

D1 | Climate change

Introduction

Environmental degradation in general, and climate change in particular, represent one of the biggest threats to human health, particularly the health of younger people in the future and that of future generations. Yet repairing the damage and preventing further harm to the environment are nowhere near priorities of local, national and international public health strategies.

Environmental degradation can have both direct and indirect impacts on health. Pollutants in air, water and soil can have a direct toxic effect on human health or they can aggravate pre-existing conditions. Air pollution, for instance, can cause inflammation of the lungs, increase the risk of coronary artery disease and lung cancer, and aggravate pre-existing asthma and Chronic Obstructive Pulmonary Disease (COPD).

Stratospheric ozone depletion, meanwhile, caused by the release of chlorofluorocarbons (once widely used as refrigerants, insulating foams and solvents), methyl bromide (used as a pesticide), halons (used in fire extinguishers) and methyl chloroform (used as an industrial solvent) has an indirect effect on human health. When these various pollutants reach the stratosphere, they break apart, releasing their constituent chlorine or bromine atoms, which cause ozone molecules to break up and disintegrate. With less of the protective ozone layer around the earth, more ultraviolet B radiation reaches the earth's surface, increasing rates of skin cancer.

Indirect effects of environmental degradation on health include aggravated levels of poverty, reduced levels of biodiversity and a changing climate. This chapter focuses on the causes, effects and challenges related to climate change as well as the contribution of transport to climate change and health.

Dramatic climate change

The impact of human activity on the earth's climate system – whether this impact is called climate change, global warming or the greenhouse effect – is often cited as the world's most serious environmental challenge. It is a 'greater threat than global terrorism', according to the UK government's chief scientific adviser (King 2004).

The relatively stable climate on which human communities depend is already changing. The average temperature of the earth's surface has risen by

0.6 °C since the late 18th century, an unprecedented increase since historical records began. The period from 1995 to 2004 included nine of the ten warmest years on record (WMO 2004), and climate-related extreme weather events – hurricanes, tropical storms, flooding, drought and heat waves – now occur with increased frequency around the world.

More worryingly, the average temperature of the earth's surface is expected to rise by between 1.4°C to 5.8 °C by the year 2100. Even the minimum predicted increase (1.4°C) within this time frame will be faster and larger than any century-long temperature trend in the last 10,000 years. Many scientists believe that an average temperature increase of 2°C by 2100 is the threshold of 'dangerous climate change' (Parry et al. 2001, IPCC 2001 a). The task required to prevent such a rise is enormous.

The Intergovernmental Panel on Climate Change (IPCC), the global body of scientists convened by the UN to study the causes, impacts and responses to climate change, is in no doubt that humanity faces a grave threat. Furthermore, they conclude that '(t)he impacts of climate change will fall disproportionately upon developing countries and the poor persons within all countries, thereby exacerbating inequities in health status and access to adequate food, clean water and other resources' (IPCC 2001 b). Cruelly, these communities are also the least responsible for damage to the climate.

What is climate change and what are the prime drivers of human influence on the climate?

The global climate system is driven and maintained by a complex set of interactions involving solar energy, and the effects of clouds and the oceans. Added to these interactions are a variety of effects resulting from human activity, in particular industrialization, agriculture, urbanization and deforestation.

The main reasons for the increase in global temperatures are: the previous 150 years of burning ever-greater quantities of fossil fuels (oil, petrol and coal); deforestation; and certain farming methods. Transport and travel are particularly major causes of climate change through the burning of fossil fuels (see Box D1.1). These activities have increased the amount of 'greenhouse gases' in the atmosphere – in particular, carbon dioxide, methane and nitrous oxide. Concentrations of carbon dioxide are now about one third higher than in pre-industrial times (IPCCc).

Greenhouse gases occur naturally and are critical for life on earth. They keep some of the sun's warmth from reflecting back into space; without them, the earth would be a significantly colder and less hospitable place. But their

increasing quantities are now causing global warming and dramatic climate change (IPCC 2001a).

Rapid climate change will manifest itself in different ways in different parts of the world. It will include more frequent severe weather events; changes in rainfall patterns, including more frequent occurrences in drought; severe heat waves; and in some places, more severe winters.

Box D1.1 The effect of transport on climate change and health

Transport has become a growing public health issue. Transport and travel are major causes of climate change – their share of world greenhouse gas emissions increased from 19% in 1971 to 23% in 1997 (IEA 1999c, IPCC 2001b). Transport energy use in 2000 was 25% higher than in 1990 and is expected to grow by nearly 90% between 2000 and 2030 because of the increasing movement of goods and people (IEA 2004).

