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LATE-QUATERNARY VEGETATIONAL HISTORY AT CUPOLA POND, OZARK NATIONAL SCENIC RIVERWAYS, SOUTHEASTERN MISSOURI

A Thesis

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ABSTRACT

A 12 meter core of lacustrine sediments from Cupola Pond, Ripley County, Missouri, provides the first continuous record in the Ozark Plateaus Region of ecologic changes from full-glacial time to the present. From 17,100 to 15,350 yr B.P., forest communities were dominated by jack and/or red pine (northern Diploxylon Pinus) and spruce (Picea). A late-glacial, transitional forest of oak (Quercus), ash (Fraxinus), pine and spruce characterized the upland vegetation that occurred during a period of climatic amelioration between 15,350 and 12,300 yr B.P. The early Holocene period from 12,300 to 9,100 yr B.P. was marked by the collapse of the northern Diploxylon pine, spruce, and ash populations, and the expansion of cool-temperate species of oak, hickory (Carya), and hornbeam (Carpinus/Ostrya type) as well as herbs of the family Compositae. Mid-Holocene warming between 9,100 and 6,700 yr B.P. brought about an apparent major decrease in the species richness of deciduous arboreal taxa. During a period of peak warming between 6,700 and 6,350 yr B.P., an oak parkland dominated the uplands (together, oak and grass (Gramineae) represented 92% of the upland-pollen assemblage). Buttonbush (Cephalanthus occidentalis) established around the shallow margin of Cupola Pond by 4,500 yr B.P. By 3,500 yr B.P., during the late-Holocene interval, the upland vegetation of oak parkland was replaced by a forest dominated by shortleaf pine (southern Diploxylon Pinus). By 3,300 yr B.P., as temperate forested environments replaced the more

xeric parkland environments in the uplands, populations of tupelo-gum (Nyssa aquatica) locally established in the bottomlands around Cupola Pond.

The sequential migration of tree taxa during the late-glacial and throughout the Holocene reflects both a biotic response to climatic change, and differences in rates and routes of migration from full-glacial refugial areas. However, taxon calibrations and modern analogues (using dissimilarity coefficients of Euclidean Distance, Standard Euclidean Distance, and Chord Distance), indicate that the Southeastern Ozark Plateaus provided a full-glacial refuge for cool-temperate deciduous taxa, including oak, maple (Acer), ash, elm and willow (Salix).

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I. INTRODUCTION

The mountains of the Ozark Plateaus traditionally have been considered as a tectonically and climatically stable region that has served as a major refugium for warm-temperate forests of oak (Quercus) and hickory (Carya) since the Tertiary Period (Braun, 1950; Steyermark, 1959). Recent studies within the east-central United States have used fossil-pollen assemblages to characterize vegetational response during the transition from full-glacial conditions of the late Pleistocene to the interglacial conditions of the Holocene (H. Delcourt, 1979; P. Delcourt, 1980; Delcourt et al., 1980). These studies suggest that refugia for mesic, deciduous forest species were located primarily in the Gulf Coastal Plain rather than in the southern Appalachian Mountain region. No late Quaternary palynological sequence, however, has yet been published from the Ozark Plateaus of Missouri or Arkansas that continuously records the critical vegetational changes from peak-glacial conditions, through the late-glacial/early Holocene transition, to the present interglacial.

Several questions are, therefore, posed by contemporary paleoecological investigations. First, did the Ozark Plateaus serve as a full-glacial refuge for warm-temperate and/or cool-temperate deciduous forest species? Second, did boreal forests replace all deciduous hardwood trees in the Ozark uplands during full-glacial times? Third, how and when did the Ozark vegetation respond to major

climatic changes at the Pleistocene/Holocene boundary and during the Holocene?

Cupola Pond, located in a karst depression in the Ozark Plateaus Physiographic Province of southeastern Missouri, is a small lake basin (0.5 ha) surrounded by a closed-canopy forest. The modern pollen rain in lakes of this size is dominated by the extra-local component (originating within a 200 m radius of the site) reflecting forest composition from the local watershed (Jacobson and Bradshaw, 1981). Pollen analysis of a 12 m core of late Quaternary sediment taken from Cupola Pond (Figures 1 and 2) provides the first continuous paleovegetational and paleoclimatic record from the southeastern Missouri Ozarks that directly tests the assertions of Braun (1950), and Steyermark (1959), concerning the antiquity and persistence of the Ozark flora through the late Pleistocene and Holocene.

Three kinds of numerical techniques are used to objectively evaluate the plant-fossil assemblages and characterize the nature of paleovegetational and paleoclimatic changes in the vicinity of Cupola Pond since the last full-glacial interval 17,000 years ago. Constrained single-link cluster analysis (Birks, 1982) delineates informal pollen-assemblage zones which assist in defining the major late Quaternary changes in plant communities at Cupola Pond. Calibration of the modern pollen/vegetation relationship allows more accurate quantification of past forest composition (Delcourt et al., 1983, 1984). Modern analogues calculated with three dissimilarity coefficients such as Euclidean Distance, Chord Distance, and

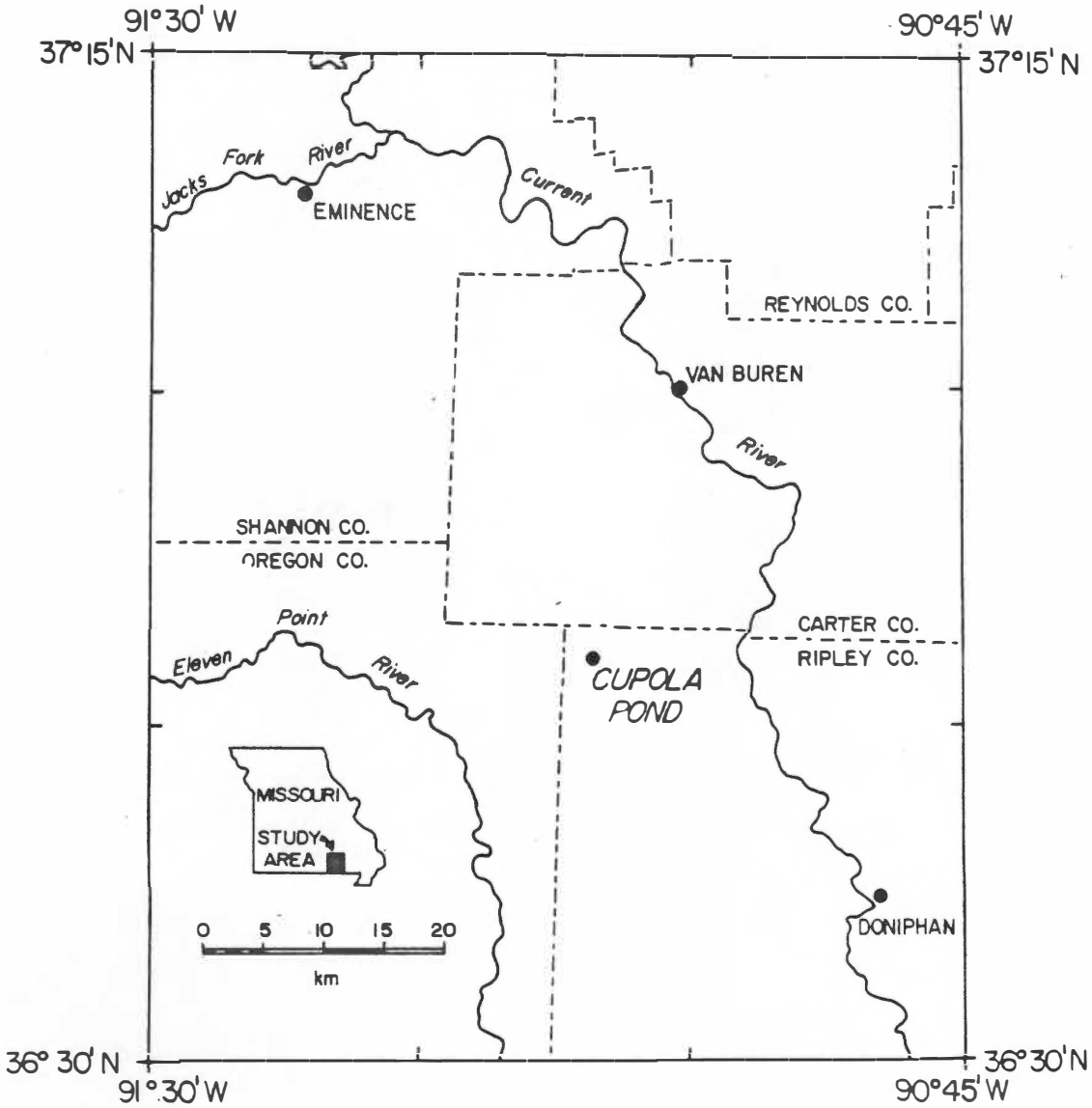


Figure 1. Location map for Cupola Pond, Ripley County, Missouri.

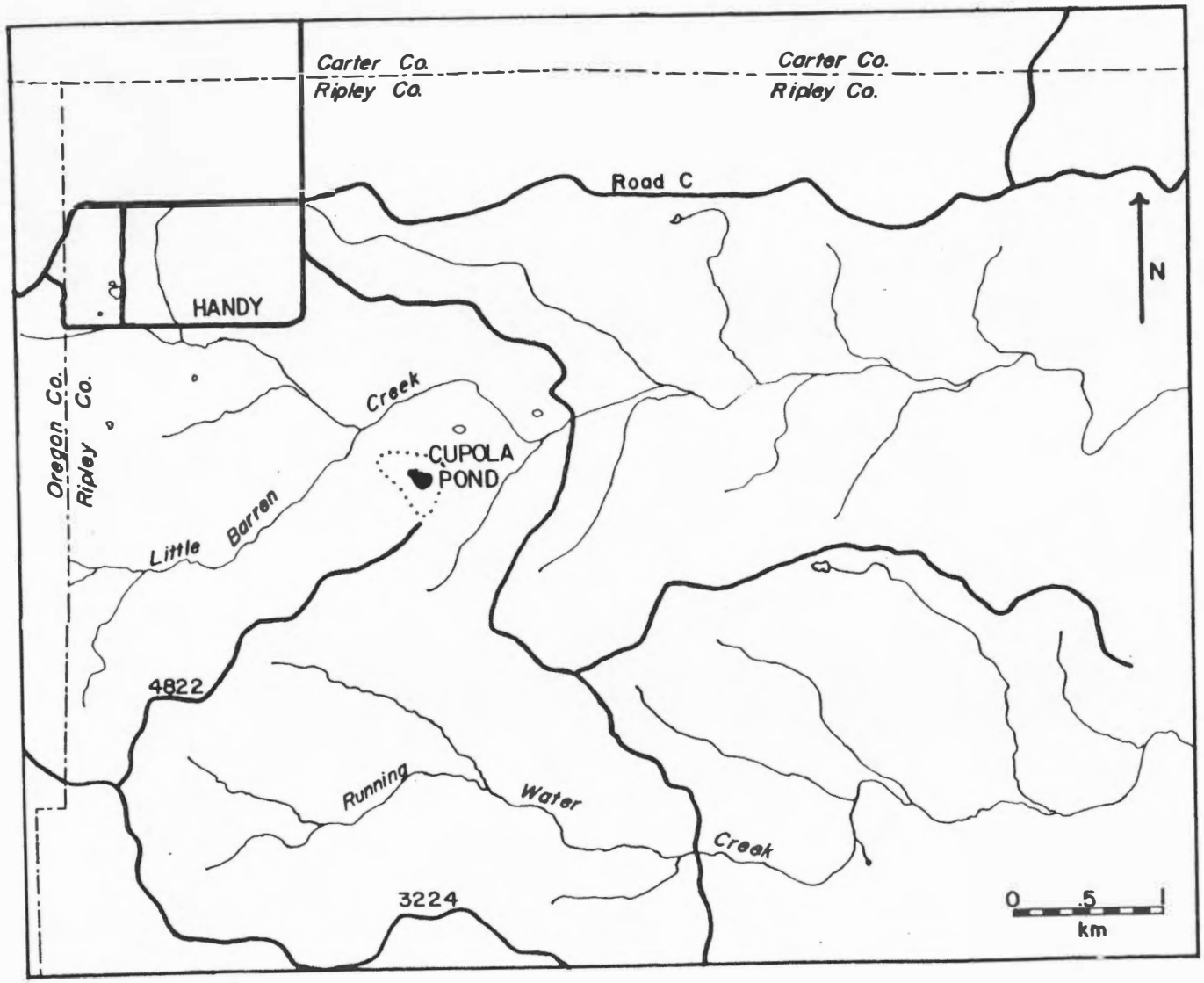


Figure 2. Cupola Pond with surrounding drainage.

Standardized Euclidean Distance (Prentice, 1982; Delcourt and Delcourt, 1984), permit identification of analogues in both vegetation and climate for past pollen assemblages.

Current ongoing projects within the Ozark National Scenic Riverways (ONSR) include investigations by James and Cynthia Price (Southwest Missouri State University) and Roger Saucier (US Army Corp of Engineers, Vicksburg). The Prices are studying the anthropology and archaeology of this area while Roger Saucier is studying Quaternary alluvial-terrace stratigraphy and riverine processes. The investigation presented here has been designed to help provide a chronology of climatic and vegetation changes through the late Quaternary as a supplement to both of these projects.

II. SITE INFORMATION

Cupola Pond is located at an elevation of 244 meters in a permanently wet, sinkhole collapse in northwest Ripley County, Missouri (36°, 47', 33" N, 91° 05' 24" W, Handy, Missouri, 7.5' U.S.G.S. Topographic Quadrangle) (Figure 1). This site is located within the Salem Plateau of the Ozark Plateaus Province, a region considered to be a classic example of karst topography (Bretz, 1942). This topography has resulted from solution of dolomitic bedrock of late-Cambrian and early-Ordovician age. The late-Cambrian units consist of the chert-rich Potosi Formation and the Eminence Dolomite. These are overlain by the Ordovician Gunter Sandstone Member of the Van Buren Formation. The Gunter Member, an important aquifer in the area (Branson, 1944), separates the Cambrian dolomites from the Van Buren dolomites of early-Ordovician age. The Van Buren dolomites are overlain by the chert-rich Gasconade dolomite. The Gasconade is, in turn, overlain by the interbedded quartz sandstones and dolomites of the Roubidoux Formation, an important ridge-forming unit within the Salem Plateau.

Valleys of the major streams in the southeastern Ozark Plateaus are steep-sided and commonly contain unpaired terraces (Saucier, 1981). The stream interfluves are strongly dissected (Branson, 1944). These streams (Figure 2) are fed both by surface run-off and by springs. Average annual precipitation is 118.4 cm/yr with only 4% in the form of snow. Most of the rain falls from April through September. With

an average temperature in January of 2.9°C, winters are cold and dry. Average temperatures in July reach 26.2°C (National Oceanic and Atmospheric Administration, 1974).

The forested watershed for Cupola Pond is about 40 ha in surface area (Figure 2), and is situated along the major interfluve between the Current and Eleven Point Rivers (Figure 1). Cupola Pond, centrally located within the watershed, is 0.5 ha in surface area. The topographic relief surrounding Cupola Pond ranges from 15 to 25 meters (Figure 2). The upper slopes and interfluve divides of the watershed are dominated by oak (Quercus alba, Q. falcata), shortleaf pine (Pinus echinata), and hickory (Carya spp.). The lower slopes are characterized by mesic trees such as flowering dogwood (Cornus florida), sassafras (Sassafras albidum), red maple (Acer rubrum), swamp white oak (Quercus bicolor), and willow (Salix spp). Tupelogum trees (Nyssa aquatica) and buttonbrush shrubs (Cephalanthus occidentalis) grow in standing water around the edge of Cupola Pond.

Sawn stumps and stump-sprouted trees are local evidence of the extensive lumbering that occurred in this area between 1890 AD and 1920 AD (Price et al., 1983). During the lumbering era, clearance of upland forests and burning of understory vegetation eliminated protective plant cover from the slopes resulting in sheetwash erosion from the uplands and major alteration of stream flow regimes (Saucier, 1981). Virgin forests were previously dominated by shortleaf pine and oak. More xeric, oak-hickory forests have grown back after lumbering. Due to sheetwash erosion, the Current River (that flows through Ripley

County, Figure 1), once navigable by small steamboats (Rafferty, 1980), is now a braided stream averaging less than one meter in water depth.

III. METHODS

Field Sampling and Techniques

Geologic and topographic maps (7.5 and 15' U.S.G.S. Topographic Quadrangles) of the area surrounding the Ozark National Scenic Riverways (ONSR) were examined to locate prospective coring sites.

Several criteria were considered in selection of a pond for coring. The pond should be permanently wet to insure minimal oxidation of organic matter. The pond should not have permanent (or ephemeral) streams that drain into or out of it. Thus, the pollen rain to the pond will reflect atmospheric, not alluvial, pollen sources, and the size of a pond is directly related to the source area contributing to the pollen rain (Tauber, 1965). The watershed for the pond should be forested to restrict surface-water runoff and overland transport of mineral sediment. The pond should be named, implying historical permanence and yet not be known to be seriously disturbed by human activities. Cupola Pond meets all these criteria, and also is known for its distinct modern flora; it is a registered National Natural Landmark.

Cupola Pond was cored on 22-23 June 1983. A 5 cm diameter, 1 m long, square-rod piston corer (Wright, 1967) was used by hand from a wooden platform built on two, four-man rafts. Coring (core CPM-83B) was terminated at a depth of 1307 cm below water surface due to friction between the sediment and the coring rod. This prevented the

crew (coring manually) from further driving the coring device. A parallel sediment core (core CPM-83A), 608 cm in length, also was obtained. The cores were described according to texture and color (Munsell Color, 1975), wrapped in plastic wrap and aluminum foil, labelled, and transported to the Program for Quaternary Studies at The University of Tennessee, Knoxville, for subsequent analyses.

Laboratory Techniques

Thirty-six duplicate sets of sediment samples were taken from core CPM-83B using a calibrated 1 cm^3 brass sampler (Delcourt, 1979) for loss-on-ignition (LOI) (Dean, 1974) and initial pollen analysis. Subsampling was done at 20 cm intervals for the upper 180 cm of the core and at 40 cm intervals for the lower 1012 cm. Residual water content was determined for each subsample interval by weighing each 1 cm^3 sample of sediment before and after drying at 100°C. The percent of organic matter was calculated (based upon dry-sediment weight) from the number of grams of organic matter per cm^3 of sediment lost during combustion at 550°C. Organic carbon content was then determined by dividing the values for organic matter by a correction factor of 2.13 (Dean, 1974).

Ten determinations for radiocarbon age were made on sediment samples from core CPM-83B and analyzed at the Laboratory of Isotope Geochemistry, University of Arizona, Tucson, Arizona. These samples were corrected for isotope fractionation with a $\delta 13C$ measurement and were then used to determine sedimentation rates at Cupola Pond. An additional sample (CPM-83B-1267), close to the base of core CPM-83B,

was analyzed by thermoluminescence dating performed by Alpha Analytic Inc., Coral Gables, Florida.

Eucalyptus-pollen tablets were added to each sediment sample to permit calculation of absolute concentration and influx of native pollen grains (Maher, 1977; Birks and Birks, 1980). These samples were then prepared for examination using standard palynomorph extraction techniques (Faegri and Iversen, 1975) (see Appendix A for a detailed description of these techniques).

Pollen grains were identified and tabulated using a Leitz Laborlux 12 microscope with 10.0 X eyepieces and a 40.0 X NPL objective (numerical aperture 0.70). A 100.0 X NPL oil immersion objective (numerical aperture 1.32) was used for identification of unknown grains. Microscope slides were prepared from each of the sample residues and palynomorphs were counted using evenly spaced transects which covered at least one-half of each slide (Faegri and Iversen, 1975). The count of each sample continued until a minimum of 300 arboreal pollen grains was reached. Palynomorph identification, based on standard keys, texts, and papers dealing with specific taxa (Helmich, 1963; Kremp, 1965; Wodehouse, 1965; Erdtman, 1966; Kapp, 1969; McAndrews et al., 1973; Faegri and Iversen, 1975; Amman, 1977; Bassett et al., 1978; Lieux, 1980, have been supplemented with reference slides of modern palynomorphs curated in the Program for Quaternary Studies of the Southeastern United States, Departments of Geological Sciences and Botany, The University of Tennessee, Knoxville.

Percentages of arboreal pollen were calculated based on the Arboreal Pollen (AP) Sum. Arboreal and non-arboreal pollen (NAP) made up of shrubs, lianas, herbs and spores calculate an Upland Pollen Sum. Percentages of unknowns were calculated based on the Upland Pollen Sum. The palynomorph percentages of aquatic taxa were calculated based on the sum of pollen grains and spores of aquatic plants plus the total pollen grains and spores of upland plants. The calculation of percentages of indeterminate grains was based on the total number of native palynomorph grains counted. Halves of conifer pollen grains were tabulated for Pinus, Picea, and Abies. Pollen tetrads of Ericaceae and Typha were counted as single dispersal units.

Measurement of the internal diameter of pine-pollen caps and morphological differences in marginal frill can be used to differentiate between groups of northern and southern species of Diploxylon Pinus (Whitehead, 1964; Amman, 1977). One hundred grains were counted from each of several stratigraphic levels at approximately 1000 year intervals when Pinus was greater or equal to 12% of the AP Sum (pollen threshhold for tree presence, Delcourt et al., 1984). These measurements were plotted as histograms of percentages within size categories of the pine-pollen caps (Whitehead, 1964).

Pollen influx rates were calculated using the following equation (Davis et al., 1973; H. Delcourt, 1978): $I = (n/a) \cdot b \cdot c \cdot d$. In this equation, I equals the palynomorph influx, n equals the number of pollen grains tallied from a stratigraphic level, a equals the number of Eucalyptus grains tallied, b equals the number of

Eucalyptus grains per *Eucalyptus* tablet based on 16,180 grains/tablet (Maher, 1977), c equals the number of *Eucalyptus* tablets added to the 1 cm^3 of sediment, and d equals the sediment accumulation rate in cm/yr.

