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Farming and Herding Along the Euphrates: Environmental Constraint and Cultural Choice (Fourth to Second Millennia B.C.)

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Subsistence and Settlement in a Marginal Environment: Tell es-Sweyhat, 1989–1995 Preliminary Report

Richard L. Zettler

and

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Museum Applied Science Center for Archaeology
University of Pennsylvania Museum of Archaeology and Anthropology
1997

SWEYHAT FLOTATION 199

Tag no.	Op.	Locus	Lot	Other Prov.	Type	Date	Excavator's comment:

Vol.	Vol. (cc)	Charcoal,>2mm		Seed > 2mm		Misc>2		1>seed>2mm		Coll Dt	Flt Dt	sort	id	T
		Lt	Hv	Lt	Hv	Lt	Hv	Lt	Hv	/	/	/	/	

GRAIN / NUT	>2	<2	<1
ct			
wt whl			
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SEEDS (charred)	>2	<2	<1

HEAVY FRACTION CHECK LIST

_____ Bone _____ Botanical
_____ Shell
_____ Metal
_____ Ceramic
_____ Other:

LIGHT FRACTION MISC.

	removed	tossed
_____ Snail shell	____	____
_____ Bone		
_____ Other		
_____ Rootlets	____	____

MISC. PLANT PARTS	>2	<2	<1

SEEDS (uncharred, modern?)	>2	<2	<1

GRAIN etc.

NUTSHELL & GRAPE

LEGUME etc.

COMMENTS

7

FARMING AND HERDING ALONG THE EUPHRATES: ENVIRONMENTAL CONSTRAINT AND CULTURAL CHOICE (FOURTH TO SECOND MILLENNIA B.C.)

Naomi F. Miller

Determining the degree to which environmental conditions constrained agriculture and pastoral production in ancient times is no easy task. To approach this topic with archaeological materials, it helps to be able to compare sites from the same time period in different but adjacent environmental zones, or different time periods of one site. The present chapter examines some of these issues as they relate to the agropastoral economy at a few sites along a 200 km stretch of the Euphrates River in northwestern Syria and southeastern Turkey: Tell es-Sweyhat, Hacınebi Tepe, Kurban Höyük, and Hassek Höyük (Fig. 7.1). These sites date between the late fourth and early second millennia B.C., though the time periods are not equally represented. The longest archaeobotanical sequence comes from Kurban Höyük. The assemblages of plant remains from the other sites each represent a single time period: late fourth millennium for Hacınebi and Hassek, and late third/early second millennium for Sweyhat. The last of these is the only one that can be considered a city.

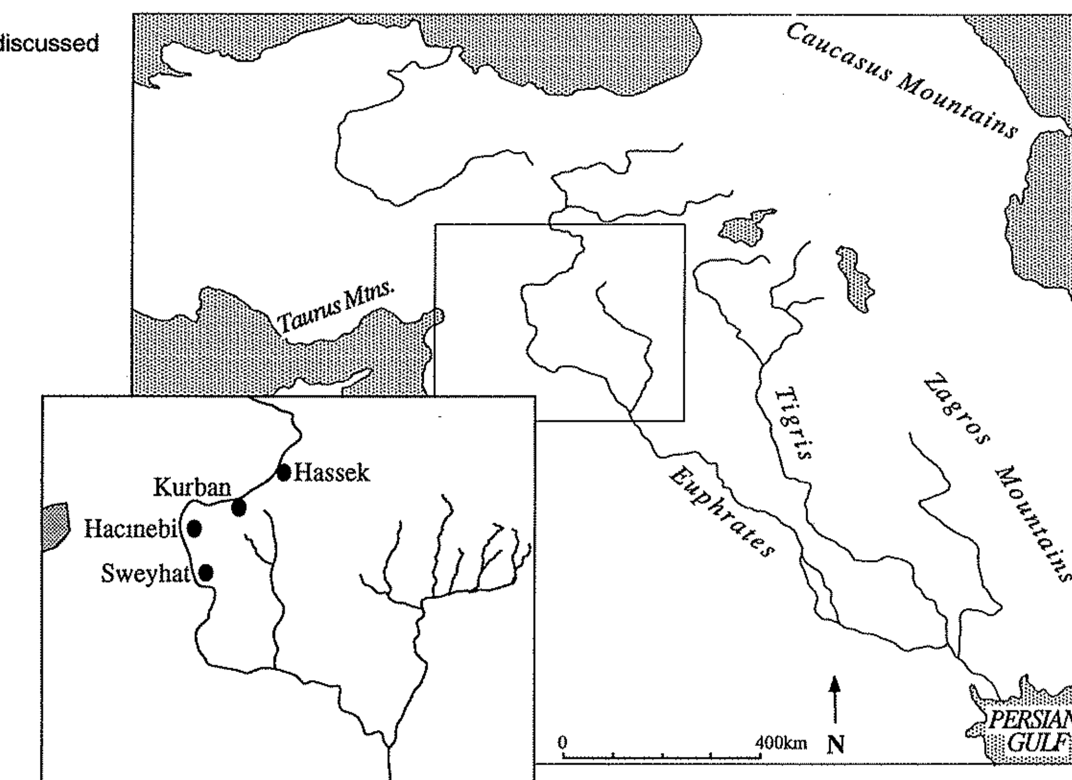


Fig. 7.1. Sites discussed in the text.

