

10 New Insights in Climate Science 2020

1 Improved models strengthen support for ambitious emission cuts to meet Paris Agreement



2 Emissions from thawing permafrost likely to be worse than expected

3 Tropical forests may have reached peak uptake of carbon

Key new insights

- Earth's temperature response to doubling the levels of carbon dioxide in the atmosphere is now better understood. While previous IPCC assessments have used an estimated range of 1.5–4.5°C, recent research now suggests a narrower range of 2.3–4.5°C.
- This means that moderate emissions reduction scenarios are less likely to meet the Paris temperature targets than previously anticipated.
- Improved regional scale models provide better information about heavy rainfall events and hot and cold extremes, offering new opportunities for water resource management.
- Regional climate predictions can now be made up to a decade ahead with higher skill than previously thought possible.

Key new insights

- Emissions of greenhouse gases from permafrost will be larger than earlier projections because of abrupt thaw processes, which are not yet included in global climate models.
- These abrupt thaw effects could as much as double the emissions from permafrost thaw under moderate and high emissions scenarios.
- Emissions from permafrost thaw could be yet higher due to effects on plant root activity, which increases soil respiration.

Key new insights

- Land ecosystems currently draw down 30% of human CO₂ emissions due to a CO₂ fertilization effect on plants.
- Deforestation of the world's tropical forests are causing these to level off as a carbon sink but this is balanced by greater recent carbon uptake in the northern hemisphere.
- Global plant biomass uptake of carbon due to CO₂ fertilization may be limited in the future by nitrogen and phosphorus sphere.
- CO₂ emissions from land-use changes continue to be high in the 21st century and remain a large threat to the land sink.

4 Climate change will severely exacerbate the water crisis



Key new insights

- Crises of water quality and quantity are intimately linked with climate change and increasing extremes.
- New empirical studies show that climate change is already causing extreme precipitation events (floods and droughts), and these extreme settings in turn lead to water crises.
- The impact of these water crises is highly unequal, which is caused by and exacerbates gender, income, and sociopolitical inequality.
- Climate change coupled with socioeconomic drivers can impact access to water of good quality.
- Water-related climate extreme events are contributing to the migration and displacement of millions of people; migration is being treated as an adaptation strategy within the international policy community.



5 Climate change can profoundly affect our mental health

Key new insights

- Climate change can directly and indirectly adversely affect mental health over short and longer time scales. Growing evidence suggests the overall burden of mental health impacts of climate variability is high and will increase with additional climate change.
- Cascading and compounding risks are contributing to anxiety and distress.
- The mental health consequences of climate variability and change can affect anyone but disproportionately affect those suffering from health inequities.
- The promotion and conservation of blue and green space within urban planning policies as well as the protection of ecosystems and biodiversity in natural environments have health co-benefits and provide resilience.

6 Governments are not seizing the opportunity for a green recovery from COVID-19



Key new insights

- Temporary COVID-19 lockdowns resulted in a large and unprecedented global reduction in GHG emissions and visible improvements in urban air quality.
- The substantial drops in GHG emissions during COVID-19-induced lockdowns are unlikely to have any significant long-term impact on global emission trajectories.
- Governments all over the world have committed to mobilizing more than US\$12 trillion for COVID-19 pandemic recovery. As a comparison, annual investments needed for a Paris-compatible emissions pathway are estimated to be US\$1.4 trillion.
- Stimulus packages allocated by leading economies for agriculture, industry, waste, energy, and transport, amounting to US\$3.7 trillion, have the potential to reduce emissions from these sectors significantly but governments do not seem to be seizing this opportunity.
- Governments' economic stimulus packages will shape GHG emissions trajectories for decades to come – for better or worse. If invested in climate-compatible activities, they could be a turning point for climate protection.

7 COVID-19 and climate change demonstrates the need for a new social contract



Key new insights

- COVID-19 and climate change exemplify transboundary risks that erode human well-being and economic security, particularly affecting the most vulnerable.
- The pandemic has spotlighted inadequacies of both governments and international institutions to cope with transboundary risks.
- Accelerating climate risks require innovative approaches to governance.
- Some communities and governments have demonstrated that COVID-19 risks can be addressed with innovative local, national, and international responses, and stronger global responses are needed.
- NGOs, community groups, youth movements, and many other social actors have shown that transboundary responses to global risks of climate change are also possible and there is mounting pressure on governments to act decisively. A new social compact would strengthen the prospects for a humane and just world with a stable climate.



8 Economic stimulus focused primarily on growth would jeopardize the Paris Agreement

Key new insights

- A growing number of studies highlight the economic benefits of strategies that stay well below 2°C or even 1.5°C.
- The costs of renewable energy, battery-electric vehicles, and other low-carbon solutions have fallen dramatically.
- A COVID-19 recovery strategy based on growth first and sustainability second is likely to fail the Paris Agreement.
- Investments are needed for a system transition but all must contribute to net energy or CO₂ savings in line with the Paris Agreement.

9 Electrification in cities pivotal for just sustainability transitions

Key new insights

- Urban electrification is a powerful pathway to an equitable energy transition.
- Over a billion people who currently lack access to electricity will benefit from stronger electrification efforts.
- Reductions in local air pollution and improvements to health and quality of life are tangible co-benefits of urban electrification.
- An actor-oriented equity-based approach to the transition will maximize the benefits and mitigate the risks of urban electrification.
- Key aspects for a successful transition include considering the constraints of the built environment, equity, governance, and how electricity-powered technologies interact with building design, urban, and mobility planning, and people's use of urban space.

10 Going to court to defend human rights can be an essential climate action

Key new insights

- Rights-based litigation is emerging as a tool to address climate change.
- Through such climate litigation, legal understandings of who or what is a rightsholder are expanding to include future, unborn generations, and elements of nature, as well as who can represent them in court.
- Climate litigation shows cross-fertilization between outcomes in different courts and tribunals, such as national case law influencing responses of international tribunals.
- Climate-related court cases address harm to people also across national boundaries.
- Courts come in as "lawmakers" to address climate change, given the absence of adequate climate action in other contexts.

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