Global warming of 1.5C Reflections from the latest report of the Intergovernmental Panel on Climate Change (IPCC)

Diana Liverman
University of Arizona


Climate change

We have 12 years to limit climate change catastrophe, warns UN

Urgent changes needed to cut risk of extreme heat, drought, floods and poverty, says IPCC

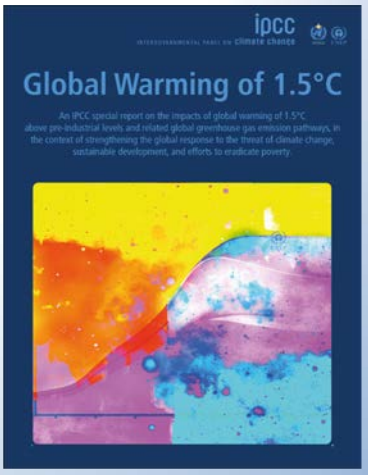
Overwhelmed by climate change? Here's what you can do

IPCC Special Report on 1.5C

Response to UN-FCCC request in the 2015 Paris Agreement

Assess the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways…in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

https://www.ipcc.ch/report/sr15/



The report in numbers

- **91** Lead Authors from **40** Countries
- **133** Contributing authors
- **6000** Studies Assessed
- **1 113** Reviewers
- **42 001** Comments
- **18** month timeline

INTERGOVERNMENTAL PANEL ON climate change

Timelines and meetings

March 2017	*Brazil*
June 2017	*UK*
July 2017	*First draft*
Sep 2017	*Expert review*
Oct 2017	*Sweden*
Dec 2017	*Second draft*
Jan 2018	*Government review*
Apr 2018	*Botswana*
May 2018	*Final Draft*
Aug 2018	*Summary for Policy Makers*
Oct 2018	*IPCC government approval of SPM S. Korea*

Approved Outline

Ch1 Observed change and carbon budgets, key concepts
Ch2 Mitigation pathways to 1.5ºC
Ch3 Impacts of 1.5ºC and 2ºC on climate, natural and human systems
Ch4 Mitigation and adaptation options, feasibility, costs
Ch5 Sustainable development, poverty eradication and reducing inequalities

ANNEX 1

Proposed outline of the special report in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development and efforts to eradicate poverty

Title:

Global warming of 1.5ºC

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

List of Contents

Front Matter (2 pages)
Summary for Policy Makers (up to 10 pages, incl. headline statements, tables, figures)
Chapter 1: Framing and context (15 pages)
Chapter 2: Mitigation pathways compatible with 1.5°C in the context of sustainable development (40 pages)
Chapter 3: Impacts of 1.5°C global warming on natural and human systems (60 pages)
Chapter 4: Strengthening and implementing the global response to the threat of climate change (50 pages)
Chapter 5: Sustainable development, poverty eradication and reducing inequalities (20 pages)
Boxes - integrated case studies/regional and cross-cutting themes (up to 20 pages)
FAQs (10 pages)
Total: up to 225

Incheon, Korea, October 2018: Report approval

Challenges

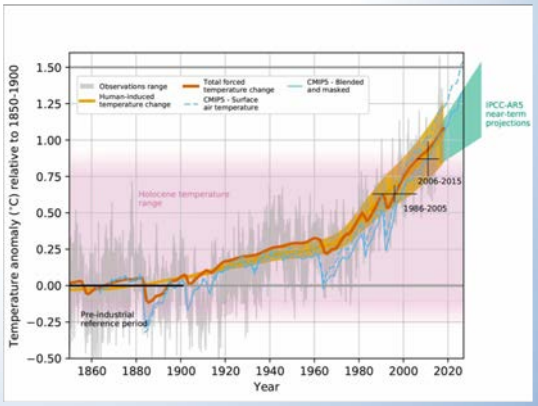
- 18 month timeline
- Collaboration between IPCC Working Groups
- High and urgent policy relevance to COP
- Lack of literature that compares 1.5ºC with 2ºC, overshoot and SDG/climate connections, most literature came out very late
- Regional implications hard to assess
- 42,000 review comments to respond to

SR1.5 main messages

- Climate has warmed almost 1ºC from preindustrial
- Every bit of warming matters, losses increase significantly from 1.5ºC to 2ºC
- Limiting warming to 1.5ºC requires deep cuts in emissions
- Even a warming of 1.5ºC undermines many development goals

