PALYNOLOGICAL STUDY OF THE SLUSHER ESTATE

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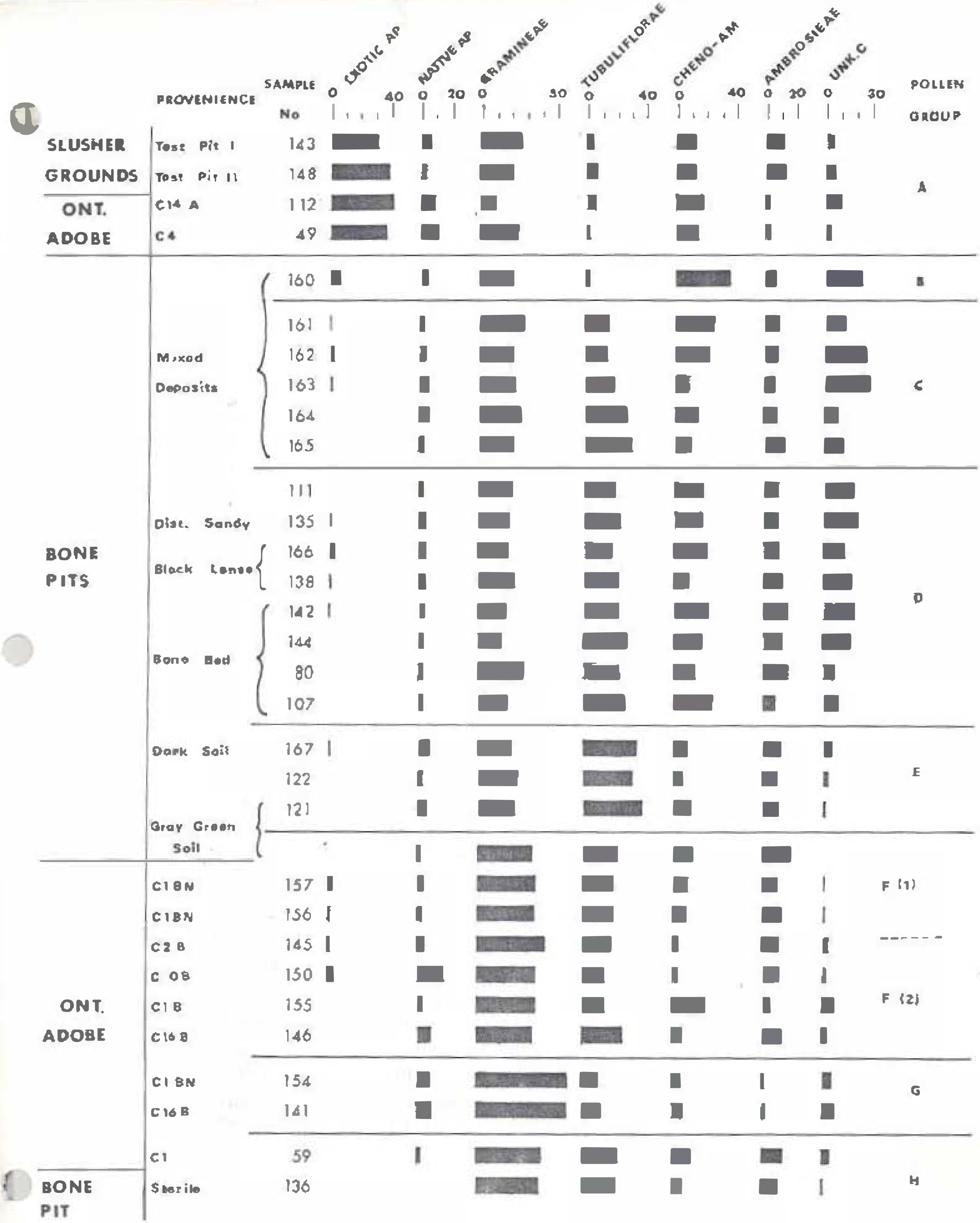
PROVENIENCE
SAMPLE No
EXOTIC AP
NATIVE AP
GRAMINEAE
TUBULIFLORAE
CHENO-AM
AMBROSIEAE
UNK. C
POLLEN GROUP
0 40
0 20
0 30
0 40
0 40
0 20
0 30
SLUSHER GROUNDS
Test Pit I 143
Test Pit II 148
ONT. ADOBE
C14 A 112
C4 49
A
BONE PITS
160
B
Mixed Deposits
161
162
163
164
165
C
111
Dist. Sandy 135
Black Lense
166
138
Bone Bed
142
144
80
107
D
Dark Soil
167
122
121
Gray Green Soil
E
ONT. ADOBE
C1 BN 157
C1 BN 156
C2 B 145
C OB 150
C1 B 155
C16 B 146
F (1)
F (2)
C1 BN 154
C16 B 141
G
C1 59
BONE PIT
Sterile 136
H

INTRODUCTION

The palynological study, including the development of a subsurface sediment sampling design, addressed three specific questions: (1) could palynological research provide information relevant to reconstructions of the cultural heritage exemplified by the historic rescurces of the Slusher Estate property; (2) could sequential variation in the vegetational and/or ecological patterns of the property be identified; and (3) could the horizons of introduction of non-native floristic elements, including crop plants, be monitored by this form of fossil record. The answer to each of these generally framed questions is affirmative. The pollen study, taken in conjunction with microstratigraphic analyses, provides relative temporal control on associated artifact assemblages at a level previously unattained in Californian historic archaeology. Both interpretations of sequential variation in vegetation patterns and sequential variation in ecological patterns are adequately evidenced, and their integration provides an additional dimension to historical reconstruction: consideration of the history of man/land relationships monitored by modifications of the fossil record. The degree to which this history is affected by the introduction of exotic taxa is also evidenced, along with the dates of introduction of particular floristic elements.

Though it was resolution of the third question which sparked original interest in the application of palynological methods at this locality, the results pertinent to the second question turn out to be more informative. In essence, the pollen record merely tends to confirm and buttress historical knowledge concerning the introduction of exotic plant taxa. It suggests that the establishment of ornamental and shade trees is a custom of somewhat longer standing than was appreciated previously, but provides little other new information. The record of paleoecological variation through time evidenced palynologically, however, suggests a rather different historical model than either of the two which are presently current.

One current model interprets the historical situation as one of progressive degradation of a native, highly productive, ecosystem to a present state of low biological productivity. Another model portrays the situation as one of swift modification of a native ecosystem to one characterized by human landscape management pressures. In the latter model ecosystem productivity is measured by different standards after modification, but has remained essentially the same from that time to the present. The palynological record suggests a model which contains elements of both current models but is different from either. It evidences multiple horizons of ecosystem modification as successive types of land managemenmt practises were enforced to respond to different identified human needs. The initiation of each horizon establishes a distinctive historical trajectory of ecosystem change, in which productivity is measured by different criteria. The rate at which changes in ecosystem productivity progress, and the directions of the changes, seem to be related more to the intensity of land management practises than any other single factor.

THE POLLEN TAXA

Taxonomic identification of the pollen observed in a sediment sample is constrained by many factors. Principal among them is the degree of similarity between the morphology of the observed pollen grain and the morphology of the pollen collected from living plants that can be taxonomically positioned as members of particular species. Highly secure taxonomic identification of fossil pollen, then, demands direct comparison with the pollen of securely identified reference collections. If these collections are geographically constrained to the general locale from which the fossil pollen is recovered, and if they are extensive enough to display the range of genetic diversity within and between species in the flora, they have a higher quality.

But the establishment of such reference collections is an arduous and expensive task. Compromises from this ideal standard are therefore normal, and to the degree that compromises are made the identification of the fossil pollen is more insecure. Identification of fossil pollen to the species level is thus rarely attempted, and identification to the generic level is provided only where the probability of taxonomic error is less than about 10%. In the present study, taxonomic assessments have been made by comparison with the information provided in standard pollen atlases and the reference collections of the Palynology Laboratory of the Department of Anthropology at Arizona State University. Since these sources do not contain comparative materials from many California sources, generic identifications of the fossil pollen are slightly less secure than the normal standard. In this study, there is approximately 20% probability that pollen identified as ABIES is actually referable to the genus PINUS, that pollen identified as POPULUS or JUNIPERUS is actually a member of the alternate genus, and that pollen identified as ACER, VITIS or PITTOSPORUM belongs in some other taxonomic category. Other generic identifications, however, are secure at the normal level.

Most identifications have been made at the family level and are normally secure. The morphology of some pollen types allows normally secure identification at the level of tribes, or groups of related genera. This is the situation for the Ambrosieae, Tubuliflorae and Liguliflorae tribes of the Compositae family. These taxa are botanically distinguished by flower anatomy. Ragweed, sulefat and dandelion are, respectively, common representatives of the Ambrosieae, Tubuliflorae and Liguliflorae tribes.

Four artificial taxonomic categories are identified in this analysis: Chenoam, ?Ceralia, Ceralia and Unknown C.

The pollen of most members of the Chenopodiaceae (Goosefoot family) is not normally distinguished from that of some members of the Amarantaceae (Amaranth family). Palynologists create an artificial taxon, Chenoam, to classify pollen which may belong to either family but is not likely to belong to any other. Synonyms are Chenopodiaceae and Chenopodinneae, among the terms found in Holocene pollen analytic literature. The pollen of all cultivated Old World cereal grasses (Ceralia) cannot be distinguished from the pollen of wild grasses except on the basis of size. Though there is a range of variation, Ceralia pollen tends to be between 45 and 60 microns in size, while wild grass pollen tends to be smaller. ZEA pollen tends to be much larger, though it varies under fossil conditions to a minimum of 60um. In this series of samples, fossil grass pollen grains not identifiable as ZEA were of three size ranges. All which measured 15-35 microns were identified as Gramineae (wild grass) pollen. All which measured 50-60 microns were identified as Ceralia pollen. Those which measured 40-50 microns were called ?Ceralia pollen. Unknown C is a tricolpate,subprolate palynomorph which has a thick (1.5um) intectate clavate exine forming a coarse reticulum (lumina ca. 1.0um). The furrows are normally wide, the polar index is approximately 0.35, the polar axis averages 33um (range=25-35), and the equatorial axis averages 24um (range=22-26).

