Water and Climate Change: Reflections from Recent IPCC Assessments

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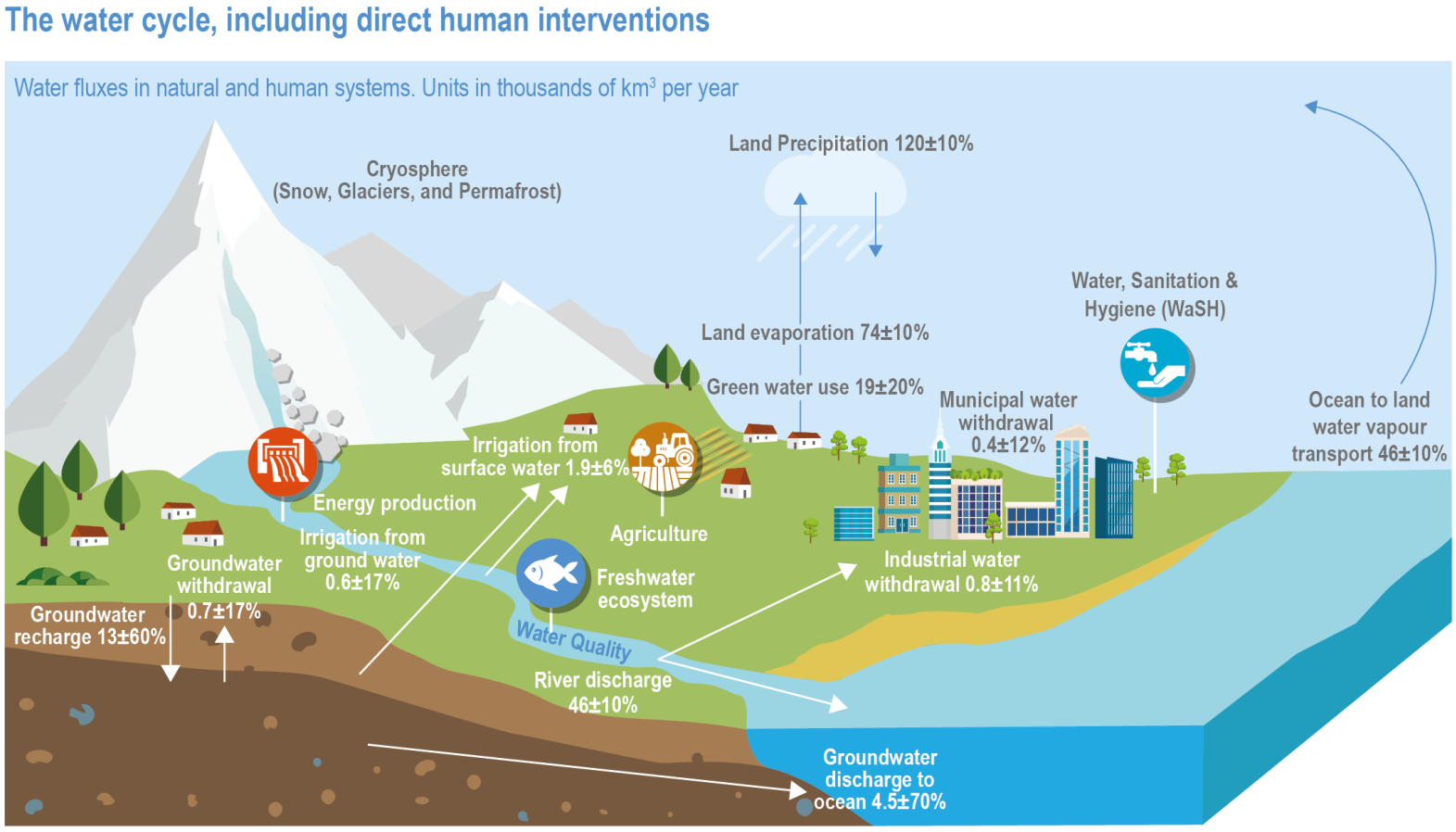
Climate crisis is also water crisis, yet water is neglected in climate change negotiations

- Climate change has led to changes in all components of the water cycle
- Resulting in impacts (mostly negative) in almost all sectors of the economy and society
- Majority of the people in the Global South in climate exposed occupations experience climate change through water.
- Most (~60%) of all adaptations are in response to water related hazards, and many adaptation are about using water to improve livelihoods, e.g. irrigation
- Most mitigation measures, including nature based ones, can have high water footprint, yet rarely discussed

1. All components of the water cycle have been affected by climate change – Heavy precipitation; Droughts; Floods; Melting of Cryosphere are some examples



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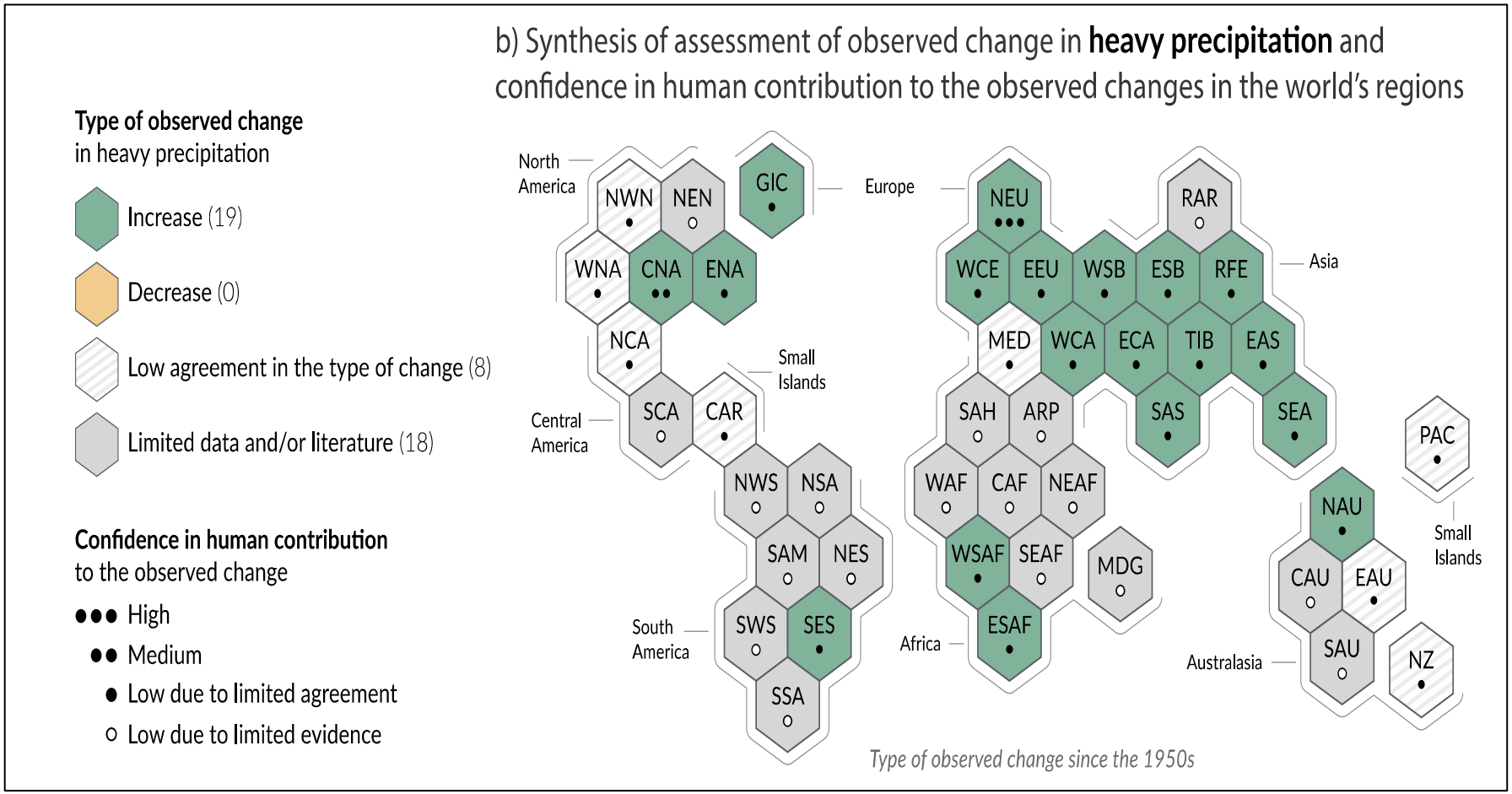
1. All components of the water cycle have been affected by climate change – Heavy precipitation (a)

