Introduction: a chronological overview

Responses in the USA to climate change have extended over more than a half century – starting with concern among a small number of scientists in the 1950s. Over time the number and diversity of people who have become attentive to the problem have increased dramatically. This Introduction highlights landmark events and other developments along the way, including those that affected the context in which climate change issues have arisen as well as those that have entailed direct action.

The chronology emphasizes US presidential and congressional decisions, but it also includes public opinion, business, court cases, state and local governments, international conferences, and particularly significant climate science developments and extreme weather events. The context and significance of the events are discussed in much more detail in various chapters.

1950s–1960s

After nearly a century of attention to climate change by mostly European scientists, climatologists in the United States began to give it more serious attention in the 1950s. As part of the Eisenhower administration's contribution to the International Geophysical Year in 1957, scientist Charles Keeling took repeated measurements of atmospheric carbon dioxide concentrations in Hawaii; he found a trend over a few years of increasing concentrations and seasonal patterns of relatively high concentrations in the fall and winter and low in the spring and summer, when trees absorb more carbon dioxide (Keeling 1960). The Keeling curve depicting these measurements has since become an icon of climatology, and it has been regularly updated (see Figure I.1). In addition, the work of Roger Revelle and Hans Suess (1957) contributed to increased interest among American scientists during this period.

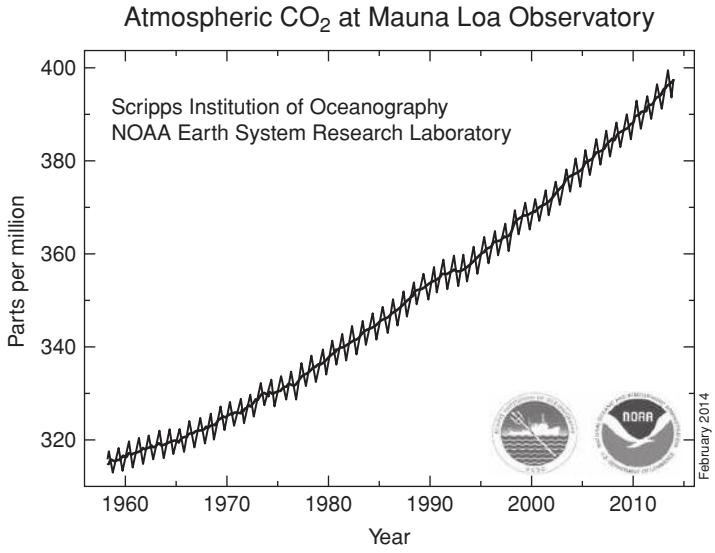

Figure I.1 The "Keeling curve" of atmospheric carbon dioxide concentrations

Source: Scripps Institution of Oceanography (2013).

1970s

There were several pertinent US government organizational developments during the 1970s, and they have directly affected the institutional context in which climate change issues have been addressed by the national government. The Environmental Protection Agency (EPA) began operations in 1970 after its creation was proposed by the Nixon administration and agreed by Congress because of concerns about air and water pollution problems. Soon thereafter, energy issues also became much more salient, starting with the quadrupling of world oil prices in 1973–1974. A series of reorganizations by the Nixon and Ford administrations led eventually to the creation of the cabinet-level Department of Energy during the Carter administration in 1977. Thus, concerns about a wide range of environmental and energy issues by the late 1970s were important elements of the circumstances in which climate change began to receive more international attention.

In 1979 the First World Climate Change Conference estimated that if there were a doubling of atmospheric carbon dioxide concentrations over pre-industrial levels, there would be an increase in the global mean surface temperature compared with pre-industrial levels of 1.4–4.5 degrees centigrade (i.e. 2.5–8.1 degrees Fahrenheit).

1980s

Nearly a decade later, in 1987, the US and other governments agreed to the Montreal Protocol on Substances that Deplete the Ozone Layer – some of which substances, such as chlorofluorocarbons (CFCs), are also powerful and long-lasting greenhouse gases that contribute to climate change. The Protocol was negotiated by the Reagan administration and ratified with bipartisan support and a unanimous Senate vote in 1988. The same year the Intergovernmental Panel on Climate Change (IPCC) was established as an international agency to review climate change research for input into international negotiations and governmental decision-making.

