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REVIEWS

The Little Ice Age: How Climate Made History, 1300-1850.

Brian Fagan. New York: Basic Books, 2000, 246 pp., $26.00 (hardcover).

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The study of the past, as often practiced, is marked by an assumption that climate conforms to a stationary, independently-distributed random process that has little effect on human behavior. Furthermore, the assumption that climatic conditions are independent and identically distributed in time is at odds with the recognition that climate naturally varies at all scales. There is considerable evidence of regime-like or quasi-periodic climate variations and of systematic trends in key climate variables during the Holocene. The unambiguous attribution of cause for such nonstationaries in a finite record is difficult, given the rich nonlinear dynamic of the climate system. The nonlinear dynamic climate system can be nonstationary as the system evolves from one regime to another. The nature of nonlinear oscillations of the system as well as the regime probabilities and its mean state may change as the external forcing factors (e.g., solar radiation, volcanic aerosols, or orbital variation) are changed (National Research Council 1999). Global climate usually changes little over the course of a human lifetime; however, transitions between fundamentally different climate regimes can occur within only decades. How such regime changes can affect human behavior also is nonlinear, and the outcomes generally cannot be predicted except in the most generalized terms. Simplistic linear deterministic models linking past human behavior have, justifiably, long been rejected; yet there is still a linkage that deserves examination, since the archaeological and historical record is replete with evidence for prehistoric, ancient, and premodern societal collapse (Weiss and Bradley 2001). In the modern period, the severe Dust Bowl drought of the 1930s (which lasted ~6 years) resulted in one of the most devastating economic and social disasters in the history of the United States (de Menocal 2001).

Post-glacial climate was long believed to have been relatively uneventful; however, paleoclimatic records increasingly demonstrate climatic instability. Multidecadal to multicentury climatic regimes started abruptly, were unprecedented in the experience of the existing societies, and appear to have had significant effects on subsistence systems that were not flexible enough to counter the rapidity, amplitude, and duration of changing climatic conditions. One interesting climatic shift was what has been termed the "Little Ice Age." Occurring roughly from 1300-1550 to 1700-1850 (Jones et al. 1998; Mann et al. 1999), the Little Ice Age (LIA) apparently was only the latest of several cold periods to occur during the Holocene. Documented most extensively in western Europe, its global extent is unclear. There is little doubt that temperature anomalies associated with the LIA were more prominent in some regions, particularly Europe, than in others. These large regional anomalies varied in amplitude, timing, and sign (Mann 2000), and appear to have been supported by general circulation models (Shindell et al. 2001).

Fagan's book examines how the LIA may have affected human behavior. Divided into four parts-warmth and its aftermath, cooling begins, the end of the "full world," and the modern warm period. Fagan's presentation relies upon a multitude of studies involving such diverse topics as historical records; art; literature; archaeology; climatic and paleoclimatic records; glaciers and ocean currents; disease; subsistence; atmospheric chemistry and solar radiation; social and

demographic factors; and volcanism. He weaves the results drawn from this variety of approaches into a very readable synthesis for both the general public and for researchers looking for a depiction of the LIA, with the focus on western Europe (including Greenland, Iceland, and Ireland). References are placed in the Notes section by chapter at the end of the text, whichwhile making for smoother continuity in readingis not my personal preference. (I prefer to have the citations placed within the text for easy reference; this is particularly true when one deals with such a complexity of issues and data, where attribution must be a serious consideration.) Some 32 figures, many done in the handsome style of the late cartographer Erwin Raisz, are provided. None of the figures or tables is numbered, but they provide good illustrations of the points being made.

As noted, the primary focus of the book is on the climate changes in preindustrial western Europe and the north Atlantic area, with some brief excursions to records from North and South America. The reasons for this bias are obvious, since most of the literature on the LIA is European and the historical record is much relied upon, but there may be more here than a historical bias, in that Europe may be most sensitive to a climatic variation such as the LIA.

The difficulties of a historical study of LIA climate are compounded by the lack of an instrumental record. Inferential data, taken from records intended for other purposes, and proxy data (such as tree-ring and ice-core records that are responding to climate in their own complex, often nonlinear way), must be relied upon. On the other hand, reconstruction of the LIA climate is approachable because boundary conditions today are similar to those of the past few thousand years.

Beginning with a discussion of the preceding Medieval Warm Period, Fagan proceeds to describe the complex atmospheric and oceanic interactions, in particular the North Atlantic Oscillation (NAO), that govern Europe's climate. Fortunately for nonclimatologists, the discussion is well illustrated. Not noted but also significant is the larger Arctic Oscillation, in which the NAO is thought to be embedded. From this base Fagan describes the climates of the LIA, their meteorological effects, and the "great famine" and other famines that occurred throughout most of western Europe.

Fagan is careful to acknowledge that the connection between climatic effects and history is fraught with pitfalls and clearly states this in a number of places. On the other hand, the evidence he presents does strongly suggest that climatic variation has had major direct and indirect effects upon human groups, giving rise to cultural change but not controlling it.

Should California and Great Basin researchers read this book? I think they should. The book does provide a nicely synthesized record of the LIA that focuses primarily on the premodern agricultural societies of western Europe; however, it has little relevance for those wanting to examine the relationship of preagricultural hunters and gatherers to climate change. For the latter, the relationship appears to be more subtle, and the regional historical and paleoclimatic records far less defined and reconciled.

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