SIXTH ASSESSMENT REPORT
Working Group II – Impacts, Adaptation and Vulnerability

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

Climate Change 2022

Impacts, Adaptation and Vulnerability

Co-Chairs of IPCC Working Group II

Report by numbers

270 Authors

67 Countries

43 % Developing countries
57 % Developed countries

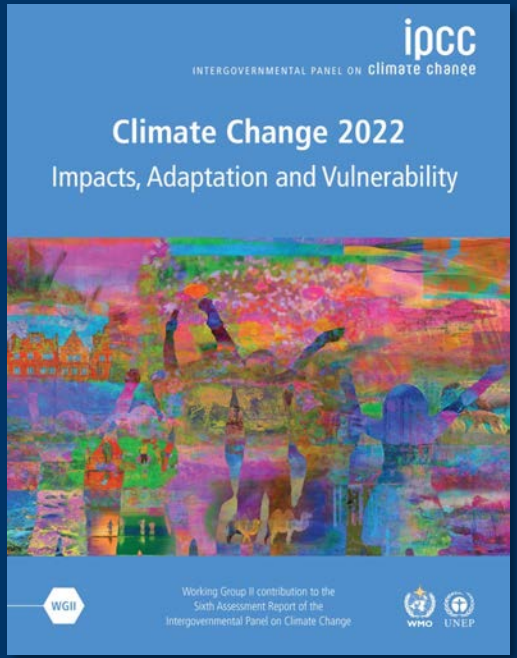
41 % Women / 59 % Men

675 Contributing authors

More than
34,000 scientific papers

62,418
Review comments

Growing scientific knowledge gives us our best understanding yet



"The scientific evidence is unequivocal: climate change is a threat to human well-being and the health of the planet.

Any further delay in concerted global action will miss the brief, rapidly closing window to secure a liveable future.

This report offers solutions to the world.

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Global warming
has caused dangerous and
widespread disruption in nature…

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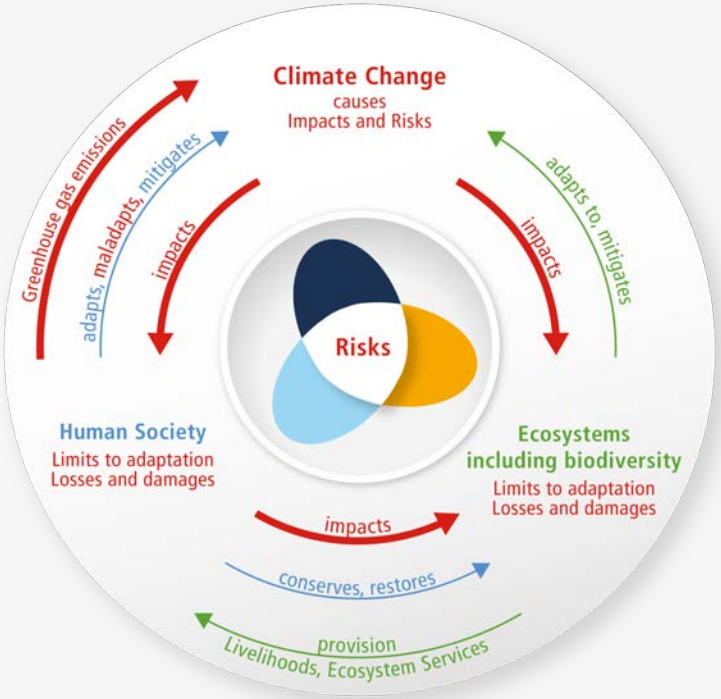
…and climate change is affecting the lives of billions of people, despite efforts to adapt.

Impacts are magnified in cities where more than half the world's population lives.

[Peter Nguyen / Unsplash]

New understanding of interconnections



The risk propeller shows that risk emerges from the overlap of:

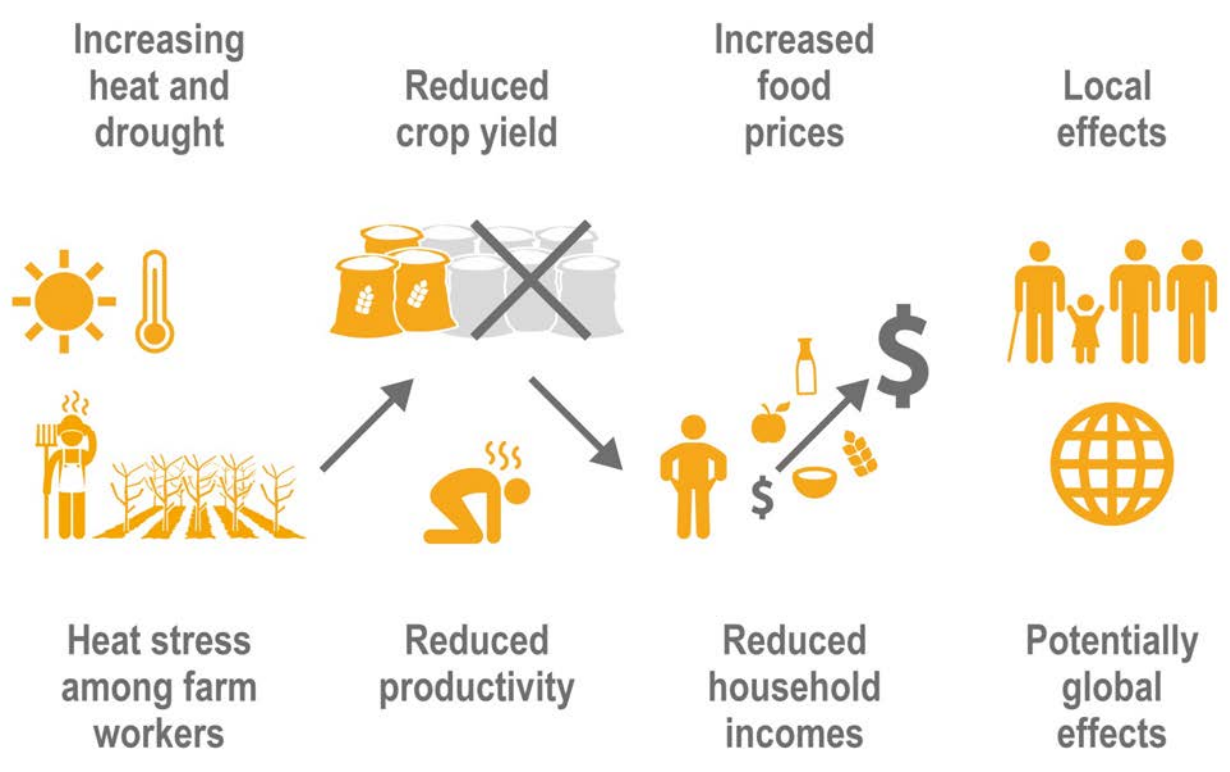
- Climate hazard(s)
- Vulnerability
- Exposure

