Climate change impact, adaptation and mitigation in agriculture:

Actions for building resilient agri-food systems

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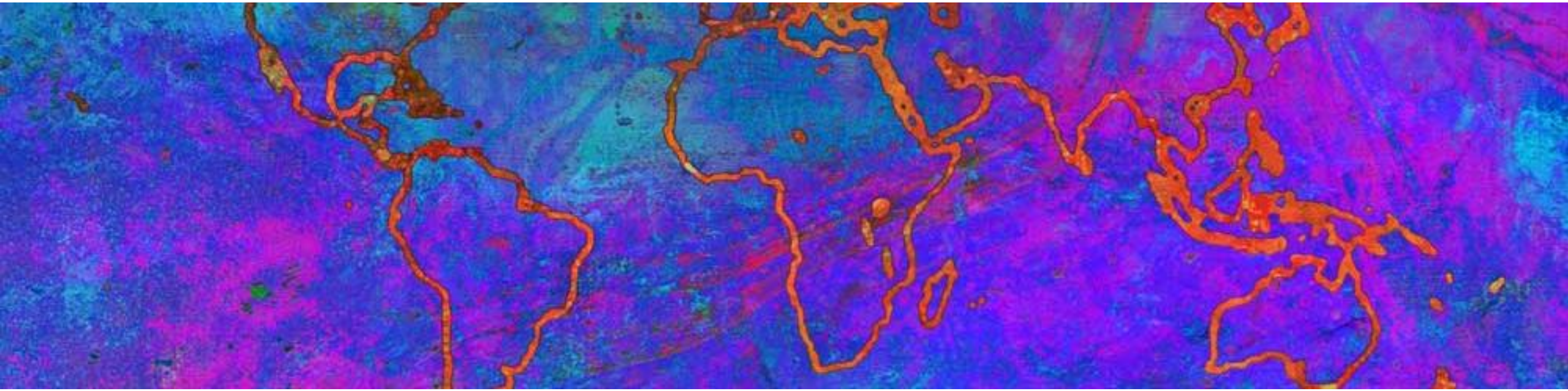


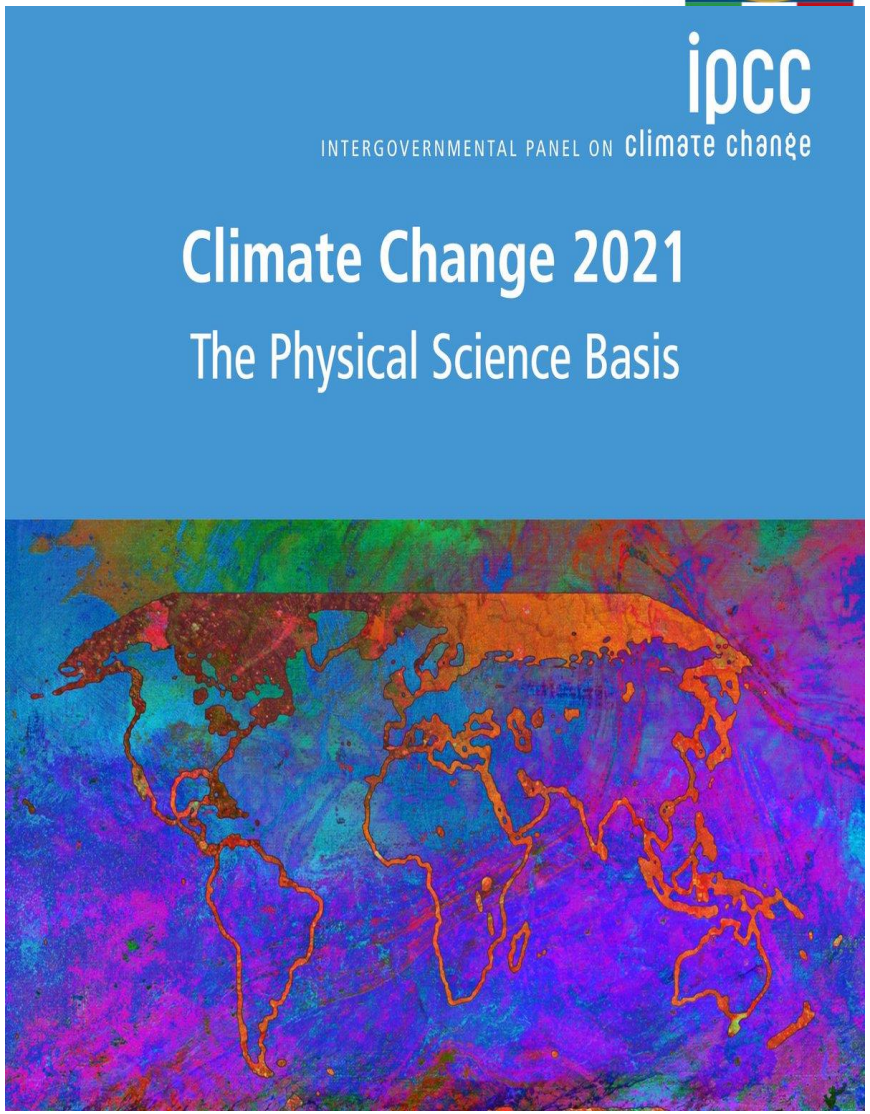
The IPCC AR6 Working Group I: The Physical Science Basis

