GREENPEACE Briefing

The Third Degree

1 February 2010

Introduction

This briefing paper examines the implications of governments' commitments to tackling climate change in terms of overall emission reductions, expected rises in average global temperature (compared to pre-industrial times) and consequent impacts on people and the environment.

Summary

Governments' combined commitments to curbing global warming, made prior to the Copenhagen climate summit set the world on track for an increase in average global temperature of 3 degrees C (5.4 degrees F) or more compared to pre-industrial times.[1] Avoiding catastrophic climate change calls for limiting temperature rise to as far as possible below 2 degrees C. This target was agreed in mid 2009 by governments that are major emitters of greenhouse gases (GHG). It is also the stated objective of the Copenhagen Accord, a non-binding political declaration concluded at the Copenhagen climate summit in December 2009.[2]

There is a huge gap between what governments are currently committed to and what they need to do in cutting emissions. To stay below the warming 'limit' of 2 degrees C, industrialised nations as a group must reduce their GHG emissions by 40% below 1990 levels by 2020. Developing nations together must reduce their projected growth in emissions by 15-30% by the same date. These efforts must be enshrined in a fair, ambitious and legally binding treaty.

The Copenhagen Accord calls on governments to submit to the UN Climate Convention secretariat, by 31 January 2010, their pledges for reducing emissions 2020 and on voluntary mitigation actions. The date provides a further opportunity for highlighting just how far governments are from taking the action that is required for combating climate change.

Pre-Copenhagen commitments

Prior to last December's Copenhagen Climate Summit, a number of industrialised and developing countries outlined their pledges, voluntary actions and policy goals on greenhouse gas emissions. In a confidential draft preliminary assessment produced during the summit on 15 December 2009 the UN Climate Convention

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[1] Preliminary Assessment of pledges made by Annex 1 Parties and voluntary actions and policy goals announced by a number of Non-Annex 1 Parties. 15 December 2009. http://www.greenpeace.org/international/press/reports/unfccc-secretariat-pledges-ass

[2] Copenhagen Accord, FCCC/CP/2009/L.7, 18 December 2009. http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf

secretariat reported on what governments' pre-Copenhagen pledges could actually mean in terms of a global average temperature rise.[3]
The assessment concluded:

> *"Unless the remaining gap of 1.9 to 4.2 Gt is closed and Parties commit themselves to strong action prior and after 2020, global emissions will peak later than 2020 and remain on an unsustainable pathway that could lead to concentrations equal or above 550 ppm with the related temperature rise around 3℃", equal or above 550ppm (sic) This in tu rn will reduce significantly the probability to stay within a temperature increase of 2℃".*

Governments' current national commitments to tackle climate change through controlling GHG emissions therefore fall short of the measures required to keep the rise in average global temperature within safe limits. The target levels pledged by industrialised countries prior to the Copenhagen Climate Summit mean a reduction of only 11–19% in greenhouse gas emissions. Taking proposed forestry credits into account, the effective cuts in emissions from fossil fuel burning fall to 6 -14 % below 1990 levels by 2020. Uncertainties in economic forecasts make it unclear as to whether there would actually be real emission reductions relative to emissions under business-as-usual scenarios.

When these emission reductions (0-1.2 gigatonnes, Gt, below business-as-usual projections) are combined with the overall voluntary emission reduction pledges made by developing countries (1.5-3.2 Gt, including reductions in deforestation) the resulting mean global temperature increase is likely to fall between 3 degrees C and 3.5 degrees C. This is assuming economic projections are accurate.

The Copenhagen Accord

In July 2009, a meeting of the 17 major GHG emitters recognised the scientific view that global mean temperature rise ought not to exceed 2 degrees C.[4] This is also recognised in the Copenhagen Accord:[5]

> *"To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change".*

It should be noted that this is higher than the ceiling of 1.5 degrees C of warming that small island states and the least developed countries consider the necessary target to be if their nations are to survive.

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[3] Preliminary Assessment of pledges made by Annex 1 Parties and voluntary actions and policy goals announced by a number of Non-Annex 1 Parties. 15 December 2009. http://www.greenpeace.org/international/press/reports/unfccc-secretariat-pledges-ass

[4] Declaration of the Leaders of the Major Economies Forum on Energy and Climate (held in L'Aquila), July 9, 2009. http://www.whitehouse.gov/the_press_office/Declaration-of-the-Leaders-the-Major-Economies-Forum-on-Energy-and-Climate/

[5] Copenhagen Accord, FCCC/CP/2009/L.7,18 December 2009, paragraph 1. http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf

Paragraph 2 of the Copenhagen Accord specifies its objective as being to "*hold the increase in global temperature below 2 degrees Celsius*". The test of whether the Accord has any role in achieving this objective becomes clearer after 31 January 2010, the date specified in the Accord by which national governments are called upon to submit to the UN Climate Convention secretariat their pledges for GHG emissions reductions and voluntary mitigation actions.

