Responding to Climate Change Through Climate-Resilient Agriculture

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Objectives of Today's Workshop

- To create conducive environment for climate-resilient policy dialogue among stakeholders
- To gather expert opinion in mitigating climate change impacts
- To integrate innovation to lessen climate change impacts

Contents for Today

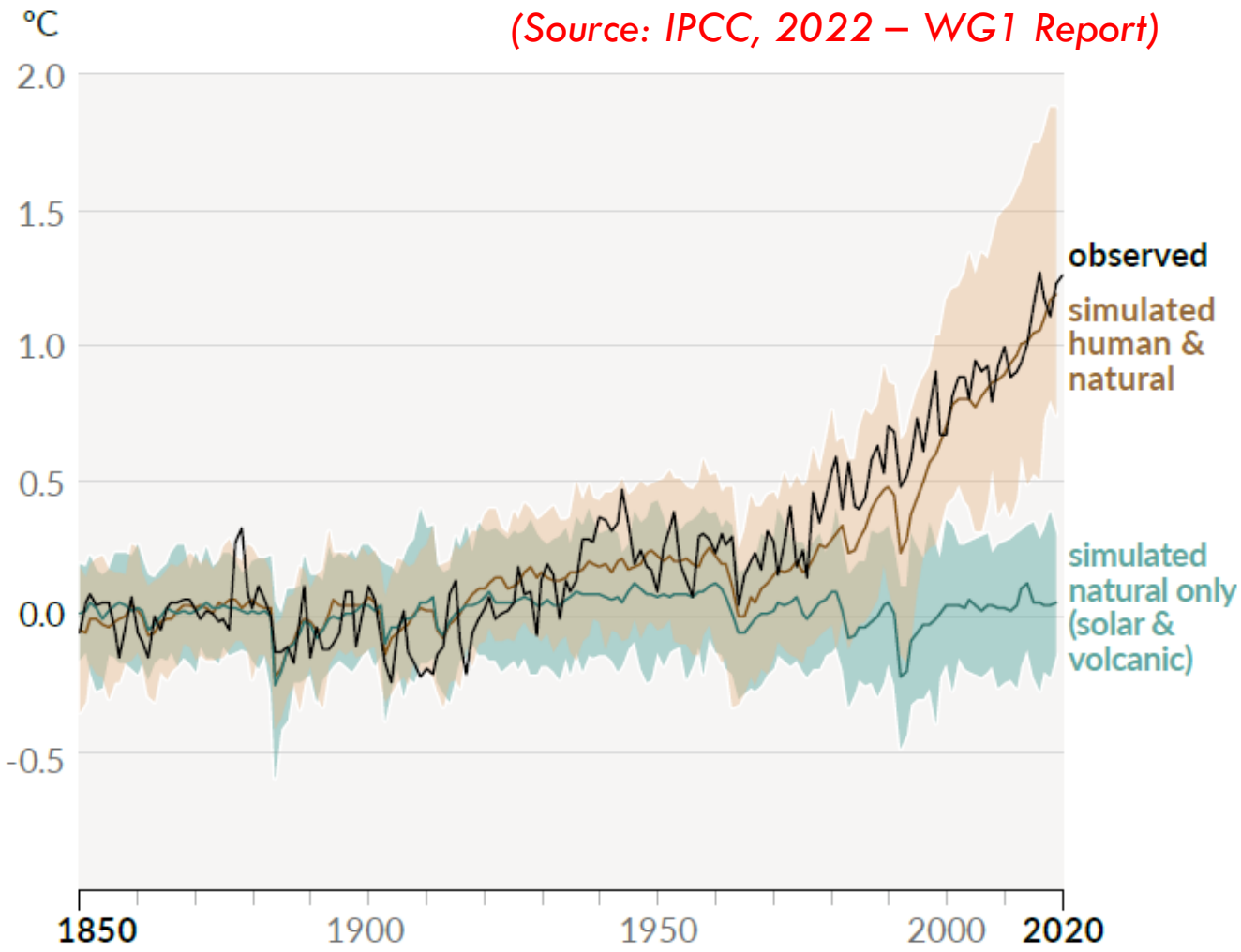
- Climate Change (CC) & Extremes
- CC Impacts – Agriculture & Food Security
- Responding to CC
- Climate-Resilient Agriculture as a Response to CC
- Opportunities & Challenges

CC & Extremes | Evidence

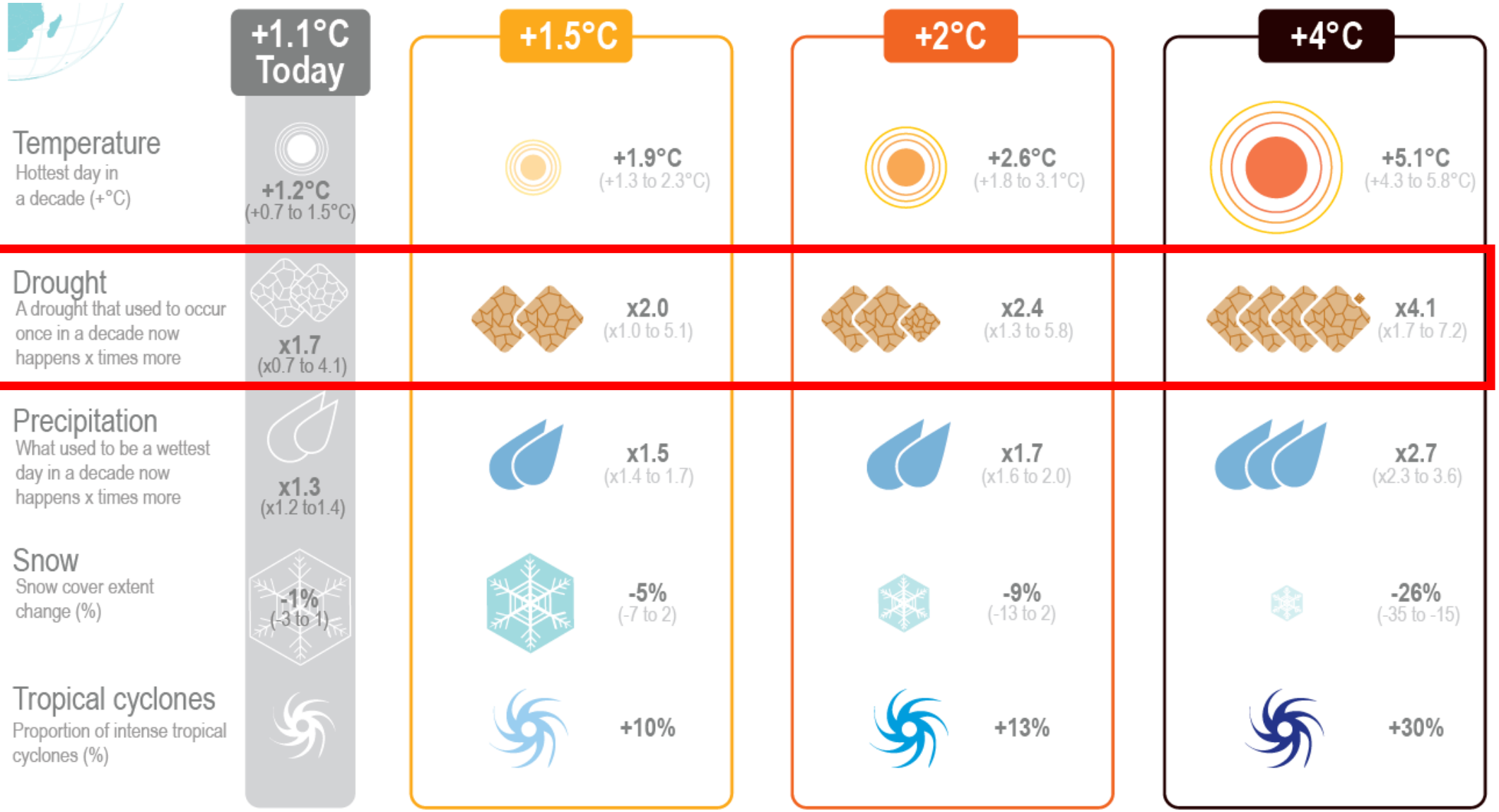
- Each of the last four decades has been successively warmer than any decade that preceded it since 1850
- Global surface temperature in the 1st two decades of the 21st century (2001-2020) was **0.99** (0.84 to 1.10)°C higher than the 1850-1900 (baseline).
  - It was **1.09** (0.95 to 1.20)°C higher in 2011-2020 than 1850-1900
    - Larger increase over land: **1.59** (1.34 to 1.83)°C

b) Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850-2020)

(Source: IPCC, 2022 – WG1 Report)



CC & Extremes | Response of Climate System (w.r.t. 1850-1900)



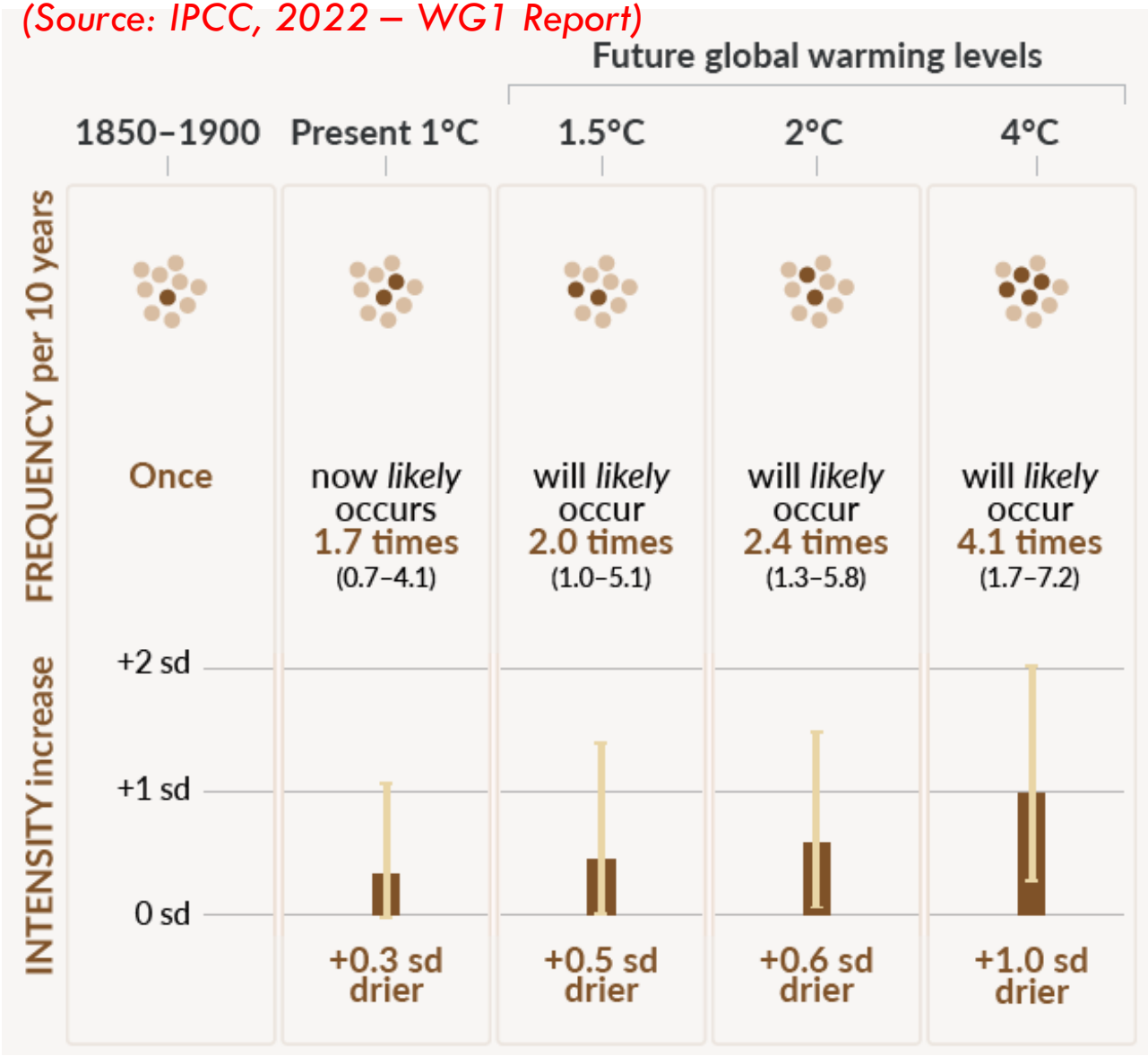
Many aspects of climate system react quickly to Temperature → with progressively higher level of temperature rise, there are greater consequences

(Source: IPCC, 2022) – WG1 Report

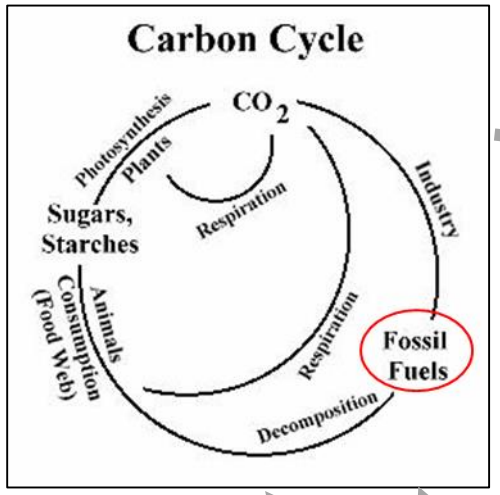
CC & Extremes | Response of Climate System (w. r. t. 1850 -1900)

- **Agricultural & ecological droughts in drying regions**
  - 10-year return period drought event that used to occur once during baseline (or without human influence) has now increased in frequency & intensity
  - Projected to increase further in future

(Source: IPCC, 2022 – WG1 Report)

