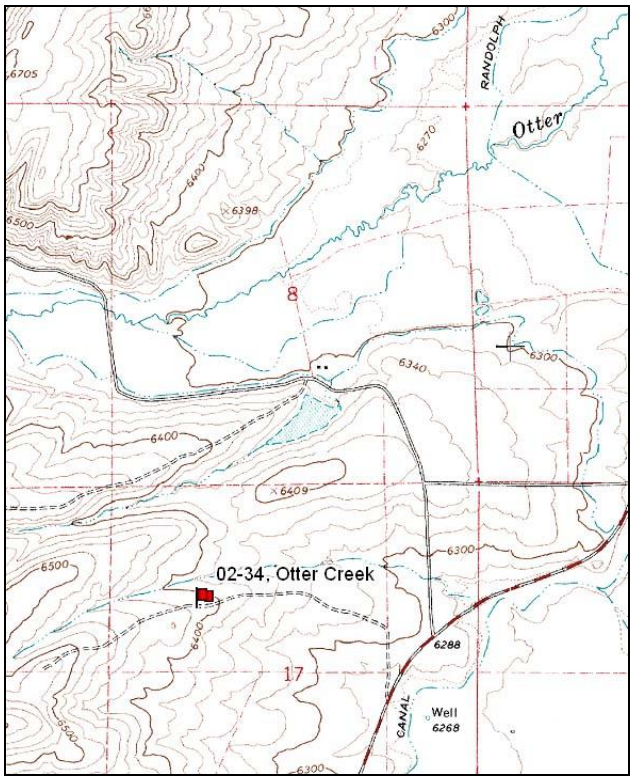
OTTER CREEK - TREND STUDY NO. 2-34-11

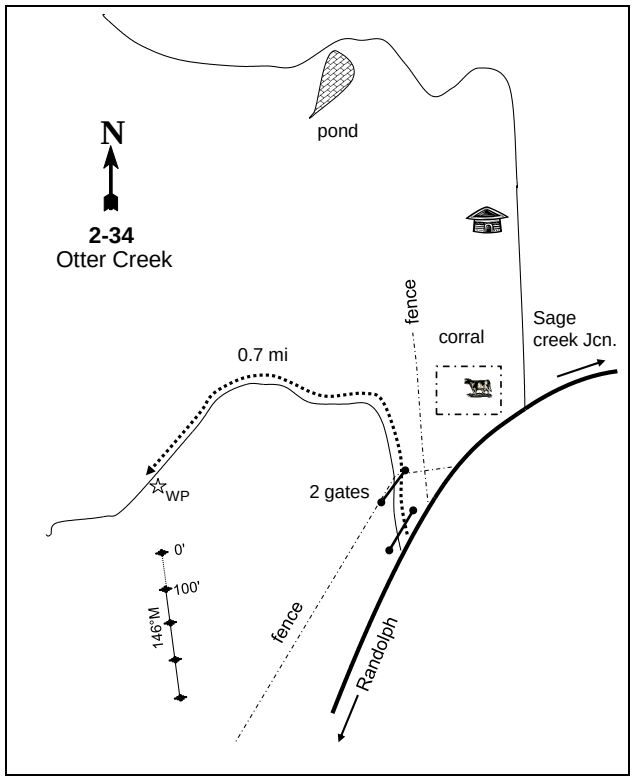
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: BLM
Elevation: 6,400 ft (1,951 m)
Aspect: East
Slope: 5%
Transect bearing: 146° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Proceed north from Randolph on U-16. Travel 0.5 mile past Nor Gray Lane. Turn left here, and proceed 0.7 miles from the first gate to a witness post on the left hand side of the road. From the witness post walk 15 feet at 160 degrees magnetic to the 0-foot stake of the baseline marked with browse tag #7977.

