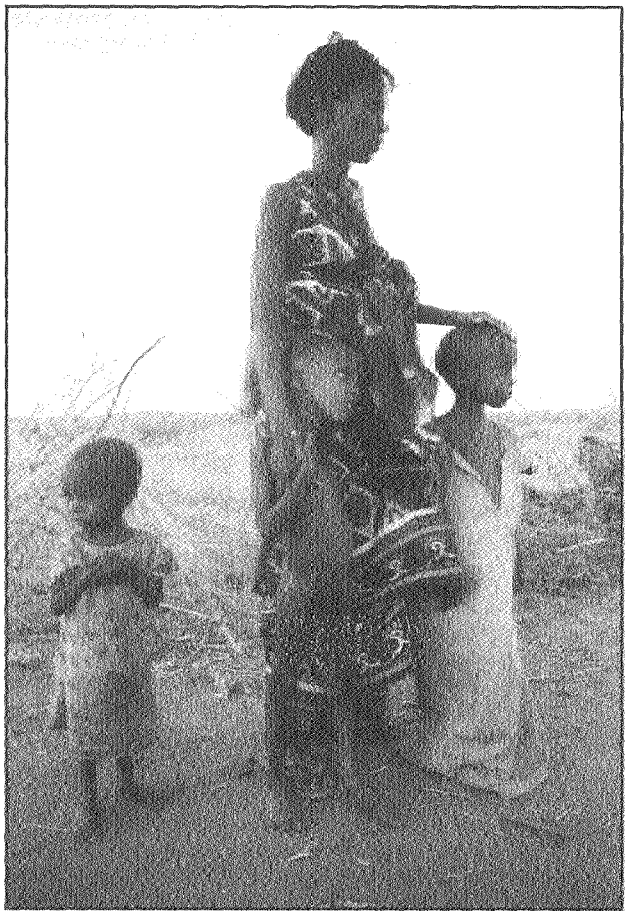

A Somalian family forced to leave their home in search of food and water after their sorghum harvest failed due to abnormally low rains. A year earlier, unusually heavy rains lashed the country, unleashing floods which made 1.5 million Somalis homeless. Climate change may be a gradual and measurable phenomenon, but its effects are severe, unpredictable and often catastrophic. *Brennan Linsley/ AP, Somalia, 1998*

Chapter

1 Environmental trends, disasters and their implications

The world is becoming increasingly vulnerable to natural disasters. From tsunamis and earthquakes to floods and famines, mankind is ever more threatened by the forces of nature. With almost a billion people now living in unplanned urban shanty towns, with deforestation wrecking ecological defences against catastrophic natural events, and with global warming making the forces of wind, rain and sun ever harder to predict and counter, the world is at risk as never before.

Events during 1998 that highlighted vulnerability:

- Hurricane Mitch, which dumped a year's rainfall on Central America in a few hours, causing vast mudslides down deforested slopes, leaving nearly 10,000 people dead and 2.5 million temporarily dependent on aid.

- worldwide epidemics of disease, droughts, forest fires and floods that accompanied the meteorological phenomena of El Niño and La Niña – many climatologists believe these will intensify and become more frequent as climatic change takes hold.

• landslides that killed hundreds of people in the north-west Himalayas in August following uncontrolled deforestation of the foothills, which had destabilized soils on steep slopes; and

• the tsunami in Papua New Guinea that drowned thousands of people on a remote, once-uninhabited shoreline.

Few scientists now doubt that climate change will be among the most pervasive environmental events of the coming century. The Intergovernmental Panel on Climate Change (IPCC), the United Nations' scientific advisers, has reported that we can already see a "discernible human influence on global climate". The changes will normally be gradual, with subtle shifts in average temperatures, rainfall and sea levels. But modifications in averages cause dramatic variations in the risks of extreme climatic events, and climate change will be manifested in a catalogue of disasters such as storms, droughts and flooding unparalleled in modern times. The main uncertainty

Box 1.1 Small island states sink beneath rising seas

Small island states are perhaps the group of nations most vulnerable to rising sea levels In the Pacific and Indian Oceans, as well as the Caribbean, several countries comprising groups of coral atolls have no land higher than a couple of metres above sea level.

