

Draft

Royal Society Statement on the UNFCCC Negotiations

In December 2009 the world's nations will gather in Copenhagen in an attempt to reach agreement over how to prevent dangerous climate change, the stated aim of the United Nations Framework Convention on Climate Change (UNFCCC).

It is certain that greenhouse gas (GHG) emissions from the burning of fossil fuels and the transformation of the land lead to a warming of climate, and it is extremely likely that they are the main cause of the global warming that has taken place in the last century.

While the extent of climate change is often expressed in a single figure – global temperature – the effects of climate change will vary greatly from region to region in temperature, precipitation, and the frequency of extreme weather events.

Climate change is not the only undesirable consequence of increased greenhouse gas emissions. Increasing atmospheric carbon dioxide also leads to ocean acidification which has significant impacts on ocean ecosystems and in turn the societies which depend on them.

Based on its assessment, which involved a large number of the most eminent climate scientists in the world, the Intergovernmental Panel on Climate Change (IPCC), reported in 2007 on the severe climate impacts that would be likely if we follow a 'business as usual' emissions strategy. The balance of scientific research since the IPCC report

suggests that climate change is happening at least as fast as was previously predicted and the impacts may be of greater magnitude, ~~than were previously predicted~~:

- global carbon dioxide (CO₂) emissions since 2000 and before the recession have been near the upper limits projected;
- global average temperature has not changed much in the past decade, but this is ~~thought to be~~ due to natural variability masking the long-term trend for a limited period, as has happened frequently in the past;
- current estimates of observed sea level rise, including new estimates of ice sheet melt, are generally larger than those previously projected;
- arctic sea ice is now younger and thinner and its summer minimum extent has been at record low levels;
- the oceans are now probably more acidic than for the last 65 million years.

The chances of accelerated climate change due to feedbacks in the climate system will increase significantly as the Earth warms further. These include a large positive feedback through reduced carbon dioxide absorption by the ocean and land, and through emissions of methane from melting tundra, and also of regime shifts in the climate system, all increase significantly as the Earth warms further.

Preventing dangerous climate change

A global temperature increase of two degrees has been widely adopted as one which below dangerous climate change

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will be prevented. However, it must be understood that there is no such thing as 'safe' climate change. Even the temperature increases to date are leading to effects that may be impossible to adapt to in some regions, notably small island states. As the temperature rises further, so will the chances of more widespread and dangerous climate impacts.

Once our actions have raised concentrations of CO₂ in the atmosphere, they will remain at higher levels for a thousand years, so to avoid the worst effects of climate change and ocean acidification, it is imperative that the emissions of ~~CO₂ carbon dioxide~~ are reduced as much as possible, as soon as possible. Non CO₂ GHGs also need to be reduced as quickly as possible.

To have a greater than 50% chance of keeping the global temperature rise below 2°C and to minimise the chances of a temperature rise of 3-4°C, it is necessary that global GHG emissions peak as soon as possible, and certainly by 2020. After that a rapid reduction, at a rate of at least 3-4% per annum is required down to very low levels in the second half of this century. ~~The importance of the cumulative emission of CO₂ carbon dioxide means that the longer it takes any delay in the global emissions to peak the more rapid the decline will have to be which will likely cause major economic and social disruption in both developed and developing countries would have to be followed by an even more rapid decline, which may not be consistent with continuing economic and social activity in the developed countries and development in the rest of the world.~~

Developed countries are responsible for the vast majority of emissions to date,

and have the highest per capita emissions, so it is incumbent on them to show leadership with early and substantial GHG cuts. However, the atmosphere is indifferent to the origin of emissions, and developing countries must also commit to addressing their increasing emissions, while continuing to raise their standard of living. Consistent with the required global trajectory, developed countries will need to reduce emissions by 25-40% by 2020 and 80-95% by 2050, and developing countries will need to limit their increase in emissions to ~~15-30% by 2020.~~

Inclusion of emissions

It is important that ~~any gases that are released due to human activity and cause warming in the climate system are included in any agreement. all man-made greenhouse influencing emissions are included in any agreement.~~ This includes the greenhouse gas emissions under the existing Kyoto Protocol and additional greenhouse gases and pre-cursor gases.

It is also important all sources are included such as —emissions from aviation and shipping. Emissions from deforestation are very significant. Any climate deal should include an agreement on deforestation that helps the developing world to address this problem. An effective policy will also ensure no net loss of biodiversity, encourage good governance and include the needs and knowledge of local and indigenous communities.

Adaptation

Any level of climate change will be dangerous somewhere and impacts will vary significantly by regions. Countries must be prepared to adapt to climate change by using/tilising scientific and technological expertise allied to local knowledge.

Comment [s4]: I believe this figure originates from [den Elzen and Holne, 2008](#). I included it because it is widely quoted.

