ANALYSEN

ROSA LUXEMBURG STIFTUNG

SUSTAINABILITY

CLIMATE CHANGE

A QUESTION OF JUSTICE

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CONTENTS

INTRODUCTION

'Heatwave causes glacier melt', 'Cape Town experiences worst drought in 100 years' 'Container ships cross ice-free Antarctic'. These snippets taken in a short space of time from various regions of the world are far more than just unrelated news. The common thread that binds them together is climate change: they are separate elements of the same bigger picture, different episodes of a shared story.

Climate change has become a grand narrative, possibly the first grand narrative of the 21st century. Its origins stretch back to the early days of industrialisation, if not to the beginnings of agriculture and forestry. At the same time, the phenomenon is intrinsically related to the politics and history of the new millennium, the consequences of globalisation, free trade and neoliberalism, and the impact of the 2007/2008 financial and economic crisis.

In spite of the fact that most of today's news and developments are related to climate change, for many years the phenomenon remained a relatively minor issue for the population in Germany. It seemed like an abstract issue, a collection of prognoses and possible outcomes spat out by computer models, far away from people's everyday lives. Only once people began to feel the direct effects – heavy rains in the summer of 2017, drought and heat waves in 2018 – did climate change become more tangible to those living in the Global North, at least for a brief period. It remains to be seen whether the sense of urgency will persist once the extreme weather has abated. In the Global South, though, the situation is different. Years of social movement protests and actions show that people there are already facing the consequences of climate change: in these places, climate change has never been a question of science and probabilities; it is a question of justice and politics. In Germany too, this perspective will gradually gain momentum over time. Recent years have seen palpable changes in temperature and precipitation levels, a sharp rise in extreme weather events, more frequent hurricanes and tropical storms – climate change has caught up with us faster than expected, and can no longer be ignored. In January 2018, a group of research institutes published a study stating that even in Europe hundreds of thousands could be affected by flooding should global temperatures continue to rise.

There have been a number of shifts in the climate change debate: questions concerning the accuracy of forecasts and prognoses or the identification of the exact causes have become largely redundant. The majority of forecasts have turned out to be true; any lingering doubt regarding calculations remains almost non-existent. In the future, the question most likely to be asked will be: if the scientific community can predict the impacts of climate change – and the options we have for halting its progress – with such astonishing accuracy, why do we seem incapable of taking effective action? Why do so many people continue to question the reliability of the forecasts or remain adamant that the Earth's temperature is not rising?

This analysis offers an introduction to the climate change debate and features basic information to help readers understand recent developments in climate

change and climate policy. The first part examines the latest scientific research: what do we currently know about climate change? What is fact and what is myth? The second part introduces current climate policy: what steps have been taken so far? What has been effective? What changes are outlined in the Paris Climate Agreement? In the final part, the analysis focuses on the movements that have emerged around the question of climate change and examines the alternatives they propose and the questions they raise.

1 CLIMATE CHANGE

1.1 How is our climate changing?

In recent times, the end of each year has been accompanied by reports of new records being set. In 2014, scientists were saying we had seen the warmest year on record since temperature measurements began in the middle of the 19th century. This record was topped in 2015; 2016 was even warmer. Although 2017 was slightly cooler than the previous year, the temperatures recorded were unprecedented for a year without the El Niño weather phenomenon, which in some years has caused a spike in heat levels.[1] The higher temperatures brought other extremes. The tropical typhoon Haiyan that devastated the Philippines in November 2013 was the most powerful storm ever recorded in the South Pacific. It was followed by more devastating storms in the shape of Pam in 2015 and Winston in 2016. The 2017 hurricane season broke every record going. Tropical storm Ophelia pushed further into the northern Atlantic than any other storm witnessed, Cyclone Harvey gave the US its heaviest rainfall to date and Irma served up wind speeds of up to 300 km/h for 37 hours – longer than any other hurricane on record.

But such facts, taken on their own, say little about the climate. The 'climate' is by definition an average: the mean value of atmospheric conditions such as rainfall, temperature and air pressure in a particular place over an extended time span. The World Meteorological Organization has set this time span at 30 years. The data, however, that weather stations collect globally, convey a very clear message, even when analysed over much longer periods: the planet's temperature has increased significantly over the last 130 years. Between 1880, when the first global network of weather stations was established, and 2012, the average surface temperature on Earth has increased by 0.85 °C.[2] In 2016, this temperature was already 1.1 °C higher than pre-industrial levels;[3] by the 2040s, the increase could be as high as 1.5 °C.[4] This may not sound like much. Yet, as changes in temperature and rainfall play out very differently depending on the region and year, this mean value implies far-reaching changes to living conditions. Even during the last Ice Age, average temperatures were only five to six degrees Celsius lower than today.

However, indications for global warming are not solely restricted to weather data. Measurements show that the oceans have also warmed significantly since the 1970s. Warm water expands, leading to sea level rise (see section 1.4). Snow cover and snowfall in the northern hemisphere have decreased by around seven per cent since the 1920s and glaciers are retreating globally. In the Arctic, where warming is at its most rapid, ice cover has decreased considerably over the last

1 El Niño (Spanish for 'the Christ child') is a recurring weather phenomenon that results from largely regular fluctuations in the ocean currents of the South Pacific. Roughly every four to five years, the cold Humboldt current stops earlier than usual. This leads to significant local weather changes and to higher temperatures globally. This phenomenon is not directly linked to global warming but may change if temperatures rise. **2** Unless otherwise stated, the following data are based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change/IPCC dated 2013/14 (see www.ipcc.ch). The IPCC does not publish any individual findings, only summaries and averages obtained through the analysis of multiple studies and investigations. The publication of the Sixth Assessment Report is planned for 2021/22. In section 1.5, we explain how the IPCC operates and how the data are collected. **3** World Meteorological Organization (2007) 'WMO Statement on the State of the Global Climate in 2016', WMO-No. 1198, Geneva 2007, available at 'https://library.wmo.int/opac/doc_num.php?explnum_id=3414'. **4** Ibid.

decades. In March 2017, cover at both poles was at its lowest recorded levels. Since 2014, several research teams have confirmed that melting processes have begun in the western Antarctic that could eventually lead to the partial or even complete disappearance of the West Antarctic Ice Sheet. Many of the issues related to the climate debate continue to remain the subject of heated discussion, but there is widespread acceptance of one fact: the Earth is getting warmer. And this is happening at a rate faster than was predicted just a few years ago.

1.2 Why is the Earth warming?

Temperatures on the planet are the result of a simple equation: energy reaches the Earth in the form of sunlight. The Earth reflects some of this energy directly back into space, while the other part is converted into heat when it hits the surface. Some of this heat radiates into space, whilst the tiny gaseous particles in our atmosphere – mostly water vapour, carbon dioxide and methane – absorb the rest, creating the same effect as a glass roof on a greenhouse. This is actually very beneficial to us: without these so-called 'greenhouse gases', the average temperature on Earth would be a frosty minus 18 °C instead of the current plus 15 °C.

It follows that temperatures on Earth are not constant but actually fluctuate. On the one hand, the amount of sunlight reaching the Earth is constantly changing because the Earth's orbit around the sun is not a perfect circle. Sometimes the Earth is closer to the sun, sometimes further away. Over the course of the last 500,000 years, these variations – known as Milankovitch cycles after the researcher who discovered them – have led to a regular succession of ice ages and warmer periods in 10,000 to 100,000-year intervals. The strength of the sun's radiation also changes. Since early modern times, researchers have recorded the presence of sunspots, which increase and decrease in number in an approximately 11-year cycle, with fewer sunspots meaning that less sunlight reaches the Earth.

On the other hand, there are two factors that influence how much of the energy entering the Earth's atmosphere actually goes on to become available to warm the planet. The first factor is called albedo, and it determines how much radiation a particular surface reflects back into space. Dark water or bare soil surfaces take up nearly all of the sun's radiation, which means their temperature increases. At the other extreme are snow and ice, which reflect nearly 100 per cent. Once set in motion, this process becomes self-reinforcing: if a large part of the Earth is covered by snow and ice, then hardly any energy is left to create warmth: temperatures drop and ice cover continues to grow.

