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Agricultural Intensification, Urbanization, and Hierarchy

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Introduction

Millennial era studies range from the metropolis of Ur in Sumer of six thousand years before the present, to the feudal lands of Europe six hundred years ago. They address the question of hunger, from the further intensification of agriculture to the emergence of urban centers, hierarchical social structure, and trade, that set the stage for the development of a world economy.

The social achievements of the millennial era were permanent settlements leading to urbanization and the organization of specialized human functions. This included land differentiated by special purposes – the separation of production spaces from population living spaces. It marks a difference from hunting-gathering societies with extensive land use, wide-ranging gathering of food plants, and seasonal following of animal herds, to a more sedentarized life. Intensification of agriculture included flood control (notably in Egypt with use of the annual inundation of the Nile), complex irrigation systems such as those of Sumer and the Classic Maya, the definition of "field" as exclusive agricultural space, and seasonal patterns of productive and fallow periods. The result of these innovations, including plant and animal domestication, was production beyond subsistence toward what Boserup (1981) has termed "population surplus."[1] The combination of increased population required by and supportable from increased food production, and specialization of work in trade, in localized workshops and manufactures, and in priestly and administrative functions, were all contributors to the process of localization of population centers, settled communities, hierarchical social organization, and ultimately urbanization. The centralization of large numbers of people in one place required attention not only to food production,

but also to food distribution, food storage, and, in times of dearth, trade and importation of grain from external suppliers. Trade in this period ultimately united the entire Mediterranean area. The control of grain markets for particular urban areas along with wide-ranging grain trade could be considered a major feature of the millennial era.

The history of hunger in the millennial era is derived from many kinds of evidence. These include written sources such as epics, histories, dramas, archives, inscriptions; material sources such as walled cities, stele, inscribed monuments, sculpture, granaries, ships, pottery; human burials and memorials; grain and other food substances that have been found in jars and storage spaces; the remains of irrigation structures, terracing, channelized raised fields, and the remains of animals that had become domesticated. The evidence so far available indicates human activities including agricultural intensification, building of significant structures, storing and distribution of food resources, transport of people and products over great distances, and development of the centralized religious and political organization to support these activities. The literatures of this era represent the views of the elite and powerful, and seldom reflect the concerns of the people. The voices of those who lived through hunger events are often voices of public officials driven to comment on human tragedy, or inadvertent references to hunger and starvation in daily accounts or records of transactions. There is no voice for the common people in the ancient world.

Hunger and plenty are described circumstantially by early Greek authors, such as Homer in (probably) the eighth century BC and the prose writers in the fifth and fourth centuries – Herodotus, Thucydides, Demosthenes, and later Galen, among others. These authors suggest that hunger, while sometimes resulting from climatic forces, water shortage, and crop failure, was also attributable to human actions. Food resources often went to supply armies, and in wartime the strategies of siege, embargo, and destruction of irrigation systems were already in use in these early periods (see chapter 6). Intentional limitation by families of their number of children, and out-migration in times of scarcity both characterize human responses to hunger and the threat of hunger in this era.

While Malthus and Boserup concentrated on increased resources and technological change as two main forces contributing to the carrying capacity of society, there must also be identified a third force, the human element of administration or management that also increased the capacity of communities to secure a food supply. The complex organization of urbanization, colonization, and establishment of fixed settlements itself may be seen as a technological innovation. The characteristic that most describes the millennial era is the social organization that led to hierarchical differentiation of classes of citizenship – of religious and political leaders, bureaucracies and

government workers, farmers, slaves, and foreigners, and enlargement of spheres of activity through widespread trade.

The political economy of management as seen in the evidence of this era includes the function of *establishing control* over contiguous territories through cooperation or subjugation, involving the sharing or appropriation of resources, the control of waterways and irrigation, and the establishment of food systems. A subsequent function is then *maintaining control* through hierarchical social structure, the perquisites and entitlements of citizenship (as in the Greek city-state), appropriation of the labor of both free and enslaved peoples, maintenance of peaceful relations, and storage and distribution of food. Responsiveness to drought, flood, and other natural disasters, as well as to human invasions, was enhanced by centralization of population and maintenance of order. Finally, the evidence of this era includes *expansion*, migration into unoccupied territories, protection of trade routes, and deportation of surplus population in times of stress, as well as war and the establishment of control over other communities.

The relations of food production and scarcity are described in this chapter, including agricultural intensification in Mesopotamia; land use, the development of resources, and the determinants of hunger in the ancient Graeco-Roman world to the third century AD; and population growth and decline in the Europe of the Middle Ages. We then turn to causes of hunger, and preventive and ameliorative measures throughout this era. This chapter serves also as an introduction to three intensive studies – Peter Garnsey's 'Responses to food crisis in the Ancient Mediterranean World' (chapter 5); Robin D. S. Yates's 'War, food shortages, and relief measures in early China' (chapter 6); and B. L. Turner's 'The Classic Maya: The rise and fall of population and agriculture' (chapter 7).

Agricultural Intensification in Mesopotamia from the Sixth Millenium BC

Mesopotamia, the land between the rivers Tigris and Euphrates, has its heartland in present day Iraq and its uplands in Syria, Turkey, and Iran, the fertile crescent where the Neolithic Revolution in food production may have first begun. The heartland, the floodplain of the Tigris-Euphrates, requires irrigation to maintain a significant population. The earliest traces of organized irrigation date to about 6000 BC, and were found on the northwest border of the plain in the foothills of the Zagros mountains.

Within the floodplain, there have been two and a half cycles of population rise and decline over the past six thousand years (figure 4.1). Yet, in many ways, the essentials of life have been remarkably stable throughout the