❖ IPCC AR-6 WGI report covers 4 main aspects

1. Current state of climate
2. Possible climate futures
3. Climate impact drivers (CIDs) and regional variations
4. Limiting future climate change

❖ What are the implications for agri-food systems?

1. How is the agri-food system contributing to the current state of climate
2. Climate futures and the impacts on the agri-food system
3. Implications for the AFOLU sector in regional variations in climate impact-drivers
4. Limiting future climate change through low-carbon and resilient-building actions



Current state of climate

Headlines

- **Human influence** has warmed the atmosphere, ocean and land.
  - *Of the 1.1 degree rise in temp since pre-industrial era, 1 degree is human induced*
- **Rapid changes** in the atmosphere, ocean, cryosphere and biosphere have occurred.
- **Scale of changes** across the climate system is unprecedented.
  - *Global mean sea level is now rising faster since 1900 than over any preceding century in at least the last 3000 years.*
- **Science is able to attribute intensifying climate extremes with human actions** in every region – heatwaves, precipitation, droughts and cyclones
- **Limiting warming levels to 1.5 by end of century is possible** but needs major paradigm shifts in 2020s.

Contributions by the agri-food system

Atmospheric concentration of methane: AR6 reports a faster growth over 2014–2019 largely driven by emissions from the fossil fuels and agriculture **(dominated by livestock)** sectors.

Atmospheric concentration of NO_2 increased to 0.95 ± 0.04 ppb yr-1 between 2014-2019- **largely due to nitrogen fertilizer and manure**

The IPCC says, that “human-induced climate change has contributed to increases in **agricultural and ecological droughts** in some regions due to evapotranspiration increases”. (graph *on next slide)*

Possible Climate Futures

Headlines

1. **Faster warming** of 1.5 degree or more expected by 2040 if no action is taken.

2. Continued global warming is projected to **intensify the global water cycle,** including its variability, global monsoon precipitation and the severity of wet and dry events

3. **Frequency and intensity of extremes** will become more drastic due to increasing global warming. E.g. hot extremes, marine heatwaves, heavy precipitation, agricultural droughts.

4. Some changes due to historical and future GHG emissions are **irreversible,** specially changes in ocean, ice sheets and global sea level

5. Ocean and land carbon sinks are projected to be less effective at slowing the accumulation of CO2 in the atmosphere.

Implications for agri-food systems

Crop production:

- Shifting agriculture seasons
- Decreasing crop yields and crop suitability (ie max-attainable yields)
- Increased pests and diseases

Livestock:

- Animal health decline from heat stress
- Impact on biomass and nutritional quality

Fisheries and aquaculture:

- Displacement and/or increased mortality of stocks
- Reduced catch

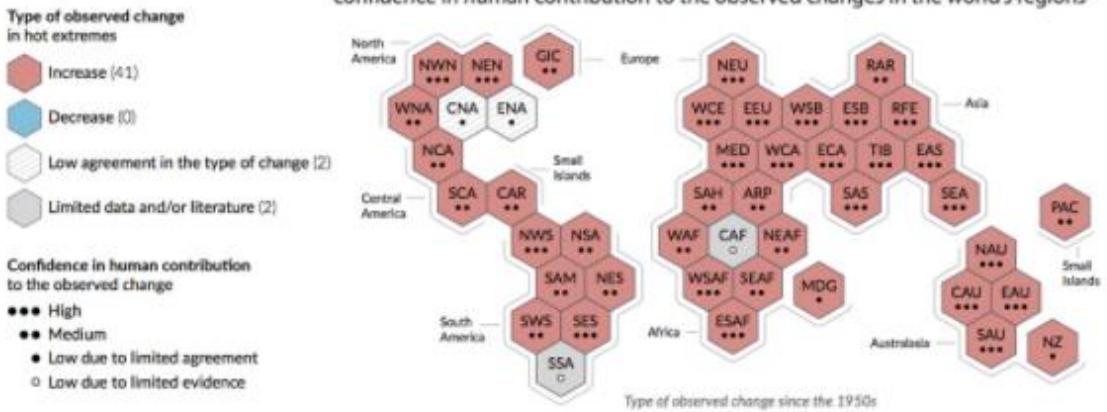
Other systemic issues:

