HABITAT RELATIONSHIPS OF MULE DEER IN THE INTERIOR DOUGLAS-FIR ZONE OF CENTRAL BRITISH COLUMBIA

WILDLIFE HABITAT RESEARCH

Province of British Columbia
Ministry of Forests
HABITAT RELATIONSHIPS OF MULE DEER 
IN THE INTERIOR DOUGLAS-FIR 
ZONE OF CENTRAL BRITISH COLUMBIA 

Working Plan 

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Citation:

SUMMARY

In the IDF biogeoclimatic zone of the B.C. interior mature stands of Douglas-fir are often a prime component of winter range areas for mule deer. Alteration of these areas by standard timber harvesting would have an adverse effect on interior mule deer populations. The purpose of this study is to determine what features of these winter ranges make them essential for deer. With such information we hope to develop timber management practices for these areas that will not lower their carrying capacity for mule deer while reconizing the concerns of forest managers.

Research will concentrate on a detailed examination of winter habitat selection.
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1.0 INTRODUCTION

In the Interior Douglas-fir zone, mature and overmature Douglas-fir stands are valued for timber production and are also a key component of mule deer winter ranges. At present harvest rates, mature fir on winter ranges will be virtually eliminated in ten years or less. This situation has led to resource management conflicts as the high rate of Douglas-fir logging results in continued loss of critical mule deer winter habitat. The problem analysis (Armleder 1981) written for this project outlined the conflict in detail and also identified four major problem areas. They are as follows:

1) Ecological Understanding - Improvements are required in the ecological understanding of mule deer/habitat relationships (both qualitative and quantitative) on which to base management decisions.

2) Wildlife Management Data - There is currently a paucity of demographic data available to wildlife managers on which to base sound decisions.

3) Timber Resource Management - Present harvesting rates and commitments for Douglas-fir will result in continued habitat loss for mule deer. Lack of flexibility in the type and pattern of harvesting has created conflicts in areas where both resources may be accommodated.

4) Integrated Resource Management - Meaningful integrated resource management is necessary so that existing knowledge is applied in the most effective way to achieve mutually agreed objectives.

Only the problem of ecological understanding will be addressed by this working plan. The need for demographic data is an inventory problem rather than a research topic. A study on an alternative harvesting system for winter ranges is being conducted as an experimental project. The final problem area, that of integrated resource management, is being addressed by both wildlife and forest managers and will be aided by the improved ecological understanding furnished by this research.

Development of a sound understanding of the basic ecological relationships between deer and their environment would provide the basis for evaluating the quality of any given habitat for deer and enable predictions to be made of the effects of forest management practices on habitat quality.

Although there are many forestry practices associated with forest management (i.e. timber harvesting, juvenile spacing, thinning, site conversion and rehabilitation, fertilization, etc.), efforts will concentrate on timber harvesting. In the B.C. interior, forest fertilization is not yet an operational practice; thinning is rare; juvenile spacing is usually done on the cutblock shortly after logging, and; site conversion and rehabilitation are not extensive. Hence, timber harvesting is and will continue to be the most significant forest activity affecting mule deer.

In the long term it will become necessary to experimentally measure changes in winter range carrying capacity resulting from timber harvesting. Documenting changes will be especially important if modified timber harvesting schemes are employed with the goal of reducing or eliminating the negative impact of winter range logging. An experiment of this type would provide the ultimate test of a working model of deer habitat relationships.

Figure 1 presents a model of the factors and mechanisms affecting mule deer when a winter range is logged. No effort has been made to quantify the components of the model nor are the various timber harvesting systems considered. The purpose of the model is to aid in putting into perspective aspects of the working plan and to help identify research components.

