Global warming of 1.5°C:
IPCC's approach to producing Reports during the Sixth Assessment Cycle (AR6)

WGII: Impacts, Adaptation and Vulnerability

Hans-O. Pörtner,
CLA Ocean Systems AR5 WGII Ch. 6
AR5 Synthesis Report
Co-Chair IPCC WGII AR6

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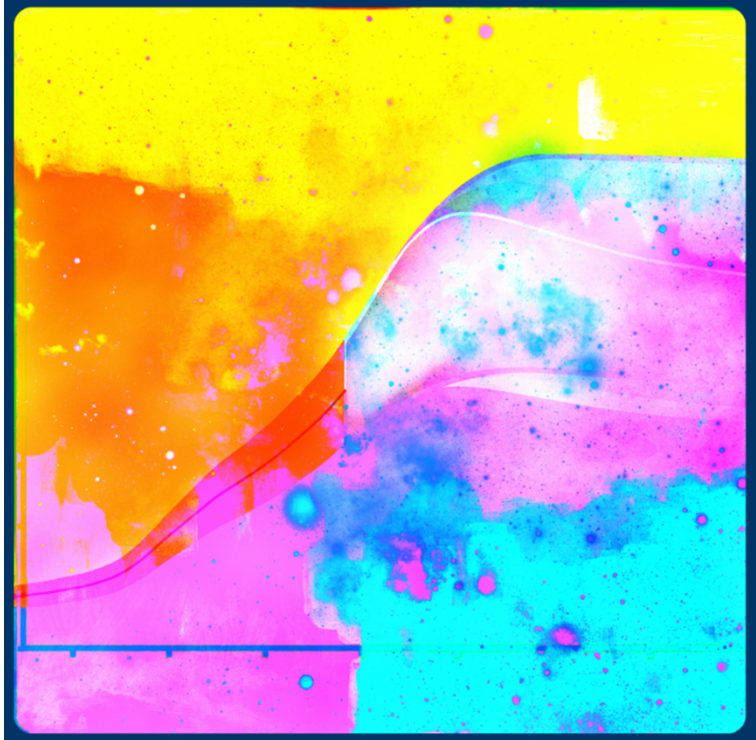


IPCC Special Report on Global Warming of 1.5°C

Avoided Impacts and Risks: Guiding AMBITION in mitigation and adaptation

Impacts of global warming 1.5°C: Where should we go?

At 1.5°C compared to 2°C:

- Less extreme weather where people live, including extreme heat and rainfall
- By 2100, global mean sea level rise will be around 10 cm lower …. but may continue to rise for centuries
- 10 million fewer people exposed to risk of rising seas (…less coastal ecosystems exposed)

Jason Florio / Aurora Photos

Where do we want to go?

At 1.5˚C compared to 2˚C:

- Lower impact on biodiversity and species
- Smaller reductions in yields of maize, rice, wheat crop yields
- Global population exposed to water shortages is up to 50% less (also less water shortages for ecosystems)

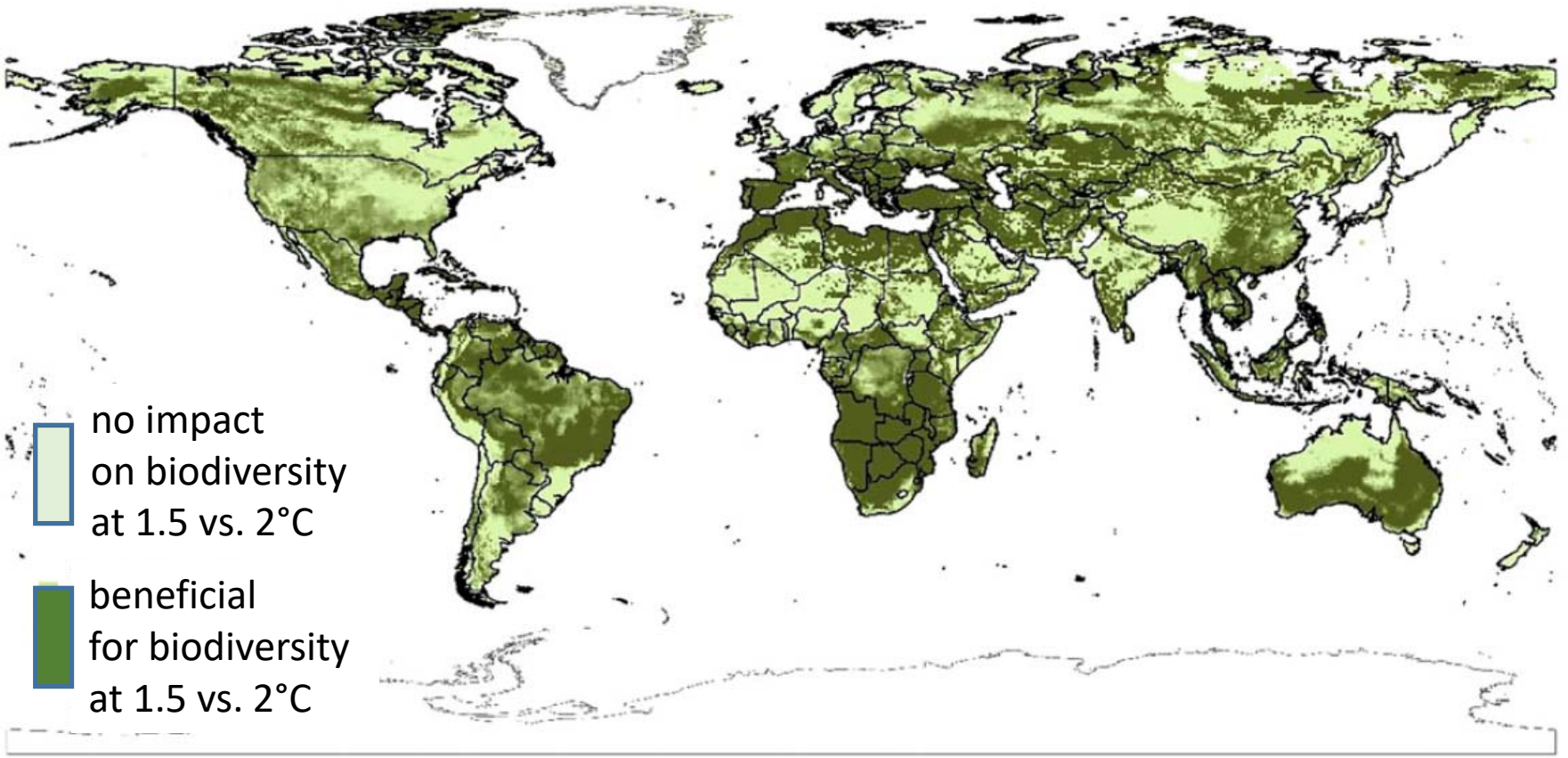
Andre Seale / Aurora Photos

Terrestrial biodiversity

P. Smith et al. 2018

At 1.5˚C compared to 2˚C:

- Lower impacts on biodiversity and species



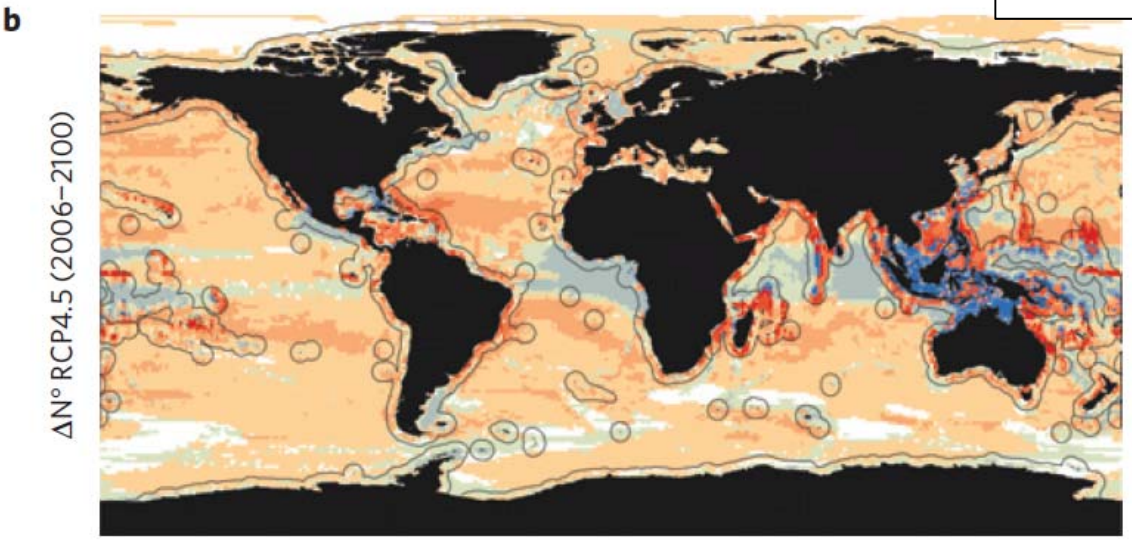
Terrestrial Meta-analysis as in SR1.5

ILLUSTRATIVE EXAMPLE

AR5: Marine biodiversity

Drivers of change: Warming and velocity....

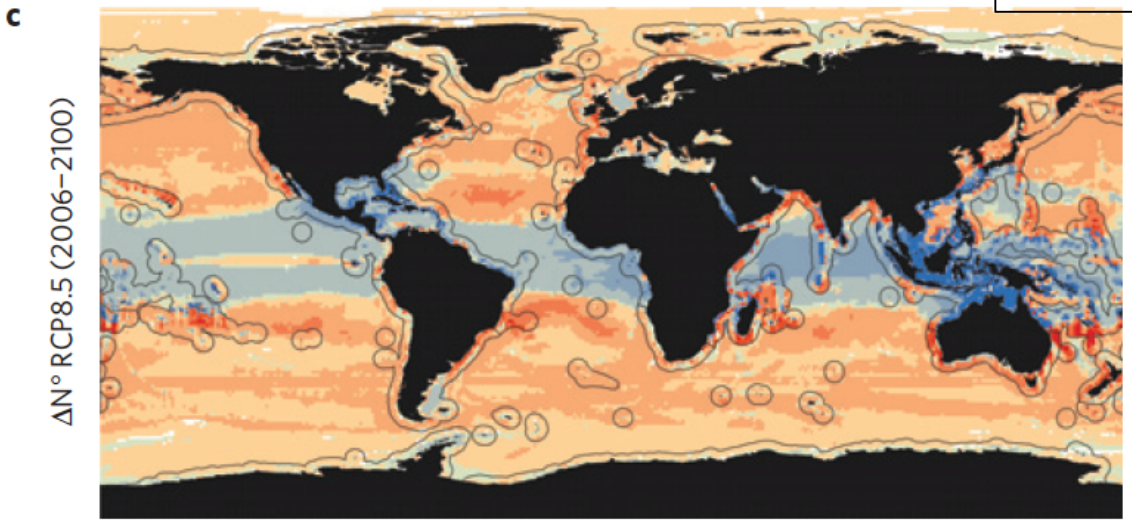
+2°C



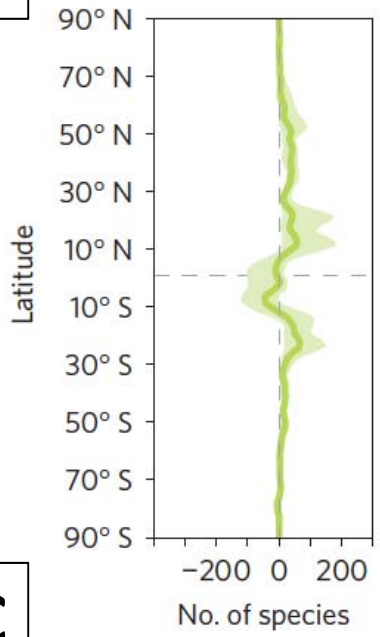
RCP4.5 versus 8.5

Ultimate Species Heat Limits surpassed in Tropics

+4°C

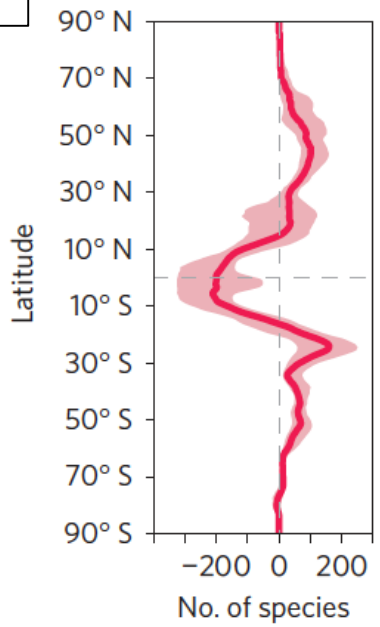


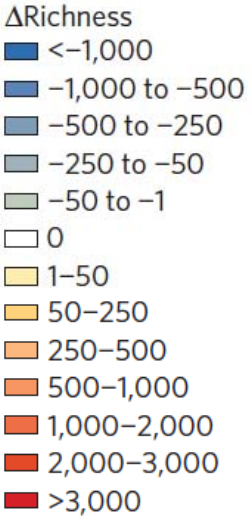
Large changes in community composition expected driven by local invasions and losses