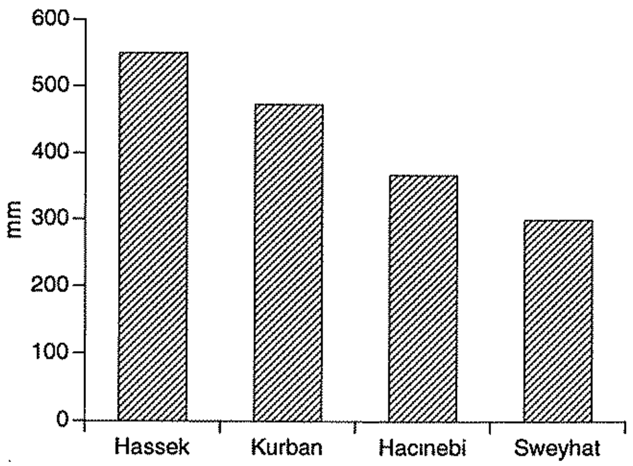


Fig. 7.2. Modern annual precipitation.

A key variable for life in the four Euphrates communities was precipitation, which increases from south to north (Fig. 7.2). Sweyhat is near the lower limit of where rainfall agriculture is possible, and in any given time period, it would have experienced the driest conditions. Precipitation is a major *non-cultural* limiting factor for vegetation, but people and their domesticated animals have a strong influence, too, through fuel-gathering and grazing.

With a higher moisture requirement, woody vegetation would be more densely distributed toward the north. The vegetation around Sweyhat would have been steppe, or steppe with a few trees, whereas oak woodland would have surrounded the sites in present-day Turkey. None of these sites is more than a few kilometers from the river, which would have supported the growth of willow, poplar, and tamarisk.

Climate fluctuations over the past 6000 years cannot be totally discounted as influences on natural vegetation and agricultural economies. Indeed, there is some evidence for a moister climate than today in the Negev and elsewhere in the Near East during the late fourth millennium (Goldberg and Rosen 1987). And some researchers claim there was a sudden and catastrophic drought toward the end of the third millennium in northern Syria, if not in the entire Near East (Weiss et al. 1993). Unfortunately, archaeobotanical evidence by itself is not that useful for identifying climate fluctuations, because the reasons people change agricultural strategies and patterns of plant use are too complex to be reduced to rainfall. For example, the rapid spread of agriculture out of the Levant during the Pre-Pottery Neolithic B period was a result of migration and/or cultural transmission rather than climate change in the source or receiving areas (Byrd 1992:53).

The data discussed here come from archaeobotanical remains excavated and analyzed between 1981 and 1994, during which time excavation and recovery strategies and my own laboratory procedures changed (Miller 1986, 1994a,b, 1996b; see also Chapter 6, this volume).[34] There are also inevitable gaps in the sequence sampled, which make it very difficult to do controlled comparisons between sites and time periods. Several explicit but arguable assumptions also require some discussion.

All of the botanical material discussed here is charred, and except for the Hassek remains, none of it comes from burnt structures. Rather, the archaeological contexts of the material include hearths, ash lenses, trashy deposits, and other cultural fill. The first assumption, therefore, is that the material comes primarily from fuel remains, either from wood or, in the case of seeds, from animal dung. A corollary is that the seeds of cultivated cereals as well as wild plants came from dung. Many archaeobotanists working in the Near East do not accept these premises, and consider crop-processing debris a more significant source of seed remains (see also Hillman 1984). Note that fuel is frequently and intentionally burned, whereas crop-processing debris is only episodically produced, and even if it were burned would be of comparatively small volume. It therefore seems unlikely that a large proportion of charred debris from hearths and trashy deposits would be from crop-processing. Arguments summarized in the previous chapter and presented in detail in other publications explain why these are plausible assumptions (Miller 1984a, 1984b; Miller and Smart 1984). Further non-quantified support can be gleaned from reported seed and charcoal assemblages; those from forested regions

