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# **Effectiveness of UNFCCC in addressing climate change**

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1 March 2018

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## I Introduction

Humans influence the climate system, and recent climate changes are already resulting in widespread impacts on human and natural systems (IPCC, 2014). Climate change is defined as:

“... a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. (United Nations, 1992).

The human activity referred to consists of the release of greenhouse gases into the atmosphere and modification of carbon sinks. There are grave concerns that the current and projected rate of emissions will lead to irreversible damage to the Earth’s climate system (Ripple *et al.*, 2017; Rockström *et al.*, 2009; Steffen *et al.*, 2015).

The United Nations Framework Convention on Climate Change leads global efforts to limit climate change. The question is whether it has been effective in addressing this issue between its inception in 1992 and the ratification of the Paris Agreement in 2016.

## 2 Methods

The evaluation of “effectiveness” requires that the term is defined first. “Effectiveness” is the relation between output and outcome (Inspectie Ontwikkelingssamenwerking en Beleidsevaluatie, 2009; UNODC, 2017). In the case of UNFCCC, outputs are *decisions* and outcomes are *policies* that implement these decisions<sup>1</sup>. The extent to which this policy is implemented in countries can be expressed in terms of a reduction in the emissions of greenhouse gases that would not have occurred in the absence of these policies.

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<sup>1</sup>As opposed to “efficiency” (relation between inputs and outputs) and “relevance” (relation between outcome and impact).

Decisions are taken on the basis of scientific evidence. The scientific evidence for climate change has been mapped and is discussed in section 3.1. The policy decisions that have been taken have been inventorized and are discussed in section 3.2. The policy reaction to a crisis such as climate change may be insufficient, even in the face of overwhelming evidence. Political forces that counter climate change policies are discussed in section 3.2.5.

### **3 Results**

This section assesses the evidence for climate change (section 3.1) and the policies that have been put into place to address it (section 3.2).

#### **3.1 Scientific evidence for climate change**

The history of climate change science is described in section 3.1.1. The concept of climate change and its impacts are set out in section 3.1.2.

##### **3.1.1 History and scientific consensus**

The first measurements on the effect of greenhouse gases were made by John Tyndall (Tyndall, 1859). The effect of a doubling of a the CO<sub>2</sub> concentration in the atmosphere was estimated at 5 °C to 6 °C by Arrhenius in 1896, an estimate that is not too far from our current estimation of 1.5 °C to 4.5 °C (Houghton, 2004).

The first concern about the relation between carbondioxide and climate change was made in 1957; (Revelle and Suess, 1957) likened the CO<sub>2</sub> emissions to “an uncontrolled geophysical experiment”. It was however only in 1988 that the Intergovernmental Panel on Climate Change (IPCC) was created by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) (General Assembly of the United Nations, 1988). It produced a series of assessment reports (IPCC, 1990, 1995, 2001b, 2007, 2014) that rapidly narrowed down the certainty about the human origin of climate change and its effects from “not possible yet” (IPCC, 1990) to “clear” (IPCC, 2014).

The rapid evolvement of climate science has been made possible by provision of better data. In order to acquire reliable national greenhouse gas data, IPCC has put into place a standard procedure for the collection, compiling and reporting of greenhouse gas emissions for Parties to the UNFCCC (see section 3.2.2). This system consists of reporting guidelines for national inventories (IPCC, 2006), quality assurance procedures (IPCC, 2001a) and a common reporting format (CRF).

Today, over 97% of climate scientists are convinced that climate change is happening and attributable to humans (Maibach *et al.*, 2014). The economic impacts of climate change are estimated at “5% of global GDP each year, now and forever” (Stern, 2007).

Year	Event
1860	John Tyndall measures and documents infrared absorption capacity of CO <sub>2</sub> and CH <sub>4</sub> .
1896	Svante Arrhenius quantified effect of CO <sub>2</sub> on the climate.
1957	Revelle and Suess liken the build-up of CO <sub>2</sub> in the atmosphere to a “large-scale geophysical experiment”
1979	World Climate Conference: “It appears plausible that an increased amount of carbon dioxide in the atmosphere can contribute to a gradual warming of the lower atmosphere, especially at higher latitudes...”
1988	Establishment of the Intergovernmental Panel on Climate Change
1992	First Assessment Report: No unequivocal detection of the enhanced greenhouse effect from observations is possible yet.
1995	Second Assessment Report: “The balance of evidence suggests a discernable human influence on global climate.”
2001	Third Assessment Report: “An increasing body of observations gives a collective picture of a warming world and other changes in the climate system.” ; “There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities. ”
2007	Fourth Assessment Report: “Warming of the climate system is unequivocal.”; “There is now higher confidence than in the TAR in projected patterns of warming and other regional-scale features, including changes in wind patterns, precipitation and some aspects of extremes and sea ice”.
2014	Fifth Assessment Report: “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. ”

Table 3.1: Climate change science timeline

### 3.1.2 The concept of climate change and its impacts

The physical process behind the greenhouse gas effect is now well understood and summarised in figure 3.1. Of the 100 units incoming short-wave radiation, about 30 are reflected by clouds or the Earth's surface (albedo); 50 units warm the Earth's surface and 20 units are net input to clouds and atmosphere. To balance this incoming radiation, 70 units are reflected back to space in the form of long wave radiation. Without this natural greenhouse effect, the Earth would be  $-18^{\circ}\text{C}$  instead of  $15^{\circ}\text{C}$ . A surplus of greenhouse gases leads to a higher absorption of long wave radiation in the atmosphere, and to balance the energy budget the Earth's surface will have to warm up (Clayton, 1995).

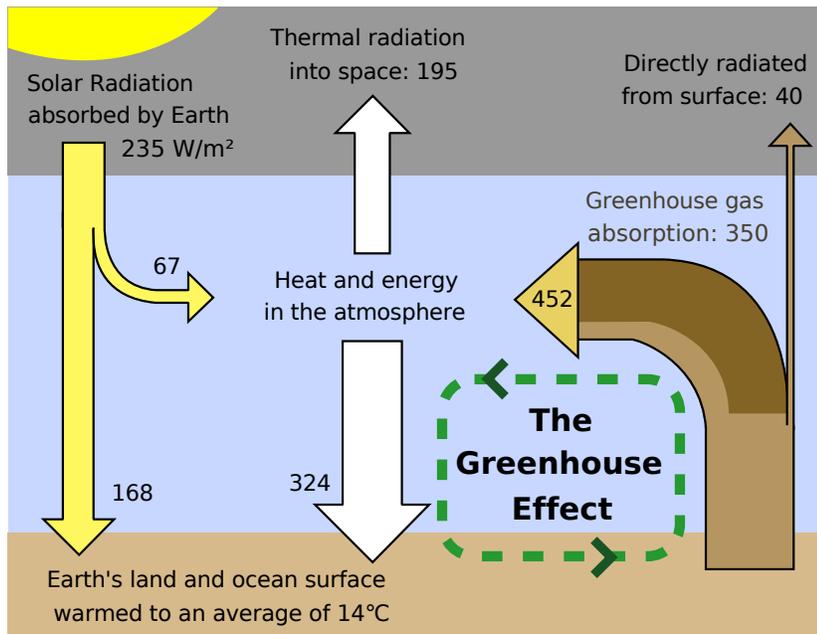


Figure 3.1: The mechanism of climate change. Source: Rekacewicz and Bournay, UNEP-Grid-Arendal