RCP 4.5

Garcia-Molinos et al. 2015, 2017 NCC





RCP 8.5

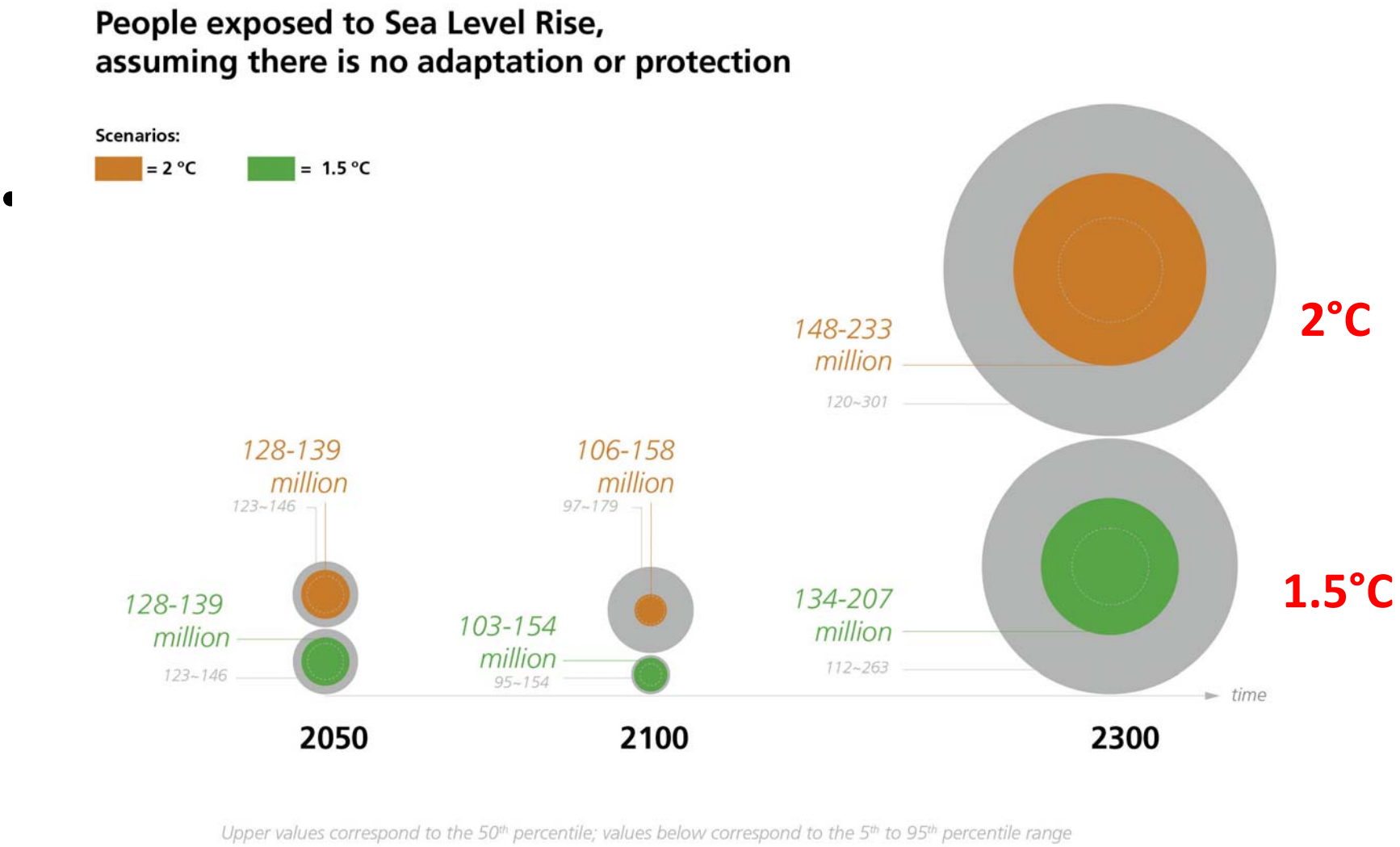
ILLUSTRATIVE EXAMPLE

Where do we want to go?

At 1.5˚C compared to 2˚C:

- Lower risk to fisheries & the livelihoods that depend on them
- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050

Natalie Behring / Aurora Photos


People exposed to Sea Level Rise,
assuming there is no adaptation or protection
Scenarios:
= 2 °C
= 1.5 °C
148-233
million
120~301
2°C
128-139
million
123~146
106-158
million
97~179
128-139
million
123~146
103-154
million
95~154
134-207
million
112~263
1.5°C
time
2050
2100
2300
Upper values correspond to the 50th percentile; values below correspond to the 5th to 95th percentile range

SR 1.5

Where do we want to go?

At 1.5˚C and 2˚C:

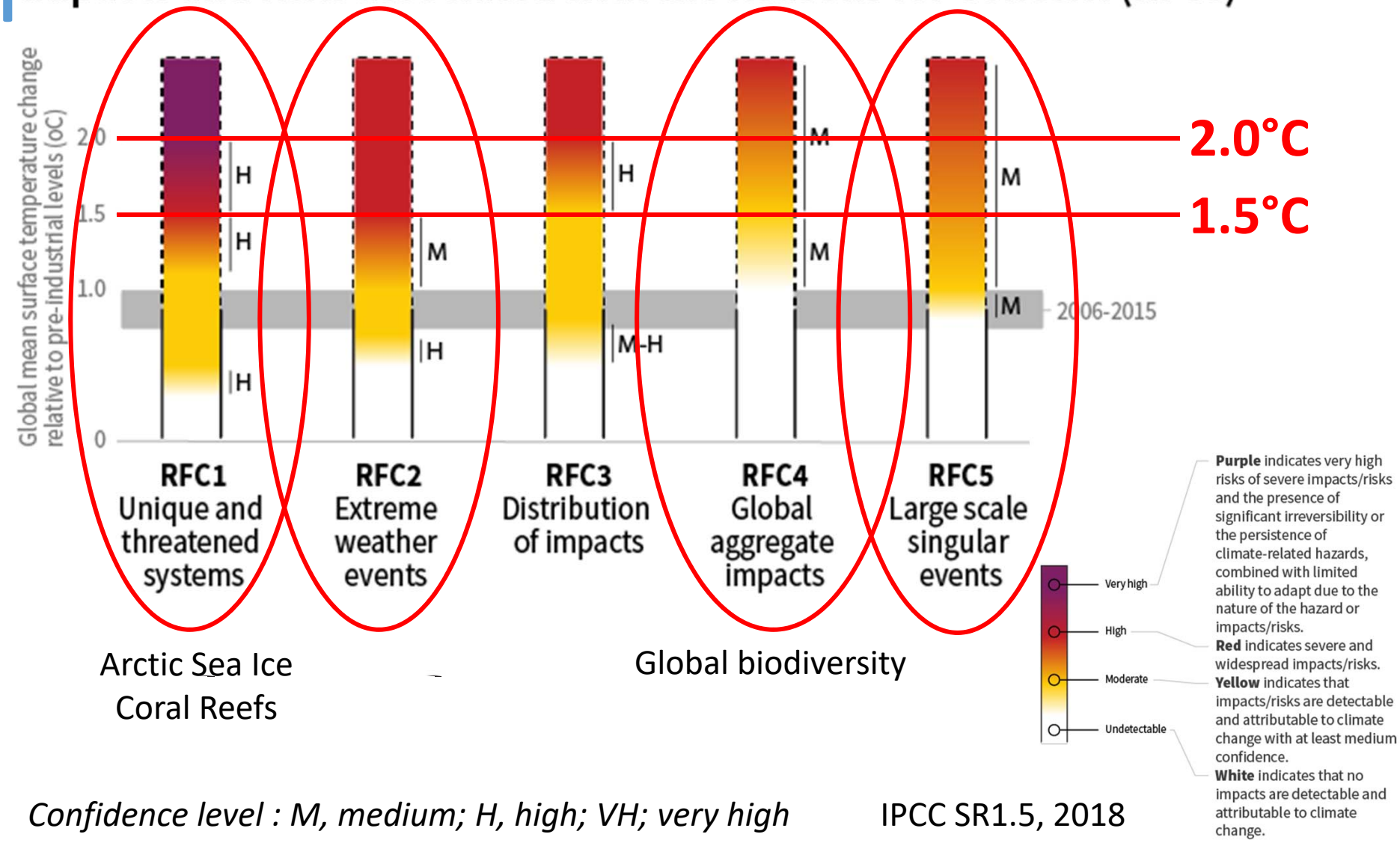
- Disproportionately high risk for Arctic, dryland regions, small island developing states and least developed countries