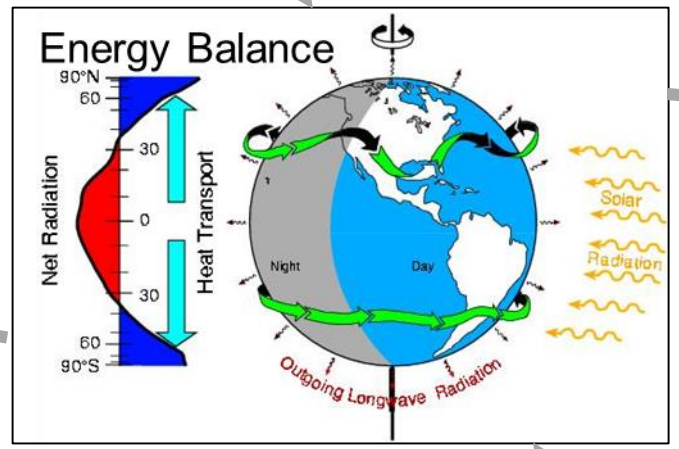


CC Impacts | Basic Narrative



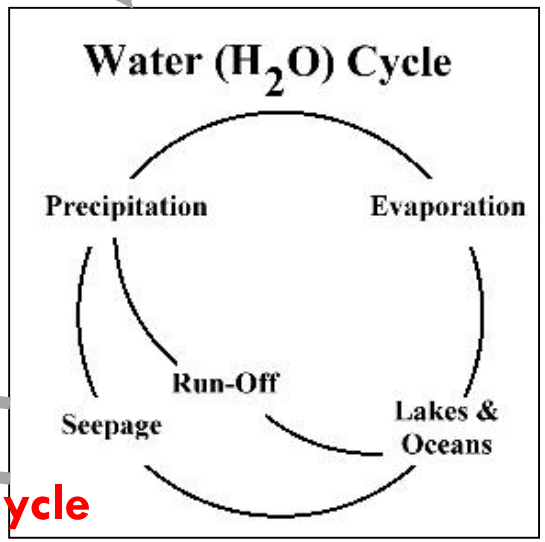
We are changing the Carbon Cycle (through fossil fuel, land use changes, etc.)

Which causes an imbalance in the amount of energy reaching the Earth (CO_2 traps heat, etc.)



Which warms the planet

Temperature



Water Vapor

Which changes the water cycle

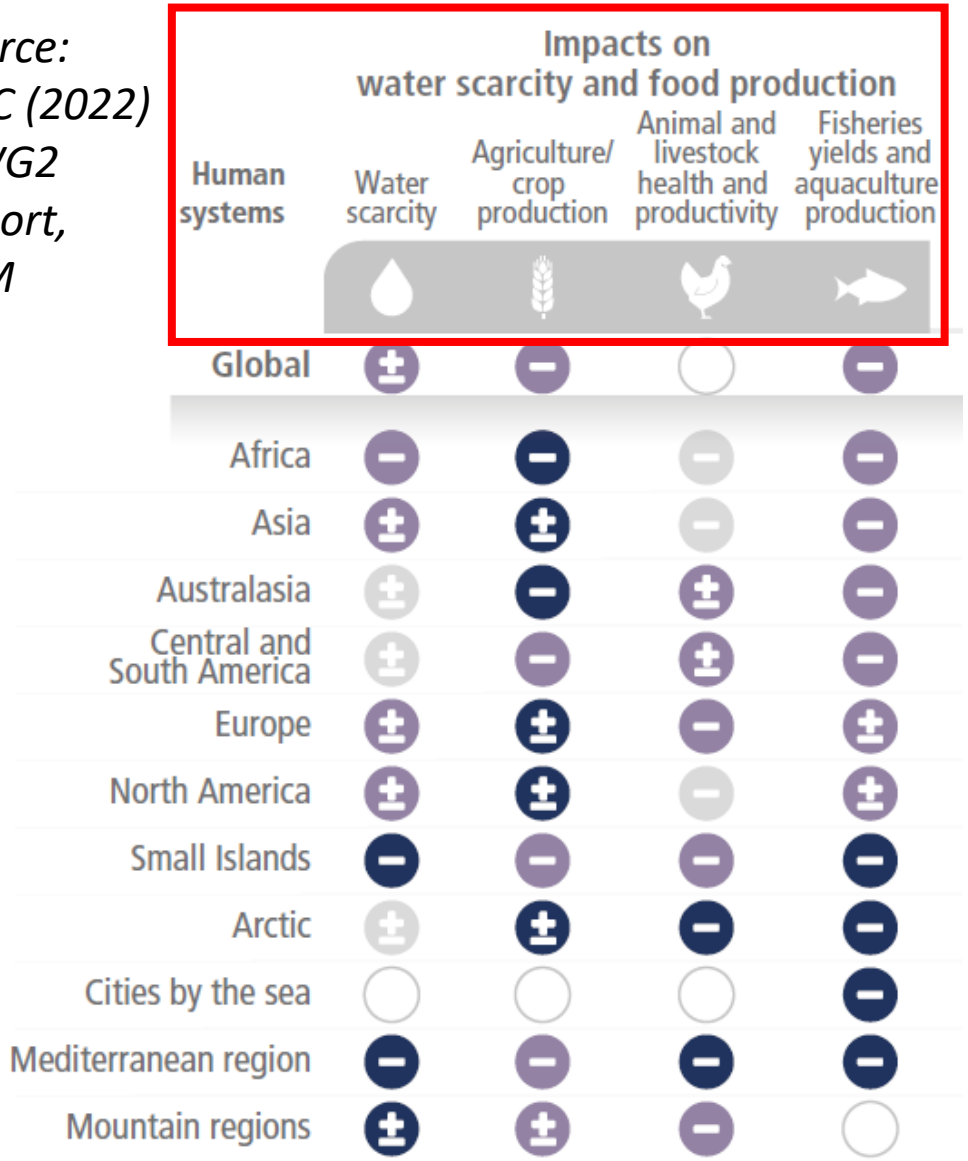
Which amplifies the climate change, mainly because of increased water vapor

Eventually feeding back on the carbon cycle

Because the Energy Balance and the Water Cycle involve the winds and ocean currents -- they are changed too, potentially changing all aspects of climate.

