

Climate Change 2022

Mountains as pivoting points for climate risks, adaptation and vulnerability

Dr Veruska Muccione

University of Zurich

IPCC WGII Lead Author (Chapter Europe and Cross-Chapter Mountains)

EUSALP Forum 2022 | 23 November 2022



Delineation of mountain regions, population densities

(a) Delineations of mountain regions and population densities in 2015

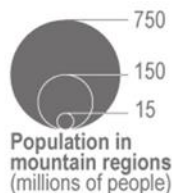
IPCC WGII Continental Regions

- Asia
- Africa
- Small Islands
- Australasia
- North America
- Central and South America
- Europe

Population density in mountain regions (people/km²)

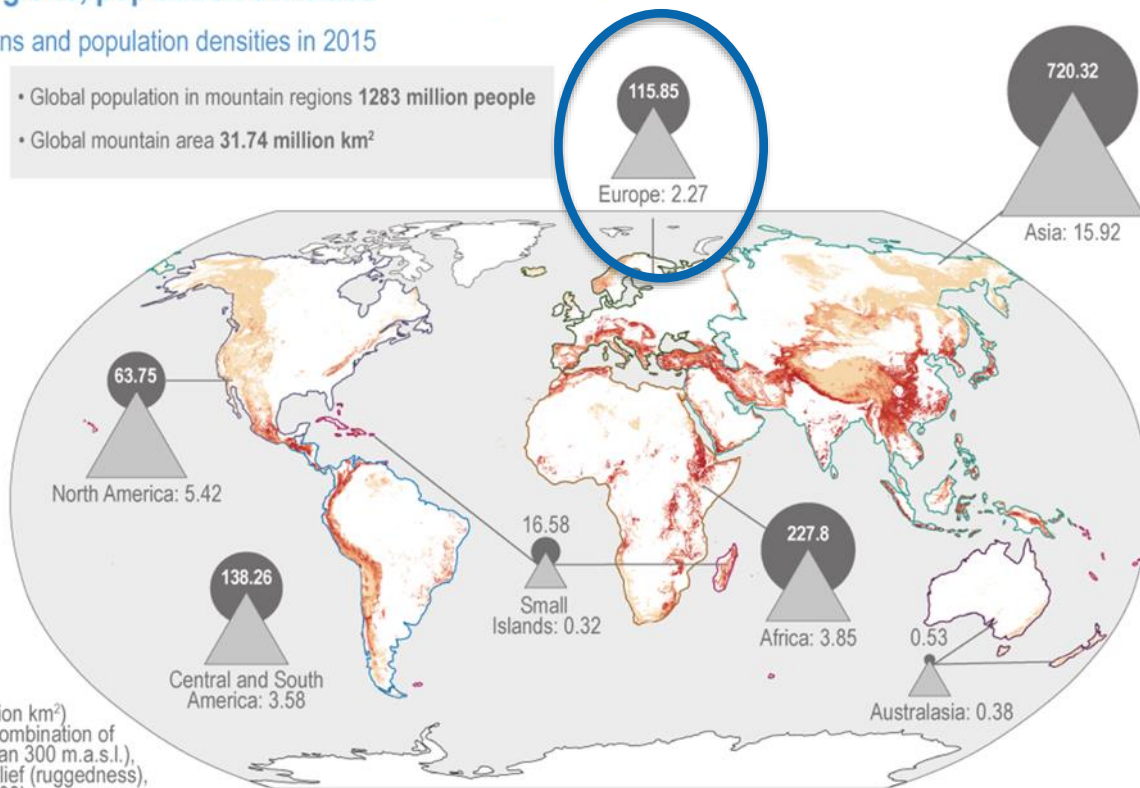


□ Non-mountainous/ out of scope regions. The assessment excludes Svalbard, Greenland and Antarctica



