Climate change 2022:
Impacts, adaptation and vulnerability

Towards Climate Resilient Development

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WGII: Guiding AMBITION in Mitigation and Adaptation, setting LONG TERM GLOBAL GOALS … for protecting biodiversity and human society

IPCC 6th Assessment Cycle: 3 Special Reports, WGI + II + III AR6
released between October 2018 and March 2022
What is already happening …

Human pressure on biodiversity is increasing constantly. At the same time conservation efforts have not been sufficient to stem the loss of biodiversity on a global scale.

Human caused climate change is increasingly threatening nature and its contributions to people, causing:

- Losses in Overfished Stocks
- Excessive Drought
- Excessive Wildfires
- Heatwaves

Pörtner et al., 2021
Climate change is affecting the lives of billions of people, despite efforts to adapt ... for example, through high intensity cyclones, sea level rise, heavy rainfall, drought
3.3 – 3.6 billion people live in hotspots of high vulnerability to climate change impacts
Observed impacts of climate change on ecosystems

Changes in ecosystem structure
- Terrestrial
- Freshwater
- Ocean

Species range shifts
- Terrestrial
- Freshwater
- Ocean

Changes in timing (phenology)
- Terrestrial
- Freshwater
- Ocean

Global: Increasing adverse impacts

- e.g. Temperature and Water changes

Observed impacts on human systems

Impacts on water scarcity and food production
- Water scarcity
- Agriculture/crop production
- Animal and livestock health and productivity
- Fisheries yields and aquaculture production

Impacts on health and wellbeing
- Infectious diseases
- Heat, malnutrition and other
- Mental health
- Displacement

Impacts on cities, settlements and infrastructure
- Inland flooding and associated damages
- Flood/storm induced damages in coastal areas
- Infrastructure
- Economic sectors

Human systems: Global
- Water scarcity: -
- Agriculture/crop production: -
- Animal and livestock health and productivity: ±
- Fisheries yields and aquaculture production: -

Temperature and Water changes

Increasing adverse and positive impacts

Increasing adverse impacts

Confidence in attribution to climate change:
- High or very high
- Medium
- Low
- Evidence limited, insufficient
- Not applicable

Source: IPCC WGII AR6 SPM Figure 2
The Future: e.g., Loss of Human (and Livestock) Habitat

Global distribution of population exposed to hyperthermia from extreme heat and humidity (concerning half to three-quarters of the population periodically by 2100).
The Future: e.g., Loss of Species Habitat and Biodiversity

Percentage of biodiversity exposed

- >80%
- 60%
- 40%
- 20%
- 10%
- 0.5%
- 0.1%

+1.5°C

+2.0°C

+3.0°C

+4.0°C
Nature’s crucial services at risk in a warming world

- Pollination
- Coastal protection
- Tourism / recreation
- Food source
- Health
- Water filtration
- Clean air / water
- Climate regulation

[Images: Ocean Image Bank/ Shaun Wolfe, Dimitris Poursanidis; FAO/Kurt Arrigo, Unsplash, Axel Fassio/CIFOR CC BY-NC-ND]
The IPCC concept of risk

Climate action entails risk reduction by adaptation and mitigation .... considering limits to adaptation

**Evaluating risks**

The diagram illustrates the relationship between hazard, exposure, vulnerability, and risk. The risk is the product of hazard and exposure, considering vulnerability.

**Limits to Adaptation**

- E.g. physical, ecological, technological, economic, political, institutional, psychological, and/or socio-cultural

**Level of added impacts/risks**

- **Very high**: Purple: Very high probability of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.
- **High**: Red: Significant and widespread impacts/risks.
- **Moderate**: Yellow: Impacts/risks are detectable and attributable to climate change with at least medium confidence.
- **Undetectable**: White: Impacts/risks are undetectable.