Observed changes in heavy precipitation since the 1950s



IPCC WGI SPM

1. All components of the water cycle have been affected by climate change – Droughts (b)

Observed changes in droughts since 1950s

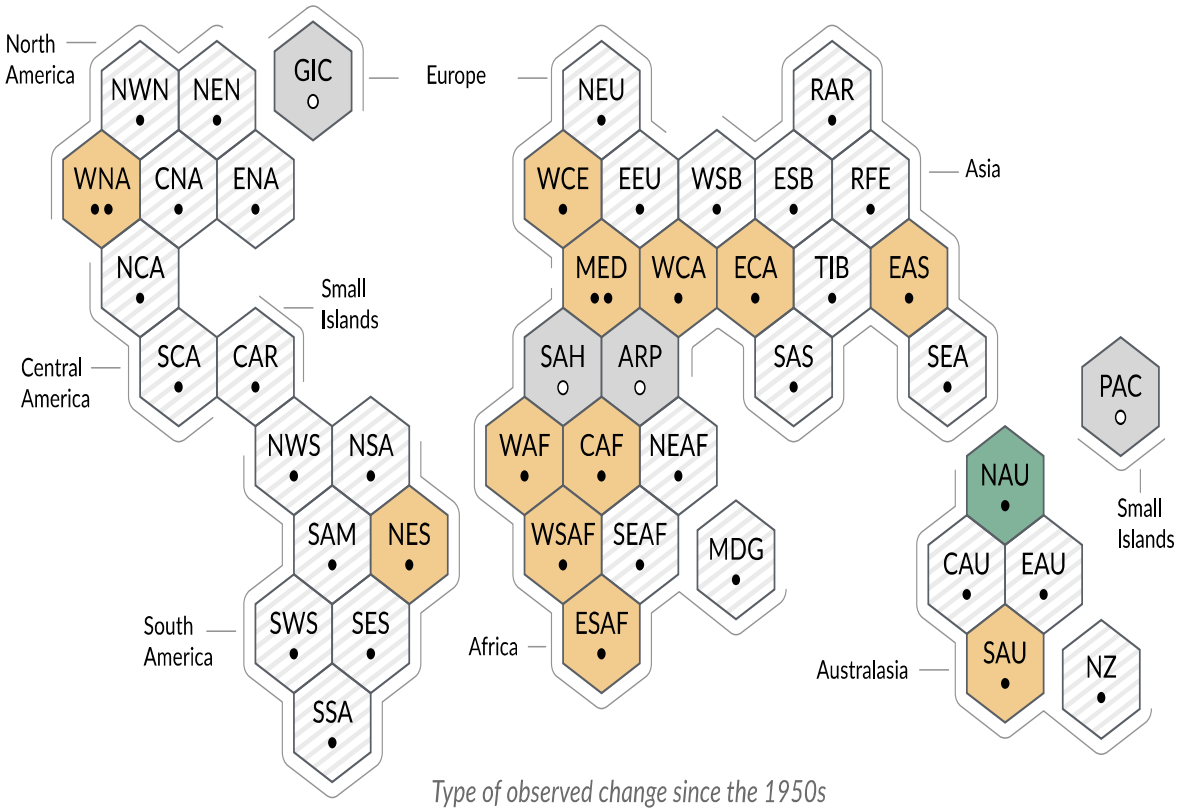
c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in agricultural and ecological drought

- Increase (12)
- Decrease (1)
- Low agreement in the type of change (28)
- Limited data and/or literature (4)

Confidence in human contribution
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- o Low due to limited evidence



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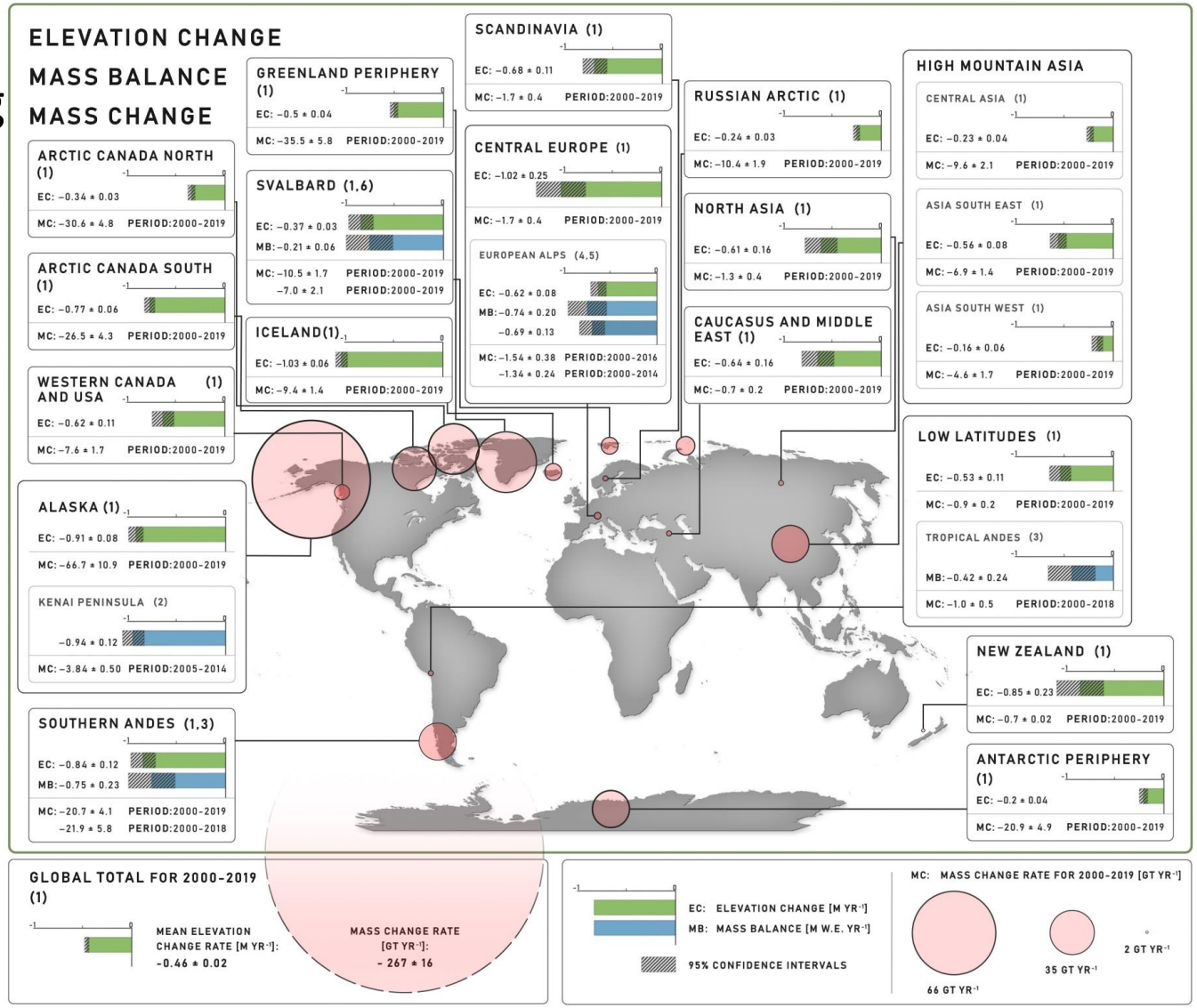
1. All components of the water cycle have been affected by climate change – Melting of cryosphere (c)

