The use of ethnographic information as a means to aid interpretation of archaeological remains has long been used by archaeologists, albeit in an unsystematic manner. Ethnography has now been perceived as a methodology that can link human behavior and its material by-products, thus providing a possible model for those prehistoric behaviors which produced the remains that are excavated by archaeologists. Within the discipline of paleoethnobotany, researchers have also turned to ethnographic analogy as a source of information. When this information is used to aid in the interpretation of ethnobotanical samples taken from archaeological deposits, the problem becomes, as Hillman states, how to relate "sample composition to human activities without resort to an excess of untestable intuition" (1976: 24). Unfortunately much ethnographic information has been used in an intuitive sort of way, and attempts to systematize the links between ethnographic information and the archaeological remains have been made only in recent years (Hillman 1973, 1981; Hally 1981; Pearsall 1985). One way to use ethnographic data is to "compile a listing of seeds' uses as foods, or seeds which would be the waste product of use of a plant as food" (Pearsall, 1985: 6). This system of listing provides possible explanations for the presence of certain taxa in the paleobotanical samples and the economic activities that they represent. Popper favors this approach for understanding the use of a given plant (1985). However, there is another link between ethnographic and

paleobotanical data, and this can be provided by attempting to compare similar spatial contexts from the past and present. To do this, soil samples can be taken from modern households and compared via contextual information with soil samples taken from archaeological sites. This idea is expressed clearly by Hally who says, "the investigation of plant utilization in the past requires that the researcher work with and integrate paleobotanical, ethnographic, and contextual data. Failure to do this almost insures that the lack of congruence between actual plant utilization and paleobotanical samples will continue to go unnoticed and unconsidered" (1981: 740).

To explore this valuable contextual link between ethnographic and archaeological data it may be helpful to examine samples from modern households. This was in part the purpose of sorting and analyzing the soil samples as a laboratory project. The other main objective was to experience laboratory procedure, and to learn necessary techniques to use in a following project based on soil samples taken from modern households. Therefore this first project is something of a preliminary training project.

The starting point of the project is a series of ethnobotanical samples that were collected as soil samples in the Jauja area of Peru by Christine Hastorf, and were consequently floated using the same procedure as for archaeological samples. There are approximately 25 of these modern ethnobotanical samples in the Paleoethnobotany Laboratory at the University of Minnesota. I had originally intended to sort and analyze a certain percentage of these

samples as a project--perhaps 50%--in order to gain some experience in sorting modern samples, as well as a means to make some observations about the relationship between the household contexts of the activities represented by these samples as evidenced by the kind of botanical information they contain.

I began the sorting procedure with a sample from "Victor's Patio"--sample #380--which I selected from the samples as a "trial run". Sorting modern samples proceeds in a very different way from the sorting of archaeological samples processed in the University of Minnesota Ethnobotany Laboratory. Generally, in sorting the archaeological flotation samples, only charred remains are withdrawn for analysis, and never are uncharred seeds considered to represent part of the archaeological record in this particular group of samples. Because I was interested in the entire composition of the sample, that is the amount of wood, chaff, fibers, etc. and seeds contained in each sample, I began by trying to separate the sample into as many component parts as were recognizable. Like archaeological samples, the modern samples were first sieved through geological screens into three size fractions: >2.0 mm., <2.0 mm., and <500 um. The process of sorting each of the fractions fully into its component parts (i.e. removing each piece of chaff to a chaff vial, etc. for the entire sample) proved to be difficult and very time-consuming. After sorting sample #380 (Victor's Patio) using this "whole sample" approach, I began to realize that each sample was going to involve quite a bit of time just in the sorting

stage. At this point I determined that I would do fewer samples than I had originally intended to do. I decided to select all of the samples collected at the Moya household in order to have samples from various activity areas within one household setting. There are seven samples from the Moya household:

Sample #	Location	Date sample taken
65	Below Moya's hearth	Sept. 9, 1979
66	Moya's hearth	Sept. 9, 1979
98	Moya's corral	Sept. 15, 1979
99	Moya's doorway	Sept. 15, 1979
823	Moya's hearth	June 1980
368	Moya's hearth	October 1982
375	Moya's patio	Sept. 10, 1979

I further narrowed down my project by eliminating sample #823 and #368 which are both hearth samples as #65 is--in this way I would only sort one hearth sample. As I proceeded in the sorting of these five samples (#65, 66, 98, 99, and 375) I used a method of sample splitting in order to arrive at manageable amounts of material to sort. I will now briefly describe the procedure of splitting and sorting followed for each sample. Because I was trying to test different methods for future sorting, the procedures followed sometimes represent experiments and therefore are not entirely standardized.

