# BIRD DIVERSITY AND FOREST SUCCESSION IN KOOTENAY NATIONAL PARK

MASTER OF SCIENCE
THESIS RESEARCH

PROGRESS REPORT

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## FOREWORD

The data analysis presented in this progress report is of a very rough nature and was done simply to determine the presence or absence of any trends. A much more sophisticated analysis will be carried out in the fall of 1989.

## 1.0 INTRODUCTION

The purpose of my research is to quantify relationships between avian communities and forest succession in the subalpine zone of Kootenay National Park.

My objectives are to:

1) Determine patterns of bird species diversity in Kootenay National Park.

2) Test hypotheses concerning factors which may contribute to this bird species diversity:
   a) successional stage
   b) habitat structure
   c) effect of ecotones
   d) size of successional habitat patch
   e) location of successional habitat patch

3) Provide recommendations for management of the avifauna of Kootenay National Park.

I have focused on objectives 1, 2a, 2b and 2c for the 1989 summer field season. Objectives 2d, 2e, and 3 will be investigated at a later date.

## 2.0 INITIAL FINDINGS

### 2.1 OBJECTIVE 1: Patterns of Bird Species Diversity

To meet objective 1, bird data available from the "Ecological Land Classification (ELC) of Kootenay National Park", will be analyzed. The bird data was obtained form the Canadian Parks Service Regional Office in early August. Analysis of this data will be carried out in the fall of 1989.

### 2.2 OBJECTIVE 2a: Diversity in Different Successional Stages

To meet objective 2a, a total of 211 circular breeding bird

plots were completed in five different successional stages, or forest age classes, in the subalpine zone. This method, where circular plots surveyed from single points are used, is based on a modification of the variable circular-plot technique described by Reynolds, Scott and Nussbaum (1980). Within each successional stage sampling transects were located on aerial photographs and previewed in the field. Points were sampled along the transects at sites 200m apart from about 1\2 hour before sunrise until 10:00 AM or until song activity was judged to be too low to be representative of bird density. Each plot had a radius of 100 m. At each sample plot I remained stationary for one minute before beginning to record bird activity. All birds seen or heard were recorded on a field sheet. The distance to each bird, at the location it was first seen or heard, was estimated and plotted on the field sheet. Approximately 10 plots per successional stage were set up at the end of May and each successional stage was censused 4 times. All censuses were carried out between June 1 and June 30, 1989.

Three of the census areas were within the borders of Kootenay National Park, one was located on the Banff side of the Vermilion Pass while the last was located at the junctions of Moose and Dainard Creeks just outside the western boundary of Kootenay National Park. The five successional stages identified are as follows:

1) Recent Clear-Cut (CC) (1 to 3 years old)
   * Because there have not been any recent large fires in the subalpine zone of KNP, clear cut patches just outside the park boundary were used to represent an early successional stage.

2) Pole-Sapling (PS) (21 years old)
   * The Vermilion Pass Burn at the north end of KNP was used for the pole-sapling stage.

3) 65 Year Old Lodgepole Pine (LP)
   * Because no homogeneous stands of "middle-aged" lodgepole pine could be found in the subalpine of KNP

an extensive area on the Banff side of the Vermilion Pass was used.

4) 150 Year Old Mixed Spruce-Pine-Fir
   * This is a very common forest age in the Vermilion Valley. The area between the Paint Pots and Marble Canyon, on the west side of Highway 93, was censused.

5) 250+ Year Old Spruce-Fir
   * A large stand of 250+ spruce-fir adjacent to the Vermilion Pass Burn just north of Marble Canyon was censused.

All five stands or patches have similar elevations (between 1600 and 1800 meters). All patches are either regenerating shrubs and seedlings, lodgepole pine, Engelmann spruce, Subalpine-fir or a mixture of these although the lowest clear-cut had some Douglas-fir around it.