Glaciers are melting at unprecedented rates in all regions including the Hindu Kush Himalayas, affecting culture and ways of lives of Indigenous peoples



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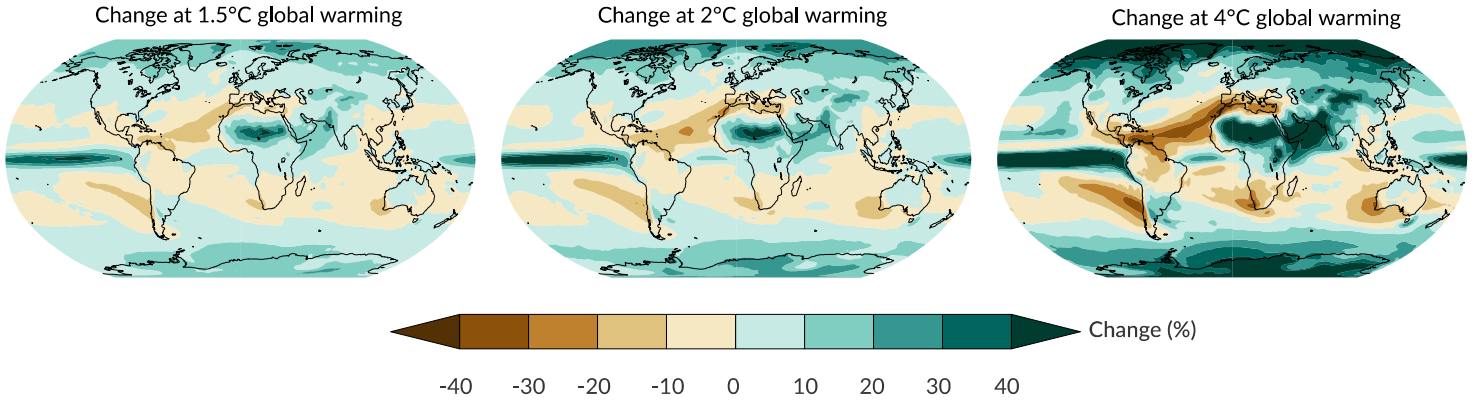
1. Water cycle will continue to intensify at higher global warming levels, and with every increment of of global warming, changes in regional mean precipitation and soil moisture will get larger (d)

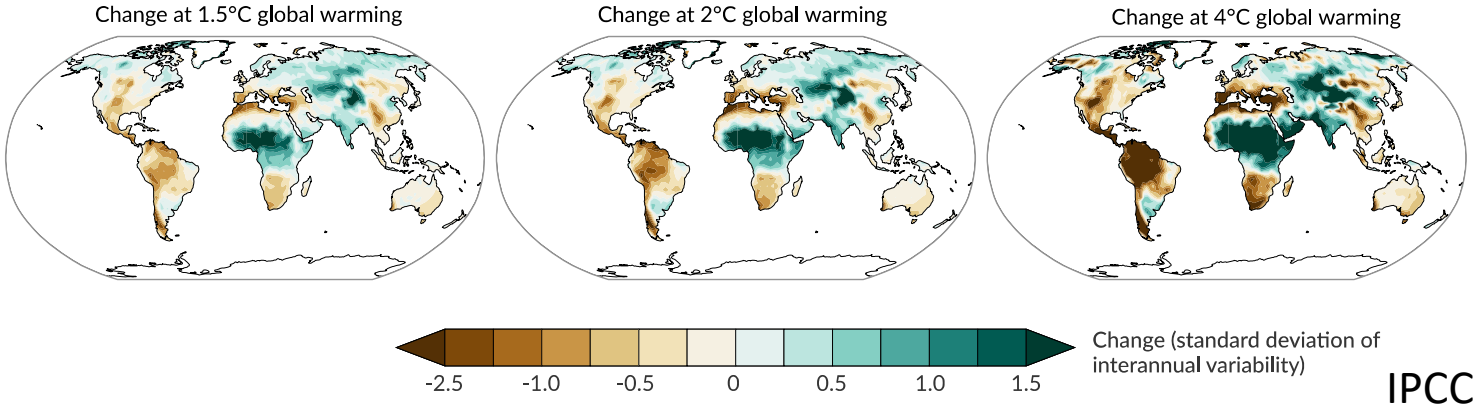
c) Annual mean precipitation change (%)
relative to 1850-1900 at three global warming levels

Precipitation increases over high latitudes, tropical oceans and parts of the monsoon regions but decreases over parts of the subtropics.



d) Annual mean soil moisture change (sd)
(standard deviation of interannual variability) relative to 1850-1900 at three global warming levels

Across warming levels changes in soil moisture largely follow changes in precipitation but also show some differences due to the influence of evapotranspiration.