Sample #65 (below Moya's hearth) was the first sample sorted which I also intended to analyze. (The first "trial run" sample was not included in analysis.) At this point I had not decided how to split the samples to be effective with my time, so the entire >2.0 portion of the sample was

sorted, that is I did not split it before sorting. I had difficulty in establishing categories for the component parts since I could not easily distinguish between different classes of plant parts, so categories such as "chaff" and "twigs" tended to be inclusive and may actually include a wide range of material. This was also the case in later samples as well. "Twigs" were identified on the basis of relative woodiness and rigidity. It is hard to know how one would go about sorting the chaff category into smaller units but this would undoubtedly entail alot of laboratory work and a large comparative collection of dried and fragmented plant parts. I realized as I was sorting that this chaff category was probably too general to be useful. There was alot of wood in sample #65 and 98 percent was charred--a percentage which might be expected in a sample from under the hearth. These categories will be analyzed further below. The <2.0 fraction of sample #65 was split and resplit so that in the end 1/4 of the portion was actually sorted. After splitting, however, I followed the same procedure in this <2.0 portion as I had for the >2.0 portion--also sorting the <2.0 fraction completely into component parts. This proved to be very time-consuming and it was at this point, after consulting with Dr. Hastorf, that I decided to only remove seeds from the <2.0 fraction. Since I would continue to sort the >2.0 fraction into component parts I would have a record of this, making it not as necessary for the <2.0. The entire <500 um. was sorted in this first sample and the very small seeds in it were removed for identification.

For sample #66, Moya's hearth, I used the new technique for sorting. I split and resplit the >2.0 portion and ended up sorting 1/4 of it. I did not split the <2.0 fraction this time but I only sorted through it to find the seeds. The <500 um. portion was split and resplit and 1/4 of the portion was then sorted for seeds.

Sample #98 was taken from Moya's corral and represents the sample with which I began a standard method for sorting the samples. Both the >2.0 and the <2.0 portions were split and resplit to yield a portion 1/4 of its original size, but only seeds were withdrawn from the <2.0 while the >2.0 portion was fully sorted into its component parts (wood, leaves, seeds, dung, etc.). Depending on the amount of material in the <500 um. fraction, it was either split or sorted in its entirety in an attempt to find the very small seeds that fall below the 500 um. screen. In this particular sample, the <500 um. fraction was not split.

Sample #99, Moya's doorway, was a larger sample than the others. For this reason I split, resplit, and resplit the sample again so that in the end I sorted only 1/8 of both the >2.0 fraction and the <2.0 fraction. As before I completely sorted 1/8 of the >2.0 portion into component parts, while I only sorted seeds from the arrived-at 1/8 of the <2.0 portion. The <500 um. fraction was split and resplit and I sorted 1/4 of the fraction for seeds.

Although sample #375 was not a particularly large sample, I decided to try to split it as many times as I had split sample #99. This resulted in 1/8 of the >2.0 and <2.0 fractions being sorted just like I had in the last sample.

Since the quantity of (500 um. material was very small (2.8 gr.), I sorted the entire fraction for seeds. However, none were found.

After completing the sorting I weighed all the material I had sorted (see Table I/ below). The original total flot size was noted as well so that in the end I could calculate the density of seeds by using the total flot size to standardize. The Table which follows presents this data so that the categories I use can be examined, along with information on weight to get a rough approximation of the amount of sorted material versus total wieght of sample. I was not able to assign weights to infrequently encountered and/or light objects (such as feathers or paper). It should be noted that in this experimental project my sorting technique changed slightly so each category cannot be considered exactly comparable to the same category in the next sample. Also, not all categories are represented in each sample. However, the notes and Tables can be easily referred to in order to see whether a given item was present in the sample.

Table I. List of component parts of the)2.0 portions with weights.

