

Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta

2006

Cows and Fish Alberta Riparian Habitat Management Society Report No. 028

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About Cows and Fish

Riparian areas are those areas along rivers, streams, lakes, wetlands, springs, and ponds that are strongly influenced by water and are recognized by water-loving vegetation. Cows and Fish is striving to foster a better understanding of how riparian areas function and how improvements in management strategies in riparian areas can enhance landscape health and productivity for the benefit of livestock producers, their communities and others who value these landscapes.

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Working with producers and communities on riparian awareness

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Executive Summary

A three year survey, to determine forage production in southern Alberta, began in the 2005 growing season. The purpose of the survey is to gather data in a variety of riparian zones based on riparian plant communities in the Foothill Fescue, Mixed Grass, Dry Grass and Central Parkland natural subregions. Additionally, species composition was assessed and will be used to update the riparian plant community and habitat type sites compositions.

Twenty-five sites were established and successfully clipped in 2006: 19 riparian and 6 upland. The following locations included riparian and upland sites: Amisk Creek, Gull Lake, Medicine River, Rosebud River (Thurn Pit) and Berry Creek. The following locations were all riparian sites: Red Deer River (Dinosaur Provincial Park), Little Sandhill Creek (Dinosaur Provincial Park), Keho Lake, Lyndon Creek, Todd Creek, Callum Creek, Waldron, St. Mary River (Woolford Provincial Park), Bow River (Wyndham Provincial Park), Gooseberry Lake, and Beaver Creek.

Average forage production in the riparian zones was 2896 kg/ha (2585 lb/acre) in 2005, ranging from 632 to 6409 kg/ha (536 to 5723 lb/acre) and showing a high degree of variability between the sites. 2006 average riparian forage values were higher than 2005 at 4278 kg/ha (3820 lb/acre) and varied from 1082 to 6873 kg/ha (966 to 6136 lb/acre). Many of the sites were subjected to high water levels during flooding in June 2005, which resulted in silt deposition that covered or removed low vegetation, having the effect of reducing the weight of the clippings. All natural subregions experienced increases in riparian forage production due to increased rainfall, especially in August in the Central Parkland subregion. In addition, the sites affected by flooding in June 2005, showed recovery and corresponding increased production. Sites away from water at a distance of 100 m or greater or with dense over-storey, e.g. *Populus* spp., generally had lower forage production, while those directly beside a stationary water body had greater forage production. Creeks and rivers had similar forage production, although less than some of the lakes.

Four upland areas composed of native rangeland or tame species were surveyed to compare upland production with their associated riparian zones and averaged forage production of 1683 kg/ha (1503 lb/acre) in 2005. The 2006 (2668 kg/ha) values were higher than 2005 (1683 kg/ha). Where both riparian and upland production was sampled at 4 sites, riparian production was greater, except for Gull Lake, where the opposite was true. Five of the riparian and upland sites were grazed, varying from 34% to 51% grazing utilisation.

A separate project was completed in 2006, evaluating forage values for different riparian health regimes on the same water body. The forage results are presented in this report. Overall, the highest total average forage was found in the healthy sites, while unhealthy sites had the lowest averages. Further correlations were made with breeding bird biodiversity, which results are found in the Cows and Fish report "Breeding Bird Surveys on Select Riparian sites in Central and Southern Alberta (2006)".

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1.0 Introduction

Alberta agriculture has relied on the production of healthy rangeland pastures since the late 1800s. When used in a sustainable fashion, these areas provide an abundant forage supply for agriculture and many other values such as recreation, soil conservation, wildlife habitat, and water quality. Riparian areas in these pastures provide only 2-5% of the landscape but maintaining a healthy riparian area has been well documented as an important component to ensuring healthy range and pasturelands (Adams and Fitch 1998).

Limited information on riparian pasture productivity exists. Varying levels of upland production information exists from most regions, based on field data generated by Alberta Sustainable Resource Development, Public Lands (AB. SRD), however riparian data is generally lacking. In the 2003 growing season, a production survey was completed mostly in the Central Parkland Natural Subregion of Alberta (DeMaere 2003). Riparian areas from a variety of water body types were sampled for plant species composition, forage and litter production, and utilization. A follow-up survey was conducted in 2005 of eleven of the 2003 survey plots with an additional seventeen sites surveyed in the Foothills Fescue, Northern Fescue, Mixed Grass and Dry Mixed Grass Natural Subregions (Desserud and Warner 2005). In 2006 twenty-two of the 2005 sites were re-surveyed and an additional three were added (Thurn Pit) (Appendix 1). Data was not available in 2005 for the Vilna site, surveyed in 2003 and 2005. Also in 2006, five of the 2005 sites were removed: Little Fish Lake, Sullivan Lake, Old Man Dam and two sections of the St. Mary River at Woolford Provincial Park. This survey will continue in 2007.

The purpose of this report is to summarize the data gathered and suggest recommendations to further increase an understanding of riparian production in these areas. This will help producers better understand how productive these areas are, and how their pastures respond over time to changes in grazing pressure and natural variability.

2.0 Methods

The field portion of the survey consisted of three parts; site establishment, plant species composition sampling, and forage clipping.

2.1 Site Establishment

Twenty-five sites were established between April 15 and May 27, 2006. Fourteen sites were in potential grazing areas (Amisk Creek, Medicine River, Iron Creek, Gull Lake, Todd Creek, Berry Creek, Beaver Creek, Rosebud River (Thurn Pit), Lyndon Creek and Callum Creek), although, of these only five were grazed in 2006. The remainder were in provincial parks (Wyndham-Carseland Provincial Park, Gooseberry Provincial Park, Woolford Provincial Park, Dinosaur Provincial Park) and at Keho Lake on the Lethbridge

Northern Irrigation District. Ten of the sites repeated those established in the 2003 survey. The remaining twelve sites targeted specific riparian community and habitat types were located by the global positioning system (GPS) coordinates recorded when initially sampled, between 1998 and 1999 (Thompson and Hansen 2002).

Five sites sampled in 2005 were not sampled in 2006 for the following reasons. The Little Fish Lake site was affected by a new road, resulting in contamination of the riparian area by thistle and other weedy species. The Sullivan Lake site was originally part of large ephemeral lake system; however, it had been separated from the main system by cultivated fields of smooth brome. The Old Man Dam site was originally in the Old Man River flood plain but was developing into upland grassland because of the proximity of cultivated fields and drying out of the site due to the height of one of the active river channels. Two of the three sites on the St. Mary River at Woolford Provincial Park were abandoned due to their similarity to other *Populus* spp./*Cornus stolonifera* sites: the POPUDEL/CORNSTO site on the Red Deer River at Dinosaur Provincial Park and the POPUBAL/CORNSTO site on the Bow River at Wyndham-Carseland Provincial Park, and a desire to maximise diversity of sites sampled. Data was not available in time for inclusion in this report for the Kussler and Vilna sites, which were sampled in 2005 and 2006.

For the grazed sites, five to ten forage production cages were installed at roughly 20 meter intervals, if the area permitted. Cages were placed at closer intervals if there was insufficient area to accommodate 20 meter spacing. The spacing of the cages was therefore largely determined by the area size, and topographical restrictions. Plant community selection was based on proximity to water and how conducive the area was to the cage specifications of a 1.25 m² area at the base by 1.25 m tall. In four pastures, upland cages were established as sites for comparison to the riparian communities. In all cases the riparian area and associated uplands were stratified and measurements of water body type, riparian band types and riparian widths were recorded.

2.2 Plant Species Composition

Plant species composition sampling occurred in 2003 and 2005. All sites were sampled with 15 subplots along 30 meter transects. All transects were permanently located with a GPS establishing geographic location (UTM coordinates) and marked with pin flags at each subplot.

The POPUBAL/CORNSTO site on the Bow River at Wyndham-Carseland Provincial Park and the POPUDEL/CORNSTO site on the Red Deer River at Dinosaur Provincial Park had been flooded in 2005, resulting in a layer of silt covering most of the forbs and litter. These sites were assessed for plant species composition again in 2006.

Data collection methodology followed Rangeland Health Assessment protocols (Adams et al. 2003). Nested subplots (1 m x 1 m) were set up at 2 m intervals, fifteen subplots per transect. Within each subplot, a Daubenmier frame (20 cm x 50 cm) provided the basis for detailed species cover estimates, a quarter meter frame for range health (the

level of litter, bare soil, mosses and lichens, and noxious weeds) and a 1 m x 1 m frame for shrub cover (Figure 2.2.1). At sites where trees or shrubs greater than 2.5 m existed, canopy cover of these were measured in one large 20 m^2 (4 m x 5 m) plot at the center of the transect (15 m). Plant species names follow the nomenclature of Moss (Moss 1994).



Figure 2.2.1 Subplot Layout Example

2.3 Forage Production

Forage production cages, and areas without cages (ungrazed sites) were clipped from July 20 to August 20, 2006 to coincide with peak forage production as closely as possible. All forage within the cages was clipped within a 0.5 m² sample. Graminoids and forbs were clipped to ground level and sorted into separate bags. Current annual growth was clipped on all shrubs rooted within the frames.

Utilization clipping occurred at all sites where grazing by cattle occurred before production clipping. Five 0.5 m² samples were clipped outside the cages and separated to graminoid, forb, and shrub components. These were usually located between the first five cages within the site (see Figure 2.3.1 below).

0.5m ² Utilization plots \square \square \square \square \square \square \square \square \square \square	riparian band b		Cage	s with ().5m² plots
	water's ed	ge			

Figure 2.3.1 Schematic layout of cage and transect locations. Configuration changed slightly at each location due to site limitations. 2.4 Site and Soil Descriptions

The site characteristics of each reference area were described, including: elevation, aspect, slope, drainage, legal land description, and GPS coordinates. Soil pedons were dug to the depth of the C Horizon, or the ground water level, whichever came first. A description of each soil profile was completed that included the following:

- 1) depth of surface soil horizons
- 2) texture of surface and subsurface soil horizons
- 3) depth to lime (effervescence with $CaCO_3$)
- 4) presence of mottles or gleying and at what depth
- 5) presence of bands of aggregate
- 6) photograph of the profile with scale provided.

Where possible, additional soil profile information was recorded, for example colour (using Munsell Reference) as well as root material, stoniness and pH. Classification to soil order and subgroup was made using the Agricultural Region of Alberta Soil Inventory Database (AGRASID 3.0).

Please see "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27", Appendix 1, for detailed soil information.

2.5 Follow-up and Data Processing

After clipping all forage cages were recovered and stored on site or at a nearby location as per the landowners' instructions. Data collected were summarized as follows:

• Forage production samples were dried and weighed by Alberta Sustainable Resource Development methodology. The data were summarized per site.

• Each landowner or land manager was interviewed for information regarding the pasture the site was located in. This information included pasture size, riparian size, present use, and historic management.

2.6 Biodiversity Forage Assessment

A separate project, the Biodiversity Project, was completed in 2006, evaluating forage values for different riparian health regimes on the same water body. Further correlations were made with breeding bird biodiversity and riparian health, which results are found in the Cows and Fish report "Breeding Bird Surveys on Select Riparian sites in Central and Southern Alberta (2006)"(Cerney 2006).

Eighteen biodiversity sites were established between May 7 and June 6, 2006, at six riparian locations: Todd Creek, Lyndon Creek, Beaver Creek, Amisk Creek, Iron Creek and Ribstone Creek. At each stream, riparian sites with three health designations were pre-assigned: healthy, healthy with problems and unhealthy, with four or five forage cages established at each site. Upon completion of the riparian health inventories, some of the pre-assigned healthy sites were assigned healthy with problems and some of the pre-assigned unhealthy sites were found to be healthy with problems.



Figure 2.6.1 Schematic of forage cage location in relation to biodiversity plots



Figure 2.6.2: Schematic showing location of forage cage in relation to the biodiversity plot

At each site the cages were located in the center of the biodiversity plot, approximately 5 to 15 m from the water feature, depending on the terrain, in an area where the vegetation would provide forage value, e.g. shrubs and graminoids (Figure 2.6.2). One forage cage was set up within each biodiversity plot, normally four plots per site. An additional cage was placed outside the biodiversity plots but within similar vegetation, to provide statistical significance (Figure 2.6.1). At some sites the size of the healthy with problems and unhealthy sites precluded four biodiversity plots, and so three were set up instead.

Grassland Range Health Assessment - Score Sheet

Site				bserver	623	Date
LSD	Quarter	Section	Township	Range	Meridian	Photo #
GPS Coord ((NAD 83) Lat.	Lonş	k	Estimated fo	rage production	livac or kg/ha

Special Observations (climate, changes in management)

Scoring (circle appropriate values and add their sum to the SCORE box):

1. What kind of plants are on the site? What is the plant community?

Dominant species

Grasses & Grasslikes	% Cover	Forbs	% Cover	Shrubs	% Cover	Trees	% Cover
							-
						<u>X</u>	
Community Type							

Ecologic	al Status (choose 1A or 1B)					Comments	Score
1A	Native Grassland:	24	16	8	0	2	
18	Modified Grassland:	9	5	0	9		

2. Are the expected plant layers present?

Community Structure	6	4	2	0	Comments	Score
internet internet in the second second						

3. Does the site retain moisture?

Litter cover and Distribution	15	8	0	-	Comments	Score
1	()					

4. Is there accelerated soil erosion? Site Normally (circle) Stable / Unstable

Site Stabi	ility					Comments	Score
4.1	Erosion:	6	4	2	0		
4.2	Bare Soil:	3	2	I	0	Human caused bare soil (%) Moss & lichen cover (%)	

5. Are noxious weeds present? (score using density distribution guide on back page)

NOXIOUS	Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1	Ganopy Cover	3	2	1	0					
5.2	Density Distribution	3	2	1	0					1
Frend (an	mensity (esc tong term (a	woward /	Stable	L / L-D	1 / 01	/ м-п / п		Site	Score (total all score	5)
trene (op)	went - circle). Opward 7 18	And the second s	Junoie .	UUKIO	a11					

Figure 2.6.3 Range Health Assessment Score Sheet



Figure 2.6.4 Locations of sites for the Riparian Forage Production survey. Sites that served as the 2006 Biodiversity Project sites are also indicated.

2.7 Range Health Assessments

Range Heath Assessments were not repeated in 2006, since they were completed in 2005 and there was little change in range conditions from 2005 to 2006. Range Health Assessments 2005) followed the Grassland Range Health Assessment format (Adams et al. 2003). Data included dominant species, ecological status (native or tame grassland), litter cover, bare soil, and noxious weeds (Figure 2.7.1).

2.8 Site Characteristics

Twenty-five riparian and upland forage sites were established in total, 19 riparian and 6 upland sites (Figure 2.8.1).

	Forage (F) Biodiversity (B)	Туре	Weather Station
CENTRAL PARKLAND			
Amisk Creek (Riparian)	F/B	stream	Camrose
Amisk Creek (Upland)	F	upland tame species	Camrose
Gull Lake (Riparian)	F	lake	Red Deer
Gull Lake (Upland)	F	upland tame species	Red Deer
Iron Creek (Riparian)	F/B	stream	Camrose
Medicine River (Riparian)	F	river	Red Deer
Medicine River (Upland)	F	upland tame species	Red Deer
DRY MIXED and MIXED GRASS	_		
Berry Creek (Riparian)	F	stream	Brooks
Berry Creek (Upland)	F	upland native species	Brooks
Little Sandhill Creek, Dinosaur Prov. Pk.	F	stream	Brooks
Red Deer River, Dinosaur Prov. Pk.	F	river (flood plain)	Brooks
Keho Lake (Mixed Grass)	F	lake	Lethbridge
FOOTHILLS FESCUE			
Beaver Creek (ROSAWOO, and SALIEXI)	F/B	stream	Claresholm
Bow River, Wyndham-Carseland Prov. Pk.	F	• (61 1 1 •)	Claresholm
(POPUBAL and ELAECOM)	F	river (flood plain)	Claresholm
Callum Creek North, Waldren	F	stream (flood plain)	Claresholm
Landen Creek South, waldron	F/B	stream (nood plain)	Claresholm
Lyndon Creek	F	stream	Drumheller
Rosebud River, Thurn Pit (Riparian)	F	stream	Drumheller
Rosebud River, Thurn Pit (Upland)	F	upland species	Drumheller
Rosebud River, Thurn Pit (Crested wheatgrass)	F	upland species	Cardston
St. Mary River, Woolford Prov. Pk.	F/B	river	Claresholm
Todd Creek	17D	stream	
NORTHERN FESCUE	E		Coronation
Gooseberry Lake Prov. Pk.	Г Г	lake	Coronation
Ribstone Creek	В	stream	Coronation

Cable 2.8.1 Forage and Biodiversity site locations listed by Natural Subregion,	
Riparian or Upland type and associated Environment Canada Weather Station	l

Seven forage sites were in the Central Parkland, five in the Dry Mixedgrass and Mixed Grass, twelve in the Foothills Fescue and one in the Northern Fescue natural subregions. Appendix 2 contains detailed information on each site. Details for the Biodiversity project sites can be found in the Cows and Fish report "Breeding Bird Surveys on Select Riparian sites in Central and Southern Alberta (2006)".

In 2005, forage production values from Vilna wetlands and the Wildhorse Hills (Kussler) were included; however, data from these sites were not available for this report, due to time constraints, so were not included.

3.0 Results and Discussion

3.1 Plant Species Composition

Plant species composition was not repeated in 2006, except for two sites, since it would not have changed appreciably from 2005 (Appendix 3). The two sites that were reassessed were the POPUBAL/CORNSTO site at Wyndham-Carseland Provincial Park and the POPUDEL/CORNSTO at Dinosaur Provincial Park, both of which had been flooded in 2005, resulting in a layer of silt covering most of the forbs and litter. Nevertheless, aside from a small amount of forb growth, the silt cover still affected the sites, so no changes were made to the species composition results. The heavy over story of the *Populus* spp. and the shrub layer most likely slowed the recovery of the forbs and grassed. The species composition of these sites should be assessed again in 2007 in the event there has been further recovery from the flood.

Although species composition was not sampled at the Gull Lake site, field observations indicated that willows (*Salix* spp.) had increased in cover over what was reported in 2003; therefore, this site should be re-assessed in 2007.

3.2 Rainfall Records

Unlike 2005, rainfall records for 2006 show a more consistent pattern, although with higher amounts than the climate normals, in general. Rainfall records for 2005 clearly provided evidence for flooding in June, showing a spike in rainfall amount, especially in the southern areas.

Generally, in 2005 most areas experienced higher than normal rainfall in June, less than normal in July and higher than normal in August. All weather stations reported considerably less rainfall in 2006 than 2005. The Camrose area had less than normal rainfall prior to July 2006, and then most of the rainfall fell during July and August 2006. Conversely, the Red Deer area saw close to normal rainfall in June, less in July and more in August and September. Coronation was similar to Camrose, expect for a dip in rainfall in July.



Figure 3.2.1 Rainfall records from Camrose, Coronation and Red Deer Weather Monitoring Stations comparing 2003 records with normals from 1971 to 2000 (Environment Canada, National Climate Archive).



Figure 3.2.2 Rainfall records for Camrose, Coronation and Red Deer Weather Monitoring Stations comparing 2005 and 2006 records with normals from 1971 to 2000 (Environment Canada, National Climate Archive).



