generally winter on the mesas at 8,000 feet or lower. South-facing slopes in steep canyons and the lower desert areas also provide some additional wintering areas.

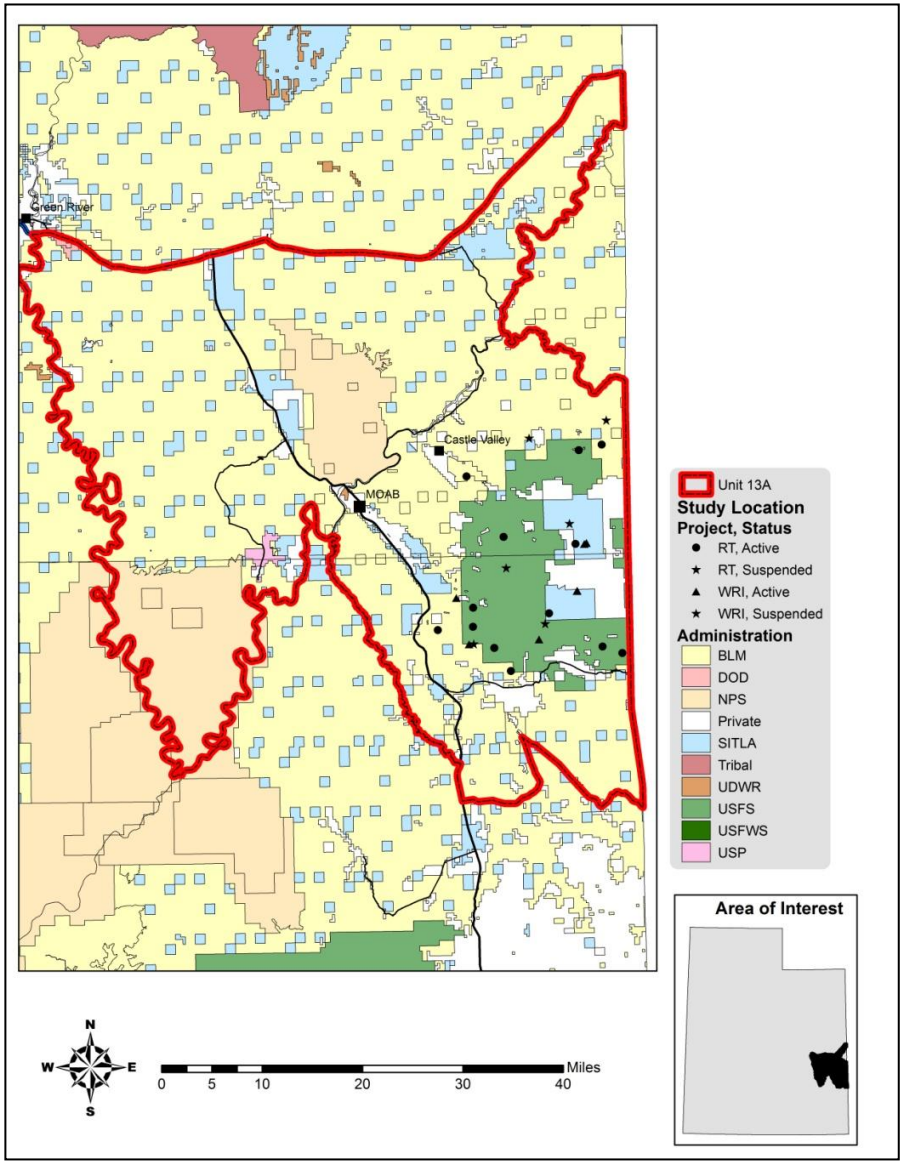
Key big game areas are: the Fisher Valley - Fisher Mesa area (USFS and BLM, approximately 2,900 acres), lower Castle Valley severe winter range (BLM and state, 3,800 acres), Upper Castle Valley and Porcupine Draw (USFS, 1,280 acres), Bromley Ridge (USFS, 1,000 acres), Black Ridge (BLM, 1,400 acres), Pole Canyon - Slaughter Flats - Buck Hollow (USFS, 9,500 acres) and North Beaver Mesa (USFS and BLM, 600 acres).



Map 1.2: Estimated mule deer habitat by season and value for WMU 13A, La Sal Mountains.



Map 1.3: Estimated elk habitat by season and value for WMU 13A, La Sal Mountains.



Map 1.4: Land ownership for WMU 13A, La Sal Mountains.

	Year Long Range		Summer Range		Winter Range		Spring/Fall	
	Area (acres)	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (Acres)*	*%*
Mule Deer	44,007	8%	182,027	35%	291,743	56%	0	0%
Elk	22,645	8%	113,382	39%	143,711	31%	11,714	4%

Table 1.1: Estimated mule deer and elk habitat acreage by season for WMU 13A, La Sal Mountains.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*
BLM	20,389	46%	2,302	1%	212,749	73%
DOD	32	<1%	0	0%	0	0%
NPS	17,900	41%	0	0%	0	0%
Private	2,417	5%	46,231	25%	25,542	9%
SITLA	1,203	3%	29,227	16%	16,915	6%
DNR	2,065	5%	0	0%	194	<1%
UDOT	0	0%	0	0%	70	<1%
USFS	0	0%	104,267	57%	36,273	12%
Total	44,007	**100%**	182,027	**100%**	291,743	**100%**

Table 1.2: Estimated mule deer habitat acreage by season and ownership for WMU 13A, La Sal Mountains.

	Year Long Range		Summer Range		Winter Range		Spring/Fall	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (Acres)*	*%*
BLM	19,764	87%	116	<1%	58,546	41%	1,483	13%
Private	765	3%	34,287	30%	14,993	10%	1,880	16%
SITLA	1,935	9%	27,949	25%	5,082	4%	86	1%
DNR	180	1%	0	0%	0	0%	0	0%
UDOT	0	0%	0	0%	41	<1%	0	0%
USFS	0	0%	51,030	45%	65,049	45%	8,265	71%
Total	22,645	**100%**	113,382	**100%**	143,711	**100%**	11,714	**100%**

Table 1.3: Estimated elk habitat acreage by season and ownership for WMU 13A, La Sal Mountains.

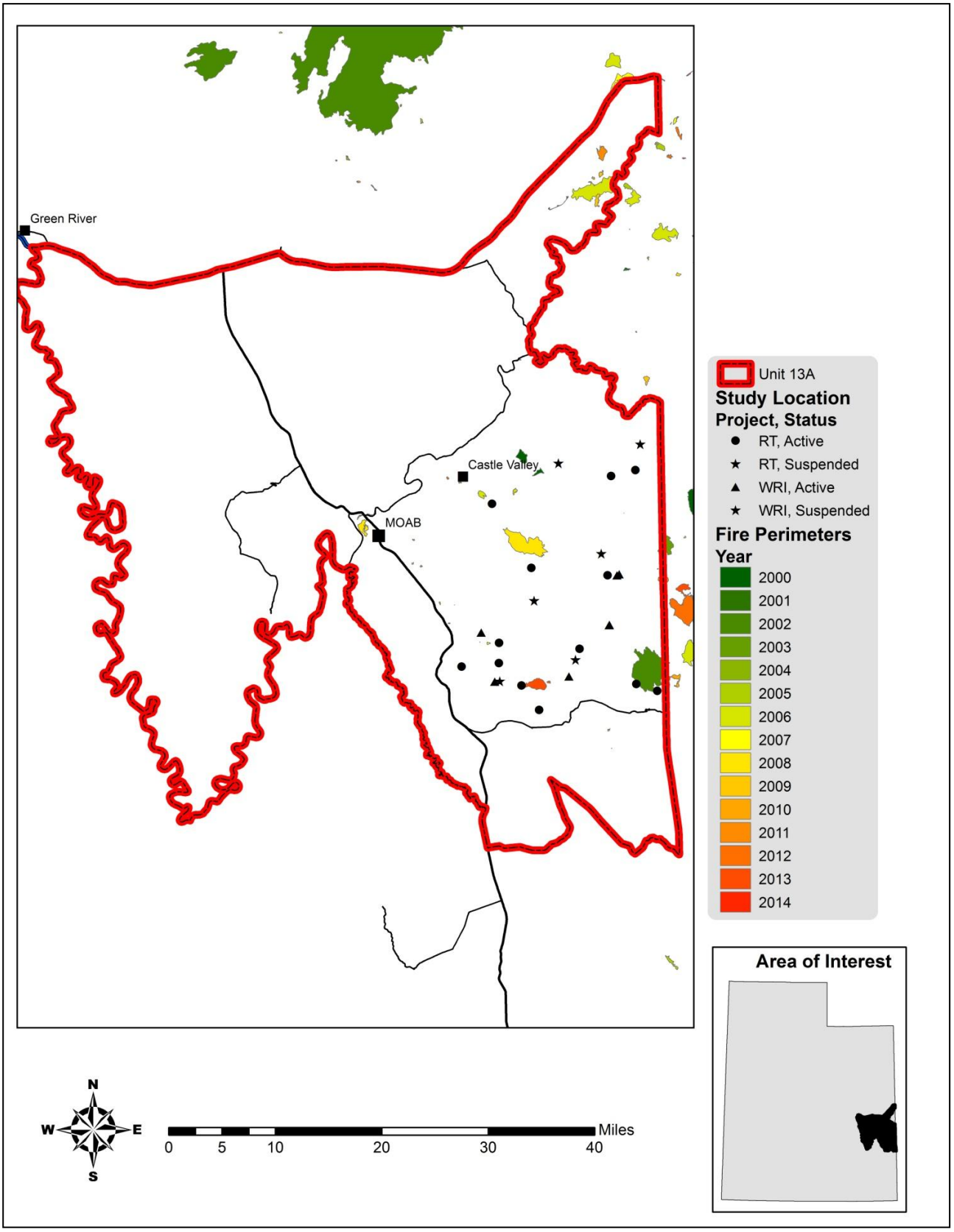
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Shrubland	Artemisia tridentata ssp. vaseyana Shrubland Alliance	1,286	0.08%	
	Coleogyne ramosissima Shrubland Alliance	544,379	34.33%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	3,309	0.21%	
	Inter-Mountain Basins Big Sagebrush Shrubland	87,138	5.49%	
	Inter-Mountain Basins Greasewood Flat	13,114	0.83%	
	Inter-Mountain Basins Mat Saltbush Shrubland	152,833	9.64%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	46,470	2.93%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	4,570	0.29%	
	Quercus gambelii Shrubland Alliance	36,038	2.27%	
	Southern Colorado Plateau Sand Shrubland	19,634	1.24%	
	Other Shrublands	6,248	0.39%	57.70%
Conifer	Colorado Plateau Pinyon-Juniper Woodland	197,039	12.42%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	13,342	0.84%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	6,171	0.39%	
	Southern Rocky Mountain Ponderosa Pine Woodland	23,958	1.51%	
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	11,570	0.73%	
	Other Conifer	3,565	0.22%	16.12%
Grassland	Native Grassland	39,458	2.49%	2.49%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	111,554	7.03%	7.03%
Exotic Tree-Shrub	Introduced Riparian Woodlands	10,961	0.69%	0.69%
Other	Hardwood	32,538	2.05%	
	Riparian	19,875	1.25%	
	Agricultural	5,570	0.35%	
	Developed	16,738	1.06%	
	Other	178,478	11.25%	15.97%
Total		1,585,839		

Table 1.4: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) for WMU 13A, La Sal Mountains.

Limiting Factors to Big Game Habitat

Habitat quality and quantity are the main limiting factors of this subunit. Continual monitoring of range conditions and deer use will help to maintain and improve habitat. Additionally, preserving and protecting existing crucial deer ranges by seeking cooperative projects with federal land management agencies and private landowners in carrying out habitat improvements such as reseedings, controlled burns, water developments etc.; planning and evaluating resource uses and developments that could impact habitat quality, develop specific vegetative objectives to maintain the quality of important deer use areas; work toward long-term habitat protection and preservation through the use of agreements with land management agencies and local governments, and through the use of conservation easements, etc. on private lands. Deer fences and crossings limiting range is always a concern but cooperation with the Utah Department of Transportation in construction of highway fences, passage structures, warning signs, etc. will continue in order to ensure proper access to habitat as well as deer and human safety.

Wildfire has had a negligible impact on the deer winter range in the unit. There have been a few small (less than 1,000 acres) fires on the winter range, but they have had minimal impact. The Hang Dog fire of 2002 was the largest wildfire in the unit at 5,971 acres, followed by the Porcupine Ranch fire of 2008 at 3,277 acres, and the West Water 2 fire of 2006 at 2,846 acres. Both the Hang Dog and Porcupine Ranch fires occurred on the La Sal mountains on summer range. The West Water 2 fire occurred in the northeast arm of the unit and had no impact on deer habitat (Map 1.5).

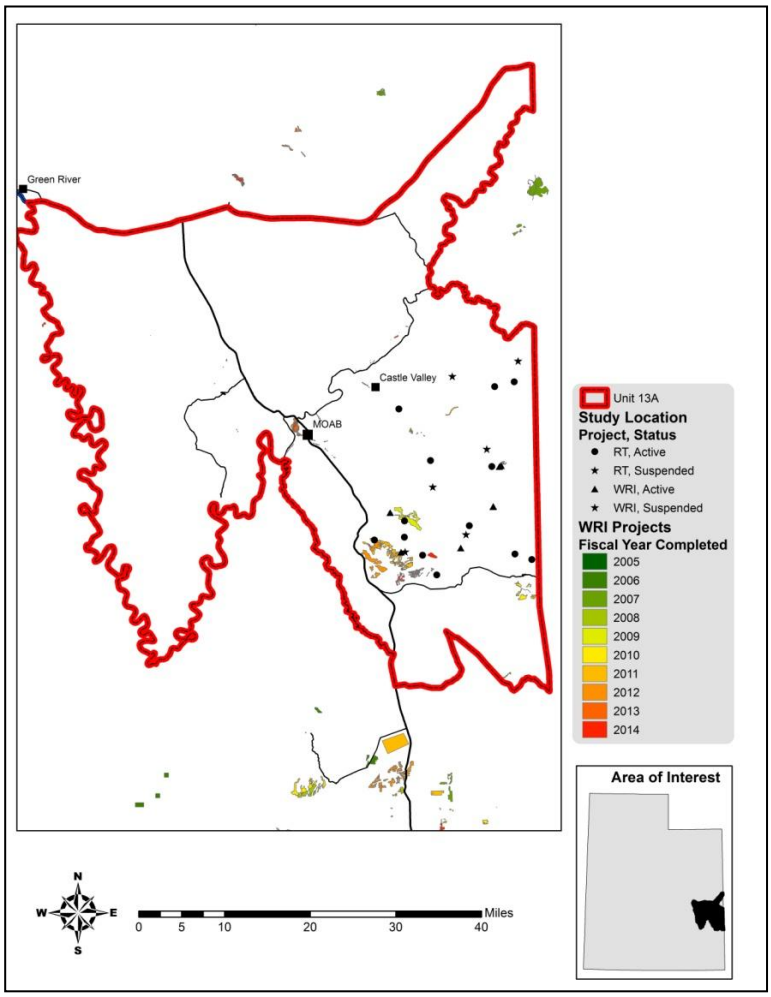


Map 1.5: Land coverage of fires by year from 2001-2014 for WMU 13A, La Sal Mountains.

Treatments/Restoration Work

There has been an active effort to address many of the limitations on this unit through the Watershed Restoration Initiative (WRI). A total of 8,502 acres of land have been treated within the La Sal Mountains unit since the WRI was implemented in 2004 (Map 1.6). Treatments frequently overlap one another bringing the total treatment acres to 11,442 acres for this unit (Table 1.5). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the State of Utah.

Vegetation removal/hand crew to remove pinyon and juniper trees is the most common management practice. Other management practices include bullhog for pinyon pine and Utah juniper removal and other similar vegetation removal techniques. The use of seeding to supplement the herbaceous understory is also very common (Table 1.5).



Map 1.6: WRI treatments by fiscal year completed for WMU 13A, La Sal Mountains.

Treatment Action	Acres
Bullhog	1,707
Forestry Practices	124
Herbicide Application	413
Planting/transplanting	51
Prescribed fire	1,052
Seeding (primary)	2,536
Vegetation removal / hand crew	4,235
Other	1,326
***Total Land Area Treated**	8,502
Total Treatment Acres	11,442

Table 1.5: WRI treatment action size (acres) for WMU 13A, La Sal Mountains.

*Does not include overlapping treatments.

Range Trend Studies

Range Trend studies have been sampled within WMU 13A on a regular basis since 1987, with studies being added or suspended as deemed necessary (Table 1.6). Due to changes in sampling methodologies, only data sampled following the 1992 sample year are included in this summary. Monitoring studies of WRI projects have been sampled since 2005. 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 1.7)

Range Trend studies that have not had recent disturbance or treatments are summarized in this report by ecological site or potential. Range Trend and WRI studies that have a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
13A-1	Two Mile Chaining	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
13A-2	East La Sal Pass	RT	Suspended	‘87, ‘94, ‘99	Not Verified
13A-3	Buck Hollow	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Gravelly Loam (Pinyon-Utah Juniper)
13A-4	Slaughter Flat	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Wyoming Big Sagebrush)
13A-5	Amasas Back	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Stony Loam (Pinyon-Utah Juniper)
13A-6	Bald Mesa	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	High Mountain Loam (Browse)
13A-7	Round Mountain	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Stony Loam (Blackbrush)
13A-8	Black Ridge	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush)
13A-9	Taylor Flat	RT	Suspended	‘87, ‘94, ‘99	Not Verified
13A-10	Upper Fisher Valley	RT	Suspended	‘87, ‘94, ‘99, ‘04, ‘09	Not Verified
13A-11	North Beaver Mesa	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
13A-12	Below Polar Rim	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
13A-13	Beaver Canyon	RT	Suspended	‘87, ‘94	Not Verified
13A-14	Lower Lackey Fan	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Upland Stony Loam (Wyoming Big Sagebrush)
13A-15	Hideout Mesa	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
13A-16	Beaver Creek	RT	Active	‘04, ‘09, ‘14	High Mountain Loam (Aspen)
13A-17	Bar -A	RT	Active	‘04, ‘09, ‘14	High Mountain Loam (Thurber Fescue)
13R-1	Horse Creek Burn	WRI	Suspended	‘07	Not Verified
13R-2	Pack Creek	WRI	Active	‘07, ‘10, ‘14	Upland Stony Loam (Utah Juniper-Pinyon)
13R-3	Black Ridge Fuel Reduction	WRI	Active	‘10,13	Upland Shallow Sandy Loam (PJ)
13R-4	Black Ridge Fuel Reduction Reference	WRI	Suspended	‘10	Not Verified
13R-5	La Sal Aspen Exclosure	WRI	Active	‘11, ‘14	High Mountain Loam (Aspen)
13R-6	La Sal Aspen	WRI	Active	‘11, ‘14	High Mountain Loam (Aspen)
13R-7	Doe Canyon	WRI	Active	‘13	High Mountain Loam (Aspen)
13R-8	Hop Creek Aspen	WRI	Active	‘13	High Mountain Loam (Aspen)
13R-9	Hop Creek Aspen Exclosure	WRI	Active	‘13	High Mountain Loam (Aspen)

Table 1.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 13A, La Sal Mountains.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
13A-1	Two Mile Chaining	Chain Unknown		1978	900	
		Seed Unknown		1978	900	
13A-3	Buck Hollow	Chain Unknown	Buck Hollow	1982	700	
		Seed Unknown	Buck Hollow	1982	700	
13A-4	Slaughter Flat	Chain Unknown		1974	940	
		Seed Unknown		1974	940	
13A-5	Amasas Back	Chain Unknown		1978	750	
		Seed Unknown		1978	750	
13A-8	Black Ridge	Chain Unknown	Buck Hollow	Historic		
		Seed Unknown	Buck Hollow	Historic		
		Lop and Scatter	Black Ridge Fuels Reduction and Vegetation Restoration - Phase II	2011	1359	1730
13A-10	Upper Fisher Valley	2-way Chain Unknown		1960		
		Seed Unknown		1960		
13A-11	North Beaver Mesa	Chain Unknown		1962	1000	
		Seed Unknown		1962	1000	
13A-12	Below Polar Rim	2-way Chain Unknown		1969	1540	
		Seed Unknown		1969	1540	
13A-14	Lower Lackey Fan	Herbicide		Historic		
		Seed Unknown		Historic		
13A-15	Hideout Mesa	Wildfire		~1992-1993		
13R-2	Pack Creek	Lop and Scatter	Pack Creek	2003		
		Bullhog	Pack Creek	Apr. 2007	127	907
		Prescribed Fire	Pack Creek	Oct. 2007	127	907
		Broadcast/Harrow	Pack Creek	Oct. 2007	127	907
13R-3	Black Ridge Fuel Reduction	Chain Unknown	Black Ridge Fuels Reduction and Vegetation Restoration	Early 1960's		
		Bullhog	Black Ridge Fuels Reduction and Vegetation Restoration	Fall 2010	1803	1408
		Aerial	Black Ridge Fuels Reduction and Vegetation Restoration	Fall 2010	1471	1408
13R-5	La Sal Aspen Exclosure	Logging/Clear-Cut	La Sal Mountain Aspen Enhancement	Sept.-Nov. 2011	124	1990
13R-6	La Sal Aspen	Logging/Clear-Cut	La Sal Mountain Aspen Enhancement	Sept.-Nov. 2011	124	1990
13R-7	Doe Canyon	Prescribed Fire	Lackey Basin Aspen Restoration	Summer 2014	3318	2620
13R-8	Hop Creek Aspen	Logging/Clear-Cut		2011-2012		
13R-9	Hop Creek Aspen Exclosure	Logging/Clear-Cut		2011-2012		

Table 1.7: Range trend and WRI studies known disturbance history for WMU 13A, La Sal Mountains.

Study Trend Summary (Undisturbed Sites)

High Mountain (Aspen)

There is one study [Beaver Creek (13A-16)] classified as a High Mountain (Aspen) ecological site that remained undisturbed over the report period (Table 1.6). This study site occurs on the southern slopes of the La Sal Mountains, just north of the town of La Sal.

Shrubs/Trees: The primary browse species is mountain snowberry (*Symphoricarpos oreophilus*). There are a few other low cover browse species present on the site. Shrub line intercept cover has remained stable from year to year and overall is good (Figure 1.2).

Quaking aspen (*Populus tremuloides*) was the dominate tree on this site. Point quarter data was not sampled on aspen trees the first two years the site was read. Line intercept cover of aspen has decreased over the sample years (Figure 1.3)

Herbaceous Understory: This study site has a good herbaceous component dominated by perennial grasses and forbs. This site supports some native and introduced grasses with Kentucky bluegrass (*Poa pratensis*) being the most abundant in both frequency and cover. Perennial grass cover has fluctuated over the years from 23% in 2004, to 54% in 2009, and 44% in 2014, but remains high. There are no annual grasses found on this site (Figure 1.4).

In addition, a diverse number of perennial and annual forbs provide substantial cover. Perennial forb cover fluctuated from 22% in 2004, to 15% in 2009, and 35% in 2014, while annual forb cover was consistently low (Figure 1.8).

Occupancy: Pellet group transect data indicates that animal occupancy fluctuates from year to year on this study. Deer pellet groups has remained low with 5 days use/acre in 2004, 0 in 2009 and 2 days use/acre in 2014. Whereas elk pellet abundance has ranged from a high of 42 days use/acre in 2004 to 12 days use/acre in 2014. Cattle occupancy has fluctuated as well with a high of 102 day use/acre in 2009 to as low as 12 day use/acre in 2014 (Figure 1.5).

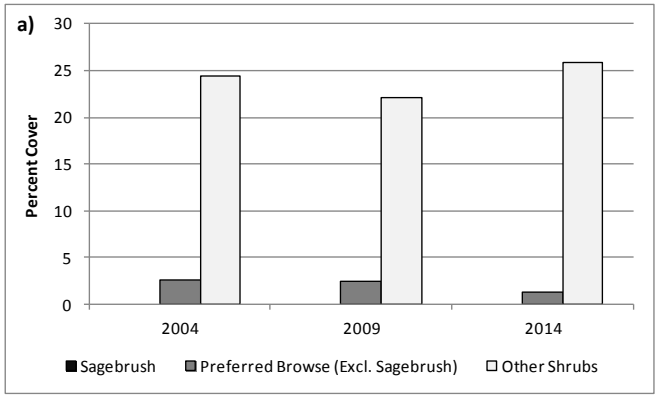


Figure 1.2: Shrub summary of the High Mountain (*Aspen*) study (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups.

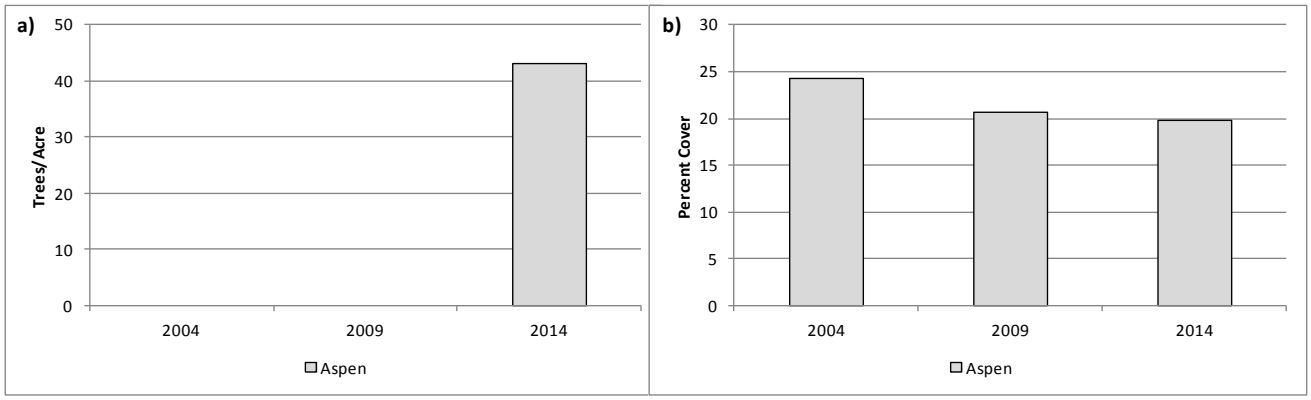


Figure 1.3: Tree summary of the High Mountain (*Aspen*) study (n=1) for WMU 13A, La Sal Mountains. a) Point-quarter tree density estimates for quaking aspen (*Populus tremuloides*). b) Line-intercept cover estimate for aspen.

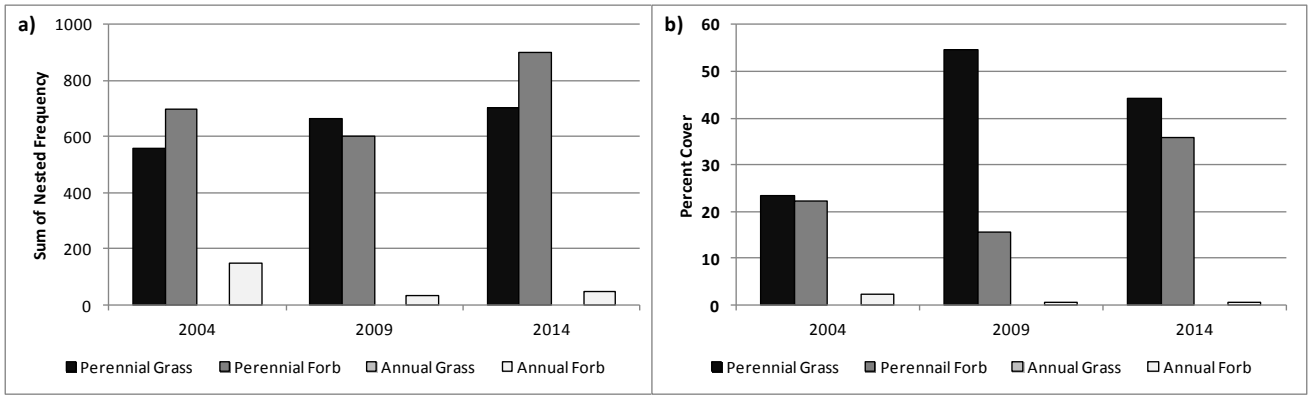


Figure 1.4: Herbaceous functional group summary of the High Mountain (*Aspen*) study (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

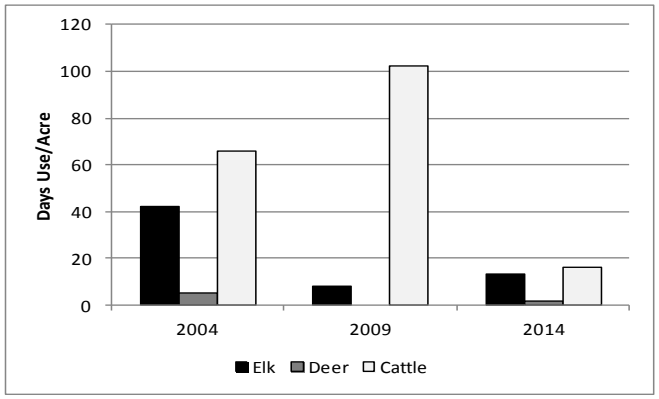


Figure 1.5: Pellet transect data for the High Mountain (*Aspen*) study (n=1) for WMU 13A, La Sal Mountains.

High Mountain (Thurber Fescue)

There is one study [Bar-A (13A-17)] classified as a High Mountain (Thurber Fescue) ecological site that remained undisturbed over the report period (Table 1.6). This study site occurs east of the La Sal Mountains.

Shrubs/Trees: The primary browse species is silver sagebrush (*Artemisia cana*). Shrub cover in most years has been less than 1%. Shrub cover has increased over the years but remains low (Figure 1.6a). The demographics of silver sagebrush population were mostly mature shrubs throughout the years, with young increasing since 2009. Density has increased and was up to 500 plants per acre in 2014 (Figure 1.6b).

Point quarter was only sampled in 2014, but it shows that there are a little over 40 quaking aspen trees per acre (Figure 1.7).

Herbaceous Understory: This study sites has a great herbaceous component dominated by perennial grasses and forbs. This site supports a variety of native and introduced grasses with Kentucky bluegrass being the most abundant in both frequency and cover. Perennial grass cover oscillates between 30-40%, depending on the year. There are no annual grasses found on this site (Figure 1.8).

In addition, a diverse number of perennial and annual forbs provide substantial cover. Perennial forb cover ranged anywhere from 46% in 2004 to 64% in 2009, and 56% in 2014. Annual forb cover was consistently low at less than 1% (Figure 1.8).

Occupancy: Pellet group transect data indicates that deer and elk occupancy has remained relatively low from year to year on this study. The abundance of deer pellet groups has ranged from 7 days use/acre in 2004 to 1 day use/acre in 2009 and 2014. Whereas elk pellet abundance has ranged from a high of 21 days use/acre in

2004 and 2009 to 13 days use/acre in 2014. Cattle occupancy has declined over the years from 44 days use/acre in 2004 to 7 days use/acre in 2014 (Figure 1.9).

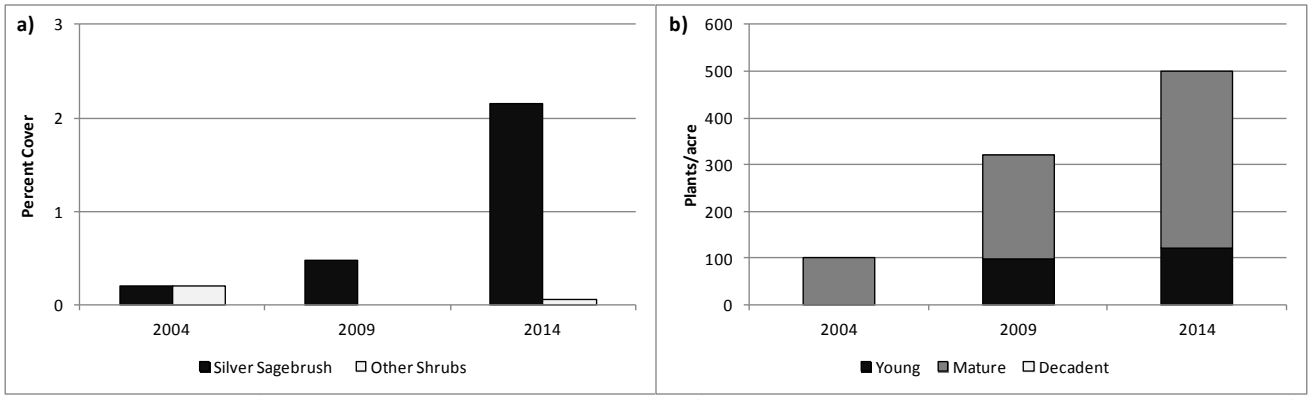


Figure 1.6: Shrub summary of the High Mountain (Thurber Fescue) study (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of silver sagebrush.

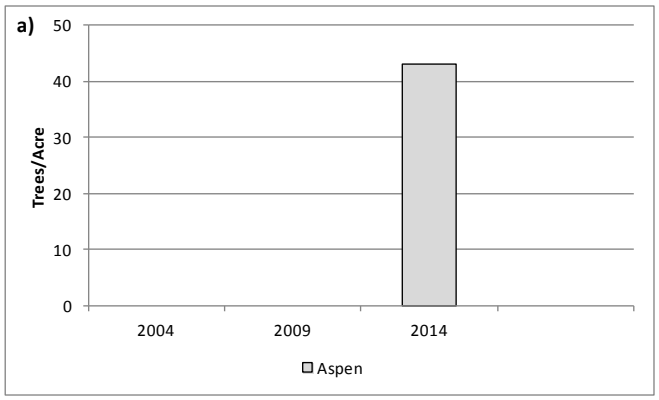


Figure 1.7: Tree summary of the High Mountain (Thurber Fescue) study (n=1) for WMU 13A, La Sal Mountains. a) Point-quarter tree density estimates for quaking aspen (*Populus tremuloides*).

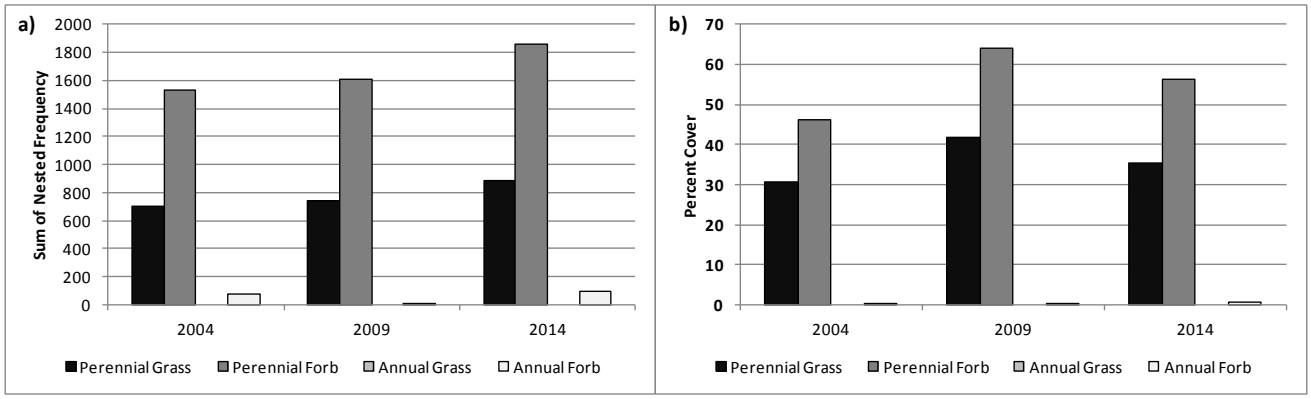


Figure 1.8: Herbaceous functional group summary of the High Mountain (Thurber Fescue) study (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

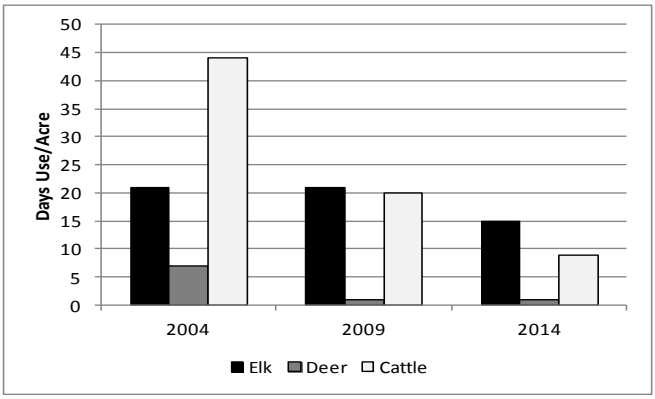


Figure 1.9: Pellet transect data for the High Mountain (Thurber Fescue) study (n=1) for WMU 13A, La Sal Mountains.

High Mountain (Browse)

There is one study [Bald Mesa (13A-6)] classified as High Mountain (Browse) ecological site that remained undisturbed over the report period (Table 1.6). This study site occurs on the west plateaus of the La Sal Mountains, just east of Moab.

Shrubs/Trees: The primary browse species is mountain snowberry. There are a few other low cover browse species present on the site, including mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Shrub cover has remained stable from year to year and overall has been good (Figure 1.10a). The demographics of mountain big sagebrush population were a mixture of age classes when the site was first established, but is now more young a mature plants, with density generally increasing (Figure 1.10b).

There were no trees located within the study area so summary of trees was not included in this report. However, repeat photos show that there are quaking aspen and various conifer trees near the study.

Herbaceous Understory: This study sites has a good herbaceous component dominated by perennial grasses and forbs. This site supports and variety of native and introduced grasses with Kentucky bluegrass being the most abundant in both frequency and cover. Perennial grass cover has generally been increasing over the most recent years, with its lowest cover in 2004 at 10% and its highest cover in 2014 with 33%. There are no annual grasses found on this site (Figure 1.11).

In addition, a diverse number of perennial and annual forbs provide substantial cover. Perennial forb cover fluctuated from 27-37% cover each year while annual forb cover remains less than 1% (Figure 1.11).

Occupancy: Pellet group transect data indicates that deer occupancy has remained low and that elk occupancy is increasing. The abundance of deer pellet groups has remained under 5 days use/acre across all sample years. Whereas elk pellet abundance has increased from 3 days use/acre in 2009 to 34 days use/acre in 2014. Cattle occupancy has seen a recent decline going from 112 days use/acre in 2004 down to 4 days use/acre in 2014 (Figure 1.12).

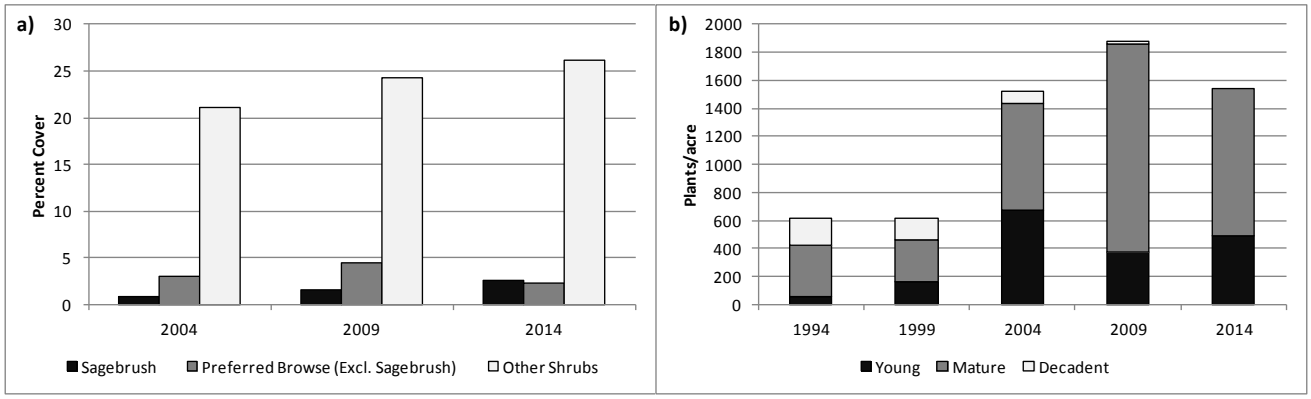


Figure 1.10: Shrub summary of the High Mountain (Browse) study (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of mountain big sagebrush.

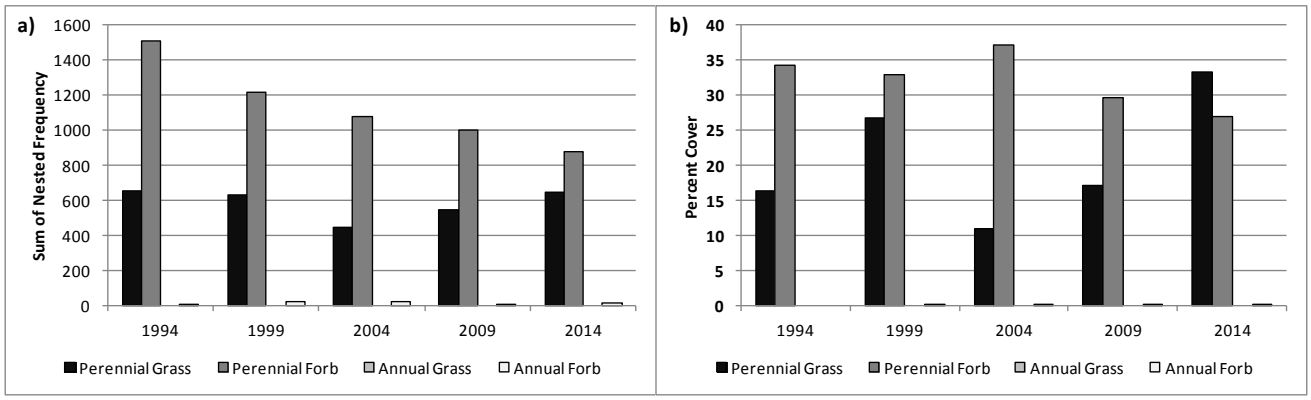


Figure 1.11: Herbaceous functional group summary of the High Mountain (Browse) study (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

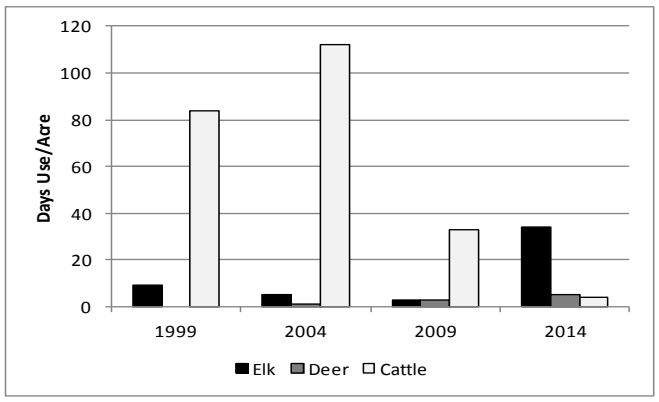


Figure 1.12: Pellet transect data for the High Mountain (Browse) study (n=1) for WMU 13A, La Sal Mountains.

Mountain (Mountain Big Sagebrush)

There are two studies [Two Mile Chaining (13A-1) and Hideout Mesa (13A-15)] classified as an Mountain (Mountain Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 1.6). Both studies are located north of UT-46 near the Utah-Colorado boarder.

Shrubs/Trees: The primary browse on both studies is mountain big sagebrush. Two Mile Chaining had stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and Utah serviceberry (*Amelanchier utahensis*) that had high cover as well. There are a few other low cover browse species present on both sites. The line-intercept cover of sagebrush is good and has increased over the sample years for Hideout Mesa and remained constant for Two Mile Chaining. The average height of sagebrush is just over 1.5

feet tall, making browse partially available through much of the year in normal winters. The demographics of the sagebrush population was a mixture of young, mature, and decadent plants, with an increasing trend in density on Hideout Mesa and a decreasing trend on Two Mile Chaining (Figure 1.13).

Pinyon pine has an ever-increasing presence on Two Mile Chaining. Additionally, ponderosa pine (*Pinus ponderosa*) was measure for the first time in 2014 on this site. Point quarter was sampled for the first time in 2014 on Hideout Mesa with both pinyon and Utah juniper being sampled (Figure 1.14).

Herbaceous Understory: The herbaceous understory of both sites is comprised of a fair number of introduced and native perennial grasses and a sparse amount of forbs. On Two Mile Chaining, perennial grass cover has remained around 10% while Hideout Mesa has seen an increasing trend since 2004. Cheatgrass (*Bromus tectorum*) was present on Two Mile Chaining in 1999 but has been absent since. Hideout Mesa varies from year to year on annual grass cover but it was as high as 12% in 2004 (Figure 1.15).

Forbs generally contributed less than 5% cover on both sites, though both sites are fairly diverse (Figure 1.15).

Occupancy: Pellet group transect data indicates moderate to low animal presence. Both sites have seen a decrease in elk presence over the sample years. The mean abundance of deer pellet groups is moderate on Two Mile Chaining and low on Hideout Mesa whereas, cattle use was moderate on Hideout Mesa and low on Two Mile Chaining (Figure 1.16).

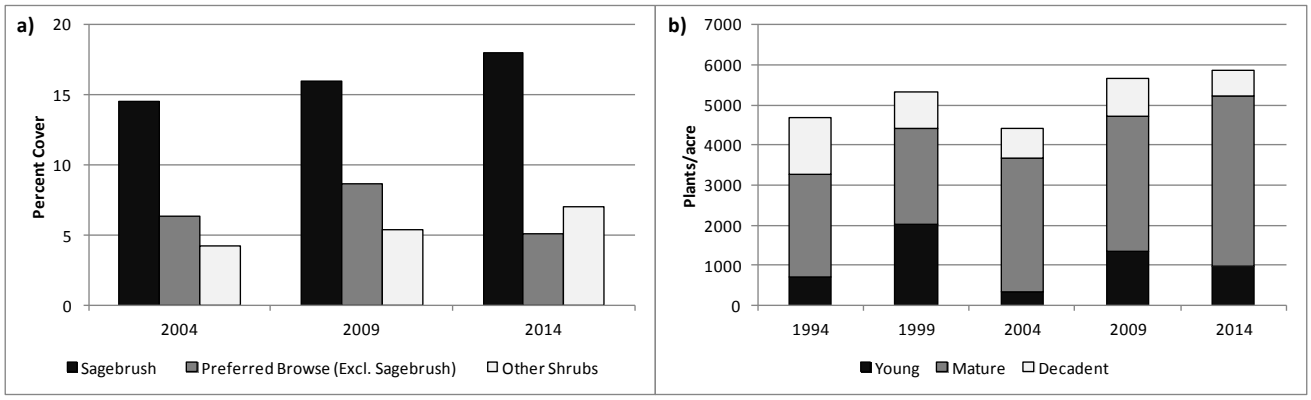


Figure 1.13: Shrub summary of the Mountain (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

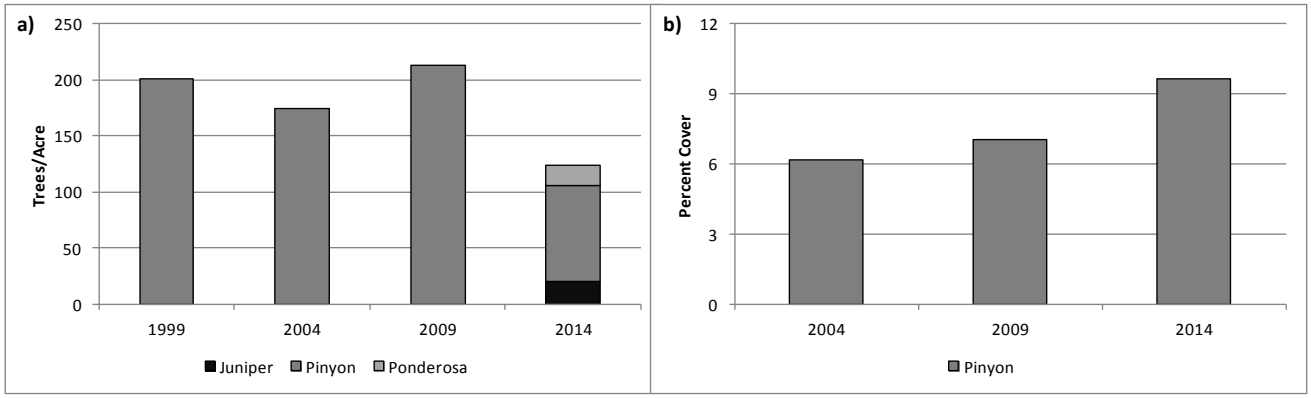


Figure 1.14: Tree summary of the Mountain (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), and ponderosa pine (*Pinus ponderosa*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

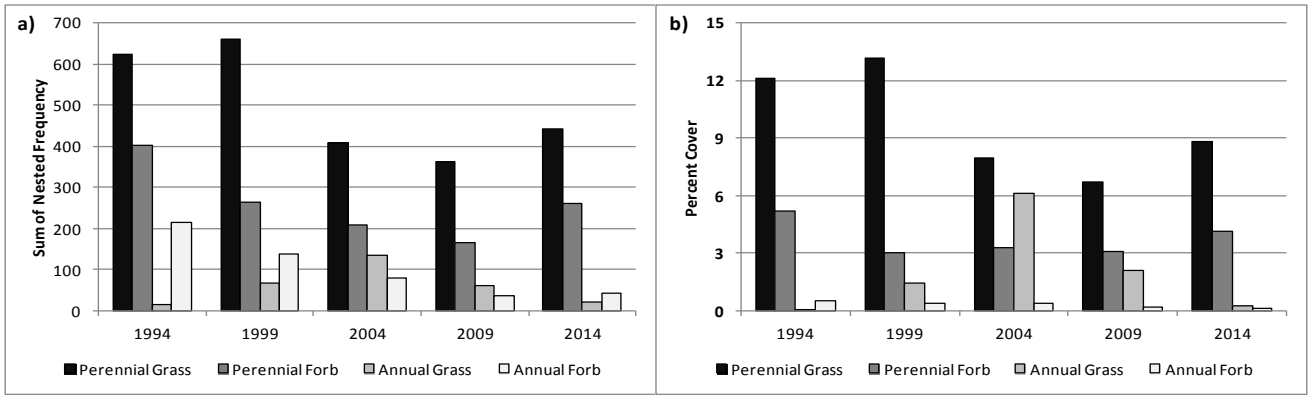


Figure 1.15: Herbaceous functional group summary of the Mountain (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

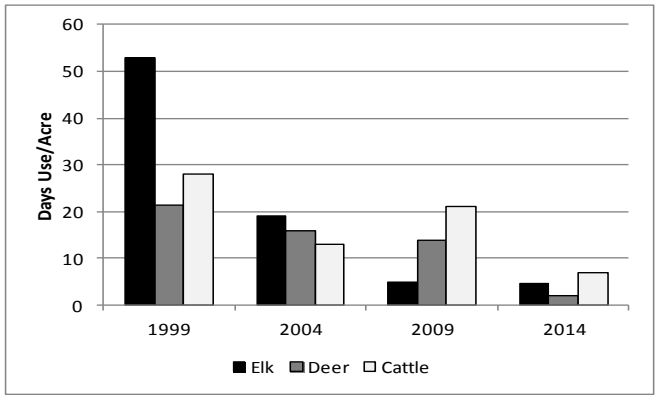


Figure 1.16: Mean pellet transect data for the Mountain (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains.

Upland (Mountain Big Sagebrush)

There are two studies [North Beaver Mesa (13A-11) and Below Polar Rim (13A-12)] classified as Upland (Mountain Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 1.6). Both studies are northeast of Moab near the Utah-Colorado boarder.

Shrubs/Trees: The primary browse on both studies is mountain big sagebrush. The mean line-intercept cover of sagebrush is good on both sites with cover increasing slightly in 2009 on both sites (Figure 1.17a). The average height of mountain big sagebrush on all of the studies is approximately 1.5 feet tall, making browse partially available through much of the year in normal winters. The demographics of the sagebrush populations have varied from year to year; however, generally the sagebrush is mature. The recruitment of young plants was highest in 1999 (Figure 1.17b). Density was variable on North Beaver Mesa while Below Polar Rim has seen a steady decrease in density of sagebrush.

Pinyon pine and Utah juniper are found on both sites. Tree density is increasing on North Beaver Mesa while it is stable on Below Polar Rim. Both sites have the potential for increased encroachment (Figure 1.18).

Herbaceous Understory: The general herbaceous composition for both sites is a fair amount of perennial grass and relatively low forb cover. The studies differ in that the dominant perennial grass species for North Beaver Mesa is crested wheatgrass, an introduced species that can often out compete other herbaceous species, while for Below Polar Rim it is blue grama, a native species. Cheatgrass is present on both sites; however, frequency and cover have remained low, and therefore this annual grass does not pose a major threat at this point in time (Figure 1.19).

Perennial and annual forb frequency and cover have remained low over the sample years (Figure 1.19).

Occupancy: The mean abundance of elk and deer pellet groups on both sites has decreased over the sample years. Elk had a strong presence in the late 1990's on both sites, but has since decreased. Cattle presence has varied from year to year on both sites, but has been generally low to moderate (Figure 1.20).

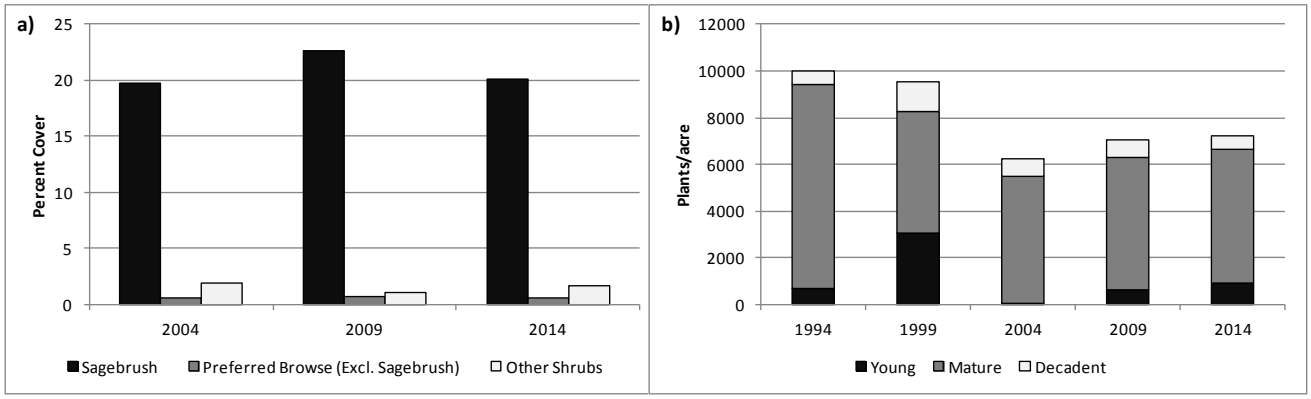


Figure 1.17: Shrub summary of the Upland (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

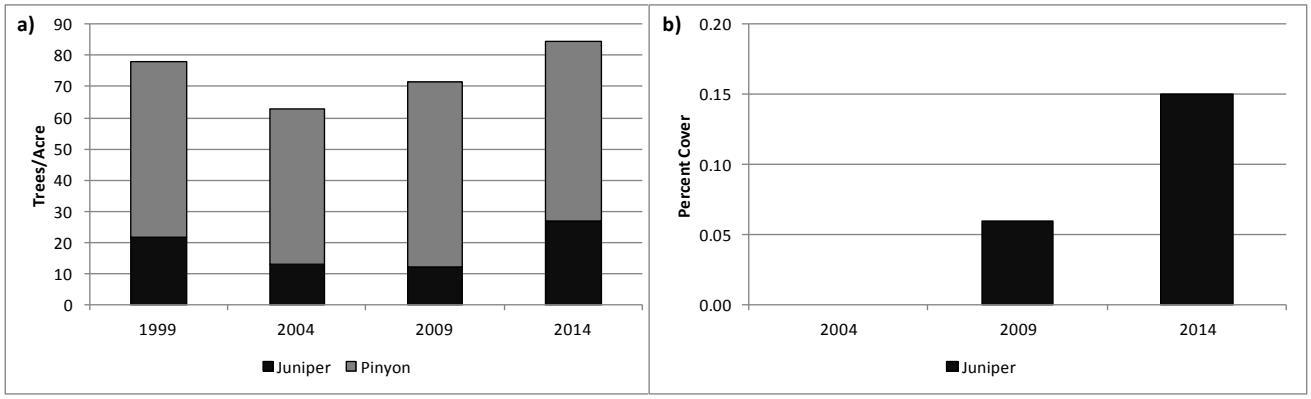


Figure 1.18: Tree summary of the Upland (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for Utah juniper.

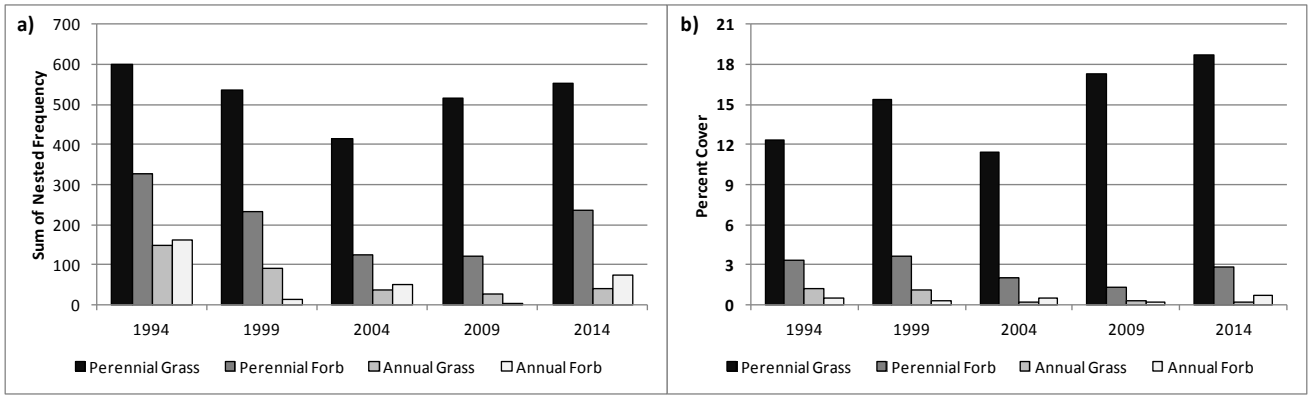


Figure 1.19: Herbaceous functional group summary of the Upland (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

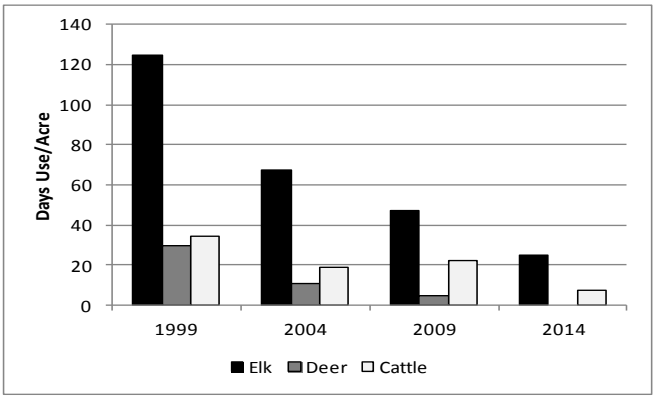


Figure 1.20: Mean pellet transect data for the Upland (Mountain Big Sagebrush) studies (n=2) for WMU 13A, La Sal Mountains.

Upland (Wyoming Big Sagebrush)

There are three studies [Buck Hollow (13A-3), Slaughter Flat (13A-4), and Lower Lackey Fan (13A-14)] classified as Upland (Wyoming Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 1.6). All three studies are located north of the town of La Sal and east of SR 191.

Shrubs/Trees: The primary browse on Slaughter Flat and Lower Lackey Fan is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*); Buck Hollow does not currently have sagebrush on the site. Both of sites with sagebrush show a general trend of increasing sagebrush cover. The mean line-intercept cover of sagebrush is good on both sites (Figure 1.21a). The average height of Wyoming big sagebrush is just over 1.5 feet tall, making browse available through much of the year in normal winters. The demographics of the sagebrush populations have varied from year to year, though density shows an overall decreasing trend. On both sites the recruitment of young plants is decreasing, mature plants are increasing and are by far the majority of the plants, and decadent plants are variable (Figure 1.21b).

Buck Hollow has the most pinyon pine and Utah juniper trees, which could explain, in part, the lack of sagebrush on the site. Pinyon and juniper trees were present on all three sites, though cover was lowest on Slaughter Flat. In general, both tree density and cover are increasing on these sites and over time could lead to significant vegetation changes on these sites (Figure 1.22b).

Herbaceous Understory: The general herbaceous trend for frequency and cover for these sites is variable from year to year. The dominant perennial grass species for Buck Hollow is smooth brome (*Bromus inermis*) an introduced species, and for Slaughter Flat and Lower Lackey Fan it is crested wheatgrass, an introduced species that can often outcompete other herbaceous species. All three sites have cheatgrass present, but because cover is low, it does not pose a major threat to site resilience at this time (Figure 1.23).

Perennial and annual forb frequency and cover have remained low over the sample years. Perennial forb cover was variable, but annual forb cover remained less than 1% on all three sites (Figure 1.23).

Occupancy: With the exception of elk occupancy, which is experiencing a decline, deer and cattle occupancy is variable from year to year, with overall trends being low. Of the three sites, deer occupancy on Lower Lackey Flat was the only increasing trend (Figure 1.24).

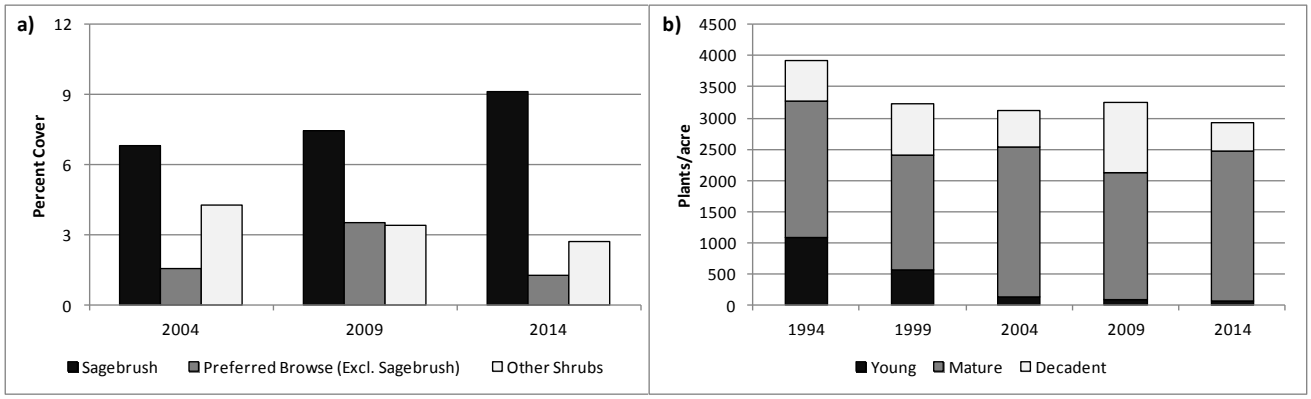


Figure 1.21: Shrub summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 13A, La Sal Mountains. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

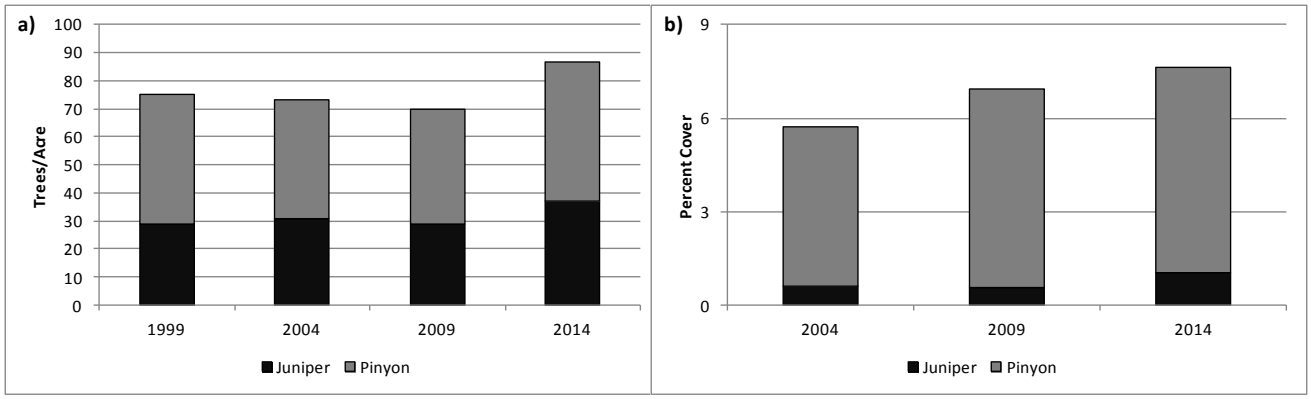


Figure 1.22: Tree summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 13A, La Sal Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

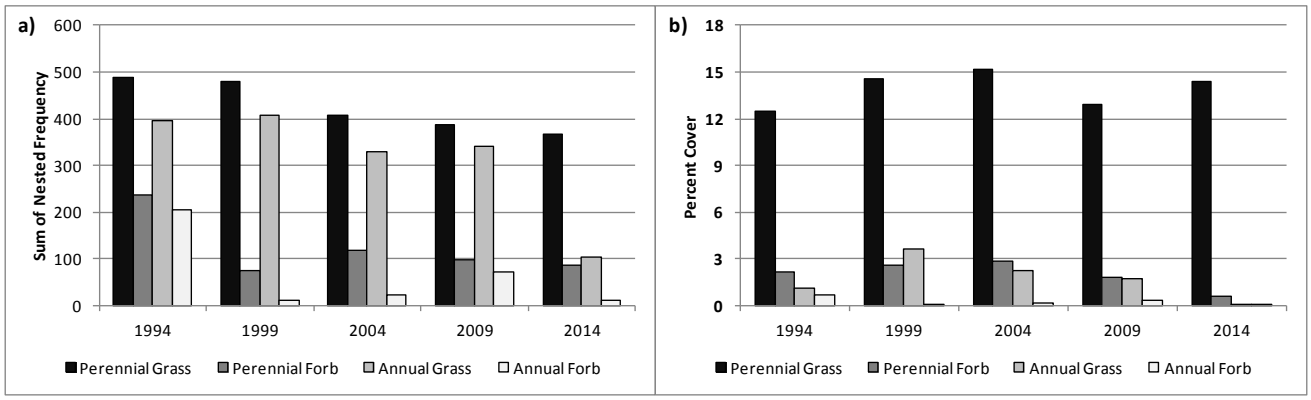


Figure 1.23: Herbaceous functional group summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 13A, La Sal Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

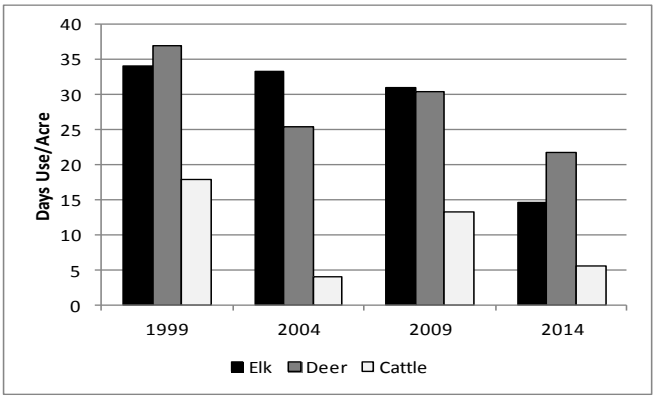


Figure 1.24: Mean pellet transect data for the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 13A, La Sal Mountains.

Upland (Black Sagebrush)

There is one study [Amasas Back (13A-5)] classified as Upland (Black Sagebrush) ecological sites that remained undisturbed over the report period (Table 1.6). Amasas Back is located south of Moab approximately 12 miles off SR 191 near Pack Creek.

Shrubs/Trees: The primary browse is black sagebrush (*Artemisia nova*). Cover of black sagebrush is decreasing, which could be attributed to increasing tree density. The mean line-intercept cover of sagebrush has recently dropped from 10% in 2009 to 7% in 2014 (Figure 1.25a). The average height of mountain big sagebrush on all of the studies is just over 1 foot tall, making browse unavailable through much of the winter even in normal years. The demographics of the sagebrush populations have varied from year to year, but are generally increasing. The recruitment of young plants is low to nonexistent in 2014, mature plants have been highest over all the study years, while decadent plants remain low (Figure 1.25b).

Encroachment from pinyon pine and Utah juniper trees is occurring on this site and is likely responsible for the decline in black sagebrush. If encroachment continues, it could pose problems for the stability and diversity of this site (Figure 1.26b).

Herbaceous Understory: The general herbaceous composition is low perennial grasses and perennial forbs, sparse annual forbs, and a moderate amount cheatgrass that has decreased over the years. The dominant perennial grass species is crested wheatgrass, an introduced species. Cheatgrass has also been dominant in years past with a cover as high as 16% in 1994, though in 2014 cover was less than 1% (Figure 1.27).

Perennial and annual forb frequency and cover have remained low over the sample years. Perennial forb cover has decreased over the sample years and annual forb cover remains less than 1% (Figure 1.27).

Occupancy: Pellet group transect data indicates that deer and elk occupy this site. The abundance of elk pellet groups has been variable over the study years while deer abundance in generally declining over the years (Figure 1.28).

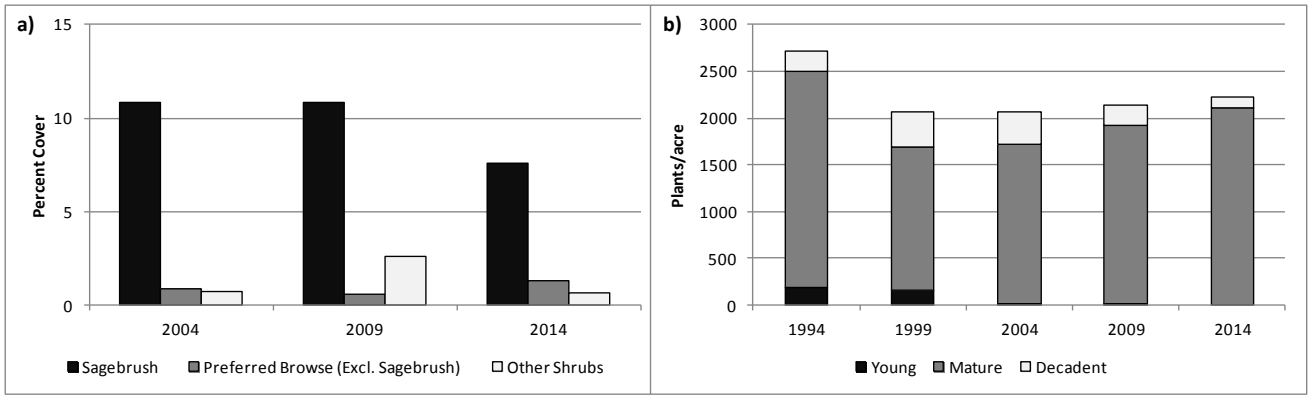


Figure 1.25: Shrub summary of the Upland (Black Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

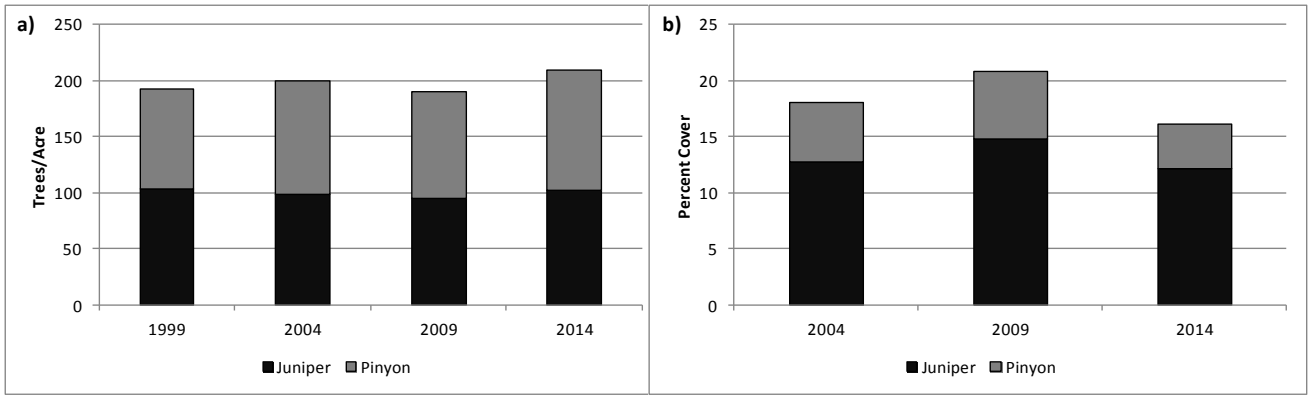


Figure 1.26: Tree summary of the Mountain (Black Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Line-intercept cover estimate for pinyon pine and Utah juniper.

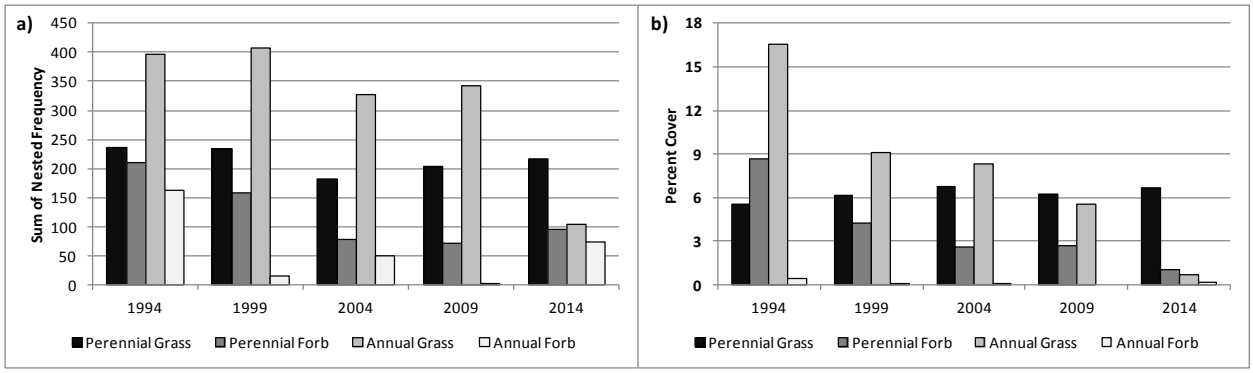


Figure 1.27: Herbaceous functional group summary of the Upland (Black Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

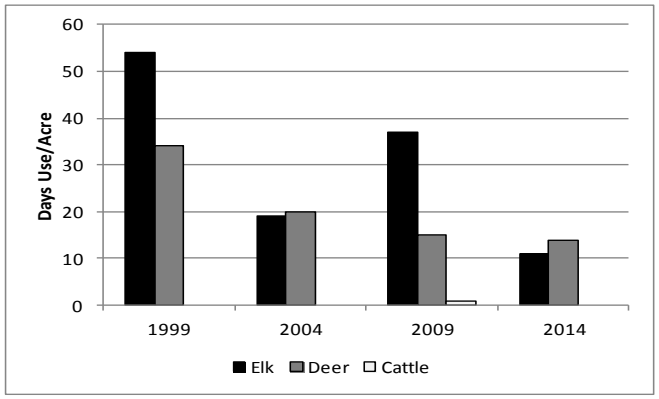


Figure 1.28: Pellet transect data for the Upland (Black Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains.

Semidesert (Wyoming Big Sagebrush)

There is one study [Round Mountain (13A-7)] classified as Semidesert (Wyoming Big Sagebrush) ecological site that remained undisturbed over the report period (Table 1.6). The Round Mountain study is located northeast of Moab near Round Mountain.

Shrubs/Trees: The primary browse on this study is blackbrush, which is considered a key browse species for deer. There is also some Wyoming big sagebrush, but it contributes little cover. The mean line-intercept cover of sagebrush is low on this site (Figure 1.29a). The average height of Wyoming big sagebrush is less than 1.5 feet tall, making browse somewhat available through much of the year in normal winters. The demographics of the sagebrush population have generally been comprised of decadent plants with little to no recruitment of young plants. There has been a decrease in sagebrush density over the study years (Figure 1.29b).

Pinyon pine and Utah juniper are increasing in cover and density, which has potential to influence the function and diversity of this site (Figure 1.30).

Herbaceous Understory: This study site has a fairly poor herbaceous component dominated primarily by cheatgrass. Perennial grass cover is less than 1% across all sample years (Figure 1.31). Cheatgrass increases the risk of fire and threatens the resiliency of this site.

Perennial and annual forb cover has been less than 1% with the exception of 2014 when annual forb cover was 3 % (Figure 1.31).

Occupancy: Pellet group transect data indicates that deer and elk occupy this study site. Elk occupancy is very low and deer abundance has been high most sample years, but has been declining since 2009 (Figure 1.32).

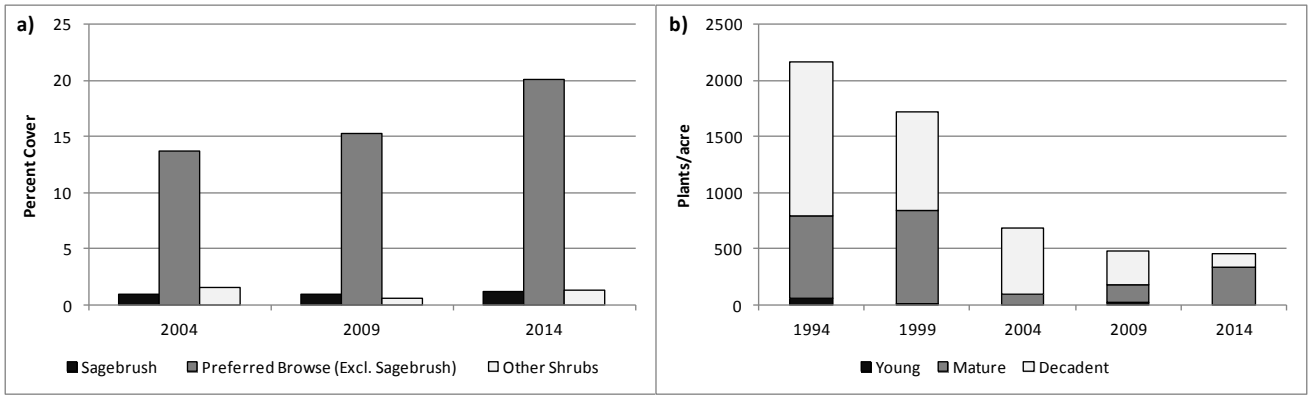


Figure 1.29: Shrub summary of the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

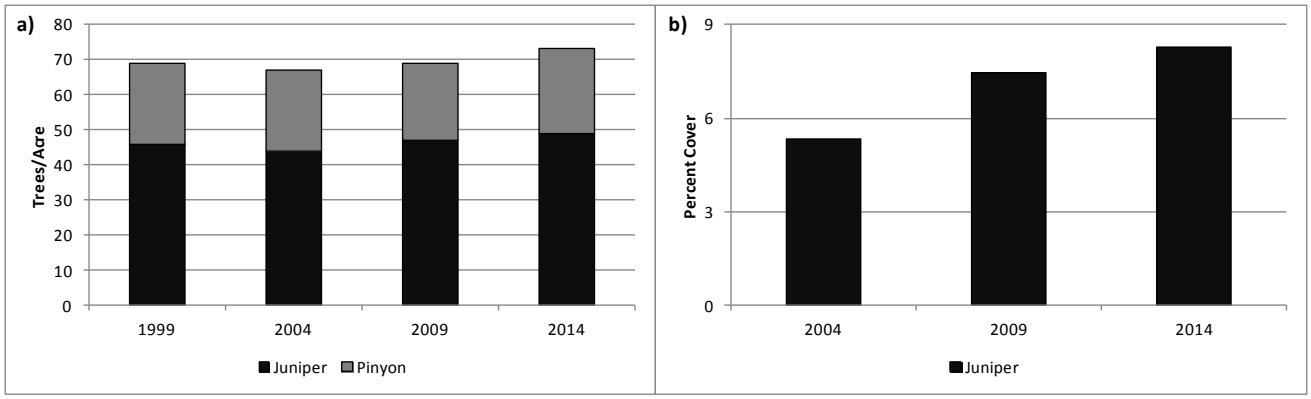


Figure 1.30: Tree summary of the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Line-intercept cover estimate for pinyon pine and Utah juniper.

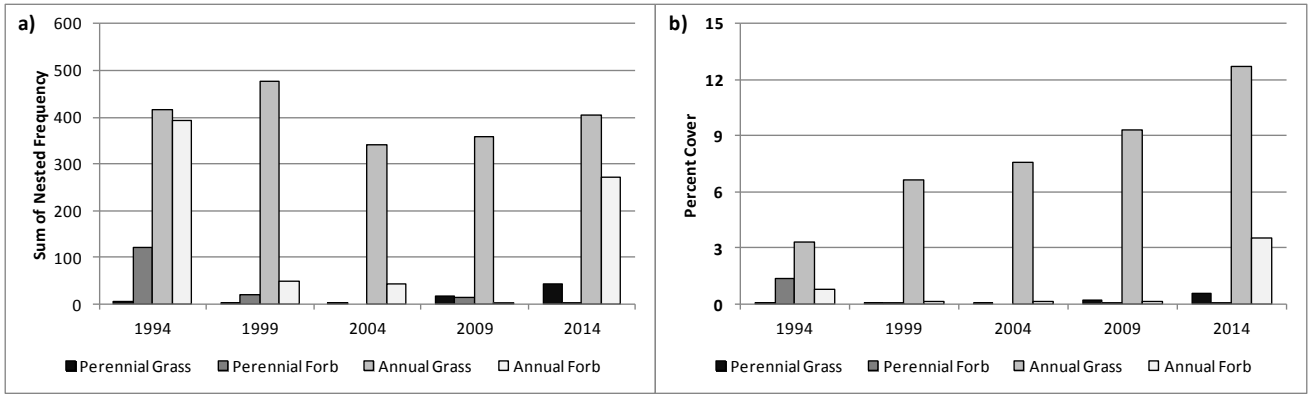


Figure 1.31: Herbaceous functional group summary of the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

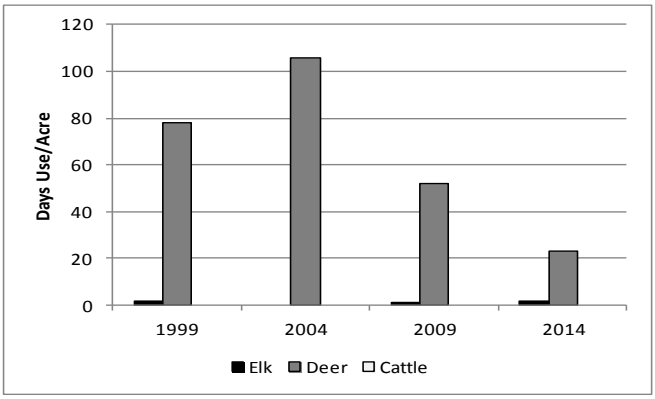


Figure 1.32: Pellet transect data for the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 13A, La Sal Mountains.

Study Trend Summary (Treated/Disturbed Sites)

Bullhog

There are two studies [Pack Creek (13R-2) and Black Ridge Fuel Reduction (13R-3)] that were treated with a bullhog during the report period (Table 1.7). Both sites are located south of Moab and east of SR 191. Both sites are classified as Upland (Pinyon-Utah Juniper) ecological site (Table 1.6). Generally, the target of the bullhog treatments was to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on Pack Creek is Wyoming big sagebrush and blackbrush, and on Black Ridge Fuel Reduction, it is green Ephedra (*Ephedra viridis*). Shrub cover was being impacted by pinyon-juniper encroachment on these studies; the mean line-intercept cover of shrubs was low. The mean shrub cover increased following treatments in all shrub categories (Figure 1.33a). Since there was no sagebrush found on Black Ridge, the sagebrush density data comes strictly from Pack Creek. The density of sagebrush generally increased post bullhog. Changes in demographics of the sagebrush populations have been positive. Decadent and mature plants dominated the population prior to treatment, but decadent plants decreased following treatment. The recruitment of young plants remains low; however, demographics are becoming more diversified (Figure 1.33b). It is expected that with the improved recruitment and health of the sagebrush that the sagebrush will continue to increase on the treatment site.

The mean density and cover of pinyon pine and Utah juniper was 150 trees/acre and 15%, respectively. The mean density of pinyon-juniper trees decreased to near 30 trees/acre, and the mean cover decreased to around 1% following treatment (Figure 1.34). Remaining density and cover is generally provided by trees that were intentionally left standing or small trees that were left standing.

Herbaceous Understory: The herbaceous understory was generally lacking prior to treatment of these studies, with the exception of cheatgrass on Pack Creek which was high at 26% cover prior to treatment. Following treatment, there was a general increase in all of the herbaceous functional groups, except annual grass, which decreased to less than 5%. Despite increases on Pack Creek perennial grass did decrease on Black Ridge Fuel Reduction from 11% pretreatment to 8% post treatment (Figure 1.35). It is possible given more years that perennial grass cover will increase.

Occupancy: Pellet group transect data indicates that elk and deer primarily occupy these study sites prior to treatment; however, following treatment deer became the primary species. The mean abundance of pellet groups of elk decreased post treatment while deer has ranged from a high of 60 days use/acre to 15 days use/acre following treatment (Figure 1.36).