Figures 1 and 2 summarize the initial findings in terms of bird density (Figure 1) and species richness (Figure 2) in the different successional stages. I found significant differences (T-Test) in bird densities between all 5 successional stages. The bird density used for comparison is simply the mean number of birds encountered per plot (i.e. the number of birds either seen or heard in a 10 minute census period). I also found significant differences (T-Test) in the number of bird species encountered per plot (i.e a rough estimate of species richness) between four of the five successional stages. There was not a significant difference in species richness between the 150 year old stand (SPF) and the 250+ year old stand (OG). The lists of bird species encountered in each successional stage can be found in Appendix I.

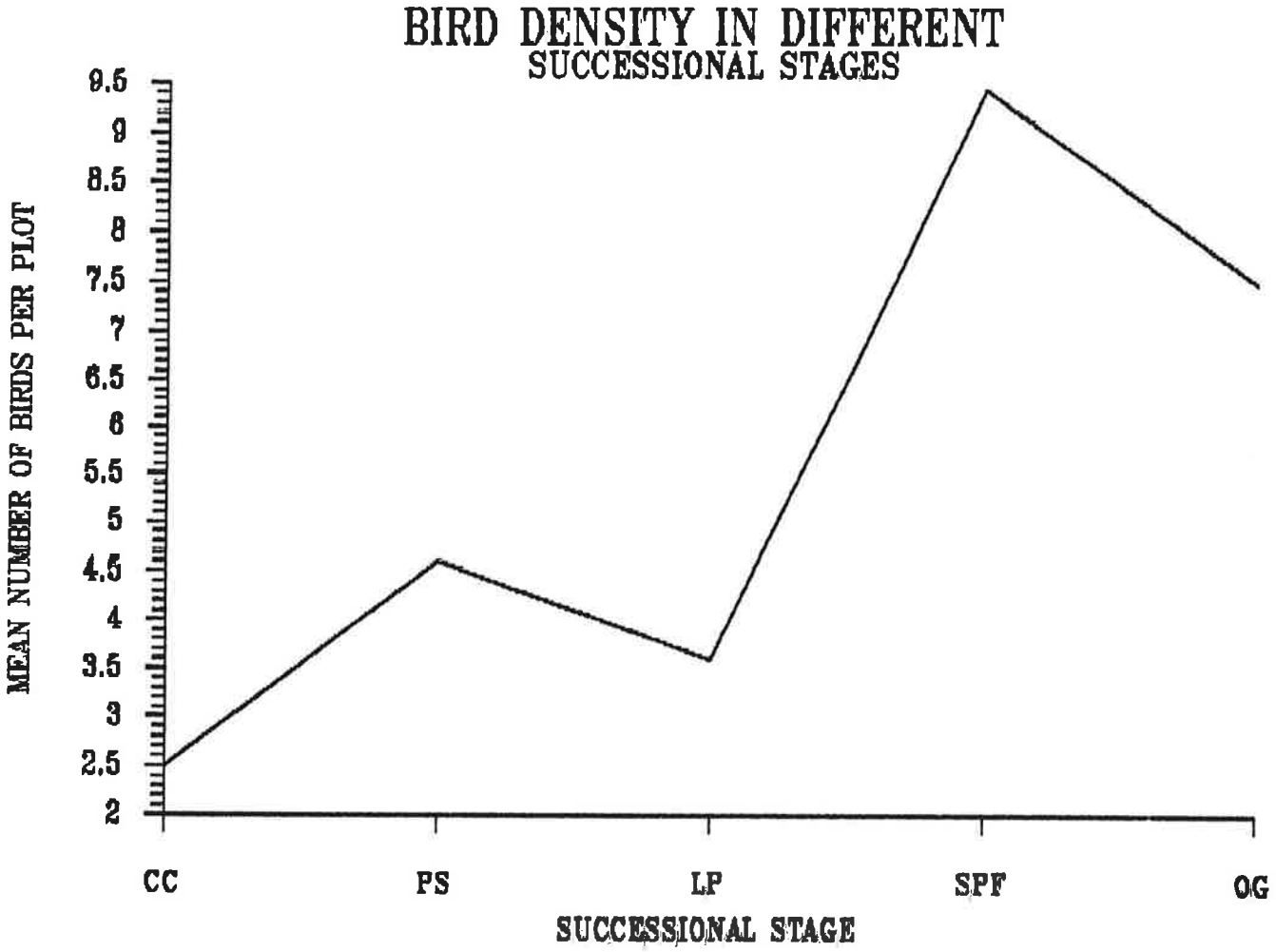


Figure 1. Bird Density in Different Successional Stages (CC=1-3 Year Old Clear Cut, PS=21 Year Old Pole Sapling, LP=65 Year Old Lodgepole Pine, SPF=150 Year Old Spruce-Pine-Fir, OG=Old Growth or 250+ Year Old Spruce-Fir).