Human activities, such as fossil fuel combustion and land use change, lead to increased concentrations of greenhouse gases in the atmosphere. Apart from carbon dioxide (CO<sub>2</sub>), there are six other greenhouse gases, namely methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF<sub>6</sub>) and nitrogen trifluoride (NF<sub>3</sub>). Each of these six other gases has higher capacity to absorb long wave radiation (Global Warming Potential (GWP)), and this allows to convert a mix of greenhouse gases into CO<sub>2</sub> equivalents.

The increased concentrations of these gases lead to the enhanced greenhouse effect as explained above. This global warming results in physical effects. The increased temperature causes ice caps to melt and the oceans' water to warm up; this results in a sea level rise. Other physical effects are more extreme weather events, changes in rainfall patterns and changes in the thermohaline circulation. Changes in climates can be sudden and irreversible.

These physical effects damage ecosystems, with grave consequences for humans (health, economy, safety) and other beings in the ecosystems (biodiversity). This is summarised in figure A.1.

### **3.2 Climate change policies**

The history of climate change policies is shown in section 3.2.1. An UN organisation has been co-ordinate the development of climate change policy (section 3.2.2).

There are two groups of Parties to the UNFCCC: Parties with an emission reduction target (Annex I) and those without one (non-Annex I). The Annex I Parties have committed themselves to emission reductions via the Kyoto Protocol (section 3.2.3), followed by the Paris Agreement (section 3.2.4).

Another line of action for coping with climate change is to declare it a hoax (section 3.2.5). Non-Annex I countries can achieve emission reductions via the Clean Development Mechanism (section 3.2.7) and the Financial Mechanism (section 3.2.8).

#### **3.2.1 History of climate change policies**

Table 3.2 shows the timeline of the development of global climate change policies.

Year	Event
1988	UN General Assembly A/RES/43/53: Establishment of Intergovernmental Panel on Climate Change (IPCC)
1992	United Nations Framework Convention on Climate Change (UNFCCC): Establish national greenhouse gas inventories; Annex I countries commit to GHG emission reductions; Goal: stabilization of GHG to prevent dangerous human interference with climate
1997	Kyoto Protocol to the UNFCCC: Annex B: countries with quantified emission reduction commitments; Establishment of flexible mechanisms (Clean Development Mechanism, Joint Implementation, Intergovernmental Emissions Trading); Goal: Annex B countries reduce GHG emissions with 5% vis-a-vis 1990 baseline in the period 2008-2012.
2005	Kyoto Protocol entered into force Start of European Union Emissions Trading System (EU ETS)
2012	End of the first commitment period of the Kyoto Protocol Doha amendment to the Kyoto Protocol (not ratified as per January 2018)
2013	Start of the second commitment period of the Kyoto Protocol
2015	Paris Agreement: - Hold global average temperature increase well below 2C of pre-industrial levels - Voluntary emission reduction targets via Nationally Determined Contributions - Entered into force on 4 November 2016
2017	United States of America announces intention to withdraw from Paris Agreement

Table 3.2: Climate change policies timeline

### 3.2.2 Foundation: the UNFCCC

The IPCC assessment reports were quickly followed up by climate change policy. The United Nations Framework Convention on Climate Change (UNFCCC) was established during the Earth Summit in Rio de Janeiro (United Nations, 1992). The objective of the Convention is “...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. In order to so, developed countries commit themselves to limit emissions (Annex I countries) and to assist developing countries in meeting the costs of adaptation to the adverse effects of climate change (Annex II countries).

The Convention created a number of bodies that support its operations:

- the Secretariat (Art. 8): organisation of the annual Conference of the Parties (CoP) and its subsidiary bodies, collect and disseminate information, and facilitate assistance to the Parties, especially developing country Parties.
- Subsidiary Body for Scientific and Technological Advice (SBSTA) (Art. 9): provide the Parties with scientific and technological advice.

- Subsidiary Body for Implementation (SBI) (Art. 10): assist the CoP with the assessment and review of the implementation of the Convention.
- Financial Mechanism (Art. 11): mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology.

The overall structure of the UNFCCC is shown in figure C.1.

The Parties to the Convention are required to develop national emission registries, and report their emissions to the UNFCCC according to a Common Reporting Format (IPCC, 2001a, 2006; UNFCCC, 2018d). Each Party is also required to submit National Communications (NCs). Annex I countries report on policies that aim to reduce greenhouse gas emissions and enhancement of sinks. Non-Annex I countries focus on adaptation and the information on their greenhouse gas inventories. Least Developed Countries (LDCs) also submit National Adaptation Programme of Actions (NAPAs), which list the most urgent activities that are required to adapt to climate change.

### 3.2.3 Binding commitments: the Kyoto Protocol

The Kyoto Protocol (KP) to the UNFCCC is the first quantitative emission reduction commitment by Annex I Parties (United Nations, 1998). These emission reduction targets apply to the commitment period 2008-2012 compared to the baseline year 1990 and are listed in Annex B.

**Flexible mechanisms** The Protocol allows for flexibility in achieving the reduction targets, in the sense that Annex B countries can reduce emissions elsewhere. To this end, each Party is allocated Assigned Amount Units (AAU) that correspond to the total target emissions over the period 2008-2012. These AAUs can be traded (International Emissions Trading). Alternatively, Annex I Parties can implement emission reduction projects. The achieved emission reductions are then allocated by the UNFCCC. Reduction projects in Annex I countries result in Emission Reduction Units (ERUs) via Joint Implementation (JI). Emission reductions in non-Annex I countries are rewarded as Certified Emission Reduction Units (CERs) via the Clean Development Mechanism (CDM).

These so-called “flexible mechanisms” have three advantages over conventional national-based emission reduction programmes. First, they allow to achieve the largest emission reduction for the lowest cost, as projects will focus on reductions with low marginal costs. Second, the CDM connects Annex I and non-Annex I countries. It thus allows Annex II Parties to meet part of their obligations by emission reductions and technology transfer to non-Annex I Parties. Finally, the flexible mechanisms allow the private sector to develop and implement reduction projects. This allows for implementation of projects for which funds would otherwise not have been available.

The mechanisms, and especially the CDM, have been criticised as offering the 21st century equivalent of Roman Catholic “indulgences”. This critique is especially popular with NGOs that conflate climate change *policy* with *policy tools* (see for example (Smith *et al.*, 2007)). The CDM is discussed in more detail in section 3.2.7.

