

Climate and Man

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It is easy to think of the earth's climate as unchanging, and for many purposes this would be an adequate assumption. However, the climate does change, slowly but continually. Paleoclimatologists looking backward far in time have found convincing evidence of major climatic variations. For example, the advance and retreat of glaciers and ice sheets have been reliable indicators of the formation of ice ages accompanying major changes in climate. Radiocarbon analyses of fossils in the ocean bottoms have revealed warm and cold periods many millennia in the past.

Recorded history going back some 2000 years clearly shows changes in climate and their effects on man, animals, plants, and the landscape. Great migrations of people and animals accompanied periods of unusual cold or prolonged droughts. The movements of plant communities toward different latitudes and different elevations indicate important alterations in climate. The rise and fall of lake levels, particularly those more or less closed from the sea, show periods of wet or dry climate. The extent of sea ice and its effect on shipping to the ports of northern Europe point to the warming or cooling of the earth's atmosphere.

There is no doubt that climate changes continually, and that it did so long before man and his technology came on the scene. Theories to explain climate have been plentiful, but none of them appears to account adequately for the observations. Some theories explain climate in terms of factors external to the earth, such as variations in the intensity of solar radiation. Other theories attribute climate changes to such phenomena as volcanic eruptions, changes in the quantity of carbon dioxide in the atmosphere, changes in sea level, or the growth of mountains. Perhaps the climate depends on all these factors in varying degrees.

Until fairly recent times, man's effect on climate must have been insig-

nificant. There were relatively few people on earth and they did not have the means for producing power in massive quantities. The discovery of the engine and the Industrial Revolution signaled the start of man's competition with nature on a major scale. Internal combustion engines using such fossil fuels as oil and gasoline, the development of giant fossil-fuel-powered furnaces, and so forth, began to introduce into the atmosphere huge masses of gases, particulates, and great amounts of heat.

As the population of the earth has been increasing at an alarming rate, the quantities of pollutants put into the air have done likewise. Only in the last decade or so have the consequences of this pollution been recognized widely. Relevant questions are being asked, such as "How is man affecting the climate?" and "How is climate affecting man?"

There is a growing conviction that the increasing concentrations of carbon dioxide and particles put into the atmosphere by human activities are playing an important role in causing changes in climate. Calculations reveal that concentrations of carbon dioxide corresponding to those which have been added to the atmosphere during this century could produce a significant warming. On the other hand, there has been a gradual cooling of the atmosphere for the last three decades. It has been speculated that this may have been brought about by changes in the earth's reflectivity caused by increases of particulate matter as a result of volcanic eruptions augmented by man's contribution.

Theoretical analyses have shown that small changes in the cloud cover of the earth can have important effects on the air temperature near the ground. Atmospheric pollution might be affecting climate by causing changes in the cloud cover.

At this time, there is still considerable debate about how man may be affecting the climate of the earth as a

