



**BRIEF ANALYSIS**

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## Revising 1,000 Years of Climate History

by David R. Legates

One of the cornerstones of the global warming “call to action” is the claim that average global temperatures over the last 1,000 years have remained rather stable, except for the significant warming during the last 100 years. This view is promoted by the United Nations Intergovernmental Panel on Climate Change (IPCC), which argues that recent warm years are mainly due to greenhouse gases emitted from the burning of fossil fuels.

However, considerable evidence exists that the climate of the last millennium fluctuated significantly — from a Medieval Warming period with temperatures comparable to today’s averages to a colder Little Ice Age that persisted until late in the 19th century. The IPCC’s conclusion rests on a dubious manipulation of data used to infer climatic conditions in past centuries that makes it “fit” with the global warming interpretation of temperatures recorded by instruments in the 20th century.

If recent global warming is largely a result of natural climate variability, policymakers acting on invalid interpretations of the evidence promoted by the IPCC may support policies to reduce global warming that are unnecessary, costly and ineffective.

**Changing Climate of the Last Millennium.** In 2001, the Third Assessment Report (TAR) of the IPCC dismissed overwhelming evidence of significant climate fluctuations during the last millennium. The TAR’s technical summary proclaimed, “...a new detailed temperature record for the Northern

Hemisphere... does not support these ‘Medieval Warming’ and ‘Little Ice Age’ periods.” However, a casual search at any reputable library provides a wealth of information concerning these climate phenomena. Thus, the TAR is based on a study that is a scientific outlier. Since the release of the IPCC report, additional evidence has shown that air temperature fluctuations over the past 1,000 years are comparable to the recorded rise in average temperatures in the latter half of the 20th century.

According to the American Geophysical Union, the

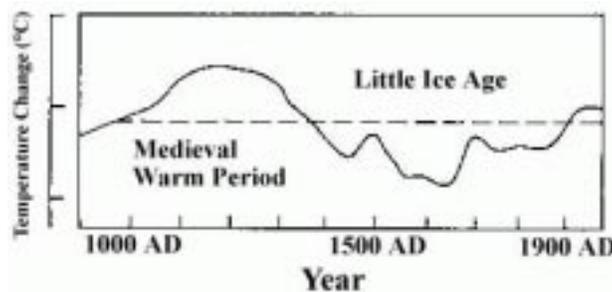
Little Ice Age was the period between about A.D. 1350 and 1900 when global air temperatures were generally cooler than those of the 20th century. For centuries before the Little Ice Age, there was a Medieval Warm Period. Both climate trends appear to have been widespread and were responsible for a number of changes in various civilizations. For example, the Medieval Warm Period coincides with the Vikings’ settlement of Greenland, Iceland and possibly North America. Farmsteads with dairy cattle, pigs, sheep and goats were prevalent in Iceland and along the southern coast of Greenland. Even England was able to compete economically with France in wine production.

On the other hand, agriculture steadily declined at higher latitudes during the Little Ice Age, while mortality rates and famines increased. By 1500, settlements in Greenland had vanished

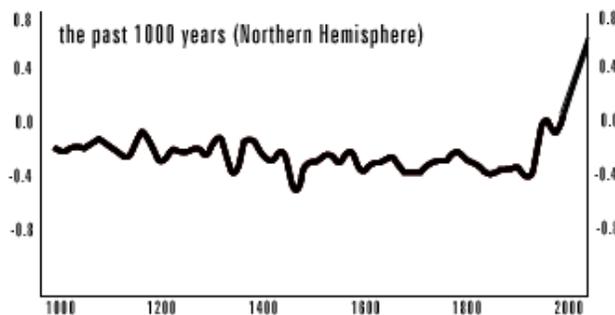
and the inhabitants of Iceland were struggling to survive.

Although European climate is better documented, the impacts during the Little Ice Age were widespread. In Argentina, Chile and southern Peru as well as southern Africa and northern China, records indicate that the last millennium began with marked warm-

### 1,000 Years of Climate Change Consensus View Prior to 2001



### Revisionist “Hockey Stick” Graph



Source: *First Assessment Report*, Intergovernmental Panel on Climate Change, 1990 (top graph); *Third Assessment Report*, Intergovernmental Panel on Climate Change, 2001 (bottom graph); uncertainty estimates omitted.