Sample #65 BELOW HEARTH	Weight(gr.)	Charred?
wood	5.1	~x
dung	2.6	x 90%
cuy dung	2.3	x 60%
chaff	.5	x (5%
eucalyptus nut	.8	–
twigs/reeds	–	–
paper	–	–
feathers	–	–
seeds	.1	(Table II)

remains	4.8	—
total wt. of sorted material	16.2	

total wt. of original sample = 870 grams

Sample #66 HEARTH

wood	3.5	x 99%
dung	1.8	x 5%
cuy dung	2.2	x 40%
chaff	1.3	x 2%
leaves	—	x 5%
eucalyptus nut	1.7	x
twigs	1.7	—
feather	—	—
bark	—	—
seeds	—	(Table II)
remains	3.7	—
total wt. of sorted material	15.9	

total wt. of original sample = 1,000 grams

Sample #98 CORRAL

wood	.6	x 2%
dung	2.0	—
chaff	.6	—
seed chaff	.2	—
styrofoam	—	—
leaves	—	—
seeds	—	(Table II)
remains	2.7	—
total wt. of sorted material	6.1	

total wt. of original sample = 900 grams

Sample #99 DOORWAY

wood	3.6	x 10%
dung	.4	—
chaff	.9	x (5%
seed chaff	.1	—
leaves	—	x 50%
styrofoam	—	—
cloth	—	—
paper	—	—
seeds	.5	(Table II)
total wt. of sorted material	5.5	

total wt. of original sample = 900 grams

Sample #375 PATIO

wood	.7	x
dung	.7	–
chaff	.1	–
seed chaff	–	–
leaves	–	–
seeds	–	–
remains	.9	–
total wt. of sorted material	2.4	

total wt. of original sample = 300 grams

There are certain problems in comparing across samples for some of these categories. First of all, the "remains" of these samples, the material which could not be identified or assigned to a category, represent a fairly large part of the fraction. This is due to the method I used and to the fact that I was not able to identify all of the possible categories. Remains, then, do not necessarily represent the same kind of material from sample to sample. The categories of chaff and twigs changed conceptually from the first sample so that I do not feel sure of their comparablilty from sample to sample. From sample #98 on I sorted out what I considered to be "seed chaff" thereby splitting the category for this sample and the following two samples.

Table II presents the data on the identificaton of seeds from both the >2.0 and the <2.0 fractions. These are presented in the "raw data" form so that taxa and counts can be examined. These absolute counts are not presented as a way to analyze or interpret the data because as stated by many researchers, including Popper (1985), this is not an adequate measurement of the data.

Table II. Absolute counts of seeds by sample

Taxa	charred?
2 maize cupules	x
1 maize embryo	–
3 *Medicago* seeds w/ seed coat frags.	x 2 (+ frags. 50%)
1 domesticated Fabaceae (pea?, bean?)	x
1 wheat or barley	x
1 lg. Poaceae	x
1 *Capsicum*	–
23 Fabaceae (wild)	x
2 *Malvastrum*	x
1 *Amaranthus*	–
6 Cyperaceae	x
1 Lamiaceae	x
2 Asteraceae	–
5 Poaceae	x 3
2 *Chenopodium/Amaranthus*	–
8 unidentified	x 7
4 sm. Poaceae	x 2
1 *Portulaca* (*pilosa*?)	x
2 unid.--round	x 1

67 total

Sample #66

1 *Medicago* w/ seed coat frags.	x frags. 30%
1 *Rumex*	–
1 wheat	x
30 unid.	x 9
8 *Verbena*	x 1
4 lg. Poaceae	x
24 Cyperaceae	x 8
24 unid. (Brassicaceae?)	x 5
42 Fabaceae (wild)	x
1 Polygonaceae	–
3 Asteraceae	x 1
5 Fabaceae	–
2 *Vaccinium*	–
12 Lamiaceae	–
3 *Malvastrum*	–
3 *Chenopodium*	–
1 *Rubus*	–
27 *Cheno./Amaranthus*	–
1 Oxalidaceae	x
22 *Amaranthus*	–

214 total

Sample #98

4 Medicago	—
29 Cyperaceae	—
1 Rumex	—
2 Tagetes	—
2 Asteraceae	—
9 unid.	x 2
9 unid. (Poaceae?)	—
11 Amaranthus	—
8 Malvastrum	—
2 Cyperaceae or Polygonaceae	—
1 Brassicaceae	—
2 Lamiaceae	—
3 Verbena	—
1 Oxalidaceae	—