Current impacts and future prospects

Global mean temperature is now approximately 0.8 degrees C above pre-industrial levels. Recent reconstructions of global temperature records reaffirm that recent warming in the Northern Hemisphere is likely to be greater than has occurred over at least the past 1,300 and possibly the past 1,700 years.[6]

Significant impacts of climate change are already being observed around the world. In many areas of the Northern Hemisphere, permafrost considered to have been frozen for thousands of years has started to thaw.[7] Ice sheets, glaciers and ice caps are melting.[8] [9] [10]

The Global Humanitarian Forum estimates that climate change may already be responsible for the deaths of some 300,000 people a year while severely affecting over 300 million people. This report remains the best estimate to date of the present and possible future human costs of ongoing climate change.[11]

Even if it were possible to reduce GHG emissions to zero immediately, climate change would continue, as the global climate system responds only slowly, and with a time lag, to GHGs already in the atmosphere. It can, therefore, be argued that the world is already beyond a 'safe level' of warming.

As warming continues, impacts are likely to be more severe. But this may not necessarily happen in a linear way. Scientists have identified a number of potential 'tipping points'. Some of these changes could occur relatively rapidly, with a "jump" from one state to another. This could be the case even if atmospheric GHG concentrations continued to rise only steadily. This could result in highly damaging climate impacts. In addition, once such thresholds are crossed they could prove extremely difficult or impossible to reverse even if GHG concentrations were subsequently reduced. Impacts could be further amplified by positive feedback

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6 Mann, M.E. et al. (2008). Proxy-Based Reconstructions of Hemispheric and Global Surface Temperature Variations over the Past Two Millennia. *Proceedings of the National Academy of Sciences* 105 (36): 13252-13257.

7 Lemke, P. et al. (2007). Observation: Changes in Snow, Ice and Frozen Ground. In: Climate Change 2007: The Physical Science Basis. Contribution of Working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Chaneg [Solomon, S. et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

8 World Glacier Monitoring Service (2010) Preliminary Glacier Mass Balance d Data 2007/2008 http: //www.geo.unizh.ch/wgms/mbb/sum08.html.

9 Chen J. L. Et al. B. D. (2009) Accelerated Antartic ice loss from satellite garvity measurements. *Nature Geoscience*, 2: 859-862.

10 Stroeve, J. et al. (2008). Arctic Sea Ice extent plummets in 2007. *EOS, Transactions, Americal Goephysical Union*, 89 (2): 13-14.

11 Global Humanitarian Forum (2009). *Human Impact Report: Climate Change – The Anatomy of a Silent Crisis.* http://ghfgeneva.org/Portals/0/pdfs/human_impact_report.pdf

mechanisms triggered by rising temperatures. One example of this is the potential release of methane from thawing tundra regions. This could amplify the warming trend considerably[12] leading to a runaway temperature rise.

As part of its Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) prepared an illustration of the natural and human systems likely to suffer global impacts as a consequence of climate change, sea level rise, changes in atmospheric carbon dioxide, and the way in which the severity of such impacts may increase relative to different magnitudes of change in global average surface temperature in the 21st century (up to 5 degrees Celsius of warming relative to 1980-1999).

These include impacts on the water cycle, food production, the integrity of ecosystems, and human health, as well as a number of more specific 'singular events' which could represent the passing of some of the more critical tipping points in the climate system (see Figure 1). Such projections are supported by a range of other, more specific studies published in recent years, such as those reviewed and considered by the IPCC[13], those documented below, and in a recent Greenpeace report.[14]

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[12] Lenton, T.M. et al. (2008). Tipping elements in the Earth's climate system. *Proceedings of the National Academy of Sciences*, 105 (6): 1786-1793.