**Free riders: withdrawals from the Protocol** The United States signed but never ratified the Kyoto Protocol. The concerns listed about the Kyoto Protocol were that “...it exempts 80 percent of the world, including major population centers such as China and India, from compliance, and would cause serious harm to the U.S. economy.” (Dessai, 2001). After the start of the first commitment period (2008), it became clear that Canada would not be able to meet its reduction commitments, and Canada subsequently withdrew from the Kyoto Protocol. The Canadian environment minister, Peter Kent, said that “The Kyoto Protocol does not cover the world’s largest two emitters, the United States and China, and therefore cannot work.” (The Guardian, 2011).

**European emissions trading** The European Commission launched the European Union Emissions Trading System (EU ETS) in 2005 (European Commission, 2018). The EU ETS is a cap-and-trade emissions trading system that covers over 11,000 energy-intensive installations in the European Union. It covers 45% of greenhouse gases in the European Union and is the world’s largest emissions trading market (European Commission, 2016). The EU ETS allows linkage with other emissions trading schemes, such as the CDM.

**Fade out: the Doha Amendment** Subsequent Conferences of the Parties (CoPs) did not succeed in agreeing on binding emission reduction targets until the Doha Amendment to the Kyoto Protocol UNFCCC (2012). The Doha Amendment forms the second commitment period of the Kyoto Protocol (2008-2020), but is not ratified to date UNFCCC (2018c). Moreover, the governments of Japan, Canada, New Zealand and the Russian Federation informed the UNFCCC Secretariat that they do “...not intend to assume a quantitative emission limitation or reduction commitment for the second commitment period”.

### 3.2.4 Voluntary commitments: the Paris Agreement

Following this *de facto* collapse of the Kyoto Protocol, the Parties reached the Paris Agreement during CoP21 in 2015 (United Nations Framework Convention on Climate Change, 2017). The Agreement entered into force on 4 November 2016 and will start in 2020 (UNFCCC, 2018e). The aim is to keep the increase in global average temperature well below 2 °C above pre-industrial levels.

The Paris Agreement does no longer foresee in mutually agreed quantitative emission reduction. Instead thereof, Parties submit Nationally Determined Contributions (NDCs); these define what each Party thinks is an ambitious and achievable target. Initial NDCs were set in 2015.

There is no enforcement regarding the setting and meeting of emission reduction targets. Progress on implementation of the NDC will take place via a “Facilitative dialogue” that will not focus on individual Parties. In spite of the non-committal nature of the Paris Agreement, the United States nevertheless announced its intention to withdraw from it on June 1st, 2017, citing “*draconian financial and economic burdens the agreement imposes on (the United States)*” (White House, 2017). The withdrawal of the United States is thought to affect climate finance rather than global emissions (Urpelainen and Van de Graaf, 2017).

### 3.2.5 Doing nothing: undermining climate change policy

**Climate change deniers: doubt is our product** Science moves slowly: it forms tentative hypothesis which are tested, updated, challenged, improved and refined. It cannot offer absolute proof, only falsification, something that politicians and media feel uncomfortable with. This is leveraged by industrial groups and politicians that have no direct interest in the reduction of greenhouse gas emissions, for example because they support the fossil fuel industry. This demand for “proof” from scientific research in order to undermine its credibility has been termed “Scientific Certainty Argumentation Methods (SCAM)” (Freudenburg *et al.*, 2008).

The tobacco industry realised that it is easier to fight scientific consensus than policies (as formulated by an employee in the tobacco industry: “*Doubt is our product*”, (Unknown, 1969)). Small amounts of scientific dissent can significantly undermine the public support for environmental policies (Aklin and Urpelainen, 2014). This phenomenon has been exploited by the tobacco industry (Bricker, 2014; Ong and Glantz, 2001) and further used by the American Petroleum Industry (American Petroleum Institute, 1998) and American conservative think-tanks (Lewandowsky *et al.*, 2013).

Emails have been stolen from climate scientists and wilfully misrepresented (Bricker, 2013; Editorial, 2010). ExxonMobil has pursued climate change denial strategy towards the public while its own scientists were convinced of and concerned by climate change (Supran and Oreskes, 2017). The media contribute to the perception that there is no scientific consensus by given equal amounts of coverage to climate change deniers and mainstream scientists (Brüggemann and Engesser, 2017).

**Conspiracy theories: the Chinese hoax** The findings of climate change science can be construed as a secret plot by powerful individuals or organisations (Lewandowsky *et al.*, 2013; Uscinski *et al.*, 2017). This is found to be related with ideology (Douglas *et al.*, 2017): for example, only 7% of American conservative republicans believe that climate scientists’ research findings are using the best available scientific evidence; only 13% believes that human behaviour is responsible for climate change (Funk and Kennedy, 2016). Below is one example of conspiracy thinking:

*“The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.” - (Trump, 2012)*

### 3.2.6 Emission of greenhouse gases

**Historical emissions in relation to the Kyoto Protocol** The emission of greenhouse gases worldwide is shown in figure 3.2. The emissions have been split into the world total (“World”) and countries that have committed to an emission reduction under the Kyoto Protocol (“Annex B”). There are Annex B countries that are in a transition towards a market economy, these have been labeled as “Annex B, transition”. Figure 3.3 shows the historical greenhouse gas emissions per region.

#### Greenhouse gas emission trend worldwide and Annex B countries

Annex B countries have an emission reduction target under the Kyoto Protocol. Annex B transition countries are East European countries (including the Russian Federation) that are undergoing a transition to a market economy. The shaded area represents the Kyoto Protocol commitment period 2008-2012.

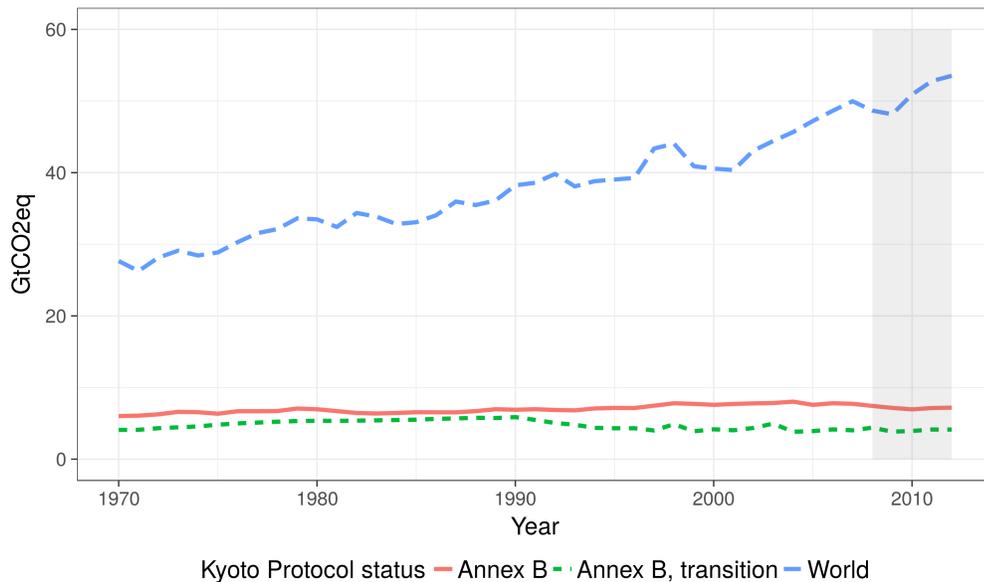


Figure 3.2: Worldwide greenhouse gas emission trend. Data source: (European Commission *et al.*, 2018)