Air travel is the least energy efficient form of transport, followed by cars and trucks. Aviation now causes 3.5% of human-generated global warming and could rise to 15% by 2050 (IPCC 2001d). In 2003, 1.6 billion passengers flew by plane, a figure that could exceed 2.3 billion by 2010. The industry predicts a rise in the number of miles flown by passengers and freight as well.

Current transport and travel patterns also harm human health directly. Globally, road crashes kill 1.2 million people and injure another 50 million each year (WHO 2004). By 2020, road injuries may be the third largest cause of disability-adjusted life years lost (Murray 1996). The populations of the rapidly expanding megacities in Asia, Africa and Latin America are increasingly exposed to levels of ambient air pollution that are often worse than those experienced in industrialized countries in the first half of the 20th century. Air pollution contributes to a higher prevalence of cancers of the trachea, bronchus and lung, and various cardio-respiratory diseases.

Modes of travel (in particular the use of cars) also negatively affect health by promoting unhealthy lifestyles. The car has reduced or denied opportunities for walking and cycling, thereby encouraging obesity and cardiovascular disease. A third of car trips in Europe cover under 3 kilometres and half less than 5 kilometres, distances that can be covered by bicycle in 15–20 minutes or by brisk walking in 30–50 minutes (WHO 2004). Some cities have even banned or discouraged cycling because there are too many cars on the road (Barter 2003). Roads and traffic can also disintegrate and

fragment communities; create stress; and consume land that could be used for agriculture or recreation.

The health effects of pollution, injuries and community severance all fall more heavily on the economically disadvantaged, children and the elderly. The unequal effect on the poor occurs both within and between countries.

The public health problems related to transport and travel show considerable inter-country difference. For example, walking and cycling is 4-5 times greater in Europe than in US and Canada, and public transport use 4-6 times greater (Pucher 1996). In Santiago 30% of people cycle or walk to work, while in Brasilia the figure is 2%; in Copenhagen it is 32% compared to 0.3% in Atlanta, 22% in Tokyo and 6% in Sydney (Newman 1999).

Across the world, car numbers and distances travelled are still rising. In OECD countries, the number of motor vehicles is expected to increase by up to 62% between 2003-2012. These countries are also leading the trend towards larger and less fuel-efficient vehicles – in spite of over two decades of serious concern over global warming. Sports utility vehicle purchases now account for more than half the market in the US, while the average Ford car is less fuel-efficient today than the Model T was over 80 years ago (Reuters 2003).

Vehicle numbers are also expanding across the world. In Thailand, the number of registered motor vehicles more than tripled from 4.9 million in 1987 to 17.7 million in 1997. In China, the number quadrupled between 1990 and 2002 to more than 55 million. If China reached Japan's level of car ownership, it would require 13 million hectares of land – equivalent to over half China's current rice cropland (Whitelegg 2003).

Impact of climate change

Since the first IPCC report in 1990, there has been a dramatic improvement in awareness of the impacts of climate change on health. The World Health Organization (WHO), the World Meteorological Organization (WMO) and the UN Environment Programme (UNEP) have published an extensive overview of these impacts (McMichael et al. 2003). Their review also points to several uncertainties and caveats including: a) the complexity of climate systems and measuring related health outcomes; b) the uncertainty in the range of assumptions linked to making an assessment; and c) the differential vulnerability of communities due to differences in population density, level of economic

development, local availability food, local environmental conditions and pre-existing health status (Woodward et al. 2000).

Nonetheless, the effects of climate change will be extensive:

- Droughts and changes in rainfall patterns will damage agricultural systems, threaten the food security of millions of people and worsen the existing food insecurity of millions of others, especially in Sub-Saharan Africa.
- The loss of habitats will result in the loss of biodiversity – up to one third of plant and animal species could disappear by 2050 in the absence of serious efforts to reduce the pollution that is causing climate change (Thomas 2004).
- Global sea levels, which rose on average by 10-20 centimetres during the 20th century, are expected to rise by a further 9 to 88 centimetres by the year 2100. If the higher end of the predicted rise in temperature is reached (5.8°C), the sea could inundate the heavily populated coastlines of countries like Bangladesh; cause the disappearance of nations like the Maldives; and destroy freshwater supplies for billions of people (for a full overview, see IPCC 2001b).
- As climate change provokes poverty and mass migrations, some social responses may compound the problem with human rights abuses – those forced to leave their homes and lands because of the effects of climate change ('climate change refugees') may be met with violence, racism and unsanitary refugee camps. It is estimated that there could be 150 million environmental refugees by 2050, an increase of 125 million from the current figure of 25 million, the majority of them in developing countries.
- An increase in the frequency of extreme weather events will result in more frequent humanitarian emergencies, particularly affecting populations in high-risk areas such as coastal zones and cities in developing countries.
- As water sources are threatened, the prospect of more conflicts over scarce water resources could rise.
- The number of excess deaths caused by thermal extremes (of heat or of cold) will rise particularly in vulnerable groups: those already suffering from cardiovascular and respiratory disease; the very young; and the elderly and frail.
- Climate change will also lead to increased rates of infectious disease, including various vector-borne and water-related diseases. Changes in temperature and surface water can affect the life-cycle of mosquitoes. As a consequence, diseases such as malaria and dengue fever, currently largely confined to tropical or subtropical regions, may spread to countries in

