DEER HERD UNIT MANAGEMENT PLAN
Deer Herd Unit # 16BC/12 - Central Mountains, Manti/San Rafael
and
Deer Herd Unit 16A - Central Mountains, Nebo
October 2015

BOUNDARY DESCRIPTIONS

Central Mountains, Manti/San Rafael Unit - Carbon, Emery, Sanpete, Sevier and Utah counties - Boundary begins US-6 and US-89 in Spanish Fork Canyon; southeast on US-6 to the Price River near Woodside; southeast along the Price River to the Green River; south along the Green River to the Swasey's Boat Ramp and the Hastings Road; south along the Hastings Road to SR-19 (I-70 frontage road); east along SR-19 to Exit 164 of I-70; west on I-70 to the Green River; south along this river to the Colorado River; south along this river (and the west shore of Lake Powell) to SR-95; north on SR-95 to a point two miles south of the SR-95/SR-24 Jct. at Hanksville; west along a line that is two miles south of SR-24 to the Burr Trail-Notom road; north along the Burr Trail-Notom road to SR-24; east on SR-24 to Caineville and the Caineville Wash road; north on this road to the Cathedral Valley road; northwest on the Cathedral Valley road to the Capital Reef National Park boundary; north and west on the CRNP boundary back to the Cathedral Valley road; west on this road to Rock Springs Bench and the Last Chance Desert road; north on this road to the Blue Flats road; north and east on this road to the Willow Springs road; north on this road to the Windy Peak road; north and west on this road to I-70; west on I-70 to US-89; north on US-89 to US-6 in Spanish Fork Canyon. Excludes all CWMUs. USGS 1:100,000 Maps: Hanksville, Hite Crossing, Huntington, La Sal, Loa, Manti, Nephi, Price, Salina, San Rafael Desert.

Central Mountains, Nebo Unit - **Juab, Millard, Sanpete, Sevier and Utah counties -** Boundary begins at US-6 and I-15 at Spanish Fork; southeast on US-6 to US-89 near Thistle; south on US-89 to US-50 at Salina; northwest on US-50 to I-15 at Scipio; north on I-15 to US-6 at Spanish Fork. Excludes all CWMUs. USGS 1:100,000 Maps: Maps: Delta, Manti, Nephi, Provo, Salina.

LAND OWNERSHIP

MANTI UNIT RANGE AREA AND APPROXIMATE OWNERSHIP

	Yearlong range		Summer Range		Winter Range	
Ownership	**Area (acres)**	**%**	**Area (acres)**	**%**	**Area (acres)**	**%**
Forest Service	**0**	**0%**	**721980**	**74%**	**300717**	**28%**
Bureau of Land Management	**24**	**2%**	**28187**	**3%**	**224215**	**21%**
Utah State Institutional Trust Lands	**1039**	**93%**	**14980**	**1.5%**	**110636**	**11%**
Private	**50**	**5%**	**198911**	**20%**	**353779**	**33%**
Department of Defense	**0**	**0%**	**0**	**0%**	**200**	**0%**
Utah State Parks	**0**	**0%**	**23**	**<1%**	**116**	**0%**
Utah Division of Wildlife Resources	**0**	**0%**	**14774**	**1.5%**	**72704**	**7%**
TOTAL	**1113**	**100%**	**978855**	**100%**	**1062367**	**100%**

SAN RAFAEL UNIT RANGE AREA AND APPROXIMATE OWNERSHIP

	Yearlong range		Summer Range		Winter Range	
Ownership	Area (acres)	%	Area (acres)	%	Area (acres)	%
Bureau of Land Management	127,012	69%	0	0%	3,650	54%
Utah State Institutional Trust Lands	12,913	7%	0	0%	79	1%
Private	22,019	12%	0	0%	3,000	45%
National Parks	17,426	9%	0	0%	0	0%
National Recreation Area	4,458	2%	0	0%	0	0%
Utah Division of Wildlife Resources	314	<1%	0	0%	0	0%
TOTAL	184,142	100%	0	0%	6,729	100%

NEBO UNIT RANGE AREA AND APPROXIMATE OWNERSHIP

	Yearlong range		Summer Range		Winter Range	
Ownership	Area (acres)	%	Area (acres)	%	Area (acres)	%
Forest Service	184360	48%	147970	87%	36390	17%
Bureau of Land Management	24010	6%	866	<1%	23144	11%
Utah State Institutional Trust Lands	6113	2%	92	<1%	6021	3%
Private	116603	30%	15438	9%	101165	48%
Utah Division of Wildlife Resources	52002	14%	6269	3%	45733	21%
TOTAL	383088	100%	170635	100%	212453	100%

UNIT MANAGEMENT GOALS

Maintain a healthy mule deer population within the long term carrying capacity of the available habitat, based on winter range trend studies conducted by the DWR every five years.

Manage the deer population at a level capable of providing a broad range of recreational opportunities, including hunting and viewing.

Balance deer herd goals and objectives with impacts on human needs, such as private property rights, agricultural crops and local economies.

POPULATION MANAGEMENT OBJECTIVES

Target Winter Herd Size – Manage for a target population of 60,600 wintering deer (modeled number) during the five-year planning period unless range conditions become unsuitable, as evaluated by DWR. Range trend data coupled with annual browse monitoring will be used to assess habitat condition. Biologists will continue to carefully monitor winter ranges and make recommendations to improve and protect winter habitat. Should over-utilization and range damage by deer occur, recommendations will be made to reduce deer populations to sustainable levels in localized areas.

Long Term Objective-

Central Mountains, Manti/San Rafael subunit	38,000 deer
Central Mountains, Nebo subunit	22,600 deer
Total Central Mountains Objective	60,600 deer

Herd Composition – Maintain a three-year average postseason buck-doe ratio of 15 to 17 bucks per 100 does in accordance with the statewide plan.