The plot shows that the countries with an emission reduction target under Annex B of the Kyoto Protocol represent only a small portion of the World's greenhouse gas emissions. During the negotiation of the Kyoto Protocol they represented 18% of the global greenhouse gas emissions (United States excluded). At the end of the commitment period (2012) this was reduced to only 13% (Canada included), due to the rapid growth of the emissions of non-Annex I countries. The Doha Amendment has seen the withdrawal of Japan, New Zealand, the Russian Federation and Canada. This reduces the share of Annex B countries in the world's emissions to a non-significant (but not unimportant) fraction.

The East European countries and the Russian Federation experienced an economic recession in the early 90's, resulting in a sharp decrease of greenhouse gas emissions. This created a large gap between the baseline year (1990) and the the commitment period (2008-2012). The gap liberates a large amount of Assigned Amount Units that these countries wanted to sell; these emissions are known as "hot air".

In summary, UNFCCC has not been effective in introducing effective climate change policies. The countries with emission reduction targets represent just 13% of the world's greenhouse gas emissions; the United States and Canada have left the Kyoto Protocol; part of the emission reductions can be attributed to economic effects rather than an effort to reduce emissions; the countries without emission reductions have seen sharply increasing greenhouse gas emissions. The situation is depicted in the plot below.

### Greenhouse gas emission trends in selected regions

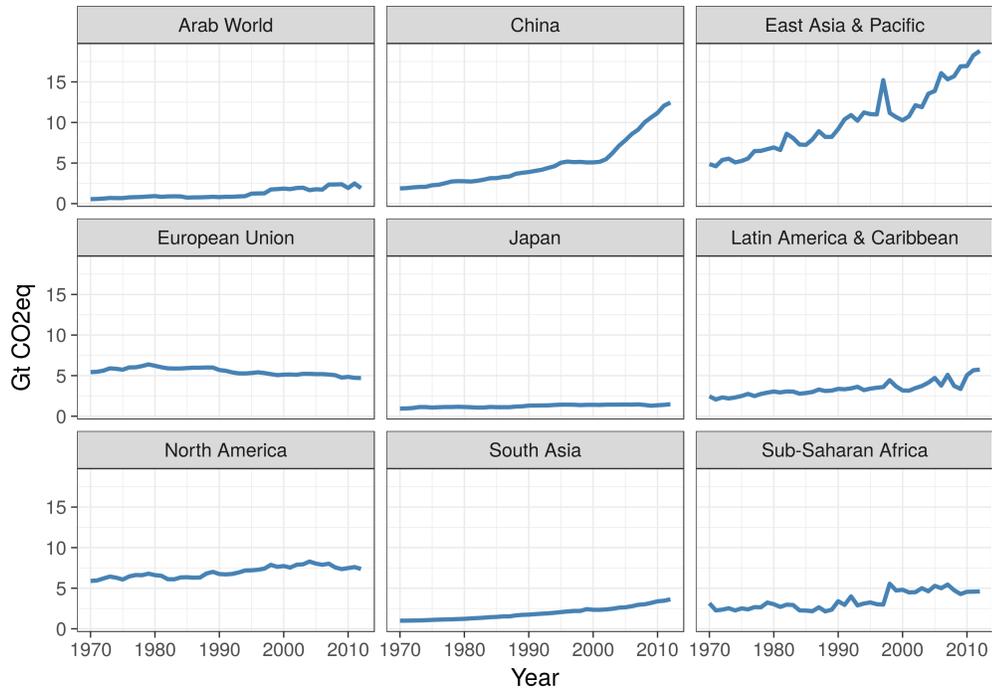


Figure 3.3: Worldwide greenhouse gas emission trend per region. Data source: (European Commission *et al.*, 2018)

Even the successful emission reduction of the European Union is not without caveats. The production of goods for this economic bloc is increasingly taking place in non-Annex B countries, such as China. This means that greenhouse gas emissions are “outsourced” from the European Union, a phenomenon known as “leakage”. One study estimated this leakage at 1.6 Gt CO<sub>2</sub> in 2008 (Peters *et al.*, 2011). Including these emissions in the Annex B group would void the emission reduction success.

**Projected emissions under the Paris Agreement** UNEP estimates that the current Nationally Determined Contributions (NDCs) are not consistent with the goals of the Paris Agreement. The annual greenhouse gas emissions are projected to be around 60 Gt CO<sub>2</sub>eq/year in 2030, whereas an emission of around 42 Gt CO<sub>2</sub>eq/year is required to keep global warming within 2 °C pre-industrial levels (UNEP, 2016). This is shown in figure B.1.

### 3.2.7 The rise and fall of the Clean Development Mechanism

The case of the Clean Development Mechanism (CDM) is important to evaluate how the role of UNFCCC has played out in the relation between Annex I and non-Annex I Parties. The mechanism is administered by the Executive Board (EB), assisted by the Secretariat of the UNFCCC.

Because CDM projects take place in non-Annex I countries, there are no “quota” to transfer (such as Assigned Amount Units (AAU) from International Emissions Trading (IET) between Annex I Parties). The CDM therefore generates offsets (emission *reductions*) via een project-based baseline-and-credit system. These Certified Emission Reductions (CERs) can be used to (1) meet the requirements of installations that participate in the European Commission Emissions Trading System (EU ETS), and to (2) allow Annex I Parties to meet their Kyoto targets.

The EB instructed UNFCCC to issue around 1.9 Gt in CERs in the period 2005 to date. As can be seen in plot 3.5, this has mainly been for Asia and the Pacific region (mainly China and India), and mainly for industrial gases. The CDM also covers afforestation and reforestation projects, the so-called Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) (UNFCCC, 2018g). In January 2018 25 projects were registered and 11 Mt CERs were issued (Fenhann, 2018).