- Food safety, high-risk livelihoods

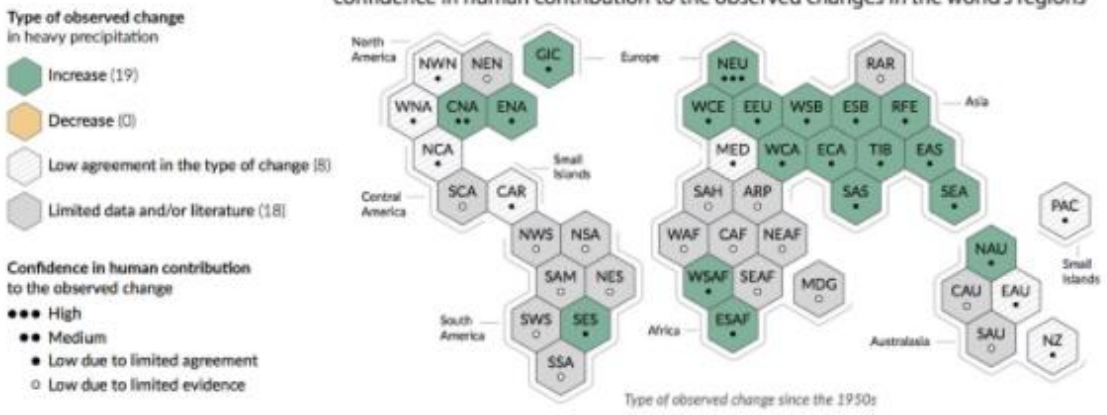
Increasing weather and climate extremes in every region

Climate change is already affecting every inhabited region across the globe with human influence contributing to many observed changes in weather and climate extremes

a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions

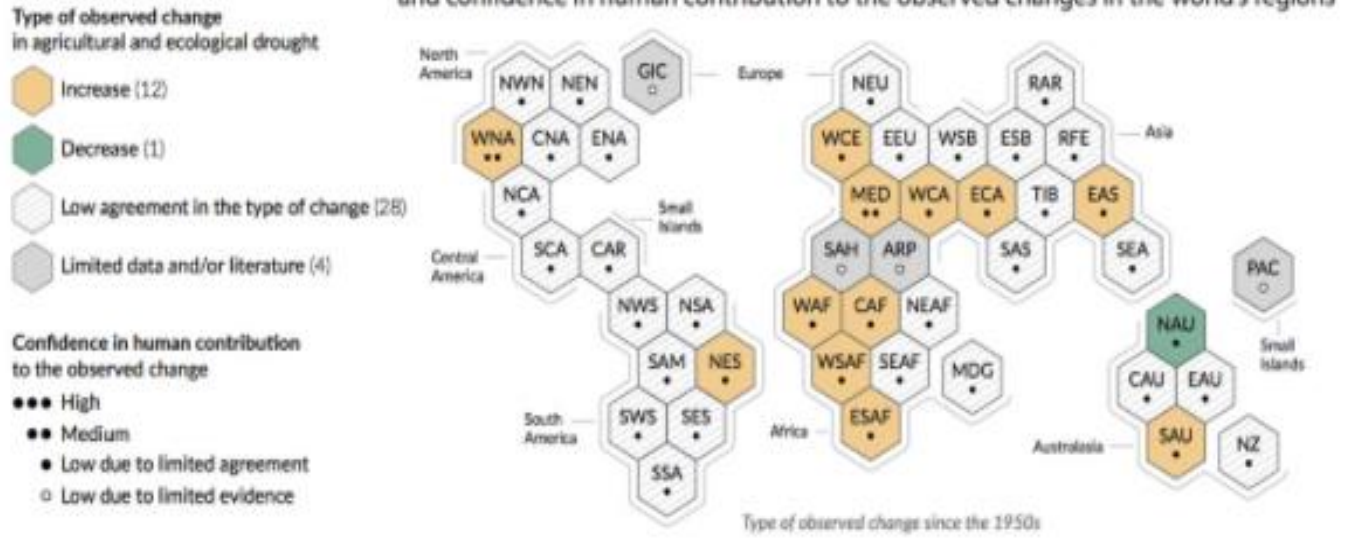


b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions



Contribution of human induced CC to agricultural and ecological droughts by region

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



https://interactive-atlas.ipcc.ch/

Climate impact drivers: heat, cold, rain, drought, snow, wind and flooding

Headlines

- With further global warming, **every region** is projected to increasingly experience concurrent and multiple changes in **climatic impact-drivers**

- **Changes in climate impact drivers will be** more widespread at 2°C compared to 1.5°C global warming.

- All regions are projected to experience further increases in hot climatic impact-drivers (CIDs) and decreases in cold CIDs.

