atf animal task force
A European Public-Private Partnership

EAAP
European Federation of Animal Science

2nd one-day symposium
of the Animal Task Force & the EAAP Commission on Livestock Farming Systems

IPCC AR6 Working Group III report: Overview of agricultural sector emissions

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AFOLU

Background

- Builds on AR5 (2014) plus 2019 special reports on Global Warming of 1.5^{O}C and Climate Change and Land

- Continues AR5 convention of combining land based emissions and removals into a single chapter, AFOLU: Agriculture, forestry and other land uses

- Cover sources and sinks of CO_2 & emissions of non-CO2 gases, primarily coming from agriculture

- Focus here will be on agriculture

Annual anthropogenic emissions from AFOLU and Non-AFOLU 2010 - 2019

Gas	Units	AFOLU	Non-AFOLU	Total	AFOLU as % of total
CO_2	*GT CO_2e yr^{-1}*	5.9	36.2	42	14
CH_4	*Mt CH_4 yr^{-1}*	157±47.1	207.5±62.2	364.4±109.3	
	GT CO_2e yr^{-1}	4.2±1.3	5.9±1.8	10.2±3	41
N_2O	*Mt N_2O yr^{-1}*	6±4	2.8±1.7	9.4±5.6	
	GT CO_2e yr^{-1}	1.8±1.1	0.8±0.5	2.6±1.5	69
Total	***GT CO_2e yr^{-1}***	**11.9±4.4**	**44±3.4**	**55.9±6.1**	**21**