Harvest – Continue general season unit by unit buck deer hunt management, using archery, any weapon, and muzzleloader hunts. Buck permits will be adjusted to maintain buck-doe ratio objectives. Caution and moderation will be used when adjusting buck permit numbers. Antlerless permits will only be issued to address specific localized crop depredation or range degradation concerns.

POPULATION MANAGEMENT STRATEGIES

Monitoring

Population Size – A population estimate will be made based on fall and spring herd composition counts conducted by biologists, harvest surveys, and mortality estimates based on radio collar studies and range rides. These data will be used in computer models to determine a winter deer herd population size. The modeled population estimate for the winter of 2015 was 25,100 deer on the Manti/San Rafael subunit and 14,000 deer on the Nebo subunit.

Buck Age Structure – Monitor age class structure of the buck population through the use of checking stations, postseason classification, uniform harvest surveys and field bag checks.

Harvest – The primary means of monitoring harvest will be through the statewide uniform harvest survey and the use of checking stations. Closely monitor hunters afield, harvest, and success rate on the San Rafael portion of the Manti subunit and consider creating a separate hunting unit for this low density population if overharvest is suspected based on these parameters. Hunters afield and harvest has increased significantly since it was placed in the Manti subunit beginning in 2012 (see San Rafael table below).

Research – Continue radio telemetry survival study on North Manti Unit. Consider initiating a gps/telemetry study on the South Manti to document deer habitat use, survival, and seasonal ranges.

Population Trends and Harvest for the Central Mountains, Manti Deer Subunit

Year	Buck harvest	Fawns / 100 does	Bucks / 100 does	Population Estimate	Population Objective	% of Objective
2012	2083	72	19	23,600	38,000	62%
2013	2168	65	19	23,500	38,000	62%
2014	2232	67	23	25,100	38,000	66%
3 Year Avg	2161	68	20			

Population Trends and Harvest for the Central Mountains, Nebo Deer Subunit

Year	Buck harvest	Fawns / 100 does	Bucks / 100 does	Population Estimate	Population Objective	% of Objective
2012	1029	58	14	14,000	22,600	62%
2013	1158	60	21	15,900	22,600	70%
2014	1020	57	18	14,000	22,600	62%
3 Year Avg	1069	58	18			

Harvest Trends for the San Rafael portion of the Manti Subunit

	2009	2010	2011	2012	2013	2014
Hunters Afield	956	864	1291	1649	1264	1463
Harvest	292	139	330	497	338	305

Population Augmentation

Pursue deer transplants to portions of the unit with low deer densities, particularly the southeast portions of the Manti subunit where numbers remain low while deer populations in other areas of the unit and around the state have increased. Consider transplant sources from areas with high deer densities and range over-utilization on this and other units as well as areas of urban nuisance populations.

Possible Transplant Locations (see Figure 1):

Emery County: East Mtn., Stump Flat, Danish Bench, Cedar Bench, North and South Horn Mtn./ Biddlecome Ridge, Black Dragon, Dry Mtn., Sage Flat, Muddy Creek Cyn., Link Cyn.

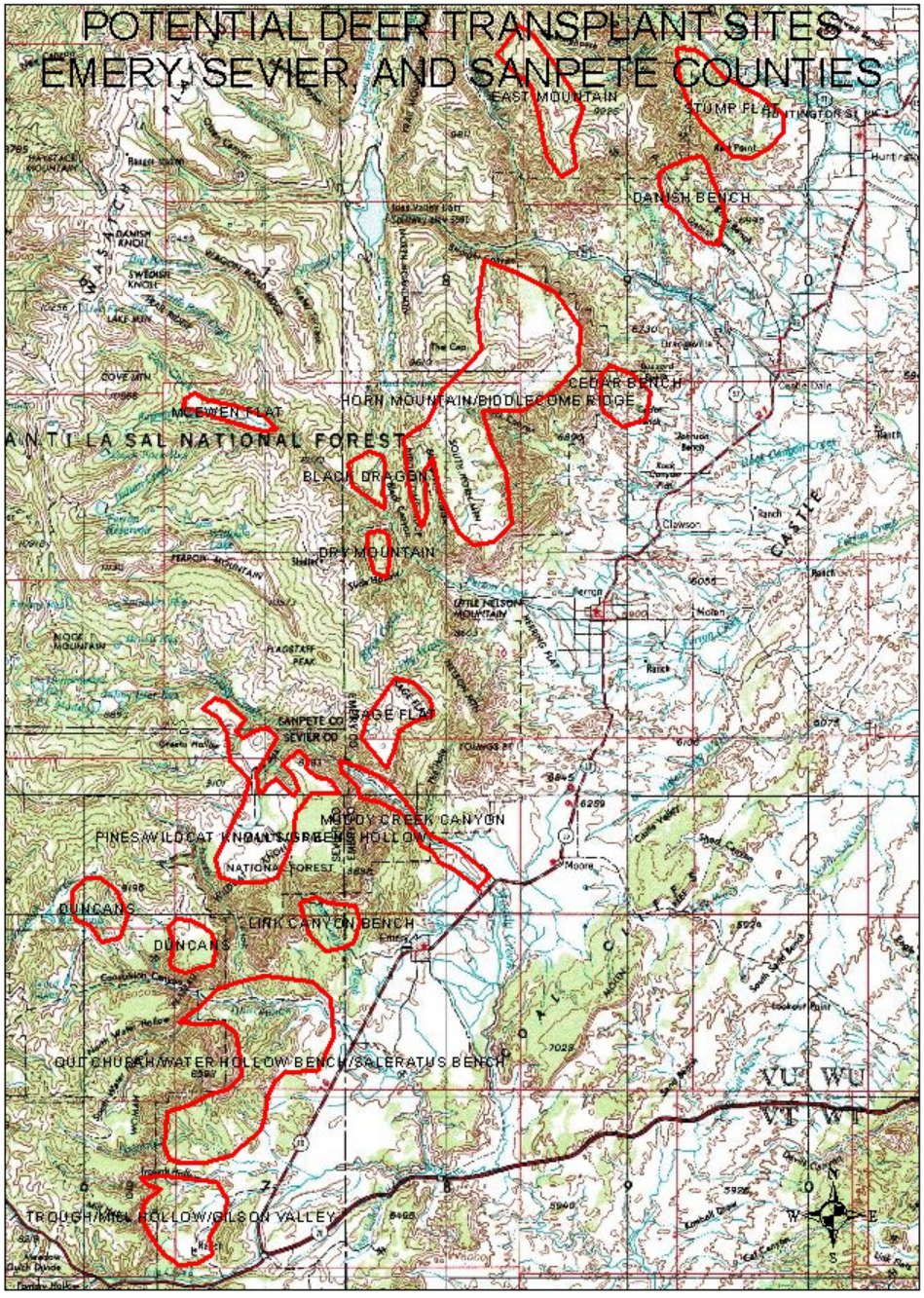
Sanpete County: McEwen Flat, The Pines/Greens Hollow/Wildcat Knolls