Pollen Zonation

Constrained single-link cluster analysis (CONSLINK) in the computer program Zonation was used to divide the pollen sequence from Cupola Pond into informal pollen-assemblage zones (Birks, 1979). CONSLINK calculates the dissimilarity between stratigraphically adjacent pairs of pollen samples, based upon percentage composition. The more similar the levels, the lower the value of the dissimilarity. Pollen assemblage zones are defined as clusters of relatively similar pollen spectra, and are separated by levels showing maximum dissimilarity (Birks, 1979). If for any stratigraphic level, pollen grains and spores of upland-plant taxa reached 5% or more of the Upland Pollen and Spore Sum, then they were used in the cluster analysis. The value of 5% was used as the cutoff value because values less than 5% are not statistically accurate unless large numbers of pollen grains are counted (on the order of 10,000 grains/level) (Birks, 1979).

CONSLINK is based on an unweighted dissimilarity coefficient (DC), the Manhattan metric. The Manhattan metric, stated as $d(j,k) = \sum_i |Pij - Pik|$, is the sum of the absolute differences between the two pollen spectra. "d" is the unweighted dissimilarity between two adjacent levels j and k, Pij is the total difference in the

pollen spectra of level j, and Pik is the total difference in the pollen spectra of level k (Prentice, 1982).

Modern Analogues

Access to computerized information on modern pollen rain and forestry-inventory data compiled for eastern North America (Delcourt et al., 1984) has permitted identification of the best modern analogues for fossil-pollen spectra at Cupola Pond selected at one thousand year intervals. To examine the influence of differential weighting of pollen taxa upon selection of analogues, these analogues were determined using Euclidean Distance, Chord Distance and Standardized Euclidean Distance. The dissimilarity coefficient of Euclidean Distance is weighted toward the major pollen types, Chord Distance deemphasizes the weighting of major taxa while Standardized Euclidean Distance treats all taxa equally, standardizing them based upon their observed variance (Prentice, 1982). In the following equations, Pij represents the pollen percentage of taxon $\underline{i}$ in pollen spectrum $\underline{j}$, P_{ik} represents the pollen percentage of taxon $\underline{i}$ in pollen spectrum $\underline{k}$, $\sum_i$ represents the summation over all taxa, d(j,k) represents the dissimilarity between pollen spectra $\underline{j}$ and $\underline{k}$, and s_i represents the standard deviation of taxon $\underline{i}$ in the data set. The formula for Euclidean Distance is stated as $d(j,k) = \sqrt{\sum_i (P_{ij}-P_{ik})^2}$. The formula for Chord Distance is stated as $d(j,k) = \sqrt{\sum_i (\sqrt{P_{ij}}-\sqrt{P_{ik}})^2}$. The formula for Standardized Euclidean Distance is stated as $d(j,k) = \sqrt{\sum_i (\frac{P_{ij}-P_{ik}}{s_i})^2}$. For each 1000 year interval, the best three analogues were identified for each of the three coefficients of dissimilarity (procedure

following Delcourt and Delcourt, 1984) (latitude and longitude coordinates for all analogues are listed in Appendix C).

Current climatologic data have been used to compare the mean annual temperature and mean annual precipitation for the locations corresponding to the best analogue selected by each of the three dissimilarity coefficients (Thomas, 1953; National Oceanic and Atmospheric Administration, 1979). These climatic values for the geographic analogues have been plotted against time in order to evaluate apparent paleoclimatic changes that have occurred at Cupola Pond in the last 17,000 years.

Taxon Calibration

To reconstruct changes in forest composition at Cupola Pond, the Taxon Calibration approach has been used in this study. These calibrations represent quantitative adjustments for differences in pollen productivity and dispersibility of grains as these factors relate to the underrepresentation or overrepresentation of taxa in pollen assemblages. By comparing modern-pollen data with measures of a taxon's dominance in forests based on Continuous Forest Inventories, calibrations have been developed for nineteen major forest taxa (Delcourt et al., 1984). These calibrations have been used to reconstruct past forest dominance determined from fossil-pollen data (Delcourt and Delcourt, 1984).

IV. RESULTS

Lithology

The sediment from core CPM-83B is a fibrous, organic clay near the core top (0-100 cm below the sediment/water interface) but is generally a silty to slightly silty clay (100-855 cm depth) with an increase in mean-particle size to clayey silt toward the base (855-1192 cm). Detailed lithological description is provided in Appendix D.

The results of the loss-on-ignition analysis are documented in Appendix B and are graphed in Figure 3. Organic content ranged from 6 to 49% of the dry weight of the sediment. The amount of organic matter averaged 32% of the sediment (dry weight) in samples from 0 to 95 cm depth and samples from 115 to 595 cm depth. Percent-organic matter averaged 10% from 635 cm to the base of the core at 1192 cm.

Chronology

Eight of the ten radiocarbon dates listed in Table 1 have been used to determine the chronology and rates of sediment accumulation for the core. Radiocarbon-date samples taken between 650 and 1192 cm depth have overlaps between mean dates (with their standard deviations). This is plausible noting the high rate of sediment accumulation. For continuity and illustration (with no apparent sediment mixing), dates A-3642 and 3645 have been disregarded. A core

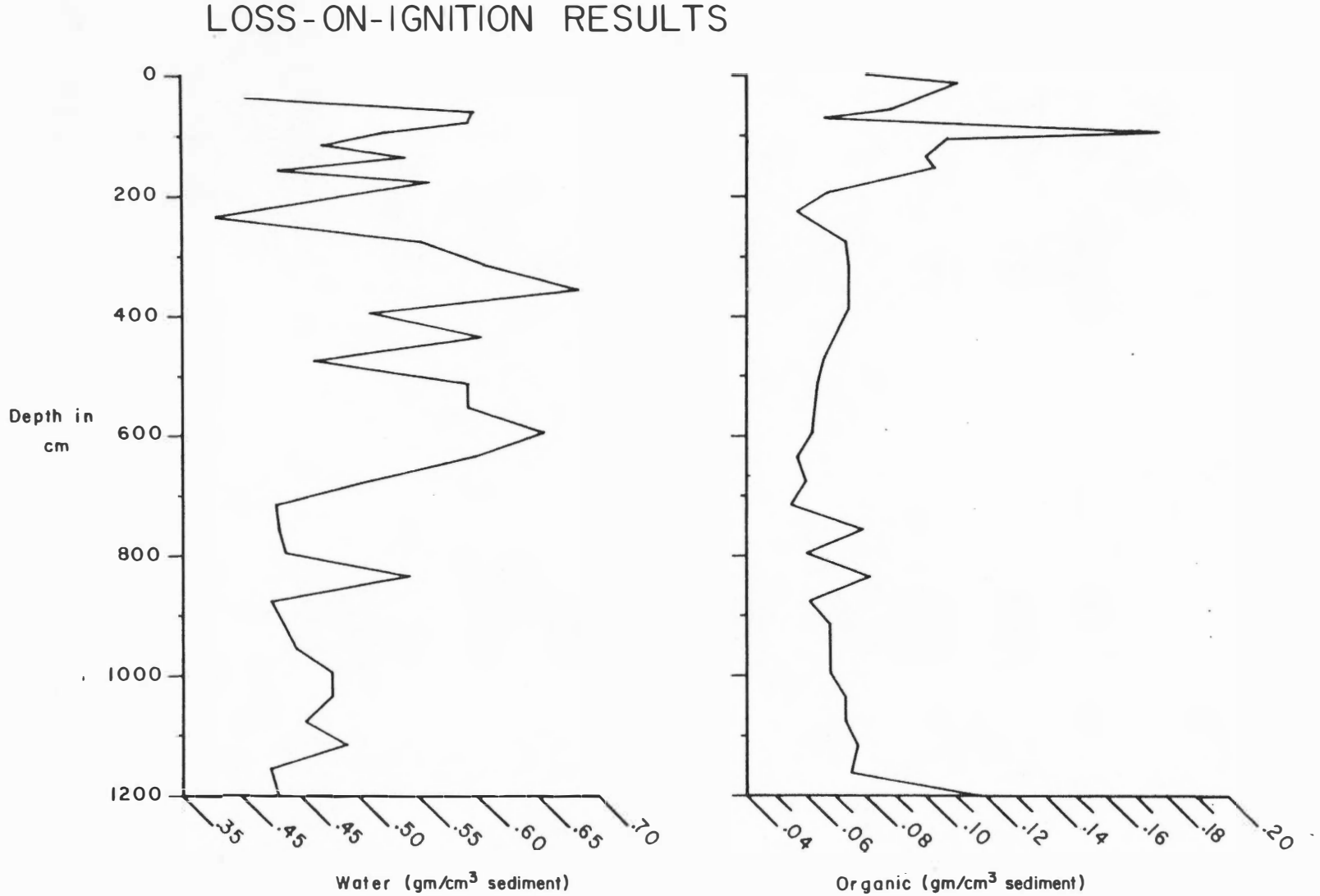


Figure 3. Loss-on-ignition results.

Table 1. Deposition Rates and Times for Cupola Pond

Radiocarbon Age (yr B.P.+ISD)	Sample Depth Internal (cm) (Lab Number for Date)	Midpoint Depth (cm)	Time Elapsed Between Midpoint Depths (yr)	Sediment Interval	Average Deposition Rate (cm/yr)	Average Deposition Time (yr/cm)
0 (AD 1983)	Sediment Surface 0.0 cm	18.0	623	18.0	0.031	32.8
590+/-80	15-21 cm (A-3637)	115.0	8240	97.0	0.012	84.9
8,830+/-130	112.5-117.5 (A-3638)	193.5	2320	78.5	0.034	29.6
11,150+/-170	189-198 (A-3639)	275.0	1830	81.5	0.045	22.5
12,980+/-240	271-279 (A-3640)	478.5	1530	203.5	0.133	7.5
14,510+/-250	474-483 (A-3641)	635.0	1130	156.5	0.138	7.2
15,640+/-470	628-642 (A-3643)	935.0	1370	300.0	0.219	4.6
17,010+/-380	929-941 (A-3644)	1184.0	100	249.0	2.490	0.4
17,110+/-340	1178-1190 (A-3646)					
14,210+/-260	662.5-671.5 (A-3642)	These dates not used for calculation of deposition rates				
16,940+/-350	1181.5-1192.5					

sample (CPM-83B-1267) was dated by thermoluminescence (TL) dating to evaluate this dating method by comparison with the radiocarbon dates that bracket this sample. The thermoluminescence date of 10,050 ± 725 yr B.P. was substantially younger than the radiocarbon dates on samples A-3646 (17,110 ± 340) and A-3645 (16,940 ± 350), both of which have overlapping standard deviations. The discrepancy in radiocarbon and thermoluminescence dates indicates the need to further refine TL techniques, particularly in the time range of younger than 30,000 yr B.P.

The rate of sediment accumulation was highest from 17,110 to 17,010 yr B.P. (2.49 cm/yr) and shows a curvilinear decrease with time (Figure 4). The lowest rate of sediment accumulation occurred during the late Holocene (Table 1). Between 8,830 and 590 yr B.P. the rate of sediment accumulation was 0.012 cm/yr.

Compaction of Sediment

Other workers have attempted to address the problem of sediment compaction (Grimm, 1983) as it relates to interpretation of sedimentation rate (sediment accumulation per unit time). Data from loss-on-ignition analysis (LOI) provides information on relative changes in water content (primarily a reflection of sediment type), porosity and organic matter measured in gm/cm^3 of sediment volume. Water loss and organic content are plotted against core depth (Figure 3), and the results of LOI are given in one thousand year intervals.

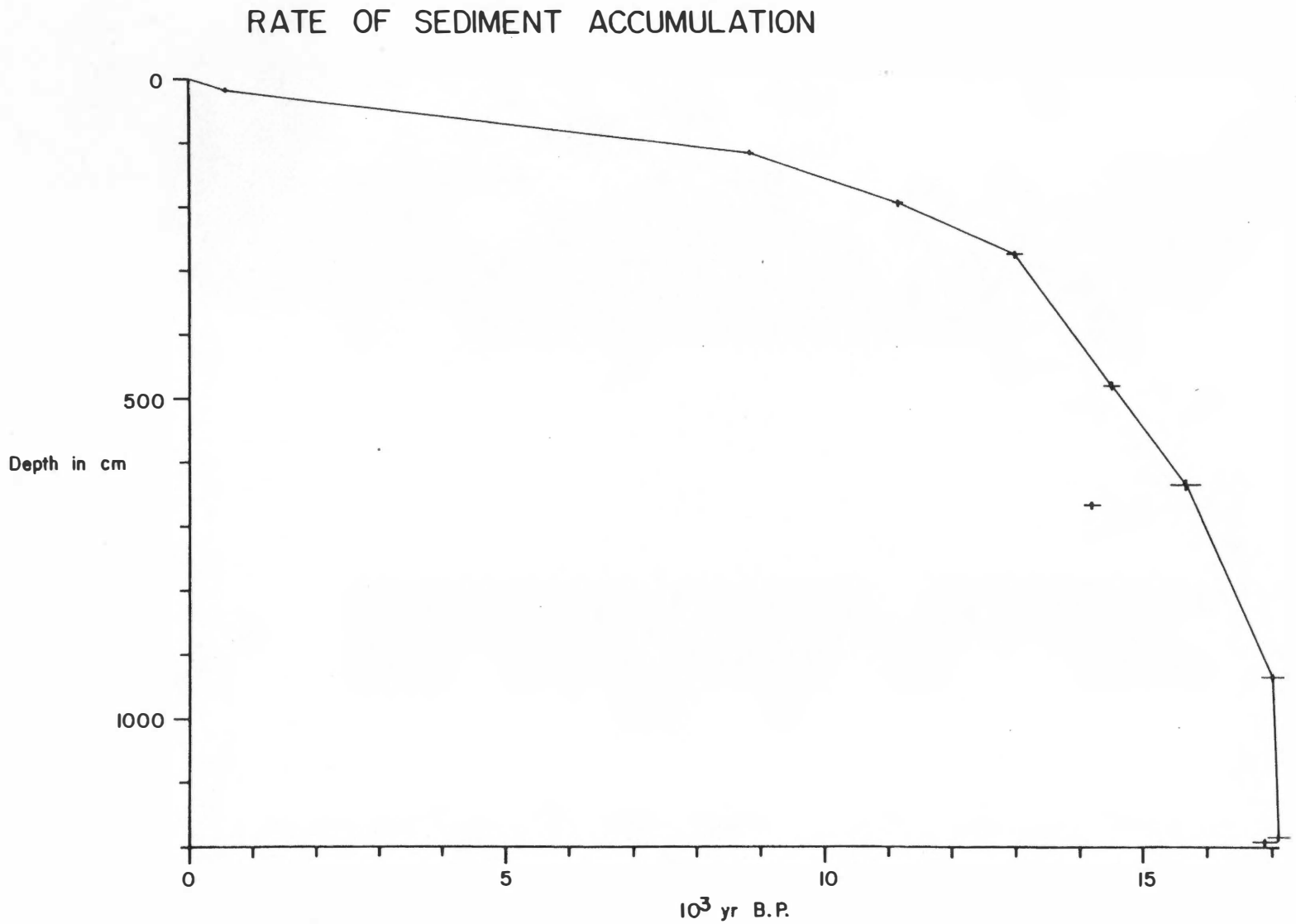


Figure 4. Sedimentation rate based on eight radiocarbon dates.

Rates of Palynomorph Influx

The highest rates of palynomorph influx (expressed as grains·cm^{-2}·yr^{-1}) generally coincide with the high rates of sediment accumulation found in the basal sediments. From 17,100 to 15,000 yr B.P., influx rates for total pollen and spore grains reached highest levels of 42,080 grains·cm^{-2}·yr^{-1}. From 15,000 to 12,000 yr B.P., influx rates were moderate and varied from 10,370 to 18,850 grains·cm^{-2}·yr^{-1}. A second period of high palynomorph influx occurred between 12,000 and 10,000 yr B.P. and was characterized by a rate of 29,370 grains·cm^{-2}·yr^{-1}. Palynomorph influx ranged from 10,280 to 12,960 grains·cm^{-2}·yr^{-1} from 10,000 to 7,200 yr B.P. Coinciding with a period of lower sedimentation from 8,000 yr B.P. to the present, influx rates were lower and varied from 4,620 to 8,080 grains·cm^{-2}·yr^{-1}.

Pollen-Assemblage Zones

The results of constrained single-link cluster analysis (CONSLINK), based on palynomorphs with percentages of 5% or more, calculated from the Upland Sum of pollen grains and spores, were used to determine informal pollen-assemblage zones and subzones at Cupola Pond. The boundaries between biostratigraphic zones were established between consecutive stratigraphic levels with a dissimilarity coefficient of 0.450 or greater. The five major pollen-assemblage zones (Figure 5) are the Pinus-Picea zone, occurring from 1192 cm to 675 cm depth and from 17,110 to 15,700 yr B.P., the Picea-Salix zone,

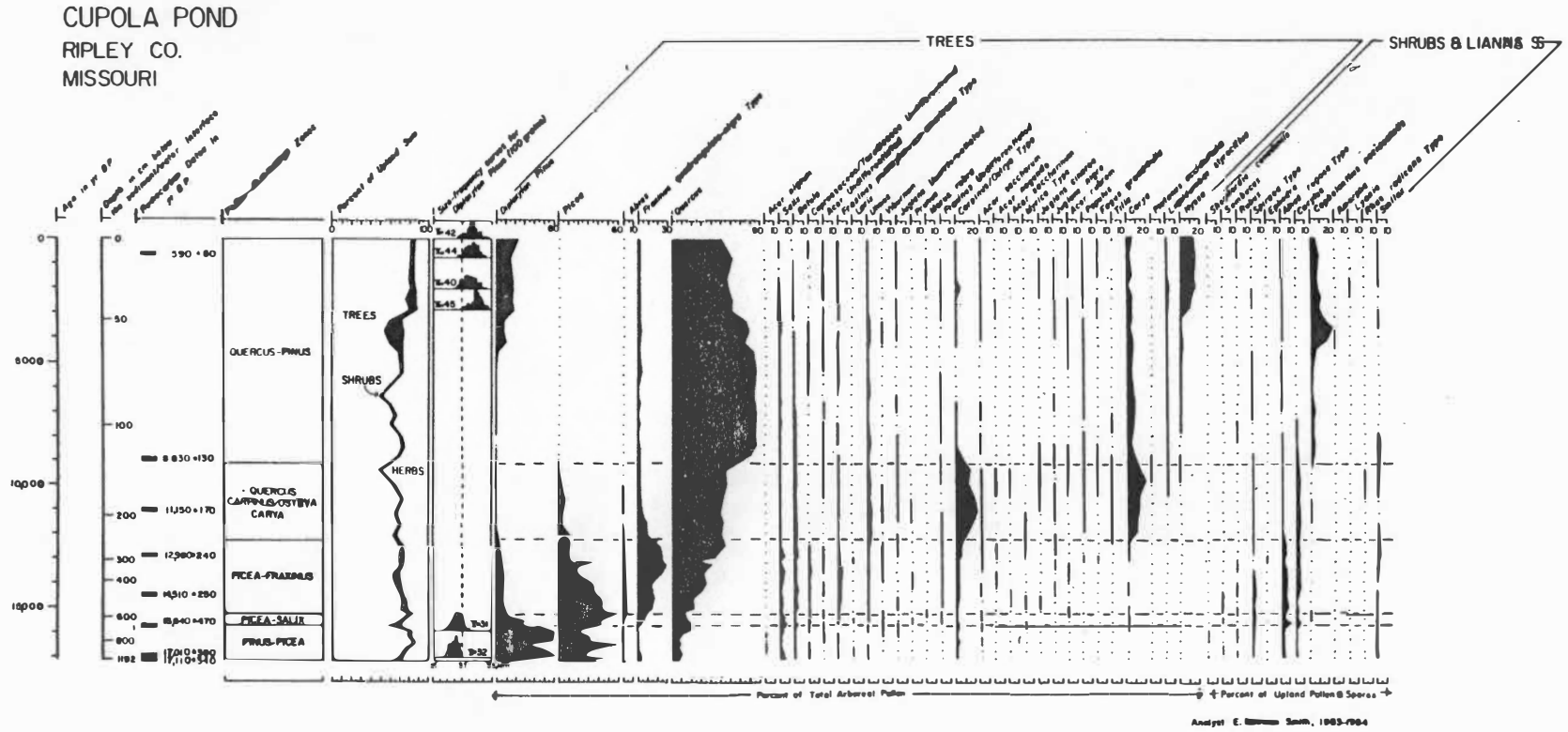


Figure 5. Arboreal pollen percentage diagram.

occurring from 675 cm to 595 cm depth and from 15,700 to 15,350 yr B.P., the Picea-Fraxinus zone, occurring from 595 cm to 245 cm depth and from 15,350 to 12,300 yr B.P., the Quercus-Carpinus/Ostrya-Carya zone, occurring from 245 cm to 125 cm depth and from 12,300 to 9,100 yr B.P., and the Quercus-Pinus zone, occurring from 125 cm to the sediment/water interface and from 9,100 yr B.P. to the present.

The Quercus-Pinus zone has been further subdivided into a Quercus-Gramineae subzone, occurring from 125 cm to 65 cm depth and from 9,100 to 4,550 yr B.P. and a Nyssa-Cephalanthus subzone which occurs from 65 cm to 0 cm and from 4,550 yr B.P. to the present.

The results of the pollen and spore analyses are summarized below and are graphically illustrated in Figures 5 and 6 (see Appendix C, Table C-1, for pollen grain and spore counts).