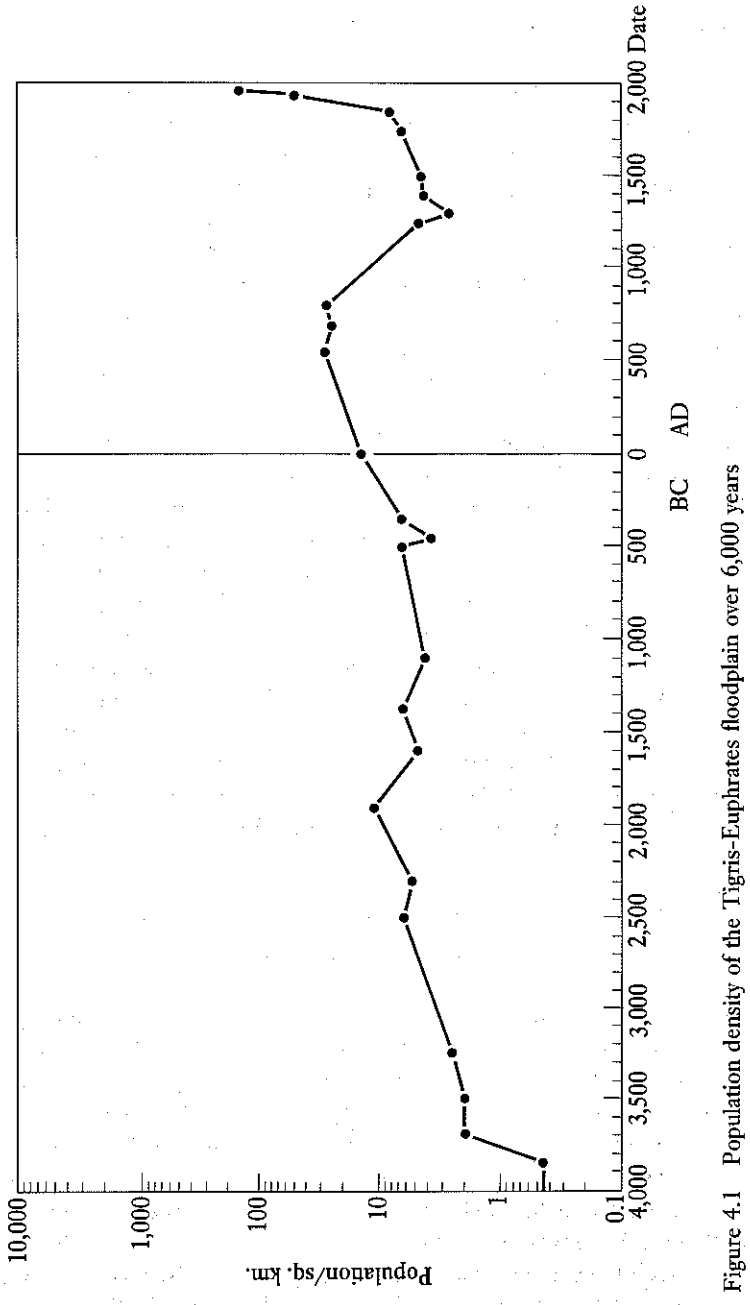

Figure 4.1 Population density of the Tigris-Euphrates floodplain over 6,000 years

period, with a cereal-based agriculture produced in ox-ploughed, irrigated, and fallowed fields. The first population increase was characterized by the rise of urban settlements and the Sumerian and Akkadian empires. A combination of archeological and historical evidence can be employed to examine the period (Flannery, 1965). The dependence on irrigation and the widespread distribution of old river courses and canal spoilbanks provide a type of roadmap to early settlement. An imaginative archeological effort has used these to survey the overall settlement of the plain (Adams, 1981). And the early invention of cuneiform writing on clay tablets has preserved, in the dry climate, the written materials of this society in a way not comparable to any other ancient one.

In the Mesopotamia of the early dynastic period, social differentiation, organized around separate production units, included extended family or kinship corporate units, the private estates of the elite public officials, and the public institutions of palace and temple (Zagarell, 1986). Land rights were specialized in the separation of levels of ownership and attribution of field cultivation rights. The temple mode of production included free individuals, some of whom occupied important positions within the temple–palace hierarchy and had ties to community kin groups. Some free individuals served as foremen, in the temple, and received field cultivation rights for their services. Under them were workers who were dependent to different degrees, not fully understood at the present time – ranging from being tied to state/temple lands but retaining family-life and land-use rights, to being deprived of family life and receiving the rations enumerated in the inscribed tablets found throughout this area. "Such encumbered laborers have been classified as helots or slaves depending on whether or not they were deprived of family life and could be separated from the land and bought and sold" (Zagarell, 1986: 417). The lowest level of the social hierarchy was made up of those who tilled the soil and produced the food.

Hunger Conditions

Food Shortage Given the prevalence of war and natural hazard in the eastern Mediterranean, food-short hunger resulting in famine was common. The water systems provided the essential ingredient for maintaining a food supply, but the climate and the morphology of the major rivers made flood and drought a recurrent hazard. Military strategy often sought to annex a neighboring state's water supply before undertaking a frontal assault on the enemy kingdom or to cut its supply as a major strategy in an attack. And siltation and salinization posed frequent threats to the utilization and maintenance of the system.

There are some direct references to hunger in the texts, most commonly in reference to sieges, a time when the scribes themselves might be expected to hunger. Describing the fall of Ur in 2004 BC, a Sumerian laments: "In its places, where the festivities of the land took place, the people lay in heaps ... Ur – its weak and strong perished through hunger" (quoted in Roux, 1980:168). But as with all written history of hunger the record is sparse, and there is no easy source or compilation of such textual references. Thus at this time the evidence is mainly indirect: geomorphic and actual historical experience with drought, flood, sedimentation, and salinization; much textual evidence of the enormous effort to maintain silt-free irrigation channels; some evidence of a long-term decline in yields; and archeological survey data reflecting the rise and fall of regional populations within the floodplain (Jacobson and Adams, 1958).

Food Poverty Evidence for chronic hunger or food poverty today relies on three major methods: food availability as compared to a currently standardized requirement; symptoms of undernutrition or malnutrition; and behavioral expressions or adjustments. In current practice the availability/requirement ratio is measured, most crudely by an overall food/population ratio, somewhat better by a food resource (in money or self-provision)/requirement ratio, or best by a direct measure of household or individual consumption. While there are no overall food production statistics utilizable for the first approach, nor household budget surveys for the third approach, there are three different types of evidence that suggest the basic adequacy of common diets in Mesopotamia. These include data on rations given to temple or palace dependents in return for their labor, wages for daily labor in irrigation construction, and the size of farm required to support an average family. If these constitute the Mesopotamian safety net, what is not readily available are data of the number who received less than the ration amount, customary daily wage, or leaseholding area, or the many times that the system, under stress or corruption, failed to meet its own standards.

Nonetheless, the evidence as shown in table 4.1 and corroborated by other information suggests basic protein–calorie sufficiency. The data were obtained by Ellison (1981) from tablets inscribed with lists of rations, mainly in the form of barley (at times with other foods), and given to "dependent" workers in palace or temple estates. The size of the rations varies by occupation, age, and gender, and in that sense they mirror differentials found in modern dietary requirement lists. There is some uncertainty in the establishment of standard measures invariant over 1,600 years, and there is a question as to whether some of the larger allowances were wages or intended for sharing with dependents. Nonetheless, data from many different periods suggest that Mesopotamians knew what it took

Table 4.1 Daily energy supply standards estimated from barley ration lists

Date (BC)	Period	Average calories
3000–2400	Early Dynastic	3,152
2400–2200	Agade	4,320
2100–2000	Ur III	2,880
2000–1600	Old Babylonian	4,140
1600–1400	Nippur	2,880
1600–1400	Nuzi	3,600
Mesopotamian average		3,495
Modern Iraq (FAO estimate)		2,790

Source: Ellison, 1981: 40–3

to feed an adult and for the most part attempted to provide it at a scale just recently realized in modern Iraq. That they were able to do so is not entirely surprising, for at its peak (2400 BC) barley had a yield comparable to modern North American standards.