SAMPLE SELECTION CRITERIA

The sampling strategy designed and executed for the pollen study produced 169 subsurface and 13 surface sediment samples. Pollen extraction and analysis was undertaken on all the surface samples, but time constraints on the study demanded selection of only 63 of the available subsurface samples. Three sets of subsurface samples were processed to extract contained fossil pollen, but only two sets could be analyzed in the time allocated to the project. The first set consisted of all samples recognized by field personnel as deriving from unmixed deposits in the archaeological provenience units. The second set consisted of the samples of two stratigraphic profiles collected in the North and South bone pit and Ontiveros Adobe areas of the site. The third set consisted of samples collected in stratigraphic sequences from loci at which mixed and unmixed deposits were superimposed.

The two former sets were given higher priority in analysis because they offered significantly less prospect that the records obtained would incorporate pollen rains of more than one temporal interval. The third set was selected to allow empirical evaluation of the degree to which mixture of the pollen rains of separate time periods would influence interpretation. Since analysis of the third set of extracted samples was not possible, this profile remains an issue for future research.

Two samples of the first set (sample numbers 49 and 112) were identified in the field as samples of unmixed depositional contexts. When analyzed, however, they yielded pollen records strongly likely to have been produced by mixture of the pollen rains of the Spanish Colonial and the Modern horizons. Their pollen spectra have been considered uninterpretable, and have not influenced the following analysis.

THE POLLEN SEQUENCE

The pollen sequence is structured on the evidence provided by sequentially organized spectrum variations in the two pollen profiles which were analyzed, the sequential depositions of sampled strata, and the relative stratigraphic positions of artificial deposits (e.g. floors, ash lenses, bone beds, etc.). The initial step in construction of the pollen sequence was preparation of a set of four data tables in which the total set of spectra recovered at each of the sampled areas of the site (North bone pit, South bone pit, Ontiveros Adobe and Slusher estate grounds) was arrayed in stratigraphic order. Inspection of

SAMPLE #	DEPOSIT/ CM DEPTH	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIEAE	UNKN. C	OTHERS
135	TOP OF BONE BED, SOME MIX WITH DISTURBED SANDY/ 40-50 CM	1.0	4.0	18.5	22.5	17.0	9.5	23.0	
138	BLACK LENSE /50	1.0	3.5	22.0	23.0	9.0	12.5	13.5	?CEREAL ZEA
142	BONE BED /60	1.0	3.0	18.0	22.0	13.5	15.0	23.5	?CEREAL ZEA
144	BONE BED /70		2.0	15.5	26.5	18.0	12.5	17.0	CERALIA ZEA
122	TRANSITION TO STERILE /50		3.0	26.0	32.0	6.0	9.5	3.0	
136	STERILE /50			40.0	23.0	7.5	10.5	1.0	

TABLE I: N8E20/21 POLLEN RECORD FREQUENCY VALUES

SAMPLE #	UNIT	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIEAE	UNKN. C	OTHERS
160	MIXED	6.0	4.5	20.0	2.0	35.5	6.0	24.0	
161	"	1.0	3.0	28.5	16.0	24.5	8.5	13.0	
162	"	2.0	3.5	21.0	14.0	21.0	8.0	26.0	?CEREAL
163	"	1.0	6.0	22.5	18.5	8.5	7.0	28.5	ZEA
164	"		6.0	26.5	27.0	15.0	8.5	9.0	?CEREAL ZEA
165	"		3.5	20.5	31.0	10.5	11.5	11.5	ZEA
111	35 CM		3.5	20.5	20.0	19.0	9.0	19.0	ZEA
135	DISTURBED LIGHT SANDY	1.0	4.0	18.5	22.5	17.0	9.5	23.0	
166	BLACK LENSE	3.0	4.5	19.5	13.5	21.5	10.5	13.0	ZEA
138	"	1.0	3.0	22.0	23.0	9.0	12.5	18.5	?CEREAL ZEA
142	BONE BED	1.0	3.0	18.0	22.0	13.5	15.0	20.5	?CEREAL ZEA
144	"		2.0	15.5	28.5	18.0	12.5	17.0	CERALIA ZEA
167	DARK SOIL	0.5	7.0	20.5	35.0	9.0	12.0	5.5	?CEREAL ZEA
168	WHITE ASH				NOT ANALYZABLE				
122	TRANSITION		3.0	26.0	32.0	6.0	9.5	3.0	
136	STERILE			40.0	23.0	7.5	10.5	1.0	

TABLE II: THE NORTH BONE PIT POLLEN RECORD SEQUENCE

SAMPLE #	UNIT	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIEAE	UNKN. C	OTHERS	POLLEN GROUP
160	MIXED	6.0	4.5	20.0	2.0	35.5	6.0	24.0		B
161	"	1.0	3.0	28.5	16.0	24.5	8.5	13.0		
162	"	2.0	3.5	21.0	14.0	21.0	8.0	26.0	?CEREAL	
163	"	1.0	6.0	22.5	18.5	8.5	7.0	28.5	ZEA	C
164	"		6.0	26.5	27.0	15.0	8.5	9.0	?CEREAL ZEA	
165	"		3.5	20.5	31.0	10.5	11.5	11.5	ZEA	
111	NOT ID'D		3.5	20.5	29.0	19.0	9.0	13.0	ZEA	
135	DISTURBED LIGHT SANDY	1.0	4.0	18.5	22.5	17.0	9.5	23.0		
166	BLACK LENSE	3.0	4.5	19.5	18.5	21.5	10.5	13.0	ZEA	
138	"	1.0	3.0	22.0	23.0	9.0	12.5	18.5	?CEREAL ZEA	
142	BONE BED	1.0	3.0	18.0	22.0	13.5	15.0	20.5	?CEREAL ZEA	D
144	"		2.0	15.5	28.5	18.0	12.5	17.0	CERALIA ZEA	
80	"		2.5	29.0	24.5	14.5	16.0	7.5	?CEREAL ZEA	
107	"		3.0	18.5	28.5	23.0	7.5	9.5	?CEREAL ZEA	
167	DARK SOIL	0.5	7.0	20.5	35.0	9.0	12.0	5.5	?CEREAL ZEA	
122	TRANSITION		3.0	26.0	32.0	6.0	9.5	3.0		E
121	GRAY-GREEN SOIL		5.0	24.0	39.5	11.0	9.0	1.0		
---	"		2.0	35.0	24.0	12.0	19.0		?CEREAL	F(1)
136	STERILE			40.0	23.0	7.5	10.5	1.0		H

TABLE III: THE INTEGRATED BONE PITS POLLEN RECORD SEQUENCE

SAMPLE #	PROV.	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIEAE	UNKN. C	OTHERS	POLLEN GROUP
147	ESTATE TP I	32.5	7.0	28.0	4.5	12.0	12.0	5.5	ZEA	
148	ESTATE TPII	39.0	3.5	22.0	7.0	13.0	13.0	6.0	?CEREAL	A
112	C14A STR 1	42.0	8.0	8.5	6.0	18.0	3.0	8.5		
49	C4 STR 1	37.0	12.5	25.0	2.5	14.5	2.5	2.0		
157	C1BN +30CM	2.5	3.5	37.0	20.5	8.5	8.5	1.0		F(1)
156	C1BN +20CM	1.5	3.0	35.0	18.5	3.5	12.0	1.5		
145	C2B STR 3	2.5	4.0	43.5	19.5	4.0	10.0	4.0		
150	C10B STR3	4.5	18.0	38.0	14.0	4.5	10.5	2.0		F(2)
155	C1BN +10CM		3.0	34.5	15.5	20.0	5.5	8.0		
146	C16B STR 2		8.0	36.0	26.0	7.0	13.0	4.0		
154	C1BN FLOOR		6.5	60.0	11.0	6.5	2.0	6.5		G
141	C16B STR 2		5.5	59.0	12.0	7.0	2.5	7.5		
59	C1 AROUND FLOOR		3.0	42.0	24.0	13.0	13.0	5.0		H

TABLE IV: THE INTEGRATED ESTATES/ONTIVEROS ADOBE POLLEN RECORD SEQUENCE these tables allowed identification of those pollen taxa which varied sequentially in the most obvious fashions. New tables utilizing only these taxa were then prepared (e.g. Table I).

Tables integrating the spectra in sequential order for adjacent sampling areas were then constructed (Tables II, III and IV). Similar, stratigraphically proximate, pollen records were next grouped into populations segregated by time. Finally, the overall sequential order of the populations was assessed by biostratigraphic correlation and a pollen diagram prepared for the site as a whole (Fig. 1).

The pollen diagram identifies the temporal order of archaeological materials associated with the pollen samples. But a number of things should be recognized in evaluating the assignment of a group of pollen records and associated artifacts to a particular position in the sequence, or the assignment of a specific pollen record to a given pollen group population:

(1) Identification of the members of a pollen group is based upon pollen record similarities; contrasts are given relatively little emphasis. Identification is also based on the stratigraphic relationships of the sampled deposits, but this has been evaluated in reference to the palynological similarity among the records. Thus some of the Ontiveros Adobe floor deposit samples (numbers 141 and 154) are placed

in an earlier pollen group than others because they are more similar to each other and to samples referred to the culturally sterile, earliest, deposits of the series. This is done despite field assessment of sample 141 as a member of a younger depositional unit (Stratum 2) than certain other floor samples (Stratum 3).

(2) The relative temporal position of a record within a group is far less reliable than the assignment of temporal position to the group as a whole. Stratigraphic relationships and contrasts among pollen spectra assigned to the same group are used to make such intra-group position assignments. However, the selection criteria relevant to group assignment specifically establishes biases against exactly those attributes which are most relevant to intra-group position assignments.

(3) Though it is possible to provide quantitative characterizations of the diagnostic attributes of each pollen group, these pollen groups were established by a qualitative method and they were not evaluated by statistical standards. The pollen sequence should thus be viewed as an interpretation of evidence framed as a hypothesis open to testing, rather than an inference supported by deductive logic. Statistical standards of hypothesis testing were not employed because so few samples could be analyzed. Groups that incorporate few pollen records would certainly be recognized as highly

problematical by statistical standards. This would be especially the case if multivariate tests were used. The pollen groups would be statistically problematical, however, because the small number of observations for each population would allow a higher probability that a given observation could be the result of chance. Yet no statistical test demonstrates that an observation is in fact the result of chance: it only estimates the probability that it could be. In the present situation it seemed less reasonable to generate the pollen sequence by a quantitative method whose outcome would be internally constrained towards conservatism. constrained.

