

## WILDLIFE MANAGEMENT UNIT 2 - CACHE

### Boundary Description

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

### Management Unit Description

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

The Wellsville Mountains have remained relatively inaccessible because of the steep topography. Rising abruptly from the valley floor, the ridge of the Wellsville Mountains reaches over 9,300 feet in elevation. The upper limit for normal winter range is generally 7,000 feet, but in severe winters that limit drops to about 6,000-6,500 feet. In some canyons the upper limit drops to 6,000 feet and excludes the north slopes. Box Elder Canyon reaches a low limit at 5,400 feet. The lower limit follows an elevation of 4,400 feet. Most deer summer on the east side of the Wellsville Mountains and migrate to the west side each fall for winter range. Coldwater Canyon is the most notable concentration area for deer, and there is some migration from the Mantua-Willard herd unit. Most of the deer that winter on Clarkston Mountain range, also summer on the Caribou National Forest in Idaho. Land development and associated habitat loss is still a critical problem facing wildlife management in this area.

The majority of the deer range, along with the largest deer herd, is within the Cache County portion of the unit. Most of this herd summers at higher elevations in the Wasatch-Cache National Forest west of the Wasatch Range summit. The majority of the winter range is also on Forest Service land. The south-facing slopes of Blacksmith Fork, Logan, Dry, Providence, and Millville canyons are all important wintering areas. The lower winter range limits are restricted by the upper limits of the towns and cities of Cove, Richmond, Smithfield, Hyde Park, North Logan, Logan, Providence, Millville, Nibley, and Hyrum. These limits to the winter range also include the deer-proof fence above agricultural land between Hyrum and Logan. Between Hyde Park and the Idaho border, the lower third of the winter range is located on private land and is threatened by increased cultivation and subdivision developments.

The Rich County portion of the Cache deer herd unit, located on the east face of the Wasatch Range, is topographically similar to the west face. However, the drainages of Swan Creek, Garden City Canyon, Jebo Canyon, Cottonwood Canyon, and Temple Canyon are not as deep as those on the west face. Elevation ranges between 5,900 feet at Bear Lake and 9,114 feet on Swan Peak. Randolph and Woodruff are the principle municipalities located in Rich County. These towns are located on a strip of private land along the Bear River. Much of the lower country is privately owned and is grazed or farmed. Estimates are that 74,560 acres (33%) of the winter range is private land (Jense et al. 1985). A much higher percentage of the severe winter range is private. The Bureau of Land Management (BLM) owns a majority of the winter range, controlling much of the land in the central part of the unit and the Crawford Mountains to the east. The upper limit of the winter

range begins at about 8,000 feet at the Idaho border and gradually descends to 6,000 feet at Cottonwood Canyon. The lower limit generally follows the 6,000-foot contour.

### **Range Trend Studies**

Twenty-eight interagency range trend studies were sampled in Unit 2 during the summer of 2011. A total of forty-five studies have been established within Unit 2 since 1984. Thirty-one range trend study sites were established in 1984, and of these studies, ten studies [High Creek (2-1), Green Canyon Exclosure (2-6), Millville Canyon (2-8), Broad Hollow Flat (2-10), Second Dam Blacksmith Fork (2-12), Hardware Plateau (2-13), Meadowville (2-17), Flat Bottom Canyon (2-23), Calls Fort Canyon (2-24), and Mouth of Two Jump Canyon (2-25)] sample mountain big sagebrush communities; one study [Mouth of Blacksmith Fork (2-2)] samples a basin big sagebrush community; two studies [Crow Mountain (2-4) and Beirdneau (2-9)] sample antelope bitterbrush communities; two studies [East of Richmond (2-3) and Smithfield Dry Canyon (2-5)] sample perennial grass communities; four studies [Spawn Creek (2-7), Lower Hodges Canyon (2-15), Upper Hodges Canyon (2-18), and Box Elder Canyon (2-22)] sample mountain brush communities; one study [Garden City Canyon (2-16)] samples a curlleaf mountain mahogany community; one study [Laketown Canyon (2-27)] samples a mountain mahogany community; seven studies [North Eden (2-28), Woodruff Creek (2-29), Stateline (2-30), South Crawford Mountains (2-31), Otter Creek (2-34), Higgins Hollow (2-35), and Rich County Landfill (2-44)] sample Wyoming big sagebrush communities; two studies [Wood Pass (2-32) and Dry Canyon (2-14)] sample juniper communities; and one study [Braizer Canyon (2-33)] samples a black sagebrush community. Five studies were established in 1990, and of these studies, two studies [Right Fork Logan Canyon (2-19) and Richmond WMA (2-20)] sample antelope bitterbrush communities; one study [Swan Creek (2-21)] samples a curlleaf mountain mahogany community; one study [Woodruff Co-op (2-36)] samples a Wyoming big sagebrush community; and one study [Wellsville Canyon (2-26)] samples a mountain brush community. Five studies were established in 1996, and of these studies, four studies [Twin Creek (2-38), Pole Hollow Spring (2-39), Warrens Spring (2-40), and Boundary Spring (2-41)] sample mountain brush communities; and one study [Rock Creek Riparian (2-37)] samples a riparian community. One study [Coldwater WMA (2R-5)] was established in 1998, and samples mountain big sagebrush community. One study [Curtis Ridge (2R-15)] was established in 2006, and samples a low sagebrush community. One study [Woodruff Longhill (2-43)] was established in 2009, and samples a Wyoming big sagebrush community. One study [Hardware Gravel Pit (2-42)] was established in 2011, and samples a mountain big sagebrush community.