Pinus-Picea zone (1192 to 675 cm depth, 17,110 to 15,700 yr B.P.). This zone is representative of full-glacial times and is characterized by moderate to high percentages of northern Diploxylon Pinus (values ranging from 17 to 61% of the Arboreal Pollen (AP) Sum). Quercus is represented in limited percentages (6 to 17%), with additional minor arboreal taxa (values from 1 to 4% of AP Sum) including Abies, Fraxinus quadrangulata-nigra-type, Salix, and Carpinus/Ostrya-type. Alnus rugosa-type pollen represented from 1 to 3% of the assemblage calculated on the Upland Pollen and Spore Sum. The non-arboreal pollen (NAP) included Gramineae (1 to 9%), Cyperaceae (1 to 6%), Thalictrum (1 to 3%), and various Compositae (totaling 1 to 7%). Typha latifolia was a minor constituent representing 1 to 2%

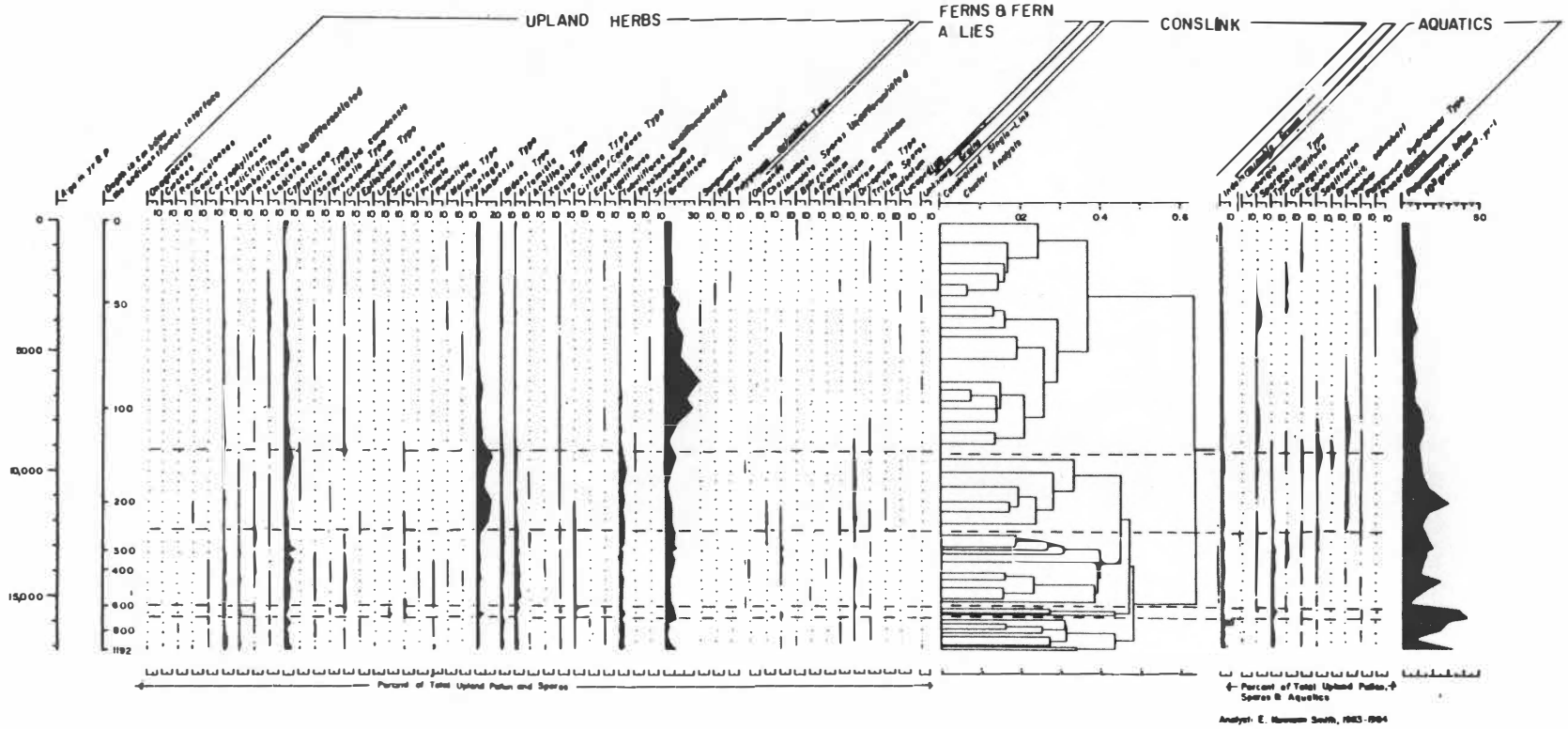


Figure 6. Upland pollen percentage diagram.

of the sum based on total pollen, spores, and aquatics. From 17,110 to 15,700 yr B.P., the percentage of Pinus varied inversely with Picea. The increase parallels influx values which generally vary from 13,600 to 42,080 grains$\cdot cm^{-2} \cdot yr^{-1}$. The percentages of indeterminable grains were very low (generally 0.5% to 3%) with the highest value in this zone (7%) occurring at 915 cm.

Picea-Salix zone (675 to 595 cm depth, 15,700 to 15,350 yr B.P.). The boundary between the Pinus-Picea zone and the Picea-Salix zone is marked by changes in both pollen influx and pollen percentages (Figures 5 and 6), and marks the boundary between full and late glacial times. Pollen influx rates show a pronounced decrease from 36,400 to 4,250 grains$\cdot cm^{-2} \cdot yr^{-1}$. The Picea-Salix zone is characterized by dominance of Picea, which represented up to 44% of the AP sum, and Salix which attained its highest percentage of 8%. Northern Diploxylon Pinus, which was the dominant pollen type in the lower Pinus-Picea zone, decreased to 24%. Quercus pollen percentages increased from 11 to 19%. Percentages of minor AP constituents such as Betula and Carpinus/Ostrya-type fluctuated. Abies percentages started minor increases toward the top of the zone. Alnus rugosa reached its maximum of 9%. Minor decreases in Cyperaceae pollen coincided with minor increases in percentages for Ambrosia-type pollen. Gramineae had moderate NAP percentages of 8 to 10% and Typha latifolia, with a maximum of 5%, continued dominance of the aquatic-plant group. Influx rates increased from 4,230 to 11,430

grains·cm^{-2}·yr^{-1} through the zone up to the major influx peak at the Picea-Salix/Picea-Fraxinus boundary.

Picea-Fraxinus zone (595 to 245 cm depth, 15,350 to 12,300 yr B.P.). The boundary between the Picea-Salix zone and the Picea-Fraxinus zone is marked by a major rise and subsequent fall in palynomorph influx. Influx rates changed from 11,430 to 23,580 grains·cm^{-2}·yr^{-1} at the zone boundary and then dropped to 9,850 grains·cm^{-2}·yr^{-1}. The Picea-Fraxinus zone is characterized by high initial Picea percentages (typically 44 to 59%) which gradually decreased toward the top of the zone (11%). The Picea peak coincided with a peak in Abies of 4%. Northern Diploxylon Pinus continued to decrease (17 to 1%) throughout this zone. Minor arboreal constituents were Salix and Betula, which fluctuated in this zone, and Carpinus/Ostrya-type and Ulmus which stabilized toward the upper portion of this zone. Alnus rugosa-type percentages remained similar throughout the zone, while minor percentages of Spiraea-type decreased, and this decrease coincided with an increase in the percentage of Corylus. Minor NAP taxa included Thalictrum, Cyperaceae, various Compositae, and Gramineae (all of which fluctuated between 1 and 8%). After the initial peak of 23,580 grains·cm^{-2}·yr^{-1}, influx rates in the Picea-Fraxinus zone were relatively stable (values between 8,800 and 13,200 grains·cm^{-2}·yr^{-1}) in the lower half of the zone and then gradually increased (9,850 to 14,900 grains·cm^{-2}·yr^{-1}).

Quercus-Carpinus/Ostrya-Carya zone (245 to 125 cm depth, 12,300 to 9,100 yr B.P.). Influx rates at the boundary between the Picea-Fraxinus zone and the Quercus-Carpinus/Ostrya-Carya zone are reasonably stable (13,370 to 14,900 grains·cm^{-2}·yr^{-1}), and represent the transition from late glacial to early Holocene. The Quercus-Carpinus/Ostrya-Carya zone is characterized by sharp increases in pollen percentages of both Carpinus/Ostrya-type (10 to 21% of the AP) and Carya (9 to 17%). Both pollen types reached maximum percentages in this zone with Carpinus/Ostrya-type reaching a peak in the middle of the zone (11,100 yr B.P.) and Carya reaching a peak toward the top of the zone (10,000 yr B.P.). Quercus was dominant throughout the zone (50 to 55%). Percentages of Picea dropped throughout the zone (from 12 to 1%) as did Fraxinus (from 9 to 3%). Ulmus and Salix were minor forest constituents that had little changes in percent within this zone. Ambrosia-type, the major NAP type, reached a maximum in this zone of 15%. Decreases in Typha latifolia coincided with increases in percentages of the aquatic plants Nuphar and Sagittaria. Influx rates were moderate to high, with an increase from 12,300 to 11,000 yr B.P. (13,370 to 28,730 grains·cm^{-2}·yr^{-1}), and a decrease from 11,000 to 9,100 yr B.P. (28,730 to 11,350 grains·cm^{-2}·yr^{-1}).

Quercus-Pinus zone (125 to 0 cm depth, 9,100 yr B.P. to present. At the boundary between the Quercus-Carpinus/Ostrya-Carya zone and the Quercus-Pinus zone, influx-rate values were relatively stable ranging across the boundary from 11,350 to 10,280 grains·cm^{-2}·yr^{-1}. These rates then gradually decreased and stabilized throughout

the zone (5,770 to 8,900 grains·cm^{-2}.yr^{-1}). The Quercus-Pinus zone is characterized by early dominance of Quercus (80 to 87% of the AP), and by increases in percentages of Pinus (2 to 22%). This pollen-assemblage zone is further subdivided into two subzones: the Quercus-Gramineae subzone and the Nyssa-Cephalanthus subzone.

Quercus-Gramineae subzone (125 to 65 cm depth, 9,100 to 4,550 yr B.P.). Within the Quercus-Gramineae subzone which represents the mid-Holocene, Quercus percentages remained between 80 and 87% (of the AP sum) whereas Gramineae percentages increased from 4 to 34% (of the total Upland Sum). Carya decreased to 5% and Carpinus/Ostrya-type decreased to trace percentages, generally less than 1%. Other minor arboreal taxa included Ulmus, Fraxinus, Salix, and Betula. Corylus percentages dropped to zero and Cephalanthus occidentalis was a minor shrub component of the pollen rain. The NAP was dominated by Gramineae with Compositae occurring consistently at low percentages. Nuphar and Sparganium-type declined from 3 to less than 1%. Few species of aquatic plants were represented in the Quercus-Gramineae subzone. Influx rates declined from 13,100 to 5,930 grains·cm^{-2}.yr^{-1}.

Nyssa-Cephalanthus subzone (65 to 0 cm depth, 4,550 yr B.P. to present). This subzone represents the late Holocene and is characterized by maximum percentages of Nyssa (15%) and Cephalanthus occidentalis (22%). Quercus, still a major arboreal taxa, decreased in percentage values from an average of 84% to 51% in the modern

(surface) sample. Both southern Diploxylon Pinus and Cephalanthus occidentalis had increases from 4,550 to 3,700 yr B.P.

After 3,700 yr B.P., Cephalanthus declined to generally less than 10% while Pinus values continued to rise to an average of 16%. This late Holocene increase in southern Diploxylon Pinus coincides with a rapid increase in Nyssa (from less than 1% to an average of 13%). Measurements of the internal cap diameter of Diploxylon Pinus pollen grains and classification of their marginal frill indicates that the Diploxylon Pinus species was Pinus echinata (short-leaf pine). Carya percentages varied between 4% and 6%. Minor arboreal taxa included Ulmus and Carpinus/Ostrya-type. Gramineae, dominant in the lower subzone, decreased to a level of 4 to 6%. Sparganium-type reached its highest percentages in the lower portion of this zone (5%). Influx values were moderate, ranging from 4,550 to 11,550 grains$\cdot$cm$^{-2}\cdot$yr^{-1}.

Quantitative Reconstruction of Late-Quaternary Vegetation

Modern analogues. Modern analogues, as determined by dissimilarity coefficients Euclidean Distance, Chord Distance, and Standardized Euclidean Distance, were plotted geographically in Figures 7-10 and in one thousand year intervals in Figure 11.

The plots based on Euclidean Distance (Figure 7) illustrate a sporadic geographic pattern. The 17,000 and 16,000 yr B.P. analogues are located in the boreal region of central Canada whereas analogues for 15,000 to 13,000 yr B.P. are located in mixed conifer/deciduous

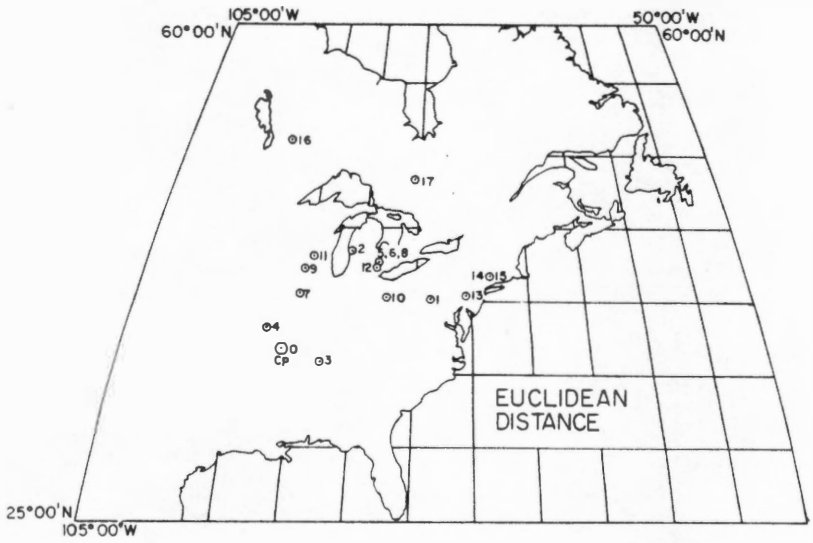


Figure 7. Location of modern analogues as determined by Euclidean distance; numbers are in thousands of years.

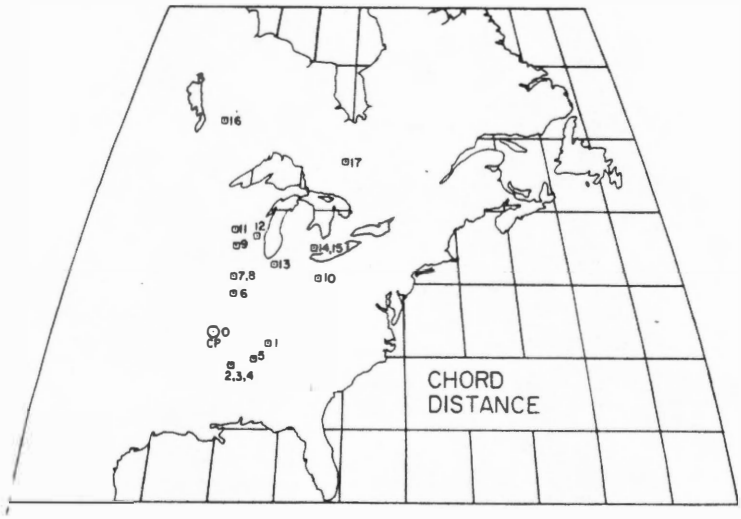


Figure 8. Location of modern analogues as determined by Chord distance; numbers are in thousands of years.

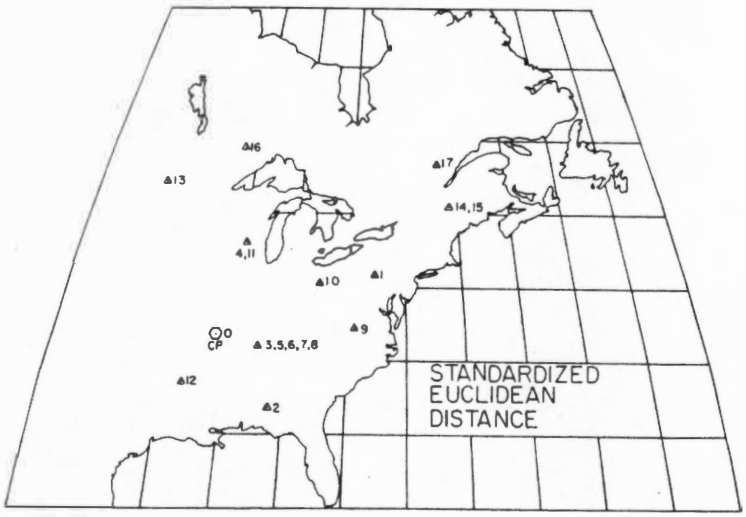


Figure 9. Location of modern analogues as determined by Standardized Euclidean distance; numbers are in thousands of years.

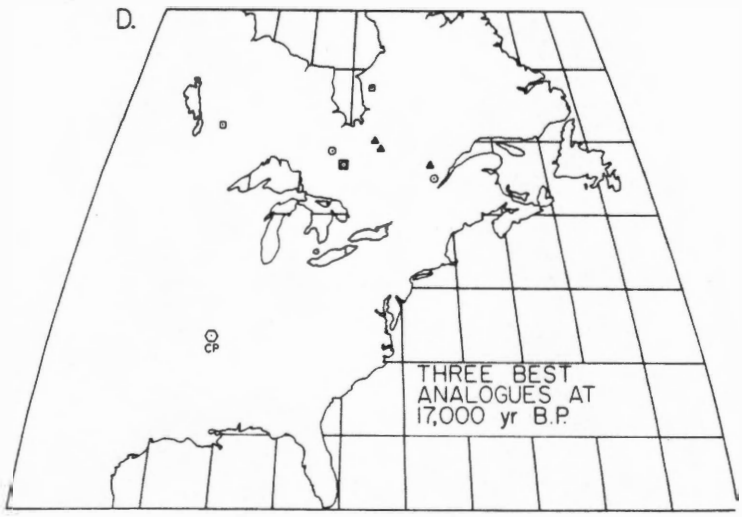


Figure 10. Location of the three best analogues at 17,000 yr B.P. as determined by the three dissimilarity coefficients.

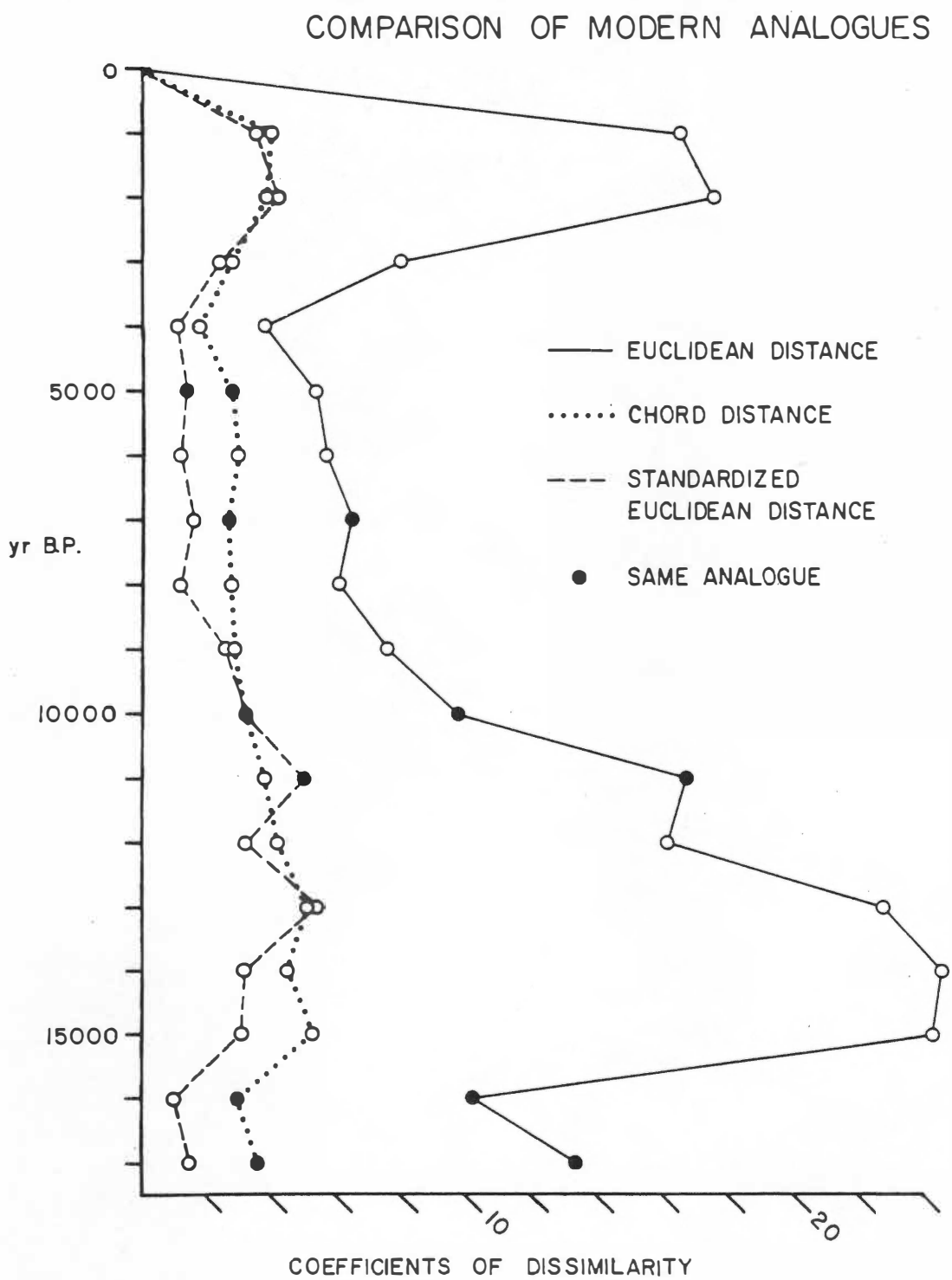


Figure 11. Comparison of modern analogues.

forests of the northeastern United States. From 12,000 to 5,000 yr B.P., analogues are located in an area of mixed conifer/deciduous hardwoods in the central United States between 40° and 44° N latitude and 82° and 91° W longitude. From 4,000 yr B.P. to the present there is no geographically consistent pattern.