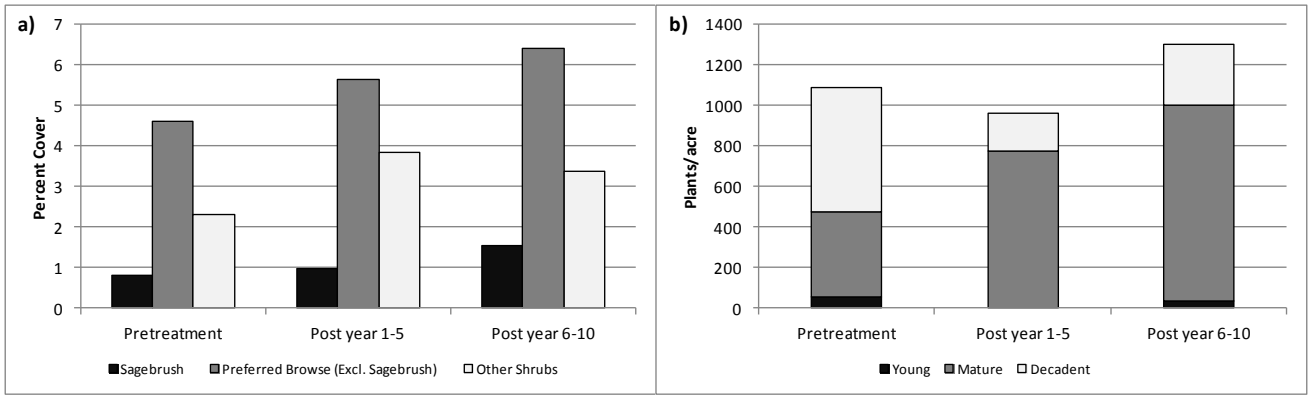


Figure 1.33: Shrub summary of the Bullhog treatment studies (n=2) for WMU 13A, La Sal Mountains. a) Mean line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

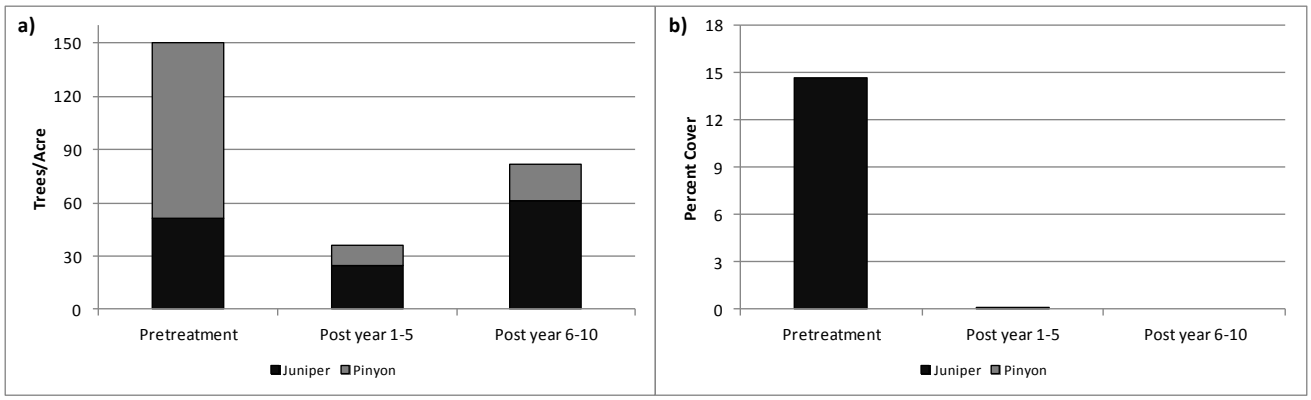


Figure 1.34: Tree summary of the Bullhog treatment studies (n=2) for WMU 13A, La Sal Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

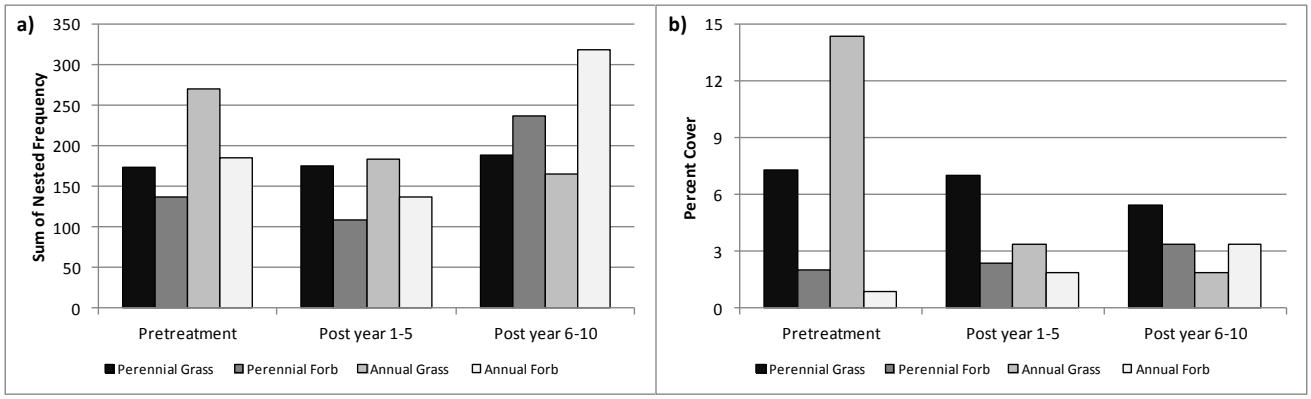


Figure 1.35: Herbaceous functional group summary of the Bullhog treatment studies (n=2) for WMU 13A, La Sal Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

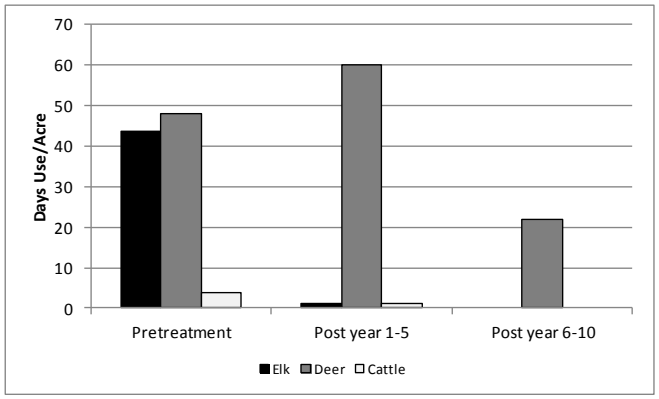


Figure 1.36: Mean pellet transect data for the Bullhog treatment studies (n=2) for WMU 13A, La Sal Mountains.

Lop and Scatter

There is one study [Black Ridge (13A-8)] that was treated with lop and scatter during the report period (Table 1.7). The Black Ridge located just north of the La Sal turn off and east of SR 191. The site is classified as Upland (Wyoming Big Sagebrush) (Table 1.5). Generally, the target of lop and scatter treatments is to reduce pinyon-juniper tree cover in order to restore sagebrush and herbaceous understory.

Shrubs/Trees: In general the only browse species on Black Ridge was Wyoming big sagebrush. Sagebrush cover stayed the same, even after treatment (Figure 1.37a). The density of sagebrush decreased following treatment. However, the demographics of the sagebrush populations have begun to diversify with an increase in young plants and a decrease in decadent ones following treatment (Figure 1.37b).

There was no record of tree cover or density prior to or following treatment and therefore it is not reported here.

Herbaceous Understory: The study site had relatively low herbaceous cover, which was dominated mainly by crested wheatgrass. Perennial grass increased in cover as did annual forbs but annual grasses and perennial forbs remained less than 1% cover following treatment (Figure 1.38).

Occupancy: Pellet group transect data indicates that deer and cattle primarily occupy these study sites, with lower abundance of pellet groups for both deer and cattle following treatments (Figure 1.39).

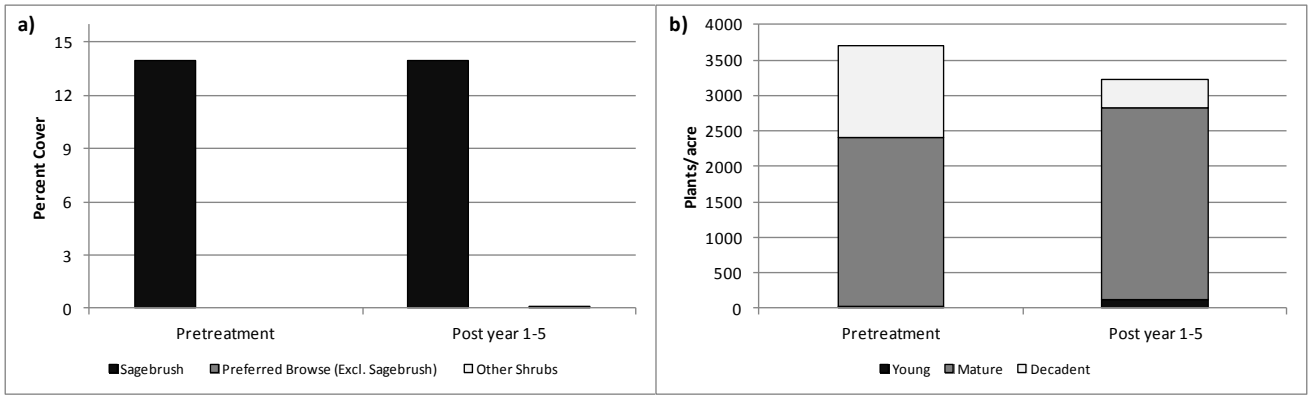


Figure 1.37: Shrub summary of the Lop and Scatter treatment studies (n=1) for WMU 13A, La Sal Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

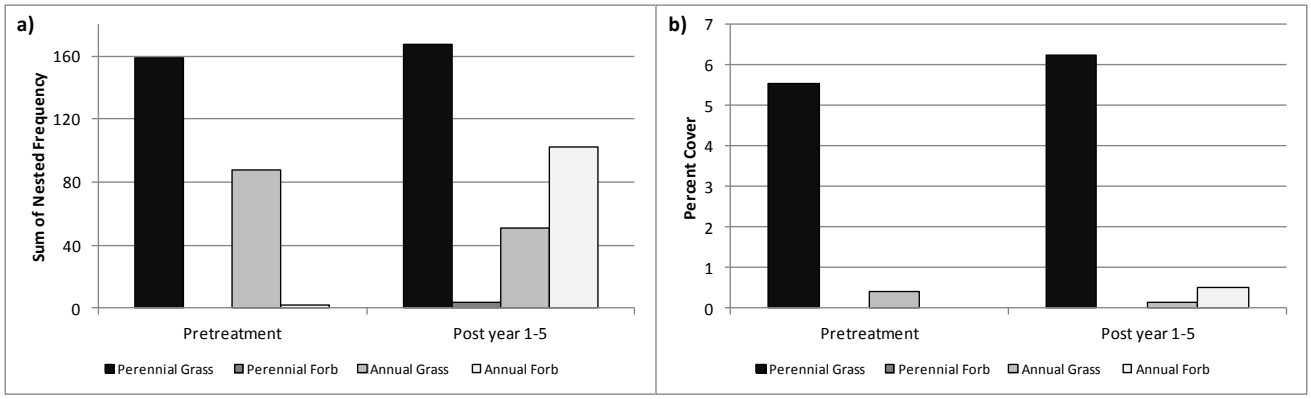


Figure 1.38: Herbaceous functional group summary of the Lop and Scatter treatment studies (n=1) for WMU 13A, La Sal Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

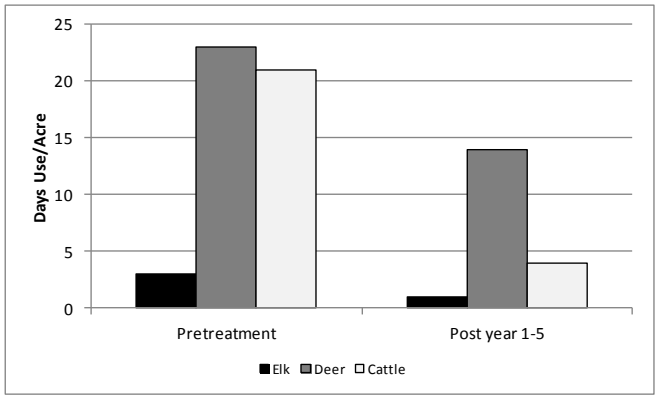


Figure 1.39: Pellet transect data for the Lop and Scatter treatment studies (n=1) for WMU 13A, La Sal Mountains.

Logging

There are four studies [La Sal Aspen Exclosure (13R-5), La Sal Aspen (13R-6), Hop Creek Aspen (13R-8), and Hop Creek Aspen Exclosure (13R-9)] that were logged during the report period (Table 1.7). These sites are located on the east side of the La Sal Mountains. These studies are classified as High Mountain (Aspen) ecological site (Table 1.6). Logging is used to remove the aspen and diversify the stand age.

Shrubs/Trees: The primary browse species on these sites is mountain snowberry. There were no sagebrush and very few preferred browse species on the study sites. Shrub cover decreased following the treatment (Figure 1.40a).

Aspen is the primary tree species on the site and the goal of the treatment is to increase aspen regeneration. Following the treatment aspen density has increased, but that is due in part to the addition of Hop Creek Aspen and Hop Creek Aspen Exclosure for which there was no pretreatment data.

Herbaceous Understory: The herbaceous understory was abundant prior to treatment, especially perennial grasses and forbs, with the most common perennial grass species being Kentucky bluegrass. Annual grasses and forbs were limited on these sites. Although the herbaceous cover decreased following treatment, there was still a relatively robust perennial understory (Figure 1.42).

Occupancy: Pellet group transect data indicates that elk, deer, and cattle occupy this study sites. Prior to the logging elk use was fairly low but increased following the treatment while deer and cattle presence decreased (Figure 1.43).

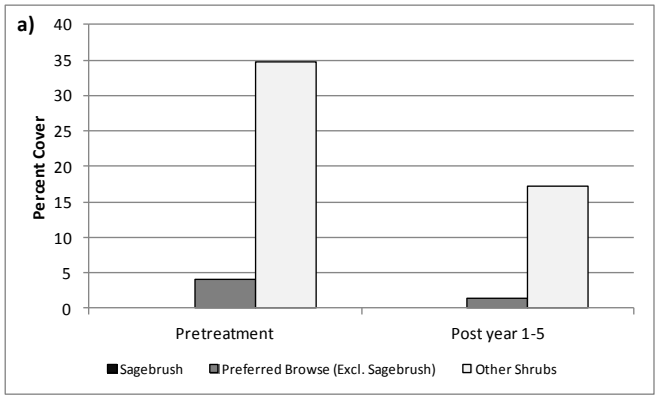


Figure 1.40: Shrub summary of the Logging treatment studies (n=4) for WMU 13A, La Sal Mountains. a) Mean line-intercept cover estimate of shrub groups.

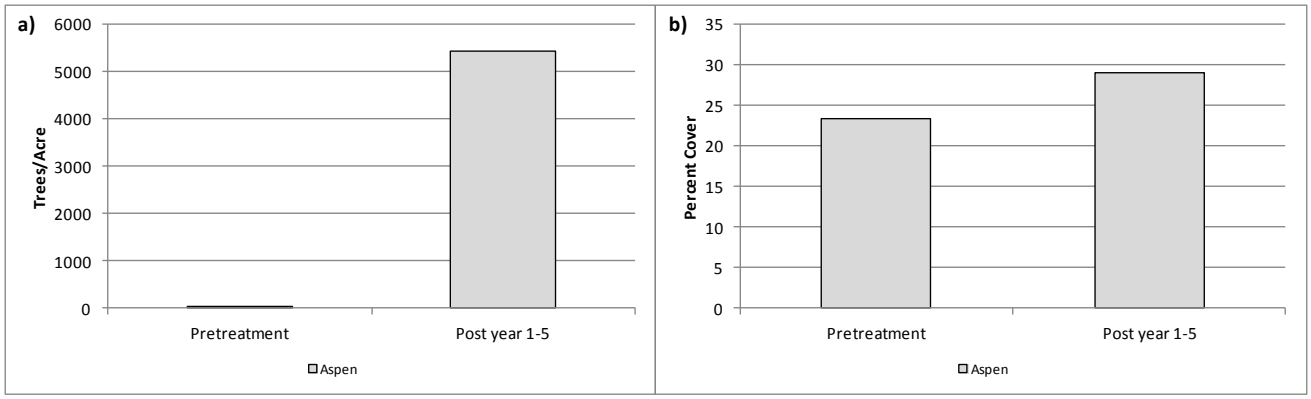


Figure 1.41: Tree summary of the Logging treatment studies (n=4) for WMU 13A, La Sal Mountains. a) Mean point-quarter tree density estimates for quaking aspen (*Populus tremuloides*). b) Mean line-intercept cover estimate for quaking aspen.

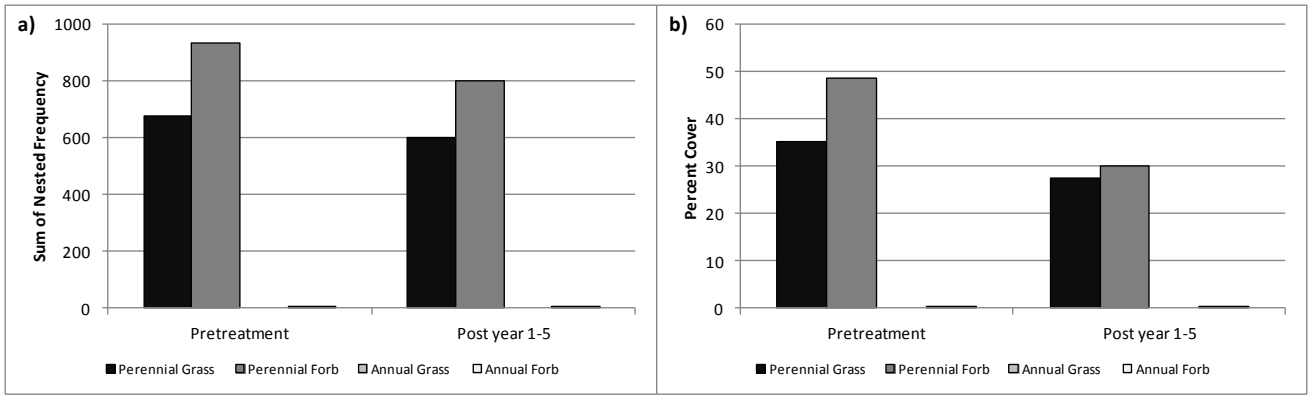


Figure 1.42: Herbaceous functional group summary of the Logging treatment studies (n=4) for WMU 13A, La Sal Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

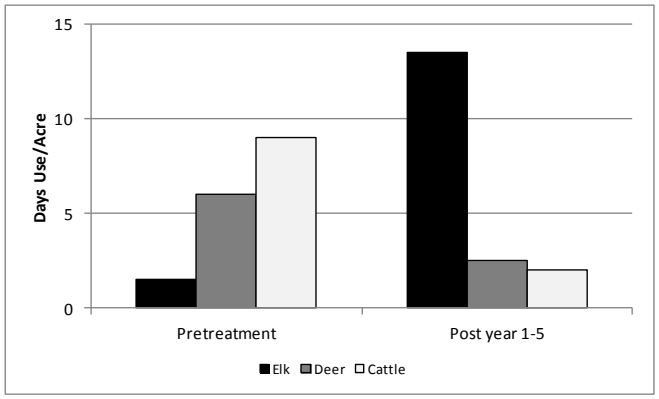
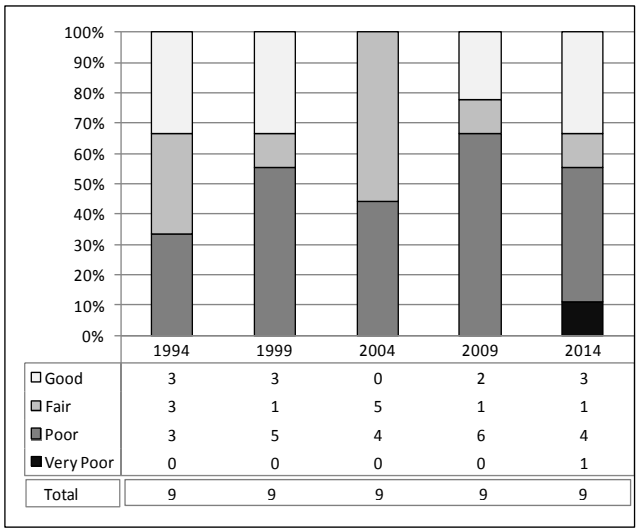


Figure 1.43: Mean pellet transect data for the Logging treatment studies (n=4) for WMU 13A, La Sal Mountains.

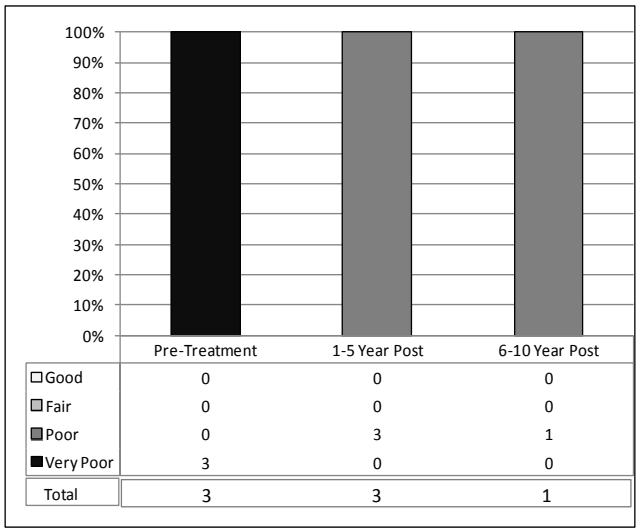
Deer Winter Range Condition Assessment

The condition of deer winter range within the La Sal Mountains management unit has continually changed on the sites sampled since 1994. The undisturbed sites sampled within the unit are considered to be in very poor to good condition as of the 2014 sampling year (Figure 1.44). Amasas Back and Round Mountain remained in poor condition due to the amount of annual grass present, having few perennial forbs, and the lack of diversity within the sagebrush demographics. Two Mile Chaining, Buck Hollow, and Lower Lackey Fan ranged from fair to poor, Slaughter Flat and Below Polar Rim ranged from poor to good, and North Beaver Mesa and Hideout Mesa remained mostly in good condition. The treated study sites have gone from very poor to poor (Figure 1.45). The three treated studies that fall within winter range are Black Ridge, Black Ridge Fuels Reduction, and Pack Creek. They all started out in very poor condition prior to treatment and since treatment have improved to fair condition (Map 1.7 and Table 1.8). It is possible given more time and continual monitoring that these sites will continue to improve.



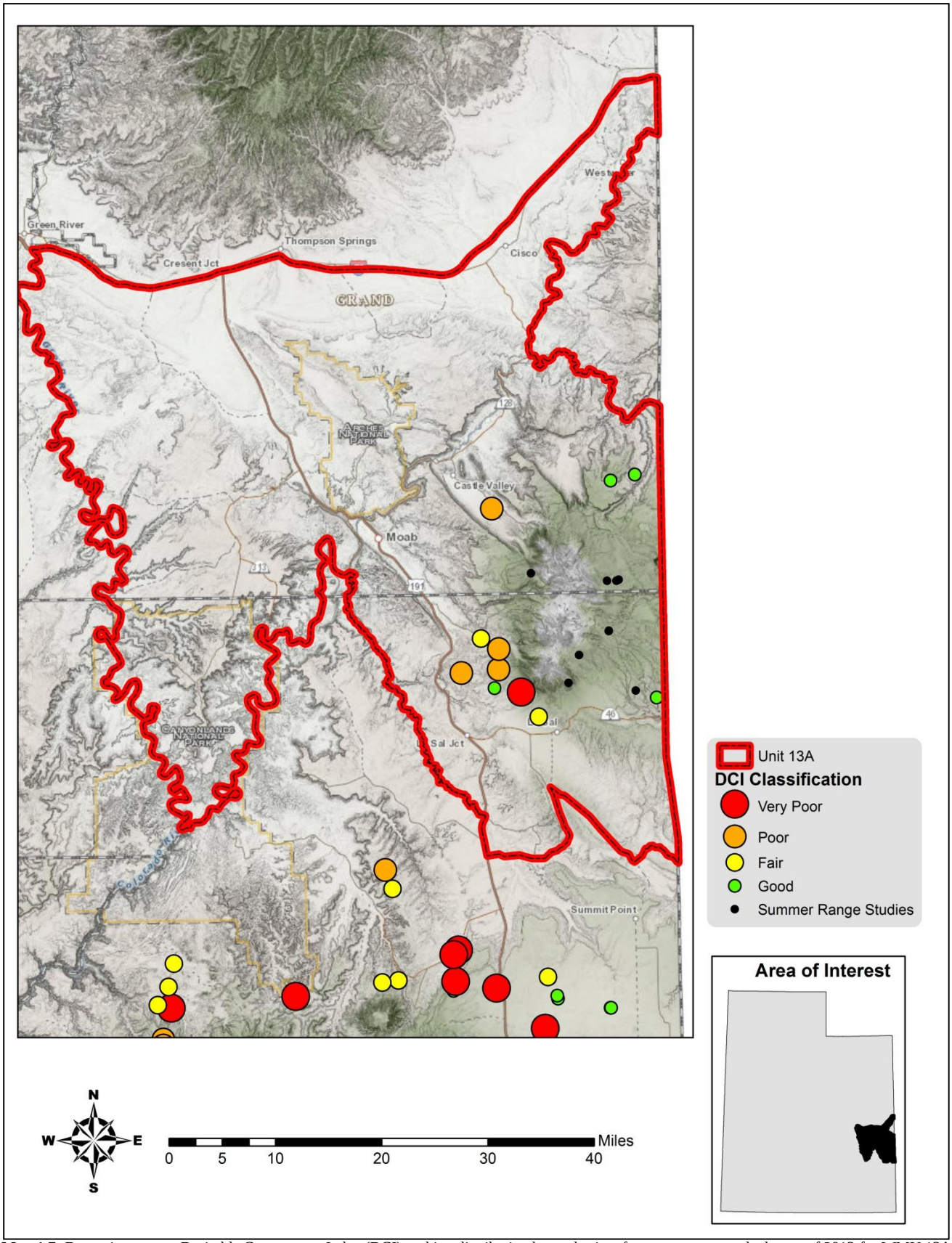
	1994	1999	2004	2009	2014
Good	3	3	0	2	3
Fair	3	1	5	1	1
Poor	3	5	4	6	4
Very Poor	0	0	0	0	1
Total	9	9	9	9	9

Figure 1.44: Deer winter range Desirable Components Index (DCI) summary by year of undisturbed sites for WMU 13A La Sal Mountains.



	Pre-Treatment	1-5 Year Post	6-10 Year Post
Good	0	0	0
Fair	0	0	0
Poor	0	3	1
Very Poor	3	0	0
Total	3	3	1

Figure 1.45: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 13A, La Sal Mountains.



Map 1.7: Deer winter range Desirable Components Index (DCI) ranking distribution by study site of most current sample date as of 2013 for WMU 13A, La Sal Mountains.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
13A-1	Two Mile Chaining	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
13A-3	Buck Hollow	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-4	Slaughter Flat	Annual Grass	Moderate	Increased fire potential.
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-5	Amasas Back	Annual Grass	High	Increased fire potential.
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-6	Bald Mesa	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
13A-7	Round Mountain	Annual Grass	High	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-8	Black Ridge	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
13A-11	North Beaver Mesa	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-12	Below Polar Rim	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-14	Lower Lackey Fan	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-15	Hideout Mesa	Annual Grass	Moderate	Increased fire potential.
		Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13A-16	Beaver Creek	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
13A-17	Bar-A	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
13R-2	Pack Creek	Annual Grass	High	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13R-3	Black Ridge Fuel Reduction	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
13R-5	La Sal Aspen Exclosure	Introduced Perennial Grass	Medium	Reduced diversity of desirable grass and forb species.
13R-6	La Sal Aspen	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
13R-7	Doe Canyon	None Identified		
13R-8	Hop Creek Aspen	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
13R-9	Hop Creek Aspen Exclosure	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.

Table 1.8: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 13A, La Sal Mountains. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

High Mountain (Aspen)

This high mountain ecological site supports an aspen community and is generally considered to be in good condition for deer and elk summer range habitat on the La Sal Mountains management unit. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. While generally in good condition, introduced perennial grasses are present in the herbaceous understory. Although providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that monitoring of this community continue. When 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.

High Mountain (Silver Sagebrush)

This high mountain ecological site supports a silver sagebrush community and is generally considered to be in good condition for deer and elk summer range habitat on the La Sal Mountains management unit. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. While in generally good condition, introduced perennial grasses are present in the herbaceous understory. Although providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

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

High Mountain (Mountain Big Sagebrush)

This high mountain ecological site supports a mountain big sagebrush community and is generally considered to be in good condition for deer and elk summer range habitat on the La Sal Mountains management unit. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. While in generally good condition, introduced perennial grasses are present in the herbaceous component on this study site. Although providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

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

Upland and Mountain (Mountain Big Sagebrush)

The higher elevation upland and mountain ecological sites, which support mountain big sagebrush communities, are generally considered to be in good condition for deer winter range habitat on this unit. These communities support robust shrub populations that provide valuable browse in mild and moderate winters. While in generally good condition, these sites appear to be prone to encroachment from pinyon-juniper trees that can reduce understory shrub and herbaceous health if not addressed. In addition, introduced perennial grasses are often the dominant herbaceous component on these study sites. Although providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence, and abundance of other more desirable native grass and forb species.

It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities. When reseeding is necessary to restore herbaceous species, care should be taken in species selection, and preference should be given to native grass species.

Upland (Wyoming Big Sagebrush)

The mid elevation upland Wyoming big sagebrush communities are generally considered to be in poor to good condition for deer winter range habitat on this unit. These communities support shrub populations that provide valuable browse in moderate to severe winters. These communities have the potential to experience encroachment from pinyon-juniper trees that can reduce understory shrub and herbaceous cover if not addressed. In addition, introduced perennial grasses can dominant the herbaceous understory on these study sites. While providing valuable forage, these grass species can often be aggressive, reducing the prevalence and abundance of native grass and forb species. Annual grasses, primarily cheatgrass, can also be an issue within these communities. Increased amounts of cheatgrass can increase fuel loads thereby increasing the threat of wildfire within these communities.

It is recommended that when necessary, work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should begin in these communities. Care should be taken in selecting treatment methods that will not increase annual grass cover. . Treatments to reduce annual grass may be necessary on some sites. Work to diminish fuel loads and create fire breaks should continue in order to reduce the threat of catastrophic fire.

Upland (Black Sagebrush)

The mid elevation upland black sagebrush community is generally considered to be in poor condition for deer winter range habitat on this unit. These communities support shrub populations that provide valuable browse in moderate to severe winters. However, these communities have the potential to experience encroachment from pinyon-juniper trees that can reduce understory shrub and herbaceous health if not addressed. In addition, introduced perennial grasses can dominant the herbaceous understory on these study sites. While providing valuable forage, these grass species can often be aggressive, reducing the prevalence and abundance of native grass and forb species. Annual grasses, primarily cheatgrass, can also be an issue within these communities. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire within these communities.

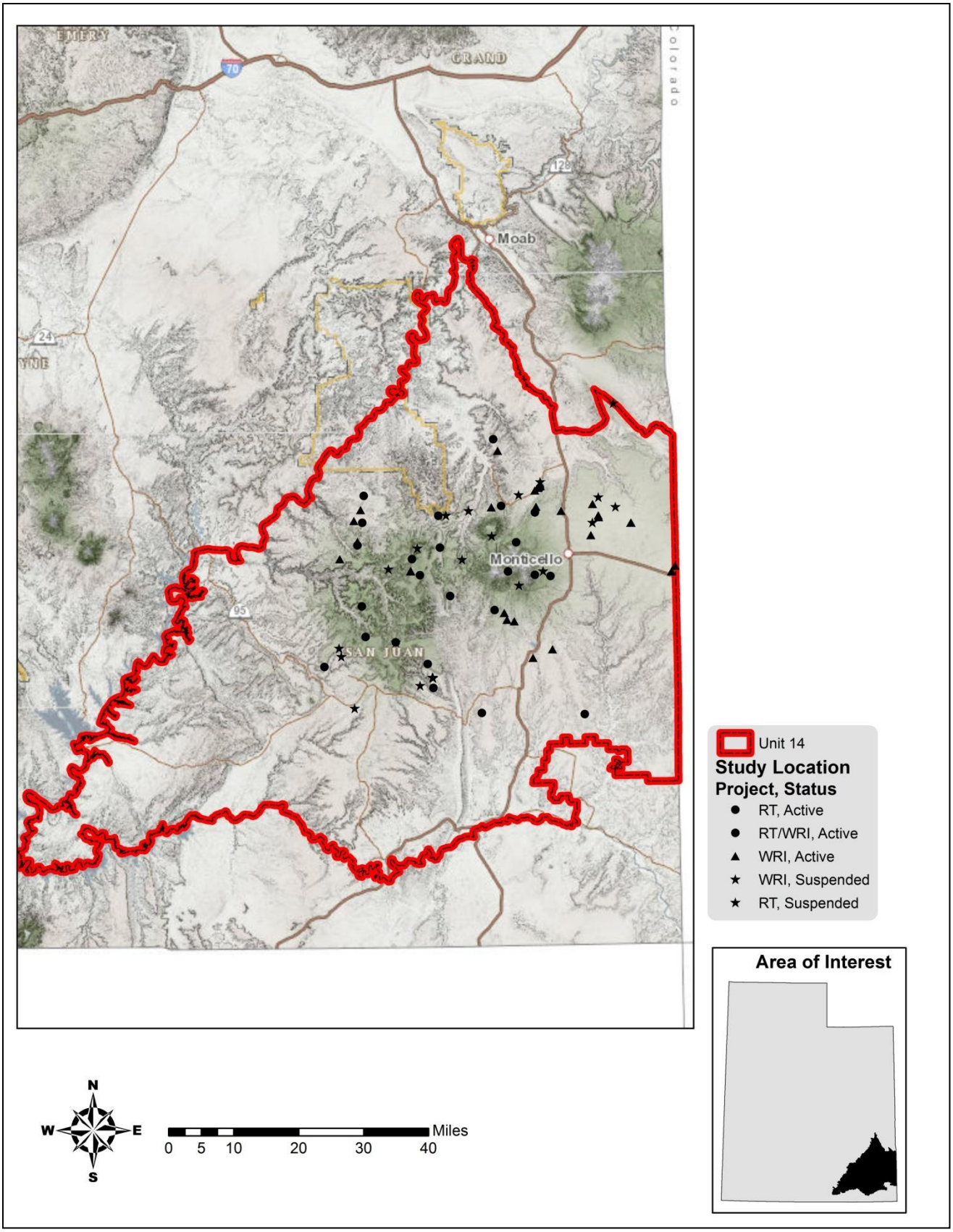
It is recommended that when necessary, work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should begin in these communities. Care should be taken in selecting treatment methods that will not increase annual grass cover. Treatments to reduce annual grass may be necessary on some sites. Work to diminish fuel loads and create fire breaks should continue in order to reduce the threat of catastrophic fire.

Semidesert (Wyoming Big Sagebrush)

The lower elevation semidesert Wyoming big sagebrush community is generally considered to be in poor condition for deer winter range habitat on the unit. This community supports shrub populations that provide valuable browse in moderate to severe winters. These communities are susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. Encroachment from pinyon-juniper trees has not been an issue within this community.

If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites.

2. WILDLIFE MANAGEMENT UNIT 14 - SAN JUAN



WILDLIFE MANAGEMENT UNIT 14 - SAN JUAN

Boundary Description

> **Grand and San Juan Counties** - Boundary begins in Moab at the Junction of the Colorado River and Highway US-191; then south on US-191 to the Big Indian Road; east on this road to the Lisbon Valley Road; east on this road to the Island Mesa Road; east on this road to the Colorado State Line; south on this state line to the Navajo Indian Reservation Boundary; west on this boundary to Lake Powell; north along the east shore of this lake to the Colorado River; north on this river to Moab and beginning point.

Management Unit Description

Geography

Abajo Mountains

The Abajo Mountains subunit (14A) covers a large portion of the eastern side of San Juan County in southeastern Utah. It is a climatically and topographically diverse area. The elevation ranges from 4,500 feet near Bluff to 11,445 feet on Abajo Peak. The Abajo Mountains, found in the west-central part of the unit, contain the unit's summer range. These mountains typically have steep slopes and rugged canyons that have well developed vegetation communities except for the rocky peaks above timberline. The highest meadow slopes have been terraced to slow destructive erosion caused by historic overgrazing. From the base of the mountain, gentle slopes extend out into the flat mesas and rough desert canyon lands that constitute the majority of the unit's land area. Major drainages include Indian Creek and Hatch Wash, which flow north to the Colorado River; and Cottonwood, Johnson, Recapture, Verdure, and Montezuma Creeks, which flow east and south to the San Juan River. Municipalities include Monticello, Blanding, Bluff, and Montezuma Creek.

Elk Ridge

The Elk Ridge subunit (14B) is located in the western half of San Juan County west of the Abajo Mountains. The dominant topographic feature is Elk Ridge, a long, flat, sedimentary plateau. Horse Mountain, found at the north end of Elk Ridge, is the highest point at approximately 9,200 feet elevation. Elk Ridge itself is relatively level and ranges from 8,600 feet at the north end to 8,400 feet at the south end. Surrounding the steep slopes below Elk Ridge are numerous flats, which provide most of the winter range on the unit. These flats are at elevations of 5,000 to 6,000 feet and dissected by numerous deep slickrock canyons, which end at the San Juan and Colorado Rivers at about 4,000 feet elevation. The most prominent drainages are South Cottonwood Wash, Butler Wash, and Comb Wash which drain into the San Juan River; and Beef Basin Wash, Dark Canyon, White Canyon, and North Cottonwood Wash which drain into the Colorado River. Two small communities, Bluff and Mexican Hat, are located along the unit's southern boundary. The unit boundaries encompass Natural Bridges National Monument and part of Canyonlands National Park.

Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 5 inches on the southwest side of the unit to 35 inches on the high elevation peaks of the Abajo Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within the 11-30 inch precipitation zone (Map 2.1) (PRISM Climate Group, Oregon State University).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Southeast division (Division 7). The mean annual PDSI of the Southeast division displayed years of moderate to extreme drought from 1989-1990, 2002-2003,

2009, and 2012. The mean annual PDSI displayed years of moderate to extreme wet years from 1983-1985 and 2005 (Figure 2.1a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1991, 1996, 2002-2004, and 2012-2013; and displayed years of moderate to extreme wet years in 1983-1985, 1993, and 2005. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2009 and 2012; and displayed years of moderate to extreme wet years in 1983-1985, 1997, and 2011 (Figure 2.1b) (Time Series Data, 2015).

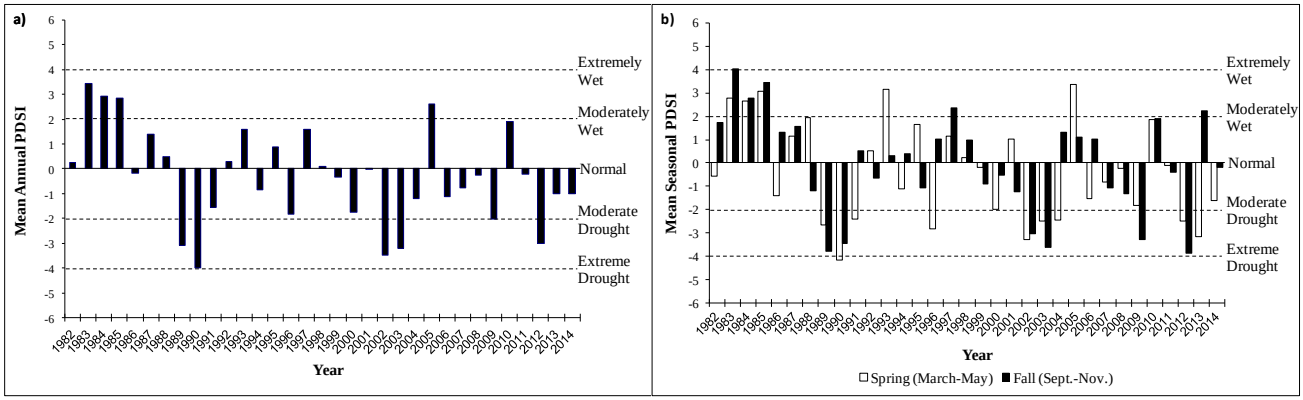
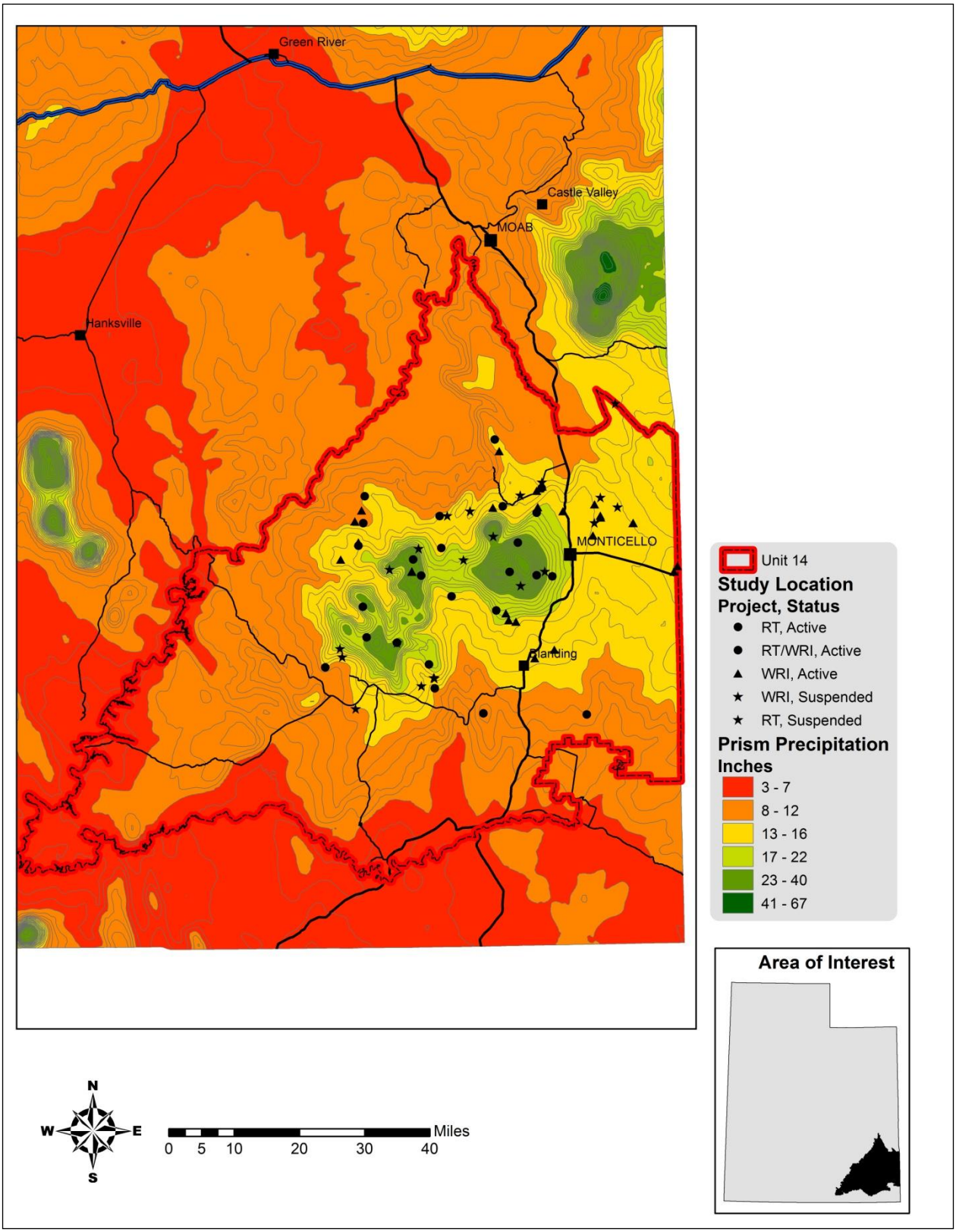


Figure 2.1: The 1982-2014 Palmer Drought Severity Index (PDSI) for the Southeast division (Division 7). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).



Map 2.1: The 1981-2010 PRISM Precipitation Model for WMU 14, San Juan (PRISM Climate Group, Oregon State University).

Big Game Habitat

Management unit 14 encompasses a large area with deer summer and winter range covering over 2 million acres. The U.S. Forest Service (USFS) administrates 76% of the summer range and the BLM 7%. Seventy percent of the winter range is on BLM land with another 15% on private lands (Table 2). Elk summer and winter ranges cover over 800,000 acres. The USFS administers nearly 100% of the summer range. BLM accounts for 51% of the winter range and the USFS 36% (Table 2.3).

Abajo Mountains

The normal deer winter range is found on various mesas at middle elevations. The upper elevation limit of most deer use during normal winters is approximately 7,000 feet. However, during mild winters the range may remain open up to 8,000 feet in elevation. The desert shrub community (semidesert ecological site) is found at low elevations along the northern boundary. Deer use this community only in the most severe winters. The sagebrush-grass and pinyon-juniper communities (upland ecological site) are found side by side on the mesa tops of the normal winter range that are very important to wintering deer. The sagebrush-grass community provides quality forage while pinyon-juniper community provides important thermal cover. The pinyon-juniper-mountain brush community mountain ecological site is the most productive, but is usually excluded from use by deep snow during the more harsh winters.

The summer range is centered on and extends down the peaks of Blue Mountain to about 8,000 feet elevation. Subalpine forest, aspen, and grass-shrub communities (high mountain ecological site) are prevalent at higher elevations. Interspersed oak brush, sagebrush-grass, and forest communities (mountain ecological site) provide the necessary cover and forage requirements for fawning and calving. The lower limit of the summer range on the north and east sides of the mountain are closer to 7,600 feet and are dominated by mixed mountain brush (Guinta & Musclow, 1983). Oak brush is the dominant vegetation type at the lower reaches of the summer range.

Extensive areas of pinyon-juniper were chained and seeded in the 1960's. Although wildlife cover requirements were not considered at the time (chained areas were large and usually square with no regard for cover or edge effect), they still provided many benefits (i.e. forage) to the big game populations.

The key areas for mule deer winter range include Alkali Flat and Harts Draw, which are the most crucial deer wintering areas. Other key areas are Shay Mesa, Indian Creek, from Deerneck Mesa to Step Hill, Cedar Point, Montezuma Canyon, and Recapture Wash.

Elk Ridge

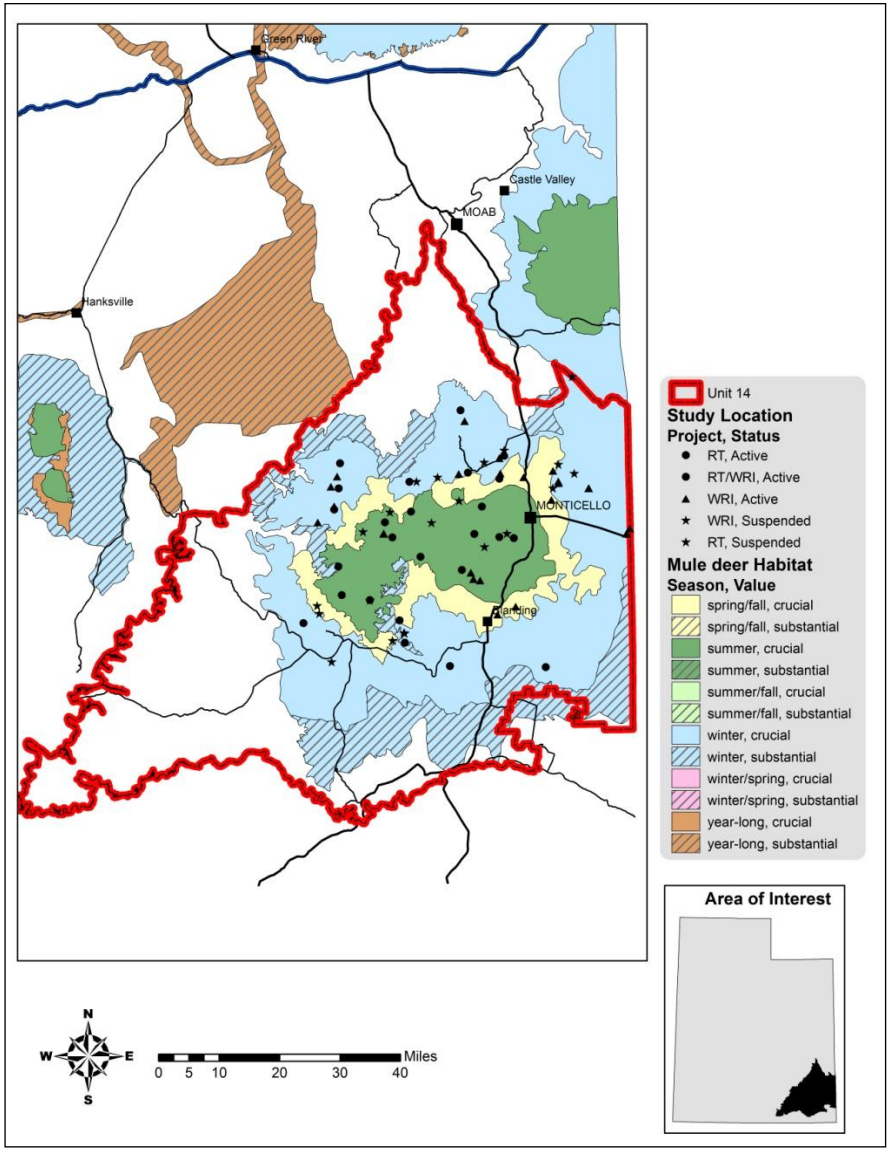
The primary winter range is found between 5,000 to 7,000 feet on the slopes and throughout the large flats surrounding Elk Ridge.

The sagebrush-grass community (upland and semidesert ecological sites), dominated by *Artemisia* shrubs, blue grama and needle-and-thread grass, are found in Beef Basin and on Black Mesa, two important crucial winter ranges. The mountain brush-grass community (mountain ecological site) occupies the upper 1% of the winter range and has the highest rate of production. However, this type is inaccessible during severe winters. The pinyon-juniper community (upland ecological site) is most prominent and occupies the majority of the winter range. This type is relatively unproductive but provides good thermal and escape cover for deer that use the adjacent, more productive types. Pinyon-juniper with mountain brush community (upland and mountain ecological site), like the mountain brush community, is found in the upper elevations of the winter range. It provides quality deer forage in normal winters but can be inaccessible to deer in severe winters. The pinyon-juniper-sagebrush community (upland ecological site) is fairly open and interspersed throughout larger tracts of pinyon-juniper woodland and is important to wintering deer in both normal and severe winters.

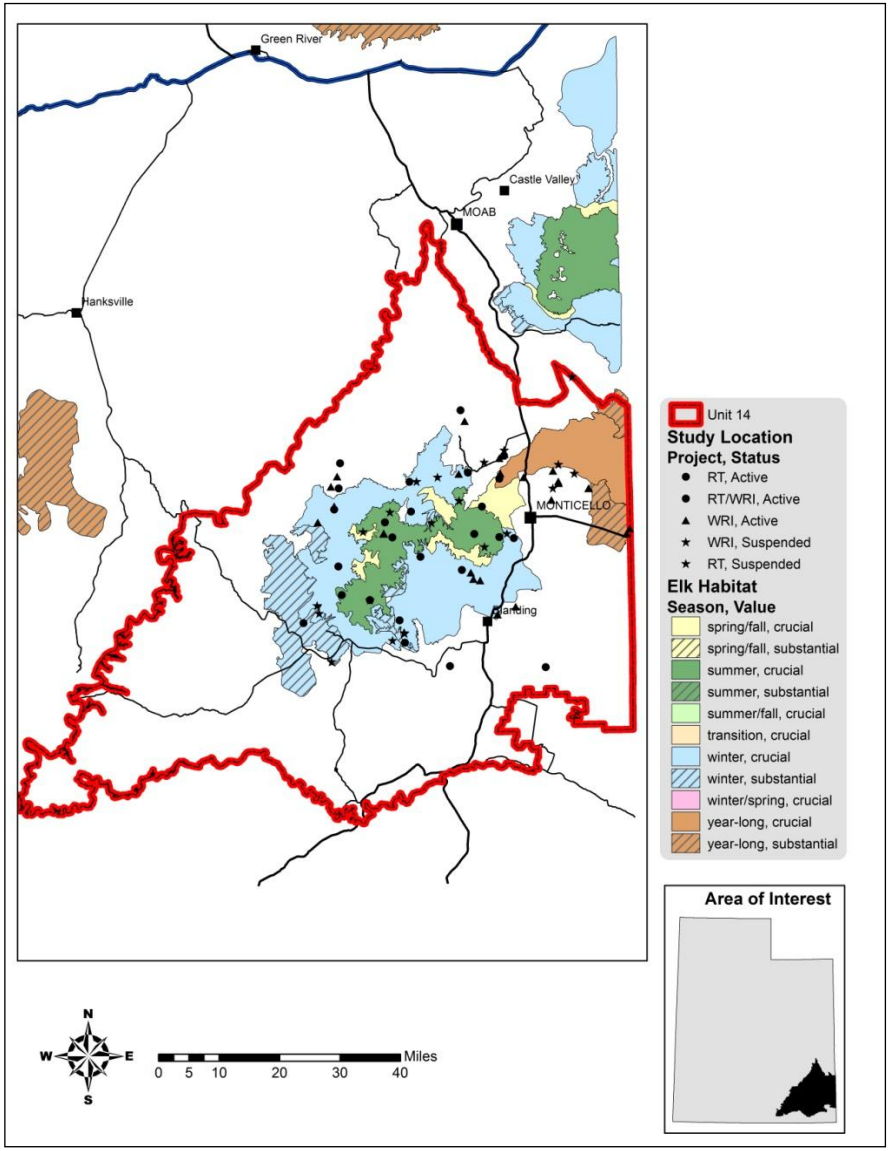
Chaining projects are located throughout the unit, which were done mostly in the 1960's to improve range for livestock, but have benefitted big game. Most of the treated and seeded areas are within pinyon-juniper communities. With trends on most overused sagebrush communities, going down, herbicide and seeding treatments have been done on several areas to open up the sagebrush, and make them more productive and increase their vigor.

The key areas for mule deer winter range include Beef Basin, Salt Creek Mesa, Dark Canyon Plateau, and Black Mesa.

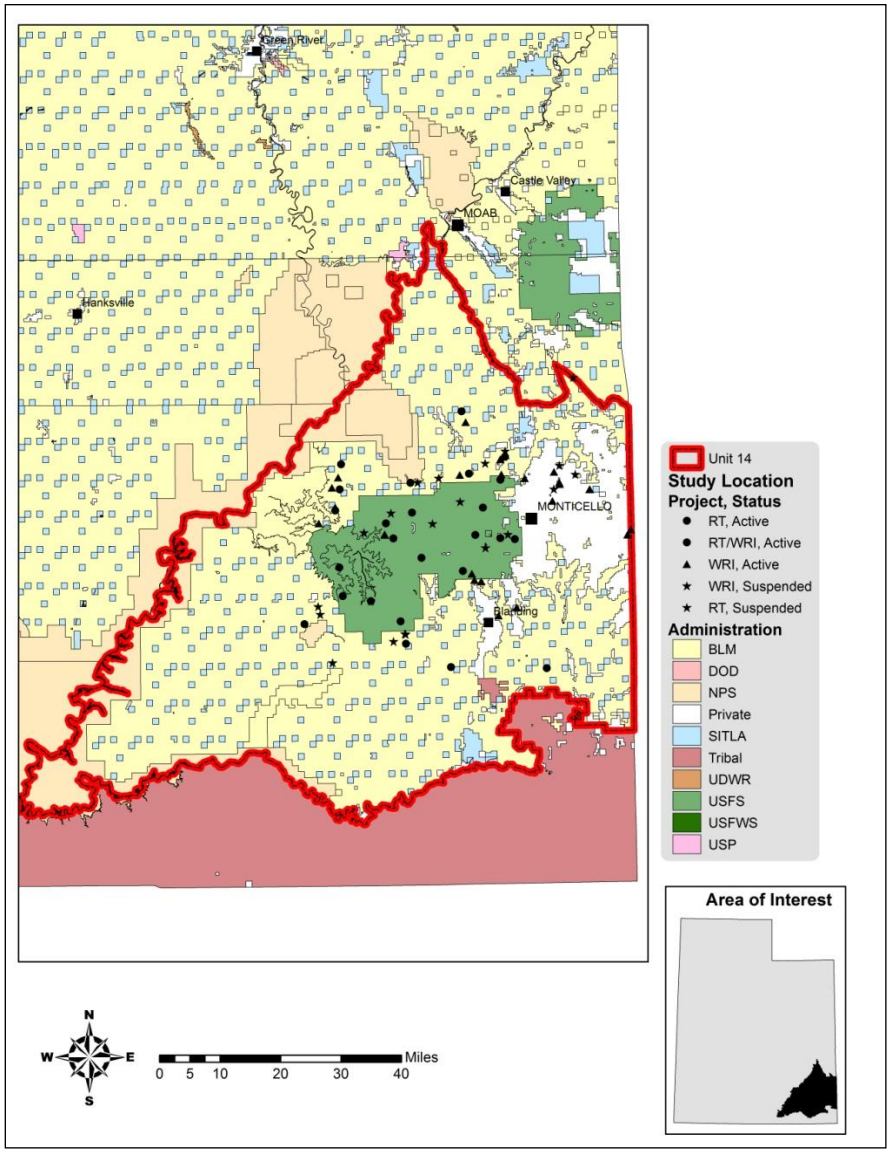
Livestock grazing is the primary land use for the herd unit. Other important land uses are logging, oil and gas exploration, mining, wood cutting, and recreation. Extensive areas of Elk Ridge are covered by ponderosa pine that provides large amounts of quality saw timber. Most of the area has been logged once and selective cuts are scheduled for the future. Oil and gas exploration has increased in recent years while mining operations are suspended due to low uranium prices. Activities associated with these land uses need to be closely monitored and steps taken to minimize and mitigate negative impacts on the water quality and on the range and associated wildlife populations.



Map 2.2: Estimated mule deer habitat by season and value for WMU 14, San Juan.



Map 2.3: Estimated elk habitat by season and value for WMU 14, San Juan.



Map 2.4: Land ownership for WMU 14, San Juan.

	Year Long Range		Summer Range		Winter Range		Spring/Fall Range	
	Area (acres)	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*
Mule Deer	29	<1%	337,423	17%	1,408,154	70%	263,030	13%
Elk	153,629	18%	129,104	15%	495,457	59%	56,171	7%

Table 2.1: Estimated mule deer and elk habitat acreage by season for WMU 14, San Juan.

	Year Long Range		Summer Range		Winter Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	0	0%	24,204	7%	979,536	70%	101,611	39%
DOE	0	0%	42	<1%	0	0%	0	0%
NPS	0	0%	0	0%	65,995	5%	65	<1%
Private	0	0%	54,147	16%	209,126	15%	74,279	28%
SITLA	0	0%	2,318	1%	112,528	8%	11,883	5%
Tribal	0	0%	0	0%	7,976	1%	0	0%
UDOT	0	0%	1	<1%	44	<1%	0	0%
USFS	0	0%	256,712	76%	33,908	2%	75,165	29%
USP	28	100%	0	0%	40	<1%	27	<1%
Total	**28**	**100%**	**337,423**	**100%**	**1,408,154**	**100%**	**263,030**	**100%**

Table 2.2: Estimated mule deer habitat acreage by season and ownership for WMU 14, San Juan.

	Year Long Range		Summer Range		Winter Range		Spring/Fall Range	
Ownership	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	46,750	30%	63	<1%	254,076	51%	4,545	8%
NPS	0	0%	0	0%	10,539	2%	0	0%
Private	96,670	63%	452	<1%	29,034	6%	6,036	11%
SITLA	7,385	5%	5	0%	25,609	5%	543	1%
UDOT	0	0%	0	0%	1	<1%	0	0%
USFS	2,824	2%	128,584	99%	176,199	36%	45,047	80%
Total	**153,629**	**100%**	**129,104**	**100%**	**495,457**	**100%**	**56,171**	**100%**

Table 2.3: Estimated elk habitat acreage by season and ownership for WMU 14, San Juan.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Shrubland	Arctostaphylos patula Shrubland Alliance	812	0.03%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	647	0.02%	
	Coleogyne ramosissima Shrubland Alliance	828,223	25.67%	
	Colorado Plateau Blackbrush-Mormon-tea Shrubland	9,221	0.29%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	3,919	0.12%	
	Grayia spinosa Shrubland Alliance	0	0.00%	
	Great Basin Semi-Desert Chaparral	14,180	0.44%	
	Inter-Mountain Basins Big Sagebrush Shrubland	303,473	9.41%	
	Inter-Mountain Basins Big Sagebrush Steppe	196	0.01%	
	Inter-Mountain Basins Greasewood Flat	15,603	0.48%	
	Inter-Mountain Basins Mat Saltbush Shrubland	7,508	0.23%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	63,616	1.97%	
	Inter-Mountain Basins Montane Sagebrush Steppe	298	0.01%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	1,341	0.04%	
	Mogollon Chaparral	629	0.02%	
	Quercus gambelii Shrubland Alliance	34,247	1.06%	
	Quercus turbinella Shrubland Alliance	108	0.00%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	209	0.01%	
	Rocky Mountain Lower Montane-Foothill Shrubland	1,639	0.05%	
	Southern Colorado Plateau Sand Shrubland	66,127	2.05%	41.90%
Conifer	Abies concolor Forest Alliance	1	0.00%	
	Colorado Plateau Pinyon-Juniper Woodland	924,475	28.65%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	1,786	0.06%	
	Inter-Mountain Basins Juniper Savanna	471	0.01%	
	Rocky Mountain Lodgepole Pine Forest	1	0.00%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	4,133	0.13%	
	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	1,908	0.06%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	18,874	0.59%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	955	0.03%	
	Southern Rocky Mountain Pinyon-Juniper Woodland	1	0.00%	
	Southern Rocky Mountain Ponderosa Pine Savanna	174	0.01%	
	Southern Rocky Mountain Ponderosa Pine Woodland	49,056	1.52%	
Conifer-Hardwood	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	11,833	0.37%	
Hardwood	Rocky Mountain Aspen Forest and Woodland	22,606	0.70%	32.12%
Grassland	Apacherian-Chihuahuan Semi-Desert Grassland	349	0.01%	
	Inter-Mountain Basins Semi-Desert Grassland	30,399	0.94%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	160	0.00%	
	Southern Rocky Mountain Montane-Subalpine Grassland	1,519	0.05%	1.01%
Other	Open Water	5,943	0.18%	
	Quarries-Strip Mines-Gravel Pits	813	0.03%	
	Riparian	60,916	1.89%	
	Sparsely Vegetated	140,105	4.34%	
	Developed	51,235	1.58%	
	Developed-Roads	14,857	0.46%	
	Exotic Herbaceous	26,032	0.81%	
	Exotic Tree-Shrub	29,644	0.92%	
	Agricultural	112,696	3.49%	
	Barren	363,449	11.26%	24.97%
Total		3,226,386		

Table 2.4: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) of deer winter range for WMU 14, San Juan.

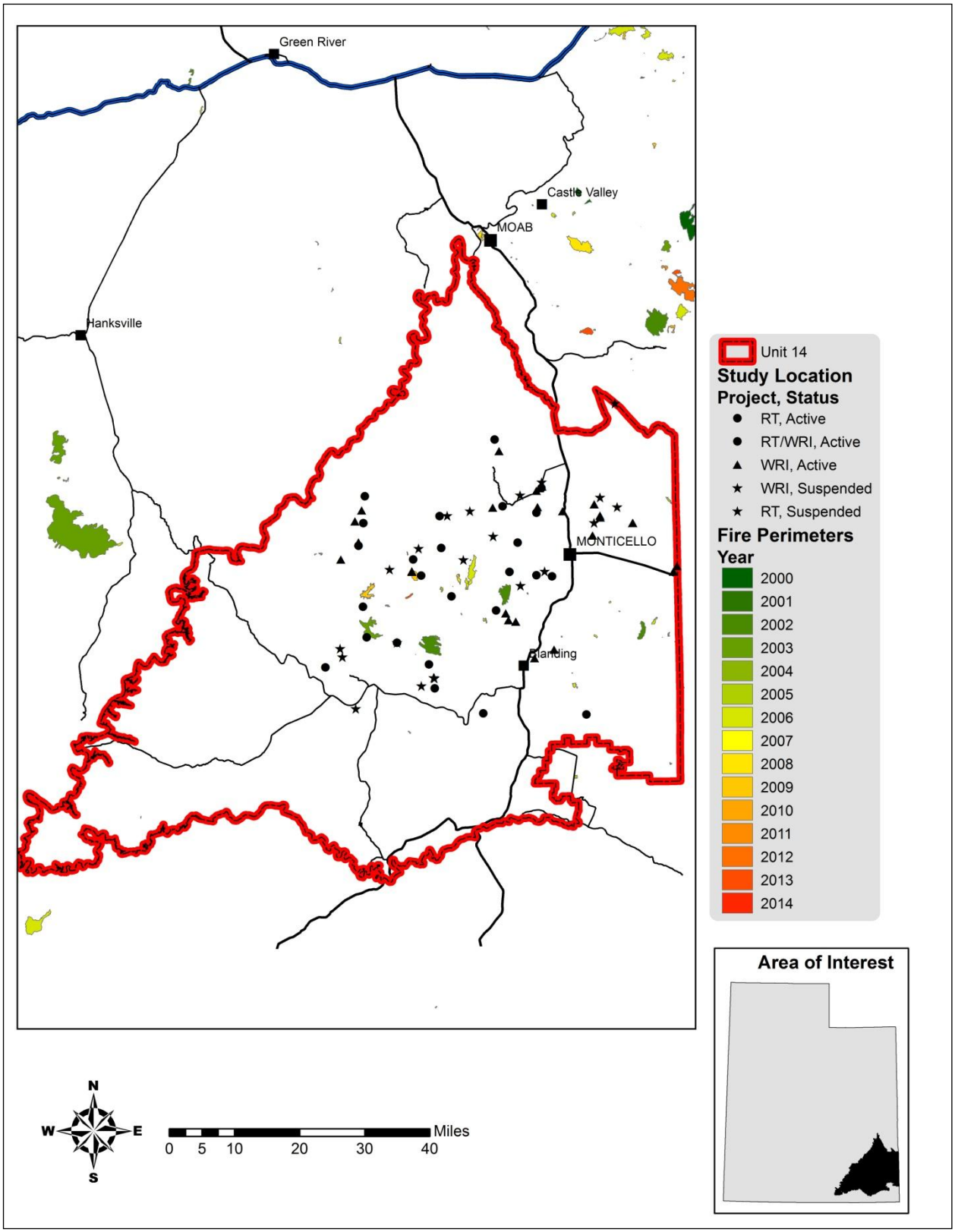
Limiting Factors to Big Game Habitat

Livestock grazing is the primary land use for the herd unit. Other important land uses are logging, oil and gas exploration, hunting, farming, timber, mining, wood cutting, and recreation. Extensive areas of Elk Ridge are covered by ponderosa pine that provides large amounts of quality saw timber. Most of the Elk Ridge area has been logged once and selective cuts are scheduled for the future. Oil and gas exploration has increased in recent years while mining operations are suspended due to low uranium prices. There has been recent development and increased activity on the crucially important Harts Point winter range. Activities associated with these land uses need to be closely monitored and steps taken to minimize and mitigate negative impacts on the water quality and on the range and associated wildlife populations.

Extended drought poses a substantial threat to important sagebrush rangelands. Large drought related die-offs of sagebrush in Ruin Park, Harts Draw, Alkali Point, and other key areas have reduced the quality of mule deer winter range. Future droughts could contribute to continued decreases of sagebrush inhibiting recovery.

On many of the range trend sites occurring in the upland and semidesert ecological sites had moderate to high cover of cheatgrass in the late 1990's and early 2000's, but cheatgrass has since decreased in abundance. Moderate to high abundance of cheatgrass may limit effective recruitment of desirable species and increase fire frequency.

Encroachment by pinyon-juniper woodland communities also poses a substantial threat to important sagebrush rangelands. Pinyon-juniper woodlands constitute 28% of the land area in this unit (Table 2.4). Encroachment of these woodlands into sagebrush communities has been shown to decrease browse and herbaceous cover, decreasing available forage for wildlife (Miller, Svejcar, & Rose, 2000).

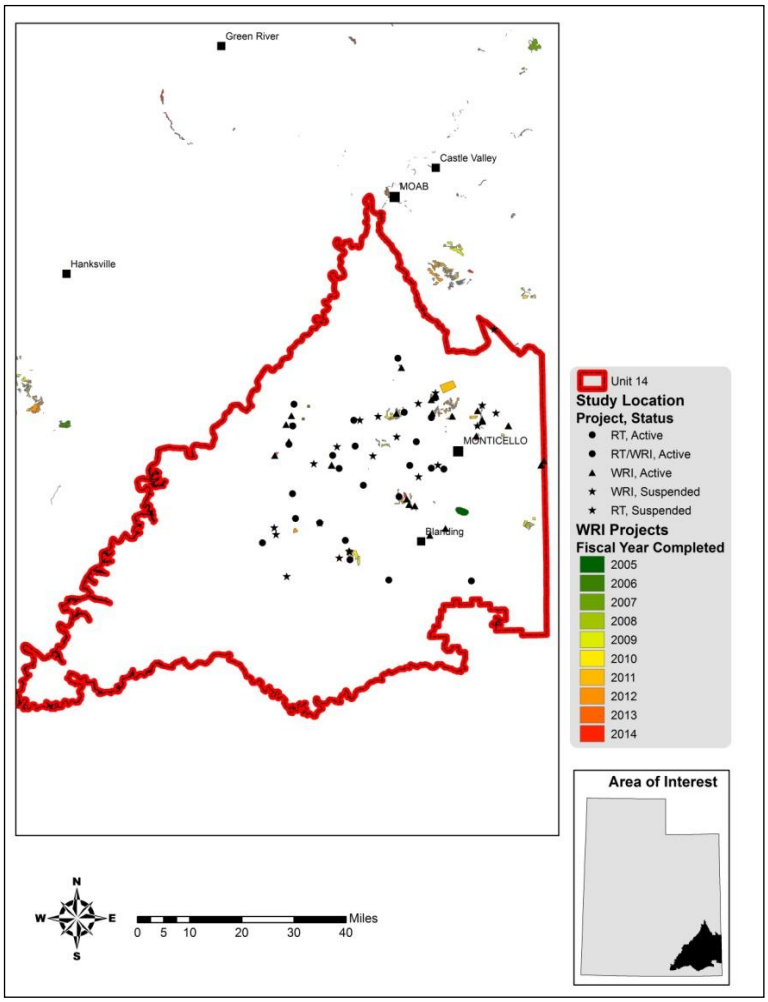


Map 2.5: Land coverage of fires by year from 2001-2014 for WMU 14, San Juan.

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 16,721 acres of land have been treated within the San Juan unit since the WRI was implemented in 2004. As seen on the map, treatments occasionally overlap one another bringing the total treatment acres to 17,502 acres for this unit (Table 2.5). Other treatments have occurred outside of the WRI through independent agencies and landowners, but WRI projects comprise the majority of work done on deer winter range throughout the State of Utah.

Treatments to reduce pinyon-juniper woodlands such as bullhog and vegetation removal/hand crew are common management practices on this unit. Other common management treatments are those to rejuvenate sagebrush stands such as herbicide, planting/transplanting and harrow. In addition, many of these treatments have been seeded to increase more desirable plant species (Table 2.5).



Map 2.6: WRI treatments by fiscal year completed for WMU 14, San Juan.

Treatment Action	Acres
Bullhog	2,848
Harrow	239
Herbicide Application	146
Planting/transplanting	55
Prescribed fire	744
Research	31
Seeding (primary)	11,182
Seeding (secondary/shrub)	56
Vegetation removal / hand crew	1,872
Other	374
***Total Land Area Treated**	**16,721**
Total Treatment Acres	**17,502**

Table 2.5: WRI treatment action size (acres) for WMU 14, San Juan.
*Does not include overlapping treatments.

Range Trend Studies

Range Trend studies have been sampled within WMU 14 on a regular basis since 1986, with studies being added or suspended as was deemed necessary (Table 2.6). Due to changes in sampling methodologies, only data sampled following the 1992 sample year are included in this summary. Monitoring studies of WRI projects have been sampled since 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 2.7).

Range Trend studies that have not had recent disturbance or treatments are summarized in this report by ecological site or potential. Range Trend and WRI studies that have a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
14-1	Alkali Point	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Loam (Wyoming Big Sagebrush)
14-2	Brushy Basin	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Bonneville Big Sagebrush)
14-3	Gold Queen Basin	RT	Suspended	‘86, ‘94, ‘99, ‘04	Not Verified
14-4	Camp Jackson Reservoir	RT	Suspended	‘86, ‘94, ‘99	Not Verified
14-5	Jackson Ridge	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	High Mountain Stony Loam (Aspen)
14-6	Harts Draw Reservoir	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Oak)
14-7	Shay Mountain	RT	Suspended	‘86, ‘94	Not Verified
14-8	Peters Point	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
14-9	Harts Draw	RT/WRI	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Sandy Loam (Wyoming Big Sagebrush)
14-10	Harts Point	RT	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
14-11	Shay Mesa	RT/WRI	Active	‘86, ‘94, ‘99, ‘04, ‘09, ‘11, ‘14	Upland Sand (Mountain Big Sagebrush)
14-12	Shingle Mill	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	High Mountain Loam (Browse)
14-13	Black Mesa	RT	Active	‘81, ‘86, ‘92, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Sandy Loam (Wyoming Big Sagebrush)
14-14	Texas Flat	RT	Suspended	‘81, ‘86, ‘92, ‘94, ‘99, ‘04, ‘09	Not Verified
14-15	Harmony Flat	RT	Suspended	‘86, ‘92, ‘99, ‘04	Not Verified
14-16	Lower Lost Park	RT	Suspended	‘86, ‘92, ‘99, ‘04, ‘09	Not Verified
14-17	Deer Flat	RT	Suspended	‘86, ‘92, ‘99	Not Verified
14-18	Kigalia Point	RT	Suspended	‘86, ‘92, ‘99, ‘04	Not Verified
14-19	Woodenshoe	RT	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘14	Mountain Gravelly Loam (Ponderosa Pine)
14-20	Gooseberry	RT	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘14	High Mountain Loam (Aspen)
14-21	North Long Point	RT	Suspended	‘86, ‘92, ‘99	Not Verified
14-22	Wild Cow Point	RT	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
14-23	South Plain	RT/WRI	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘12, ‘14	Upland Sand (Mountain Big Sagebrush)
14-24	Ruin Park	RT	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘14	Semidesert Sandy Loam (Wyoming Big Sagebrush)
14-25	Davis Pocket	RT	Suspended	‘86, ‘92	Not Verified
14-26	The Wilderness	RT	Suspended	‘86, ‘92, ‘99	Not Verified
14-27	Mormon Pasture Point	RT	Active	‘86, ‘92, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Oak)
14-28	North Cottonwood	RT	Suspended	‘86, ‘99	Not Verified
14-29	Salt Creek Mesa	RT	Active	‘92, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush)
14-30	Milk Ranch Point	RT	Active	‘92, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
14-31	Chippean Ridge	RT	Active	‘92, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
13-32	Lower Deer Flat	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush)
14-34	Big Flat	RT	Active	‘04, ‘09 ‘14	Mountain Loam (Mountain Big Sagebrush)
14-35	Dickson Gulch	RT	Active	‘09, ‘14	High Mountain Loam (Aspen)
14-36	Dry Mesa	RT	Active	‘09, ‘14	Upland Loam (Mountain Big Sagebrush)
14-37	Kigalia Point II	RT	Active	‘09, ‘14	Mountain Loam (Ponderosa Pine)
14-38	Arch Canyon	RT	Active	‘14	Upland Loam (Big Sagebrush)
14R-1	Cathedral Butte	RT	Suspended	‘01, ‘04	Not Verified
14R-2	Jerry Hines CRP	RT	Suspended	‘01	Not Verified
14R-3	Little Baullies 1	RT	Suspended	‘98	Not Verified
14R-4	Little Baullies 2	RT	Suspended	‘98	Not Verified
14R-5	Turner Water Canyon (Hart Draw)	WRI	Suspended	‘04	Not Verified
14R-6	Dugout (Hart Draw)	WRI	Active	‘04, ‘08, ‘13	Semidesert Sandy Loam (Wyoming Big Sagebrush)
14R-7	Adams CE Harrow	WRI	Active	‘04, ‘07, ‘12	Not Verified
14R-8	Adams CE Control	WRI	Active	‘04, ‘07, ‘12	Not Verified
14R-9	Hart Draw Flat 1	WRI	Active	‘05, ‘08, ‘13	Upland Loam (Basin Big Sagebrush)
14R-10	Hart Draw Flat 2	WRI	Active	’05, ‘08, ‘13	Upland Loam (Basin Big Sagebrush)
14R-11	Harts Windmill	WRI	Active	‘05, ‘08, ‘13	Upland Loam (Basin Big Sagebrush)

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
14R-12	Bell Draw Drill	WRI	Suspended	‘06	Not Verified
14R-13	Bell Draw Dixie	WRI	Active	‘06, ‘09, ‘10	Not Verified
14R-14	Sitla Dixie	WRI	Active	‘06, ‘09, ‘10	Not Verified
14R-15	Sitla Dixie 2	WRI	Active	‘06, ‘12	Not Verified
14R-16	Harvey John Mesa	WRI	Active	‘06, ‘10, ‘14	Upland Sand (Mountain Big Sagebrush)
14R-17	Stateline South	WRI	Active	‘06, ‘12	Not Verified
14R-18	Stateline North	WRI	Active	‘06, ‘09, ‘13	Semidesert Sandy Loam (Wyoming Big Sagebrush)
14R-19	Peter's Canyon	WRI	Active	‘07, ‘10, ‘14	Upland Loam (Mountain Big Sagebrush)
14R-20	Johnson Creek	WRI	Active	‘07, ‘10, ‘14	Upland Loam (Mountain Big Sagebrush)
14R-21	Shay Mesa Bullhog	WRI	Active	‘08, ‘11, ‘14	Upland Loam (Mountain Big Sagebrush)
14R-22	Harts Draw Reference	WRI	Suspended	‘09	Not Verified
14R-23	Gunnison Sage Grouse Reference	WRI	Suspended	‘09	Not Verified
14R-24	Lisbon Valley GIP	WRI	Suspended	‘08	Not Verified
14R-25	Peters Point BLM	WRI	Active	‘11, ‘14	Upland Clay Loam (Pinyon-Utah Juniper)
14R-27	Seep Creek	WRI	Active	‘12	Not Verified
14R-28	Johnson Creek 2	WRI	Active	‘12	Not Verified
14R-29	South Plain 2	WRI	Active	‘12	Not Verified
14R-30	North Plain	WRI	Active	‘12	Not Verified
14R-31	Dark Canyon	WRI	Active	‘12	Not Verified
14R-33	Sego Spring 1	WRI	Active	‘14	High Mountain Loam (Aspen)
14R-34	Sego Spring 2	WRI	Active	‘14	High Mountain Loam (Aspen)
14R-35	Blanding East	WRI	Active	‘14	Upland Loam (Pinyon-Utah Juniper)
14R-36	Mustang Mesa	WRI	Active	‘14	Upland Shallow Loam (Pinyon-Utah Juniper)
14R-37	Lower Wild Cow Point	WRI	Active	‘14	Upland Loam (Mountain Big Sagebrush)

Table 2.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 14, San Juan.

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
14-2	Brushy Basin	Chain Unknown		1971	1,400	
		Seed Unknown		1971	1,400	
		Bullhog	Brushy Basin Habitat Improvement Project Phase II	2013-2014	573	2275
14-6	Harts Draw Reservoir	Seed Unknown		Historic		
14-8	Peters Point	Chain Unknown		1962		
		Seed Unknown		1962		
14-9	Harts Draw	1-Aerator/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14-11	Shay Mesa	Chain Unknown		mid-1960's		
		Seed Unknown		mid-1960's		
		Bullhog	Shay Mesa Phase II	May-June 2009	545	1091
14-14	Texas Flat	Railed		1955		
		Rangeland Drill		1955		
		Herbicide		Oct. 1986		
14-16	Lower Lost Park	Chain Unknown		1969		
		Seed Unknown		1969		
		Herbicide		Oct. 1986		
14-19	Woodenshoe	Wildfire	Woodenshoe	2003	2,710	
14-20	Gooseberry	Logging: Selective		1963		
		Logging: Selective		1998-1999		
14-22	Wild Cow Point	Chain Unknown		Early 1960's		
		Seed Unknown		Early 1960's		
14-23	South Plain	Rangeland Drill	Beef Basin Sagebrush Restoration (Phase 1)	Fall 2014	875	2939
		Aerial After	Beef Basin Sagebrush Restoration (Phase 1)	Fall 2014	875	2939
		Herbicide	Beef Basin Sagebrush Restoration (Phase 1)	Fall 2014	1,371	2939
		Sagebrush Seedlings Transplant	Beef Basin Sagebrush Restoration (Phase 1)	Spring 2014		2939
14-27	Mormon Pasture Point	Chain Unknown		Early 1970's	900	
		Seed Unknown		Early 1970's	900	
		Herbicide		1985	200	
14-29	Salt Creek Mesa	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Prescribed Fire	Salt Creek	2002	130	
14-30	Milk Ranch Point	Plow		1953		
		Seed Unknown		1953		
14-32	Lower Deer Flat	Chain Unknown		Historic		
		Seed Unknown		Historic		
14-36	Dry Mesa	Chain Unknown		Historic		
		Seed Unknown		Historic		
14-37	Kilgalia Point II	Logging: Selective		1960's		
		Prescribed Fire		1998		
		Seed Unknown		Historic		
14-38	Arch Canyon	Chain Unknown		Historic		
		Seed Unknown		Historic		
14R-5	Turner Water Canyon (Hart Draw)	1-Aerator/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14R-6	Dugout (Hart Draw)	Aerator (Single Drum)/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14R-7	Adams CE Harrow	2-way Dixie Harrow		Fall 2001	320	PDB
14R-9	Hart Draw Flat 1	Aerator (Single Drum)/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14R-10	Hart Draw Flat 2	Aerator (Single Drum)/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14R-11	Harts Windmill	Aerator (Single Drum)/Seed	Hart Draw Sagebrush Restoration (year 1)	Dec. 2005	629	246
14R-12	Bell Draw Drill	Disc	Bell Draw	Fall 2006	219	295
		Rangeland Drill	Bell Draw	Fall 2006	219	295
14R-13	Bell Draw Dixie	1-way Dixie Harrow	Bell Draw	Fall 2006	102	295
		Broadcast Before	Bell Draw	Fall 2006	102	295
14R-14	SITLA Dixie	1-way Dixie Harrow	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	275	334
		Broadcast Before	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	275	334
14R-15	SITLA Dixie 2	1-way Dixie Harrow	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	275	334

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
		Broadcast Before	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	275	334
14R-16	Harvey John Mesa	1-way Dixie Harrow	Harvey John Kratcher Mesa	Fall 2006	270	526
		Broadcast Before	Harvey John Kratcher Mesa	Fall 2006	270	526
14R-17	State Line South	1-way Dixie Harrow	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	240	334
14R-18	Stateline North	1-way Dixie Harrow	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	240	334
		Seed Unknown	Gunnison Sage-grouse Sagebrush Treatments phase 1	Fall 2006	150	334
14R-19	Peter's Canyon	Bullhog	Peter's Canyon	Dec. 2006	170	906
		Prescribed Fire	Peter's Canyon	Oct. 2007	170	906
		Broadcast/Harrow	Peter's Canyon	Dec. 2007	170	906
14R-20	Johnson Creek	Lop and Scatter	Johnson Creek	Fall 2007	300	905
		Broadcast/Harrow	Johnson Creek	Fall 2007	300	905
14R-21	Shay Mesa Bullhog	Chain Unknown		1959		
		Seed Unknown		1959		
		Bullhog	Shay Mesa Phase II	Apr.-Sept. 2009	545	1091
		Aerial Before	Shay Mesa Phase II	Winter 2008	212	1091
14R-25	Peters Point BLM	Bullhog	Peters Point - Phase I	Fall 2011-Spring 2012	1,253	1944
14R-27	Seep Creek	Herbicide	Seep Creek Sagebrush and Wet Meadow Enhancement	Fall 2012	130	2325
		Disc	Seep Creek Sagebrush and Wet Meadow Enhancement	Fall 2012	130	2325
		Rangeland Drill	Seep Creek Sagebrush and Wet Meadow Enhancement	Fall 2012	130	2325
		Aerial After	Seep Creek Sagebrush and Wet Meadow Enhancement	Fall 2012	130	2325
		Transplant	Seep Creek Sagebrush and Wet Meadow Enhancement	Spring 2013	130	2325
14R-28	Johnson Creek 2	Bullhog	Johnson Creek Hazard Fuel	2012	1,800	2265
14R-29	South Plain 2	Herbicide	Beef Basin Sagebrush Restoration (Phase 1)	2014		2177
14R-30	North Plain	Herbicide	Beef Basin Sagebrush Restoration (Phase 1)	2014		2177
14R-31	Dark Canyon	Bullhog	Beef Basin Sagebrush Restoration (Phase 2)	2013		2636
14R-33	Sego Spring I	Logging	North Elk Ridge Aspen Restoration Phase I	2015	95	3004
14R-35	Blanding East	Bullhog/lop and scatter	Blanding East Fuel Reduction and Vegetation Restoration - Phase I	Fall 2014-2015	500	3000
		Aerial Before	Blanding East Fuel Reduction and Vegetation Restoration - Phase I	Fall 2014-2016	208	3000
14R-36	Mustang Mesa	Lop and Scatter	Mustang Mesa Lop and Scatter	2015	420	3050
		Aerial Before	Mustang Mesa Lop and Scatter	2015	450	3050
14R-37	Lower Wild Cow Point	Bullhog	Dark Canyon Plateau Phase II	2015		2938

Table 2.7: Range trend and WRI studies known disturbance history for WMU 14, San Juan.

Study Trend Summary (Undisturbed Sites)

High Mountain (Aspen)

There are two studies [Jackson Ridge (14-5) and Dickson Gulch (14-35)] classified as High Mountain (Aspen) ecological sites that remained undisturbed over the report period (Table 2.6). Both studies occur on the Abajo mountains. The Jackson Ridge study is located on the north slope of Jackson Ridge near the pass. The Dickson Gulch study is located on the east side of Abajo Peak in Dickson Gulch.

Shrubs/Trees: The primary browse/tree on the Jackson Ridge and Dickson Gulch studies is aspen (*Populus tremuloides*). The herbaceous understory is good with high cover provided by grasses and forbs. The mean line-intercept cover of aspen is good on these sites ranging from 31% in 2004 to near 51% in 2014. The mean cover of other conifer species has ranged from 3% in 2003 to 8% in 2014 (Figure 2.3b). The density of aspen

is increasing on the sites with an estimated density of 188 trees/acre in 2009 to 540 trees/acre in 2014 (Figure 2.3a). Understory browse species are rare on these sites.

Herbaceous Understory: Both study sites have a good herbaceous understory with a good mix of perennial grasses and forbs. However, the introduced grass species Kentucky bluegrass (*Poa pratensis*) is the dominant grass species on these sites. Numerous native grass species also occur on the sites, but at much lower cover and frequencies than the introduced species. Competition with this introduced grass may limit other desirable herbaceous species. Mean nested frequency of perennial grasses has fluctuated, but has remained relatively high since 1994 (Figure 2.4a). The mean cover of perennial grass increased from 11% in 1994 to 35% in 2014 (Figure 2.4b); this increase can be attributed to establishment of the Dickson gulch study in 2009. Annual grass species are rare on both study sites.

Native perennial forb species composition is diverse and has high nested frequency and cover. The mean nested frequency of perennial forb species has decreased since 1994, but remains relatively high. Mean cover increased from 23% in 1994 to 28% in 2008, and with the establishment of the Dickson Gulch study cover increased from 50% in 2009 to 52% in 2014 (Figure 2.4). Annual forbs have remained in relatively low abundance.

Occupancy: Animal pellet groups have been relatively low on these sites. Pellet group transect data indicates that elk predominately occupy these studies, though this is more pronounced on the Jackson Ridge study. The mean abundance of elk pellet groups has ranged from 15 days use/acre in 2009 to 5 days use/acre in 2014. Deer pellet groups are typically sampled in low abundance on both study sites. Livestock sign from cattle is higher on the Dickson Gulch study, but is still considered low (Figure 2.5).

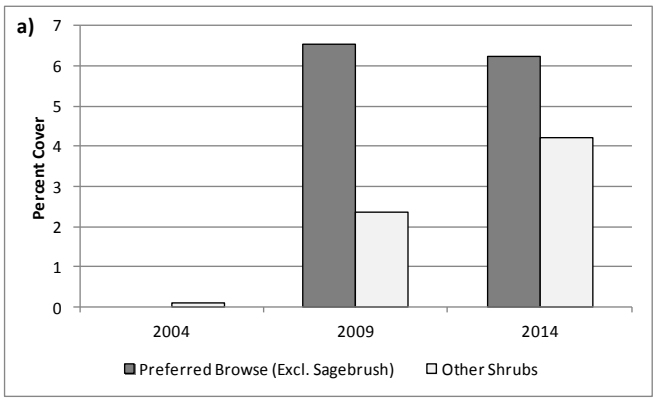


Figure 2.2: Shrub summary of the High Mountain (Aspen) studies (n=2) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups.