84 total

Sample #99

1 talwi	x
2 wheat	—
4 maize kernels frags.	x
13 Capsicum	—
1 Medicago seed + frags.	x + 50% frags.
8 Rumex	—
14 unid.	x 7
4 Cyperaceae	—
2 Poaceae	x 1
1 Verbena	—
8 Cheno./Amaranthus	—
19 lg. Amaranthus	—
5 Chenopodium (quinoa?)	x
10 Amaranthus w/ seed coats	—
19 Fabaceae (wild)	x
1 Vaccinium	—
1 Cyperaceae or Polygonaceae	—
3 Asteraceae	—

116 total

Sample #375

1 Medicago	—
8 Cyperaceae	x
1 sm. Cheno./Amaranthus	—
4 Vaccinium	—
6 Amaranthus	—
1 unid.	—

21 total

Since these samples are from modern contexts, they were sorted with a different strategy than paleobotanical samples--I removed the uncharred material (wood, seeds, etc.), as well as the charred material that the sample contained and this will be used as a basis for analysis. Whereas in archaeological contexts uncharred botanical material is usually considered to be of modern origin and to represent "contamination", the uncharred material in my modern samples is considered to be that which represents the activities which took place in the household, and is therefore valid for analysis. Unfortunately it may also represent some "contamination" which cannot be controlled for in the same way it is in archaeological samples. At the same time, I expect that a wider spectrum of material (representing activities) will be available in the ethnographic samples since the material did not have to 1) be charred through some process or accident (as archaeological material does) or 2) be preserved over a long period of time. Miksicek states that in archaeological contexts, "with few exceptions, unless a plant part has been carbonized it will just not be preserved in an open-air site" (1985: 671). However, charring of these remains, except in the case of wood which often reflects its function as fuel, only results from accidents (Pearsall, 1983: 122). It has been stated that there are varying probabilities of plant remains being deposited and preserved in the archaeological record, and the interpretation of these remains must include an understanding of the processes that

led to their preservation (Minnis 1985, Pearsall 1985). Because of the factors of charring, deposition and preservation, archaeological samples may reflect only a small portion of the original material resulting from a given activity. The analysis of modern samples provides a look at this "original material" and should therefore provide a fuller picture of the deposition of plant remains in households. It may eventually be possible to understand what percentage of this deposition charred material represents, thereby making possible a way to extrapolate into the past to gain a fuller perspective on a given archaeological sample. My expectations are that the samples will give a more complete picture of the household activities than what can be expected of many archaeological samples. The drawback of this project is that with such a small sample population I will only be able to suggest possible interpretations of the data instead of giving a firm analysis/interpretation.

Many methods and measurements have been suggested and tested in the recent paleobotanical literature as means to quantify and analyze the raw data gained by sorting samples. I will now review some of these methods and discuss the possibility of using them to analyze my flotation data from modern households. One method that is considered to generally be good both because of ease of application and results is called ubiquity or presence/absence analysis (Popper 1985, Hastorf 1981). This measurement is based on how often a given taxa appears in a group of samples. The frequency of a taxa is then calculated as the number of

samples in which a taxa is present, expressed as a percentage of the total number of samples in a group (Popper 1985). This measurement avoids various problems associated with calculating counts or percentages of taxa within a sample--each taxon is considered independently instead (Miksicek, 1985: 679). Also, because a sample is counted equally if 1 or 100 individuals of the taxon are present, it avoids the problem of differential preservation (Hastorf 1981). This measurement can be applied to the flotation samples from my project although it is also true that for five samples, the distribution of various taxa will often be 1.00. With a greater number of samples the distribution would be more variable.

It may be useful to compare the presence analysis measurement in my samples with a different method that is based on taxa being somewhat dependent on each other. One such method is called seed occurrence by Pearsall. She uses it for each context by tabulating total seed count and then expressing individual seed occurrence as a percentage of that total (1985:15). This is basically the same measurement as Miksicek's relative abundance in which the number of individuals of one taxon is divided by the total number of individuals of all taxa. He notes that this is not an independent measure (1985: 679). This particular kind of calculation may necessitate standardizing the volume of the samples so that small portions are not compared to large ones in which a wider array appear because of sample size. Seed occurrence as used by Pearsall is a type of percentage, which Miller defines as a "proportion times 100" (1985: 6).