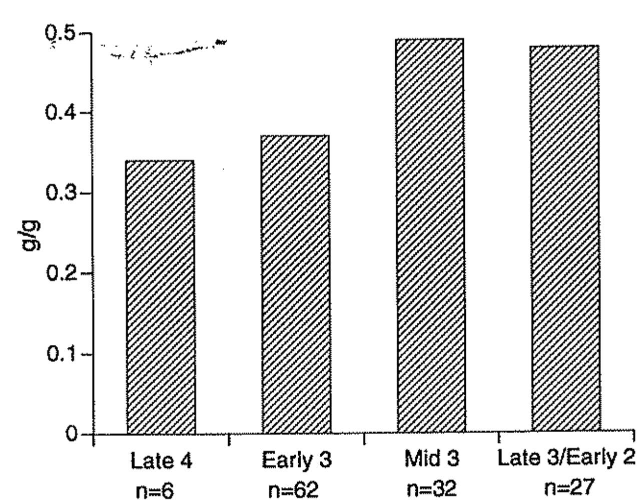


Fig. 7.3. Kurban Höyük, seed:charcoal.
Source: unpublished data

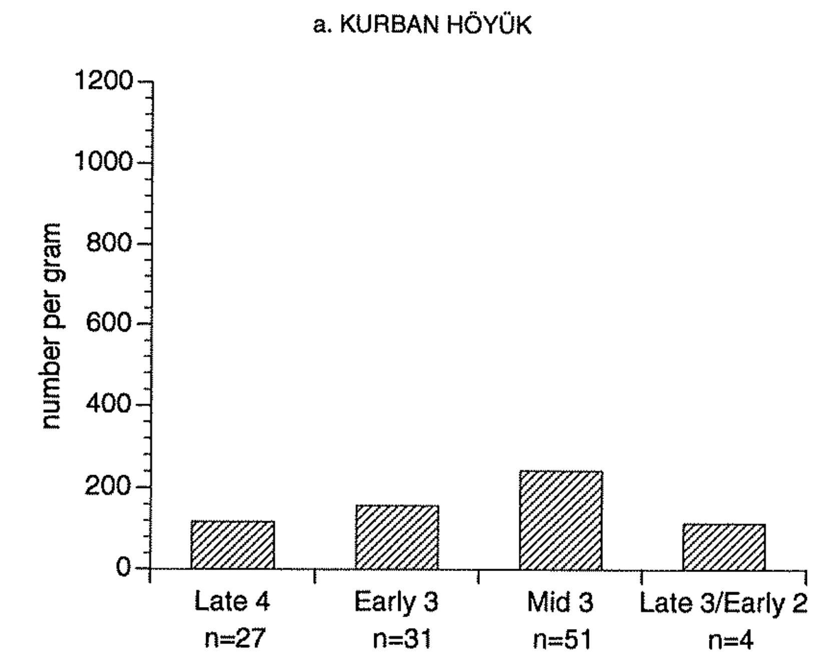
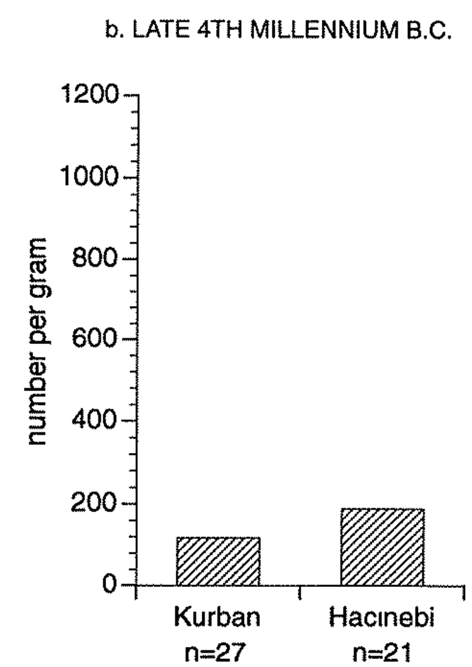
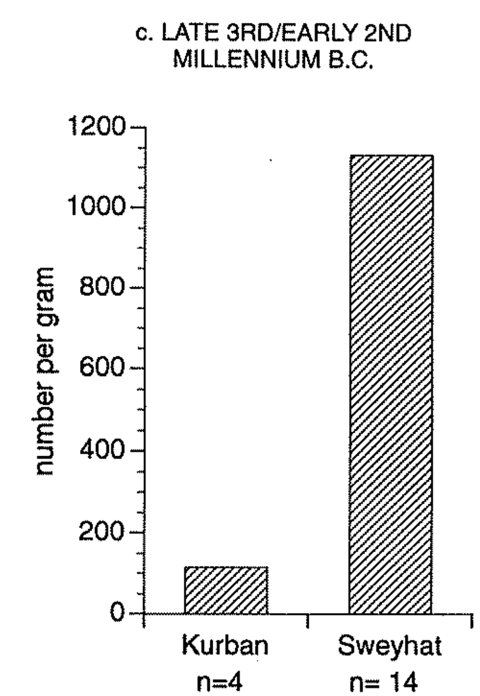
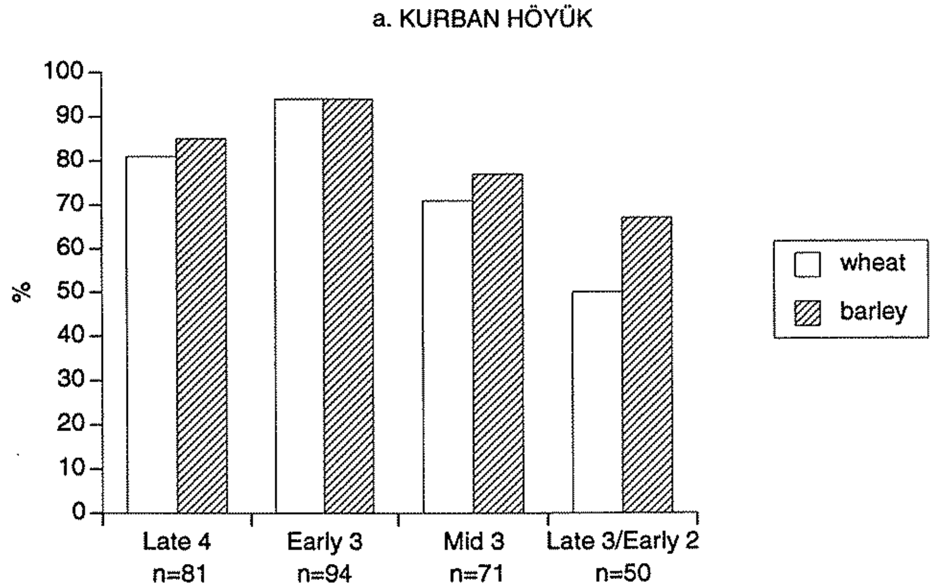


Fig. 7.4a–c. Wild seed:cereal (number per gram).
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 (unmeasurable cereal), SW 2351 (outlier), and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data, samples with no cereal omitted