(4) Pollen sequence formation follows biostratigraphic principals, but is methodologically similar to the establishment of artifact sequences by the techniques of seriation. Certain assumptions are involved (some better evidenced than others); both qualitative and quantitative procedural options exist (each of which has adherants and antagonists); and some degree of curve fitting and turning of blind eyes towards data inconsistencies goes on. The sequence as a whole, then, is based on a "soft" scientific methodology. It must be recognized as an approximation of the true temporal ordering sought, rather than a palynological argument for of the temporal position of each and every sample and associated lot of artifacts.

One of the assumptions used here, for example, is that the lateral distance separating the bone pits, the Adobe and the Slusher estate test pits is not great enough to introduce palynological variability. Thus it is assumed that if a bone pit sample were absolutely contemporary to a floor sample from the Adobe the two would reveal sufficiently similar pollen spectra that they would be placed in the same pollen group population. There are grounds for questioning this assumption as well as grounds for accepting it. The pollen sequence illustrated on Figure 1, then, is my interpretation of this body of evidence. Another palynologist, or one addressing this body of data in the context of greater or lesser information, might present a quite different interpretation.

The units of the pollen sequence have been assigned letters, rather than numbers or names, to emphasize the fact that they are not zones or zonules in the biostratigraphic sense and to emphasize that they have no known regional applicability. It is not unlikely that this pollen sequence specifically applies only to this site. I have chosen to assign the letter designations of the sequence units, or pollen groups, from latest to earliest. This follows geological, rather than archaeological or biostratigraphic, conventions.

The most recent pollen group (A) is represented in samples collected between 0 and 20cm depth in the Slusher estate test pits and also in Stratum 1 deposits superimposed on the

Ontiveros Adobe. This group of records uniquely contains pollen of exotic trees in excess of 30%. No other pollen samples yield as much as 10% such pollen.

Pollen group B is identified solely by the single sample recovered from mixed sediment deposits at a depth of 10cm in the North bone pit. Obviously, one sample cannot adequately characterize a population and this record could represent a statistical anomaly. It uniquely combines the sort of low frequency values for Tubuliflorae pollen characteristic of pollen group A (< 10%) with the sort of high frequency values for Unknown C pollen (> 20%) which are only observed consistently in pollen group C records. However, it is specifically characterized by high frequency values (> 30%) for Chenoam pollen. Such a pattern of contrast from all other samples argues for the existence of a separate pollen group which, unfortunately, is represented in this sample suite by only one record.

Pollen group C is more distinguished from the other pollen groups by its internal variability than by any other feature. This is consistent with its occurrence in samples of the mixed deposit stratum at the top of the North bone pit. There is a fairly regular pattern of proportional relationship between Gramineae, Tubuliflorae and Chenoam pollen values, however, which is roughly 22:15:20 for younger members of the group and 25:20:10 for elder members. Such multivariate relationships are easier for the specialist to identify as meaningful. In more informal terms, pollen group C is characterized as the group with somewhat more grass pollen (ca. 23-24%) than the stratigraphically superimposed group B or the stratigraphically older group D records (ca. 18-20%).

The pollen group D records are, essentially, associated with the bone-enriched deposits and lenses of the North and South bone pits. Though the extreme frequency values for Gramineae, Tubuliflorae and Chenoam pollen of these spectra exceed those of the samples of pollen group C there is less variability. This is meaningful, as there are about half again as many records for group D and thus more, not less, variability would be expected. Also, all the records of group C derive from one depositional unit at one bone pit location while those of group D come from both bone pits and have some lateral spread within both the North and South pits. The proportional relationship of Gramineae, Tubuliflorae and Chenoam pollen values in the group D spectra is approximately 19:22:18. Thus they tend to have more Tubuliflorae as well as less grass pollen than the spectra of group C. Equally relevant is the fact that the group D records are the earliest in the sequence to yield values for Unknown C pollen above 10% as a general rule.

The three pollen records of group E are differentiated by their high values for Tubuliflorae pollen (ca. 35%). Group E pollen records derive from early deposits in both the

North and South bone pits. There is no independent evidence that these deposits date to a time distinct from that represented by the Stratum 2 and Stratum 3 deposits sampled at the Ontiveros Adobe, but this is the evident inference to be drawn from the palynological record. The question of whether the pollen group E records are younger or older than those of the Stratum 2 and Stratum 3 deposits remains open, however. I have interpreted them as younger because some of the floor context pollen records from the Adobe are more strongly similar to those of "sterile", pre-occupational, context. It is possible that I have been too highly guided in this interpretation by untestable assumptions about the degree of spatial pollen spectrum variation likely to occur with the passage of time.

The group F pollen records constitute a large series, with a good deal of internal consistency, characterized by grass pollen frequency values in the 35-40% range. Part of the [illegible] h [illegible] large number of records fall into the group F category is that [illegible] excavation strategy was specifically directed towards examination of the floor and supra-floor deposits of the Ontiveros Adobe, and the group F samples tend to derive from those contexts. [illegible] e member of [illegible] green deposit near the base of the South bone pit. Another sample [illegible] d. [illegible] oup F pollen records are associated with both Stratum 2 and [illegible] osits at the Ontiveros Adobe. The two strata have a relative stratigraphic relationship which would suggest that certain group F samples are younger than others, but this is not palynologically clear. In fact, on palynological grounds some Stratum 2 context samples seem older than some Stratum 3 context samples.

Some of the group F pollen records contain no exotic arboreal pollen while others do. This is of interest because floor context pollen records referable to an older pollen group also contain no pollen of introduced trees. I have interpreted this sort of intra-group variability for the group F records as a temporal marker, and positioned those samples without exotic tree pollen earlier. As noted above, this is not as reliable an index of temporal priority as is group assignment.

The two records of pollen group G contain substantially more grass pollen (ca. 60%) than those of group F. I have used this characteristic as a marker of temporal priority, to be consistent with similar judgements in differentiating group B. However, the segregation of group G from group F pollen records is more problematical in some respects, and it may well be the case that the contrast between the two is better assessed as an expression of an expectable range of variation than a temporally significant distinction. This would be the preferred interpretation if the group E pollen records were actually older than those of groups F and G.

Only one sample collected from culturally sterile unmixed deposits yielded sufficient pollen for analysis. It derived from a point near the surface from which the North bone pit was excavated in Spanish Colonial times. A sample of sandy matrix collected "around floor" of the Ontiveros Adobe produced a pollen spectrum with identical diagnostic characteristics and has been similarly identified as representing the pre-occupation pollen rain. These spectra of pollen group B are characterized by the occurrence of ca. 40% grass pollen [illegible] with [illegible] Tubuliflorae pollen.

RELATIONSHIPS OF THE POLLEN AND HISTORIC SEQUENCES

The historic data available for the Hawkins-Slusher locality identify four principal, sequential, chronological units: the horizon [illegible] nce of historic occupancy, the horizon of occupancy of the Ontiveros Adobe (A.D. 1810-15 to ca. 1835), an historic horizon of non-occupancy (A.D. ca. 1835 to ca. 1870), and the horizon of occupancy by the Fulton, Hawkins, Nimocks and Slusher families. The latter horizon may be divisible into smaller units through identification of specific historically documented structures or other remains. Palynologically, however, it seems likely that the entirety of this last historic episode is represented only by the pollen records of Group A.

The record of group B contains EUCALYPTUS pollen. Since the importation of this ornamental is generally recognized to have occurred subsequent to the Anglo domination of southern California, the group B pollen record must be placed in either the last or the next to last episodes of the historic sequence. EUCALYPTUS pollen occurs in the group A series, but it is invariably associated in those cases with JUGLANS (Walnut) or ALNUS (Alder) pollen or both. The group B EUCALYPTUS pollen is not so associated. There are also two pollen records of the group D series in which EUCALYPTUS pollen occurs (samples 135 and 166). In those cases it also lacks association with JUGLANS or ALNUS pollen. The inference to be drawn from this distribution is that all of the samples referable to the mixed, the disturbed sandy and the black lense deposits of the North bone pit date to the historic horizon of non-occupancy of the locality (ca. A.D. 1835 to ca. 1870), rather than the latest horizon when EUCALYPTUS was locally planted as an ornamental along with other trees and shrubs.

The horizon during which residents of the Ortiveros Adobe occupied the site is represented in the pollen sequence by the records of groups D, E, F and G, though only the group D records obtained from the bone beds of the bone pits are involved. As this episode is very short in duration, the degree of palynological variability seems extreme. Common sense would suggest that in the course of a mere 20-30 years pollen rain reflections of vegetational change would be expected to vary only to slight degree. The observed variability would then imply that the assumptions upon which the pollen sequence are founded are invalid, and the degree of correspondence between the pollen sequence and the historical sequence that seems evidenced is actually an artifact of the analytic method employed.

There are two grounds upon which such argument founders, however. First, the principal source of variability in the pollen sequence is variability in the floor samples from the Ontiveros Adobe; that is, in the contrast between the records of group F and those of group G. Field observations provide evidence that the floor was resurfaced a number of times during the few years the dwelling was occupied. It was resurfaced with raw material from the same source, but all room floors and all portions of any one room floor were not resurfaced simultaneously. Floor surfaces damaged by use and traffic appear to have been repaired during the period of residency as demanded and as convenient. Thus any time-dependent variations in local conditions influencing the pollen rain would have a probability of being reflected in the total group of floor samples. The record seems to indicate two such episodes, reflected as the pollen spectra of group F and group G.

Second, though it is certainly true that the character of the pollen rain at any given time is a reflection of the character of the vegetation, vegetation pattern characteristics are not the only factors which condition the pollen records of sediment samples. Observed pollen rain records, including the mathematical relationships which obtain among the taxa of a pollen spectrum, are influenced simultaneously by three factors: the quantities of pollen produced by each taxon in the pollen rain source area; the quantities of pollen dispersed by each taxon to the locus of the sample; and the quantity of pollen of each taxon preserved in the depositional environment sampled. Each of these factors, in turn, is influenced by a variety of climatic, edaphic and biotic conditions. Since the pollen rain preserved in a sample is such a miniscule fraction of the pollen rain produced and dispersed by vegetation at any one time, many variations tend to be proportionally reduced to the point that they are statistically invisible in sediment samples. Thus vegetation pattern change is normally observed palynologically as a process which takes decades or centuries to occur.