Comment [b5]: Where do these numbers come from?

Comment [s3]: We need an extra sentence to explain explicitly why they are important.

As climate change will have the greatest impacts on the poor, any global agreement must properly support the adaptation and development of vulnerable countries and communities through finance, technology transfers and capacity building.

Early mitigation action is ~~urgent crucial~~ because the costs of adaptation, ~~and even the likelihood it may be practically possible,~~ will likely increase rapidly with increasing GHG levels. While mitigation reduces the need for adaptation, the reverse is not true. Even the current atmospheric GHG concentrations have committed us to impacts that some people and environments will not be able to adapt to.

Negative emissions

Removing GHGs from the atmosphere (negative emissions) may be necessary under any emissions scenario to help reduce atmospheric GHG concentrations towards pre-industrial levels. No technologies for removing GHGs from the atmosphere have yet been demonstrated to be effective and economically, socially and environmentally sustainable. Such technologies should be researched but they are not alternatives to emissions reductions.

~~Research Requirements?The Role of Science~~

~~Scientists have played an integral role in identifying and understanding climate change. It is essential they play a continuing role in~~ Further climate science research is essential to ~~reduc~~ing the uncertainty ~~over on~~ likely national and regional impacts of ~~emission scenarios for GHG emissions and possible threshold in the climate system. This information will underpin~~

effective mitigation and adaptation policy decisions.

~~Improved information on possible thresholds in the climate system or in the socio-economic response to climate change would be extremely beneficial for mitigation decisions. The planning and execution of adaptation measures requires the best possible projection information. The UNFCCC and its delivery bodies must ensure that evidence based decisions are at the core of its implementation strategy. This includes the flexible mechanisms and the allocation of any existing or new funds.~~

14 October 2009

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Royal Society Statement on the UNFCCC Negotiations

In December 2009 the world's nations will gather in Copenhagen in an attempt to reach agreement over how to prevent dangerous climate change, the stated aim of the United Nations Framework Convention on Climate Change (UNFCCC).

It is certain that greenhouse gas (GHG) emissions from the burning of fossil fuels and the transformation of the land lead to a warming of climate, and it is extremely likely that they are the main cause of the global warming that has taken place in the last century.

While the extent of climate change is often expressed in a single figure – global temperature – the effects of climate change will vary greatly from region to region in temperature, precipitation, and the frequency of extreme weather events.

Climate change is not the only undesirable consequence of increased greenhouse gas emissions. Increasing atmospheric carbon dioxide also leads to ocean acidification which is irreversible on timescale of at least tens of thousands of years and will have profound impacts on many marine ecosystems and in turn the societies which depend on them.

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Based on its assessment, which involved a large number of the most eminent climate scientists in the world, the Intergovernmental Panel on Climate Change (IPCC), reported in 2007 on the severe climate impacts that would be likely if we follow a 'business as usual' emissions strategy. The balance of scientific research since the IPCC report suggests that climate change is happening at least as fast as was previously predicted and the impacts may be of greater magnitude, ~~than were previously predicted~~:

- global carbon dioxide (CO₂) emissions since 2000 and before the recession have been near the upper limits projected;
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 - current estimates of observed sea level rise, including new estimates of ice sheet melt, are generally larger than those previously projected;
 - arctic sea ice is now younger and thinner and its summer minimum extent has been at record low levels;
 - in the last 200 years ocean acidity has increase by 30%, a rate probably faster than anytime in the last 65 million years.
 - ~~the oceans are now probably more acidic than for the last 65 million years.~~
- The chances of accelerated climate change due to feedbacks in the climate system will increase significantly as the Earth warms further. These include a large

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Preventing dangerous climate change

A global temperature increase of two degrees has been widely adopted as one which below dangerous climate change will be prevented. However, it must be understood that there is no such thing as 'safe' climate change. Even the temperature increases to date are leading to effects that may be impossible to adapt to in some regions, notably small island states. As the temperature rises further, so will the chances of more widespread and dangerous climate impacts.

~~Once our actions have raised concentrations of CO₂ in the atmosphere, and oceans they will remain at higher levels in the atmosphere, for a thousand years and for tens of thousands of years in the ocean, so to avoid the worst effects of climate change and ocean acidification, it is imperative that emissions of CO₂ are reduced as much as possible, as soon as possible. Once our actions have raised concentrations of CO₂ in the atmosphere, they will remain at higher levels for a thousand years, so to avoid the worst effects of climate change and ocean acidification, it is imperative that the emissions of CO₂ carbon dioxide are reduced as much as possible, as soon as possible.~~ Non CO₂ GHGs also need to be reduced as quickly as possible.

