The Dynamics of Forest Succession in Bryce Canyon National Park

Final Report

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INTRODUCTION AND RESTATEMENT OF THE OBJECTIVES

During the summer of 1991 work was begun on the project entitled "The Dynamics of Forest Succession in Bryce Canyon National Park". This project was funded by the Bryce Canyon Natural History Association (BCNHA) and built on the previous work by Dr. Hayle Buchanan begun in 1957 and continued by Buchanan and Harper in 1980. There were three main objectives of the current study: 1) Provide a quantitative description of plant successional changes over the last 34 years; 2) Provide a pictorial record showing changes in Park landscape and plant communities over time; 3) Provide a quantitative description of the soil associated with the 266 forest study plots. Completion of the three objectives contributes to the development and understanding of a long-term database that will facilitate an understanding of how changes occurring in the park relate to natural conditions and processes. In addition, understanding park ecology better will help guide park personnel in their efforts at protecting the park ecosystems through effective management.

METHODS

Design of forest sampling program

Nine connecting transect lines which collectively extended nearly the entire length of Bryce Canyon National Park were established during the period 1957-59. The transect lines were placed in such a way that all the forest communities on the Paunsaugunt Plateau were sampled in an unbiased manner. The first transect began at the canyon rim and was located with respect to permanent landmarks such as the edge of the rim, compass bearings on distant mountains, etc. Location of transects in respect to major landmarks increased the ease with which individual transects could be relocated in the future. Successive transects began and ended either at park boundary corners or at rock monuments located on park boundaries or near roads. Each transect was set on a definite compass reading. A surveyor's chain was used to locate points for study plots at intervals of 91.44 m (300 ft) along each transect. A steel peg marked the corner of a 1.0 m^2 quadrat at each study plot along the transect. In all, 266 sampling points were located. Each quadrat was located so that two of its opposite corners were positioned directly on the transect line. A portable, hinged aluminum quadrat frame was used to delimit each plot while the plants within its boundaries were mapped. To facilitate mapping of plant cover at each quadrat, outlines of the quadrat were printed on sheets of graph paper before going to the field. The scale outline of the 1.0 m^2 quadrat was divided into 16 subsections. It was a simple procedure to place the outline of the plants in their exact position on the grid outline of the scaled map. Each plant was identified by a symbol that was explained on the sheet below the map. An estimate was made of the canopy cover contributed by each plant species in each plot.

Collection of the pictorial record

During the first sampling period of 1957-1959 approximately one-third of the study plots were photographed. These photo-plots were marked with two steel pegs along the transect line. A third steel peg was located about six feet away from the plot directly beneath the tripod-supported camera used to photograph the quadrat. Two or more supplementary photographs were taken of nearby vegetation at each photo plot in order to document plant growth, progress of tree diseases, deterioration or recovery of over-grazed shrubs, invasion of understory vegetation, and other ecological changes. During the sampling period of 1978-1980 the study plots and photo plots were photographed as done at the commencement of the the study. During the fourth sampling period (1991) all of the original 266 study plots that could be located were photographed, not just the photo plots. However, at this time instead of continuing the use of 3 X 5 B/W plate film and a relatively small lens (with a wider field of view), B/W pictures were made with 35mm film and a 60mm macro lens. Future work should be done using color film.

During the fall of 1992 we received a request from BCNP personnel to enlarge the original agreement between St. Lawrence University and the BCNHA. It was agreed that we would not only provide a 1991 pictorial record of changes in the park for one third of the study plots, but that we would use extant negatives and data sheets to provide a copy of all photographs and data, extending back to 1957, prepared with archival quality materials including acid free paper, special glue etc. This work was completed, acknowledged, and paid for by December of 1993.

Collection and physical analysis of the soil samples

Soil depth in each plot was measured by forcing a 1 cm X 50 cm soil depth probe into the soil until it reached a rock or some other significant obstruction. One soil depth measurement was made in each of the of the four major compass quadrants, approximately 4 meters from the center of the plot. The average and standard deviation of soil depth for a plot reflect calculations based on all four samples. Composite soil samples were taken from each plot by removing one 2 cm X 15 cm circular soil core from each quadrant. Soils were removed to a field station, air dried, and processed by the Brigham Young University Agronomy and Horticulture department according to standard soil analysis procedures.

Particle size analysis was done with the hydrometer method. pH was obtained via a 1:1 soil to distilled water ratio. Organic matter oxidation was carried out with potassium dichromate. Total nitrogen was determined colorimetrically after Kjeldahl digestion. Exchangable cations were extracted with 1N ammonium acetate, whereas sulfur was extracted with KCL. Phosphorus was was extracted with 0.2N acetic acid and determined colorimetrically using ammonium molybdate. Cation exchange capacity was determined after extraction with sodium acetate (Black, 1965; Page, 1982).

Quantitative methods

1. Soils

The basic statistics of mean, standard deviation, minimum, and maximum were calculated for 15 soil characteristics. The relationships amongst these characteristics were explored by first preparing Pearson product moment correlations for all possible pairwise combination of soil characteristics. Multivariate linear combinations of the 15 characteristics were prepared with the MINITAB Principal Components Analysis (PCA).

2. Seedlings and Saplings

The seedling and sapling data obtained by means of the quarter method as described above were used to calculate raw estimates of density as well as the index called importance value. Importance values for seedlings and saplings ranged from 0-200 and were formed by adding the relative frequency (0-100) and relative density (0-100). For each plot the relative density for each species was obtained by dividing the average density of that species on the plot by the sum of the average densities of all species occurring on the plot. Relative frequency was defined as the percentage contribution of each species to the four quadrants where that species was the closest individual to the center stake of the plot. Changes in seedling, sapling, and tree densities and importance values were calculated for only those plots that had an individual present in either 1958, 1991, or both years. Whereas this may seem obvious, it is tempting to make averages and comparisions for all 223 forest plots. Such averages would incorporate many potentially misleading zeros, a practice not followed in this study.

3. Trees

The tree data were summarized in a manner very similar to seedlings and saplings, however the calculation of importance values also incorporated the relative basal area (0-100), obtained by dividing the total basal area of a species (BA/spp) on a plot by the sum of the basal area of all species occurring on the plot. Tree importance values thus ranged from 0-300. The index BA/Spp is independent of tree density but has no fixed sampling units because the distance to the sampled trees varies with the plot. We also caculated the more traditional index of basal area per hectare (BA/Ha). Results for both indicies are presented below. Classification of forest type was first done according to the suggestions of Roberts, et al. (1989). There are numerous other techniques that could be used to classify and/or ordinate the study plots. We have experimented with many and chosen TWINSPAN (Cornell Ecology Programs) to also classify the study plots. We used pseudospecies cut levels of 0, 25, 50, 100, and 200 to define the abundance categories. All other program parameters were set with suggested defaults. For

the 154 plots on the upper part of the study transect we used a combination of the classifications suggested by the third through sixth divisions. For the 69 plots on the lower part of the study transect we mostly adhered to the plot classifications suggested by the second division, forming four forest types, but six plots needed to be reclassified by other criteria.

Incidence of Limbrust and Mistletoe

As we made vegetation measurements in 1991 we were struck with the commonness of what we called limbrust and mistletoe. As a result, we devised our own subjective, qualitative index for these two diseases. For each of the four trees measured at each plot we estimated the degree of disease severity from 0-4, or none to extensive. For example, if all four trees were severely infested with limbrust the plot score would be 16, if none were infested the plot score would be zero.

4. Understory

Nomenclature for the 103 understory species found on the study plots follows Spence and Buchanan (1993). The number of understory species found on each of the study plots, the number of plots where the species was found, the average density of individuals on those plots where the species was found, and the standard deviation of the average density were calculated. The data are reported for each of four study years (1957, 1968, 1980, 1991). Species density was compared for those plots where a given species occurred in more than one year. A multivariate test similar to a paired t-test was used to test each species for a change in density. Any species with a low test statistic probability can be interpreted as having at least one year (of the four) with a statistically significant difference in average density.

We have examined park-wide trends in changes in understory species diversity by comparing how the number of grass, shrub, and forb species changed over the last 34 years. All 103 species listed in Appendix R were analyzed. We used two different statistical tests to examine patterns of change. We present first our results using regression techniques. There follows results from using paired t-tests.

Regression techniques are often used to build and evaluate models of prediction. In our case we used the number of species on each plot at the beginning of a time interval to predict the number of species on the plot at the end of the time interval. The null hypothesis was that the number of species per plot did not change and those plots having many species at the beginning of the time interval would still have many later on, etc. Under this hypothesis the slope of the regression line is one, not zero (as would be the case if we simply tested for a relationship between one sampling date and the next, without regard

for individual plots). In the figures below we tested whether the regression slopes were different from one.

Another way to test for changes in species diversity is to assume that the average change of a species number (per plot) is zero, regardless of the number of species on the plot at the beginning of the time interval. Each plot is then paired with itself and the null hypothesis is that the average change is zero. Tests were also performed in this manner.

Understory Ordination With Respect To Soil Physical Measurements

The computer program CANOCO (Cornell Ecology Programs) was used to ordinate the 17 soil chemical and physical measurements (the 15 reported in Table 2 plus %Silt and elevation) for 61 (see Table 12) of the 103 understory species reported in Appendix R. These 61 species were all those that occurred on at least seven plots for at least one of the study years 1958, 1980, 1991. Furthermore, because we used 1991 soil data we also required the species to be present in 1991. The remaining 42 of the 103 species occurred less frequently. The 61 "more common" species were found on a total of 247 of the 266 plots. The ordination was determined using canonical correspondence analysis (CCA).

RESULTS & DISCUSSION

0. Correlation and Causation

As this study has progressed through the years we are have become increasingly aware how each of the original 266 study plots is a separate story to be analyzed and discussed. In truth, no two spots on earth are exactly the same. We are awed that even though there are strong patterns and good generalizations that have been observed, there are also many exceptions. A study of any one of these exceptions would reveal secrets of the perpetuation or elimination of diversity. Our analysis of patterns of change suggests causal mechanisms but we are cognizant that even though two variables may be strongly correlated, they may be just that, responding in a similar fashion to some other causal factor. As the complexity of the correlations has started to unfold before us we have begun to see possible causal forces grouped under three major categories: 1) abiotic factors (elevation, and its relationship with slope and exposure, rainfall and snowpack, and temperature, temperature; soil chemistry); 2) site history (fire and grazing history, proximity to roads, and "initial" densities of important species); 3) biotic factors (plant diseases, animal use, and interspecific competition expressed mostly through adult tree shading and nutrient use, adult tree propagule density, and myriads of understory plant competitive interactions). The magnitude of the study has also admitted the non-zero probability of human errors of measurement, data transcription, and analysis.

1. Soils

The significant patterns evident in numerous interrelationships among the 15 soil characteristics reported in Table 2 need to be evaluated by soil science experts (Table 3). Necessary raw data are given in Appendix A. Extraction of the first three principal components summarizes 53% of these data and provides insight into some of the strongest patterns (Table 4). The first PCA axis is negatively correlated with CEC, log %O.M., Log K and Log N. For readers less familiar with PCA this means that soils with high CEC values will also have high %O.M., K, and N. Plots having soils such as these will be found to have large negative values on the first PCA axis. The second PCA axis is positively correlated with pH, ppm Ca, and average soil depth. The third PCA axis is negatively correlated with %Sand, average soil depth, and the standard deviation of soil depth. The third axis is also positively correlated with %Clay. It is not surprizing that %Clay and %Sand should be inversely related even though it is not required mathematically due to the presence of silt. It is also not a surprise to find a positive relationship between the depth of the soils and the variability of the soil depth. PCA analysis did not indicate significant relationships for ppm Mg, water capacity, log P, log Fe, and log SO_4 even though some of these characteristics were significantly correlated with those variables found to be most dominant in the first three axes.

The broad scatter of plots with little obvious pattern shown in Figure 1 for PCA axes 1 and 2 is very similar to the pattern observed with PCA 1 vs. PCA 3, and PCA 2 vs. PCA 3, or when all three of the first three axes are plotted together. Among other things this means that there are large, fairly continuous gradients in the park for most of the soil characteristics measured. The study plots cannot be easily assigned to discrete groups based on their soils. Nevertheless, a few plots stand out as somewhat unusual (e.g. see plots 19, 209, 185, 217) and there exists a weak but significant negative correlation between plot elevation and PCA 1 (Figure 2).

Table 2. Descriptive statistics of 15 soil characteristics for 223 forest plots in BCNP.

Characteristic	N	Mean	StDev	Min	Max
pH	223	7.2	0.5	5.1	8.1
%Sand	223	39.1	7.9	19.7	74.4
%Clay	223	26.3	7.1	6.4	53.1
Cat.Ex.C	223	39.3	11.9	15.7	74.5
%OM	223	7.1	3.9	1.5	29.5
ppm P	223	8.7	7.6	2.0	60.8
ppm Fe	223	5.6	5.3	0.2	73.8
ppm SO4	223	12.7	17.7	0.1	149.1
ppm N	223	2094.1	931.3	600.0	6605.0
ppm K	223	363.0	205.8	40.0	2270.0
ppm Ca	223	9205	3195	1170	18830
ppm Mg	223	610.2	336.3	120.0	1650.0
WaterCap	223	0.126	0.03	0.1	0.27
dep-mean (cm)	223	24.1	9.8	4.3	54.35
dep-stdv	223	9.7	4.1	1.3	21.0

Table 3. Pearson product-moment correlations amongst the 15 soil characteristics measured for the 223 forest plots.

	pH	%Sand	%Clay	CEC	ppmCa	ppmMg	Water Cap.	Avg. Depth	Std. Depth	%OM	log P	log Fe	log SO4	log K
%Sand	-.081													
%Clay	.261	-.615												
Cat.Ex.C	-.305	-.064	-.218											
ppm Ca	.411	.033	-.008	.443										
ppm Mg	-.102	-.088	.053	.426	.149									
WaterCap	.119	.044	.116	-.161	.006	.045								
dep-mean	.194	-.002	.173	-.182	.136	-.139	.199							
dep-stdv	.120	-.019	.022	.025	.172	-.050	.147	.570						
log%OM	-.311	.040	-.258	.796	.404	.361	-.071	-.129	.025					
log P	.172	.026	.019	-.039	.056	.003	.177	.141	-.051	.041				
log Fe	-.209	.148	-.207	.386	.138	.185	-.069	-.065	.029	.496	-.026			
log SO4	-.421	.165	-.278	.398	-.003	.200	-.035	-.039	.064	.330	-.134	.339		
log K	-.355	-.016	-.294	.544	.095	.272	-.297	-.289	-.010	.475	-.049	.328	.325	
log N	-.197	-.075	-.131	.721	.347	.319	-.090	-.189	-.036	.797	.123	.438	.272	.444

Figure 1. The relationship between the first two principal components for 223 forested plots.

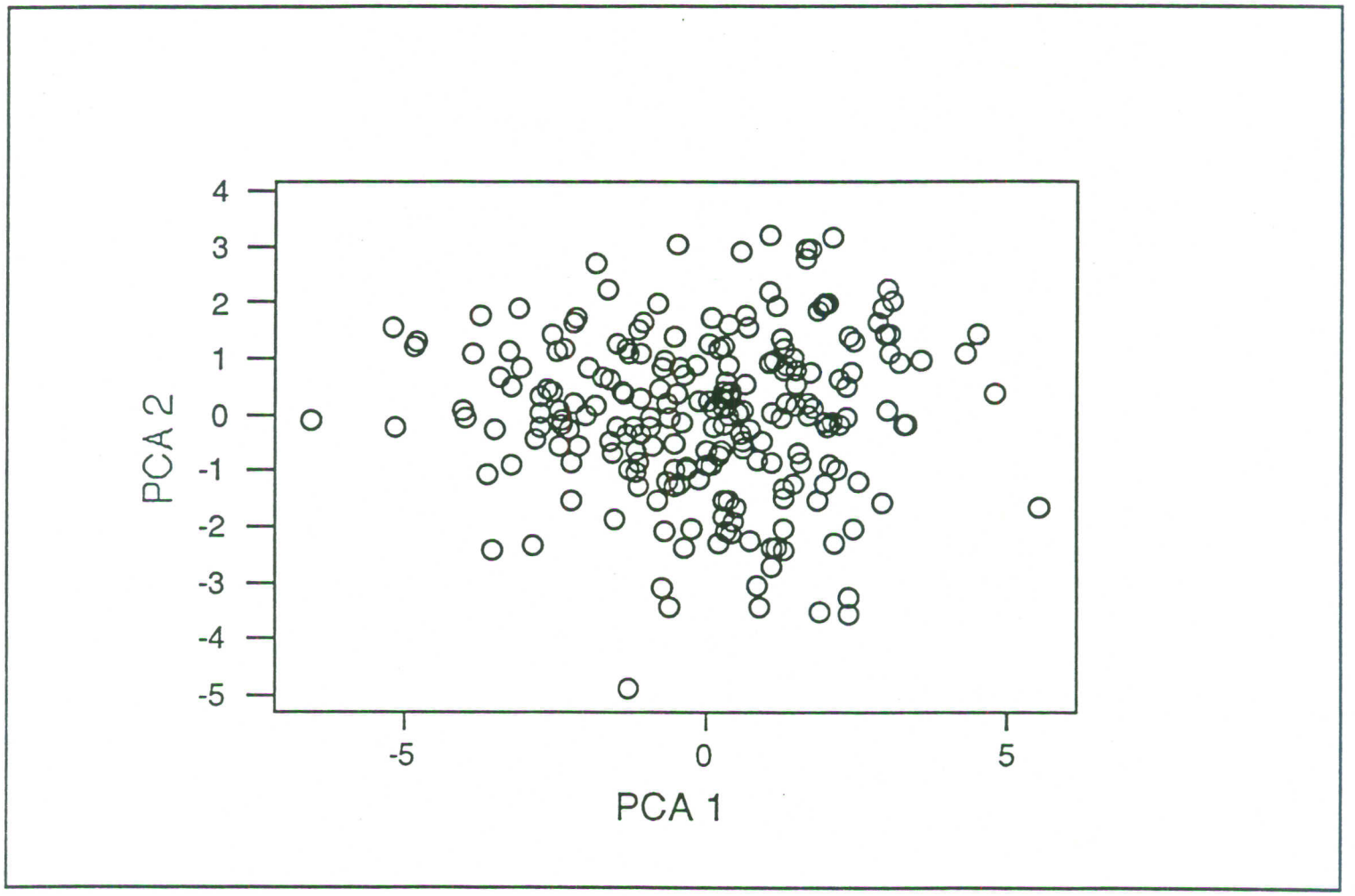
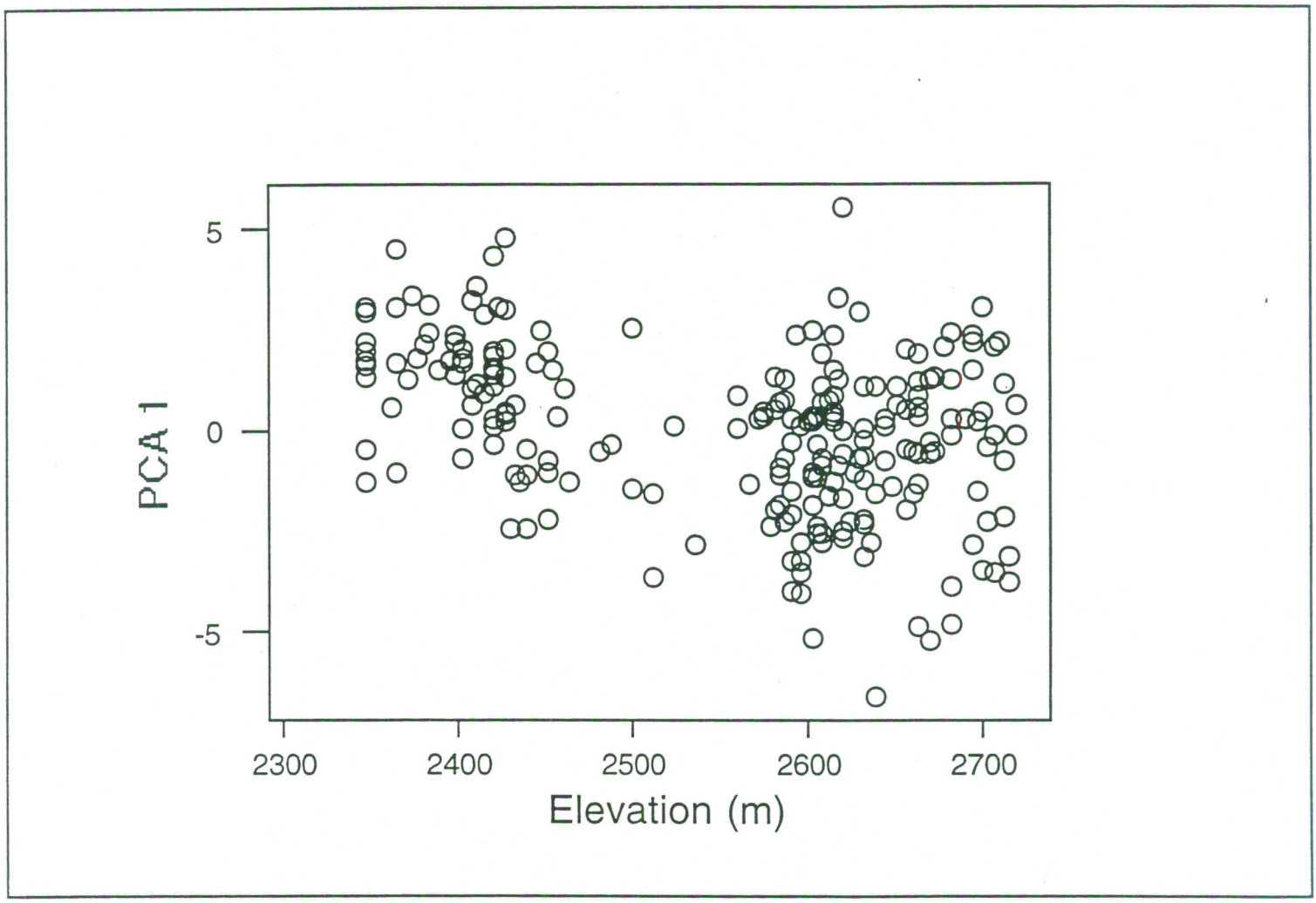


Figure 2. The relationship between plot elevation and the first principal component for 223 forested plots.



As we have attempted to understand patterns of forest change we have become even more aware of the importance of elevation as a prime factor correlated with patterns of understory and overstory abundance and composition. Aside from the correlation of elevation with temperature and precipitation, elevation is significantly correlated with 9 of the 15 soil chemical and physical parameters we measured (Figure 3). Organic matter, cation exchange capacity, sulfur, and nitrogen in soils all increase with elevation, whereas, soil depth, water capacity, pH, phosphorus, and calcium all decrease with increasing elevation. Our samples showed no significant relationship between elevation and soil texture (%sand, silt, clay), potassium, iron, or magnesium. In examining Figure 3 it is important to recall that the apparent scarcity of samples around 2500 meters is a result of the moderately sharp drop in elevation approximately half-way through the park. We are pleased that the BCNHA agreed to document soil chemistry for this study and expect that these baseline data will only become more valuable with the passage of time.

Table 4. Principal components analysis of the 15 soil characteristics measured for the 223 forest plots.

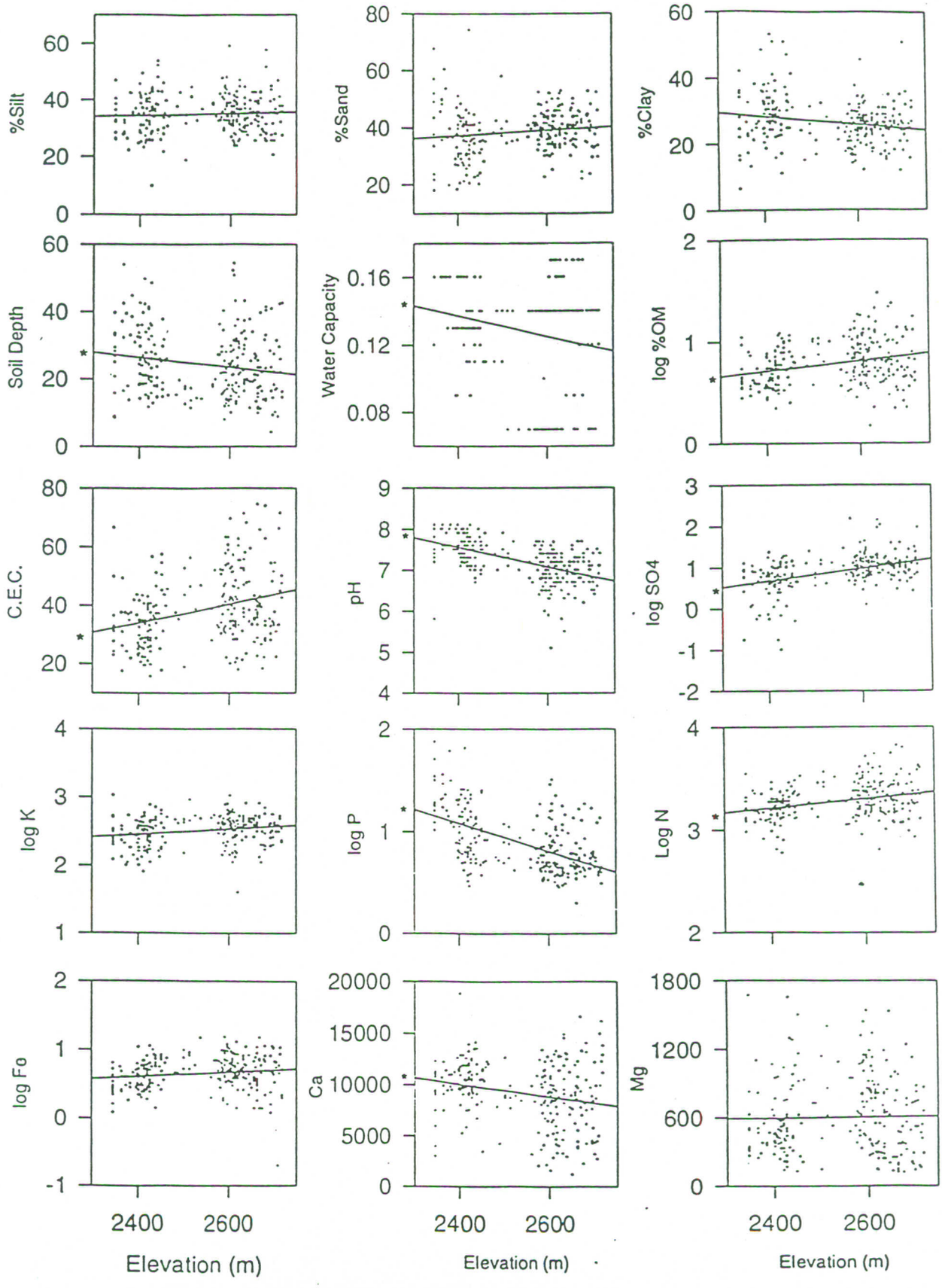
Principal Component Analysis

Eigenanalysis of the Correlation Matrix

Eigenvalue	4.1420	2.0579	1.6705	1.3082	1.1338	0.8953
Proportion	0.276	0.137	0.111	0.087	0.076	0.060
Cumulative	0.276	0.413	0.525	0.612	0.687	0.747

Variable	PC1	PC2	PC3
pH	0.223	0.385	0.024
%Sand	-0.048	-0.266	-0.535
%Clay	0.194	0.312	0.432
Cat.Ex.C	-0.429	0.156	0.068
ppm Ca	-0.155	0.472	-0.051
ppm Mg	-0.227	0.140	0.195
WaterCap	0.108	0.204	-0.208
dep-mean	0.148	0.359	-0.409
dep-stdv	0.027	0.331	-0.417
log%OM	-0.428	0.166	-0.020
log P	0.026	0.199	-0.055
log Fe	-0.295	0.016	-0.155
log SO4	-0.268	-0.144	-0.228
log K	-0.345	-0.105	0.083
log N	-0.393	0.193	0.102

Figure 3. The relationship between plot elevation and 15 soil chemical or physicl characteristics. The regressions that are significant are indicated with an asterisk along the y -axis.



2. Seedlings and Saplings

Because of the pronounced effect of elevation on much of the study results we have included a figure showing the elevation of the study plots along the study transect (Figure 4). The undulating pattern of elevation with plot number reminds the reader that the study transect crossed several small ridges and valleys as it proceeds from the north to the south end of the park.

Elevation has a strong influence on the distribution of the common species of trees. ABCO (see Appendix R for four letter species codes), POTR and PIPU are restricted to the upper part of the study transect, mostly above 2560 m. JUSC prefers lower elevations, mostly below 2600 m (Figs. 5 - 7). It should be noted however, that even though there appear to be elevational limits acting on some species there does not appear to be a gradient effect of species importance values with respect to elevation (Figs. 5-7). In order to not let elevation obscure patterns of forest succession we have divided our analysis of the study transect into two parts, plots 1-166 (top) and 167-266 (bottom) (Figs. 5-7). This particular division of the study plots was done so as to isolate all plots having ABCO or expected to have ABCO in the near future, from those plots where ABCO still seems to be removed. The geography of the study transect as well as the seedling and adult tree distributions observed in 1957 and 1991 have guided our selection of plot 166 as the breakpoint location. We suggest that in future ecological studies of the park a location near plot 170, near Whiteman Spring and East Creek should be used for a natural division of major ecological units.

Plots located in the upper part of the study transect are experiencing massive competitive pressure by ABCO. ABCO has increased in average seedling density by 1349 seedlings/HA (+41%) (Table 5), whereas, PIFL seedlings have decreased 144/HA (-54%). Plots with PSME (-672 seedlings/HA, -23%) and JUSC (-348 seedlings/HA, -69%) have experienced non-significant, but possibly negative changes in density. PIPO increased a non-significant 206 seedlings/HA (+63%). The changes in seedling importance values are even more dramatic, with ABCO increasing at the expense of all other species except PIED (Figure 8-9). PIED was only found on one plot in 1991 and thus a change cannot be evaluated.

Even though the vast majority of plots showed an increase in ABCO at the same time other species decreased, it is important to observe that all species (all those having enough ocurrances to be evaluated) had at least some plots where their importance values increased at the same time ABCO was decreasing (Fig, 8-9). This has an important slowing effect on the speed that ABCO can dominate the upper part of the study transect. In other words, there are isolated pockets where tree species diversity is being maintained. Further study of unusual plots such as plots 3, 13, 30, 34, 57, 76, 89, and 96 is encouraged. JUSC appears to be the most resistant to the competitive pressure of ABCO (Figure 8-9). Furthermore, JUSC appears to be increasing at the expense of PIPO (Figure 8-9).

Figure 4. The relationship betwen plot number and elevation for 223 forested study plots.

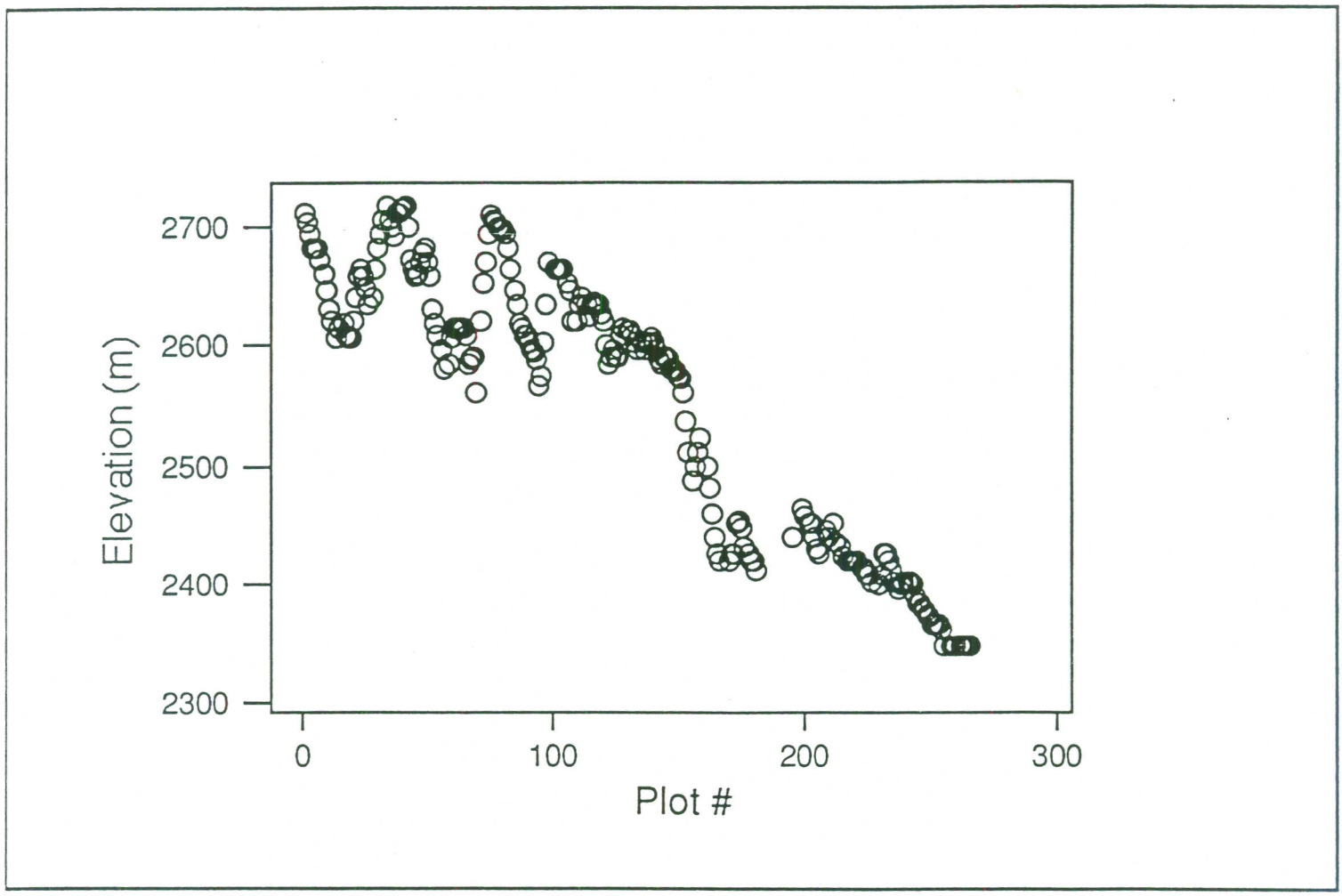


Figure 5. The relationship between tree importance value (1991) and elevation.

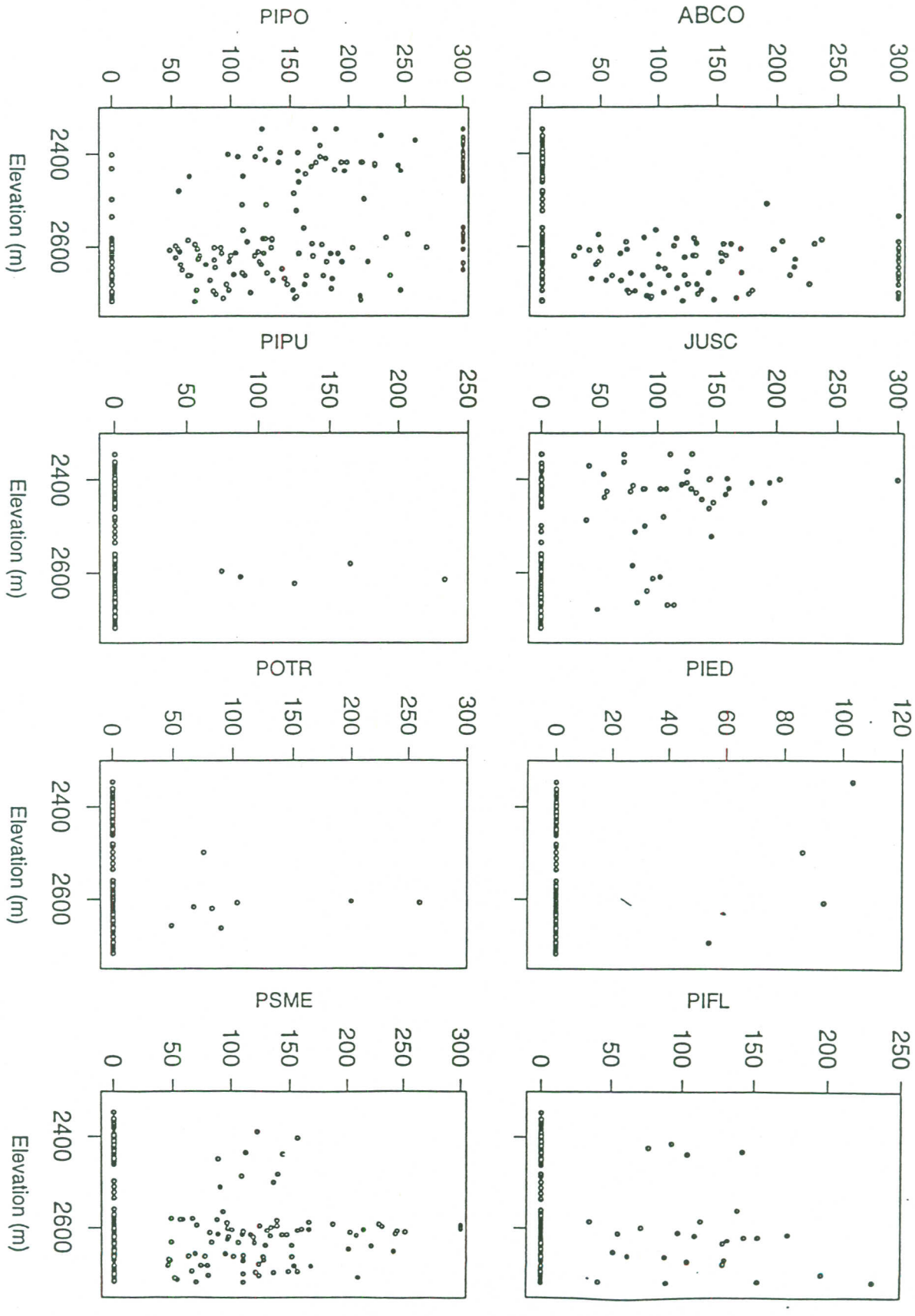


Figure 6. The relationship between 1957 seedling importance values and elevation.

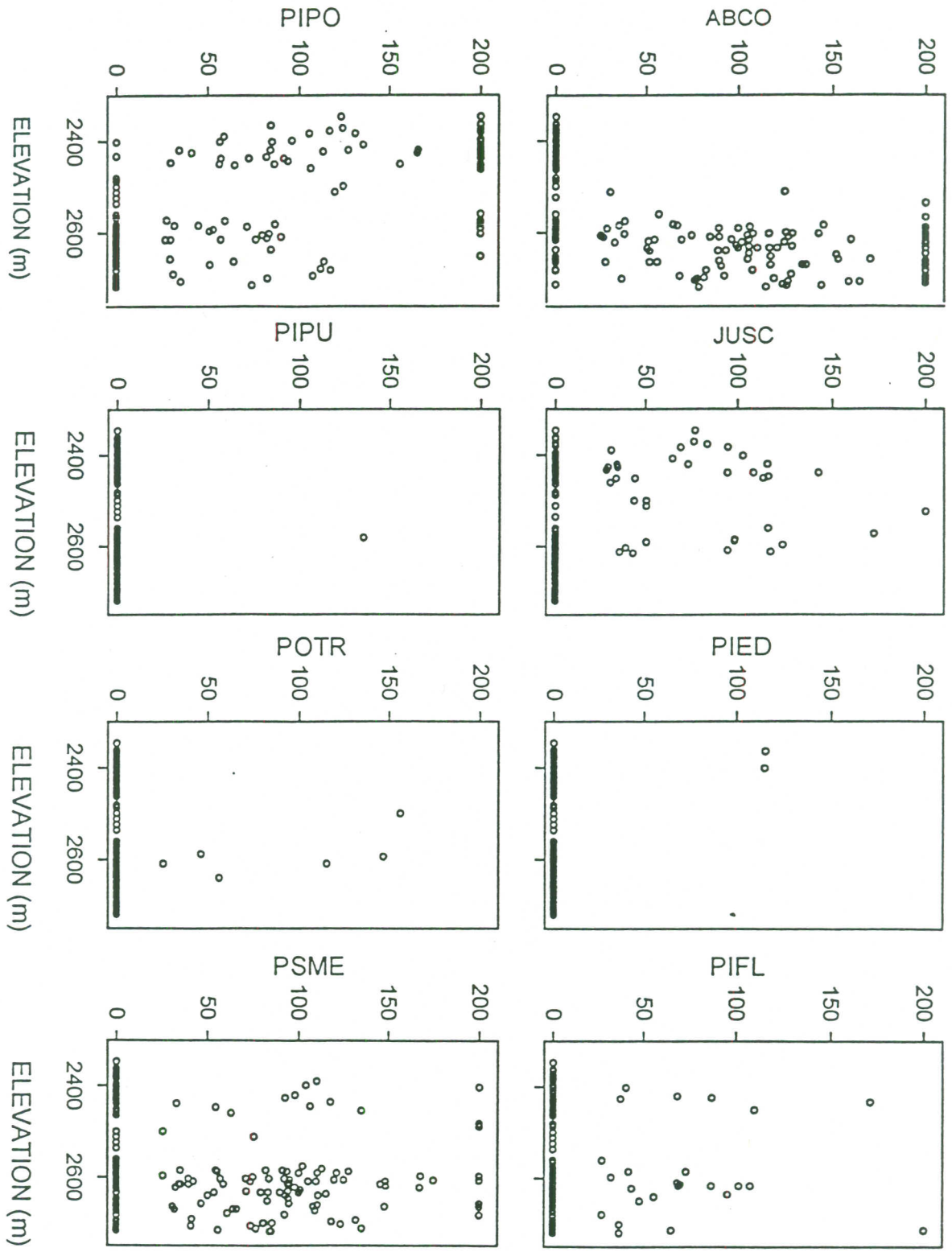
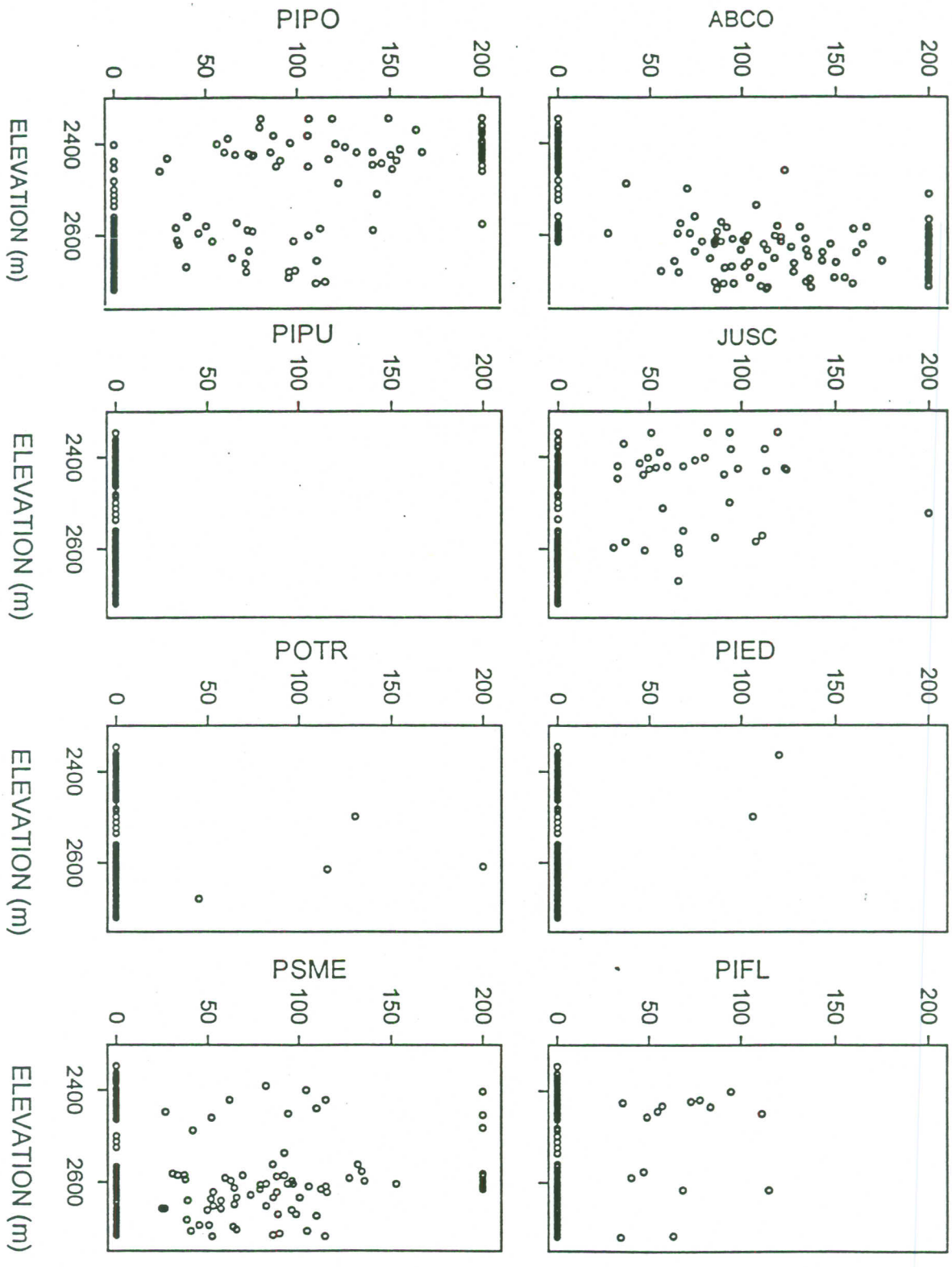


Figure 7. The relationship between 1991 seedling importance values and elevation.



Tree seedling densities for all species were much lower on average in the lower part of the study transect (Table 5). Plots located in the lower part of the study transect are not experiencing the same kind of changes as those plots in the upper part. JUSC (261 seedlings/HA [+196%]), PIFL (49 seedlings/HA [+56%]), PIPO (44 seedlings/HA [+38%]), and PSME (288 seedlings/HA [+430%]), were observed to have non-significant increases in density, whereas, PIED (-125 seedlings/HA [-41%]), was observed to have a non-significant decrease in density. The relative importance value of the three most common species, JUSC (+8%), PIPO (-4%), and PSME (-2%) also did not change significantly.

With the reduced number of plots located in the bottom part of the study transect it is more difficult to see patterns of species replacement if it is happening. Approximately the same number of plots that show an increase in JUSC IV show a decline in PIPO IV, however, the opposite is also true (Figure 9). A similar relationship appears with plots having PIPO and PSME (Figure 9). Reduced sample sizes make understanding other species interactions even more problematic.

Changes in tree sapling density and importance values over the duration of the study period show trends very similar to those of the tree seedlings. The median ABCO sapling density increased by 99% ($P<.01$) whereas the median sapling densities of PIPO (-61%) significantly declined. POTR (-100%), and PSME (-22%) showed non-significant declines in density. PIFL (+88%) and JUSC (+171) showed non-significant increases in median density. Please note that even though mean values are reported in Table 6 because of the stucture of these data, changes in median values were tested for statistical significance and are reported here. ABCO (+46%) increased siginificantly in mean importance value whereas PIPO (-39%) and PSME (-21%) significantly declined. PIFL (-10%) and POTR (-38%) had a non-significant decline in mean importance value whereas JUSC (+27%) had a non-significant increase.

There were fewer changes in sapling density and importance values on the lower part of the study transect. JUSC (+152%) median density increased significantly at the same time PIPO (+30%, $P<.10$) and PSME (+129%, $P<.06$) showed almost significant increases. PIFL median density stayed about the same. None of the changes in sapling importance value were close to the $P<.10$ significance level and consequently, it should be inferred that on the lower part of the study transect species composition stayed relatively constant for the last three decades.

TABLE 5. Summary of tree seedling average plot density and importance values. Significance values for density changes were evaluated with the Wilcoxon Signed Rank test. Significance values for importance value changes were evaluated with the Paired t-test.

	Top						Bottom					
Tree	1958 Density			1991 Density			1958 Density			1991 Density		
Spp.	N	Mean	1 SE	Mean	1 SE	Change	N	Mean	1 SE	Mean	1 SE	Change
ABCO	136	3291 ±	1138	4640 ±	937	1349 *	0	0 ±	…	0 ±	…	… …
JUSC	23	507 ±	238	159 ±	122	-348 NS	31	133 ±	95	394 ±	196	261 NS
PIED	1	0 ±	…	25 ±	…	25 NS	2	303 ±	237	178 ±	178	-125 …
PIFL	22	268 ±	87	124 ±	67	-144 *	9	88 ±	47	137 ±	47	49 NS
PIPO	49	325 ±	100	532 ±	322	206 NS	68	115 ±	37	159 ±	50	44 NS
PIPU	1	17313 ±	…	0 ±	…	-17313 NS	0	0 ±	…	0 ±	…	… …
POTR	8	576 ±	287	533 ±	300	-43 NS	0	0 ±	…	0 ±	…	… …
PSME	113	2883 ±	1405	2210 ±	696	-672 NS	12	67 ±	29	355 ±	239	288 NS

	Top						Bottom					
Tree	1958 IV			1991 IV			1958 IV			1991 IV		
Spp.	N	Mean	1 SE	Mean	1 SE	Change	N	Mean	1 SE	Mean	1 SE	Change
ABCO	136	104 ±	6	144 ±	5	40 ***	0	0 ±	…	0 ±	…	… …
JUSC	23	63 ±	12	50 ±	11	-13 NS	31	47 ±	8	56 ±	7	8 NS
PIED	1	0 ±	…	106 ±	…	106 …	2	115 ±	0	60 ±	60	-55 NS
PIFL	22	58 ±	9	17 ±	7	-42 **	9	57 ±	20	71 ±	8	14 NS
PIPO	49	87 ±	10	57 ±	8	-31 **	68	155 ±	7	152 ±	7	-4 NS
PIPU	1	135 ±	…	0 ±	…	-135 …	0	0 ±	…	0 ±	…	… …
POTR	8	68 ±	22	61 ±	27	-7 NS	0	0 ±	…	0 ±	…	… …
PSME	113	79 ±	5	56 ±	6	-23 **	12	85 ±	18	83 ±	20	-2 NS

Figure 8. The relationship between the change in seedling importance values between 1957-1991 for various combinations of species pairs. The 154 plots shown are from the upper part of the study transect.