However, vegetation pattern change is only one means by which paleoecological change is monitored palynologically. Ecological changes affecting the quantities of pollen produced, dispersed and preserved may be far more rapid than those which affect the plants as members of a plant association. A short duration drought, a modification of the mean wind direction during the pollination season, or a short term disturbance of soil surfaces may create significant variation in the character of the pollen rain with very little monitorable effect on the vegetation characteristics of the source area of the pollen rain. If sediment samples are available that can be identified as short interval pollen traps for the pollen rain, as is the case for the floor samples from the Ontiveros Adobe, we should not be surprised to find that they are highly variable. Each of the samples could, for example, represent the pollen rain of a specific day in a specific year.

Indeed, the surprising thing about the pollen records of the samples assigned to this short time hroizon is not that they incorporate palynologically significant differences, but that any of the samples is sufficiently similar in pollen content that its record can be placed in a population of related records. In all probability, the fact that the records can be placed in groups is due to the incredibly large degree of reduction that occurs between the time the pollen rain is deposited in a sample and the time we observe it decades, centuries or millenia after the event. All that is left to observe are the most highly significant variations the samples once contained. The less significant variations in variety and proportions of pollen taxa have been reduced to the point that we can no longer monitor their existence.

The assumptions upon which the pollen sequence are founded, then, are not invalidated by the extraordinary variability observed in the pollen records assignable to the very few years of Spanish Colonial occupation. The deposits sampled are short interval pollen traps, and the variability observed is not inconsistent with that expectable for short interval pollen rains. If anything, it is a conservative expression of such variability. The kind of variation observed is extraordinary if it is concieved as a reflection of vegetation change, however. What we observe, then, is more securely interpreted as a function of paleoecological variation through time than a function of vegetation pattern change per se.

The group H pollen records are the only ones available which derive from deposits at all likely to have trapped pollen during the pre-occupation episode. Even if the group H pollen records are actually more ancient than those of group G, they derive from deposits that date subsequent to the excavation of the bone pits. Thus though they might be older than samples from the floor deposits of the Ontiveros Adobe, they cannot pre-date the years of Spanish Colonial occupation.

PALEOECOLOGICAL AND PALEOVEGETATIONAL RECONSTRUCTIONS

The variability in the pollen records of the Ontiveros Adobe occupation horizon indicates that the short interval depositions sampled in that situation provide poor opportunities to monitor vegetation pattern change. It is fairly clear, however, that the deposits which produce pollen records referable to groups A, C and H are not of the short interval trap type. The distinctions between them may thus be interpretable in paleovegetation terms.

Such interpretation, and paleoecological interpretation as well, can proceed by two distinctive methods and by a combination of both methods. The first method places primary emphasis on consideration of the suite of taxa represented in the samples of a given pollen group and the frequency and constancy with which those taxa are represented. In group A, for example, Labitae, ULMUS, EUCALYPTUS and ALNUS occur in every sample, RHUS and JUGLANS occur in 3/4 of the samples, and Solanaceae and Leguminosae occur in half. This associational pattern is unique to the group A series, though only RHUS occurs specifically and uniquely in this pollen group. Application of this method suggests that the group A samples reflect a unique vegetation pattern in which RHUS is a member, but the pattern is more distinctively characterized by the association of a mixture of native and exotic trees and shrubs.

The second method proceeds from a primary consideration of the empirical similarities and differences between pollen records collected from surficial deposits under observable vegetation and ecological conditions and those of more ancient deposits. Surface sample pollen records are assumed to be the best available modern pollen rain homolouges of the fossil pollen rains recoverable from older sediment samples. There are clear problems of direct interpretation of fossil/modern pollen rain relationships, however, because the modern records may be less affected by factors influencing pollen preservation. Surface sample pollen records were collected and analyzed as a part of this research program to test the value of this assumption empirically, as well as to guide interpretation of the fossil pollen sequence data if the test proved positive.

THE SURFACE SAMPLE RECORD

Existing vegetation patterns in Los Angeles County are all heavily modified by historic land use practises. Even areas in which attempts have been made during the last 50 years to encourage re-generation of floras which approximate those that existed a century ago are severely affected by the existence of exotic introduced species which are adapted to local conditions and compete heavily against native species. In any case, the pollen rains of even the most pristine native flora plant associations in Los Angeles County are to some extent affected by the pollen production and dispersal characteristics of the plant associations of the surrounding disturbed and managed landscape. When collecting surface sample pollen rains which could be used as empirical controls for the interpretation of fossil pollen records, then, we recognized that it was not likely that any could be recovered that would be expected to produce statistically equivalent pollen rains to those dating more than a half century old. In addition, logistical problems constrained our ability to collect or analyze large numbers of such samples or to assess the total range of variability that might be observed in the samples of any given floristic or ecological class. We could, however, analyze and collect a sufficient number of samples to address specific problems in an initial fashion. We chose three problems significant to interpretation of the fossil pollen records of the Slusher locality: the effect of land disturbance on modern surface sample pollen rain, the character of modern pollen dispersal, and the reflection of highly contrasting ecological systems in the pollen rain.

The character of modern landscape management in Los Angeles County has very great potential to affect the pollen rain of surface samples. In this highly urbanized area, fire constitutes an unusually extreme danger to life and property. The seasonal distribution of rainfall and the mildness of the winter season result in an extraordinarily productive growing season followed by an extended drought period. The result is rapid growth and development of herbaceous and shrub floras in winter, followed by a long season in which much of this biomass is either dormant or dead. This vegetation constitutes a very real and serious fire hazard. Strongly enforced ordinances require landowners to reduce the potential danger by removing the bulk of vegetation prior to the fire danger period. Most who own reasonably large contiguous tracts (including municipal and county governments) disc plow the vegetation two or more times during the growing season to reduce the biomass production of the plot sufficiently to lower the fire hazard. This practise, however, also reduces the pollen productivity of the plot; it reduces the plot's potential as regards pollen preservation; and it creates a surface sediment layer in which preserved pollen which has rained down since the last discing is intermixed with any that may be preserved in the deposit from earlier times to the depth reached by the plow.

In order to determine empirically what the actual effect is, five samples were collected. Four came from the grounds of the Slusher estate, which is a small area that is relatively undisturbed by discing. The fifth was collected about 1/4 mile north in a large field which is regularly and intensively disced, quite disturbed by commercial traffic, and effectively surrounded by urbanized and semi-urbanized lands. Three of the Slusher estate surface samples came from areas of undisturbed sediments. One was collected from the surface area at the southwest corner of the structure wall south of the windmill. This area is canopied by trees and shrubs and has essentially no ground cover. A second was collected from the sediments which have collected within the ruins of a small brick structure about 15 meters south

VEG-ECOLOGICAL PATTERN	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIBAE	UNKN. C
NORTHERN DISTUR.	7.5	8.5	17.5	11.0	13.0	17.0	18.0
ESTATE DUSTURBED	12.0	19.0	24.0	4.0	15.0	12.0	2.0
GRASSY AREA	20.0	15.5	31.0	5.0	11.5	3.5	2.5
WITHIN STRUCTURE	37.0	6.5	7.5	3.5	8.5	5.0	20.5
CANOPIED AREA	75.0	4.5	8.0	2.0	3.5	4.5	1.5

TABLE V: SLUSHER AREA SURFACE POLLEN RECORDS of the first collection area. The third was collected in the grassy area surrounding the eastern fountain on the estate. The sample from disced ground on the estate was collected from the central, open, portion of the estate property west of the first collection area.

Comparing the two disturbed surface samples and the three undisturbed (Table V) reveals the fact that the former contain uniformly lower frequencies of exotic arboreal pollen (EUCALYPTUS and ULMUS) and higher frequencies of Ambrosieae pollen. Ambrosieae pollen is produced by ragweed-like plants well adapted to growth on disturbed soils. However, the plants which produce Chenoam pollen are similarly adapted, and many of the species which produce Tubuliflorae pollen are also. Though plants of these taxa are normally more abundant on the plots than Ambrosieae pollen producers, their pollen is not observed in higher frequency than on undisturbed plots. The higher frequency of Ambrosieae pollen thus apparantly reflects the occurrence of disturbed ground ecology, but not the nature of the disturbed ground vegetation.

Alternatively, the frequencies and relative proportions of exotic and native arboreal pollen seem to be informative as regards vegetation. The same seems true of the frequency value for grass pollen.

In the northern plot area there are no trees of any sort.

The low total arboreal pollen frequency (16%) seems to reflect a low regional tree density, and the 1:1 ratio of exotic to native tree pollen seems to indicate that pollen of both classes is equally distributed to the plot. The open plot area on the estate has a total AP frequency of 31.0%, indicating a decidedly more proximate position in relation to trees. In addition, it has a 1:1.5 ratio of exotic to native tree pollen, indicating only slightly more proximity to native than to introduced arboreal taxa. This is indeed the case. By contrast, the canopied plot yielded 79.5% arboreal pollen, in a ratio of 16.6:1. All of the trees which shade the plot are exotics. The fountain plot is less densely canopied than the structure plot, and less distant from native taxa. It contains 35.5% arboreal pollen at a ratio of 2:1.5, while the structure plot contained 43.5% arboreal pollen at a ratio of 5.7:1. The grassiest plots, in terms of decreasing grass density, are the fountain plot, the open estate plot and the northern plot. Their grass pollen frequency values are 31.0%, 24.0% and 17.5% respectively.

Two groups of surface samples were collected to address the question of the degrees to which ecological contrasts are represented in the modern pollen rain. The first group of six samples was collected at Whittier Narrows State Park, a low-lying area of permanent stream flow and high water tables. The second group, of two samples, was collected on the vegetated slopes of Turnbull Canyon, which is an area of

VEG-ECOLOGICAL PATTERN	EXOTIC AP	NATIVE AP	GRAM-INEAE	TUBULI-FLORAE	CHENO-AM	AMBRO-SIEAE	UNKN. C	
CANE-GRAPE SWALE	15.6	23.5	10.5	5.0	4.0	8.0	15.5	
GRAPE-BLACKBERRY THICKET	5.5	34.0	10.5	13.0	8.0	2.0	14.5	
OPEN AREA	2.5	7.5	6.0	8.0	3.0		62.0	
SEDGE SWALE	3.5	12.5	5.5	21.5	7.0	1.5	40.0	
BACCHARIS THICKET	0.5	4.0	3.0	19.5	28.0	1.0	38.5	
SUCCESSIONAL RIPARIAN WOODS	5.0	39.5	1.5	4.0	4.5	1.0	26.5	
OPEN SUCCESSIONAL COASTAL SCRUB	1.0	7.5	11.5	15.0	1.5	8.0	46.5	
CLOSED CANOPY RHUS		4.5	12.5	3.5	3.0			RHUS=63.5%

TABLE VI: NARROWS AND TURNBULL AREAS SURFACE POLLEN RECORDS much drier and cooler ecology. The ecology of the Slusher estate area constitutes another, intermediate, contrast.

