



Language

Many scientists and environmentalists have been aware for decades that the impact of human activity on climate change needs to be modified, if we are to avoid a dangerous rise in global temperature. The scientific case, and the urgent need for further investigation, was widely recognized by the end of the 1970s: the World Climate Research Programme was launched in 1979. But despite pressure from scientists, some governments (partly because of economic fears) refused to respond, and powerful corporations (most notably oil companies) sought to undermine or demolish the scientific findings and resisted any change. Nevertheless, during the next three decades some political progress was made through international conferences and agreements. Environmental campaigning against fossil fuels, to save forests and for international agreements increased, and hotter summers, droughts, floods and melting ice caps impinged on public consciousness. Finally, in 2015 the UN Conference on Climate Change in Paris reached an Agreement by almost all developed and developing countries to cooperate in trying to keep the overall rise in global temperature well below 2 degrees centigrade (2.0C), and to aim at only a 1.5C increase.

By 2018-19 public campaigning on climate change round the world had become front-page news. The economic arguments for adjusting creatively to limiting climate change, and various technological solutions (which were becoming more viable) gained prominence, and influenced some governments. However, the recent rise of right wing populist leaders and parties that reject the importance of international cooperation, and deride much scientific evidence on climate change, created new obstacles.

Today's environmental movement is often traced to the first Earth Day in April 1970, when marches, demonstrations and teach-ins took place, especially in the US. Green concerns have since been pursued by a very wide range of organizations, activists, and local communities and around the world, focusing on diverse threats to the environment. Many indigenous peoples have also been prominent in resisting threats to their lands, environment and lifestyles and have often in recent decades been supported by environmentalists - though occasionally (as has happened in Australia) indigenous economic priorities and environmentalist policies may conflict. Climate change now embraces many earlier environmental issues, such as saving the earth's remaining major forests and other wooded areas from logging, burning, and various forms of agricultural and industrial exploitation. Preventing climate change is linked as well to opposing coal mining, oil production and pipelines - and the newer process of fracking shale for oil and gas - that (in addition to their very damaging local impacts) produce fuels that emit greenhouse gases destructive to the planet. Limiting climate change is also linked to preventing major roads and airports, which encourage increasing traffic and flights. (This issue was highlighted in the UK when government plans to go ahead with creating a third runway at Heathrow airport - opposed for many years by environmentalists - were ruled illegal by the court of appeal in March 2020, on the grounds the plans did not take sufficiently into account the government's own commitment to the target of net-zero emissions by 2050, which is enshrined in law.)

One major environmental issue in recent decades that does not overlap with resisting climate change - and may even have a role in preventing it - is nuclear energy. The dangers of immediate accidental pollution posed by nuclear power plants remain very real (as the Chernobyl and Fukushima disasters demonstrated); and hazards from the very long term storing of depleted nuclear materials remain. But environmentalists and experts are divided on whether reliance on nuclear power is necessary as part of an immediate strategy of transforming energy supplies. (Policy on nuclear energy is also linked to the quite distinct but crucial issue of nuclear weapons proliferation.)

Two other central environmental problems, which have gained in urgency, are increasing desertification (especially in Africa and Asia), and the rapid decline in biodiversity. Both these calamities, although they have a number of causes, are connected to, and exacerbated by, climate change, which alters the natural environment. The scale of the threat to biodiversity (and food production in the future) was stressed in the UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services report in May 2019, which estimated a 47% decline in natural ecosystems and that 25% of plant and animal species are threatened with extinction.

All three of these issues - climate, desertification and protecting biodiversity - were internationally recognized in 1992 at the UN Rio Earth Summit, and enshrined in UN Framework Conventions. Progress on protecting biodiversity among the 196 signatories to the 1992 UN Convention has been limited to agreement in principle on 20



conservation targets in 2010, and the scheduling of a meeting in Kunming, China to develop an overall strategy that will take place from 17-30 May 2021. Most global progress - though very far from sufficient - has in fact been made on tackling climate change.

The Scientific and Political Background: the 1950s to the Montreal Protocol on the Ozone Layer, 1987

General scientific awareness that the earth's climate is warming, and that this is likely to have very serious environmental consequences, began to emerge in the 1950s and 1960s. There have been major alterations in the climate in the distant past (leading for example to the destruction of the dinosaurs), and more minor but significant changes in past centuries. The 'little ice age' (which led to the spreading of glaciers, and freezing of lakes and rivers in winter in parts of the world), is generally dated from the 14th to the mid-19th century. Climatologists have also noted the short term fluctuations caused by the El Nino effect (the warming of sea surface temperatures every few years in the tropical eastern Pacific) and the La Nina effect which denotes a cooling due to lower than average sea surface temperature there.