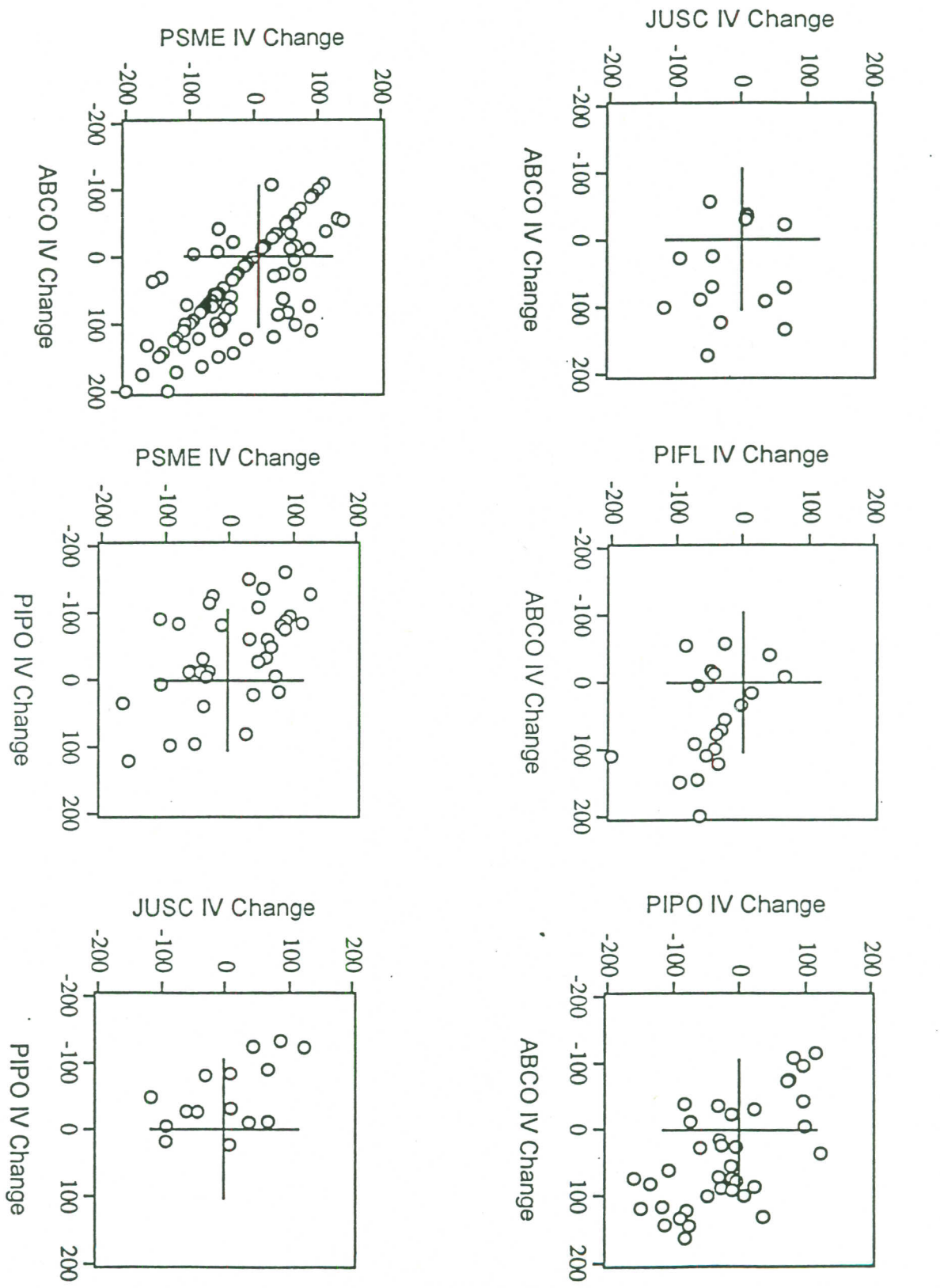


Figure 9. The relationship between the change in seedling importance values between 1957-1991 for various combinations of species pairs. The 69 plots shown are from the lower part of the study transect.

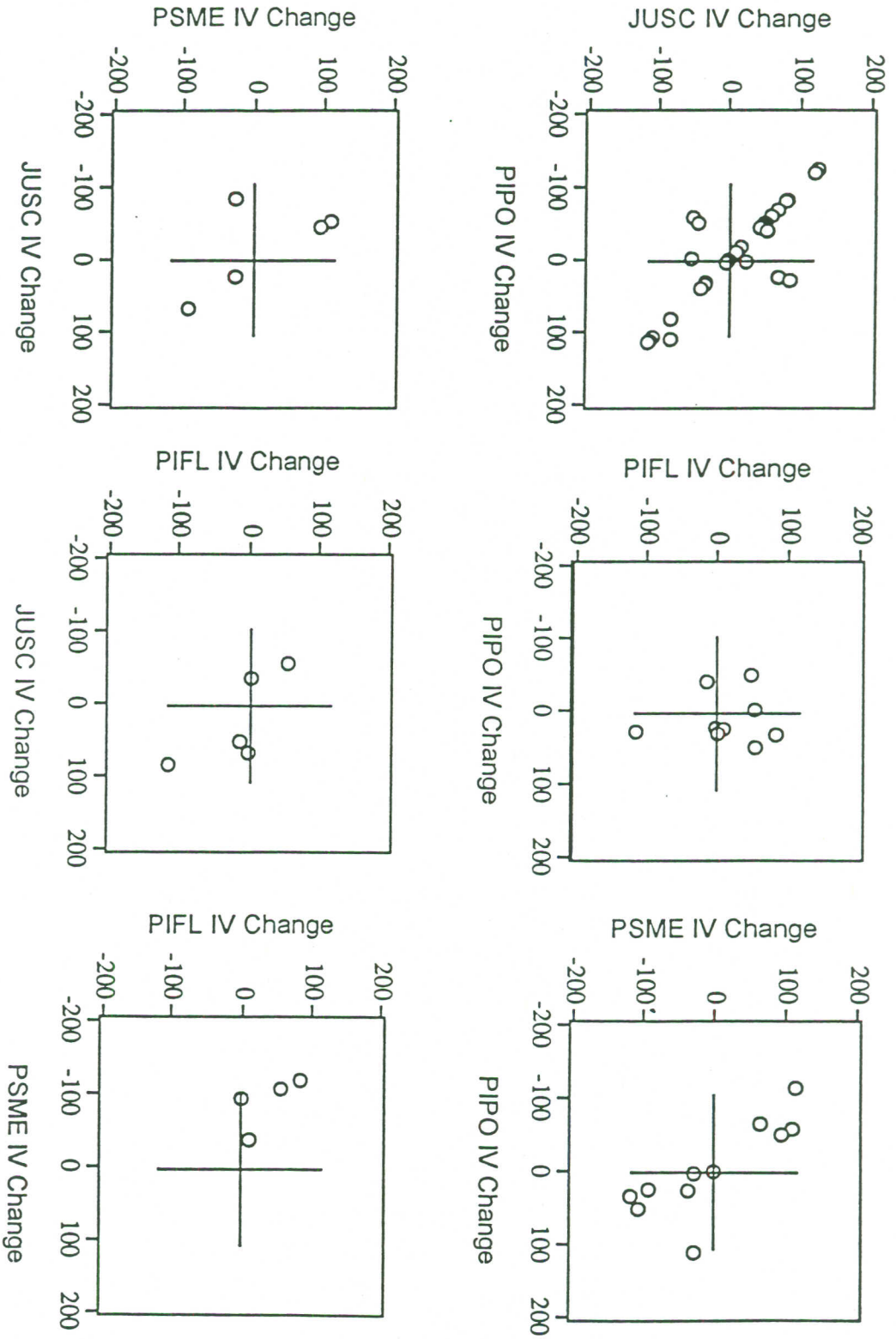


TABLE 6. Summary of tree sapling average plot density and importance values. Significance values for density changes were evaluated with the Wilcoxon Signed Rank test. Significance values for importance value changes were evaluated with the Paired t-test.

	Top						Bottom					
Tree	1958 Density			1991 Density			1958 Density			1991 Density		
Spp.	N	Mean	1SE	Mean	1SE	Change	N	Mean	1SE	Mean	1SE	Change
ABCO	122	3425 ±	2241	523 ±	147	-2902 **	0	0 ±	…	0 ±	…	… …
JUSC	28	57 ±	18	220 ±	113	163 NS	35	12 ±	2	118 ±	53	106 *
PIED	1	11 ±	…	0 ±	…	11 --	2	636 ±	95	0 ±	0	-636 NS
PIFL	32	165 ±	61	171 ±	42	6 NS	13	505 ±	500	499 ±	483	-6 NS
PIPO	77	485 ±	338	145 ±	41	-340 *	68	72 ±	22	111 ±	31	39 NS
PIPU	2	104 ±	104	3023 ±	2894	2918 NS	0	0 ±	…	0 ±	…	… …
POTR	17	1916 ±	1515	269 ±	133	-1647 NS	0	0 ±	…	0 ±	…	… …
PSME	124	246 ±	60	3364 ±	3149	3118 NS	11	15 ±	4	35 ±	8	20 NS

	Top						Bottom					
Tree	1958 IV			1991 IV			1958 IV			1991 IV		
Spp.	N	Mean	1SE	Mean	1SE	Change	N	Mean	1SE	Mean	1SE	Change
ABCO	122	85 ±	6	124 ±	5	39 ***	0	0 ±	…	0 ±	…	… …
JUSC	28	48 ±	9	61 ±	9	13 NS	35	45 ±	7	51 ±	7	6 NS
PIED	1	34 ±	…	0 ±	…	… …	2	78 ±	43	0 ±	0	-78 NS
PIFL	32	61 ±	8	55 ±	8	-6 NS	13	24 ±	12	49 ±	10	25 NS
PIPO	77	89 ±	6	54 ±	7	-35 ***	68	162 ±	6	154 ±	7	-9 NS
PIPU	2	100 ±	100	92 ±	24	-8 NS	0	0 ±	…	0 ±	…	… …
POTR	17	61 ±	7	38 ±	13	-23 NS	0	0 ±	…	0 ±	…	… …
PSME	124	73 ±	4	58 ±	5	-14 *	11	65 ±	14	86 ±	17	22 NS

We are hesitant to assign much importance to correlations between changes in seedling importance values and soil chemistry, however, we report here our significant findings which may suggest followup studies at some time in the future. There were no significant linear correlations between any of the 15 chemical and physical parameters given in Table 2, %Silt and elevation, and the change in ABCO, PIED, or PIPU seedling importance value. Plots having increased % Sand showed significantly greater increases in importance values of JUSC on the upper study plots, but no significant relationship was found on the lower study plots. PIFL seedling change was negatively correlated with average plot soil depth for the upper study plots only. PIPO was positively correlated with log % organic matter, whereas POTR seedling change was positively correlated with log potassium on the upper plots. PSME seedling change was negatively correlated with soil water capacity on the upper plots. The only significant correlation on the lower study plots was a negative relationship between PIPO seedling change and log nitrogen. The seventeen chemical and physical parameters combined with those seedlings present in enough plots to test with correlation analysis created 170 separate correlation tests. We note that if 170 separate correlations are tested at the 0.05% significance level, 9 are expected to show significance just by random chance. Our readers will observe that we have reported just six significant relationships, and in accordance with the previous observation, we suggest that either these reported relationships are highly questionable or that a more powerful multivariate test is called for.

4. Trees

The median basal area per hectare (BA/Ha) increased dramatically for three of the four most dominat species on the upper study plots (ABCO, +48%, PIFL, +58%, and PIPO, +25%) (Table 7). JUSC (+244%) appeared to make large gains in basal area but the difference was not statistically significant. POTR and PSME basal areas stayed about the same over the 34 years of the study period. Medians were used instead of means due to the decidedly non-parametric distribution of plot values.

The decline in basal area/species (BA/Spp) on the upper study plots for PIPO (-13%, not significant) and PSME (-29%) during the same period when ABCO (+45%) was increasing shows again how ABCO appears to be out competing the other tree species. POTR (-33%, not significant) also declined, whereas JUSC (+21%, not significant) and PIFL (+18%, not significant) increased their plot basal area. As the ABCO canopy closed it is not a surprise that the average tree density declined (not significantly) for PIPO (-8%), POTR (-12%), and ABCO (-29%). It is somewhat a surprise that the density of JUSC increased by 163%. PSME (+17%, not significant) and PIFL (+20%, not significant) tree densities remained about constant.

As an example of the complexity and pitfalls in assigning causal mechanisms of tree change we share the following. Even though average tree basal area of ABCO has increased over the same time that average tree basal area of PSME has decreased there are still at least 8 plots where the opposite holds true. Our examination of those eight plots has not yielded a consistent explanation for the increase of PSME. Even though PSME is commonly though to be much less shade tolerant than ABCO (Roberts, et al., 1989), on the 62 plots where ABCO and PSME seedlings co-occurred, the average decline in PSME seedling IV was not correlated with the change in ABCO basal area, the 1958 initial basal area of ABCO, or the 1958 IV of ABCO. There was however, a very weak, but almost significant (r^2=.33, P=.055) positive correlation between plot pH and the change in PSME seedling IV and a weak, but significant (r^2=.111, P<.001) negative correlation between plot water capacity and the change in PSME seedling IV. As mentioned previously, sorting out the relative importance of abiotic factors, site history and biotic factors will require much additional study.

It will be recalled that plots on the bottom part of the study transect do not have ABCO trees or seedlings by definition. Average plot density of PIPO on plots found in the bottom half of the study transect has increased by 112% (Table 7). The gain in JUSC tree density (+171%) was not statistically significant, nor were the trends of reduced density observed for PSME (-43%) and PIFL (-15%). The growth of PIPO saplings to become trees was seen partially in the dramatic decline in average plot basal area per species for PIPO (-36%). In contrast, not only did plots containing JUSC have a non-significant trend for increased tree density but they showed an increase of 72% in average plot BA/Spp. The BA/Spp reductions of PSME (-69%) and PIFL (-14%) were not significant. On the other hand the increase in density for JUSC and PIPO showed significantly for median BA/Ha for JUSC (+39%) and PIPO (+51%). PIFL (+124%) and PSME (-70%) were not common and showed no significant changes in BA/Ha.

TABLE 7. Summary of tree average plot basal area per hectare (BA/Ha), basal area per species (BA/Spp), density, and importance values. Significance values and confidence intervals (C.I.) for the BA/Ha were evaluated with the Wilcoxon Signed Rank test. All other significance values were evaluated with the Paired t-test. Basal area units are indicated. Density units are trees per hectare.

	Top						Bottom					
Tree	1958 BA/Ha		1991 BA/Ha				1958 BA/Ha		1991 BA/Ha			
Spp.	N	Median	(C.I.)	Median		Change	N	Median	(C.I.)	Median		Change
ABCO	91	3.58	(2.68,4.81)	5.56	(4.24,7.08)	1.73 *	0		Not enough data			
JUSC	16	0.72	(0.27,1.68)	3.10	(1.20,12.90)	1.76 NS	35	2.04	(0.99,3.41)	3.20	(1.93,4.69)	0.80 *
PIED	4	5.93	?	4.19	Not enough data		1		Not enough data			
PIFL	34	2.29	(1.03,7.82)	3.39	(1.91,10.96)	1.32 *	7	0.25	(0.04,2.30)	0.46	(0.00,1.41)	0.31 NS
PIPO	106	4.48	(3.08,6.30)	5.10	(3.95,6.64)	1.10 *	67	1.81	(1.46,2.21)	2.84	(2.21,3.61)	0.92 *
PIPU	5	5.10	(0.00,55.2)	9.20	(4.6, 18.4)	4.80 NS	0		Not enough data			
POTR	19	3.41	(1.99,5.20)	1.72	(0.00,9.21)	-0.40 NS	0		Not enough data			
PSME	112	4.97	(3.64,6.92)	4.83	(3.63,6.60)	0.29 NS	9	6.00	(1.20,13.1)	0.57	(0.00,9.18)	-4.20 NS

	Top						Bottom					
Tree	1958 BA/Spp			1991 BA/Spp			1958 BA/Spp			1991 BA/Spp		
Species	N	Mean	1 SE	Mean	1 SE	Change	N	Mean	1 SE	Mean	1 SE	Change
ABCO	91	869 ±	84	1256 ±	132	387 **	0	… ±	…	… ±	…	…
JUSC	16	502 ±	198	605 ±	192	104 NS	35	790 ±	156	1357 ±	235	567 **
PIED	4	206 ±	128	308 ±	103	102 NS	1	0 ±	…	275 ±	…	275 …
PIFL	34	563 ±	105	663 ±	138	100 NS	7	431 ±	212	370 ±	184	-61 NS
PIPO	106	1851 ±	185	1606 ±	159	-245 NS	67	3744 ±	408	2388 ±	279	-1356 ***
PIPU	5	942 ±	759	1439 ±	627	497 NS	0	… ±	…	… ±	…	… …
POTR	19	462 ±	177	309 ±	112	-153 NS	0	… ±	…	… ±	…	… …
PSME	112	1428 ±	166	1015 ±	147	-413 *	9	1561 ±	683	477 ±	298	-1084 NS

Table 7. (continued)

Tree Species	Top N	1958 Density Mean	± 1 SE	1991 Density Mean	± 1 SE	Change	Bottom N	1958 Density Mean	± 1 SE	1991 Density Mean	± 1 SE	Change
ABCO	91	262	120	186	32	-76 NS	0	…	…	…	…	…
JUSC	16	35	14	92	24	57 *	35	52	15	141	83	89 NS
PIED	4	143	85	98	83	-45 NS	1	0	…	489	…	489 …
PIFL	34	201	80	242	86	40 NS	7	13	4	11	4	-2 NS
PIPO	106	157	37	145	31	-12 NS	67	25	3	53	5	28 ***
PIPU	5	294	275	165	38	-129 NS	0	…	…	…	…	… …
POTR	19	206	53	181	110	-25 NS	0	…	…	…	…	… …
PSME	112	180	52	210	69	30 NS	9	63	21	36	19	-27 NS

Tree Species	Top N	1958 IV Mean	± 1 SE	1991 IV Mean	± 1 SE	Change	Bottom N	1958 IV Mean	± 1 SE	1991 IV Mean	± 1 SE	Change
ABCO	91	126	9	156	10	30 ***	0	…	…	…	…	… …
JUSC	16	50	12	74	11	24 NS	35	103	12	125	11	22 *
PIED	4	54	18	58	21	5 NS	1	0	…	103	…	103 NS
PIFL	34	79	9	77	12	-2 NS	7	60	16	59	22	-1 NS
PIPO	106	148	9	143	8	-5 NS	67	234	9	229	10	-6 NS
PIPU	5	85	52	137	29	52 NS	0	…	…	…	…	… …
POTR	19	104	21	54	17	-50 ***	0	…	…	…	…	… …
PSME	112	116	7	99	7	-17 *	9	109	18	53	22	-55 NS

Classification of Plots according to Roberts *et al.* (1989)

In accordance with the original grant proposal requirements we have used the vegetation classification of Roberts *et al.* (1989) to assign plot categories for each of our 266 plots (Table 8).

Table 8. A list of plot groups defined by the vegetation classification scheme of Roberts, *et al.* (1989).

HABITAT	MEMBERS OF HABITAT (plots)
ABCO present:	
ARPA	1, 37, 45, 109, 114, 133, 153
MARE–JUCO	87, 89
MARE--MARE	2, 5, 6, 7, 11, 13, 16, 25, 26, 28, 32, 33, 42, 43, 44, 47, 49, 50, 51, 52, 56, 66, 68, 71, 80, 83, 86, 92, 93, 96, 97, 101, 121, 123, 124, 125, 126, 154
JUCO	19, 90, 113, 120
SYOR	14, 17, 20, 39, 57, 82, 95, 122, 127
ABCO absent:	
Picea pungens/JUCO	88
PIFL/*Pinus longaeva*	41, 48, 60, 64, 119, 214
PSME/ARPA	23, 30, 46, 65, 108, 110, 111,135, 143, 144, 164, 212, 241
PSME/MARE--PIPO	61, 62, 63, 98, 117, 132, 134, 136, 138, 140, 141, 142, 148, 156, 162, 173, 244
PIPO/ARPA	67, 69, 116, 149, 151, 152, 161, 171, 174, 175, 178, 219, 221, 224, 225, 230, 231, 234, 243, 254
PIPO/ARNO	180, 238, 247
PIPO/PUTR	74, 150, 200, 202, 203, 205, 206, 217, 218, 232, 235, 236, 248, 249, 250, 255, 256, 259, 260, 261, 262, 263, 264, 265, 266
sites without trees	
ARNO/STCO	167, 169, 182, 183, 187, 190, 191, 192, 193, 194, 197, 198
Juncus arcticus/CARO	168, 257, 258
unclassified sites	
without trees	27, 55, 70, 99, 100, 155, 160, 177, 184, 185, 186, 188, 196, 228, 240
ABCO present	3, 4, 8, 9, 10, 22, 24, 29, 34, 35, 36, 38, 53, 54, 75, 76, 77, 78, 79, 81, 84, 85, 91, 94, 102, 103, 107, 118
ABCO absent/PSME present	18, 21, 31, 58, 72, 104, 115, 128, 130, 131, 137, 139, 157, 158
ABCO absent/PSME absent/PIPO present	40, 59, 73, 106, 145, 146, 147, 159, 163, 165, 166, 170, 172, 176, 179, 181, 195, 199, 204, 209, 210, 211, 215, 220, 223, 226, 233, 237, 239, 245, 246, 251, 252, 253
ABCO absent/PSME absent/PIPO absent	227, 242

Classification of Plots according to TWINSPAN

Any attempt to classify parts of nature will misrepresent the patterns of gradual change and abrupt change that really exist. The professional ecological literature has many hundreds of articles touting some particular balance between emphasizing discrete plant communities as opposed to gradients between plant communities that only exist in a statistical construct. We believe that most any numerical technique will recognize that the upper part of our Bryce Canyon National Park study transect is dominated by ABCO and has lesser amounts of PIPO, PSME, PIFL, and POTR. In the lower part of the study transect PIPO dominates accompanied with lesser amounts of JUSC and PSME. We have chosen to divide the 1957 study plots in such a way so as to show pockets of tree diversity. We could have used objective quantitative techniques to illustrate even more diversity but we have tried to highlight the major tree groupings that we believe existed in 1958. (Figure 10).

On the upper plots if ABCO, PIPO, and PSME form three corners of an ordination or classification triangle then four of the recognized vegetation groups can be seen as the possible two and three species combinations of these three species, that is, ABCO/PSME, ABCO/PIPO, PIPO/PSME, and ABCO/PSME/PIPO (Figure 11 and Figure 10). All that remains is to recognize those plots have large amounts of POTR (with PSME and ABCO), those plots having large amounts of PIFL (with PSME, ABCO, and PIPO), and finally those plots having a combination of PIPO and JUSC.

The change from a relatively equal distribution of forest types to an ABCO dominated forest on the upper plots is seen most dramatically by observing that ABCO importance values (IVs) increased (or stayed the same) on 64 plots located in nine of the ten 1957 forest types (Figure 12) whereas, ABCO IVs decreased (or remained the same) in 41 plots located in five of the ten original forest types. The ABCO takeover was most pronounced in forest plots the were originally classified as POTR, PSME, PIPO, and PSME/PIPO.

It was encouraging that plots having PIFL, PIED, JUSC, or PIPU stayed about the same in number, however these trees are rare on the upper study plots and unless they are encouraged in some way will likely remain less common. POTR increased or stayed the same on only three plots while decreasing or staying the same on 16 plots. PSME IVs declined or held constant on 64 plots while increasing or staying the same on 49, whereas PIPO showed approximately equal gains and losses, increasing or staying the same on 55 plots and decreasing or staying the same on 59 plots. PIPO lost the most in average plot IV on plots that had the most PIPO in 1957. It is important to emphasize again that our studies show that despite the many plots that showed an increase in ABCO IV and as a result, a loss in average tree diversity in the park, there are still many pockets of diversity, that if encouraged could help provide for future generations of non-ABCO trees.

Classification of the 69 plots located on the lower reaches of the study transect is much simpler that the upper study plots. PIPO dominated 35 of the study plots, virtually alone. PIPO and JUSC occupy together another 23 plots. The PIPO/JUSC mixture is joined by PSME for eight plots, and the PIPO/JUSC mixture is joined by PIFL for four plots (Figure 13). The change in the 1957 forest structure was mostly that of an increase in JUSC IV and a corresponding decline in PSME and PIPO IVs (Figure 14). Importance values of the less common trees, PIFL and PIED stayed about the same.

Figure 10. TWINSPAN analysis of eight tree species found on 154 study plots in 1957 in the upper elevations of Bryce Canyon National Park. Major forest types are indicated.

Figure 11. Graphical interpretation of important forest groups found by TWINSPAN analysis of the 154 study plots in 1957 in the upper elevations of Bryce Canyon National Park.

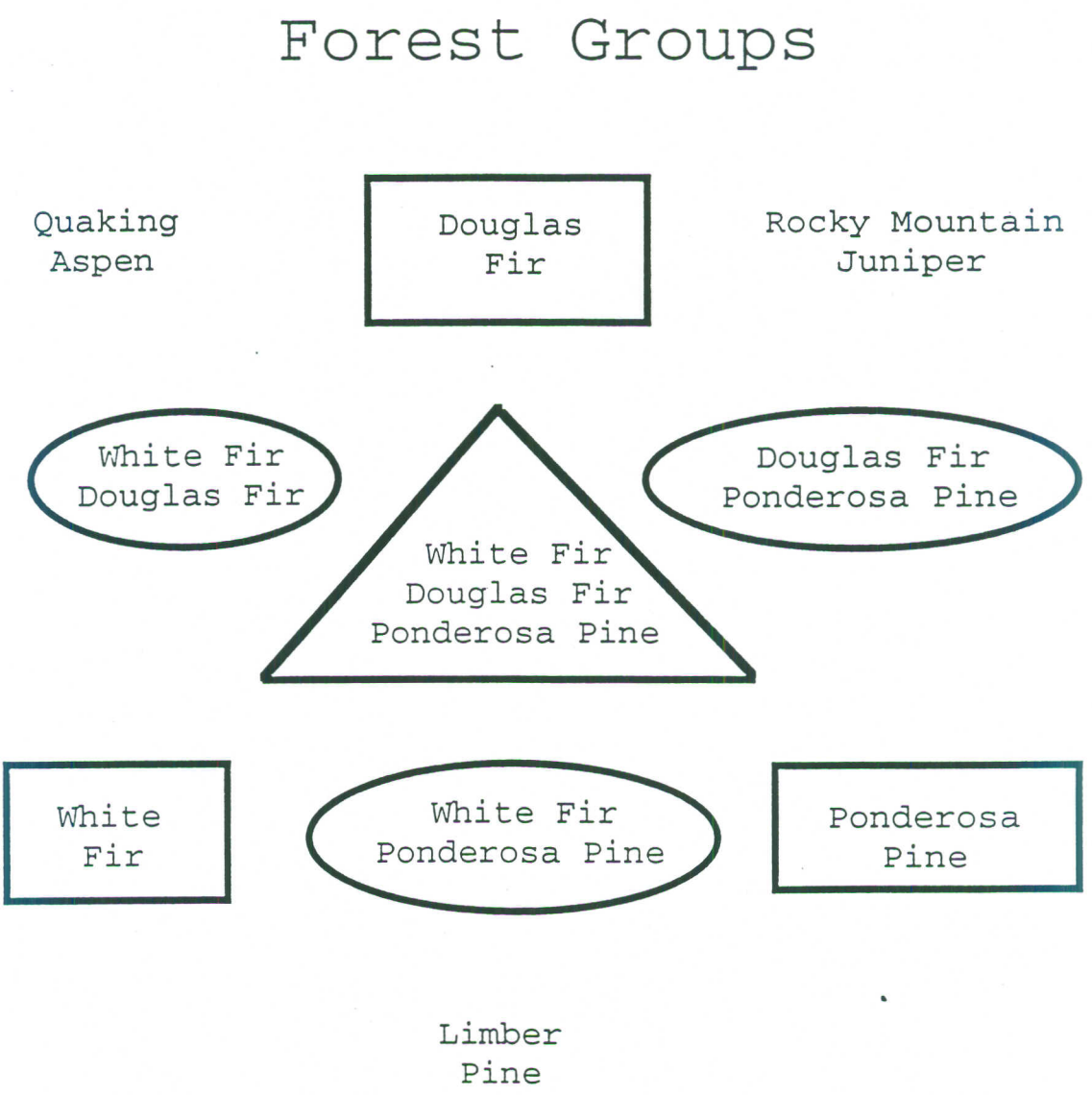


Figure 12. The change in importance values for those tree species occuring on plots on the upper part of the study transect. Numbers above or below each bar indicate the number of plots constituing the average change indicated by the bar. A plot may be used more than once in calculating averages if the IV change was close to zero (see text).

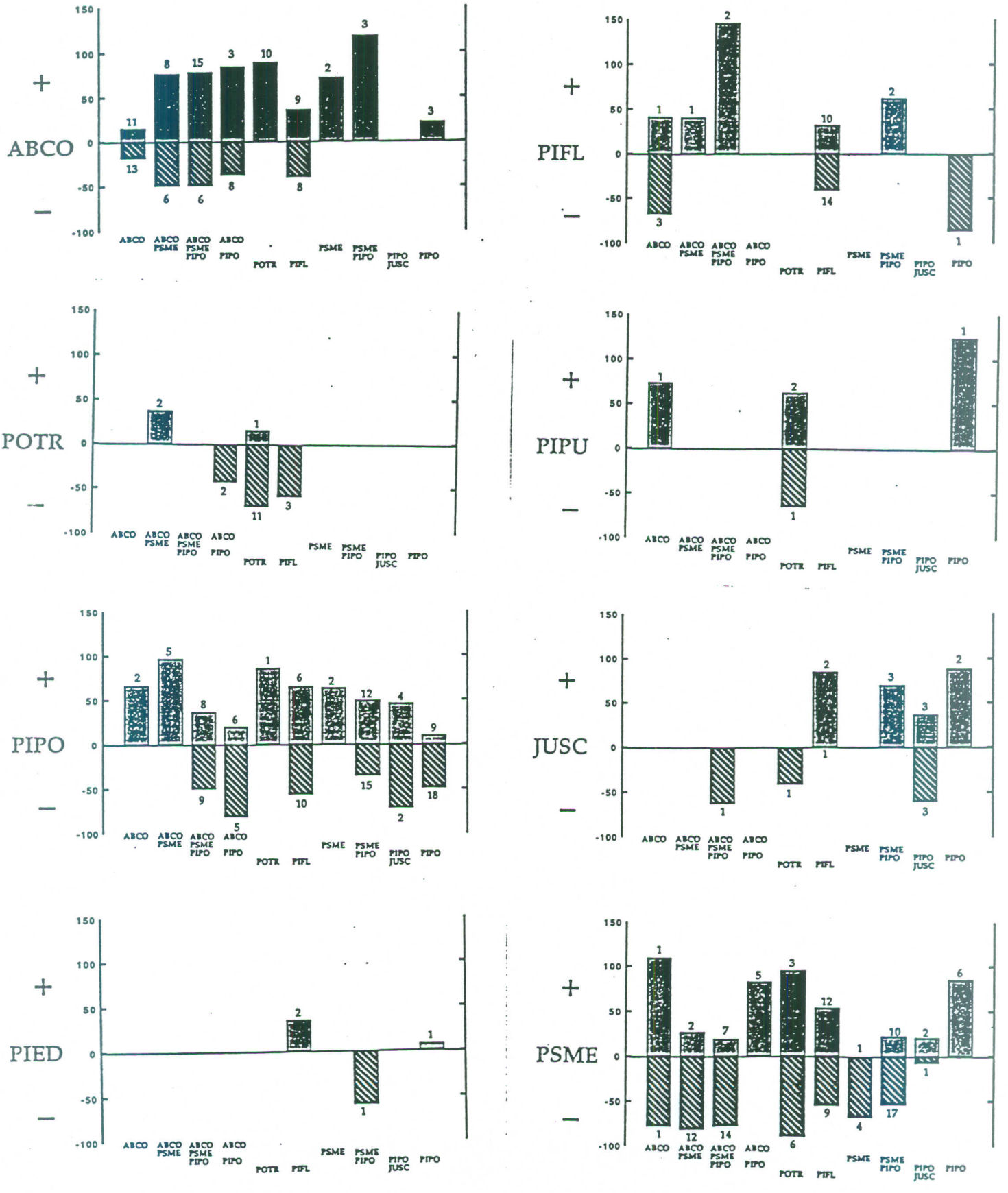


Figure 13. TWINSPAN analysis of eight tree species found on 69 study plots in 1957 in the lower elevations of Bryce Canyon National Park. Major forest types are indicated.

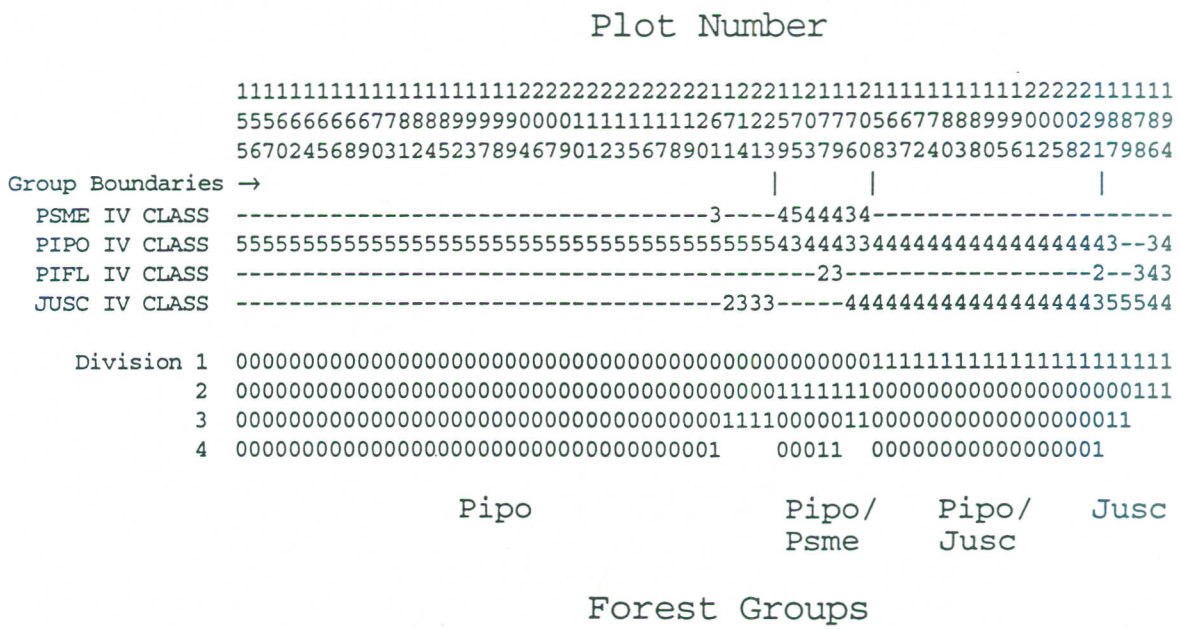
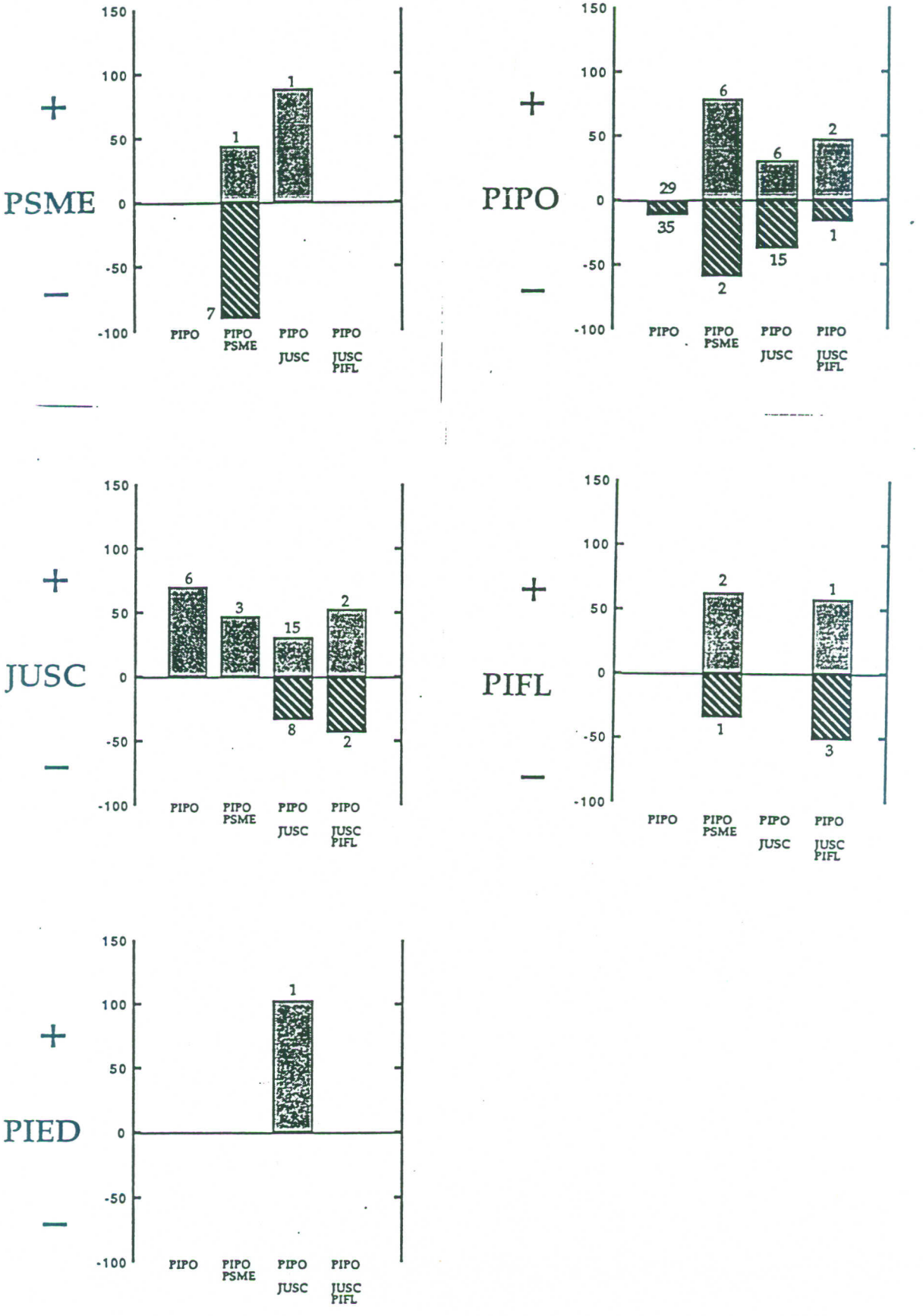


Figure 14. The change in importance values for those tree species occuring on plots on the lower part of the study transect. Numbers above or below each bar indicate the number of plots constituing the average change indicated by the bar. A plot may be used more than once in calculating averages if the IV change was close to zero (see text).



Soil Chemical and Physical Parameters and Forest Groups

It should not be surprising that given the numerous significant relationships between soil chemical measurements and elevation (Figure 3) as well as the significant relationship between forest type and elevation (Table 9), that there were several significant relationships between soil chemical measurements and forest type. For plots on the upper part of the study transect PIPO was generally found on soils having a higher pH than ABCO ($P<.001$). PIPO seemed to prefer plots having more calcium ($P<.02$), and drier soils ($P<.01$) than ABCO. Significant differences were also found amongst the 10 forest types for log P and log K, but the vegetation preferences were not clear.

For plots on the lower study plots it appears that PIPO prefers soils higher in phosphorus ($P<.025$) than does JUSC. There was also a significant difference ($P<.02$) amongst the groups for log calcium, possibly for JUSC to prefer soils with higher calcium, but once again the pattern it not entirely clear without further analysis.

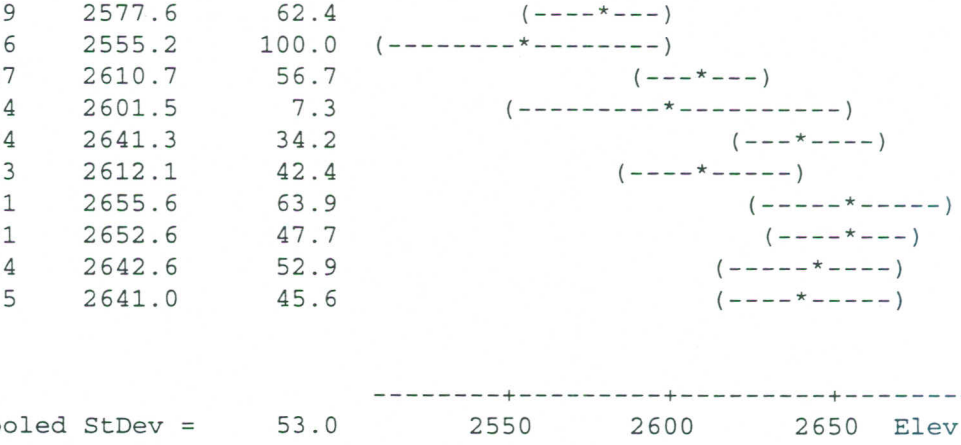
Table 9. The relationship between forest type and elevation for the 154 study plots on the upper part of the transect.

Analysis of Variance

Source	DF	SS	MS	F	p
TreeGrps	9	122480	13609	4.85	0.000
Error	144	404121	2806		
Total	153	526601			

Forest Type	N	Mean	StDev
PIPO	19	2577.6	62.4
PIPO/JUSC	6	2555.2	100.0
PIPO/PSME	27	2610.7	56.7
PSME	4	2601.5	7.3
PIFL	24	2641.3	34.2
POTR	13	2612.1	42.4
ABCO/PIPO	11	2655.6	63.9
ABCO/PS/PI	21	2652.6	47.7
ABCO/PSME	14	2642.6	52.9
ABCO	15	2641.0	45.6

Individual 95% CIs For Mean Based on Pooled StDev



Pooled StDev = 53.0

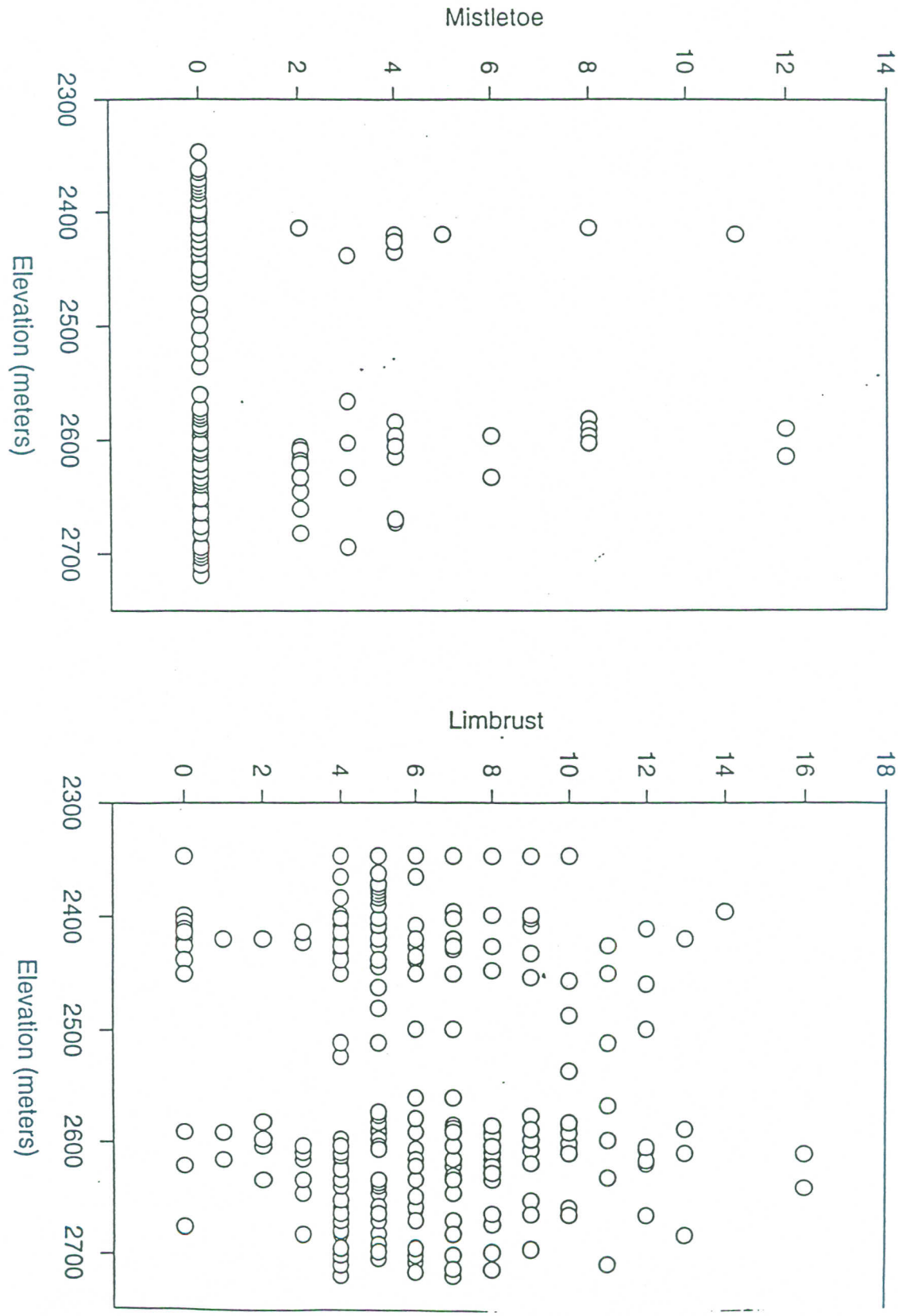
Incidence of Limbrust and Mistletoe

All manner of extreme and intermediate values of limbrust and mistletoe were found, not correlated with elevation (Figure 15). The incidence of mistletoe was inversely correlated with that of limbrust ($P<0.001$, $R^2=23.7$). The amount of mistletoe was not correlated with any of the soil parameters we measured. There was a significant, direct relationship between the amount of mistletoe and the tree importance value of PSME ($R^2=9.5\%$, $P<0.001$), but no other tree species importance values were correlated with mistletoe. Furthermore, mistletoe incidence was not correlated with either sapling importance values nor seedling importance values. Maybe most important, when the change in tree importance values were compared with mistletoe frequency, we found no significant correlations.

The amount of limbrust was inversely correlated with soil pH, ($P<0.001$, $R^2=4.6\%$) and inversely correlated with ppm Ca in the soil ($P<0.001$, $R^2=8.8\%$). There were no other significant relationships between soils and limbrust incidence. There was a significant, direct relationship between the amount of mistletoe and the importance value of ABCO ($R^2=3.7\%$, $P<0.005$), as well as POTR ($R^2=5.5\%$, $P<0.001$). Limbrust incidence was inversely correlated with importance values of PSME ($R^2=2.2\%$, $P<0.05$). Limbrust was less frequent on plots having larger increases in importance values of JUCO ($P<0.05$, $R^2=11.8\%$). However, frequency of limbrust was not correlated with any other change in individual tree species importance value. Furthermore, we found no correlation between sapling or seedling importance values and limbrust incidence.

It should be emphasized that we did not collect tree samples for pathogen classification, so our usage of the terms limbrust and mistletoe should be taken quite loosely. What should not be missed, however, is that Figure 15 indicates that something is causing extensive branch damage throughout the park.

Figure 15. The relationship between elevation and the incidence of limbrust and mistletoe. Each plot is represented by a circle. See text for explanation of disease index.



5. Understory

Of the 103 understory forbs, 53 species did not occur on the same plots often enough to test statistically for a difference in density (Table 10). Thirty-nine species showed no change in density over the 34 years of the study period. Four species (Achillea millefolium, Aster chilensis, Draba subalpina, and Linum kingii) showed a significant increase in density, whereas three additional species (Circium calcareum, Oenothera howardii and Penstemon laevis) showed a non-significant trend towards increased density. Cordylanthus kingii, Euphorbia sp., and Lithospermum multiflorum showed a significant decrease in density, whereas Cymopterus purpureus showed a non-significant trend towards decreased density. We have not studied yet whether some forb species are being replaced by others or if the changes in forb density are correlated with changes in grasses, shrubs, or trees.

Three of the 16 grass and sedge species (Bromus carinatus, Muhlenbergia montana, and Stipa hymenoides) increased in density whereas Stipa lettermanii was the only grass or sedge declining in density. It was disconcerting that six of the 19 shrub species (Arctostaphylos patula, Artemesia nova, Chrysothamnus depressus, Mahonia repens, Pachystima myrsinites, and Symphoricarpos oreophilus) showed a significant decline in density, whereas none of the 19 shrub species increased in density.

Table 10. Consolidated list of understory plants. Species density, standard deviation and sample size are given for each year for those plots where the species occurred. Two-way ANOVARs and the associated probabilities indicate those species having a significant change in average plant density for at least one of the study years. Asterisks indicate species absence or lack of enough data to compute appropriate statistics.

