Impact on Water Levels on Breeding Canada Geese and the Methodology for Mitigation and Enhancement in the Flathead Drainage

Annual Report
1983 - 1984

DOE/BP-203

January 1984

This Document should be cited as follows:

Gregory, Shari, Dennis Mackey, James Claar, Joseph Ball, "Impact on Water Levels on Breeding Canada Geese and the Methodology for Mitigation and Enhancement in the Flathead Drainage", Project No. 1983-00200, 104 electronic pages, (BPA Report DOE/BP-203)

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

IMPACTS OF WATER LEVELS ON BREEDING CANADA GEESE AND THE METHODOLOGY FOR MITIGATION AND ENHANCEMENT IN THE FLATHEAD DRAINAGE

ANNUAL REPORT 1983

Prepared by

Shari Gregory, Study Biologist
Dennis Mackey, Study Biologist
Confederated Salish & Kootenai Tribes
Pablo, Montana

James J. Claar, Project Supervisor
Bureau of Indian Affairs

Joe Ball, Principal Investigator
U.S. Fish and Wildlife Service

Bonneville Power Administration
Agreement No. DE-A179-83RPl0062

ABSTRACT

The lower Flathead River Canada goose study was initiated to determine goose population trends and the effects of water level fluctuations on Canada goose nest and brood habitat, as a result of releases from Kerr Dam. This report presents data collected during the 1983 field season (15 February to 30 September, 1983) as part of an ongoing project. Goose territorial pair surveys indicated no significant difference between boat and aerial survey methods. The number of indicated goose pairs was significantly greater on morning than afternoon aerial surveys. Eighteen artificial nest structures were erected in trees prior to the 1983 nesting season. Three of these were used by geese. A total of 52 nest structures were placed in trees along the study area. Nest numbers increased from 36 in 1982 to 53 in 1983. Nest success was relatively high at 68%. The nesting period occurred from March through mid-May. Seventy-two percent of the nests were island ground nests. Twenty-eight percent of all nests were below the high water mark and potentially vulnerable to flooding. Twelve cover types were defined and the entire study area was mapped. Vegetative cover types were described in terms of dominant species, plant species composition, and various physiographic characteristics. Vegetative and physiographic characteristics were sampled at ground nests and random sites on islands. The proportion of nests in specific cover types was significantly different from random sites which may indicate selection by nesting geese for certain cover types. Vertical vegetation cover at nest sites below 1 m height was significantly greater than at random sites. Five geese were radio-marked during the brood period. Two intensively used brood areas were identified. Observations of broods in these areas indicated broods fed on aquatic vegetation and developing wheat. Gravel bars, tall grass, and tall shrub types were used as loafing areas. Maximum movements of broods ranged from 1.7 to 22.6 km. Post-fledging movements ranged from 15.2 to 54.4 km. Geese used the river less and reservoirs more as the post-fledging period progressed.

TABLE OF CONTENTS

	Page
ABSTRACT	i
LIST OF FIGURES	iii
LIST OF TABLES	iv
INTRODUCTION	1
STUDY AREA	3
METHODS	7
RESULTS AND DISCUSSION	19
Territorial Pair Surveys	19
Artificial Nest Structures	25
Goose Production Estimates	25
Vegetation Analysis	36
Nest and Brood Site Analysis	50
Brood Habitat Use and Movements	56
Post-Fledging Movements and Distribution	64
CONCLUSIONS	69
LITERATURE CITED	70
APPENDICES	73

LIST OF FIGURES

Page

Figure 1. The lower Flathead River from Kerr Dam to the confluence with the Clark Fork River at Paradise, Montana..... 5

Figure 2. Six physiographic segments of the lower Flathead River study area..... 11

Figure 3. Vegetation sampling scheme. Ten 1 m^2 and 2 m plots were placed at 5 m intervals along a 25 m transect line, and were used to record frequency and cover of herbaceous and shrub vegetation. Trees were counted and measured within 2 circles (5.0 m radius) centered at 5 and 20 m points..... 13

Figure 4. Frequency distribution of nest initiation by Canada geese, on the lower Flathead River, Montana, 1983..... 30

Figure 5. Frequency distribution of incubation initiation by Canada geese, on the lower Flathead River, Montana, 1983..... 31

Figure 6. Frequency distribution of Canada goose hatching dates, on the lower Flathead River, Montana, 1983..... 32

Figure 7. Maximum, mean, and minimum discharge rates from Kerr Dam during March, April, May, and June 1983, lower Flathead River, Montana.. 35

Figure 8. Cover type map of McDonald Island brood area lower Flathead River, Montana, 1983.. 60

Figure 9. Cover type map of Mission Creek brood area, lower Flathead River, Montana, 1983..... 63

LIST OF TABLES

Page

Table 1. Counts from Canada goose pair surveys conducted by boat, lower Flathead River, Montana, 1983..... 20

Table 2. Comparison of counts from Canada goose pair surveys conducted from a boat and during morning aerial surveys, lower Flathead River, Montana, 1983..... 22

Table 3. Counts from Canada goose pair surveys conducted from a plane, lower Flathead River, Montana, 1983..... 23

Table 4. Number of Canada goose nests in the northern 37 km of the lower Flathead River study area, Montana, 1980-1983..... 26

Table 5. Number of nests and nesting success of Canada geese, lower Flathead River, Montana, 1953-1960 and 1980-1983..... 28

Table 6. Canada goose nest types, lower Flathead River, Montana, 1983..... 33

Table 7. Cover types used for stratifying vegetation sampling sites on the lower Flathead river study area, Montana, 1983..... 37

Table 8. Segment length, number of sites and cover types sampled per segment on the lower Flathead River study area, Montana, 1983..... 39

Table 9. Average vertical vegetation cover of riparian and upland samples of cover types, lower Flathead River, Montana, 1983..... 47

Table 10. Average vertical cover of vegetation in each cover type, lower Flathead River, Montana, 1983..... 48

Table 11. Number and percent of nest and random sites sampled with respect to cover types, lower Flathead River, Montana, 1983..... 52

LIST OF TABLES CONT.

Page

Table 12. Vertical cover within 5.0 m of ground nest sites and random island sites, lower Flathead River, Montana, 1983..... 55

Table 13. Cover type/activity use by Canada goose broods within the McDonald Island brood area, lower Flathead River, Montana, 1983..... 57

Table 14. Cover type composition of the McDonald Island brood area, lower Flathead River, Montana, 1983..... 59

Table 15. Cover type/activity use by Canada goose broods within the Mission Creek brood area, lower Flathead River, Montana, 1983..... 61

Table 16. Cover type composition of the Mission Creek brood area, lower Flathead River, Montana, 1983..... 62

Table 17. Maximum Canada goose brood movements, lower Flathead River, Montana, 1983..... 65

Table 18. Maximum post-fledging Canada goose movements, lower Flathead River, Montana, 19833 66

Table 19. Numbers of Canada geese observed on aerial censuses, Flathead Valley, Montana, 1983..... 68

INTRODUCTION

Western Canada goose (*Branta canadensis moffitti*) nesting populations on the lower Flathead River from 1980 through 1982 were lower than those documented during the 1950's (Ball 1983). The population status appears to depend primarily on the availability of secure nest sites. Fluctuating water levels resulting from the operation of Kerr Dam can impact goose reproductive output in several ways. When water levels are extremely low, nest islands may be attached to the mainland, promoting nest destruction by mammalian predators and possibly discouraging nesting by some goose pairs. Nest flooding occurs during periods of high water levels since many geese nest below the high water mark (HWM). During the past 20 years, providing secure artificial nest sites at Ninepipe Reservoir resulted in major increases in the nesting Canada goose population (Ball 1981), and there is every reason to expect similar results on the Flathead River if nest site limitations can be remedied.

The brood rearing period is poorly understood, primarily because geese are exceptionally wary and secretive during this phase of the reproductive cycle (Ball et al. 1981). As with other waterfowl, the early brood period likely consists of extensive use of

shallow shoreline areas where animal biomass such as insects, crustaceans, and small mollusks are available to goslings. The shallow water zone on the Flathead River provides habitat for invertebrate production and is directly affected by water fluctuations. Broods have been observed using various vegetation types both directly and indirectly affected by water level fluctuations. Our purpose is to study Canada goose habitat availability and use, and relate it to the affects of fluctuations in water releases from Kerr Dam.

Specific objectives during this first contract phase, December 20, 1982 through September 30, 1983, included the following:

Nest Studies

1. Determine population impacts of providing additional secure nest sites for geese along the river.

2. Compare effectiveness of tree nest structures, stone pillar nest structures and natural sites with respect to:
   a. acceptance and nest success rates
   b. vulnerability to human disturbance
   c. vulnerability and effect of water level fluctuations
   d. cost (initial, maintenance, projected life).

3. Develop techniques and guidelines that maximize effectiveness of nest structure management programs, while minimizing costs.
   a. Experiment with nest materials to minimize deterioration and loss.
      Target: ≥ 5 year intervals between maintenance visits.
   b. Document nest activities of ducks on the river.

Brood Studies

1. Describe habitat selection by goose broods on the lower Flathead River and relate it to water fluctuations.

2. Document survival of goslings.

3. Document the location of key goose brood rearing areas.

4. Describe the vegetation characteristics of brood rearing areas.

5. Record river water levels at key brood rearing areas when broods are present and relate these levels to releases from Kerr Dam.

6. Formulate any management recommendations necessary to protect and enhance brood habitat.

STUDY AREA

The lower Flathead drainage encompasses an area of about 3900 km^2 in northwestern Montana, forming one of the state's largest rivers. The Flathead River is formed by three main tributaries originating along the west slope of the continental divide in British Columbia, Canada, and south of Glacier National Park, Montana. These three forks join and flow for approximately 40 km before entering Flathead Lake. After leaving the lake, the river flows south and then west to its confluence with the Clark Fork of the Columbia River.

Kerr Dam, a hydropower facility currently operated by Montana Power Company, is located 6.9 km below the outlet of Flathead Lake near Polson, Montana. Our study area, the lower Flathead River (Figure 11, flows from Kerr Dam **115.9** km (72 mi) to the Clark Fork River at Paradise, Montana. Approximately 110 km of the river lie within the boundaries of the Flathead Indian Reservation.

A history of glaciation dominates the landscape of the Flathead Basin. At least four major glacial advances reached the area, the most extensive pushing southward to St. Ignatius. During the last of the ice advances, approximately 25,000 years ago, a continuous ice sheet covered the Rocky Mountain Trench to the site of Flathead Lake. Southward, Glacial Lake Missoula filled western Montana valleys, held back by an enormous ice dam. About 12,000 years ago the ice dam gave way, draining the entire lake in a few days. The lower stretches of the lower Flathead River exhibit scoured canyon walls as evidence of the torrential flow. Surrounding hillsides of the middle stretches of the lower Flathead River show bend and ripple marks from lakeshore effects. In the initial 6.5 km below Kerr dam, the lower Flathead River cuts through the terminal morraine resulting from the

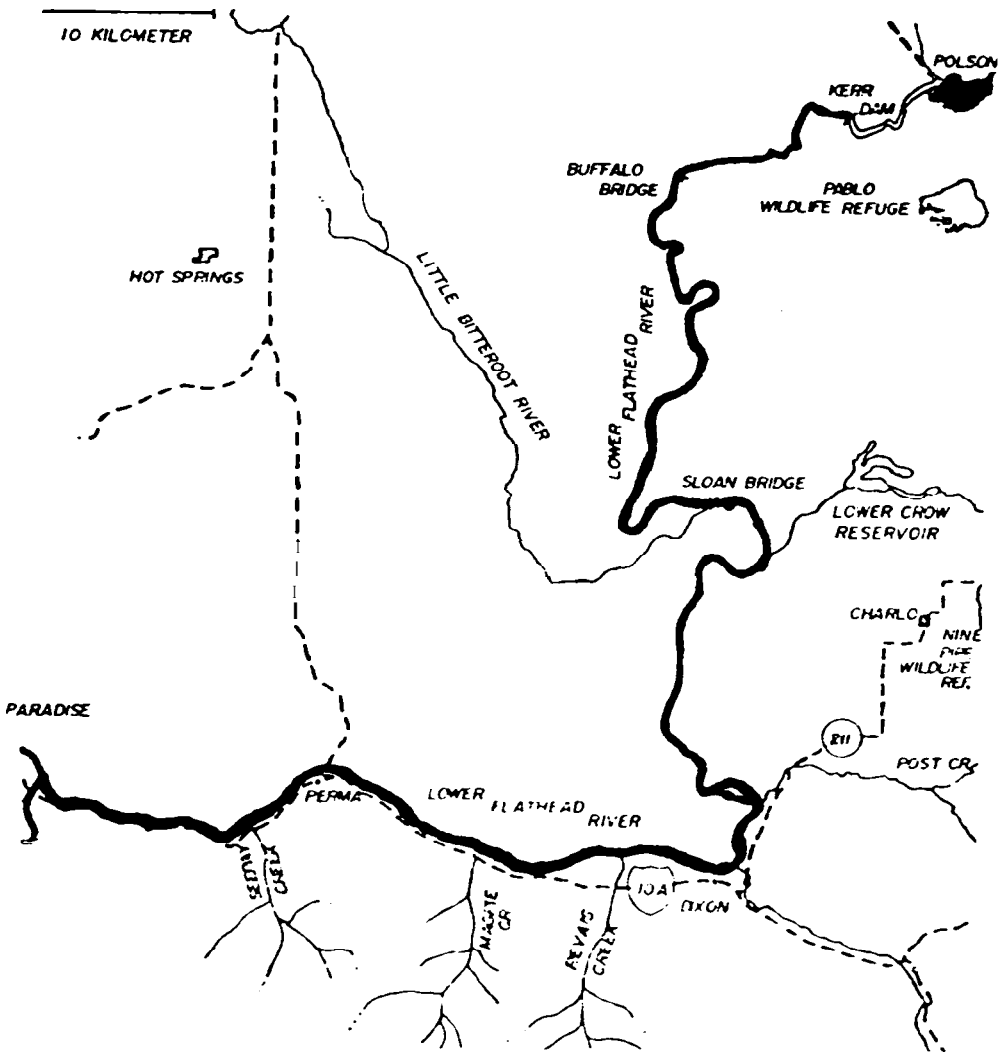


Figure 1. The lower Flathead River from Kerr Dam to the confluence with the Clark Fork River at Paradise, Montana.

glacier which formed the Flathead Lake basin (Zackheim 1983).

This initial stretch of river below the dam is characterized by a steep rocky canyon, with extensive whitewater expressing the steepest gradient (3 m/km) of the lower Flathead River. Water level fluctuations, as a result of power peaking operations at Kerr Dam, are often severe in this section, changing as much as 2 m in 3 hours (USGS, unpublished data).

The next 64 km downstream have a lesser gradient of 0.64 m/km, producing a blend of riffle and pool areas in a comparatively smooth flowing river moving about 6.5 km/hr. Fine grained lactustrine sediments characterize the river substrate as the channel flows south. Rocky mountain juniper (*Juninerus scopulorum*) and ponderosa pine (*Pinus ponderosa*) dominate the riparian vegetation of this section.

Near Dixon, Montana, the river takes a sharp bend to the west, and slows to about 5 km/hr for the remaining 45 km. The average drop of only 0.28 m/km has allowed for the establishment of many islands, backwaters, and gravel bars. The highest concentration of nesting Canada geese has traditionally been found in this area. The banks are commonly lined with red-osier dogwood (*Cornus stolonifera*), willows (*Salix*

spp.), black cottonwood (Populus trichocarpa), or ponderosa pine. Water level fluctuations are less extreme in the lower river, yet have been measured as much as 30 cm/hr at the Dixon bridge (letter dated 28 Sept., 1979, from John G. Wood, Area Manager USFWS, Billings, MT to Col. L.K. Moraski, District Engineer, U.S. Army Corps of Engineers, Seattle, WA).

METHODS

Territorial Pair Surveys

Pair surveys were conducted by boat, weekly from 15 March through 13 April. The entire study area was surveyed between 0730 and 1800 hours from the northern to southern ends. Data recorded at each goose observation were time, location, number of geese, and goose behavior. Geese were classified as indicated territorial pairs or non-breeding birds using methods similar to Hanson and Eberhardt (1971) and Allen et al. (1978). Pairs of geese were counted as indicated territorial pairs if they were at least 10 m from any other geese when observed. Single geese so spaced were considered to represent the male of a nesting pair, and hence were also counted as an indicated territorial pair. Flocked geese (> 2 birds) were considered non-breeding birds.

Aerial surveys were conducted weekly from 17 March through 14 April. Weather permitting, surveys were conducted in the morning (approximately 0900 to 1030 hours) and afternoon (approximately 1330 to 1500 hours). Surveys were flown from the northern to southern ends of the study area. Indicated territorial pairs and non-breeding geese were defined the same as for surveys by boat.

Paired t tests (Sokal and Rohlf 1981:359) were used to test the hypothesis that there was no difference in the number of indicated territorial pairs observed on boat and aerial surveys. Tests of equal variance (Sokal and Rohlf 1981:l90) were used on all data comparing morning and afternoon aerial surveys. If variances were not significantly different, t tests (Sokal and Rohlf 1981:228) were used to test the hypothesis that there was no difference in the mean number of indicated pairs, single, paired, and non-breeding geese on morning and afternoon aerial surveys.