As tides rise, their citizens have nowhere to go Island atoll states that may partly or entirely disappear include Tuvalu and Kiribati in the Pacific, Anguilla in the Caribbean and the Maldives in the Indian Ocean. Many islands that make up the larger nations of Indonesia and the Philippines are also under threat. The Maldives comprise more than a thousand coral islands, with most of the 234,000 population living less than two metres above sea level. Already, high tides sometimes cover the airport runway in the capital, Male. "We are," President Maumoon Abdul Gayoom told the UN Small Island States conference in 1994, "an endangered nation."

Coral reefs are living systems Healthy coral can grow to compensate for rising sea levels, provided the rise is not too fast. But where coral has been damaged by human activity, or is close to its upper temperature tolerance limit of roughly 29 degrees Celsius, it may not be able to grow fast enough to survive expected rates of sea-level rise. Clear evidence of the vulnerability of coral reefs to higher temperatures has been provided over the past 20 years by outbreaks of coral 'bleaching', a kind of temporary death, whenever sea temperatures get too high.

Even if they are not engulfed by sea water, many coral atolls will become uninhabitable as saline water penetrates the shallow layers of fresh rainwater, stored within surface sands, on which residents rely for drinking. In the Caribbean, the islands of Barbados Antigua, St Kitts and the Bahamas are among those heavily dependent on t hese groundwaters. Any changes in local climate could leave them vulnerable to lethal tropical storms With no high ground to flee to for shelter, such storms would be devastating.

A study prepared by UNEP has ranked Pacific island countries in order of their vulnerability to sea-level rise, according to attributes such as altitude, number of islands and total land area. The five most vulnerable are Tokelau, the Marshall Islands, Tuvalu, and the far-flung islands that make up the Republic of Kiribati. It concludes that they are "composed entirely of atolls and raised coral islands which will be devastated if projected [sea-level] rises occur...profound impacts may result in these states ceasing to exist..." This moment could come as early as the middle of the next century.

Clearly, some of these countries will be better able than others to protect their coastlines from the early phases of sea-level rise. But many will find it an immense burden without substantial international aid Countries where the IPCC estimates that engineering works to maintain coastal protection will cost more than five per cent of GDP each year include Anguilla, Cocos Islands, Gambia, Guinea-Bissau, Guyana, Kiribati, Maldives, Marshall Islands, Mozambique, Tokelau, Turks and Caicos Islands, and Tuvalu.

Ultimately, on some islands both rich and poor, these efforts may be doomed Just as wealthy nations like Britain are already identifying land that must be sacrificed to rising tides, so will small island states. Evacuation of entire islands, sometimes even entire nations, may prove the only course. The only question may be whether it is done in a planned manner over many years, with a new life for inhabitants ensured elsewhere, or in a rush, involving refugee camps and some lives lost along the way.

The UNEP study, prepared by the Association of South Pacific Environmental Institutions, had stern warnings for the authorities on some islands. For instance, it said that on the Tarawa atoll (where Bairiki, capital of Kiribati, is situated) "it is recommended that immediate plans for resettlement are drawn up by the appropriate authorities."

is where and when they will occur. Although global trends seem clear to scientists, predicting the effects of climate change at the national level is much more difficult.

Coastal flooding will worsen

It is clear, however, that some of the earliest and most unrelenting impacts of climate change will be in the world's coastal regions. These zones make up a small part of the planet's surface. But almost three billion people, half of the world's population, live in coastal zones, which provide many of the most fertile agricultural lands, and most accessible and convenient sites for large urban areas. Thirteen of the world's 15 largest urban conglomerations are on coasts, and the population of coastal areas is rising at double the global average

First and foremost, coastal zones face flooding. As greenhouse gases warm the earth s atmosphere, sea temperatures rise, causing the world's oceans to expand and occupy more space. And, increasingly, the melting of snow and ice on land will add to the amount of water in the oceans. This process is already under way. Worldwide, the tides have crept up by an average of around 20 centimetres over the past century.