The climate has already warmed by 1ºC or more

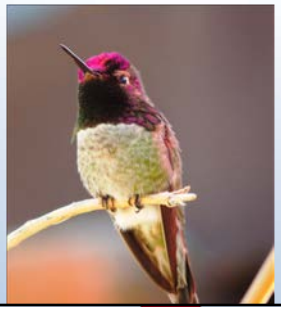
- Since pre-industrial times (~1850), human activities have caused approximately 1°C of global warming
- Observed warming has been greater than 1°C near poles, over land, and at night
- At current rate of warming, earth would reach 1.5°C between 2030 and 2052

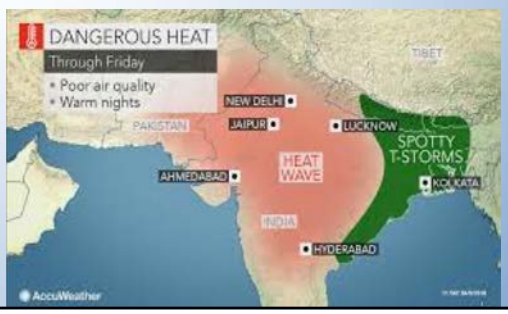


INTERGOVERNMENTAL PANEL ON climate change

Warming has already had impacts on society and ecosystems

- heat waves, severe storms, droughts, ocean temperatures, ice loss, fires





Every bit of warming matters… with significantly more serious impacts at 2ºC compared to 1.5ºC

- 1.5ºC has less serious impacts on people and ecosystems than 2ºC or higher temperatures
  - *At 1.5ºC tropical corals survive, at 2ºC they disappear*
  - *Risk of habitat loss for many species, and the transformation of ecosystems, is 50% less at 1.5ºC*

1.5ºC compared to 2ºC : Impacts on health and livelihoods

- Proportion of people exposed to water stress and heatwaves could double
- Sea level rise is about 10 cm less with 10+ million less people at risk Poverty rises by 100+ million from 1.5ºC to 2ºC
- Economic impacts are less at 1.5ºC
- Some are affected more than others because of differential vulnerabilities

  Small islands, least developed countries, women and children

12

SDG Impacts at at 1.5ºC and 2ºC

Table 5.1: Sustainable development implications of avoided impacts between 1.5°C and 2°C global warming

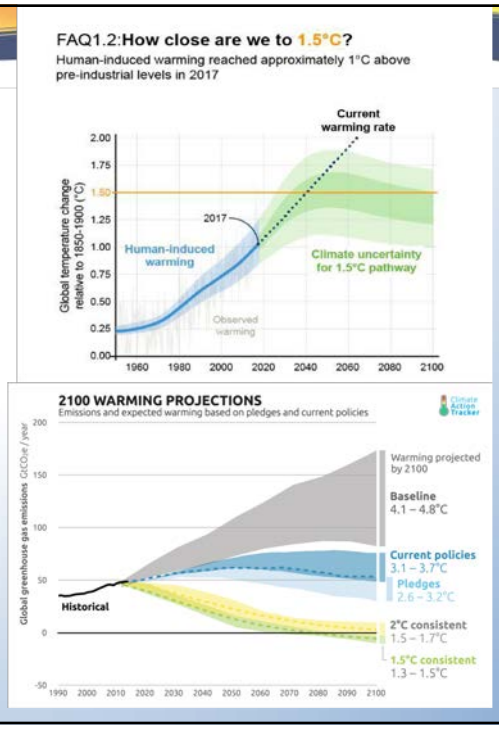
Impacts	Chapter 3 section	1.5°C	2°C	Sustainable development goals (SDGs) more easily achieved when limiting warming to 1.5°C
Water scarcity	3.4.2.1	4% more people exposed to water stress	8% more people exposed to water stress with 184-270 million people more exposed	SDG 6 water availability for all
	Table 3.4	496 (range 103-1159) million people exposed and vulnerable to water stress	586 (range 115-1347) million people exposed and vulnerable to water stress	
Ecosystems	3.4.3 Table 3.4	Around 7% of land area experiences biome shifts	Around 13% (range 8-20%) of land area experiences biome shifts	SDG 15 to protect terrestrial ecosystems and halt biodiversity loss
	Box 3.5	70-90% of coral reefs at risk from bleaching	99% of coral reefs at risk from bleaching	
Coastal cities	3.4.5.2	Less cities and coasts exposed to sea level rise and extreme events	More people and cities exposed to flooding	SDG 11 to make cities and human settlements safe and resilient
	3.4.5.1	31-69 million people exposed to coastal flooding	32-79 million exposed to coastal flooding	
Food systems	3.4.6 and Box 3.1	Significant declines in crop yields avoided, some yields may increase	Average crop yields decline	SDG 2 to end hunger and achieve food security
	Table 3.4	32-36 million people exposed to lower yields	330-396 million people exposed to lower yields	
Health	3.4.7	Lower risk of temperature related morbidity and smaller mosquito range	Higher risks of temperature related morbidity and mortality and larger range of mosquitoes	SDG 3 to ensure healthy lives for all
	Table 3.4	3546-4508 million people exposed to heatwaves	5417-6710 million people exposed to heatwaves	