In 1984, one study (East of Richmond) was suspended. In 1990, one study (Rich County Landfill) was suspended. In 1996, seven studies (Smithfield Dry Canyon, Spawn Creek, Millville Canyon, Broad Hollow Flat, Dry Canyon, Upper Hodges Canyon, and Box Elder Canyon) were suspended. In 2001, six studies (Crow Mountain, Green Canyon Exclosure, Richmond WMA, Calls Fort Canyon, Wellsville Canyon, and Boundary Spring) were suspended. In 2006, two studies (Rock Creek Riparian and Lower Hodges Canyon) were suspended. These sites were suspended for various reasons and if the need arises in the future, these studies can be sampled again. To access maps, discussions, and data tables for suspended studies see: <http://www.wildlife.utah.gov/range>.

## SUMMARY

### WILDLIFE MANAGEMENT UNIT 2 - CACHE

#### Community Types

Deer winter range within a unit is summarized into three categories based on ecological potentials which include **low potential**, **mid-level potential** and **high potential**. Low potential sites include desert shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and cliffrose (*Cowania mexicana* ssp. *stansburiana*) communities. Mid-level potential sites include mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) communities. High potential sites include mountain brush communities. Low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) communities are placed within the low potential or mid-level potential scales based on precipitation and elevation. Deer **summer range** is summarized separately from winter range as a fourth category and typically includes aspen (*Populus tremuloides*) and high elevation mountain brush communities. Twenty eight interagency range trend studies were sampled in Unit 2 during the summer of 2011.

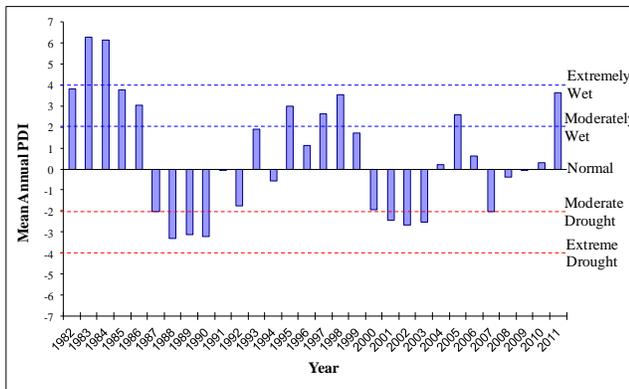
Eighteen of the studies [High Creek (2-1), Mouth of Blacksmith Fork (2-2), Beirdneau (2-9), Second Dam Blacksmith Fork (2-12), Hardware Plateau (2-13), Garden City Canyon (2-16), Meadowville (2-17), Right Fork Logan Canyon (2-19), Swan Creek (2-21), Flat Bottom Canyon (2-23), Mouth of Two Jump Canyon (2-25), Laketown Canyon (2-27), Twin Creek (2-38), Pole Hollow Spring (2-39), Warrens Spring (2-40), Hardware Gravel Pit (2-42), Coldwater WMA (2R-5), and Curtis Ridge (2R-15)] are categorized as mid-level potential sites for deer winter range, and sample mountain big sagebrush, basin big sagebrush, or other mountain brush communities. Though categorized as deer winter range in this summary, the Twin Creek and Pole Hollow Spring studies are considered to be crucial deer summer range and fawning habitat. The Mouth of Two Jump Canyon and Coldwater WMA studies are considered to be elk year-long range; and the Beirdneau, Second Dam Blacksmith Fork, Hardware Plateau, Garden City Canyon, Meadowville, Right Fork Logan Canyon, Swan Creek, Flat Bottom Canyon, Laketown Canyon, Twin Creek, Pole Hollow Spring, Warren Spring, Hardware Gravel Pit, and Curtis Ridge studies are considered elk winter range.

The remaining ten studies [North Eden (2-28), Woodruff Creek (2-29), State Line (2-30), South Crawford Mountains (2-31), Wood Pass (2-32), Braizer Canyon (2-33), Otter Creek (2-34), Higgins Hollow (2-35), Woodruff Co-op (2-36), and Woodruff Longhill (2-43)] are classified as low potential deer winter range sites, and sample Wyoming big sagebrush or black sagebrush communities. The Woodruff Creek, Otter Creek, Higgins Hollow, and Woodruff Long Hill studies are also considered to be elk winter range.

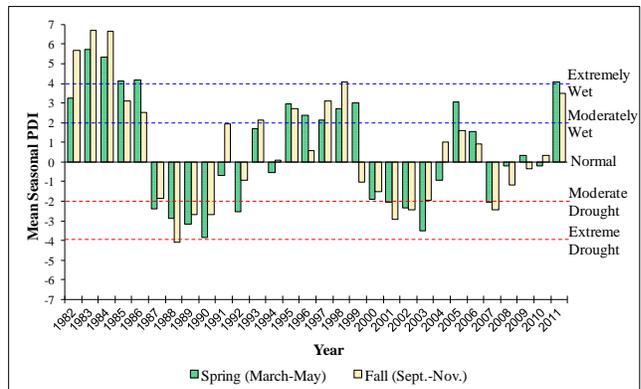
#### Precipitation

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation and 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 Northern Mountains (Division 5). The Northern Mountains had a historic annual mean precipitation of 19.16 inches from 1895 to 2011. The mean annual PDSI of the Northern Mountains displays a cycle of several wet years followed by several drought years, over the course of study years in the unit. Over the course of the study, wetter than normal years in the Northern Mountains included 1982-1986, 1993, 1995-1999, 2005, and 2011. Drought years included 1987-1992, 2000-2003 and 2007 (Figure 1 and Figure 2) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 8-10 in. on the South Crawford Mountains and Woodruff Co-op studies; 10-12 in. on the State Line, Otter Creek, and Higgins Hollow studies; 12-14 in. on the Meadowville, Laketown Canyon, Wood Pass, and Brazier Canyon studies; 14-16 in. on the North Eden, Woodruff Creek, and Woodruff Longhill studies; 18-20 in. on the Hardware Plateau, Garden City Canyon, Warren Spring, and Hardware Gravel Pit studies; 20-24 in. on the High Creek, Mouth of Blacksmith Fork, Second Dam Blacksmith Fork, Right Fork Logan Canyon, Swan Creek, Flat Bottom Canyon, and Pole Hollow Spring



**Figure 1.** The 30 year mean annual Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = 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  $\leq -4.0$  = Extreme Drought (Time Series Data 2012).



