Yeki bud, yeki nabud
ESSAYS ON THE ARCHAEOLOGY OF IRAN IN HONOR OF WILLIAM M. SUMNER

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ARCHAEOBOTANY IN IRAN, PAST AND FUTURE

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The two most important sources of evidence for vegetation and land use in ancient Iran are plant remains found on archaeological sites and pollen from lake cores. The former more directly reflect plant use by ancient people, for they are remains of plants used for food, fodder, fuel, construction, and other purposes, brought into settlements by people and animals. They consist primarily of seeds and wood remains, usually preserved in charred form, and also include some archaeological pollen. In contrast to remains from archaeological sites, lake sediment pollen records regional vegetation. It is important both for reconstructing the environment in which people lived and for identifying human impact on the vegetation.

From the beginning of modern archaeological studies in the 1960s, plant remains from Iran have provided important information about a variety of topics. Collaboration among botanists, archaeobotanists, and other archaeologists has been affected by intellectual trends in the rest of the Near East and elsewhere. An early example is Hans Helbaek's (1969) work on the Deh Luran plain, which was part of one of the earliest and most influential projects concerned with early agriculture—Holm, Flannery, and Neely's (1969) *Archaeology and Human Ecology of the Deh Luran Plain*. Hans Helbaek pioneered the study of the development of agricultural economies and technology and was the first person in Iran to use flotation to obtain plant remains. An archaeologist, Henry Wright's broad-based interest in the early civilizations prompted him to take flotation samples (he was probably the first to measure soil volume) from Farukhabad and Sharafshad (see Wright et al. 1981). William Sumner's unceasing support of archaeobotanical research at Malayer provided the material for one of the first large-scale archaeological studies of an early city (Miller 1982). Setting the environmental scene for all this was basic work by Willem van Zeist and colleagues on pollen cores from the central Zagros mountains that documented the harsh conditions of the last Ice Age and the gradual return and spread of trees to the Zagros (van Zeist and Bottema 1977, 1991).

After a brief outline of the major vegetation zones of Iran, this chapter discusses some of the issues that archaeobotanical data are well-suited to address: human impact on the environment that accompanied the development of agricultural and pastoral economies starting about ten thousand years ago, the impact of the early civilizations on the landscape, and the spread of new crops and technologies from and to neighboring regions (figure 2.1).

All the members of the basic Near Eastern crop complexes—the wheats (emmer, einkorn, hard wheat, and bread wheat) and barleys (the two-row and hulled and naked six-row types), lentil and other pulses, and flax, whether for oil or fiber—have been grown in Iran for more than seven thousand years. With the possible exception of grape, fruit-growing began later. After the Bronze Age, we know a variety of other crops that came to Iran, such as millets, sesame, rice, cotton, and sugar cane, but the introduction of these crops is not always attested archaeobotanically (see Zohary and Hopf 1984) for overviews of the
different crops) (table 2.1). The long span of human settlement in Iran led inevitably to changes in the landscape, and this too can be traced in the archaeological record.

**PHYTOGRAPHY**

Iran can be divided into five major vegetation provinces: Caspian, Zagros, central Iranian Plateau, Khorasan, and Lur-Baluchistan (this section is based primarily on Zohary [1963]). The influence of the Mediterranean climate regime is manifested by moisture-bearing winds that predominate in the winter. Trade winds associated with high pressure are a significant factor for the extremely arid climate in most of Iran. Generally speaking, precipitation increases with altitude and decreases with latitude. Although archaeological and archaeological research has favored some regions over others, this overview is provided as background to this and subsequent chapters, and to encourage future archaeological research. A number of surveys of the climate and vegetation history in the Near East are available that include discussions of pollen and macroremains. Evidence for Iran (for example, Miller 1999a; van Zeist and Bottema 1991; Wilkox 1999).

**CAUCASIAN REGION**

The Caspian region includes the Caspian Sea lowlands and the northern mountains up to the south. The mountains rise in an east–west direction and reach a maximum elevation of 5,670 m. There is a pronounced rain shadow on the southern slopes facing the central Iranian Plateau. The coastal plain and northern slopes are favored with more than 1,000 mm annual precipitation, and the lower altitudes experience mild winters. The climax vegetation is described by Zohary (1963) as thermophilous and temperate forest. Despite the agricultural richness of this area today, there are no archaeological reports published for any site in this region. One area that may prove fruitful is the southern slopes of the Elburz, a possible route for agriculture into Turkmensia (Harris and Goudine 1996; see below).