Figure 3.2.3 Rainfall records for Clareshom and Cardston Weather Monitoring Stations comparing 2005 and 2006 records with normals from 1971 to 2000 (Environment Canada, National Climate Archive).



Figure 3.2.4 Rainfall records for Lethbridge, Brooks and Drumheller Weather Monitoring Stations comparing 2005 and 2006 records with normals from 1971 to 2000 (Environment Canada, National Climate Archive).

The Claresholm area in 2006 had higher than normal rainfall in June and less than normal in July through September. Cardston in 2006 had considerably less rainfall than normal; however, some of the weather station data was missing, possibly making the results inaccurate.

Lethbridge rainfall in 2006 followed normal patterns until August, when higher than normal amounts fell. The Brooks and Oyen areas had similar patterns, normal rainfall in May and June 2006, then less than normal in July and August 2006.

3.3 Comparison of the 2005 Survey with the 1999 Survey

A comparison of the 2005 species composition, with a survey conducted in 1999 and 2000, is displayed in detrended correspondence analysis diagrams (Figure 3.3.1 and Figure 3.3.2).



Figure 3.3.1 Detrended Correspondence Analysis showing plant communities; those followed by "b" are from the 1999 survey.

For the most part, species composition from the 2005 plots is similar to the 1999 plots, based on their position in the DCA diagrams, displayed with similar colours (Figure 3.3.1). The *Populus* spp. plots (POPUxxx) are clustered together due to the *Cornus stolinifera* cover, except the POPUHERB site, which has similar *Populus balsamifera* cover as the POPUBAL sites.

Acronym	Site Name
POPUDEL	Little Sandhill Creek, Dinosaur Prov. Pk.
DESCCAE	Red Deer River, Dinosaur Prov. Pk,
SCIRPUN	Gooseberry Lake, Prov. Pk
SCIRPUNb	Gooseberry Lake, Prov. Pk
PHALARU	Keho Lake
SALIPET	Little Fish Lake
SALIPETb	Little Fish Lake
CAREATH	Lyndon Creek
CAREATHb	Lyndon Creek
POPBHERB	Old Man Dam
POPBHERBb	Old Man Dam
SALIBEB	Sullivan Lake
SALIBEBb	Sullivan Lake
ELEOPAL	Todd Creek
POAPRAT	Callum Creek North
BROMINE	Callum Creek South
POPUANG	St. Mary River, Woolford Prov. Pk.
POPUTRE	St. Mary River, Woolford Prov. Pk.
SALILUT	St. Mary River, Woolford Prov. Pk.
POPUBAL	Bow River, Wyndham-Carseland Prov. Pk.
POPUBALb	Bow River, Wyndham-Carseland Prov. Pk.
ELACOM	Bow River, Wyndham-Carseland Prov. Pk.
ELACOMb	Bow River, Wyndham-Carseland Prov. Pk.

 Table 3.3.1 Species acronyms and corresponding site names for Figure 3.3.1

Gooseberry Lake (GOOS), Bow River, Wyndham-Carseland Provincial Park ELAECOM (WYNEL), and POPUBAL (WYNPB), and Old Man Dam (OLDM) had the closest similarity of plant composition between the 2005 and 1999 surveys (Figure 3.3.2). Lyndon Creek (LYND) differed slightly, possibly because of changes to the creek bank caused by flooding in 2005. Little Fish Lake (LFISH) and Sullivan Lake (SULL) also differed, being ephemeral wetlands whose species composition might vary more rapidly with changing moisture levels. 2005 was a wet year, as shown by the rainfall records (Section 3.2) while 1999 and 2000 may have been drier. The remaining sites did not have corresponding 1999 data.



(32% explained variance)

Figure 3.3.2 Detrended Correspondence Analysis showing site names; those followed by "B" are from the 1999 survey.

3.4 Forage Production

All Subregions

Total average forage production in the riparian zones in 2006 (4278 kg/ha) was greater than 2005 (2852 kg/ha) (Table 3.4.1). The largest increase was in the Dry Mixed Grass and Mixed Grass subregion (1858 kg/ha increase) caused in a large part by recovery from the 2005 June flood in Dinosaur Provincial Park, and a drop in the water level of Berry Creek, which exposed greater *Carex* spp. cover. Similarly, total average forage production in the upland regions increased in 2006 (2668 kg/ha) over 2005 (1683 kg/ha).

Table 3.4.1 Average riparian forage production by Natural Subregion (kg/ha)

				Increase
	2003	2005	2006	2006/2005
Central Parkland (n=4, 3-2003)	4356	2852	4640	1788
Dry Mixed and Mixed Grass (n=4, 1-2003)	3520	2224	4081	1858
Foothills Fescue (n=10)		2369	2705	336
Northern Fescue (n=1)		4138	5688	1550
Total average riparian forage	3938	2896	4278	1383

			Increase
2003	2005	2006	2006/2005
3763	2046	3304	1258
553	1321	2032	712
	1119	1894	774
2158	1683	2668	985
	2003 3763 553 2158	20032005376320465531321111911683	2003200520063763204633045531321203211191894215816832668

Table 3.4.2 Average upland forage production by Natural Subregion (kg/ha)



Figure 3.4.1 Average riparian forage production by Natural Subregion (kg/ha)



Figure 3.4.2 Average upland forage production by Natural Subregion (kg/ha)

Central Parkland

In the Central Parkland, overall forage production increased in 2006 (4640 kg/ha) over 2005 (2852 kg/ha) and greater than the 2003 values (4356 kg/ha) (Table 3.4.1).

Amisk Creek

Amisk Creek riparian forage production in 2006 (5230 kg/ha) was greater than 2005 (3839 kg/ha) although it was still lower than 2003 (5451 kg/ha) levels (Appendix 1). Five of the Amisk Creek cages were in the same location in 2006 and 2005. In 2006, three of the cages were also used for the Biodiversity Project forage production and thus were placed further downstream and farther apart than in 2005, although still in the same plant community type. Amisk Creek water level was low in 2005, due to a lack of rainfall after June, resulting in upland species in the riparian area, e.g. smooth brome (*Bromus inermis*). In 2006 a beaver dam upstream of the sampling site raised the water level; which, despite a dry summer, increased sedge (*Carex* spp.) growth. This most likely increased the forage and litter weights.

Amisk Creek upland forage also increased in 2006 (3254 kg/ha), probably due to late summer rainfall, that resulted in new growth in August. Litter production more than doubled over 2005, probably a result of more than three years with little to no grazing. The upland cages were placed in the same location in 2003, 2005 and 2006.

Gull Lake

Gull Lake forage production more than doubled in 2006 over 2005 in the riparian site (3263 kg/ha vs. 1567 kg/ha) and had a one and half increase in the upland site (4537 kg/ha vs. 2718 kg/ha) (Appendix 1). The sampling cages were placed in the same locations in 2005 and 2006. Gull Lake water level was lower in 2006 than 2005, allowing more graminoid growth. In contrast, much of the site was water covered in 2005. The upland site had not been grazed for four years in 2006, resulting in abundant graminoid growth.

Iron Creek

Iron Creek forage values were higher in 2006 (3193 kg/ha) than 2005 (2410 kg/ha) (Appendix 1). Five of the Iron Creek cages were in the same location in 2006 and 2005. In 2006, five of the cages were also used for the Biodiversity Project forage production and thus were placed further downstream and farther apart than in 2005, although still in the same plant community type.

The Iron Creek water level was lower in 2006 than 2005, probably due to lower rainfall and also several man-made dams upstream of the sampling site. The lower water levels resulted in increased graminoid growth; nevertheless, many of the cages were partially submerged, which also happened in 2005. This reduced the amount of litter, similar to the 2005 values.



Figure 3.4.3 2003 -2006 Forage production separated into graminoid, forb, and shrub components (Central Parkland Natural Subregion sites).

Medicine River

Medicine River riparian forage values in 2006 (6873 kg/ha) were almost twice those of 2005 (3594 kg/ha) (Appendix 1). The river was lower in 2006, exposing reed canary grass (*Phalaris arundinacea*) with high forage value, which had been covered by high water in 2005. The upland values were also greater in 2006 (2121 kg/ha vs. 1395 kg/ha) due to late summer rainfall and graminoid re-growth. The 2003 riparian values for Medicine River are not included in the comparison chart (Figure 3.4.2) because the original 2003 site had to be moved in 2005 due to a house construction. The 2005 and 2006 riparian sampling cages were in the same location.

Dry Mixed Grass and Mixed Grass

In the Dry Mixed Grass and Mixed Grass areas, overall forage production was greater in 2006 (4081 kg/ha) than 2005 (2224 kg/ha) in the riparian sites as well as in the upland sites (2032 kg/ha vs. 1321 kg/ha) (Tables 3.4.1 and 3.4.2).



Figure 3.4.4 2003 -2006 Forage production separated into graminoid, forb, and shrub components for the Dry Mixed Grass, Mixed Grass, and Northern Fescue Natural Subregion sites.

Berry Creek

In 2006, the Berry Creek water level was lower than the previous year when the water level of the creek had been raised by the irrigation canal system. This resulted in the exposure of more riparian areas with greater graminoid cover, e.g. sedge (*Carex* spp.) and more than double the forage production over 2005 (5584 kg/ha vs. 2110 kg/ha) (Appendix 1). The changing water levels and stream bank at Berry Creek required the riparian site to be moved downstream in 2005 and again in 2006. The same plant community was sampled; however, differences in the production for the three years could be partially attributed to the changing site locations.

Berry Creek upland forage values almost doubled in 2006 (2032 kg/ha) over 2005 (1321 kg/ha), which in turn was more than double 2003 values (553 kg/ha). The increase, in part due to rainfall amounts, could be primarily attributed to range management: the area was not grazed in 2006; grazed once in the spring in 2005; and heavily grazed in previous years. The upland cages were in the same location in 2003, 2005 and 2006.

Keho Lake

The Keho Lake site, dominated by reed canary grass (*Phalaris arundinacea*), had the second highest forage production (6533 kg/ha) in all the riparian and upland sites, similar to its position in 2005 (4595 kg/ha). The 2005 site had been disturbed by mechanical means in 2006, so another site, approximately 50 m from the 2005 site, was sampled instead. Although the plant community was similar, the 2006 site contained no forbs, unlike 2005; therefore comparisons in forage production cannot be made.

Little Sandhill Creek (Dinosaur Park Provincial Park)

The forage production at the DESCCAE site (Little Sandhill Creek) almost doubled in 2006 (3062 kg/ha) over 2005 production (1558 kg/ha), probably due to recovery following the 2005 flood. The same site was sampled in 2005 and 2006.

Red Deer River (Dinosaur Park Provincial Park)

One of the sites with the lowest forage production was the POPUDEL-CORNSTO (Red Deer River) site at Dinosaur Provincial Park with 1145 kg/ha, although in line with most other sites, the forage increased in 2006 (1145 kg/ha) over 2005 (632) (Appendix 1). In 2005 the site had been flooded in June, resulting in heavy silt deposits and reduced graminoid and forb cover. Some recovery occurred in 2006, though the heavy over story of trees and shrubs inhibited graminoid and forb growth in comparison to other sites. The same site was sampled in 2005 and 2006.

Rosebud River (Thurn Pit)

Four sites were sampled at Thurn Pit on the Rosebud River. The riparian bench showed an increase in production in 2006 (2316 kg/ha) over 2005 (1299 kg/ha), as did the crested wheatgrass site (1624 kg/ha in 2006 and 940 kg/ha in 2005). Conversely, the upland site had less production in 2006 than 2005 (2162 kg/ha in 2006 and 3366 kg/ha in 2005).

Northern Fescue

Gooseberry Lake Provincial Park

Gooseberry Lake Provincial Park (SCIRPUN) had 5688 kg/ha in forage cover in 2006 compared to 4138 kg/ha in 2005. The site is a combination of rushes (*Scirpus pungens*) and foxtail barley (*Hordeum jubatum*) which in 2006 appeared to have greater cover of rushes than foxtail barley than in 2005, probably due to higher lake levels. The same site was sampled in 2005 and 2006.

Foothills Fescue

Drier conditions in the Foothills Fescue region in 2006 resulted in the lowest total average forage production increase, 2705 kg/ha in 2006 versus 2369 kg/ha in 2005.

A few sites showed an increase, but the majority had similar or less forage production than 2005.

Beaver Creek

Consistent with many of the Foothills Fescue sites, Beaver Creek forage production decreased in 2006 as compared to 2005. The ROSAWOO site produced 1731 kg/ha in 2006 compared to 2618 kg/ha, while the SALIEXI site produced 3627 kg/ha versus 4279 kg/ha in 2005. The graminoid component remained more or less the same, while the shrub component decreased. The decrease was probably due to an increase in the height of the shrubs, taking them out of forage reach, i.e. greater than 2 m. For example, in 2005, at the SALIEXI site, new sandbars produced by the 2005 June flood, resulted in a proliferation of young sandbar willow (*Salix exigua*), which following two year's growth reached heights of over 2 m. The same sites were sampled in 2005 and 2006.



Figure 3.4.5 2005 -2006 Forage production separated into graminoid, forb, and shrub components for the Foothills Fescue Natural Subregion sites.

Bow River, Wyndham-Carseland Provincial Park

The Bow River, Wyndham-Carseland Park ELAECOM site produced higher forage in 2006 (1328 kg/ha) than 2005 (789 kg/ha). The dry summer of 2006 reduced the shrub cover, and probably resulted in higher graminoid and forb cover with greater forage

production. In contrast, the POPUBAL/CORNSTO site, affected by the 2005 June flood, still had not recovered and in fact had less production than 2005. That site was also affected by human traffic as it is in the midst of camping grounds. The same sites were sampled in 2005 and 2006.

Callum Creek, Waldron

The two Callum Creek sites (North and South) did not follow the trend of increased forage in 2006. Instead, their forage productions were similar to 2005 or slightly lower. The north site produced 2543 kg/ha in 2006 and 2602 in 2005, while the south site produced 2938 kg/ha in 2006 and 3334 kg/ha in 2005. Rainfall amounts in the area were lower in 2006, resulting in reduced graminoid and forb growth. The same sites were sampled in 2005 and 2006.

Lyndon Creek

Heavy flooding in June 2005 at Lyndon Creek compromised the forage sampling by sediment deposition, and reduced the average forage production values. As a result the 2006 forage production showed a large increase, 6327 kg/ha over 2728 kg/ha in 2005. The same site was sampled in 2005 and 2006.

St. Mary River, Woolford Provincial Park

Only the SALILUT site was sampled at St. Mary River, Woolford Provincial Park in 2006, and dry conditions resulted in slightly lower forage production (1111 kg/ha in 2006, 1242 kg/ha in 2005). The same site was sampled in 2005 and 2006.

Todd Creek

Todd Creek was flooded in 2005, covering four of the cages with silt, and reducing the forage production. In 2006 forage production (5690 kg/ha) increased over 2005 values (3916 kg/ha) following recovery from the 2005 flood. In 2006, only six cages were setup, as the remaining four were used for the 2006 Biodiversity Project forage production and were located in different community types.

3.5 Forage Utilization

Forage utilization in the sites with known current year grazing or obvious herbage grazing was measured by setting up five plots outside the caged plots, in the same area. The utilization was calculated as the percentage difference between the forage production of the caged and uncaged plots.

The forage utilization at Medicine River was 36%. This site has continual grazing throughout the summer, of 50-60 yearlings plus two llamas, resulting in overall low remaining forage approximately 2000 kg/ha. Berry Creek was not grazed by cattle this

year; however wild ungulate utilization was evident and measured at 51% in the riparian area. Lyndon Creek had 45% forage utilization of a high forage production, over 6000 kg/ha, grazed by both cattle and wild ungulates. The Callum Creek (North) site was similar to Medicine River, with grazing throughout the summer, in this case by horses. Forage utilization of a potential 2500 kg/ha was 50%. The grazing utilization for Thurn Pit Upland was 34%, although the grazing regime is not available.



Figure 3.5.1 Grazed sites, showing percent grazed as compared to ungrazed plots

3.6 <u>Litter production</u>

Overall, litter production in 2006 was higher than 2005, varying from 20 kg/ha (18 lbs/acre) to 3366 kg/ha (3006 lbs/acre). Total average litter production for the Central Parkland and the Fooothills/Northern Fescue subregions was higher in 2005, while the Mixed Grass and Dry Mixed Grass subregions were slightly lower (Figure 3.6.1, Table 3.6.1).

Central Parkland

Amisk Creek showed an increase in litter in the riparian area in 2006 (3247 kg/ha) over 2005 (371 kg/ha) (Figure 3.6.2.). In 2005 Amisk Creek had a higher water level, due to the large amount of rainfall that summer, and many of the cages were under water, reducing the litter collection. In the upland region the increase (3366 kg/ha vs. 1239 kg/ha) is most likely due to the grazing practice over the previous three years. The

pasture had not been grazed for three years, resulting in ever increasing litter from the previous year. Iron Creek also had lower water levels in 2006, partially caused by a dam installed upstream of the site, allowing increased litter collection. Gull Lake and Medicine River showed similar litter values in 2005 and 2006 in the riparian areas.

Dry Mixed Grass and Mixed Grass

Berry Creek water levels were lower in 2006 than 2005, resulting in greater accumulation of litter (Figure 3.6.3). The Dinosaur Provincial Park sites had almost no litter in 2005 due to silt deposit by the 2005 flood and recovery in 2006 resulted in litter accumulation. Lake Keho had higher water levels in 2006 than 2005; however, the site was moved because of disturbance preventing a comparison.

Foothills Fescue and Northern Fescue

The St. Mary River, Woolford Provincial Park (SALILUT) and the Bow River, Wyndham-Carseland Provincial Park sites were considerably drier in 2006 than 2005, as shown by the rainfall records, resulting in very small amounts of litter. Lyndon Creek and Todd Creek flooded in 2005, reducing litter by silt cover; therefore 2006 had greater litter production. Gooseberry Lake, in the Northern Fescue subregion, had a lower water level in 2006 than 2005 resulting in an increase in litter accumulation.



Figure 3.6.1 Average litter production by natural subregion comparing 2005 and 2006 values.

	2005	2006
Central Parkland	1092	2373
Dry Mixed Grass And Mixed Grass	1618	1493
Foothills Fescue	452	721
Northern Fescue	851	5494

2006 values.

Table 3.6.1 Average litter production by natural subregion comparing 2005 and

	Litter Production (kg/ha)						
	0 5	00 1	000	1500	2000	2500 3	000 3500
CENTRAL PARKLAND							
Amisk Creek (Riparian) 2003			1				
Amisk Creek (Riparian) 2005		<u>-</u>					
Amisk Creek (Riparian) 2006			1		-		
Amisk Creek (Upland) 2003							
Amisk Creek (Upland) 2005		I	<u> </u>	+-			
Amisk Creek (Upland) 2006		I	1				
Gull Lake (Riparian) 2003			+				
Gull Lake (Riparian) 2005		<u></u>	+				
Gull Lake (Riparian) 2006		I	╞╸───				
Gull Lake (Upland) 2003							
Gull Lake (Upland) 2005			+-1				
Gull Lake (Upland) 2006		I					
Iron Creek (Riparian) 2003		I	1	1		∎┼───┤	
Iron Creek (Riparian) 2005		I	1				
Iron Creek (Riparian) 2006		I	1		1		
Medicine River (Riparian) 2005		і	T				
Medicine River (Riparian) 2006		I	1	1	-		-
Medicine River (Upland) 2003							
Medicine River (Upland) 2005		1	÷	+-1			
Medicine River (Upland) 2006	<u> </u>	ا ا					
Medicine River (Upland Grazed) 2006							

Figure 3.6.2 2003 - 2006 Litter production. Error bars indicate standard deviation if applicable - Central Parkland Natural Subregion site.