Natural changes in the climate are distinct from the possible direct adverse impact of human activity on global warming. Scientific interest in the possible human impact due to a 'greenhouse effect' began in the 19th century, but sustained study dates from the 1950s. The International Geophysical Year launched in 1957 by the International Council for Science mobilized scientists from almost 70 countries in research to understand the system of the earth. One important result of continuing significance was that the American scientist Charles D. Keeling established how to measure CO₂ levels in the atmosphere. An immediate issue for scientific debate (and potential for public confusion) was why from 1940 to the late 1960s there had been a worldwide cooling of average surface air temperature of 0.2C. The impact of several volcanic eruptions, and the role of some industrially produced chemicals, which began to be phased out under Clean Air Acts in the 1960s, are two suggested causes.

Some scientists focused on the long term warming effect of greenhouse gases. Roger Revelle had drawn attention in 1958 to the danger that carbon dioxide (CO₂) produced by human activity might not (as earlier thought) be quickly absorbed by the oceans. During the 1970s there was a significant increase in scientific research into climate change internationally, and the first World Climate Conference bringing together research on the physical basis of climate change was held in 1979. The Villach Conference in 1985, a major international meeting in Austria on the greenhouse effect involving key researchers from a range of disciplines, found that a number of gases, including methane, chlorofluorocarbons (CFCs) and nitrous oxide, as well as CO₂, could promote global warming. The Conference called on policy makers to take action.

The UN Environmental Programme (UNEP) - one of the sponsors of the conference - then promoted the plan for an international convention on climate change. The result was the 1987 Montreal Protocol, a governmental agreement to limit emission of ozone-destroying gases. The growing hole in the ozone layer over the South Pole was, research indicated, a primary cause of the gradually shifting direction of the southern jet stream, which affected storm tracks and rainfall over South America, East Africa and Australia.

The Montreal agreement has had an important impact on the phasing out of ozone destroying chemicals (used for example in aerosols and refrigerators), which may have enabled some reparation of the damage to the ozone layer. A paper published in the eminent scientific journal *Nature* in early 2020 noted that satellite imaging in September 2019 showed the ozone hole had shrunk back to its 1982 level. (This news was shortly followed in April 2020 by a reported opening up of a large hole in the ozone layer over the arctic, which closed again within a few weeks. The Copernicus Atmospheric Monitoring Service indicated the hole had been caused by unusual weather patterns over the arctic)

UN Frameworks Agreed, despite Political and Corporate Resistance: Rio Convention 1992 and Kyoto Protocol 1997

Since the late 1980s a number of scientific sceptics have strongly challenged the growing body of scientific research on climate change, and especially the role of human activity. Some sceptics could be seen as voicing genuinely scientific concerns about the reliability of data or the possibility of alternative explanations - such as changes in solar activity - for apparent evidence of warming. But scientific findings on climate change have become highly politicized, because accepting them required major economic and social changes that challenge business interests, social behaviour and some political ideologies. Corporations most affected by the findings, notably the oil industry, began to commission their own scientific research. The US-led Global Climate coalition was created in 1989 to pressure governments to resist policy change based on predictions of global warming. Some right wing



politicians in the west (most importantly Ronald Reagan and George W. Bush in the USA) impeded international scientific and political cooperation in addressing climate change.

The issue also highlighted divergent economic interests of highly developed countries (which have been creating environmental problems through industrialization over the past two centuries), and many less developed countries (many exploited in the past by the west) still trying to improve their basic living standards. China, seeking from the 1980s to become a major economic power, was prominent at first in refusing to modify its policies, such as extensive use of coal, or accept international constraints, although it did join international negotiations on climate change. China also claimed to represent the interests of developing countries.

Nevertheless, scientific and political progress in understanding and addressing the human causes of climate change has been achieved, despite setbacks. One important development was the creation by the UN in 1988 of the Intergovernmental Panel on Climate Change (IPCC), whose reports have helped to establish the reality and urgency of climate change. The UN 1992 Rio de Janeiro Conference produced (as noted earlier) the Framework Convention on Climate Change with 154 signatories, though the US blocked demands for significant action. At the follow-up second meeting of the signatories to the Convention in 1996 the US (with Bill Clinton now the President) agreed for the first time to the principle of legally binding emissions targets. But the US delegation stressed that developing countries must begin to play a positive role.

The 1997 Kyoto Protocol agreed on targets for greenhouse gas emissions by industrialized countries, but allowed governments and corporations to meet their targets partly by trading emissions permits and creating 'carbon sinks', for example new forests, to absorb emissions. Outstanding decisions about detailed rules to implement cutting emissions were deferred to later conferences. The US signed the Protocol, but the US Senate voted 95-0 on a presumptive resolution opposing the Protocol, so it was never even submitted to the Senate for ratification.