As a result, the inhabitants of coastal zones are becoming more vulnerable to flooding Some three million people are made homeless by floods every year, many of them in coastal zones; ten million are at constant risk of coastal flooding, while 46 million coastal inhabitants could be hit by storm surges.

And this is just the beginning. Climate scientists predict that sea-level rise will accelerate in the coming years, with a 44-centimetre rise in average sea levels by 2080 Moreover, if the great ice sheets on Greenland and Antarctica melt only slightly faster than expected, the rise could be doubled. And many places will experience sea-level rises many times the global average because of changes in ocean currents or because the land is already sinking naturally. A recent study by the Hadley Centre at the British government's Meteorological Office, with Delft Hydraulics of the Netherlands, estimates that the numbers at risk of flooding will increase tenfold by 2080, with "many people experiencing flooding more frequently than once per year". The study is the first to assess the impact of IPCC predictions of sea-level rise, combined with increasing coastal populations and the upgrading of sea defences likely from predictions of increased national wealth.

Nothing can stop the process. So far, only surface waters have warmed up as a result of the higher temperature of the atmosphere. The long process of warming the middle and lower depths has barely begun. The Hadley Centre, using standard assumptions about the physics of the oceans, says that "even if climate change could be halted today, the surface warming already incurred will progressively penetrate deeper and deeper into the ocean, causing sea levels to rise still further" – for at least 500 years.

Rising sea levels threaten rich and poor communities alike. Individual cities at risk include Tokyo and Shanghai (respectively the world's largest and fifth-largest cities), Lagos (likely to be the third-largest city by 2015), Hong Kong, Alexandria, Recife, Tianjin, Jakarta, Sydney, Bangkok, St Petersburg, Osaka, Hamburg and Venice. Most will seek to protect themselves by building ever-higher dykes, walls and barricades. But the costs will be astronomical. And the bill for building sea walls to protect rural areas, however densely populated, will be beyond the capacity of most countries. Protecting the Netherlands, a relatively small country, from a 50-centimetre rise in sea level has been put at 3.5 trillion US dollars. In the Maldives, the present cost of protecting shorelines is already around US$ 13,000 per metre of coast.

The biggest threats are to river deltas and small low-lying islands. A half-metre sea-level rise would flood coastal land in eastern China, including the Yangtze delta, where 30 million people live. But the precise risk will depend on many factors. Bangladesh which sits astride the massive river deltas of the Brahmaputra and Ganges, could

lose much of its land, unless natural siltation processes occur fast enough to build the land ever higher. In Egypt's Nile delta, where rising seas could flood the homes of seven million people and 12 per cent of the country's arable land, there is no such defence mechanism. Since the construction of the Aswan High Dam, the river carries little sediment to its lower reaches. The delta is already sinking and giving ground to the Mediterranean. The former delta-mouth village of Borg-el-Borellos is now two kilometres out to sea. Accelerating sea-level rise could cause a further dramatic increase in erosion with the threat of sudden, catastrophic sea invasions.

Other large vulnerable populations live on river deltas in India, Mozambique, Pakistan and Viet Nam. Along the western coast of Africa, from Senegal, Gambia and Sierra Leone to Nigeria, Cameroon and Gabon, many big cities lie on low lagoon coasts.

The situation is also grave for small low-lying island states such as those in the South Pacific. According to the IPCC, "for some island nations, the high cost of providing storm-surge protection would make it [protection] essentially infeasible". For instance, some 80 per cent of the Majuro atoll, home to the capital of the Marshall Islands in the Pacific, could vanish. "Rising sea levels could annihilate our islands as effectively as an atomic bomb," Tom Kijiner, foreign minister of the Marshall Islands, told a UN Small Island States conference in 1994.

