



[Climate Change: An Encyclopedia of Science and History]

Environmental Health and Preventive Medicine

[p. 509] During the past 50 years, the subject of climate change has come to be considered one of the most significant problems facing humanity and has been debated extensively. Scientists, the Intergovernmental Panel on Climate Change, special interest groups, and government lobbyists have collected extensive information to determine both the degree of the problem and what should be done to mitigate its effects. A few historians of medicine and environmental health have contributed to the current debates. These include Vladimir Jankovic, in *Confronting the Climate: British Airs and the Making of Environmental Medicine* (2010), and Naomi Oreskes and Erik Conway, in *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (2010).

A consideration of historical examples before the 20th century can help us understand how climate change threats have long impacted human society as well as how society has sought to respond to them. There were important milestones in environmental health and preventive medicine as reactions to the impact of climate change phenomena between 1200 and 1900. Understanding the responses of human beings working in earlier environmental health traditions and foundations of preventive medicine provides useful background for current debates surrounding global warming.

It may be regarded as a long-standing belief in medicine and epidemiology that the different forms of disease affecting a given population are highly influenced by that population's social living conditions and biological environment. Historically, this belief can be traced as far back as the early observations made by ancient Greek physicians. For example, Hippocrates of Cos (ca. 460–370/377 BCE) wrote works on medical subjects such as physical diagnoses, dietetics, and hygiene while expressively stating in his work *Of Air, Water and Situation* (ca. 400 BCE) the following: [W]hen a physician comes a perfect stranger to a City, he should consider well the situation of it, how it stands with respect to the Winds, and the risings of the Sun. . . . He should also consider what sort of Water they use, whether standing and soft, or hard and from high grounds and rocks, or salt and such as will not boil well. The Land should be consider'd too, whether it be naked and dry, or woody and watery; whether in a bottom and suffocating place, or upon an eminence and cold. Nor should the way of Living they are

most fond of be forgot; as whether, for instance, they love drinking, feasting, and idleness, or are given to exercise and labour, or are lovers of eating but not of drinking.

As documented in the ancient writings of the physicians and philosophers from the fifth century BCE, it became known that various human diseases required specific temperatures or moisture conditions in order to affect the human body. Other forms of diseases could only be transmitted to people if particular carrier animals were present. A good historical example is endemic malaria that survived in hot and humid climate zones and necessitated its transmission through mosquitoes. This was still the case in the southern parts of Europe throughout the late medieval and early modern period before malaria eventually became eradicated in these regions during the 19th and 20th centuries following major environmental health projects that involved the drying of swamps, the moving of population groups, and then later on the application of detergents and insecticides. Furthermore, diseases could be endemic to specific populations and become adjusted to these climates and environmental conditions.

Consider, for example, the devastating infections of the North American native peoples when Old and New World populations came into direct contact with them after the major discoveries and explorations of the 15th and 16th centuries. The enormous susceptibility of native populations to human [p. 510] viruses such as smallpox has been interpreted as a lack of genetic immunity, based on the former eradication of the smallpox virus (due to the small number of inhabitants and low exposure rates) and the harsh climate conditions on the North American continent. These had likewise posed crucial environmental constraints on viruses and bacteria from the time that the native peoples had immigrated during the Pleistocene Epoch over the Beringia land bridge from East Asia approximately 20,000 years ago. This early case of the human migration tendency, leading to altered disease and susceptibility patterns, shows the tight interrelationship among climate conditions, environmental impacts, and human diseases.

Another important example of changes in population health conditions is found in the era of European climate history often termed the Medieval Warm Period. This period lasted from approximately 1000 CE to the beginning of the 1300s, when the Northern Hemisphere, and particularly southwestern France and Spain, were influenced by relatively moist, warm airstreams from the Atlantic Ocean. The weather changes led to a more positive environment for grain agriculture and coincided with the invention of three-field crop rotation as a more intense way to cultivate European soils. In the

following years, between the 11th century and the end of the 12th century, the overall population in Europe grew by one-third to one-half, totaling about 50 million inhabitants.