To have a greater than 50% chance of keeping the global temperature rise below 2°C and to minimise the chances of a temperature rise of 3-4°C, it is necessary

that global GHG emissions peak as soon as possible, and certainly by 2020. After that a rapid reduction, at a rate of at least 3-4% per annum is required down to very low levels in the second half of this century. The importance of the cumulative emission of CO₂ carbon dioxide means that ~~the longer it takes any delay in the~~ global emissions ~~to peak the more rapid the decline will have to be which will likely cause major economic and social disruption in both developed and developing countries would have to be followed by an even more rapid decline, which may not be consistent with continuing economic and social activity in the developed countries and development in the rest of the world.~~

Developed countries are responsible for the vast majority of emissions to date, and have the highest per capita emissions, so it is incumbent on them to show leadership with early and substantial GHG cuts. However, the atmosphere is indifferent to the origin of emissions, and developing countries must also commit to addressing their increasing emissions, while continuing to raise their standard of living. Consistent with the required global trajectory, developed countries will need to reduce emissions by 25-40% by 2020 and 80-95% by 2050, and developing countries will need to limit their increase in emissions to 15-30% by 2020.

Inclusion of emissions

It is important that ~~any gases that are released due to human activity and cause warming or acidification in the climate~~ Earth and climate systems are included in any agreement. ~~all man-made greenhouse influencing emissions are included in any agreement.~~ This includes ~~the greenhouse gas emissions under the~~

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[existing Kyoto Protocol and additional greenhouse gases and pre-cursor gases.](#)

[It is also important all sources are included such as](#)—emissions from aviation and shipping. Emissions from deforestation are [very](#) significant. Any climate deal should include an agreement on deforestation that helps the developing world to address this problem. An effective policy will also ensure no net loss of biodiversity, encourage good governance and include the needs and knowledge of local and indigenous communities.

Adaptation

Any level of climate change will be dangerous somewhere and impacts will vary significantly by regions. Countries must be prepared to adapt to climate change by [using](#) ~~utilising~~ scientific and technological expertise allied to local knowledge.

As climate change will have the greatest impacts on the poor, any global agreement must properly support the adaptation and development of vulnerable countries and communities through finance, technology transfers and capacity building.

Early mitigation action is [urgent](#) ~~crucial~~ because the costs of adaptation, ~~and even the likelihood it may be practically possible,~~ will likely increase rapidly with increasing GHG levels. While mitigation reduces the need for adaptation, the reverse is not true. Even the current atmospheric GHG concentrations have committed us to impacts that some people and environments will not be able to adapt to.

Negative emissions

Removing GHGs from the atmosphere (negative emissions) may be necessary

under any emissions scenario to help reduce atmospheric GHG concentrations towards pre-industrial levels. No technologies for removing GHGs from the atmosphere have yet been demonstrated to be effective and economically, socially and environmentally sustainable. Such technologies should be researched but they are not alternatives to emissions reductions.

~~Research Requirements?~~The Role of Science

~~Scientists have played an integral role in identifying and understanding climate change. It is essential they play a continuing role in~~ [Further climate science research is essential to reducing the uncertainty over on likely national and regional impacts of emission scenarios for GHG emissions and possible threshold in the climate system. This information will underpin effective mitigation and adaptation policy decisions.](#)

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Preventing Dangerous Climate Change: The Royal Society Statement on the Global Climate Negotiations

In December 2009 the world's nations will gather in Copenhagen in an attempt to reach agreement over how to prevent dangerous interference with the climate, the stated aim of the United Nations Framework Convention on Climate Change (UNFCCC).

A maximum global temperature increase of 2°C since pre-industrial times has been adopted as a goal to prevent dangerous climate change by many nations. If global greenhouse gas (GHG) emissions are reduced at 3 – 4% per year after 2020, there is a 50-50 chance of limiting global temperature increase to 2°C; but only if GHG emissions begin to decline within the next decade. By 2050, emissions would need to be down to near 50% of their 1990 levels, with continuing reductions in the second half of this century.

It is not only the rate of GHG emissions that matters but also their accumulation over time, particularly for the long-lived gases such as carbon dioxide (CO₂). Once our actions have raised concentrations of CO₂ in the atmosphere, levels will remain elevated for more than a thousand years. If we are to avoid lasting effects of climate change and ocean acidification, it is imperative that emissions of CO₂ are reduced as much as possible as soon as possible, consistent with continued social and economic development. The crucial role played by the cumulative emissions of CO₂ means that the later global emissions peak, the more rapid the eventual decline would have to be, which would likely cause economic and social disruption across the globe. Emissions of non CO₂ GHGs also need to be reduced as quickly as possible.

There is no such thing as 'safe' climate change. Even the global temperature increase to date (about 0.75°C) is contributing to effects that are impossible to adapt to in some regions, notably small low-lying islands and coastal areas. As the temperature rises further, so will the risk of more widespread and dangerous climate impacts from sea level rise, from increasing frequency and intensity of climate extremes, heat waves, floods and droughts, especially in vulnerable areas.