The second factor affecting incoming solar energy is the concentration of greenhouse gases in the atmosphere. The primary culprits are carbon dioxide (CO_2) and, to a lesser degree, methane (CH_4) and nitrous oxide (N_2O). Most of the carbon dioxide on Earth is locked into rock formations, while only a tiny proportion is present in the atmosphere and water. The weathering of rocks filters CO_2 out of the atmosphere and binds it to stone; volcanic activity returns it to the atmosphere. This long-term carbon cycle is probably the reason why in the past the Earth has always managed to find its way back from periods of extreme tempera-

tures to conditions more favourable to life. Chemical weathering, however, is a very slow process, the effects of which only become apparent after several tens or hundreds of thousands of years, and it has no impact on rapid changes to greenhouse gas levels. This means higher concentrations of greenhouse gases in the atmosphere retain more warmth and therefore lead to rising temperatures.

Scientists have been measuring atmospheric CO_2 concentrations since the 1950s. Satellites have been gathering detailed data on land and water surface temperatures since 1971. These indicate a direct correlation between the energy within the Earth's system and the rise of atmospheric CO_2 concentrations. Over 90 per cent of this additional thermal energy is stored in the oceans, increasing their temperature; the rest is warming the atmosphere. Moreover, chemical analysis of ice cores taken from the Antarctic and Greenland and the air trapped within them allows researchers to calculate the Earth's temperatures and atmospheric composition over time. These analyses show that a direct link has existed between temperatures and atmospheric CO_2 levels over the last 400,000 years: the higher CO_2 levels rose, the warmer the Earth became.[5]

The Swedish scientist and Nobel Prize winner Svante Arrhenius recognised this simple correlation long before data from ice cores could confirm his hypothesis. Building on the work of physicist Eunice Foote and John Tyndall, who, in 1956 and 1962, first described the effects of greenhouse gases on Earth temperatures,[6] Arrhenius, armed only with a pen and paper, created a simple climate model. According to his calculations, a doubling of atmospheric CO_2 concentrations would lead to a five to six-degree rise of average temperatures on Earth.

In essence, this basic finding has remained unchanged. Today, supercomputers use complex models to calculate how an increase in atmospheric CO_2 concentrations impacts temperatures on Earth. They factor in a large number of possible feedback effects: ocean currents and clouding, the reaction of vegetation and ocean organisms, ice melt and the cooling effect of tiny dust particles. In its latest summary of the available research dating from 2013, the IPCC concluded that a doubling of CO_2 concentrations would most likely lead to a temperature increase of 1.5 to 4.5 degrees Celsius.

In recent years, scientists worldwide have been conducting research to find out precisely how the climate system is reacting to rising CO_2 levels. So far, it is clear that no short-term mechanism to stop global warming exists. The Earth reacts to changes in the concentration of greenhouse gases, and this reaction can be extremely drastic. For instance, 55 million years ago, during the Paleocene-Eocene Thermal Maximum (PETM), temperatures suddenly increased by 6 °C within 20,000 years after large amounts of greenhouse gases entered the atmosphere.

These dramatic reactions are caused by the fact that the Earth does not warm evenly. The climate system features numerous tipping points: when certain levels are exceeded, the result is

5 The Vostok ice core is the most famous. It was extracted from the Antarctic in the '70s and '80s by a Franco–Russian research team and documents a period of roughly 400,000 years. More recent ice cores extracted as part of Europe's EPICA project go back even further, up to 900,000 years. **6** See www.news.ucsb.edu/2018/018985/righting-scientific-wrong.

sudden, far-reaching changes to the Earth's climate and ecosystems that are self-reinforcing and irreversible. Climate scientists have identified several of these 'tipping points' that might be triggered by a temperate rise of just 1 to 3 degrees. This could lead to events such as the melting of the Antarctic ice shelves: the disappearance of these 'barriers', which protect the continental ice sheet from warmer ocean water, will cause other, larger ice sheets to melt too. If the Earth's temperature rises even further, ocean currents, which influence the local climate in many regions of the world, may weaken or shut down altogether. As a result, vast swathes of tropical rainforest could be turned into savanna, which would reduce CO_2 uptake and further drive temperature rises.[7]

1.3 Are humans responsible for current global warming?

Current global warming trends are anthropogenic – that is, caused by human activity. The vast majority of scientists agree on this (see section 1.5). It is true that the climate has changed dramatically many times over the course of the Earth's history. There were times when it was much warmer than it is today, with no trace of ice remaining even at the poles, and times when glaciers covered almost the entire surface of the Earth. However, natural causes cannot explain the current rise in temperatures, whereas the anthropogenic rise of atmospheric greenhouse gas concentrations can.

During the last 800,000 years, atmospheric CO_2 levels remained relatively constant at 280 ppm (parts per million, the unit generally used to measure concentrations of trace gases). Since humans began burning fossil fuels (coal, oil and gas) on an industrial scale and using them as their prime source of energy some 150 years ago, atmospheric CO_2 concentrations have skyrocketed by over 150 per cent. In 2014, the symbolically significant threshold of 400 ppm was breached. By 2017, levels had risen to 403 ppm.[8] In addition to natural CO_2 emissions, around 90 per cent of the CO_2 we emit into the atmosphere is produced by the burning of fossil fuels and cement production. The remaining 10 per cent results from changes in land use, mainly the clearing of forests and intensive industrial agriculture. Since the onset of industrialisation, the concentration of methane in the atmosphere, the second most significant greenhouse gas after CO_2, has more than doubled. The main sources of methane are livestock farming, rice cultivation and landfills, along with the extraction and transport of natural gas.[9]

The climate's reaction to these changes is predictable: it gets warmer. The first significant warming period from the start of the 19th century up to the 1940s was the result of both anthropogenic and natural causes. During this time, both the concentration of greenhouse gases and the sun's activity increased. Between 1940 and 1970, temperatures rose more slowly due to the cooling effect of soot and dust particles emitted by industrial processes, which only abated with the introduction of new environmental guidelines and filter technologies.

7 Lenton, T. M.; Held, H.; Kriegler, E.; Hall, J. W.; Lucht, W.; Rahmstorf, S.; Schellnhuber, H. J. (2008) 'Tipping elements in the Earth's climate system', in Proceedings of the National Academy of Sciences of the United Nations of America, No. 105, 2008, pp. 1786–1793. **8** The most recent data are available at 'www.esrl.noaa.gov/gmd/ccgg/trends/global.html#global'.

The most significant increase in temperatures has occurred since the 1970s, and can only be explained by human activity. None of the natural causes that could explain this increase apply: since the 1970s, rather than increasing, the sun's activity has actually been on the wane. The distribution of warmth in the atmosphere also shows that no source external to the Earth is behind current warming. If this were the case, the outer layers of the atmosphere would be heating up; however, these layers are currently cooling down – indicating that greenhouse gases in the atmospheric layers closer to the Earth are retaining warmth, which then does not reach the outer layers. Moreover, the chemical makeup of the additional CO_2 in the atmosphere shows it originated from fossil fuels. The burning of fossil fuels is evidently the main cause of rising atmospheric CO_2 levels.

In comparison to naturally occurring carbon dioxide, the share produced by humans is indeed small. The reason why it nevertheless has such a considerable impact is because CO_2 accumulates: plants cannot absorb as much CO_2 as is being emitted. Deforestation and the destruction of natural vegetation reinforce this effect. Once CO_2 enters the air and water cycles, the concentration of the gas takes a long time to decrease. Once started, the process of global warming will probably last for thousands of years.

1.4 What are the consequences of global warming?

Whether it is flooding along the Oder, the hottest summer in over a hundred years or a hurricane, every extreme weather event raises the same question: are we seeing the first impacts of climate change? Of course, we can never directly link any single event to long-term climate change because the weather, unlike the climate, is a product of chance. Even under a constantly stable climate, there would still be very hot and very cold days, and the possibility of level 5 tropical storms such as the recent Typhoon Haiyan and Hurricane Irma.

