Part One

Introduction

1

Grasping the essentials of the climate change problem

1.1 Climate change intertwined with life

Ecosystems are interconnected (Commoner, 1971). Hydrological and bio-physical spheres flow into each other. Production and consumption patterns are interlinked across continents. 'National spaces, previously fragmented, are being integrated on a global scale' (UNIDO, 2008: 5). The ecological, social and economic crises are interlocking crises (WCED, 1987: 4) with intergenerational scope in an increasingly globalizing world!

Contrast that with our governance patterns. Local governance cannot cope with global externalities. National governance is affected by competing ideologies, interests and fragmented systems. Democratic politics is locked into 4–5-year recurring elections; while political decisions on institutions, technologies and infrastructure lead to long-term, locked-in, processes (Barbier, 2011: 238). Current investments are locking the world into an insecure, inefficient and high-carbon energy system (IEA, 2011). Lock-in refers to the difficulties in reversing decisions because of the high costs involved, and because these have a high inertia. Transboundary governance is affected by the competition between short-term national versus regional interests. Global governance is fractured along national interests, and is fragmented, pluralist, incoherent and often counter-productive. 'Glocal' (global to local) governance is affected by past politics. Path dependency affects the future.

Within these interconnected, interflowing, interlinked, integrated, interlocking and intergenerational crises is the climate change problem. The question that arises is, Should climate change be dealt with as a relatively small problem with clear contours or should it be addressed as a systemic problem? In 1989, Pier Vellinga of the Netherlands' Environment Ministry cautioned that the global community cannot afford to make climate change a systemic developmental problem because addressing the climate change problem would then become captive to addressing all other global problems! Bert Metz (2010) cautions about politicizing the problem, arguing that a technocratic framing may yield better results. However, as the years have shown, climate change is far from a single-issue technocratic problem:

> Furthermore, the suggestion that technical and normative considerations exist in separate universes is a fundamental misinterpretation of what climate change means as a driver of social change. It is not a 'natural' process that affects societies from the 'outside' – it is part of the metabolism of a socio-ecosystem. The challenge of building sustainable societies, in other words, cannot just be about technologies – or even institutions. The 'soft' infrastructures in the minds of members of society – their attitudes, beliefs and behavioural patterns – are intimately intertwined with the 'hard' infrastructures of steel and concrete through which we shape the world – and ourselves.
>
> *(Crowley, 2012: 3)*

This chapter provides the context for the history of climate change governance. When the climate change problem was discussed in the 1980s, there were 'both North–South inequities and East–West tensions' (Toronto Declaration, 1988: Para. 14). The world has changed considerably since then. North–South inequities remain but the membership of the two groups has changed. East–West tensions have evolved (see Chapter 8).

A key message of this book is that the 'glocal' community is on a steep learning curve, it is moving from challenge to challenge – and this is promising! The problem is not technocratic – but very political: the way solutions are crafted or not crafted will have implications for 'who gets what, when, where, and how'! There is no avoiding the politics of climate change. However, political, social and technological solutions may well be in sight. Anil Agarwal of the Centre for Science and Environment in New Delhi once told me in a conversation that a global shift towards using renewable energy in place of fossil fuels would make the whole issue of sharing global resources, risks and responsibilities equitably ('ecospace sharing'; see 1.4.1) totally irrelevant! But in the meantime, we would have to focus on equity issues. With Brazil generating about 50% of its energy supply from renewables and Germany about 30%, we may be well on our way to making this revolution occur! Thus the emphasis on technocratic solutions is needed, not just in terms of adaptation and mitigation, but also in terms of re-engineering society in order to provide the trend-breaks society needs (Barrett, 2009). However, it will have to take place in the context of the politics of climate change.

Key to addressing a problem is understanding its nature (Hisschemöller, 1993). However, as problems are socially constructed, they cannot be defined 'objectively' and 'enduringly'. As this book demonstrates, problem definitions evolve as knowledge and perceptions develop. The science and its critique (see 1.2), the dominant framings (see 1.3) and the North–South realities (see 1.4) have all evolved.

