

Antelope Creek Ranch

(Antelope Creek Habitat Development Area)



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Antelope Creek Habitat Development Area

Introduction

The Antelope Creek Habitat Development Area (ACHDA) was established in 1986 through a multi-agency partnership. Alberta Fish and Wildlife Division, Wildlife Habitat Canada, Ducks Unlimited Canada and the Alberta Fish and Game Association were the purchasing partners of the Antelope Creek Ranch. ACHDA is located in southern Alberta, west of Brooks. The land base is managed to provide productive plant cover for livestock and wildlife, and adequate nest cover for waterfowl on Mixed Grass prairie and wetland margins. Crested wheatgrass, irrigated pasture and native rangeland are incorporated into a complementary, deferred-rotation grazing system to achieve the management goals.

The Antelope Creek Habitat Development Area serves as a demonstration project for producers and resource managers in the Mixed Grass prairie region. ACHDA research focuses on range improvement through specialized grazing systems to benefit both livestock and wildlife. ACHDA has been a valuable tool in assisting several M.Sc. thesis research projects from the University of Alberta and the University of Lethbridge. In addition, ACHDA supports independent studies concerning wetlands, industrial reclamation, and tame grass production.

Research at ACHDA ranch consists of a co-operative, multi-disciplinary monitoring program to document changes in range vegetation and range condition, forage production and utilization, litter reserves, cattle performance, soil chemical and physical characteristics, and changes in relative diversity of wildlife.

This report covers the range vegetation and forage production component of the research. Jane Ecclestone¹ carried out the research at ACHDA under the supervision of Rangeland Management, Lands Division, Lethbridge, with funding support from the Antelope Creek Ranch.

¹Contract employee with Alberta SRD

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2007 Summary

Moisture conditions were good at the beginning of the 2007 season at Antelope Creek. This resulted in excellent early growth over-all, however as precipitation dropped off in June and July, growth was halted before the end of the growing season. January and February brought no precipitation, and March was slightly less than 50 percent of the 30 year average for that month. April and May received above average precipitation, while June received 30 percent below the 30 year average; July and August were very dry; finally September brought enough precipitation to keep the fields damp.

The cattle were released into the West Crested Wheat Field on May 15th, and taken off Native Field #3 on October 29. As a result of very low overall late spring and summer precipitation, vegetation growth stopped in July with production negatively impacted. None of the fields were grazed twice, and the Cassils field was not grazed at all.

Industrial activities involved reclamation of 2 lease well sites both on in Field #2, at the the Northwest battery site and also between the dams at the Northwest end of San Francisco Lake. Four well heads were also removed from leases in Field #2. Activities in Field #3 included the cleanup of two sumps left from drilling wells the previous fall, as well there was one well drilled at the end of October. Pengrowth sold its oil interests on the ranch in April but not before having two spills one stayed on lease but the other required fencing of the affected area as the grass was mowed and collected during the winter. There were numerous trucks traveling on the roads due to the reclamation projects and drilling activities on the ranch this past year.

Weather Information

Table 1. Brooks Temperatures and Precipitation.

	Mean temperatures (C)			Total precipitation (mm)		
	2006	2007	30 yr avg	2006	2007	30 yr avg
January	-2	-5.7	-11.3	10	0	14.7
February	-5	-6.8	-8.4	8	0	12.2
March	-3	2.8	-2.1	27	7.5	19.5
April	8	4.4	5.5	31	77.4	27.9
May	13	12	11.6	49	64.2	44.1
June	17	16.3	16	79	46	58.8
July	21	22.2	18.3	12	4	41.7
August	18	17.3	17.4	22	43.6	39.3
September	13.5	11.4	11.5	15.2	32	39.4
October	3.5	*M	6.3	18.3	*M	17
November	-4.9	*M	-4	12	*M	14.7
December	-3.5	*M	-9.9	5.2	*M	18.9

*M = Missing Data

The data used for Table 1, and Figures 1 and 2 were obtained from Environment Canada for Brooks. (The data may contain errors.)

Figure 1. Brooks Weather Station Precipitation

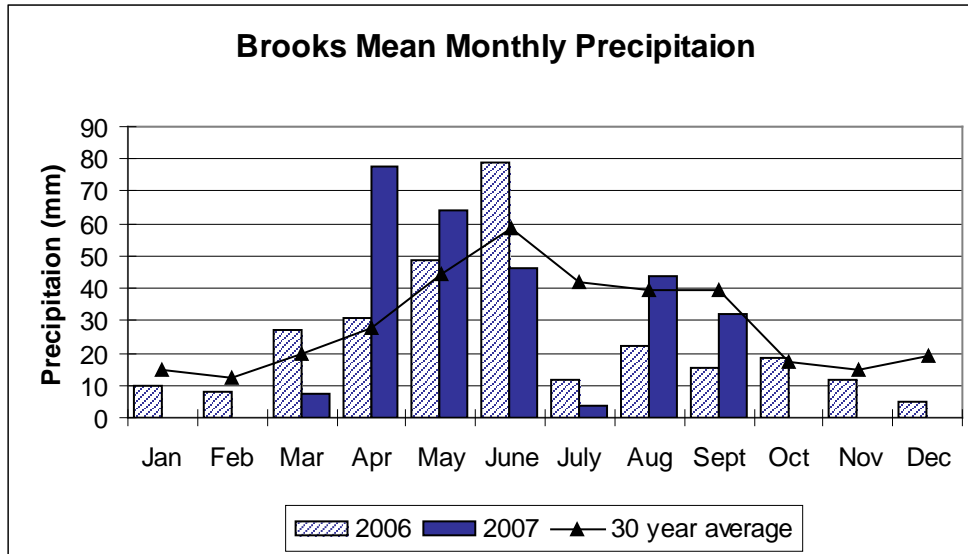
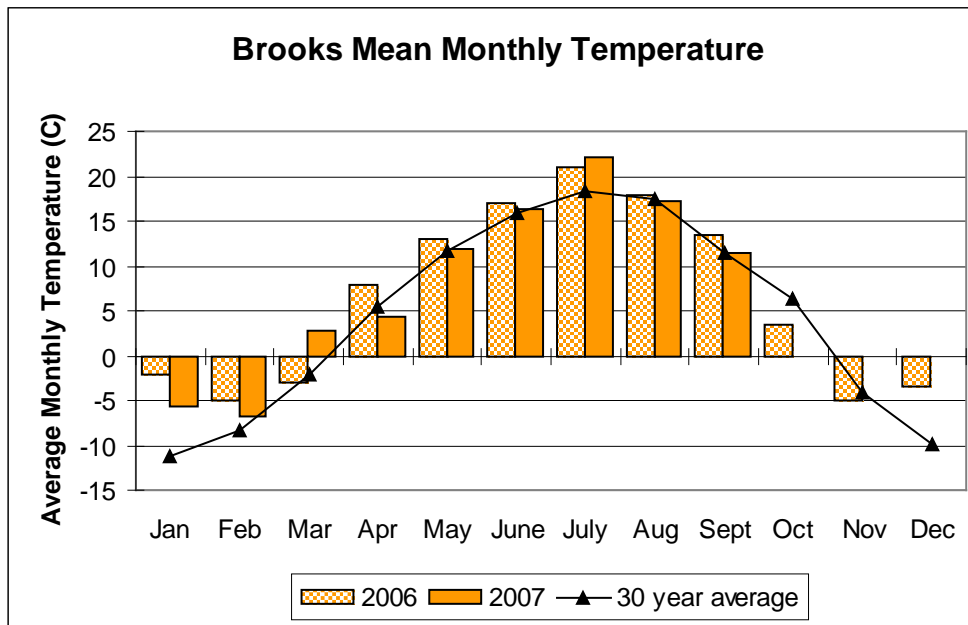


Figure 2. Brooks Weather Station Temperatures



Field Observations

By Jane Ecclestone

As a result of cattle rubbing, two cages in the East Crested Wheat field were knocked over, while repairs were required with two cages in native field #3, and four cages in native field #4, likely because of winter conditions. Repairs to native cages were completed in June before these fields were grazed. Cattle also grazed the tops off grasses in some of the cages in the Crested fields, the Pivot and Flood fields. In particular cages in the pivot fields were noticeably grazed likely because of low production in grazing areas accessible to cattle.

