Adaptation: incremental or transformational? IPCC Special Report on 1.5°C – Chapter 4

Reinhard Mechler

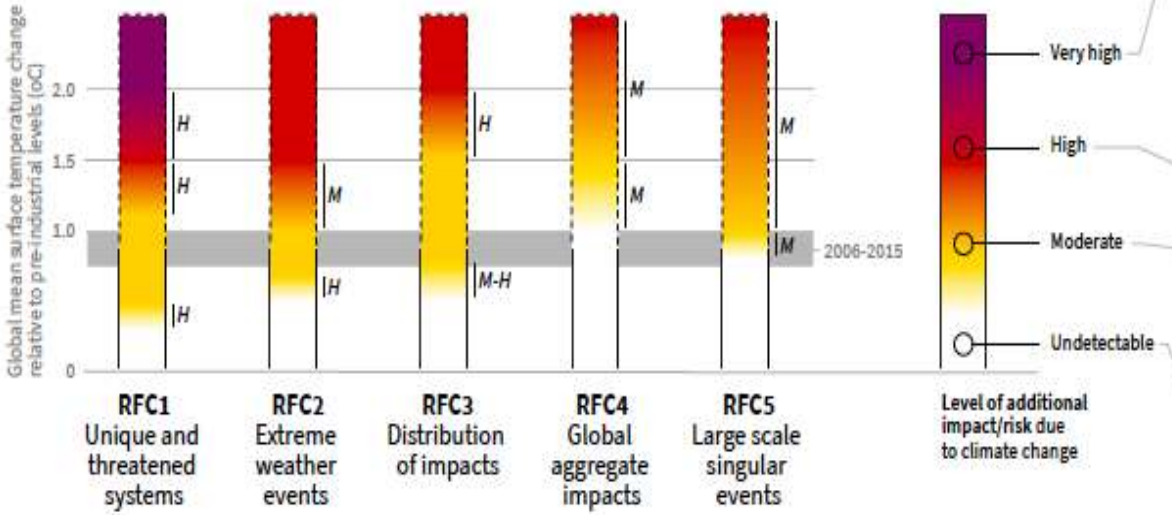
IPCC Pavilion-COP 24
Katowice, 6.12.2018

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Risks in the IPCC SR15
The Reasons for Concern

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

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



Purple indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.

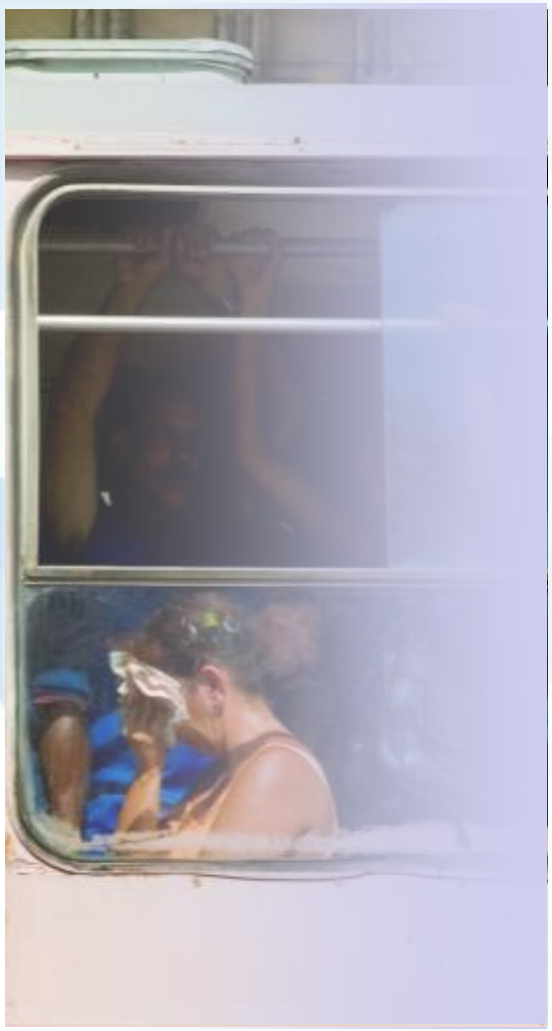
Red indicates severe and widespread impacts/risks.

Yellow indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence.

White indicates that no impacts are detectable and attributable to climate change.

Chapter 3: Hoegh-Guldberg et al., 2018

Adaptation at 1.5° C vs. 2 C°



B6. Most adaptation needs are lower for global warming of 1.5°C compared to 2°C (*high confidence*). There are a wide range of adaptation options that can reduce the risks of climate change (high confidence).