Map Name: Randolph




Diagrammatic Sketch:




Township: 11N Range: 7E Section: 17

GPS: NAD 83, UTM 12S 484694 E 4616262 N

**Site Information**

Site Description: This study is located approximately two miles north of Randolph on the west side of SR 16. The area is administered by the Bureau of Land Management (BLM) as part of the New Canyon allotment. Prior to 1984, the study area was treated with an unknown herbicide or some kind of mechanical means to control sagebrush. In addition, crested wheatgrass was drill seeded to increase forage production for livestock. By 2001, the area had returned to a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community. In the spring of 2004, a total 355 acres were treated with a Lawson aerator; a greenstripping design was used, which left some untreated strips of sagebrush. Although the exact seed mix is unknown, the seed mix included thickspike wheatgrass (*Agropyron dasystachyum*), crested wheatgrass (*A. cristatum*), slender wheatgrass (*A. trachycaulum*), Lewis flax (*Linum lewisii*), and forage kochia (*Kochia prostrata*). The pasture just south of the study area remains a thick sagebrush community. Many different animals occupy the area including cattle, sheep, deer, pronghorn, elk, and sage-grouse. Deer and pronghorn pellet groups were combined due to their similarity in appearance. Deer/pronghorn pellet groups were sampled in high abundance in 2001, but low abundance in 2006 and 2011. Elk pellet groups were sampled in low abundance in 2011. Sampled cattle pats have been minimal since 2001. Sage-grouse pellet groups were observed on the study in 2001 and 2011 (Table - Pellet Group Data).

Browse: Browse composition consists of a fairly dense stand of Wyoming big sagebrush, which has made up half of the total vegetation cover for the majority of the study's duration; except after the Lawson aeration treatment where cover decreased considerably when measured in 2006. The sagebrush population has been centered within the mature demographic for the duration of the study, except in 1984 when the majority of the population was centered within the young age class. Decadence within the sagebrush population has fluctuated with a mixture of low and high decadence over the course of the study years. The sagebrush population has had light to moderate utilization over the course of the study. The sagebrush population has displayed good vigor for the majority of sampled years, except in 1996 when most of the population experienced early leaf abscission due to dry conditions. Recruitment of young sagebrush plants has been good since the outset of the study (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory consists mainly of perennial grasses, with crested wheatgrass dominating the area. Before the study was established in 1984, the study was seeded and again in 2004 with the aerator treatment. Of the seeded perennial grass species, crested wheatgrass has been the only grass species sampled. Sandberg bluegrass (*Poa secunda*) is the only other common perennial grass found on the site. Forbs occur rarely and produced very little cover (Table - Herbaceous Trends).

Soil: Soils are part of the Pancheri component, which is found on hilltops. The parent material consists of eolian deposits derived from mixed sources (Soil Survey Staff 2011). Soils have a loam texture with a neutral soil reaction (pH 6.9) and limited organic matter (Table - Soil Analysis Data). Exposed bare ground cover is common, and is found primarily between the interspaces of browse cover. Adequate protective ground cover is provided by high amounts of vegetation and litter (Table - Basic Cover). The herbaceous cover provided by crested wheatgrass helps stabilize the soil. The study area is not badly eroded even though the amount of exposed bare ground is greater than the nearby undisturbed big sagebrush types. The soil erosion condition was classified to be slight in 2001 due to pedestalling around sagebrush. However, the erosion condition class was determined to be stable in 2006 and 2011.

**Trend Assessments**

Browse:

- **1984 to 1990 - down (-2):** The density for Wyoming big sagebrush decreased 20% from 9,565 plants/acre to 7,665 plants/acre. Decadence within the sagebrush population increased from 9% to 35%. Poor vigor in the sagebrush population increased from 0% to 10%.
- **1990 to 1996 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence within the sagebrush population decreased to 9%. However, the sagebrush population increased in poor vigor to 87%. Young sagebrush plants decreased from 28% to 16% of the population. Sagebrush cover was estimated at 17%.
- **1996 to 2001 - stable (0):** The density for Wyoming big sagebrush increased 9% from 9,620 plants/acre to 10,440 plants/acre. Decadence within the sagebrush population increased to 41%. However, the sagebrush population decreased in poor vigor to 2%. Young sagebrush plants decreased to 12% of the population. Sagebrush cover decreased and was estimated at 12%
- **2001 to 2006 - down (-2):** The density for Wyoming big sagebrush decreased 35% to 6,760 plants/acre. The decrease in density was directly related to the aerator treatment which occurred in the spring of 2004. Decadence within the sagebrush population decreased to 21%. However, the sagebrush population increased in poor vigor to 14%. Young sagebrush plants decreased to 7% of the population. Sagebrush cover decreased and was estimated at 9%.
- **2006 to 2011 - slightly up (+1):** The density for Wyoming big sagebrush increased 14% to 7,720 plants/acre. Decadence within the sagebrush population decreased to 8%. Moreover, the sagebrush population decreased in poor vigor to 4%. Young sagebrush plants increased to 43% of the population. Sagebrush cover increased and was estimated at 17%. The Lawson aeration is likely involved in the revitalization the sagebrush population.

