Reviews

THORLEIF SJØVOLD (ed.): *Introduksjonen av jordbruk i Norden. Foredrag holdt ved fellesnordisk symposium i Oslo april 1980.* Det Norske Videnskaps-Akademi. Universitetsforlaget, Oslo 1982. 282 pp.

MAREK ZVELEBIL: *From Forager to Farmer in the Boreal Zone. Reconstructing economic patterns through catchment analysis in prehistoric Finland.* BAR International Series 115 (i-ii), Oxford 1981. 472 pp.

The two works display superficial similarity, both being reproduced typescript. In other ways they are very different. *Introduksjon* offers a series of papers by Scandinavian scholars, while *Forager to Farmer* is the result of a PhD thesis by a non-Scandinavian.

Introduksjon is well-organised, and goes a long way towards summing up the current state of research, an unusual achievement for an edited volume. The English summaries of the papers are, however, usually too brief to do justice to the originals, which may deflect some of the attention this volume undoubtedly deserves. One immediately noticable point concerns the breakdown of papers: two (Hagen and Waterbolk) discuss the development of agriculture outside Scandinavia. Although interesting in their own right, they contribute little to the main theme of the volume. Two more papers deal with Denmark, while a full 15 cover Norway, Sweden and Finland. The impetus of research, anchored in Denmark in the middle years of the century, now seems to have moved to the north.

The Scandinavian papers may be divided into 2 categories. From southern Scandinavia, there is much archaeological evidence of early agriculture, and pollen analysis attempts to understand *what kind* of farming was practiced. From the boreal zone, however, there is virtually no archaeological evidence, so pollen is usually also the only source of information on *whether* agriculture was practiced.

The two papers from Denmark are by Troels-Smith and Steensberg, neither of them describing very recent work. Troels-Smith provides a resumé of his major article in *Aarbøger* 1953, describing the results of the Aamosen investigations, and compares the Danish and Swiss evidence. The various types of agriculture discerned in the pollen diagrams are linked to particular archaeological cultures; economic change thus takes place by invasion or influence. The linking of agricultural type to archaeological culture is sometimes rather roundabout – the elm decline (believed to result from fodder collection) in the Neverkær pollen diagram is ascribed to the Ertebølle culture because of a thick-walled potsherd found at the same level. Cereal type pollen also appears at this level. The Muldbjerg settlement is also dated to this phase with its neolithic A pottery. The Muldbjerg C14 dates of around 2800 bc thus date a post-elm decline Ertebølle/neolithic A complex with domestic livestock. However, some pollen analysts have argued that the elm decline all over north-western Europe should be dated to 3100/3000 bc (Smith and Pilcher 1973). Skaarup (1973) has shown that the later shell middens are to be seen as neolithic hunting stations, not as late Ertebølle survivors alongside immigrant farmers, and the many C14 dates now available suggest that the Ertebølle ended around 3200/3100 bc (Tauber 1972, S.H. Andersen 1973). Not all the evidence is therefore in favour of an Ertebølle responsibility for the elm decline (which may not have been caused by man at all – Rowley-Conwy 1982), or for that matter for an Ertebølle/neolithic A overlap. The major landnam clearances (sometimes regarded as evidence of swidden cultivation) are attributed to neolithic B immigrants. Whether it is justifiable to ascribe agricultural types to archaeological cultures in this way is uncertain. Becker's (1947) neolithic A–B–C sequence is not supported by radiocarbon, and it is doubtful whether an ethnic interpretation of these groups can be sustained. Nevertheless, the results of the Aamosen project remain central to any discussion of early agriculture in Denmark.

Steensberg describes the important slash and burn experiments from Draved, carried out in the 1950's and published in 1979. He suggests that the major landnam features in the pollen diagrams resulted primarily from efforts to provide grazing for cattle, one or two cereal crops being taken first. Particularly striking is the generally low yield produced by the experimental slash and burn fields, suggesting that (if this really was the neolithic method) cereal cultivation would have been precarious indeed.