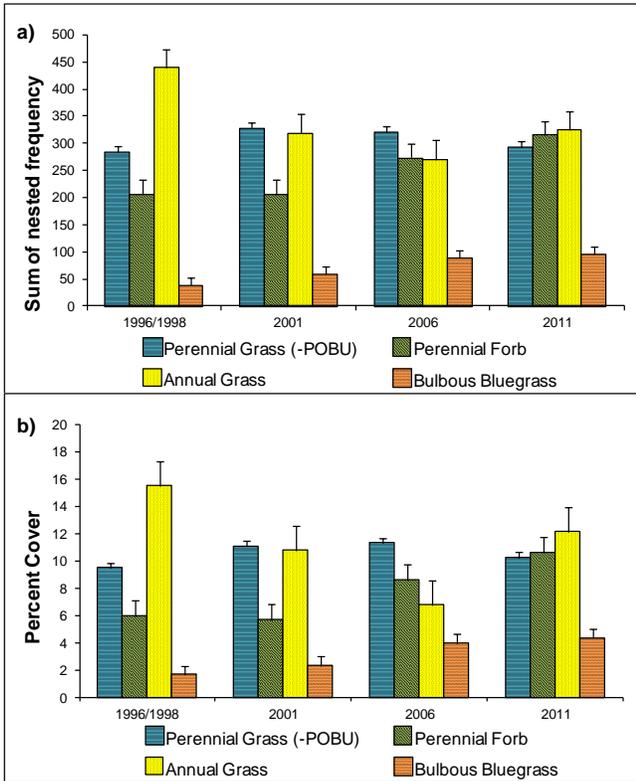
**Figure 2.** The 30 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = 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  $\leq -4.0$  = Extreme Drought (Time Series Data 2012).

studies; 24-28 in. on the Beirdneau and Curtis Ridge studies; 28-32 in. on Mouth of Two Jump Canyon, Twin Creek, and Coldwater WMA studies (PRISM Climate Group 2011).

### Mountain/Basin Big Sagebrush and Antelope Bitterbrush Communities (Mid-Level Potential)

**Browse:** The mid-level potential site cumulative median browse trend for the unit has decreased over the course of the study. The decreases in trend occurred in the 1990, 2001, and 2006 sample years (Figure 9a). The dominant browse species on the majority of the mid-level potential studies is mountain big sagebrush, though basin big sagebrush was the dominant species on the Mouth of Blacksmith Fork study. The two big sagebrush species were averaged together in this summary. The addition of the Hardware Gravel Pit, Coldwater WMA, and Curtis Ridge studies after 1996 has influenced the means for the variables of big sagebrush in the unit. If these three studies are excluded, there is a definitive decline in big sagebrush on the mid-level potential studies in the unit. A wildfire removed most of the browse from the Mouth of Blacksmith Fork study sometime between 2006 and 2011, and was the primary driver of the decline in big sagebrush in 2011. The mean density big sagebrush of all the mid-level potential studies decreased significantly from 1996/1998 to 2001. Since 2001, mean density of big sagebrush has increased slightly each sample year, but has remained significantly similar (Figure 4a). Despite the changes in density, mean cover of big sagebrush increased significantly in 2006, and remained higher in 2011 (Figure 4b). The mean decadence of big sagebrush has been high since 1996/1998 despite a significant decrease in 2006 (Figure 4c). If studies established after 1996 are excluded from the sample the mean density of big sagebrush has shown a steady decrease since 1996 (Figure 5a), and mean cover has shown a steady decrease since 2001 (Figure 5b).

