

**COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY  
U.S. HOUSE OF REPRESENTATIVES**

**HEARING CHARTER**

*An Update on the Climate Crisis: From Science to Solutions*

Wednesday, January 15, 2020  
10:00 a.m.  
2318 Rayburn House Office Building

**PURPOSE**

The purpose of this hearing is to provide an update on the state of climate science. The Committee will receive expert testimony on significant climate reports published in 2019 and will discuss report findings that include: climate change impacts to our lands, oceans, and the cryosphere, and associated risks to human society and ecosystems; the gap in anticipated global emissions and emissions levels needed to keep global temperatures below 1.5°C or 2°C of warming above preindustrial levels. Additionally, witnesses will discuss opportunities to address climate change impacts through adaptation and mitigation. This hearing will specifically touch on the findings of the following three reports: 1) IPCC Special Report: Climate Change and Land, August 2019; 2) IPCC Special Report: The Ocean and Cryosphere in a Changing Climate, October 2019; 3) United Nations Environment Programme: Emissions Gap Report 2019, November 2019.

**WITNESSES**

- **Dr. Pamela McElwee**, Associate Professor of Human Ecology, School of Environmental and Biological Sciences, Rutgers, The State University of New Jersey
- **Dr. Richard Murray**, Deputy Director & Vice President for Research, Woods Hole Oceanographic Institution
- **Dr. Heidi Steltzer** - Professor of Environment and Sustainability, Fort Lewis College, Colorado
- **Mr. Michael Shellenberger**, Founder and President, Environmental Progress
- **Ms. Taryn Fransen**, Senior Fellow, Global Climate Program, World Resources Institute

**OVERARCHING QUESTIONS**

- What does the most recent science tell us about how climate change impacts lands, oceans and the cryosphere, and how do these impacts affect people and ecosystems?
- What impacts are Americans already experiencing due to climate change, and what impacts are projected to occur?
- What solutions to address climate change and reduce greenhouse gas emissions are ready for implementation, and which require additional investment?
- What actions should the United States take to adapt to and mitigate impacts from climate change?

## **BACKGROUND**

### IPCC Special Report on Climate Change and Lands

The Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> Special Report on Climate Change and Lands (Lands Report)<sup>2</sup> examines the interplay between land use and anthropogenic climate change. This includes how land use affects the degree and impacts of climate change, how climate change in turn impacts the land, and how policy reform and behavior change can offer climate solutions.<sup>3</sup> The Lands Report represents a synthesis of over 7000 academic papers and was prepared by 107 scientists from 52 countries. This report represents a major milestone, as it is the first IPCC Report with more authors from developing nations, which will experience the worst impacts of climate change, than authors from developed nations.<sup>4</sup>

The Lands Report emphasizes that climate impacts on land are already severe, and that land use in turn is a significant driver of climate change. In some areas, land is degrading due to more frequent and intense heat waves and droughts; rainfall patterns are shifting in frequency and in intensity;<sup>5</sup> crop yields and livestock productivity are diminished;<sup>6</sup> and risks from agricultural pests and diseases are changing.<sup>7</sup> Human behaviors and land management policies are driving intensive exploitation which is also degrading land. For example, agricultural soil is degrading at rates 10 to 100 times faster than it is formed.<sup>8</sup>

The Lands Report also evaluates climate impacts on food security in terms of availability from yield and production, access in terms of prices and ability to get food, utilization in nutrition and cooking, and stability from disruptions.<sup>9</sup> Warming of 2°C threatens a food crisis, with disproportionate risks for tropical and sub-tropical regions. Climate change may impact the nutritional content of foods, and water scarcity will increasingly become a dire problem with every increment of warming. Climate change can drive migration and can impact the food system from production to supply chain.<sup>10</sup> Nearly one-third of food produced is currently wasted, presenting opportunities to improve food security.<sup>11</sup> Also, plant-based diets or sustainably-produced animal sources of food offer opportunities to reduce emissions and adapt to stressed conditions.<sup>12</sup>

Agriculture, deforestation, and other land management practices contribute significantly to the

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<sup>1</sup> The IPCC is a United Nations (UN) body responsible for scientific assessments of climate change, with an aim to inform policymakers on climate science, implications, and strategies. It was established by the UN Environment Programme and World Meteorological Organization in 1988. It has 195 member states. It produces periodic Assessment Reports (AR) every four to six years, as well as Special Reports, which undertake interdisciplinary issues that span more than one of its three Working Groups. Special Reports are typically shorter and more focused. At its 41<sup>st</sup> Session in 2015, the IPCC decided to produce a Methodology Report, AR6, and three Special Reports, on Global Warming of 1.5°C, Oceans and Cryosphere in a Changing Climate, and Climate Change and Land.