Turning now to the papers about southern and central Sweden, Jennbert-Spång suggests that there was considerable continuity between the Ertebølle and the neolithic, and so provides an alternative to the immigrations of Troels-Smith. Welinder briefly describes a computer simulation of a forest clearance pollen diagram, and concludes that the elm decline may be no more that a statistical creation caused by the regeneration of birch. The simulated diagram is »fairly similar« to the actual one. Built into the model are certain assumptions such as slash and burn agriculture, and that the pollen in the sample derives from a 2 km circle round the sample point. It

would be interesting to know how similar the model diagram would be to the real one if other assumptions were used.

Göransson's article is probably the most original and provocative in the book. His most important suggestion is that the middle neolithic »regeneration« of the forest in fact represents the development of coppiced or pollarded woodland, used cyclically to provide grazing, wood and small areas for cultivation. This would explain why grasses etc. are much more common in this »regenerated« woodland than in the undisturbed woodland of earlier periods. Göransson's explanation is at least as likely as the development of areas of permanent pasture (Troels-Smith 1953), or the decline of agriculture due to climatic fluctuations (Gräslund 1980) or soil exhaustion due to too short a fallow period (Whittle 1978). Göransson's theory is particularly attractive because of the likelihood of areas of coppice developing »by accident« close to a settlement. As trees were felled to provide building material, and/or were ringbarked to provide agricultural plots, so more light would reach the forest floor and encourage ground vegetation. We may assume that neolithic farmers were perfectly well aware of the ability of the stumps of many tree species to produce new shoots after felling. The need for a supply of easily cut timber of uniform development would be likely to result in some areas being protected from grazing animals for the first few years after felling, so that this growth of new shoots could become useful timber. Cyclical use of the woodland would result. It is significant that Göransson finds some evidence of ringbarking in his pollen diagrams: after ringbarking, trees produce a large amount of pollen before dying, and the uneven values of some trees could be interpreted as evidence of this. Göransson suggests a period of shifting fire clearance between the ringbarking and coppicing phases, but this would seem hardly necessary in ecological terms: the initial ringbarking could lead straight into the coppicing phase as suggested above. Thus Göransson's work raises some problems, but does succeed in airing some exciting new ideas about the neolithic use of forests. It is hoped that these ideas will be further developed in future.

In southern Scandinavia, therefore, there are still some problems in the palynological diagnosis of agricultural type. Further north, the problems seem even greater. Most of the *Introduksjon* papers deal with areas north of the temperate zone, so comparisons with *Forager to Farmer* are particularly relevant. A good point about *Introduksjon* is that several of the papers are in pairs, being pollen analytical and archaeological commentaries on early agriculture in particular areas. This enables comparisons to be made between the two lines of evidence, and a major problem appears: the pollen analysts are unanimous in claiming evidence for neolithic agriculture, while the archaeologists are unable to provide any supporting evidence. Archaeological evidence has been specifically looked for – Baudou's archaeological commentary on north Sweden mentions the Norrböle area, where pollen evidence of neolithic agriculture has been claimed. Excavation of 7 contemporary sites within a few km of the pollen sample point has however produced nothing but *wild* animal bones. Engelmark, describing the pollen evidence from the same area, does have the advantage of being able to point to the only neolithic site in northern Scandinavia with evidence of domestic animals: Bjurselet. Several contributors to *Introduksjon* mention it as the kind of neolithic site to be looked for in other areas, but the evidence is far from convincing. The domestic animals (mainly sheep) form under 2% of the fauna, and at least some of them are recent intrusions (Lepiksaar 1975). This is scarcely sufficient basis for the »large scale sheep farming« sometimes suggested. Future excavations will hopefully provide more information; but in the meantime we may speculate whether anyone would go to the trouble of keeping domestic animals if they were to provide only 2% of the kill – or for that matter whether such small numbers of animals would cause vegetational changes visible in pollen diagrams.

The other northern areas do not have sites like Bjurselet. The history of neolithic agriculture is written entirely from the pollen diagrams for east Norway (Mikkelsen, Høeg), north Norway (Vorren and Nielsen) and Finland (Huttunen, Tolonen, Vuorela). One exception is the paper by Aalto, where agriculture is claimed on the basis of plant macrofossils – but the associated pollen core has no agricultural indicators. Much is often based on minor components of the diagrams. The reviewer is probably not alone in feeling some disquiet when permanent settlement is claimed on the basis of a single pollen grain of *Plantago major* (Vuorela and Aalto 1982). »Cereal type« pollen is often assumed to be evidence of cereal cultivation, although S.T. Andersen (1978) emphasises the overlap between pollen from cereals and wild grasses.