**ZAGROS REGION**

The Zagros region incorporates the highlands of western Iran. The mountains run in a northwest–southeast direction. The rain shadow on the eastern slopes can be quite pronounced, but the western slopes are favored by winter moisture from the Mediterranean. Interposed among the 3,000–4,000 m peaks are intermontane valleys, the location of most of the settlements in this region. Precipitation varies from 200 to 1,000 mm, so dry farming can be practiced in most of the region. The dominant vegetation in the wetter north and west is xerophilous oak forest, with a general trend toward the drier south and east to a pistachio or pistacho-almond steppe–forest. Suiassia, with its cool moist winter and hot dry summer can be considered part of this region, though it lies just at the edge of the dry-farming zone. Most of the archaeological research in Iran has been done in this area.

During the last glacial period, cold, dry conditions could not support forests. In the central Zagros, pollen from Lake Zelbor shows that the vegetation was mainly cold dry steppe dominated by Artemisia and members of the Chenopodiaceae family (van Zelst and Bottema 1991). With warming in the Holocene, trees repopulated the Zagros, though vegetation change followed climate change. It took some time for oak to reach its present distribution. For example, oak had not yet reached the site of Tepe Abelux Hezam, occupied during the Neolithic (Wilkox 1990:226). Even as late as the Proto–Elamite period, small quantities of oak in the archaeological record of Malvaz may indicate its absence in a region that today is at the edge of the oak forest (Miller 1999a).

**CENTRAL IRANIAN PLATEAU**

The central Iranian Plateau, almost completely surrounded by mountain ranges, has a very continental climate. Elevations are about 300 m, though the land rises to 4,000 m in some places. Steppe and desert (including the Dashte-e Ka'is in the north and the Dashte-e Lut in the south), sand dunes, salt deserts (karras), gullies and pebble steppe are common. Some spots are unreported, due to annual precipitation that ranges from 200 mm down to 0 mm. At higher elevations there are some remnant forests, but mostly the region is characterized by Artemisia or Ammophila steppe, with sparsely wooded (sand–moist) and halophytic (salt–moist) habitats being common. Very little archaeological research has come out of this region. Tepe Yalah is at its southern edge, and Shah-i Sokhteh is on the east, but the environment there is harsh in most of the region that has never been much human occupation there.

**HORMOZIAN REGION**

The Khorasan region in northeastern Iran is an upland area that reaches an elevation of 3,000 m. Annual precipitation ranges from 100 to 500 mm. Consequently, the vegetation is primarily steppe or desert, with forest remnants in the upper elevations. The natural vegetation in much of the area would be juniper steppe–forest. Archaeobotanical remains from Hazar have been investigated—in addition to staple cereals and pulses, some native wild olive and also grape seeds were encountered (Costantini and Dyson 1990).
Helbæk used macroremains to investigate ancient farming, nutrition, ecology, and landscape change, and he recognized the importance of taking into account the archeological context of the plant remains. At Ali Koh, in the rainfall agriculture zone of Khuzestan, he found domesticated plants in the earliest levels, dating to about ten thousand years ago. They included emmer, a grain that was most likely domesticated first in the Levantine cor- region. Other material, particularly obsidian, shows that there was contact down the Taurus-Zagros arc, so the routes of contact do not require us to assume large movements of populations. The other cultivated were hulled two-row bar- ley, naked barley, lentil, and a trace of einkorn. Most remarkable, however, were large numbers in the category “endemic legumes,” clover-like plants that include *Trigonob- lus*, Trigonolobus, and Medicago, all of which are preferred forage plants in the area. Helbæk believed that the in- habitants of Ali Koh collected them to eat, and that they also ate cereal chaff, it seems more likely that many of the remains actually came from animal dung burned as fuel (Miller 1976b), or perhaps from crop processing (see Hillman 1984).

ENVIRONMENTAL CONSEQUENCES OF AGRICULTURE AND PASTORALISM Helbæk’s discussion of the Prehistoric and Human Ecol- ogy on the Deh Luran Plain project was one of the earliest to raise the question of environmental change and human impact on the landscape:

Left to itself, the terrain would have changed even if, as here presumed, it had not been modified more or less stable. Exposed to man’s exploitation, nothing would be untouched. (1969:412)

Both macroremains and pollen evidence from the early farming site of Ali Koh (Woolley and Hole 1978) suggest a decline in sedges (generally plants of moist ground), but no other evidence for moisture change; that is, there was some localized shift in drainage, but not overall climate change. In addition, the sediments evidence suggests that there was no significant change in the vegetation of the natural pasture, so the vegetation of the natural pastures changed, too. Food preservation techniques helped out even the food supply from year to year. Where practiced, irrigation stabilized and also helped increase yields, especially after the introduction of summer crops allowed two plantings annually. As the pas- toral component became a more important part of the agricultural system, whether through transhumance of some portion of a farming population or the development of specialized nomadic pastoralism, more people (and animals) could be supported on the land, and the potential for overuse was realized—evidence for several kinds of land degrada- tion appears on the archaeological record: lower quality pastures and deforestation (apparent at Ali Koh, see above, and at Malan, see below).

