



Creating the Nation's first BioPark

National Zoological Park · Smithsonian Institution · Washington, D.C. 20008-2598

Letter From the Desk of David Challinor  
February 1996

In my January 1996 letter I discussed the accumulating evidence of global warming. An important and perhaps major cause of this temperature increase appears to be the release into the stratosphere of human-produced gases caused by actions ranging from burning of fossil fuels to excessive fertilization of farms and lawns. Suppose the world's average temperature as we have known it for the past few generations does become significantly warmer, how might such a change affect the human condition? Although the variables necessary to calculate global climate change are multitudinous and have complicated interactions, scientists can still reasonably predict some of the global warming consequences our grandchildren might face.

I wrote in last month's letter that scientists predict winters will become warmer, but that summer temperatures would remain relatively unchanged. Warmer winters mean fewer frosty nights; this change reduces a principal control on the winter survival of many insect species. Aphids, for example, are a major crop-attacking insect. They can reproduce both sexually and asexually but as a species are particularly sensitive to cold snaps. Aphid researchers in Britain discovered that insecticide-resistant aphids within the species (*Myzus persicae*) are more likely to be killed by cold winter nights than the ones that are not resistant to pesticides. If, as predicted, average British temperatures rise by about 3°C by the end of the next century, the number of frosty nights would be cut by a quarter; this would allow more aphids and other crop damaging insects to survive and expand their range northwards.

Crop pest expansion is not the only problem that could be caused by a changing climate. Insect vectors of tropical diseases are also generally limited by low winter temperatures, but there is a continual risk of tropical scourges being accidentally introduced to northern latitudes, especially during the summer; this may allow them to gain a temporary foothold before the first frost.

The rampant spread of tropical diseases is unlikely, however, because today we can contain their spread using quarantines, vaccines and sanitary measures. You may remember that malaria was common in Washington, D.C. until the turn of this century; families who could afford to moved to the cooler hills above the city. Today in the US malarial patients are kept in well-screened rooms to avoid being bitten by transient mosquitoes, of which some local species are still potential vectors of malaria.



Breaking the cycle of insect-borne diseases by screening the rooms of malarial patients, for example, is possible only in countries whose citizens are prosperous enough to afford window screens. Most of the world's people do not enjoy such luxury. Thus, the larger the potential host population, the more virulent the attacking pathogen can afford to be. Clearly if a small host population was infected by a lethal pathogen (bacteria or virus), the pathogen itself would not survive due to the lack of hosts to infect. Highly lethal Human Immunodeficiency Virus (HIV), for example, has for its host population all humans of reproductive age as well as fetuses in some cases. Like other lethal pathogens, HIV has a vulnerable chink in its armor and could theoretically be eliminated within a human generation if its human host altered its sexual behavior and avoided shared needles when using drugs. Such a behavioral change seems reasonable when almost certain death is the alternative, but we know that such is not the case. Change in human behavior may be almost impossible to achieve without continual reminders of the consequences of maintaining a former lifestyle and a strong acceptance of the connection between the dangerous behavior and future consequences. Exhorting teenagers not to smoke or Los Angelenos to curtail their driving is futile because the eventual consequences for the individual seem too remote.

It is also difficult to focus people's attention on climate change because it happens so gradually and the consequences are often local. Despite the prediction of global warming, average temperature change at any one spot on earth could remain statistically insignificant for decades. In such circumstances local inhabitants would understandably tend to ignore the threat.

Although winters are expected to be warmer than previously, one consequence of such a trend could, surprisingly, be more snow. Snowmobilers and other outdoor winter activists often refer to the weather as being "too cold to snow." The lower the air temperature, the less moisture it can hold. Hence, there are the dry desert valleys of Antarctica and the thin layers of new snow deposited on continental glaciers during extremely frigid winters. Scientists believe that glaciers normally build up between the great ice ages. For example, when a large block of air over a relatively warm ocean becomes saturated with moisture and moves overland into a low pressure trough, it may either be swept up rapidly to high, cool elevations and fall as snow or collide with a fast moving cold front and precipitate as snow before the damp air mass can release its contents as rain. Thus, cold fronts will always be necessary to produce snow, but the more moisture laden the air, the heavier the snowfall. The paralyzing blizzard in mid-January 1996 along the east coast is a good example of this phenomenon. Before the storm the water temperature in the Gulf Stream south of Hatteras was an amazing 74°F instead of the more usual 68° or 69°F. The air above the

Stream was therefore saturated with water. As the ocean air moved west and north along the coast, it collided with the frigid air pushed further south than usual by the jet stream. The resulting "Blizzard of '96" became worldwide news.

A final and rather novel consequence of global warming is its effect on temperate zone-dwelling mammals. We can expect to observe a gradual diminution in mammals' body size as noted in a biological dictum known as Bergmann's Rule, which postulates a positive relation between body size and latitude. Thus, within a mammal species with a long north-south range, those at the northern (colder) end would tend to have larger bodies in which to conserve heat. Smaller body size allows heat to dissipate more rapidly. A recent article in Science 270:2012-14 (22 Dec 95) describes some meticulous research on the contents of wood rat middens in the Great Basin and the Colorado plateau. By plotting the size of fecal pellets deposited in these middens during the past 25,000 years -- including the last glacial maximum about 21,000 years ago -- it was concluded that these sedentary rats have become smaller as the climate warmed. Scientifically the research is valuable to show that Bergmann's Rule is not false. This diminution in body size of pack rats over such a long time is clearly of interest only to zoologists.

Despite the threat of more violent weather, increased exposure to tropical diseases, and even smaller pack rats, I do not want to close this letter on a note of gloom and doom. Humans are extraordinarily resilient and generally have been able to counter or at least dampen nature's assaults. Cities in earthquake-prone areas increasingly require quake-"resistant" construction. The prosperous temperate zone nations have long controlled and, in the case of small pox, even eradicated tropical scourges. Just the threat of such diseases spreading north has prompted an expanded global effort to control or eliminate cholera, dengue fever, river blindness, malaria, Guinea worm and innumerable other insect and water-borne tropical diseases, most of which have a weak link in their defensive armor. The battle against such pathogens continues with some success, but as a terrestrial species competing with earth's other organisms for space and nutrients, we must remember that Homo sapiens will not survive indefinitely. Of all the species that have ever existed since life began on earth about 3 billion years ago, 99.9% of them are now extinct. We should not delude ourselves into believing we are an exception, but rather work hard to exploit our behavioral flexibility to dampen the rate at which we are harming our relatively small habitat and that of our fellow creatures.

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As of 1 January 1996 my status at the Smithsonian has changed. I retired as a part-time federal employee and now enjoy the position of Scientist Emeritus. My telephone and fax numbers remain the same, and I will retain my office at the Zoo. I will continue to write my "Letters From the Desk of David Challinor" and would welcome any comments or questions on them.

David Challinor  
202/673-4705  
202/673-4607 FAX