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Landscape and Cityscape in the Ḥisma: The Resources of Ancient Al-Ḥumayma

The site of al-Ḥumayma, ancient Hawar or Auara, was the major Nabataean, Roman, Byzantine, and early Islamic centre in the Ḥisma, Jordan's southern desert.[1] The ruins of the settlement, approximately 10 ha in area, are at an elevation of 955 m on the east slope of some rugged sandstone hills between the Jabal al-Qalkha and Jabal al-Ḥumayma 3 km east of the Wādī 'Arabah. The site dominates the west edge of a rolling plane framed on the east and north by white sandstone hills. Precipitation in the region averages only 80 mm/year, but the lowland plain is watered as well by the winter rains that run off the ash-Sharā escarpment, which forms the dramatic north boundary of the roughly triangular catchment basin, 240 km^2 in area. The Wādī al-Qalkha carries run-off water past the site.

Despite the very arid environment, this site flourished for 800 years, relying as much on local resources as on the profits of trade and passing caravans. The loessal soil in the plains is sandy and light, but suitable for grain production. The precipitation, although meager in local terms, could be concentrated by directing the run-off from the surrounding sandstone hills into fields, or by storing it up in cisterns and reservoirs. Many wild species of plants were available for food, medicine, fodder, and fuel, and a prolific stock of wild species of mammals, birds, and reptiles was subject to exploitation. The environment also supported a remarkable variety of domesticated animals. We will consider these four natural resources of the environment of al-Ḥumayma in turn, and their interaction with the human history of the site: the manipulation of the water resources by the population of Hawar, the potential fertility of the soil, and the patterns of exploitation of wild and domesticated species of plants and of animals. This approach will allow an estimate of the bearing capacity of the catchment area in antiquity and the effect of human occupation on the natural environment.

History of Hawar

According to Ouranios's *Arabika* (*FGrH* 675 frag. A.1.b) Auara (the Greek transliteration of Nabataean Hawar) was founded by the Nabataean king Aretas III (87-62 BC) in response to an oracle.[2] Nothing is known of the early history of the settlement, but an extensive water-supply system was built in the early years, probably to attract settlers, caravans, and a market. Early and Middle Nabataean ceramics are found at the site. Trajan's *Via Nova*, built along the course of a pre-existing Nabataean north/south road, passed through or very close to the settlement, and archaeological and literary evidence indicate that Hawar flourished in the Late Roman, Byzantine, Umayyad, and early Abbasid periods. Ptolemy includes Αὔαρα in his list of towns in Arabia Petraea (*Geography* 5.16.4), and Stephanus Byzantinus provides the alternate name Αὔαθα. The site was included in the source for the Peutinger Table, perhaps Agrippa's map of the empire in Rome, and the *Notitia Dignitatum* (*Or.* 34.25) records the presence of a unit of *equites sagittarii indigenae* at Hauare (Hauanae, Havarra). A fort was built at the north edge of the site in the second century AC. According to the contemporary Beersheba Edict, the governor of Palestina Tertia assessed Hawar the highest sum of any settlement in Transjordan, just after the Roman fort at present-day Udhruḥ. Hawar continued to flourish in the early Islamic period under the name al-Ḥumayma, and soon after 687/8, 'Ali ibn 'Abd

[1] The Project Director is J. P. Oleson, University of Victoria. Co-Directors are K. 'Amr, Department of Antiquities of Jordan, R. Schick, Albright Institute, and R. Foote, Harvard University. The project has been funded by the Social Sciences and Humanities Research Council of Canada, Taggart Foundation, Van Berchem Foundation, and the American Schools of Oriental Research. For recent reports and full bibliography, see J. P. Oleson, 'The Water-Supply System of Ancient Auara: Preliminary Results of the Humeima Hydraulic Survey'. Pp.269-275 in *SHAJ* IV. Amman: Department of Antiquities, 1992; J. P. Oleson, K. 'Amr, and R. Schick, 'The Humeima Excavation Project, Jordan: Preliminary Report of the 1991-1992 Seasons'. *ADAJ* 37 (1993) 461-502; J. P. Oleson, K. 'Amr, R. Foote, and R. Schick, 'The Humeima Excavation Project, Jordan: Preliminary Report of the 1993 Season', *Classical Views/Echos du monde classique* 13 (1994) 141-79; J. P. Oleson, K. 'Amr, and R. Schick,' Preliminary Report of the Humeima Excavation Project, 1993,'*ADAJ* 39 (1995) 317-354. For the ancient name of Humeima, see now D. Graf, 'The 'God' of Humayma.' Pp. 67-76 in Z.J. Kapera, ed., *Intertestamental Studies in Honour of Józef Tadeusz Milik* Kraków: Enigma Press, 1992. The text of this presentation was adapted in part from technical reports by M.J. Goldstein on soil, C. Thomas Shay, M. Kapinga and C. Jorgenson on botanical remains, K. Riley on the 1987-89 faunal remains, L. Quintero on the 1991 faunal remains, and M. Finnegan and R. Lane on the 1995 faunal remains. Those authors are not responsible for any errors I may have introduced while editing their text and tables and interpreting their reports for this publication.

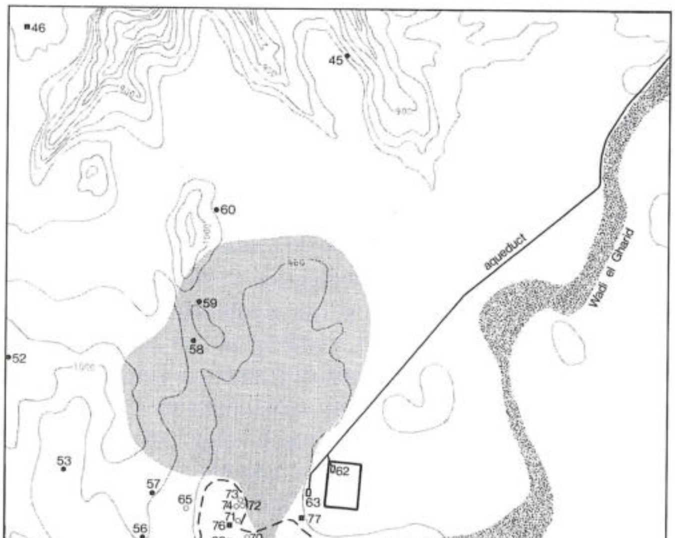
[2] For the history of the site, see especially J.P. Oleson, and J. Eadie, 'The Water-Supply Systems of Nabataean and Roman Humayma,' *BASOR* 262 (1986) 49-76.

Allah ibn al-'Abbās purchased the town, which became a centre for the Abbasid family's revolt against the Umayyad dynasty. The family built a fortified house at the site which has been identified by our excavation. Ceramic evidence shows the virtual cessation of habitation after the mid-eighth century, but there are traces of light, intermittent occupation through the Ottoman period.