When the geographic position for the best modern analogues are plotted based on Chord Distance (Figure 8), analogues for 17,000 and 16,000 yr B.P. (which are consistent with the Euclidean Distance results) are located in the boreal region of central Canada. Analogues from 15,000 to 11,000 yr B.P. are located centrally in the United States in a mixed conifer/deciduous forest whereas analogues for the time interval between 10,000 and 6,000 yr B.P. are further south in a region of xeric deciduous forests. The analogues from 5,000 yr B.P. to the present are located in the southeastern evergreen forest region of the south-central United States.

For 17,000 and 16,000 yr B.P., modern analogues based on Standardized Euclidean Distance are located in central and eastern Canada in regions characterized by spruce and jack pine (Figure 9). There is a shift for the 14,000 and 15,000 yr B.P. analogues to the Maritime Boreal Forest dominated by spruce and fir. Analogues for 13,000 to 9,000 yr B.P. are broadly distributed across the Great Lakes Forest Region of mixed conifers and cool-temperate deciduous forest. This is in contrast to the analogues for 8,000 to 5,000 yr B.P. and 3,000 yr B.P. which are within the xeric cedar glade region of Middle Tennessee (note the analogue for 4,000 yr B.P. is located in

southwestern Wisconsin). Analogues for 2,000 yr B.P. to the present are dispersed across a wide geographic region of the eastern deciduous forest.

Of the three methods, only results of the Chord Distance are consistent with the supplemental palynological data concerning northern and southern Diploxylon Pinus species. In addition, the vegetational analogues from Chord Distance are compatible with a progressive normal trend of vegetational response to changes in thermal gradients through the late Quaternary.

Figure 10 is a plot of the three best analogues for 17,000 yr B.P. as determined by each of the dissimilarity coefficients. These analogues illustrate that during full-glacial times the area around Cupola Pond was dominated by boreal forests and by a continental boreal climate.

Figure 11 provides a comparison of the modern analogues and is used to illustrate periods of vegetational stability compared to periods of instability. When two or more dissimilarity coefficients pick the same analogue, that analogue is plotted as a black dot on Figure 11. The relative dissimilarity shows that during time periods of relative vegetational and environmental stability (such as the full-glacial or the mid-Holocene intervals), better analogues are identified than during periods of rapid change (such as the transitional time between full-glacial and the Holocene). The apparent lack of good analogue from 3,000 to 1,000 yr B.P. probably reflects the fact that the modern-pollen spectrum from Cupola Pond

data is not in the modern-pollen data set. It is interesting to note that with the exception of the analogue for 11,000 yr B.P., if an analogue site was replicated, the duplication was always present in the Chord Distance coefficient. This again suggests that of the three dissimilarity coefficients, the Chord Distance best illustrates the environmental trend.

Taxon calibration. Pollen/vegetation calibrations were used for nineteen major tree taxa in order to correct fossil-pollen percentages based upon their differences in pollen productivity and dispersal. For convenience in comparison, the boundaries of the pollen-assemblage zones from Cupola Pond have been superimposed over the paleovegetational results of the taxon calibrations (Figure 12). In this way, tree percentages reconstructed for past forest dominance can be discussed for each zone (percentages of forest composition as calculated with the taxon calibrations are in Appendix C).

In the Pinus-Picea zone, northern Diploxylon pine (primarily jack and red pine) ranged from 16% to 42% of the forest composition while spruce (probably both white and black spruce) varied from 30% to 51%. Minor tree populations are reconstructed for fir (8%), ash (5%), oak (9%), maple (6.5%), elm (1%), willow (1%), and juniper (1%).

In the Picea-Salix zone, northern Diploxylon pine decreased to 20%, spruce remained at 36% and minor components included fir (8%), ash (7%), oak (12%), maple (5%), elm (1%), willow (0.5%), juniper (1%), and birch (1%).

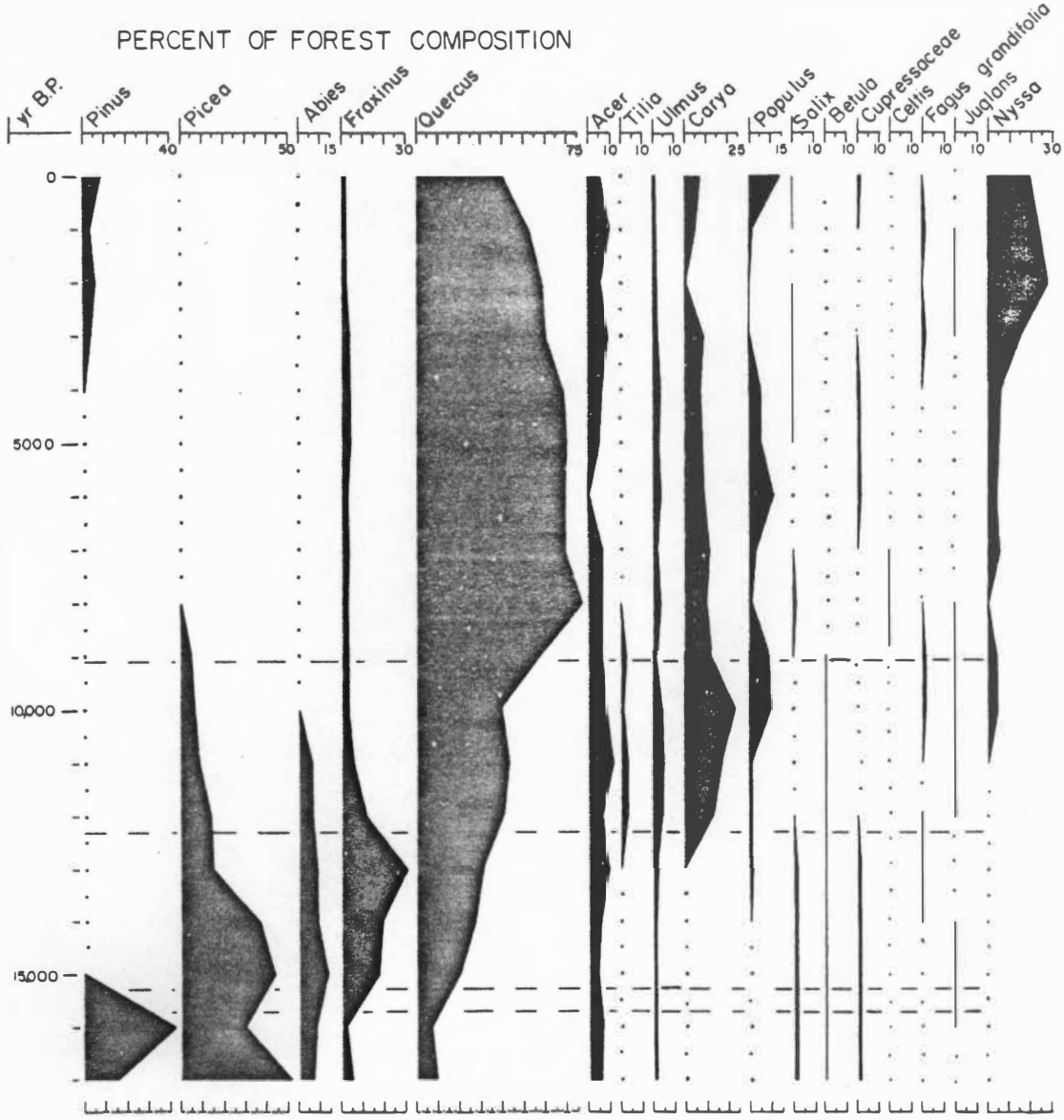


Figure 12. Reconstructed forest composition at Cupola Pond, based upon taxon calibrations for major tree species.

In the Picea-Fraxinus zone, spruce dominated the forest (44%) with ash (29%) and fir (13%) reaching maximum percentages. Oak increased in abundance (27% to 30%) while maple (4% to 8%), elm (1%), willow (1%), and juniper (1%) remained minor taxa.

In the Quercus-Carpinus/Ostrya-Carya zone, oak attained dominance (39% to 42%). Only in the fossil-pollen record is Carpinus/Ostrya-type apparently a major forest component. It cannot be considered in this taxon calibration because of the lack of modern forestry data with which to calibrate its pollen productivity and dispersal. For this reason, reconstructed values for other tree taxa must be considered as maximum percentages possible during this time period. Hickory attained peak abundance in this zone (23%) as did maples (11%), juniper (1.5%) and basswood (3.5%). Fir (5% to 0%), ash (11%), spruce (14% to 6%), and birch (0.3%) decreased in abundance while poplars (9%), elm (4% to 5%), and tupelogum (4% to 5%) increased in abundance. Beech (1%) and walnut (0.5%) were also present.

In the Quercus-Gramineae subzone, oak was dominant (68% to 76%). Hickory (8% to 11%) and poplar (5%) were also major components. Minor forest components included maple (0% to 6%), juniper (1%), ash (3%), tupelogum (4%), pine (3%), willow (1%), and elm (2% to 3%).

In the Nyssa-Cephlanthus subzone, oak was still dominant but was joined by an abundant tupelogum population (6% to 28%). Minor forest components were maple (5%), hickory (0% to 9%), ash (2% to 4%), pine (0% to 8%), poplar (0% to 13%), juniper (1%), beech (1.5%), willow (1%), and elm (1% to 2%).

The major contribution of Taxon Calibration is that it allows a quantitative reconstruction of major tree taxa as well as insight into the fluctuations in minor populations of other taxa within the forests within the study area.

V. PALEOECOLOGICAL INTERPRETATION

Sediment from Cupola Pond provides the first continuous record of sedimentation in southeastern Missouri and northern Arkansas from 17,100 yr B.P. to the present. The pond is located in a karst collapse, and the watershed, which has no permanent or ephemeral streams, is characterized by steep upland slopes and a topographic relief of 15 to 25 meters. The sedimentary sequence within the pond ranges from a clayey silt at the base through silty clay, to organic clays at the top of the core. The lack of sand-sized or coarser clastic sediment in the core is considered evidence that a continuous perimeter of vegetation surrounded the pond even during periods of rapid sediment accumulation (full glacial, late glacial/early Holocene). High rates of sediment accumulation and high and variable palynomorph influx between 17,110 and 10,000 yr B.P., indicate a period of landscape instability, increased overland flow, and rapid sediment infilling of the pond basin. This contrasts with the generally low influx rates and sediment accumulation between 10,000 yr B.P. and the present. During the Holocene, a smaller and more stable source area resulted in more gradual accumulations of pollen and sediment.

Influx rates of pollen grains and spores are varied at Cupola Pond. When correlated to vegetation types that are dominant at periods of peak and low influx, these rates are opposite to rates typical of medium-sized (50 to 100 ha) lakes within eastern North

America (Davis et al., 1973). This can be attributed to two factors. Boreal forests dominated by spruce characteristically have influx rates of 5,000 to 15,000 grains·cm^{-2}·yr^{-1}, whereas deciduous assemblages have rates between 14,000 and 40,000 grains·cm^{-2}·yr^{-1} (Davis et al., 1973). High influx rates during the full glacial can be attributed to increased surface erosion and a larger overall source area for sediment, whereas low influx rates during the Holocene are due to a smaller source area within a relatively stable landscape. Jacobson and Bradshaw (1981) suggest that lower rates of pollen influx are to be expected in small, closed basins (less than 1 ha), like the modern Cupola Pond basin, which collect pollen from a smaller source area.

The graph of indeterminable grains (Figure 6, p. 24), when compared with the graph of palynomorph-influx rates (Figure 6), illustrates the relationship between influx and landscape stability. At a time characterized by landscape instability, accelerated sheet-wash and redeposition of more highly oxidized palynomorphs would result in a higher percentage of damaged and unrecognizable grains. During times of landscape stability, however, pollen preservation would be of higher quality with a lower percentage of indeterminable grains.

Pollen-vegetation calibrations based upon regional-scale data sets (Delcourt et al., 1983) supplement knowledge of the general properties of pollen production and dispersal in interpreting local changes in plant-community composition as reflected in the fossil

record at Cupola Pond (Figures 5 and 6, pp. 22 and 24). Pollen grains of Abies, for example, are poorly represented in the pollen record (Figure 6). These trees, however, constituted up to 13% of the reconstructed forest assemblage between 15,350 and 12,300 yr B.P. (Figure 12). The difference in the arboreal pollen percentage and the taxon calibrated percentage is due to poor pollen productivity and poor dispersal.

In contrast to fir, pine and oak are overrepresented in the pollen record. They are considered to be present in the watershed only if values of Pinus and Quercus are greater than or equal to a threshhold pollen value of 12.5% and 6%, respectively, of the AP Sum. Pine and oak both are excellent producers of pollen, and pine pollen, with two bladders on each grain, is easily dispersed. Taxon calibration for oak indicates that even during the full-glacial interval, oak may have represented as much as 9% of the forest (Figure 12).

Pinus-Picea zone. At 17,110 yr B.P., the vegetation within and surrounding the Cupola Pond basin was dominated by arboreal taxa which were tolerant of cold mean-winter temperatures. In the uplands, spruce (51%) was the most abundant of these and today grows at high mountain or cold subhumid sites (Fowells, 1965) in well-drained, nutrient-rich forest soils (Gleason et al., 1968). At 16% of the forest, jack pine (as evidenced by pollen grain measurements) was the next most abundant species. Jack pine, which typically lives in continental climates with hot, dry summers, cold winters (Fowells, 1965) and in nutrient-poor soils (Fernald, 1970), is frequently found

associated with spruce. Carleton (1982) suggested that boundaries separating forests dominated on one side by jack pine and by spruce on the other, are gradational and that changes in dominance reflect available soil moisture and soil development (dry, nutrient-poor soil favoring the pine).

Lowland sites still dominated by spruce also had populations of fir (8%) and small populations of deciduous trees including maple, ash, willow, birch, and oak; however, much of the Quercus (oak) pollen may have been derived from long-distance transport (Delcourt et al., 1983). The pond edge was dominated by alder which typically grows in wet soils such as bottomlands, stream edges and swamps (Gleason et al., 1968; Fernald, 1970).

The full-glacial period of time between 17,110 and 15,750 yr B.P. was characterized by a change from a spruce flat (Braun, 1950) to an open pine parkland. Jack pine increased to 42% of the forest with subsequent decreases in spruce. This transition, in addition to high pollen influx levels and high rates of sediment accumulation, was evidence of sediment transport from the watershed around the pool. The lack of increase in Compositae pollen, which usually shows percentage increases with forest opening (Fernald, 1970), indicates that the watershed remained forested and that the transition from spruce to pine dominance was gradual (Carlton, 1982).

With the change in dominance from spruce to pine, several minor forest components also fluctuated in percentage. Willow, a disturbance-favored taxon, usually confined to lowlands and alluvial

areas (Fernald, 1970), had forest percentage increases coincident with those of pine, whereas hornbeam, which requires well-developed soil (Steyermark, 1963), had percentage decreases that coincided with fluctuations in spruce.

Within the upland herb and fern populations there was little change except for the grasses; grass had increases that coincided with pine. The aquatic populations also showed little change. Cattail, an emergent, shallow-water marsh plant (Godfrey and Wooten, 1979), was the dominant aquatic plant in this zone. The dominance of cattail along with decreases in sedge, that coincided with increases in pine and grass, indicate a further drying trend toward the upper zone boundary (16,000 to 15,750 yr B.P.).

Picea-Salix zone. At 15,700 yr B.P., jack pine began a major decrease in dominance that would utlimately lead to its population collapse. Initially high values for pine coincided with peak percentages of willow that gradually decreased throughout the zone.

The uplands were dominated by spruce which increased in percentage throughout the zone. High soil moisture continued and resulted in an expansion in the lowlands of fir and cool-temperate deciduous taxa (ash and oak) that occurred between 15,500 and 15,350 yr B.P. Decreases in moderate percentages of Compositae and Gramineae from 15,750 to 15,500 yr B.P. coincided with decreases in willow and hornbeam and indicate that a more open forest canopy (probably due to rapid decreases in the pine population) continued to close as more mesic taxa established in the upland.

Alder, which reached its highest percentages in this zone, remained the most prevalent shrub around the fringe of the pond. Hazel, tolerant of a variety of moisture conditions (Fernald, 1970), but preferring open forest, also reached its highest percentages. Both peaks, however, are in the period from 15,700 to 15,500 yr B.P., again supporting the trend toward forest closure.

Within the aquatic community, cattail remained the dominant taxon at 15,700 yr B.P. but decreased from 15,500 to 15,350 yr B.P. Sparganium-type and Coleogeton populations, which are generally more abundant in deeper water (Muenscher, 1944) increased during the same period (15,500 to 15,350 yr B.P.).

Picea-Fraxinus zone. Changes in pollen percentages within the Picea-Fraxinus zone indicate that the upland vegetation was in a period of major transition. Decreases in northern boreal conifers coincided with initial increases in populations of cool-temperate deciduous species.

At 15,350 yr B.P. spruce (44% of the forest) dominated the uplands and fir (13%) reached maximum density within the upland population. The lowlands were dominated by ash (17%) and oak (19%). By 14,000 yr B.P. Pinus pollen was probably present only due to long distance transport (values below 12%) and fir decreased to less than 9% of the forest. Spruce, still dominant in the uplands, had decreased to 37%, while ash, oak, birch, willow and beech became important taxa on the watershed surrounding Cupola Pond.

With continued climatic amelioration, deciduous forest assemblages expanded and diversified with increases in elm (2%), an indicator of high soil moisture (Braun, 1974), and hornbeam, which requires moist to dry, well-developed soils (Steyermark, 1963).

From 15,750 to 13,000 yr B.P. oak and ash generally were in abundance. Alder, a hydric species that surrounded the pond initially within the zone, was gradually replaced by buttonbush as the dominant shrub.

Pollen-influx rates throughout the Picea-Fraxinus zone were moderate (10,400 to 18,800 grain·cm^{-2}·yr^{-1}). The expansion of moisture-tolerant taxa (birch, ash, and hornbeam) suggests soil moisture levels were moderate to high, at least up until 13,500 yr B.P. Within the zone, the aquatic community showed little change. The moderate influx levels could be attributed to canopy closure as evidenced by low levels of Compositae and Gramineae (Tauber, 1965).

From 13,300 to 13,000 yr B.P., a short-lived climatic reversal occurred. Picea and Abies percentages increased while Quercus decreased. Other minor decreases are reflected in pollen of Salix, Betula, and Fraxinus pennsylvanica-americana-type, which grow best in moist, rich upland forests (Harlow and Harrar, 1969). Fraxinus quadrangulata-nigra-type increased to a maximum at this time. F. quadrangulata, blue ash, is a dry tolerant species primarily restricted to warm-temperate portions of the southeastern United States (Little, 1971). F. nigra is a lowland species, whose modern range extends into Canada, that is intolerant of a dense forest

canopy (Harlow and Harrar, 1969). The dominant Fraxinus species at Cupola Pond in the late-glacial interval was probably F. nigra, based upon the temperature and precipitation estimates reconstructed from analogues. This period of time was also characterized by increases in pollen of Gramineae, consistent values of Compositae pollen and decreases in all aquatic pollen types. This indicates a period of slightly lowered water levels in the pond with limited decreases in forest canopy.

Quercus-Carpinus/Ostrya-Carya zone. From 12,350 to 9,100 yr B.P., the uplands were dominated by oak (40% of the forest) and an increasing population of hickory (13 to 23%). These deciduous populations replaced boreal populations of spruce, which declined to 6%, and fir, which disappeared completely from the uplands by 10,000 yr B.P. Declining populations of ash were replaced in the lowlands by Carpinus/Ostrya-type populations that expanded into an open-canopy forest, along with maples (11%), poplar (9%), and basswood (Tilia, 1 to 3%). Tilia is an important component within this zone as it is a genus typically restricted to Northern Hardwood and Eastern Deciduous Forests (Fowells, 1965). Tilia typically grows in areas with good soil development (Fernald, 1950).

The watershed around Cupola Pond was dominated initially by hornbeam populations that expanded into an open canopy forest. Carpinus/Ostrya-type percentages remained at high levels but were gradually replaced by Carya between 11,000 and 10,000 yr B.P. Shrubs within the forest and at the pond's edge were dominantly hazel.

Nuphar (water lily) became prevalent within the pond at 12,300 yr B.P. and indicates initially high and then persistently high levels of standing water (Steyermark, 1963). Additional minor components were Sparganium-type, Ludwigia-type, and Sagittaria, which between 10,000 and 9,500 yr B.P. replaced Nuphar as the dominant aquatics. Sagittaria prefers standing water but is tolerant of periodic drying (Godfry and Wooten, 1979).

The period from 10,000 to 9,100 yr B.P. was a period of drying and forest canopy opening, indicated by expansion of Quercus, Ambrosia-type, Gramineae, and Sagittaria. This drying caused major decreases or collapses in populations of Carpinus/Ostrya-type and Corylus.

Quercus-Pinus zone. Throughout the Quercus-Pinus zone, oaks dominated the upland vegetation with limited populations of hickory. The lowlands had willow and elm, which occurred on wet flats and bottomlands (Fowells, 1965), and poplar (probably Populus deltoides (cottonwood) which prefers moist alluvial soils) (Harlow and Harrar, 1969). The vegetation composition was indicative of the landscape stability, with the zone divided into two subzones based primarily on changes in pollen percentages that indicate changes in apparent soil moisture. This landscape stability is further illustrated by low stable influx values, especially from 7,000 yr B.P. to the present.

Quercus-Gramineae subzone. The Quercus-Gramineae subzone is characterized by a drying trend (see in Figures 5 and 6, pp. 22 and 24). At 9,100 yr B.P. the uplands were dominated by oak (55%) and hickory (12%) while the lowlands were dominated by maple (6%) and poplar (9%). Minor lowland species included ash, elm, and basswood. Cephalanthus occidentalis (buttonbush), a temperate to tropical marsh or swamp shrub (Fernald, 1950), was present in the littoral area at the edge of the pond while floating plants such as Sparganium-type and Nuphar were present in the pond.