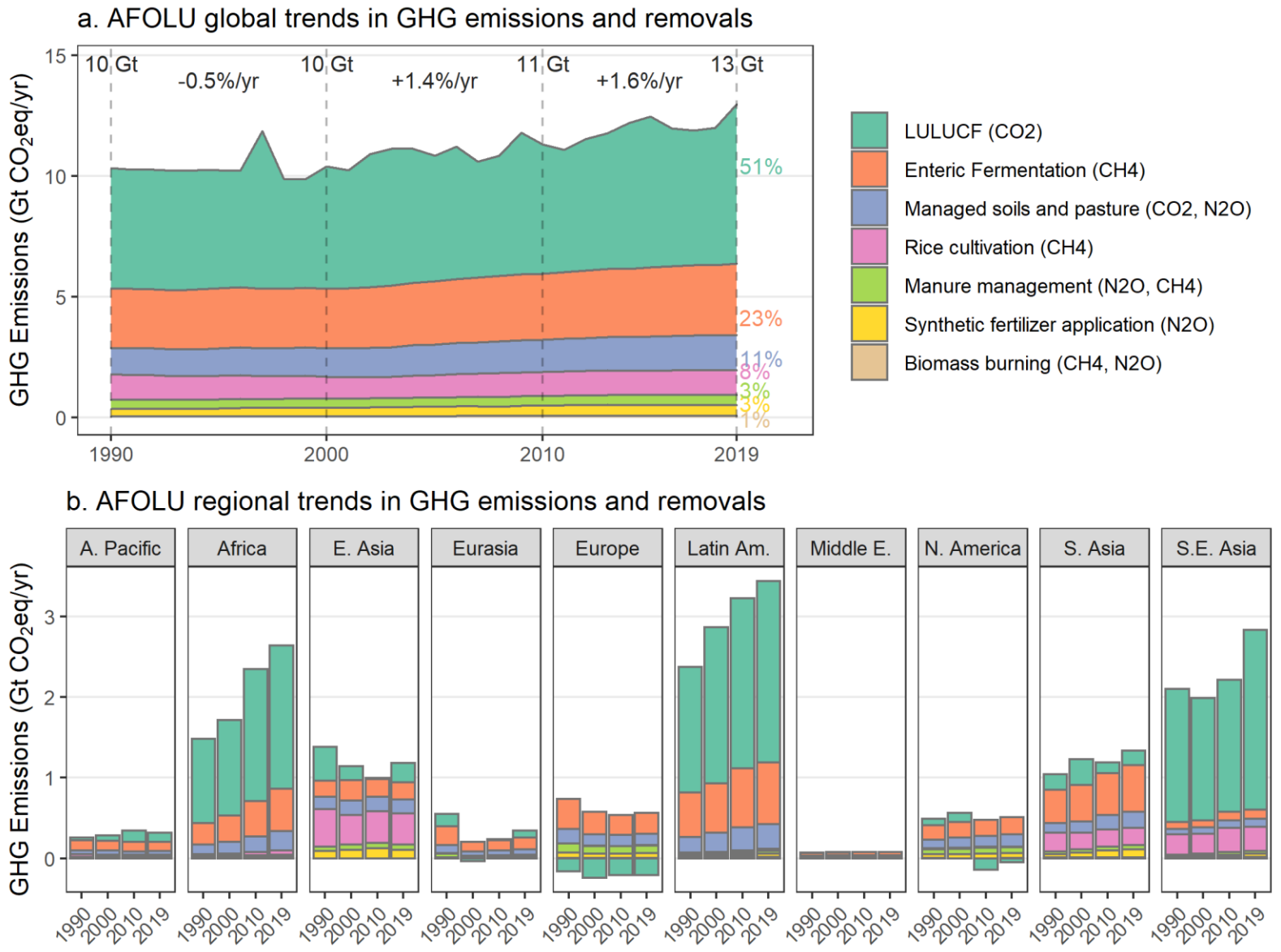
Some key Findings for agriculture

- Agriculture makes a substantial contribution to total non-CO_2 GHG emissions (47%)
- Methane the dominant agricultural gas
- Agricultural non-CO_2 emissions continue to rise