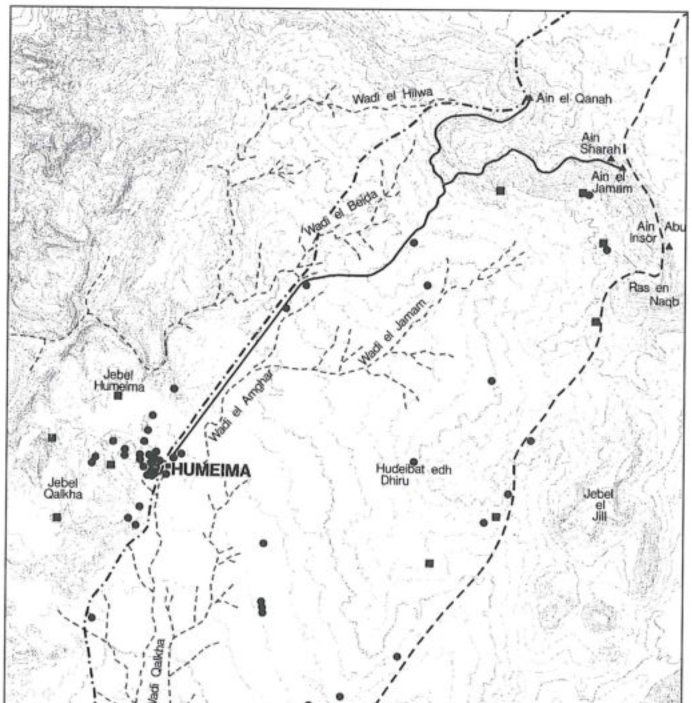
Water Resources

Since the water-supply system of Hawar is presented in detail elsewhere, its characteristics will only be summarized here.[3] Soon after the foundation of Hawar, an aqueduct of traditional Nabataean design (a ground-level, roofed conduit of stone gutter blocks) was built to carry water 26.5 km from 'Ayn Ghāna, 'Ayn Jammām, and 'Ayn ash-Sharā to an open reservoir with a capacity of 633.4 m at the north end of the site. The flow was approximately 6.192 m^3/hour. A reservoir with a capacity of 1273.3 m^3, also served by the aqueduct, was later built inside the Roman fort. The habitation centre was served as well by a pair of large, rectangular, roofed reservoirs with a total capacity of 933.1 m^3, fed by run-off water from a catchment to the north of the settlement area. There were also at least 13 smaller cisterns associated with nearby houses, fed by the same run-off field, and with a collective total capacity of 1444.5 m^3. Dots on FIG.1 indicate the location of these structures. Finally, there were at least 41 rock-cut and built cisterns, with a total capacity of 3766 m^3, in the rocky foothills around the plain of Hawar, and a dam which created a pool of approximately 1000 m^3. The system also included several wadi barriers and carefully modified run-off fields which were intended to harvest water for storage in the soil rather than in basins. Dots on FIG. 2 indicate the location of these structures.

Although only a few of the cisterns have been dated through excavation – to the first two centuries of Hawar's existence – the technique of stone-working and construction, and the chronology of the site's development, suggest that all but one of the cisterns (which seems to be Umayyad in date) belong to the Nabataean/Roman period. Furthermore, the importance of stored water to survival in such an arid environment suggests that cisterns must have been built early on, and that – once built – they would have been maintained and used until the abandonment of the site. In fact, most of the ancient cisterns in the region are still in use today. Assuming, then, that all of these facilities were in use at once and were filled to capacity, the total supply of stored water in the habitation centre would have been 4284.3 m^3. To this can be added the 6.2 m^3/hour supplied by the aqueduct. In addition, the cisterns and dammed pool farther off in the countryside



1. Al-Ḥumayma: Schematic plan of ancient remains, with indication of water-supply structures.



2. Map: Catchment area of ancient al-Ḥumayma, with indication of water-supply structures.

[3] The water-supply system is discussed in J.P. Oleson, 'Aqueducts, Cisterns, and the Strategy of Water Supply at Nabataean and Roman Auara (Jordan). Pp. 45-62 in A. Trevor Hodge, ed., *Future Currents in Aqueduct Studies.* Leeds: Francis Cairns, 1991 and *idem*, 'The Origins and Design of Nabataean Water-Supply Systems.' Pp. 707-19 in *SHAJ* V Amman: Department of Antiquities, 1995.

had a capacity of 4766 m^3. The total regional amount of water that could be stored once all the cisterns and reservoirs had been built was 9050.3 m^3.

A reasonable figure for the minimum daily personal water requirement for drinking, cooking, and washing at ancient Hawar is 8.0 lt.[4] If we assume that the run-off water in the cisterns in the habitation centre was intended entirely for human consumption, and that the system was designed with a safety margin of 100% (i.e. that the inhabitants counted on the cisterns being filled only every second year), the 4284.3 m^3 stored there could have supported a population of approximately 734 souls. If we assume that up to half the water in the two central, public cisterns was used to water animals, the population figure would be 654. As for livestock, camels require approximately 5.0 lt/day when eating dry fodder, goats or sheep 3.0 lt/day.[5] If we assume that the herds were composed of 10% camels and 90% goats and sheep, we get the figures of 20 camels and 180 ovicaprids supported by a 50% share of the water in the two public cisterns.[6] If we assume that 80% of the water in the cisterns and pool outside the settlement centre was intended for livestock — since the human population was undoubtedly more thinly scattered in the countryside — that there was a safety margin of 100% (although in fact many animals most likely were slaughtered in times of drought because of the problem of finding fodder), and that the proportion of camels, sheep and goats was the same as in the settlement centre, we get the following figures: 163 persons, 163 camels, 1469 ovicaprids. The combined regional total is 817 persons, 183 camels, and 1649 ovicaprids. The combined regional population density reconstructed above is 3.4 persons/km^2, the urban density 146.8 persons/km^2, the suburban density 1.4 persons/km^2. All of these figures, of course, are highly hypothetical, but they give an idea of the very significant carrying capacity of this arid landscape with regard to water supply. In fact, it is likely that many families moved from the rural sandstone hills to the settlement and back again many times in the course of a year.

Soil Resources

The basin east of al-Ḥumayma stretching for 25 km to north and south, is filled with light, very sandy, loessal soil, for the most part apparently carried in by wind in the Pleistocene period and deposited in a fossil lake bottom.[7] Today the bedouin plant wheat and barley in fields that have been watered by the run-off from the winter rains. The location and extent of the run-off determines the location of the cultivated areas. Four samples of soil from fields in the centre of al-Ḥumayma and in the immediate vicinity were analyzed.[8]

Sample 1: Surface of field, 50 m west of the Roman bath (site E077).

Sample 2: Surface of field between Lower Church (C101) and site no. 054.

Sample 3: Surface of field at very north edge of settlement centre catchment, at approach to site no. 045.

Sample 4: Surface of field 1 km east of watch-tower just east of al-Ḥumayma.

The chemical properties of the four soil samples were very similar (see TABLE 1). The analysis indicated that the general agricultural potential of the soil is surprisingly high for a desert area. The pH is slightly alkaline (soils with pHs over 8.5 are said to be "alkali"). Most grain plants would perform sufficiently well at a pH of 8. Electrical conductivity (EC) is a measure of the soluble salts in the soil. In many desert regions salt is the major impediment to agriculture. While an EC of 1 mS/cm^3 in Sample 3 is slightly high, salts are not a major problem below an EC of 4. Soils are said to be "saline" at an EC of over 4. The EC would in any case be lowered by the localized soaking which preceded sowing, according to the agricultural method practiced in this region.