Disputes over Kyoto Protocol, Undermining of Climate Science and Failure at Copenhagen 1997

Political and corporate resistance to government action to combat climate change continued. Although the anti-climate change pressure group Global Climate Coalition collapsed in the light of the growing evidence on global warming, oil companies continued to obstruct progress, as did some governments. Follow-up conferences to clarify the rules and commitments under the Kyoto Protocol held in Buenos Aires in 1998 and in The Hague in November 2000 (where the US and EU clashed), failed to agree. George W. Bush withdrew from the Kyoto Protocol, citing damage to the US economy. Other nations decided to proceed without the US and finally agreed the detail of the Protocol at Marrakesh in November 2001. Japan, European countries and others ratified the Protocol. But the Australian government under climate sceptic John Howard, despite having achieved exceptionally favourable targets at Kyoto, refused to ratify it - and only did so (under a new government) in 2007. Russia refused to decide immediately; but President Putin eventually announced Russian support in 2004 and ratified the deal, and enabled the Protocol to come into effect in February 2005. The first phase for achieving emissions targets ended in 2012.

The European Union played an active part in supporting the Kyoto Protocol process. Another inter-governmental body that has been surprisingly successful in pressing for action to limit climate change is the Alliance of Small Island States (AOSIS), whose members face extinction through rising sea levels due to global warming. Formed at the end of the 1980s, at the Rio Earth Summit in 1992 AOSIS had well over 30 members and were able to get their special problems recognized. (By 2019 there were 15 members from the Pacific Ocean, 16 Caribbean states, and 8 - including the Maldives, Mauritius, the Seychelles and Singapore - from the Atlantic, the Indian Ocean and South China Sea. Members included a few low-lying coastal countries such as Belize and Guyana.)

Technological progress in making effective use of solar energy and wind power had by the 21st century made the phasing out of fossil fuels more realistic. Moreover, the economic argument for avoiding serious global warming had also become stronger, especially as the scientific evidence of rising temperatures, and rapidly melting ice in Greenland and the Antarctic as well as in the Arctic, had become more alarming. The UK government commissioned the 2006 Stern Report, which argued that it would be more costly to have to manage the impact of climate change than to take effective measures to prevent it. Public awareness of the issue had also been raised, for example by US Senator Al Gore's 2006 film *An Inconvenient Truth* (though this also prompted criticisms). Environmental campaigners had also begun to mobilize more specifically round climate change as a key issue: the Global Climate Campaign started to coordinate international protests in 2005.

Rising public concern and governmental willingness to consider serious action on climate change also provoked, however, a backlash from climate sceptics and further scientific controversy. One controversial issue was whether



there really had been a steep rise in global temperature in the latter part of the 20th century, compared with the average northern hemisphere temperature (deduced from a range of factors including tree rings, corals, ice cores and published records) in the previous 1000 years. This dispute centred on a 'hockey stick' graph developed by Michael Mann and colleagues in a 1999 paper, which was used in the 2001 IPCC Report. After well publicized debunking of the graph, especially in the USA, including interventions from Congress, the US National Academy of Sciences in 2006 concluded that the findings of a steep rise in global warming were generally sound. Researchers also found there were not convincing evidence for one possible non-human cause of the temperature rise, changes in solar energy.

The second controversy - 'climate gate' - arose in 2009, after publication of hacked emails of scientists at the University of East Anglia (UEA) supplying data to the IPCC. These often informal communications, going back over years, included discussion of how to present data convincingly. The emails were widely used to discredit all the research, with headlines alleging data manipulation and silencing of critics. The IPCC insisted the data in its reports were based on peer-reviewed research and further reviews by experts and governments. An official UK enquiry into the affair defended the rigour and honesty of the UEA scientists and refuted claims that they had subverted peer review or stifled criticism, but did find that they should have been more willing to provide information about their research and act with more transparency. Further scientific analyses of the data on the earth's temperature, in response to the 'climate gate' row, confirmed the UEA data.

The hacking of climate scientists' emails took place just ahead of the December 2009 Copenhagen Climate Change Conference. Despite a large gathering of world leaders, Copenhagen failed to produce any significant commitments to preventing climate change. Blame for this stalemate was assigned by some delegates and demonstrators to the highly industrialized countries for failing to accept their primary culpability or to respond to just demands from developing nations. China was blamed by others for prioritizing its own economic interests and blocking any precise commitments. Though China had been rapidly developing alternative energy sources, it still relied heavily on coal. Copenhagen was the focus for sustained lobbying by many established environmental groups like Friends of the Earth, and prompted marches and rallies in up to 70 countries coordinated by the Global Climate Campaign. Indigenous peoples from around the world (who had met in Alaska in 2009 to agree a common policy on climate change) highlighted their demands at Copenhagen.

Worsening Global Warming Predictions and Mixed Political Responses: Doha 2012, Paris 2015 and Madrid 2019

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A UN conference to promote the next phase of the Kyoto process took place in Doha, Qatar in December 2012, where signatories agreed targets for the second phase (2013-20), though the Canadian government pulled out of the Protocol at that stage. The Doha Amendment, signed by 192 countries established a second phase, 2013-2020, during which industrialized countries committed to cut greenhouse gas emissions. But its coming into force depended on at least three quarters of the parties accepting new commitments. The EU Climate and Energy Package in 2013 set the target of a 20 per cent reduction in greenhouse gas emissions below 1990 levels.