- There are **limits to adaptation and adaptive capacity** for some human and natural systems at global warming of 1.5°C, with associated losses (*medium confidence*).

- **become more pronounced at higher levels** of warming and vary by sector, with site-specific implications for vulnerable regions, ecosystems, and human health (*medium confidence*).

- A3. Future climate-related risks would be reduced by upscaling and acceleration of far-reaching, multi-level and cross-sectoral climate mitigation and by both **incremental and transformational adaptation** (*high confidence*).

Risk, Adaptation, Limits, SDGs

System (RFC)	Regions	1.5°C	2°C	Adaptation	Adaptation-potential	SDG
Agriculture and Food security (2,4)	Global, Africa, Asia	32-36 million people affected by reduced yields	330-396 million people with reduced yields	Climate resistant varieties, irrigation	Medium, higher in high latitudes than in low latitudes	
Water resources (3)	Global, Africa, Mediterra-nean	496 million people waterstressed	590 million people waterstressed	Rationing Wells Rainwater tanks	Low	
Coral reefs (1)	Tropics	70-90% at risk of loss	99% at risk of loss	-	Very limited	
Coastal settlements (2,3)	Global, Asia, SIDS	31-69 million people at risk	32-79 million people at risk	Coastal , Mangrove	Low-medium. Some atolls may become uninhabitable at 1.5°C/2°C	
Health (2,3,4)	Global,part. tropics	+ 350 million people exposed to deadly heatwaves in megacities by 2050		Hydration, cooling zones, green roofs	Medium, low in tropics	

Synthesis from IPCC SR15 2018 (ch.3,4, 5)

Risk, Adaptation, Limits, SDGs

System (RFC)	Regions	1.5°C	2°C	Adaptation	Adaptation-potential	SDG
Agriculture and Food security (2,4)	Global, Africa, Asia	32-36 million people affected by reduced yields	330-396 million people with reduced yields	Climate resistant varieties, irrigation	Medium, higher in high latitudes than in low latitudes	
Water resources (3)	**Global, Africa, Mediterra-nean**	**496 million people waterstressed**	**590 million people waterstressed**	**Rationing Wells Rainwater tanks**	**Low**	
Coral reefs (1)	Tropics	70-90% at risk of loss	99% at risk of loss	-	Very limited	
Coastal settlements (2,3)	Global, Asia, SIDS	31-69 million people at risk	32-79 million people at risk	Coastal , Mangrove	Low-medium. Some atolls may become uninhabitable at 1.5°C/2°C	
Health (2,3,4)	Global,part. tropics	+ 350 million people exposed to deadly heatwaves in megacities by 2050		Hydration, cooling zones, green roofs	Medium, low in tropics	

Synthesis from IPCC SR15 2018 (ch.3,4, 5)

Risk, Adaptation, Limits, SDGs

System (RFC)	Regions	1.5°C	2°C	Adaptation	Adaptation-potential	SDG
Agriculture and Food security (2,4)	Global, Africa, Asia	32-36 million people affected by reduced yields	330-396 million people with reduced yields	Climate resistant varieties, irrigation	Medium, higher in high latitudes than in low latitudes	
Water resources (3)	Global, Africa, Mediterra-nean	496 million people waterstressed	590 million people waterstressed	Rationing Wells Rainwater tanks	Low	
Coral reefs (1)	**Tropics**	**70-90% at risk of loss**	**99% at risk of loss**	-	**Very limited**	
Coastal settlements (2,3)	Global, Asia, SIDS	31-69 million people at risk	32-79 million people at risk	Coastal , Mangrove	Low-medium. Some atolls may become uninhabitable at 1.5°C/2°C	
Health (2,3,4)	Global,part. tropics	+ 350 million people exposed to deadly heatwaves in megacities by 2050		Hydration, cooling zones, green roofs	Medium, low in tropics	

Synthesis from IPCC SR15 2018 (ch.3,4, 5)

Risk, Adaptation, Limits, SDGs

System (RFC)	Regions	1.5°C	2°C	Adaptation	Adaptation-potential	SDG
Agriculture and Food security (2,4)	Global, Africa, Asia	32-36 million people affected by reduced yields	330-396 million people with reduced yields	Climate resistant varieties, irrigation	Medium, higher in high latitudes than in low latitudes	
Water resources (3)	Global, Africa, Mediterra-nean	496 million people waterstressed	590 million people waterstressed	Rationing Wells Rainwater tanks	Low	
Coral reefs (1)	Tropics	70-90% at risk of loss	99% at risk of loss	-	Very limited	
Coastal settlements (2,3)	**Global, Asia, SIDS**	**31-69 million people at risk**	**32-79 million people at risk**	**Coastal , Mangrove**	**Low-medium. Some atolls may become uninhabitable at 1.5°C/2°C**	
Health (2,3,4)	Global,part. tropics	+ 350 million people exposed to deadly heatwaves in megacities by 2050		Hydration, cooling zones, green roofs	Medium, low in tropics	