In addition to total salts, excess sodium (Na) is a problem in many desert areas. Exchangeable sodium is less than 1 milli-equivalents per 100 grams (meg/100gm) in all the al-Ḥumayma samples. This figure represents less than a 1/10 of the cation exchange capacity, resulting in an exchangeable sodium percentage (ESP) of less than 2%. This level is good for agriculture. Soil with ESPs exceeding 15% are termed "sodic" and cause major problems for agricultural production.

With regard to plant nutrients, available calcium and magnesium in all four samples are high, but in balance. Available potassium is also high. Nitrogen and phosphorus, however, are both low. Phosphorus is especially low, reaching a maximum of only 7 ppm, a level which would result in low grain yields for the ancient farmer.

Since most virgin, arid soils would be substantially higher in phosphorus (possibly 20 times higher), it is possible that the available phosphorus at al-Ḥumayma has

4 Estimates of human water needs vary significantly, but this figure seems a useful middle-of-the-road estimate. For further discussion, see S.E. Helms, 'Paleo-Beduin and Transmigrant Urbanism.' Pp. 97-113 in *SHAJ* I Amman: Department of Antiquities; 1982 *idem*, *Jawa* London: Methuen, 1981. 188-89; B. de Vries, 'The el-Lejjun Water System.' Pp. 399-428 in S. Thomas Parker ed., *The Roman Frontier in Central Jordan* , I. Oxford: BAR, Intl. Ser. 340, 1987.

5 See works cited in n. 4.

6 All of these figures, of course, are hypothetical, but at least they give a possible picture of the human and animal occupation of the site. It is interesting to note that the 1273 m^3 of water stored in the reservoir in the Roman fort would have been sufficient to support 436 men for one year, approximately equal to the size of the auxiliary detachment likely to have been stationed there; see S.T. Parker, *Romans and Saracens: A History of the Arabian Frontier.* Winona Lake: Eisenbrauns, 1986, 105. This figure does not, of course, allow for the watering of any military livestock. Since this reservoir was filled by the aqueduct, it was not necessary to allow for a safety margin against atypical rainfall patterns.

7 There is an excellent review of topography and soil in D.O.Henry, 'Topographic Influences on Epipaleolithic Land-use Patterns in Southern Jordan.' Pp. 21-27 in *SHAJ* III. Amman: Department. of Antiquities, 1987. The evolution of the landscape is discussed in G. Osborne and J.M. Duford, 'Geomorphological Processes in the Inselberg Region of South-Western Jordan.' *PEQ* 113 (1981) 1-17; see also F. Bender, *Geology of Jordan* Berlin: Borntraeger, 1974, 20-1, 188-93.

8 The analysis was carried out by Soilcon Laboratories of Richmond B.C.

been depleted by agricultural activity in antiquity. The normal cure for low phosphorus and nitrogen is the addition of organic matter, manure in particular. The present-day farmers at the site do not seem to make intentional use of manure as part of their agricultural regimen, and the situation was probably similar in antiquity. Because of the sparse vegetation, the livestock is grazed over a wide area, resulting in scattering of the manure thinly over a region for the most part unsuitable for agricultural production. Furthermore, the aridity of the climate does not foster the decay of manure or vegetation and the formation of humus. Dung and dead vegetation simply dehydrate, are reduced to a powder, and blow away. Even if manure were carried from corrals or campsites to a field likely to be watered by rain and run-off, it would not enrich the soil before the rain arrived.

Cation exchange capacity (CEC) is a measure of the ability of soils to store available nutrients such as potassium, calcium, and magnesium. The CECs of all the al-Ḥumayma samples are fairly high for the texture and age of soil and would be adequate for agriculture.

The physical properties of the soil samples are more variable. Sample 1 is loam in texture and has excellent physical properties, including an available water storage capacity (AWSC) of 13%. Sample 2 is a sandy loam, with an AWSC of only 1.8%. This soil would be very droughty for grain production based on water storage in the soil before sowing. Sample 3 falls between samples 1 and 2 in water storage capacity. Since soil physical properties are longer lived than chemical properties, the ancient farmers probably faced the same limited water storage capacities the soils now possess.

Wild and Cultivated Plant Resources

The al-Ḥumayma area embraces at least four major vegetation units belonging to several geobotanical regions. These units include desert, desert savanna steppe (grassland) and steppe-maquis (Mediterranean-type shrub).[9] Although the desert vegetation includes mostly annuals, it is characterized by several types of shrubs (e.g., *Anabasis articulata, Hammada salicorica*). Groves of trees, such as *Acacia tortilis*, can be found in areas where there is sufficient soil moisture for tree growth. The steppe vegetation is characterized by the shrub *Artemisia herba-alba*. These vegetation units all have floral affinities to the east and south in the Arabian Peninsula and beyond. The Mediterranean steppe-maquis is a mixture of grassland and shrub that contains species more typical of the Mediterranean basin.

Flotation samples from 40 loci have been analyzed so far (another 100 are still undergoing processing). They came from four locations: the Late Roman bath building (E077); the Byzantine Lower Church (C101); an Umayyad/Early Abbasid house or market complex built on top of a Byzantine church (B100); and an Umayyad house built on top of a Byzantine church and a Nabataean or Roman structure adjacent to a Nabataean-type cistern (F102) (TABLES 2-4). The samples derive from various contexts including occupation level, fire pit, dump, midden, destruction level, collapse and fill. They were associated with such materials as iron, copper, glass, ceramics, plaster, stone, bone and ash. The estimated dates for the samples range from the fifth to eighth century AC with the majority spanning the seventh century.

The samples contained 633 seeds; 611.5 were charred and 21.5 were uncharred. The uncharred seeds (TABLE 3) are considered recent intrusions. Of the charred seeds (TABLE 2), 10.2% or 61.5 belonged to domesticated plants such as cereals, tree crops, vines and other fruits. These were, in order of abundance, six-rowed barley (*Hordeum vulgare*), fig (*Ficus* sp.), unidentified grass family species (*Gramineae*), date (*Phoenix dactylifera*), bread wheat (*Triticum aestivum*), olive (*Olea europaea*), grape (*Vitis vinifera*), chick pea (*Cicer arietinum*), fig (cf. *Ficus* sp.) and unidentified wheat (*Triticum* sp.). Most of the domesticates were found in relatively few samples. The more frequent domesticates were barley, found in 12.5% of the samples, fig in 12.5%, unidentified grass family species in 7.5%, and date in 7.5%. Each of the remaining domesticates was found in only 2.5% of the samples (TABLE 2).

Over 30 types of wild plant seeds were identified (TABLE 2). The nine with percentages of more than 1% were white broom (*Retama raetam*), plantain (*Plantago* sp.), chickweed (*Cerastium* sp.) sea-blite (*Suaeda* sp.), common peganum (*Peganum harmala*), medick (*Medicago scutellata*) and unidentified members of the pink (Caryophyllaceae), legume (Leguminosae) and goosefoot (Chenopodiaceae) families. These wild seed types were more frequent in the samples (2.5 to 22.5%) than most of the domesticates.

The interpretation of past plant uses depends upon factors such as the preserving conditions, which part of the plant was used and how it was prepared. Some reconstructions of uses of the species identified at al-Ḥumayma are summarized in TABLE 4. There is a good mix of grain foods, vegetables, herbs, and oil seeds.