Economic losses 22% less at 1.5C than 2C and up to 2% of GDP in 2050 (SDG8)

We are a long way from limiting warming to 1.5C with current policies and commitments

- At current warming rate global average temperature reaches 1.5ºC in 2040 and 2ºC in 2060
- Current policies take us to 3.1Cº-3.7ºC by 2100
- Paris agreement takes us to 2.6ºC-3.2ºC by 2100

IPCC SR1.5C Chapter 1



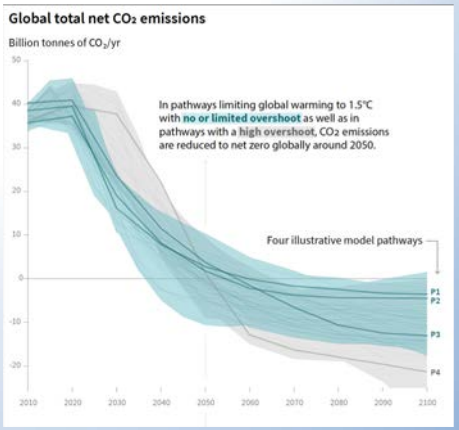
Global warming will undermine sustainable development

Climate impacts will make it difficult to achieve the Sustainable Development Goals (SDGs) - more so at 2ºC than 1.5ºC

- Eradicating poverty and hunger
- Securing health, wellbeing and clean water
- Reducing inequality between and within countries
- Protecting life below water and life on land

For a chance to limit warming to 1.5ºC we must make deep and rapid cuts in emissions

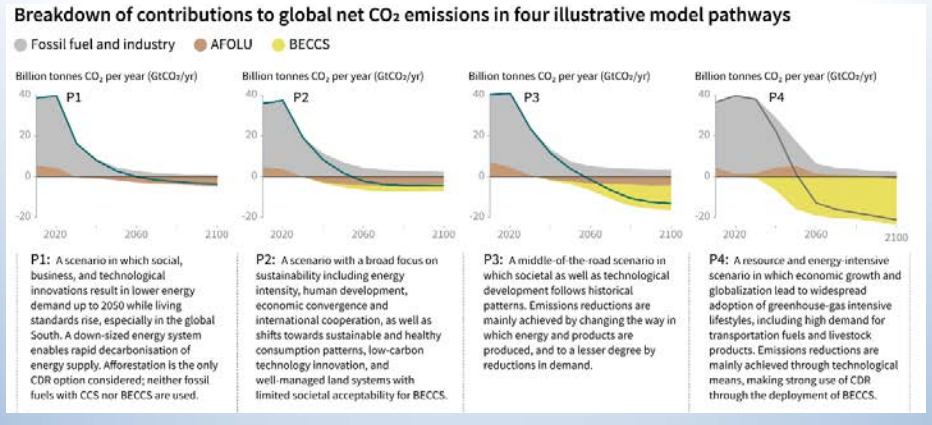
- ***Limiting warming to 1.5ºC is incredibly challenging***
- Any chance of 1.5ºC requires ***halving emissions by 2030 and net zero emissions by 2050***
- Step increase and shifts in investments in energy system
- Massive sequestration efforts through land use or technology (CCS)