...of human systems, ecosystems and their biodiversity

[Axel Guibourg CC BY-NC-ND 2.0; Hugh Han / Unsplash; Axel Fassio/CIFOR CC BY-NC-ND 2.0]

Simultaneous extreme events compound risks

Multiple extreme events that compound the risks are more difficult to manage



Overlapping challenges

- Limited access to water, sanitation and health services
- Climate-sensitive livelihoods
- High levels of poverty
- Weak leadership
- Lack of funding
- Lack of accountability and trust in government

[Denis Onyodi / KRCS CC BY-NC 2.0; Marco Dormino UN Photo CC BY-NC-ND 2.0; Markus Krisetya / Unsplash]

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Every small increase in warming will result in increased risks.

[Ocean Image Bank / The Ocean Agency]

Nature's crucial services at risk in a warming world

Pollination

Coastal protection

Tourism / recreation

Food source

Health

Water filtration

Clean air

Climate regulation

[Ocean Image Bank/ Shaun Wolfe, Dimitris Poursanidis; FAO/Kurt Arrigo, Unsplash, Axel Fassio/CIFOR CC BY-NC-ND

Future global climate risks

Heat stress

Exposure to heat waves will continue to increase with additional warming.

Water scarcity

At 2°C, regions relying on snowmelt could experience 20% decline in water availability for agriculture after 2050.

Food security

Climate change will increasingly undermine food security.

Flood risk

About a billion people in low-lying cities by the sea and on Small Islands at risk from sea level rise by mid-century.

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Action on adaptation has increased but progress is uneven and we are not adapting fast enough.

[Boskalis / Rijkswaterstaat]

“There are increasing gaps between adaptation action taken and what’s needed.

These gaps are largest among lower income populations.

They are expected to grow.

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There are options we can take
to reduce the risks to people and nature.

[Il Vagabiondo / Unsplash]

Nature offers significant untapped potential.

[World Agroforestry / Julius Atia CC BY-NC-SA 2.0]

Water management

Options on farms:

- Irrigation
- Rainwater storage, water-saving tech
- Moisture conservation in soils

Economic and ecological benefits; reduced vulnerability

Wider options:

- Securing drinking water
- Flood and drought risk management
- Working with nature, land-use planning

Effectiveness declines with increased warming

Improving food security

Effective options:

- Cultivar improvements
- Agroforestry
- Farm and landscape diversification
- Community-based adaptation
- Strengthening biodiversity

Wider benefits:

- Food security and nutrition
- Health and well-being
- Livelihoods

[Jacquelyn Turner / CCAFS CC BY-NC-SA 2.0; FAO / Riccardo De Luca]

[Chuttersnap, Jordan Brierley / Unsplash; SDOT Photos CC BY-NC 2.0]

Transforming cities

By 2050 urban areas could be home to two-thirds of the world's population.

Effective options

- Nature-based and engineering approaches together
- Establishing green and blue spaces
- Urban agriculture
- Social-safety nets for disaster management

Wider benefits

- Public health improvements
- Ecosystem conservation

Adapting informal settlements

Effective options:

- Local knowledge
- Adequate capacity (information, funding, tools)
- Engagement of policymakers
- Involvement of residents in decision-making
- Institutional change (accountability, commitment, transparency)

Maladaptation

Adaptation that results in unintended consequences

The most disadvantaged groups are most affected by maladaptation.

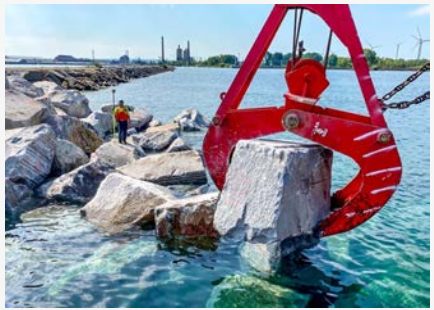
[Denis Onyodi / KRCS CC BY-NC 2.0]

There are limits to adaptation

- Even effective adaptation cannot prevent all losses and damages
- Above 1.5°C some natural solutions may no longer work.
- Above 1.5°C, lack of fresh water could mean that people living on small islands and those dependent on glaciers and snowmelt can no longer adapt.
- By 2°C it will be challenging to farm multiple staple crops in many current growing areas.

Financial constraints

- Current global financial flows are insufficient
- Most finance targets emissions reductions rather than adaptation
- Climate impacts can slow down economic growth



“To avoid mounting losses, urgent action is required to adapt to climate change.

At the same time, it is essential to make rapid, deep cuts in greenhouse gas emissions to keep the maximum number of adaptation options open.

