AN ASSESSMENT OF GRAZING CAPACITY IN THE FORSTER-HORSETHIEF RANGE UNIT

Forest Service
Invermere Forest District
B.C. Ministry of Forests

October 1996

Robert A. Ellis

Westworth, Brusnyk & Associates Ltd.
Edmonton, Alberta
Valemount, British Columbia

ACKNOWLEDGEMENTS

The author wishes to acknowledge Gail Berg, Range Ecologist, B.C. Minstry of Forests for her support, advice and guidance throughout the study. Thanks are also extended to Jim Sicotte for his very capabable assistance during the field studies.

I also wish to acknowledge the technical assistance provided by other staff of Westworth, Brusnyk & Associates Ltd.: Kari Donnelly for report production and Doug Skinner for editing and review.

ABSTRACT

A range survey was conducted in the Forster-Horsethief Range Unit near Radium, British Columbia. Twenty transects were established, of which 7 had production cages. Based on field surveys conducted in early July, 1996, five broad range types were delineated including cutblocks, wetlands, open forest, mature forest, and grasslands. Within these range types, seven vegetation community types were classified and mapped within the range unit. Productivity estimates indicated that the capacity for livestock with current grazing patterns are: 379 AUMs for Forster Pasture, 191 AUMs for Baltic Pasture, 202 AUMs for Bextram Pasture, 37 AUMs for Broken Tree Pasture.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

1.0 INTRODUCTION

Rangelands are an important resource in British Columbia, particularly for the ranching industry. In 1989/1990, almost one million animal unit months (AUMs) or 60% of the total forage requirement for beef production in the province were produced on Crown lands (Meidinger and Pojar 1991). Aside from providing grazeable forage for domestic livestock, rangeland use may impact fish habitat and provide important habitat for wildlife, and various recreational opportunities and aesthetic benefits for residents and visitors. Although rangeland includes natural grasslands, shrublands, alpine communities, and wet meadows, forested lands contribute significantly to the forage base, accounting for almost 80% of the rangelands in British Columbia (Meidinger and Pojar 1991). Logging activities and fire are important factors in the conversion of forest into rangelands.

Management of rangelands is primarily under the jurisdiction of the Forest Service, British Columbia Ministry of Forests. Because of the importance of rangeland users (people or animals or both) the Ministries of Environment and Agriculture and Fisheries may also become involved in rangeland management and planning (MOF 1989). Within the Ministry of Forests, technical expertise in managing Crown rangelands is provided by the Range Section which issues grazing tenures and hay cutting permits for domestic livestock, monitors tenure and permit compliance, and conducts vegetation inventories.

Rangeland management and planning activities of the Range Section are based on the guidelines and policies outlined in the Range Program. The program, which was recently reviewed by the Range Program Review Task Force (MOF 1989), is administered through six regions and 43 districts located throughout British Columbia. The Forster-Horsethief Creek area has historically been used for timber harvesting and domestic livestock grazing, but as in other areas of the province, a more comprehensive plan for resource allocation was required.

As part of its on-going range management program in the Invermere Forest District, the Range Section identified a need to conduct a forage assessment of the Forster-Horsethief Range Unit. The following report, which was prepared by Westworth, Brusnyk & Associates Ltd., presents the results of this forage assessment. The information should assist resource managers in developing and implementing management plans that will ensure sustained forage yields for domestic livestock and also ensure compatibility with other land uses in the region.

1.1 Objectives

The overall objective of the study was to determine forage production levels, species composition of plant communities, and carrying capacity for the Forster-Horsethief Range Unit. Specific objectives of the range inventory were to:

- Identify and map primary and secondary ranges;
- Identify and sample major vegetation communities within primary and secondary ranges; and
- Collect forage productivity data to determine carrying capacity within each vegetation community.

1.2 Regional and Biophysical Setting

The Forster-Horsethief Range Unit is located west of Radium Hot Springs. It is bounded on the north by Forster Creek and on the south by Horsethief Creek, on the east by the Columbia River, and on the west by the lower slopes of the Purcell Mountains (Figure 1). Both Forster and Horsethief Creeks originate in the Purcell Mountains west of the study area and flow east, eventually emptying into the Columbia River. The range unit is composed of four main pastures; Forster, Baltic, Bextram and Broken Tree. A fifth much smaller pasture, Barbour Pasture, located at the southeast corner of the range is not described in this report. It is used exclusively as pasture for winter horse grazing. Each of the main pastures, which range in size from 1318 ha to 3351 ha, contains different proportions of crown and private lands (Table 1). Forster-Horsethief Range Unit can be accessed by road from Highway 93/95 at Radium. A gravel road, known as the Westside Road, provides access to the range unit and forest service roads provide access to the four main pastures. Major land uses in the area consist of livestock grazing, timber harvesting, and recreation.

The Forster-Horsethief Range Unit is both geographically and ecologically diverse. Three biogeoclimatic zones are represented in the range unit including the Engelmann Spruce-Subalpine Fir, Montane Spruce and Interior Douglas-fir (Meidinger and Pojar 1991). However, Crown grazing lands, the focal point of this study, are primarily located in the Interior Douglas-fir zone. Although species composition of these biogeoclimatic zones is relatively well known, population sizes and in the case of wildlife, patterns of habitat use and seasonal movements have not been well documented.

Based on discussions with Ministry of Forests personnel, the lower elevations of Forster-Horsethief Range Unit appear to be used by wintering elk. During the summer, elk move to higher elevations. White-tailed deer and mule deer are also common at lower elevations while moose prefer riparian and cutblock habitats adjacent to forest cover.