At 1.5˚C compared to 2˚C:

- Lower risks for health, livelihoods, food security, water supply, human security and economic growth
- A wide range of adaptation options can reduce climate risks; less adaptation needs at 1.5˚C

Jason Florio / Aurora Photos

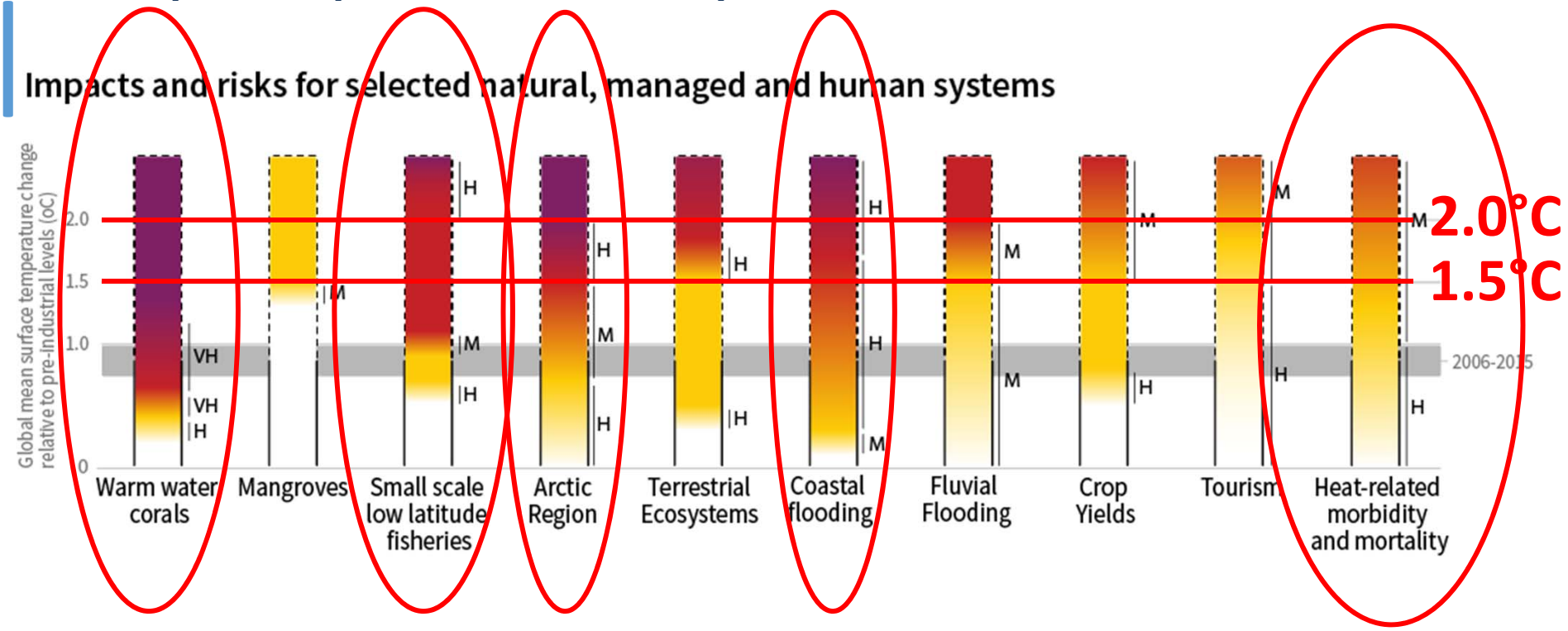
Impacts and risks associated with the Reasons for Concern (RFCs)



Confidence level : M, medium; H, high; VH; very high

IPCC SR1.5, 2018

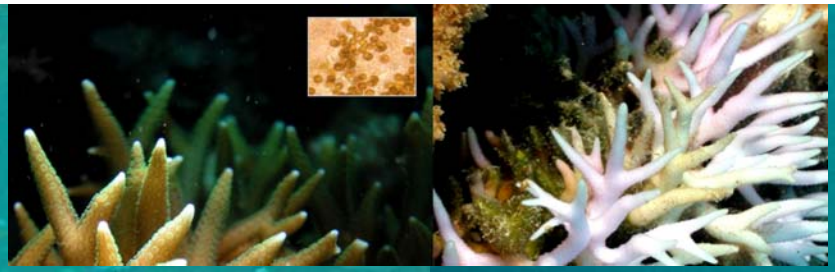
….half a degree matters… every bit of warming matters….
… for ecosystems, biodiversity and humankind



…less loss and damage at 1.5°C

Confidence level : M, medium; H, high; VH; very high

IPCC SR1.5, 2018



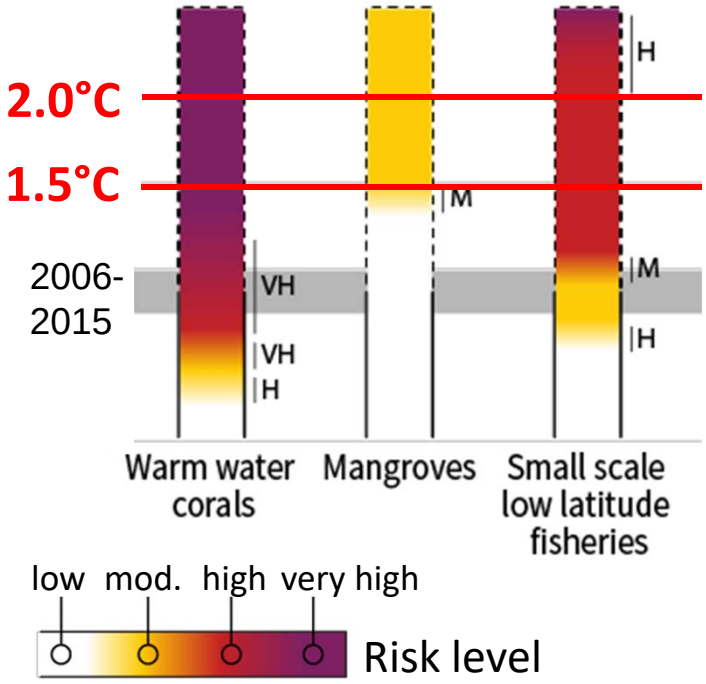
OBSERVATIONS

0.8 to 1.0°C

Vulnerable ecosystem identified in AR5 and SR1.5

Warm water coral reefs under various pressures

Assessing risk of global warming



Verons 2009

Even in a 1.5°C warmer world.... high risk of losing 70 to 90% of coral reefs and their services to humankind; ... even higher losses at 2°C

