ELK POPULATION AND HABITAT ASSESSMENT IN NELWAY AREA OF WEST KOOTENAY REGION

DONE AS PARTIAL REQUIREMENT FOR
GRADUATION FROM WILDLAND RECREATION TECHNOLOGY
PROGRAM - SELKIRK COLLEGE - 1982

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SUMMARY:

The elk population in the Nelway area was intensively studied during the winter of 1981-82. The herd was found to be approximately 45 to 50 animals in number through the use of track counts on established transects, which were run monthly after fresh snowfalls. In supplement to this population estimation, aerial counts were done from fixed wing and rotor aircraft three times during the winter. The results backed up the track count population estimations. The vegetation being utilized by the elk and deer was recorded from ground investigations. It was found that Red Stem Ceanothus (Ceanothus sanguineus) was the major elk preference and somewhat surprisingly False Box (Paxistima myrsinites) was the major deer preference. Speculations of low direct competition between elk and deer were made from this data. Elk movements with regard to snow depth were studied intensively, and it was observed that snow depth 1 meter and greater brought elk movements to a near standstill. These elk, however, were not travelling very great distances even when snow depths were low. Elk body condition was observed in all parts of the study area throughout the winter. Elk in the Wallack-Atkinson Creek area seemed to suffer more from nutritional stress near the end of the winter than the elk from other parts of the study area. No mortality, however, was observed in the elk population. Deer mortality in the study area and adjacent winter ranges was quite high with the severe winter. This was observed to be at least partially caused by energy inefficient feeding habits.

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INTRODUCTION:

This report is based on a field study which was done on a particular herd of elk in the Nelway, British Columbia area by myself in the winter of 1981 and 82. The report mainly deals with estimations of the herd population and movements, however, some time is given to the question of how much competitive pressure is being put on local deer populations by these elk. The study area is presently managed with whitetailed deer being the priority species and primary concern of the British Columbia Fish and Wildlife Branch. It is not desired that elk populations increase to a point where they cause damage to deer herd populations. At the same time it is desired that a moderate number of elk remain in the area to maintain the natural diversity of species and health of the ecosystem. In the report I have introduced my recommendations for the management of this elk population only after careful study of the present situation and factors affecting it.

CONCLUSION:

From the data collected and observations made in the field, combined with research, I have generated some overall recommendations which I feel are the most appropriate for this particular situation after giving consideration to the management objectives of the Fish and Wildlife Branch. These recommendations are as follows:

1. To increase the number of limited entry hunting permits on elk in Management Unit 4-8 to between 15 and 25 in order to obtain some harvest of the population. I feel 40 to 60 percent of these permits should be cow/calf permits with the remainder being bull permits.

2. To obtain and maintain an elk population in the Pend d'oreille Valley and the study area that is 10 to 25 percent lower than the present population. This will avoid range damage and theoretically allow an increase of deer populations.

3. To coordinate any logging operations in the area with wildlife interests if possible. This would include good slash clean-up and small, maximum clear cut size standards such as 150 meters.

4. To coordinate domestic range animal use, of Wallack-Atkinson area, with wild ungulate use of the same area by restricting domestic stock use of this crown land for 1 to 2 months just prior to the onset of winter and during winter itself. For example, from September 1st to March 30th.

5. To restrict snowmobile use from areas of great importance to wintering ungulates such as those delineated on Map ( ) in order to avoid disturbance and mortality of wintering ungulates.

6. To enhance the habitat in the study area for utilization by wild ungulates through use of prescribed burns and small clear and selection logging cuts on south facing slopes. This would promote the growth of primary browse species such as (Ceanothus sanguineus) in areas where it can be best used by ungulates in winter.

It is my strong personal opinion that the elk population should be reduced to the recommended level within the near future, as I have observed some mortality of ceanothus plants from overbrowsing already. The obvious consequences of not obtaining some harvest of the elk are starvation, disease, and mortality for deer, as well as elk, in future winters. The quality and integrety of this winter range can be maintained or enhanced through implementation of the preceeding recommendations.

THE STUDY AREA

LOCATION AND SIZE:

The study area is located in the Kootenay region of British Columbia which encompasses the southeastern portion of the province. The area is found in the southernmost portion of the Fish and Wildlife Management Unit 4-8 which lies to the east of Trail, the south of Nelson, the west of the Salmo-Creston highway summit and to the north of the United States-Canada border. More specifically, the study area lies within 3 kilometers of highway 6 between the Nelway border crossing and the junction with highway 3. This area is found on the 82F/3 map of the National Topographic System. The area is approximately 5000 ha or 50 square kilometers in size.

DRAINAGE:

The study area is bisected by the Salmo River which flows from north to south through most of the study area then turns to the west and eventually empties into the Pend d'oreille River. The South Salmo River crosses the north end of the study area as it flows west and empties into the Salmo River. Located on a small plateau to the east of highway 6 is found Rosebud Lake from which an outflow creek flows west and into the Salmo River. One kilometer to the west of Nelway lies Lommond Lake which has a small outflow stream that flows west to the Pend d'oreille River. Various other creeks and streams drain the study area, all of them eventually flowing into the Salmo or Pend d'oreille Rivers.

