BIOL 475
VEGETATION DESCRIPTION AND ANALYSIS

LABORATORY 4
2 OCT 2005
POINT-CENTERED-QUARTER (PCQ) METHOD

Team Members _____, _____, _____, _____

OBJECTIVE

The purpose of this lab is to familiarize you with the Point-Centered-Quarter Method (PCQ). During this lab we will determine the following for each tree species in the forest in the vicinity of each of your relevés:

Absolute density, relative density, absolute frequency, relative frequency, absolute dominance, relative dominance, importance value, and relative importance value.

Each team will do three 100-m PCQ transects. Team 1 will do three transects in the white spruce forest adjacent to their relevés. Team 2 will do three transect in the black spruce forest adjacent to their releves.

A report on the PCQ and Plot-count method (Lab 5) will be due Monday Oct 16.

READING ASSIGNMENT

Mueller-Dombois and Ellenberg. 1974. *Aims and Methods of Vegetation Ecology*. New York: John Wiley and Sons, page 93-120. "The Count-Plot Method and Plotless Sampling Techniques".

MATERIALS

100-m tape
Biltmore stick
Meter stick
Data sheets (this handout)
Table of dbh to basal area conversions (Table 1, this handout)
Pencil
Hand calculator
Graph paper

METHODS

Species density, frequency, dominance (basal area) and importance value: the point-centered quarter method.

Randomly locate a point near each relevé. Make sure that it is well within the stand of either white spruce or black spruce and a 100-m transect will not extend beyond the stand into another forest type. Stretch the meter tape to its full length in a random direction. Sample points at 10-m intervals along the tape (6 points total). At each sample point, lay a meter stick perpendicular to the transect to define an imaginary "X" that defines four quadrants. Record the following for the nearest tree in each quadrant: (1) the tree species, (2) the distance from the sample point to the tree, and (3) the diameter at breast height of the tree. Sample a total of 10 points (40 trees).

Count dead trees greater than breast height. Note next to species code if the tree is dead. We will want to know this information later.

Table 1. Conversion of dbh to basal area.

dbh (cm)	BA (cm2)	dbh (cm)	BA (cm2)	dbh (cm)	BA (cm2)	dbh (cm)	BA (cm2)
1	0.8	26	530.9	51	2042.8	76	4536.5
2	3.1	27	572.6	52	2123.7	77	4656.6
3	7.1	28	615.8	53	2206.2	78	4778.4
4	12.6	29	660.5	54	2290.2	79	4901.7
5	19.6	30	706.9	55	2375.8	80	5026.5
6	28.3	31	754.8	56	2463.0	81	5153.0
7	38.5	32	804.2	57	2551.8	82	5281.0
8	50.3	33	855.3	58	2642.1	83	5410.6
9	63.6	34	907.9	59	2734.0	84	5541.8
10	78.5	35	962.1	60	2827.4	85	5674.5
11	95.0	36	1017.9	61	2922.5	86	5808.8
12	113.1	37	1075.2	62	3019.1	87	5944.7
13	132.7	38	1134.1	63	3117.2	88	6082.1
14	153.9	39	1194.6	64	3217.0	89	6221.1
15	176.7	40	1256.6	65	3318.3	90	6361.7
16	201.1	41	1320.3	66	3421.2	91	6503.9
17	227.0	42	1385.4	67	3525.7	92	6647.6
18	254.5	43	1452.2	68	3631.7	93	6792.9
19	283.5	44	1520.5	69	3739.3	94	6939.8
20	314.2	45	1590.4	70	3848.5	95	7088.2
21	346.4	46	1661.9	71	3959.2	96	7238.2
22	380.1	47	1734.9	72	4071.5	97	7389.8
23	415.5	48	1809.6	73	4185.4	98	7543.0
24	452.4	49	1885.7	74	4300.8	99	7697.7
25	490.9	50	1963.5	75	4417.9	100	7854.0

Field Data Sheets: Fill in the table completely for the transect at each relevé. There is one data sheet for each of the 3 relevés that each team sampled.