Sevier County: The Pines/Greens Hollow/Wildcat Knolls, Link Cyn, Quichupah Cyn./Water Hollow/Saleratus Benches, Trough and Mill Hollow/Gilson Valley

Disease Management

Investigate and manage diseases that threaten mule deer populations and continue monitoring for chronic wasting disease (CWD) as stated in the Statewide plan. This unit is a CWD positive unit. Continue surveillance through check stations and other methods to document prevalence, and location of positive animals.

Figure 1. Map of Potential Deer Transplant Sites on the Southeast Manti.



Limiting Factors (may prevent achieving management objectives)

Crop Depredation – Take all steps necessary to minimize depredation as prescribed by state law and DWR policy.

Habitat – Winter range is a limiting factor for deer on this unit. Portions of critical winter ranges are in poor condition (see range trend summary below). Factors contributing to poor range conditions include recent droughts and range use by deer and domestic livestock. This has resulted in a reduction of winter range carrying capacity. Utilization of key shrub species on critical winter ranges will be closely monitored.

Predation – Follow DWR predator management policy:

- If the population estimate is less than 90% of objective and is stable or decreasing and fawn to doe ratio drops below 70 for 2 of the last 3 years or if the fawn survival rate drops below 50% for one year, then a Predator Management Plan targeting coyotes will be implemented on that subunit. If the population trend is increasing the population must be below 65% of objective and meet the above criteria in order to initiate Predator Management for Coyotes. In 2015, the Central Mountains unit did not qualify for predator management specific to coyotes as the population trend was increasing and was 66% of objective.

- If the population estimate is less than 90% of objective and the doe survival rate drops below 85% for 2 of the last 3 years or below 80% for one year, then a Predator Management Plan targeting cougar would be implemented on that subunit. This unit did not qualify for predator management specific to cougars in 2015 as the population is increasing.

Highway Mortality – Cooperate with the Utah Dept. Of Transportation in construction of highway fences, passage structures, warning signs, etc. Collect highway mortality data. A deer highway crossing study along SR-6 is ongoing. Propose analysis of SR-96, SR-31, and SR-264 to minimize highway mortalities in the future.

Illegal Harvest – Should illegal kill become an identified and significant source of mortality attempt to develop specific preventive measures within the context of an action plan developed in cooperation with the Law Enforcement section.

Special Considerations

When unit by unit deer management went into effect in 2011, the San Rafael unit remained part of the Manti general season deer hunt boundary. The majority of deer numbers are concentrated on the unit where there are agricultural corridors. These lands often times provide favorable food water and cover to deer. Deer numbers along these corridors are not in decline and provide hunting opportunity to local hunters. Most of the deer harvested on this unit occurs near to agricultural areas. Currently the decision to keep the San Rafael unit within the Manti general season unit was based on the following considerations:

- Deer hunters would continue to have the opportunity to hunt both the Manti and San Rafael sides of highway SR-10 on or near private land. Private land areas on the east side of SR-10 is where most of the deer occur on the San Rafael subunit.
- The agricultural areas on both sides of SR-10 should be within the same unit and delineation of a boundary to accomplish this would be difficult.
- Setting management objectives for San Rafael unit deer population and sex-ratios would be unreliable due to small and isolated deer herds resulting in inadequate sample sizes.

HABITAT MANAGEMENT OBJECTIVES

Protect, maintain, and/or improve deer habitat through direct range improvements to support and maintain herd population management objectives.

Work with private landowners and federal, state, and local governments to maintain and protect critical and existing ranges from future losses and degradation through grazing management and OHV and Travel Plan modifications.

Work with federal, private, and state partners to improve crucial deer habitats through the WRI process.

Work with federal and state partners in fire rehabilitation on crucial deer habitat through the WRI process.

Maintain and protect critical winter range from future losses. Acquire critical winter range when the opportunity arises.

Minimize and mitigate impacts from energy development activities.

Minimize deer vehicle collisions along highways on the unit.

HABITAT MANAGEMENT STRATEGIES

Continue to improve, protect, and restore sagebrush steppe habitats critical to deer. Cooperate with federal land management agencies and private landowners in carrying out habitat improvements such as pinion-juniper removal, reseedings, controlled burns, grazing management, water developments, etc. on public and private lands. Habitat improvement projects will occur on both winter ranges as well as summer range.