During the early 14th century, however, the average temperatures dropped—as testified by crop changes, lowered river water levels, the reduction of cultivated vineyards, and so on. As a result, Europe experienced a prolonged period of colder weather for about half a millennium, which historians later called the Little Ice Age. There is good evidence in the archaeological and historical epidemiology literature, such as in Sheldon Watts's *Epidemics and History: Disease, Power, and Imperialism* (1999), that poverty increased substantially in Europe between the 13th and 16th centuries. Brian M. Fagan, in *Little Ice Age* (2000), has argued that the climate changes of the 14th and 15th centuries greatly impacted the economic and social trends of the period. Certain historians of medicine such as Alfred Jay Bollet, in *Plagues and Poxes* (2004), have argued that the devastating conditions of the long series of plague epidemics since 1347 (leading to an estimated net loss of more than 75 million people worldwide) could only have arisen as a result of the drastically changed climatic conditions.

During the Little Ice Age, mean temperatures changed frequently, with the coldest periods recorded directly after 1650, 1770, and 1850. It is suggestive that these periods coincide with major European conflicts, including the Thirty Years' War, the Seven Years' War, and the mid-19th-century Bourgeois revolutions.

[p. 511] In Western Europe during the late 18th century, crop damages caused by drought, hailstorms, and exceptionally cold winters resulted in the steep rise of grain prices in major cities and starvation in wide areas of the countryside. For a major part of the 18th century, France had experienced a significant increase in its agricultural productivity, with the prices for agricultural goods remaining high due to the ongoing population growth. With the devastating harvests after 1770, however, the lower social classes experienced considerable undernourishment, leading to an increased political frustration with the ruling aristocracy. Neither the powers of the absolutist military nor the commission work of the Royal Academy of Sciences in France—such as Pierre-Joseph Desault (1738–1795) and later Joseph Claude Récamier (1774–1852) and François Magendie (1783–1855)—in conjunction with Parisian municipalities, in their efforts to enhance nutritional values, could remedy the food shortages and living conditions. Political support for King Louis XVI (1754–1793) dwindled dramatically, and the French Revolution of 1789 ensued, with one of the major demands being the

decrease of bread shortages and the lowering of food prices, something that the Jacobin government made as one of its major priorities, followed by state security and egalitarian liberal rights.

On the other side of the English Channel following the English Civil War, a national social security system had been developed. Between the late 1600s and the early 1800s, what came to be known as the Old Poor Law protected the poorest members of British society from food scarcity and led to an increase in the prospect for work and the establishment of poor houses in major cities and municipalities. The law had its origins in central government legislation and was significantly funded through mandatory local property taxes and administered on the clerical parish level. The 18th century then saw a particular growth in hospitals for patients with chronic diseases and mental illness, as exemplified by the Bedlam asylum in London.

When looking further into the historical changes of climate and its impact on man-made environments and public health during the 18th century, note that the agricultural economies of the Mediterranean regions also were severely affected. The wine crop failed in the late 1770s for many annual cycles, and with the decline in grain productivity, the gross income of farmers became substantially reduced. This in turn led to forms of considerable policing of peasants and day laborers and the strengthening of obsolete noble prerogatives that gave rise to public discontent in the autonomous north Italian regions and the French-Italian territories and islands. After the end of the 17th century, ecological contexts were significantly altered through the worldwide phenomena of population growth—particularly in Western Europe and China. Population growth was made possible [p. 512] through the application of innovative and successful farming methodologies and irrigation systems. General living conditions also changed. In Western Europe, for example, city growth and industrialization led to significant increases in population densities, instigating a relocation of European soldiers, traders, and colonists to the Americas and other continents. From this significant transformation in population and environmental dynamics also emanated new routes for the proliferation of epidemics and diseases. A most remarkable example was the onset of a number of cholera epidemics that reached Europe from East Asia in the 1810s. After the latter half of the 18th century, circumscribed epidemics began to devastate many regions in the world, leading, for example, to a typhus epidemic in London in 1750 that decimated the densely populated poor districts of the English metropolis. On the other hand, the increase of agricultural productivity and political stability in Europe and North America constrained the spread of cholera and other

epidemics and fortunately decreased incidence rates and disease lethality in these regions of the world.