	1957			1968			1980			1991			
Forbs	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	F	Prob.
Achillea millefolium	15	5.67	8.62	14	5.36	5.15	18	6.28	8.04	25	9.40	13.49	3.54	.024
Agoseris glauca	0	*	*	2	3.00	1.41	7	1.00	*	1	1.00	*	*	*
Androsace septentrionalis	0	*	*	1	1.00	*	0	*	*	2	2.50	0.71	*	*
Anemone multifida	1	2.00	*	0	*	*	0	*	*	0	*	*	*	*
Antennaria parvifolia	2	30.00	11.31	2	47.50	33.23	3	8.33	8.08	2	3.00	2.83	1.03	.528
Antennaria rosulata	0	*	*	2	5.00	*	1	43.00	*	4	59.75	70.06	0.52	.699
Apocynum androsaemifolium	4	2.00	1.41	4	1.75	0.96	3	1.33	0.58	4	1.75	0.96	0.90	.483
Aquilegia caerulea	1	1.00	*	2	1.00	*	0	*	*	2	1.50	0.71	0.50	.707
Arabis demissa	4	2.50	3.00	5	1.60	0.89	0	*	*	12	2.42	1.24	*	*
Arabis holboellii	0	*	*	0	*	*	1	2.00	*	0	*	*	*	*
Arenaria fendleri	40	4.50	5.38	26	4.77	4.93	34	4.65	5.82	39	5.26	6.46	0.72	.544
Arnica cordifolia	5	2.60	1.52	4	4.50	4.36	3	1.67	0.58	3	4.33	2.31	1.67	.310
Artemisia ludoviciana	9	3.00	2.50	7	4.71	3.73	7	2.29	1.89	10	10.30	18.67	2.12	.141
Aster chilensis	29	7.48	9.78	16	4.06	4.55	34	8.24	15.73	31	13.32	19.72	2.91	.042
Aster occidentalis	1	3.00	*	1	23.00	*	1	9.00	*	2	14.00	18.38	*	*
Astragalus amphioxys	19	2.79	1.84	6	3.50	3.02	4	1.25	0.50	15	1.93	2.58	0.84	.498
Astragalus argophyllus	1	1.00	*	1	1.00	*	0	*	*	1	4.00	*	*	*
Astragalus convallarius	8	3.62	4.53	3	2.67	1.15	8	2.00	1.31	17	2.76	4.01	1.35	.306
Astragalus humistratus	1	3.00	*	1	7.00	*	1	1.00	*	0	*	*	*	*
Astragalus kentrophyta	1	1.00	*	4	4.75	4.35	2	5.00	5.66	2	2.00	1.41	1.40	.443
Astragalus megacarpus	1	13.00	*	1	7.00	*	2	2.50	2.12	2	1.50	0.71	*	*
Astragalus miser	27	2.74	2.36	23	2.22	1.68	27	2.52	2.24	22	2.64	2.42	0.67	.574
Balsarmorhiza sagittata	9	4.11	4.48	8	4.13	3.72	9	3.67	2.18	9	3.11	1.62	0.23	.878
Boraginaceae sp.	0	*	*	0	*	*	0	*	*	1	2.00	*	*	*
Calochortus nuttallii	4	1.00	*	0	*	*	4	1.75	1.50	1	1.00	*	*	*
Calylophus lavandulifolius	8	3.50	3.12	5	4.20	2.77	11	4.91	10.04	17	4.71	4.92	0.20	.896
Castilleja linariifolia	16	1.69	1.35	4	1.25	0.50	7	1.14	0.38	9	2.78	2.11	0.41	.748
Chaenactis douglasii	2	1.00	*	2	1.00	*	2	1.00	*	3	2.67	1.53	*	*
Cirsium arizonicum	4	1.25	0.50	3	1.33	0.58	4	1.25	0.50	3	4.33	4.93	0.10	.959
Cirsium calcareum	6	1.83	1.33	9	1.89	1.54	14	1.36	0.63	26	2.62	1.94	2.85	.060
Clematis columbiana	11	2.18	1.78	9	2.11	1.45	12	1.75	1.14	14	1.86	1.88	0.68	.572

Comandra umbellata	1	1.00	*	0	*	*	0	*	*	2	4.50	4.95	*	*
Composite sp.	0	*	*	1	28.00	*	0	*	*	0	*	*	*	*
Cordylanthus kingii	5	3.80	2.68	0	*	*	9	3.11	3.10	5	1.60	0.89	10.05	.047
Crepis intermedia	2	1.50	0.71	0	*	*	2	1.00	*	7	2.00	1.53	*	*
Cryptantha sp.	10	5.10	5.76	4	4.50	2.65	15	3.13	3.20	14	5.57	5.50	1.09	.380
Cymopterus purpureus	6	4.33	3.33	2	5.50	2.12	6	5.17	3.97	7	3.57	3.10	3.41	.067
Draba subalpina	19	2.21	2.07	14	5.36	4.31	18	1.94	1.43	13	10.46	12.26	5.22	.006
Erigeron canus	3	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Erigeron flagellaris	23	5.91	8.67	23	14.70	23.89	14	4.07	3.71	25	8.64	14.96	2.17	.105
Erigeron simplex	0	*	*	0	*	*	1	1.00	*	0	*	*	*	*
Erigeron speiosus	2	6.50	7.78	1	16.00	*	1	20.00	*	2	5.50	6.36	*	*
Eriogonum alatum	10	2.30	3.77	4	3.00	3.37	9	1.56	1.01	10	2.20	1.40	0.24	.868
Eriogonum racemosum	33	2.73	2.48	18	3.06	3.64	31	2.32	1.96	36	3.22	3.27	2.16	.100
Eriogonum stellatum	1	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Eriogonum umbellatum	0	*	*	1	3.00	*	0	*	*	1	1.00	*	*	*
Erysimum asperum	1	1.00	*	2	3.00	2.83	3	1.33	0.58	3	1.33	0.58	*	*
Euphorbia sp.	30	2.80	2.35	12	1.58	1.00	24	2.00	2.89	32	1.84	1.19	3.49	.023
Fragaria vesca	7	3.57	3.55	6	3.67	2.16	6	3.00	1.67	6	3.00	02.53	0.68	.578
Frasera speciosa	5	1.40	0.55	2	1.50	0.71	3	1.33	0.58	2	4.00	4.24	*	*
Fritillaria atropurpurea	0	*	*	0	*	*	1	1.00	*	0	*	*	*	*
Gayophytum lasiospermum	0	*	*	0	*	*	2	67.50	38.89	0	*	*	*	*
Gentiana affinis	0	*	*	0	*	*	0	*	*	1	99.00	*	*	*
Geranium sp.	12	2.75	2.45	15	1.73	1.16	15	1.87	1.06	14	2.00	1.84	1.48	.238
Gilia aggregata	5	2.20	2.68	5	3.60	1.52	5	1.80	1.10	1	1.00	*	*	*
Haplopappus armerioides	1	1.00	*	0	*	*	1	1.00	*	0	*	*	*	*
Haplopappus parryi	2	3.50	2.12	1	2.00	*	2	4.50	2.12	1	5.00	*	*	*
Hymenopappus filifolius	11	2.09	1.58	5	1.60	0.89	9	2.00	1.22	14	2.36	2.50	0.60	.626
Hymenoxys acaulis	7	15.57	16.55	3	40.33	50.82	7	11.86	14.83	9	9.78	9.47	1.86	.185
Hymenoxys richardsonii	13	1.38	0.65	8	1.38	0.74	7	2.00	1.83	8	1.50	0.53	0.30	.823
Leptodactylon pungens	7	4.71	3.40	1	3.00	*	6	3.50	3.02	6	5.17	4.26	0.83	.514
Lesquerella intermedia	5	1.40	0.89	0	*	*	3	1.33	0.58	8	1.38	0.52	1.29	.343
Leucocrinum montanum	13	3.62	3.52	14	3.86	2.71	20	2.70	2.25	38	3.53	4.52	0.63	.602
Linum kingii	15	1.40	0.74	6	2.33	1.03	6	1.50	0.55	9	1.56	0.73	3.60	.043
Lithospermum incisum	0	*	*	0	*	*	2	1.00	*	0	*	*	*	*
Lithospermum multiflorum	3	1.33	0.58	1	3.00	*	4	1.00	*	9	1.11	0.33	7.42	.041
Lithospermum perenne	8	2.12	0.99	6	1.50	0.84	10	1.60	1.26	7	1.86	1.57	0.46	.722
Lotus utahensis	6	2.50	2.26	2	5.00	2.83	5	3.80	3.42	4	3.50	1.91	0.48	.711
Lupinus argenteus	1	3.00	*	3	2.33	2.31	0	*	*	1	1.00	*	*	*
Lupinus sp.	0	*	*	0	*	*	0	*	*	1	1.00	*	*	*

Lychnis drummondii	1	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Lygodesmia grandiflora	3	1.67	0.58	0	*	*	1	2.00	*	2	5.00	1.41	24.83	.140
Machaeranthera canescens	1	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Machaeranthera grindelioides	1	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Mimulus rubellus	0	*	*	0	*	*	6	122.33	161.32	0	*	*	*	*
Oenothera howardii	12	1.67	0.98	8	2.38	1.51	9	3.00	1.87	12	3.58	2.71	3.05	.052
Orthocarpus luteus	0	*	*	0	*	*	1	3.00	*	0	*	*	*	*
Orthocarpus purpureo-albus	0	*	*	0	*	*	4	5.75	3.50	0	*	*	*	*
Pedicularis centranthera	16	2.38	1.67	5	2.60	2.61	18	3.06	2.44	39	2.36	1.83	0.67	.575
Pediocactus simpsonii	1	1.00	*	0	*	*	0	*	*	1	1.00	*	*	*
Penstemon caespitosus	18	4.33	4.67	10	1.90	1.37	15	3.40	2.32	12	5.17	3.30	0.23	.876
Penstemon comarrhenus	2	3.00	*	0	*	*	1	1.00	*	0	*	*	*	*
Penstemon laevis	21	3.29	3.70	12	2.25	1.36	12	2.17	2.59	20	5.30	8.18	2.55	.080
Penstemon leiophyllus	1	1.00	*	0	*	*	0	*	*	4	1.75	0.96	*	*
Phlox longifolia	1	1.00	*	0	*	*	4	3.00	2.71	2	2.50	0.71	*	*
Polygonum aviculare	10	4.10	4.70	1	9.00	*	2	1.50	0.71	0	*	*	38.75	113
Potentilla crinita	13	3.69	5.48	17	2.53	2.67	17	3.82	6.76	22	3.64	4.58	0.94	.429
Pseudocymopterus lemmonii	3	3.33	4.04	3	6.00	5.57	1	10.00	*	5	2.00	1.41	1.97	.261
Pyrola sp.	0	*	*	0	*	*	0	*	*	1	1.00	*	*	*
Senecio multilobatus	15	2.67	4.86	22	2.41	3.25	11	1.27	0.47	25	1.64	0.81	1.32	.291
Senecio spartioides	1	1.00	*	0	*	*	0	*	*	0	*	*	*	*
Solidago spathulata	7	8.7	9.62	3	2.33	2.31	2	4.50	4.95	0	*	*	0.39	.720
Stephanomeria spinosa	0	*	*	0	*	*	1	1.00	*	2	1.00	*	*	*
Streptanthus cordatus	0	*	*	8	11.12	8.51	1	10.00	*	0	*	*	*	*
Taraxacum officinale	2	4.0	4.24	1	1.00	*	2	1.00	*	1	1.00	*	*	*
Thalictrum fendleri	1	2.0	*	2	2.00	1.41	2	2.50	0.71	4	1.00	*	*	*
Townsendia incana	1	11.0	*	0	*	*	0	*	*	0	*	*	*	*
Townsendia montana	0	*	*	0	*	*	0	*	*	1	3.00	*	*	*
Tragopogon dubuis	0	*	*	0	*	*	1	1.00	*	0	*	*	*	*
Trifolium sp.	1	1.0	*	0	*	*	0	*	*	0	*	*	*	*
Viola adunca	0	*	*	1	2.00	*	1	3.00	*	1	1.00	*	*	*
Viola purpurea	1	1.0	*	1	1.00	*	1	2.00	*	0	*	*	*	*
Zigadenus elegans	2	1.0	*	2	2.50	0.71	1	1.00	*	4	1.50	0.58	6.17	.143
No vegetation	2	*	*	5	*	*	3	*	*	2	*	*	*	*

	1957			1968			1980			1991			
Shrubs	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	F	Prob.
Amelanchier utahensis	2	1.0	*	2	1.00	*	2	1.00	*	1	1.00	*	*	*
Arctostaphylos patula	53	2.0	1.01	37	3.32	2.54	42	1.83	1.01	46	1.87	1.47	10.58	.000
Artemisia nova	24	7.7	7.44	12	5.83	4.47	24	4.17	3.20	24	4.08	3.08	4.52	.007
Ceanothus martinii	19	1.5	0.77	16	2.12	1.67	14	1.79	0.97	18	1.83	1.10	1.22	.317
Cercocarpus montanus	1	1.0	*	0	*	*	1	1.00	*	0	*	*	*	*
Chrysothamnus depressus	61	7.8	7.27	38	5.55	4.58	57	4.95	4.06	58	5.47	4.46	9.20	.000
Chrysothamnus parryi	7	2.7	1.60	5	2.20	1.79	6	3.17	2.04	6	3.50	1.76	0.75	.542
Gutierrezia sarothrae	18	4.3	4.20	11	6.09	6.91	12	3.33	4.36	21	2.29	1.45	1.67	.197
Juniperus communis	8	2.7	3.06	8	2.12	1.81	9	1.67	0.71	11	2.00	1.18	0.81	.502
Mahonia repens	79	5.6	6.98	72	5.25	5.97	77	4.52	4.94	89	5.16	4.27	3.03	.030
Paxistima myrsinites	79	7.4	8.44	64	4.42	4.91	62	3.42	3.57	59	3.03	3.32	24.66	.000
Petradoria pumila	4	3.5	2.65	6	4.83	5.85	6	4.33	6.31	6	3.17	3.92	0.78	.530
Purshia tridentata	46	1.8	1.43	29	1.59	0.82	35	1.83	1.27	38	2.13	1.76	1.56	.204
Quercus gambelii	3	3.6	3.79	2	7.00	8.49	3	2.00	1.73	3	3.00	2.65	1.21	.396
Ribes cereum	5	1.4	0.89	4	1.25	0.50	3	1.33	0.58	4	1.75	0.96	1.06	.424
Rosa woodsii	17	1.8	1.55	11	2.27	1.49	13	1.69	1.18	13	2.46	1.85	0.73	.541
Sambuccus caerulea	1	1.0	*	1	1.00	*	1	1.00	*	1	1.00	*	*	*
Symphoricarpos oreophilus	55	3.0	2.42	51	2.63	2.04	52	2.13	1.67	55	2.82	1.94	4.83	.003
Tetradymia canescens	15	3.2	4.73	8	3.87	4.42	10	1.20	0.42	12	1.67	0.98	1.99	.144

	1957			1968			1980			1991			
Grasses & Sedges	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	F	Prob.
Bouteloua gracilis	4	5.0	3.27	1	6.00	*	1	8.00	*	1	9.00	*	*	*
Bromus carinatus	16	3.8	4.67	16	3.87	3.24	20	4.60	6.17	28	8.29	8.02	3.88	.017
Carex rossii	26	6.0	7.15	14	3.14	2.57	39	3.77	3.02	118	3.23	2.99	1.61	.196
Elymus elymoides	59	3.5	4.75	38	4.89	6.14	38	3.50	3.14	44	4.55	6.15	0.89	.448
Elymus scribneri	0	*	*	0	*	*	0	*	*	1	1.00	*	*	*
Elymus smithii	35	11.0	11.94	10	7.70	8.55	17	9.18	8.19	31	12.55	18.15	1.48	.232
Elymus spicatus	5	12.0	11.02	1	3.00	*	6	8.67	8.21	0	*	*	4.59	.179
Festuca ovina	0	*	*	0	*	*	0	*	*	1	6.00	*	*	*
Juncus arcticus	2	28.0	28.28	0	*	*	1	5.00	*	3	10.33	6.66	0.87	.603
Koeleria macrantha	21	8.3	5.51	10	12.10	10.99	21	5.90	4.96	31	9.71	12.27	1.92	.143
Muhlenbergia montana	5	6.2	5.07	3	4.33	3.21	3	10.67	6.81	1	27.00	*	10.01	.025
Muhlenbergia richardsoni	2	2.5	0.71	1	1.00	*	1	1.00	*	7	6.86	4.95	*	*
Poa fendleriana	36	8.0	10.44	36	7.25	6.45	51	6.51	7.18	80	5.63	7.40	0.37	.774
Stipa comata	24	10.0	8.79	11	10.27	8.57	24	8.92	6.31	35	9.06	7.09	0.91	.441
Stipa hymenoides	72	3.7	3.30	58	3.10	2.77	71	2.48	2.17	12	4.08	2.27	3.56	.017
Stipa lettermanii	37	11.6	19.49	29	5.97	6.53	32	4.97	4.78	20	4.80	6.15	3.96	.012

	1957			1968			1980			1991			
Trees	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	N	MEAN	STDEV	F	Prob.
Abies concolor	4	1.2	0.50	3	1.33	0.58	3	1.33	0.58	6	1.50	0.84	0.15	.925
Juniperus scopulorum	0	*	*	0	*	*	0	*	*	0	*	*	*	*
Picea pungens	0	*	*	0	*	*	0	*	*	0	*	*	*	*
Pinus edulis	0	*	*	0	*	*	0	*	*	0	*	*	*	*
Pinus flexilus	0	*	*	0	*	*	0	*	*	0	*	*	*	*
Pinus ponderosa	0	*	*	1	1.00	*	2	1.00	*	4	1.00	*	*	*
Populus tremuloides	2	1.0	*	1	1.00	*	2	1.00	*	2	1.50	0.71	*	*
Pseudotsuga menziessii	1	1.0	*	0	*	*	1	1.00	*	1	1.00	*	*	*
Tree reproductions	51	4.6	5.02	70	5.69	8.28	53	3.89	4.69	74	3.85	4.15	?	?

The average number of grass species per plot declined between 1957 and 1980 (Figure 16), but increased between 1980 and 1991 (Figure 17), resulting in an overall average gain in grass species per plot between 1957 and 1991 (Figure 18). Shrubs showed almost the opposite trends. Shrub species diversity declined between 1957 and 1980 (Figure 19), and held constant between 1980 and 1991 (Figure 20), resulting in an average loss of shrubs per plot for the period between 1957 and 1991 (Figure 21). The pattern for forbs was more complex. There was a non-significant trend for reduced forb diversity between 1957 and 1980 (Figure 22), and no change in forb species diversity between 1980 and 1991 (Figure 23). However, because of the additive effect of the non-significant changes, there was an almost significant trend (P=0.06) for increased forb species diversity during the 1957-1991 study period (Figure 24). In general then, as shrub species diversity declined, grass and forb species diversity increased. These patterns do not appear to be correlated with elevation.

Figure 16. The relationship between the number of grass species per plot in 1957 and 1980. Numbers inside the circles represent the number of plots on which there occurred the same number of species in 1957 and 1980. For example the number 18 at (2,2) indicates that two grass species were present on 18 plots in 1957 and two grass species were present on the same 18 plots in 1980. It should be noted that the species present in these 18 plots in 1957 may not be the same as those present on the plots in 1980. The regression was forced through the origin.

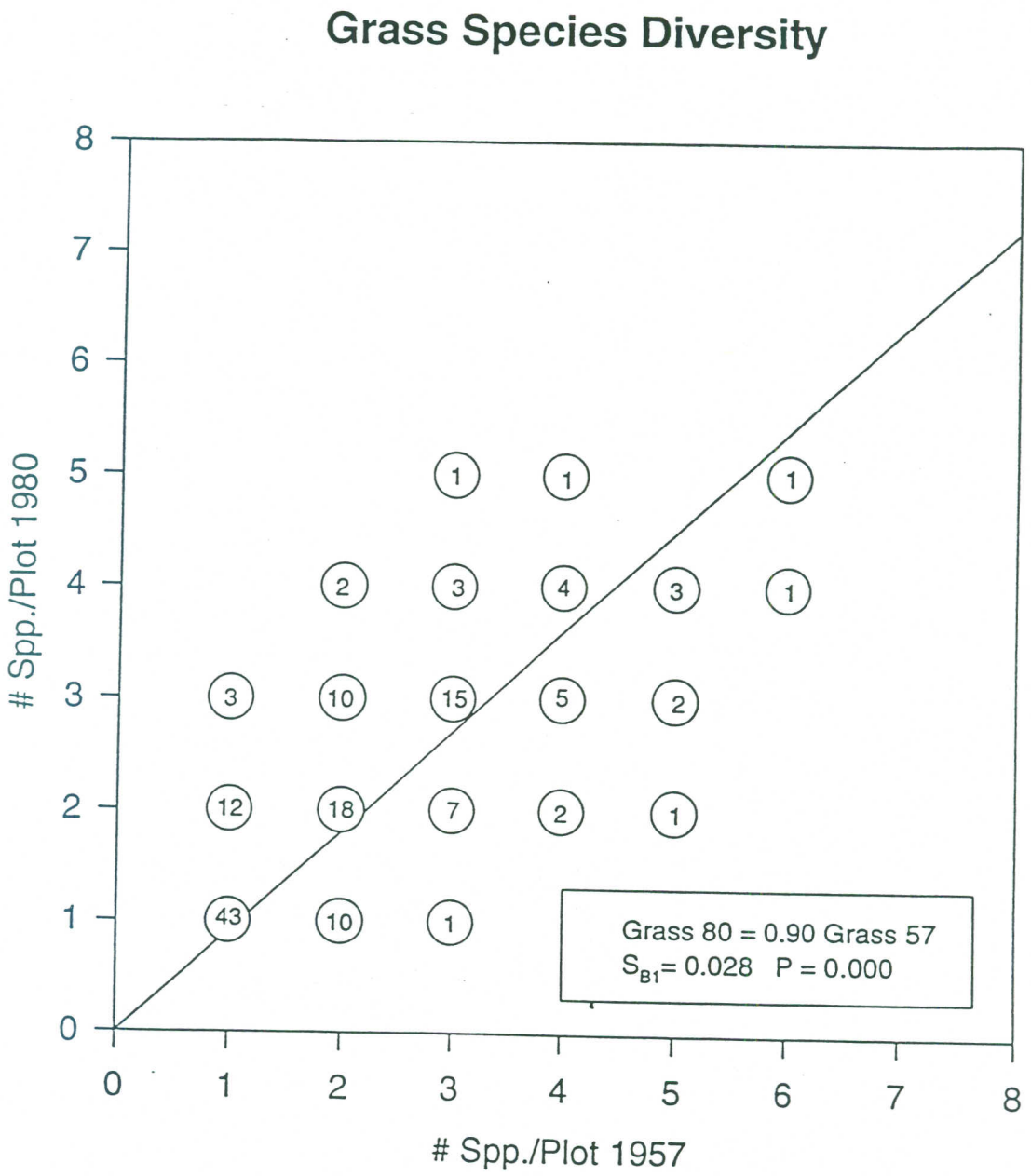


Figure 17. The relationship between the number of grass species per plot in 1980 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

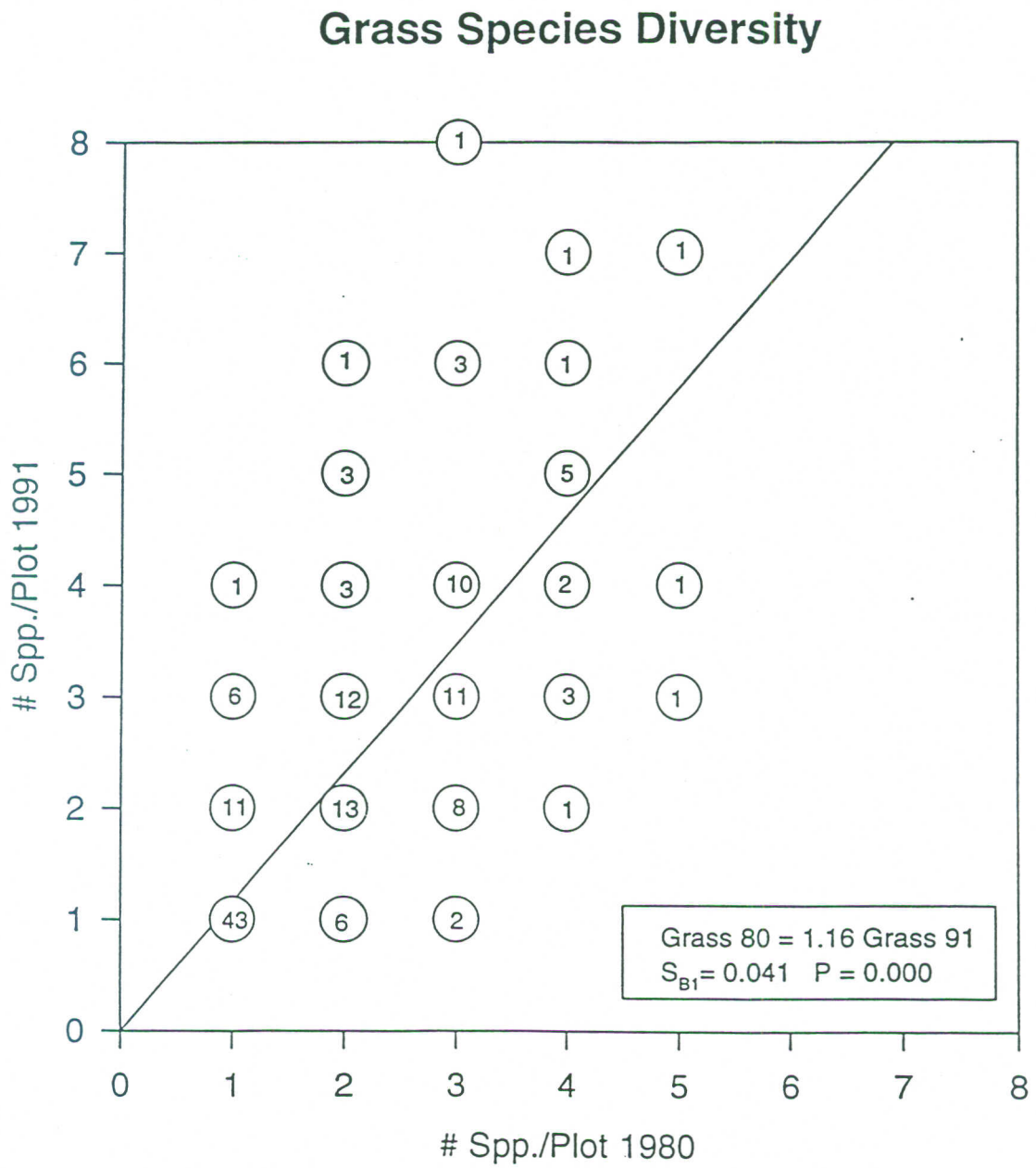


Figure 18. The relationship between the number of grass species per plot in 1957 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

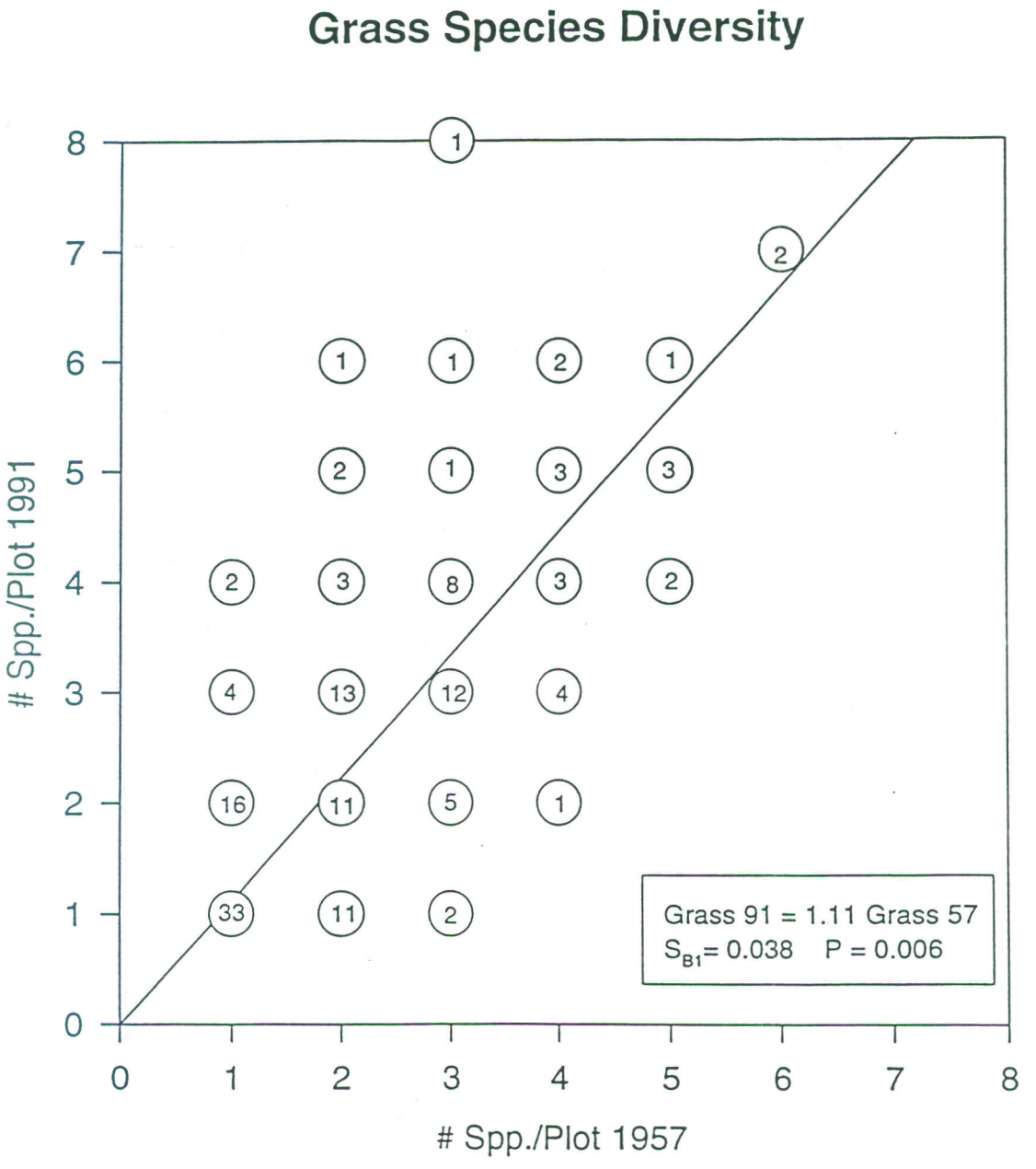


Figure 19. The relationship between the number of shrub species per plot in 1957 and 1980. See Figure 16 for a more complete description of how to interpret the plot.

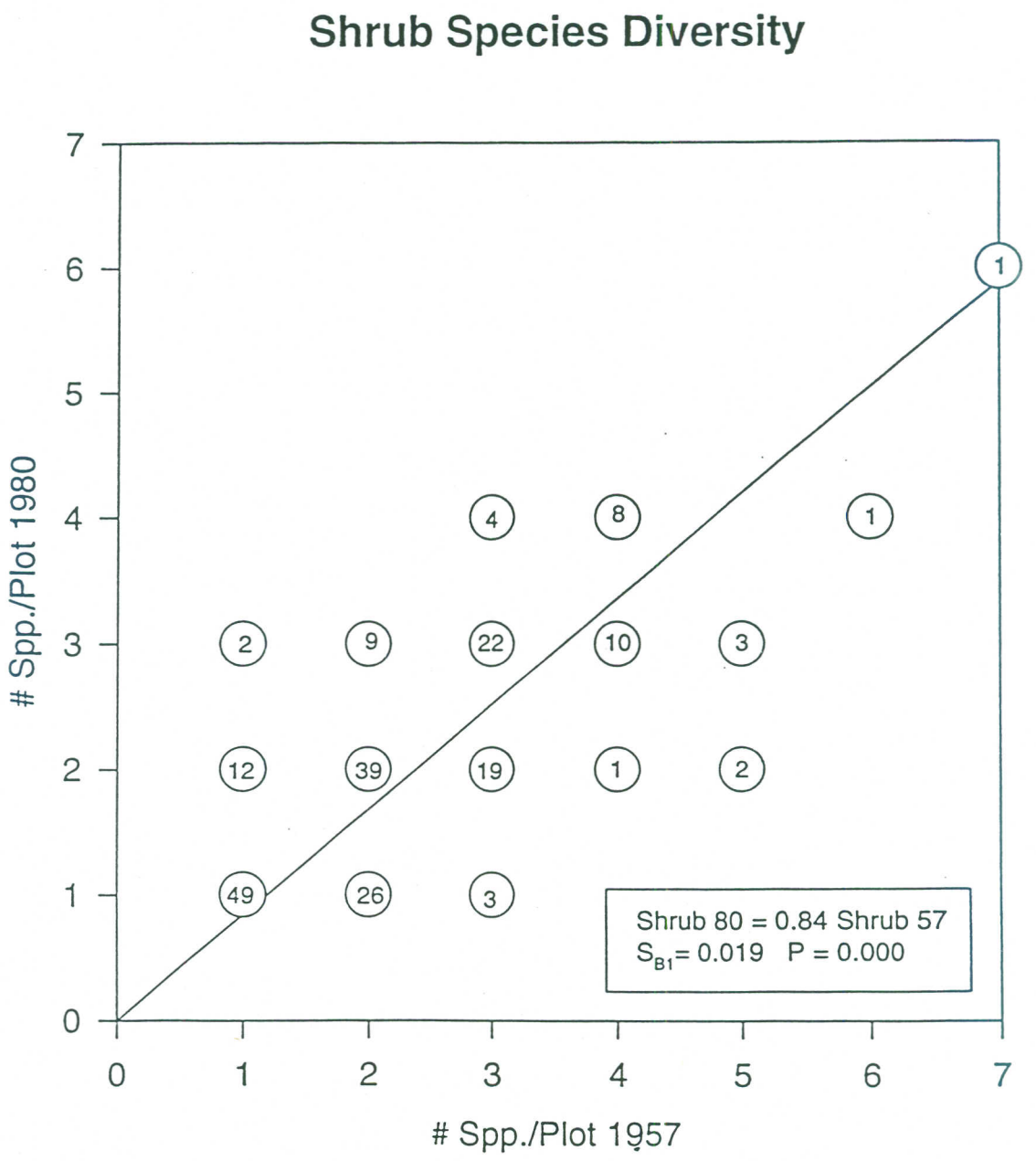


Figure 20. The relationship between the number of shrub species per plot in 1980 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

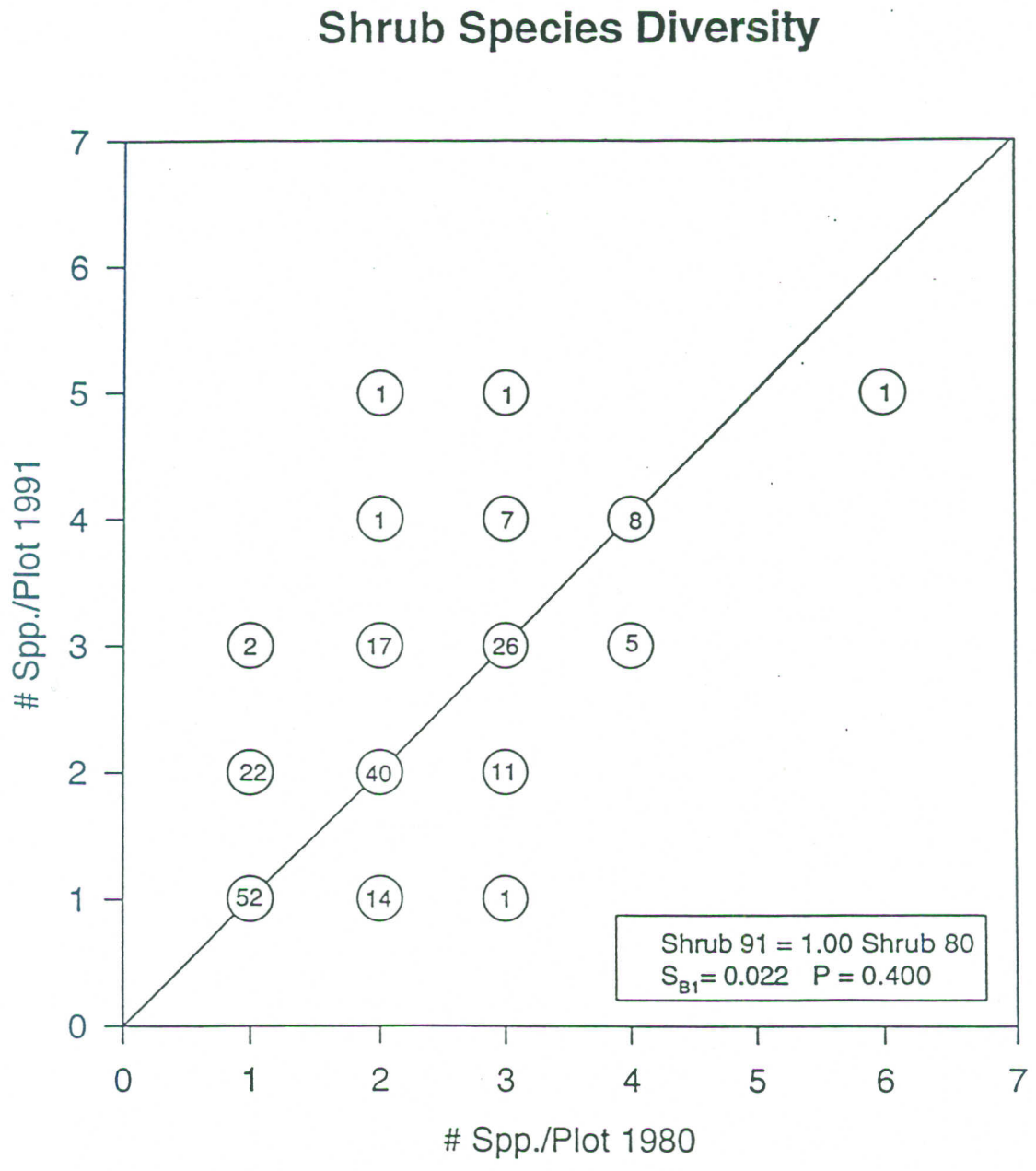


Figure 21. The relationship between the number of shrub species per plot in 1957 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

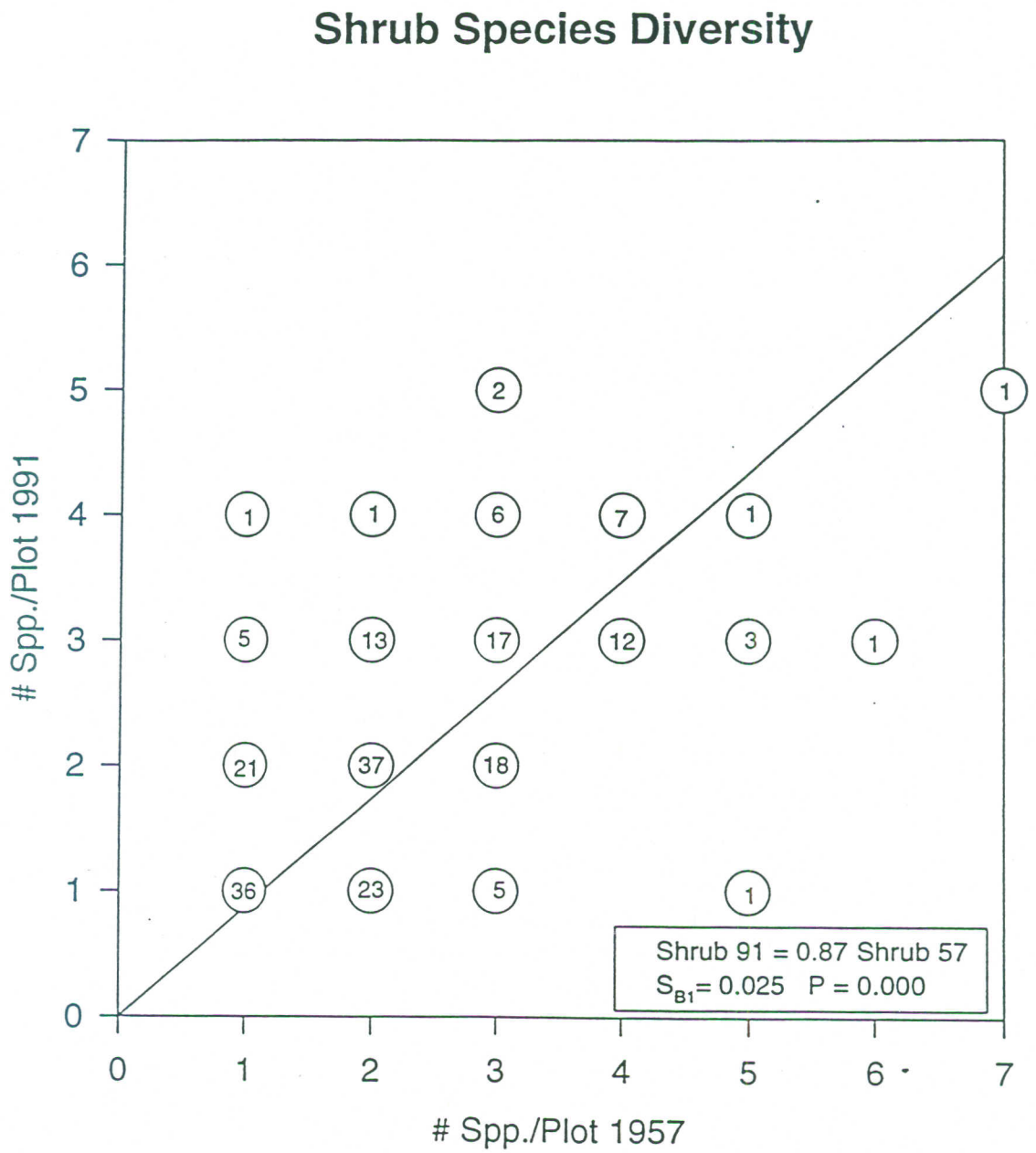


Figure 22. The relationship between the number of forb species per plot in 1957 and 1980. See Figure 16 for a more complete description of how to interpret the plot.

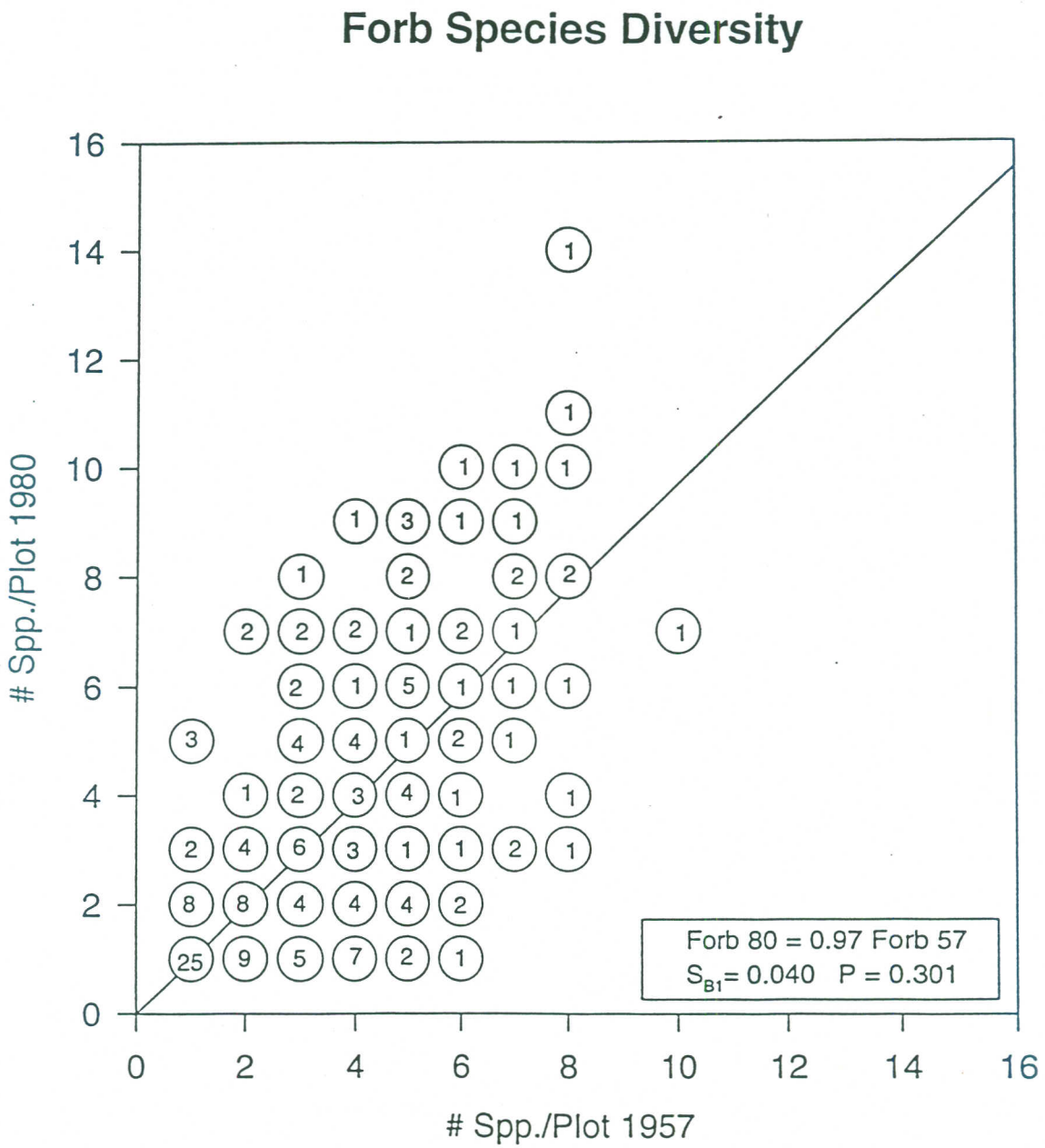


Figure 23. The relationship between the number of forb species per plot in 1980 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

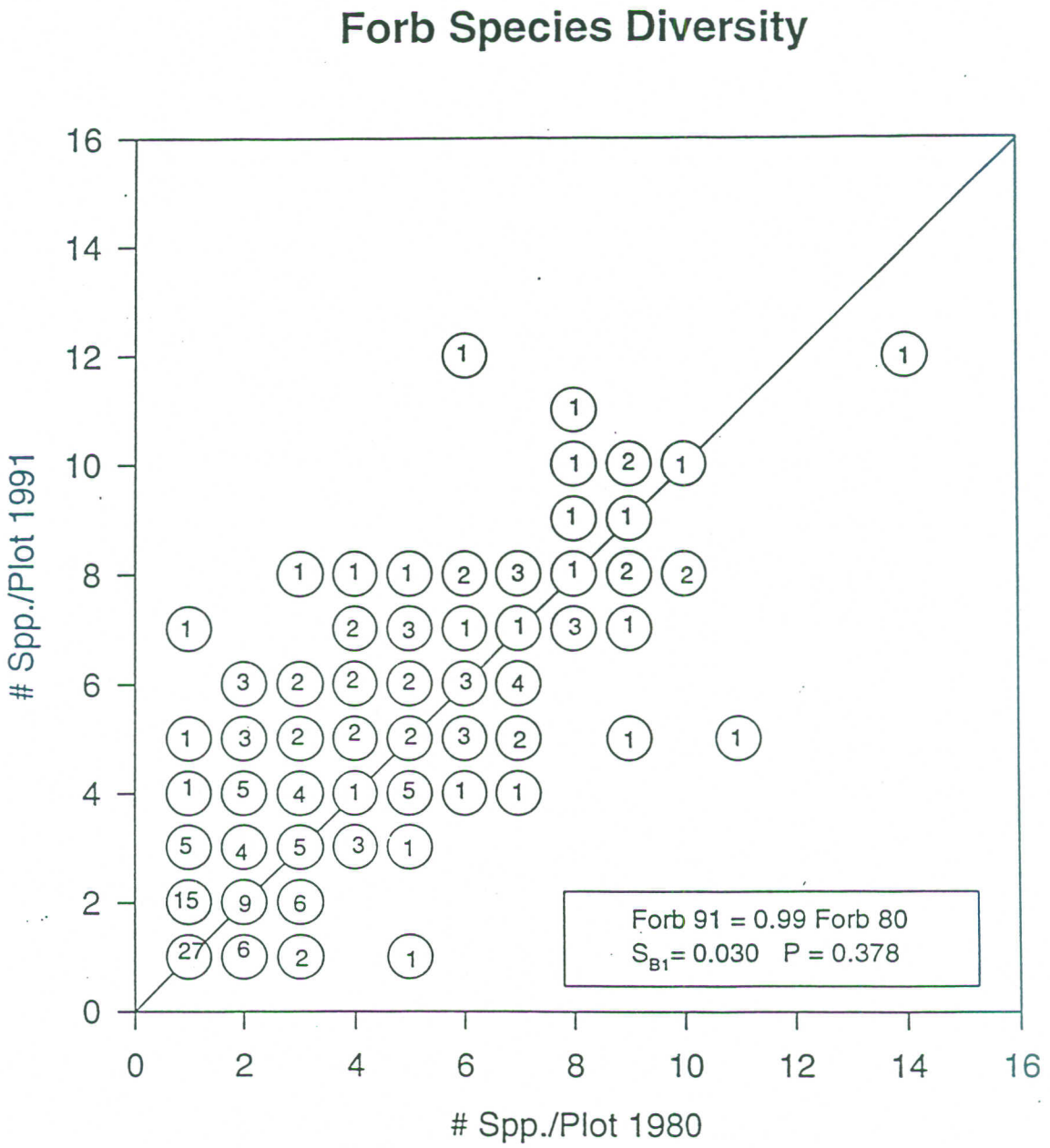


Figure 24. The relationship between the number of forb species per plot in 1957 and 1991. See Figure 16 for a more complete description of how to interpret the plot.