Grass:

- **1984 to 1990 - stable (0):** The sum of nested frequency for perennial grasses remained similar. Crested wheatgrass decreased significantly in nested frequency. Sandberg bluegrass increased significantly in nested frequency.
- **1990 to 1996 - slightly up (+1):** The sum of nested frequency for perennial grasses increased 10%. Crested wheatgrass provided 12% cover. Sandberg bluegrass had a significant increase in nested frequency, and had a cover of 5%.
- **1996 to 2001 - stable (0):** The sum of nested frequency for perennial grasses remained similar. Crested wheatgrass decreased in cover to 11%. Sandberg bluegrass decreased in cover to 3%.
- **2001 to 2006 - stable (0):** The sum of nested frequency for perennial grasses remained similar. Crested wheatgrass increased in cover to 23%. Sandberg bluegrass maintained a cover of 3%.
- **2006 to 2011 - slightly up (+1):** The sum of nested frequency for perennial grasses increased 12%. Crested wheatgrass decreased in cover to 13%. Sandberg bluegrass had a significant increased in nested frequency, and increased in cover to 6%.

Forb:

- **1984 to 1990 - up (+2):** The sum of nested frequency for perennial forbs increased two-fold, but remained relatively rare on the site. Hoods phlox (*Phlox hoodii*) and longleaf phlox (*P. longifolia*) increased significantly in nested frequency. Clover (*Trifolium sp.*) had a significant decrease in nested frequency.
- **1990 to 1996 - slightly down (-1):** The sum of nested frequency for perennial forbs decreased 22%. Because of the small size of the forb community, the decrease is likely due to small, accumulative decreases in nested frequency across the perennial forb community.
- **1996 to 2001 - stable (0):** The sum of nested frequency for perennial forbs remained similar. No one forb species had a cover above 1%.

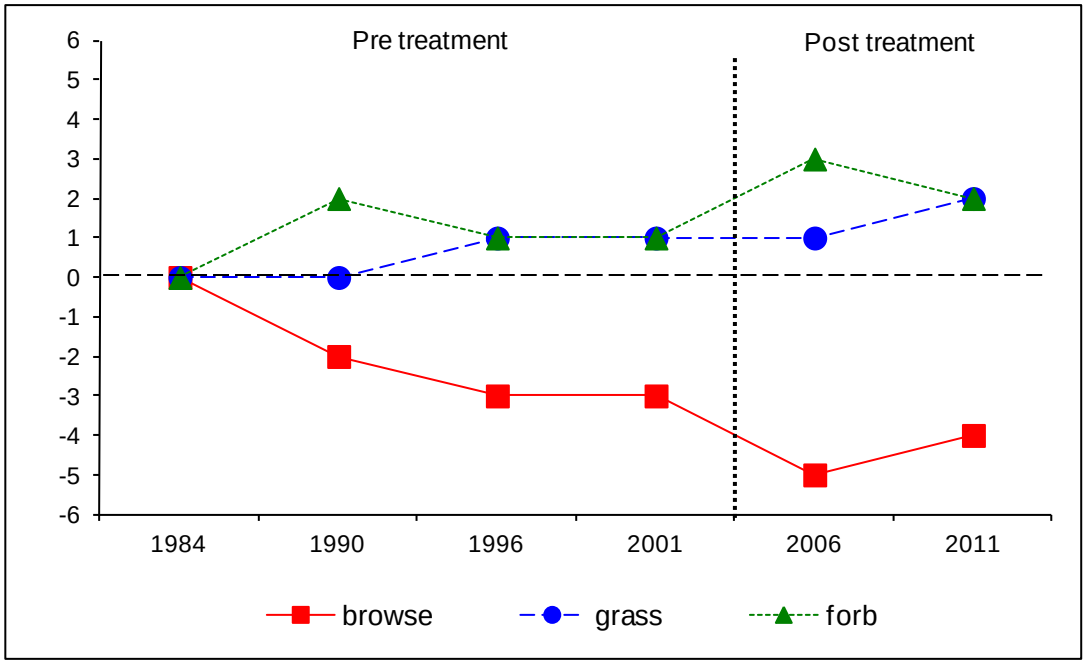
- **2001 to 2006 - up (+2):** The sum of nested frequency for perennial forbs increased 88%. As a seeded species, Lewis flax was observed for the first time, and had a significant increase in nested frequency. Lewis flax had a cover near 1%. Hoods phlox increased in cover from less than 1% to 3%.
- **2006 to 2011 - slightly down (-1):** The sum of nested frequency for perennial forbs decreased 26%. Lewis flax had a significant decrease in nested frequency. The annual forb species pale alyssum (*Alyssum alyssoides*) had a significant increase in nested frequency, and had a cover of less than 1%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 2, study no: 34