The archaeobotanical record is particularly thin at the end of the Holocene and does not really pick up again until the fourth millennium in the Kirk river basin of Fars, at Malan, and to a lesser extent in Khuzestan in Susiana and Deh Luran. William Sumner documented the long settlement history of the Kirk river basin (Sumner 1972). The excavations he directed at Malan during the 1970s yielded archaeobotanical evidence of environment and land use primarily during Bimash (1400–2800 BCE) and Kaftar (2400–1600 BCE) times (Miller 1982, 1984, 1985). Despite the several hundred year gap in settlement in the middle of the third millennium, the settlement sur- vey allows us to imagine some of the influences on the landscape that go beyond the evidence from the Malan excavation. In particular, Malan started out as a small center, in a valley characterized by a relatively low popula- tion density, in the Kaftar phase, Malan had grown to a maximum extent and served or exploited, depending on your point of view; a populous hinterland. On these grounds alone, one might expect the archaeobotanical record to show changes in the landscape and land use pattern, and indeed it does. In particular, woodland char-coal suggests that Malan was established in the zone of pistachio-almond forest, which at the time also had ju- niper. In the Kaftar phase, under conditions of higher population density and correspondingly higher demand for agricultural products and fuel, this nearby forest was thinned, and the somewhat more distant (20 km or so) oak forest was tamped for more fuel. Ethnoarchaeological work at Malan established the likelihood that many chaff-encrusted seeds on Near Eastern archaeozoological sites originated in dung fuel; it is sufficient to note here that the argument was supported by a large increase in the proportion of seeds to charcoal that corresponded to the proposed deforestation.

The Khorasanian does not allow the same sort of discussion, at least not yet, as samples are fewer and smaller. Almost any generalization one makes could be overruled with the analysis of relatively few additional samples. Nevertheless, there do seem to be some small differences between Farahabadi on the Deh Luran plain and Shahrabadi and Susa in Susiana that may reflect differ- ences between rain-fed and irrigation agriculture, in terms of crop choice for people and fodder for animals.

For example, Farahabadi and other Deh Luran assem- blages generally have more small-seeded legumes, while lentil is relatively more common in Susiana (Miller 1981a, 1981b, and unpublished laboratory notes).

NEW TECHNOLOGIES, NEW CROPS As agriculture replaced the foraging way of life, new farm- ing practices and new processing techniques were employed. When we find evidence for new crops in archeobotanical assemblages they may reflect new tech- nologies as well.

BRIGITTON On the Deh Luran plain, irrigation improves crop sec- rity and productivity. The earliest farmers did not irrigate, but Helbæk (1969) suggested several indicators of irriga- tion at sixth-to-millennium Tepe Sabi. Where Ali Koh had a few basil seeds that were similar in size to the wild type, Sabi had larger ones comparable to later archaeological examples known to have been irrigated. An overall increase in the amount of six-row barley, which generally requires more water than the two-row type, suggested irrigation, as did a single splitkerte fragment and a grain of free-thresh- ing wheat. These three crops appear to have been domesticated earlier elsewhere, but there is no need to propose newcomers to the region brought the crops—they could have spread through a series of local trade contacts along the edge of the Zagros Forest.

In the Zagros region and northern Khuzestan, irriga- tion is an option that reduces risk and improves yields. In lowland Susiana and the arid interior where rainfall is un- der 250 mm per year, agriculture cannot be practiced without it. We can infer irrigation at Shah-i Solotika from an increase in the size of basil seeds (Costantini 1977). Costantini found a similar assemblage in earlier levels at Tepe Yahyâ, also located in a very arid region where irriga- tion was practiced (Lamborg-Kordovsky and Tosi 1989). The very small size of orchard-grass seeds found both at Shah-i Solotika and Tepe Yahyâ are further indicators of irrigation (see Miller 1999).

