

IPCC WGII report on climate change impacts, adaptation and vulnerability – key findings

March 31, 2014

The Intergovernmental Panel on Climate Change (IPCC) is the world's leading body for assessing climate science. Its Fifth Assessment Report (AR5) is being released in 2013-2014 in four pieces¹. The first part in September 2013 reconfirmed that climate change is happening, we're causing it, and it is rapidly getting worse. The second part, Working Group II report assesses **in more than 2000 pages and 30 chapters** the damage we've already caused to the natural and human systems; what's ahead if we continue burning fossil fuels and destroying forests and how we can reduce and manage risks ahead.

WG II Key findings in a nutshell

- **Climate impacts are already widespread** – on all continents and across the ocean. And it's already hurting us. Impacts from recent extreme climatic events, such as heat waves, droughts, floods, and wildfires, demonstrate significant vulnerability and exposure of some ecosystems and many human systems, such as food production, to climate variability.
- **Ecosystems and species, food and water security, livelihoods and human health are already impacted and are at increasing risk as warming continues.** The tropics, the Arctic, the coasts and low-lying regions face particular challenges.
- **Climate change is an increasing threat to human security**, as it harms access to food, water and shelter, destroys property, compromises culture and identity, increases forced migration and rivalry, and challenges the ability of states to provide the conditions necessary for human security. Indirectly, it can fuel risks of violent conflicts.
- **4°C warming by 2100 – where we're now heading – implies high or very high risks** and impacts to natural and human systems. Adaptation is of limited help.
- **Limiting warming to below 2°C – the goal governments have agreed to under UN – would reduce many key risks to medium or low-level**, when combined with robust adaptation measures. However, for some key risks 1.5°C warming is already too much.
- **For marine biodiversity loss risks remain high even with 2°C warming and adaptation.** The current rate of ocean acidification is unprecedented in the past 65-300 million years and can only be slowed down by cutting CO₂ emissions caused by fossil fuel burning.
- **Risks of large-scale, abrupt and irreversible changes** to natural and human systems can be reduced by preventing further warming and by protecting ecosystems from other stressors. **For the Amazon**, warming and deforestation form a dangerous cocktail.
- **Climate change will hurt the economy and more warming implies higher losses**, but estimates vary wildly and aggregate impacts hide large differences between countries. Narrow focus on quantifiable costs and benefits can bias decisions against the poor, the ecosystems and those in the future whose values can be excluded or are understated.
- **Healthy ecosystems and human systems can better cope with climate hazards** than those already weakened by other environmental and social stressors. Inequalities, poverty, gender discrimination, and lack of institutions increase vulnerability to climate hazards.
- **Bridging the existing funding gap on adaptation will be crucial** but not alone sufficient. Intra-country inequalities, management deficits and inconsistent development models must be addressed too, to reduce vulnerability of those most at risk. Adaptation needs to be locally tailored and aligned with mitigation and development strategies.

Observed impacts of climate change are already widespread and consequential

Observed impacts of climate change are already here, there and everywhere. Recent changes in climate have caused impacts on natural and human systems on **all continents and across the oceans**. For example:

- Air temperatures and oceans are **warming**, glaciers **melting** and sea-levels **rising**.
- **Heat waves** are increasing and **rain patterns** changing.
- Plant and animal **species** are moving and changing in abundance and behavior.
- Increased **tree mortality**, observed in many places worldwide, has been attributed to climate change in some regions.
- The physical and chemical properties of **oceans** have changed significantly.
- Coral reefs have experienced increased **mass bleaching and mortality**.
- Many **fishes**, invertebrates, and phytoplankton have shifted their distribution and/or abundance poleward and/or to deeper, cooler waters.
- Major climate-driven changes occur in the **Arctic** region, the boreal forest and many freshwater ecosystems. Permafrost continues to warm and thaw, which further accelerates warming.
- Negative impacts on crop and **food production** have been more common than positive impacts.
- Climate impacts on the hydrological cycle, and notably the availability of **freshwater resources**, have been observed on all continents and many islands.
- In recent decades, climate change has likely contributed to human **ill health**.
- Some parts of the world already **exceed** the international standard for safe work activity during the hottest months of the year. '**Cascading**' impacts of climate change from physical climate through ecosystems on people can now be detected along chains of evidence.