ILLUSTRATION 1 - WEST KOOTENAY REGION, LOCATION AS A FUNCTION OF THE PROVINCE OF BRITISH COLUMBIA

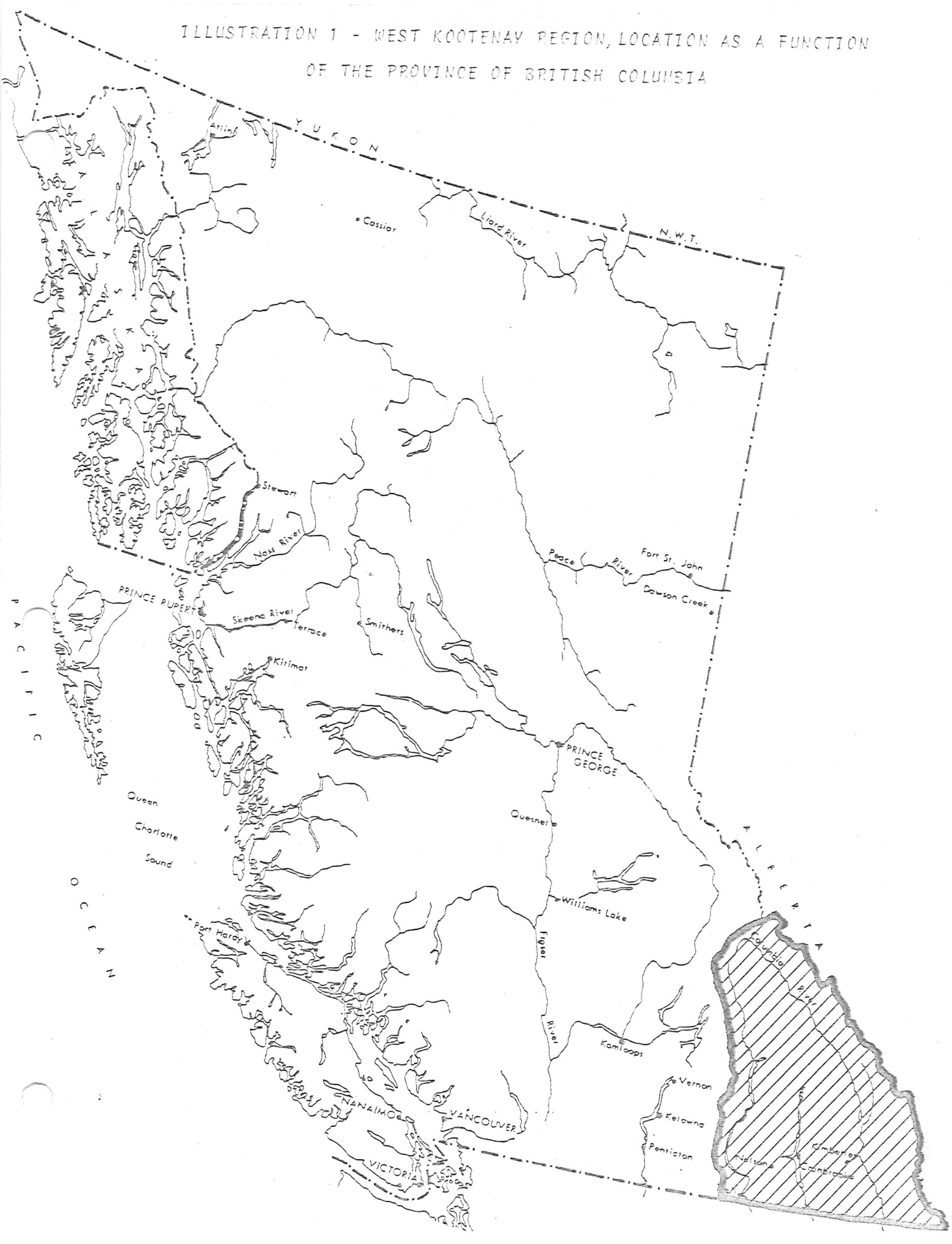
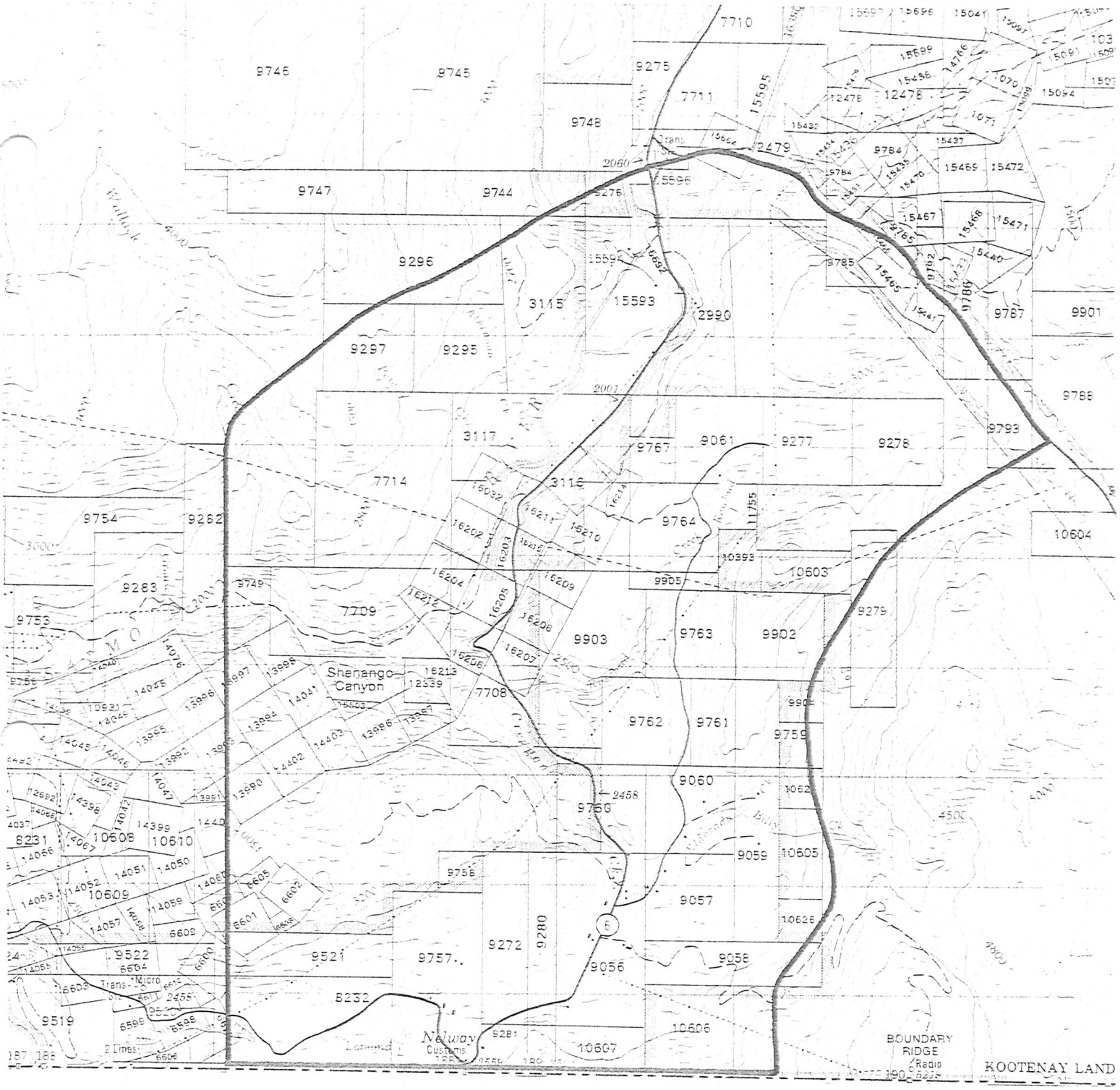