Artificial Nest Structures

Two artificial tree nest structures were located within a systematically selected 0.6 km segment of the river, approximately every 4.0 km. All nest structures were located in trees specifically selected to

maximize structure life and visibility of structures to geese. Trees selected for structure placement were: ponderosa pine, >30 cm in diameter at breast height (DBH); "healthy" appearing trees lacking dead tops, within 15 m of the HWM, relatively isolated from other trees; trees with roots that were not severely undercut by erosion; positioned at least 100 m from other artificial goose nest structures, heron and osprey nests, and previous years goose nests; and situated away from human access points. Structures were placed from 6-13 m above the ground and facing the river. One of 2 nest materials (expanded shale or ponderosa pine bark) were randomly assigned to each structure of the pair. Characteristics recorded at each nest tree included DBH, height, nest height, and distance to HWM.

Goose Production Estimates

Production estimates were obtained from intensive ground searches for nests on all islands of the study area. Previous studies (Geis 1956, Ball 1981) indicated most nesting by Canada geese on the study area occured on islands; therefore, mainland areas were not searched. For each nest, data recorded were location, number of eggs laid, number of eggs hatched, stage of egg development, nest type, and nest fate. Egg

development was classified using methods similar to Westerskov (1950). Nest fate was determined by classifying egg shell fragments as hatched or depredated using methods similar to Reardon (1951). A nest was considered abandoned if all the eggs were unbroken in the nest and cold. Nests destroyed by flooding were recorded. To avoid missing nests, we attempted to visit all nests at least twice, before and after hatching. Nest success was calculated as the percent of total nests of known fate that hatched at least one egg (Geis 1956) Incubation initiation was calculated by backdating from the date the nest was found, using the stage of egg development. Initiation of egg laying was determined by backdating seven days from the date of incubation initiation (Hanson and Eberhardt 1971). Hatching dates were calculated using an incubation period of 28 days (Hanson and Eberhardt 1971, Bellrose 1978:160).

Vegetation Analysis

Based on an initial reconnaissance cover type mapping of the entire study area, the river was divided into 6 physiographic units (Figure 2) and 12 cover types. Within each physiographic unit, 10 equidistant lines were drawn to provide random sampling sites for repetitious cover types. Along

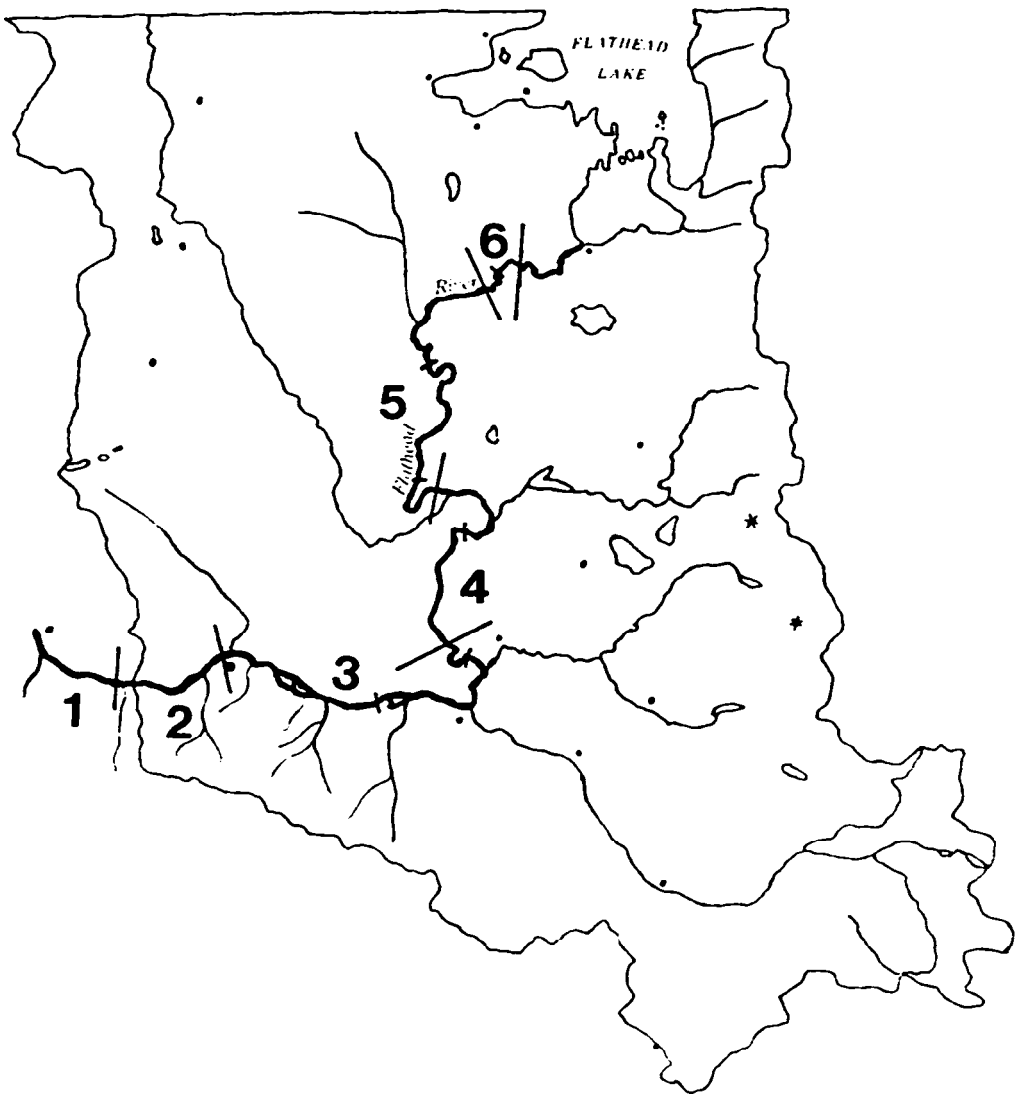


Figure 2. Six physiographic segments of the lower Flathead River study area.

these lines, examples of different cover types were selected when representative homogeneous vegetation covered at least 0.04 ha. When a cover type was not sufficiently well represented by this randomly

selective stratification process, other sites were subjectively chosen for sampling.

In each community selected, a 25 m transect line was laid out parallel to the river in homogeneous vegetation, attempting to avoid ecotones. Along this transect the following measures were made (Figure 3).

1. Ten 1 m^2 plots were placed at 5 m intervals on both sides of the line within which the canopy cover (by species) of herbaceous plants was recorded in the following cover classes:

+	<l%
1	1-5%
2	5-25%
3	25-50%
4	50-75%
5	75-95%
6	95-100%

   The ground surface coverage of rock, plant litter, bare ground, and bryophytes was also recorded in these classes.

2. Ten similar 2 m^2 plots were used to record canopy coverage of low shrubs and small trees (<2 m height). The number of tree seedlings (<20 cm height) was also recorded in these plots.

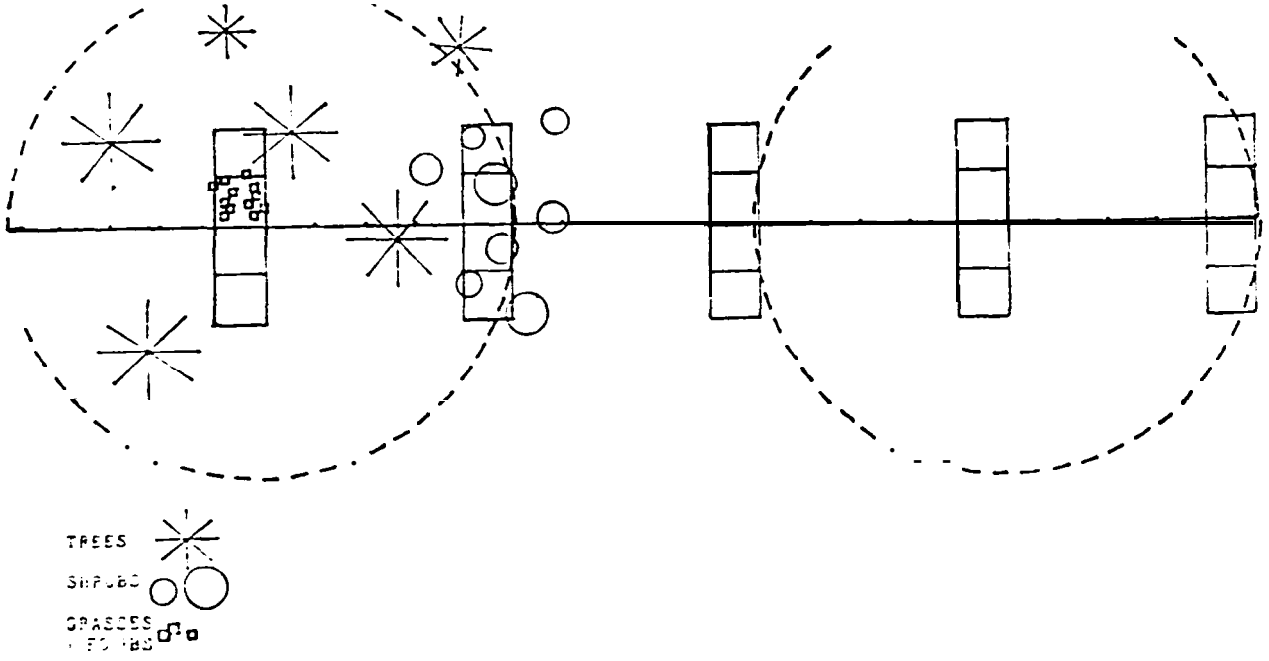


Figure 3. Vegetation sampling scheme Ten 1 m^2 and 2 m^2 plots were placed at 5 m intervals along a 25 m transect line, and were used to record frequency and cover of herbaceous and shrubs vegetation. Trees were counted and measured within 2 circles (5.0 m radius) centered at 5 and 20 m points.

3. The average height of graminoids (grasses and grass-like plants), forbs, and shrubs were recorded for each plot, and the phenology of each plant species was recorded.
4. Canopy cover (by species) of shrubs and trees was recorded by the line-intercept method (Canfield 1941) along the entire 25 m line.
5. Total overhead canopy cover was also recorded at 5 m intervals using a densiometer (a small convex gridded mirror).
6. Tree density and the average DBH were recorded for major tree species within 2 circular plots with a radius of 5.0 m located at either end of the line. The number of stumps and logs was also recorded in these 2 circles.
7. Vertical vegetation cover was measured from 5, 10, and 15 m distances at 4 height levels (0.0-0.3 m,0.3-1.0 m, 1.0-2.0 m, 2.0-3.0 m) using a checkered density board, 0.5 m X 3.0 m (de Vos and Mosby 1969:142, Noon 1981).
8. Various other site characteristics were recorded such as: slope (in %), aspect, configuration, landform, edge type, shape, adjacent community cover type, evidence of use by livestock and/or wildlife, evidence of past burning activity, USFS

Habitat Type (Pfister et al. 1977, Mueggler and Stewart 1980), and USFWS Wetland Classification (Cowardin et al. 1979).

9. Location characteristics were recorded such as UTM (Universal Transverse Mercator) coordinates, river km (RK) (Hydrology and Hydraulics Committee 1976) to the nearest 0.16 km, and the distance to and above the HWM.

10. Each site was permanently marked with a steel post and metal tag. The compass bearing taken on the transect line will allow resampling if desired.

Major species of aquatic plants were recorded. At least one representative of each vascular plant species encountered was collected. Plant names follow Hitchcock and Cronquist (1973). Plants which were unidentifiable in the field were also collected and pressed to be identified during the winter.

Nest and Brood Site Analysis

A quantitative study of the vegetation density, structure and general physiography of brood areas and nest sites was begun this field season. The eventual outcome of this study will be a multivariate comparison of sites used by nesting and brooding geese to random sites from islands and representative areas along the river.

Brood sites received a slightly more detailed investigation than nest sites, as described below, because they generally encompass more varied and larger areas. At each site designated as a brood location (from radio-telemetry or from incidental observations), a 314 m^2 circular plot was located. At each plot, the vegetation cover type, dominant plant species, directional aspect, percent slope, lateral and horizontal distance to the HWM, the nearest different cover type, and the distance to the change in cover type, were recorded. The topography of a 60 m profile (perpendicular to the river) from the water's edge through the plot was described, and/or fit to one of five patterns. Vegetation density, expressed as percent vertical cover, was estimated using a density board (de Vos and Mosby 1969:142, Noon 1981) divided into four height intervals: 0.0-0.3 m, 0.3-1.0 m,1.0-2.0 m, and 2.0-3.0 m. This was placed at the 4 points where transect lines running in each of the 4 cardinal directions intersected the outer circle of the plot.

Overstory coverage was recorded at each of these 4 cardinal points and at the plot center using a densiometer. The average height of the herbaceous vegetation layer and the shrub layer (within 1.0 m of

each point) was also recorded at each of the 4 cardinal points. Each of these values were averaged for the entire plot.

The line intercept method was used to determine canopy coverage along a 20 m transect line running N-S through the center of the plot. Coverage of tree, shrub, forb, or grass canopy, as well as litter, bare ground/rock, and water, was recorded to the nearest decimeter. A photo was also taken at each plot. Similar plots with the same measures will be placed at random points within 60 m of the river's edge (high water mark) to allow a measure of availability of habitat features.

Measures at nest sites were similar to brood sites, with the following differences. The plot size was reduced to approximately 80 m^2 in area with the nest considered the plot center. The density board was held at a 5 m distance from the nest in each of the 4 cardinal directions, and vegetation heights were also taken from these points. The overstory canopy coverage was read with a densiometer held at 1 m height at these 4 points, and at the nest level in the plot center. The line intercept was read along a 10 m line running N-S through the plot center. The distances to and above the HWM were measured from the

nest itself. Identical measures were made at random sites on islands, at a random distance within 60 m of the HWM.

Brood Habitat Use and Movements

The brood period was considered the time interval between hatching and fledging. Brood data were obtained using radio-telemetry. Transmitters (configuration RB5, Telonics, Mesa, AZ) were attached to plastic Canada goose neck collars (Craven 1979), and the total transmitting package weighed approximately 60 g. Locations were obtained using ground triangulation or by visual observations after a single bearing was taken (Cochran 1980:517).

At intensively used brood areas, continuous observations of broods were made. The amount of time broods spent in different cover types and performing various activities was recorded. Activity types were: 1) loafing, 2) feeding, 3) flying, 4) swimming, and 5) preening. Brood locations were plotted every 30 minutes during the observation period to objectively identify the use of cover types and to delineate the brood area. The minimum area method of home range calculation (Mohr 1947) was used to graphically delineate the brood area.

Brood movements were determined by calculating the straight-line distance between the 2 locations farthest apart during the brood period. These data should be considered maximum brood movements.

Post-fledging Movements and Distribution

Maximum post-fledging movements were determined by calculating the straight-line distance between the 2 locations farthest apart from fledging to 30 September. Post-fledging distribution was determined from locations of radio-marked geese and aerial censuses performed during September.

RESULTS AND DISCUSSION

Territorial Pair Surveys

The number of indicated territorial pairs observed on boat surveys remained relatively constant throughout the survey period (Table 1). The number of single geese observed increased through time while the number of pairs declined. Single geese were assumed to be males standing guard in the vicinity of their nesting hens as described by Bellrose (1978:160). Therefore, we expected the number of single geese to increase and the number of pairs to decrease as more females began to incubate.

Table 1. Counts from Canada goose pair surveys conducted by boat, lower Flathead River, Montana, 1983.

Date	Singles	Pairs	Indicated a Terr. Pairs	Non-Breeders	Total Geese
3/15	**4**	**64**	**68**	**84**	**216**
3/23	**9**	**52**	**61**	**115**	**228**
3/29	**19**	**42**	**61**	**19**	**125**
4/5	**24**	**45**	**69**	**61**	**175**
4/13	**25**	**45**	**70**	**33**	**148**

[a] No. Indicated Territorial Pairs = No. Singles + No. Pairs

There was no significant difference ($P>0.05$) between the number of indicated pairs observed during boat ($\bar{x}=67.0$, SD=4.1), and morning aerial ($\bar{x}=71.5$, SD=6.4) surveys (Table 2) Other studies have found aerial surveys an unsuitable index of Canada goose breeding populations. Tacha and Linder (1978) found aerial circling surveys of Canada goose breeding populations were unsuitable because of significant variation in estimates. Hanson and Eberhardt (1971) found aerial surveys identified only 63% of the territorial pairs observed on ground surveys. Geis (1956) noted that aerial counts did not give an accurate estimate of the number of breeding geese. The number of indicated pairs observed on both boat and aerial surveys convert to 1.3 pairs per nest. This is similar to the 1.2 pairs/nest observed by Hanson and Eberhardt (1971) and identical to the ratio observed by Ball et al. (1981).

The number of indicated pairs was significantly greater on morning than afternoon aerial surveys ($P<0.05$)(Table 3). The number of single and non-breeding geese observed was also significantly greater in the morning than the afternoon ($P<0.05$), but the number of pairs was not significantly different ($P>0.051$. We hypothesize that geese classified as singles and non-breeders were leaving the river in the

Table 2. Comparison of Canada goose pair surveys conducted from a boat and during morning aerial surveys, lower Flathead River, Montana, 1983.

Date	No. Indicated Territorial Pairs	
	Boat Surveys	Morning Aerial Surveys
3/15	68	--
3/17	--	67
3/29	61	--
4/1	--	68
4/5	69	--
4/7	--	70
4/13	70	--
4/14	--	81
	$\bar{x} \pm$ SD 67.0 $\pm$ 4.1	

Table 3. Counts from Canada goose pair surveys conducted from a plane, lower Flathead River, Montana, 1983.