A breakthrough at the international level was achieved in 2015 at the end of the UN Climate Change Conference, with the signing of the Paris Agreement to keep global temperature below 2.0C above pre-industrial levels in this century and to aim at the target of 1.5C. The Agreement brought together both industrialized and developing countries, and recognized the special needs of the latter as well as of countries most vulnerable to climate change. It stressed the role of a global response and appropriate financial and technological frameworks. Almost all countries pledged to set their own targets and report on progress. Paris also brought together the US government under President Obama and the Chinese government (the two entered into an earlier bilateral agreement in late 2014) in a major commitment to combat climate change. (China had overtaken the USA as the main emitter of CO₂ in 2006, but had also made rapid progress in developing nuclear energy and solar and wind power) However, the Paris Agreement left it open to countries to determine the nature of their contributions to limiting emissions, though



it specified that parties should report regularly both on their emissions and on their implementation efforts.

The urgent need for governments and key sectors of the economy to adopt constructive policies was underlined by new scientific evidence of potentially catastrophic global warming. Researchers warned in 2015 that the collapse of the West Antarctic ice sheet might be irreversible. The IPCC reported in 2019 that global warming was increasing droughts, soil erosion and wildfires in tropical countries and reducing crop yields, whilst thawing permafrost near the poles. As a result many parts of the world could become uninhabitable: the report estimated that without urgent action in the next 12 years global catastrophe would be unavoidable. The changes required included not only cutting emissions from fossil fuels and an end to deforestation, but major changes in current agriculture based on intensive farming, high use of chemical fertiliser and emissions from large herds of cattle. Thirdly, a study in *Nature* in December 2019, based on research by 96 polar scientists from 50 international bodies, indicated that Greenland's ice sheet was melting seven times faster than in the 1990s and would, unless the trend was reversed, result in an estimated 100 million people around the world being flooded annually by the end of this century.

Awareness of the scientific evidence added urgency to two UN conferences on climate change in 2019. The Climate Session of the General Assembly in New York in September 2019 ended with 65 countries and the European Union committing themselves to reach net-zero carbon emissions by 2050 (i.e. to take compensating action for any carbon emissions they released). Another 59 delegations promised to announce their new commitments shortly. India's Prime Minister did promise a fivefold increase in renewable energy, but he did not promise to reduce state financing for coal; and he also refused to commit to reaching net-zero carbon emissions by 2050. Russia also refused to do so. China, which by 2019 emitted almost a third of the world's carbon dioxide (despite cutting the role of coal in its own energy supply from 72 per cent in 2005 to 59 per cent in 2018), and which had inserted the concept of 'ecological civilization' into its constitution, also refused to accept the 2050 net-zero goal. The US government under President Trump, a climate change sceptic, predictably refused as well. (Trump was committed to withdraw from the Paris Agreement, which he would be legally entitled to do if he won a second term as president in November 2020.)

The UN Climate Conference in Madrid in December 2019 failed to agree any new targets. Given the opposition of major powers (apart from the EU bloc) to taking any - or sufficient - action to prevent climate change, and given the rise of nationalist populist movements and governments rejecting the scientific evidence (notably the election of Jair Bolsonaro in Brazil), this failure was unsurprising. After being extended by two days the Madrid conference (officially the 25th Conference of the Parties to the UN Framework Convention on Climate Change, dubbed 'COP 25') agreed only to reiterate the Paris goals. Many countries had not updated their plans to meet these goals when they came to Madrid, and significant emitters of CO₂, such as oil-producing Saudi Arabia and coal-producing Australia, actively obstructed any agreement to go beyond Paris. The aim of improving the rules governing global carbon markets (where rich countries buy carbon credits from the poor when they organize carbon capture projects) was sabotaged in particular by Brazil, and deferred to talks in 2020. The coalition of least developed countries, generally the most vulnerable to climate change, had pressed for progress at Madrid and left disillusioned. New evidence publicized during the conference showed emissions had risen by 4 per cent since the Paris agreement, and that the world needed to cut emissions by 7 per cent each year for the next decade to avoid disastrous warming.

The next UN Climate Conference, COP 26, was scheduled for late 2020, to be hosted by the UK government in Glasgow. However, the global impact of Covid-19 prompted the UN to defer the conference to a later date. The possible upsides of the pandemic were that the drastic drop in business activity, tourism and travel provided some breathing space in the rise in carbon emissions, and raised serious questions about the organization of the global economy and the role of global supply chains.