A national US public opinion survey in the spring of 1988 found that 63 percent worried "a great deal" or "fair amount" about "global warming."[1] A few months later, the US Senate Committee on Energy and Natural Resources held hearings on climate change; at those hearings James Hansen, Director of the Institute for Space Studies of the National Aeronautics and Space Administration (NASA), testified that "The greenhouse effect has been detected, and it is changing our climate now" (Sheppard 2008). He thus became the first US government scientist to state publicly that climate change was a problem. That same summer, there were widespread droughts and record-breaking heat waves in many areas of the USA.

A year later the federal government established the Global Change Research Program to coordinate and integrate federal research on climate change and other issues.

1990s

An amendment to the Clean Air Act in 1990, proposed by President George H.W. Bush and approved by Congress, established a cap-and-trade program to limit sulfur dioxide (SO_2) emissions from power plants and thus reduce the problem of acid rain, which had become especially severe in southern California. That system – in light of its widely recognized cost-effective success – became the precursor to subsequent proposals to create a cap-and-trade system to limit greenhouse gas emissions.

In 1992 President George H.W. Bush signed the UN Framework Convention on Climate Change (FCCC) at an international conference in Rio de Janeiro. There was bipartisan support for it, and the Senate ratified the FCCC by a unanimous vote.

1 The survey results reported in the Introduction are all based on annual Gallup polls about environmental issues taken in the spring at the time of Earth Day. The annual timing and question are thus the same in each of the polls reported.

The agreement, which remains the legal basis for many international climate change programs, established the goal of stabilizing greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system."

During the 1992 presidential election campaign, between the incumbent George H.W. Bush and challenger Bill Clinton, climate change was an explicit national campaign issue for the first time. Public opinion surveys at the time found that between 57 and 62 percent of the public worried "a great deal" or "a fair amount" about "global warming."

In 1993, the recently elected Clinton administration proposed a tax on carbon emissions, specifically on the basis of the heat content of fossil fuels; this was the first formal proposal in the USA for national legislation that would have affected the price of carbon. The proposal was passed by the House of Representatives by a narrow majority – but with a strongly partisan division and in spite of strong opposition from agricultural and industrial lobbyists. In the Senate, the American Petroleum Industry, the National Association of Manufacturers, and other organized business lobbies opposed it. It was abandoned in the Senate without a formal floor vote, as senators from fossil-fuel-intensive states such as Texas, Louisiana, and West Virginia expressed their opposition.

In 1995 the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) concluded that there was a "discernible" human impact on the climate.

In 1997 the Senate passed the Byrd–Hagel amendment, which was a non-binding sense of the Senate resolution that the United States should not be a signatory to an international agreement regarding the UN Framework Convention on Climate Change that would limit US greenhouse gas emissions unless it also limited the greenhouse gas emissions of developing countries. The Senate vote was unanimously in favor of the resolution. The same year, the Clinton administration signed the Kyoto Protocol, but did not submit it to the Senate for ratification. The Protocol set a goal of reducing industrialized countries' greenhouse gas emissions to 5 percent below 1990 levels during the first commitment period of 2008–2012. The Senate vote on the Byrd–Hagel amendment and the Clinton administration's decision not to submit the Protocol for ratification reflected an impasse on climate change issues, at least at the national level.

In 1998, 50 percent in a national public opinion survey said they worried "a great deal" or "a fair amount" about "global warming," which was about a 10 percent decline from previous years.

As climate science research continued to accumulate at an increasing rate, an article by Mann, Bradley, and Hughes (1999) presented a curve of northern hemisphere