Date	No. Singles		No. Pairs		No. Indicated Territorial Pairs[a]		No. Non-Breeders		
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Total
3/17	8	---	59	---	67	---	38	---	167
3/25	---	9	---	26	---	35	---	3	67
4/1	27	---	41	---	68	---	30	---	139
4/1	---	14	---	26	---	40	---	21	87
4/7	36	---	34	---	/o	---	28	---	132
4/8	---	15	---	33	---	48	---	14	95
4/12	39	---	40	---	78	---	26	---	144
4/12	---	18	---	43	---	61	---	30	134
4/14	41	---	40	---	81	---	37	---	158
4/14	---	23	---	38	---	61	---	19	118
x + S D	30.0+13.4	15.8+5.2	42.9+9.5	33.2+7.5	72.8+6.3	49.0+11.9	31.8+5.4	17.4+9.9	

[a]No. Indicated Territorial Pairs = No. Singles + No. Pairs

afternoon, possibly to feed. Other studies have noted territorial defense by Canada geese was at highest levels during the pre-laying and laying periods (Cooper 1978, Akesson and Raveling 1982). In our study, the similarity of goose pairs observed between morning and afternoon aerial surveys may be a result of increased territorial defense during the pre-incubation period resulting in the need for both geese of the pair to remain on their territory (paired goose observations were assumed to represent pairs in which the female had not begun incubation).

Experiments concerning boat and aerial goose territorial pair surveys should continue. The age structure of the goose population likely changes somewhat from year to year, and because not all Canada geese breed until their third year (Craighead and Stockstad 1964), the ratio of indicated territorial pairs per nest likely also varies between years; the extent of this variation must be known before managers can interpret the results of pair surveys. Surveys should continue to determine if the ratio of pairs per nest varies significantly between years. Other reasons for continuing pair surveys include to increase the sample size for each survey method, to determine if radio-marked nesting geese are leaving the study area during the afternoon, and to determine

if patterns in the 1983 data hold between years.

Artificial Nest Structures

Eighteen artificial tree nest structures were placed throughout the northern 37 km of the study area prior to the 1983 nesting season. This section of the study area has had low goose nesting densities in the past (Table 4) which was why we selected this area to begin erecting structures. From 1980-1982, 3 to 4 goose nests at natural sites were located in this section. During 1983, 9 nests were located in this area; 3 of these 9 nests were in our recently placed structures. Other studies have noted artificial nest structures being readily accepted by nesting Canada geese (Yocum 1952, Craighead and Stockstad 1961, Brakhage 1965).

Fifty-two artificial nest structures were placed in trees along the entire study area during 1983. Characteristics of nests and trees used for structure placement are given in Appendix 1. We will monitor use of these artificial structures to determine if use increases through time and if geese are shifting from natural ground nest sites to elevated artificial nests.

Goose Production Estimate

Nest numbers on the lower Flathead River from 1980-1982 were lower than those observed in the 1950's

Table 4. Number of Canada goose nests in the northern 37 km of the lower Flathead River study area, Montana 1980-1983.

Year	No. Nests
1980	3[a]
1981	4[a]
1982	4[a]
1983	9

[a] From Ball, I.J. (1980-1982), unpublished data.

(Table 5). Nest numbers increased from 36 in 1982 to 53 in 1983.

The apparent population increase in 1983 may not be as dramatic as it first appears. Pair and nest surveys were more intensive in 1983 than in previous years, and we estimate that approximately 4 nests were found that may have gone undetected previously. This is primarily a result of several goose nests located in red-tailed hawk *Buteo jamaicensis* and great blue heron (*Ardea herodias*) nests which we located on aerial surveys and would have been very difficult to observe from a boat. In addition, 3 of our artificial tree structures were used which were unavailable in previous years.

The 68% nesting success observed in 1983 was substantially higher than success rates in 1980 and 1982, and comparable to the relatively high nesting success of 74% in 1981 (Table 5). Ball (1981) noted the 53% nest success in 1980 was "probably below the level at which viable populations can be maintained." Hanson and Eberhardt (1971) reported a mean nest success of 71%. Bellrose (1978: 161) noted average nest success of most studies was approximately 70%.

In 1983 egg laying began the first week in March and peaked between the last week in March and first

Table 5. Number of nests and nesting success of Canada geese, lower Flathead River, Montana, 1953-1960 and 1980-1983.

Year	No. Nests	Nesting Success (%)
1953-1960 mean[a]	46	65
1980a	24	53
1981[a]	32	74
1982a	36	43
1983	53	68

[a] Data from Ball (1983).

week in April (Figure 4). Initiation of incubation peaked the first and second weeks of April (Figure 5), and hatching peaked the last week in April through the first week in May (Figure 6). The earliest known hatching date was 23 April and the latest was 19 May. Dates of nest initiation observed in our study are similar to those observed by Geis (1956) for Flathead Lake, and Hanson and Eberhardt (1971) for eastern Washington.

Canada geese heavily used islands for nesting on our study area. Seventy-four percent of the nests were island ground nests (Table 6). The importance of islands to nesting geese is further indicated by nest distribution on the study area. Eighty-three percent of the nests were located in the southern one-half of the study area where 89 percent of the islands occur. The importance of islands to nesting geese on the lower Flathead River has been noted by others (Geis 1956, Ball 1981).

Writing of the lower Flathead River, Geis (1956:410) noted "heavy water releases at Kerr Dam in May and June usually result in flooding of the islands and bottomland meadows." Fifteen (38%) of the island ground nests on our study area were below the HWM during 1983.. These 15 nests comprised 28% of the

Figure 4. Frequency distribution of nest initiation by Canada geese, on the lower Flathead River, Montana, 1983.

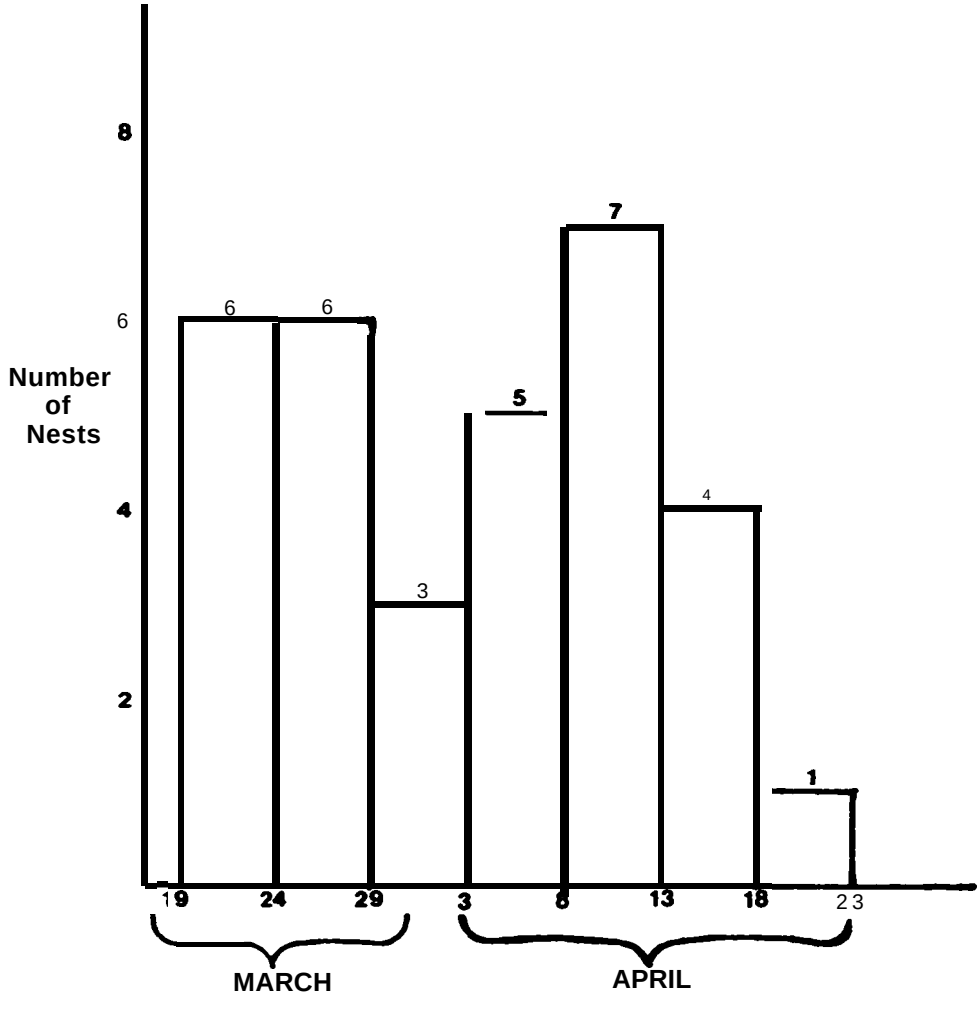


Figure 5. Frequency distribution of incubation initiation by Canada geese, on the lower Flathead River, Montana, 1983.

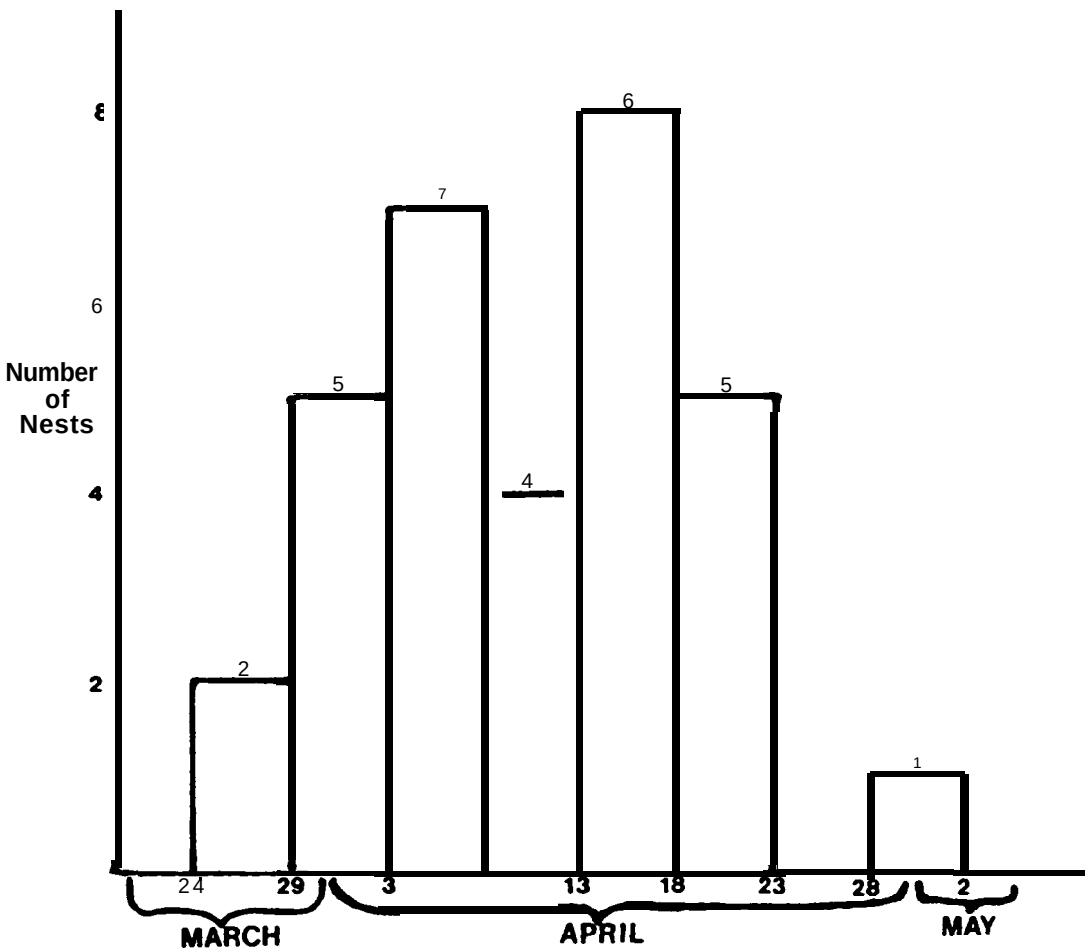


Figure 6. Frequency distribution of Canada goose hatching dates, on lower Flathead River, Montana, 1983.

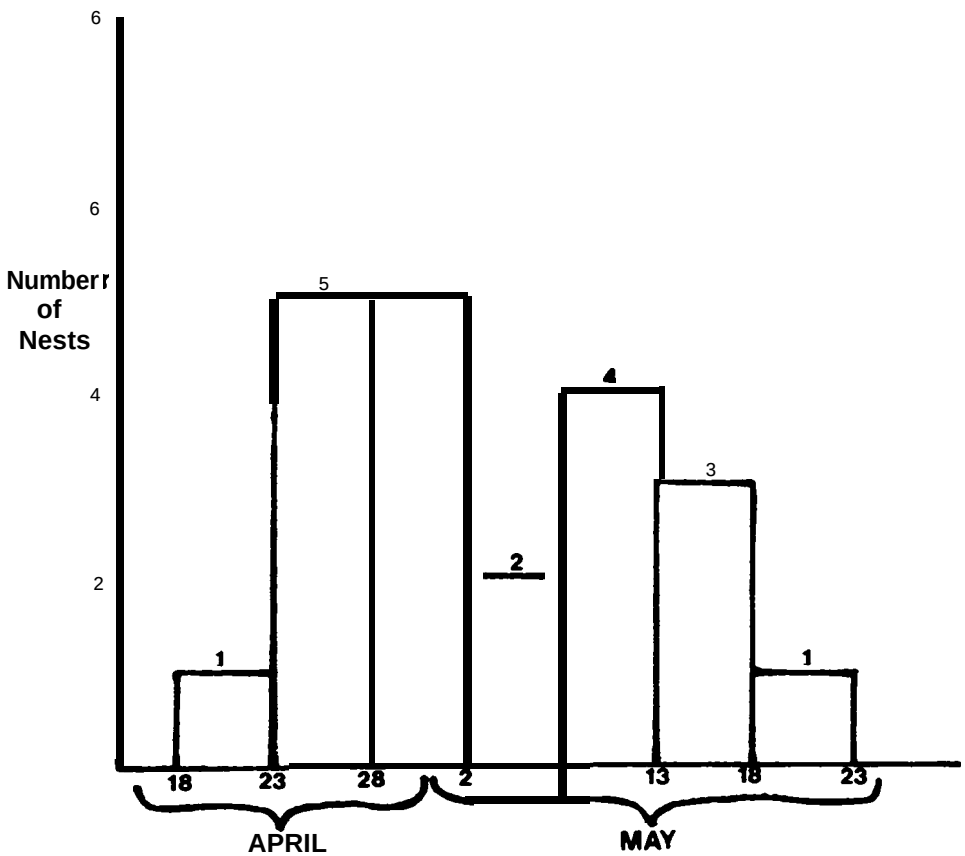


Table 6. Canada goose nest types, lower Flathead River, Montana, 1983.

Nest Type	Number	% of Total Nests
Island Ground Nests	39	74
Osprey, Heron, and Hawk Nests	7	13
Artificial Nesting Structures	5	9
Other	2	4
Total	53	100

nesting goose population on the lower Flathead River in 1983. Nests below the HWH are potentially vulnerable to destruction by flooding. Figure 7 shows discharge rates from Kerr Dam during the 1983 goose nesting season. We observed river water levels reaching the HWM as a result of the dramatic increase in discharge rates from 29 May through 2 June. Although these discharge rates did occur after the last known hatching date, these data do indicate the potential for nest flooding and serious impacts on the nesting goose population.

Low water levels during the nesting period can result in serious predation rates and/or discouragement of nesting by allowing predators access to nesting islands (Sherwood 1968, Vermeer 1970, Ball et al. 1981). Our observations indicate discharge rates from Kerr Dam below 6000 cfs may expose some nesting islands to access by predators. During March and April, minimum discharge rates were commonly below 6000 cfs (Figure 7) which illustrates a potential problem between nesting geese and low water levels on the lower Flathead River.

No duck nests were located on nest searches. Incidental observations indicate that the common merganser (*Mergus merganser*) was the primary duck species nesting on the river.

