LYEBROOK METHODS - PART 1
Data Collection

General:

From June through August of 1993, a field crew of two individuals, knowledgeable of and trained in plant communities and soils of the Green Mountains, sampled 29 forest communities in the Lye Brook Wilderness area. The area had been previously stratified by cover type and by mapped Ecological Landtypes (ELTs) using aerial photos, existing ELT maps, geologic and surfical maps, and recent silvicultural surveys, with hopes to have at least three plots located in each of the cover types and ELTs identified. Reconnaissance was then conducted in these areas, and stands that passed the rejection criteria were sampled. Stands rejected were those that: a) were less than one ha in size; b) had signs of recent disturbance (within last 50 years); c) were exceedingly heterogeneous; d) were dominated by exotic species (eg. plantations). The sampling regime consisted of the placement and sampling of one 20 x 40 meter permanent plot in each stand; size of the plot varied as communities were encountered that were very homogeneous, and did not require as large a plot size to capture the species diversity of the general community. Therefore, the first 9 plots were 20 x 40 m, with one exception (plot 7) being 20 x 20 m; the remaining plots were 10 x 20 m in size.

Environmental data:

Data was collected in each plot on topographical variables (slope, aspect, elevation, microtopography), as well as physiographic variables, including general landscape position, geologic material, modes of depostion, distance to water, and disturbance. A cross-sectional diagram of the site was also drawn. In one of the corners of each plot, a soil pit was dug with a spade, large enough to characterize horizons, and to 90 cm depth or to an impermeable layer, whichever came first. General soil-related characteristics were described, including pedon classification, bedrock type, outcrops, surface fragments, seeps, drainage, and soil temperature at three depths (surface, organic/mineral soil interface, and 30 cm). Each horizon was described by depth, color, texture, structure, consistence, % coarse fragments, roots, boundary, pH, and mottling, using standard soil survey methods. Notes were taken on inclusions or other unusual attributes. It should be noted that a qualified soil scientist provided training and regular review of the crews' soil characterizations, and participated in the sampling approximately one day per week.

Vegetation data:

Within each plot, vegetation was sampled by vertical stratum using various sizes of nested subplots. Trees (> 12.9 cm dbh) were sampled over the entire plot, collecting species and diameter information. Tall shrubs (S1, 2 m tall - 12.9 cm dbh) and low shrubs (S2, 50 cm tall - < 2 m tall) were sampled by splitting the plot into 10 x 10 m quadrats, and recording, by species in each quadrat, species code and an estimate of % aerial coverage. The two shrub categories were kept separate. Ground flora were sampled using two strategies. First, all species in the entire plot, including mosses and lichens, were recorded by species code and life form, and then given a cover class code for each 10 x 10 m quadrat using a modified Braun-Blanquet scale (6 = > 50%; 5 = 25-50%; 4 = 10-25%; 3 = 5-10%; 2 = 1-5%; 1 = < 1%-scattered; r = solitary individual). Then, three, 1-m^2 frames were placed within each 10 x 10 quadrat, and in each frame species code, life form, and an estimate of % aerial coverage for the frame was noted. For the dominant tree species in the overstory, two individuals were cored and height and age were estimated for each, to determine site index.

LYEBROOK METHODS - PART 2
Data Entry, Validation and Preparation for Analysis

General:

Data was entered by the field crew during September and October following sampling. The data was entered using the PC Ord program developed by Bruce McCune of Oregon State University (1991), which allows for a simple and speedy data entry process with a conversion to Cornell formats needed for multivariate analyses.

Data was not converted into a format compatible with databases - no one to our knowledge has yet developed a simple conversion program from Cornell formats to a database-compatible format.

Environmental data:

A subset of the environmental data collected was selected for entry into the PC Ord program for use in the analyses. The selection process was somewhat arbitrary, based upon our perceptions of important variables from the field work, and including some we have seen to be important in other analyses on Forest data. Some variables did not translate as well as others into analysis variables, and will be used for interpretation. Before data was entered, a code sheet was generated for those environmental variables that would be used in the Lye Brook analyses, AND the overall Forest ELT data analysis - the purpose was for future ease of merging data sets. Therefore, approximately 210 environmental variables were recognized and coded, of which the Lye Brook variables were part, although not all variables were recorded in Lye Brook. The reason for the large number of variables is due largely to the peculiarities of the CANOCO program that we wished to use: categorical variables can only be included by doing one of two things: either converting them to ordinal variables, or by using each category as a variable in the analysis. Using categorical variables in the latter way, which is how we started, tends to inflate the number of variables in the analysis; later we chose to convert all categorical variables to ordinal variables, where it made ecological sense to do so.