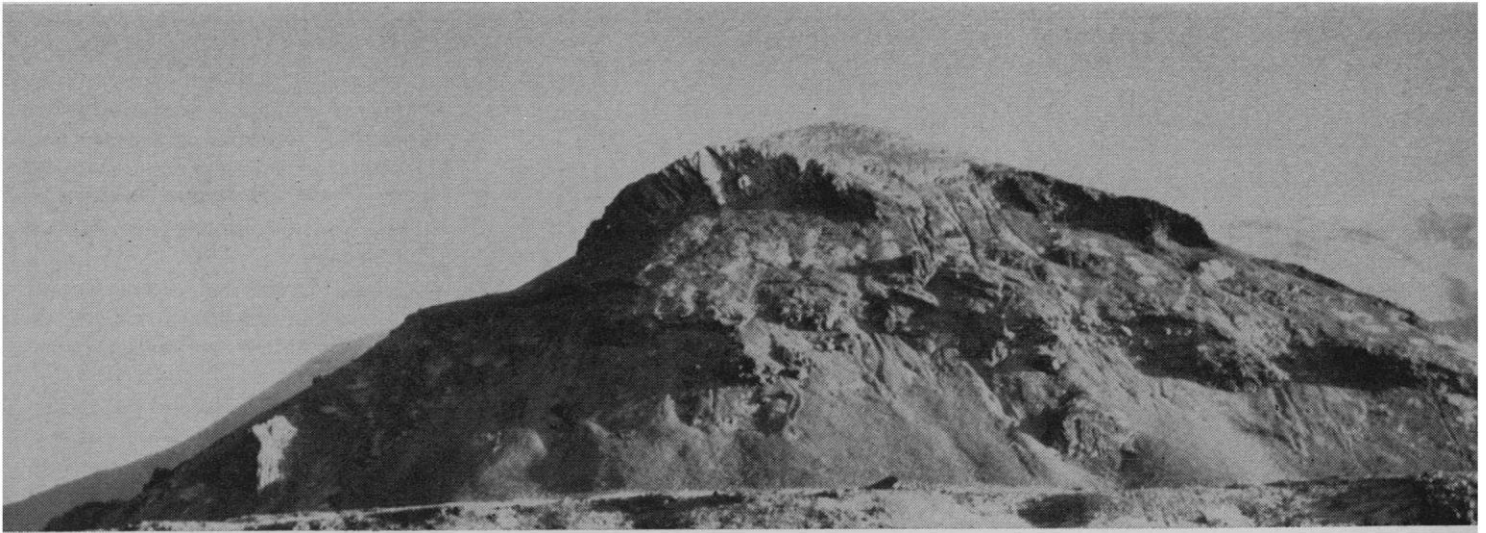
whole, but there is no doubt that, on a smaller scale, human activity can change the climate. In a city, particularly if it is large and industrialized, such meteorological factors as temperature and precipitation are higher than in the surrounding country while wind speed and relative humidity are lower. In some cases, important climate changes may be caused downwind of cities and large industrial plants.

The effects of climate on society are many and varied. Some are obvious; some of them are more subtle. As the chemical composition of the air is changed by the addition of toxic substances, they may bring about serious health hazards. If the atmosphere cools, for example, there can be important changes in the ecology of a region. Certain species of plants and animals may thrive, while others suffer. If the cooling takes place over the entire earth, it would be expected that sea ice would begin to spread equatorward making shipping to poleward latitudes difficult or impossible. Growing seasons at middle and higher latitudes could become perilously short. A prolonged cooling trend leads to speculations as to how long it will continue. If it goes on long enough, the end result might conceivably be a Little Ice Age, such as that which occurred between A.D. 1500 and 1900, influencing life on earth in many vital ways.

Various aspects of the subject of climate and man are to be discussed in a symposium to be held on 29 December 1969 at the AAAS meeting in Boston. There will be four half-sessions having the following titles: (i) Natural Climate Changes; (ii) Changes in the Earth's Hydrosphere; (iii) Man's Effect on Climate; and (iv) Climate's Effect on Man. In a 1-day symposium it is not possible to examine such a complex topic in detail. Nevertheless, the important relevant questions can be brought into the open. In light of the crucial nature of our changing environment, it is essential that a broad spectrum of scientists and laymen be informed on the interaction of climate and man.

This symposium, Climate and Man, is being sponsored by the Section on Atmospheric and Hydrospheric Sciences, the Committee on Environmental Alteration of the American Association for the Advancement of Science, and by the American Meteorological Society.

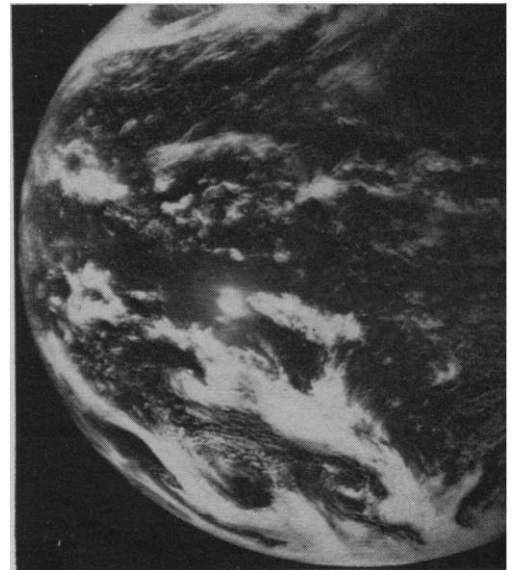
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