Figure 3.6.3 2003 – 2006 Litter production. Error bars indicate standard deviation if applicable - Dry Mixed Grass, Mixed Grass, and Northern Fescue Natural Subregion sites.



Figure 3.6.4 2005 – 2006 Litter production. Error bars indicate standard deviation if applicable - Foothills Fescue Natural Subregion sites.
3.7 Grouping Sites by Water Body Type

Some trends do occur by grouping riparian sites by water body type (Figure 3.7.1). When grouped by water body type production values in 2005 indicated that ephemeral water areas produce the most, followed by lake-shore riparian areas. This could not be confirmed in 2006 because none of the ephemeral water areas were included in the survey, i.e. Sullivan Lake, Little Fish Lake and Vilna wetlands. This differs from the 2003 findings that lake-shore riparian areas produce substantially less. The difference is due to the inclusion of Keho Lake and Gooseberry Lake, both of which had over 5600 kg/ha (5000 lbs/acre) of forage production. Creeks and rivers produced similar forage values, while areas greater than 100 m from water sources, had the lowest forage production (Figure 3.7.1). In 2005, rivers had lower forage production and graminoid cover than areas greater than 100 m from water sources due to the effects of the June 2005 flooding throughout southern Alberta.

Another difference occurs when comparing riparian sites by their proximity to water (Figure 3.7.2). In 2006, production of riparian bands directly beside water averaged 3455 kg/ha (3085 lbs/acre) compared to 1725 kg/ha (1541 lbs/acre) produced by bands further up the bank. This difference would be expected as soil moisture would increase closer to the water source increasing the availability of water to plants (Adams and Fitch 1998).



Figure 3.7.1 2005 and 2006 mean forage production grouped by water body type including comparison to upland sites and flood plains, i.e. >100 m from water (not including Thurn Pit).

Table 3.7.1 2005 and 2006 mean forage production grouped by water body type including comparison to upland sites and flood plains, i.e. >100 m from water (not including Thurn Pit).

	Graminoids (kg.ha)		Total Forage (kg/ha)	
	2005	2006	2005	2006
Stream (2005 n=10 2006 n=11)	2057	3193	2692	2851
River (2005 n=4 2006 n=2)	1117	3457	1584	3086
Upland and Flood Plain (2005 n=8 2006 n=7)	2425	1932	2766	1725
Lake (n=3)	3272	4960	3433	4428

Table 3.7.2 2005 and 2006 mean forage production comparison (based on proximity to water) (not including Thurn Pit).

	Graminoids		Total	Forage
	2006	2005	2006	2005
Adjacent to water (2006 n=16, 2005 n=21)	3870	2505	3455	3068
>100 m from water (2006 n=7, 2005 n=8)	1932	2426	1725	2766



Figure 3.7.2 2005 and 2006 mean forage production comparison (based on proximity to water).

 Table 3.7.3 Forage production sites grouped by water body

STREAM Amisk Creek (Riparian) Beaver Creek (ROSAWOO, and SALIEXI) Berry Creek (Riparian) Callum Creek North, Waldron Callum Creek South, Waldron Iron Creek (Riparian) including exclosure Little Sandhill Creek, Dinosaur Prov. Pk. Lyndon Creek Todd Creek RIVER Medicine River (Riparian) St. Mary River, Woolford Prov. Pk. **UPLAND and FLOOD PLAIN** Amisk Creek (Upland) Berry Creek (Upland) Bow River, Wyndham-Carseland Prov. Pk. (POPUBAL and ELAECOM) Gull Lake (Upland) Medicine River (Upland) Red Deer River, Dinosaur Prov. Pk. LAKE Gooseberry Lake Prov. Pk. Gull Lake (Riparian) Keho Lake (Mixed Grass)

3.8 Range Health Assessments

In 2005 range health was assessed for the upland grassland sites, and some of the riparian sites that were over 100 m from water sources, e.g. on flood plains, or ephemeral water sources, that included non-riparian obligate graminoid species. Except for two riparian, sites, Callum Creek and Todd Creek, only upland sites were assessed. Callum Creek and Todd Creek, while considered riparian sites, also contain upland graminoid species, e.g. *Bromus inermis*, and thus were assessed. Sites in provincial parks, or areas that had no grazing for over ten years were not included.

The Range Health Assessment protocol developed by Adams et al. (2003) was followed. The results included healthy sites (recorded scores from 75 to 95), healthy with problems (60 to 68) and one unhealthy site (32) (Table 3.8.1).

An examination of the stocking rates shows the least healthy site, Medicine River, had continuous grazing, including llamas, which may have similar grazing practices as sheep or horses, i.e. close cropping. The two sites with the highest range health scores, Amisk

Creek and Todd Creek, had variable grazing, only when moisture conditions provide good forage. In the case of the Amisk Creek upland site, forage increased with higher moisture, promoting grassland growth, while in the case of Todd Creek, forage increased with lower moisture levels, allowing the wetland to dry out. The Berry Creek site also had variable grazing; nevertheless, the site has sandy soil, promoting dry conditions and bare soil. In addition, the site contained considerable *Agropyron cristatum*.

Range Health Assessments were not repeated in 2006, since they were done in 2005. Several sites did show potential changes to range health, while others remained similar to 2005 conditions. The 2005 table is included for reference, with comments regarding 2006 observations (Table 3.8.1).

Although not grazed prior to clipping in 2006, Todd Creek may be affected by horse grazing in 2007. Berry Creek had no grazing in 2006 prior to clipping and the forage weights indicate range health may be improving.

In 2006, Medicine River Upland remained in a condition similar to 2005 having a comparable stocking rate. Amisk Creek also remained the same, having had no grazing for two years.

	Site Name	Range	Health Score	Grazing Strategy, comments
		Score	Value	
	Amisk Creek Upland	95	Healthy	Variable, grazed only when moisture conditions warrant good forage value, e.g. high moisture levels; not grazed in 2006
	Berry Creek Upland	68	Healthy with problems	June 15 and later, 10–15 bulls, when moisture conditions warrant, non-native species (<i>Agropyron cristatum</i>); not grazed in 2006
	Medicine River Upland ungrazed	60	Healthy with problems	14 cow/calf pairs, 1 bull, 2 llamas, May to October continuous
	Medicine River Upland grazed	32	Unhealthy	14 cow/calf pairs, 1 bull, 2 llamas, May to October continuous
31	Callum Creek North, Waldron	67	Healthy with problems	n/a, non-native species (<i>Bromus inermis, Poa pratensis</i>) and low litter; horse and cow/calf grazing, May to October, intermittent
	Callum Creek South, Waldron	62	Healthy with problems	Not grazed in 2005 and 2006 due to high water
	Gull Lake Upland	75	Healthy	Ungrazed, non-native species (Bromus inermis, Poa pratensis)
	Todd Creek	82	Healthy	Variable, grazed only when moisture conditions warrant good forage value, e.g. low moisture levels; in 2006 evidence of early spring grazing, resulting in soil pugging, with no forage affects.

 Table 3.8.1 Sites with 2005 Range Health Assessments: range health score, value and comments.

3.9 Biodiversity Forage Results

3.9.1. Forage Production

In the biodiversity sites, forage production ranged from over 7,400 kg/ha (AM13) to 1,800 kg/ha (IR035) quite a variation between the sites (Figure 3.9.1).



Figure 3.9.1: Forage production separated into graminoid, forb, and shrub components, sorted by riparian health.

Overall, the highest total average forage was found in the healthy sites, the next in the healthy with problems and the lowest in the unhealthy sites (Figure 3.9.2). This trend continued in the vegetation components with healthy sites having on average greater graminoid, forb and shrub cover. Unhealthy sites averaged greater forb cover than healthy with problem sites, which could be consistent with the results of excessive grazing, e.g. an increase in species such as pasture sage (*Artemisia frigida*) (Adams et al. 2003).

Healthy sites would normally have more tall shrubs and trees and greater graminoid and forb cover due to less grazing. Healthy with problems sites should still have some tree

and shrub cover; however, grazing would reduce the graminoid cover. Unhealthy sites may be solely covered by graminoids and forbs with few shrubs.



Figure 3.9.2: Average forage production separated into graminoid, forb, and shrub components, sorted by riparian health.

3.9.2. Litter production

Litter production in the biodiversity sites followed the expected trends: the healthy sites averaged the highest litter production, followed by healthy with problems and the unhealthy sites with the lowest (Figure 3.9.4). While the vegetation of grazed sites recovers within the protection of cages, usually from the stored seedbank, the accumulated litter of past years would be less in grazed areas.

The healthy with problems and unhealthy sites all had evidence of grazing; whereas most of the healthy sites had less or no grazing. Grazing reduces litter by shortening the graminoid and forb structure and reducing the subsequent vegetation residue; therefore, the grazed sites would be expected to have less litter than the ungrazed, e.g. healthy sites (Adams et al. 2003).

Litter Production (kg/ha)



Figure 3.9.3: Total average litter production (kg/ha) sorted by riparian health.



Figure 3.9.4: Biodiversity sites litter production (kg/ha) showing standard deviation.

4.0 Conclusion

Average forage production in the riparian zones was 2896 kg/ha (2585 lb/acre) in 2005, ranging from 632 to 6409 kg/ha (536 to 5723 lb/acre) and showing a high degree of variability between the sites. 2006 average riparian forage values were higher than 2005 at 4278 kg/ha (3820 lb/acre) and varied from 1082 to 6873 kg/ha (966 to 6136 lb/acre).

In the Central Parkland, Dry Mixed Grass and Mixed Grass, and Northern Fescue overall forage production increased in 2006 over 2005. The increase was probably due to a combination of mid-summer rainfall and reduced grazing in most sites. Dry conditions in the Foothills Fescue region in 2006 resulted in a small average increase, where a few sites showed an increase, but the majority had similar or less forage production than 2005.

Unlike 2005, where only one site was grazed, five sites were grazed in 2006. Average grazing utilization was approximately 34%.

A separate study compared forage production among different riparian health regimes on the same water body (Cows and Fish report "Breeding Bird Surveys on Select Riparian sites in Central and Southern Alberta (2006)". Overall, the highest total average forage was found in the healthy sites, while the unhealthy sites had the lowest forage values, an expected trend. Within the breakdown by vegetation types, the only anomaly was a higher forb value for unhealthy sites as compared to healthy with problems, probably explained by the results of grazing.

Shrub forage production, up to 2.5 m in height, was incorporated into the clipping design in 2005 and 2006, unlike 2003. Most of the riparian sites situated away (100 m or more) from water had shrubs as a major vegetation component, e.g. buckbrush (*Symphoricarpos occidentalis*), red osier dogwood (*Cornus stolonifera*) or silverberry (*Elaeagnus commutata*). *Cornus stolonifera*, especially, showed evidence of browsing by wild ungulates in the provincial parks, although the extent of forage utilization was not measured for these species.

The higher than average rainfall for the southern areas, and flooding in several locations, affected the species composition and total forage production in 2005. Greater than average rainfall in 2005 would have been expected to result in greater forager production than in 2003, which was the end of a period of drought. Instead, at several locations, silt deposition by flooding and higher water levels reduced the available forage. Subsequently, recovery in 2006, with continuing higher rainfall than 2003, possibly resulted in increased nutrients correspondingly higher forage production overall.

Range Health Assessments for upland and drier flood plain areas indicated a range from unhealthy to healthy, the differences probably due to grazing practices.

Recommendations:

- The species composition should be re-sampled at the following sites in 2007:
 - Gull Lake Riparian an increase in willow (*Salix* spp.) species
 - Bow River, Wyndham-Carseland Provincial Park POPUBAL/CORNSTO recovery from the 2005 flood
 - Berry Creek Upland improved rangeland management, and possible encroachment by crested wheat grass
- Re-sample the species composition of areas that were flooded in 2005. Silt deposit and water action likely reduced the presence of many forbs and small shrubs.
- Several sites showed possible changes in range health; therefore it is recommended Range Health Assessments be repeated in 2007.
- With an additional study, perform detailed soil analysis and relate forage production to soil composition.

5.0 References

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Appendix 1

Table A.1 Detail Forage Production Values for sites sampled in 2003, 2005 and 2006.	
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	Graminoids (kg/ha)	Forbs (kg/ha)	Shrubs (kg/ha)	Total (kg/ha)	Total (lbs/acre)	Increase/ Decrease (kg/ha)
CENTRAL PARKLAND						
Amisk Creek (Riparian) 2003	4744	707	0	5451	4867	
Amisk Creek (Riparian) 2005	3282	549	9	3839	3428	-1612
Amisk Creek (Riparian) 2006	4200	883	147	5230	4670	1391
Amisk Creek (Upland) 2003	4675	296	63	5034	4495	
Amisk Creek (Upland) 2005	1971	90	0	2061	1841	-2973
Amisk Creek (Upland) 2006	3208	0	46	3254	2905	1192
Gull Lake (Riparian) 2003	2172	400	570	3143	2806	
Gull Lake (Riparian) 2005	1450	117	0	1567	1399	-1576
Gull Lake (Riparian) 2006	2764	335	165	3263	2914	1697
Gull Lake (Upland) 2003	3057	182	0	3240	2893	
Gull Lake (Upland) 2005	2541	177	0	2718	2427	-522
Gull Lake (Upland) 2006	4430	107	0	4537	4051	1819
Iron Creek (Riparian) 2003	4240	234	0	4474	3995	
Iron Creek (Riparian) 2005	2188	222	0	2410	2151	-2064
Iron Creek (Riparian) 2006	3053	131	9	3193	2851	783
Medicine River (Riparian) 2005	3486	104	4	3594	3209	
Medicine River (Riparian) 2006	6553	284	36	6873	6136	3279
Medicine River (Upland) 2003	2622	393	0	3015	2692	
Medicine River (Upland) 2005	1321	38	0	1359	1214	-1656
Medicine River (Upland) 2006	2002	119	0	2121	1894	762
Medicine River (Upland Grazed) 2006	1342	9	0	1351	1206	
DRY MIXED GRASS AND MIXED G	RASS					
Berry Creek (Riparian) 2003	3109	373	38	3520	3143	
Berry Creek (Riparian) 2005	1822	288	0	2110	1884	-1410
Berry Creek (Riparian) 2006	4671	913	0	5584	4986	3474
Berry Creek (Riparian Grazed) 2006	2598	125	0	2723	2431	
Berry Creek (Upland) 2003	661	151	3	814	727	
Berry Creek (Upland) 2005	1198	56	67	1321	1179	767
Berry Creek (Upland) 2006	1434	539	59	2032	1815	712
Keho Lake (Riparian) 2005	4352	243	0	4595	4103	
Keho Lake (Riparian) 2006	6533	0	0	6533	5833	1938
Little Sandhill Creek, Dinosaur Park (DESCCAE) 2005	1558	0	0	1558	1391	
Little Sandhill Creek, Dinosaur Park (DESCCAE) 2006	3044	0	18	3062	2734	1504
Red Deer River, Dinosaur Park (POPUDEL) 2005	252	103	277	632	564	

	Graminoids (kg/ha)	Forbs (kg/ha)	Shrubs (kg/ha)	Total (kg/ha)	Total (lbs/acre)	Increase/ Decrease (kg/ha)
Red Deer River, Dinosaur Park						
(POPUDEL) 2006	455	286	404	1145	1022	514
FOOTHILLS FESCUE						
Beaver Creek (ROSAWOO) 2003	1342	358	886	2587	2309	
Beaver Creek (ROSAWOO) 2005	1552	317	749	2618	2338	31
Beaver Creek (ROSAWOO) 2006	1037	161	534	1731	1546	-887
Beaver Creek (SALIEXI) 2003	2764	147	1368	4279	3820	
Beaver Creek (SALIEXI) 2005	947	55	2625	3627	3238	-652
Beaver Creek (SALIEXI) 2006	968	260	751	1979	1767	-1648
Bow River, Wyndham-Carseland Prov.						
Pk. (ELAECOM) 2005	537	26	225	789	704	
Bow River, Wyndham-Carseland Prov.	570	204	255	1229	1100	520
PK. (ELAECOM) 2006 Bow River, Wyndham-Carseland Prov	579	394	333	1328	1180	539
Pk. (POPUBAL) 2005	695	338	498	1531	1367	
Bow River, Wyndham-Carseland Prov.						
Pk. (POPUBAL) 2006	254	222	606	1082	966	-449
Callum Creek North , Waldron 2005	2144	221	237	2602	2324	
Callum Creek North, Waldron 2006	1987	556	0	2543	2270	-59
Callum Creek North, Waldron Grazed	1022	227	2	1261	1126	
	1022	237	2	2224	2077	
Callum Creek South, Waldron 2005	2963	335	36	3334	2977	
Callum Creek South, Waldron 2006	1786	790	362	2938	2623	-396
Lyndon Creek 2005	2484	146	98	2728	2436	
Lyndon Creek 2006	5781	266	279	6327	5649	3599
Lyndon Creek Grazed 2006	3939	197	25	3468	3096	-2859
Rosebud River, Thurn Pit (Riparian			10.00	1.000	44.50	
Bench) 2005	1023	265	10.93	1299	1159	
Rosebud River, Thurn Pit (Riparian Bench) 2006	17/3	306	178	2316	2068	1017
Rosebud River, Thurn Pit (Upland)	1745	390	170	2310	2008	1017
2005	3098	245	22	3365	3005	
Rosebud River, Thurn Pit (Upland)						
2006	1743	368	52	2162	1930	-1203
Rosebud River, Thurn Pit (Upland	710	260	10	1024	014	
Grazed) 2005 Resolved Piver, Thurn Dit (Unland	/18	269	19	1024	914	
Grazed) 2006	963	418	50	1432	1279	408
Rosebud River, Thurn Pit Crested						
Wheatgrass 2005	928	12	0.00	940	839	
Rosebud River, Thurn Pit Crested						
Wheatgrass 2006	1625	0	0.00	1624	1450	684
St. Mary River, Woolford Prov. Pk.	510	242	101	1242	1100	
St. Mary River, Woolford Prov Pk	519	2 4 2	401	1242	1109	
(SALILUT) 2006	361	606	144	1111	992	-131

	Graminoids (kg/ha)	Forbs (kg/ha)	Shrubs (kg/ha)	Total (kg/ha)	Total (lbs/acre)	Increase/ Decrease (kg/ha)
Todd Creek 2005	3442	364	110	3916	3496	
Todd Creek 2006	5604	79	7	5690	5080	1774
NORTHERN FESCUE						
Gooseberry Lake 2005	4015	123	0	4138	3695	
Gooseberry Lake 2006	5583	105	0	5688	5079	1550

Note: Refer to Cows and Fish reports number 21 and 27 for additional sites sampled in 2003 and 2005.