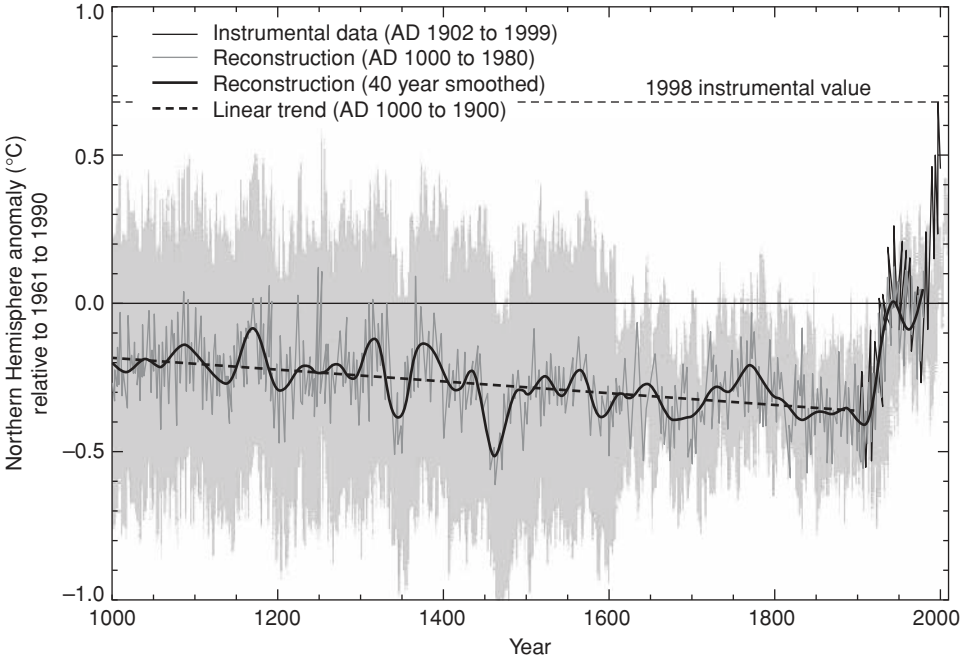

Figure I.2 The "hockey stick" curve of long-term temperature trends

Source: Mann, Bradley, and Hughes (1999).

temperatures from the eleventh century to the late twentieth century showing a decline during the fifteenth to nineteenth centuries and then a sharp increase in the nineteenth and twentieth centuries. Because of its shape, it came to be known as the "hockey stick" curve, and like the Keeling curve of atmospheric carbon dioxide concentrations, it became an iconic graph (see Figure I.2).

2000–2008

During the 2000 presidential election, climate change was an issue, with candidate Al Gore advocating more serious action on it and candidate George W. Bush expressing less enthusiasm about doing so. In that year, 72 percent in a national public opinion survey said they worried "a great deal" or "a fair amount" about "global warming" – which was 20 percentage points higher than two years previously. However, four years later, in the presidential election year of 2004, only 51 percent in a national public opinion survey worried "a great deal" or "a fair amount" – a decline of about 20 percentage points.

In the meantime, in early 2001, the recently elected George W. Bush administration announced that it opposed US participation in the Kyoto Protocol and that it would not submit the Protocol to the Senate for ratification. The Protocol nevertheless entered into force internationally in 2005, without US participation. At the Conference of the Parties to the UNFCCC (COP) meeting in Montreal, Canada – after the US delegation walked out because the meeting was also serving as the Meeting of the Parties to the Kyoto Protocol (CMP) – the COP agreed to establish two parallel tracks to consider actions in the post-2012 period in order to accommodate the US position – one track concerning the Kyoto Protocol without the USA and the other a track under the UNFCCC and including the USA. In 2007, the USA agreed to the COP-13 Bali Action Plan, which identified four main elements for future international cooperation: mitigation, adaptation, technology, and finance.

Domestically, during the first decade of the new millennium, the state of California adopted numerous energy efficiency and renewable energy policies and programs. In particular, in 2006 it adopted the Global Warming Solutions Act with the goal of reducing greenhouse gas emissions to 1990 levels by 2020; a key part of the program is a cap-and-trade system that began operations in 2012. Also during the decade, on the other side of the country, the Regional Greenhouse Gas Initiative (RGGI) was established with a cap-and-trade system for the carbon dioxide emissions of electric power plants in nine Northeastern states beginning in 2009. Also during the decade, many other states in several regions of the country began to develop their own climate change programs, as did numerous cities and other local government agencies.

During the period 2001–2008 at the national level, the initiative in addressing climate change shifted to the Congress, where Senators McCain and Lieberman proposed a mandatory national cap-and-trade system for greenhouse gases in 2003. Known as the Climate Stewardship Act, it would have established a nation-wide system covering all greenhouse gases and most sectors of the economy. It was defeated in the Senate by a vote of 43 to 55. The Senate considered cap-and-trade legislation again in 2008 – this time known as the Climate Security Act, with Senator John Warner of Virginia being a co-sponsor with Senator Lieberman. It failed to receive enough votes for a cloture of debate and thus was not further considered.