  1990 – 1999 5.2±1.4

  2010 – 2019 6±1.6

AFOLU trends in GHG emissions and removals

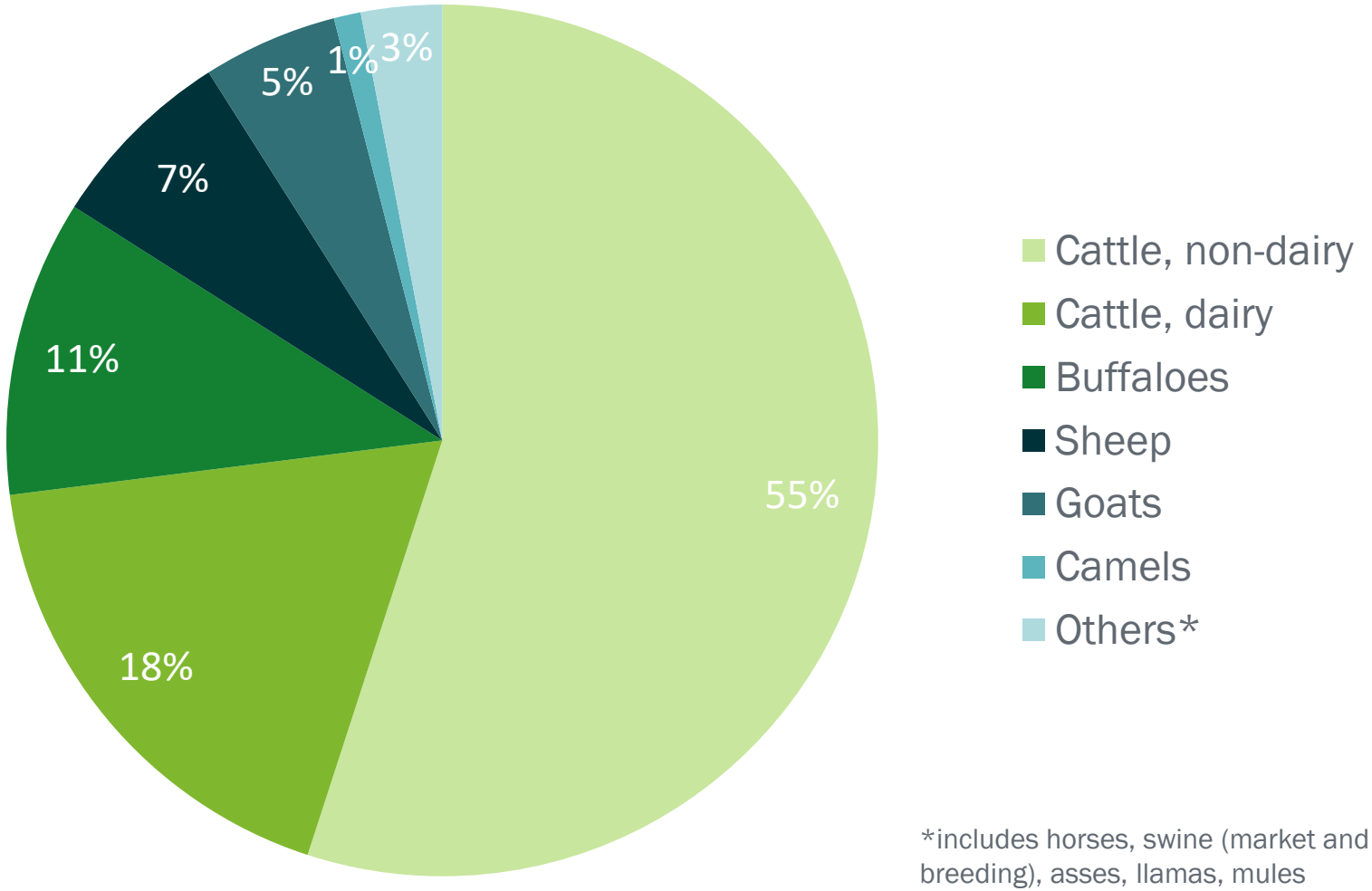


Some key facts on agricultural emissions

- Enteric methane dominates agricultural emissions (47%) followed by rice (22%)
- Emissions from all non-LULUCF categories other than rice rising
- Considerable regional variation in emissions profiles & rates of change