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	Litter (kg/ha)	Standard Deviation	Increase/ decrease (kg/ha)
CENTRAL PARKLAND			
Amisk Creek (Riparian) 2003	1646	n/a	
Amisk Creek (Riparian) 2005	371	299	-1275
Amisk Creek (Riparian) 2006	3247	1654	2875
Amisk Creek (Upland) 2003	707	n/a	
Amisk Creek (Upland) 2005	1239	370	532
Amisk Creek (Upland) 2006	3366	1331	2128
Gull Lake (Riparian) 2003	952	250	
Gull Lake (Riparian) 2005	870	548	-82
Gull Lake (Riparian) 2006	1075	1153	205
Gull Lake (Upland) 2003	576	238	
Gull Lake (Upland) 2005	826	359	250
Gull Lake (Upland) 2006	1024	385	199
Iron Creek (Riparian) 2003	2430	429	
Iron Creek (Riparian) 2005	1561	498	-869
Iron Creek (Riparian) 2006	3126	783	1565
Medicine River (Riparian) 2005	1566	308	
Medicine River (Riparian) 2006	2043	953	477
Medicine River (Upland) 2003	133.6	n/a	
Medicine River (Upland) 2005	1364	308	1230
Medicine River (Upland) 2006	367	232	-996
Medicine River (Upland Grazed) 2006 DRY MIXED GRASS AND MIXED GRASS	184	116	
Berry Creek (Riparian) 2003	1623	462	
Berry Creek (Riparian) 2005	0	0	-1623
Berry Creek (Riparian) 2006	1893	900	1893
Berry Creek (Riparian Grazed) 2006	755	1141	
Berry Creek (Upland) 2003	179	30	
Berry Creek (Upland) 2005	237	352	58
Berry Creek (Upland) 2006	176	82	-62
Keho Lake 2005	6473	3656	
Keho Lake 2006	458	979	-6014
Little Sandhill Creek, Dinosaur Prov. Park (DESCCAE)			
2005	0	0	
Little Sandhill Creek, Dinosaur Prov. Park (DESCCAE)			
2006	1912	1536	1912

	Litter		Increase/
	(kg/ha)	S.D.	decrease
Red Deer River, Dinosaur Prov. Park (POPUDEL) 2005	0	0	
Red Deer River, Dinosaur Prov. Park (POPUDEL) 2006	1708	1536	1708
NORTHERN FESCUE			
Gooseberry Lake 2005	851	821	
Gooseberry Lake 2006	5494	1309	4643
FOOTHILLS FESCUE			
Beaver Creek (ROSAWOO) 2003	1212	203	
Beaver Creek (ROSAWOO) 2005 (missing)	n/a	n/a	
Beaver Creek (ROSAWOO) 2006	2318	395	n/a
Beaver Creek (SALIEXI) 2003	530	135	
Beaver Creek (SALIEXI) 2005 (missing)	n/a	n/a	
Beaver Creek (SALIEXI) 2006	639	395	n/a
Bow River, Wyndham-Carseland Prov. Pk. (ELAECOM)			
2005	1330	n/a	
Bow River, Wyndham-Carseland Prov. Pk. (ELAECOM)			
2006	524	209	-806
Bow River, Wyndham-Carseland Prov. Pk. (POPUBAL)			
2005	536	n/a	
Bow River, Wyndham-Carseland Prov. Pk. (POPUBAL)			
2006	296	497	-240
Callum Creek North, Waldron 2005	224	349	
Callum Creek North, Waldron 2006	370	278	147
Callum Creek North, Waldron (grazed) 2006	72	160	
Callum Creek South, Waldron 2005	442	200	
Callum Creek South, Waldron 2006	1345	337	903
Lyndon Creek 2005	0	0	
Lyndon Creek 2006	795	593	795
Lyndon Creek (Riparian Grazed) 2006	468	333	
Rosebud River, Thurn Pit (Riparian Bench) 2005	23	28	
Rosebud River, Thurn Pit (Riparian Bench) 2006	20	30	-3
Rosebud River, Thurn Pit (Upland) 2005	3778	1948	
Rosebud River, Thurn Pit (Upland) 2006	1148	193	-2629
Rosebud River, Thurn Pit (Upland grazed) 2005	25.2	14	
Rosebud River, Thurn Pit (Upland grazed) 2006	3.1	7	-22
Rosebud River, Thurn Pit (Crested Wheatgrass) 2005	66	59	
Rosebud River, Thurn Pit (Crested Wheatgrass) 2006	108	107	43
St. Mary River, Woolford Prov. Pk (SALILUT) 2005	1061	673	
St. Mary River, Woolford Prov. Pk. (SALILUT) 2006	456	426	-605
Todd Creek 2005	0	0	
Todd Creek 2006	445	174	445

Note: Refer to Cows and Fish reports number 21 and 27 for additional sites sampled in 2003 and 2005.

Appendix 2. Information of Sites Used in the 2006 Riparian Production Survey.

Site Name: Amisk Creek Site ID # (not assigned) Community/Habitat Type: ELEOPAL (estimated) - Riparian POAPRAT (estimated) - Upland Sites: 1 riparian, 1 upland.

Water Body Type: Creek (~4 m wide channel)

Riparian Band Descriptions (including sampled): Sampled band (1-2m wide) is directly next to creek with 0-5% slope and aspects of either N or S. Site area is a large U-shape meander, there are many shrubs (willow / poplar) inside of meander, outside has thin band of shrubs and then directly uphill to upland. Some shrubs hang over sampled riparian band. Upland site is flat and mainly domestic / introduced species.

Site Size: 8 ha (20 acres)Upland: 5%Riparian/Water: 95%

Upland Type: Mainly agronomic species, especially where upland cages were installed. This area was previously used as a winter feeding location. Some other areas in the pasture have small amounts of native species.

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: No grazing was done prior to the sampling date

2005: No grazing was done prior to the sampling date, August 25, 2005.

Current Grazing strategy: Varies slightly, if the forage is required, depending on moisture conditions.

Historic Grazing strategy: Prior to the late 1970's the area was part of a larger pasture and continuously grazed. Since that time the pasture was divided into two and controlled grazing of the riparian pasture has occurred.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZGW20/FP1	Orthic Humic Gleysol	0%	Silty Clay
-				
Upland	ZGW20/FP1	Orthic Humic Gleysol	0%	Silty Clay Loam



Figure A.2.1 Site schematic Amisk Creek Riparian and Upland.



Figure A.2.2 Amisk Creek Riparian East (P. Desserud) Aug. 10, 2006



Figure A.2.3 Amisk Creek Riparian Detail (P. Desserud) Aug. 10, 2006



Figure A.2.4 Amisk Creek Upland West (P. Desserud) Aug. 10, 2006



Figure A.2.5 Amisk Creek Upland Detail (P. Desserud) Aug. 10, 2006

Site Name: Beaver Creek Site ID # (not assigned) Community/Habitat Type: ROSAWOO CT and SALIEXI CT

Sites: 2 Riparian

Water Body Type: Creek (5-8m wide)

Riparian Band Descriptions (including sampled): Sampled riparian bands are two different bands close to one another. A *Salix exigua* community is sampled in patches that are large enough for the cages closest to the creek. Further away from the creek is a larger fully sampled *Rosa woodsii* community.

Site Size: 130 ha (160 acres) Upland: 70% Riparian/Water: 25%

Upland Type: Mainly native rangeland.

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: The site was not grazed prior to the clipping; 85 head were in the 320 acre field from Sept 1-18.

2005: Gate was opened to the 1/4 to the south and grazed 100 cow / calf pairs for the last 2 weeks of July (on the 320 acres).

Current Grazing strategy: Typically this pasture (the 160 acres) would hold 30 cow / calf pairs and a bull from June 15 to the end of September. Relatively new ranch plan; higher stocking rate, shorter duration to maximize growing season rest.

Historic Grazing strategy: No information on historic strategy.

2003 Stocking Rate: 0.36 pair months / ha (July)

2005 Stocking Rate: 0.19 AUM /ha

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse	Texture
			Fragment	
Riparians	ZUN1/SC1I2	Orthic Regosol*	Not available	Not available

*Site was not included in 2005 study for field pedon construction and classification data is from 2003 report.



Figure A.2.6 Site schematic of Beaver Creek.



Figure A.2.7 Beaver Creek (ROSAWOO) 3 East (P. Desserud) Aug. 1, 2006



Figure A.2.8 Beaver Creek (ROSAWOO) 3 Detail (P. Desserud) Aug. 1, 2006



Figure A.2.9Beaver Creek (SALIEXI) East (P. Desserud) Aug. 1, 2006



Figure A.2.10 Beaver Creek (SALIEXI) Detail (P. Desserud) Aug. 1, 2006

Site Name: Berry Creek Site ID # (not assigned)

Community/Habitat Type: STIPCUR (estimated) - Upland CARELAS (estimated) – Riparian

Sites: 1 Riparian; 1 Upland

Water Type: Creek (10-20m)

Riparian Band Descriptions (including sampled): Sampled riparian band (0.5-1m) is nearest creek on bar side. The creek level was lower than 2005, with several *Carex* plant communities accessible. Upland is flat rangeland next to the creek.

Site Size: 8 ha (20 acres)Riparian/Water: 100%

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: Ungrazed at time of clipping; evidence of ungulate grazing in the riparian area

2005: Site had been grazed only one day prior to clipping, although there was evidence of ungulate grazing.

2006 Stocking Rate: n/a

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	VGR19/SC2	Cumulic Regosol*	0%	Sandy Clay
Upland	VGR19/SC2	Orthic Brown	0%	Sandy Loam
		Chernozem*		

*AGRASID soil polygon described as a Cumulic Regosol on moderately fine textured (CL, SCL, SiCL) sediments deposited by water that includes poorly drained Chernozemic soils. Topographical features are related to valleys with terraces with slopes ranging from 1-5% on terraces and up to 35% on side slopes.



Figure A.2.11 Site schematic Berry Creek.



Figure A.2.12 Berry Creek Riparian North (P. Desserud) Aug. 13, 2006



Figure A.2.13 Berry Creek Riparian Detail (P. Desserud) Aug. 13, 2006



Figure A.2.14 Berry Creek Upland North (P. Desserud) Aug. 13, 2006



Figure A.2.15 Berry Creek Upland Detail (P. Desserud) Aug. 13, 2006

Site Name: Bow River, Wyndham-Carseland Provincial Park Site ID: 9901314 Community/Habitat Type: ELAECOM CT

Sites: 1 Riparian

Water Body Type: Sub-irrigated meadow

Riparian Band Descriptions (including sampled): The site is a narrow band between a road-bed and a fenced grazing pasture. The site required two 15 m transects. Ten of the transect subplots, evenly spaced, were clipped for forage. The site was obviously once dominated by *Elaeagnus commutata*, with many large dead or dying shrubs. *Symphoricarpos occidentalis* is now the dominant shrub. The site is bordered by a thick growth of *Amelanchier alnifolia*, which may start encroaching.

Site Size: 500 sq m Riparian/Water: 100%

Water Sources: Lowland, run-off from adjacent road and pastures

Grazing Time / Stocking Rate: No grazing. Site is in a provincial park.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN1/FP3	Misc. Undiff. Min.	0%	Sandy Clay Loam

AGRASID soil polygon #28326 described as Miscellaneous Undifferentiated Mineral soils, characterized as well drained. Topographical features associated with this polygon are confined, terraced floodplain landforms with limiting slopes of 3%.



Figure A.2.53 Bow River, Wyndham-Carseland Provincial Park (ELAECOM) South Aug. 14, 2006



Figure A.2.54 Bow River, Wyndham-Carseland Provincial Park (ELAECOM) Detail Aug. 14, 2006



Figure A.2.55 Site schematic for Bow River, Wyndham-Carseland Provincial Park (ELAECOM CT).

Site Name: Bow River, Wyndham-Carseland Provincial Park Site ID: 9901311 Community/Habitat Type: POPUBAL/CORNSTO CT

Sites: 1 Riparian

Water Body Type: Ephemeral drainage channel

Riparian Band Descriptions (including sampled): The site is a circular area adjacent to an ephemeral creek and two campgrounds. The creek had overflowed the area during the June 2005 flooding of the Bow River, but was dry during the sample period. Much of the standing litter had been removed by the flood. Two concentric circular transects were required due to the shape and size of the area. Ten of the transect subplots, evenly spaced, were clipped for forage.

Site Size: 500 sq. m Riparian/Water: 100%

Water Sources: Ephemeral drainage channel

Current Year Grazing Time / Stocking Rate: No grazing. Site is in a Provincial park.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN1/FP3	Misc. Undiff. Min.	0%	Sandy Clay Loam

AGRASID soil polygon #28326 described as Miscellaneous Undifferentiated Mineral soils, characterized as well drained. Topographical features associated with this polygon are confined, terraced floodplain landforms with limiting slopes of 3%.



Figure A.2.56 Wyndham-Carseland Park (POPUBAL/CORNSTO CT) South (P. Desserud). Aug. 14, 2006



Figure A.2.57 Wyndham-Carseland Park (POPUBAL/CORNSTO CT) Detail Aug. 14, 2006 (P. Desserud).



Figure A.2.58 Site schematic for Bow River, Wyndham-Carseland Provincial Park (POPUBAL/CORNSTO CT).

Site Name: Callum Creek South, Waldron Site ID # (not assigned) Community/Habitat Type: POAPRAT-BROMINE-AGROSMI Sites: 1 Riparian

Water Body Type: Creek (~2 m wide channel)

Riparian Band Descriptions (including sampled): Set up nine cages in two random sites (see diagram). A single transect was deemed inappropriate since species occurred in various concentrated clusters over the whole area. Sampling was done inside the cages and additional subplots two to three meters from each cage, totalling 15 subplots. June flooding had removed all standing and fallen litter.

Site Size: 8 ha (20 acres)

Riparian/Water: 100%

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: Due to wet conditions the site had not been grazed.

2005: Due to flooding the site had not been grazed.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN2/SC2	Misc. Undiff. Min.	0%	Sandy Loam

AGRISID soil polygon described as predominately (80%) well drained miscellaneous undifferentiated mineral soil as well as (20%) Orthic Regosol and (20%) Orthic Humic Regosol. Topographical features described as valley landscape with long steep side slopes that include some relatively flat terraces.



Figure A.2.16 Site schematic for Callum Creek South, Waldron



Figure A.2.17 Callum Creek South, Waldron East (P. Desserud) Aug. 6, 2006



Figure A.2.18 Callum Creek South, Waldron Detail (P. Desserud) Aug. 6, 2006

Site Name: Callum Creek North, Waldron Site ID # (not assigned) Community/Habitat Type: BROMINE/POACOMP (estimated)

Sites: 1 Riparian

Water Body Type: Creek (~2 m wide channel)

Riparian Band Descriptions (including sampled): Due to small size of the site, set up five cages. Sampled a semi-circular transect along the creek including cages and two additional subplots two meters from each cage, totalling 15 subplots. June 2005 flooding had removed all standing and fallen litter.

Site Size: 20 acres Riparian/Water: 100%

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: Horses and 1 heifer.

2005: Horse grazing

2006 Stocking Rate: unknown

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN2/SC2	Misc. Undiff. Min.	0%	Sandy Loam

AGRISID soil polygon described as predominately (80%) well drained miscellaneous undifferentiated mineral soil as well as (20%) Orthic Regosol and (20%) Orthic Humic Regosol. Topographical features described as valley landscape with long steep side slopes that include some relatively flat terraces.


Figure A.2.19 Site schematic for Callum Creek North, Waldron.



Figure A.2.20 Callum Creek North, Waldron East (P. Desserud) Aug. 6, 2006



Figure A.2.21 Callum Creek North, Waldron Detail (P. Desserud) Aug. 6, 2006

Site Name: Gooseberry Lake Provincial Park Site ID: 9900053 Community/Habitat Type: SCIRPUN HT

Sites: 1 Riparian

Water Body Type: Lake

Riparian Band Descriptions (including sampled): The site is a band of *Scirpus pungens* on the lakeside, approximately 50m in length. It is bordered by a sub-mesic area of *Melilotus alba* and *Crepis tectorum*, a sub-hydric area of *Hordeum jubatum* and a sub-hydric area of *Deschampsia caespitosa*. Due to the narrowness and short length of the band, forage plots were clipped at evenly spaced positions along the species composition transect.

Site Size: n/a Riparian/Water. 100%

Water Sources: Gooseberry Lake

Grazing Time / Stocking Rate: none, Provincial Park; possible wild ungulate browsing.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZWA1/W3	Misc.Water*	0%	Loamy Sand

AGRASID soil polygon #9067 described as miscellaneous water soils that are not strongly contrasted from the dominant or co-dominant soil types.



Figure A.2.27 Site schematic for Gooseberry Lake (SCIRPUN HT).



Figure A.2.28 Gooseberry Lake (SCIRPUN) Detail North (P. Desserud) Aug. 12, 2006

Site Name: Gull Lake Site ID # (not assigned) Community/Habitat Type: SALIEXI/JUNCBAL (Riparian) (estimated) POAPRAT/AGROTRA (Upland) (estimated)

Sites: 1 Riparian; 1 Upland; 1 Exclosure (5m² panels)

Water Body Type: Lake (>100 ha)

Riparian Band Descriptions (including sampled): Sampling occurs on the upper riparian band by a large lake. Other bands closer to the water are an emergent *Scirpus spp.* band (0-10m wide) next to water, followed by a *Carex / Calamagrostis spp.* band (~14m). The upland is directly next to riparian consisting mainly of introduced species.

Site Size: ~80acres Upland: 70% Riparian/Water: 30%

Upland Type: Mixture of native and tame species. Some native species occur on the upper benches although most of the area has been seeded to tame.

Water Sources: The lake is the main water source.

Grazing Time / Stocking Rate:

2006: 100 cow / calf pairs for one month in September – October.

2005: No grazing.

Current Grazing strategy: Pasture is being cross-fenced from 3 large pastures each bordering the lake to 6 smaller paddocks. There will be 3 'shore' and 3 upland paddocks. Grazing system will be used to coordinate use between riparian and upland pastures. Upland pastures will have water systems installed.

Historic Grazing strategy: 3 large pastures, all with access to lake. Cattle left in these larger pastures for longer times; no control on riparian grazing.

2003 Stocking Rate: 3.1 pair months / ha (September – October)

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZGW21/U11	Orthic Humic Gleysol	25%	Sandy Clay
Upland	ZGW21/U11	Orthic Humic Gleysol	0%	Silty Clay





Figure A.2.30 Gull Lake Riparian North (P. Desserud) Aug. 9, 2006



Figure A.2.31 Gull Lake Upland North (P. Desserud) Aug. 9, 2006



Figure A.2.32 Gull Lake Upland Detail (P. Desserud) Aug. 9, 2006

Site Name: Iron Creek Site ID # (not assigned) Community/Habitat Type: CAREUTR (estimated)

Sites: 1 Riparian; 1 Exclosure (group of five cages)

Water Body Type: Creek (3-5m wide)

Riparian Band Descriptions (including sampled): Single Riparian band (~3m wide) next to creek. The sampled area has 0-5% slope and mainly 102° aspects throughout.

Site Size: 41 ha (100acres) Upland: 80% Riparian/Water: 15%/5%

Upland Type: Primarily native.

