

Air Conditioned Earth

Jenny Molloy

Climate change and global warming are currently big news on the political agenda, and have recently become firmly engrained in the public psyche. After decades of environmental concern and the recent international drive to lower carbon emissions, carbon emissions continue to rise and the trend of global warming shows no signs of abating (1). A time lag between action and results would be expected due to the persistence of CO₂ in the atmosphere. However, the pressing question is, will reversal occur quickly enough to save the planet from a catastrophic incident such as the collapse of the Arctic sea ice? Current research suggests perhaps not. Arctic sea ice following the 2007 melt season was 40% below the 1979–2000 average, and may be almost non-existent by 2030 (2). Therefore, while cutting emissions is still believed to be the optimum long-term strategy, scientists have also investigated the planet's short term emergency options—utilising technology at the planetary scale to engineer a global cooling system and gain control of the climate.

Predicting exactly how the planet would respond to interventions such as those described in the box is an enormously complex task, perhaps almost impossible. As such, geoengineering is regarded by most as an insurance plan, to be used only in the case of impending catastrophe. However, there were concerns that the presence of such 'insurance' might lead to a reduction in the sense of urgency surrounding climate change, and increasing political inertia. This 'moral hazard' objection had, until recently, been a deterrent to serious consideration of geoengineering methods (9). However, a conference held at Harvard University in November 2007 showed no sign of this concern. As one delegate reported:

"I think a lot of us came away from that meeting much

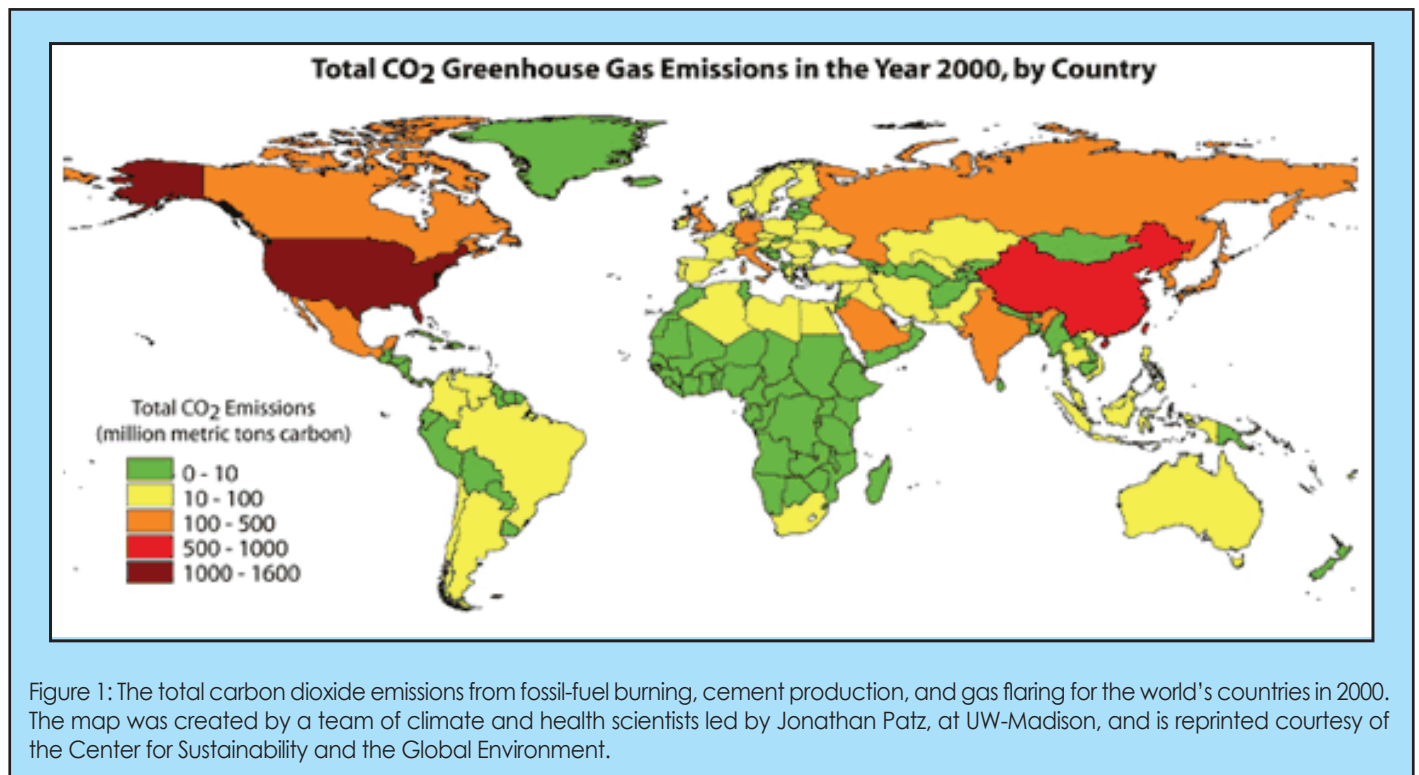
more scared than we were when we went in... Frightened about climate change, and frightened about what humans might get desperate enough to do about it." (10)