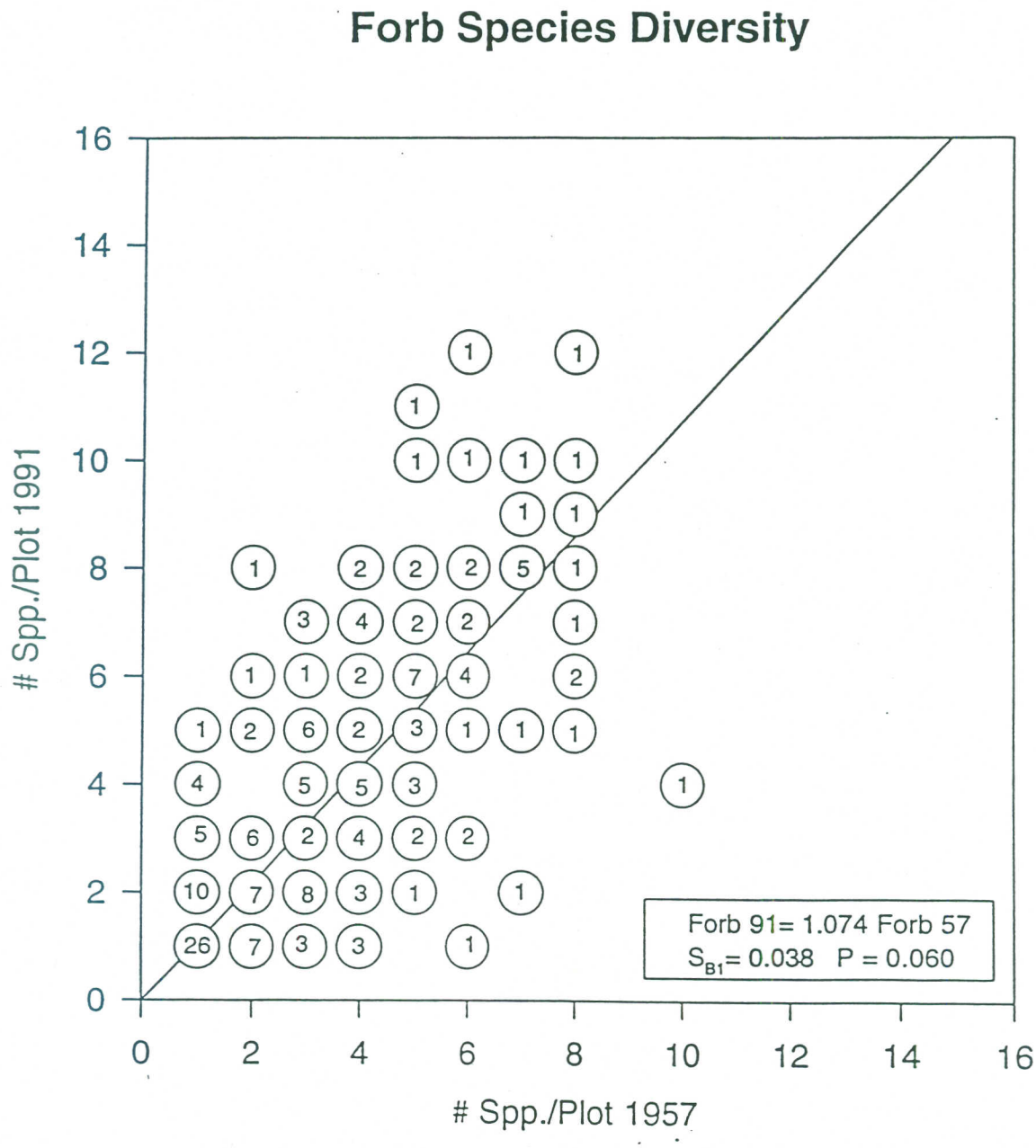


Table 11 shows that when understory species change is examined with paired t-tests there was a non-significant decline of about 1% in grass species during 1957 to 1980, followed by an increase of 22.5% in grass species diversity from 1980-1991, resulting in an overall increase of 15.0% for the 1957-1991 interval. Shrubs species diversity declined 10.8% between 1957 and 1980, increased 5.6% between 1980 and 1991, for an overall nonsignificant decline of 2.3% for the 1957-1991 interval. Forbs species diversity increased an nonsignificant 2.7% between 1957 and 1991, increased 12.1% between 1980 and 1991, for an overall gain of 13.4% between 1957 and 1991.

It is important to emphasize that these analyses were done using all understory species for all plots. Different conclusions may be reached if only forested plots are used or if selected subsets of species are used. For example, if only the most common understory species are used (see Table 12), dramatically different patterns of changes in species number were observed. The loss of species diversity observed for the 1957-1980 period using only the most common species appears to be very similar to the losses of species diversity reported by Buchanan and Harper in 1980. It may be that some of the observed differences in species presence over decade long sampling periods may be attributable to the time of year in which the plots were sampled, or the moisture conditions preceding the sampling period of a given year. Even though we have plot maps showing where specific individuals occurred and we do not rely on having flowers for most species identifications, little is known of the longevity of vegetative parts for most of these species. In addition, most taxonomists differ at least slightly in how broadly or narrowly they construe any given species. Even though we have taken steps to minimize the effect of changing personnel, some of the variation in later years of this study may be due to changing definitions of species concepts.

Table 11. The average number of understory species per $1m^2$ plot and the change in the number of understory species per plot for three selected time intervals. T values and their associated probabilities that there was no change in species number were calculated with the paired t-test.

	Sampling Date or Interval	N	Mean	S.E.	T	Probability
Grasses and Sedges	1957	172	2.1	0.09		
	1980	164	2.0	0.08		
	1991	173	2.4	0.12		
	Change in Species Number					
	1957-1980	145	-0.02	0.07	-0.29	0.770
	1980-1991	150	0.45	0.09	4.73	0.000
	1957-1991	147	0.40	0.09	4.39	0.000
Shrubs	1957	232	2.1	0.07		
	1980	220	2.0	0.06		
	1991	223	2.1	0.07		
	Change in Species Number					
	1957-1980	211	-0.23	0.05	-4.33	0.000
	1980-1991	209	0.12	0.05	2.36	0.019
	1957-1991	211	-0.10	0.07	-1.43	0.150
Forbs	1957	190	3.3	0.16		
	1980	177	3.5	0.21		
	1991	194	3.8	0.19		
	Change in Species Number					
	1957-1980	167	0.09	0.17	0.53	0.600
	1980-1991	169	0.43	0.13	3.21	0.002
	1957-1991	177	0.53	0.15	3.58	0.000

Table 12. Species acronyms and names for the seven most common tree species and the 61 understory species reported in Figures 26-27.

FORBS

ACMI	*Achillea millefolium* L.
AGGL	*Agoseris glauca* (Pursh) Raf.
ARDE	*Arabis demissa* Greene
ARFE	*Arenaria fendleri* Gray
ARLU	*Artemisia ludoviciana* Nutt.
ASCH	*Aster chilensis* Nees
ASCO	*Astragalus convallarius* (Nutt.) T.& G.
ASAM	*Astragalus amphioxys* Gray
ASMI	*Astragalus miser* Dougl. ex Hook.
BASA	*Balsarmorhiza sagittata* (Pursh) Nutt.
CALA	*Calylophus lavandulifolius* (T.& G.) Raven
CALI	*Castilleja linariifolia* Benth
CICA	*Cirsium calcareum* (Jones) Woot.& Standl.
CLCO	*Clematis columbiana* (Nutt.) T.& G.
COKI	*Cordylanthus kingii* Wats.
CRIN	*Crepis intermedia* (Gray)
CRSP	*Crypantha sp.* Lehm.
CYPU	*Cymopterus purpureus* Wats.
DRSU	*Draba subalpina* Goodman & Hitchc.
ERFL	*Erigeron flagellaris* Gray
ERAL	*Eriogonum alatum* Torr. in Sitgr.
ERRA	*Eriogonum racemosum* Nutt.
EUSP	*Euphorbia* sp. L.
GESP	*Geranium* sp. L.
HYFI	*Hymenopappus filifolius* Hook.
HYAC	*Hymenoxys acaulis* (Pursh) Parker
HYRI	*Hymenoxys richardsonii* (Hook.) Cockerell
LEPU	*Leptodactylon pungens* (Torr.) Nutt.
LEIN	*Lesquerella intermedia* (Wats.) Heller
LEMO	*Leucocrinum montanum* Nutt. ex Gray
LIKI	*Linum kingii* Wats.
LIPE	*Lithospermum perenne* L.
LIMU	*Lithospermum multiflorum* Torr.
OEHO	*Oenothera howardii* (A.Nels.) W.L.Wagner
PECE	*Pedicularis centranthera* Gray
PELA	*Penstemon laevis* Pennell
PECA	*Penstemom caespitosus* Nutt. ex Gray
POAV	*Polygonum aviculare* L.
POCR	*Potentilla crinita* Gray
SEMU	*Senecio multilobatus* T.& G.
SOSP	*Solidago spathulata* NJ

GRASSES & SEDGES

BRCA *Bromus carinatus* H.& A.
CARO *Carex rossii* F. Boott
ELEL *Elymus elymoides* (Raf.) Swezey
ELSM *Elymus smithii* (Rydb.) Gould
KOMA *Koeleria macrantha* (Ledeb.) Schultes
MURI *Muhlenbergia richardsonis* (Trin.) Rydb.
POFE *Poa fendleriana* (Steudel) Vasey
STCO *Stipa comata* Trin. & Rupr.
STHY *Stipa hymenoides* R.& S.
STLE *Stipa lettermanii* Vasey

SHRUBS

ARNO *Artemisia nova* A.Nels.
ARPA *Arctostaphylos patula* Greene
CEMA *Ceanothus martinii* Jones
CHDE *Chrysothamnus depressus* Nutt.
GUSA *Gutierrezia sarothrae* (Pursh) Raf.
JUCO *Juniperus communis* L.
MARE *Mahonia repens* (Lindl.) G. Don
PAMY *Pachystima myrsinites* (Pursh) Raf.
PUTR *Purshia tridentata* (Pursh) DC
ROWO *Rosa woodsii* Lindl.
SYOR *Symphoricarpos oreophilus* Gray
TECA *Tetradymia canescens* DC

TREES

ABCO *Abies concolor* (Gord. & Glend.) Lindl.
JUSC *Juniperus scopulorum* Sarg.
PIPU *Picea pungens* Engelm.
PIFL *Pinus flexilus* James
PIPO *Pinus ponderosa* Lawson
POTR *Populus temuloides* Michx.
PSME *Pseudotsuga menziezii* (Mirbel) Franco

Understory Ordination With Respect To Soil Physical Measurements

Figure 25 shows the resulting vectors of the CCA ordination of 17 abiotic variables. It can be seen that elevation, calcium, pH, and % organic matter are the most useful variables in describing the joint distributions of species and plots. The ordination of 61 understory species are shown in Figure 26 and the biplot of species and abiotic variables is shown in Figure 27. The biplot contains a wealth of information. Not only do we begin to see possible chemical and physical correlates of species distribution patterns (e.g. notice that the shrubs PAMY, MARE, SYOR, and ROWO all generally occur on plots with higher elevation, higher %organic matter, higher nitrogen, shallower soil depth, and lower pH than the shrubs ACMI, GUSA, and ARNO), but we also see indications of which species are potential or existing competitors (e.g. the shrubs PAMY and JUCO co-occur frequently, the shrubs GUSA and ACMI also co-occur, and not on the plots of PAMY and JUCO).

Even a casual examination of Figures 26 and 27 will indicate a plethora of species interactions that beg to be studied in more depth. Obra (1995) has begun such an analysis of the data obtained for this study and identified 20 pairs of understory competitors. Because we know the locations of all plants occurring on 266 plots for one summer during each of four consecutive decades, we are able to examine which pairs of species persist and which lose (or gain) one or more species. It has been remarkable to see how long-lived and unchanging in size or number, selected individuals of certain grass and forbs species can be. Futhermore, Obra presents evidence that the majority of significant changes in understory species diversity occurred in habitats dominated by *Pinus ponderosa/Purshia tridentata* or *Artemisia nova/Stipa comata*.

It should be remembered that up to this point in time all work has been at the sampling unit resolution of a 1 m^2 plot, with no distinction made for the placement of individuals within the plot. There is a wealth of information waiting investigators who look at the plant interations within each of the study plots. We encourage Park personnel to begin studies of the understory using the long term data recorded as a part of this study.

Figure 25. CCA ordination of 17 physical and chemical variables as given in Table 2. Arrow lengths and directions indicate the magnitude of importance amongst the 17 variables and their relationships to the species under consideration as well as the 247 study plots (not shown here).

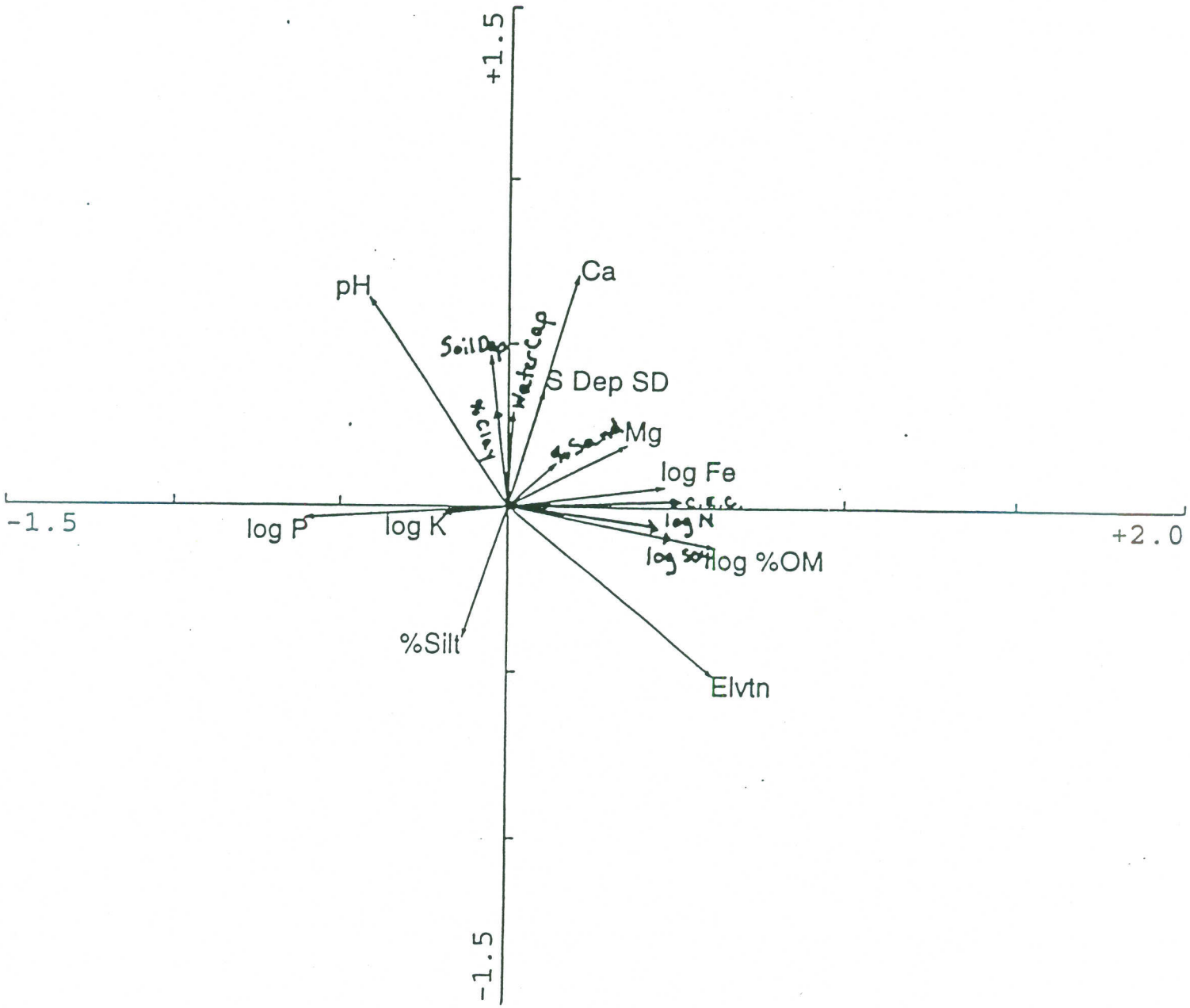


Figure 26. CCA ordination of 61 common understory species listed in Table 12. Life-form groups are indicated.

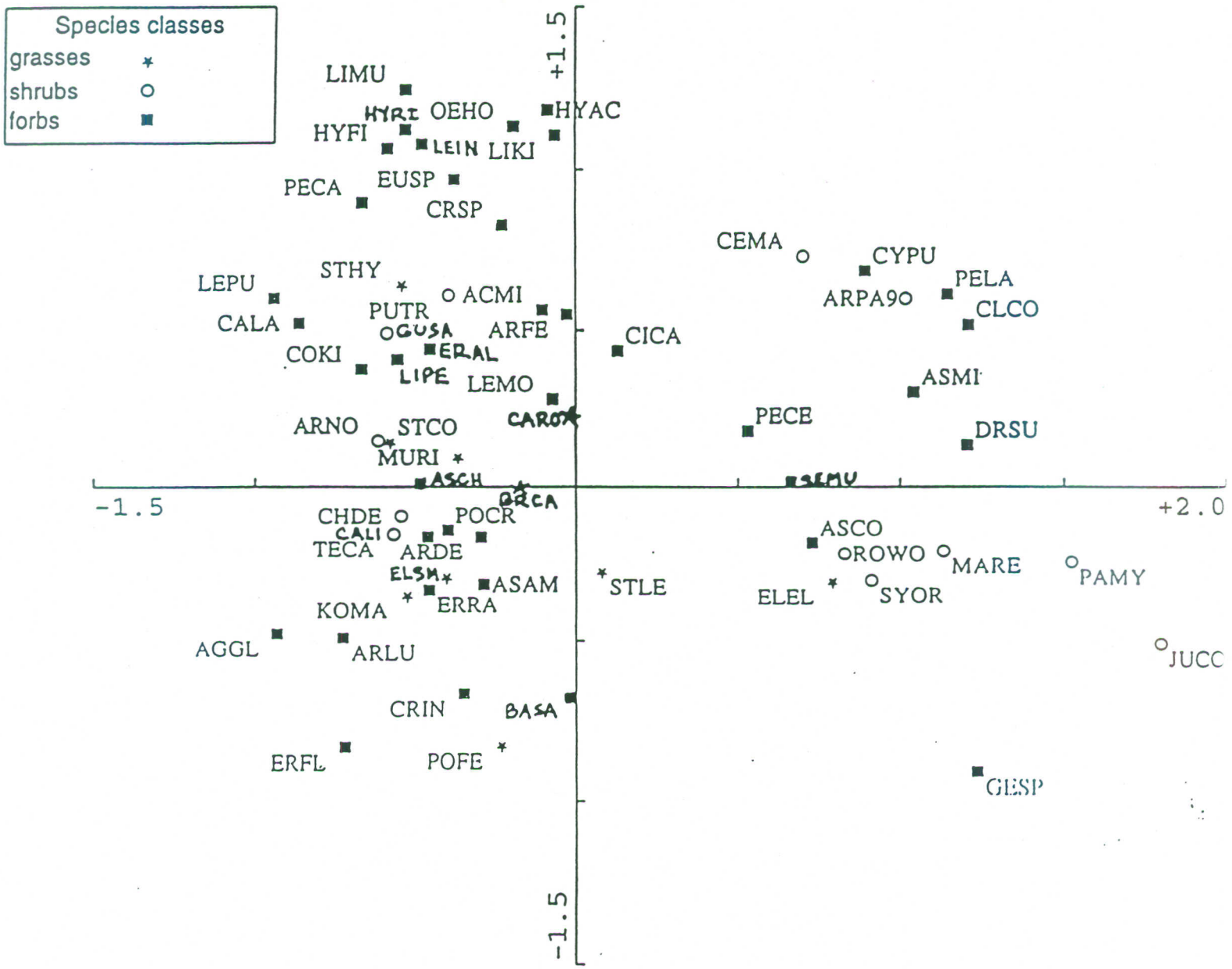
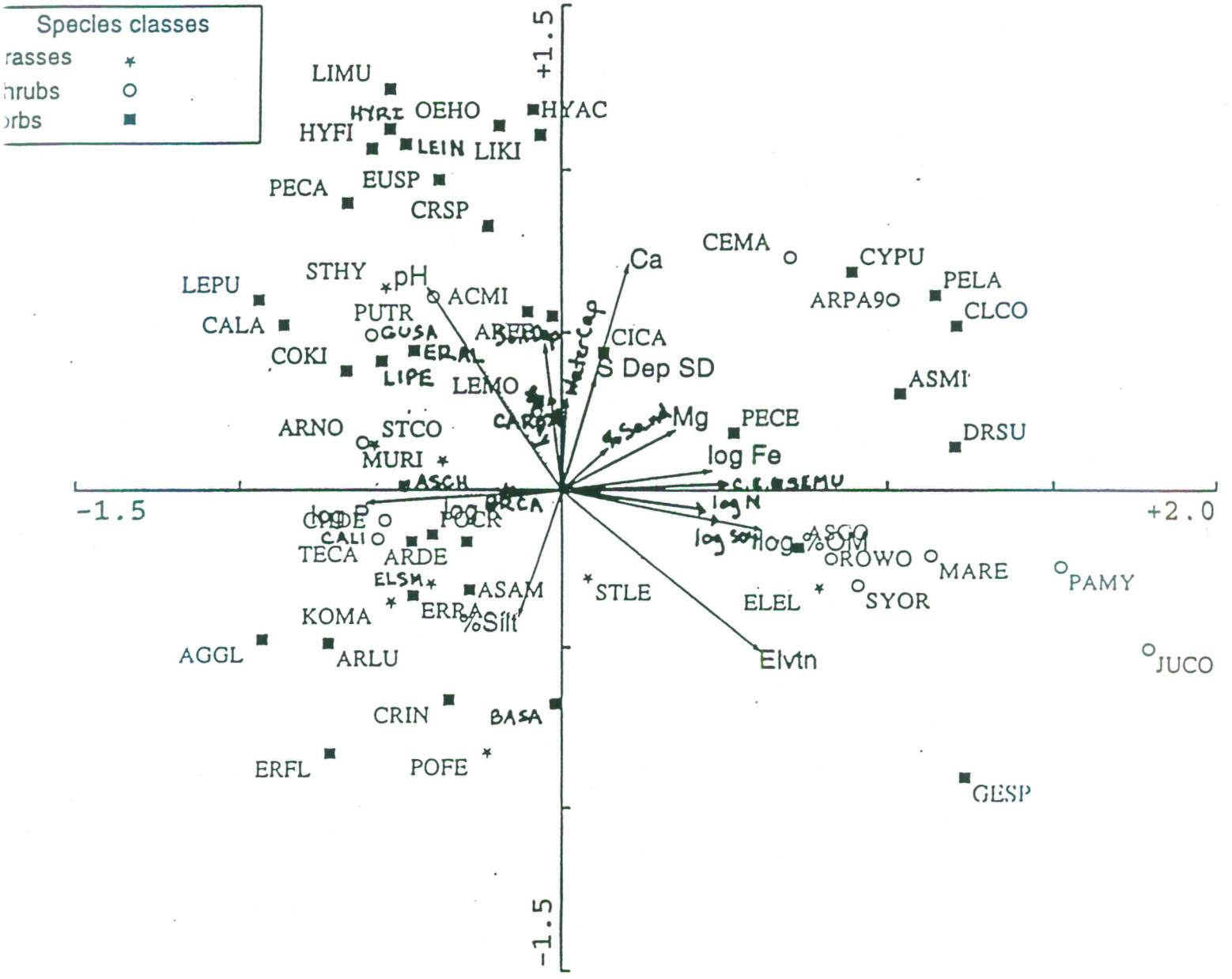


Figure 27. CCA ordination of 17 physical and chemical variables and 61 common understory species. This figure is a composite of Figures 25 and 26.



CONCLUSIONS

Because of the dominance of White Fir in the higher elevations of the Park and the elevation-sensitive nature of this species we have suggested that in future years the ecological studies of the park use a location near plot 170, near Whiteman Spring and East Creek for a natural division of major ecological units. The conclusions given in this report follow this recommendation, utilizing what we call the upper or "top" section, and lower or "bottom" section of the park.

For the upper section of the park there is no question that the major conclusion from the vegetation analysis is that White Fir seedlings are increasing in density at the expense of the three other dominant tree species: Ponderosa Pine, Limber Pine, and Douglas Fir. Changes in mature tree relative importance values take longer to emerge, with non-significant, but noteworthy trends in declining relative importance of Limber Pine and Ponderosa Pine, but White Fir already significantly increasing at the expense of Douglas Fir and Quaking Aspen. Tree basal area per hectare has increased for all seven tree species except Quaking Aspen, even though for some species we did not find a statistically significant increase. The tree basal area per species increased for White Fir but declined for Douglas Fir.

With the sweeping increase in White Fir dominance in the upper part of the park it is tempting to over generalize and attribute the changes to unstoppable, irreversable plant succession. Nevertheless, we are encouraged by unsusual plots such as those where PSME increased at the expense of White Fir. Unusual plots such as plots 3, 13, 30, 34, 57, 76, 89, and 96 should be studied to understand better how diversity has been maintained without human intervention.

In the lower section of the park all three of the major tree species, Ponderosa Pine, Rocky Mountain Juniper, and Douglas Fir have non significant trends towards increasing seedling density, without any significant change in relative importance values. Ponderosa Pine mature tree densities have doubled and Rocky Mountain Juniper tree densities show a non-significant tripling in density, but only part of that increase can be attributed to the non-significant halving of Douglas Fir tree densities. Measures of basal area per hectare show essentially the same pattern for these three species. Ponderosa Pine basal area per species declined significantly during the same time that Rocky Mountain Juniper basal area per species increased. It is important to note that Rocky Mountain Juniper was the only species in the bottom part of the park showing a significant increase in mature tree importance value over the last 34 years, while the other three common tree species, Limber Pine, Ponderosa Pine, and Douglas Fir showed non-signficant declines in importance value. We encourage park personnel to incorporate this finding in future plans for controlled burns.

The pattern of increasing homogenization of the overstory trees was only partially mirrored in the understory changes in the park. Six of the 19 shrub species showed a significant decline in density, a per plot diversity loss of –2.3%. None of the 19 shrub species increased in density. Seven species of understory forbs showed either a

significant increase in density or a non-significant trend towards increased density, whereas three species of understory forbs appeared to be declining in density. The overall change in per plot forb species diversity was +13.4%. Three of the 16 grass and sedge increased in density whereas only one grass or sedge declined in density, resulting in an average per plot increase of +15% in grass and sedge species diversity. It should be noted that these analyses were done using all understory species for all plots. Different conclusions may be reached if other subsets of species are used. Park personnel should also study the locations of the less common understory species identified in this study to insure that species diversity is maintained in the future. With the completion of this study it is now possible to begin more efficiently the study of understory plant competitive and symbiotic interactions as well as tree-understory interactions.

In future studies of understory and tree species distributions the preliminary findings of the importance of soil chemisty should not be forgotten. Soil pH, calcium, phosphorus, potassium, organic matter and water seem to be the most significant soil paramenters affecting vascular plant distributions. The baseline soils data collected here will also permit long term monitoring of pollutants, should they occurr.

Even an informal study like ours of the incidence of tree pathogens showed that 18% of the plots had at least some incidence of what appeared to be a mistletoe and 99% of the plots had one or more trees with at least some indication of a limb rust. Areas of pathogen density and intensity varied in our informal study but we saw no clear patterns. If not done already Park personnel should incorporate knowledge of areas of high pathogen density into the future plans for controlled burns.

The need to quickly locate plots for future studies, such as a study of tree diseases and species diversity pockets, gives importance to the suggestion that all plots be visited with appropriate GPS technology to create reference points for easier plot location.

We are pleased to hear that the Bryce Canyon National Park personnel are taking action to further document trends in forest dynamics and especially that action has been taken to reintroduce controlled fires in the park. We believe that the above results fully support their work. These controlled fires are essential in reducing pathogen intensity and in preserving the diversity of understory and overstory vegetation that are an integral part of the heritage of Bryce Canyon National Park. We suggest that plots from this study that have been burned since 1991 be revisited soon to monitor changes in the vegetation.

ACKNOWLEDGEMENTS

In a study of this magnitude there have been valuable and sometimes key contributions from many people. Even though we are sure we have missed some we would like to express thanks to the following: Kimball T. Harper for many ideas, analyses, and helpful suggestions; John Spence for valuable field work and identifications; St. Lawrence University students Mohan Babapulle, Michael Clark, Nathan Emmons, and Kevin Shenefiel for months of summer labor preparing data files, figures, and statistical analyses; Columbia University student Joan Obra for additional months of summer labor preparing data files, figures, and statistical analyses; Rachel and Kirsten McKnight for work as pack horses; Joan McKnight for careful work preparing archives of photographs, negatives, and data; BCNP Resource Managers Terese Johnson, Susan Colclazer, and especially Richard Bryant for years of helpful guidance as well as patience; and finally the BCNHA, the PEW Foundation, and St. Lawrence University for financial support.

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Appendix A. Soil and physical and chemical measurements for 266 plots.

PLOT	pH	%sand	%clay	%silt	CEC	%om	ppm P	ppm Fe
1	7.10	46.02	26.49	27.50	47.47	4.88	3.08	5.20
2	6.70	48.13	23.86	28.02	54.60	12.76	4.48	6.80
3	7.00	44.02	28.42	27.57	32.89	4.40	4.31	2.40
4	7.30	41.55	30.00	28.45	33.00	5.15	5.80	5.00
5	7.20	42.02	32.49	25.50	27.91	3.27	3.64	2.20
6	6.70	41.84	30.14	28.02	28.60	6.28	5.86	6.80
7	6.80	43.94	26.49	29.57	26.59	4.59	4.03	4.60
8	6.90	39.55	26.14	34.30	41.80	9.92	4.31	7.80
9	7.00	35.94	28.49	35.57	38.34	3.87	3.58	2.20
10	7.20	47.26	24.00	28.74	21.20	2.23	4.42	5.00
11	7.10	43.94	26.56	29.50	17.99	1.47	4.42	2.60
13	6.90	45.87	28.49	25.64	53.20	11.99	15.65	9.40
14	7.20	25.12	34.14	40.74	20.40	4.54	7.81	8.60
16	6.60	43.70	21.93	34.38	21.80	5.00	11.17	4.00
17	5.10	35.81	26.56	37.57	33.12	6.35	13.13	3.00
18	6.80	42.98	24.36	32.66	42.40	11.38	28.89	6.40
19	6.50	43.80	24.56	31.64	51.38	4.94	9.09	3.40
20	7.40	39.48	24.07	36.45	33.20	4.98	4.82	3.80
21	5.50	47.87	24.56	27.57	68.20	29.47	14.48	11.20
22	7.50	40.83	26.22	32.95	35.00	6.12	6.15	3.60
23	7.00	35.80	28.56	35.64	74.46	21.58	1.99	11.00
24	6.70	35.12	22.14	42.74	43.20	11.46	4.99	6.80
25	6.40	37.80	30.56	31.64	59.46	6.42	5.40	3.20
26	6.50	38.98	24.07	36.95	36.00	6.58	10.22	4.80
27	5.80	47.73	22.49	29.78	71.33	20.91	17.57	8.20
28	6.30	41.05	25.44	33.51	23.40	5.06	5.63	3.80
29	6.90	33.73	30.56	35.71	41.20	5.25	5.95	3.20
30	7.40	42.83	25.73	31.44	34.60	9.50	4.14	8.20
31	7.10	39.73	34.56	25.71	28.17	3.23	5.40	1.60
32	6.50	33.26	31.51	35.22	31.00	6.70	5.57	6.60
33	7.40	29.66	32.56	37.78	42.51	4.06	4.48	2.20
34	6.40	29.48	35.44	35.08	22.40	3.56	5.11	5.60
35	6.50	23.66	50.63	25.71	34.03	2.24	6.09	4.40
36	7.50	35.12	25.44	39.44	35.40	5.54	4.31	5.00
37	6.60	37.66	24.56	37.78	66.37	7.87	4.03	6.00
38	7.50	33.19	25.73	41.08	33.40	4.38	3.75	4.60
39	6.90	39.66	24.63	35.71	71.46	12.90	4.26	8.80
40	7.10	52.40	15.51	32.09	44.80	17.40	13.46	10.80
41	7.10	33.66	30.63	35.71	50.07	6.52	3.97	2.00
42	7.10	42.04	17.87	40.09	51.60	13.68	5.74	10.60
43	7.30	41.66	24.63	33.71	39.38	10.23	6.86	6.00
44	7.30	50.11	15.13	34.16	37.40	10.28	3.86	9.00
45	7.60	45.80	28.56	25.64	27.38	4.19	4.59	1.40
46	7.20	46.76	17.44	35.80	38.40	6.37	4.42	5.60
47	7.70	37.80	34.63	27.57	39.51	5.80	5.34	7.40
48	7.70	45.46	28.02	26.52	22.20	3.51	4.42	7.40
49	6.20	22.00	26.56	51.44	62.85	13.75	8.48	8.40
50	7.20	35.68	23.87	40.45	40.40	6.48	4.54	7.00
51	6.90	30.00	30.56	39.44	35.60	6.38	13.40	4.00
52	6.70	49.91	19.93	30.16	31.20	9.48	7.33	5.40

53	7.30	42.00	32.56	25.44	28.29	3.42	10.41	1.40
54	6.80	51.84	20.00	28.16	57.20	13.12	7.99	6.80
55	7.20	34.00	24.56	41.44	29.99	5.48	18.74	3.40
56	7.00	44.49	23.86	31.66	58.80	18.28	9.59	12.00
57	6.40	32.00	20.56	47.44	50.72	12.94	18.52	3.60
58	7.20	48.20	21.86	29.94	37.00	6.68	7.03	9.80
59	6.30	34.00	30.56	35.44	39.77	5.80	6.91	5.40
60	7.69	39.84	28.00	32.16	33.60	6.24	4.65	5.80
61	7.30	40.56	26.56	32.88	32.34	8.28	5.05	4.20
62	7.40	44.20	31.93	23.87	28.40	3.62	4.59	4.00
63	7.30	30.56	26.56	42.88	32.86	6.30	6.44	4.60
64	7.50	49.91	12.00	38.09	34.40	5.59	4.77	5.60
65	7.60	40.56	24.56	34.88	34.69	6.04	4.09	3.80
66	7.50	33.91	25.93	40.16	43.00	6.85	5.86	6.40
67	7.60	38.56	16.56	44.88	31.17	4.49	4.42	2.00
68	7.10	38.20	14.00	47.80	47.40	6.81	4.54	15.40
69	7.20	36.56	24.56	38.88	38.86	5.22	5.34	2.00
70	7.70	47.91	18.00	34.09	30.60	5.52	7.15	8.89
71	7.20	45.64	28.22	26.14	55.40	8.09	9.15	8.60
72	7.20	40.13	24.00	35.87	33.60	4.61	4.65	4.80
73	7.30	40.56	16.56	42.88	42.90	6.99	5.57	1.40
74	7.20	44.63	11.86	43.51	54.40	10.92	5.51	8.20
75	6.80	32.76	20.56	46.68	33.25	4.57	12.08	0.20
76	6.50	38.56	19.93	41.51	40.00	6.82	4.42	73.80
77	7.40	40.76	22.56	36.68	37.69	5.40	5.51	3.40
78	6.80	38.78	25.86	35.37	33.20	4.53	6.33	11.00
79	7.00	52.76	26.56	20.68	48.12	4.46	16.78	4.80
80	7.00	44.56	23.93	31.51	34.60	5.11	6.15	11.40
81	6.70	34.76	20.56	44.68	30.25	2.59	4.88	1.20
82	7.20	24.49	18.00	57.51	74.00	13.60	18.45	11.40
83	6.90	40.76	28.56	30.68	36.90	5.24	7.69	3.00
84	6.70	34.13	26.07	39.80	34.40	5.36	9.65	8.40
85	7.30	32.76	26.56	40.68	37.55	5.44	2.97	4.60
86	7.10	40.13	26.00	33.87	42.00	7.76	22.41	13.20
87	6.70	33.84	27.35	38.81	48.38	8.29	3.19	3.80
88	6.40	51.98	24.07	23.94	28.20	4.64	7.27	9.00
89	6.60	29.84	45.35	24.81	41.60	7.01	16.00	6.60
90	5.90	30.20	34.07	35.73	20.00	3.84	7.45	6.20
91	6.50	29.91	37.35	32.74	38.47	9.53	4.59	1.60
92	6.00	39.70	26.29	34.02	22.00	2.80	4.09	3.40
93	6.50	40.06	23.42	36.52	31.95	5.15	3.25	1.80
94	6.70	39.55	26.36	34.09	52.00	11.12	10.34	7.00
95	7.70	43.91	23.35	32.74	39.51	7.47	14.27	5.00
96	7.10	48.69	24.43	26.88	34.40	6.52	4.09	6.40
97	7.20	39.84	27.42	32.74	52.68	12.64	11.62	5.60
98	7.00	33.12	24.36	42.52	65.90	23.39	16.36	15.20
99	6.80	45.84	25.28	28.88	18.39	2.20	12.80	1.40
100	6.30	48.27	15.86	35.87	35.80	6.60	5.92	3.40
101	6.60	33.84	27.50	38.66	33.38	4.92	4.77	1.80
102	6.30	40.27	20.00	39.73	39.60	7.58	3.47	3.80
103	6.70	43.91	25.28	30.81	28.82	4.48	3.42	3.60
104	6.70	43.48	24.29	32.23	22.60	2.96	4.48	2.60
106	7.10	40.76	16.50	42.74	33.20	3.97	6.09	2.80
107	6.90	37.84	25.35	36.81	47.99	8.70	3.86	4.40

108	6.90	32.76	22.58	44.66	60.40	17.14	6.56	6.40
109	6.70	33.84	19.35	46.81	62.72	13.18	3.81	5.00
110	6.50	37.19	18.36	44.45	52.00	12.94	4.09	7.20
111	7.10	43.84	25.28	30.88	47.60	9.68	3.08	6.00
113	7.30	45.84	23.28	30.88	55.68	12.13	4.37	7.40
114	6.80	36.98	26.36	36.66	55.40	10.68	2.86	4.40
115	7.00	33.84	27.64	38.52	46.94	6.34	3.81	4.00
116	6.80	52.90	18.36	28.74	58.00	15.44	3.97	6.20
117	7.00	51.84	17.35	30.81	37.29	6.30	3.75	2.60
118	7.40	38.04	28.72	33.24	38.80	4.45	4.42	2.60
119	7.19	45.84	25.28	28.88	52.68	9.71	3.69	5.20
120	7.20	44.11	24.58	31.31	45.80	8.55	2.97	4.20
121	7.40	31.84	29.28	38.88	41.73	4.60	3.36	3.60
122	6.79	52.40	18.50	29.10	40.00	8.76	4.09	5.60
123	7.20	39.84	27.42	32.74	41.21	7.35	3.58	4.00
124	6.80	22.47	18.79	58.74	60.60	7.76	6.33	11.00
125	6.60	36.65	25.64	37.71	63.23	13.29	4.48	7.20
126	6.90	44.92	16.36	38.72	57.80	15.58	5.86	9.89
127	7.40	36.65	27.57	35.78	51.64	12.14	32.01	7.40
128	7.30	34.85	28.36	36.79	42.80	4.73	3.69	4.40
130	7.40	36.20	24.43	39.37	38.80	3.84	4.94	4.00
131	7.50	38.72	33.57	27.71	46.41	9.19	8.24	9.00
132	7.20	36.20	24.29	39.51	46.60	6.77	4.03	6.00
133	7.10	41.44	27.50	31.06	42.77	8.32	4.42	5.00
134	6.70	41.48	16.36	42.16	63.20	11.22	4.99	9.60
135	6.30	45.66	23.50	30.85	69.63	17.88	13.73	10.40
136	6.90	43.55	14.58	41.87	54.20	9.04	4.59	6.90
137	7.30	35.66	29.42	34.92	32.06	3.72	3.97	5.00
138	7.00	41.48	20.86	37.66	52.60	9.27	4.03	5.20
139	7.40	37.58	31.64	30.78	36.89	6.59	4.59	4.80
140	7.30	43.77	22.36	33.87	42.60	7.55	4.99	5.00
141	7.00	31.58	29.64	38.78	60.77	10.74	4.71	5.00
142	6.50	37.12	20.65	42.23	43.80	4.90	3.42	4.60
143	7.40	35.58	31.64	32.78	52.03	10.39	6.80	4.80
144	7.40	39.70	16.79	43.51	53.60	7.68	3.42	6.00
145	7.70	37.51	29.64	32.85	32.73	4.17	3.42	4.20
146	6.80	39.12	16.72	44.16	46.60	8.47	5.05	5.20
147	6.40	35.51	28.78	35.70	30.38	3.36	4.31	2.80
148	7.70	40.76	18.36	40.88	34.00	4.11	4.26	3.80
149	7.00	41.51	24.78	33.70	52.28	11.04	5.51	6.80
150	7.30	40.49	17.51	42.00	32.40	3.24	4.99	3.80
151	7.60	41.58	25.86	32.56	33.24	4.91	6.80	7.00
152	6.80	40.70	21.08	38.22	28.00	3.65	4.42	4.00
153	7.00	35.51	27.86	36.63	46.81	9.95	8.66	15.00
154	7.10	34.49	21.01	44.50	56.40	9.52	5.51	9.20
155	7.30	39.51	25.86	34.63	43.68	9.98	7.81	9.80
156	7.00	42.42	14.94	42.65	35.20	5.73	5.22	4.60
157	7.50	37.08	31.21	31.71	52.81	10.69	4.88	7.60
158	7.40	42.20	16.79	41.01	46.40	7.45	7.51	5.20
159	7.70	35.08	32.21	32.71	38.69	6.32	4.14	6.00
160	7.30	41.98	16.79	41.22	46.60	10.80	10.98	8.20
161	7.90	58.08	23.14	18.78	18.91	3.74	11.75	5.20
162	7.40	38.42	23.93	37.66	37.40	6.97	5.63	4.60
163	7.90	28.15	41.14	30.71	39.77	6.29	5.17	6.29

164	6.70	44.63	25.93	29.44	37.20	8.68	5.40	5.80
165	7.70	74.37	15.70	9.93	27.77	4.38	3.86	6.40
166	7.50	46.20	28.00	25.80	28.00	3.25	6.33	4.80
167	7.40	43.44	26.70	29.86	27.12	4.81	20.93	5.80
168	7.18	37.12	26.07	36.81	28.80	4.12	64.67	2.60
169	7.60	41.22	28.99	29.78	22.17	3.42	16.71	6.80
170	7.10	37.05	30.36	32.59	38.60	8.28	12.93	4.40
171	7.70	32.22	39.06	28.71	25.82	5.35	5.34	6.40
172	7.80	30.76	26.36	42.88	31.60	5.25	6.56	5.00
173	6.90	31.15	46.99	21.86	17.73	2.50	3.75	8.20
174	7.50	32.40	32.50	35.10	31.20	5.50	4.99	4.80
175	7.80	20.15	37.06	42.78	25.04	4.45	4.71	5.60
176	7.60	40.90	22.36	36.74	36.29	5.87	11.36	3.20
177	7.00	45.15	28.99	25.86	24.12	11.50	15.51	11.20
178	7.70	28.96	28.36	42.68	35.00	5.88	7.63	3.20
179	7.80	23.15	40.99	35.86	25.55	5.80	18.89	4.20
180	7.50	30.89	28.72	40.39	39.40	7.17	12.73	2.80
181	7.90	40.50	32.14	27.35	19.43	5.44	25.59	6.80
182	7.20	42.31	26.72	30.97	28.60	3.55	13.80	2.40
183	7.70	48.50	28.07	23.42	25.30	4.24	15.37	5.80
184	7.10	44.24	18.65	37.11	20.60	4.10	25.59	3.00
185	7.90	39.58	32.07	28.35	25.95	3.66	20.39	5.20
186	7.40	41.05	20.36	38.59	23.40	2.82	9.71	2.20
187	7.90	18.19	35.78	45.42	23.32	3.48	19.94	4.40
188	7.30	20.40	30.36	49.24	28.40	3.47	22.81	2.20
190	7.30	27.68	30.43	41.89	40.60	4.80	12.14	2.40
191	7.90	26.72	33.93	39.35	19.43	3.48	16.36	5.20
192	7.60	25.55	32.29	42.16	31.00	3.77	25.09	2.60
193	7.80	26.72	35.86	37.42	19.70	3.33	22.81	5.00
194	7.50	20.49	35.93	43.58	37.49	3.75	20.78	2.80
195	7.00	41.08	10.99	47.93	33.91	6.70	7.87	8.00
196	7.10	22.49	23.93	53.58	51.20	7.79	11.82	6.40
197	7.70	31.08	16.92	52.00	28.70	3.29	13.26	5.60
198	7.50	23.98	30.07	45.94	45.20	3.75	23.70	2.60
199	7.60	35.08	30.92	34.00	45.52	6.14	8.24	7.40
200	7.10	35.68	24.65	39.67	43.60	7.08	8.24	3.60
202	7.00	41.68	24.72	33.60	54.60	7.92	10.60	7.00
203	7.60	39.08	32.92	28.00	57.52	11.49	25.18	4.80
204	6.80	34.40	22.65	42.95	40.00	10.04	13.87	7.20
205	7.10	35.08	30.95	34.07	56.74	12.07	10.60	5.60
206	7.10	33.84	22.00	44.16	28.80	8.93	13.80	6.20
209	8.00	23.08	50.85	26.07	37.17	5.23	9.03	3.00
210	7.30	36.20	25.64	38.16	46.60	9.62	4.88	1.40
211	7.70	35.08	34.85	30.07	50.48	10.19	9.96	7.60
212	7.00	31.55	30.00	38.45	35.60	10.72	8.66	8.40
214	7.50	35.84	28.36	35.80	39.40	7.76	5.97	9.80
215	7.70	39.08	32.85	28.07	33.00	5.29	2.92	3.00
217	8.00	23.08	50.85	26.07	21.00	2.20	3.75	1.89
218	7.20	41.19	24.29	34.52	38.40	8.02	7.03	5.20
219	7.90	35.08	33.06	31.86	40.04	6.47	3.25	2.60
220	7.30	30.40	30.43	39.17	43.00	7.13	6.03	4.40
221	7.90	41.08	27.06	31.86	40.57	6.12	5.68	8.00
223	7.90	21.08	53.06	25.86	34.70	3.38	4.99	2.40
224	7.30	35.48	24.29	40.23	33.60	4.39	6.33	3.80

225	8.00	28.86	35.86	35.28	43.43	6.45	6.03	2.00
226	7.40	43.41	22.14	34.45	34.80	5.46	8.60	3.20
227	7.90	30.86	37.93	31.21	41.61	6.93	7.63	2.60
228	7.50	26.98	48.36	24.66	43.60	3.48	7.75	5.00
230	7.60	46.98	24.43	28.59	22.80	3.56	6.56	3.00
231	8.00	30.86	33.86	35.28	22.43	4.46	4.88	3.00
232	7.30	37.12	26.58	36.30	40.60	4.58	6.97	3.60
233	8.10	40.86	30.29	28.85	15.65	3.07	4.94	2.40
234	7.50	42.04	26.72	31.24	29.00	5.48	6.31	6.00
235	8.00	36.86	38.29	24.85	25.04	4.35	4.14	3.00
236	7.40	44.40	24.65	30.95	32.60	7.12	13.94	4.00
237	8.00	28.94	36.14	34.92	36.65	5.09	20.16	2.80
238	7.50	33.12	24.58	42.30	27.00	3.55	18.08	3.20
239	7.90	29.73	29.06	41.21	29.61	5.45	11.17	3.00
240	7.70	40.40	26.86	32.74	27.20	5.32	16.57	5.80
241	7.90	51.13	23.06	25.21	34.57	7.59	6.27	10.80
242	7.60	26.76	32.72	40.52	35.00	2.69	8.17	4.20
243	8.10	37.73	33.06	29.21	24.91	3.79	5.57	6.20
244	7.50	36.47	26.79	36.74	41.80	4.71	11.04	4.60
245	8.10	39.73	26.00	34.27	21.78	3.86	12.01	2.80
246	7.60	39.68	24.86	35.46	37.40	3.19	31.26	3.20
247	8.00	19.73	38.07	42.20	34.83	5.45	60.80	1.80
248	7.60	36.50	21.14	42.36	37.00	3.84	14.00	4.00
249	7.90	53.73	24.00	22.27	24.13	3.92	15.79	3.00
250	7.60	60.50	13.14	26.36	37.40	4.16	22.73	4.00
251	8.00	49.73	22.43	27.84	17.35	2.92	20.93	2.40
252	7.60	48.29	23.14	28.58	30.80	3.43	35.74	4.80
253	8.10	35.73	32.58	31.70	26.09	3.69	16.92	2.60
254	7.50	50.07	17.21	32.72	49.20	7.31	28.98	4.00
255	8.00	45.66	26.58	27.77	37.43	7.88	20.47	5.60
256	7.40	52.14	15.14	32.72	32.60	2.77	12.21	5.20
257	7.20	23.66	36.14	40.20	36.39	4.49	31.36	1.20
258	7.30	18.00	35.28	46.72	66.60	5.38	74.81	2.40
259	8.00	37.66	34.07	28.27	22.83	4.06	19.19	1.60
260	5.80	67.62	6.36	26.02	32.80	11.06	10.22	6.40
261	8.10	33.66	28.00	38.34	27.52	3.52	17.86	2.20
262	7.40	57.12	16.36	26.52	31.40	3.83	50.50	3.40
263	8.00	43.66	22.00	34.34	24.13	4.34	18.59	3.00
264	7.50	49.12	24.43	26.45	31.00	3.41	17.43	4.20
265	7.80	21.66	42.07	36.27	49.83	9.33	34.24	2.60
266	7.50	43.55	24.36	32.09	31.60	3.54	15.93	2.80

Appendix A. Continued.

