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CLIMATE CHANGE 2014

Mitigation of Climate Change

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Working Group III contribution to the
IPCC Fifth Assessment Report

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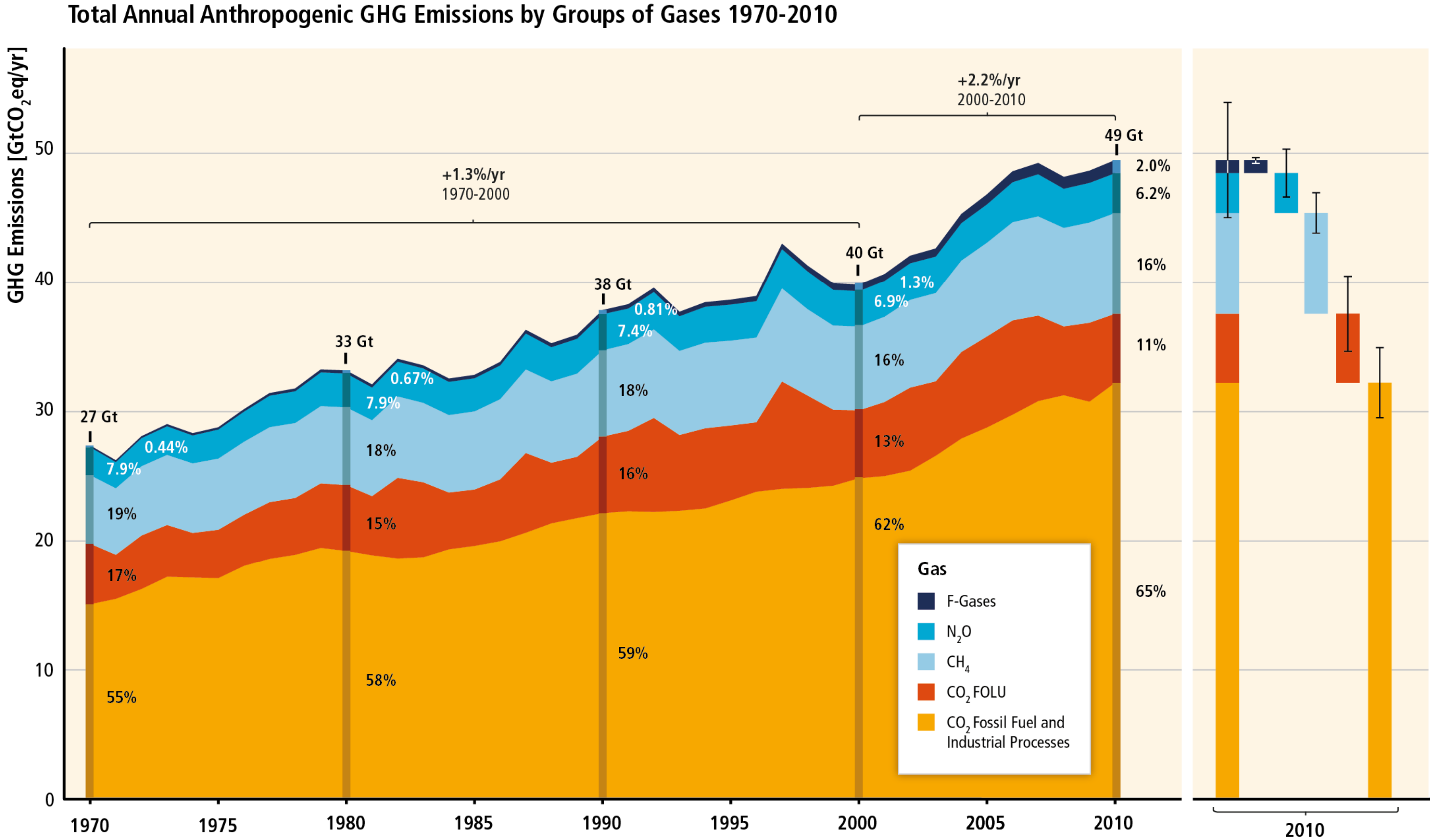
GHG emissions accelerate despite reduction efforts. Most emission growth is CO_2 from fossil fuel combustion and industrial processes.