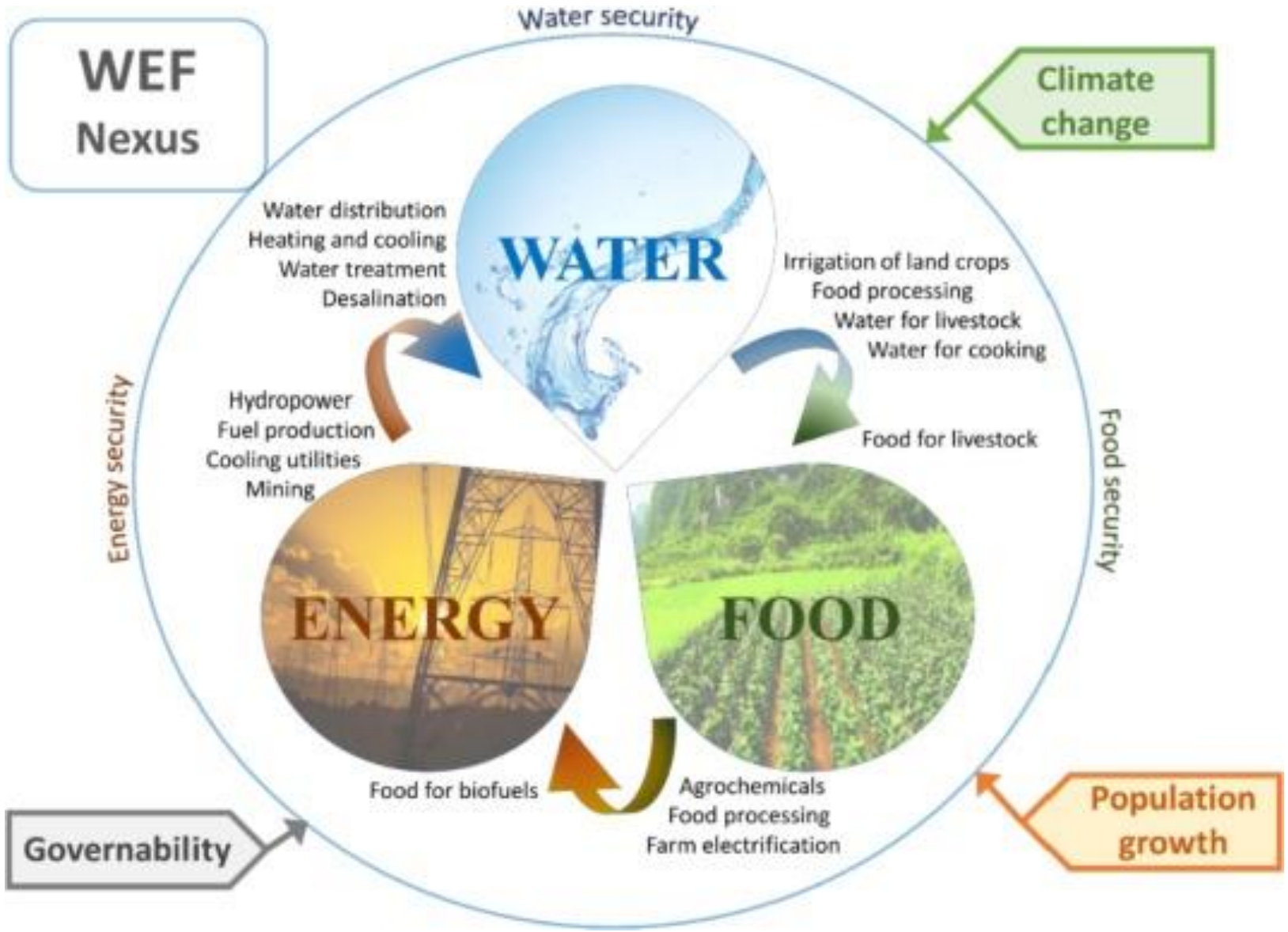
CC Impacts | Observed Impacts on Water & Food Systems

Source: IPCC (2022) – WG2 Report, SPM



- Change in precipitation pattern → increased risk of floods & droughts, water scarcity → loss of crops, etc.
- Increase in Temperature → Increases evapotranspiration → Decreases soil moisture & affects runoff → implications for agriculture, ecosystems
- Indirectly, it has implications to various dimensions, including **international trade, stability & conflict, finance & business, and national economy**.
- It will ultimately sets ground for various **policy responses**.

CC Impacts | Manifestation Through Water



COP27

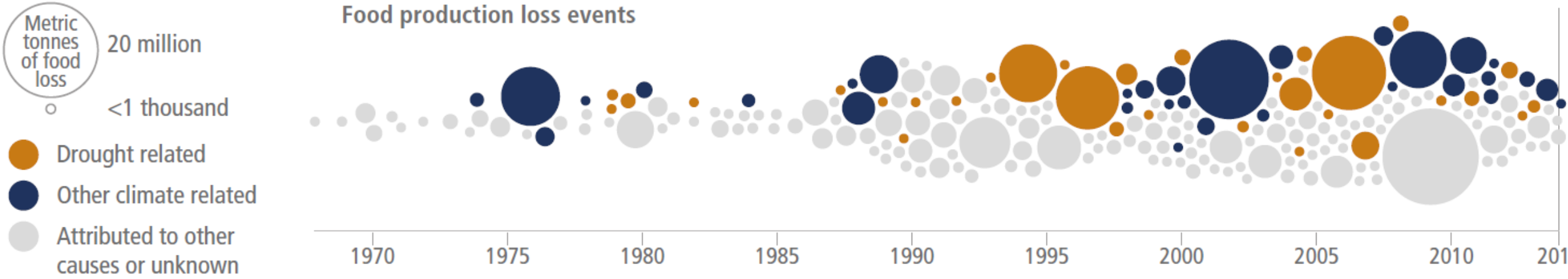
Recognized Water Crisis as Climate Crisis

Water as a Climate Solution

CC Impacts | Food Security

Frequency of climate-related food production losses in crops, livestock, fisheries, and aquaculture has been increasing over the last decades

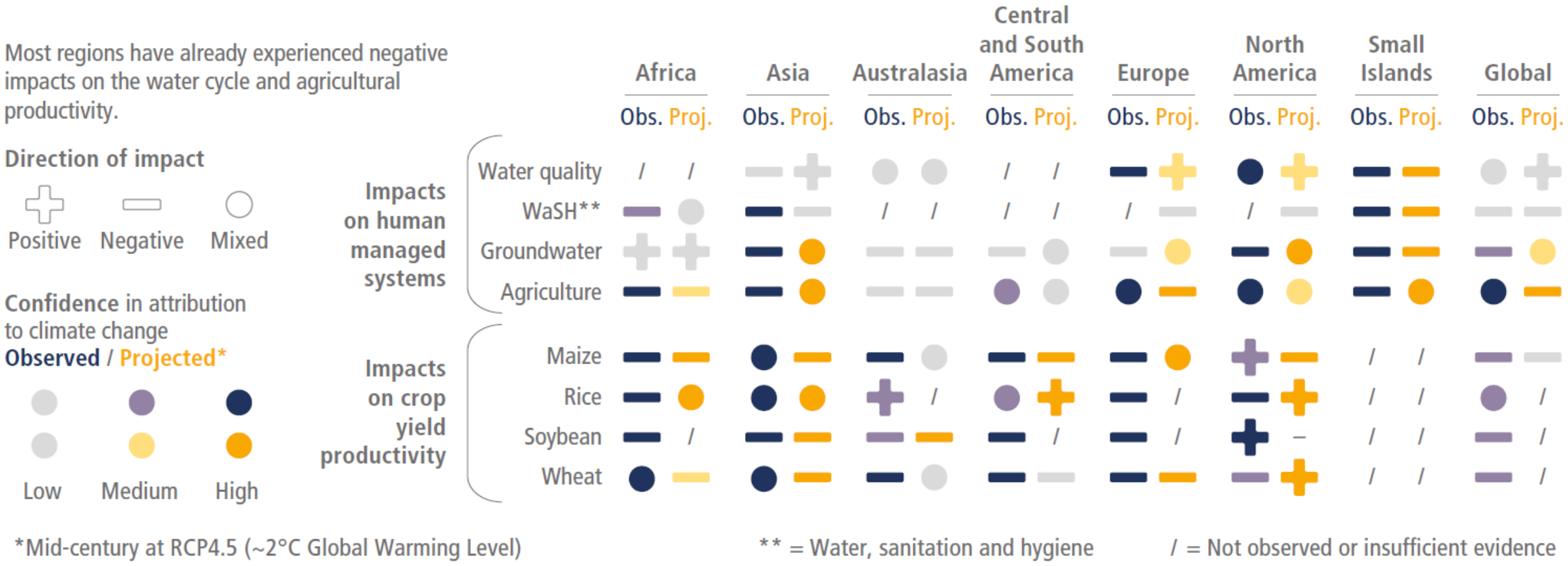
Source: IPCC (2022) – WG2 Report



- *Example: yield loss from agriculture is projected up to 32% under RCP8.5 scenarios*
- *Drought-driven yield loss is estimated up to 20% for rice*
- *Flood-related risks to agricultural production are projected to increase over Europe, with a mean increase of expected annual output losses of approximately €11 million (at 1.5°C GWL); €12 million (at 2°C GWL) and €15 million (at 3°C GWL) relative to the 2010 baseline (Koks et al., 2019)*