A Supreme Court decision in 2007 in the case of *Massachusetts v. EPA* significantly changed the place of climate change on the national agenda. In a 5–4 decision the court ruled that the EPA could regulate greenhouse gases through the Clean Air Act. Although

there were still many administrative and legal processes to come into play, the decision marked a turning point because it created a new legal basis for the executive branch to develop regulations and because it pushed climate change issues more deeply into the federal court system.

During the presidential election year of 2008, 66 percent in a national public opinion survey said they worried "a great deal" or "a fair amount" about "global warming." Presidential candidate Senator McCain said very little about climate change during the campaign, despite his long efforts to address the problem in the Senate; President Obama also said little about the issue, despite having supported cap-and-trade legislation as a senator as a co-sponsor of the McCain–Lieberman bill in 2003.

2009–2012

In 2009 the House of Representatives took the initiative on climate change in the form of the American Clean Energy and Security Act; introduced by Representatives Waxman of California and Markey of Massachusetts, it would have established an extensive cap-and-trade system and substantially expanded the government's energy efficiency and renewable energy programs. The bill was passed by a 219-to-212 vote, with 83 percent of the Democrats voting in favor and 95 percent of the Republicans voting against. In the Senate, a year later, however, there was not sufficient support for a similar cap-and-trade bill to gain the 60-vote super-majority vote needed for cloture, though there appeared to be a simple majority of votes in favor of passage if a cloture motion could have been passed.

Business lobbies were split on the issue. There was substantial support for cap-and-trade legislation by key segments of the electric power industry, by energy efficiency and renewable energy firms, and by some other major individual firms. However, the coal industry, the oil and gas industry, the chemical industry, and perhaps most importantly umbrella business organizations such as the Chamber of Commerce and the National Association of Manufacturers, as well as industry-specific organizations such as the American Petroleum Institute, all continued to oppose all cap-and-trade proposals.

At the COP-15 meeting in Copenhagen in 2009 President Obama reached agreement with a small subset of the nearly 200 governments represented at the conference: along with Brazil, China, India, and South Africa, the USA eschewed making formal

commitments to emission targets within the context of the multilateral FCCC and instead agreed to a schedule of "pledges" to be made more specific later.

In the United States, following the 2010 congressional election, the Tea Party caucus in the House of Representatives supported legislation that would have prevented the government from funding a high-level climate advisor on the White Staff and would have prevented the Department of State from having a Chief Negotiator at climate change international conferences. The proposals passed the House but were defeated in the Senate.

At the COP-18 in Doha near the end of 2012, there was an agreement to extend the Kyoto Protocol with a commitment on the part of industrial countries to reduce greenhouse gas emissions by at least 18 percent below 1990 levels between 2013 and 2020. The USA was not a party to this agreement.

2013

After having mentioned climate change briefly in his victory speech on election night in November 2012, President Obama gave climate change more extensive attention in his January 2013 inauguration speech and then yet more attention in February in his State of the Union speech. Two other events marked 2013 as a potential landmark year in the evolution of US government climate change policymaking. The first was a speech by President Obama (US White House 2013a), who noted a series of measures the administration could take without congressional actions endorsing them in the context of a "new national climate action plan." The measures included new standards for carbon dioxide; emissions standards for existing and new electric power plants, with flexibility for how individual states implement them; increased production of natural gas, with measures to prevent methane emissions; allowing additional wind and solar installations on government land managed by the Interior Department and expanding the use of renewable power on Defense Department bases; continuing to strengthen fuel efficiency standards for trucks, buses, and vans as well as cars; increased federal government use of renewable energy to 20 percent of its electricity by 2020; and increased federal government budget support for state and local adaptation projects to protect against droughts, floods, and wildfires. In their totality the measures could contribute to significant reductions in US greenhouse gas emissions. It was unlikely, however, that these measures would be sufficient to reduce emissions enough to meet the administration's stated goal of a 17 percent reduction from 2005 levels by 2020 – even in combination with other measures already undertaken by the administration

such as increases in motor vehicle fuel efficiency standards. Nevertheless, the speech did signal the administration's intention to address climate change across a wide range of domestic policies. Importantly, however, such measures would be subject to industry challenges in court cases, state- and local-level opposition in some instances, and attempts by climate deniers and others in Congress to try to undermine them.