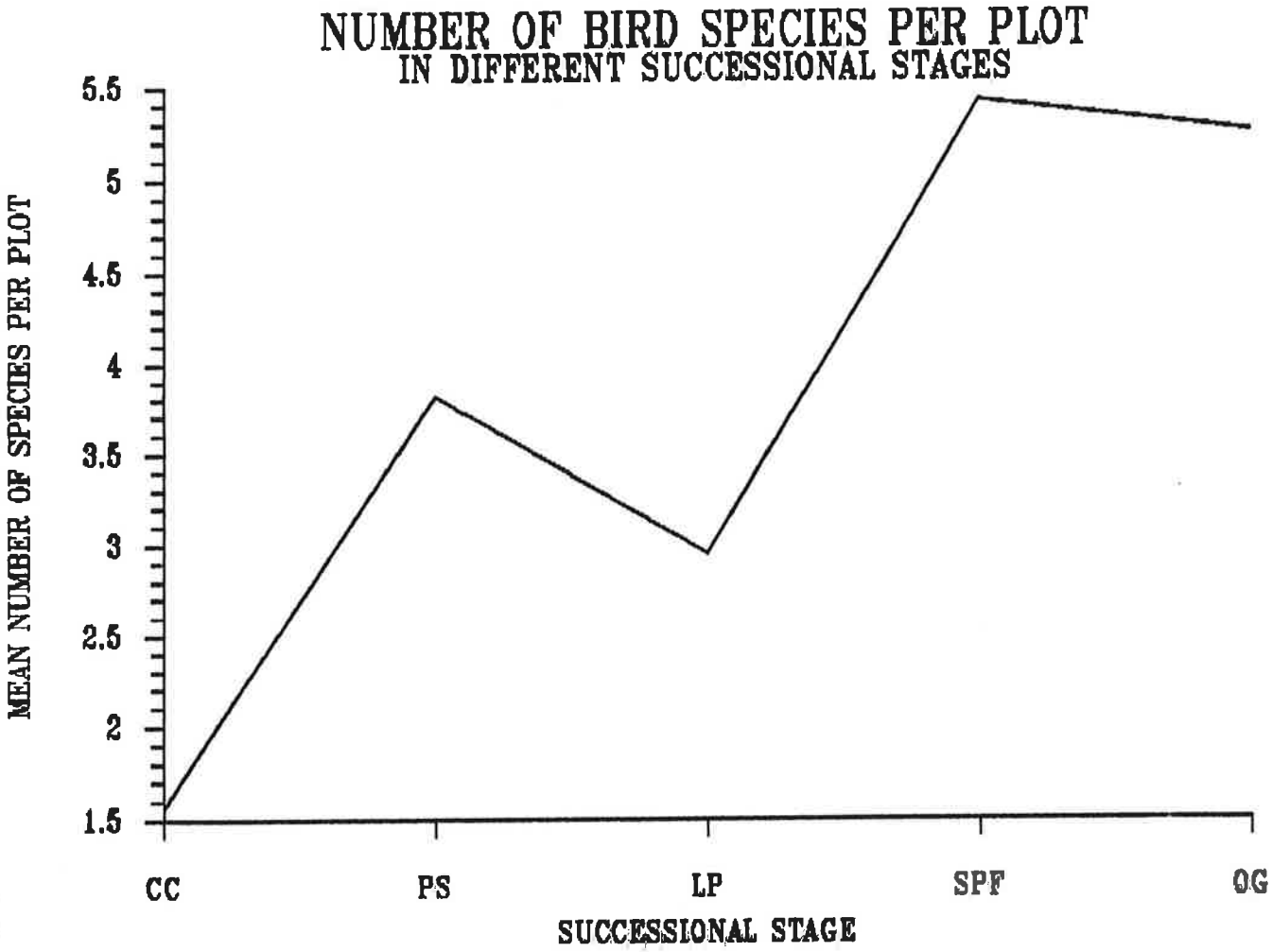


Figure 2. The Number of Bird Species Per Plot in Different Successional Stages (CC=1-3 Year Old Clear Cut, PS=21 Year Old Pole-Sapling, LP=65 Year Old Lodgepole Pine, SPF=150 Year Old Spruce-Pine-Fir, OG=Old Growth or 250+ Year Old Spruce-Fir).

## 2.3 OBJECTIVE 2b: Bird Diversity and Habitat Structure

In order to determine relationships between bird diversity and forest structure, 200 vegetation plots, 40 in each successional stage, were sampled. Within each bird plot four vegetation plots were set up at fifty meter intervals along the bird transects (the bird circles were located every 200 meters along a transect). Plots were four meters in radius about a central point. At each plot location, canopy cover was estimated to the nearest percent for each layer. Five layers were recognized:

1) Herb-Creeping Plant Layer -- 0.0 - 0.5 meters
2) Low Shrub -- 0.5 - 1.0 meters
3) High Shrub -- 1.0 - 10.0 meters
4) Main Canopy -- 10.0 - 20.0 meters
5) High Canopy -- >20 meters

In order to get an estimate of crown volume, the crown depth of one representative tree, of each species present, was measured. Using the crown depth and the percent cover of each species an estimate of crown volume for each species can be determined.

At every second plot a snag and stump analysis was done. The following were noted:

1) Species of tree (if possible)
2) Height of tree (using a Sunto clinometer)
3) DBH of tree
4) Decay class of tree (either solid, decaying or punky).

Also, at every second plot, the numbers of i) downed trees and ii) trees with dead tops, were noted.

A Vegetation Description Form can be found in Appendix II.