ILLUSTRATION 2 - STUDY AREA LOCATION AS A FUNCTION OF THE WEST KOOTENAY REGION

1.	STUDY AREA	5.	NELSON	9.	FERNIE
2	SALMO	6	CRESTON	10	NAKUSP
3	TRAIL	7	CRANBROOK	11	REVELSTOKE
4.	CASTLEGAR	8.	KIMBERLEY	12.	INVERMERE

ILLUSTRATION 3



THE STUDY AREA

LEGEND

STUDY AREA BOUNDARIES

Scale 1:50 000 Échelle

Miles 1 0 1 2 3 Milles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

TOPOGRAPHY:

The Salmo river flows through the area at about 2000 feet above sea level. The valley walls rise from the river quite steeply averaging between 30 and 40 percent incline. The Rosebud Plateau area is at about 2600 feet elevation and from there steep hillsides rise on both sides up to 3400 feet on the north side and 4500 feet on the south. Lommond Lake lies at 2650 feet and is surrounded by a fairly large, relatively flat area with some hillsides that rise slowly to 3200 feet.

HUMAN DEVELOPMENT:

The study area presently remains in a very rural state with only spotted inhabitation mostly in the Nelway area. Some ranching and farming is currently taking place in the Lommond Lake and Salmo River flat areas and this may be having some impact on wild ungulate species populations. Two power transmission lines run east and west across the study area and have manipulated the habitat somewhat during their construction. In addition, a natural gas transmission line parallels the Salmo River through the study area. Some logging has occured near the Salmo River where it turns to the west. Overall, the area is in a fairly natural state and has good potential for ungulate production.

VEGETATION ANALYSIS:

On the steep valley walls along the Salmo River and on the Rosebud Lake plateau area, mixed stands of the following tree species occur:

Lodgepole Pine	(Pinus contorta)
Western Larch	(Larix occidentalis)
Douglass Fir	(Pseudotsuga menziesii)
Engelman Spruce	(Picea engelmannii)
White Pine	(Pinus monticola)
Western Red Cedar	(Thuja plicata)
Western Hemlock	(Tsuga heterophulla)
Trembling Aspen	(Populus tremuloides)
Black Cottonwood	(Populus tricocarpa)
Sitka Mnt Alder	(Alnus viridi sinuata)
Red Alder	(Alnus rubra)
Paper Birch	(Betula papyrifera)

The understory shrub species in these areas are as follows:

Buffalo Berry	(Sheperdia canadensis)
Saskatoon Berry	(Amelanchier alnifolia)
Thimbleberry	(Rubus parviflorus)
Red osier dogwood	(Cornus siricea)
Waxberry	(Symphoricarpos albus)
Red stem ceanothus	(Ceanothus sanguineus)
Ocean spray	(Holodiscus discolor)
Wild Rose spp.	(Rosa spp.)
Black hawthorn	(Crataegus douglasii)
Douglass maple	(Acer glabrum)
False Box	(Paxistima myrsinites)
Kinnickinnick	(Arctostaphylos uva ursi)
Bracken Fern	(Pteridium aquilinum)

Various bunch and blue grasses have now begun to grow especially on the power lines, flat cleared farming areas and on burned off south facing slopes in the area.