Besides rising tides, many low-lying coastal areas face the threat of ever more frequent and intense tropical storms. Warmer ocean temperatures can generate stronger storms and evaporate more water, making rainfall more intense in coastal areas. There is evidence of this already. Western Samoa in the Pacific, for instance, was hit by three violent cyclones in four years at the end of the 1980s and early 1990s. Previously it had expected one cyclone a century. Such storms not only physically destroy man-made and natural sea defences such as coral, they also contaminate underground water resources with salt, forcing evacuation.

Continental interiors dry up

As some nations succumb to rising waters, others will become parched and increasingly at risk from catastrophic drought and famine. While making coastal regions wetter, global warming will cause the hot deserts of continental interiors to expand as evaporation rates increase. On the fringes of the deserts, rivers will dry up and crops will fail as droughts intensify.

In some places, major food crops will be able to make more efficient use of water in an atmosphere richer in carbon dioxide and yield bumper crops. But, in others, drought and higher temperatures could cause crop failure. Predictions about local climatic changes remain very uncertain and their implications for crops even more so. But they do serve to highlight regions at risk from climate change. And the IPCC's projections suggest "increased risk of hunger and famine, particularly in sub-Saharan Africa; south, east and south-east Asia, tropical areas of Latin America, as well as some Pacific island nations." A study by the Environmental Change Unit at the University of Oxford, UK, similarly finds that yields of millet, the most important grain crop of many poorer communities in Africa, could decline by two-thirds.

African pastures from the Sahel to Ethiopia and Zimbabwe, scenes of major droughts and famines in the past 25 years, are likely under most climate predictions to see more and worse droughts. The IPCC warns that "because climatic extremes drive rangeland systems [unfenced pastures], small changes in the frequency of extreme events may have a disproportionate effect". There is likely to be "an acceleration of desertification"

Similar threats face South America. On the pampas grasslands, crop and animal production could drop drastically. One scenario from Oxford's Environmental Change Unit suggests that wheat output in the whole of Latin America could fall by anything from 5 to 50 per cent

Diminished rainfall in arid regions will damage underground water reserves, many of them already suffering serious overabstraction. Rivers will fare no better. Several scientists predict dramatic reductions in the flows of many major rivers that are vital to the water supplies of the countries through which they run. Again, projections should be seen as indicators of the possible scale of change rather than detailed forecasts. But researchers writing in the *Journal of Geophysical Research* project that, on the basis of existing climate models, the Indus – which currently waters the

Box 1.2 Scarce resources: flashpoints for future conflicts?

Environmental changes raise the risks of 'resource wars' as nations and communities fight for rights to key resources such as water. Fresh water accounts for only 2 5 per cent of the planet's total water resources. Of this fraction, only three per cent is directly accessible in rivers and lakes, and over two-thirds of this precious commodity is consumed by irrigation, often feeding cash-crops for export to Northern markets. As global warming disturbs traditional rainfall patterns, the pressure to irrigate will grow, leading the UN Food and Agriculture Organization (FAO) to believe that "human demands are about to collide with the ability of the hydrological cycle to supply water."

A number of international rivers have already been widely pinpointed as likely flashpoints for future water conflicts. Boutros Boutros-Ghali, who was Egypt's foreign minister before becoming the UN Secretary-General from 1992 to 1996, has frequently forecast that the waters of the River Nile are the most likely future cause of war between Egypt and its neighbours.

Egypt currently uses the majority of the flow of the river, which it captures behind the Aswan High Dam near the border with Sudan. But, as the most downstream nation on the river, it is permanently at risk of an upstream neighbour threatening its supply Ethiopia, where the Blue Nile rises, increasingly needs that water and has reportedly begun a series of dams and diversions on the Nile's headwaters.

Since 1929, Egypt and Sudan have had an agreement to share the Nile's waters, although for many years now Sudan has not taken its full entitlement, leaving it available for Egypt. But if Sudan wants to resume taking its full entitlement, while Ethiopia asserts its own claims, tensions could develop. The more so if, as climatologists predict, the river's flow may fall by perhaps 11 per cent in the coming century.