A point made by several contributors (Mikkelsen, Engelmark, Tolonen, and indeed Zvelebil in *Forager to Farmer*) is that many of the claimed »indicator plants« are in fact native to northern Scandinavia, particularly the coastal regions. Discussion of this by Vorren and Nielsen in their paper on north Norway would have been welcome – their claimed grazing horizon on the Lofoten Islands at 3560±80 b.c. is both the earliest and the most northerly of those discussed in *Introduksjon*. Johansen's archaeological commentary points out that no neolithic sites of anything like this antiquity are known, and he mentions elsewhere (1979) that only two early neolithic finds (thin-butted axes) are known from the whole of Norway north of the Arctic Circle. The conventional limit of farming at around 3500 b.c. is the Rössen culture, which extended about as far north as Hamburg, some 1600 km south of the Lofoten Islands. The presence of domestic animals so far north so early seems from an archaeological point of view very unlikely.

Several of the Finnish papers (Huttunen, Aalto, Vuorela) note that the appearance of culture indicators is often contemporary with that of spruce. One explanation is that early farmers exhausted the soil, allowing spruce to immigrate. Variations in the spruce pollen curve, and increases in herbs etc., thus indicate subsequent human clearances for agricultural and/or pastoral purposes.

Other possible causes of such phenomena do come to mind, however, and it would be interesting to know how palynologists distinguish anthropogenic from other causes. An important point in this connection is that fire is a natural component of spruce forest ecology. Much work has been done in North

America demonstrating that the boreal woodland mosaic is a product of numerous forest fires, so that the forest consists of patches burnt at different times and in different stages of post-fire succession (e.g. Bloomberg 1950, Heinselman 1973, Rowe and Scotter 1973, Swain 1973). Bloomberg (op. cit.) stresses that fire is important because little undergrowth (even spruce saplings) can flourish under spruce forest. Periodic burning removes the spruce, allowing pine to colonise the area. These pines create a suitable environment which spruce may re-invade. Because so little light and heat reach the ground beneath dense spruce stands, decomposition of dead, dry vegetable matter on the forest floor is slowed. Spruce stands thus become increasingly combustible with age (Bloomberg op. cit.).

The importance of the early post-fire successional stages for grazing wildlife is stressed by all the authorities quoted above. »Vigorous growth of grasses, sedges and other herbs characteristically succeeds fire in many areas of the boreal forest« (Rowe and Scotter 1973, 449), which provides excellent conditions for wild ungulates. This has great importance for boreal hunter-gatherers in the New World (Winterhalder 1981). Other factors which can clear areas of spruce and initiate post-clearance succession are snow-throw (Pruitt 1958), wind-throw (Sernander 1936) and beaver activity (Coles and Orme 1983).

North Scandinavian spruce forests show similar evidence of repeated burning, the fires often being caused by lightning strikes, but also by campfires etc. (e.g. Saari 1923, Siren 1955, Uggla 1958). Of particular interest are the plants which recolonise the burnt areas. In northern Scandinavia these include many of the plant types regarded as evidence of human activity, such as Gramineae, Polygonaceae (including *Polygonum* spp. and *Rumex acetosella*), Plantaginaceae (including *Plantago major* and *P. media*), Chenopodiaceae, *Urtica* (nettle) and ferns etc. (Buch 1945, Fagerström 1942–43, Petterson 1931). It would therefore seem that there might be considerable problems in distinguishing between a natural fire succession and one caused by human clearance, let alone between different kinds of human clearance (e.g. for swidden agriculture, for permanent arable, for domestic animal grazing, or for that matter for increasing graze for wild mammals – the last-named is widely documented ethnographically). The regularity with which »culture indicators« first occur at the same time as the appearance of spruce (see above) emphasises the problem.

Periods of apparent stability in boreal pollen diagrams do not necessarily indicate that areas of the forest mosaic were not being burnt; the balanced turnover of mosaic elements can lead to unchanged regional pollen representation (Wright and Heinselman 1973). Charcoal is not necessarily an indication of human activity: »Most of the forests in northern Sweden have been devastated by fire, and particles of charcoal from ancient forest fires are very common in the humus cover« (Uggla 1958, 99, reviewer's translation). Charcoal is found continuously in North American lakes from the early post-glacial (Heinselman 1973).