temperate climates (Bouma and Kaay 1995). Diarrhoeal diseases, including cholera, cryptosporidium, giardia, shigellosis and typhoid, may increase as a result of more frequent and severe floods and drought (McMichael et al. 2003).

- Climate change is also expected to increase rates of rodent-borne disease (because of a warmer climate changing habitats that will allow rodents to move into new areas), including leptospirosis, tularemia, viral haemorrhagic diseases, lyme disease, tick-borne encephalitis and hantavirus pulmonary syndrome.

The economic and societal costs of these impacts are estimated to be huge (Parry et al. 2001), and will overwhelm even the most optimistic projections for economic growth in vulnerable regions. An increase of 2°C by the 2050s could result in:

- 228 million more people at risk from malaria;
- 12 million more at risk from hunger as crop yields fall;
- 2240 million more at risk from water shortages, particularly in the subtropics;
- 20 million more at risk from coastal flooding.

An increase of 4°C could by the 2080s result in:

- 334 million more people at risk from malaria;
- 128 million more at risk from hunger as crop yields fall;
- 3500 million more at risk from water shortages, particularly in the subtropics;
- 108 million more at risk from coastal flooding.

The institutional and political response to climate change

Just two years after the publication of the first IPCC report, the UN Framework Convention on Climate Change (UNFCCC) was agreed and signed at the 1992 UN Conference on Environment and Development (the 'Earth Summit') held in Rio de Janeiro. Some 189 countries, including the United States, have now ratified the Convention. This calls on Parties to:

'Protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse affects thereof.'

However, the Convention created non-binding targets for industrialized



14 Droughts threaten the food security of millions in the developing world.

countries to bring their greenhouse gas emissions back to 1990 levels by the year 2000. In 1995, the Parties to the Convention established 'as a matter of urgency' a process to negotiate a new protocol, one with binding targets and timeframes. The result was the Kyoto Protocol, agreed in 1997, whose aim is for developed countries only to reduce their 1990 levels of emissions by a minimum of 5% by 2008-2012. Some 129 countries have since acceded to or ratified the protocol, although it 'entered into force' and became legally binding only in 2005, eight years after it was drafted.

Although it is a step in the right direction, the Kyoto Protocol offers little reassurance. To start with, the level of reduction in emissions that it requires is totally inadequate. The IPCC estimates that, in order to avoid catastrophic destabilization of the climate, global greenhouse gas emissions need to be halved by 2050. Allowing for economic development in non-industrialized (Southern) countries, emissions from the North will need to be reduced by 60-80% in the same time frame – ten times greater than the reductions called for by Kyoto.

Secondly, the biggest polluter in the world, the United States, withdrew from the Kyoto Protocol in 2001. The US, with 4% of the global population, is responsible for 25% of global carbon dioxide emissions. Another country that has failed to support the Kyoto Protocol is Australia.

Thirdly, some observers think that the reporting and accountability mechanisms are too weak. There is widespread concern that the Kyoto Protocol will

'leak', failing to deliver the carbon dioxide emission reductions it requires. A lack of institutional capacity may mean that it will be impossible to verify the reductions claimed, especially by means of the flexible mechanisms (see Box D1.2).

Fourthly, others object to the inclusion of 'carbon sinks' – the planting of trees to absorb or 'offset' carbon emissions – as carbon stored in the tree will eventually find its way back into the atmosphere, meaning that the burden of reducing emissions is simply shifted to future generations. Sinks can also divert political and financial resources away from the primary task: to reduce carbon dioxide emissions.