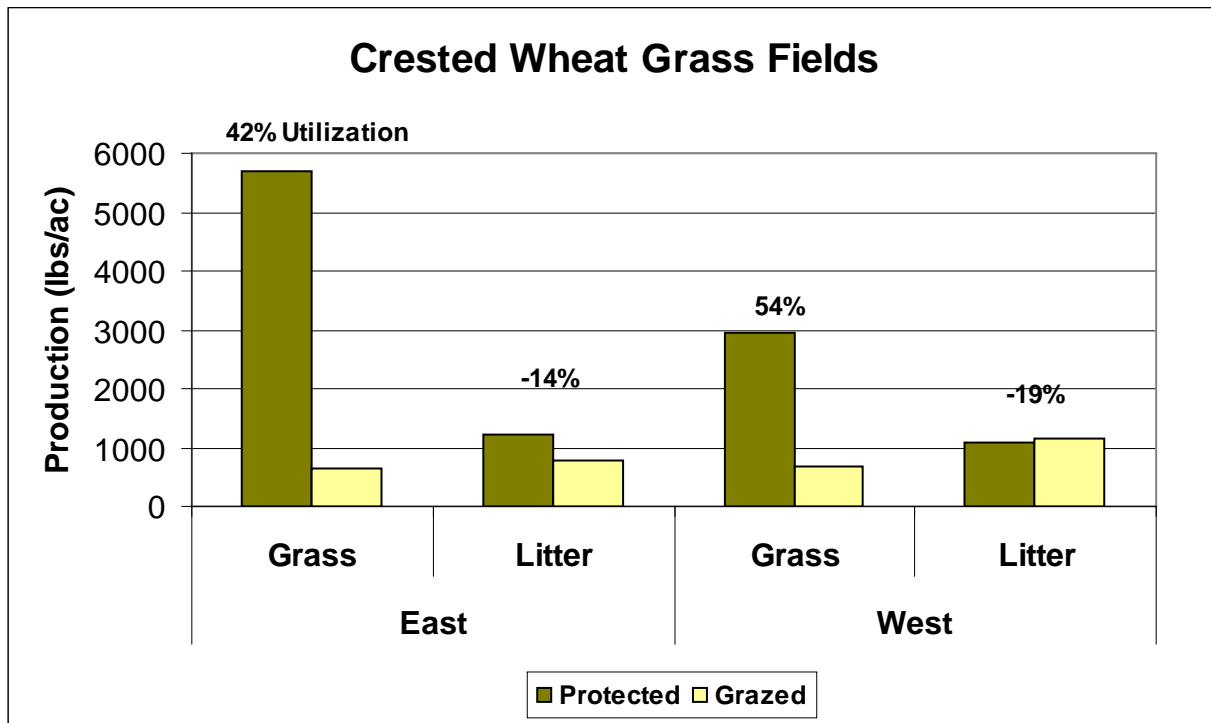
Cattle were moved into the West Crested field on May 15th, then into the East Crested Wheat field on 21 of May and moved out early on June 4th, as problems with the solar watering system prevented irrigation-adequate water supply for the cattle in this field. The East Flood was utilized for grazing next from June 4th to the 14th, then the East Pivot until June 27th. Fields were clipped as the cattle moved out of the fields or within a few days of moving. On June 29th a hail storm damaged the Crested Wheat grass field, further inhibiting growth and chances for a second grazing on this field. The West Pivot was utilized from June 27 to July 17th. The cattle spent 1 day grazing in the San Francisco field, then went into Native field #4 on July 18th until August 12. Further, approximately three and a half weeks were spent grazing in Native fields #1, #2, and #3 and moved from each field on September 6, October 3, and October 29 respectively. In addition the cattle spent one more day grazing in San Francisco field (North), before moving finally to Field #3.

Wildlife observations at the ranch were frequent. May 25th two Northern Harriers were observed soaring over field 3, followed by a viewing of a canvasback and mallard at the wetland on field 3, and a white-tailed rabbit also on field 3 and 6 Yellow-headed blackbirds were observed at East field four. On May 31st a Marbled Godwit and Northern Harrier were sighted flying low over field 1. On July 18th there was an early morning sighting of a Northern Harrier over the Control field. Also that day while clipping in the West Pivot field on July 18th, several times Swainson Hawks were heard calling in the treed area bordering the south side of the field, and in early evening a White-tail rabbit was sighted near the southeast ranch gate. On July 6th when leaving the ranch in early evening an adult badge was spotted running along the west roadside near the southeast access. On July 27 in the early morning at the southwest entrance a dark-morphed Rough-legged Hawk was sighted perched on a telephone pole. During a two week weed survey many more sightings were recorded. In the early morning of July 30th a Swainson's Hawk was sighted preying on a snake and feeding from a distance, a few minutes later two more Swainson's were on the ground at a well-si~~ghte~~ road which entered onto field #1; later that morning a Short-eared owl was sighted on a fence post near the northeast access to the ranch, flying low over the main road directly in front of my quad. On the 31 of July another (perhaps the same owl) was sighted on a fence post in the early morning bordering the canal road and field #1, about 30 metres from well-si~~ghte~~ (08-07). The next day this Short-eared owl was

observed moving between the fence post and about 10 meters into field #1 where it was likely protecting its nest. On morning arrival of August 2nd while driving through the southwest access a Rough-legged Hawk was sighted on a telephone pole located at the well-sight in the far south-west corner of field #3. That day a Swainson was observed soaring over field #4, two over field #2, one over field #1, while two Northern Harriers were seen perched in willows on the dam at the south-centre of field #2. Many more sightings of waterfowl were made, too many to record, as well Eastern Kingbirds were quite prevalent in Willows near the Northwest access.

Crested Wheat Fields

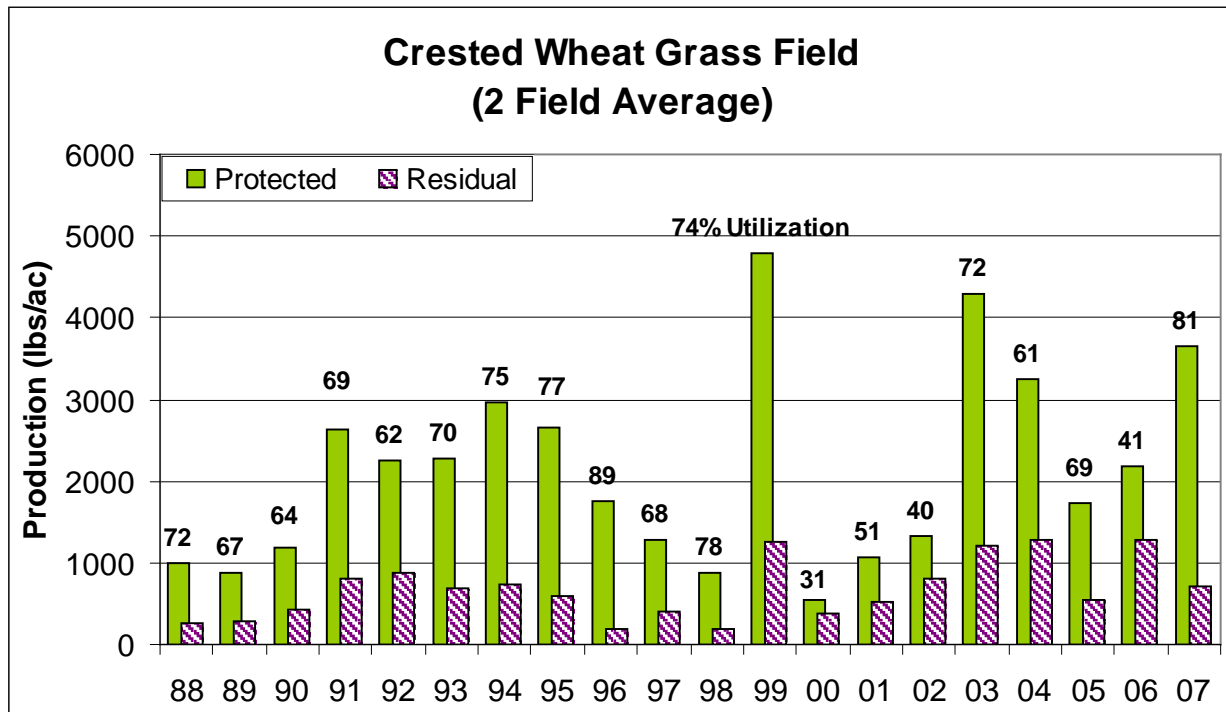
Figure 3. Production and Utilization of the East and West fields



The West field was grazed from May 15th to May 22nd. This field was clipped on May 21st and the grass production was 2958 lbs per acre. Utilization after the first clip was 77 %. The East field was grazed from May 21st to June 4th. This field was clipped on June 4th, and grass production was 5679 lbs per acre. Utilization after the first clip was 89 %.

Production and utilization of the East and West Crested Wheat fields are averaged and compared to previous years' production in Figure 4. The combined AUM's harvested was 198, and average adjusted utilization was 81%.