[Axel Fassio/CIFOR CC BY-NC-ND 2.0]

Accelerating adaptation

- Political commitment and follow-through across all levels of government
- Institutional framework: clear goals, priorities that define responsibilities
- Enhancing knowledge of impacts and risks improves responses
- Monitoring and evaluation of adaptation measures are essential to track progress
- Inclusive governance that prioritises equity and justice – direct participation

The wider benefits of adaptation

For more than 3.4 billion people in rural areas: improved roads, reliable energy, clean water, food security

SDG 1: No poverty

Green buildings, green spaces, clean water, renewable energy, sustainable transport – in cities

SDG 3: Good health and wellbeing

Policies that increase youth access to land, credit, knowledge and skills can support agri-food employment

SDG 10: Reduced inequality

Restored and connected habitats can provide corridors for vulnerable species

SDG 14/15: Life on land & below water

Land and ocean ecosystems

Examples of climate responses and adaptation options	Forest-based adaptation*	Sustainable aquaculture and fisheries	Agroforestry	Biodiversity management and ecosystem connectivity
Potential feasibility:	high	medium	medium	medium
Synergies with mitigation:	high	medium	high	high

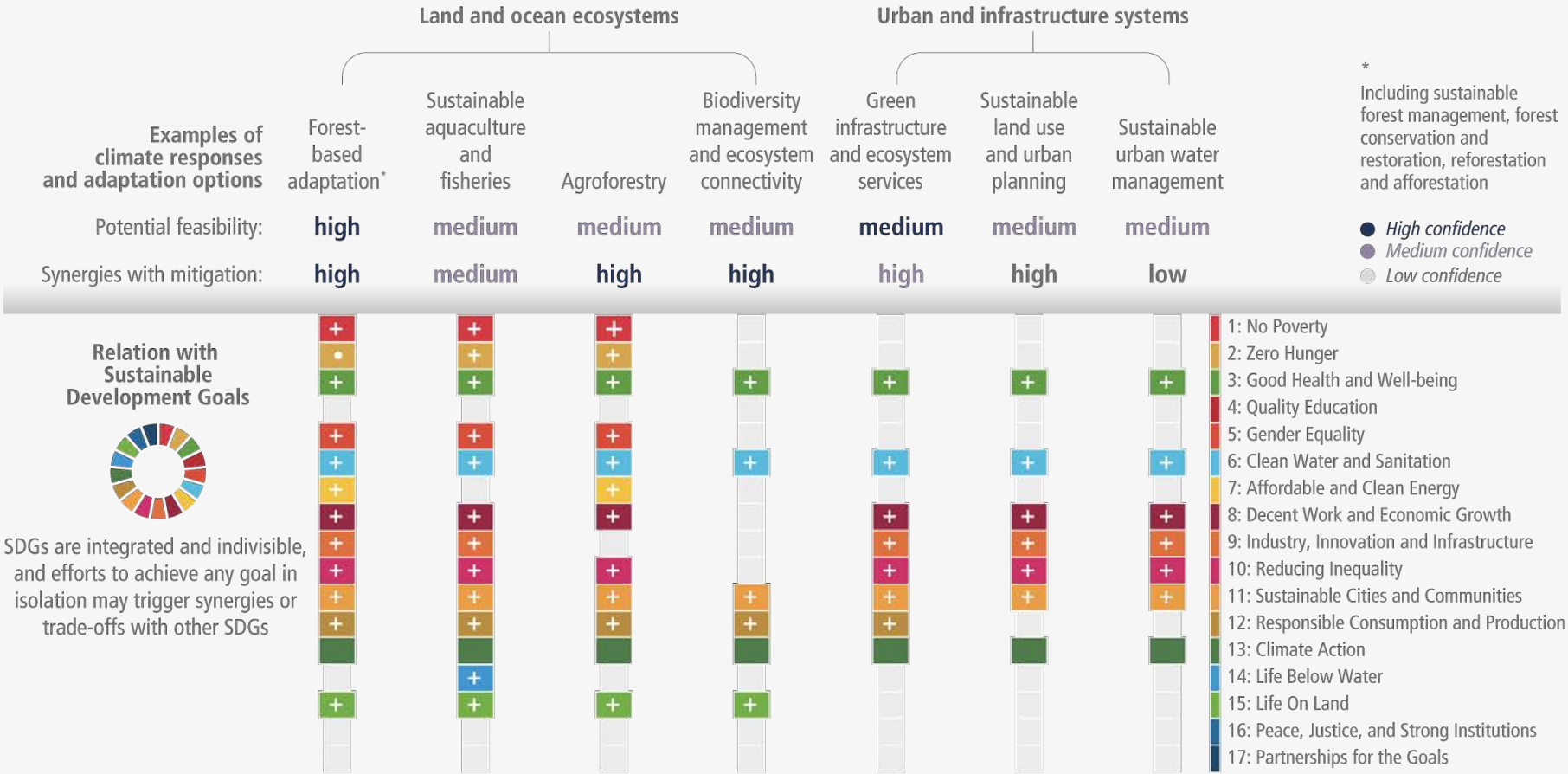
* Including sustainable forest management, forest conservation and restoration, reforestation and afforestation

- *High confidence*
- *Medium confidence*
- *Low confidence*

Relation with Sustainable Development Goals

SDGs are integrated and indivisible, and efforts to achieve any goal in isolation may trigger synergies or trade-offs with other SDGs

1: No Poverty
2: Zero Hunger
3: Good Health and Well-being
4: Quality Education
5: Gender Equality
6: Clean Water and Sanitation
7: Affordable and Clean Energy
8: Decent Work and Economic Growth
9: Industry, Innovation and Infrastructure
10: Reducing Inequality
11: Sustainable Cities and Communities
12: Responsible Consumption and Production
13: Climate Action
14: Life Below Water
15: Life On Land
16: Peace, Justice, and Strong Institutions
17: Partnerships for the Goals


Land and ocean ecosystems
Urban and infrastructure systems
Examples of climate responses and adaptation options
Forest-based adaptation*
Sustainable aquaculture and fisheries
Agroforestry
Biodiversity management and ecosystem connectivity
Green infrastructure and ecosystem services
Sustainable land use and urban planning
Sustainable urban water management
Potential feasibility:
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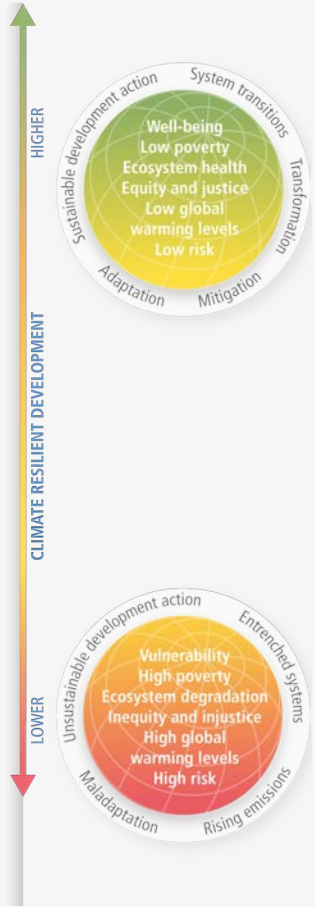
Our future?