e.g. enteric methane rising most in Africa, Latin America & S. Asia

Global enteric fermentation by sub-sector (2001 – 2011)

Data from FAO Statistics Division, ESS Working Paper No. 2.



*includes horses, swine (market and breeding), asses, llamas, mules

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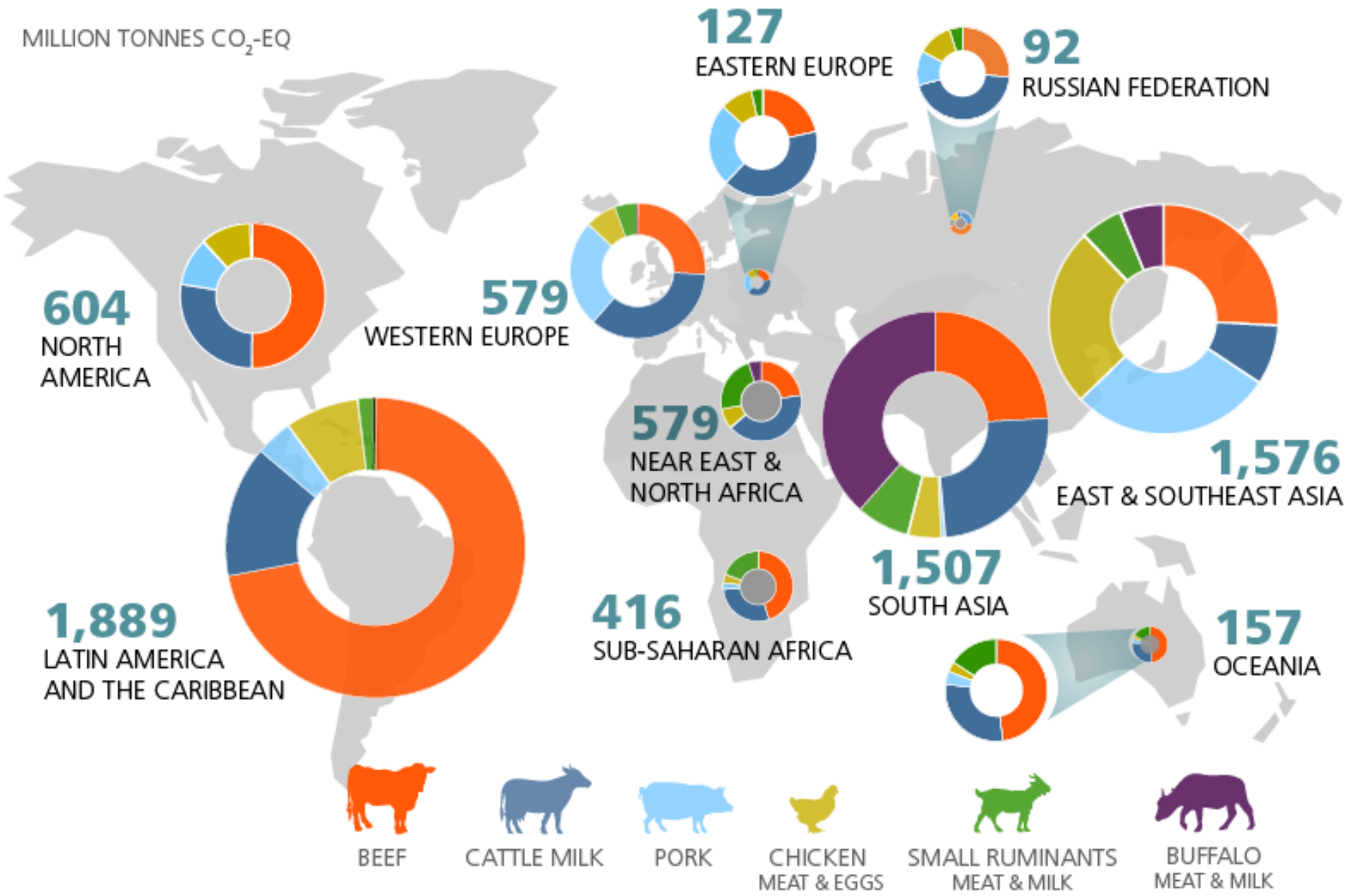
Global livestock emissions by species

