Detection and attribution of observed climate change impacts

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Outline

- Observed impacts of recent climatic changes
- Non-observed impacts of recent climatic changes
- The link between observations and adaptation

What is impact detection and attribution?

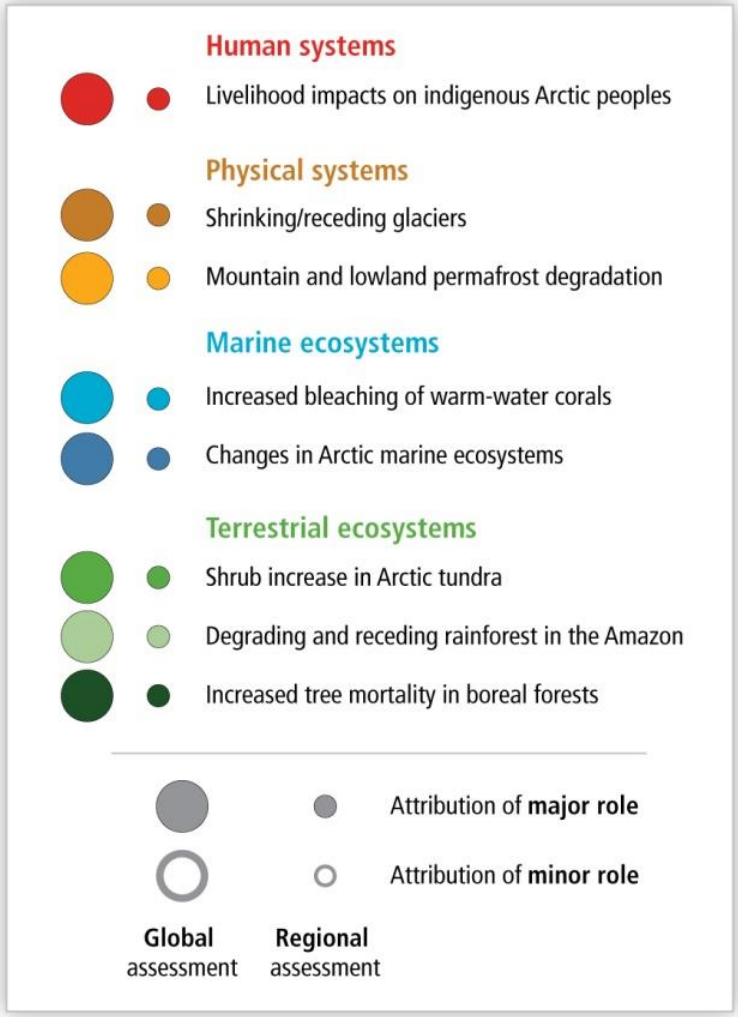
Long term observational data for

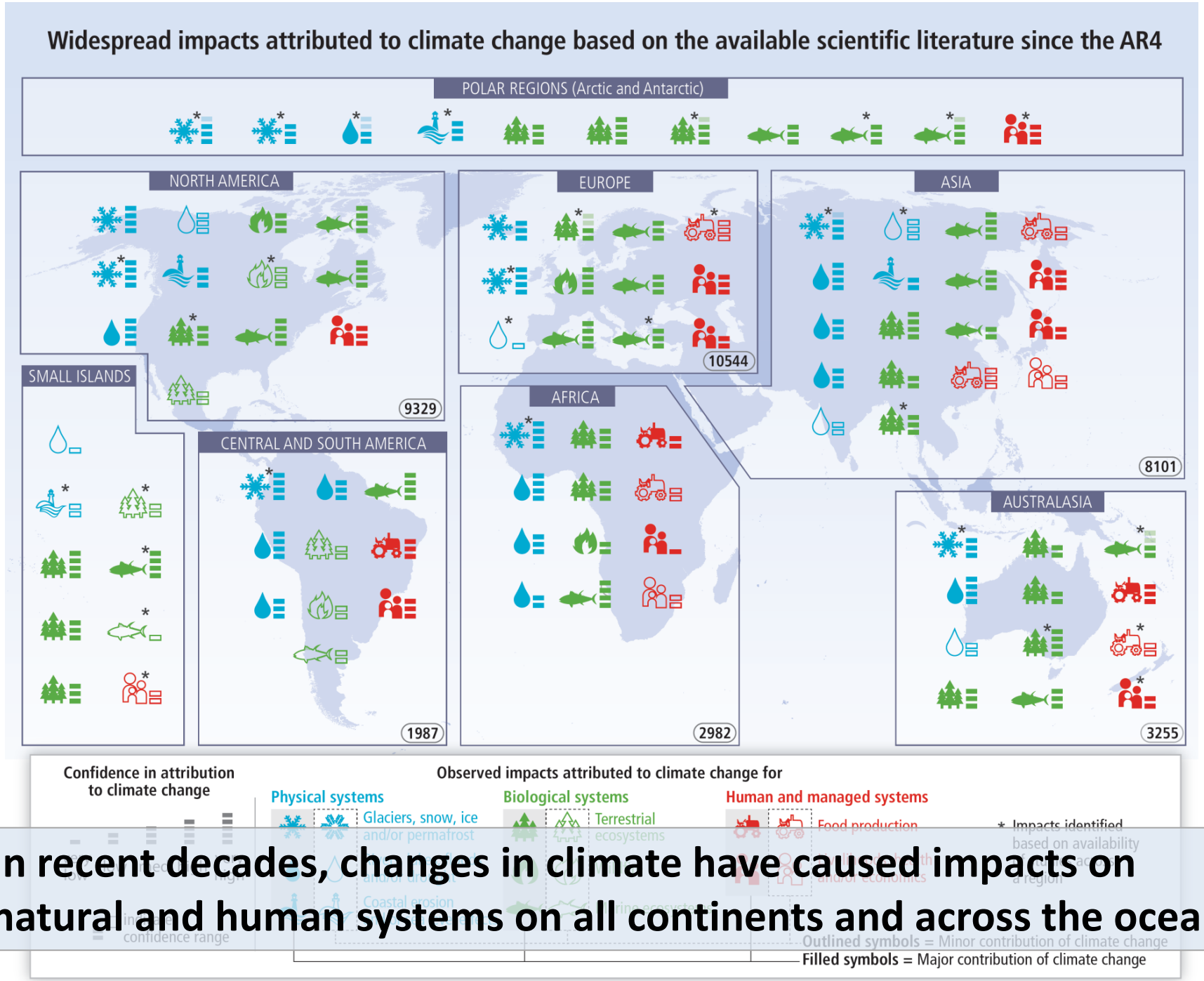
- Characteristics of the impact system
- Climate drivers
- Non-climate drivers

Model of the impact system

Adaptation ?

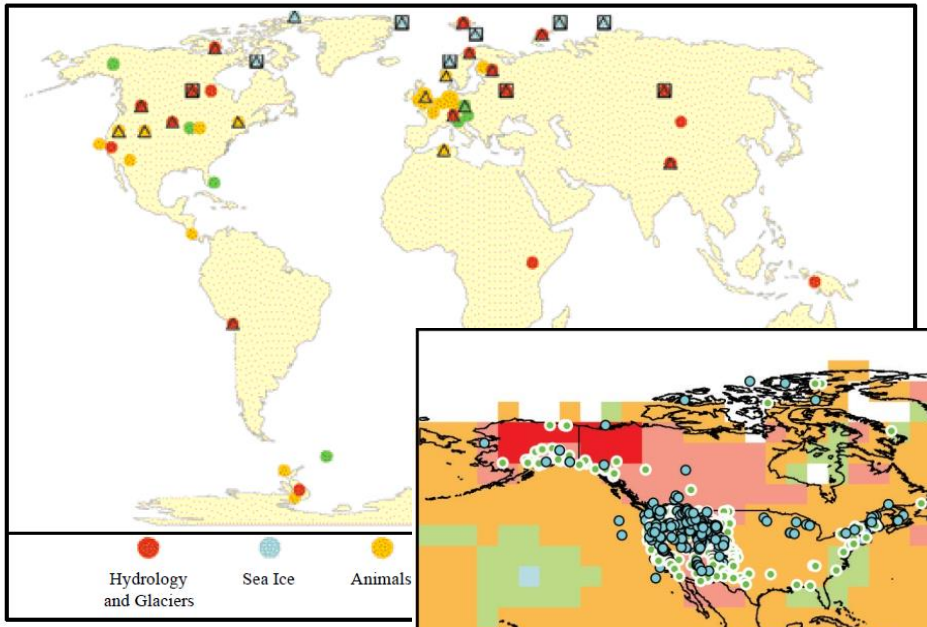
Reason for concern: Loss of unique and threatened systems