- Reduced climate risks – adaptation
- Reduced greenhouse gas emissions – mitigation
- Enhanced biodiversity
- Achieved the Sustainable Development Goals

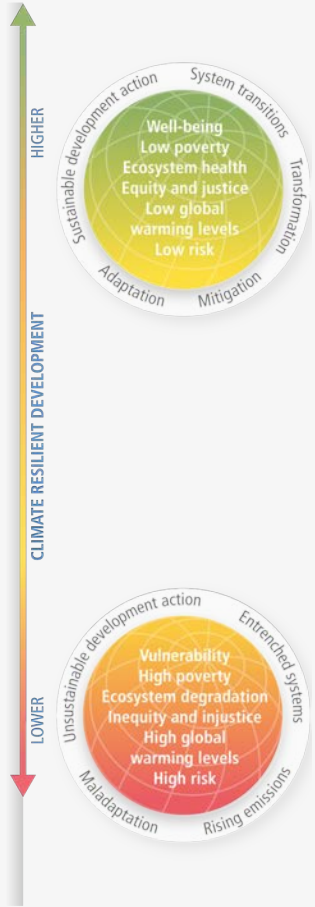
This is Climate Resilient Development.



Climate Resilient Development

The solutions framework:

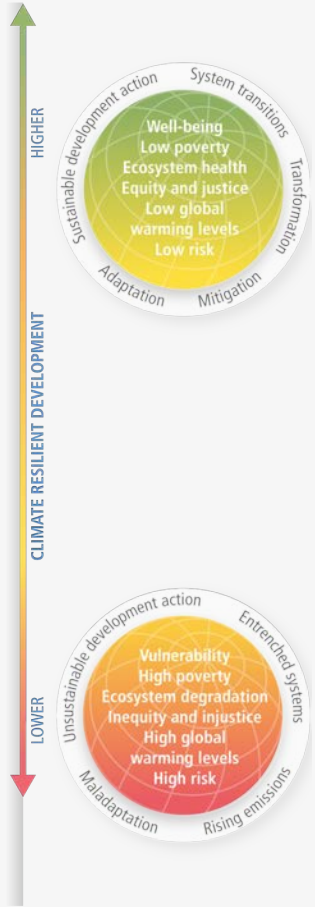
- Is considered across government and all of civil society
- Involves everyone – forming partnerships



Climate Resilient Development

The solutions framework:

- Draws on wide-ranging knowledge (scientific, Indigenous, local, practical)

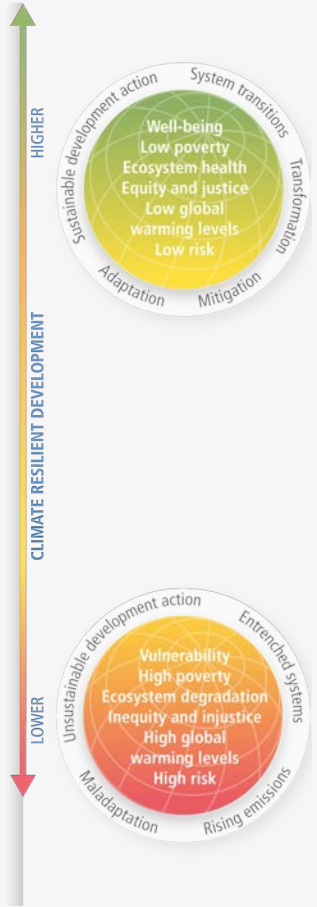


[thisisengineering-raeng / Unsplash; Aris Sanjaya/CIFOR CC BY-NC-ND 2.0]

Climate Resilient Development

The solutions framework:

- Conserves and restores ecosystems

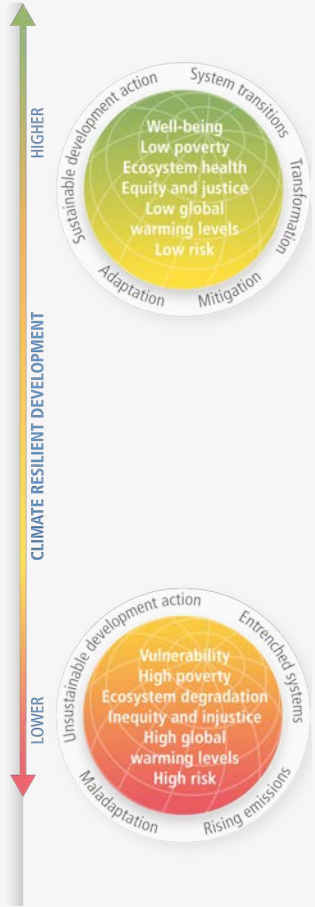


[Yuichi Ishida/UNDP Timor-Leste CC BY-NY 2.0; Axel Fassio/CIFOR CC BY-NC-ND 2.0]

Climate Resilient Development

The solutions framework:

- Involves marginalized groups
- Prioritises equity and justice
- Reconciles different interests, values and world views



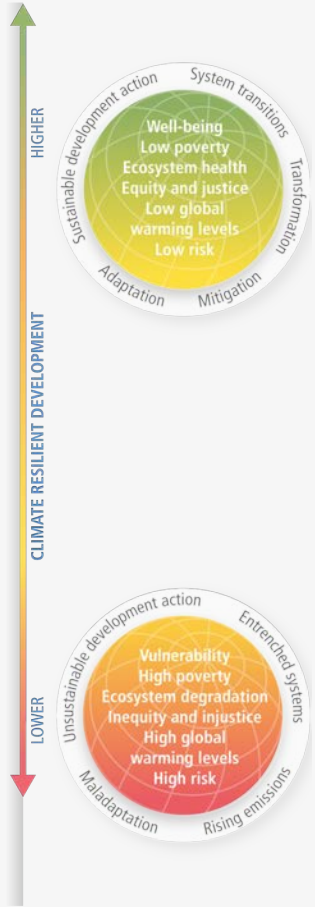
[Mika Baumeister / Unsplash; Aulia Erlangga/CIFOR CC BY-NC-ND 2.0]