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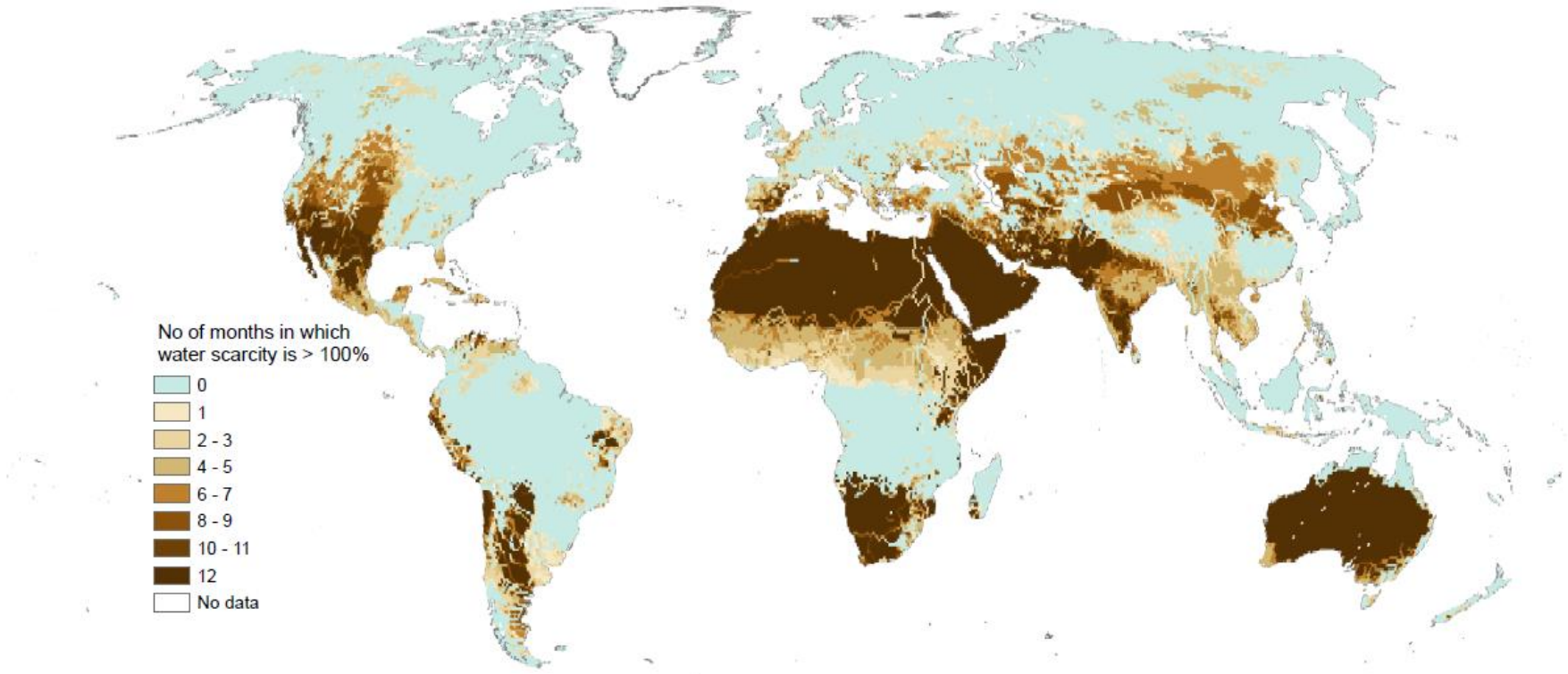
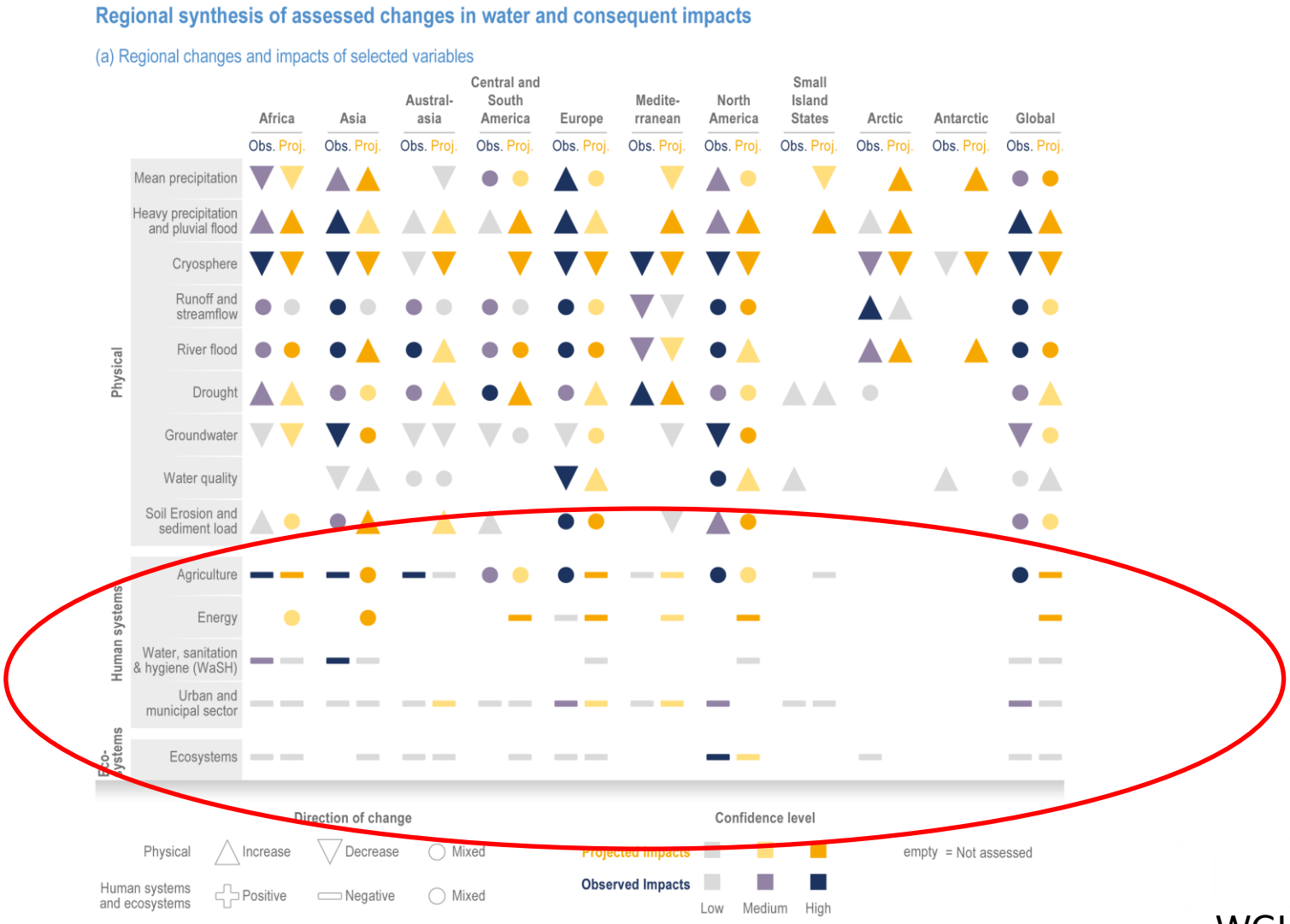
1. Approximately 4 billion experience severe water scarcity for at least one month per year due to climatic and non-climatic factors and climate change is exacerbating water scarcity further (e)



Water scarcity: ratio of water demand to water supply
Severe water scarcity: water demand exceeds supply (ie: water scarcity is greater than 100%)

2. All sectors of the economy and society, especially in the Global South, are feeling negative impacts of changes in water cycle (a)