However, barley is not in itself sufficient for an adequate diet. Vitamin A and C deficiencies may have been serious and there are frequent textual references to blindness and scattered references to what might have been a scurvy-like disease (Ellison, 1981, 1983).

Food Deprivation The barley rations data also suggest the possibility of trying to identify the adequacy of intrafamilial distribution based on gender and age differentials. In particular, the rations for children do not appear adequate for their needs, many children receiving the equivalent of only 900 calories per day (Ellison, 1981:30). And while the averages for both men and women seem adequate, there are still frequent listings of both men and women below the requirement for an active life. A benign explanation for such differentials is not apparent.

Responses The long-term adaptations to coping with hunger are primarily irrigation, storage, redistribution, and the social organization required to do these, as well as population movement and control. The supply adaptations – irrigation, storage, and redistribution – are well documented, while the population restrictions are evidenced through settlement site development or abandonment and through immigration by other cultures. What is less known are the adjustments to hunger – the short-term changes and emergency responses. One extraordinary measure is documented in a series of "siege documents" detailing the sale of children, almost all girls,

by their parents into slavery for a token payment and for the promise that the child would be fed (Oppenheim, 1955).

Population Dynamics

In addition to the common questions of hunger history, the exploration of population regulation, as well as theories of population growth and decline, includes hunger as a major causative variable. The 6,000-year population history of the Tigris-Euphrates floodplain (figure 4.1) suggests a dynamic oscillation very different from the conventional view of continual progress (as does chapter 3). And within the region itself subregions and city-states evidence oscillation in growth and decline including extinction.[2]

These population fluctuations have been compared with three sources of perturbations: environmental fluctuation, political events (empire formation, invasions, civil war and revolts), and technological innovations. No single set seems to correlate easily with population. Indeed, population oscillations that span millennia have been little studied and have no ready explanation.

If one considers Boserupian innovation, Malthusian collapse, and Marxist exploitation as potential prime movers, there is evidence in this long history of particular roles for each of these processes. But there is no clear evidence to award a leading role either to population growth as requiring irrigation intensification, or to irrigation intensification as permitting more rapid population growth, or to the requirements of surplus extraction as requiring the intensification of irrigation and the massive population needed to execute it. Rather, these population dynamics appear as a resultant of the interaction of all these forces. In addition, the emergence of hierarchical social structure had an impact on both land use and food distribution.

Food Production and Trade in the Graeco-Roman World

The City-State and Social Hierarchy in Greece of the Fifth and Fourth Centuries BC

"Ancient Greece" denotes a number of widely dispersed land areas around the Mediterranean Sea, whose traditional center is roughly the Peloponnesos taken together with much of the peninsula to its north. The population of Attica at this period was made up of 20,000 to 30,000 citizens. Wives and children of citizens added another 50,000 to 60,000 souls, and then there was an unknown number of resident aliens (metics), plus an unknown number of slaves. The high point of population in the fifth century BC, before the Peloponnesian War, is estimated at 250,000–300,000 (Garnsey, 1988:90).

In Attica and other mainland areas of this period, the "state" did not own land as such. Only citizens could own land. They worked the land themselves along with any slaves they had. The metics, a class of resident non-citizens, worked at commerce and banking. They could not own and bequeath land, but they could rent. Outside of those metics whose activities were wholly mercantile, and whatever slaves happened to be employed in manufacturing, construction projects, or mining, everyone contributed to food production.

Continuous labor would be given to family gardens of vegetables, thus making families self-sufficient in this respect. Attica has thin soil. The main fruits grown there are olives and grape vines, both of which require concentrated work at given seasons, but little attention at other times. Athens was not self-sufficient, however, in grain production. The city was always an importer of grain. Cereals were mainly imported from areas around the Black Sea and Egypt. Some grain may have been cultivated on the plain east of Mt Hymettos and in the Thriasian Plain. There was not much grazing land for cattle. Sheep and goats grazed on hillsides, and cheese was an important element in the diet, but herding seems not to have been a principal Attic occupation.

Citizens were mainly divided into rich and poor. There are intimations of the old Solonian system of four timocratic classes based on annual income, but in effect, the division is "haves" vs "have-nots." All citizens were eligible to be allotted to the Council of Five Hundred, a body that prepared the agenda for the *ekklesia*, and all had a vote in the *ekklesia*, where final decisions were made on all the most important business of the city. Citizens also served in the lawcourts where, in panels of 500 or 1000 or more, they judged disputes and crimes and monitored the accounts of retiring officials. When a foreign potentate made a gift of grain to the state, the distribution went to the citizens. The city democracy of Athens has been likened to a political guild (Polanyi et al., 1957). Resources gained, such as tribute or payments from confederate cities, were distributed among the citizens, as was conquered land. Cleruchies, or overseas settlements of citizens, were strategically placed sometimes to enhance the grain supply and sometimes to protect trade routes. And finally, the city paid from the proceeds of its political activity for allotments of grain as well as for jury duty, religious rites, and preparation of actors for theatrical performances.

Certain lands were delimited as belonging to a given hero or god. Such a lot was called *temenos*. It could be rented and whatever income it realized would go to the hero or god; that is, to the priests who administered it. In

times of need the people (the state) could borrow gold or silver from the god. Sacred calendars show a great number of feast days. On these days people got meat from lambs, kids, and pigs that were sacrificed. For some it was the only meat in their diet. Presumably the hero's or god's treasury helped finance these sacrifices. In the calendars available, prices are listed for various sacrificial animals.

Inasmuch as the population of Attica remained more or less constant during the years under consideration here, and much grain was imported, there seemed to be no need for radical advances in technology. The agricultural intensification of Egypt and Mesopotamia was not characteristic of this area. Where need was felt – until about 350 BC, that is – the response might have been more grain-carrying ships or grain-storage areas at Eleusis, in Piraeus, or in the Agora. There was no known experimentation with new grains or grasses, crop rotation, or the like, although development of treated products such as cheese, olive oil, and wine enabled maintenance and storage of food resources from one season to another.

A few well-known and handsomely adorned springs provided water for public consumption. Shallow (7 to 10 m) wells provided water for families. The archeological record, however, shows evidence of drought not only at Athens but elsewhere in the Greek world some time around the middle of the fourth century. Demosthenes reported in 361 BC that "my land not only produced no crops, but that year, as you all know, the water even dried up in the wells, so that not a vegetable grew in the garden" (from Demosthenes' oration against Polykles, chapter 61; quoted in Camp, 1982).

References to grain shortages found in literature and decrees during the following 25 years or so establish a diminished food supply (Jameson, 1983). A convincing element of the archeological record is one sort of technological change. Athenians, pressed by drought, discovered new springs and accordingly provided them with fountain houses, and later, under further pressure, they developed a bottle-shaped cistern, 3 to 7 m deep, that was sunk into the ground and provided with channels to catch rainwater from roofs. Increased gifts of grain, financed by private citizens or admiring neighbor-states, were a previous and subsequent response to food shortages (Camp, 1982). In fact it may be said generally of the Greek world that response to troubles of many sorts was characteristically set in motion by private and individual energy and funds.