Climate Resilient Development

The solutions framework:

- Requires scaled-up investment and international cooperation

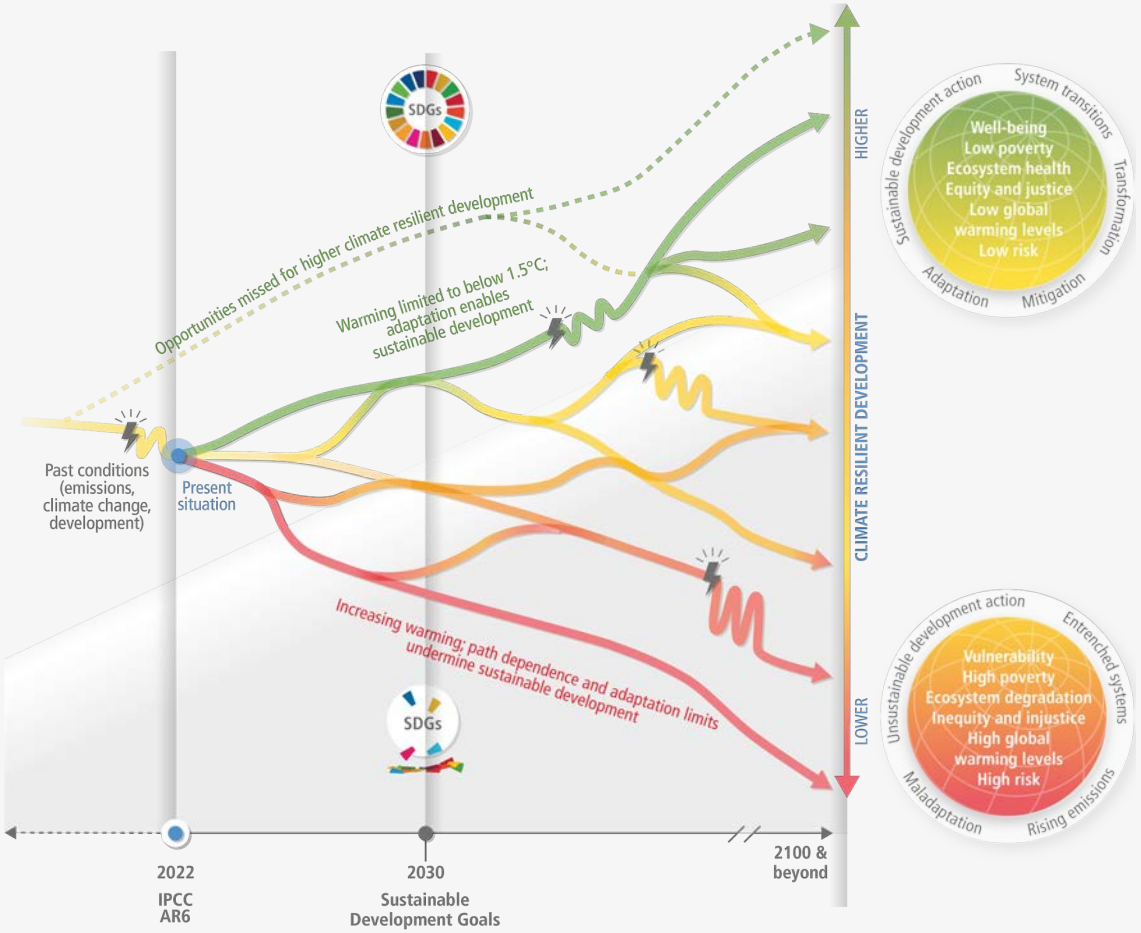
[Kumerra Gemechu/CIFOR CC BY-NC-ND 2.0, Thisisengineering Raeng / Unsplash]



Increasing urgency

Starting today, every action, every decision matters.

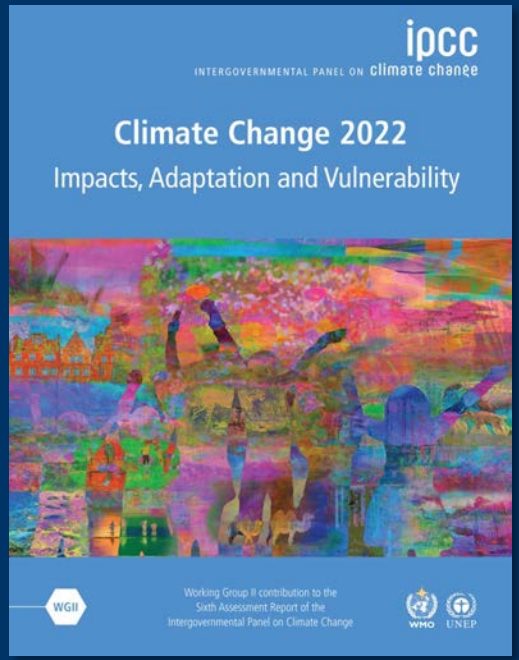
Worldwide action is more urgent than previously assessed.



Climate Resilient Development in action

[Juan Pablo Sarmiento/CIFOR CC BY-NC-ND 2.0; Marlon del Aguila Guerrero/CIFOR CC BY-NC-ND 2.0]

> Climate resilient development is already challenging at current global warming levels.
>
> The prospects will become further limited if warming exceeds 1.5°C and may not be possible if warming exceeds 2°C.