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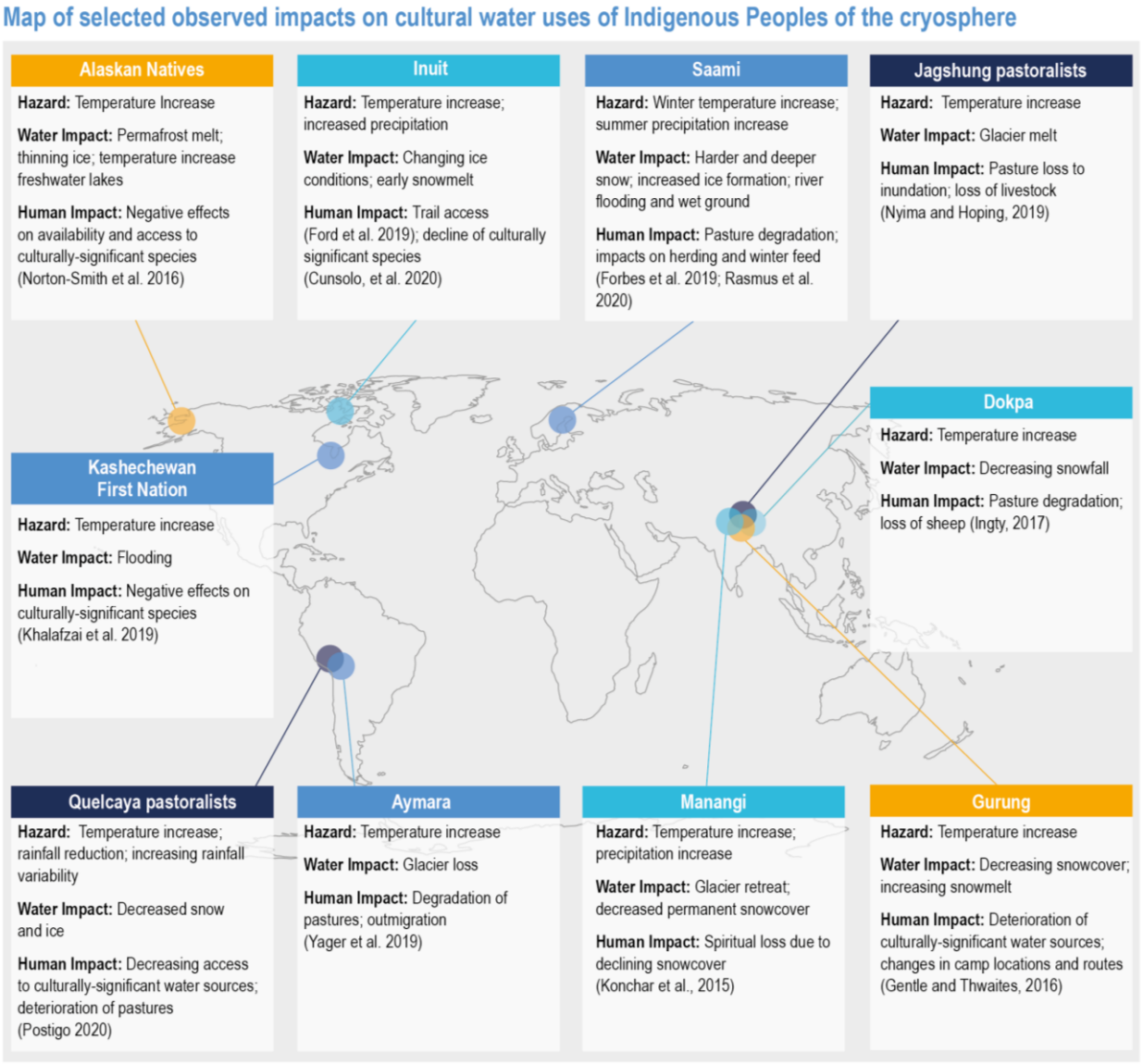
2. All sectors of the economy and society, especially in the Glo South, are feeling negative impacts of changes in water cycle (b)

- Agriculture: 3/4th of global harvested land experienced drought related agricultural losses between 1983-2009, with production loss of 9-10% due to weather extremes alone.
- Energy: Between 1981-2000, utilisation rate of hydropower plants declined by 5.5% in drought years compared to normal years, with thermo-electric plants faring worse
- Health: Extreme events like floods are linked with increased incidence of water related diseases
- Urban:17% of cities experienced statistically significant increases in extreme precipitation between 1973-2012
- Freshwater Ecosystems: Between 1970-2015, 35% of wetland area declined, with climate change being an important driver

3. Impacts of changing water cycle are being felt disproportionately by women, poor farmers, Indigenous people (a)



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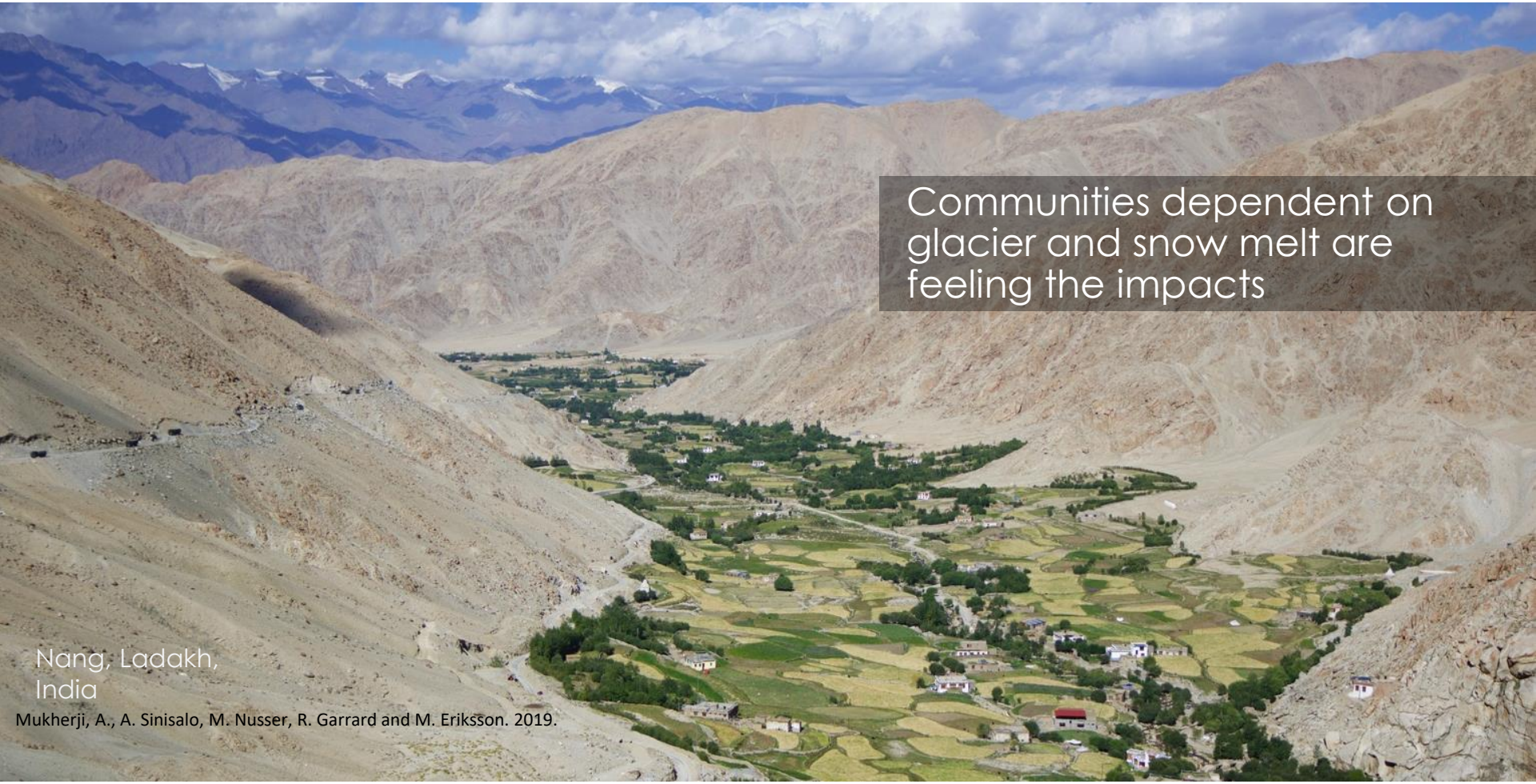
3. Those who are most vulnerable and have not contributed to carbon emissions and global warming are the ones facing the most severe impacts (b)