After data was entered using the PC Ord program, and converted into Cornell Condensed Format, the C-Edit program in CANOCO was used to correct data entry errors and to convert categorical variables to ordinal variables. The large number of variables made it technically impossible to run CANOCO on the Lye Brook data without eliminating many variables from the analysis; because many of the variables would be eliminated because they were not measured or were not categories occurring in Lye Brook, we decided the analysis would be more efficiently run by reducing the number of unused environmental variables and therefore renumbering the variables. A new set of environmental codes was generated, which is the current working set:

N.CODE	NAME	DESCRIPTION
1	MARBLE	Marble bedrock type (presence/absence - 1/0)
2	QRTZTE	Quartzite bedrock type (presence/absence - 1/0)
3	SCHIST	Schist bedrock type (presence/absence - 1/0)
4	PRFUNC	Profound Unconformity type (presence/absence - 1/0)
5	ELEVTN	Elevation, in feet, to nearest one foot
6	SLOPE	Percent slope, to nearest one percent
7	SOILTP	Soil temperature at 30cm, in degrees Farenheit, to 1 degree.
8	DPTHIM	Depth to an impermeable layer, to 1 cm
9	BHTHCK	Bh layer thickness, to 1 cm.
10	SPOTHK	Spodic layer thickness, to 1 cm.
11	MTTLTK	Depth to mottling, to 1 cm.
12	SLMTHK	Solum thickness (A+B), to 1 cm.
13	OTHICK	Thickness of organic horizons, to 1 cm
14	ATHICK	Thickness of A horizon, to 1 cm.
15	%CRSFR	% Coarse Fragments, weighted average, to 1%.
16	TFASP	Azimuth, transformed using Beer's transformation, to 0.01 unit.
17	LNDFRM	Landform, ordinal codes of: 1 = Point/Knob 2 = Ridge 3 = High Flat 4 = Upper Mountain Slope 5 = Mountain Slope 6 = Lower Mountain Slope 7 = Hummocks 8 = Low Flat
18	SFCFRG	% Surface Fragments, in ordinal classes: 5.0 = midpoint, < 10% 17.5 = midpoint, 10-25% 60 = midpoint, > 25%
19	DRNAGE	Drainage, in ordinal classes: 1 = Extremely well-drained (EWD) 2 = Well-drained (WD) 3 = Moderately well-drained (MWD) 4 = Somewhat poorly drained (SPD) 5 = Poorly drained (PD) 6 = Very poorly drained (VPD)
20	605b	ELT code, presence/absence (1/0)
21	902b	"
22	903a	"
23	903d	"
24	905b	"
25	905d	"
26	902d	"
27	921d	"
28	DSTH2O	Distance to Water, in ordinal classes: 15 = midpoint, 0-30m 50 = midpoint, 30-70m 70 = midpoint (+/-), > 70m

N.CODE	NAME	DESCRIPTION
29	BNYUNI	Benchy/Uniform topography, order is fall-line first, (1/0)

30	CNCUNI	Concave/Uniform topography, order is fall-line first, (1/0)
31	CNXHUM	Convex/Hummocky topography, order is fall-line first, (1/0)
32	CNXUNI	Convex/Uniform topography, order is fall-line first, (1/0)
33	LNRHUM	Linear/Hummocky topography, order is fall-line first, (1/0)
34	LNRUNI	Linear/Uniform topography, order is fall-line first, (1/0)
35	AMENIA	Amenia soil series, (1/0)
36	BERKSH	Berkshire soil series, (1/0)
37	HGBACK	Hogback soil series, (1/0)
38	HGTVLL	Houghtonville soil series, (1/0)
39	MARLOW	Marlow soil series, (1/0)
40	MUNDAL	Mundal soil series, (1/0)
41	PERU	Peru soil series, (1/0)
42	WORDEN	Worden soil series, (1/0)
43	BROSPR	Borosaprist soils, (1/0)
44	ORGFRG	Organics over Fragments soils, (1/0)
45	DNFRTH	Danforth soil series, (1/0)
46	%OUTCP	% Outcrops, in ordinal classes: 1 = < 1% outcrops 2 = 1-2% outcrops 3.5 = 2-5% outcrops 8 = 6-10% outcrops 17.5 = 10-25% outcrops 60 = > 25% outcrops
47	SEEPS	Occurrence of seeps, in ordinal classes: 1 = no seeps 2 = few seeps 3 = seeps are common 4 = many seeps
48	SOILpH	pH of mineral soil in ordinal classes: 1 = acidic 2 = neutral 3 = alkaline

Currently, there are two working versions of this data set - one in Cornell condensed format (LYBRENV.ENV) and one in Cornell full format (LBFULL.ENV). In each of the environmental data sets, the data is followed by a list of these variable names, in positions consistent with their numerical code. Following the variable names is a list of row labels, which correspond to plot numbers, using the convention LB (Lyebrook) 93 (1993 data) 01 (plot number). There are 28 plots for which there's data; plot 28 was described, but limited data collected, and so was not added to this data set, hence the jump from plot 27 to 29 in the list.