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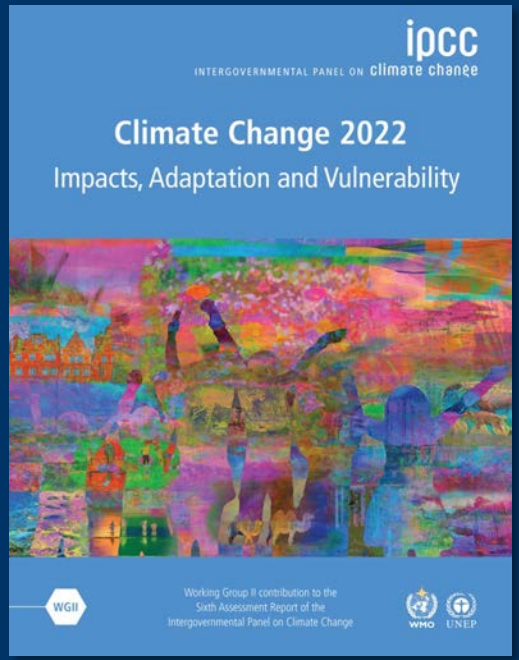
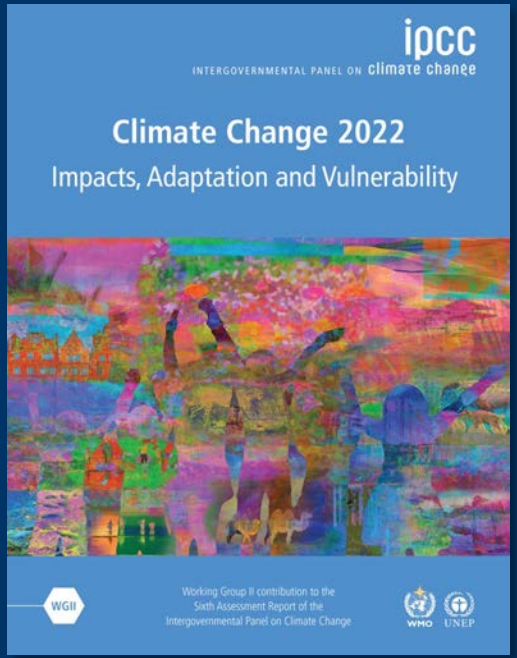


“

CCP6 : Polar Regions

Chapter 5: Food and Fibre

Chapter 14: North America



> Contractions of the polar climate zones lead to distribution shifts and changes in food webs, induce declines in many species (*medium confidence*)
>
> with impacts on subsistence harvests and commercial fisheries, and threaten global dependence on polar regions for substantial marine food production (*high confidence*).

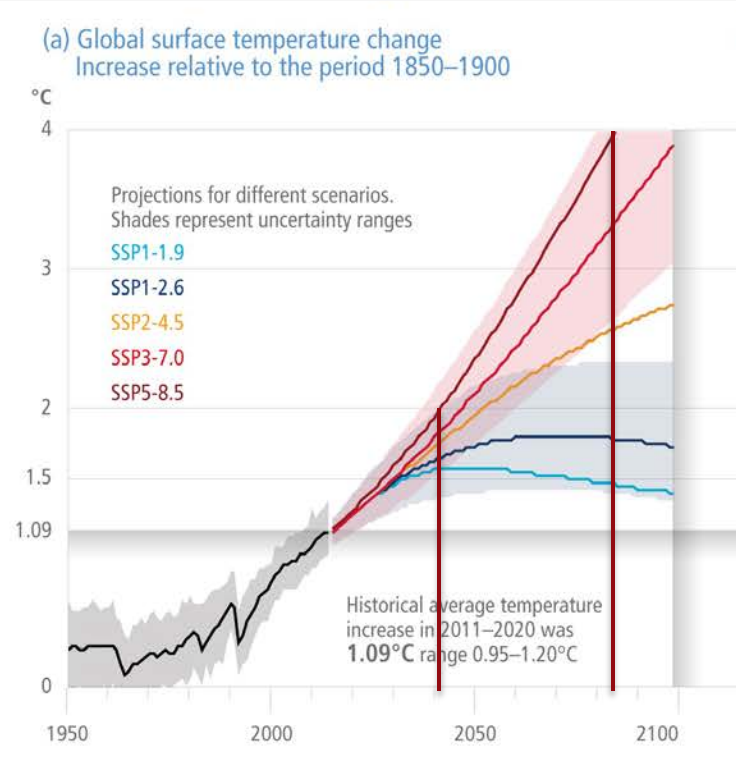
Link to the WGII report:
https://www.ipcc.ch/report/ar6/wg2/

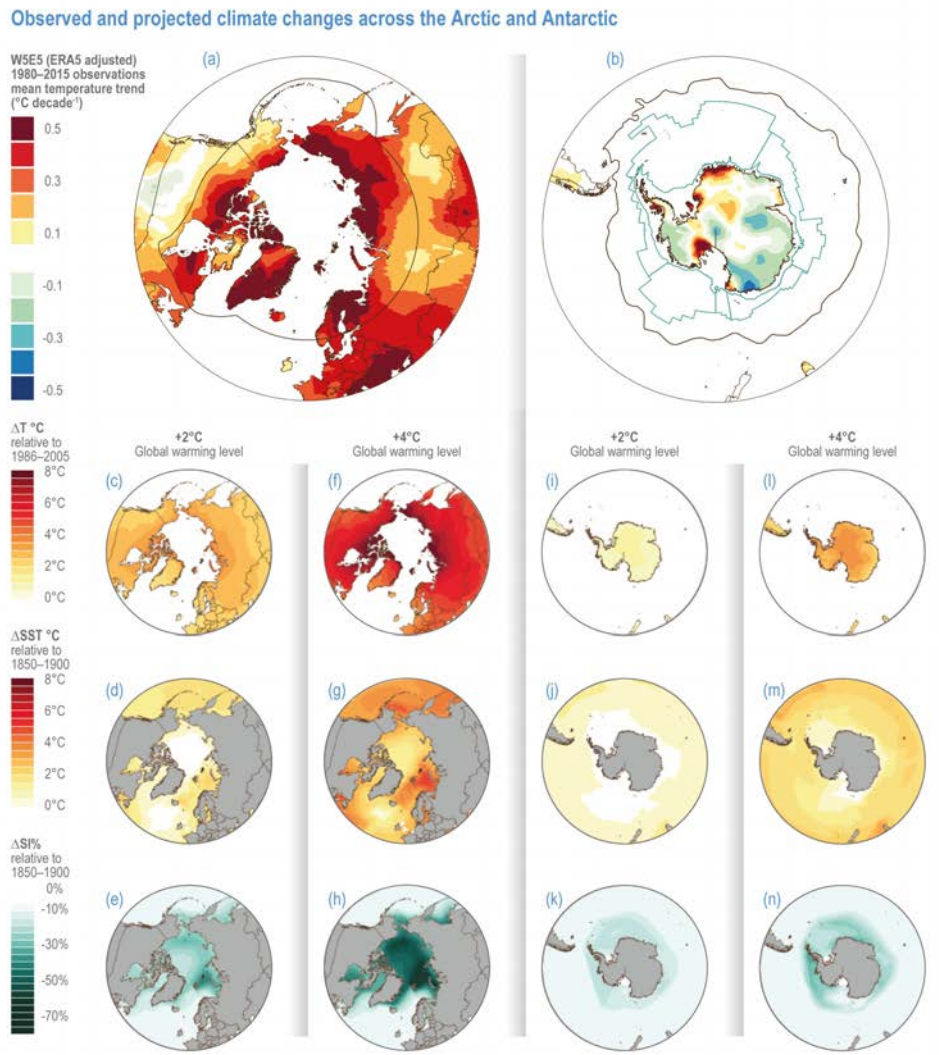
For information on fisheries adaptation:
CCP6 : Polar Regions
Chapter 5: Food and Fibre
Chapter 14: North America