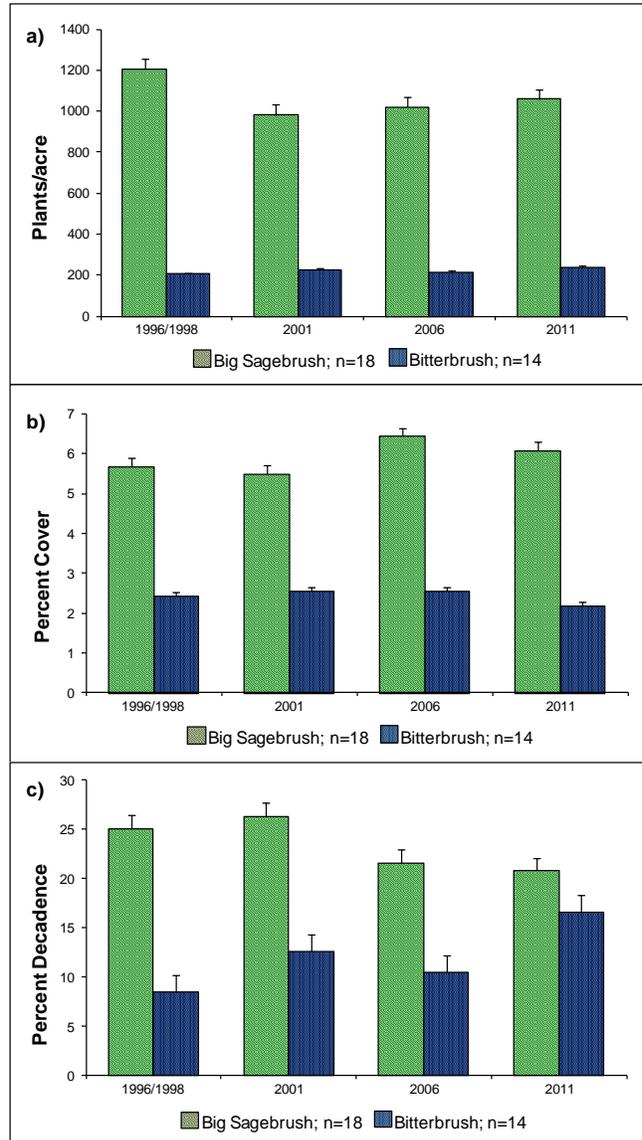
Antelope bitterbrush (*Purshia tridentata*) is the dominant browse species on the Beirdneau and Right Fork Logan Canyon studies, and is a common component on the High Creek, Second Dam Blacksmith Fork, Hardware Plateau, Garden City Canyon, Meadowville, Swan Creek, Twin Creek, Pole Hollow Spring, Warrens Spring, Hardware Gravel Pit, and Curtis Ridge studies. The mean antelope bitterbrush density and cover has remained fairly similar since 1996/1998 (Figure 4a and Figure 4b). Mean decadence of antelope bitterbrush was moderate from in 1996/1998 to 2006, but increased significantly in 2011 due to the inclusion of the new study Hardware Gravel Pit (Figure 4c). Low sagebrush is the dominant browse species on the Garden City Canyon and Curtis Ridge studies, but was not included in this summary. For more information on low sagebrush, refer to the discussion section of these two studies.



**Figure 3.** a) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass (*Poa bulbosa*) sum of nested frequency by year for WMU 2, Cache. b) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 2.

**Herbaceous Understory:** The mid-level potential median cumulative grass trend for the unit has increased over the course of the study years. The main increase was in 1990, with a slight increase in 2001. The median trend has remained fairly stable since 2001 (Figure 9a). Desirable perennial grass species are typically only moderately diverse and abundant on these studies. Annual grass species are prevalent and often dominate the herbaceous component. Cheatgrass (*Bromus tectorum*) is typically the most common annual grass species, but the weedy species jointed goatgrass (*Aegilops cylindrica*) and the weedy species winter rye (*Secale cereale*) are the dominant species on the Mouth of Blacksmith Fork study. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) is also common on many of the studies. The mean sum of nested frequency and cover of perennial grasses, excluding bulbous bluegrass, was significantly higher in 2001 and 2006 than in 1996/1998 and 2011. The mean sum of nested frequency and cover of annual grasses steadily decreased from 1996/1998 to 2006, but increased again in 2011. The mean nested frequency and cover of bulbous bluegrass has steadily increased since 1996/1998 (Figure 3a and Figure 3b).

The mid-level potential median cumulative forb trend for the unit has decreased slightly over the course of the study. There was a slight decrease in trend in 1990 and 1996/1998, but the median trend of forbs has remained stable since 1996/1998 (Figure 9a). Perennial forbs have been more diverse and often more abundant than perennial grasses within the sampled communities. However, while some of the studies have a good composition of desirable forbs, many of the studies are dominated by weedy or low value forage species. The



**Figure 4.** a) Mid-level potential sites mean density of big sagebrush (*Artemisia tridentata*) antelope bitterbrush (*Purshia tridentata*) by year for WMU 2, Cache. b) Mid-level potential sites mean cover of big sagebrush and antelope bitterbrush by year for WMU 2. c) Mid-level potential sites mean decadence of big sagebrush and antelope bitterbrush by year for WMU 2.

mean sum of nested frequency and cover of perennial forbs has steadily increased since 2001 (Figure 3a and Figure 3b).

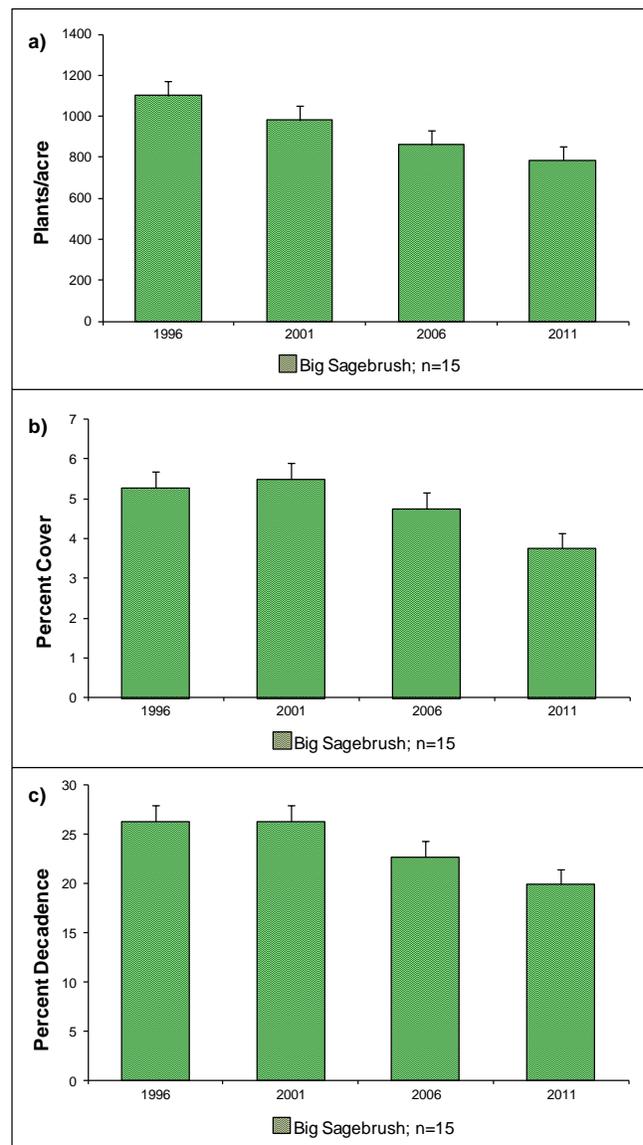
**Browse Utilization & Animal Presence:** Big sagebrush plants on many of the mid-level potential studies displayed heavy use at the outset of the studies in 1984, but have displayed mostly light to moderate use throughout the subsequent study years. While prolonged heavy utilization of browse can have detrimental effects on the health of the browse community, it does not appear that animal utilization of big sagebrush is a primary concern for the mid-level potential studies on this unit.