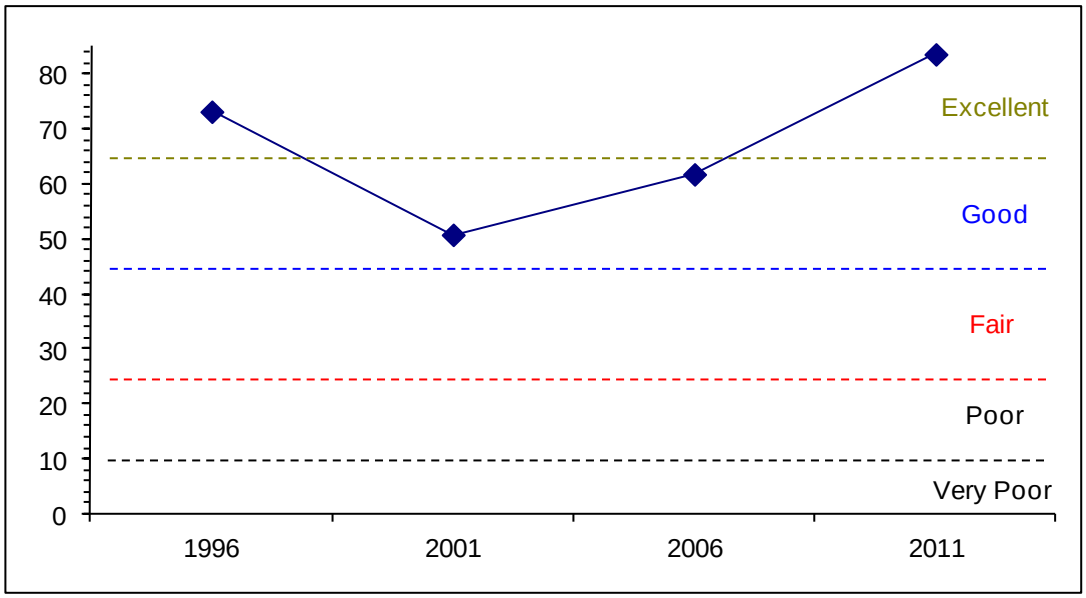
| Year | Preferred Browse Cover | Preferred Browse Decadence | Preferred Browse Young | Perennial Grass Cover | Annual Grass Cover | Perennial Forb Cover | Noxious Weeds | **Total Score** | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| 96 | 20.3 | 12.3 | 7.9 | 30.0 | 0.0 | 2.7 | 0.0 | **73.3** | Excellent |
| 01 | 14.2 | 2.7 | 6.0 | 26.3 | 0.0 | 1.5 | 0.0 | **50.8** | Good |
| 06 | 11.4 | 8.7 | 3.5 | 30.0 | 0.0 | 8.2 | 0.0 | **61.8** | Good |
| 11 | 21.4 | 12.6 | 15.0 | 30.0 | 0.0 | 4.6 | 0.0 | **83.6** | Excellent |