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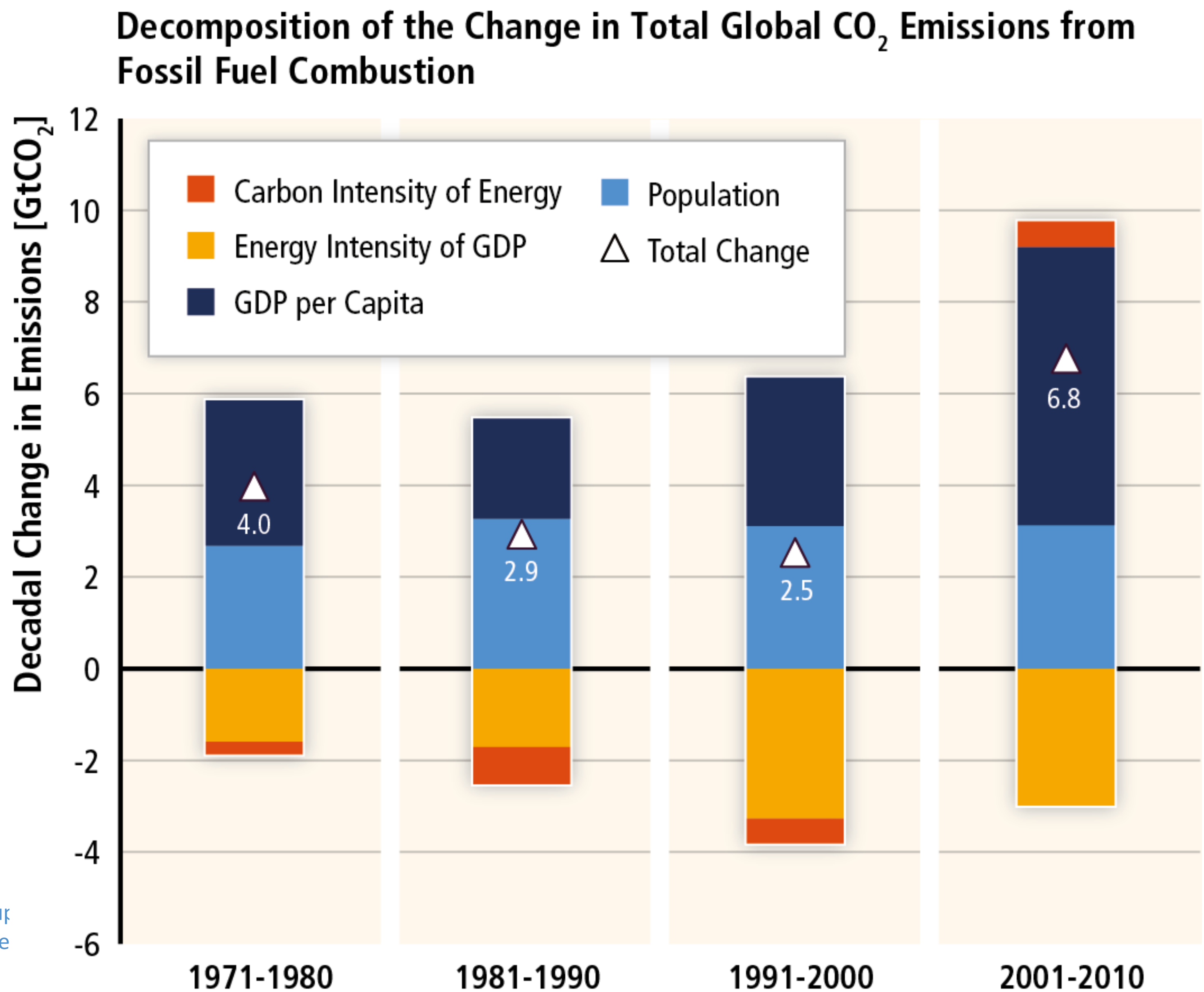
GHG emissions rise with growth in GDP and population; long-standing trend of decarbonisation of energy reversed.