As a population, the samples of the Narrows area are distinct from those of the Slusher estate and Turnbull Canyon areas in the higher frequency values for native tree pollen (Tables V and VI). Also, the native tree pollen record is more influenced by riparian taxa (ALNUS, JUGLANS, SALIX) than is the case elsewhere, where JUNIPERUS, QUERCUS and PINUS tend to dominate. This generalization does not apply, however, to individual sample spectra. Differentiation of the Slusher and Turnbull modern pollen rains is best effected by the contrast in the frequency of exotic tree pollen. The highly human-managed ecology of the former is reflected in its higher exotic AP values. The contrast in temperature values for the three districts does not seem palynologically evidenced, nor does any contrast in relative aridity between the Slusher and Turnbull districts.

When the individual samples of the three populations are compared in respect to Unknown C pollen, it is evident that each group contains relatively low and relatively high values for this pollen type. In both the Whittier Narrows and the Turnbull populations, high frequency values are recovered from plots evidencing floristic recovery from an earlier human-managed state. In the Slusher population, the plots with the highest Unknown C frequency values do not yield values on the order of those of successional flora plots in the other districts. But they are the least managed plots of the Slusher modern surface series.

The 13 samples do not constitute an adequate series of empirical controls, but they appear to provide data patterns relevant to interpretation of the fossil records. It seems fairly clear that the sort of extreme soil surface disturbance caused by discing elevates the Ambrosieae pollen frequency. This does not reflect a palynological response to locally increased numbers of Ambrosieae pollen producers, however: rather, it seems to reflect the singular ecological stresses soil disturbance places on any vegetation which happens to occupy the location. Relative increases in the frequency of Unknown C pollen similarly appear to reflect ecological rather than vegetation conditions. The data suggest that once a plot has been subject to human management, release of management pressure will be reflected by an increase in the Unknown C pollen frequency. Irrespective of the flora involved, a plot which is either yet subject to management or recovered more fully from management will produce a pollen rain with less Unknown C pollen.

The surface sample data suggests that the frequency of grass pollen in a record is a reasonable monitor of the density of grass cover, though the relationship is not fully proportional. Thus a densely grassy plot may yield as much as 20 or as little as 4 times as much Gramineae pollen as one which is essentially lacking any grass plants at all. Interestingly, this generalization seems to apply only to herbaceous grass pollen producers. The shrubby cane plant (ARUNDO DONAX) produces Gramineae pollen but the sample collected from the cane-grape swale contained little more such pollen than was observed in the canopied area lacking herbaceous grass.

The surface pollen rain data also suggests that the arboreal pollen frequency value monitors immediate tree density, though background values of 4-15% can occur far from any trees. Today, the proportion of exotic to native arboreal pollen seems to monitor human horticulture intensity. Highly managed landscapes yield exotic:native AP ratios in excess of 1:1; minimally managed ones yield ratios below 1:1 even though exotic AP producers may be conspicuously present.

In general, the taxonomic representation of the arboreal flora and the arboreal pollen flora are not in close correspondence. JUNIPERUS occurs quite consistently in the Slusher surface pollen rain, for example, though it is not a member of the local flora, and QUERCUS pollen is normally overrepresented. A congery of native riparian arboreal taxa, however, normally plays a stronger role in the native arboreal pollen rain along the floodplain that is the case elsewhere.

INTERPRETATION OF THE FOSSIL POLLEN SPECTRA: PALEOVEGETATION AND PALEOECOLOGY

The most ancient samples of the fossil series, those of group H, are characterized by moderately high values for both Gramineae and Tubuliflorae pollen. The former seems best interpreted as reflecting a quite continuous ground cover of herbaceous grassy vegetation; the latter appears to indicate the occurrence of fairly numerous forbes as well. This is consistent with the surprisingly high value for Ambrosieae pollen in this population, indicating the occurrence of ecological conditions acting parallel to those which today generate mechanical soil surface disturbance.

The samples of the group G population evidence the existence of significantly denser stands of herbaceous grass than had occurred somewhat earlier and, despite the construction of the Ontiveros Adobe and its use as a ranch headquarters, less soil disturbance. The proximity to a native tree population including riparian elements seems also to have increased. These modifications of vegetation and ecology may all have been induced by man. As exctic herbaceous grass species spread through southern California, they may have first competed more heavily against native forbes than native grasses, and first occupied the relatively more disturbed soil niches. Similarly, exploitation of clay deposits and native hay in the local stream channel floodplain was very likely required for support of corralled equids and construction of the Ontiveros Adobe. The result would have been a reduction in competition between grass plants and shrubby or arboreal riparian taxa. The occupants of the Ontiveros Adobe may have recognized these changes as beneficial. To them, it would have seemed that the very act of stocking the empty range improved its quality, and the act of building their home brought in its wake the establishment of shade plants near their domestic water source and a reduction in the insect and rodent populations with whom they shared the floodplain.

But within a few years, as evidenced by the group F(2) pollen spectra, range conditions had deteriorated to their former state. Slightly later, during the period represented by the F(1) pollen series, the land was showing signs of human management. Elm tree saplings, probably offspring of trees planted to the southwest of the Adobe to provide shade, may have begun sprouting on the floodplain to compete against native riparian trees. The combination of competition by woody taxa and continuous mowing seems to have reduced the quality or quantity (or both) of the native hay crop of the floodplain. The first pollen which may be identified as a crop plant, possibly a European cereal, shows up at this time. One may interpret its occurrence as an effort to supplement a deteriorating wild plant fodder supply for the ranch's corralled horses with oats or wheat.

Not more than a decade later, when the pollen records of group B were deposited in the lower levels of the bone pits, the continuously grassy range land was already gone. Grazing was still a highly productive economic activity, but the land supported forbes in as great or greater quantities than grasses. The competitive power of grass against weedy taxa seems to have been so far reduced that cottonwood was able to survive and pollinate at the locality.

The younger records of pollen group D have been attributed to the non-occupancy period beginning about A.D. 1835. They do not evidence vegetation or ecological conditions distinct from those obtaining slightly earlier, with the exception of an apparent reduction or abandonment of the local cultivation of Old World cereal crops. Maize continued to be locally grown. The somewhat higher values for Unknown C pollen suggest a slackening of human management pressures on local ecology.

Somewhat later in the ca. A.D. 1835-1870 period, as evidenced by the records of pollen group C, the pollen sequence seems to reflect successive episodes of increasing forbe and grass development as the reduction of management pressure evidenced in the younger group D records led to a return towards aboriginal ecological relationships, followed by and overlapping with an interval in which a further reduction in management occurred. The deposits which yield the group C pollen records, however, are of mixed origin and the fact that they are more highly variable than those of group D may be an artifact of that situation. The conservative interpretation of the group C spectra would be that they reflect paleoecological and paleovegetation conditions no different from those represented by the group D records as a whole: the occurrence of a relatively degraded grazing range subject to occasional increases and decreases in management pressure.

If we grant the argument that the single record of pollen group B identifies a temporal segment of the sequence, it may identify the time of most extreme lows of ecosystem productivity. The characterizing high Chenoam value of this pollen group is approached in the modern pollen rain spectra only by the record obtained in the BACCHARIS (mulefat) thicket regenerated on abandoned farmland in the Narrows district and by the disturbed plots in the Slusher estate series. Clearly, the frequency of Chenoam pollen does not reflect the occurrence of specific plant taxa. It seems to identify the degree to which forbes or shrubs adapted to highly stressed land may flourish.

The characteristic diversity and frequency values for exotic arboreal pollen in the group A spectra seem clear palynological indices of the historically recorded maintenence of garden ornamentals on the property during the Fulton, Hawkins, Nimocks and Slusher occupations. Variability in the grass values and the relative proportions of native to exotic arboreal pollen types in the spectra of this group suggest that the plot of land in the immediate area of the Ontiveros Adobe was more frequently subject to landscaping modifications than the part of the estate where structures yet stand. This is somewhat more evidenced if the samples attributed to the Adobe cornerstore and possible wall melt (samples 115 and 49) are considered actual members of the group A population.

SUMMARY

The pollen studies undertaken in association with archaeological research on the Slusher estate allow development of a number of interesting insights in the areas of cultural history, paleoecological and paleovegetational change through time, and potential development of the methods appropriate to Californian archaeological research. Taking the latter first, it seems evident that pollen study may be profitably alligned and integrated with fine-grained geoarchaeological and microstratigraphic studies. In conjunction with appropriately implemented sediment sample collection strategies, development of extraordinarily discriminating relative chronologies seems not only possible but uniquely relevant to the study of Californian history and prehistory.

The process of integration of highly discrete locus-specific relative pollen chronologies would, by itself, be lengthy and extremely labor intensive. Thus it would be both costly and tedious. In terms of the existing economic climate and the prevailing attitude that only the most obviously significant qualities of historic properties should be recovered and subject to analysis, it would be easy to dismiss the potential of Californian sites to produce pollen chronologies of this type. However, the microstratigraphic discriminations required for such pollen studies provide sets of observations which are significant in their own right and subject to geomorphological interpretation at broader geographic scales. Such interpretations may be integrated from fewer locations within a district or region and, given appropriate expertise and opportunity, can lead to the rapid development of district-level relative chronology models which can be independently tested by analysis of variations in either cultural or biological fossil records.

At a more down-to-earth level, this pollen study demonstrates that irrespective of the uses we may put them to, paleoecological and paleovegetation reconstructions can be based on the pollen records of archaeological deposits in southern California. Those presented here document that such pollen records seem to provide more direct reconstructions of paleoecological than paleovegetation patterns and their changes through time. This may, however, be an artifact of the particular historical periods sampled.

Certainly, the vegetational pattern differences between the period since ca. 1870 and the preceeding periods are obvious enough. It may also be an artifact of the decision to examine and analyze the available record by univariate and non-statistical techniques rather than in a multivariate frame of reference. As more surface sample and fossil record data is accumulated in future, both the types and the geographic scales of paleofloristic and paleoecological reconstructions may be substantially broadened.