**Trend Summary**

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 2, Study no: 34



DEER DESIRABLE COMPONENTS INDEX TREND, LOW POTENTIAL SCALE--
Management unit 2, Study no: 34




HERBACEOUS TRENDS--
Management unit 02, Study no: 34

| Type | Species | Nested Frequency | | | | | | Average Cover % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | '84 | '90 | '96 | '01 | '06 | '11 | '96 | '01 | '06 | '11 |
| G | Agropyron cristatum | b341 | a309 | ab310 | a300 | b317 | b313 | 11.62 | 10.64 | 23.34 | 13.43 |
| G | Carex sp. | - | 4 | - | 4 | 5 | 10 | - | .01 | .18 | .09 |
| G | Oryzopsis hymenoides | - | - | - | 3 | - | - | - | .00 | - | - |
| G | Poa secunda | a147 | bc208 | d265 | bcd227 | b190 | cd248 | 5.29 | 2.48 | 3.41 | 5.74 |
| G | Stipa comata | - | 3 | 2 | 3 | - | - | .01 | .03 | - | - |
| Total for Annual Grasses | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total for Perennial Grasses | | 488 | 524 | 577 | 537 | 512 | 571 | 16.93 | 13.17 | 26.93 | 19.26 |
| Total for Grasses | | 488 | 524 | 577 | 537 | 512 | 571 | 16.93 | 13.17 | 26.93 | 19.26 |
| F | Alyssum alyssoides (a) | - | - | a- | b20 | c52 | d116 | - | .04 | .09 | .42 |
| F | Arabis sp. | - | - | - | 1 | 1 | - | - | .00 | .00 | - |
| F | Arenaria sp. | - | - | - | - | 1 | - | - | - | .03 | - |
| F | Astragalus convallarius | - | - | - | - | - | 7 | - | - | - | .07 |
| F | Astragalus utahensis | ab2 | b6 | ab5 | ab3 | a- | ab3 | .03 | .00 | .00 | .01 |
| F | Calochortus nuttallii | - | - | - | 2 | - | - | - | .00 | - | - |
| F | Chenopodium leptophyllum(a) | - | - | - | - | - | 2 | - | - | - | .00 |
| F | Cordylanthus ramosus (a) | - | - | a- | a2 | a- | b30 | - | .01 | - | 1.08 |
| F | Epilobium brachycarpum (a) | - | - | - | - | - | 3 | - | - | - | .03 |
| F | Erigeron pumilus | - | - | - | 1 | 1 | 1 | - | .00 | .00 | .03 |
| F | Holosteum umbellatum (a) | - | - | a- | a- | a- | b56 | - | - | - | .81 |
| F | Linum lewisii | - | - | a- | a- | b79 | a- | - | - | .87 | - |
| F | Lomatium sp. | - | 1 | - | 9 | - | - | - | .02 | - | - |
| F | Phlox hoodii | a38 | b81 | ab75 | ab58 | b85 | b80 | 1.16 | .54 | 2.77 | 1.62 |
| F | Phlox longifolia | a- | b50 | b31 | b25 | b50 | b53 | .15 | .10 | .30 | .46 |
| F | Tragopogon dubius (a) | - | - | - | 4 | - | 1 | - | .03 | - | .00 |

| Type | Species | Nested Frequency | | | | | | Average Cover % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | '84 | '90 | '96 | '01 | '06 | '11 | '96 | '01 | '06 | '11 |
| F | Trifolium sp. | $_{b}$29 | $_{a}$4 | $_{a}$- | $_{ab}$18 | $_{ab}$7 | $_{b}$23 | - | .05 | .02 | .11 |
| F | Unknown forb-perennial | 1 | - | - | - | - | - | - | - | - | - |
| F | Zigadenus paniculatus | - | - | - | 4 | 3 | - | - | .03 | .07 | - |
| Total for Annual Forbs | | 0 | 0 | 0 | 26 | 52 | 208 | 0 | 0.07 | 0.08 | 2.35 |
| Total for Perennial Forbs | | 70 | 142 | 111 | 121 | 227 | 167 | 1.35 | 0.77 | 4.09 | 2.31 |
| Total for Forbs | | 70 | 142 | 111 | 147 | 279 | 375 | 1.35 | 0.85 | 4.18 | 4.66 |