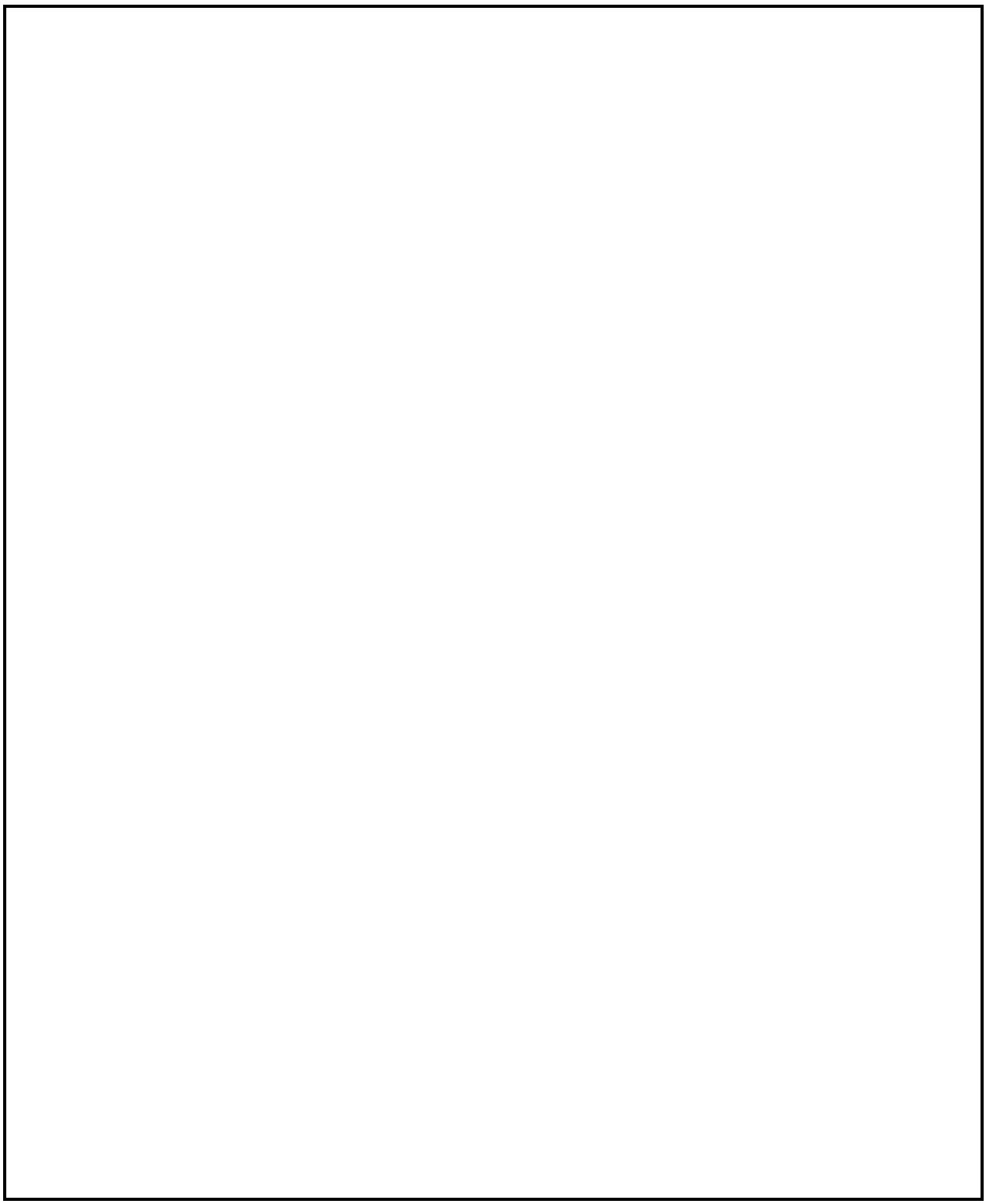

Figure 1. Location of the Forster-Horsethief Range Unit.

Table 1. Area of private and Crown lands in the Forster-Horsethief Range Unit.

Pasture	Total Area (ha)	Private Lands (ha)	Crown Lands	
			Utilized	Unutilized (ha)
Forster	3351	486	389	2476
Baltic	2944	856	244	1844
Bextram	1887	905	242	740
Broken Tree	1318	920	244	154

1.3 Pastures of the Forster-Horsethief Range Unit

Forster Pasture, located at the west end of Forster-Horsethief Range Unit, extends across a wide elevation gradient from approximately 1000 m near Horsethief Creek to over 2700 m near the top of Starbird Ridge. For the most part, Forster Pasture is dominated by homogeneous mature closed and open Douglas-fir and lodgepole pine forests on steep south or southwest facing slopes. Aspen is occasionally found mixed with conifers on dry south facing slopes. Deeply incised south-flowing drainage channels provide increased topographic variation in terms of aspect, and moisture regime. Balsam poplar may be present in mixed conifer stands on steep moist slopes along stream channels. A tall shrub layer, dominated by alder, is usually very well developed on these sites. Where stream channels are broader and soils are uniformly wet, lush tall shrub and forb communities have developed. Along the Horsethief Creek floodplain extensive wet meadows dominated by sedges and scattered shrubs are present. Most of the utilized range in this pasture consists of cutblocks and associated landings and access roads. Numerous small creeks scattered throughout this pasture provide livestock and wildlife with good water sources.

Baltic Pasture, located east of Forster Pasture, increases in elevation from approximately 1100 m in the east to over 2400 m on Mount Forster in the west. Most of the utilized rangeland lies between 1100 and 1300 m. Cutblocks, an abandoned hydroline right-of-way, and a few open forest areas provide the majority of grazing opportunities on utilized reangeland. Mature closed coniferous forests characterize most of the unutilized range in Baltic Pasture. Douglas-fir and lodgepole pine are the dominant trees. Stands of aspen mixed with Douglas-fir or lodgepole pine are found occasionally at lower elevations. Mixed coniferous stands that include Engelmann spruce are common at higher elevations.

Bextram Pasture, located east of Baltic Pasture, has relatively low relief and varies in elevation from 1000 m to just over 1100 m. The majority of utilized range consists of cutblocks and open forest areas.

Unutilized range is composed predominantly of closed mixed coniferous forests of Douglas-fir and lodgepole pine. Trembling aspen is found only in scattered patches and is usually mixed with either Douglas-fir or lodgepole pine.

Broken Tree Pasture, located near the southeast corner of the range unit, borders Horsethief Creek to the south. Steep south-facing banks approximately 80 m high flank this portion of Horsethief Creek. Surrounding upland areas are gently rolling and have low relief with elevations generally between 900 and 1000 m. Most of the utilized range consists of open forest that is harvested for Christmas trees and sparsely treed grassland areas near the north bank of Horsethief Creek. These grassland areas are noteworthy because of the presence of big sagebrush which has not been previously recorded in the Invermere Forest District.

2.0 METHODS

2.1 Preliminary Investigations

Prior to the field survey, preliminary range types were mapped using 1:20,000 black-and-white aerial photographs and 1:20,000 forest cover maps. A reconnaissance-level field trip of the range unit was undertaken with the Range Ecologist to obtain an overview of community types and grazing practices. Sampling effort for the vegetation and range survey was then stratified on the basis of the preliminary range type map and information obtained during the field trip. This sampling approach resulted in the establishment of 20 transects within the 4 pastures of the Forster-Horsethief Range Unit. Transect locations were marked on aerial photographs to facilitate classification and delineation of community types.

2.2 Vegetation Survey

A vegetation survey designed to document species composition and percentage cover was conducted July 2 - July 20, 1996 using sampling methods described in Alberta Forest Service's Range Survey Manual (Alberta Forest Service 1990). Vegetation was surveyed along 20 transects, 7 of which had production cages. Vegetation was sampled on 15 microplots placed at 2 m intervals along each 30 m transect. Cover (%) of grass and forb species was estimated using 20 cm x 50 cm quadrats and, when present, shrub species cover was estimated on 1 m x 1 m quadrats. A 20 m x 20 m plot was used to determine cover estimates for trees and tall shrubs (stems 2.5 m). When the cover for a species observed within the microplots exceeded 15% estimates were recorded to the nearest 5%, whereas cover estimates for species with cover values between 0 and 15% were estimated to the nearest 1%. Cover estimates for trees and tall shrubs in the macroplot were recorded to the nearest 5%. All information was recorded on specifically-designed grazing inventory forms provided by the B.C. Ministry of Forests. A 35 mm colour photograph was also taken along each transect to document existing vegetation conditions. To assist in future range monitoring programs, all transect locations (UTM coordinates) were determined using a hand held Global Positioning System unit. A permanent marker, consisting of a metal stake with attached metal tag, was placed at the beginning of each transect to further assist future transect relocation.

2.3 Forage Production

One objective of the study was to collect forage production data for use in calculating carrying capacities for the Forster-Horsethief Range Unit. Herbage production and forage use levels within a range type are typically determined by harvesting vegetation from protected (e.g. production cages) and unprotected

quadrats at each transect. In the present study, exclosure cages constructed from 2.54 cm^2 wire mesh were used to exclude herbivore grazing from an area of approximately 1.25 m^2.

The assessment of forage production in the Forster-Horsethief Range Unit was undertaken between August 7-10, 1996. Vegetation was hand harvested from 2, 50 cm x 100 cm quadrats at transects which contained exclosure cages (one from beneath the exclosure cage and one outside) if there was obvious grazing activity outside the cage. If there was no obvious grazing outside the cage only the quadrat in the exclosure cage was harvested. In the case of transects with no exclosure cages, only 1 quadrat was harvested. In this case, vegetation was hand harvested from a 50 cm x 100 cm quadrat randomly placed near the beginning or end of each transect. Harvested material was field sorted into grasses (and grass-like vegetation), forbs, and shrubs and placed into labelled paper bags for drying.