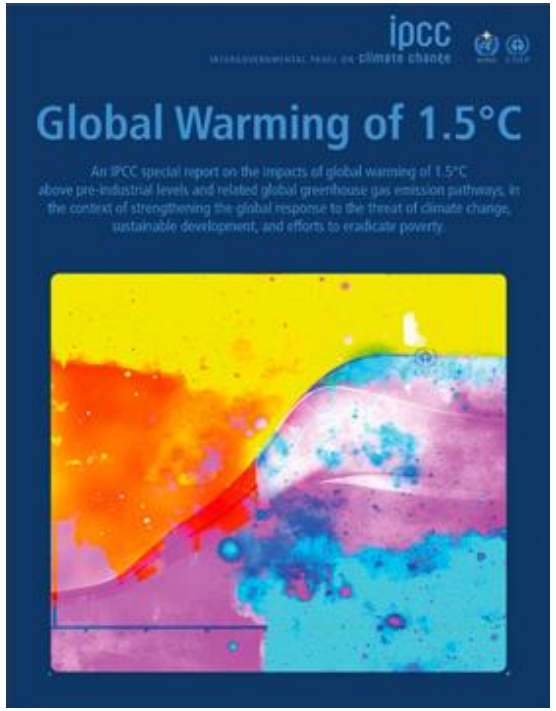
Implications for agriculture and land use

Extreme heat thresholds relevant to agriculture are projected to be exceeded more frequently at higher global warming levels (say 2 degree than 1.5). Asia and Africa are at higher risk.

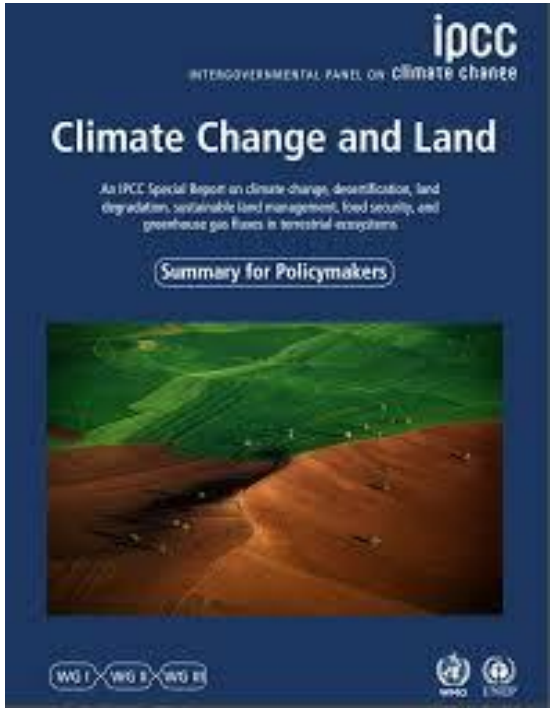
Regional implications: Changes in Climate Impact Drivers such as drought, aridity, fire weather will affect agriculture sectors, forestry, fisheries and ecosystems in the following main regions – *Southern Africa, the Mediterranean, North Central America, Western North America, the Amazon regions, South Western South America, and Australia*

Innovative Pathways of Action

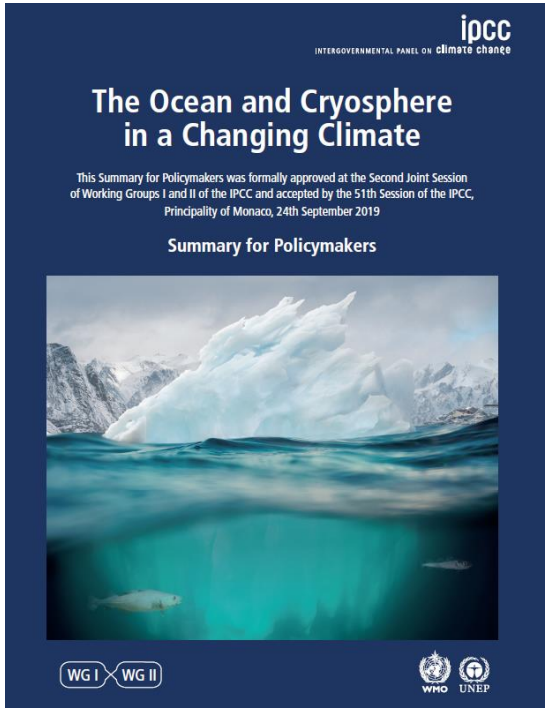
IPCC reports – Growing scientific evidence