The only way that plant remains can be preserved for any length of time in soils which are subject to alternating wet and dry cycles is through charring or mineralization. The probability of a plant food becoming charred is dictated by its structure and the way in which it is processed. Few plant foods are likely to become charred during preparation other than cereal grains that are parched or roasted over a fire. With this qualification in mind it is possible to offer some insights into the ancient vegetation, agricultural economy, and uses of wild plants of the Hawar area, particularly during Byzantine times.

9 See M. Zohary, *Plant Life of Palestine, Israel and Jordan*. New York: Ronald Press, 1962.

Archaeological, geological, and botanical evidence all suggest that the local climate and vegetation of this arid area in Byzantine times were similar to those.[10] A number of the seed types from the site today can be referred to the communities within deserts and grasslands, although many could also be found in disturbed ground.

Although the desert vegetation includes mostly annual plants such as those belonging to the pink and legume families, it is characterized by several types of shrubs. In sandy areas, these would have included white broom, the seeds of which were numerous in the al-Ḥumayma flotation samples and perhaps shrubby species of milk-vetch. Saline depressions would have supported salt-tolerant species of sea-blite. The Mesopotamian grassland steppe is represented among the seeds by grasses such as rye grass and Bermuda grass. This type of plant community would also have included annuals and scattered shrubs.

Many of the seed types belong to plants characteristic of disturbed ground, such as that found along roadsides and trails, fields and pastures, and areas within the settlement. Considering the fact that Hawar was located on a caravan route and that both travelers and the local pastoral inhabitants probably established temporary tent camps in the area, it is not surprising that many of the seed types belong to plants of disturbed ground. These plants include chickweed, plantain, common peganum, medick, trigonel, poppy, scorpion vetch, goosefoot, bedstraw, pigweed and fumitory.

The domesticates found at al-Ḥumayma include the traditional crops of cereals, legumes, olives, grapes, figs and dates. These have been part of the Near Eastern crop complex since at least the Bronze Age. It is not known, however, whether all these crops were grown locally or brought in by caravan. Arabic sources mention a grove of 500 olive trees at the site around AD 700,[11] and olive, fig, and apple trees are successfully cultivated by one of the landowners at the site today. The wild watermelon seed found may have come from a plant that was cultivated locally.

The wild seeds found at al-Ḥumayma may have come from several sources. They could be from plants that grew in the settlement area itself, or they could have been brought to it with such things as fodder, fuel or manure. The seeds of white broom, for example, could have been carried in on shrubs used as fuel. Fuel was certainly an important application of local plants. The Romans even heated the hot bath with a local shrub (*Haloxylon articulatum*, also called *Hammada salicorica*) still used by the bedouin today to boil their tea water.[12]

Some of the wild plants found undoubtedly were brought to the site intentionally by the ancient inhabitants of Hawar for use as food or medicine or both (TABLE 4). Trigonel, coronilla, poppy and lolium are today used for fodder. White broom, common peganum, milk-vetch, watermelon, plantain, bedstraw, pigweed, poppy, chickweed, medick, goosefoot, and coronilla are eaten or are useful in medicine.

Archaeological research in the region of Ḥumayma has shown that over the long span of its existence, the people settled at Hawar depended on a mixed regime of graingrowing and pastoralism, supplemented by trade and military activities. Analysis of the botanical remains indicate that the inhabitants made excellent use of local soil for growing domesticated grains and fruits, and that they harvested wild species as well. The main crops grown in the fields around the town were barley, wheat, and chickpeas, possibly supplemented by figs, dates, and grapes. We cannot yet tell, however, if the seeds of the last three domesticates were produced locally or imported. Barley, fig, and date predominate in the samples. In antiquity as today, there was probably significant production of wheat and barley in the fields around Ḥumayma. During the winter, while the grain crops were growing, the livestock would be grazed in the rocky highlands surrounding the Ḥumayma basin, where the rains had refreshed the landscape. During the summer, after the grain had been harvested, the flocks would be grazed on any stubble left in the fields, or fed on the whole, uprooted grasses left after threshing. Both procedures are followed today. It is clear from analysis of flotation samples from the habitation area that there was also great reliance on wild species used for food or medicine (white broom, common paganum, milk-vetch, watermelon, plantain, bedstraw, pigweed, poppy, chickweed, medick, goosefoot, and coronilla), or for fodder (trigonel, coronilla, poppy, lolium).

Wild and Domesticated Animal Resources

The landscape around Hawar was heavily used for grazing as well as for drought farming. Analysis of the bones found in the 1989, 1991-93 and 1995 seasons is nearly complete, but the overall summary of the statistics was not available at the time this paper had to go to press. As might be expected, sheep and goat predominate among the remains of domesticated mammals, along with camel, equid, pig, cow, and dog. Among birds, chicken, dove, and raven are found, along with numerous ostrich eggs. Wild mammals include gazelle, mountain lion, hare, rodents (probably gerbils and jerboas), and possibly boar.

[10] D.O.Henry, 'An Investigation of the Prehistory of Southern Jordan.' *PEQ* 115 (1983) 1-24; N. Shehadeh, 'The Climate of Jordan in the Past and Present.'Pp. 25-37 in *SHAJ* II. Amman: Department of Antiquities, 1985; R. Rehav, 'The Debate over Climatic Changes in the Negev, Fourth-Seventh Centuries C.E.' *PEQ* 121 (1989) 71-78.

[11] Upon purchasing al-Ḥumayma, Ali ibn Abd Allah built a *qaṣr* with a garden there; in'Abd al Aziz al-Duri, 'Abd al-Jabbar al-Mutallabi, eds., *Akhbar ad-Dawla al-Abasiyya.* Beirut: 1971,107, 108, 149, 154; Abu 'Ubayd al-Bakri, *Mu'jam ma Ista'jama min Asma' al-Buldan wa al-Mawadi'*. Cairo: 1945-51, 130. Balâdhurî tells us that 'Ali was noted for his piety and that he prayed two rak'as each day in front of each of his 500 olive trees and 500 rak'as each day in his mosque; Abu al-Hasan Ahmad ibn Yahya al-Balâdhurî, ed., *Ansâb al-Ashrâf*, 3: *'Abd al-'Azîz al-Dûrî*. Wiesbaden: 1978 iii, 75.

[12] J.P. Oleson, 'Humeima Hydraulic Survey, 1989:Preliminary Field Report.' *ADAJ* 34 (1990) 305.

It was interesting to discover that large quantities of fish were imported: mullet and sea bream from the Red Sea, and Nile perch, probably from lagoons in the 'Aqaba area. Fresh oysters and conch were imported from 'Aqaba as well, in the shell. The results presented here are still tentative, particularly with regard to changes in use of animals over time, since the chronological information has not yet been entered. The tables do not go beyond genus identification for many of the categories, and the identification of fish species remains to be verified. The statistics below are based for the most part on material recovered in the 1995 season, summarized on TABLE 7, but with reference to the data from the 1987-1991 seasons that still has to be incorporated (TABLES 5-6).

Excavation of five areas at al-Ḥumayma in 1995 resulted in the recovery of 7851 animal bones and bone fragments. The bones were dry-brushed, washed when necessary, and separated into generalized categories such as large, medium, or small mammals, fish, and birds, etc. Bones possessing diagnostic morphologic features were further identified, when possible, to family, genus, and species.[13] All bones were examined for butcher marks, spalls, rodent or carnivore gnawing, and evidence of burning. Worked bone or bone tools, separated from the assemblage, were washed, repaired, and registered.