Continue to monitor permanent range trend studies located throughout the unit.

Conduct cooperative seasonal range assessments to evaluate forage condition and utilization. Determining opportunities for habitat improvements will be an integral part of these surveys. This will also be pivotal in determining if antlerless harvest is necessary.

Work toward long term habitat protection and preservation through the use of agreements with federal agencies and local governments and the use of conservation easements on private lands.

Support, cooperate with, and provide input to land management planning efforts dealing with actions affecting habitat security, quality and quantity.

Work with land management agencies and energy companies to minimize and mitigate impacts of energy development activities. Oil and gas specific habitat biologists will lead this effort.
Continue to monitor deer survival on this unit through radio telemetry studies. Use telemetry data to determine potential habitat improvement projects.

Manage vehicle access on Division of Wildlife Resources land to limit human disturbance during times of high stress, such as winter and fawning.

Manage riparian areas in critical fawning habitat to furnish water, cover and succulent forage from mid to late summer.

Protect deer winter ranges from wildfire by reseeding burned areas, creating fuel breaks and vegetated

green strips and reseed areas dominated by Cheat grass with desirable perennial vegetation.

Reduce expansion of pinion-juniper and other woodlands into sagebrush habitats and improve habitats dominated by pinion-juniper woodlands by completing habitat restoration projects like lop & scatter, bullhog, and chaining.

Manage conifer encroachment on important summer ranges by utilizing prescribed fire.

Seek opportunities to increase browse in burned areas of critical winter range.

Utilize antlerless deer harvest to improve or protect forage conditions when vegetative declines are attributed to deer over utilization.

PERMANENT RANGE TREND SUMMARIES – **Central Mountains, Manti**

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.

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 (See Figure 2).

Central Mountains Manti North

Most of the winter range in subunit 16B lies on the east side of the Wasatch Plateau which is a broad alluvial fan ranging in elevation from 5500 to 7500 feet. 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, and below Scofield Reservoir. The winter range is made up of mountain big sagebrush and 8yoming big sagebrush communities with pinyon-juniper woodlands interspersed throughout the area.

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. 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.

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. An extensive road system provides year-round access to large portions of the winter range. Heavily used access roads to coal mines and gas wells 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.

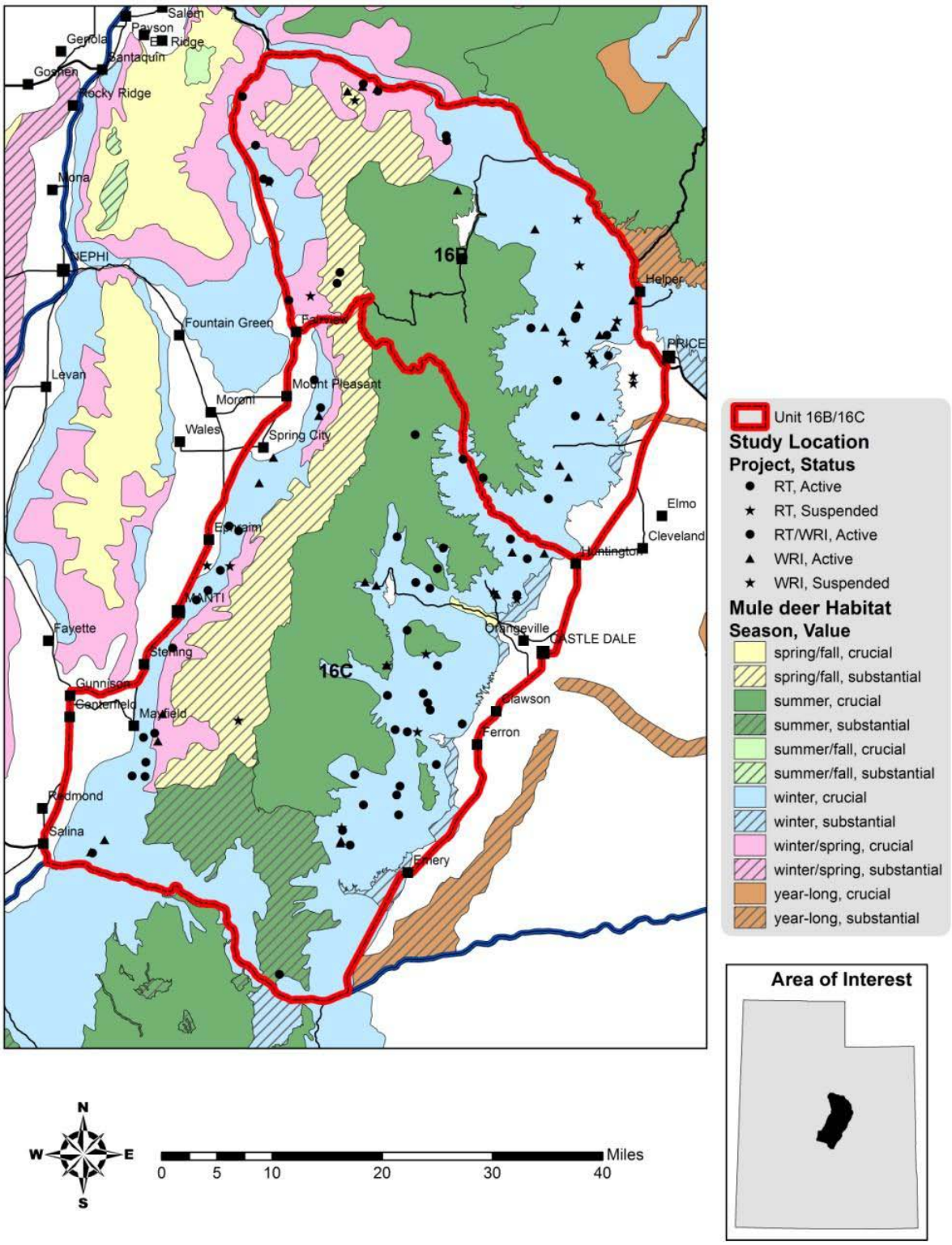
Central Mountains Manti South

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. 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.