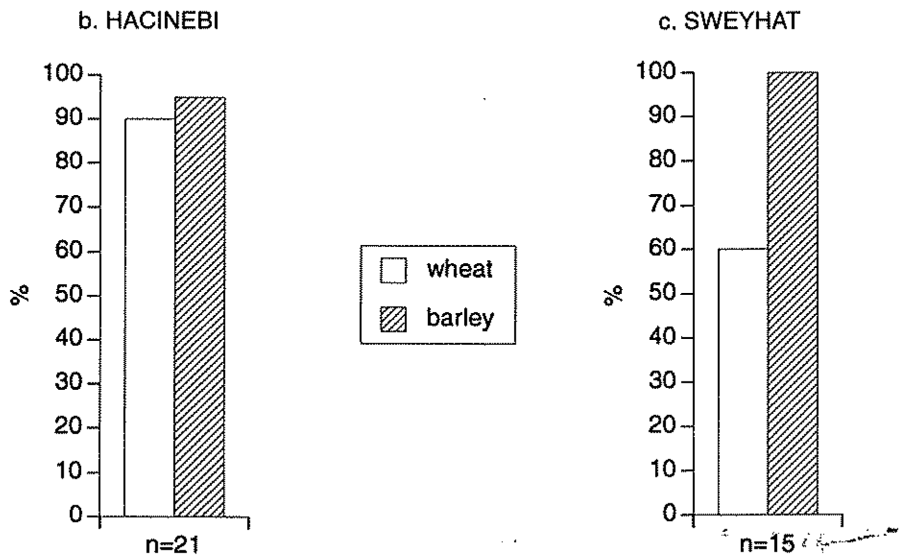


Fig. 7.5a–c. Wheat and barley frequency.
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data

tend to have high concentrations of wood charcoal and low concentrations of seeds, whereas the converse holds in assemblages from the steppe (see Miller 1991: 154–155 for sites and references).

Archaeological wood charcoal provides direct evidence of ancient fuel use, for it is a common fuel residue. Although people select fuel from the broader botanical environment, they are likely to collect types that are relatively close to hand. Therefore, wood charcoal is an incomplete, but fairly good indicator of local vegetation (see Miller 1985). The charcoal from Hacınebi and early third millennium levels at Kurban is consistent with vegetation reconstructions (see Zohary 1973 and van Zeist and Bottema 1991: fig. 45), as it consists mainly of oak and a few other steppe forest types. Even today, two relict oaks on a bluff above Kurban and unirrigated pistachio orchards which dot the land around Hacınebi show that full-grown trees can grow in the region with rainfall alone.

A major deforestation episode occurred between the early and mid-third millennium; a sharp increase in the average seed to charcoal ratio by weight suggests dung fuel use increased relative to that of wood (Fig. 7.3). The Sweyhat samples postdate that northern deforestation, but people there still had some access to oak. Not surprising for this dry area, the main woods burned were the riverine types, poplar and tamarisk. In contrast to the more northern sites, Sweyhat also had a few pieces of a chenopodiaceous shrub, which is true steppe vegetation.

To get a general picture of agricultural practices, one can consider two basic characteristics of the flotation samples: the number of wild seeds relative to the weight of

