

CLIMATIC CHANGE AND ITS HISTORICAL SIGNIFICANCE IN THE MIDDLE AGES

Richard R. Ring
Ripon College
Ripon

The physical environments in which men live and have lived in the past are so crucial to the quality, and even to the duration of their lives that reminders of this condition would seem almost superfluous. Historians have been aware, intuitively at least, that the world is enough with us that it ought to be accorded some place in our histories. Some historians, notably Lynn White, Jr., have shown how man affects and changes his environment—often detrimentally; and have even suggested that “the roots of our ecologic crisis” are to be found in a specifically Christian view of nature (White 1967). I wish to explore the opposite proposition: namely, that the environment, and especially the climate, of the historical past have changed; and that such changes have had a significant effect on human societies. For the European Middle Ages the evidence for certain changes is, I think, unequivocal.

The reasons for the general historical ignorance of the environment seem to be two persistent attitudes. The first holds that historians, being mainly concerned with the conscious elements in mankind’s long evolution, ought to leave such subjects as man’s interaction with the environment to other disciplines. The second significant attitude has been that the environment has formed a largely unchanging backdrop for the human drama. This latter point of view, in part reflecting a reaction to the environmental and climatic determinism of Ellsworth Huntington, is rooted in an all too pervasive anthropocentric skepticism. Historians and scientists rightly reacted against sweeping pronouncements about historical effects of climatic changes, based on slim and often questionable evidence, and against attributing too much of human historical development to the influence of climate. The result, however, is that “climatic history has been peculiarly neglected by our historians” (Lamb 1965a). This statement is still valid and is, if anything, an understatement, despite the excellent introduction to the history of climate by E. Le Roy Ladurie (1971).

The reaction has proceeded too far and has hung on too long. Many have overlooked the wealth of evidence recently adduced by climatologists from archaeological, botanical, zoological, glaciological, and oceanographic studies, and from historical documents. The weight of the evidence forces one to conclude “that the climate does change and that there are fluctuations varying from the scale involving a century or so to the large scale involving millions of years and embracing the great Ice Ages” (Veryard 1963). Studies of atmospheric carbon, ocean levels, ice cores, pollen samples, tree-rings, and volcanic ash have contributed to the

certainty that the climate has changed within the historical period (Suess 1970; Bloch 1965; Johnsen et al. 1970; Ahlman 1949; Frank 1969; Schove and Lowther 1957; Thorarinson 1970). But have the changes in climate had a significant effect on human societies? This is the question which has led historians to neglect climate; for their usual answer has been that any great differences attributable to climatic changes seem unlikely (Slicher van Bath 1963a). Bearing on this difficult area of interpretation, recent studies have demonstrated many correlations between, for example, climate and agriculture. In spite of the fact that climatic influences on specific vegetational patterns are often obscured by anthropogenic effects, "there is no doubt that climatic changes or fluctuations over periods of 100 to 300 years, if of sufficient magnitude, must have a profound effect on the economic life and products of the people" (Whyte 1963). In my opinion the propositions that climatic changes in the historical period have occurred and that these changes have had a major influence on human history are now well established.

How does this conclusion affect medieval history and historians of the European Middle Ages? First let me give the general picture of the medieval climate drawn by climatologists such as Brooks, Lamb and Flohn. Although these scientists do not always agree in detail, a number of salient points stand out. First of all "it has . . . been firmly established that the weather was extraordinarily good in Europe during the period A.D. 800-1200" (Flohn 1969). Brooks and Lamb date this "good" climate to the two centuries between 1000 and 1200, or perhaps extending until about 1250 or slightly later (Brooks 1954; Lamb 1965b). This period which Lamb, perhaps with some exaggeration, frequently calls a "little optimum" was characterized by mean temperatures about 1-1.5°C higher than at present (Lamb 1969a). This was particularly the case with summer temperatures; moreover, summers generally started earlier and lasted longer. Winter temperatures were apparently more like those now; and though winter conditions were often cold they were mild at the beginning and the end of the "little optimum" period, and seldom very severe (Lamb 1966, 1969a). Changes in the precipitation patterns were probably even more important than temperature change. Brooks at least thinks that they "leave the most numerous and easily identified traces" (Brooks 1954). Both he and Lamb picture the 200 or more years starting about 1000 A.D. as a long comparatively dry period, in which the summers especially were warmer and drier (Brooks 1954, Lamb 1966). This period of relative dryness was followed by much heavier precipitation beginning sometime in the 13th century. These changes are quite noticeable in the references to climate in medieval chronicles compiled by Britton (1937), and in the recent studies of Brandon (1971 a and b). A third prominent feature of the European climate during the high Middle Ages was its general stability; there was none of the great storminess which characterized the period after about 1250 (Lamb 1965a), Brandon 1971b). All of these conditions occurred to varying degrees in different parts of medieval Europe and it is at least possible that they