However, the probability – and, therefore, in the long-term, the frequency – of such extreme events is greater in a warmer climate. Higher average temperatures mean there is more energy, for example, to drive storms, or more evaporation and therefore higher precipitation levels that can in turn lead to flooding. Until recently, researchers were very cautious about drawing a link between extreme weather events and climate change. Extreme events are difficult to predict as numerous factors need to coincide in order for them to happen and natural fluctuations can be considerable. They also occur rarely, which means there is very little data available that can be used to recognise trends. However, by analysing data from Europe and the US, where weather data covering extended periods are available, and with the help of computer models, scientists are now able to make much more accurate predictions. For example, the number of heat waves in Europe, Asia and Australia has increased sharply in the last 50 years – and there can be little doubt that they will continue to become more frequent as

9 See Cremonese, L. and Gusev, A. (2016) The Uncertain Climate Cost of Natural Gas, IASS Working Paper, December 2016, available at 'https://www.iass-potsdam.de/sites/default/files/files/wp_dec_2016_en_uncertain_climate_cost_of_natural_gas.pdf'.

the Earth's temperature rises.[10] The same is also highly likely for heavy rainfall. Higher levels of evaporation cause higher precipitation, which increases by around two to three per cent per degree Celsius of air temperature. However, this does not mean that the entire globe will experience higher rainfall; the effect of higher temperatures will vary widely among regions. Nevertheless, new studies have shown that extreme rainfall is on the rise worldwide – in both humid and arid regions.[11] Such spells of brief yet intense rainfall often lead to flooding. Moreover, in its most recent report, the IPCC has made clear that the probability of storms and tornados has risen. This is also borne out by recent measurements.

The same applies to tropical storms. Most climate models predict that while higher temperatures will not lead to more tropical storms, both the frequency and intensity of very strong tropical storms – category 4 and 5 storms – will increase. This has been confirmed by measurements taken by climate research centres, some of which have been in existence for over a century in the US, as well as global climate and weather data collected by satellites since the 1970s.

However, for many people, the most immediate threat posed by climate change is sea level rise. As a result of the expansion of warmer water and the melting of glaciers, the global sea level has been rising since the middle of the 20th century. Today, it is 20 centimetres higher than in 1880. Most recently, this increase has accelerated, reaching an average of over 3.4 millimetres per year.[12] Sea level rise takes place with a considerable delay: even if effective measures are put in place to halt the rise in global temperatures, the seas and oceans will continue to rise for years to come. In its 2013 report, the IPCC predicted sea level rise of 28 to 98 centimetres by the end of the century, with a total increase of between one and three metres by the year 2300. Recent studies have since continuously adjusted these figures upwards. The US Global Change Research Program Climate Science Special Report published in November 2017 predicts sea level rise of 2.4 metres as early as 2100.[13] If the West Antarctic Ice Sheet becomes unstable and melts, as current research findings are suggesting, we should expect an additional sea level rise of several metres. The increase in sea level is an event that will impact billions of people. One third of the global population lives in coastal areas. Low-lying islands such as the Maldives and many Pacific island nations would become uninhabitable even if sea levels were to rise just slightly. If, as predicted, they rise considerably, vast swathes of land will be inundated, with several major cities the world over at risk of flooding.

Even today, low-lying regions are experiencing salination and consequently the devastation of agricultural land as a direct result of sea level rise. In early 2018, a study by the Potsdam Institute for Climate Impact Research calculated that increased temperatures across the

10 IPCC (2014) 'Climate Change: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change', Geneva 2014. See also Coumou, D. and Robinson, A. (2013) 'Historic and future increase in the global land area affected by monthly heat extremes', in Environmental Research Letters, 14 August 2013. An accumulation of heat waves such as this would be extremely unlikely in a stable climate. **11** Tollefson, J. (2016) 'Global warming already driving increases in rainfall extremes', 7 March 2016, available at 'http://www.nature.com/news/global-warming-already-driving-increases-in-rainfall-extremes-1.19508'. **12** See http://sealevel.colorado.edu/. **13** See https://science2017.globalchange.gov/chapter/executive-summary/.

globe could put far more people at risk of flooding. If global temperatures rise by two degrees, the number of people at risk in Germany would increase from 100,000 to 700,000 should no adaptation measures be put in place; in Asia and the US, millions more would be affected, the study predicts.[14]

Moreover, the warming of the oceans will make life harder for the fishing industry as warm water contains less oxygen. Pronounced warming will lead to an increase in ocean 'dead zones', where fish cannot survive. Conditions for marine life will also become more difficult because CO_2 dissolves in and acidifies the oceans. There is already evidence that ocean acidification is taking place.

Less clear are the consequences for agriculture. Some models predict increasing harvests of staple foods, whereas others predict negative impacts under moderate global warming. The consequences of global warming so far, however, seem to have more of a negative than a positive impact on harvests. What is clear is that regions closest to the poles, such as the Scandinavian countries and Canada, will benefit most. The negative impacts will be greatest for those countries already struggling with heat and drought, and which are today most affected by poverty, exploitation and war. Should global warming ever exceed two degrees Celsius, the production of staple foods will very likely collapse globally.

The same is true for many other potential consequences of global warming, such as the extinction of animals and plants that are unable to adapt quickly enough to changed climatic conditions, or the destruction of sensitive ecosystems, such as rainforests or the Arctic. The consequences fundamentally depend on how emission levels develop. Should emissions continue to rise at the current rate, the Earth could become four to six degrees warmer. The effects of such warming are difficult to fathom.

1.5 How accurate are the forecasts?

The concept of climate change is not a new one. The basic mechanism behind it – that rising concentrations of CO_2 lead to an increase in temperatures on Earth – has been known for 150 years. Data on the Earth's history obtained from ice cores, sediments or pollen analyses confirm this, as do laboratory experiments and computer models designed to simulate the climate system in as much detail as possible. It is undisputed that the Earth is currently warming. Moreover, the vast majority of the scientific community agrees that human activity is to blame. The IPCC declared in its latest report that current warming was caused by human activity with at least 95 per cent confidence – about as definitive as a scientific statement can get.

The debate in the media and society, however, does not reflect this consensus among researchers concerning the central facts. Rather, climate change is often presented as a 'contested issue'. Unlike other environmental concerns, such as the hole in the ozone layer or the damaging effects of pollution, climate change has become a battleground for fierce struggles over (scientific) truth and political worldviews.

14 Potsdam Institute for Climate Impact Research (2018), 'Adaptation now: River flood risks increase around the globe under future warming', press release, 11 January 2018, available at 'https://www.pik-potsdam.de/news/press-releases/adaptation-now-river-flood-risks-increase-around-the-globe-under-future-warming'.

These controversies have repeatedly surfaced at the IPCC, which was created by the UNEP, the UN's environment agency and the World Meteorological Organization (WMO) in 1988. The IPCC itself is not involved in research. Instead, every four to five years it publishes a comprehensive scientific report of several thousand pages that summarises the latest research findings in the field of climate change. The IPCC has repeatedly been subjected to intense criticism and accusations of scaremongering and exaggerating the facts, even though it is viewed as a conservative body that produces extremely cautious assessments and prognoses by climate scientists. Many climate and ocean scientists, for instance, believe that sea level rise will exceed the predictions of the IPCC report by a wide margin.[15] The IPCC analyses can therefore be regarded as the 'lowest common denominator' of climate research findings.

Contradictory assessments of the situation – ranging from 'every hot day is a sign of climate change' to 'new facts refute claims about climate change' – make many people feel uncertain; they do not know what or whom to believe, and a number of different aspects all play a part in this.

On the one hand, there is a small but influential group of 'climate sceptics', i.e. scientists and/or laypeople, who either deny outright the existence of global warming, or dispute that it is the result of human activity. Unlike renowned climate scientists, who follow the standard scientific practice of questioning current models and developing new hypotheses, these climate sceptics position themselves outside of the scientific peer-review system. They accuse science of being a monolithic block that works with manipulated data, suppresses dissenting opinions and is controlled by politicians.[16] Although many of these researchers have a dubious reputation among serious scientists, and many of their so-called facts are easy to refute, they play a far more prominent role in the media and the public sphere in general than their scientific relevance would justify, particularly in the US. This phenomenon has become even more pronounced since an avowed climate sceptic, Donald Trump, became president of the US. The media often prefer to publish stories on bitter arguments and sensational new results rather than the many small pieces offered by researchers that contribute to the puzzle by complementing or confirming previous assumptions. On countless occasions, journalists have revealed that prominent climate sceptics are on the payroll of big oil or other lobby organisations. Since 2014, the New York attorney general's office has been investigating the US's largest oil company, Exxon. The corporation is accused of having had in-depth knowledge of global warming – as far back as the 1970s – obtained through its own research. Besides being accused of keeping this knowledge secret, the corporation is also alleged to have funded and published studies and reports denying climate change over a ten-year period.[17] Meanwhile, there

15 See Horton, B. P.; Rahmstorf, S.; Engelhart, S. E.; Kemp, A. C., 'Expert assessment of sea-level rise by AD 2100 and AD 2300', available at 'https://www.sciencedirect.com/science/article/abs/pii/S0277379113004381'. **16** See, for example, the position paper published by the European Institute for Climate and Energy (EIKE), a coalition of climate sceptics, who present their arguments as scientific and regularly make appearances in the media, available at 'www.eike-klima-energie.eu/die-mission/grundsatzpapier-klima/'. **17** Jerving, S.; Jennings, K.; Melissa, M.; Rust, S. (2015) 'What Exxon knew about the Earth's melting Arctic', in The Los Angeles Times, 9 October 2015, available at 'http://graphics.latimes.com/exxon-arctic/'.

seems to be an overlap between radical climate sceptics and the New Right.[18] Islamophobic blogs decry the 'climate scam'.[19] In his writings, Anders Breivik, the perpetrator of the 2011 terrorist attacks in Oslo, also picked up on the classical arguments of climate sceptics, i.e. that climate change had been invented for political gain.