The above discussion of spruce and fire is put forward by the reviewer (who is neither an ecologist nor a palynologist) as a question which others are more competent to discuss. In view of the replacement of spruce by other trees after forest fires, and the growth of plants such as Gramineae, Chenopodiaceae, *Urtica* and *Rumex* in naturally burnt areas, ecological and palynological discussion of, for example, the following quote would be interesting.

> »From a botanical point of view it is logical to interpret a horizon as a cultivation phase if e.g. the natural Gramineae pollen proportion and quantity increases, and if there appear among the weeds e.g. Chenopodiaceae, *Urtica* and *Rumex acetosella*. This is particularly the case if a contemporary drop in spruce and rise in birch and alder can be observed from the tree pollen.«
>
> (Vuorela, *Introduksjon* p. 255, reviewer's translation).

Pollen evidence for agriculture in areas such as north Scandinavia where there is no independent evidence for or against farming seems thus somewhat problematic. The impression gained from *Introduksjon* is of current deadlock: in the absence of archaeological evidence, claims put forward by pollen analysis are hard to assess. The importance of Zvelebil's *Forager to Farmer* in this context is that it develops a methodology for breaking this deadlock, and examining the economies of south west Finland.

Zvelebil's method is to develop a General Model Strategy (GMS); this is based on a reconstruction of the prehistoric environment. Optimal settlement locations are predicted. An optimal location is one »where all the vital resources can be exploited proportionately to their sustained yields« (p. 71) within the terms of minimising effort and risk. As population pressure develops, groups may have to increase their work effort and their risk factor. This should be visible as a departure from the GMS; in other words, sites will be found in suboptimal locations regarding effort and/or risk minimisation.

Essentially, the approach succeeds. For it to do so, reconstruction of both the environment and of likely human exploitative abilities must be sufficiently reliable to allow the rest of the process to be based on it. Any reconstruction of this kind remains to some extent hypothetical, but the thoroughness of Zvelebil's treatment is reassuring. Each resource is considered against each environmental zone, and annual productivity for each zone is calculated from the biomass, meatweight and calorific value of each resource. The *accessibility of this annual productivity* is the key to the GMS. This is estimated with reference to resource reliability, resource value, energy expenditure in procurement, and energy return. The result is an estimate of the resource value for each zone and season. This approach seems preferable to that of Jochim (1976), which is based on quantification of such factors as resource agglomeration and mobility. The relevance of these factors to human exploiters clearly varies between species, making interspecific comparisons difficult. Zvelebil gets round this by ranking resource *accessibility*: although the results are explicitly estimates, the values for the various resources are comparable in a way that Jochim's are not.

Once optimal site location is predicted, it is tested against actual site location. This actual location is examined by means

of site catchment analysis. The various problems with this are discussed, and the technique made more flexible by using circles of varying sizes for different activities. For arable, a 1.5 km circle is used, for fishing 5 km, for hunting 10 km and for swidden 15 km. These values are based on ethnographic and historical sources. This makes the technique more flexible, and the detailed environmental treatment makes it more precise, than many earlier applications.

The various environments are examined, by season, to see how close they are to the ideal strategy of the GMS – that all resources should be exploited in proportion to their accessibility. The resulting prediction for early settlement in southwest Finland involves summer use of coasts for fish, and winter residence on the large inland lakes with seal populations, with some elk hunting also being carried out. When population rises to a point where it is no longer possible to minimise effort and risk, specialisation is predicted: all-year occupation of the coasts adds a winter seal specialisation, and all-year settlement on the interior lakes adds a fish specialisation in summer. Risk increases correspondingly. The third stage is for relatively increased mobility, involving special purpose camps in less favourable locations. The fourth possible stage predicted is the emergence of a fully mobile economy, with small groups occupying areas just inland from the coasts, and inland areas not on major lakes – i.e. a high work-input economy filling the less favourable interstices between the more sedentary specialists.