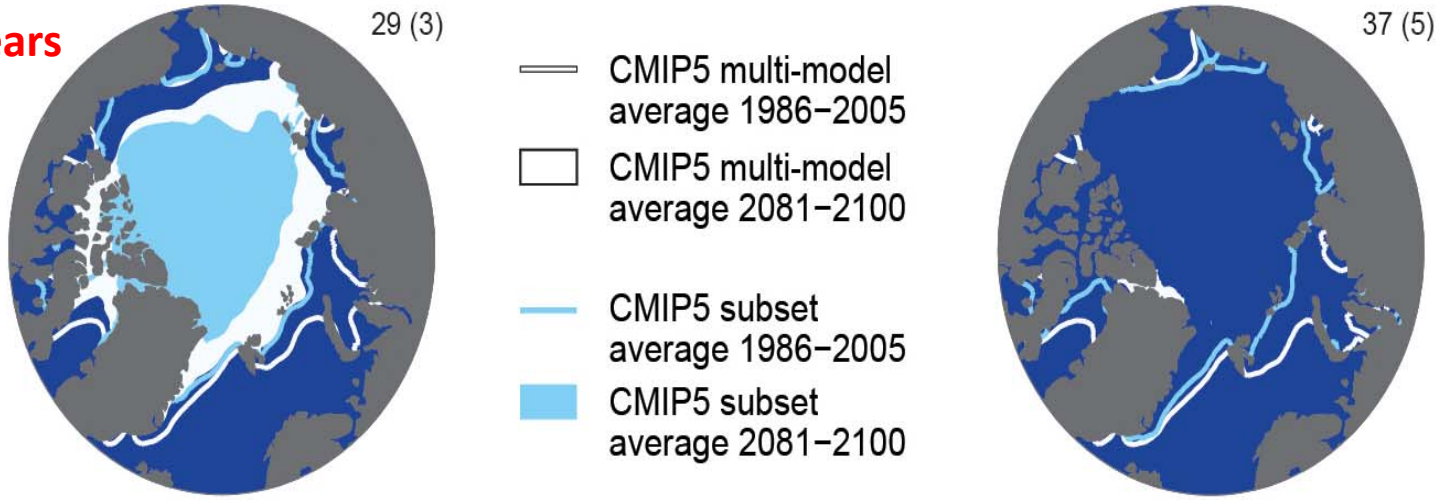
2016

Vulnerable ecosystems identified in AR5 and SR1.5:
Arctic summer sea ice systems

1.5°C	≥2°C
RCP 2.6 ambitious mitigation	RCP 8.5 business as usual

Northern Hemisphere September sea ice extent (average 2081–2100)

1 in 100 years ice-free at 1.5°C



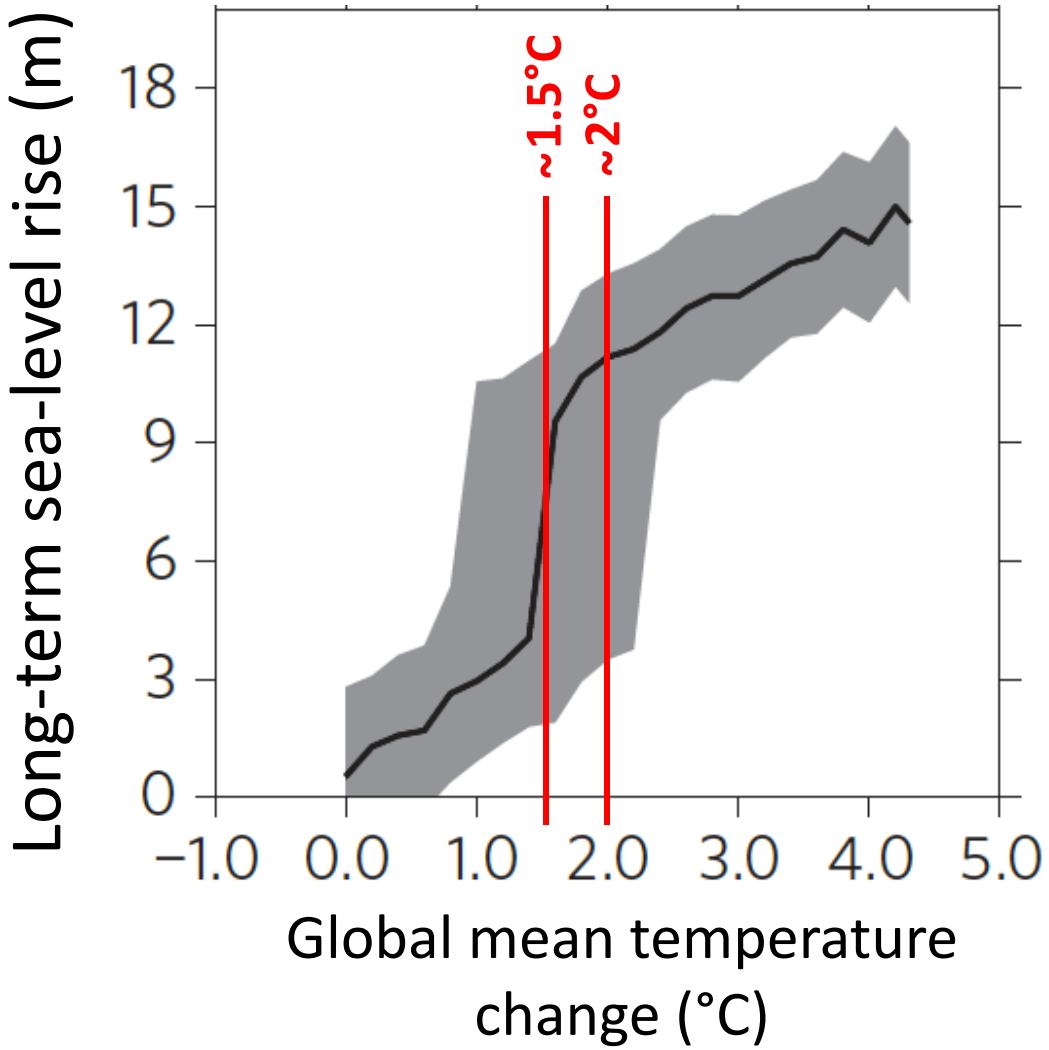
> 1 in 10 years ice-free at 2°C

AR5 WGI SPM.7b, 8c

Sea level rise beyond 2100 may challenge biological and human systems:

1.5°C

High ambition mitigation needed



....affecting habitat, freshwater resources, human society through flood events

Coming close to Paleo-findings....