1.2 Science, scientific uncertainty and climate sceptics

1.2.1 The problem

Anthropogenic or human-induced climate change is a post-industrialization problem caused by the net emissions of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and chlorofluorocarbons (CFCs) into the atmosphere. These gases emerge from the way we produce and consume. They emerge from our energy, agricultural, industrial and spatial planning systems. Water vapour and ozone in the troposphere and stratosphere are also GHGs. These gases envelope the earth and increase its temperature. The energy from the sun is the motor that drives the earth's climatic system. This energy arrives in the form of short-wave radiation of which about 70% is absorbed by the earth's surface and atmosphere. The earth also emits energy in the form of long-wave radiation. GHGs can absorb or re-radiate back this outgoing long-wave radiation as it is emitted from the earth, warming our planet further. Overall, the earth is about 30° warmer because of this GHG effect. By adding additional GHGs to the atmosphere, the accumulated concentration of these gases may lead to the *enhanced* global warming effect. This warming may change global climate patterns. However, there are a number of other elements that can also reinforce or negate the warming effect (see 1.2.2).

This global warming leads to expansion of the waters in the seas (imagine a boiling kettle), melting glaciers, changing wind and rainfall patterns, salt water intrusion into coastal areas as the sea level rises, and possibly extreme weather events. Beyond a certain point it can lead to non-linear irreversible changes – also referred to as 'tipping points' or crossing 'planetary boundaries' – the melting of polar ice and the slow-down of ocean circulation patterns. For a more nuanced and detailed analysis see the reports of the Intergovernmental Panel on Climate Change (IPCC). The IPCC assesses the work of scholars, building on the initial premises of Joseph Fourier in 1824 who postulated that there was a greenhouse effect; John Tyndall in 1861 who analysed the role of water vapour; Svante Arrhenius who argued that a CO_2 doubling in the atmosphere could lead to a few degrees of warming; and Guy Callendar who, in 1938, argued that CO_2 concentrations were indeed increasing in the atmosphere.

1.2.2 Sceptics and their rebuttal

Climate change is a global-scale inadvertent experiment. Although the basic relationship between increased concentrations of GHGs and warming is undisputed, it is not always clear how sensitive the earth's climate is to such concentration build-up. This is reflected in the language of uncertainty. Natural scientists can try to evaluate this uncertainty 'objectively' while social scientists argue that uncertainty is a social construct – i.e. an idea that society defines (Jassanoff, 1990; Shackley and Skodvin, 1995). This uncertainty can be used to justify action through the precautionary principle – i.e. the argument that even if there are doubts about the links between cause and effect, if the effect may eventually be irreversible, this irreversibility justifies action to minimize the cause. This is a dominant argument that frames the European Union's (EU's) perspective on climate change. At the same time, this uncertainty can be used to justify inaction or postpone action by those who argue that the costs of current measures to deal with the cause are too high, and possibly in the future these costs will come down. This is an argument used by the US government. However, as far back as in 1989, it was argued by countries participating in the Tata Conference Statement (1989: Art. 5.5) that 'If nations delay actions in an elusive quest for scientific certainty, the risks and costs will mount unacceptably'.

Part of the political problem of making decisions is the rise of climate sceptics. In the pre-1990 period there were scarcely any sceptics. However, by 1996 the sceptics were organizing themselves, arguing that climate models did not adequately take into account the impacts of water vapour and other feedback effects, that the models did not reflect the reality of the global system and that IPCC reports reflected political and not scientific consensus (Emsley, ed., 1996). There has been a gradual intensity in the rise of scepticism in the post-2000 period. With 1998 being the warmest year in recorded history up to that point, many began to play on public ignorance by arguing that the scholars were manipulating the data and were deliberating making mistakes to prove their own hypothesis. This scepticism has been predominantly present in the USA, and some say that this is politically motivated (Bowen, 2008; Mooney, 2006). Similar attacks have been launched to question the integrity of the scientists participating in IPCC, their email exchanges and some mistakes in the IPCC reports, but subsequent reviews of IPCC work have shown that their basic conclusions are correct.

The main arguments of the climate sceptics and their rebuttals can be clustered as follows (see Table 1.1). First, the contribution of anthropogenic emissions is marginal compared with natural causes. Anthropogenic emissions are a mere 3–4% of total emissions of GHGs; and events such as solar variation, volcanic eruptions and the El Niño Southern Oscillation and other natural variability can cause greater changes and related problems. Anthropogenic emissions are also not significant in terms of global time-scales: through history the climate of the earth has been changing, the temperature has fluctuated and there have been ice ages.