Miller then cites Minnis' study of flood plain woods as an example of an adequate use of percentages (Ibid.). For seed taxa however, Pearsall finds that there is a "lack of direct correlation between raw seed counts or percentages and dietary importance of the plant..." (1983: 121) and in this way does not favor it as an integral part of interpretation.

Miksicek also uses something called a seed concentration index. This was first used by Bohrer and called the SCI, a measurement which expresses the number of seeds per unit-volume of charcoal recovered. It is most useful in comparing the abundance of a single taxon in various contexts (Miksicek 1985: 679). Since I have only small amounts of charcoal I will not attempt to calculate this. Miksicek's SCI is a measurement that is based on the number of seeds per gram of material recovered by flotation. This can be easily used not only for archaeological botanical samples but also with the material I have from modern households and can therefore serve as a method to approach a density measure on a taxon basis. However, Miksicek does find that the measurement is more reliable for rare taxa and more variable for common taxa (1985: 685).

The use of ratios constitutes another measurement that has been used successfully by some researchers. In particular Miller (1985) has explored them as a means of interpretation. One type of ratio is defined by her as density measures, percentages and porportions--measurements in which the material represented by the numerator is included within the denominator. Some of these are described above although they are not normally called "ratio"

measurements by the researchers using them. A second kind of ratio are the comparison ratios in which the "numerator and denominator are composed of mutually exclusive terms" (1985: 4). This kind of ratio is often used in interpretation with charcoal serving as the denominator in an effort to control for preservation (e.g. Pearsall 1983). Another example of a comparison ratio cited by Miller is nutshell and charcoal--the items being compared "are assumed to be functionally equivalent so that changes in relative amounts recovered actually represent replacement of one type by another" (1985: 7). This kind of example may not be very useful when interpreting samples that do not have as long of a time span as paleoethnobotanical samples do, although other kinds of ratios may have a better potential in an interpretive sense.

Recently there has been an interest in trying to interpret the material from flotation samples in such a way as to understand crop-processing and finer points in the utilization of plant resources (Dennell 1976, Hillman 1973, 1981). This approach proposes to "document how the form of a plant or the composition of an assemblage of plants changes depending on how man uses, processes, stores, and prepares the plants. This change affects not only the plant or plant part used by man but also its by-products" (Popper, 1985: 2). Dennell uses "composition types" to refer to different kinds of samples that represent anything from a contaminated single crop to a mixture of several crops and processing stages (Hubbard, 1976: 263). The use of these types is questionable in Hubbard's opinion because the classification of compostions of seed-samples can be difficult to

determine. However, the classification of crop-processing contexts is for him a valuable contribution (Hubbard, 1976: 262). Hubbard states also that "simple statistical parameters are probably too crude ever to yield unambiguous evidence concerning the existence or nature of prehistoric crop-processing technologies" (1976: 263). Despite this some investigators continue to explore the "composition" of the samples for clues about the crop-processing activities that gave it its particular make-up. What is meant by the word "composition" as used by these researchers? Hillman uses it in two ways: 1) sample composition which is defined in terms of the frequencies--per unit kilogram of grain--of each of the weed seed contaminants, and also in terms of the frequency distribution of grain size of the crop itself, and 2) species composition which refers to the breakdown of taxa identified within one sample. When I use the word "composition" I will be referring to this second definition given by Hillman (1973).

Along with these measurements and methods of quantifying the botanical data should be mentioned two more that Miksicek discusses in his paper. One of these is called the species diversity index (SDI). To compute it he uses the Shannon-Weiner Diversity Index which provides a number in a range from 0 to 3.5. He claims that this measurement "should be useful for distinguishing trash fill which should have a high diversity index from a single function feature which should have a low diversity" (1985: 680). It may be interesting to use this kind of measurement on samples taken from areas of known use. One other measurement is called

Importance Value (IV) by Miksicek and he describes it as a quantitative ranking of plant remains actually recovered from a site. It averages 2 or more independent measures of abundance to give a new value (1985: 679).

Interpretation of the botanical data from the modern households

The data presented in Table I and Table II can be analyzed using some of the methods discussed in the previous section of this paper. This analysis is a way to compare one sample to another without including many of the biases and distortions of simply reading the raw data in an absolute count form.