Figure 2. Seasonal Ranges on the Manti Subunit Showing Range Trend Study Locations



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 (Figure 3), 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 (Table 1). 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 (Table 2). 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.

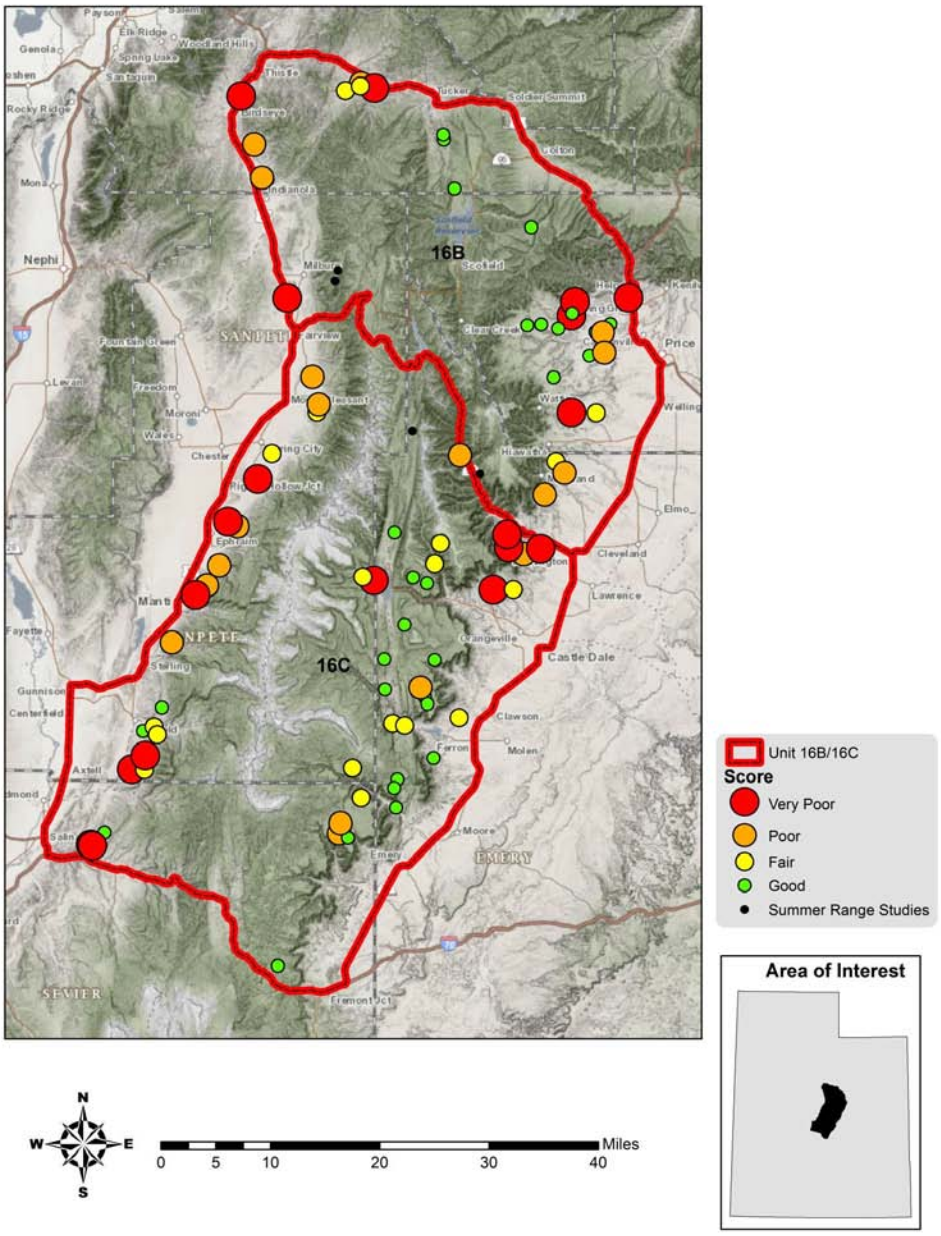
Table 1. Deer Winter Range Desirable Components Index (DCI) Summary by year of Undisturbed Range Trend Sites on Manti Unit

	1994	1997/1999	2002/04	2007/09	2014
Good	4	9	6	10	17
Fair	7	16	12	9	5
Poor	6	3	9	7	8
Very Poor	5	6	8	9	6
Total	22	34	35	35	36

Table 2. Deer winter range Desirable Components Index (DCI) summary by year of treated/disturbed sites for the Manti Unit

	Pre-Treatment	Post Year 1-5	Post Year 6-10	Post Year 11-15
Good	9	9	12	3
Fair	6	9	8	2
Poor	11	12	4	2
Very Poor	16	12	6	1
Total	48	48	31	8

Figure 3. Map of Range Trend Sites on the Manti Subunit showing site condition.