2.4 Laboratory Methods and Data Analysis

Upon the completion of the field work, the harvested vegetation was oven-dried for 48 hours at 70°C and weighed to the nearest 0.1 gm. Production (kg/ha) was calculated from raw data ($g/0.5m^2$) by multiplying by 20 (a conversion factor for converting $g/0.5m^2$ to kg/ha). Herbage production on each range type was calculated as the average of all clipped plots within each range type. For domestic livestock, forage was defined as that portion of the herbage that is palatable to the grazing animal in question. Since livestock are primarily grazers, the forb portion, with the exception of black medic, alfalfa, sweet clover and white clover, of all range types was considered unpalatable and was not considered to be forage. In the case of wildlife, all forbs and grasses and some shrubs were considered as palatable forage.

Species composition and foliar cover estimates for each quadrat were input into digital files for analysis. Data entry accuracy was verified using the Data Entry II module of SPSS for Windows statistical software. Following data entry, average species cover values were calculated for each transect. Transect data was then classified using TWINSPAN (Two-way Indicator Species Analysis), a computer program that produces an ordered two-way table in which similar transects are grouped together. The groups established by TWINSPAN were then inspected to determine the appropriate level for division into preliminary community types. Final classification of transects into community types was based on TWINSPAN divisions and modifications based on variations in dominant plant species.

Data collected from 70 transects in 2 adjoining range units (Frances Creek and Forster-Horsethief) were jointly analyzed with TWINSPAN. Data from both range units were combined to provide an enhanced data set on which to base community type description. Some community types derived from the

classification process occur in both range units while other community types are restricted to one range unit. The distribution of community types within each range unit is summarized in Table 2.

Table 2. Vegetation community types found in Frances Creek and Forster-Horsethief Range Units.

Community Type	Range Unit	
	Frances Creek	**Forster-Horsethief Creek**
1. Kentucky bluegrass/black medic-white clover	✓	✓
2. Junegrass/black medic-rosy pussytoes	✓	
Douglas-fir/junegrass/rosy pussytoes		✓
3. Douglas-fir-lodgepole pine/kinnikinnick/pinegrass	✓	✓
4. Trembling aspen/kinnikinnick/pinegrass	✓	
Trembling aspen/saskatoon/pinegrass		✓
5. Lodgepole pine/dwarf blueberry/pinegrass	✓	
Lodgepole pine/snowberry/pinegrass		✓
6. Sedge fen	✓	✓
7. Scrub birch-Labrador tea-shrubby cinquefoil	✓	
Cow parsnip-fireweed		✓
8. Bunchberry/black huckleberry/Engelmann spruce	✓	

2.5 Calculating Carrying Capacity

Stratification of the study area into primary, secondary, and non-use (tertiary) ranges is the first step in calculating grazing capacity. Primary range can be defined as those areas that livestock prefer to use under very little management (Maduram 1979). Secondary range is characterized as having some feature(s) that restrict livestock grazing and may include steep slopes, barriers to grazing such as brush, long distances to water, or a plant community that does not contain palatable forage species. Carrying capacity calculations do not usually include forage growing on secondary range since this may result in overstocking the primary range. Non-use areas or tertiary range were those areas that contain significant barriers to movement such as excessive amounts of deadfall, steep slopes, and/ or absence of palatable forage.

Primary and secondary ranges were further subdivided into vegetation community types. Vegetation community types were considered to be areas exhibiting uniform species composition and herbage production levels. Productivity was then estimated for each community type, and a weighted mean (weighted by area) of herbage production in primary and secondary range was calculated. Unpalatable herbage was subtracted from total herbage to provide forage estimates for domestic livestock. A safe use factor was also applied to the available forage and was defined as the level of herbivore grazing that the vegetation can withstand indefinitely without lasting detrimental effects. Typical safe use factors used in inventories of native rangelands include a 50% level of use during the growing season and a 70% level of use during the dormant season. Tame grass reseedings can generally withstand a higher level of use of growing season herbivore use (60%) than native grass swards. Therefore, herbage growing on primary range minus unpalatable herbage minus a safe use factor yields available forage for domestic livestock and wildlife consumption. Since 1 AUM is equal to 450 kg of forage (Basarab 1987), grazing capacity (in AUMs) can be calculated.

Calculations of forage production on open forest areas are adjusted to account for partial canopy closure and thus, result in lower overall forage production estimates. Canopy closure was obtained either from 1:20,000 forest cover maps or estimated from 1:20,000 black-and-white airphotos for each polygon on the range map, i.e. if polygon 1 covers 400 ha and has 30% crown closure the effective production area is 70% x 400 = 280 ha. A total effective production area is obtained for all polygons for each community type within primary and secondary range. For example, if community type 1 in primary range has an estimated production of 500 kg/ha and an effective production area of 300 ha the number of AUMs in CT1 on primary range would be: 300 ha x 500 kg/ha = 150,000 kg of production.

Therefore:

$$\text{AUMs} = \frac{\text{150000 kg of production}}{\text{450 kg/day}} = \text{333 days of grazing for 1 cow.}$$

3.0 RESULTS AND DISCUSSION

3.1 Community Type Descriptions

Seven vegetation community types characterized by 139 vascular plant species (Appendix 1) were identified in the Forster-Horsethief Range Unit. To provide summary descriptions of each community type identified in the range unit, a checksheet format was used. Each checksheet contains information on site location, important biophysical features, and plant species cover data. The grazing capacity of each community type along with a representative photograph of each transect also accompanies each checksheet.

Community Type 1 (N = 3). Kentucky bluegrass/black medic-white clover (Photo 1).

This community type is typical of meadows, landings, and roadsides that have been seeded. Typically, mineral soil is exposed and early successional mosses (e.g. *Ceratodon* spp.) are often prominent. Although total area covered by CT1 is relatively low, the proportionately higher cover of palatable forage it contains makes it important forage habitat for livestock and wildlife.

Representative Sites: FH 11, FH17, FH19
Landscape Position: Upland (P)
Elevation: 1080-1560 m
Slope: 0 %
Aspect: Level

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	**Range**
Grasses			
Poa pratensis	Kentucky bluegrass	2	(0.7-2.6)
Agrostis stolonifera	creeping bentgrass	2	(0-4.3)
Festuca pratensis	meadow fescue	2	(0-6)
Elymus repens	quackgrass	1	(0-1.5)
Phleum pratense	timothy	t	(0-0.6)
Forbs			
Trifolium repens	white clover	4	(0.6-8.0)
Medicago lupulina	black medic	3	(0.2-7.9)
Antennaria microphylla	rosy pussytoes	3	(0-8.6)
Taraxacum officinale	common dandelion	2	(1.0-2.2)
Leucanthemum vulgare	oxeye daisy	2	(0.1-6.9)
Fragaria virginiana	wild strawberry	1	(0-2.1)
Aster ciliolatus	fringed aster	1	(0.5-0.7)
Plantago major	common plantain	1	(0-1.5)
Mosses/Lichens			
Ceratodon spp.		6	(0-9.7)

Production (kg/ha):	Grasses	1790
	Forbs	276
	Shrubs	0
	Total	**2066**

Stocking Rate: 1928 kg/ha ÷ 450 kg/ha x 50% stocking rate = **2.1 AUMs per hectare**

Community Type 2 (N = 2). Douglas-fir/junegrass/rosy pussytoes (Photo 2).