The first method discussed above is ubiquity or presence/absence analysis. This should prove to be a useful way to get a general picture of the occurrence of taxa when all the samples are included. I used this method first with the "non-seed" component parts of the sample from the >2.0 portions to find out what kinds of distribution I would get. I would expect to get a high number (1.00 or close to it) for many of the categories since I noticed as I was sorting that many of these seemed to be present in most samples. Also, from observatons of household activities I know that some activities take place across wide areas (such as animals walking around many different areas of the house). Following is the presence/absence distribution of non-seed taxa.

Table III. Ubiquity distribution for non-seed taxa.

Category	Value	Comments
wood	1.00	

dung	1.00	
cuy dung	.40	sample #65, 66
twigs	.40	65, 66
reeds	.40	65, 66
chaff	1.00	
seed chaff	.60	
leaves	.60	66, 98, 99
burned clay	.40	65, 66
eucalyptus nut	.40	65, 66
cupressaceae frag.	.20	not valid category
bark	.20	66
feather	.40	65, 66
plant tendril	.20	not valid category
styrofoam frag.	.40	98, 99
ceramics	.20	65
paper	.40	65, 99
pine needle	.20	65
cloth	.20	99

In this breakdown there is, of course, no indication of amounts of taxa within any given sample or overall. Although this is in part the purpose of calculating ubiquity, it may be more helpful to look at some kind of quantity measurement for a taxa such as wood because some samples had very little and others had more. The ubiquity distribution can give no indication of this. More interesting than the distribution numbers here is the demonstration of similarity in sample composition. For instance, it is apparent that sample #65 and 66 are very similar in regards to taxa present. Next I list the seed taxa data using the presence/absence analysis.

Table IV. Ubiquity distribution for seed taxa.

category	value	comments
maize kernels	.20	sample #99
maize cupules	.20	65
maize embryo	.20	65
total maize	.40	
Medicago	1.00	
domesticated Fabaceae--		
pea?, bean?	.20	65
wheat or barley	.20	65
large Poaceae	.40	65, 66
Capsicum	.40	65, 99
Fabaceae (wild)	.60	65, 66, 98

Malvastrum	.60	65, 66, 98
Amaranthus	1.00	
Cyperaceae	.80	65, 66, 98, 99
Lamiaceae	.60	65, 66, 98
Asteraceae	.80	65, 66, 98, 99
sm. Poaceae	.40	65, 99
Chero./Amaranthus	.80	65, 66, 98, 99
Portulaca	.20	65
Rumex	.60	66, 98, 99
wheat	.40	66, 99
Verbena	.60	66, 98, 99
Brassicaceae	.40	66, 98
Polygonaceae	.20	66
Vaccinium	.60	66, 99, 375
Chenopodium	.40	66, 99
Rubus	.20	66
Oxalidaceae	.40	66, 98
Tagetes	.20	98
Cyper. or Polyg.	.40	98, 99
"talwi"	.20	99

This demonstration of ubiquity indicates that there are quite a few seed taxa that appear in only one or two samples (18 out of 29 have a distribution value of .20 or .40). This pattern would most likely be amplified when more samples are analyzed since more taxa could be expected to occur after a larger volume of material had been sorted. The distribution also indicates that Medicago (clover), Amaranthus, Cyperaceae, and Asteraceae are ubquitous taxa relative to the others which may indicate their abundance as weed seeds or their economic importance. For instance, from field observations it has been noted that Medicago is a common weed that grows among crops, and is used frequently as animal feed. Dry Medicago may at times be burnt in the hearth/stove as well. Food crops such as wheat, Capsicum, talwi, and maize tend to have low ubiquity values as compared to weeds in general, although certain categories of weeds also have low ubiquity values. Although the ubiquity analysis may give some indication of economic importance, it

is difficult to make hard and fast statements on the basis of five samples.

Another method of quantifying the data is one used by Pearsall called seed occurrence. As defined by her this is a tabulation of total seed count with individual taxa expressed as a percentage of that total (see above). This measurement is a way to compare certain taxa from sample to sample in order to understand their differential occurrence, but it does not have the quality that ubiquity analysis does--that of weighting rarely-occurring taxa (such as maize) on equal terms with taxa such as Cyperaceae that have higher raw counts. The seed occurrence measurement awards higher raw counts with higher values, thus we can expect taxa such as maize to have small occurrence values. Below I have tabulated seed occurrence by sample.