CC Impacts | Food Security

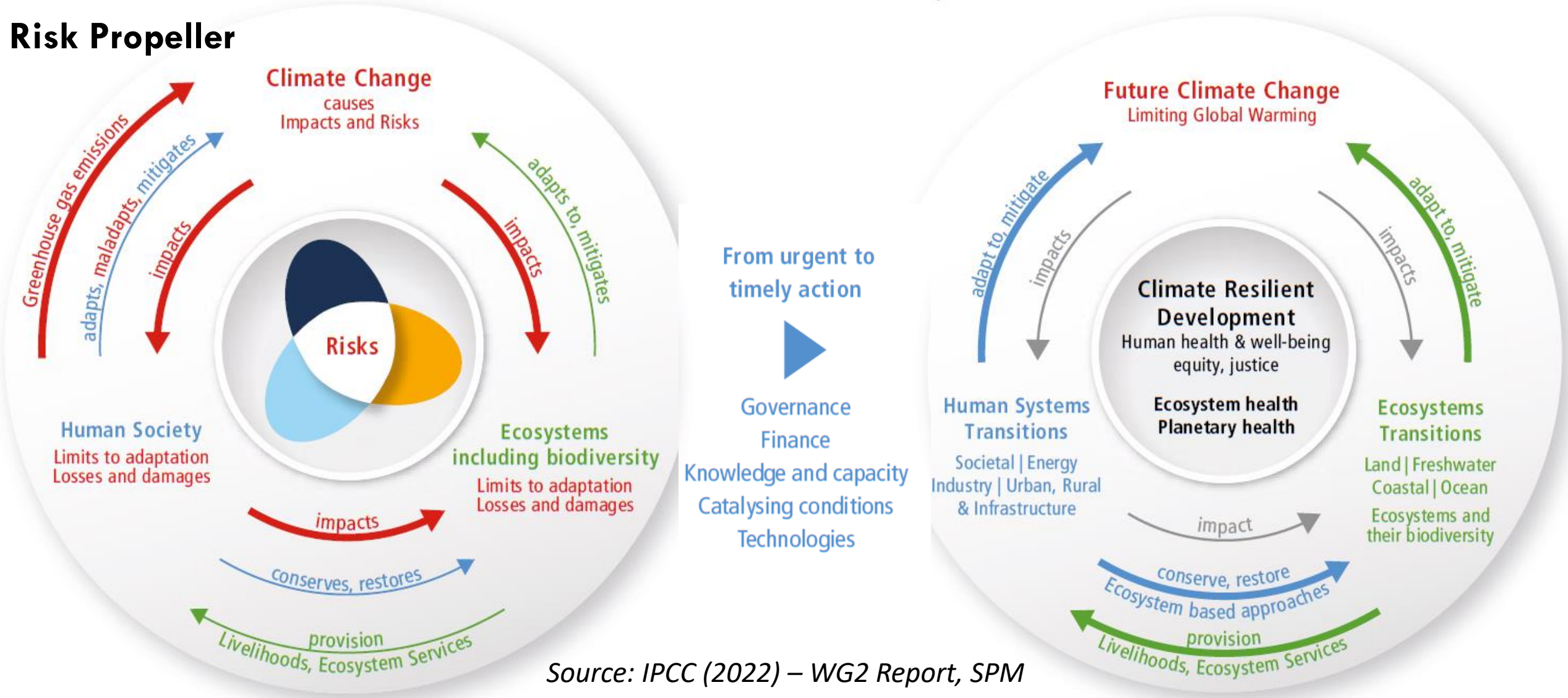
…impacts in the Water Cycle for Human-Managed Systems & Crop Yield Productivity



