POLICY FORUM

ENVIRONMENT

Climate Change Science: Adapt, Mitigate, or Ignore?

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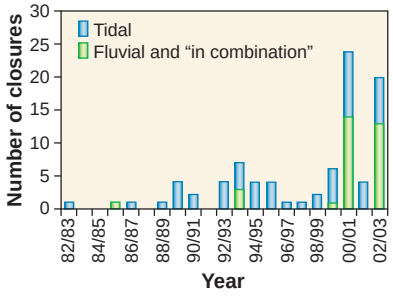
Climate change is real, and the causal link to increased greenhouse emissions is now well established. Globally, the ten hottest years on record have occurred since 1991, and in the past century, temperatures have risen by about 0.6°C (*1*). In that same period, global sea level has risen by about 20 cm—partly from melting of land ice and partly from thermal expansion of the oceans. Ice caps are disappearing from many mountain peaks (*2*, *3*), and summer and autumn Arctic sea ice has thinned by up to 40% in recent decades, although there is some evidence for stabilization (*4*, *5*). In Britain, usage of the Thames Barrier, which protects London from flooding down the Thames Estuary, has increased from less than once a year in the 1980s to an average of more than six times a year (see the figure, right) (*6*, *7*). This is a clear measure of increased frequency of high storm surges around North Sea coasts, combined with high flood levels in the River Thames. Last year, Europe experienced an unprecedented heat wave, France alone bearing around 15,000 excess or premature fatalities as a consequence. Although this was clearly an extreme event, when average temperatures are rising, extreme temperature events become more frequent and more serious. In my view, climate change is the most severe problem that we are facing today—more serious even than the threat of terrorism.

Some climate change can always be attributed to natural cycles and disturbances in the Earth's climate system, but we cannot explain the general warming trend over the last century without invoking human-induced effects. For instance, researchers from the United Kingdom's Hadley Centre modeled the effects on climate of such factors as volcanic eruptions and changes in solar output and compared these with the effects of additional greenhouse gases emitted through the burning of fossil fuels, land-use change, and industrial processes. Only the forcing from increasing greenhouse gas and aerosol concentrations could explain the general upward trend in temperature over the past 150 years (7).

In less than 200 years, human activity has increased the atmospheric concentration of greenhouse gases by some 50% relative to preindustrial levels (*1*, *8*). At about 372 ppm, today's atmospheric carbon dioxide level is higher than at any time in at least the past 420,000 years. Owing to the inertia of the climate system, it is already too late to stop any further warming from occurring (*9*). However, if we could stabilize the atmosphere's carbon dioxide concentration at some realistically achievable and relatively low level, there is still a good chance of mitigating the worst effects of climate change. For instance, current models suggest that stabilizing carbon dioxide levels at around 550 ppm by 2100 could reduce flooding frequency by some 80 to 90% along the most vulnerable parts of the Indian and Bangladesh coastlines, as compared with a scenario of continuing growth in consumption of fossil fuels (*10*).



Rising water. Number of closures per annum of the Thames barrier to protect London from flooding. [Source: DEFRA, U.K. (*6*)]

To begin to assess risks and potential responses in the United Kingdom, I convened a team of national experts to investigate the specific threat of increased flooding and coastline vulnerabilities that the we are likely to face from global warming. The panel considered a period from 30 to 100 years into the future and used climate change scenarios published by the Tyndall Centre and based on the Hadley Centre models (*11*). Four scenarios were presented, ranging from low to high emissions. Socioeconomic scenarios were developed by researchers at the University of Sussex for the U.K. Office of Science and Technology (*8*) and represented (among other policy differences) different levels of government intervention in emissions control.

The researchers concluded (*12*) that a combination of sea-level rise and increased storminess will allow storm surges to reach much further inland, so that Britain's coastal defenses will be subjected both to higher water levels and to more energetic wave attack. If we assume continuation of existing shoreline management strategies, these combined effects have the potential to increase risk of floods in 2080 by up to 30 times present levels. In the highest emission scenario, by 2080, flood levels that are now expected only once in 100 years could be recurring every 3 years. Also in the worst-case scenario, the number of people at "high" risk of flooding in Britain will more than double to nearly 3.5 million. Potential economic damage to properties runs into tens of billions of pounds per annum. Under the current insurance market, properties in many flood plain areas would be uninsurable.

There is also potential for serious increases in coastal erosion. The coastline of England and Wales totals approximately 3700 km, two-thirds of which could experience significant erosion. A totally noninterventionist strategy with regard to greenhouse gas emissions and shoreline management would lead to erosion 9 times more severe than the present day.

I have commissioned a new team to consider ways that the United Kingdom can attempt to mitigate this threat, and they are due to report early in 2004. But we already know that the costs of adapting to such a worst-case scenario would be enormous.

The U.K.'s Flood and Coastal Defences Report is a single case study, considering some of the effects of global warming in just one part of the world. As a consequence of continued warming, millions more people around the world may in future be exposed to the risk of hunger, drought, flooding, and debilitating diseases such as malaria (*13*). Poor people in developing countries are likely to be most vulnerable. For instance by 2080, if we assume continuing growth rates in consumption of fossil fuels, the numbers of additional people exposed to frequent flooding in the river delta areas such as the Nile, the Mekong, and Bangladesh, and from coastline cities and villages of India, Japan, and the Philippines, would be counted in hundreds of millions assuming no adaptation measures were implemented (*14*).