Moreover, there are also many people who by no means consider themselves radical climate sceptics, but are nonetheless exasperated by the intense controversies surrounding climate change. This probably has to do with the complexity of the issue. Detecting changes in the climate requires long-term observations, and the Earth's climate undergoes many natural shifts, which occur in addition to and at the same time as human activities that affect the climate. As researchers have repeatedly stressed, predicting a trend requires a timeframe of at least 15 years. In our fast-paced world, this fact is difficult to convey. Even in cases where long-term data do exist, a complex system like the world's climate makes definitive predictions impossible. It is therefore not surprising that a key aspect of the work of the IPCC consists in dividing hypotheses and findings on climate change into different categories: virtually certain (over 99 per cent confidence); extremely likely (over 95 per cent confidence) and very likely (over 90 per cent confidence).

Because research is very technical and increasingly focused on the creation of computer models, climate change is becoming an ever more complex issue. Although climate change models are helpful to understand the details of the Earth's climate system and to assess the likely effects on individual regions, they nonetheless reinforce the impression that only a select group of adept experts can actually understand new climate change findings. The question of whether humans are, despite our increasingly powerful computers, actually able to accurately predict changes to something as complex as the Earth's climate is undoubtedly justified. But how precise do the predictions have to be? This question points to the classical concern that drives all environmental policy: how great must a risk be to require (or justify) action? Or, expressed in different terms, how much evidence of a chemical's carcinogenic properties is required for it to be prohibited? If the probability of an MCA (Maximum Credible Accident) in a nuclear reactor is less than two per cent, does that make the use of nuclear energy appropriate? Or should we only proceed if it is less than one per cent? Would it be better to avoid such risks entirely? Moreover, who should be making these calls?

These questions also play a key role in climate change discussions. Climate change is a highly political issue – but this does not mean that action should not be taken. On the contrary, this very fact is what makes action possible in the first place. How climate change is researched and discussed, as well as what is recognised as the 'truth' and how people respond to it are all political questions.

Scientifically speaking, the IPCC is doing an excellent job – and there are very few scientific institutions that work as trans-

18 Goldenberg, S. (2015) 'Work of prominent climate change denier was funded by energy industry', in The Guardian, 21 February 2015, available at 'www.theguardian.com/environment/2015/feb/21/climate-change-denier-willie-soon-funded-energy-industry http://www.ucsusa.org/assets/documents/global_warming/exxon_report.pdf'. **19** This is the key phrase used by some, for example, the right-wing website 'Politically Incorrect', to report on climate change.

parently as the panel does – but it nevertheless remains a political body. Unlike the reports themselves, the summaries of the reports are approved by representatives of the states involved in the panel. Even though they cannot change the data, the choice of wording and of which issues to highlight is, of course, subject to intense debate. However, any allegation that the science is not yet sufficiently reliable to justify action fails to recognise that political action can never be reduced to the implementation of scientific 'truths', and ignores the fact that every day, politicians make decisions in other domains based on assessments that are methodologically far sketchier than our current knowledge about climate change. Everyone agrees that economic research institutes are political institutions, and only rarely are economic prognoses more than rough estimates. Nonetheless, this has never stopped a government from calculating revenue and establishing a budget based on such data.

Furthermore, it is notable that with regard to climate change in particular, the research itself and calls for more reliable forecasts have become the subject of intense discussion and debate. No one is questioning the available data; there is clear evidence for climate change, and the process has been well researched. What is more, the forecasts are gaining in accuracy and coincide with observations and measurements on the ground. The fact that large numbers of people in the US and Europe remain unconvinced that climate change is happening and that it is caused by human activity is not a problem that can be solved with more data or even more reliable predictions: the issue here is not a question of science but of politics and society.

2 CLIMATE POLICY

2.1 What does climate change have to do with justice?

A warmer climate does not necessarily have to be worse than a cooler one. Nevertheless, the current and expected future consequences of climate change mean that global warming, and mainly the speed at which it is occurring, will potentially have drastic impacts on ecosystems and society. In the past, abrupt climate change has often led to the mass extinction of species. The period in which humankind has emerged is called the Holocene, the current geological epoch that encompasses the 10,000 years since the end of the last ice age – a period with an unusually stable climate. Many societies will probably not be able to adapt to a rapidly changing climate.

Many political and military institutions classify climate change as a 'security risk' because they predict that 'natural' disasters, such as droughts, famines, floods and storms could lead to civil unrest and greater migration. In 2015, 19 million were displaced by extreme weather events or their effects; sea level rise is a particularly high risk for Asia, where millions could be affected. Multiple scientists have made a connection between the effects of climate change and the Arab Spring uprisings of 2011. In a 2014 report, the US Depart-

ment of Defence called climate change a 'threat multiplier' because it heightens the risk of existing threats such as terrorism.[20]

However, this assessment of climate change as a security risk also has its critics. As some social scientists argue, 'natural' events alone cannot explain uprisings, unrest and migration. They point to the data of UN organisations showing that hunger and malnutrition are only rarely the consequence of drought or insufficient production. Rather, poverty, inadequate social security and the fluctuation of food prices due to speculation are behind such events. Moreover, as advocates of migrant rights point out, this focus on security portrays the victims of climate change as a threat. This is because climate change affects people in different regions of the world in very unequal ways: the most severely affected are those who have contributed the least to global warming. The countries and regions where the effects of climate change will be felt most intensely, such as the Sahel in Africa or the coastlines of Southeast Asia, have only emitted very small amounts of greenhouse gases into the atmosphere over the past 150 years – in stark contrast to Europe and the US, whose economic success is in no small part thanks to the 'externalisation' (a concept introduced by Stephan Lessenich) of the negative ecological consequences of their mode of production and lifestyles. Since the 1990s, this has led to discussions on whether industrialised nations should bear the brunt of the costs of climate change because the historical responsibility is theirs. Should emerging nations also have to reduce their emissions or do they, like industrialised nations in the past, have a right to burn fossil fuels in order to 'develop' their economies?

In terms of emission levels, the emerging nations have already caught up. Today, China is the greatest emitter of CO_2, ahead even of the US. Overall, however, the contribution of the Global South to climate change is much smaller than that of the Global North, in particular when comparing not just national but per capita emissions. In 2014, this figure stood at 16.5 tons per year in the US, 8.9 tons in Germany and 7.5 tons in China. Per capita emissions in the Gulf States are even higher (Qatar tops the list with over 40 tons per year) and far lower in countries such as India, where yearly per capita emissions were 1.7 tons. Emissions in African countries such as Ethiopia amount to just 0.1 tons per person per year.[21] If we were to add together all the emissions that the rich countries of the North have released into the atmosphere over recent centuries, the US would be way out in front, accounting for roughly 30 per cent. China's share, meanwhile, would amount to just 10 per cent. If we look at historical per capita emissions, however, countries such as Luxembourg and the UK are up there with the US. But even such data provide a distorted picture. Today's large corporations operate on a

20 For more on the theory that climate change exacerbates conflicts and crises, see Burke, M. B.; Miguel, E.; Satyanath, S.; Dykema, J. A.; Lobell, D. B. (2009) 'Warming increases the risk of civil war in Africa', in Proceedings of the National Academy of Sciences of the United Nations of America, No. 106, 2009, pp. 20670–20674. See also Kelley, C. P.; Mohtadi, S.; Cane, M. A.; Seager, R.; Kushnirr, Y. (2015) 'Climate change in the Fertile Crescent and implications of the recent Syrian drought', in Proceedings of the National Academy of Sciences of the United Nations of America, No. 112, 2015, pp. 3241–3246. **21** The World Bank: Data. CO2 emissions (metric tons per capita), Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, available at 'https://data.worldbank.org/indicator/en.atm.co2e.pc'.

global scale – but this is not considered when apportioning responsibility for emissions, which are attributed to the country where goods are produced, rather than the one where the final product is consumed. One third of China's emissions are generated during the production of goods for export.