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--
Management unit 02, Study no: 34

| Type | Species | Strip Frequency | | | | Average Cover % | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | '96 | '01 | '06 | '11 | '96 | '01 | '06 | '11 |
| B | Artemisia tridentata wyomingensis | 98 | 94 | 89 | 93 | 16.12 | 11.36 | 9.11 | 17.08 |
| B | Atriplex gardneri falcata | 8 | 9 | 7 | 1 | .06 | .18 | .03 | - |
| B | Chrysothamnus viscidiflorus stenophyllus | 10 | 5 | 10 | 9 | .60 | .03 | .18 | .18 |
| B | Eriogonum microthecum | 1 | 1 | 0 | 1 | .15 | .03 | - | - |
| B | Opuntia sp. | 2 | 1 | 1 | 1 | - | - | - | - |
| Total for Browse | | 119 | 110 | 107 | 105 | 16.93 | 11.60 | 9.32 | 17.26 |

CANOPY COVER, LINE INTERCEPT--
Management unit 02, Study no: 34

| Species | Percent Cover | |
|---|---|---|
| | '06 | '11 |
| Artemisia tridentata wyomingensis | 7.81 | 17.25 |
| Atriplex gardneri falcata | .16 | - |
| Chrysothamnus viscidiflorus stenophyllus | .20 | .15 |

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02, Study no: 34

| Species | Average leader growth (in) | | |
|---|---|---|---|
| | '01 | '06 | '11 |
| Artemisia tridentata wyomingensis | 0.8 | 1.0 | 4.3 |

BASIC COVER--
Management unit 02, Study no: 34

| Cover Type | Average Cover % | | | | | |
|---|---|---|---|---|---|---|
| | '84 | '90 | '96 | '01 | '06 | '11 |
| Vegetation | 13.50 | 5.00 | 36.29 | 28.72 | 38.15 | 37.52 |
| Rock | 0 | 0 | .03 | .01 | .04 | .00 |
| Pavement | 0 | 0 | .22 | .10 | .04 | .04 |
| Litter | 40.25 | 40.50 | 29.26 | 35.75 | 43.18 | 27.14 |
| Cryptogams | 0 | .50 | 3.84 | 4.25 | 1.48 | 1.04 |
| Bare Ground | 46.25 | 54.00 | 42.42 | 46.36 | 33.09 | 40.24 |

SOIL ANALYSIS DATA --
Management unit 02, Study no: 34, Study Name: Otter Creek

| Effective rooting depth (in) | pH | Loam | | | %OM | PPM P | PPM K | ds/m |
|---|---|---|---|---|---|---|---|---|
| | | %sand | %silt | %clay | | | | |
| 15.6 | 6.9 | 40.6 | 35.1 | 24.4 | 1.4 | 15.2 | 108.8 | 0.6 |

PELLET GROUP DATA--
Management unit 02, Study no: 34

| Type | Quadrat Frequency | | | |
|---|---|---|---|---|
| | '96 | '01 | '06 | '11 |
| Sheep | 3 | 4 | - | - |
| Rabbit | 1 | - | 2 | 16 |
| Grouse | - | - | - | 1 |
| Elk | 7 | - | 1 | 1 |
| Deer/Pronghorn | 14 | 23 | 20 | 20 |
| Cattle | 5 | 6 | 3 | 4 |

| Days use per acre (ha) | | |
|---|---|---|
| '01 | '06 | '11 |
| 3 (8) | - | - |
| - | - | - |
| - | - | - |
| - | - | 1 (3) |
| 42 (103) | 28 (69) | 16 (40) |
| 11 (27) | 11 (27) | 14 (34) |