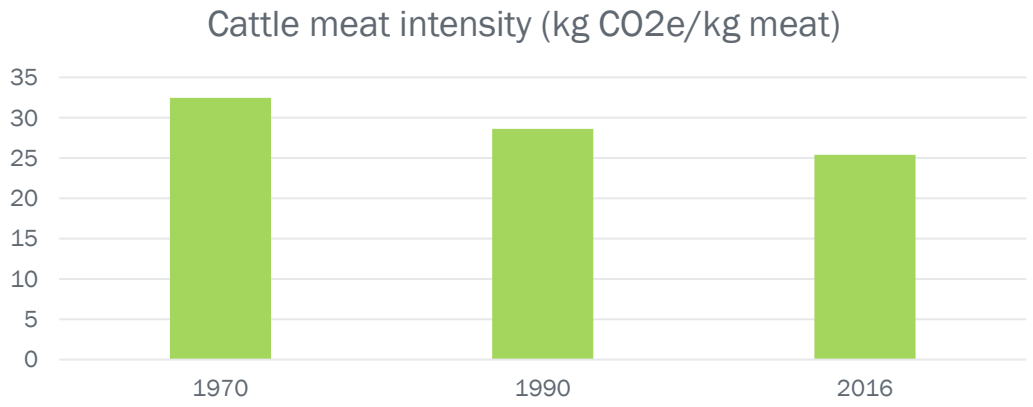
FAO 2019

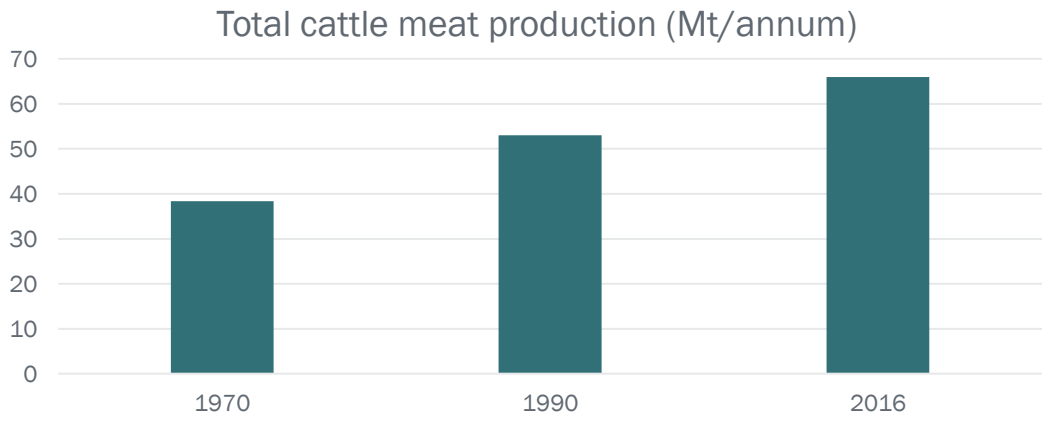


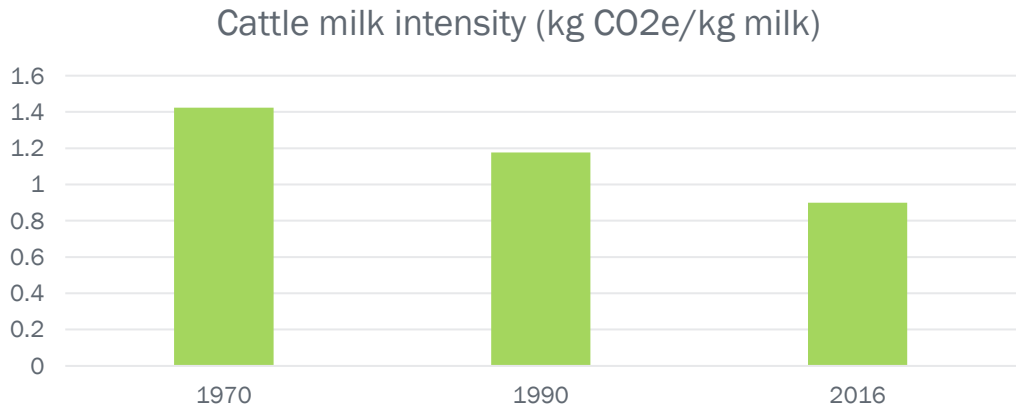
Anthropogenic drivers of agricultural emissions

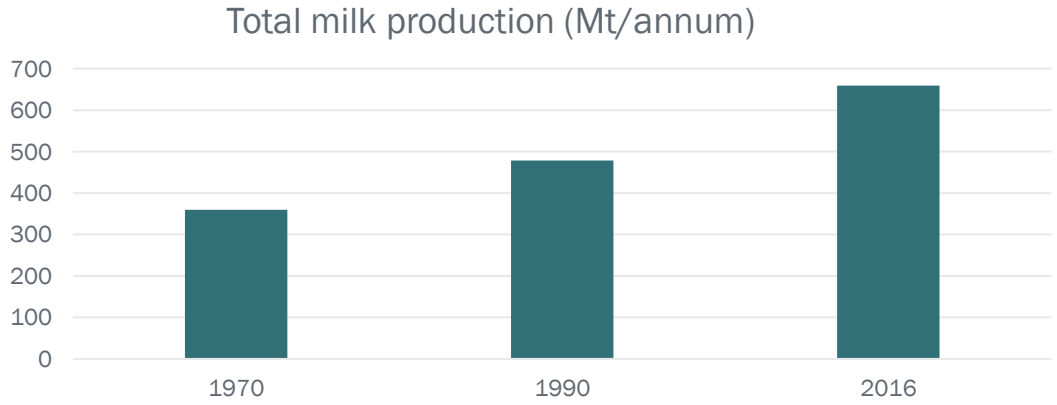
- Increased fertiliser use
  - Synthetic fertiliser >41% since 1990
- Increased livestock populations
  - Large ruminants >18% since 1990
  - Small ruminants >30% since 1990
- Increased productivity per animal
  - Beef >16% since 1990
  - Dairy >70% since 1990
  - Pig meat >17% since 1990
- Increased total milk & meat consumption
  - Meat > 24% since 1990
  - Milk > 22% since 1990
  - Increase a further 14% by 2029