[13] Lemke, P., et al Observations: Changes in Snow, Ice and Frozen Ground, In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment report of the Intergovernmental Panel on Climate Change [Solomon, S. (eds.), et al.] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[14] Greenpeace International (2009). *Racing Over the Edge. New science on the Climate Crisis*, 12pp. http://www.greenpeace.org/raw/content/international/press/reports/racing-over-the-edge.pdf

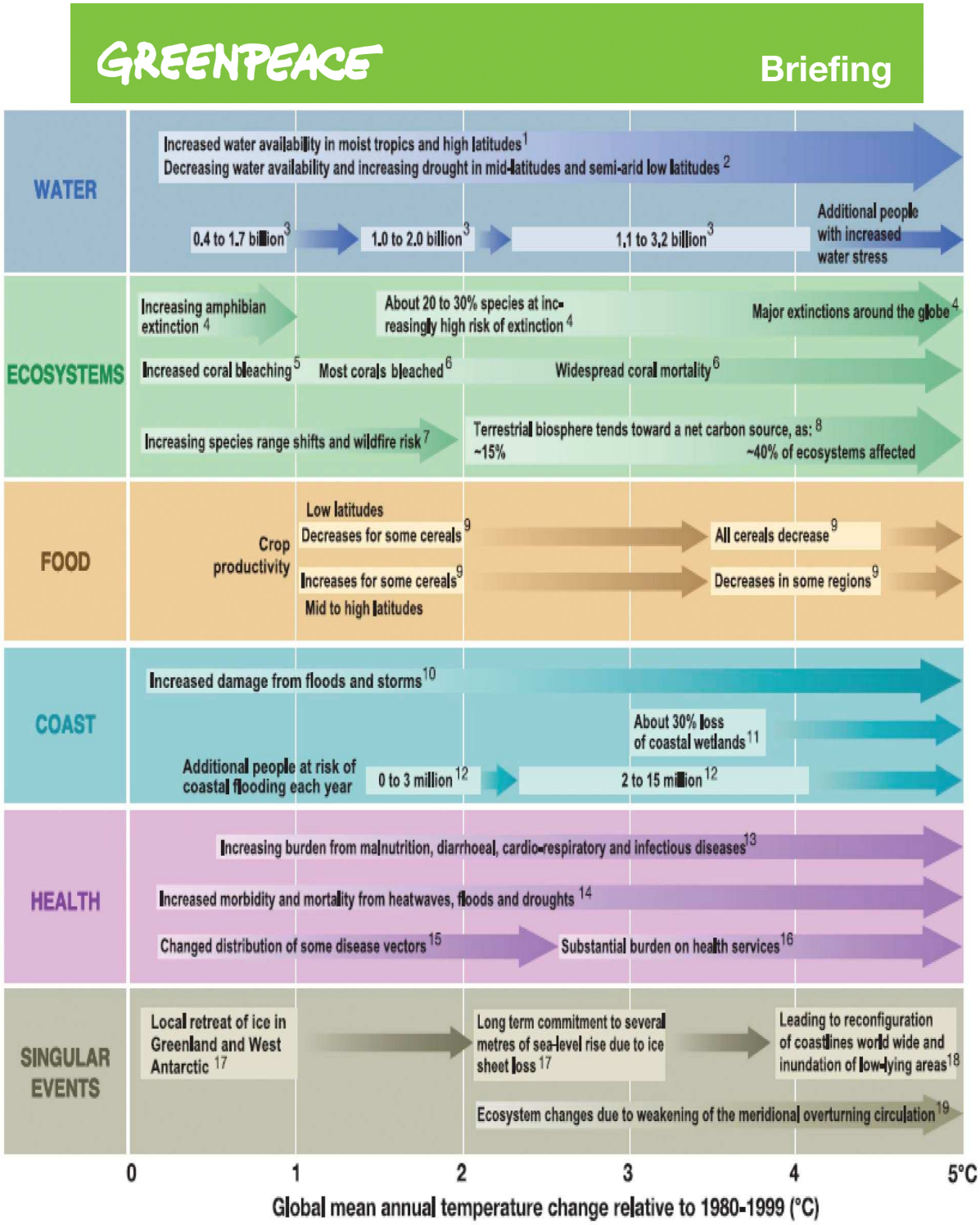

Figure 1: Examples of global impacts projected for changes in climate (and sea level and atmospheric CO2 where relevant) associated with different amounts of increase in global average surface temperature in the 21st century. Reproduced from IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 976pp.)

Warming by 3 degrees C +

With warming of 3 degrees C or more , all consequences, including the amount of further warming the world might be committed to become more unpredictable and uncontrollable. This is due also to a variety of feedback effects where impacts could trigger further warming.

- 3 degrees C or more could lead to a 20% increase in heat-related human mortality in some EU countries and six- to eight-fold rise in the number of heatwave days.[15]

- Negative impacts on agriculture could lead to decreases in global crop production, in excess of 550 million people being at risk of hunger and up to 1.3 billion people being undernourished.[16]

- Near-total or complete de-glaciation of the Greenland ice sheet and the West Antarctic ice sheets could occur.[17]

Most importantly a temperature rise of 3 degrees C or more would mean a high risk of crossing a large number of irreversible tipping points.