2 GOAL AND OBJECTIVES

The goal of this project is to better understand the ecological relationships between mule deer and their winter range. Better understanding of the factors and relationships involved will lead to a greater ability to predict the impact of any habitat manipulation on the quality of a winter range. In addition to determining the requirements of the animal and the range supply it is essential to understand how these interact to develop the framework from which carrying capacity analyses can be made (Moen 1973, Robbins 1973, Connolly 1981). However, quantitative measures of carrying capacity are difficult, time consuming and costly to obtain. Our efforts will therefore initially concentrate on studying the habitat use of mule deer on and around winter ranges. The reasons behind observed patterns of use will be explored to improve our understanding of the processes involved. This will provide the background necessary to develop modified forest management practices designed to improve integrated management.
Figure 1. Model of the factors and mechanisms affecting mule deer when a winter range is logged.
Measures of habitat selection or preference should be reflective of habitat quality, because individual biological fitness should form the basis for habitat selection (Lack 1954, Levins 1962, 1966, Brown 1969a, Fretwell and Lucas 1970, Fretwell 1972, Templeton and Rothman 1974, Rosenzweig 1974, Doyle 1975). If habitat quality changes as a result of forest management, it follows that the carrying capacity will also change. It is therefore important that we be able to determine the magnitude and the effect of these changes.

There are several objectives to be met within the scope of this study. The time periods within which these objectives will be met may vary depending upon factors beyond our control i.e. the severity of the winters. The objectives are as follows:

1. To intensively monitor habitat use on the Knife Creek winter range over the 1983/84 winter before the area is further altered by logging.
2. To intensively monitor habitat use on the Knife Creek winter range over the 1984/85 winter after a substantial area is logged with a specialized system designed for winter range (Armleder 1983).
3. To intensively monitor habitat use on the Churn Creek winter range over the 1985/86 winter.
4. To monitor the seasonal movements of the radio-collared deer from both study areas during the life of the collars.
5. To monitor habitat use on the three study areas using track and pellet-group transects.
6. To ecologically map and describe the key portion of the Knife Creek winter range during the summer of 1983.
7. To measure the micro-climate characteristics (snow, temperature, wind) on various sites on the Knife and Churn Creek winter ranges.
8. To study the food habits of deer over several different winters on the Knife Creek and Churn Creek winter ranges.

3 STUDY AREAS

Snowfall levels on winter ranges in the Cariboo vary widely. Since snow conditions are one of the major factors in the mule deer – forestry controversy, study areas were selected to cover most of this variation. Because of limited program resources only one area will be studied intensively
during each winter. The Knife Creek area will be studied in the short term since it offers the possibility of valuable short term data. The Churn Creek winter range will be studied intensively in the future while the Beaver Valley study area will receive less attention. The basic criteria used for selection of study areas (particularly the intensive areas) were as follows:

1. substantial mule deer winter range (numbers of deer and area)
2. past logging over part of area, preferably reflecting a variety of intensities and methods
3. mature/overmature fir on much of area with no logging history
4. variety of habitats (i.e. topography)
5. enough mature Douglas-fir present for habitat manipulation experiment
6. relevant to problem areas faced by managers
7. no planned development in the next five years
8. spring and fall ranges close by
9. minimum hunting and harassment pressure
10. accessibility (from Williams Lake and within study area)
11. extent and nature of background data

3.1 Churn Creek

The Churn Creek study area is located 85 kilometres southwest of Williams Lake in the Interior Douglas-fir (IDFb) subzone. Immediately adjacent to Churn Creek the area is transitional to the Ponderosa Pine - Bunchgrass (PPBGs) subzone. The area lies between Little Gaspard Creek to the north and Churn Creek on the south. Elevation ranges from 1500 metres on ridge tops to 750 metres at Churn Creek itself. No logging has occurred in the Churn Creek valley, however, the plateau area to the north contains numerous cutblocks. The area is grazed by cattle from the Gang Ranch. Figure 2 provides a general location of the study area while Figure 3 presents more detail.

3.2 Knife Creek

The Knife Creek study area lies in the Interior Douglas-fir (IDFb) subzone and is located approximately 15 kilometres southeast of Williams Lake. Specifically, the area lies between Jones Creek on the north and east, Knife Creek on the south, and Highway 97 on the west (Figures 2 and 4). The area is gently rolling with elevation ranging from 750 to 900 metres. Most of
the area was lightly logged in the 1940's and '50's. In the mid 1970's timber
was removed from a number of cutblocks logged by diameter limit logging.
Areas of open range lie adjacent to the winter range and are grazed by cattle.