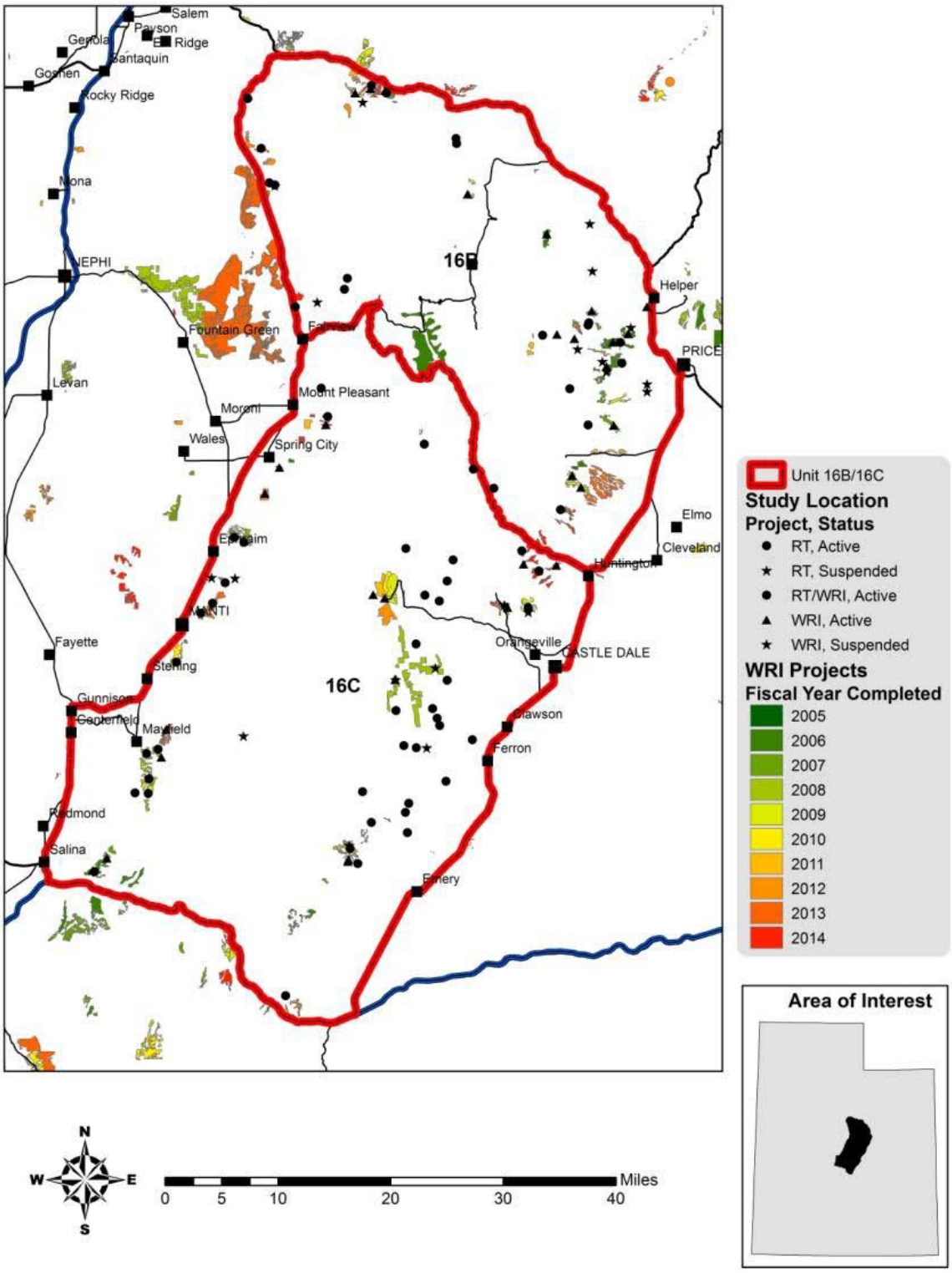
Treatments/Restoration Work

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 (Figure 4), treatments occasionally overlap one another bringing the total treatment acres to 38,043 acres for this unit. 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, chaining, and lop-and-scatter are common management practices on this unit (Table 3). Other common management treatments are those to rejuvenate sagebrush stands such as herbicide, disc, and harrow treatments. In addition to these treatments, many have had seeding treatments associated with it to increase desirable species.

Table 3. WRI treatment size (acres) for Manti Subunit.

Treatment Action	**Acres**
Lop and Scatter	11,428
Anchor Chain	6,956
Herbicide Application	5,478
Seeding	4,994
Bull hog	2,493
Harrow	2,472
Disc	1,963
Research	788
Prescribed Fire	718
Planting/Transplanting	496
PJ push	246
Greenstripping	11
Aerator	1
***Total Land Area Treated**	**36,336**
Total Treatment Acres	**38,043**

Figure 4. Habitat Projects Completed on the Manti Subunit, 2005-2014.



PERMANENT RANGE TREND SUMMARIES – **Central Mountains, Nebo**

Management Unit Description

This management subunit incorporates most of the old North and South Nebo deer herd units. The old North Nebo deer herd unit included about 490,240 acres. Physiographically, the unit was dominated by high mountains such as Santaquin Peak, Bald Mountain, and Mount Nebo. Mount Nebo represents the southernmost extension of the Wasatch Range. These mountains constitute the heart of a diverse and productive summer range, making up about 29% of the unit. Normal winter range constitutes approximately 32% of the area. The Mount Nebo summer range has a long history of high hunting success and depredation problems, a growing elk herd, and limited winter range.

The San Pitch Mountains make up the majority of the old South Nebo herd unit. This low mountain range contains all of the summer range on the unit and 40% of the area. The surrounding foothills and western slopes provide winter range that makes up the remaining 60% of the range. The upper limit of the winter range is approximately 7,000 feet in elevation, but extends to 8,000 feet on the south exposures in canyons on the west side of the unit. Twenty-five percent of the winter range was classified as severe winter range in the 1976 range inventory. The upper limit of severe winter range is 6,000 feet, while the lower limit (5,200 feet) of the winter range is restricted by highways, reservoirs, agriculture, and small communities.