In terms of becoming more engaged internationally, in the speech the president expressed his intentions to increase government-private partnering for increased investment in natural gas in other countries; end government support for coal-fired electric power plants; undertake negotiations to reduce barriers to international trade in clean energy technologies; and cooperate more actively in bilateral and other international venues. There were several international agreements reached subsequently during 2013: two bilateral agreements with China (US Department of State 2013; US White House 2013a) and an agreement with the G-20 and other countries (US White House 2013b). In the first bilateral agreement, China and the USA agreed to undertake cooperative actions in five areas: emissions and black carbon from heavy-duty trucks; financing of energy efficiency in buildings; carbon capture and storage projects; improving greenhouse gas data collection and measurement; and the development of electricity "smart grids." Like the speech on domestic policies, the agreement with China represented the potential for substantial gains in mitigating emissions – between them China and the USA account for more than 40 percent of total global greenhouse gas emissions. The actual implementation of the agreement, however, and thus its climate change impacts, remain to be seen. The same could be said for the other 2013 international agreements: China and the USA agreed in September to phase down the production and consumption of hydrofluorocarbons (HFCs), which are powerful, long-lived greenhouse gases used in refrigerators, air conditioners, and industrial processes as substitutes for chemicals that have been prohibited by the Montreal Protocol on Substances that Deplete the Ozone Layer. At the same time as this China–US bilateral agreement, the USA signed on to a similar agreement with the G-20 and other countries.[2]

Also during 2013, however, the atmospheric carbon dioxide concentration level at the iconic Mauna Loa Observatory in Hawaii reached 400 parts per million (ppm), which was 26.2 percent higher than the 317 ppm level in the observatory's initial

2 The G-20 includes Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States, and the European Union. In addition, the following had signed the agreement by early September 2013: Ethiopia, Spain, Senegal, Brunei, Kazakhstan, and Singapore.

measurements in 1958 and the highest concentration level for the earth in about three million years.

2014

In the State of the Union Speech, President Obama (2014) noted that "a changing climate is already harming western communities struggling with drought, and coastal cities dealing with floods" and highlighted the administration's "work with states, utilities, and others to set new standards on the amount of carbon pollution [emitted by] power plants"; he also noted that the "shift to a cleaner energy economy won't happen overnight, and it will require tough choices along the way. But the debate is settled. Climate change is a fact."

In technical and tangible ways, the administration was moving ahead, for instance with the increased use of the "social cost of carbon" (US Interagency Working Group on Social Cost of Carbon 2013) in assessing the costs and benefits of regulatory climate change mitigation and adaptation programs and in allocating financial resources in energy budgets through the annual budget cycle. These and other administration initiatives on climate change and energy policies, however, were encountering continuing challenges among some groups in the Congress, particularly in the House of Representatives, and in court cases being pursued by some industry groups and state governments.

These developments and issues are considered in detail in the remainder of the book, as follows: Chapter 1 establishes the national, sectoral, and regional economic contexts of climate change issues within the United States. The chapter emphasizes regional variations within the United States in the sources and the impacts of climate change; it is in part, therefore, an analysis of *economic geography*. The chapter also puts the US emissions and the economics of the issues in an *international comparative context*. Chapter 2 focuses on *business* interests, attitudes, actions, and inactions. It emphasizes differences between firms that are leaders and firms that are laggards on climate change issues; the oil and gas, automotive, and insurance industries receive special attention because of their importance and because of the tendency of US firms to be laggards within those industries. In Chapter 3 concerning *public opinion* there is much data about perceptions of the problem and preferences for policies. Differences in opinions according to party identities, ideologies, and regions receive special attention. In Chapter 4 there is a focus on *governments at the local, state, and regional*

levels – including the role of states in court cases in a federal political system and the role of "swing states" in presidential elections.

US national government policy issues in three principal *issue clusters* are the topics of Chapters 5, 6, and 7. Chapter 5 emphasizes issues concerning market-based cap-and-trade systems, taxes, and other *regulatory measures* to reduce greenhouse gas emissions. Chapter 6 concerns *technological approaches* to mitigating greenhouse gas emissions – government subsidies, regulations, and other measures to facilitate energy technology innovation and diffusion. Chapter 7 is about a variety of modes of *international cooperation*, and it traces the evolution of international efforts to address a wide range of climate change issues.

Chapter 8 adopts a more normative approach, which identifies key leadership issues and potential pathways that could be pursued for more effective actions – within the economic and political constraints that are analyzed in the empirical analyses of Chapters 1–7.