Synthesis from IPCC SR15 2018 (ch.3,4, 5)

Risk, Adaptation, Limits, SDGs

System (RFC)	Regions	1.5°C	2°C	Adaptation	Adaptation-potential	SDG
Agriculture and Food security (2,4)	Global, Africa, Asia	32-36 million people affected by reduced yields	330-396 million people with reduced yields	Climate resistant varieties, irrigation	Medium, higher in high latitudes than in low latitudes	
Water resources (3)	Global, Africa, Mediterra-nean	496 million people waterstressed	590 million people waterstressed	Rationing Wells Rainwater tanks	Low	
Coral reefs (1)	Tropics	70-90% at risk of loss	99% at risk of loss	-	Very limited	
Coastal settlements (2,3)	Global, Asia, SIDS	31-69 million people at risk	32-79 million people at risk	Coastal , Mangrove	Low-medium. Some atolls may become uninhabitable at 1.5°C/2°C	
Health (2,3,4)	**Global,part. tropics**	**+ 350 million people exposed to deadly heatwaves in megacities by 2050**		**Hydration, cooling zones, green roofs**	**Medium, low in tropics**	

Synthesis from IPCC SR15 2018 (ch.3,4, 5)

Adaptation agriculture

- **Changing agricultural practices effective**: a diversity of options exists, including mixed crop-livestock production systems …a cost-effective adaptation strategy in many global agriculture systems (*robust evidence, medium agreement*).

- **Improving irrigation efficiency** to effectively deal with changing global water endowments, especially if achieved via farmers adopting new behaviour and water-efficient practices rather than through large-scale infrastructure (*medium evidence, medium agreement*).

- Improving the efficiency of food production and closing yield gaps have potential to reduce **emissions from agriculture, reduce pressure on land and enhance food security** and future mitigation potential (*high confidence*).