Falls in GHG intensity, increases in total product produced



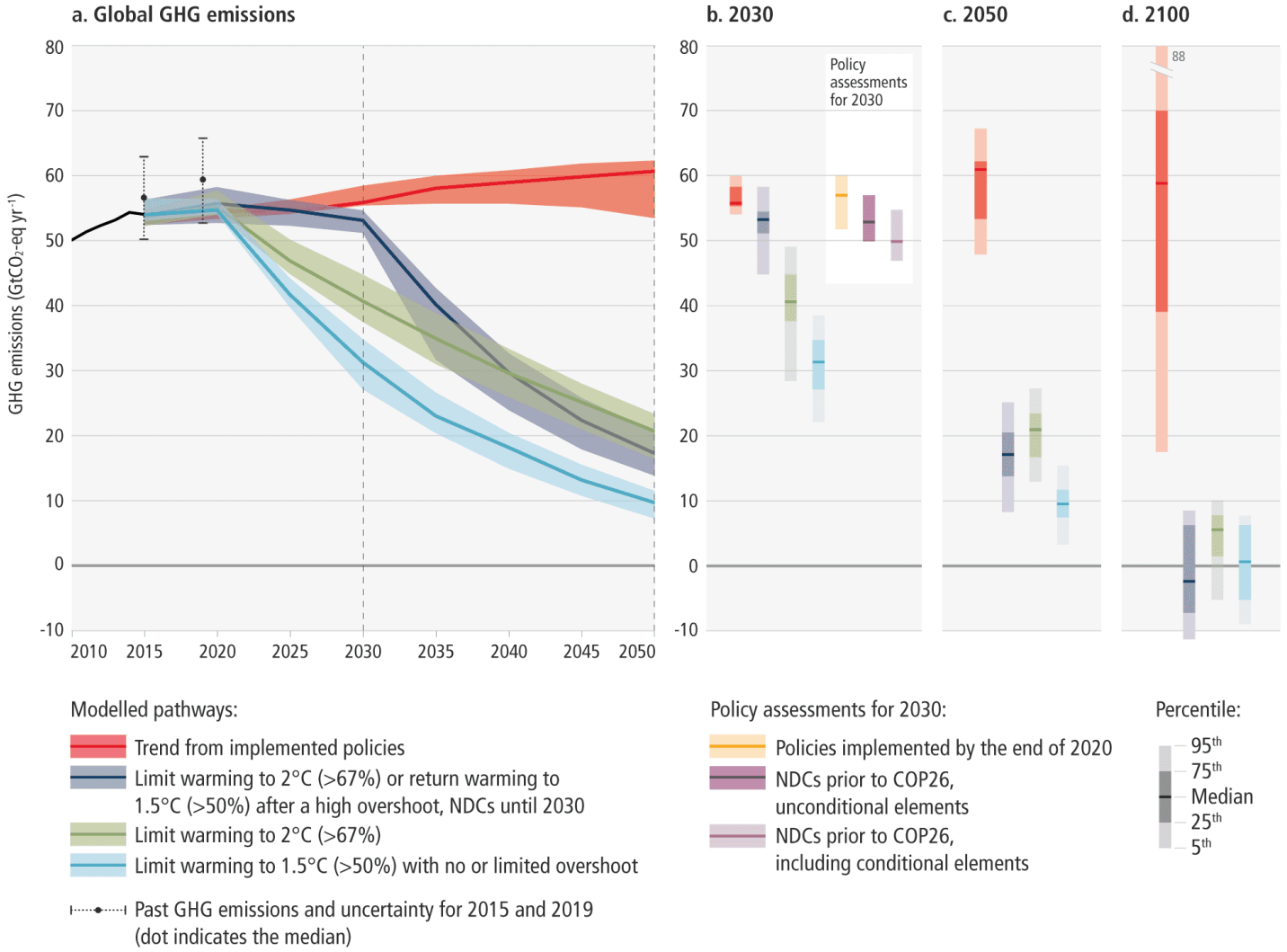






Potential to reduce agricultural emissions

Projected global GHG emissions from NDCs announced prior to COP26 would make it likely that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C.