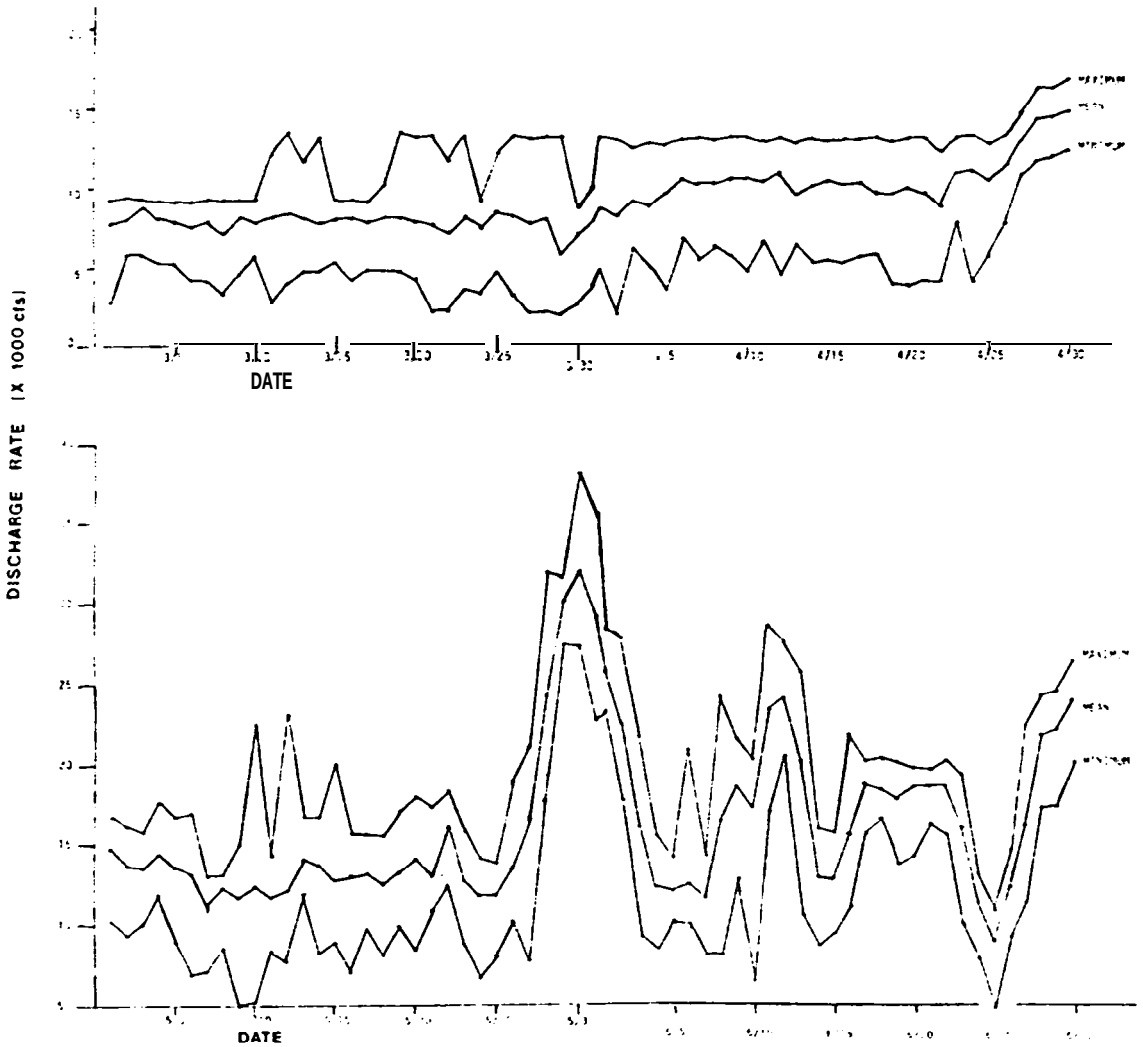


Figure 7. Maximum, mean, and minimum discharge rates[a] from Kerr Dam during March, April, May, and June 1983, lower Flathead River, Montana.

[a] Unpublished USDI - Geological Survey data from lower Flathead River gage station No. 123700C located below Kerr Dam at river km 110.4.

Vegetation Analysis

In an initial attempt to categorize the riparian and adjacent upland plant communities of the lower Flathead River, 12 cover types were selected and defined (Table 7). These were used for habitat descriptions, and for stratification of vegetation sampling sites. The cover types were designed to be relatively exclusive categories, successively defined by the criteria listed, and were chosen to merge easily with other existing or developing riparian vegetation classification systems (Warner 1979, Batchelor et al. 1982).

The riparian zone is defined, for our purposes, as the area bordering an aquatic ecosystem, including areas with above normal soil moisture due to the proximity of an aquatic system (Warner 1979). Adjacent upland communities are normally much drier and less varied than their riparian counterparts; however, the distinction is often difficult to define in the field, because upland communities can be found within a few meters of the river, and riparian zones may be far from the main river channel. Upland communities can usually be distinguished by their vegetative composition--similar to areas that are far from the river and independent of its direct influence.

Table 7. Cover types used for stratifying vegetation sampling sites on the lower Flathead River study area, Montana.

Cover type	Requirements
Vegetated types	
Coniferous forest	At least 20% canopy coverage of coniferous trees
Deciduous forest	At least 20% canopy coverage of deciduous trees
Tall shrub	At least 30% canopy coverage of tall shrubs (>1 m)
Short shrub	At least 30% canopy coverage of short shrubs (<1 m)
Short grass	At least 30% canopy coverage of short grass (<0.5 m)
Tall grass	At least 30% canopy coverage of tall grass (<0.5 m)
Forb dominated	At least 20% vegetative cover dominated by forbs
Cropland	Tilled within the past 10 years
Non-vegetated types	Less than 20% vegetative cover
Gravel bar	Composed of particles >2mm diameter
Sand bar	Composed of particles <2mm diameter
Cliff	Area with slope >45%
Water	

The field season for sampling vegetation composition of the lower Flathead River is approximately mid-May through September, possibly extending into October. In the past field season 68 transects were established throughout the study area, with their random placement stratified by both river segment and cover type (Table 8). Much of the data collected will not be assimilated until mid-winter, and are not available for this report. General descriptions of each upland and riparian cover type will be modified as the system is refined with additional sampling and data analysis. Data used in the following descriptions are presented in Appendix 2.

Coniferous forest. This cover type is most frequently encountered in the upper half of the lower Flathead River. Riparian sites sampled were usually dominated by ponderosa pine (*Pinus ponderosa*) and/or Rocky Mountain juniper (*Juniperus scopulorum*), while upland sites sampled were all dominated by Douglas fir (*Pseudotsuga menziesii*).

Riparian examples of the coniferous forest type were found on straight or undulating topography with a highly variable slope (0-80%, $\bar{x}$ = 22%). Most communities sampled were oblong or strip-shaped, with a distinct change in composition along their edge.

Table 8, Segment length and number of sites and cover types sampled per segment on the lower Flathead River study area, Montana, 1983.

River Segment	Segment length (km)	Number of samples	Number of cover types sampled
1	6.4	5	4
2	11.3	15	6
3	33.1	16	6
4	21.6	12	5
5	36.7	12	5
6	6.8	8	4
Total	115.9	68	

All sites sampled were within 3.5 m above the HWM, and over half the sites were within 1.0 m of the river (HWM). The distance inland varied from 0 to 90 m, averaging 14 m from the HWH. Cattle use was evident in over half the sites studied. The riparian examples of this type were classified as "forested wetland" (Cowardin, et al. 1979).

Upland examples of this type were found on steep north or northwestern exposures averaging 52% slope (ranging from 30-70%). These communities were more often round than strip-shaped, but also had a distinct edge, commonly neighboring a big sagebrush (*Artemisia tridentata*) community. Sampled sites were from 20 to 135 m above the river (HWM), and from 46 to 800 m inland.

Deciduous forest. This cover type was found throughout the study area with the exception of segment 6 (near the dam). All sites sampled in this type were riparian, dominated by either black cottonwood (*Popullus trichocarpa*) or aspen (*Populus tremuloides*). The typical site was on a bench or beach area, with a concave to slightly undulating surface and negligable slope. Sampled communities varied from round to strip-shaped, with a distinct change to the adjacent cover type which was usually tall shrubs or coniferous

forest. On the average, sites were 0.7 m above the HWM (varying from 2.0 m above to 2.0 m below) and were 40 m inland (ranging from 18 m toward the channel to 100 m inland).

Cattle grazing was noticed in nearly half the sites, and evidence of use by white-tailed deer (Odocoileus viginianus), beaver (Castor canadensis), rabbit (Sylbilagus spp.) and ring-necked pheasant (Phasiznus colchicus) were recorded in this type. Depending on maturity of the stand, this type was classified as either "forested wetland" or "scrub-shrub wetland" (Cowardin et al. 1979).

Tall shrub. This cover type was also only sampled in the riparian zone this year. All sites were in segments 2, 3 and 4 on the lower part of the river, where this is the most common type. Three species were dominant in these samples: red-osier dogwood (Cornus stolonifera), Douglas hawthorn (Crataegus douglasii), and sandbar willow (Salix exgua).,Sampled sites were on straight, undulating or concave topography, on benches or banks, with an average of 5% slope. Those sites dominated by red-osier dogwood had no measurable slope. The edge of communities sampled varied, with some hawthorn and red-osier dogwood sites displaying a gradual change of type, while all sandbar willow

stands were distinctly bordered by another cover type.

These sites were frequently below high water level, ranging from 1.0 m above to 1.0 m below HWM ($\bar{X}$=0.lm>. The average horizontal distance of transects from the HWM was 7.0 m toward the channel. Very little evidence of livestock use was noted, but several sites in this type had white-tailed deer and beaver sign. This and the following shrub type were classified as "scrub-shrub wetlands" (Cowardin et al. 1979).

Short shrub. This type was found throughout the study area, most frequently in upland communities adjacent to the riparian zone. The 2 riparian sites sampled were dominated by sandbar willow and by western snowberry (*Sumphoricarpos occidentalis*). Upland sites were dominated by big sagebrush and bitterbrush (*Purshia tridentata*).

Riparian short shrub sites were on straight or undulating beach or bench landforms with little (4%) or no slope. Both sites were oblong shaped with distinct edges, adjacent to Rocky Mountain juniper forests.

Upland sites sampled were usually on undulating or concave ground, on benches or hillsides. The average slope was 26% with a range from 2 to 58%.

These round or oblong shaped communities often had a gradual border with the adjacent communities, which were frequently ponderosa pine or forb dominated communities. The height above the HWM varied from 5 to 130 m. Evidence of past use by cattle was occasionally evident, and deer sign or sightings were frequent.

Short grass. To simplify terminology, the short grass type includes all short graminoids. This type is relatively infrequent, but is found scattered throughout the study area. One riparian and 4 upland sites were evaluated this field season. This type can be easily confused with the forb dominated cover type on aerial photographs, due to infestation of range weeds (mostly forbs) in the area. Several dominant species were found in examples of this type, the most frequent being Canada bluegrass (Poa cop*ressa*) and Kentucky bluegrass (Poa *prat*ensis)..Other species include rough fescue (*Festuca scabre*lla). cheatgrass (*Bromus tector*um), sand dropseed (*Aristid*a long*iseta*), and needle-and-thread grass (Stipa comata).

The one riparian site sampled was dominated by Kentucky bluegrass (Poa *pratensis*), an introduced pasture species which appears to be quite tolerant of temporary spring flooding. This site was on a concave

bench with a 5% slope, probably an old stream channel. Although it was 46 m inland, it was only 0.5 m above the apparent HWM. The border between the strip-shaped grass community and adjacent black cottonwood and aspen forests was distinct. This site was classified as a "persistent emergent wetland,, (Cowardin et al. 1979).

Upland examples of this type were found on undulating or convex benches and hillsides. Bench sites varied from 0 to 8% slope, while the hillside site had a 35% slope. These communities were round or oblong, with a gradual or distinct edge bordering a coniferous forest. The height above the HWM varied from 2.0 to 40.0 m (averaging 13.8 m), while the horizontal distance averaged 69 m. Recent or past use by livestock was evident in all examples studied.

Tall grass. To simplify terminology, the tall grass cover type includes all graminoids, not only true grasses All sampled stands cf this type were in the riparian zone, in the lower 4 segments of the river. Species dominating these stands included reed canary grass (Phalaris arundinaceae) bulrush (Scirpus acutus), spike-rush (Eleocharis spp.), and sedges (Carex spp.). Sites were variable, found on either straight, undulating or concave surfaces, on

beaches, benches, and gentle to moderately steep slopes. The average slope was 7%, with a range from 0 to 34%. Shape of communities also varied from round or oblong to linear, but always had a distinct edge. Adjacent communities were mostly tall shrub types, with an occasional deciduous or coniferous forest cover type represented. All sites sampled were below the HWH ($\bar{X}$=-1.1 m) ranging from 0.3 to 3.0 m below. Evidence of occasional use by cattle, deer and beaver was observed. Examples of this type were also classified as "persistent emergent wetlands" (Cowardin et al. 1979).

Forb dominated.This is the most widespread and highly variable type studied, with sampled sites in all 6 segments of the lower Flathead River. Riparian stands sampled were mostly on gravel bars, in backwaters, or on gently sloping banks. Dominant species of these riparian sites were Columbia River mugwort (*Artemisia Lindleyana*) common dogbane (*Apocynum cannabinum*), horsetails (*Equisetum* spp.), nodding onion (*Allium cernuum*) blanket-flower (*Gaillardia artistata*), and tickseed (*Coreopsis atkinsoniana*). Upland sites of this type were mostly weed infested rangeland dominated by spotted knapweed (*Centaurea maculata*) and cinquefoil (*Potentilla gracilis*).

Riparian sites representing this type were commonly on straight ground with a negligible slope ($\bar{X}$= 3% on beaches, benches and in backwater sloughs. Communities sampled were either oblong or strip-shaped, usually with a distinct edge bordering on a variety of shrub, forest, or non-vegetated cover types. All sites sampled were 0.5 to 2.5 m below the HWM, averaging 1.5 m below. Little disturbance from livestock was observed, and the only wildlife sign noted was a large black bear (*Ursus americanus*) track in the middle of a transect. This type was classified as either "persistent wetland, (sites with *Equisetum* spp.), or "non-persistent wetland,, (Cowardin et al. 1979).

The two upland sites examined were west facing, one with a slope of 12% and the other a level bench. Both were oblong in shape and were bordered by juniper forests. The sites were about 5 m above and 44 m inland from the river (HWM). Both sites appeared to have been heavily grazed in the past.

Vertical vegetation cover of different cover types. The cover types described here were selected and defined on the basis of dominant plant form and structure; therefore, it is not surprising that there is considerable difference in the amount and position

Table 9. Average vertical vegetation cover of riparian and upland samples of cover types, lower Flathead River, Montana, 1983.

Distance:		5 m				10 m				15 m			
Height Level:		0-.3	.3-1	1-2	2-3	0-.3	.3-1	1-2	2-3	0-.3	.3-1	1-2	2-3
Cover type:													
Coniferous Forest	R[a]	57	44	36	32	72	74	68	67	84	80	78	77
	U[b]	35	12	21	23	80	50	63	65	93	84	92	88
Short Shrub	R	87	56	0	0	100	79	2	0	100	100	2	0
	U	64	49	28	20	83	69	32	20	99	83	66	55
Short grass	R	53	3	0	0	100	11	0	0	100	23	0	0
	U	28	5	1	0	42	6	0	0	50	18	0	0
Forb dominated	R	26	5	0	0	37	10	4	0	49	15	5	0
	U	40	0	0	0	60	6	0	0	70	35	0	0

[a]R = riparian

[b]U = upland

Table 10. Average vertical cover of vegetation in each cover type, lower Flathead River, MT, 1983.

Distance:	5 m				10 m				15 m			
Height Level:	0-.3	.3-1	1-2	2-3	0-.3	.3-1	1-2	2-3	0-.3	.3-1	1-2	2-3
Cover type:												
Coniferous forest	52	37	33	31	73	69	67	67	86	81	81	79
Deciduous forest	70	50	31	35	90	79	48	58	97	91	58	63
Tall shrub	93	78	74	71	97	92	97	69	98	96	99	85
Short shrub	71	51	20	14	88	72	23	14	99	88	48	39
Short grass	33	5	0	0	53	7	0	0	60	19	0	0
Tall grass	89	33	1	0	99	43	7	0	100	52	6	0
Forb dominated	27	4	0	0	39	9	3	0	50	17	4	0

of vertical cover between types. These data can be used as an index to available hiding cover for wildlife (Noon 1979). Four levels were measured at three distances. The lowest level (0.0-0.3 m) was measured as an index to the amount of hiding cover available to geese on the ground.

Where data allowed comparisions between upland and riparian sites of the same cover types, riparian sites were more dense than upland sites in the lower two levels of the shrub and grass types, but less dense than the upland sites of the coniferous forest type (Table 9).

Riparian and upland sites were combined for a comparison of average vertical cover between cover types (Table 10). The tall shrub cover type provided the densest vegetation at all height levels observed. At a 10 m distance this type provided nearly complete visual obstruction, with an average of 90% cover at the lower three levels, and an average of 69% at the upper level. Deciduous and coniferous forest cover types were the next densest types. Comparing forest types, greater density was observed below 1.0 m in the deciduous forest type; however, coniferous forests had greater density above the 1.0 m level. The short shrub cover type was intermediate in cover between

forest types and the tall grass type, providing dense cover (>70%) below 1.0 m (at 10 m distance), but relatively sparse cover (<25%) above 1.0 m. The tall grass type produces very dense cover (nearly 100%) at 10 and 15 m distances in the lowest level (0.0 - 0.3 m), moderate cover (>30%) in the next level, and very little cover (<10%) above 1.0 m. Short grass and forb communities provided similar vertical cover, both displaying moderate cover (approximately 30%) in the lowest level only. Riparian examples of short grass were slightly higher than other grass or forb sites, and in no case was there any significant cover above 0.3 m for either cover type.

In summary, at a short distance (5.0 m), tall grass and tall shrub communities apparently offer the most hiding cover below 0.3 m. In all cover types except the short grass or forb dominated cover types, this lowest height level provides at least 70% cover at 10 m, and greater than 85% cover at 15 m.

Nest and Brood Site Analysis

Analyses of the site characteristics were made at each of the 39 Canada goose island ground nests found in the spring of 1983. All nests analyzed were on islands; therefore, the 28 randomly located sites were also situated on islands. A few generalizations

and interpretations follow; however, with such small sample sizes, it must be realized that these are preliminary results, subject to reconsideration with additional data.

Nest sites were found in a variety of cover types, with 82% found in three types including the tall shrub type (38%), coniferous forest type (31%) and short shrub type (15%). Two nests were found in the forb type (5%), and one in a cottonwood forest (Table 11). A $\underline{X}^2$ (goodness-of-fit) test found the proportion of nests in each cover type was significantly different from the distribution of cover types at the random sites ($\underline{X}^2$ =23.5 with 6 DF; $\underline{P}$ < 0.005). This may indicate a selection for certain cover types at nest sites.

Red-osier dogwood was the dominant species at 23% of the nest sites. Wild rose (Rosa spp.) and willows (tall shrub species) were also commonly observed at these sites. All nests found in the coniferous forest type were in ponderosa pine and/or Rocky Mountain juniper stands. Short shrub species included western snowberry, willow, and rose. The three nests found in the tall grass type were all in reed canary grass.