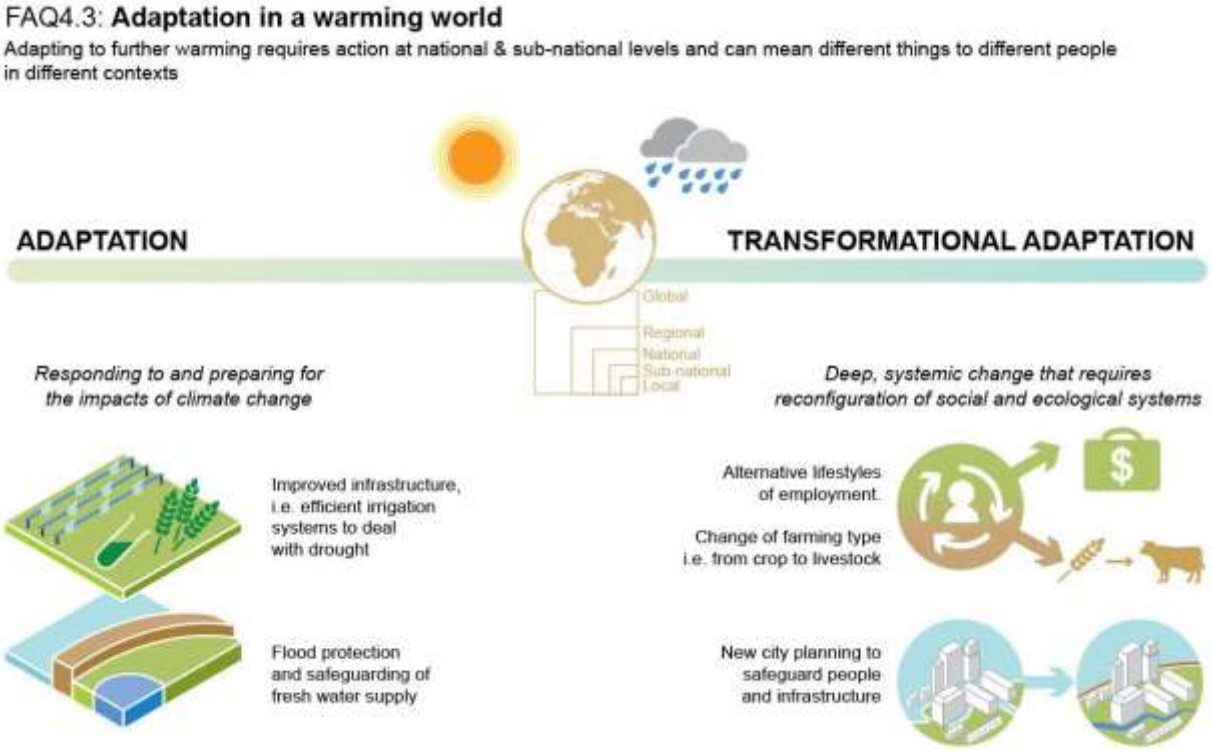
Adaptation water

- Cities to integrate sustainable water resource management and the supply of water services in ways to support mitigation, adaptation and development through **waste-water recycling and storm water diversion.**
- Urban design in many cities now seeks to **mediate run-off, encourage groundwater recharge and enhance water quality.**
- Growing evidence suggests that investing in **behavioural shifts** towards using irrigation technology such as **micro-sprinklers or drip irrigation**, is an effective and quick adaptation strategy **as opposed to large dams** which have high financial, ecological and social costs.

Adaptation: Incremental and Transformational

Incremental adaptation:
Adaptation that maintains the essence and integrity of a system or process at a given scale.

Transformational adaptation:
Adaptation that changes the fundamental attributes of a socio-ecological system in anticipation of climate change and its impacts.



Soft and hard limits

Table 5.2: Soft and hard adaptation limits in the context of 1.5°C and 2°C of global warming

System/Region	Example	Soft Limit	Hard Limit
Coral reefs	Loss of 70-90% of tropical coral reefs by mid-century under 1.5°C scenario (total loss under 2°C scenario) (se Chapter 3, Sections 3.4.4 and 3.5.2.1, Box 3.4)		✓
Biodiversity	6% of insects, 8% of plants and 4% of vertebrates lose over 50% of the climatically determined geographic range at 1.5°C (18% of insects, 16% of plants, 8% of vertebrates at 2°C) (see Chapter 3, Section 3.4.3.3)		✓
Poverty	24-357 million people exposed to multi-sector climate risks and vulnerable to poverty at 1.5°C (86-1,220 million at 2°C) (see Section 5.2.2)	✓	
Human health	Twice as many megacities exposed to heat stress at 1.5°C compared to present, potentially exposing 350 million additional people to deadly heat wave conditions by 2050 (see Chapter 3, Section 3.4.8)	✓	✓
Coastal livelihoods	Large-scale changes in oceanic systems (temperature, acidification) inflict damage and losses to livelihoods, income, cultural identity and health for coastal-dependent communities at 1.5°C (potential higher losses at 2°C) (see Chapter 3, Sections 3.4.4, 3.4.5, 3.4.6.3, Box 3.4, Box 3.5, Cross-Chapter Box 6; Chapter 4, Section 4.3.5; Section 5.2.3)	✓	✓
Small Island Developing States	Sea level rise and increased wave run up combined with increased aridity and decreased freshwater availability at 1.5°C warming potentially leaving several atoll islands uninhabitable (see Chapter 3, Sections 3.4.3, 3.4.5, Box 3.5; Chapter 4, Cross-Chapter Box 9)		✓

Cross-chapter box in Roy et al. 2018 (IPCC SR15 ch. 5)

Summary

- Stabilizing at 1.5°C requires transformational mitigation as well as ramping up incremental and sometimes transformational adaptation
- Risks and adaptation needs substantially lower at 1.5°C than at 2 °C, but higher than at 1°C
- Food production and security as well as water sectors affected: variety of adaptation options at hand
- Some limits to adaptation and adaptive capacity
- Considerations for equity and international support for those at risk
- Transformational adaptation to push soft limits: the Loss and Damage policy space?

Transformation: synergies, actions, process

- **D6.** Sustainable development **supports, and often enables**, the fundamental societal and systems transitions and transformations that help limit global warming to 1.5°C.

- **Facilitates pursuit of climate-resilient development pathways** that achieve ambitious mitigation and adaptation in conjunction with poverty eradication and efforts to reduce inequalities (*high confidence*).

- **Social justice and equity core aspects** of climate-resilient development pathways: address challenges and inevitable trade-offs, widen opportunities, and ensure options, visions, and values are deliberated, between and within countries and communities, without making the poor and disadvantaged worse off.