Water Sources: The creek is the main water source.

Grazing Time / Stocking Rate

2006: Evidence of early spring grazing, no effect on vegetation at sampling time

2005: No grazing up to sampling date (August 25, 2005)

Historic Grazing strategy: No grazing previous 4 years

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	BLKP9/SC1h	Orthic Humic Gleysol*	0%	Silty Clay

*Soil is labeled in AGRASID as a Significant Soil. Codominant soils are Orthic Black Chernozem and Black Solod. Soils described as Orthic Black Chernozemic on moderately fine textured sediments (CL, SCL, SiCL) deposited by water. Topographical features described as valleys with steep slopes ranging from 1-5% on the floodplain and up to 35% on the side slopes.



Figure A.2.36 Iron Creek Riparian North (P. Desserud) Aug. 11, 2006



Figure A.2.37 Iron Creek Riparian Detail (P. Desserud) Aug. 11, 2006



Figure A.2.38 Site schematic for Iron Creek (CAREUTR).

Site Name: Keho Lake Site ID: 9901297 Community/Habitat Type: PHALARU HT

Water Body Type: Irrigation lake

Riparian Band Descriptions (including sampled): The site is a narrow band between a raised road-bed and the lake edge, and was sampled using a 30 m transect.

Site Size: 400 sq m Riparian/Water: 100%

Water Sources: Irrigation lake and runoff from adjacent road and pastures

Current Year Grazing Time / Stocking Rate: Wild ungulate browsing.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	LET5/I3lc	Orthic Dark Brown Chernozem*	0%	CL

*AGRASID soil polygon # 6240 described as an Orthic Dark Brown Chernozem with the polygon composed of 60% Lethbridge series, 20% Miscellaneous Eroded ZDB, and 20% Coaldale series of medium texture (L, SiL) sediments deposited by wind and water. Topographical features are described as inclined to steep, low relief landforms (channelled) with limiting slope of 9%.



Figure A.2.39 Site schematic for Keho Lake (PHALARU HT).



Figure A.2.40 Keho Lake (PHALARU) North (M. Wood) Aug. 5, 2006



Figure A.2.41 Keho Lake (PHALARU) Detail (P. Desserud) Aug. 3, 2006

Site Name: Little Sandhill Creek, Dinosaur Provincial Park Site ID: 9903055 Community/Habitat Type: DESCCAE HT

Sites: 1 Riparian

Water Body Type: Incised channel beside creek

Riparian Band Descriptions (including sampled): Site is a narrow band between *Salix* spp. and *Sheperdia argentea* stands.

Site Size: n/a

Riparian/Water: 50%

Water Sources: Little Sandhill Creek

Grazing Time / Stocking Rate: Provincial Park, no grazing, possible wild ungulate browsing.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape	Classification	Coarse	Texture
	Model		Fragment	
Riparian	ZUN1/15	Misc. Undiff. Mineral Soil*	0%	Sandy Clay
Upland	VGR1/FP1	Cumulic Regosol*	0%	Clay Loam

AGRASID soil polygon #28072 described as miscellaneous undifferentiated mineral soil based on undifferentiated parent material. The topographical features are based on a meander floodplain landform with a limiting slope of 2%.



Figure A.2.22 Site schematic for Little Sandhill Creek, Dinosaur Provincial Park (DESCCAE HT).



Figure A.2.23 Little Sandhill Creek, Dinosaur Park (DESCCAE) South (P. Desserud) Aug. 13, 2006

Site Name: Lyndon Creek Site ID: 9890156 Community/Habitat Type: CAREATH HT

Sites: 1 Riparian

Water Body Type: Creek

Riparian Band Descriptions (including sampled): The site is a sandy alluviual plane of *Carex atherodes* and *Salix exigua* on the north side of the creek. Sampling and species composition were done in three bands varying from over 100% *Carex atherodes* to 60% *Salix exigua*.

Site Size: 60 sq. m

Riparian/Water: 100%

Water Sources: Creek

Grazing Time / Stocking Rate

The riparian sampling area is a small part (0.006 ha) of the entire 1 ha pasture. The stocking rate is calculated for the entire pasture.

2006: 30 pairs April 1-15, once calved in for short time stretch; 125 replacement heifers and 4 bulls, 1 week June 15; 400 pairs for 2 days in July.

2005: 350 cow/calf pairs April 1 to May 30, twice for 3 days at a time, including feeding. 115 heifers in July, for 10 days.

Prior to 2005: March 20 to May 1, 60 cow/calf pairs.

2006 Stocking Rate: approx. 5.3 AUM/ha

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
				~ 1
Riparian	CWY6/IUhc	Calcareous Black Chernozemic	0%	Sand

AGRASID soil polygon described as a well drained Calcareous Black Chernozemic. The polygon is composed of 60% Cowley series, 20% Beazer series, and 20% Standoff series. Due to the proximity of the water table a pedon was not constructed for this site as there was still a considerable amount of standing water in the immediate vicinity of the cages.

A pedon location was chosen immediately adjacent to the cages that would be reflective of the site.



Figure A.2.42 Site schematic for Lyndon Creek (CAREATH HT).



Figure A.2.43 Lyndon Creek Riparian North West (P. Desserud) Aug. 5, 2006



Figure A.2.44 Lyndon Creek Riparian Ungrazed Detail (P. Desserud) Aug. 5, 2006

Site Name: Medicine River (South) Site ID # (not assigned) Community/Habitat Type: PHALARU/BROMINE (Riparian) (estimated) FESTRUB/AGROTRA (Upland) (estimated) Sites: 1 Riparian, 1 Upland

Sites. 1 Ripartan, 1 Optand

Water Body Type: River (~20m wide)

Riparian Band Descriptions (including sampled): Single riparian band (~5m wide) next to river, around 20% slope and 150° aspects. Upland is just north of riparian site.

Site Size: 16 ha (40acres)Upland: 95%Riparian/Water: 5%

Upland Type: Tame species

Water Sources: All access to river has been fenced off.

Grazing Time / Stocking Rate

2006: 20 heifers and 2 lamas, June 1^{st} – Sept 1^{st}

2005: 14 cow/calf pairs, 1 bull, and 2 llamas May to August.

2003: 25 cow/calf pairs for 3 weeks in late August.

Historic Grazing strategy: Riparian area fenced in 2005, so cattle had no access to the river. Prior to 2005, no fencing on riparian areas, and cattle were allowed full access to the river bank, and river was their primary source of water. Many years ago Riparian Site was the main watering source for a much larger pasture.

2006 Stocking Rate: 2.8 AUM / ha

2005 Stocking Rate: 4.37 AUM /ha

2003 Stocking Rate: 1.17 AUM/ha

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian 1	ZUN19/SC2	Orthic Regosol	0%	Silty Clay Loam
Upland	ZUN19/SC2	Orthic Black Chernozem*	0%	Sandy Loam

*AGRASID soil polygon classified as 60% Orthic Regosol, 20% Miscellaneous Coarse ZBL (Orthic Black Chernozem) and 20% Miscellaneous Gleysol (Othic Humic Gleysol). Topographical features described as valley with terraces.



Figure A.2.45 Site schematic for Medicine River (PHALARU/BROMINE – riparian), (FESTRUB/AGROTRA – upland).



Figure A.2.46 Medicine River Riparian West (P. Desserud) Aug. 9, 2006



Figure A.2.47 Medicine River Riparian Detail (P. Desserud) Aug. 9, 2006



Figure A.2.48 Medicine River Upland West (P. Desserud) Aug. 9, 2006



Figure A.2.49 Medicine River Upland Detail (P. Desserud) Aug. 9, 2006

Site Name: Red Deer River, Dinosaur Provincial Park - Steveville Bridge Site ID: 9901044 Community/Habitat Type: POPUDEL/CORNSTO CT

Sites: 1 Upland

Water Body Type: Red Deer River.

Riparian Band Descriptions (including sampled): The site is heavy bush, with much deadfall, unsuitable for a line transect. Due to the small size of the site, two areas in close proximity to each other were sampled. Forage plots and species composition subplots were randomly placed where *Cornus stolinifera* was found.

Site Information:

Site Size: n/a Riparian/Water: not collected

Water Sources: Red Deer River

Grazing Time / Stocking Rate: Provincial park, no grazing, possible wild ungulate browsing.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No. 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Upland	VGR1/FP1	Cumulic Regosol*	0%	Clay Loam

*AGRASID soil polygon #322 described as a Cumulic Regosol o moderately fine textured (CL, SiCL, SCL) sediments deposited by water. The topographical features are based on a meander floodplain landform with a limiting slope of 2%. The site is characterised as well drained.



Figure A.2.24 Site schematic Red Deer River, Dinosaur Provincial Park (POPUDEL/CORNSTO CT).



Figure A.2.25 Red Deer River, Dinosaur Park (POPUDEL/CORNSTO) North (P. Desserud) Aug. 13, 2006



Figure A.2.26 Red Deer River, Dinosaur Park (POPUDEL/CORNSTO) Detail (P. Desserud) Aug. 13, 2006

Site Name: Rosebud River, Thurn Pit **Site ID** # (not assigned)

Sites: 1 riparian bench, 2 upland, 1 tame pasture.

Water Body Type: Creek (~4 m wide channel)

Riparian Band Descriptions (including sampled): Two cages are on the north side of the creek and 2 are on the south side. These cages are on the bench above the creek close to the top of the bank in a band of sparse snowberry. Eight cages are in the upland on this side of the active rail line including 2 on crested wheatgrass. Two additional forage clippings are taken from the west side of the rail line which is ungrazed. No cages are located here. The upland is native mixed grass prairie. The grazed side of the demonstration site is in poor condition. The ungrazed side is recovering from previous heavy grazing. Parcel 2 will be fenced into 3 parts including a riparian pasture. A watering system for livestock will also be provided.

Cages: 10 Wheatland County

Parcel 1 (ungrazed)

Grazing Time / Stocking Rate: No grazing currently.

Historic grazing strategy: Has been rested from grazing since 1994. Gravel extraction and reclamation taking place in various locations throughout pasture. Heavily overgrazed prior to 1994. 112 acres.

Parcel 2 & 3 (grazed as one unit)

Grazing Time / Stocking Rate : Current stocking rate set at 25 Animal Units from April 1st to December 21st. Lessee usually puts 25 cow-calf pairs in May, but runs out of grass and has to remove them by August -4 month grazing period.

- Parcel 2 115 acres(native pasture)
- Parcel 3 42 acres(seeded to crested wheatgrass)

Current stocking rate: 0.64 AUM/ac

Historic grazing strategy: Up until 1997 the grazing capacity was set at 31 AU/year. Rosebud River is the main water source for Parcel's 2 and 3. Parcels are heavily overgrazed. The reduction is stocking rate has not improved pasture condition. Site Name: St. Mary River, Woolford Provincial Park Site ID: 9902036 Community/Habitat Type: SALILUT CT

Sites: 1 Riparian

Water Body Type: River

Riparian Band Descriptions (including sampled): The site is an area adjacent to the St. Mary River. Sampling followed the *Salix luteae* growth, a strip along the river bank, and a linear transect was used for species composition.

Site Size: Riparian/Water: 100%

Water Sources: River

Current Year Grazing Time / Stocking Rate: No grazing. Site is in a provincial park.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN16/FP3	Misc. Undiff. Min*	25%	Clay Loam

*AGRASID soil polygon # 9864. See previous descriptive notes.



Figure A.2.50 St. Mary River, Woolford Provincial Park (SALILUT) West (M. Wood) Aug. 3m 2006



Figure A.2.51 St. Mary River, Woolford Provincial Park (SALILUT) Detail (M. Wood) Aug. 3, 2006



Figure A.2.52 Site schematic for St. Mary River, Woolford Provincial Park (SALILUT CT).

Site Name: Todd Creek Site ID: 9890176 Community/Habitat Type: SCIRPUN HT (potential POAPALU)

Water Body Type: Creek (~15 m wide channel)

Riparian Band Descriptions (including sampled): Five cages were set up along the creek and five were set up on the north side of a band of willow. The creek overflowed during the June 2005 flood, removing all standing and fallen litter.

Site Size: n/a

Riparian/Water: 100%

Water Sources: Creek is the main water source.

Grazing Time / Stocking Rate

2006: Ungrazed prior to sampling date

2005: No grazing on this site.

Soil Characteristics:

For more detailed soil characteristics and photographs, please refer to "Forage Production Survey of Riparian Areas in the Grassland and Parkland Natural Regions of Alberta 2005, Cows and Fish Report No 27".

Site	Soil Landscape Model	Classification	Coarse Fragment	Texture
Riparian	ZUN1/SC2	Misc. Undiff. Min	25%	Sandy Clay Loam

AGRASID soil polygon described as Miscellaneous Undifferentiated Mineral soil.



Figure A.2.33 Site schematic for Todd Creek (ELEOPAL HT).



Figure A.2.34 Todd Creek Riparian East (P. Desserud) Aug. 2, 2006



Figure A.2.35 Todd Creek Riparian Detail (P. Desserud) Aug. 2 2006

Appendix 3 Site Species Composition and Forage Values

Amisk Creek (E) – Riparian (ELEOPAL)

Plant Species Composition

Date Sampled: July 10, 2003

1 5 /		Cover (%)	Freq (%)
Graminoids			
creeping spike-rush	Eleocharis palustris	12.7	33.3
fowl bluegrass	Poa palustris	11.0	53.3
small-fruited bulrush	Scirpus microcarpus	8.7	53.3
awned sedge	Carex atherodes	7.0	26.7
northern reed grass	Calamagrostis inexpansa	6.3	26.7
Kentucky bluegrass	Poa pratensis	5.3	33.3
quackgrass	Agropyron repens	2.0	26.7
great bulrush	Scirpus acutus	2.0	20.0
smooth brome	Bromus inermis	1.7	6.7
slough grass	Beckmannia syzigachne	1.4	26.7
beaked sedge	Carex utriculata	1.0	6.7
reed canary grass	Phalaris arundinacea	1.0	13.3
	Graminoids total	60.1	
Forbs			
pale persicaria	Polygonum lapathifolium	6.7	46.7
western dock	Rumex occidentalis	2.2	33.3
Canada thistle	Cirsium arvense	1.7	20.0
perennial sow thistle	Sonchus arvensis	1.3	20.0
fireweed	Epilobium angustifolium	0.7	20.0
lamb's quarters	Chenopodium album	0.5	13.3
water parsnip	Sium suave	0.5	13.3
water avens	Geum rivale	0.3	6.7
common dandelion	Taraxacum officinale	0.2	6.7
long-stalked chickweed	Stellaria longipes	0.2	6.7
Philadelphia fleabane	Erigeron philadelphicus	0.2	6.7
wild mint	Mentha arvensis	0.2	6.7
	Forbs total	14.8	

Site: Amisk Creek (E) – Riparian (continued)

	•	Cover (%)	Freq (%)
Other			
Litter		42.3	73.3
Soil		28.3	60.0
Bryophytes		2.0	6.7
Other Total		72.7	
Shrub / Tree Plot		72.7 Cover (%)	Height (m)
Shrub / Tree Plot aspen	Populus tremuloides	72.7 Cover (%) 2.0	Height (m) 8.0
Shrub / Tree Plot aspen beaked willow	Populus tremuloides Salix bebbiana	72.7 Cover (%) 2.0 5.0	Height (m) 8.0 5.0

Forage Production

Date Clipped: August 26, 2003					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	4743.6	775.8	4235.4	692.7	
Forbs	707.4	86.7	631.6	77.5	
Shrubs	-	-	-	-	
Total Forage	5451.0	789.4	4867.0	704.8	
Litter	1646.4	356.8	1470.0	318.6	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10

Caged Plots: n=10,

Date Clipped: August 25, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	3281.7	1308.0	2930.1	1167.8	
Forbs	548.5	297.1	489.7	265.2	
Shrubs	8.7	50	7.8	44	
Total Forage	3838.9	1307.4	3427.6	3427.6	
Litter	3281.7	1308.0	2930.1	2930.1	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10 Date Clipped: August

Date Clipped: August 10, 2006						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.		
Graminoids	4200.4	1365.3	3750.4	1219.0		
Forbs	883.1	837.5	788.5	747.8		
Shrubs	146.7	120.5	131.0	107.6		
Total Forage	5230.2	1583.9	4669.8	1414.2		
Litter	3246.7	1653.6	2898.8	1476.4		

No Uncaged Plots: Forage Utilization at Clipping: 0%

Amisk Creek – Upland (POAPRAT)

Forage Production

Plant Species Composition

Date Sampled: July 10, 2003

1 5 7		Cover (%)	Freq (%)
Graminoids			
Kentucky bluegrass	Poa pratensis	36.0	93.3
smooth brome	Bromus inermis	15.3	53.3
quackgrass	Agropyron repens	12.1	60.0
foxtail barley	Hordeum jubatum	1.5	13.3
	Graminoids total	64.9	
Forbs			
northern bedstraw	Galium boreale	6.0	46.7
yarrow	Achillea millefolium	3.8	33.3
alfalfa	Medicago sativa	3.0	20.0
wild vetch	Vicia americana	0.7	6.7
tufted phlox	Phlox caespitosa	0.2	6.7
	Forbs total	13.7	
Shrub / Tree			
buckbrush	Symphoricarpos occidentalis	5.9	73.3
	Shrub / Tree Total	5.9	
Other			
Litter		67.3	100.0
Soil		5.0	26.7
	Other Total	72.3	

Forage Production

Caged Plots n=10 Date Clipped: August 26, 2003						
Forage Type	kg/ha	s.d.	lb/acre	s.d.		
Graminoids	4675.4	447.0	4174.5	399.1		
Forbs	296.2	107.7	264.5	96.2		
Shrubs	62.6	58.2	55.9	52.0		
Total Forage	5034.2	401.3	4494.9	358.3		
Litter	706.8	154.1	631.1	137.6		

No Uncaged Plots: Forage Utilization at Clipping: 0%

Date Clipped: August 5, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	1971	516.9	1760.0	461.5	
Forbs	90.22	174.1	80.6	155.5	
Shrubs	0	0	0.0	0.0	
Total Forage	2061	413.1	1840.5	368.9	
Litter	1239	369.6	1105.9	330.0	

Caged Plots: n=10 Date Clipped: August 5, 2005

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=5

Date Clipped: August 10, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3207.6	605.8	2863.9	540.9
Forbs	0.0	0.0	0.0	0.0
Shrubs	46.0	102.9	41.1	91.8
Total Forage	3253.6	581.8	2905.0	519.5
Litter	3366.4	1330.7	3005.7	1188.1

No Uncaged Plots: Forage Utilization at Clipping: 0%
Beaver Creek – Riparian

No Plant Species Composition for all Beaver Creek Riparian Sites. Vegetation types were recorded by riparian classification (Thompson and Hansen 2002).