The assumption has to be made that sites are logically located regarding the resources, that human beings do the reasonable thing. This could be seen as a weakness, but the clear trends that emerge when Zvelebil considers the known sites of each culture and period more than justify his use of the technique of site catchment analysis. The Combed Ware I sites on the coast and lakes are located to exploit resources as the GMS predicts – coastal sites are in areas suitable for summer fishing, not for winter sealing, for example. Specialisation on seal takes place early, with Jäkärlä culture sites located in places where seal availability is on average double the mean value for the whole coast. The appearance of sealing technology supports the interpretation. Seal specialisation increases with time, as seal availability is even more above average at Kiukais sites. Particularly interesting is the result from the Corded Ware, usually regarded as a farming culture (see above). Some sites are just inland from the coast, but have much lower seal potentials than those of the specialist groups. Osteological evidence, such as it is, suggests a generalised sealing/fishing/fowling economy, carried out in spring and early summer. Corded Ware inland sites have their highest potential in summer, suggesting inland fishing. Sites away from waterways have their highest potential as winter hunting sites. Thus the Corded Ware seems to have been a highly mobile foraging adaptation along the lines of the GMS stage 4 (above) – no adequate weighting for increased arable soils can be seen, and no domestic animals or cultivated plants are known. (Zvelebil put large quantities of earth from two Corded Ware sites through a froth flotation system in an effort to find carbonised cereal grains and recovered none). Bronze Age sites are in the same area inland from the coast as the Corded Ware, but are (a) not found in the other typical Corded Ware locations, and (b) are clearly located with a view to maximising arable land within 3 km. This is particularly the case for the Late Bronze Age, and this is the earliest evidence for the appearance of a mixed farming/foraging economy. This conclusion is supported by the sporadic finds of domestic animal bones from Late Bronze Age settlements.

Zvelebil explicitly follows Finnish practice and regards the different cultures as different ethnic groups. This sort of equation has become rare in the last decade or so, and the whole concept questioned. In the Finnish case, however, the suggestion appears to have some justification, because the models of economy produced for each culture are so internally coherent that each is able to stand by itself as a complete economy viable all year round. A more serious problem is Zvelebil's assumption that group size in all cases approximates the hunter-gatherer band, around 15–35 people. Demographic aspects of mobility and sedentism are hardly discussed, and it would have been interesting to see whether larger group sizes might be an aspect of the sedentary coastal specialists, for example.

More detailed discussion of the integration of farming and hunting in the Late Bronze Age would have been of interest. Zvelebil concludes that both swidden and arable would have played a part at an early stage. He is able to demonstrate the Late Bronze Age preference for locations with high arable values within 3 km, so arable receives support. The status of swidden is more problematic. In more recent times, manure for the arable necessitated grazing domestic animals on regenerating swidden, and this could have been an important factor. If elk were still numerous enough to be widely hunted, however, would swidden clearings not be likely to be closer to the settlements than 15 km? The need to guard against the depredations of grazing animals would be a likely factor limiting the viability of far-flung swidden fields.

In general, however, *Forager to Farmer* succeeds in presenting a convincing picture of economic change in southwest Finland in the period under review. Only when this is done does Zvelebil put Finland in a wider context. The sequence of change in Finland is quite closely parallelled in Latvia and Estonia, and in general terms in the whole of boreal Eurasia. A useful review is presented of the ethnography of the northern rim of the continent, an area usually beyond the reach of those who do not read Russian. The whole picture is one of »progressive subdivision of an originally unspecified economic niche through the specialisation on marine resources, anadromous fish and reindeer on the one hand, and through a further diversification of economy by the addition of farming and herding on the other« (p. 151). The most likely reason for this to occur is population pressure. Ethnographically known hunter-gatherers do not usually approach carrying capacity; and the number of sites in Finland declines between 1800 and 1200 b.c., the period in which farming first appears. Both of these factors lead Zvelebil to look for an environmental reduction in carrying capacity rather than an increase in absolute population numbers. The decline from the postglacial climatic optimum and the deteriorating climate in boreal Eurasia as a whole is the im-

portant factor: »The adoption of agriculture during a period of climatic deterioration may seem paradoxical, but this is not so when it is viewed as part of a complex economy, aimed more likely at minimising risk rather than increasing productivity in a situation when a number of formerly used plant resources – water chestnut, hazelnut, to mention but two – were disappearing from the area« (p. 163).