As of August 14th, 1989 no analysis of the vegetation data has been done. A log-linear analysis will be conducted in the fall of 1989 to determine whether these structural characteristics can be used to predict bird species diversity.I hypothesize that:

1) There will be a positive relationship between bird species diversity and foliage height diversity.

2) The presence of cavity nesting birds will be correlated to the presence of snags and stumps.

## 2.4 OBJECTIVE 2c: The Edge Effect

To meet objective 2c, circular breeding bird plots were conducted along a transect perpendicular to the edge between the pole-sapling successional stage and the old growth successional stage. The censusing points for the edge plots were located so that half of the plot was in the pole sapling forest type and half of the plot was in the old growth forest type. I had hypothesized that:

1) Bird species diversity at the edge between two successional habitat patches would be greater than the bird species diversity found in homogeneous patches of each successional stage.

Figure 3 summarizes the initial findings. I found significant differences (T-Test) in bird density (using the number of birds per plot as my estimate of density) between the old growth edge plots and all plots found in homogeneous old growth forest but I did not find a significant difference in density between the pole sapling edge plots and the plots found in homogeneous pole-sapling stands. Due to time limitations and other factors, transects between other combinations of edge (i.e. clear cut and old growth or spruce-pine-fir and pole-sapling etc.) were not set up or censused during the 1989 field season.