Political and Economic Initiatives, Growing Public Awareness and Multiplying Protests

Some signs of hope for limiting climate change have, however, emerged, even in the USA. The impact of Trump's rejection of the scientific evidence, and his support for greater use of oil and coal, is diminished by two factors. One is the significant drop in the price of renewable energy sources, which encourages switching to use of them. The other is the political role of those individual US states and cities where the governments have been, and are still, committed to combat climate change, and are developing new climate-change policies. The US in 2019 was responsible for about 15 per cent of global emissions, i.e. about half those of China. Many businesses around the world are beginning to see the potential of developing new carbon-free technologies (for example electric cars) and recognize the dangers of climate change. Over 80 major companies adopted the goal of net-zero emissions in 2019, although they were generally responsible for low greenhouse gas emissions.



Business activity is, however, still a major contributor to climate change. Companies developing fossil fuels, despite declaring commitment to promote technologies which reduce emissions and their damage to the environment, also maintained they would continue to develop new sources of oil and gas. Moreover a March 2020 report by US environmentalists, *Banking on Climate Change*, found that the 35 leading investment banks had since the Paris Agreement in 2015 provided 255 billion dollars for extracting oil, gas and coal.

Public awareness of climate change and other environmental issues has certainly increased and had some impact on governments and industry. David Attenborough's BBC television series on the marine environment 'The Blue Planet' in 2017, and his role as a celebrated film maker over many decades covering different species and environments, have made him a prominent and influential advocate of the dangers of climate change to all aspects of our planet. Climate change has also moved up the news agenda to feature prominently on many mainstream media, although this has been partially undermined by the prevalence of conspiracy theories and misleading or untrue scientific claims circulating on social media and actively propagated by the far right.

Nevertheless, the direct experience in many countries in recent years of devastating floods, hurricanes, droughts and forest fires has also raised awareness. For example the US states of Illinois, Iowa, Nebraska and Indiana suffered particularly in May-June 2019 from weeks of storms and flooding dams and rivers that destroyed millions of hectares of farmland. They also experienced a near record number of tornadoes. India was reported in July 2019 to be suffering from its worst water crisis ever, as its sixth largest city, Chennai (with a population of 10 million) had strictly rationed water for two months, and it was predicted 21 cities could run out of ground water in 2020. Natural catastrophes have, of course, occurred in the past; but their frequency, scale and intensity now can be credibly linked to global warming. The 2019 fires in the Amazon (where they were partially ignited deliberately to clear the land, and governments, in Bolivia as well as Brazil, were slow to try to put them out) created widespread popular alarm and anger. In Australia forest fires are an annual occurrence, but the bush fires that raged for five months in 2019-20 were on an unprecedented scale, destroying thousands of homes, enveloping cities in toxic smoke, decimating the wildlife and killing 33 people.

The election of Trump in 2016 prompted a widespread rise in social activism in the US, including the People's Climate March in April 2017 in Washington and 300 other cities. (The first Climate March took place in New York in 2014 to coincide with a UN Climate meeting.) The youthful Sunrise Movement developed out of earlier US green campaigning groups in 2017 to promote a Green New Deal. Popular protests about climate change also reached greater intensity around the world in 2018-19 with the birth of two major movements. The first is the school strike movement sparked by Greta Thunberg, the Swedish teenager who in August 2018 sat down outside the Swedish parliament with a homemade placard: School Strike for the Climate. The school protests have spread rapidly, taken up first in The Hague and then Canberra and across Australia, they extended to the rest of Europe, and went global on 15 March 2019. Greta Thunberg herself has travelled widely (by train and sailing boat) and addressed UN conferences on climate change.

The second major movement is Extinction Rebellion (XR) launched in the UK to organize nonviolent obstruction of daily economic activity creating climate change - for example through blockading key areas of cities such as London. A second goal is to bring pressure on the government when mass arrests fill the police cells, jails and the courts. Police announced over 1,000 arrests at the Extinction Rebellion blockades in London by 22 April 2019.

Initial public response to the mass protests was quite often positive, despite disruption to people's work and lives, though some initiatives (such as trying to block tube trains in the rush hour in London) prompted anger among commuters and wider criticism about the appropriateness of the target. XR has spread rapidly to other countries. Its policy goal is to reduce greenhouse gas emissions to net-zero by 2025. The high profile of climate concerns and activism in the UK was reflected in the annual Glastonbury music festival in the summer of 2019, when David Attenborough appeared on the stage to speak, as did a co-founder of Extinction Rebellion and a representative of Greenpeace.

The Covid-19 pandemic that spread round the world from January 2020, and the government response of locking down their population and restricting all public gatherings, put a stop to many planned protests, including the global marking of the 50th anniversary of the first Earth Day on 22 April 2020. Earth Day was however marked by global digital intercommunication. The impact of and response to the virus did, however, open up possibilities for re-organizing aspects of work, transport and public life in the future, with more emphasis on communication technologies, but also a greater emphasis on the role of the local community and economy.



There has in recent years already been increasing debate about the kinds of socio-economic change, alterations in personal life styles (such as ceasing to fly, or adopting a vegan diet) and the political measures at local, regional, national and international levels that are needed to prevent disastrous climate change. These proposals range from radical reconstruction of the global capitalist economic model dominant since the 1980s, and fundamental changes in agricultural production and energy use, to attempts to reform current practices, with a strong emphasis on new technologies.