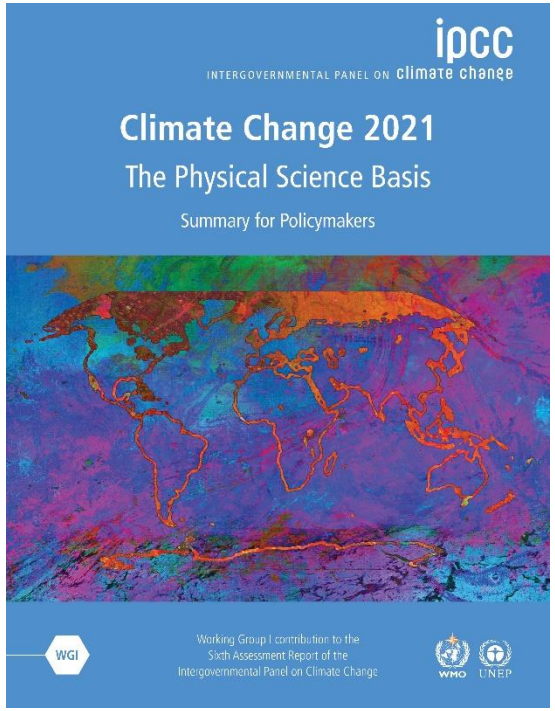
2018



2019



2019



2021

Food security will be increasingly affected by future climate change

e.g. supply chain disruptions; declined yields; increased prices; reduced nutrients; increased hunger

Climate Change Impacts: Some Key Facts

- Climate change could push 122 million more people, mainly farmers, into extreme poverty by 2030.
- Climate change is projected to increase cereal prices 29 percent by 2050.
- Agriculture absorbs 26 percent of the economic impact of climate disasters, rising to 83 percent for drought in developing countries.
- Water scarcity affects 40 percent of the population. For every 1 °C rise, 500 million extra people will face a 20 percent dip in renewable water resources

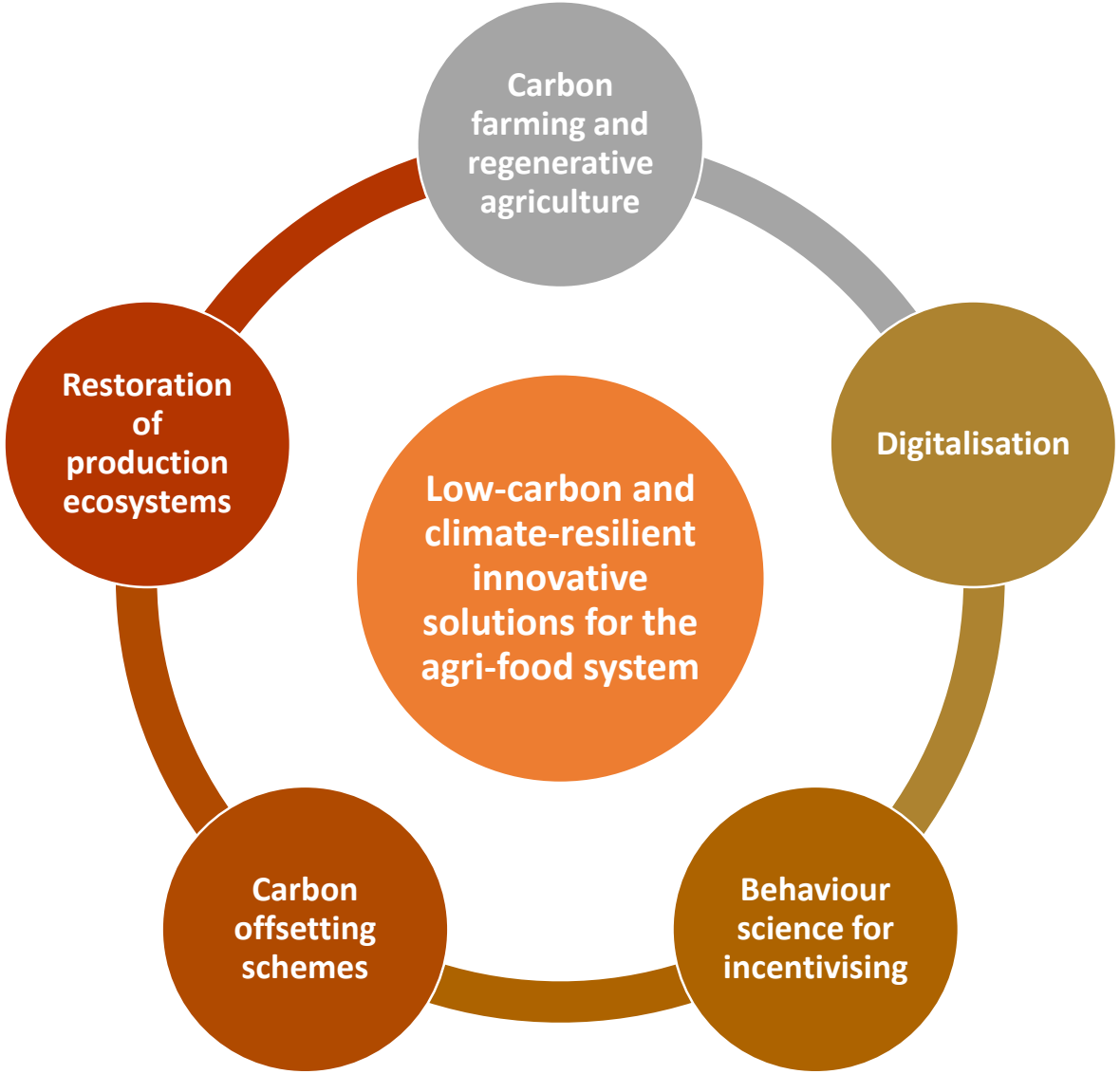
Adaptation and Mitigation: National Climate Action