This open tree community type is found in Broken Tree Pasture adjacent to Horsethief Creek. The driest parts of this community at the top of the steep south-facing embankment overlooking Horsethief Creek are characterized by the presence of big sage brush, and sparse grass and forb cover. Slightly moister areas are dominated by stands of cut-over Douglas-fir with a well developed grass understory usually with pinegrass as the leading species. *Cladina* spp. (reindeer lichen), which is usually indicative of very dry site conditions, is common in both transects of this CT. Although both FH15 and FH16 have been classified into the same group it is a somewhat awkward fit. FH15 appears to be succeeding to a sparsely treed grassland with big sagebrush as the characteristic shrub while FH16 appears to be succeeding to an open forest with pinegrass as the usual characteristic understory species. Lack of a good nearby water source may explain why CT2 appears to have been only very lightly grazed.

Representative Sites: FH15, FH16
Landscape Position: Upland (P)
Elevation: 940 m
Slope: 7-8 %
Aspect: 40-212

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	Range
Grasses			
Koeleria macrantha	junegrass	1	(0.7-1.3)
Calamagrostis rubescens	pinegrass	1	(0-2.3)
Elymus spicata	bluebunch wheatgrass	1	(0-1.1)
Festuca campestris	rough fescue	1	(0.4-0.5)
Forbs			
Antennaria microphylla	rosy pussytoes	1	(0.9-1.0)
Comandra umbellata	pale comandra	1	(0-1.1)
Erigeron filifolius	thread-leaved fleabane	1	(0-1.1)
Solidago spathulata	spike-like goldenrod	1	(0.5-1.3)
Astragalus miser	timber milk-vetch	1	(0-1.0)

Shrubs			
Arctostaphylos uva-ursi	kinnikinnick	3	(0-5.0)
Artemesia tridentata	big sagebrush	2	(0-4.4)
Trees			
Pseudotsuga menziesii	Douglas-fir	3	(0-5.6)
Mosses/Lichens			
Cladina spp.		5	(2.0-7.5)
Peltigera spp.		1	(0.3-2.3)

Production (kg/ha):	Grasses	542
	Forbs	60
	Shrubs	169
	Total	**771**

Stocking Rate: 542 kg/ha ÷ 450 kg/ha x 50% stocking rate = **0.6 AUMs per hectare**

Community Type 3 (N = 5). Douglas-fir-lodgepole pine/kinnikinnick/pinegrass (Photo 3).

This community type is characteristic of open to closed forest areas that have moderate site moisture. Both Douglas-fir and lodgepole pine may be present and their cover may vary from low moderate. CT3 is similar to CT4 and CT5 in term of species composition and forage productivity. In general CT3 can be distinguished from CT4 and CT5 by the absence of saskatoon, birch-leaved spiraea, and trembling aspen and by the presence of yellow penstemon. *Pleurozium* spp. is generally present while *Ceratodon* spp. is generally absent or has low cover.

Representative Sites: FH1, FH2, FH3, FH4, FH20
Landscape Position: Upland (P)
Elevation: 980-1220 m
Slope: 0-25 %
Aspect: Variable

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	**Range**
Grasses			
Calamagrostis rubescens	pinegrass	2	(0-2.9)
Stipa nelsonii	Columbia needlegrass	1	(0-2.9)
Dactylis glomerata	orchardgrass	1	(0-3.1)
Forbs			
Fragaria virginiana	wild strawberry	3	(0.5-4.7)
Linnaea borealis	twinflower	1	(0-5.5)
Viola sp.	violet	1	(0-1.9)
Penstemon confertus	yellow penstemon	1	(0.2-1.0)
Aster conspicuus	showy aster	1	(0-2.0)
Taraxacum officinale	common dandelion	1	(0.1-3.5)
Antennaria neglecta	field pussytoes	1	(0-1.3)
Astragalus miser	timber milk-vetch	1	(0-1.1)
Shrubs			
Arctostaphylos uva-ursi	kinnikinnick	4	(0.1-9.7)
Mahonia repens	creeping Oregon-grape	1	(0-5.3)

Symphoricarpos albus	common snowberry	1	(0-3.3)
Rosa acicularis	prickly rose	1	(0.1-0.9)
Trees			
Pseudotsuga menziesii	Douglas-fir	7	(1.9-18.7)
Pinus contorta	lodgepole pine	7	(0-23.3)
Mosses/Lichens			
Pleurozium spp.		7	(0.1-28.2)
Peltigera spp.		2	(0.6-2.0)
Cladina spp.		1	(0.2-3.8)

Production (kg/ha):	Grasses	664
	Forbs	230
	Shrubs	158
	Total	**1052**

Stocking Rate: 664 kg/ha ÷ 450 kg/ha x 50% stocking rate = **0.7 AUMs per hectare**

Community Type 4 (N = 2). Trembling aspen/saskatoon/pinegrass (Photo 4).

This community type is characteristic of open to closed forest on moist sites with trembling aspen dominant or codominant in the tree layer. The understory is shrub-dominated with saskatoon and creeping Oregon-grape as the most prominent species. The leaf-litter layer is generally well developed and moss cover is low. Although this community type occurs only sporadically in Forster-Horsethief range unit, it probably forms significant wildlife habitat because of the relatively high cover of preferred browse species such as saskatoon and aspen. Browse production and availability is generally higher in young aspen stands. If these young stands have nearby cover that is suitable for wildlife, their potential as a source of browse and forage may be high.

Representative Sites: FH14, FH18
Landscape Position: Upland (P)
Elevation: 960-1540 m
Slope: 12-63 %
Aspect: 106-166

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	**Range**
Grasses			
Calamagrostis rubescens	pinegrass	2	(1.0-2.7)
Forbs			
Aster conspicuus	showy aster	2	(0-4.6)
Fragaria virginiana	wild strawberry	1	(0.1-1.3)
Taraxacum officinale	common dandelion	1	(0-0.8)
Shrubs			
Amelanchier alnifolia	saskatoon	3	(0.1-5.9)
Mahonia repens	creeping Oregon-grape	3	(0.1-5.0)
Shepherdia canadensis	soopolallie	2	(1.4-2.2)
Symphoricarpos albus	common snowberry	2	(0-2.9)
Spiraea betulifolia	birch-leaved spiraea	1	(0.2-2.0)
Arctostaphylos uva-ursi	kinnikinnick	1	(0.7)
Symphoricarpos occidentalis	western snowberry	1	(0-2.9)

Trees			
Populus tremuloides	trembling aspen	16	(6.5-23.3)
Pseudotsuga menziesii	Douglas-fir	9	(7.5-9.3)
Mosses/Lichens			
Bracythecium spp.		1	(0-1.8)

Production (kg/ha):	Grasses	293
	Forbs	192
	Shrubs	259
	Total	**744**

Stocking Rate: 293 kg/ha ÷ 450 kg/ha x 50% stocking rate = **0.3 AUMs per hectare**

Community Type 5 (N = 4). Lodgepole pine /snowberry/pinegrass(Photo 5).

This community type is characteristic of recent cutblocks on moist sites. Trees are immature and tree cover is variable with various mixtures of aspen, Douglas-fir, and lodgepole pine present. Forb and low shrub layers are usually well developed. Pinegrass cover is also usually well developed. This is an early successional community in which the moss layer is absent or poorly developed. The leading moss genera is *Ceratodon* which is often characteristic of disturbed sites with exposed mineral soil. *Pleurozium* which is characteristic of mature, undisturbed mixed or conifer dominated communities generally has very low cover or is absent. The prominence of fireweed in the forb layer is also typical of communities that are disturbed or in an early stage of succession. FH5 might also be classified as CT4 because aspen has significant cover. However, FH5 also has relatively higher cover of both Douglas-Fir and lodgepole pine than transects in CT4.