occurred in regular patterns shifting from west to east and back again. Climatologists are now busy trying to explain these climatic changes and other larger ones. But as medieval historians we are rightly more interested in the possible effects on medieval society.

Up until now discussion of the role played by climatic changes in the economic life of the Middle Ages has centered mostly on the period from the 14th century on. In 1955, for example, Gustaf Utterström proposed a thesis relating the "secular depression" of the 14th and early 15th centuries to changes in the climate. Although Utterström asserted that he "had no intention of suggesting that climate is a universal explanation of all these complex relations", his work has met with only cursory treatment or else downright rejection (Le Roy Ladurie 1959, Slicher van Bath 1963a, Duby 1968). Perhaps it would be wiser, in spite of the meager data, if historians examined more closely the correlations between the "good" climate of the high Middle Ages and the great development of European economic life which occurred between the 10th and the 13th centuries. The general timing is intriguing. That the "little climatic optimum" corresponds chronologically with the period of greatest agricultural expansion in the medieval world can hardly be coincidental. But, of course, this observation does not get us very far. When, however, climatologists discover that during the high Middle Ages European "vineyards extended generally 4°-5° latitude farther north and 100-200 meters higher above sea level than at present", then historians should begin to take notice. Moreover, the conclusion that "the change in the average length of the growing season between the opposite extreme climates of the thirteenth and the seventeenth centuries over most of England probably amounted to 15-20 per cent on the ground between sea level and 200 m. elevation" (Lamb 1966), should be of great significance to students of medieval agriculture. In other areas a drop in the prevailing mean temperature of the same seemingly trivial order as is projected for the medieval rise, i.e. about 1C, is enough to shorten the average growing season by about two weeks and to double "the frequency of snow on the ground in most of the inland districts of England" (Lamb 1969b). Other observers have noted certain thermophilous species of plants "for which summers have generally not been warm enough for reproduction by seed since about the 12th century" (Perring 1965). These general conclusions and bits of evidence suggest the need for many more detailed studies of medieval agricultural patterns taking into consideration the probable effects of climatic changes on those patterns. Here I wish only to suggest one broad question to which such studies might contribute some answers.

How did the rapidly expanding populations of the high Middle Ages maintain an adequate food supply? In a narrower context this question has been at the heart of what Titow calls "The Standard of Living Controversy" (Titow 1969). During the period between the 11th and the middle of the 14th centuries the population of England at least increased by a factor of 3.5 to 4 times. Granted that this is only an estimate, it is the best estimate which we have at present. But did the production of food during

this period of population expansion also increase nearly fourfold? Are there factors which would allow us to postulate such an increase? Consider first the extension of arable land. The high Middle Ages are well known as a period of great agricultural colonization both external and internal; but no one supposes, I think, that there could "possibly have been anything like the doubling of that area [the arable] between 1086 and the end of the thirteenth century" (Titow 1969). This proposition would hold good, I think, for the continent as well as for England. What about an increase in food production due to a rise in the yield ratios? While the farmers of Western Europe in the 13th century had generally higher yields than those of the Carolingian period, most historians agree that they could not have hoped for more than 3 to 4 times as much as they sowed. Recent studies show that the increase in yield rates in the high Middle Ages was something in the order of 50 per cent (Slicher van Bath 1963b, Duby 1968). These crude estimates (again they are the best we have) of the major factors which increased medieval agricultural production allow us to postulate only about a three-fold increase in the amount of food available. Consideration of other possible factors does not help very much. There is very strong evidence against the notion that legumes replaced cereals in any significant way by the 13th century (Titow 1969). Technological advance—and this is a much controverted subject—probably acted more to change the input of labor necessary to produce a given amount of food than to increase the total amount of food available.