Pellet group transect data indicates that deer and elk both occupy these study areas. The mean abundance of sampled deer pellet groups has decreased from moderate abundance in 2001 to much lower abundance in 2011. Deer pellet groups were sampled in the highest abundance on the Hardware Plateau, Garden City Canyon, Meadowville, Swan Creek, Mouth of Two Jump Canyon, and Warren Spring studies, but deer use was much lower on many of these studies in 2011. The mean abundance of sampled elk pellet groups was light in 2001 and 2011, with more moderate use in 2006. The reduced use by both wildlife species in 2011 was most likely due to the severe winter of 2010-2011, which likely limited access to many of the sites. Elk pellet groups were sampled in the highest abundance on the Right Fork Logan Canyon and Swan Creek studies. Livestock use appears to be mostly light on the studies (Figure 10a).

**Deer Desirable Components Index (DCI):** The mid-level potential deer DCI has remained fairly stable since 1996, with rankings ranging from poor to very-poor-poor since 1996/1998. Attributes of preferred browse species have had poor scores, and annual grass scores have been moderately high since 1996/1998 (Table 1 and Figure 8).

**Discussion:** If studies established after 1996 are excluded, there has been a substantial decline in big sagebrush populations that gives some cause for concern in these mid-level potential communities. The High Creek and Pole Hollow Spring studies have driven the pattern of big sagebrush decline from 1996 to 2006 for mid-level potential studies on the unit. A wild fire on the Mouth of Blacksmith Fork study between 2006 and 2011 removed most of the browse from that study, and was the primary cause of decreases in big sagebrush in 2011. Other causes of the sagebrush decline are varied and multiple causes may have compounded effects on the mid-level potential studies in this unit.

Precipitation can have large impacts on the vegetation trends, and there have been several moderate drought periods since 1996 (Figure 1 and



**Figure 5.** a) Mid-level potential sites mean density of big sagebrush (*Artemisia tridentata*), excluding studies established after 1996, by year for WMU 2, Cache. b) Mid-level potential sites mean cover of big sagebrush, excluding studies established after 1996, by year for WMU 2. c) Mid-level potential sites mean decadence of big sagebrush, excluding studies established after 1996, by year for WMU 2.

Figure 2). While lack of precipitation may have caused some stress on sagebrush plants, it does not appear to be the primary cause of the decline on the mid-level potential studies.

The abundance of weedy annual grass species, and the increase of the exotic, weedy, perennial grass bulbous bluegrass are the more likely causes of sagebrush decline. These weedy species can form dense mats of cover that compete with seedling and young sagebrush plants, which limits establishment of new sagebrush plants into the population. As the sagebrush population matures, decadence increases and density decreases as old plants begin to die. Annual grass species such as cheatgrass can also increase fuel loads and increase the chance of a catastrophic fire event. Annual grass species are present on all of the mid-level potential studies, but are not overly abundant on the Twin Creek, Pole Hollow Spring, Warrens Spring, and Curtis Ridge studies. Annual grasses have had a large increase on the Mouth of Blacksmith Fork canyon following the wildfire. Annual grasses have had decreases on the High Creek, Beirdneau, Garden City Canyon, Swan Creek, Mouth of Two Jump Canyon, Pole Hollow Spring, and Warrens Spring studies. However, decreases in annual grass species on many of the studies appears to correspond with increases in the weedy species bulbous bluegrass. Bulbous bluegrass is present on all of the mid-level potential studies except Laketown Canyon, and has shown marked increases on High Creek, Right Fork Logan Canyon, Swan Creek, Flat Bottom Canyon, Mouth of Two Jump Canyon, Twin Creek, Coldwater WMA, and Curtis Ridge studies since 1996. There was a large increase in bulbous bluegrass on the Mouth of Blacksmith Fork study from 1996 to 2006, but bulbous bluegrass decreased substantially on the site in 2011 following the wildfire.