3.3 Beaver Valley

The Beaver Valley study area lies in the Sub-Boreal Spruce (SRSb) subzone
and is located approximately 45 kilometres northeast of Williams Lake.
Elevations range from 700 metres in the valley bottom to 1100 metres on the
surrounding hills. The valley bottom is used primarily for agriculture while
the surrounding plateau contains numerous logged areas. Figures 2 and 5
present maps of the location of the study area.

4 METHODS AND APPROACHES

4.1 Capturing

Data collected from radio-collared deer equipped with radio-transmitters
will provide the basis for a detailed assessment of habitat selection.
Animals will be captured while concentrated on their winter and spring
ranges. Efforts will be made to capture deer in a variety of habitats and
locations on the study areas to obtain a better representation of the
population. The capture technique will involve the use of mechanical traps
and/or immobilizing drugs.

Both sexes and all age groups (fawns, yearlings and adults) will be
studied; however, differential capturability results in an emphasis on young
females. This is not undesirable since they represent the present and/or
future breeding population. If their requirements are met then those of the
other segments of the population will be adequate.

The two immobilizing drugs which have been used are Rompun (Xylazine
hydrochloride) and Anectine (Succinylcholine chloride). During the spring of
1981 Rompun was successfully used to immobilize three deer. The drug was
remotely injected by using either Cap-Chur darts (Palmer Chemical Equipment
Co.) or Pneu Darts (Pneu Dart Inc.) fired from a Cap-Chur gun. If Rompun is
employed in the future it will be used in conjunction with Ketamine
hydrochloride. Using these drugs in combination should result in reduced
induction and recovery times. However, the recovery times will still be
relatively long (approximately two hours) (Gullet and Jessup 1982) thus
precluding the use of these drugs during periods of low temperatures.
Figure 2. Location of study areas within biogeoclimatic zones.
Figure 3. Location of the Churn Creek study area.

Scale 1:50,000
Figure 4. Location of the Knife Creek study area.

Scale 1:50,000
Figure 5. Location of the Beaver Valley study area.

Scale 1:50,000
Anectine was used in the spring of 1982 to immobilize three animals. The advantages of this drug are greatly reduced induction and immobilization times; however, dosage levels are much more critical.

The mechanical traps used are single-gate Clover traps (Clover 1956). In the winter of 1982 baited traps were used during periods of deep snow when the animals were on restricted diets and found baits appealing. Twelve deer were captured in this manner at Knife Creek. One deer at Churn Creek was captured in January 1983. The same technique will be used in following winters if conditions permit. Whatever methods are employed, the objective is to use efficient capture techniques that least disturb the animals.

If fewer than six radio-collared deer are on the Knife Creek winter range in late November 1983 then additional animals will be captured at that time for the winter data collection period. Later that winter ten additional deer will be radio-collared for monitoring during the winter of 1984/85. Starting in the winter of 1984/85, ten animals will be captured at Churn Creek and radio-collared to provide the basis for intensive monitoring the following winter.

4.2 Radio-telemetry equipment

Thirty radio-collars were obtained for use on this project; twenty with the standard configuration and ten with the mortality feature. The transmitters are lithium battery powered units emitting pulsing signals in the 148-150 MHz range with a life of two to four years (Telonics Inc.).

The collars are made of butyl rubber and can be adjusted up to a maximum circumference of 73 centimetres. Allowance will be made for neck swelling of males during the rut.

The receiving unit (Telonics Inc.) incorporates an auto-scanner plus a digital processor. The scanner allows the storage and continuous scanning of all transmitting frequencies, a feature especially important for aerial tracking. Accuracy in determining signal direction is improved with the digital processor. In theory, the unit can identify whether the animals are active or completely stationary. In practice, local atmospheric conditions make this determination impossible. The antennas used are directional "H" antennas which can be hand-held or fixed to aircraft for locating animals from the air.
4.3 Monitoring

Throughout the spring, summer and fall, animals from both winter ranges will be located monthly. The locations will be made either from the ground or from aircraft depending on accessibility.

These locations will be accurate to only ±250 metres as we are only interested in seasonal movements and general habitat use. During the 1983/84 winter the animals at Churn Creek will remain on this infrequent schedule, however, the level of accuracy of the locations will be increased by taking more bearings for a given location.