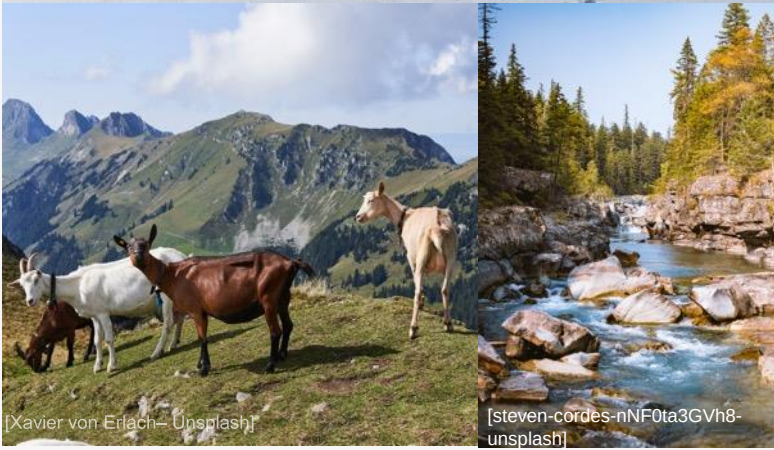
Mountain area (million km²) characterised as a combination of elevation (greater than 300 m.a.s.l.), slope and relative relief (ruggedness), based on Kapos (2000)

- Global population in mountain regions 1283 million people
- Global mountain area 31.74 million km²



Observed climate change and impacts in mountain regions in a 1.1°C warmer world

- Climate change impacts, and their attribution to human influence, have increased - observable and serious consequences for people and ecosystems in many mountain regions.
- Variable timing of glacier- and snow-melt increasingly affecting people and economies.
- Observed seasonal changes negatively affecting tourism (e.g. winter)
- Exposure to climate-related hazards such as flash floods and landslides are contributing to an increase in disasters affecting a growing number of people in mountain regions and further downstream.





“

Increasing temperatures will continue to induce changes in mountain regions throughout the 21st century, with expected negative consequences for mountain cryosphere, biodiversity, ecosystem services and human well being (CCP5.3.1)

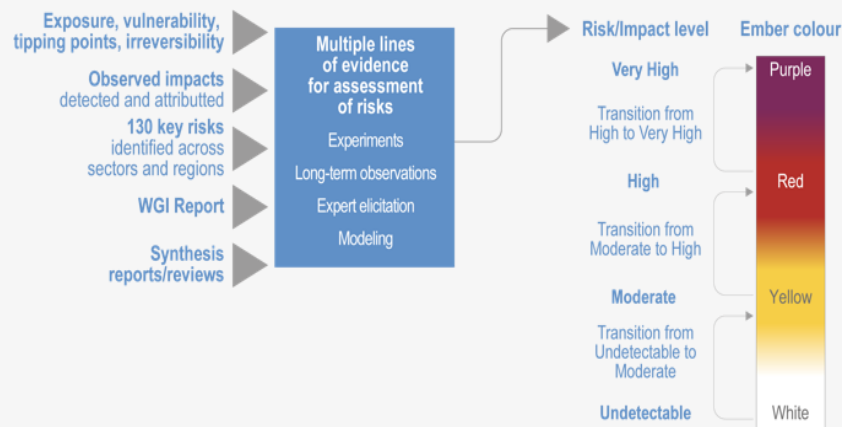
Projected impacts at 1.5°C and beyond

- Many low elevation and small glaciers will lose most of their total mass at 1.5°C.
- Endemic mountain species will be at increasingly risk of extinction by exceeding 1.5°C (even temporarily).
- Regions relaying on glacier- and snow-melt for irrigation will face erratic water supply and increased food insecurity (already irreversible).
- At 2°C GWL, the operation of low altitude resorts discontinued without snowmaking while beyond 3°C GWL snowmaking will be a necessary but not always sufficient for most resorts
- Damages and losses from water related hazards such as floods and landslides are projected to increase between 1.5°C and 3°C.