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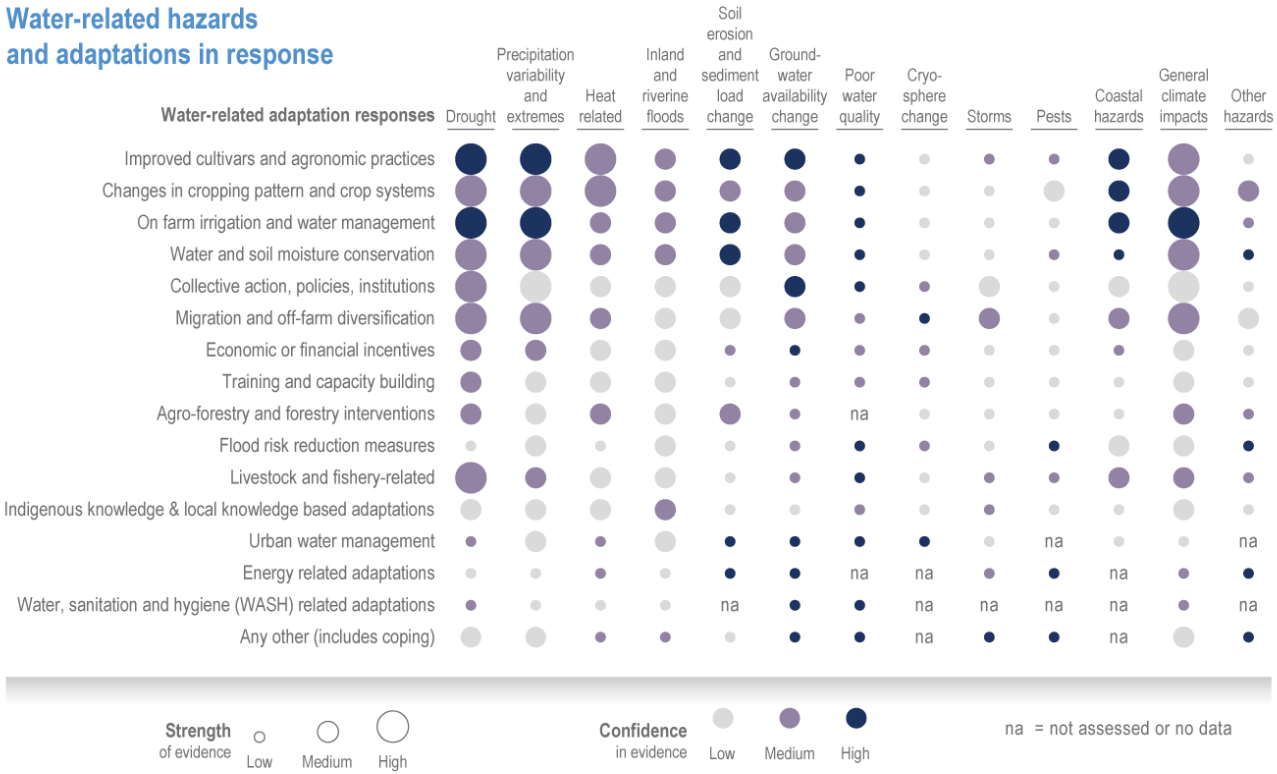
4. Water is central to adaptation ~60% of all adaptation is occurring in response to water related hazards (a)



Meta review of 1891 articles

359 articles on water-related adaptation that measures outcomes

Water related adaptation
- Water as hazard
- Water as response

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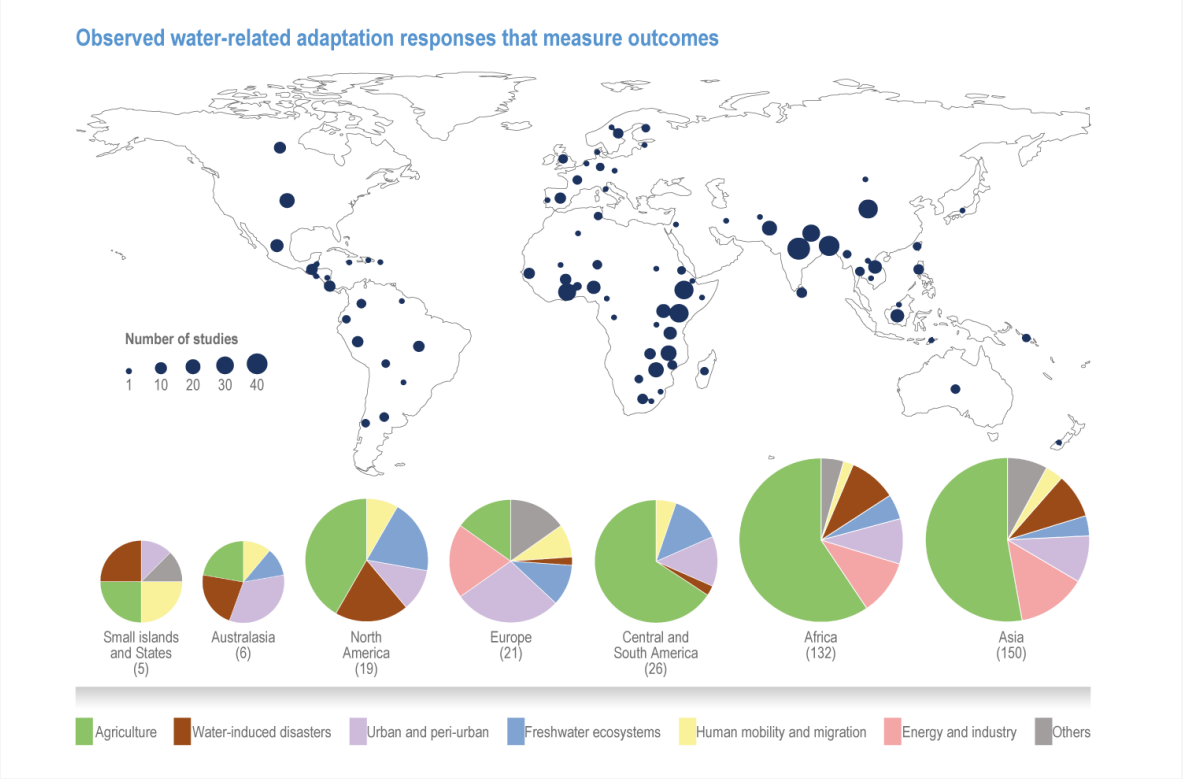
4. Documented cases of water related adaptation is happening in all regions, and more so in Africa and Asia where there is high dependence on climate exposed livelihoods like agriculture (b)