Finally, the results of this study offer another dimension to our comprehension of culture history in Colonial and Pioneer California. It would appear facile to concieve of those periods as having either a generally negative or a generally positive effect upon a smoothly functioning, highly adapted, stable aboriginal ecosystem. The Spanish Mission Period occupants of this property did not, in the short term, enter and swiftly degrade a native paradise by introducing new economic standards and new forms of residence. If anything, the most immediate ecological response to their establishment seems to have been an enhancement of exactly those landscape qualities which attracted colonists to the area. In a short term frame of reference, the willingness of aboriginal populations to accept the missions and intruding colonists may have been as much a function of recognition that their actions showed portent of higher native standards of living as it was a funtion of the introduction of disease, new religious concepts and practises and new socio-political systems.

In the long term, however, pursuit of the same activities that initially resulted in enhancement of ecosystem productivity resulted in its gradual degradation to an earlier state and then continued degradation to a worsened one. Maintainence of the same level of living standard now required more investment of human labor, not less, and more intensive landscape management and manipulation. In the Colonial Period, the cause of this situation appears to have been the continuous and persistant ecological pressure created by increasing numbers of livestock.

It would be convenient and satisfying if this study yielded a historical lesson we might apply to our own times. Unfortunately, it does not. The historical trajectory of events of the Colonial Period was in fact abruptly truncated by the very different cultural patterns introduced and aggressively defended by the Anglo pioneers, which were intimately related to events occurring elsewhere in the United States and other Western nations. The primary landscape manipulation pattern shifted from cattle production to a mixture of low intensity livestock-crop plant production and low intensity levels of industrialization and local resource exploitation. As far as the available pollen record reflects this, the pressures of such land management practises seem to have made matters little worse though they made them no better. The period of sale and subdivision of Rancho Santa Gertrudes did not result in the creation of a new ecological balance between man and the land. The rate of ecosystem modification was, instead, slowed as the scale upon which intensive pressure was applied was reduced. Where large tracts were previously intensively grazed, now small tracts became about as intensively cropped.

The scene was set about the time the group B pollen record was deposited for the crossing of an ecological threshold that would have seen the productivity of the landscape significantly worsened under human management pressure. But this trajectory was truncated at this locality by Fulton's decision to convert the site area to a park-like oasis and the efforts of subsequent owners to maintain it as a totally artificial ecological system. This remains the situation to the present day, and has become the normal man/land relationship pattern for Los Angeles County.

The picture which emerges, then, is neither one of progressive increase or progressive decrease in the productivity of the land through time. Rather, it is one in which the establishment of a type of management practise results initially in the creation of a distinctive ecosystem which then progresses along its own unique historical trajectory. The rate and direction of that progress seems to depend in each historical period upon the degree of intensity with which the management practise is persued. In the Colonial Period, continuously increasing grazing pressure degraded the ecosystem's potential to remain in a stable, enhanced, state within a few decades and engendered a fairly rapid trajectory of lowering levels of ecosystem productivity. In the Anglo Pioneer Period, the farming of smaller tracts at low intensity levels slowed the rate at which this decline was progressing and introduced new component variables into the system (e.g. exotic trees) which changed its character. Productivity now became effectively measured by the potential of the land to support neither grasslands nor cattle, but the economic and aesthetic demands of an agrarian population.

The low levels of demand which persisted for some decades allowed the rate of decline in ecosystem productivity to slow markedly, but the direction of the trajectory remained the same. At approximately the point at which the accumulated decline had reached a threshold beyond which productivity would have been reduced at a swifter rate on the Slusher property, however, yet another type of land management practise was established and yet another ecosystem was formed. In this system, all concern for native ecosystem components and their aboriginal interrelationships has been abandoned. Land use practises are directed towards the maintenence of a horticulturally managed landscape which is valued for its aesthetic, not its economic, qualities. These values have been of sufficient significance that the labor and materials costs of persistant continuation of the artificial ecosystem have been borne with minimal complaint. The productivity of this ecosystem is measured by the degree to which it satisfies the aesthetic values it is designed to enhance. By that standard, the system is less productive in 1980 than it was in 1940 as a result of smaller labor and materials investment. It's productivity can be restored and even enhanced quite rapidly if those investments are again made. If they are not made, there will be a swift degradation of the ecosystem's productivity as the horticultural taxa succumb to disease, old age and the competition of wild and escaped taxa capable of invasion.

Sould the latter historical trajectory occur, yet another ecosystem will have come into existence on the Slusher property. As was the case formerly, it is likely that this ecosystem's characteristics will be determined by the nature of the land management practises employed. Thus its future productivity will also be measured by the capacity of the land to provide for human, not strictly biotic, needs.

APPENDIX

[illegible]N	COMMON REFERENT
ABIES	Fir
PINUS	Pine
JUNIPERUS	Juniper
QUERCUS	Oak
LITHOCARPUS	Lithocarpus
POPULUS	Cottonwood
SALIX	Willow
ALNUS	Alder
JUGLANS	Walnut
Betulaceae	Birch family
ACER	Maple genus, incl. box elder
ULMUS	Elm
CARYA	Hickory, pecan
EUCALYPTUS	Eucalyptus
RHUS	Sumac genus, incl. laurel sumac, lemonadeberry, sugarbush
Rhamnaceae	Buckthorn family, incl. coffeeberry
Rosaceae	Rose family, incl. blackberry
PITTOSPORUM	Pittosporum
EPHEDRA	Mormon tea
Chenoam	Artificial taxon = Chenopodiaceae + AMARANTHUS
Gramineae	Grass family (Poaceae)
Ambrosieae	Tribe of Compositae incl. ragweed
Tubuliflorae	Tribe of Compositae incl. sunflower, aster, mulefat
Liguliflorae	Tribe of Compositae incl. dandelicnlion
ARTEMESIA	Sagebrush
Leguminosae	Pea family, incl. clover
Solanaceae	Nightshade family, incl. jimsonweed, tree tobacco
Labitae	Mint family, incl. sage
Lilliaceae	Lilly family, incl. yucca
Euphorbiaceae	Spurge family
Umbelliferae	Umbel family, incl. carrot, Queen Anne's lace
Onagraceae	Evening primrose family
Malvaceae	Mallow family
Caprifoliaceae	Honeysuckle family, incl. elderberry
Geraniaceae	Geranium family, incl. filaree
Cruciferae	Mustard family, incl. wild radish
Portulacaceae	Purslane family
Ranunculaceae	Ranunculus family
Caryophyllaceae	Pink family, incl. chickweed
RUMEX	
Cyperaceae	Sedge family
TYPHA	Cattail
VITIS	Grape
Polygonaceae	Buckwheat family, incl. knotweed
ZEA	Corn, maize
CUCURBITA	Squash genus, incl. pumpkin

POLLEN OBSERVED

CASE LABEL	NO.	3 ABIES 12 BETULAC. 21 EPHEDRA 30 LILLIAC. 39 RANUN. 48 CERALIA	4 PINUS 13 ACER 22 CHNO-AM. 31 EUPHOR. 40 CARYOPH. 49 ZEA	5 JUNIP. 14 ULMUS 23 GRAMIN. 32 UMBEL. 41 RUMEX 50 UNKN.	6 QUERCUS 15 CARYA 24 AMBROS. 33 ONAGRAC. 42 UNK C 51 CUCURB.	7 LITHOCAR 16 EUCALYP. 25 TUBULIF. 34 MALVAC. 43 CYPERAC. 52 TOTAL	8 POPULUS 17 RHUS 26 LIGULIF. 35 CAPRIFO. 44 TYPHA	9 SALIX 18 RHAMNAC. 27 LEGUMIN. 36 GERANIA. 45 VITIS	10 ALNUS 19 ROSAC. 28 SOLANAC. 37 CRUCIF. 46 POLYGON.	11 JUGLANS 20 PITSPOR. 29 LABITAE 38 PORTUL. 47 ? CEREAL
Turnbull Canyon open scrub surface	1	0.000	4.0000	0.000	3.0000	0.000	0.000	0.000	1.000	1.000
		0.000	6.0000	1.000	1.000	0.000	0.000	2.0000	0.000	0.000
		1.000	3.0000	23.0000	16.0000	30.0000	0.000	1.000	1.000	4.0000
		0.000	0.000	0.000	0.000	0.000	1.000	1.000	8.0000	0.000
		0.000	0.000	0.000	91.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	200.0000				
Turnbull Canyon RHUS thicket surface	2	0.000	0.000	5.0000	4.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	127.0000	0.000	3.0000	0.000
		0.000	6.0000	25.0000	0.000	7.0000	0.000	2.0000	0.000	4.0000
		11.0000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	5.0000	0.000	200.0000				
Slusher Estate canopied surface	3	0.000	0.000	3.0000	4.0000	0.000	0.000	0.000	2.0000	0.000
		0.000	0.000	148.0000	0.000	2.0000	0.000	0.000	0.000	0.000
		0.000	7.0000	16.0000	9.0000	4.0000	0.000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	3.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	200.0000				
Slusher Estate disturbed surface	4	0.000	18.0000	7.0000	3.0000	0.000	0.000	7.0000	6.0000	0.000
		0.000	0.000	16.0000	0.000	8.0000	0.000	0.000	1.000	0.000
		0.000	31.0000	48.0000	25.0000	8.0000	5.0000	4.0000	0.000	0.000
		2.0000	3.0000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
		0.000	0.000	0.000	4.0000	0.000	0.000	0.000	1.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
Slusher within structure surface	5	0.000	1.000	3.0000	5.0000	0.000	0.000	3.0000	1.000	0.000
		0.000	0.000	41.0000	0.000	33.0000	3.0000	0.000	1.000	0.000
		2.0000	17.0000	15.0000	10.000	7.0000	2.0000	10.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.0000
		0.000	0.000	0.000	41.0000	0.000	0.000	0.000	1.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
Slusher Estate grassy area surface	6	0.000	14.0000	10.000	3.0000	0.000	0.000	3.0000	1.000	0.000
		0.000	0.000	40.0000	0.000	0.000	1.0000	4.0000	1.000	0.000
		1.000	23.0000	62.0000	7.0000	10.000	5.0000	2.0000	0.000	0.000
		2.0000	0.000	0.000	0.000	[illegible]	0.000	0.000	3.0000	0.000
		0.000	0.000	0.000	5.0000	0.000	0.000	0.000	1.000	0.000
		0.000	0.000	0.000	0.000	200.0000				
North of Estate disturbed surface	7	0.000	4.0000	1.000	0.000	0.000	0.000	3.0000	1.000	9.0000
		0.000	0.000	10.000	0.000	4.0000	0.000	0.000	0.000	0.000
		0.000	26.0000	35.0000	34.0000	22.0000	1.000	0.000	5.0000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.0000	0.000
		0.000	0.000	2.0000	36.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	3.0000	0.000	200.0000				
Narrows sedge swale	8	1.000	4.0000	5.0000	9.0000	0.000	0.000	0.000	3.0000	1.000
		1.000	0.000	3.0000	0.000	4.0000	5.0000	0.000	0.000	0.000