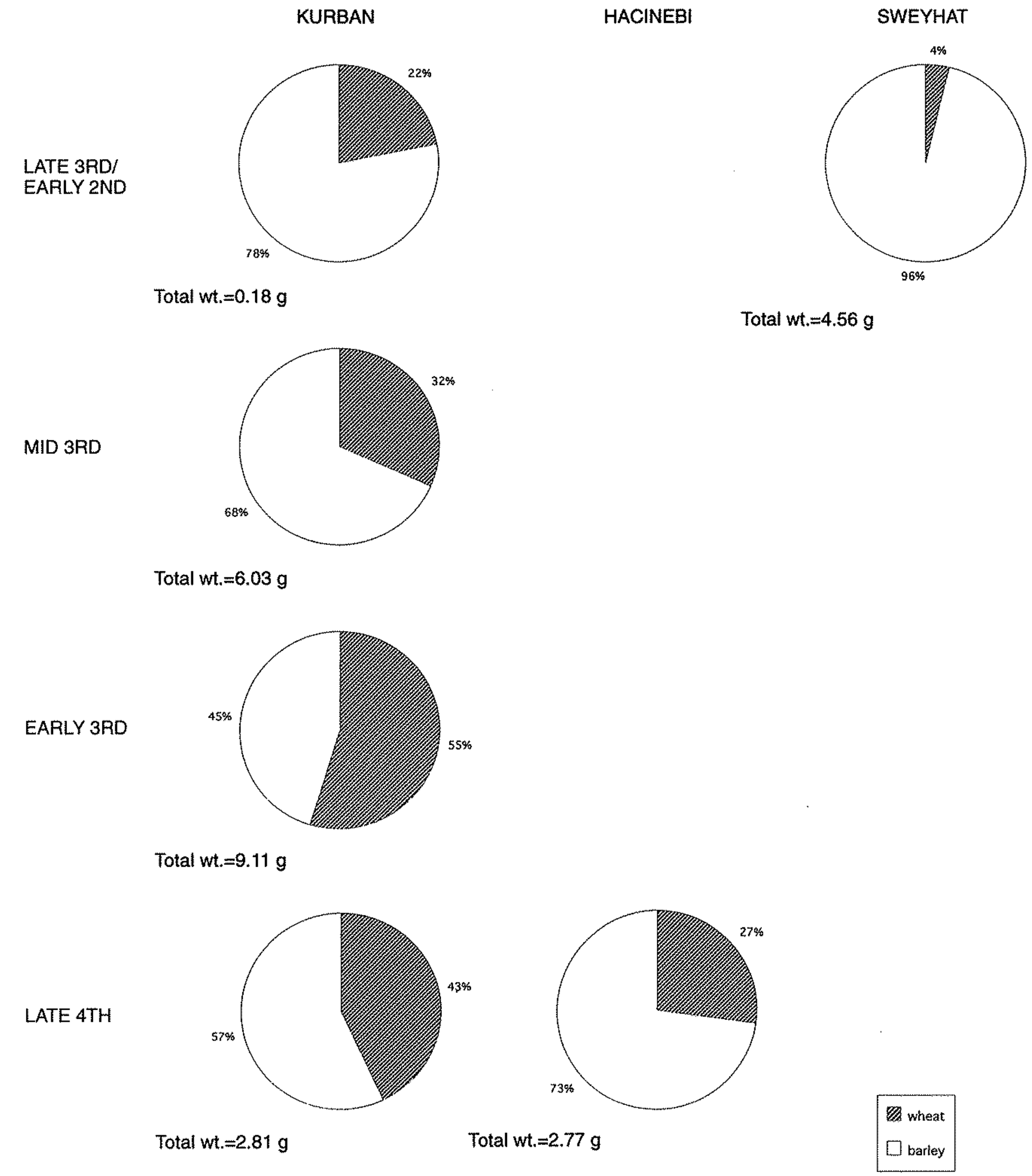


Fig. 7.6. Wheat and barley amounts.
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data

cereal grains, and the amount of wheat relative to barley.

An Archaeobotanical Indicator for the Importance of Pastoral Production

Insofar as the seeds come from dung fuel, the wild seed to cultivated cereal ratio quantifies foddering practices. In feeding their flocks, herders must take into account the needs of the animals, the seasonal availability of natural pasture and field stubble, and the cost of labor. It is much less labor intensive to let animals graze than it is to grow fodder for them, and labor cost is a major limiting factor for fodder production (Tully et al. 1985:213). Nevertheless, animals may be foddered. Winter snow cover and depleted pastures (Tully 1984:58) or summer drought (Sweet 1974:96) prevent the animals from grazing for some portion of the year. Indeed, the limiting factor for herd size in northern Syria is the winter fodder supply; during the rest of the year the animals graze on stubble and steppe where available (Tully 1984:50). Foddering may be necessary to protect the steppe plants from grazing at some points in the growing season (Shoup 1990:196). If agricultural fields cover the land, it might become very important to limit the places the animals could trample by stall-feeding them.

It is worth noting that at Tell Toqaan, nomads' flocks of sheep would travel as far as 60–70 km to steppe pastures, but the village flocks and cattle herds would stay in the village (Sweet 1974:97–100). It therefore seems likely that when sheep and goat husbandry is emphasized, people are more likely to let the *animals* do the walking and put them out to graze. On the other hand, when agricultural fields cover the landscape, herders would have to exercise careful control over where the animals roamed, so the value of large herds would be offset in part by the cost of herd management. Cattle and pigs, more easily confined to the settlement, might become more attractive. For this reason I am using the wild seed to cereal ratio as a rough way to monitor the economic emphasis on pastoralism (Fig. 7.4).[35]

The category "wild seed" includes plants that are identified to family or genus, so their exact habitats cannot be determined. However, by far the greatest number at all sites are legumes like *Trigonella* and *Astragalus*, which are most probably endemic steppe plants. I think it fair to say that near Sweyhat the marginal conditions for agriculture and correspondingly suitable conditions for grazing encouraged an economy based on pastoralism, which is reflected in the extraordinarily high proportions of wild plant seeds. If I had included the statistically outlying sample in which I assiduously counted each of 13,553 wild seeds, the average wild seed to cereal ratio would have jumped to nearly 6000.

Hacınebi follows the same pattern. In the late fourth millennium, when the best evidence from charcoal suggests both Kurban and Hacınebi had access to forest woods for fuel, evidence from fodder suggests Hacınebi animals ate more wild plants than those at Kurban Höyük. The wild seed to cereal ratio at Kurban is much closer to that of Hacınebi than it is to that of Sweyhat, however.

Crop Choice

Like fodder choice, crop choice, too, is influenced by both environmental and cultural factors. The major cereals, wheat and barley, are grown for grain and straw, and are eaten in several forms by people and animals. Although the varieties of wheat and barley each have their own requirements, it is generally the case that barley has a shorter growing season and so needs less water than wheat. The straw is softer and more suited to animal fodder, and the husks are attached to the grains by a layer of cells, so removing them requires milling. Farmers in much of the Near East grow barley primarily for fodder (e.g., Sweet 1974:73; Miller 1982; Tully 1984:43). People are most likely to consume it in the form of beer.[36] Wheat, on the other hand, tends to be preferred for human food. The relatively large amounts of barley in the charred material from most of these assemblages presumably reflects its preferred use as fodder; barley eaten as food might show up in cess deposits, as it did in a late third millennium deposit at Malyan (Miller 1982:363–365), but no such deposits have been found on the sites discussed here.

Barley occurs in almost all the samples, regardless of time and place (Fig. 7.5). Wheat is less common, and as one goes from north to south, that is, from wetter to drier conditions, wheat declines in popularity. This generalization looks more dramatic if one considers the total quantity of wheat and barley rather than just frequency (Fig. 7.6).[37] Wheat is nearly always more important at Kurban than it is at Hacınebi, and what little wheat occurs at Sweyhat may just be occasional weed contamination; similar low quantities of wheat were recovered from Selenkahiye, which lies right on the Euphrates about 30 km south of Sweyhat.

Further supporting the view that wheat was not grown as a separate crop at these Syrian sites is the fact that analyzed cereal remains from a burnt building at Sweyhat had stores of barley, but no wheat at all (van Zeist and Bakker-Heeres 1985[1988]). In fact, after considering the ethnographic and ethnohistoric data for northern Syria, Michael Danti (see Chapter 5) suggests that the large storage structures like those at Sweyhat, Hajji Ibrahim, and Raqā'i might have been intended for storing winter fodder, not food (see McCorriston 1995:36). Undoubtedly, people living in these steppe settlements consumed cereal grains and other plant foods, but these data do not speak directly to this issue.