Slightly to the north of Rosebud Lake there is a small hill that was burnt off in a forest fire and is now inhabited by very heavy concentrations of red stem ceanothus (Ceanothus sanguineus). This hill has a direct southerly exposure and is

the first point in the study area to be barren of snow in the spring. For the purpose of this report I will name this hill, Rosebud Hill.

METHODS FOR POPULATION ANALYSIS

Two actual methods were used to estimate the elk population of the study area. First, sightings were made from fixed wing and rotor aircraft, and on the ground. Of course, it is not expected that all the animals present were seen on any one flight, which necessitates the need for the second method, track counts. Established transect lines were stratigically positioned in areas that are used as transportation routes, between areas that meet different elk requirements, by a majority of the animals in the area. The track counts were done immediately after a fresh snowfall each month to prevent the counting of the same animal twice. From a combination of the compiled data, accurate estimates were made of the population of elk in the study area.

From the actual sightings of the elk, I have made estimates of the cow-bull ratio. However, there may be some inaccuracies if some of the bulls segregate themselves from the rest of the herd and winter outside the study area.

POPULATION ANALYSIS:

ELK POPULATION OF STUDY AREA

The actual exact population of elk within the study area varies greatly with the season of the year. The greatest population occurs during the winter and spring seasons between the months of December and May. The following data refers to the population of elk in the study area at this time in the 1981-82 season.

ELK SIGHTINGS ON FOOT OR SKIS

1. December 5, 1981 - sighted 3 cows on Rosebud Hill
2. December 12, 1981 - sighted 5 cows on Rosebud Hill
3. January 20,1982 - sighted 2 cows on Rosebud Hill
4. January 1982 - John Gwilliam sighted 9 cows at Lammond Lake

ELK SIGHTINGS FROM FIXED WIND AIRCRAFT

1. January 30, 1982 - sighted 9 cows and two bulls on bench above Lommond Lake (Total 11)

   - sighted 7 cows on west side of Rosebud Hill (Total 7)

ELK SIGHTINGS FROM HELICOPTER BY FISH AND WILDLIFE STAFF AND MYSELF

1. January 11, 1982 - sighted 22 unclassified elk and 1 spike bull on Rosebud Hill (Total 23)

   - sighted 1-6point bull, 2-5point bulls, 1-3point bull, 1-spike bull and 6 unclassified elk in Wallack-Atkinson Creek area (Total 11)

2. February 2, 1982 - sighted 1 spike bull and 1 young cow on east side of Wallack Creek at about 2500' ASL (Total 2)

   - sighted 6 unclassified elk bull in Wallack-Atkinson Creek area (Total 7)

TRACK COUNTS ON ESTABLISHED SKI TRANSECTS LOCATED IN ROSEBUD HILL AREA (TRANSECTS ARE SHOWN ON MAP)

1. Transects 1R, 2R, 3R December count, after fresh snowfall - 24 sets of tracks
2. Transects 1R. 2R, 3R, January count, after fresh snowfall - 18 sets of tracks
3. Transects 1R, 2R, 3R, February count, after fresh snowfall - 20 sets of tracks
4. Transects 1R, 2R, 3R, March count, after fresh snowfall - 18 sets of tracks

TRACK COUNTS ON ESTABLISHED SKI TRANSECTS LOCATED ON THE EAST SIDE OF THE STUDY AREA (TRANSECTS ARE SHOWN ON MAP)

1. Transect 1W January count after fresh snowfall - 11 sets of tracks
2. Transect 1W February count after fresh snowfall - 10 sets of tracks
3. Transect 2W January count after fresh snowfall - 15 sets of tracks
4. Transect 2W February count after fresh snowfall - 17 sets of tracks

POPULATION DATA COMPILATION

ESTIMATE FROM SIGHTINGS AND TRACK COUNTS:

Over the winter of 1981-82 I made a very important observation that pertains directly to the population estimates. This observation was that all the groups of elk remained in fairly confined areas and tended not to wander into areas occupied by other elk groups for extended periods of time. This may be because the very deep snow inhibited

them from extended wandering, or it may just be that the elk naturally spaced themselves to prevent overbrowsing of areas. With this observation in mind, it is safe to assume that the addition of the populations in each group will give an accurate elk population for the entire study area. I have identified five groups of elk in the study area, three on the east side of the Salmo River and two on the west side. The three Rosebud groups of elk located around Rosebud Hill are represented by the transects 1R, 2R, 3R. The two west side elk groups are represented by the transects 1W and 2W. The data is compiled on figure (1). My data from the three aerial surveys backs up my track count findings very well and, therefore, I consider them to be correct. I feel that I can say that there were between 45 and 50 elk in the study area during the winter of 1981-82 at a 95% confidence level.