Photo: Danny Postma, Unsplash

Key risks assessments and key risks in mountains



- Loss of lives, harm to people, and damages to infrastructures from landslides and floods.
- Adverse impacts to livelihoods and risks to economic sectors for mountain communities and in the lowlands from changes in water supply and its managements.
- Changes to mountain ecosystems and risks of mountain top species extinction due to warming and range constraints including shifts in treelines.
- Intangible losses and harm to people and loss of cultural values from decline of ice, snow cover and warming as well as increase in disasters.



[Photos V.Muccione]

“

There are options we can take in every region and every sector to adapt to climate change, but their effectiveness declines with increased warming.

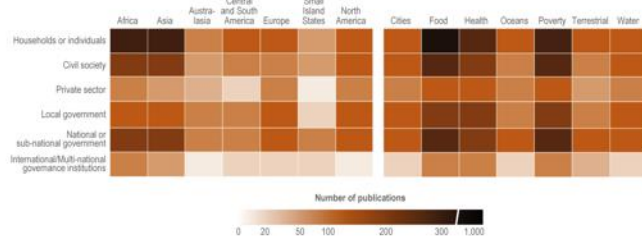
Adaptation is happening and nature offers solutions

There are options we can take everywhere and in every sector.

Nature offers significant and untapped potential to adapt and to improve people's lives and livelihoods.

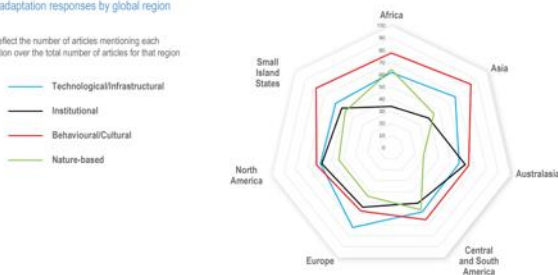
Who is responding, by geographic region and sector?

(a) Number of publications reporting engagement of each actor in adaptation-related responses during the period (2013–2019)



(b) Type of adaptation responses by global region

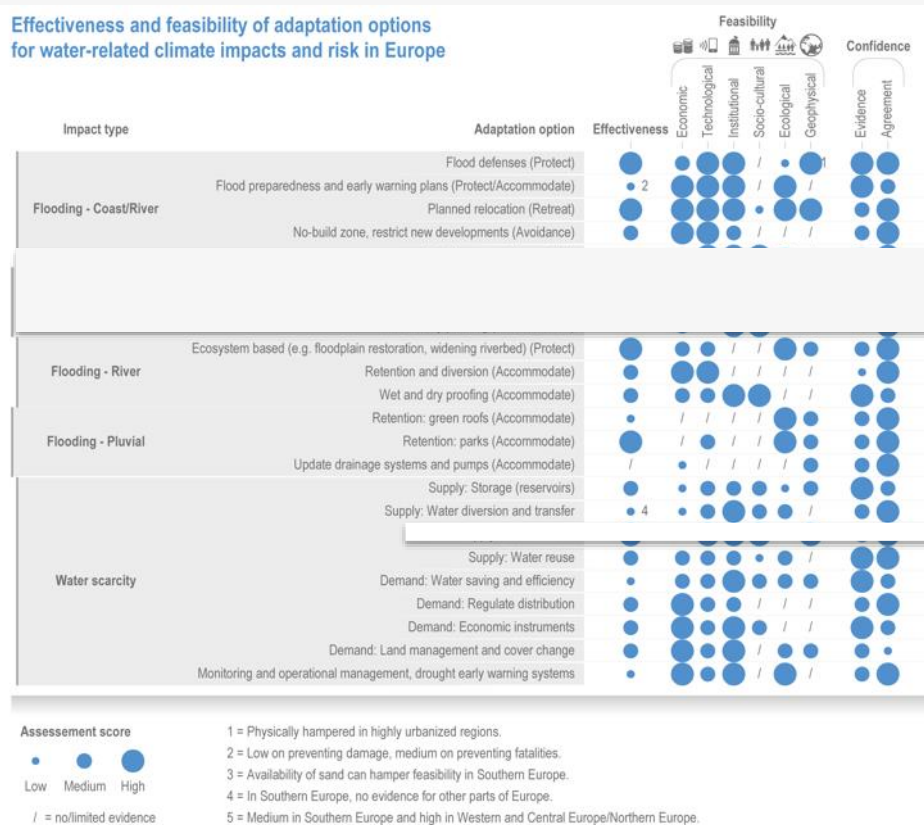
Percentages reflect the number of articles mentioning each type of adaptation over the total number of articles for that region