Plot	ppm SO4	ppm N	ppm K	ppm Ca	ppm Mg	WaterCap	Avg.Depth
1	94.04	2165.00	220.00	12860.0	660.0	0.12	42.5000
2	5.33	2355.00	400.00	8620.0	880.0	0.12	16.7500
3	11.06	1250.00	190.00	7610.0	1130.0	0.12	40.8750
4	4.66	1935.00	290.00	7480.0	610.0	0.17	41.3750
5	11.35	1165.00	190.00	6100.0	1240.0	0.17	40.3750
6	10.05	1760.00	290.09	4190.0	770.0	0.17	13.5000
7	27.25	1190.00	200.00	6970.0	380.0	0.17	16.3750
8	12.76	2685.00	370.00	8550.0	840.0	0.17	13.3750
9	11.57	1215.00	460.00	11200.0	1530.0	0.17	19.1667
10	3.56	1005.00	230.00	3240.0	710.0	0.17	27.2500
11	6.38	640.00	40.00	4000.0	300.0	0.17	31.2500
13	43.39	2915.00	400.00	9230.0	770.0	0.16	21.0000
14	8.29	1720.00	130.00	4620.0	370.0	0.17	31.8750
16	10.77	1705.00	270.00	3280.0	370.0	0.17	26.2500
17	17.10	1715.00	150.00	2840.0	280.0	0.17	50.7500
18	20.66	4240.00	600.00	6310.0	840.0	0.14	25.2500
19	23.19	2315.00	360.00	8380.0	820.0	0.14	17.0000
20	7.81	1960.00	450.00	8820.0	890.0	0.14	14.6250
21	108.13	5455.00	810.09	12920.0	1100.0	0.14	19.5000
22	7.19	2900.00	480.00	9240.0	1000.0	0.14	19.6250
23	39.12	5485.00	380.00	12230.0	980.0	0.14	21.0000
24	12.31	2945.00	450.00	8940.0	750.0	0.14	21.2500
25	16.06	2075.00	439.00	8940.0	960.0	0.14	25.2500
26	9.13	2185.00	490.00	5520.9	670.0	0.14	16.3750
27	16.46	4040.00	430.00	9080.0	830.0	0.14	19.7500
28	7.12	1495.00	260.00	2930.0	650.0	0.14	19.8750
29	11.86	1465.00	310.00	9670.0	480.0	0.14	23.3750
30	12.83	2720.00	170.00	10440.0	320.0	0.14	33.0000
31	9.62	1565.00	250.00	4450.0	730.0	0.14	23.5000
32	12.23	1755.00	370.00	4440.0	750.0	0.14	17.1250
33	7.39	1775.00	350.00	11140.0	870.0	0.14	14.5000
34	5.51	1275.00	310.00	2690.0	520.0	0.14	31.3750
35	7.74	850.00	260.00	3180.0	520.0	0.14	27.3750
36	7.53	2180.00	390.00	9690.0	490.0	0.14	28.3750
37	31.00	2750.00	310.00	14890.0	470.0	0.14	42.2500
38	6.51	1815.00	380.00	9920.0	160.0	0.14	29.5000
39	23.37	3790.00	480.00	16110.0	540.0	0.14	21.8750
40	16.30	4210.00	530.00	12240.0	420.0	0.14	25.8750
41	11.86	2375.00	230.00	13750.0	290.0	0.14	16.1250
42	27.01	3980.00	560.00	12140.0	740.0	0.14	22.0000
43	15.82	2860.00	110.00	13230.0	520.0	0.14	22.0000
44	11.06	2805.00	360.00	10740.0	370.0	0.14	25.5000
45	13.70	1450.00	260.00	11870.0	250.0	0.14	26.1250
46	11.42	1975.00	530.00	9890.0	250.0	0.14	26.7500
47	10.12	1885.00	130.00	7760.0	470.0	0.14	39.6250
48	7.39	1490.00	200.00	8170.0	370.0	0.14	31.6250
49	39.75	3815.00	570.00	13120.0	710.0	0.14	23.1250
50	11.50	2245.00	490.00	8440.0	370.0	0.14	23.5000
51	13.13	1875.00	390.00	6210.0	250.0	0.14	27.3750
52	19.56	2700.00	310.00	4600.0	240.0	0.14	22.5000

53	7.26	1215.00	150.00	7140.0	290.0	0.14	37.6250
54	30.55	3935.00	249.00	6540.0	1010.0	0.14	28.6250
55	6.11	1835.00	320.00	5190.0	660.0	0.14	21.2500
56	39.78	3585.00	550.00	7950.0	1150.0	0.14	18.1250
57	6.85	3315.00	330.00	8030.0	1070.0	0.14	28.0000
58	10.77	2385.00	430.00	7210.0	810.0	0.14	15.8750
59	4.40	1825.00	350.00	8510.0	1050.0	0.14	18.0000
60	6.85	2250.00	260.00	8500.0	810.0	0.14	23.1250
61	5.98	1940.00	160.00	13250.0	550.0	0.14	18.7500
62	9.55	1540.00	260.00	4150.0	850.0	0.14	15.7500
63	6.38	1490.00	200.00	5920.0	830.0	0.14	13.3750
64	7.87	1585.00	270.00	9430.0	770.0	0.14	31.6250
65	5.51	2015.00	150.00	11810.0	1130.0	0.14	31.3750
66	3.75	2130.00	140.00	9770.0	630.0	0.14	34.5000
67	7.94	1575.00	210.00	11350.0	740.0	0.14	25.3750
68	10.77	2775.00	410.00	6690.0	1010.0	0.14	19.5000
69	10.84	1650.00	490.00	9890.0	950.0	0.14	18.3750
70	6.11	1870.00	160.00	8840.0	460.0	0.14	21.8750
71	13.43	2115.00	360.00	12830.0	820.0	0.14	21.2500
72	12.16	1735.00	480.00	7610.0	250.0	0.14	34.0000
73	6.04	2585.00	520.00	9350.0	270.0	0.14	11.2500
74	13.28	3390.00	410.00	8850.0	210.0	0.07	4.2500
75	2.73	1760.00	390.00	4920.0	180.0	0.07	8.8750
76	11.28	2180.00	2270.00	7160.0	290.0	0.07	12.2500
77	8.57	1815.00	420.00	9890.0	830.0	0.07	10.1250
78	8.64	1910.00	200.00	4280.0	140.0	0.07	18.2500
79	16.96	3410.00	560.00	8410.0	290.0	0.07	9.3750
80	4.46	1505.00	320.00	5710.0	190.0	0.07	14.3750
81	7.05	975.00	300.00	4190.0	200.0	0.07	16.3750
82	14.50	6310.00	690.00	13990.0	560.0	0.09	14.0000
83	11.94	1950.00	400.00	5490.0	200.0	0.09	17.2500
84	8.22	1390.00	430.00	7800.0	630.0	0.09	37.7500
85	12.53	1510.00	450.00	11840.0	520.0	0.14	18.3750
86	17.66	2415.00	440.00	5290.0	150.0	0.14	23.8750
87	12.75	2585.00	320.00	7840.0	780.0	0.14	12.6250
88	8.22	1340.00	110.00	2870.0	350.0	0.14	54.2500
89	25.74	2835.00	450.00	6540.0	660.0	0.14	31.5000
90	2.86	1505.00	140.00	1550.0	270.0	0.14	28.0000
91	15.82	2340.00	220.00	5000.0	740.0	0.14	13.7500
92	6.38	895.00	190.00	2110.1	440.0	0.10	17.0000
93	4.66	1790.00	280.00	4030.0	820.0	0.14	8.0000
94	6.58	1120.00	540.00	8350.0	950.0	0.14	19.8750
95	7.46	2350.00	290.00	2050.0	660.0	0.14	36.2500
96	5.51	1470.00	380.00	10000.0	400.0	0.14	24.3750
97	9.48	2790.00	390.00	14870.0	810.0	0.07	28.8750
98	9.05	6605.00	800.00	16530.0	470.0	0.07	17.7500
99	2.98	1165.00	310.00	2220.0	120.0	0.12	13.8750
100	12.68	1715.00	410.00	3830.0	150.0	0.14	14.6250
101	4.92	1540.00	370.00	3930.0	190.0	0.07	15.6250
102	10.55	1550.00	420.00	4380.0	180.0	0.07	11.6250
103	6.45	1590.00	310.00	3770.0	190.0	0.07	9.8750
104	6.51	1170.00	370.00	3870.0	120.0	0.07	11.2500
106	18.12	1470.00	420.00	1170.0	130.0	0.14	19.1250
107	8.43	1885.00	480.00	7050.0	200.0	0.14	11.3750

108	13.57	2915.00	360.00	12670.0	140.0	0.14	17.6250
109	16.58	2840.00	400.00	12710.0	240.0	0.07	30.5000
110	19.39	2630.00	530.00	11880.0	370.0	0.16	34.2500
111	11.79	2310.00	390.00	12490.0	850.0	0.16	19.6250
113	140.75	2860.00	350.00	14500.0	1190.0	0.14	37.2500
114	17.41	2465.00	520.00	11400.0	550.0	0.07	21.8750
115	92.02	1850.00	470.00	9520.9	640.0	0.14	19.0000
116	7.12	3455.00	390.00	13060.0	240.0	0.07	31.8750
117	20.41	1600.00	460.00	8178.0	280.0	0.07	30.0000
118	9.41	1610.00	370.00	10560.0	340.0	0.07	43.2500
119	13.51	2275.00	359.00	12750.0	290.0	0.16	33.5000
120	12.90	1970.00	400.00	11360.0	390.9	0.16	29.2500
121	9.98	1390.00	560.00	9350.0	920.0	0.14	23.7500
122	17.27	2135.00	400.00	10720.0	330.0	0.14	40.2500
123	11.72	1560.00	400.00	8450.0	690.0	0.14	13.7500
124	14.42	3575.00	780.00	9180.0	1120.0	0.14	12.0000
125	11.28	4060.00	290.00	10280.0	1440.0	0.14	28.0000
126	18.90	3060.00	760.00	11480.0	1150.0	0.14	22.8750
127	14.12	4375.00	250.00	9610.0	1340.0	0.07	23.6250
128	14.65	1615.00	370.00	8510.0	300.0	0.07	31.2500
130	6.85	1450.00	420.00	8400.0	610.0	0.07	35.7500
131	13.36	2585.00	590.00	12960.0	890.0	0.07	43.2500
132	1.26	1705.00	650.00	9920.0	920.0	0.07	16.2500
133	9.84	2375.00	430.00	7200.0	860.0	0.14	13.8750
134	16.58	2575.00	640.00	6440.0	860.0	0.14	18.0000
135	9.41	5095.00	1040.00	8960.0	1190.0	0.14	14.8750
136	22.85	2355.00	640.00	9170.0	1130.0	0.14	24.5000
137	7.12	1425.00	490.00	8240.0	840.0	0.07	10.0000
138	13.43	2295.00	580.00	10610.0	410.0	0.07	29.8750
139	4.46	2560.00	340.90	12300.0	370.0	0.07	52.1250
140	16.14	1885.00	600.00	10860.0	410.0	0.07	24.6250
141	10.77	3165.00	460.00	12720.0	1540.0	0.07	13.2500
142	19.39	1345.00	380.00	4050.0	800.0	0.07	11.8750
143	4.66	3440.00	420.00	13380.0	1320.0	0.14	21.8750
144	10.34	1960.00	410.00	12220.0	560.0	0.14	14.0000
145	8.64	1665.00	320.00	10880.0	1100.0	0.07	12.7500
146	14.04	2350.00	480.00	8250.0	1080.0	0.07	16.5000
147	5.84	1200.00	530.00	3640.0	489.0	0.07	29.6250
148	12.46	1370.00	360.00	10070.0	440.0	0.07	15.3750
149	7.26	2875.00	510.00	12440.0	640.0	0.07	21.6250
150	149.05	1295.00	410.00	5290.0	380.0	0.07	27.1250
151	4.66	2010.00	330.00	10870.0	530.0	0.07	27.1250
152	28.90	1110.00	330.00	3160.0	480.0	0.07	17.6250
153	12.90	3235.00	480.00	8430.0	1090.0	0.07	14.1250
154	15.20	2885.00	910.00	7670.0	1400.0	0.07	11.5000
155	7.33	2860.90	470.00	8930.0	1140.0	0.14	12.6250
156	24.46	1580.00	410.00	4180.0	730.0	0.14	19.6250
157	5.64	2825.00	420.00	12640.0	420.0	0.14	17.1250
158	12.16	2600.00	449.00	8690.0	860.0	0.14	13.6250
159	4.07	1885.00	530.00	8890.0	530.0	0.14	14.3750
160	11.64	3615.00	450.00	9900.0	620.0	0.14	17.2500
161	3.62	1315.00	150.00	8710.0	150.0	0.11	17.8750
162	12.61	1830.00	460.00	7820.0	730.0	0.11	15.2500
163	4.40	2200.00	210.00	12280.0	210.0	0.11	26.1250

164	9.84	2070.00	370.00	6710.0	980.0	0.11	17.6250
165	4.14	1440.00	440.00	10970.0	440.0	0.11	19.2500
166	9.84	1280.00	240.00	9200.0	750.0	0.16	14.7500
167	3.88	1585.00	520.00	5840.0	520.0	0.16	18.6250
168	9.55	1920.00	580.00	7490.0	590.0	0.12	25.0000
169	5.84	1965.00	330.00	10410.0	330.0	0.16	21.0000
170	10.34	1880.00	260.00	10500.0	1040.0	0.14	20.8750
171	5.98	800.00	170.00	9830.0	170.0	0.14	36.0000
172	10.17	1785.00	210.00	10630.0	210.0	0.14	28.0000
173	6.99	1285.00	630.00	3450.0	630.0	0.14	18.8750
174	10.91	1310.00	260.00	10340.0	260.0	0.14	31.7500
175	4.14	2240.00	130.00	8350.0	130.0	0.14	25.3750
176	4.98	1905.00	340.00	9850.0	340.0	0.14	17.8750
177	11.86	2150.00	760.00	10930.0	760.0	0.14	48.5000
178	0.68	1990.00	220.00	10440.0	220.0	0.13	26.0000
179	6.24	2290.00	229.00	7540.0	220.0	0.13	24.2500
180	1.60	1095.00	330.00	10670.0	330.0	0.13	41.2500
181	14.65	2025.00	420.00	10500.0	420.0	0.13	42.2500
182	4.46	1565.00	370.00	9900.0	370.0	0.16	39.6250
183	7.33	1700.00	500.00	9050.0	500.0	0.16	21.1250
184	4.40	1985.00	430.00	5270.0	430.0	0.16	36.0000
185	0.56	1565.00	380.00	7990.0	380.0	0.16	18.5000
186	6.04	975.00	280.00	9540.0	400.0	0.16	29.7500
187	0.74	1410.00	280.00	9690.0	280.0	0.16	32.5000
188	4.27	1625.00	370.00	9710.0	450.0	0.16	24.0000
190	3.56	650.00	310.00	9880.0	570.0	0.16	49.6250
191	4.53	1441.66	370.00	9770.0	490.0	0.16	33.8750
192	9.48	1615.00	320.00	10720.0	420.0	0.11	24.6250
193	2.48	1449.99	260.00	9400.0	480.0	0.11	32.7500
194	13.81	1885.00	360.00	9610.0	630.0	0.11	23.1250
195	13.20	1383.33	460.90	9090.0	420.0	0.16	20.3750
196	19.23	1905.00	450.00	11990.0	440.0	0.13	14.5000
197	1.13	1649.99	370.00	11070.0	310.0	0.16	18.1250
198	14.35	1480.00	410.00	11500.0	620.0	0.16	37.7500
199	4.40	3308.32	500.00	12000.0	930.0	0.11	15.1250
200	0.50	2125.00	350.00	11710.0	550.0	0.11	25.5000
202	6.11	2355.00	560.00	11380.0	1160.0	0.12	16.8750
203	3.37	3008.32	180.00	10540.0	920.0	0.12	14.7500
204	10.48	2890.00	700.00	8050.0	1280.0	0.12	14.7500
205	16.78	1633.33	450.00	9180.0	1650.0	0.09	12.8750
206	4.14	1795.00	270.00	12340.0	510.0	0.09	35.8750
209	3.56	2633.32	160.00	10500.0	1060.0	0.13	26.0000
210	4.79	1775.00	500.00	13540.0	880.0	0.13	23.6250
211	13.81	1641.66	170.00	11550.0	1500.0	0.13	29.7500
212	6.58	2405.00	450.00	14110.0	850.0	0.13	27.3750
214	18.65	1750.00	350.00	13460.0	1300.0	0.13	30.1250
215	2.92	600.00	190.00	11310.0	400.0	0.13	36.5000
217	2.54	1558.33	159.00	9010.0	300.0	0.13	19.8750
218	4.14	1820.00	280.00	13910.0	140.0	0.13	31.7500
219	0.17	2358.32	310.00	11230.0	530.0	0.13	14.2500
220	5.05	1915.00	370.00	13240.0	550.0	0.13	35.0000
221	2.42	1299.99	170.00	11880.0	220.0	0.13	11.7500
223	3.37	1849.99	160.00	9920.0	570.0	0.13	21.1250
224	4.72	1370.00	340.00	12600.0	380.0	0.13	15.2500

225	4.46	1866.66	330.00	11890.0	960.0	0.13	39.6250
226	10.48	1165.00	330.09	12880.0	590.0	0.13	18.5000
227	3.94	1391.66	180.00	11780.0	950.0	0.13	42.6250
228	6.18	1265.00	450.00	12580.0	1070.0	0.13	32.6250
230	6.92	1285.00	210.00	11510.0	620.0	0.13	33.7500
231	4.33	1116.66	130.00	9670.0	430.0	0.13	27.0000
232	4.46	1645.00	420.00	12530.0	600.0	0.13	20.6250
233	0.10	1316.66	110.00	8750.0	270.0	0.13	15.7500
234	6.78	1615.00	150.00	12060.0	580.0	0.13	40.7500
235	1.11	1724.99	80.00	9770.0	240.0	0.13	25.5000
236	4.72	2490.00	370.00	12880.0	460.0	0.13	25.6250
237	3.05	1866.66	270.00	10070.0	670.0	0.09	35.8750
238	7.60	1545.00	350.00	11340.0	460.0	0.09	24.5000
239	2.35	1991.66	240.00	9500.0	470.0	0.16	32.3750
240	9.48	850.00	180.00	11870.0	480.0	0.16	27.7500
241	23.73	1858.33	160.00	18830.0	770.0	0.13	21.5000
242	6.65	2900.00	100.00	10940.0	350.0	0.13	14.2500
243	17.50	1183.33	120.00	9539.0	400.0	0.13	18.2500
244	7.33	1230.00	140.00	11220.0	470.0	0.13	31.0000
245	5.84	1466.66	180.00	9470.0	380.0	0.16	44.7500
246	8.64	820.00	290.00	10980.0	360.0	0.16	38.5000
247	0.68	2224.99	540.00	9810.0	590.0	0.16	33.0000
248	4.66	1260.00	110.00	10920.0	550.0	0.13	13.7500
249	0.56	1449.99	100.00	9430.0	380.0	0.16	17.8750
250	7.87	1530.00	210.00	11360.0	290.0	0.16	39.3750
251	1.23	1174.99	130.00	9060.0	250.0	0.16	53.8750
252	11.13	1200.00	330.00	7460.0	510.0	0.16	32.3750
253	3.88	1516.66	230.00	9880.0	470.0	0.16	42.5000
254	8.01	2250.00	370.00	12210.0	820.0	0.16	16.5000
255	1.11	2408.32	270.00	10660.0	1100.0	0.16	37.0000
256	8.43	950.00	340.00	7440.0	510.0	0.12	33.0000
257	0.17	1608.33	500.00	3950.0	830.0	0.12	33.6250
258	8.15	2065.00	1050.00	5910.0	1670.0	0.16	29.3750
259	2.60	1583.33	240.00	9400.0	490.0	0.16	27.0000
260	8.57	1880.00	220.00	2960.0	310.0	0.12	8.8750
261	5.91	1283.33	250.00	8990.0	510.0	0.16	39.6250
262	8.99	1310.00	200.00	10730.0	330.0	0.16	8.5000
263	12.68	1616.66	120.00	9250.0	330.0	0.16	15.7500
264	8.71	1195.00	310.00	11210.0	270.0	0.16	25.1250
265	5.58	3483.32	530.00	12280.0	630.0	0.16	20.7500
266	7.81	1240.00	250.00	11020.0	350.0	0.16	28.2500

Appendix B. Plot loadings for soil principal components

Row	Plot No.	PCA1	PCA2	PCA3
1	1	-0.75780	0.46864	-1.81519
2	2	-2.23446	-0.86303	0.20637
3	3	1.48155	0.16538	-1.06086
4	4	1.27253	1.32078	-1.56353
5	5	2.42344	0.73759	-1.27642
6	6	0.27380	-1.54939	0.41875
7	7	1.29569	-1.30406	-1.33023
8	8	-1.59758	-0.46741	0.43945
9	9	0.30392	0.28237	0.63489
10	10	2.93404	-1.58548	-1.10180
11	11	5.51576	-1.66272	-1.30936
12	13	-2.56398	0.39440	-0.80486
13	14	2.33692	0.47848	0.26298
14	16	1.28543	-2.03919	-0.72893
15	17	1.10331	-0.85184	-2.05889
16	18	-2.40080	-0.10809	-0.22882
17	19	-1.15808	-1.04543	0.01080
18	20	0.01680	-0.90550	0.98672
19	21	-6.57606	-0.10354	-0.61419
20	22	-0.48014	0.34842	0.40071
21	23	-4.83174	1.20365	0.71627
22	24	-1.99111	-0.00460	-0.12182
23	25	-1.37398	0.42191	-0.10957
24	26	-0.63667	-1.18859	0.07454
25	28	1.10965	-2.40009	0.21018
26	29	0.56253	-0.35114	0.81439
27	30	-0.15054	0.85847	-1.47312
28	31	2.20143	-1.00211	0.84456
29	32	-0.09752	-1.14959	0.76966
30	33	0.63764	0.55542	1.78593
31	34	2.06643	-0.90877	0.42344
32	35	3.03328	0.08713	1.45056
33	36	0.28328	0.42587	-0.06734
34	37	-2.15180	1.70562	-1.68163
35	38	1.14537	0.95827	-1.06083
36	39	-3.77080	1.76266	-0.87782
37	40	-3.10010	0.84396	-2.68331
38	41	-0.10401	0.25562	1.42512
39	42	-3.44941	0.67777	-1.21955
40	43	-0.51435	1.40085	-1.24982
41	44	-1.34775	0.36481	-2.84507
42	45	2.02819	-0.21672	-0.43332
43	46	-0.50387	-0.52017	-1.82738
44	47	1.28381	1.15139	-0.37735
45	48	2.08588	-0.13754	-1.18736
46	49	-3.87923	1.09076	0.94755
47	50	-0.59955	-0.07050	-0.42594
48	51	0.53050	0.04760	0.20246
49	52	-0.68297	-2.09216	-1.09224

50	53	3.30116	-0.16299	-0.24415
51	54	-2.77970	0.33486	-2.22376
52	56	-4.05801	0.08109	-0.27665
53	57	-1.95484	0.82285	0.09112
54	58	-1.10586	-0.84323	-0.73911
55	59	-0.37481	-0.16163	0.90688
56	60	0.33557	0.57082	-0.05450
57	61	0.43208	0.26457	0.35760
58	62	1.46937	-1.25741	0.48492
59	63	0.84795	-0.82968	1.56281
60	64	0.20362	-0.72777	-1.80809
61	65	0.70250	1.54902	-0.78165
62	66	0.66650	1.75465	-0.67808
63	67	1.27679	-0.05590	-0.43145
64	68	-2.10305	-0.55650	-0.72812
65	69	0.02861	-0.63195	1.10883
66	71	-1.71327	0.66428	-0.21310
67	72	0.62072	-0.59688	-0.90121
68	73	-0.29847	-0.92481	0.27130
69	74	-2.86817	-2.33528	0.58194
70	75	2.15464	-2.31719	2.23949
71	76	-3.55721	-2.41990	-0.10953
72	77	-0.42169	-1.24442	1.17863
73	78	0.46638	-1.93639	0.09205
74	79	-1.49732	-1.86163	0.48854
75	80	0.22028	-2.31520	0.28944
76	81	2.36432	-3.25822	1.14449
77	82	-4.80964	1.30908	1.54419
78	83	0.36008	-1.53786	0.39137
79	84	0.11666	-0.20710	-0.42766
80	85	0.06921	0.23465	0.10627
81	86	-0.90380	-0.20526	-1.03161
82	87	-1.27195	-1.00750	1.58245
83	88	1.87945	-1.52357	-2.47367
84	89	-0.68107	0.93726	1.20173
85	90	2.45818	-2.05174	1.22151
86	91	0.09816	-0.89112	2.31260
87	92	2.36708	-3.54554	0.45474
88	93	0.74450	-2.25540	0.95580
89	94	-1.31458	-0.36236	0.27542
90	95	0.43198	0.41468	-1.46686
91	96	0.24276	-0.66733	-1.00419
92	97	-2.18808	1.62193	0.06015
93	98	-5.19516	1.55854	1.29356
94	101	1.17477	-2.38792	1.55040
95	102	-0.59835	-3.45471	0.74692
96	103	0.88243	-3.45074	1.08632
97	104	1.88600	-3.51389	0.62069
98	106	1.09794	-2.71558	-0.73400
99	107	-0.78250	-1.54388	0.91207
100	108	-2.48124	1.10638	-0.45610
101	109	-2.64983	0.43140	-0.52476
102	110	-2.34200	1.16040	-2.43441
103	111	-1.58953	0.63697	-0.65935

104	113	-3.11651	1.89492	-2.31243
105	114	-2.27553	-0.25918	0.51943
106	115	-1.19680	-0.21653	-0.21395
107	116	-2.76028	0.04518	-1.63014
108	117	-0.22879	-2.05560	-1.35237
109	118	1.06506	0.93176	-1.01567
110	119	-1.06122	1.07462	-1.71593
111	120	-0.61311	0.21366	-0.99121
112	121	0.23980	0.28982	0.72686
113	122	-0.91511	-0.03846	-3.01040
114	123	-0.31563	-1.00278	0.82829
115	124	-3.53704	-0.28673	1.99613
116	125	-3.27258	1.13295	0.41352
117	126	-4.01259	-0.06741	-0.51913
118	127	-2.57097	1.40697	1.03685
119	128	0.35874	-0.02539	-0.30425
120	130	0.74681	-0.28787	0.03925
121	131	-1.65504	2.23313	-0.48199
122	132	-0.89100	-0.57286	1.78142
123	133	-1.05560	-0.36865	0.26909
124	134	-3.26037	-0.91231	-0.59861
125	135	-5.16406	-0.24003	0.72099
126	136	-2.75917	-0.22761	-1.35928
127	137	0.30755	-1.81229	2.28334
128	138	-1.83975	0.16697	-1.21232
129	139	0.36030	1.57040	-0.34146
130	140	-1.13719	-0.64145	-0.43408
131	141	-3.23307	0.50648	2.70108
132	142	-0.70505	-3.11676	1.06613
133	143	-1.85083	2.68930	0.53195
134	144	-1.48294	-0.24111	-0.21754
135	145	0.30205	-0.17531	1.33079
136	146	-2.24678	-1.54570	0.72403
137	147	1.30075	-2.41837	1.02230
138	148	0.49180	-1.67039	0.46132
139	149	-2.40335	-0.18097	0.78394
140	150	0.32195	-2.09942	-1.53385
141	151	0.30692	0.09913	0.03665
142	152	0.86516	-3.05423	-0.21888
143	153	-2.83755	-0.43317	1.55580
144	154	-3.63397	-1.06269	1.89820
145	156	-0.35715	-2.37406	-0.49826
146	157	-1.46610	1.24704	0.65623
147	158	-1.54668	-0.70565	0.09198
148	159	0.13097	0.11565	1.34825
149	161	2.55583	-1.19212	-1.30525
150	162	-0.52926	-0.99222	0.75938
151	163	1.04720	2.17573	1.25483
152	164	-1.09620	-1.30059	0.34310
153	165	0.42759	-2.11228	-2.52734
154	166	1.52332	-0.69981	-0.17494
155	170	-0.33774	0.68391	0.65029
156	171	2.97565	1.40943	-0.39731
157	172	1.32496	0.88209	-0.12347

158	173	1.97840	-1.24273	2.10528
159	174	1.49878	0.52727	0.19233
160	175	2.46672	1.27836	1.60795
161	176	0.62406	-0.45984	0.49615
162	178	1.99203	1.97426	0.34649
163	179	1.95250	1.94103	1.24063
164	180	1.84484	1.83480	-0.18942
165	181	1.15960	1.93507	-1.51474
166	195	-0.50111	-1.28230	-1.47232
167	199	-1.29309	1.09048	1.56302
168	200	0.36169	0.87916	0.90684
169	202	-2.18580	0.18818	0.76318
170	203	-1.03029	1.64937	1.49648
171	204	-2.44536	-0.58260	1.41748
172	205	-2.45253	0.06224	2.09354
173	206	0.21061	1.18374	-0.76411
174	209	1.65684	2.94596	3.23152
175	210	-0.44389	0.83603	0.96155
176	211	-0.78190	1.97254	1.00472
177	212	-1.30063	1.16413	1.04993
178	214	-1.12042	1.48590	-0.03106
179	215	3.07156	1.42428	-1.20779
180	217	4.29597	1.09524	3.27720
181	218	0.29875	1.19189	-1.30893
182	219	1.47461	0.98527	2.74121
183	220	0.07887	1.71409	0.36874
184	221	1.11319	0.01522	0.63164
185	223	2.86003	1.63713	3.95811
186	224	0.93531	-0.46550	0.85637
187	225	1.05517	3.21065	0.42212
188	226	0.62648	0.05109	-0.77240
189	227	1.67446	2.76270	0.74911
190	230	2.20324	0.60541	-1.72303
191	231	3.21194	0.93500	0.70564
192	232	0.38770	0.35481	0.54000
193	233	4.80587	0.35294	1.22525
194	234	1.35449	0.85455	-0.87283
195	235	3.57927	0.94273	1.36997
196	236	0.06611	1.24918	-1.05652
197	237	1.73878	2.94638	0.31857
198	238	1.35728	0.20904	0.38400
199	239	2.03270	1.96876	0.16870
200	241	-0.72351	0.84359	-0.94253
201	242	1.75856	0.74067	1.77236
202	243	2.34397	-0.03718	0.38770
203	244	1.48760	0.78796	-0.27199
204	245	3.10430	1.99292	-2.08330
205	246	2.40238	1.36439	-1.88689
206	247	2.11499	3.15399	2.45472
207	248	1.78441	0.13133	0.12208
208	249	3.34583	-0.19277	-0.22249
209	250	1.28660	0.80157	-4.29153
210	251	4.50321	1.41818	-2.61864
211	252	1.68464	-0.00963	-1.73520

212	253	3.02172	2.24086	-0.63829
213	254	-1.07662	0.28253	-0.65489
214	255	0.58115	2.88254	-1.17163
215	256	1.59067	-0.87303	-2.74905
216	259	3.06708	1.07253	0.89160
217	260	-1.26196	-4.88481	-2.05735
218	261	2.95686	1.88476	-0.88340
219	262	1.29107	-1.49891	-1.10909
220	263	2.20474	-0.18186	-0.56675
221	264	1.71370	0.18642	-1.76403
222	265	-0.47488	3.04911	2.77909
223	266	1.97686	-0.13135	-0.49338

APPENDIX C. Average 1958 seedling density (seedlings/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	0	0	0	145	0	0	0	0
2	1054	0	0	0	0	0	0	989
3	441	0	0	0	0	0	0	583
4	0	0	0	0	0	0	0	1652
5	59	0	0	0	707	0	0	0
6	123	0	0	0	0	0	0	0
7	338	0	0	0	0	0	0	1795
8	11815	0	0	0	0	0	0	0
9	166	0	0	0	0	0	0	0
10	293	0	0	0	0	0	0	81
11	163	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	19290
14	351	0	0	0	0	0	0	60
16	1054	0	0	0	0	0	0	0
17	875	0	0	0	0	0	0	0
18	449	0	0	0	0	0	0	1054
19	2143	0	0	0	0	0	0	6504
20	169	0	0	0	0	0	0	0
21	68	0	0	0	0	0	0	413
22	95	0	0	0	0	0	0	219
23	0	0	0	0	0	0	0	240
24	0	0	0	0	0	0	0	503
25	247	0	0	73	0	0	0	0
26	4217	0	0	0	0	0	0	194
28	126	0	0	0	0	0	91	73
29	31	0	0	0	0	0	0	84
30	30	0	0	0	0	0	0	22
31	625	0	0	0	2954	0	0	0
32	141	0	0	0	0	0	0	135
33	1958	0	0	0	0	0	0	2954
34	5569	0	0	0	0	0	0	1054
35	326	0	0	0	1652	0	0	875
36	875	0	0	0	66	0	0	184
37	304	0	0	0	0	0	0	326
38	0	0	0	264	0	0	0	397
39	8573	0	0	0	0	0	0	541
40	32	0	0	0	31	0	0	0
41	135	0	0	29	0	0	0	86
42	110	0	0	46	0	0	0	240
43	219	0	0	0	0	0	0	0
44	106	0	0	0	0	0	0	0
45	9612	0	0	0	413	0	0	0
46	48	0	0	0	0	0	0	73
47	3810	0	0	0	0	0	0	0
48	0	0	0	31	1313	0	0	169
49	364	0	0	0	0	0	0	0
50	4217	0	0	0	0	0	0	2954
51	1958	0	0	0	0	0	0	541
52	326	0	0	0	0	0	0	730
53	10000	0	0	0	0	0	0	0

54	79	0	0	0	0	0	730	0
56	364	0	0	0	0	0	0	0
57	2954	0	0	0	0	17313	0	0
58	0	0	0	326	135	0	0	219
59	0	0	0	0	0	0	0	29
60	0	0	0	240	135	0	0	42
61	156	0	0	0	0	0	0	37
62	135	0	0	541	31	0	0	0
63	219	0	0	326	200	0	0	0
64	135	0	0	169	0	0	0	156
65	0	0	0	0	103	0	0	55
66	1652	0	0	1652	0	0	0	6504
67	625	0	0	0	0	0	0	0
68	1652	0	0	0	0	0	0	0
69	31	413	0	9	0	0	0	0
71	4217	0	0	1054	0	0	0	413
72	174	0	0	0	0	0	0	240
73	541	0	0	0	7	0	0	39
74	126	0	0	0	0	0	0	0
75	541	0	0	0	0	0	0	0
76	164	0	0	0	18	0	0	0
77	103	0	0	0	0	0	0	0
78	36	0	0	0	0	0	0	46
79	19	0	0	0	0	0	0	264
80	835	0	0	0	0	0	0	0
81	388	0	0	0	0	0	0	0
82	1550	0	0	0	0	0	0	0
83	264	0	0	0	0	0	0	0
84	86505	0	0	0	0	0	0	0
85	953	0	0	0	0	0	0	0
86	1054	0	0	0	0	0	0	2954
87	91	0	0	0	0	0	0	219
88	1652	0	0	0	0	0	219	111111
89	4217	0	0	0	0	0	0	1313
90	875	0	0	0	0	0	0	0
91	2500	0	0	0	0	0	0	0
92	0	0	0	0	413	0	1054	0
93	2954	0	0	0	0	0	0	6504
94	5251	0	0	0	0	0	0	0
95	23	0	0	0	17	0	0	135
96	6504	0	0	0	0	0	0	625
97	264	0	0	730	0	0	0	41
98	413	0	0	0	0	0	0	69
101	110	0	0	0	1652	0	0	103
102	130	0	0	0	0	0	0	0
103	163	0	0	0	0	0	0	0
104	12	0	0	0	73	0	0	413
106	0	0	0	0	6	0	0	0
107	1652	0	0	0	0	0	0	1313
108	68	0	0	0	0	0	0	184
109	103	0	0	0	0	0	0	0
110	184	0	0	0	0	0	0	77
111	91	0	0	103	0	0	0	145
113	3810	0	0	0	0	0	0	0

114	14172	0	0	0	0	0	0	0
115	219	0	0	0	0	0	0	110
116	0	0	0	0	9	0	0	81
117	469	0	0	0	0	0	0	469
118	625	0	0	0	0	0	0	413
119	156	0	0	0	0	0	0	55
120	34	0	0	0	0	0	0	413
121	26015	0	0	0	0	0	0	26015
122	26015	0	0	0	0	0	0	1313
123	111111	0	0	0	0	0	0	111111
124	0	0	0	0	0	0	0	1173
125	283	0	0	0	0	0	0	1652
126	135	1054	0	0	0	0	0	2954
127	21	0	0	23	0	0	0	9
128	730	184	0	0	17	0	0	91
130	0	60	0	0	5	0	0	0
131	0	27	0	117	0	0	0	117
132	0	156	0	0	0	0	0	68
133	88	0	0	0	0	0	0	42
134	0	0	0	11	0	0	0	149
135	18	19	0	0	81	0	0	20
136	0	6504	0	0	73	0	0	19
137	0	0	0	0	81	0	0	0
138	129	0	0	0	0	0	0	264
139	0	0	0	0	63	0	0	145
140	304	0	0	0	0	0	0	264
141	0	0	0	0	0	0	0	69
142	0	541	0	0	0	0	156	42
143	11	81	0	0	7	0	0	11
144	0	0	0	0	81	0	0	0
145	0	0	0	0	145	0	0	0
146	0	0	0	0	26	0	0	91
147	0	0	0	0	57	0	0	97
148	0	0	0	0	49	0	0	0
149	0	0	0	0	56	0	0	0
150	0	0	0	0	20	0	0	0
151	0	1313	0	0	29	0	0	0
152	0	0	0	0	94	0	0	0
153	56689	0	0	0	0	0	0	0
154	110	0	0	0	0	0	0	38
156	0	0	0	0	0	0	0	14
157	0	541	0	0	0	0	2356	0
158	156	9	0	0	2954	0	0	0
159	0	10	0	0	0	0	0	0
161	0	6	0	0	1652	0	0	5
162	0	0	0	0	0	0	0	28
163	0	15	0	0	219	0	0	36
164	0	730	0	0	240	0	0	81
165	0	0	0	0	38	0	0	0
166	0	0	0	0	9	0	0	0
170	0	0	0	0	387	0	0	0
171	0	18	0	0	174	0	0	0
172	0	4	0	12	16	0	0	66
173	0	4	0	0	17	0	0	0

174	0	0	0	0	39	0	0	219
175	0	135	0	0	6	0	0	7
176	0	0	0	0	22	0	0	0
178	0	0	0	0	22	0	0	0
179	0	46	0	0	50	0	0	0
180	0	0	0	0	53	0	0	0
181	0	0	0	0	6	0	0	0
195	0	264	0	0	53	0	0	0
199	0	0	0	0	57	0	0	0
200	0	0	0	0	75	0	0	0
202	0	0	0	0	13	0	0	0
203	0	135	0	0	18	0	0	0
204	0	0	0	0	4	0	0	0
205	0	0	0	0	2	0	0	0
206	0	0	0	0	63	0	0	0
209	0	0	0	0	6	0	0	24
210	0	2954	0	0	240	0	0	0
211	0	42	0	413	33	0	0	0
212	0	0	0	0	35	0	0	73
214	0	4	0	112	0	0	0	0
215	0	0	0	219	135	0	0	0
217	0	17	0	0	164	0	0	0
218	0	0	0	0	27	0	0	0
219	0	0	0	0	30	0	0	0
220	0	219	0	0	23	0	0	0
221	0	0	0	0	68	0	0	0
223	0	0	0	0	126	0	0	0
224	0	0	0	0	169	0	0	0
225	0	0	0	0	219	0	0	0
226	0	39	0	0	60	0	0	0
227	0	66	0	13	6	0	0	0
230	0	0	0	0	678	0	0	0
231	0	0	0	0	110	0	0	0
232	0	0	0	0	503	0	0	0
233	0	0	0	0	66	0	0	0
234	0	0	0	24	5	0	0	27
235	0	0	0	0	2143	0	0	0
236	0	0	0	0	1173	0	0	0
237	0	0	0	0	4	0	0	0
238	0	0	0	0	3	0	0	0
239	0	0	66	0	8	0	0	0
241	0	0	0	0	0	0	0	44
242	0	0	0	0	81	0	0	0
243	0	0	0	0	13	0	0	15
244	0	23	0	0	35	0	0	326
245	0	11	0	0	13	0	0	0
246	0	10	0	0	4	0	0	0
247	0	0	0	0	2	0	0	0
248	0	81	0	0	58	0	0	0
249	0	0	0	0	117	0	0	0
250	0	31	0	0	30	0	0	0
251	0	0	0	0	10	0	0	0
252	0	0	0	0	40	0	0	0
253	0	0	0	0	14	0	0	0

254	0	0	541	0	58	0	0	0
255	0	0	0	0	8	0	0	0
256	0	0	0	0	7	0	0	0
259	0	0	0	0	5	0	0	0
260	0	0	0	0	60	0	0	0
261	0	0	0	0	8	0	0	0
262	0	0	0	0	15	0	0	0
263	0	0	0	0	35	0	0	0
264	0	0	0	0	25	0	0	0
265	0	0	0	0	28	0	0	0
266	0	17	0	0	46	0	0	0

APPENDIX D. Average 1991 seedling density (seedlings/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	583	0	0	0	0	0	0	1068
2	7182	0	0	0	0	0	0	1352
3	26015	0	0	0	0	0	0	8900
4	2500	0	0	0	0	0	0	0
5	126	0	0	0	0	0	0	0
6	126	0	0	0	114	0	0	0
7	1413	0	0	0	0	0	0	0
8	97656	0	0	0	0	0	0	31888
9	2184	0	0	0	0	0	0	0
10	14172	0	0	0	0	0	0	0
11	27778	0	0	0	0	0	0	0
13	2713	0	0	0	0	0	0	0
14	1858	0	0	0	0	0	0	11815
16	22957	0	0	0	0	0	0	0
17	4565	0	0	0	0	0	0	0
18	1157	0	0	0	0	0	0	0
19	1958	0	0	0	0	0	0	0
20	521	0	0	0	0	0	0	201
21	90	0	0	0	0	0	0	42
22	551	0	0	0	0	0	0	0
23	351	0	0	0	0	0	0	0
24	738	0	0	0	0	0	0	351
25	150	0	0	0	0	0	0	99
26	3810	0	0	0	0	0	0	0
28	19290	0	0	0	0	0	0	0
29	40000	0	0	0	0	0	0	0
30	521	0	0	0	2356	0	0	449
31	314	0	0	0	0	0	0	79
32	941	0	0	0	0	0	0	175
33	184	0	0	0	0	0	0	1413
34	14872	0	0	0	0	0	0	56689
35	4109	0	0	0	0	0	0	0
36	118	0	0	0	0	0	0	0
37	798	0	0	0	0	0	0	0
38	2066	0	0	0	0	0	0	0
39	8900	0	0	1352	0	0	0	0
40	96	0	0	0	0	0	0	151
41	2551	0	0	388	0	0	0	1096
42	1352	0	0	0	0	0	0	0
43	2551	0	0	0	0	0	0	13521
44	835	0	0	0	0	0	0	0
45	2403	0	0	0	15625	0	0	285
46	189	0	0	0	0	0	0	161
47	6719	0	0	0	0	0	0	11815
48	70	0	0	0	875	0	237	0
49	453	0	0	0	0	0	0	0
50	1372	0	0	0	0	0	0	0
51	34294	0	0	0	0	0	0	0
52	685	0	0	0	0	0	0	0
53	5102	0	0	0	0	0	0	0

54	0	0	0	0	0	0	835	0
56	625	0	0	0	0	0	0	0
57	3228	0	0	0	0	0	0	0
58	918	164	0	0	124	0	0	168
59	2451	0	0	0	0	0	0	105
60	208	0	0	319	210	0	0	0
61	11	0	0	0	29	0	0	0
62	66	0	0	578	0	0	0	0
63	4328	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	108
65	237	166	0	0	0	0	0	0
66	31888	0	0	0	0	0	0	2891
67	438	0	0	79	0	0	0	0
68	2029	0	0	0	0	0	0	0
69	0	47	0	0	0	0	0	61
71	1014	0	0	0	0	0	0	1736
72	170	0	0	0	0	0	0	81
73	29	26	0	0	9	0	0	0
74	240	0	0	0	572	0	0	0
75	84	0	0	0	0	0	0	0
76	367	0	0	0	2066	0	0	0
77	119	0	0	0	1027	0	0	0
78	351	0	0	0	0	0	0	0
79	184	0	0	0	0	0	0	30
80	738	0	0	0	0	0	0	0
81	1014	0	0	0	0	0	0	0
82	13521	0	0	0	0	0	0	0
83	326	0	0	0	0	0	0	0
84	24414	0	0	0	0	0	0	0
85	1795	0	0	0	0	0	0	0
86	3303	0	0	0	0	0	0	0
87	1111	0	0	0	0	0	738	0
88	12913	0	0	0	0	0	0	22957
89	6719	0	0	0	0	0	0	0
90	5251	0	0	0	0	0	0	0
91	8900	0	0	0	0	0	0	0
92	118	0	0	0	164	0	0	41
93	7695	0	0	0	0	0	0	0
94	18262	0	0	0	0	0	0	0
95	34	0	0	0	0	0	0	172
96	4444	0	0	0	0	0	0	3906
97	219	0	0	0	0	0	0	0
98	29	0	0	0	0	0	0	78
101	112	0	0	0	0	0	0	0
102	155	0	0	0	0	0	0	0
103	589	0	0	0	0	0	0	0
104	40	0	0	0	35	0	0	0
106	9	0	0	0	11	0	0	8
107	2551	0	0	0	0	0	0	0
108	2225	0	0	0	0	0	0	19290
109	420	0	0	0	0	0	0	0
110	989	0	0	0	0	0	0	0
111	438	0	0	0	0	0	0	71
113	1082	0	0	0	0	0	0	3303

114	4959	0	0	0	0	0	0	0
115	4217	0	0	0	0	0	0	0
116	44	0	0	0	89	0	0	48
117	416	0	0	0	0	0	0	657
118	2891	0	0	0	0	0	0	1993
119	359	0	0	0	0	0	0	340
120	1736	0	0	0	203	0	0	0
121	18262	0	0	0	0	0	0	0
122	2603	0	0	0	0	0	0	2066
123	5102	0	0	0	0	0	0	0
124	2356	0	0	0	0	0	0	13521
125	301	0	0	0	0	0	0	0
126	526	0	0	0	0	0	0	0
127	61	0	0	0	0	0	0	244
128	4328	0	0	0	0	0	0	178
130	149	0	0	0	19	0	0	29
131	0	0	0	0	0	0	0	1294
132	0	0	0	0	0	0	0	87
133	212	0	0	0	0	0	0	0
134	86	29	0	0	0	0	0	70
135	0	32	0	0	0	0	0	110
136	20	53	0	0	208	0	0	700
137	0	0	0	0	196	0	0	46
138	150	0	0	0	0	0	0	72
139	0	0	0	0	0	0	0	131
140	1240	0	0	0	0	0	0	0
141	0	0	0	0	0	0	0	319
142	0	0	0	0	0	0	0	453
143	0	25	0	0	0	0	0	5
144	0	0	0	0	38	0	0	20
145	0	0	0	0	142	0	0	473
146	0	0	0	0	60	0	0	37
147	0	0	0	0	0	0	0	43
148	19290	0	0	0	44	0	0	1173
149	0	0	0	0	45	0	0	0
150	0	10	0	4	3	0	0	0
151	338	192	0	0	0	0	0	0
152	240	0	0	0	149	0	0	607
153	13521	0	0	0	0	0	0	27778
154	283	0	0	0	0	0	0	0
156	123	0	0	0	747	0	0	173
157	613	0	0	0	0	0	2451	0
158	0	51	0	0	657	0	0	0
159	0	13	0	0	0	0	0	0
161	0	20	25	0	0	0	0	0
162	0	0	0	0	0	0	0	340
163	6299	0	0	0	12	0	0	124
164	0	0	0	0	144	0	0	75
165	0	2829	0	0	48	0	0	0
166	0	0	0	0	21	0	0	0
170	0	0	0	0	19	0	0	157
171	0	0	0	0	140	0	0	0
172	0	192	0	28	42	0	0	0
173	0	0	0	0	953	0	0	227

174	0	0	0	0	0	0	0	364
175	0	196	0	0	2311	0	0	50
176	0	0	0	0	46	0	0	0
178	0	0	0	0	66	0	0	0
179	0	47	0	0	61	0	0	0
180	0	0	0	0	60	0	0	0
181	0	0	0	0	7	0	0	0
195	0	0	0	0	29	0	0	0
199	0	0	0	0	37	0	0	0
200	0	0	0	46	147	0	0	0
202	0	0	0	0	46	0	0	0
203	0	0	0	0	22	0	0	0
204	0	5	0	0	17	0	0	0
205	0	2500	0	0	21	0	0	0
206	0	12	0	0	36	0	0	0
209	0	0	0	21	50	0	0	0
210	0	551	0	0	0	0	0	2954
211	0	0	0	289	46	0	0	0
212	0	0	0	15	29	0	0	0
214	0	5102	0	413	249	0	0	0
215	0	131	0	220	109	0	0	0
217	0	19	0	0	235	0	0	0
218	0	0	0	0	26	0	0	0
219	0	56	0	0	531	0	0	0
220	0	0	0	0	43	0	0	0
221	0	29	0	0	38	0	0	0
223	0	0	0	0	56	0	0	0
224	0	62	0	0	254	0	0	0
225	0	0	0	0	74	0	0	0
226	0	8	0	0	25	0	0	0
227	0	48	0	137	12	0	0	0
230	0	0	0	0	546	0	0	0
231	0	0	0	0	56	0	0	0
232	0	0	0	0	150	0	0	0
233	0	0	0	0	18	0	0	0
234	0	0	0	63	12	0	0	44
235	0	0	0	0	678	0	0	0
236	0	2770	0	0	2268	0	0	0
237	0	0	0	0	11	0	0	0
238	0	0	0	0	9	0	0	0
239	0	0	0	0	19	0	0	0
241	0	0	0	0	0	0	0	128
242	0	0	0	0	165	0	0	0
243	0	0	0	0	23	0	0	26
244	0	164	0	0	65	0	0	308
245	0	25	0	0	15	0	0	0
246	0	12	0	0	5	0	0	0
247	0	0	0	0	18	0	0	0
248	0	0	0	0	189	0	0	0
249	0	0	0	0	157	0	0	0
250	0	7	0	0	58	0	0	0
251	0	0	0	0	13	0	0	0
252	0	0	0	0	68	0	0	0
253	0	0	0	0	70	0	0	0