This moist climate was followed by a period of peak drying in which xeric populations expanded (9,100 to 6,700 yr B.P.). Oak populations ranged from 67% to 77% of the upland forest, while upland hickory populations represented 9%. Gramineae dominated the non-arboreal taxa and reached its peak value of 34% (based on the upland sum). Maximum drying probably occurred from 6,700 to 6,350 yr B.P. when ash (2%), willow (0%), birch (0%), and maple (0%) decreased to their lowest percentages within the zone and Carpinus/Ostrya-type disappeared from the pollen assemblage. Cephalanthus occidentalis decreased to trace values. Upland herbs were adversely affected as illustrated by decreased values of Cyperaceae, Umbelliferae, and Compositae.

Water levels of Cupola Pond decreased and remained at levels lower than today. A minor increase in palynomorph influx rates in spite of a lowering water table indicates additional forest opening which is supported by high percentages of grass. This may, however,

be due to exposure of drained marsh flats and replacement of many aquatics and shrubs with grasses. The presence of Sparganium-type and Polygonum hydropiper, a plant favoring marshy areas (Steyermark, 1963), indicates that even during peak warming, the Cupola Pond basin remained wet.

Nyssa-Cephalanthus subzone. At 4,550 yr B.P., major increases in mesic taxa signified a dramatic change in the basin around Cupola Pond. Oaks still dominated the uplands (40% to 60%), but southern Diploxylon pine immigrated and expanded into the upland, and hickory continued as a subdominant (4% to 8%). Pollen grain measurements and examination of marginal frill show that the pine species was P. echinata or short-leaf (yellow) pine. Initial expansion of these pines correlated with rapid expansion and proliferation of buttonbush around the pond margin as water levels within the basin rose. In the lowland within the Cupola Pond basin, Nyssa aquatica (tupelogum), which lives in areas that are periodically under water (Harlow and Harrar, 1969), developed around and within the pond at approximately 3,300 yr B.P., and with canopy closure around the edge of the pond, buttonbush populations decreased. Diversification of upland deciduous taxa and increases in the ratio of arboreal to non-arboreal pollen, suggests closure of the upland canopy as well. Increases in influx rates at 2,000 yr B.P. may therefore be due to increased surface run-off. Hickory was briefly replaced in the uplands (8 to 0%) by Carpinus/Ostrya-type (increases from a trace to 5% then decreases back

to a trace) at 2,000 yr B.P. and then returned (0 to 4%). In addition to the tupelogum surrounding Cupola Pond, the lowlands within the watershed were also populated by maple (9%), ash (2%), and sparse elm.

During the initial increases in buttonbush, the aquatic pollen was dominated by Sparganium-type which, at the time tupelogum expanded, was replaced in dominance by Potamogeton. Both of these plants indicate standing water, a condition that exists at the pond today.

Despite the extensive logging that occurred in this area around the turn of the 20th century (Rafferty, 1980), there is little evidence in the pollen record of disturbance-favored taxa or decreases in the percentage of arboreal pollen in the surface sample. This may be due to the tupelogum and buttonbush which serve as biotic filters, buffering the pond from historic peaks in pollen influx and sedimentation commonly seen at other sites (Delcourt and Delcourt, 1980).

VI. VEGETATIONAL HISTORY OF THE REGION

Studies of palynomorphs have been used in the central United States to characterize vegetational response to major climatic events such as the Wisconsinan glaciation and the Hypsithermal drying (Figure 13). King (1973) stated that with the onset of late Wisconsinan glaciation in western Missouri (23,000 yr B.P.), pine parklands were invaded and replaced by forests dominated by spruce as the climate cooled and available moisture increased. This correlates well with the findings of Cushing (1975) and H. Delcourt (1979). Cushing (1975) found a site (Tupelo Gum Pond) that dated the existence of a pine/herb-dominated forest in southeastern Missouri at 25,000 yr B.P., whereas Delcourt discussed upland populations of spruce and pine with an admixture of deciduous trees including oak, ash, ironwood, and hickory, that occurred in north-central Tennessee from 19,000 to 16,300 yr B.P. The extent of these boreal spruce forests is well illustrated by additional studies in Iowa (Van Zant, 1979) and Illinois (King, 1973); both studies discuss boreal spruce forests that existed in these respective areas up until approximately 11,500 yr B.P.

With the collapse of late Wisconsinan glaciation, and the subsequent decline of spruce and jack pine populations, cool-temperate northern hardwoods followed the Mississippi River Valley north as they migrated into more mesic environments (Delcourt et al., 1980). By 10,000 yr B.P., major areas of Missouri (King, 1973),

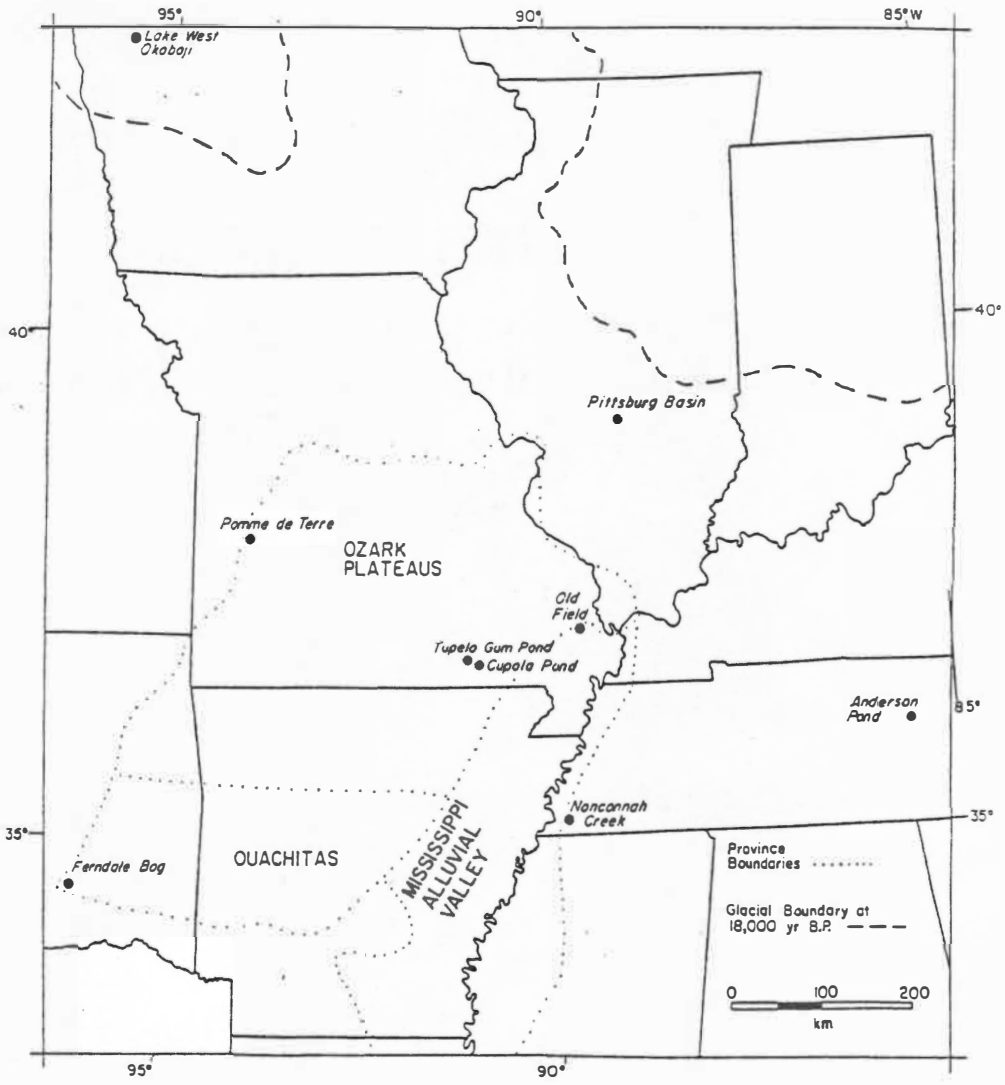


Figure 13. Regional sites used for the study of fossil pollen.

Iowa (Van Zant, 1979), and Illinois (King, 1981) were populated by more mesic taxa such as oak, ash, birch, and alder.

From 9,000 to 5,000 yr B.P., the central United States experienced a period of drying and increased temperature called the Hypsithermal Interval (Wright, 1976). The apparent time of peak warmth or drying varies in the eastern United States, but the effects are obvious. In Iowa, northern Missouri, and Illinois, the Prairie Peninsula (Transeau, 1935) expanded eastward with extensive development of grasslands (Van Zant, 1979; King, 1973; King and Allen, 1981) while further south in Oklahoma and Tennessee, mesic upland forests were replaced by oak-hickory parklands (H. Delcourt, 1979; Albert, 1981). In Missouri, these mesic forests were replaced by an oak-grass parkland.

From 5,000 yr B.P. to the present, with the return of more mesic conditions and with increased available precipitation, the Prairie Peninsula retreated. Subsequently, mesic tree taxa re-advanced into the uplands, migrating westward at both the northern and southern margins of the former Prairie Peninsula (such as beech and white pine in Wisconsin and Minnesota (Davis, 1981), and shortleaf pine and tupelogum in Missouri).

VII. SUMMARY AND CONCLUSIONS

During the late Quaternary, the area in the central United States between 35° and 40° North latitude was dominated by a boreal forest of jack pine and spruce. Precipitation rates, as indicated by modern analogues for Cupola Pond and Anderson Pond, Tennessee (Delcourt, 1979), were low (63 to 79 cm/yr), as were mean annual temperatures. The Laurentide Ice Sheet acted as an orographic barrier restricting the southward expansion of the Artic airmass and resulted in moderate winters south of the 18,000 yr B.P. glacial limit (Bryson and Wendland, 1967). These mild winters, coupled with cooler summers effectively reduced evapotranspiration, and increased soil moisture in spite of reduced precipitation. The seasonality of the precipitation (Bryson and Wendland, 1967), the podzolic soil development characteristic of boreal spruce/pine forests, and high soil moisture, resulted in a high rate of surface runoff as illustrated at Cupola Pond by high rates of sediment accumulation and palynomorph influx both of which occurred between 17,110 and 16,000 yr B.P.

The major limiting factors for temperature tolerance in deciduous taxa are minimum winter temperatures and duration of low winter temperatures. Under the full-glacial conditions described above, the Ozark valleys may have acted as refugia for certain cool-temperate taxa such as oak, ash, maple, birch, and willow. Taxon

calibrations of pollen percentages indicate these taxa were present in the lowlands.

With increases in precipitation between 15,700 and 15,350 yr B.P., these refugial populations, along with spruce and fir, expanded into a parkland of jack pine. This community may have resembled a community described by Braun (1950) as a spruce flat (spruce, jack pine, black ash, and birch). Carlton (1982) suggested that spruce invasion of jack pine communities is gradual, therefore as late-successional spruce and hardwood populations developed, canopy closure would have increased resulting in reduced influx rates.

Between 15,350 and 9,100 yr B.P., the forest assemblages changed greatly as a series of cool-temperate northern hardwood species migrated through southern Missouri from refuge areas farther to the south. With late-glacial climatic amelioration between 15,350 and 12,300 yr B.P., spruce and pine populations were replaced by forests of oak and ash for which there are no close analogues today. Cushing (1967) described a similar assemblage that occurred in Minnesota between 13,000 and 11,000 yr B.P. He suggested this represented a shift from a closed to a more open forest; however, evidence from Cupola Pond does not support Cushing's hypothesis in that influx rates are low and the percent of arboreal to non-arboreal pollen is high.

Between 12,300 and 9,100 yr B.P., spruce, pine, and fir disappeared from the fossil record and with forest opening and increased moisture, hornbeam replaced ash in the lowlands. These

increases in precipitation resulted in expansion of the pond margin within the basin itself and hazel surrounded a pool filled with water lilies. The peak in hornbeam was followed by a rise in upland hickory indicating a change toward drier conditions.

From 9,100 to 4,550 yr B.P. a long-term drying trend had a major impact on the vegetation as well as sedimentation within the Cupola Pond basin. With mature forest stabilizing slopes, reductions in total precipitation resulted in dramatic reductions in surface-water runoff. Xeric oak species, already dominant in the uplands, expanded into the lower areas as well. A previously diverse deciduous forest was replaced by an oak/hickory parkland as grasses, dominant in an expanding Prairie Peninsula to the north (King, 1981), established locally in "barrens." Apparent population dynamics, modern analogues, and pollen influx data suggest that this was a period of environmental stress. High percentages of Gramineae pollen do alter the ratio of AP to NAP, but this could be due to local populations of grass that inhabited the marsh zone exposed at Cupola Pond by dropping water tables (Van Zant, 1979).

Minimum water levels (as indicated by aquatic plant percentages), and maximum oak and grass populations indicate that peak warming and drought in southeastern Missouri occurred between 6,700 and 6,350 yr B.P.

At 4,550 yr B.P., a major increase in precipitation occurred within the study area. Water levels increased in the pond and buttonbush established in marshes around the pond in sites previously

occupied by grass. In the uplands, shortleaf pine, migrating from the south, moved into the parklands.

At 3,300 yr B.P., with continued high precipitation, tupelogum established around the perimeter of the pond and rapidly became dominant. As the forest canopy around the pond closed, buttonbush populations diminished to present day levels. Comparison of the surface sample with the late-Holocene samples suggests that the modern climatic regime has dominated the area in and around the Ozark National Scenic Riverways for the last 4,000 years.

In summary, the sequential arrival and rise to dominance of deciduous taxa that occurred from 15,750 to 9,100 yr B.P. (Figure 5, p. 22) suggests that a series of species migrated through southeastern Missouri in response to major changes in climate. A similar migrational sequence occurs in the Chatsworth Bog site to the north in central Illinois (King, 1981); however, the timing at Chatsworth was delayed by 1000 years.

Quercus pollen is not distinguishable beyond genus level with a routine light-microscope (Solomon, 1983 a,b) so that it is difficult to determine whether increase in percentages of oak represent increases in the proximity of immigrating species, expansion of one or more species populations already within the watershed, or increases in species diversity. Increases in pollen values of oak to levels that consistently exceed 6% do, however, indicate that even at 17,000 yr B.P., at least one species of oak was present in the Cupola Pond watershed.

Undoubtedly, southeastern Missouri was a major link in the late Quaternary migrational path of cool-temperate/warm-temperate deciduous species. Evidence from this study indicates that the Ozark Plateaus also served as a full-glacial refuge for species of temperate, deciduous trees.

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APPENDICES

APPENDIX A

EXTRACTION TECHNIQUE

CHEMICAL TREATMENT OF SAMPLES

1. Transfer sediment and exotic pollen to a 15-ml polypropylene centrifuge tube with 10 ml 10% hydrochloric acid (HCl), stir, heat several min. in a boiling water bath until reaction with calcareous sediments and matrix of Eucalyptus tablets stops; add tertiary butyl alcohol (TBA) to wet particles that otherwise might float on the meniscus; centrifuge 2 min., decant supernatant into a bucket containing sodium bicarbonate to neutralize excess acid.

2. Add 10 ml 10% potassium hydroxide (KOH); stir; heat for 2 min. on boiling water bath. This step disperses organics and breaks down humic substances.

3. If sandy or containing large bits of organic matter, sieve through a 250 μm mesh screen. Concentrate by centrifugation, adding TBA each time; decant.

4. Wash with 10 ml distilled water until supernatant is clear, stir, add TBA, centrifuge, and decant after each water wash. These washes remove humic substances and clay-size particles that, if not removed, would later interfere with dispersion.

5. Add 10 ml 10% HCl, stir, add TBA, centrifuge, decant.

6. Add 5 ml concentrated hydrofluoric acid (HF), stir, heat in boiling water bath 20 min., stiring after 10 min.; add 95% ethyl alcohol (ETOH) to reduce density, add TBA, centrifuge, decant; if still silty, repeat this step up to 4 times. This step removes silicate minerals.

7. Add 5 ml concentrated HCl, stir, heat in boiling water bath 20 min., stirring after 10 min., add ETOH, centrifuge, decant; repeat if necessary. If this material threatens to boil over, squirt with ETOH in centrifuge tube. This step removes the silicofluoride gel that may form from HF reaction with silicate-rich sediments.

8. Rinse with 10 ml glacial acetic acid to further dehydrate, stir, add TBA, centrifuge, decant.

9. Acetolyze with 4.5 ml acetic anhydride + 0.5 ml concentrated sulfuric acid, added directly to each centrifuge tube and well-stirred; heat 1 min. in boiling bath, stirring well after 30 sec.; add 5 ml glacial acetic acid, stir, centrifuge, decant.

10. Rinse with 10 ml glacial acetic acid to remove the acid - soluble products of acetylation, stir, add TBA, centrifuge, decant.

11. Rinse with 7 ml water + 3 ml 10% KOH to neutralize and disperse material, stir, add TBA, centrifuge, decant.

12. Add 10 ml water + 1 drop 0.5% Safranin O stain, stir, add TBA, centrifuge, decant.

13. Wash with 10 ml TBA to dehydrate, stir, centrifuge, decant.

14. Transfer to labeled 1 dram vials with TBA, centrifuge, decant.

15. Add a few drops of silicone oil (2000 centistokes viscosity), stir, allow TBA to evaporate overnight in a dust-free place.

Slides for counting are made using a well-mixed drop of silicone oil-pollen residue on a microscope slide covered with a 22 mm x 22 mm coverslip (No. 1 thickness). Fingernail polish will tack down the corners to keep the coverslip from moving when grains are rolled for better viewing. Each slide should be clearly labeled as to site and sample number and kept in a slide box for future reference. Counts of native and exotic pollen grains and spores are made along systematic, nonoverlapping transects spaced across 1/2 or a whole slide, to eliminate bias from any "edge effect" caused by the tendency for grains of different sizes to distribute themselves unevenly under the coverslip.

Running tallies may be kept on a denominator tally counter. When a standardized pollen sum is reached, data can be transferred to a standardized data sheet for coding, formatting, keypunching, construction of pollen diagrams, statistical analyses, and interpretation.

To prevent loss of palynomorphs during decanting of pollen residues from samples in the upper levels of the core, the initial KOH stage (Faegri and Iversen, 1975), used to disperse humates, was lengthened from 2 minutes to 4 minutes, and the volumes of acid concentrates used to dissolve silicates, dissolve silicate gels, and acetolyze organic materials were reduced by 20%, while the diluting agents of these acids were increased by 20%. This served to reduce the overall density of the liquid and therefore allow the pollen grains to sink more easily during centrifuging.

APPENDIX B

LOSS-ON-IGNITION DATA

Table B-1. Loss-on-Ignition Data

Depth (cm)	Native Grains/ Exotic Grains	Exotic Grains/ Tablet	No. of Tablets	Concentration
0	483.5/53= 9.23	16,180	1	149,341
20	369 /62= 5.95	16,180	4	385,084
30	466.5/48= 9.72	16,180	4	692,078
35	457 /45=10.16	16,180	4	657,555
40	420 /46= 9.13	16,180	4	590,893
45	452.5/57= 7.94	16,180	4	513,877
50	502 /77= 6.52	16,180	4	421,974
55	698.5/61=11.45	16,180	3	555,783
60	588.5/51=11.54	16,180	4	746,869
65	484 /64= 7.63	16,180	4	493,814
75	506 /68= 7.44	16,180	4	481,517
86	687 /66=10.41	16,180	4	673,735
90	614.5/68= 9.07	16,180	4	587,010
95	488 /54= 9.04	16,180	4	585,069
99	600 /41=14.63	16,180	4	946,853
105	434 /26=16.69	16,180	4	1,080,177
110	506 /30=16.87	16,180	4	1,091,826
115	406 /23=17.65	16,180	3	856,731
135	645 /125= 5.16	16,180	4	333,955
155	628.5/27=23.28	16,180	1	376,670
175	501.5/50=10.03	16,180	3	486,856
195	538 /42=13.45	16,180	3	652,863
215	514 /69= 7.45	16,180	3	361,623
235	551 /59= 9.39	16,180	2	303,860
255	446.5/64= 6.98	16,180	3	338,809
275	490.5/112=4.38	16,180	2	141,737
295	454.5/67= 6.78	16,180	1	109,700
315	448/132 = 3.5	16,180	2	113,260
355	505/165 = 3.06	16,180	2	99,022
415	474/ 95 = 4.99	16,180	1	80,738
455	446/185 = 2.41	16,180	2	77,988
495	413.5/151=2.73	16,180	2	88,343
555	439/298 = 1.47	16,180	3	71,353
575	386/ 73 = 5.28	16,180	2	170,861
615	468/183 = 2.56	16,180	2	82,841
635	516.5/185=2.79	16,180	1	45,142
655	156 /130=1.20	16,180	1	19,416
695	390.5/114=3.43	16,180	3	166,492
735	419.5/ 74=5.67	16,180	2	183,481
775	403.5/34=11.87	16,180	1	192,057
815	385/137 = 2.81	16,180	3	136,397
856	436.5/127=3.44	16,180	2	111,318
915	463.5/173=2.68	16,180	2	86,725
935	459.5/114=4.03	16,180	1	62,205

Table B-1 (continued)

Depth (cm)	Native Grains/ Exotic Grains	Exotic Grains/ Tablet	No. of Tablets	Concentration
955	411 /47 = 8.74	16,180	1	141,413
995	501 /234 = 2.14	16,180	2	69,250
1035	365.5/67 = 5.45	16,180	2	176,362
1059	412 /161 = 2.56	16,180	2	82,842
1095	342.5/42 = 8.15	16,180	1	131,867
1115	397.5/106= 3.75	16,180	2	121,350
1155	400 /105 = 3.81	16,180	2	123,292
1192	487.5/165= 2.95	16,180	2	95,462