The consequences of global warming in different regions are disparate with respect to both their severity and their nature. As environmental researcher Dale Jamieson, of New York University, acknowledges; "Climate change involves winners and losers". Africa will bear the majority of the burden of death through climate mediated changes in infectious diseases rates (11), as well as reduction in crop production (12). It appears that the hardest hit nations will be those that are least equipped to adapt to climate change,

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and those that have contributed least to atmospheric CO₂ levels (Figure 1). Africa has some of the lowest per-capita emissions of greenhouse gases, but regions of the continent are gravely at risk from warming-related diseases such as malaria and malnutrition (11). Estimated deaths attributable to climate change in 2000 were 88 per million across Africa compared to a world average of 28 (11). However, the USA, despite being the world's top emitter of greenhouse gases, had a mortality rate of less than 0.15 (11).

For many developed nations, the foreseeable effects will be much milder and may even be beneficial, especially with regard to crop production (12). As President Putin joked at a global conference "an increase of two or three degrees wouldn't be so bad for a northern country like Russia.



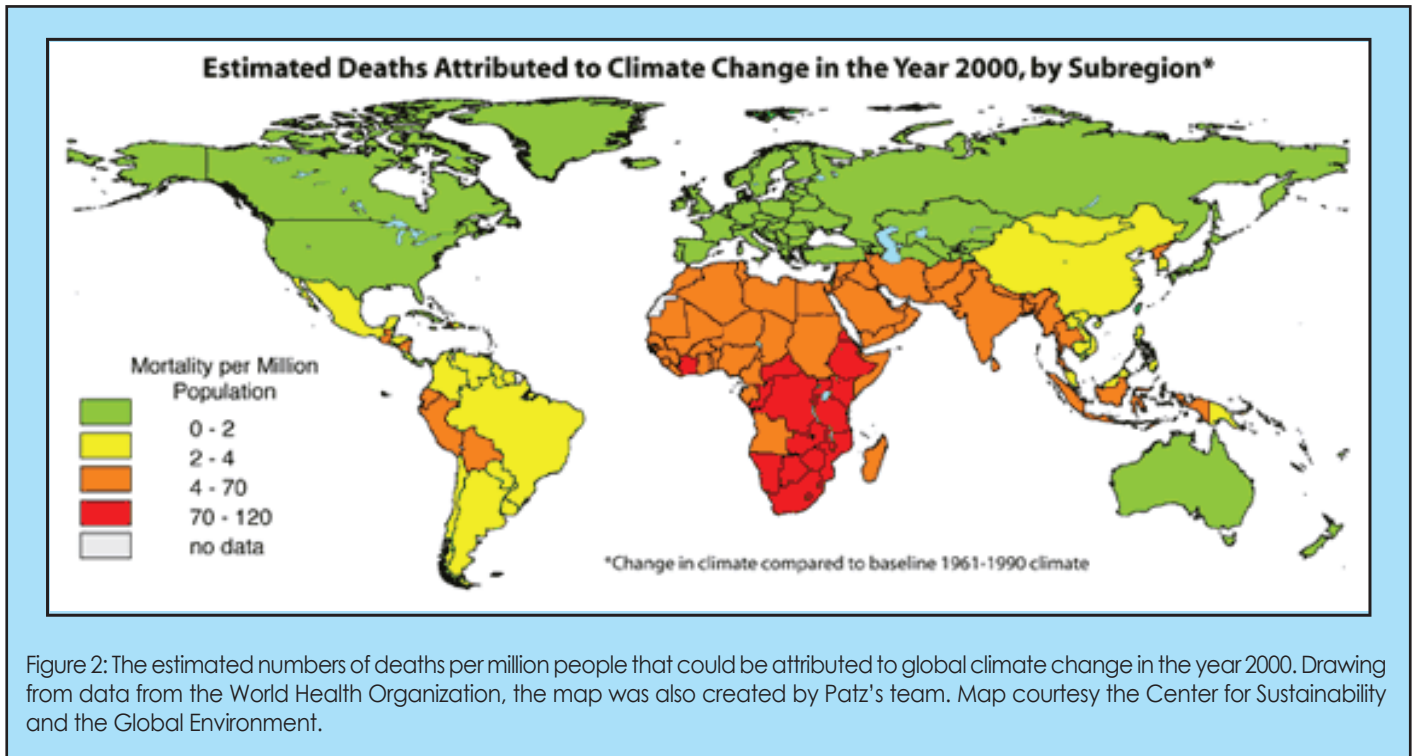


Figure 2: The estimated numbers of deaths per million people that could be attributed to global climate change in the year 2000. Drawing from data from the World Health Organization, the map was also created by Patz's team. Map courtesy the Center for Sustainability and the Global Environment.