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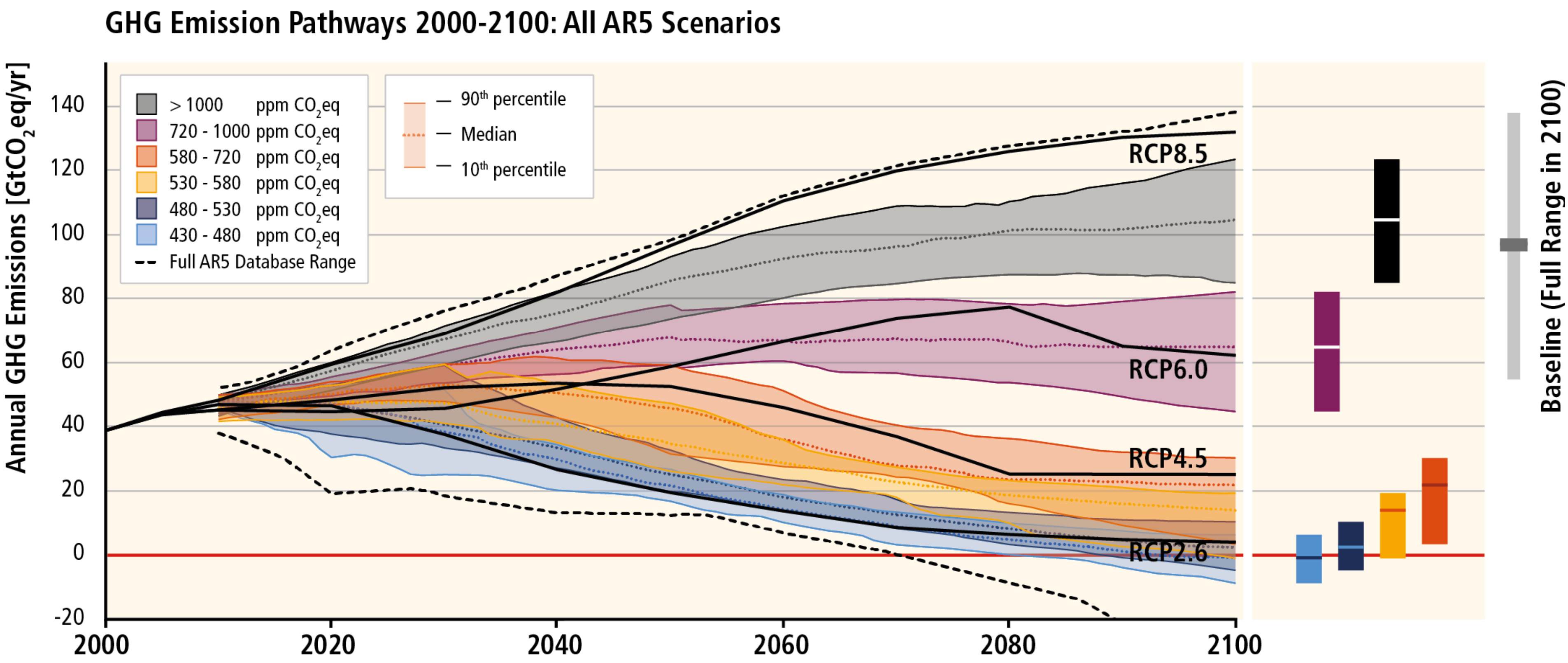