**Confidence level for transition**

- 5 = Very high
- 4 = High
- 3 = Medium
- 2 = Low
- 1 = Transition range

**see figure caption for definition**
Global and regional risk provide orientation for action (adaptation and mitigation) … minimizing risk by keeping global warming below 1.5°C
AR6 insight: Risks are developing sooner than assessed in AR5 … emphasizing the ambitious side of the Paris Agreement (GWL ≤ 1.5°C)
Vulnerable population groups have the most urgent need for adaptation … but:

There are increasing gaps between adaptation action taken and what’s needed
Towards Transformation: Five System Transitions

- Make possible the adaptation required for human health and well being; economic and social resilience; ecosystem health and planetary health.
- Have co-benefits with mitigation and are important for achieving the low global warming levels that would avoid many limits to adaptation.

Land, ocean, coastal and freshwater ecosystems
Urban, rural and infrastructure
Energy
Industry
Society
### The Feasibility of Adaptation measures: e.g. Land and ocean ecosystems

<table>
<thead>
<tr>
<th>System transitions</th>
<th>Climate responses and adaptation options</th>
<th>Potential feasibility</th>
<th>Synergies with mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land and ocean ecosystems</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal socio-ecological systems</td>
<td>Coastal defence and hardening Integrated coastal zone management</td>
<td>✓</td>
<td>not assessed</td>
</tr>
<tr>
<td>Terrestrial and ocean ecosystem</td>
<td>Forest-based adaptation Sustainable aquaculture and fisheries Agroforestry</td>
<td>✓</td>
<td>Economic Technological Institutional Social Environmental Geo-physical</td>
</tr>
<tr>
<td>Water security</td>
<td>Water use efficiency and water resource management</td>
<td>✓</td>
<td>Economic Technological Institutional Social Environmental Geo-physical</td>
</tr>
<tr>
<td>Food security</td>
<td>Improved cropland management Efficient livestock systems</td>
<td>✓</td>
<td>Economic Technological Institutional Social Environmental Geo-physical</td>
</tr>
</tbody>
</table>

**Dimensions of potential feasibility**

- Economic
- Technological
- Institutional
- Social
- Environmental
- Geophysical

**Confidence level in potential feasibility and in synergies with mitigation**

- Low
- Medium
- High

**Feasibility level and synergies with mitigation**

- Low
- Medium
- High
- Insufficient evidence

**Footnotes:**

1. The term response is used here instead of adaptation because some responses, such as retreat, may or may not be considered to be adaptation.
2. Including sustainable forest management, forest conservation and restoration, reforestation and afforestation.
Current imbalance …

The risk propeller shows that risk emerges from the overlap of:
- **Climate hazard(s)**
- **Vulnerability**
- **Exposure**

...of human systems, ecosystems and their biodiversity

**Future Climate Change**
Limiting Global Warming

**Climate Resilient Development**
Human health & well-being
- **equity, justice**
- **Ecosystem health**
- **Planetary health**

**Ecosystems Transitions**
- Land | Freshwater
- Coastal | Ocean
- Ecosystems and their biodiversity

Source:
IPCC WGII AR6
SPM Figure 1
Integrating conservation, climate and societal actions: spatial planning

Treating climate, biodiversity, and human society as coupled systems is key to successful outcomes. To be successful, conservation and climate actions would go hand in hand across landscapes, in cities and rural areas, taking people’s needs into consideration, for maximized benefits for climate, biodiversity and humans.
Some high level conclusions from the WGII report(s):

- **Meeting the ambitious side of the Paris agreement has no acceptable alternative.**

- A holistic concept (CRD) integrates mitigation, adaptation, development, and also covers **loss and damage**.

- Justice and equity demand **shared responsibility** for the present and the future. (A dynamic basis for everybody’s regular financial contributions would be the cumulative emissions per **country**, past and present.)
Some high level conclusions from the WGII report(s):

- Solutions of the **climate and the biodiversity crises depend on each other**.

- **Global Goals**: As much as limiting warming to 1.5° would be a **GG for Mitigation**, limiting risk to medium levels could be a **GG for Adaptation**. According to WGII both GGs would nicely match.

- CRD and the closing time window call for tying development to using renewable energies only.

- **Climate action** for mitigation and adaptation has no alternative and is an **existential necessity**.
The science is clear.

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

IPCC AR6 reports offer solutions to the world.

However, it is getting late!
Thank you!

IPCC Working Group II Author Team

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