Responses to Hunger and Food Shortage in the Roman Empire

The Roman Empire comprised the entire Mediterranean area from Spain to Syria and from the Rhine and Danube to Egypt. Total population in the early empire was about 50–60 million, and in the first and second centuries AD the population of the city of Rome was roughly 1 million.

Food shortages in the city are documented with some frequency, particularly in times of civil disturbances and wars, but they rarely reach a critical stage in this period, in contrast to early Rome and late antiquity (Garnsey, 1983). Occasionally famine was reported, but chronic hunger is hardly attested at all, which may be true for the entire Roman Empire in this period due to general peace and prosperity. There are no detailed descriptions of hunger like that of the plague in Thucydides or that quoted from a late antique source (see chapter 5). Due to the nature of the sources the focus is almost entirely on the political aspects or consequences of food shortage: the complaints or riots of the population forcing the emperor to take drastic measures. Beginning in the late Republic, cheap or even free grain was distributed to the urban poor, not for social or humanitarian but for political reasons, to keep the dissatisfaction level low and gain political support in upcoming elections. Like the evidence of other social and economic aspects of life, hunger certainly was not thought a subject worth detailed study in itself.

Apart from natural disasters and diseases, which played a significant role in early Roman history, food shortages were mostly the result of human actions: wars, civil wars, piracy, failure to transport food to where it was needed, speculation. Therefore there is little evidence for food shortages in times of peace and well-functioning government. Moreover, the social organization prevailing in the Roman empire was such that, with the few exceptions of very large cities (Rome, Alexandria, Antioch), food supply was organized regionally and locally. Throughout the ancient Mediterranean world, official strategy for preventing food shortage was control of the grain market. Although there had been a free grain market in earlier Rome, by the late empire grain was controlled. The grain supply of Rome was termed the *annona*. The *annona* served to restrict speculation and in case of a famine to authorize subsidized distribution of grain. The controls were binding to ship owners and administered through officials in Rome as well as in the port of Ostia. Later personified as the daughter of the goddess Ceres, Annona appeared on coins throughout the period of the empire (Rickman, 1980). The practice of control of grain supplies was used in many outlying areas as well as in the major urban centers.

The Roman Empire was characterized by a high density of urbanization, but most cities were small and agricultural. It has been estimated that no more than 10–15 percent of the entire population was non-agricultural. Resources were therefore distributed widely, both socially and geographically. All citizens could own land. Although in some areas (such as North Africa) land was largely concentrated in a few hands, particularly in the

huge estates owned by the emperor and wealthy senators, most of the population was still working in agriculture as tenants or laborers. Just as in Rome the Senate and later the emperor assumed responsibility for distributing food to the population, on the local level in the provinces the aristocracy were responsible for supplying food whenever necessary. Munificence and individual philanthropy were here, as in Attica, an established condition for office-holding and promotion into the imperial aristocracy.

The Concept of Land Tenure and Appropriation of Resources In Rome just as in Greece land tenure was valued very highly: from the earliest time, the patrilineal clan or *gens* was the most important landholding social group, and its representative was the individual household. Children were important for long-term sustaining of land and family home. Continuity of the household and its obligations was confirmed by having male children to carry on the lineage and female children to marry into the community of citizens. It was a citizen's privilege, and at the same time landed property or the income thereof served as a basis for the citizen's rights and duties, including service in the army.

The concept of citizen as farmer and fighter can be traced back to the archaic period and appears down to the first century BC. Only when the area controlled by Rome extended around the entire Mediterranean did this system fall into disuse. At this time, there appeared professional armies composed of proletarian volunteers replacing the landowning citizen militia. In close parallel there emerged the large slave-run latifundia (large estates producing profitable crops such as oil and wine rather than grain), because land remained the only reputable form of investing the riches gained in the empire. Consequently landless proletarians flocked in great numbers to the cities and eventually to Rome, swelling the population of the capital and forcing the gradual introduction of measures to feed them. Nevertheless, small and middle farmers continued to exist in large numbers in Italy and throughout the empire. Typically, veterans were discharged after their military service with a "pension" ideally consisting of land; we therefore see large-scale distribution of land in the age of civil wars (during the periods of Sulla, Pompey, and Augustus). The senatorial government of the republic was unable ideologically and practically to cope with these problems. Only the emerging centralized government of the dictator Caesar and the emperor in disguise, Augustus, proved able to do so: they aimed at solving the immediate crisis by settling hundreds of thousands of soldiers on confiscated or bought land, reducing the numbers of persons in need of food support by exporting enormous numbers of veterans and civilians from Rome to colonies in the provinces, and putting into place the structures necessary to secure a steady and sufficient food supply (granaries, harbor facilities,

officials in charge of food supply, control of speculation, encouragement and emergency support for grain traders, ship captains, etc.). These measures, however, were kept to the necessary minimum; the financial capacity of the empire did not allow more, and the prevailing ideology did not want more. The army of 300,000 troops, though small in comparison to the size of the empire, devoured much of the existing resources. The food resources therefore were mostly left in private hands, except that the emperor disposed of the resources of the provinces to support the population of Rome and the army. Except for times of emergency the Roman citizens did not pay any taxes during this period.

Beginning in the late second century AD and increasingly in late antiquity, all this changed for various reasons. Massive outside pressure and increasing expenses for the army forced the emperor to institute and later to increase taxes. Wars and civil wars brought large-scale disruption and devastation. The need to supply the armies became a tremendous burden for the areas in which those armies were garrisoned or fought. There were therefore increasing food shortages and increasing government intervention such as mandatory corporations of bakers, ship owners, and similar essential professions, families tied to the soil or to their professions, and wages and prices regulated by imperial decree. These habits of rule became institutionalized throughout late antiquity and in the Europe of the early Middle Ages, with land and wealth concentrated in the hands of an aristocracy, continuing professionalization of the armies, development of peasant farming, and a proletariat engaged in production and trade of transportable goods.

Population Growth and Decline in Medieval Europe

The Middle Ages represent a fairly long period of well-documented change in population growth and decline (Herlihy, 1985). Though the epoch remains very much a part of the "pre-statistical age," some statistics have survived, and indirect evidence on medieval social experiences is very abundant. It is therefore a period that invites the testing of hypotheses on the relationship between population movements, resource utilization, plenty, and penury. We look here at three hypotheses: Ester Boserup's argument that a high level of population density provokes a move to more intensive agriculture; and the current views of both Malthusianists and Marxists concerning the crisis of the fourteenth century.

Land Tenure in the Early Middle Ages

The system of agriculture practiced in the European north in late antiquity and the early Middle Ages seems to correspond well with Boserup's model

of a long-fallow, semi-migratory agricultural system. To be sure, the Romans in conquering Gaul and Britain introduced more intensive methods, but it is not known how well Roman villas survived the tumult of the barbarian migrations. The barbarians themselves certainly relied principally on long-fallow systems (Barker, 1985).