Mean values also obfuscate the enormous differences that exist within countries. Whereas the lifestyles of the globalised elite in Brazil, China or India put just as much strain on the environment as those led by consumers in the North, the emissions produced by small-scale farmers and slum dwellers in the same countries lie far below the mean value. There is also a need to differentiate among the industrialised nations themselves. Studies show that a person's ecological footprint increases in step with income. In Canada, the ecological footprint of the richest 10 per cent is two to three times greater than that of the poorest 10 per cent. As early as the 1990s, Indian activists argued that emissions should not be taken at face value, asking whether the amount of methane released by the small-scale rice paddies tended to by an Indian subsistence farmer should really be compared to the CO_2 emitted by a 4x4 driver out for a Sunday afternoon ride?

At the same time, those who contribute the least to climate change are also those least able to protect themselves against its consequences. Hurricane Katrina powerfully demonstrated the extent to which this is also true for the countries of the Global North. When this category five tropical storm hit the southern US city of New Orleans in August 2005, the levees failed and the storm flooded around 80 per cent of the town. The white middle and upper classes lived mostly in elevated parts of the city and, as they owned their own vehicles and had the necessary financial means, they were able to get out of the town in time. The mostly black population in the poorer quarters, however, were left to fend for themselves. No evacuation was carried out, and in the wake of the catastrophe survivors trapped by the flooding had to wait days for water, food, medicine and aid. At least 1,800 people died and hundreds of thousands had to leave the city. Most were unable to return to their homes and neighbourhoods, and still live scattered across the US to this day. In the aftermath, the city tore down most of the destroyed parts of the town, mainly public housing projects, and sold the land to private investors.

Hurricane Katrina is one event that highlights numerous issues: the impossibility of predicting natural disasters; how climate change increases the likelihood and intensity of such disasters; the unequal opportunities that the poor and the rich have to protect themselves; racism and the indifference of the elite vis-à-vis society's weakest members; how drastic cuts to public spending and infrastructure investment driven by neoliberal policies during the years preceding the catastrophe meant that the city was neither able to maintain the levees nor provide the necessary emergency aid in the face of such a disaster.

What is true for New Orleans is true for the rest of the world. Climate change itself does not cause inequality, but it does reinforce existing inequalities. What is more, climate change, when combined with past decades of neoliberal economic policies, frequently leads

to catastrophic outcomes. In particular, states in Africa and Latin America or Asia that will be heavily affected by climate change have, since the 1980s – often in exchange for World Bank or IMF loans – cut back their social security systems and public infrastructure and services, the very structures that are supposed to protect the population in the case of disaster. Moreover, in some cases it has been the exact same institutions, the World Bank in particular, that have led the charge when it comes to the implementation of climate protection and adaptation measures. As of yet, there has been no critical analysis of how neoliberal policies have, since then 1980s, heightened many groups' susceptibility to climate change – and continue to do so. Instead, these policies remain in place, albeit under a different guise, even when it comes to climate change.

2.2 What measures has the world taken to combat global warming?

In 1992 in Rio de Janeiro, thousands of representatives of states and NGOs met for the United Nations Conference on Environment and Development. Known as the Earth Summit or Rio Summit, this conference marked the beginning of international climate policy. Four years earlier, the IPCC had met for the first time and, in an elaborate process, compiled all the available research on global warming. The data sent a sufficiently strong message and the Rio conference subsequently adopted the Framework Convention on Climate Change (UNFCCC) to achieve a 'stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.[22]

But who defines what 'dangerous' levels are? And dangerous for whom? To make this vague goal more concrete, the 2 °C limit was established in the years that followed: according to this target, average temperatures on Earth should not rise beyond 2 °C compared to pre-industrial levels. It was thought that this would prevent the worst effects of global warming and limit the likelihood of self-reinforcing processes or abrupt shifts triggered by the reaching of certain tipping points. Two decades later, the international community was still far from complying with its target of limiting warming to below 2 °C. Nevertheless, the Paris Climate Summit in December 2015 agreed on an even more ambitious aim: the text of the agreement states that global warming should be kept 'well below two degrees' and efforts should be made to limit the increase to 1.5 °C. This was mostly down to pressure from African states and Pacific island nations.
Since 1992, a number of countries have introduced climate protection legislation. States, companies and cities, as well as many organisations both large and small, have committed themselves to tackling the issue. Nonetheless, international actors are still those setting the agenda; annual climate conferences, where the heads of state and government meet, are central events when it comes to climate policy. In 1997, in the Japanese city of Kyoto, delegates signed the first legally binding climate agreement, a pact based on the Framework Convention on Climate Change. It specified binding emission reduction targets for individual industrialised countries: between 2008

22 United Nations Framework Convention on Climate Change, Art. 2, available at 'unfccc.int/resource/docs/convkp/convger.pdf'.

and 2012 they were to reduce their greenhouse gas emissions by 5.2 per cent compared to 1990 levels. This was more of a conservative compromise than an ambitious goal. Nevertheless, the US, fearing potential negative consequences for its economy if emerging nations such as China did not also commit to reducing emissions, refused to ratify the document. Despite this, the Kyoto Protocol entered into force in 2005. Without the US, and considering the generous exceptions granted to Russia in order to ensure its accession, the Protocol did not achieve much.

At the end of 2009, delegates met in Copenhagen to decide on a new post-2012 treaty. However, conflicts at the conference escalated – both between North and South and between the industrialised countries and emerging nations – causing the negotiations to collapse. It took another six years before any progress could be made. On 12 December 2015, the Paris Climate Summit culminated in a new climate agreement. The Paris Agreement entered into force just under a year later on 4 November 2016. It has been signed by all of the world's states. However, the treaty, which was hailed as a huge diplomatic success and a giant leap forward in terms of climate policy, suffered a bitter setback as Donald Trump, a staunch opponent of climate protection and the Paris Agreement, was elected president of the United States shortly after it came into effect. Trump has since announced that the US will withdraw from the agreement. For now, at least, this has been nothing more than rhetoric: a country can only formally signal its intention to exit the agreement three years after signing it, meaning Trump has to wait until November 2019. It then takes another year for the state to actually leave the agreement – just in time for the next US presidential elections in 2020.

2.3 What have previous measures achieved?

What measures are necessary to limit global warming to below the 2 °C threshold, or, ideally, 1.5 degrees? If emissions rise, as they have been doing for the past 150 years, they accumulate in the atmosphere, the Earth becomes warmer and this leads to a self-reinforcing process. When ice cover at the poles and on mountaintops decreases, less sunlight is reflected; warming increases the amount of moisture in the atmosphere and this additionally acts as a greenhouse gas. There is a certain amount of delay in this process: even if we cut greenhouse gas emissions by 100 per cent, global warming will continue for a long time.

As evidenced by the models and data from the Earth's history, changes to the climate system are by no means linear. Our climate is a complex system with many feedback loops; there are therefore numerous tipping points. Go beyond these tipping points and the system abruptly enters another state. Small changes to factors such as temperature or rainfall can thus lead to large-scale and significant changes in climatic conditions. Scientists have identified a whole set of such tipping points; for example, there is the possibility that the Gulf Stream in the North Atlantic might shut down, or the patterns of the Indian Monsoon could change. Another such point is the self-reinforcing melting of the Greenland ice sheet or the thawing of permafrost in Russia and Canada,

releasing huge amounts of methane. As these tipping points cannot be exactly specified, and because the effects would be serious and irreversible, scientists are calling for immediate measures. The sooner atmospheric CO_2 concentrations begin to decrease again, the greater the opportunity to slow global warming and reduce the potential for extreme climate change.