Annual agricultural mitigation potential (Gt CO_{2e} yr^{-1}) by carbon price

Mitigation option	Estimate type	<$20/t CO2e	<$50/t CO2e	<$100/t CO2e	Technical
Agriculture total	**Sectoral**	**0.9** (0.5-1.4)	**1.6** (1-2.4)	**4.1** (1.7-6.7)	**11.2** (1.6-28.5)
	IAM	**0.9** (0-3.1)	**1.3** (0-3.2)	**1.8** (0.7-3.3)	ND
Agriculture - Carbon sequestration	**Sectoral**	**0.5** (0.4-0.6)	**1.2** (0.9-1.6)	**3.4** (1.4-5.5)	**9.5** (1.1-25.3)
	IAM	ND	ND	ND	ND
Agriculture – CH4 & N2O reduction	**Sectoral**	**0.4** (0.1-0.8)	**0.4** (0.1-1.8)	**0.6** (0.3-1.3)	**1.7** (0.5-3.2)
	IAM	**0.9** (0-3.1)	**1.3** (0-3.2)	**1.8** (0.7-3.3)	ND

Some key Findings

- Soil carbon management has the largest technical and economic mitigation potential
- Direct reduction in CH_4 and N_2O emissions relatively small and price insensitive
- Considerable variation in estimated mitigation potential from different approaches
- Mitigation approaches & estimated mitigation potentials not new but agricultural emissions continue to rise!

Farm system Approaches to mitigation

- **Robust evidence and high agreement that systems need to change**

- ***Agro Ecology* (including regen agriculture)**
  - limited evidence at the system level
- ***Conservation Agriculture***
  - Good for adaptation, mitigation impact context specific
- ***Integrated production systems***
  - Some evidence but impact context specific
- ***Organic farming***
  - Lower emissions/ha, variable impact per unit product
  - Large scale conversation may increase emissions

Sustainable Intensification (SI)

- Needs focus on agricultural intensification & sustainability
  - Increase production per unit area
  - Reduce environmental externalities
  - Land sparing
- *Evidence suggest there has been intensification* (More production from similar land area) *but degradation also increased in some areas* (not sustainable)
- *Pressure to increase food supply and reduce environmental impact means SI needed but implementation challenging*

Demand side measures

Estimated high mitigation potential when compared with direct approaches but implementation challenging

- ***Shift to "sustainable & healthy" diets*** ***(1.7 Gt CO_{2e} yr^{-1} (1-2.7))***
  - Mitigate emissions directly via consuming less animal products globally
  - Reduced pressure on land use for animal feed
  - Reduce some forms of malnutrition
  - Adverse economic impacts but poorly quantified

- ***Reduce food loss & waste*** ***(2.1 Gt CO_{2e} yr^{-1} (0.1-5.8))***
  - Data refers to losses across the whole value chain
  - Direct agriculture reductions ***(0.5 Gt CO_{2e} yr^{-1} (0.0-0.9))***

Mitigation challenges

Considerable barriers to achieving economic and technical mitigation potential at scale

- Design and coverage of financing mechanisms
- Scale and accessibility of financing
- Risk and uncertainty
- Poverty
- Cultural values and social acceptance
- Transparent and accountable governance
- Clear land tenure and land use rights
- Lack of institutional capacity.

Thank You

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GHG metrics and their use for methane

‘Best’ metric depends on intended use

GWP used extensively for national and international reporting of emissions, GHG footprinting of products, pricing schemes etc

GWP

GWP averages the warming effect of an emission pulse over a given timeframe (e.g. 20, 50, 100 years).

GTP

GTP estimates the warming effect of an emission pulse at the end of a given period of time (e.g. 20, 50 100 years), ignoring the warming that occurs in between the emission and the chosen end time point

GWP*

GWP* compares the warming coming from continuous emissions of a short-lived non-CO_2 gas (e.g. methane) with the warming coming from a one-off emission pulse of CO_2.

GWP* provides a better estimate of the warming coming from continuous emissions of methane. Cumulative GWP* estimates the total warming coming from a time series of methane emissions. Instantaneous GWP* estimates the change in warming relative to a previous point in time (20 years in the current formulation)

GWP and GTP describe the marginal effect of each emission relative to the absence of that emission