Source: IPCC (2022) – WG2 Report

Responding to CC | From Risk to Climate Resilient Development

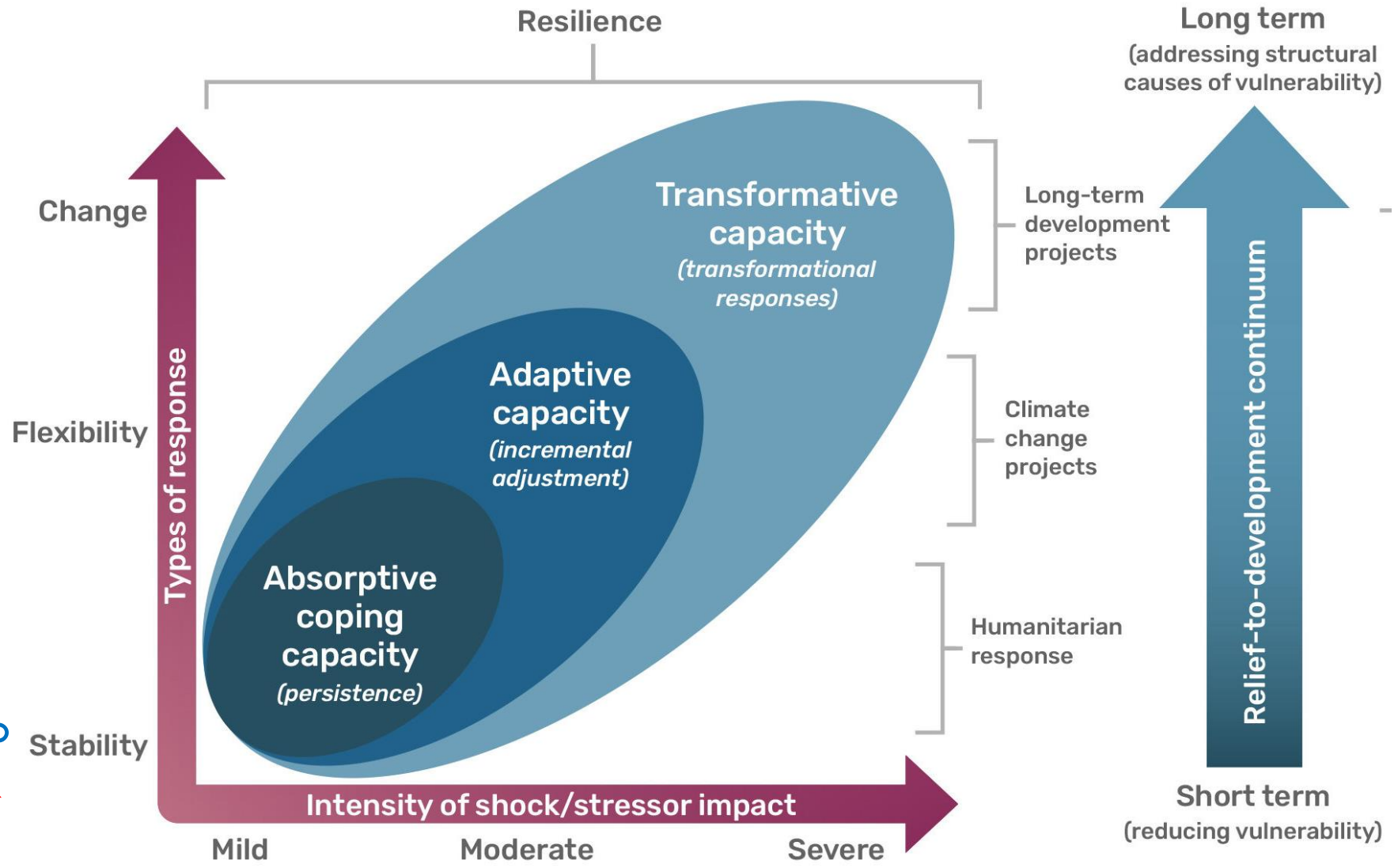
Risk Propeller



Source: IPCC (2022) – WG2 Report, SPM

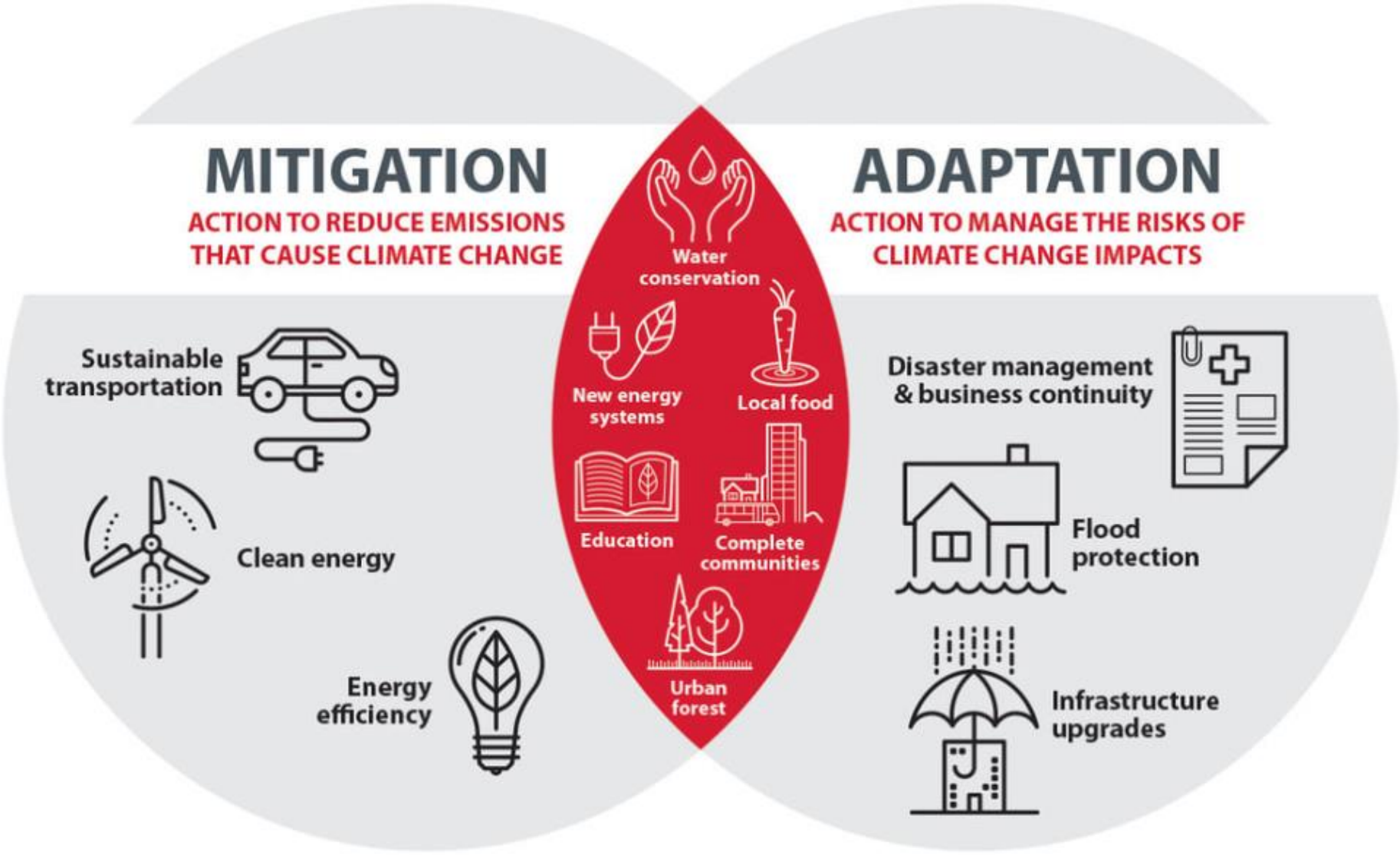
Responding to CC | Adaptation Vs Resilience

- **CC Adaptation** → The process of adjustment of human & natural systems to the actual or expected impacts of CC
- **Resilience** →The ability of human or natural system to withstand the impacts of **exogenous** shocks & to cope with or **rebound** from them.
  - Capacity of a system to face **multiple shocks & stressors** & withstand them



Responding to CC | Adaptation Vs Mitigation

- **Mitigation** → Limiting atmospheric GHG concentration through emission reduction or sinks.
- **Adaptation** → The processes of adjustment to actual or expected climate and its effects.
- Some actions contribute to **both Adaptation & Mitigation** (shared area in Figure).



Responding to CC | Framework for Resilience Building to CC

- Resilience Framework (Example: Singapore's Climate Change Resilience Framework)
  - Understand local climate
  - Identify/quantify vulnerabilities, risks and impacts
  - Formulate adaptation options → Needs research!
  - Assess and prioritize options → Needs research!
  - Implement measures
  - Monitor and evaluate effectiveness
  - Review strategies & Update (as necessary)