1. Transect No. (corresponds to relevé no.) _____

(1) Sample Point No.	(2) Quadrant No.	(3) Species code	(4) Distance (m)	(5) dbh (cm)	(6) Basal area (cm^2)
1	1				
	2				
	3				
	4				
2	5				
	6				
	7				
	8				
3	9				
	10				
	11				
	12				
4	13				
	14				
	15				
	16				
5	17				
	18				
	19				
	20				
6	21				
	22				
	23				
	24				
7	25				
	25				
	27				
	28				
8	29				
	30				
	31				
	32				
9	33				
	34				
	35				
	36				
10	37				
	36				
	39				
	40				

m=10	n=40		d_t=		

2. Transect No. (corresponds to relevé no.) _____

(1) Sample Point No.	(2) Quadrant No.	(3) Species code	(4) Distance (m)	(5) dbh (cm)	(6) Basal area (cm^2)
1	1				
	2				
	3				
	4				
2	5				
	6				
	7				
	8				
3	9				
	10				
	11				
	12				
4	13				
	14				
	15				
	16				
5	17				
	18				
	19				
	20				
6	21				
	22				
	23				
	24				
7	25				
	25				
	27				
	28				
8	29				
	30				
	31				
	32				
9	33				
	34				
	35				
	36				
10	37				
	36				
	39				
	40				
m=10	n=40		d_t=		

3. Transect No. (corresponds to relevé no.) _____

(1) Sample Point No.	(2) Quadrant No.	(3) Species code	(4) Distance (m)	(5) dbh (cm)	(6) Basal area (cm^2)
1	1				
	2				
	3				
	4				
2	5				
	6				
	7				
	8				
3	9				
	10				
	11				
	12				
4	13				
	14				
	15				
	16				
5	17				
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6	21				
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7	25				
	25				
	27				
	28				
8	29				
	30				
	31				
	32				
9	33				
	34				
	35				
	36				
10	37				
	36				
	39				
	40				
m=10	n=40		d_t=		

PCQ Summary data sheets.

Calculate the values for each column for each species in each of your 3 transects. Each team should fill out the three tables for their respective transects using the calculation methods described on the next page. Obtain the data for the other three transects from the other team.

Transect No. ______________

A. Species code	B. Absolute frequency (Fa_j)	C. Relative Frequency (Fr_j)	D. Absolute Density (Da_j)	E. Relative density (Dr_j)	F. Absolute Dominance (Ba_j)	G. Relative Dominance (Br_j)	H. Importance Value (IV_j)

Transect No. ______________

A. Species code	B. Absolute frequency (Fa_j)	C. Relative Frequency (Fr_j)	D. Absolute Density (Da_j)	E. Relative density (Dr_j)	F. Absolute Dominance (Ba_j)	G. Relative Dominance (Br_j)	H. Importance Value (IV_j)

Transect No. ______________

A. Species code	B. Absolute frequency (Fa_j)	C. Relative Frequency (Fr_j)	D. Absolute Density (Da_j)	E. Relative density (Dr_j)	F. Absolute Dominance (Ba_j)	G. Relative Dominance (Br_j)	H. Importance Value (IV_j)

Fill in table above tables using the calculations described below.

Calculate the absolute density of <u>all</u> trees (Da):

Step 1. Calculate the **total distance, d_t**:

$$d_t = \sum_{i=1}^{n} d_i = \_\_\_\_\_ \text{ meters}$$

where d_t is the total distance, d_i is the distance to tree number i, and n is the total number of trees.

Step 2. Calculate the **average distance between trees, $\bar{d}$**:

$$\bar{d} = \bar{d}_t \div n = \_\_\_\_\_ \text{ meters}$$

Step 3. Calculate the **average area occupied per tree, A**:

$$A = \bar{d}^2 = \_\_\_\_\_ \text{ meters}^2$$

Step 4. Calculate the **absolute density for all trees, Da**, in trees per hectare (ha):

$$Da = (10^4 \text{ m}^2) \div A = \_\_\_\_\_ \text{ trees/ha}$$

Note: One hectar is 100 x 100 meters, or 10^4 meters^2.

Step 5. Fill in Table 3 (note that capital letters match column headings and in certain cases are not in order they are calculated!):

A. Species code. Record the names of all species encountered. Use a six letter code for each species (first three letters of the genus name and first three letters of the species name). Then calculate each of the following values for *each species.*

B. Absolute frequency of species j, Faj:

$$Fa_j = M_j \div m$$

where M_j is the number of points where species j occurs, and m is the total number of points (10 for each transect).

C. Relative frequency of species j, Frj, is the absolute frequency of species j divided by the sum of the absolute frequencies for all species:

$$Fr_j = Fa_j \div \sum_{k=1}^{p} Fa_k \bullet 100\%$$

where the denominator is the sum of the absolute frequencies (i.e., the sum of column B in Table 3) for all species, k is the species number, and p is the total number of species.

E. Relative density of species j, Dr_j, is the number of occurrences of species j divided by the total number of trees:

$$Dr_j = N_j \div n \bullet 100\%$$

where N_j is the number of occurrences of species j and n is the total number of trees.

D. Absolute density of species j, Da_j, is the relative density of species j times the absolute density of all trees:

$$Da_j = Dr_j \bullet Da$$

where Da is the absolute density for all trees (calculated in Step 4).