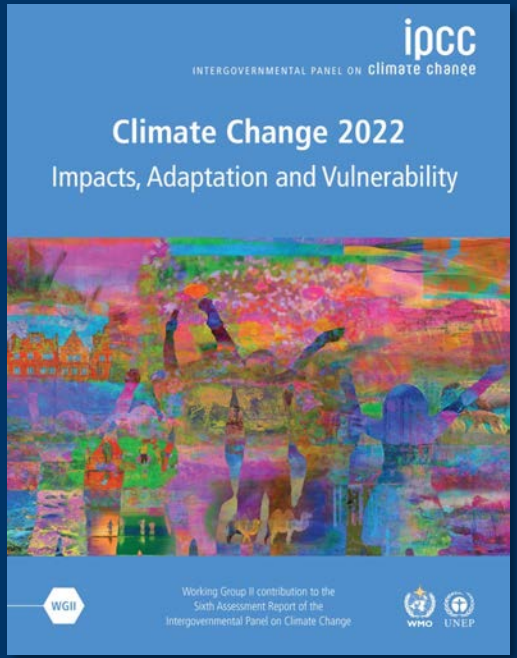
Link to the interactive Atlas (WGI):
https://www.ipcc.ch/report/ar6/wg2/

For Interactive projections of physical changes

Climate change will increasingly impact Polar regions







> Cascading and interacting effects of climate change impacts in polar regions will reduce access to, and productivity of future fisheries, and pose significant risks to regional and global food and nutritional security that increase with atmospheric carbon levels and declines in sea-ice (*high confidence*).

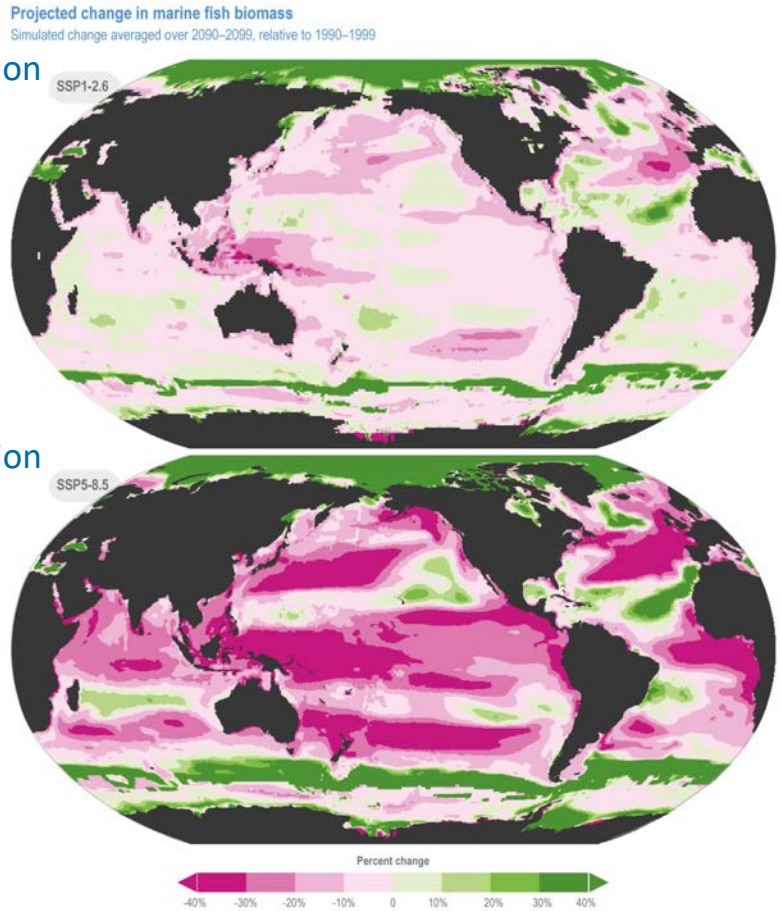
Increasing urgency

Declines in fish biomass projected for Bering Sea

Adaptation planning needed to minimize impacts

High CO_2 Mitigation
Less warming
(SSP1 2.6)

Low CO_2 Mitigation
High warming
(SSP5 8.5)



Atlas Figure A1.11

Increasing urgency

Declines in benthic biomass projected for SEBS, potential increases in NEBS

Adaptation planning needed to minimize impacts

High CO_2 Mitigation
Less warming
(SSP1 2.6)