After 1.5°C warming key risks start turning from moderate to high

The WG II report updates its "[Reasons for Concern](#)" graph that visualizes how overall global and regional risks for **people, economies, and ecosystems** will increase along with temperature.

By now world's surface temperature has increased by about 0.85°C since pre-industrial levels. For unique and threatened ecosystems and cultures, and for extreme weather events, risks are high already with around 1.6°C warming above pre-industrial levels (1°C above recent levels).

Risks for large-scale singular events such as ice sheet disintegration, methane release from clathrates, and onset of long-term droughts remain moderate until 1.6°C, but increase disproportionately between 1.6°C and 2.6°C warming compared to pre-industrial levels (1°C – 2°C above current levels), due the potential for a large and irreversible sea-level rise from ice-sheet loss. (See Box SPM.4.)

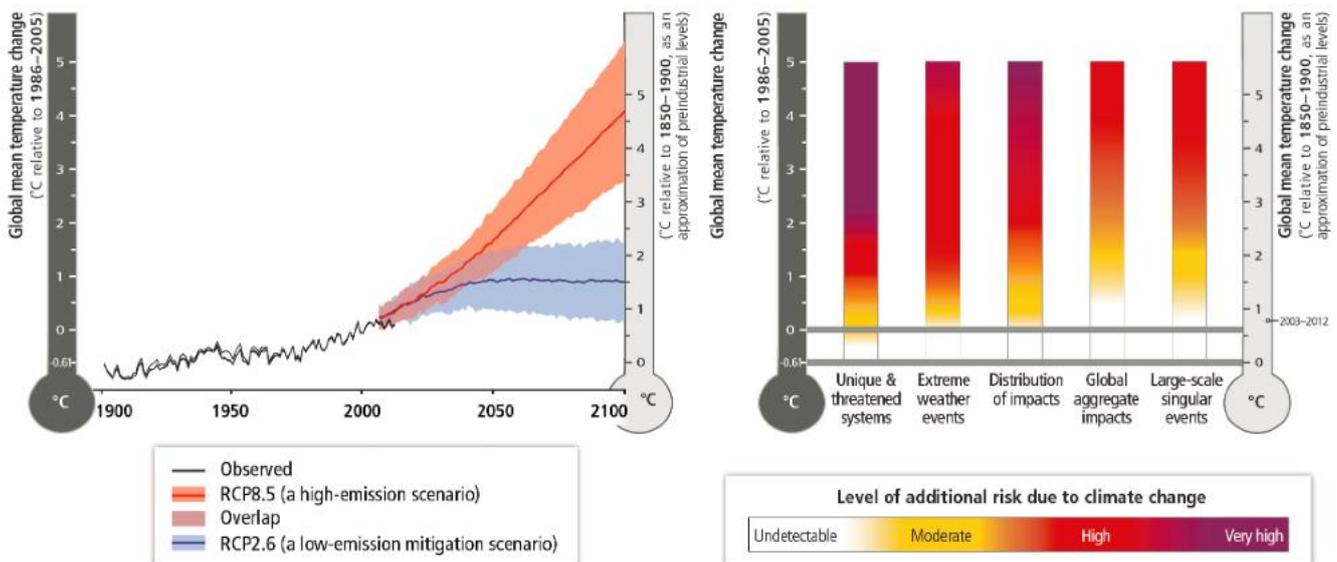


Figure 1. On the left, the red line implies temperature increases for the RCP8.5 scenario and the blue for RCP2.6. On the right, the colors on the five "pillars" reflect an updated assessment of risks for each Reason for Concern. (NOTE! This is a simplified caption. For the original caption, see IPCC WG II SPM Figure 1.)