- Most water adaptations in Global South is in agriculture
- Most water adaptation in Global North is in urban sector

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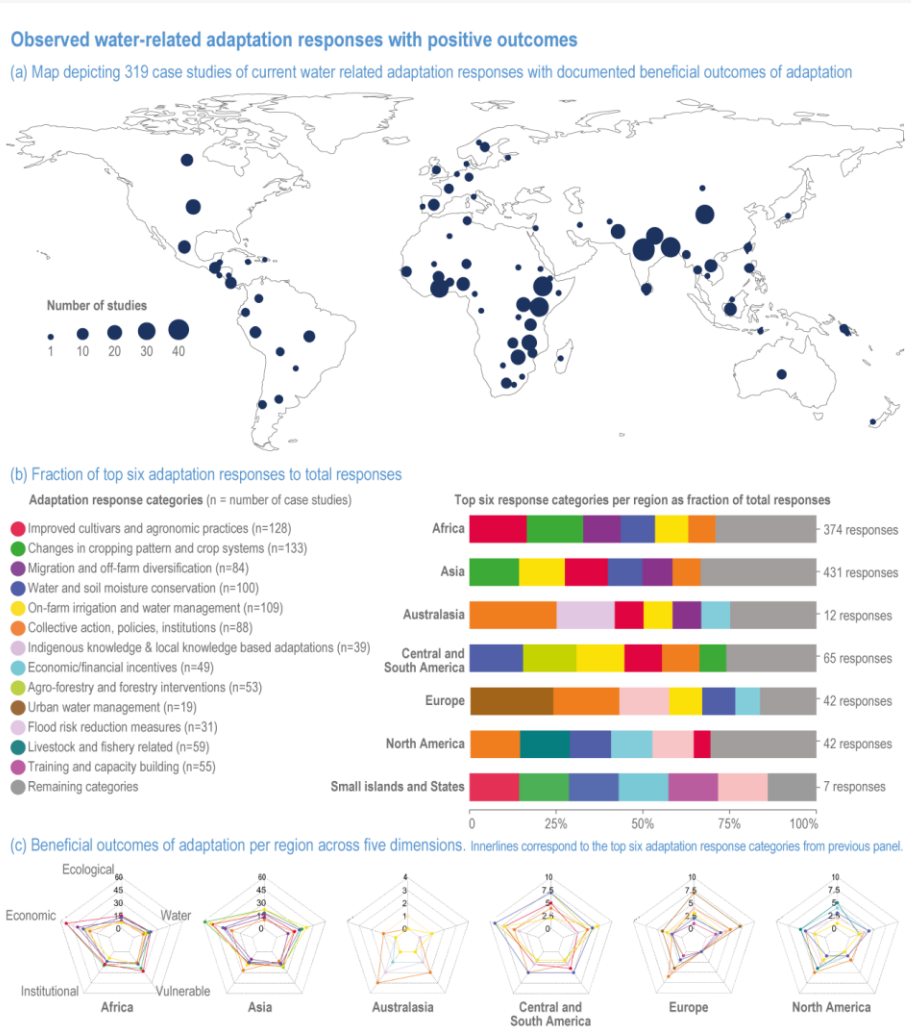
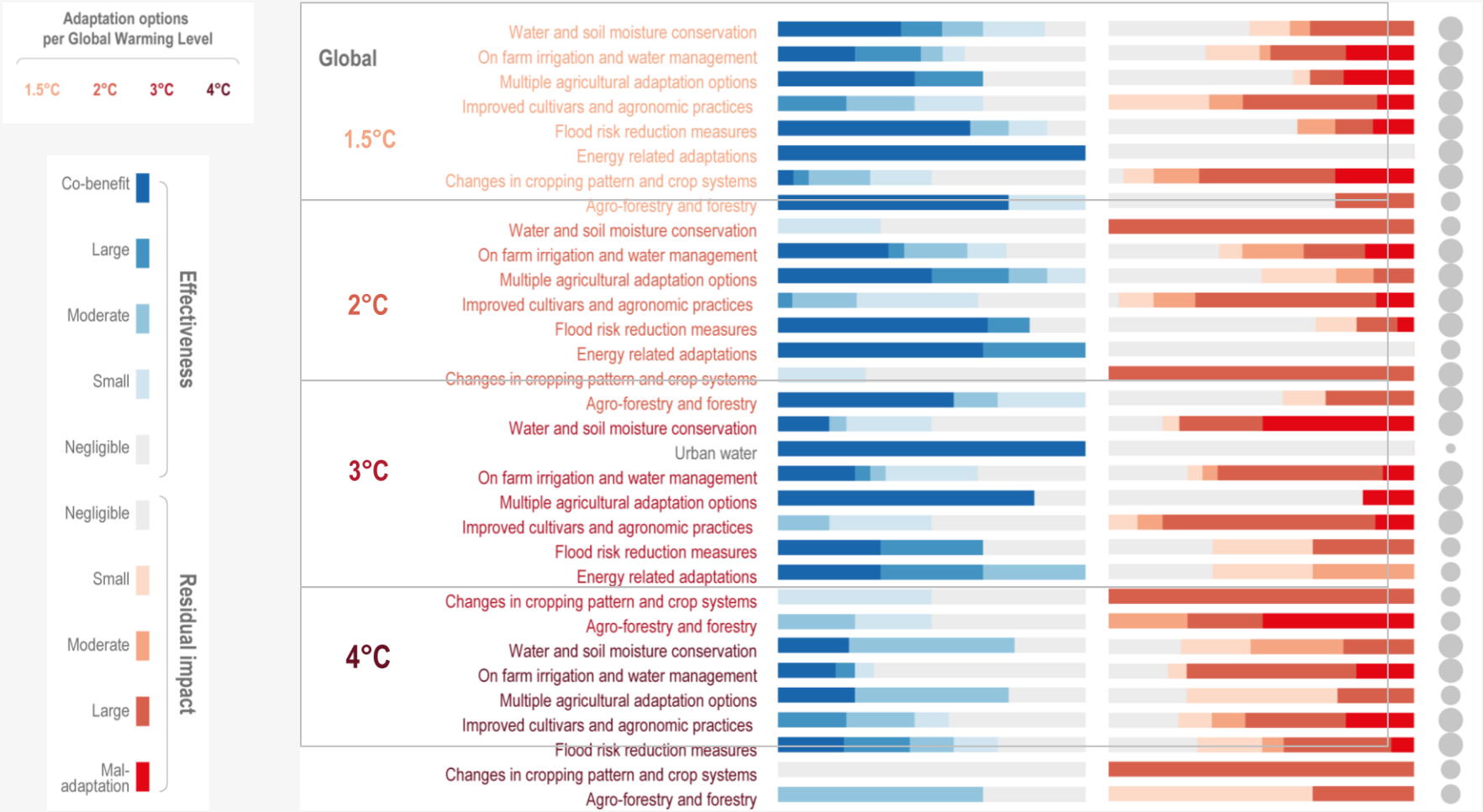