Archaeobotanical Indicators at Kurban Höyük

Kurban Höyük provides a long sequence at a single site. The work of Wilkinson (1990), Wattenmaker (1990), Wattenmaker and Stein (1986), Algaze (1990), and Miller (1986) allows us to begin to specify several interrelated land-use variables, including settlement distribution and population levels, agricultural intensity, and herd management strategies (Table 7.1, Fig. 7.7).[38]

The late fourth millennium settlement at Kurban was relatively large, and Wilkinson has proposed an agricultural pattern of short fallow (i.e., 1- to 2-year intervals between cropping). The vegetation was probably open oak woodland, and pig bones predominate in the assemblage. The association between oak forest and pig husbandry has ethnographic parallels in the Mediterranean region, where acorn-eating pigs are herded (Parsons 1962), but it has not been determined whether the Kurban pigs were free-ranging among the oak trees or confined to sties in town. The number of cow and caprid bones is about the same, and the animal fodder emphasized cultivated plants.

The early third millennium saw the decline of Uruk influence, a greatly diminished Kurban, and a general reduction in settlement area within the site's catchment. Wilkinson associates these changes with a lower intensity land use (with fallow periods of up to 8 years). The faunal and floral remains are consistent with this view; there is no evidence for forest disturbance (the seed to charcoal ratio has not changed), and a smaller proportion of land was devoted to fodder production (the proportion of wild plants relative to cereals sharply increases). In addition, caprid bones now dominate the assemblage. Thus, animals (primarily sheep-goat) were now brought to pasture, but their dung was not yet needed to stretch fuel resources.

The pattern of animal management suggested by this high proportion of sheep-goat relative to pig and cattle and foddering practices emphasizing non-cultivated plants continues into the mid-third millennium, despite the fact that substantial social change and vegetation disturbance occurred. In particular, archaeological analyses by Algaze (1990), Wattenmaker (1990), and Wilkinson (1990) suggest that Kurban was integrated into a larger political or economic system in the mid-third millennium B.C., at which time it reached its maximum size. Wattenmaker (1990) finds evidence that the inhabitants of Kurban began to raise animals for distribution outside their own households. Wilkinson concludes that although land was not intensively manured near the site, it was cropped annually, and land on the upper terrace was not settled at all. I think it likely that this unoccupied area was left for grazing rather than cultivation. It is also in this period that the effects of deforestation are first felt. Both the presumed specialization of pastoral

Table 7.1. Kurban Höyük, settlement and land use summary

Period† (millennium, general period Kurban sequence)	Kurban population*	Catchment population (per sq km)*	Fallow interval (inferred)*	Landscape (inferred)
Late 3/Early 2 Early-Mid Bronze Kurban III, H	relatively small	38	1–4 years	degraded oak woodland
Mid 3 Mid-Late EBA Kurban IV, G	maximum	86	1 year	deforestation, degraded oak woodland
Early 3 Early EBA Kurban V, F	small	21 (dispersed hamlets)	1–8 year	oak woodland
Late 4 Late Chalco Kurban VI, E	relatively large	61	1–2 year	oak woodland

† Kurban sequence designations: Roman numerals in Algaze (1990), letter in Wilkinson (1990)
* Wilkinson (1990)

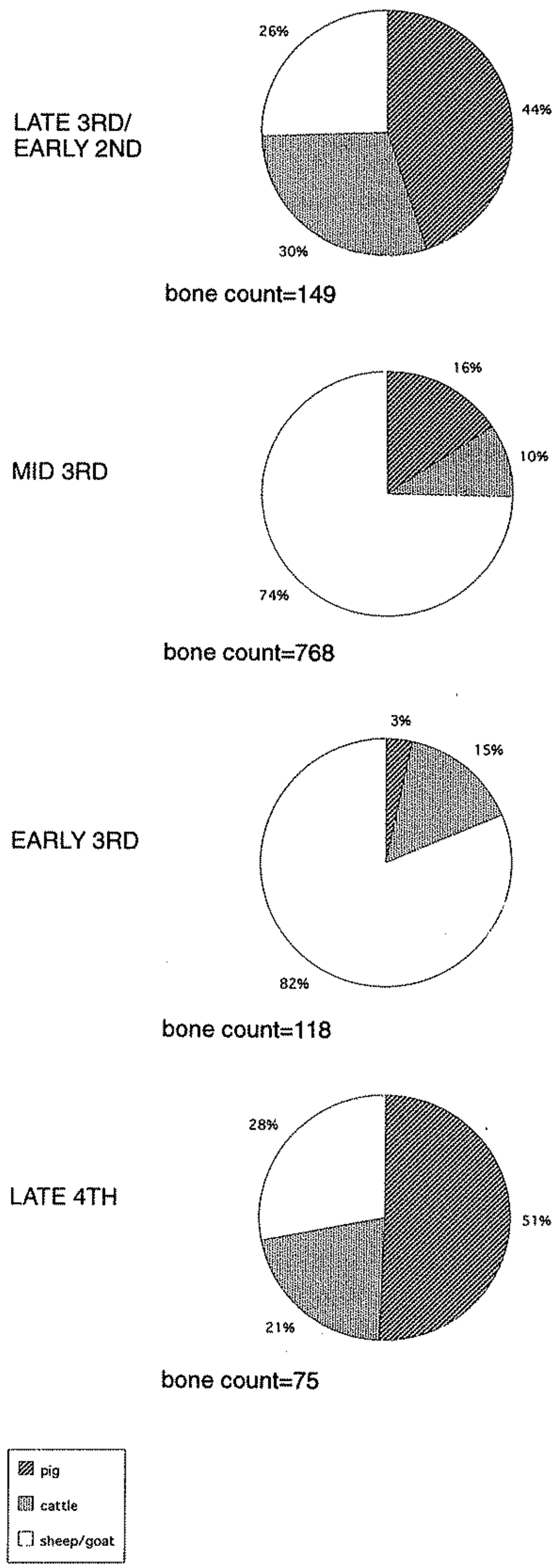


Fig. 7.7. Kurban Höyük domestic ungulates. Source: Wattenmaker and Stein (1986)

production and the reduction in forest occur at a time of high population density.

