PART I Context, Tools and Systems

1 Adaptation and the Paris Agreement

1.1 THE GLOBAL CONTEXT

Around 1950 humanity began a phase of explosive growth in manufacture, trade, consumption, technology and the transformation of natural ecosystems and traditional societies. The speed of change ensured that weaknesses inherited from the past continued to deform our societies, including the exclusion and oppression of many people on grounds such as 'race', gender, caste, class and faith. Ignorance and greed also ensured that economic change had many negative side effects, notably the destruction of ecosystems and ecological services that sustain society, and the pollution of the air, food and water that sustain health.

Carbon dioxide (CO_2) from burning organic carbon in wood and coal was one pollutant that would soon come to have a particular significance. For by 1950 the biosphere – the global system comprising all life – had already absorbed almost as much extra CO_2 as it could without changing the composition of the air and the heat balance of the biosphere. As emission rates grew further the atmospheric concentration of CO_2 quickly rose to a level not seen for at least 800,000 years (Snyder, 2016; Our World in Data, 2020a). It has continued to rise ever since, with our annual carbon emissions soaring from a few billion tonnes in the 1960s to 40 or 50 billion tonnes in the 2010s (Ballantyne et al., 2012; Our World in Data, 2020b).

Because CO_2 is a greenhouse gas (GHG), this at once began the process of trapping abnormal amounts of solar radiation within the biosphere. Land use change and industry then added more and different GHGs, some of them far more potent than CO_2, including methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6) and

compounds based on bonds between atoms of carbon and fluorine (such as the chlorofluorocarbons or CFCs). All have different heat-trapping (and other) effects, persist in the atmosphere for different lengths of time and react differently with other chemicals and under varied physical conditions in the biosphere.

The various sources (emission origins), sinks (absorption processes) and net rate of growth in GHG concentrations in the atmosphere are monitored and reported in detail for CO_2 (Le Quéré et al., 2015, 2018; Friedlingstein et al., 2019, 2020) and CH_4 (Saunois et al., 2016, 2020). These studies show not only an increasing understanding of the complex heat-trapping effect of GHGs over time but also a series of discoveries that call into question each level of understanding almost as soon as it is reached. These uncertainties have arisen, for example, from methane sources in melting permafrost, decaying peat and warming sea beds (Chapter 2), and from nitrous oxide released by the breakdown of fertilisers in farmland. These are capable of amplifying climate change and its impacts beyond the scope of previous models.

While GHG emissions were escalating, we were also changing ecosystems and extinguishing species. This was degrading the capacity of the biosphere to absorb GHGs and buffer their effects. The net result of all these processes came to be seen as an approaching crisis of global heating, mass extinction and ecological breakdown. Our first response was a false dawn in the early 1970s, when the United Nations Environment Programme (UNEP) was founded, followed by a pause when the political world was polarised by the Cold War. There was a more complete effort in the early 1990s, built around the United Nations Conference on Environment and Development in Rio de Janeiro, where two key environmental treaties were agreed: the Convention on Biological Diversity (CBD), which sought to head off mass extinction and ecological collapse, and the United Nations Framework Convention on Climate Change (UNFCCC).

The latter sketched out a path by which we would bring net GHG emissions under control (a process known as 'mitigation'), in

order to head off the climatic effects of global heating ('climate change') and cope with their consequences ('adaptation'). The story since has been one of long pauses, scientific progress, political controversy, denial, distraction and occasional flurries of constructive thought and useful activity, notably in 2007 and 2015. In the process it came to be realised that the drivers of global heating and climate change are so foundational to our ways of life that mitigating them adequately would be very hard and expensive.

With public support, political will, leadership and cultural change this might not be impossible, but the difficulty of achieving adequate mitigation meant that adaptation came to be seen as an equal priority. This is partly an admission of defeat but mainly a pragmatic survival response. Besides which, many adaptation actions can contribute to mitigation and vice versa, as well as helping to reduce biodiversity loss and ecosystem breakdown. Thus, we have realised that all these problems are connected and can only be solved through systemic action based on holistic thinking.

1.2 THE CLIMATE CONVENTION

The UNFCCC entered into force in 1994 and provides the main framework for global discussions on mitigation, adaptation and 'means of implementation' aspects of the climate response (Kamphof, 2018a). Decisions are taken each year at a Conference of the Parties (CoP), the first of which, CoP 1/1995, was held in Berlin.[1] Some of these were game-changing: CoP 13/2007 in Bali, for example, coincided with and contributed to a sea change in governments' perceptions of climate change as a major economic threat, and hence their engagement with mitigation; while CoP 21/2015 in Paris yielded an agreement that set out new paths for mitigation and adaptation

[1] Other recent CoPs took place in Cancún (16/2010), Durban (17/2011), Doha (18/2012), Warsaw (19/2013), Lima (20/2014), Paris (21/2015), Marrakech (22/2016), Bonn (23/2017), Katowice (24/2018) and Madrid (25/2019). The next CoP (26) is planned for Glasgow in late 2021, having been rescheduled from 2020 due to the Covid-19 pandemic – see later in this chapter and Chapter 2.

efforts to follow, based on new ways for nations to cooperate (see Section 1.5). Decisions of special significance for adaptation had also previously been made at CoP 11/2005 in Nairobi, where the Nairobi Work Programme was agreed, and at CoP 16/2010 in Cancún. The latter authorised an Adaptation Committee at the UNFCCC Secretariat, and also issued the Cancún Adaptation Framework, which called for equal priority between mitigation and adaptation, while focusing adaptation on water, health, farms, food security, coastal zones and ecological and other systems.