Figure 4. Production and Utilization of Crested Wheat Grass

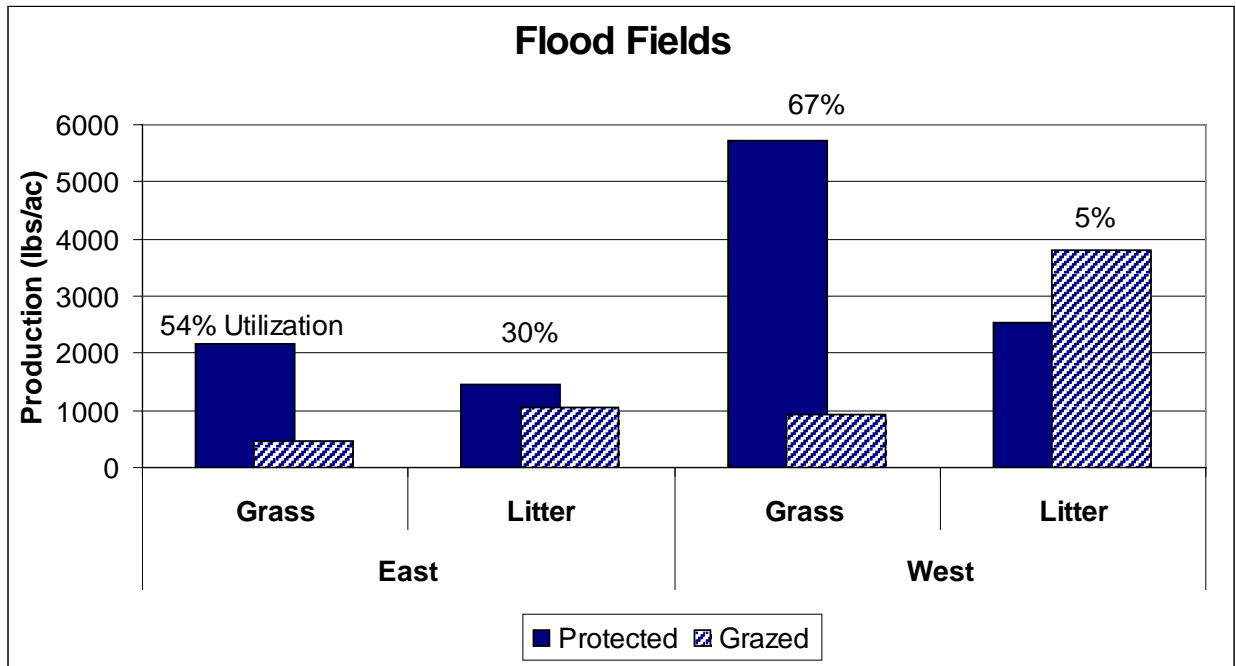


Flood Field

This field was idle for a number of years before the Ranch Technical Committee agreed to use it once again in the grazing rotation. Declining production on the cultivated fields, re-seeding of the pivot fields and drought made it necessary to utilize the area in 1996. In 2000, the flood field was split into east and west fields.

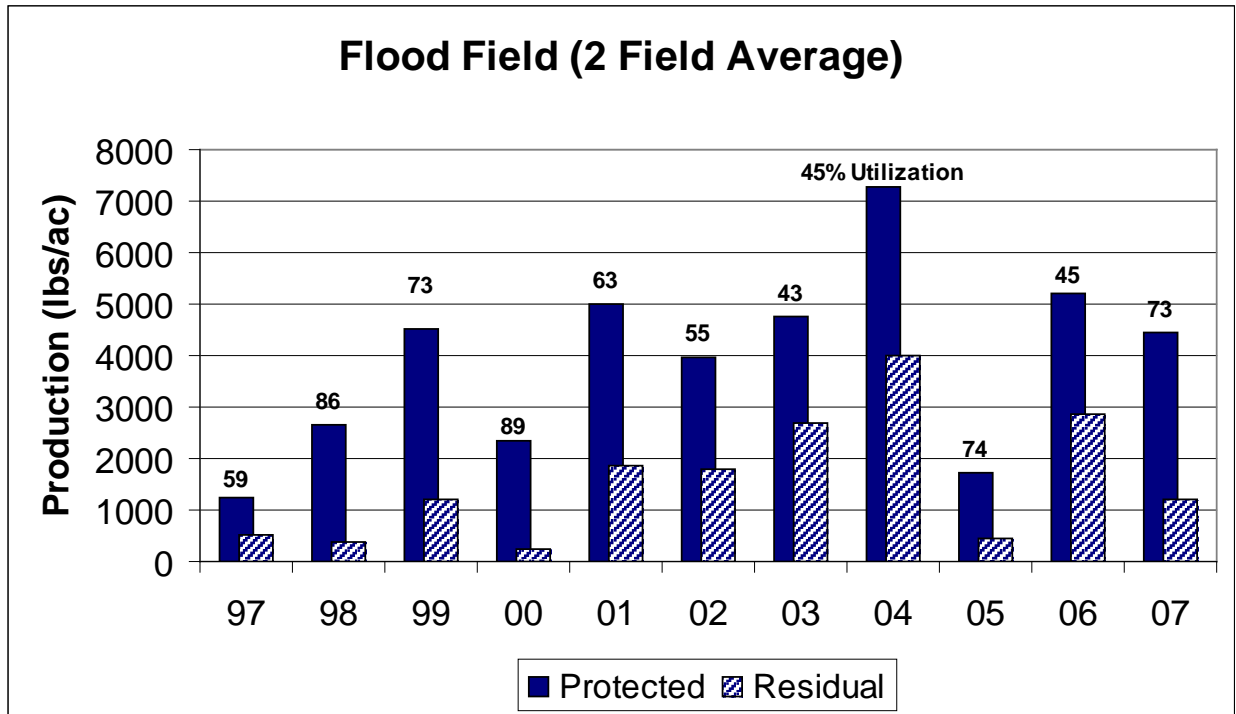
The cattle grazed the East Flood field from June 2nd to June 14th. The East field was clipped June 14th after grazing. Production was found to total 2175 lbs/ac, with a total of 317 AUM’s harvested and utilization of 54 (Figure 5.). The West Flood Field was grazed from June 21st to July 5th, and was clipped on July 6th. Production at this time was 5710 lbs/ac. Utilization after the first collection was 83% and total of 152 AUM’s were harvested.

Figure 5. Flood Field production and utilization



In 2007, end of season clipping was performed in early November in the east and west flood fields. The east flood field yielded 1438 lbs/ac, leading to an adjusted utilization of 54%. The west flood field yielded 961 lbs/ac for an adjusted utilization of 83%.

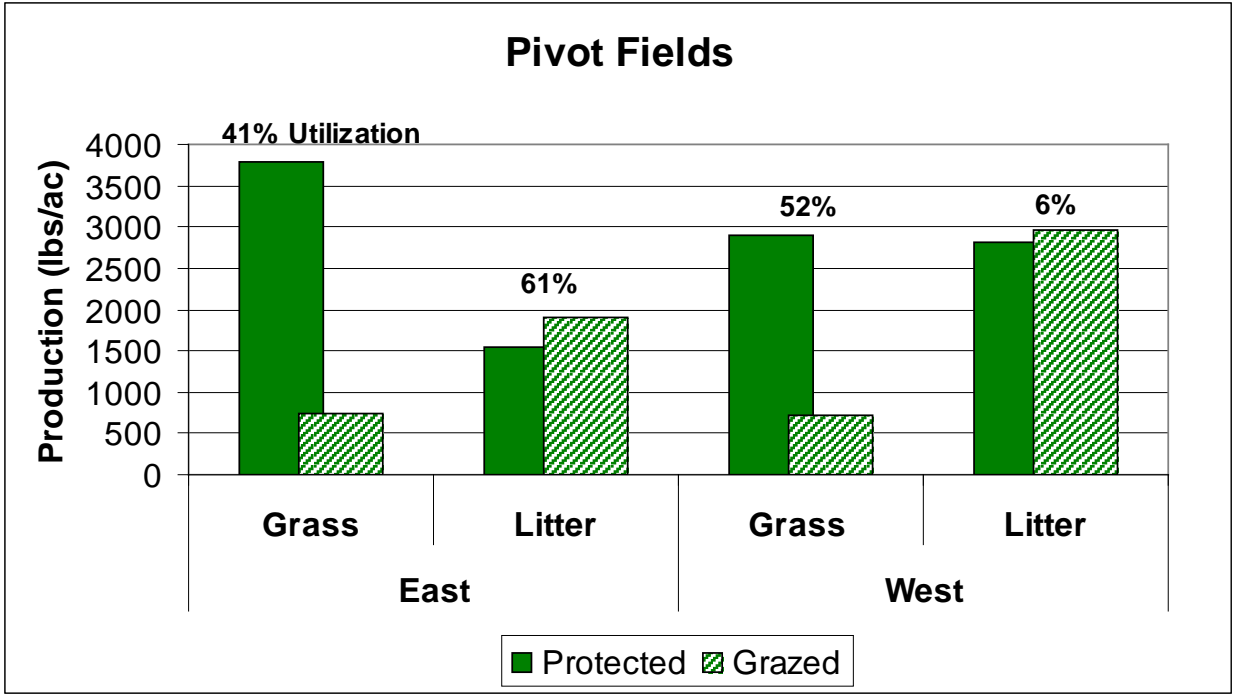
Figure 6. Production and Utilization of the Flood Fields