Are we then to accept the proposition that the medieval population slowly "starved to death" due to an inability to produce enough food? This is precisely the danger to which some have pointed as being the common historical experience of pre-industrial societies; even momentous agricultural advances in production are usually substantially neutralized by population growth. Titow answers the question with an "inescapable" affirmative, at least for 13th century England. In light of a progressive decline in the amount of cultivated land per capita and hence a decline in the quantity of food produced per capita he concludes "that there must have been a deterioration" in the standard of living of the English peasantry in the 13th century (Titow 1969). But how long had this process been going on? Are we to assume that the peasantry in the 11th century, for example, lived significantly above the subsistence level with respect to food?

Some additional factor would seem necessary in order to make sense out of this disorderly picture, and I would like to suggest that this factor was the "good" climate, the "warm epoch", of the high Middle Ages. But how could the climate have affected the major elements in the production of food which I have outlined? I think that the key concept should be stability or consistency. It has already been pointed out that climatologists view the high Middle Ages as a period with more stable, less stormy climatic conditions than during the subsequent period beginning about 1250. I suggest that this situation has a corollary in agricultural production; that the more stable and generally warmer and drier (summer) climate allowed

the medieval farmer to achieve more regularly, more consistently, average to above average harvests. A close look at the climatic and the harvest data compiled by historians and climatologists lends some credence to this suggestion; greater fluctuations in the climate and in harvests seem to occur after the middle of the 13th century than before (Easton 1928; Titow 1960, 1970). While some have maintained that one of the basic features of the rural economy of the Middle Ages was "the extreme irregularity of cereal production" (Duby 1968), almost all of the evidence of irregularity in yields comes from the early 14th century. I suggest that the production of food was more regular during the high Middle Ages than is generally believed, and that this greater consistency was a major factor in keeping the food supply and population more or less in balance.

An improved climate, moreover, undoubtedly affected other factors which must be considered in any calculation of the total amount of food available. Distribution of food supplies is almost as important as their production. Even a slightly improved climate in the high Middle Ages probably contributed to better transportation systems and a greater ability to store food; the storability and transportability of tillage crops are, and must have been even in the Middle Ages, the main buffers against adverse short term changes in climate. We must also consider the possibility that a long term climatic improvement subtly changed certain agricultural practices and thus contributed to a greater supply of food; such was the case during the warming trend in England during the early part of the 20th century (Lamb 1965a).

I would like to stress once more that much of this falls in the realm of speculation; but I hope that it is neither too wild nor too trivial for your palates. Few detailed studies of local areas, the sort urged by Professor Titow, taking into account climatic and other environmental changes exist at present. If I have convinced you of the importance of further study in this area and of the significance of environment and climate for medieval agriculture, and indeed all of medieval society, then I shall regard my task as having been successful.

BIBLIOGRAPHY

- Ahlman, H. W. 1949. The present climatic fluctuation. *Geographical Jour.* 112: 165-195.
- Berger, Ranier, ed. 1970. *Scientific Methods in Medieval Archaeology*. Berkeley and Los Angeles.
- Bloch, M. R. 1965. A hypothesis for the change of ocean levels depending on the albedo of the Polar Ice Caps. *Paleogeogr., Paleoclimatol., Paleocol.* 1: 127-142.
- Brandon, P. F. 1917a. Agriculture and the effects of flood and weather at Barnhorne, Sussex, during the late Middle Ages. *Sussex Archaeol. Coll.* 109: 69-93.
- Brandon, P. F. 1917b. Late-medieval weather in Sussex and its agricultural significance. *Trans. Inst. British Geographers* 54: 1-17.