BROWSE CHARACTERISTICS--
Management unit 02, Study no: 34

| | | Age class distribution | | | | Utilization | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Plants per Acre (excluding seedlings) | % Young | % Mature | % Decadent | Seedling (plants/acre) | % moderate | % heavy | % poor vigor | Average Height Crown (in) |
| Artemisia tridentata wyomingensis | | | | | | | | | |
| 84 | **9565** | 55 | 36 | 9 | 699 | 51 | 8 | 0 | 17/28 |
| 90 | **7665** | 28 | 37 | 35 | 166 | 42 | 0 | 10 | 15/14 |
| 96 | **9620** | 16 | 76 | 9 | 400 | 31 | 3 | 87 | 16/23 |
| 01 | **10440** | 12 | 47 | 41 | - | 32 | 0 | 2 | 15/22 |
| 06 | **6760** | 7 | 72 | 21 | 340 | 20 | 14 | 14 | 12/18 |
| 11 | **7720** | 43 | 50 | 8 | 27560 | 12 | 0 | 4 | 16/23 |
| Atriplex gardneri falcata | | | | | | | | | |
| 84 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| 90 | **33** | 100 | 0 | - | - | 0 | 0 | 0 | -/- |
| 96 | **180** | 0 | 100 | - | - | 0 | 0 | 0 | 4/10 |
| 01 | **240** | 0 | 100 | - | - | 0 | 0 | 0 | 2/7 |
| 06 | **160** | 13 | 88 | - | - | 0 | 0 | 0 | 4/10 |
| 11 | **20** | 0 | 100 | - | - | 0 | 0 | 0 | 3/6 |

| | | Age class distribution | | | | Utilization | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Plants per Acre (excluding seedlings) | % Young | % Mature | % Decadent | Seedling (plants/acre) | % moderate | % heavy | % poor vigor | Average Height Crown (in) |
| Chrysothamnus viscidiflorus stenophyllus | | | | | | | | | |
| 84 | **332** | 50 | 50 | 0 | - | 10 | 0 | 0 | 11/25 |
| 90 | **699** | 0 | 5 | 95 | - | 0 | 0 | 86 | 8/15 |
| 96 | **340** | 0 | 94 | 6 | - | 0 | 0 | 88 | 9/15 |
| 01 | **140** | 0 | 57 | 43 | - | 0 | 0 | 0 | 7/14 |
| 06 | **320** | 0 | 88 | 13 | - | 0 | 0 | 19 | 10/17 |
| 11 | **340** | 0 | 100 | 0 | - | 6 | 0 | 0 | 8/15 |
| Eriogonum microthecum | | | | | | | | | |
| 84 | **0** | 0 | 0 | 0 | - | 0 | 0 | 0 | -/- |
| 90 | **0** | 0 | 0 | 0 | - | 0 | 0 | 0 | -/- |
| 96 | **20** | 0 | 100 | 0 | - | 0 | 0 | 0 | 6/11 |
| 01 | **20** | 0 | 0 | 100 | - | 0 | 0 | 0 | 6/9 |
| 06 | **0** | 0 | 0 | 0 | - | 0 | 0 | 0 | -/- |
| 11 | **20** | 0 | 100 | 0 | - | 0 | 0 | 0 | 6/8 |
| Leptodactylon pungens | | | | | | | | | |
| 84 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| 90 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| 96 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| 01 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | 33/44 |
| 06 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| 11 | **0** | 0 | 0 | - | - | 0 | 0 | 0 | -/- |
| Opuntia sp. | | | | | | | | | |
| 84 | **33** | 0 | 100 | - | - | 0 | 0 | 0 | 7/17 |
| 90 | **33** | 0 | 100 | - | - | 0 | 0 | 0 | 6/17 |
| 96 | **60** | 33 | 67 | - | - | 0 | 0 | 0 | 4/7 |
| 01 | **20** | 0 | 100 | - | - | 0 | 0 | 0 | 4/11 |
| 06 | **20** | 0 | 100 | - | - | 0 | 0 | 0 | 6/16 |
| 11 | **20** | 0 | 100 | - | - | 0 | 0 | 0 | 4/12 |