Diminished flow could partly be made up by an audacious joint engineering scheme between Egypt and Sudan. The plan is to increase the flow of the White Nile by digging a canal to bypass the vast Sudd wetland in southern Sudan The canal is already half-built, but work was abandoned more than a decade ago because of civil war. Indeed the waters of the region play an important role in the politics of the secessionist movement in southern Sudan. John Garang, leader of the Sudan People's Liberation Army in the south, did his PhD on the Nile's waters at an American university. He argued that the canal would steal the south's water. The civil war remains to be resolved. And the waters of the Nile give Egypt a vital interest in the future of southern Sudan.

Another disputed international river is the Euphrates, which rises in Turkey and flows through Syria en route to Iraq and the sea. Turkey is currently building a series of huge dams in the river's headwaters, to the consternation of its downstream neighbours which rely on the river for much of their water, according to Greg Shapland, author of *Rivers of Discord*. As long ago as 1975, the three countries almost went to war over the river when Iraq threatened to blow up the Syrian Tabqa Dam to release water for its farmers Syria in turn blamed Turkey for the low flows in the river. During the Gulf conflict at the start of the 1990s, Western analysts proposed that Turkey should cut off the flow of water to Iraq, the so-called Spigot Option

In the intricate politics of the Middle East, water is an issue alongside land to be resolved between Israel and its neighbours. Palestinians have, according to Shapland, objected that Israel has annexed most of the flow of the River Jordan through Jordan; that its hold on the Golan Heights gives it control of the headwaters of the Jordan; and that its excessive use of underground water damages Palestinian development both in Gaza and on the West Bank. As long ago as 1965, Israeli aircraft attacked Syrian construction sites working to divert water away from Israel towards other Arab states.

In the former Soviet territories of central Asia, there are signs of tension between Uzbekistan, Tajikistan and Kazakhstan over the use of the rivers that flow into the much-diminished Aral Sea. Upstream abstractions to irrigate cotton fields are causing downstream ecological devastation, according to a 1995 report by the UN Development Programme.

Meanwhile, India and Pakistan have an international treaty agreeing a division of the waters of the River Indus and its tributaries But such a treaty could come under pressure if relations between the two countries were to deteriorate – or if the climatologists are right that the Indus could lose 40 per cent of its flow in the coming century In each of these cases, a fragile peace currently holds. But can that peace survive if climate change alters river flows drastically?

world's largest irrigation system in one of the world's most populous nations, Pakistan – will lose 43 per cent of its flow. The River Niger, which feeds five arid countries in west Africa, is projected to lose 31 per cent, and the Nile, lifeblood for Egypt and Sudan, 11 per cent. And all this is forecast to happen as levels of atmospheric carbon dioxide double, which could be within 100 years. Such drastic changes of flow in international rivers raise the spectre of water wars, as downstream countries fight to secure their water rights. Equally within countries, the prospects of community water wars grow (see box 1.2).

But in other places, river flows could increase with equally disastrous consequences. Warming will melt mountain glaciers and snow, changing the seasonal flow of rivers, disrupting agriculture and risking the catastrophic failure of large dams. One study quoted by the IPCC found that the amount of water running off from the glaciers of central Asia in 2050 each year could be three times as much as today.

Infectious disease spreading

Hotter and longer heatwaves, such as those experienced in much of the Middle East and India during 1998, raise death rates from heart and lung disease. Air pollution, and pollen and mould spores in the atmosphere, will all become more deadly in hotter temperatures. The overall effect, predicts Paul Epstein of the Harvard Medical School, is likely to be a doubling in heat-related deaths worldwide by 2020 and a much bigger increase by 2050.

Meanwhile, warmer, wetter weather is already extending the range of infectious tropical diseases such as river blindness, malaria, schistosomiasis, dengue and yellow fevers to areas where they are not currently endemic and where the local population has no immunity. The IPCC says that by 2100, 60 per cent of the world's population will be living in potential malarial zones – though with good public health measures the disease need not spread so far. African highland cities such as Harare and Nairobi, which are at present largely malaria-free, are especially vulnerable. There could be an extra 50 to 80 million cases of malaria and 3.5 million cases of river blindness.