The nearest different cover type to the nest site was usually water (54%, 21 nests), and occasionally a shrub or grass type (Appendix 3). The

Table 11. Number and percent of nest and random sites sampled with respect to cover types, lower Flathead River, Montana, 1983.

Cover Type	Number of nest sites	% of nest sites	Number of random sites	% of random sites
Coniferous Forest	12	30.8	9	32.1
Deciduous Forest	1	2.6	3	10.7
Tall Shrub	15	38.4	9	32.1
Short Shrub	6	15.4	0	0
Tall Grass	3	7.7	0	0
Forbs	2	5.1	6	21.5
Water	0	0	1	3.6

average height of nest site was 0.4 m above the HWM, with 15 nests (38%) situated below the HWH. The horizontal distance from the river edge (HWM) varied from 13.8 m inland to 1.0 m towards the river bed, and averaged 1.9 m inland. Topographic type was extremely variable and has not yet been analyzed.

Overstory cover at nest sites averaged 36% ranging from 0 to 98%. Similar results were obtained from the 4 measurements made at 5.0 m distances from the nest bowl ($\bar{X}$ = 33%, range 0-91%). The height of the herbaceous layer at the nest site averaged 33.5 cm (± 21.6 cm) while the height of the shrub layer averaged 90.6 cm (± 68.0 cm). Overstory cover and vegetation heights were similar at random sites, suggesting that these may not be important selection criteria for nest sites.

Horizontal coverage was measured by life-form class and ground cover categories; however, results were so varied that no interpretations can be made with the available data. This characteristic may be dependent on cover type, which suggests an analysis of sites within each cover type.

A $\bar{X}^2$ analysis revealed the distribution of vertical vegetative cover to be significantly different between nest sites and random sites ($\bar{X}^2$ = 12.3, 3 DF; $P < 0.01$). It appears the vertical

vegetative cover at nest sites is greater in the lower two height classes (0.0 -0.3 m, 0.3 - 1.0 m) and less in the upper two height classes (Table 12) than at random sites. This implies that ground nesting geese may prefer nest sites with dense vegetation as hiding cover near the ground, and more sparse cover above the 1.0 m level.

Incidental observations of Canada goose broods along the lower Flathead were used to select 9 sites for testing brood site analysis procedures. These samples provided an indication of the type of information available from the procedures, but were insufficient to produce interpretable results (Appendix 3).

The following cover types were represented (with the respective number of plots in parentheses): coniferous forest (2); deciduous forest (2); short grass (1); tall grass (1); cropland (1); cliffs (1); and water (1). In 44% of the plots, water was the nearest different cover type to the observed site. The height above the HWM averaged 0.6 m, varying from 0.0 to 12.4 m above HWM. Distance inland from the river's edge (HWM) averaged 29.3 m and varied from 0.0 to 100 m. Average overstory cover for each plot was 17%, varying from 0 to 7%. Average canopy cover of graminoids (grasses and grass-like plants), was 67%,

Table 12. Vertical cover within 5.0 m of ground nest sites and random island sites, lower Flathead River, Montana, 1983.

Height class	Nest Sites	Random Sites
0.0-0.3m	87	66
0.3-l.0m	61	46
l.0-2.0m	25	29
2.0-3.0m	19	21

and of forbs was 30% while trees and shrubs averaged only 10 and 5% cover, respectively. Vertical vegetation cover at brood sites, as at nest sites, was greater in the lowest level (0.0-0.3 m height) and measured progressively less at higher levels.

Brood Habitat Use and Movements

One goose (bird No. 7) was trapped and radio-marked while brooding goslings on her nest. Four molting adult geese were trapped and radio-marked during the last half of the brood period. All data obtained from radio-marked geese are presented in Appendix 4.

Two intensively used brood areas were identified on the study area. Broods in the McDonald Island brood area (located at RK28.0) were observed for 22 hours over a 4 day period. Three radio-marked broods, and from 34 to 59 geese total were using this area during the time period. Cover type/activity use patterns of broods indicated most feeding was performed in water, apparently on aquatic vegetation (Table 13). Very little feeding was observed in the short grass or cropland (alfalfa field) types. Gravel bars were used extensively as loafing areas. Broods were unobserved for 26 percent of the time period. Our data suggest that a substantial portion of this unobserved period

Table 13. Cover type/activity use by Canada goose broods within the McDonald Island brood area, lower Flathead River, Montana, 1983.

Cover type/Activity	Observation Time (minutes)	% Use
Short Grass/feeding	**20**	**1.5**
Short Grass/loafing	**120**	**9.2**
Cropland (Alfalfa field)/ feeding	**5**	**0.4**
Gravel Bar/Loafing	344	26.4
Gravel Bar/feeding	**36**	**2.8**
Water/feeding	143	**11.0**
Water/loafing	45	3.4
Water/swimming	**245**	**18.8**
Unobserved	**346**	**26.5**
Total	1304	**100.0**

was spent using the tall shrub and coniferous forest cover types on McDonald Island.

Water comprised 64% of the McDonald Island brood area (Table 14, Figure 8). The tall shrub and coniferous forest types also comprised a substantial portion of the area.

One radio-marked brood and from 30 to 65 geese total were observed for 14 hours over a two day period at the Mission Creek brood area. This area is located 2 km up Mission Creek from its confluence with the lower Flathead River (RK 45.0). Tall grass, tall shrub, and deciduous forest types were used extensively for loafing (Table 15). Feeding was performed in water and cropland (developing wheatfield). Broods were unobserved approximately 50% of the time. Tall shrub and deciduous forest types appeared to be the cover types used most during the unobserved period. Cover type composition of the Mission Creek brood area (Table 16, Figure 9) show 70% of the area was cropland. Water and deciduous forests also comprised substantial portions of the area.

Canada goose brood habitat has been described as areas with short, succulent green vegetation such as pasture grass, alfalfa, and semiaquatic plants with few shrubs and trees (Hanson and Eberhardt 1971; Ball et al. 1981, Ball 1981). Although our observations of

Table 14. Cover type composition of the McDonald Island brood area, lower Flathead River, Montana, 1983.

Cover type	% of Brood Area
Water	64
Short and Tall Grasses	3
Tall Shrubs	16
Short Shrub	2
Gravel Bar	5
Deciduous Forest	1
Coniferous Forest	9

Figure 8. Cover type map of McDonald Island brood area, lower Flathead River, Montana, 1983.

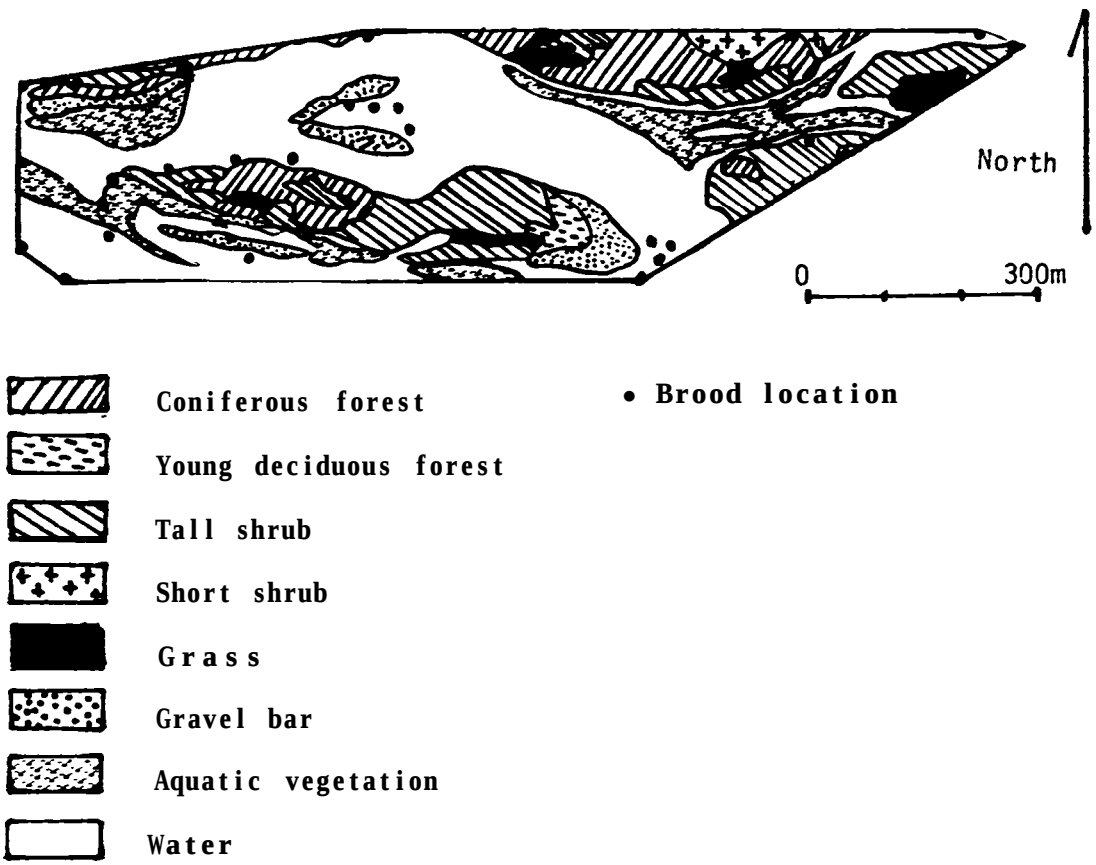


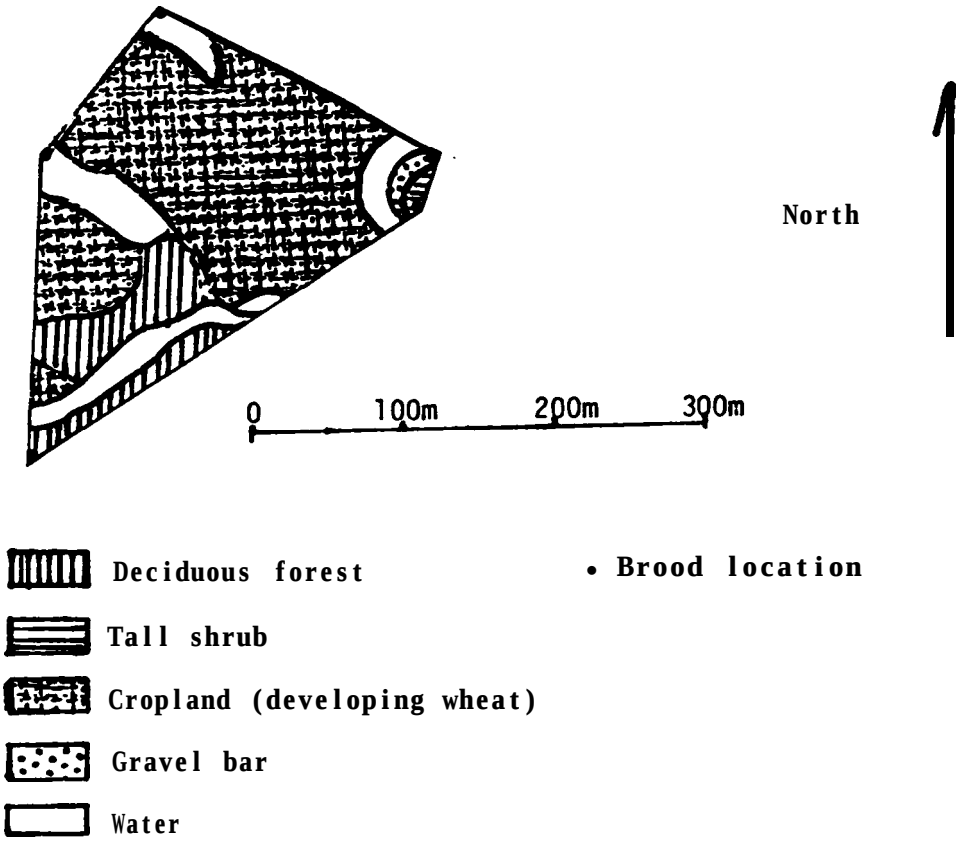
Table 15. Cover type/activity use by Canada goose broods within the Mission Creek brood area, lower Flathead River, Montana, 1983.

Cover type/Activity	Observation Time (Minutes)	% Use
Tall Grass – Tall Shrub/loafing	195	23.2
Cropland (Developing wheatfield)/feeding	36	4.3
Deciduous Forest/loafing	75	8.9
Water/feeding	40	4.8
Water/preening	45	5.3
Water/loafing	25	3.0
Water/swimming	15	1.8
Unobserved	410	48.7
Total	841	100.0

Table 16. Cover type composition of Misson Creek brood area, lower Flathead River, Montana, 1983.

Cover type	% of Brood Area
Water	16
Cropland (Developing wheat)	70
Tail shrub/tall grass	1
Deciduous Forest	12
Gravel Bar	1

Figure 9. Cover type map of the Mission Creek brood area, lower Flathead River, Montana, 1983.



late brood habitat use do not indicate heavy use of this type of habitat, it may have been more important to young broods or broods in other locations on the study area. Ball et al. (1981) noted broods using areas of developing wheat, which is similar to our observations.

Brood number 7 moved a maximum distance of 22.6 km during the brood period (Table 17). Virtually all of this movement was conducted the first week after hatching when the brood moved down the lower Flathead River, to the Clark Fork River and spent the rest of the brood period in an area near Paradise, Montana. As many as 9 broods were observed using this area. Bellrose (1978:162) noted that Canada goose broods on some western rivers move downstream many miles to feeding areas.

Maximum distances moved by brood numbers 4, 10, 14, and 18 were variable ranging from 1.7 to 15.5 km (Table 17). All movements recorded were during the last half of the brood period. Brood mixing was observed in all 4 of these broods.

Post-fledging Movements and Distribution

Maximum post-fledging movements of 5 radio-marked geese varied from 15.2 to 54.4 km (Table 18). The farthest movement (54.4 km) was made by bird number 7 when she moved from the brood area at

Table 17. Maximum Canada goose brood movements, lower Flathead River, Montana, 1983.

Brood No.	Maximum Movement (km)
4	2.8
7	22.6
10	10.0
14	15.5
18	1.7

Table 18. Maximumm post-fledging Canada goose movements, lower Flathead River, Montana, 1983.

Bird No.	Maximum Movement
4	15.3
7	54.4
10	15.2
14	33.4
18	31.2

Paradise, Montana to Pablo Reservoir. The other 4 radio-marked geese moved between the Flathead River and Pablo, Kicking Horse, and Ninepipe Reservoirs.

Radio-marked geese used the study area less and the reservoirs more as the post-fledging period progressed. During September aerial surveys, we observed few geese on the river and large numbers on reservoirs (Table 19), and areas surrounding reservoirs, possibly because of the large amount of cereal grain fields available to feeding geese around reservoirs.

Table 19. Numbers of Canada geese observed on aerial censuses, Flathead Valley, Montana, 1983.

Area	Date		
	9/13/83	9/22/83	9/28/83
Lower Flathead River	0	25	60
East Bay of Flathead Lake	--	50	0
Pablo Reservoir	--	300	375
Kicking Horse Reservoir	--	120	0
Ninepipe Reservoir	--	460	260
Total	--	955	695

CONCLUSIONS

Artificial tree nest structures show promise for providing secure nest sites for geese at a reasonable cost. Materials for tree structures cost approximately $20.00 per structure and 6 man hours were invested in construction and placement of each structure. Durability of nest materials will be evaluated over the next several years. Habitat selection sampling techniques were tested and study plans drawn for relating effects of water fluctutations to goose brood areas. Gosling survival estimates were not made because of extensive brood mixing. In the future, emphasis will be placed on survival estimates before brood mixing occurs. The study area was mapped to vegetation cover type and sampling was begun to determine community types. Two intensively used brood areas were identified, and cover types of these areas were described and mapped. The proportion of nests in specific cover types was significantly different from random sites which may indicate selection by nesting geese for certain cover types. Preliminary data indicate that substantial water fluctuations from March through mid-May could result in significant nest destruction from flooding.

LITERATURE CITED

Akesson, T. R., and D. G. Raveling. 1982. Behaviors associated with seasonal reproduction and long-term monogamy in Canada geese. Condor 84:188-196.

Allen, G. T., S. E. F.ast, B. J. Langstaff, D. W. Tomrdle, and B. L. Troutman. 1978. Census of Canada geese on the Palouse River, Washington, during the spring of 1977. Murrelet 59:96-100.

Ball, I. J.,E. L. Bowhay, and C.F. Yocum. 1981. Ecology and management of the western Canada goose in Washington. Wash. Dept. of Game Biol. Bull. 17. 67 pp.

Ball, I. J., 1981. Breeding biology and management of Canada geese in the Flathead Valley. Project report to the Confederated Salish and Kootenai Tribes and USDI - Bureau of Indian Affairs. Pablo, MT. 12 pp.

Ball, I. J., 1983. Management plan for Canada geese on tribal lands in the Flathead Valley. Report to the Confederated Salish and Kootenai Tribes, Pablo, MT. 9 pp.

Batchelor, R., Chairman. 1982. A taxonomic classification system for Montana riparian vegetation types. Montana State Rural Areas Development Committee, Wildl. Subcomm., Riparian Prog. Team, Bozeman, MT. March, 1982. Unpublished report.

Bellrose, F. C. 1978. Ducks, geese, and swans of North America, 2nd edition. Stackpole Books, Harrisburg, PA. 540 pp.

Brakhage, G. K. 1965. Biology and behavior of tub-nesting Canada geese. J. Wildl. Manage. 29:751-771.