However, so far, global climate policy has achieved absolutely nothing. Rather, the increase in emissions has accelerated. Between 1990, the year the Kyoto Protocol was signed, and 2010, greenhouse gas emissions increased from 37 to over 50 gigatons of CO_2e,[23] or by over a third. Globally, emissions have only fallen once – as a consequence of the financial crisis that shook the world in 2009 – before returning to even higher levels shortly thereafter. Between 2014 and 2016, emissions largely remained stable. Observers were already discussing the possibility that perhaps a peak had been reached, hoping that this was the start of a new, low-emission era. However, they were gravely mistaken: 2017 saw another sharp uptick in greenhouse gas emissions of 1.7 per cent. The figure for 2018 is set to be even higher. A sea change is clearly still some way off – if such a shift is even possible in a growth-based economy.

2.4 Why have previous efforts to protect the climate been so unsuccessful?

Considering the amount of effort required to organise and conduct large-scale climate conferences and the importance of the issue of climate change – controversies in the world of media and politics aside – it is surprising how few of these countless words have actually been turned into action. There are multiple reasons as to why efforts to cut emissions and slow climate change have, so far, not worked.

On the one hand, it took years to create a binding climate agreement. The Kyoto Protocol, the world's first ever global climate agreement, was in force from 2008 to 2012. However, key industrialised countries, such as the US, Canada and Australia, never became party to the agreement. When the Kyoto Protocol expired, negotiations failed and it was not until 2015 that a new climate pact was reached with the Paris Agreement. Even in those cases where agreements were achieved, these were always, and continue to be, full of loopholes. Agreeing on 1990 as the base year in the Kyoto Protocol, for example, meant that the former states of the Soviet Union and post-reunification Germany were able to claim enormous CO_2 emission reductions.[24] Furthermore, the Kyoto Protocol's so-called flexible (i.e. 'market-based') mechanisms, which are also present in the Paris Agreement, albeit in a slightly revised form, provided a system whereby emissions could be traded. Instead of reducing emissions, as had been agreed, companies or countries could buy emission certificates from other countries or from projects, frequently in the Global South (see section 2.5). This has a two-fold negative

23 Carbon dioxide equivalents (CO2e) is a unit for expressing the impact other greenhouse gases, such as nitrous oxide and methane, have on the climate in terms of the amount of CO2 that would have the same effect. **24** All of the emission reductions agreed in the Kyoto Protocol were always calculated in relation to the base year: 1990. In the years that followed, both in Germany's new federal states and in the former Eastern Bloc countries, numerous old factories were shut down and a large part of the region's industry collapsed, which meant that these countries had 'achieved' emission reductions without actually taking any concrete action.

effect. Chaotic carbon markets and the lack of controls often makes it impossible to say whether a claimed emissions reduction has actually taken place. At the same time, the option of simply buying cheap emission certificates elsewhere removes the incentive for both industrialised and emerging countries to make the necessary transition to alternative forms of mobility, energy generation and production.

Above all else, such a transition would imply one thing: a move away from fossil fuels. Studies show that if we are to limit the increase of global average temperatures to 2 °C, then we can only burn 20 per cent of currently known fossil fuel reserves, leaving eighty per cent in the ground.[25] However, there is nothing to indicate that such a transition is occurring, even though recent calculations indicate that it would be both possible and economically viable to phase out fossil fuels in order to reach the two-degree target.[26] So far, climate negotiations have never touched upon the issue of fossil fuels. Oil and energy companies, whether multinational corporations or state companies, are powerful stakeholders, and nearly every state in the world subsidises the production of coal, gas and oil. The International Monetary Fund (IMF) has calculated that fossil fuels are subsidised to the tune of USD 500 million a year. If we factor in indirect subsidies, such as health and disposal costs, the yearly total comes to USD 5 billion.[27]

Although for many years people have talked about the depletion of fossil fuels (particularly peak oil – the point at which the amount of oil produced decreases and prices begin to rise indefinitely) and how they are the main cause of climate change, fossil fuels appear to be making an unexpected comeback. In part, this is due to the expansion of fracking, a technically highly complex method of producing oil and gas that is also very damaging to the environment. In the past it was mainly emerging nations, such as China, India and Brazil that refused to agree to emission cuts – arguing that they too were entitled to use fossil fuels to develop their economies – but this trend has shifted in recent years. While China has been making firm commitments to reduce its emissions since 2015, and is increasingly moving away from fossil fuels, today it is mainly countries in the west, such as the US and Canada, that are investing in new coal, oil and gas extraction or remain focused on extracting brown coal – the most damaging of all fossil fuels – as is the case in Germany, for example.

Underlying all of these aspects is a fundamental problem: effective measures against global warming are incompatible with current economic policies. During the last 25 years, humanity recognised global warming and understood the need for action. This very period, however, was also marked by the collapse of the Eastern Bloc, followed by a wave of economic globalisation, the enforcement of free trade agreements and the implementa-

25 In the third section of its 2014 report, the IPCC predicts that in order to meet the two-degree target, only around 1,000 gigatons of additional CO2e can be released. Currently, existing fossil fuel reserves are known to contain approximately three or even four times that amount. See www.ipcc.ch/report/ar5/wg3/ and McGlade, C. and Ekins, P. (2015) 'The geographical distribution of fossil fuels unused when limiting global warming to 2°C.', in Nature, No. 517, pp. 187–190; Carrington, D. (2015) 'Leave fossil fuels buried to prevent climate change, study urges', in The Guardian, 7 January 2015, available at 'www.theguardian.com/environment/2015/jan/07/much-worlds-fossil-fuel-reserve-must-stay-buried-prevent-climate-change-study-says'. **26** The New Climate Economy: Report 2016, available at 'http://newclimateeconomy.report/2016/'. **27** IMF/IEA (2017) 'World Energy Outlook 2017', available at 'www.iea.org/weo2017/'.

tion of neoliberal economic policies in large parts of the world. The reduction of trade barriers and tariffs has increased competition between states and regions. Environmental policies, stricter controls and higher energy prices quickly become detrimental to national competitiveness. The prospect of companies outsourcing production abroad is a major concern. 2009, when the world was at the height of the economic crisis, was the only year in this century in which emissions did not rise further, highlighting the fact that global economic conditions have a far greater impact on emissions than all negotiations.

As long as we do not question and deal with this fundamental contradiction, we cannot expect emissions to go down. The age of free trade agreements, in which social and environmental legislation is frequently rejected as an 'obstacle' to free trade, is not over. Until recently, the World Trade Organisation (WTO) was urging countries to open their markets, thereby undermining local environmental legislation. In 2014, after a complaint by Japan and the EU, the WTO forced the Canadian province of Ontario to withdraw a part of its energy transition law, which was put in place to promote renewable and local energy production.[28] The WTO ruling was followed by regional and bilateral free trade agreements. The more recent shift in US policy under President Trump is unlikely to do much to reduce the commercial push for locations and production conditions favourable to business; in fact, the opposite is true. These phenomena will become more widespread, which is bad news for advocates of stricter environmental controls and more effective climate policy.

2.5 What does the Paris Climate Agreement say about climate protection?

From 30 November to 11 December 2015, the COP21 (Conference of the Parties to the Framework Convention on Climate Change), the 21st UN climate conference, took place in Paris. Expectations were high and they were met: after the failure of the Copenhagen conference in 2009 and the ensuing years of deadlock, parties hoped to thrash out a new, legally binding climate agreement in Paris. On 12 December 2015, against a backdrop of jubilant delegates and worldwide rejoicing, France's then foreign minister Laurent Fabius finally announced that the Paris Agreement had been adopted.

This is, first and foremost, a diplomatic success. By signing the Paris Agreement, (almost) every state officially acknowledges that climate change is real, that it is being caused by human activity and that action must be taken to mitigate its effects. Unlike with the Kyoto Protocol, this time the US was on board, at least initially, as was China. These two competing world powers, together responsible for around 40 per cent of global emissions, had negotiated a deal to reduce their emissions in the run-up to the conference.[29] The target ultimately enshrined in the agreement was even more ambitious, aiming to restrict warming by 1.5 °C rather than 2 °C compared to pre-industrial levels.