Warming by 2 degrees C +

This level of warming could already mean that serious tipping points are reached leading to irreversible large-scale impacts.

- Possible partial, but irreversible deglaciation of the Greenland ice sheet and even the West Antarctic ice sheet, eventually leading to sea level rise of several metres.[18]

- 2-2.5 degrees temperature rise may lead to significant decreases in the production of wheat and maize in India, and of rice in China.[19]

- 2.5 degree C warming could lead to 20-80% loss of the Amazon rainforest and its species, turning the forests from a major 'sink' for atmospheric CO2 into a source of CO2.[20]

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15 CLIM36 - Heat and health - Assessment, September 2008. http://themes.eea.europa.eu/IMS/IMS/ISpecs/ISpecification20080711160728/IAssessment1232438914408/view_content

16 Schmidhuber, J. and N. Fransesco (2007). Global food security under climate change. http://www.pnas.org/content/104/50/19703.full

17 Parry, M.L. et al. (eds) (2007). *Climate Change 2007: Impacts, Adaption and Vulnerability*. Contribution of Working Group II to the Intergovernmental Panel on Climate Change Fourth Assessment Report [Solomon et al. (eds.)]. Cambridge: Cambridge University Press, 793-794.

18 Meehl, G.A. et al. (2007). *2007: Global Climate Projections* in: *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Fourth Assessment Report [Solomon et al. (eds.)]. Cambridge, Cambridge University Press, 828-831.

19 Meehl, G.A. et al. (2007). *2007: Global Climate Projections.* In: *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Fourth Assessment Report [Solomon et al. (eds.)]. Cambridge, Cambridge University Press, 789-793.

- Warming exceeding 2.5 degree C risks reducing crop yield globally and could adversely affect hundreds of millions of people through increased coastal flooding.[21]

- Warming of roughly 2-3 degree C could result in extinction of up to 30% of the world's animal and plant species.[22]

Warming by 1.5 degrees C +

- Substantial /severe adverse effects on food production, water supply, and ecosystems of sub-Saharan Africa and small island developing states.

- Increased flooding in large river deltas, due to sea level rise, storm surges and river flooding.

- Estimated that with rise of 1.5 - 2.0 degree C up to 3 million additional people would be at risk from coastal flooding.[23] Reductions in water supplies would affect 0.4 to 1.7 billion people.[24]

The 1.5 degree C 'gap'

Recently, the IPCC illustration shown in Figure 1 above has been published in an amended form to illustrate the implications of the unambitious GHG reduction targets committed to internationally.[25]

The figure has been overlaid with coloured borders which illustrate the possible impacts which could be avoided by emission reduction targets which are more ambitious than those currently on the table.

In this illustration, the blue box encloses those impacts that could be avoided through financed adaptation. The green box encloses impacts to be avoided by current emission reduction pledges. The red box denotes impacts that are unavoided, i.e. the gap between what can be adapted to at current levels of funding, and what will be mitigated at currently proposed levels of GHG mitigation. This analysis assumes that

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20 Meehl, G.A. et al. (2007). *2007: Global Climate Projections.* In: *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Fourth Assessment Report [Solomon et al. (eds.)]. Cambridge, Cambridge University Press, 789-793.

21 Nicholls R.J. et al. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Fourth Assessment Report [Solomon et al. (eds.)] Cambridge: Cambridge University Press, pp 315–356.

22 Meehl, G.A. et al. (2007) *2007: Global Climate Projections* in: *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon et al. (eds.)] p. 789-793.

23 Hare, H.C, Schaeffer, M. and M. Meinshausen (2009). *Emission reductions by the USA in 2020 and the risk of exceeding 2°C warming*. http://www.climateanalytics.org/ p. 6 and 20.

24 Kundzewicz, Z.W. et al. (2007). *2007: Freshwater Resources and their Management* in *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press, 173-210.

25 Parry, M. (2010) Copenhagen number crunch. Nature Reports Climate Change. Published online: 14 January 2010, doi:10.1038/climate 2010.01

without mitigation measures, the temperature rise by 2100 would be in excess of 4 degrees.[26]

What this graphic shows clearly, therefore, are the unavoided impacts that are likely to occur if governments fail to significantly strengthen their current pledges on emissions. There is effectively a gap corresponding to an average global temperature rise of 1.5 degree C (or greater). This 1.5 degree C gap represents an increased risk of extinctions, of changing agricultural production patterns, changing availability of water resources and increased risk of disease. A significant proportion of the burden is likely to be carried by developing countries.