Low CO_2 Mitigation
High warming
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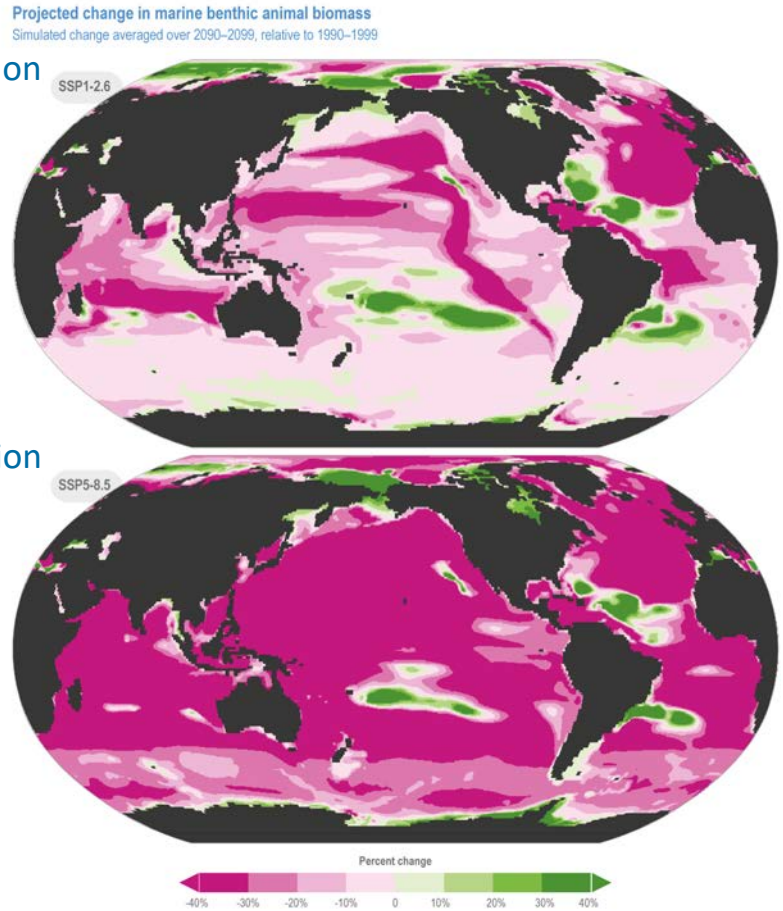
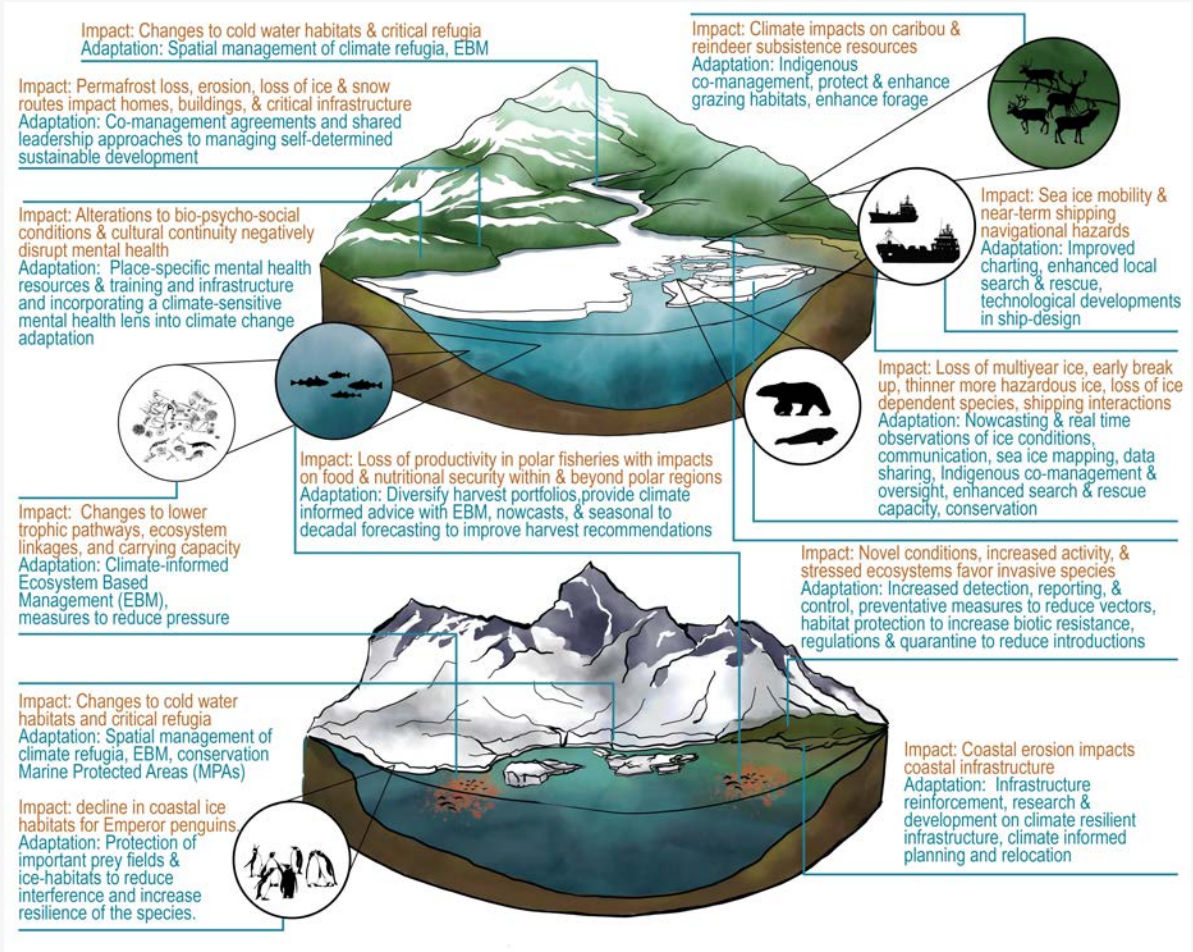


Increasing urgency

Adaptation can reduce risks to polar fisheries if coupled with mitigation

“ Implementation of adaptive management that is closely linked to monitoring, research, and low cost and inclusive public participation in decisions, high resolution forecast and projection tools, climate-informed survey and monitoring design”



Key Elements of Polar Climate Resilient Development