4. Water related adaptations have many benefits, but may not always reduce climate risks (c)

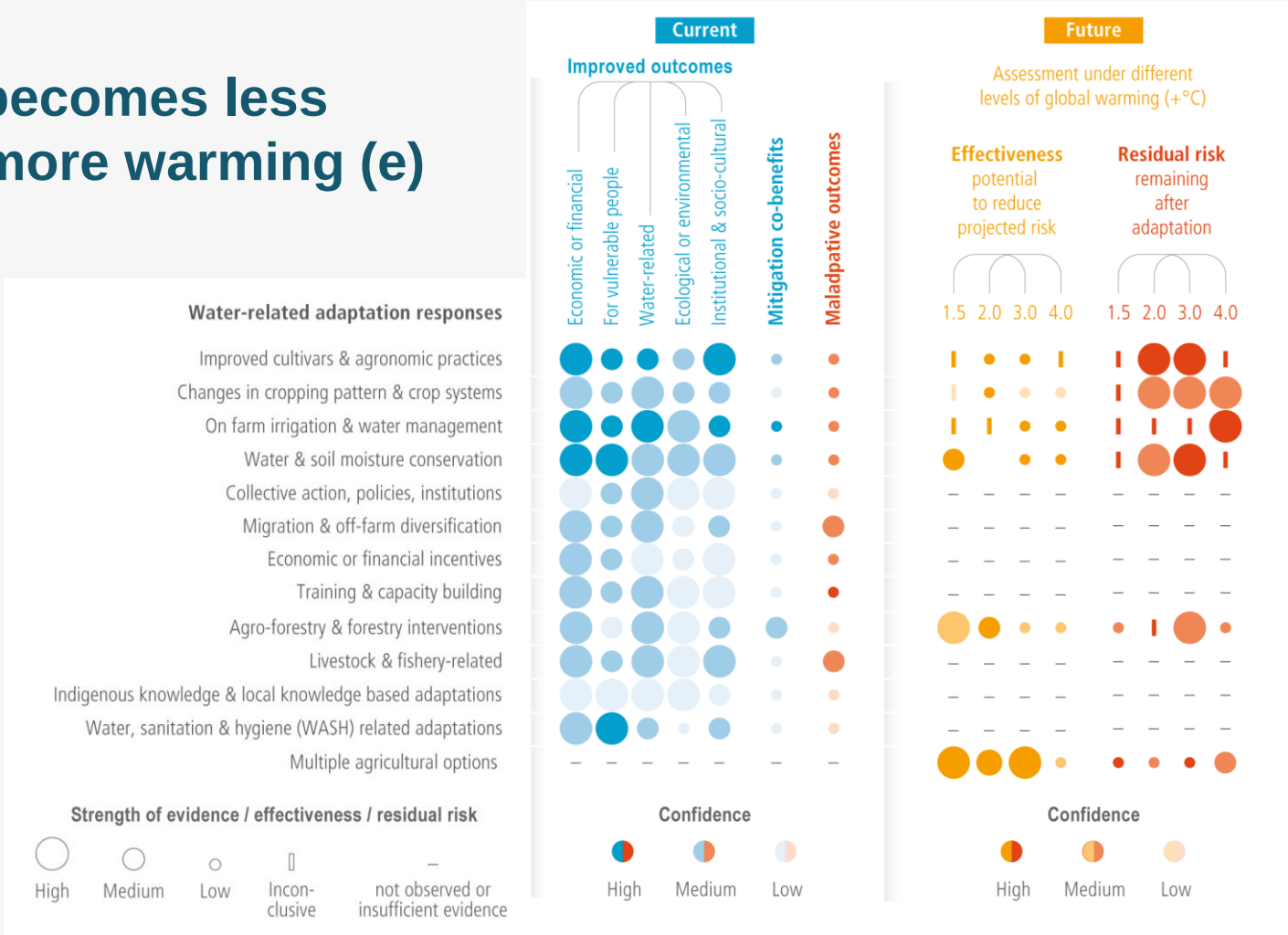
- In the Global South, benefits of adaptation are economic and livelihoods related
- In the Global North, benefits of adaptation also includes better outcomes for the environment

4. Future Effectiveness of Adaptation (d)



4. Adaptation becomes less effective with more warming (e)

- Water-related adaptation is most effective up to 1.5°C and effectiveness decreases with increasing warming
- Residual impacts remain, especially at higher levels of warming



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5. Most Mitigation measures and Carbon Dioxide Removals (CDR) approaches and technologies can have large trade-offs with water and food security (a)

"Many mitigation measures (including CDR approaches and technologies) have considerable water footprint (*high confidence*), which must be managed in socially and politically acceptable ways to reduce the water intensity of mitigation while increasing synergies with sustainable development (*medium evidence*, *high agreement*)"
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5. Bio-Energy Crops (b)

- Bio-energy crops along with other nature based solutions can potentially limit global warming by the end of the 21st century to 1.5°C, but can potentially double the global area and population living under severe water stress compared to the current baseline (Senthil Kumar, 2020)
- Bio-energy crops can significantly impact food prices via demand for land and water (Fuhrman et al., 2020; Muratori et al., 2016).

5. Afforestation and re-forestation (c)

- Hugely popular tool of mitigation, with some very optimistic estimates saying additional 0.9 billion ha of canopy cover in suitable locations could store 205 Gt of carbon (Bastin et al., 2019)
- If done at inappropriate locations, or inappropriate species, then can lead to trade-offs between land, bio-diversity, and water resources
- Global Assessments on Forest and Water reiterated "afforestation and reforestation should be concentrated in water-abundant locations and where transpiration can potentially be captured downwind as precipitation". (IUFRO, 2018)
- Extensive BECCS and afforestation/reforestation deployment can alter the water cycle at regional scales (*high confidence*)

Water is an integral part of resilience and needs to be more visible in climate negotiations

- Climate change is experienced first and foremost through changes in water regimes (e.g. extreme rainfall, floods, droughts etc.), especially by a large majority in the Global South who depend on climate exposed occupations like agriculture
- Since the most vulnerable feel climate impacts through water, water also becomes the vehicle through which climate injustice propagates.
- Water is a part of the problem, but also a part of the solution. Many of the adaptation measures involve use of water (e.g. irrigation, soil moisture conservation, rainwater harvesting) to improve livelihoods, reduce vulnerability etc.
- Mitigation is the need of the hour, but if not well planned, some mitigation measures can make local water and food security worse through high water footprint. Water needs a seat at the mitigation table.

IWMI International Water Management Institute

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Thank you