<sup>2</sup> IPCC, 2019: Special Report on Climate Change and Lands <https://www.ipcc.ch/srccl/> (Lands Report)

<sup>3</sup> Summary for Policymakers, Lands Report

<sup>4</sup> [https://www.ipcc.ch/2019/08/08/land-is-a-critical-resource\\_srccl/](https://www.ipcc.ch/2019/08/08/land-is-a-critical-resource_srccl/)

<sup>5</sup> Ibid. at 2: Section A2

<sup>6</sup> Ibid. at 2: Section A5

<sup>7</sup> Ibid. at 2: Section A2

<sup>8</sup> Ibid. at 2: Section A1

<sup>9</sup> Ibid. at 2: Section A2

<sup>10</sup> Ibid. at 2: Section A5

<sup>11</sup> Ibid. at 2: Section A1

<sup>12</sup> Ibid. at 2: Section B6

carbon cycle and climate change overall, producing about 23% of anthropogenic emissions. The agricultural sector can play a critical role in climate solutions. Land is both a source and sink of greenhouse gas (GHG) emissions and absorbs 29% of GHGs humans emit annually into field soils and plant growth. However, this ability of land to soften the impacts of climate change is limited, as the ability of soils to perform this function diminishes as temperatures rise.<sup>13</sup>

Early progress toward a far-reaching transformation of agriculture, forestry, and land use, with actions well underway by 2040, is necessary to reach the goals of the Paris Agreement. Improving agricultural practices through better soil management, genetics, and agroforestry, is both possible and often a mutually beneficial solution for both reducing emissions and maintaining or boosting production levels.<sup>14</sup> Stopping deforestation should be a critical global policy priority and restoring forests can store atmospheric carbon.<sup>15</sup> However, the report says that some policies, such as afforestation and bioenergy with carbon capture and sequestration, must be implemented carefully; these policies can create competition with land for food crops, which can exacerbate food insecurity.<sup>16</sup> Timelines are short for preserving agricultural productivity, land quality, biodiversity, and food security. The agricultural sector faces the shortest window to implement successful adaptation and mitigation measures due to the diminishing capability of fields to store carbon and diminishing crop yields.<sup>17</sup>

### IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

In September 2019, the UN IPCC released the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) as part of the Sixth Assessment Report Cycle.<sup>18</sup> The SROCC offers a stark view of both current and future conditions of the oceans and cryosphere as we continue to emit large amounts of carbon into the atmosphere. The prognosis if we continue with business as usual is bleak; however, the report emphasizes that under a low emissions scenario, catastrophic impacts can be avoided.

The oceans and cryosphere directly or indirectly affect all people on Earth. Oceans cover 71% of the Earth's surface, while the cryosphere, or the frozen parts of the Earth's system, cover 10% of the Earth in the form of glaciers and ice sheets.<sup>19</sup> Coastal communities, small islands, polar zones and high mountains are at risk from changes such as sea level rise and melting glaciers and ice sheets. Communities further inland face threats from ocean changes through extreme weather events. The ecosystems of the oceans and cryosphere provide many services: the uptake of carbon dioxide and heat, supplying food and water, providing renewable energy, as well as tourism, trade, and transport. The SROCC states that the world is at or near critical tipping points that if passed, will trap the Earth into a positive feedback loop, leading to irreversible melting of ice sheets and further, catastrophic warming.