We could spend less on fur coats, and the grain harvest would go up" (13). Last summer, the North West shipping passage opened through the Arctic for the first time in living memory after a record ice melt, cutting thousands of miles off shipping routes between Europe and Asia, giving an economic benefit to northern nations (14). The increased accessibility of the Arctic has prompted several countries to lay claim to the possibly oil rich ocean floor below (15). A Russian mission which planted a flag beneath the North Pole in August 2007 was challenged by Canada and criticised by the US; all three parties stand to gain from what is generally perceived as an environmental disaster (14).

Should the technology eventually become available to 'air condition' the earth, the major question will be: Who controls the thermostat?

The effects of climate change cause much political tension, as seen at the 2007 UN conference on climate change in Bali, where negotiations nearly fell apart as the US demanded firmer commitments from developing countries, before eventually agreeing to the proposals (16).

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As UN Secretary-General Ban Ki-moon stated, "there is a divide of position between and among countries" (16). Any geoengineering project, which would inherently operate globally and have differential effects on geographic populations, is almost certain to be subject to even wider international disagreement. Developing countries, who will be most seriously affected by global warming, would probably want more drastic action sooner than more

comfortable first world nations.

Critically, there is currently no international agreement or democratically elected group to make this decision. The level of global consent that constitutes a mandate for action

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would have to be decided, as unanimity could be difficult to obtain given the possible risks of geoengineering. The UN could take responsibility for forming a governing body, as the majority of independent states have agreed to honour its decisions, and it can enforce sanctions on those who fail to

Possible Methods of Geoengineering:

- A giant sunshade composed of a cloud of small reflecting spacecraft weighing ~20m tonnes. Could block 1.8% of the sun's energy from reaching earth for the cost of a few trillion dollars (3).
- Spread tiny sulphate particles in the Earth's upper atmosphere mimicking volcanic eruptions, such as Mount Pinatubo in 1991, which reduced the 1992 summer temperature in the Northern Hemisphere by 2°C (4). The estimated annual cost is \$25-50 billion (5), compared to the \$500 billion US annual defense budget (6).
- Blasting sea water into the air to enhance marine cloud cover (7)—Localised but even cheaper.
- Alternatives include iron fertilisation and other methods of manipulating the uptake of CO₂ by the oceans (8).

comply (17). No other organisation currently has this level of influence, and any global governing body would need such abilities to manage resources, monitor results and maintain authority for several decades at least.

The financiers of globally agreed projects would likely be developed or rapidly industrialising countries such as the US, Russia and China. This is likely to cost less than reducing

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their emissions (18), but there is a serious risk that subsequent decisions would be biased in their favour. It is also worth noting that any of these nations, or a coalition of smaller states, would be able to finance a project autonomously, if they felt it to be in their best interests. However, any climate alteration undertaken in the absence of complete international agreement raises serious judicial issues. There would be no clear procedure for appeal, and the countries performing the modification may not be willing to pay compensation for cross-boundary harm.

Should a nation decide to go ahead with unilateral climate modification without international approval, there is also the risk of the technology being used as a weapon. Climate modification could serve to increase a country's economic success, while slowly disrupting that of its enemies. The UN already has a convention prohibiting the use of environmental modification techniques as a military weapon (ENMOD), which has been ratified by 73 countries (19). The international response to a rogue state taking the climatic fate of others in its hands would be severe, but the climate could take several years to return to its previous state after the perturbation, if indeed it ever could (20).

There is currently no consensus on when we will be capable of deliberately altering the amount of energy our planet absorbs. What is clear is that, even if scientific advancement were to allow the advent of an air-conditioned Earth, political and economic factors would still be a serious problem. Negotiations over when and how to employ such radical measures need to begin soon, so that an international framework is already in place should we ever need to undertake such drastic measures, and before any risks become reality. Regulations to control the



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pollution that deposited acid rain on Scandinavia were agreed only after the damage had been done (21), but with the possibility of deliberate attempts to modify the climate, such agreements must be made before any country could start geoengineering projects.

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