In the late third/early second millennium, the intensity of land use seems to have lessened. Population levels fell; Wilkinson posits a return to a short fallow system. Archaeologically, pig and cattle bones predominate, and Wattenmaker says that the faunal assemblage reflects herding strategies geared once again toward household production and consumption. Corresponding to the decline in sheep-goat bones, the wild seed to cereal ratio drops. Wood fuel use seems to continue at the same rate as in the previous period.

Dependence on pig (and cattle, too, in later times) and feeding animals cereals is associated with the short fallow system. Perhaps, as Wattenmaker suggests, the fallow fields provide land on which small flocks can be pastured without disrupting cultivation. Two distinct land-use patterns can be seen in periods when sheep and goat predominate: a low-intensity land use pattern favored sheep and goat herding in the early EBA, but pastoral production complemented intensive annual cropping in the mid-to-late EBA.

If one compares contemporary occupations along the Euphrates, emphasis on wheat or barley cultivation seems to reflect the clinal distribution in precipitation. That is, settlements in areas with higher precipitation grew more wheat. Can cereal preference be extended to cover precipitation shifts through time, as well? Weiss and colleagues (1993) suggest deforestation was one result of a massive drought that hit the Near East at the end of the third millennium B.C. The occupation of Kurban Höyük spans this period, so it provides an opportunity to test this hypothesis.

As discussed above, the biggest decline in wood fuel use at Kurban occurred between the early and mid-third millennium, and associated deforestation is likely to be correlated with high population densities rather than climate change. During a prolonged dry spell farmers might respond more directly to adverse conditions by planting more drought-tolerant crops, like barley. The Kurban evidence, however, suggests barley production began to expand between the early and mid-third millennium. It therefore seems likely that there was no great drought, and climate did not dictate the economic choices made over time by the ancient people of Kurban.

Wilkinson inferred the history of fallowing around Kurban from sherd scatters and estimated population levels (Table 7.1). At the fairly gross taxonomic levels considered here, population levels do not seem to have determined crop choice or herd animal preference. On the other hand, evidence suggests people considered both crop production and animal husbandry in choosing

how to allocate their time and land resources. Of all the variables considered in this discussion, the changes in the proportion of barley are negatively associated with changes in the wild to cultivated ratio and the proportion of sheep-goat, and positively with pig (Table 7.2). In short, wild and cultivated fodder are negatively associated, wild fodder and sheep-goat are positively associated.

As a very preliminary assessment of these data, I would suggest that fodder crops were least important when the available animals could fend for themselves in the grazing lands around the settlement. When wild plants were not as available for fodder (for whatever reason), it made economic sense to plant fodder (i.e., barley) for the animals.

Crop Choice at Hassek Höyük

An appreciation of environmental constraints allows one to pinpoint a possible "ethnic" factor in crop choice by examining clear evidence of food remains from Hassek Höyük. Upstream from Kurban, Hassek enjoys the highest rainfall of all the sites under discussion. It also appears to be one of those walled Uruk enclaves built and inhabited by people from the south and surrounded by a local settlement (Behm-Blancke 1989), like Hacınebi just downstream (Stein and Mısır 1994) or Godin Tepe in the Zagros mountains (Weiss and Young 1975). H.-J. Gregor (1992) has identified stored crop remains, which presumably represent human food, from a burnt building. The field crops found were barley, chickpea, and lentil, without a grain of wheat. There are no non-Uruk late fourth millennium samples from Hassek with which to compare these finds directly, but given the north-to-south gradient in wheat and barley popularity along the Euphrates during the fourth and third millennia, it looks like the Uruk transplants may have brought some of their food habits with them. This interpretation is far from certain, as there are plausible alternative explanations. For example, the building might have burned in the late spring, after the barley harvest but before the wheat harvest.

Summary

Although the available sample makes it very difficult to control for both space and time, emphasis on herding as indicated by a high ratio of wild seeds to cultivated cereals decreases as precipitation rises. The wild seed quantities are also higher in situations where there is independent faunal evidence for the importance of sheep and goat husbandry. As for the cereals, the popularity of wheat relative to barley tends to be lower in areas of low rainfall, but the proportion of wheat cannot be predicted from rainfall data alone. In short, foddering

Table 7.2. Directional changes in agriculture and settlement variables at Kurban Höyük

	Late 4-Early 3	Early 3-Mid 3	Mid 3-Late 3-Early 2
% barley	-	+	+
wild/cereal	+	-	-
% sheep-goat	+	-	-
% pig	-	+	+
% cattle	-	-	+
population	-	+	-

practices and crop choice are strongly influenced by environment, but social and economic factors operate as well, and can be recognized through the analysis of archaeobotanical evidence.