The SROCC covers observed changes, projected changes, and the implementation of responses to changes in the oceans and cryosphere. Observed changes to the oceans include increased warming,

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<sup>13</sup> Ibid. at 2: Section A3

<sup>14</sup> Ibid. at 2: Sections B2-B6

<sup>15</sup> Ibid. at 2: Section B7

<sup>16</sup> Ibid. at 2: Section B3

<sup>17</sup> Ibid. at 2: Section A3

<sup>18</sup> IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate <https://www.ipcc.ch/srocc/> (SROCC)

<sup>19</sup> Summary for Policymakers, SROCC

higher acidity, declining oxygen, disruption of fish species, more extreme storms, and increasingly frequent marine heat waves.<sup>20</sup> Melting ice sheets are now the primary driver of the sea level rise that threatens coastal communities with flooding. Coastal ecosystems are being damaged by climate change and human activity, weakening their ability to act as a buffer for sea level rise.<sup>21</sup> In polar and high mountain areas, snowpack is declining, which has threatened water supplies and led to increasing incidence of wildfires.<sup>22</sup>

Even if we were able to quickly and dramatically reduce GHG emissions, there are many locked-in changes projected to occur in the near future. These expected changes to coasts include higher sea level rise than was predicted in the IPCC's Sixth Assessment Report, which, without significant adaptation efforts, will lead to frequent and devastating coastal flooding.<sup>23</sup> In the Arctic, sea-ice free summers are more likely to occur, with far-reaching impacts on Arctic shipping and global trade, ecosystems, and coastal communities.<sup>24</sup> In the high mountain regions, snowpack decline will significantly threaten economies that rely on the ski industry.<sup>25</sup>

Continuing with business as usual will cause increasing ocean acidification and oxygen deprivation, the collapse of many fisheries, increasingly frequent and intense extreme weather, devastating sea level rise, and the loss of many biodiverse ecosystems. Thawing permafrost will release carbon into the atmosphere, accelerating the positive feedback loop of global warming. However, shifting to a low emissions pathway will dramatically reduce the aforementioned risks. The SROCC recommends shifting to ocean-based renewable energy sources to mitigate climate change and prevent catastrophic impacts on the oceans and cryosphere. It also calls for rapidly scaling up adaptation efforts to reduce the severity of impacts for marine ecosystems and Arctic and coastal communities.<sup>26</sup>

### UNEP Emissions Gap Report 2019

The United Nations Environment Programme (UNEP)<sup>27</sup> released its tenth annual Emissions Gap Report (EGR)<sup>28</sup> in November 2019. The report provides an independent scientific assessment of the gap between anticipated carbon emission levels in 2030 and levels that would limit the rise of global temperatures to 1.5°C and 2°C over preindustrial levels. Prepared by 57 scientists from 33 expert institutions spanning 25 countries, the 2019 edition synthesizes the most current research into seven chapters organized around the key questions underpinning the 2018 Talanoa Dialogue, a product of the 23<sup>rd</sup> Conference of Parties (COP).<sup>29</sup> In the spirit of open discussion, the assessment

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<sup>20</sup> Chapter 5, SROCC

<sup>21</sup> Chapter 4, SROCC

<sup>22</sup> Chapters 2 and 3, SROCC

<sup>23</sup> Chapter 6, SROCC

<sup>24</sup> Chapter 3, SROCC

<sup>25</sup> Chapter 2, SROCC

<sup>26</sup> Chapter 6, SROCC

<sup>27</sup> The United Nations Environment Programme (UNEP) is a separate entity from the United Nations Framework Convention on Climate Change (UNFCCC), though its work is closely tied to the latter's goals. The UNEP was founded in 1972 to coordinate UN efforts on sustainable development, climate, biodiversity, and other related fields. At the request of several member countries, the Emissions Gap Report was developed in 2010 to fill the need for an independent synthesis of emissions estimates, similar to the work of the IPCC. (<https://www.unenvironment.org/resources/emissions-gap-report-2019>)

<sup>28</sup> United Nations Environment Programme (2019). Emissions Gap Report 2019. UNEP, Nairobi.

<https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf?sequence=1&isAllowed=y>

<sup>29</sup> The 23<sup>rd</sup> Conference of Parties (COP23) launched the Talanoa Dialogue, a mandated process aimed at increasing cooperation and facilitating dialogue between Parties in effort to build up to implementing the strongest possible emissions reduction commitments.

not only updates the status and projections of current global greenhouse gas emissions but also issues estimates of the drastic cuts required to comply with the Paris Agreement goals and bring warming down to within 1.5°C and 2°C.