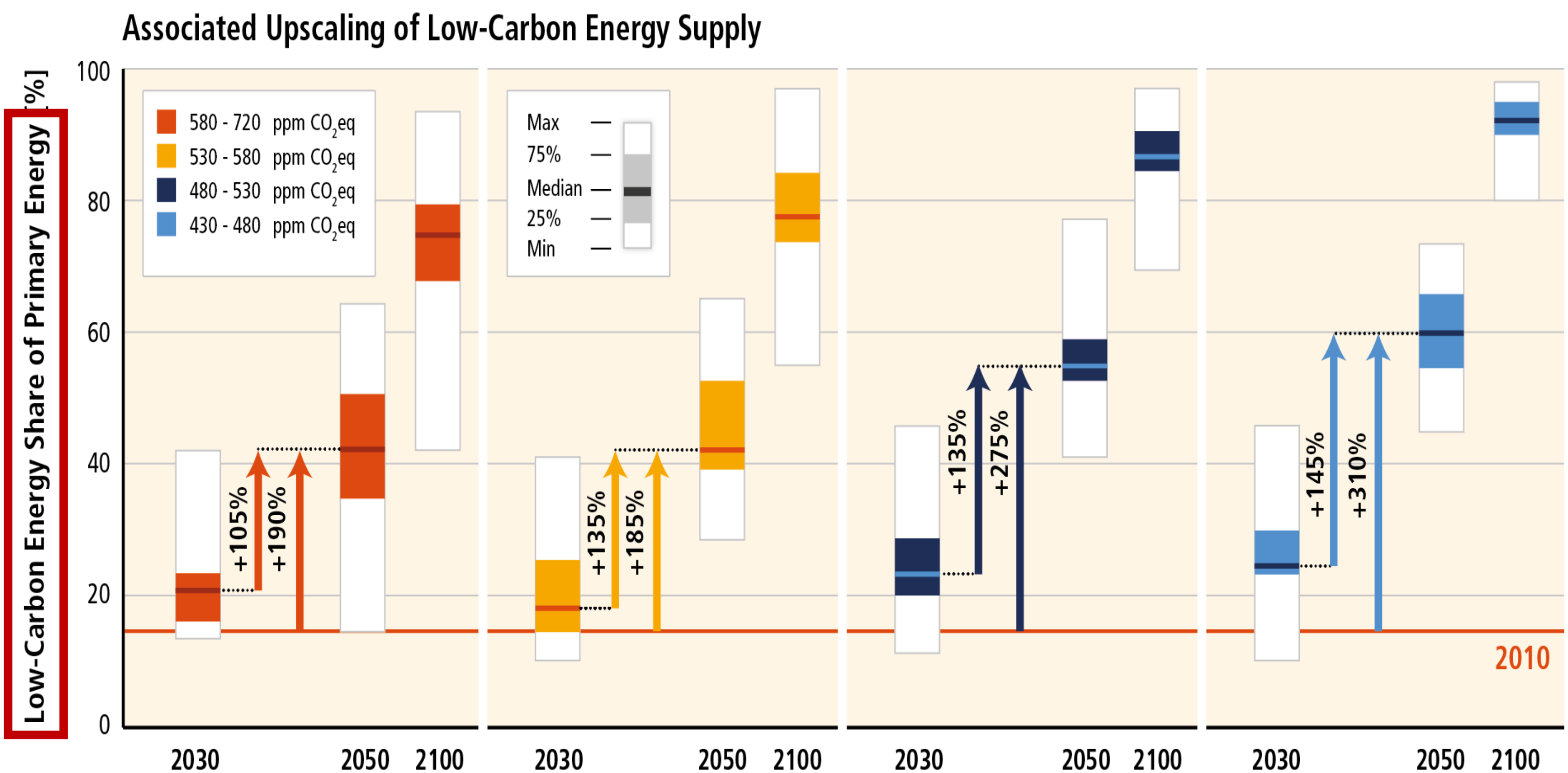
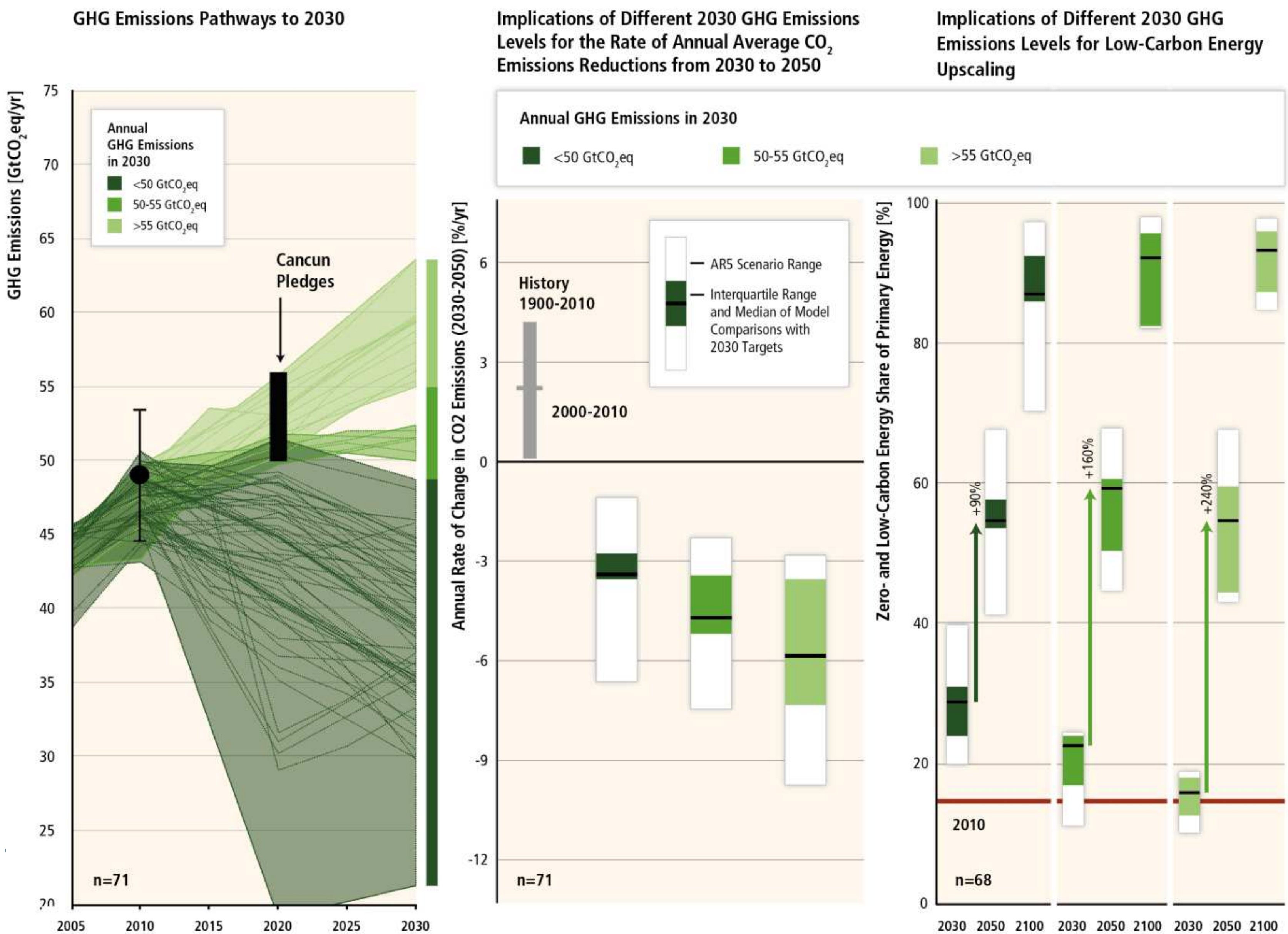
Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21st century.