Deer Winter Range Condition Assessment

Twenty-one interagency range trend studies were sampled in Unit 16A during the summer of 2012. A total of twenty-four studies have been established within the Unit 16A since 1983 (Figure 5). The key areas identified and sampled with 12 trend studies in 1983 are still priority areas. Three new studies were added in 1989. The majority of the studies are on UDWR land. However, much of the critical range is under private ownership and was not sampled due to restricted access and limited management opportunities. The 15 permanently-marked trend studies originally sampled in early August 1983 were resampled in mid-July of the drier year of 1989, and in late May of 1997, 2002, 2007, and 2012. All sample big game winter range areas, although many sites had some evidence of summer deer occupancy. The studies range in elevation from approximately 5,400 feet (1,646 m) to 6,500 feet (1,981 m). The prominent winter range vegetation types that were sampled include: mixed oak/big sagebrush, sagebrush/grass, mountain brush, bitterbrush, and cliffrose. To access maps, discussions, and data tables for all range trend studies see: http://www.wildlife.utah.gov/range.

Occupancy: Pellet group transect data indicates that deer predominantly occupy these mid-level potential study areas. The mean abundance of deer pellet groups was high on most studies in 1997 and 2007, but was substantially lower in 2012. The decrease in pellet abundance is likely due to the mild winter of 2011-2012 which allowed animals to remain on higher elevation range. The mean abundance of elk and livestock sign has been generally low since 1998. Sheep pellet groups were abundant on the Deep Creek and Fountain Green Plateau studies in several sample years.

Discussion: Decreases in the preferred browse species sagebrush and cliffrose are a cause of concern on these mid-level potential sites (Table 4). Wildfire's on the Santaquin Bench, Nebo Creek, Hop Creek Browse, and Big Hollow studies has certainly contributed to the decrease in sagebrush, but are not the singular cause. Gambel oak is increasing on several sites and may be competing directly with sagebrush. This seems to be the case particularly on the Santaquin Bench, North Canyon, and Steele Ranch studies. Decreases in cover and density of cliffrose are particularly pronounced on the Tithing Mountain study, but are also occurring on the Gardner Canyon, Birch Creek, and Chicken Creek studies.