Canfield, R. H. 1941. Application of the line interception method in sampling range vegetation. J. For. 39:388-394.

Cochran, W. W. 1980. Wildlife telemetry. Pages 507-520 in S.D. Schemnitz ed. Wildlife management techniques manual. 4th edition, The Wildl. Soc., Washington, D.C.

Cooper, J. A. 1978. The history and breeding biology of the Canada geese of Marshy Point, Manitoba. Wildl. Monogr. 61. 87 pp.

Cowardin, L. M., V. Carter, F. C. Golet and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States U.S. Dept. of Interior. FWS/OBS 79/31. 103 pp.

Craighead, J. J., and D. S. Stockstad. 1961. Evaluating the use of aerial nesting platforms by Canada geese. J. Wildl. Manage. 25:363-372.

Craighead, J. J., and D. S. Stockstad. 1964. Breeding age of Canada geese. J. Wildl. Manage. 28:57-64.

Craven, S. R. 1979. Some problems with Canada goose neckbands. Wildl. Soc. Bull. 7:268-273.

de Vos, A. and H. S. Mosby. 1969. Habitat analysis and evaluation. Pages 135-172 in R.H. Giles ed. Wildlife management techniques manual. 3rd edition, The Wildl. Soc., Washington, D.C.

Geis, M. B. 1956. Productivity of Canada geese in the Flathead Valley, Montana. J. Wildl. Manage. 20:409-419.

Hanson, W. C., and L. L. Eberhardt. 1971. A Columbia River Canada goose population, 1950-1970. Wildl. Monogr. 28. 61 pp.

Hitchcock, C. L. and A. Cronquist. 1973. Flora of the pacific northwest. Univ. of Wash. Press, Seattle. 730 pp.

Hydrology and Hydraulics Committee 1976. River mile index. Clark Fork - Pend Oreille River. Pacific Northwest River Basins Commission.

Mohr, C. 0. 1947. Table of equivalent populations of North American small mammals. Am. Midl. Nat. 37:223-249.

Mueggler, W. and W, Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Serv. Gen. Tech. Rep. INT-66.

Noon, B. R. 1981. Techniques for sampling avian habitats. Pages 42-52 in D.E. Capen ed., The use of multivariate statistics in studies of wildlife habitat. USDA For. Service Gen. Tech. Rep. RM-87, 249 pp. R.M. For. and Range Expt. Sta., Ft. Collins, Colo.

Pfister, R., B, Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USDA Forest Serv. Gen. Tech. Rep. INT-34.

Rearden, J . D. 1951. Identification of waterfowl nest predators. J. Wildl. Manage. 15:386-395.

Sherwood, G. A. 1968. Factors limiting production and expansion of local populations of Canada geese. Pages 73-85 in R.L. Hines and C. Schoenfeld eds. Canada goose management. Dembar Educ. Res. Serv. Inc., Madison, WI.

Sokal, R. R., and F. J. Rohlf. 1981. Biometry, 2nd edition W. H. Freeman and Co., San Francisco. 859 pp.

Tacha, T. C., and R. L. Linder. 1978. Analysis of aerial circling surveys for Canada goose breeding populations. Wildl. Soc. Bull. 6:42-44.

Vermeer, K. 1970. A study of Canada geese, Branta canadensis, nesting on islands in southeastern Alberta. Canadian J. Zool. 48:235-240.

Warner, R.E. 1979. California riparian study program--background information and proposed study design. Calif. Dept. of Fish and Game Planning Branch, Sacramento, CA. 177 pp.

Westerskov, K. 1950. Methods of determining the age of game- bird eggs. J. Wildl. Manage. 14:56-67.

Yocom, C. F. 1952. Techniques used to increase nesting of Canada geese. J. Wildl. Manage. 16:425-428.

Zackheim, H., ed. 1983. Flathead River Basin environmental impact study; Final report. E.P.A. June, 1983. 184 pp.

APPENDICES

Appendix 1

Characteristics of trees used for placement of nest structures. Lower Flathead River, MT. 1983.

Appendix 1. Characteristics of trees used for placement of nest structures, lower Flathead River, Montana, 1983.

TREE #	NEST MATERIAL	NEST HT (M)	TREE HT (M)	TREE DBH (CM)	DISTANCE (M)
1	WOODCHIPS	7.5	39.1	[illegible]	1.0
2	SHALE	7.3	20.3	71.7	0.0
3	SHALE		21.7	76.8	0.0
4	WOODCHIPS	9.9	23.7	81.9	2.0
5	WOODCHIPS	8	18.6	48.6	8.0
6	SHALE	[illegible]	19.6	59.3	2.0
7	WOODCHIPS	9.6	28.7	100.0	3.0
8	SHALE	6.3	29.1	92.9	8.0
9	SHALE	9.6	30.7	76.8	1.0
10	WOODCHIPS	9.9	21.9	37.8	1.0
11	WOODCHIPS	9.9	19.0	50.7	5.0
12	SHALE	6.9	13.9	53.8	5.0
13	SHALE	7.2	23.4	90.6	4.0
14	WOODCHIPS	9.0	21.0	74.3	1.0
15	SHALE	11.1	18.3	55.3	5.0
16	WOODCHIPS	6.6	13.1	33.3	3.0
	WOODCHIPS	9.9	15.3	49.9	7.0
[illegible]	SHALE	[illegible]	17.1	33.9	[illegible]
[illegible]	WOODCHIPS	[illegible]	21.0	67.3	[illegible]
	SHALE	[illegible]	13.4	[illegible]	0.0
	[illegible]		21.7	[illegible]	[illegible]

Appendix 1. Continued.

TREE #	WEST MATERIAL	WEST AT [illegible]	TREE A [illegible]	TREE DBH [illegible] IN	DIST HWM [illegible]
[illegible]	SHALE	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	WOODCHIPS	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SHALE	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	WOODCHIPS	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	WOODCHIPS	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SHALE		[illegible]	[illegible]	[illegible]
[illegible]	WOODCHIPS	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SHALE	[illegible]	[illegible]	[illegible]	[illegible]

- - - - - - - - - G R A N D T O T A L S - - - - - - - -

[illegible]	[illegible]	[illegible]	[illegible]

- - - - - - - - - - R E P O R T A V E R - - - - - - - - -

[illegible]	[illegible]	[illegible]	[illegible]

- - - - - - - - - -

Appendix 1. Continued.

TREE #	NEST MATERIAL	NEST HT. (M)	TREE HT (M)	TREE DBH (CM)	DIST HWM (M)
22	SHALE	9.9	38.9	59.6	4.0
23	SHALE	9.5	25.5	71.9	3.0
24	WOODCHIPS	10.5	13.6	63.1	1.0
25	WOODCHIPS	10.3	24.0	95.0	0.0
26	SHALE	10.3	22.4	50.6	1.0
27	WOODCHIPS	9.5	20.8	52.7	3.0
28	SHALE	8.7	17.0	62.7	6.0
29	WOODCHIPS	10.5	20.4	61.4	1.3
30	SHALE	7.3	16.8	73.7	8.0
31	SHALE	11.4	30.0	88.8	0.0
32	WOODCHIPS	11.1	20.3	69.4	5.0
33	WOODCHIPS	8.1	19.7	67.3	8.0
34	SHALE	9.0	17.6	71.7	0.0
35	WOODCHIPS	8.4	19.0	53.9	3.0
36	SHALE	6.9	18.7	58.4	0.0
37	SHALE	9.9	21.5	55.0	0.0
38	WOODCHIPS	9.2	25.0	79.4	7.0
39	WOODCHIPS	13.0	37.4	92.7	4.0
40	SHALE	13.1	35.5	89.6	12.0
41	SHALE	10.2	25.3	99.8	3.0
42	WOODCHIPS	9.9	24.1	94.7	0.3
43	WOODCHIPS	9.0	14.4	51.2	1.0
44	SHALE	[illegible]	[illegible]	[illegible]	[illegible]

Appendix 2

Vegetation inventory data, LFR, 1983.

Appendix 2.' Vegetation inventory data, LFR, 1983

LFR VEGETATION INVENTORY 1983 PHYSICAL CHARACTERISTICS OF PLOTS

PLOT #	DOMINANT SPECIES	HAB.--DIST VERT--HORIZ	SLOPE %	ASPECT DEGREES	CONFIG-URATION	LAND-FORM	SHAPE	EDGE TYPE
CONIFEROUS FOREST - RIPARIAN								
1	JUSC	3 5 20 0	0	130-SE	STRAIGHT	BENCH	ROUND	DISTINCT
3	JUSC	2 0 3 0	50	296-NW	UNDULAT	SLOPE	STRIP	DISTINCT
16	JUSC	2 0 0 0	24	290-W	STRAIGHT	SLOPE	STRIP	DISTINCT
49	JUSC	0 0 0 0	0	0 0 E	UNDULAT	BENCH	OBLONG	GRADUAL
28	JUSC-PIPO	3 0 0 0	11	166-S	UNDULAT	SLOPE	STRIP	DISTINCT
41	JUSC-PIPO	1 0 1 0 0	0	100-E	UNDULAT	BENCH	OBLONG	GRADUAL
13	JUSC-POTR	1 . 7 0	10	050-W	STRAIGHT	SLOPE	STRIP	DISTINCT
19	PIPO			310-W	UNDULAT	SLOPE	STRIP	DISTINCT
31	PIPO	3 0 1 0 0 0		314-NW	UNDULAT	BENCH	OBLONG	GRADUAL
43	PIPO	1 0 2 0	31	20- 0	STRAIGHT	SLOPE	STRIP	DISTINCT
55	PIPO	3 5 40 0	10	330-N	UNDULAT	BENCH	ROUND	DISTINCT
21	PSME-JUSC	3 0 0 0	60	332-N	UNDULAT	SLOPE	STRIP	DISTINCT
- - - - - AVERAGE FOR 8 - - - - -

Appendix 2. Continued.

PLOT #	DOMINANT SPECIES	HUM--DIST [illegible]	SLOPE [illegible]	[illegible]	CONFIG-URATION	LAND-FORM	SHAPE	EDGE TYPE
TALL SHRUB - RIPARIAN								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CONCAVE	BENCH	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	BENCH	BELONG	GRADUAL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	BELONG	GRADUAL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	BELONG	GRADUAL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	SLOPE	STRIP	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CONCAVE	BENCH	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	BEACH	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	STRIP	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SLOPE	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	STRIP	DISTINCT
- - - - - AVERAGE FOR [illegible] - - - - -								
[illegible]								
- - - - - STANDARD DEV [illegible] - - - - -								
[illegible]								
SHORT SHRUB - RIPARIAN								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BEACH	BELONG	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	BENCH	BELONG	DISTINCT
- - - - - AVERAGE FOR [illegible] - - - - -								
[illegible]								
- - - - - STANDARD DEV [illegible] - - - - -								
[illegible]								
SHORT SHRUB - UPLAND								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	STRAIGHT	BENCH	ROUND	GRADUAL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	SLOPE	ROUND	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CONCAVE	BENCH	ROUND	DISTINCT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	SLOPE	BELONG	GRADUAL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	UNDULAT	SLOPE	BELONG	DISTINCT
- - - AVERAGE FOR [illegible] - - -								
[illegible]								
- - - - - STANDARD DEV [illegible] - - - - -								
[illegible]								
SHORT SHRUB - TOTAL								
- AVERAGE FOR [illegible] - - - -								
[illegible]								
- - - - - STANDARD DEV [illegible] - - - - -								
[illegible]								
SHORT GRASS - RIPARIAN								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	BENCH	STRIP	DISTINCT
SHORT GRASS - UPLAND								
[illegible]								
[illegible]								
[illegible]								
[illegible]								
TOTAL [illegible] SHORT GRASS								
[illegible]								

Appendix 2. Continued.

LFR VEGETATION INVENTORY 1988 PHYSICAL CHARACTERISTICS OF PLOTS

PLOT	DOMINANT SPECIES	HUM--DIS. VERT--HORIZ	SLOPE (%)	ASPECT RIVER	ASPECT ORATION	LAND-FORM	SHAPE	EDGE TYPE
TALL GRASS - RIPARIAN								
43	CAREX	-1 0 -5 0	5	160-E	UNDULAT	BEACH	RE[illegible]	DISTINCT
5.	CAREX	-1 1 -30 0	4	7[illegible]-E	UNDULAT	SLOPE	OBLONG	DISTINCT
5.	CAREX	-1 6 -3 0 0	2	130-N	CONCAVE	BENCH	OBLONG	DISTINCT
53	CAREX	-1 0 -77 0 0	[illegible]	[illegible]-E	CONCAVE	BENCH	STRIP	DISTINCT
15	CAREX-TYLA	-0 5 -2 0 34	370-W	UNDULAT	SLOPE	STRIP	DISTINCT	
34	SUEDC	-. 0 -15.0 10	00[illegible]-SW	STRAIGH	BEACH	STRIP	DISTINCT	
61	PHAR	-0 5 -1[illegible] 0 0	38-NE	STRA.GH	BENCH	ROUND	DISTINCT	
41	PHAR	-0 5 . . 0 0	0	197-S	UNDULAT	BENCH	OBLONG	DISTINCT
	AVERAGE FOR							
		-1 1 -32 1	7					
	STANDARD DEV							
		0 0 [illegible] 2 [illegible]						
FORB DOMINATED - RIPARIAN								
57	APCA	-. 0 -3[illegible] 0		154-E	STRAIGH	BEACH	STRIP	DISTINCT
24	ARLI	-. 0 0 0	5	04-N	STRAIGH	BEACH	OBLONG	GRADUAL
35	ARLI	-1 0 -12 0	0	2[illegible]-S	STRAIGH	BENCH	OBLONG	DISTINCT
63	ARLI	-1 0 -40 0	0	174-S	STRAIGH	SLOUG	OBLONG	DISTINCT
64	ARLI	-0 5 -68 0	5	118-E	UNDULAT	BEACH	OBLONG	DISTINCT
29	ARLI-ALCE	-0 0 . 5 0	10	101-E	STRAIGH	BEACH	STRIP	DISTINCT
44	ARLI-GAAR	-1 0 . 7 7 0	0	141-SE	STRAIGH	BEACH	OBLONG	DISTINCT
51	COAT-ASTER	-0.0 -19.0	0	70-E	STRAIGH	BEACH	STRIP	DISTINCT
41	EQUIS	-1 5 20 0	5	4-N	STRAIGH	BEACH	STRIP	DISTINCT
1.	EQUIS-JUNC	-1 5 -5 0	0	254-L'	STRAIGH	BENCH	STRIP	DISTINCT
	AVERAGE FOR							
		-1 5 -24 2	3					
	STANDARD DEV							
		0 0 29 2	4					
FORB DOMINATED - UPLAND								
	DFM -FOCO	0 0 10 0	1	1 [illegible]-W	STRAIGH	BENCH	OBLONG	GRADUAL
14	GEMA-POGR	4 5 47 0	12	152-W	STRAIGH	SLOPE	OBLONG	GRADUAL
18	POGR-ARTE	5 0 41 0	1	0[illegible]-W	STRAIGH	BENCH	OBLONG	DISTINCT
	AVERAGE FOR							
		4 34 3	1					
	STANDARD DEV							
		0 0 13	3					
FORB DOMINATED - TOTAL								
	AVERAGE FOR							
		0 0 . 1 0 0	1					
	STANDARD DEV							

Appendix 2 . Continued.

LFR VEGETATION INVENTORY 1980 BIOTIC CHARACTER STUDY OF PLOTS

PLOT #	DOMINANT SPECIES	ADJACENT COMMUNITIES	WILDLIFE SIGN/USE	CATTLE SIGN/USE	WETLAND CLASSIFICATION
	JUSC	7-CEMA, 9-PRVI	CHIPMUNKS	OLD	FORESTED WETLAND
9	JUSC	3-ARTR 9	FLICKATCHER	OLD	FORESTED WETLAND
16	JUSC	7-CEMA		NONE	FORESTED WETLAND
49	JUSC	2-BARX 3-POTRI	PHEASANTS	RECENT	FORESTED WETLAND
38	JUSC-PIPO	7-ARTR 4-POTR		OLD	FORESTED WETLAND
41	JUSC-PIPO	5-BTES 6-[illegible]		OLD	FORESTED WETLAND
13	JUSC-POTR	7-CEMA 5-MOUNTAIN CHICKADEES		NONE	FORESTED WETLAND
19	PIPO	73		RECENT	FORESTED WETLAND
31	PIPO	3-COST		NONE	FORESTED WETLAND
43	PIPO	7-6		RECENT/GRAZED	FORESTED WETLAND
55	PIPO	2-POTRI		NONE	FORESTED WETLAND
21	PSME-JUSC	4-POTR, 5-POCO, 9		NONE	FORESTED WETLAND
4	PSME	1-JUSC 4-ARTR	TOWNSEND'S	OLD	UPLAND
7	PSME	4-ARTR	SPARROW HAWK	NONE	UPLAND
11	[illegible]	4-ARTR SLOP	SEA SER	NONE	UPLAND
6	POTR	3-COST, 4-CAREX	PHEASANT	NONE	FORESTED WETLAND
48	POTR	2-POTRI, 5-POCO-		RECENT/GRAZED	FORESTED WETLAND
36	POTR-SYOC	3-POTRI 3-BAREX		NONE	SCRUB-SHRUB WETLAND
25	POTRI	[illegible]	WHITE TEER	OLD	FORESTED WETLAND
32	POTRI	3-BAMM	BEAVER	OLD	FORESTED WETLAND
37	POTRI	1-PIPO-JUSC	RABBIT	NONE	FORESTED WETLAND
50	POTRI	[illegible]	BEAVER	NONE	FORESTED WETLAND
14	POTRI	4-PIPO 6-CAREX-	DEER	RECENT/GRAZED	FORESTED WETLAND
12	POTRI-BAEX	1-PIPO		NONE	SCRUB-SHRUB WETLAND
30	COST	2-POTRI 9		NONE	SCRUB-SHRUB WETLAND
24	COST-RIOC	2-POTRI	BEAVER	OLD	SCRUB-SHRUB WETLAND
[illegible]	COST-ROUC	6-BRAR -PIPO		NONE	SCRUB-SHRUB WETLAND
[illegible]	COST-SPRI	6-POTRI	BEAVER	NONE	SCRUB-SHRUB WETLAND
[illegible]	COST	3-COST	DEER	NONE	SCRUB-SHRUB WETLAND
[illegible]	[illegible]	[illegible]		NONE	SCRUB-SHRUB WETLAND
[illegible]	[illegible]	[illegible]		[illegible]	SCRUB-SHRUB
[illegible]	[illegible]	[illegible]		[illegible]	SCRUB-SHRUB WETLAND
[illegible]	[illegible]	[illegible]		[illegible]	SCRUB-SHRUB WETLAND
[illegible]	[illegible]	[illegible]			SCRUB-SHRUB WETLAND
[illegible]	[illegible]	[illegible]		[illegible]	SCRUB-SHRUB WETLAND

Appendix 2 . Continued.