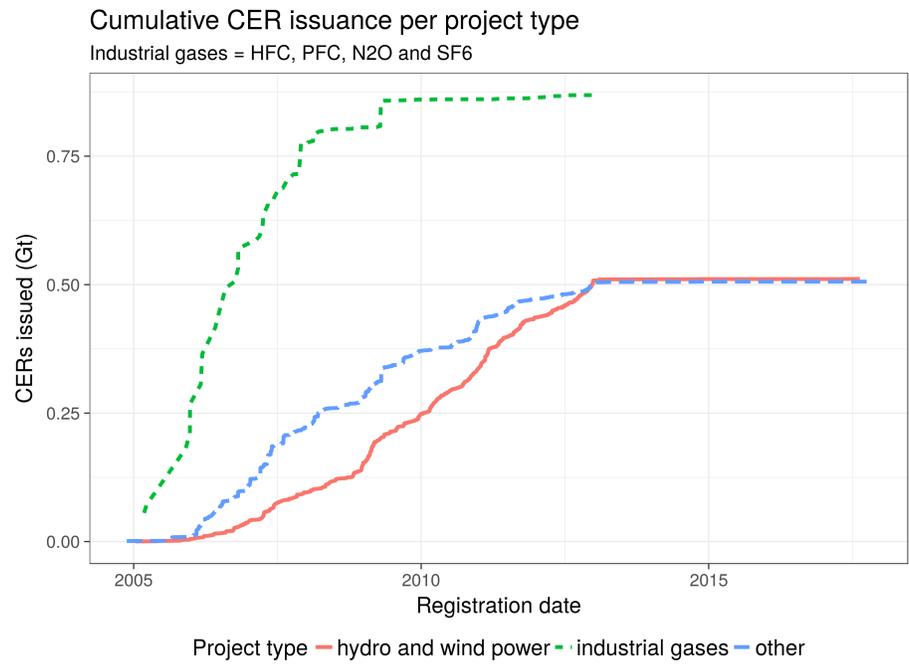


Figure 3.4: CERs issued per project type. Data source: (Fenhann, 2018)

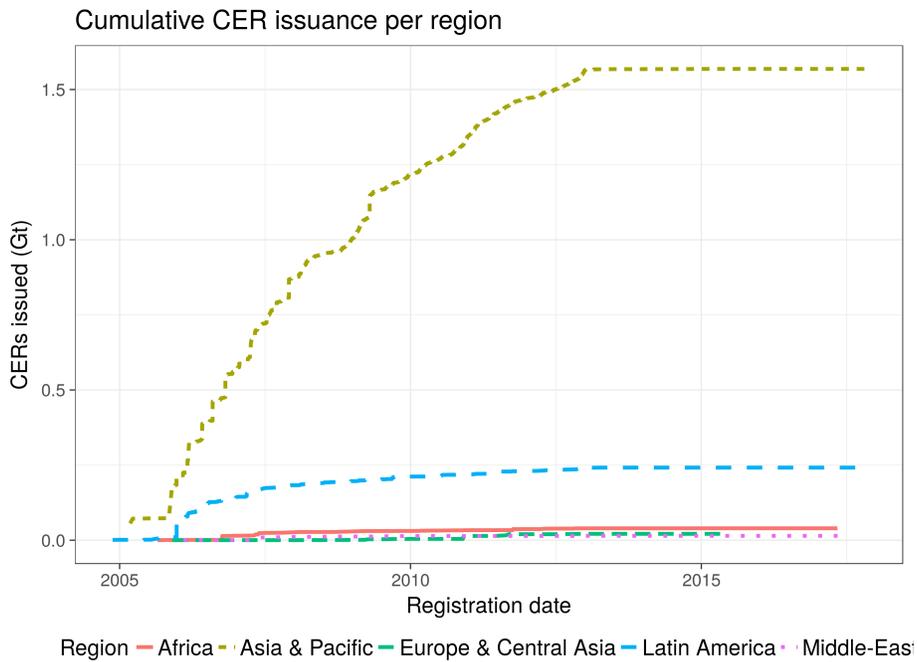


Figure 3.5: CERs issued per region. Data source: (Fenhann, 2018)

Generating CERs is a complex procedure, and involves obtaining Host Country approval, demonstration of project additionality, independent validation of the Project Design Document (PDD), monitoring and independent validation of the monitoring report. The time period between the start of public consultation and issuance of the first CERs takes typically between 1,000 and 1,500 days (Fenhann, 2018). The complexity of the rules, the costs of hiring independent third parties and the waiting times contribute to high transaction costs.

The criticisms of the CDM can be centered around the following topics: (1) design; (2) additionality; and (3) governance.

**Design** The CDM works with a project-based baseline-and-credit system because it takes place in Parties that have no “quota” or emission reduction targets; the demand must come from baseline-and-credit systems that have such quota (mainly the EU ETS). The oversupply of emission quota in the EU ETS and the economic recession of 2008 reduced the demand so much that the price of CERs fell to 0.40 EUR/CER (Carbon Pulse, 2016), down from 20 USD/CER in 2008 (The Economist, 2012). This resulted in the collapse of the CDM, as new issuances result in a loss for the CDM projects. As can be seen in the plots above, the supply curves flatten out after 2012, meaning that supply essentially stopped.

**Additionality** Each project must undergo an additionality test before it is registered UNFCCC (2018b). The Executive Board has approved around 40 tools for assessing additionality, baseline validity and emissions leakage. Broadly speaking, additionality refers to the likelihood that a project would have taken place in the absence of the policy intervention, in this case the CDM. Assessing additionality is difficult because the project baseline has gone once it starts; the validator has to assess an unobserved, hypothetical scenario (Gillenwater, 2012). In view of the CER price volatility outlined above, financial additionality for CDM projects is a risky undertaking. The additionality of industrial gases projects was deemed insufficient, leading to the banning of these projects from the EU ETS (European Commission, 2011). Concerns were also raised over the additionality tests of hydropower, noting the improbability that a mature and common practice technology would depend on CDM to go ahead (Haya, 2007).

**Governance** The governance of the UNFCCC is has led to high transaction costs. The CDM does not allow direct contact between project proponent and the UNFCCC secretariat; procedures are lengthy; the perception is that CDM is “slow, opaque, unresponsive and politicized” (High-Level Panel on the CDM Policy Dialogue, 2012). The Executive Board is legislator, administrator and judge, all at the same time (UNFCCC, 2018a), and therefore the “Trias Politica” of good governance is violated.

### 3.2.8 Financial Mechanism

The Convention has a Financial Mechanism, consisting of the Green Climate Fund (GCF) and the Global Environment Facility (GEF). The GEF administers the Least Developed Countries Fund and the Special Climate Change Fund. During the 21st Conference of the Parties it was decided that all these funds would serve the Paris Agreement. Another fund, the Adaptation Fund may be included later. (UNFCCC, 2015). The World Bank's Clean Investment Funds consist of the Clean Technology Fund, the Strategic Climate Fund, the Pilot Program for Climate Resilience, Forest Investment Program, and the Scaling Up Renewable Energy in Low Income Countries Program (Climate Investment Funds and CIF, 2018). As can be seen in the overview below, there is overlap between the activities of some of these fund.