5-9 m : ...during the last interglacial (Eemian, 125.000 ya, at 0.7-2°C above pre-industrial)

>7m : ...last time when the atmosphere had 400 ppm CO_2 (in Pliocene, 3-5 Mya)

Knutti et al., Ngeo 2015

TO BE ASSESSED IN AR6

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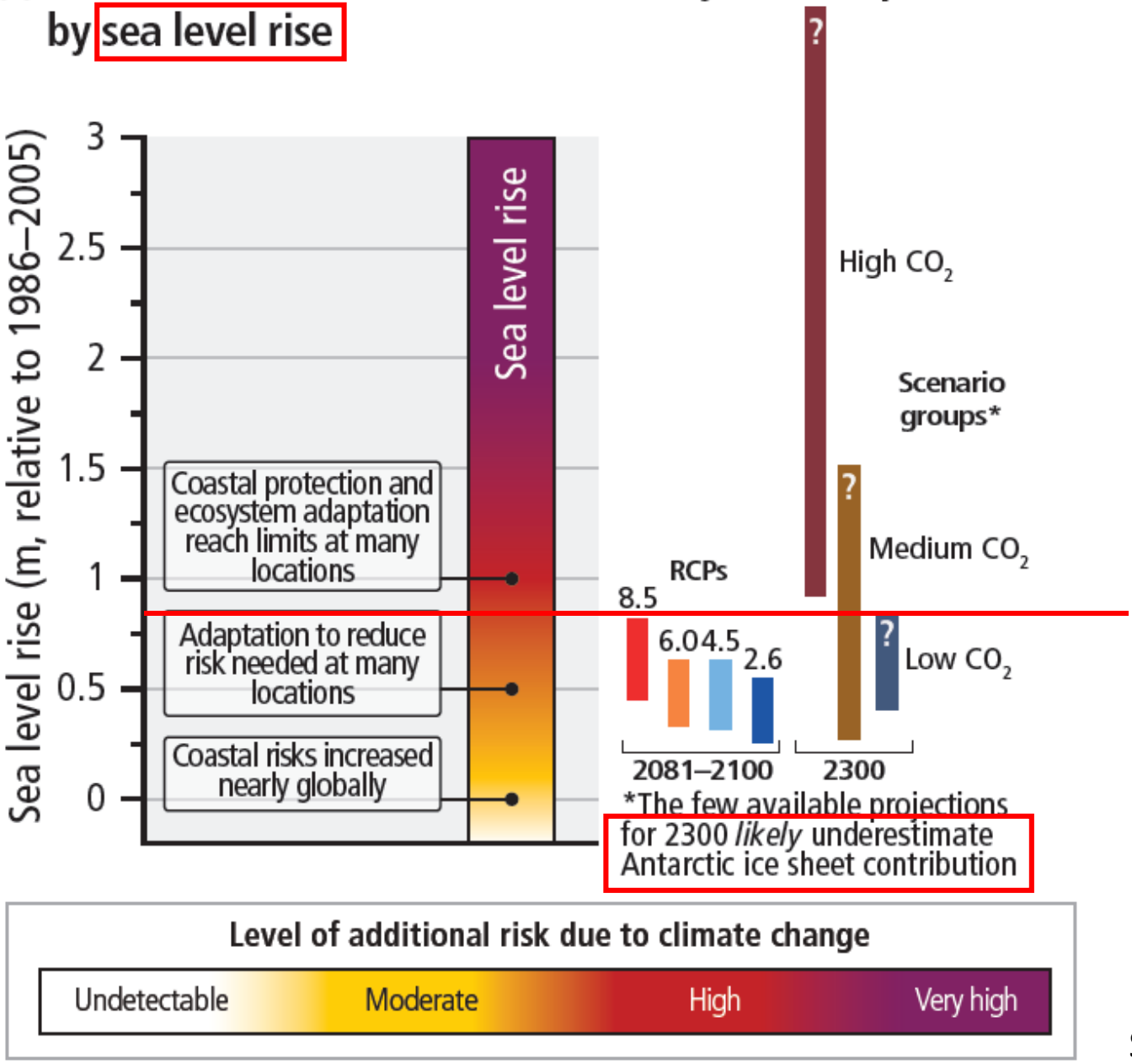
1.5°C

AR5 SYR



Increasing risk associated with high sea level beyond 2100 under RCPs > 2.6

~1.5°C (2300)

However..... Contribution of Antarctic ice sheet likely underestimated

SYR 2.5

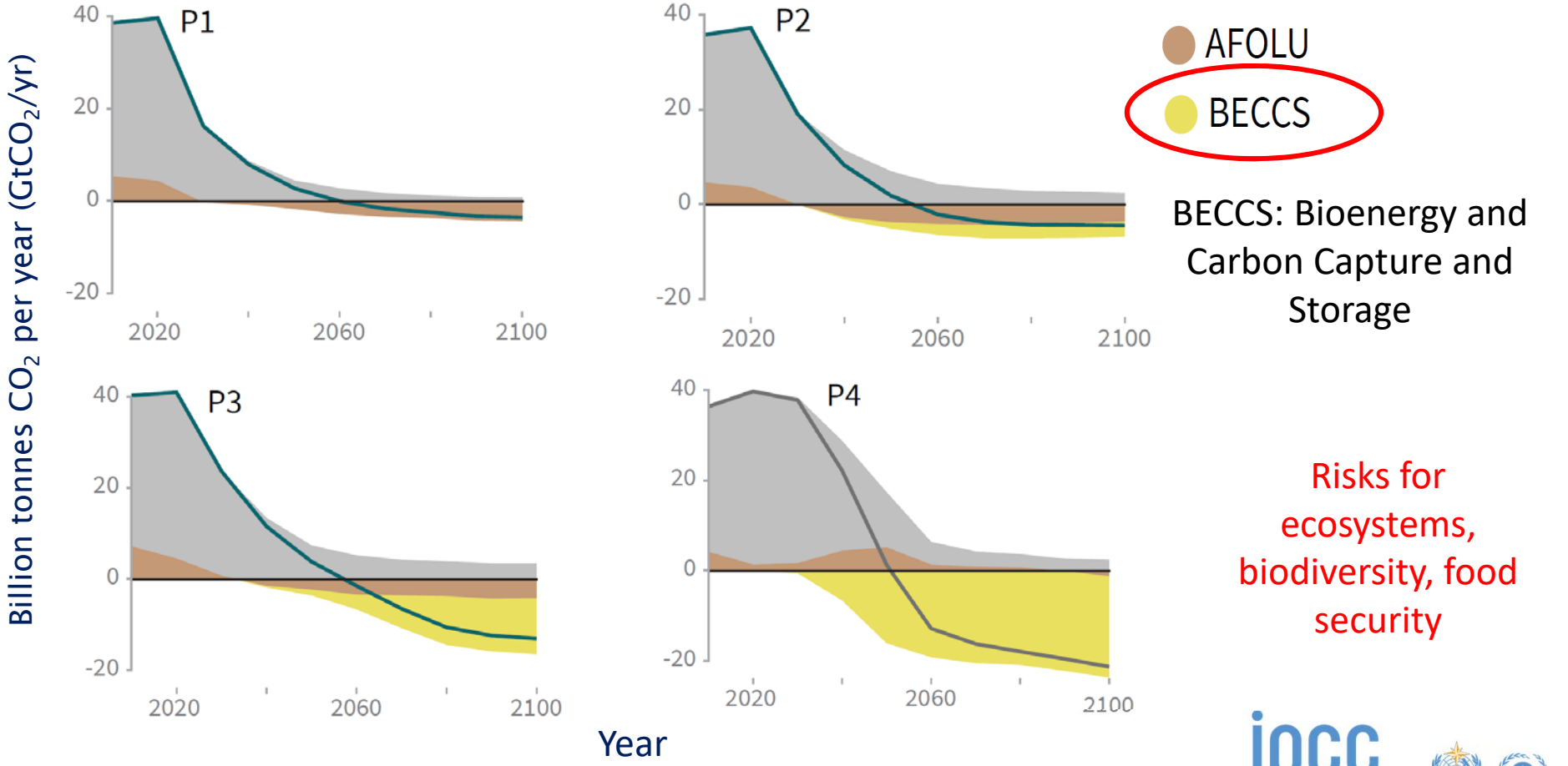
How do we get there?