APPENDIX C

POLLEN TABULATION

EXPLANATION OF ABBREVIATIONS

ABIES	ABIES
ACERX	ACER UNDIFF
ACNEGUND	ACER NEGUNDO
ACPENNSY	ACER PENNSYLVANICUM
ACRUBRUM	ACER RUBRUM
ACSACNUM	ACER SACCHARINUM
ACSACRUM	ACER SACCHARUM
BETULA	BETULA
CARYA	CARYA
CASTANEA	CASTENEA
CELTIS	CELTIS
CORYLACE	CORYLACEAE
CUPRESSX	CUPRESSACEAE UNDIFF
FAGUS	FAGUS (F GRANDIFOLIA)
FRAXINUX	FRAXINUS UNDIFF
FRAXNIGT	FRAXINUS NIGRA TYPE
FRAXPNAM	FRAXINUS PENNSYLVANICA/AMERICANA
JUGCINER	JUGLANS CINEREA
JUGLANSX	JUGLANS UNDIFF
JUGNIGRA	JUGLANS NIGRA
LARIX	LARIX
LIQUIDAM	LIQUIDAMBAR (L STYRACIFLUA)
MACLURA	MACLURA
MORUS	MORUS
MYRICATY	MYRICA TYPE TREES
NYSSA	NYSSA
OSTRYCAR	OSTRYA/CARPINUS
OXYDENDRA	OXYDENDRUM ARBOREUM
PICEAX	PICEA UNDIFF
PINDIPLX	PINUS DIPLOXYLON UNDIFF
PINHAPLO	PINUS STROBUS
PINUSX	PINUS UNDIFF
PLATANUS	PLATANUS (P OCCIDENTALIS)
POPULUS	POPULUS
QUERCUS	QUERCUS
RHAMNUST	RHAMNUS TYPE
RHUSRADI	RHUS RADICANS/VERNIX TYPE
ROSATREE	ROSAGEAE TREES
SALIX	SALIX
TILIA	TILIA
ULMUS	ULMUS
VIBURNUT	VIBURNUM TREES
ALNRUGOT	ALNUS RUGOSA/SERRULATA TYPE
ALNUSX	ALNUS UNDIFF
AMORPHAS	AMORPHA SHRUBS

ANDROMED	ANDROMEDA
CEPHALAN	CEPHALANTHUS
CHAMAEDA	CHAMAEDAPNE CALYCULATA
CHIMAPHI	CHIMAPHILA
CORYLUS	CORYLUS
EPHEDRA	EPHEDRA
LEDUM	LEDUM GROENLANDICUM
LEUCOTHO	LEUCOTHOE
LYONIA	LYONIA
RHODOSHR	RHODODENDRON
SAMBUCUS	SAMBUCUS
SHEPHCAN	SHEPHERDIA CANADENSIS
VACCONST	VACCINIUM CONSTABLAE
SPIRAEAT	SPIRAEA TYPE
VACCORYM	VACCINIUM CORYMBOSUM
VACCGAYL	VACCINIUM STAMNEUM-ARBOREUM/ GAYLUSSACIA
SMILAX	SMILAX
AMBROSIT	AMBROSIA TYPE
AMORPHA	AMORPHA HERBS
ARTEMISI	ARTEMISIA
BIDENSTY	BIDENS TYPE
CALTHA	CALTHA
CHENOAMX	CHENOPODIACEAE/AMARANTHACEAE UNDIFF
COMPOSIX	COMPOSITAE UNDIFF
CRUCIFER	CRUCIFERAE
EPILOBIU	EPILOBIUM
GALAX	GALAX APHYLLA
GAURA	GAURA
GRAMINEX	GRAMINEAE UNDIFF
HIBISCUS	HIBISCUS
IVACILIT	IVA CILIATA TYPE
IVAXANTH	IVA XANTHIFOLIA
LABIATAE	LABIATAE
LAMIACEA	LAMIACEAE
LIGUHRBX	LEGUMINOSAE HERBS/UNDIFF
LIGULIEL	LIGULIELORAE
LOBELIA	LOBELIA
MENTHA	MENTHA TYPE
MONOTROP	MONOTROPA
ONAGRACE	ONAGRACEAE
PETALOST	PETALOSTEMUM
PLANTAGX	PLANTAGO UNDIFF
POLYGONM	POLYGONUM
POTENTIL	POTENTILLA
PRIMULA	PRIMULA
PRIMULAC	PRIMULACEAE
PRUNELLA	PRUNELLA TYPE
RANCULUS	RANUNCULUS

ROSAHRBX	ROSACEAE HERBS/UNDIFF
SANGUICA	SANGUISORBA CANADENSIS
SARCOBAT	SARCOBATUS
SAXIFRAG	SAXIFRAGACEAE
THALICTR	THALICTRUM
TUBULIFL	TUBULIFLORAE UNDIFF
UMBELLIF	UMBELLIFERAE
URTICA	URTICA
XANTHIUM	XANTHIUM
ADIANTUM	ADIANTUM
ATHYRIUM	ATHYRIUM
BOTRYCH	BOTRYCHIUM
CHEILANT	CHEILANTHES
CYSTOPTE	CYSTOPTERIS
DRYOPTER	DRYOPTERIS
EQUISETU	EQUISETUM
LYCOPOD	LYCOPODIUM UNDIFF
MONOLETE	MONOLETES
OSMUNDA	OSMUNDA
POLYPODM	POLYPODIUM
PTERIDIU	PTERIDIUM
TRILETE	TRILETES
BRASENIA	BRASENIA (B SCHREBERI)
COLEOGET	COLEOGETON (POTAMOGETON)
COLEOGET	POTAMOGETON, COLEOGETON
EUPOTAMO	EUPOTAMOGETON
JUSSIAET	LUDWIGIA/JUSSIAEA TYPE
LUDWIGIA	LUDWIGIA
MYRIOPHY	MYRIOPHYLLUM
NUPHAR	NUPHAR
POLYGAVI	POLYGONUM AVICULARE TYPE
POLYGHYD	POLYGONUM HYDROPIPER TYPE
POLYGVIV	POLYGONUM VIVIPARUM TYPE
POTAMOGE	POTAMOGETON
PROSERPI	PROSERPINACA
SAGITTAR	SAGITTARIA
TYPHALAT	TYPHA LATIFOLIA (TETRADS)
TYPHSPAR	TYPHA/SPARGANIUM

Table C-1 includes total polynomorph counts by taxa per level. The numbers in the table are consecutive and correspond to depth intervals listed in the table footnote.

Table C-1. Pollen Data

Taxon					
ABIES					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	1.0
1.0	4.5	5.0	0.0	3.0	4.0
4.0	7.5	10.5	12.0	1.0	0.0
0.0	3.0	2.5	1.0	5.0	0.0
0.0	3.0	2.0	2.0	0.0	5.0
5.0	3.5	5.5	9.0		
ACERX					
1.0	2.0	2.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0
0.0	2.0	1.0	1.0	1.0	0.0
3.0	1.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	2.0	0.0	0.0
1.0	0.0	0.0	1.0	0.0	0.0
1.0	2.0	0.0	1.0	0.0	0.0
0.0	0.0	2.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
ACNEGUND					
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0		
ACRUBRUM					
0.0	1.0	0.0	0.0	0.0	1.0
0.0	1.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
2.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0		
ACSACNUM					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
ACSACRUM					
1.0	1.0	3.0	0.0	1.0	0.0
4.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	3.0	0.0
0.0	0.0	9.0	5.0	5.0	2.0
4.0	2.0	0.0	2.0	0.0	0.0
2.0	0.0	0.0	0.0	1.0	0.0
0.0	2.0	0.0	0.0	1.0	0.0
0.0	1.0	0.0	1.0	0.0	0.0
0.0	1.0	0.0	0.0		
ACERNIGR					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	1.0
0.0	1.0	0.0	7.0	0.0	0.0
0.0	0.0	0.0	0.0		
BETULA					
0.0	0.0	1.0	1.0	2.0	1.0
0.0	0.0	2.0	1.0	1.0	2.0
0.0	3.0	3.0	2.0	5.0	6.0
3.0	6.0	3.0	6.0	8.0	9.0
4.0	13.0	1.0	3.0	4.0	4.0
13.0	6.0	9.0	1.0	1.0	2.0
4.0	2.0	2.0	0.0	2.0	3.0
2.0	6.0	4.0	6.0	1.0	3.0
1.0	1.0	2.0	3.0		
OSTRYCAR					
0.0	2.0	1.0	19.0	1.0	1.0
2.0	1.0	1.0	0.0	0.0	0.0
0.0	1.0	2.0	4.0	0.0	13.0
44.0	48.0	68.0	73.0	62.0	35.0
16.0	15.0	8.0	7.0	8.0	5.0
7.0	6.0	5.0	3.0	2.0	4.0
3.0	7.0	1.0	1.0	7.0	4.0
1.0	4.0	7.0	2.0	5.0	2.0
1.0	10.0	7.0	5.0		
CARYA					
20.0	8.0	20.0	0.0	15.0	19.0
16.0	12.0	20.0	21.0	17.0	29.0
28.0	24.0	26.0	19.0	15.0	20.0
42.0	68.0	40.0	37.0	31.0	30.0
1.0	0.0	4.0	0.0	0.0	0.0
2.0	0.0	0.0	1.0	0.0	1.0
0.0	2.0	0.0	0.0	0.0	1.0
2.0	1.0	2.0	0.0	0.0	1.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	1.0		
CASTANEA					
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	2.0	0.0		
CELTMAC					
0.0	0.0	0.0	0.0	1.0	0.0
1.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	1.0	2.0	1.0	1.0
2.0	0.0	0.0	0.0	3.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CUPRESSX					
2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	1.0	0.0	6.0	1.0
0.0	1.0	0.0	1.0	1.0	4.0
0.0	1.0	0.0	0.0	0.0	2.0
1.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	1.0	1.0		
FAGUS					
0.0	1.0	0.0	0.0	0.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
FRAXINUX					
0.0	0.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	1.0
3.0	0.0	1.0	1.0	0.0	0.0
1.0	0.0	0.0	0.0	4.0	1.0
1.0	7.0	0.0	3.0	3.0	2.0
0.0	4.0	0.0	0.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.0	0.0	0.0	2.0
0.0	1.0	0.0	2.0		
FRAXNIGT					
6.0	3.0	6.0	3.0	2.0	3.0
2.0	11.0	5.0	6.0	12.0	0.0
3.0	8.0	1.0	4.0	2.0	3.0
10.0	10.0	9.0	14.0	31.0	30.0
70.0	78.0	80.0	95.0	74.0	40.0
44.0	50.0	42.0	29.0	20.0	12.0
0.0	4.0	4.0	1.0	3.0	1.0
1.0	12.0	6.0	6.0	0.0	0.0
3.0	5.0	6.0	18.0	.	.

Table C-1 (continued)

Taxon					
FRAXPNAM					
0.0	1.0	2.0	1.0	0.0	1.0
0.0	0.0	2.0	3.0	1.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
2.0	0.0	1.0	1.0	0.0	2.0
2.0	7.0	6.0	5.0	10.0	6.0
4.0	3.0	1.0	1.0	0.0	1.0
0.0	0.0	0.0	1.0	0.0	1.0
1.0	0.0	1.0	1.0	0.0	0.0
0.0	2.0	4.0	1.0		
JUGCINER					
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	3.0
1.0	1.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
JUGLANSX					
2.0	0.0	1.0	0.0	0.0	1.0
1.0	1.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	1.0	1.0
1.0	2.0	0.0	1.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	1.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
JUGNIGRA					
0.0	0.0	1.0	1.0	0.0	1.0
1.0	1.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	1.0	1.0	0.0	0.0
1.0	0.0	0.0	1.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
LARIX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.0	0.0		
LIQUIDAM					
3.0	0.0	4.0	7.0	4.0	2.0
3.0	3.0	2.0	4.0	2.0	2.0
3.0	4.0	1.0	1.0	0.0	1.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	2.0	2.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0		
MORUS					

Table C-1 (continued)

Taxon					
0.0	0.0	2.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
MYRICATY					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	1.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0		
NYSSA					
50.0	46.0	50.0	57.0	36.0	35.0
1.0	5.0	4.0	5.0	0.0	1.0
1.0	1.0	3.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
PICEAX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
2.0	9.5	20.0	10.5	10.5	40.5
37.5	28.5	107.0	54.0	62.0	111.0
101.0	136.5	128.5	178.5	136.5	135.5
27.5	60.5	99.5	96.5	184.5	107.5
71.0	154.5	146.0	144.0	59.5	53.5
118.5	133.5	123.0	164.0		
PINUSX					
18.0	26.0	37.5	39.0	29.0	38.5
14.0	14.5	21.5	4.0	2.0	3.0
0.5	1.0	1.0	0.0	0.0	2.0
3.0	1.0	2.5	2.0	1.5	1.0
4.0	7.5	7.0	7.0	10.0	14.0
20.0	14.5	25.0	16.5	77.5	49.5
15.5	139.5	113.5	123.5	75.0	101.5
125.5	49.0	54.5	58.0	138.5	143.5
73.0	75.5	35.0	21.0		
PINDIPLO					
71.5	19.0	28.0	27.0	27.0	30.0
12.0	16.0	17.0	4.0	2.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	2.0	0.0	2.0
0.0	2.0	5.0	5.0	9.0	3.0
5.0	5.0	7.0	16.0	28.0	27.0
12.0	54.5	73.0	77.0	22.5	57.0
59.5	37.0	34.0	30.0	86.0	66.0
83.0	37.0	67.5	28.0		
PLATANUS					
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
POPULUS					
5.0	0.0	1.0	0.0	1.0	0.0
0.0	2.0	1.0	1.0	2.0	5.0
1.0	1.0	0.0	0.0	6.0	2.0
4.0	4.0	1.0	0.0	1.0	0.0
0.0	0.0	2.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
PRUNUS					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
QUERCUS					
199.0	186.0	206.0	209.0	201.0	219.0
229.0	300.0	255.0	276.0	313.0	330.0
310.0	257.0	314.0	258.0	317.0	251.0
169.0	216.0	189.0	173.0	183.0	173.0
166.0	138.0	76.0	127.0	100.0	103.0
94.0	66.0	72.0	39.0	49.0	57.0
17.0	36.0	21.0	29.0	18.0	30.0
25.0	37.0	36.0	57.0	20.0	30.0
12.0	26.0	24.0	32.0		
SALIX					
9.0	0.0	0.0	1.0	1.0	2.0
8.0	9.0	3.0	1.0	3.0	4.0
6.0	1.0	7.0	4.0	3.0	0.0
5.0	0.0	3.0	3.0	1.0	3.0
0.0	10.0	3.0	4.0	13.0	5.0
0.0	3.0	5.0	2.0	13.0	7.0
7.0	2.0	4.0	0.0	1.0	1.0
9.0	6.0	6.0	3.0	3.0	1.0
2.0	6.0	8.0	10.0		
TILIA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
2.0	0.0	1.0	2.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
ULMUS					
3.0	3.0	1.0	3.0	1.0	1.0
7.0	5.0	9.0	4.0	6.0	12.0

Table C-1 (continued)

Taxon					
4.0	4.0	3.0	6.0	11.0	5.0
9.0	15.0	7.0	17.0	10.0	13.0
5.0	5.0	5.0	3.0	3.0	3.0
2.0	1.0	1.0	1.0	1.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
1.0	2.0	0.0	4.0	1.0	1.0
1.0	1.0	1.0	1.0		
VIBURNUT					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
1.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0		
ALNRUGOS					
1.0	0.0	2.0	0.0	1.0	1.0
0.0	1.0	0.0	0.0	1.0	1.0
1.0	0.0	0.0	0.0	1.0	0.0
3.0	3.0	3.0	2.0	2.0	3.0
10.0	12.0	6.0	6.0	20.0	20.0
18.0	14.0	22.0	11.0	4.0	15.0
13.0	5.0	4.0	4.0	4.0	9.0
7.0	10.0	13.0	9.0	1.0	5.0
3.0	11.0	12.0	6.0		
AMORPHAS					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CEPHALAN					
18.0	29.0	24.0	28.0	40.0	35.0
63.0	147.0	89.0	23.0	9.0	2.0
5.0	13.0	7.0	3.0	10.0	7.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CORYLUS					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	2.0	2.0	1.0
5.0	14.0	7.0	12.0	12.0	12.0
6.0	11.0	9.0	5.0	13.0	12.0
13.0	4.0	2.0	3.0	1.0	3.0
5.0	2.0	1.0	1.0	0.0	4.0
7.0	3.0	6.0	8.0	2.0	5.0
3.0	6.0	9.0	5.0		
LYONIA					
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
SAMBUCUS					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	1.0	0.0		
SHEPHERD					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	0.0	0.0
0.0	2.0	0.0	2.0	0.0	1.0
0.0	1.0	0.0	1.0		
EPHEDRA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
SMILAX					
1.0	1.0	1.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	4.0	0.0
4.0	5.0	0.0	0.0	0.0	2.0
0.0	6.0	5.0	0.0	1.0	0.0
0.0	0.0	1.0	2.0	2.0	12.0
2.0	0.0	4.0	4.0	0.0	0.0
0.0	2.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0		
RHUSRADI					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CARYOPHY					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	1.0
0.0	1.0	0.0	0.0	1.0	0.0
0.0	1.0	0.0	0.0	1.0	0.0
1.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2		
CHENOAMX					
0.0	1.0	2.0	1.0	0.0	1.0
0.0	1.0	0.0	0.0	2.0	2.0
2.0	1.0	0.0	2.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	2.0	3.0
4.0	1.0	1.0	0.0	1.0	3.0
0.0	0.0	0.0	0.0	1.0	0.0
1.0	0.0	1.0	4.0	0.0	1.0
0.0	1.0	0.0	2.0		
TUBULIFL					
0.0	0.0	0.0	0.0	2.0	2.0
1.0	2.0	0.0	2.0	2.0	0.0
3.0	7.0	3.0	0.0	4.0	1.0
19.0	32.0	15.0	19.0	9.0	18.0
10.0	11.0	2.0	9.0	5.0	2.0
10.0	5.0	7.0	3.0	4.0	17.0
1.0	8.0	11.0	11.0	11.0	8.0
16.0	7.0	5.0	9.0	7.0	6.0
3.0	5.0	1.0	7.0		
CIRSCART					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	4.0
2.0	2.0	2.0	0.0	1.0	1.0
0.0	2.0	1.0	0.0	3.0	0.0
0.0	1.0	0.0	5.0	1.0	2.0
0.0	2.0	1.0	1.0	0.0	1.0
0.0	0.0	0.0	2.0		
ACHILLEA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	3.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	2.0	0.0	1.0
1.0	1.0	0.0	1.0		
AMBROSIT					
14.0	14.0	15.0	14.0	11.0	12.0
11.0	7.0	10.0	12.0	7.0	23.0
36.0	21.0	20.0	14.0	26.0	20.0
93.0	57.0	57.0	75.0	64.0	53.0
11.0	10.0	7.0	9.0	13.0	12.0
13.0	6.0	6.0	5.0	9.0	5.0
9.0	5.0	3.0	5.0	2.0	6.0
6.0	9.0	2.0	15.0	2.0	7.0
6.0	7.0	2.0	4.0		
ARTEMISI					
3.0	1.0	4.0	2.0	2.0	1.0
1.0	5.0	0.0	3.0	1.0	1.0
6.0	0.0	3.0	1.0	0.0	1.0
7.0	5.0	4.0	6.0	3.0	7.0
8.0	8.0	5.0	13.0	10.0	13.0

Table C-1 (continued)

Taxon					
16.0	13.0	20.0	3.0	15.0	5.0
0.0	5.0	4.0	3.0	6.0	5.7
10.0	7.0	7.0	13.0	2.0	8.0
5.0	9.0	9.0	13.0		
BIDENSTY					
5.0	0.0	3.0	3.0	0.0	4.0
5.0	10.0	4.0	4.0	1.0	2.0
3.0	1.0	2.0	2.0	1.0	4.0
12.0	7.0	7.0	3.0	6.0	10.0
8.0	11.0	10.0	7.0	8.0	10.0
4.0	1.0	5.0	3.0	5.0	2.0
0.0	5.0	10.0	5.0	3.0	7.0
1.0	9.0	8.0	5.0	2.0	6.0
3.0	3.0	3.0	3.0		
IVACILIT					
3.0	0.0	1.0	2.0	1.0	1.0
0.0	1.0	0.0	0.0	1.0	1.0
2.0	2.0	1.0	2.0	0.0	1.0
3.0	1.0	2.0	2.0	0.0	0.0
1.0	0.0	0.0	1.0	1.0	2.0
2.0	1.0	0.0	0.0	0.0	4.0
0.0	0.0	1.0	1.0	1.0	1.0
0.0	2.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0		
LIGULIFL					
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0
0.0	0.0	1.0	0.0	1.0	1.0
1.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0	.	.
XANTHIUM					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	3.0
0.0	0.0	0.0	0.0		
CRUCIFER					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	1.0
1.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	2.0	3.0	0.0
3.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	3.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0		
CYPERACE					
18.0	1.0	6.0	6.0	1.0	0.0
11.0	15.0	16.0	8.0	25.0	17.0
14.0	17.0	18.0	12.0	21.0	16.0
43.0	29.0	6.0	11.0	9.0	18.0
13.0	26.0	48.0	7.0	39.0	19.0
15.0	18.0	17.0	9.0	20.0	6.0

Table C-1 (continued)