Comparing 2°C and 4°C warmer futures underlines the choice we are facing

Governments have agreed to limit warming to less than 2°C, but with recent emission trends we could be heading towards 4°C warming by the end of the century, as the IPCC WG1 report found.

Throughout the WG II report, the IPCC compares these two possible futures - 2°C and 4°C warming. This is enabled by new scenarios, or Representative Concentration Pathways (RCP), which assume different levels of emission cuts. The SRES scenarios used before (and still in parallel with new scenarios) do not assume any mitigation policies.

One of the four new IPCC scenarios is compatible with staying below 2°C (RCP2.6), while one is a so-called business-as-usual scenario (RCP8.5), that results in warming of about 5°C by 2100, compared to pre-industrial levels (or 3.7°C above 1986–2005 levels by 2081–2100). The remaining two scenarios fall in betweenⁱⁱ.

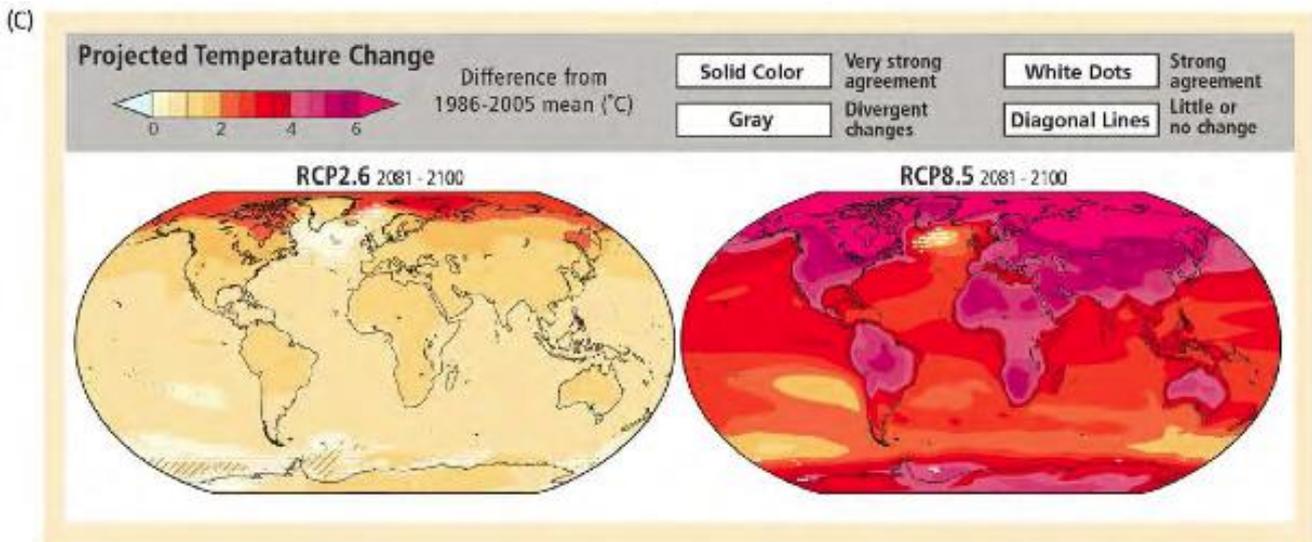


Figure SPM.4. C) Projected temperature increase under a low-emission mitigation scenario (RCP2.6) and a high-emission scenario (RCP8.5). (NOTE! This is a simplified caption. For the full original caption, see IPCC WG II Figure SPM.4 (c))

Keeping below 2°C with adaptation would protect from high and very high risks

The IPCC identifies 12 key global risks for different sectors and 2-3 key regional risks for each region, for which it assesses the risks implied by 2°C or 4°C long-term warming – with and without adaptation.ⁱⁱⁱ

For most of these key global risks **4°C warming by 2100 would imply high or very high risks, even with adaptation**. But by limiting warming to 2°C and implementing high adaptation measures, risks can be reduced to medium or low level. This is true for risks related to