However, most natural causes are in balance with the effects; many natural causes (e.g. solar variation, volcanic eruptions) cannot be controlled while human causes can be controlled; and the issue is not whether the earth will have a problem

Table 1.1 *The arguments of the sceptics and their rebuttal*

Arguments	Rebuttal
Anthropogenic emissions marginal	Small but significant
Only 3–4% of total GHG emissions, natural emissions more important	But natural system can cope with natural emissions; not the anthropogenic increment
Not significant in geological time-scales	But we worry about now and our children
Solar cycle variation can influence by 0.2–0.4°	Solar variation small in comparison with expected climate impacts
Volcanoes, El Niño, meteorite hits are important	These cannot be controlled
Impact of anthropogenic emissions marginal	Unprecedented and has non-linear impacts
Radiative effect small – CO_2 doubling leads to 1° rise; 2° rise is no big deal	Disregards feedback mechanisms, rise is unprecedented in the last 10,000 years, regional variations high, non-linear impacts; the temperature increase is already at 0.8°C and there is more in the pipeline because of delayed feed-back effects
Evidence of warming unconvincing	Scientifically accurate
Upper atmosphere is colder	But lower atmosphere is warmer
Measurements are in warmer urban areas	But are corrected for heat island effect
Decades of CO_2 emissions did not lead to warming (1940–1960; since 1998 the world has been getting cooler; 2008–2010: cold winters in US/Europe)	1940–1960: because of cooling effect of sulphates; post-1998 averages are higher than pre-1998 averages; very warm in Greenland, big temperature variations linked to complex feedback processes
There have been ice ages in the past	Linked to changes in the tilt of the earth's axis; next ice age expected in 20,000 years
Model generalizations cannot capture reality	The models are getting better over time
IPCC work – political consensus, not fact	IPCC work – scientific convergence
Warming is not necessarily a problem	Long-term winners are unpredictable
Warming is good: enhanced precipitation, longer growing season, increased plant growth, melting of Arctic opens transport/ mining options	Regional variations problematic for some; non-linear impacts will be problematic for all
If a problem, can be dealt with by adaptation and geo-engineering	There are limits to adaptation, and geo-engineering has many side effects
Mitigation measures are problematic	Depends on how they are designed
Ineffective: Sea level will continue to rise for centuries; positive feedback effects	Hence, need for early action

Table 1.1 (*cont.*)

Arguments	Rebuttal
Expensive: Is too expensive, leads to leakage and loss of competitiveness	Not necessarily, depends on design of response system
Disruptive: World economy will collapse	Not necessarily
Diverts scarce resources from global priorities	Climate change impacts on global priorities,
It is cheaper to take action later – new technologies	But the problem set in motion may be irreversible
The science is self-serving	The critique is also self-serving
Helps climate scientists, actors and big government supporters remain in power, in line with doomsday thinking	Helps neo-liberals, small government supporters, technology optimists and GHG-producing industry retain power

in geological time-scales but whether humans are creating a problem for current and following generations. Moreover, with a changing baseline, the effect of natural variability may become increasingly more difficult to handle causing, for instance, extreme conditions that were previously very rare.

Second, the impact of anthropogenic emissions is miniscule and the signature of anthropogenic emissions against the background noise is difficult to detect. The radiative effect of CO_2 is limited; a CO_2 doubling in the atmosphere in relation to pre-industrial levels leads to a maximum of 1ºC rise in temperature (Rahmstorf, 2009: 38). This may appear easy to deal with for the public – take off a sweater; adjust the thermostat!

However, this is without considering any feedback mechanism in the climate system (like the ice-albedo effect – where warming leads to melting of ice and thus decreases the albedo or reflection of the heat by the ice and leads to more warming). By how much temperatures would increase exactly with a CO_2 doubling from pre-industrial levels is subject to scientific debate, but about 3° seems reasonable though some argue that we are moving to a 4° rise. Furthermore, such a rise is unprecedented over the last 10,000 years, occurs over a very short time span, and a mean rise in temperature hides huge spatial variations. These spatial variations may exacerbate the situation of vulnerable lands and peoples, and can lead to non-linear irreversible impacts such as the melting of the Greenland ice sheet, boreal forest die-back in the USA and Russia, instability of the West Antarctic Ice Sheet and changes in the Indian monsoons (Lenton *et al.*, 2008).

Third, sceptics argue that the evidence of warming is not convincing. For example, there is a time-lag between emissions of GHGs and the resultant warming of about 5 months (Kuo *et al.*, 1990). This is not consistent with historic time-lags through ice-core studies (Petit *et al.*, 1999: 433). Furthermore, the temperature is increasing in the lower atmosphere while it is much colder in the upper atmosphere (Schwartzkopf and Ramaswamy, 2008). Moreover, the causal relationship is problematic as there have been very warm periods on earth in the past without a corresponding increase in anthropogenic GHGs; there have recently been decades that were relatively cool (e.g. 1940–1960), and temperatures have not reached the record of 1998 since then. Model generalizations simplify reality into a caricature and the IPCC consensus reflects political consensus, not scientific fact. The predictions of doom of the Club of Rome (Meadows, 1972) did not materialize.