Taxon					
0.0	12.0	20.0	2.0	11.0	12.0
17.0	26.0	8.0	29.0	7.0	22.0
11.0	12.0	20.0	30.0		
GRAMINEX					
27.0	15.0	26.0	19.0	22.0	23.0
69.0	70.0	65.0	82.0	77.0	232.0
166.0	100.0	160.0	58.0	36.0	16.0
63.0	34.0	12.0	23.0	27.0	27.0
33.0	33.0	48.0	19.0	41.0	25.0
13.0	11.0	15.0	15.0	31.0	36.0
14.0	3.0	11.0	3.0	5.0	16.0
27.0	18.0	9.0	26.0	8.0	11.0
4.0	8.0	17.0	41.0		
ONAGRACE					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0		
PLANTAGX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
POLYGAVI					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
POLYGVIV					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
RUMEX					
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
THALICTR					
1.0	0.0	0.0	0.0	0.0	0.0
2.0	1.0	6.0	3.0	3.0	2.0
1.0	1.0	2.0	1.0	1.0	3.0
1.0	3.0	1.0	5.0	2.0	1.0
1.0	2.0	3.0	3.0	6.0	4.0
0.0	7.0	5.0	5.0	4.0	5.0
2.0	2.0	1.0	3.0	3.0	14.0
10.0	10.0	5.0	10.0	1.0	4.0
1.0	1.0	1.0	13.0		
UMBELLIF					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	2.0	1.0
2.0	0.0	0.0	4.0	1.0	3.0
4.0	2.0	1.0	1.0	1.0	4.0
2.0	0.0	1.0	1.0	0.0	1.0
5.0	0.0	3.0	1.0	0.0	1.0
1.0	1.0	0.0	3.0		
URTICA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	2.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0		
LABIATAE					
0.0	0.0	0.0	0.0	1.0	1.0
6.0	4.0	8.0	1.0	0.0	1.0
0.0	1.0	0.0	0.0	0.0	0.0
1.0	0.0	1.0	1.0	1.0	0.0
2.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	2.0	1.0	0.0	0.0
0.0	2.0	0.0	0.0	3.0	1.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	3.0	0.0	0.0		
MENTHA					
0.0	0.0	2.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	0.0	0.0	1.0	0.0
0.0	1.0	1.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	1.0		
PRUNELLA					
0.0	0.0	0.0	0.0	0.0	0.0
2.0	5.0	5.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	2.0
0.0	2.0	1.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0		
SAXIFRAG					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
RANCULAX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0		
PRIMULA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
1.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0		
PETALOST					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
6.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
LEGUHRBX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
SARCOBAT					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		

Table C-1 (continued)

Taxon					
ADIATUM					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
ATHYRIUM					
0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	2.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
BOTRYCH					
3.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CHEILANT					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
DRYOPTET					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
3.0	3.0	6.0	3.0	1.0	5.0
2.0	0.0	0.0	0.0	0.0	4.0
0.0	1.0	0.0	2.0	1.0	4.0
0.0	1.0	1.0	2.0	1.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
EQUISETU					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
LYCOPOD					

Table C-1 (continued)

Taxon					
2.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
MONOLETE					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	3.0	6.0	0.0	5.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
3.0	0.0	0.0	0.0	0.0	1.0
4.0	5.0	2.0	7.0	1.0	3.0
0.0	1.0	1.0	3.0		
PTERIDIU					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
TRILETE					
0.0	0.0	6.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	0.0
4.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	1.0	1.0	0.0	0.0
0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	1.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0		
OSMUNDA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	0.0		
CYSTOPTE					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	2.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
CIRCAEA					
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
EPILOBIU					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
GAURA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
EUPATORT					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
SANGUINA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
POLYGONA					
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
ROSAHRBX					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	1.0	0.0	1.0	1.0
3.0	0.0	0.0	2.0	0.0	1.0
3.0	0.0	0.0	0.0	1.0	0.0
0.0	2.0	0.0	1.0	0.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	2.0	2.0	0.0		
SANGUICA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	1.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	1.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
1.0	0.0	2.0	7.0		
POTENTIL					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
2.0	2.0	1.0	1.0	0.0	0.0
0.0	0.0	2.0	0.0	1.0	0.0
0.0	3.0	5.0	2.0	2.0	0.0
0.0	0.0	1.0	5.0	0.0	0.0
SPIRAEAT					
0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
3.0	2.0	1.0	1.0	0.0	1.0
2.0	0.0	0.0	0.0	0.0	6.0
9.0	9.0	4.0	0.0	7.0	0.0
0.0	2.0	2.0	1.0	1.0	4.0
0.0	6.0	6.0	8.0	5.0	0.0
0.0	8.0	0.0	6.0		
RUBUS					
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	5.0	0.0	0.0
0.0	1.0	0.0	0.0	1.0	0.0
0.0	0.0	1.0	0.0	0.0	0.0
0.0	1.0	1.0	1.0	1.0	0.0
0.0	0.0	4.0	1.0		
BRASENIA					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
9.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
JUSSIAET					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

Table C-1 (continued)

Taxon					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0		
NUPHAR					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
1.0	2.0	6.0	12.0	15.0	9.0
7.0	10.0	8.0	7.0	8.0	10.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	1.0		
POLYGHYD					
1.0	1.0	0.0	2.0	0.0	1.0
0.0	2.0	4.0	3.0	1.0	1.0
0.0	2.0	2.0	0.0	0.0	1.0
2.0	0.0	2.0	3.0	0.0	4.0
0.0	1.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
1.0	1.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0		
COLEOGET					
0.0	0.0	0.0	2.0	6.0	1.0
5.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	3.0	7.0	1.0	10.0	0.0
0.0	0.0	0.0	1.0	1.0	7.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	1.0	1.0	0.0	0.0
EUPOTAMO					
3.0	2.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0
6.0	5.0	1.0	2.0	0.0	0.0
2.0	0.0	4.0	2.0	0.0	0.0
4.0	0.0	0.0	1.0	0.0	0.0
0.0	1.0	1.0	0.0	0.0	0.0
1.0	0.0	0.0	2.0	0.0	0.0
0.0	2.0	0.0	2.0		
PROSERPI					
0.0	0.0	0.0	0.0	0.0	3.0
2.0	3.0	2.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0		
SAGITTAR					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	2.0	5.0	4.0
32.0	4.0	1.0	5.0	2.0	1.0

Table C-1 (continued)

Taxon					
8.0	5.0	0.0	5.0	1.0	2.0
2.0	0.0	0.0	1.0	0.0	0.0
0.0	0.0	0.0	1.0	0.0	0.0
0.0	1.0	2.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0		
TYPANGSP					
0.0	0.0	0.0	0.0	4.0	0.0
17.0	32.0	24.0	1.0	0.0	2.0
1.0	1.0	5.0	10.0	6.0	4.0
1.0	5.0	1.0	0.0	0.0	3.0
0.0	1.0	0.0	5.0	1.0	0.0
2.0	1.0	3.0	0.0	0.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0		
TYPHAT					
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
3.0	2.0	2.0	2.0	0.0	4.0
1.0	2.0	5.5	11.0	3.0	13.0
5.0	5.0	7.0	5.0	7.0	8.5
8.0	6.0	1.0	4.5	2.0	2.0
11.0	9.0	4.5	8.0	1.5	4.0
1.0	2.0	3.0	4.5		
INDETERM					
9.0	4.0	5.0	6.0	3.0	6.0
2.0	6.0	6.0	7.0	4.0	9.0
8.0	7.0	5.0	5.0	4.0	3.0
11.0	14.0	4.0	4.0	4.0	13.0
2.0	16.0	12.0	5.0	12.0	9.0
9.0	1.0	6.0	6.0	6.0	57.0
20.0	4.0	8.0	7.0	3.0	11.0
34.0	8.0	6.0	12.0	2.0	13.0
12.0	5.0	17.0	11.0		
EUCANOS					
53.0	62.0	48.0	45.0	46.0	57.0
77.0	61.0	51.0	64.0	68.0	66.0
68.0	54.0	41.0	26.0	30.0	23.0
125.0	27.0	50.0	42.0	69.0	59.0
64.0	112.0	67.0	132.0	165.0	95.0
185.0	151.0	298.0	73.0	183.0	185.0
130.0	114.0	74.0	34.0	137.0	127.0
173.0	114.0	47.0	234.0	67.0	161.0
42.0	106.0	105.0	165.0		

Table C-1 (continued)

CUPOLAM029 181 36 48 00N 91 05 30W244. LAKE E. NEWMAN SMITH CT

52. DEPTHS 114. VARIABLES

SURFACE	0.0	0.0	0.0	0.0	0.0
	15.0	21.0	18.0	590.0	80.0
	112.5	117.5	115.0	8830.0	130.0
	189.0	198.0	193.5	11150.0	170.0
	271.0	279.0	275.0	12980.0	240.0
	474.0	483.0	478.5	14510.0	250.0
	550.5	559.5	555.0	14210.0	260.0
	628.0	642.0	635.0	15640.0	470.0
	929.0	941.0	935.0	17010.0	380.0
	1069.5	1080.5	1075.0	16940.0	350.0
	1178.0	1190.0	1184.0	17110.0	340.0
DEPTH					
0.0	20.0	30.0	35.0	40.0	45.0
50.0	55.0	60.6	65.0	75.0	86.0
90.0	95.0	99.0	105.0	110.0	115.0
135.0	155.0	175.0	195.0	215.0	235.0
255.0	275.0	295.0	315.0	355.0	415.0
455.0	495.0	555.0	575.0	615.0	635.0
655.0	695.0	735.0	775.0	815.0	856.0
915.0	935.0	955.0	995.0	1035.0	1059.0
1095.0	1115.0	1155.0	1192.0		

Table C-2. Percentages of Reconstructed Forest Composition Based Upon Taxon Calibrations

V-ABIES	V-ACER	V-BETULA	V-CARYA	V-CUPR	V-FAGUS	V-FRAX	V-JUGLAN	V-NYSSA	V-PICEA	V-PINUS	V-POPUL	V-QUERC	V-SALIX	V-TILIA	V-ULMUS	AGE
0.00	5.59	0.00	7.07	1.41	0.00	0.00	0.00	19.39	0.00	8.25	13.80	40.21	0.79	0.00	1.18	0
0.00	9.77	0.00	4.87	0.00	1.48	2.64	0.00	23.88	0.00	2.87	0.90	52.24	0.00	0.00	1.32	1000
0.00	5.01	0.00	0.00	0.00	0.00	2.78	0.00	28.34	0.00	5.41	0.30	56.67	0.00	0.00	1.49	2000
0.00	8.10	0.00	8.51	0.00	1.67	2.24	0.03	14.66	0.00	3.41	0.00	59.83	0.08	0.00	1.46	3000
0.00	5.75	0.00	7.11	1.30	0.00	3.61	0.00	6.23	0.00	0.00	4.75	67.97	0.34	0.00	2.92	4000
0.00	4.92	0.00	7.97	1.28	0.00	4.12	0.00	5.15	0.00	0.00	4.73	69.84	0.00	0.00	1.98	5000
0.00	0.00	0.00	9.14	1.21	0.00	2.35	0.00	4.31	0.00	0.00	10.88	68.92	0.00	0.00	3.18	6000
0.00	6.43	0.00	11.56	0.00	0.00	3.20	0.00	4.57	0.00	0.00	3.44	69.03	0.00	0.00	1.76	7000
0.00	5.65	0.00	9.86	0.00	0.00	3.04	0.00	0.00	0.00	0.00	0.92	76.81	0.19	0.00	2.92	8000
0.00	6.05	0.20	11.80	0.00	1.41	2.56	0.61	4.10	4.62	0.00	8.55	55.63	0.00	2.03	2.42	9000
0.00	7.79	0.14	23.42	0.00	1.33	3.05	0.16	3.64	6.04	0.00	9.93	39.10	0.00	1.29	4.10	10000
5.73	11.40	0.13	17.00	0.00	0.00	5.02	0.02	0.00	8.56	0.00	1.01	42.59	0.00	3.48	5.04	11000
5.87	6.67	0.60	13.07	0.00	0.00	11.15	0.00	0.00	14.01	0.00	0.57	41.00	0.00	2.59	4.46	12000
8.12	8.74	0.97	0.00	1.24	1.22	29.85	0.00	0.00	15.05	0.00	0.89	30.82	1.08	0.00	2.01	13000
8.30	5.01	0.07	0.00	1.41	0.00	18.91	0.00	0.00	37.06	0.00	0.00	27.23	0.52	0.00	1.47	14000
13.10	4.12	0.72	0.00	1.13	0.00	17.01	0.00	0.00	44.17	0.00	0.00	18.69	0.33	0.00	0.72	15000
8.12	7.79	0.00	0.00	1.33	0.00	2.28	0.00	0.00	30.15	42.48	0.00	7.26	0.00	0.00	0.58	16000
7.95	6.55	0.29	0.00	1.17	0.00	4.89	0.00	0.00	51.40	16.61	0.00	9.28	0.70	0.00	1.12	17000

Table C-3. Percentages at Each Depth for Each Taxon

Taxon																			
ABIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.21	0.00	0.00	0.19	0.23	0.98	1.06	0.00	0.63	0.89	0.93	1.84	2.48	3.21	0.22	0.00	0.00	0.80
	0.62	0.26	1.32	0.00	0.00	0.68	0.51	0.42	0.00	1.26	1.45	0.91	1.46	1.99					
ACFRX	0.21	0.55	0.43	0.00	0.00	0.00	0.21	0.15	0.18	0.21	0.00	0.00	0.00	0.42	0.17	0.25	0.21	0.00	0.52
	0.17	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.48	0.00	0.00	0.23	0.00	0.00	0.27	0.00	0.00	0.68	0.53
	0.00	0.26	0.00	0.00	0.00	0.00	0.51	0.21	0.00	0.00	0.00	0.00	0.00	0.00					
ACNEGUND	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00					
ACRUBRUM	0.00	0.28	0.00	0.00	0.00	0.23	0.00	0.15	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.34
	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00					
ACSACNUM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
ACSACRUM	0.21	0.28	0.65	0.00	0.25	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.63	0.00	0.00
	0.00	1.86	0.97	1.01	0.39	0.93	0.43	0.00	0.48	0.00	0.00	0.47	0.00	0.00	0.00	0.22	0.00	0.00	0.53
	0.00	0.00	0.26	0.00	0.00	0.23	0.00	0.21	0.00	0.00	0.00	0.26	0.00	0.00					
ALNRUGOS	0.21	0.00	0.43	0.00	0.25	0.23	0.00	0.15	0.00	0.00	0.20	0.15	0.17	0.00	0.00	0.00	0.21	0.00	0.52
	0.51	0.62	0.39	0.40	0.58	2.32	2.61	1.27	1.44	4.20	4.46	4.19	3.44	5.20	2.96	0.88	3.48	8.90	1.34
	0.99	1.03	1.06	2.18	1.68	2.27	3.30	1.89	0.27	1.26	0.87	2.85	3.19	1.33					
ARTEMISI	0.62	0.28	0.87	0.45	0.49	0.23	0.21	0.76	0.00	0.64	0.20	0.15	1.00	0.00	0.52	0.25	0.00	0.26	1.20
	0.85	0.83	1.17	0.60	1.36	1.86	1.74	1.06	3.13	2.10	2.90	3.72	3.10	4.73	0.81	3.31	1.16	0.00	1.34
	0.99	0.77	1.59	1.38	2.40	1.59	1.77	2.73	0.55	2.02	1.45	2.33	2.39	2.88					
ATHYRIUM	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.48	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.26	0.26	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
BETULA	0.00	0.00	0.22	0.22	0.49	0.23	0.00	0.00	0.36	0.21	0.20	0.30	0.00	0.63	0.52	0.50	1.05	1.56	0.52
	1.02	0.62	1.17	1.61	1.75	0.93	2.82	0.21	0.72	0.84	0.89	3.02	1.47	2.13	0.27	0.22	0.46	2.74	0.53
	0.49	0.00	0.53	0.73	0.48	1.36	1.01	1.26	0.27	0.76	0.29	0.26	0.53	0.66					
CARYA	4.10	2.21	4.34	0.00	3.68	4.30	3.36	1.83	3.64	4.45	3.40	4.30	4.66	5.05	4.47	4.73	3.16	5.21	7.22
	11.61	8.27	7.21	6.24	5.82	0.23	0.00	0.85	0.00	0.00	0.00	0.47	0.00	0.00	0.27	0.00	0.23	0.00	0.53
	0.00	0.00	0.00	0.24	0.48	0.23	0.51	0.00	0.00	0.25	0.00	0.00	0.00	0.22					
CARYOPHY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.25	0.00	0.00	0.22	0.00	0.00	0.27
	0.00	0.00	0.26	0.00	0.24	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.04					
CASTANEA	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00
	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.53	0.00					
CHENOAMX	0.00	0.28	0.43	0.22	0.00	0.23	0.00	0.15	0.00	0.00	0.40	0.30	0.33	0.21	0.00	0.50	0.21	0.26	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.42	0.67	0.93	0.25	0.24	0.00	0.22	0.70	0.00	0.00
	0.00	0.00	0.26	0.00	0.24	0.00	0.25	0.84	0.00	0.25	0.00	0.26	0.00	0.44					
CORYLUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.42	0.26	0.86
	2.39	1.45	2.34	2.41	2.33	1.39	2.39	1.91	1.20	2.73	2.68	3.02	0.98	0.47	0.81	0.22	0.70	3.42	0.53
	0.25	0.26	0.00	0.97	1.68	0.68	1.52	1.68	0.55	1.26	0.87	1.55	2.39	1.11					

Table C-3 (continued)

Taxon																			
CRUCIFER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	0.00	0.00	0.00	0.00	0.19	0.23	0.00	0.00	0.24	0.21	0.00	0.00	0.00	0.00	0.54	0.66	0.00	2.05	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.52	0.00	0.00					
CRUPRESSX	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.21	0.00	1.26	0.22	0.00	0.25	0.00	0.27	0.22	0.93	0.00	0.27
	0.00	0.00	0.00	0.48	0.24	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.27	0.22					
CYPERACE	3.69	0.28	1.30	1.34	0.25	0.00	2.31	2.28	2.91	1.69	5.00	2.52	2.33	3.58	3.09	2.99	4.42	4.17	7.39
	4.95	1.24	2.14	1.81	3.49	3.02	5.65	10.19	1.68	8.19	4.24	3.49	4.42	4.02	2.42	4.42	1.39	0.00	3.20
	4.93	0.51	2.91	2.91	4.09	5.89	2.03	6.08	1.92	5.54	3.19	3.10	5.32	6.65					
EPHEDRA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
EQUISFTU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
FAGUS	0.00	0.28	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
FRAXINUX	0.00	0.00	0.22	0.22	0.25	0.23	0.00	0.00	0.00	0.00	0.00	0.15	0.50	0.00	0.17	0.25	0.00	0.00	0.17
	0.00	0.00	0.00	0.80	0.19	0.23	1.52	0.00	0.72	0.63	0.45	0.00	0.98	0.00	0.00	0.22	0.23	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.50	0.00	0.26	0.00	0.44					
FRAXPNAM	0.00	0.28	0.43	0.22	0.00	0.23	0.00	0.00	0.36	0.64	0.20	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.34
	0.00	0.21	0.19	0.00	0.39	0.46	1.52	1.27	1.20	2.10	1.34	0.93	0.74	0.24	0.27	0.00	0.23	0.00	0.00
	0.00	0.26	0.00	0.24	0.24	0.00	0.25	0.21	0.00	0.00	0.00	0.52	1.06	0.22					
GRAMINEX	5.54	4.14	5.65	4.25	5.39	5.21	14.50	10.65	11.83	17.37	15.40	34.42	27.60	21.05	27.49	14.43	7.58	4.17	10.82
	5.81	2.48	4.48	5.43	5.24	7.67	7.17	10.19	4.57	8.61	5.58	3.02	2.70	3.55	4.03	6.84	8.35	9.59	0.80
	2.71	0.77	1.32	3.88	6.49	4.08	2.28	5.45	2.19	2.77	1.16	2.07	4.52	9.09					
JUGLANSX	0.41	0.00	0.22	0.00	0.00	0.23	0.21	0.15	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.21	0.26	0.17
	0.34	0.00	0.19	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.27
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
JUGCINER	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.17
	0.17	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
JUGNIGRA	0.00	0.00	0.22	0.22	0.00	0.23	0.21	0.15	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.26	0.00
	0.00	0.21	0.19	0.00	0.00	0.23	0.00	0.00	0.24	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
LABIATAE	0.00	0.00	0.00	0.00	0.25	0.23	1.26	0.61	1.46	0.21	0.00	0.15	0.00	0.21	0.00	0.00	0.00	0.00	0.17
	0.00	0.21	0.19	0.20	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.23	0.25	0.47	0.27	0.00	0.00	0.00	0.53
	0.00	0.00	0.79	0.24	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.78	0.00	0.00					
LARIX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00
	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00					
LEGUMRBX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					

Table C-3 (continued)

Taxon																			
LIGULIFL	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00
	0.25	0.00	0.26	0.24	0.24	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00					
LIQUIDAM	0.62	0.00	0.87	1.57	0.98	0.45	0.63	0.46	0.36	0.85	0.40	0.30	0.50	0.84	0.17	0.25	0.00	0.26	0.00
	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.42	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00					
LYCOPOD	0.41	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
MONOLETE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.19	0.00	0.65	1.27	0.00	1.05	0.00	0.23	0.00	0.00	0.00	0.00	0.00	2.05	0.00
	0.00	0.00	0.00	0.24	0.96	1.13	0.51	1.47	0.27	0.76	0.00	0.26	0.27	0.66					
MORUS	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
NYSSA	10.26	12.71	10.86	12.75	8.82	7.93	0.21	0.76	0.73	1.06	0.00	0.15	0.17	0.21	0.52	0.00	0.00	0.00	0.34
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
ONAGRACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00					
OSMUNDA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00					
OSTRYCAR	0.00	0.55	0.22	4.25	0.25	0.23	0.42	0.15	0.18	0.00	0.00	0.00	0.00	0.21	0.34	1.00	0.00	3.39	7.56
	8.20	14.06	14.22	12.47	6.79	3.72	3.26	1.70	1.68	1.68	1.12	1.63	1.47	0.18	0.81	0.44	0.93	2.05	1.87
	0.25	0.26	1.85	0.97	0.24	0.91	1.77	0.42	1.37	0.50	0.29	2.59	1.86	1.11					
PETALOST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.03
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
PICEAX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34
	1.62	4.14	2.04	2.11	7.86	8.71	6.19	22.72	12.98	13.03	24.78	23.49	33.50	30.38	47.98	30.13	31.44	18.84	16.15
	24.54	24.81	48.81	26.05	17.07	34.99	37.01	30.19	16.30	13.48	34.40	34.54	32.71	36.35					
PINUSX	3.69	7.18	8.14	8.72	7.11	8.72	2.94	2.21	3.91	0.85	0.40	0.45	0.08	0.21	0.17	0.00	0.00	0.52	0.52
	0.17	0.52	0.39	0.30	0.19	0.93	1.63	1.49	1.68	2.10	3.13	4.65	3.56	5.91	4.44	17.11	11.48	10.62	37.25
	27.99	31.75	19.84	24.59	30.17	11.10	13.81	12.16	37.95	36.15	21.10	19.53	9.31	4.65					
PINDIPLO	14.67	5.25	6.08	6.04	6.62	6.80	2.52	2.43	3.09	0.85	0.40	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.39	0.00	0.39	0.00	0.43	1.06	1.20	1.89	0.67	1.16	1.23	1.65	4.30	6.18	6.26	8.22	14.55
	18.00	19.79	5.95	13.81	14.30	8.38	8.62	6.29	23.56	16.62	24.09	9.57	17.95	6.21					
PLATANUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
POPULUS	1.03	0.00	0.22	0.00	0.25	0.00	0.00	0.30	0.18	0.21	0.40	0.74	0.17	0.21	0.00	0.00	1.26	0.52	0.69
	0.68	0.21	0.00	0.20	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					