Representative Sites: FH5, FH6, FH7, FH10
Landscape Position: Upland (P)
Elevation: 1080-1580 m
Slope: 0-46 %
Aspect: Primarily level, 0-114

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	Range
Grasses			
Calamagrostis rubescens	pinegrass	4	(2.3-4.9)
Forbs			
Arnica cordifolia	heart-leaved arnica	2	(0.3-3.5)
Cornus canadensis	bunchberrry	2	(0-5.1)
Fragaria virginiana	wild strawberry	2	(0.1-3.9)
Epilobium angustifolium	fireweed	1	(0-2.1)
Aster conspicuus	showy aster	1	(0.5-2.9)
Linnaea borealis	twinflower	1	(0-1.3)
Taraxacum officinale	common dandelion	1	(0-0.9)
Shrubs			
Symphoricarpos albus	common snowberry	2	(0-3.7)

Symphoricarpos occidentalis	western snowberry	2	(0-6.5)
Spiraea betulifolia	birch-leaved spiraea	2	(0.2-3.6)
Rosa acicularis	prickly rose	2	(0-5.2)
Amelanchier alnifolia	saskatoon	1	(0-2.4)
Shepherdia canadensis	soopolallie	1	(0-2.0)
Vaccinium caespitosum	dwarf blueberry	1	(0-2.0)
Arctostaphylos uva-ursi	kinnikinnick	1	(0-3.1)
Trees			
Pinus contorta	lodgepole pine	2	(0.5-4.7)
Populus tremuloides	trembling aspen	2	(0-3.7)
Pseudotsuga menziesii	Douglas-fir	2	(0-5.6)
Mosses/Lichens			
Ceratodon spp.		2	(0-5.5)

Production (kg/ha):	Grasses	810
	Forbs	299
	Shrubs	375
	Total	**1484**

Stocking Rate: 810 kg/ha ÷ 450 kg/ha x 50% stocking rate = **0.9 AUMs per hectare**

Community Type 6 (N = 2). Sedge fen (Photo 6).

This community type is a wetland community found adjacent to Horsethief Creek at the west end of Forster Pasture. Vegetation in this very wet CT is dominated by sedges, buckbean, and scattered clumps of scrub birch, willow, and mountain alder. This CT is probably little used by wildlife except as access to a good water source. There was no sign of grazing in this CT either by livestock or wildlife.

Representative Sites: FH8, FH9
Landscape Position: Bottomland (B)
Elevation: 1080 m
Slope: 0 %
Aspect: Level

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	Range
Grasses			
Carex lanuginosa	woolly sedge	7	(1.5-11.7)
Forbs			
Menyanthes trifoliata	buckbean	13	(0-25)
Potentilla palustris	marsh cinquefoil	2	(0.6-3.5)
Shrubs			
Betula glandulosa	scrub birch	1	(0.7-1.1)
Alnus incana	mountain alder	1	(0-1.9)
Salix candida	hoary willow	1	(0.6-0.9)
Mosses/Lichens			
Drepanocladus spp.		7	(2.7-11.7)
Mnium spp.		3	(2.1-4.7)

Production (kg/ha):	Grasses	2161
	Forbs	759
	Shrubs	56
	Total	**2976**

Stocking Rate: 2161 kg/ha ÷ 450 kg/ha x 50% stocking rate = **2.4 AUMs per hectare**

Community Type 7 (N = 2). Cow-parsnip-fireweed (Photo 7).

This community type is found along avalanche paths that have either stream channels or seepage areas. It is found on the steep upper slopes of Mount Forster in Forster and Baltic pastures. This CT consists of very well developed tall forb and shrub layers on very moist soils. However, this CT shows a high degree of patchiness with dominance shifting between the tall forbs and tall shrub layers. FH12 is dominated by tall forbs while FH13 is dominated by tall shrubs. CT7 is largely unaccessible to livestock but it is important to wildlife because of it's high forage production.

Representative Sites: FH12, FH13
Landscape Position: Upland (P)
Elevation: 1680 m
Slope: 25 %
Aspect: 180

Scientific Name	Common Name	Foliar Cover (%)	
		Mean	**Range**
Shrubs			
Lonicera involucrata	black twinberry	20	(0-35.2)
Salix glauca	grey-leaved willow	5	(0-10.5)
Salix sp.	willow	5	(0-9.3)
Rubus parviflorus	thimbleberry	2	(0.3-3.3)
Sambucus racemosa	black elder	1	(0-2.7)
Forbs			
Heracleum lanatum	cow-parsnip	23	(19.7-26.0)
Urtica dioica	stinging nettle	13	(7.7-16.5)
Epilobium angustifolium	fireweed	11	(7.4-14.8)
Viola canadensis	Canada violet	6	(4.8-7.9)
Thalictrum venulosum	veiny meadowrue	5	(3.3-5.9)
Actaea rubra	baneberry	3	(0-6.7)
Aster conspicuus	showy aster	2	(0-4.0)

Production (kg/ha):	Grasses	15
	Forbs	1476
	Shrubs	2191
	Total	**3682**

Stocking Rate: 1491 kg/ha[1] ÷ 450 kg/ha x 50% stocking rate = **1.7 AUMs per hectare**

[1] Includes 100% of forb production as estimated palatable forage.

3.2 Primary and Secondary Ranges

Five basic range types, including improved range, cutblocks, grasslands, open forests and mature forests, are present in the Forster-Horsethief Range Unit. Mature forest and cutblocks are the two largest range types within the range unit, distantly followed by open forest and grassland.

Herbage and forage production levels and grazing capacities for vegetation community types in primary and secondary ranges at Forster, Baltic, Bextram, and Broken Tree Pastures are summarized in Table 3. Community Type 1 (Kentucky bluegrass/black medic-white clover) was confined largely to seeded landings that were too small to map. However, an estimate of total landing area in the primary and secondary range of each pasture was determined with the aid of airphotos by counting the number of landings and multiplying by 0.25 hectares.

Table 3. Herbage and forage productivity (kg/ha) and carrying capacities for Forster, Baltic, Bextram and Broken Tree Pastures.

Pasture	Range	Community Type	Area (ha)	Grass (kg/ha)	Forbs (kg/ha)	Palatable Forbs[1] (kg/ha)	Forage (kg/ha)	Total Forage (kg/ha)	AUMs[2]
Forster	Primary	CT1	3	1790	276	138	1928	5784	6
		CT5	30	810	299	0	810	24300	27
		CT6	144	2161	759	0	2161	311184	346
		Total	**177**					**341268**	**379**
	Secondary	CT3	122	664	230	0	664	81008	90
		CT4	13	293	192	0	293	3809	4
		CT7	77	15	1476	1476[3]	1491	114807	128
		Total	**212**					**199624**	**222**
Baltic	Primary	CT1	4	1790	276	138	1928	7712	9
		CT3	38	664	230	0	664	25532	28
		CT4	27	293	192	0	293	7911	9
		CT5	161	810	299	0	810	130410	145
		Total	**230**					**171565**	**191**
	Secondary	CT7	14	15	1476	1476	1491	20874	23
		Total	**14**					**20874**	**23**

Pasture	Range	Community Type	Area (ha)	Grass (kg/ha)	Forbs (kg/ha)	Palatable Forbs[1] (kg/ha)	Forage (kg/ha)	Total Forage (kg/ha)	AUMs[2]
Bextram	Primary	CT1	4	1790	276	138	1928	7712	9
		CT3	131	664	230	0	664	86984	97
		CT5	107	810	299	0	810	86670	96
		Total	**242**					**181366**	**202**
Broken	Primary	CT1	1	1790	276	138	1928	1928	2
Tree		CT2	58	542	60	0	542	30436	35
		Total	**59**					**33364**	**37**
	Secondary	CT2	185	542	60	0	542	100270	111
		Total	**185**					**100270**	**111**

1 Palatable forbs are black medic, white clover, alfalfa and yellow clover.
2 AUM = (Total forage x 0.5) ÷ 50 kg.
3 100% of Forb production included in this estimate.