Climate actions should support defining and implementing **Nationally Determined Contributions (NDCs)**, **National Adaptation Plans (NAPs)** and **Nationally Appropriate Mitigation Actions (NAMAs)** in the agricultural sectors. This includes:

- Develop and implement the current NDCs, NAPs NAMAs
- Support to revise and enhance the new round of NDCs, NAPs
- Track progress of NDC, NAPs implementation
- Mobilizing multilateral (GCF, GEF and AF) and bilateral funds for country and regional support

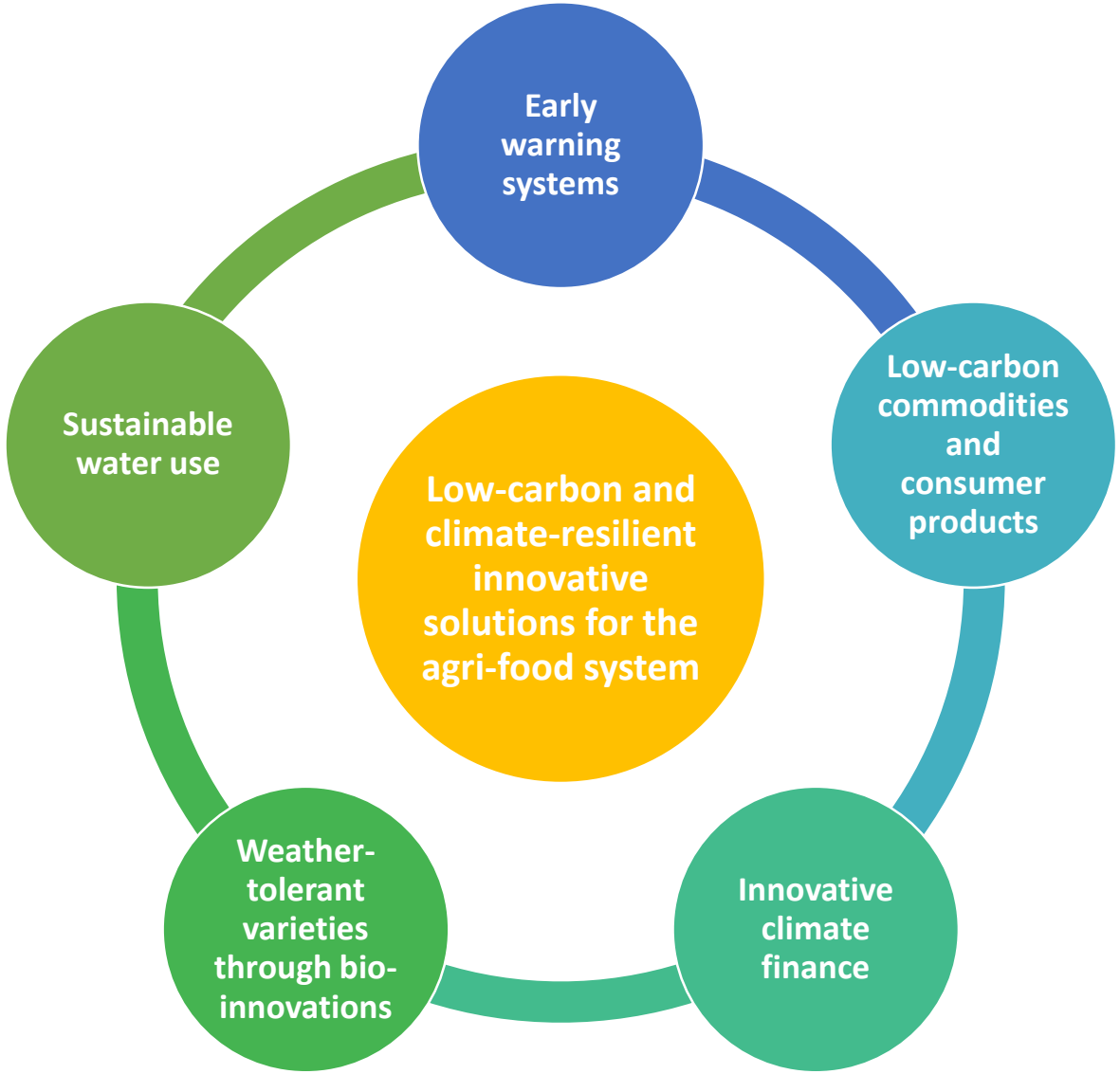
Opportunities to champion innovative solutions which disrupt business-as-usual