Predominantly, the recovered bone was in a good to excellent state of preservation, but due to breakage and fragmentation, it was often in a poor condition with respect to identification. Of the recovered bones, 2.80% were so badly broken that they could not be classified, and are listed as undetermined bone (TABLE 7). Bones of a certain size and thickness, but lacking specific morphologic features, could only be classified in general categories: large, medium, and small mammals (these categories were responsible for 73.66% of all recovered bone). Bones belonging to the large mammal category (3.40% of the total assemblage) probably represent the cow (*Bos*) and the horse or donkey (*Equus*). Bones belonging to the medium mammal category (69.19% of the total assemblage) undoubtedly represent non-diagnostic fragments of sheep (*Ovis*) and goats (*Capra*), although the bones of wild ungulates may be represented as well. Bones within the non-diagnostic small mammal category (1.07% of the total assemblage) belong to rabbits, cats and the smaller rodents. These percentages are in line with the identified mammal categories, where domesticated sheep and goats form the largest percentage of identified remains (30.57%), followed by domestic chicken (*Gallus*) (22.84%) and domestic pig (*Sus*) (19.89%)(TABLE 7). These trends correspond well with the initial, rough analysis data recovered from the 1992 and 1993 field seasons at Ḥumayma. The corresponding statistics for 1987-1991 are somewhat different: ovicaprids 35.05% of the identified species, bird (probably mostly domestic chicken) 4.47%, and domestic pig only 0.69%.

Many of the diagnostic sheep/goat, pig and cattle bones from the 1993-1995 seasons showed evidence of spalls, or green bone fractures. These fracture types generally occur during the butchering process of the animal, when heavy blows are delivered against the shafts of long bones of the axial skeleton with a sharp tool not unlike a cleaver. The majority of sheep/goat, pig and cattle bone fragments and spalls recovered from the site were autopodia, metapodials, phalanges, and hoof cores – bones associated with the lower, non-meat bearing portions of the legs. Very likely, one of the first steps in the process of butchering sheep and goats, pigs and cattle involved removing the lower legs in the region of the articulation between radius and tibia and their associated autopodia. These disarticulated leg bones were undoubtedly discarded as the meat bearing portions of the carcass were further processed.

In the 1995 collection, identified sheep outnumber identified goat by a slight but significant margin: 5.45% to 4.09% (13.60% and 10.20% of the sheep, goat, and ovicaprids taken together) — a ratio which can be seen at some earlier sites in Jordan.[14] The slightly larger proportion of sheep over the hardier goats might be taken to suggest that a more lush grazing environment was available for these animals at Ḥumayma during the occupation layers that produced these remains. It should be noted, however, that the preliminary statistics from the earlier seasons give a very different result (TABLE 6), the goats constituting 2.56% of all identified species, and sheep only 0.73% (6.67% and 1.90% of the sheep, goat and ovicaprids taken together). Discrepancies such as this can be the accidental result of the sampling or analysis, or may indicate chronological differences in herding practices, or even reflect the location of butchering areas.

The 1995 excavations indicate that the chicken (*Gallus gallus*) also formed an important part of the diet at the Ḥumayma site (22.84%) (TABLES 6-7), particularly as compared with earlier sites in Jordan.[15] Chicken accounts for more of the faunal remains than do pig (19.89%) and either sheep or goats singularly (but not combined) and must be counted with the population's meat preference along with sheep, goats, pigs and cattle. The domesticated horse and donkey, beasts of burden and at the same time a secondary meat source, were recovered in moderate numbers (4.32% combined) during the 1995 field sea-

[13] Without the aid of a comparative collection in the field laboratory, the following sources were useful in the identification process: J. Boessneck, 'Osteological Differences Between Sheep (*Ovis aries* Linne') and Goat (*Capra hircus* Linne').' Pp. 331-58 in D.R. Brothwell and E. Higgs, eds., *Science in Archaeology*. New York: Praeger, 1969; E. Schmid, *Atlas of Animal Bones for Prehistorians, Archaeologists and Quaternary Geologists.* Amsterdam: Elsevier, 1972.

[14] M. Finnegan, 'Faunal Remains from Bab edh-Dhra, 1975.'Pp. 51-54 in *AASOR*, 1978, 51-54; *Idem*, 'Preliminary report of animal remains recovered from the 1993 excavations at Tell Nimrin, Jordan.' Unpublished Report to the Directors; D.L. West, 'Preliminary report of animal bones recovered from the 1990 excavations at Tell Nimrin, Jordan.' Unpublished Report to the Directors.'

[15] *Op. cit.*

son. Fish bones represented 2.11% of the overall faunal inventory in 1995 (TABLE 7), and 30.46% in the earlier seasons (TABLE 6), with representation of the families *Mugilidae* (mullet), *Sparidae* (sea bream), *Mochokidae* (perch), and possibly *Cyprinidae* (carp) and *Bagridae* (armored catfish). Given that they had to be imported fresh from 'Aqaba, marine shells represent an a very impressive 6.93% of the 1995 faunal remains, 7.92% of the 1991 sample, including the families *Trochidae* (top-shells), *Strombidae* (conch), *Ostreidae* (oysters), and *Tridacnidae* (clams).

Remains of the pig were found in 1995 in a greater proportion (19.89%) than at a number of other Jordanian sites, suggesting that it had a prominent place in the diet along with chicken, sheep and goat. Since in the 1991 and earlier excavations pigs constitute only 0.50% of the sample, the increase for the 1995 material may derive from the Roman fort, where excavation began only in 1993. Spatial and chronological analysis of the material is not yet complete. No measurements were taken to determine if the pigs associated with al-Ḥumayma were wild or domesticated using the criteria of Flannery.[16] Pigs recovered from the Middle Bronze Age levels of nearby Jericho, because of small size and immaturity, have been called domesticated when compared to the bones of the hunted wild pigs excavated from earlier Pre-Pottery Neolithic levels of the same site.[17] Nevertheless, it is possible that some of the fragments of pig recovered from al-Ḥumayma may belong to the wild boar which today can still be found in the thickets of the well-watered larger wadis and in the Jordan Valley. The wild boar would have been easi-ly accessible, although a formidable quarry for the hunters of al-Ḥumayma.

Overall, the 1995 faunal data are in general agreement with the faunal data from the earlier field seasons which indicate that throughout time sheep and goat were favored in the diet of the inhabitants at al-Ḥumayma. To a lesser extent, cattle were utilized for their milk, meat and skin. Cattle yield approximately six times the edible meat as sheep or goats, making them a close second for meat production. While inhabitants at al-Ḥumayma overwhelmingly followed a subsistence pattern based on animal husbandry and agriculture, they occasionally varied their diets by means of the chase – hunting the wild hare (*Lepus*) and deer (*Cervus*) (one each) in addition to the boar. Deer, represented by one bone fragment in the 1995 assemblage, may have been somewhat rare to this region of Jordan in the later time periods, preferring the more forested areas of the earlier time periods in the region. The smaller gazelle (*Gazella* sp.) appears in the 1987-91 material (0.20%). Although it was not identified in 1995, some of the medium mammal bones may represent this animal. Inhabiting drier climates than the red deer, the gazelle would have browsed in dry grass steppe and desert region near al-Ḥumayma and could have been captured by nets or snares.[18] Ostriches may have been captured for their meat, but so far only fragments of egg-shells have been recovered. The rodents identified in the faunal remains of every season might derive in part from burrowing by these animals into cultural deposits laid down long before. Some, however, may represent individuals caught for consumption; even today the local bedouin catch and cook the jerboa that populate the site. The single fox (*Vulpes* sp.) that appeared in the 1991 sample, and the 4 unidentified carnivore bones (probably lynx or mountain lion) in the 1995 sample probably represent preditors whose corpses were brought back to the site to allow recovery of the pelts.