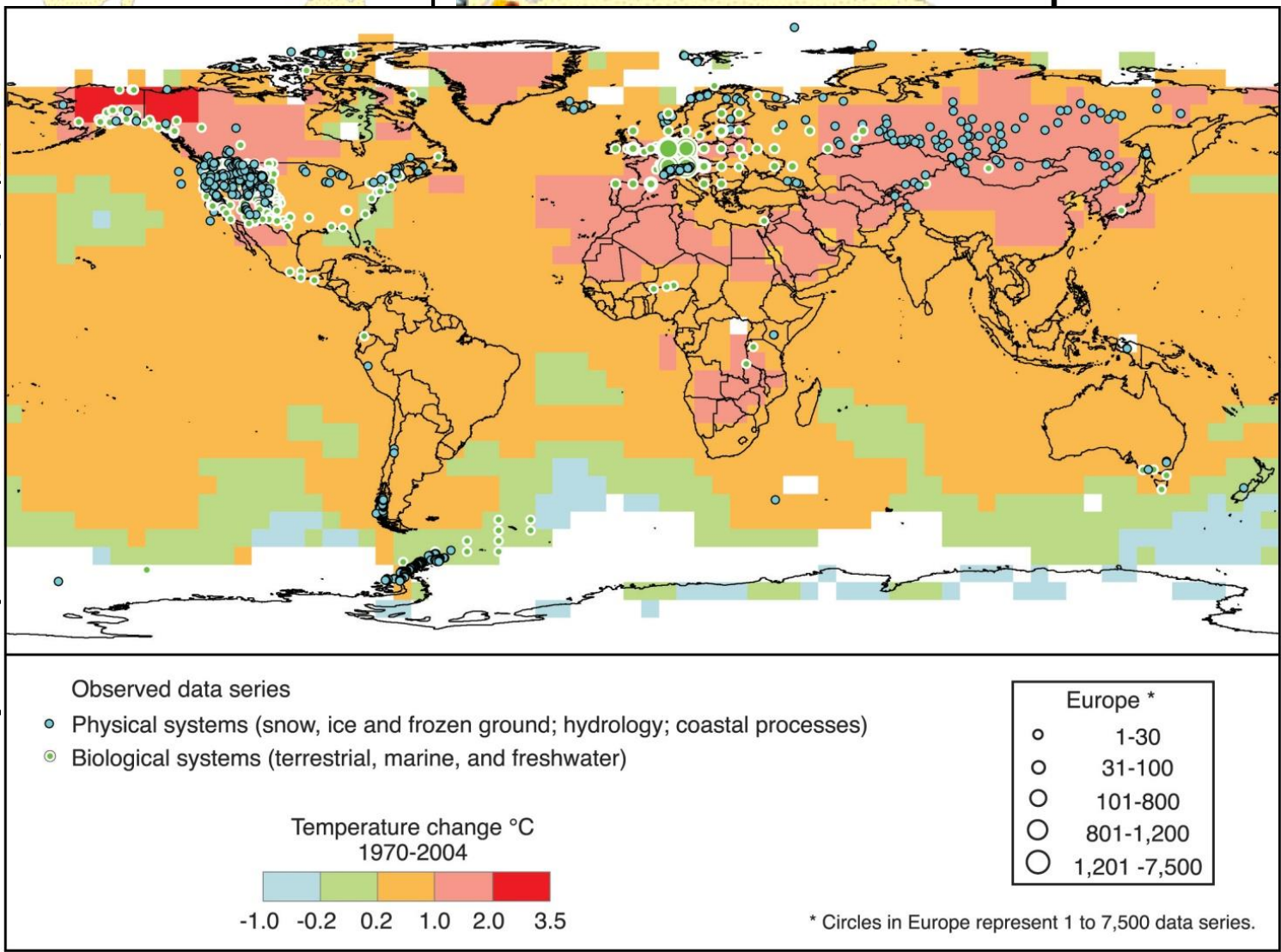


In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans.