Pre-dating, informing and later paralleling the UNFCCC process, the Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by UNEP and the World Meteorological Organisation. Its role is to analyse scientific findings on climate change and to inform the United Nations (UN) system about them, which it has done through a series of assessment reports (IPCC, 1992, 1995, 2001, 2007, 2014) and reviews on particular topics (most recently: IPCC, 2018, 2019a, 2019b). The sixth IPCC Assessment Report is due in 2022, and is expected to spell out: the certainty of human agency in driving climate change; the true dimensions and urgency of the emerging climate threat; and the transformative scale of global, economy-wide interventions needed to mount an adequate climate response. Many hopes are therefore pinned on the success of the CoPs in 2021–2023.

National and international laws have a common origin in top-down rule by governments, where leaders and apex forums make decisions that bind citizens and institutions to certain norms of behaviour. International law continued this tradition, and the CBD, which originated at the Rio Conference alongside the UNFCCC in 1992, reflects this top-down approach as a binding treaty imposed by all governments on all governments and the citizens and institutions over which they have jurisdiction. The UNFCCC could not be formulated in the same way, however, since even at the time (it became worse later) there was too much debate on the causes of climate change and what to do about it to agree upon anything more definite

than a 'framework convention', with the details to be worked out later. These details would be provided by the CoPs, which were expected to produce leadership statements, technical guidance documents and specific binding protocols, which they did, for example, in the Kyoto Protocol at CoP 3/1997 (and its amendment at CoP 18/2012 in Doha) on reducing and reporting GHG emissions.

Meanwhile, three things happened. First, the climate response became embroiled in intense and extended debate, based partly on scientific uncertainties but mainly on the political exploitation of those uncertainties by groups with an interest in preventing binding GHG emission reductions (Chapter 2). Second, the subject of climate change became much more complex: 'mitigation' grew to embrace many different GHGs and their diverse and changing sources and sinks in all economic sectors in all countries; and 'adaptation' grew to cover an extraordinary range of factors as it was realised that vulnerability extended to every aspect of everyone's economic system and society, and they would all need to be strengthened in different ways against changing threats. Third, it became clear that this dynamic complexity, in the absence of an all-knowing 'hegemon with the power to impose a single set of rules' (Overdevest and Zeitlin, 2011: 2), meant that the top-down approach to organising the climate response would not work (Overdevest and Zeitlin, 2014). Opinion among European Commission (EC) and European Union (EU) member state stakeholders seemed to reach this conclusion after a humiliating failure of EU climate diplomacy at CoP 15/2009 in Copenhagen, and thereafter 'the EU moved away from its ambition of legally binding instruments towards more soft yet universal agreements' (Kamphof, 2018a: 3).

1.3 EXPERIMENTALIST GOVERNANCE

These three factors opened the way for a new approach based on 'experimentalist' governance, a form that is typically established by agreement among central, global or apex actors and local, national or subsidiary ones. It has three defining characteristics: (1) there are

overarching but provisional goals and ways to assess progress; (2) there is broad discretion for subsidiary actors to pursue the goals in their own way, provided that they report regularly and transparently so that they can all learn from each other (e.g. through peer dialogue and periodic reviews); and (3) there are opportunities to revise the goals and ways of assessing progress, and the decision-making procedures themselves, in response to the results of the review process (Sabel and Zeitlin, 2012; Zeitlin and Sabel, 2013). Thus, it involves free actors in a common enterprise where progress is made iteratively, through repeated cycles of design, effort and learning, followed by redesign, renewed effort and new learning until the goal is reached or changed.

This kind of governance system emerged in large cultural domains where centralised rule was hard to sustain, yet all actors recognised their common interests and the need to cooperate in protecting those interests. This combination often occurs in large political entities, but not necessarily so. The ancient Roman Empire, for example, maintained centralised rule over a large area by means of professional legions, good roads, loyal colonies and intimidated client states (Luttwak, 1976), and its immediate successor, the Byzantine Empire, retained centralised control using its military and religious prestige (Rocker, 1937). For clearer cases of *experimentalist* governance, we would have to look to vast cultural domains with weak central control, including the 1,000-year Holy Roman Empire of the German people (Wilson, 2016) and the EU (Sabel and Zeitlin, 2012).