ESTIMATION OF BULL-COW RATIO:

For this estimation I have data that can be misleading. Within the study area during the winter, the bull-cow ratio was about 16 bulls to every 100 cows. However, I have some evidence that a bachelor herd of elk were living on the north side of the south fork of the Salmo River adjacent to the study area during the winter. These animals, if they were actually a part of the study area herd, would even the ratio considerably. In addition, the larger bulls tended to stay at higher elevations than the remainder of the herd, therefore, several of the herd bulls may have been overlooked as they were outside the study area bounderies and not intensively studied by myself.

TRACK COUNT TRANSECT NUMBER	1R	2R	3R	1W	2W	
DECEMBER COUNT	10	7	7	—	—	
JANUARY COUNT	7	7	4	11	15	
FEBRUARY COUNT	8	9	3	10	17	
MARCH COUNT	6	8	4	—	—	
AVERAGE OF COUNTS	7.8	7.8	4.5	10.5	16	47

TOTAL OF AVERAGES

FIGURE 1 - Population estimation data acquired from track counts done monthly between the months of December and March after fresh snowfalls.

SEASONAL POPULATION TRENDS AND MOVEMENT:

During the winter and spring months from December to May, the herd population consistently stayed at about the 45 to 50 animal level. At about the middle of May, the pregnant cows of the herd tend to band up into a few groups of between 5 to 10 animals for calving. In this particular study area, calving seems to take place in the Rosebud Hill area and up the Wallach Creek drainage at about the 4000' to 4500' elevation. These areas are very important to the population, at this time, for about one month. Afterwards, the cow-calf groups begin to disperse into higher elevations and onto summer ranges. The animals on the west side of the study area move northwestward into high elevation areas on the north side of the Pend d'oreille River. The animals on the east side of the study area move eastward towards the Salmo-Creston Summit and use that area as their summer range. The actual study area becomes vacant of elk at about the end of June. Near the end of summer, between the middle of August and September, depending on climatic conditions, the rutting season beains and lasts until about the beginning of October. At this time the animals move down into mid-elevation areas. After the rut, the animals wander very slowly down to the study area where the first elk move into the Rosebud Hill area at about the end of November. Somewhat later, elk move into the west side of the study area. The population then peaks in the study area for the winter and spring months. The yearly population and movement cycle is then complete.

LOCAL MOVEMENTS OF HERD WHILE IN STUDY AREA

ROSEBUD HILL HERD:

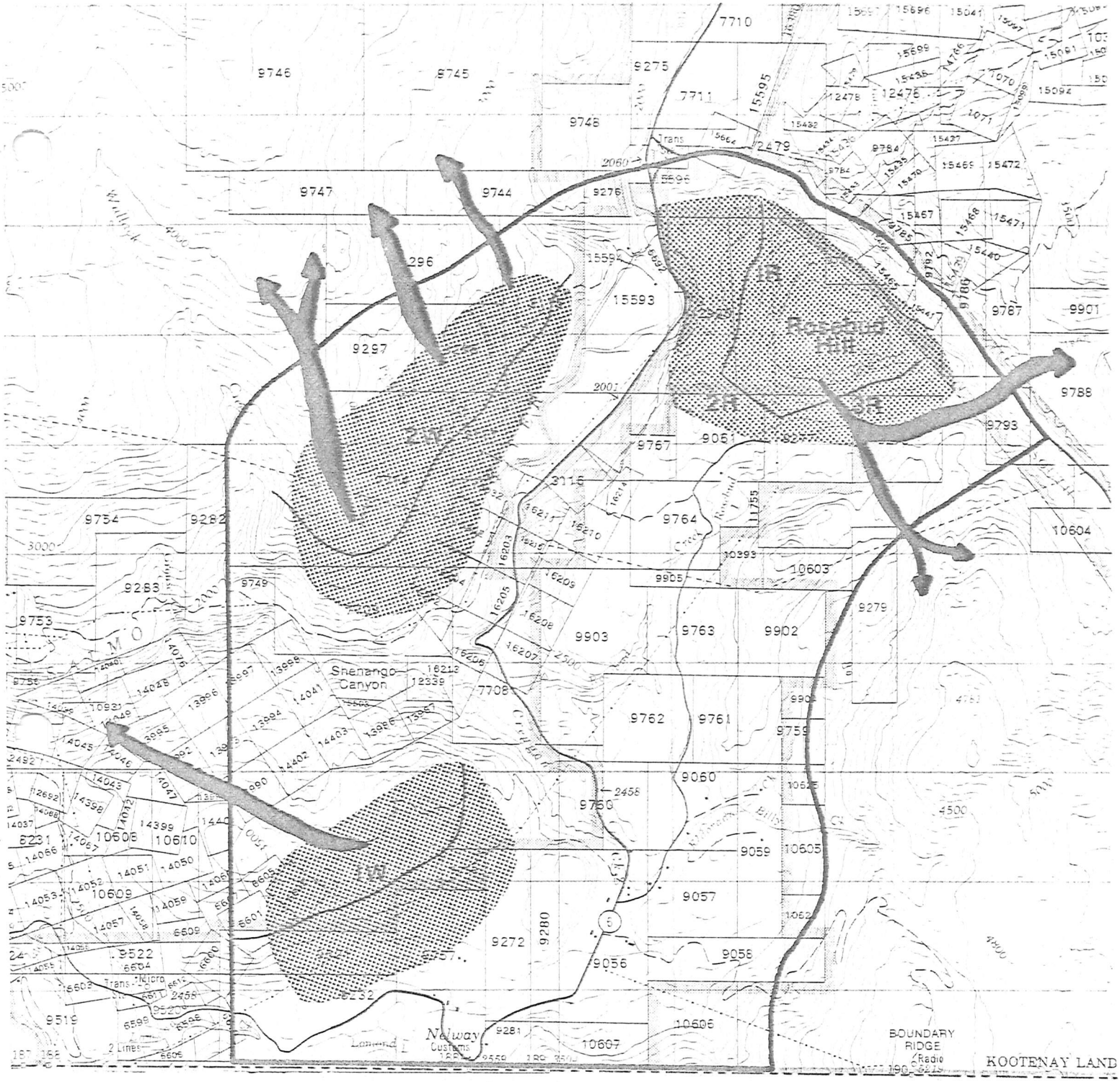
The Rosebud Hill herd generally stayed within 1 mile of the hill throughout the winter and used it for feeding extensively as it was usually windblown of snow and accessible. While the snow was very deep on the hill periodically throughout the winter, the elk remained on the west facing slopes under dense cover above the Salmo River. The southeast facing slopes of the hill were heavily utilized in the early winter before snow depths became excessive in these areas.