- Increased species extinction
- reduced water access for the poor
- negative impacts on crop yields and increases in yield variability
- displacement (i.e. loss of homes) associated with extreme events
- reduction in terrestrial carbon sink (Boreal tipping point & Amazon tipping point)
- reduced growth and survival of commercially valuable shellfish and other calcifiers due to ocean acidification
- urban risks associated with housing

But for marine biodiversity loss; urban risks associated with water supply systems and for risks of declining work productivity, morbidity, and mortality caused by exposure to heat waves, **risks remain high even with 2°C warming and adaptation**.

For violent conflict arising from deterioration of resource-dependent livelihoods, and for urban risks associated with energy systems, risks would be high in 4°C *without* adaptation, but low with adaptation.

Regions face different risks

The IPCC identifies the following key risks for different regions^{iv}:

- **Africa** – water stress, reduced food productivity, spread of diseases
- **Europe** – flooding, freshwater availability, extreme heat events
- **Asia** – flooding, heat-related mortality, drought-related water and food shortage
- **Australasia** – damage and loss of coral reefs & other species, flood damage, coastal damage
- **North America** – wildfires, heat extremes, floods
- **Central and South America** – water shortage, urban floods, food production
- **Small Islands** – loss of livelihoods & infrastructure, sea-level rise & high water
- **The Ocean** – distributional shift in fish & invertebrate species, loss of coral reefs and their services, coastal inundation and habitat loss
- **Polar regions** – risks for ecosystems, risks for health and well-being of Arctic residents and unprecedented challenges and hazards to northern communities

Most of these risks (two out of three) can be reduced to medium or low level with 2°C warming and adaptation.

However, some risks remain high even with action (and very high for coral reefs in the Ocean). These are:

- increased risk of **heat-related mortality in Asia**
- damage and loss of coral reefs and some native **species in Australia**
- damage to ecosystems and humans caused by **wildfires in North America**
- **water availability** in some regions and **urban flooding in Central and South America**
- **sea level rise** and high-water-level events in low-lying coastal areas of small islands
- Reduced biodiversity, fisheries abundance, and coastal protection by **coral reefs in the Ocean**.
- All key risks related to **polar regions**

Climate change acts as a stress multiplier, so adaptation needs to be integrated with mitigation and development strategies

Climate-related risks interact with other biophysical stressors (such as biodiversity loss, soil erosion, and water contamination) and with social stressors (such as inequalities, poverty, gender discrimination, and lack of institutions). Acting as a threat multiplier, climate change makes existing problems worse. People already vulnerable and marginalized within their societies, particularly those who are impoverished – regardless of the wealth of the country in which they reside – in both north and south will be most at risk. This raises many ethical questions for how to respond to climate change. Today there is an adaptation gap and it is growing.

To be successful, adaptation needs to be locally tailored, aligned with mitigation and development strategies, and address different social and environmental stressors in a holistic and just manner.

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ⁱ The IPCC 5th Assessment Report will be published in four parts by different Working Groups (WG):

WG I: **The Physical Science Basis**, was published 27 Sep 2013, Stockholm, Sweden

WG II: **Impacts, Adaptation and Vulnerability**, 31 Mar 2014, Yokohama, Japan

WG III: **Mitigation of Climate Change**, 13 Apr 2014, Berlin, Germany

AR5 **Synthesis Report (SYR)**, 27-31 October 2014, Copenhagen, Denmark

ⁱⁱ The two scenarios that fall in between are RCP4.5 and RCP6.0. The number refers to the radiative forcing level (W/m²) each scenario will lead to by 2100. So RCP2.6 will lead to radiative forcing of 2.6 W/m² by 2100.

ⁱⁱⁱ WGII Technical Summary, Table TS.4. In this briefing "high" and "low" are interpreted from the figures.

^{iv} WG II SPM Assessment Box SPM.2 Table 1