Pivot Fields

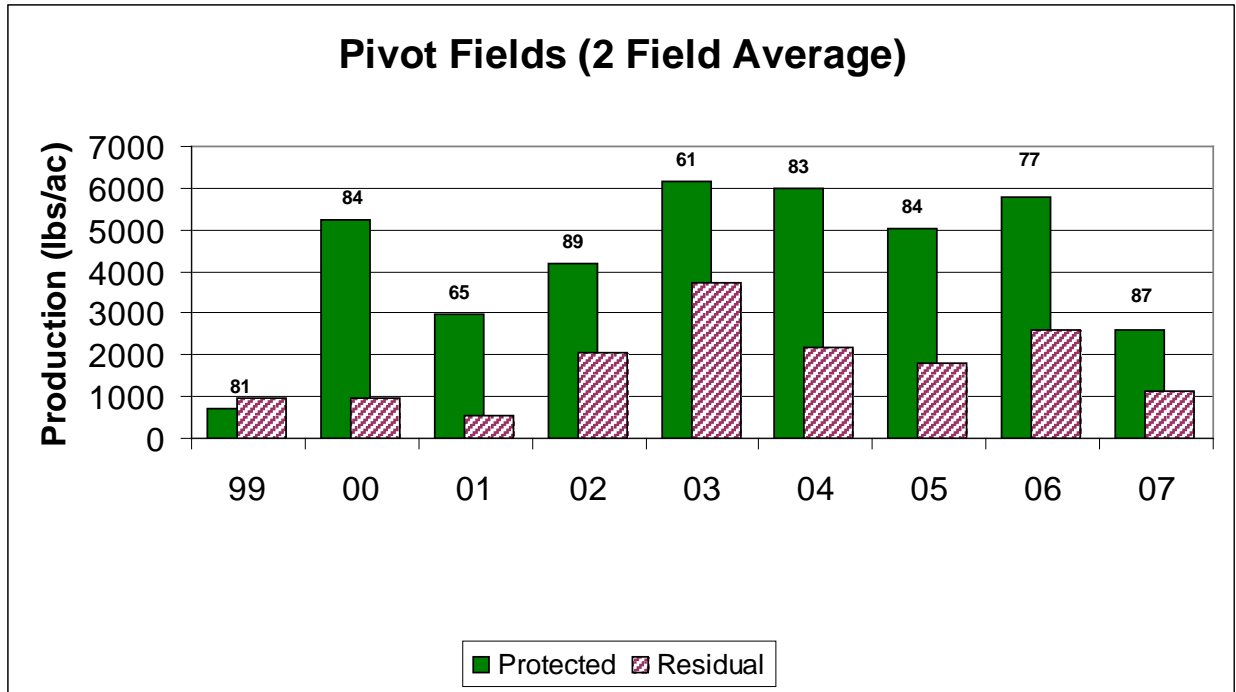
The East Pivot field was grazed from June 14th to June 21st. Clipping was completed on June 27th with production totaling 3780 lbs/ac. Initial utilization was recorded at 55%. The West Pivot field was grazed from July 5th to July 13th. The clipping took place July 12th with total production on the field being 2898 lbs/ac, and an initial utilization of 57% (Figure 7.).

Figure 7. 2007 Production and Utilization for East and West Pivot fields



The end of season clipping was completed the beginning of November. The east pivot yielded an additional 1354 lbs/ac for a total of 5134 lbs/ac with 74 AUMs harvested. The west pivot yielded 932 lbs/ac at years end for a total forage production of 3830 lbs/ac and 88 AUMs harvested.

Figure 8. Production and Utilization of Pivot Fields



*98 – No data collected this year.

Native Fields

The native fields are grazed in a complementary deferred rotational system. The grazing rotation began with 245 cow/calf pairs in field 4. Cattle grazed field 4 from July 18th to August 12th for a total of 25 days. The cattle were moved to field 1 and grazed from August 12th to September 7th for 26 days. Field 2 was grazed from September 7th to October 2nd for a total of 25 days. Field 3 was grazed from October 2nd to October 20th for a total of 21 days. Clipping of the native fields began in September after the cattle were moved from field 3, and was completed in November after the cattle were taken home. Grass and litter yields since 1988 have been summarized below (Table 2).

The figures in the **Protected** column are production clips taken under “roving” cages in the grazed area of the pasture (deferred, rotational system). These cages are moved after clipping each year to more accurately record the previous year’s re-growth. In 1998, six cages were placed in an area further away from each enclosure, but still within the same soil polygon. There are a total of thirteen cages on each field, seven near the enclosure and 6 further away. Cages were moved in order to get a better representation of utilization. The **Grazed** figures represent what is left after cattle grazed the field (not protected by cages or enclosure). The **Enclosure** numbers are from a site that is permanently protected from grazing. Finally, the **Control** figures are the clips taken from the season-long grazed field (control field), under the roving cages.

Table 2. Average Production and Litter Levels on Four Native Pastures and the Control Field

Summary of Grass & Litter Yields & Utilization on Native Field 1988-2007										
	Grass (lbs/ac)					Litter (lbs/ac)				
	Protected*	Grazed	% Utilized	Exclosure	Control	Protected*	Grazed	% Utilized	Exclosure	Control
1988	245	180	26	224	n/a	53	43	18	47	n/a
1989	335	186	44	284	n/a	53	24	54	61	n/a
1990	308	231	25	291	107	85	68	21	72	49
1991	316	264	16	253	249	100	59	41	89	22
1992	456	267	41	419	n/a	136	126	8	324	n/a
1993	986	647	34	645	702	324	113	65	293	251
1994	934	697	25	869	1047	406	339	17	361	536
1995	755	510	32	667	592	430	381	11	602	160
1996	489	296	39	459	330	508	397	22	623	140
1997	820	485	41	783	793	415	359	14	401	74
1998	875	500	43	751	702	269	273	-2	406	26
1999	2199	1376	37	1536	2147	317	379	-20	498	97
2000	447	176	61	259	254	1170	652	44	832	400
2001	333	146	56	362	198	511	347	32	641	164
2002	803	528	34	947	680	394	334	15	924	181
2003	1381	1105	20	1286	1040	1256	903	28	1640	356
2004	662	537	19	771	712	484	470	3	892	409
2005	1479	1337	10	1939	1797	791	1091	-38	1762	960
2006	2188	1796	18	2018	1842	1284	1086	15	2086	1551
2007	1938	1272	31	2420	1522	1640	1101	33	2502	998

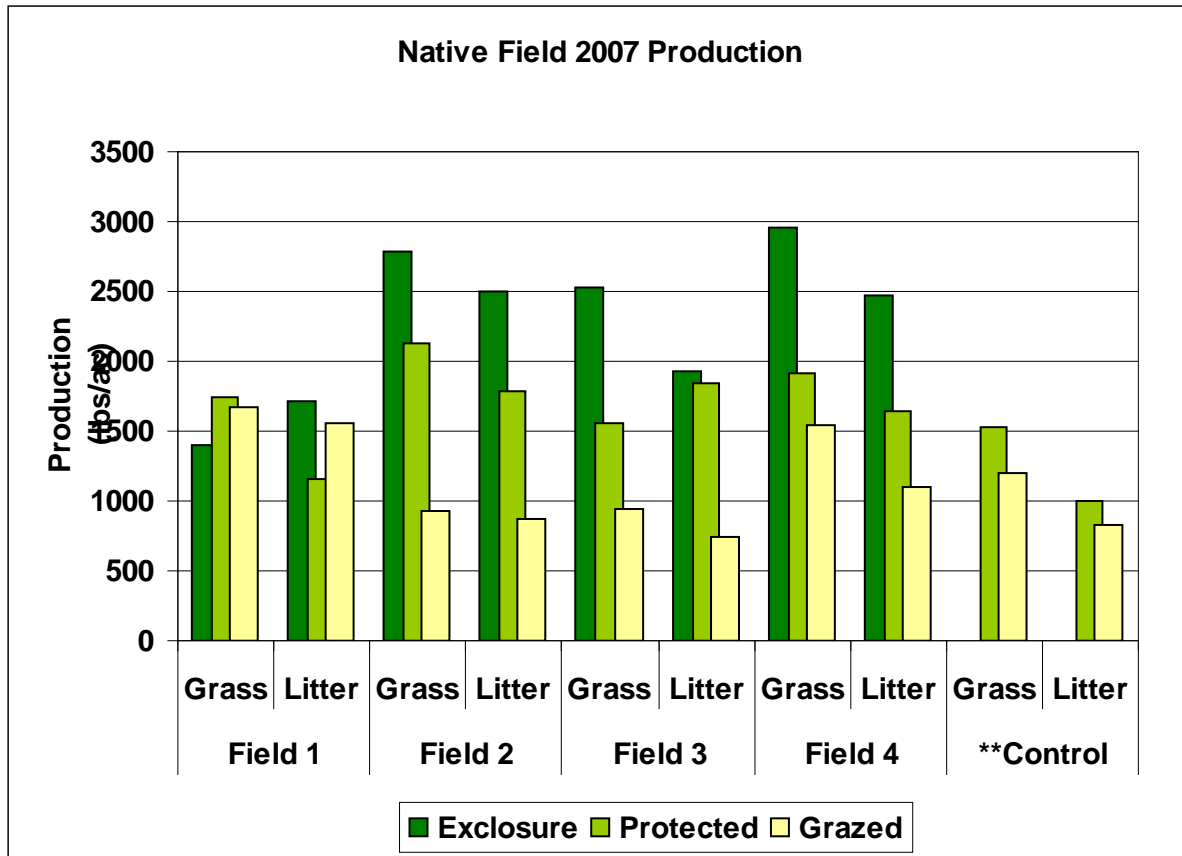
Utilization was calculated from the protected and grazed columns. Overall utilization, taken as an average of all native fields, was 31% (Table 2). There were 1119 AUM's harvested from the native fields in 2007 compared to 938 AUM's in 2006.

Grass production generally increased between 1988 and 1999. 1999 production levels reflected the exceptional rainfall that year. From 1999 to 2002 production on the native range declined as a reflection of consecutive drought years. In 2003 above average precipitation resulted in higher grass production than in previous years. 2004 saw very good moisture levels, although production was down from 2003. Reasons for the decline may include a late start to the growing season along with cool periods during the summer. Since 2004, grass production has increased, with 2006 resulting in grass production near 1999 levels. Favorable moisture and temperature conditions during these years are a likely cause for this improved production.