One important political initiative for change is the Green New Deal, introduced simultaneously in the House by newly elected Democratic Congresswoman Alexandria Ocasio-Cortez, and in the Senate by Ed Markey on 7 February 2019. The Green New Deal is supported as a general approach by many Democrats. Several contenders for the presidential nomination put forward their own versions. In essence the aim is to combine a more just social programme with economic policies designed to ensure net zero US emissions by 2050: phasing out coal and oil, major investment in alternative technologies linked to the mass creation of 'green' jobs, and economic assistance for communities hit by this policy shift. The Green New Deal concept has, however, multiple origins and a much wider global resonance, suggesting a coherent strategy for tackling climate change linked to social justice issues, but open to varying interpretations and degrees of radicalism. Several books with that title are listed in the bibliography below.

COP 26 in Glasgow: Environmental, Technological and Political Context

The delayed 26th Conference of the Parties to the 1992 UN Framework Convention on Climate Change (COP 26) began in Glasgow on 31 October 2021. The purpose of COP 26 was to follow up the 2015 Paris Agreement, which set a target of trying not to exceed a 1.5 centigrade rise in global temperature over pre-industrial levels by 2050. Individual governments were asked to set national targets for reducing greenhouse gas emissions and to indicate the changes in energy policy and other aspects of the economy which would enable these national targets to be fulfilled. Over 120 heads of state came to Glasgow. Although the serious work is done by national delegations, heads of state can strengthen international commitment and enhance the long-term importance of the event.

Holding this conference encouraged many (but not all) governments to set targets and frame appropriate policies, and raised media awareness of climate issues. Moreover in 2021 unprecedented high temperatures in many parts of the world, including the far north of Canada and Siberia, and devastating fires, droughts, hurricanes and floods demonstrated the urgency of decisive government action. The IPCC Report published in August 2021 underlined the scientific evidence for the extent of green house gas emissions (2.400 billion tonnes of carbon dioxide since 1850) and how much damage had already been done. The Report was less cautious than the IPCC had been earlier in setting out the scientific evidence, and its findings were underlined by the research and responses of other climate experts.

Days before COP 26 began a new study of world forests included in the 257 UNESCO world heritage sites was published, and reported that although these had generally played a crucial role in carbon capture, 10 of them had become emitters of greenhouse gases as a result of logging, agriculture and fires. New research also found that oceans, which have been major absorbers of green house gases, have, as a result of climate change, speeded up their reactions and may soon be unable to fulfil this function.

The conference had, however, also been preceded by accelerating advances in new technologies to take the place of oil and coal in the economy and a major fall in the costs of green energy from solar and wind power. These developments also indicated the greater willingness of many businesses to take advantage of them, and of some financial bodies to invest in them. Over 450 global companies had signed up to the 2015 Paris agreement and private sector investment in green technology outstripped investment in fossil fuels. However, environmentalists queried the tendency to replace the role of fossil fuels in existing forms of transport such as air travel and private cars, noted potentially harmful effects of some new technologies such as undue reliance on certain mineral resources, and criticized the emphasis on expensive and technologically difficult approaches such as carbon capture, as opposed to promoting life style changes. Moreover, Global Witness, after scanning the lists of delegates to COP 26, revealed during the conference that there were over 500 representatives of fossil fuel companies, more than any national delegation.

The political context of the Glasgow Conference, despite evidence of a greater sense of urgency among some governments and public opinion, raised doubts about its prospects of real success. Greenpeace International leaked documents from the IPCC proceedings, which showed governments of Saudi Arabia, Japan, India and Australia tried to water down the scientific evidence on fossil fuels raising the global temperature. All these



governments also initially decided not to be represented at Glasgow by heads of state, though the Australian and Indian prime ministers subsequently changed their minds. The anti-environmentalist Jair Bolsonaro of Brazil (which is the sixth largest emitter of greenhouse gases) stayed away to highlight his opposition to any policy that sought to reduce emissions, including by less meat eating, and was joined by the President of Argentina, another major beef exporter. President Putin, who has only slightly moderated his scepticism about climate change, also decided to stay away. Russia is the second largest producer of gas, and the Russian economy and political leverage depend heavily on oil and on gas exports.

The position of China, now by far the largest emitter of greenhouse gases, is complex. Although President Xi Jinping decided not to attend Glasgow in person (he had not travelled much even inside China since the outbreak of Covid-19) he has espoused a policy of 'ecological civilization', China has made significant advances in green technology, and the government presided over Part One of the UN Biodiversity Conference in October 2021, stressing China's historic environmental credentials and the role of biodiversity in its culture, and will host the Conference in China in 2022. However, China's economy is still partly reliant on coal at home (and due to the current energy crisis is opening more coal mines) and promotes coal mines abroad. The government has nevertheless committed to stop funding coal mining abroad, and to reach peak emissions by 2030, and to be carbon neutral by 2060.