Primary range in Forster, Baltic, and Bextram Pastures is composed primarily of cutblocks and their associated access roads and landings. Primary range in Broken Tree Pasture consists of open forest and grasslands. The widespread nature of primary range reflects, in part, the fact that water sources for livestock are well distributed throughout most of the range. Secondary range is limited to open forest and avalanche areas in Forster Pasture that are on steep terrain with little access, and large portion of Broken Tree Pasture where access to water is poor.

Eventually as vegetation on cutblocks succeeds to a mature forest community, available forage will gradually decrease and these logged areas will revert to secondary or unutilized range. Some cutblocks that were harvested 15 years ago and subsequently replanted continue to have good forage production. Because of the open tree cover on these cutblocks, livestock movement is largely unimpeded. Other similar aged cutblocks are heavily overgrown and are considered to be unutilized range.

3.3 Herbage and Forage Productivity

Forage production (kg/ha) for each community type (CT) is summarized in Table 4. Community types that have forage production greater than 1000 kg/ha include Kentucky bluegrass/black medic-white clover, sedge fen, and cowparsnip-fireweed. The Kentucky bluegrass/black medic-white clover CT is found in all pastures along logging access roads and landings, and re-seeded meadows, and although it

forms a relatively small proportion of each pasture, it has high forage value for livestock. Sedge fen is found in Forster Pasture along the floodplain of Horsethief Creek. Although sedge fen has very high forage production, it is seldom grazed by livestock except opportunistically by livestock seeking access to water. The cowparsnip-fireweed community type is characteristic of avalanche areas that have small stream channels or experience seepage. This CT is found on steep mountain slopes in Forster and Baltic Pastures. Although largely unaccessible to livestock, this CT is valuable for wildlife because of its high forb forage production.

Table 4. Forage production for community types in the Forster-Horsethief Range Unit.

Community Type	Forage Production (kg/ha)
1. Kentucky bluegrass/black medic-white clover	1928
2. Douglas-fir/Junegrass/rosy pussytoes	542
3. Douglas-fir-lodgepole pine/kinnikinnick/pinegrass	664
4. Trembling aspen/saskatoon/pinegrass	293
5. Lodgepole pine/snowberry/pinegrass	810
6. Sedge fen	2161
7. Cow parsnip-fireweed	1491

Community types that have forage production between 500-1000 kg/ha include Douglas-fir/junegrass/rosy pussytoes, Douglas-fir-lodgepole pine/kinnikinnick/pinegrass and lodgepole pine/snowberry/pinegrass. The Douglas-fir/junegrass/rosy pussytoes occurs only on southerly exposures in Broken Tree Pasture. Most of the available forage in this CT consists of native grasses, such as junegrass, pinegrass, bluebunch wheatgrass, and rough fescue. The Douglas-fir-lodgepole pine/kinnikinnick/pinegrass CT is characteristic of open and closed forest communities in which native grasses, predominantly pinegrass, comprise most of the forage. Preferred browse species such as aspen and saskatoon are largely absent in this CT. This is the most widespread rangeland CT and is characteristic of logged areas in early to intermediate stages of succession. Most of the available forage in this CT is composed of native grasses, predominantly pinegrass. Because the majority of sites sampled were less than 20 years post-harvest, the effect of canopy closure on understory production is probably none to low. As succession proceeds and canopy closure increases, a decrease in forage production is anticipated in this CT.

The trembling aspen/kinnikinnick/pinegrass community type had forage production of less than 500 kg/ha. This CT occurs only sporadically in the range unit. Pine grass forms most of the available forage in this CT. However, the relatively high proportion of preferred browse species, such as saskatoon and aspen, present in this CT make it important for wildlife.

An important consideration in any range inventory is the effect that variations in annual precipitation have on herbage production, particularly with respect to rainfall. Researchers in Canada and the United States have reported that vegetation is sensitive to variations in rainfall during the growing season (Smoliak 1956, Bennett et al. 1987, Rosiere 1987). Graminoids, and to a lesser extent, forbs respond to increased rainfall between May and July by exhibiting increased growth rates. In mountainous areas, however, the effects of variations in annual rainfall is less clear, particularly as it relates to amount of snow melt, landscape position and presence of seepage areas. The Forster-Horsethief Range Unit received above-normal rainfall in May, June and July 1996 and below average rainfall amounts in August 1996. During June and July 1996, rainfall was almost 60 and 15% higher, respectively, than the 30-year normals recorded at Kootenay West Gate meteorological station (Figure 2). However, rainfall in August set a new record low with 89% less rainfall than the 30-year normal. As a result of higher June and July rainfall, herbage production levels were likely somewhat higher than normal during the present study, which raises the question about the extent to which herbage production measurements obtained in 1996 reflect the average levels that can be expected in the region over the long-term. Because of this, annual monitoring of the exclosure cages should be undertaken to accurately determine average production levels for use in establishing grazing capacities in the Forster-Horsethief Range Unit.

3.4 Range Management Considerations

3.4.1 Limiting Landscape Features

Domestic livestock use of the Forster-Horsethief Range Unit is strongly influenced by topography, vegetation, and available stock water. Access to stock water for domestic livestock is generally good in Forster, Baltic and Bextram Pastures. Only in Broken Tree Pasture does grazing appear to be constrained by lack of access to water. Steep topography and dense forest along the slopes of Starbird Ridge and Mount Forster are the main impediments to livestock grazing in Forster and Baltic Pastures. Closed forests generally provide little forage and are usually not used as range habitat. Forest harvesting activities at the west end of Forster Pasture, the east side of Baltic Pasture and throughout most of Bextram Pasture has resulted in an expanded network of roads and trails that provide good rangeland access for livestock. Steep terrain does not appear to hinder livestock movement as long as there is access by road or trail. Where these roads extend into higher elevation areas, livestock use of clearcuts for grazing is evident.