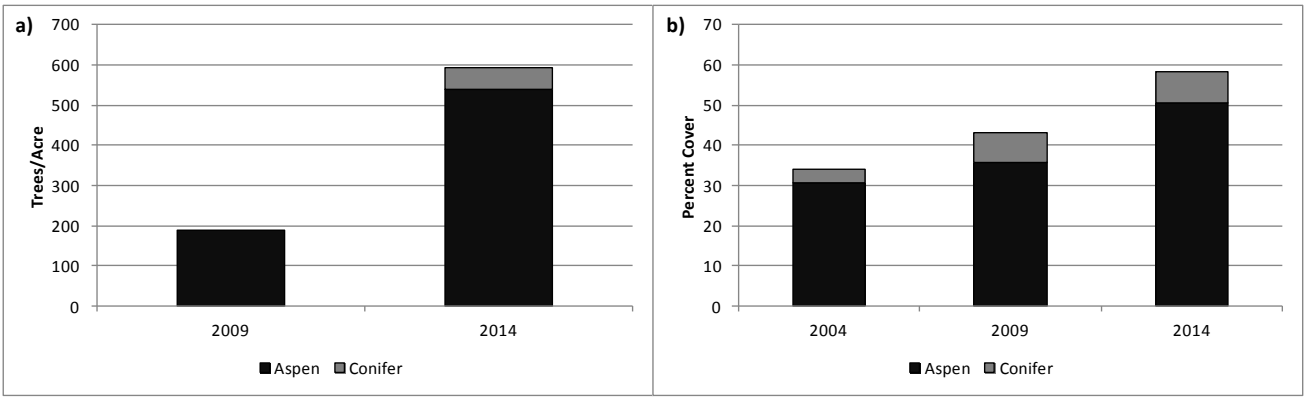


Figure 2.3: Tree summary of the High Mountain (Aspen) studies (n=2) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for aspen (*Populus tremuloides*) and conifer species. b) Mean line-intercept cover estimate for aspen and conifer.

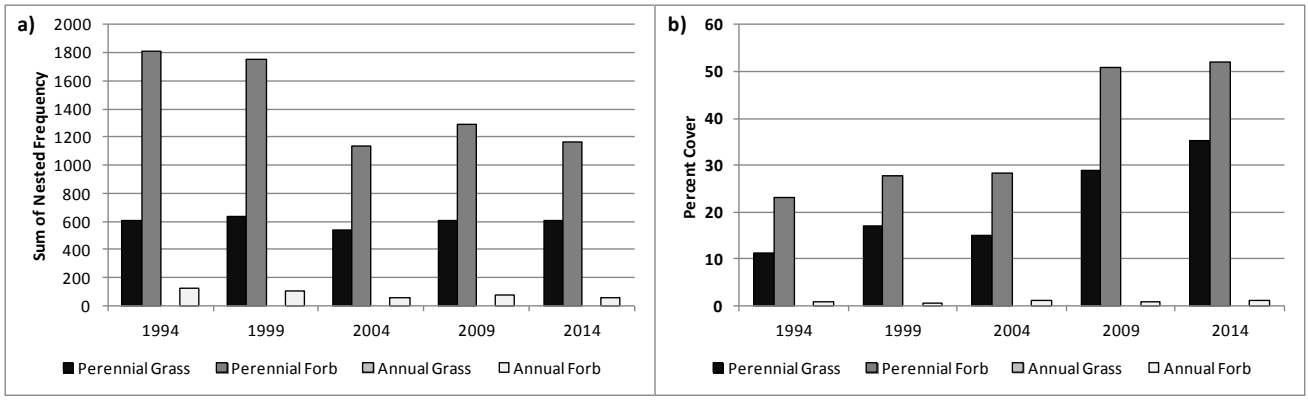


Figure 2.4: Herbaceous functional group summary of the High Mountain (Aspen) studies (n=2) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

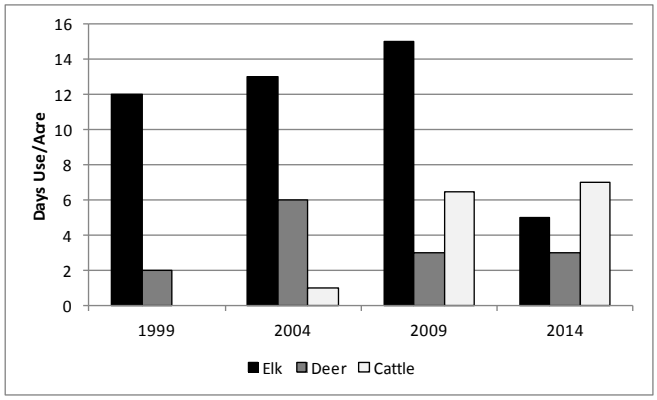


Figure 2.5: Mean pellet transect data for the High Mountain (Aspen) studies (n=2) for WMU 14, San Juan.

High Mountain (Browse) and Mountain (Browse/Oak)

There is one study [Shingle Mill (14-12)] classified as High Mountain (Browse) ecological site, two studies [Harts Draw Reservoir (14-6) and Mormon Pasture Point (14-27)] classified as Mountain (Oak), and two studies [Milk Ranch Point (14-30) and Chippean Ridge (14-31)] classified as Mountain (Browse) that remained undisturbed over the report period (Table 2.6). The Shingle Mill and Harts Draw Reservoir sites occur on the north and east side of the Abajo mountains. The Mormon Pasture Point, Milk Ranch, and Chippean Ridge sites occur on the high elevation flats of Elk Ridge.

Shrubs/Trees: There is a mixture of mountain browse species on these studies primarily, Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), Gambel oak (*Quercus gambelii*), mountain mahogany (*Cercocarpus montanus*), and mountain snowberry (*Symphoricarpos oreophilus*). Other preferred browse species are common, but occur at much lower coverage than these species. The mean line-intercept cover of sagebrush has remained similar since 2004 at 6-7%. The mean cover of other preferred browse species has ranged from 18% in 2014 to 21% in 2009 (Figure 2.6a). The average height of the mountain big sagebrush is approximately one and half to two feet, making browse available through much of the year in mild winters. The demographics of the sagebrush population were a mixture of mostly mature and decadent plants; though decadence was more pronounced in 1994 (Figure 2.6b).

Pinyon pine and Utah juniper are encroaching on these studies, with the exception of Harts Draw. The mean density of pinyon-juniper trees has increased since 2003 (Figure 2.7a). Mean tree cover has steadily increased from 5% in 2004 to near 7% in 2014 (Figure 2.7b). The increase in mean tree cover corresponds to increases in the average size of trees in photographs. These sites are under threat of further encroachment by pinyon-juniper trees, which would result in decreased cover of valuable browse and forage species, though rates of encroachment may vary from site to site.

Herbaceous Understory: These sites have a good herbaceous component dominated by perennial grass. However, the dominant grass species are seeded species that are often considered aggressive. These include intermediate wheatgrass (*Agropyron intermedium*), crested wheatgrass (*A. cristatum*), and smooth brome (*Bromus inermis*). The high abundance of introduced grasses is particularly pronounced on these sites except for Shingle Mill. Numerous native grass species occur on these sites. Mean nested frequency of perennial grasses has fluctuated, but has remained high since 1994 (Figure 2.8a). The mean cover of perennial grass has ranged from 14% in 1994 to 21% in 2009 (Figure 2.8b). Annual grass species are rare on this site.

Native perennial forb species composition is diverse with moderate to high nested frequency and cover, though diversity and cover were low in 2014. The mean nested frequency and cover of perennial forb species has fluctuated with cover ranging from 6% in 2014 to 13% in 1999 (Figure 2.8). Annual forbs are rarely present on these sites.

Occupancy: Pellet group transect data indicates that cattle predominately occupy these studies, though cattle presence was similar to elk and deer in 2004. The mean abundance of deer pellet groups has ranged from 16 days use/acre in 1999 to 7 days use/acre in 2014. The mean abundance of elk pellet groups has ranged from 13 days use/acre in 2009 to 5 days use/acre in 2014. The mean abundance of cattle pellet groups has ranged from 27 days use/acre in 2009 to 12 days use/acre in 2014 (Figure 2.9).

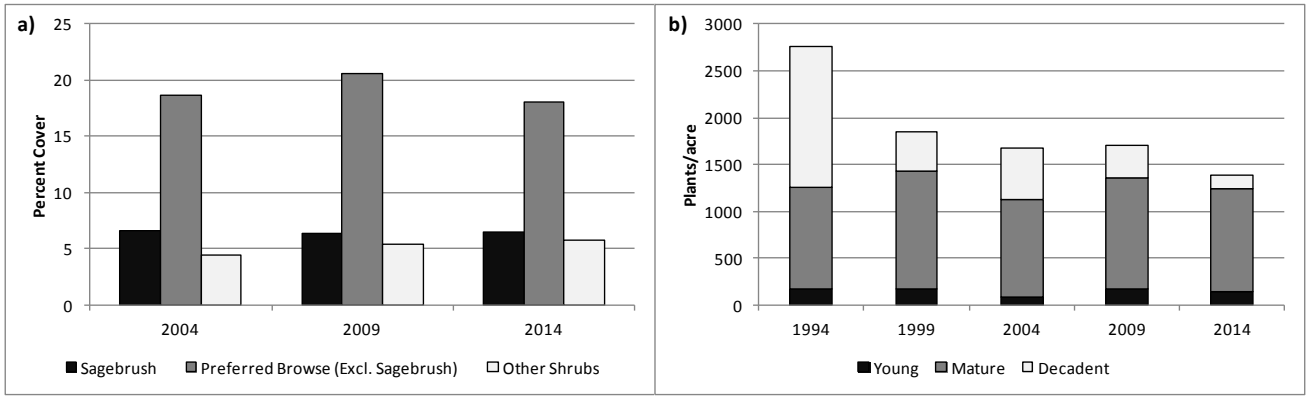


Figure 2.6: Shrub summary of the High Mountain (Browse) and Mountain (Browse/Oak) studies (n=5) for WMU 14, San Juan. a) Line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

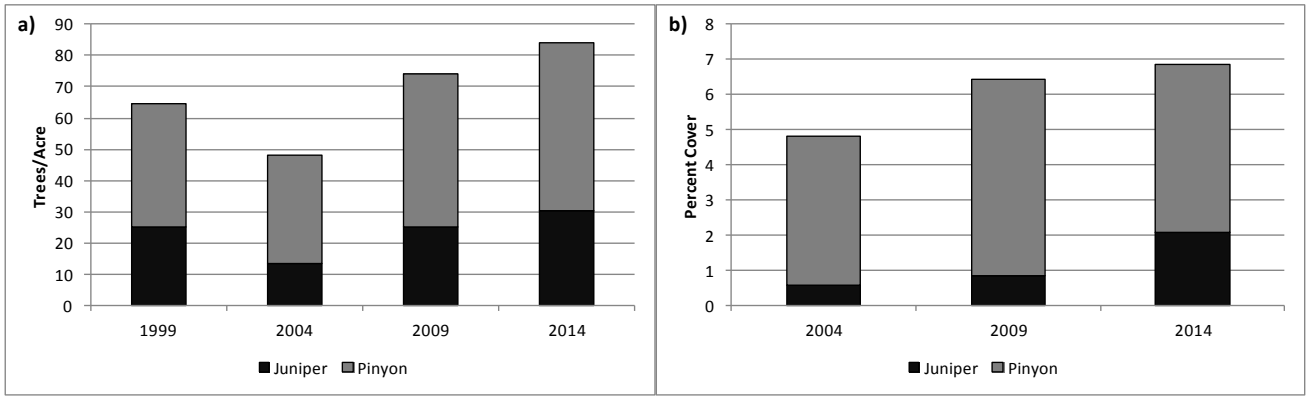


Figure 2.7: Tree summary of the High Mountain (Browse) and Mountain (Browse/Oak) studies (n=5) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

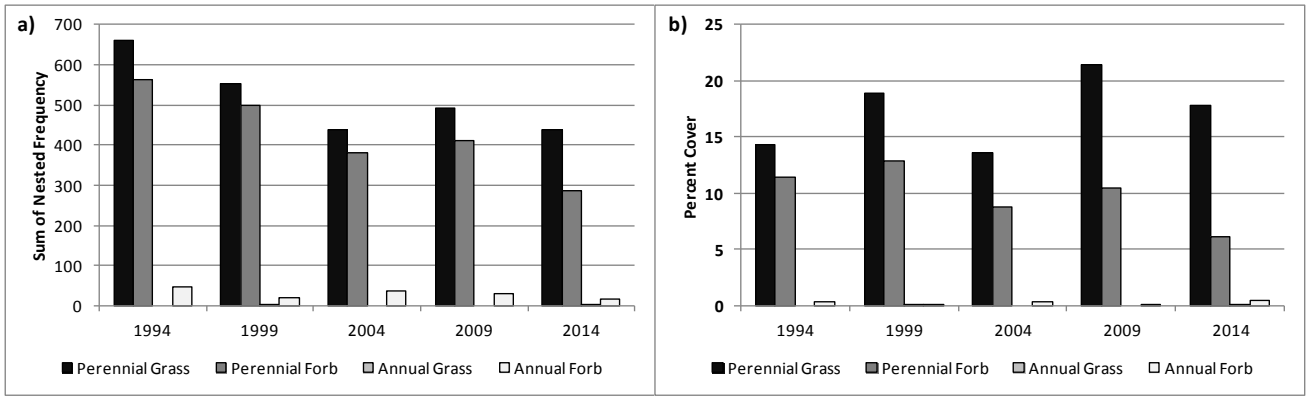


Figure 2.8: Herbaceous functional group summary of the High Mountain (Browse) and Mountain (Browse/Oak) studies (n=5) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

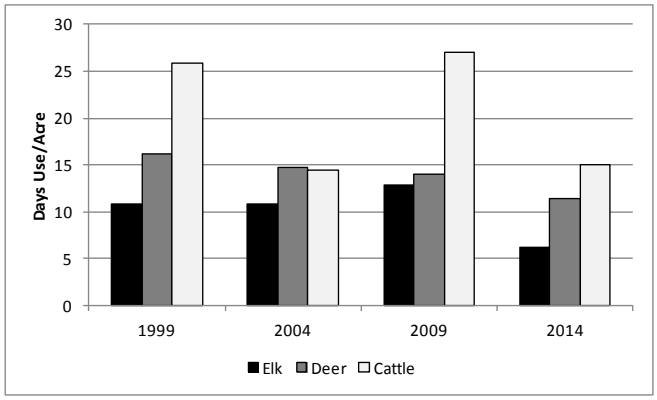


Figure 2.9: Mean pellet transect data for the High Mountain (Browse) and Mountain (Browse/Oak) studies (n=5) for WMU 14, San Juan.

Mountain (Mountain Big Sagebrush)

There is one study [Big Flat (14-34)] classified as Mountain (Mountain Big Sagebrush) ecological site that remained undisturbed over the report period (Table 2.6). The Big Flat study is located on Elk Ridge on the south side of Horse Mountain.

Shrubs/Trees: The primary browse on the Big Flat study is mountain big sagebrush. Other preferred browse species are rare, and occur at much lower coverage than sagebrush. The mean line-intercept cover of sagebrush is good on this site ranging from 21% in 2014 to 25% in 2004. The mean cover of sagebrush has been decreasing since 2004. The mean cover of other preferred browse species has ranged from 2% to <1% (Figure 2.10a). The demographics of the sagebrush population are a mixture of mostly mature and young plants (Figure 2.10b). There is no active pinyon-juniper encroachment at this time and therefore it is not included in this report.

Herbaceous Understory: The study site has a good herbaceous component dominated by perennial grass. However, the dominant grasses are introduced species that are often considered aggressive. These include Kentucky bluegrass and smooth brome. Numerous native species also occur on the sites, but at much lower cover and frequencies than the introduced species. Competition with these introduced grasses may limit other desirable herbaceous species. Nested frequency of perennial grasses has fluctuated, but has remained relatively high since 1998 (Figure 2.11a). Cover of perennial grass has fluctuated, ranging from 12% in 2004 to 25% in 2009 (Figure 2.11b). Annual grass was not sampled on this study site.

Native perennial forb species composition is diverse with moderate to high nested frequency and cover. Cover of perennial forb species has ranged from 10% in 2004 to 20% in 2009 (Figure 2.11). Annual forb frequency and cover have been low on this site.

Occupancy: The mean abundance of deer pellet groups has ranged from 16 days use/acre in 2004 to 7 days use/acre in 2014. The mean abundance of Elk pellet groups has ranged from 32 days use/acre in 2004 to 1 day use/acre in 2014. The mean abundance of cattle pellet groups has ranged from 34 days use/acre in 2009 to 4 days use/acre in 2014 (Figure 2.12).

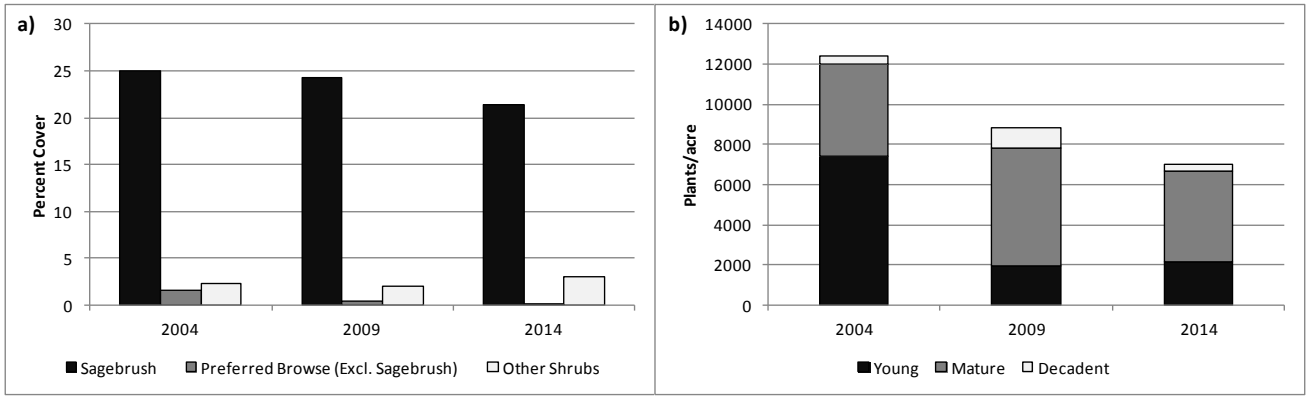


Figure 2.10: Shrub summary of the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 14, San Juan. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

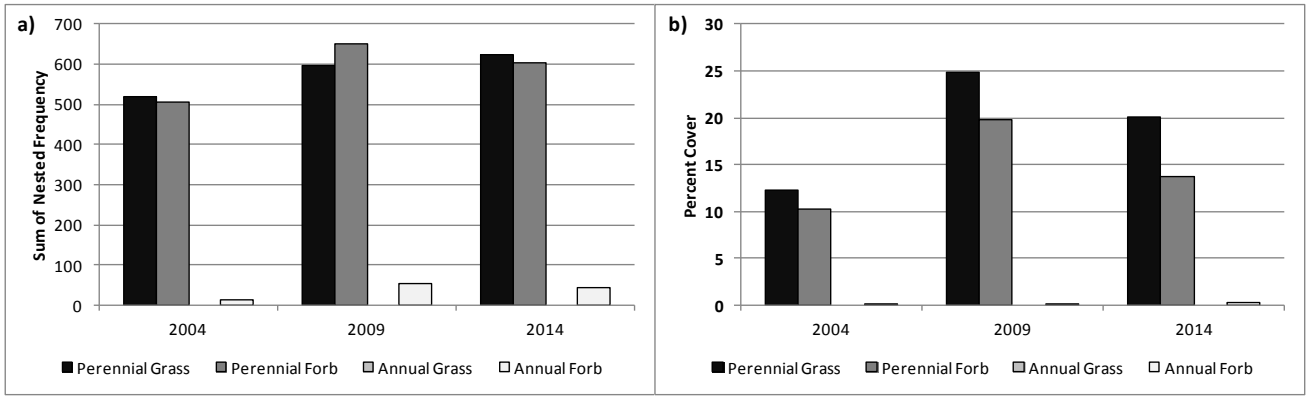


Figure 2.11: Herbaceous functional group summary of the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 14, San Juan. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

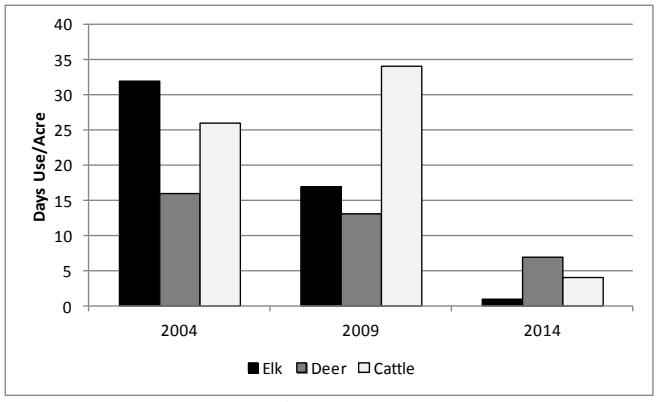


Figure 2.12: Pellet transect data for the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 14, San Juan.

Mountain (Ponderosa Pine)

There are two studies [Gooseberry (14-20) and Kigalia Point II (14-37)] classified as a Mountain (Ponderosa Pine) ecological site that remained undisturbed over the report period (Table 2.6). The Gooseberry study occurs east of the Gooseberry guard station on Elk Ridge. The Kigalia Point II study occurs on the south end of the Elk Ridge just north of the Bears Ears.

Shrubs/Trees: The primary understory browse on these studies is mountain snowberry. Other browse species are not common on this site, and occur at much lower coverage (Figure 2.13b).

Ponderosa pine (*Pinus ponderosa*) and aspen are the dominant tree species on these sites. Cover of Aspen decreased from 7% in 2004 to 4% in 2009. Cover of ponderosa pine increased from 32% in 2004 to 45% in 2009, but decreased to 39% in 2014 (Figure 2.14b).

Herbaceous Understory: These sites have a robust herbaceous component dominated by perennial grasses and a good element of perennial forbs. However, the dominant grass species are introduced and are often considered aggressive. These include Kentucky bluegrass, intermediate wheatgrass, and smooth brome. Numerous native species also occur on these sites, but at much lower cover and frequencies than the introduced species. Competition with these introduced grasses may limit other desirable herbaceous species from establishing. Nested frequency of perennial grasses has remained similar since 1992, though cover was low in 1999 and 2004 (Figure 2.15a). The mean cover of perennial grass decreased from 24% in 1992 to 7% in 1999, but has since increased to 10% in 2004, 24% in 2009, and 31% in 2014 (Figure 2.15b). Annual grass species were rare on the study sites.

Native perennial forb species composition is diverse with moderate nested frequency and cover. The mean nested frequency and cover of perennial forb species remained similar with slight fluctuation. The mean cover ranged from 8% in 1992 and 2004 to 12% in 1999 (Figure 2.15). Annual forbs were sparse on these sites.

Occupancy: Pellet group transect data indicates low use on these study, though cattle presence was moderately high in 1999. The mean abundance of deer pellet groups has ranged from 11 days use/acre in 1999 to 3 days use/acre in 2004. The mean abundance of elk pellet groups has ranged from 14 days use/acre in 2004 to 1 days use/acre in 2014. The mean abundance of livestock sign from cattle has range from moderately high in 1999 at 26 days use/acre to absent in 2014 (Figure 2.16).

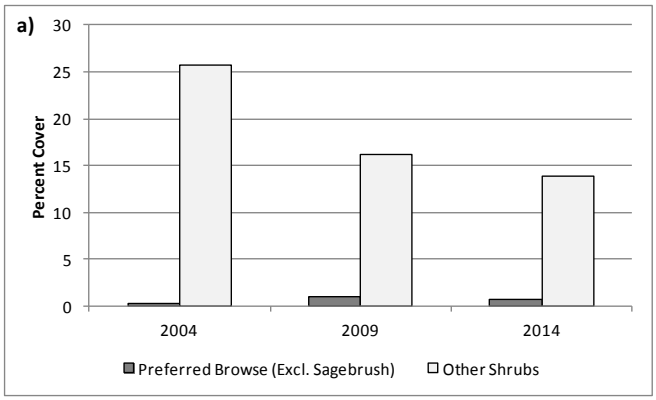


Figure 2.13: Shrub summary of the Mountain (Ponderosa Pine) studies (n=2) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups.

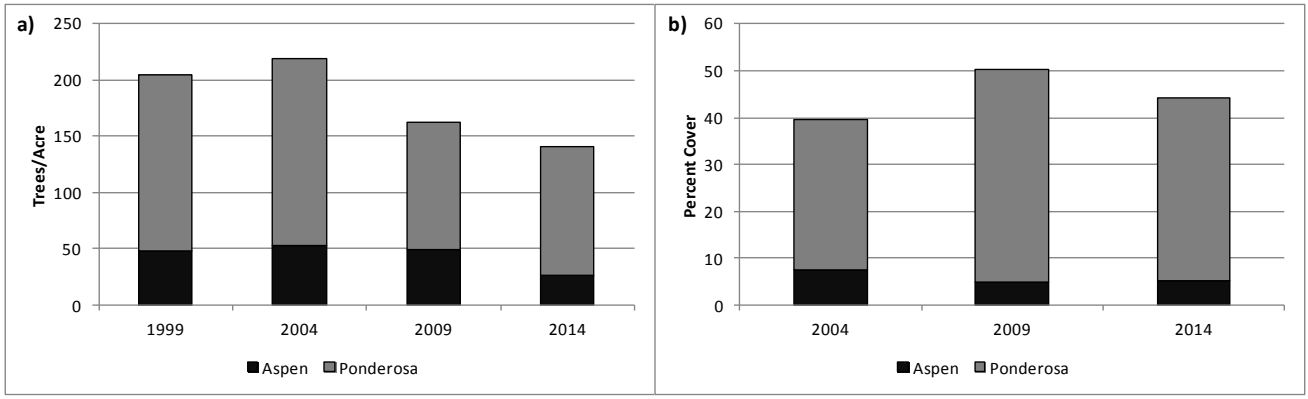


Figure 2.14: Tree summary of the Mountain (Ponderosa Pine) studies (n=2) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for aspen (*Populus tremuloides*) and ponderosa pine (*Pinus ponderosa*). b) Mean line-intercept cover estimate for aspen and ponderosa.

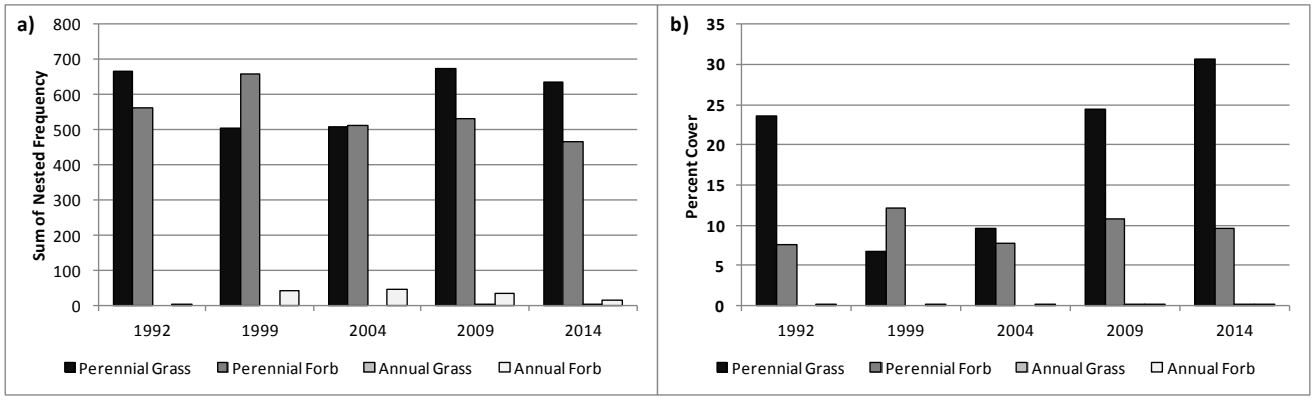


Figure 2.15: Herbaceous functional group summary of the Mountain (Ponderosa Pine) studies (n=2) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

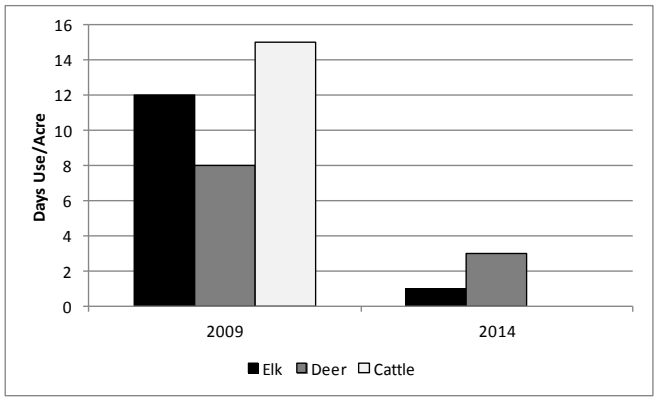


Figure 2.16: Mean pellet transect data for the Mountain (Ponderosa Pine) studies (n=2) for WMU 14, San Juan.

Upland (Mountain Big Sagebrush)

There are six studies [Peters Point (14-8), Harts Point (14-10), Wild Cow Point (14-22), South Plain (14-23), Lower Deer Flat (14-32), and Dry Mesa (14-36)] classified as an Upland (Mountain Big Sagebrush) ecological site that remained undisturbed over the report period (Table 2.6). Peters Point and Harts Point are located on the north side of the Abajo Mountains. Wild Cow Point and South Plain are located on the north end of Elk Ridge. Dry Mesa is located in the middle of Elk Ridge on Dry mesa. Lower Deer Flat is located on the southern end of Elk Ridge west of Natural Bridges National Monument.

Shrubs/Trees: The primary browse on the Peter Point, Harts Point, and Lower Deer Flat studies is mountain big sagebrush. The primary browse on the Wild Cow Point study is a mixture of black sagebrush (*Artemisia*

nova) and mountain big sagebrush. The primary browse on the South Plain study is a low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*). The primary browse on the Dry Mesa study is a mixture of mountain big sagebrush and Gambel oak. The mean line-intercept cover of sagebrush is good on these sites ranging from 13% in 2009 to 10% in 2014, though cover of sagebrush is low on the South Plain site. The mean cover of other preferred browse species has ranged from <1% in 2004 to 2% in 2009 (Figure 2.17a). The average height of the mountain big sagebrush is approximately one and half to two feet making browse available through much of the year in mild winters. The demographics of the sagebrush populations have generally been comprised of mature and decadent plants, with the number of decadent plants substantially higher in 2004. The mean recruitment of young sagebrush plants has remained below 10% of the population since 2004 (Figure 2.17b).

Encroachment from Utah juniper and pinyon pine trees is a concern on these sites. Although density of pinyon-juniper trees has fluctuated over the sample years, it has remained relatively similar at around 80 trees/acre (Figure 2.18a). Mean tree cover has also remained similar since 2004, though juniper has increased (Figure 2.18b). These sites are considered to be in Phase I of woodland succession. These study sites are under threat of further encroachment by pinyon-juniper trees, which would result in decreases in valuable browse and forage species.

Herbaceous Understory: These study sites have a good herbaceous component dominated by perennial grass. However, on the Peters Point, Wild Cow Point, and Lower Deer Flat studies, the dominant grass species is the seeded species crested wheatgrass and on the Dry Mesa study, the dominant grass species is smooth brome. Competition with these introduced grass species may limit other desirable herbaceous species. Mean nested frequency of perennial grasses has fluctuated, but has remained relatively high since 1994 (Figure 2.19a). The mean cover of perennial grass has fluctuated ranging from 11% in 2004 to 17% in 2009. Annual grassed have remained a minor component of the site with mean cover ranging from 1% in 2009 to 7% in 1999 (Figure 2.19b).

Native perennial forbs have low mean nested frequency and cover of all sampled species. Mean cover has remained similar over the sample years at 2% (Figure 2.19). Annual forbs have remained rare on the site.

Occupancy: Pellet group transect data indicates that deer predominately occupy these studies. The mean abundance of deer pellet groups has ranged from a high of 59 days use/acre in 1999 to a low of 10 days use/acre in 2014. Elk pellet groups are typically sampled in low abundance on the study site. The abundance of livestock sign from cattle has ranged from a high of 21 days use/acre in 2009 to a low of 8 days use/acre in 2014 (Figure 2.20).

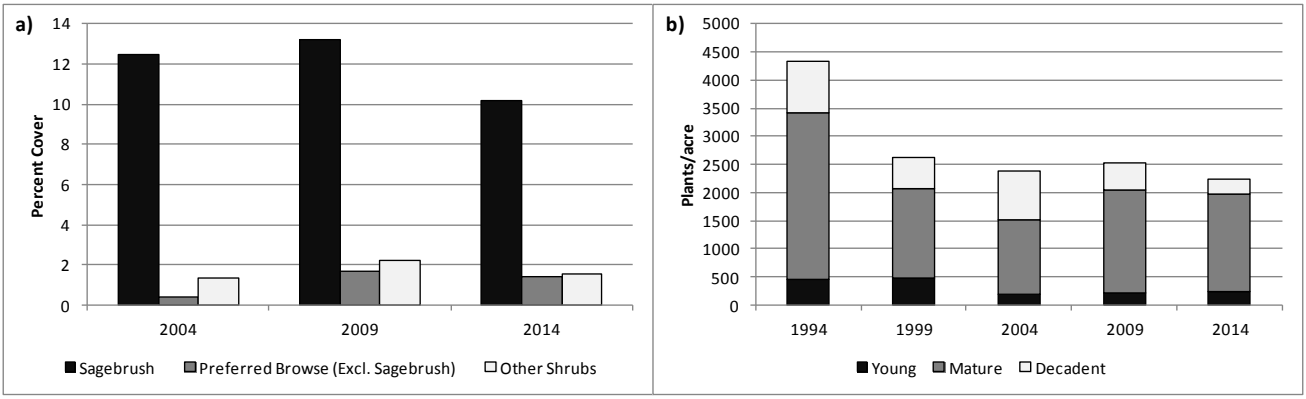


Figure 2.17: Shrub summary of the Upland (Mountain Big Sagebrush) studies (n=6) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

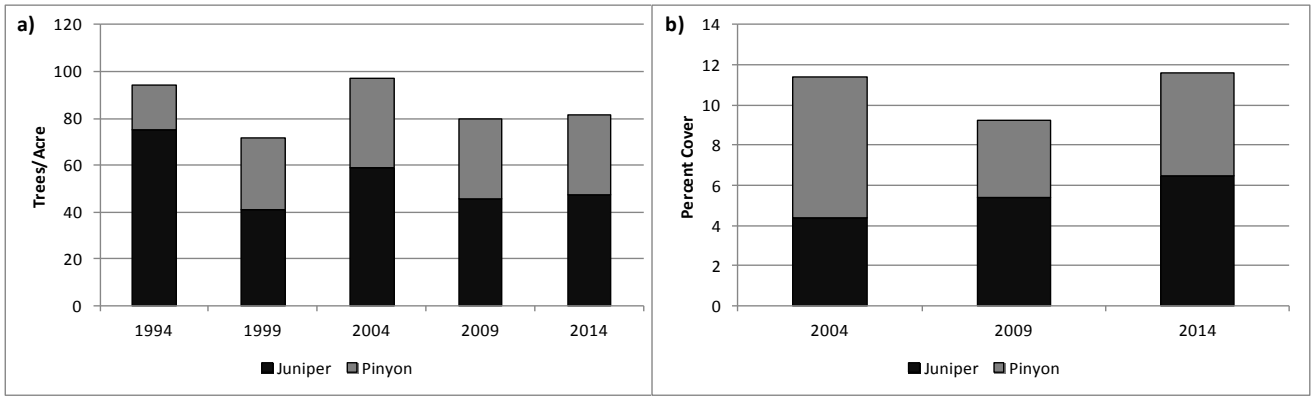


Figure 2.18: Tree summary of the Upland (Mountain Big Sagebrush) studies (n=6) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

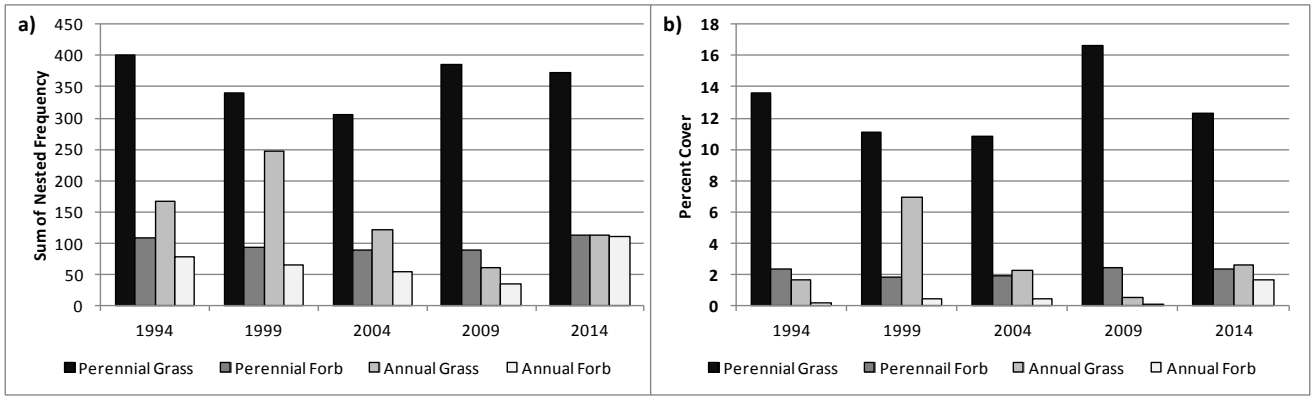


Figure 2.19: Herbaceous functional group summary of the Upland (Mountain Big Sagebrush) studies (n=6) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

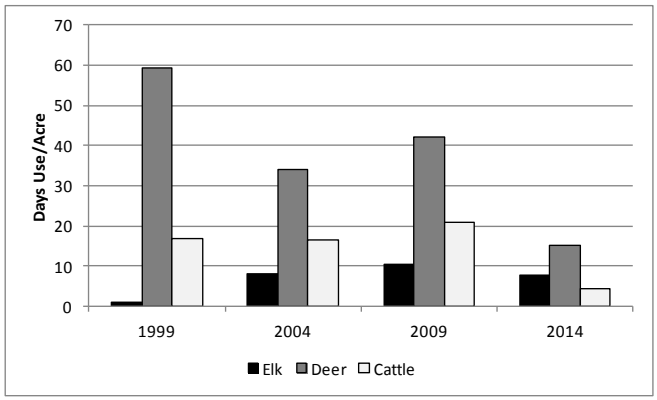


Figure 2.20: Mean pellet transect data for the Upland (Mountain Big Sagebrush) studies (n=6) for WMU 14, San Juan.

Semidesert (Wyoming Big Sagebrush)

There are three studies [Alkali Point (14-1), Black Mesa (14-13), and Ruin Park (14-24)] classified as Semidesert (Wyoming Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 2.6). The Alkali Point study is located east of Blanding on Alkali Point Bench. The Black Mesa study is located west of Blanding on the north end of Black Mesa. The Ruin Park study is located on the north end of Elk Ridge in Ruin Park.

Shrubs/Trees: The primary browse on these studies is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) except for Ruin Park that had a large sagebrush die off. Other preferred browse species were rare on these studies. The mean line-intercept cover of sagebrush is low on these sites, and has remained

similar at 3% to 4% since 2004 (Figure 2.21a). However, trends in cover have varied on individual sites. Sagebrush cover has decreased from 6% to 3% from 2004 to 2014 on the Alkali Point study and remained similar on the Black Mesa study at 5-6%. Sagebrush has not been sampled on the Ruin Park study since 1999. The average height of Wyoming big sagebrush on Black Mesa and Alkali Point is approximately two feet tall, making browse available through much of the year in normal winters. The demographics of the sagebrush populations have generally been a mixture of mature and decadent plants with recruitment of young plants comprising less than 10% of the population on most of the study sites since 1999. Despite the stable trends of the mean cover of sagebrush, there has been a steady decrease in density on both the Alkali Point and Black Mesa studies since 1999, though Alkali Point increased in 2014 (Figure 2.21b).

Encroachment from Utah juniper is a concern on the sites. Mean density and cover of juniper trees has increased over the sample years (Figure 2.22a) (Figure 2.22b). These sites are classified as being in Phase I of woodland succession. These study sites are under threat of further encroachment by juniper trees, which would result in decreases in valuable browse and forage species.

Herbaceous Understory: Herbaceous understories vary at each study. The Alkali Point study is dominated by the introduced annual grass species cheatgrass (*Bromus tectorum*), but the other studies are primarily dominated by native perennial grass species. The mean nested frequency of perennial grasses decreased in 1999, but has since increased. The mean cover of perennial grass increased from 5% in 1994 and 1999 to 11-12% in all subsequent years. The annual grass species cheatgrass is very abundant on the Alkali Point and was abundant on the Ruin Park and Black Mesa in 1999 and 2004 (Figure 2.23). Cheatgrass remains a threat for increased fire on these studies, but is more pronounced on the Alkali Point study.

Native perennial forb species composition is generally fairly diverse on these studies, but with low nested frequency and cover of all sampled species (Figure 2.23). Annual forbs are rare on these sites.

Occupancy: Pellet group transect data indicates that deer almost exclusively occupy these study sites. The mean abundance of deer pellet groups has ranged from a high of 88 days use/acre in 1999 to a low of 15 days use/acre in 2014 (Figure 2.24). Since the die-off of sagebrush on the Ruin Park study, deer presence has been low. Black Mesa and Alkali Point studies had low deer presence on the site in 2014. Elk pellet groups were typically sampled in low abundance on these sites.

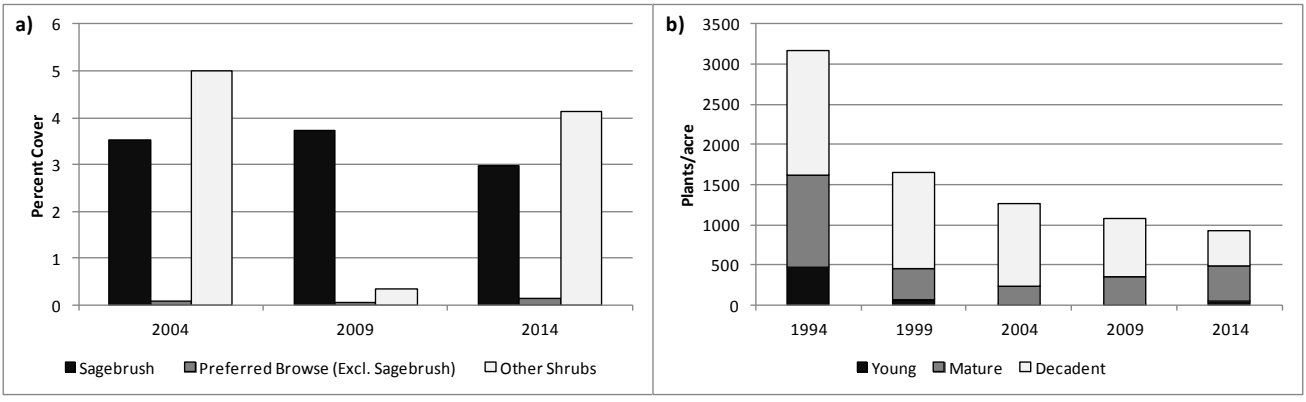


Figure 2.21: Shrub summary of the Semidesert (Wyoming Big Sagebrush) studies (n=3) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

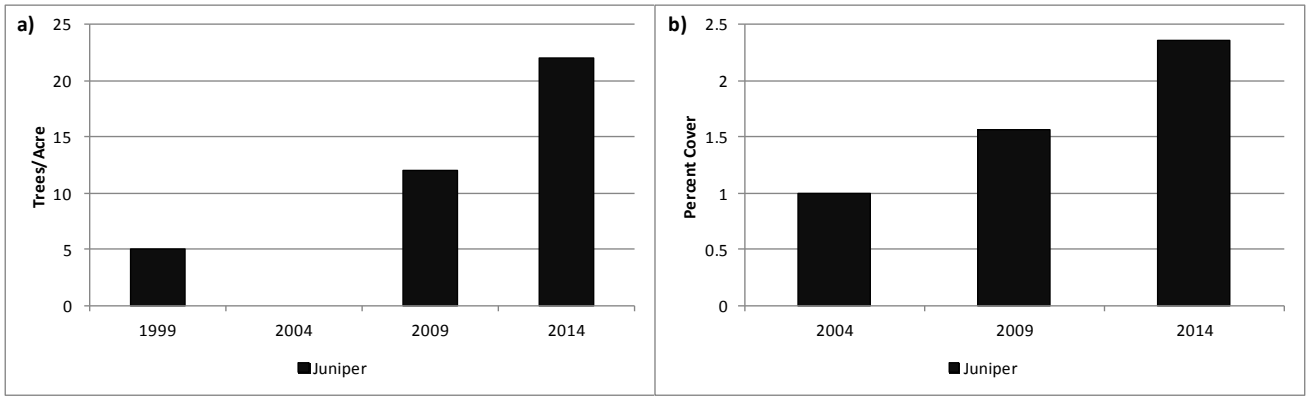


Figure 2.22: Tree summary of the Semidesert (Wyoming Big Sagebrush) studies (n=3) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

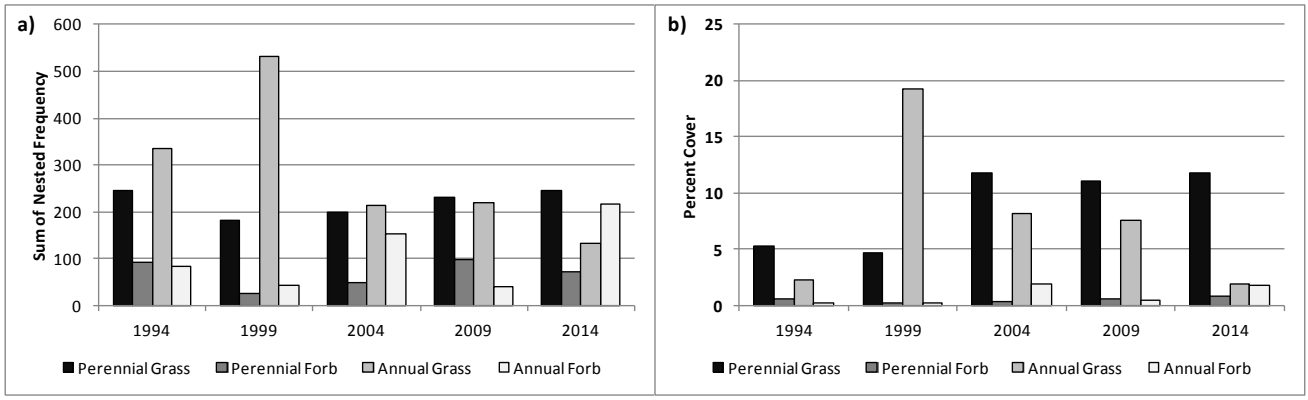


Figure 2.23: Herbaceous functional group summary of the Semidesert (Wyoming Big Sagebrush) studies (n=3) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

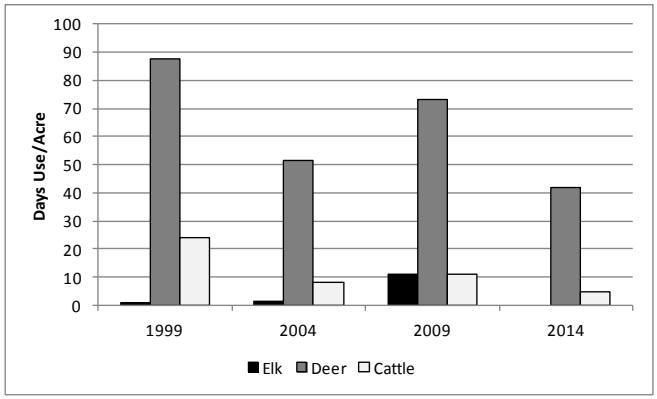


Figure 2.24: Mean pellet transect data for the Semidesert (Wyoming Big Sagebrush) studies (n=3) for WMU 14, San Juan.

Study Trend Summary (Treated/Disturbed Sites)

Bullhog

There are five studies [Brushy Basin (14-2), Shay Mesa (14-11), Peter's Canyon (14R-19), Shay Mesa Bullhog (14R-21), and Peter's Point BLM (14R-25)] that were treated with a bullhog during the report period (Table 2.7). All of the studies except the Brushy Basin study are located on the benches on the north end of Abajo Mountains. The Brush Basin study is located on the south end of Abajo Mountain in Brushy Basin. All of the studies are classified as either Upland (Mountain Big Sagebrush) or Upland (Pinyon-Utah Juniper) ecological

sites (Table 2.6). Generally, the target of the bullhog treatments was to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on all of the studies is big sagebrush. Sagebrush was impacted by pinyon-juniper encroachment on these studies, as evident by the mean line-intercept cover of sagebrush being low on many of the sites. The mean cover of sagebrush was reduced from near 9% prior to treatment to just over 7% following treatment. The mean cover of preferred browse decreased from 3% prior to treatment to <1% following treatment (Figure 2.25a). The mean density of sagebrush also decreased from 2,335 plants/acre to 1,725 plants/acre. However, changes in demographics of the sagebrush populations have been positive on most of the studies (Figure 2.25b). It is expected that with the improved recruitment and health of the sagebrush following treatment that sagebrush will continue to increase on most of the treatment sites.

The mean density and cover of pinyon pine and Utah juniper trees was moderately high at 141 trees/acre and 22%, respectively. The mean density of pinyon-juniper trees decreased to 59 tree/acre and the mean cover decreased to 7% following treatment (Figure 2.26). Remaining density and cover is generally provided by trees that were intentionally not treated or small trees that were left standing.

Herbaceous Understory: The herbaceous component was generally lacking or in poor condition prior to treatment. There was a general increase in all herbaceous functional groups following treatment. Perennial grass had the largest response, increasing in mean cover from 6% to 10%. Annual grass, namely cheatgrass, was rare on most study sites prior to treatment. Following treatment mean annual grass cover increased from <1% to 2% (Figure 2.27).

Perennial forb cover increased from 1% to 2%. Annual forbs remained rare (Figure 2.27).

Occupancy: Pellet group transect data indicates that elk primarily occupied these study sites prior to treatment, but following use has decreased similar to that of deer and cattle. The mean abundance of pellet groups of elk decreased from 20 days use/acre to 10 days use/acre following treatment (Figure 2.28). Pellet group transect data for deer and cattle indicated low presence with less than 8 day use/acre for either species.

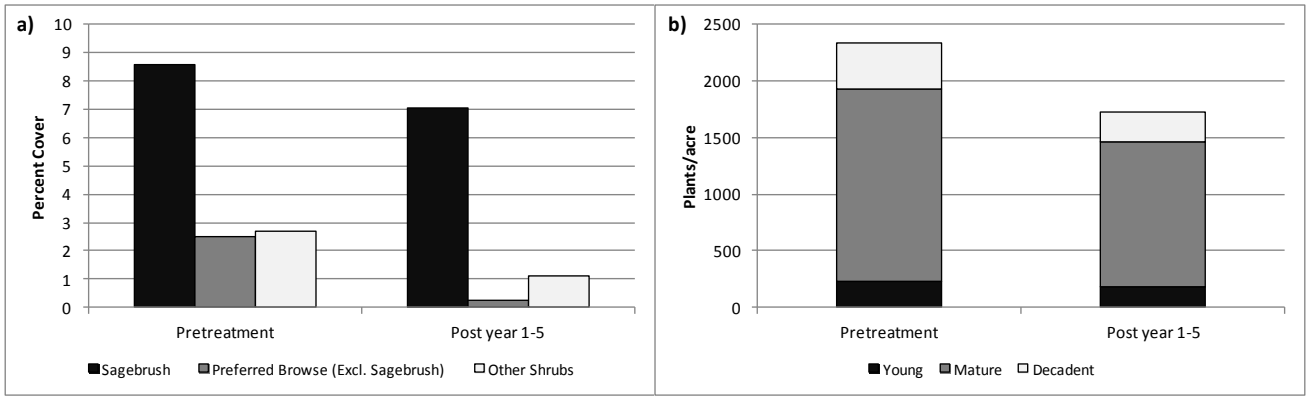


Figure 2.25: Shrub summary of the Bullhog treatment studies (n=5) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

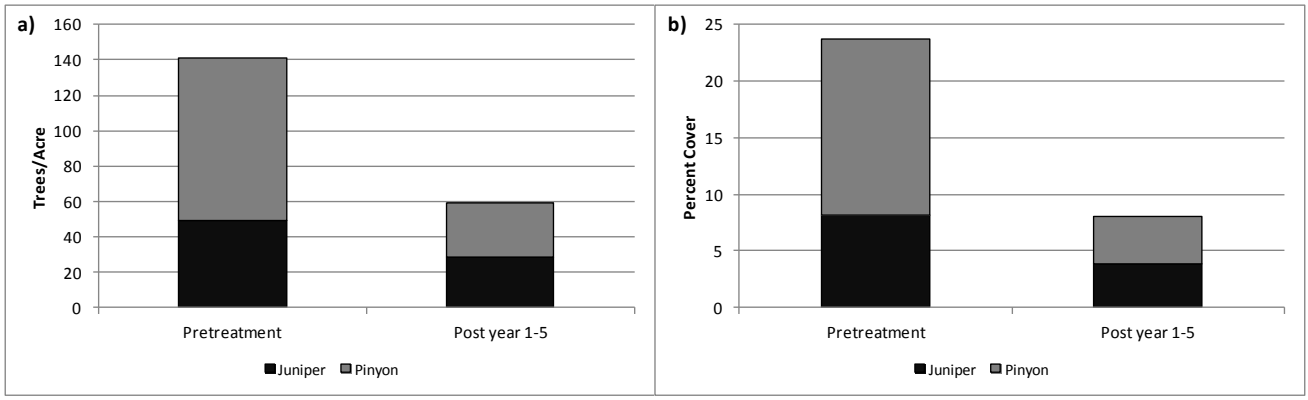


Figure 2.26: Tree summary of the Bullhog treatment studies (n=5) for WMU 14, San Juan. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

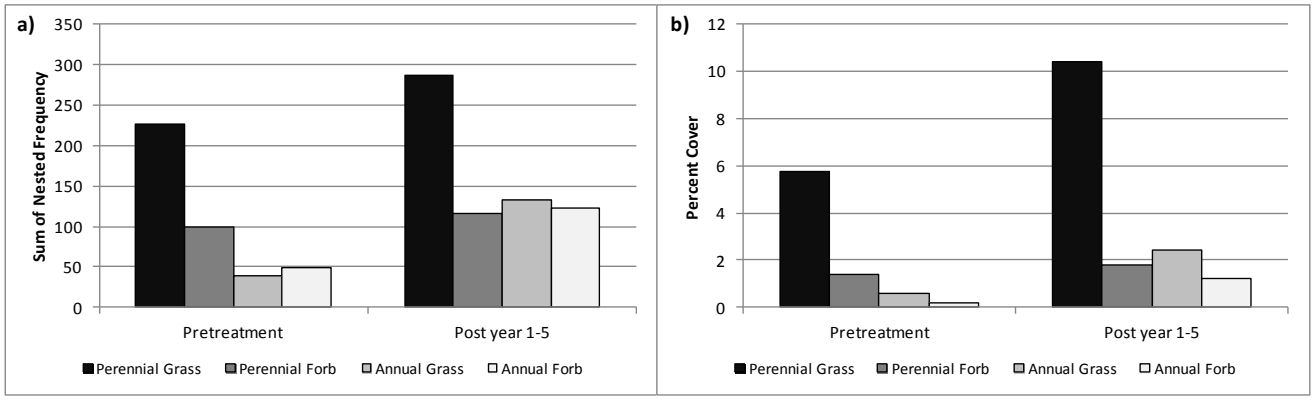


Figure 2.27: Herbaceous functional group summary of the Bullhog treatment studies (n=5) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

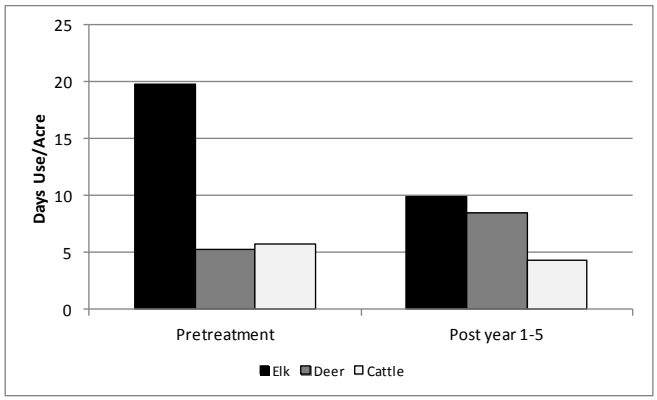


Figure 2.28: Mean pellet transect data for the Bullhog treatment studies (n=5) for WMU 14, San Juan.

Aerator

There are five studies [Harts Draw (14-9), Dugout Hart Draw (14R-6), Harts Draw Flat 1 (14R-9), Harts Draw Flat 2 (14R-10), and Harts Windmill (14R-11)] that are treated with an aerator during the report period (Table 2.7). These studies are located north of Abajo Mountains in Harts Draw. These studies are classified as Upland (Basin Big Sagebrush) and Semidesert (Wyoming Big Sagebrush) ecological sites (Table 2.6). Generally, the target of the aerator treatments was to rejuvenate decadent stands of sagebrush and increase the herbaceous understory.

Shrubs/Trees: The primary browse on these studies are Wyoming big sagebrush and (*A. t.* ssp. *tridentata*), while other preferred browse species were rare. The mean cover of sagebrush was reduced following

treatments from near 5% to just under 4% 1-10 years post treatment (Figure 2.29a). The mean density of sagebrush also decreased from 1,325 plants/acre to 990 plants/acre in 1-5 years post treatment and 980 plants/acre in 6-10 years post treatment. Changes in demographics of the sagebrush populations have been positive on most of the studies. Mean decadence has decreased in the population though it remains high 6-10 years post treatment. The mean recruitment of young plants remained poor following the harrow treatments (Figure 2.29b). Encroachment from pinyon pine and juniper trees has not been a major concern on these studies.

Herbaceous Understory: The herbaceous component was fair to good on the Harts Draw, Dugout (Harts Draw), and Harts Draw 1 studies, but was poor on the Harts Draw 2 and Harts Windmill studies prior to treatment. The mean perennial grass cover remained similar at 11-13%. Annual grass, primarily cheatgrass, had the largest response, increasing in mean nested frequency, but decreasing in mean cover from 13% to 7%, 1-5 years post treatment. Cheatgrass substantially decreased in both mean nested frequency and cover to <1%.

Mean annual forb cover acted similarly to that of annual grass, but not as pronounced with mean cover ranging from 2% 6-10 years post treatment and 8% 1-5 years post treatment (Figure 2.30). Perennial forb cover remained low.

Occupancy: Pellet group transect data indicates that deer and cattle primarily occupy these study sites. The mean abundance of pellet groups for deer decreased from 30 days use/acre prior to treatment to 22 days use/acre 1-5 years post treatment and 17 days use/acre 6-10 years post treatment. The mean abundance of pellet groups for cattle increased from 25 days use/acre prior to treatment to 40 days use/acre 1-5 years post treatment and decreased to 12 days use/acre 6-10 years post treatment (Figure 2.31).

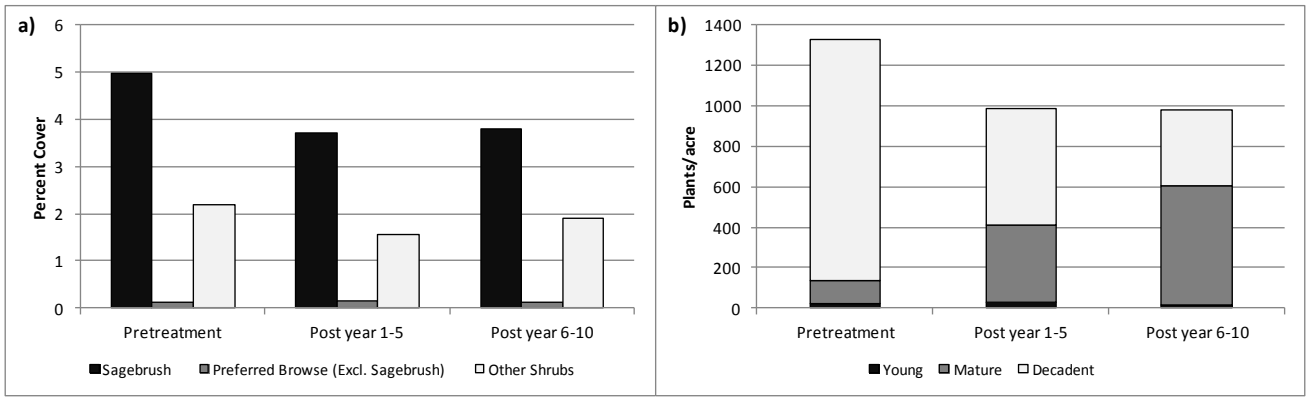


Figure 2.29: Shrub summary of the Aerator treatment studies (n=5) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

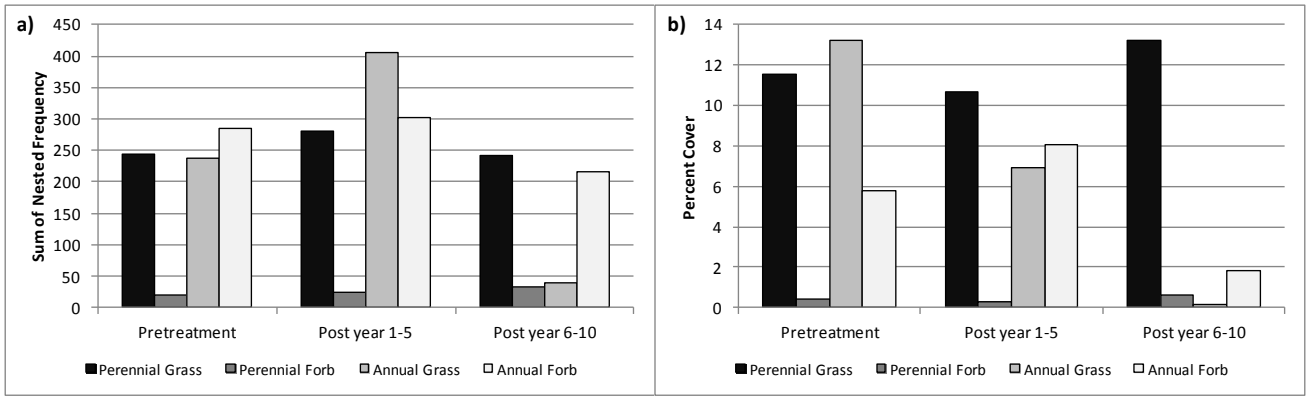


Figure 2.30: Herbaceous functional group summary of the Aerator treatment studies (n=5) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

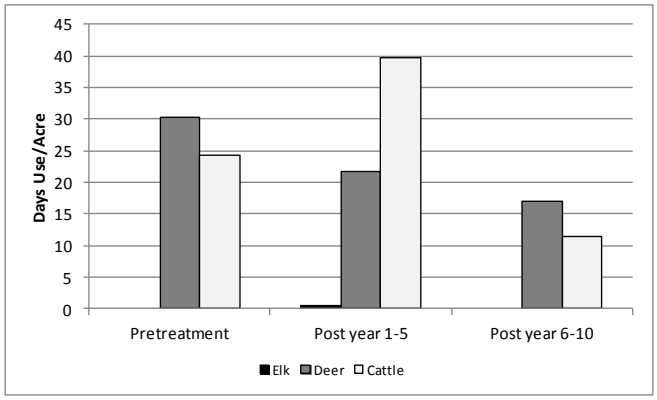


Figure 2.31: Mean pellet transect data for the Aerator treatment studies (n=5) for WMU 14, San Juan.

Harrow

There are six studies [Adams CE Harrow (14R-7), SITLA Dixie (14R-14), SITLA Dixie 2 (14R-15), Harvey John Mesa (14R-16), Stateline South (14R-17), and Stateline North (14R-18)] that were treated with a harrow during the report period (Table 2.7). The Adams CE Harrow, SITLA Dixie, SITLA Dixie 2, Stateline South, and Stateline North studies are located on the flats east of Monticello. Harvey John Mesa is located on a bench south of the Abajo Mountains northeast Johnson Creek. These studies are classified as Semidesert (Wyoming Big Sagebrush), Upland (Black Sagebrush), Upland (Big Sagebrush), and Upland (Pinyon-Utah Juniper) ecological sites (Table 2.6). Generally, the target of the harrow treatments is to rejuvenate decadent stands of sagebrush and increase the herbaceous understory.

Shrubs/Trees: The primary browse on all of the studies is big sagebrush and black sagebrush. Other preferred browse species provided little cover, except for dwarf rabbitbrush (*Chrysothamnus depressus*) and winterfat (*Ceratoides lanata*) which provided moderate cover on the Adams CE Harrow study. The mean cover of sagebrush was reduced following treatments from 27% to 16% 1-5 years post treatment and increased to 19% 6-10 years post treatment (Figure 2.32a). The mean density of sagebrush increased from 7,647 plants/acre to 9,890 plants/acre post treatment 1-5 years, but decreased post treatment 6-10 years to 5,719 plants/acre. Changes in demographics of the sagebrush populations have been positive on most of the studies. Mean decadence has decreased in the population and the mean recruitment of young plants increased following the harrow treatments (Figure 2.32b). Encroachment from pinyon pine and juniper trees has not been a major concern on these studies and is therefore not reported.

Herbaceous Understory: The herbaceous component was fair to good on the studies except for Harvey John Mesa. The study sites had an herbaceous component comprised of native and introduced grass and forb species. Annual forbs had the largest response increasing in mean cover from <1% to 4% 1-5 years post

treatment. This increase is primarily driven by the Stateline North study, which increased in annual forb cover from 0% to 8% following treatment. The mean cover of annual grass has decreased from 2% to 1% 6-10 years post treatment. The mean perennial grass cover increased from 4% to 7% 1-5 years post treatment and 6% 6-10 years post treatment, and the mean perennial forb cover increased from 1% to 4% 1-5 years post treatment and 2% 6-10 years post treatment (Figure 2.33).

Occupancy: Pellet group transect data indicates that deer and cattle primarily occupy these study sites, though presence was low. The mean abundance of pellet groups for deer remained low over the study years at 3-4 days use/acre. The mean abundance of pellet groups for cattle increased from 3 days use/acre prior to treatment to 7 days use/acre 1-5 years post treatment and 5 days use/acre 6-10 years post treatment (Figure 2.34).

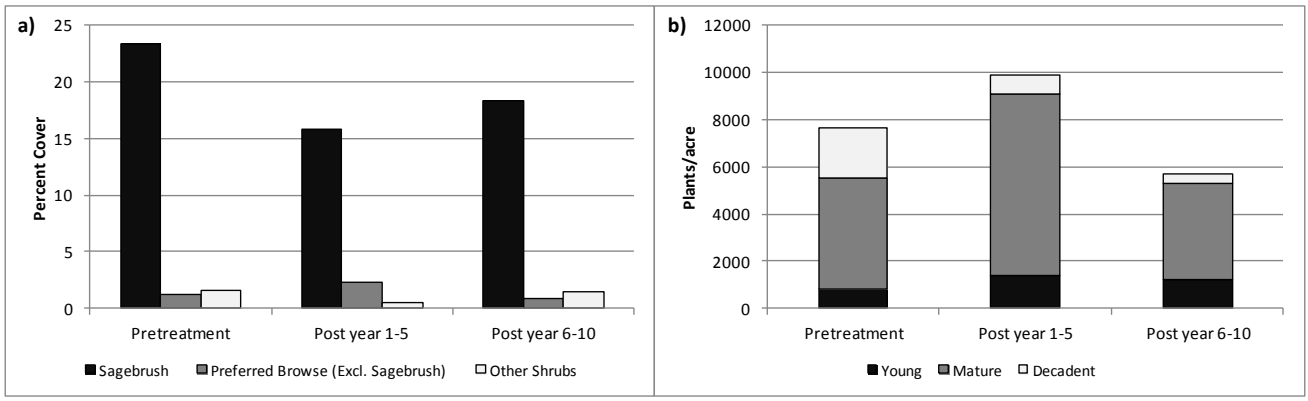


Figure 2.32: Shrub summary of the Harrow treatment studies (n=6) for WMU 14, San Juan. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

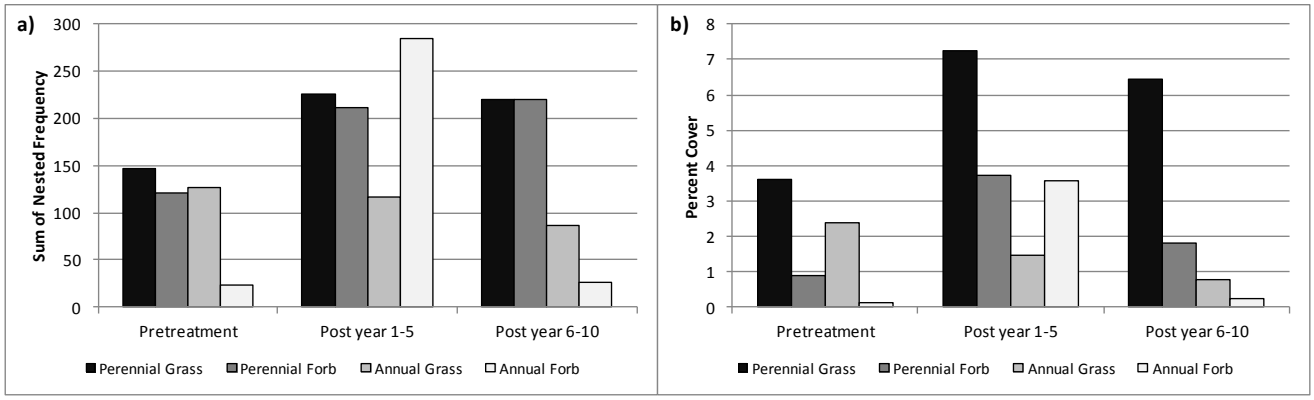


Figure 2.33: Herbaceous functional group summary of the Harrow treatment studies (n=6) for WMU 14, San Juan. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

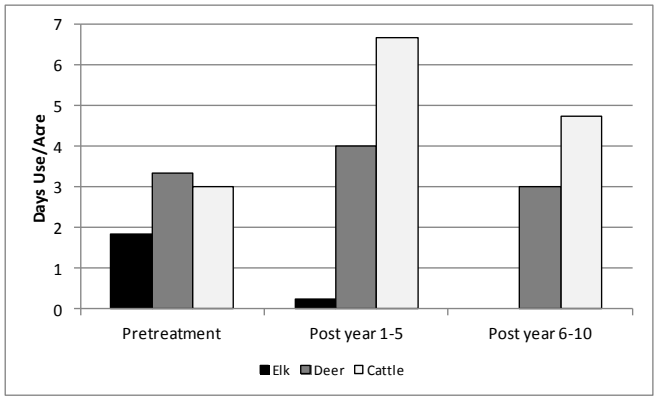


Figure 2.34: Mean pellet transect data for the Harrow treatment studies (n=6) for WMU 14, San Juan.

Lop and Scatter

There is one study [Johnson Creek (14R-20)] that was treated with a lop and scatter during the report period (Table 2.7). The Johnson Creek study is located on the south side of the Abajo Mountain east of Johnson Creek. The Johnson Creek study is classified as an Upland (Mountain Big Sagebrush) ecological site (Table 2.6). Generally, the target of the lop and scatter treatment is to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on the Johnson Creek study is mountain big sagebrush, Utah serviceberry and Gambel oak. The cover of sagebrush increased from <1% prior to treatments to 2% 1-5 years post treatment and 7% 6-10 years post treatment. The other preferred browse species, mainly serviceberry and oak, decreased from 6% prior to treatment to 4% 1-5 years post treatment and 1% 6-10 years post treatment (Figure 2.35a). The density of sagebrush remained similar following 1-5 post treatment at 700 plants/acre, but 6-10 years post treatment mean density of sagebrush increased to 4,160 plants/acre. The density of decadent plants decreased and the density of young plants increased substantially after the treatment (Figure 2.35b).

Prior to treatment the density and cover of pinyon pine and Utah juniper trees was high at 533 trees/acre and 42%, respectively. The density and cover of pinyon-juniper trees decreased to 62 tree/acre and 9% cover 1-5 years post treatment and 109 trees/acre and 4% cover 6-10 years post treatment, respectively (Figure 2.36). Young trees that were missed in the treatment generally provide remaining density and cover.

Herbaceous Understory: This study site has a poor herbaceous component with the dominant grass species being the annual species cheatgrass. Annual grass and perennial forb had the largest response increasing in cover from 4% to 18% and 5% to 15% 1-5 years post treatment and decreasing to 7% and 10% 6-10 years post treatment, respectively. Annual forb cover and frequency decreased following treatment. Perennial grass increased following treatment from 1% to 4% following treatment (Figure 2.37). Cheatgrass remains a substantial threat for increased fire on this study site.

Occupancy: Pellet group transect data indicates that cattle and deer primarily occupy this study site. The abundance of pellet groups for deer decreased from 11 days use/acre prior to treatment to 9 days use/acre 1-5 years post treatment and 1 day use/acre 6-10 years post treatment. The abundance of pellet groups for cattle decreased from 28 days use/acre prior to treatment to 11 days use/acre 1-5 years post treatment and 2 days use/acre 6-10 years post treatment (Figure 2.38).

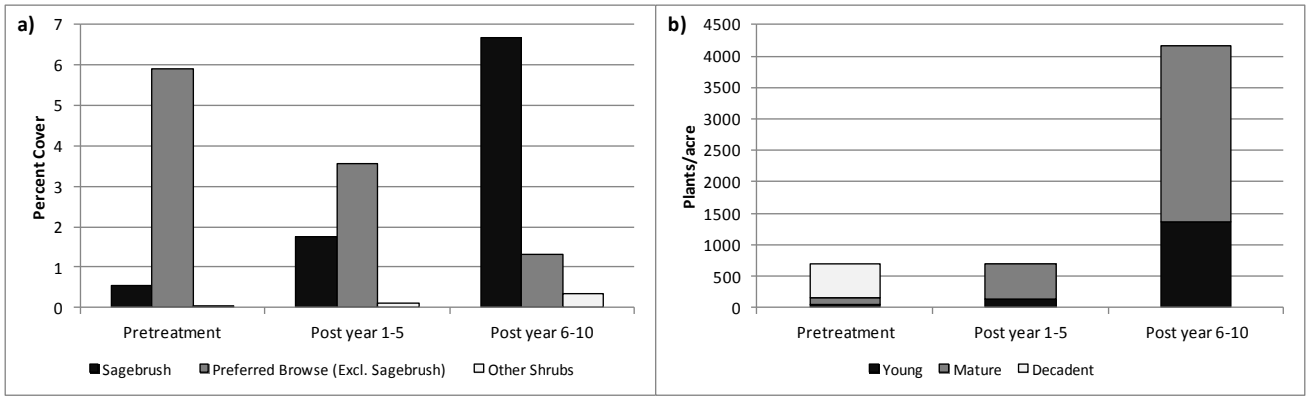


Figure 2.35: Shrub summary of the Lop and Scatter treatment studies (n=1) for WMU 14, San Juan. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

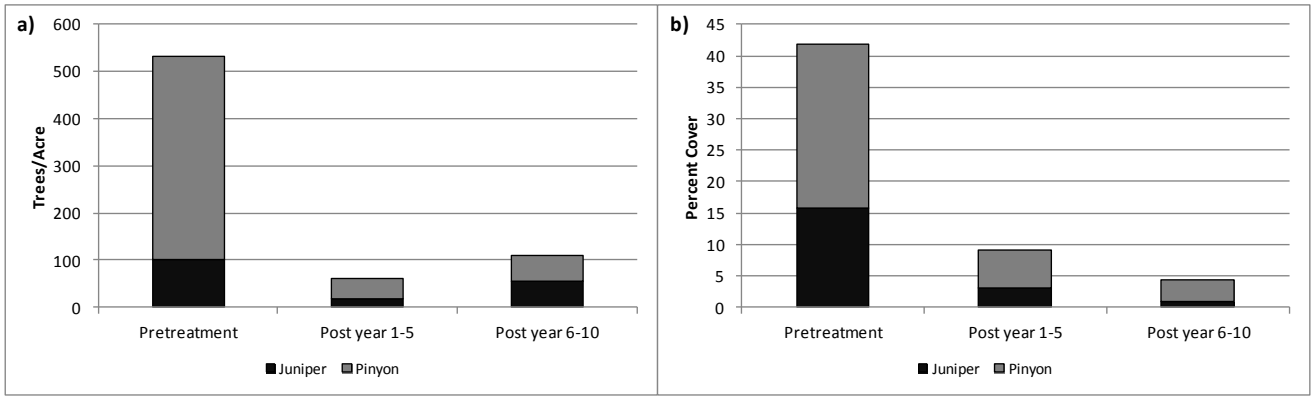


Figure 2.36: Tree summary of the Lop and Scatter treatment studies (n=1) for WMU 14, San Juan. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Line-intercept cover estimate for pinyon pine and Utah juniper.

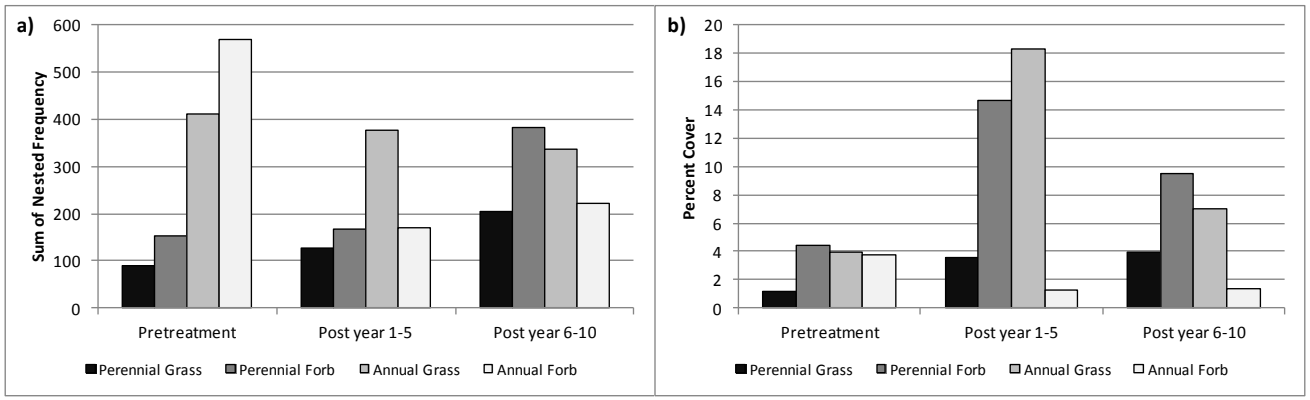


Figure 2.37: Herbaceous functional group summary of the Lop and Scatter treatment studies (n=1) for WMU 14, San Juan. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

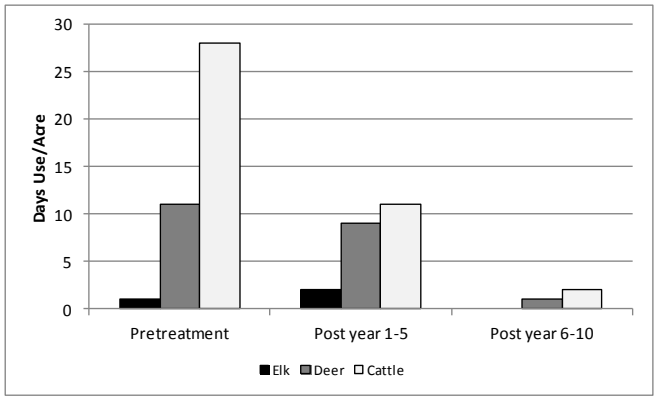


Figure 2.38: Pellet transect data for the Lop and Scatter treatment studies (n=1) for WMU 14, San Juan.

Wildfire

There are two studies [Woodenshoe (14-19) and Salt Creek Mesa (14-29)] that were burned in fires during the report period (Table 2.7). The Woodenshoe study burned in the Woodenshoe fire in 2003 and the Salt Creek Mesa study partially burned in the Salt Creek prescribed fire in 2002. The Woodenshoe study is classified as a Mountain (Ponderosa) ecological site and the Salt Creek study is classified as an Upland (Mountain Big Sagebrush) ecological site (Table 2.6).

For this summary only the Woodenshoe study site was used for summarization of the wildfire disturbance, because Salt Creek Mesa was only partially burned and would not be representative.

Shrubs/Trees: The primary browse on Woodenshoe study was mountain big sagebrush, Gambel oak, and mountain snowberry. The wildfire killed, nearly all of the shrub species. Pretreatment line intercept cover of browse was not sampled, but pictures show a substantial decrease 1-5 years post treatment. Cover of sagebrush remained similar at 2% from 1-5 years post to 6-10 years treatment, but increased to 4% cover 11-15 years post treatment. Cover of preferred browse has increased from 1% 1-5 years to 9% 6-10 years post treatment and 12% 11-15 years post treatment (Figure 2.39a). Prior to disturbance the demographics of the sagebrush population was a mixture of mature and young plants. Following the wildfires, the small populations of sagebrush was mostly young plants 1-5 years post treatment, but 6-15 years post treatment has been a mixture of young and mature plants (Figure 2.39b).

The density of ponderosa pine was low at 53 trees/acre prior to disturbance. Density was not sampled 1-5 years post disturbance. The density of ponderosa pine decreased to 33 tree/acre 6-10 years post disturbance and 35 trees/acre 11-15 years post disturbance (Figure 2.40a). Line intercept cover of ponderosa was not sampled prior to disturbance, but has increased with time since disturbance (Figure 2.40b).

Herbaceous Understory: The herbaceous component has been good on the site, and has been generally dominated by perennial grasses and forbs, though annual forbs were dominant 1-5 years post treatment. Cover of perennial grass species have fluctuated on the site, decreasing from 10% cover prior to disturbance to 6% cover 1-5 years after disturbance, increasing to 12% 6-10 years post disturbance, and decreasing to 8% 11-15 years post disturbance. Cover of perennial forb species have fluctuated on the site, remaining similar cover prior to disturbance to 1-5 years after disturbance at 7%, increasing to 16% 6-10 years post disturbance, and decreasing to 9% 11-15 years post disturbance. Annual grasses and forbs have remained rare, though annual forbs were common on the site 1-5 years post disturbance at 3% (Figure 2.41)

Occupancy: Pellet group transect data indicates that cattle primarily occupied this study site prior to the fire. The mean abundance of pellet groups of wildlife species remained similar with slight fluctuation following the wildfire, but presence has remained low. The abundance of cattle sign has slightly decreased from 26 days use/acre prior to treatment to 20 days use/acre 11-15 years post disturbance (Figure 2.42).

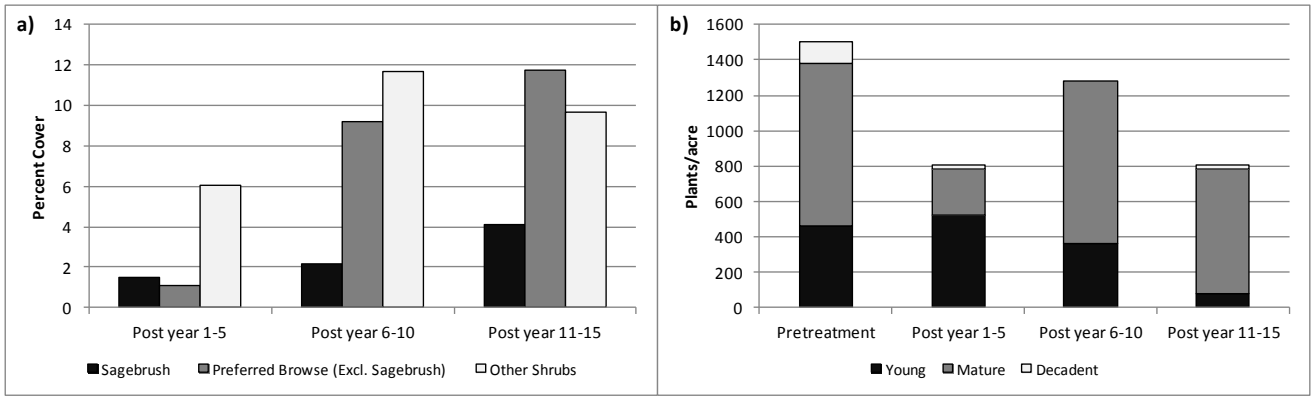


Figure 2.39: Shrub summary of the Wildfire disturbance studies (n=1) for WMU 14, San Juan. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

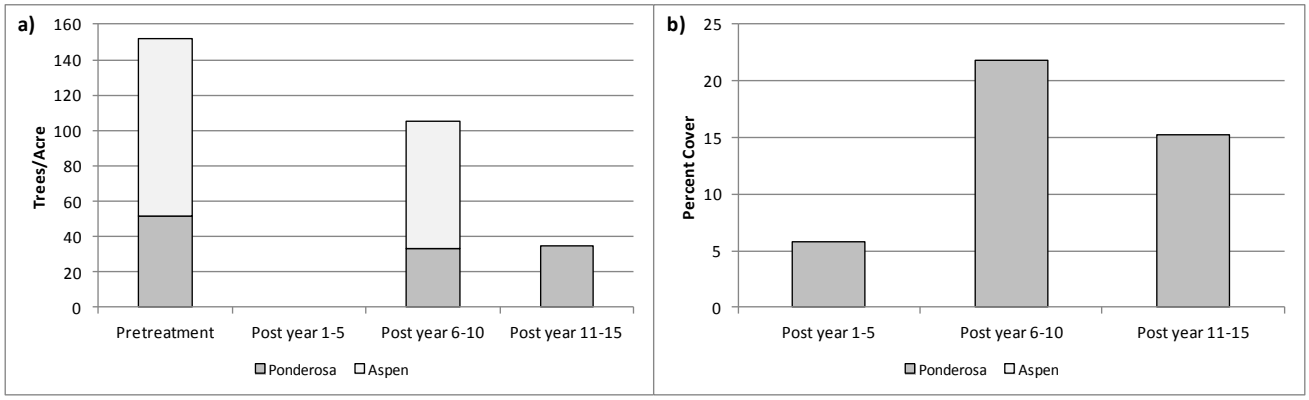


Figure 2.40: Tree summary of the Wildfire disturbance studies (n=1) for WMU 14, San Juan. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Line-intercept cover estimate for pinyon pine and Utah juniper.