However, carbon isotope analysis shows that current concentrations are from fossil sources; and there are explanations for aberrations in warming related to climatic variations linked to, for instance, the solar cycle and the El Niño Southern Oscillation. For example, between 1940 and 1960 there was less warming probably because of the cooling effect of sulphates emitted by thermal power plants into the atmosphere (Mitchell and Johns, 1997; Mitchell *et al.*, 2001). The year 1998 was very warm because of natural variation due to a very strong El Niño in this case; that this record has not been topped yet does not mean that the earth is cooling. While accepting that laboratory models do not represent reality, it is impossible to set up a global scale experiment; past predictions are only inaccurate when they have led to policy measures to avoid the outcome predicted; and the past predictions of the Club of Rome (Meadows, 1972) with respect to CO_2 emissions and climate change have more or less come true (Vellinga, 2012: 29). The real uncertainty lies in knowledge regarding the sensitivity of the climate system to GHG emissions. The climate system could have moderate sensitivity if there are more sinks that absorb GHGs than we know of, if a CO_2 doubling is not eventually accompanied by increased water vapour, and if increased cloud cover leads to cooling. The ice ages are caused by changes in the tilt of the earth's axis, and the next ice age is not expected for 20,000 years.

Fourth, the accumulation of GHGs is not necessarily problematic – as this can increase precipitation in some regions, lengthen the growing season, encourage plant growth through enhanced CO_2 concentrations, and thereby be beneficial. For example, carbon fertilization could lead to a net benefit of USD 37 billion to the USA (Mendelsohn *et al.*, 1994). History shows that during the period AD 850–1350, there was enhanced warming which led, on balance, to more food, trade and better health. The melting of the Arctic opens up options for transportation and mining. There are, for those who hope to be winners, no reasons to frame the climate change issue as a 'problem'. If the problem turns out to be serious, one can always adapt or apply geo-engineering methods.

However, it is difficult to downscale global changes to local levels – the climate may become unpredictable; in the long term the non-linear effects are definitely problematic for society and may threaten human life on earth; geo-engineering addresses primarily the symptoms of climate change and has many side effects (see 2.7).

Fifth, the planned measures are ineffective, expensive, disruptive and not a priority. The targets adopted in the Kyoto Protocol of 1997 (see Chapter 5) contribute to barely effecting a 0.1°change in temperatures over a hundred-year period. Sea-level rise will continue long after measures are taken. The measures proposed are expensive, may lead to carbon leakage to other parts of the world and will affect the competitiveness of industry. Significant measures to deal with climate change can disrupt the economies of the world without having any additional benefits. None of this implies that countries should not invest in measures that can have other benefits. The money can be better spent on other issues such as addressing developmental challenges (Lomborg, 2001)! Measures could perhaps better be postponed to a time when the new technologies are cheaper (Wigley *et al.*, 1996).

However, measures need not be ineffective, expensive and disruptive or come at the cost of development priorities. This all depends on how the measures are designed (see Chapter 2).

Finally, promoting climate change as a problem is seen as self-serving for specific groups of actors – it helps to generate resources and power for climate scientists and climate actors, and it appeals to some neo-Marxists, supporters of big government, and those who see themselves as 'losing' from the climate problem.

However, this argument is equally self-serving for neo-liberal, small government supporters, and GHG-intensive industry and consumers who are afraid to 'lose' if climate mitigation is emphasized (see Table 1.1). For more details see Vellinga (2012).

I believe that there is enough evidence that climate change is a serious problem (IPCC reports; Joint Statement of Academy of Sciences, 2001; NRC, 2010), and that the uncertainty in the science does not necessarily disprove the causal links (van der Sluijs, 1997; Vellinga, 2012). However, the media apparently need to present debates rather than facts in order to generate discussion and viewership, thereby often providing a platform for two opposing views even when the views may not be equally authoritative. The media often undermine the authority and legitimacy of the IPCC, recognized through the award of the Nobel Peace Prize in 2007, in the search for 'balance' with the views of other stakeholders. This search for 'balance' creates a bias (Boykoff and Boykoff, 2004) and confuses the public. This public is also becoming increasingly sceptical of modern scientists, seeing