By about 750, a short-fallow system, based on permanent homesteads (known most commonly as *mansi*) and estates (manors), had come to dominate northern agriculture. This move to more intensive methods also marks the emergence of the European peasantry as a historic class. The remarkable aspect of this change is that the Germanic migrants did not impose their own extensive methods on the former Roman provinces – a common result of similar migrations, according to Boserup. Rather, they adopted short-fallow agriculture, and the methods were taken into Germany itself, never part of the Roman Empire.

Do growing population densities chiefly explain this transition? This is difficult to discern. *Penuria hominum*, a shortage of people, seems to have been the bane of the late empire. And the initial reaction of the barbarians themselves to hunger was migration. The more powerful (or at least the more visible) stimulus to change seems to have been the emergence of barbarian kingdoms, based on a highly stratified social structure, with kings, warrior elites, and priests ruling over a now settled and fully "peasantified" population. The barbarians either took over or had to compete with well-organized states, the heirs of the ancient empire. A further factor was the growing reliance on heavy cavalry as the chief instrument of warfare – a change which was making war more expensive and therefore the preserve of the warrior elite. Eager to marshal resources for the support of armies and monasteries, the elites seem to have required the common freeman to remain fixed upon the land. Probably because the freemen were inefficient farmers, the elites taxed them in time – the one resource the cultivators possessed in abundance. By about 750, the typical dependent cultivator would spend half his time (three days a week) working on the lord's manor. Now a full-time cultivator, he ceased to be a fighter; he thus lost this as his chief claim to status and freedom. He became, in sum, a peasant and a serf. The establishment of a peasant economy in Europe north of the Alps in the early Middle Ages was a decisive change, but its relationship with population densities remains obscure and questionable.

Peasant Economy and the Late-Medieval Crisis

The new peasant economy did, however, show a remarkable capacity for growth, perhaps because the dues the lord could claim from the peasants were fixed by custom; the peasants therefore could increase their own

share of output by greater effort or by enlarging the areas of cultivation. In contrast, the slave economy of the ancient world seems to have powerfully repressed demographic growth. For example, the population of ancient Italy seems to have grown hardly at all between the third and first centuries BC (according to Brunt, 1971). The medieval peasant economy rather favored expansion. At least there is no doubt that the numbers of Europeans grew substantially, from at least the year 1000, and were at very high levels when struck by the great plague of 1348.

Interpretations of Population Decline

The plague introduced a period of radical population decline, and Malthusians and Marxists have proposed divergent interpretations of the causes of this great debacle. According to the Malthusian view (well represented by the late M. M. Postan in England and Emmanuel Le Roy Ladurie in France), the small population of the early Middle Ages enjoyed an abundance of resources. Cheap and plenteous food launched and sustained a long wave of expansion (the first phase of a "long-term agrarian cycle"). But by about 1300, increasing human numbers and exhaustion of new lands became the continent's nemesis. A deepening crisis of overpopulation is manifest in recurrent famines, devastating epidemics and violent competition (wars and revolts) over diminished resources. There ensued, roughly between 1350 and 1420, a horrendous population collapse, probably by as much as two-thirds. The population then stabilized at very low levels, but did not begin to grown again until around 1480, when the long-term agrarian cycle started anew.

Marxist historians, represented by Robert Brenner in America and Guy Bois in France, agree with the data but see the crisis as rooted in the collapse of "feudal rents." The feudal economy could expand only extensively, by taking new lands under cultivation, but the good soils had all been claimed by about 1250. Diminishing returns set in, and the first to suffer from the new penury were the lords. The peasants, many of whom were crowded onto marginal lands, simply could not sustain high levels of rent. Faced with declining rents, the lords took to direct expropriation (pillage) or collective expropriation (wars) to repair their failing fortunes. The heightened levels of social violence increased vulnerability to hunger and epidemics.

The two views invite the following comments: the Malthusian model does not seem to correspond very well with actual population movements. The plagues and famines did not strike against a vigorously expanding population. Rather, Europe's population seems to have remained stable, though at very high levels, a century before 1350. If fourteenth-century

plagues and famines were a Malthusian reckoning, they should have occurred a hundred years earlier. And the Marxist model, as outlined above, seems itself to have a Malthusian basis, as it is the growing reliance on poorer soils and the diminished returns to the cultivators that provoke the crisis in feudal rents.

Most recently, historians have been developing a different concept, one not of Malthusian crisis, but of Malthusian deadlock or stalemate. Europe's population by the late thirteenth century had reached a stunning size, and famines were widespread and recurrent. Yet the remarkable aspect of these famines is the slight impact they had on absolute numbers of people. Even the great north-European famine of 1315–17 seems to have produced no considerable and lasting reduction in human numbers. When compared with the impact of epidemics, its consequences appear trivial. Many Europeans in this large population doubtless went hungry, but the community successfully maintained its size until plague overwhelmed it. This Malthusian deadlock might have held on indefinitely within Europe. The plague broke its grip, and ultimately made possible a profound reorganization of the European economy. (See chapter 8)

Causes of and Responses to Hunger throughout the Millennial Era

All of the known civilizations from antiquity to the Middle Ages were characterized by functional specialization leading to hierarchical social systems. Agricultural intensification and the growth of non-agricultural labor resulted in high status for the non-agricultural sector, particularly those who owned the means of production or were in roles of political or religious leadership. Low status for agricultural sectors of society is seen from Mesopotamian temple laborers, to the farmer-warriors of the Roman Empire, to the Middle Ages with their development of peasant economies tied to the land and to food production. At the same time, other ways of acquiring foodstuffs were developed. Trade and protection of trade routes initiated both the safety net of alternate sources of food, and colonization and warfare to secure the sources. It is in this setting that excess appropriation as a cause of hunger emerges, and creates an endemic food poverty.

Causes of Hunger: Excess Appropriation

Appropriation, closely linked to social stratification, refers to the acquisition of resources other than through ownership, production, or exchange. It includes appropriation of the means of production such as labor or land or food itself, or of surplus value in the form of taxation. Appropriation of

labor can be through colonization of peoples, through raiding of "barbarian tribes," by tribute, by debt, through peonage, and through slavery. Tribute resulted from subjugation of a people and the requirement of labor from colonies. Those in debt eased their indebtedness through sale of children or young people into indentured servitude. Peonage refers to those individuals bound to the land and allowed to maintain a family, while those in slavery were attached to their owner without benefit of a family themselves. Hierarchical social structure was the cause and in turn the result of excess appropriation of labor and taxation.