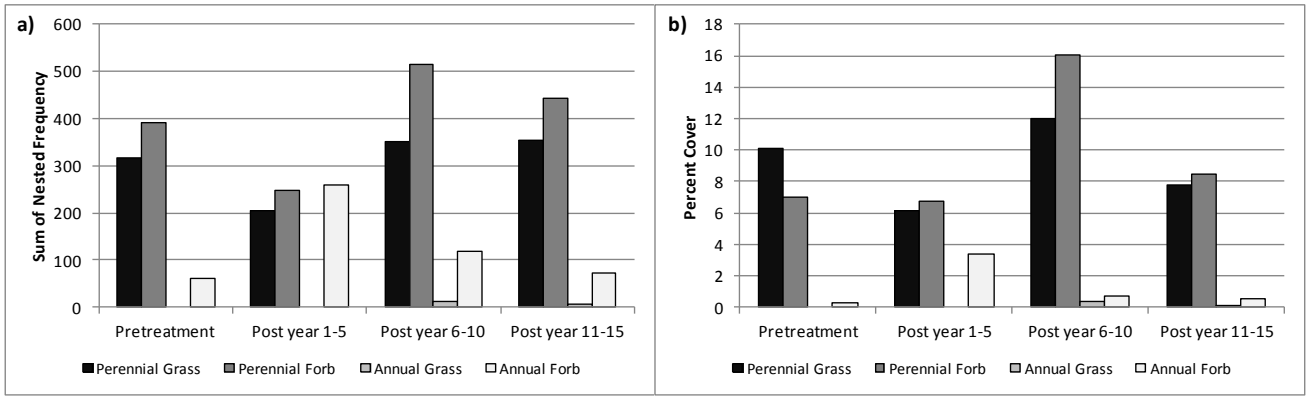


Figure 2.41: Herbaceous functional group summary of the Wildfire disturbance studies (n=1) for WMU 14, San Juan. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

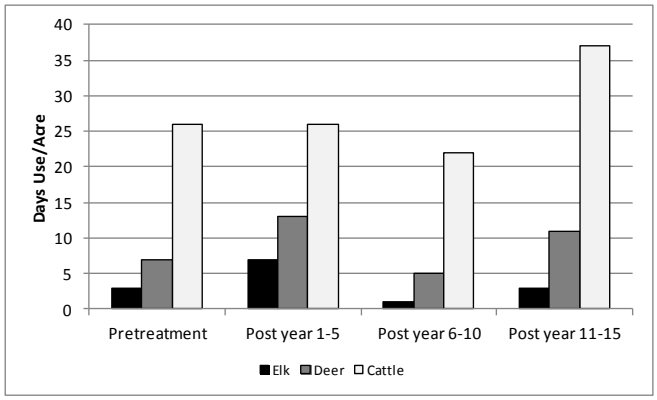
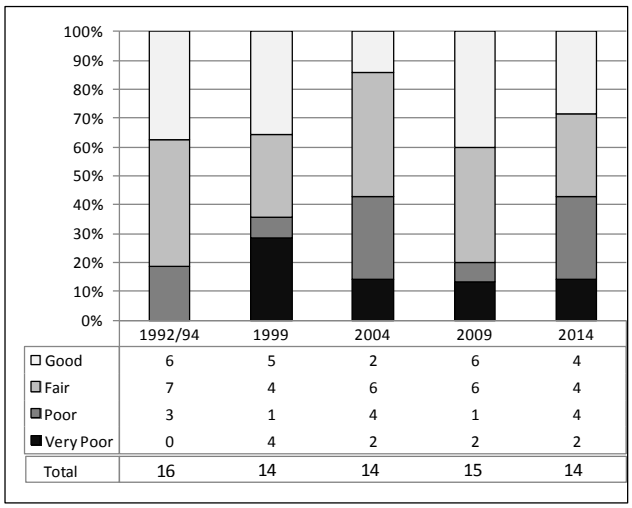


Figure 2.42: Mean pellet transect data for the Wildfire disturbance studies (n=1) for WMU 14, San Juan.

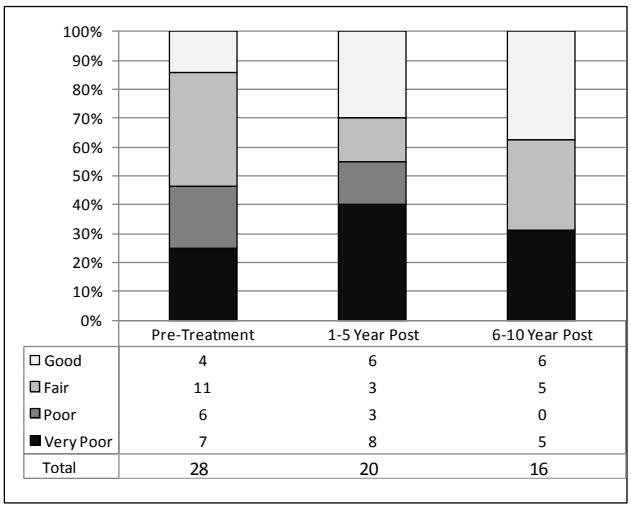
Deer Winter Range Condition Assessment

The condition of deer winter range within the San Juan management unit has fluctuated on the study sites sampled since 1992/94. The majority of the sites sampled within the unit are considered to be in good to poor condition based on the most current sample data. The sites classified as being in poor or very poor condition are sites with decreasing or little amounts of sagebrush and little to no recruitment of young sagebrush plants to the community (Figure 2.43 and Figure 2.44). The condition of disturbed and treated sites typically improves with increased time after treatment or disturbance. The majority of disturbed or treated study sites that ranked as being in poor or very poor condition 6-10 years after disturbance are sagebrush improvement and pinyon-juniper reduction projects. These study sites are generally still lacking in available browse species (Map 2.7 and Table 2.8).



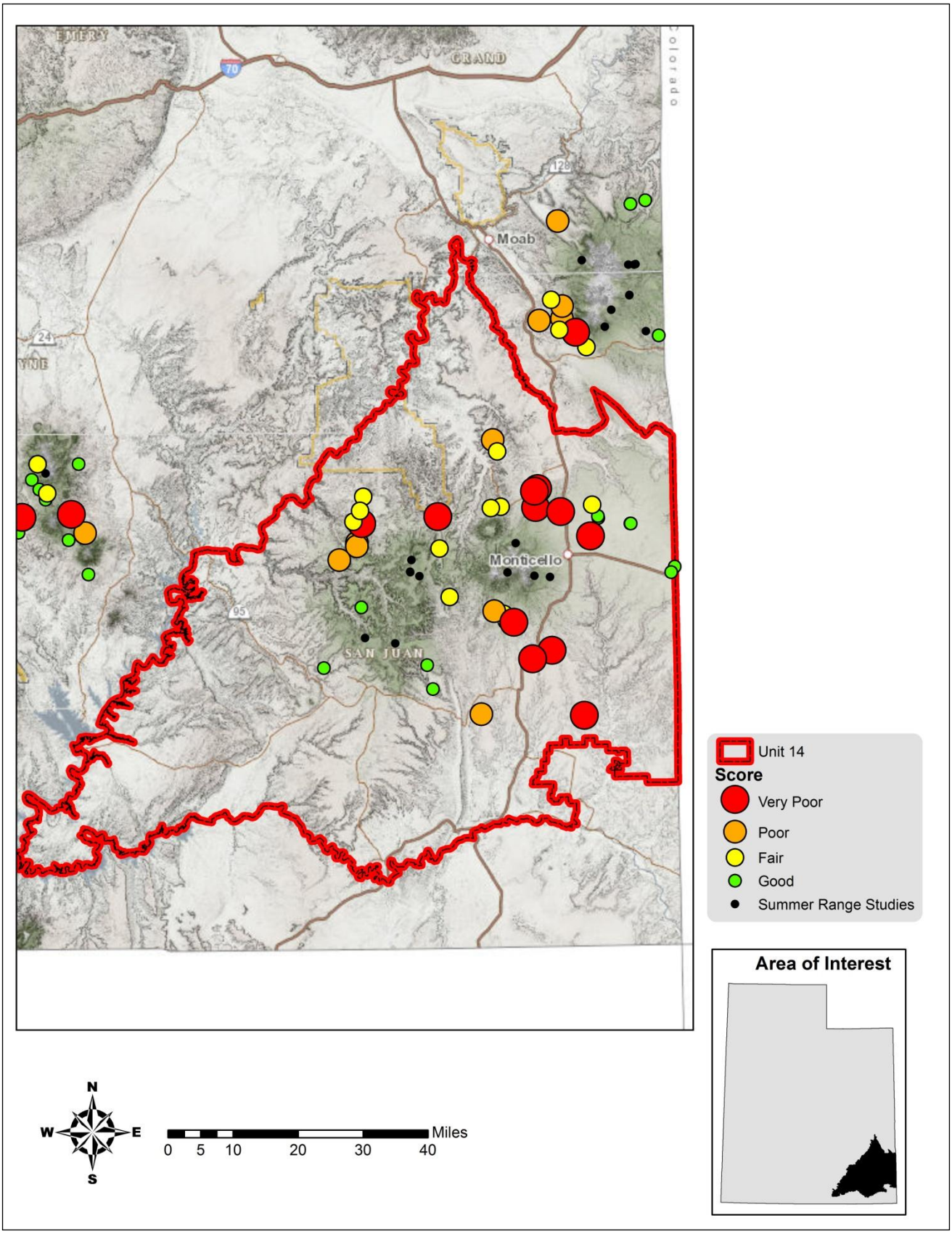
	1992/94	1999	2004	2009	2014
Good	6	5	2	6	4
Fair	7	4	6	6	4
Poor	3	1	4	1	4
Very Poor	0	4	2	2	2
Total	16	14	14	15	14

Figure 2.43: Deer winter range Desirable Components Index (DCI) summary by year of undisturbed sites for WMU 14, San Juan.



	Pre-Treatment	1-5 Year Post	6-10 Year Post
Good	4	6	6
Fair	11	3	5
Poor	6	3	0
Very Poor	7	8	5
Total	28	20	16

Figure 2.44: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 14, San Juan.



Map 2.7: Deer winter range Desirable Components Index (DCI) ranking distribution by study site of most current sample date as of 2014 for WMU 14, San Juan.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
14-1	Alkali Point	Loss of Sagebrush	High	Reduced browse
14-2	Brushy Basin	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14-5	Jackson Ridge	Conifer Encroachment	Moderate	Reduced Aspen and herbaceous vigor
14-6	Harts Draw Reservoir	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species
14-8	Peters Point	PJ Encroachment/ Introduced Perennial Grass	Moderate	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-9	Harts Draw	Loss of Sagebrush	Low	Reduced browse
14-10	Harts Point	Loss of Sagebrush	Low	Reduced browse
14-11	Shay Mesa	Annual Grass	Low	Increased fire potential
14-12	Shingle Mill	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor
14-13	Black Mesa	Loss of Sagebrush	High	Reduced browse
14-19	Woodenshoe	None Identified		
14-20	Gooseberry	None Identified		
14-22	Wild Cow Point	PJ Encroachment/ Introduced Perennial Grass	Moderate	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-23	South Plain	Loss of Sagebrush	High	Reduced browse
14-24	Ruin Park	Loss of Sagebrush	High	Reduced browse
14-27	Mormon Pasture Point	PJ Encroachment/ Introduced Perennial Grass	Moderate	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-29	Salt Creek Mesa	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor
14-30	Milk Ranch Point	PJ Encroachment/ Introduced Perennial Grass	Low	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-31	Chippean Ridge	PJ Encroachment/ Introduced Perennial Grass	Low	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-32	Lower Deer Flat	PJ Encroachment/ Introduced Perennial Grass	Moderate	Reduced understory shrub, herbaceous vigor, and diversity of desirable grass and forb species
14-34	Big Flat	None Identified		
14-35	Dickson Gulch	None Identified		
14-36	Dry Mesa	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14-37	Kigalia Point II	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14-38	Arch Canyon	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
14R-6	Dugout (Hart Draw)	Loss of Sagebrush	Low	Reduced browse
14R-7	Adams CE Harrow	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14R-8	Adams CE Control	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14R-9	Hart Draw Flat 1	Annual Grass	Low	Increased fire potential
14R-10	Hart Draw Flat 2	Annual Weeds	High	Reduced diversity of desirable grass and forb species
14R-11	Harts Windmill	Annual Weeds	High	Reduced diversity of desirable grass and forb species
14R-13	Bell Draw Dixie	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species
14R-14	Sitla Dixie	Reduced Understory	High	Reduced diversity of desirable grass and forb species
14R-15	Sitla Dixie 2	Reduced Understory	High	Reduced diversity of desirable grass and forb species
14R-16	Harvey John Mesa	Reduced Understory	High	Reduced diversity of desirable grass and forb species
14R-17	Stateline South	Annual Grass	Low	Increased fire potential
14R-18	Stateline North	Annual Grass	Low	Increased fire potential
14R-19	Peter's Canyon	P-J Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
14R-20	Johnson Creek	Annual Grass	Low	Increased fire potential
14R-21	Shay Mesa Bullhog	P-J Encroachment	Low	Reduced understory shrub and herbaceous vigor
14R-25	Peters Point BLM	P-J Encroachment	Moderate	Reduced understory shrub and herbaceous vigor
14R-27	Seep Creek	Annual Weeds	High	Reduced diversity of desirable grass and forb species
14R-28	Johnson Creek 2	P-J Encroachment	High	Reduced understory shrub and herbaceous vigor
14R-29	South Plain 2	Loss of Sagebrush	High	Reduced browse
14R-30	North Plain	Loss of Sagebrush	High	Reduced browse
14R-31	Dark Canyon	P-J Encroachment	High	Reduced understory shrub and herbaceous vigor
14R-33	Sego Spring 1	Conifer Encroachment	Moderate	Reduced Aspen and herbaceous vigor
14R-34	Sego Spring 2	Conifer Encroachment	Moderate	Reduced Aspen and herbaceous vigor
14R-35	Blanding East	P-J Encroachment	High	Reduced understory shrub and herbaceous vigor
14R-36	Mustang Mesa	P-J Encroachment	High	Reduced understory shrub and herbaceous vigor
14R-37	Lower Wild Cow Point	P-J Encroachment	High	Reduced understory shrub and herbaceous vigor

Table 2.8: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 14, San Juan. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

High Mountain (Aspen)

The higher elevation mountain sites that support aspen communities are generally considered to be in good condition for deer summer habitat on the San Juan management unit. These communities support good herbaceous understory that provides valuable forage in summer months. While in generally good condition, these sites appear to be prone to encroachment from conifer trees. In addition, introduced perennial grasses can dominant herbaceous component on these study sites. While providing valuable forage, these grass species can often be aggressive at higher elevation and precipitation and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that work to reduce conifer encroachment (e.g. logging, fire, etc.) should continue in these communities. When 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.

High Mountain (Browse) and Mountain (Browse/Oak)

The higher elevation mountain sites that support mountain browse communities are generally considered to be in good condition for deer winter range habitat on the unit. These communities support robust shrub populations that provide valuable browse in mild and moderate winters and yearlong use. While generally in good condition, these sites appear to be prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous prevalence if not addressed. In addition, introduced perennial grasses are often the dominant herbaceous component on these study sites. While providing valuable forage, these grass species can often be aggressive at higher elevation and precipitation and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities. When 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 (Mountain Big Sagebrush)

The higher elevation mountain sites that support mountain big sagebrush communities are generally considered to be in good condition for deer summer range habitat on the unit. These communities support good herbaceous understory that provides valuable forage in summer months. Introduced perennial grasses are often the dominant herbaceous component on these study sites. While providing valuable forage, these grass species can often be aggressive at higher elevation and precipitation and can reduce the prevalence and abundance of other more desirable native grass and forb species.

Although pinyon-juniper were not sampled, it is recommended that work to monitor and reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) where necessary should continue in these communities. When 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 (Ponderosa Pine)

The higher elevation mountain sites that support ponderosa pine communities are generally considered to be in good condition for deer summer range habitat on the unit. These communities support a good herbaceous understory that provides valuable forage in summer months. Introduced perennial grasses are often the dominant herbaceous component on these study sites. While providing valuable forage, these grass species can often be aggressive at higher elevation and precipitation and can reduce the prevalence and abundance of other more desirable native grass and forb species.

It is recommended that work to maintain healthy ponderosa communities continue. When reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible.

Upland (Mountain Big Sagebrush)

The mid elevation upland mountain big sagebrush communities are generally considered to be in fair to poor condition for deer winter range habitat on the unit. These communities support moderate to low shrub populations that provide valuable browse in moderate to severe winters. Drought has affected these areas and continued drought could have a further negative impact on the remaining shrubs communities. These communities are also prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous health if not addressed. Annual grass, primarily cheatgrass, can also be an issue within these communities. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire within these communities. If wildfire occurs within these communities, they lose most of their value as deer winter range as reestablishment of valuable browse species is typically slow.

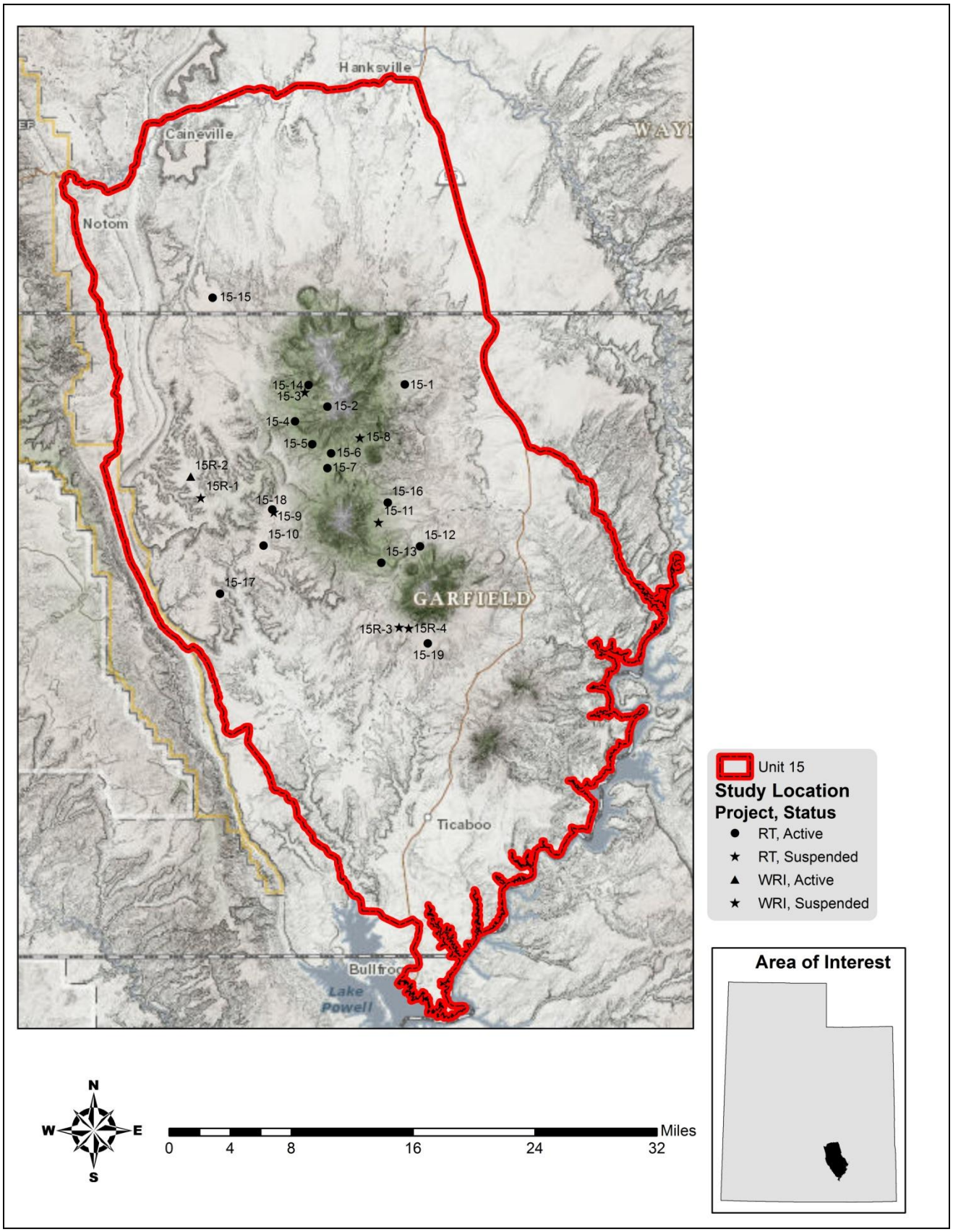
It is recommended that work to reduce pinyon-juniper encroachment should continue in these communities. Care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. Work to diminish fuel loads and create fire breaks should continue in order to reduce the threat of catastrophic fire.

Semidesert (Wyoming Big Sagebrush)

The lower elevation semidesert Wyoming big sagebrush communities that have not been disturbed are generally considered to be in poor condition for deer winter range habitat on the unit. These communities support depleted shrub populations that provide minimal browse in moderate to severe winters. These communities have seen decreases in sagebrush abundance since 1994 with a large decrease from 1994 to 1999. Drought has affected these areas and continued drought could further have a negative impact on the remaining shrubs communities. These communities are susceptible to invasion from annual grass, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire within these communities. Encroachment from pinyon-juniper trees is generally slow and is not typically an issue within these communities. If wildfire occurs within these communities, they lose most of their value as deer winter range as reestablishment of valuable browse species is typically slow.

If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. It is recommended that work to diminish fuel loads and create fire breaks should continue within these communities in order to reduce the threat of catastrophic fire. Treatments to establish and increase browse species more rapidly following wildfire should also be implemented, and treatments to increase browse species on historic fires should be considered.

3. WILDLIFE MANAGEMENT UNIT 15 – HENRY MOUNTAINS



WILDLIFE MANAGEMENT UNIT 15 – HENRY MOUNTAINS

Boundary Description

> **Garfield, Kane and Wayne counties**—Boundary begins on SR-95 at a point two miles south of Hanksville; south on SR-95 to Lake Powell; south along the west shore of Lake Powell to SR-276 at Bullfrog; north on SR-276 to the Notom road; north on this road to a point two miles south of SR-24; east along a line that is two miles south of SR-24 to SR-95. It excludes Capitol Reef National Park.

Management Unit Description

Geography

The Henry Mountains lie between the Waterpocket Fold on the west, the canyon of the Colorado River and Lake Powell to the southeast, and the Fremont and Dirty Devil Rivers to the north and northeast. The mountain peaks are the result of vertical intrusives of igneous rock that have penetrated from a broad basin into the sedimentary strata (Stokes, 1986). The majority of the mountain rises gently upward to these peaks; which are (from north to south) Mt. Ellen (11,615 feet), Mt. Pennell (11,371 feet), Mt. Hillars (10,650 feet), Mt. Holmes (7,930 feet), and Mt. Ellsworth (8,235 feet). From the base of the peaks, gentle slopes extend out into the flat mesas and rough desert canyon lands that constitute the majority of the unit's land area. Towns in this area include Hanksville, Notom, and Ticaboo.

The Glen Canyon Dam on the Colorado River in Arizona created Lake Powell, which stretches northeast into Utah and makes up the southeastern border of this unit. The south flowing stream systems that drain the Henry Mountains run into Lake Powell while the streams to the north flow into the Fremont River and to the east into the Dirty Devil River.

Climate Data

The 30 year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 7 inches along the Colorado River to 41 inches on the peaks of the Henry Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within 8-40 inches of precipitation (Table 3.1).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the South Central division (Division 4) and Southeast division (Division 7). The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed years of moderate to extreme wet years from 1982-1985, 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, 2002-2004, and 2013; and displayed years of moderate to extreme wet years in 1982-1985, 1993, 1995, 1999, 2001, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009 and 2012; and displayed years of moderate to extreme wet years in 1982-1985, 1997-1998, 2008 and 2011 (Figure 3.1b)

The mean annual PDSI of the Southeast division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, 2009, and 2012. The mean annual PDSI displayed years of moderate to extreme wet years from 1983-1985 and 2005 (Figure 3.2a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1991, 1996, 2002-2004, and 2012-2013; and displayed years of moderate to extreme wet years in 1983-1985, 1993, and 2005. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2009 and 2012; and displayed years of moderate to extreme wet years in 1983-1985, 1997, and 2011 (Figure 3.2b) (Time Series Data, 2015).

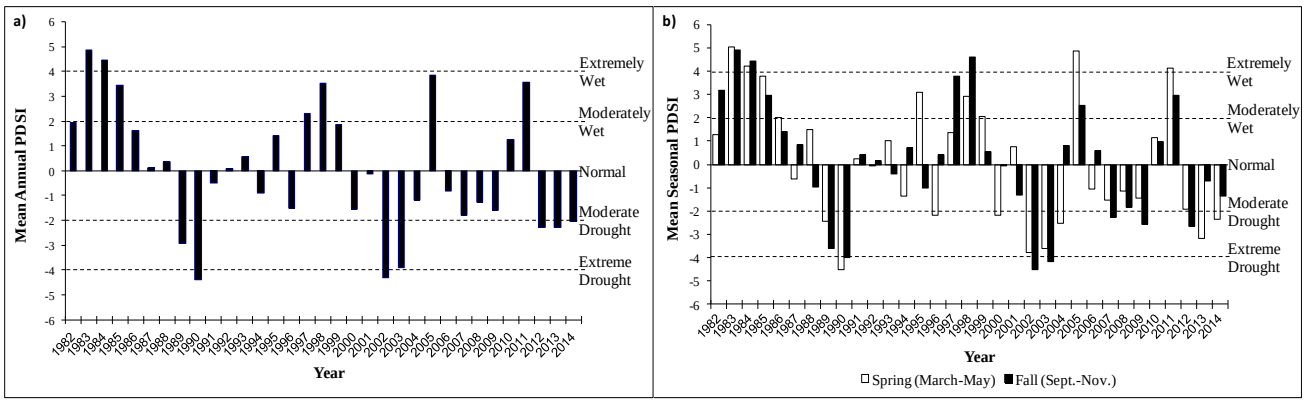


Figure 3.1: The 1982-2014 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).

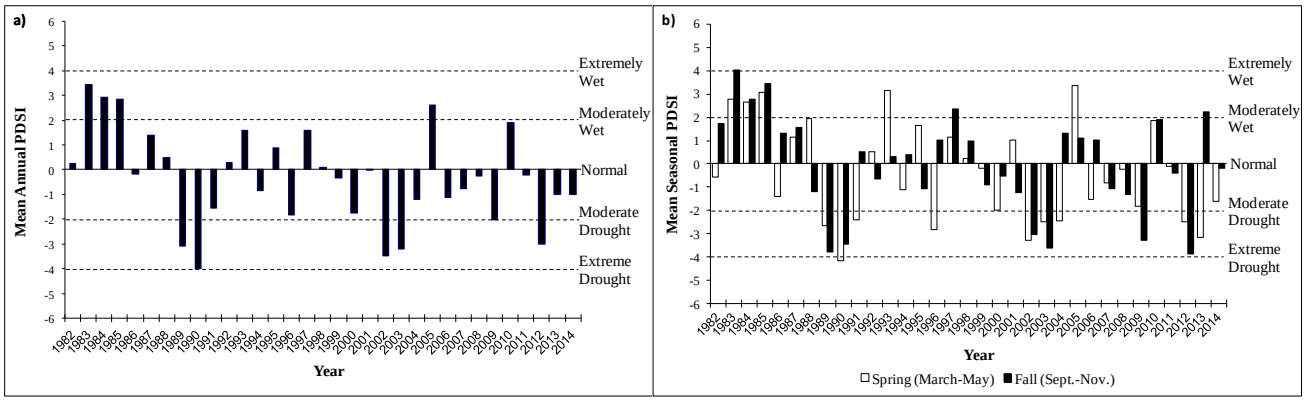
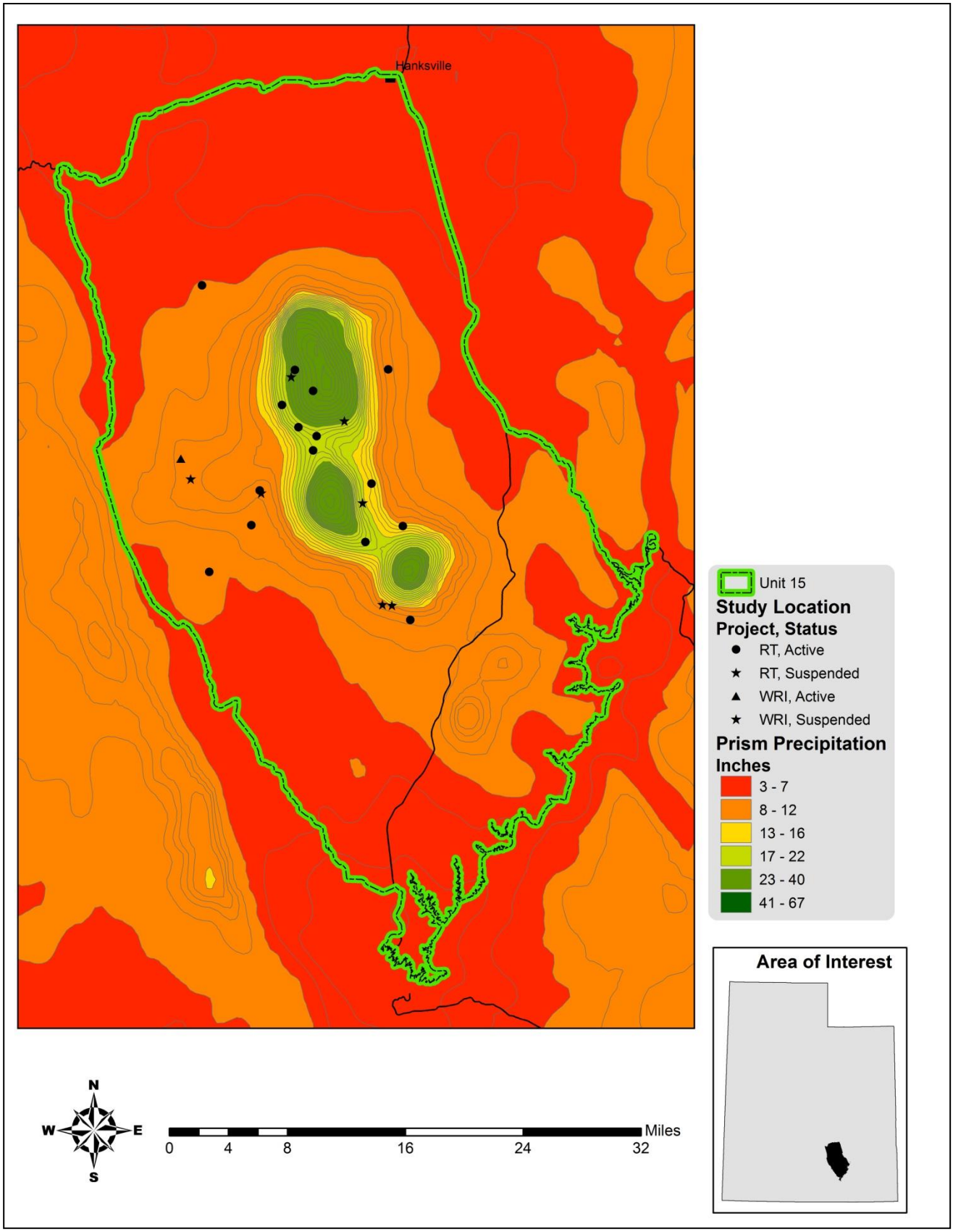


Figure 3.2: The 1982-2014 Palmer Drought Severity Index (PDSI) for the Southeast division (Division 7). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).



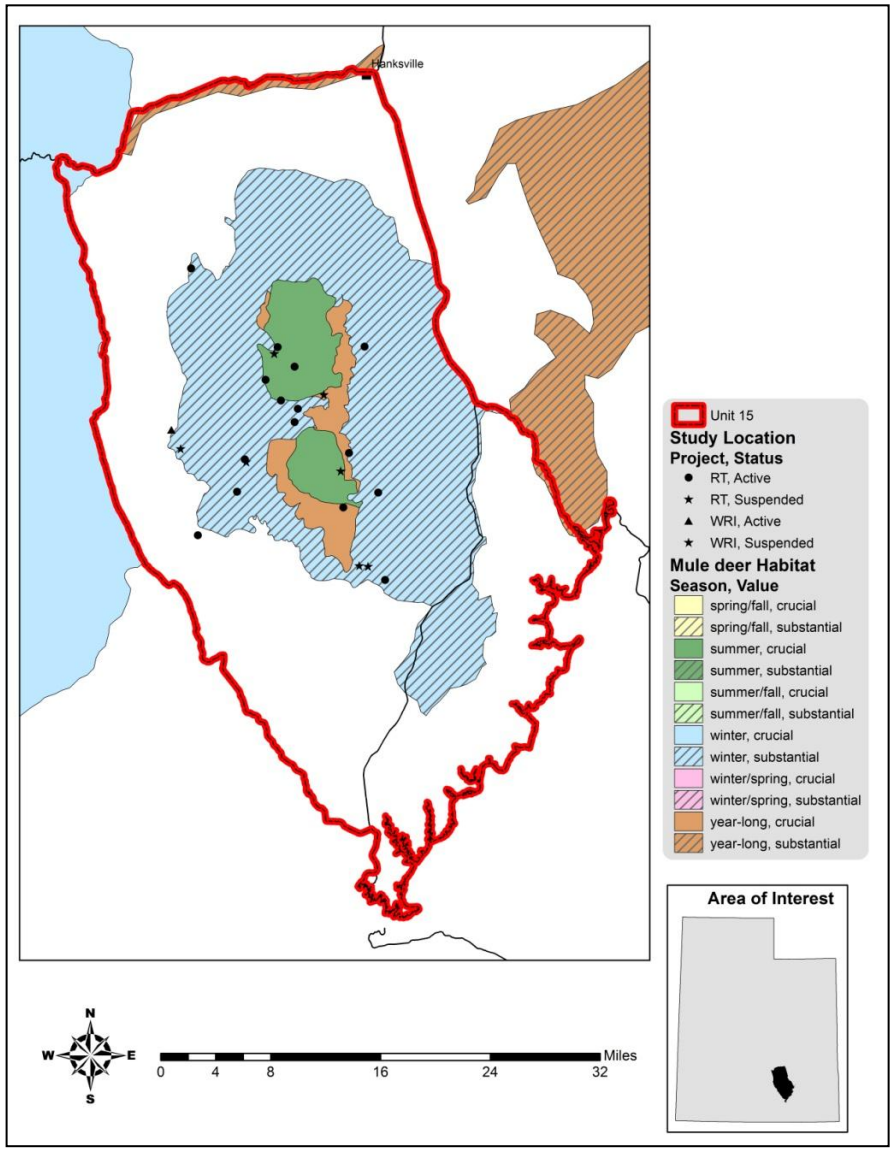
Map 3.1: The 1981-2010 PRISM Precipitation Model for WMU 15, Henry Mountains (PRISM Climate Group, Oregon State University).

Big Game Habitat

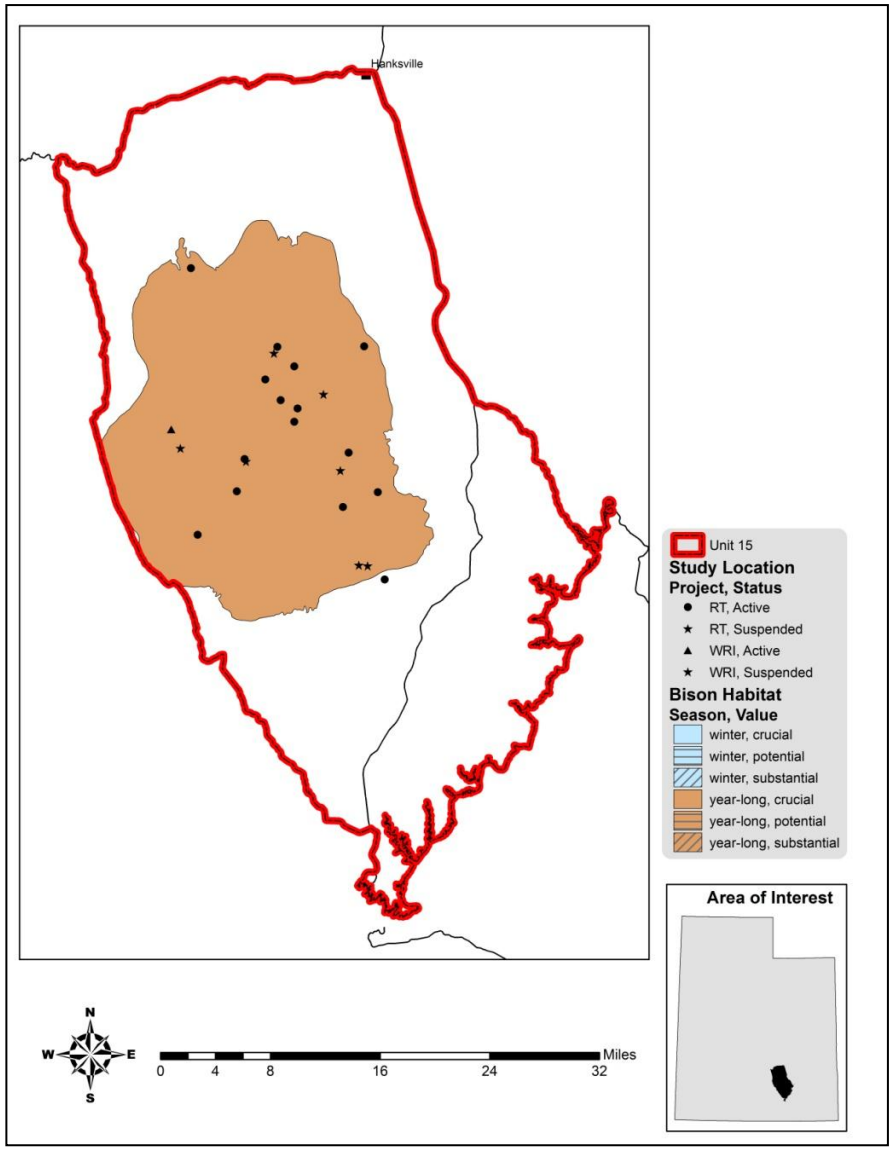
Total mule deer range in the wildlife management unit is estimated at 373,833 acres with 34,517 acres classified as year-long range, 301,051 acres of this classified as winter range, and 38,265 acres classified as summer range (Table 3.2 and Map 3.2). Total bison range is estimated at 301,472 acres with all of it being classified as year-long range (Table 3.3 and Map 3.1). There is a substantial amount of winter range for deer but a considerably lower amount of year-long and summer range (Table 3.1). The majority of the big game winter range in this unit is located on BLM managed lands. Minor portions of the winter range occur on Utah State School Trust Lands, and private holdings.

According to Landfire Existing Vegetation Coverage models, shrublands comprise almost 47% of the unit. Over half of the shrubland consists of the blackbrush (*Coleogyne ramosissima*) shrub alliance, which is a key browse species for mule deer. Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodlands make up 13% of this unit while annual grassland cover is less than 1% making it a minimal threat to habitat loss. Other coverage types are about one third of the unit (Table 3.4).

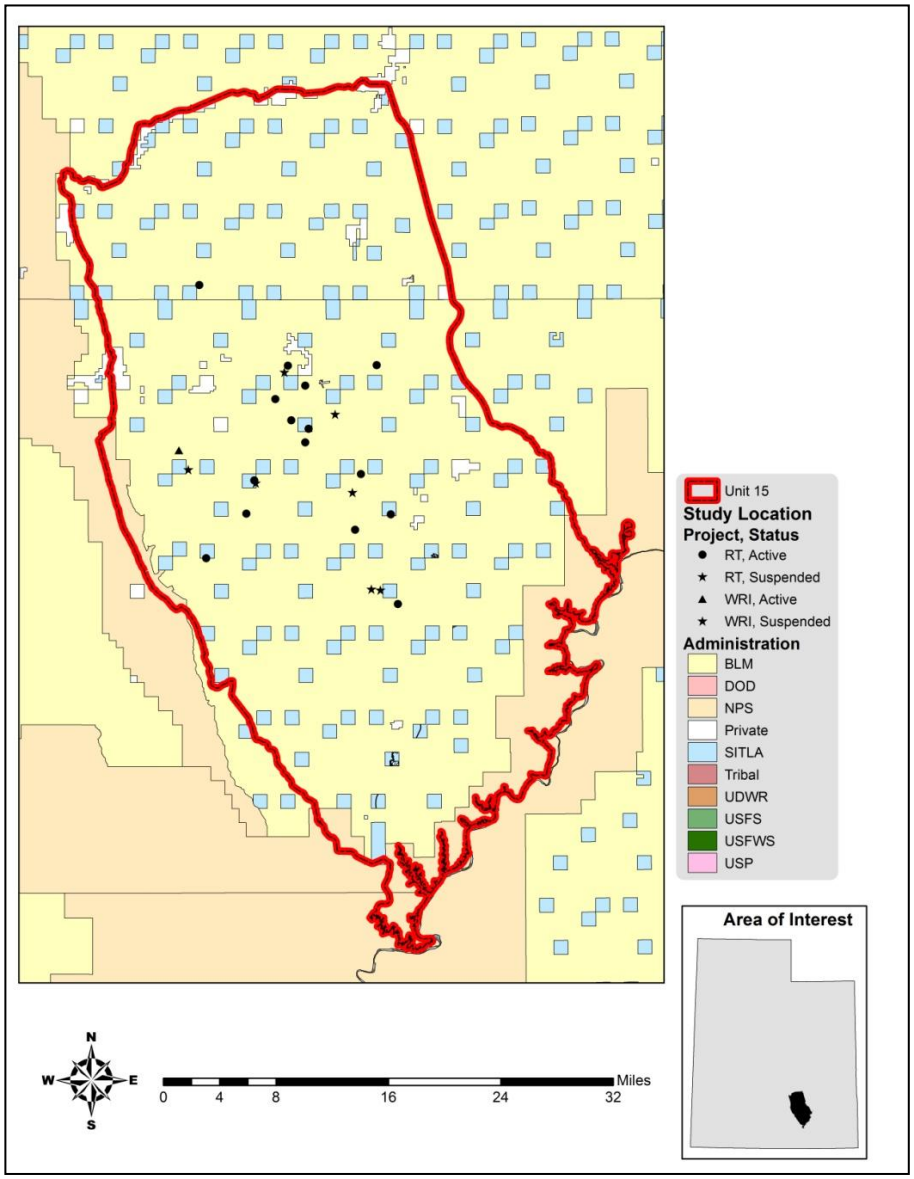
The key areas in this unit are associated primarily with the pinyon-juniper chaining and re-vegetation treatments. The exceptions are other areas that are frequently used by bison and mule deer. The following areas are considered to be crucial deer winter habitat: Crescent Creek, Birch Spring, Cave Flat, Quaking Aspen Spring, Dugout Creek, and Coyote Creek. The Bullfrog Creek area is considered crucial deer spring/fall/ summer habitat and Airplane Spring is considered crucial year round deer habitat. The Mud Spring area is considered to be crucial year round habitat for both bison and deer. The Steven's Mesa and Swap Mesa areas sample desert shrub communities that are considered to be crucial year-long habitat for bison and crucial winter habitat for deer. The Nasty Flat area is considered to be crucial year-long bison habitat and crucial deer summer habitat.



Map 3.2: Estimated mule deer habitat by season and value for WMU 15, Henry Mountains.



Map 3.3: Estimated bison habitat by season and value for WMU 15, Henry Mountains.



Map 3.4: Land ownership for WMU 15, Henry Mountains.

	Year Long Range		Summer Range		Winter Range	
	Area (acres)	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*
Mule Deer	34,517	9%	38,265	10%	301,051	81%
Bison	301,472	100%	0	0%	0	0%

Table 3.1: Estimated mule deer and elk habitat acreage by season for WMU 15, Henry Mountains.

	Year Long Range		Summer Range		Winter Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*
BLM	26,714	77%	32,507	85%	263,516	88%
NPS	926	3%	0	0%	15	<1%
Private	3,848	11%	1,362	4%	6,492	2%
SITLA	3,029	9%	4,396	11%	31,001	10%
UDOT	0	0%	0	0%	27	<1%
Total	34,517	**100%**	38,265	**100%**	301,051	**100%**

Table 3.2: Estimated mule deer habitat acreage by season and ownership for WMU 15, Henry Mountains.

	Year Long Range	
Ownership	*Area (acres)*	*%*
BLM	258,627	86%
NPS	7,361	2%
Private	3,694	1%
SITLA	31,789	11%
Total	301,472	**100%**

Table 3.3: Estimated bison habitat acreage by season and ownership for WMU 15, Henry Mountains.

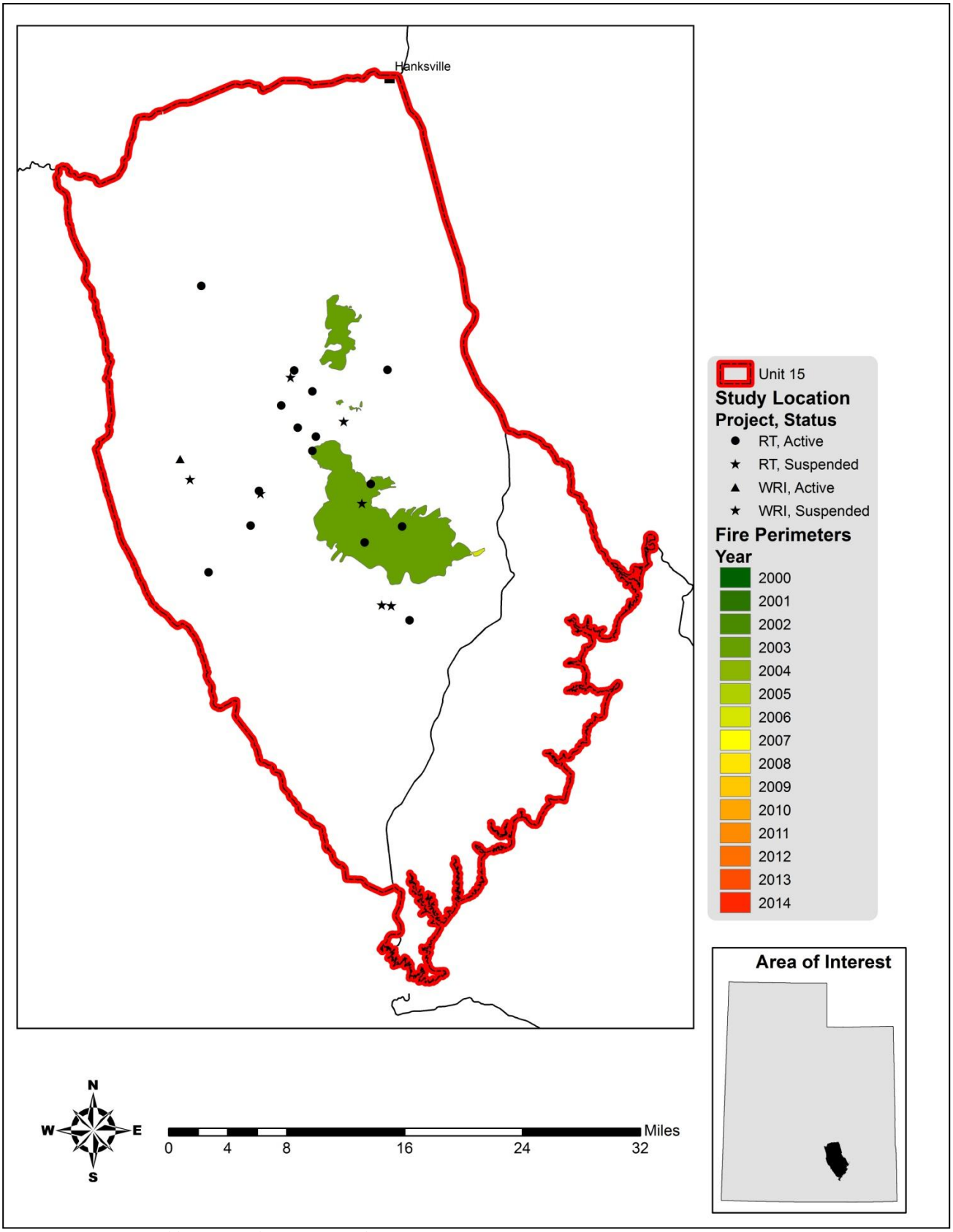
Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Shrubland	Coleogyne ramosissima Shrubland Alliance	234,690	27.24%	
	Colorado Plateau Blackbrush-Mormon-tea Shrubland	10,767	1.25%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	1,351	0.16%	
	Inter-Mountain Basins Big Sagebrush Shrubland	18,902	2.19%	
	Inter-Mountain Basins Greasewood Flat	3,622	0.42%	
	Inter-Mountain Basins Mat Saltbush Shrubland	46,161	5.36%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	50,176	5.82%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	9,192	1.07%	
	Southern Colorado Plateau Sand Shrubland	24,740	2.87%	
	Other Shrublands	1,453	0.17%	46.55%
Conifer	Colorado Plateau Pinyon-Juniper Woodland	109,246	12.68%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,197	0.14%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	1,330	0.15%	
	Southern Rocky Mountain Ponderosa Pine Woodland	7,375	0.86%	
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	724	0.08%	
	Other Conifer	1,223	0.14%	14.06%
Grassland	Native Grassland	32,109	3.73%	3.73%
Exotic Herbaceous	Introduced Upland Vegetation-Annual Grassland	4,373	0.51%	0.51%
Exotic Tree-Shrub	Introduced Riparian Shrubland/Woodland	16,666	1.93%	1.93%
Other	Hardwood	2,920	0.34%	
	Riparian	6,344	0.74%	
	Agricultural	1,141	0.13%	
	Developed	4,730	0.55%	
	Other	271,091	31.47%	33.22%
Total		861,523		

Table 3.4**:** LANDFIRE existing vegetation coverage ((LANDFIRE: LANDFIRE 1.3.0, 2014)) for WMU 15, Henry Mountains.

Limiting Factors to Big Game Habitat

Habitat quality and quantity are the main limiting factors of this subunit. Continual monitoring of range conditions and big game use will help to maintain and improve habitat. Additionally, preserving and protecting existing crucial big game ranges by seeking cooperative projects with federal land management agencies and private landowners in carrying out habitat improvements. Such projects could include reseedings, controlled burns, water developments, tree removal, etc. Other measures could include planning and evaluating resource use and developments that might affect habitat quality; develop specific vegetative objectives to maintain the quality of important deer use areas; work toward long-term habitat protection and preservation through the use of agreements with land management agencies and local governments; and through the use of conservation easements, etc. on private lands. Deer fences and crossings limiting range is always a concern but cooperation with the Utah Department of Transportation in construction of highway fences, passage structures, warning signs, etc. will continue in order to ensure proper access to habitat as well as deer and human safety.

Wildfire has had a moderate impact on the deer winter range in the unit. Few fires have occurred, but the ones that have are large fires. The Bulldog fire of 2003 was the largest wildfire in the unit at 31,753 acres followed by the Lonesome Beaver fire of 2003 at 4,555 acres. The Lonesome Beaver fire occurred mainly on deer summer range and bison year-long range while the Bulldog fire occurred on deer summer and winter range, and bison year-long range (Map 3.5).

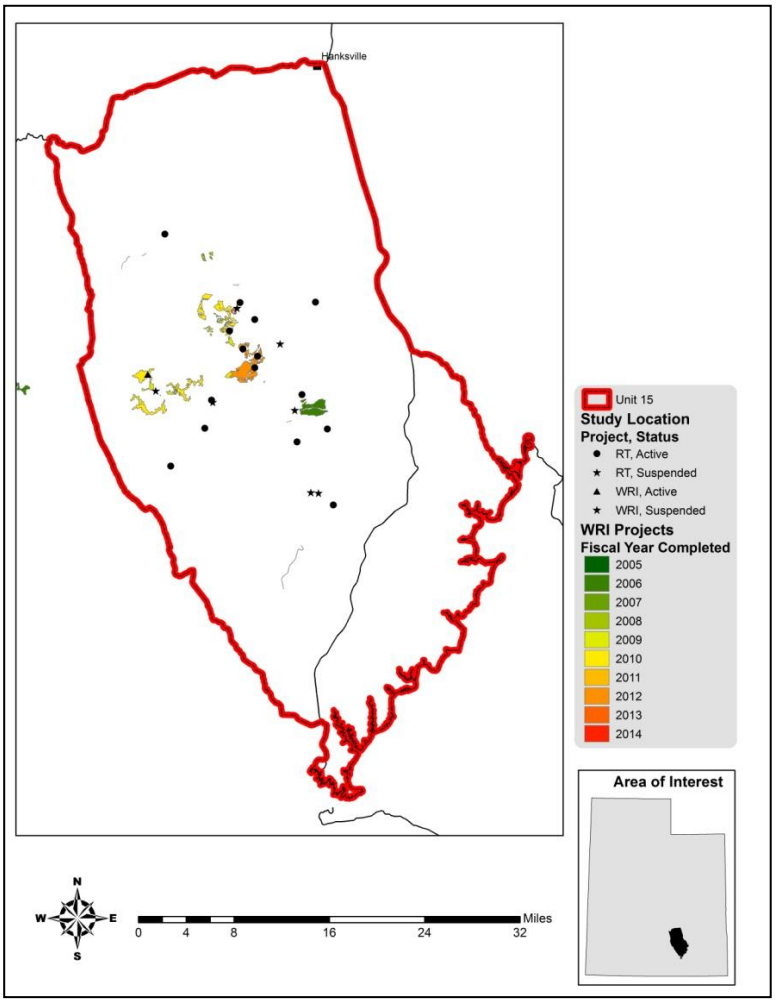


Map 3.5: Land coverage of fires by year from 2001-2014 for WMU 15, Henry Mountains.

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 6,613 acres of land have been treated within the Henry Mountains unit since the WRI was implemented in 2004 (Map 3.6). Treatments frequently overlap one another bringing the total treatment acres to 9,199 acres for this unit (Table 3.5). Other treatments have occurred outside of the WRI through independent agencies and landowners, but the WRI comprises the majority of work done on deer winter ranges throughout the State of Utah.

Treatments to reduce pinyon-juniper woodlands such as vegetation removal/hand crew are common management practices on this unit. In addition, many of these treatments have been seeded to increase more desirable plant species (Table 3.5).



Map 3.6: WRI treatments by fiscal year completed for WMU 15, Henry Mountains.

Treatment Action	Acres
Chain Harrow	174
Seeding (primary)	3,496
Vegetation removal / hand crew	5,529
***Total Land Area Treated**	**6,613**
Total Treatment Acres	**9,199**

Table 3.5: WRI treatment action size (acres) for WMU 15, Henry Mountains.

*Does not include overlapping treatments.

Range Trend Studies

Range Trend studies have been sampled within WMU 15 on a regular basis since 1987, with studies being added or suspended as was deemed necessary (Table 3.6). Due to changes in sampling methodologies, only data sampled following the 1992 sample year are included in this summary. Monitoring studies of WRI projects have been sampled since 2005. 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 3.7).

Range Trend studies that have not had a recent disturbance or treatment are summarized in this report by ecological site or potential. Range Trend and WRI studies that have a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
15-1	Eagle Bench	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Gravelly Loam (Wyoming Big Sagebrush)
15-2	Nasty Flat	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	High Mountain Stony Loam (Aspen)
15-3	Dugout	RT	Suspended	‘87, ‘94, ‘99	Not Verified
15-4	South Creek Chaining	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Stony Loam (Mountain Big Sagebrush)
15-5	Bates Knob	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
15-6	Box Springs Chaining	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Pinyon-Utah Juniper)
15-7	Airplane Spring	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Black Sagebrush)
15-8	Garden Basin	RT	Suspended	‘87, ‘94, ‘99	Not Verified
15-9	Cave Flat Chaining	RT	Suspended	‘87, ‘94, ‘99, ‘09	Not Verified
15-10	Cave Flat	RT	Active	‘87, ‘94, ‘99, ‘11, ‘14	Semidesert Sandy Loam (Wyoming Big Sagebrush)
15-11	Above Coyote Bench	RT	Suspended	‘87, ‘94, ‘99	Not Verified
15-12	Quaking Aspen Spring	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Black Sagebrush)
15-13	Sidehill Spring	RT	Active	‘87, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush)
15-14	Dugout Creek	RT	Active	‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
15-15	Steven’s Mesa	RT	Active	‘04, ‘09, ‘14	Semidesert Sandy Loam (Four-Wing Saltbush)
15-16	Coyote Spring	RT	Active	‘09, ‘14	Upland Stony Loam (Wyoming Big Sagebrush)
15-17	Swap Mesa	RT	Active	‘09, ‘14	Semidesert Sandy Loam (Fourwing Saltbush)
15-18	Cave Flat Chaining 2	RT	Active	‘14	Semidesert Shallow Sandy Loam (Shadscale)
15-19	Copper Creek	RT	Active	‘14	Semidesert Sandy Loam (Blackbrush)
15R-1	Tarantula Mesa Reference	WRI	Suspended	‘09	Not Verified
15R-2	Tarantula Mesa Lop and Scatter	WRI	Active	‘09,‘12	Semidesert Sandy Loam (Wyoming Big Sagebrush)
15R-3	Indian Springs	WRI	Suspended	‘10	Not Verified
15R-4	Indian Springs Reference	WRI	Suspended	‘10	Not Verified

Table 3.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 15, Henry Mountains.

Study #	Study Name	Type	Disturbance Name (if available)	Date	Size (acres)	WRI Project #
15-1	Eagle Bench	Chain Unknown		1968		
		Seed Unknown		1968		
		Lop and Scatter		1999-2004		
15-4	South Creek Chaining	Chain Unknown	South Creek Pinyon-Juniper Project	1968-1969		
		Seed Unknown	South Creek Pinyon-Juniper Project	1968-1969		
		Lop and Scatter		1999-2004		
		Lop and Scatter	Dugout Flat Lop and Scatter Phase II	Fall 2009	1396	1335
15-5	Bates Knob	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Lop and Scatter	Airplane Springs Fuels Project	Summer 2008	1464	1123
15-6	Box Springs Chaining	Chain Unknown		1984		
		Seed Unknown		1984		
		Lop and Scatter	Airplane Springs Fuels Project	Summer 2008	1464	1123
15-7	Airplane Spring	Chain Unknown		Mid 1960's		
		Seed Unknown		Mid 1960's		
		Lop and Scatter	Airplane Springs Fuels Project	Summer 2008	1464	1123
15-9	Cave Flat Chaining	Chain Unknown		Fall 1983		
		Seed Unknown		Fall 1983		
15-12	Quaking Aspen Spring	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Wildfire	Bulldog	2003	31754	
		Chain Unknown		2003		
		Aerial		2003	2200	
		Dribbler		2003	900	
15-13	Sidehill Spring	Wildfire	Bulldog	2003	31754	
		Chain Unknown		2003		
		Seed Unknown	BLM Bulldog Fire (Non-WSA)	2003	2200	
15-16	Coyote Spring	Wildfire	Bulldog	2003	31754	
		Chain Unknown		2003		
		Seed Unknown	BLM Bulldog Fire (Non-WSA)	2003	2200	
15-17	Swap Mesa	Wildfire		Historic		
15R-2	Tarantula Mesa Lop and Scatter	Chain Unknown		1962-1965		
		Lop and Scatter	Tarantula Mesa Lop and Scatter Phase II	Sept. 2009	1784	1336
15R-3	Indian Springs	Lop and Scatter	Indian Springs Fuels Project			1662

Table 3.7: Range trend and WRI studies known disturbance history for WMU 15, Henry Mountains.

Study Trend Summary (Undisturbed Sites)

High Mountain (Aspen)

There is one study [Nasty Flat (15-2)] classified as High Mountain (Aspen) ecological site that remained undisturbed over the report period (Table 3.6). This study site occurs on the Henry Mountains near McMillan Spring Campground.

Shrubs/Trees: The primary browse specie is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), though it contributes little cover. There are a few other low cover browse species present on the site. Shrub line intercept cover has fluctuated from year to year and overall is low (Figure 3.3a). The average height of sagebrush on this site is one foot making it largely unavailable throughout the winter. Sagebrush demographics show a community of diverse age classes (Figure 3.3b).

Quaking aspen (*Populus tremuloides*) was the dominate tree on this site; Douglas fir (*Pseudotsuga menziesii*) and limber pine (*Pinus flexilis*) were also present. Point quarter data shows that tree density has decreased over the sample years, but that cover remains similar. Cover of limber pine and Douglas fir has increased in cover over the sample years (Figure 3.4).

Herbaceous Understory: This study sites has a fair herbaceous component dominated by perennial grasses and forbs. This site supports some native and introduced grasses with mutton bluegrass (*Poa fendleriana*) being the most abundant grass species. Perennial grass cover has fluctuated over the years but has generally been increasing since 2004. There are no annual grasses found on this site (Figure 3.5).

In addition, a diverse number of perennial forbs provide some cover. Forb cover has remained fairly consistent over the study years with annual forbs contributing less than 1% (Figure 3.5).

Occupancy: Pellet group transect data indicates that deer and cattle/bison primarily use this area and that animal occupancy fluctuates from year to year. In general, deer occupancy is moderate to low and cattle/bison is low (Figure 3.6).

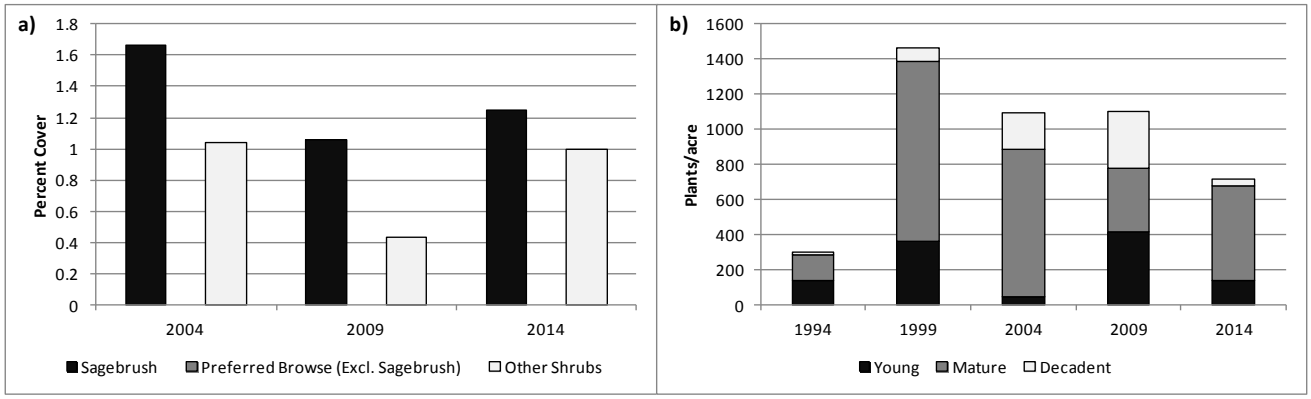


Figure 3.3: Shrub summary of the High Mountain (*Aspen*) study (n=1) for WMU 15, Henry Mountains. a) Line-intercept cover estimate of shrub groups.

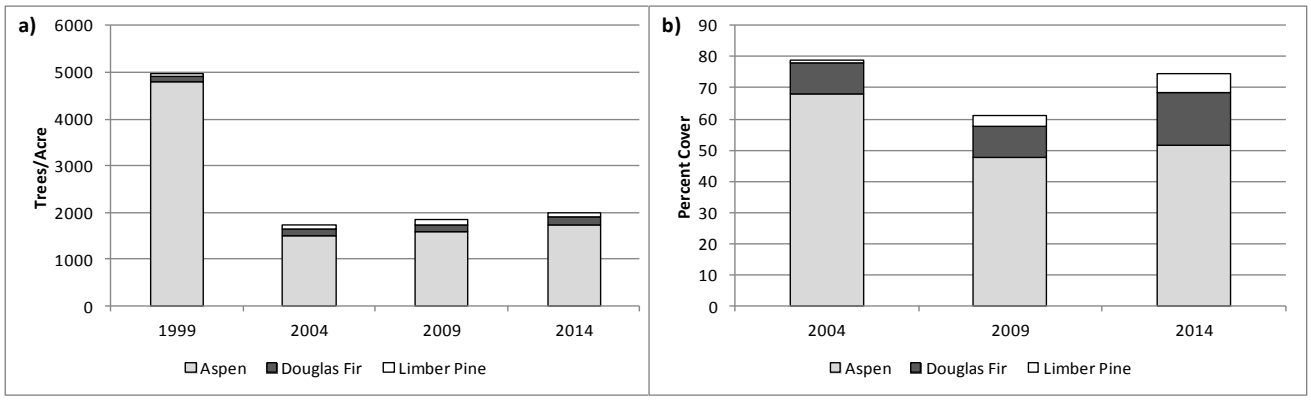


Figure 3.4: Tree summary of the High Mountain (*Aspen*) study (n=1) for WMU 15, Henry Mountains. a) Point-quarter tree density estimates for quaking aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*). b) Line-intercept cover estimate for quaking aspen, Douglas fir, and limber pine.

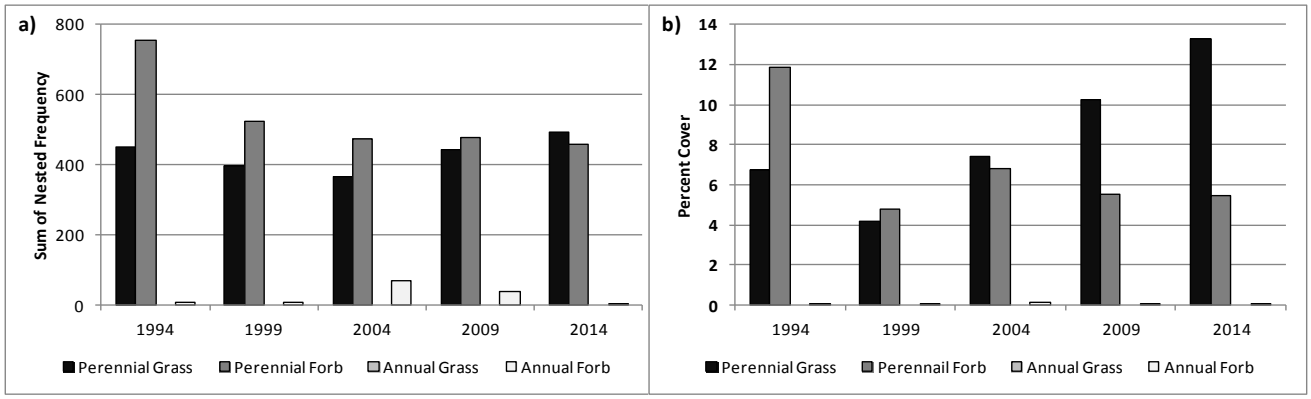


Figure 3.5: Herbaceous functional group summary of the High Mountain (*Aspen*) study (n=1) for WMU 15, Henry Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

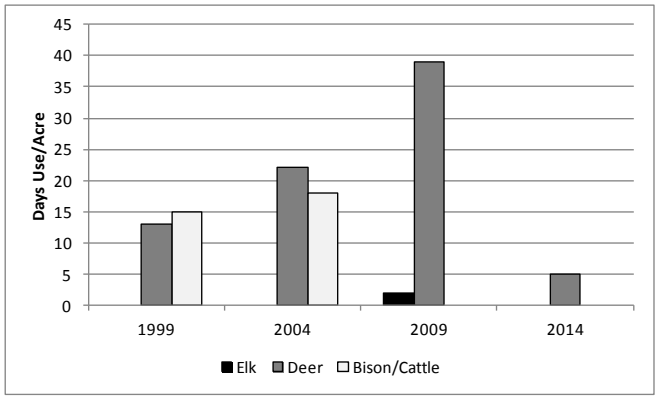


Figure 3.6: Pellet transect data for the High Mountain (*Aspen*) study (n=1) for WMU 15, Henry Mountains.

Mountain (Mountain Big Sagebrush)

There is one study [Dugout Creek (15-14)] classified as an Mountain (Mountain Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 3.6). This study is located on the Henry Mountains near McMillan Spring Campground.

Shrubs/Trees: The primary browse on this study is mountain big sagebrush with black sagebrush (*Artemisia nova*) and Gambel oak (*Quercus gambelii*) also contributing some cover. There are a few other low cover browse species present. The line-intercept cover of sagebrush is good and has remained similar over the sample years (Figure 1.13a). The average height of mountain sagebrush is just over 1.5 feet tall; making it partially available through much of the year in normal winters, while the average black sagebrush height is just under a foot making is mostly unavailable during the winter months. The demographics of the sagebrush population show variation from year to year in age class, with mature plants being dominant. Density also varies from year to year with the highest density occurring in 2009 (Figure 3.13b).

Utah juniper is the main tree species on this site. Other tree species measured on the site include pinyon pine, Douglas fir, and limber pine. Density was measured for the first time in 2014, but cover shows slight increases from year to year (Figure 3.14).

Herbaceous Understory: The herbaceous understory is comprised mainly of native grasses with some introduced ones as well. Perennial grasses fluctuate with slender wheatgrass (*Agropyron trachycaulum*) being the dominant species. Cheatgrass (*Bromus tectorum*) is present on the site and with the exception of 2004, cover remains low (Figure 3.15).

Forbs generally contributed less than 5% cover, though forb species were fairly diverse (Figure 3.15).

Occupancy: Pellet group transect data indicates that elk occupied this area in the past. Currently occupancy by any animals is very low (Figure 3.16).

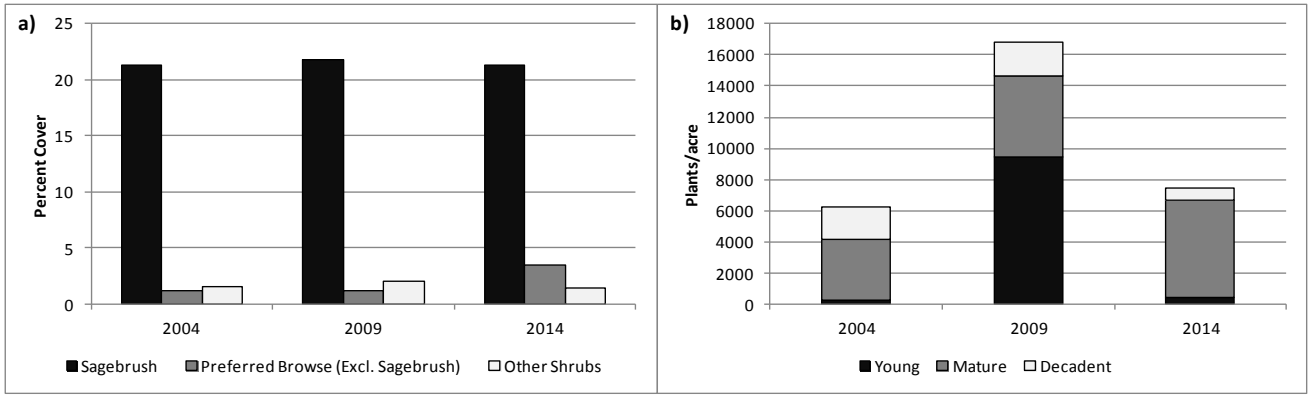


Figure 3.7: Shrub summary of the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

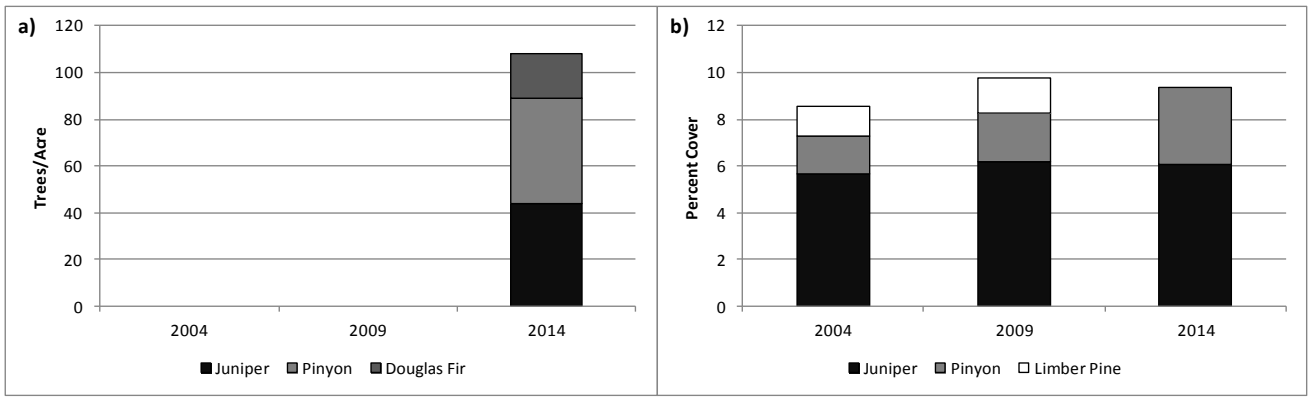


Figure 3.8: Tree summary of the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), and Douglas fir (*Pseudotsuga menziesii*). b) Line-intercept cover estimate for pinyon pine, Utah juniper, and limber pine (*Pinus flexilis*).

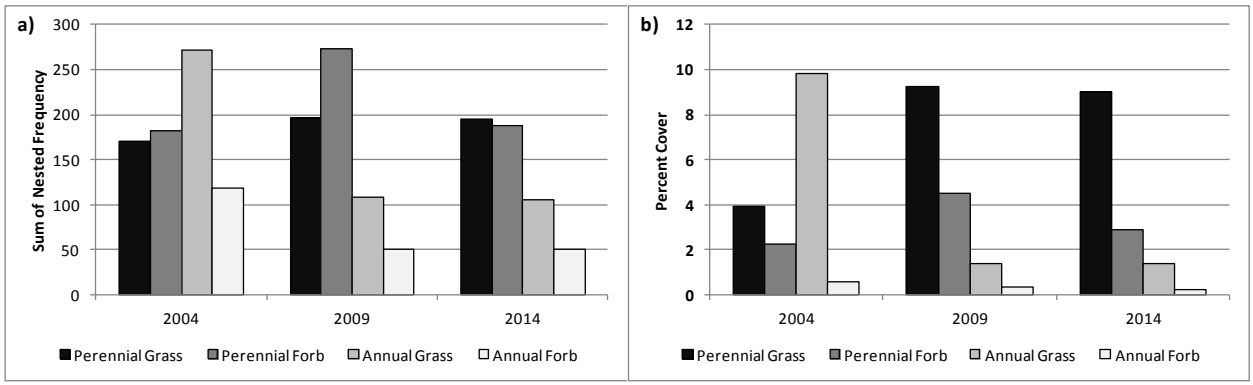


Figure 3.9: Herbaceous functional group summary of the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

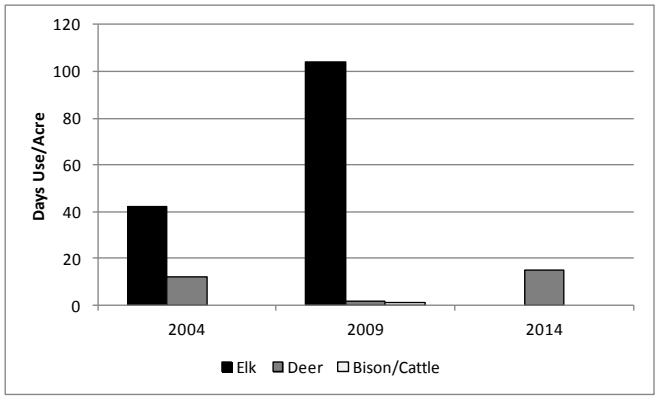


Figure 3.10: Pellet transect data for the Mountain (Mountain Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains.

Semidesert (Wyoming Big Sagebrush)

There is one study [Cave Flat (15-10)] classified as a Semidesert (Wyoming Big Sagebrush) ecological site that remained undisturbed over the report period (Table 3.6). This study is located west of the Henry Mountains near Bullfrog Creek.

Shrubs/Trees: The primary browse on this study is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). There are also other shrubs but they contribute little cover. Line-intercept cover of sagebrush is good on this site and is increasing over time (Figure 3.11a). The average height of Wyoming big sagebrush is around 1.5 feet tall, making browse somewhat available through much of the year in normal winters. The demographics of the sagebrush population have generally been comprised of mature plants with little recruitment of young plants in recent years. There has been a decrease in sagebrush density in 2011 and 2014 (Figure 3.11b).

There were no trees present on this site and are therefore not included in the summary.

Herbaceous Understory: This study site has low herbaceous cover and consists mainly of perennial grasses. Perennial grass cover is almost exclusively made up of native species. Cheatgrass, an annual grass, is present and increases the risk of fire and threatens the resiliency of this site (Figure 3.12).

Perennial and annual forb cover has almost always been less than 1% with the exception of 1999 when annual forb cover was 2 % (Figure 3.12).

Occupancy: Pellet group transect data indicates that deer and bison/cattle occupy this study site. Deer occupancy varies from year to year and bison/cattle occupancy to low to moderate (Figure 3.13).

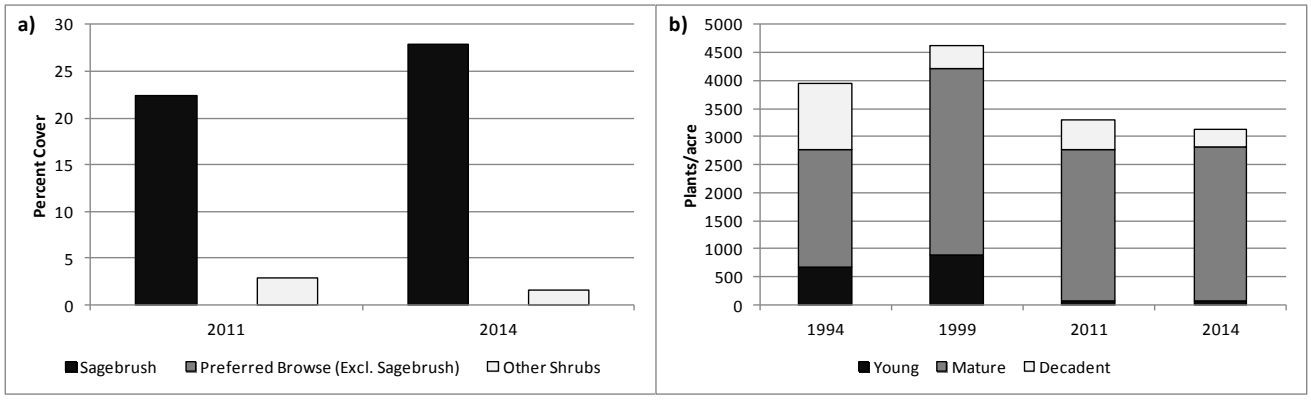


Figure 3.11: Shrub summary of the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

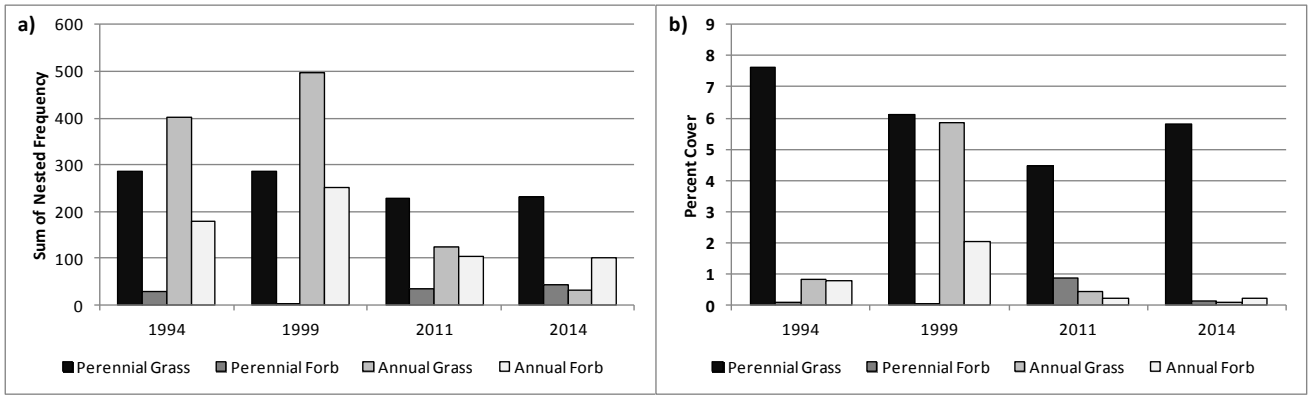


Figure 3.12: Herbaceous functional group summary of the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

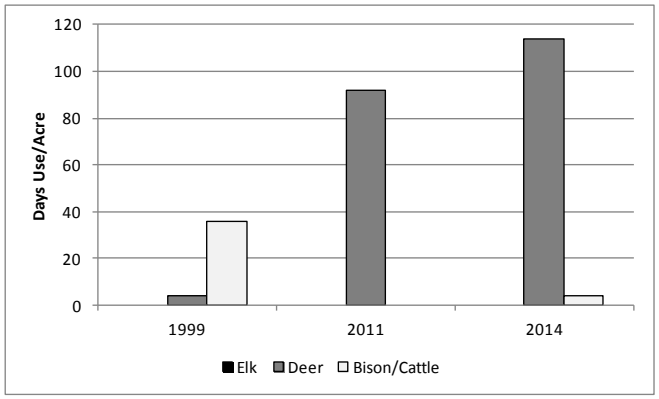


Figure 3.13: Pellet transect data for the Semidesert (Wyoming Big Sagebrush) studies (n=1) for WMU 15, Henry Mountains.

Semidesert (Blackbrush)

There is one study [Copper Creek (15-19)] classified as a Semidesert (Blackbrush) ecological site that remained undisturbed over the report period (Table 3.6). This study is located on the south end of the Henry Mountains.

Shrubs/Trees: The primary browse on this study is blackbrush, which is considered a key browse species for deer. There is also some Wyoming big sagebrush, but it contributes little cover. Line-intercept cover of blackbrush is good on this site (Figure 3.14a). The height of Wyoming big sagebrush is just over 2 feet tall and blackbrush is over 1 foot tall, making browse largely available through much of the year in normal winters. The sagebrush demographics show varied age classes on the site with more mature plants than the other categories (Figure 3.14b).

Point quarter data shows that Utah juniper is present on the site but in low density (Figure 3.15).

Herbaceous Understory: This study site has a fairly poor herbaceous component with total cover less than 5%. Perennial grass cover is less than 2%. Cheatgrass, an annual grass, is present on the site, which increases the risk of fire and threatens the resiliency of this site (Figure 3.16).

Perennial forb cover is less than 1% and annual forb cover is just over 2%, and provides little ground cover (Figure 3.16).

Occupancy: Pellet group transect data indicates that elk, deer, and bison/cattle occupy this study site but in low abundance (Figure 3.17).

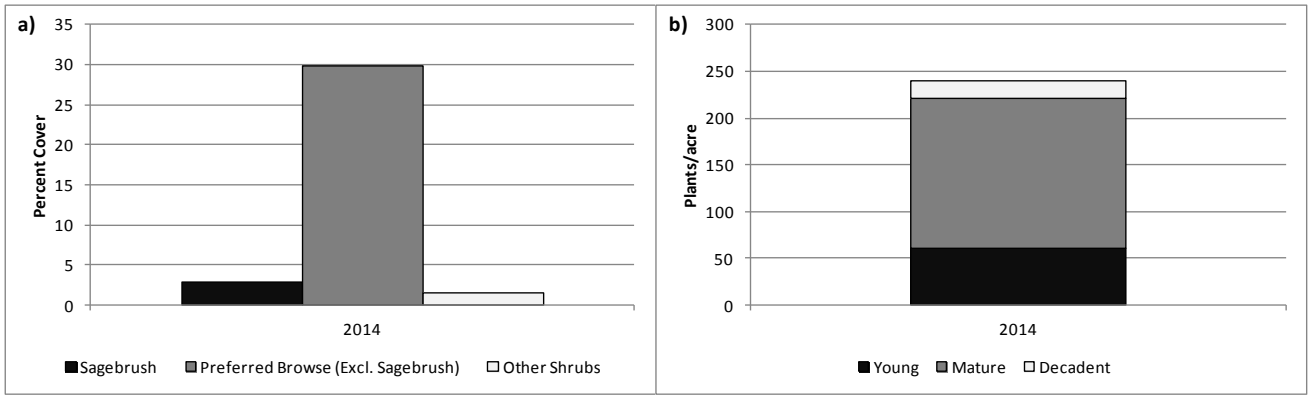


Figure 3.14: Shrub summary of the Semidesert (Blackbrush) studies (n=1) for WMU 15, Henry Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

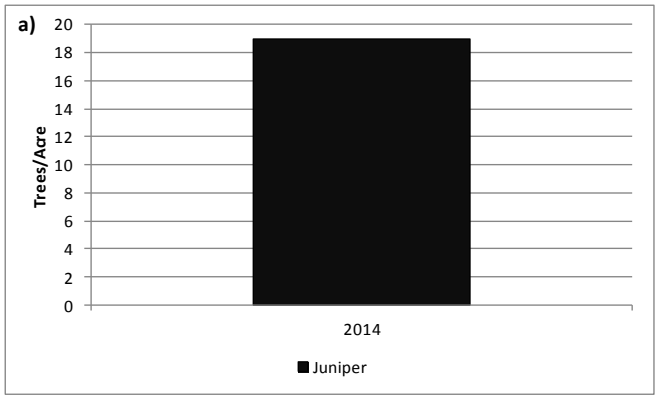


Figure 3.15: Tree summary of the Semidesert (Blackbrush) studies (n=1) for WMU 15, Henry Mountains. a) Point-quarter tree density estimates for Utah juniper (*Juniperus osteosperma*).

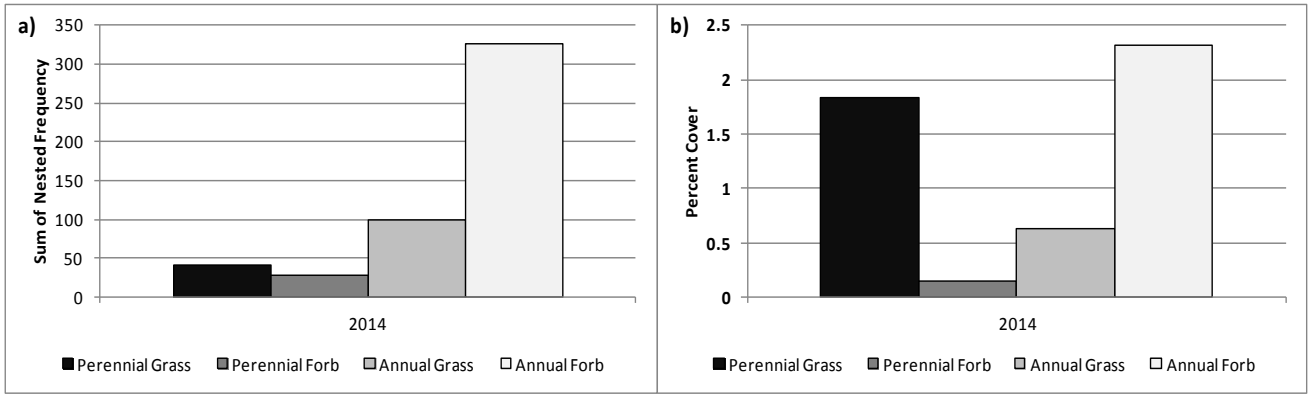


Figure 3.16: Herbaceous functional group summary of the Semidesert (Blackbrush) studies (n=1) for WMU 15, Henry Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

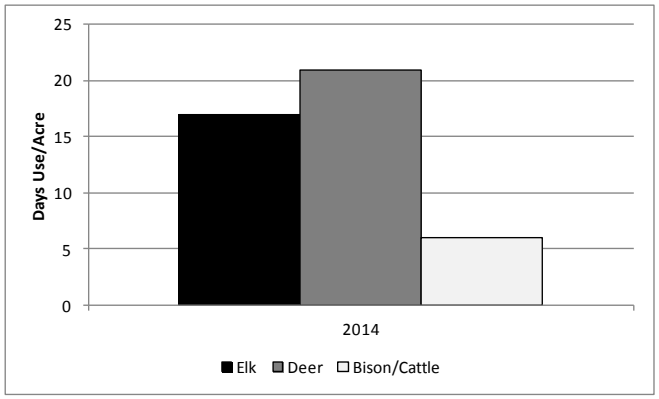


Figure 3.17: Pellet transect data for the Semidesert (Blackbrush) studies (n=1) for WMU 15, Henry Mountains.