The EGR details the acceleration of GHG emissions and thus, the increasingly difficult challenge of enacting the political and technical changes required to rein in emissions. Emissions show no signs of peaking, reaching a record high of 55.3 gigatons of carbon dioxide equivalents (GtCO<sub>2e</sub>) in 2018, and bolstered by a 2.0 percent growth in fossil fuel emissions. This has created an estimated emissions gap of about 32 GtCO<sub>2e</sub> between current annual emissions and the track towards 1.5°C warming; instead, under current policies, global trends indicate an increase to annual emissions of 60 GtCO<sub>2e</sub>. The EGR notes that developing countries use more energy per unit of economic activity than developed countries do; a critical difference as wealthier countries are increasingly outsourcing their carbon consumption to other countries in order to meet their own emissions goals.

The EGR specifically examines the performance of G20 nations<sup>30</sup> and finds that the United States is not on track to meet the 2010 Cancun Pledges, which formalized the emission reduction goals agreed upon in the Copenhagen Accord of COP15 into non-legally binding commitments.<sup>31</sup> Not only are significant actions required of the United States to meet its nationally determined contributions (NDCs)<sup>32</sup> set in the Paris Agreement, but, to stay within 1.5°C or 2°C of warming, the nation will have to set more stringent emissions targets. The EGR asks that developed nations like the United States lead the global charge towards emissions reductions, ideally towards a fundamental decarbonization of the global economy. Although the magnitude of this challenge is acknowledged, the authors also stress the multitude of co-benefits that could arise from such a shift. Solutions, such as the widespread expansion of renewable energy technologies, energy efficiency measures, and electrification of end uses, are emphasized as necessary to mitigation efforts. The authors also highlighted a few U.S.-specific policies identified to help meet the NDCs:

- Introduce regulations on power plants, clean energy standards and carbon pricing to achieve an electricity supply that is 100 percent carbon-free
- Implement carbon pricing on industrial emissions
- Strengthen vehicle and fuel economy standards to be in line with zero emissions for new cars in 2030
- Implement clean building standards so that all new buildings are 100 per cent electrified by 2030

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<sup>30</sup> The G20 is an organization of the world's largest 20 economies and include: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the European Union.

<sup>31</sup> <https://unfccc.int/process-and-meetings/conferences/past-conferences/cancun-climate-change-conference-november-2010/cancun-climate-change-conference-november-2010-0>

<sup>32</sup> The Nationally Determined Contributions refer to the voluntary Paris Agreement targets that each country set for themselves, based on the maximum each country believes is possible for themselves. These goals are essentially a reaffirmation of the Cancun Pledges. Each year, signatories are expected to report on their emissions and mitigation efforts, and continually revisit the targets for improvement.

## **ADDITIONAL READING**

- International Cryosphere Climate Initiative, “Cryosphere1.5°: Where Urgency and Ambition Meet – Why Cryosphere Dynamics Must Mean 1.5° Pathways for 2020 NDCs,” (2019) [http://iccinet.org/wp-content/uploads/2019/12/Cryosphere1-5\\_191211a\\_high-res.pdf](http://iccinet.org/wp-content/uploads/2019/12/Cryosphere1-5_191211a_high-res.pdf)
- Ocean and Climate Platform, “Ocean and Climate Change: New Challenges – Focus on 5 Key Themes of the IPCC Special Report on the Ocean and Cryosphere,” (2019) <https://ocean-climate.org/wp-content/uploads/2019/12/fiches-EN-web.pdf>
- International Union for Conservation of Nature and Natural Resources, “Ocean deoxygenation: Everyone’s Problem – Causes, impacts, consequences, and solutions,” (2019) <https://portals.iucn.org/library/sites/library/files/documents/00%20intro%20DEOX.pdf>
- Future Earth & The Earth League, “10 New Insights in Climate Science,” (2019) <https://futureearth.org/wp-content/uploads/2019/12/10-New-Insights-in-Climate-Science-2019.pdf>