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The United Kingdom is now seeking international commitment to reduce carbon dioxide and other greenhouse gas emissions worldwide under the framework of the United Nations Framework Convention on Climate Change (UNFCCC). Our ambition is for the world's developed economies to cut emissions of greenhouse gases by 60% from 1990 levels by around 2050. The British government has already committed to reducing the country's emissions by this figure over this time scale. Delaying action for decades, or even just years, is not a serious option. I am firmly convinced that if we do not begin now, more substantial, more disruptive, and more expensive change will be needed later on. We need early, well-planned action, for example, to allow businesses to plan to act in the course of normal capital replacement cycles and to encourage the development of new energy technologies.

We in the United Kingdom intend to achieve our emissions cuts by reducing the amount of energy we consume and by substantially increasing our use of renewable energy resources. Though our target for emissions reduction sounds ambitious, we have calculated that it will not have a serious impact on the U.K. economy. This analysis must be treated with a certain amount of caution—it requires projection long into the future and is naturally sensitive to the initial assumptions. But, in agreement with our analysis, an extensive review (*15*) by the Intergovernmental Panel on Climate Change (IPCC) suggests that stabilizing atmospheric carbon dioxide at 550 ppm would lead to an average gross domestic product (GDP) loss for developed countries by 2050 of only around 1%. This figure should be more than offset by the reduction from the risks, for example, of flooding associated with climate change. For instance, if just one flood broke through the Thames Barrier today, it would cost about £30 billion in damage to London, roughly 2% of the current U.K. GDP.

Moreover, it's a myth that reducing carbon emissions necessarily makes us poorer. Taking action to tackle climate change can create economic opportunities and higher living standards. Between 1990 and 2000, Great Britain's economy grew by 30%, employment increased by 4.8%, and our greenhouse gas emissions intensity (*16*) fell by 30%; our overall emissions fell by 12% (*17*). And this example does not simply apply to industrialized nations. Between 1990 and 2000, the Chinese economy grew by over 60% yet their emissions intensity fell. Europe, Japan, and the United States contain the vast majority of the world's scientific and technological capacity, and it is in our own interest to help developing countries leapfrog into non–carbon emissions technologies by creating new products and services.

As the world's only remaining superpower, the United States is accustomed to leading internationally coordinated action. But at present, the U.S. government is failing to take up the challenge of global warming. The president has recently published a report saying that more research is needed. New research will clearly be beneficial, but not because of doubt about what is driving global warming. Understanding in greater detail the response of our complex climate system to human interventions will help countries and businesses adapt to the climate change that is inevitable and help target investment where it is most needed. But we already know enough about the problem to agree on the urgent need to address it.

The Bush Administration's current strategy relies largely on market-based incentives and voluntary actions. The market will certainly be valuable for choosing among mitigation approaches. We need to investigate all means of reducing atmospheric carbon dioxide: sequestration, fusion, fuel cells, renewables, and so on. But the market cannot decide that mitigation is necessary, nor can it establish the basic international framework in which all actors can take their place. That requires a political decision based on sound scientific evidence, and the U.K. government firmly believes the time to make that decision is now.

Although the U.S. government has declared support for the objectives and activities of the UNFCCC, it has refused to countenance any remedial action now or in the future, and it failed to ratify the Kyoto accord for emissions reductions. The Kyoto Protocol has been criticized repeatedly on the basis that its targets are too low to have a significant impact (*18*). However, the point of the Kyoto Protocol was to set up an international process whose scope could then be ratcheted up. As well as emissions targets, Kyoto provides a detailed economic process that puts a value on not emitting carbon dioxide and enables countries to trade carbon emissions. Europe has already set up a preliminary emissions trading market that will be operating by 2005—putting us ahead of the game for when global trading commences, as it surely will. If Russia ratifies Kyoto, the first steps toward trading will immediately come into force. With or without U.S. participation, this will be a very significant market, eventually worth trillions of dollars.

New discussions are about to start under the auspices of the UNFCCC to tackle climate change beyond 2008–12. Future agreements about emissions control do not need to follow the exact pattern of Kyoto—alternative ideas are always welcome at the international table, indeed, they will be needed. But any alternative would need to accept that immediate action is required and would need to involve all countries in tackling what is a truly global problem. And developing countries would need to be brought into the process as part of a North-South science and technology capacity-building exercise embedded in a framework that recognizes that issues of justice and equity lie at the heart of the climate change problem (*19*).

Climate change is no respecter of national boundaries. We in Great Britain are attempting to show leadership, and many other countries, including some of our European partners, are also in the vanguard. But we cannot solve the problem in isolation. The United Kingdom is responsible for only around 2% of world's emissions, the United States for more than 20% (although it contains only 4% of world's population).

The United States is already in the forefront of the science and technology of global change, and the next step is surely to tackle emissions control too. We can only overcome this challenge by facing it together, shoulder to shoulder. We in the rest of the world are now looking to the U.S.A. to play its leading part.

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