FERMENTATION Although the primary reason people consumed fermented beverages may well have been for their psychotropic ef- fects, fermentation has nutritional and storage consequences as well. Wine, for example, extends the avail- ability of grapes (raisins do, too). It would be hard to distinguish intentional production of vinegar in the ar- cheological record because it is a pickling agent as well as evidence that wine has spoiled. As of this writing, the
earliest evidence for wine production has come not from microremains but from residues of grape wine retained with trebiči pančko in a pottery vessel found at the Neolithic site of Hajji Firuz in northwestern Iran (McGovern et al. 1996). The site lies within the range of wild grape, so we do not know if the grapes fermented were cultivated. In the Near East generally, and Iran in particular, large numbers of grape seeds do not appear until the third millennium BCE. It is not possible to distinguish wild (Vitis vinifera subsp. altaica) and domesticated (V. v. subsp. vinifera) grape based on shape, but Helmut Knoll (1999) observes that it is only in the domesticated variety that underdeveloped seeds occur in the ripe fruit.

This criterion is new, so older reports do not mention whether underdeveloped grape seeds were encountered. It is nonetheless probable that vines were coming under cultivation during the fourth millennium. At Maljan, for example, there are a few Banash grape seeds, but quite a bit more in the Kafsh phase, including a few burled mineralized ones from a late Iron I deposit (Miller 1982). Many grape seeds were found at Shahr-i Sokhta, which is a further indication that grape cultivation had become widespread by the third millennium (Costantini 1977). Wood of the vine would be hard to cut, so its presence may best be interpreted as trimmings from cultivated plants. Never common, the first appearance of grape wood fragments at Maljan (Miller 1982) and Mehr加班, Pakino (Tish establish) 1997,) dates to the middle to third millennium, further supporting the view that significant grape cultivation is a relatively late phenomenon.

Once began, the tradition of wine-making was never lost, judging from residual analysis on some jar sherds from fourth millennium levels at Godin. By about 3500 BCE, people were drinking beer there, too (Michal et al. 1993). In contrast to grapes, which can ferment naturally from yeasts that grow on the fruit, barley beer has a more complex manufacturing process that involves sprouting the barley to create the malt on which the yeasts work.

SUMMER CROPS: MILLET, BCE, SESAME. The dry summers that prevail over most of Iran do not permit summer cropping without some form of irrigation. Several exotic crops probably arrived in western Iran as domestics. For example, Lorenzo Costantini reported the surprising presence of brome-millet (Avena milletum) as early as the fifth millennium BCE at Tepe Yahya (Lunberg-Karlberg and Tosi 1989), along with some Patois. The presumed homeland of the wild ancestors of both these food plants is Central Asia (Zohary and Hopf 2000). The earliest really secure evidence of brome-millet as a crop, however, comes from Haftaran (1900–1550 BCE) in northwestern Iran (Nesbitt and Summers 1983), and the best evidence for Patois is dates to about the same time and comes from Jorobat in Uzbekistan (Miller 1999). Assuming the identifications to species hold up, the geographically and temporally isolated Yahya finds may be evidence of trade rather than the spread of the cultivation of those crops. Rice from Peshin period (about 2.0 BCE–22 CE) deposits at the Ville Royale II excavation at Susa is the earliest attested to date for the Near East (Miller 1981b). Whether by sea or overland, rice must have arrived in Iran from south or east Asia, but it is difficult to trace, as there are no reports from coastal sites and few from the interior. Sesame, which may have been originally domesticated in India, first appears in the archaeobotanical record of Iran in Iron Age Bastam (Hof and Willerdig 1989).

QUESTIONS AND CHALLENGES FOR ARCHAEOBOTANY IN IRAN. At this point, the single most important goal for archaeobotanical research in Iran must be continued documentation for all regions to trace changes in landscape and land use. Of particular interest is the spread of agriculture and the history of individual crops.

THE SPREAD OF AGRICULTURE BEYOND IRAN. The Near Eastern crop complexes, which developed and spread over much of southwest Asia during the PPNB, was adopted by people in neighboring regions. Wheat and barley occur as early as the seventh millennium BCE at Mehr加班 in Pakistan (Costantini and Costantini–Biari 1953), Alqalin, a Neolithic site in the Tunasistan, connections based on material culture can be traced along the Cause. The Carpathian coast or the northern edge of the Irans Plateau along the Elburz mountains (Harris and Goden 1996), but einkorn is the main crop plant (Harris et al. 1996). It is hard to imagine that einkorn, having evolved in Asia, would thrive in the semi-arid Carpathian lowland forest. Therefore, based on the plant evidence, perhaps the southern route is the more likely. Excavation of suitable sites in both regions would certainly help answer this question.

ORIGIN AND SPREAD OF BREAD WHEAT. Hexaploid bread wheat (Triticum aestivum) evolved after initial wheat domestication. It has the genes of a tetraploid domesticated emmer, Triticum dicoccum, and a diploid wild type, Triticum uratocum. It could not have evolved until people brought the domesticated wheat into contact with the wild einkorn, most probably southwest of