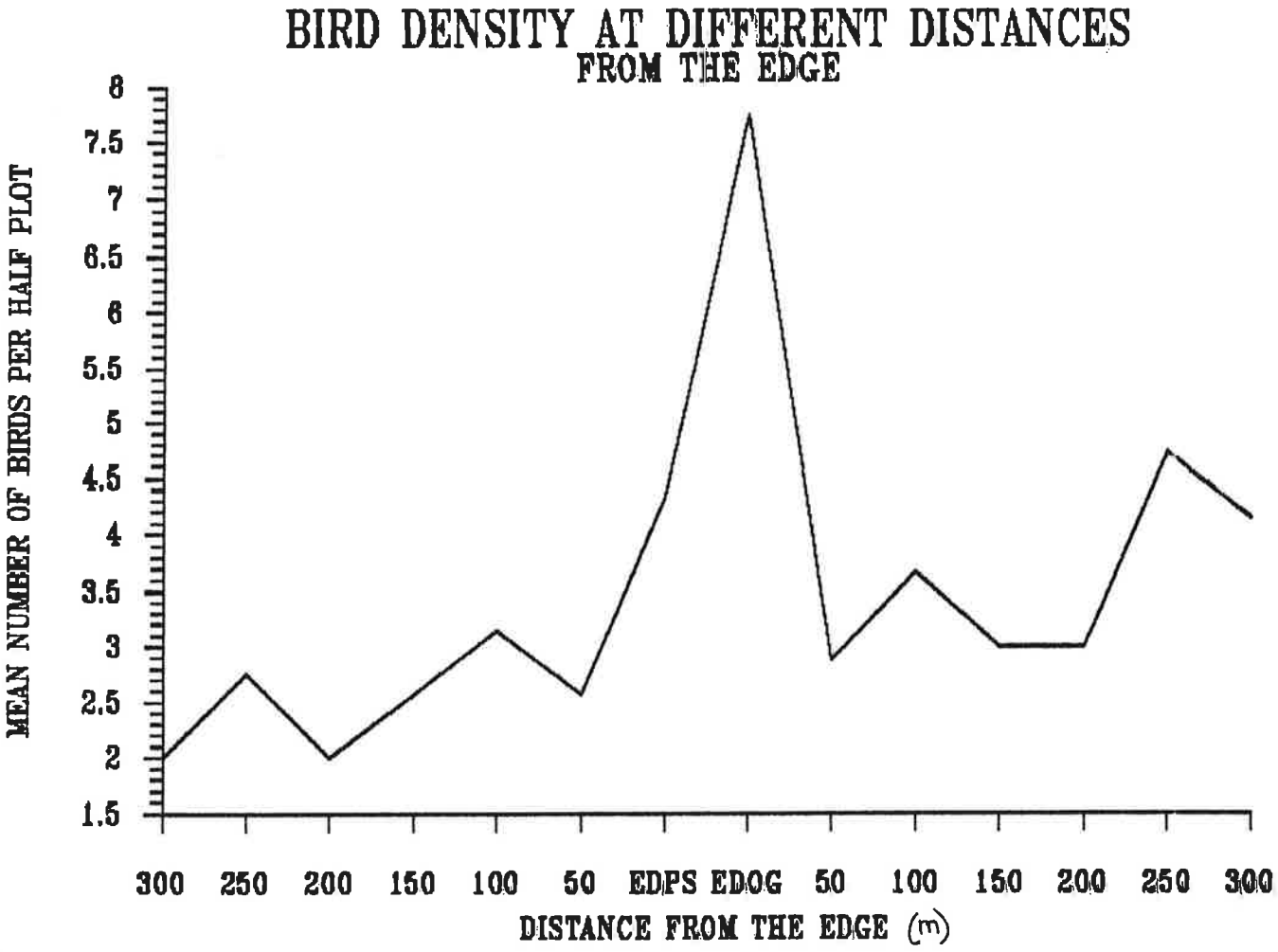


Figure 3. Bird Densities at Different Distances from the Edge Between Pole-Sapling and Old Growth Stands (The densities used are mean densities of half plots: i.e PSCE = Pole-sapling plot C, east half).