At ACHDA, the highest production has normally been under the deferred, rotational system. This years grass production on grazed (protected from 2007) range was greatest in Fields 1 and 2. Field 2 and Field 4 had greatest overall grass production in the exclosures (Figure 9). It is interesting to note that in all fields except Field 1, grass production in the protected cages was greater than that in the exclosures, whereas litter was always greatest within the exclosures. The

last 3 years, 2005-2007, have shown the greatest production trend ever seen at the ranch. All three years were granted spring moisture above the 30 year average.

Figure 9. 2007 Average grass and litter levels on four native range fields and control field



**Control field does not contain a permanent enclosure

Figure 10. Historical average grass production on native range pastures under various grazing treatments at ACHDA

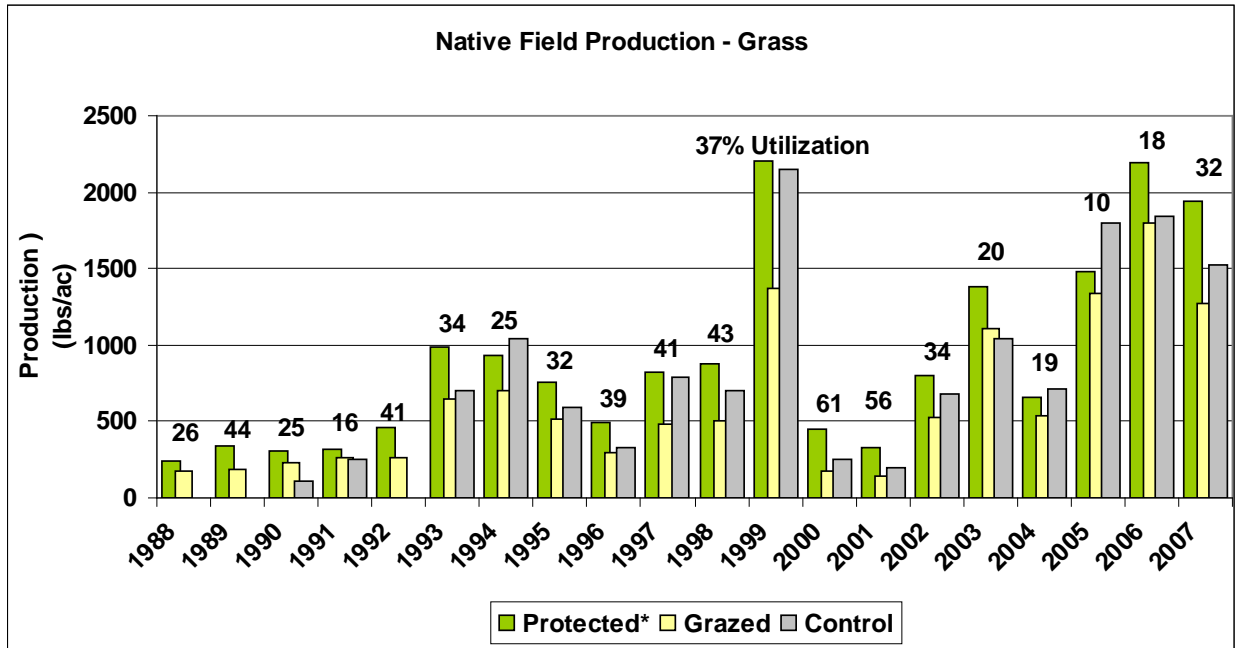
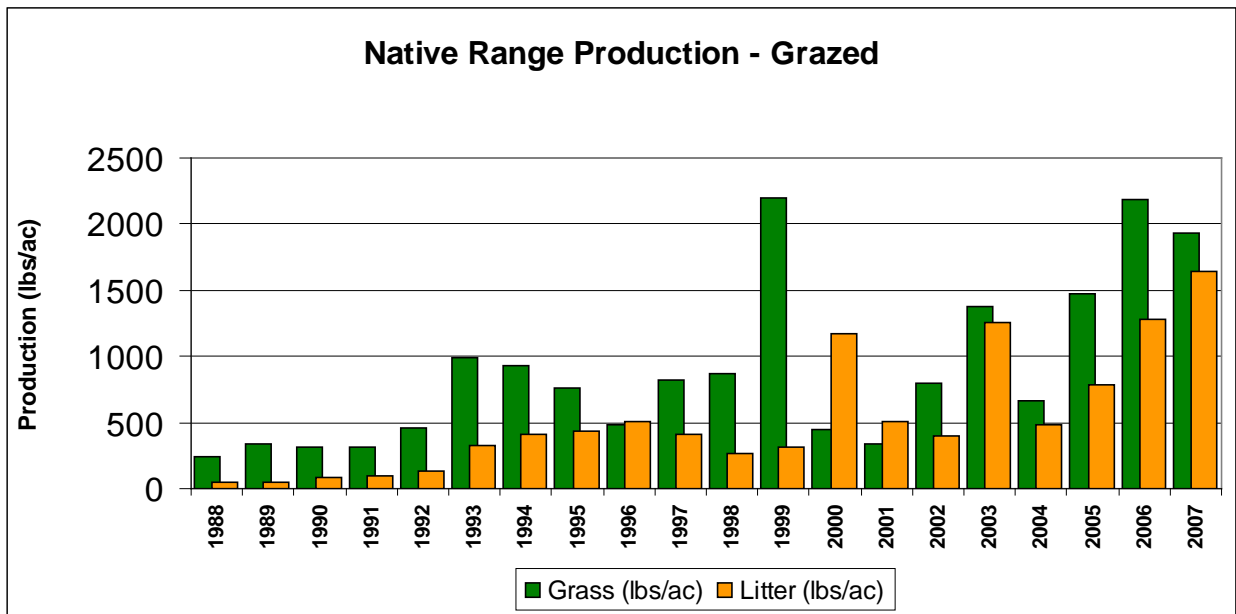


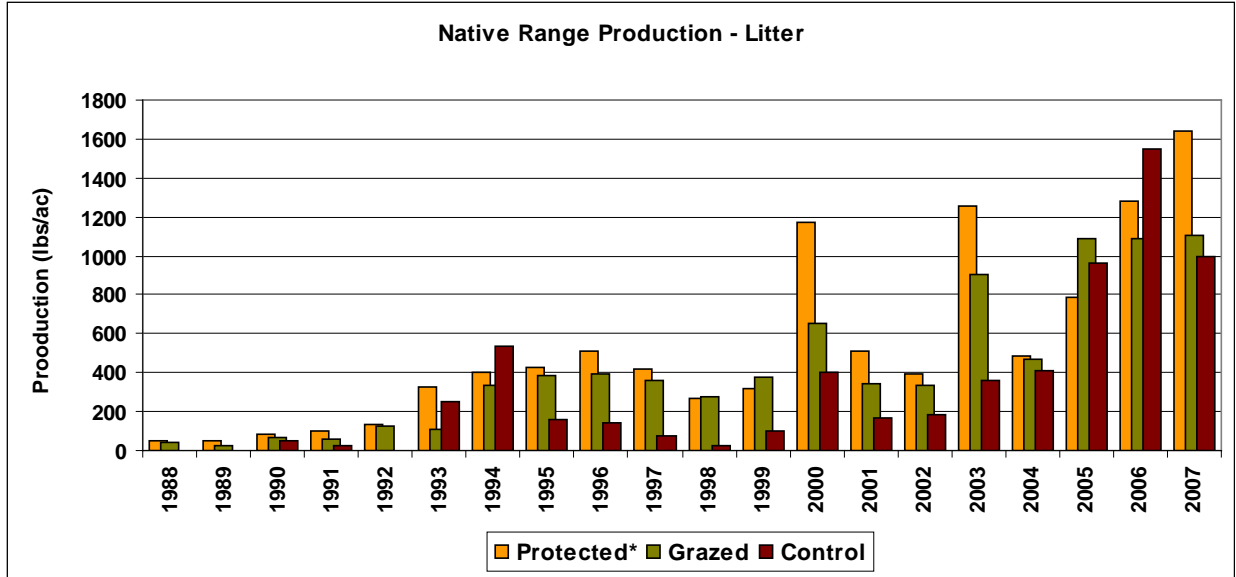
Figure 11. Historical production of grass and litter on native range under a deferred rotation (average of the four native fields)



Litter levels within the native fields have shown consistent production under the deferred rotation system. The Range Health Assessment, includes the function of litter and its contribution to the status of range health (Adams et al, 2005). Using the litter guidelines found in the Range Health Assessment, we can see from production numbers, litter levels in the four

native pastures have been steadily increasing the last 4 years, and is well above what range health would consider the healthy normal of 400 lbs/ac (loamy) and 250 lbs/ac (blowout).

Figure 12. Average litter component of native range pastures under three different treatments at ACHDA.



The **Control Field** was introduced in 1990. The first control field was located on a neighboring pasture under a continuous grazing scheme. In 1992, Antelope Creek Ranch set aside a portion of the land base to be used as a control pasture under a continuous grazing program. In 2007, 10 yearlings grazed the pasture from May 15 until October 29. A litter level of 998 lbs/ac in 2007 brings the production far above the recommended level of 400 lbs/ac for healthy (loamy) sites, and well above the 260lbs/ac average on blowout sites.

For the history of the production and utilization for each of the native range fields see the appendix.