LFR VEGETATION INVENTORY 198 3 BIOTIC CHARACTERISTICS OF PLOTS

PLOT	DOMINANT SPECIES	ADJACENT COMMUNITIES	WILDLIFE SIGN USE	CATTLE SIGN/USE	WETLAND CLASSIFICATION
53	SAEX	1-JUSC		NONE	SCRUB-SHRUB WETLAND
39	SYOC	1-JUSC,4-CAREX	GOLDFINCH	RECENT/GRAZED	SCRUB-SHRUB WETLAND
10	ARTR	1-PIPO-JUSC	F GOPHERS	OLD	UPLAND
7	PUTR	1-PIPO-JUSC	2 DEER	OLD/GRAZED	UPLAND
37	PUTR	3-POPOTR2,1-PIP	DEER	NONE	UPLAND
47	PUTR	7,6	RABBIT	NONE	UPLAND
17	PUTR-ARFR	7-CENA,6-AGSP		OLD	UPLAND
33	POPR-COAT	2-POTR2,2-POTR		OLD	PERSISTENT EMERGENT
5	ACGR	1-PIPO-JUSC	GOPHERS	OLD	UPLAND
3	FESC	1-PIPO,4-CHNA-A	OH OWL MOLARK	OLD	UPLAND
10	POCC-BRTE	1-PSME-JUSC	MICROTUS	OLD/GRAZED	UPLAND
42	STCO-ARLO	1-JUMA (641)		RECENT	UPLAND
43	CAREX	4-SYOC		RECENT/GRAZED	PERSISTENT EMERGENT
51	CAREX	POTR,SAEX JUSC		OLD	PERSISTENT EMERGENT
56	CAREX	2-POTR2,3-SAEX-		NONE	PERSISTENT EMERGENT
58	CAREX	1-PIPO,3	BEAVERS	NONE	PERSISTENT EMERGENT
15	CAREX-TYLA	2-POTR2		NONE	PERSISTENT EMERGENT
34	ELEOC	3-SALIX/PHAR		NONE	PERSISTENT EMERGENT
41	PHAR	3-COST-POTR2,9-	DEER	NONE	PERSISTENT EMERGENT
45	PHAR	3-SAEX		NONE	PERSISTENT EMERGENT
19	ARCA	7 11	BLK FESLA	NONE	NONPERSISTENT EMERG
24	ARLI	2-POTR2	GOLDEF	NONE	NONPERSISTENT EMERG
27	ARLI	11 3-SAEX	DEPRES	NONE	NONPERSISTENT EMERG
43	ARLI	1-JUSC		NONE	NONPERSISTENT EMERG
4	ARLI	7-CHAR		NONE	NONPERSISTENT EMERG
9	ARLI-ALSC	1-PIPO-JUSC,11		NONE	NONPERSISTENT EMERG
1	ARLI-AVAR	1-CIST,11		OLD	NONPERSISTENT EMERG
2	COAT-ASTOR	1-POTR2		NONE	NONPERSISTENT EMERG
44	EQUIS	1-JUSC		NONE	PERSISTENT EMERGENT
22	EQUIS-	1-POTR		NONE	PERSISTENT EMERGENT
18	CENA-FOOF	1-PIPO,1-POTR		OLD	UPLAND
13	FOOF-ERTE	1-JUSC		OLD GRAZED	UPLAND

Appendix 2. Continued.

VEGETATION INVENTORY 1980 VEGETATION DENSITY FROM 4 LEVELS/3 DISTANCES

PLOT DOM DISTANCE--5 METERS---- ----10 METERS---- ----15 METERS----
SPP HT 0- 3 3-6 6-9M 0- 3 3-6 6-9M 0- 3 3-6 6-9M

CONIFEROUS FOREST - RIPARIAN

| | | |

Appendix 2. Continued.

LFR VEGETATION INVENTORY 1983 VEGETATION DENSITY FROM 4 LEVELS/3 DISTANCES

PLOT SPM DISTANCE--5 METERS---- -----10 METERS----- -----15 METERS-----
SPP HT 0-1 1-2 2-3M 0-1 1-2 2-3M 0-1 1-2 2-3M

DECIDUOUS FOREST - RIPARIAN (only)

6 POTR 1.00 0 91 0 54 1 00 1 00 1 00 0 94 0 88 1 00 1 00 1 00 3 96
68 POTR 0.60 0 23 0 00 0 00 1 00 0 77 0 53 0 52 1 00 0 59 0 52 0 70
38 POTR-S 1 00 3 94 0 65 0 00 1 00 1 00 0 20 0 00 1.00 1 00 0 14 0 00
15 POTRC 1 00 0 74 0 16 0 00 1 00 0 89 0 13 0 00 1.03 0 97 0 13 0 00
32 POTRC 0 87 0 60 0 94 0 58 0 93 0 97 1.00 0 96 1 00 1.00 1 00 1 CC
40 POTRS 0 07 0.14 0 00 0.02 0 93 3 97 0 64 0 92 1.00 1 00 0 94 0 93
53 POTRC 0.60 0 94 1 00 0 92 1 CO 1.00 1 00 1 00 1.00 1.00 1 00 1 00
[illegible] POTRC [illegible] 0 0 0 0 0 0 0 03 0 03 0 40 0 00 0.13 0 92 0 73 0 40 0 48 0.98
61 POTRC- 0 40 0 00 0 00 3 00 0 87 0 5 4 0 0 0 0 0 0 1 00 0 97 0 00 0 00

AVERAGE FOR I
3 70 0 50 0 31 0 31 0 90 0 79 0 46 0 56 0 97 0 91 0 58 0 63
STANDARD E E V R
0 34 0 33 0 36 0 35 0 16 0 31 0 39 0 43 0 08 0 19 0 39 0 45

TALL SHRUB - RIPARIAN

6 0 [illegible] ET 1 00 0 ii 1 00 0 98 1 00 1 00 1 00 1 00 1 00 1 00 1 00 1 00
2 [illegible] COST-R 1.00 0 94 0 03 0 20 1 00 0.97 0 98 0 74 1.00 1. co 1.00 0.96
30 COST-R [illegible] 0.93 0.74 0.96 0.98 1.00 0 71 1 00 1 00 1.03 1 00 1 00 1.00
22 CC ii- S 0.93 0 60 0 98 0 74 1 .00 0 96 0 96 0 30 1 00 1 00 0.96 0 18
67 CRDC 0 60 3 31 1 00 1 00 0.87 0.97 1 00 0 00 1 00 1 00 1 00 1 00 1 00
57 CRDC-S 0.93 0 94 0 96 5.96 1 0 0 1 0 0 1 00 1 00 1.00 1 00 1 00 1 .00
17 SAP:: 0 27 0 57 0 90 0.16 0 50 0 69 0 94 0 52 0.80 0.57 1 00 0 78
20 SAEX 1 00 1.00 0 10 0 00 1 00 1.00 0 76 0 06 1 00 1 00 0 96 0 45
36 SAEX 1 00 0.60 0 80 0 89 1.00 1 00 1 00 1 00 1 00 1 00 1 00 1 00
64 SAEX 1 00 1 00 0 80 0. 93 1 00 1 00 1 00 1 00 1 00 1 00 1 00 1 00
cc SAEX -C 1.00 0 91 0 58 0 90 1 00 1 00 1 00 1.00 1 co 1 00 1 00 1 CL

AVERAGE FOR R
0 93 0 73 0.74 0 71 0 97 0 93 0 97 0 69 0 98 0 96 0 99 0 80
STANDARD DEV R
0 11 0 21 0 33 0 37 0 07 3 11 0 07 0 39 0 04 0 13 0 a2 0.24

SHORT SHRUB - RIPARIAN

50 SAEX 0 80 0 79 0 00 0 00 1 00 1 00 0 00 0 00 1 00 1 00 0 00 0 00
39 RYOC 0 90 0 [illegible] 0 00 1 00 0 57 0 04 0 CC 1 00 1 00 0 04 0 00

AVERAGE FOR R
0 57 0 54 0 00 0 00 1 00 0 79 0 02 0 00 1 00 1 00 0 02 0 00
STANDARD DEV R
0 17 0 39 0 00 0 00 0 00 0 22 0 11 0 00 0 00 0 00 0 00 0 00

SHORT SHRUB - UPLAND

[illegible] A [illegible] 0 00 0 [illegible] 1 0 0 00 0 [illegible] 1 24 0 00 0 00 0 00 0 40 0 00 0 00
PUTR 0 87 0 94 [illegible] 96 1 00 1 00 0 94 0 98 1 00 1 00 0 97 1 00 1 39
37 PUT R 0 [illegible] 0 00 1 38 0 [illegible] 0 [illegible] 0 2 0 38 0 00 1 00 0 77 0 52 1 24
47 PUT UTR 0 0 0 [illegible] 0 04 0 [illegible] 1 [illegible] 1 [illegible] 1 04 1 00 1 00 1 00 0 73 1 39
[illegible] PUTR [illegible] 0 00 0 0 0 0 0 73 1 00 0 1 0 [illegible] 1 00 1 00 1 00 0 74
AVERAGE FOR R
[illegible]
STANDARD DEV R
[illegible]

SHORT SHRUB - TOTAL
[illegible]
STANDARD DEV R
[illegible]

Appendix 2. Continued.

SR VEGETATION INVENTORY 1983 VEGETATION DENSITY FROM 4 LEVELS/3 DISTANCES

| PLOT-SUM | DISTANCE-METERS | | |

Appendix 2. Continued.

LER VEGETATION INVENTORY 1961 VEGETATION DENSITY FROM 4 LEVELS/3 DISTANCES

| PLOT DCM | DISTANCE-FT METERS | | |

Appendix 3

Nest and brood site characteristics, LFR, 1983.

Appendix 3. Rest and Brood characteristics, LFR, 1993.

LFR CANADA GOOSE GROUND-NEST SITE CHARACTERISTICS
1983

PLOT NAME NEST

PLOT #	COV TYP	DOM SPP	HORIZONTAL COVER-VEG.: TREE	SHRB	FORB	GRMN	TOT	GROUND SURFACE: LITR	BG/RK	MOH	VERTICAL COVER 0-.3	3-1	1-2	2-3	0-1
N-24	1	JUNI	0	41	4	0	43	15	0	40	100	84	32	37	184
N-30	1	JUNI	52	5	0	36	93	47	12	0	60	33	6	15	93
N-34	1	JUNI	0	3	2	8	13	16	22	59	100	60	5	0	160
N-39	1	JUNI	52	39	0	33	124	6	0	0	93	76	33	36	169
N-45	1	JUNI	70	17	0	39	126	1	36	5	77	71	84	73	148
N-53	1	JUNI	51	0	24	33	106	0	45	0	87	64	47	47	151
N-24	1	P.PI	37	48	0	0	85	17	13	22	88	64	24	20	156
w-47	1	P.PI	90	12	0	0	102	38	90	0	80	7s	73	68	155
N-9	1	P.PI	20	0	0	40	60	40	0	0	77	58	46	30	135
N-23	1	POND	83	37	0	24	146	42	0	0	80	40	28	25	120
N-32	1	POND	100	0	0	25	125	84	0	0	37	9	10	7	36
N-33	1	POND	40	52	12	1	105	36	0	0	100	78	25	3	178
N-34	2	COTT	100	53	1	26	180	26	0	0	78	41	33	9	139
N-10	3	DOGW	0	34	3	0	39	55	0	0	92	74	10	0	168
N-l:	3	DOGW	0	81	0	0	81	90	0	10	100	84	76	48	184
N-13	2	DOGW	0	61	1	0	62	86	0	0	100	91	39	15	191
N-14	3	DOGW	0	37	23	4	44	34	12	13	100	57	66	62	157
N-30	3	DOGW	0	9	0	9	18	SO	0	33	100	71	24	12	171
n-37	2	DOGW	0	35	26	29	90	5	0	18	63	66	9	8	149
N-16	3	DOGW	0	59	2	27	88	13	2	14	100	94	44	20	194
N-22	3	DOGW	0	49	3	24	77	20	2	0	90	73	35	20	143
N-17	3	DOGW	0	65	11	3	79	49	28	0	80	76	45	40	158
N-27	3	ROSE	0	43	28	0	71	10	20	24	98	63	5	0	161
N-42	3	ROSE	0	49	0	38	87	3	8	0	82	66	8	0	148
N-l	3	WILL	63	3	2	97	165	0	0	0	100	21	9	13	121
n-4	3	WILL	0	10	0	63	73	0	0	37	100	51	0	0	151
N-19	3	WILL	0	41	0	86	127	13	0	0	100	56	19	2	156
N-11	3	WILL	0	24	0	55	79	33	3	0	98	63	3	0	161
N-21	4	DOGW	0	32	0	27	59	34	16	26	72	68	25	23	140
N-28	4	ROSE	0	61	49	25	115	8	0	20	90	66	2	0	156
N-10	4	ROSE	0	7	0	81	88	4	1	0	38	[illegible]	1	0	47
N-29	4	SNOW	35	24	13	45	117	21	17	0	90	52	27	25	142
N-8	4	SNOW	0	53	0	0	53	13	24	10	100	99	3	1	199
N-12	4	WILL	0	77	0	0	77	6:	12	0	75	72	49	56	147
x-2	6	C.GR	5	3	0	100	108	0	0	0	100	56	13	8	156
N-3	6	C.GR	2	0	0	100	102	0	0	6	100	49	0	0	149
N-7	.	C.GR	0	0	0	100	100	0	0	0	100	35	0	0	135
N-44	7	ONIO	0	0	3	2	10	7	17	[illegible]	70	4	0	0	74
N-6	7	SOTI	0	54	14	3	72	6	20	0	98	84	1	0	183
TOTALS FOR NEST			300	1[illegible]0	227	936	[illegible]	419	11[illegible]	399	403	979	985	727	4[illegible]3
AVERAGE FOR NEST			21	31		30	38	26	10	13	a:	61	25	19	1[illegible]3
STANDARD DEV NEST			32	44	11	32	3[illegible]	24	17	17	17	22	23	2:	35

Appendix 3. Continued.

LFR CANADA GOOSE GROUND-NEST SITE CHARACTERISTICS
1983

PLOT NAME: NEST

PLOT #	COV TYP	DOMINANT SPECIES	DIFF TYPE	DIST TO HWM VERT	DIST TO HWM HORIZ	TOPO-TYPE	NEST COVER	AVE COVER	G/F HT	SHRUB HT.
N-26	1	JUNIPER	12	1.0	0.8	4	36	52	18.0	110.0
N-30	1	JUNIPER	5	0.9	1.0	4	92	59	22.0	64.0
N-34	1	JUNIPER	3	6.9	1.0	5	19	13	22.0	105.0
N-39	1	JUNIPER	3	2.0	0.7	0	98	26	42.0	113.0
N-49	1	JUNIPER	12	-1.0	-1.0	5	94	47	23.0	52.0
N-53	1	JUNIPER	12	-1.0	-1.0	5	91	9	11.0	0.0
N-24	1	PPINE/JUN..	12	2.2	0.9	4	55	51	29.0	74.0
N-47	1	P.PINE/JUN	1	-1.0	-1.0	5	98	60	24.0	68.0
N-9	1	P.PINE/JUN		2.1	13.6	3	0	28	13.0	52.0
N-23	1	PONDEROSA	3	1.9	1.0	4	90	44	25.0	84.0
N-32	1	PONDEROSA	5	1.0	11.4	1	74	85	27.0	20.0
N-33	1	PONDEROSA	3	0.5	4.2	3	24	21	30.0	108.0
N-34	2	COTTONWOOD	5	0.4	4.0	2	41	69	26.0	103.0
N-10	3	DOGWOOD	4	1.9	9.6	5	8	14	15.0	115.0
N-12	2	DOGWOOD	12	-1.0	-1.0	3	47	11	8.0	196.0
N-13	3	DOGWOOD	12	-1.0	-1.0	5	11	18	41.0	190.0
N-14	3	DOGWOOD	12	-1.0	-1.0	5	22	56	18.0	290.0
N-20	3	DOGWOOD	12	1.0	0.8	4	0	45	28.0	110.0
N-37	3	DOGWOOD	5	0.5	2.0	3	21	23	27.0	143.0
N-15	3	DOGWOOD/C.	12	0.3	1.5	5	29	21	57.0	149.0
N-22	3	DOGWOOD/RO	5	0.5	0.2	2	27	48	17.0	190.E
M-17	3	DOGWOOD/VI	12	-1.0	-1.0		13	21	16.0	138.0
N-27	3	ROSE	12	1.0	1.1	4	21	19	17.0	107.0
N-42	3	ROSE	6	-1.0	-1.0	3	0	19	34.0	105.0
N-1	3	VILLGV	6	-1.0	-1.0	5	43	32	105.0	122.0
N-4	3	WILLOW	12	-1.0	-1.0	3	10	19	83.0	160.0
N-19	2	WILLOW/C.	7	-1.0	-1.0	5	21	37	35.t	143.0
N-11	3	WILLOW/C.G	12	1.6	8.0	5	22	10	38.0	198.0
N-21	4	DOGWOOD/RO	12	1.0	1.5	4	39	20	6.0	44.0
N-28	4	ROSE	12	0.7	1.5	2	27	4	36.0	90.0
N-50	4	ROSE/DOGWO	7	0.5	0.5	4	1	10	13.0	35.0
N-29	4	SNOWB ERRY	1	0.3	1.6	2	9	30	21.0	38.0
N-6	4	SNOWB ERRY	1t	2.0	5.7	4	45	34	10.0	43.0
N-18	4	WILLOW/C.G	12	-1.0	-1.0	4	73	10	17.0	77.0
K-2	6	C.GRASS	12	-1.0	-1.0	3	9	28	81.0	125.0
N-3	6	C.GRASS	12	-1.0	-1.0	3	25	17	36.0	0.0
N-7	4	C.GRASS	12	2.2	8.9	5	8	10	61.0	0.0
N-44	7	ONION	12	-1.0	-1.0	2	0	0	19.0	35.0
N-[illegible]	7	EQU[illegible]ETUM	[illegible]	1.0	5.6	5	42	12	40.0	75.0
TOTALS FOR NEST				1[illegible].2	[illegible]		[illegible]	[illegible]	[illegible]	416.0
AVERAGE FOR NEST				0.4	1.9		36	30	31.5	100.4
STANDARD DEV NEST				1.0	3.8		21	21	22.8	61.9

Appendix 3. Continued.