Semidesert (Four-Wing Saltbush)

There are two studies [Steven's Mesa (15-15) and Swap Mesa (15-17)] classified as Semidesert (Four-Wing Saltbush) ecological site that remained undisturbed over the report period (Table 3.6). The Steven's Mesa study is located northwest of the Henry Mountains but east of Capitol Reef National Park and Swap Mesa is located west of the Henry Mountains on Swap Mesa.

Shrubs/Trees: The primary browse is broom snakeweed (*Gutierrezia sarothrae*) on Swap Mesa, and narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) on Steven's Mesa. There is also some four-wing saltbush on both sites (*Atriplex canescens*), but it contributes little cover. There is no sagebrush on either site (Figure 3.18).

There were no trees present on either site and are therefore not included in the summary.

Herbaceous Understory: Steven's Mesa has low perennial herbaceous cover. While cheatgrass is not present on this site, it does have a fair cover of annual forbs. Swap Mesa has a good amount of perennial grass frequency and cover; however, cheatgrass is also present but is sparse (Figure 3.19). The presence of cheatgrass increases the risk of fire and threatens the resiliency of this site.

Perennial and annual forb cover has been sparse on Swap Mesa, with the exception of 2014 when perennial forb cover was 5% (Figure 3.19).

Occupancy: Pellet group transect data indicates that bison/cattle occupy these study sites. Bison/cattle occupancy has been low on Steven Mesa and moderate on Swap Mesa over the study years (Figure 3.20).

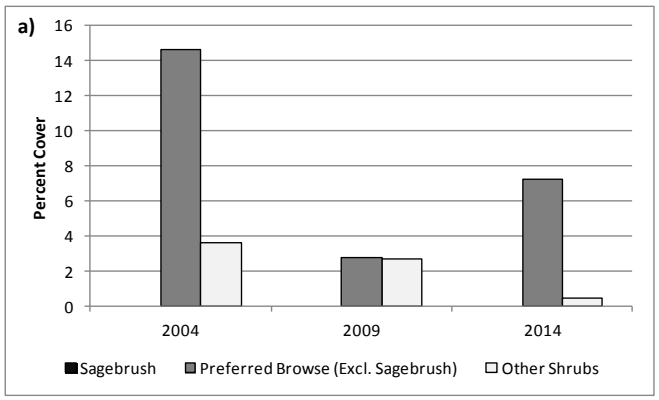


Figure 3.18: Shrub summary of the Semidesert (Four-Wing Saltbush) studies (n=2) for WMU 15, Henry Mountains. a) Mean line-intercept cover estimate of shrub groups.

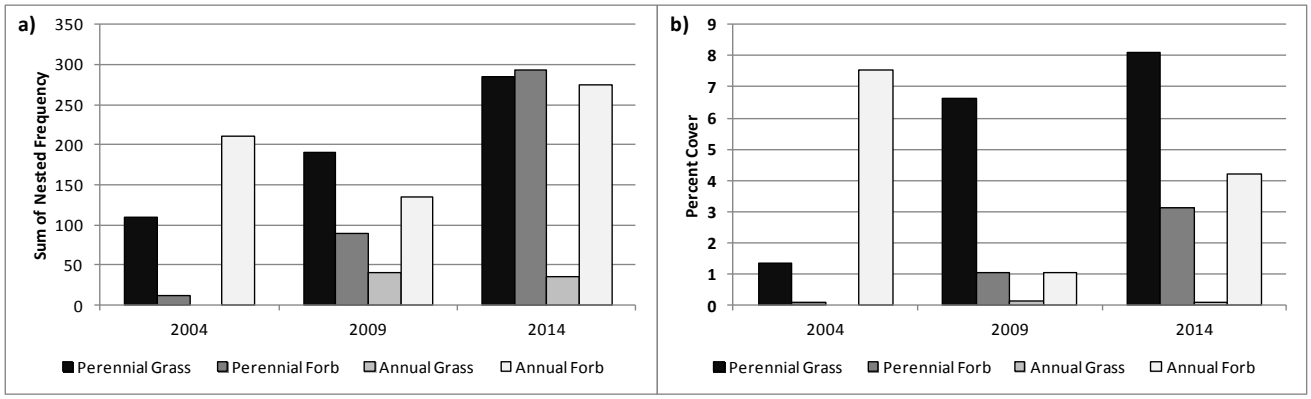


Figure 3.19: Herbaceous functional group summary of the Semidesert (Four-Wing Saltbush) studies (n=2) for WMU 15, Henry Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

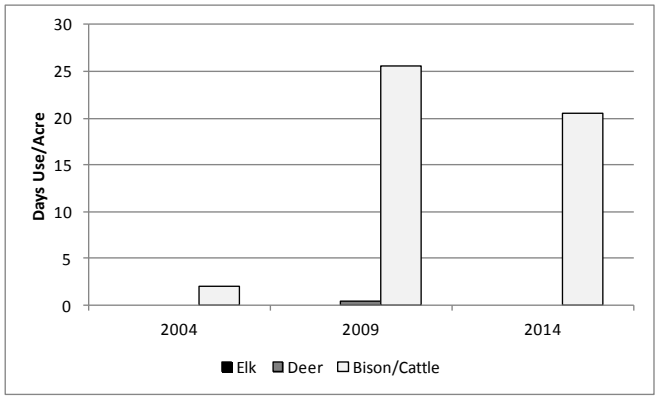


Figure 3.20: Mean pellet transect data for the Semidesert (Four-Wing Saltbush) studies (n=2) for WMU 15, Henry Mountains.

Semidesert (Shadscale)

There is one study [Cave Flat Chaining 2 (15-18)] classified as Semidesert (Shadscale) ecological site that remained undisturbed over the report period (Table 3.6). This study is located west of the Henry Mountains near Bullfrog Creek.

Shrubs/Trees: Browse cover on this study comes almost exclusively from Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and broom snakeweed. There are a few other species but they contribute very little cover. Line-intercept cover of sagebrush is very low on this site (Figure 3.21a). Sagebrush height is just over 2 feet tall, making browse available through much of the year in normal winters. The sagebrush population is comprised solely of young plants. Sagebrush density is fairly low as well (Figure 3.21b).

Pinyon pine and Utah juniper are present on the site and will likely increase over time. These trees have the potential to influence the function and diversity of this site (Figure 3.22).

Herbaceous Understory: This study site has a fairly poor herbaceous component dominated primarily by cheatgrass. Cheatgrass increases the risk of fire and threatens the resiliency of this site. Perennial grass cover was around 2.5% (Figure 3.23).

Perennial forb was less than 1% and annual forb cover was just over 1 % (Figure 3.23).

Occupancy: Pellet group transect data indicates that deer and bison/cattle occupy this study site. Deer occur in moderate abundance and bison/cattle in low abundance (Figure 3.24).

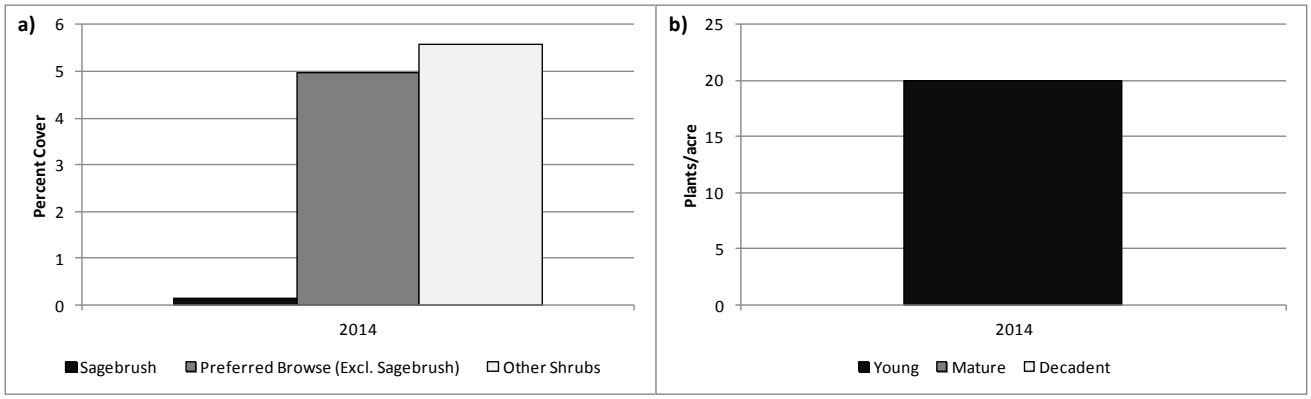


Figure 3.21: Shrub summary of the Semidesert (Shadscale) studies (n=1) for WMU 15, Henry Mountains. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

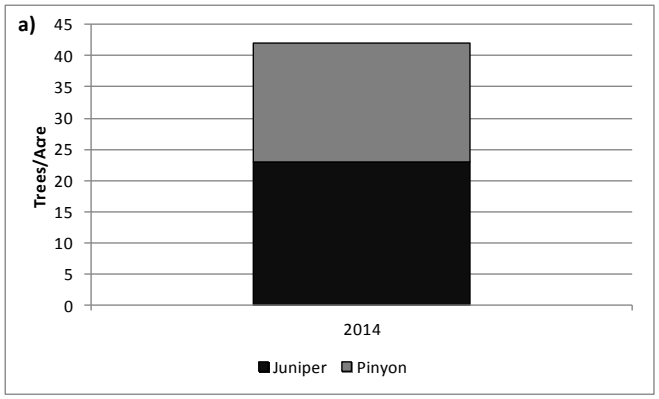


Figure 3.22: Tree summary of the Semidesert (Shadscale) studies (n=1) for WMU 15, Henry Mountains. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*).

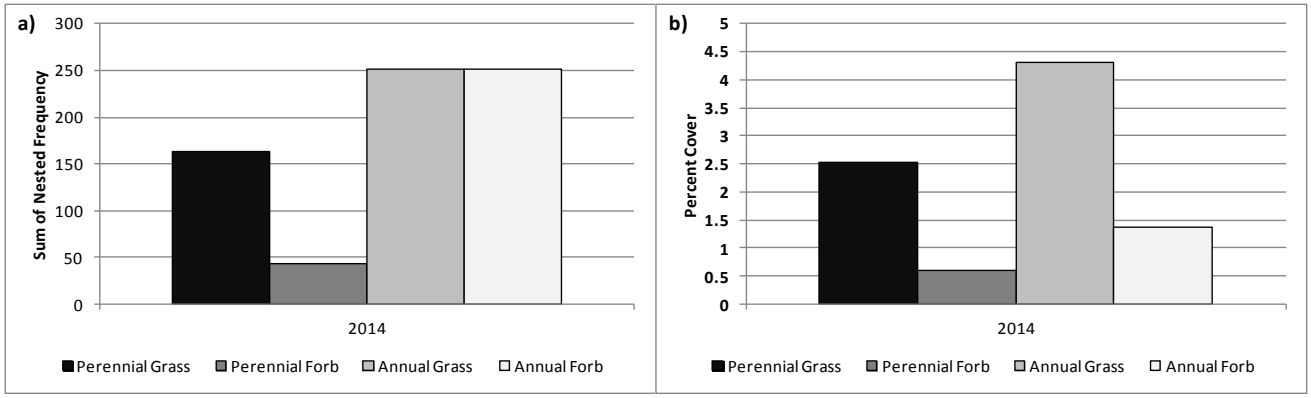


Figure 3.23: Herbaceous functional group summary of the Semidesert (Shadscale) studies (n=1) for WMU 15, Henry Mountains. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

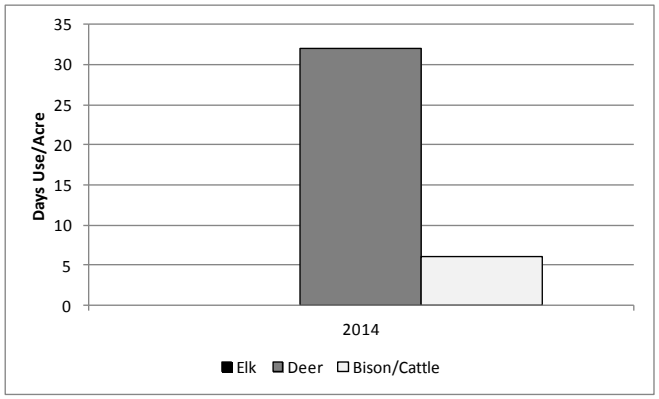


Figure 3.24: Pellet transect data for the Semidesert (Shadscale) studies (n=1) for WMU 15, Henry Mountains.

Study Trend Summary (Treated/Disturbed Sites)

Lop and Scatter

There are six studies [Eagle Bench (15-1), South Creek Chaining (15-4), Bates Knob (15-5), Box Springs Chaining (15-6), Airplane Spring (15-7), and Tarantula Mesa Lop and Scatter (15R-2)] that were treated with lop and scatter during the report period. The Eagle Bench study is located on the east side of the Henry Mountains; South Creek Chaining, Bates Knob, Box Springs Chaining, and Airplane Spring are on the west side of the Henry Mountains; and Tarantula Mesa Lop and Scatter is west of the Henry Mountains near Capital Reef National Park. Eagle Bench and Tarantula Mesa Lop and Scatter are considered Semidesert (Wyoming Big Sagebrush); South Creek Chaining and Bates Knob are classified as Upland (Mountain Big Sagebrush); Box Springs Chaining is Upland (Pinyon-Juniper); and Airplane Spring is Upland (Black Sagebrush) (Table 3.5). Generally, the target of lop and scatter treatments is to reduce pinyon-juniper tree cover in order to restore sagebrush and herbaceous understory.

Shrubs/Trees: Wyoming big sagebrush was the main browse species on Eagle Bench and Tarantula Mesa Lop and Scatter, mountain big sagebrush was the primary browse on South Creek Chaining, Bates Knob, and Box Springs Chaining, and black sagebrush was the principal shrub on Airplane Springs Chaining. Mean sagebrush cover increased as time since treatment increased (Figure 3.25a). The mean density of sagebrush increased following treatment. Additionally, the demographics of the sagebrush populations have begun to diversify with an increase in young plants (Figure 3.25b).

Tree cover decreased post treatment and continues to decline. Tree density on the other hand decreased the 1-5 years post treatment but increased in all other post categories (Figure 3.26).

Herbaceous Understory: Perennial and annual forb cover was generally less than 1% with the exception of South Creek Chaining which had variable perennial forb cover over the sample years. Box Springs Chaining and Tarantula Mesa Lop and Scatter were the only two sites without cheatgrass, although it was present at all other sites and was typically less than 1% cover. Perennial grass cover decreased 1-5 and 11-15 years post treatment but increased 6-10 years post treatment. Most sites were dominated by crested wheatgrass. Eagle Bench was the only site where perennial native grasses were dominant (Figure 3.27).

Occupancy: Pellet group transect data indicates that deer and bison/cattle primarily occupy these study sites, with lower abundance of pellet groups for bison/cattle recorded following treatments. However, deer have experienced a steady increase in occupancy since treatment (Figure 3.28).

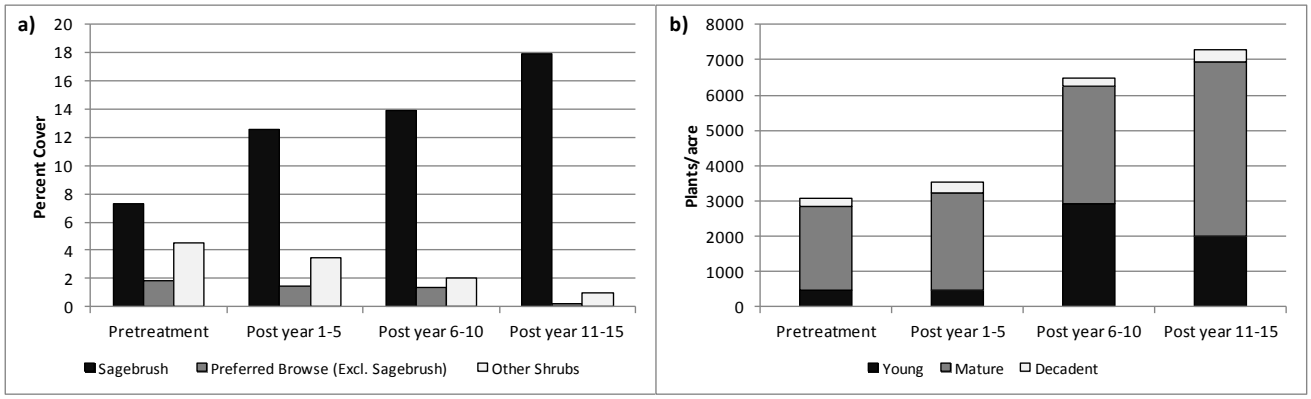


Figure 3.25: Shrub summary of the Lop and Scatter treatment studies (n=6) for WMU 15, Henry Mountains. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

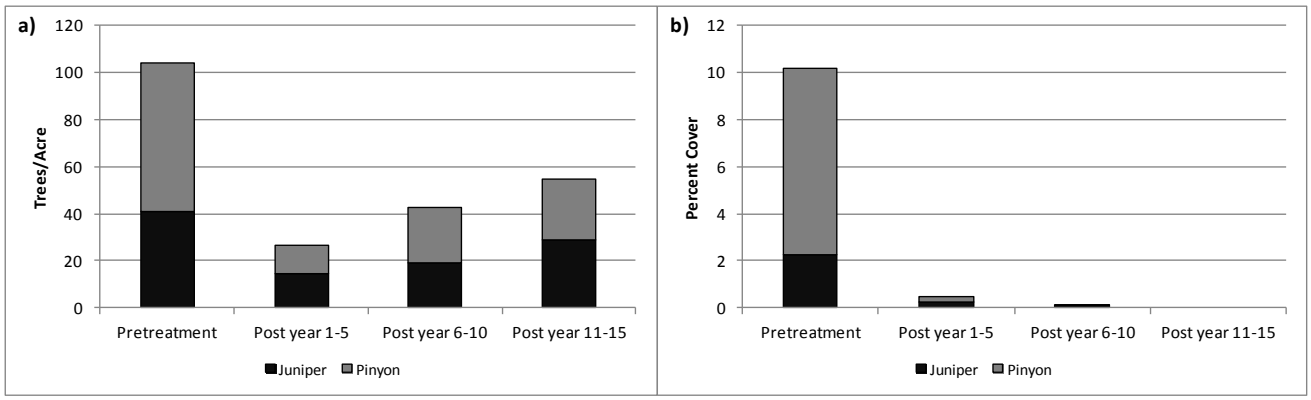


Figure 3.26: Tree summary of the Lop and Scatter treatment studies (n=6) for WMU 15, Henry Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

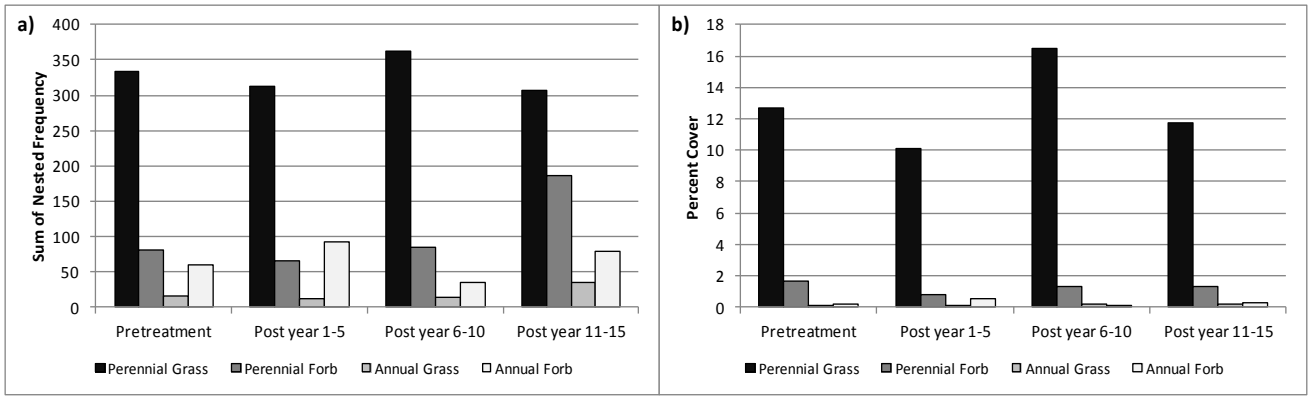


Figure 3.27: Herbaceous functional group summary of the Lop and Scatter treatment studies (n=6) for WMU 15, Henry Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

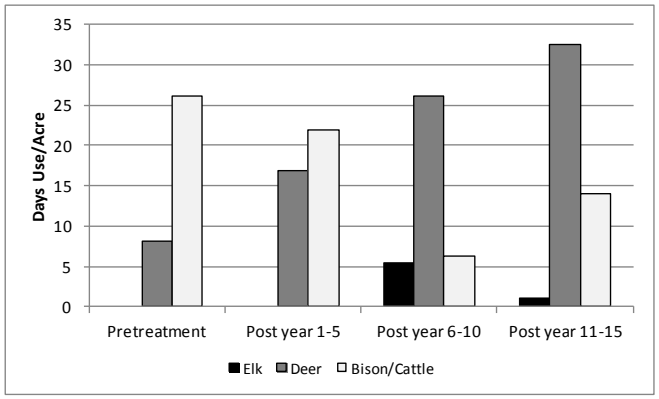


Figure 3.28: Mean pellet transect data for the Lop and Scatter treatment studies (n=6) for WMU 15, Henry Mountains.

Wildfire

There are three studies [Quaking Aspen Spring (15-12), Sidehill Spring (15-13), and Coyote Spring (15-16)] that were burned by wildfire during the report period. These sites are located on the east and southeast foothills of Mount Pennell. These studies are classified as Upland potential with Quaking Aspen Spring being black sagebrush, Sidehill Spring being mountain big sagebrush, and Coyote Spring being Wyoming big sagebrush ecological sites (Table 3.6). All of these studies were burned in the Bulldog fire of 2003.

Shrubs/Trees: The primary browse species on Quaking Aspen Spring and Sidehill Spring is mountain big sagebrush while there is not a dominant browse species on Coyote Spring as there are few browse species and they are all less than 1% cover. The mean sagebrush cover and density has slowly increased since disturbance. Quaking Aspen Spring has increased some but the largest increase was seen on Sidehill Spring where sagebrush cover increased from <1% in 2004 to 10% in 2014. Density of sagebrush remains low; however, the presence of young plants is encouraging for future sagebrush establishment (Figure 3.29).

Pinyon and juniper trees were present on the site prior to the disturbance. Tree density decreased to near zero 1-5 years post fire and is slowly coming back (Figure 3.30).

Herbaceous Understory: Perennial grass has steadily increased since the wildfire. These sites were seeded with crested wheatgrass and intermediate wheatgrass and are the primary grass species present post disturbance. While cheatgrass was present on all of the sites, it was very abundant on Sidehill Spring prior to the disturbance. However, after the fire, cheatgrass cover decreased across all sites. Perennial and annual forb cover increased the year following the fire but decreased in subsequent years (Figure 3.31).

Occupancy: Pellet group transect data indicates that deer and bison/cattle occupy these study sites. Prior to the wildfire deer use was fairly high but decreased considerably following the disturbance. While bison/cattle use was low before the fire but has since increased and is now moderate (Figure 3.32).

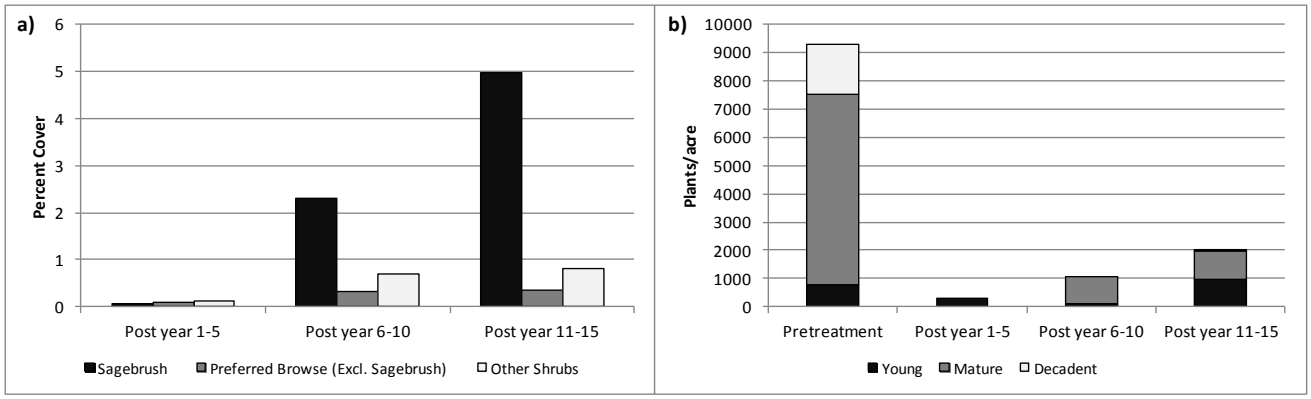


Figure 3.29: Shrub summary of the Wildfire disturbance studies (n=3) for WMU 15, Henry Mountains. a) Mean line-intercept cover estimate of shrub groups.

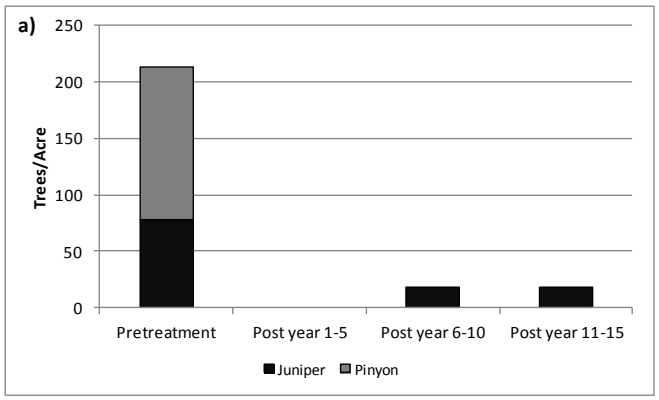


Figure 3.30: Tree summary of the Wildfire disturbance studies (n=3) for WMU 15, Henry Mountains. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*).

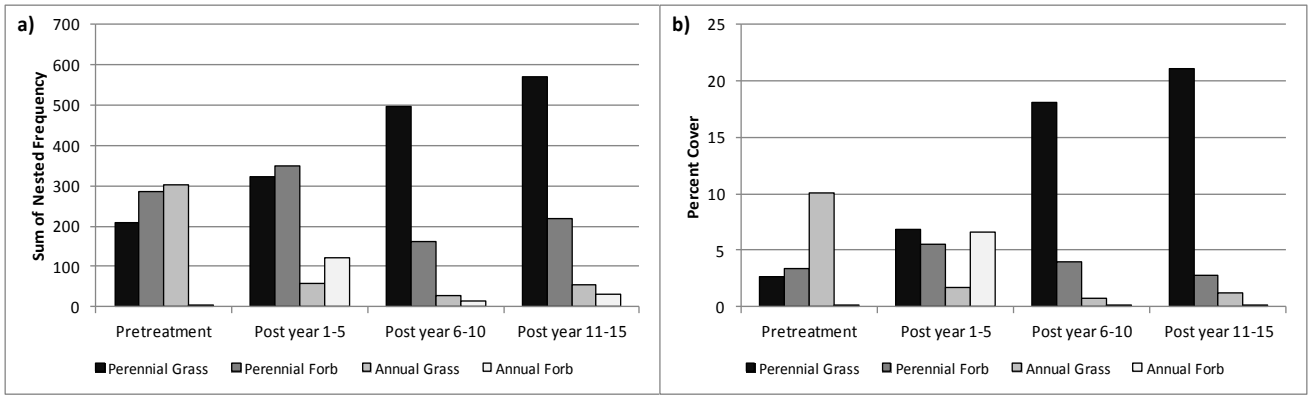


Figure 3.31: Herbaceous functional group summary of the Wildfire disturbance studies (n=3) for WMU 15, Henry Mountains. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

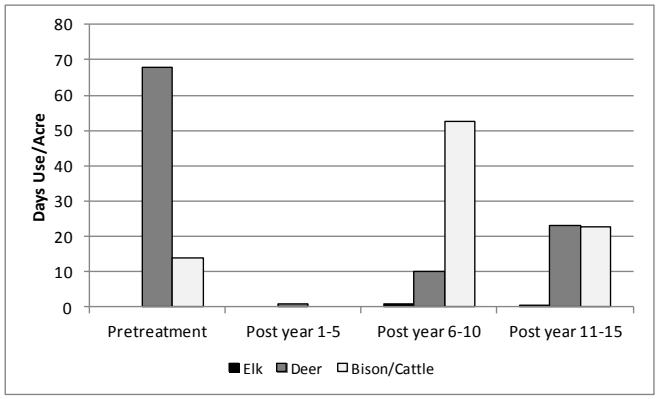
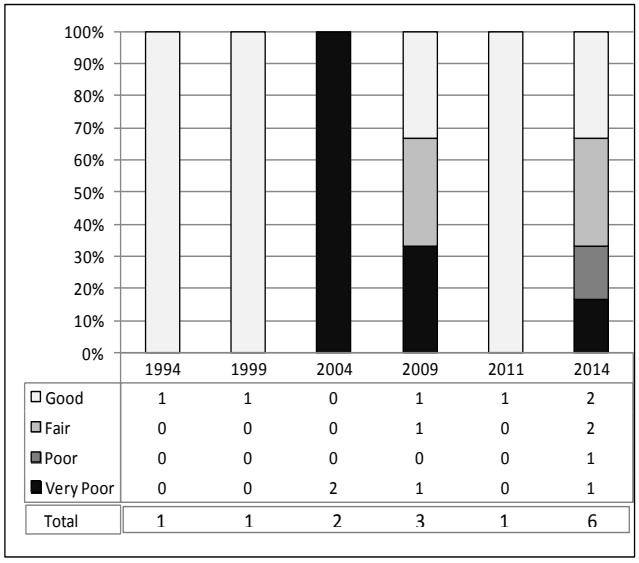


Figure 3.32: Mean pellet transect data for the Wildfire disturbance studies (n=3) for WMU 15, Henry Mountains.

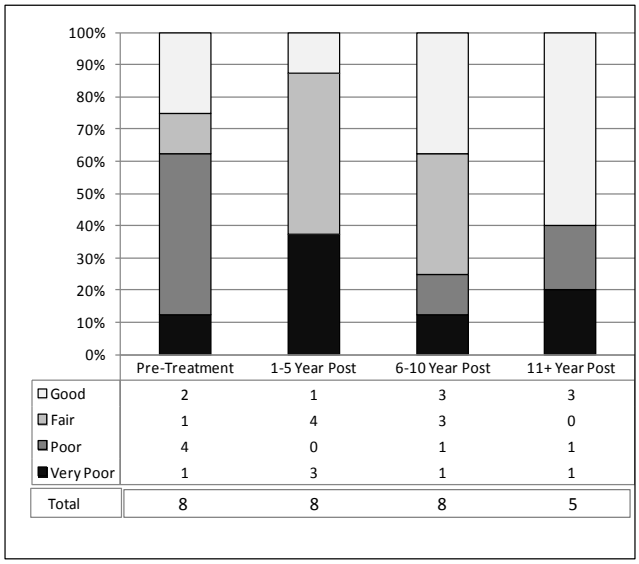
Deer Winter Range Condition Assessment

The condition of deer winter range within the Henry Mountains management unit has remained fairly consistent on the sites sampled since 1994. The undisturbed sites sampled within the unit are considered to be in very poor to good condition as of the 2014 sampling year (Figure 3.33). Cave Flat was sampled in 1994, 1999, 2001, and 2014 and has remained in good condition; as was Copper Creek, which was added in 2014. Steven's Mesa has ranged from very poor to poor, Swap Mesa remained fair, and Cave Flat Chaining very poor all due to a lack of browse cover and density. Dugout Creek, which has been very poor to fair, was good in 2009 because of an increase in density as well as a diversification of sagebrush demographics. The treated study sites range from very poor to good (Figure 3.34). In general, the treated sites have improved as time since treatment increases. South Creek Chaining, Bates Knob, and Sidehill Spring all went from poor to good; Eagle Bench and Airplane Spring went from fair to good; and Box Springs Chaining went from very poor to fair. Tarantula Mesa Lop and Scatter, Quaking Aspen Spring, and Coyote Spring all remained good, poor, and very poor, respectively (Map 3.7 and Table 3.8). It is possible given more time and continual monitoring that these sites will continue to improve.



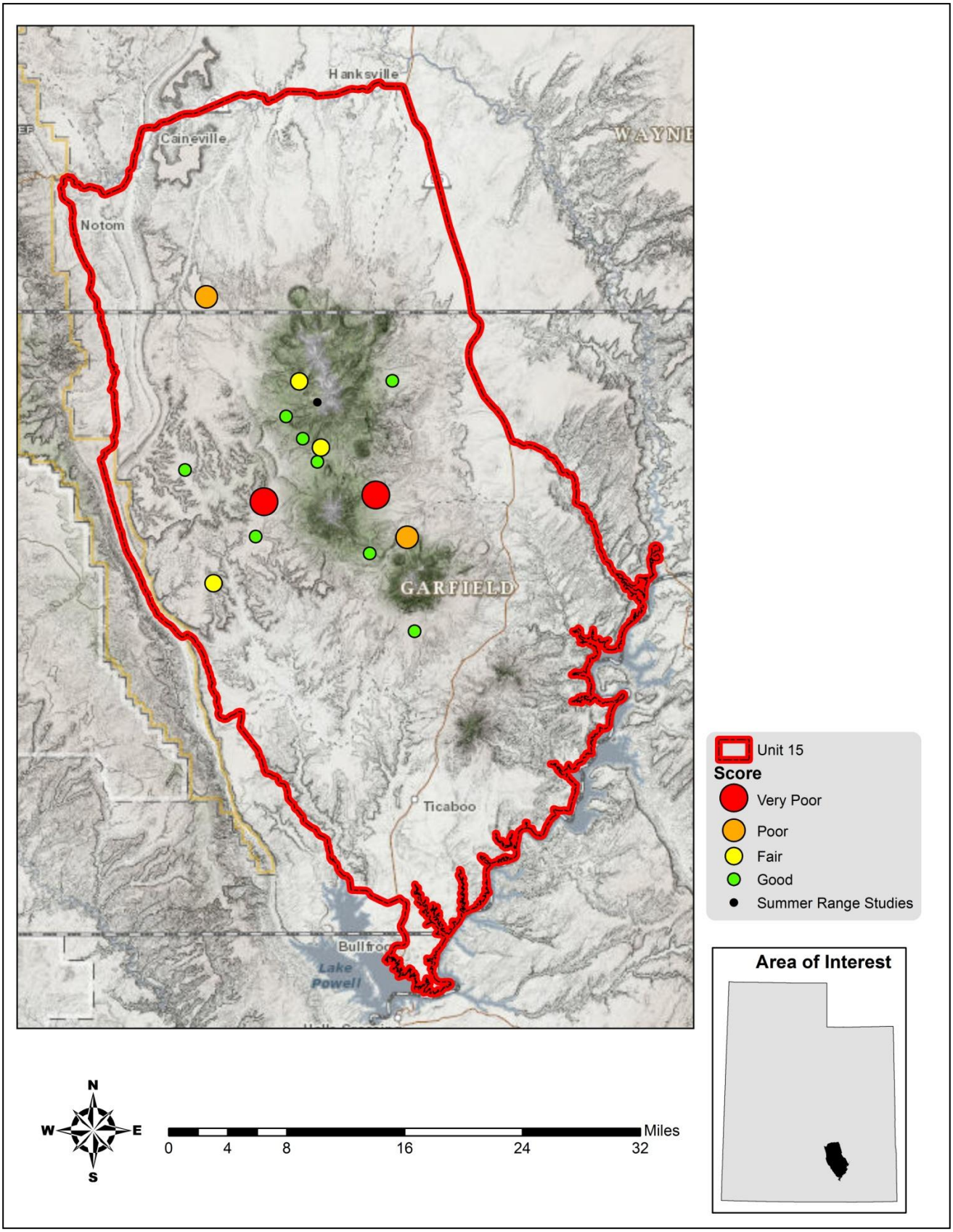
	1994	1999	2004	2009	2011	2014
Good	1	1	0	1	1	2
Fair	0	0	0	1	0	2
Poor	0	0	0	0	0	1
Very Poor	0	0	2	1	0	1
Total	1	1	2	3	1	6

Figure 3.33: Deer winter range Desirable Components Index (DCI) summary by year of undisturbed sites for WMU 15 Henry Mountains.



	Pre-Treatment	1-5 Year Post	6-10 Year Post	11+ Year Post
Good	2	1	3	3
Fair	1	4	3	0
Poor	4	0	1	1
Very Poor	1	3	1	1
Total	8	8	8	5

Figure 3.34: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 15, Henry Mountains.



Map 3.7: Deer winter range Desirable Components Index (DCI) ranking distribution by study site of most current sample date as of 2013 for WMU 15, Henry Mountains.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
15-1	Eagle Bench	Annual Grass	Low	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-2	Nasty Flat	Conifer Encroachment	Moderate	Reduce aspen and understory cover.
15-4	South Creek Chaining	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-5	Bates Knob	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-6	Box Springs Chaining	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-7	Airplane Spring	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-10	Cave Flat	Annual Grass	Low	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-12	Quaking Aspen Spring	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-13	Sidehill Spring	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-14	Dugout Creek	Annual Grass	Low	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-15	Steven's Mesa	None Identified		
15-16	Coyote Spring	Annual Grass	Low	Increased fire potential.
		Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
15-17	Swap Mesa	Annual Grass	Low	Increased fire potential.
15-18	Cave Flat Chaining 2	Annual Grass	Moderate	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15-19	Copper Creek	Annual Grass	Low	Increased fire potential.
		PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
15R-2	Tarantula Mesa Lop and Scatter	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.

Table 3.8: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 15, Henry Mountains. All assessments are based off the most current sample date for each study site.

Discussion and Recommendations

High Mountain (Aspen)

This high mountain ecological site supports an aspen community and is generally considered to be in good condition for deer and elk summer range habitat on the Henry Mountains management unit. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. Conifer encroachment is a current threat to this aspen community. Encroaching conifer competes with aspen and understory species for valuable resources, decreasing wildlife quality and quantity. Another potential threat to aspen communities is introduced perennial grasses in the understory. These grasses are often seeded after a treatment, and while providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species.

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

The higher elevation mountain ecological site which supports mountain big sagebrush are generally considered to be in fair condition for deer winter range habitat on this unit. This community supports robust shrub populations that provide valuable browse in mild and moderate winters. This community can be susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can boost fuel loads and

increase the threat of wildfire in these communities. This ecological site is also prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous health if not addressed.

Care should be taken in selecting treatment methods that will not increase annual grass loads. It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities.

Semidesert (Wyoming Big Sagebrush)

The lower elevation semidesert Wyoming big sagebrush community is generally considered to be in good condition for deer winter range habitat on the unit. This community supports shrub populations that provide valuable browse in moderate to severe winters. This community is susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. This ecological site is also prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous health if not addressed.

If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities.

Semidesert (Blackbrush)

The lower elevation semidesert black sagebrush community is generally considered to be in good condition for deer winter range habitat on the unit. This community supports shrub populations that provide valuable browse in moderate to severe winters. This community is susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. This ecological site is also prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous health if not addressed.

If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. Treatments to reduce annual grass may be necessary on some sites. It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities.

Semidesert (Four-Wing Saltbush)

The lower elevation semidesert four-wing saltbush community is generally considered to be in poor to fair condition for deer winter range habitat on the unit. This community is susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. Encroachment from pinyon-juniper trees has not been an issue within this community.

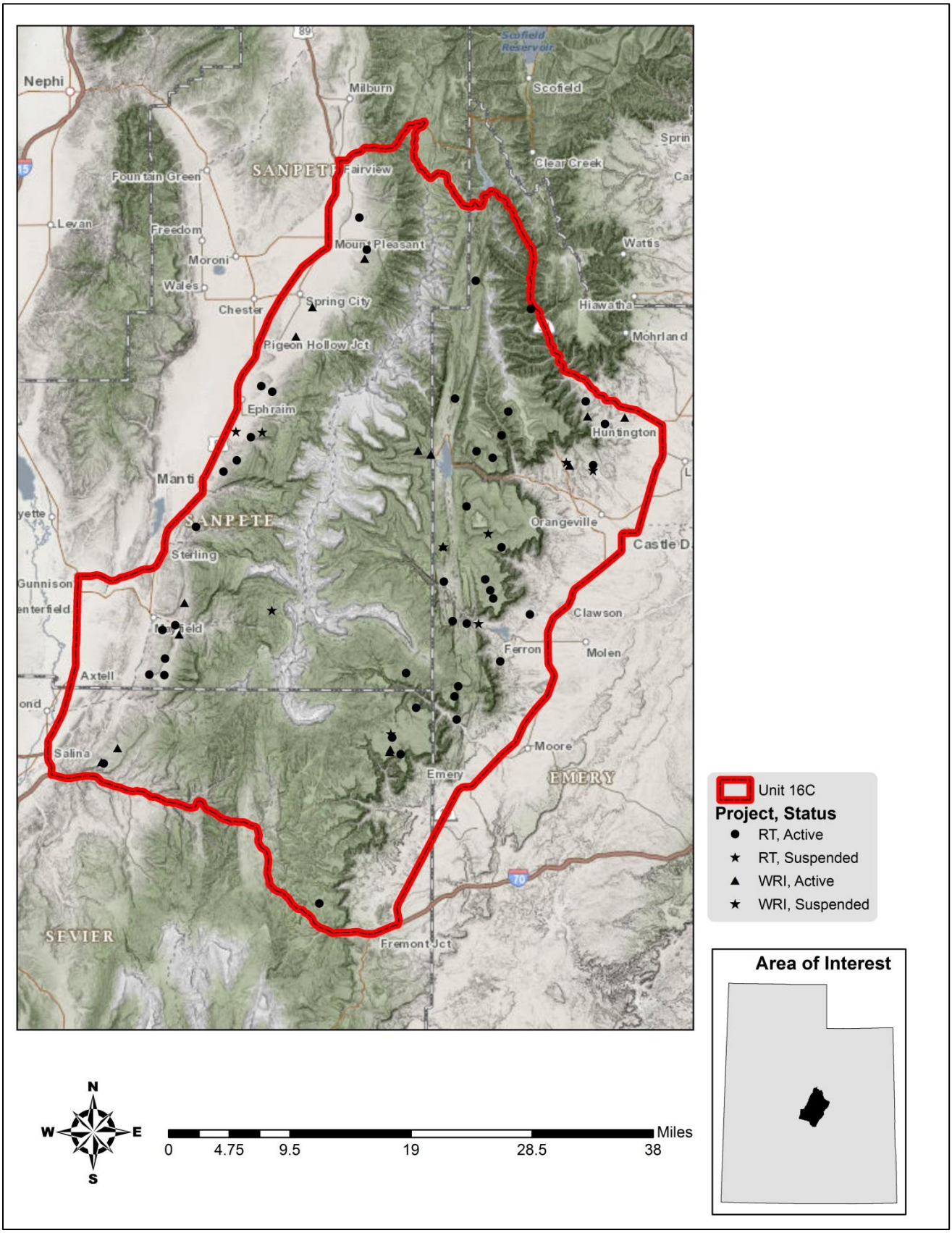
If treatments occur, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites.

Semidesert (Shadscale)

The lower elevation semidesert shadscale community is generally considered to be in very poor condition for deer winter range habitat on the unit. This community is susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. This ecological site is also prone to encroachment from pinyon-juniper trees, which can reduce understory shrub and herbaceous health if not addressed.

If treatments occur, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. It is recommended that work to reduce pinyon-juniper encroachment (e.g. bullhog, chaining, lop and scatter, etc.) should continue in these communities.

4. WILDLIFE MANAGEMENT UNIT 16B/C – MANTI NORTH/SOUTH



Boundary Descriptions

16B: Utah, Sanpete, Emery, and Carbon counties - Boundary begins at Highway SR-10 and Highway SR-31 in Huntington; then north on SR-10 to Highway US-6; northwest on US-6 to Highway US-89; south on US-89 to SR-31; southeast on SR-31 to Huntington.

16C: Sanpete, Emery, and Sevier counties - Boundary begins at the junction of Highway SR-10 and Highway SR-31 at Huntington; then south on SR-10 to Interstate 70; west on I-70 to Highway US-89 at Salina; north on US-89 to SR-31 at Fairview; southeast on SR-31 to SR-10 at the beginning point at Huntington.

Management Unit Description

Geography

Wasatch Plateau

Unit 16B covers the east and west sides of the Wasatch Plateau. Skyline Drive to Soldiers Summit roughly divides the eastern and western halves of the unit. This unit was previously called the Northeast Manti Deer Herd Unit 30. In the spring of 1998, this unit was incorporated into the much larger Wildlife Management Unit 16. Unit 16C was previously called Deer Herd Unit 31- South East Manti. It was enlarged in the spring of 1998 to include both the east and west sides of the Wasatch Plateau and renamed Wildlife Management Unit 16C. Unit 16C is a subunit of the very large management unit 16, which encompasses areas in Utah, Carbon, Juab, Sevier, and Sanpete Counties.

Wildlife Management Unit 16C covers the southern portion of the Wasatch Plateau. As with unit 16B, this subunit's western and eastern halves are divided roughly by Skyline Drive. The upper limits of the winter range on 16C generally follows the rim of the plateau and the 9,000 foot level of the south and west exposures of the large canyons and mountain slopes. Many of the plateaus drop steeply to the valley floor below to the very lowest portion of the herd unit that supports a low desert shrub type on unproductive shale hills. This acreage is not considered part of the winter range.

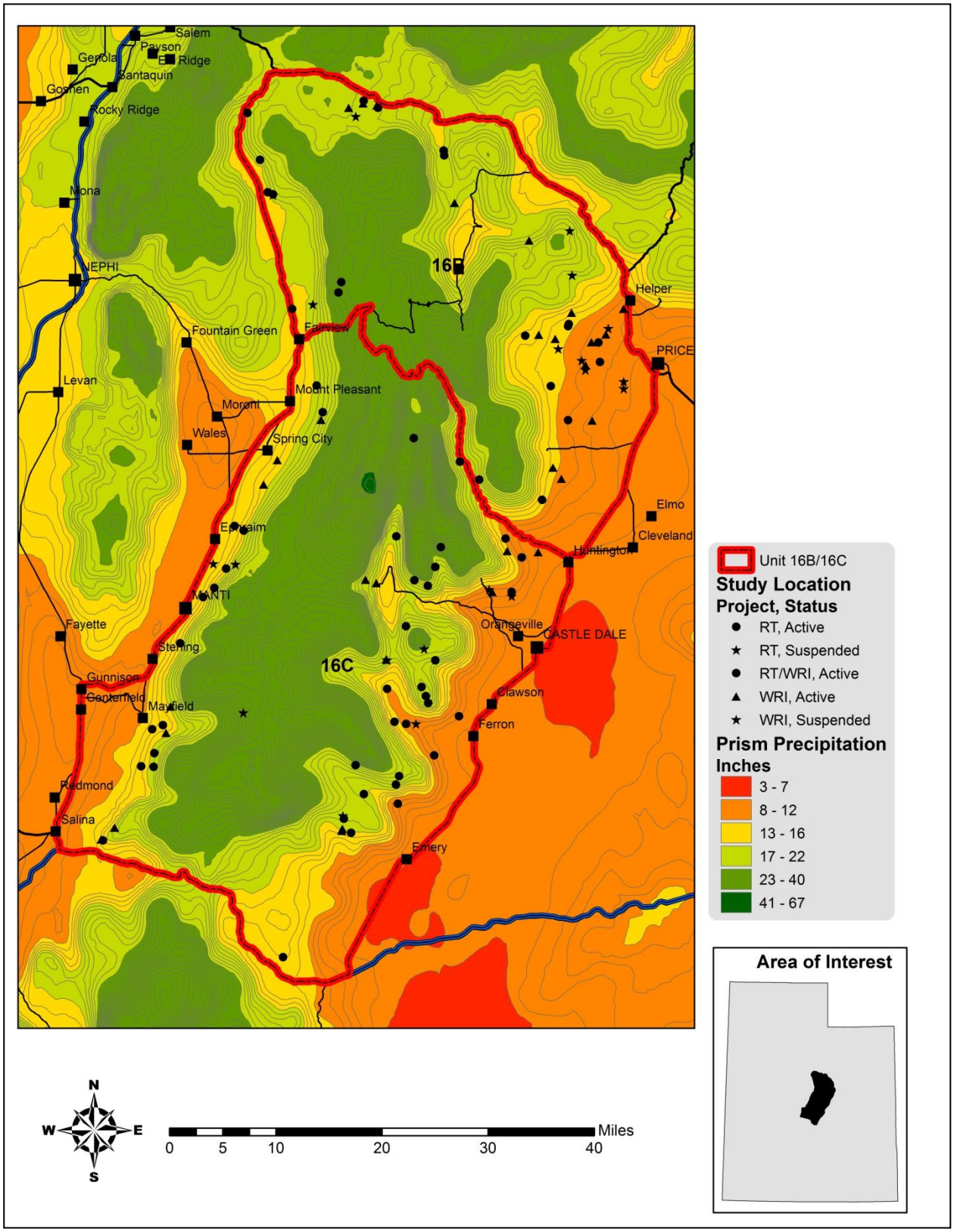
Climate Data

The 30-year (1981-2010) annual precipitation PRISM model shows precipitation ranges on the unit from 8 inches on the east side of 16B to 32inches on the central peaks of the unit. Unit 16C ranges 7 inches on the southeast sides of the unit, and 42 inches on the high elevation peaks of the Central Mountains. All of the Range Trend and WRI monitoring studies on the unit occur within the 9-27 inch precipitation zone (Map 4.1) (PRISM Climate Group, Oregon State University).

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the South Central, Northern Mountains, and Southeast divisions (Divisions 4,5, and 7). The mean annual PDSI of the South Central division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, and 2012-2014. The mean annual PDSI displayed years of moderate to extreme wet years from 1982-1985, 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, 2002-2004, and 2013; and displayed years of moderate to extreme wet years in 1982-1985, 1993, 1995, 1999, 2001, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2007, 2009 and 2012; and displayed years of moderate to extreme wet years in 1982-1985, 1997-1998, 2008 and 2011 (Figure 4.1b)

The mean annual PDSI of the Northern Mountains division displayed years of moderate to extreme drought from 1988-1990, 2000-2003, and 2012-2013. The mean annual PDSI displayed years of moderate to extreme wet years from 1982-1986, 1995, 1997-1998, 2005, and 2011 (Figure 4.2a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1990, 1992, 2000-2004, and 2012-2014; and displayed years of moderate to extreme wet years in 1982-1986, 1995-1996, 1998-1999, 2005, and 2011. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1988-1990, 2000-2003, 2007, and 2012-2013; and displayed years of moderate to extreme wet years in 1982-1986, 1995, 1997-1998 (Figure 4.2b)

The mean annual PDSI of the Southeast division displayed years of moderate to extreme drought from 1989-1990, 2002-2003, 2009, and 2012. The mean annual PDSI displayed years of moderate to extreme wet years from 1983-1985 and 2005 (Figure 4.3a). The mean spring (March-May) PDSI displayed years of moderate to extreme drought in 1989-1991, 1996, 2002-2004, and 2012-2013; and displayed years of moderate to extreme wet years in 1983-1985, 1993, and 2005. The mean fall (Sept.-Nov.) PDSI displayed years of moderate to extreme drought in 1989-1990, 2002-2003, 2009 and 2012; and displayed years of moderate to extreme wet years in 1983-1985, 1997, and 2011 (Figure 4.3b) (Time Series Data, 2015).



Map 4.1: The 1981-2010 PRISM Precipitation Model for WMU 16B/C, Manti North/South (PRISM Climate Group, Oregon State University).

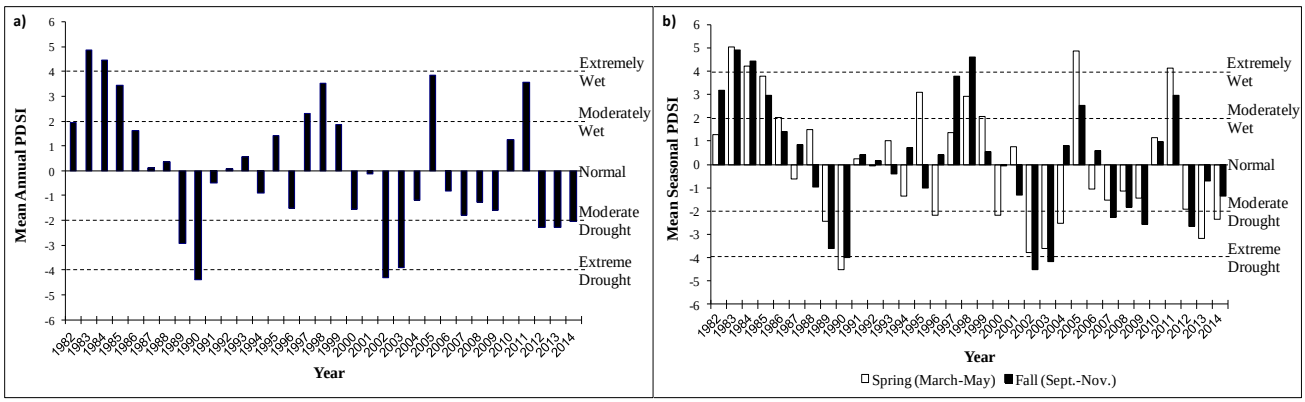


Figure 4.1: The 1982-2014 Palmer Drought Severity Index (PDSI) for the South Central division (Division 4). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).

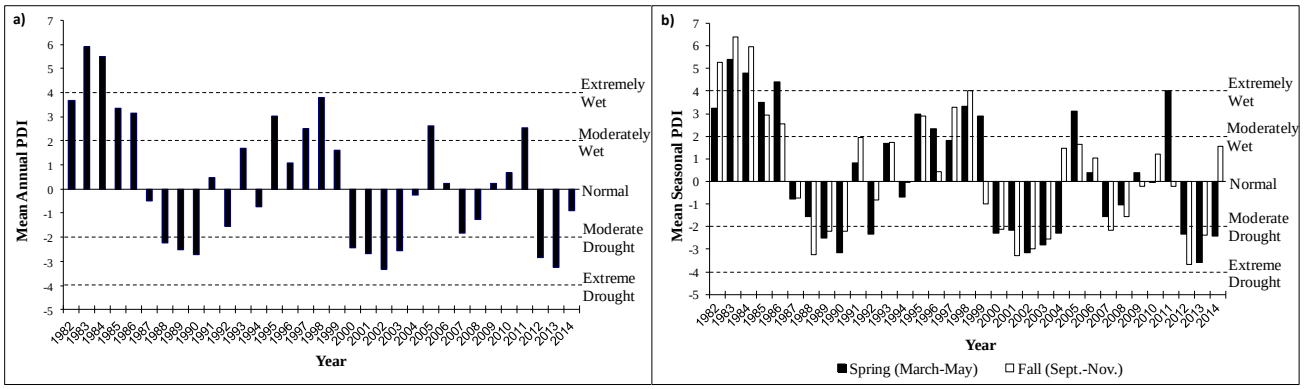


Figure 4.2: The 1982-2014 Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).

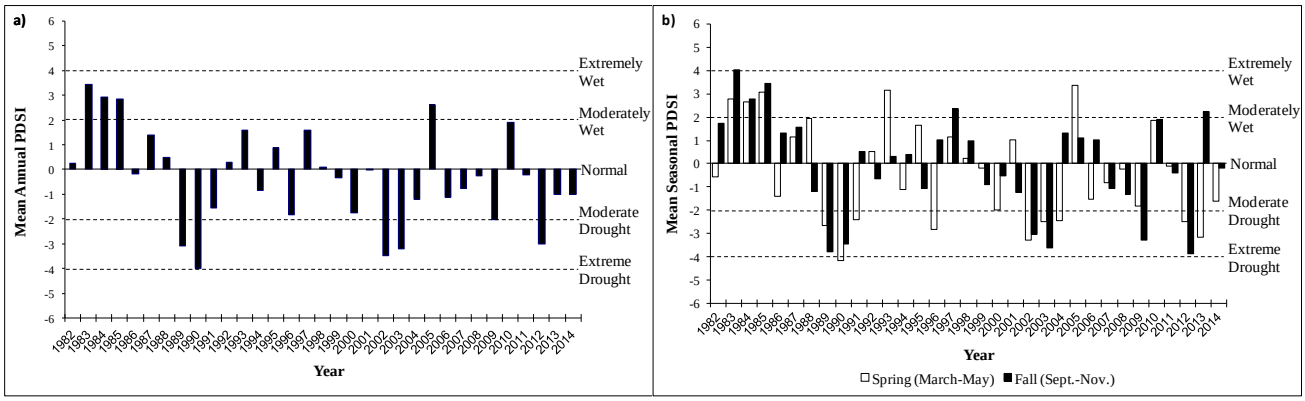


Figure 4.3: The 1982-2014 Palmer Drought Severity Index (PDSI) for the Southeast division (Division 7). The PDSI is based on climate data gathered from 1895 to 2014. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2014). a) Mean annual PDSI. b) Mean spring (March-May) and fall (Sept.-Nov.) (Time Series Data, 2015).

Big Game Habitat

Management unit 16B and 16C is large with deer summer and winter ranges covering nearly 1.4 million acres. The U.S. Forest Service (USFS) administers 81% of the summer range and the BLM 1%. Fifty-one percent of the winter range is on federal land with another 30% on private lands (Table 4.2). Elk summer and winter ranges cover over 1.2 million acres. The USFS administers 80% of the summer range and 42% of the winter range, while private lands comprised 19% of elk summer range and 23% of elk winter range (Table 4.3).

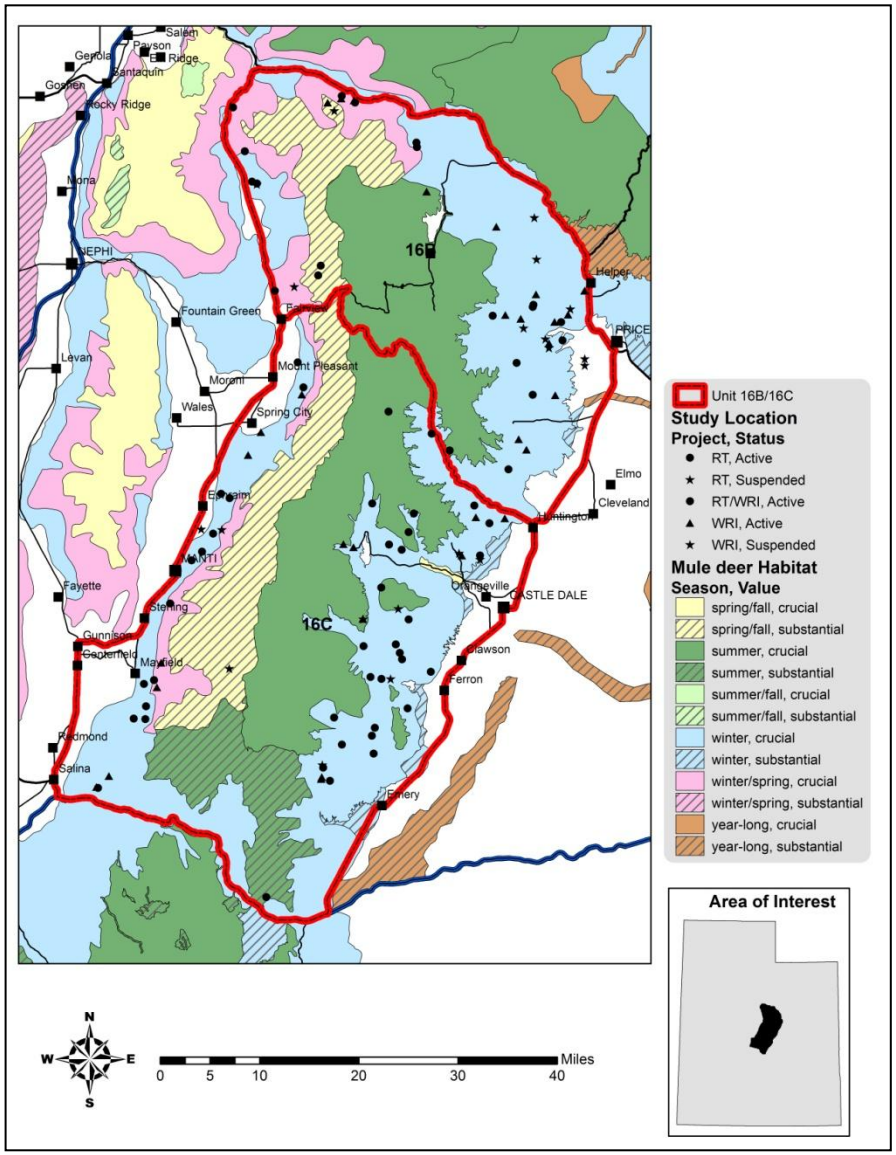
Central Mountains Manti North

Most of the winter range in subunit 16B lies on the east side of the Wasatch Plateau, which rises straight up from the valley floor to ridges with heights over 9,500 feet. The winter range is a narrow strip of land along the base of the plateau below the 8,000 foot contour. It runs from Price Canyon south to Huntington Canyon. Other important winter ranges include a large section of land along the Price River in the Colton area, below Scofield Reservoir, and in the mouths of several side canyons in Huntington Canyon. Elk winter ranges are found on south-facing grassy points at high elevations on the Wasatch Plateau.

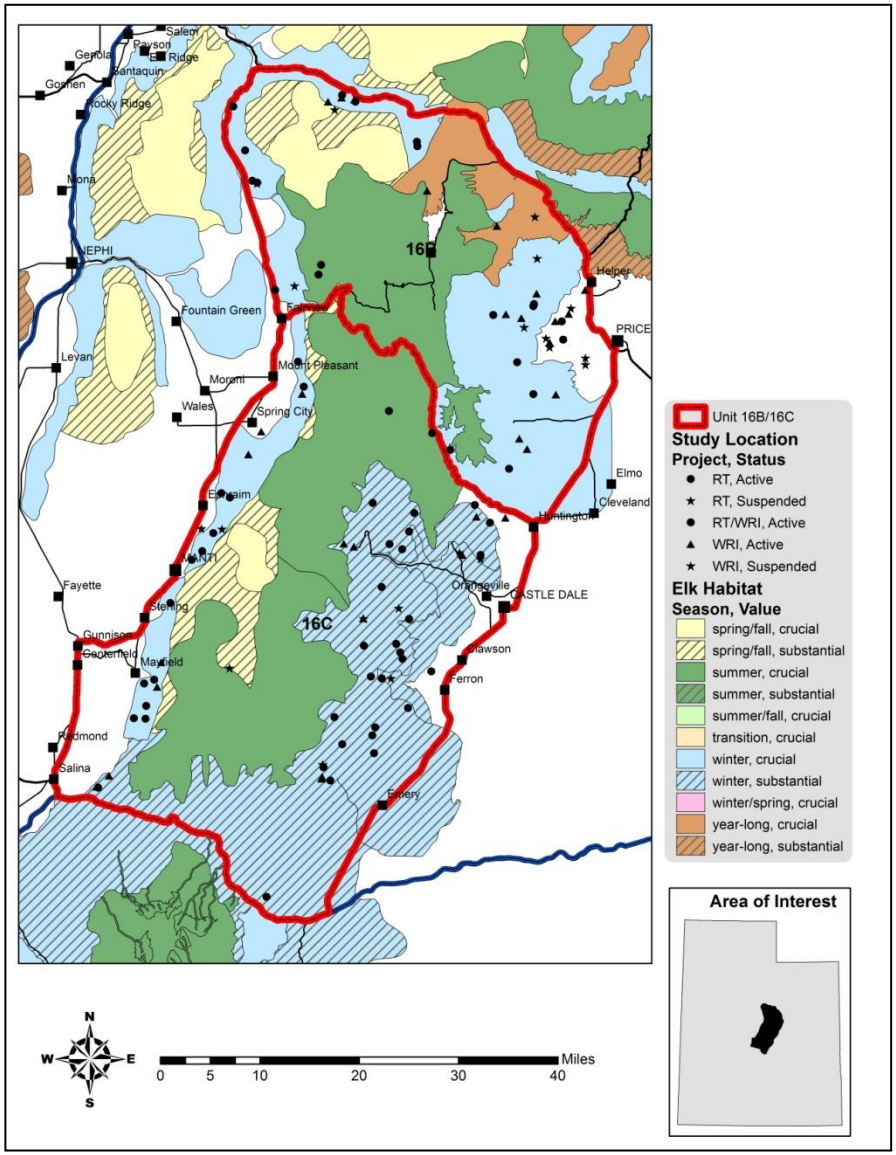
Key wintering areas for deer include Wildcat Canyon and the Gordon Creek basin, Consumers Bench, Porphyry Bench, North Spring, several areas in Huntington Canyon, Gentry Mountain, Spring Canyon drainages, and the foot hills along US 89 and US 6. Preferred elk wintering areas include Miles Point, Reynolds Point on Trail Mountain, Telephone Bench, and Diamanti Bench. The winter range is made up of several habitat types, which include pinyon-juniper, sagebrush/grass, mountain brush, grassland, seedings, and other miscellaneous vegetation types.

Central Mountains Manti South

The key deer wintering areas are the lower end of Muddy Creek and Ferron Creek, Black Dragon, Biddlecome Hollow, Cottonwood Canyon, and Huntington Canyon. Elk winter higher on Trail Mountain, North and South Horn Mountain, Sage Flat and the foot hills along US 89 from salina to Mount Pleasant. Deer also utilize these areas during mild winters. Elk utilize the mahogany and sagebrush on the lower points of the plateau, such as North and South Horn Mountain and Trail Mountain. On the Southeast Manti Unit, much of the key winter range is on Forest Service lands. Pinyon-juniper benches become more limited to the south and there are mostly low desert shrub foothills associated with Muddy Creek. Overall, the pinyon-juniper type occupies a fair amount of the winter range at low elevations, but is not critical to the trend monitoring program. However, the chained and seeded portions of this type provide important wintering areas and are monitored for trend. Chaining treatments are sampled in the foothills from Huntington Canyon to south of Dry Wash. Other key areas at Middle and Dry Mountains are also sampled. The big sagebrush/grass range type is found on many key areas, especially on the North East Manti Unit, but also on high elevation elk winter range on Trail, East, and Horn Mountains. Big sagebrush/grass is limited on crucial deer winter range, but key areas are found on Black Dragon and Muddy Creek.



Map 4.2: Estimated mule deer habitat by season and value for WMU 16B/C, Manti North/South.



Map 4.3: Estimated elk habitat by season and value for WMU 16B/C, Manti North/South.

	Spring/Fall Range		Summer Range		Winter Range		Winter/Spring Range		Year Long Range	
			Area (acres)	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*
Mule Deer	**214,607**	14%	**514,340**	34%	**660,409**	44%	**100,946**	7%	**1,115**	<1%
Elk	**151,898**	10%	**538,237**	37%	**705,660**	48%	0	0%	**62,963**	4%

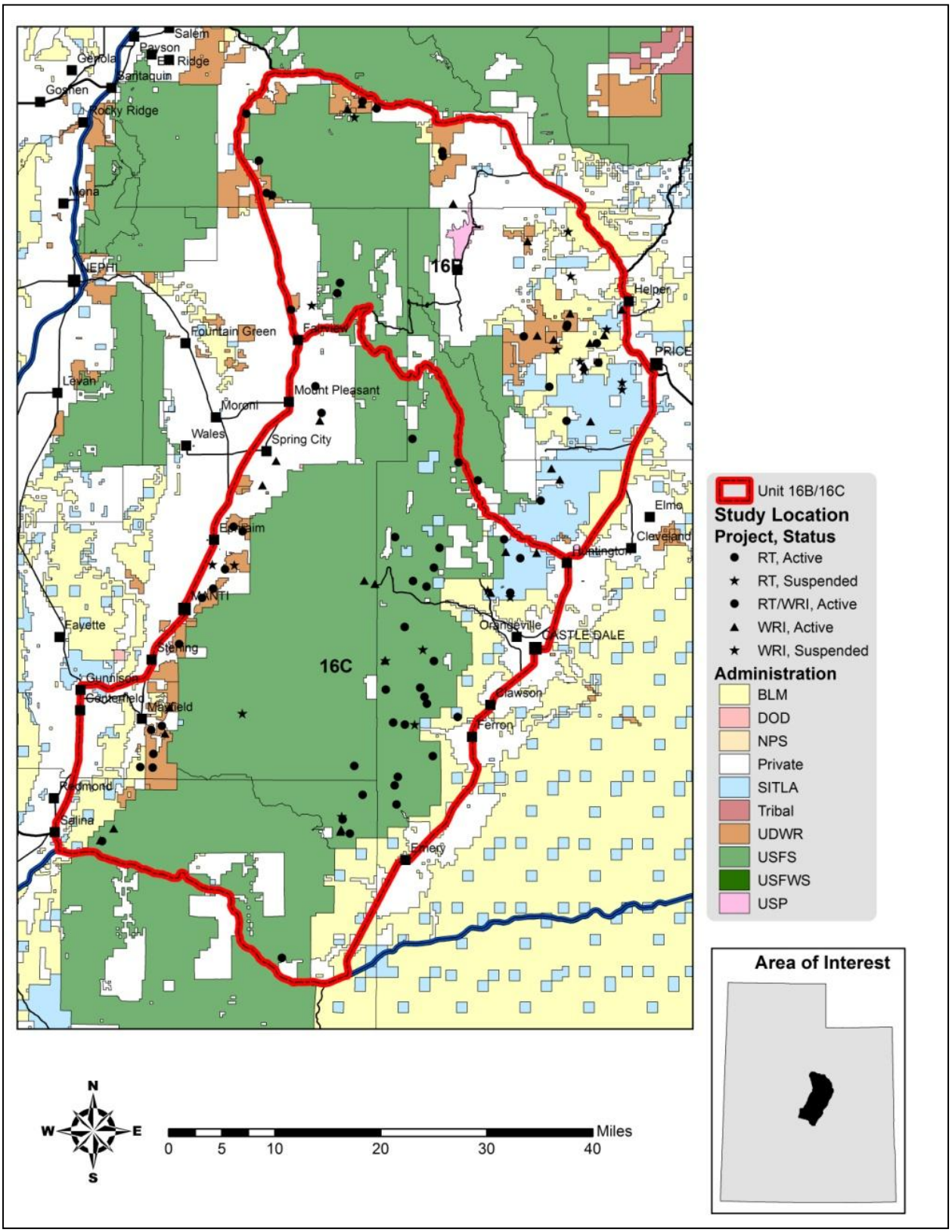
Table 4.1: Estimated mule deer and elk habitat acreage by season for WMU 16B/C, Manti North/South.

	Spring/Fall Range		Summer Range		Winter Range		Winter/Spring Range		Year Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*	*Area (acres)*	*%*
BLM	1,067	0%	4,995	1%	122711	19%	2169	2%	28	2%
DOD	0	0%	0	0%	62	0%	16	0%	0	0%
Private	22,760	11%	86,327	17%	199755	30%	33052	33%	51	5%
SITLA	28	0%	4,796	1%	81656	12%	844	1%	1037	93%
UDOT	0	0%	0	<1%	114	0%	0	<1%	0	0%
UDWR	2,115	1%	1,013	0%	43927	7%	19210	19%	0	0%
USFS	188,638	88%	416,101	81%	211690	32%	45654	45%	0	0%
USP	0	0%	1,108	0%	494	0%	0	0%	0	0%
Total	**214,607**	**100%**	**514,340**	**100%**	**660,409**	**100%**	**100,946**	**100%**	**1,115**	**100%**

Table 4.2: Estimated mule deer habitat acreage by season and ownership for WMU 16B/C, Manti North/South.

	Spring/Fall Range		Summer Range		Winter Range		Year-Long Range	
Ownership	*Area (acres)*	*%*	*Area (acres)*	*%*	*Area (Acres)*	*%*	*Area (acres)*	*%*
BLM	789	1%	935	0%	111,562	16%	8,325	13%
DOD	0	0%	0	0%	78	0%	0	0%
Private	12,834	8%	101,533	19%	162,827	23%	49,480	79%
SITLA	10	0%	3,278	1%	78,951	11%	1,405	2%
UDOT	0	0%	15	<1%	64	0%	7	<1%
UDWR	4,845	3%	1,938	<1%	54,512	8%	2,541	4%
USFS	133,420	88%	429,766	80%	297,150	42%	929	1%
USP	0	0%	772	<1%	517	0%	276	<1%
Total	**151898**	**100%**	**538,237**	**100%**	**705,660**	**100%**	**62,963**	**100%**

Table 4.3: Estimated elk habitat acreage by season and ownership for WMU 16B/C, Manti North/South.



Map 4.4: Land ownership for WMU 16B/C, Manti North/South.

Group	Existing Vegetation Type	Acres	% of Total	Group % of Total
Shrubland	Arctostaphylos patula Shrubland Alliance	910	0.06%	
	Artemisia tridentata ssp. vaseyana Shrubland Alliance	54,756	3.34%	
	Coleogyne ramosissima Shrubland Alliance	1,618	0.10%	
	Colorado Plateau Mixed Low Sagebrush Shrubland	58,181	3.55%	
	Grayia spinosa Shrubland Alliance	37	0.00%	
	Great Basin Semi-Desert Chaparral	2,642	0.16%	
	Inter-Mountain Basins Big Sagebrush Shrubland	94,030	5.73%	
	Inter-Mountain Basins Big Sagebrush Steppe	182	0.01%	
	Inter-Mountain Basins Greasewood Flat	9,072	0.55%	
	Inter-Mountain Basins Mat Saltbush Shrubland	19,817	1.21%	
	Inter-Mountain Basins Mixed Salt Desert Scrub	76,519	4.66%	
	Inter-Mountain Basins Montane Sagebrush Steppe	38,028	2.32%	
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	21,430	1.31%	
	Mogollon Chaparral	42	0.00%	
	Mojave Mid-Elevation Mixed Desert Scrub	0.2	0.00%	
	Quercus gambelii Shrubland Alliance	21,967	1.34%	
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	32,155	1.96%	
	Rocky Mountain Lower Montane-Foothill Shrubland	24,357	1.48%	
	Southern Colorado Plateau Sand Shrubland	62	0.00%	27.78%
Conifer	Abies concolor Forest Alliance	10,442	0.64%	
	Colorado Plateau Pinyon-Juniper Woodland	295,767	18.03%	
	Great Basin Pinyon-Juniper Woodland	1	0.00%	
	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	25,676	1.57%	
	Inter-Mountain Basins Juniper Savanna	5	0.00%	
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	566	0.03%	
	Rocky Mountain Lodgepole Pine Forest	818	0.05%	
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	70,878	4.32%	
	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	154	0.01%	
	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	47	0.00%	
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	12,836	0.78%	
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	41,289	2.52%	
	Southern Rocky Mountain Ponderosa Pine Savanna	75	0.00%	
	Southern Rocky Mountain Ponderosa Pine Woodland	4,804	0.29%	28.24%
Conifer-Hardwood	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	139,728	8.52%	8.52%
Hardwood	Rocky Mountain Aspen Forest and Woodland	247,662	15.10%	
	Rocky Mountain Bigtooth Maple Ravine Woodland	22,986	1.40%	16.50%
Grassland	Inter-Mountain Basins Semi-Desert Grassland	5,269	0.32%	
	Rocky Mountain Alpine Dwarf-Shrubland	724	0.04%	
	Rocky Mountain Alpine Turf	29	0.00%	
	Rocky Mountain Subalpine-Montane Mesic Meadow	31,944	1.95%	
	Southern Rocky Mountain Montane-Subalpine Grassland	40,387	2.46%	4.78%
Other	Agricultural	47,480	2.89%	
	Barren	38,664	2.36%	
	Developed	18,090	1.10%	
	Developed-High Intensity	18	0.00%	
	Developed-Low Intensity	2,462	0.15%	
	Developed-Medium Intensity	554	0.03%	
	Developed-Roads	16,884	1.03%	
	Exotic Herbaceous	21,861	1.33%	
	Exotic Tree-Shrub	178	0.01%	
	Open Water	6,262	0.38%	
	Quarries-Strip Mines-Gravel Pits	503	0.03%	
	Riparian	19,184	1.17%	
	Snow-Ice	2	0.00%	
	Sparsely Vegetated	60,479	3.69%	14.18%
Total		1,640,510		

Table 4.4: Landfire existing vegetation coverage (LANDFIRE: LANDFIRE 1.3.0, 2014) of deer winter range for WMU 16B/C, Manti North/South.

Limiting Factors to Big Game Habitat

Central Mountains Manti North

The Manti-North area has historically supported a variety of wildlife and outdoor recreation, livestock grazing, ranches and farms, energy developments, and some forest industry. Industrial activities on the

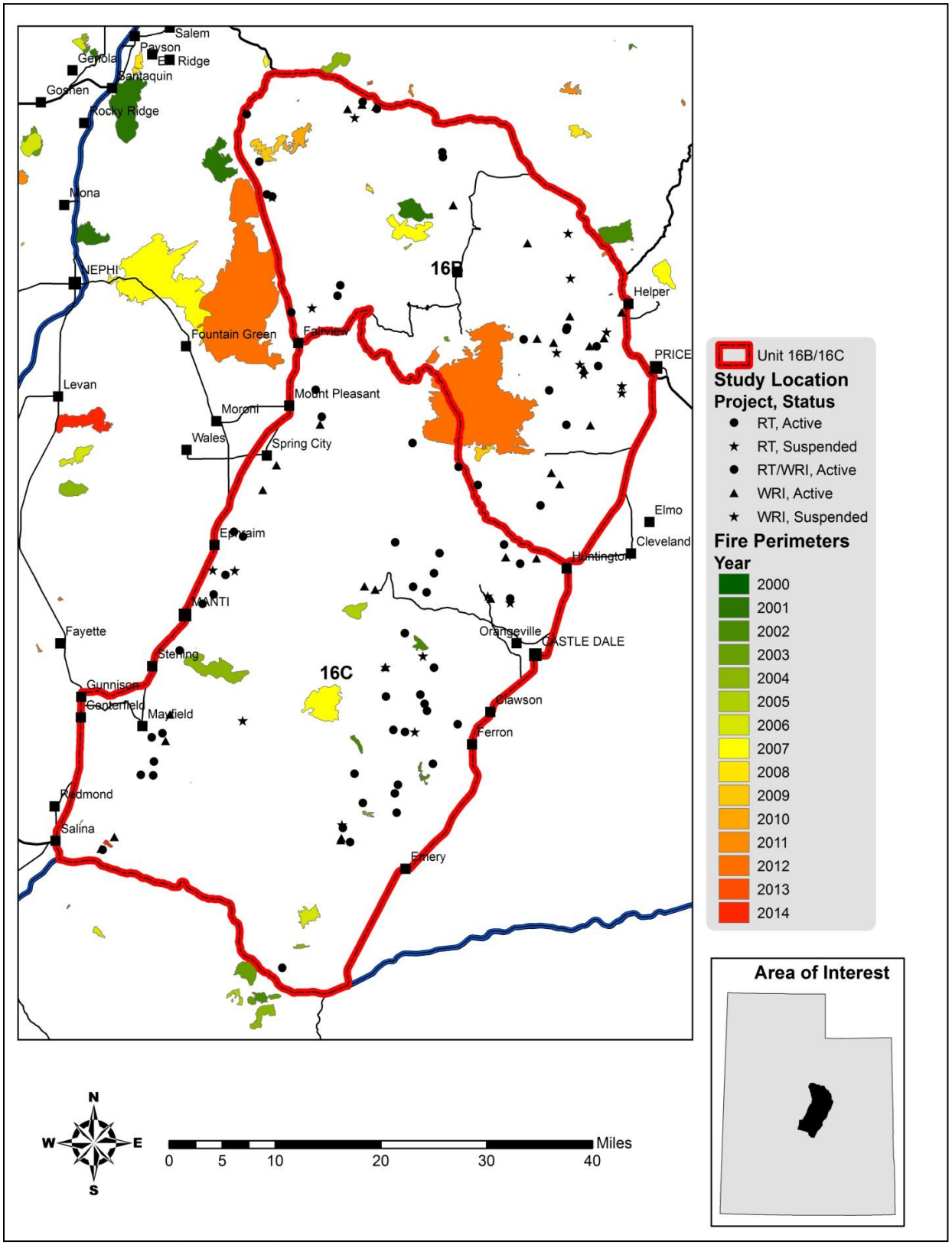
unit are associated primarily with coal production, electrical power generation, and oil and gas development. Exploration and development activities for oil and gas have the potential for future increases. Add to this a growing demand for low-sulfur Wasatch coal, and the demands placed upon winter ranges in this area will likely increase. Power plants, pipelines, slack piles, coal load-out facilities, ghost towns, railroads, and agriculture compete for valuable winter range property. The Huntington Canyon Power Plant alone has removed over 400 acres of crucial winter range. An extensive road system provides year-round access to large portions of the winter range. Heavily used access roads to coal mines dissect important winter ranges all along the east side of the Wasatch Plateau and are accountable for a large number of the highway deer mortality.

Central Mountains Manti South

The upper portions of the winter range on Forest Service lands are managed primarily for livestock grazing. Widespread watershed rehabilitation through contour trenching and seeding was done on this rangeland in the 1960's. An extensive road system provides access to a large percentage of the winter range. Many roads in crucial areas are open or maintained and used winter long in relation to various activities, namely mining, gas wells, the Horn Mountain TV towers, and for recreation. Access is more restricted further south in the Ferron and Muddy Creek drainages. The lowest foothill ranges are accessible year-round and are usually adjacent to agricultural areas. Coal mining and the power plants are the major economic activities in the area. Other associated impacts include road improvements, truck traffic, and an increased human population. Outdoor recreation is popular in the area. These activities include camping, hunting, fishing, four-wheeling, and snowmobiling and are facilitated by the extensive road system in the mountains and foothills.

Both

Encroachment by pinyon-juniper woodland communities also poses a substantial threat to important sagebrush rangelands. Pinyon-juniper woodlands dominate the vegetation cover within the deer winter range on WMU 16B and 16C (Table 4.4). Encroachment and invasion of these woodlands into sagebrush communities has been shown to decrease sagebrush and herbaceous cover, and therefore decreases available forage for wildlife (Miller, Svejcar, & Rose, 2000).

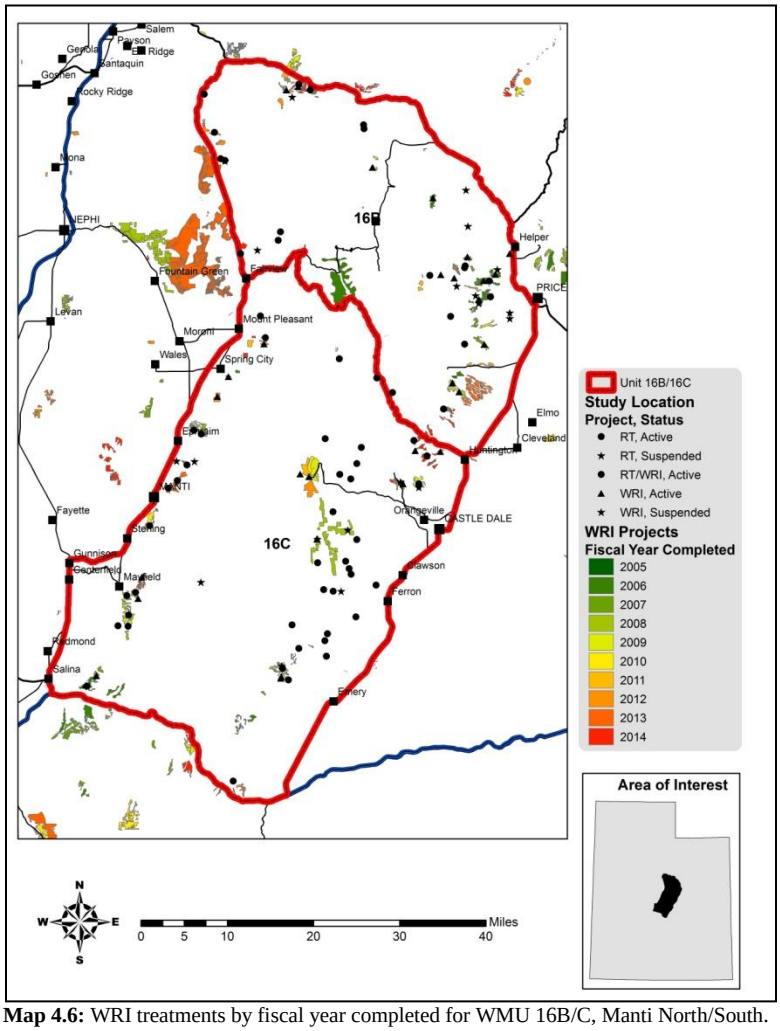


Map 4.5: Land coverage of fires by year from 2001-2014 for WMU 16B/C, Manti North/South.

Treatments/Restoration Work

There has been an active effort to address many of the limitations on these units through the Watershed Restoration Initiative (WRI). A total of 36,336 acres of land have been treated within the Manti North and South units since the WRI was implemented in 2004. As seen on the map, treatments occasionally overlap one another bringing the total treatment acres to 38,043 acres for this unit (Map 4.6). 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.

Treatments to reduce pinyon-juniper woodlands such as bullhog and vegetation removal/hand crew are common management practices on this unit. Other common management treatments are those to rejuvenate sagebrush stands such as brush beater and harrow treatments. In addition to these treatments, many have had seeding treatments associated with it to increase desirable species (Table 4.5).



Map 4.6: WRI treatments by fiscal year completed for WMU 16B/C, Manti North/South.

Treatment Action	Acres
Anchor chain	148
Brush beater (mower)	845
Bullhog	9,147
Chain Harrow	400
Harrow	1,295
Herbicide Application	5,472
Interseeding	57
Mower	51
PJ push	200
Planting/transplanting	2
Road decommissioning	18
Roller chopper	266
Seeding (primary)	8,871
Seeding (secondary/shrub)	2,740
Vegetation removal / hand crew	8,340
Other	191
***Total Land Area Treated**	**36,336**
Total Treatment Acres	**38,043**

Table 4.5: WRI treatment action size (acres) for WMU 16B/C, Manti North/South.
*Does not include overlapping treatments.

Range Trend Studies

Range Trend studies have been sampled within WMU 16B and 16C on a regular basis since 1985, with studies being added or suspended as was deemed necessary (Table 4.6). Due to changes in sampling methodologies, only data sampled following the 1992 sample year are included in this summary. Monitoring studies of WRI projects began in 2004. When possible, WRI monitoring studies are established prior to treatment and sampled on a regular basis following treatment. Due to the long-term nature of the studies, many of the Range Trend and WRI studies have had some sort of disturbance or treatment prior to or since study establishment (Table 4.7).

Range Trend studies that have not had recent disturbance or treatments are summarized in this report by ecological site. Range Trend and WRI studies that have a disturbance or treatment during the reported sample period are summarized in this report by the disturbance or treatment type.