Since the chronological information has not yet been entered into the faunal database, only gross generalizations can be made concerning trends in the use of various species at al-Ḥumayma over time. With the assignment of dates to loci, trends in percentages of bones of sheep and goats, pigs, chickens, and cattle may emerge. As well, placement of wild animals within a time framework may throw light on changing hunting patterns over time.

In any case, it is likely that – except for pigs, equids, and dogs – the domestic animals and birds were raised for more than just their meat. Mature animals could produce a wide variety of valuable secondary products: from sheep/goat, wool, hair and milk; from cattle, milk and work potential (e.g. pulling a plough); from camels, milk, hair, and work potential (transport); from chickens, eggs.

In conclusion, it is likely that a mixed animal farming policy was employed, involving the use of both primary and secondary products, with no single product of paramount importance. The meat demand was met almost exclusively by domestic animals, and sheep/goat in particular. It is possible that some feral species which live in the vicinity today, for example, chukar partridge and quail, may have been hunted in antiquity as they are today, but simply have not been recovered or recognized yet. The dove (probably rock or stock dove) is one species which may have either been hunted or a domesticate. Our understanding of the use of wild and domesticated animals in ancient Hawar will be elucidated further by analysis of the rest of the bone collection.

Conclusions

To the eyes of a modern Canadian scholar who lives in the rain forest of British Columbia, the desert landscape around al-Ḥumayma looks like a desolate — but beautiful —wasteland. Nevertheless, survey and excavation at the site, and analysis of the ecofacts recovered have shown

[16] K. Flannery, 'Early Pig Domestication in the Fertile Crescent: A Retrospective Look.' Pp. 163-187 in *Hilly Flanks: Essays on the Prehistory of Southwest Asia. Studies in Ancient Oriental Civilization* No.36. Chicago: Oriental Institute, 1982.

[17] J. Clutton-Brock, 'The Primary Food Animals of the Jericho Tell from the Proto-Neolthic to the Byzantine Period.'*Levant* 3 (1971) 41-55.

[18] G. Cansdale, *Animals of the Bible Lands.* London: Paternoster Press, 1970.

that the ancient inhabitants of the site were able to live quite comfortably by paying close attention to the resources of the landscape and respecting the shape and limitations of the ecosystem. Locally produced food could easily have supported the maximum regional population of 817 suggested by the capacity of the water-supply system. The figure of 654 persons for the settlement centre — although admittedly hypothetical — also corresponds well with the number of separate structures — approximately 40, mostly houses — identifiable on the surface of the site. These date for the most part to the early Islamic period, but the population may have hovered around this figure from the very foundation of the city.

Table 1. Analysis of soil samples from al-Ḥumayma.

		Sample 1	Sample 2	Sample 3	Sample 4
CHEMICAL ANALYSES:					
pH		7.95	8.0	8.0	8.0
EC	mS/cm^3	0.62	0.70	1	0.70
Total Carbon*	%	3.31	1.68	2.61	2.09
Total Nitrogen	%	0.07	0.04	0.02	0.03
Avail. Phosphorus	ppm	2	7	<2	<2
Avail. Potassium	ppm	650	465	160	160
Avail. Calcium	ppm	2600	2000	2450	2050
Avail. Magnesium	ppm	295	120	195	165
CEC (NaOAc)	meg/100g	17.3	8.8	12.5	8
Exc Ca (NH_4OAc)	meg/100g	13.8	10.3	12.6	10.7
Exc Mg (NH_4OAc)	meg/100g	2.7	1.1	1.8	1.6
Exc Na (NH_4OAc)	meg/100g	0.3	0.2	0.1	0.1
Exc K (NH_4OAc)	meg/100g	1.8	1.3	0.4	0.5
ESP	%	1.7	1.9	0.8	0.6
* Organic C and carbonate C.					
PARTICLE SIZE ANALYSIS:					
gravel	% by wt	0.9	6.8	0.8	3.2
sand	% by wt	45.8	71.6	64.1	n/a
silt	% by wt	33.1	19.0	25.4	n/a
clay	% by wt	21.2	9.4	10.4	n/a
Textural class		loam	sandy loam	sandy loam	
WATER RETENTION:					
1/10 bar	% by vol	32.6	27.9	28.1	
1/3 bar	% by vol	29.6	17.3	19.7	
15 bar	% by vol	15.7	15.4	12.9	
AWSC	% by vol	13.9	1.8	6.7	
Bulk Density	kg/m^3	1530	1827	1666	
Particle Density	kg/m^3	2561	2582	2618	
Total Porosity	% by vol	40.3	29.3	36.3	

Table 2. Abundance and frequency of charred seeds from al-Ḥumayma.