Table V. Seed occurrence values for taxa by sample.

Sample #65

TAXA	VALUE
maize	5.2
Medicago	5.2
domesticated Fabaceae (pea, bean?)	1.7
wheat or barley	1.7
lg. Poaceae	1.7
Capsicum	1.7
Fabaceae (wild)	40.0
Malvastrum	3.5
Amaranthus	1.7
Cyperaceae	10.5
Lamiaceae	1.7
Asteraceae	3.5
Poaceae	8.7
Cheno./Amaranthus	3.5
Poaceae	8.7
Portulaca (pilosa?)	1.7

Sample #66

Medicago	.5

Rumex	.5
wheat	.5
Verbena	4.3
lg. Poaceae	2.2
Cyperaceae	13.0
unid. (Brassicaceae?)	13.0
Fabaceae (wild)	22.8
Polygonaceae	.5
Asteraceae	1.6
Fabaceae	2.7
Vaccinium	2.9
Lamiaceae	6.5
Malvastrum	1.6
Chenopodium	1.6
Rubus	.5
Cheno./Amaranthus	14.7
Oxalidaceae	.5
Amaranthus	11.9

Sample #98

Medicago	6.0
Cyperaceae	43.9
Rumex	1.5
Tagetes	3.0
Asteraceae	3.0
Amaranthus	16.7
Malvastrum	12.1
Cyperaceae or Polygonaceae	3.0
Brassicaceae	1.5
Lamiaceae	3.0
Verbena	4.5
Oxalidaceae	1.5

Sample #99

talwi	1.0
wheat	2.0
maize	3.9
Capsicum	12.7
Medicago	1.0
Rumex	7.8
Cyperaceae	3.9
Poaceae	1.9
Verbena	1.0
Cheno./Amaranthus	7.8
Amaranthus	28.0
Chenopodium	4.9
Fabaceae (wild)	18.6
Vaccinium	1.0
Cyperaceae or Polygonaceae	1.0
Asteraceae	2.9

Sample #375

Medicago	5.0
Cyperaceae	40.0

Chenopodium/Amaranthus	5.0
Vaccinium	20.0
Amaranthus	30.0

It is obvious here that seed occurrence is very similar to raw counts since the high values (such as that for cyperaceae in sample #98) reflect the high number of cyperaceae in that sample. Given the fact that the perrcentages are computed based on the total number of seeds, all taxa are dependent on each other within a sample. Some standardization would be introduced in this method if the samples were more similar in size, however assuming that "enough" of each flot portion was sorted so that the seeds identified are representative of the total population, it is not inaccurate to compare seed occurrence values per taxa across samples. Sample #375 is an example of this not being the case--the volume sorted was not large enough to be truly representative, thus the large values for each taxon.

In order to give a general idea of seed density per sample I have calculated the following numbers. First, sorted quantities were multiplied by the denominator of the fraction into which they had been split. Then the)2.0 mm., (2.0 mm., and (500 um. portions were added together, and the resulting number was divided by the original total sample size (before flotation).

Table VI. Seed densities by sample

Sample #65	(10) + (50 x 4)	870	=	.24
Sample #66	(3 x 4) + (211) + (3 x 4)	1,000	=	.24
Sample #98	(84 x 4) + (6)	900	=	.38
Sample #99	(116 x 8) + (2)	900	=	1.03
Sample #375	(21 x 8)	300	=	.56

Using this as a density measurement, it can be seen that the densest sample is #99 (doorway), the next being #375 (patio), then #98 (corral), #375 (patio), and #65 (below hearth) and #66 (hearth) the least dense. Doorways may be dense in terms of seeds because they are sort of "collecting areas" as is sometimes evidenced in some of the paleoethnobotanical samples from the University of Minnesota collection. Analagous again to the prehistoric evidence, hearths often contain less material than would be expected. Because cooking activities take place at the hearth, one might expect there to be a higher concentration of seeds here, but apparently other areas collect more seeds due to being more heavily used as processing sites. The previous measurement is not unlike the seed concentration index discussed by Miksicek, except that the standardizer in the density equation is the volume of original material. Miksicek defines his SCI as the number of seeds per gram of material recovered by flotation (see discussion above). The following is a computation of the SCI.