28 Moore, R. (2013) 'Ontario to change green energy law after WTO ruling', in The Canadian Press, 29 May 2013, available at 'www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/ontario-to-change-green-energy-law-after-wto-ruling/article12236781'. **29** Taylor, L.; Branigan, T. (2014) 'US and China strike deal on carbon cuts in push for global climate change pact', The Guardian, 12 November 2014, available at 'https://www.theguardian.com/environment/2014/nov/12/china-and-us-make-carbon-pledge'.

The fact that this deal was at all possible was due in part to the fresh approach adopted by lead negotiators from 2014. They stopped setting specific targets for individual countries and instead invited states to suggest their own. In the run-up to the Paris Climate Summit, every country submitted details on their 'Intended Nationally Determined Contributions' (INDC) to reducing emissions. Now that the Paris Agreement has been signed, these simply go by the name NDCs: 'Nationally Determined Contributions'. This means that each government declares the amount by which they intend to reduce their country's emissions and how they plan to achieve this goal. These pledges include a commitment to regularly report on how the implementation of proposed measures is going at future climate conferences. The Paris Agreement stipulates that all signatory countries must set out new, more ambitious NDCs every five years.

The negotiators' hope that by making such statements voluntary, they were less likely to be met with resistance – thereby increasing the likelihood of an agreement being reached – appears to have paid off. However, it remains to be seen whether this approach actually goes far enough to protect the climate. The NDCs can take on very different forms, making them difficult to compare. One example is the fact that countries use different base years. Some also do not state their reduction targets in concrete figures, i.e. the amount of CO_2 that they plan to reduce; they simply make vague proclamations. There are no plans to impose sanctions. If a country misses its target, nothing happens. Even if all of the countries implement their planned measures and were to reduce their emissions by the amount stated – which has yet to actually happen – we would still be nowhere near achieving the 2 °C target. It has been calculated that even if all voluntary obligations as stated in November 2017 were met, we would still be facing a temperature rise of 3.2 °C.[30] Even when it comes to financial commitments for adaptation measures – the second crucial issue contained in the agreement – concrete measures have so far been few and far between. There is an enormous gap between the acknowledgement that climate change is a pressing issue and the actual solutions negotiated under the Paris Agreement.

Accordingly, the calendar of international climate diplomacy events, with all its summits, preliminary meetings, institutions, working groups and expert panels, should be regarded primarily as a forum for parties to negotiate and argue over how to deal with climate change, and which interests to take into consideration. There are two key issues in today's climate politics. Firstly, there is the continued search for 'technological' solutions. The lobby for 'industrial-scale' technological solutions to the problem of climate change has grown in recent years. Conversely, environmental groups and social movements that are fighting against climate change have pointed to the need for humanity to change its relationship with the natural world. They argue that the root cause of global warming is an attitude based on the domination and exploitation of nature.

Due to pressure from indigenous groups and individual states, such concerns have, to a certain degree, made their

30 See http://climateactiontracker.org/global.html.

way into climate-related documents. All concrete proposals, however, point in the opposite direction: there is no change in fundamental attitudes, rather, technology and efficiency are meant to solve the problem. Such strategies include Carbon Capture and Storage (CCS), along with geo-engineering proposals such as the idea of deploying huge solar sails in space, artificial ocean fertilisation or the sealing off of large land areas to reflect sunlight.[31] These proposals are based on a (highly controversial) argument: because we are unable to halt climate change by reducing emissions, dangerous warming must be prevented by technological means. In 2007, the IPCC was still arguing the case for the only truly safe approach, i.e., reducing emissions. In its most recent report, however, the panel now also contemplates geo-engineering as a possible solution.

The second major issue is the role of markets. The Kyoto Protocol established so-called flexible mechanisms and the possibility of trading emission certificates on financial markets. Underlying this is a very simple idea: the Earth's climate does not care where we reduce emissions. A company can, therefore, provide funding to a project or pay a company to reduce emissions elsewhere instead of reducing emissions itself. Such projects or companies receive certificates equivalent to the amount of emissions saved and can sell these on carbon trade exchanges. However, numerous studies show that in practice the system does not work.[32] Due to a surplus of emission allowances, the price of certificates is far too low. With most certificates, it is also not clear whether and to what extent they actually represent real emissions reductions. There is no mechanism to prevent emissions from being counted multiple times. Moreover, the system has been highly susceptible to corruption and fraud. Even the United Nations estimates that over a third of certificates traded on carbon markets are fake.[33] Courts have repeatedly sentenced fraudsters who have evaded paying millions in taxes by trading certificates.[34] Nevertheless, emissions trading has become increasingly prominent, and the issue plays a key role in the Paris Agreement and many national and regional climate protection plans.

Since the 2007 financial crisis, the financial sector has been searching for new investment opportunities. Investments in land, the environment and nature services are a fast-growing and lucrative market. A whole range of new climate-related speculative instruments has emerged. One of these is the controversial REDD+ mechanism that incorporates forests into emissions trading. Since forests absorb atmospheric CO_2, deforestation contributes to climate change. Accordingly, REDD+ advocates argue that certificates should be awarded for forest conservation. Concretely, this means that if a country or company claims to have halted plans to totally or partially cut down a forest,

31 See www.etcgroup.org/issues/climate-geoengineering and www.boell.de/en/geoengineering. **32** See Gilbertson, T. and Reyes, O. (2009) 'Carbon Trading. How it works and why it fails' in Critical Currents, No. 7, Dag Hammarskjöld Foundation, Uppsala, 2009; Bullock, S.; Childs, M.; Picken, T. (2009) A Dangerous Distraction. Why offsetting is failing the climate and people: the evidence, Friends of the Earth (eds), London 2009, available at 'ww.foei.org/wp-content/uploads/2014/02/dangerous_distraction.pdf'. **33** UNEP (ed) (2014) 'The Emissions Gap Report 2014', available at 'www.unep.org/publications/ebooks/emissionsgapreport2014/portals/50268/pdf/EGR2014_LOWRES.pdf'. **34** https://www.reuters.com/article/us-deutschebank-court/former-deutsche-banker-jailed-for-carbon-trading-fraud-idUSKCN0YZ1S6; https://www.france24.com/en/20160503-france-trial-multi-billion-carbon-emissions-trading-fraud-opens-paris.

then it is entitled to carbon certificates for the trees left standing – a market worth billions, and one that is almost impossible to control. Deals of this sort already in place have led to the displacement of local populations and the destruction and clearing of rainforests with the aim of creating profit-generating plantations in combination with a large-scale selloff of CO_2 certificates.

Meanwhile, in October 2016, the International Civil Aviation Organization (IACO) agreed on a climate plan for the aviation sector. Air traffic is one of the fastest growing sources of greenhouse gas emissions. Under the plan, aviation emissions are to be allowed to continue to rise until 2020, after which all emissions exceeding the 2020 base year must be offset by purchasing emission certificates. As the aim is to compensate for these emissions largely through forestry projects, the plan is expected to give these projects a major boost.[35]

The trade in emission certificates largely takes place between the Global North and the Global South. The European Union Emissions Trading System (ETS), the largest scheme of its kind in the world, allows participating companies to 'purchase' a share of the stipulated reductions from countries in the Global South. Instead of reducing their emissions themselves, they buy certificates from projects in other parts of the world. The number of certificates they are allowed to purchase differs from country to country; in Germany, the figure stands at 22 per cent of the stipulated emissions reduction target. Critics have dubbed this a 'new form of colonialism'. Movements from the Global South strongly reject mechanisms such as REDD+, alleging that they only aim to further monetise nature and ensure financial markets gain control of the last remaining commons.[36] In addition, the mechanism is closely linked to land grabbing because the certification process is complex and the sale of CO_2 certificates on international markets is only profitable for large-scale producers. Environmental organisations argue that it is not a good idea to delegate responsibility for protecting the world's climate to an institution as crisis-prone as the stock exchange.