Beaver Creek - ROSAWOO: Common Wild Rose (Rosa woodsii) Community Type

Beaver Creek - SALIEXI: Sandbar Willow (Salix exigua) Community Type

Forage Production

Rosa Caged Plots: n=9					
Date Clipped: Septem	ber 4, 5 2003				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	1342.4	138.2	1198.6	123.4	
Forbs	357.8	139.9	319.4	124.9	
Shrubs	886.4	136.7	791.5	122.0	
Total Forage	2586.7	184.1	2309.6	164.4	
Litter	1211.6	203.3	1081.8	181.5	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Salix Caged Plots: n=9

Date Clipped: September 4, 5 2003

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2764.0	442.4	2467.9	395.0
Forbs	146.7	54.2	131.0	48.4
Shrubs	1367.8	364.6	1221.3	325.6
Total Forage	4278.4	522.6	3820.1	466.6
Litter	530.2	134.5	473.4	120.1

No Uncaged Plots: Forage Utilization at Clipping: 0%

Rosa Caged Plots: n=10

	0			
Date	Clipped:	September,	5	2005

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1552	n/a	1385.7	n/a
Forb	317	n/a	283.3	n/a
Shrub	749	n/a	668.5	n/a
Total Forage	2618	n/a	2337.5	n/a
Litter	-		_	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Note: standard deviation (s.d.) was missing from this data.

Site: Beaver Creek - Forage production (continued)

Date Clipped: Sept	Date Clipped: September, 5 2005						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.			
Graminoids	947	n/a	845.8	n/a			
Forb	55	n/a	48.8	n/a			
Shrub	2625	n/a	2343.5	n/a			
Total Forage	3627	n/a	3238.1	n/a			
Litter	-		-				

Salix Caged Plots: n=10

No Uncaged Plots: Forage Utilization at Clipping: 0%

Note: standard deviation (s.d.) was missing from this data.

Rosa Caged Plots: n=3

Date Clipped: August 1, 2006					
kg/ha	s.d.	lbs/acre	s.d.		
1036.7	529.0	925.6	472.3		
160.7	241.2	143.5	215.3		
533.9	770.0	476.7	687.5		
1731.3	1261.2	1545.8	1126.1		
2318.0	395.3	2069.6	353.0		
	t 1, 2006 kg/ha 1036.7 160.7 533.9 1731.3 2318.0	kg/ha s.d. 1036.7 529.0 160.7 241.2 533.9 770.0 1731.3 1261.2 2318.0 395.3	kg/has.d.lbs/acre1036.7529.0925.6160.7241.2143.5533.9770.0476.71731.31261.21545.82318.0395.32069.6		

No Uncaged Plots: Forage Utilization at Clipping: 0%

Salix Caged Plots: n=3

Bana Caged Hous. II-5						
Date Clipped: August 1, 2006						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.		
Graminoids	967.9	348.4	864.2	311.1		
Forb	260.4	244.6	232.5	218.4		
Shrub	750.8	356.4	670.4	318.2		
Total Forage	1979.1	479.5	1767.0	428.1		
Litter	638.8	559.6	570.4	499.6		

Berry Creek – Riparian (CARELAS)

Plant Species Composition

Date Sampled: July 12, 2003

		Cover (%)	Freq (%)
Graminoids			
slender sedge	Carex lasiocarpa	23.7	80.0
small-fruited bulrush	Scirpus microcarpus	13.7	80.0
water sedge	Carex aquatilis	4.7	40.0
foxtail barley	Hordeum jubatum	4.2	40.0
creeping spike-rush	Eleocharis palustris	3.0	20.0
narrow reed grass	Calamagrostis stricta	3.0	20.0
Baltic rush	Juncus balticus	2.3	20.0
three-square rush	Scirpus pungens	1.7	33.3
fowl manna grass	Glyceria striata	1.7	13.3
tall manna grass	Glyceria grandis	1.3	6.7
common great bulrush	Scirpus validus	1.0	6.7
	Graminoids total	60.3	
Forbs			
marsh aster	Aster borealis	2.5	26.7
wild licorice	Glycyrrhiza lepidota	1.3	6.7
aster	Aster species	1.3	26.7
wild mint	Mentha arvensis	1.2	20.0
northern water-horehound	Lycopus uniflorus	1.0	13.3
silverweed	Potentilla anserina	0.7	6.7
perennial sow thistle	Sonchus arvensis	0.3	6.7
	Forbs total	8.3	
Shrub / Tree			
buckbrush	Symphoricarpos occidentalis	2.1	13.3
common wild rose	Rosa woodsii	1.9	33.3
basket willow	Salix petiolaris	0.2	13.3
	Shrub / Tree total	4.2	
Other			
Litter		59.3	100.0
Water		25.0	53.3
Other Total		84.3	

Site: Berry Creek – Riparian (continued)

Caged Plots: n=8					
Date Clipped: August	20, 2003				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	3108.8	320.6	2775.7	286.2	
Forbs	373.0	106.8	333.0	95.3	
Shrubs	38.3	38.3	34.2	34.2	
Total Forage	3520.0	315.2	3142.9	281.4	
Litter	1623.0	462.4	1449.1	412.9	

Forage Production

Uncaged Plots: n=5 Date Clipped: August 20, 2003

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	468.8	120.9	418.6	108.0
Forb	81.6	29.0	72.9	25.9
Shrub	2.8	-	2.5	-
Total Forage	553.2	145.1	493.9	129.6

Forage Utilization at Clipping: 83%

Caged Plots: n=10

Date Clipped: August 9, 2005

11 0				
Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1829	309.9	1633	276.7
Forbs	288	198.8	257	177.5
Shrubs	-	-	-	-
Total Forage	2117		1890	
Litter	-		-	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=5

Date Chipped. Mugust 15, 2000	Date	Clipped:	August	13,	2006
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Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	4670.7	1340.0	4170.3	1196.4
Forbs	913.4	528.5	815.6	471.9
Shrubs	0.0	0.0	0.0	0.0
Total Forage	5584.2	1333.2	4985.9	1190.3
Litter	1893.4	900.1	1690.5	803.7

Site: Berry Creek Riparian – Grazed

Date Clipped: August 13, 2006						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.		
Graminoids	2598.3	685.0	2319.9	611.6		
Forbs	124.6	92.5	111.3	82.6		
Shrubs	0.0	0.0	0.0	0.0		
Total Forage	2723.0	634.2	2431.2	566.3		
Litter	755.2	1141.0	674.3	1018.8		

Uncaged Plots: n=5 Date Clipped: August 13, 2006

Forage Utilization at Clipping: 49%

Berry Creek – Upland (STIPCUR)

Plant Species Composition

Date: July 12, 2003

		Cover (%)	Freq (%)
Graminoids			
porcupine grass	Stipa curtiseta	35.7	100
crested wheatgrass*	Agropyron cristatum	13	10
June grass	Koeleria macrantha	7.7	80
sand grass	Calamovilfa longifolia	6.7	46.7
needle-and-thread	Stipa comata	2	33.3
hairy wild rye	Elymus innovatus	1.3	13.3
plains rough fescue	Festuca hallii	0.3	6.7
	Graminoids Total	53.7	
Forbs			
pasture sagewort	Artemisia frigida	3.5	26.7
compact selaginella	Selaginella densa	2.7	13.3
prickly pear cactus	Opuntia fragilis	1.2	20
unknown species	Unknown species	0.7	6.7
prairie goldenbean	Thermopsis rhombifolia	0.6	20
lamb's quarters	Chenopodium album	0.1	6.7
	Forbs total	8.8	
Shrub / Tree			
common wild rose	Rosa woodsii	5.3	53.3
sagebrush	Artemisia canadensis	1.7	6.7
	Shrub / Tree Total	6.9	
Other			
Litter		38.7	100
Soil		22.3	100
Bryophytes		9.7	60
	Other Total	70.7	

* crested wheatgrass cover was observed August 9, 2005

Site: Berry Creek – Upland (continued)

Forage Production

Caged Plots: n=10							
Date Clipped: August 20, 2003							
Forage Type	kg/ha	s.d.	lbs/acre	s.d.			
Graminoids	660.6	54.3	589.8	48.4			
Forbs	150.6	91.0	134.5	81.2			
Shrubs	2.8	-	2.5	-			
Total Forage	814.0	95.5	726.8	85.2			
Litter	178.8	29.7	159.6	26.5			

Uncaged Plots: n=5

Date Clipped: August 20, 2003

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	251.2	38.7	224.3	34.6
Forbs	14.0	6.5	12.5	5.8
Shrubs	-	-	-	-
Total Forage	265.2	36.2	236.8	32.3

Forage Utilization at Clipping: 60%

Caged Plots: n=10

Date Clipped: August 9, 2005

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1198	505	1069.3	450.9
Forbs	55.6	74.9	49.6	66.9
Shrubs	67.44	124.4	60.2	111.1
Total Forage	1321	496	1179.2	442.9
Litter	237.2	351.5	211.8	313.8

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=5

Date Chipped: August 13, 2006							
Forage Type	kg/ha	s.d.	lbs/acre	s.d.			
Graminoids	1434.4	152.2	1280.7	135.9			
Forbs	538.6	535.0	480.9	477.7			
Shrubs	59.4	121.5	53.0	108.5			
Total Forage	2032.4	577.9	1814.6	516.0			
Litter	175.5	82.1	156.7	73.3			

Bow River, Wyndham-Carseland Provincial Park (ELAECOM CT)

Plant Species Composition

Date Sampled: July 28, 2005

Shrubs

Total Forage

				Cover	(%)	Constancy (%)
Graminoids						
Kentucky Bluegrass	Poa prate	nsis		28		80
Reed	Phragmite	Phragmites australis		3		25
Western Wheatgrass	Agropyroi	n smithii		0.1		1
	Graminoi	ds Total		31.1	1	
Forbs						
Wild Blue Flax	Linum lew	visii		0.4		5
Bog Violet	Viola nepl	hrophylla		0.2	,	1
	Forbs tota	al		0.6		
Shrubs						
Buckbrush	Symphorie	carpos occiden	talis	47		80
Prickly Rose	Rosa acci	Rosa accicularis				30
Silverberry	Elaeagnus	s commutata		10		25
	Shrubs to	tal		74		
Trees						
Other						
Bare Soil						
Bryophytes				2		
			_			
		Forage Produc	<u>ction</u>			
Uncaged Plots: n=10						
Date Clipped: July 28, 2	2005					
Forage Type	kg/ha	s.d.	lbs/a	cre	s.d.	
Graminoids	537.3	n/a	479	0.8	n/a	
Forbs	26.4	n/a	23.	.6	n/a	

Litter1330.1n/a1187.6n/aNote: The ten forage subplots were combined and averaged in error therefore standard
deviation (s.d.) could not be calculatedn/a

n/a

200.8

704.1

n/a

224.9

788.6

Uncaged Caged Plots: n=10							
Date Clipped: August 10, 2006							
Forage Type	kg/ha	s.d.	lbs/acre	s.d.			
Graminoids	579.3	548.0	517.3	489.3			
Forbs	393.7	466.5	351.5	416.5			
Shrubs	355.3	203.6	317.3	181.7			
Total Forage	1328.4	599.9	1186.0	535.6			
Litter	524.0	208.9	467.9	186.6			

Site: Bow River, Wyndham Carseland Provincial Park - (ELAECOM) (continued)

Forage Utilization at Clipping: 0%

Bow River, Wyndham-Carseland Provincial Park (POPUBAL CORNSTO)

Plant Species Composition

Date Sampled: July 28, 2005

		Cover (%)	Constancy (%)
Graminoids			
Awnless Brome	Bromus inermis	6	73
Canada Bluegrass	Poa compressa	5	17
	Graminoids Total	11.0	
Forbs			
Star Flowered			
Solomon's-Seal	Smilacina stellata	7	67
Veiny Meadow Rue	Thalictrum venulosum	6	47
Smooth Aster	Aster laevis	5	40
Canada Anemone	Anemone canadensis	5	13
Wild Licorice	Glycyrrhiza lepidota	3	13
Canada Goldenrod	Solidago canadensis	1	20
Leafy Arnica	Arnica chamissonis	1	13
Sweet Scented			
Bedstraw	Galium triflorum	1	7
Common Dandelion	Taraxacum officinale	1	7
	Forbs total	13	
Shrubs			
Undifferentiated Rose	Rosa spp.	24	80
Red Osier Dogwood	Cornus stolonifera	15	100
Thorny Buffaloberry	Shepardia argentea	15	100
Chokecherry	Prunus virginiana	11	27
Saskatoon	Amelanchier alnifolia	10	100
Beaked Willow	Salix bebbiana	10	100
Buckbrush	Symphoricarpos occidentalis	9	33
Common Bearberry	Arctostaphylos uva-ursi	2	20
Silverberry	Elaeagnus commutata	2	13
	Shrubs total	98	
Trees		· · · · · · · · · · · · · · · · · · ·	
Balsam Poplar	Populus balsamifera	65	100
_	Trees total	0	
Other			
Bare Soil			
Bryophytes		1.7	

Site: Bow River, Wyndham Carseland Provincial Park - (POPUBAL / CORNSTO) (continued)

Forage Production

Uncaged Plots: n=10							
Date Clipped: July 28, 2005							
Forage Type	kg/ha	s.d.	lbs/acre	s.d.			
Graminoids	694.9	n/a	620.5	n/a			
Forbs	337.9	n/a	301.7	n/a			
Shrubs	497.8	n/a	444.5	n/a			
Total Forage	1530.7		1366.7				
Litter	1072.7	n/a	957.8	n/a			

Note: The ten forage subplots were combined and averaged in error therefore standard deviation (s.d.) could not be calculated

Uncaged Plots: n=10

Date Clipped: August 14, 2006

2 are empread 1 a guist 1 i, 2000								
Forage Type	kg/ha	s.d.	lbs/acre	s.d.				
Graminoids	254.0	182.6	226.8	163.0				
Forbs	222.1	265.0	198.3	236.6				
Shrubs	605.9	250.1	541.0	223.3				
Total Forage	1082.0	209.4	966.0	187.0				
Litter	295.9	496.5	264.2	443.3				

Forage Utilization at Clipping: 0%

Callum Creek North, Waldron (POACOMP/BROMINE) (estimated)

Plant Species Composition

Date Sampled: August 3, 2005

		Cover (%)	Constancy (%)
Graminoids			
Canada Bluegrass	Poa compressa	25	93
Awnless Brome	Bromus inermis	24	87
Timothy	Phleum pratense	6	73
Western Wheatgrass	Agropyron smithii	3	47
	Agropyron	3	27
Slender Wheatgrass	trachycaulum	_	
Undifferentiated Wheatgrass	Agropyron spp.	2	20
	Graminoids Total	63	
Forbs			
Common Horsetail	Equisetum arvense	5.7	27
Three Flowered Avens	Geum trifolium	4.1	40
Wild Strawberry	Frageria virginiana	3.7	47
Graceful Cinquefoil	Potentilla gracilis	2.7	27
Canada Thistle	Cirsium arvense	2.1	27
Common Yarrow	Achillea millefolium	1.9	40
Early Blue Violet	Viola adunca	1.7	13
Northern Bedstraw	Galium boreale	1.1	27
Common Scouring-Rush	Equisetum hyemale	1	20
Prairie Crocus	Anemone patens	1	13
Prairie Sagewort	Artemisia ludoviciana	0.7	7
Common Dandelion	Taraxacum officinale	0.4	13
Brown-bracted Mountain			
Everlasting	Antennaria umbrinella	0.3	7
Showy Locoweed	Oxytropis splendens	0.3	7
Undifferentiated Milkweed	Astragalus spp.	0.1	13
	Forbs total	26.8	
Shrubs/Treed			
	Symphoricarpos	10	-
Buckbrush	occidentalis	10	5
	Shrubs/Trees Total	10	5
Other			
Bare Soil		10	
Bryophytes			

Site: Callum Creek North (continued)

Forage Production

Caged Plots: n=5 Date Clipped: August 3, 2005				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2144.5	264.3	1914.7	236.0
Forbs	221.2	326.3	197.5	291.4
Shrubs	236.7	262.3	211.3	234.2
Total Forage	2823.6	312.8	2521.1	279.3
Litter	221.2	199.3	197.5	178.0

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=5

Date Clipped: August 6, 200	August 6, 2006	A	lipped:	Date
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Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1986.8	200.2	1774.0	178.8
Forbs	556.0	369.3	496.5	329.7
Shrubs	0.0	0.0	0.0	0.0
Total Forage	2542.9	394.7	2270.4	352.4
Litter	370.4	278.2	330.7	248.4
	C11 1 0.11			

Forage Utilization at Clipping: 0%

Site: Callum Creek North, Waldron – Grazed

Uncaged Plots: n=5 Date Clipped: August 6, 2006

Date Chipped: August 6, 2006				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1021.7	293.8	912.3	262.3
Forbs	237.4	112.0	212.0	100.0
Shrubs	2.2	4.9	2.0	4.4
Total Forage	1261.3	201.2	1126.2	179.6
Litter	71.6	160.1	63.9	142.9

Forage Utilization at Clipping: 50%

Callum Creek South, Waldron (POAPRAT)

Plant Species Composition

Date Sampled: August 3, 2005

2 >p		Cover (%)	Constancy (%)
Graminoids			
Kentucky Bluegrass	Poa pratensis	61	93
Western Wheatgrass	Agropyron smithii	13	80
Awnless Brome	Bromus inermis	11	30
Slender Wheatgrass	Agropyron trachycaulum	2	33
Wire Rush	Juncus balticus	1	7
June Grass	Koeleria macrantha	1	13
	Graminoids Total	89	
Forbs			
Canada Thistle	Cirsium arvense	10	100
Common Yarrow	Achillea millefolium	1	27
Three Flowered Avens	Geum triflorium	1	13
Wild Vetch	Vicia americana	1	20
Northern Bedstraw	Galium boreale	0.5	20
Undifferentiated Arnica	Arinca spp.	0.1	7
	Forbs total	13.6	
Shrubs			
Buckbrush	Symphoricarpos occidentalis	10	100
	Shrubs total	10	
Trees			
Other			
Bare Soil		10	
Bryophytes			

Site: Callum Creek South, Waldron (continued)

Forage Production

Caged Plots: n=10 Date Clipped: August 3, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	2963.4	942.5	2645.9	841.5	
Forbs	335.1	297.8	299.2	265.9	
Shrubs	35.7		31.9		
Total Forage	217.5	199.6	194.2	178.2	
Litter	3551.7	894.0	3171.2	798.2	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10

Date Clipped: August 6, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1786.4	898.7	1595.0	802.4
Forbs	790.3	1034.6	705.6	923.7
Shrubs	361.5	344.0	322.8	307.1
Total Forage	2938.2	841.4	2623.4	751.2
Litter	1344.9	673.3	1200.8	601.1

Gooseberry Lake Provincial Park (SCIRPUN HT)

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Plant Species Composition

Date: August 20, 2005

,,		Cover (%)	Constancy (%)
Graminoids			
Three-square Rush	Scirpus pungens	62	100
Foxtail Barley	Hordeum jubatum	44	100
Small-fruited Bulrush	Scirpus microcarpus	1	7
	Graminoids total	107	
Forbs			
Annual Hawk's-beard	Crepis tectorum	6	53
Common Chickweed	Stellaria media	0.13	7
	Forbs total	6.13	
Shrubs/Trees			
		-	-
Other			