F. Absolute dominance for species j, Ba_j, is the mean basal area for species j times the absolute density of species j:

$$Ba_j = \bar{Ba}_j \bullet Da_j$$

where k is an individual of species j, and t is the number of occurrences of species j.

G. Relative dominance of species j, Br_j, is the absolute dominance of species j divided by the sum of dominance for all species:

$$Br_j = \frac{Ba_j}{\sum_{i=1}^{p} Ba_i} \bullet 100\%$$

where the denominator is the sum of the absolute dominance (i.e., the sum of column F in Table 3) for all species, and p is the total number of species.

H. Importance value for species j, IV_j, is the sum of the relative frequency, relative density, and relative dominance for the species:

$$IV_j = Fr_j + Dr_j + Br_j$$

REPORT DUE 16 OCT (200 POINTS)

Write a brief (less than 10 pages including tables and figures) but thorough and thoughtful report that discusses these two aspects of the forest sampling exercises:

1. **Comparison of the white-spruce and black-spruce forest structure.** Make a set of graphs that compares the mean densities, basal areas, frequencies, and tree heights (you will get tree heights with the Plot-Count Method next week) of each tree species for each forest type. Examine the differences in forest structure between the black spruce and white spruce forests. What tree species occur in each forest? What are the dominant tree species? What are their densities, and basal areas, and frequencies? Were all the tree species encountered in each sample?

2. **Comparison of the PCQ and Plot-Count methods.** Compare the data you obtained from each method. Which method seems like the better approach? What are the advantages and disadvantages of each method. In the PCQ method is any one of the factors that make up the species importance value most important? Before writing your report read in your textbook and on the web more information on each method.

Pool all of the class data and fill out the tables on the next page before writing your report. Everyone in the class should be working with the same data set. The report should have an Introduction, Methods, Results, Discussion and Conclusions and Literature Cited.

Introduction: This should be short (1 paragraph). Give a brief background of where the methods come from and how they are generally used with some literature citations. Also describe the purpose of this lab and the types of forests sampled.

Methods: You should cite the Lab Handout and the textbook for the general PCQ and Plot Count methods. It is not necessary to write out detailed methods for the PCQ and Plot-Count methods, but do describe information that is specific to this particular sampling exercise (no of transects, no of trees sampled, how the data were pooled, etc.).

Results: Include only the four the tables below and appropriate bar graphs or other data summary figures. Please, do not include details of calculations or hand-written notes. Be sure to check all your calculations and make sure the tables makes sense. Do this as a group and check each others numbers). The results section should present the data and data summaries to the reader. Point out particularly interesting or important pieces of information that you will come back to in the discussion.

Discussion: Thoroughly discuss the two points described above.

Conclusions: This should be a summary of your major points. A few bulleted statements that emphasize your take-home message is a good approach.

Literature cited: Include any literature cited in the text of your report. Use a standardized format such as that of your favorite journal (e.g. *Ecology*).

SUMMARY OF CLASS DATA:

PCQ METHOD

Mean PCQ class data for <u>White Spruce</u> stands (mean of 3 transects). Enter mean and standard deviation.

A. Species code	B. Absolute frequency (Fa_j) No. of points where the species occurred	C. Relative Frequency (Fr_j) (%)	D. Absolute Density (Da_j) (Trees/ha)	E. Relative density (Dr_j) (%)	F. Absolute Dominance (Ba_j) (m^2/ha)	G. Relative Dominance (Br_j) (%)	H. Importance Value (IV_j)

Mean PCQ class data for <u>Black Spruce</u> stands (mean of 3 transects). Enter mean and standard deviation.

A. Species code	B. Absolute frequency (Fa_j)	C. Relative Frequency (Fr_j)	D. Absolute Density (Da_j)	E. Relative density (Dr_j)	F. Absolute Dominance (Ba_j)	G. Relative Dominance (Br_j)	H. Importance Value (IV_j)

PLOT-COUNT METHOD (to be filled in after Lab 5)

Mean plot-count class data for White Spruce stands (mean of 5 plots because one of the white spruce plots turned out to be black spruce). Enter mean and standard deviation.

Tree Species	Density (no. of trees/ha)	Basal Area (m^2/ha)	Frequency (% of plots)	Saplings (no. /ha)	Tree height (m)

Mean plot-count class data for Black Spruce stands (mean of 6 plots). Enter mean and standard deviation.

Tree Species	Density (no. of trees/ha)	Basal Area (m^2/ha)	Frequency (% of plots)	Saplings (no. /ha)	Tree height (m)