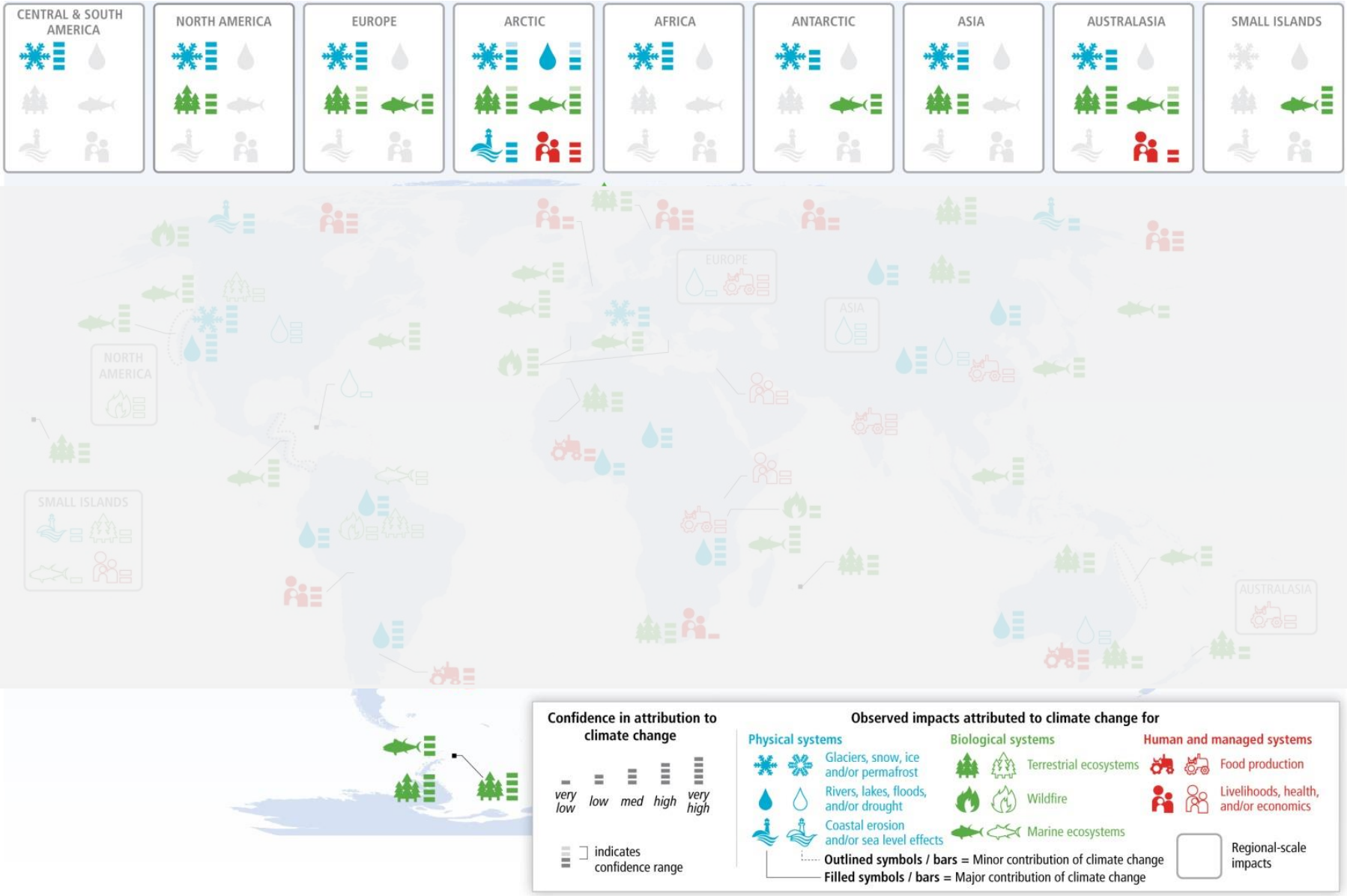
Observed impacts – Third Assessment report, SPM