The animals at Knife Creek will be monitored much more frequently during the 1983/84 and 1984/85 winters. The objective is to gather location data on individual deer by monitoring them very intensively over short periods so that their habitat use throughout the day can be identified during a particular weather condition. This will provide more meaningful information than the infrequent locations. At least one session of 24-hour intensive monitoring will be conducted each winter month. These sessions will consist of three to six hour monitoring periods within which the animals being monitored will be located every 15-20 minutes. It will only be possible to monitor a few animals (3-5) during these intensive periods. The entire 24-hour period will be covered over several consecutive days. The same individuals will not necessarily be studied over the course of the 24-hour period.

Intensive monitoring will be done under different weather conditions (e.g. clear, stormy, cold) during the winter. The accuracy of the monitoring will be greatly increased by the use of a 'null' antenna tower system which has been set up on the Knife Creek winter range. This system employs a twin antenna apparatus and uses a 'null' instead of a 'peak' signal to determine the bearing. Theoretically, this is accurate to one degree. This system should produce locations accurate to .05 hectares.

4.4 Pellet-group surveys

Pellet-group transects have been established to provide an index of habitat use between broad habitat types on a winter range. Although

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pellet-group surveys have associated difficulties and limitations (Smith 1964, Van Ritten and Bennett 1965, Bailey and Putnam 1981) they have the advantage of using an inert kind of evidence to which plot sampling and statistical analyses can be applied. This will supplement the habitat use data collected from the radio-collared animals and the track surveys, together with other surveys, will provide data on relative habitat use.

Circular sampling plots with an area of 10 m² (radius of 1.78 m) were marked with an aluminum stake at the centre. Five plots were arranged into a cluster and will constitute a sampling unit. Six clusters arranged linearly comprise a transect (Figure 6). Transects were oriented diagonally to slope contours to cover the widest habitat variation.

The transects were located using a stratified systematic sampling scheme. Variables used in stratifying the winter ranges included degree of canopy cover, slope, and aspect.

In the summer and fall of 1981, 18 and 15 transects (totalling 198 clusters and 990 plots) were established and cleared on the Churn Creek and Beaver Valley study areas, respectively. These plots are cleared in October before the first snowfall and again in March-April to enable the study of winter habitat use. Presently data from the transects has been collected for the 1981-1982 winter and the 1982-1983 winter providing habitat use information for these periods. The monitoring of the transects will continue through the 1984-1985 winter.

4.5 Track surveys

Track survey transects were established on the Knife Creek and Beaver Valley study areas in February 1982. Data collected from these surveys is intended to supplement habitat use information obtained from the pellet-group surveys and radio-telemetry. In contrast to pellet-group data which provides an indication of habitat use over the entire winter period, the track surveys measure habitat use over specific periods during the winter. The objective is to conduct the surveys once during each of the winter months a few days after snowfalls significant enough to cover old tracks.

A sampling unit consists of 100 metres of transect. Six 100-metre
Figure 6. Arrangement of pellet-group sampling plots comprising a transect.

Figure 7. Layout of a track transect replicate (six 100-metre segments).
segments will comprise a replicate (Figure 7). There are three replicates in each habitat type; any more would be unreasonable considering the available manpower.

Transects were located in each of the following habitats (if present) on each study area: mature Douglas-fir; selectively logged areas (at the levels present on the study areas); clearcuts; and open range. Other habitat characteristics (i.e. aspect, slope, elevation, etc.) will be taken into account to permit comparisons of overstory cover. The data do not represent a detailed examination of habitat use, however, the current level of detail is useful for providing preliminary information to managers.

In conducting track surveys, the following procedures will be employed:
1. transects will be monitored two or three days after significant snowfalls
2. the number of mule deer tracks crossing the transect will be recorded for each 100-metre segment

4.6 Habitat assessment

In order to understand wildlife habitat relationships the importance of the various habitat components must be understood. Habitat characteristics will be documented in order to provide a summary of the availability of various components. This will be compared to the habitat use data to determine whether a statistical difference exists between use and availability of specific habitat components. Use/availability calculations will be made for each sex and age group during various periods (e.g. adult females during winter days with temperatures below -20°C). Woods (1981) has produced a computer program to compare use and availability of a large array of habitat factors using the Bonferroni Z-statistic to form statistical confidence intervals around the use data (Neu et al. 1974). This approach will be used.