Finally, there are concerns about the appropriateness of some of the flexible mechanisms (see Box D1.2) in the Kyoto protocol. These mechanisms are based on the premise that the global atmosphere can be 'commodified' for trading within a market system. Developed countries that have ratified the

Box D1.2 The flexible mechanisms of the Kyoto Protocol

There are two flexible mechanisms for countries to meet their Kyoto Protocol targets – the Clean Development Mechanism (CDM) and Joint Implementation.

The CDM is designed to generate emissions reductions credits for developed countries that finance emissions-reducing projects in developing countries. For example, Canada is financing an energy efficiency project in China. By helping to reduce emissions in China, Canada will gain additional credits to increase its own level of emissions. These projects must be approved by the CDM executive board and are intended to contribute to sustainable development in the developing country partners.

Joint Implementation is the means by which industrialized countries cooperate with each other in meeting emissions reduction targets. For example, a German-financed energy efficiency project in the Russian Federation, or Norwegian-financed renewable energy projects in Hungary that reduce emissions, can be credited to the country that financed the project. In theory, this is an efficient means of generating the same overall emissions reductions for industrialized countries. In practice, however, the 'reductions' could be 'theoretical' as well because the emissions baselines in the cooperating countries are not always accurate and are often inflated estimates of future emissions (hot air).

Protocol can meet their targets by reducing their own domestic emissions or by trading in various ways for ‘emissions reductions credits’ – countries may buy or sell their ‘right’ to emit greenhouse gases. Such trading does not recognize the rights of those who lack the funds to participate in the market.

Getting to the root of the problem

Critics point out that the Kyoto Protocol characterizes the problem of climate change and the production of greenhouse gases without addressing the institutions and power imbalances that have resulted in both the overuse and unequal use of the atmosphere (Lohmann 2001). Understanding the political dimensions to the problem of climate change is vital if there is to be any hope of addressing the public health emergency that will ensue.

The forces shaping many of the socio-economic and health inequalities between poor and rich countries are also driving climate change. The growth of corporate globalization and market liberalization, which has created unprecedented wealth for a significant minority of the world’s population, does not just result in the social costs described in part A, but also has environmental costs. The expansion in global trade, which has increased carbon emissions because of the increased movement in goods, services and people, has benefited millions of consumers in richer countries, and the profit margins of a relatively small number of corporations, most of them based in industrialized countries. Particularly notable is the increase in the movement of food, both within and between countries, which has been accompanied by corresponding increases in obesity but no significant reductions in malnutrition (see part D chapter 3). Several billions of poorer people in developing countries have seen their lands and livelihoods turned into environmentally-damaging agricultural systems that produce food and commodities for higher income countries. These people not only receive little, if any, benefit from such agriculture; they are also the ones who bear the brunt of the costs associated with environmental degradation.

Serious political commitment and widespread social mobilization are needed to change the current patterns and forms of economic globalization, and to overcome the disproportionate and unaccountable power of large corporations and financial institutions, many of which are reluctant for people to become better informed and educated about the consequences of rapid climate change. Such commitment and mobilization are also needed to ensure action to prevent further climate change and to tackle the consequences of the change that will undoubtedly take place.

Corporations and institutions rooted in the oil, automobile and transport-

related industries particularly stand to lose out from an effective response to climate change unless they themselves change. Using attractive advertising campaigns, some large oil companies such as Shell and BP promote themselves as ‘green’ industries and emphasize their involvement in renewable energies while still continuing, if not expanding, their search for oil. Exxon Mobil has run an advertising campaign in the US press extensively criticising the Kyoto Protocol and dismissing the widely accepted consensus on the science of climate change. Oil companies have also spent \$12 million since 1997 in funding ‘think-tanks’ and lobby groups that question climate change and oppose efforts to address it, yet individuals from these groups often appear in the media as ‘independent experts’.

Powerful institutions with vested interests, and the governments of the major industrialized countries, are clearly at the root of the lack of progress in implementing an effective response to the climate problem facing everyone. There is neither the commitment nor leadership required to address the problem. For example, in the last 10 years, although the World Bank Group distributed approximately \$1.5 billion for renewable energy projects around the world, it made approximately \$27.6 billion available to the extractive industries (oil, coal and gas exploration) and the fossil-fuelled power sector. Expenditure on fossil fuels and the energy sector relative to renewable energy currently exists at a ratio of 18:1. And while the UK is making an effort to raise the issue of climate change for discussion, UK Prime Minister Tony Blair told the World Economic Forum in 2005 that any action requiring cuts in economic growth would not succeed.