[Photos V. Muccione]

Adaptation options for flooding and water scarcity

Effectiveness and feasibility of adaptation options
for water-related climate impacts and risk in Europe

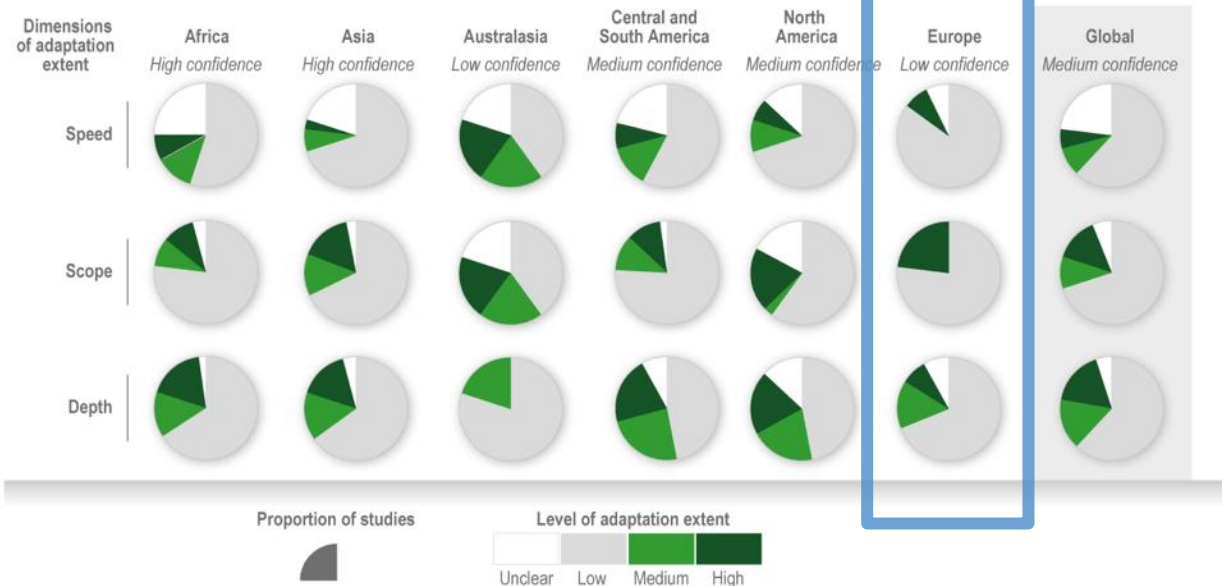


early warning systems,
water and ecosystem-based
adaptation,
sediment
engineering-based options,
land-use change
managed retreat

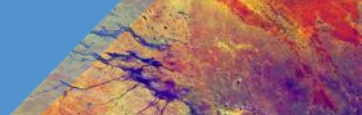
efficiency improvements
water storage
water reuse
early warning systems
land-use change

The extent of implemented and planned adaptation in mountains is insufficient to address future (key) risks in mountains and in particular at higher warming (beyond 1.5°C)