The conclusions presented here are in no way definitive. The number of samples is small and the amount of material is also small. Note, for example, that the identified cereals in the Sweyhat assemblage considered in Tables 6 and 7 consisted of 4.37 g of barley and 0.19 g of wheat, which can be converted to a cereal grain equivalent of about 456 seeds, averaging no more than a few seeds a year. It is also unfortunate that there is only one multi-period sequence, the one from Kurban. Nevertheless, it is my conviction that even small amounts of material interpreted according to their archaeological context can begin to show regularities that at least raise interesting questions. What is needed is more archaeobotanical laboratory and field work to increase the assemblage available for study. If the patterns hinted at here are real, and not just a happy statistical accident, this work has two significant results. First, it demonstrates how understanding the archaeological context of archaeobotanical remains enables us to integrate the study of the agricultural and pastoral economies, not just along the Euphrates, but any place where dung is burned. Second, it suggests an approach to isolating and assessing the strength of environmental and cultural variables in the subsistence economy. As direct evidence of ancient vegetation and land use, plant remains can help us understand and monitor not just environmental conditions and changes, but also the economic and cultural patterns that prevailed.

Acknowledgments

I would like to thank Lee Marfoe, Gil Stein, and Richard Zettler, directors (respectively) of the excavations at Kurban Höyük, Hacınebi Tepe, and Tell es-Sweyhat, and Wilma Wetterstrom for her ever-helpful comments.

Notes

34. The material from Hassek Höyük was analyzed by H.-J. Gregor (1992). Botanical remains from other sites along the Euphrates have been published, but the archaeological contexts are not trashy, the quantity of material is insufficient, or the samples are reported in insufficient detail for direct comparison. See the volume bibliography for references.

35. As Bottema (1984) demonstrated, the seed content of dung is quite variable and depends on what the animal has eaten. Seeds do not necessarily occur in dung fuel, but when they do, at least some may be preserved.

36. In season, green barley may be cooked and served in place of rice, in a dish called *frika* (personal experience, Nefileh, Syria, June 8, 1995).

37. Korucutepe is a couple of hundred kilometers upriver from Kurban. It enjoys a similar rainfall pattern, but is a bit cooler on average. In their report, van Zeist and Bakker-Heeres (1975: Table 1) include four Chalcolithic samples comparable in archaeological context to those discussed in this chapter. Wheat represents 71% of the identified cereal, a higher proportion than at any of the sites to the south.

38. Though methodologically problematic, I present sums of animal bone counts by period to give a rough idea of the material. For this argument, one need not estimate the amount or relative importance of the meat and milk products provided by the three categories: pig, cattle, and sheep-goat.

8

FAUNAL REMAINS FROM TELL ES-SWEYHAT AND TELL HAJJI IBRAHIM

Jill A. Weber

Analysis of animal bone from archaeological sites can provide a picture of ancient patterns of animal production, consumption, and procurement. When compared within and between sites, these patterns can reflect differences in area or site functions and status. Preliminary analysis of vertebrate species represented at Sweyhat and Hajji Ibrahim suggests considerable differences between the two sites. This analysis also highlights differences between Sweyhat and other urban centers in northern Mesopotamia.

Excavations were begun at Sweyhat in the early 1970s (Holland 1976) and the animal remains from those excavation were published by Buitenhuis (1983). This study is based on the continued excavations, beginning in 1989. Only mammal bones from the 1989, 1991, and 1993 seasons are included here, as they were shipped to the University of Pennsylvania Museum and made available for study. Included are the bone remains from excavations beginning in 1993 at the 0.25 ha. site of Hajji Ibrahim. A very brief preliminary report on both sites appears in Zettler et al. 1996.

Unfortunately, the Sweyhat and Hajji Ibrahim samples are not directly comparable at this time. The 1993 Hajji Ibrahim assemblage was analyzed before the present protocol was put in place; at some point, it will be re-evaluated in order to standardize the information analyzed from the two sites. The biggest difference is that the Hajji Ibrahim material was counted, but not weighed. In addition, the 1995 material (from both sites) analyzed in the field has been weighed but not counted. This will be remedied at a later date, and remains from the 1995 and 1997 seasons, as well as all bird, reptile, and fish bones, will be included in a subsequent report.

Sampling Methodology

Different loci sampled at Sweyhat included inside and outside areas of domestic spaces, trash dumps, street deposits, industrial areas, and a "kitchen" building. Other contexts not yet sampled will probably do little to change the overall character of the faunal assemblage, except in terms of intrasite variability. An exception might be material from the earliest occupation at Sweyhat. Little of that phase has been excavated and thus new material could produce a different picture. Samples from Hajji Ibrahim are mainly from domestic rooms and courtyards. Grain storage installations did not yield any animal bones and, to date, no large trash pits have been encountered. Any new finds (especially trash pits) could drastically change the nature of the Hajji Ibrahim faunal assemblage.

Bone from both sites was routinely collected during the course of excavation. Screening was not routine, but smaller bones (phalanges, loose teeth) of medium-sized animals such as sheep and goat are well represented, as are the long bones and teeth of rodents, birds, and reptiles. An exception is a collection of burials from classical levels at Hajji Ibrahim: all of the soil from these burials was screened. The result was a plethora of rodent bones. Rodent bones were common, however, from all areas of excavation (screened as well as unscreened). This suggests that no systematic bias towards larger bones and larger animals was introduced by the workers. However, the fact that, at Sweyhat, 67% of the "small animal" bones were identified to subfamily or better, as compared to 41% and 38% for medium- and large-sized animals, respectively, suggests that the skeletal remains of smaller animals were more complete than those of larger animals. In 1995, a more systematic sieving program was introduced, which will provide more information on possible sampling bias. In a similar vein, soil sent to flotation for botanical remains often contained animals bones as well. I examined the heavy fractions from flotation, and the majority of animal bones present were tiny, unidentifiable pieces. The only exception were whole ceramic vessels whose entire soil contents were floated and found to contain a wealth of bird