Thus Zvelebil uses sophisticated techniques of ecological analysis to provide an explanation for the appearance of farming in southwest Finland. The differences between this approach and that of *Introduksjon* have been one of the most interesting aspects of reviewing the two works. In *Introduksjon* we repeatedly find claims that there was agriculture in the neolithic based on pollen analysis alone, with no supporting archaeological evidence. *Farmer to Forager*, however, specifically questions these claims on the basis of the Corded Ware site locations.

Either the neolithic farming and herding sites will be found; or Zvelebil will be proved right and the earliest agriculture will belong to the Late Bronze Age. Zvelebil's thorough treatment, the absence of conventional evidence of neolithic agriculture, and the problems of pollen interpretation, are all factors leading the reviewer to suspect that the latter will be the case. At all events, pollen analysis has now made considerable claims for northern Scandinavia. The evaluation of these claims will be one of the most important aspects of archaeological work in the next twenty years.

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ESTER BOSERUP: *Population and Technological Change. A Study of Long-Term Trends.* The University of Chicago Press, Chicago 1981. xi+225pp., tables, bibliography, and index.

In 1965 Ester Boserup published *Conditions of Agricultural Growth*, a book which rapidly became a standard reference among many students occupied with such topics as primitive agriculture and population pressure especially. The book was translated into Spanish, French, Swedish and Japanese, and it looks as if we are here already dealing with a »classic« less than twenty years after the publication of the book.

In the preface to the new book, *Population and Technological Change. A Study of Long-Term Trends*, Ester Boserup tries to clarify the different scope of this new book in relation to the old one. Though both books are focussed on those types of technology which are supposed to be related to population changes, the new one not only discusses problems having relations to agriculture, but also to other »population-linked« technologies, where the word »technology« should be understood in the broad sense. This makes the new book different and much more comprehensive when compared with *Conditions of Agricultural Growth.* Yet, behind all this is still the perception of a development reverse to the Malthusian one, and the importance of population size when discussing technological innovations is constantly in the foreground. When the point is looking for »models« the archaeologist of today is still much of a hunter, and in this respect there is much to gain or think over in Ester Boserups new book, especially because she looks at things as an economist, often focusing on phenomena, which would seldom enter the mind of an archaeologist.

The book is divided into five parts; in the introductory first part can be found considerations on the relationship between population density and food supply systems in general. Here there are also tables giving population estimates for different areas in the world covering a time span from A.D. 1 to the present day, thus giving a first picture of the demographic evolution, which is to be more closely looked upon in later parts of the book.

In the second part of the book the main topic is population and technology in the Ancient World. Starting with hunter-gatherers' economy of today, it is shown how relatively small an input of time is needed to get sufficient food. The same must have been the case in prehistoric times, not least because food-gathering populations then lived in more favorable areas, while populations of today practising this type of economy mostly live in marginal areas with poor soil or an unfavorable climate. Thus it is unlikely that prehistoric hunter-gatherers lived in a state of permanent semi-starvation, keeping their numbers from increasing. Instead the low population increase may have been due to different diseases, including high child mortality in general. Some other reasons are also discussed, however.

In a subsequent chapter Ester Boserup is dealing with ancient agriculture, and such different areas as Mesopotamia, Pre-Columbian Mesoamerica and Europe are considered. The very slow diffusion of the techniques of food production seem to show that in sparsely populated areas this type of economy is not always preferred to hunting and gathering. Here as elsewhere, Ester Boserup neglects such archaeological notions as »periods« and »cultures«, and the reader thus gets the impression that the theories put forward are of general value when dealing with pre-industrial societies. This way of thinking would still be unfamiliar to many archaeologists, having in the main their experience from material remains, which are often »local« types belonging to a certain area and period. Many of Ester Boserup's observations, however, concern such topics as flow irrigation, slash and burn technique, use of animal draft power etc., phenomena which are of a universal nature.

Especially interesting is the view put forward on the relationship between population density and agricultural strategy, already shown in a table in part one. Certainly, it is a well known fact that population density has to be low within communities practising forest-fallow, compared with e.g. flow irrigation, to take the extreme contrast, but here the evolution from a primitive to a highly developed agricultural technique is shown in a table step by step, indicating population density figures pr. km^2 for each type of agriculture. Forest fallow for instance, which needs extensive use of land, would have a population density which is no higher than 4 persons per km^2, whereas annual cropping combined with intensive animal husbandry would take place only in communities with a population density of 64–256 persons per km^2. Though the data in this table are from modern times, they are also worth studying for an archaeologist.