Multiple mitigation options assessed

- Rapid transition from fossil fuel to renewables, nuclear, and bioenergy
- Increases in energy efficiency
- Reduced energy demand
- Protection and expansion of forests and carbon sinks
- Dietary changes (less meat)
- Carbon capture and storage (CCS) technology after 2030
- Modeled pathways do not include geoengineering options for cooling the planet (e.g. solar radiation management)

SPM3b | Characteristics of four illustrative model pathways (MAGICC and FAIR IAMs)

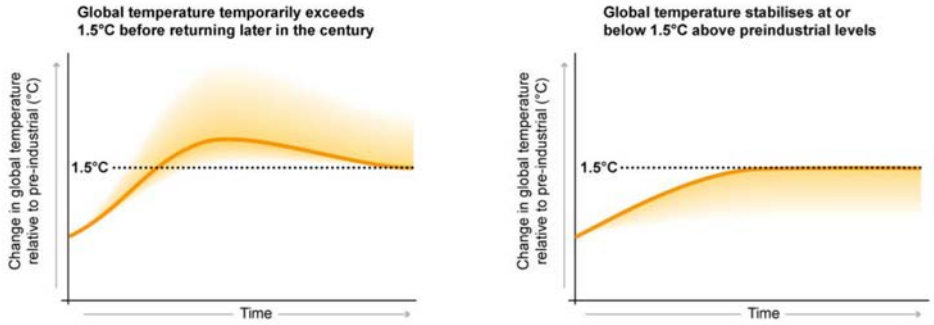


ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP

Likely temperature overshoot

FAQ2.1: **Conceptual pathways that limit global warming to 1.5°C**

Two main pathways illustrate different interpretations for limiting global warming to 1.5°C. The consequences will be different depending on the pathway



SPM3b | Characteristics of four illustrative model pathways

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or low overshoot	No or low overshoot	No or low overshoot	High overshoot	No or low overshoot
CO_2 emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-59,-40)
- in 2050 (% rel to 2010)	-93	-95	-91	-97	(-104,-91)
Kyoto-GHG emissions* in 2030 (% rel to 2010)	-50	-49	-35	-2	(-55,-38)
- in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
Final energy demand** in 2030 (% rel to 2010)	-15	-5	17	39	(-12, 7)
- in 2050 (% rel to 2010)	-32	2	21	44	(-11, 22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47, 65)
- in 2050 (%)	77	81	63	70	(69, 87)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78,-59)
- in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95,-74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
- in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
- in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
- in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
- in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(243,438)
- in 2050 (% rel to 2010)	832	1327	878	1137	(575,1300)
Cumulative CCS until 2100 ($GtCO_2$)	0	348	687	1218	(550, 1017)
- of which BECCS ($GtCO_2$)	0	151	414	1191	(364, 662)
Land area of bioenergy crops in 2050 (million hectare)	22	93	283	724	(151, 320)
Agricultural CH_4 emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-46,-23)
Agricultural N_2O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,4)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

* Kyoto-gas emissions are based on SAR GWP-100
** Changes in energy demand are associated with improvements in energy efficiency and behaviour change

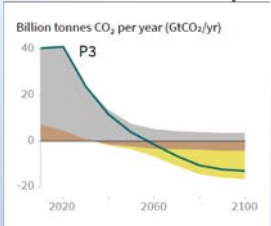
ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP

Pathway P2 (Limited overshoot)
Energy System change from 2010

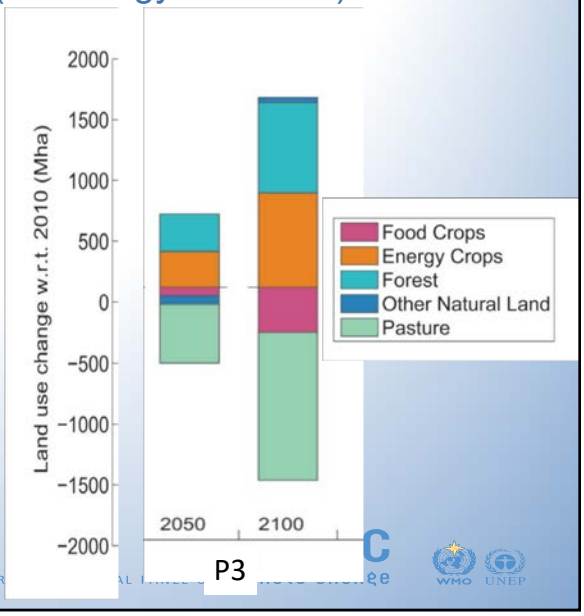
Action	2030	2050
Energy Demand	-5%	2%
Energy from Coal	-61%	-77%
Energy from Oil	-13%	-50%
Energy from Gas	-20%	-53%
Energy from Nuclear	+83%	+98%
Energy from renewables (wind, solar, hydro, geothermal)	+470%	+1327%
CCS+Bioenergy	+348 GT	+151 GT