Responding to CC | Types of Responses

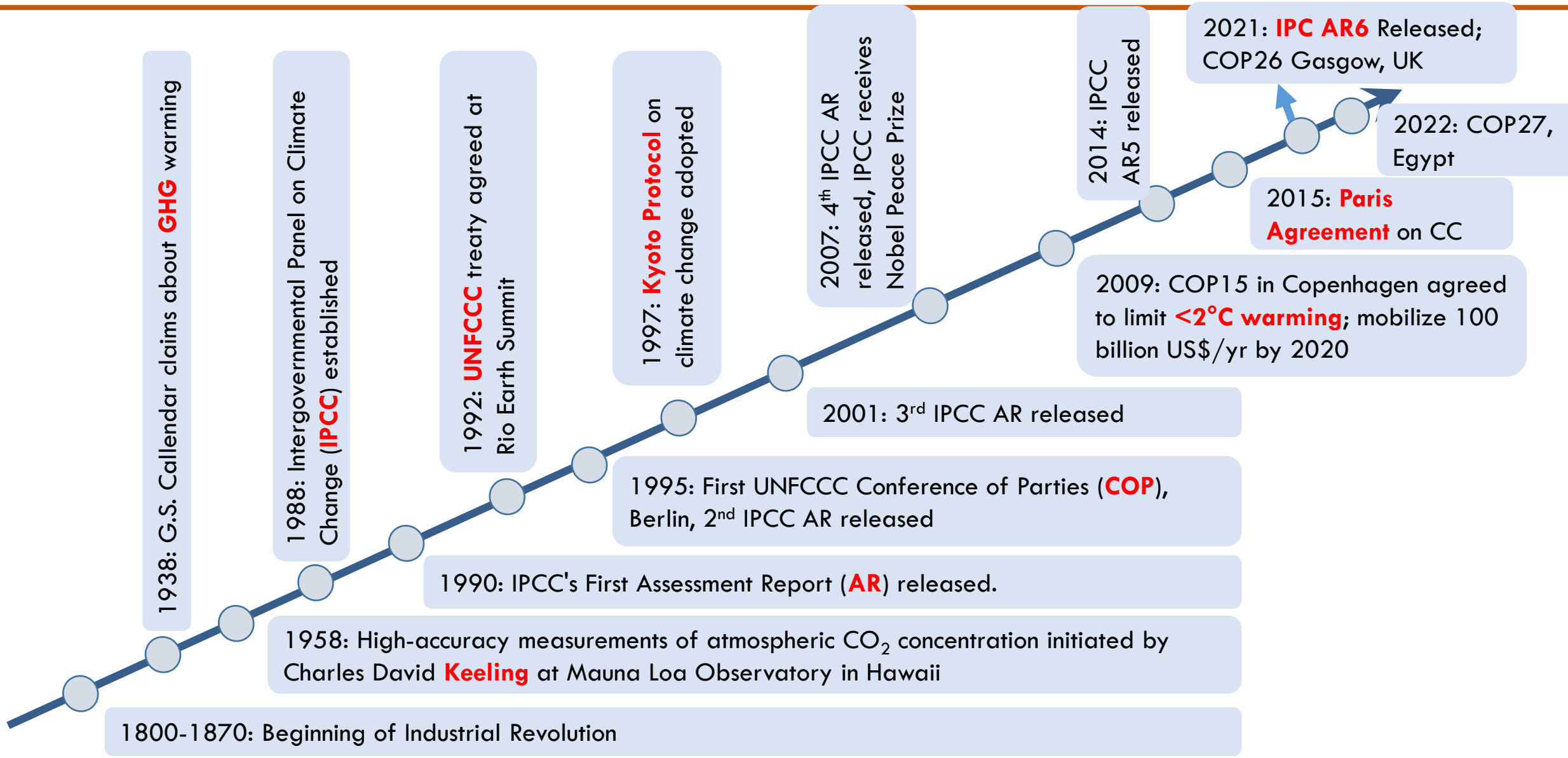
- Technical measures
  - National, Universal
- Financial measures
  - National; **global**/international
- Social/public measures
  - National; **global**/international
- Policy & governance measures
  - National – NAP, NAPA, LAPA, etc.
- **Global** responses & frameworks

Many 10% solutions works better than a single 100% solution !

Responding to CC | Need for Global Responses

- Climate change (CC) is a complex problem touching almost every aspect of **human-economic-natural system**.
- CC is a **global scale** problem.
- Need combination of various measures → globally **coordinated responses** will be necessary.
- **Huge resources are required for upscaling** and to reach economics-of-scale.
- Needs to influence **8 billion** global citizens.
- But it is **not a sliver-bullet** and involves variety of obstacles and challenges.

Responding to CC | A Stock-Taking of Global Responses



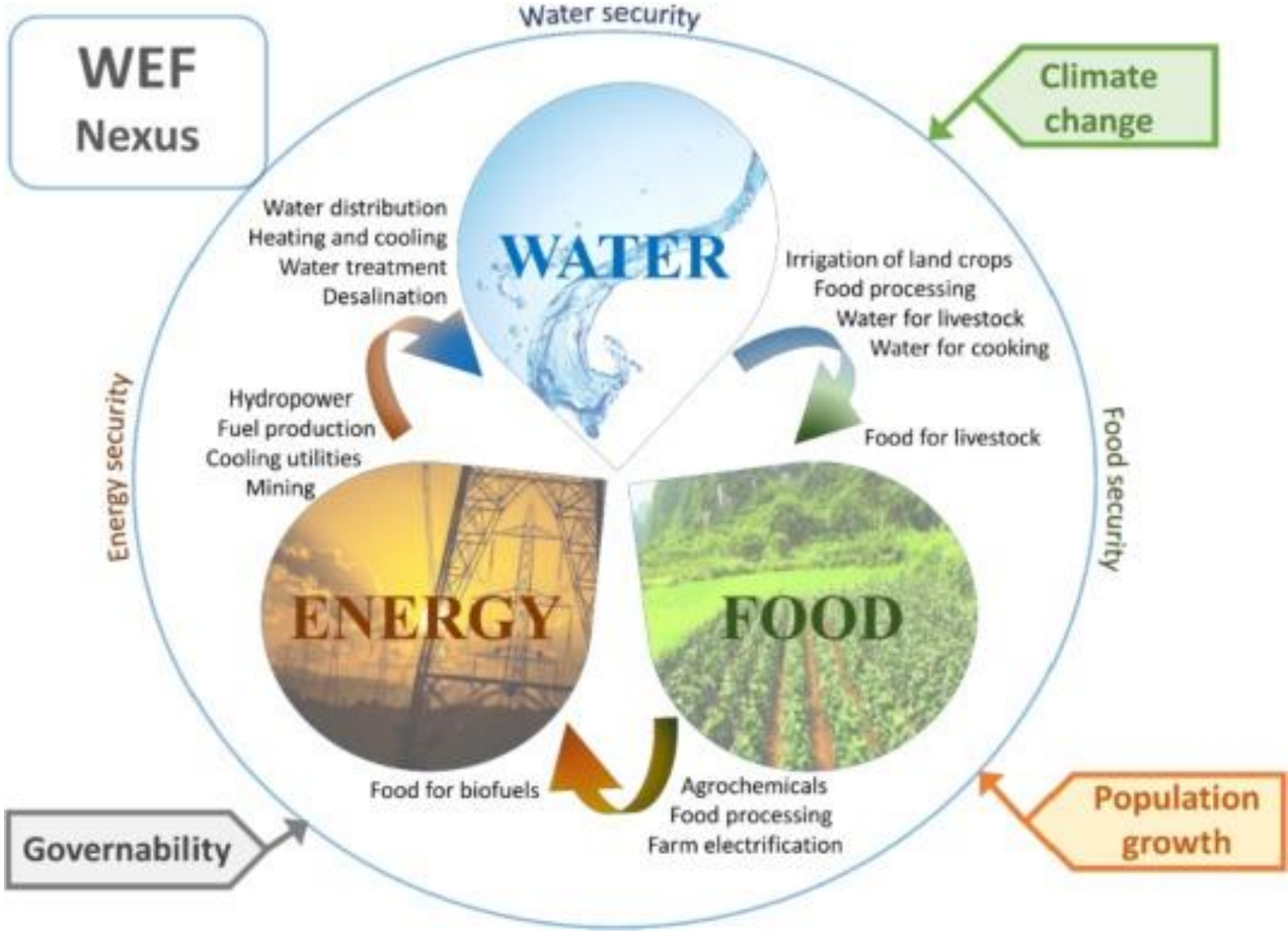
Climate-Resilient Agriculture as a Response to CC