The decline of population in the Roman Empire of the first century AD has complex and controversial origins, but food poverty, want, and hunger figure significantly in most analyses (see chapter 5). The connection in the first century between food productivity and excess appropriation, and the constant threat and frequent reality of hunger, resulted from the fragility of productivity. With a few exceptions, Roman agriculture was unable to generate consistent surpluses, sometimes sustained serious failures, and continually suffered from inadequate land transport (Evans, 1981). Not only was food production and distribution fragile, but in many areas there were appropriations – obligations imposed centrally – that proved overwhelming. The historian Rostovtzeff defined the problem as internally driven – the pressure of government on the people – "the supremacy of the interests of the state over those of the population" (1957:377–8). A loss of productivity provided difficulty to the urban dwellers who demanded to be fed, but it proved disastrous to the peasantry. Excess appropriations were variously described as the predations of moving armies on peasant communities in their path, the continuing oppression by neighboring standing armies of the food resources of communities in peace time, or the appropriation of harvests by urban dwellers. While each was a legitimized entitlement of Roman citizenship, direct appropriation of food left the peasantry hungry and without recourse. Galen's AD 148 description of the appropriations of city dwellers is graphic:

> For those who live in the cities, in accordance with their habit of procuring sufficient grain at the beginning of summer to last for the entire coming year, took from the fields all the wheat, barley, beans and lentils, leaving the other legumes to the *rustici*, although they even carted off no small portion of these to the city as well. Consequently the peasantry of these districts, having consumed during the winter whatever was left, were literally compelled for the rest of the year to feed on noxious plants, eating the shoots and tendrils of trees and shrubs, the bulbs and roots of unwholesome plants (quoted in Evans, 1981).

The maintenance of a standing army meant an unrelenting fiscal drain upon already fragile resources, and "involved many in personal contact with

a soldiery whose behavior too often ranged from crudely extortionate to openly murderous" (Evans, 1981:439). The other side of this description is provided by Brunt, who noted that in this era, even in peace time, only three of five soldiers lived to return home (Brunt, 1971).

Responses to Hunger and the Threat of Hunger

Food Shortage: Migration and Other Strategies Consequences of the hardships of food shortage must always have involved dispersal of people to "greener pastures," sometimes voluntarily, sometimes by decree. Successful migration and the establishment of colonies in new areas created center–periphery relationships making possible development of new areas for food production and protection of transport, and enhancing trade relationships.

One of the most effective forms of warfare was to block the movement of a population or the transport of their food by siege (see chapter 6). It was as if the walled city, designed for protection against enemies, became their agent, causing either starvation or capitulation.

Short-term adjustment to the fear of food poverty and long-term adaptation to food shortage have sometimes differed in motivation and pursued opposing objectives. In the Rome of the empire, families in fear of food poverty were known to limit the number of their children, thereby limiting the number of mouths to feed. Government response to food need, on the other hand, was often enlargement of the army and colonization, resulting in official exhortation to have more children, and including entitlement programs targeted to large families, or support of poor families through direct monetary gift.

Food Poverty: Citizen Entitlement Programs Entitlement in the urbanized ancient world was generally legitimated through citizenship, itself dependent on parentage and residence. While entitlement refers to access to and control over resources, it also refers to exemption from obligation. Citizens were often exempt from taxation but benefited from taxation of the colonies. Levels of citizenship and some form of entitlement characterized all known ancient communities from Sumer and Greece to Rome, and included those landless laborers and slaves resulting from labor appropriation. Their dependent (as opposed to free) status entitled them to food rations, as seen in the Sumerian tablets, to public distributions of grain, as in Attica, or to dispensation from the public granaries of Rome.

In Rome, an entitlement program under the *lex frumentarium*, or grain law, was established by Gaius Gracchus in 123 BC, in which fixed amounts of grain were made available to citizens at subsidized prices. Subsequent

political exigencies first limited and then increased the number of citizens who might benefit, and the program was still functioning by the time of Trajan. At its peak in 46 BC, an estimated 320,000 Roman citizens were enrolled, entitling them to purchase subsidized grain. A large number of inscriptions to officials and local dignitaries indicate the extent and importance this program attained (Rickman, 1980).

Food Poverty: Intentional Family Limitation On the family level, adjustment to hunger or the fear of hunger has often taken the form of intentional limitation of the number of children a family would have (Newman, 1972). The prevalence of references by early authors to abstinence, contraception (Preus, 1975), abortion (Dickison, 1973), exposure (Patterson, 1985), and infanticide (Ben Khader et al., 1987; Engles, 1980; Pomeroy, 1983) in times of want, suggest that these were strategies that were known and used in households for spacing between children or to limit the total number of offspring.[3] While the extent of their use has been a subject of question, and is not known with any assurance, their variety and the explicit descriptions of their use in conjunction with lack of consistent reference to large families, except for the very wealthy, give some indication of their acceptance.

In ancient Greece, the most frequent reference to postnatal family limitation strategy was to exposure of a newborn infant, either in an open place where it might be found and "taken up," and possibly sold into slavery, or by placing the newborn in a well or "in some distant place" where it probably would not be found.[4] Many were discovered in Angel's excavations of wells in Attica (Angel, 1945). Effective life was seen to begin with citizenship, signaled by acceptance into the family by the father – there is a specific term, *brephos*, that refers to a fetus and newborn until the ceremony of acceptance. Exposure was one of the ways of choosing the timing, number, and gender of offspring.

According to Patterson (1985) the most cogent and usual reasons for exposure were illegitimacy, a visible defect in the infant, too many children in the family already, or gender selection. Legitimacy was particularly important in a society where citizenship, civil status, and heritage were central issues, and the infant born at an inappropriate time or to inappropriate parents was particularly problematic (Patterson, 1985). Exposure left the possibility of the infant being found. Although this was a part of literary and theatrical tradition, it is not clear how extensively exposure was practiced or how realistic was the expectation of an exposed infant becoming a foundling or even being sold into slavery.

Gender selection also provided a motivating factor in exposure. An estimate of the rate of female infanticide at Athens places exposure of

female infants at 10 percent or more of those born (Golden, 1981). The evidence of inscriptions on the Delphinion at Miletus, naming newly enfranchised mercenary soldiers and their families, indicated among the children a ratio of boys to girls of four to one. Pomeroy concludes "the people whose names appear on the Delphinion gave preference to males and exposed or neglected their female offspring, and such practices were not anomalous in Hellenistic Greece" (1983:218). A more subtle and more pervasive form of gender selection may well have been special care of male children as opposed to female. While this practice is difficult to document, it has been perceived in many societies, from the Indus Valley to the western reaches of the Roman Empire (Harris, 1986; Miller, 1981; Wemple, 1981). Differential treatment affects births in the uext generation in that it limits the number of females surviving, and may have contributed to lack of population growth in this period.

The further development of Christianity and its interpretations in the Middle Ages introduced a changing set of values and caveats. While exposure and infanticide were unacceptable to Christians, other forms of family limitation became evident in the Middle Ages. As LeRoy Ladurie notes from religious sources in a Christian village in France in the thirteenth and fourteenth centuries: "The documents concerning Montaillou, like others, exhibit both male and adult chauvinism, omitting to mention the existence of some daughters, the presence of young babies or the death of children who perished very early" (1979:77). He indicates also widespread knowledge of herbal medicine for contraceptive purposes. In this era, the practice of withdrawal or coitus interruptus is also documented. The exhortation "*Si non caste tamen caute*", "If not chastely, at least cautiously", was found by Biller as early as 1049; by the thirteenth century it was a commonplace. He derives evidence of coitus interruptus from the writings of the confessors, who consistently condemned the practice, and cites the Savoyarde Peter de Palude: "referring to the married man who engages in contraceptive coitus interruptus, he writes that he does this in order to avoid having children 'whom he cannot feed' (*quos nutrire non possit*)" (1982:24).