Table VII. Seed concentration index by sample (following Miksicek).

Sample #65	217	20.3 = 10.7
Sample #66	233	90.4 = 2.6
Sample #98	342	40.4 = 8.5
Sample #99	930	77.8 = 11.9
Sample #375	375	31.8 = 5.3

In this SCI measurement, #99 is still the densest sample and #66 the least, but the other 3 samples are in different positions relative to each other. The SCI has the potential of being distorted by using the amount of material recovered by flotation as a standardizer. This quantity——

that material which is floated out of the soil sample during the flotation process--is dependent on many variables beyond the original vloume. Some of these variables include 1) the speed of the water passing through the soil sample during flotation, and 2) the amount of roots in the soil--both factors which may increase or decrease the quantity of resulting floated material. Along the same lines, a very rocky sample will distort the original weight by making it much heavier than a sample with fewer rocks. Some of these problems can be avoided by using volume as the standardizer when calculating densities. This necessitates taking good volume measurements for each sample prior to flotation.

It would be interesting to quantify some of the data in such a way as to be able to talk about sample composition as outlined by Hillman (see above). Although Table II provides a way to scan sample compsosition, it does not give a systematic presentation. I do not feel capable of providing this data on the basis of five samples from one household. However, the search for diagnostic sample compositions is an issue that I hope to be able to address after sorting a larger population of samples.

One more issue must be discussed in order to link these modern household samples with their archaeological counterparts. The question arises as to what these samples would look like in a couple of hundred years as paleoethnobotanical samples taken from an archaeological site. The information given in Table I and II can once again be referred to in order to see how much charred material was present in each sample. In these Tables, under the charred

column, a check indicates that the material was burned. If the check is followed by a number or percentage, it indicates the part of the category that was burned. A quick look at the samples indicates that the quantity of charred material in sample #65 and # 66 is much greater than in the other samples, and therefore they would have a much greater chance of appearing in archaeological samples. For instance, in sample #65, 61 out of the 67 seeds were charred, meaning that almost all of the seeds would make it into a paleoethnobotanical sample given normal environmental conditions. In sample #99 (doorway), the "densest" of the samples, only 38 of the 116 seeds were charred, meaning that the archaeological sample would be considerably less dense. In sample #98 (corral) only a few fragments of wood and two unidentifiable seeds would be represented in the paleoethnobotanical sample. The evidence supplied in these modern samples pertaining to charred and uncharred material potentially has great value for helping to interpret samples taken from archaeological contexts, and a further step in interpretation would be to quantify only the charred material from the samples to compare with all of the data taken together. This could provide some probabilistic statements as to what kinds of taxa tend to get charred and therefore to survive, as well as about what percentage of a sample from a given context would be represented by charred material.

Results and conclusions

It is difficult, with so few samples, to make conclusions about the relationship between sample attributes

such as seed density and composition and the household contexts from which the samples came. However, I have tried to use some measurements to quantify and analyze the data as well as attempting to make some statements about the possible nature of this relationship in specific cases. I have also tried to offer some general comments about the modern samples. Even with these few samples it is clear that they are different from each other in important ways. Whereas the composition of sample #65 and #66 is similar (in non-seed components), they look quite different from the corral sample. The analysis of sample composition, then, provides an interesting alternative to the analysis of samples using seeds only. The data on charred and uncharred material also provides some interesting information. For example, the dung from the corral, none of it burned, would not become part of an archaeological sample. Sample #375, almost completely devoid of charred seeds, would be a fairly sterile-looking archaeological sample!

Most of my results and conclusions are methodological ones. I learned how to treat modern samples so that they could be sorted relatively quickly but so that the information provided is still sufficient for analysis. I think the kind of splitting I employed worked well, and the complete sorting of the >2.0 fraction into its component parts served as an adequate way to examine sample composition without doing a complete sort on the <2.0 fraction as well.

Although this project is far from complete it has illustrated some of the problems in sorting modern samples

and some of the approaches to solving these problems. Although my original methods were time-consuming, and I still did not sort my later samples quickly, I feel I have gained some experience that will aid me in sorting and analyzing the modern samples from my upcoming project.

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