- GCF helps developing countries limit or reduce their greenhouse gas (GHG) emissions and adapt to climate change (GCF, 2018).
- GEF invests in energy efficiency, renewable energy, sustainable transport and climate-smart agriculture to support mitigation (GEF, 2018).
- The Adaptation Fund finances climate change adaptation and resilience activities in developing countries (Adaptation Fund, 2018).
- Clean Investment Funds (Climate Investment Funds and CIF, 2018):
  - The Clean Technology Fund (CTF) provides middle-income countries to scale up the demonstration, deployment, and transfer of low carbon technologies in renewable energy, energy efficiency, and sustainable transport.
  - The Pilot Program for Climate Resilience (PPCR) is helping developing countries integrate climate resilience into development planning.
  - The Scaling Up Renewable Energy in Low Income Countries Program (SREP) is helping to deploy renewable energy solutions for increased energy access and economic growth in the world's poorest countries.
  - The Forest Investment Program (FIP) supports efforts of developing countries to reduce deforestation and forest degradation and promote sustainable forest management that leads to emissions' reductions and enhancement of forest carbon stocks (REDD+).

The withdrawal of the United States from the Paris Agreement has consequences for climate funds. It contributed about USD 2.7 billion per year in 2013 and 2014, constituting for over 10% of the public climate finance that flowed from developed to developing countries. The United States has pledged 3 billion USD to the GCF, but has delivered only 1 billion. The remaining 2 billion USD are unlikely to be delivered, thus jeopardizing 20% of GCF's budget (Urpelainen and Van de Graaf, 2017).

## **4 Discussion**

Climate change science (section 4.1) has developed rapidly, whereas implementation of policy measures has been developing much slower (section 4.2). After an initially rapid development, the CDM (section 4.3) has sizzled out and has not yet been replaced by a more robust policy instrument.

### **4.1 Climate change science**

The IPCC has managed to provide clarity on climate change science in a relatively short time span. The majority of climate scientists (> 97%) now agrees that climate change is caused by humankind and that there will be grave consequences if the issue is not addressed urgently. Another achievement of IPCC is the introduction of standardized national greenhouse gas emission inventories, which are regularly reported according to a common reporting format. This makes it possible to add greenhouse gas emissions of different countries, the development of scenarios and the setting of meaningful reduction targets.

Climate science has proven to be an easy target for climate change deniers and conspiracy theorists. These groups have learned from the tobacco industry that it is easier to fight climate science than climate policies. This is made possible because the general public concludes that absence of absolute proof means that the science is likely to be correct. The media make matters worse by giving as much attention to the 97% mainstream climate scientists as to the 3% climate deniers - thus suggesting a 50/50 consensus. The withdrawal of the United States from the Paris Agreement has proven that climate change deniers and conspiracy theorists have real influence on climate cooperation.

## 4.2 Climate change policies

Global climate change policy, as coordinated by UNFCCC, has made less progress. The first and only international agreement that sets out quantitative targets - the Kyoto Protocol - has seen limited success. Canada and the United States have withdrawn from the protocol during the first commitment period (2008-2012), whereas Japan, New Zealand and the Russian Federation have indicated that do not intend to participate in the second commitment period (2012-2020). The Doha Amendment to the Kyoto Protocol has not been ratified as per January 2018. The emission reductions that it would cover have become marginal with the withdrawal of the aforementioned countries. Moreover, the greenhouse gas emissions of countries that were not covered by reduction targets (non-Annex I) have grown rapidly.

The Paris Agreement, the policy environment for 2020 onwards, hinges on an important assumption, namely that countries can be trusted to set and implement their own emission reduction targets. The current targets (Nationally Determined Contributions) are not sufficient to limit global temperature rise well below 2 °C above pre-industrial levels. The United States has chosen to be withdraw from the Agreement, leaving a financial gap in the Green Climate Fund.

## 4.3 Involvement of non-Annex I countries

An attempt to include non-Annex I Parties in the reduction of greenhouse gas emissions has also been only partially successful. The Clean Development Mechanism has been able to generate 1.9 Gt in emission reductions. However, this was mainly achieved in a select group of countries and focussed on industrial gases. Doubts have been raised over the additionality of industrial gas and hydropower projects. The governance of the CDM has not been able to develop an accessible and streamlined process and it combines too many roles. The CDM depends on demand from policy regimes with an enforced emission reduction target. The supply of emission reductions has outstripped that demand, leading to the collapse of the CDM after 2012.

There is a plethora of climate funds with sometimes overlapping objectives. The withdrawal of the United States from the Paris Agreement has jeopardized an important source of funding for the Green Climate Fund.

## 5 Conclusion

The vast majority of climate scientists agree that climate change is occurring and manmade. Damage to ecosystems is already occurring and the costs are estimated at 5% of global GNP, now and forever. It is therefore of vital importance that climate change policy as coordinated by the UNFCCC finds a response to this threat in the short term.

The effectiveness of UNFCCC can be expressed as the extent to which global policy decisions are implemented in national measures to reduce climate change policies. The UNFCCC has been effective to only a limited extent. Global emissions of greenhouse gases are rising; the Kyoto Protocol covered less than one fifth of these emissions; the Doha Amendment to the Kyoto Protocol has not been ratified and has also become irrelevant with the withdrawal of some large emitters; and the Paris Agreement hinges on the assumption that countries will collectively implement sufficient voluntary emission reduction measures - which is currently not the case. The withdrawal of the United States from the Paris Agreement has jeopardized the Green Climate Fund.

## References

- Adaptation Fund (2018). AF | Adaptation Fund.
- Aklin, M. and Urpelainen, J. (2014). Perceptions of scientific dissent undermine public support for environmental policy. *Environmental Science and Policy*, 38:173–177.
- American Petroleum Institute (1998). Global Climate Science Communications Team Action Plan.
- Bricker, B. J. (2013). Climategate: A Case Study in the Intersection of Facticity and Conspiracy Theory. *Communication Studies*, 64(2):218–239.
- Bricker, B. J. (2014). Feigning Environmentalism: Antienvironmental Organizations, Strategic Naming, and Definitional Argument. *Western Journal of Communication*, 78(5):636–652.
- Brüggemann, M. and Engesser, S. (2017). Beyond false balance: How interpretive journalism shapes media coverage of climate change. *Global Environmental Change*, 42:58–67.
- Carbon Pulse (2016). Airlines will be CDM’s lifeline, but expect CER price slump first, say analysts.
- Clayton, K. (1995). The threat of global warming. In O’Riordan, T., editor, *Environmental Science for Environmental Management*, pages 110–130. 2nd edition.
- Climate Investment Funds and CIF (2018). What We Do | Climate Investment Funds.
- Dessai, S. (2001). The climate regime from The Hague to Marrakech: Saving or Sinking the Kyoto Protocol? Technical report.
- Douglas, K. M., Sutton, R. M., and Cichocka, A. (2017). The Psychology of Conspiracy Theories. *Current Directions in Psychological Science*, 26(6):538–542.
- Editorial (2010). Closing the Climategate. *Nature*, 468(7322):345–345.
- European Commission (2011). European Commission - Press release - Emissions trading: Commission welcomes vote to ban certain industrial gas credits.