LOMMOND LAKE HERD:

The Lommond Lake herd moved around mostly on the south facing slopes just to the north of Lommond Lake, but, occasionally, the animals travelled to the west towards the Pend d'oreille River for short periods of time.

WALLACK ATKINSON CREEK HERD:

The Wallack Athinson Creek herd was the widest ranging herd in the study area. They ranged all along the southeast facing slopes above the Salmo River between the elevations of 2000' and 4000'. These wide ranging movements of this herd were probably caused by the poorer quality of the range necessitating longer distances of herd movement. This herd may have been in some stress near the end of the winter as they were forced to contain themselves to very small areas during times of very deep snow where browse is not abundant.



LEGEND

Areas Heavily Used By Wintering Elk

Migration Route

Ski Transect & Number — 2R

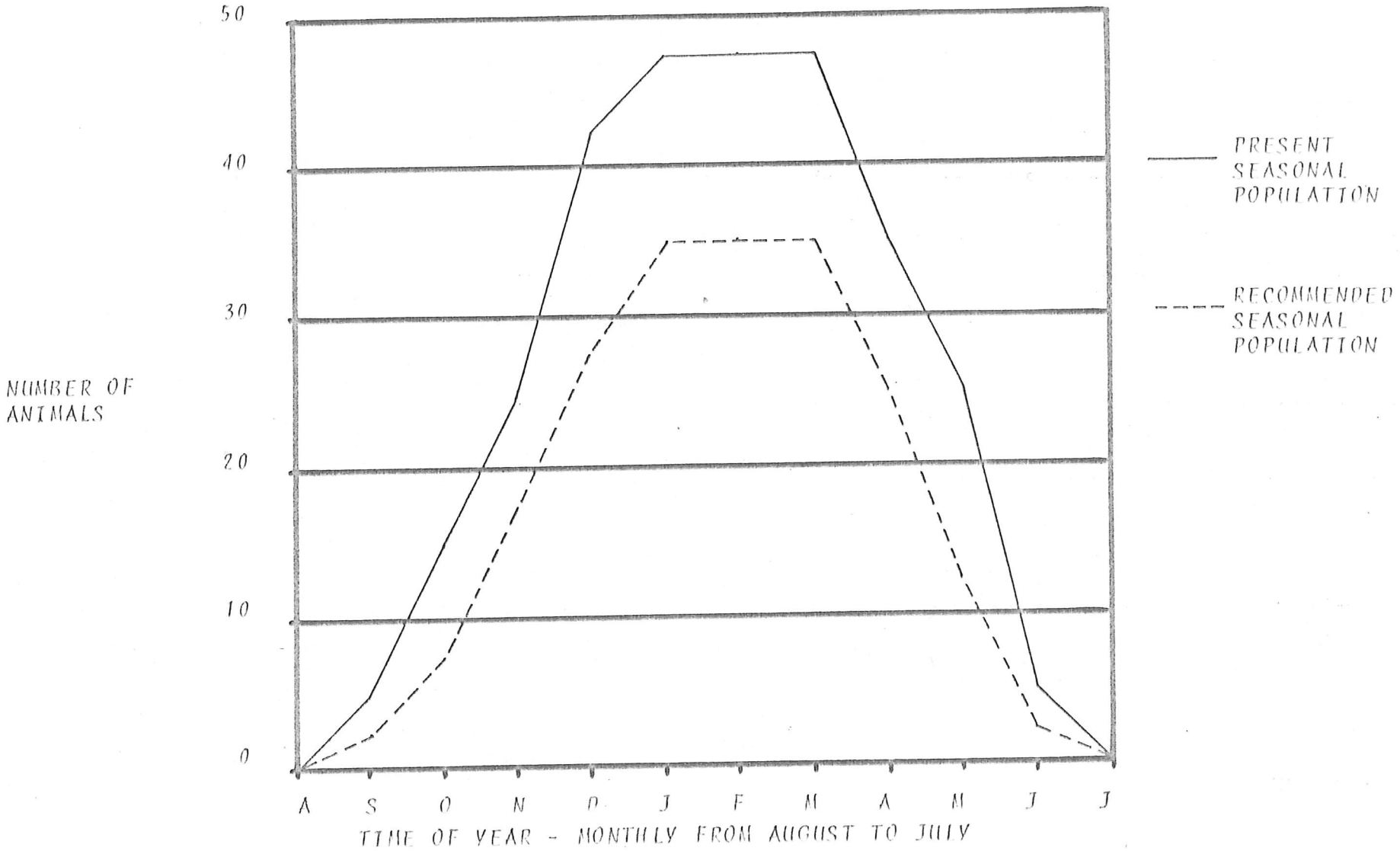


FIGURE 2 - Present annual population trends as opposed to recommended population levels.

FORAGE PREFERENCE OF ELK IN STUDY AREA

The elk in the study area, during the winter and spring months, seem to be primarily browsers rather than grazers. This is possibly because the availability of grasses during the winter months is quite low unless the animals crater for it. The animals probably prefer to browse during winter for several reasons. Firstly, from an energetics point of view, the elk would be foolish to crater for grass species because the grasses cure and dry out before the snows occur. Therefore, they are very low in nutrients and crude protein. The animals would have to move out into openings where deeper snows occur, crater the snow away, and feed for sometime then return to cover. The amount of energy they would have burned in this process would be greater than the energy they would receive from the grasses. Moreover, the animals would be fighting a loosing battle and would become emaciated well before the winter had past. The browse species, though they may not have high nutrient content during winter, are much more easily obtained and will easily sustain healthy elk in the study area through the winters. As I have mentioned, (Ceanothus sanguineus) occurs in moderate amounts throughout most of the study area and in high concentrations in isolated areas such as Rosebud Hill. This is the foremost browse species of the study area herds. In addition to the ceanothus, these herds also eat the following browse species in low to moderate amounts; Saskatoon Berry (Amelanchier alnifolia), Buffalo Berry (Sheperdia canadensis), Dpuglas Maple (Acer glabrum), Red Osier Dogwood (Cornus siricea),