254	0	0	356	0	19	0	0	0
255	0	0	0	0	8	0	0	0
256	0	7	0	0	19	0	0	0
259	0	0	0	0	12	0	0	0
260	0	0	0	0	25	0	0	0
261	0	0	0	0	33	0	0	0
262	0	0	0	0	17	0	0	0
263	0	0	0	0	129	0	0	0
264	0	15	0	0	34	0	0	0
265	0	201	0	0	12	0	0	0
266	0	57	0	0	26	0	0	0

APPENDIX E. Seedling relative density for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	0	0	0	100	0	0	0	0	35	0	0	0	0	0	0	65
2	52	0	0	0	0	0	0	48	84	0	0	0	0	0	0	16
3	43	0	0	0	0	0	0	57	75	0	0	0	0	0	0	25
4	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0
5	8	0	0	0	92	0	0	0	100	0	0	0	0	0	0	0
6	100	0	0	0	0	0	0	0	53	0	0	0	47	0	0	0
7	16	0	0	0	0	0	0	84	100	0	0	0	0	0	0	0
8	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
9	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
10	78	0	0	0	0	0	0	22	100	0	0	0	0	0	0	0
11	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0
14	85	0	0	0	0	0	0	15	14	0	0	0	0	0	0	86
16	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
17	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
18	30	0	0	0	0	0	0	70	100	0	0	0	0	0	0	0
19	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	72	0	0	0	0	0	0	28
21	14	0	0	0	0	0	0	86	68	0	0	0	0	0	0	32
22	30	0	0	0	0	0	0	70	100	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	100	68	0	0	0	0	0	0	32
25	77	0	0	23	0	0	0	0	60	0	0	0	0	0	0	40
26	96	0	0	0	0	0	0	4	100	0	0	0	0	0	0	0
28	43	0	0	0	0	0	31	25	100	0	0	0	0	0	0	0
29	27	0	0	0	0	0	0	73	100	0	0	0	0	0	0	0
30	58	0	0	0	0	0	0	42	16	0	0	0	71	0	0	13
31	17	0	0	0	83	0	0	0	80	0	0	0	0	0	0	20
32	51	0	0	0	0	0	0	49	84	0	0	0	0	0	0	16
33	40	0	0	0	0	0	0	60	11	0	0	0	0	0	0	89
34	84	0	0	0	0	0	0	16	21	0	0	0	0	0	0	79
35	11	0	0	0	58	0	0	31	100	0	0	0	0	0	0	0
36	78	0	0	0	6	0	0	16	100	0	0	0	0	0	0	0
37	48	0	0	0	0	0	0	52	100	0	0	0	0	0	0	0
38	0	0	0	40	0	0	0	60	100	0	0	0	0	0	0	0
39	94	0	0	0	0	0	0	6	87	0	0	13	0	0	0	0
40	50	0	0	0	50	0	0	0	39	0	0	0	0	0	0	61
41	54	0	0	12	0	0	0	34	63	0	0	10	0	0	0	27
42	28	0	0	12	0	0	0	61	100	0	0	0	0	0	0	0
43	100	0	0	0	0	0	0	0	16	0	0	0	0	0	0	84
44	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
45	96	0	0	0	4	0	0	0	13	0	0	0	85	0	0	2
46	40	0	0	0	0	0	0	60	54	0	0	0	0	0	0	46
47	100	0	0	0	0	0	0	0	36	0	0	0	0	0	0	64
48	0	0	0	2	87	0	0	11	6	0	0	0	74	0	20	0
49	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
50	59	0	0	0	0	0	0	41	100	0	0	0	0	0	0	0

51	78	0	0	0	0	0	0	22	100	0	0	0	0	0	0	0
52	31	0	0	0	0	0	0	69	100	0	0	0	0	0	0	0
53	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
54	10	0	0	0	0	0	90	0	0	0	0	0	0	0	100	0
56	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
57	15	0	0	0	0	85	0	0	100	0	0	0	0	0	0	0
58	0	0	0	48	20	0	0	32	67	12	0	0	9	0	0	12
59	0	0	0	0	0	0	0	100	96	0	0	0	0	0	0	4
60	0	0	0	58	32	0	0	10	28	0	0	43	29	0	0	0
61	81	0	0	0	0	0	0	19	27	0	0	0	73	0	0	0
62	19	0	0	76	4	0	0	0	10	0	0	90	0	0	0	0
63	29	0	0	44	27	0	0	0	100	0	0	0	0	0	0	0
64	29	0	0	37	0	0	0	34	0	0	0	0	0	0	0	100
65	0	0	0	0	65	0	0	35	59	41	0	0	0	0	0	0
66	17	0	0	17	0	0	0	66	92	0	0	0	0	0	0	8
67	100	0	0	0	0	0	0	0	85	0	0	15	0	0	0	0
68	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
69	7	91	0	2	0	0	0	0	0	43	0	0	0	0	0	57
71	74	0	0	19	0	0	0	7	37	0	0	0	0	0	0	63
72	42	0	0	0	0	0	0	58	68	0	0	0	0	0	0	32
73	92	0	0	0	1	0	0	7	45	41	0	0	14	0	0	0
74	100	0	0	0	0	0	0	0	30	0	0	0	70	0	0	0
75	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
76	90	0	0	0	10	0	0	0	15	0	0	0	85	0	0	0
77	100	0	0	0	0	0	0	0	10	0	0	0	90	0	0	0
78	44	0	0	0	0	0	0	56	100	0	0	0	0	0	0	0
79	7	0	0	0	0	0	0	93	86	0	0	0	0	0	0	14
80	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
81	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
82	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
83	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
84	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
85	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
86	26	0	0	0	0	0	0	74	100	0	0	0	0	0	0	0
87	29	0	0	0	0	0	0	71	60	0	0	0	0	0	40	0
88	1	0	0	0	0	0	0	98	36	0	0	0	0	0	0	64
89	76	0	0	0	0	0	0	24	100	0	0	0	0	0	0	0
90	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
91	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
92	0	0	0	0	28	0	72	0	36	0	0	0	51	0	0	13
93	31	0	0	0	0	0	0	69	100	0	0	0	0	0	0	0
94	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
95	13	0	0	0	10	0	0	77	16	0	0	0	0	0	0	84
96	91	0	0	0	0	0	0	9	53	0	0	0	0	0	0	47
97	25	0	0	71	0	0	0	4	100	0	0	0	0	0	0	0
98	86	0	0	0	0	0	0	14	27	0	0	0	0	0	0	73
101	6	0	0	0	89	0	0	6	100	0	0	0	0	0	0	0
102	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
103	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
104	2	0	0	0	15	0	0	83	53	0	0	0	47	0	0	0
106	0	0	0	0	100	0	0	0	33	0	0	0	39	0	0	28
107	56	0	0	0	0	0	0	44	100	0	0	0	0	0	0	0
108	27	0	0	0	0	0	0	73	10	0	0	0	0	0	0	90
109	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0

110	70	0	0	0	0	0	0	30	100	0	0	0	0	0	0	0
111	27	0	0	30	0	0	0	43	86	0	0	0	0	0	0	14
113	100	0	0	0	0	0	0	0	25	0	0	0	0	0	0	75
114	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
115	67	0	0	0	0	0	0	33	100	0	0	0	0	0	0	0
116	0	0	0	0	10	0	0	90	24	0	0	0	49	0	0	27
117	50	0	0	0	0	0	0	50	39	0	0	0	0	0	0	61
118	60	0	0	0	0	0	0	40	59	0	0	0	0	0	0	41
119	74	0	0	0	0	0	0	26	51	0	0	0	0	0	0	49
120	8	0	0	0	0	0	0	92	90	0	0	0	10	0	0	0
121	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
122	95	0	0	0	0	0	0	5	56	0	0	0	0	0	0	44
123	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
124	0	0	0	0	0	0	0	100	15	0	0	0	0	0	0	85
125	15	0	0	0	0	0	0	85	100	0	0	0	0	0	0	0
126	3	25	0	0	0	0	0	71	100	0	0	0	0	0	0	0
127	40	0	0	43	0	0	0	17	20	0	0	0	0	0	0	80
128	71	18	0	0	2	0	0	9	96	0	0	0	0	0	0	4
130	0	92	0	0	8	0	0	0	76	0	0	0	10	0	0	15
131	0	11	0	45	0	0	0	45	0	0	0	0	0	0	0	100
132	0	70	0	0	0	0	0	30	0	0	0	0	0	0	0	100
133	68	0	0	0	0	0	0	32	100	0	0	0	0	0	0	0
134	0	0	0	7	0	0	0	93	47	16	0	0	0	0	0	38
135	13	14	0	0	59	0	0	14	0	22	0	0	0	0	0	78
136	0	99	0	0	1	0	0	0	2	5	0	0	21	0	0	71
137	0	0	0	0	100	0	0	0	0	0	0	0	81	0	0	19
138	33	0	0	0	0	0	0	67	68	0	0	0	0	0	0	32
139	0	0	0	0	30	0	0	70	0	0	0	0	0	0	0	100
140	54	0	0	0	0	0	0	46	100	0	0	0	0	0	0	0
141	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
142	0	73	0	0	0	0	21	6	0	0	0	0	0	0	0	100
143	10	74	0	0	7	0	0	10	0	83	0	0	0	0	0	17
144	0	0	0	0	100	0	0	0	0	0	0	0	66	0	0	34
145	0	0	0	0	100	0	0	0	0	0	0	0	23	0	0	77
146	0	0	0	0	22	0	0	78	0	0	0	0	62	0	0	38
147	0	0	0	0	37	0	0	63	0	0	0	0	0	0	0	100
148	0	0	0	0	100	0	0	0	94	0	0	0	0	0	0	6
149	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
150	0	0	0	0	100	0	0	0	0	61	0	22	17	0	0	0
151	0	98	0	0	2	0	0	0	64	36	0	0	0	0	0	0
152	0	0	0	0	100	0	0	0	24	0	0	0	15	0	0	61
153	100	0	0	0	0	0	0	0	33	0	0	0	0	0	0	67
154	74	0	0	0	0	0	0	26	100	0	0	0	0	0	0	0
156	0	0	0	0	0	0	0	100	12	0	0	0	72	0	0	17
157	0	19	0	0	0	0	81	0	20	0	0	0	0	0	80	0
158	5	0	0	0	95	0	0	0	0	7	0	0	93	0	0	0
159	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0
161	0	0	0	0	99	0	0	0	0	44	56	0	0	0	0	0
162	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
163	0	6	0	0	81	0	0	13	98	0	0	0	0	0	0	2
164	0	69	0	0	23	0	0	8	0	0	0	0	66	0	0	34
165	0	0	0	0	100	0	0	0	0	98	0	0	2	0	0	0
166	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
170	0	0	0	0	100	0	0	0	0	0	0	0	11	0	0	89

171	0	10	0	0	90	0	0	0	0	0	0	0	100	0	0	0
172	0	4	0	12	16	0	0	67	0	73	0	11	16	0	0	0
173	0	19	0	0	81	0	0	0	0	0	0	0	81	0	0	19
174	0	0	0	0	15	0	0	85	0	0	0	0	0	0	0	100
175	0	91	0	0	4	0	0	5	0	8	0	0	90	0	0	2
176	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
178	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
179	0	48	0	0	52	0	0	0	0	43	0	0	57	0	0	0
180	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
181	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
195	0	83	0	0	17	0	0	0	0	0	0	0	100	0	0	0
199	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
200	0	0	0	0	100	0	0	0	0	0	0	24	76	0	0	0
202	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
203	0	88	0	0	12	0	0	0	0	0	0	0	100	0	0	0
204	0	0	0	0	100	0	0	0	0	21	0	0	79	0	0	0
205	0	0	0	0	100	0	0	0	0	99	0	0	1	0	0	0
206	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
209	0	0	0	0	19	0	0	81	0	0	0	30	70	0	0	0
210	0	92	0	0	8	0	0	0	0	16	0	0	0	0	0	84
211	0	9	0	85	7	0	0	0	0	0	0	86	14	0	0	0
212	0	0	0	0	32	0	0	68	0	0	0	33	67	0	0	0
214	0	3	0	97	0	0	0	0	0	89	0	7	4	0	0	0
215	0	0	0	62	38	0	0	0	0	28	0	48	24	0	0	0
217	0	9	0	0	91	0	0	0	0	8	0	0	92	0	0	0
218	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
219	0	0	0	0	100	0	0	0	0	10	0	0	90	0	0	0
220	0	91	0	0	9	0	0	0	0	0	0	0	100	0	0	0
221	0	0	0	0	100	0	0	0	0	43	0	0	57	0	0	0
223	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
224	0	0	0	0	100	0	0	0	0	20	0	0	80	0	0	0
225	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
226	0	39	0	0	61	0	0	0	0	25	0	0	75	0	0	0
227	0	78	0	15	7	0	0	0	0	24	0	70	6	0	0	0
230	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
231	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
232	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
233	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
234	0	0	0	43	9	0	0	48	0	0	0	53	10	0	0	37
235	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
236	0	0	0	0	100	0	0	0	0	55	0	0	45	0	0	0
237	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
238	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
239	0	0	90	0	10	0	0	0	0	0	0	0	100	0	0	0
241	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
242	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
243	0	0	0	0	46	0	0	54	0	0	0	0	46	0	0	54
244	0	6	0	0	9	0	0	85	0	31	0	0	12	0	0	57
245	0	44	0	0	56	0	0	0	0	63	0	0	37	0	0	0
246	0	70	0	0	30	0	0	0	0	69	0	0	31	0	0	0
247	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
248	0	58	0	0	42	0	0	0	0	0	0	0	100	0	0	0
249	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
250	0	51	0	0	49	0	0	0	0	11	0	0	89	0	0	0

251	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
252	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
253	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
254	0	0	90	0	10	0	0	0	0	0	95	0	5	0	0	0
255	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
256	0	0	0	0	100	0	0	0	0	26	0	0	74	0	0	0
259	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
260	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
261	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
262	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
263	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
264	0	0	0	0	100	0	0	0	0	32	0	0	68	0	0	0
265	0	0	0	0	100	0	0	0	0	94	0	0	6	0	0	0
266	0	27	0	0	73	0	0	0	0	69	0	0	31	0	0	0

APPENDIX F. Seedling relative frequency for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	0	0	0	100	0	0	0	0	75	0	0	0	0	0	0	25
2	25	0	0	0	0	0	0	75	50	0	0	0	0	0	0	50
3	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
4	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0
5	75	0	0	0	25	0	0	0	100	0	0	0	0	0	0	0
6	100	0	0	0	0	0	0	0	75	0	0	0	25	0	0	0
7	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
8	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
9	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
10	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
11	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
13	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
14	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
16	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
17	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
18	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
19	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
20	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
21	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
22	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
23	0	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	100	75	0	0	0	0	0	0	25
25	75	0	0	25	0	0	0	0	75	0	0	0	0	0	0	25
26	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
28	50	0	0	0	0	0	25	25	100	0	0	0	0	0	0	0
29	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
30	50	0	0	0	0	0	0	50	50	0	0	0	25	0	0	25
31	75	0	0	0	25	0	0	0	75	0	0	0	0	0	0	25
32	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
33	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
34	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
35	25	0	0	0	25	0	0	50	100	0	0	0	0	0	0	0
36	50	0	0	0	25	0	0	25	100	0	0	0	0	0	0	0
37	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
38	0	0	0	25	0	0	0	75	100	0	0	0	0	0	0	0
39	50	0	0	0	0	0	0	50	50	0	0	50	0	0	0	0
40	75	0	0	0	25	0	0	0	75	0	0	0	0	0	0	25
41	25	0	0	25	0	0	0	50	50	0	0	25	0	0	0	25
42	50	0	0	25	0	0	0	25	100	0	0	0	0	0	0	0
43	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
44	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
45	75	0	0	0	25	0	0	0	50	0	0	0	25	0	0	25
46	50	0	0	0	0	0	0	50	50	0	0	0	0	0	0	50
47	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
48	0	0	0	25	25	0	0	50	50	0	0	0	25	0	25	0
49	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
50	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
51	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0

52	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
53	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
54	75	0	0	0	0	0	25	0	0	0	0	0	0	0	100	0
56	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
57	50	0	0	0	0	50	0	0	100	0	0	0	0	0	0	0
58	0	0	0	25	25	0	0	50	25	25	0	0	25	0	0	25
59	0	0	0	0	0	0	0	100	25	0	0	0	0	0	0	75
60	0	0	0	50	25	0	0	25	50	0	0	25	25	0	0	0
61	25	0	0	0	0	0	0	75	75	0	0	0	25	0	0	0
62	50	0	0	25	25	0	0	0	75	0	0	25	0	0	0	0
63	25	0	0	25	50	0	0	0	100	0	0	0	0	0	0	0
64	25	0	0	50	0	0	0	25	0	0	0	0	0	0	0	100
65	0	0	0	0	25	0	0	75	75	25	0	0	0	0	0	0
66	50	0	0	25	0	0	0	25	75	0	0	0	0	0	0	25
67	100	0	0	0	0	0	0	0	75	0	0	25	0	0	0	0
68	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
69	50	25	0	25	0	0	0	0	0	25	0	0	0	0	0	75
71	50	0	0	25	0	0	0	25	75	0	0	0	0	0	0	25
72	75	0	0	0	0	0	0	25	50	0	0	0	0	0	0	50
73	25	0	0	0	50	0	0	25	50	25	0	0	25	0	0	0
74	100	0	0	0	0	0	0	0	75	0	0	0	25	0	0	0
75	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
76	75	0	0	0	25	0	0	0	75	0	0	0	25	0	0	0
77	100	0	0	0	0	0	0	0	75	0	0	0	25	0	0	0
78	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
79	75	0	0	0	0	0	0	25	50	0	0	0	0	0	0	50
80	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
81	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
82	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
83	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
84	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
85	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
86	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
87	25	0	0	0	0	0	0	75	25	0	0	0	0	0	75	0
88	25	0	0	0	0	0	25	50	50	0	0	0	0	0	0	50
89	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
90	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
91	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
92	0	0	0	0	25	0	75	0	50	0	0	0	25	0	0	25
93	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
94	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
95	25	0	0	0	50	0	0	25	50	0	0	0	0	0	0	50
96	25	0	0	0	0	0	0	75	50	0	0	0	0	0	0	50
97	25	0	0	25	0	0	0	50	100	0	0	0	0	0	0	0
98	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
101	50	0	0	0	25	0	0	25	100	0	0	0	0	0	0	0
102	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
103	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
104	25	0	0	0	50	0	0	25	75	0	0	0	25	0	0	0
106	0	0	0	0	100	0	0	0	50	0	0	0	25	0	0	25
107	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
108	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
109	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
110	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0

111	25	0	0	25	0	0	0	50	75	0	0	0	0	0	0	25
113	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
114	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
115	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
116	0	0	0	0	75	0	0	25	50	0	0	0	25	0	0	25
117	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
118	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
119	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
120	25	0	0	0	0	0	0	75	75	0	0	0	25	0	0	0
121	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
122	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
123	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
124	0	0	0	0	0	0	0	100	50	0	0	0	0	0	0	50
125	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
126	25	25	0	0	0	0	0	50	100	0	0	0	0	0	0	0
127	50	0	0	25	0	0	0	25	75	0	0	0	0	0	0	25
128	25	25	0	0	25	0	0	25	25	0	0	0	0	0	0	75
130	0	25	0	0	75	0	0	0	25	0	0	0	25	0	0	50
131	0	25	0	25	0	0	0	50	0	0	0	0	0	0	0	100
132	0	25	0	0	0	0	0	75	0	0	0	0	0	0	0	100
133	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
134	0	0	0	25	0	0	0	75	25	50	0	0	0	0	0	25
135	25	25	0	0	25	0	0	25	0	25	0	0	0	0	0	75
136	0	25	0	0	50	0	0	25	25	25	0	0	25	0	0	25
137	0	0	0	0	100	0	0	0	0	0	0	0	25	0	0	75
138	75	0	0	0	0	0	0	25	50	0	0	0	0	0	0	50
139	0	0	0	0	50	0	0	50	0	0	0	0	0	0	0	100
140	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
141	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
142	0	25	0	0	0	0	25	50	0	0	0	0	0	0	0	100
143	25	25	0	0	25	0	0	25	0	25	0	0	0	0	0	75
144	0	0	0	0	100	0	0	0	0	0	0	0	75	0	0	25
145	0	0	0	0	100	0	0	0	0	0	0	0	50	0	0	50
146	0	0	0	0	50	0	0	50	0	0	0	0	50	0	0	50
147	0	0	0	0	50	0	0	50	0	0	0	0	0	0	0	100
148	0	0	0	0	100	0	0	0	25	0	0	0	50	0	0	25
149	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
150	0	0	0	0	100	0	0	0	0	25	0	25	50	0	0	0
151	0	75	0	0	25	0	0	0	25	75	0	0	0	0	0	0
152	0	0	0	0	100	0	0	0	50	0	0	0	25	0	0	25
153	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
154	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
156	0	0	0	0	0	0	0	100	25	0	0	0	50	0	0	25
157	0	25	0	0	0	0	75	0	50	0	0	0	0	0	50	0
158	25	50	0	0	25	0	0	0	0	50	0	0	50	0	0	0
159	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0
161	0	50	0	0	25	0	0	25	0	50	50	0	0	0	0	0
162	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
163	0	25	0	0	25	0	0	50	25	0	0	0	25	0	0	50
164	0	25	0	0	50	0	0	25	0	0	0	0	25	0	0	75
165	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
166	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
170	0	0	0	0	100	0	0	0	0	0	0	0	75	0	0	25
171	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0

172	0	25	0	25	25	0	0	25	0	25	0	25	50	0	0	0
173	0	25	0	0	75	0	0	0	0	0	0	0	25	0	0	75
174	0	0	0	0	50	0	0	50	0	0	0	0	0	0	0	100
175	0	25	0	0	25	0	0	50	0	25	0	0	50	0	0	25
176	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
178	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
179	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
180	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
181	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
195	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
199	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
200	0	0	0	0	100	0	0	0	0	0	0	25	75	0	0	0
202	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
203	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
204	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
205	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
206	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
209	0	0	0	0	75	0	0	25	0	0	0	25	75	0	0	0
210	0	50	0	0	50	0	0	0	0	75	0	0	0	0	0	25
211	0	25	0	25	50	0	0	0	0	0	0	25	75	0	0	0
212	0	0	0	0	50	0	0	50	0	0	0	50	50	0	0	0
214	0	25	0	75	0	0	0	0	0	25	0	50	25	0	0	0
215	0	0	0	25	75	0	0	0	0	25	0	25	50	0	0	0
217	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
218	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
219	0	0	0	0	100	0	0	0	0	50	0	0	50	0	0	0
220	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
221	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
223	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
224	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
225	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
226	0	25	0	0	75	0	0	0	0	50	0	0	50	0	0	0
227	0	25	0	25	50	0	0	0	0	25	0	25	50	0	0	0
230	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
231	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
232	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
233	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
234	0	0	0	25	25	0	0	50	0	0	0	25	50	0	0	25
235	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
236	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
237	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
238	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
239	0	0	25	0	75	0	0	0	0	0	0	0	100	0	0	0
241	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
242	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
243	0	0	0	0	50	0	0	50	0	0	0	0	50	0	0	50
244	0	25	0	0	50	0	0	25	0	25	0	0	50	0	0	25
245	0	25	0	0	75	0	0	0	0	50	0	0	50	0	0	0
246	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
247	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
248	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
249	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
250	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
251	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0

252	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
253	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
254	0	0	25	0	75	0	0	0	0	0	25	0	75	0	0	0
255	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
256	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
259	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
260	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
261	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
262	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
263	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
264	0	0	0	0	100	0	0	0	0	50	0	0	50	0	0	0
265	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
266	0	50	0	0	50	0	0	0	0	25	0	0	75	0	0	0

APPENDIX G. Seedling importance value for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	0	0	0	200	0	0	0	0	110	0	0	0	0	0	0	90
2	77	0	0	0	0	0	0	123	134	0	0	0	0	0	0	66
3	68	0	0	0	0	0	0	132	150	0	0	0	0	0	0	50
4	0	0	0	0	0	0	0	200	200	0	0	0	0	0	0	0
5	83	0	0	0	117	0	0	0	200	0	0	0	0	0	0	0
6	200	0	0	0	0	0	0	0	128	0	0	0	72	0	0	0
7	91	0	0	0	0	0	0	109	200	0	0	0	0	0	0	0
8	200	0	0	0	0	0	0	0	150	0	0	0	0	0	0	50
9	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
10	128	0	0	0	0	0	0	72	200	0	0	0	0	0	0	0
11	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
13	25	0	0	0	0	0	0	175	200	0	0	0	0	0	0	0
14	160	0	0	0	0	0	0	40	89	0	0	0	0	0	0	111
16	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
17	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
18	105	0	0	0	0	0	0	95	200	0	0	0	0	0	0	0
19	75	0	0	0	0	0	0	125	200	0	0	0	0	0	0	0
20	200	0	0	0	0	0	0	0	147	0	0	0	0	0	0	53
21	89	0	0	0	0	0	0	111	143	0	0	0	0	0	0	57
22	105	0	0	0	0	0	0	95	175	0	0	0	0	0	0	25
23	0	0	0	0	0	0	0	200	200	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	200	143	0	0	0	0	0	0	57
25	152	0	0	48	0	0	0	0	135	0	0	0	0	0	0	65
26	121	0	0	0	0	0	0	79	200	0	0	0	0	0	0	0
28	93	0	0	0	0	0	56	50	200	0	0	0	0	0	0	0
29	52	0	0	0	0	0	0	148	200	0	0	0	0	0	0	0
30	108	0	0	0	0	0	0	92	66	0	0	0	96	0	0	38
31	92	0	0	0	108	0	0	0	155	0	0	0	0	0	0	45
32	126	0	0	0	0	0	0	74	159	0	0	0	0	0	0	41
33	115	0	0	0	0	0	0	85	86	0	0	0	0	0	0	114
34	159	0	0	0	0	0	0	41	96	0	0	0	0	0	0	104
35	36	0	0	0	83	0	0	81	200	0	0	0	0	0	0	0
36	128	0	0	0	31	0	0	41	200	0	0	0	0	0	0	0
37	123	0	0	0	0	0	0	77	200	0	0	0	0	0	0	0
38	0	0	0	65	0	0	0	135	200	0	0	0	0	0	0	0
39	144	0	0	0	0	0	0	56	137	0	0	63	0	0	0	0
40	125	0	0	0	75	0	0	0	114	0	0	0	0	0	0	86
41	79	0	0	37	0	0	0	84	113	0	0	35	0	0	0	52
42	78	0	0	37	0	0	0	86	200	0	0	0	0	0	0	0
43	200	0	0	0	0	0	0	0	91	0	0	0	0	0	0	109
44	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
45	171	0	0	0	29	0	0	0	63	0	0	0	110	0	0	27
46	90	0	0	0	0	0	0	110	104	0	0	0	0	0	0	96
47	200	0	0	0	0	0	0	0	111	0	0	0	0	0	0	89
48	0	0	0	27	112	0	0	61	56	0	0	0	99	0	45	0
49	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
50	134	0	0	0	0	0	0	66	200	0	0	0	0	0	0	0
51	153	0	0	0	0	0	0	47	200	0	0	0	0	0	0	0

52	106	0	0	0	0	0	0	94	200	0	0	0	0	0	0	0
53	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
54	85	0	0	0	0	0	115	0	0	0	0	0	0	0	200	0
56	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
57	65	0	0	0	0	135	0	0	200	0	0	0	0	0	0	0
58	0	0	0	73	45	0	0	82	92	37	0	0	34	0	0	37
59	0	0	0	0	0	0	0	200	121	0	0	0	0	0	0	79
60	0	0	0	108	57	0	0	35	78	0	0	68	54	0	0	0
61	106	0	0	0	0	0	0	94	102	0	0	0	98	0	0	0
62	69	0	0	101	29	0	0	0	85	0	0	115	0	0	0	0
63	54	0	0	69	77	0	0	0	200	0	0	0	0	0	0	0
64	54	0	0	87	0	0	0	59	0	0	0	0	0	0	0	200
65	0	0	0	0	90	0	0	110	134	66	0	0	0	0	0	0
66	67	0	0	42	0	0	0	91	167	0	0	0	0	0	0	33
67	200	0	0	0	0	0	0	0	160	0	0	40	0	0	0	0
68	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
69	57	116	0	27	0	0	0	0	0	68	0	0	0	0	0	132
71	124	0	0	44	0	0	0	32	112	0	0	0	0	0	0	88
72	117	0	0	0	0	0	0	83	118	0	0	0	0	0	0	82
73	117	0	0	0	51	0	0	32	95	66	0	0	39	0	0	0
74	200	0	0	0	0	0	0	0	105	0	0	0	95	0	0	0
75	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
76	165	0	0	0	35	0	0	0	90	0	0	0	110	0	0	0
77	200	0	0	0	0	0	0	0	85	0	0	0	115	0	0	0
78	119	0	0	0	0	0	0	81	200	0	0	0	0	0	0	0
79	82	0	0	0	0	0	0	118	136	0	0	0	0	0	0	64
80	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
81	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
82	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
83	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
84	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
85	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
86	51	0	0	0	0	0	0	149	200	0	0	0	0	0	0	0
87	54	0	0	0	0	0	0	146	85	0	0	0	0	0	115	0
88	26	0	0	0	0	0	25	148	86	0	0	0	0	0	0	114
89	126	0	0	0	0	0	0	74	200	0	0	0	0	0	0	0
90	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
91	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
92	0	0	0	0	53	0	147	0	86	0	0	0	76	0	0	38
93	106	0	0	0	0	0	0	94	200	0	0	0	0	0	0	0
94	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
95	38	0	0	0	60	0	0	102	66	0	0	0	0	0	0	134
96	116	0	0	0	0	0	0	84	103	0	0	0	0	0	0	97
97	50	0	0	96	0	0	0	54	200	0	0	0	0	0	0	0
98	136	0	0	0	0	0	0	64	102	0	0	0	0	0	0	98
101	56	0	0	0	114	0	0	31	200	0	0	0	0	0	0	0
102	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
103	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
104	27	0	0	0	65	0	0	108	128	0	0	0	72	0	0	0
106	0	0	0	0	200	0	0	0	83	0	0	0	64	0	0	53
107	106	0	0	0	0	0	0	94	200	0	0	0	0	0	0	0
108	102	0	0	0	0	0	0	98	85	0	0	0	0	0	0	115
109	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
110	120	0	0	0	0	0	0	80	200	0	0	0	0	0	0	0

111	52	0	0	55	0	0	0	93	161	0	0	0	0	0	0	39
113	200	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
114	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
115	117	0	0	0	0	0	0	83	200	0	0	0	0	0	0	0
116	0	0	0	0	85	0	0	115	74	0	0	0	74	0	0	52
117	100	0	0	0	0	0	0	100	114	0	0	0	0	0	0	86
118	110	0	0	0	0	0	0	90	134	0	0	0	0	0	0	66
119	99	0	0	0	0	0	0	101	126	0	0	0	0	0	0	74
120	33	0	0	0	0	0	0	167	165	0	0	0	35	0	0	0
121	125	0	0	0	0	0	0	75	200	0	0	0	0	0	0	0
122	145	0	0	0	0	0	0	55	131	0	0	0	0	0	0	69
123	100	0	0	0	0	0	0	100	200	0	0	0	0	0	0	0
124	0	0	0	0	0	0	0	200	65	0	0	0	0	0	0	135
125	90	0	0	0	0	0	0	110	200	0	0	0	0	0	0	0
126	28	50	0	0	0	0	0	121	200	0	0	0	0	0	0	0
127	90	0	0	68	0	0	0	42	95	0	0	0	0	0	0	105
128	96	43	0	0	27	0	0	34	121	0	0	0	0	0	0	79
130	0	117	0	0	83	0	0	0	101	0	0	0	35	0	0	65
131	0	36	0	70	0	0	0	95	0	0	0	0	0	0	0	200
132	0	95	0	0	0	0	0	105	0	0	0	0	0	0	0	200
133	143	0	0	0	0	0	0	57	200	0	0	0	0	0	0	0
134	0	0	0	32	0	0	0	168	72	66	0	0	0	0	0	63
135	38	39	0	0	84	0	0	39	0	47	0	0	0	0	0	153
136	0	124	0	0	51	0	0	25	27	30	0	0	46	0	0	96
137	0	0	0	0	200	0	0	0	0	0	0	0	106	0	0	94
138	108	0	0	0	0	0	0	92	118	0	0	0	0	0	0	82
139	0	0	0	0	80	0	0	120	0	0	0	0	0	0	0	200
140	129	0	0	0	0	0	0	71	200	0	0	0	0	0	0	0
141	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	200
142	0	98	0	0	0	0	46	56	0	0	0	0	0	0	0	200
143	35	99	0	0	32	0	0	35	0	108	0	0	0	0	0	92
144	0	0	0	0	200	0	0	0	0	0	0	0	141	0	0	59
145	0	0	0	0	200	0	0	0	0	0	0	0	73	0	0	127
146	0	0	0	0	72	0	0	128	0	0	0	0	112	0	0	88
147	0	0	0	0	87	0	0	113	0	0	0	0	0	0	0	200
148	0	0	0	0	200	0	0	0	119	0	0	0	50	0	0	31
149	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
150	0	0	0	0	200	0	0	0	0	86	0	47	67	0	0	0
151	0	173	0	0	27	0	0	0	89	111	0	0	0	0	0	0
152	0	0	0	0	200	0	0	0	74	0	0	0	40	0	0	86
153	200	0	0	0	0	0	0	0	108	0	0	0	0	0	0	92
154	124	0	0	0	0	0	0	76	200	0	0	0	0	0	0	0
156	0	0	0	0	0	0	0	200	37	0	0	0	122	0	0	42
157	0	44	0	0	0	0	156	0	70	0	0	0	0	0	130	0
158	30	50	0	0	120	0	0	0	0	57	0	0	143	0	0	0
159	0	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0
161	0	50	0	0	124	0	0	25	0	94	106	0	0	0	0	0
162	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	200
163	0	31	0	0	106	0	0	63	123	0	0	0	25	0	0	52
164	0	94	0	0	73	0	0	33	0	0	0	0	91	0	0	109
165	0	0	0	0	200	0	0	0	0	123	0	0	77	0	0	0
166	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
170	0	0	0	0	200	0	0	0	0	0	0	0	86	0	0	114
171	0	35	0	0	165	0	0	0	0	0	0	0	200	0	0	0

172	0	29	0	37	41	0	0	92	0	98	0	36	66	0	0	0
173	0	44	0	0	156	0	0	0	0	0	0	0	106	0	0	94
174	0	0	0	0	65	0	0	135	0	0	0	0	0	0	0	200
175	0	116	0	0	29	0	0	55	0	33	0	0	140	0	0	27
176	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
178	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
179	0	73	0	0	127	0	0	0	0	68	0	0	132	0	0	0
180	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
181	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
195	0	108	0	0	92	0	0	0	0	0	0	0	200	0	0	0
199	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
200	0	0	0	0	200	0	0	0	0	0	0	49	151	0	0	0
202	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
203	0	113	0	0	87	0	0	0	0	0	0	0	200	0	0	0
204	0	0	0	0	200	0	0	0	0	46	0	0	154	0	0	0
205	0	0	0	0	200	0	0	0	0	124	0	0	76	0	0	0
206	0	0	0	0	200	0	0	0	0	50	0	0	150	0	0	0
209	0	0	0	0	94	0	0	106	0	0	0	55	145	0	0	0
210	0	142	0	0	58	0	0	0	0	91	0	0	0	0	0	109
211	0	34	0	110	57	0	0	0	0	0	0	111	89	0	0	0
212	0	0	0	0	82	0	0	118	0	0	0	83	117	0	0	0
214	0	28	0	172	0	0	0	0	0	114	0	57	29	0	0	0
215	0	0	0	87	113	0	0	0	0	53	0	73	74	0	0	0
217	0	34	0	0	166	0	0	0	0	33	0	0	167	0	0	0
218	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
219	0	0	0	0	200	0	0	0	0	60	0	0	140	0	0	0
220	0	116	0	0	84	0	0	0	0	0	0	0	200	0	0	0
221	0	0	0	0	200	0	0	0	0	68	0	0	132	0	0	0
223	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
224	0	0	0	0	200	0	0	0	0	45	0	0	155	0	0	0
225	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
226	0	64	0	0	136	0	0	0	0	75	0	0	125	0	0	0
227	0	103	0	40	57	0	0	0	0	49	0	95	56	0	0	0
230	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
231	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
232	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
233	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
234	0	0	0	68	34	0	0	98	0	0	0	78	60	0	0	62
235	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
236	0	0	0	0	200	0	0	0	0	80	0	0	120	0	0	0
237	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
238	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
239	0	0	115	0	85	0	0	0	0	0	0	0	200	0	0	0
241	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	200
242	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
243	0	0	0	0	96	0	0	104	0	0	0	0	96	0	0	104
244	0	31	0	0	59	0	0	110	0	56	0	0	62	0	0	82
245	0	69	0	0	131	0	0	0	0	113	0	0	87	0	0	0
246	0	95	0	0	105	0	0	0	0	94	0	0	106	0	0	0
247	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
248	0	83	0	0	117	0	0	0	0	0	0	0	200	0	0	0
249	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
250	0	76	0	0	124	0	0	0	0	36	0	0	164	0	0	0
251	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0

252	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
253	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
254	0	0	115	0	85	0	0	0	0	0	120	0	80	0	0	0
255	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
256	0	0	0	0	200	0	0	0	0	51	0	0	149	0	0	0
259	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
260	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
261	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
262	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
263	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
264	0	0	0	0	200	0	0	0	0	82	0	0	118	0	0	0
265	0	0	0	0	200	0	0	0	0	119	0	0	81	0	0	0
266	0	77	0	0	123	0	0	0	0	94	0	0	106	0	0	0

APPENDIX H. Average 1958 sapling density (seedlings/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	117	0	0	0	0	0	0	0
2	326	0	0	0	0	0	0	413
3	15	0	0	0	0	0	0	51
4	250000	0	0	0	0	0	0	255
5	1575	0	0	0	44	0	0	186
6	136	0	0	0	52	0	0	0
7	0	0	0	0	0	0	321	517
8	129	0	0	0	0	0	0	11
9	81	0	0	0	0	0	0	0
10	149	0	0	0	0	0	0	60
11	153	0	0	0	0	0	0	0
13	57	0	0	0	0	0	0	100
14	1457	0	0	0	326	0	0	293
16	145	0	0	0	0	0	0	135
17	3810	0	0	0	0	0	0	0
18	2143	0	0	0	413	0	730	730
19	678	0	0	0	0	0	578	0
20	145	0	0	0	0	0	0	0
21	29	219	0	0	0	0	0	48
22	26015	0	0	0	23	0	0	184
23	0	0	0	0	0	0	0	58
24	117	0	0	0	0	0	0	72
25	63	0	0	0	73	0	0	27
26	625	0	0	0	0	0	184	156
28	0	0	0	0	264	0	42	730
29	0	0	0	0	135	0	0	595
30	25	0	0	18	0	0	0	16
31	91	0	0	0	0	0	0	199
32	293	0	0	0	730	0	0	209
33	469	0	0	0	16	0	0	0
34	184	0	0	0	0	0	413	413
35	0	0	0	0	0	0	199	2143
36	140	0	0	0	0	0	0	0
37	0	0	0	103	0	0	0	205
38	0	0	0	0	63	0	0	0
39	252	0	0	0	0	0	0	0
40	63	0	0	117	0	0	0	23
41	66	0	0	184	0	0	0	50
42	826	0	0	0	0	0	0	6504
43	240	0	0	135	0	0	0	81
44	199	0	0	1652	0	0	0	0
45	42	0	0	55	156	0	0	219
46	156	0	0	0	23	0	0	169
47	0	0	0	14	0	0	0	42
48	0	0	0	22	0	0	0	42
49	219	0	0	0	0	0	2954	0
50	76	0	0	0	0	0	0	135
51	449	0	0	0	0	0	0	541
52	71	0	0	0	0	0	0	0

53	388	0	0	0	0	0	0	0
54	121	0	0	0	0	0	0	0
56	578	0	0	0	0	0	0	77
57	1313	0	0	0	0	0	0	156
58	0	0	0	0	66	0	0	1652
59	0	0	0	156	46	0	0	413
60	0	0	0	156	90	0	0	0
61	0	0	0	0	46	0	55	6
62	0	0	0	541	184	0	0	730
63	0	0	0	730	293	0	0	0
64	0	0	0	174	0	0	0	31
65	0	0	0	63	103	0	0	184
66	0	0	0	0	26015	0	26015	117
67	0	0	0	8	15	0	0	0
68	111111	0	0	0	0	0	541	199
69	10	0	0	42	4	0	0	27
71	0	46	0	29	0	0	0	0
72	0	0	0	0	2143	0	0	1652
73	0	264	0	0	13	0	0	0
74	0	0	11	0	41	0	0	73
75	36	0	0	0	7	0	0	24
76	58	0	0	0	73	0	0	0
77	77	0	0	0	39	0	0	20
78	58	0	0	0	0	0	0	0
79	77	0	0	0	0	0	9	22
80	20	0	0	0	0	0	0	0
81	108	0	0	0	156	0	0	0
82	184	0	0	0	264	0	0	0
83	117	0	0	0	0	0	0	77
84	1526	0	0	0	0	0	0	1054
85	678	0	0	0	0	0	0	0
86	103	0	0	0	0	0	0	326
87	0	0	0	0	0	209	0	0
88	541	0	0	0	0	0	0	0
89	1652	0	0	0	0	0	0	1652
90	930	0	0	0	0	0	156	0
91	205	0	0	0	0	0	0	135
92	184	0	0	0	126	0	0	0
93	0	0	0	0	149	0	0	326
94	240	0	0	0	0	0	0	730
95	0	0	0	21	0	0	0	69
96	46	0	0	0	1313	0	0	73
97	0	0	0	875	11	0	0	184
98	81	0	0	0	0	0	0	20
101	20	0	0	0	117	0	0	55
102	31	0	0	0	117	0	0	0
103	73	0	0	0	41	0	0	22
104	5	0	0	0	7	0	0	0
106	4	5	0	0	22	0	0	0
107	219	0	0	0	0	0	0	97
108	135	0	0	0	0	0	66	55
109	0	0	0	0	135	0	0	88
110	23	0	0	0	0	0	0	19
111	0	156	0	0	0	0	0	48

113	364	0	0	0	0	0	0	0
114	27	0	0	0	0	0	0	31
115	0	0	0	39	0	0	0	31
116	0	0	0	0	27	0	0	39
117	1054	0	0	0	63	0	0	117
118	264	264	0	0	0	0	0	264
119	0	0	0	103	60	0	0	541
120	135	0	0	0	156	0	0	413
121	541	0	0	0	0	0	0	489
122	413	0	0	0	0	0	0	46
123	1054	0	0	0	0	0	0	232
124	293	0	0	0	0	0	0	0
125	121	0	0	0	0	0	0	0
126	55	0	0	0	0	0	0	541
127	156	15	0	0	0	0	0	86
128	0	0	0	0	34	0	0	16
130	0	55	0	0	5	0	0	34
131	0	0	0	0	26	0	0	62
132	0	0	0	0	24	0	0	33
133	0	0	0	0	81	0	0	53
134	0	11	0	0	18	0	0	16
135	0	0	0	0	16	0	0	26
136	0	18	0	0	55	0	0	19
137	0	0	0	0	63	0	0	0
138	10	0	0	0	0	0	0	15
139	0	0	0	0	19	0	0	39
140	0	0	0	0	39	0	0	55
141	0	0	0	0	0	0	0	176
142	0	0	0	0	541	0	0	79
143	0	22	0	0	7	0	0	15
144	0	19	0	0	9	0	0	60
145	0	0	0	0	23	0	0	0
146	0	0	0	0	38	0	0	0
147	0	0	0	50	30	0	0	26
148	0	0	0	0	364	0	0	0
149	0	0	0	0	100	0	0	0
150	0	0	0	0	42	0	0	0
151	0	0	0	0	163	0	0	0
152	0	0	0	0	169	0	0	0
153	503	0	0	0	0	0	0	0
154	46	0	0	0	0	0	52	413
156	0	24	0	0	0	0	0	19
157	0	326	0	0	0	0	264	169
158	0	81	0	0	219	0	0	0
159	0	57	0	0	0	0	0	0
161	0	19	0	0	0	0	0	35
162	0	0	0	0	156	0	0	0
163	0	0	0	0	24	0	0	34
164	0	0	0	0	69	0	0	240
165	0	0	0	0	678	0	0	0
166	0	0	0	0	86	0	0	0
170	0	2	0	0	35	0	0	0
171	0	0	0	0	57	0	0	0
172	0	29	0	0	17	0	0	4

173	0	0	0	0	10	0	0	30
174	0	0	0	0	30	0	0	26
175	0	10	0	0	9	0	0	4
176	0	0	0	0	34	0	0	0
178	0	0	0	0	19	0	0	0
179	0	0	0	0	50	0	0	0
180	0	0	0	0	94	0	0	0
181	0	0	0	0	16	0	0	0
195	0	0	0	0	36	0	0	0
199	0	0	0	0	17	0	0	0
200	0	0	0	0	103	0	0	0
202	0	0	0	0	26	0	0	0
203	0	0	0	0	17	0	0	0
204	0	0	0	0	4	0	0	0
205	0	0	0	0	8	0	0	0
206	0	0	0	0	12	0	0	0
209	0	18	0	0	9	0	0	22
210	0	0	0	15	31	0	0	0
211	0	0	0	39	20	0	0	0
212	0	0	0	0	19	0	0	14
214	0	39	0	0	0	0	0	0
215	0	0	0	0	26	0	0	23
217	0	36	0	0	19	0	0	0
218	0	0	0	0	60	0	0	0
219	0	0	0	0	28	0	0	0
220	0	9	0	0	41	0	0	0
221	0	0	0	0	91	0	0	0
223	0	0	0	0	169	0	0	0
224	0	0	0	0	79	0	0	0
225	0	0	0	0	75	0	0	0
226	0	17	0	0	9	0	0	0
227	0	26	0	0	22	0	0	0
230	0	0	0	0	130	0	0	0
231	0	15	0	3	97	0	0	0
232	0	0	0	0	32	0	0	0
233	0	0	0	0	199	0	0	0
234	0	29	0	0	11	0	0	6
235	0	0	0	0	49	0	0	0
236	0	0	0	0	1457	0	0	0
237	0	0	0	0	48	0	0	0
238	0	5	0	0	39	0	0	0
239	0	0	0	0	91	0	0	0
241	0	19	0	0	0	0	0	38
242	0	11	0	0	9	0	0	0
243	0	22	0	0	7	0	0	0
244	0	55	0	0	66	0	0	0
245	0	0	0	0	69	0	0	0
246	0	0	0	0	10	0	0	0
247	0	0	0	0	13	0	0	0
248	0	0	0	0	53	0	0	0
249	0	0	0	0	388	0	0	0
250	0	5	0	0	81	0	0	0
251	0	8	0	0	29	0	0	0
252	0	0	0	0	41	0	0	0

253	0	0	0	0	16	0	0	0
254	0	10	541	0	15	0	0	0
255	0	4	0	0	3	0	0	0
256	0	0	0	0	42	0	0	0
259	0	0	0	0	13	0	0	0
260	0	0	0	0	25	0	0	0
261	0	0	0	0	11	0	0	0
262	0	0	0	0	25	0	0	0
263	0	0	0	0	23	0	0	0
264	0	34	0	0	73	0	0	0
265	0	0	730	6504	110	0	0	0
266	0	8	0	0	351	0	0	0

APPENDIX I. Average 1991 sapling density (seedlings/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	4691	0	0	92	0	0	0	0
2	304	0	0	115	0	0	0	331
3	21	0	0	12	0	0	0	41
4	376	0	0	0	0	0	0	216
5	88	0	0	0	170	0	0	0
6	141	0	0	0	0	0	0	0
7	51	0	0	0	0	0	0	0
8	271	0	0	0	0	0	0	0
9	110	0	0	0	0	0	0	0
10	84	0	0	0	0	0	0	0
11	176	0	0	0	0	0	0	109
13	16437	0	0	0	0	0	0	390625
14	348	0	0	0	373	0	0	0
16	69	0	0	0	0	0	0	1413
17	2551	0	0	0	0	0	0	427
18	700	0	0	0	308	0	0	0
19	215	0	0	0	0	0	485	0
20	188	0	0	0	0	0	0	0
21	143	0	0	0	0	0	0	308
22	210	0	0	0	0	0	0	30
23	100	0	0	0	0	0	0	46
24	59	0	0	0	0	0	0	0
25	76	0	0	0	0	0	0	0
26	105	0	0	0	0	0	0	0
28	42	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	237
30	37	0	0	0	0	0	0	285
31	228	0	0	0	0	0	0	693
32	335	0	0	0	403	0	0	85
33	185	0	0	0	1736	0	0	2500
34	155	0	0	0	0	0	0	607
35	282	0	0	0	1257	0	0	0
36	477	0	0	0	0	0	0	105
37	258	0	0	0	0	0	0	2713
38	4006	0	0	208	0	0	0	93
39	224	0	0	264	0	0	0	0
40	326	0	0	26	0	0	0	0
41	91	0	0	234	0	0	0	0
42	338	0	0	0	0	0	0	4328
43	1435	0	0	0	0	0	0	0
44	238	0	0	865	0	0	0	0
45	89	0	0	0	0	0	0	153
46	168	0	0	0	0	0	0	22
47	289	0	0	0	0	0	0	0
48	0	0	0	46	0	0	0	47
49	1223	0	0	0	0	0	2225	0
50	230	0	0	0	0	0	0	0
51	460	0	0	0	0	0	0	0
52	74	0	0	0	0	0	0	52
53	397	0	0	0	0	0	0	0