Food Deprivation: Family Entitlement Strategies In Rome at the time of the empire, the *alimenta* was a government entitlement program (modeled on earlier private initiatives) devised under Trajan to provide cash payments for poor children outside Rome in the states and municipalities (Garnsey, 1968; Veyne, 1965). An inscription at Veleia announced distribution in that area to 263 boys, 35 girls, and 2 illegitimate children. A total of 46 such inscriptions has been found in different municipalities. The *alimenta* entitlement program was well known as the subject of a bas-relief at Beneventum and on a series of widely distributed coins.[5]

Conclusion

Agricultural intensification, urbanization, and the complex social organization to support them have been the dominant historical themes in this era. This review has focused on the causes and consequences of hunger, and strategies for its prevention or amelioration. Examples of particular societies have included a discussion of agricultural intensification in Mesopotamia from 6000 BC, land use and citizenship in the Graeco-Roman world from the fifth century BC to the third century AD, and population growth and decline in medieval Europe. All of the examples have dealt with questions of the balance of population and food resources. Permanent settlements and sedentarization of hunting-gathering populations made possible the surplus production that could support non-producers of food, the specialization of function that led to social stratification. The causes of hunger have ranged from drought, flood, and other natural disasters that curtail food production, to hierarchical social structure with its rules of inclusion and exclusion that limit the distribution of food and wealth, to the excess appropriation of surplus value that characterized the empires of antiquity in their relationships with subject peoples. The consequences of hunger have resulted first in changes in food habits, hoarding, and attempts at restraint of the supply of food. In circumstances of greater need, the consequences of huuger have included food riots against those in political power, raids and warfare against those with resources, out-migration when possible. Strategies of prevention have differed depending on whether there is fear of food shortage at the societal level, or fear of food poverty at the level of the family. All of the societies have undergone periods of plenty and periods of famine, of growth and decline, and long periods of stagnation and barely enough.

NOTES

1 Technology, in Boserup's first work *The Conditions of Agricultural Growth* (1965), referred to agricultural innovation. In *Population and Technological Change* (1981), the reference is to population-related technologies, including not only agricultural methods, but also sanitary methods, literacy, and administrative techniques. This last group is emphasized in this chapter as social organization for population snrplus.

2 Some of the best indicators of rise and decline of populations are from archeological sites of continuous residence for millennia, such as Gomolava on the Sava River in present-day Yugoslavia, which was earlier part of the Roman Province of Pannonia (Museum of Voivodina, 1986), or Esbus in Transjordan, also a Roman outpost (LaBianca, 1987). Rather than suggesting a continuing progress, both sites indicate alternating periods of fertility and drought, of wealth and poverty, of population density and fewer numbers. Chapter 7 describes such an oscillation and ultimate decline of the Mayan civilization of the Yucatan Peninsula.

3 Written evidence for the use of fertility regulation in the ancient world is derived from a number of sources. The later Hippocratic authors (probably fourth to third centuries BC) included abortion in a treatise on the diseases of women, suggesting that methods of abortion were known and practiced at that time. Aristotle, in the *Politics*, differentiated on the basis of prenatal movement between the "unformed fetus" and the "formed" one, thus establishing indicators of an acceptable timing for abortion. The herbal compendium of Dioscorides Pedanius of Anazarbus (first century AD), *De Materia Medica*, included a large number of emmenagogues and abortifacients. Soranus of Ephesus, in the second century AD, recommended against such abortifacients "unless they were necessary," also suggesting use.

Contraceptive methods from a number of these sources included herbal infusions of roots, barks, leaves, flowers, pessaries (often with a honey base), and douches of brine or vinegar. Many of the methods enumerated have symbolic or religious value, but no contraceptive effectiveness. Some, however, particularly those creating an acidic environment for sperm (such as those including citrus, vinegar or honey), can be effective spermicides. Others have been found to be oxytocics, muscle relaxants, or plant estrogens, and theoretically are capable of impeding conception (Himes, 1963; Hopkins, 1965–6; Newman, 1985; Riddle, 1985).

4 There is controversy as to the extent of exposure in antiquity between British investigators, who note widespread nuclear family structure with close-knit family ties (on the basis of tombstones with inscriptions), and French investigators, such as Veyne, who consider exposure to have been ubiquitous in antiquity and familial love to have appeared only with the advent of Christianity. Veyne writes of private life in the Roman Empire: "The story is told in snfficient detail to bring out the dramatic contrast with Christianization." He then describes "the transition from 'civic man' to 'inward man'" and later asserts that "the Roman family, just to take one example, has little in common with its legendary image or with what we would call a family" (1987:1–2).

5 Interpretations of this program vary greatly. *The Oxford Classical Dictionary* asserts "Its primary object was to increase the birth-rate among the poorer classes, partly, as Pliny suggests (*Panegyricus* 26), with a view to the recruiting of the Roman legions" (Hammond and Scullard, 1978:45). The ratio of males to females would support this view. Evans, on the other hand, suggests "in Italy at least, the incidence of malnutrition-related exposure and infanticide seems to have been of sufficient magnitude that late in the First Century AD the imperial government, following local precedent, designed a program to counteract it: the celebrated and much-discussed *alimenta*" (1981:429).

REFERENCES

Adams, Robert McC. 1981: *Heartland of Cities: Surveys of ancient settlement and land use on the central floodplain of the Euphrates*. Chicago: University of Chicago Press.

Angel, J. L. 1945: Skeletal material from Attica. *Hesperia*, 14, 249–63.

Barker, Graeme 1985: *Prehistoric Farming in Europe*. Cambridge: Cambridge University Press.

Ben Khader, Aicha Ben Abed, and Soren, David 1987: *Carthage: A mosaic of ancient Tunisia*. New York: The American Museum of Natural History and W. W. Norton.

Biller, P. P. A. 1982: Birth-control in the West in the thirteenth and early fourteenth centuries. *Past and Present*, 94, 3–26.

Boserup, Ester 1965: *The Conditions of Agricultural Growth*. London: Allen and Unwin.

Boserup, Ester 1981: *Population and Technological Change*. Chicago: University of Chicago Press.

Brunt, P. A. 1971: *Italian Manpower 225 BC to AD 14*. London: Oxford University Press.

Camp II, John McK. 1982: Drought and famine in the fourth century BC. *Hesperia*, Supplement 20, 9–17.