The habitat input will involve producing four maps per study area, one each for elevation, slope, and aspect plus a composition map consisting of vegetational data. In each case it is necessary to form a

This is not the full ecological picture I will correlate with our maps.
data set for input by mapping the study area and then placing a grid over the mapped area and recording the habitat description for each X-Y co-ordinate. The physical characteristics (elevation, slope, aspect) will be mapped with the use of aerial photos, contour maps and ground checks. Rather than measuring the biological characteristics at each X-Y co-ordinate and producing a separate map for each biological parameter, the program accepts habitat types which are associated with a specific combination of biological parameters.

Habitat types will be delineated on aerial photos and then sampled on the ground. The sampling may indicate the need for more habitat types and will help define boundaries. Stratification will be done on the basis of ecosystem associations and immature seral stages. Habitat descriptions will be made in each type. Tables 1 and 2 display the variables for which Wood's (1981) program is designed. Most of these variables will also be used for this project with additions for hygrotope, slash loading, and presence and abundance of major herbs.

The majority of the work involved in habitat typing will be carried out by the ecological classification crew of the Cariboo Forest Region Research Section. The core portion of the Knife Creek study area will be mapped in August/September 1983 and the Churn Creek area will be done the following summer.

Table 1. Input variables for location using the X, Y co-ordinate method (from Woods 1981)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Limits</th>
<th>Columna</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDN</td>
<td>Animal number</td>
<td>1 - 25</td>
<td>5, 6</td>
</tr>
<tr>
<td>IDL</td>
<td>Location number</td>
<td>0 - 099</td>
<td>6 - 10</td>
</tr>
<tr>
<td>ID</td>
<td>Day (of the year)</td>
<td>0 - 366</td>
<td>14 - 16</td>
</tr>
<tr>
<td>IY</td>
<td>Year (last two digits)</td>
<td>0 - 99</td>
<td>18 - 19</td>
</tr>
<tr>
<td>IOBSRVR</td>
<td>Observer</td>
<td>0 - 9</td>
<td>21</td>
</tr>
<tr>
<td>OSNOW</td>
<td>Snow Depth</td>
<td>0 - 999</td>
<td>23 - 25</td>
</tr>
<tr>
<td>ITEMP</td>
<td>Temperature</td>
<td>-99 - +120</td>
<td>26 - 28</td>
</tr>
<tr>
<td>ITIME</td>
<td>Time</td>
<td>1 - 2400</td>
<td>36 - 39</td>
</tr>
<tr>
<td>IXC</td>
<td>X co-ordinate of location</td>
<td>1 - 99,999,999,999</td>
<td>49 - 59</td>
</tr>
<tr>
<td>IYX</td>
<td>Y co-ordinate of location</td>
<td>1 - 99,999,999,999</td>
<td>61 - 71</td>
</tr>
</tbody>
</table>
Table 2. Map input data transformation into class data (from Woods 1981)

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<th>Factor</th>
<th>TRNSFM</th>
<th>Add</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>Elevation</td>
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<td>1</td>
<td>500 ft intervals</td>
</tr>
<tr>
<td>Slope</td>
<td>0.05</td>
<td>1</td>
<td>20% intervals</td>
</tr>
<tr>
<td>Aspect</td>
<td>0.022</td>
<td>1</td>
<td>NE, E, etc., 8 classes</td>
</tr>
<tr>
<td>Structural vegetation</td>
<td>1.0</td>
<td>0</td>
<td>discrete classes</td>
</tr>
<tr>
<td>Habitat type</td>
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<td>0</td>
<td>discrete classes</td>
</tr>
<tr>
<td>Major tree species</td>
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<td>0</td>
<td>discrete classes</td>
</tr>
<tr>
<td>Forest age</td>
<td>0.05</td>
<td>1</td>
<td>20 year intervals</td>
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<tr>
<td>Forest height</td>
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<td>1</td>
<td>10 m intervals</td>
</tr>
<tr>
<td>Percent tree cover</td>
<td>0.1</td>
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<td>10% intervals</td>
</tr>
<tr>
<td>Tree density</td>
<td>1.0</td>
<td>1</td>
<td>1 m intervals (distance between trees)</td>
</tr>
<tr>
<td>Tree abundance</td>
<td>1.0</td>
<td>1</td>
<td>1 tree interval (trees per 100 m²)</td>
</tr>
<tr>
<td>Shrub species</td>
<td>1.0</td>
<td>0</td>
<td>discrete classes</td>
</tr>
<tr>
<td>Shrub height</td>
<td>1.0</td>
<td>0</td>
<td>1 m intervals</td>
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<tr>
<td>Percent shrub cover</td>
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<tr>
<td>Shrub density</td>
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<td>1</td>
<td>1 m intervals</td>
</tr>
<tr>
<td>Shrub abundance</td>
<td>0.1</td>
<td>1</td>
<td>10 stems/m² intervals</td>
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<tr>
<td>Seral stage</td>
<td>1.0</td>
<td>0</td>
<td>discrete classes</td>
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<tr>
<td>Years since last burn</td>
<td>0.2</td>
<td>1</td>
<td>5 year intervals</td>
</tr>
</tbody>
</table>