The incidence rate of epidemics declined following the altered environmental contexts that reduced the natural habitats of viruses and bacteria. With the application of the three-field crop rotation, the agricultural economies of Western Europe morphed into intensive forms of cattle farming that in turn led to a decrease in the prevalence of malaria in the Mediterranean countries. Due to these new agricultural processes, the mosquitoes now primarily fed on cattle, transmitting the plasmodia parasites to them so that the life cycle of malaria transmission in humans eventually became disrupted. By the middle of the 18th century, environmental health conditions became more and more intentionally adjusted, originating in the requirement for public health programs and city planning projects (sewage, sanitation, and water supplies). The new public health tradition led to the implementation of technological and planning reforms, giving rise to the opening of additional city hospitals, decentralized health care departments, and the provision of clean water. During the early 19th century, public health programs in major European and North American cities and metropolitan regions, such as Boston and Philadelphia, became more and more efficient in containing the spread of disease and in improving general health and nutrition. The formerly serious epidemics of plague, cholera, and typhoid fever faded out.

At the same time, however, when the basic living conditions improved in major European and subsequent American metropolises, the industrial pollution (coal dust, smoke, oil sewage, and so on) ensued. In the area of environmental health, New York City physicians Burrill Bernard Crohn [p. 513] (1884–1983), Leon Ginzburg (1898–1988), and Gordon D. Oppenheimer (1900–1974) had, for example, described an inflammatory condition of the small intestine that came to be known as Crohn's disease. After 1932, the reporting of cases of Crohn's disease allowed for the calculation of the prevalence and incidence rates in major cities around the world. Modern epidemiological studies after the 1950s have revealed that the incidence rates in developing countries increased with the emerging economic development. Before the landmark investigations of Crohn and his collaborators, cases of inflammatory diseases of the small and large intestines had been recognized in England, Scotland, Ireland, Germany, and Poland and were recorded in medical journals, textbooks, and hospital records. A review of modern medical literature reveals that there were many attempts to review historical case descriptions. As in other instances of retrospective diagnoses, the undertaking is difficult because of the similarities between Crohn's disease and

ulcerative colitis, cancer, and dysentery and could have been influenced by the medical knowledge, diagnostic tools, and procedures available at the time of the occurrence. The emergence of Crohn's disease in the British Isles as economic development progressed parallels the breathtaking development of industrialization as an important factor in historical epidemiology and particularly so in that of urban mortality changes.

It was not until the late 19th century that scientists suggested that human emissions of greenhouse gases might be able to change the global climate. The Irish physicist John Tyndall (1820–1893) had explored the consumption of heat in different gases, and Svante Arrhenius (1859–1927), a Swedish scientist, calculated in 1896 that doubling the atmospheric CO₂ would lead to increased surface temperatures of 5–6 degrees Celsius. Arrhenius thought that the impact of global warming would eventually lead to the reduction of snowfalls, ice coverage, and glacial activity and might have beneficial health effects. It was not until the late 19th century that scientists suggested that human emissions of greenhouse gases might be able to change the global climate. The Irish physicist John Tyndall (1820–1893) had explored the consumption of heat in different gases, and Svante Arrhenius (1859–1927), a Swedish scientist, calculated in 1896 that doubling the atmospheric CO₂ would lead to increased surface temperatures of 5–6 degrees Celsius. Arrhenius thought that the impact of global warming would eventually lead to the reduction of snowfalls, ice coverage, and glacial activity and might have beneficial health effects.

At the end of the 20th century, a consensus position emerged acknowledging that human activity had led to gradual warming phenomena, as reflected in the reports of the Intergovernmental Panel on Climate Change. The effect of global warming on public health and the response required by public health officials has been discussed in the research literature. For example, a roundtable is sponsored by the United Nations Foundation, the National Institute of Environmental Health Sciences, the National Center for Environmental Health, and the Centers for Disease Control and Prevention concerning the intersection of climate change, environmental health, and public health programs worldwide.

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