Unpleasant surprises will abound. When north-east Kenya suffered unseasonal heavy rain in early 1998 a cattle disease called Rift Valley fever jumped the species barrier and killed more than a thousand humans within a few weeks

Dams and bridges, drains and dykes, and all infrastructure built on low-lying coasts or other flood zones may be "susceptible to sudden changes and surprises and increased frequency or intensity of extreme [climatic] events," says the IPCC Typically, it suggests, disasters currently likely every 100 years could soon have a 'return period' of just 25 years. In some countries, the assets at risk from flooding have a value greater than ten per cent of gross domestic product (GDP). The insurance industry is already getting to grips with the increasing risks. It will no longer grant property insurance on some storm-threatened islands. It claims to be under stress from a series of 'billion-dollar' storms since 1987 that it blames on climate change (see box 1.3).

Flooding and storms may not be the only natural risks to cities. More cities – from Borneo to California to southern Australia – are likely to be at risk of incineration by forest and bush fires. In Siberia, Alaska and northern Canada, settlements may succumb to smashed roads and pipes, and collapsing buildings as permafrost melts. Landslides will hit communities as rainfall increases and hillside vegetation is disturbed by climate change.

There is little doubt that the consequences of global warming will be felt most seriously among the citizens of the developing world. This is for three reasons:

- the increased incidence of extreme climatic events is likely to be most evident in the tropics:

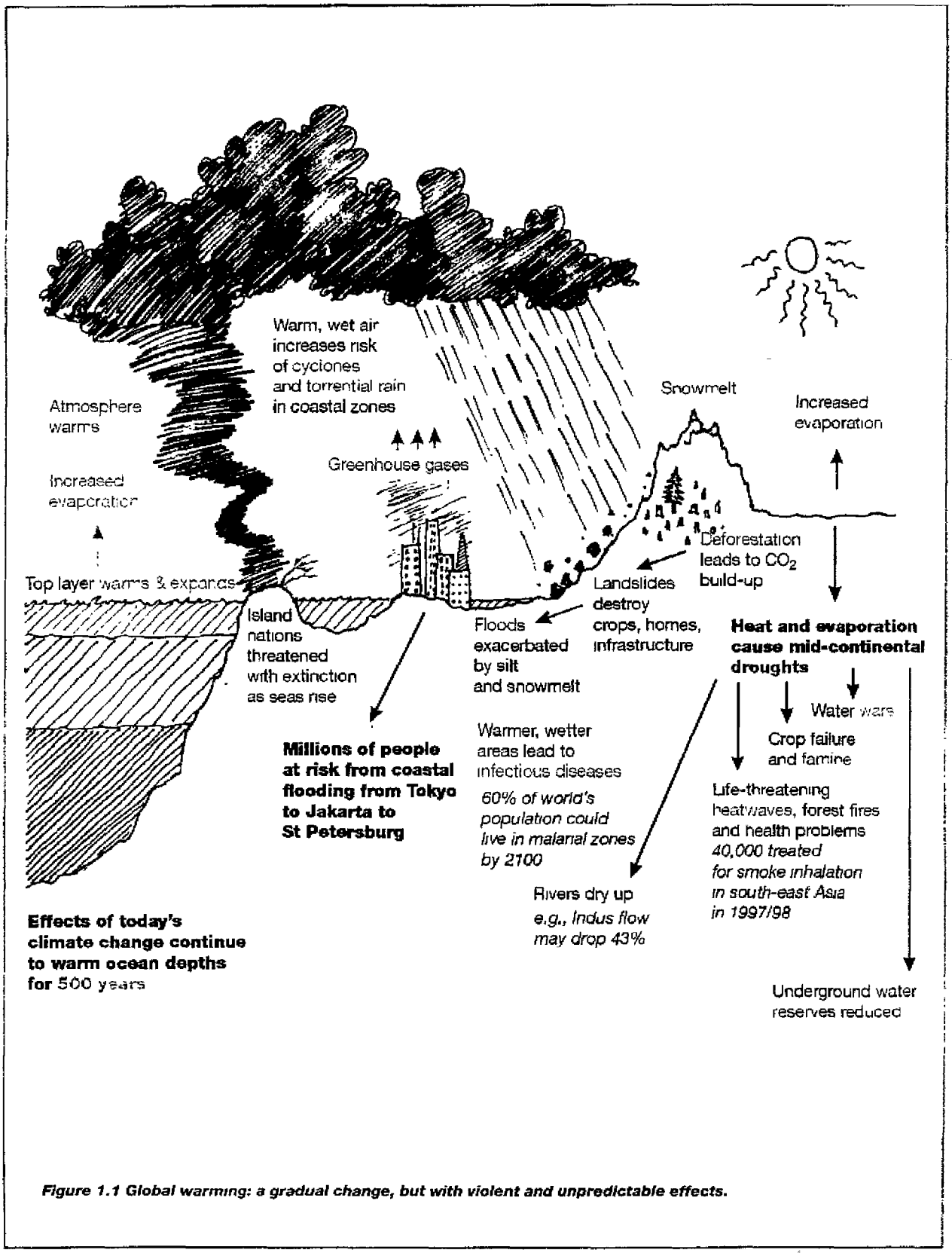

Figure 1.1 Global warming: a gradual change, but with violent and unpredictable effects.

• developing nations are most dependent on those living natural resources, such as forests and soils, that will be disrupted by climate change; and

• poorer nations are less able to invest in adapting to changing climate and have less robust institutions and infrastructures for handling the consequences.

The cost of trying to adapt to changing climate "could create a serious burden for developing countries" says the IPCC. Just as likely, the countries will fail to adapt and will pay the price in increasing numbers of 'natural' disasters.

El Niño: the model

While climate change is regarded as a gradual phenomenon, it will largely manifest itself in the changing frequency of extreme meteorological events – unexpected droughts and floods, record heatwaves and snowstorms – that will trigger human disasters. One model for these likely events is provided by the record El Niño suffered round the world during 1997 and 1998.

El Niño is a periodic natural event, but it has become more intense and frequent in the past 20 years and there is some evidence to suggest that this may be a consequence of global warming. If this is the case, then El Niños could become semi-permanent features of the world's weather system. Even if not, recent events demonstrate the instability of the world's weather systems and its capacity to switch modes, unleashing extreme weather on unsuspecting communities.

In the El Niño winter of 1997-1998, heavy rains caused mudslides in California that washed houses off cliffs. Ice storms on the eastern seaboard from Maine to Quebec downed so many power lines that thousands of people had to live in the dark and cold for weeks. At the same time, the worst drought in a hundred years hit the island of New Guinea, killing crops and leaving some of the most isolated people on earth starving.

For the 12 El Niño months from the summer of 1997 to the summer of 1998, the world experienced some of the most intense and widespread fires ever recorded. Forests burned from Brazil to Borneo, Peru to New Guinea and Florida to Sardinia, sending palls of smoke that forced schools to close and raised hospital admissions hundreds of kilometres away.

Indonesia's rain forests got no rain and the months of dry weather turned the forests into the world's largest pile of firewood. As five million hectares burned in Kalimantan and Sumatra, some 40,000 Indonesians were treated in hospitals for smoke inhalation. One estimate put the death toll at a thousand. Doctors in Singapore, where air pollution was the worst ever, reported epidemics of asthma, eczema and conjunctivitis. In Kuala Lumpur, schoolchildren were ordered to stay indoors as asthma cases rose sevenfold "Never in history has such a large population been exposed to such high levels of pollutants," said one Hong Kong professor. The health of 70 million people was affected.

All 234 people aboard an Indonesian Garuda Airbus perished when the plane plunged into a mountainside as it approached a smog-bound airport in Sumatra. The same day, two cargo ships collided in the smoke-filled Straits of Malacca between Sumatra and mainland Malaysia, killing 29. Fires spread to Java. In Irian Jaya, 150 died when crops failed and smog prevented relief supplies being flown in.