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96/98	12.0	5.9	3.1	18.5	-10.9	8.1	-0.7	<b>36.0</b>	Very Poor-Poor
01	11.3	5.1	1.8	18.9	-8.1	8.0	-0.6	<b>36.3</b>	Very Poor-Poor
06	13.2	6.6	1.8	20.7	-4.6	9.0	-0.9	<b>45.8</b>	Poor
11	12.5	5.2	1.8	18.1	-7.7	8.9	-0.8	<b>38.1</b>	Poor

**Table 1.** Mid-level potential scale mean deer DCI scores and rankings (n=18) by year for WMU 2, Cache. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

### Wyoming Big Sagebrush and Black Sagebrush Communities (Low Potential)

**Browse:** The low potential site cumulative median browse trend for the unit has decreased over the course of the study. Trend decreased slightly in 1990 and again in 2006 (Figure 9b). Wyoming big sagebrush is common on all of the low potential studies, and is the dominant browse species on all of the studies except Wood Pass and Brazier Canyon, which are dominated by black sagebrush. The mean density and cover of Wyoming big sagebrush decreased significantly in 2006. There was an increase in both parameters in 2011, but most of this increase was due to the addition of the Woodruff Longhill study (Figure 7a and Figure 7b). Mean decadence of Wyoming big sagebrush has fluctuated somewhat, but has been high on the studies since 1996 (Figure 7c).

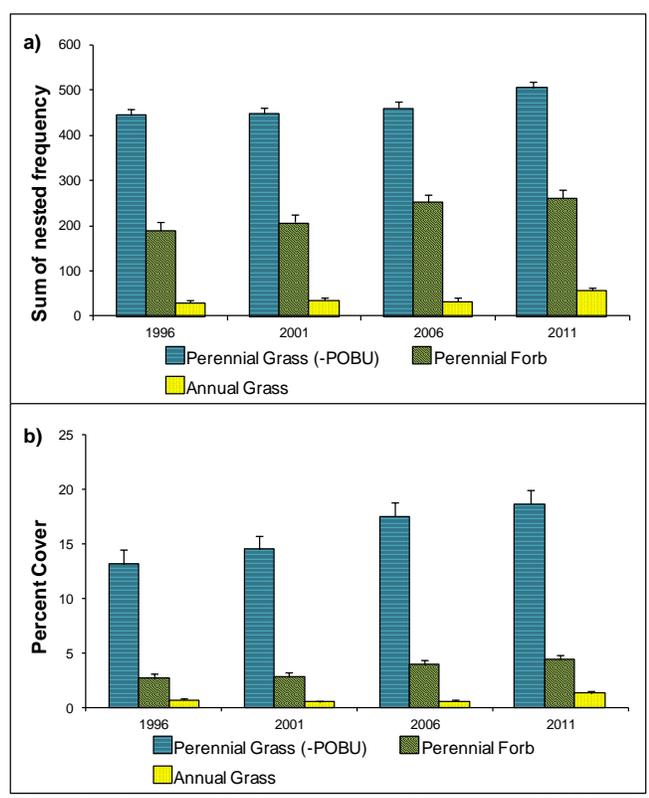
**Black sagebrush** is the dominant browse species on the Wood Pass and Brazier Canyon studies, with less dense populations also occurring on the North Eden and South Crawford Mountains' studies. Mean density of black sagebrush was similar from 1996 to 2006, but decreased significantly in 2011 (Figure 7a). Mean cover of black sagebrush was similar in 1996, 2006, and 2011, but was significantly higher in 2001 (Figure 7b). Mean decadence of black sagebrush was low in 1996, but has steadily increased since that time. There has been a significant increase in mean decadence from 2001 to 2011 (Figure 7c).

**Herbaceous Understory:** The low potential median cumulative grass trend for the unit remained relatively stable over the course of the study, but increased slightly in 2011(Figure 9b). Perennial grasses comprise the majority of the herbaceous understory on most of these studies. Grasses within these communities are

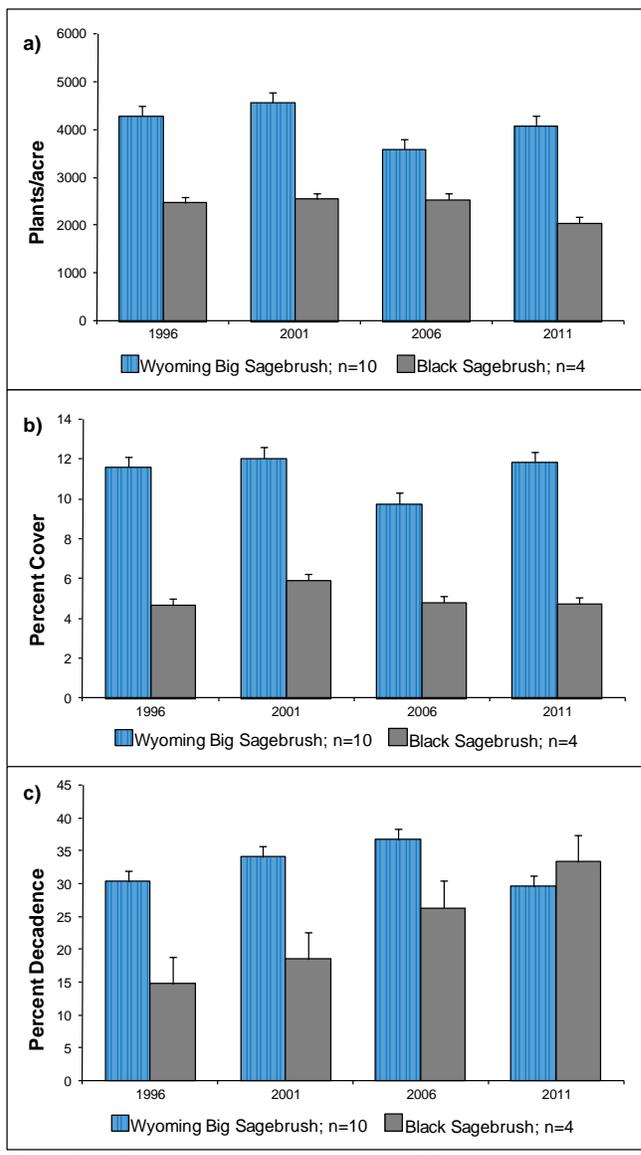
moderately diverse and abundant. Annual grass species are much less common within these low potential communities than the mid-level potential communities. Bulbous bluegrass is very rare on the sites and was not included in the summary for low potential sites. Mean sum of nested frequency of perennial grasses remained similar from 1996 to 2006, then increased significantly in 2011 (Figure 6a). Mean cover of perennial grasses was similar from 1996 to 2001, increased significantly in 2006, and remained similar in 2011 (Figure 6b).