Extent of adaptation observed in mountain regions



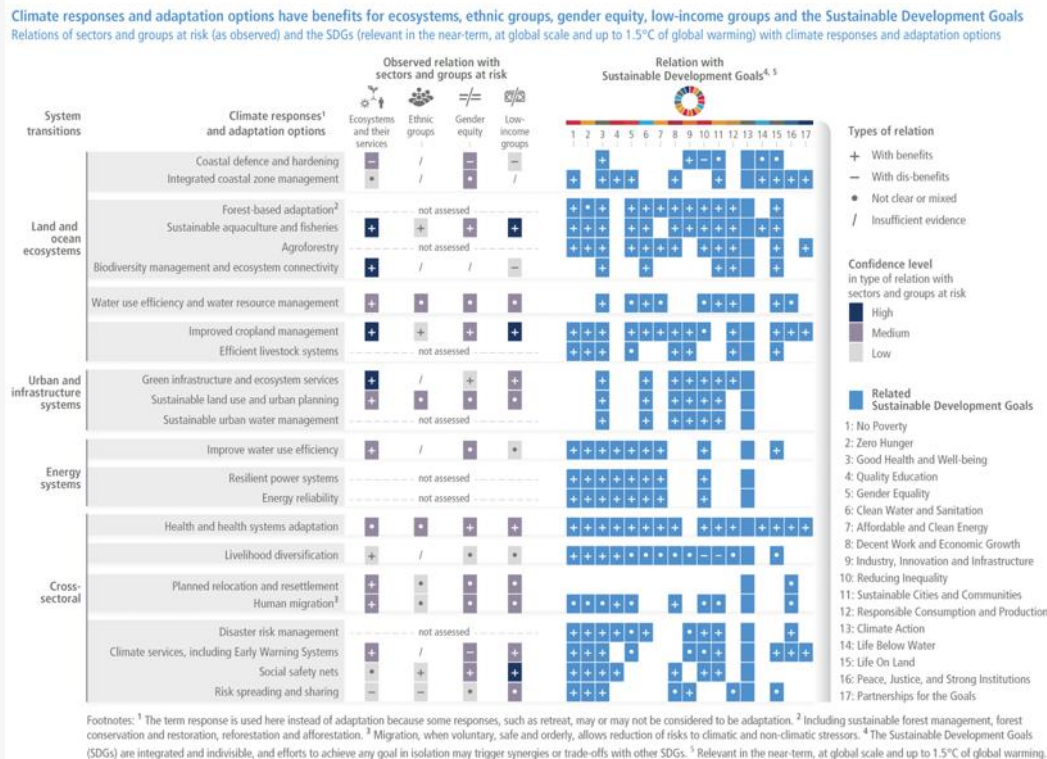
Extent of planned and implemented adaptation actions observed in mountain regions shown in terms of three dimensions: i) speed (timeframe within which adaptations are being implemented), ii) scope (the scale of changes observed from the adaptation action), and iii) its depth (i.e., degree to which a change reflects something new)



With warming above 1.5°C the needs for adaptation to address the key risks becomes increasingly urgent.

- Effective measures to reduce risks are those that are robust under uncertain futures (i.e. allow for adaptive planning), incorporate people's concern and values and address multiple risks.
 - Examples: Ecosystem-based adaptation / awareness raising combined with early warning systems; multi-purpose water reservoirs.
- Regional cooperation and transboundary governance enable long-term actions where risks go beyond boundaries and jurisdictions (e.g share data/information, form joint management committees, bring in policy that benefits all countries).
- Ability of adaptation to reduce risks declines with increasing warming.

Adaptation and sustainable development



To avoid mounting losses and damages urgent actions are required

- Reduced climate risks – adaptation
- Reduced greenhouse gas emissions – mitigation
- Enhanced biodiversity

This is Climate Resilient Development.

- Is considered across government and all of civil society
- Draws on wide-ranging knowledge (scientific, Indigenous, local, practical)
- Involves everyone – forming partnerships
- Conserves and restores ecosystems
- Involves marginalized groups
- Prioritises equity and justice
- Reconciles different interests, values and world views
- Requires scaled-up investment and international cooperation