AFOLU (forests and land use), BECCS (Bioenergy and CCS) and Sustainable Development

Pathways to 1.5ºC rely on negative emissions with negative implications for sustainable development



P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

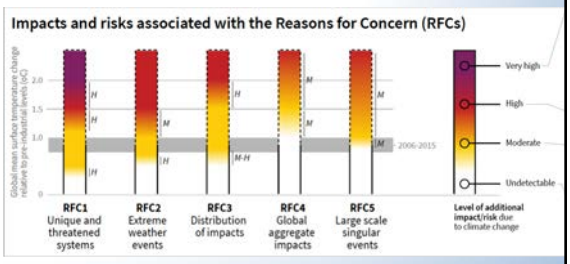


Adaptation responses

A wide range of adaptation options are available…and needed even at 1.5ºC

- Ecosystem-based adaptation e.g. ecosystem restoration and avoided degradation and deforestation, biodiversity management
- Coastal defense and hardening
- Agricultural adaptation e.g. efficient irrigation, improved seeds, soil management
- Disaster risk management, risk spreading and sharing
- Community-based adaptation
- Urban adaptation: green infrastructure, sustainable planning, and sustainable water management

IPCCSR1.5 SPM



Climate responses and sustainable development
Adaptation synergies and tradeoffs

- Limiting warming to 1.5ºC makes adaptation much easier than at 2 ºC or above
- Overall, the impacts of adaptation on sustainable development, poverty eradication and reducing inequalities in general, and the SDGs specifically, are expected to be largely positive
- But adaptation, if not well planned can have tradeoffs with sustainable development

Adaptation and sustainable development: Agriculture

- Adapting agriculture to climate change has direct benefits for SDG2 hunger as well as poverty, health etc.
- But if agricultural adaptation involves expanded area or use of irrigation and chemicals there are trade-offs with water, health and ecosystem SDGs
- Adaptation projects have also overlooked women, the poor and indigenous knowledge

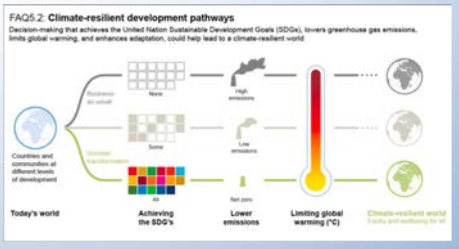
Adaptation options in housing sector

- Increased air conditioning can increase energy costs and use of fossil fuels
- Adaptation can be expensive for poor

Chapter 5 proposes : Climate Resilient Development Pathways to 1.5ºC

Trajectories that strengthen sustainable development and efforts to eradicate poverty through equitable societal transformations across all scales and economies, while reducing the threat of climate change through ambitious mitigation, adaptation, and climate resilience

Can we meet the SDGs, reduce emissions and adapt to climate change?



The longer we wait….

- Larger and faster reductions will need to be made
- We rely more on bioenergy and CCS
- Higher the risk of overshoot and associated impacts
- We will undermine the SDGs
- Adaptation will be more difficult

Criticisms so far…

- Too pessimistic/depressing
- Not pessimistic enough (tipping points, conflict and migration)
- Doesn't address the question of allocation of responsibility
- Did not adequately answer key questions of costs and benefits, (loss and damage, costs and limits of adaptation)
- Reliance on Integrated Assessment Models
- Key sections rely on small number of papers
- Disagreements with assessment of nuclear, SRM, BECCS etc.
- Many research gaps

Thank you and thanks to the IPCC SR1.5C team