54	80	0	0	0	0	0	0	0
56	121	0	0	0	0	0	0	0
57	460	0	0	0	0	0	0	0
58	91	0	0	308	0	0	0	188
59	63	0	0	152	0	0	0	153
60	0	0	0	144	84	0	0	0
61	171	0	0	0	0	0	512	14
62	27	0	0	507	173	0	0	434
63	0	0	0	494	335	0	0	0
64	127	0	0	175	0	0	0	53
65	31	0	0	65	98	0	0	0
66	258	0	0	0	0	0	0	0
67	28	0	0	60	0	0	0	0
68	40	155	0	0	0	0	595	0
69	30	291	0	21	0	0	0	0
71	3156	0	0	930	0	0	0	875
72	1206	0	0	0	1413	0	0	0
73	24	40	0	0	48	0	0	0
74	257	0	0	0	0	0	0	0
75	145	0	0	0	0	0	0	0
76	124	0	0	0	0	0	0	0
77	41	0	0	0	37	0	0	0
78	59	0	0	0	0	0	0	0
79	19	0	0	0	0	0	0	7
80	1479	0	0	0	0	0	0	5
81	159	0	0	0	0	0	0	0
82	73	0	0	0	0	0	0	0
83	103	0	0	0	0	0	0	0
84	2225	0	0	0	0	0	0	0
85	1157	0	0	0	0	0	0	0
86	1352	0	0	0	0	0	0	0
87	0	0	0	0	141	129	0	420
88	168	0	0	0	0	5917	0	416
89	2143	0	0	0	0	0	373	707
90	205	0	0	0	0	0	0	0
91	930	0	0	0	0	0	0	212
92	163	0	0	0	158	0	0	0
93	125	0	0	0	0	0	0	202
94	1111	0	0	0	0	0	0	0
95	27	0	0	0	0	0	0	102
96	38	0	0	88	1890	0	0	0
97	46	0	0	434	0	0	0	0
98	122	0	0	0	0	0	0	129
101	114	0	0	0	343	0	0	0
102	40	0	0	0	0	0	0	23
103	102	0	0	0	94	0	0	218
104	18	0	0	0	69	0	0	364
106	0	0	0	0	5	0	0	3
107	541	0	0	0	0	0	0	1600
108	29	0	0	0	0	0	0	102
109	123	0	0	0	0	0	0	90
110	17	0	0	0	0	0	0	16
111	0	30	0	0	40	0	0	81
113	747	0	0	0	0	0	0	47

114	36	0	0	0	0	0	0	78
115	685	0	0	0	0	0	0	43
116	0	0	0	0	44	0	0	44
117	289	0	0	0	0	0	0	122
118	69	67	0	0	0	0	0	283
119	170	0	0	0	51	0	0	179
120	112	0	0	0	158	0	0	0
121	164	0	0	0	0	0	0	244
122	601	0	0	0	0	0	0	0
123	189	0	0	0	0	0	0	240
124	367	0	0	0	0	0	0	25
125	265	0	0	0	0	0	0	0
126	64	135	0	0	0	0	0	0
127	364	61	0	29	0	0	0	11
128	199	140	0	0	23	0	0	0
130	4	0	0	0	24	0	0	0
131	0	29	0	210	0	0	0	63
132	0	140	0	0	0	0	0	45
133	117	0	0	0	0	0	0	1276
134	0	0	0	0	26	0	0	41
135	15	278	0	0	82	0	0	512
136	0	27	0	0	58	0	0	453
137	0	0	0	0	81	0	0	84
138	138	0	0	0	0	0	0	28
139	0	0	0	0	38	0	0	53
140	319	0	0	0	0	0	0	282
141	0	0	0	0	0	0	0	94
142	0	460	0	0	0	0	0	25
143	0	50	0	0	6	0	0	0
144	0	0	0	0	108	0	0	56
145	0	0	0	0	60	0	0	116
146	0	0	0	0	21	0	0	78
147	0	0	0	0	0	0	0	60
148	0	0	0	0	81	0	0	0
149	0	0	0	0	96	0	0	197
150	0	0	0	0	20	0	0	0
151	0	3156	0	0	89	0	0	0
152	136	0	0	0	228	0	0	0
153	235	0	0	0	0	0	0	0
154	68	0	0	0	0	0	166	48
156	37	0	0	0	0	0	0	31
157	0	254	0	0	0	0	220	0
158	137	112	0	0	0	0	0	0
159	0	14	0	0	0	0	0	29
161	0	40	0	0	22	0	0	206
162	0	0	0	0	40	0	0	49
163	0	21	0	0	0	0	0	45
164	0	651	0	0	556	0	0	56
165	0	0	0	0	64	0	0	0
166	0	0	0	0	40	0	0	0
170	0	0	0	24	26	0	0	0
171	0	20	0	0	40	0	0	0
172	0	15	0	0	7	0	0	57
173	0	7	0	0	19	0	0	0

174	0	0	0	25	22	0	0	63
175	0	8	0	0	10	0	0	38
176	0	0	0	0	39	0	0	0
178	0	0	0	0	43	0	0	0
179	0	45	0	0	97	0	0	0
180	0	0	0	0	46	0	0	0
181	0	0	0	0	20	0	0	0
195	0	323	0	0	51	0	0	0
199	0	0	0	0	73	0	0	0
200	0	0	0	0	121	0	0	0
202	0	0	0	0	27	0	0	0
203	0	169	0	0	58	0	0	0
204	0	0	0	4	8	0	0	0
205	0	0	0	0	22	0	0	0
206	0	130	0	0	69	0	0	0
209	0	21	0	0	36	0	0	18
210	0	1736	0	0	94	0	0	0
211	0	47	0	0	65	0	0	0
212	0	0	0	0	53	0	0	32
214	0	0	0	41	3	0	0	24
215	0	0	0	0	124	0	0	0
217	0	0	0	27	20	0	0	0
218	0	0	0	0	56	0	0	0
219	0	24	0	0	39	0	0	0
220	0	184	0	0	27	0	0	0
221	0	715	0	0	102	0	0	0
223	0	0	0	12	77	0	0	0
224	0	0	0	19	1479	0	0	0
225	0	0	0	0	410	0	0	0
226	0	0	0	0	16	0	0	0
227	0	25	0	13	14	0	0	0
230	0	0	0	0	416	0	0	0
231	0	58	0	0	147	0	0	0
232	0	0	0	0	335	0	0	0
233	0	0	0	0	221	0	0	0
234	0	0	0	21	20	0	0	24
235	0	0	0	0	185	0	0	0
236	0	0	0	0	1413	0	0	0
237	0	0	0	0	6	0	0	0
238	0	48	0	0	0	0	0	0
239	0	0	0	0	30	0	0	0
241	0	0	0	0	0	0	0	82
242	0	47	0	0	86	0	0	0
243	0	4	0	0	0	0	0	51
244	0	19	0	0	105	0	0	0
245	0	0	0	0	28	0	0	0
246	0	0	0	0	4	0	0	0
247	0	0	0	0	10	0	0	0
248	0	88	0	0	43	0	0	0
249	0	0	0	0	379	0	0	0
250	0	0	0	0	99	0	0	0
251	0	0	0	0	8	0	0	0
252	0	0	0	0	26	0	0	0
253	0	0	0	0	35	0	0	0

254	0	0	0	0	21	0	0	0
255	0	0	0	0	7	0	0	0
256	0	0	0	0	25	0	0	0
259	0	28	0	0	18	0	0	0
260	0	0	0	0	36	0	0	0
261	0	0	0	0	13	0	0	0
262	0	0	0	0	20	0	0	0
263	0	0	0	0	21	0	0	0
264	0	0	0	0	22	0	0	0
265	0	351	0	6299	72	0	0	0
266	0	18	0	0	291	0	0	0

APPENDIX J. Sapling relative density for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	100	0	0	0	0	0	0	0	98	0	0	2	0	0	0	0
2	44	0	0	0	0	0	0	56	41	0	0	15	0	0	0	44
3	23	0	0	0	0	0	0	77	28	0	0	16	0	0	0	56
4	100	0	0	0	0	0	0	0	63	0	0	0	0	0	0	37
5	87	0	0	0	2	0	0	10	34	0	0	0	66	0	0	0
6	72	0	0	0	28	0	0	0	100	0	0	0	0	0	0	0
7	0	0	0	0	0	0	38	62	100	0	0	0	0	0	0	0
8	92	0	0	0	0	0	0	8	100	0	0	0	0	0	0	0
9	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
10	71	0	0	0	0	0	0	29	100	0	0	0	0	0	0	0
11	100	0	0	0	0	0	0	0	62	0	0	0	0	0	0	38
13	36	0	0	0	0	0	0	64	4	0	0	0	0	0	0	96
14	70	0	0	0	16	0	0	14	48	0	0	0	52	0	0	0
16	52	0	0	0	0	0	0	48	5	0	0	0	0	0	0	95
17	100	0	0	0	0	0	0	0	86	0	0	0	0	0	0	14
18	53	0	0	0	10	0	18	18	69	0	0	0	31	0	0	0
19	54	0	0	0	0	0	46	0	31	0	0	0	0	0	69	0
20	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
21	10	74	0	0	0	0	0	16	32	0	0	0	0	0	0	68
22	99	0	0	0	0	0	0	1	88	0	0	0	0	0	0	12
23	0	0	0	0	0	0	0	100	69	0	0	0	0	0	0	31
24	62	0	0	0	0	0	0	38	100	0	0	0	0	0	0	0
25	38	0	0	0	45	0	0	17	100	0	0	0	0	0	0	0
26	65	0	0	0	0	0	19	16	100	0	0	0	0	0	0	0
28	0	0	0	0	25	0	4	70	100	0	0	0	0	0	0	0
29	0	0	0	0	18	0	0	82	0	0	0	0	0	0	0	100
30	42	0	0	31	0	0	0	28	12	0	0	0	0	0	0	88
31	31	0	0	0	0	0	0	69	25	0	0	0	0	0	0	75
32	24	0	0	0	59	0	0	17	41	0	0	0	49	0	0	10
33	97	0	0	0	3	0	0	0	4	0	0	0	39	0	0	57
34	18	0	0	0	0	0	41	41	20	0	0	0	0	0	0	80
35	0	0	0	0	0	0	9	91	18	0	0	0	82	0	0	0
36	100	0	0	0	0	0	0	0	82	0	0	0	0	0	0	18
37	0	0	0	33	0	0	0	67	9	0	0	0	0	0	0	91
38	0	0	0	0	100	0	0	0	93	0	0	5	0	0	0	2
39	100	0	0	0	0	0	0	0	46	0	0	54	0	0	0	0
40	31	0	0	58	0	0	0	11	93	0	0	7	0	0	0	0
41	22	0	0	61	0	0	0	17	28	0	0	72	0	0	0	0
42	11	0	0	0	0	0	0	89	7	0	0	0	0	0	0	93
43	53	0	0	30	0	0	0	18	100	0	0	0	0	0	0	0
44	11	0	0	89	0	0	0	0	22	0	0	78	0	0	0	0
45	9	0	0	12	33	0	0	46	37	0	0	0	0	0	0	63
46	45	0	0	0	7	0	0	48	88	0	0	0	0	0	0	12
47	0	0	0	25	0	0	0	75	100	0	0	0	0	0	0	0
48	0	0	0	35	0	0	0	65	0	0	0	49	0	0	0	51
49	7	0	0	0	0	0	93	0	35	0	0	0	0	0	65	0
50	36	0	0	0	0	0	0	64	100	0	0	0	0	0	0	0
51	45	0	0	0	0	0	0	55	100	0	0	0	0	0	0	0

52	100	0	0	0	0	0	0	0	59	0	0	0	0	0	0	41
53	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
54	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
56	88	0	0	0	0	0	0	12	100	0	0	0	0	0	0	0
57	89	0	0	0	0	0	0	11	100	0	0	0	0	0	0	0
58	0	0	0	0	4	0	0	96	15	0	0	53	0	0	0	32
59	0	0	0	25	7	0	0	67	17	0	0	41	0	0	0	42
60	0	0	0	64	36	0	0	0	0	0	0	63	37	0	0	0
61	0	0	0	0	43	0	51	6	25	0	0	0	0	0	73	2
62	0	0	0	37	13	0	0	50	2	0	0	44	15	0	0	38
63	0	0	0	71	29	0	0	0	0	0	0	60	40	0	0	0
64	0	0	0	85	0	0	0	15	36	0	0	49	0	0	0	15
65	0	0	0	18	30	0	0	53	16	0	0	33	51	0	0	0
66	0	0	0	0	50	0	50	0	100	0	0	0	0	0	0	0
67	0	0	0	33	67	0	0	0	32	0	0	68	0	0	0	0
68	99	0	0	0	0	0	0	0	5	20	0	0	0	0	75	0
69	12	0	0	51	5	0	0	33	9	85	0	6	0	0	0	0
71	0	62	0	38	0	0	0	0	64	0	0	19	0	0	0	18
72	0	0	0	0	56	0	0	44	46	0	0	0	54	0	0	0
73	0	95	0	0	5	0	0	0	21	36	0	0	43	0	0	0
74	0	0	9	0	32	0	0	58	100	0	0	0	0	0	0	0
75	54	0	0	0	10	0	0	36	100	0	0	0	0	0	0	0
76	44	0	0	0	56	0	0	0	100	0	0	0	0	0	0	0
77	57	0	0	0	29	0	0	15	52	0	0	0	48	0	0	0
78	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
79	72	0	0	0	0	0	8	20	73	0	0	0	0	0	0	27
80	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
81	41	0	0	0	59	0	0	0	100	0	0	0	0	0	0	0
82	41	0	0	0	59	0	0	0	100	0	0	0	0	0	0	0
83	60	0	0	0	0	0	0	40	100	0	0	0	0	0	0	0
84	59	0	0	0	0	0	0	41	100	0	0	0	0	0	0	0
85	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
86	24	0	0	0	0	0	0	76	100	0	0	0	0	0	0	0
87	0	0	0	0	0	100	0	0	0	0	0	0	20	19	0	61
88	100	0	0	0	0	0	0	0	3	0	0	0	0	91	0	6
89	50	0	0	0	0	0	0	50	66	0	0	0	0	0	12	22
90	86	0	0	0	0	0	14	0	100	0	0	0	0	0	0	0
91	60	0	0	0	0	0	0	40	81	0	0	0	0	0	0	19
92	59	0	0	0	41	0	0	0	51	0	0	0	49	0	0	0
93	0	0	0	0	31	0	0	69	38	0	0	0	0	0	0	62
94	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
95	0	0	0	23	0	0	0	77	21	0	0	0	0	0	0	79
96	3	0	0	0	92	0	0	5	2	0	0	4	94	0	0	0
97	0	0	0	82	1	0	0	17	10	0	0	90	0	0	0	0
98	80	0	0	0	0	0	0	20	49	0	0	0	0	0	0	51
101	11	0	0	0	61	0	0	28	25	0	0	0	75	0	0	0
102	21	0	0	0	79	0	0	0	63	0	0	0	0	0	0	37
103	54	0	0	0	30	0	0	16	25	0	0	0	23	0	0	53
104	41	0	0	0	59	0	0	0	4	0	0	0	15	0	0	81
106	14	15	0	0	71	0	0	0	0	0	0	0	63	0	0	37
107	69	0	0	0	0	0	0	31	25	0	0	0	0	0	0	75
108	53	0	0	0	0	0	26	21	22	0	0	0	0	0	0	78
109	0	0	0	0	60	0	0	40	58	0	0	0	0	0	0	42
110	54	0	0	0	0	0	0	46	51	0	0	0	0	0	0	49

111	0	76	0	0	0	0	0	24	0	20	0	0	27	0	0	54
113	100	0	0	0	0	0	0	0	94	0	0	0	0	0	0	6
114	46	0	0	0	0	0	0	54	32	0	0	0	0	0	0	68
115	0	0	0	56	0	0	0	44	94	0	0	0	0	0	0	6
116	0	0	0	0	41	0	0	59	0	0	0	0	50	0	0	50
117	85	0	0	0	5	0	0	9	70	0	0	0	0	0	0	30
118	33	33	0	0	0	0	0	33	16	16	0	0	0	0	0	68
119	0	0	0	15	9	0	0	77	43	0	0	0	13	0	0	45
120	19	0	0	0	22	0	0	59	41	0	0	0	59	0	0	0
121	52	0	0	0	0	0	0	48	40	0	0	0	0	0	0	60
122	90	0	0	0	0	0	0	10	100	0	0	0	0	0	0	0
123	82	0	0	0	0	0	0	18	44	0	0	0	0	0	0	56
124	100	0	0	0	0	0	0	0	94	0	0	0	0	0	0	6
125	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
126	9	0	0	0	0	0	0	91	32	68	0	0	0	0	0	0
127	61	6	0	0	0	0	0	34	78	13	0	6	0	0	0	2
128	0	0	0	0	68	0	0	32	55	39	0	0	6	0	0	0
130	0	58	0	0	6	0	0	36	15	0	0	0	85	0	0	0
131	0	0	0	0	29	0	0	71	0	10	0	69	0	0	0	21
132	0	0	0	0	42	0	0	58	0	76	0	0	0	0	0	24
133	0	0	0	0	61	0	0	39	8	0	0	0	0	0	0	92
134	0	25	0	0	40	0	0	36	0	0	0	0	38	0	0	62
135	0	0	0	0	38	0	0	62	2	31	0	0	9	0	0	58
136	0	20	0	0	60	0	0	20	0	5	0	0	11	0	0	84
137	0	0	0	0	100	0	0	0	0	0	0	0	49	0	0	51
138	40	0	0	0	0	0	0	60	83	0	0	0	0	0	0	17
139	0	0	0	0	33	0	0	67	0	0	0	0	42	0	0	58
140	0	0	0	0	42	0	0	58	53	0	0	0	0	0	0	47
141	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
142	0	0	0	0	87	0	0	13	0	95	0	0	0	0	0	5
143	0	49	0	0	17	0	0	35	0	89	0	0	11	0	0	0
144	0	22	0	0	10	0	0	68	0	0	0	0	66	0	0	34
145	0	0	0	0	100	0	0	0	0	0	0	0	34	0	0	66
146	0	0	0	0	100	0	0	0	0	0	0	0	21	0	0	79
147	0	0	0	47	29	0	0	24	0	0	0	0	0	0	0	100
148	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
149	0	0	0	0	100	0	0	0	0	0	0	0	33	0	0	67
150	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
151	0	0	0	0	100	0	0	0	0	97	0	0	3	0	0	0
152	0	0	0	0	100	0	0	0	37	0	0	0	63	0	0	0
153	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
154	9	0	0	0	0	0	10	81	24	0	0	0	0	0	59	17
156	0	56	0	0	0	0	0	44	54	0	0	0	0	0	0	46
157	0	43	0	0	0	0	35	22	0	54	0	0	0	0	46	0
158	0	27	0	0	73	0	0	0	55	45	0	0	0	0	0	0
159	0	100	0	0	0	0	0	0	0	33	0	0	0	0	0	67
161	0	35	0	0	0	0	0	65	0	15	0	0	8	0	0	77
162	0	0	0	0	100	0	0	0	0	0	0	0	45	0	0	55
163	0	0	0	0	42	0	0	58	0	32	0	0	0	0	0	68
164	0	0	0	0	22	0	0	78	0	52	0	0	44	0	0	4
165	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
166	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
170	0	6	0	0	94	0	0	0	0	0	0	48	52	0	0	0
171	0	0	0	0	100	0	0	0	0	33	0	0	67	0	0	0

172	0	58	0	0	34	0	0	8	0	19	0	0	8	0	0	72
173	0	0	0	0	25	0	0	75	0	28	0	0	72	0	0	0
174	0	0	0	0	54	0	0	46	0	0	0	23	20	0	0	58
175	0	43	0	0	39	0	0	18	0	13	0	0	18	0	0	68
176	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
178	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
179	0	0	0	0	100	0	0	0	0	32	0	0	68	0	0	0
180	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
181	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
195	0	0	0	0	100	0	0	0	0	86	0	0	14	0	0	0
199	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
200	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
202	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
203	0	0	0	0	100	0	0	0	0	74	0	0	26	0	0	0
204	0	0	0	0	100	0	0	0	0	0	0	30	70	0	0	0
205	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
206	0	0	0	0	100	0	0	0	0	65	0	0	35	0	0	0
209	0	38	0	0	18	0	0	44	0	28	0	0	48	0	0	24
210	0	0	0	33	67	0	0	0	0	95	0	0	5	0	0	0
211	0	0	0	66	34	0	0	0	0	42	0	0	58	0	0	0
212	0	0	0	0	58	0	0	42	0	0	0	0	63	0	0	37
214	0	100	0	0	0	0	0	0	0	0	0	60	5	0	0	35
215	0	0	0	0	53	0	0	47	0	0	0	0	100	0	0	0
217	0	66	0	0	34	0	0	0	0	0	0	57	43	0	0	0
218	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
219	0	0	0	0	100	0	0	0	0	38	0	0	62	0	0	0
220	0	17	0	0	83	0	0	0	0	87	0	0	13	0	0	0
221	0	0	0	0	100	0	0	0	0	87	0	0	13	0	0	0
223	0	0	0	0	100	0	0	0	0	0	0	13	87	0	0	0
224	0	0	0	0	100	0	0	0	0	0	0	1	99	0	0	0
225	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
226	0	66	0	0	34	0	0	0	0	0	0	0	100	0	0	0
227	0	54	0	0	46	0	0	0	0	48	0	26	27	0	0	0
230	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
231	0	13	0	2	85	0	0	0	0	28	0	0	72	0	0	0
232	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
233	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
234	0	63	0	0	24	0	0	13	0	0	0	33	30	0	0	37
235	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
236	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
237	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
238	0	12	0	0	88	0	0	0	0	100	0	0	0	0	0	0
239	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
241	0	34	0	0	0	0	0	66	0	0	0	0	0	0	0	100
242	0	56	0	0	44	0	0	0	0	35	0	0	65	0	0	0
243	0	75	0	0	25	0	0	0	0	8	0	0	0	0	0	92
244	0	45	0	0	55	0	0	0	0	16	0	0	84	0	0	0
245	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
246	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
247	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
248	0	0	0	0	100	0	0	0	0	67	0	0	33	0	0	0
249	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
250	0	5	0	0	95	0	0	0	0	0	0	0	100	0	0	0
251	0	21	0	0	79	0	0	0	0	0	0	0	100	0	0	0

252	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
253	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
254	0	2	96	0	3	0	0	0	0	0	0	0	100	0	0	0
255	0	54	0	0	46	0	0	0	0	0	0	0	100	0	0	0
256	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
259	0	0	0	0	100	0	0	0	0	61	0	0	39	0	0	0
260	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
261	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
262	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
263	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
264	0	32	0	0	68	0	0	0	0	0	0	0	100	0	0	0
265	0	0	10	89	1	0	0	0	0	5	0	94	1	0	0	0
266	0	2	0	0	98	0	0	0	0	6	0	0	94	0	0	0

APPENDIX K. Sapling relative frequency for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	100	0	0	0	0	0	0	0	25	0	0	75	0	0	0	0
2	50	0	0	0	0	0	0	50	50	0	0	25	0	0	0	25
3	75	0	0	0	0	0	0	25	25	0	0	25	0	0	0	50
4	25	0	0	0	0	0	0	75	50	0	0	0	0	0	0	50
5	25	0	0	0	25	0	0	50	50	0	0	0	50	0	0	0
6	25	0	0	0	75	0	0	0	100	0	0	0	0	0	0	0
7	0	0	0	0	0	0	75	25	100	0	0	0	0	0	0	0
8	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
9	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
10	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
11	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
13	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
14	50	0	0	0	25	0	0	25	75	0	0	0	25	0	0	0
16	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
17	100	0	0	0	0	0	0	0	50	0	0	0	0	0	0	50
18	25	0	0	0	25	0	25	25	75	0	0	0	25	0	0	0
19	50	0	0	0	0	0	50	0	25	0	0	0	0	0	75	0
20	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
21	25	25	0	0	0	0	0	50	50	0	0	0	0	0	0	50
22	25	0	0	0	50	0	0	25	50	0	0	0	0	0	0	50
23	0	0	0	0	0	0	0	100	50	0	0	0	0	0	0	50
24	25	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0
25	50	0	0	0	25	0	0	25	100	0	0	0	0	0	0	0
26	50	0	0	0	0	0	25	25	100	0	0	0	0	0	0	0
28	0	0	0	0	25	0	50	25	100	0	0	0	0	0	0	0
29	0	0	0	0	25	0	0	75	0	0	0	0	0	0	0	100
30	50	0	0	25	0	0	0	25	75	0	0	0	0	0	0	25
31	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25
32	25	0	0	0	25	0	0	50	50	0	0	0	25	0	0	25
33	75	0	0	0	25	0	0	0	50	0	0	0	25	0	0	25
34	50	0	0	0	0	0	25	25	75	0	0	0	0	0	0	25
35	0	0	0	0	0	0	50	50	75	0	0	0	25	0	0	0
36	100	0	0	0	0	0	0	0	50	0	0	0	0	0	0	50
37	0	0	0	25	0	0	0	75	75	0	0	0	0	0	0	25
38	0	0	0	0	100	0	0	0	50	0	0	25	0	0	0	25
39	100	0	0	0	0	0	0	0	75	0	0	25	0	0	0	0
40	50	0	0	25	0	0	0	25	50	0	0	50	0	0	0	0
41	25	0	0	50	0	0	0	25	50	0	0	50	0	0	0	0
42	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
43	50	0	0	25	0	0	0	25	100	0	0	0	0	0	0	0
44	75	0	0	25	0	0	0	0	75	0	0	25	0	0	0	0
45	25	0	0	25	25	0	0	25	75	0	0	0	0	0	0	25
46	25	0	0	0	25	0	0	50	75	0	0	0	0	0	0	25
47	0	0	0	75	0	0	0	25	100	0	0	0	0	0	0	0
48	0	0	0	75	0	0	0	25	0	0	0	50	0	0	0	50
49	75	0	0	0	0	0	25	0	75	0	0	0	0	0	25	0
50	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
51	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0

52	100	0	0	0	0	0	0	0	50	0	0	0	0	0	0	50
53	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
54	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
56	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
57	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
58	0	0	0	0	75	0	0	25	25	0	0	25	0	0	0	50
59	0	0	0	25	50	0	0	25	50	0	0	25	0	0	0	25
60	0	0	0	25	75	0	0	0	0	0	0	50	50	0	0	0
61	0	0	0	0	25	0	25	50	25	0	0	0	0	0	25	50
62	0	0	0	25	25	0	0	50	25	0	0	25	25	0	0	25
63	0	0	0	50	50	0	0	0	0	0	0	50	50	0	0	0
64	0	0	0	75	0	0	0	25	25	0	0	50	0	0	0	25
65	0	0	0	50	25	0	0	25	25	0	0	50	25	0	0	0
66	0	0	0	0	25	0	25	50	100	0	0	0	0	0	0	0
67	0	0	0	50	50	0	0	0	50	0	0	50	0	0	0	0
68	25	0	0	0	0	0	25	50	25	25	0	0	0	0	50	0
69	25	0	0	25	25	0	0	25	50	25	0	25	0	0	0	0
71	0	25	0	75	0	0	0	0	50	0	0	25	0	0	0	25
72	0	0	0	0	50	0	0	50	50	0	0	0	50	0	0	0
73	0	25	0	0	75	0	0	0	25	25	0	0	50	0	0	0
74	0	0	25	0	50	0	0	25	100	0	0	0	0	0	0	0
75	25	0	0	0	50	0	0	25	100	0	0	0	0	0	0	0
76	75	0	0	0	25	0	0	0	100	0	0	0	0	0	0	0
77	50	0	0	0	25	0	0	25	50	0	0	0	50	0	0	0
78	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
79	50	0	0	0	0	0	25	25	75	0	0	0	0	0	0	25
80	100	0	0	0	0	0	0	0	50	0	0	0	0	0	0	50
81	75	0	0	0	25	0	0	0	100	0	0	0	0	0	0	0
82	75	0	0	0	25	0	0	0	100	0	0	0	0	0	0	0
83	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
84	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
85	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
86	50	0	0	0	0	0	0	50	100	0	0	0	0	0	0	0
87	0	0	0	0	0	100	0	0	0	0	0	0	25	50	0	25
88	100	0	0	0	0	0	0	0	50	0	0	0	0	25	0	25
89	25	0	0	0	0	0	0	75	50	0	0	0	0	0	25	25
90	75	0	0	0	0	0	25	0	100	0	0	0	0	0	0	0
91	75	0	0	0	0	0	0	25	75	0	0	0	0	0	0	25
92	50	0	0	0	50	0	0	0	75	0	0	0	25	0	0	0
93	0	0	0	0	75	0	0	25	50	0	0	0	0	0	0	50
94	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
95	0	0	0	50	0	0	0	50	75	0	0	0	0	0	0	25
96	25	0	0	0	50	0	0	25	25	0	0	50	25	0	0	0
97	0	0	0	50	25	0	0	25	75	0	0	25	0	0	0	0
98	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
101	25	0	0	0	25	0	0	50	50	0	0	0	50	0	0	0
102	75	0	0	0	25	0	0	0	75	0	0	0	0	0	0	25
103	25	0	0	0	50	0	0	25	25	0	0	0	50	0	0	25
104	50	0	0	0	50	0	0	0	25	0	0	0	50	0	0	25
106	25	25	0	0	50	0	0	0	0	0	0	0	75	0	0	25
107	50	0	0	0	0	0	0	50	50	0	0	0	0	0	0	50
108	25	0	0	0	0	0	50	25	25	0	0	0	0	0	0	75
109	0	0	0	0	25	0	0	75	75	0	0	0	0	0	0	25
110	50	0	0	0	0	0	0	50	75	0	0	0	0	0	0	25

111	0	25	0	0	0	0	0	75	0	25	0	0	25	0	0	50
113	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
114	75	0	0	0	0	0	0	25	50	0	0	0	0	0	0	50
115	0	0	0	25	0	0	0	75	50	0	0	0	0	0	0	50
116	0	0	0	0	75	0	0	25	0	0	0	0	25	0	0	75
117	25	0	0	0	50	0	0	25	75	0	0	0	0	0	0	25
118	25	25	0	0	0	0	0	50	50	25	0	0	0	0	0	25
119	0	0	0	25	50	0	0	25	25	0	0	0	25	0	0	50
120	50	0	0	0	25	0	0	25	75	0	0	0	25	0	0	0
121	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
122	75	0	0	0	0	0	0	25	100	0	0	0	0	0	0	0
123	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
124	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	25
125	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
126	25	0	0	0	0	0	0	75	50	50	0	0	0	0	0	0
127	25	25	0	0	0	0	0	50	25	25	0	25	0	0	0	25
128	0	0	0	0	25	0	0	75	50	25	0	0	25	0	0	0
130	0	25	0	0	50	0	0	25	25	0	0	0	75	0	0	0
131	0	0	0	0	25	0	0	75	0	25	0	25	0	0	0	50
132	0	0	0	0	25	0	0	75	0	25	0	0	0	0	0	75
133	0	0	0	0	25	0	0	75	75	0	0	0	0	0	0	25
134	0	25	0	0	25	0	0	50	0	0	0	0	50	0	0	50
135	0	0	0	0	50	0	0	50	25	25	0	0	25	0	0	25
136	0	25	0	0	25	0	0	50	0	50	0	0	25	0	0	25
137	0	0	0	0	100	0	0	0	0	0	0	0	75	0	0	25
138	25	0	0	0	0	0	0	75	75	0	0	0	0	0	0	25
139	0	0	0	0	50	0	0	50	0	0	0	0	25	0	0	75
140	0	0	0	0	25	0	0	75	75	0	0	0	0	0	0	25
141	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100
142	0	0	0	0	25	0	0	75	0	25	0	0	0	0	0	75
143	0	25	0	0	25	0	0	50	0	50	0	0	50	0	0	0
144	0	25	0	0	50	0	0	25	0	0	0	0	75	0	0	25
145	0	0	0	0	100	0	0	0	0	0	0	0	75	0	0	25
146	0	0	0	0	100	0	0	0	0	0	0	0	50	0	0	50
147	0	0	0	25	50	0	0	25	0	0	0	0	0	0	0	100
148	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
149	0	0	0	0	100	0	0	0	0	0	0	0	75	0	0	25
150	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
151	0	0	0	0	100	0	0	0	0	50	0	0	50	0	0	0
152	0	0	0	0	100	0	0	0	50	0	0	0	50	0	0	0
153	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
154	25	0	0	0	0	0	50	25	50	0	0	0	0	0	25	25
156	0	25	0	0	0	0	0	75	50	0	0	0	0	0	0	50
157	0	25	0	0	0	0	25	50	0	75	0	0	0	0	25	0
158	0	75	0	0	25	0	0	0	25	75	0	0	0	0	0	0
159	0	100	0	0	0	0	0	0	0	50	0	0	0	0	0	50
161	0	25	0	0	0	0	0	75	0	50	0	0	25	0	0	25
162	0	0	0	0	50	0	0	50	0	0	0	0	25	0	0	75
163	0	0	0	0	75	0	0	25	0	25	0	0	0	0	0	75
164	0	0	0	0	50	0	0	50	0	25	0	0	25	0	0	50
165	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
166	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
170	0	50	0	0	50	0	0	0	0	0	0	25	75	0	0	0
171	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0

172	0	25	0	0	50	0	0	25	0	50	0	0	25	0	0	25
173	0	0	0	0	50	0	0	50	0	25	0	0	75	0	0	0
174	0	0	0	0	50	0	0	50	0	0	0	25	25	0	0	50
175	0	50	0	0	25	0	0	25	0	25	0	0	50	0	0	25
176	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
178	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
179	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
180	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
181	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
195	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
199	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
200	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
202	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
203	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
204	0	0	0	0	100	0	0	0	0	0	0	25	75	0	0	0
205	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
206	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
209	0	25	0	0	50	0	0	25	0	25	0	0	25	0	0	50
210	0	0	0	50	50	0	0	0	0	25	0	0	75	0	0	0
211	0	0	0	25	75	0	0	0	0	25	0	0	75	0	0	0
212	0	0	0	0	50	0	0	50	0	0	0	0	25	0	0	75
214	0	25	0	0	75	0	0	0	0	0	0	25	50	0	0	25
215	0	0	0	0	75	0	0	25	0	0	0	0	100	0	0	0
217	0	25	0	0	75	0	0	0	0	0	0	25	75	0	0	0
218	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
219	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
220	0	50	0	0	50	0	0	0	0	25	0	0	75	0	0	0
221	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
223	0	0	0	0	100	0	0	0	0	0	0	25	75	0	0	0
224	0	0	0	0	100	0	0	0	0	0	0	25	75	0	0	0
225	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
226	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
227	0	25	0	0	75	0	0	0	0	25	0	25	50	0	0	0
230	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
231	0	25	0	25	50	0	0	0	0	25	0	0	75	0	0	0
232	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
233	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
234	0	25	0	0	50	0	0	25	0	0	0	25	25	0	0	50
235	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
236	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
237	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
238	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
239	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
241	0	25	0	0	0	0	0	75	0	0	0	0	0	0	0	100
242	0	75	0	0	25	0	0	0	0	25	0	0	75	0	0	0
243	0	50	0	0	50	0	0	0	0	75	0	0	0	0	0	25
244	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0
245	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
246	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
247	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
248	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
249	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
250	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
251	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0

252	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
253	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
254	0	25	25	0	50	0	0	0	0	0	0	0	100	0	0	0
255	0	50	0	0	50	0	0	0	0	0	0	0	100	0	0	0
256	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
259	0	0	0	0	100	0	0	0	0	25	0	0	75	0	0	0
260	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
261	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
262	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
263	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0
264	0	25	0	0	75	0	0	0	0	0	0	0	100	0	0	0
265	0	0	25	25	50	0	0	0	0	25	0	25	50	0	0	0
266	0	25	0	0	75	0	0	0	0	25	0	0	75	0	0	0

APPENDIX L. Sapling importance value for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot		JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME
1	200	0	0	0	0	0	0	0	123	0	0	77	0	0	0	0
2	94	0	0	0	0	0	0	106	91	0	0	40	0	0	0	69
3	98	0	0	0	0	0	0	102	53	0	0	41	0	0	0	106
4	125	0	0	0	0	0	0	75	113	0	0	0	0	0	0	87
5	112	0	0	0	27	0	0	60	84	0	0	0	116	0	0	0
6	97	0	0	0	103	0	0	0	200	0	0	0	0	0	0	0
7	0	0	0	0	0	0	113	87	200	0	0	0	0	0	0	0
8	167	0	0	0	0	0	0	33	200	0	0	0	0	0	0	0
9	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
10	146	0	0	0	0	0	0	54	200	0	0	0	0	0	0	0
11	200	0	0	0	0	0	0	0	137	0	0	0	0	0	0	63
13	86	0	0	0	0	0	0	114	79	0	0	0	0	0	0	121
14	120	0	0	0	41	0	0	39	123	0	0	0	77	0	0	0
16	127	0	0	0	0	0	0	73	80	0	0	0	0	0	0	120
17	200	0	0	0	0	0	0	0	136	0	0	0	0	0	0	64
18	78	0	0	0	35	0	43	43	144	0	0	0	56	0	0	0
19	104	0	0	0	0	0	96	0	56	0	0	0	0	0	144	0
20	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
21	35	99	0	0	0	0	0	66	82	0	0	0	0	0	0	118
22	124	0	0	0	50	0	0	26	138	0	0	0	0	0	0	62
23	0	0	0	0	0	0	0	200	119	0	0	0	0	0	0	81
24	87	0	0	0	0	0	0	113	200	0	0	0	0	0	0	0
25	88	0	0	0	70	0	0	42	200	0	0	0	0	0	0	0
26	115	0	0	0	0	0	44	41	200	0	0	0	0	0	0	0
28	0	0	0	0	50	0	54	95	200	0	0	0	0	0	0	0
29	0	0	0	0	43	0	0	157	0	0	0	0	0	0	0	200
30	92	0	0	56	0	0	0	53	87	0	0	0	0	0	0	113
31	81	0	0	0	0	0	0	119	100	0	0	0	0	0	0	100
32	49	0	0	0	84	0	0	67	91	0	0	0	74	0	0	35
33	172	0	0	0	28	0	0	0	54	0	0	0	64	0	0	82
34	68	0	0	0	0	0	66	66	95	0	0	0	0	0	0	105
35	0	0	0	0	0	0	59	141	93	0	0	0	107	0	0	0
36	200	0	0	0	0	0	0	0	132	0	0	0	0	0	0	68
37	0	0	0	58	0	0	0	142	84	0	0	0	0	0	0	116
38	0	0	0	0	200	0	0	0	143	0	0	30	0	0	0	27
39	200	0	0	0	0	0	0	0	121	0	0	79	0	0	0	0
40	81	0	0	83	0	0	0	36	143	0	0	57	0	0	0	0
41	47	0	0	111	0	0	0	42	78	0	0	122	0	0	0	0
42	86	0	0	0	0	0	0	114	82	0	0	0	0	0	0	118
43	103	0	0	55	0	0	0	43	200	0	0	0	0	0	0	0
44	86	0	0	114	0	0	0	0	97	0	0	103	0	0	0	0
45	34	0	0	37	58	0	0	71	112	0	0	0	0	0	0	88
46	70	0	0	0	32	0	0	98	163	0	0	0	0	0	0	37
47	0	0	0	100	0	0	0	100	200	0	0	0	0	0	0	0
48	0	0	0	110	0	0	0	90	0	0	0	99	0	0	0	101
49	82	0	0	0	0	0	118	0	110	0	0	0	0	0	90	0
50	111	0	0	0	0	0	0	89	200	0	0	0	0	0	0	0
51	120	0	0	0	0	0	0	80	200	0	0	0	0	0	0	0

52	200	0	0	0	0	0	0	0	109	0	0	0	0	0	0	91
53	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
54	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
56	138	0	0	0	0	0	0	62	200	0	0	0	0	0	0	0
57	139	0	0	0	0	0	0	61	200	0	0	0	0	0	0	0
58	0	0	0	0	79	0	0	121	40	0	0	78	0	0	0	82
59	0	0	0	50	57	0	0	92	67	0	0	66	0	0	0	67
60	0	0	0	89	111	0	0	0	0	0	0	113	87	0	0	0
61	0	0	0	0	68	0	76	56	50	0	0	0	0	0	98	52
62	0	0	0	62	38	0	0	100	27	0	0	69	40	0	0	63
63	0	0	0	121	79	0	0	0	0	0	0	110	90	0	0	0
64	0	0	0	160	0	0	0	40	61	0	0	99	0	0	0	40
65	0	0	0	68	55	0	0	78	41	0	0	83	76	0	0	0
66	0	0	0	0	75	0	75	50	200	0	0	0	0	0	0	0
67	0	0	0	83	117	0	0	0	82	0	0	118	0	0	0	0
68	124	0	0	0	0	0	25	50	30	45	0	0	0	0	125	0
69	37	0	0	76	30	0	0	58	59	110	0	31	0	0	0	0
71	0	87	0	113	0	0	0	0	114	0	0	44	0	0	0	43
72	0	0	0	0	106	0	0	94	96	0	0	0	104	0	0	0
73	0	120	0	0	80	0	0	0	46	61	0	0	93	0	0	0
74	0	0	34	0	82	0	0	83	200	0	0	0	0	0	0	0
75	79	0	0	0	60	0	0	61	200	0	0	0	0	0	0	0
76	119	0	0	0	81	0	0	0	200	0	0	0	0	0	0	0
77	107	0	0	0	54	0	0	40	102	0	0	0	98	0	0	0
78	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
79	122	0	0	0	0	0	33	45	148	0	0	0	0	0	0	52
80	200	0	0	0	0	0	0	0	150	0	0	0	0	0	0	50
81	116	0	0	0	84	0	0	0	200	0	0	0	0	0	0	0
82	116	0	0	0	84	0	0	0	200	0	0	0	0	0	0	0
83	110	0	0	0	0	0	0	90	200	0	0	0	0	0	0	0
84	134	0	0	0	0	0	0	66	200	0	0	0	0	0	0	0
85	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
86	74	0	0	0	0	0	0	126	200	0	0	0	0	0	0	0
87	0	0	0	0	0	200	0	0	0	0	0	0	45	69	0	86
88	200	0	0	0	0	0	0	0	53	0	0	0	0	116	0	31
89	75	0	0	0	0	0	0	125	116	0	0	0	0	0	37	47
90	161	0	0	0	0	0	39	0	200	0	0	0	0	0	0	0
91	135	0	0	0	0	0	0	65	156	0	0	0	0	0	0	44
92	109	0	0	0	91	0	0	0	126	0	0	0	74	0	0	0
93	0	0	0	0	106	0	0	94	88	0	0	0	0	0	0	112
94	100	0	0	0	0	0	0	100	200	0	0	0	0	0	0	0
95	0	0	0	73	0	0	0	127	96	0	0	0	0	0	0	104
96	28	0	0	0	142	0	0	30	27	0	0	54	119	0	0	0
97	0	0	0	132	26	0	0	42	85	0	0	115	0	0	0	0
98	105	0	0	0	0	0	0	95	124	0	0	0	0	0	0	76
101	36	0	0	0	86	0	0	78	75	0	0	0	125	0	0	0
102	96	0	0	0	104	0	0	0	138	0	0	0	0	0	0	62
103	79	0	0	0	80	0	0	41	50	0	0	0	73	0	0	78
104	91	0	0	0	109	0	0	0	29	0	0	0	65	0	0	106
106	39	40	0	0	121	0	0	0	0	0	0	0	138	0	0	62
107	119	0	0	0	0	0	0	81	75	0	0	0	0	0	0	125
108	78	0	0	0	0	0	76	46	47	0	0	0	0	0	0	153
109	0	0	0	0	85	0	0	115	133	0	0	0	0	0	0	67
110	104	0	0	0	0	0	0	96	126	0	0	0	0	0	0	74

111	0	101	0	0	0	0	0	99	0	45	0	0	52	0	0	104
113	200	0	0	0	0	0	0	0	169	0	0	0	0	0	0	31
114	121	0	0	0	0	0	0	79	82	0	0	0	0	0	0	118
115	0	0	0	81	0	0	0	119	144	0	0	0	0	0	0	56
116	0	0	0	0	116	0	0	84	0	0	0	0	75	0	0	125
117	110	0	0	0	55	0	0	34	145	0	0	0	0	0	0	55
118	58	58	0	0	0	0	0	83	66	41	0	0	0	0	0	93
119	0	0	0	40	59	0	0	102	68	0	0	0	38	0	0	95
120	69	0	0	0	47	0	0	84	116	0	0	0	84	0	0	0
121	77	0	0	0	0	0	0	123	115	0	0	0	0	0	0	85
122	165	0	0	0	0	0	0	35	200	0	0	0	0	0	0	0
123	107	0	0	0	0	0	0	93	119	0	0	0	0	0	0	81
124	200	0	0	0	0	0	0	0	169	0	0	0	0	0	0	31
125	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
126	34	0	0	0	0	0	0	166	82	118	0	0	0	0	0	0
127	86	31	0	0	0	0	0	84	103	38	0	31	0	0	0	27
128	0	0	0	0	93	0	0	107	105	64	0	0	31	0	0	0
130	0	83	0	0	56	0	0	61	40	0	0	0	160	0	0	0
131	0	0	0	0	54	0	0	146	0	35	0	94	0	0	0	71
132	0	0	0	0	67	0	0	133	0	101	0	0	0	0	0	99
133	0	0	0	0	86	0	0	114	83	0	0	0	0	0	0	117
134	0	50	0	0	65	0	0	86	0	0	0	0	88	0	0	112
135	0	0	0	0	88	0	0	112	27	56	0	0	34	0	0	83
136	0	45	0	0	85	0	0	70	0	55	0	0	36	0	0	109
137	0	0	0	0	200	0	0	0	0	0	0	0	124	0	0	76
138	65	0	0	0	0	0	0	135	158	0	0	0	0	0	0	42
139	0	0	0	0	83	0	0	117	0	0	0	0	67	0	0	133
140	0	0	0	0	67	0	0	133	128	0	0	0	0	0	0	72
141	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	200
142	0	0	0	0	112	0	0	88	0	120	0	0	0	0	0	80
143	0	74	0	0	42	0	0	85	0	139	0	0	61	0	0	0
144	0	47	0	0	60	0	0	93	0	0	0	0	141	0	0	59
145	0	0	0	0	200	0	0	0	0	0	0	0	109	0	0	91
146	0	0	0	0	200	0	0	0	0	0	0	0	71	0	0	129
147	0	0	0	72	79	0	0	49	0	0	0	0	0	0	0	200
148	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
149	0	0	0	0	200	0	0	0	0	0	0	0	108	0	0	92
150	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
151	0	0	0	0	200	0	0	0	0	147	0	0	53	0	0	0
152	0	0	0	0	200	0	0	0	87	0	0	0	113	0	0	0
153	200	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
154	34	0	0	0	0	0	60	106	74	0	0	0	0	0	84	42
156	0	81	0	0	0	0	0	119	104	0	0	0	0	0	0	96
157	0	68	0	0	0	0	60	72	0	129	0	0	0	0	71	0
158	0	102	0	0	98	0	0	0	80	120	0	0	0	0	0	0
159	0	200	0	0	0	0	0	0	0	83	0	0	0	0	0	117
161	0	60	0	0	0	0	0	140	0	65	0	0	33	0	0	102
162	0	0	0	0	150	0	0	50	0	0	0	0	70	0	0	130
163	0	0	0	0	117	0	0	83	0	57	0	0	0	0	0	143
164	0	0	0	0	72	0	0	128	0	77	0	0	69	0	0	54
165	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
166	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
170	0	56	0	0	144	0	0	0	0	0	0	73	127	0	0	0
171	0	0	0	0	200	0	0	0	0	58	0	0	142	0	0	0

172	0	83	0	0	84	0	0	33	0	69	0	0	33	0	0	97
173	0	0	0	0	75	0	0	125	0	53	0	0	147	0	0	0
174	0	0	0	0	104	0	0	96	0	0	0	48	45	0	0	108
175	0	93	0	0	64	0	0	43	0	38	0	0	68	0	0	93
176	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
178	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
179	0	0	0	0	200	0	0	0	0	57	0	0	143	0	0	0
180	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
181	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
195	0	0	0	0	200	0	0	0	0	111	0	0	89	0	0	0
199	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
200	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
202	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
203	0	0	0	0	200	0	0	0	0	99	0	0	101	0	0	0
204	0	0	0	0	200	0	0	0	0	0	0	55	145	0	0	0
205	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
206	0	0	0	0	200	0	0	0	0	90	0	0	110	0	0	0
209	0	63	0	0	68	0	0	69	0	53	0	0	73	0	0	74
210	0	0	0	83	117	0	0	0	0	120	0	0	80	0	0	0
211	0	0	0	91	109	0	0	0	0	67	0	0	133	0	0	0
212	0	0	0	0	108	0	0	92	0	0	0	0	88	0	0	112
214	0	125	0	0	75	0	0	0	0	0	0	85	55	0	0	60
215	0	0	0	0	128	0	0	72	0	0	0	0	200	0	0	0
217	0	91	0	0	109	0	0	0	0	0	0	82	118	0	0	0
218	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
219	0	0	0	0	200	0	0	0	0	63	0	0	137	0	0	0
220	0	67	0	0	133	0	0	0	0	112	0	0	88	0	0	0
221	0	0	0	0	200	0	0	0	0	112	0	0	88	0	0	0
223	0	0	0	0	200	0	0	0	0	0	0	38	162	0	0	0
224	0	0	0	0	200	0	0	0	0	0	0	26	174	0	0	0
225	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
226	0	91	0	0	109	0	0	0	0	0	0	0	200	0	0	0
227	0	79	0	0	121	0	0	0	0	73	0	51	77	0	0	0
230	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
231	0	38	0	27	135	0	0	0	0	53	0	0	147	0	0	0
232	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
233	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
234	0	88	0	0	74	0	0	38	0	0	0	58	55	0	0	87
235	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
236	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
237	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
238	0	37	0	0	163	0	0	0	0	125	0	0	75	0	0	0
239	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
241	0	59	0	0	0	0	0	141	0	0	0	0	0	0	0	200
242	0	131	0	0	69	0	0	0	0	60	0	0	140	0	0	0
243	0	125	0	0	75	0	0	0	0	83	0	0	0	0	0	117
244	0	70	0	0	130	0	0	0	0	41	0	0	159	0	0	0
245	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
246	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
247	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
248	0	0	0	0	200	0	0	0	0	92	0	0	108	0	0	0
249	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
250	0	30	0	0	170	0	0	0	0	0	0	0	200	0	0	0
251	0	46	0	0	154	0	0	0	0	0	0	0	200	0	0	0

252	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
253	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
254	0	27	121	0	53	0	0	0	0	0	0	0	200	0	0	0
255	0	104	0	0	96	0	0	0	0	0	0	0	200	0	0	0
256	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
259	0	0	0	0	200	0	0	0	0	86	0	0	114	0	0	0
260	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
261	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
262	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
263	0	0	0	0	200	0	0	0	0	0	0	0	200	0	0	0
264	0	57	0	0	143	0	0	0	0	0	0	0	200	0	0	0
265	0	0	35	114	51	0	0	0	0	30	0	119	51	0	0	0
266	0	27	0	0	173	0	0	0	0	31	0	0	169	0	0	0

APPENDIX M. Tree frequency for 223 forested plots.