- Four **Dimensions of Food Security** that are impacted by **CC** are (ADB, 2012);
  - **Availability of Food** → reduced by a drop in production due to CC
  - **Access to Food** → CC-intensifies events that lead to damaged infrastructure & loss of livelihood assets & income
  - **Stability of food supply** → could be influenced by food price fluctuations and higher dependency on imports
  - **Utilization of food** → can be affected indirectly by food safety hazards associated with pests & animal diseases

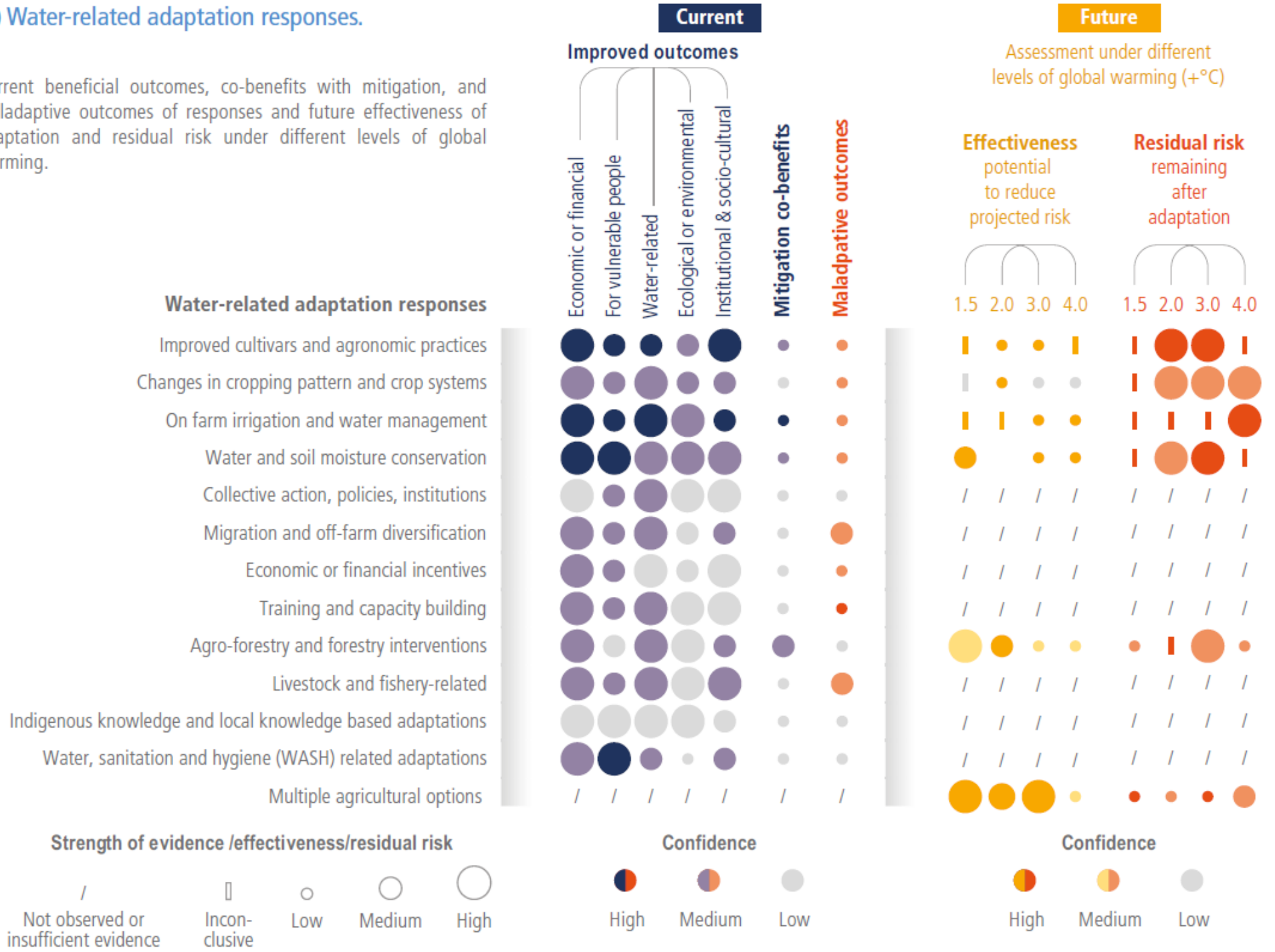
- **Climate-Resilient Agriculture (CRA)** integrates 3 aspects of sustainability (social, economic & environment) & **composes of three pillars**;
  - **Sustainably increasing agricultural productivity** → to support equitable increase in farm incomes, food security & development
  - **Adapting & building resilience** of agriculture & food system to CC at multiple levels; &
  - Reducing **GHG emissions** from agriculture & increasing **carbon sequestration**.

Climate-Resilient Agriculture as a Response to CC

- The **solution may NOT only come from agriculture** space, but also from other related spaces such as water, energy, etc.



Climate-Resilient Agriculture as a Response to CC | Potential Adaptat Responses



Source: IPCC (2022) – WG2 Report

Example: Adaptation Options – Rice, Songhram Basin, Thailand

		Baseline	2020-2049		Unit
			RCP4.5	RCP8.5	
Maximum temperature	Jul. – Nov.	31.2	31.9	32.0	°C
Minimum temperature	Jul. – Nov.	22.7	23.3	23.5	°C
Rainfall	Jul. – Nov.	827	707	719	mm
Rice yield (KDML105)	Rainfed season	**1.94**	1.94	1.95	t/ha
AO1: Change in planting date	1 week early		1.97		t/ha
				1.95	t/ha
AO2: Change in fertilizer application date	1 week early		2.06		t/ha
	2 weeks early			1.99	t/ha
AO3: Change in fertilizer application dose	14 N kg/ha		1.94	1.95	t/ha
AO4: Supply irrigation water	60 mm (15 Oct)		2.23	2.23	t/ha

Opportunities & Challenges

- **De-risk agriculture for small-scale producers**, especially women,
  - Through savings-led financial inclusions
- Seek **nutrition** outcomes from actions in adaptation in agriculture
  - Consideration of and awareness raising on dietary diversity
  - Integrate policy actions in CC & agriculture with nutrition
- Use **farmer field & business schools** as social learning platforms
  - To scale out climate-resilient practices
- **Prioritize research for development programs** in climate-resilient agriculture
  - For risk-proofing of investments cooperatives and financial institutions
- Increase **business performance** of cooperatives (related to agriculture)

Opportunities & Challenges

- Changing mind-set of "self-sufficient" agricultural practices
- Scaling-up the solutions
  - Key spaces are: institutional, financial, political, partnership, cultural, data/information, etc.
- Investment in research, **innovation** & technology development
  - Mind-set of investment is research is like a non-productive investment!
- Risk diversification
  - Promoting **insurance mechanisms** for climatic extremes

Take Home Messages

- Uncertainty in climate change quantification and impact assessment
  - Past is NOT a good indicator of future
  - Frequency, location, magnitude, duration of extreme events may change
  - Technology, exposure, and capacity
  - Reliable and long-term **data/information** system
- Responding to vulnerabilities and risks
  - Translating the impacts to societal implications (vulnerability & risks)
  - Continuous engagement: Stakeholders participation, idea-harvesting, and ownership
  - A platform for "Science-Policy-Practice" dialogue
- Resilience-building is a long-term process
  - It should run in program-mode rather than in project-mode
  - There is no blue-print for resilient-building → it evolves gradually with learning

Thank You!