- To limit warming to 1.5˚C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - ↳ *Compared to 20% for 2˚C*
- To limit warming to 1.5˚C, CO_2 emissions would need to reach 'net zero' around 2050
  - ↳ *Compared to around 2075 for 2˚C*
- Reducing non-CO_2 emissions would have direct and immediate health benefits

Gerhard Zwerger-Schoner / Aurora Photos

Different pathways and mitigation strategies could limit global warming to 1.5˚C, variable needs for negative emission technologies

….bringing their own risks



BECCS: Bioenergy and Carbon Capture and Storage

Risks for ecosystems, biodiversity, food security

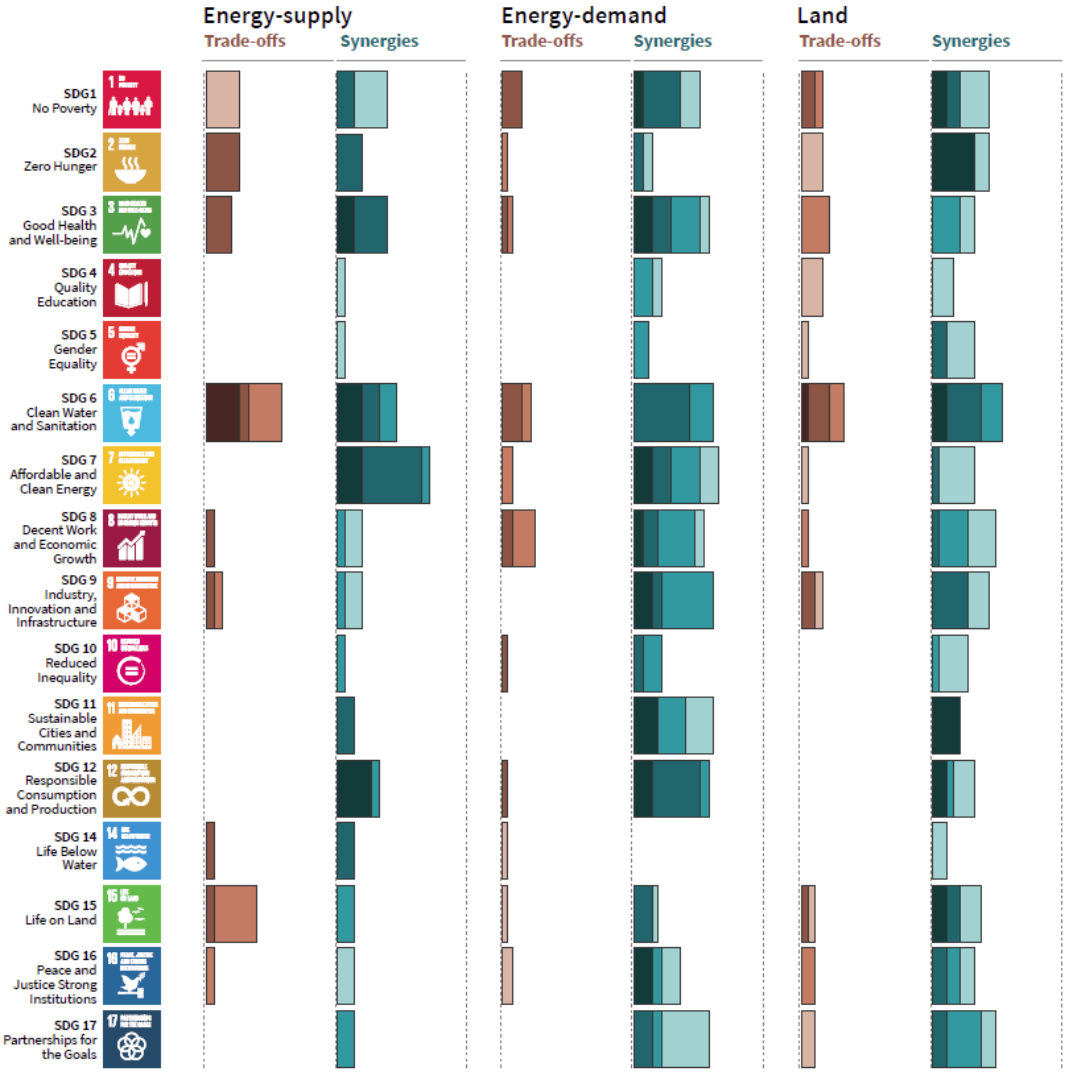
Ambitious emissions reduction minimizes the need for carbon dioxide removal, e.g. BECCS

- Co-benefits for
  - Human health
  - Ecosystem restoration and carbon storage (soils and biomass)
  - Biodiversity conservation
  - Reduced competition for land
  - Food security for humankind

Peter Essick / Aurora Photos

1.5°C facilitates reaching SDGs

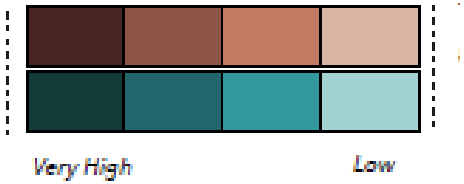
Indicative linkages between mitigation and sustainable development using SDGs (the linkages do not show costs and benefit)



1.5°C linked to reaching SDGs

Length shows strength of connection

Shades show level of confidence



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Limiting warming to 1.5˚C

Would require rapid, far-reaching and unprecedented changes in all systems

- A range of technologies and behavioural changes
- Scale up in annual investment in low carbon energy and energy efficiency by factor of five by 2050
- Renewables supply 70-85% of electricity in 2050
- Coal declines steeply, ~zero in electricity by 2050
- Oil and especially gas persist longer – gas use rises by 2050 in some pathways
- Deep emissions cuts in transport and buildings
- Changes in land use and urban planning

Mint Images / Aurora Photos

The Paris agreement provides a sense of urgency:
Overcoming societal and political inertia, accelerating transformation....

A common response even among those who (should) know...including us!?