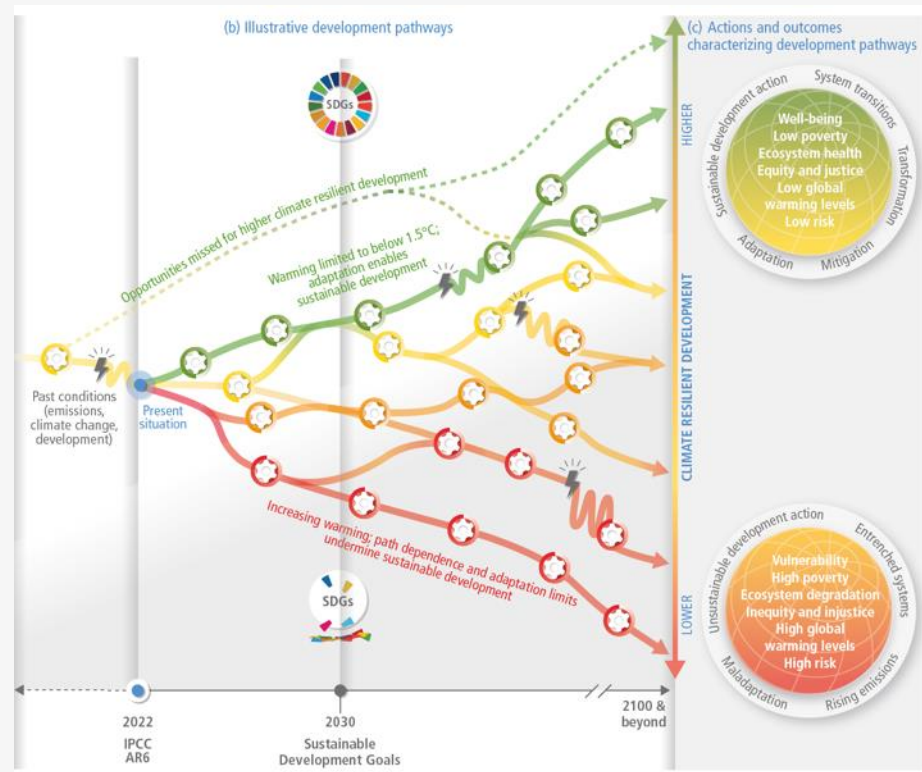
Climate resilient development pathways – benefits for people, nature and the climate

Starting today,
every action,
every decision
matters.

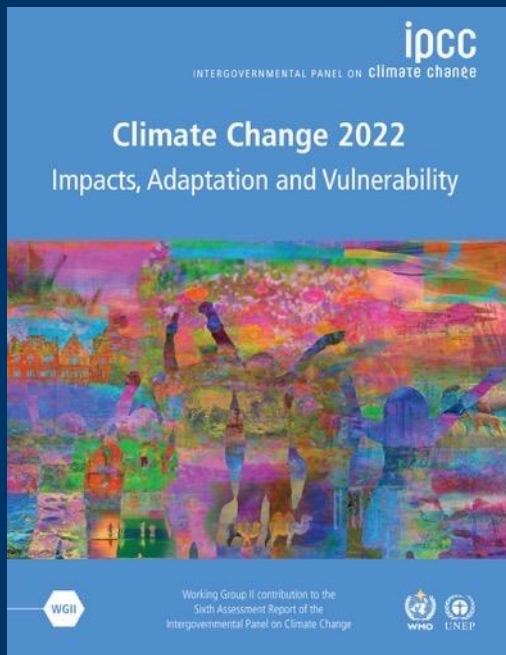
 Illustrative climatic or non-climatic shock, e.g. COVID-19, drought or floods, that disrupts the development pathway

 Narrowing window of opportunity for higher CRD

[Figure SPM.6]



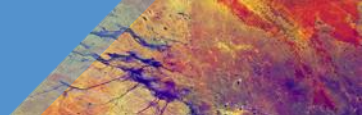
“Climate resilient development is already challenging at current global warming levels. The prospects will become further limited if warming exceeds 1.5°C and may not be possible if warming exceeds 2°C.”



The science is clear.

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

This report offers solutions to the world.



Thank you!

veruska.muccione@geo.uzh.ch

For More Information:

 www.ipcc.ch

✉ IPCC Secretariat: ipcc-sec@wmo.int
IPCC Press Office: ipcc-media@wmo.int

Follow Us:

 /  @IPCC

 @IPCC_CH #IPCCReport

 [linkedin.com/company/ipcc](https://www.linkedin.com/company/ipcc)