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
16B-1	Long Ridge South	RT	Suspended	‘89 ’97 ‘02, ‘07	Not Verified
16B-2	Long Ridge North	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Stony Loam (Mountain Big Sagebrush)
16B-3	Rocky Hollow	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
16B-4	Dry Creek Chaining	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Shallow Loam (Pinyon-Utah Juniper)
16B-5	Jackson Unit	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Gravelly Loam (Pinyon-Utah Juniper)
16B-6	Mill Fork	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Mountain Loam (Mountain Big Sagebrush)
16B-7	East Dairy Fork	RT	Suspended	‘89 ‘97	Not Verified
16B-8	Starvation Mahogany	RT	Active	‘89, ‘99 ‘02, ‘07, ‘14	Mountain Shallow Loam (Curlleaf Mahogany)
16B-9	Starvation Mountain Brush	RT	Active	‘89, ‘99 ‘02, ‘07, ‘14	Mountain Stony Loam (Browse)
16B-10	Dairy Fork Burn	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Big Sagebrush)
16B-11	Hilltop	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Shallow Hardpan (Pinyon-Utah Juniper)
16B-12	Oak Creek	RT	Suspended	‘89 ‘97	Not Verified
16B-13	Oak Creek Ridge Aspen	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	High Mountain Loam (Aspen)
16B-14	Oak Creek Ridge Seeding	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	High Mountain Clay (Slender Wheatgrass)
16B-15	Ford Ridge	RT	Suspended	‘88, ‘94, ‘99	Not Verified
16B-16	Hardscrabble	RT	Suspended	‘88, ‘94, ‘99	Not Verified
16B-17	Slackpile	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Wyoming Big Sagebrush)
16B-18	Porphyry Bench	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Loam (Wyoming Big Sagebrush)
16B-19	North Spring Bench	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Wyoming Big Sagebrush)
16B-20	Telephone Bench	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Black Sagebrush)
16B-21	Huntington Canyon	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Stony Loam (Mountain Big Sagebrush)
16B-22	Poison Spring Bench	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Black Sagebrush)
16B-23	Consumer Bench	RT/WRI	Active	‘94, ‘99, ‘04, ‘09, ‘12, ‘14	Semidesert Loam (Wyoming Big Sagebrush)
16B-24	Wiregrass Bench	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
16C-1	Manti Face Chaining	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Black Sagebrush)
16C-2	Willow Creek	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Shallow Loam (Pinyon-Utah Juniper)
16C-3	North Manti Face	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Mountain Big Sagebrush)
16C-4	Bald Mountain	RT	Suspended	‘89, ‘97, ‘02	Not Verified
16C-5	Cane Valley	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Clay (Pinyon-Utah Juniper)
16C-6	Black Hill	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Shallow Loam (Wyoming Big Sagebrush)
16C-7	Mayfield Mountain Face	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Black Sagebrush)
16C-8	Pole Canyon Chaining	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Mountain Big Sagebrush-Indian Ricegrass)
16C-9	Pole Canyon Oak	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Mountain Stony Loam (Oak)
16C-10	Julius Pasture	RT	Suspended	‘89 ‘97	Not Verified
16C-11	Above South Hollow	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-12	Manti Dump	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Wyoming Big Sagebrush)
16C-13	West Huntington Canyon	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Shallow Loam (Mountain Big Sagebrush)
16C-14	Red Point	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Stony Loam (Pinyon-Utah Juniper)
16C-15	Howard FS Chaining	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Pinyon-Utah Juniper)
16C-16	Church Mine Road	RT	Suspended	‘88	Not Verified
16C-17	Middle Mountain	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
16C-18	East Mountain	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	High Mountain Loam (Mountain Big

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
					Sagebrush)
16C-19	Trail Mountain Exclosure	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
16C-20	Miles Point	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-21	North Horn Cap	RT	Suspended	‘88, ‘94, ‘99	Not Verified
16C-22	North Horn- Rock Canyon	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Shallow Loam (Black Sagebrush)
16C-23	Black Dragon	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Mountain Big Sagebrush)
16C-24	South Horn Exclosure	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
16C-25	South Horn 1/4 Corner	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-26	Dry Mountain	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Sand (Mountain Big Sagebrush)
16C-27	Birch Creek Chaining	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Mountain Big Sagebrush)
16C-28	South of Dry Wash	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Shallow Loam (Birchleaf Mountain Mahogany)
16C-29	Scab Hollow	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Curlleaf Mahogany)
16C-30	Upper Hole Trail	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Browse)
16C-31	Box Canyon Knolls	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Mountain Shallow Loam (Black Sagebrush)
16C-32	Muddy Creek	RT	Active	‘88, ‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Clay (Shadscale)
16C-33	Little Nelson Mountain	RT	Suspended	‘94, ‘99, ‘04, ‘09	Not Verified
16C-34	South Sage Flat	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Black Sagebrush)
16C-35	Wildcat Knolls	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Mountain Shallow Loam (Black Sagebrush)
16C-36	Danish Bench	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Semidesert Shallow Loam (Black Sagebrush)
16C-37	Joes Valley Overlook	RT	Active	‘94, ‘99, ‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-38	Pleasant Creek	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-39	Cove Creek	RT	Active	‘89 ‘97 ‘02, ‘07, ‘14	Upland Loam (Shrub)
16C-40	Cedar Mountain	RT	Active	‘85, ‘91, ‘99, ‘04, ‘09, ‘14	Upland Shallow Loam (Black Sagebrush)
16C-41	Trough Hollow	RT	Active	‘85, ‘91, ‘99, ‘04, ‘09, ‘14	Mountain Shallow Loam (Mountain Big Sagebrush)
16C-42	Box Canyon Sage-Grouse	RT	Active	‘04, ‘09, ‘14	Mountain Shallow Loam (Mountain Big Sagebrush)
16C-43	Olson Draw Sage-Grouse	RT	Active	‘04, ‘09, ‘14	Mountain Loam (Mountain Big Sagebrush)
16C-44	North Horn	RT	Active	‘05, ‘09, ‘14	Mountain Shallow Loam (Birchleaf Mahogany)
16C-45	Olsen Canyon	RT	Active	‘07, ‘14	Upland Gravelly Loam (Wyoming Big Sagebrush)
16C-46	Indian Hollow	RT	Active	‘14	Semidesert Shallow Loam (Black Sagebrush)
16R-1	Price Pipeline South	RT	Suspended	‘97, ‘04	Not Verified
16R-2	Price Pipeline Native South	RT	Suspended	‘97, ‘04	Not Verified
16R-3	Price Pipeline Native North	RT	Suspended	‘97, ‘04	Not Verified
16R-4	Price Pipeline North	RT	Suspended	‘97, ‘04	Not Verified
16R-5	Scad Hollow	RT	Active	‘98, ‘04, ‘09, ‘14	High Mountain Loam (Silver Sagebrush)
16R-6	North Slackpile	RT	Active	‘98, ‘04, ‘09, ‘14	Upland Loam (Wyoming Big Sagebrush)
16R-10	Gordon Creek Burn	RT	Suspended	‘99, ‘01, ‘04, ‘09	Not Verified
16R-11	Lower Cedar Bench	WRI	Active	‘04, ‘07, ‘12	Not Verified
16R-12	Upper Cedar Bench	WRI	Active	‘04, ‘07, ‘12	Not Verified
16R-13	Upper Porphyry	WRI	Active	‘04, ‘07, ‘09, ‘10, ‘12	Not Verified
16R-14	Consumer Bench North	WRI	Active	‘05, ‘08, ‘12	Not Verified
16R-15	Consumer Bench 2	WRI	Active	‘05, ‘08, ‘12	Not Verified
16R-16	Wildcat Push	WRI	Active	‘05, ‘10, ‘14	Upland Loam (Mountain Big Sagebrush)
16R-17	Cedar Mountain Brush Saw	WRI	Active	‘05, ‘08, ‘13	Upland Shallow Loam (Black Sagebrush)
16R-18	Cedar Mountain Dixie	WRI	Active	‘05, ‘08, ‘13	Upland Shallow Loam (Black Sagebrush)
16R-19	Lower Fish Creek WMA	WRI	Active	‘05, ‘10	Not Verified
16R-20	Howerton's	WRI	Active	‘05, ‘07, ‘13	Not Verified
16R-21	Stump Flat	WRI	Active	‘06, ‘10, ‘14	Upland Stony Loam (Pinyon-Utah Juniper)
16R-23	North Spring	WRI	Active	‘06, ‘10, ‘14	Semidesert Loam (Wyoming Big Sagebrush)
16R-24	12 Mile Dixie	WRI	Active	‘06, ‘10, ‘13	Not Verified
16R-25	Black Dragon Bullhog	WRI	Active	‘06, ‘09, ‘12	Not Verified
16R-27	DC Plateau	WRI	Suspended	‘07	Not Verified
16R-29	Wildcat Disking Reference	WRI	Suspended	‘08	Not Verified
16R-30	Mill Fork Chaining	WRI	Active	‘07, ‘10, ‘14	Mountain Loam (Mountain Big Sagebrush)
16R-31	Mohrland Roller Chopper 1	WRI	Active	‘08, ‘11, ‘14	Upland Shallow Loam (Black Sagebrush)
16R-32	Mohrland Roller Chopper 2	WRI	Active	‘08, ‘11, ‘14	Upland Shallow Loam (Black Sagebrush)
16R-33	Scofield Dixie	WRI	Active	‘08, ‘11	Not Verified
16R-34	Wildcat Dixie Harrow	WRI	Active	‘09, ‘10, ‘13	Not Verified
16R-35	Upper Porphyry Reference	WRI	Suspended	‘09	Not Verified
16R-36	Consumer Bench Reference	WRI	Suspended	‘09	Not Verified
16R-37	Wildcat Disking	WRI	Active	‘09, ‘10, ‘13	Mountain Loam (Mountain Big Sagebrush)
16R-38	Black Dragon Reference	WRI	Suspended	‘09	Not Verified
16R-42	Canal Canyon	WRI	Active	‘11, ‘14	Upland Shallow Loam (Pinyon-Utah Juniper)

Study #	Study Name	Project	Status	Year(s) Sampled	Ecological Site Description
16R-43	Swasey Mountain Brush Bullhog	WRI	Active	‘11	Not Verified
16R-44	Swasey Bullhog	WRI	Active	‘11	Not Verified
16R-45	Grimes Wash	WRI	Suspended	‘11	Not Verified
16R-46	Dairy fork 1	WRI	Active	‘12	Not Verified
16R-47	Dairy fork 2	WRI	Active	‘12	Not Verified
16R-48	North Hollow	WRI	Active	‘12	Not Verified
16R-49	Stump Flat 2	WRI	Active	‘13	Semidesert Shallow Loam (Black Sagebrush)
16R-50	Bear Ranch	WRI	Active	‘13	Mountain Gravely Loam (Oak)
16R-51	North Canyon	WRI	Active	‘13	Upland Stony Loam (Mountain Big Sagebrush)
16R-52	Helper Benches	WRI	Active	‘14	Upland Stony Loam (Pinyon-Utah Juniper)
16R-53	Gimes Wash 2	WRI	Active	‘14	Upland Shallow Loam (Pinyon-Utah Juniper)

Table 4.6: Range trend and WRI project studies monitoring history and ecological site potential for WMU 16B/C, Central Mountains, Manti North/South.

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
16B-4	Dry Creek Chaining	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Bullhog	Dry Canyon Wildlife Improvement and Fuels Reduction Project Phase I	July 2010 - July 2012	496	1701
16B-5	Jackson Unit	Chain Unknown		1972		
		Seed Unknown		1972		
16B-6	Mill Fork	Aerial After	Mill Fork Wildlife Habitat Improvement Project	October 2007	462	716
		2-way Ely/Smooth Chain	Mill Fork Wildlife Habitat Improvement Project	October 2007	350	716
		Dribbler	Mill Fork Wildlife Habitat Improvement Project	October 2007	370	716
16B-9	Starvation Mountain Brush	Bullhog		2002		
16B-10	Dairy Fork Burn	Wildfire		1988		
		Chain Unknown		1988		
		Disc		1988		
		Seed Unknown		1988		
		One-Way Ely Chaining	Mill Fork Wildlife Habitat Improvement Project	Fall 2006-Fall 2004	486	716
		One-Way Smooth Chaining	Mill Fork Wildlife Habitat Improvement Project	Fall 2006-Fall 2005	486	716
		Seeding: Aerial	Mill Fork Wildlife Habitat Improvement Project	Fall 2006-Fall 2006	486	716
		Lop and Scatter	Mill Fork Wildlife Habitat Improvement Project	Fall 2006-Fall 2007	486	716
		*Lop and Scatter	Mill Fork Wildlife Habitat Improvement Project Phase 2	2014	553	3019
16B-11	Hilltop	Chain Unknown		1978	250	
		Seed Unknown		1978	250	
16B-14	Oak Creek Ridge Seeding	Herbicide		1988		
		Seed Unknown		1988		
16B-18	Porphyry Bench	2-Aerator/Seed	Price West Benches Year 1--Porphyry Bench	Nov. 2004 and Apr. 2005	1104	229
		Aerial After	Price West Benches Year 1--Porphyry Bench	Dec. 2004	1104	229
16B-22	Poison Spring Bench	Chain Unknown		late 1960's		
		Seed Unknown		late 1960's		
16B-23	Consumer Bench	2-Aerator/Seed	Price West Benches Year 2	Fall 2004-Spring 2005	1851	228
		Aerial After	Price West Benches Year 2	Mar. 2005	2750	228
16C-1	Manti Face Chaining	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Lop and Scatter	Manti Face Lop and Scatter	Fall 2012	853	1707
16C-2	Willow Creek	Chain Unknown	Bald Mountain	1969	700	
		Seed Unknown	Bald Mountain	1969	700	
16C-3	North Manti Face	Lop and Scatter	Manti Face Lop and Scatter	2012	853	1707
16C-5	Cane Valley	2-way Chain Unknown		1982		
		Aerial		1982		
		Lop and Scatter	Black Hills WMA Lop and Scatter	Fall 2007	878	710
16C-6	Black Hill	Chain Unknown		1987		
		Seed Unknown		1987		
		Lop and Scatter	Black Hills WMA Lop and Scatter	2012	878	710
16C-7	Mayfield Mountain Face	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Lop and Scatter	Twelve Mile Wma Habitat Improvement	Fall 2007	1,294	273
		Seeding Truax Drill	Twelve Mile Wma Habitat Improvement	Fall 2007	60	273
16C-8	Pole Canyon Chaining	Chain Unknown		Prior to 1960		
		Seed Unknown		Prior to 1960		
		Lop and Scatter		1997 to 2002		

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
16C-9	Pole Canyon Oak	Chain Unknown		1970's		
		One-Way Smooth Chaining	Twelve Mile WMA Habitat Improvement Year 2	Fall 2008	514	1059
		Seeding: Aerial	Twelve Mile WMA Habitat Improvement Year 2	Fall 2009	614	1059
		Seeding: Dribbler	Twelve Mile WMA Habitat Improvement Year 2	Fall 2010	540	1059
16C-11	Above South Hollow	Chain Unknown		Prior to 1960		
		Seed Unknown		Prior to 1960		
		One-Way Smooth Chaining	Twelve Mile WMA Habitat Improvement Yr. 2	Fall 2008	614	1059
16C-12	Manti Dump	Chain Unknown	East Manti Dump	1961		
		Seed Unknown	East Manti Dump	1961		
16C-13	West Huntington Canyon	Wildfire		Historic		
16C-14	Red Point	Chain Unknown		1973	300	
		Seed Unknown		1973	300	
		Lop and Scatter	Burma Rd. Pinyon/Juniper Removal	Fall 2013	1,312	2556
16C-15	Howard FS Chaining	Chain Unknown		Early 1970's		
		Seed Unknown		Early 1970's		
16C-17	Middle Mountain	Chain Unknown		Historic	200	
		Bullhog		Spring 2009		
16C-18	East Mountain	Herbicide		late 1960's		
16C-19	Trail Mountain Exclosure	Contour Trench		1960's		
		Seed Unknown		1960's		
16C-23	Black Dragon	Contour Trench		1965		
		Seed Unknown		1965		
16C-26	Dry Mountain	Chain Unknown		1967		
		Seed Unknown		1967		
		Lop and Scatter		1999		
16C-27	Birch Creek Chaining	Chain Unknown		1972		
		Contour Trench		1972		
		Seed Unknown		1972		
		Lop and Scatter		Fall 2004		
16C-28	South of Dry Wash	Chain Unknown		1972	35	
		Seed Unknown		1972	35	
16C-34	South Sage Flat	Seed Unknown		Historic		
16C-36	Danish Bench	Chain Unknown		Historic		
		Seed Unknown		Historic		
		Lop and Scatter	Danish Bench Lop and Scatter	Spring 2009	586	1390
16C-37	Joe's Valley Overlook	Contour Trench		Historic		
		Seed Unknown		Historic		
16C-38	Pleasant Creek	One-Way Ely Chaining	Bear Mountain CWMU Habitat Enhancement	Spring 2014	285	2602
16C-40	Cedar Mountain	Seed Unknown		1979-1980		
		Chain Unknown		1979-1980		
		One-Way Dixie Harrow	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year 1	Fall 2005	2564	216
16C-42	Box Canyon Sage Grouse	Seed Unknown		Historic		
		1-way Dixie Harrow	Wildcat Knolls Habitat Improvement	Fall 2008	435	1161
		Broadcast Before	Wildcat Knolls Habitat Improvement	Fall 2008	810	1161
		Rangeland Drill	Wildcat Sagebrush Restoration Project Phase II	Fall 2009	466	1392
16C-44	North Horn	Contour Trench		Historic		
16C-45	Olsen Canyon	Seed Unknown		Historic		
		Chain Unknown		Historic		
		Lop and Scatter	Twelve Mile Wma Habitat Improvement	2006-2007		273
16R-6	North Slackpile	Roller Chopper	Gordon Creek Roller Chopper	Fall 2006	199	513
16R-10	Gordon Creek Burn	Prescribed Fire		Mar. 1999	160	
		Broadcast/Harrow		Mar. 1999	160	
16R-11	Lower Cedar Bench	Push	Cedar Bench	Spring 2005		PDB

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
		Broadcast Before	Cedar Bench	Spring 2005		PDB
16R-12	Upper Cedar Bench	Push	Cedar Bench	Spring 2005		PDB
		Broadcast Before	Cedar Bench	Spring 2005		PDB
16R-13	Upper Porphyry	2-Aerator/Seed	Price West Benches Year 1--Porphyry Bench	Nov. 2004 and Apr. 2005	1104	229
		Aerial After (Seeding)	Price West Benches Year 1--Porphyry Bench	Dec. 2004	1104	229
16R-14	Consumer Bench North	2-Aerator/Seed	Price West Benches Year 2	Fall 2004-Spring2005	1851	228
		Aerial After (Seeding)	Price West Benches Year 2	Mar. 2005	2750	228
16R-15	Consumer Bench 2	2-Aerator/Seed	Price West Benches Year 2	Fall 2004-Spring2005	1851	228
		Aerial After	Price West Benches Year 2	Mar. 2005	2750	228
16R-16	Wildcat Push	Roller Chopper	Wildcat Canyon P-J Removal	Oct. 2007	140	32
		Aerial Before (Seeding)	Wildcat Canyon P-J Removal	Oct. 2007	140	32
		Dribbler	Wildcat Canyon P-J Removal	Oct. 2007	140	32
16R-17	Cedar Mountain Brush Saw	Chain Unknown		1970's		
		Brush Saw	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year 2	2006	2469	465
		Bullhog or Lop and Scatter		2008-2013		
16R-18	Cedar Mountain Dixie	Chain Unknown		1970's		
		Seed Unknown		1970's		
		2-Way Dixie Harrow	Fishlake NF PJ Maintenance-Sagebrush Enhancement - Year	Fall 2005	4445	216
16R-19	Lower Fish Creek WMA	Herbicide	Lower Fish Creek Sage-Grouse Habitat Improvement	Jun. 2006	74	17
16R-20	Howerton's	Disc	Spring City Plateau Demonstration Project	Oct. 2005	50	169
		Rangeland Drill	Spring City Plateau Demonstration Project	Oct. 2005	50	169
		Herbicide (Plateau)	Spring City Plateau Demonstration Project	Nov. 2005	50	169
16R-21	Stump Flat	Chain Unknown		Historic		
		Roller Chopper	Stump Flat Pinyon/Juniper Habitat Restoration	Fall 2006	67	431
16R-23	North Spring	1-way Dixie Harrow	Price West Benches Phase 3 - North Springs	Oct. 2006	680	430
			Price West Benches Phase 3 - North Springs	Oct. 2006	340	430
16R-24	12 Mile Dixie	Agriculture		Historic		
			Twelve Mile WMA Habitat Improvement	Nov. 2006	40	273
			Twelve Mile WMA Habitat Improvement	May 2007	40	273
			Twelve Mile WMA Habitat Improvement	Oct. 2007	40	273
			Twelve Mile WMA Habitat Improvement	Oct. 2007	40	273
			Twelve Mile WMA Habitat Improvement	Jan. 2008	40	273
16R-25	Black Dragon Bullhog	Bullhog	Black Dragon	Fall 2006-Jun. 2008	5775	514
16R-30	Mill Fork Chaining	2-way Ely/Smooth Chain	Mill Fork Wildlife Habitat Improvement	Oct. 2007	350	716
		Aerial Before (Seeding)	Mill Fork Wildlife Habitat Improvement	Oct. 2007	462	716
		Dribbler	Mill Fork Wildlife Habitat Improvement	Oct. 2007	350	716
16R-31	Mohrland Roller Chopper 1	2-way Chain Unknown		1960's		
		Seed Unknown		1960's		
		Roller Chopper	Mohrland PJ Removal	Nov. 2008	743	1083
		Aerial Before (Seeding)	Mohrland PJ Removal	Oct. 2008	743	1083
		Dribbler	Mohrland PJ Removal	Nov. 2008	743	1083
16R-32	Mohrland Roller	2-way Chain Unknown		1960's		

HERD UNIT	STUDY NAME	TYPE	NAME	DATE	SIZE (ACRES)	WRI Project #
	Chopper 2					
		Seed Unknown		1960's		
		Roller Chopper	Mohrland PJ Removal	Nov. 2008	743	1083
		Aerial Before (Seeding)	Mohrland PJ Removal	Oct. 2008	743	1083
		Dribbler	Mohrland PJ Removal	Nov. 2008	743	1083
16R-33	Scofield Dixie	2-way Dixie Harrow	Scofield Sage Grouse Habitat Restoration	Nov. 2008	150	1085
			Scofield Sage Grouse Habitat Restoration	Nov. 2008	150	1085
16R-34	Wildcat Dixie Harrow	1-way Dixie Harrow	Wildcat Knolls Habitat Improvement	Fall 2008	435	1161
		Broadcast Before	Wildcat Knolls Habitat Improvement	Fall 2008	810	1161
16R-37	Wildcat Disking	2-way Disc	Wildcat Knolls Habitat Improvement	Fall 2008	375	1161
		1-way Chain Harrow	Wildcat Knolls Habitat Improvement	Fall 2008	375	1161
		Broadcast Before (Seeding)	Wildcat Knolls Habitat Improvement	Fall 2008	810	1161
		Rangeland Drill	Wildcat Sagebrush Restoration Project Phase II	Fall 2009	466	1392
16R-42	Canal Canyon	2-way Ely/Smooth Chain	Canal Canyon Project	Oct. 2011	314	1921
		Dribbler	Canal Canyon Project	Oct. 2011	314	1921
		Aerial Before (Seeding)	Canal Canyon Project	Oct. 2011	314	1921
		Aerial After (Seeding)	Canal Canyon Project	Jan. 2012	314	1921
		Herbicide	Canal Canyon Project	Fall 2012	314	1921
16R-43	Swasey Mountain Brush Bullhog	Bullhog	Swasey Wildlife Improvement and Hazardous Fuels Reduction	Winter 2011-2012	1734	2091
16R-44	Swasey Bullhog	Bullhog	Swasey Wildlife Improvement and Hazardous Fuels Reduction	Winter 2011-2012	1734	2091
16R-45	Grimes Wash	2-way Ely Chain	Grimes Wash PJ Removal	Fall 2011	147	1946
		Aerial Before (Seeding)	Grimes Wash PJ Removal	Fall 2011	225	1946
16R-46	Dairy fork 1	Bullhog	Dairy Fork Habitat Improvement Phase 2	Fall2012-Spring2013	350	2214
16R-47	Dairy fork 2	2-way Ely/Smooth Chain	Dairy Fork Habitat Improvement Phase 2	Fall 2013	500	2214
		Aerial Before (Seeding)	Dairy Fork Habitat Improvement Phase 2	Fall 2013	500	2214
		Dribbler	Dairy Fork Habitat Improvement Phase 2	Fall 2013	500	2214
16R-48	North Hollow	Chain Unknown		Historic		
		2-way Ely/Smooth Chain	North Hollow WMA and LS Conservation Easement Habitat Improvement	Nov. 2012	392	2276
		Aerial Before (Seeding)	North Hollow WMA and LS Conservation Easement Habitat Improvement	Nov. 2012	420	2276
		Dribbler	North Hollow WMA and LS Conservation Easement Habitat Improvement	Nov. 2012	420	2276
		Aerial After (Seeding)	North Hollow WMA and LS Conservation Easement Habitat Improvement	Jan. 2013	420	2276
16R-49	Stump Flat 2	Bullhog	Stump Flat Pinyon/Juniper Removal Project	Fall 2013	460	2693
		Aerial (Seeding)	Stump Flat Pinyon/Juniper Removal Project	Fall 2013	460	2693
16R-50	Bear Ranch	2-way Ely/Smooth Chain	Bear Mountain CWMU Habitat Enhancement	Fall 2013	285	2602
		Aerial (Seeding)	Bear Mountain CWMU Habitat Enhancement	Fall 2013	285	2602
16R-52	Helper Benches	2-way Ely Chain	Helper Benches Pinyon/Juniper Removal	2015	308	3006
		Seeding	Helper Benches Pinyon/Juniper Removal	2015	308	3006

Table 4.7: Range trend and WRI studies known disturbance history for WMU 16B/C, Manti North/South.

Study Trend Summary (Undisturbed Sites)

High Mountain (Aspen)

There is one study [Oak Creek Ridge Aspen (16B-13)] classified as a High Mountain (Aspen) ecological site that remained undisturbed over the report period (Table 4.6). The study occurs on Elk Creek Ridge in the Central Mountains west of Skyline Drive.

Shrubs/Trees: The primary browse/tree on the Oak Creek Aspen study is aspen (*Populus tremuloides*). The line-intercept cover of aspen is good on this site ranging from 71% in 2002 to near 65% in 2014. The cover of other conifer species has remained negligible since 2002. The density of aspen is decreasing on the site from an estimated density of 590 trees/acre in 2002 to 381 trees/acre in 2014 (Figure 4.4). Understory browse species are rare on these sites.

Herbaceous Understory: The study site has a good herbaceous component with a mix of perennial grasses and forbs. The native grass species mountain brome (*Bromus carinatus*) is the dominant grass species on this site. Few other native grass species occur on the site and they have much lower cover and frequency values. Nested frequency of perennial grasses has fluctuated, but has remained relatively high since 1997 (Figure 4.6a). The cover of perennial grass increased from 6% in 1997 to 28% in 2014 (Figure 4.6b); this increase is largely attributed to an increase in mountain brome. Annual grass species are absent on the study.

Native perennial forb species composition is diverse with high nested frequency and cover. The nested frequency of perennial forb species decreased in 1997, but remains relatively high. Cover has steadily decreased from 30% in 1997 to 19% in 2014. Annual forbs increased in abundance from 1997 to 2007, but decreased dramatically in 2014 (Figure 4.6). The weedy species mountain tarweed (*Madia glomerata*) has persisted on the site and can become a nuisance without proper management.

Occupancy: Animal pellet groups have been low on this site. Pellet group transect data indicates that cattle predominately occupy this study. Elk and deer pellet groups are typically sampled in low abundance for this site. Cattle pats have been sampled in low abundance each sample year with a high of 15 days use/acre in 2002 to a low of 4 days use/acre in 2007 and 2014 (Figure 4.7).

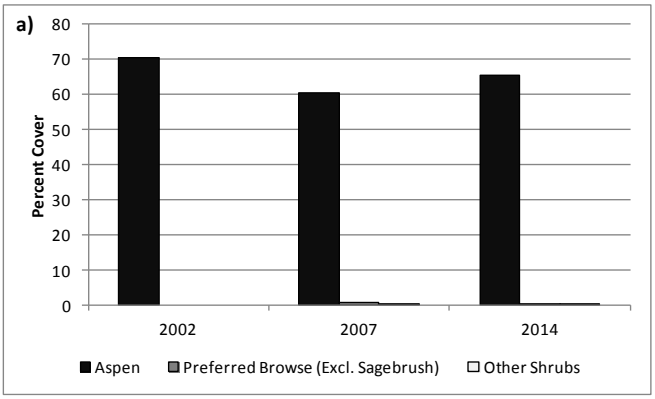


Figure 4.4: Shrub summary of the High Mountain (Aspen) studies (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups.

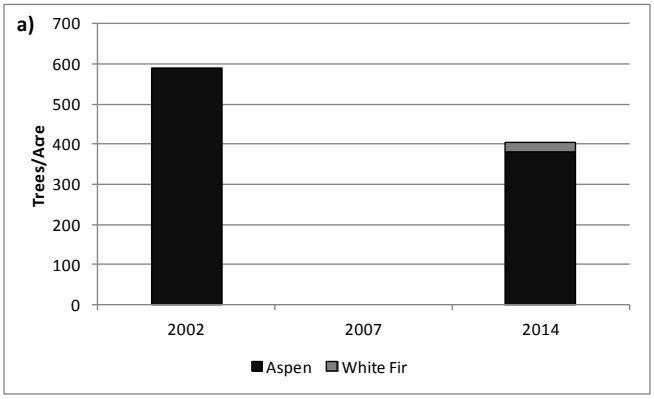


Figure 4.5: Tree summary of the High Mountain (Aspen) studies (n=1) for WMU 16B/C, Manti North/South. a) Point-quarter tree density estimates for aspen (*Populus tremuloides*) and conifer species.

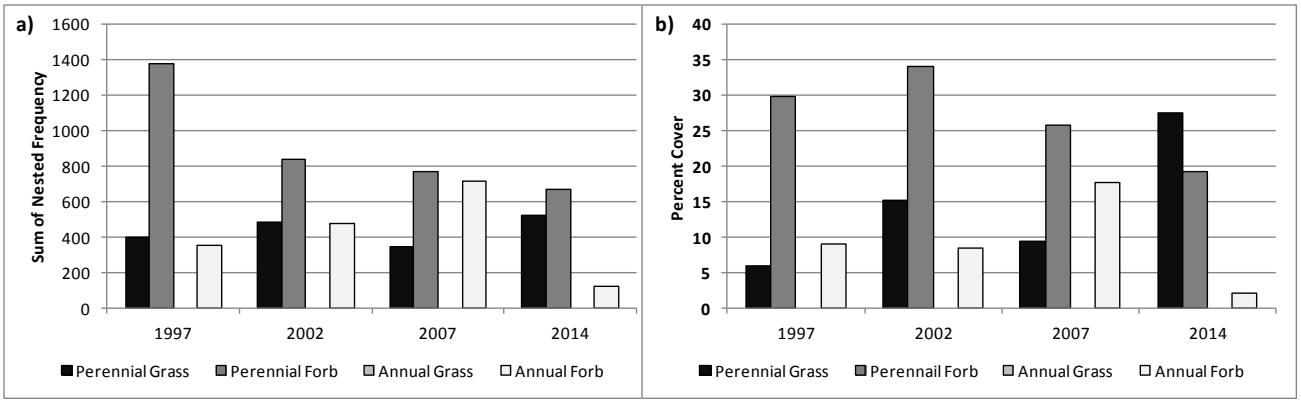


Figure 4.6: Herbaceous functional group summary of the High Mountain (Aspen) studies (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

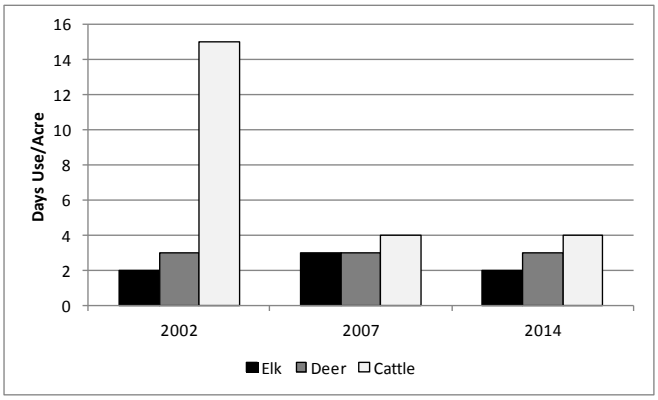


Figure 4.7: Pellet transect data for the High Mountain (Aspen) studies (n=1) for WMU 16B/C, Manti North/South.

High Mountain (Mountain Big Sagebrush)

There is one study [East Mountain (16C-18)] classified as High Mountain (Mountain Big Sagebrush) ecological site that remained undisturbed over the report period (Table 4.6). East Mountain occurs in the high elevation flats of Cedar Mountain east of Salina.

Shrubs/Trees: The primary browse on this study is mountain big sagebrush. The line-intercept cover of sagebrush has fluctuated slightly since 2004 ranging from 13 to 16%. The cover of other shrub species has remained similar at 4-5% since 2004 (Figure 4.8a). The average height of the mountain big sagebrush

is approximately one and half feet, making browse available through much of the year in mild winters. The demographics of the sagebrush population were a mixture of mostly mature and decadent plants with young plants increasing over the report period (Figure 4.8b).

Herbaceous Understory: This site has a good herbaceous component dominated by perennial grass and forb species. Numerous native grass species occur on this site. Nested frequency of perennial grasses have fluctuated, and have remained high since 1994 (Figure 4.9a). The cover of perennial grass has ranged from 8% in 2009 to 13% in 2014 (Figure 4.9b). Annual grass species are rare to near absent.

Native perennial forb species composition is diverse with high nested frequency and cover. The cover of perennial forbs has ranged from 7% in 1994 to above 17% in 1999 (Figure 4.9b).

Occupancy: Pellet group transect data indicates that elk predominately occupy this study. The abundance of elk pellet groups has ranged from a high of 76 days use/acre in 2009 to a low of 31 days use/acre in 2014. The abundance of deer pellet groups has ranged from a high of 21 days use/acre in 2004 to a low of 2 days use/acre in 2009. The abundance of cattle pellet groups has been rare over the sample period (Figure 4.10).

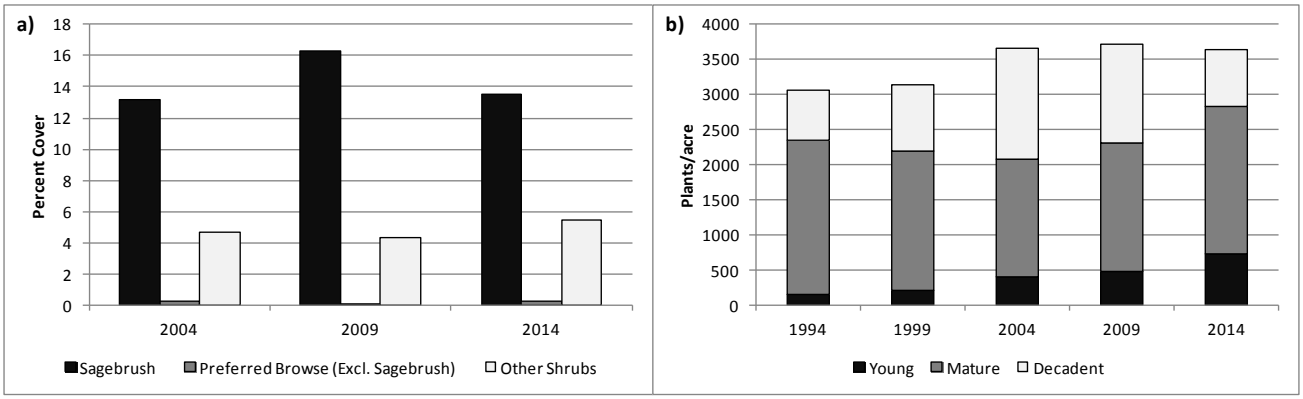


Figure 4.8: Shrub summary of the High Mountain (Mountain Big Sagebrush) study (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

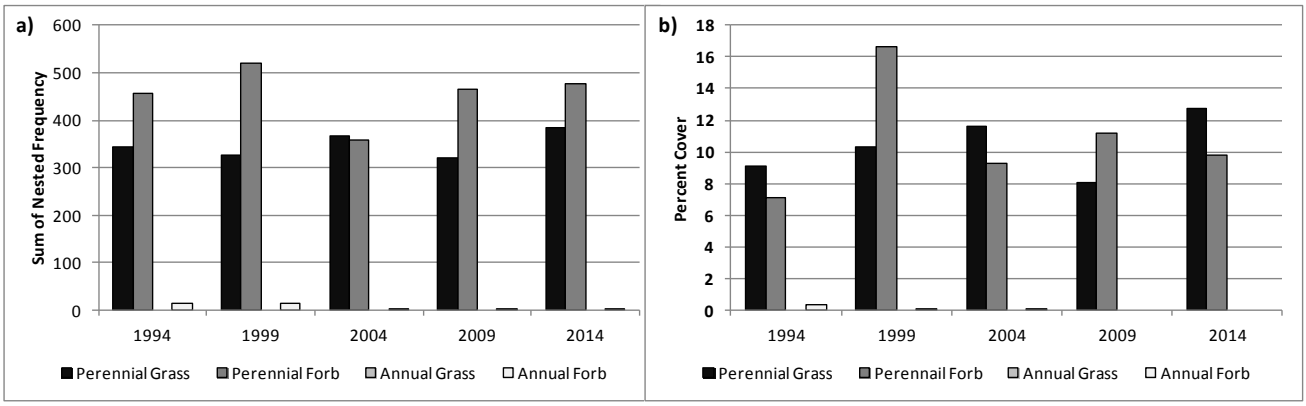


Figure 4.9: Herbaceous functional group summary of the High Mountain (Mountain Big Sagebrush) (n=1) for 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

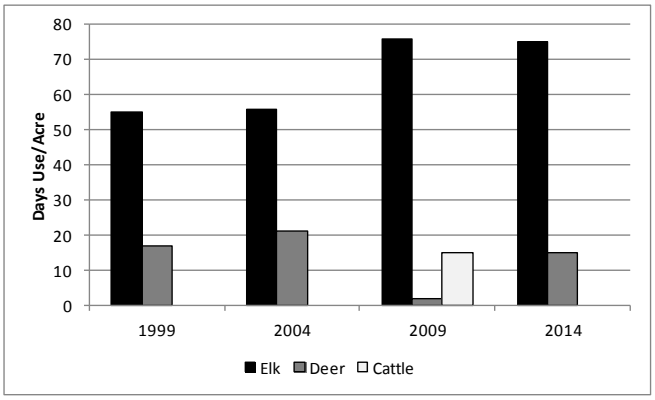


Figure 4.10: Pellet transect data for the High Mountain (Mountain Big Sagebrush) study (n=1) for WMU 16B/C, Manti North/South.

High Mountain (Silver Sagebrush)

There is one study [Scad Valley (16R-5)] classified as a High Mountain (Silver Sagebrush) ecological site that remained undisturbed over the report period (Table 4.6). The Scad Valley study is located in a valley west of Seeley and East Mountains.

Shrubs/Trees: The primary browse on the Scad Valley study is mountain silver sagebrush (*Artemisia cana*). The line-intercept cover of silver sagebrush is moderate and increasing on this site ranging from 6% in 2004 to 10% in 2014 (Figure 4.11). The demographics of the sagebrush population are mostly mature and young plants with mature plants being the most prevalent (Figure 4.11b).

Herbaceous Understory: The study site has a good herbaceous component dominated by perennial forbs. However, grass species are also high in abundance and include the introduced species Kentucky bluegrass (*Poa pratensis*), which is considered to be aggressive at higher elevation and precipitation. Many native species also occur on the site, but at much lower cover and frequency values than the introduced species. Competition with these introduced grasses may limit other desirable herbaceous species. Nested frequency of perennial grasses has generally increased, and has remained high since 1998 (Figure 4.12a). Cover of perennial grass has increased from 24% in 1998 to 46% in 2014 (Figure 4.12b). Annual grass is rare on this study site.

Native perennial forb species composition is diverse with very high nested frequency and cover. Cover of perennial forb species has increased from 39% in 1998 to 47% in 2014 (Figure 4.12b). Annual forbs are rare on this site.

Occupancy: Pellet group transect data indicates that sheep predominately occupy this study while elk and deer are rarely sampled. The abundance of sheep pellet groups has ranged from a high of 143 days use/acre in 2014 to a low of 11 days use/acre in 1998 (Figure 4.13).

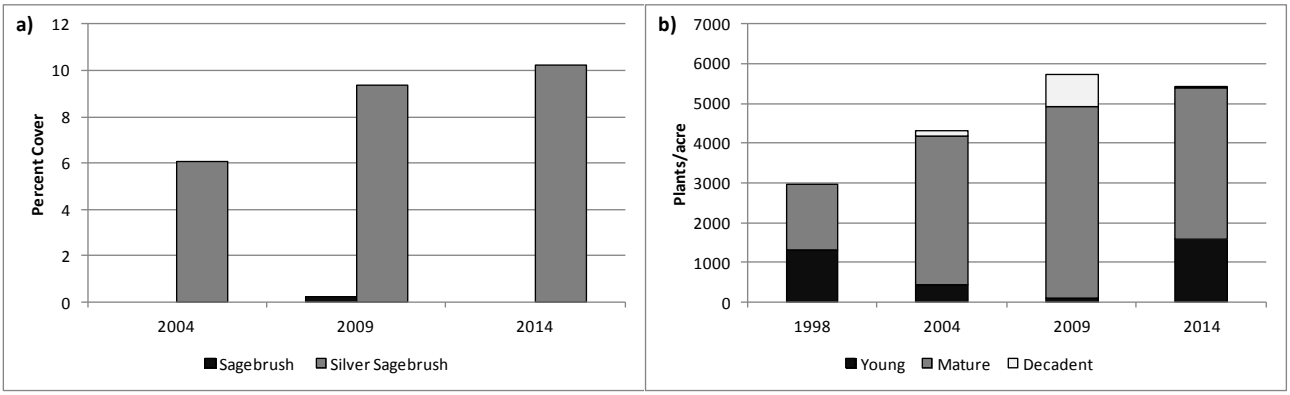


Figure 4.11: Shrub summary of the High Mountain (Silver Sagebrush) study (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

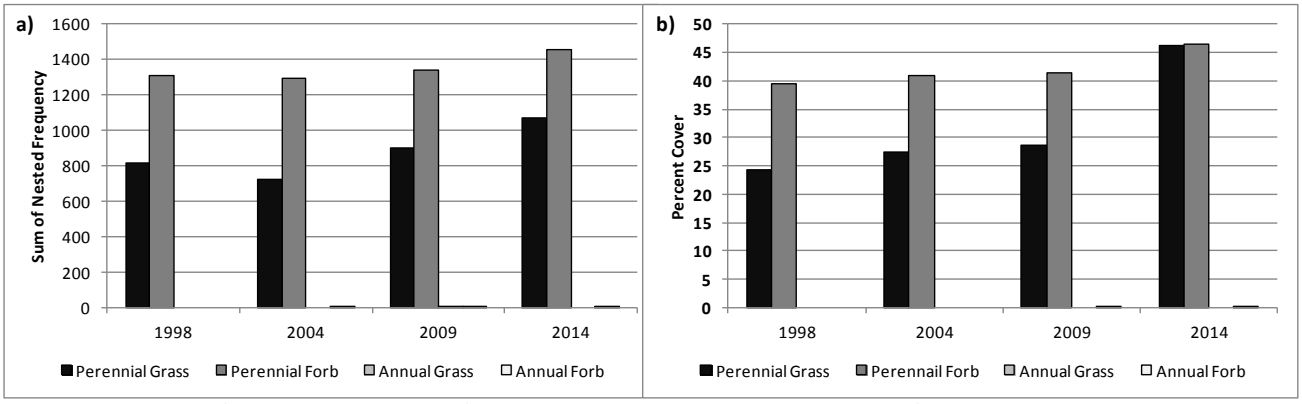


Figure 4.12: Herbaceous functional group summary of the High Mountain (Silver Sagebrush) study (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

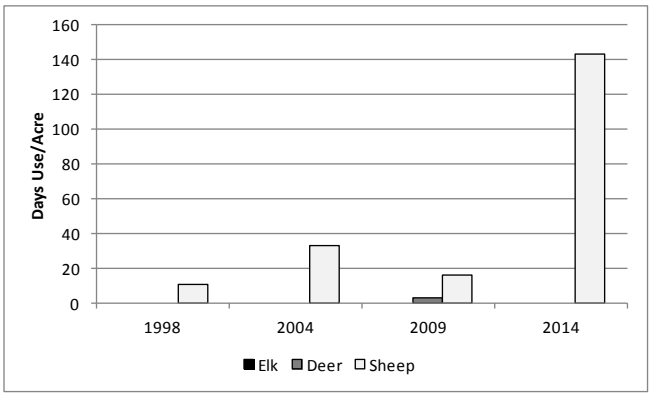


Figure 4.13: Pellet transect data for the High Mountain (Silver Sagebrush) study (n=1) for WMU 16B/C, Manti North/South.

High Mountain (Slender Wheatgrass)

There is one study [Oak Creek Ridge Seeding (16B-14)] classified as High Mountain (Slender Wheatgrass) ecological site that remained undisturbed over the report period (Table 4.6). The study occurs on Elk Creek Ridge in the Central Mountains west of Skyline Drive.

Shrub: There were no shrubs or trees sampled on the site.

Herbaceous Understory: This site has a poor herbaceous community with annual forbs being dominant in 2014. However, the grass component is fairly common and is dominated by seeded species that are often considered aggressive at higher elevation and precipitation. These include Kentucky bluegrass, intermediate wheatgrass (*Agropyron intermedium*), and smooth brome (*Bromus inermis*). A small number of native species also occur on the site, but occur at much lower cover and frequencies than the introduced species. Competition with these introduced grasses may limit other desirable herbaceous species. However, nested frequency of perennial grasses has generally decreased since 1997 (Figure 4.14a), but cover of perennial grass has decreased from 25% in 2002 to around 3% in 2014 (Figure 4.14b). Annual grass species were not sampled on the study site.

Native perennial forb species composition is diverse with high nested frequency and moderate cover. The mean nested frequency of perennial forb species remained similar from 1997 to 2007, but decreased in 2014. Cover remained similar from 1997 to 2007 at 11-13%, but decreased to 7% in 2014 (Figure 4.14b). The weedy increaser species mountain tarweed dominated the site in 1997 and 2014. Mountain tarweed can become a nuisance without proper management.

Occupancy: Pellet group transect data indicates low use by big game on this study and is predominantly occupied by livestock. The mean abundance of deer pellet groups has ranged from 3 days use/acre in 2007 to 0 days use/acre in 2014. The mean abundance of elk pellet groups has ranged from 10 days use/acre in 2007 to 0 days use/acre in 2014. Livestock sign from cattle was high in 2002 at 43 days use/acre, but was low in subsequent samplings at 9 and 15 days use/acre in 2007 and 2014, respectively (Figure 4.15).

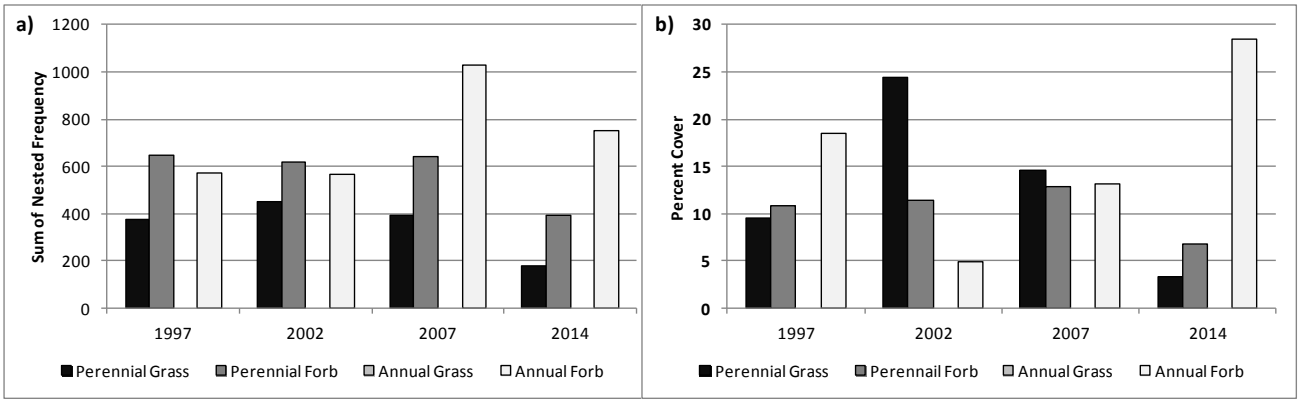


Figure 4.14: Herbaceous functional group summary of the High Mountain (Slender Wheatgrass) study (n=1) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

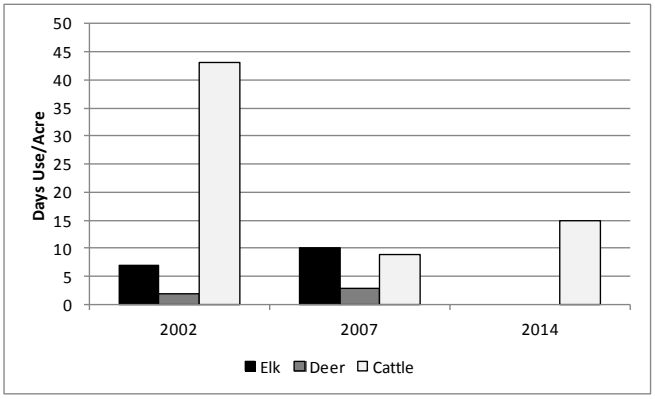


Figure 4.15: Pellet transect data for the High Mountain (Slender Wheatgrass) study (n=1) for WMU 16B/C, Manti North/South.

Mountain (Birchleaf Mountain Mahogany)

There is one study [North Horn (16C-44)] classified as a Mountain (Birchleaf Mountain Mahogany) ecological site that remained undisturbed over the report period (Table 4.6). North Horn is located on the northwest side of North Horn Mountain.

Shrubs/Trees: The primary browse on the North Horn study is true mountain mahogany (*Cercocarpus montanus*). Although decreasing, the line-intercept cover of mahogany remains good ranging from 18% in 2014 to 33% in 2005. Total cover of sagebrush species (*Artemisia spp.*) is low (Figure 4.16a). The average height of mountain big sagebrush is approximately one to one and half feet making sagebrush somewhat available in mild winters. The demographics of the sagebrush population have been generally comprised of mature plants and young plants. Recruitment of young sagebrush plants was 50% of the population in 2014 (Figure 4.16b).

Density of limber pine trees were low in 2014, but have steadily increased in cover over the sample period (Figure 4.17).

Herbaceous Understory: This study site has a good herbaceous component dominated by the perennial grass species Salina wildrye (*Elymus salina*). There are other perennial grass species present, but these are found in low abundance, which include the seeded species crested wheatgrass (*Agropyron cristatum*) and smooth brome. Competition with these introduced grass species may limit establishment of other desirable herbaceous species. Nested frequency of perennial grasses has remained stable, and has remained relatively high since 2004 (Figure 4.18a). Cover of perennial grass has also remained high and stable from year to year at near 12% to 14%. Annual grass species were not sampled on the study site (Figure 4.18b).

Native perennial forb species occur frequently, but provide little cover. Cover has remained similar over the sample years at 3-4% (Figure 4.18b). Annual forbs were very rare on this site.

Occupancy: Pellet group transect data generally indicate that elk predominately occupy this study; however, occupancy is still considered low for all sampled species. Abundance of elk pellet groups has ranged from a high of 17 days use/acre in 2005 and 2009 to a low of 14 days use/acre in 2014. Deer pellet groups have ranged from a high of 17 days use/acre in 2005 to a low of 3 days use/acre in 2014. The abundance of livestock sign from cattle has ranged from a high of 9 days use/acre in 2009 to a low of 2 days use/acre in 2004 (Figure 4.19).

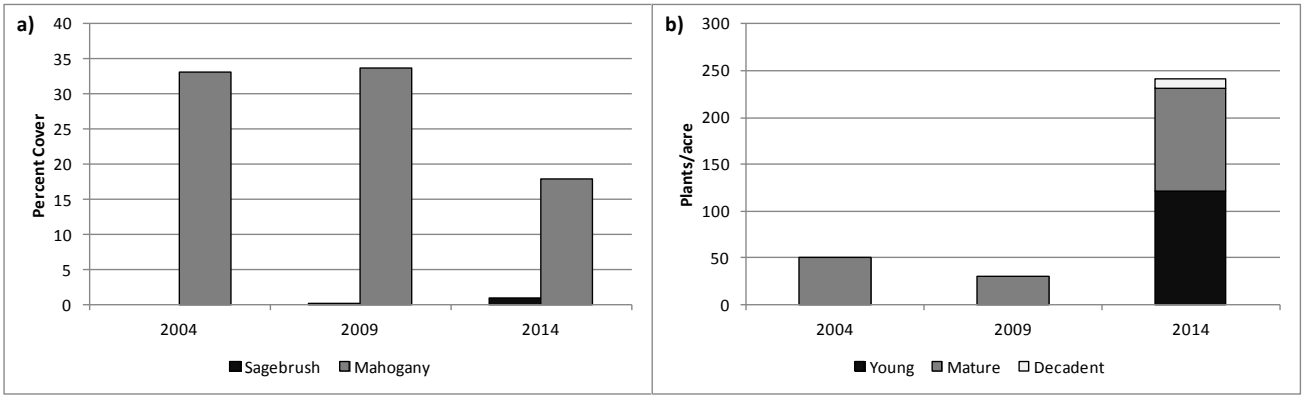


Figure 4.16: Shrub summary of the Mountain (Birchleaf Mountain Mahogany) study (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

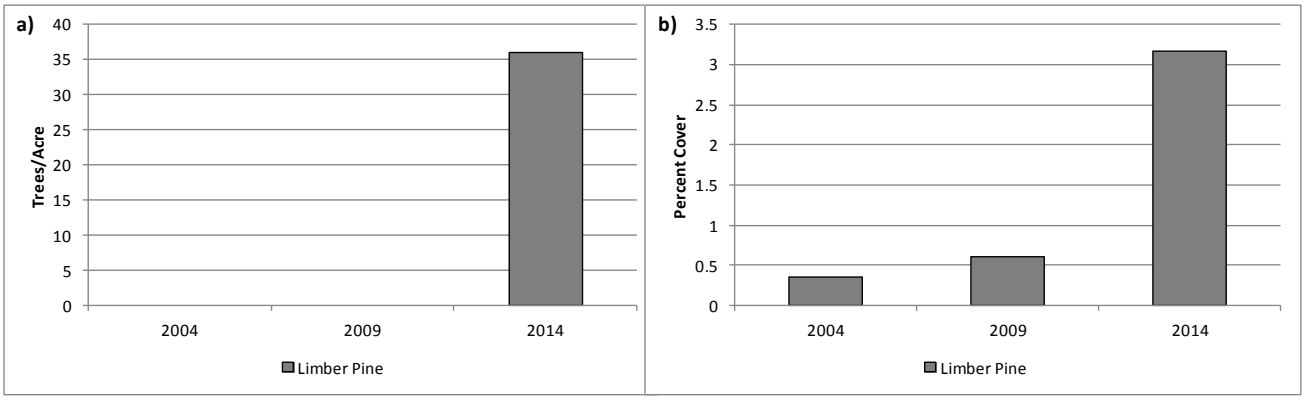


Figure 4.17: Tree summary of the Mountain (Birchleaf Mountain Mahogany) study (n=1) for WMU 16B/C, Manti North/South. a) Point-quarter tree density estimates for limber pine. b) Line-intercept cover estimate for limber pine.

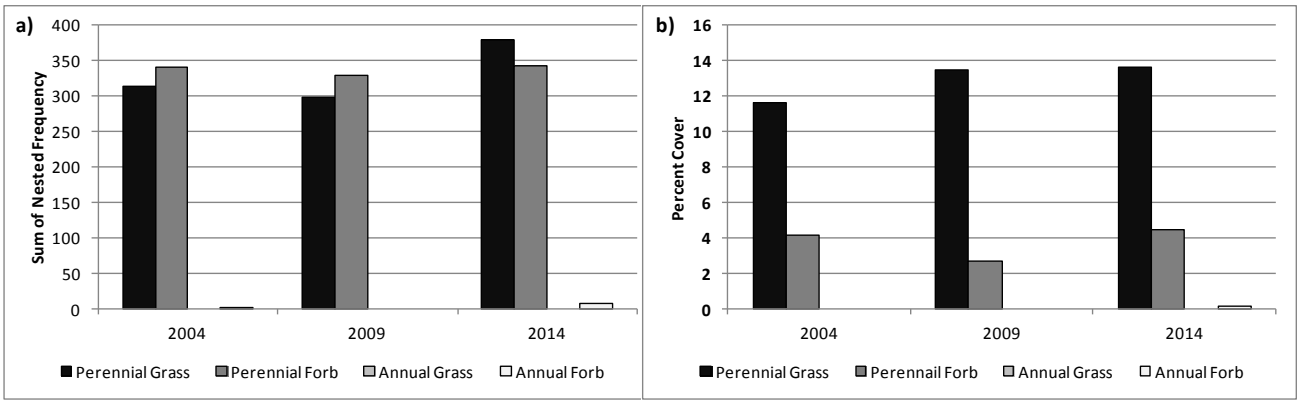


Figure 4.18: Herbaceous functional group summary of the Mountain (Birchleaf Mountain Mahogany) study (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

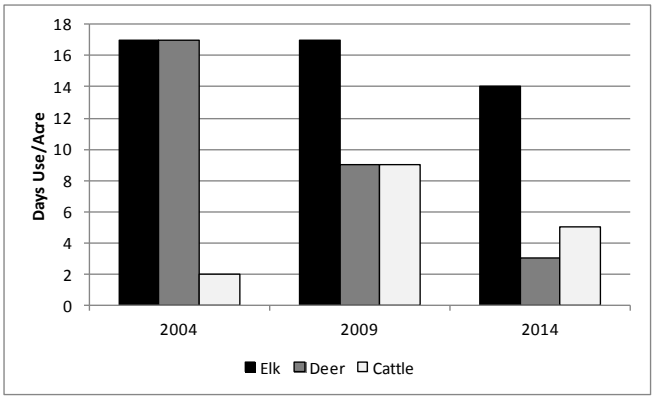


Figure 4.19: Pellet transect data for the Mountain (Birchleaf Mountain Mahogany) study (n=1) for WMU 16B/C, Manti North/South.

Mountain (Black Sagebrush)

There are four studies [North Horn Rock Canyon (16C-22), Box Canyon Knolls (16C-31), South Sage Flat (16C-34), and Wildcat Knoll (16C-35)] classified as Mountain (Black Sagebrush) ecological sites that remained undisturbed over the report period (Table 4.6). The North Horn Rock Canyon study is located on a bench south of North Horn Mountain and north of Rock Canyon (Daniels Canyon). The Box Canyon Knolls, South Sage Flat, and Wildcat Knoll studies are located on plateau tops west of White Mountain and south of Flagstaff Peak.

Shrubs/Trees: The primary browse on these studies is black sagebrush (*Artemisia nova*) except for North Horn Rock Canyon where mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is becoming increasingly co-dominant. Other preferred browse species were rare on these studies. The mean line-intercept cover of sagebrush is moderate on these sites, and has steadily increased from 8% to 12% since 2004 (Figure 4.20a). The exception to the mean increase in cover is the North Horn Rock Canyon study where cover has decreased from 10% in 2004 to 8% in 2014. The average height of black sagebrush on these studies is approximately half a foot while mountain big sagebrush is approximately one and half feet tall, making browse somewhat available through much of the year in normal winters. The demographics of the sagebrush populations have generally been a mixture of mature and young plants with recruitment of young plants comprising more than 10% of the population on most of the study sites, except in 1994 and 2004 where recruitment was less than 10%. Despite a sharp decrease in the mean density of sagebrush in 2004 that followed a moderate drought that occurred in 2002 and 2003, sagebrush has generally increased in density since 1994 (Figure 4.20b).

Encroachment from Utah juniper and pinyon pine is generally not a concern for these sites. North Horn Rock Canyon is the only study that contributes to the presence of woodland trees in the figures. Density and cover of pinyon trees is low despite a slight increase in pinyon pine cover (Figure 4.21). This site is considered to be in Phase I of woodland succession.

Herbaceous Understory: These studies have a good herbaceous component dominated by native perennial grasses; except for South Sage Flat where the herbaceous understory is dominated by the introduced perennial crested wheatgrass. Competition with these introduced grass species may limit other desirable herbaceous species. The mean nested frequency of perennial grasses decreased because of the drought 2002-2003, but is now slowly recovering (Figure 4.22a). However, mean cover of perennial grass increased from 10% in 1994, to 12% in 1999 and remained stable from 2002 to 2009, and increased again in 2014 to 15% (Figure 4.22b). Annual grass species were not sampled on these study sites.

Native perennial forb species composition is fairly diverse on these studies, but with low nested frequency and cover of all sampled species (Figure 4.22). Annual forbs were rare on these sites.

Occupancy: Pellet group transect data indicates that elk predominantly occupy these study sites. The mean abundance of elk pellet groups has ranged from a high of 79 days use/acre in 1999 to a low of 33 days use/acre in 2014 (Figure 4.23). Deer and cattle pellet groups are typically sampled in low abundance on these sites.

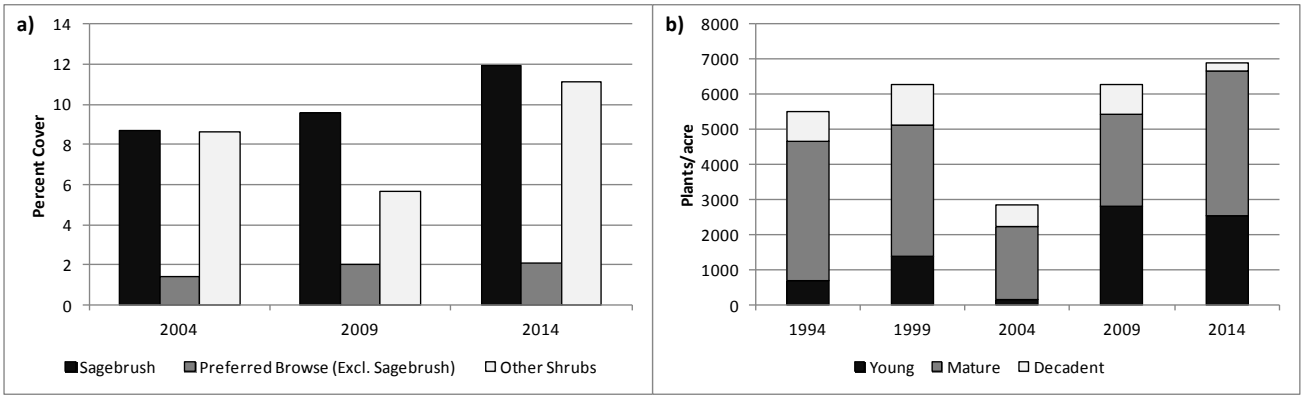


Figure 4.20: Shrub summary of the Mountain (Black Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

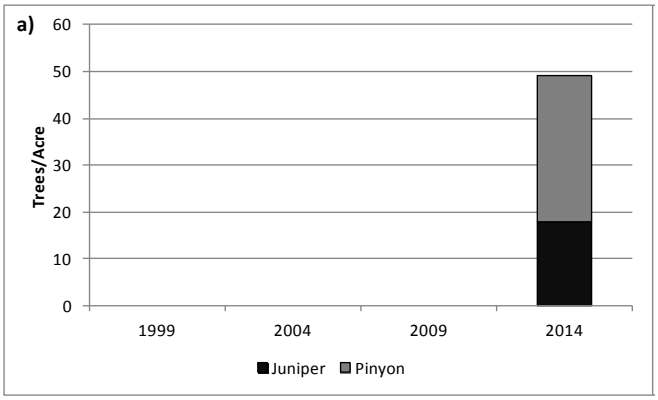


Figure 4.21: Tree summary of the Mountain (Black Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*).

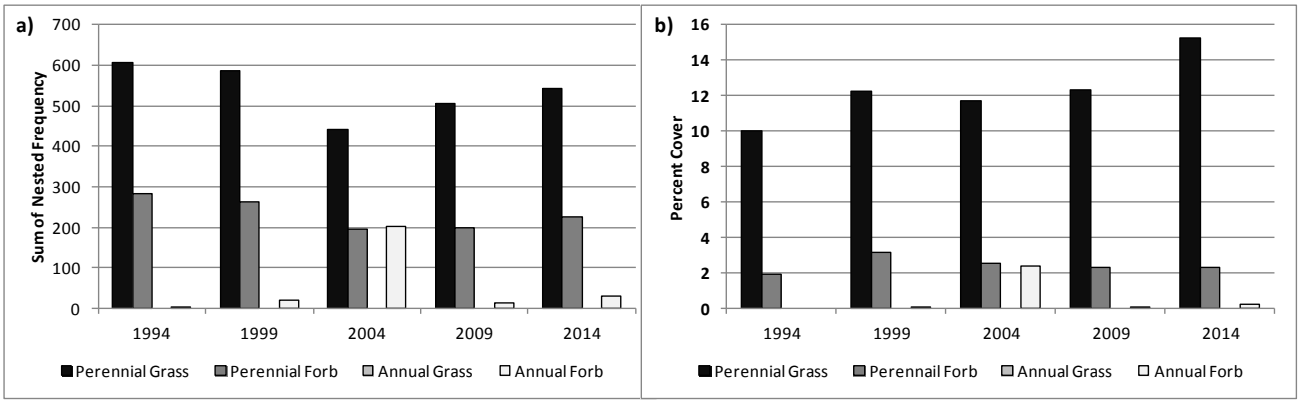


Figure 4.22: Herbaceous functional group summary of the Mountain (Black Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

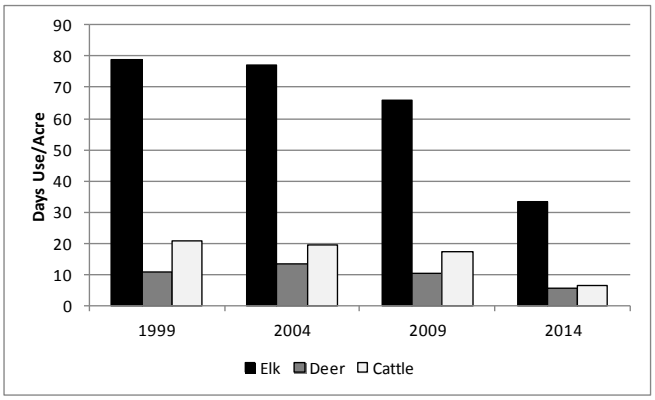


Figure 4.23: Mean pellet transect data for the Mountain (Black Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South.

Mountain (Browse)

There are four studies [Middle Mountain (16C-17), Trail Mountain Exclosure (16C-19), South Horn Exclosure (16C-24), and Upper Hole Trail (16C-30)] classified as Mountain (Browse) ecological sites that remained undisturbed over the report period (Table 4.6). Both Middle Mountain and Trail Mountain Exclosure studies are found above and adjacent to Joes Valley Reservoir on Middle Mountain and Reynold Point, respectively. The South Horn Exclosure is located on a large plateau south of North Horn Mountain and north of South Horn Mountain. Upper Hole Trail is located on a flat southeast of Flagstaff Peak.

Shrubs/Trees: The primary browse on the Trail Mountain Exclosure and South Horn Exclosure studies is Mountain big sagebrush. Curlleaf mountain mahogany (*Cercocarpus ledifolius*), Utah serviceberry (*Amelanchier utahensis*), Gambel oak (*Quercus gambelii*), mountain mahogany (*Cercocarpus montanus*), and mountain snowberry (*Symphoricarpos oreophilus*) are species that are also present on these sites. The Upper Hole Trail study has curlleaf mountain mahogany as the primary browse, while the Middle Mountain study is predominantly a mixture of mountain big sagebrush, black sagebrush, true mountain mahogany, and Utah serviceberry. The mean line-intercept cover of sagebrush is moderate and has been stable on these sites near 10% since 2004. Curlleaf mountain mahogany on the Upper Hole Trail has a line-intercept cover that is good ranging from near 18% in 2004 to 16% in 2014. The mean cover of other preferred browse species is also good on these sites and remaining similar at 17-18% since 2004 (Figure 4.24b).

The mean cover of pinyon and juniper trees is low for most of these sites; however, the South Horn Exclosure mainly drives the trend for these sites where pinyon pine is the dominant species. Mean cover of trees increased from 17% in 2004 to 20% in 2014; whereas mean cover of pinyon and juniper has remained low but has slowly increased from 7% in 2004 to near 10% in 2014 (b). The density for pinyon and juniper has only been sampled on the South Horn Exclosure, except in 2014 when the Trail Mountain Exclosure study was added. Estimated density has increased with a density of 43 trees/acre in 1999 to 61 trees/acre in 2009, but density decreased slightly to 57 trees/acre in 2014 (Figure 4.25a).

Herbaceous Understory: The study sites have a good herbaceous understory with a good mix of perennial grasses and forbs. However, the introduced grass species crested wheatgrass and intermediate wheatgrass are present on these sites. Numerous native grass species also occur on the sites at higher cover and frequencies than the introduced species. Many of the sites are dominated by the native perennial grass species Salina wildrye (*Elymus salina*). Mean nested frequency of perennial grasses has been high, but decreased considerably in 2004 following the drought in 2002 and 2003 (Figure 4.26a). The mean cover of perennial grass has remained near 9 to 10% since 1994 (Figure 4.26b). Annual grass species are absent on these site, except for South Horn Exclosure where annual grass is present but extremely rare.

Native perennial forb species composition is diverse with high nested frequency and cover; however, the South Horn Exclosure has been fairly low in both metrics. The mean nested frequency of perennial forb species decreased since 1994, but remains relatively high. Mean cover has fluctuated from a high of 8% in 1999 to 5% in 2004. Annual forbs have remained in relatively low abundance, except on the South Horn Exclosure where annual forbs have been moderately high since 1994(Figure 4.26).

Occupancy: Pellet group transect data indicates that elk predominately occupy these studies, though this is more pronounced on the Trail Mountain Exclosure study. The mean abundance of elk pellet groups has ranged from a high of 41 days use/acre in 2004 to a low of 27 days use/acre in 2014. Deer pellet groups are typically sampled in low abundance on both study sites ranging from 27 days use/acre in 1999 to 10 days use/acre in 2014. Livestock sign from cattle was moderate 2009, but remaining years have been considered low (Figure 4.27).

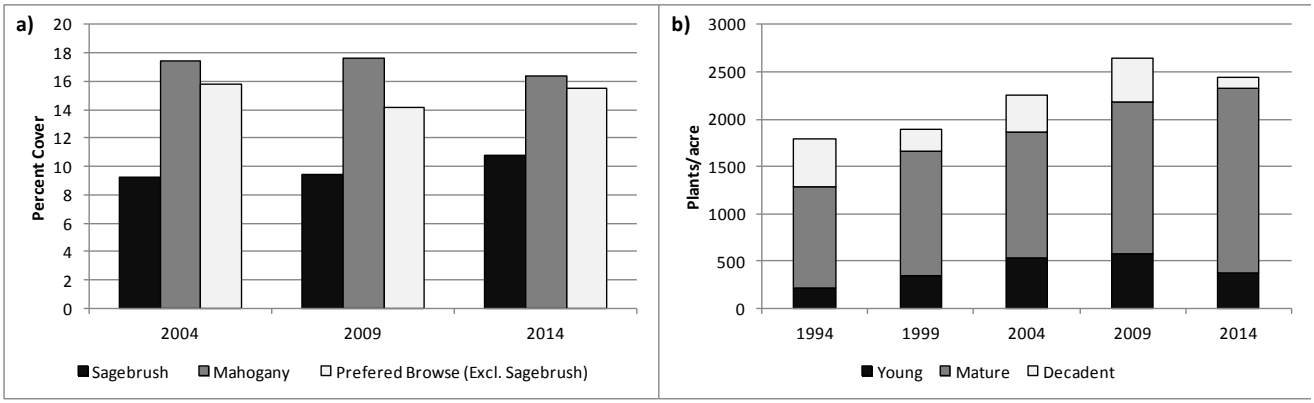


Figure 4.24: Shrub summary of the Mountain (Browse) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups.

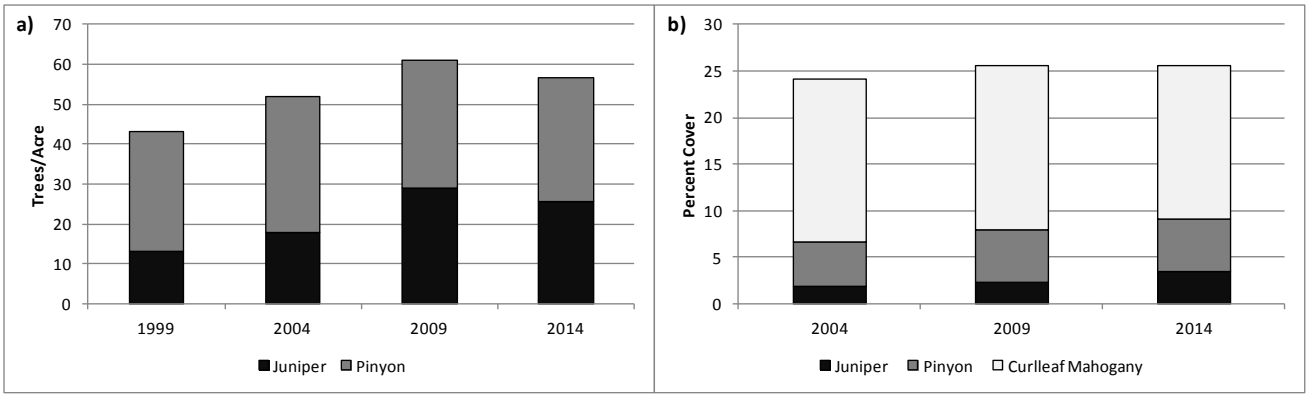


Figure 4.25: Tree summary of the Mountain (Browse) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine, Utah juniper, and curlleaf mahogany.

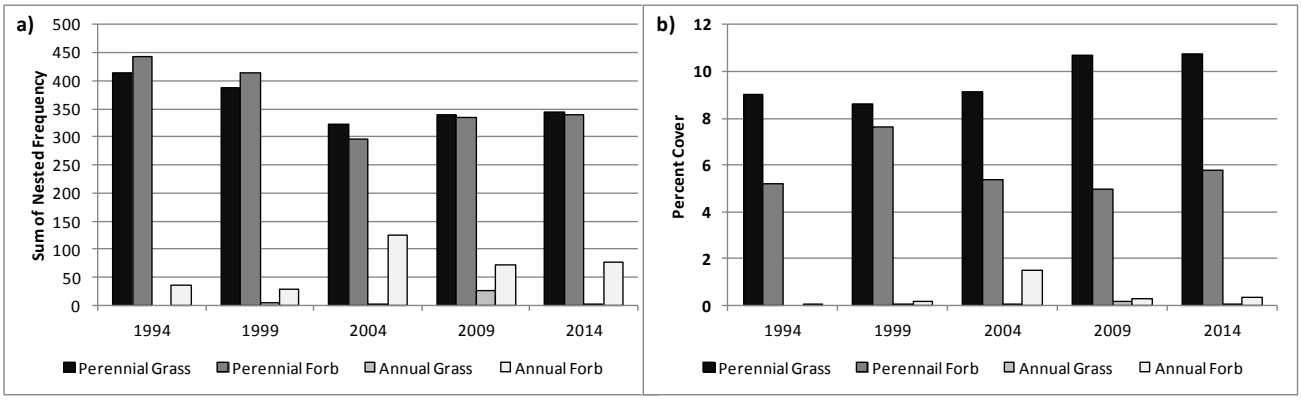


Figure 4.26: Herbaceous functional group summary of the Mountain (Browse) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

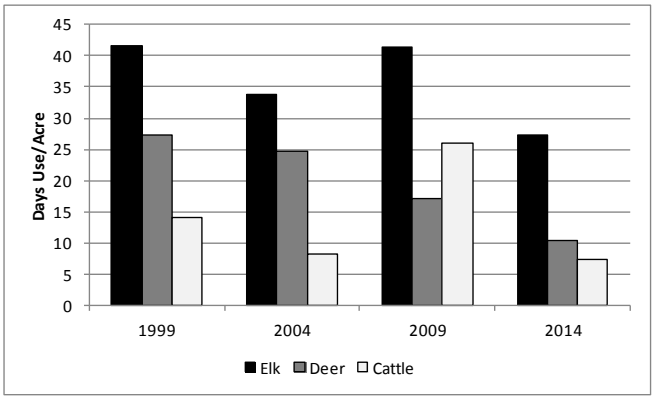


Figure 4.27: Mean pellet transect data for the Mountain (Browse) studies (n=4) for WMU 16B/C, Manti North/South.

Mountain (Curlleaf Mountain Mahogany)

There are two studies [Starvation Mahogany (16B-8) and Scab Hollow (16C-29)] classified as a Mountain (Curlleaf Mountain Mahogany) ecological site that remained undisturbed over the report period (Table 4.6). The Starvation Mahogany study is located southwest of Soldier Summit. The Scab Hollow study is located southeast of Heliotrope Mountain and west of Moore.

Shrubs/Trees: The primary browse species on these studies is curlleaf mountain mahogany and true mountain mahogany. Other preferred browse species are common, but occur at much lower coverage than these species. The mean line-intercept cover of combined mahogany species has varied slightly from a high of 16% to a low of 12%. Mountain big sagebrush is more prominent on Starvation Mahogany study therefore the trend for the mean line-intercept cover is driven by this study and has remained low since 2004 (Figure 4.28a). The demographics of the sagebrush population were a mixture of mostly mature and decadent plants, though decadence has steadily decreased since 1999 (Figure 4.28b).

Pinyon pine and Utah juniper are present and infrequent on the Starvation Mahogany study, but are not present on the Scab Hollow study. The density of pinyon-juniper trees was low 2014. Curlleaf mountain mahogany steadily decreased from 93 trees/acre in 1999 to 61 trees/acre in 2014 (Figure 4.29a). Juniper and mahogany tree cover has remained steady since 2004 (Figure 4.29b).

Herbaceous Understory: These sites have a good herbaceous component dominated by perennial grass. The grass species crested wheatgrass and smooth brome are found in low abundance on the Starvation Mahogany study. Numerous native grass species occur on the Starvation Mahogany study, but the Scab Hollow site is low in perennial grass species richness. Mean nested frequency of perennial grasses has fluctuated, but has remained high since 1994 (Figure 4.30a). The mean cover of perennial grass beginning in 1999 has increased from 13% to 23% in 2014 (Figure 4.30b). Annual grasses are very rare on these sites.

Native perennial forb species composition is diverse with low and high nested frequencies on the Scab Hollow and Starvation Mahogany studies, respectively. Mean line-intercept cover for perennial forbs has remained between 4-7% since 1999 (Figure 4.30).

Occupancy: Pellet group transect data indicates that elk predominately occupy these studies. The mean abundance of elk pellet groups has ranged from a high of 48 days use/acre in 1999 to a low of 34 days use/acre in 2014. The mean abundance of deer pellet groups has ranged from 32 days use/acre in 2009 to7 days use/acre in 2014. Cattle pellet groups have been low since 1999 (Figure 4.31).

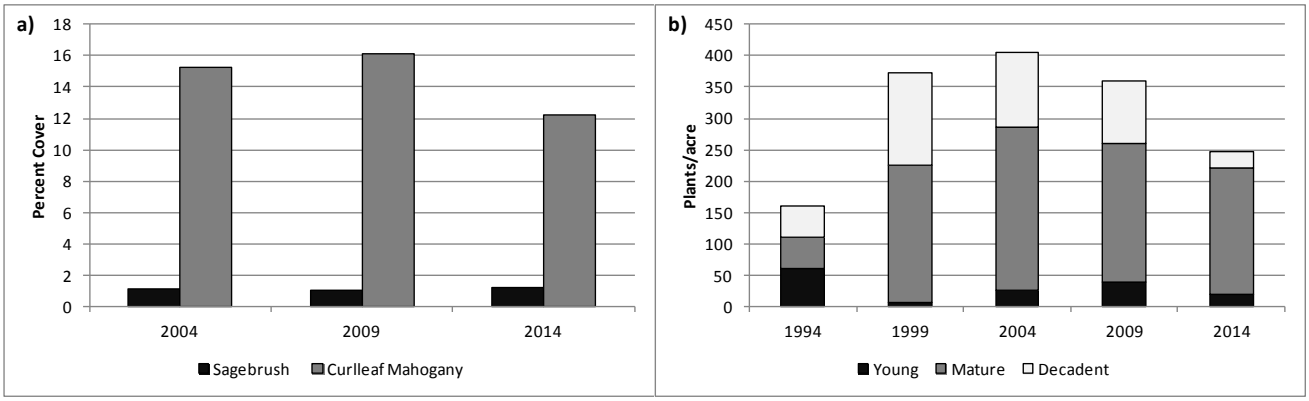


Figure 4.28: Shrub summary of the Mountain (Curlleaf Mountain Mahogany) studies (n=2) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

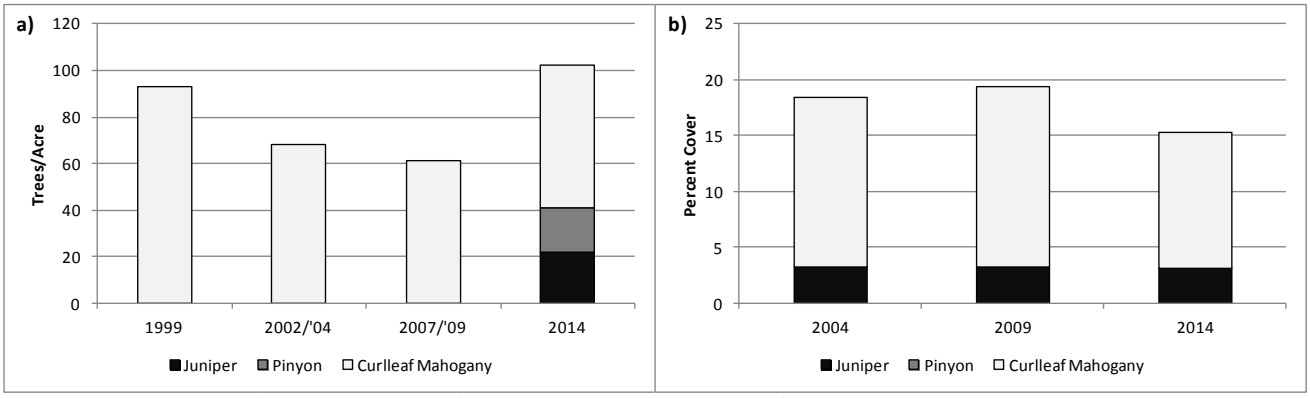


Figure 4.29: Tree summary of the Mountain (Curlleaf Mountain Mahogany) studies (n=2) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), and Curlleaf mountain mahogany (*Cercocarpus ledifolius*). b) Mean line-intercept cover estimate for pinyon pine, Utah juniper and Curlleaf mountain mahogany.

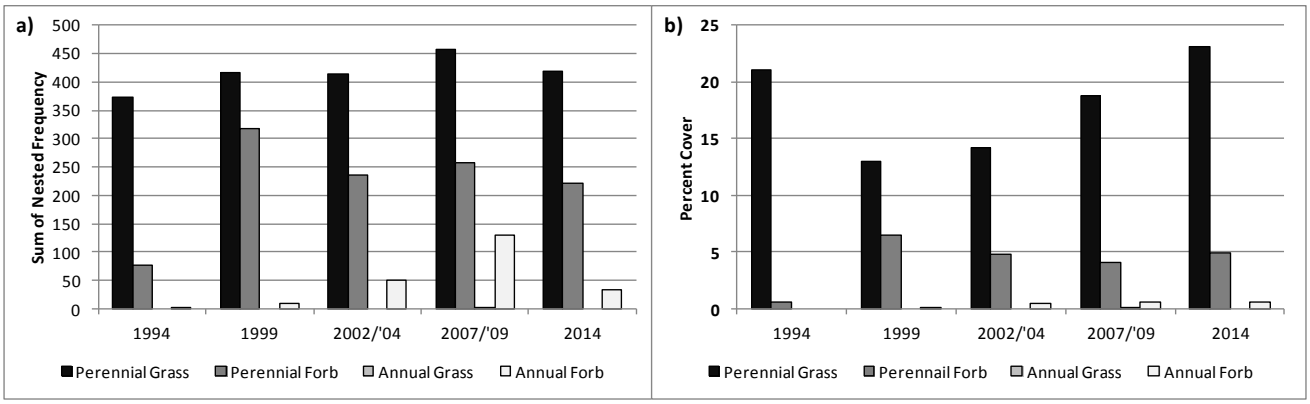


Figure 4.30: Herbaceous functional group summary of the Mountain (Curlleaf Mountain Mahogany) studies (n=2) for 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

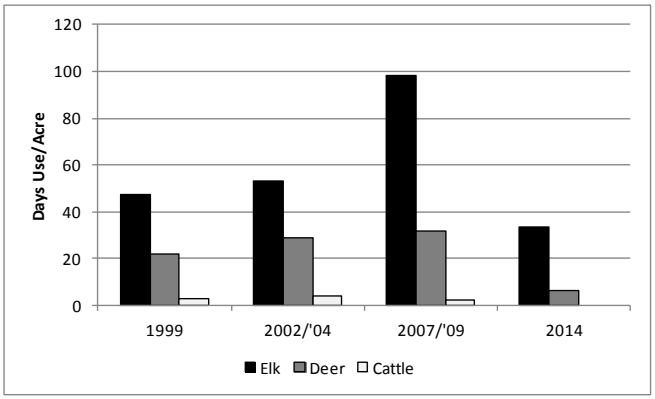


Figure 4.31: Mean pellet transect data for the Mountain (Curlleaf Mountain Mahogany) studies (n=2) for WMU 16B/C, Manti North/South.

Mountain (Mountain Big Sagebrush)

There are eight studies [Huntington Canyon (16B-21), West Huntington Canyon (16C-13), Miles Point (16C-20), South Horn ¼ Corner (16C-25), Joe's Valley Overlook (16C-37), Pleasant Creek (16C-38), Through Hollow (16C-41), and Olson Draw Sage-grouse (16C-43)] classified as Mountain (Mountain Big Sagebrush) ecological site that remained undisturbed over the report period (Table 4.6). Both Huntington Canyon and West Huntington Canyon studies are found east of East Mountain. The South Horn ¼ Corner and Olson Draw Sage-Grouse studies are both located on the sagebrush flats of South Horn Mountain. The studies Miles Point and Joe's Valley Overlook are found east and southeast of Reynold Point, respectively. Pleasant Creek is located on the east bench of the town of Mt. Pleasant, and the Through Hollow study is located northeast of I-70 and Moroni Peak.

Shrubs/Trees: The primary browse on these studies is mountain big sagebrush, except for on the Joe's Valley Overlook and Through Hollow studies where antelope bitterbrush (*Purshia tridentata*) is a co-dominant browse species. Other preferred browse species are rare, and occur at much lower coverage than the sagebrush. The mean line-intercept cover of sagebrush is moderate and decreased from 12% in 2002/2004 to 10% in 2014. The Through Hollow and Olson Draw Sage-Grouse studies have high sagebrush cover but also follow the decreasing trend. The average height of mountain big sagebrush on these studies is approximately two feet in height, making browse mostly available through much of the year in normal winters. The mean cover of other preferred browse species has decreased slightly from above 5% in 2002/2004 to 4%in 2014 (Figure 4.32a). The demographics of the sagebrush population are mostly mature plants with decadence decreasing while young recruitment has generally increased since 1994 (Figure 4.32b).