Invasive Plant Survey

The east side of Antelope Creek Habitat Development Area (ACHDA) has been heavily impacted by industrial activities such as oil and gas lease sites, pipelines, roads, irrigation and power lines. These activities have provided an opportunity for exploitation by non-native grass species and other weed species. Vehicle traffic is an excellent carrier for weed seed as some vehicles are traveling many hundreds of miles a day and all the seeds on the undercarriage are not cleaned off before entering the property. Other modes of introduction are through the irrigation canals, as well as on wildlife and domestic livestock. These seeds are then able to get a good start in the disturbance areas where there is no competition and eventually they spread into the surrounding prairie.

Due to the Oil and Gas industries reclamation practices of the past ACHDA has been left with many patches of crested wheat grass (*Agropyron pectiniforme*) (CWG) associated with the native prairie fields. These fields are typically grazed in the late summer and early fall using our deferred rest rotation. The combination of these old reclamation practices combined with this grazing regime has resulted in some very healthy CWG stands in the native prairie which have now become invasive and are moving into the native pastures due to the fact that the CWG has hardened off and is unpalatable to the cattle by the time they reach these areas.

With these points in mind we are developed a three (3) year study to determine the extent of CWG and disturbance allowed weed invasion on the ACHDA, and then to try a combination of grazing, mowing and spraying to control the CWG and invasive weeds.

Year One

The first year of the study (2007) consisted of data collection on the location of CWG and invasive weeds by searching on quad and foot following existing roads, pipelines, wells and irrigation canals and then tracking these areas with GPS. It is estimated that half of the sites have were located by the end of the field season. This data will be entered into a database and can be used as a layer in the cumulative effects database that is being developed. It will also be used in implementing control measures in the second and third years as well. The option of opening up the CWG canopy using a mower in the fall of the year should be explored as the old CWG growth may act as a grazing barrier to the cattle in year two and three of the study.

Year Two

Data collection of CWG and invasive weeds will continue.

The second year will see control measures implemented on noxious and restricted weeds that had been found during, along with eradication measures of nuisance weeds using a combination of mowing and herbicides on the areas identified in the first year.

As well in the second year the cattle will be brought into the fields while the native pasture is still dormant but the CWG is starting to grow. Five to ten cows will be fitted with GPS tracking collars so that herd movements and grazing patterns can be established (dependant on the availability of collars). This will prove or disprove our theory that the cattle will graze the CWG

while it is young and tender instead of the dormant native grasses. Understanding the timing of grazing and utilization of CWG will allow us to choose appropriate control measures. **Due to the unavailability of collars, this portion of the Year Two project will be put off indefinitely.**

Year Three

Year three of the study will consist of analyzing the information gained from the second year and then modifying the grazing accordingly. There will also be a follow up on the weeds from the years before to see how effective the control measures have been, and to continue treatments if needed in order to insure adequate control.

Range Survey

Traditionally at ACHDA range health was rated according to “Range Condition and Stocking Rates for Alberta” (1988). Since 1988 a new methodology has been adopted in Alberta that focuses on range health, rather than strictly range condition. This new model builds on plant community type in relation to site potential, but adds new indicators of natural processes and functions, important functions performed by healthy rangelands (Dry Mixedgrass – Range Plant Community Guide).

ACHDA is managed to improve or maintain a “good to excellent” range condition level (75-100%). Figure 13 shows the averaged range health of the four native fields and the control field. It is important to note that as range health has improved, soil exposure has declined as shown in Figure 15 and 16. This is the response that one would expect as the forage stand becomes more vigorous due to decreased stress (not grazing pressure). The response is also dependant on the productive species returning to the plant community. Through proper management these plants thrive, increase production, and provide protection for the soil

In 2004 range surveys were completed on all the ACHDA native fields, along with the control pasture and Cassils. Transects for the range surveys followed previous transect lines in order to utilize a direct comparison to past results and trends. Using the scoring guidelines for range health, Healthy = 75-100%; Healthy with problems = 50-74%; Unhealthy < 50%, each transect was evaluated and recorded. This season all native pastures received range scores of Healthy (Figure 14), as all pastures were in excellent condition with a stable or upward trend in all instances.

In 2005, Leah Rigney converted range condition scores to range health scores (Figure 13).

Figure 13 Conversion of range condition to range health scores.

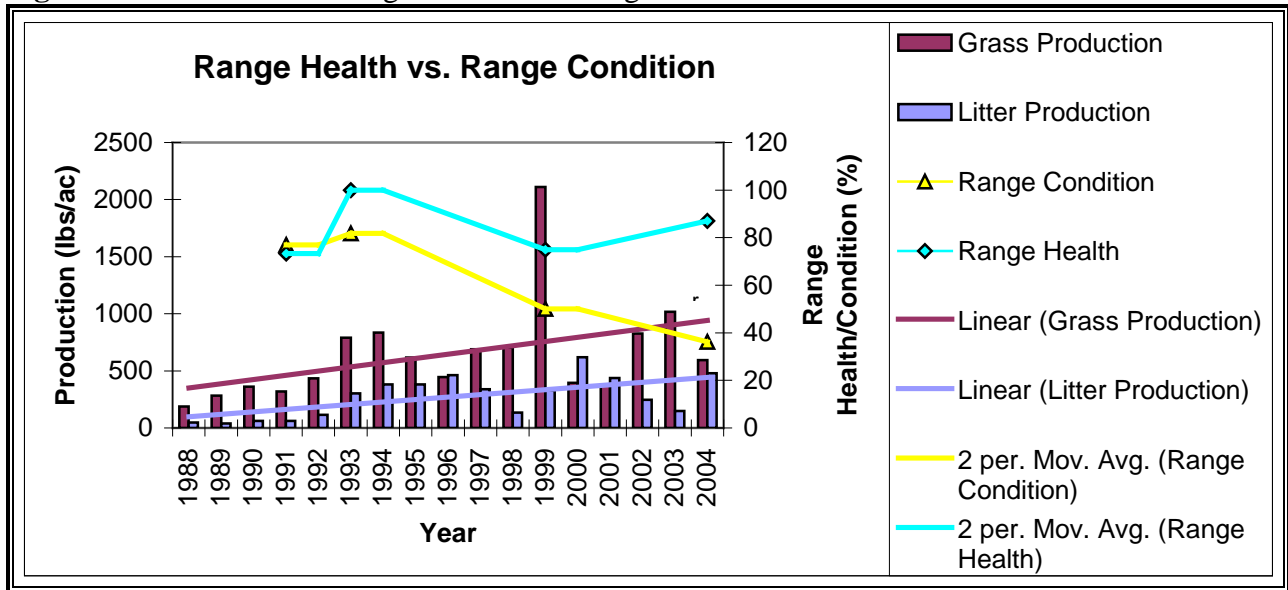
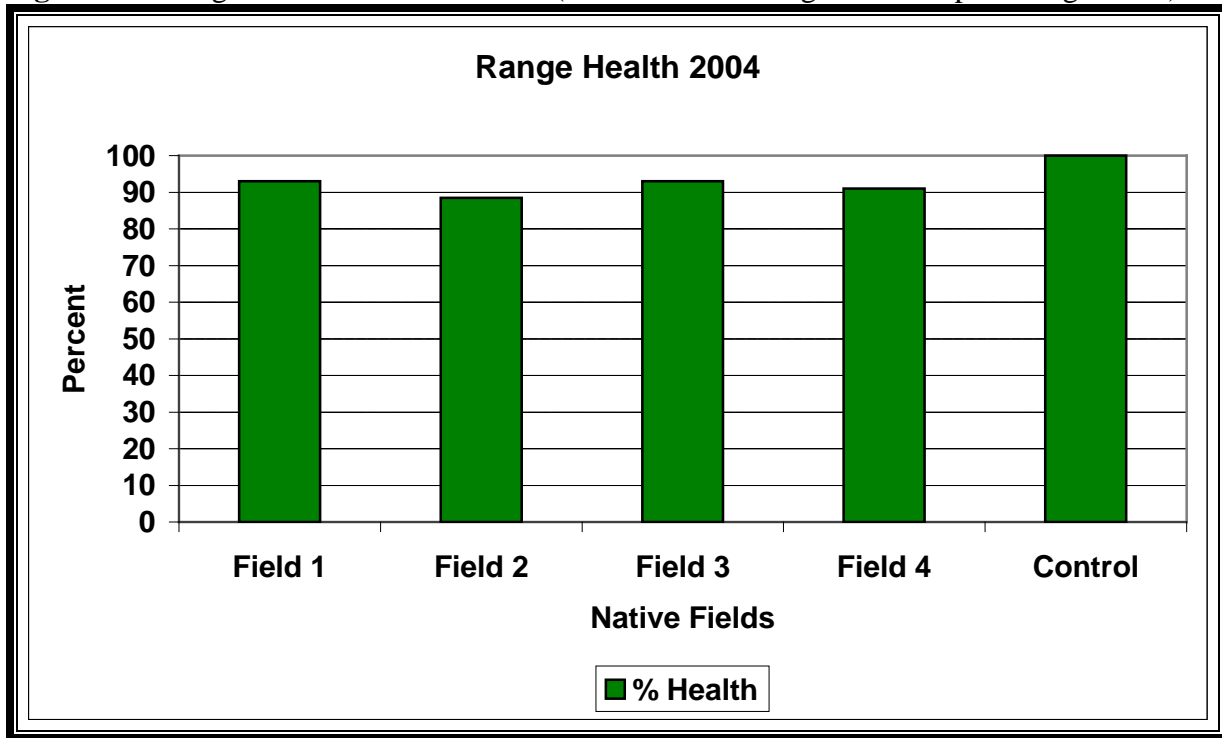


Figure 14. Range Health for native fields (transects are averaged for one percentage score)



Indicated in Figure 15, range condition score under the guidelines used prior to new Range Health Assessment criteria.