## 3.0 WORK SCHEDULE

At this point my work schedule remains as presented in my research proposal. The work schedule is as follows:

| TERM | |
|---|---|
| Sept. 88 - Dec. 88 | - attend courses at SFU |
| Jan. 89 - April 89 | - attend courses, do literature review and write research proposal |
| May 89 - August 89 | - collect data in the field |
| Sept. 89 - Dec. 89 | - analyze data |
| Jan. 90 - April 90 | - analyze data and attend courses |
| May 90 - August 90 | - collect data in field |
| Sept. 90 - Dec. 90 | - analyze data and write thesis |

## APPENDIX I

## LIST OF BIRD SPECIES ENCOUNTERED

| Bird Species | Successional Stage CC | PS | LP | SPF | OG |
|---|---|---|---|---|---|
| Townsend's Solitaire | X | X | | | |
| Dark-eyed Junco | X | X | X | X | X |
| Pine Siskin | X | X | X | X | X |
| Robin | X | X | X | X | X |
| Common Raven | X | X | X | | |
| Chipping Sparrow | X | | | X | X |
| Hermit Thrush | | X | X | X | X |
| Swainson's Thrush | | X | X | X | X |
| Yellow-rumped Warbler | | X | X | X | X |
| Bohemian Waxwing | | X | X | X | X |
| Wilson's Warbler | | X | X | | X |
| Mountain Chickadee | | X | X | X | X |
| Clark's Nutcracker | | X | X | | X |
| Olive-sided Flycatcher | | X | | | X |
| Spruce Grouse | | X | X | X | X |
| Goshawk | | X | | | |
| Dusky Flycatcher | | X | | | |
| Northern Flicker | | X | X | X | X |
| Red-breasted Nuthatch | | X | | X | X |
| Townsend's Warbler | | | X | X | X |
| Varied Thrush | | | X | X | X |
| Ruby-crowned Kinglet | | | X | X | X |
| Brown Creeper | | | X | | |
| Golden-crowned Kinglet | | | X | X | X |
| Boreal Chickadee | | | X | X | X |
| White-winged Crossbill | | | X | | X |
| Gray Jay | | | | X | X |
| Northern Three Toed Woodpecker | | | | X | X |
| Hammond's Flycatcher | | | | X | |
| Evening Grosbeak | | | | X | X |
| Winter Wren | | | | X | X |
| Tennessee Warbler | | | | X | |
| McGillavray's Warbler | | | | X | |
| Black-capped Chickadee | | | | | X |
| Rufous Hummingbird | | | | | X |
| Orange-crowned Warbler | | | | | X |

APPENDIX II

RETURN TO:
D. CATT
KOOTENAY NAT. PARK
BOX 220 RADIUM B.C.
V0A 1M0

VEGETATION DESCRIPTION FORM  DATE: ___ ___ ___ (D) (M) (Y)

SITE: _____
PLOT: _____
SUBPLOT: _____
UTM: __ _____ _____

ECOSITE: _____
VEG'N TYPE: _____

ASPECT(N,S,E,W): ___

1) FOLIAGE COVER INFORMATION

MAIN CANOPY HEIGHT ____m

| LAYER | | %COVER | SPECIES COMPOSITION |
|---|---|---|---|
| HERB-CREEP | (0-.5m) | _____ | _____ |
| LOW SHRUB | (.5-1m) | _____ | _____ |
| HIGH SHRUB | (1-10m) | _____ | _____ |
| MAIN CANOPY | (10-20m) | _____ | |
| HIGH CANOPY | (>20m) | _____ | _____ ___%LP ___%SF ___%SP |

2) SNAGS AND STUMPS (>10cm)

| SPECIES | HEIGHT(m) | DBH(cm) | DECAY CLASS |
|---|---|---|---|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

Solid-Bark On
Decay-Bark Off
Punky-Soft

| | | |
|---|---|---|
| SNAGS _____ | 1 | 0 |
| | 2 | low |
| DOWNED TREES _____ | 3 | med |
| | 4 | high |
| DEAD TOPS _____ | 5 | v. high |

TOTAL SNAGS _____
TOTAL STUMPS _____

3) CROWN DEPTH (ONE REPRESENTATIVE TREE)

| SPECIES | TREE HEIGHT | CROWN HEIGHT |
|---|---|---|
| _____ | _____m | _____m |
| _____ | _____m | _____m |
| _____ | _____m | _____m |

COMMENTS:
_____
_____
_____