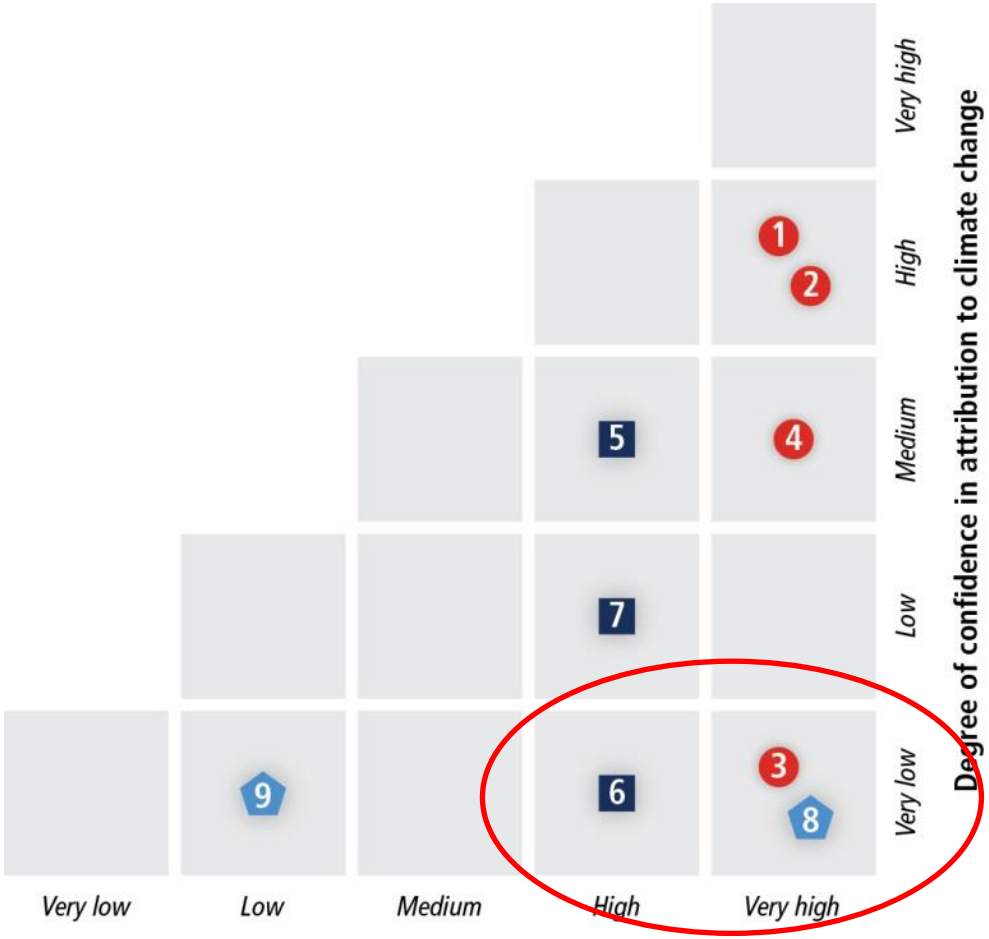
Observed impacts Fourth Assessment report, SPM



Observed impacts – AR5 Chapter 18



Gaps I - Coastal erosion



Evidence of changes in species and ecosystems

1. Increase in coral bleaching
2. Shift in range limits of species distribution
3. Decline in the extent of salt marshes and mangroves
4. Decline in the extent of seagrasses