4.7 Micro-climate

Micro-climate is being assessed in various habitats on both the Knife Creek and Churn Creek winter ranges. This is done with weather stations consisting of a 31-day recording thermograph, a pair of maximum and minimum thermometers and four snow stakes. Because of limited availability of equipment, weather stations were placed in only a few habitats in each study area. The sites were chosen to measure maximum variability on the study areas (4 and 8 stations in Knife Creek and Churn Creek, respectively). These data will be used to examine habitat use during specific weather conditions and to understand how micro-climate is modified by various habitats.

Surveys to measure snow depths under different cover types will be carried out on the Knife Creek experimental harvesting block in the winter of 1983/84. The objective of these surveys is to measure the effect of
harvesting on snow distribution and accumulation, however, the data will have implications to this project. Refer to the experimental harvesting working plan (Armleder, 1983) for a description of the survey method.

4.8 Food habits

Fresh pellet groups will be collected on the Knife Creek and Churn Creek winter ranges to identify food habits through fecal fragment analysis. These samples will provide both a species list of forage plants and their relative abundance in the winter diet. As well as identification of material, fecal nitrogen levels will be determined for each winter month. The fecal nitrogen levels are related to the crude protein intake of the animals and can be used as an index of their nutritional status, however, confounding factors make this technique a rough estimate (Nelson et al., 1982).

Samples consisting of two or three pellets will be collected from each of approximately 20 fresh pellet groups on each study area once a month. Collecting will be done between December and March. If manpower is available the collecting may be expanded to include the Beaver Valley study area. The samples will be kept frozen until they can be dried and sent to a lab for analysis. The method of fecal fragment analysis is described in Hansen et al. (no date).

5 SCHEDULE

A schedule of activities for the duration of the project is provided in Table 3. The 1983/84 period is the third year of data collection although most of 1981 was used to establish various aspects of the project (e.g. pellet-group plots, micro-climate stations, equipment acquisition, capture techniques). The timing of events is much the same in all years with the exception of the final year, much of which will be spent on data analyses and report writing.
Table 3. Schedule of activities

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>1983-84</th>
<th>1984-85</th>
<th>1985-86</th>
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<td></td>
<td>J F M A M J J A S O N D J F M</td>
<td>SPRING</td>
<td>SUMMER</td>
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<tr>
<td>Capturing and Radio-Collar Placement</td>
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<tr>
<td>- Knife Creek</td>
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<td></td>
<td></td>
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<tr>
<td>- Churn Creek</td>
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<td></td>
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<tr>
<td>Periodic Radio-Telemetry Monitoring</td>
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<td>- Knife Creek</td>
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<td>- Churn Creek</td>
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<tr>
<td>Intensive Radio-Telemetry Monitoring</td>
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<td>- Knife Creek</td>
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<tr>
<td>- Churn Creek</td>
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<tr>
<td>Pellet-Group Counting and Clearing</td>
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<tr>
<td>Track Surveys</td>
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<tr>
<td>Ecological Mapping</td>
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<td>Micro-Climate Monitoring</td>
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<td>Experimental Harvesting</td>
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