Figure 15. Range Condition of Native Fields

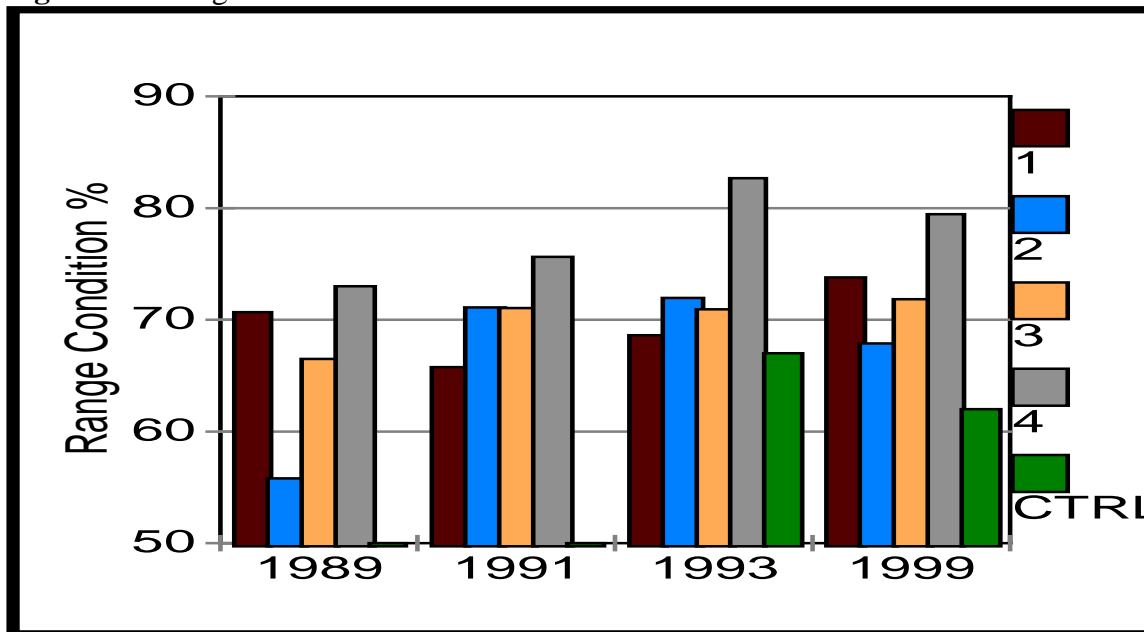


Figure 16. Vegetation Cover and Soil Exposure of Native Range under a Complementary, Deferred-Rotation Grazing System.

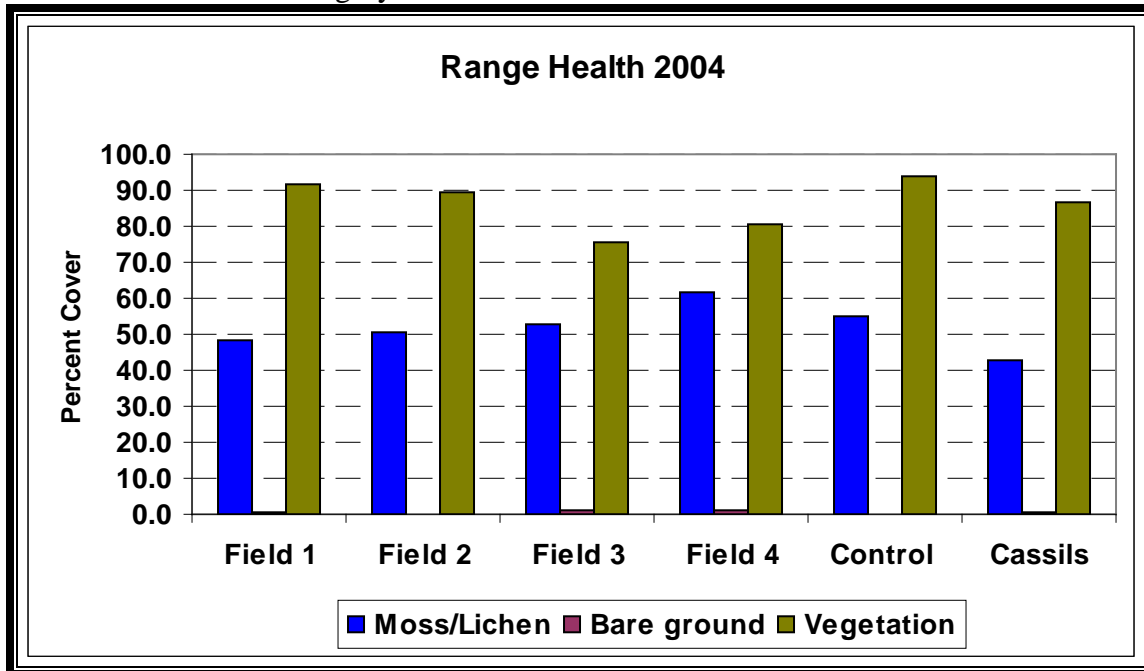
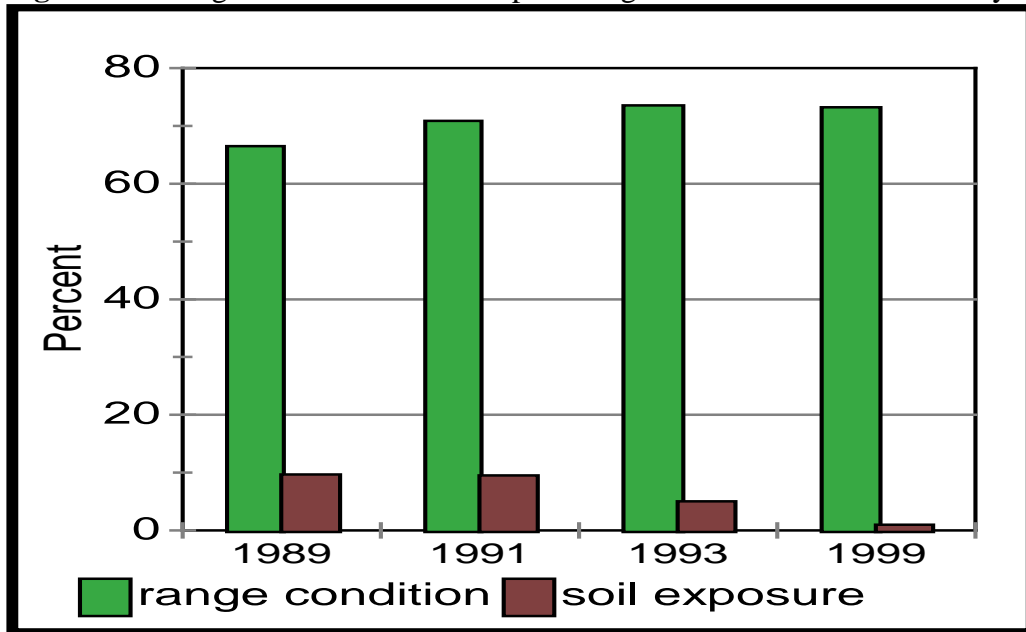


Figure 17. Range condition and cover percentage from 1999 ACHDA surveys



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Appendix

Appendix A

Livestock records from ACHDA

ACHDA Ranch	LIVESTOCK PERFORMANCE AND STOCKING RATES																			
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cow / Calf Pairs (No.)	135	135	136	135	175	175	235	235	235	235	235	235	250	251	143	206	260	260	258	245
*Mean cow weight (lbs.)	---	1127	1241	1186	1259	1129	1150	1226	1293	1201	1152	1260	1302	1300	1319	---	---	---	---	---
Mean cow gain (lbs.)	---	273	90	115	146	174	116	138	169	146	149	124	108	144	143	---	---	---	---	---
Mean calf fall weight (lbs.)	---	550	551	575	593	563	521	557	553	563	547	562	542	525	597	---	---	---	---	---
Mean calf gain (lbs.)	---	437	383	410	410	381	353	386	384	387	376	395	365	347	410	---	---	---	---	---
Average calf daily gain (lbs.)	---	2.63	2.3	2.47	2.47	2.31	2.14	2.34	2.23	2.28	2.36	2.31	2.34	2.48	2.56	---	---	---	---	---
Ranch Grazing Period (months)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.7	5.7	5.7	5.2	4.5	5.3	5.4	5.5	5	5.1	5.5
Steers (No.)	---	---	---	---	---	---	---	---	---	---	6	10	9	8	4	6	10	10	10	10
Mean Steer weight (lbs.)	---	---	---	---	---	---	---	---	---	---	---	609	688	633	633	746	---	---	---	---
Mean Steer gain (lbs.)	---	---	---	---	---	---	---	---	---	---	---	275	230	267	189	199	---	---	---	---
Average steer daily gain (lbs.)	---	---	---	---	---	---	---	---	---	---	---	3	2	2	---	2	---	---	---	---
Adjusted AUM's-Ranch	961	870	953	917	1226	1224	1640	1643	1730	1696	1702	1742	1733	1568	1036	1530	1731	2033	1811	1846
Adjusted AUM's-Four Native Pastures	609	622	618	409	816	497	817		1059	1093	938	1048	958	778	560	712	818	940	938	1100
Adjusted AUM's-Control Pasture										59	24	25	26	71	12	16	37	0	29	36
Adjusted AUM's-Cassils													89	58	25	163	132	89	122	0
Adjusted AUM's-Pivots													434	487	214	266	304	581	292	161
Adjusted AUM's-Floods													116	177	109	106	90	200	183	277
Adjusted AUM's-Crested Wheat Fields													87	46	92	219	327	223	198	198
Adjusted AUM's-San Francisco Lake																			12	74
Adjusted AUM's-Holding Pasture/home													23	22	24	48	23	0	37*	
Mean Stocking Rate- Ranch (ac./AUM)	4.83	5.34	4.88	5.07	3.79	3.28	2.83	2.83	2.68	3.24	3.23	3.16	3.17	3.50	5.31	3.60	3.20	2.70	3.04	2.98
Mean Stocking Rate-Four Native (ac./AUM)	7.27	7.12	7.17	10.8	5.42	8.19	5.41		4.17	3.60	4.19	3.75	4.10	5.05	7.02	5.50	4.80	4.50	4.50	5.00

* Holding Pasture was only used for horse grazing. *Cattle gains are no longer recorded due to difficulty in acquiring a weigh scale.