Ocean Spray (Holodiscus discolor), Waxberry (Symphericarpos albus), Wild Rose Spp. (Rosa spp.), Douglass Fir (Pseudotsuga menziesii), Trembling Aspen (Populus tremuloides), and Western Red Cedar (Thuja plicata). In the later spring the elk begin to switch their food habits back to more of a balance between grazing and browsing when the forage species are more readily available and nutritious. From fecal pellet samples taken during the winter, the winter diet of these elk is made up between 70% and 80% of (Ceanothus sanguineus) and the remainder a mixture of other browse species mentioned.

FORAGE PREFERENCE OF DEER IN STUDY AREA

A moderate number of whitetailed deer exist in the study area which compete with the elk for the available browse and forage during winter and spring when they are occupying the same range. To estimate the extent of the elk's competitive pressure on the deer herds it is necessary to realize the food preference of the deer as compared to that of the elk herds. Very strange feeding habits of deer on the east side of the study area were observed during the winter of 1981-82. The deer were expending tremendous amounts of energy to crater for False Box (Paxistima myrsinites) through up to 1 meter of snow. These deer were utilizing the False Box (Paxistima myrsinites) as their major browse species and were spending several hours per day cratering for it. Again, from an energetics point of view these animals are foolish to do this, as they were loosing body condition rapidly during the winter. I found one yearly doe in the Rosebud area that had been taken down by coyotes

in March. An autopsy was preformed with the following results:

Percentage fat in bone marrow - 13%

Rumen contents - full with almost 100% False Box (Pasixtima myrsinites)

Pregnantcy status - pregnant with 2 embryos - 1 male, 1 female

Age - 1 year

General body condition - very lean and emaciated

Lung tissue - pink and spongy no signs of lungworms or pneumonia

The amount of snow received during the 1981-82 winter was higher than usual for the study area, and it is possible that this group of deer habitually have cratered for false box in years before and did not have the instinct to switch to more easily obtained browse species. Consequently, in winters with heavy snowfalls they are subject to die-offs. Until this habit in this deer herd changes, the elk are not directly competing for food with the whitetailed deer in the study area. The ceanothus sanguineus in the area is being very heavily utilized by elk and a majority of the ceanothus bushes are browsed very heavily up to the maximum height which the elk can reach. This indicates that most of the ceanothus browse is well out of the reach of deer. With this being the case, the deer do not actually have much ceanothus available to them unless the elk numbers are trimmed back or the amount of ceanothus is increased by the use of prescribed burns. The best sollution to

the problem would be a combination of fire and elk harvest to bring the deer herd up to a larger, healthier population. Taking all this in mind, it seems that the elk are putting significant, competitive pressure on the deer herd somewhat directly but mostly indirectly.