The most important positive factor was that Joe Biden's election as US President in November 2020 meant that Trump's proposed withdrawal from the UN climate agreements was prevented, and instead the Administration was strongly committed to reducing greenhouse gas emissions (the US is responsible for the second largest amount of emissions) and Biden was promoting an ambitious national programme to switch to green energy. However he was still trying to get his programme through Congress.

The extent to which even the more constructive governments on climate action were failing to meet the scientific challenge was underlined by the UN report issued a week before COP 26 started, which found that the pledges made by governments up to that point would the earth was heading towards a potentially catastrophic 2.7 degrees of global warming.

Outcomes of the Conference

During the two first days of the conference, attended by heads of state, two potentially very significant commitments were announced: to end deforestation and to cut methane gas emissions by 30 per cent by 2030. The Forestry Agreement, supported by over 100 countries, promised to end and reverse deforestation by 2030, and was backed by pledges of 8.75 billion government funding to protect and restore forests, and by 5.3 billion private investment promised by CEOs from more than 30 financial institutions. If the agreement does result in effective action it would have major importance, but there are grounds for considerable skepticism. A similar agreement reached in 2014 has not resulted in any serious action, even in countries where governments do have some commitment to preventing disastrous climate change. Moreover, the signatories to the new agreement include Brazil, where President Bolsonaro has actively encouraged destruction of the Amazon rainforest to benefit the economy since his election in 2018 - although a future government may return to Brazil's earlier support for climate change measures. Another signatory is Indonesia, where there has been devastating deforestation in order to produce palm oil. Moreover, promises of funds from governments who regularly fall short on their promises of funds for international causes, and from financial institutions, which have funded fossil fuel activities for decades, do not inspire great confidence.

The pledge on methane gas emissions, promoted by the US and EU, is intended to end such emissions from leaking from fossil fuel activities and infrastructure. Although methane has to date been responsible for only 39 per cent of the rise in global warming, and lasts less long in the atmosphere than carbon dioxide, methane levels have risen sharply since 2007. In the short term an end to emissions would be very significant and easier to achieve than a rapid decrease in carbon dioxide. The most obvious gap in this agreement is that major methane emitters, China, India and Russia, have not signed up. Russia in particular is well known for its leaking fossil fuel infrastructure and also has large reserves of methane trapped under the permafrost in Siberia, where higher temperatures will probably lead to its release into the atmosphere.

A third commitment in the first week was a pledge by 40 countries to start phasing out the greatest source of carbon emissions: coal. This had not been specified at previous COPs. Even Vietnam and Poland, both heavily reliant on coal, signed up. Some countries also promised to stop financing overseas coal production. But China, India and Australia did not sign this pledge.



These three initiatives were incorporated into the final text of the COP, which was negotiated in detail in the second week in the quest for unanimity required by the UN process. The important question of finance to help poorer countries and those most vulnerable to climate change was also haggled over. After an agreed final draft was submitted to delegates on the final day of the conference. China and India caused a last minute crisis by insisting on watering down the commitment to 'phase out coal' to 'phase down' coal. Angry representatives of small island states facing destruction from rising sea levels reluctantly agreed in order not to jeopardise the whole agreement.

Assessments of COP 26 and its potential to keep down the extent of global warming varied considerably. Analysts calculate that even if national pledges reaffirmed at Glasgow were delivered the increase in global warming would be 2.4C by 2021. At best it could be claimed that COP 26 just about kept hope of not exceeding 1.5 degrees warming alive and that agreements on forestry, methane and even coal were a step forward, but only if governments honoured their pledges. Optimistic claims relied heavily on pressurizing governments to make progress by the scheduling of a follow-up conference to monitor degrees of implementation to be held in 2022.

Resisting Damage to the Climate and Environment 2020-2021

There are two strands of climate activism: long term opposition to corporations and government policies that raise the levels of greenhouse gas emissions (and often inflict other forms of environmental damage); and mobilizing directly to influence the outcome of UN Conferences. Both approaches range from working through political and legal institutions to various forms of radical protest. In the run-up to COP 26 media reports of various types of activism increased.

Campaigners have turned to the courts quite often to try to achieve environmental goals. Six young campaigners took the 27 EU governments and six others to the Court of Human Rights in early 2020 for their failure to reduce the greenhouse gases destroying the planet. But governmental bodies are also using the law to try to resist climate change. One significant development in the US was an increase in the number of law suits brought against corporations by cities and states experiencing rising sea levels, depletion of fish stocks or flooding, seeking reparations for measures to reduce the damage. Minnesota is also suing Exxon for deception and fraud and for promoting misleading information about climate science. Legal proceedings are also being brought elsewhere. Norwegian cities have taken their government to the EU Court for its heavy reliance on oil and gas exports, and a Dutch court ordered Shell to cut its contribution to global emissions by 45% by 2030.