Citizens around the world are slowly beginning to realize and respond to the climate change crisis. But the nature of that citizen response must become more robust. Individual consumer action will not be enough. In the medium-to long-term, economic growth and climate protection are not compatible. The viability and emulation of Western lifestyles and consumption patterns needs to be examined and alternatives developed.

Recommendations

If the political obstacles can be overcome, the IPCC suggests that it would be possible to surpass the Kyoto targets with existing technology at relatively modest costs (IPCC 2001b). Even relatively conventional economic analysts, such as the former head of the Confederation of British Industry Adair Turner, have suggested that meeting the challenge of climate change could be achieved without crippling expense. As a member of the International Climate Task Force, Turner said that it would even be possible to meet the more pressing



15 Transport and travel are major drivers of climate change.

need of staying under the 2°C increase threshold by spending around 0.05% per year of global GDP on actions that can prevent dangerous climate change. In other words, delaying the economic growth that would have occurred by 2050 to spring 2051 (International Climate Change Taskforce 2005). It is certainly possible and imperative to help the most vulnerable countries and communities to adapt to climate change.

What is required is a social mobilization that insists on:

- Cuts in greenhouse gas emissions by industrialized countries in the order of 60-80% (relative to 1990 levels) by the middle of this century – far beyond the targets of the Kyoto Protocol.
- Funds and other resources for poorer countries to adapt to irreversible climate change, bearing in mind that richer country subsidies to their domestic fossil fuel industries stood at US\$ 73 billion per year in the late 1990s (see Box D1.3).

Box D1.3 Adaptation to climate change and equity

It is becoming increasingly clear that the adverse impacts of climate change in the near term (over the next decade or so) are almost impossible to prevent, even with the most drastic cuts in emissions. Hence adaptation to climate change in addition to reduced emissions is vital.

The seventh Conference of Parties to the UN Framework Convention on Climate Change in Morocco in 2001 created several new funds (as part of the 'Marrakesh Accords') to help developing countries adapt to the impacts of climate change. However, contributions to these funds are purely voluntary and have attracted only small amounts from a few rich countries.

- The widespread implementation of small-scale renewable energy projects that can simultaneously tackle poverty and reduce climate change. This will require political commitment, new funds from governments in all countries, and a major shift in the priorities of the World Bank and other development bodies.

The World Health Organization and UNICEF need to be lending their weight to the campaign, using their mandate to protect the health of current and future generations.

Health professional associations, especially public health associations (particularly within developed countries), should be calling for local health impact assessments on climate change of trade and economic activities as well as of health care services. Doctors and other health professionals need to communicate the threats of climate change to health as a public health emergency, and to publicize ways of tackling that emergency and minimizing further climate change. As with many other topics in this report, the health community as a whole needs to take up a more independent and assertive position in relation to the policy agendas set in the trade and industrial sectors.

Recommendations on transport Reducing transport's contribution to climate change requires reversing the trend for greater car and truck numbers and longer journeys (see Box D1.1). Although technology can improve efficiency, more vehicles, larger vehicles and longer journeys can negate these improvements.

The core objectives must be to:

- Redesign trade rules. Governments must prioritize implementing national and international measures aimed at 'internalizing' social and environmental costs – the 'polluter pays' principle.
- Promote land use policies that aim to meet needs for access to jobs, goods, services and leisure locally by encouraging walking, cycling and public transport.
- Promote walking and cycling as the least polluting, healthiest and most equitable modes of transport, in particular by reducing the danger faced by walkers and cyclists from more harmful means of transport.
- Stop subsidizing harmful transport and travel, whether through road building, grants to car manufacturers, low tax on aviation fuel, or World Bank subsidies for fossil fuel production.

Resources

Climate change related resources

BP's Environment Policies <<http://www.bp.com/genericsection.do?categoryId=931&contentId=2016995>>.

Linkages is provided by the International Institute for Sustainable Development. It is designed to be an electronic clearing-house for information on past and upcoming international meetings related to environment and development policy <<http://www.iisd.ca/>>.

The Global Commons Institute (GCI) is an independent group concerned with the protection of the global commons <<http://www.gci.org.uk/>>.

United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto protocol <<http://unfccc.int>>.

Transport related resources

carfree.com: website with detailed ideas how to design car free cities <<http://www.carfree.com>>.

Transport and Health study group: this is a network of health and transport professionals in the UK involved in understanding and addressing the links between transport and health. Involved in promoting Green Travel Plans for health services <<http://www.stockport.nhs.uk/thsg>>.

Victoria Transport Policy Institute: provides free on-line a wide range of papers on transport. These include the economic costs, the health effects, and how to introduce change <<http://www.vtpio>>.

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