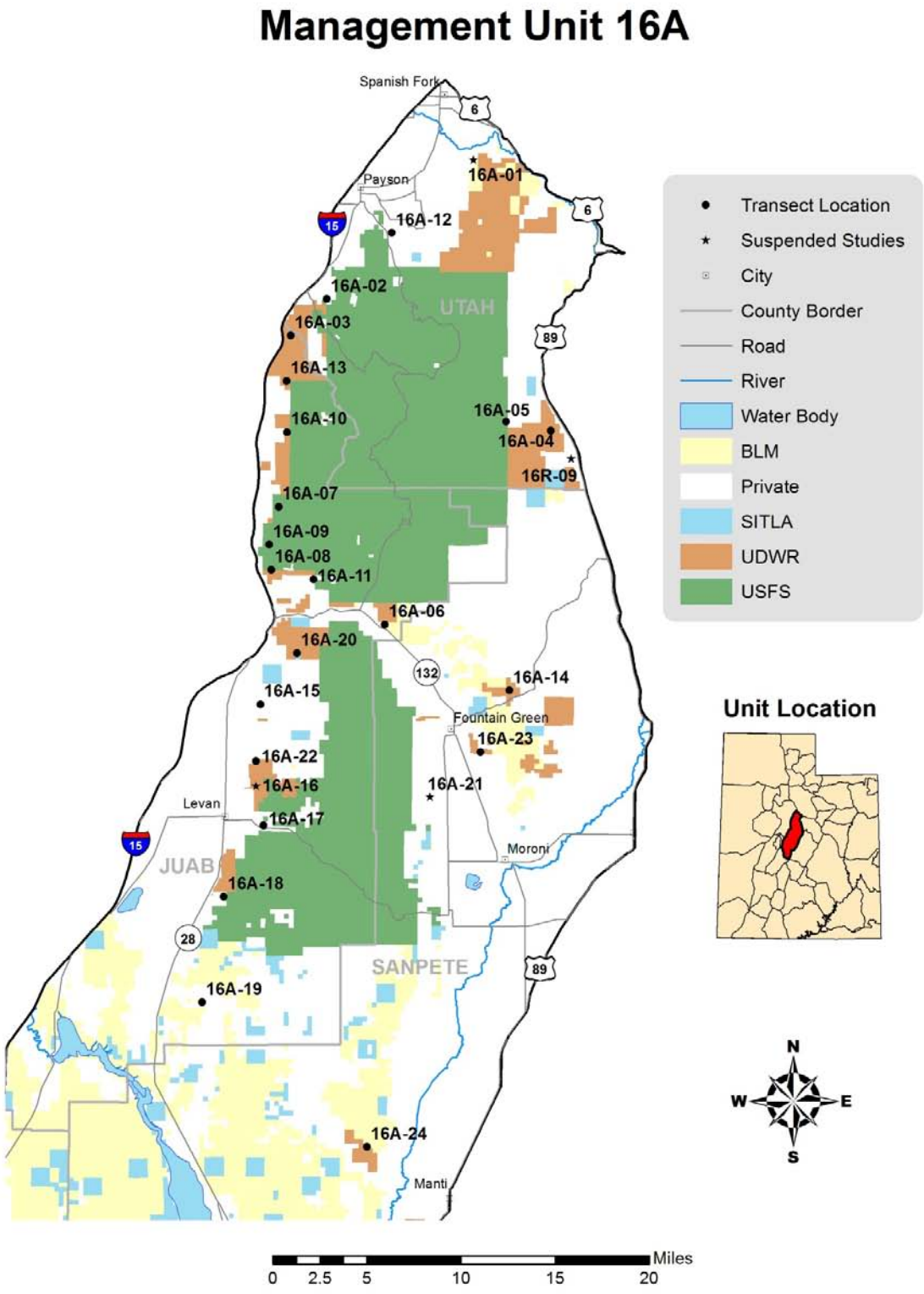


Figure 5. Range Trend Study Locations on the Manti, Nebo Subunit

The abundance of weedy annual species and bulbous bluegrass is likely contributing to decreases in both the sagebrush and cliffrose populations on these mid-level potential sites. These weedy species can form dense mats of cover that compete with other more desirable herbaceous species and with seedlings and young shrubs which limits establishment of new plants into the population. Annual grass species can also increase fuel loads and increase the chance of a catastrophic fire event. Bulbous bluegrass is a particular concern on the Santaquin Bench, Rees Flat, Tithing Mountain, Old Pinery, and Triangle Ranch studies. Cheatgrass and other annual grasses are a particular concern on the Nebo Creek, Willow Creek, Gardner Canyon, Birch Creek, Tithing Mountain, Big Hollow, Old Pinery, Chicken Creek, and Flat Canyon studies.

Heavy utilization by animals may be compounding problems from competition. Deer pellet groups have been particularly abundant on the Santaquin Hill, Wash Canyon, Hop Creek Browse, Willow Creek, Gardner Canyon, Tithing Mountain Steele Ranch, and Old Pinery studies. Livestock utilization appears to be relatively light on most of these studies, but sheep pellets have been abundant at times on the Deep Creek and Fountain Green Plateau study.

Table 4. Mid-level potential scale mean deer DCI scores and rankings (n=20) by year for WMU 16A, Central Mountains, Nebo. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	13.4	8.0	6.1	18.8	-3.6	7.8	-1.2	49.2	Poor-Fair
02	14.9	4.9	3.2	17.6	-3.4	6.1	-1.2	42.1	Poor
07	11.8	5.6	2.5	18.6	-5.5	6.3	-1.2	38.1	Poor
12	14.1	8.2	4.4	20.0	-4.9	5.9	-1.2	46.6	Poor

Limiting Factors to Big Game Habitat – Nebo Subunit

The principal limiting factor and management concern in the old North Nebo unit is the lack of good-condition winter range, especially severe winter range on the west side of the unit. In this area, from Spanish Fork Canyon south to Nephi, the normal winter range averages 2 miles or less in width. Severe winter range is even narrower, ranging from as narrow as a few hundred yards, up to 1.5 miles. Total severe winter range accounts for only about 12% of the area. However, the winter range on the east and south sides of the unit is more expansive, and not nearly as critical. Some of the major problems related to the limited winter range on the unit, especially low elevation severe winter range, include: restricted access to traditional wintering areas west of I-15, predominately private ownership of critical ranges (63% of normal winter range), and agricultural depredation. To remedy the situation, the UDWR has acquired approximately 12,800 acres of winter range in the unit (7% of winter range) and has attempted treatments and rehabilitation in these critical areas. The available winter range, especially critical areas on the west side of the unit, remains threatened by development and a high fire hazard from cheatgrass.

A major threat to deer winter habitat is the development of winter range on private property. Most of the winter range on the north end of the Nebo unit is private and there is continual expansion of new home building in the higher elevations of winter range in the communities of Spanish Fork, Salem, Woodland Hills and Elk Ridge. The same is true on the south end of the major portion of the Nebo Unit, along Water Hollow and Big Hollow, however the development there is more for cabin lots not for residential housing. Both of these areas have historically been very important winter ranges for large populations of mule deer. State owned WMAs along the east and west side of the unit are important areas of protection but may prove inadequate in the future to sustain the deer population at our desired objective

as private development continue in the years to come. Further habitat acquisition and rehabilitation are necessary to adequately maintain the winter range.

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 Nebo unit since the WRI was implemented in 2004 (Table 5). As seen on the map, treatments occasionally overlap one another bringing the total treatment acres to 38,043 acres for this unit. 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, chaining, and lop-and-scatter are common management practices on this unit. Other common management treatments are those to rejuvenate sagebrush stands such as herbicide, disc, and harrow treatments. In addition to these treatments, many have had seeding treatments associated with it to increase desirable species.

Table 5. WRI treatment size (acres) for Nebo Subunit.

Treatment Action	Acres
Lop and Scatter	11,428
Anchor Chain	6,956
Herbicide Application	5,478
Seeding	4,994
Bull hog	2,493
Harrow	2,472
Disc	1,963
Research	788
Prescribed Fire	718
Planting/Transplanting	496
PJ push	246
Greenstripping	11
Aerator	1
***Total Land Area Treated**	**36,336**
Total Treatment Acres	**38,043**

Discussion and Recommendations

Summer Range Habitats
Summer habitats at high elevations on this unit include spruce-fir, aspen, alpine, and mountain shrub habitat types. These areas are generally considered to be in good condition for deer summer range habitat. This community supports a diverse herbaceous understory that provides valuable forage during the summer months. While in generally good condition, major concerns include conifer encroachment in to aspen stands, an abundance of introduced aggressive perennial grasses, and noxious weeds. All of which have an impact on the quality and quantity of forb species important to mule deer 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.

Habitat projects that promote aspen and forb communities as well as a diverse age structure of the forest are recommended. Such projects may include: prescribed fire, timber management, mechanical

treatment, and grazing management. 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.

Winter Range Habitats

Winter range habitats include sagebrush steppe, pinyon-juniper woodlands, and salt desert shrub habitats. 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. Many of these stands show very high utilization by ungulates. As a result, many stands are decadent. Annual grasses, primarily cheatgrass, can 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 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.