1.5°C target addressed through climate change mitigation in the agrifood system



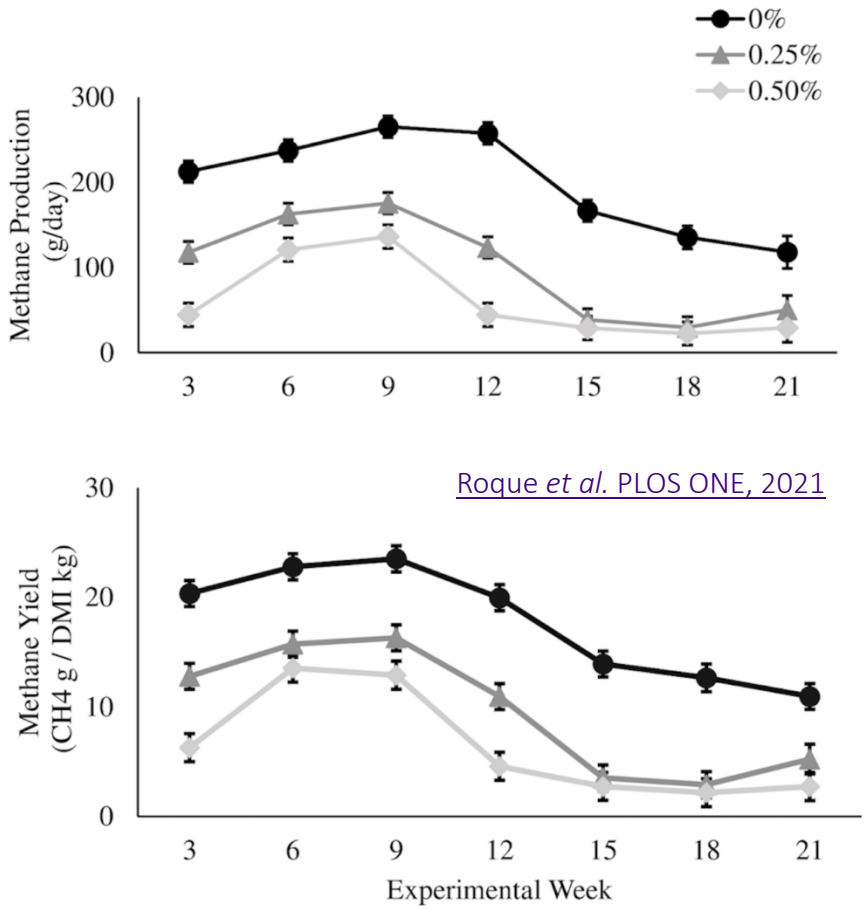
Innovative solutions which disrupt business-as-usual

Climate change adaptation in the agrifood system to prepare for worsening climatic conditions



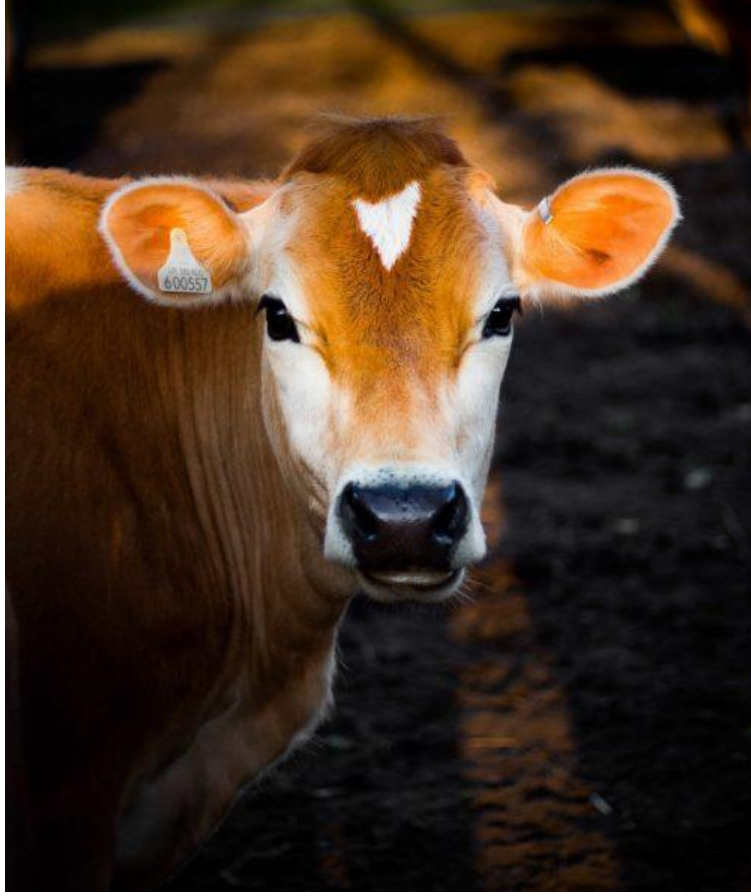
NEW research attempts to reduce enteric methane in Beef