## BRIEF ANALYSIS

No.450

Page 2

ing supplanted by extreme cold during the middle centuries. Proxy indicators — such as tree rings and ice cores — in New Zealand, Australia and California confirm that the changes were widespread. Such effects have been well documented in the peer-reviewed scientific literature.

**TAR Rewrites Climate History for the Millennium.** The TAR's technical summary presents quite different findings concerning global temperatures. This "new" record (see figure), compiled by Michael Mann of the University of Virginia and colleagues Ray Bradley, and Malcolm Hughes, purports to show that Northern Hemisphere air temperatures steadily decreased from about A.D. 1000 until the early 1900s in the midst of the industrial revolution. At that point, hemispheric air temperatures abruptly increased, which the TAR cites as further "proof" of an anthropogenic influence on climate change.

Mann and his colleagues compiled a historical climate reconstruction — called the "hockey stick" because of its shape — primarily using tree ring records to infer air temperature trends. Their use of proxy data is not novel, but the methods they used, and thus the results, certainly are novel. One of the most important methodological problems is that Mann and his colleagues simply attached the surface temperature record of the 20th century to the end of the proxy record. This is an apples-to-oranges comparison as air temperature readings are not directly comparable to proxy records. However, putting the two different sets of data together in this way makes a stunning visual display for the average reader.

Failure to characterize the uncertainty in the instrumental record also gives the false impression that air temperatures during the 1900s are known *without error*. This is the only way Mann could conclude that the 1990s are the warmest decade, and 1998 the warmest year, in the last millennium. Worse, prior to A.D. 1400, the "hockey stick" uses data from nine locations in addition to statistical summaries derived from data for North America only. Although the "hockey stick" purports to be a Northern Hemisphere assessment, four of these additional locations are in the *Southern Hemisphere*, including Tasmania and Patagonia!

The widespread acceptance of this revisionist history was possible because the global warming community was eager to accept the "hockey stick" as proof of anthropogenic climate change. It also helped that Mann was also one of the lead authors of the TAR chapter that proclaimed the "hockey stick" as the new reality.

**The Medieval Warm Period and the Little Ice Age Return — To the Science Books.** More recent studies provide additional evidence that the conclusions of Mann and his colleagues are erroneous. Writing in the journals *Climate Research* (January 2003) and *Energy and Environment* (April 2003), astrophysicists Willie Soon and Sallie Baliunas and colleagues reexamined a large number of proxy records and composite analyses that describe the climate of the last 1,000 years. By examining each record independently, rather than merging them into a single time series, they sought to determine whether the Medieval Warm Period and the Little Ice Age were evident in the *individual* proxy records and analyses. Soon and Baliunas concluded that "The Medieval Warm Period and Little Ice Age are widespread climatic anomalies," and there is a wide range of compatible evidence in a number of studies and analyses.

Two independent efforts, led by Jan Esper and Keith Briffa, produced an alternative time-series to the Mann "hockey stick" by carefully selecting tree-ring chronologies from the temperate and arctic zones of the Northern Hemisphere. Unlike the dramatic temperature increase in the "hockey stick," their results show Medieval warming is comparable in magnitude with estimates for the late 20th century, and was followed by a long and variable Little Ice Age. In fact, a direct comparison of the Esper curve with the Mann "hockey stick" shows that Esper's curve has a significantly lower mean average temperature during the Little Ice Age. Esper's estimate of the temperature difference between the Medieval Warm Period and the Little Ice Age is about 1.2°C or about four times that estimated by Mann. Note too that Esper and colleagues *did not* attach the instrumental record as Mann erroneously did. Absent the instrumental record, Esper's estimate of the temperature for the mid-1900s is consistent with that for the turn of the century and shows no dramatic change after about 1950.

**Conclusion.** The scientific evidence, including the two most recent studies of the climate for the past 1,000 years, strongly indicates that Northern Hemisphere temperatures have been both as warm as and substantially cooler than the present, absent any possible human influence. Such evidence should not be dismissed or manipulated to support predetermined conclusions, as the IPCC's *Third Assessment Report* does.

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