Common Name	Family Name	Scientific Name	Abundance		Frequency (n=40)	
			# seeds	%	# samples	%
DOMESTICATES						
Cereals						
Six-rowed Barley	Gramineae	*Hordeum vulgare*	24.0	3.9	5.0	12.5
Grass family	Gramineae	Unident. Gramineae	12.0	2.0	3.0	7.5
Bread Wheat	Gramineae	*Triticum aestivum*	2.5	0.4	1.0	2.5
Wheat	Gramineae	*Triticum sp.*	0.5	0.0	1.0	2.5
Legumes						
Chick-pea	Leguminosae	*Cicer arietinum*	1.0	0.2	1.0	2.5
Tree Crops and Vines						
Fig	Moraceae	*Ficus sp.*	14.5	2.4	5.0	12.5
Date	Palmae	*Phoenix dactylifera*	3.0	0.5	3.0	7.5
Olive	Oleaceae	*Olea europaea*	2.0	0.3	1.0	2.5
cf. Fig	Moraceae	*cf. Ficus*	1.0	0.2	1.0	2.5
Grape	Vitaceae	*Vitis vinifera*	1.0	0.2	1.0	2.5
WILD PLANTS						
White broom	Leguminosae	*Retama raetam*	86.0	14.1	5.0	12.5
Goosefoot family	Chenopodiaceae	Unident. Chenopodiaceae	26.0	4.3	9.0	22.5
Mouse-ear chickweed	Caryophyllaceae	*Cerastium sp.*	22.5	3.7	5.0	12.5
Plantain	Plantaginaceae	*Plantago sp.*	21.0	3.4	7.0	17.5
Common peganum	Zygophyllaceae	*Peganum harmala*	17.5	2.9	1.0	2.5
Medick	Leguminosae	*Medicago scutellata*	17.5	2.9	5.0	12.5
Sea-Blite	Chenopodiaceae	*Suaeda sp.*	13.0	2.1	5.0	12.5
Legume family	Leguminosae	Unident. Leguminosae	8.0	1.3	6.0	15.0
Pink family	Caryophyllaceae	Unident. Caryophyllaceae	7.5	1.2	5.0	12.5
Trigonel	Leguminosae	*Trigonella sp.*	5.5	0.9	1.0	2.5
Mallow family	Malvaceae	Unident. Malvaceae	5.0	0.8	6.0	15.0
Poppy	Papaveraceae	*Papaver sp.*	5.0	0.8	4.0	10.0
Sedge family	Cyperaceae	Unident. Cyperaceae	4.0	0.7	2.0	5.0
Grass family	Gramineae	Unident. Gramineae	4.0	0.7	3.0	7.5
cf. Pink family	cf. Caryophyllaceae	cf. Caryophyllaceae	4.0	0.7	4.0	10.0
Scorpion vetch	Leguminosae	*Coronilla sp.*	3.5	0.6	1.0	2.5
Goosefoot	Chenopodiaceae	*Chenopodium sp.*	3.5	0.6	1.0	2.5
cf. Trigonel	Leguminosae	*cf. Trigonella sp.*	3.5	0.6	2.0	5.0
Oval-leaved Androsace	Primulaceae	*Androsace maxima*	3.0	0.5	2.0	5.0
Mustard family	Cruciferae	Unident. Cruciferae	3.0	0.5	3.0	7.5
Bedstraw	Rubiaceae	*Galium sp.*	2.0	0.3	2.0	5.0
Rye grass	Gramineae	*Lolium sp.*	2.0	0.3	2.0	5.0
Alkanna	Boraginaceae	*Alkanna sp.*	2.0	0.3	1.0	2.5
cf. Star-of-Bethlehem	Liliaceae	*cf. Ornithogalum*	1.5	0.2	1.0	2.5
Daisy family	Compositae	Unident. Compositae	1.0	0.2	1.0	2.5
Wild Watermelon	Cucurbitaceae	*Citrullus colocynthis*	1.0	0.2	1.0	2.5
Parsley family	Umbelliferae	Unident. Umbelliferae	1.0	0.2	1.0	2.5
Bermuda grass	Gramineae	*Cynodon dactylon*	1.0	0.2	1.0	2.5
Pigweed	Amaranthaceae	*Amaranthus sp.*	1.0	0.2	1.0	2.5
Nightshade family	Solanaceae	*Solanaceae*	1.0	0.2	1.0	2.5
Fumitory	Fumariaceae	*Fumaria sp.*	1.0	0.2	1.0	2.5
Milk-Vetch	Leguminosae	*Astragalus sp.*	1.0	0.2	1.0	2.5
cf. Goosefoot family	cf. Chenopodiaceae	cf. Chenopodiaceae	1.0	0.2	1.0	2.5
cf. Medick	Leguminosae	*cf. Medicago*	1.0	0.2	1.0	2.5
cf. Scorpion vetch	cf. Leguminosae	*cf. Coronilla*	1.0	0.2	1.0	2.5
cf. Grass family	cf. Gramineae	cf. Gramineae	0.5	0.0	1.0	2.5
cf. Pigweed	cf. Amaranthaceae	*cf. Amaranthus sp.*	0.5	0.0	1.0	2.5
Unidentified seeds			267.5	43.7	25.0	62.5
TOTAL =			611.5		100.0	

Table 3. Abundance and frequency of uncharred seeds from al-Ḥumayma.

			Abundance		Frequency (n=40)	
Common Name	**Family Name**	**Scientific Name**	**# seeds**	**%**	**# samples**	**%**
Mallow Family	Malvaceae	Unident. Malvaceae	3.0	14.0	4.0	10.0
Puccoon	Boraginaceae	*Lithospermum sp.*	2.0	9.3	2.0	5.0
Poppy	Papaveraceae	*Papaver sp.*	2.0	9.3	3.0	7.5
Pink Family	Caryophyllaceae	Unident. Caryophyllaceae	1.5	7.0	2.0	5.0
Sow Thistle	Compositae	*Sonchus oleraceus*	1.0	4.7	1.0	2.5
Sedge Family	Cyperaceae	Unident. Cyperaceae	1.0	4.7	1.0	2.5
Borage Family	Boraginaceae	Unident. Boraginaceae	1.0	4.7	1.0	2.5
cf. Pink Family	cf. Caryophyllaceae	cf. Caryophyllaceae	1.0	4.7	1.0	2.5
Storksbill	Geraniaceae	*Erodium sp.*	0.5	2.3	1.0	2.5
	Compositae	*Hedypnois rhagdioloides*	0.5	2.3	1.0	2.5
unidentified seeds			8.0	37.2	7.0	17.5
TOTAL =			21.5	100.0		

Table 4. Domesticated and wild plant uses at al-Ḥumayma.

Common name	**Scientific name**	**Description**	**Cultivated fields**	**Waysides, wasteland**	**Other locations**	**Use(s)**
DOMESTICATES						
Six-rowed Barley	*Hordeum vulgare*	Annual grass	Yes	Yes		One of the most important grain crops
Bread Wheat	*Triticum aestivum*	Grass	Yes			Wheat normally used for making bread, etc.
Chick-pea	*Cicer arietinum*	Erect or sprawling annual herb	Yes	Yes		Seeds eaten, also made into flour, fodder
Date	*Phoenix dactylifera*	Perennial tree	Yes			Staple food and dessert
Olive	*Olea europaea*	Evergreen bush or tree	Yes	Yes	Hillsides in garigue or maquis	Fruit pickled, source of olive oil. Also used in decoration, fuel, craft, medicine and fodder
Fig	*Ficus (F. carica)*	Trees, shrubs and climbers	Yes			Edible fruit, also used forfodder, craft, medicine, food and poison
Grape	*Vitis vinifera*	Deciduous climber or trailer	Yes	Yes	In thickets and wooded ravines	Fruit eaten fresh or dried, seeds used to make oil, used in medicine, fodder, crafts and beverages

Common name	Scientific name	Description	Cultivated fields	Waysides, wasteland	Other locations	Use(s)
WILD PLANTS						
Oval-leaved Androsace	*Androsace maxima*	Herbaceous annual	Yes	Yes		
Common peganum	*Peganum harmala*	Herbaceous perennial		Yes	Roadsides	Often a relic of cultivation, used in medicine and as a condiment
Trigonel	*Trigonella (T. sprunerana, T. strangulata, T. spinosa, T. spiculata)*	Annual herb, rarely a perennial	Yes	Yes	Dry rocky hillsides, garrigue	A fodder plant
Scorpion vetch	*Coronilla (C. securidaca, C. scorpioides)*	Annual or perennial herbs or shrubs	Yes	Yes		*C. scorpioides* purgative used for fodder
Mouse-eared chickweed	*Cerastium (C. dubium, C. dichotomum C. brachypetalum, C. semidecandrum, C. illyricum, C. glomeratum)*				Some are widely distributed; mountain slopes, river banks cultivated fields, damp ground	Consumed as a potherb
Sea blite	*Suaeda (S. aegyptiaca)*	Annual or perennial herbs or shrubs			Cosmopol-itan, near salt marshes/lakes	Eaten cooked or raw
Milk-Vetch	*Astragalus (A. asterias, A. hamosus, A. boeticus, A. lusitanicus, A. caprinus, A. echinus)*	Annual, biennial and perennial herbs and subshrubs	Yes	Yes	Cosmopol-itan	*A. hamosus and A. boeticus* used for food, *A. hamosus* also used medicinally
White broom	*Retama raetam*	shrub		Yes	Dominates large sand and gravelly areas	Medicinal, used as fuel
Fumitory	*Fumaria (F. gaillardotii, F. judaica, F. macrocarpa, F. petteri, F. officinalis, F. densiflora, F. bracteosa)*	Annual	Yes	Yes	Europe, Mediterranean and Western Asia	
Medick	*Medicago scutellata*	Annual	Yes	Yes	Mediterranean Cultivated and fallow fields and waste ground	