Using Red seaweed reduces enteric methane by over 80%



Roque *et al.* PLOS ONE, 2021

Asparagopsis taxiformis inclusion effects on methane emissions during the 21 week experimental period.
https://doi.org/10.1371/journal.pone.0247820.g003



Gene editing new applications – reducing enteric methane

The rumen microbiome comprises Millions of bacteria, ciliary protozoa, anaerobic fungi, and archaea, which are the essential microorganisms in methane (CH4) production from byproducts (H+) of the digestion of the other microorganisms.

Opportunities for innovation

- Opportunity for FAO to harness **innovation and digital technology**
- Urgency of action requires **accelerated technological innovation** (e.g. methane reduction, resource efficiency, precision farming, reducing food loss and waste)
- Making agri-food systems part of the solution **requires innovation**
- FAO's new **strategies on climate change and science and innovation**.

The Koronivia Joint Work on Agriculture

Koronivia Joint Work on Agriculture

Six elements of the Decision

- **Modalities for implementation** of the outcomes of the **five in-session workshops** on issues related to agriculture and other future topics that may arise from this work
- **Methods and approaches** for assessing adaptation, **adaptation co-benefits** and **resilience**
- Improved **soil** carbon, soil health and soil fertility under grassland and cropland as well as **integrated systems**, including **water management**
- Improved **nutrient use** and **manure management** towards sustainable and resilient agricultural systems
- Improved **livestock management** systems
- **Socioeconomic and food security dimensions** of climate change in the agricultural sector

COP26: Expectations and possible implications

The Global Situation – Climate Emergency

“Governments around the world should all declare a state of climate emergency”

- **IPCC Reports:** 1.5^{o}C; Land ; Oceans; 2021
- **Hunger on the rise:** link to climate change (SOFI 2021)
- **SDG13** (climate action) central to 2030 Agenda
- **COVID-19 recovery plans:** Build back greener

UN Climate Change Conference – COP26

31 October - 12 November 2021 | Glasgow, UK

COP26 Presidency Goals:

- **Mitigation:** Secure global net zero by mid-century and keep 1.5 degrees within reach
- **Adaptation**: Adapt to protect communities and natural habitats
- **Finance**: Mobilise at least USD 100bn in climate finance
- **Collaboration:** Work together to deliver climate action

UN CLIMATE CHANGE CONFERENCE UK 2021

IN PARTNERSHIP WITH ITALY

Roadmap 2021

2022

June 2021

Climate Change Conference (SB 52)
Bonn
31 May -17 Jun

July 2021

Asia-Pacific Climate Week
Virtual
6-9 July

High-Level Political Forum
New York
6-15 Jul

Food Systems pre Summit
Rome
26-28 July

IPCC-54 WGI AR6,
26-30 Jul tbc

August 2021

Sixth Assessment Report, *Climate Change 2021: The Physical Science Basis (*Working Group I)
6 August 2021

Youth engagement in the UNFCCC process and more ambitious climate action
Virtual
25-26 Aug

September 2021

IUCN World Congress
Marseille
3-11 Sept

Food Systems Summit
New York
23 Sept

UN HL Dialogue on Energy
20 Sept, TBC

Youth 4Climate: Driving Ambition
Milan
28-30 Sept

October 2021

Pre-COP 26
Milan
30 Sept-2 Oct

Council on Food Security
Rome
11-15 Oct

UN Biodiversity Conference COP-15
Kunming
11-24 October

G20 Rome Summit
Rome
30-31 Oct

Africa Climate Week
Virtual
Sept (TBC)

November 2021

Climate Change Conference (COP 26)
Glasgow
31 Oct- 12 Nov

December 2021

SUMMARY

- Agriculture and food systems are a huge part of the **CLIMATE SOLUTION**
  - They must transform through inclusive, multisectoral approaches that reduce emissions, draw down carbon, and boost climate resilience and adaptation.
- **SCIENCE AND INNOVATION** are the key to advance **ADAPTATION AND MITIGATION ACTIONS** and to achieve more efficient, inclusive, resilient and sustainable agri-food systems
  - play a crucial role in identifying and assessment of **RISKS, INEQUALITIES, SYNERGIES AND TRADE-OFFS**
- The **SCIENCE, POLICY AND PRACTICE INTERFACE** needs to be strengthened and streamlined to boost its impact of adaptation and mitigation actions
- 2021 is an important opportunity to transform the agri-food systems and LINK IT TO THE CLIMATE CHANGE AND BIODIVERSITY AGENDAS – **UN FOOD SYSTEMS SUMMIT 2021**, COP26 and CBD COP15

Thank You