Elsewhere, as the worldwide epidemic of conflagrations reached its peak, Peruvian fires closed in on the ancient city of Machu Picchu Blazes in eastern Kazakhstan spread into neighbouring China's Xinjiang province Bush fires threatened an area of the remote Kimberley and Pilbara regions of Western Australia the size of England. In South America, floods made half a million Peruvians homeless along a coastline that often has no rain for years at a time. Neighbouring Ecuador said it would take ten

years to repair the damage. And in northern Tibet, the worst snow in 50 years starved or froze to death hundreds of herders and mountain dwellers.

Growing cities concentrate risks

The world is becoming increasingly urban. In the past 40 years, while overall population has doubled, its urban population has increased fivefold. Four-fifths of the world's population growth in the 1990s has occurred in urban areas, through both natural growth and inward migration. Cities will shortly be home to half the world's population. In theory, cities provide a man-made environment more secure from the vicissitudes of natural hazards. But this depends on the quality of construction and emergency

Box 1.3 Insurance and natural disasters

If any business in the private sector has an international overview of natural disasters, it is the insurance industry. It considers that natural disasters represent about 85 per cent of insured catastrophe losses globally. In 1998 alone, Munich Re, one of the world's largest reinsurance company, estimated that natural disasters caused over US$ 90 billion of economic losses. Compared to the 1960s, the past decade has seen the number of great natural catastrophes triple, costing the world's economies nine times as much.

The insurance industry has recently suffered from a series of 'billion-dollar' storms – in 1992, payouts for disasters hit a record US$ 22 billion after a series of catastrophic hurricanes in the Caribbean.

That year, Hurricane Andrew brought insurance losses of US$ 16 billion. Despite narrowly missing Miami, it was the US's most expensive natural disaster ever. In one night, it drained a tenth of the industry's global reserves for catastrophic damage to property. Such natural disasters played a part in the well-publicized collapse of Lloyds of London in the early 1990s.

As a direct result of the events of 1992, many insurance and reinsurance companies have refused to provide cover in the Caribbean – leaving many places financially unprotected when Hurricane Georges ripped through the region in September 1998

Industry leaders have begun to see the hand of man in many of these natural climatic events. At Munich Re, meteorologists concluded that as global warming progressed it would result in a world that was more stormy, with worse and more frequent extremes of drought-related fires and floods. Foreseeing an escalation in insurance claims as a result, the company issued a public plea for global action on climate change.

The mood has spread The insurance industry, worth US$ 2 trillion a year, has since sought alliances in its pursuit of action against destructive environmental change. Its leading figures have shared public platforms with Greenpeace and formed a strategic alliance with UNEP

In 1995, the president of the Reinsurance Association of America, Franklin Nutter, warned that the insurance industry was "first in line" to be affected by climate change. "It could bankrupt the industry," he said. That year, the industry formally joined hands with UNEP to address global environmental issues, including global warming.

In 1997, the industry presented a paper to the Kyoto climate conference. It noted that "while the effect of climate change on the frequency or severity of extreme weather events remains unknown, it is clear that even small changes in regional storm patterns or in the hydrological cycle could lead to increased property damage " And it warned that "changes in human health (e.g., spreading of diseases) may affect the life assurance and pension industries "

At a meeting held in Cambridge, England, in September 1998, just as Hurricane Georges began its progress through the Caribbean, industry leaders joined with representatives of the banking sector to demand a central role in designing global strategies for combating global warming, such as emissions trading.

While most of the insurance sector's concern necessarily relates to rich nations, aid agencies should still be encouraged to form their own alliances with the industry for forecasting and strategic planning for major disasters in the developing world, and for lobbying governments to take timely action to reduce global warming and mitigate its effects

Humanitarian agencies should also lobby the insurance industry and governments to provide more cover for the world's poor, who are the hardest hit by natural disasters.

When Hurricane Mitch devastated Central America in October 1998, it wreaked, according to Munich Re, US$ 7 billion of economic havoc, but only 150 million dollars' worth was insured – just two per cent of total losses. In richer countries, insurance is a major component of disaster preparedness, but for millions of people in the developing world insurance is an unaffordable luxury.