Impacts on coastal processes

5. Decreased calcification
6. Increased beach erosion
7. Increased saltwater intrusion

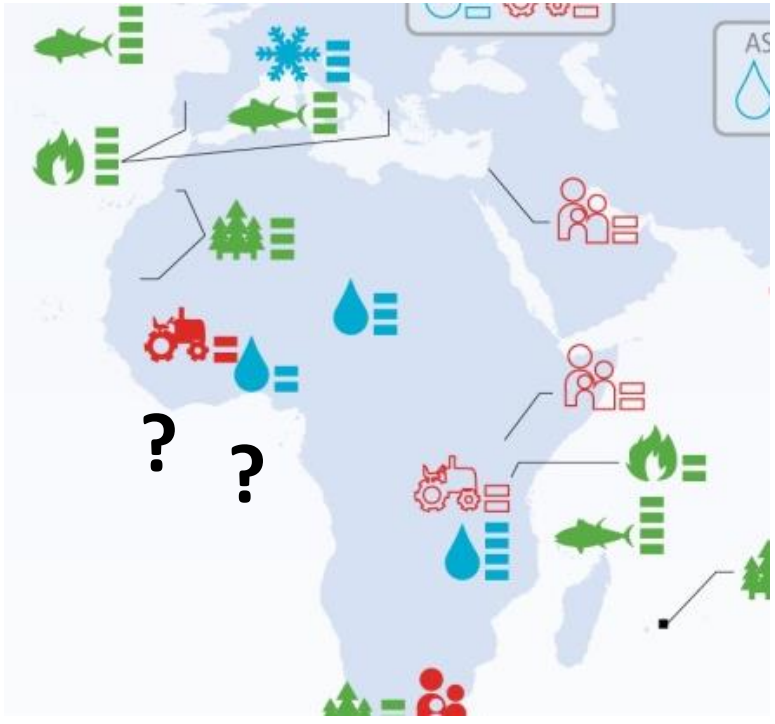
Impacts on human systems

8. Increased flood damage
9. Decreased harbor operations

Wong et al., 2014; Figure 5-5

Gaps I –example:
Coastal inundation in West-Africa

- Lack of continued tide gauge monitoring
- Lack of detailed flood information
- Subsidence, sediment trapping and diversion
- Exposure and vulnerability



Gaps II: Impacts of extreme weather

- Changes in many extreme weather and climate events have been observed since about 1950
- Some of these changes have been linked to human influences
- Impacts from recent climate-related extremes reveal significant vulnerability and exposure to current climate variability
- We can not currently attribute IMPACTS of extreme weather to anthropogenic forcing

Gaps III: Human system

- Food production beyond the big 4
- Occupational and public health
- Energy and Infrastructure
- Other important sectors

Take home messages

- Knowledge of observed impacts has improved vastly
- High quality observations are vital
- Interactions of different drivers of change and socioeconomic data are important
- Detected and attributed impacts may not be the most relevant indicator for (future) risk

A question and a challenge

To assess the impacts of climate variability and increase resilience, both climate variables and societal factors determining vulnerability need to be monitored and integrated in a transdisciplinary effort

Is the attribution of observed impacts to anthropogenic forcing of the climate system a central requirement for effective adaptation approaches?