Appendix B

HISTORY OF PRODUCTION AND USE OF NATIVE AND CONTROL FIELDS AT ANTELOPE CREEK (lbs/ac)

2007	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	1401	1472	1676	-14	229	726	298	59	1713	1153	1561	-35
2	2788	2132	933	56	831	1038	113	89	2496	1787	870	51
3	2534	2243	941	58	377	85	51	41	1926	1837	745	59
4	2958	1915	1537	20	97	70	61	13	3871	1784	1228	31
Cassils												
Control		1522	1206	21		311	56	82		998	831	

2006	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	1544	1983	1696	14	258	97	202	-109	1748	1503	931	38
2	1858	1936	1631	16	41	160	74	54	1240	663	948	-43
3	1764	2243	1888	16	225	373	258	31	1988	1513	1367	10
4	2905	2590	1969	24	37	264	118	55	3367	1459	1099	25
Cassils		2231	1285	42		111	123	-10		751	796	-6
Control		1842	1655	10		127	338	-166		1551	1589	-3

2005	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	1645	1502	1261	16	51	113	72	36	996	1034	949	8
2	1533	1269	1196	6	58	105	17	84	1113	615	1060	-72
3	1669	1206	1324	-10	124	232	53	77	2084	803	1117	-39
4	2908	1940	1565	19	35	97	79	19	2855	711	1237	-74
Cassils		996	343	66		73	38	47		873	1203	-38
Control		1798	1363	24		116	76	35		960	753	22

2004	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	565	629		0	106	317		0	935	590		0
2	640	790	538	32	14	19	27	-46	571	469	434	7
3	906	595	590	1	67	37	67	-83	1125	478	466	3
4	1051	602	498	17	90	45	33	28	939	496	410	17
Cassils		973	717	26						545	463	15
Control		794	712	10		36	96	-164		409	540	-32

2003	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	1106	1768	1204	32	150	38	38	0	1706	1461	824	44
2	1138	1594	1006	37	114	50	151	-199	937	1528	981	36
3	1384	1017		100	149	35		100	1384	149		100
4	1566	1159		100	11	26		100	1553	849		100
Cassils		2141	1112	48		126	9	93		2783	1115	60
Control		1041	900	13		168	41	76		356	408	-15

2002	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	747	686	433	37	43	54	46	14	1017	287	358	-25
2	943	832	370	55	64	116	59	49	727	673	279	59
3	964	827	513	38	13	70	45	35	738	247	170	31
4	1136	869	795	9	33	40	85	-113	1216	368	529	-44
Cassils		442	331	25		176	55	69		371	506	-36
Control		681	424	38		71	88	-24		181	185	-2

2001	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	318	235	90	62	9	55	10	82	581	574	244	57
2	264	443	197	55	36	24	83	-242	713	590	359	39
3	395	381	167	56	11	15	3	82	721	437	348	20
4	470	274	131	52	20	2	22	-1217	548	443	435	2
Cassils		460	192	58		222	1	99		1081	408	62
Control		198	145	27		14	4	71		164	288	-75

2000	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	216	641	255	60	7	17	29	-69	535	1376	885	36
2	299	451	266	41	48	3	36	-1082	783	942	607	36
3	306	394	115	71	34	8	1	83	545	619	527	15
4	216	302	67	78	7	6	19	-214	1466	1742	588	66
Cassils		436	112	74		41	7	82		1666	768	54
Control		254	140	45		8	19	-138		400	345	14

1999	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	1096	1820	1000	45	51	95	111	-18	323	323	519	-61
2	1434	2611	1649	37	56	184	51	72	615	414	327	21
3	2126	2110	1377	35	13	129	67	48	711	329	174	47
4	1489	2253	1477	34	4	49	17	66	342	202	497	-146
Control		2147	734	66		57	19	67		97	102	-6

1998	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	611	1008	557	45	59	188	191	-1	391	318	512	-61
2	776	992	526	47	15	28	14	51	367	333	270	19
3	843	704	484	31	40	27	8	71	411	134	97	28
4	774	796	436	45	25	24	19	21	454	291	215	26
Control		702	359	49		76	29	61		26	69	-167

1997	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	996	1034	772	25	137	101	137	-36	506	488	295	40
2	832	902	419	54	116	80	52	35	355	262	370	-41
3	608	689	297	57	86	49	69	-39	303	339	205	40
4	695	655	453	31	48	116	58	49	441	573	564	1
Control		793	8	99		90	2	98		74	3	96

1996	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	406	529	363	31	36	31	24	23	556	617	431	30
2	435	470			33	26			663	312		
3	456	447	243	46	18	42	43	-2	662	462	373	19
4	539	510	281	45	20	56	13	77	611	643	388	40
Control		330	151	54		29	36	-24		140	134	4

1995	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	645	782	538	31	16	9	17	-85	497	497	322	35
2	636	705	341	52	24	26	19	29	476	408	423	-4
3	607	618	506	18	37	17	69	-306	632	381	275	28
4	781	914	656	28	42	61	29	53	688	434	503	-16
Control		592	312	47		30	8	72		160	215	-35

1994	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	928	1127	958	15	27	39	53	-36	246	350	310	11
2	880	926	576	38	23	18	20	-8	268	313	245	22
3	836	835	608	27	26	32	20	36	462	381	309	19
4	831	848	646	24	21	12	25	-107	466	581	493	15
Control		1047	414	60		9	4	56		536	293	45

1993	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	689	993	638	36	29	53	10	82	275	406	47	89
2	611	975	581	40	13	45	11	76	364	293	46	84
3	684	789			32	45			271	302		
4	595	1188	721	39	24	104	66	37	262	297	247	17
Control		702				61				251		

1992	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	501	614	322	48	10	30	11	64	439	114	63	44
2	396	368	242	34	20	18	7	61	229	59	57	4
3	406	435	303	31	18	16	20	-23	229	116	116	0
4	373	407	201	51	20	25	17	31	398	256	267	-4

1991	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	315		332		63		46		125		61	
2	280				20				63			
3	251	320	190	41	32	28	26	10	84	61	42	31
4	165	493	268	46	24	54	10	82	85	188	73	61
Ward's		248	125	50		108	31	71		22	11	50

1990	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	208	294	158	46	55	30	21	31	67	122	89	26
2	259	265	131	50	49	63	51	20	48	73	54	26
3	382	361	325	10	60	47	50	-7	83	61	75	-22
4	312	308			40	20			90	52		
Ward's		107	73	32		24	37	-54		48	44	8

1989	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	318	345	184	47	85	73	84	-15	119	53	32	39
2	233	290	170	41	55	140	70	50	40	37	8	79
3	223	283			31	50			48	40		
4	356	418	204	51	21	105	29	72	38	82	32	60

1988	GRASS				FORBS				LITTER			
	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.	Exclosure	Protected	Grazed	% Util.
1	256	260	191	26	29	60	34	44	65	79	67	16
2	210	189	202	-7	138	116	109	5	36	24	49	-105
3	181	188	181	4	16	24	44	-81	48	46	27	42
4	248	339	156	54	43	61	29	53	39	62	30	51

Appendix C

ACHDA Summary of Range Surveys – 2004

Site Description:

General

Ecoregion: Grasslands

Ecosubregion: Dry Mixed Grassland

Ecodistrict: Bow City Plain

Vegetation type: Grassland

Precipitation Zone: 10 – 14 inches/yr

Regional Landforms: Uplands

Local landform: Level, Depression, and Mid-slope

Landform elements: Undulating and Plain

Slopes: 0.5 – 5%

Major Soil Types: Hemaruka (HUK), Wardlow (WDW), Ronalaine (ROL)

Definition of Range Health:

Range Health is defined by the ability of rangeland to perform certain key functions. The functions of healthy range include: Net primary production, maintenance of soil/site stability, capture and beneficial release of water, nutrient and energy cycling and functional diversity of plant species.

Range Health Assessment Scoring Categories:

Using the previous list as a guideline, range health scoring categories are as follows:

Healthy = 75 – 100%; Healthy with problems = 50 – 74%; Unhealthy < 50%