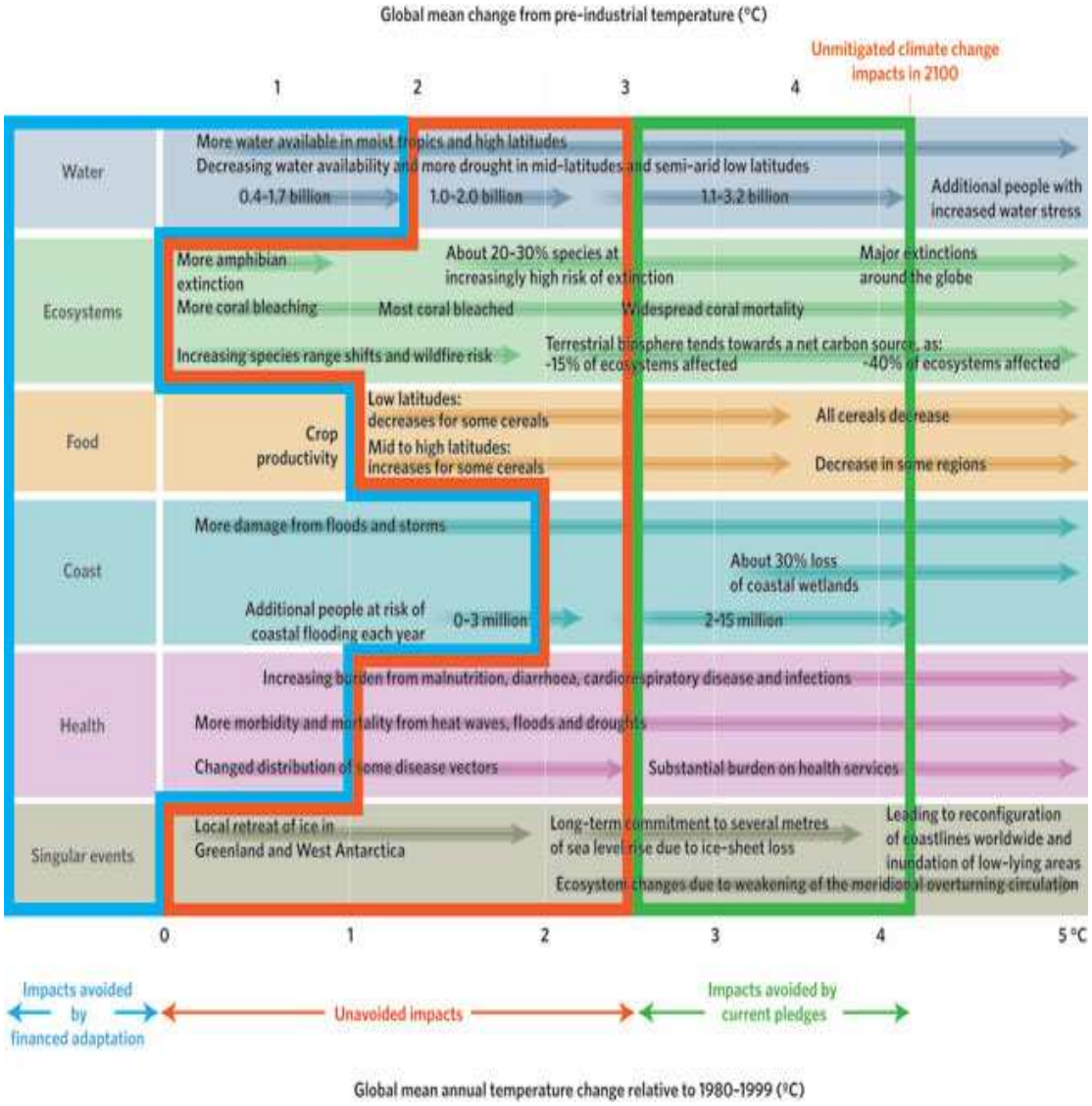

Figure 2: Illustration of the 1.5 degree C gap of unavoided impacts likely to result from current international commitments to adaptation funding and mitigation as laid out in the Copenhagen Accord, overlaid on the examples of global projected impacts from the IPCC 4th Assessment Report. [Reproduced with permission from Parry, M. (2010)]

For more information:

[26] Parry, M. (2010) Copenhagen number crunch. Nature Reports Climate Change. Published online: 14 January 2010, doi:10.1038/climate 2010.01

Further background information on climate change impacts and tipping points can be found in the Greenpeace briefing “Racing Over the Edge", published in May 2009.[27]

[27] Greenpeace International (2009). *Racing Over the Edge. New science on the Climate Crisis,* 12pp. http://www.greenpeace.org/raw/content/international/press/reports/racing-over-the-edge.pdf