The low potential median cumulative forb trend for the unit decreased slightly in 1990 and 1996, but increased slightly in 2001 and 2006. Trend has remained stable overall (Figure 9b). Perennial forbs are also moderately diverse, but are not as abundant as perennial grasses within the sampled communities. The mean sum of nested frequency and cover of perennial forbs was similar from 1996 to 2001, increased significantly in 2006, and remained similar in 2011 (Figure 6a and Figure 6b).

**Browse Utilization & Animal Presence:** Wyoming big sagebrush and black sagebrush plants on most of the low potential studies displayed moderate to heavy use at the outset of the study in 1984, but have displayed light to moderate use in subsequent sample years. Utilization of Wyoming big sagebrush was heavier on the State Line, South Crawford Mountains, and Woodruff Co-op studies in 2011, likely due to the severe winter of 2010-2011 restricting animals' access to higher elevation winter range. While prolonged heavy utilization of browse can have detrimental effects on the health of the browse community, it does not appear that animal utilization of sagebrush is a



**Figure 6.** a) Low potential sites mean perennial grass, perennial forb, and annual grass sum of nested frequency by year for WMU 2, Cache. b) Low potential sites mean perennial grass, perennial forb, and annual grass cover by year for WMU 2.



**Figure 7.** a) Low potential sites mean density of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and black sagebrush (*A. nova*) by year for WMU 2, Cache. b) Low potential sites mean cover of Wyoming big sagebrush and black sagebrush by year for WMU 2. c) Low potential sites mean decadence of Wyoming big sagebrush and black sagebrush by year for WMU 2.

primary concern for the low potential studies on this unit.

Pellet group transect data indicates that deer predominantly occupy these study areas. The mean abundance of sampled deer pellet groups has been high. The abundance of sampled deer pellet groups increased slightly in 2006, but decreased again in 2011. Deer pellet groups were sampled in the highest abundance on the North Eden, Woodruff Creek, South Crawford Mountains, Braizer Canyon, Otter Creek, Woodruff Co-op, and Woodruff Longhill studies. In 2011, there was a large increase in the abundance of deer pellet groups on the Stateline and Woodruff Co-op studies, but a large decrease in abundance on the North Eden and Woodruff Creek studies. These increases and decreases in presence are likely due to restricted movement of animals because of the severe winter of 2010-2011. Elk pellet groups have been sampled in low abundance on most studies, but have been sampled moderate abundance on the Wood Pass study. Cattle sign has been sampled in low abundance on most studies, but was high on the Woodruff Co-op study in 2001 (Figure 10b).

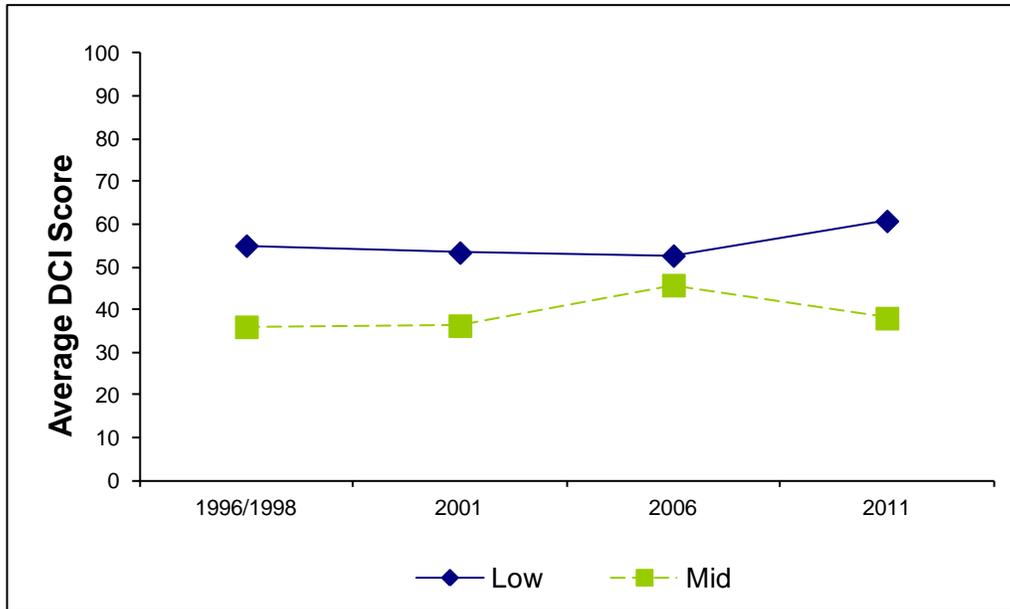
Deer Desirable Components Index (DCI): The low potential deer DCI has remained relatively stable since 1996 with a ranking of good. The DCI shows that the unit is characterized by studies with moderate browse cover and high perennial grass cover (Table 2 and Figure 8).