Table C-3 (continued)

Taxon																			
POTENTIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.47	0.49	0.24	0.27	0.00	0.00	0.00	0.00
	0.49	0.00	0.26	0.00	0.00	0.68	1.27	0.42	0.55	0.00	0.00	0.00	0.27	0.11					
PTERIDIU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
QUERCUS	40.82	51.38	44.73	46.76	49.26	49.60	48.11	45.63	46.41	58.47	62.60	48.96	51.54	54.11	53.95	64.18	66.74	65.36	29.04
	36.89	39.09	33.69	36.82	33.56	38.56	29.97	16.14	30.53	21.01	22.99	21.86	16.20	17.02	10.48	10.82	13.23	11.64	9.61
	5.18	7.46	4.76	7.27	6.01	8.38	9.13	11.95	5.48	7.56	3.48	6.73	6.38	7.09					
RANGULAX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.26	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.26	0.00	0.00					
ROSAHRBX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00
	0.00	0.21	0.00	0.20	0.19	0.70	0.00	0.00	0.48	0.00	0.22	0.70	0.00	0.00	0.00	0.22	0.00	0.00	0.53
	0.00	0.26	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.52	0.53	0.00					
RUMEX	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
SALIX	1.85	0.00	0.00	0.22	0.25	0.45	1.68	1.37	0.55	0.21	0.60	0.59	1.00	0.21	1.20	1.00	0.63	0.00	0.86
	0.00	0.62	0.58	0.20	0.58	0.00	2.17	0.64	0.96	2.73	1.12	0.00	0.74	1.18	0.54	2.87	1.62	4.79	0.53
	0.99	0.00	0.26	0.24	2.16	1.36	1.52	0.63	0.82	0.25	0.58	1.55	2.13	2.22					
SARCOBAT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
SAXIFRAG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	1.37	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
SHEPHERD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.26	0.00	0.00	0.00	0.45	0.00	0.42	0.00	0.25	0.00	0.26	0.00	0.22					
THALICTR	0.21	0.00	0.00	0.00	0.00	0.00	0.42	0.15	1.09	0.64	0.60	0.30	0.17	0.21	0.34	0.25	0.21	0.78	0.17
	0.51	0.21	0.97	0.40	0.19	0.23	0.43	0.64	0.72	1.26	0.89	0.00	1.72	1.18	1.34	0.88	1.16	1.37	0.53
	0.25	0.77	0.79	3.39	2.40	2.27	1.27	2.10	0.27	1.01	0.29	0.26	0.27	2.88					
TILIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.34
	0.00	0.21	0.39	0.20	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
TUBULIFL	0.00	0.00	0.00	0.00	0.49	0.45	0.21	0.30	0.00	0.42	0.40	0.00	0.50	1.47	0.52	0.00	0.84	0.26	3.26
	5.47	3.10	3.70	1.81	3.49	2.32	2.39	0.42	2.16	1.05	0.45	2.33	1.23	1.65	0.81	0.88	3.94	0.68	2.14
	2.71	2.83	2.91	1.94	3.85	1.59	1.27	1.89	1.92	1.51	0.87	1.29	0.27	1.55					
ULMUS	0.62	0.83	0.22	0.67	0.25	0.23	1.47	0.76	1.64	0.85	1.20	1.78	0.67	0.84	0.52	1.49	2.32	1.30	1.55
	2.56	1.45	3.31	2.01	2.52	1.16	1.09	1.06	0.72	0.63	0.67	0.47	0.25	0.24	0.27	0.22	0.00	0.00	0.27
	0.00	0.00	0.00	0.00	0.24	0.45	0.00	0.84	0.27	0.25	0.29	0.26	0.27	0.22					
UMBELLIE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.00	0.40	0.19	0.46	0.00	0.00	0.96	0.21	0.67	0.93	0.49	0.24	0.27	0.22	0.93	1.37	0.00
	0.25	0.26	0.00	0.24	1.20	0.00	0.76	0.21	0.00	0.25	0.29	0.26	0.00	0.66					

Table C-3 (continued)

Taxon																			
URTICA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00					
BOTRYCH	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.24	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
PLANTAGX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
XANTHIUM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.76	0.00	0.00	0.00	0.00					
SAMBUCUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.23	0.00	0.00
	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.27	0.00					
RUBUS	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.25	0.00	0.00	0.22	0.00	0.00	0.00
	0.25	0.00	0.00	0.00	0.00	0.23	0.25	0.21	0.27	0.00	0.00	0.00	1.06	0.22					
TRILETE	0.00	0.00	1.30	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.69
	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.21	0.24	0.00	0.00	0.00	0.00	0.00	0.27	0.22	0.00	0.00	0.00
	0.00	0.26	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22					
CEPHALAN	3.69	8.01	5.21	6.26	9.80	7.93	13.24	22.36	16.20	4.87	1.80	0.30	0.83	2.74	1.20	0.75	2.11	1.82	0.00
	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
ADIATUM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
EPILOBIU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
ACHILLEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.42	0.00	0.25	0.29	0.26	0.00	0.22					
AMBROSIT	2.87	3.87	3.26	3.13	2.70	2.72	2.31	1.06	1.82	2.54	1.40	3.41	5.99	4.42	3.44	3.48	5.47	5.21	15.98
	9.74	11.79	14.61	12.88	10.28	2.56	2.17	1.49	2.16	2.73	2.68	3.02	1.47	1.42	1.34	1.99	1.16	6.16	1.34
	0.74	1.29	0.53	1.45	1.44	2.04	0.51	3.14	0.55	1.76	1.74	1.81	0.53	0.89					
AMORPHAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
BIDENSTY	1.03	0.00	0.65	0.67	0.00	0.91	1.05	1.52	0.73	0.85	0.20	0.30	0.50	0.21	0.34	0.50	0.21	1.04	2.06
	1.20	1.45	0.58	1.21	1.94	1.86	2.39	2.12	1.68	1.68	2.23	0.93	0.25	1.18	0.81	1.10	0.46	0.00	1.34
	2.47	1.29	0.79	1.70	0.24	2.04	2.03	1.05	0.55	1.51	0.87	0.78	0.80	0.66					
CELTMAC	0.00	0.00	0.00	0.00	0.25	0.00	0.21	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.17	0.50	0.21	0.26	0.34
	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					

Table C-3 (continued)

Taxon																			
CHEILANT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.20	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
DRYOPTET	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52
	0.51	1.24	0.58	0.20	0.97	0.46	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.25	0.00	0.54	0.22	0.93	0.00	0.27
	0.25	0.51	0.26	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
FRAXNIGT	1.23	0.83	1.30	0.67	0.49	0.68	0.42	1.67	0.91	1.27	2.40	0.00	0.50	1.68	0.17	1.00	0.42	0.78	1.72
	1.71	1.86	2.73	6.24	5.82	16.26	16.94	16.99	22.84	15.55	8.93	10.23	12.27	9.93	7.80	4.42	2.78	0.00	1.07
	0.99	0.26	0.79	0.24	0.24	2.72	1.52	1.26	0.00	0.00	0.87	1.29	1.60	3.99					
GAURA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00					
IVACILIT	0.62	0.00	0.22	0.45	0.25	0.23	0.00	0.15	0.00	0.00	0.20	0.15	0.33	0.42	0.17	0.50	0.00	0.26	0.52
	0.17	0.41	0.39	0.00	0.00	0.23	0.00	0.00	0.24	0.21	0.45	0.47	0.25	0.00	0.00	0.00	0.93	0.00	0.00
	0.25	0.26	0.24	0.00	0.45	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00						
LYONIA	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
MENTHA	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.23	0.22	0.00	0.00	0.21	0.00	0.00	0.25	0.24	0.27	0.22	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.22					
MYRICATY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.40	0.19	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.68	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00					
PRIMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.23	0.25	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00					
PRUNELLA	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.76	0.91	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.48	0.00	0.45	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
PRUNUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
RHUSRADT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
SANGUICA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.22	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.29	0.00	0.53	1.55					
SMILAX	0.21	0.28	0.22	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.69
	0.85	0.00	0.00	0.00	0.39	0.00	1.30	1.06	0.00	0.21	0.00	0.00	0.00	0.24	0.54	0.44	2.78	1.37	0.00
	0.99	1.03	0.00	0.00	0.00	0.45	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00					
SPIRAEAT	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.52
	0.34	0.21	0.19	0.00	0.19	0.46	0.00	0.00	0.00	0.00	1.34	2.09	2.21	0.95	0.00	1.55	0.00	0.00	0.53
	0.49	0.26	0.26	0.97	0.00	1.36	1.52	1.68	1.37	0.00	0.00	2.07	0.00	1.33					

Table C-3 (continued)

Taxon																			
VIBURNUT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.21	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.68	0.00
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00					
CYSTOPTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.46	0.00	0.27
	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
ACERNIGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.24	0.00	0.23	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00					
CIRSCART	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.78	0.46	0.43	0.42	0.00	0.21	0.22	0.00	0.49	0.24	0.00	0.66	0.00	0.00	0.27
	0.00	1.29	0.26	0.48	0.00	0.45	0.25	0.21	0.00	0.25	0.00	0.00	0.00	0.44					
EUPATORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
CIRCAEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
SANGUINA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
POLYGONA	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					

Table C-4. Modern Analogues

Yr B.P.	Site No.	FIPS Code	Latitude	Longitude	Relative Coefficient of Dissimilarity
		BEST 3 EUCLIDEAN DISTANCES			
0	50042	28095	33.78	-88.69	14.80
0	1023	55025	43.17	-89.78	15.19
0	50204	01109	31.79	-85.88	15.61
500	50002	47085	35.90	-87.78	16.94
1000	646	42009	40.12	-78.63	16.54
1000	50002	47085	35.90	-87.78	16.60
1000	125	27903	45.42	-93.68	17.37
2000	463	26901	43.35	-86.08	17.61
2000	50042	28095	33.78	-88.69	18.19
2000	50200	22003	30.50	-92.83	18.19
3000	50002	47085	35.90	-87.78	7.98
3000	646	42009	40.12	-78.63	9.54
3000	498	21902	38.48	-82.87	9.86
4000	924		38.22	-92.63	3.89
4000	402	55025	42.88	-89.25	4.36
4000	398	55025	43.07	-89.62	5.01
5000	775	26901	42.67	-83.33	5.52
5000	917	17901	40.55	-90.17	6.00
5000	923	29085	37.88	-93.33	6.42
6000	775	26901	42.67	-83.33	5.69
6000	923	29085	37.88	-93.33	6.90
6000	1006	17901	42.32	-89.93	7.10
7000	917	17901	40.55	-90.17	6.47
7000	775	26901	42.67	-83.33	6.78
7000	1006	17901	42.32	-89.93	7.23
8000	775	26901	42.67	-83.33	6.14
8000	923	29085	37.88	-93.33	6.57
8000	917	17901	40.55	-90.17	6.77
9000	1004	17901	42.27	-90.08	7.61
9000	1007	17901	42.33	-90.12	9.02
9000	1021	55049	43.10	-89.92	9.67
10000	609	39901	40.22	-82.50	9.85
10000	1010	55123	43.52	-90.78	13.48
10000	514	39901	40.35	-83.80	14.49
11000	399	55025	43.13	-89.50	16.82
11000	609	39901	40.22	-82.50	18.33
11000	1011	55123	43.68	-90.73	18.46
12000	483	26161	42.33	-83.63	16.18
12000	487	26901	42.18	-85.12	17.07
12000	902	55131	43.33	-88.20	17.45
13000	1229	42091	40.33	-75.48	22.91
13000	50038	22107	32.14	-91.23	25.29

Table C-4 (continued)

Yr B.P.	Site No.	FIPS Code	Latitude	Longitude	Relative Coefficient of Dissimilarity
13000	462	26017	43.50	-83.82	25.74
14000	667	09005	41.72	-73.28	24.57
14000	502	17901	42.33	-88.05	25.71
14000	50097	47019	36.17	-82.00	29.63
15000	667	09005	41.72	-73.28	24.30
15000	1079	70014	48.00	-69.40	27.05
15000	1050	70002	47.42	-71.20	31.45
16000	979	68SLD	51.03	-93.97	10.25
16000	884	68SLD	50.07	-91.87	10.27
16000	263	63FRO	49.67	100.75	11.25
17000	688	68TDI	48.33	-80.50	13.46
17000	1050	70002	47.42	-71.20	14.78
17000	894	68CDI	49.25	-81.72	14.95
		BEST 3 CHORD DISTANCES			
0	770	51179	38.53	-77.47	4.00
0	50043	28081	34.15	-88.72	4.02
0	50017	37023	35.72	-81.47	4.06
1000	50003	47081	35.95	-87.55	3.99
1000	50043	28081	34.15	-88.72	4.25
1000	50044	28071	34.31	-89.30	4.31
2000	50044	28071	34.31	-89.30	3.98
2000	50200	22003	30.50	-92.83	4.00
2000	50017	27023	35.72	-81.47	4.38
3000	50043	28081	34.15	-88.72	2.85
3000	50003	47081	35.95	-87.55	3.08
3000	50044	28071	34.31	-89.30	3.15
3500	50043	28081	34.15	-88.72	2.19
3500	50003	47081	35.95	-87.55	2.31
3500	924		38.22	-92.63	2.37
4000	50043	28081	34.15	-88.72	1.85
4000	50044	28071	34.31	-89.30	2.17
4000	50003	47081	35.95	-87.55	2.29
5000	50003	47081	35.95	-87.55	2.84
5000	917	17901	40.55	-90.17	2.90
5000	920	29181	36.75	-90.67	3.04
6000	914	17902	39.22	-89.97	3.06
6000	917	17901	40.55	-90.17	3.07
6000	918	29031	37.28	-89.83	3.11
7000	917	17901	40.55	-90.17	2.72
7000	50003	47081	35.95	-87.55	2.92
7000	1007	17901	42.33	-90.12	2.93
8000	917	17901	40.55	-90.17	2.88

Table C-4 (continued)

Yr B.P.	Site No.	FIPS Code	Latitude	Longitude	Relative Coefficient of Dissimilarity
8000	923	29085	37.88	-93.33	2.91
8000	396	55049	42.97	-90.05	3.00
9000	1007	17901	42.33	-90.12	2.85
9000	1004	17901	42.27	-90.08	2.94
9000	774	18090	41.33	-86.25	2.95
10000	509	39901	40.22	-82.50	3.27
10000	1004	17901	42.27	-90.08	3.67
10000	774	18099	41.33	-86.25	3.75
11000	1011	55123	43.68	-90.73	3.85
11000	395	55049	43.00	-90.10	4.08
11000	904	55133	43.15	-88.43	4.12
12000	904	55133	43.15	-88.43	4.22
12000	1011	55123	43.68	-90.73	4.34
12000	395	55049	43.00	-90.10	4.50
13000	493	18140	41.23	-86.63	5.13
13000	502	17901	42.33	-88.05	5.39
13000	490	26901	41.95	-85.70	5.42
1400	502	17901	42.33	-88.05	4.51
14000	163	63FRO	49.33	-99.58	5.93
14000	266	63FRO	49.40	-99.28	6.05
15000	502	17901	42.33	-88.05	5.35
15000	989	70006	50.60	-77.57	5.52
15000	1079	70014	48.00	-69.40	5.54
16000	979	68SLD	51.03	-93.97	2.98
16000	983	68SLD	51.08	-94.18	2.99
16000	884	68SLD	50.07	-91.87	3.10
17000	688	68TDI	48.33	-80.50	3.69
17000	995	70000	53.57	-77.79	3.82
17000	980	68SLD	51.00	-93.85	3.85
		BEST 3 STD EUCLIDEAN DISTANCES			
0	651	42027	40.73	-77.78	3.15
0	50047	01109	31.72	-86.13	3.20
0	50072	37019	34.09	-78.22	3.76
1000	651	42027	40.73	-77.78	3.53
1000	50047	01109	31.72	-86.13	3.90
1000	50072	37019	34.09	-78.32	4.31
2000	50047	01109	31.72	-86.13	4.04
2000	50084	28087	33.56	-88.47	4.51
2000	651	42027	40.73	-77.78	4.70
3000	50003	47081	35.95	-87.55	2.42
3000	785	54081	37.62	-81.10	2.55
3000	398	55025	43.07	-89.62	2.63

Table C-4 (continued)

Yr B.P.	Site No.	FIPS Code	Latitude	Longitude	Relative Coefficient of Dissimilarity
4000	398	55025	43.07	-89.62	1.08
4000	50003	47081	35.95	-87.55	1.09
4000	402	55025	42.88	-89.25	1.44
5000	50003	47081	35.95	-87.55	1.37
5000	398	55025	43.07	-89.62	1.49
5000	775	26901	42.67	-83.33	1.83
6000	50003	47081	35.95	-87.55	1.25
6000	398	55025	43.07	-89.62	1.35
6000	775	26901	42.67	-83.33	1.75
7000	50003	47081	35.95	-87.55	1.57
7000	398	55025	43.07	-89.62	1.65
7000	391	55111	43.42	-89.72	1.87
8000	50003	47081	35.95	-87.55	1.25
8000	398	55025	43.07	=89.62	1.45
8000	402	55025	42.88	-89.25	1.55
9000	768	51143	37.08	-79.40	2.70
9000	395	55049	43.00	-90.10	2.72
10000	609	39901	40.22	-82.50	4.11
10000	50184	05051	34.51	-93.27	5.23
10000	496	21901	37.30	-83.45	5.50
11000	399	55025	43.13	-89.50	4.97
11000	532	68NBD	47.03	-79.80	5.45
11000	528	68NBD	46.18	-79.42	5.56
12000	50184	05051	34.51	-93.27	3.34
12000	395	55049	43.00	-90.10	4.18
12000	902	55131	43.33	-88.20	4.20
13000	51	38901	47.10	-98.58	5.36
13000	50037	28001	31.55	-91.20	5.57
13000	1037	70001	45.45	-70.88	5.82
14000	1037	70001	45.45	-70.88	3.26
14000	50037	28001	31.55	-91.20	3.65
14000	52	38901	48.02	-98.75	4.09
15000	1037	70001	45.45	-70.88	3.09
15000	1079	70014	48.00	-69.40	3.76
15000	1085	70001	46.57	-71.60	3.79
16000	878	68PAD	49.47	-91.32	0.94
16000	979	68SLD	51.03	-93.97	1.03
16000	884	68SLD	50.07	-91.87	1.04
17000	1075	70002	48.27	-71.67	1.50
17000	988	70006	50.03	-77.13	1.55
17000	1054	70011	49.37	-76.70	1.55

APPENDIX D

LITHOLOGY DATA

Table D-1. Lithology

Depth in cm Below Sediment Surface	Sediment Description
0- 15	Water-saturated, unconsolidated, clayey organic matter (10 YR 2/2)
15- 35	Fibrous, organic clay (10 YR 2/2)
35- 88	Organic clay (10 YR 2/2)
88- 100	Organic, slightly silty clay (10 YR 3/2) with large wood fragments
100- 159	Slightly silty clay (10 YR 3/1)
159- 199	Slightly silty clay (10 YR 4/2)
199- 244	Slightly silty clay (10 YR 3/2)
244- 297	Slightly silty clay (10 YR 3/1)
297- 392	Very slightly silty clay (10 YR 3/2)
392- 472	Slightly silty clay (10 YR 3/1)
472- 544	Slightly silty clay (10 YR 3/2)
544- 582	Slightly silty clay (10 YR 3/1)
582- 602	Silty clay (10 YR 3/1) with weathered chert fragments (1.0-2.0 mm) (10 YR 8/1)
602- 686	Silty clay (10 YR 4/1) with minor gray color mottling
686- 760	Silty clay (10 YR 4/1)
760- 831	Clayey, coarse-grained silt (10 YR 4/1), with interbedded silts (10 YR 8/1) and sparse, angular chert grains (3-4 mm)
831- 855	Silty clay (10 YR 4/1)
855-1051	Clayey silt (10 YR 4/1)
1051-1101	Clayey silt (10 YR 4/1) with large, carbonized plant-macrofossil fragments
1101-1125	Slightly clayey silt (10 YR 4/1)
1125-1171	Clayey silt (10 YR 4/1) with large, carbonized plant-macrofossil fragments
1171-1195	Clayey silt (10 YR 4/1) with sparse fine-grained sand

VITA

Everett Newman Smith, Jr., was born in Fort Leavenworth, Kansas, on September 28, 1949. Upon graduation from Madison Central High School in Richmond, Kentucky, he entered East Tennessee State University in Johnson City, Tennessee, and completed the requirements for a Bachelor of Science degree in 1972 with majors in Biology and Geology. For two years he served in the United States Army in Europe, and upon discharge held various sales positions. In 1981 he entered the Graduate Program in Geology at The University of Tennessee, Knoxville, and received his Master of Science degree in August 1984.