Bare Soil

Bryophytes

Forage Production

Uncaged plots n=10 Date Clipped: August

Date Clipped: August 20, 2005				
kg/ha	s.d.	lbs/acre	s.d.	
4014.8	763.6	3584.6	681.8	
123.4	174.5	110.2	155.8	
0.0	0.0	0.0	0.0	
4138.2	765.1	3694.8	683.1	
425.3	411.0	379.7	367.0	
	st 20, 2005 kg/ha 4014.8 123.4 0.0 4138.2 425.3	kg/ha s.d. 4014.8 763.6 123.4 174.5 0.0 0.0 4138.2 765.1 425.3 411.0	kg/ha s.d. lbs/acre 4014.8 763.6 3584.6 123.4 174.5 110.2 0.0 0.0 0.0 4138.2 765.1 3694.8 425.3 411.0 379.7	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Uncaged Plots: n=10

Date Clipped: August 12, 2006				
Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	5582.9	1175.0	4984.7	1049.1
Forbs	105.1	115.5	93.8	103.2
Shrubs	0.0	0.0	0.0	0.0
Total Forage	5687.9	1165.4	5078.5	1040.6
Litter	5494.0	1309.0	4905.3	1168.7

Gull Lake SALIEXI/JUNCBAL (Riparian) (estimated)

Plant Species Composition

Date Sampled: July 08, 2003 – Gull Lake (Riparian)

		Cover (%)	Freq (%)
Graminoids			
Baltic rush	Juncus balticus	34.7	100.0
slender sedge	Carex lasiocarpa	1.9	46.7
tufted hair grass	Deschampsia caespitosa	0.9	26.7
redtop	Agrostis stolonifera	0.7	13.3
northern reed grass	Calamagrostis inexpansa	0.5	33.3
Kentucky bluegrass	Poa pratensis	0.3	13.3
	Graminoids total	38.9	
Forbs			
wild mint	Mentha arvensis	4.5	80.0
perennial sow thistle	Sonchus arvensis	4.0	53.3
common dandelion	Taraxacum officinale	3.3	53.3
unknown species	Unknown species	3.3	40.0
bog violet	Viola nephrophylla	1.4	33.3
red clover	Trifolium pratense	1.3	20.0
creeping buttercup	Ranunculus cymbalaria	0.3	6.7
beard-tongue	Penstemon spp.	0.2	6.7
meadow horsetail	Equisetum pratense	0.2	6.7
skullcap	Scutellaria galericulata	0.1	6.7
	Forbs total	18.7	
Shrub / Tree			
autumn willow	Salix serissima	3.3	40.0
beaked willow	Salix bebbiana	2.2	33.3
balsam poplar	Populus balsamifera	1.7	40.0
yellow willow	Salix lutea	1.1	13.3
basket willow	Salix petiolaris	0.5	13.3
	Shrub / Tree Total	8.7	
Other			
Litter		68.0	100.0
Bryophytes		12.0	93.3
Other Total		80.0	

Site: Gull Lake – Riparian (continued)

Forage Production

Caged Plots n=10 Date Clipped: Septem	nber 02, 2003			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2172.2	242.8	1939.5	216.8
Forbs	400.4	102.8	357.5	91.8
Shrubs	570.4	159.6	509.3	142.5
Total Forage	3143.0	259.6	2806.3	231.8
Litter	951.6	250.4	849.7	223.5

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10

Date Clipped: August 26, 2005

Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1449.8	733.4	1294.4	1294.4
Forbs	116.9	16.1	104.4	104.4
Shrubs	0.0	0.0	0.0	0.0
Total Forage	1566.7	813.5	1398.8	1398.8
Litter	434.9	273.8	388.3	388.3

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10

Date Clipped: August 9, 2006

Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2763.6	984.7	2467.5	879.2
Forbs	334.6	168.1	298.7	150.1
Shrubs	165.2	260.2	147.5	232.3
Total Forage	3263.4	996.3	2913.7	889.5
Litter	1074.7	1153.4	959.5	1029.8
			A	

Gull Lake POAPRAT/AGROTRA (Upland) (estimated)

Plant Species Composition

Date Sampled: July 08, 2003 – Gull Lake (Upland)

		Cover (%)	Freq (%)
Graminoids			
Kentucky bluegrass	Poa pratensis	33.7	100.0
slender wheatgrass	Agropyron trachycaulum	16.3	66.7
timothy	Phleum pratense	3.7	40.0
	Graminoids Total	53.7	
Forbs			
red clover	Trifolium pratense	40.0	93.3
common dandelion	Taraxacum officinale	5.1	73.3
common plantain	Plantago major	1.0	13.3
	Forbs Total	46.1	
Other			
Litter		52.0	100.0
Feces		1.3	6.7
Other Total		53.3	

Forage Production

Caged Plots: n=10				
Date Clipped: Septem	nber 2, 2003			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3057.4	332.1	2729.9	296.5
Forb	182.4	49.5	162.9	44.2
Shrub	-	-	-	-
Total Forage	3239.8	317.1	2892.7	283.1
Litter	575.6	238.0	513.9	212.5

Site: Gull Lake - Upland (continued)

Caged Plots: n=10					
Date Clipped: August 26, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	2541.2	548.9	2268.9	490.1	
Forb	176.9	179.8	157.9	160.5	
Shrub	0	0	0	0	
Total Forage	2718.1	922.9	2426.9	824.0	
Litter	301.7	211.4	269.3	188.8	

No Uncaged Plots: Forage Utilization at Clipping 0%

Caged Plots: n=5 Date Clipped: August 9, 2006

Date Clipped: August 9	, 2006			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	4430.4	2055.4	3955.7	1835.2
Forb	106.6	92.7	95.2	82.8
Shrub	0.0	0.0	0.0	0.0
Total Forage	4537.0	2008.0	4050.9	1792.9
Litter	1024.3	385.4	914.6	344.1
			A · · ·	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Forage Production (Exclosure)

Plots: n=1				
Date Clipped: August	t 26, 2005			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2860	-	2553.6	-
Forb	-	-	-	-
Shrub	-	-	-	-
Total Forage				
Litter	-	-	-	-

Iron Creek (Riparian) (CAREUTR) – estimated

Plant Species Composition

Date Sampled: July 09, 2003

1 5 7		Cover (%)	Freq (%)
Graminoids			
beaked sedge	Carex utriculata	55.7	100.0
small-fruited bulrush	Scirpus microcarpus	5.0	46.7
water sedge	Carex aquatilis	4.0	26.7
tall manna grass	Glyceria grandis	2.7	40.0
slough grass	Beckmannia syzigachne	2.2	26.7
creeping spike-rush	Eleocharis palustris	0.7	6.7
	Graminoids total	70.3	
Forb			
yellow avens	Geum macrophyllum	0.2	6.7
	Forbs total	0.2	
Other			
Soil		40.0	100.0
Litter		31.0	93.3
Bryophytes		2.7	20.0
Other Total		73.7	

Forage Production

Cage Installation: June 08, 2003

Caged Plots n=10 Date Clipped: August 30, 2003					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	4239.6	255.1	3785.4	227.8	
Forbs	234.4	93.1	209.3	83.1	
Shrubs	-	-	-	-	
Total Forage	4474.0	179.7	3994.7	160.5	
Litter	2430.4	429.0	2170.0	383.0	

Site: Iron Creek – Riparian (continued)

Uncaged Plots n=5				
Date Clipped: Augus	t 30, 2003			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	4751.6	725.5	4242.6	647.8
Forb	107.2	61.1	95.7	54.5
Shrub	-	-	-	-
Total Forage	4858.8	696.9	4338.3	622.3
T T (11) (1		o/ [™] / 1º º1 1	>	

Forage Utilization at Clipping: -7%^{*} (negligible)

Caged Plots n=10

Duccomplete. Tugubt 20, 2000	Date cli	pped:	August	26,	2005
------------------------------	----------	-------	--------	-----	------

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2008.6	425.3	1793.4	379.7
Forbs	221.6	244.8	197.9	218.6
Shrubs				
Total Forage	2230.3	719.3	1991.3	642.2
Litter	468.3	249.2	418.1	222.5

No Uncaged Plots: Forage Utilization at Clipping: 0%

Caged Plots: n=10

Caged Plots: n=5

Date	clipped	: August	1,	2006
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Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3052.8	913.3	2725.7	815.5
Forbs	131.0	175.2	116.9	156.4
Shrubs	9.1	28.8	8.1	25.7
Total Forage	3192.9	833.9	2850.8	744.5
Litter	3126.5	1671.4	2791.5	1492.4
	T T . 111		0.01	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Forage Production (Exclosure)

Date clipped: August 26, 2005						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.		
Graminoids	1779.2	226.3	1588.5	202.0		
Forbs	523.5	759.4	467.4	678.0		
Shrubs	-	-	-	-		
Total Forage	2302.6	711.8	2055.9	635.5		
Litter	359.2	140.0	320.8	125.0		

^{*} Utilization is measured by percent difference between the uncaged plots and the first five production plots.

Site: Iron Creek – Riparian (continued)

Caged Plots: n=5

Dute enpped. August 11, 2000					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	2993.2	614.3	2672.5	548.5	
Forbs	383.1	434.2	342.0	387.6	
Shrubs	0.0	0.0	0.0	0.0	
Total Forage	3376.3	373.5	3014.5	333.5	
Litter	3695.2	783.4	3299.3	699.4	

Date clipped: August 11, 2006

Keho Lake (PHALARU)

Plant Species Composition

Date Sampled: August 7, 2005

		Cover (%)	Constancy (%)
Graminoids			
Reed Canary Grass	Phalarus arundinacea	100	100
Awnless Brome	Bromus inermis	1	13
	Graminoids total	104	
Forbs			
Water Smartweed	Polygonum coccineum	8	27
Canada Thistle	Cirsium arvense	7	73
	Forbs total	15	
Shrubs/Trees			
		_	
Other			
Bare Soil		_	
Bryophytes		-	

Forage Production

Uncaged Plots: n=10 Date Clipped: August 7, 2005

Date Chipped: Augus	17,2005			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	4352.2	2175.5	3885.9	1942.4
Forbs	243.14	246.1	217.1	219.8
Total Forage	4595.34	2212.2	4103.0	1975.1
Litter	3236.28	1828.2	2889.5	1632.3
Eorogo Utilization at	Clipping: 0%			

Forage Utilization at Clipping: 0%

Uncaged Plots: n=10

Chaged I lots. II-10					
Date clipped: August 3, 2006					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	6533.5	2165.3	5833.5	1933.3	
Forbs	0.0	0.0	0.0	0.0	
Shrubs	0.0	0.0	0.0	0.0	
Total Forage	6533.5	2165.3	5833.5	1933.3	
Litter	458.4	979.0	409.3	874.1	

Forage Utilization at Clipping: 0%

Little Sandhill Creek, Dinosaur Provincial Park (DESCCAE)

Plant Species Composition

Date Sampled: August 9, 2005

I		Cover (%)	Constancy (%)
Graminoids			
Tufted Hair Grass	Deschampsia caespitosa	37	87
Creeping Spike Rush	Eleocharis palustris	16	47
Slender Wheatgrass	Agropyron trachycaulum	4	53
Western Wheatgrass	Agropyron smithii	3	27
Foxtail Barley	Hordeum jubatum	2	53
Slender Wheatgrass (var.			
AGROTRA)	Agropyron unilaterale	1	7
	Graminoids total	64	
Forbs			
Undifferentiated Aster	Aster sp.	1	7
	Forbs total	1	
Shrubs			
	Symphoricarpos		
Buckbrush	occidentalis	10	47
Silver Sagebrush	Artemisia canadensis	6	13
Thorny Buffaloberry	Sheperdia argentea	5	13
Prickly Rose	Rosa accicularis	2	33
	Shrubs total	23	
Trees			
		0	0
Other			
Bare Soil			

Bryophytes

Site: Little Sandhill Creek, Dinosaur Provincial Park - (DESCCAE) (continued)

Forage Production

Uncaged plots: n=10 Date Clipped: August 9, 2005				
Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1730.7	37.1	1545.2	33.1
Forbs	-		-	
Shrubs	-	-	-	
Total Forage	1730.7	741.3	1545.2	661.9
Litter	-		-	

No Uncaged Plots: Forage Utilization at Clipping: 0%

Uncaged Plots: n=10

Date Clipped: August 13, 2006

Forage type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3044.4	652.7	2718.2	582.7
Forbs	0.0	0.0	0.0	0.0
Shrubs	17.9	56.5	16.0	50.5
Total Forage	3062.3	616.9	2734.2	550.8
Litter	1912.4	1535.8	1707.5	1371.3

Lyndon Creek (CAREATH CT)

Plant Species Composition

Date Sampled: August 18, 2005

Due Sumplea Hagast 10, 2		Cover (%)	Constancy (%)
Graminoids			
Awned Sedge	Carex atherodes	73	93
Kentucky Bluegrass	Poa pratensis	12	53
Slender Wheatgrass	Agropyron trachycaulum	5	40
Timothy	Phleum pratense	0.3	20
Tufted Hair Grass	Deschampsia caespitosa	0.2	13
	Graminoids Total	91	
Forbs			
Western Willow Aster	Aster hesperius	3	67
Smooth Aster	Aster laevis	1	13
Wild Vetch	Vicia americana	1	13
Water Parsnip	Sium suave	0.5	27
	Forbs total	5.5	
Shrubs			
Sandbar Willow	Salix exigua	19	67
	Shrubs total	19	
Trees			
		-	
Other			
Bare Soil		-	
Bryophytes		-	

Forage Production

Plots: n=6					
Date Clipped: August 18, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	2483.8	500.1	2217.7	446.5	
Forbs	145.7	61.7	130.1	55.1	
Shrubs	98.3	143.4	87.8	128.0	
Total Forage	2727.8	419.6	2435.5	374.7	

Site: Lyndon Creek (continued)

Caged Plots: n=10					
Date clipped: August 3, 2006					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	5781.3	1620.4	5161.9	1446.8	
Forbs	266.1	294.0	237.6	262.5	
Shrubs	279.2	250.6	249.3	223.7	
Total Forage	6326.6	1494.3	5648.8	1334.2	
Litter	794.6	593.4	709.5	529.8	

Caged Plots: n=10

Forage Utilization at Clipping: 0%

Site: Lyndon Creek - Grazed

Uncaged Plots: n=5

Date clipped: August 3, 2006					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	3939.3	1641.9	3517.2	1466.0	
Forbs	196.8	282.6	175.7	252.3	
Shrubs	25.4	30.7	22.7	27.4	
Total Forage	3467.9	2181.8	3096.3	1948.0	
Litter	467.8	332.6	417.7	297.0	

Forage Utilization at Clipping: 45%

Medicine River (S) – Upland (FESTRUB/AGROTRA) - estimated

Plant Species Composition

Date Sampled: July 08, 2003

1 2		Cover (%)	Freq (%)
Graminoids			
red fescue	Festuca rubra	17.9	73.3
slender wheatgrass	Agropyron trachycaulum	15.0	80.0
Kentucky bluegrass	Poa pratensis	13.7	73.3
timothy	Phleum pratense	6.5	60.0
	Graminoids Total	53.1	
Forb			
common dandelion	Taraxacum officinale	15.3	93.3
alfalfa	Medicago sativa	4.3	46.7
yarrow	Achillea millefolium	3.0	46.7
meadow horsetail	Equisetum pratense	1.5	26.7
bog violet	Viola nephrophylla	0.7	6.7
red clover	Trifolium pratense	0.5	20.0
	Forb Total	25.2	
Other			
Litter		79.1	100.0
Soil		14.7	80.0
	Other Total	93.7	

Forage Production

Cage Installation: June 9,2003

Caged Plots n=10 Date Clipped: September 1, 2003 Forage Type kg/ha s.d. lbs/acre s.d. Graminoids 365.8 2340.8 2621.6 326.6 393.2 106.7 Forb 351.1 95.3 0 0 0 Shrub 0 **Total Forage** 3014.8 346.1 2691.8 309.0 Litter 133.6 25.8 119.3 23.0

Site: Medicine River – Upland (continued)

Date clipped: August 25, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	2475.1	383.9	2209.9	342.8	
Forb	175.5	193.3	156.7	172.6	
Shrub	0	0	0	0	
Total Forage	2650.6	335.2	2366.6	299.3	
Litter	593.6	53.4	530.0	47.7	

Caged Plots: n=5 Date clipped: August 25, 2005

Forage Utilization at Clipping: 0%

Uncaged Plots: n=5 Date clipped: August 25, 2005

Date clipped: August 25, 2005					
Forage Type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	1321.2	542.8	1179.6	484.6	
Forb	38.1	16.6	34.0	14.9	
Shrub	20.0	0.0	17.9	0.0	
Total Forage	1379.2	538.0	1231.5	480.3	
Litter	0	0	0	0	

Forage Utilization at Clipping: 62%

Caged Plots: n=5

Date clipped: August 9, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	2002.4	982.8	1787.9	877.5
Forbs	118.6	97.2	105.9	86.8
Shrubs	0.0	0.0	0.0	0.0
Total Forage	2121.0	985.3	1893.8	879.7
Litter	114.0	254.9	101.8	227.6

Forage Utilization at Clipping: 0%

Site: Medicine River (Upland) - Grazed

Uncaged Plots: n=5

Forage Type	kơ/hạ	h a	lbs/acre	hə
Craminoida	1242.2	7(0.0	1100.4	<u> </u>
	1342.2	/68.2	1198.4	685.9
Forbs	8.6	7.1	7.7	6.4
Shrubs	0.0	0.0	0.0	0.0
Total Forage	1350.8	767.9	1206.1	685.6
Litter	367.2	231.9	327.9	207.1

Forage Utilization at Clipping: 36%

Medicine River South – Riparian (PHALARU/BROMINE) - estimated

Plant Species Composition

Date Sampled: July 08, 2003

Dute Sumplea. Vary 00, 200.	-	Cover (%)	Freq (%)
Graminoids			
reed canary grass	Phalaris arundinacea	33.3	73.3
smooth brome	Bromus inermis	26.0	73.3
slender wheatgrass	Agropyron trachycaulum	4.3	33.3
Kentucky bluegrass	Poa pratensis	1.3	20.0
marsh reed grass	Calamagrostis canadensis	0.3	6.7
tall manna grass	Glyceria grandis	0.3	6.7
	Graminoids Total	65.7	
Forbs			
meadow horsetail	Equisetum pratense	11.3	73.3
common dandelion	Taraxacum officinale	2.4	40.0
Canada goldenrod	Solidago canadensis	1.9	33.3
beard-tongue	Penstemon species	0.4	13.3
red clover	Trifolium pratense	0.3	6.7
avens	Geum spp.	0.2	13.3
wild vetch	Vicia americana	0.1	6.7
wormseed mustard	Erysimum cheiranthoides	0.1	6.7
mustard	Mustard spp.	0.1	6.7
stinkweed	Thlaspi arvense	0.1	6.7
	Forbs Total	16.9	
Shrub / Tree			
mountain willow	Salix pseudomonticola	0.4	13.3
	Shrub / Tree Total	0.4	
Other			
Litter		67.7	100.0
Soil		31.0	100.0
	Other Total	98.7	

Site: Medicine River South – Riparian (continued)

Forage Production

Cage Installation: June 9,2003

Caged Plots n=5

Date Clipped: S	September	1,	2003
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Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	5393.2	353.7	4815.4	315.8
Forbs	848.4	311.7	757.5	278.4
Shrubs	26.0	-	23.2	-
Total Forage	6267.6	305.7	5596.2	273.0
Litter	575.2	213.9	513.6	191.0