Common name	**Scientific name**	**Description**	**Cultivated fields**	**Waysides, wasteland**	**Other locations**	**Use(s)**
Alkanna	*Alkanna (A. tinctoria, A. galilaea, A. hirsutissima, A. strigosa)*	Perennial herbs			Dry hillsides in garrigue, sandy and rocky places	*A. tinctoria* eaten as a vegetable; dye derived from roots
Wild Watermelon	*Citrullus colocynthis*	Prostrate trailing perennial herb		Yes	Dry sandy and rocky places	Seeds are eaten, also used medicinally
Plantain	*Plantago (P. major, P. coronopus, P. lanceolata, P. lagopus, P. amplexicaulis, P. notata, P. ovata, P. loeflingii, P. cretica, P. bellardi, P. afra)*	Annual or perennial herbs or sometimes woody subshrubs	Yes	Yes	Rocky slopes	Food source *P. cretica and P. afra* used medicinally
Goosefoot	*Chenopodium (C. botrys, C. foliosum, C. vulvaria, C. murale, C. opulifolium, C. album)*	Annual or rarely perenial herbs	Yes	Yes		Food source
Bedstraw	*Galium (G. canum, G. humifusum, G. setaceum, G. peplidifolium, G. aparine, G. pisiferum, G. tricornutum)*	Annual or perennial herbs or subshrubs	Yes	Yes	Rocky ground, crevices	*G. aparine* eaten and used medicinally
Pigweed	*Amaranthus (A. hybridus, A. retroflexus, A. albus, A. viridis, A, graezicans)*	Annual or rarely a perennial herb	Yes	Yes		Food source, *A. lividus & A. retroflexus* used medicinally
Poppy	*Papaver (P. rhoeas, P. minus, P. hybridum)*	Annual or perennial herbs	Yes	Yes		*P. rhoeas* used as spice, also used in craft, fodder and medicine
Rye grass	*Lolium (L. multiflorum, L. rigidum, L. perenne, L. loliaceum)*	Annual or perennial grasses	Yes	Yes		*L. rigidum* used for fodder
Bermuda grass	*Cynodon dactylon*	Perennial grass	Yes	Yes	Sandy areas	Cool drink is made from the root

Table 5. Al-Ḥumayma 1987 -1991. Number and percentage of all animal bones.

	1987-1989	% of Total	1991	% of Total	1987-1991	% of Total
Camel	1	0.54	6	0.22	7	0.24
Cattle	11	5.91	31	1.12	42	1.42
Chicken	13	6.99	97	3.45	110	3.71
Dog	4	2.15	1	0.04	5	0.17
Dove	2	1.08	—		2	0.07
Equid	2	1.08	52	1.87	54	1.82
Fish	25	13.44	848	30.51	873	29.44
Fox	—		1	0.04	1	0.03
Gazelle	—		5	0.18	5	0.17
Goat	6	3.22	57	2.05	63	2.12
Hare	—		2	0.07	2	0.07
Large Mammal	—		17		17	0.57
Marine Shell	—		220	7.92	220	7.42
Medium Mammal	—		19		19	0.64
Ostrich (egg)	1	0.54	397	14.28	398	13.42
Pig	13	6.99	4	0.14	17	0.57
Raven	2	1.08	—		2	0.07
Rodent	—		42	1.51	42	1.42
Sheep	5	2.69	13	0.47	18	0.61
Sheep/Goat	101	54.30	762	27.42	863	29.11
Small Egg Shell	—		56	2.02	56	1.89
Small Mammal	—		41	1.48	41	1.38
Small Ruminant	—		108	3.89	108	3.64
Total	186		2779		2965	
Unidentified	169	47.88 (of 355)	8652	75.69 (of 11431)	8821	74.84 (of 11786)

Table 6. Al- Ḥumayma 1978 -1991. Al-Number and percentage of identified species.

	1987-1989	% of ID	1991	% of ID	1987-1991	% of ID
Camel	1	0.54	6	0.26	7	0.28
Cattle	11	5.91	31	1.36	42	1.71
Chicken	13	6.99	97	4.26	110	4.47
Dog	4	2.15	1	0.04	5	0.20
Dove	2	1.08	—		2	0.08
Equid	2	1.08	52	2.28	54	2.19
Fish	25	13.44	848	37.26	873	35.46
Fox	—		1	0.04	1	0.04
Gazelle	—		5	0.22	5	0.20
Goat	6	3.22	57	2.50	63	2.56
Hare	—		2	0.08	2	0.08
Ostrich (egg)	1	0.54	397	17.44	398	16.17
Pig	13	6.99	4	0.18	17	0.69
Raven	2	1.08	—		2	0.08
Sheep	5	2.69	13	0.57	18	0.73
Sheep/Goat	101	54.30	762	33.48	863	35.05
Total	186		2276		2462	

Table 7. Al-Ḥumayma 1995. Number and percentage of all animal bones .

	No. of Pages	No. of Pieces	No. of Total	% of ID Species Only
Archamedes	10	12	0.15	1.36
Bird	2	8	0.10	
Camel	5	5	0.06	0.57
Carnivore	3	4	0.05	
Cattle	4	4	0.05	0.45
Chicken	135	201	2.56	22.84
Clam	1	3	0.04	0.34
Clam/Oyster	6	12	0.15	1.36
Conch	1	1	0.01	
Deer	1	1	0.01	0.11
Dog	1	2	0.03	0.23
Egg Shell	2	34	0.43	
Equids	12	38	0.48	4.32
Fish	56	166	2.11	
Goat	33	36	0.46	4.09
Hare	1	1	0.01	0.11
Large Bird	1	1	0.01	
Large Mammal	75	267	3.40	
Medium Bird	62	90	1.15	
Medium Mammal	1188	5432	69.19	
Ostreidae	3	3	0.04	0.34
Ostrich Shell	6	10	0.13	1.14
Pig	80	175	2.23	19.89
Rodent	1	1	0.01	
Sea Urchin	1	3	0.04	0.34
Sheep	43	48	0.61	5.45
Sheep/Goat	195	269	3.43	30.57
Small Bird	6	6	0.08	
Small Mammal	47	84	1.07	
Small Rodent	5	26	0.33	
Snail	13	39	0.50	
Trochus	13	17	0.22	1.93
Un-ID Marine Shell	17	45	0.57	
Undetermined	43	221	2.80	
Undetermined Mammal	71	586	7.46	
Total	2143	7851	100.00	
Total of Identified Species:	565	880	11.21 (of 7851)	