Nevertheless, recent years have seen a host of additional climate-related financial instruments enter the market. Climate-smart agriculture certificates, for example, are granted for particularly 'climate friendly' forms of agriculture, mostly involving particular technologies or genetically modified plants. A central role in the development of this concept has been played by the World Bank. Peasant organisations such as Via Campesina sharply criticise the project, saying that it simply perpetuates the same trend that has seen large agribusiness companies take control of global food production over the last 20 years. According to Via Campesina, this has led to hunger, malnutrition and dependency on the world market, even in countries that used to be able to meet their own needs for staple foods.[37]

35 For the latest on this scheme, see www.icao.int/Newsroom/Pages/ICAO-Council-reaches-landmark-decision-on-aviation-emissions-offsetting.aspx; for a critical perspective, see www.redd-monitor.org/2018/01/11/the-international-civil-aviation-organisations-draft-rules-for-carbon-trading-and-climate-crisis/. **36** See www.redd-monitor.org/2011/09/17/our-carbon-is-not-for-sale-via-campesina-rejects-redd-again/; 'We reject REDD+ in all its versions', letter from Chiapas, Mexico opposing REDD in California's Global Warming Solutions Act (AB 32), available at 'www.redd-monitor.org/2013/04/30/we-reject-redd-in-all-its-versions-letter-from-chiapas-mexico-opposing-redd-in-californias-global-warming-solutions-act-ab-32/'. **37** La Via Campesina (2014) 'UN-masking Climate Smart Agriculture', available at 'https://viacampesina.org/en/un-masking-climate-smart-agriculture/'.

Blue Carbon, another such mechanism, expands the REDD+ principle to the oceans. Mangroves, salt meadows and seagrass also bind CO_2 and should, therefore, be included in carbon trading schemes. A 'fish carbon' for marine life is already being discussed. As these examples show, climate negotiations are not only about protecting the climate; they are also about establishing new markets and (re)structuring the relationship between society and nature, from which mainly investors and powerful actors on the financial markets profit.

3 OUTLOOK AND ALTERNATIVES

3.1 A global climate movement?

8 November 2016 marked an unexpected shift in the international climate debate. In the Moroccan city of Marrakesh, thousands of delegates convened for the first climate conference after the Paris Agreement. The mood was positive. The treaty had entered into force just a few days before – the aim was now to flesh out its contents. Then came the news that Donald Trump had been elected president of the United States. The delegates were shocked. Activists embraced in floods of tears. The US delegation was stunned into silence. Negotiations continued as planned, but over everyone hung the shadow of uncertainty. In the run-up to the election, Trump had repeatedly denied the existence of climate change; he had also stated his intention to terminate the US's climate protection plan, increase coal mining and leave the Paris Agreement.

Twelve months later and he had largely held true to his promises. But at the following climate conference, held in November 2017 in Bonn, there were more US representatives than ever before. Alongside the official delegation, who went about their job as usual, most of them without comment, the negotiations were also attended by a 'US People's Delegation'. This group included the governors of several states, mayors, environmental activists and representatives of indigenous communities. They gave interviews, organised events, offered their opinions on the state of negotiations and loudly voiced their protest at a speech made by the 'official' delegation. They represent a shift that is currently underway in the US: faced with a president who wants to undo all the progress that has been made in tackling climate change, a strong resistance movement has taken shape. Major states with strong economies, such as California, have pledged to carry on improving their own climate protection plans and independently implement the Paris Agreement. Environmental activists, unions and people's movements against racism and discrimination have joined forces and are fighting together on multiple fronts.

Even though the situation the US finds itself in is an unusual one, similar developments can be observed around the globe. Climate change is no longer solely an issue for high-ranking diplomats and international politicians. The feeling that not enough is being done 'up there' has led to grassroots organisations springing up all over the world. However, powerful,

broad-based movements for climate justice have been around for many years, mainly in countries of the Global South such as India. Meanwhile, numerous (usually local) initiatives have emerged in industrialised nations in recent years, such as the Transition Towns movement, an initiative that strives for more climate-friendly cities and municipalities. In Oxford and Harvard, students and alumni are protesting against their universities investing in shares or funds that directly or indirectly encourage the use of fossil fuels. Across the whole of Europe, Climate Camps take place every summer. These are events where activists can link up, experience alternative forms of living and where – as recently seen in the Rhineland – protests against the continuation of climate-damaging measures are organised. The day before the start of the climate summit in Bonn, thousands of activists stormed the Garzweiler opencast mine in Hambach to protest against the continued extraction of coal.

These movements have increasingly joined forces in recent years, even though they are still made up of very different groups. The movement is united by the belief that current climate policy is inadequate, and measures against climate change are urgently required. This includes acknowledging the use of fossil fuels as a central problem, halting production of oil, gas and coal, and leaving most of the remaining fossil fuel reserves in the ground. There is also a general consensus that risky geo-engineering projects, genetic engineering and underground storage of CO_2 are no solution, and that a radical reduction in emissions is needed. There is, however, less agreement on how these goals should be achieved.

The groups involved have very different viewpoints when it comes to these crucial political and strategic questions. Some of these issues have yet to be the subject of more in-depth debate. Is climate change a question of lifestyle, a problem that requires each individual to change and live a 'greener' and more climate-conscious life? Or does such an approach fall into the neoliberal trap of the responsible consumer? Should we not instead highlight the fact that the problem of climate change can only be solved politically rather than at the individual level, and requires us to call into question fundamental relations of power and domination? Is climate change the inevitable consequence of the capitalist dynamic and its all-consuming obsession with profit and exploitation that will therefore ultimately destroy the Earth? Or is a 'green capitalism' possible: a system that is less environmentally destructive, yet still built on exploitation and inequality? Is climate change 'the' central problem that we need to solve before all others to preserve the Earth from the worst? Or should we reject this doomsday mindset because it has a de-politicising effect, invoking quick fixes rather than providing the space needed to tackle the problem at a more fundamental level?

In order to become an influential power, the climate movement in the North will need to extend beyond its own circles – by connecting with (other) social struggles and linking up with groups away from the green, alternative, academic milieu. As challenging and potentially conflict-laden as such partnerships may be, they offer the opportunity to address climate change as a political issue – a question of justice – as

the struggles in many countries of the Global South and currently in the US have shown. The issue of climate change has the potential to become a common cause for different movements. In times like these, when the capitalist model has lost credibility but many people lack the perspective and hope they need to believe that other 'possible worlds' might exist, the issue of climate change offers the chance to shift the focus to alternatives to the current system, as well as the opportunity to discuss these alternatives and put them to the test.

The slogan 'System change, not climate change' that campaigns surrounding and against the climate conferences have been using for years – with different nuances – clearly shows that climate change is not an environmental problem but rather a battlefield where not just the future of the Earth is at stake, but also the future of human society. Reactions to climate change – which aspects are taken seriously, which are ignored, who has to bear the consequences and costs – reflect the relationships of power and domination in society, while simultaneously perpetuating them.

International climate negotiations can be a stage where struggles over precisely these issues are played out. Equally, however, climate policy is not the arena in which the future of our planet will be decided. What will be decisive are those areas of society that directly impact the climate: energy policy, which is still responsible for the lion's share of emissions; mobility and transport; agriculture, which contributes roughly nine per cent of greenhouse gas emissions, and the organisation of which has direct effects on food and the survival of billions of people; economic policy, the neoliberal orientation of which fuels emissions and drives people worldwide into insecure living conditions and precarity; urban policies and gentrification; racism and police violence; and, finally, the struggles against an economic order in which one side always has less and the other always has more, struggles against an economic system that leads to exclusion and, with a disregard for the impact on nature and people, always strives for profit maximisation. To ask the question 'What climate do we want?' is also to ask 'What kind of world do we want to live in?'

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4 LINKS FOR FURTHER READING

4.1 Climate research

www.realclimate.org/
http://climateanalytics.org/
https://www.ldeo.columbia.edu/

4.2 Climate policy: news

http://newsroom.unfccc.int/
www.climatechangenews.com/
https://insideclimatenews.org/
https://worldat1c.org/

4.3 Climate justice: organisations, groups and movements

https://www.rosalux.de/en/dossiers/climate-justice/
www.climate-justice-now.org/
www.climatenetwork.org/
www.350.org
https://climatespace2013.wordpress.com/
http://redd-monitor.org (on the REDD+ mechanism)
www.geoengineeringmonitor.org/ (on geo-engineering)
http://focusweb.org/climate-and-environment-justice
http://systemicalternatives.org/
https://corporateeurope.org/environment/climate-and-energy

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‘Climate change itself does not cause inequality, but it does reinforce existing inequalities. What is more, climate change, when combined with past decades of neoliberal economic policies, frequently leads to catastrophic outcomes.’

JULIANE SCHUMACHER