Developed countries are responsible for the vast majority of emissions to date, and have the highest per capita emissions, so it is incumbent on them to show leadership with early achievement of substantial rates of reduction in GHG emissions. However, the atmosphere is indifferent to the origin of emissions, and so while developing countries must be able to raise their standards of living, they too will need to curb their increasing GHG emissions, consistent with the required global trajectory. This action will also reduce air pollution and have immediate benefits for human health.

Science of climate change

It is certain that GHG emissions from the burning of fossil fuels and from land use change lead to a warming of climate, and it is very likely that these GHGs are the dominant cause of the global warming that has been taking place over the last 50 years.

Whilst the extent of climate change is often expressed in a single figure – global temperature – the effects of climate change (such as temperature, precipitation and the frequency of extreme weather events) will vary greatly from place to place.

Increasing atmospheric CO₂ also leads to ocean acidification which risks profound impacts on many marine ecosystems and in turn the societies which depend on them. In the last 250 years ocean acidity has increased by 30%, and the oceans are now probably more acidic than for the last several million years.

Many of the impacts of increasing GHGs will be irreversible on timescales of more than a thousand years.

The Intergovernmental Panel on Climate Change (IPCC) assessment in 2007, which involved a large number of the most eminent climate change scientists in the world, highlighted the severe climate effects that could result from a 'business as usual' approach to global GHG emissions. The balance of scientific research since the IPCC report broadly confirms and strengthens its key findings. Major observational findings since the IPCC report include:

- Global CO₂ emissions since 2000, before the recession, have been near the upper limits projected. Levels of CO₂ in the atmosphere continue to rise.
- The trend in global average temperature within the last decade has been small but this is very likely to be largely due to the natural variability masking the long term trend. Such a masking effect has occurred in the past. Nevertheless the decade 2000-2009 has been warmer, on average, than any other decade in the previous 150 years.
- Estimates of current sea level rise are generally larger than those previously projected.
- Arctic sea ice is now younger and thinner than at any point in the observed record and its summer minimum extent has, in recent years, been at record low levels.

Continuing climate change even at the current rate will lead to very significant impacts. Some feedbacks raise concerns that this change will accelerate as the Earth warms further. These feedbacks include reduced CO₂ absorption by the ocean and land, emissions of methane from melting tundra, and the impact on the reflection of solar radiation and the heat transfer from the ocean of changing sea ice. The circulation of the atmosphere or ocean may also undergo rapid changes leading to major shifts in regional climate. Possible examples include big changes in the Indian Summer Monsoon rainfall (e.g. more severe reductions as in 2006 and 2009), summers with almost permanent high pressure systems over Europe (as in the record warmth of 2003), and the weakening of the overturning circulation in the North Atlantic with associated changes in regional temperature and storms.

Inclusion of emissions

It is important that all substances that are released due to human activity and that can cause climate change or acidification are considered in any agreement. This includes the GHG

emissions under the existing Kyoto Protocol and additional GHG, aerosols and pre-cursor gases.

All sources of emissions need to be incorporated in an agreement, including emissions from international aviation, shipping and deforestation. Deforestation alone accounts for approximately 10-20% of current CO₂ emissions and is taking place predominantly in the developing world. To be effective any climate agreement must address the emissions of deforestation, and ensure minimal loss of biodiversity, encourage good governance and address the needs and knowledge of local and indigenous communities.

Adaptation

Any level of climate change will be dangerous somewhere and the impacts will vary significantly by region. Countries must be prepared to adapt to climate change by using scientific and technological expertise allied to local knowledge.

As climate change will have the greatest impacts on the poor, any global agreement should properly support the adaptation and development of vulnerable countries and communities through sufficient finance, technology transfers and capacity building.

Critical adaptation considerations include agriculture and forestry, which will require substantial investment to maintain or increase productivity as air temperatures increase, rainfall patterns change and the frequency of extreme weather events alter.

A continuing effort in monitoring and understanding climate change, reducing uncertainty, particularly of regional impacts of climate change, is essential for the underpinning of effective adaptation policy.

Negative emissions

The deliberate removal of GHGs from the atmosphere (negative emissions) may eventually be necessary to help reduce atmospheric GHG concentrations towards pre-industrial levels or to counteract residual emissions from, for example, agricultural activity, which may be impossible to eliminate. However, no technologies for doing so have yet been demonstrated to be effective and economically, socially and environmentally sustainable at the scale likely to be required. Such technologies cannot be considered as alternatives to emissions reductions.

Evidence-Based Policy

The UNFCCC and its delivery bodies must ensure that evidence-based decisions are at the core of its implementation strategy, including the flexible mechanisms and the allocation of any existing or new funds. It is also vitally important for nations and regions to use evidence-based policy when deciding upon responses for both mitigation and adaptation.

9 November 2009