

Climate change impacts already locked in—but the worst can still be avoided

November 16 2017



An artwork commissioned as part of the HELIX project. Credit: Erica Nockalls

Some impacts of global warming – such as sea level rise and coastal flooding – are already locked in and unavoidable, according to a major research project.

Global temperatures have already risen by around 1°C, and a further 0.5°C [warming](#) is expected. The full impacts of current warming have not yet been seen, since ice sheets and oceans take many decades to fully react to higher temperatures. But more severe impacts can still be avoided if global [greenhouse gas emissions](#) are reduced.

More than 50 scientists from 16 institutions in 13 countries have worked on the HELIX project (High-End Climate Impacts and Extremes), which has just finished after four years. The project examined the possible effects of warming of 1.5°C, 2°C, 4°C and 6°C compared to pre-industrial levels.

Even with rapid cuts in global greenhouse gas emissions keeping warming below 2°C, sea levels could rise by 0.5m by the end of the 21st Century, particularly affecting small island states and low-lying countries. HELIX calculations suggest this could impact 2.5 million in Bangladesh.

However, if emissions continue and [global warming](#) exceeds 4°C, sea levels will rise further and could impact around 12 million people in Bangladesh if a storm surge from tropical cyclones adds further to the impact.

Increased rainfall is expected to further compound the flooding risk by raising river levels.

"A warmer atmosphere can hold more water, so rainfall would be more intense," said HELIX project leader Professor Richard Betts, of the University of Exeter.

"This would inevitably mean more flooding, and our research suggests the largest increase in [flood risk](#) would be in parts of America, Asia and Europe."

At 4°C, the researchers say most countries – nations accounting for 73% of world's population 79% of the global GDP – could experience a five-fold increase in river flood risk and flood damage (compared to a baseline period 1976-2005).

HELIX scientists advised EU officials before the signing of the Paris Agreement, in which 195 countries pledged to keep warming "well below" 2°C.

And the research findings suggest this would limit flooding risk – though the risk would still double at 1.5°C and rise by 170% at 2°C.

Professor Beets added: "This wetter climate should also mean fewer droughts in some areas, though droughts could become more common in other areas – for example some parts of Africa and southern Europe."

This complex picture of different effects in different areas also applies in terms of crop production.

"Some places will do better and some will do worse," Professor Betts said.



The Brahmaputra River. Credit: Guwahati Assam

"For example, with warming of 4°C , some parts of Europe would have improved production of certain crops, while other crops would be harder to grow. In Britain, it would become harder to grow wheat but easier to grow maize.

"Overall, worldwide food security would be more at risk, not just from changing crop yields but because extreme weather affects the people who grow the crops."

HELIX used sophisticated computer models and vast datasets to produce its projections.

Professor Betts said: "It is clear that humanity has a huge challenge to deal with here.

"The countries of the world have agreed to try to minimise global warming, and the debate has now moved on to exactly how to achieve this is – but we will have to live with some changes that are already unavoidable."

Case study: Warming 'will cause more floods in Bangladesh'

Global warming will make river flooding more common and more severe around one of Asia's major rivers, according to research carried out as part of the HELIX project.

Scientists compared likely flooding around the Brahmaputra River in Bangladesh at different levels of warming – and found it would be happen more during the wetter months from January to August at 2°C compared to 1.5°C (compared to pre-industrial levels).

The research, carried out by Bangladesh University of Engineering and Technology, also suggests that there will be fewer periods of low water levels in the drier months from September to December.

The Brahmaputra, which flows through China and India, is Bangladesh's main source of fresh water but is prone to flooding – and earlier this year floods killed scores of people and caused widespread destruction.

Bangladesh's flat, low-lying landscape makes it very vulnerable to flooding, and therefore to climate change. Large-scale flooding risks arise from two sources - high river flows and rising sea levels.

The Brahmaputra River is a major cause of nationwide flooding in Bangladesh, but it is also crucial in terms of people's access to water and food.

The findings about flood risk are a real concern, as floods have historically caused catastrophic damage in Bangladesh in terms of loss of life, damage to crops, destruction of infrastructure and hindrance to economic growth.

More information: Khaled Mohammed et al. Extreme flows and water availability of the Brahmaputra River under 1.5 and 2 °C global warming scenarios, *Climatic Change* (2017). [DOI: 10.1007/s10584-017-2073-2](https://doi.org/10.1007/s10584-017-2073-2)

Provided by University of Exeter

Citation: Climate change impacts already locked in—but the worst can still be avoided (2017, November 16) retrieved 23 April 2024 from <https://phys.org/news/2017-11-climate-impacts-ndash-worst.html>

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