Historically the aims of subsidiary actors were mainly collective security and efficient trade, but more recent experimentalist regimes have been used in the domains of food, the nuclear power generation industry and air-traffic safety (Sabel and Zeitlin, 2011). The EU is a particularly rich source of experimentation in this model, owing to its Holy Roman Empire heritage via the Federal Republic of Germany, as a hands-off oversight and standard-setting body, and the creative tension between and among the EU institutions and member states. By 2000 it had already developed an experimentalist approach to internal problem-solving, an example being the Water

Framework Directive (WFD, Sabel and Zeitlin, 2012). In this process, tensions between the top-down regulatory and bottom-up experimentalist preferences of the various member states occurred in the 1990s, until the decisive shift in favour of experimentalism occurred by 2000 (Box 1.1).

BOX 1.1 Experimentalist governance and the EU Water Framework Directive

Years of negotiation among EU Member States produced a series of directives, including the Urban Waste Water Treatment Directive (1991) and the Nitrates Directive (1991). These aimed to tackle the problem of eutrophication, the accumulation of nitrate and phosphorus compounds from sewage and fertiliser pollution, which causes excessive algal growth that can suffocate aquatic life. They also targeted health issues such as microbial pollution in bathing water, and nitrates in drinking water. . . . Realising that the world is complex, that local conditions vary, that member states all have different legal systems, priorities and capabilities, and that a 'one-size-fits-all' approach might not be the best way forward, the EU then developed its Water Framework Directive or WFD (2000). This requires integrated river basin management, and aims to ensure clean rivers, lakes, ground water and coastal beaches throughout its member states. It is a unique 'gold standard' in the management of water resources. It sets standards for river basin planning, and for the ecological quality and chemical purity of surface and ground waters. For river basins, the aims are general protection of aquatic ecology, and specific protection of unique and valuable habitats, drinking water resources, and bathing water, and all these objectives must be integrated for each river basin.

The central requirement of the WFD is that the environment must be protected to a high level, in its entirety. For ecological quality, water bodies are supposed to show no more than a slight departure from the biological community which would be expected with minimal human impact – the equivalent, say, of a Canadian lake

BOX 1.1 **(cont.)**

exposed only to summer campers and duck-hunters. . . . As the member states tried to put the WFD into effect, they quickly developed a Common Implementation Strategy. In this, each country developed its own ideas of what good practice actually meant and how to measure progress, then applied them while studying the results, and compared notes so that they could all learn from each other. Every now and then the European Commission would study progress and lessons learned, and make proposals for everyone to think about. This kind of networked, exploratory peer learning, now called 'experimentalist governance' by academics, has proved to be an immensely powerful approach to managing systems that are too complex and dynamic for top-down rule-making to work very well.

Caldecott (2020): 163–165

1.4 EXPERIMENTALISM, SUSTAINABILITY AND SYSTEMS THINKING

The Sustainable Development Goals

Once the EU had abandoned a top-down approach around 2010 it began to exert a stronger influence on the UN, by supporting the UNEP and more generally being in favour of experimentalist solutions to major problems of environment and development. This approach contributed to the agreement in 2015 of the UN 2030 Agenda for Sustainable Development (UN, 2015) and the Sustainable Development Goals or SDGs (Kamphof, 2018a, 2018b; Table 1.1). The SDGs are overarching goals in an experimentalist sense, with autonomous actors and iterative learning processes, but each is related to the outputs of different complex systems. For example, SDG 6 (on water) depends upon the management of water resources, and those resources are themselves outputs of complex systems involving catchments, aquifers, farms, dams, pipes, treatment

Table 1.1 *The SDGs for 2015–2030*

SDG	Summary description
1	*No poverty*: End poverty in all its forms everywhere, through inclusive economic growth and equality.
2	*Zero hunger*: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3	*Good health and well-being*: Ensure healthy lives and promote well-being for all at all ages, as essential to sustainable development.
4	*Quality education*: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, as the foundation for improving people's lives sustainably.
5	*Gender equality*: Promote gender equality and empowerment of all women and girls as a necessary foundation for a peaceful, prosperous and sustainable world.
6	*Clean water and sanitation*: Ensure availability and sustainable management of water and sanitation for all.
7	*Affordable and clean energy*: Ensure access to affordable, reliable, sustainable and modern energy for all, as this is central to nearly every major challenge and opportunity.
8	*Decent work and economic growth*: Promote sustained, inclusive and sustainable economic growth with full and productive employment and decent work for all.
9	*Industry, innovation and infrastructure*: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.
10	*Reduced inequalities*: Reduce inequality within and among countries, through policies that are universal in principle and pay attention to the needs of disadvantaged and marginalised populations.
11	*Sustainable cities and communities*: Make cities inclusive, safe, resilient and sustainable, with opportunities for all and access to basic services, energy, housing, transportation and more.
12	*Responsible consumption and production*: Ensure sustainable consumption and production in all sectors.
13	*Climate action*: Take urgent action to combat climate change and its impacts, as global challenges that affect everyone, everywhere.