Pinyon pine and Utah juniper are present but are found infrequently on these sites. Prior to 2014 point-quarter was only taken on the Pleasant Creek site due to the lack of observable encroachment on the other sites. The other sites were measured for the first time in 2014. The average density of pinyon-juniper trees was low in 2014 (Figure 4.33a). Juniper tree cover has remained between 3-5% since 2004 (Figure 4.33b).

Herbaceous Understory: The study site has a good herbaceous component dominated by perennial grass. The seeded species crested wheatgrass and Kentucky bluegrass are found in low abundance but are considered be aggressive at higher elevation and precipitation. Numerous native species also occur on these sites and make up more of the cover than do the introduced species. Nested frequency of perennial grasses has fluctuated slightly, but has remained relatively high since 1994. A slight decrease in nested frequency follows the drought in 2002 and 2003, but recovers during the follow in sample years (Figure 4.34a). Cover of perennial grass follows the same pattern as nested frequency, and ranges from a low of

14% in 1994 and 2002/2003 to a high of 22% in 2014 (Figure 4.34b). Annual grass was not sampled on these study sites.

Native perennial forb species composition is diverse with fair nested frequency and cover. Nested frequency of perennial forb species has ranged from 3% in 1994 to 6% in 2014 (Figure 4.34). Annual forb cover was low but nested frequency fluctuated over the years sampled.

Occupancy: Pellet group transect data indicates that elk predominately occupy these studies. The mean abundance of elk pellet groups has ranged from a high of 71 days use/acre in 2004 to a low of 17 days use/acre in 2014. The mean abundance of deer pellet groups has ranged from 18 days use/acre in 2004 to 4 days use/acre in 2014. The mean abundance of cattle pellet groups has ranged from 17 days use/acre in 2007/2009 to 6 days use/acre in 2014 (Figure 4.35).

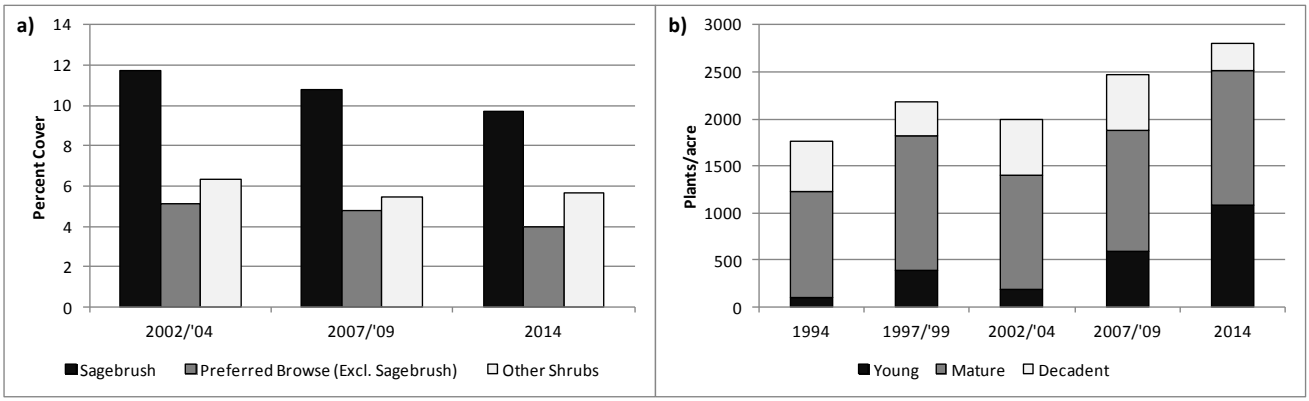


Figure 4.32: Shrub summary of the Mountain (Mountain Big Sagebrush) studies (n=8) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

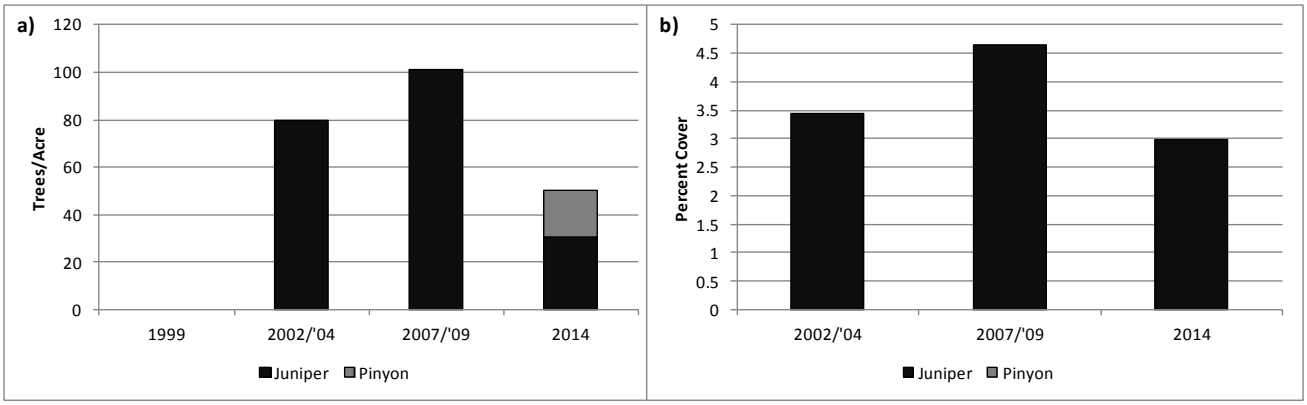


Figure 4.33: Tree summary of the High Mountain (Browse) and Mountain (Browse/Oak) studies (n=8) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper (n=8).

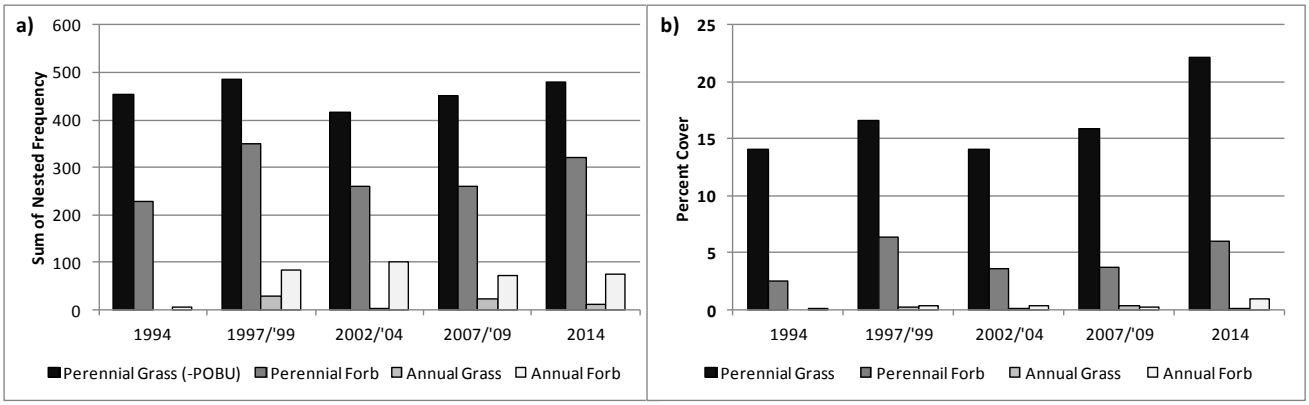


Figure 4.34: Herbaceous functional group summary of the Mountain (Mountain Big Sagebrush) studies (n=8) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

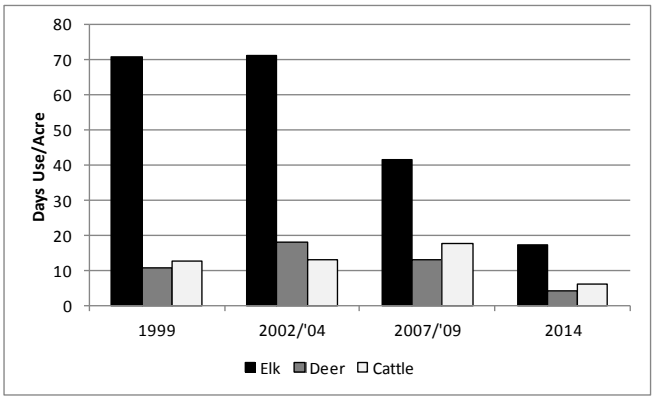


Figure 4.35: Pellet transect data for the Mountain (Mountain Big Sagebrush) studies (n=8) for WMU 16B/C, Manti North/South.

Upland (Big Sagebrush)

There is one study [Dairy Fork Burn (16B-10)] classified as an Upland (Big Sagebrush) ecological site that remained undisturbed over the report period (Table 4.6). This study occurs between Sky High and Davis Hill and is south of US 6.

Shrubs/Trees: The primary browse that occurs on this site is big sagebrush (*Artemisia tridentata* ssp. *tridentata*) (Figure 4.36). Other browse species are not common on this site. Line-intercept cover for big sagebrush has decreased from near 5% in 2007 to just over 2% in 2014. However, density of sagebrush has steadily increased since 1997. The average height of big sagebrush on this site is approximately three feet in height, making browse available through much of the year in normal winters. The demographics of the sagebrush population are mostly mature plants with recruitment of young plants remaining consistent over the sample periods. Decadence has increased slightly each year since the beginning of the sample period in 1997(Figure 4.36b).

Herbaceous Understory: This site has a good herbaceous component and is dominated by perennial grass. However, the dominant grasses are seeded species that are often considered aggressive at higher elevation and precipitation. These include crested wheatgrass, Kentucky bluegrass, intermediate wheatgrass, and smooth brome. Few native species also occur on the site, but at much lower cover and frequencies than the introduced species. Competition with these introduced grasses may limit other desirable herbaceous species. Nested frequency of perennial grasses has fluctuated slightly, but has generally increased since 1997 (Figure 4.37a). The mean cover of perennial grass has increased rapidly from 20% in 1997 to over

45% in 2014 (Figure 4.37b). The annual grass species cheatgrass (*Bromus tectorum*) has been sampled in low nested frequency and cover since 1997.

Native perennial forb species composition is fairly diverse with low nested frequency and cover. The total nested frequency of perennial forb species fluctuated considerably, but total cover was around 4% in 1997 but has remained under 1% since 2002 (Figure 4.37). The noxious weeds nodding plumeless thistle (*Carduus nutans*) and whitetop (*Cardaria draba*) have been or are currently present on the site, but have been found in low nested frequencies and covers since 1997. The weedy species povertyweed (*Iva axillaris*) has been sampled on the site since 2007, and is considered a weedy increaser when improperly managed.

Occupancy: Pellet group transect data indicates recent low use on this study, but has a history of high occupancy. Pellet group data also indicates that elk predominantly occupy this site. The mean abundance of elk pellet groups has ranged from a high of 116 days use/acre in 2002 to a low of 17 days use/acre in 2014. The mean abundance of deer pellet groups has remained very low since 2002 (Figure 4.38).

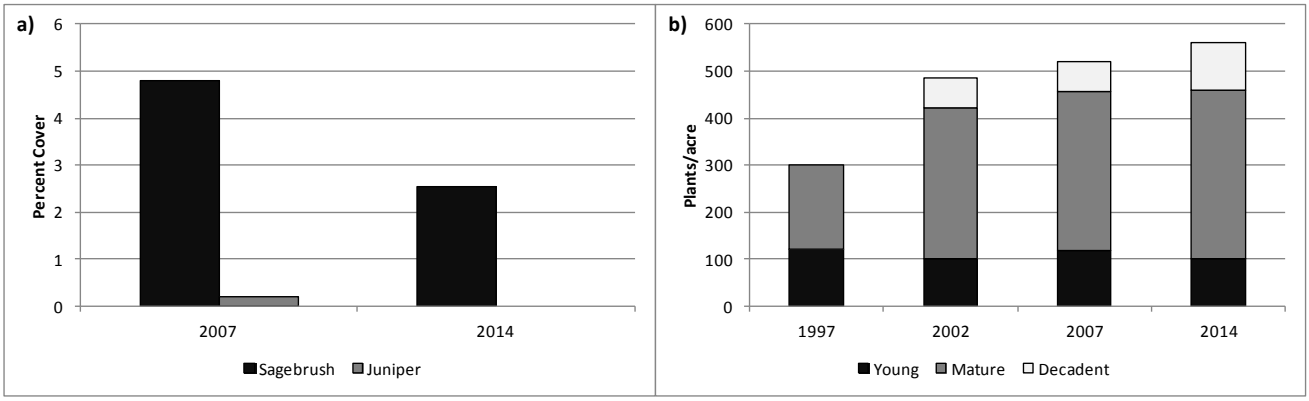


Figure 4.36: Shrub summary of the Upland (Big Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups (including Juniper). b) Density and demographics of sagebrush (*Artemisia spp.*) species.

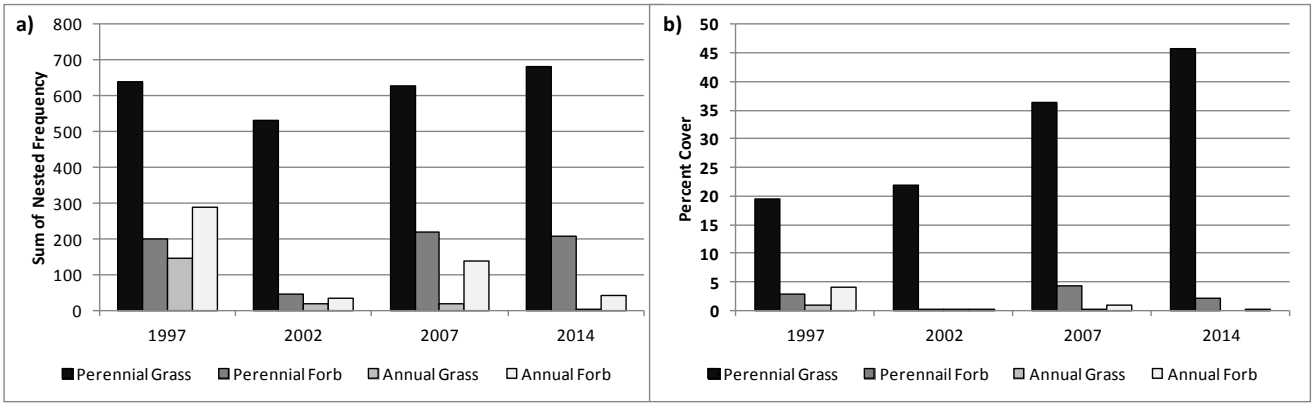


Figure 4.37: Herbaceous functional group summary of the Upland (Big Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

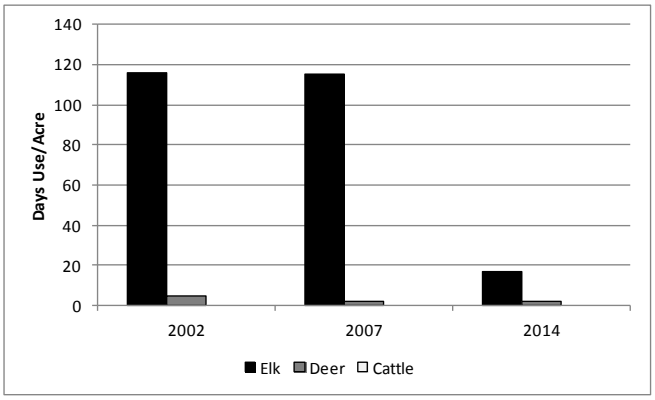


Figure 4.38: Mean pellet transect data for the Upland (Big Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South.

Upland (Black Sagebrush)

There is one study [Telephone Bench (16B-20)] classified as an Upland (Black Sagebrush) ecological site that remained undisturbed over the report period (Table 4.6). Telephone Bench is located on a sagebrush bench west of Price and east of The Elbow.

Shrubs/Trees: The primary browse on the Telephone Bench study is black sagebrush. The line-intercept cover of sagebrush is good and has steadily increased in from 5% in 2004 to 19% in 2014. The cover of other preferred browse species has ranged from 1% in 2004 to 2% in 2009 and 2014 (Figure 4.39a). The average height of the mountain big sagebrush is approximately half to one foot making browse mostly available through much of the year for mild winters. The demographics of the sagebrush population have been generally comprised of mature plants and decadent plants from 1994 to 2004, but the number of young plants was substantially higher in 2009. The Recruitment of young sagebrush plants to the population has likely contributed to the 40% increase in mature plants in 2014 (Figure 4.39b). Pinyon and juniper encroachment has not been an issue on this site and is not included in this summary.

Herbaceous Understory: These study sites have a good herbaceous component dominated by perennial grass. Mean nested frequency of perennial grasses has remained high since 1994, but there was a depression in frequency following the drought in 2002 and 2003 (Figure 4.40a). The cover of perennial grass has fluctuated, but generally increasing from 16% in 1994 to 24% in 2014. Annual grasses have remained rare on this site (Figure 4.40b).

Native perennial forb species richness is good and has moderate total nested frequency and cover. Mean cover has varied over the sample period and has ranged from a low of near 2% in 2014 to 6% in 2004 (Figure 4.40). Cover of annual forbs was low throughout the sample years, though nested frequency was high in 2004 and 2009.

Occupancy: Pellet group transect data indicates that elk predominately occupy these studies. The abundance of elk pellet groups has ranged from a high of 94 days use/acre in 2004 to a low of 26 days use/acre in 2014. Deer pellet groups are typically sampled in low to moderate abundance on this site from 34 days use/acre in 2009 to 12 days use/acre in 2014. The abundance of livestock sign from cattle has remained low since 1999 (Figure 4.41).

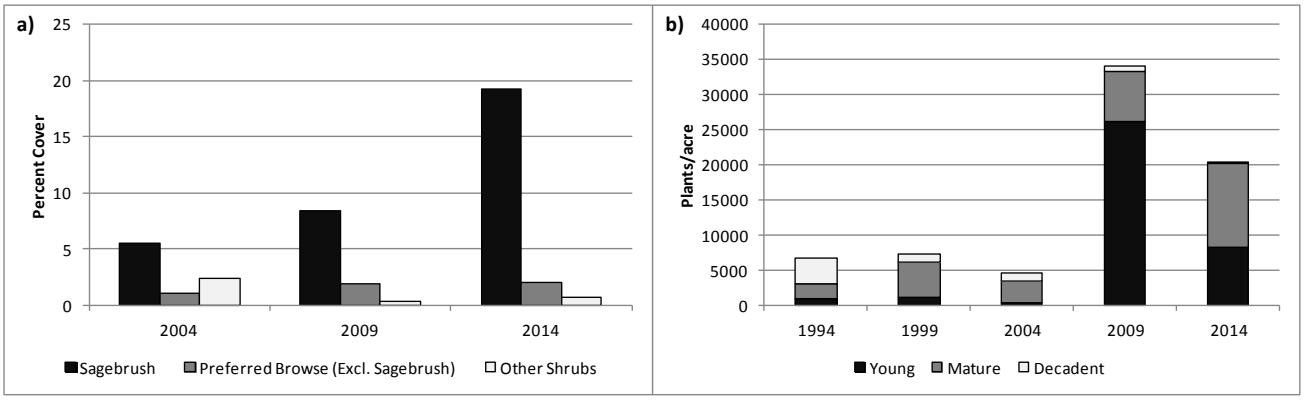


Figure 4.39: Shrub summary of the Upland (Black Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

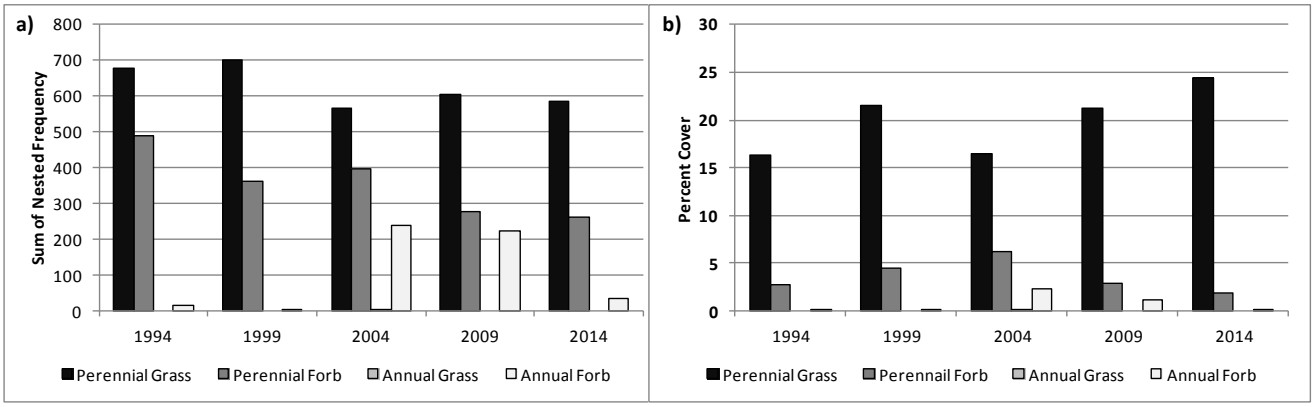


Figure 4.40: Herbaceous functional group summary of the Upland (Black Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

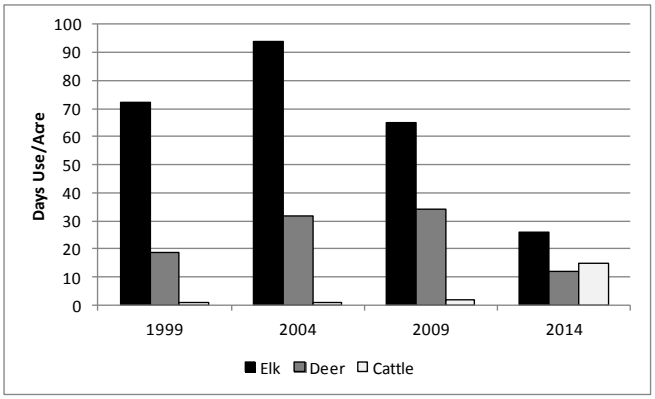


Figure 4.41: Mean pellet transect data for the Upland (Black Sagebrush) studies (n=1) for WMU 16B/C, Manti North/South.

Upland (Mountain Big Sagebrush)

There are four studies [Long Ridge North (16B-2), Rocky Hollow (16B-3), Wiregrass Bench (16B-24), Black Dragon (16C-23)] classified as Upland (Mountain Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 4.6). Both Long Ridge North and Rocky Hollow are located north of Indianola on the foothills of Bone Yard. The Wiregrass Bench study is located west of Price on a sagebrush flat northeast Star Point. Black Dragon is located south of Joes Valley Reservoir.

Shrubs/Trees: The primary browse important to big game on these studies is mountain big sagebrush. Other preferred browse species were rare on these studies. The mean line-intercept cover of sagebrush is low to moderate on these sites, where cover has been variable ranging from a low of 9% in 2002/2004 and 2014 to high of 12% in 2007/2009 (Figure 4.42a). All studies have decreased in cover except for the Black Dragon study where cover has been moderate and increased from 12% in 2004 to 14% in 2014. The average height of mountain big sagebrush on these studies is approximately one and half feet tall, making browse available through much of the year in mild winters. The demographics of the sagebrush populations have generally been a mixture of mature and young plants with decadent plants comprising near 20% of the population on most of the study sites since 1994 (Figure 4.42b).

Pinyon pine and Utah juniper are present and are found infrequently on or near these sites, and point-quarter was taken for the first time in 2014 on the Rocky Hollow and Wiregrass Bench sites due to the presence of observable encroachment. The average density of pinyon-juniper trees was low in 2014. Tree cover has remained below 1% since 2002/2004 (Figure 4.43a, Figure 4.43b).

Herbaceous Understory: These study sites have varying herbaceous understory vegetation. The Black Dragon study is dominated by the introduced grass species crested wheatgrass. The Wiregrass Bench and Long Ridge North studies are dominated by the native perennial grasses blue grama (*Bouteloua gracilis*) and Salina wildrye; and bluebunch wheatgrass (*Agropyron spicatum*), respectively. The Rocky Hollow study is dominated by the invasive annual cheatgrass. The mean nested frequency of perennial grasses has generally decreased over the sample period. The mean cover of perennial grass decreased in 1997/1999 and is attributed to the addition of the Rocky Hollow and Long Ridge North sites. Since 1997/1999, mean cover of perennial grasses has steadily increased from to 12% to 23% cover in 2014. Trends for annual grass are driven by the presence of cheatgrass on the Rocky Hollow study and the Wiregrass Bench, but cheatgrass is a minor component on Wirebench Bench. The threat for increased fire remains on all of these studies, but is more pronounced on Rocky Hollow (Figure 4.44).

Excluding the Black Dragon study where native perennial forb species composition is poor, the remaining studies are fairly diverse in species richness. Mean nested frequency for perennial forbs have generally increased over the sample period but with low to moderate nested frequency; however, mean cover has remained low over the same period (Figure 4.44). Annual forbs have remained common on the site over the sample years.

Occupancy: Pellet group transect data indicates that deer generally occupy these study sites. The mean abundance of deer pellet groups has ranged from a high of 76 days use/acre in 2002/2004 to a low of 36 days use/acre in 2014. Elk pellet groups have ranged from a high of 38 days use/acre in 1999 and 2007/2009 to a low of 22 days use/acre in 2014. Cattle pellet groups have been sampled in low abundance since 1999 (Figure 4.45).

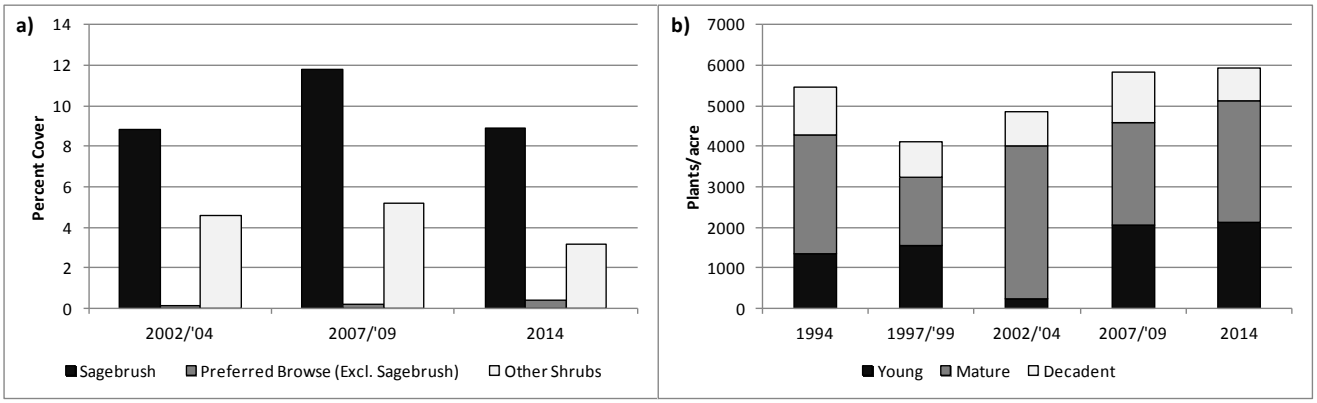


Figure 4.42: Shrub summary of the Upland (Mountain Big Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

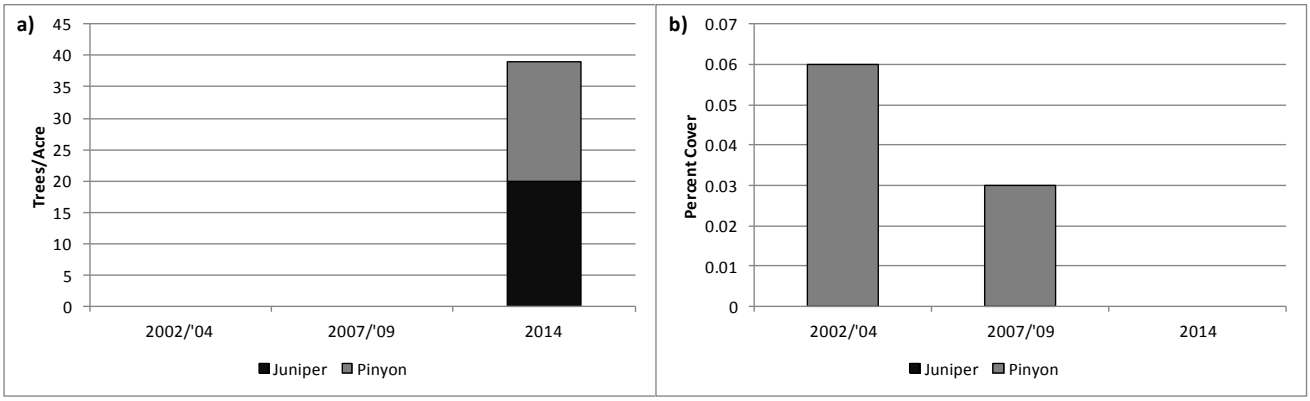


Figure 4.43: Tree summary of the Upland (Mountain Big Sagebrush) studies (n=3) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

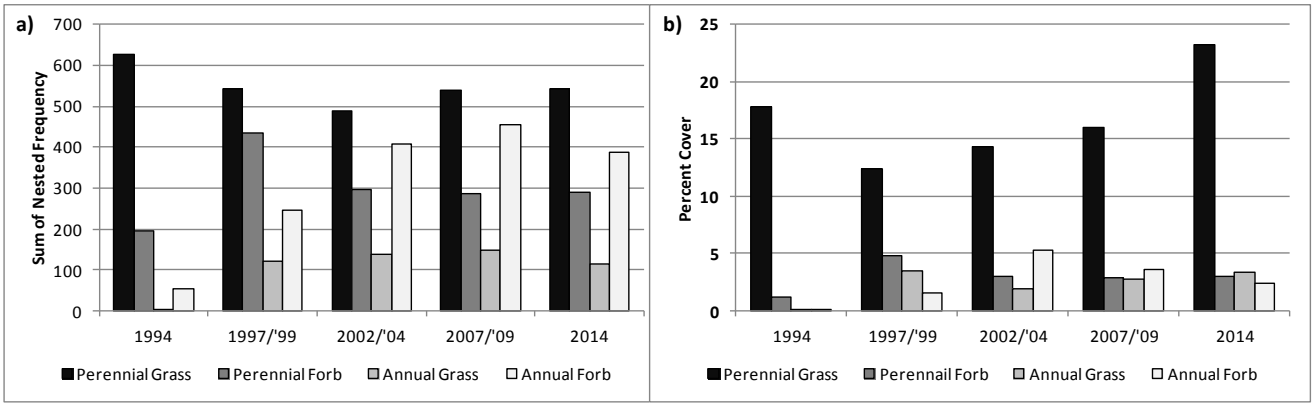


Figure 4.44: Herbaceous functional group summary of the Upland (Mountain Big Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

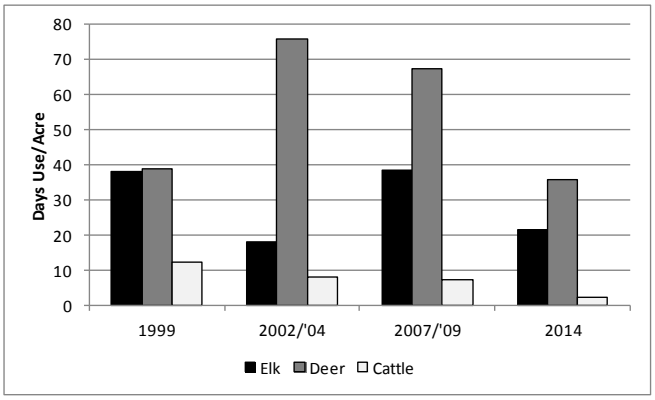


Figure 4.45: Mean pellet transect data for the Upland (Mountain Big Sagebrush) studies (n=4) for WMU 16B/C, Manti North/South.

Upland (Pinyon-Utah Juniper)

There are four studies [Jackson Unit (16B-5), Hilltop (16B-11), Willow Creek (16C-2), and Howard FS Chaining (16C-15)] classified as an Upland (Pinyon-Utah Juniper) ecological site that remained undisturbed over the report period (Table 4.6). Jackson Unit is located north of the town of Birdseye and east of Loafer Mountain. Hilltop is found north of the town of Fairview and is located on a hill just east of US 89. Willow Creek is located on the foothills of Bald Mountain southeast of Ephraim. The Howard FS Chaining study is located west of the town of Huntington on Racehorse Flat.

Shrubs/Trees: The primary browse on these sites differ with the dominant browse species on Jackson Unit being rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*). The primary browse species on Hilltop is Gabel oak. Willow Creek's primary browse species is antelope bitterbrush, and the primary browse on Howard FS Chaining is black sagebrush. The mean line-intercept cover of sagebrush is poor on Hilltop and Howard FS Chaining with mean cover being just above 2%, though the trend is driven by the Howard FS Chaining. The mean cover of other preferred browse species has decreased slightly from just above 2% in 2002/2004 to just below 2% in 2014 (Figure 4.46a). The average height of black sagebrush is approximately a half foot making browse likely unavailable through much of the year in normal winters. The demographics of the sagebrush population have been generally comprised of mature and decadent plants, but the number of decadent plants has remained consistent while mature plants have decreased over the sample periods. Recruitment of young sagebrush plants has remained below 10% of the population since 1994 (Figure 4.46b).

Encroachment from Utah juniper and pinyon pine trees is a concern on these sites and has likely contributed to a loss in species richness. Density of pinyon-juniper decreased in 2002/2004 due to the additions of the Jackson Unit, Hilltop, and Willow Creek studies to the Howard FS Chaining study but has remained relatively similar since 2002/2004 (Figure 4.47a). Mean tree cover has increased slightly from just over 9% in 2002/2004 to near 12% in 2014 (Figure 4.47b). These sites are classified as transitioning to Phase II or are in Phase II of woodland succession. These study sites are under threat of further encroachment by pinyon-juniper trees, which would result in decreases in valuable browse and forage species.

Herbaceous Understory: These study sites have a poor herbaceous understory dominated by perennial grass. However, the dominant grass species are the introduced seeded species crested wheatgrass and intermediate wheatgrass that are often considered aggressive at higher elevation and precipitation. Competition with these introduced grass species may limit other desirable herbaceous species. Mean nested frequency of perennial grasses increased considerably in 1997/1999, and is due to the additions of the Jackson Unit, Hilltop, and Willow Creek studies to the Howard FS Chaining study. There has been a

general decrease in perennial grass frequency since 2002/2004, but it still remains high due to the above mention seeded species (Figure 4.48a). The mean cover of perennial grass has generally increased from nearly 13% in 1997/1999 to 15% in 2014. Annual grassed have remained a minor component of the sites with cover less than 1% since 1994 (Figure 4.48b).

Native perennial forb species are low on these sites with low mean nested frequency and cover of all sampled species. Mean cover has remained near 1% or less over the sample years (Figure 4.48). Annual forbs have remained common on the site since, but forbs were abundant in 2007/2009.

Occupancy: Excluding the 1999 sample year where cattle pellet groups were very high, transect data indicates that deer predominately occupy these studies. The mean abundance of deer pellet groups has ranged from a high of 72 days use/acre in 2002/2004 to a low of 18 days use/acre in 2014. Elk pellet groups are typically sampled in low abundance on these study sites. The abundance of livestock sign from cattle has ranged from a high of 158 days use/acre in 1999 to a low of 0 days use/acre in 2014 (Figure 4.49).

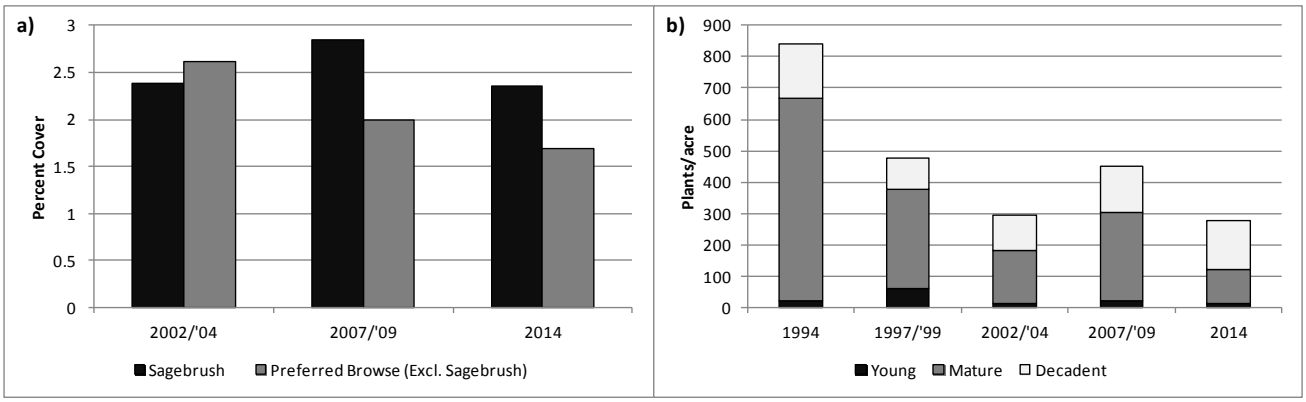


Figure 4.46: Shrub summary of the Upland (Pinyon-Utah Juniper) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

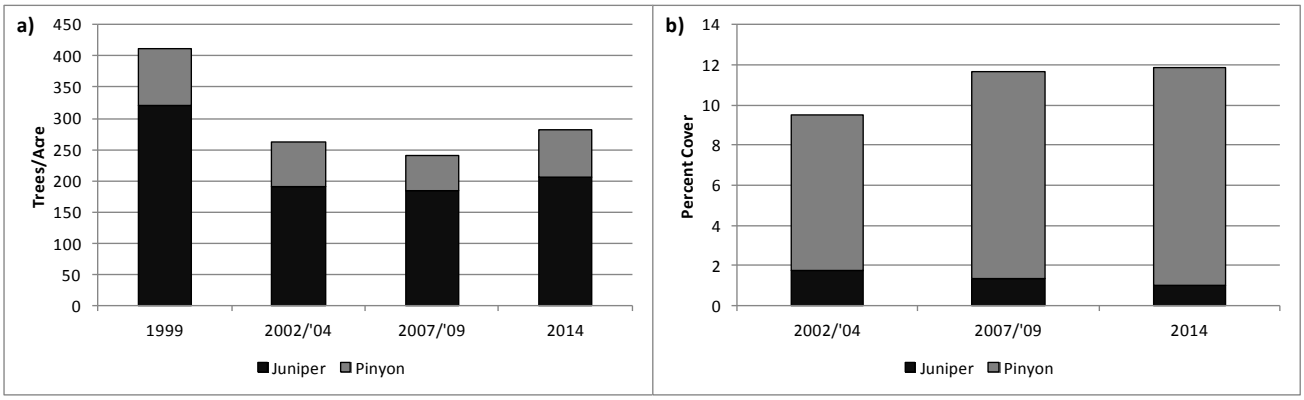


Figure 4.47: Tree summary of the Upland (Pinyon-Utah Juniper) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

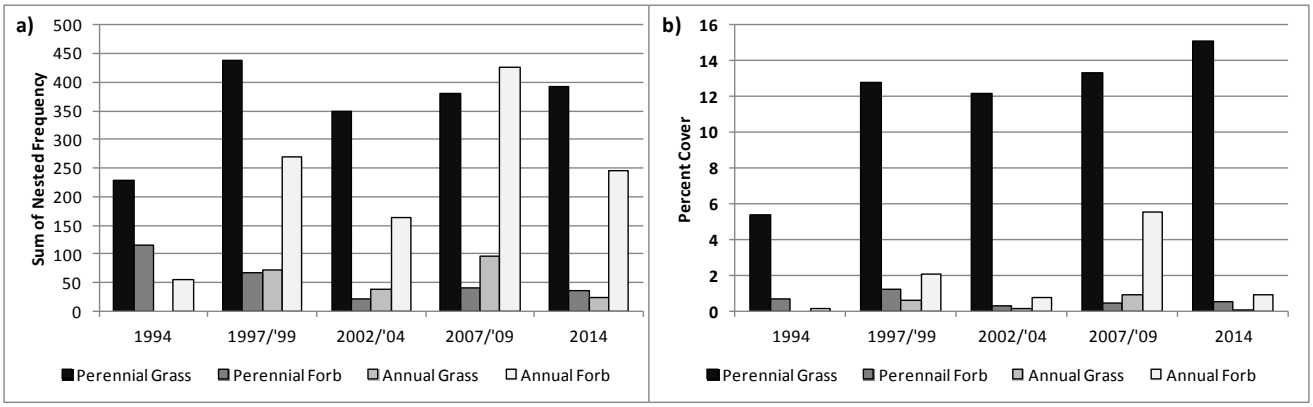


Figure 4.48: Herbaceous functional group summary of the Upland (Pinyon-Utah Juniper) studies (n=4) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

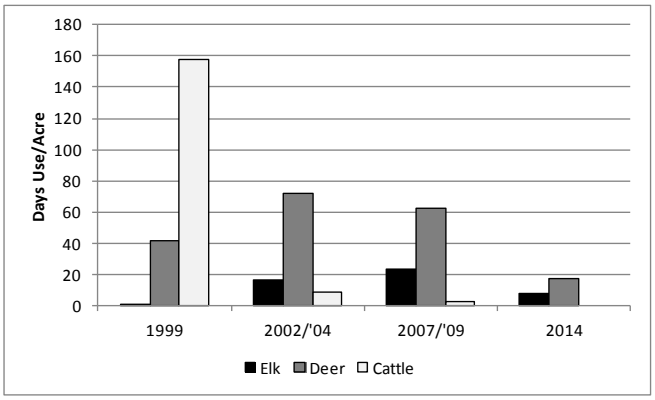


Figure 4.49: Mean pellet transect data for the Upland (Pinyon-Utah Juniper) studies (n=6) for WMU 16B/C, Manti North/South.

Upland (Shrub)

There is one study [Cove Creek (16C-39)] classified as a Upland (Shrub) ecological site that remained undisturbed over the report period (Table 4.6). The Cove Creek study is located northeast of Mount Pleasant and east of Round Hill.

Shrubs/Trees: The primary browse on this study is mountain big sagebrush. Another common preferred browse species found on the site is antelope bitterbrush. The line-intercept cover of sagebrush is moderate on this site, and has remained similar at 15% to 17% since 2002 (Figure 4.50a). The average height of mountain big sagebrush is approximately two and half feet tall, making browse available through much of the year in normal winters. The demographics of the sagebrush populations have generally been mature plants with nearly 20% of young plants comprising the population from year to year. Decadent plants have steadily increased within the population since site establishment (Figure 4.50b). Pinyon and juniper encroachment is not an issue on this site and is not included in the report.

Herbaceous Understory: This study site has poor herbaceous understory that is dominated by the weedy perennial species bulbous bluegrass (*Poa bulbosa*). The nested frequency of perennial grasses, excluding bulbous bluegrass, has varied slightly but remained low. Cover of bulbous bluegrass has increased over the sample period and in found at high frequency. The cover of perennial grass, excluding bulbous bluegrass, has varied ranging from a high of 10% in 2002 to a low of less than 3% in 2014. Cover of bulbous bluegrass increased significantly from 1997 to 2002, but it has since remained high in cover ranging from a high of 47% in 2002 to 33% in 2007. The annual grass species cheatgrass is also

abundant and has varied in cover from a high of 16% in 1997 to a low of 5% in 2002 (Figure 4.51). Cheatgrass remains a threat for increased fire on this study.

Native perennial forb species composition is low in diversity, and is low in nested frequency and cover of all sampled species (Figure 4.51). Annual forbs have remained rare on the site.

Occupancy: Pellet group transect data indicates that deer predominantly occupy this site and have ranged from moderate to high abundance. The abundance of deer pellet groups have ranged from a high of 92 days use/acre in 2007 to a low of 35 days use/acre in 2002 (Figure 4.52). Elk pellet groups are typically sampled in low abundance on this site.

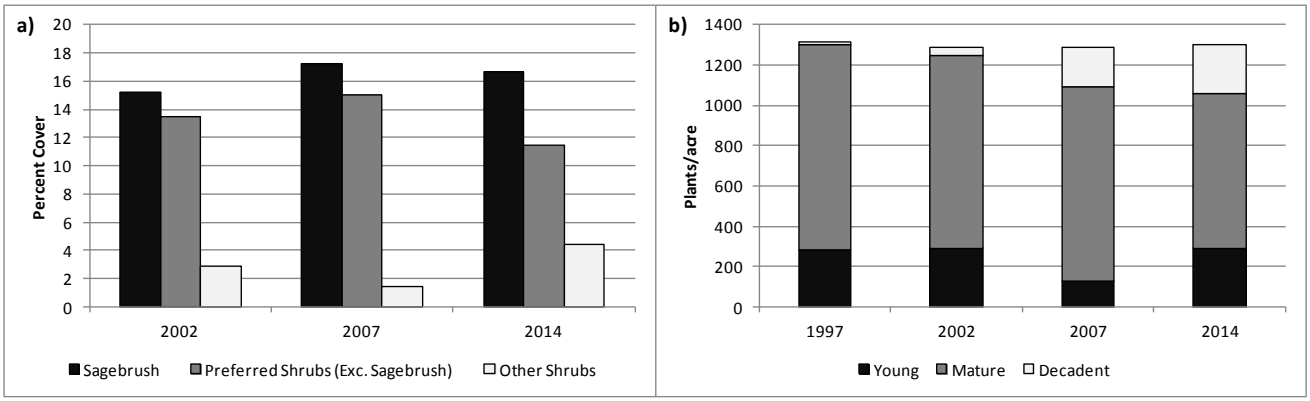


Figure 4.50: Shrub summary of the Upland (Shrub) studies (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

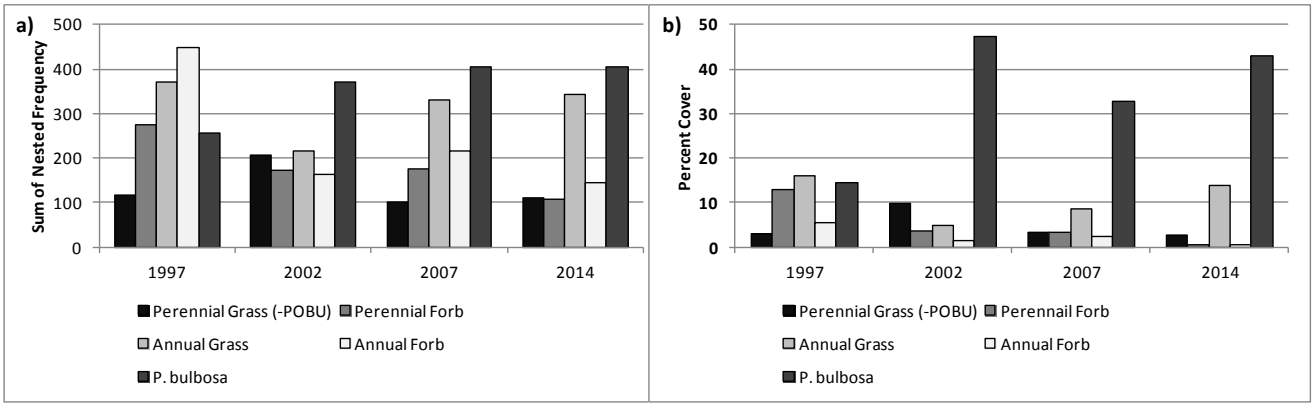


Figure 4.51: Herbaceous functional group summary of the Upland (Shrub) studies (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

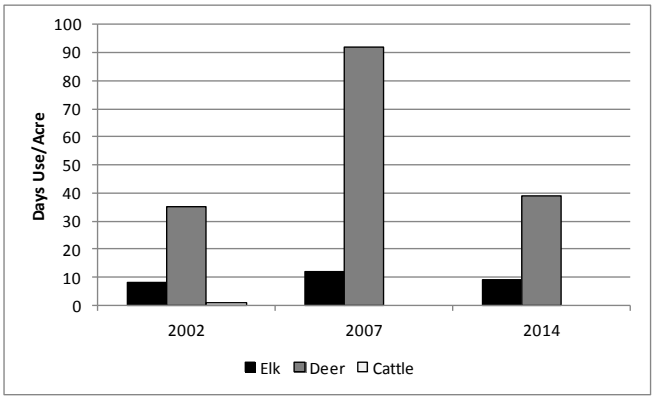


Figure 4.52: Mean pellet transect data for the Upland (Shrub) studies (n=1) for WMU 16B/C, Manti North/South.

Upland (Wyoming Big Sagebrush)

There are three studies [Slackpile (16B-17), North Spring Bench (16B-19), and Manti Dump (16C-12)] classified as Upland (Wyoming Big Sagebrush) ecological sites that remained undisturbed over the report period (Table 4.6). Both the Slackpile and North Spring Bench studies are located on benches west of price and are found east of The Elbow. The Manti Dump study is located south of the town of Manti in the upper foothills above Palisade State Park.

Shrubs/Trees: The primary browse species on these studies is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*); however, the trend on Manti Dump is increasing sagebrush while the remaining studies have decreased is sagebrush density and cover. The mean line-intercept cover of sagebrush is low on these sites ranging from 3% in 2002/2004 and 2014 to near 8% in 2007/2009 (Figure 4.53a).

Encroachment from Utah juniper and pinyon pine trees is a concern on these sites. Mean density of pinyon-juniper was reduced in 2002/2004 due to the additions of the Manti Dump and Slackpile studies to the North Spring Bench study, but has increased in density since 2002/2004 (Figure 4.54a). Mean tree cover has increased from near 7% in 2002/2004 to 12% in 2014. Pinyon pine has maintained consistent cover, and much of the increase in cover is due to increases in juniper cover (Figure 4.54b). Slackpile is classified as Phase I while the remaining studies are classified as transitioning to Phase II of woodland succession. These study sites are under threat of further encroachment by pinyon-juniper trees, which would result in decreased valuable browse and forage species.

Herbaceous Understory: These study sites have a poor to moderate herbaceous understory of perennial grasses and forbs. Perennial grasses are the dominant herbaceous component, but differ in species profiles. North Spring Bench has increased in needle-and-tread (*Stipa comata*) while blue grama has decreased in abundance. Slackpile is dominated by the native perennial grasses bluebunch wheatgrass and Indian ricegrass (*Oryzopsis hymenoides*). However, the introduced grass species crested wheatgrass is the dominant grass species on Manti Dump. Competition with this introduced grass may limit other desirable herbaceous species. Mean nested frequency of perennial grasses has fluctuated, but has remained relatively high since 1994 (Figure 4.55a). The mean cover of perennial grass, excluding bulbous bluegrass, has generally increased from 12% in 1994 to 21% in 2014. Bulbous bluegrass has only been sampled on the Manti Dump study and has increased in both nested frequency and cover (Figure 4.55b). Annual grass species are rare on both study sites and are less than 1% in cover from year to year.

Native perennial forbs are low to moderate in species richness with low nested frequencies and covers. The mean nested frequency of perennial forb species increased from 1994 to 2002/2004, but has since decreased in nested frequency. Mean cover follows the same trend pattern with a high of near 3% in 2002/2004 and lows less than 1% in 1994 and 2014 (Figure 4.55). Annual forb composition is moderate but has remained relatively low abundance.

Occupancy: Pellet group transect data indicates that deer predominately occupy these studies, though this is more pronounced on the North Spring Bench study. The mean abundance of deer pellet groups has decreased from a high of 117 days use/acre in 2009 to a low of 23 days use/acre in 2014. Elk and cattle pellet groups are typically sampled in low abundance on these sites (Figure 4.56).

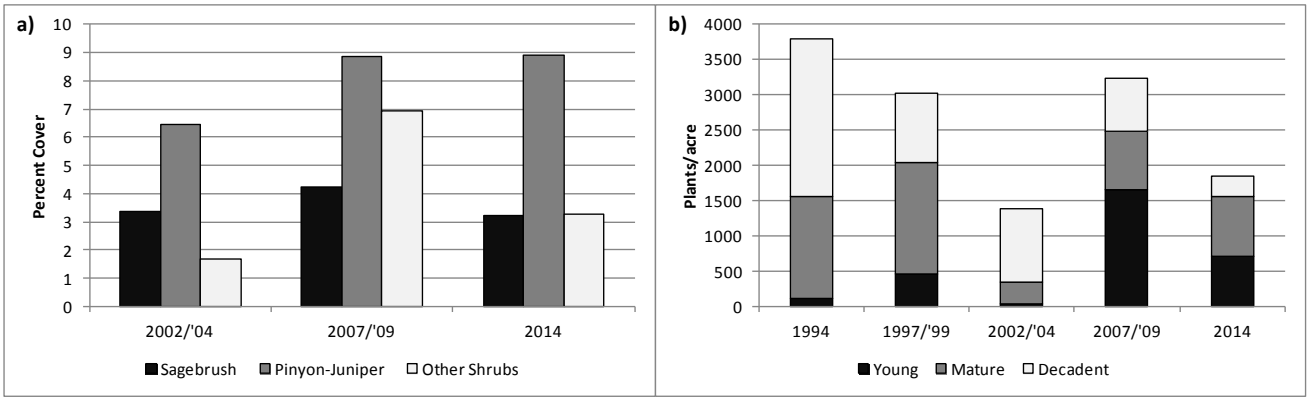


Figure 4.53: Shrub summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

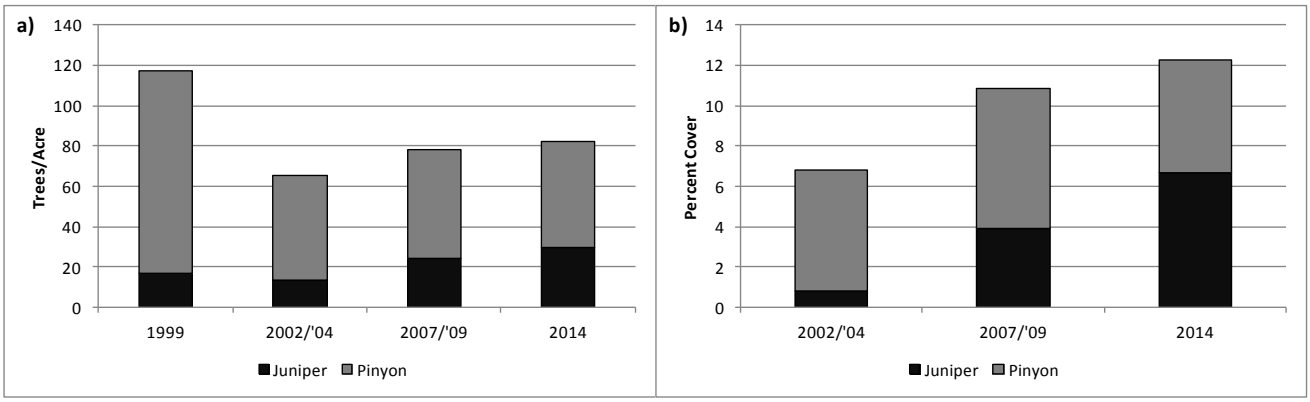


Figure 4.54: Tree summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

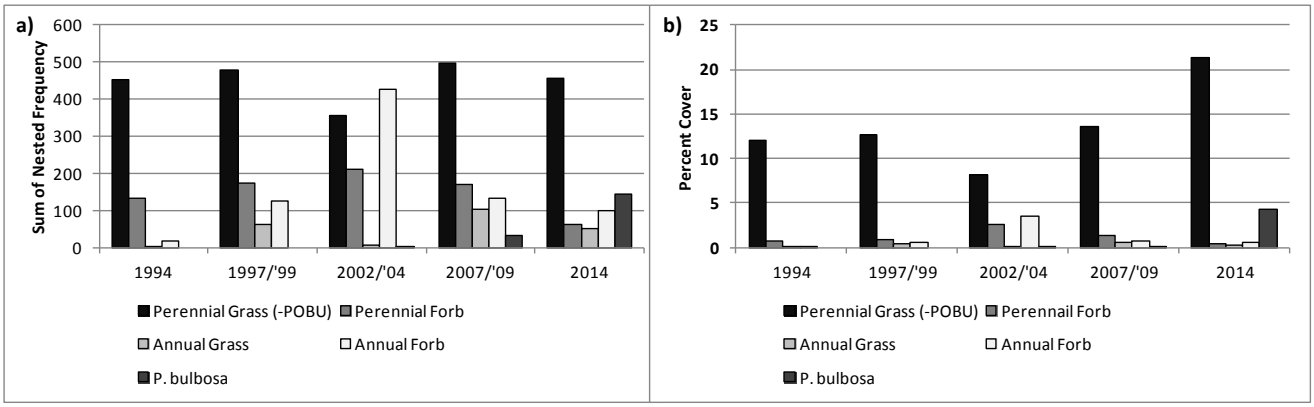


Figure 4.55: Herbaceous functional group summary of the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

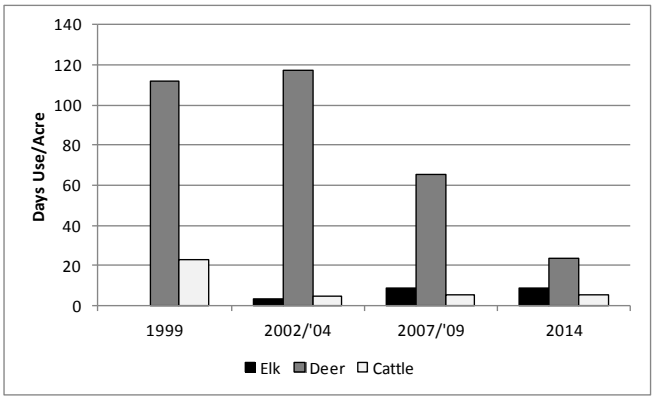


Figure 4.56: Mean pellet transect data for the Upland (Wyoming Big Sagebrush) studies (n=3) for WMU 16B/C, Manti North/South.

Semidesert (Birchleaf Mountain Mahogany)

There is one study [South of Dry Wash (16C-28)] classified as a Semidesert (Birchleaf Mountain Mahogany) ecological site that remained undisturbed over the report period (Table 4.6). The study is located on the northeast bench of Nelson Mountain southwest of the town of Ferron.

Shrubs/Trees: The primary browse on this site is a mixture of mountain browse species, primarily, black sagebrush, mountain mahogany, and green ephedra (*Ephedra viridis*). The line-intercept cover of sagebrush has decreased from near 9% in 2004 to 4% in 2014. The cover of other preferred browse species has a similar trend decreasing from near 12% in 2004 to 7% in 2014 (Figure 4.57a). The average height of the mountain big sagebrush is approximately a half foot, making browse somewhat available through much of the year in mild winters. The demographics of the sagebrush population is mostly mature plants with the density of mature plants increasing from 2,400 plants/acre in 1994, to 3,700 plants/acre in 2009, and decreasing to 2,300 plants/acre in 2014 with decadence becoming less pronounced in 2014 (Figure 4.57b).

Pinyon pine and Utah juniper have encroached on this site with density of pinyon-juniper trees remaining stable since 1999 (Figure 4.58a). Mean tree cover has steadily increased from 13% in 1999 to near 19% in 2014. Much of the cover increase is due to pinyon pine (Figure 4.58b). This site is under threat of further encroachment by pinyon-juniper trees, which would result in decreased cover of valuable browse and forage species.

Herbaceous Understory: These sites have a moderate herbaceous component dominated by perennial grass. A few native grass species occur on this site. Nested frequency of perennial grasses generally decreased with the drought in 2002 and 2003, and has remained moderate since 1994 (Figure 4.59a). The cover of perennial grass follows the same general trend as nested frequency decreasing from 9% in 1994 to 5% in 2014 with a signature decrease in cover to 3% in 2004 (Figure 4.59b). Annual grass species are rare on this site.

Native perennial forb species composition is poor in species richness and is low nested frequency and cover. The mean nested frequency and cover of perennial forb species has generally decreased with cover ranging from near 2% in 1994 to less than 1% in 2014 (Figure 4.59). Annual forbs remained rare on the site.

Occupancy: Pellet group transect data indicates that deer predominately occupy this site. The abundance of deer pellet groups has ranged from a high of 85 days use/acre in 1999 to a low of 0 days use/acre in 2014. The abundance of elk pellet groups has ranged from a high of 21 days use/acre in 2007 to a low of 0 days use/acre in 2014 (Figure 4.60).

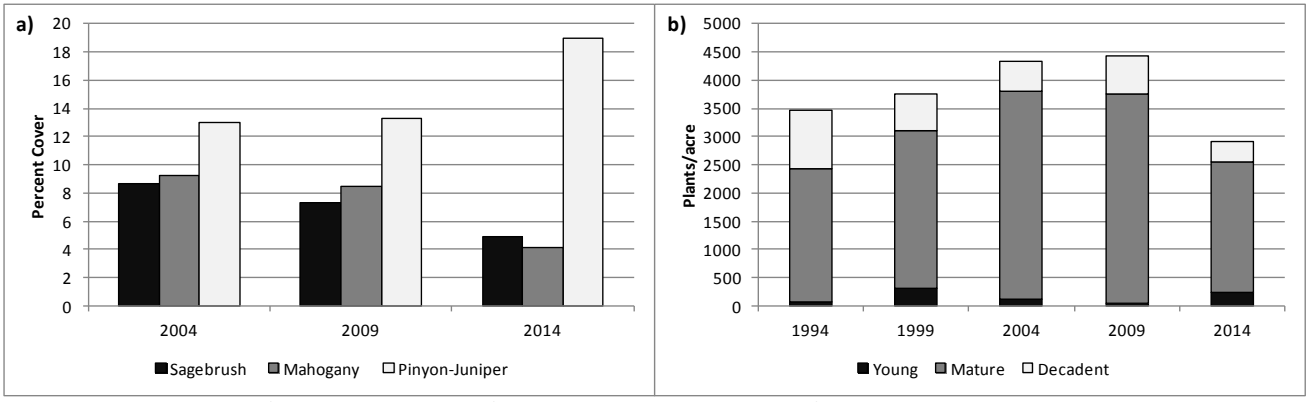


Figure 4.57: Shrub summary of the Semidesert (Birchleaf Mountain Mahogany) studies (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species.

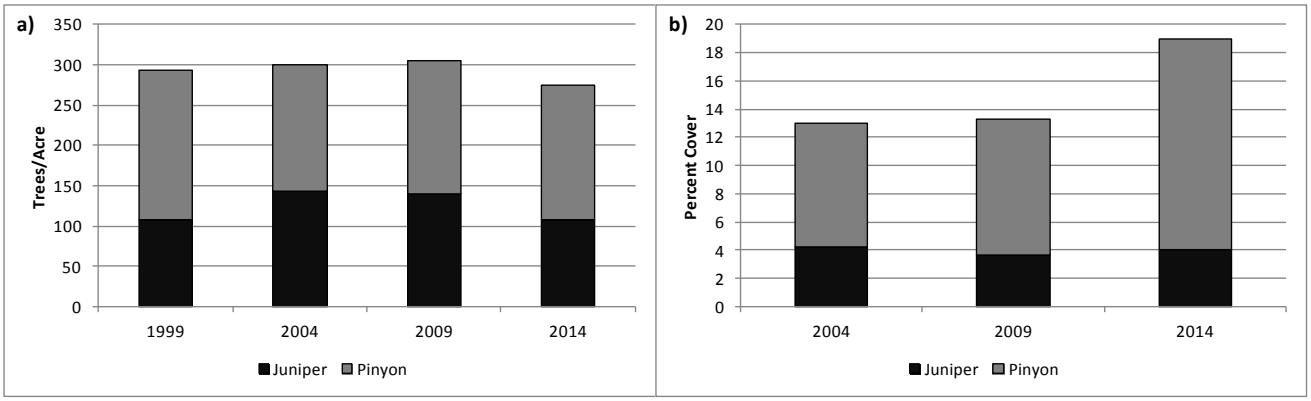


Figure 4.58: Tree summary of the Semidesert (Birchleaf Mountain Mahogany) studies (n=1) for WMU 16B/C, Manti North/South. a) Point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Line-intercept cover estimate for pinyon pine and Utah juniper.

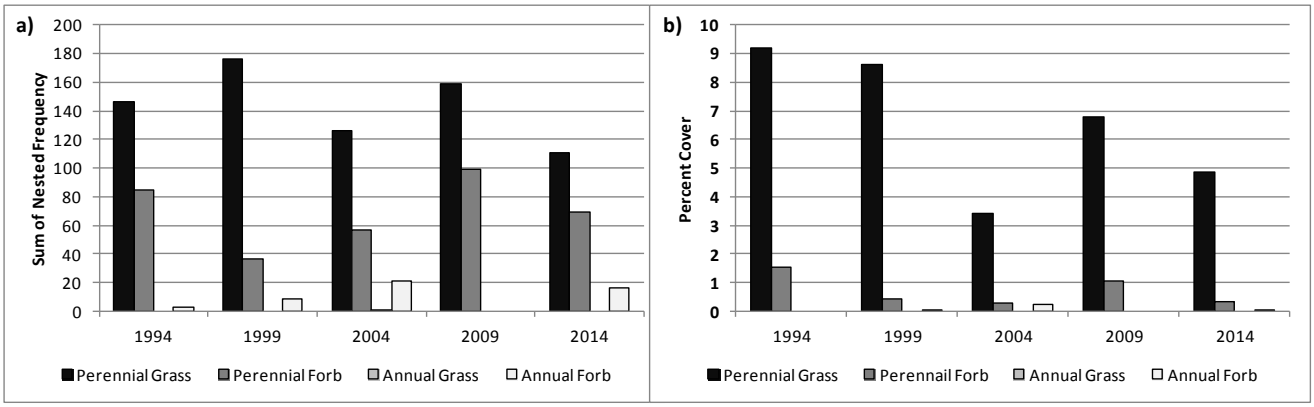


Figure 4.59: Herbaceous functional group summary of the Semidesert (Birchleaf Mountain Mahogany) studies (n=1) for 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

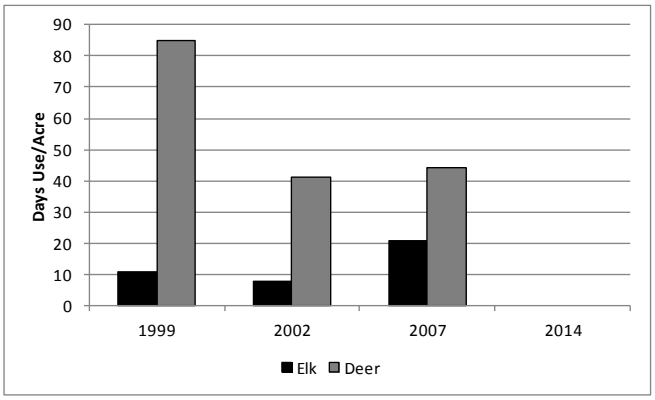


Figure 4.60: Pellet transect data for the Semidesert (Birchleaf Mountain Mahogany) studies (n=1) for WMU 16B/C, Manti North/South.

Semidesert (Shadescale)

There is one study [Muddy Creek (16C-32)] classified as a Semidesert (Shadescale) ecological site that remained undisturbed over the report period (Table 4.6). This study occurs on the south end of Nelson Mountain on the north side of Wash Rock Canyon.

Shrubs/Trees: The primary browse species on this study is shadescale (*Atriplex confertifolia*). The mean line-intercept cover of shadescale is low and decreasing from 7% in 2002/2004 to near 4% in 2009 and 2014 (Figure 4.61). While Wyoming big sagebrush is found on the site, it is not common, and occurs at much lower coverage. A significant decrease in sagebrush density occurred following the drought in 2002 and 2003 that left a small population of decadent plants (Figure 4.61b).

Herbaceous Understory: This site has a fair herbaceous component dominated by perennial grass. Several native species occur on the site with Indian ricegrass as the dominant species. Nested frequency of perennial grasses has generally increased since 1994 (Figure 4.62a). The mean cover of perennial grass increased from 5% in 1994 to around 12% in 2014. There was a marked decrease in cover in 2004 that followed the drought in 2002 and 2003 (Figure 4.62b). Annual grass species are rare on the site.

Native perennial forb species composition is poor with low nested frequency and cover. The nested frequency and cover of annual forb species has increased. Mean cover of annual forbs increased from less than 1% in 1994 to 3% in 2014 (Figure 4.62).

Occupancy: Pellet group transect data indicates that elk predominately occupy this site and are sampled in high abundance. The abundance of elk pellet groups has ranged from a high of 80 days use/acre in 1999 to a low of 26 days use/acre in 2014. The abundance of deer pellet groups has ranged from a high of 19 days use/acre in 2004 to a low of 5 days use/acre in 2009. Livestock sign from cattle is low to absent on this site (Figure 4.63).

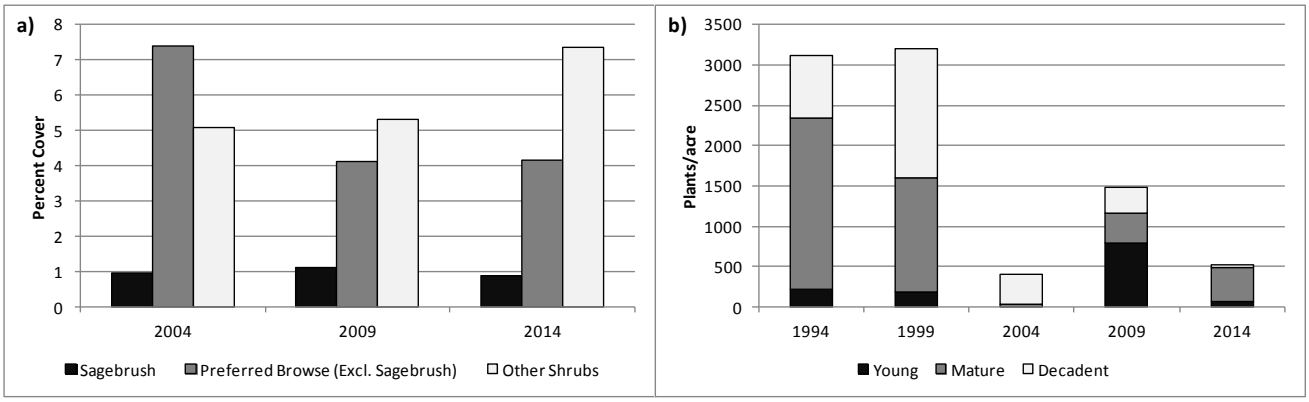


Figure 4.61: Shrub summary of the Semidesert (Shadscale) study (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups. b) Density and demographics of sagebrush (*Artemisia spp.*) species

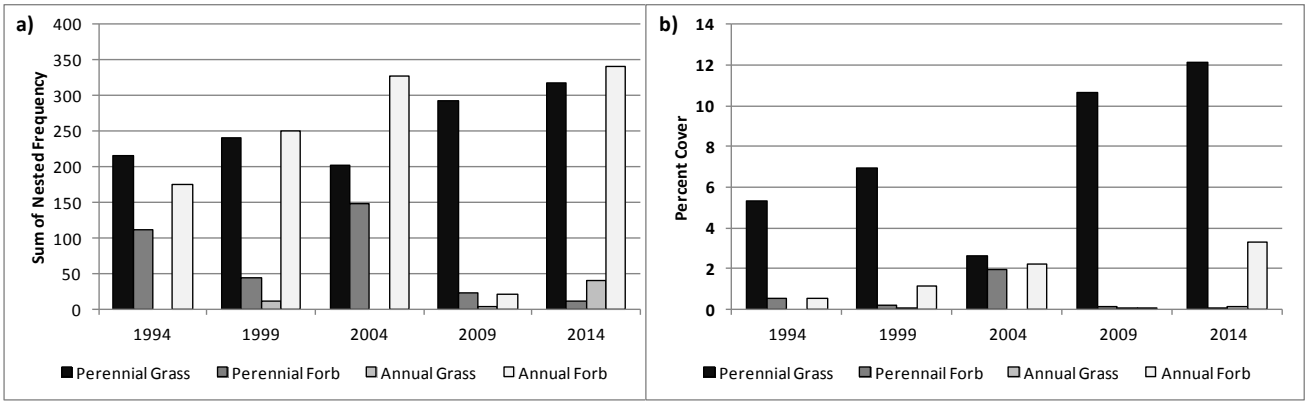


Figure 4.62: Herbaceous functional group summary of the Semidesert (Shadscale) studies (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

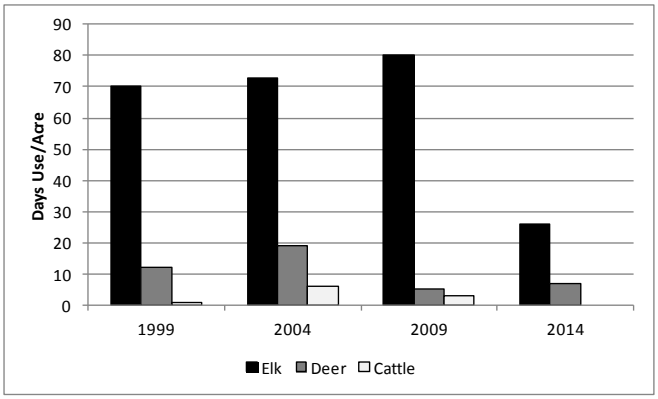


Figure 4.63: Pellet transect data for the Semidesert (Shadscale) studies (n=1) for WMU 16B/C, Manti North/South.

Study Trend Summary (Treated/Disturbed Sites)

Aerator

There are five studies [Porphyry Bench (16B-18), Consumer Bench (16B-23), Consumer Bench North (16R-14), Consumer Bench 2 (16R-15), and Upper Porphyry (16R-13)] that were treated with an aerator during the report period (Table 4.7). All of the studies are located on the upper west benches of the city of Price and east of The Elbow. All of the studies are classified as either Semidesert (Wyoming Big Sagebrush) or Upland (Wyoming Big Sagebrush) ecological sites (Table 4.6). Generally, the target of the aerator treatments was to rejuvenate Wyoming big sagebrush cover in order to restore sagebrush health and herbaceous understory.

Shrubs/Trees: The primary browse on all of the studies is Wyoming big sagebrush. Sagebrush was likely impacted by drought in 2002 and 2003 on these studies. The mean line-intercept cover of sagebrush was moderate prior to 2004, but was low on many of the sites following the fore mentioned drought. The mean cover of sagebrush decreased following treatments from near 7% to less than 5% (Figure 4.64a). However, mean density of sagebrush increased from 2,524 plants/acre to 3,443 plants/acre. Moreover, changes in demographics of the sagebrush populations have been positive on most of the studies with decadence decreasing and recruitment of young increasing (Figure 4.64b). The Porphyry Bench study is the exception to this trend. It is expected that with the improved recruitment and health of the sagebrush following treatment that the sagebrush will continue to increase on most of the treatment sites.

Herbaceous Understory: The herbaceous understory was generally lacking or in poor condition prior to treatment. There was a general increase in grasses following treatment, with a significant increase in the first post treatment sampling. Perennial grass had the largest response increasing in mean cover from 6% to near 17% in the first sampling following treatment, but decreased to 10% in the second post treatment sampling. However, perennial forb cover decreased from 7% in the pre-treatment sampling to less than 1% in the second post-treatment sampling. Annual grass, namely cheatgrass, was rare on most study sites prior to treatment with no notable increases following treatment (Figure 4.65).

Occupancy: Pellet group transect data indicates that deer primarily occupy these study sites. Pellet group abundance for both deer and elk sampled decreased following treatment. The mean abundance of pellet groups of elk decreased from 17 days use/acre prior to treatment to a low of 8 days use/acre in the second post year sampling. Mean abundance of pellet groups of deer decreased from 136 days use/acre prior to treatment to 56 days use/acre in the second post year sampling, but is still considered to be in high abundance (Figure 4.66).

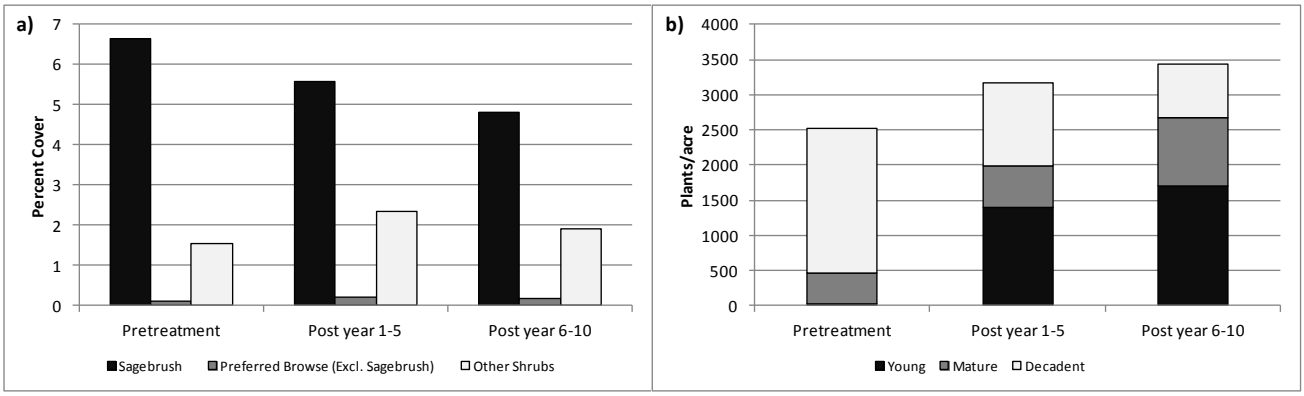


Figure 4.64: Shrub summary of the Aerator treatment studies (n=5) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

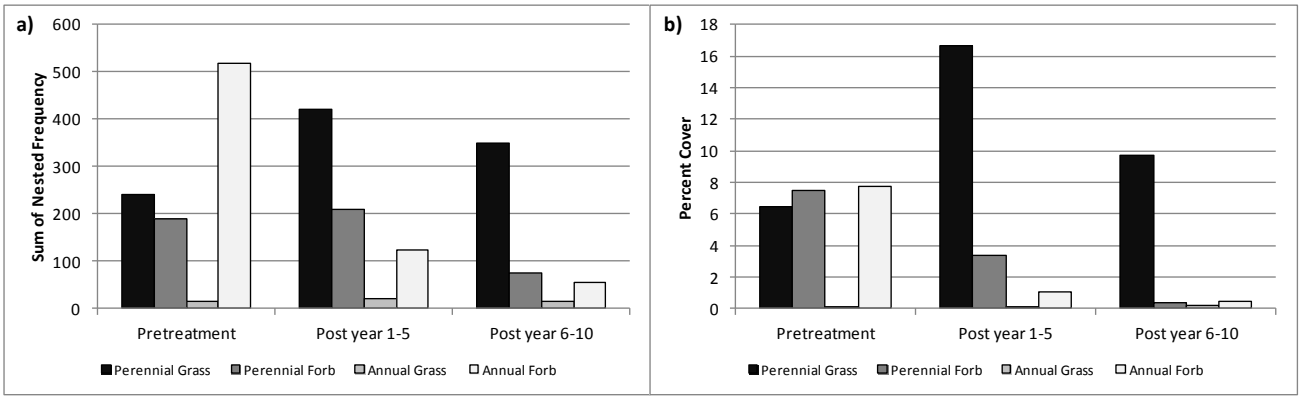


Figure 4.65: Herbaceous functional group summary of the Aerator treatment studies (n=5) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

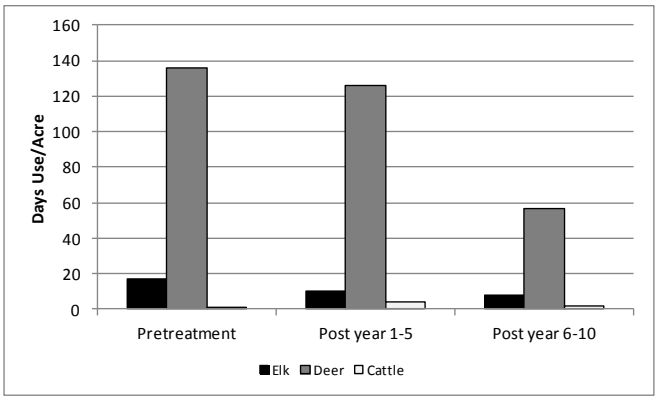


Figure 4.66: Mean pellet transect data for the Aerator treatment studies (n=5) for WMU 16B/C, Manti North/South.

Bullhog

There are four studies [Dry Creek Chaining (16B-4), Dry Mountain (16C-26), Black Dragon Bullhog (16R-25), and Dairy Fork 1 (16R-46)] that were treated with a bullhog during the report period (Table 4.7). Dry Creek Chaining is located southeast of the town of Birdseye and is found on the western foothills of Cedar Knoll. Dairy Fork 1 is located to the east of and at the base of Sky High Mountain. The Dry Mountain and Black Dragon Bullhog studies are located east of Wrigley Hill on high sagebrush flats. The studies are classified as Upland (Mountain Big Sagebrush) and Upland (Pinyon-Utah Juniper), and Mountain (oak) and (Browse) ecological sites (Table 4.6). Generally, the target of bullhog treatments is to reduce pinyon pine and Utah juniper density and cover to rejuvenate browse and increase the herbaceous understory.

Shrubs/Trees: The primary browse on the Dry Creek Chaining, Black Dragon, and Dairy Fork Burn studies is true mountain mahogany while on the primary browse on the Dry Mountain study is mountain big sagebrush. Other preferred browse species are fairly common. The mean cover of sagebrush at post treatment years 1-5 remained similar to pretreatment values at near 7% (Figure 4.67a). However, the mean density of sagebrush slightly increased from 1,115 plants/acre to 1,327 plants/acre. Changes in demographics of the sagebrush populations have been positive on most of the studies. Mean decadence has remained similar following treatment, but the mean recruitment of young and mature plants increased following bullhog treatment (Figure 4.67b).

Pinyon pine and Utah juniper have encroached on these sites with density of pinyon-juniper trees decreasing considerably following bullhog treatment (Figure 4.68a). Mean tree cover has decreased

following treatment from 23% pre-treatment to 8% post-treatment 1-5 years (Figure 4.68b). These sites are under threat of further encroachment by pinyon-juniper trees, which would result in decreased cover of valuable browse and forage species.

Herbaceous Understory: The herbaceous component has been fair on majority of these studies, but the Dry Creek Chaining has a higher presence of annual grasses and forbs. All of the study sites had an herbaceous component comprised primarily of native grass and forb species, and both had a positive response following treatment. Annual grass, primarily cheatgrass, had little response on the Dry Creek Chaining with cover remaining similar at 2-3%. The presence of cheatgrass remains a substantial threat for increased fire on this study. Annual grasses are rare on Dairy Fork 1 with much lower nested frequency and cover then the Dry Creek Chaining study. Mean perennial grass cover increased from 6% to 8%, mean perennial forb cover increased from 5% to 10%, and mean perennial forb cover increased from 3% to 5% following treatment. The mean annual forb cover decreased from 3% to near 1% following treatment with the main trend being driven by the Dry Creek Chaining study (Figure 4.69).

Occupancy: Pellet group transect data indicates that deer primarily occupy these study sites. The mean abundance of pellet groups for deer decreased from 30 days use/acre prior to treatment to 12 days use/acre following treatment. Elk and cattle pellet groups are found in low abundance on these sites (Figure 4.70).

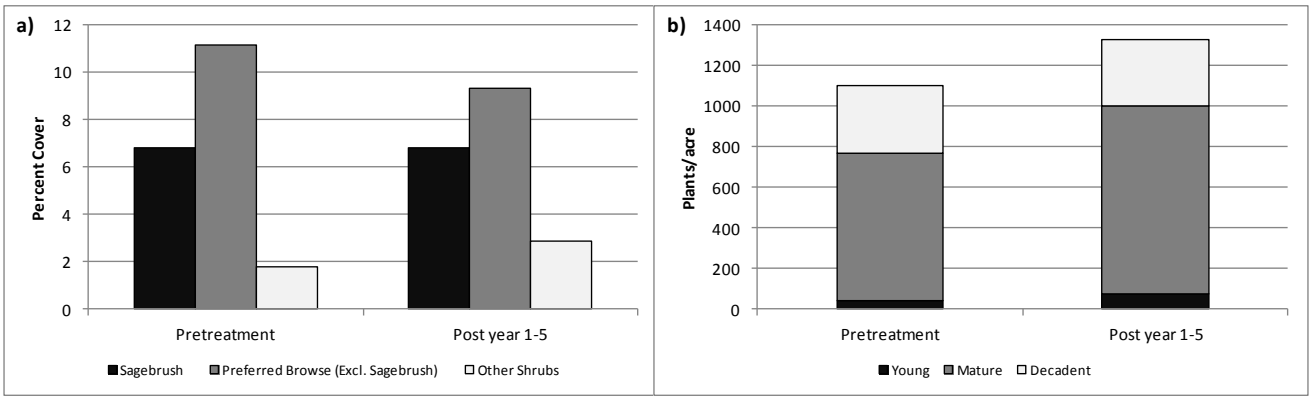


Figure 4.67: Shrub summary of the Bullhog treatment studies (n=4) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

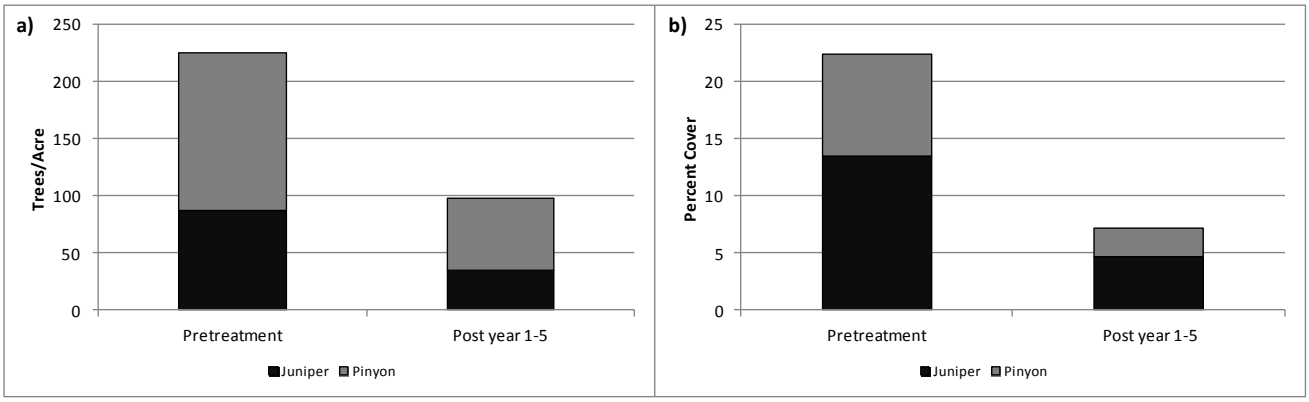


Figure 4.68: Tree summary of the Bullhog treatment studies (n=4) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

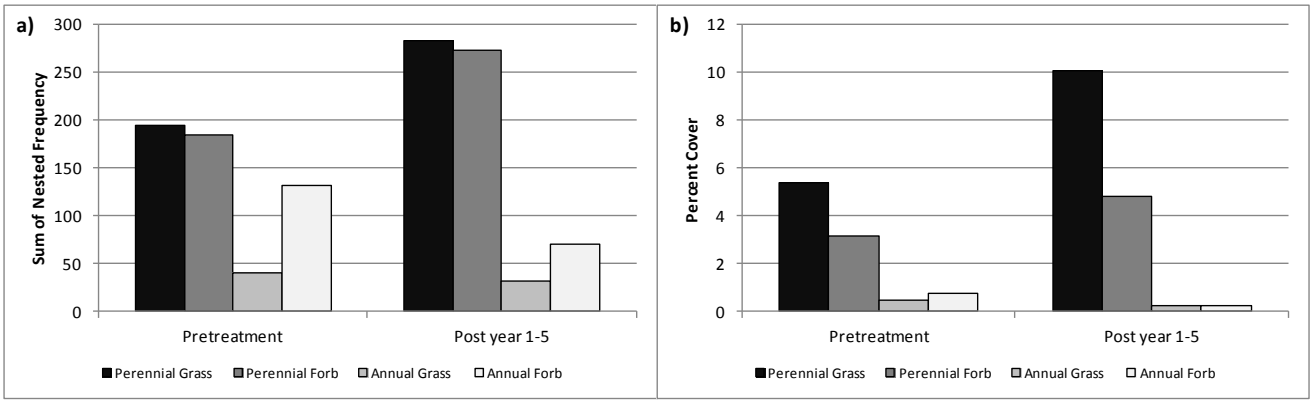


Figure 4.69: Herbaceous functional group summary of the Bullhog treatment studies (n=4) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

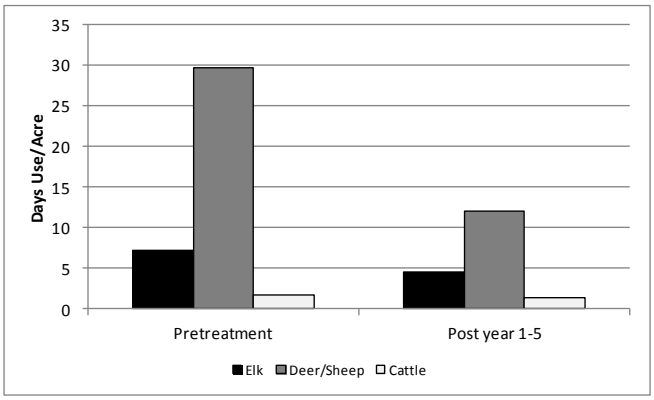


Figure 4.70: Mean pellet transect data for the Bullhog treatment studies (n=4) for WMU 16B/C, Manti North/South.