Vegetation data:

Vegetation data was entered by stratum, such that each stratum had its own file; the ground flora stratum has three files corresponding to three measures of abundance collected at each plot The shrub strata (S1 and S2) each have two files corresponding to two measures of abundance; the tree stratum has one file based upon one measure of abundance.

As in the environmental data set, a code sheet was prepared listing all species that occurred in BOTH the Lye Brook data set and the Forest ELT data set, to provide a mechanism for merging files later. Codes were originally assigned to all ferns, shrubs, herbs, mosses, and trees with the following numerical designations:

Ferns: Codes 1-99
Shrubs: Codes 100-199
Herbs: Codes 200-799
Mosses: Codes 800-999
Trees: Codes >1000 (Seedlings=1000's, Saplings=2000's, Sawtimber= 3000's)

However, as for the environmental data set, the numbers of species in the data set that did not occur in Lye Brook turned out to be excessive for the purposes of analyzing the LB data. Consequently, species that did not occur in Lye Brook were removed from the data set, and the remaining species were numbered consecutively; the species name codes remained the same as for the large species code list, so conversion back is possible if needed. In each of the species data sets, the data is followed by a list of these species names, in positions that dictate their numerical code.

Ground Flora

Cover Class (CCHERBS.SPE): Herbs, ferns, mosses and lichens were all recorded under the ground flora heading. Percent cover, by species, was first derived from cover class codes assigned to species in the 10x10m quadrats. Each cover class value was converted to an actual value using the midpoint of that cover class range. The seven class ranges were: <0.1 (R), 0.1-0.9 (<1), 1.0-4.9, 5.0-9.9, 10.0-24.9, 25.0-49.9, >50.0. The midpoint values were averaged across the number of quadrats (four or eight depending on the plot number) to get mean %cover for each species. All percent cover figures based on cover class values are accurate to 0.01%.

Percent Cover (1X1HERB.SPE): For all species occurring in the m^2 frames, their actual percent cover values were averaged across the total m^2 frames in the plot. This percent cover figure is accurate to the 0.01. Because some species in the plot did not occur in any of the frames, the number of species in this data file is less than that for the preceding file.

Frequency (FHERB.SPE): Frequency was calculated based upon frequency of occurrence in square meter frames, averaged by species over the entire plot. Species not occurring in the m^2 frames but recorded by cover class in the plot were given a frequency value based on their average cover class code, derived by the method described above for the CCHERBS file. Frequency values assigned to each cover class range were 0.0001, 0.0005, 0.0010, 0.0050, 0.0100, 0.0150, 0.0200, respectively. In order to preserve the species diversity of a plot and the integrity of the frequency value, the preceding methodology allowed species that did not occur in any m^2 frames to receive a maximum frequency value of 0.0200 while a species that occurred as R in only one m^2 frame received 0.0400. Frequencies were recorded to the 0.0001 level.

Shrubs (S1 & S2)

Frequency (S1FSHRUB.SPE; S2FSHRUB.SPE): Frequency was calculated for both S1 and S2 shrubs by dividing total number of quadrat occurrences for a species in the plot by the number of quadrats in that plot (either four or eight).

Percent Cover (S1SHRUB.SPE; S2SHRUB.SPE): Mean percent cover of S1 and S2 shrubs was calculated by averaging percent cover figures for each species over the number of quadrats sampled (either four or eight).

Trees

Basal Area (LBTREE.SPE): The diameter of every tree recorded was converted to basal area (BA = .00007854 * dbh^2). For each species, basal areas for individuals were added to come up with a total BA by species, in square meters.

Currently, all of the vegetation data files are set up in Cornell Condensed format. The row labelling convention is the same as for the Environmental data.

File Information

The following is general information regarding the current status of each Lye Brook datafile:

Filename	Size	Latest	Format	Location
LYBRENV.ENV	11.445KB	3/3/95	ASCII/Cornell Condensed	GMNF
LBFULL.ENV	16.961KB	3/3/95	ASCII/Cornell Full	GMNF
CCHERBS.SPE	15.689KB	1/23/95	ASCII/Cornell Condensed	GMNF
1X1HERB.SPE	11.485KB	1/19/95	ASCII/Cornell Condensed	GMNF
FHERB.SPE	15.204KB	3/30/94	ASCII/Cornell Condensed	GMNF, UVM
S1FSHRUB.SPE	6.597KB	3/30/94	ASCII/Cornell Condensed	GMNF, UVM
S2FSHRUB.SPE	7.050KB	3/30/94	ASCII/Cornell Condensed	GMNF, UVM
S1SHRUB.SPE	6.590KB	3/30/94	ASCII/Cornell Condensed	GMNF, UVM
S2SHRUB.SPE	7.050KB	3/30/94	ASCII/Cornell Condensed	GMNF, UVM
LBTREE.SPE	2.082KB	2/10/95	ASCII/Cornell Condensed	GMNF, UVM
LBANAL.DOC	18.435KB	3/7/95	MS Word for Windows 2.0	GMNF

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