- Britton, C.E. 1937. *A Meteorological Chronology to A.D. 1450*. London. Meteorological Office, Air Ministry: Geophysical Memoirs, v. 8, no. 70.
- Brooks, C. E. P. 1954. The climatic changes of the past thousand years. *Experientia* 10: 153-158.
- Changes of Climate*. 1963. Proceedings of the Rome Symposium organized by UNESCO and the World Meteorological Organization. Rome, 2-7 October 1961.
- Duby, G. 1968. *Rural Economy and Country Life in the Medieval West*. London.
- Easton, C. 1928. *Les hivers dans l'Europe occidentale*. Leiden.
- Flohn, H. 1969. *Climate and Weather*. New York.
- Frank, A. H. E. 1969. Pollen stratigraphy of the Lak of Vico (central Italy). *Paleogeogr., Paleoclimatol., Paleoecol.* 6: 67-85.
- Johnsen, S. J., et al. 1970. Climatic oscillations 1200-2000 A.D. *Nature* 227: 482-489.
- Johnson, C. G. and L. P. Smith, eds. 1965. *The Biological Significance of Climatic Changes in Britain*. London. Symposia of the Institute of Biology, 14.
- Lamb, H. H. 1965a. "Britain's Changing Climate," in Johnson and Smith, pp. 3-31.
- Lamb, H. H. 1965b. The early medieval warm period and its sequel. *Paleogeogr., Paleoclimatol., Paleoecol.* 1: 13-37.
- Lamb, H. H. 1966. *The Changing Climate: Selected Papers*. London.
- Lamb, H. H. 1969a. "Climatic Fluctuations," in *General Climatology*, 2. Edited by H. Flohn. Amsterdam, pp. 73-249.
- Lamb, H. H. 1969b. New look of climatology. *Nature* 223: 1209-1215.
- Le Roy Ladurie, E. 1959. Histoire et Climate. *Annales; ESC* 14: 3-34.
- Le Roy Ladurie, E. 1971. *Times of Feast, Times of Famine: A History of Climate since the year 1000*. Garden City, N.Y. Translated and revised from *Histoire de climat depuis l'an mil*. Paris, 1967.
- Perring, F. H. 1965. "The Advances and Retreat of British Flora," in Johnson and Smith, pp. 51-59.
- Schove, D. J. and A. W. G. Lowther. 1957. Tree rings and medieval archaeology. *Medieval Archaeol.* 1: 78-95.
- Slicher van Bath, B. H. 1963a. *The Agrarian History of Western Europe, A.D. 500-1830*. New York.
- Slicher van Bath, B. H. 1963b. *Yield Ratios, 810-1820*. Wageningen: A. A. G. Bijdragen, 10.
- Suess, H. E. 1970. "Climate and Radiocarbon during the Middle Ages," in Berger, pp. 159-166.
- Thorarinson, S. 1970. "Tephrochronology and Medieval Iceland," in Berger, pp. 295-328.

- Titow, J. Z. 1960. Evidence of weather in the account rolls of the Bishopric of Winchester, 1209-1350. *Econ. Hist. Review* 2nd ser., 12: 360-407.
- Titow, J. Z. 1969. *English Rural Society, 1200-1350*. London.
- Titow, J. Z. 1970. Le climat à travers les roles de comptabilité de l'éveche de Winchester (1350-1450). *Annales; ESC* 25: 312-347.
- Utterström, G. 1955. Climatic fluctuations and population problems in early modern history. *Scand. Econ. Hist. Review* 3: 3-47.
- Veryard, R. G. 1963. "A Review of Studies on Climatic Fluctuations during the period of the Meteorological Record," in *Changes of Climate*, pp. 3-15.
- White, L., Jr. 1967. The historical roots of our ecologic crisis. *Science* 155: 1203-1207.
- Whyte, R. O. 1963. "The Significance of Climatic Change for Natural Vegetation and Agriculture," in *Changes in Climate*, pp. 381-386.