Another table shows the number of operations needed within different food supply systems. The more primitive ones need only a few operations, whereas multicropping and investment in water control would need much more work and would not be possible until there is a very high population density. This is illuminated by referring to the evolution in Mesopotamia especially, but also the development of ancient European agriculture is considered. Nicely according to Ester Boserup's theories, it can be shown that Greece and Italy with the higher population density in the first millennium B.C. had short fallow systems, whereas the areas north of the Alps had more primitive systems.

In the following there are two chapters on ancient urbanisation, which look most interesting from an archaeological point of view. Again, it is the economist at work, and – not surprisingly in this case – Ester Boserup draws attention to the apparent relationship between population size and urbanization. There are reflections on the size of the surplus needed to feed the inhabitants in the towns; mainly arguing out from ancient sources on taxation, she proposes a surplus of about 10%, which would be at the disposal of the inhabitants in the towns. This involves that a town with say 1.000 inhabitants – supposed to be occupied with non food producing activities – should be surrounded by a food producing population, which is ten times as large, i.e. 10.000 persons. Furthermore these have to live at a distance, which is no more than 7–8 kilometers from the center of the city. This is the distance which could be overcome with a primitive land transport technology. Certainly, such figures should not be taken quite literally, and Ester Boserup herself mentions several exceptions; but it is under-

lined that long distance food transport did not take place in pre-industrial societies due to the poor land transport technology and infrastructure.

Further calculations show that only areas with a population density of more than 64 persons per km^2 could be urbanized: a circle with a radius of the above mentioned 7 km from the center of a town would cover an area of 154 km^2, and with the said density of 64 persons per km^2, there would here live about 17.000 persons. The surplus these persons could produce (10%) may feed an urban population of 1700 persons. With a population density of f.i. 6 persons per km^2, there would live 1.000 persons in the same area, and in this case these could only feed 100 persons. This is so small a population that the settlement would hardly deserve the term urban center or town. Thus it is possible for Ester Boserup to conclude that urbanization in areas with low population densities and long transport distances was not possible in ancient societies.

The hypothesis put forward here that low population density is an obstacle to urbanization, is a most interesting one, and it remains to be seen how archaeologists, who have suggested many explanations for the emergence of towns but not this one, will react.

The subsequent chapter deals with characteristic features of ancient urbanization, especially trade and the scientific and technological progress caused by a high grade of specialization. When looking at Europe after the fall of the Roman Empire, Ester Boserup argues that the breakdown may very well have been due to epidemics, where the subsequent depopulation was highly destructive to the urbanized economy and the infrastructure, a theme which has often been debated among historians.

In part III the rôle of demographic factors in the European development is further discussed. The period from 850 A.D. to the emergence of the Black Death saw five centuries of population increase with economic progress, e.g. the introduction of the three-course rotation and further urbanization. Periods, however, followed with population decline and labor shortage, and then the agricultural system had to shift back to a more extensive strategy. The relationship between dense population, intensive agricultural systems, and technological progress in the broad sense of this word, can also be seen when looking at Tuscany and the Netherlands during the Renaissance and later, or the Industrial Revolution in Great Britain, since these areas are among the most densely populated in the periods mentioned.

As it can be seen, we are now dealing with periods which are rather more within the fields of the historian and economist. This is also the case with part IV and V on diffusion of industrial technologies, technological change in the Third World and several other topics, which should not be dealt with here.

Ester Boserup's new book is an important and inspiring one; especially the chapters on Ancient agriculture and urbanization ought to make archaeologists reflect in a more untraditional way; it also reminds one of the large rôle that demographic studies now play in this field of research. Though the book is most complex, with a wealth of details, some archaeologists maybe would complain that several new investigations from the last decades are not considered. This objection, however, is hardly essential since Ester Boserup is working along a general line that would scarcely be affected by a couple of new archaeological investigations. The essential thing is that the archaeologist in this book can find many valuable views that may help interpreting the archaeological material, or construct new »models«, where other factors than diffusion, i.e. demographic ones, are responsible for innovations.

Svend Nielsen