surface		0.000	14.0000	11.0000	3.0000	43.0000	0.000	0.000	2.0000	0.000
		0.000	1.000	2.0000	0.000	0.000	0.000	1.000	0.000	0.000
		2.0000	0.000	0.000	30.0000	2.0000	1.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
Narrows	9	0.000	9.0000	6.0000	13.0000	0.000	0.000	2.0000	13.0000	2.0000
ARUNDO-VITIS		0.000	1.000	20.0000	0.000	11.0000	6.0000	9.0000	1.000	0.000
surface		0.000	8.0000	21.0000	16.0000	10.000	0.000	8.0000	4.0000	0.000
		0.000	3.0000	1.000	0.000	1.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	31.0000	0.000	0.000	2.0000	0.000	0.000
		0.000	0.000	4.0000	0.000	202.0000				
Narrows	10	0.000	15.0000	18.0000	16.0000	0.000	0.000	1.000	14.0000	4.0000
VITIS-Blackberry		0.000	0.000	9.0000	0.000	2.0000	1.000	2.0000	6.0000	0.000
thicket		0.000	16.0000	21.0000	4.0000	26.0000	6.0000	1.000	2.0000	0.000
surface		0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000
		0.000	0.000	0.000	29.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	4.0000	0.000	200.0000				
Narrows	11	0.000	1.000	0.000	7.0000	0.000	0.000	0.000	2.0000	5.0000
BACCHARIS		0.000	0.000	4.0000	0.000	1.000	0.000	0.000	1.000	0.000
thicket		0.000	6.0000	12.0000	0.000	16.0000	0.000	0.000	3.0000	0.000
surface		0.000	0.000	12.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	124.0000	1.000	0.000	0.000	0.000	0.000
		0.000	1.000	4.0000	0.000	200.0000				
Narrows	12	0.000	0.000	0.000	9.0000	0.000	0.000	0.000	0.000	0.000
open area		0.000	0.000	0.000	0.000	1.000	3.0000	0.000	0.000	0.000
surface		0.000	56.0000	6.0000	2.0000	39.0000	0.000	1.000	0.000	0.000
		3.0000	2.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	77.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
Narrows	13	0.000	2.0000	0.000	4.0000	4.0000	0.000	0.000	1.000	72.0000
successional		0.000	0.000	5.0000	0.000	5.0000	0.000	0.000	0.000	0.000
woods		0.000	9.0000	3.0000	3.0000	8.0000	0.000	2.0000	6.0000	0.000
surface		1.000	0.000	7.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	9.0000	53.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	6.0000	0.000	200.0000				
sp.# 115	14	0.000	5.0000	0.000	5.0000	0.000	0.000	2.0000	1.000	0.000
		0.000	0.000	3.0000	0.000	0.000	1.000	0.000	0.000	0.000
		0.000	16.0000	34.0000	6.0000	14.0000	1.000	0.000	1.000	0.000
		0.000	1.000	0.000	0.000	0.000	0.000	3.0000	0.000	0.000
		0.000	0.000	0.000	6.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	2.0000	100.0000				
sp.# 55	15	0.000	9.0000	10.000	9.0000	0.000	0.000	0.000	0.000	1.000
		0.000	0.000	29.0000	0.000	4.0000	1.000	0.000	0.000	0.000
		0.000	32.0000	69.0000	6.0000	5.0000	1.000	5.0000	1.000	0.000
		1.000	0.000	0.000	1.000	0.000	0.000	3.0000	1.000	0.000
		0.000	0.000	0.000	13.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	200.0000				
sp.# 112	16	0.000	6.0000	0.000	6.0000	0.000	0.000	0.000	2.0000	1.000
		0.000	0.000	76.0000	0.000	8.0000	1.000	1.000	0.000	4.0000
		0.000	36.0000	17.0000	5.0000	12.0000	1.000	1.000	0.000	1.000
		0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	17.0000	0.000	0.000	1.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 49	17	0.000	9.0000	1.000	5.0000	0.000	0.000	0.000	2.0000	1.000
		0.000	0.000	70.0000	0.000	5.0000	0.000	0.000	0.000	0.000
		0.000	29.0000	50.0000	5.0000	5.0000	1.000	3.0000	2.0000	1.000

		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	4.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	201.0000				
sp.# 157	18	0.000	0.000	0.000	7.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	5.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	17.0000	74.0000	17.0000	34.0000	41.0000	1.000	0.000	1.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	200.0000				
sp.# 156	19	0.000	0.000	0.000	6.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	3.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	17.0000	70.0000	24.0000	35.0000	39.0000	1.000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	3.0000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	200.0000				
sp.# 145	20	0.000	1.000	0.000	7.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	5.0000	0.000	0.000	0.000	0.000	1.000	0.000
		0.000	16.0000	87.0000	20.0000	39.0000	9.0000	3.0000	1.000	1.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	8.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 150	21	0.000	0.000	20.0000	16.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	9.0000	0.000	0.000	0.000	1.000	1.000	0.000
		0.000	9.0000	76.0000	21.0000	28.0000	12.0000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	4.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 155	22	0.000	0.000	0.000	5.0000	0.000	0.000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	40.0000	77.0000	11.0000	31.0000	16.0000	0.000	0.000	0.000
		1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	16.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 146	23	0.000	1.000	0.000	6.0000	0.000	0.000	0.000	0.000	1.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	7.0000	36.0000	13.0000	26.0000	4.0000	2.0000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	1.000	0.000	4.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	101.0000				
sp.# 154	24	0.000	1.000	0.000	2.0000	0.000	14.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	13.0000	120.0000	4.0000	22.0000	8.0000	0.000	0.000	0.000
		1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	13.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 141	25	0.000	2.0000	7.0000	7.0000	0.000	0.000	0.000	3.0000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	14.0000	118.0000	5.0000	24.0000	1.000	0.000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	15.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	3.0000	0.000	200.0000				
sp.# 59	26	0.000	1.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	13.0000	42.0000	8.0000	24.0000	2.0000	1.000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

		0.000	0.000	0.000	5.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	100.0000				
sp.# 160	27	2.0000	2.0000	0.000	3.0000	0.000	0.000	2.0000	0.000	0.000
		0.000	0.000	9.0000	0.000	3.0000	0.000	0.000	1.000	0.000
		0.000	71.0000	40.0000	12.0000	4.0000	1.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	48.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 161	28	0.000	0.000	0.000	4.0000	0.000	2.0000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	49.0000	57.0000	17.0000	32.0000	10.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	26.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	200.0000				
sp.# 162	29	0.000	1.000	0.000	3.0000	0.000	3.0000	0.000	1.000	0.000
		0.000	0.000	4.0000	0.000	0.000	0.000	2.0000	0.000	0.000
		0.000	42.0000	42.0000	16.0000	28.0000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	52.0000	0.000	0.000	0.000	0.000	4.0000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 163	30	0.000	2.0000	0.000	3.0000	0.000	6.0000	0.000	0.000	1.000
		0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	17.0000	49.0000	14.0000	37.0000	6.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	57.0000	0.000	0.000	0.000	0.000	0.000
		0.000	4.0000	1.000	0.000	200.0000				
sp.# 164	31	0.000	0.000	0.000	5.0000	0.000	5.0000	0.000	0.000	2.0000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	38.0000	53.0000	17.0000	54.0000	6.0000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	18.0000	0.000	0.000	0.000	0.000	3.0000
		0.000	3.0000	2.0000	0.000	200.0000				
sp.# 165	32	0.000	0.000	0.000	5.0000	0.000	0.000	1.000	0.000	1.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	21.0000	41.0000	23.0000	62.0000	19.0000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	23.0000	0.000	0.000	0.000	0.000	0.000
		0.000	1.000	2.0000	0.000	200.0000				
sp.# 111	33	0.000	0.000	0.000	0.000	0.000	4.0000	0.000	0.000	2.0000
		0.000	0.000	0.000	0.000	0.000	0.000	2.0000	0.000	0.000
		0.000	38.0000	41.0000	18.0000	40.0000	12.0000	0.000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	38.0000	0.000	0.000	0.000	0.000	2.0000
		0.000	1.000	1.000	0.000	200.0000				
sp.# 135	34	0.000	0.000	0.000	5.0000	0.000	3.0000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000
		0.000	34.0000	37.0000	19.0000	45.0000	3.0000	1.000	2.0000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	46.0000	0.000	0.000	0.000	0.000	1.000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 166	35	0.000	2.0000	0.000	5.0000	0.000	1.000	0.000	1.000	0.000
		0.000	0.000	4.0000	0.000	[illegible]	0.000	0.000	0.000	0.000
		0.000	43.0000	39.0000	21.0000	37.0000	3.0000	2.0000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	4.0000	0.000	0.000