European Commission (2016). The EU Emissions Trading System (EU ETS). Technical report.

European Commission (2018). Phases 1 and 2 (2005-2012) | Climate Action.

European Commission, Joint Research Centre (JRC), and Netherlands Environmental Assessment Agency (PBL) (2018). Emissions database for Global Atmospheric Research (EDGAR).

Fenhann, J. (2018). UNEP DTU CDM/JI Pipeline Analysis and Database.

Freudenburg, W. R., Gramling, R., and Davidson, D. J. (2008). Scientific Certainty Argumentation Methods (SCAMs): Science and the politics of doubt. *Sociological Inquiry*, 78(1):2-38.

Funk, C. and Kennedy, B. (2016). The Politics of Climate Change in the United States | Pew Research Center. Technical report, Pew Research Center.

GCF (2018). About the Fund - Green Climate Fund.

GEF (2018). Climate Change | Global Environment Facility.

General Assembly of the United Nations (1988). A/RES/43/53. Protection of global climate for present and future generations of mankind.

Gillenwater, M. (2012). Michael Gillenwater What is Additionality? Part 1: A long standing problem. Technical report.

Haya, B. (2007). How the CDM is subsidizing hydro developers and harming the Kyoto Protocol. Technical report, International Rivers.

High-Level Panel on the CDM Policy Dialogue (2012). Climate Change, Carbon Markets and the CDM: A Call to Action. Technical report.

Houghton, J. T. J. T. (2004). *Global warming: the complete briefing*. Cambridge University Press, 3rd edition.

Inspectie Ontwikkelingssamenwerking en Beleidsevaluatie (2009). Evaluatiebeleid en richtlijnen voor evaluaties. page 54.

IPCC (1990). IPCC First Assessment Report 1990. Technical report.

IPCC (1995). IPCC Second Assessment Climate Change 1995 (SAR). Technical report, IPCC.

- IPCC (2001a). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.
- IPCC (2001b). IPCC Third Assessment Report 2001: Climate Change (TAR). Technical report.
- IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
- IPCC (2007). IPCC Fourth Assessment Report: Climate Change 2007 (AR4). Technical report.
- IPCC (2014). IPCC Fifth Assessment Report - Synthesis Report.
- Lewandowsky, S., Oberauer, K., and Gignac, G. E. (2013). NASA Faked the Moon Landing—Therefore, (Climate) Science Is a Hoax. *Psychological Science*, 24(5):622–633.
- Maibach, E., Myers, T., and Leiserowitz, A. (2014). Climate scientists need to set the record straight: There is a scientific consensus that human-caused climate change is happening. *Earth's Future*, 2:1–4.
- Ong, E. K. and Glantz, S. A. (2001). Constructing "sound science" and "good epidemiology": Tobacco, lawyers, and public relations firms. *American Journal of Public Health*, 91(11):1749–1757.
- Peters, G. P., Minx, J. C., Weber, C. L., and Edenhofer, O. (2011). Growth in emission transfers via international trade from 1990 to 2008. *Proceedings of the National Academy of Sciences*, 108(21):8903–8908.
- Revelle, R. and Suess, H. E. (1957). Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO<sub>2</sub> during the Past Decades. *Tellus*, 9(1):18–27.
- Ripple, W. J., Wolf, C., Galetti, M., Newsome, T. M., Alamgir, M., Crist, E., Mahmoud, M. I., and Laurance, W. F. (2017). World Scientists' Warning to Humanity: A Second Notice. *BioScience*, pages 1–9.

- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., and Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Nature*, 461(24 September 2009).
- Smith, K., Byakola, T., Lang, C., Reddy, T., Hartzell, J., Reyes, O., Santos, R., Smith, D. K., and Peric, Z. (2007). The Carbon Neutral Myth: Offset Indulgences for Climate Sins. Technical report, Carbon Trade Watch.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Meyers, V. R. B., Sörlin, S., and The (2015). Planetary boundaries: Guiding human development on a changing planet. *Science (New York, N.Y.)*, 348(6223):1217–1217.
- Stern, N. H. (2007). Stern Review: The Economics of Climate Change. Technical report.
- Supran, G. and Oreskes, N. (2017). Assessing ExxonMobil's climate change communications (1977-2014). *Environmental Research Letters*, 12(8).
- The Economist (2012). Complete Disaster in the Making | The Economist.
- The Guardian (2011). Canada pulls out of Kyoto protocol | Environment | The Guardian.
- Trump, D. (2012). The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.
- Tyndall, J. (1859). On the transmission of heat of different qualities through gases of different kinds. *Proceedings of the Royal Institution*, 3:155–158.
- UNEP (2016). *The Emissions Gap Report 2016*.
- UNFCCC (2012). Doha amendment to the Kyoto Protocol Article 1: Amendment.
- UNFCCC (2015). Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015.
- UNFCCC (2018a). CDM: Executive Board (EB) | Governance.

UNFCCC (2018b). CDM: Tools.

UNFCCC (2018c). Doha Amendment.

UNFCCC (2018d). National Reports.

UNFCCC (2018e). The Paris Agreement - main page.

UNFCCC (2018f). UNFCCC Bodies.

UNFCCC (2018g). UNFCCC documents in relation to REDD.

United Nations (1992). United Nations Framework Convention on Climate Change.

United Nations (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change.

United Nations Framework Convention on Climate Change (2017). The Paris Agreement.

Unknown (1969). Smoking and Health Proposal. Technical report, Brown & Williamson Records, Minnesota Documents.

UNODC (2017). What is evaluation? Technical report, UNODC.

Urpelainen, J. and Van de Graaf, T. (2017). United States Non-Cooperation and the Paris Agreement. *SSRN Electronic Journal*, Forthcomin.

Uscinski, J., Douglas, K., and Lewandowsky, S. (2017). Conspiracy Thinking and Climate Change Beliefs. In *Oxford Research Encyclopedia of Climate Science*, number September, pages 1–43. Oxford University Press.

White House (2017). Statement by President Trump on the Paris Climate Accord.