Feasibility at various levels:

- **Keeping warming to 1.5 according to the laws of chemistry and physics ---- yes**
- **Technologies to support mitigation and adaptation measures ---- yes**
- **Redirection of financial flows ---- yes (stopping fossil fuel subsidies)**
- **Informed policy leading and directing societal transformation ---- may be .....? BOTTLE NECK**

Half a degree… every bit of warming matters

Each year matters

Each choice matters

Ashley Cooper/ Aurora Photos

Sixth Assessment Cycle (AR6)

Special Reports

3 Special Reports

1. October 2018 - Special Report on Global Warming of 1.5 °C (SR15)
2. August 2019 - Climate Change and Land (SRCCL)
3. September 2019 - Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)

Methodology Report update

May 2019: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

AR6 Main Report

2021: Working Group I, II, and III contribution to the Sixth Assessment Report
April 2022: Synthesis Report of the Sixth Assessment Report

** Dates are subject to change*

IPCC Writing and Review Process

★ = Lead Author Meetings (LAMs)

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Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)

1. Framing and Context of the Report
2. High Mountain Areas
3. Polar Regions
4. Sea level rise and implications for low lying islands, coasts and communities
5. Changing ocean, marine ecosystems, and dependent communities
6. Extremes, abrupt changes and managing risks

\+ Cross-chapter box: Low lying islands and coasts

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Outline of Special Report on Climate Change and Land (SRCCL)

Summary for Policy Makers
Technical Summary

Chapter 1: Framing and Context
Chapter 2: Land-Climate Interactions
Chapter 3: Desertification
Chapter 4: Land Degradation
Chapter 5: Food Security
Chapter 6: Interlinkages between desertification, land degradation, food security and GHG fluxes: Synergies, trade-offs and Integrated Response Options
Chapter 7: Risk management and decision making in relation to sustainable development

Boxes, Case Studies and FAQs

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Working Group II Outline

Chapter 1: Point of departure and key concepts

SECTION 1: RISKS, ADAPTATION AND SUSTAINABILITY FOR SYSTEMS IMPACTED BY CLIMATE CHANGE

Chapter 2: Terrestrial and freshwater ecosystems and their services
Chapter 3: Ocean and coastal ecosystems and their services
Chapter 4: Water
Chapter 5: Food, fibre, and other ecosystem products
Chapter 6: Cities, settlements and key infrastructure
Chapter 7: Health, wellbeing and the changing structure of communities
Chapter 8: Poverty, livelihoods and sustainable development

Working Group II Outline (cont'd)

SECTION 2: REGIONS

Chapter 9: Africa
Chapter 10: Asia
Chapter 11: Australasia
Chapter 12: Central and South America
Chapter 13: Europe
Chapter 14: North America
Chapter 15: Small Islands

Each chapter to cover regional oceans and specific land ocean interactions

SECTION 3: SUSTAINABLE DEVELOPMENT PATHWAYS: INTEGRATING ADAPTATION AND MITIGATION

Chapter 16: Key risks across sectors and regions
Chapter 17: Decision-making options for managing risk
Chapter 18: Climate resilient development pathways

CROSS-CHAPTER PAPERS (built by chapter authors)
(with material for TS/SPM as appropriate)
integrating sectors, regions and updating from special reports

Biodiversity hotspots (land, coasts and oceans)
chs. 2,3,9-15, SROCC, SRCCL

Cities and settlements by the sea
chs. 3,6,9-15,16-18, SROCC

Deserts, semi-arid areas, and desertification
chs. 2,4,5,9-14, SRCCL

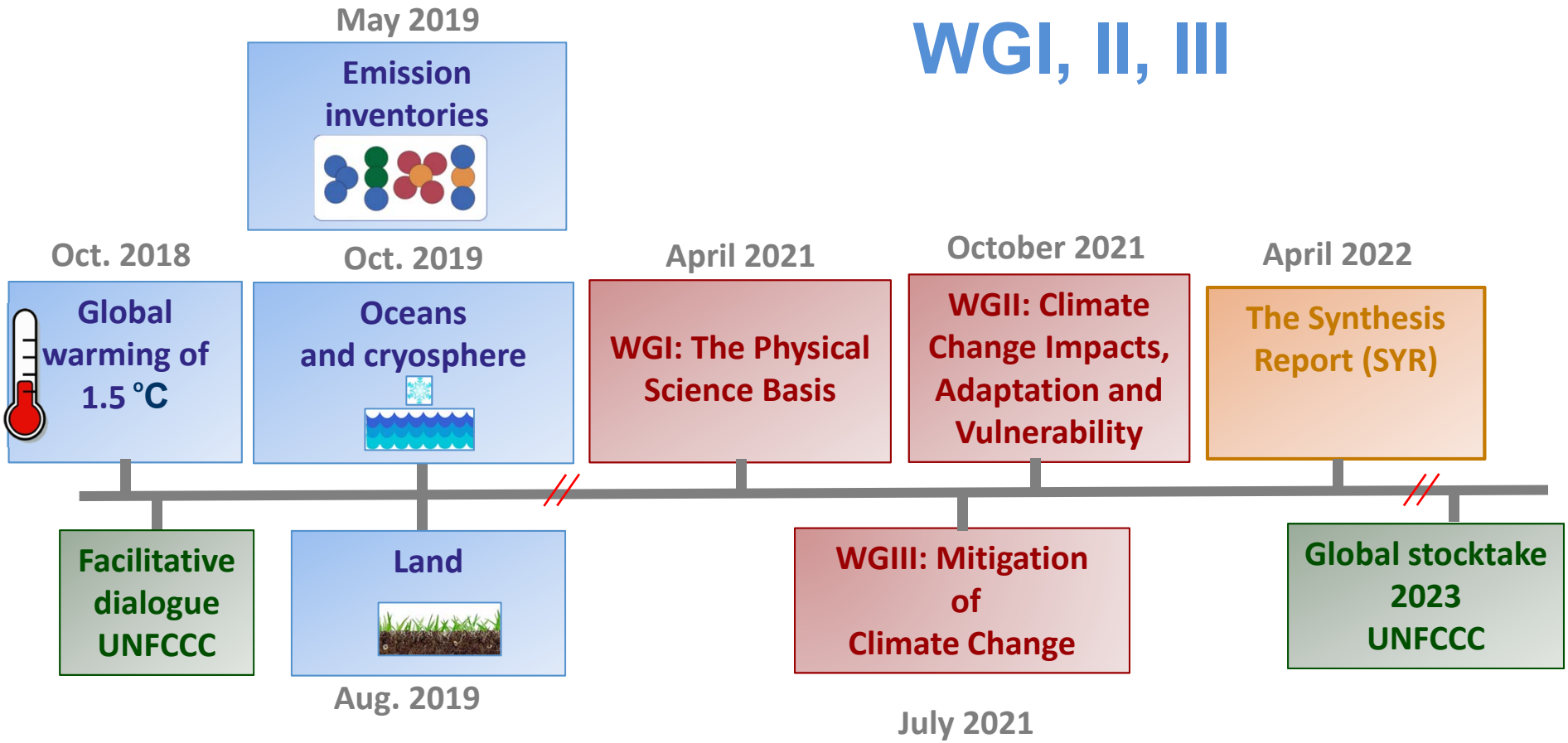
Mediterranean region, chs. 3,6,9-15,16-18, SROCC, SRCCL

Mountains, chs. 2,9-14, SROCC

Polar regions, chs. 2-8,10-15, SROCC, SRCCL

Tropical forests, chs. 2,9,11,12, SRCCL

AR6 schedule
WGI, II, III



Special Reports Main Reports

All Authors, Review Editors selected based on government and bureau nominations

Become involved: e.g. as Expert Reviewer, Contributing Author, see ipcc.ch

Do not forget….

Half a degree… every bit of warming matters

Each year matters

Each choice matters

Ashley Cooper/ Aurora Photos

Thank you for your attention

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IPCC Press Office: ipcc-media@wmo.int

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