Legal proceedings tend, however, to be very slow. Moreover, some fossil fuel companies are also using the law courts to penalize governments that have adopted climate friendly policies. For example, after the Netherlands government closed five power stations, three companies accepted the compensation offered, but two sued the government. One route for companies has been to sue under the Energy Charter Treaty for large sums in compensation for loss of earnings. A significant way to undermine fossil fuel companies - especially the most intransigent - is to withdraw investment in them by pension funds and social institutions. This goal has been pursued by campaigners such as Make My Money Matter, as has the associated tactic of pressing for election of new board members with a green agenda in some companies.

Many of the most committed opponents of climate change, however, are the individuals and local communities - often indigenous peoples - who campaign against and resist mining and oil production and threats to forests and water sources. The award of the Goldman Prize for the environment in June 2021 highlighted this form of activism, giving the award to Japanese anti-coal activist Kimiko Hirahata, as well as to Liz Chicaje Churay from the indigenous Bora in Peru, who led a campaign for her people's land to become a national park to preserve the Amazon rainforest on it and many rare species. The prize was also awarded to a Vietnamese man active in protecting pangolins and so maintaining biodiversity.

Climate activists who had been largely diverted to online protest during the Covid lock downs began to engage again in public demonstrations in the summer and autumn of 2021. In the UK Extinction Rebellion, after a debate about the diminishing returns of mass blockades, organized two weeks of protest centred on the policy demand for an end to fossil fuel development, and largely limited blockades to the City of London, though Oxford Circus, a central shopping area and traffic hub the Science Museum (because it has accepted several grants from fossil fuel companies) were included. A more extensive strategy of blocking motorways was, however, adopted by a new group, Insulate Britain, calling for rapid insulation of all homes.

Protests also re-emerged in other countries: in Switzerland, for example, there were ceremonies to mark and



publicize the end of a glacier. A much more ambitious campaign was launched in Namibia and Botswana, where campaigners are attempting to block a Canadian company, Recon Africa, which has begun preliminary drilling for oil and gas in the Kvango area of Namibia. The company plans to drill in the whole Okavango Delta, so threatening the lives and livelihoods of not only 200,000 local people in the area of initial exploration, but up to a million people in the Delta as a whole, which includes northern Botswana. The drilling, and associated pipelines and roads would also be disastrous for the very diverse wild life in Okavango, currently protected by national parks. Indeed, campaigners warn that the developments, including use of chemicals for fracking, are likely to contaminate the water supply, which could be wholly disastrous, quite apart from the climate implications. Environmental organizations throughout Africa, and globally, have mobilized to stop the drilling, lobbying Namibia's Assembly and raising the demand in protests in Vancouver, Windhoek and Pretoria and other cities in June 2021.

International environmental NGOs attended the COP 26 conference to listen, lobby delegates, brief journalists and increase pressure on governments to be more ambitious in their commitments. Former Irish president and Chair of The Elders, Mary Robinson, commented publicly on the failure of the host government, the UK, to commit to ending any future development of coal or oil - the government was still envisaging opening up a new coking coal mine to promote steel production, and a new oil well in the North Sea.

Radical protest movements also descended on Glasgow to underscore the urgency of major action to combat further climate change. The student movement, Fridays for the Future, sparked by Greta Thunberg, held a large march of school children through the city on Friday, 12 November, in the first week of the conference, backed by demonstrations in other parts of the world. Extinction Rebellion also moved up to Glasgow and undertook selective blockages.

This bibliography is divided into four sections. 1. 'The Scientific, Political and Economic Context of Climate Change' lists some sources on the scientific evidence and disputes, materials relating to national and international politics surrounding climate change, and also some of the economic debates. 2. The second section on 'Averting Climate Change' provides some sources indicating the ideological and technological diversity of different responses advocated to tackle climate change, or to prevent or mitigate some of its effects. 3. The third section covers active public campaigning, including mass protests at UN Climate Summits, lobbying national governments, electoral politics, promoting 'ecocide' as a crime under international law, campaigns for divestment from fossil fuel companies, and various forms of non violent direct action and civil disobedience, to prevent disastrous global warming. 4. The fourth section includes post-2015 climate-related campaigns: against fossil fuel production, including the especially polluting tar sands and fracking of shale, and fossil fuel pipelines. (References for earlier campaigns can be found under Vol. 2. A.4.a. and 4.b. and C.2.d and 2.e.)

Other environmental campaigns, for example to preserve forests from destruction and a wide range of commercial exploitation, and to prevent airport expansion and motorways, are also - in addition to urgent fears about local pollution and the undermining of communal rights - very closely linked to preventing climate change. Campaigns of this type have been launched by environmental protesters and indigenous peoples (see Vol. 2. B.2.b.) for decades. Post 2015 references on these campaigns have been added to Vol. 2. C. 2.b. and 2.f. respectively.

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