Thank you for your attention

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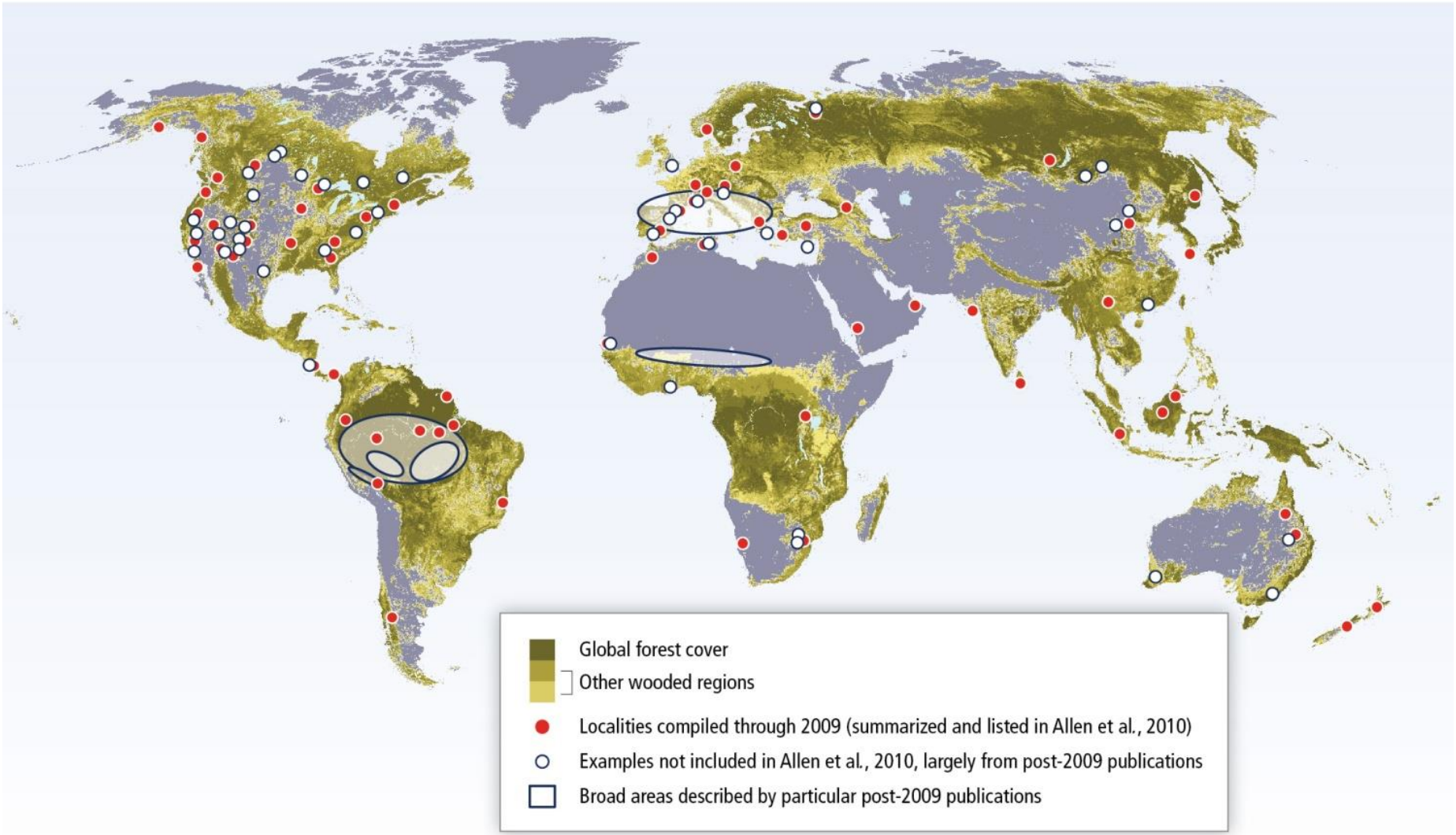
Domain	Essential Climate Variables
Atmospheric (over land, sea and ice)	Surface wind speed and direction; precipitation; upper-air temperature; upper-air wind speed and direction; water vapour; cloud properties; Earth radiation budget (including solar irradiance); carbon dioxide; methane and other long-lived greenhouse gases; and ozone and aerosol properties, supported by their precursors.
Oceanic	Sea-surface temperature; sea-surface salinity; sea level; sea state; sea ice; ocean colour.
Terrestrial	Lakes; snow cover; glaciers and ice caps;, ice sheets; albedo; land cover (including vegetation type); fraction of Absorbed Photosynthetically Active Radiation (FAPAR); Leaf Area Index (LAI); above-ground biomass; fire disturbance; soil moisture.

Drought and heat induced tree mortality



Settele et al., 2014; Figure 4-7

Gaps II: Health effects

Table 11-1 | The association between different climatic drivers and the global prevalence and geographic distribution of selected vector-borne diseases observed over the period 2008-2012. Among the vector-borne diseases shown here, only dengue fever was associated with climate variables at both the global and local levels (*high confidence*), while malaria and hemorrhagic fever with renal syndrome showed a positive association at the local level (*high confidence*).

Disease	Area	Cases per year	Climate sensitivity and confidence in climate effect	Key references
Mosquito-borne diseases				
Malaria	Mainly Africa, SE Asia	About 220 million		WHO (2008); Kelly-Hope et al. (2009); Alonso et al. (2011); Omumbo et al. (2011)
Dengue	100 countries, esp. Asia Pacific	About 50 million		Beebe (2009); Pham et al. (2011); Astrom et al. (2012); Earnest et al. (2012); Descloux (2012)