LFR CANADA GOOSE GROUND-NEST SITE CHARACTERISTICS
1988

- - - - PLOT NAME RANDOM - - - -

PLOT #	COV TYP	DOMINANT SPECIES	DIFF TYPE	DIST TO HWM VERT	DIST TO HWM HORIZ	TOPO-TYPE	NEST COVER	AVE COVER	G/F HT.	SHRUB HT.
R-IO	1	JUNIPER	12	1 1	4 .6	3	41	is	29 0	40 0
R-37	1	JUNIPER.PI	5	0.5	30.0	4	36	25	30.0	65.0
R-70	1	JUNIPER/RO	2	0.3	2.a	3	85	91	68.0	193.0
R-95	1	P.PINE/GRA	3	1 3	31.0	5	78	36	20.0	7s. 0
R-45	1	PINE-JUNIP	12	-1 0	-1 0	4	26	67	27.0	97.0
R-10	1	PINE/BALSA	12	2.4	22.0	4	27	51	40 0	0.0
R-54	1	PINE/JUNIP	12	0.3	4.0	3	76	67	21.3	20.0
X-41	1	PONDEROSA	5	0.:	34.0	2	8.	81	35.0	26.0
R-10	1	PONDEROSA	3	1 6	15.0	4	85	74	24.0	13.c
a-33	2	COTTONWOOD	5	-1.0	1.0	2	77	31	4s.c	50.0
R-24	2	COTTONWOOD	3	0.9	6.9	2	98	87	16 0	130.0
n-71	2	COTTONWOOD	1:	-1.0	-1 0	3	43	42	4s 0	151 0
R-87	3	DOGWOOD	12	-1 3	-1 .0	1	ES	73	60.0	241.0
R-56	3	DOGWOOD/GR	12	-1.0	-1.0	2	37	87	70.0	197.0
R-64	3	DOGWOOD/RO	12	-1.0	-1 0	3	60	61	36.0	179.0
R-84	3	DOGWOOD/WI	12	-1.0	-1 0	2	7	36	46.0	144.0
a-90	3	DOGWOOD/WI	12	-1.0	-1.0	4	89	49	41.0	210 0
R-35	3	ROSE	5	0 5	2.c	2	28	31	33.0	103.0
X-74	3	ROSE	5	0.3	2.3	3	66	44	25.0	163 0
R-97	3	WILD ROSE/	12	-1.0	-1.0	2	85	so	57.0	143.0
R-52	3	WILLOW-CAN	12	-1.0	-1.0	5	4	15	68.0	130 0
ii-7	4	HERBACEOUS	2	-1.0	-1.0	1	0	0	6.0	15.3
R-10	7	HERBACEOUS	12	-1.0	-1 0	1	5	0	18.0	16 0
R-62	7	HERBACEOUS	12	-1.0	-1.0	2	4	2	21.0	44 0
R-13	7	ISL.COMPOS	12	-1.0	-1.0	1	0	0	14.0	23.0
R-31	7	ISL.COMPOS	12	-1 0	-1.0	1	0	0	7.0	20 0
R-5	7	ONIONS/HOR	12	-1 0	-1.0	1	0	1	21.0	50.0
R-777	12	WATER	1	-1.0	-1.0	3	31	15	27.0	40 0

- - - - - TOTALS FOR RANDOM -

	-7.2	130 7	[illegible]	[illegible]	996 0	[illegible]

- - - - - AVERAGE FOR RANDOM -

	-3.3	4 7	45	42	35.4	92 9

- - - - - STANDARD DEV RANDOM -

	[illegible]	15 0	34	30	19 5	70.5

- -

Appendix 3. **Continued.**

LFR CANADA GOOSE GROUND-NEST SITE CHARACTERISTICS
1983

- - - - PLOT NAME RANDOM - - - -

PLOT #	COV TYP	DOM SPP	HORIZONTAL COVER--VEG. TREE	SHRB	FORB	GRMN	TOT	GROUND SURFACE LITR	BG/RK	MOH	VERTICAL COVER 0-.3	.3-1	1-2	t - 3	0-:
R-10	1	JUNI	36	41	2	18	97	46	0	0	SO	23	26	20	73
R-37	1	JUNI	0	37	37	61	135	6	0	0	9s	50	30	5	145
R-70	1	JUNI	75	93	0	0	168	100	0	0	88	84	57	40	172
R-95	1	P.PI	30	57	4	70	161	21	0	0	70	34	5	0	104
R-45	1	PINE	50	0	40	82	172	15	0	0	47	28	31	19	7:
R-10	1	PINE	27	2	15	47	91	36	0	0	45	20	23	20	is
a-54	1	PINE	73	0	0	5	76	100	0	0	73	79	56	63	152
R-41	1	POND	70	19	28	8	125	73	0	0	58	36	40	42	94
R-10	1	POND	88	0	1	14	103	65	0	0	10	9	21	13	19
a-33	2	COTT	43	1	5	80	129	15	2	0	80	35	22	24	lit
R-26	2	COTT	100	76	3	0	179	21	0	0	85	94	70	55	179
R-71	2	COTT	0	31	0	28	59	26	0	38	92	71	23	0	163
K-87	3	DOGW	0	100	20	0	120	30	so	0	100	100	68	72	200
R-26	3	DOGW	0	15	0	81	96	10	4	0	7s	so	29	36	125
R-66	3	DOGW	0	39	0	66	105	39	0	5	93	83	66	65	176
R-66	3	DOGV	0	18	65	22	105	39	20	0	100	97	73	42	197
R-90	3	DOGW	0	24	38	66	128	8	5	12	98	76	80	53	174
R-35	3	ROSE	0	51	46	5	102	3	0	0	100	81	13	0	181
R-74	3	ROSE	0	60	74	26	162	35	0	0	98	93	49	24	191
n-97	3	WILD	0	33	67	17	117	83	0	0	100	100	45	0	200
R-32	3	WILL	0	15	67	63	145	31	0	so	82	28	2	0	110
R-7	4	HERB	0	8	7	0	15	0	85	0	10	0	0	0	10
R-10	7	HERB	0	0	38	0	38	0	60	2s	SC	7	0	0	57
R-62	7	HERB	0	0	29	21	50	0	87	0	2s	3	0	0	29
R-13	7	ISL.	0	5	27	1	35	0	65	0	8	0	0	0	8
R-31	7	ISL.	0	0	25	0	25	0	75	22	2	[illegible]	0	11	372
R-S	7	ONIO	3	8	47	4	62	0	49	8	33				
a-77	[illegible]	WATE	0	0	20	37	57	0	26	30	87	8	0	0	95

- - - - - T O T A L S FOR RANDOM -

	595	733	709	822	459	824	528	190	154	493	817	593	947

- - - - - AVERAGE FOR RANDOM -

	21	26	25	29	102	29	19	:	66	45	29	21	112

- - - - - STANDARD DEV RANDOM -

	32	29	13	29	46	31	39	13	32	36	26	24	[illegible]

Appendix 3. Continued.

LFR CANADA GOOSE BROOD SITE CHARACTERISTICS
1983

PLOT #	COV TYP	DOMINANT SPECIES	DIFF TYPE	DIST TO NEAR VERT	DIST TO NEAR HORIZ	TOPO-TYPE	AVE COVER	C/F Xi.	SHRUB HT
I-12	1	JUNIPER	12	0 0	0 0		27	40.a	100 0
I-25	1	JUNIPER	5	0.6	34.0		15	10.0	0.0
I-19	2	COTTONWOOD	5	0.4	20 2		34	45.0	30.0
I-20	2	COTTONWOOD	4	0.3	25 1		57	40.0	200.0
x-14	5	GRASS	12	3.3	3i.a		0	14.0	0.0
I-10	6	GRASS	1	0.7	10 3 0		0	35.0	0.0
I-13	8	WILD OATS	12	2.4	54 4		2	73 7	0.0
I-16	11	CLAYBANKS	11	0.0	0 2		19	47.0	40 0
I-15	12	WATER	0	0.0	0.0		0	0.0	0 0
AVERAGE				0.6	29 3		17	33.9	41.1
STANDARD DEV.				0.7	30	4	19	21.3	54.4

PLOT #	COV TYP	DOM SPP	HORIZONTAL COVER--VEG. TREE	SHRB	FORB	GRMI	TOT	GROUND SURFACE LITR	BG/RK	HOM:	VERTICAL COVER 0-.3	.3-1	1-2	2-3	0-1
I-12	1	JUNI	22	16	57	62	157	0	0	0	98	64	50	20	162
I-25	1	JUNI	IS	0	27	100	142	0	0	0	10	2	19	25	12
t-19	2	COTT	36	4	44	33	167	3	3	0	83	27	27	42	110
I-20	2	COTT	15	23	0	73	111	21	0	0	87	33	2s	25	123
t-14	5	GRAS	0	0	30	100	130	0	0	0	30	7	0	0	37
t-10	6	GRAS	0	0	14	87	101	0	0	0	90	9	0	0	99
t-13	8	VILD	0	0	69	55	124	0	31	0	75	32	0	0	107
I-16	·	CLAY	0	0	26	12	73	0	27	[illegible]	[illegible]	54	14	8	126
I-15	·	WATE	3	3	0	0	0	0	0	100	0	0	0	0	0
AVERAGE			10	2	30	57	112	3	.	1f	61	25	15	13	86
STANDARD DEV			12	3	22	30	48	7	12	32	35	22	15	14	53

Appendix 4

Location Information from 5 radio-marked geese. LFR, 1983.

Appendix 4. Location information from 5 radio-marked geese, lower flathead River, Montana, 1983.

#	B#	LOC #	MHD	DATE	TIME	LOC QU	COV TYP	LDF TYP	ACT	BRD
17	4	1	G	06-29-83	1745	G	2	C		
18	4	2	G	07-01-83	900	G	2&3	C		
19	4	0	G	07-04-83	1000	G		C		
20	4	3	G	07-06-83	1350	G		FR		
21	4	4	G	07-14-a:	815	V		C		
68	4	0	A	07-23-83	1200	V	8	FR		
71	4	0	G	07-25-83	1000	G		C		
76	4	0	G	07-26-83	1400	G		C		
79	4	5	G	08-02-83	1040	V	9	FR	1&5	
81	4	5	G	08-03-83	1230	G		C		
101	4	0	A	08-26-83	1035	G		FR		
104	3	7	G	09-06-83	1500	G		R	1	
3	4	8	A	09-13-83	1105	G	10	R	1	
a	4	9	A	09-22-83	1345	G	12	R	1	
..	4	10	A	09-23-83	0	N				

CODES:

Location Quality

S - specific
G - general
V - visual
N - none

Method

G - Ground
A - Aerial

Cover Type

1 - Con. Forest
2 - Dec. Forest
3 - High Shrub
4 - Sht. Shrub
5 - Sht. Grass
6 - Tall Grass
7 - Forb Dom.
o - Cropland
9 - Gravel Bar
10 - Sand Bar
11 - Cliff
12 Water
13 - Pasture
14 - Island

Landform

A & e -

L - lake
R - reservoir
P - potholes
C - creek
FR - Flathead river
BW - backwater
B - beach
F - flat

Activity

1 - loafing
2 - feeding
3 - flying
4 - swimming
5 - preening

Appendix 4. Continued.

OBS #	F#	LOC #	MHD	DATE	TIME	LOC QU	CIV TYP	LDF TYP	ACT	BRD SZ
61	18	1	G	06-24-83	1115	G		FR		
62	18	2	G	06-26-83	1300	G		FR		
63	18	3	G	06-27-83	1034	G		FR		
64	18	4	G	06-28-83	1015	G		FR		
65	18	5	G	06-29-83	730	G		FR		
46	18	6	G	06-30-83	730	G		FR		
67	18	0	G	07-01-83	1030	G		FR		
63	18	0	A	07-23-83	1215	G		R		
73	18	0	G	07-25-83	0	N				
78	18	7	G	07-27-83	915	V	8	A	1	
80	18	a	G	08-02-83	1310	G		C		
84	18	9	G	08-03-83	1230	G		C		
86	18	10	G	08-03-83	5600	V	9	FR	1	
89	18	0	G	08-04-83	1200	G		FR		
92	18	0	G	08-10-83	1130	G		FR		
99	18	12	A	08-26-83	1050	V		FR	3	
6	18	13	A	09-13-83	1030	G	10	R	1	
11	18	14	A	09-22-83	1355	V		R	3	
16	18	15	A	09-29-83	1345	G				
107	18	16		10-01-83	0	G				

Appendix 4. Continued.

OBS #	B#	LOC #	MND	DATE	TIME	LOL GU	COV TYP	LDF TYP	ACT	BRD SZ
7	7	23	A	09-22-83	1515	V	12	FR	4	
[illegible]	7	24	A	09-23-83	955	G	8		1&2	
39	10	1	G	06-10-83	1300	V	365	FR		7+
40	13	2	G	06-14-83	1500	V		FR		6
41	10	0	G	06-15-83	1730			FR		
42	10	3	G	06-24-83	1115	G	3&12	FR	4	
43	10	4	G	06-26-83	1300	V	9	CR		
44	10	5	G	06-27-83	1034	V	12	FR	4	
45	10	6	G	06-28-83	1015	V	9	FR	1	
46	10	7	G	06-29-83	730	V	14	FR	2	
47	10	8	G	06-30-83	730	V	14	FR	1	
48	10	0	G	07-01-83	1030	V	12	FR	4	
49	10	0	G	07-04-83	1030	G		FR		
74	10	0	G	07-25-83	0	N				
75	10	9	G	07-26-83	1330	G	12	P		
13	10	10	G	08-03-83	1230	G		C		
85	10	11	G	08-03-83	1600	V	9	FR	1	
88	10	0	G	08-04-83	1200	G		FR		
91	10	12	G	08-10-83	1000	G	13	FR	1&5	
100	10	13	A	08-26-83	1030	G		R		
105	10	14	G	09-06-83	1500	G		R	1	
5	10	15	A	09-16-83	1100	G			3	
[illegible]	10	30	A	09-22-83	3	N				
[illegible]	10	[illegible]	A	09-28-83	[illegible]	G	3		1&2	

Appendi x 4·

TBE #	BY	DOC #	MHD	DATE	TIME	LOC GU	DEV TYP	LOF TYP	ACT	BRD SC
1	14	1	G	06-10-83	1400	V	1	FR		
50	14	2	8	06-13-83	1330	V	21	FR	4	
51	14	3	G	06-14-83	1900	V		FR		
52	14	0	G	06-15-83	1730	G		FR		
53	14	4	8	06-24-83	1130	8		FR		
54	14	5	G	06-26-83	1300	8		FR		
55	14	6	G	06-27-83	1034	8		8R		
56	14	7	8	06-28-83	1015	G		FR		
57	14	8	8	06-29-83	730	G		FR		
58	14	0	G	07-01-83	1000	G		FR		
59	14	9	G	07-04-83	1100	V		FR		
60	14	10	G	07-21-83	1505	G		FR		
70	14	11	8	07-25-83	1130	8		!!!		
77	14	0	8	07-26-83	1430	G		FR		
82	14	12	G	08-03-83	1230	8		8		
87	14	0	G	08-04-83	1200	8		8R		
90	14	13	8	08-10-83	1000	8	13	FR	1&5	
94	14	14	8	08-25-83	1400	V	12	R	4	
97	14	15	A	08-26-83	1020	G	13	R	1	
103	14	16	G	09-06-83	1400	8		R	1,2,	
4	14	17	A	09-13-83	0	N				
9	14	18	A	09-22-83	0	"				
14	14	19	A	09-29-83	0	"				