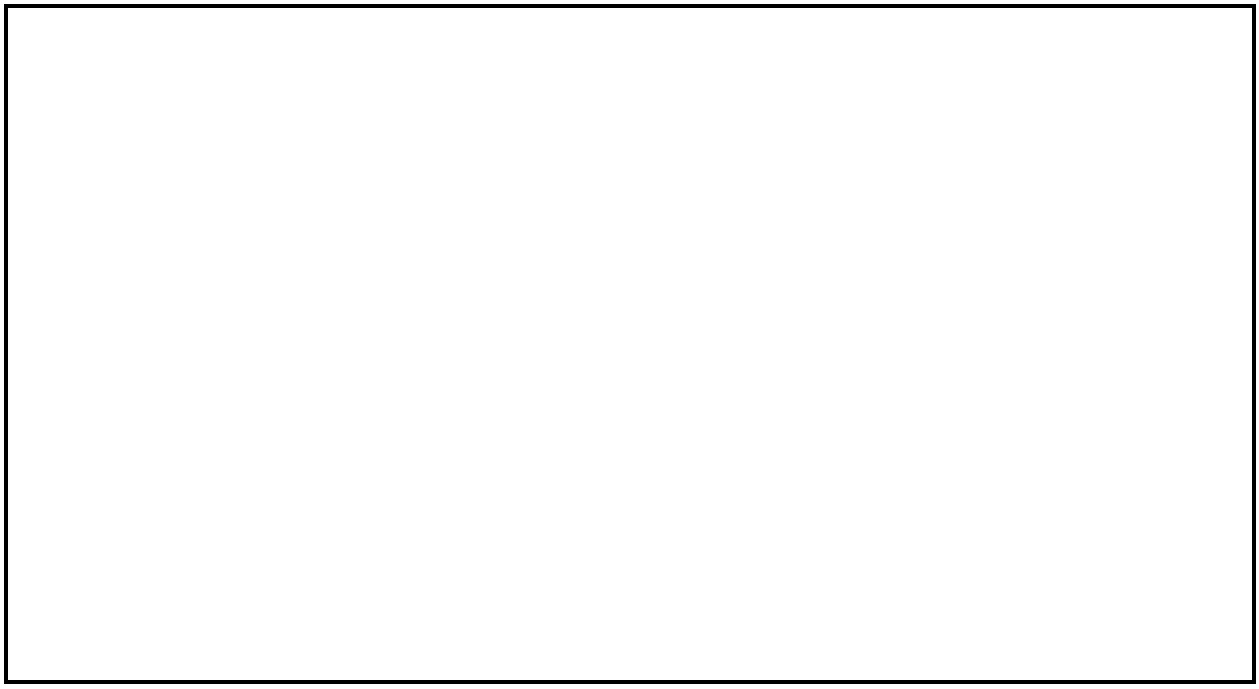

Figure 2. Monthly comparisons of 1996 rainfall with 30 year long-term normals, Kootenay West Gate meteorological station located in Kootenay National Park.

3.4.2 Patterns of Grazing Use

Presently, a herd of approximately 166 cattle have been grazing the Forster-Horsethief Range Unit from early May until mid-October. Grazing rotation usually commences in Bextram and proceeds to Baltic, Forster, and eventually Broken Tree Pastures. Only approximately 40 cattle are grazed on Broken Tree Pasture. The remainder of the herd is pastured on nearby private land.

Based on AUMs calculated for 1996 (Table 3) it would appear that livestock grazing on all pastures is below the current grazing capacity. Recent logging activities in Foster, Baltic, and Bextram Pastures probably ensure that there is sufficient rangeland for the current herd in the forseeable future. As forest cover gradually becomes re-established on harvested sites, forage production will gradually decline and access for livestock will become more difficult. Thus, presently preferred areas will become less preferred and overall primary range will decrease. Assuming no new forest harvesting, carrying capacity on these pastures is expected to change over the next 10-30 years as forest succession proceeds on existing harvested areas.

Since current grazing levels are much lower than calculated carrying capacity, it is predicted that few if any areas would show signs of heavy grazing pressure. In general, this appears to be true except for some seeded landings and roadside edges in Baltic and Bextram Pastures that are heavily grazed.

3.4.3 Poisonous Plants or Noxious Weeds

Timber milk-vetch was the only poisonous plant noted during the study. Although widespread, timber milk-vetch cover was generally very low. Potentially important noxious weeds including diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), and leafy spurge, (*Euphorbia esula*), were not observed in the range unit.

3.4.4 Ungrazed Sites For Potential Monitoring

All primary range within the Forster-Horsethief Range Unit appears to have been grazed by livestock to some extent and no native rangeland communities could be considered pristine. However, grassland areas in Broken Tree Pasture which contain big sagebrush may provide a potentially useful monitoring site.

3.4.5 Damaged Trails or Watering Areas

Trails throughout the Forster-Horsethief Range Unit appear to be in relatively good condition. No trail damage attributable to livestock was noted during the study. Most watering areas showed only minor evidence of livestock use. In addition, no serious erosion was noted along observed trails or adjacent watering areas.

3.4.6 Access Problems

Access for domestic livestock, throughout Forster-Horsethief Range Unit, is generally good. All pastures are road accessible and numerous logging roads and trails provide good access to primary range within each pasture.

3.4.7 Wildlife Use

Based on observations of fecal groups during the range inventory, ungulate activity appears to be concentrated in grassland and open woodland areas, and to a much lesser extent in harvested cutblocks. Most of grassland areas are located in Broken Tree Pasture. Small areas of grassland and adjacent open woodland provide critical winter range for elk and white-tailed deer, and important range for mule deer. This mix of exposed, open grass dominated areas and open forest with significant shrub cover provides ideal habitat for elk during the winter. Elk and/or deer pellets were only occasionally noted on grassland areas sampled. Open treed areas, especially aspen dominated sites, are also important as wildlife habitat because important browse species such as saskatoon and aspen often have high cover on these sites. Good forage and browse was noted in the other pastures especially on recent post-harvest areas. However, pellet groups and evidence of browsing were seen much less frequently on these sites.

The degree of forage competition between elk and livestock on primary range was not determined in the present study. Maintaining levels of cattle grazing on primary range and leaving forage on secondary range for elk will reduce forage competition, but is unlikely to eliminate it completely. Moose and deer do not usually compete with livestock because they tend to use different types of forage and habitat. Management practices such as placing salt away from water should be continued to disperse cattle grazing pressure. Limiting stocking rates to reflect the grazing capacity provided by primary range will also ensure moderate levels of livestock use and will minimize forage competition between cattle and native ungulates.

4.0 RECOMMENDATIONS

Based on the range inventory conducted in 1996, a number of recommendations regarding range management in Forster-Horsethief Range Unit can be made:

1. Controlled burns may be required in Broken Tree Pasture to control tree encroachment on grassland community types.

2. Because of above-normal rainfall experienced in 1996, levels of herbage production beneath the exclosure cages should be monitored for at least an additional three or four years. Appropriate adjustments to grazing capacities within the primary ranges of Forster, Baltic, Bextram, and Broken Tree Pastures can then be made.

3. Presently, salting is the preferred management technique used to obtain a better distribution of livestock on these ranges. Salt locations are moved each year to prevent localized overuse. These salting practices should be continued to effectively use and maintain current levels of rangeland forage.

4. The present number of AUMs in all pastures of the Forster-Horsethief Unit appear to be within or near their carrying capacity. Overall range conditions are good indicating that this level of use is sustainable.

5. An on-going program to monitor the range productivity and carrying capacity should be maintained with re-assessment conducted on a regular basis. Production and utilization plots should be clipped and assessed every two years.

5.0 LITERATURE CITED

Alberta Forest Service. 1990. Range Survey Manual. Alberta Forest Service, Forest Land Use Section, Edmonton, Alberta.

Basarab, J. 1987. Understanding the Animal Unit Months (AUMs). Alberta Agriculture Agdex 420/16-1/3 pp.

Bennett, D.L., G.D. Lemme and P.D. Evenson. 1987. Understory herbage production of major soils within the Black Hills of south Dakota. J. Range. Manage. 40(2):166-170.

Irving, R. and L. Brusnyk. 1994. An assessment of grazing capacity in Findlay and Whitetail Pastures. Prep. by D.A. Westworth & Associates Ltd. for the B.C. Ministry of Forests, Invermere, B.C. 72 pp.

Maduram, G.H. 1979. Range Management. Unpubl. Rept. Alberta Energy and Natural Resources, Edmonton, Alberta. 106 pp.

Meidinger, D. and J. Pojar (eds.). 1991. Ecosystems of British Columbia. B.C. Ministry of Forests, Victoria, B.C. 330 pp.

MOF. 1989. Range Program Revies: Final report of the Review Task Force. B.C. Ministry of Forests, Victoria, B.C. 61 pp.

Rosiere, R.E. 1987. An evaluation of grazing intensity influences on California annual range. J. Range. Manage. 40(2):160-165.

Smoliak, S. 1956. Influence of climatic conditions of forage production of shortgrass rangeland. J. Range. Manage. 9:89-91.

APPENDIX 1. Species list of plants recorded in the Forster-Horsethief Range Unit, July, 1996.