No Uncaged Plots: Forage Utilization at Clipping 0%

Caged Plots: n=10 Date clipped: August 25, 2005

Date chipped: August	, 25, 2005			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3485.6	1285.0	3112.1	1147.3
Forbs	104.3	261.3	93.1	233.3
Shrubs	4.1	18.0	3.7	16.0
Total Forage	3594.0	1166.7	3208.9	1041.7
Litter	212.7	244.3	189.9	218.1

No Uncaged Plots: Forage Utilization at Clipping 0%

Uncaged Plots: n=10

Date clipped: August 9, 2006

6553.4	2363.3	5851.3	2110.1
			2110.1
284.0	221.6	253.5	197.8
35.5	112.3	31.7	100.2
6872.9	2260.3	6136.5	2018.1
2043.3	952.9	1824.4	850.8
	284.0 35.5 6872.9 2043.3	284.0 221.6 35.5 112.3 6872.9 2260.3 2043.3 952.9	284.0 221.6 253.5 35.5 112.3 31.7 6872.9 2260.3 6136.5 2043.3 952.9 1824.4

Forage Utilization at Clipping: 0%

Red Deer River, Dinosaur Provincial Park (POPUDEL - CORNSTO)

Plant Species Composition

Date Sampled: August 18, 2005

		Cover (%)	Constancy (%)
Graminoids			
Awnless Brome	Bromus inermis	11	80
	Graminoids total	11	
Forbs			
Canada Goldenrod	Solidago canadensis	3	27
Star Flowered Solomon's-Seal	Smilacina stellata	1	13
Sticky Purple Geranium	Geranium viscosissium	0.3	13
Smooth Aster	Aster laevis	0.1	7
Wild Strawberry	Frageria virginiana	0.1	7
Wild Vetch	Vicia americana	0.1	7
	Forbs total	4.7	
Shrubs			
Red Osier Dogwood	Cornus stolonifera	23	73
Prickly Rose	Rosa accicularis	17	60
Western Clematis	Clematis ligusticifolia	10	67
Choke Cherry	Prunus virginiana	7	27
Northern Gooseberry	Ribes oxyacanthoides	1	13
Silverberry	Elaeagnus commutata	1	7
	Shrubs total	59	
Trees			
Plains Cottonwood	Populus deltoides	50	
Water Birch	Betula occidentalis	20	
Balsam Poplar	Populus balsamifera	10	
	Trees total	80	
Other			
Bare Soil		-	
Bryophytes		-	

Site: Red Deer River, Dinosaur Provincial Park – (POPUDEL - CORNSTO) (continued)

Forage Production

Uncaged plots: n=10 Date Clipped: August 18, 2005					
Forage type	kg/ha	s.d.	lbs/acre	s.d.	
Graminoids	251.8	147.2	224.9	131.4	
Forbs	102.5	118.1	91.5	105.5	
Shrubs	277.1	204.1	247.4	182.3	
Total Forage	631.5	231.0	563.8	206.2	
Litter	_		_		

No Uncaged Plots: Forage Utilization at Clipping: 0%

Uncaged plots: n=10

	\sim	-			
Date	Cl	ipped:	August	13,	2006

e s.d.
301.9
51.2
83.0
4 302.9
7 1064.9
1

Rosebud River, Thurn Pit Upland

Forage Production

s.d.

Caged Plots: n=2Date Clipped: October17, 2005Forage Typekg/has.d.lbs/acreCommingide2000.5247.027.66.5

Graminoids	3098.5	247.9	2766.5	221.3
Forbs	245.3	346.9	219.0	309.7
Shrubs	21.8	30.9	19.5	27.6
Total Forage	3365.6	129.9	3005.0	116.0
Litter	3777.8	1948.2	3373.0	1739.5

Forage Utilization at Clipping: 0%

Uncaged Plots: n=5

Date Clipped: October17, 2005

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	718.4	342.9	640.8	306.1
Forbs	268.5	192.5	239.5	171.9
Shrubs	18.7	33.0	16.7	29.4
Total Forage	1023.9	161.3	913.4	144.0
Litter	25.2	14.0	22.5	12.5

Forage Utilization at Clipping: 70%

Caged Plots: n=2

Date Clipped: September 21, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1742.6	228.9	1554.5	204.4
Forbs	367.7	198.0	328.0	176.8
Shrubs	52.1	73.7	46.5	65.8
Total Forage	2162.4	353.2	1929.0	315.4
Litter	1148.5	192.4	1024.5	171.8
	CIII			

Forage Utilization at Clipping: 0%

Uncaged Plots: n=5

Date	Clip	bed:	Sept	tember	21,	2006
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Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	963.4	541.0	859.4	483.0
Forbs	418.1	210.9	373.0	188.3
Shrubs	50.4	104.2	45.0	93.0
Total Forage	1432.0	426.1	1277.4	380.4
Litter	3.1	7.0	2.8	6.3

Forage Utilization at Clipping: 10%

Rosebud River, Thurn Pit Crested Wheatgrass

Forage Production

Caged Plots: n=2						
Date Clipped: October17, 2005						
Forage Type	kg/ha	s.d.	lbs/acre	s.d.		
Graminoids	928.2	256.6	828.0	229.1		
Forbs	11.8	16.6	10.5	14.8		
Shrubs	0.0	0.0	0.0	0.0		
Total Forage	940.0	273.2	838.5	244.0		
Litter	65.6	59.4	58.5	53.0		

No Uncaged Plots: Forage Utilization at Clipping 0%

Caged Plots: n=2

Date Clipped: September 21, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1624.9	141.8	1554.5	595.5
Forbs	0.0	0.0	353.3	124.2
Shrubs	0.0	0.0	158.8	174.3
Total Forage	1624.9	141.8	2066.5	738.7
Litter	108.2	106.9	17.8	27.0
Rosebud River, Thurn Pit Riparian Bench

(Outside the active riparian area - not part of Riparian Health Inventory)

Forage Production

Caged Plots: n=4 Date Clipped: October17, 2005				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1022.6	5125.0	912.3	256.3
Forbs	265.4	87.6	236.8	78.3
Shrubs	10.9	13.6	9.8	12.1
Total Forage	1299.0	274.7	1158.8	245.3
Litter	23.0	27.8	20.5	24.8

No Uncaged Plots: Forage Utilization at Clipping 0%

Caged Plots: n=4

Date Clipped: September 21, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	1742.6	666.9	1554.5	595.5
Forbs	396.0	139.1	353.3	124.2
Shrubs	178.0	195.3	158.8	174.3
Total Forage	2316.5	827.4	2066.5	738.7
Litter	19.9	30.2	17.8	27.0

No Uncaged Plots: Forage Utilization at Clipping 0%

St. Mary River, Woolford Provincial Park (SALILUT CT)

Plant Species Composition

Date Sampled: August 12, 2005

1 0 /		Cover (%)	Constancy (%)
Graminoids			
Bluejoint	Calamogrostis canadensis	7	67
Kentucky Bluegrass	Poa pratensis	4	53
Northern Wheatgrass	Agropyron dasystachyum	4	27
Reed Canary Grass	Phalarus arundinacea	3	7
Awnless Brome	Bromus inermis	1	20
Drooping Wood-reed	Cinna latifolia	1	20
Woolly Sedge	Carex lanuginosa	0.3	7
Slender Wheatgrass	Agropyron trachycaulum	0.3	7
Plains Muhly	Muhlenbergia cuspidata	0.1	7
	Graminoids Total	20.7	
Forbs			
Diffuse Knapweed	Centaurea diffusa	7	53
White sweet-clover	Melilotus alba	5	67
Wild Licorice	Glycyrrhiza lepidota	5	7
Undifferentiated Goldenrod	Solidago spp.	2	27
Late Goldenrod	Solidago gigantea	2	20
Canada Thistle	Cirsium arvense	1	7
Common Scouring Rush	Equisetum hyemale	1	7
Common Horsetail	Equisetum arvense	0.4	20
Common Yarrow	Achillea millefolium	0.1	7
Common Dandelion	Taraxacum officinale	0.1	6.7
	Forbs total	23.6	
Shrubs			
Yellow Willow	Salix lutea	30	60
Sandbar Willow	Salix exigua	16	67
Buckbrush	Symphoricarpos occidentalis	0.3	7
	Shrubs total	46.3	
Trees			
Balsam Poplar	Populus balsamifera	1	7
	Trees total	93.6	
Other			
Bare Soil			
Bryophytes		0	

Site: St. Mary River, Woolford Provincial Park - (SALILUT CT) (continued)

Forage Production

Uncaged Plots: n=10 Date Clipped: August 12, 2005				
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	519.4	158.5	463.8	141.5
Forbs	241.7	215.6	215.8	192.5
Shrubs	480.8	386.7	429.3	345.3
Total Forage	1241.9	484.9	1108.8	433.0
Litter	530.5	334.7	473.7	298.8

Forage Utilization at Clipping: 0%

Uncaged Plots: n=10

Date Clipped: August 4, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	360.8	129.4	322.1	115.5
Forbs	605.6	406.5	540.7	363.0
Shrubs	144.4	145.8	128.9	130.2
Total Forage	1110.8	413.5	991.8	369.2
Litter	456.4	426.5	407.5	380.8

Forage Utilization at Clipping: 0%

Todd Creek (ELEOPAL HT) (possibly changed to POAPALU)

Plant Species Composition

Date Sampled: August 4, 2005

1 0 7		Cover (%)	Constancy (%)
Graminoids			
Fowl Bluegrass	Poa palustris	25	80
Three-square Rush	Scirpus pungens	19	80
Slough grass	Beckmannia syzigachne	17	40
Awned Sedge	Carex atherodes	7	33
Creeping Spike Rush	Eleocharis palustris	5	27
Timothy	Phleum pratense	1	27
Slender Wheatgrass	Agropyron trachycaulum	1	20
	Graminoids Total	75	
Forbs			
Graceful Cinquefoil	Potentilla gracilis	4	53
Alsike Clover	Trifolium hubridum	4	33
Common Dandelion	Taraxacum officinale	2	33
Common Plantain	Plantago major	1	7
	Forbs total	11	
Shrubs/Trees			
		-	-
Other			
Bare Soil		10	
Bryophytes		10	

Forage Production

Caged Plots: n=10				
Date Clipped: Augus	st 4, 2005			
Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	3442.1	1125.6	3073.3	1005.0
Forbs	364.3	96.2	325.3	85.9
Shrubs	109.58	774.848	97.8393	691.828
Total Forage	3915.9	1281.0	3496.4	1143.7
Litter	_		_	

No Uncaged Plots: Forage Utilization at Clipping 0%

Site: Todd Creek - (continued)

Caged Plots: n=6 Date clipped: August 2, 2006

Forage Type	kg/ha	s.d.	lbs/acre	s.d.
Graminoids	5604.1	1159.3	5003.6	1035.1
Forbs	78.8	89.6	70.4	80.0
Shrubs	7.2	17.6	6.4	15.7
Total Forage	5690.1	1125.0	5080.4	1004.4
Litter	445.3	348.8	397.6	311.4

No Uncaged Plots: Forage Utilization at Clipping: 0%

common name	Scientific name	Abbreviation
common yarrow	Achillea millefolium	ACHIMIL
northern wheatgrass	Agropyron dasystachyum	AGRODAS
quackgrass	Agropyron repens	AGROREP
western wheatgrass	Agropyron smithii	AGROSMI
undifferentiated wheatgrass	Agropyron spp.	AGRO spp.
slender wheatgrass	Agropyron trachycaulum	AGROTRA
slender wheatgrass (var. agrotra)	Agropyron unilaterale	AGROUNI
redtop	Agrostis stolonifera	AGROSSTO
Saskatoon	Amelanchier alnifolia	AMELALN
Canada anemone	Anemone canadensis	ANEMCAN
cut-leaved anemone	Anemone multifida	ANEMMUL
prairie crocus	Anemone patens	ANEMPAT
brown-bracted mountain everlasting	Antennaria umbrinella	ANTEUMB
common bearberry	Arctostaphylos uva-ursi	ARCTUVA
undifferentiated arnica	Arnica spp.	ARNI spp.
leafy arnica	Arnica chamissonis	ARNICHA
silver sagebrush	Artemisia canadensis	ARTECAN
pasture sagewort	Artemisia frigida	ARTEFRI
prairie sagewort	Artemisia ludoviciana	ARTELUD
showy aster	Aster conspicuus	ASTECON
western willow aster	Aster hesperius	ASTEHES
smooth aster	Aster laevis	ASTELAE
undifferentiated aster	Aster sp.	ASTE spp.
leafy-bracted aster	Aster subspicatus	ASTESUB
undifferentiated milkweed	Astragalus spp.	ASTRA spp.
slough grass	Beckmannia syzigachne	BECKSYZ
water birch	Betula occidentalis	BETUOCC
awnless brome	Bromus inermis	BROMINE
bluejoint	Calamagrostis canadensis	CALACAN
northern reed grass	Calamagrostis inexpansa	CALAINE
sand grass	Calamovilfa longifolia	CALALON
common caragana	Caragana arborescens	CARAARB
awned sedge	Carex atherodes	CAREATH
woolly sedge	Carex lanuginosa	CARELAN
slender sedge	Carex lasiocarpa	CARELAS
small bottle sedge	Carex utriclata	CAREUTR
diffuse knapweed	Centaurea diffusa	CENTDIF
lamb's quarters	Chenopodium album	CHENALB

Appendix 4 Riparian Production Survey Species List, according to Moss (1994)

appendix 4 (continued) common name

drooping wood-reed Canada thistle western clematis purple clematis red osier dogwood annual hawk's-beard tufted hair grass silverberry creeping spike rush hairy wild rye fireweed common horsetail common scouring rush meadow horsetail Philadelphia fleabane plains rough fescue wild strawberry northern bedstraw small bedstraw sweet scented bedstraw wild white geranium sticky purple geranium water avens yellow avens three flowered avens tall manna grass wild licorice foxtail barley wire rush June grass wild blue flax white sweet-clover wild mint wild bergamot plains muhly mat muhly prickly pear cactus showy locoweed beard-tongue

Scientific name	Abbreviation
Cinna latifolia	CINNLAT
Cirsium arvense	CIRSARV
Clematis ligusticifolia	CLEMLIG
Clematis occidentalis	CLEMOCC
Cornus stolonifera	CORNSTO
Crepis tectorum	CREPTEC
Deschampsia caespitosa	DESCCAE
Elaeagnus commutata	ELAECOM
Eleocharis palustris	ELEOPAL
Elymus innovatus	ELYMINN
Epilobium angustifolium	EPILANG
Equisetum arvense	EQUIARV
Equisetum hyemale	EQUIHYE
Equisetum pratense	EQUIPRA
Erigeron philadelphicus	ERIGPHI
Festuca hallii	FESTHAL
Fragaria virginiana	FRAGVIR
Galium boreale	GALIBOR
Galium trifidum	GALITRF
Galium triflorum	GALITRI
Geranium richardsonii	GERARIC
Geranium viscosissimum	GERAVIS
Geum rivale	GEUMRIV
Geum macrophyllum	GEUMMAC
Geum trifolium	GEUMTRI
Glyceria grandis	GLYCGRA
Glycyrrihiza lepidota	GLYCLEP
Hordeum jubatum	HORDJUB
Juncus balticus	JUNCBAL
Koeleria macrantha	KOELMAC
Linum lewisii	LINULEW
Melilotus alba	MELIALB
Mentha arvensis	MENTARV
Monarda fistulosa	MONAFIS
Muhlenbergia cuspidata	MUHLCUS
Muhlenbergia richardsonii	MUHLRIC
Opuntia fragilis	OPUNFRA
Oxytropis splendens	OXYTSPL
Penstemon spp.	PENSSPP

appendix 4 (continued) common name

reed canary grass timothy reed common plantain Canada bluegrass fowl bluegrass kentucky bluegrass undifferentiated bluegrass water smartweed pale persicaria narrow leaf cottonwood balsam poplar plains cottonwood aspen shrubby cinquefoil graceful cinquefoil chokecherry common pink wintergreen creeping buttercup bristly black current northern gooseberry prickly rose undifferentiated rose common wild rose western dock beaked willow pussy willow sandbar willow yellow willow basket willow autumn willow great bulrush small-fruited bulrush three-square rush skullcap compact selaginella thorny buffaloberry water parsnip star flowered solomon's-seal

Scientific name	Abbreviation
Phalaris arundinacea	PHALARU
Phleum pratense	PHLEPRA
Phragmites australis	PHRAAUS
Plantago major	PLANMAJ
Poa compressa	POACOMP
Poa palustris	POAPALU
Poa pratensis	POAPRAT
Poa spp.	POA sp.
Polygonum coccineum	POLYCOC
Polygonum lapathifolium	POLYLAP
Populus angustifolia	POPUANG
Populus balsamifera	POPUBAL
Populus deltoides	POPUDEL
Populus tremuloides	POPUTRE
Potentilla fruticosa	POTEFRU
Potentilla gracilis	POTEGRA
Prunus virginiana	PRUNVIR
Pyroasa asarifolia	PYROASA
Ranunculus cymbalaria	RNUCYM
Ribes lacustre	RIBELAC
Ribes oxyacanthoides	RIBEOXY
Rosa accicularis	ROSAACC
Rosa spp.	ROSA sp.
Rosa woodsii	ROSAWOO
Rumex occidentalis	RUMEOCC
Salix bebiana	SALIBEB
Salix discolor	SALIDIS
Salix exigua	SALIEXI
Salix lutea	SALILUT
Salix petiolaris	SALIPET
Salix serissima	SALISER
Scirpus acutus	SCIRACU
Scirpus microcarpus	SCIRMIC
Scirpus pungens	SCIRPUN
Scutellaria galericulata	SCUTGAL
Selaginella densa	SELADEN
Sheperdia argentea	SHEPARG
Sium suave	SIUMSUA
Smilacina stellata	SMILSTE

appendix 4 (completed)		
common name	Scientific name	Abbreviation
Canada goldenrod	Solidago canadensis	SOLICAN
late goldenrod	Solidago gigantea	SOLIGIG
low goldenrod	Solidago missouriensis	SOLIMIS
undifferentiated goldenrod	Solidago spp.	SOLI sp.
perennial sow thistle	Sonchus arvensis	SONCARV
long-leaved chickweed	Stellaria longipes	STELLON
common chickweed	Stellaria media	STELMED
needle-and-thread	Stipa comata	STIPCOM
porcupine grass	Stipa curtiseta	STIPCUR
green needle grass	Stipa viridula	STIPVIR
buckbrush	Symphoricarpos	
	occidentalis	SYMPOCC
common dandelion	Taraxacum officinale	TARAOFF
veiny meadow rue	Thalictrum venulosum	THALVEN
golden bean	Thermopsis rhombifolia	THERRHO
alsike clover	Trifolium hubridum	TRIFHUB
white clover	Trifolium repens	TRIFREP
wild vetch	Vicia americana	VICIAME
early blue violet	Viola adunca	VIOLADU
western canada violet	Viola canadensis	VIOLCAN
bog violet	Viola nephrophylla	VIOLNEP
marsh violet	Viola palustris	VIOLPAL