	1958								1991							
	ABCO		PIED		PIPO		POTR		ABCO		PIED		PIPO		POTR	
Plot	JUSC		PIFL		PIPU		PSME		JUSC		PIFL		PIPU		PSME	
1	3	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	3	2	0	0	0	0	0	0	2
3	2	0	0	0	1	0	0	1	1	0	0	0	1	0	0	2
4	3	0	0	0	0	0	0	1	3	0	0	0	0	0	0	1
5	0	0	0	0	2	0	0	2	1	0	0	0	2	0	0	1
6	1	0	0	0	2	0	0	1	1	0	0	0	2	0	0	1
7	0	0	0	1	1	0	1	1	1	0	0	1	1	0	0	1
8	2	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0
9	1	0	0	0	1	0	0	2	4	0	0	0	0	0	0	0
10	3	0	0	0	1	0	0	0	3	0	0	0	1	0	0	0
11	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
13	2	0	0	0	0	0	0	2	3	0	0	0	0	0	0	1
14	3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	2
16	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0
17	0	0	0	0	0	0	4	0	1	0	0	0	0	0	3	0
18	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	2
19	0	0	0	0	0	0	0	4	1	0	0	0	1	0	0	2
20	1	0	0	1	0	0	0	2	3	0	0	1	0	0	0	0
21	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	3
22	2	0	0	1	0	0	0	1	2	0	0	1	0	0	0	1
23	0	1	0	0	1	0	0	2	0	1	0	0	1	0	0	2
24	1	0	0	0	0	0	0	3	2	0	0	0	1	0	0	1
25	2	0	0	1	1	0	0	0	2	0	0	1	1	0	0	0
26	2	0	0	0	1	0	0	1	4	0	0	0	0	0	0	0
28	1	0	0	0	1	0	0	2	1	0	0	0	1	0	0	2
29	1	0	0	0	2	0	0	1	1	0	0	0	2	0	0	1
30	0	0	0	0	2	0	0	2	0	0	0	0	1	0	0	3
31	0	0	0	0	1	0	0	3	0	0	0	0	2	0	0	2
32	1	1	0	0	0	0	0	2	1	0	0	0	0	0	0	3
33	3	0	0	1	0	0	0	0	2	0	0	0	1	0	0	1
34	1	0	0	0	2	0	1	0	2	0	0	0	2	0	0	0
35	1	0	0	0	1	0	0	2	1	0	0	0	1	0	0	2
36	3	0	0	0	1	0	0	0	2	0	0	0	2	0	0	0
37	2	0	0	0	2	0	0	0	1	0	0	0	2	0	0	1
38	2	0	0	0	0	0	0	2	2	0	0	1	1	0	0	0
39	2	0	0	0	0	0	0	2	2	0	0	2	0	0	0	0
40	0	0	0	0	1	0	0	3	0	0	0	2	2	0	0	0
41	0	0	0	3	0	0	0	1	0	0	0	3	0	0	0	1
42	3	0	0	1	0	0	0	0	3	0	0	1	0	0	0	0
43	1	0	0	0	1	0	0	2	1	0	0	0	2	0	0	1
44	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
45	2	0	0	0	0	0	0	2	2	0	0	0	1	0	1	0
46	0	0	0	1	1	0	0	2	0	0	0	1	2	0	0	1
47	1	0	0	1	0	0	0	2	1	0	0	1	0	0	0	2
48	0	1	0	1	0	0	0	2	0	1	0	2	0	0	0	1
49	0	0	0	1	1	0	1	1	3	0	0	0	0	0	0	1
50	3	0	0	0	0	0	1	0	4	0	0	0	0	0	0	0
51	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0

52	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
53	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
54	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0
56	3	0	0	1	0	0	0	0	2	0	0	1	0	1	0	0
57	0	0	0	0	0	3	0	1	1	0	0	0	0	2	0	1
58	0	0	0	0	2	0	0	2	0	0	0	1	1	0	0	2
59	0	0	1	0	2	0	0	1	0	0	0	0	4	0	0	0
60	0	0	0	3	1	0	0	0	0	0	0	2	1	0	0	1
61	1	0	0	1	1	0	1	0	0	0	0	0	2	0	0	2
62	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	1
63	0	0	0	1	2	0	0	1	0	0	0	0	3	0	0	1
64	0	0	0	2	2	0	0	0	0	0	0	3	1	0	0	0
65	0	0	0	2	0	0	0	2	0	0	0	1	0	0	0	3
66	2	0	0	1	0	0	0	1	2	0	0	1	0	0	0	1
67	0	0	0	1	3	0	0	0	0	0	0	0	4	0	0	0
68	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
69	1	0	0	0	1	0	0	2	0	0	0	2	2	0	0	0
71	0	0	0	1	2	0	0	1	1	0	0	1	2	0	0	0
72	0	0	0	1	1	0	0	2	0	0	0	0	1	0	0	3
73	0	1	0	1	1	0	0	1	0	1	0	0	3	0	0	0
74	0	0	0	1	2	0	0	1	0	0	1	0	3	0	0	0
75	2	0	0	0	1	0	0	1	1	0	0	0	2	0	0	1
76	3	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0
77	3	0	0	0	0	0	0	1	2	0	0	0	1	0	0	1
78	2	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0
79	1	0	0	0	0	0	0	3	3	0	0	0	0	0	0	1
80	1	0	0	0	2	0	0	1	1	0	0	0	1	0	0	2
81	3	0	0	0	1	0	0	0	2	0	0	0	1	0	0	1
82	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
83	2	0	0	0	0	0	2	0	2	0	0	0	0	0	2	0
84	2	0	0	0	0	0	1	1	3	0	0	0	1	0	0	0
85	1	0	0	0	0	0	1	2	4	0	0	0	0	0	0	0
86	0	0	0	0	0	0	1	3	2	0	0	0	0	0	1	1
87	1	0	0	0	0	2	1	0	1	0	0	0	0	3	0	0
88	0	0	0	0	0	0	4	0	0	0	0	0	0	1	1	2
89	1	0	0	0	0	0	2	1	2	0	0	0	0	0	2	0
90	2	0	0	0	1	0	0	1	4	0	0	0	0	0	0	0
91	2	0	0	0	0	0	1	1	3	0	0	0	0	0	0	1
92	1	0	0	0	2	0	0	1	2	0	0	0	2	0	0	0
93	4	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0
94	2	0	0	0	2	0	0	0	1	0	0	0	2	0	0	1
95	1	0	0	0	3	0	0	0	1	0	0	0	3	0	0	0
96	1	0	0	0	2	0	0	1	1	0	0	0	2	0	0	1
97	1	0	0	1	1	0	0	1	1	0	0	1	2	0	0	0
98	0	1	0	0	2	0	0	1	0	1	0	0	2	0	0	1
101	3	0	0	0	1	0	0	0	1	0	0	0	1	0	0	2
102	2	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0
103	3	0	0	0	1	0	0	0	1	0	0	0	1	0	0	2
104	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	1
106	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
107	0	0	0	0	1	0	0	3	2	0	0	0	0	0	0	2
108	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	2
109	1	0	0	1	2	0	0	0	1	0	0	0	1	0	0	2
110	0	0	0	0	3	0	0	1	0	0	0	0	2	0	0	2

111	0	0	0	0	2	0	0	2	0	1	0	0	1	0	0	2
113	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
114	1	0	0	0	3	0	0	0	2	0	0	0	1	1	0	0
115	0	0	0	0	3	0	0	1	0	0	0	0	2	0	0	2
116	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
117	0	0	0	0	2	0	0	2	0	0	0	0	3	0	0	1
118	2	0	0	0	1	0	0	1	2	0	0	0	1	0	0	1
119	0	0	0	2	1	0	0	1	0	0	0	2	1	0	0	1
120	0	0	0	0	3	0	0	1	1	0	0	0	3	0	0	0
121	2	0	0	0	1	0	0	1	2	0	0	0	1	0	0	1
122	1	0	0	0	2	0	0	1	2	0	0	0	1	0	0	1
123	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	3
124	1	0	0	0	0	0	0	3	3	0	0	0	0	0	0	1
125	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
126	2	0	0	0	0	0	0	2	2	0	0	0	0	0	0	2
127	1	0	1	1	1	0	0	0	1	1	1	1	0	0	0	0
128	0	0	0	0	3	0	0	1	0	0	0	0	2	0	0	2
130	0	0	0	0	4	0	0	0	0	1	0	0	2	0	0	1
131	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	3
132	0	0	0	0	2	0	0	2	0	0	0	0	1	0	0	3
133	0	0	0	0	4	0	0	0	1	0	0	0	3	0	0	0
134	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	4
135	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
136	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
137	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	1
138	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
139	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	3
140	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	3
141	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	3
142	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
143	0	0	0	0	2	0	0	2	0	1	0	0	1	0	0	2
144	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	3
145	0	0	0	0	3	0	0	1	0	0	0	0	4	0	0	0
146	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
147	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
148	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	1
149	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
150	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
151	0	1	0	0	3	0	0	0	0	0	0	0	4	0	0	0
152	0	0	0	0	3	0	0	1	0	0	0	0	4	0	0	0
153	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0
154	2	0	0	0	1	0	1	0	3	0	0	0	1	0	0	0
156	0	0	0	0	2	0	0	2	0	1	0	0	2	0	0	1
157	0	2	0	0	0	0	1	1	0	1	0	0	0	0	1	2
158	0	0	0	0	4	0	0	0	0	2	0	0	1	0	0	1
159	0	1	0	0	3	0	0	0	0	3	0	0	1	0	0	0
161	0	0	1	0	3	0	0	0	0	0	1	0	3	0	0	0
162	0	1	0	0	2	0	0	1	0	1	0	0	1	0	0	2
163	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
164	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2
165	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
166	0	1	0	0	3	0	0	0	0	0	0	0	4	0	0	0
170	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
171	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0

172	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
173	0	1	0	0	3	0	0	0	0	1	0	0	2	0	0	1
174	0	0	0	0	3	0	0	1	0	0	0	0	4	0	0	0
175	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
176	0	0	0	0	3	0	0	1	0	0	0	0	4	0	0	0
178	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
179	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
180	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
181	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
195	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
199	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
200	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
202	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
203	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
204	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
205	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
206	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
209	0	2	0	0	2	0	0	0	0	2	0	0	2	0	0	0
210	0	0	0	0	2	0	0	2	0	0	0	1	3	0	0	0
211	0	2	0	0	1	0	0	1	0	1	0	0	3	0	0	0
212	0	0	0	1	2	0	0	1	0	0	0	0	2	0	0	2
214	0	3	0	1	0	0	0	0	0	2	0	2	0	0	0	0
215	0	0	0	1	2	0	0	1	0	0	0	1	3	0	0	0
217	0	1	0	0	3	0	0	0	0	2	0	0	2	0	0	0
218	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
219	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
220	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
221	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
223	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
224	0	1	0	2	1	0	0	0	0	1	0	1	2	0	0	0
225	0	2	0	0	2	0	0	0	0	3	0	0	1	0	0	0
226	0	2	0	0	2	0	0	0	0	3	0	0	1	0	0	0
227	0	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0
230	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
231	0	1	0	1	2	0	0	0	0	2	0	0	2	0	0	0
232	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
233	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
234	0	1	0	1	2	0	0	0	0	2	0	0	2	0	0	0
235	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
236	0	1	0	0	3	0	0	0	0	2	0	0	2	0	0	0
237	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
238	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
239	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
241	0	2	0	0	1	0	0	1	0	2	0	0	0	0	0	2
242	0	3	0	0	1	0	0	0	0	4	0	0	0	0	0	0
243	0	1	0	0	3	0	0	0	0	2	0	0	2	0	0	0
244	0	0	0	0	3	0	0	1	0	1	0	0	2	0	0	1
245	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
246	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
247	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
248	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
249	0	1	0	0	3	0	0	0	0	0	0	0	4	0	0	0
250	0	0	0	0	4	0	0	0	0	1	0	0	3	0	0	0
251	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0

252	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
253	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
254	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
255	0	1	0	0	3	0	0	0	0	1	0	0	3	0	0	0
256	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
259	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
260	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
261	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
262	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
263	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0
264	0	1	0	0	3	0	0	0	0	2	0	0	2	0	0	0
265	0	2	0	0	2	0	0	0	0	1	1	0	2	0	0	0
266	0	1	0	0	3	0	0	0	0	2	0	0	2	0	0	0

APPENDIX N. Total 1958 tree basal area (cm^2/tree species) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	1361	0	0	1032	0	0	0	0
2	290	0	0	0	0	0	0	968
3	1484	0	0	0	1355	0	0	484
4	1129	0	0	0	0	0	0	97
5	0	0	0	0	1258	0	0	484
6	1871	0	0	0	768	0	0	135
7	0	0	0	90	387	0	90	90
8	439	0	0	0	0	0	0	1077
9	174	0	0	0	271	0	0	1032
10	1677	0	0	0	97	0	0	0
11	1265	0	0	0	0	0	0	0
13	1200	0	0	0	0	0	0	1097
14	1071	0	0	0	0	0	0	226
16	1432	0	0	0	0	0	0	2839
17	0	0	0	0	0	0	1194	0
18	0	0	0	0	0	0	3348	0
19	0	0	0	0	0	0	0	787
20	129	0	0	1161	0	0	0	4774
21	0	0	0	0	1361	0	0	2039
22	987	0	0	142	0	0	0	161
23	0	161	0	0	342	0	0	3465
24	219	0	0	0	0	0	0	4794
25	1639	0	0	155	2581	0	0	0
26	187	0	0	0	84	0	0	142
28	116	0	0	0	168	0	0	1574
29	419	0	0	0	748	0	0	161
30	0	0	0	0	3484	0	0	587
31	0	0	0	0	497	0	0	1458
32	484	181	0	0	0	0	0	1103
33	1032	0	0	316	0	0	0	0
34	129	0	0	0	1187	0	90	0
35	206	0	0	0	123	0	0	1613
36	1948	0	0	0	3032	0	0	0
37	606	0	0	0	348	0	0	0
38	2161	0	0	0	0	0	0	723
39	219	0	0	0	0	0	0	3084
40	0	0	0	0	3387	0	0	3103
41	0	0	0	1897	0	0	0	277
42	2665	0	0	1548	0	0	0	0
43	387	0	0	0	103	0	0	1394
44	742	0	0	0	0	0	0	0
45	987	0	0	0	0	0	0	419
46	0	0	0	477	129	0	0	639
47	548	0	0	761	0	0	0	4258
48	0	226	0	329	0	0	0	2271
49	0	0	0	490	6387	0	135	1581
50	852	0	0	0	0	0	77	0
51	1032	0	0	0	0	0	0	0
52	2303	0	0	0	0	0	0	0

53	703	0	0	0	0	0	0	0
54	884	0	0	0	0	0	0	148
56	1335	0	0	219	0	0	0	0
57	0	0	0	0	0	3916	0	103
58	0	0	0	0	716	0	0	2632
59	0	0	110	0	2058	0	0	613
60	0	0	0	568	613	0	0	0
61	1613	0	0	2710	619	0	77	0
62	0	0	0	0	3497	0	0	0
63	0	0	0	135	258	0	0	581
64	0	0	0	452	3452	0	0	0
65	0	0	0	639	0	0	0	613
66	852	0	0	561	0	0	0	1039
67	0	0	0	645	2213	0	0	0
68	2658	0	0	0	0	0	0	0
69	277	0	0	0	1987	0	0	716
71	0	0	0	1419	2903	0	0	239
72	0	0	0	697	258	0	0	335
73	0	774	0	206	774	0	0	2355
74	0	0	0	1226	1774	0	0	903
75	3639	0	0	0	1419	0	0	1032
76	432	0	0	0	1277	0	0	0
77	1742	0	0	0	0	0	0	387
78	406	0	0	0	0	0	0	619
79	1548	0	0	0	0	0	0	5168
80	135	0	0	0	6774	0	0	1019
81	665	0	0	0	606	0	0	0
82	852	0	0	0	0	0	0	0
83	1323	0	0	0	0	0	348	0
84	516	0	0	0	0	0	219	5935
85	90	0	0	0	0	0	200	4065
86	0	0	0	0	0	0	465	6303
87	110	0	0	0	0	794	258	0
88	0	0	0	0	0	0	1013	0
89	948	0	0	0	0	0	658	226
90	819	0	0	0	4452	0	0	194
91	594	0	0	0	0	0	148	2323
92	290	0	0	0	3271	0	0	981
93	1755	0	0	0	0	0	0	0
94	639	0	0	0	632	0	0	0
95	1000	0	0	0	7329	0	0	0
96	97	0	0	0	329	0	0	245
97	1032	0	0	219	2968	0	0	4516
98	0	3097	0	0	6503	0	0	723
101	1865	0	0	0	3548	0	0	0
102	1587	0	0	0	4097	0	0	0
103	2923	0	0	0	355	0	0	0
104	0	0	0	0	6329	0	0	0
106	0	0	0	0	1581	0	0	0
107	0	0	0	0	1484	0	0	6581
108	1097	0	0	0	181	0	148	1871
109	742	0	0	168	2194	0	0	0
110	0	0	0	0	3774	0	0	716
111	0	0	0	0	1000	0	0	1581

173	0	710	0	0	4200	0	0	0
174	0	0	0	0	4271	0	0	3355
175	0	0	0	0	6935	0	0	0
176	0	0	0	0	419	0	0	142
178	0	0	0	0	2968	0	0	0
179	0	484	0	0	1284	0	0	0
180	0	0	0	0	4981	0	0	0
181	0	0	0	0	1097	0	0	0
195	0	0	0	0	5052	0	0	0
199	0	219	0	0	2652	0	0	0
200	0	0	0	0	852	0	0	0
202	0	0	0	0	2523	0	0	0
203	0	0	0	0	3084	0	0	0
204	0	303	0	0	2271	0	0	0
205	0	342	0	0	2187	0	0	0
206	0	0	0	0	5748	0	0	0
209	0	1858	0	0	3568	0	0	0
210	0	0	0	0	342	0	0	6271
211	0	2613	0	0	239	0	0	1110
212	0	0	0	142	2716	0	0	652
214	0	1510	0	103	0	0	0	0
215	0	0	0	168	942	0	0	406
217	0	1226	0	0	1690	0	0	0
218	0	0	0	0	2265	0	0	0
219	0	0	0	0	4368	0	0	0
220	0	2452	0	0	3548	0	0	0
221	0	0	0	0	1265	0	0	0
223	0	0	0	0	1226	0	0	0
224	0	613	0	819	226	0	0	0
225	0	2194	0	0	961	0	0	0
226	0	1290	0	0	490	0	0	0
227	0	3987	0	0	0	0	0	0
230	0	768	0	0	8936	0	0	0
231	0	748	0	239	7548	0	0	0
232	0	0	0	0	6632	0	0	0
233	0	0	0	0	4290	0	0	0
234	0	1439	0	1548	897	0	0	0
235	0	187	0	0	3535	0	0	0
236	0	368	0	0	3852	0	0	0
237	0	0	0	0	781	0	0	0
238	0	0	0	0	1058	0	0	0
239	0	0	0	0	6645	0	0	0
241	0	768	0	0	2226	0	0	1710
242	0	1445	0	0	490	0	0	0
243	0	697	0	0	1510	0	0	0
244	0	0	0	0	1252	0	0	406
245	0	0	0	0	11458	0	0	0
246	0	329	0	0	1045	0	0	0
247	0	0	0	0	3471	0	0	0
248	0	0	0	0	8671	0	0	0
249	0	148	0	0	7394	0	0	0
250	0	0	0	0	10200	0	0	0
251	0	0	0	0	2484	0	0	0
252	0	0	0	0	7174	0	0	0

APPENDIX O. Average 1958 tree density (trees/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	54	0	0	15	0	0	0	0
2	340	0	0	0	0	0	0	367
3	166	0	0	0	30	0	0	260
4	241	0	0	0	0	0	0	2603
5	0	0	0	0	22	0	0	51
6	98	0	0	0	64	0	0	27
7	0	0	0	1708	521	0	875	243
8	50	0	0	0	0	0	0	212
9	121	0	0	0	24	0	0	38
10	68	0	0	0	49	0	0	0
11	95	0	0	0	0	0	0	0
13	127	0	0	0	0	0	0	150
14	62	0	0	0	0	0	0	130
16	148	0	0	0	0	0	0	29
17	0	0	0	0	0	0	190	0
18	0	0	0	0	0	0	117	0
19	0	0	0	0	0	0	0	240
20	1502	0	0	166	0	0	0	29
21	0	0	0	0	28	0	0	97
22	159	0	0	65	0	0	0	53
23	0	209	0	0	129	0	0	95
24	113	0	0	0	0	0	0	39
25	60	0	0	71	331	0	0	0
26	477	0	0	0	2657	0	0	114
28	394	0	0	0	2500	0	0	66
29	128	0	0	0	53	0	0	310
30	0	0	0	0	10	0	0	40
31	0	0	0	0	203	0	0	47
32	44	79	0	0	0	0	0	165
33	212	0	0	58	0	0	0	0
34	100	0	0	0	333	0	39	0
35	176	0	0	0	685	0	0	41
36	36	0	0	0	73	0	0	0
37	129	0	0	0	345	0	0	0
38	110	0	0	0	0	0	0	74
39	512	0	0	0	0	0	0	964
40	0	0	0	0	182	0	0	77
41	0	0	0	72	0	0	0	35
42	67	0	0	807	0	0	0	0
43	1392	0	0	0	101	0	0	219
44	265	0	0	0	0	0	0	0
45	27	0	0	0	0	0	0	31
46	0	0	0	111	254	0	0	18
47	20	0	0	2143	0	0	0	160
48	0	21	0	79	0	0	0	36
49	0	0	0	10	631	0	14	13
50	328	0	0	0	0	0	397	0
51	572	0	0	0	0	0	0	0
52	49	0	0	0	0	0	0	0

53	89	0	0	0	0	0	0	0
54	53	0	0	0	0	0	0	33
56	84	0	0	276	0	0	0	0
57	0	0	0	0	0	79	0	59
58	0	0	0	0	38	0	0	195
59	0	0	178	0	36	0	0	370
60	0	0	0	36	98	0	0	0
61	23	0	0	23	477	0	693	0
62	0	0	0	0	89	0	0	0
63	0	0	0	16	254	0	0	370
64	0	0	0	61	59	0	0	0
65	0	0	0	45	0	0	0	105
66	99	0	0	297	0	0	0	62
67	0	0	0	28	44	0	0	0
68	48	0	0	0	0	0	0	0
69	33	0	0	0	274	0	0	247
71	0	0	0	445	38	0	0	11
72	0	0	0	18	58	0	0	176
73	0	8	0	130	10	0	0	119
74	0	0	0	2	102	0	0	6
75	10	0	0	0	5	0	0	6
76	34	0	0	0	826	0	0	0
77	75	0	0	0	0	0	0	53
78	40	0	0	0	0	0	0	247
79	230	0	0	0	0	0	0	76
80	210	0	0	0	12	0	0	1257
81	11	0	0	0	13	0	0	0
82	218	0	0	0	0	0	0	0
83	201	0	0	0	0	0	209	0
84	139	0	0	0	0	0	308	98
85	132	0	0	0	0	0	150	89
86	0	0	0	0	0	0	70	67
87	211	0	0	0	0	1392	206	0
88	0	0	0	0	0	0	216	0
89	10851	0	0	0	0	0	174	250
90	138	0	0	0	36	0	0	41
91	53	0	0	0	0	0	31	119
92	14	0	0	0	12	0	0	19
93	64	0	0	0	0	0	0	0
94	94	0	0	0	225	0	0	0
95	25	0	0	0	291	0	0	0
96	42	0	0	0	807	0	0	5102
97	96	0	0	18	42	0	0	8
98	0	117	0	0	46	0	0	24
101	17	0	0	0	116	0	0	0
102	50	0	0	0	43	0	0	0
103	17	0	0	0	173	0	0	0
104	0	0	0	0	8	0	0	0
106	0	0	0	0	10	0	0	0
107	0	0	0	0	8	0	0	16
108	124	0	0	0	15	0	65	51
109	110	0	0	16	27	0	0	0
110	0	0	0	0	64	0	0	33
111	0	0	0	0	23	0	0	86

113	257	0	0	0	0	0	0	0
114	115	0	0	0	69	0	0	0
115	0	0	0	0	113	0	0	17
116	0	0	0	0	31	0	0	0
117	0	0	0	0	107	0	0	224
118	51	0	0	0	5	0	0	129
119	0	0	0	94	71	0	0	88
120	0	0	0	0	96	0	0	175
121	99	0	0	0	71	0	0	489
122	58	0	0	0	119	0	0	71
123	0	0	0	0	0	0	0	121
124	314	0	0	0	0	0	0	116
125	97	0	0	0	0	0	0	0
126	512	0	0	0	0	0	0	98
127	64	0	370	25	807	0	0	0
128	0	0	0	0	58	0	0	21
130	0	0	0	0	11	0	0	0
131	0	0	0	0	79	0	0	186
132	0	0	0	0	25	0	0	166
133	0	0	0	0	40	0	0	0
134	0	0	0	11	0	0	0	13
135	0	0	0	0	14	0	0	34
136	0	0	0	0	56	0	0	38
137	0	0	0	0	22	0	0	0
138	0	0	0	0	0	0	0	26
139	0	0	0	0	0	0	0	48
140	0	0	0	0	42	0	0	82
141	0	0	0	0	33	0	0	53
142	0	0	0	0	174	0	0	664
143	0	0	0	0	16	0	0	10
144	0	0	0	0	44	0	0	22
145	0	0	0	0	23	0	0	9
146	0	0	0	0	118	0	0	0
147	0	0	0	0	37	0	0	0
148	0	0	0	0	43	0	0	0
149	0	0	0	0	58	0	0	0
150	0	0	0	0	17	0	0	0
151	0	8	0	0	35	0	0	0
152	0	0	0	0	37	0	0	5
153	60	0	0	0	0	0	0	308
154	147	0	0	0	77	0	36	0
156	0	0	0	0	95	0	0	14
157	0	62	0	0	0	0	131	23
158	0	0	0	0	9	0	0	0
159	0	13	0	0	46	0	0	0
161	0	0	23	0	24	0	0	0
162	0	20	0	0	182	0	0	381
163	0	0	0	0	43	0	0	0
164	0	0	0	0	40	0	0	74
165	0	0	0	0	17	0	0	0
166	0	18	0	0	46	0	0	0
170	0	0	0	0	5	0	0	0
171	0	0	0	0	21	0	0	0
172	0	0	0	0	21	0	0	0

173	0	41	0	0	8	0	0	0
174	0	0	0	0	27	0	0	36
175	0	0	0	0	14	0	0	0
176	0	0	0	0	13	0	0	10
178	0	0	0	0	9	0	0	0
179	0	53	0	0	5	0	0	0
180	0	0	0	0	11	0	0	0
181	0	0	0	0	3	0	0	0
195	0	0	0	0	31	0	0	0
199	0	384	0	0	28	0	0	0
200	0	0	0	0	61	0	0	0
202	0	0	0	0	34	0	0	0
203	0	0	0	0	23	0	0	0
204	0	3	0	0	39	0	0	0
205	0	379	0	0	35	0	0	0
206	0	0	0	0	21	0	0	0
209	0	24	0	0	21	0	0	0
210	0	0	0	0	23	0	0	30
211	0	22	0	0	64	0	0	11
212	0	0	0	8	24	0	0	110
214	0	19	0	21	0	0	0	0
215	0	0	0	16	12	0	0	58
217	0	85	0	0	40	0	0	0
218	0	0	0	0	54	0	0	0
219	0	0	0	0	11	0	0	0
220	0	5	0	0	8	0	0	0
221	0	0	0	0	28	0	0	0
223	0	0	0	0	27	0	0	0
224	0	25	0	18	11	0	0	0
225	0	62	0	0	9	0	0	0
226	0	39	0	0	106	0	0	0
227	0	52	0	0	0	0	0	0
230	0	52	0	0	19	0	0	0
231	0	10	0	2	14	0	0	0
232	0	0	0	0	12	0	0	0
233	0	0	0	0	10	0	0	0
234	0	84	0	28	78	0	0	0
235	0	64	0	0	21	0	0	0
236	0	112	0	0	30	0	0	0
237	0	0	0	0	110	0	0	0
238	0	0	0	0	31	0	0	0
239	0	0	0	0	8	0	0	0
241	0	112	0	0	21	0	0	140
242	0	16	0	0	18	0	0	0
243	0	69	0	0	35	0	0	0
244	0	0	0	0	26	0	0	172
245	0	0	0	0	15	0	0	0
246	0	13	0	0	6	0	0	0
247	0	0	0	0	4	0	0	0
248	0	0	0	0	9	0	0	0
249	0	45	0	0	9	0	0	0
250	0	0	0	0	15	0	0	0
251	0	0	0	0	8	0	0	0
252	0	0	0	0	9	0	0	0

253	0	0	0	0	7	0	0	0
254	0	0	0	0	39	0	0	0
255	0	6	0	0	12	0	0	0
256	0	0	0	0	32	0	0	0
259	0	0	0	0	14	0	0	0
260	0	0	0	0	68	0	0	0
261	0	0	0	0	6	0	0	0
262	0	0	0	0	8	0	0	0
263	0	0	0	0	54	0	0	0
264	0	19	0	0	34	0	0	0
265	0	18	0	0	12	0	0	0
266	0	7	0	0	8	0	0	0

APPENDIX P. Total 1991 tree basal area (cm^2/tree species) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	668	0	0	0	0	0	0	0
2	1403	0	0	0	0	0	0	820
3	1691	0	0	0	1932	0	0	1820
4	1758	0	0	0	0	0	0	503
5	131	0	0	0	1647	0	0	2055
6	136	0	0	0	1793	0	0	191
7	735	0	0	143	666	0	0	246
8	3904	0	0	0	0	0	0	0
9	2343	0	0	0	0	0	0	0
10	2385	0	0	0	373	0	0	0
11	1905	0	0	0	0	0	0	0
13	1619	0	0	0	0	0	0	6348
14	943	0	0	0	0	0	0	783
16	2415	0	0	0	0	0	0	0
17	87	0	0	0	0	0	1231	0
18	0	0	0	0	0	0	1688	194
19	423	0	0	0	257	0	0	622
20	606	0	0	1948	0	0	0	0
21	0	0	0	0	2035	0	0	3004
22	2252	0	0	430	0	0	0	784
23	0	415	0	0	523	0	0	4110
24	378	0	0	0	1940	0	0	401
25	2421	0	0	363	2837	0	0	0
26	683	0	0	0	0	0	0	0
28	293	0	0	0	263	0	0	1854
29	855	0	0	0	1152	0	0	257
30	0	0	0	0	2419	0	0	1446
31	0	0	0	0	869	0	0	1268
32	119	0	0	0	0	0	0	2308
33	431	0	0	0	272	0	0	430
34	304	0	0	0	1548	0	0	0
35	296	0	0	0	290	0	0	509
36	1275	0	0	0	4372	0	0	0
37	430	0	0	0	623	0	0	145
38	2685	0	0	194	102	0	0	0
39	282	0	0	927	0	0	0	0
40	0	0	0	894	5243	0	0	0
41	0	0	0	2320	0	0	0	92
42	371	0	0	1728	0	0	0	0
43	133	0	0	0	1338	0	0	3107
44	1372	0	0	0	0	0	0	0
45	1515	0	0	0	320	0	100	0
46	0	0	0	661	728	0	0	670
47	1122	0	0	887	0	0	0	4822
48	0	343	0	735	0	0	0	2393
49	558	0	0	0	0	0	0	1182
50	1726	0	0	0	0	0	0	0
51	1775	0	0	0	0	0	0	0
52	2339	0	0	0	0	0	0	0

53	1431	0	0	0	0	0	0	0
54	865	0	0	0	0	0	0	0
56	1971	0	0	249	0	170	0	0
57	2324	0	0	0	0	3607	0	299
58	0	0	0	135	2463	0	0	929
59	0	0	0	0	3913	0	0	0
60	0	0	0	894	824	0	0	840
61	0	0	0	0	1292	0	0	342
62	0	0	0	0	623	0	0	108
63	0	0	0	0	878	0	0	1035
64	0	0	0	1550	620	0	0	0
65	0	0	0	507	0	0	0	1292
66	1888	0	0	784	0	0	0	616
67	0	0	0	0	5163	0	0	0
68	3848	0	0	0	0	0	0	0
69	0	0	0	3307	4169	0	0	0
71	95	0	0	1893	3876	0	0	0
72	0	0	0	0	495	0	0	1107
73	0	179	0	0	817	0	0	0
74	0	0	408	0	3209	0	0	0
75	152	0	0	0	2220	0	0	224
76	1453	0	0	0	0	0	0	0
77	1801	0	0	0	665	0	0	713
78	1405	0	0	0	0	0	0	0
79	8682	0	0	0	0	0	0	337
80	287	0	0	0	1832	0	0	1280
81	991	0	0	0	233	0	0	177
82	1321	0	0	0	0	0	0	0
83	2456	0	0	0	0	0	546	0
84	2250	0	0	0	222	0	0	0
85	677	0	0	0	0	0	0	0
86	718	0	0	0	0	0	594	235
87	568	0	0	0	0	1637	0	0
88	0	0	0	0	0	219	471	212
89	1593	0	0	0	0	0	892	0
90	546	0	0	0	0	0	0	0
91	826	0	0	0	0	0	0	85
92	203	0	0	0	3893	0	0	0
93	1600	0	0	0	129	0	0	0
94	1452	0	0	0	1074	0	0	141
95	1307	0	0	0	8357	0	0	0
96	272	0	0	0	351	0	0	511
97	117	0	0	132	536	0	0	0
98	0	2669	0	0	7758	0	0	850
101	2463	0	0	0	491	0	0	362
102	2032	0	0	0	2285	0	0	0
103	143	0	0	0	755	0	0	249
104	0	0	0	0	1684	0	0	408
106	0	0	0	0	2843	0	0	0
107	175	0	0	0	0	0	0	2721
108	0	0	0	0	683	0	216	1188
109	1110	0	0	0	99	0	0	393
110	0	0	0	0	3147	0	0	1376
111	0	391	0	0	564	0	0	1654

113	3130	0	0	0	0	0	0	0
114	462	0	0	0	263	1562	0	0
115	0	0	0	0	2240	0	0	850
116	0	0	0	0	5115	0	0	0
117	0	0	0	0	570	0	0	281
118	750	0	0	0	2534	0	0	317
119	0	0	0	911	405	0	0	774
120	441	0	0	0	1125	0	0	0
121	588	0	0	0	211	0	0	437
122	2137	0	0	0	2324	0	0	503
123	117	0	0	0	0	0	0	931
124	409	0	0	0	0	0	0	693
125	936	0	0	0	0	0	0	0
126	3851	0	0	0	0	0	0	1475
127	211	2198	434	957	0	0	0	0
128	0	0	0	0	312	0	0	5230
130	0	343	0	0	1654	0	0	603
131	0	0	0	0	340	0	0	9723
132	0	0	0	0	527	0	0	3436
133	83	0	0	0	3533	0	0	0
134	0	0	0	0	0	0	0	5624
135	0	0	0	0	739	0	0	1151
136	0	0	0	0	3993	0	0	2104
137	0	0	0	0	370	0	0	441
138	0	0	0	0	0	0	0	5710
139	0	0	0	0	111	0	0	2521
140	0	0	0	0	350	0	0	1057
141	0	0	0	0	479	0	0	713
142	0	0	0	0	1126	0	0	885
143	0	487	0	0	1987	0	0	391
144	0	0	0	0	940	0	0	3373
145	0	0	0	0	4314	0	0	0
146	0	0	0	0	3974	0	0	0
147	0	0	0	0	2412	0	0	0
148	0	0	0	0	727	0	0	177
149	0	0	0	0	2749	0	0	0
150	0	0	0	0	1617	0	0	0
151	0	0	0	0	2382	0	0	0
152	0	0	0	0	968	0	0	0
153	3413	0	0	0	0	0	0	0
154	1940	0	0	0	840	0	0	0
156	0	290	0	0	2851	0	0	269
157	0	163	0	0	0	0	129	535
158	0	425	0	0	3805	0	0	519
159	0	681	0	0	573	0	0	0
161	0	0	391	0	3259	0	0	0
162	0	1099	0	0	290	0	0	548
163	0	0	0	0	2505	0	0	0
164	0	0	0	0	2242	0	0	333
165	0	0	0	0	556	0	0	0
166	0	0	0	0	1197	0	0	0
170	0	0	0	0	12874	0	0	0
171	0	0	0	0	1875	0	0	0
172	0	360	0	0	3578	0	0	0

173	0	1669	0	0	232	0	0	167
174	0	0	0	0	4611	0	0	0
175	0	0	0	0	8595	0	0	0
176	0	0	0	0	1181	0	0	0
178	0	0	0	0	1479	0	0	0
179	0	642	0	0	1135	0	0	0
180	0	0	0	0	1317	0	0	0
181	0	0	0	0	1569	0	0	0
195	0	0	0	0	5097	0	0	0
199	0	412	0	0	971	0	0	0
200	0	0	0	0	1228	0	0	0
202	0	0	0	0	3331	0	0	0
203	0	0	0	0	5667	0	0	0
204	0	214	0	0	3153	0	0	0
205	0	594	0	0	3402	0	0	0
206	0	0	0	0	1291	0	0	0
209	0	1550	0	0	2741	0	0	0
210	0	0	0	373	513	0	0	0
211	0	1619	0	0	811	0	0	0
212	0	0	0	0	1097	0	0	352
214	0	851	0	917	0	0	0	0
215	0	0	0	119	1424	0	0	0
217	0	1538	0	0	1187	0	0	0
218	0	430	0	0	1040	0	0	0
219	0	585	0	0	2026	0	0	0
220	0	302	0	0	988	0	0	0
221	0	0	0	0	1052	0	0	0
223	0	0	0	0	1701	0	0	0
224	0	760	0	1180	252	0	0	0
225	0	3522	0	0	95	0	0	0
226	0	6185	0	0	437	0	0	0
227	0	4400	0	0	0	0	0	0
230	0	2003	0	0	710	0	0	0
231	0	2503	0	0	4896	0	0	0
232	0	665	0	0	2245	0	0	0
233	0	129	0	0	2229	0	0	0
234	0	4106	0	0	1461	0	0	0
235	0	814	0	0	2944	0	0	0
236	0	899	0	0	88	0	0	0
237	0	0	0	0	2803	0	0	0
238	0	0	0	0	2932	0	0	0
239	0	0	0	0	1874	0	0	0
241	0	1166	0	0	0	0	0	2647
242	0	3135	0	0	0	0	0	0
243	0	1235	0	0	2304	0	0	0
244	0	1035	0	0	2019	0	0	1128
245	0	0	0	0	588	0	0	0
246	0	1346	0	0	1903	0	0	0
247	0	0	0	0	1593	0	0	0
248	0	0	0	0	1562	0	0	0
249	0	0	0	0	593	0	0	0
250	0	174	0	0	3112	0	0	0
251	0	0	0	0	3374	0	0	0
252	0	0	0	0	2524	0	0	0

253	0	0	0	0	1697	0	0	0
254	0	0	0	0	8334	0	0	0
255	0	1263	0	0	6597	0	0	0
256	0	0	0	0	1290	0	0	0
259	0	0	0	0	3211	0	0	0
260	0	0	0	0	6038	0	0	0
261	0	0	0	0	5673	0	0	0
262	0	0	0	0	1586	0	0	0
263	0	0	0	0	2188	0	0	0
264	0	534	0	0	531	0	0	0
265	0	360	275	0	878	0	0	0
266	0	507	0	0	2279	0	0	0

APPENDIX Q. Average 1991 tree density (trees/HA) for 223 forested plots.

Plot	ABCO	JUSC	PIED	PIFL	PIPO	PIPU	POTR	PSME
1	83	0	0	0	0	0	0	0
2	489	0	0	0	0	0	0	282
3	51	0	0	0	31	0	0	220
4	541	0	0	0	0	0	0	195
5	1858	0	0	0	60	0	0	10
6	138	0	0	0	62	0	0	27
7	34	0	0	2066	578	0	0	262
8	100	0	0	0	0	0	0	0
9	41	0	0	0	0	0	0	0
10	63	0	0	0	56	0	0	0
11	103	0	0	0	0	0	0	0
13	218	0	0	0	0	0	0	74
14	221	0	0	0	0	0	0	238
16	102	0	0	0	0	0	0	0
17	197	0	0	0	0	0	2104	0
18	0	0	0	0	0	0	278	185
19	48	0	0	0	87	0	0	189
20	224	0	0	163	0	0	0	0
21	0	0	0	0	21	0	0	133
22	133	0	0	59	0	0	0	50
23	0	185	0	0	115	0	0	74
24	39	0	0	0	115	0	0	185
25	54	0	0	89	297	0	0	0
26	353	0	0	0	0	0	0	0
28	271	0	0	0	2829	0	0	68
29	126	0	0	0	57	0	0	348
30	0	0	0	0	35	0	0	24
31	0	0	0	0	109	0	0	69
32	304	0	0	0	0	0	0	198
33	133	0	0	0	83	0	0	191
34	116	0	0	0	376	0	0	0
35	204	0	0	0	589	0	0	120
36	31	0	0	0	41	0	0	0
37	250	0	0	0	403	0	0	127
38	83	0	0	31	210	0	0	0
39	1223	0	0	427	0	0	0	0
40	0	0	0	48	147	0	0	0
41	0	0	0	60	0	0	0	41
42	109	0	0	835	0	0	0	0
43	38	0	0	0	80	0	0	25
44	181	0	0	0	0	0	0	0
45	35	0	0	0	165	0	44	0
46	0	0	0	100	55	0	0	172
47	22	0	0	1890	0	0	0	147
48	0	18	0	76	0	0	0	39
49	76	0	0	0	0	0	0	224
50	379	0	0	0	0	0	0	0
51	551	0	0	0	0	0	0	0
52	62	0	0	0	0	0	0	0

53	105	0	0	0	0	0	0	0
54	57	0	0	0	0	0	0	0
56	146	0	0	232	0	271	0	0
57	45	0	0	0	0	102	0	33
58	0	0	0	34	175	0	0	345
59	0	0	0	0	66	0	0	0
60	0	0	0	40	79	0	0	52
61	0	0	0	0	109	0	0	68
62	0	0	0	0	348	0	0	1126
63	0	0	0	0	130	0	0	230
64	0	0	0	53	149	0	0	0
65	0	0	0	85	0	0	0	107
66	80	0	0	231	0	0	0	51
67	0	0	0	0	31	0	0	0
68	240	0	0	0	0	0	0	0
69	0	0	0	41	51	0	0	0
71	12	0	0	1111	39	0	0	0
72	0	0	0	0	57	0	0	1890
73	0	220	0	0	88	0	0	0
74	0	0	13	0	62	0	0	0
75	35	0	0	0	11	0	0	10
76	44	0	0	0	0	0	0	0
77	48	0	0	0	75	0	0	59
78	79	0	0	0	0	0	0	0
79	28	0	0	0	0	0	0	306
80	212	0	0	0	27	0	0	221
81	36	0	0	0	136	0	0	69
82	489	0	0	0	0	0	0	0
83	169	0	0	0	0	0	46	0
84	129	0	0	0	140	0	0	0
85	188	0	0	0	0	0	0	0
86	72	0	0	0	0	0	73	1958
87	33	0	0	0	0	176	0	0
88	0	0	0	0	0	219	149	212
89	1958	0	0	0	0	0	413	0
90	297	0	0	0	0	0	0	0
91	130	0	0	0	0	0	0	72
92	39	0	0	0	12	0	0	0
93	149	0	0	0	68	0	0	0
94	147	0	0	0	164	0	0	517
95	25	0	0	0	244	0	0	0
96	36	0	0	0	780	0	0	7182
97	38	0	0	423	26	0	0	0
98	0	101	0	0	44	0	0	23
101	8	0	0	0	20	0	0	55
102	47	0	0	0	141	0	0	0
103	73	0	0	0	234	0	0	17
104	0	0	0	0	6	0	0	1
106	0	0	0	0	23	0	0	0
107	104	0	0	0	0	0	0	136
108	0	0	0	0	61	0	68	17
109	105	0	0	0	127	0	0	69
110	0	0	0	0	1068	0	0	24
111	0	126	0	0	27	0	0	94

113	244	0	0	0	0	0	0	0
114	95	0	0	0	32	59	0	0
115	0	0	0	0	38	0	0	27
116	0	0	0	0	42	0	0	0
117	0	0	0	0	147	0	0	135
118	151	0	0	0	5	0	0	26
119	0	0	0	97	71	0	0	87
120	159	0	0	0	45	0	0	0
121	92	0	0	0	67	0	0	434
122	70	0	0	0	183	0	0	66
123	136	0	0	0	0	0	0	247
124	247	0	0	0	0	0	0	257
125	145	0	0	0	0	0	0	0
126	420	0	0	0	0	0	0	94
127	118	117	345	28	0	0	0	0
128	0	0	0	0	20	0	0	34
130	0	55	0	0	9	0	0	32
131	0	0	0	0	72	0	0	183
132	0	0	0	0	15	0	0	133
133	178	0	0	0	43	0	0	0
134	0	0	0	0	0	0	0	80
135	0	0	0	0	29	0	0	36
136	0	0	0	0	52	0	0	34
137	0	0	0	0	70	0	0	15
138	0	0	0	0	0	0	0	29
139	0	0	0	0	23	0	0	64
140	0	0	0	0	43	0	0	77
141	0	0	0	0	36	0	0	865
142	0	0	0	0	216	0	0	551
143	0	21	0	0	23	0	0	14
144	0	0	0	0	41	0	0	21
145	0	0	0	0	45	0	0	0
146	0	0	0	0	107	0	0	0
147	0	0	0	0	32	0	0	0
148	0	0	0	0	280	0	0	79
149	0	0	0	0	69	0	0	0
150	0	0	0	0	43	0	0	0
151	0	0	0	0	96	0	0	0
152	0	0	0	0	87	0	0	0
153	92	0	0	0	0	0	0	0
154	96	0	0	0	112	0	0	0
156	0	29	0	0	104	0	0	416
157	0	345	0	0	0	0	267	163
158	0	56	0	0	64	0	0	142
159	0	154	0	0	798	0	0	0
161	0	0	31	0	30	0	0	0
162	0	45	0	0	31	0	0	119
163	0	0	0	0	44	0	0	0
164	0	0	0	0	54	0	0	223
165	0	0	0	0	494	0	0	0
166	0	0	0	0	181	0	0	0
170	0	0	0	0	20	0	0	0
171	0	0	0	0	30	0	0	0
172	0	20	0	0	27	0	0	0

173	0	51	0	0	4	0	0	68
174	0	0	0	0	37	0	0	0
175	0	0	0	0	16	0	0	0
176	0	0	0	0	52	0	0	0
178	0	0	0	0	25	0	0	0
179	0	55	0	0	65	0	0	0
180	0	0	0	0	115	0	0	0
181	0	0	0	0	24	0	0	0
195	0	0	0	0	49	0	0	0
199	0	376	0	0	48	0	0	0
200	0	0	0	0	73	0	0	0
202	0	0	0	0	84	0	0	0
203	0	0	0	0	42	0	0	0
204	0	11	0	0	39	0	0	0
205	0	457	0	0	36	0	0	0
206	0	0	0	0	51	0	0	0
209	0	25	0	0	24	0	0	0
210	0	0	0	21	36	0	0	0
211	0	2891	0	0	43	0	0	0
212	0	0	0	0	28	0	0	17
214	0	30	0	20	0	0	0	0
215	0	0	0	21	27	0	0	0
217	0	58	0	0	210	0	0	0
218	0	38	0	0	72	0	0	0
219	0	18	0	0	15	0	0	0
220	0	23	0	0	36	0	0	0
221	0	0	0	0	72	0	0	0
223	0	0	0	0	34	0	0	0
224	0	24	0	17	84	0	0	0
225	0	27	0	0	96	0	0	0
226	0	19	0	0	152	0	0	0
227	0	50	0	0	0	0	0	0
230	0	35	0	0	43	0	0	0
231	0	20	0	0	28	0	0	0
232	0	10	0	0	103	0	0	0
233	0	25	0	0	73	0	0	0
234	0	45	0	0	78	0	0	0
235	0	72	0	0	26	0	0	0
236	0	92	0	0	58	0	0	0
237	0	0	0	0	106	0	0	0
238	0	0	0	0	65	0	0	0
239	0	0	0	0	83	0	0	0
241	0	125	0	0	0	0	0	73
242	0	18	0	0	0	0	0	0
243	0	69	0	0	24	0	0	0
244	0	9	0	0	62	0	0	163
245	0	0	0	0	66	0	0	0
246	0	11	0	0	8	0	0	0
247	0	0	0	0	18	0	0	0
248	0	0	0	0	34	0	0	0
249	0	0	0	0	72	0	0	0
250	0	5	0	0	45	0	0	0
251	0	0	0	0	19	0	0	0
252	0	0	0	0	40	0	0	0

253	0	0	0	0	12	0	0	0
254	0	0	0	0	19	0	0	0
255	0	5	0	0	13	0	0	0
256	0	0	0	0	60	0	0	0
259	0	0	0	0	28	0	0	0
260	0	0	0	0	89	0	0	0
261	0	0	0	0	24	0	0	0
262	0	0	0	0	34	0	0	0
263	0	0	0	0	77	0	0	0
264	0	22	0	0	189	0	0	0
265	0	179	489	0	148	0	0	0
266	0	19	0	0	12	0	0	0