Scientific Name	Common Name	Acronym
Abies lasiocarpa	subalpine fir	abielas
Acer glabrum	Douglas maple	acergla
Achillea millefolium	yarrow	achimil
Actaea rubra	baneberry	actarub
Agoseris glauca	pale agoseris	agosgla
Agrostis scabra	hair or winter bentgrass	agrosca
Agrostis stolonifera	creeping bentgrass	agrossto
Allium cernuum	nodding onion	allicer
Alnus incana	mountain alder	alnuinc
Amelanchier alnifolia	saskatoon	amelaln
Anemone multifida	cut-leaved anemone	anemmul
Antennaria sp.	pussytoes	ante sp
Antennaria microphylla	rosy pussytoes	antemic
Antennaria neglecta	field pussytoes	anteneg
Apocynum androsaemifolium	spreading dogbane	apocand
Arabis holbellii	Holboell's rockcress	arabhol
Arctostaphylos uva-ursi	kinnikinnick	arctuva
Arnica cordifolia	heart-leaved arnica	arnicor
Artemesia campestris	northern wormwood	artecam
Artemisia frigida	pasture sage	artefri
Artemisia tridentata	big sagebrush	artetri
Aster ciliolatus	fringed aster	astecil
Aster conspicuus	showy aster	astecon
Astragalus miser	timber milk-vetch	astrmis
Betula glandulosa	scrub birch	betugla
Betula papyrifera	paper birch	betupap
Bromus inermis	smooth brome	bromine
Calamagrostis canadensis	bluejoint	calacan
Calamagrostis rubescens	pinegrass	calarub
Calamagrostis stricta	slimstem reedgrass	calastr
Campanula rotundifolia	common harebell	camprot
Carex sp.	sedge	care sp

Carex aquatilis	water sedge	careaqu
Carex concinnoides	northwestern sedge	carecon
Carex diandra	lesser panicled sedge	caredia
Carex lanuginosa	woolly sedge	carelan
Carex utriculata	beaked sedge	careutr
Castilleja lutescens	yellowish paintbrush	castlut
Castilleja miniata	common red paintbrush	castmin
Cerastium arvense	field chickweed	ceraarv
Chimaphila umbellata	Prince's pine	chimumb
Chrysothamnus nauseosus	common rabbit-brush	chrynau
Cirsium arvense	Canada thistle	cirsarv
Comandra umbellata	pale comandra	comaumb
Cornus canadensis	bunchberry	corncan
Cornus stolonifera	red-osier dogwood	cornsto
Crepis atrabarba	slender hawksbeard	crepatr
Dactylis glomerata	orchardgrass	dactglo
Delphinium glaucum	tall larkspur	delpgla
Disporum trachycarpum	rough-fruited fairybells	disptra
Elymus glaucus	blue wildrye	elymgla
Elymus hispidus	intermediate wheatgrass	elymhis
Elymus repens	quackgrass	elymrep
Elymus smithii	western wheatgrass	elymsmi
Elymus spicata	bluebunch wheatgrass	elymspi
Elymus trachycaulus	slender wheatgrass	elymtra
Epilobium sp.		epil sp
Epilobium angustifolium	fireweed	epilang
Equisetum arvense	common horsetail	equiarv
Equisetum fluviatile	swamp horsetail	equiflu
Erigeron caespitosus	tufted fleabane	erigcae
Erigeron filifolius	thread-leaved fleabane	erigfil
Festuca sp.	fescue	fest sp
Festuca campestris	rough fescue	festcam
Festuca pratensis	meadow fescue	festpra
Fragaria virginiana	wild strawberry	fragvir
Gaillardia aristata	brown-eyed Susan	gailari
Galium boreale	northern bedstraw	galibor

Galium labradoricum	northern bog bedstraw	galilab
Galium triflorum	sweet-scented bedstraw	galitri
Gentianella amarella	northern gentian	gentama
Hedysarum sulphurescens	yellow hedysarum	hedysul
Heracleum lanatum	cow-parsnip	heralan
Heuchera cylindrica	round-leaved alumroot	heuccyl
Hieracium albiflorum	white-flowered hawkweed	hieralb
Hieracium umbellatum	narrow-leaved hawkweed	hierumb
Juncus bufonius	toad rush	juncbuf
Juncus tenuis	Willd.	juncten
Juniperus communis	common juniper	junicom
Koeleria macrantha	junegrass	koelmac
Leucanthemum vulgare	oxeye daisy	leucvul
Linnaea borealis	twinflower	linnbor
Linum perenne	western blue flax	linuper
Lithospermum ruderale	lemonweed	lithrud
Lonicera involucrata	black twinberry	loniinv
Lycopodium annotinum	stiff clubmoss	lycoann
Mahonia repens	creeping Oregon-grape	mahorep
Medicago lupulina	black medic	medilup
Melampyrum lineare	cow-wheat	melalin
Menyanthes trifoliata	buckbean	menytri
Osmorhiza sp.	sweet-cicely	osmo sp
Oxytropis sericea	silky locoweed	oxytser
Penstemon confertus	yellow penstemon	penscon
Phleum pratense	timothy	phlepra
Picea engelmannii	Engelmann spruce	piceeng
Picea glauca	white spruce	picegla
Pinus contorta	lodgepole pine	pinucon
Plantago major	common plantain	planmaj
Platanthera hyperborea	green-flowered bog orchid	plathyp
Poa pratensis	Kentucky bluegrass	poa pra
Populus tremuloides	trembling aspen	poputre
Potentilla sp.	cinquefoil	pote sp
Potentilla glandulosa	sticky cinquefoil	potegla
Potentilla palustris	marsh cinquefoil	potepal

Pseudotsuga menziesii	Douglas-fir	pseumen
Ribes sp.	gooseberry	ribe sp
Rosa acicularis	prickly rose	rosaaci
Rubus idaeus	red raspberry	rubuida
Rubus parviflorus	thimbleberry	rubupar
Salix sp.	willow	sali sp
Salix candida	hoary willow	salican
Salix glauca	grey-leaved willow	saligla
Salix maccalliana	McCalla's willow	salimac
Sambucus racemosa	black elder	sambrac
Scirpus validus	soft-stemmed bulrush	scirval
Senecio streptanthifolius	Rocky Mountain butterweed	senestr
Shepherdia canadensis	soopolallie	shepcan
Smilacina racemosa	false Solomon's seal	smilrac
Smilacina stellata	star-flowered false Solomon's-seal	smilste
Solidago spathulata	spike-like goldenrod	solispa
Spiraea betulifolia	birch-leaved spiraea	spirbet
Stellaria longifolia	long-leaved	starwort
Stipa nelsonii	Columbia needlegrass	stipnel
Stipa richardsonii	spreading needlegrass	stipric
Symphoricarpos albus	common snowberry	sympalb
Symphoricarpos occidentalis	western snowberry	sympocc
Taraxacum officinale	common dandelion	taraoff
Thalictrum venulosum	veiny meadowrue	thalven
Trifolium pratense	red clover	trifpra
Trifolium repens	white clover	trifrep
Typha latifolia	common cattail	typhlat
Urtica dioica	stinging nettle	urtidio
Utricularia vulgaris	greater bladderwort	utrivul
Vaccinium caespitosum	dwarf blueberry	vacccae
Viola sp.	violet	viol sp
Viola canadensis	Canada violet	violcan

Mosses and Lichens

Brachythecium spp.	bracspp
Ceratodon spp.	ceraspp

Cladonia spp.	cladspp
Dicranum spp.	dicrspp
Drepanocladus spp.	drepspp
Mnium spp.	mniuspp
Peltigera spp.	peltspp
Pleurozium spp.	pleuspp
Polytrichum spp.	polyspp