ELK HARVEST IN 1981-82 SEASON:

The study area is found in the Wildlife Management Unit 4-8 for which there was a limited entry hunt with 2 bull permits and 3 cow/calf permits available. The season ran from September 10 to October 15 of 1981. I was able to contact all the recipients of the limited entry hunting permits by telephone with the following results:

1. No elk were taken in the management unit during the 1981-82 season.
2. Only two of the tag holders hunted the elk to any great extent.
3. One tag holder did not hunt the elk at all.
4. None of the tag holders hunted in the study area.
5. All elk hunting in the management unit was done in the Pend d'oreille Valley to the east of the study area.

The reason why the study area was not hunted for elk was because there were very few to no elk in the area during the hunting season. From my own observation, I found very low-hunting pressure of elk in surrounding management units where there were public open seasons on elk rather than limited entry seasons. This is because the elk populations were quite low to moderate in surrounding areas as well.

It seems evident that to control the elk population in the study area itself, there are several hunting season manipulations that should be used to achieve some harvest of the Nelway elk. This can be done over a period of hunting seasons with liberalization first occuring in the number of permits for limited entry hunting. If necessary, a one or two week public open season could be imposed. There is already some evidence of range damage in isolated areas of the study area by elk, and it seems that some reduction in numbers should occur. I feel that the winter population of the study area should be reduced to and maintained at about 35 - 40 animals. This will control range damage, possible inhibition of deer population maintenance and growth, and prevent breakout of disease due to range overstocking. However, the elk should remain in the area to keep diversity of species and overall range health intact.

OTHER USES OF AREA:

Three other major uses of the study area preceeding and during the winter-spring occupancy by the elk are ranching, recreation and logging. My major concern of these three is ranching, more specifically, the number of cattle and horses that use the slopes on the west side of the Salmo River during summer and fall months. I personally counted 50 head of cattle and 12 horses, owned by a local rancher, which are allowed to feed on these slopes just prior to the elk migration into the area in early winter. This causes further reduction in habitat and forage quality that is used by the Wallack Athinson Creek herd. This use by domestic livestock could be hurting the

wild ungulate populations, especially the Wallach-Athinson Creek elk.

Another concern is the recreational use of the area during the winter by snowmobilers. This is done mainly in the Rosebud Flats area where several wintering deer and elk are present. These two uses seem somewhat uncompatible and I feel that recreational use with snowmobiles should be restricted to higher elevation areas where wintering wildlife does not exist. This would minimize disturbance of wildlife in the area during the most critical time of year.

Logging is also present in the study area in very small amounts and could be coordinated to enhance wildlife populations in the area through use of small, clear or selection cuts which enhance growth of browse species, beneficial to ungulates.

Overall, I would like to see a small Co-ordinated Resource Management Plan done for this area which could tie all these uses together into a more efficient working system to benefit the party's involved and the environment.

ELK MOVEMENTS IN RELATION TO SNOW DEPTH:

Elk in the study area tended to stay in fairly confined areas regardless of snow depth. However, when snow reached depths of 80 cm or greater movements of the herd became even more restricted and were usually less than 250 meters per

day. These deep snow conditions lasted from late December to mid February during the winter of 1981-82. At this time, the snow depth even on the open windswept face of Rosebud Hill varied from 60 to 80 cm. On flat open areas near Rosebud Lake snow depth varied from 80 to 130 cm and under dense coniferous cover it was maintained at approximately 20 to 40% less depending on slope and aspect. The Rosebud herd generally stayed in heavy timbered areas at this time on southwest facing slopes of up to 50% incline. The Lommond Lake herd used south facing slopes under dense cover of about 30% incline. The Wallack-Atkinson Creek herd was forced to use southeast facing slopes with greater snow retention under moderately stocked coniferous forest. These slopes retained up to 130 cm of snow for several weeks during the winter, and at this time the Wallack-Atkinson Creek herd movements were at a bare minimum, often being less than 100 meters per day. The habitat in this area was the very same that had previously been used by the cattle and horses already metioned. A combination of heavy snow retentions on these slopes and reductions in browse reserves due to range animals was obviously not advantageous to the wintering elk population. I believe, myself, that this group of elk was subject to much greater levels of nutritional stress than the other study area elk groups during the winter of 1981-82. This belief comes from direct observation of animals from all the herds in the study area during late winter. This situation, however, may not have occurred in a less severe, more average winter. By the same token, this situation may

not have occurred if the range was not used by domestic stock just prior to the onset of winter.

ACKNOWLEDGMENTS:

I would first like to acknowledge Guy Woods, Wildlife Biologist, B.C. Fish and Wildlife Branch who first initiated this project and provided classified count data from two helicopter flights, one of which I was included in.

I would also like to acknowledge Peter Ommundsen, Wildlife Biologist, Selkirk College who gave consultation regarding aspects of the project and took great interest in my personal achievements in the Fish and Wildlife field.

I am also indebted to Peter Davidson, Wildlife Biologist, Sheep Enhancement Project, B. C. Fish and Wildlife Branch who also gave consultation on aspects of the project where difficulty was encountered and broadened my knowledge of wildlife management techniques during a practicum in Cranbrook.

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