Discussion: The mean Wyoming big sagebrush density and cover decreased in 2006 within the low potential studies on the unit. The decrease in density was primarily driven by decreases on the Brazier Canyon, Otter Creek, and Higgins Hollow studies in 2006. The Otter Creek study was part of an aerator treatment that occurred in 2004, reducing browse on the study site. The decrease in Wyoming big sagebrush cover was primarily due to a decrease on the North Eden study, which has steadily decreased in Wyoming big sagebrush cover since 1996 despite a fairly stable density. Much of the decrease in cover on the North Eden study is due to a decrease in the average plant size, as well as an increase in decadence. Despite the decreases in Wyoming big sagebrush, it remains relatively abundant on the low potential studies within the unit.

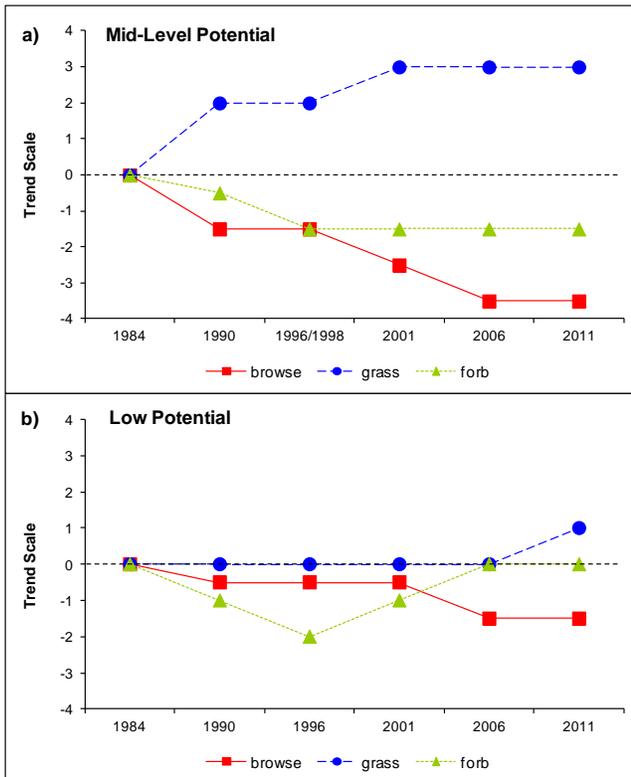
Causes of sagebrush decline are varied and multiple causes may have compounded effects on the low potential studies in this unit. The moderate drought period from 2000 to 2004 (Figure 1 and Figure 2) has likely caused increased stress on plants, and negatively impacted these low potential studies. Annual grass species are not prevalent on most of the studies, but the weedy species cheatgrass has increased on the North Eden study since 1996. The weedy perennial species bulbous bluegrass is not common on any of the low potential studies in this unit. Perennial grass and forb species have increased on many of the studies as browse species decline, and may compete with browse establishment. This is especially the case for the seeded perennial species crested wheatgrass (*Agropyron cristatum*) which is prevalent on the Otter Creek and Woodruff Co-op studies.

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	17.4	6.1	3.5	23.0	-0.4	5.3	0.0	<b>55.0</b>	Good
01	18.2	4.1	2.3	23.9	-0.3	5.5	-0.2	<b>53.4</b>	Good
06	15.3	3.5	2.7	24.7	-0.3	6.9	0.0	<b>52.7</b>	Good
11	18.1	4.9	5.7	25.6	-0.7	7.2	0.0	<b>60.8</b>	Good

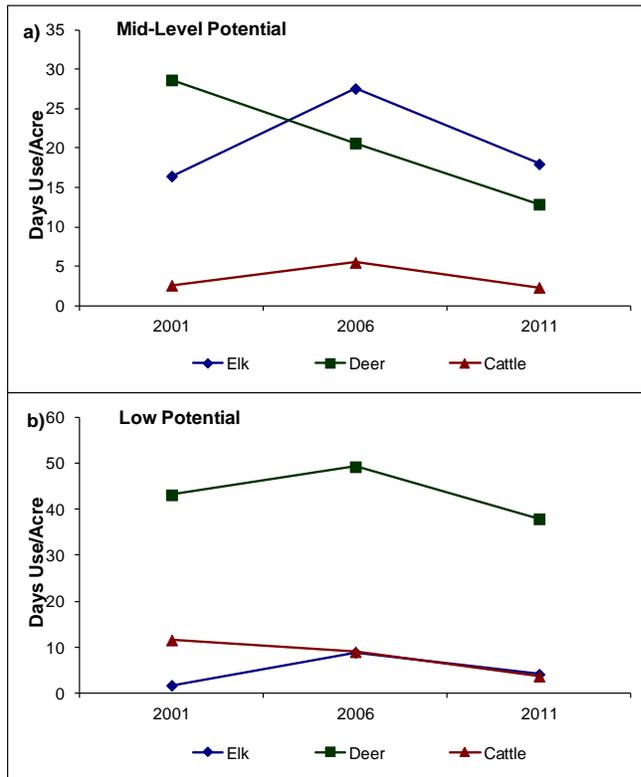
**Table 2.** Low potential scale mean deer DCI scores and rankings (n=10) by year for WMU 2, Cache. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.



**Figure 8.** Mean low (n=10) and mid-level (n=18) potential scale deer DCI scores by year for WMU 2, Cache. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.



**Figure 9.** a) Mid-level potential sites cumulative median browse, grass and forb trends by year for WMU 2, Cache. b) low potential sites cumulative median browse, grass and forb trends by year for WMU 2.



**Figure 10.** a) Mid-level potential sites mean animals days use/acre (n=18) by year for WMU 2, Cache. b) Low potential sites mean animal days use/acre (n=10) by year for WMU 2.