		0.000	0.000	0.000	26.0000	0.000	0.000	0.000	0.000	8.0000
		0.000	0.000	2.0000	0.000	200.0000				
sp.# 138	36	0.000	0.000	0.000	3.0000	0.000	2.0000	0.000	0.000	1.000
		0.000	0.000	2.0000	0.000	0.000	0.000	0.000	1.000	0.000
		0.000	18.0000	44.0000	25.0000	46.0000	5.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	1.000	0.000	9.0000	0.000	0.000
		0.000	0.000	0.000	37.0000	0.000	0.000	0.000	0.000	1.000
		0.000	1.000	4.0000	0.000	200.0000				
sp.# 142	37	0.000	0.000	0.000	4.0000	0.000	2.0000	0.000	0.000	0.000
		0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	27.0000	36.0000	3[illegible].0000	44.0000	6.0000	2.0000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	3.0000	0.000	0.000
		0.000	0.000	0.000	41.0000	0.000	0.000	0.000	0.000	1.000
		0.000	1.000	1.000	0.000	200.0000				
sp.# 144	38	0.000	0.000	0.000	2.0000	0.000	2.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	36.0000	31.0000	25.0000	57.0000	2.0000	0.000	0.000	0.000
		0.000	0.000	0.000	1.000	0.000	0.000	4.0000	0.000	0.000
		0.000	0.000	0.000	34.0000	0.000	0.000	0.000	0.000	4.0000
		1.000	0.000	1.000	0.000	200.0000				
sp.# 80	39	0.000	0.000	0.000	2.0000	0.000	3.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	29.0000	58.0000	32.0000	49.0000	7.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	15.0000	0.000	0.000	0.000	0.000	5.0000
		0.000	0.000	0.000	0.000	200.0000				
sp.# 107	40	0.000	0.000	0.000	4.0000	0.000	2.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	47.0000	37.0000	15.0000	57.0000	11.0000	1.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	19.0000	0.000	0.000	0.000	0.000	3.0000
		3.0000	0.000	1.000	0.000	200.0000				
sp.# 167	41	0.000	0.000	0.000	7.0000	0.000	4.0000	2.0000	0.000	1.000
		0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	13.0000	41.0000	24.0000	70.0000	4.0000	2.0000	0.000	0.000
		0.000	0.000	0.000	0.000	1.000	0.000	4.0000	0.000	0.000
		0.000	0.000	0.000	11.0000	0.000	0.000	0.000	0.000	6.0000
		0.000	2.0000	1.000	1.000	200.0000				
sp.# 122	42	0.000	0.000	0.000	1.000	0.000	2.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
		0.000	6.0000	26.0000	19.0000	32.0000	[illegible]	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	3.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	1.000	0.000	100.0000				
sp.# 121	43	0.000	0.000	0.000	6.0000	0.000	4.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	22.0000	49.0000	18.0000	79.0000	15.0000	2.0000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
		0.000	0.000	0.000	3.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	200.0000				
no sp.#	44	0.000	0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	12.0000	35.0000	17.0000	24.0000	3.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.0000

		0.000	0.000	0.000	0.000	100.0000				
sp.# 136	45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		0.000	15.0000	80.0000	42.0000	46.0000	14.0000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	3.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	2.0000	0.000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	0.000	200.0000				
sp.# 147	46	0.000	3.0000	1.000	3.0000	0.000	0.000	1.000	1.000	2.0000
		0.000	0.000	61.0000	0.000	4.0000	3.0000	0.000	0.000	0.000
		0.000	24.0000	52.0000	16.0000	9.0000	1.000	0.000	2.0000	1.000
		0.000	0.000	0.000	0.000	2.0000	0.000	0.000	0.000	0.000
		0.000	0.000	0.000	11.0000	0.000	0.000	0.000	0.000	0.000
		2.0000	1.000	0.000	0.000	200.0000				
sp.# 149	47	0.000	4.0000	0.000	2.0000	0.000	0.000	0.000	1.000	0.000
		0.000	0.000	71.0000	0.000	7.0000	0.000	0.000	0.000	0.000
		0.000	26.0000	45.0000	7.0000	14.0000	2.0000	0.000	0.000	2.0000
		0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
		0.000	1.000	0.000	12.0000	0.000	0.000	0.000	0.000	3.0000
		0.000	0.000	1.000	0.000	200.0000				

NUMBER OF CASES READ. 47

VARIABLE NO.	NAME	MEAN	STANDARD DEVIATION	ST.ERR. OF MEAN	COEFF. OF VARIATION	SMALLEST VALUE	SMALLEST Z-SCORE	LARGEST VALUE	LARGEST Z-SCORE	RANGE	TOTAL FREQUENCY
3	ABIES	0.064	0.323	0.0472	5.06530	0.0	-0.20	2.000	5.99	2.000	47
4	PINUS	2.574	4.267	0.6224	1.65738	0.0	-0.60	13.000	3.62	13.000	47
5	JUNIP.	2.064	4.493	0.6554	2.17726	0.0	-0.46	20.000	3.99	20.000	47
6	QUERCUS	4.894	3.447	0.5029	0.70432	0.0	-1.42	16.000	3.22	16.000	47
7	LITHOCAR	0.085	0.583	0.0851	6.85569	0.0	-0.15	4.000	6.71	4.000	47
8	POPULUS	1.255	2.480	0.3618	1.97566	0.0	-0.51	14.000	5.14	14.000	47
9	SALIX	0.596	1.313	0.1915	2.20420	0.0	-0.45	7.000	4.88	7.000	47
10	ALNUS	1.362	3.075	0.4485	2.25793	0.0	-0.44	14.000	4.11	14.000	47
11	JUGLANS	2.298	10.513	1.5334	4.57498	0.0	-0.22	72.000	6.63	72.000	47
12	BETULAC.	0.021	0.146	0.0213	6.85568	0.0	-0.15	1.000	6.71	1.000	47
13	ACER	0.149	0.884	0.1290	5.93629	0.0	-0.17	6.000	6.62	6.000	47
14	ULMUS	13.957	28.543	4.1634	2.04500	0.0	-0.49	143.000	4.70	148.000	47
15	CARYA	0.021	0.146	0.0213	6.85568	0.0	-0.15	1.000	6.71	1.000	47
16	EUCALYP.	2.234	5.296	0.7726	2.37081	0.0	-0.42	33.000	5.81	33.000	47
17	RHUS	3.277	18.489	2.6969	5.64286	0.0	-0.18	127.000	6.69	127.000	47
18	RHAMNAC.	0.489	1.503	0.2191	3.06[illegible]84	0.0	-0.33	9.000	5.67	9.000	47
19	ROSAC.	0.404	1.014	0.1479	2.5[illegible]89[illegible]	0.0	-0.40	6.000	5.52	6.000	47
20	PITSPOR.	0.085	0.583	0.0851	6.85569	0.0	-0.15	4.000	6.71	4.000	47
21	EPHEDRA	0.085	0.351	0.0512	4.12148	0.0	-0.24	2.000	5.46	2.000	47
22	CHNO-AM.	23.532	14.711	2.1459	0.62518	3.000	-1.40	71.000	3.23	68.000	47
23	GRAMIN.	44.702	25.595	3.7334	0.57256	3.000	-1.63	120.000	2.94	117.000	47
24	AMBROS.	14.979	9.520	1.3886	0.63557	0.0	-1.57	42.000	2.84	42.000	47
25	TUBULIF.	29.681	18.711	2.7292	0.63040	4.000	-1.37	79.000	2.64	75.000	47
26	LIGULIF.	6.255	8.706	1.2700	1.39186	0.0	-0.72	41.000	3.99	41.000	47
27	LEGUMIN.	1.319	2.012	0.2935	1.52523	0.0	-0.66	10.000	4.31	10.000	47
28	SOLANAC.	0.787	1.366	0.1993	1.73559	0.0	-0.58	6.000	3.82	6.000	47
29	LABITAE	0.319	0.887	0.1294	2.78008	0.0	-0.36	4.000	4.15	4.000	47
30	LILLIAC.	0.468	1.692	0.2468	3.61499	0.0	-0.28	11.000	6.22	11.000	47
31	EUPHOR.	0.255	0.706	0.1030	2.76565	0.0	-0.36	3.000	3.89	3.000	47

32	UMBEL.	0.463	2.020	0.2946	4.31551	0.0	-0.23	12.000	5.71	12.000	47
33	ONAGRAC.	0.064	0.247	0.0360	3.37112	0.0	-0.26	1.000	3.79	1.000	47
34	MALVAC.	0.213	0.463	0.0676	2.17736	0.0	-0.40	2.000	3.86	2.000	47
35	CAPRIFO.	0.043	0.204	0.0298	4.79469	0.0	-0.21	1.000	4.69	1.000	47
36	GERANIA.	0.681	1.695	0.2473	2.49004	0.0	-0.40	9.000	4.91	9.000	47
37	CRUCIF.	0.362	1.358	0.1981	3.75491	0.0	-0.27	8.000	5.62	8.000	47
38	PORTUL.	0.085	0.351	0.0512	4.12143	0.0	-0.24	2.000	5.46	2.000	47
39	RANUN.	0.043	0.292	0.0426	6.85567	0.0	-0.15	2.000	6.71	2.000	47
40	CARYOPH.	0.043	0.204	0.0298	4.79470	0.0	-0.31	1.000	4.69	1.000	47
41	RUMEX	0.234	1.339	0.1953	5.71949	0.0	-0.17	9.000	6.55	9.000	47
42	UNK C	25.596	26.921	3.9269	1.05180	0.0	-0.95	124.000	3.66	124.000	47
43	CYPERAC.	0.128	0.536	0.0782	4.20161	0.0	-0.24	3.000	5.36	3.000	47
44	TYPHA	0.021	0.146	0.0213	6.85569	0.0	-0.15	1.000	6.71	1.000	47
45	VITIS	0.064	0.323	0.0472	5.06531	0.0	-0.28	2.000	5.99	2.000	47
46	POLYGON.	0.064	0.247	0.0360	3.87113	0.0	-0.26	1.000	3.79	1.000	47
47	? CEREAL	0.957	1.888	0.2753	1.97159	0.0	-0.51	8.000	3.73	8.000	47
48	CERALIA	0.128	0.536	0.0782	4.20160	0.0	-0.24	3.000	5.36	3.000	47
49	ZEA	0.319	0.810	0.1182	2.53935	0.0	-0.39	4.000	4.54	4.000	47
50	UNKN.	1.660	1.387	0.2024	0.83604	0.0	-1.20	6.000	3.13	6.000	47
51	CUCURB.	0.064	0.323	0.0472	5.06529	0.0	-0.20	2.000	5.99	2.000	47
52	TOTAL	189.447	31.128	4.5405	0.16431	100.000	-2.87	202.000	0.40	102.000	47

BMDP1D - SIMPLE DATA DESCRIPTION
HEALTH SCIENCES COMPUTING FACILITY
UNIVERSITY OF CALIFORNIA, LOS ANGELES
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PROGRAM REVISED NOVEMBER, 1978
MANUAL DATE -- 1977

PROGRAM CONTROL INFORMATION

NO MORE CONTROL LANGUAGE. PROGRAM TERMINATED.