## Annexes

### A Climate change: cause and effect

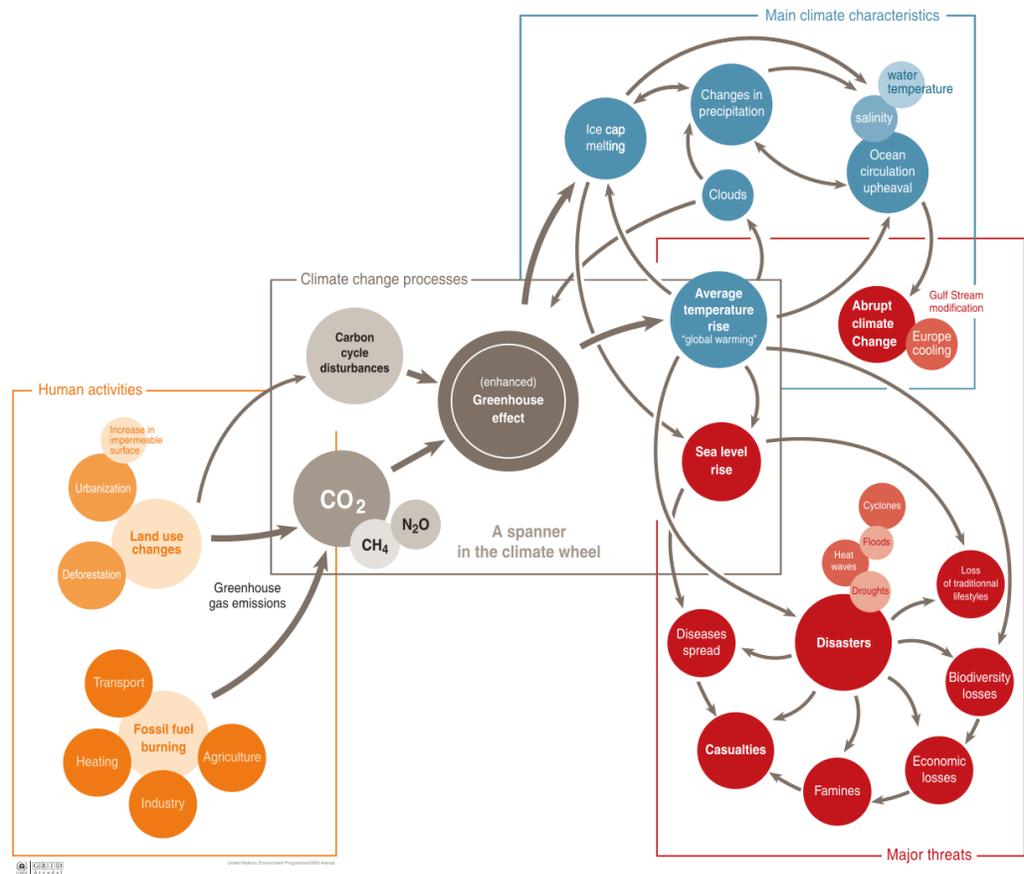


Figure A.1: Climate change: cause and effect of climate change. Source: Rekacewicz and Bournay, UNEP/GRID-Arendal

## B The Paris Accord emissions gap

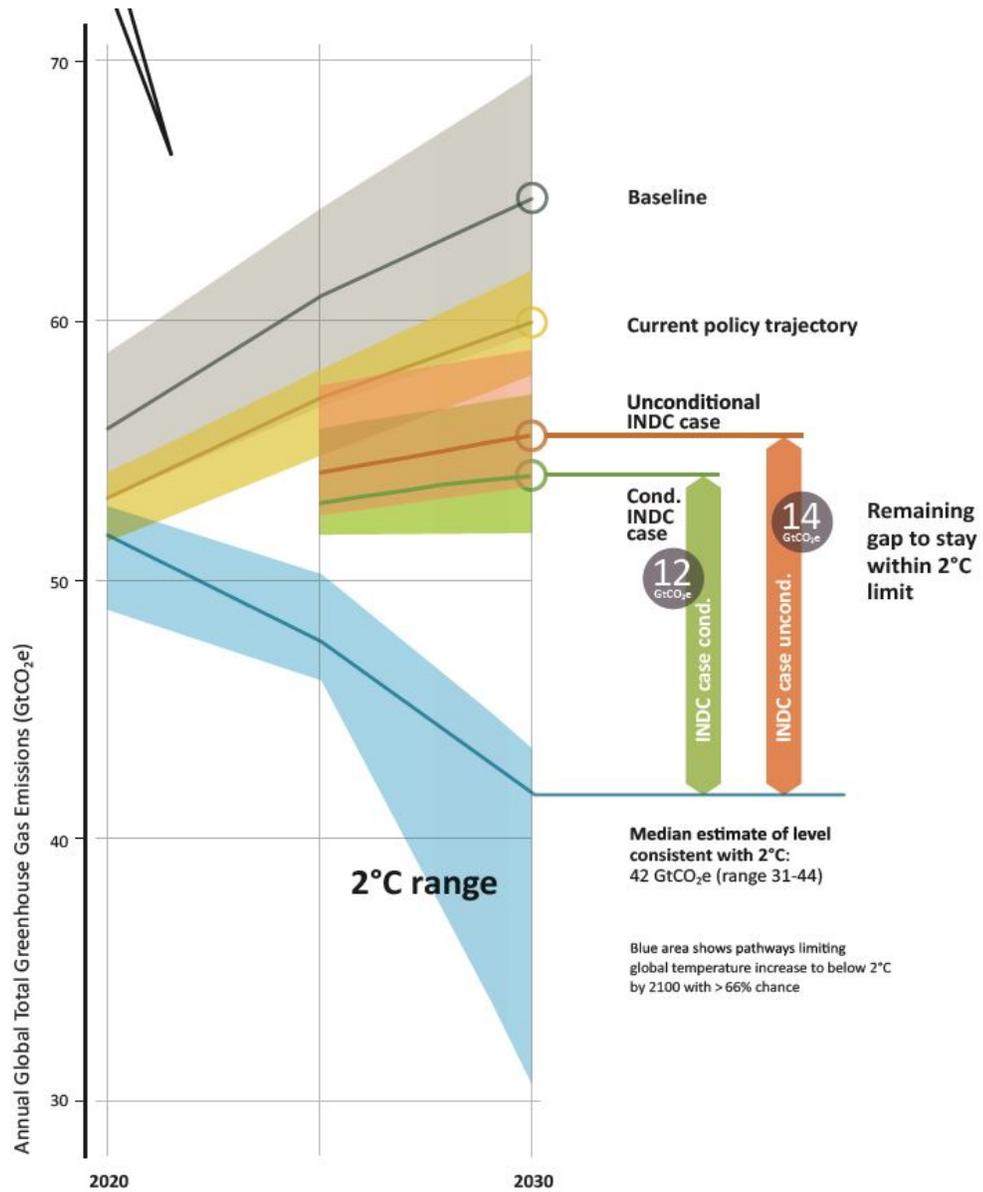


Figure B.1: Forecasted greenhouse gas emissions and gap with Paris Agreement target. Source: UNEP Emissions Gap Report (UNEP, 2016)

## C Governance structure of the UNFCCC



Figure C.1: Structure of the UNFCCC. Source: (UNFCCC, 2018f)