Campbell, Bruce M. S. 1982: Population pressure, inheritance and the land market in a fourteenth-century peasant community. In Richard M. Smith (ed.), *Land, Kinship and Life-Cycle*, Cambridge: Cambridge University Press.

de Jong, J. W. 1985: The overburdened earth in India and Greece. *Journal of the American Oriental Society*, 105, 397–400.

Dickison, Sheila K. 1973: Abortion in antiquity. *Arethusa*, 6, 159–66.

Ellison, Rosemary 1981: Diet in Mesopotamia: The evidence of the barley ration texts, (*c*.3000–1400 BC). *Iraq*, 45, 35–45.

Ellison, Rosemary 1983: Some thoughts on the diet of Mesopotamia from *c*.3000–600 BC. *Iraq*, 45, 146–50.

Engles, Donald 1980: The problem of female infanticide in the Graeco-Roman world. *Classical Philology*, 75, 112–20.

Evans, J. E. 1981: Wheat prodnction and its social consequences in the Roman world. *Classical Quarterly*, 31, 428–42.

Feen, Richard Harrow 1983: Abortion and exposure in ancient Greece: Assessing the status of the fetus and 'newborn' from classical sources. In William B. Bondeson, H. Tristram Engelhardt, Jr, Stuart Spicker, and Daniel H. Winship (eds), *Abortion and the Status of the Fetus*, Dordrecht: D. Reidel, 283–300.

Flannery, Kent V. 1965: The ecology of early food production in Mesopotamia. *Science*, 147, 1247–56.

Garnsey, Peter 1968: Trajan's *alimenta*: Some problems, *Historia*, 17, 381.

Garnsey, Peter 1983: Famine in Rome. In Peter Garnsey and C. R. Whittaker (eds), *Trade and Famine in Classical Antiquity*, The Cambridge Philological Society, supplementary vol. 8, 56–65.

Garnsey, Peter 1988: *Famine and Food Supply in the Graeco-Roman World: Responses to risk and crisis*. Cambridge: Cambridge University Press.

Garnsey, Peter, Gallant, T., and Rathbone, D. 1984: Thessaly and the grain supply of Rome during the second century BC. *The Journal of Roman Studies*, 74, 30–44.

Golden, Mark 1981: The exposure of girls at Athens. *Phoenix*, 35, 316–31.

Hammel, E. A. and Howell, Nancy 1987: Research in population and culture: An evolutionary framework. *Current Anthropology*, 28, 141–60.

Hammond, N. G. L. and Scullard, H. H. (eds) 1978: *The Oxford Classical Dictionary*. Oxford: Clarendon Press, second edition.

Harriss, Barbara 1986: The intrafamily distribution of hunger in south Asia. Helsinki, Finland: Paper for WIDER Project on Hunger and Poverty: Seminar on Food Strategies. Draft.

Herlihy, David 1985: *Medieval Households*. Cambridge Mass.: Harvard University Press.

Himes, N. E. 1963: *Medical History of Contraception*. New York: Gamut Press (first published 1936).

Hopkins, M. K. 1965–6: Contraception in the Roman Empire. *Comparative Studies in Society and History*, 8, 124–51.

Jacobson, Thorbild and Adams, Robert McC. 1958: Salt and silt in Mesopotamian agriculture. *Science*, 128, 1251–8.

Jameson, Michael 1983: Famine in the Greek World. In Peter Garnsey and C. R. Whittaker (eds), *Trade and Famine in Classical Antiquity*, The Cambridge Philological Society, supplementary vol. 8, 6–12.

La Bianca, Oystein Sakala 1987: Sedentarization and Nomadization: *Food System Cycles at Hesban and Vicinity in Transjordan*. Winona Lake, Indiana: Andrews University Press.

Lee, Ronald Demos 1986: Malthus and Boserup: A dynamic synthesis. In David Coleman and Roger Schofield (eds), *The State of Population Theory*, New York: Basil Blackwell.

LeRoy Ladurie, Emmanuel 1979: *Montaillou: The promised land of error*. New York: Vintage Books, translated by Barbara Bray.

Lucas, Henry S. 1930: The great European famine of 1315, 1316, and 1317. *Speculum: A Journal of Medieval Studies*, 5, 343–77.

Miller, Barbara D. 1981: *The Endangered Sex*. Ithaca, NY: Cornell University Press.

Museum of Voivodina 1986: *Gomolava: Prehistory to the Middle Ages*. Novi Sad, Yugoslavia.

Newman, Lucile F. 1972: Birth control: An anthropological view. Addison-Wesley Modular Publications, 27, 1–21.

Newman, Lucile F. (ed.) 1985: *Women's Medicine: A Cross Cultural Study of Indigenous Methods of Fertility Regulation*. New Brunswick, NJ: Rutgers University Press.

Oppenheim, A. L. 1955: Siege documents from Nippur. *Iraq*, 17, 69–89.

Patterson, Cynthia 1985: "Not worth the rearing": The causes of infant exposure in ancient Greece. *Transactions of the American Philological Association*, 115, 103–23.

Polanyi, Karl, Arensberg, Conrad M., and Pearson, Harry W. (eds), 1957: *Trade and Market in the Early Empires: Economies in theory and history*. Glencoe, Ill.: The Free Press.

Pomeroy, Sarah 1983: Infanticide in Hellenistic Greece. In A. Cameron and A. Kuhrt (eds), *Images of Women in Antiquity*, London: Croom Helm, 207–22.

Preus, Anthony 1975: Biomedical techniques for influencing human reproduction in the fourth century BC. *Arethusa*, 8.

Rickman, Geoffrey 1980: *The Corn Supply of Ancient Rome*. Oxford: Clarendon Press.

Riddle, John M. 1985: *Dioscorides on Pharmacy and Medicine*. Austin: University of Texas Press.

Rostovtzeff, M. 1957: *The Social and Economic History of the Roman Empire*. Oxford: Clarendon Press, second edition revised by P. M. Fraser.

Rouche, Michel 1973: La faim à l'époque carolingienne: essai sur quelques types de rations alimentaires. *Revue Historique*, 295–320.

Roux, Georges 1980: *Ancient Iraq*. Harmondsworth: Penguin Books, second edition.

Saller, Richard P. and Shaw, Brent D. 1984: Tombstones and Roman family relations in the principate: Civilians, soldiers and slaves, *The Journal of Roman Studies*, 74, 124–56.

Veyne, P. 1965: Les "Alimenta" de Trajan. In *Les Empereurs Romains d'Espagne*, Paris: Editions du Centre National de la Recherche Scientifique, 169–70.

Veyne, Paul, (ed.) 1987: *A History of Private Life: from Pagan Rome to Byzantium*. Cambridge, Mass.: The Belknap Press, translated by Arthur Goldhammer.

Wemple, Suzanne Fonay 1981: *Women in Frankish Society: Marriage and the cloister 500 to 900*. Philadelphia: University of Pennsylvania Press.

Zagarell, Allen 1986: Trade, women, class, and society in ancient western Asia. *Current Anthropology*, 27, 415–30.