Chaining

There are six studies [Mill Fork (16B-6), Pole Canyon Oak (16C-9), Above South Hollow (16C-11), Mill Fork Chaining (16R-30), Canal Canyon (16R-42), and Dairy Fork 2 (16R-47)] that were treated with a chaining during the report period (Table 4.7). The Mill Fork, Mill Fork Chaining, and Dairy Fork 2 studies are located south of US 6 on the north slopes of Davis Hill. The Canal Canyon study is located on the east bench just northeast of Pigeon Hollow. The Above South Hollow and Pole Canyon Oak studies are located to the south of the town of Mayfield. The above studies are all classified as Mountain potential ecological sites, except for the Canal Canyon study, which is classified as an Upland potential ecological site (Table 4.6). Generally, the target of the chaining treatments was to remove encroaching pinyon and juniper trees, and to rejuvenate degraded sagebrush and increase the herbaceous understory.

Shrubs/Trees: The primary browse differs from one study to another. The Pole Canyon Oak study is primarily Gambel oak, but has a component of mountain browse. The Mill Fork study has mountain big sagebrush as the main browse species. The Mill Fork Chaining, Dairy Fork 2, Canal Canyon, and Above South Hollow studies had a dominate overstory of pinyon and juniper trees. The mean cover of sagebrush for these studies was reduced following treatments from near 6% to near 3% at the second post treatment sampling (Figure 4.71a). The mean density of sagebrush has not changed; however, mean density of young sagebrush has increased from near 15 plants/acre to 432 plants/acre and a decrease in decadence from 664 plants/acre to 74 plants/acre at the second post treatment sampling. Changes in demographics of the sagebrush populations have been positive on these studies; however, the main driver of this trend is the Mill Fork study (Figure 4.71b).

The mean density and cover of pinyon pine and Utah juniper trees was high at 227 trees/acre and 35%, respectively. The mean density of pinyon-juniper trees decreased to 105 tree/acre and the mean cover decreased to 2% following treatment in the second post sampling (Figure 4.72). Remaining density and cover is generally provided by trees that were intentionally not treated or small trees that escaped treatment.

Herbaceous Understory: The herbaceous component was fair to good on the Pole Canyon Oak, Above South Hollow, Mill Fork Chaining, and Canal Canyon, but was generally lacking on the Mill Fork and Dairy Fork 2 studies prior to treatment on these studies. All but one study had a herbaceous component that had non-native perennial grasses, annual grass, or noxious weeds. The mean perennial grass cover increased from 6% to 29% and mean perennial forb cover increased from 1% to 4%; however, this increase is due to the introduced perennial grass species crested wheatgrass, intermediate wheatgrass, and smooth brome. The annual grass trend is driven by the Mill Fork Chaining study with cheatgrass remaining a substantial threat for increased fire on this study. The mean annual forb cover remained similar, but the mean sum of nested frequency decreased following treatment (Figure 4.73).

Occupancy: Pellet group transect data indicates that deer primarily occupy these study sites. The mean abundance of pellet groups for deer decreased from 37 days use/acre prior to treatment to 24 days use/acre in the second post treatment sampling. Pellet group abundance of elk has remained similar and low (Figure 4.74).

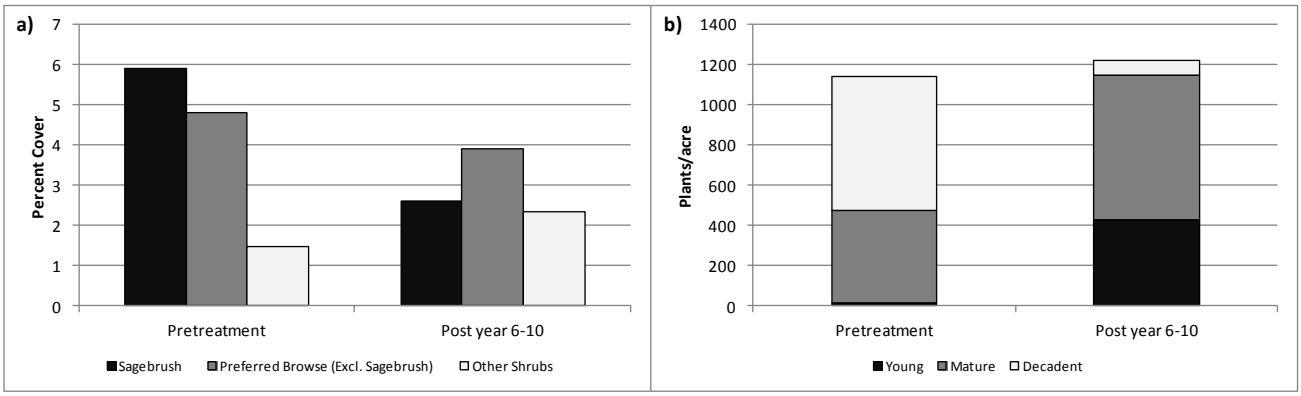


Figure 4.71: Shrub summary of the Chaining treatment studies (n=6) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

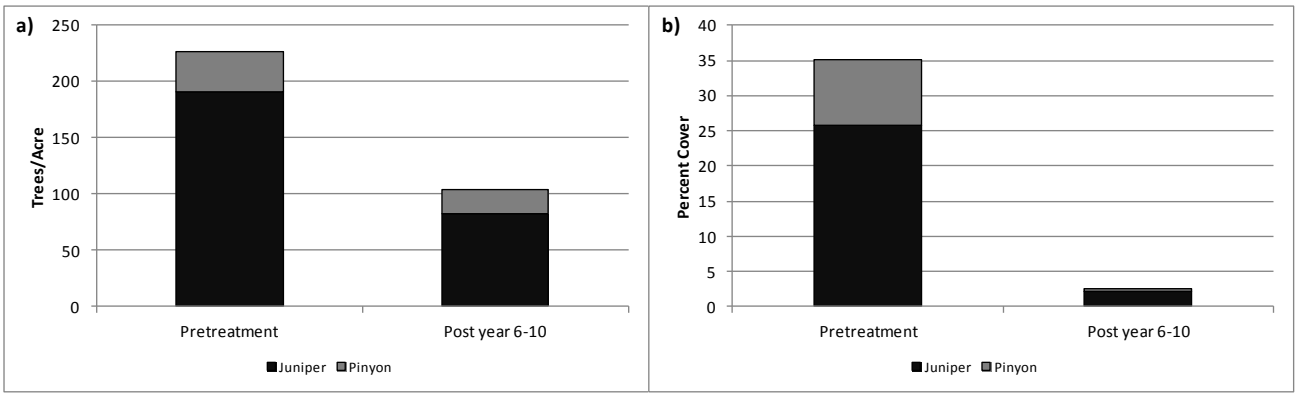


Figure 4.72: Tree summary of the Chaining treatment studies (n=6) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

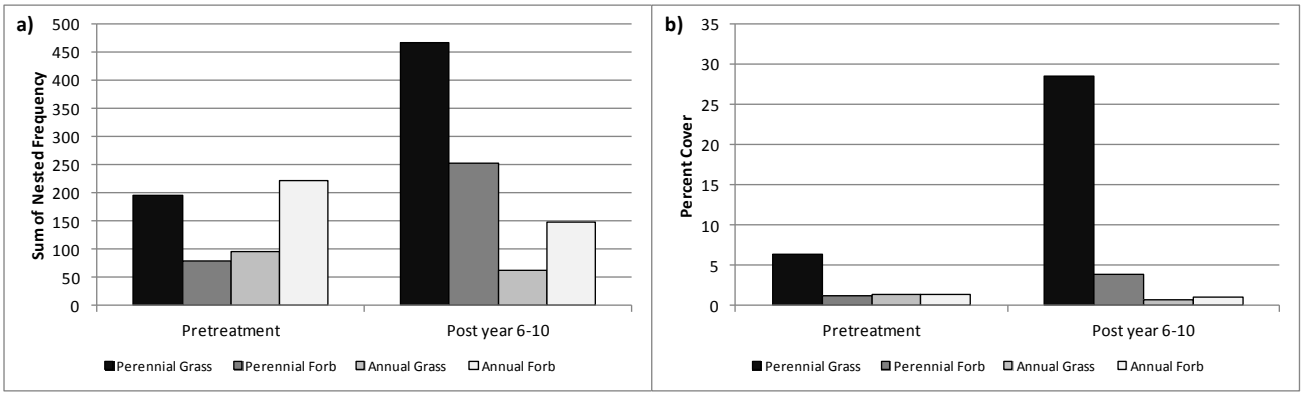


Figure 4.73: Herbaceous functional group summary of the Chaining treatment studies (n=6) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

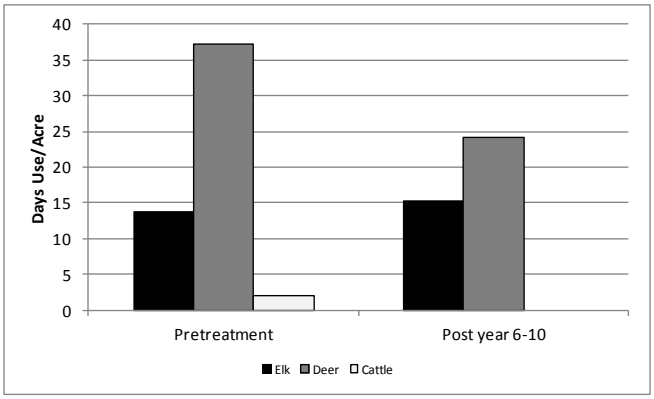


Figure 4.74: Mean pellet transect data for the Chaining treatment studies (n=6) for WMU 16B/C, Manti North/South.

Disc

There is one study [Howerton's (16R-20)] that was treated with a disc during the report period (Table 4.7). The Howerton's study is located southeast of the town of Spring City. This study is classified as an Upland (Mountain Big Sagebrush) ecological site (Table 4.6). Generally, the target of disc treatments is to disturb the ground and seed species that enhance the herbaceous understory.

Shrubs/Trees: The primary browse on the Howerton's study is the seeded species forage kochia (*Kochia prostrata*). The cover of forage Kochia was sampled at 2% following treatment (Figure 4.75).

Herbaceous Understory: The study sites have a poor herbaceous component dominated by perennial grasses and annual forbs. The dominant grass species are seeded species such as crested and intermediate wheatgrass. Competition with these introduced grasses may limit other desirable herbaceous species. Perennial grass had the largest response increasing in cover from less than 1% to 27% in the second post year sampling. Annual forb cover and frequency has varied dramatically since the pretreatment sampling. Cover increased from over 5% to 21% at the first post treatment sampling, but decreased to 6% at the second post treatment sampling. Annual grasses, primarily cheatgrass, are fairly common on the study and remain a substantial threat for increased fire. Cheatgrass has decreased dramatically from 42% cover prior to treatment to 28% and 6% in the first and second post treatment samplings, respectively (Figure 4.76).

Occupancy: Pellet group transect data indicates that deer exclusively occupy this site. The abundance of pellet groups for deer increased from 10 days use/acre prior to treatment to 28 days use/acre following treatment in the second post treatment sampling (Figure 4.77).

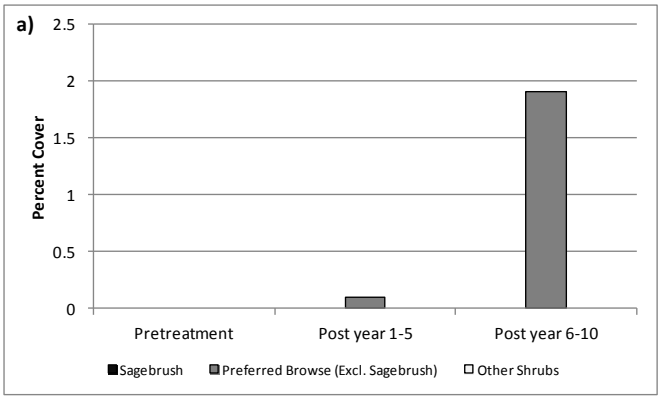


Figure 4.75: Shrub summary of the Disc treatment studies (n=1) for WMU 16B/C, Manti North/South. a) Line-intercept cover estimate of shrub groups.

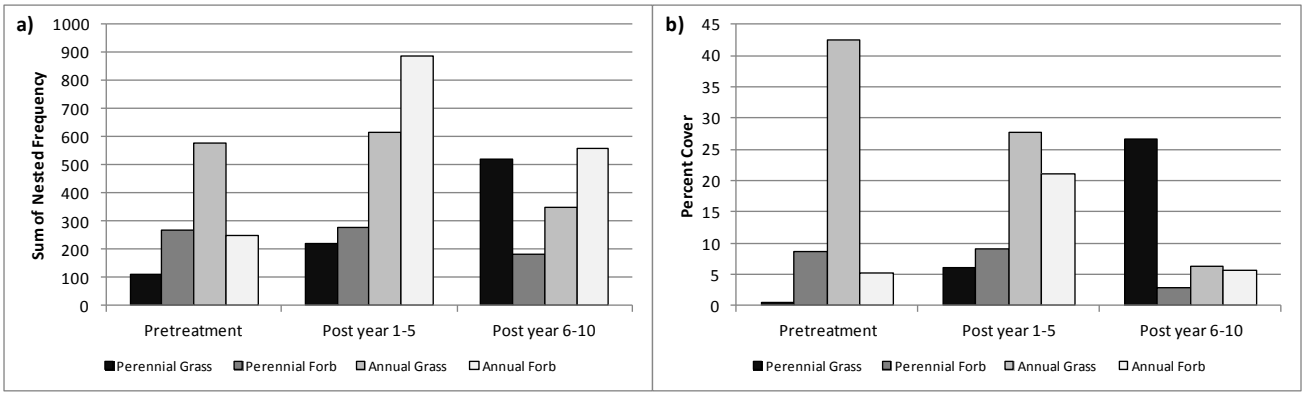


Figure 4.76: Herbaceous functional group summary of the Disc treatment studies (n=1) for WMU 16B/C, Manti North/South. a) Sum of nested frequency of herbaceous functional groups. b) Quadrat cover estimate of herbaceous functional groups.

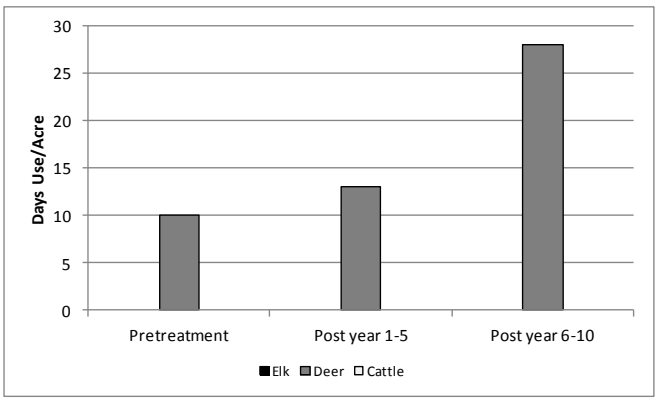


Figure 4.77: Pellet transect data for the Disc treatment studies (n=1) for WMU 16B/C, Manti North/South.

Harrow

There are five studies [Box Canyon Sage-Grouse (16C-42), North Spring (16R-23), Scofield Dixie (16R-33), Wildcat Dixie Harrow (16R-34), and Wildcat Disking (16R-37)] that were harrowed during the report period (Table 4.7). The Scofield Dixie is located in a flat northwest of Scofield Reservoir. The North Spring study is found in a flat northeast of Hiawatha and east of Gentry Mountain. Box Canyon

Sage-Grouse, Wildcat Disking, and Wildcat Dixie Harrow are all studies found a flat east of Duncan Mountain. The Box Canyon, Scofield Dixie, Wildcat Dixie Harrow, and Wildcat Dixie studies are classified as Mountain (Mountain Big Sagebrush) ecological sites while the North Spring study is classified as a Semidesert (Wyoming Big Sagebrush) ecological site (Table 4.6). Generally, the target of the harrow treatments was to rejuvenate decadent sagebrush and increase the herbaceous understory.

Shrubs/Trees: The primary browse on all of the studies was either mountain big sagebrush or Wyoming big sagebrush. Prior to disturbance, sagebrush was common on all of the study sites with a mean line-intercept of 26% and was reduced to 6% and 8% following treatment at the first and second post treatment samplings, respectively (Figure 4.78a). Prior to disturbance the demographics of the sagebrush population was a mixture of decadent and mature plants with limited recruitment of young plants. Following the treatment, the demographic structure of the populations of sagebrush has been diversified with increases of young and decreases in decadence (Figure 4.78b).

Herbaceous Understory: The herbaceous component was diverse across the sites, and generally dominated by introduced perennial grass species, specifically crested wheatgrass, intermediate wheatgrass, and smooth brome. Competition with these introduced grasses may limit other desirable herbaceous species. Perennial forb species are also prevalent across these sites, except the North Spring study where annual forb species are more common. Mean perennial grass species have increased on the sites, increasing from 15% cover prior to disturbance to 21% cover in the second post treatment sampling. Most of this increase is due to the seeded species crested and intermediate wheatgrass, and smooth brome. Perennial forb species have decreased each year following the harrow treatment with mean perennial forb cover decreasing from 8% following treatment to 2% in the second post treatment sampling. Annual grass, primarily cheatgrass, has been rare on these study sites (Figure 4.79).

Occupancy: Pellet group transect data indicates that deer primarily occupy these study sites. The mean abundance of pellet groups of wildlife and cattle have steadily decreased following the harrow treatments. However, the abundance of sage-grouse pellets increased on the Box Canyon and Wildcat Dixie studies with pellet groups increasing from 9 pellet groups/acre prior to treatment to 37 and 17 pellet groups/acre in the respective first and second sampling periods following treatment (Figure 4.80).

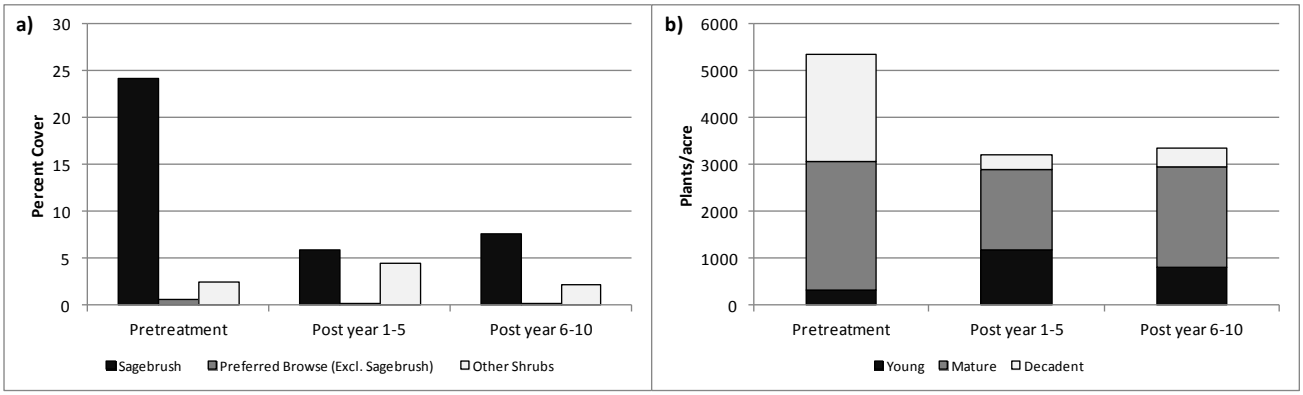


Figure 4.78: Shrub summary of the Harrow disturbance studies (n=5) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

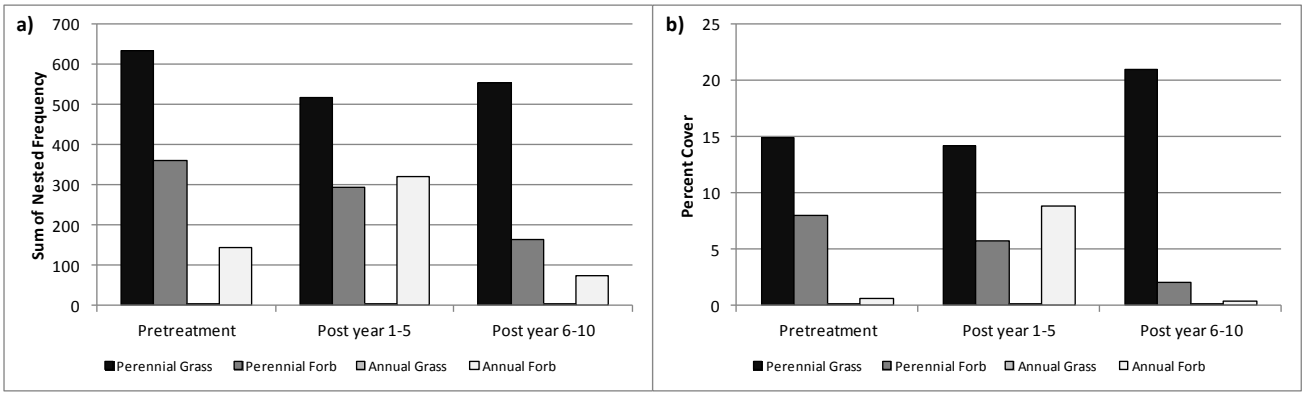


Figure 4.79: Herbaceous functional group summary of the Harrow disturbance studies (n=5) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

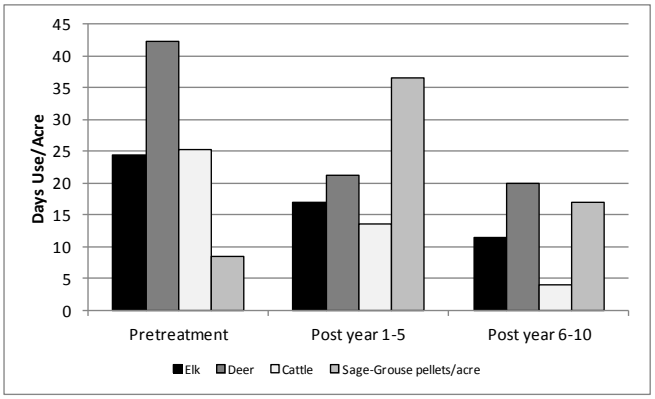


Figure 4.80: Mean pellet transect data for the Harrow disturbance studies (n=5) for WMU 16B/C, Manti North/South.

Herbicide

There are two studies [Fish Creek WMA (16R-19) and 12 Mile Dixie (16R-24)] that were treated with herbicide during the report period (Table 4.7). The Fish Creek WMA study is located directly east of Scofield Reservoir. The 12 Mile Dixie study is found southeast of the town Mayfield and in a flat in Olsen Canyon. The Fish Creek WMA study is classified as an Mountain (Mountain Big Sagebrush) ecological site, and the 12 Mile Dixie study is classified as an Upland (Basin Big Sagebrush) ecological site (Table 4.6). Generally, the target of herbicide treatments is to remove or reduce the targeted weedy components of the understory, increase beneficial species, and improve the composition of the understory.

Shrubs/Trees: The primary browse on the Fish Creek WMA study is mountain big sagebrush and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*). Browse species have remained rare on the 12 Mile Dixie. Stickyleaf low rabbitbrush composed over half of "other" browse cover on the Fish Creek WMA study, and was the target of the treatment. Prior to disturbance, sagebrush was common on the Fish Creek WMA study with a line-intercept cover of 19% and increased to 23% cover in the first post treatment sampling. Stickyleaf low rabbitbrush decreased slightly from 25% cover prior to treatment to 20% cover following treatment (Figure 4.81a). Prior to disturbance, the demographics of the sagebrush population on the Fish Creek WMA was comprised of a mixture of decadent and mature plants with limited recruitment of young plants. Following the herbicide treatment however, the sagebrush demographics stratified into a population comprised primarily of mature plants with a significant reduction in decadent plants (Figure 4.81b).

Herbaceous Understory: The herbaceous component was mixed across the Fish Creek WMA and 12 Mile Dixie studies, but was prior to treatment generally dominated by perennial and annual grasses, respectively. Perennial grass species increased substantially on 12 Mile Dixie while increasing slightly on Fish Creek WMA. The magnitude of increase is masked by the high nested frequency and cover on the Fish Creek WMA study. Mean perennial grass cover increased from near 9% prior to disturbance to 17% cover in the first post treatment sample period. Most of this increase is due to the introduced species crested and intermediate wheatgrass, which were seeded following the herbicide treatment on 12 Mile Dixie. Annual grasses, primarily cheatgrass, on 12 Mile Dixie decreased in line-intercept cover from 10% prior to treatment to less than 1% following treatment. Again, the magnitude of the decrease is masked by absence of cheatgrass on the Fish Creek WMA study (Figure 4.82). The herbicide target on 12 Mile Dixie was the noxious weed squarrose knapweed (*Centaurea virgata*), which has been found in low abundance since site establishment.

Occupancy: Pellet group transect data indicates that elk primarily occupied the Fish Creek WMA study prior to treatment, but occupied by deer following treatment. However, the mean abundance of pellet groups shows that cattle are common on both sites (Figure 4.83).

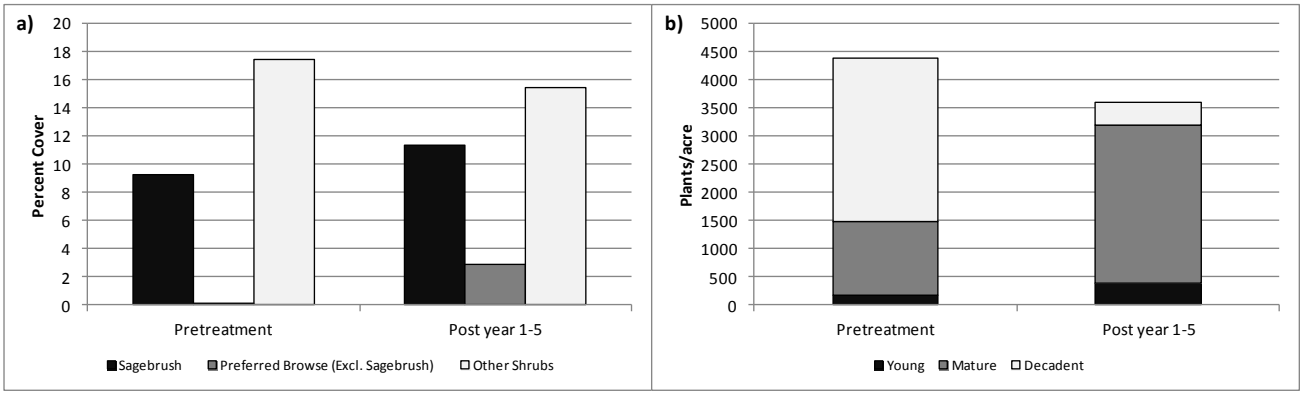


Figure 4.81: Shrub summary of the Herbicide treatment studies (n=2) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

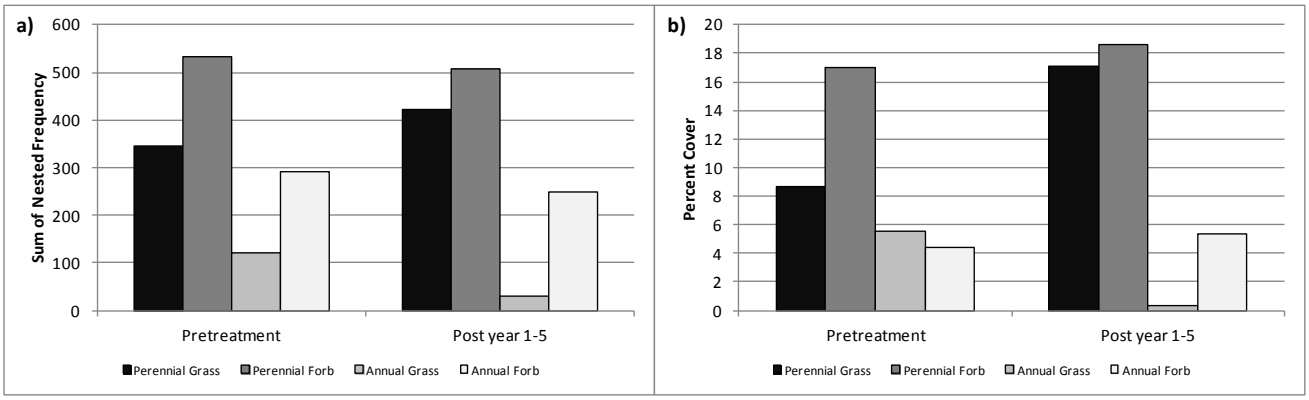


Figure 4.82: Herbaceous functional group summary of the Herbicide treatment studies (n=2) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

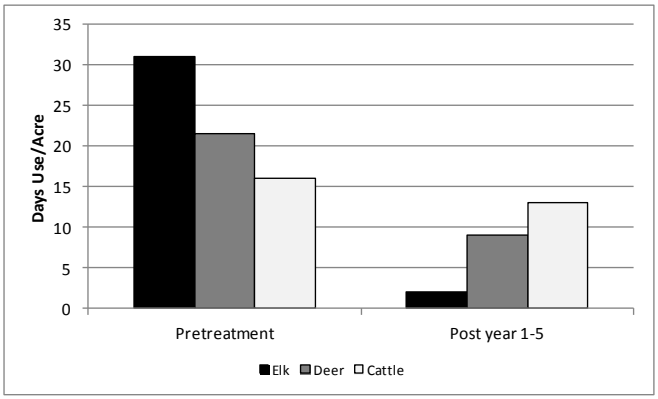


Figure 4.83: Mean pellet transect data for the Herbicide Treatment studies (n=2) for WMU 16B/C, Manti North/South.

Lop and Scatter

There are ten studies [Poison Spring Bench (16B-22), Manti Face Chaining (16C-1), North Manti Face (16C-3), Cane Valley (16C-5), Black Hill (16C-6), Mayfield Mountain Face (16C-7), Pole Canyon Chaining (16C-8), Red Point (16C-14), Birch Creek Chaining (16C-27), and Danish Bench (16C-36)] that were lop and scattered during the report period (Table 4.7). The Black Hill, Cane Valley, North Manti Face, Manti Face Chaining, Mayfield Mountain Face, and Pole Canyon Chaining studies are all located on the east benches of the US 89 corridor; while the Poison Spring Bench, Red Point, Danish Bench, and Birch Creek Chaining studies are located on the benches west of State Road 10. Except for the Danish Bench study, which is considered a Semidesert (Black Sagebrush) ecological site, all of the aforementioned studies are classified as Upland potentials that are either considered to be mountain big sagebrush, Wyoming big sagebrush, black sagebrush, or pinyon-Utah juniper ecological sites (Table 4.6). Generally, the target of lop and scatter treatments is to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on the majority of these studies was either mountain big sagebrush or black sagebrush; however, the main browse species on the Pole Canyon Chaining, Black Hill, and Cane Valley studies are rabbitbrush species (*Chrysothamnus spp.*). The Red Point study has green ephedra as the primary browse species. Prior to treatment, sagebrush had a mean line-intercept of near 6%. Six to ten years following treatment, sagebrush cover has remained similar at 7% (Figure 4.84a). Prior to lop and scatter, the demographics of the sagebrush population consisted of mostly mature plants with limited recruitment of young, and had a total mean density of 1,692 plants/acre. Following treatment, sagebrush density increased to 2,856 plants/acre then decreased to 1,974 plants/acre in the first and second post treatment samplings, respectively. Each post treatment sampling showed increases in the number of mature and young plants relative to the pre treatment year (Figure 4.84b).

The density and cover of pinyon pine and Utah juniper trees was moderate at 164 trees/acre and just over 8%, respectively, prior to treatment. The density and cover of pinyon-juniper trees decreased to 84 tree/acre and 3% cover 1-5 years post treatment and 66 trees/acre and less than 1% cover 6-10 years post treatment, respectively (Figure 4.85). Young trees that were missed in the treatment generally provide remaining density and cover.

Herbaceous Understory: The herbaceous component was mixed across the sites, but was generally dominated by perennial grasses and annual forbs on most of the sites. Perennial grass species have increased substantially on the sites, increasing from near 11% cover prior to disturbance to 18% cover in the second post treatment sampling. Most of this increase is due to the seeded species crested wheatgrass and intermediate wheatgrass. Annual grasses, primarily cheatgrass, decreased 1-5 years following

treatment on most of the study sites. However, annual grass cover increased to near pre treatment levels in the second post treatment sampling. Cheatgrass cover is such that it remains a threat for increased fire potential on the Pole Canyon study. Annual forbs are common on most of the sites, but provide low cover. Perennial forbs have remained rare on the site (Figure 4.86).

Occupancy: Pellet group transect data indicates that deer primarily occupy these studies prior to and after treatment. Mean abundance of deer pellet groups decreased from near 80 days use/acre to 30 days use/acre in the first and second post treatment years. The mean abundance of pellet groups of wildlife species and cattle have decreased following the lop and scatter treatments (Figure 4.87).

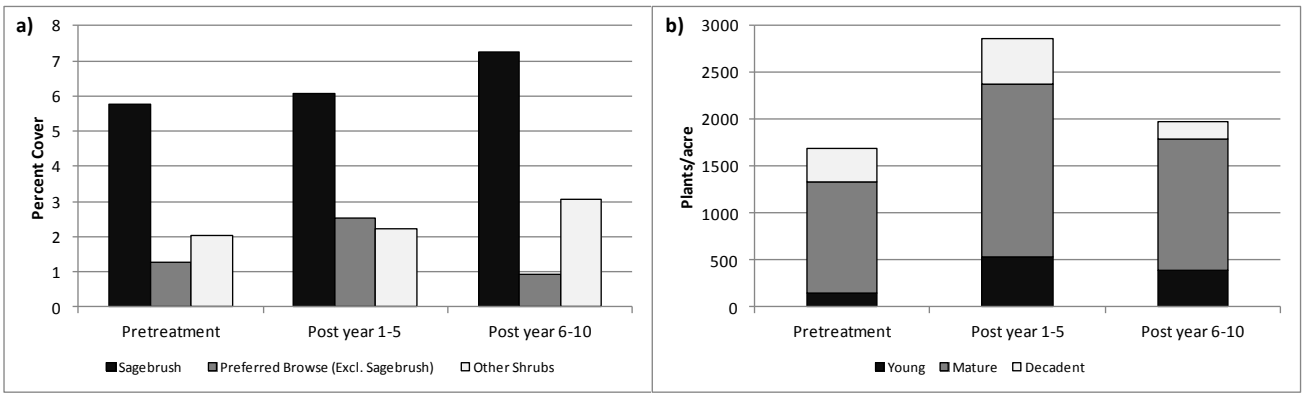


Figure 4.84: Shrub summary of the Lop and Scatter treatment studies (n=10) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups.

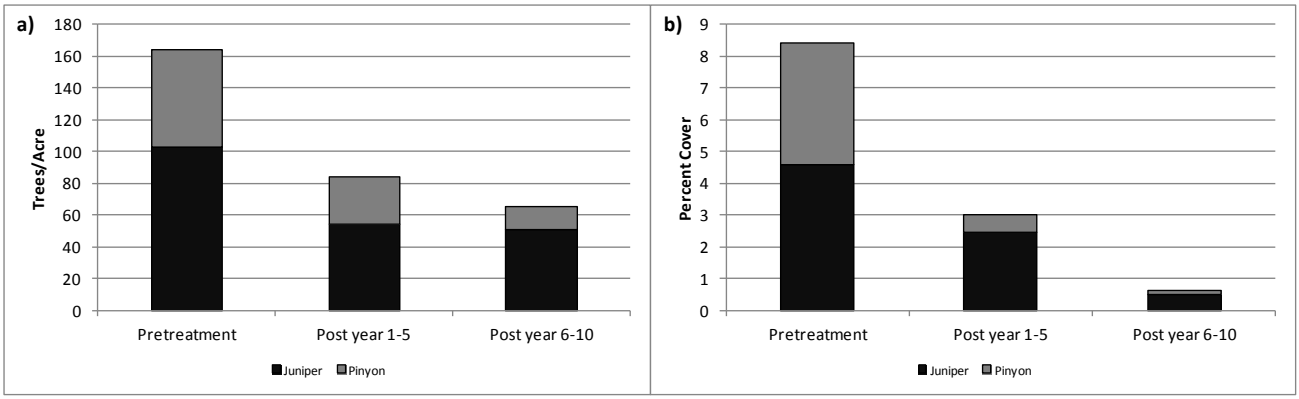


Figure 4.85: Tree summary of the Lop and Scatter treatment studies (n=10) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

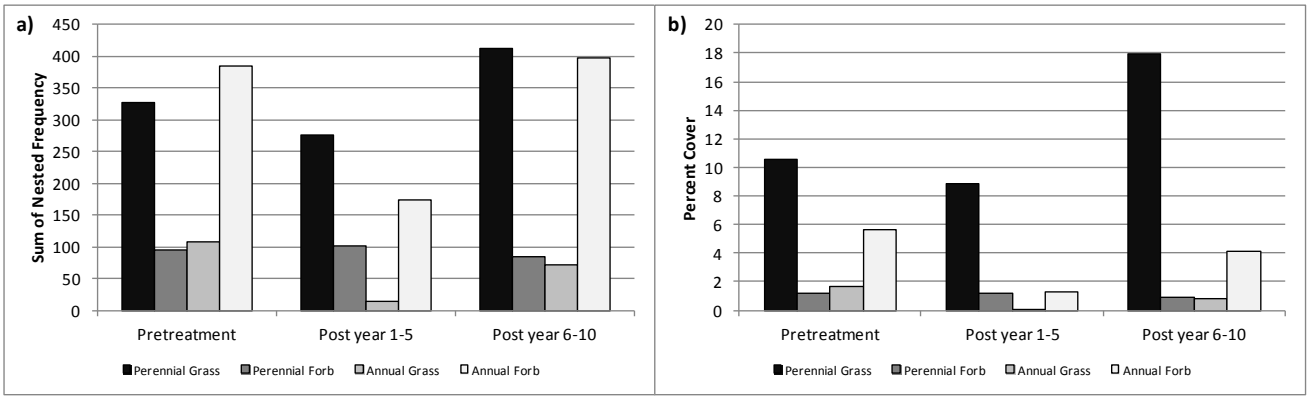


Figure 4.86: Herbaceous functional group summary of the Lop and Scatter treatment studies (n=10) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

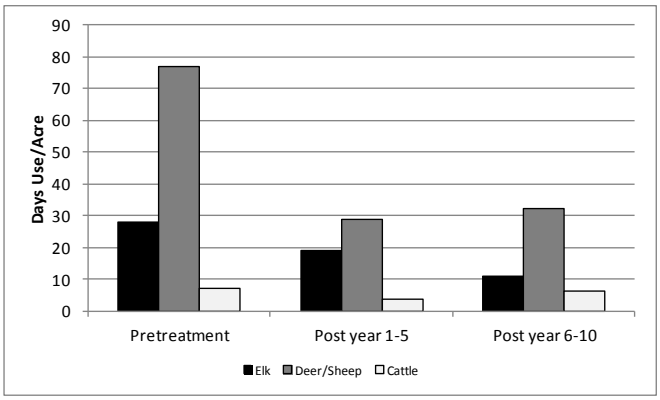


Figure 4.87: Mean pellet transect data for the Lop and Scatter treatment studies (n=10) for WMU 16B/C, Manti North/South.

Pinyon-Juniper Push

There are two studies [Lower Cedar Bench (16R-11) and Upper Cedar Bench (16R-12)] that were pinyon-juniper pushed during the report period (Table 4.7). Both Upper and Lower Cedar Bench studies are located west of the city of Price, and are found on the east benches of The Elbow. Both studies are classified as Upland (Wyoming Big Sagebrush) ecological sites (Table 4.6). Generally, the target of pinyon-juniper push treatments is to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on the Upper Cedar Bench study is black sagebrush, while the primary browse on the Lower Cedar Bench study is Wyoming big sagebrush. Prior to treatment, sagebrush was fairly common on all of the study sites with a mean line-intercept of over 6%. Following the treatment, mean cover remained similar in the first post treatment sampling, but increased to 10% mean cover in the second post treatment sampling (Figure 4.88a). Prior to disturbance the demographics of the sagebrush population was a nearly even mixture of decadent, mature, and young plants. Following the push treatments, the populations of sagebrush contracted slightly with density of sagebrush decreasing from 3,584 plants/acre prior to treatment to 2,774 plants/acre in the first post treatment sampling with an associated decrease in both decadent and young plants within the populations. In the second post treatment sampling, mean sagebrush density increased significantly to 8,404 plants/acre with much of the increase coming from young and mature plants to the populations (Figure 4.88b).

The mean density and cover of pinyon pine and Utah juniper trees was moderately high at 261 trees/acre and 20% cover prior to treatment. The density and cover of pinyon-juniper trees decreased to 90 tree/acre

and 4% cover in the first post treatment sampling and 73 trees/acre and less than 1% cover in the second post treatment (Figure 4.89). Young trees that were missed in the treatment generally provide remaining density and cover.

Herbaceous Understory: The herbaceous component was mixed across the sites, but was generally dominated by the perennial grass species Salina wildrye and needle-and-thread on all of the sites with a much lower abundance of forb species. Perennial grass species have increased substantially on the sites, increasing from a mean cover 9% prior to disturbance to 20% in the second post treatment sampling. Annual grasses, primarily cheatgrass, have remained low on the study sites since pre treatment samplings. Cover of perennial and annual forbs have remained low over the sample years (Figure 4.90).

Occupancy: Pellet group transect data indicates that deer primarily occupy these studies. The mean abundance of deer pellet groups of deer has steadily decreased following treatment; however, mean abundance of elk pellet groups was high in the pre treatment and first post treatment samplings at 86 and 67 days use/acre, respectively. Mean abundance of deer however, increased from 33 days use/acre to a high in the second post treatment sampling of 55 days use/acre (Figure 4.91).

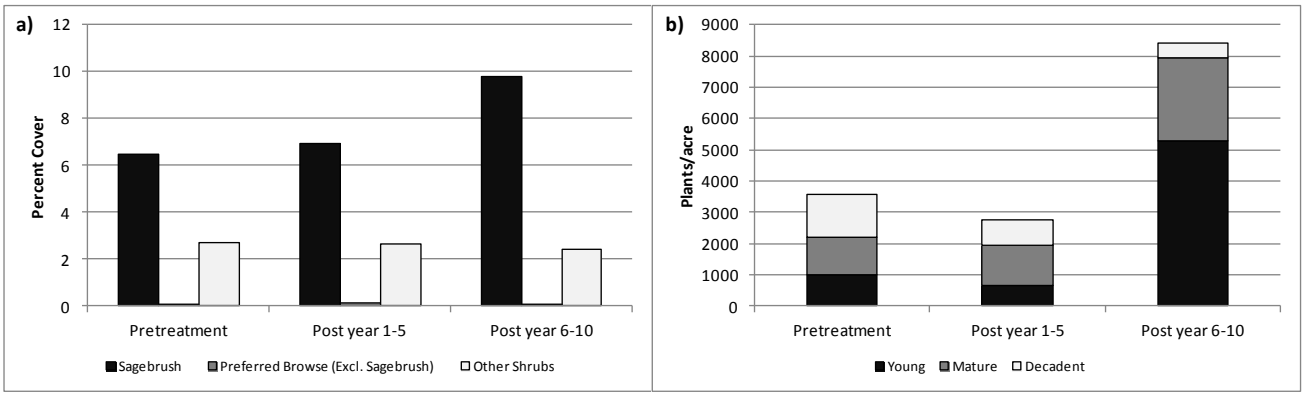


Figure 4.88: Shrub summary of the Pinyon-Juniper Push disturbance studies (n=2) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

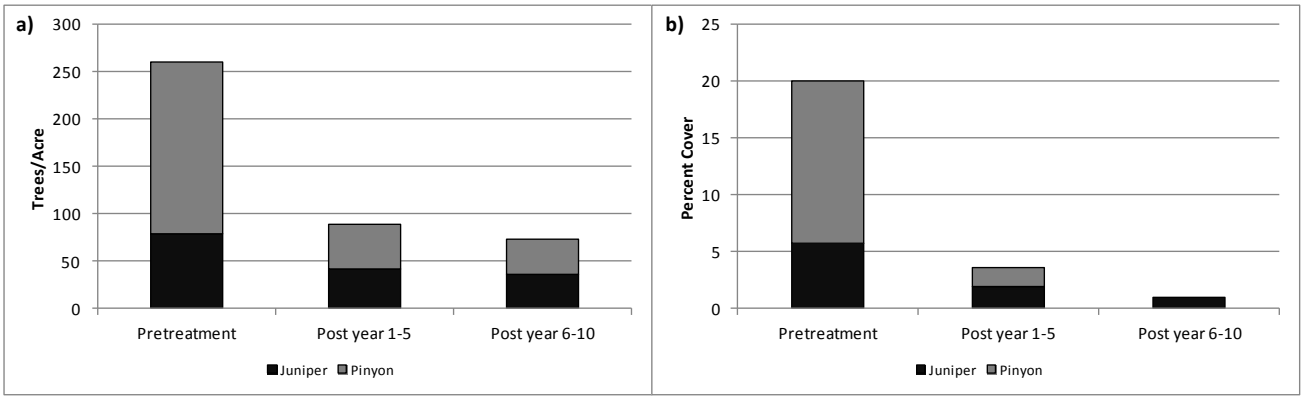


Figure 4.89: Tree summary of the Pinyon-Juniper Push disturbance studies (n=2) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

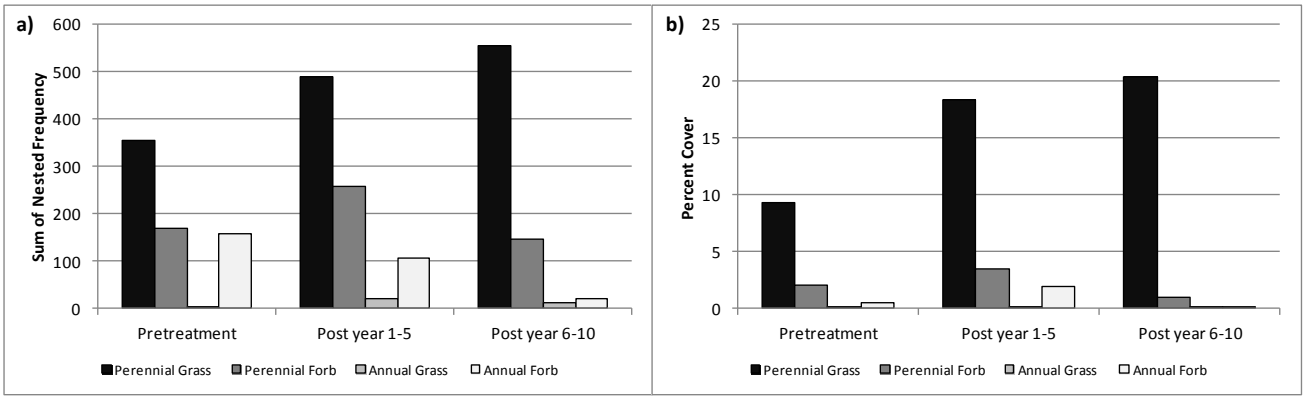


Figure 4.90: Herbaceous functional group summary of the Pinyon-Juniper Push disturbance studies (n=2) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

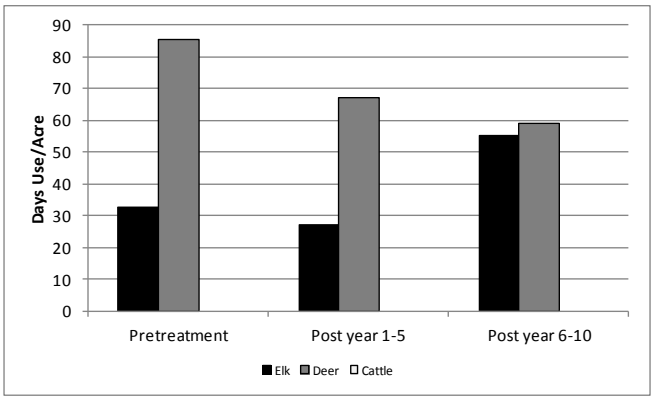


Figure 4.91: Mean pellet transect data for the Pinyon-Juniper Push treatment studies (n=2) for WMU 16B/C, Manti North/South.

Roller Chopper

There are five studies [North Slackpile (16R-6), Wildcat Push (16R-16), Stump Flat (16R-21), Mohrland Roller Chopper 1 (16R-31), and Mohrland Roller Chopper 2 (16R-32)] that were treated with a roller chopper during the report period (Table 4.7). Both Wildcat Push and North Slackpile studies are located northwest of the city of Price. The Mohrland Roller Chopper 1 & 2 studies are located south of Hiawatha on flats east of East Mountain. The Stump Flat study is located east of the town Huntington on the benches south of State Road 31. All of the aforementioned studies are classified as Upland potentials that are either considered to be mountain big sagebrush, Wyoming big sagebrush, black sagebrush, or pinyon-Utah juniper ecological sites (Table 4.6). Generally, the target of roller chopper treatments is to reduce pinyon-juniper tree cover in order to restore the sagebrush and herbaceous understory.

Shrubs/Trees: The primary browse on all of the studies was either black sagebrush, mountain big sagebrush or Wyoming big sagebrush. However, shrubs are sparse to near absent on the Wildcat Push study. Prior to disturbance, sagebrush was fairly common on all of the study sites, except for the Wildcat Push study. Prior to treatment sagebrush had a mean line-intercept of 7%. Following the treatments, mean sagebrush cover decreased to 6% and 3% in the respective first and second post treatment samplings (Figure 4.92a). Prior to disturbance the demographics of the sagebrush population was a mixture of decadent and mature plants with limited recruitment of young plants. Following the treatments, the populations of sagebrush have been comprised primarily of mature and young plants; moreover, density of sagebrush increased from 2,874 plants/acre prior to treatment to 5,350 and 4,509 plants/acre in the first and second post treatments, respectively (Figure 4.92b).

Prior to treatment the mean density and cover of pinyon pine and Utah juniper trees was high at 199 trees/acre and 12%, respectively. The density and cover of pinyon-juniper trees decreased to 76 tree/acre and 1% cover in the first post treatment sampling and 62 trees/acre and less than 1% cover in the second post treatment (Figure 4.93). Young trees that were missed in the treatment generally provide remaining density and cover.

Herbaceous Understory: The herbaceous component was similar across the sites, but was generally dominated by perennial grasses on all of the sites with a much lower abundance of forb species. Perennial grass species have increased substantially on the sites, increasing from 7% mean cover prior to disturbance to 20% mean cover in the second post treatment sampling. Most of this increase is due to the introduced species crested and intermediate wheatgrass, which were seeded on many of the sites in either historic treatments or current roller chopper treatments. Annual grasses, primarily cheatgrass, have remained low on the study sites since pre treatment samplings (Figure 4.94).

Occupancy: Pellet group transect data indicates that the presence wildlife species has been mixed on these study sites. Mean abundance of deer was 24 days use/acre in the first post treatment sampling, but elk was the most abundant species present at on these sites at 33 days use/acre in the second post treatment sampling. The mean of abundance of cattle sign has gradually increased, but still remains low (Figure 4.95).

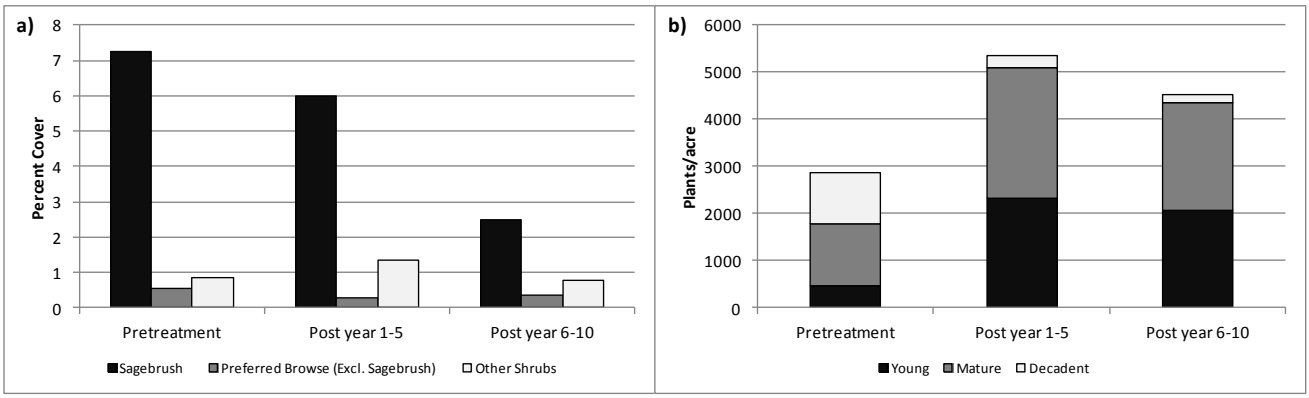


Figure 4.92: Shrub summary of the Roller Chopper treatment studies (n=5) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups. b) Mean density and demographics of sagebrush (*Artemisia spp.*) species.

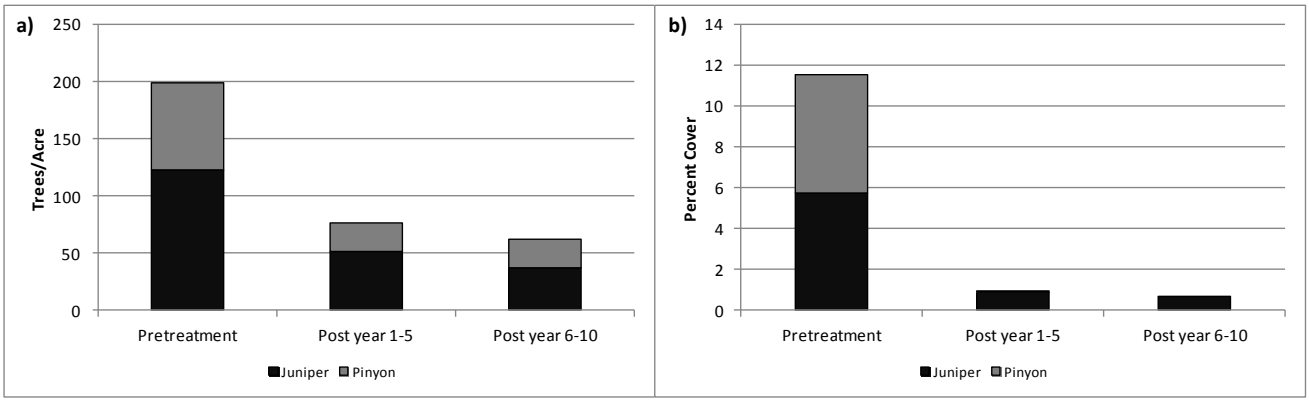


Figure 4.93: Tree summary of the Roller Chopper treatment studies (n=5) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

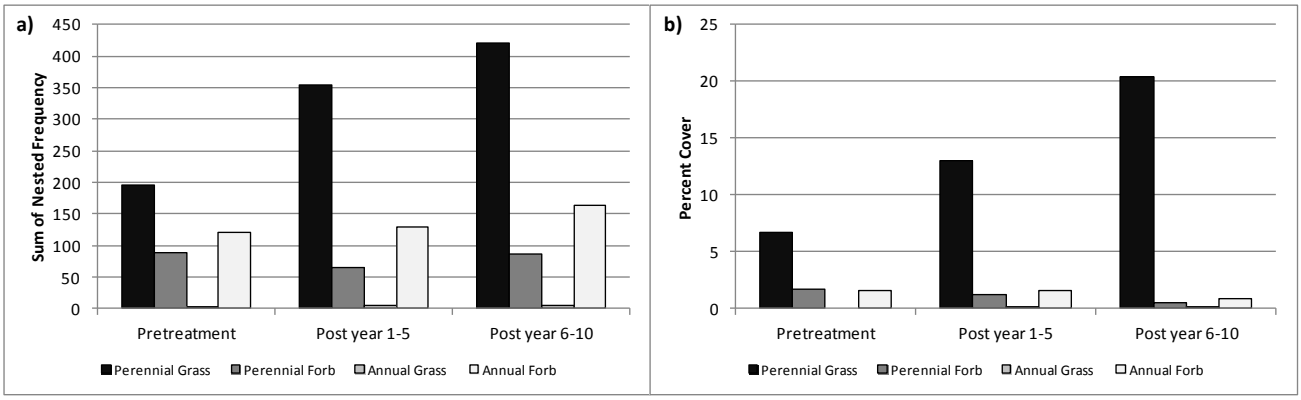


Figure 4.94: Herbaceous functional group summary of the Roller Chopper treatment studies (n=5) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

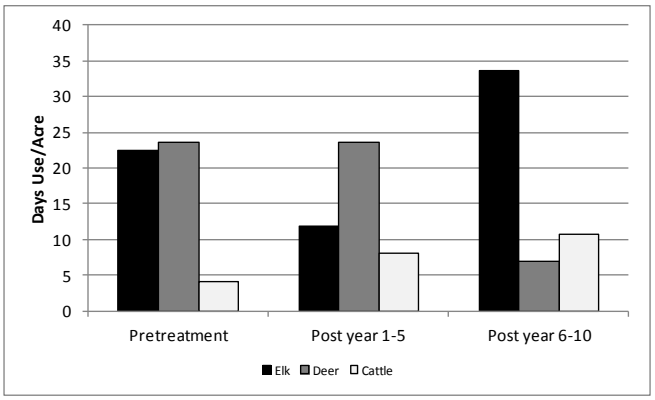


Figure 4.95: Mean pellet transect data for the Roller Chopper Treatment studies (n=5) for WMU 16B/C, Manti North/South.

Dixie Harrow/Brushsaw

There are three studies [Cedar Mountain (16C-40), Cedar Mountain Brush Saw (16R-17), and Cedar Mountain Dixie (16R-18)] that were treated with a combination of Dixie harrow and brush saw during the report period (Table 4.7). These studies are located east of the town Salina and are found on the high flats of Cedar Mountain. All of these studies are classified as Upland (Black Sagebrush) ecological sites (Table 4.6). Generally, the target of these combined treatments is to reduce pinyon-juniper tree cover in order to restore the herbaceous understory.

Shrubs/Trees: The primary preferred browse on all of the studies was black sagebrush; however, of the three sites, black sagebrush is most common on Cedar Mountain Brush Saw. Although the primary browse, sagebrush was not common on all of the study sites with mean line-intercepts below 2% since pre treatment. Sagebrush cover increased considerably in the second post treatment sampling. However, Gambel oak provides additional browse for wildlife on the Cedar Mountain Brush Saw and has increased in cover from just over 1% prior to treatment to over 5% cover in the second post treatment sampling (Figure 4.96a). Sagebrush densities vary on all of these sites and contribute little to the overall understory quality of these communities (Figure 4.96b).

Encroachment from pinyon pine and Utah juniper trees was substantial prior to treatment. The mean density and cover of pinyon pine and Utah juniper trees was moderate at 276 trees/acre and 12%, respectively, prior to treatment. The density and cover of pinyon-juniper trees decreased to 118 tree/acre and 5% cover in the first post treatment sampling and 43 trees/acre and less than 2% cover in the second

post treatment (Figure 4.97). Young trees that were missed in the treatment generally provide remaining density and cover.

Herbaceous Understory: The herbaceous component was similar across the sites, and is generally dominated by the perennial grass with a moderate abundance of forb species. Perennial grass species have increased substantially on the sites, increasing from 14% mean cover prior to disturbance to 30% mean cover in the second post treatment sampling. Most of this increase is due to the seeded species crested and intermediate wheatgrass, and smooth brome, which were likely, seeded historically on these sites. Annual forbs are common on these sites, but have provided little cover since pre treatment (Figure 4.98).

Occupancy: Pellet group transect data indicates that elk primarily have occupied these study sites. The mean abundance of pellet groups of elk has generally increased following treatment, but has been considered low in abundance since pre treatment. The mean abundance of deer and cattle sign is also considered low, but has generally increased since pre treatment samplings (Figure 4.99).

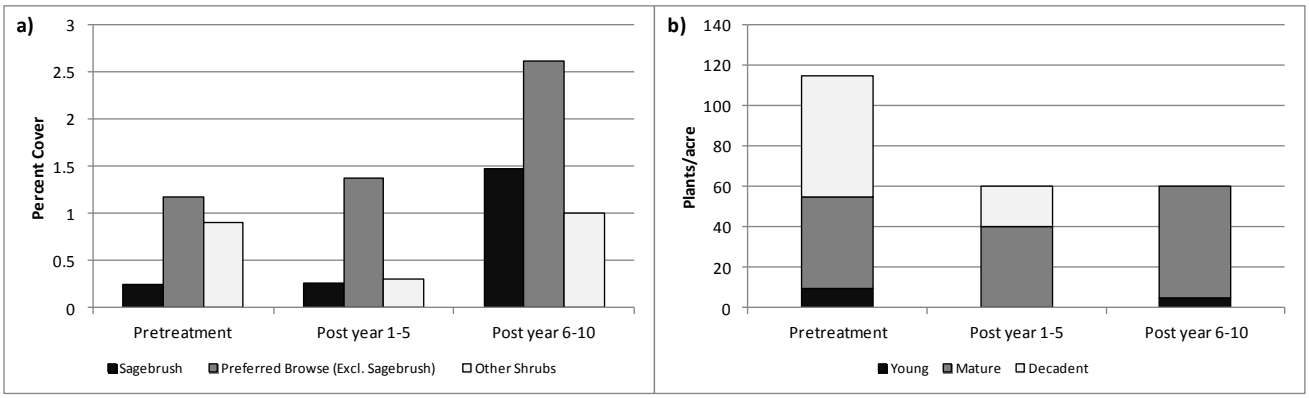


Figure 4.96: Shrub summary of the Dixie Harrow/Brushsaw treatment studies (n=3) for WMU 16B/C, Manti North/South. a) Mean line-intercept cover estimate of shrub groups.

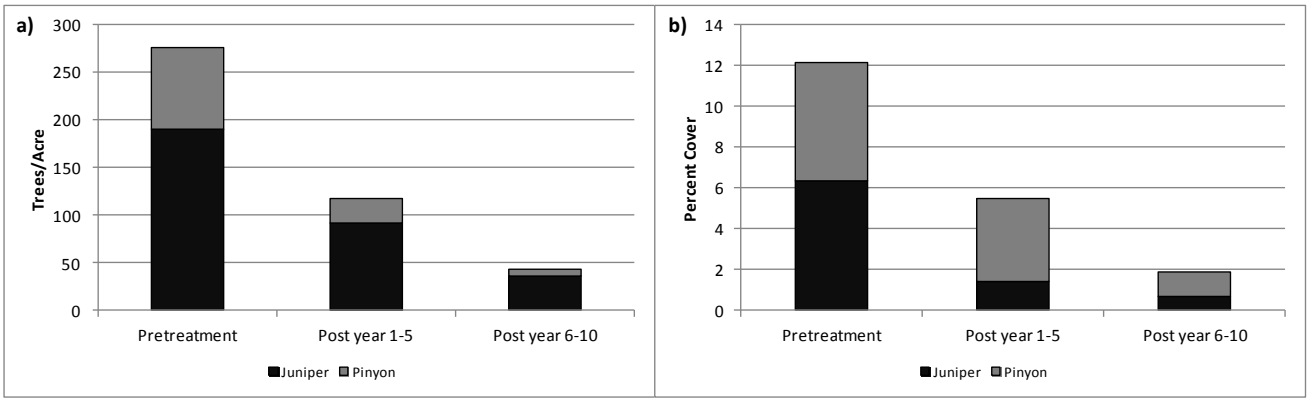


Figure 4.97: Tree summary of the Dixie Harrow/Brushsaw treatment studies (n=3) for WMU 16B/C, Manti North/South. a) Mean point-quarter tree density estimates for pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). b) Mean line-intercept cover estimate for pinyon pine and Utah juniper.

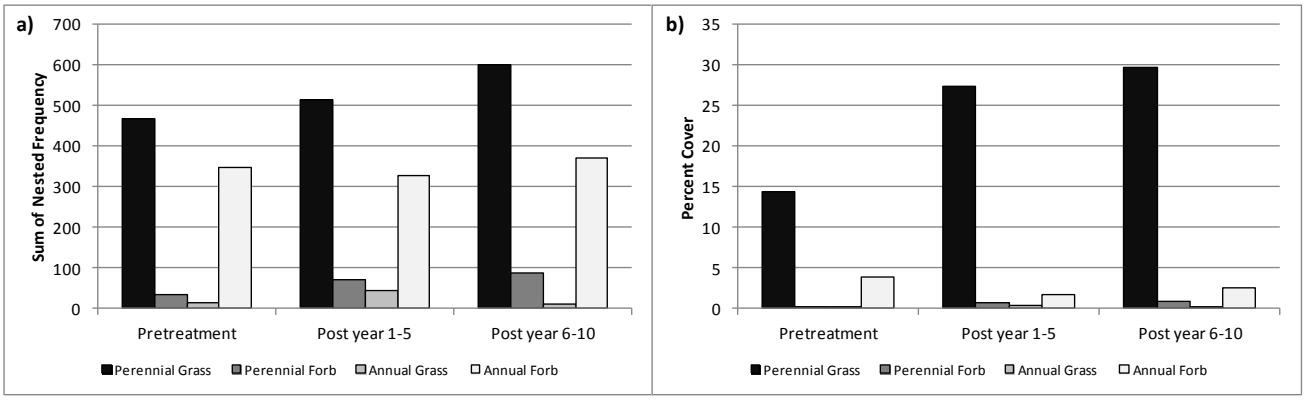


Figure 4.98: Herbaceous functional group summary of the Dixie Harrow/Brushsaw treatment studies (n=3) for WMU 16B/C, Manti North/South. a) Mean sum of nested frequency of herbaceous functional groups. b) Mean quadrat cover estimate of herbaceous functional groups.

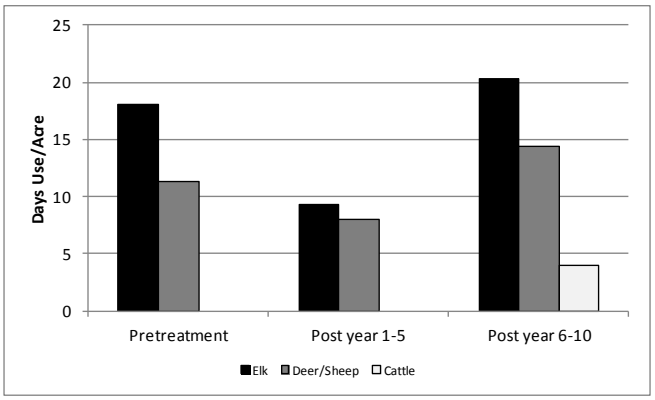


Figure 4.99: Mean pellet transect data for the Dixie Harrow/Brushsaw treatment studies (n=3) for WMU 16B/C, Manti North/South.

Deer Winter Range Condition Assessment

The condition of deer winter range within the North and South Manti management units have slightly improved on the study sites sampled since 1994 with a slight majority being classified as fair to good most sample years. The majority of sites sampled within the unit are considered to be in fair to good condition based on the most current sample data, and the proportion of sites classified as being in poor or very poor condition has generally decreased since 1994; however, there was a substantial decrease in the poor and very poor categories in the 1997 and 1999 sample years (Figure 4.100 and Figure 4.101). The only undisturbed studies that are currently considered to be in very poor condition are the Jackson Unit, Hilltop, Slackpile, North Spring Bench, and Howard FS Chaining studies that have a depleted browse component and are dominated by pinyon and juniper trees. The condition of disturbed and treated sites typically improves with increased time after disturbance on these units. The majority of disturbed or treated study sites that ranked as being in poor or very poor condition 6 to 10 years after disturbance are those studies that were considered poor and very poor prior to treatment. Additionally, these studies were not sampled in the 11 to 15 post sample years, which may have resulted in the increase of fair to good sites in proportion to poor to very poor sites. These study sites generally are still lacking in available browse species, and have typically experienced significant pinyon and juniper encroachment in the past and have not yet recovered their depleted browse understory. Additionally, many of these studies have vigorous herbaceous understories that are dominated by seeded perennial grass that may limit the recruitment of sagebrush and other preferred browse species (Map 4.7 and Table 4.8).

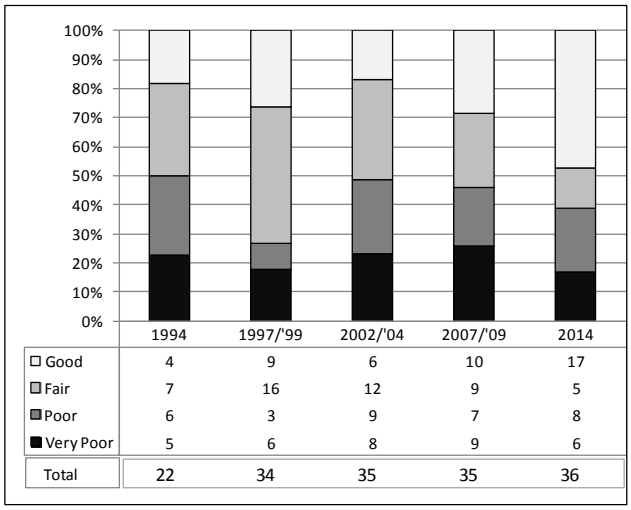


Figure 4.100: Deer winter range Desirable Components Index (DCI) summary by year of undisturbed sites for WMU 16B/C, Manti North/South.

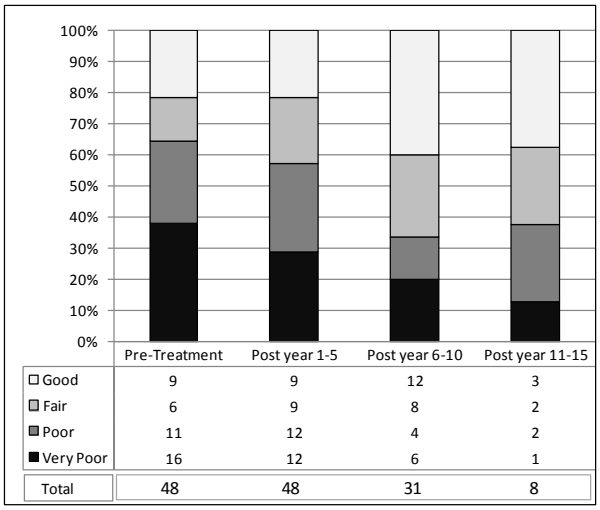
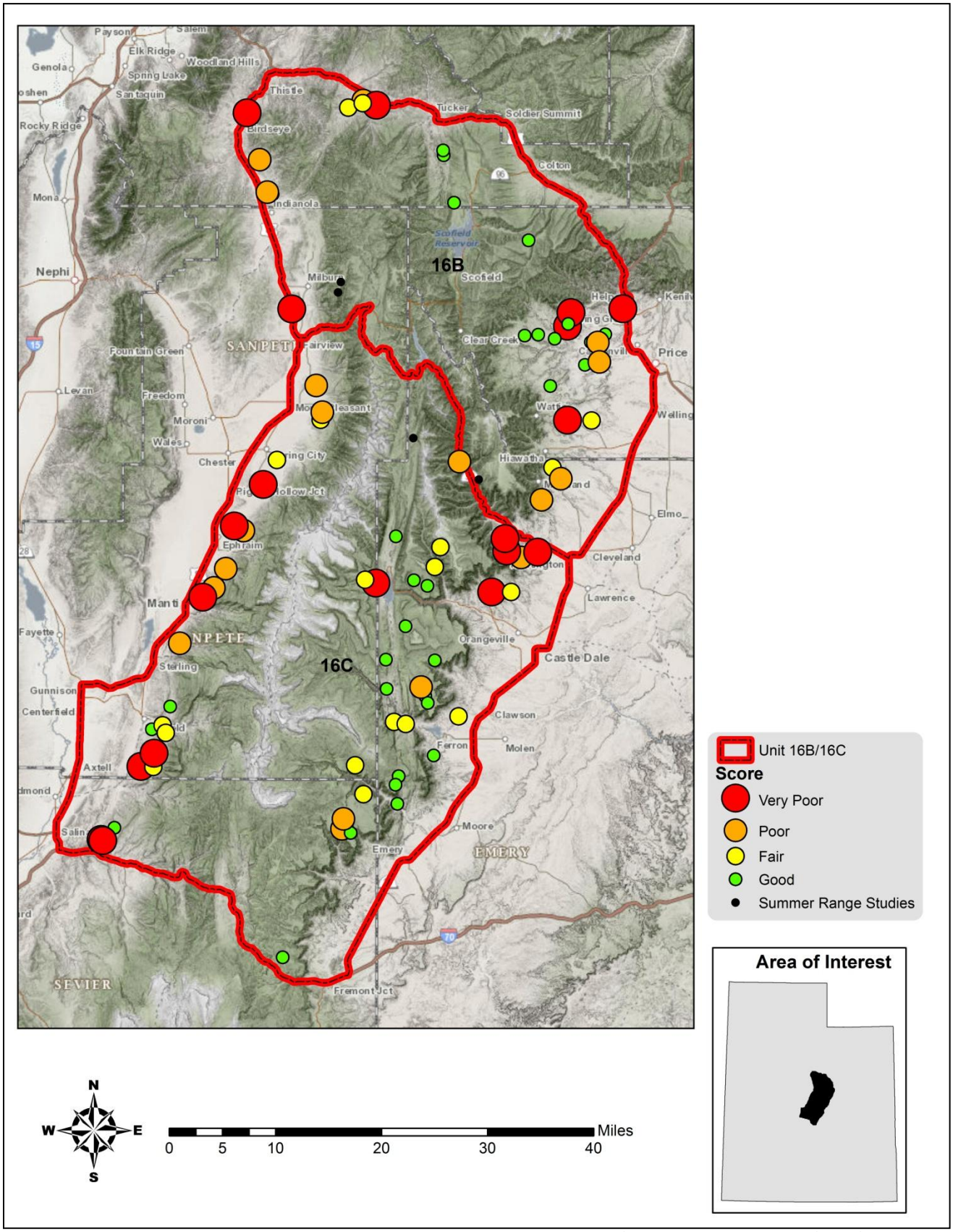


Figure 4.101: Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for WMU 16B/C, Manti North/South.



Map 4.7: Deer winter range Desirable Components Index (DCI) ranking distribution by study site of most current sample date as of 2014 for WMU 16B/C, Manti North/South.

Study #	Study Name	Limiting Factor and/or Threat	Level of Threat	Potential Impact
16B-02	Long Ridge North	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16B-03	Rocky Hollow	PJ Encroachment/Annual grass	Moderate	Reduced understory shrub and herbaceous vigor/increased fire potential.
16B-04	Dry Creek Chaining	PJ Encroachment/Annual grass	High	Reduced understory shrub and herbaceous vigor/increased fire potential.
16B-05	Jackson Unit	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16B-06	Mill Fork	PJ Encroachment/Perennial Grass	Low	Reduced understory shrub and herbaceous vigor/ Reduced diversity of desirable grass and forb species.
16B-08	Starvation Mahogany	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16B-09	Starvation Mountain Brush	Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16B-10	Dairy Fork Burn	Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16B-11	Hilltop	PJ Encroachment/Perennial Grass	Moderate	Reduced understory shrub and herbaceous vigor/ Reduced diversity of desirable grass and forb species.
16B-13	Oak Creek Ridge Aspen	Noxious Weed	Moderate	Invasion and reduced herbaceous diversity.
16B-14	Oak Creek Ridge Seeding	Noxious Weed	High	Invasion and reduced herbaceous diversity.
16B-17	Slackpile	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16B-18	Porphyry Bench	High Shrub Decadence	High	Loss of shrub recruitment to population.
16B-19	North Spring Bench	PJ Encroachment/High Shrub Decadence	Moderate	Reduced diversity of desirable grass and forb species/ Loss of shrub recruitment to population.
16B-20	Telephone Bench	Not Identified		
16B-21	Huntington Canyon	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16B-22	Poison Spring Bench	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16B-23	Consumer Bench	High Shrub Decadence	High	Loss of shrub recruitment to population.
16B-24	Wire Grass Bench	High Shrub Decadence	Low	Loss of shrub recruitment to population.
16C-01	Manti Face Chaining	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16C-02	Willow Creek	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16C-03	North Manti Face	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16C-05	Cane Valley	Introduced Perennial Grass /PJ Encroachment	High	Reduced diversity of desirable grass and forb species/Reduced understory shrub and herbaceous vigor.
16C-06	Black Hill	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16C-07	Mayfield Mountain Face	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
16C-08	Pole Canyon Chaining	Introduced Perennial Grass /PJ Encroachment	Low	Reduced diversity of desirable grass and forb species/Reduced understory shrub and herbaceous vigor.
16C-09	Pole Canyon Oak	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16C-11	Above South Hollow	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16C-12	Manti Dump	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16C-13	West Huntington Canyon	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-14	Red Point	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-15	Howard FS Chaining	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16C-17	Middle Mountain	Not Identified		
16C-18	East Mountain	Not Identified		
16C-19	Trail Mountain Exclosure	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-20	Miles Point	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-22	North Horn- Rock Canyon	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-23	Black Dragon	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16C-24	South Horn Exclosure	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16C-25	South Horn 1/4 Corner	Not Identified		
16C-26	Dry Mountain	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-27	Birch Creek Chaining	Introduced Perennial Grass /PJ Encroachment	Low	Reduced diversity of desirable grass and forb species/Reduced understory shrub and herbaceous vigor.
16C-28	South of Dry Wash	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16C-29	Scab Hollow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-30	Upper Hole Trail	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-31	Box Canyon Knolls	None Identified		
16C-32	Muddy Creek	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
16C-34	South Sage Flat	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
16C-35	Wildcat Knolls	None Identified		
16C-36	Danish Bench	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-37	Joes Valley Overlook	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-38	Pleasant Creek	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-39	Cove Creek	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16C-40	Cedar Mountain	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16C-41	Trough Hollow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-42	Box Canyon Sage-Grouse	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16C-43	Olson Draw Sage-Grouse	None Identified		

16C-44	North Horn	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-45	Olsen Canyon	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16C-46	Indian Hollow	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16R-05	Scad Hollow	None Identified		
16R-06	North Slackpile	None Identified		
16R-11	Lower Cedar Bench	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16R-12	Upper Cedar Bench	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16R-13	Upper Porphyry	Introduced Perennial Grass	Low	Reduced diversity of desirable grass and forb species.
16R-14	Consumer Bench North	None Identified		
16R-15	Consumer Bench 2	None Identified		
16R-16	Wildcat Push	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16R-17	Cedar Mountain Brush Saw	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16R-18	Cedar Mountain Dixie	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16R-19	Lower Fish Creek WMA	None Identified		
16R-20	Howerton's	Introduced Perennial Grass	High	Reduced diversity of desirable grass and forb species.
16R-21	Stump Flat	PJ Encroachment/Perennial Grass	Low	Reduced understory shrub and herbaceous vigor/ Reduced diversity of desirable grass and forb species.
16R-22	Levan Spray and Drill	Annual Grass	High	Increased fire potential/Reduced diversity of desirable grass and forb species.
16R-23	North Spring	None Identified		
16R-24	12 Mile Dixie	Annual Grass	Low	Increased fire potential.
16R-25	Black Dragon Bullhog	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.
16R-26	Fountain Green Dixie and Plateau	Annual Grass	Low	Increased fire potential.
16R-28	Willow Creek Dixie	Annual Grass	High	Increased fire potential.
16R-30	Mill Fork Chaining	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16R-31	Mohrland Roller Chopper 1	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16R-32	Mohrland Roller Chopper 2	PJ Encroachment	Moderate	Reduced understory shrub and herbaceous vigor.
16R-33	Scofield Dixie	Noxious Weed	Moderate	Invasion and reduced herbaceous diversity.
16R-34	Wildcat Dixie Harrow	None Identified		
16R-37	Wildcat Disking	Introduced Perennial Grass	Moderate	Reduced diversity of desirable grass and forb species.
16R-40	Mona Bench	Annual Grass	High	Increased fire potential.
16R-41	Mona Bench 2	Annual Grass	High	Increased fire potential.
16R-42	Canal Canyon	Annual Grass	High	Increased fire potential.
16R-43	Swasey Mountain Brush Bullhog	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-44	Swasey Bullhog	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-46	Dairy fork 1	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-47	Dairy fork 2	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-48	North Hollow	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-49	Stump Flat 2	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-50	Bear Ranch	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-51	North Canyon	Annual Grass	High	Increased fire potential.
16R-52	Helper Benches	PJ Encroachment	High	Reduced understory shrub and herbaceous vigor.
16R-53	Grimes Wash 2	PJ Encroachment	Low	Reduced understory shrub and herbaceous vigor.

Table 4.8: Assessment of the potential limiting factors and/or threats and level of threat to study sites for WMU 16B/C, Manti North/South. All assessments are based off of the most current sample date for each study site.

Discussion and Recommendations

High Mountain (Aspen)

This high mountain ecological site supports an aspen community and is generally considered to be in good condition for deer and elk summer range habitat on the Manti North unit. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. While in generally good condition, introduced perennial grasses are present in the herbaceous understory. While providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species. Additionally, the presence of noxious weeds, namely hounds tongue, have the potential to expand within the understory and reduce the amount of valuable forb species available to wildlife during summer months.

It is recommended that monitoring of this community continue. When reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible. Additional actions may be necessary to reduce the presence of noxious weeds within this community type.

High Mountain (Slender Wheatgrass)

This high mountain ecological site supports grass and forb communities that are generally considered to be in good condition for deer and elk winter range habitat on Manti North unit. This community supports a diverse herbaceous component that provides valuable forage during the summer months. While in generally good condition, introduced perennial grasses are present in the community. Although they provide valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species. Additionally, the presence of invasive and noxious weeds, namely tarweed and hounds tongue, have the potential to expand within the herbaceous community and reduce the amount of valuable forb species available to wildlife during summer months.

It is recommended that monitoring of this community continue. When reseeding is necessary to restore herbaceous species, care should be taken in species selection and preference should be given to native grass species when possible. Additional actions may be necessary to reduce the presence of noxious weeds within this community type.

High Mountain/Mountain (Mountain Big and Silver Sagebrush Communities)

The higher elevation mountain ecological sites that support sagebrush communities are generally considered to be in good condition for deer winter range habitat on this unit. These communities support robust shrub populations that provide valuable browse in mild and moderate winters. These sites are not prone to encroachment from pinyon-juniper trees or invasion of cheatgrass. As with the ecological potentials mentioned above, introduced perennial grasses are often the dominant herbaceous component on these study sites. While providing valuable forage, these grass species can often be aggressive at higher elevations and can reduce the prevalence and abundance of other more desirable native grass and forb species. Intensive herbivore may also lead to a weakened herbaceous community structure that can result in the introduction of invasive and noxious weeds that reduce the amount of valuable forb species available to wildlife during summer months

It is recommended that monitoring of this community continue. If habitat rehabilitation is needed in these community types, it is likely not necessary to seed these forb communities due to their high diversity and resilience to disturbance. 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. Monitoring should also continue in order to watch for the presence of noxious weeds within this community type.

Upland (Pinyon-Utah Juniper)

The mid elevation upland pinyon and juniper communities are generally considered to be in poor to very poor condition for deer winter range habitat on these units. These communities support small, dispersed shrub populations that provide valuable browse in mild to moderate winters. These communities are prone to increases of pinyon-juniper tree density and cover as community phases climax. Climax community phases have reduced understory diversity and vigor, and shrub populations display high decadence and low densities if the progression is not set back through pinyon and juniper tree removal. As with the high potential mountain sites, these upland mid-potential sites have introduced perennial grasses present in the herbaceous understory. While providing valuable forage, these grass species can

often be aggressive at higher elevations of these upland potentials and can reduce the prevalence and abundance of other more desirable native grass and forb species. Annual grass, primarily cheatgrass, can also be an issue within these communities. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire within these communities. If wildfire occurs within these communities, they lose most of their value as deer winter range and reestablishment of valuable browse species is typically slow.

It is recommended that work to reduce pinyon-juniper should continue in these communities in order to diversify community structure and increase the availability of preferred browse in these crucial winter ranges for when winters are harsh. When 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. Care should also be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. Furthermore, work to diminish fuel loads and create fire breaks should continue in order to reduce the threat of catastrophic fire.

Upland (Shrub Communities)

These mid elevation upland communities are generally variable in deer winter range with many of the communities in poor to very poor condition; however, there are a few communities that are considered to be in good to excellent condition. These communities support many vegetation types including the following: black sagebrush, basin big sagebrush, Wyoming big sagebrush, mountain big sagebrush, antelope bitterbrush, and mahogany species. These communities support large, dense shrub populations that provide valuable browse in mild to moderate winters for deer. These communities are prone to encroachment from pinyon-juniper trees which can reduce understory shrub and herbaceous health if not addressed. As with the high potential mountain sites, these upland mid-potential sites have introduced perennial grasses present in the herbaceous understory. These grass species can often be aggressive at higher elevations of these upland potentials and can reduce the abundance of other more desirable native grass and forb species. Annual grass, primarily cheatgrass, can also be an issue within these communities. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire within these communities. If wildfire occurs within these communities they lose most of their value as deer winter range and reestablishment of valuable browse species is typically slow.

Although most of the communities have small populations of pinyon and juniper trees, it is strongly recommended that work to prevent and reduce pinyon-juniper encroachment should continue in these communities. When 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. Moreover, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. Work to diminish fuel loads and create fire breaks should continue in order to reduce the threat of catastrophic fire that results in the loss of preferred browse. If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads.

Semidesert (Birchleaf Mahogany, Black Sagebrush, and Shadscale)

The lower elevation semidesert shrub communities are generally considered to be in poor condition for deer winter range habitat on the unit. These communities support shrub populations that provide valuable browse in moderate to severe winters. These communities are susceptible to invasion from annual grasses, primarily cheatgrass. Increased amounts of cheatgrass can increase fuel loads and increase the threat of wildfire on within these communities. If wildfire occurs within these communities, they lose most of their value as deer winter range and reestablishment of valuable browse species is typically slow. Encroachment from pinyon-juniper trees is a moderate threat within these communities.

If a treatment to rejuvenate sagebrush occurs, care should be taken in selecting treatment methods that will not increase annual grass loads. Treatments to reduce annual grass may be necessary on some sites. Treatments to establish and increase browse species more rapidly following wildfire should also be implemented, and treatments to increase browse species on historic fires should be considered.

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