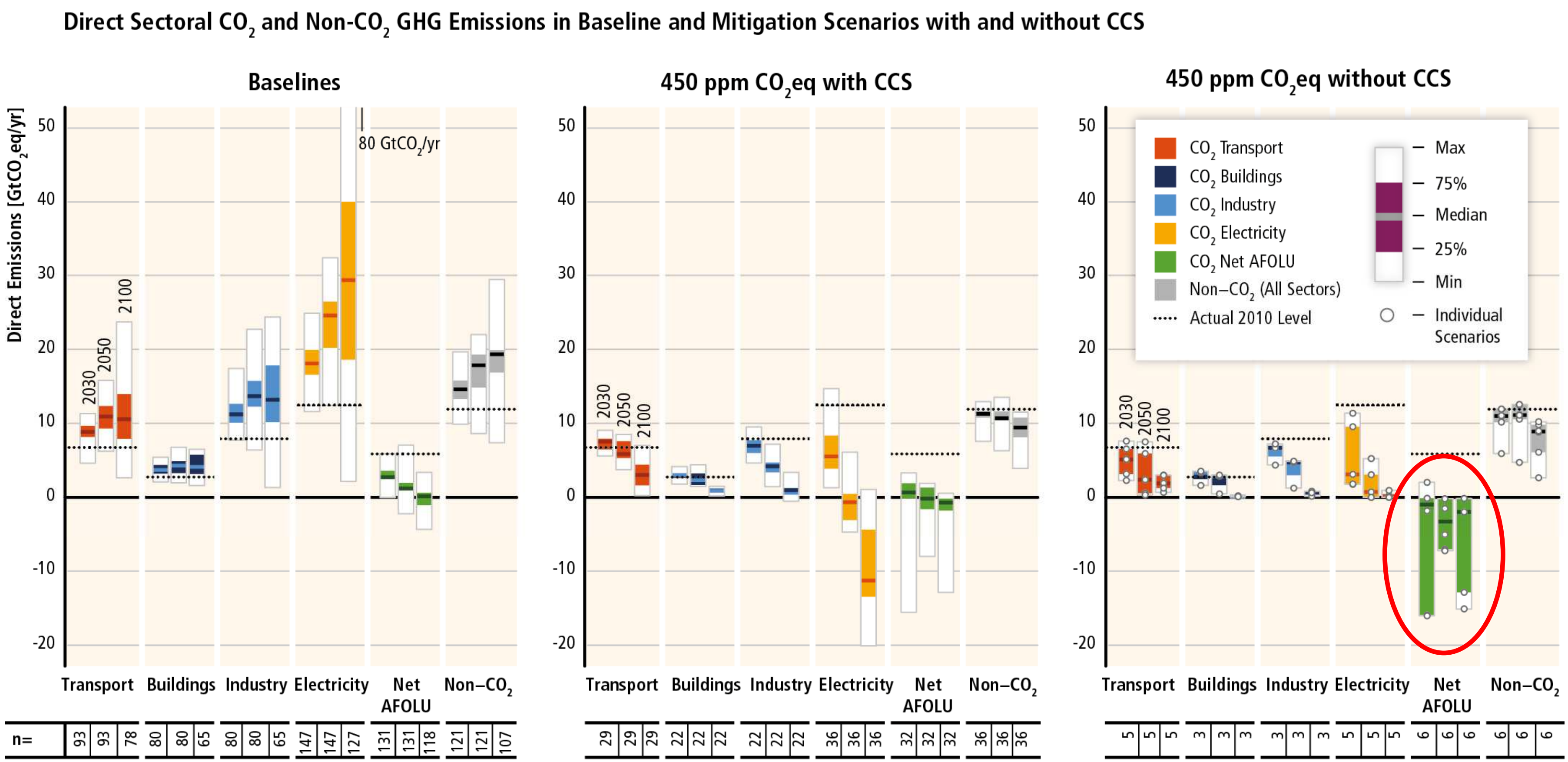
Mitigation requires major technological and institutional changes including the upscaling of low- and zero carbon energy



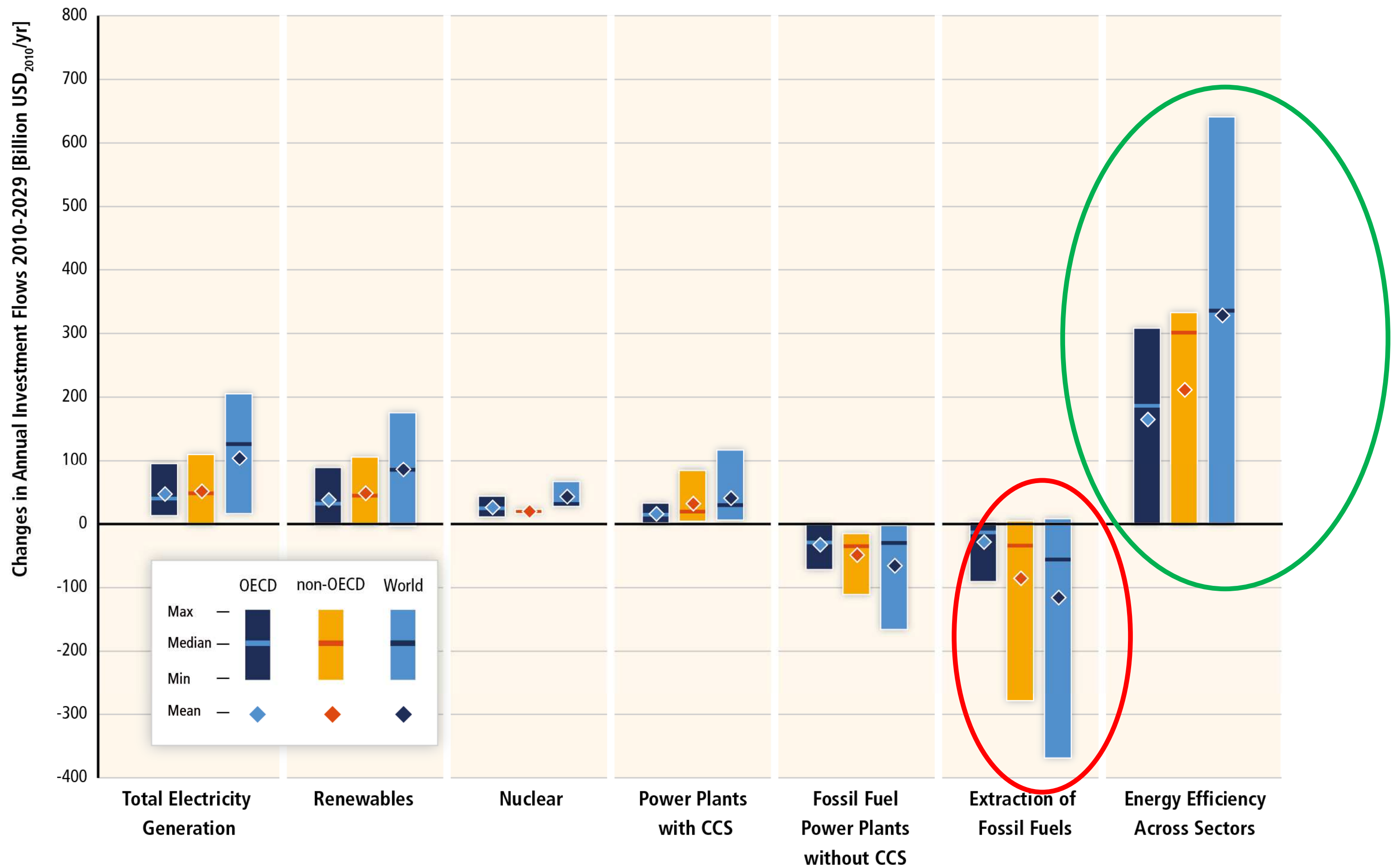
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



Mitigation requires changes throughout the economy. Efforts in one sector determine mitigation efforts in others.



Substantial reductions in emissions would require large changes in investment patterns.



# of Studies:	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	3	3	4

Since AR4, there has been an increased focus on policies designed to integrate multiple objectives, increase co-benefits and reduce adverse side-effects.

- **Sector-specific policies** dominates the economy-wide policies.
- **Regulatory approaches and information** measures are often environmentally effective.
- Since AR4, **cap and trade systems for GHGs have been established in a number of countries** and regions.
- In some countries, **tax-based policies for reducing GHG emissions**–alongside technology–have helped to weaken the link between GHG emissions and GDP
- **The reduction of subsidies for GHG-related activities in various sectors can achieve emission reductions**, depending on the social and economic context.

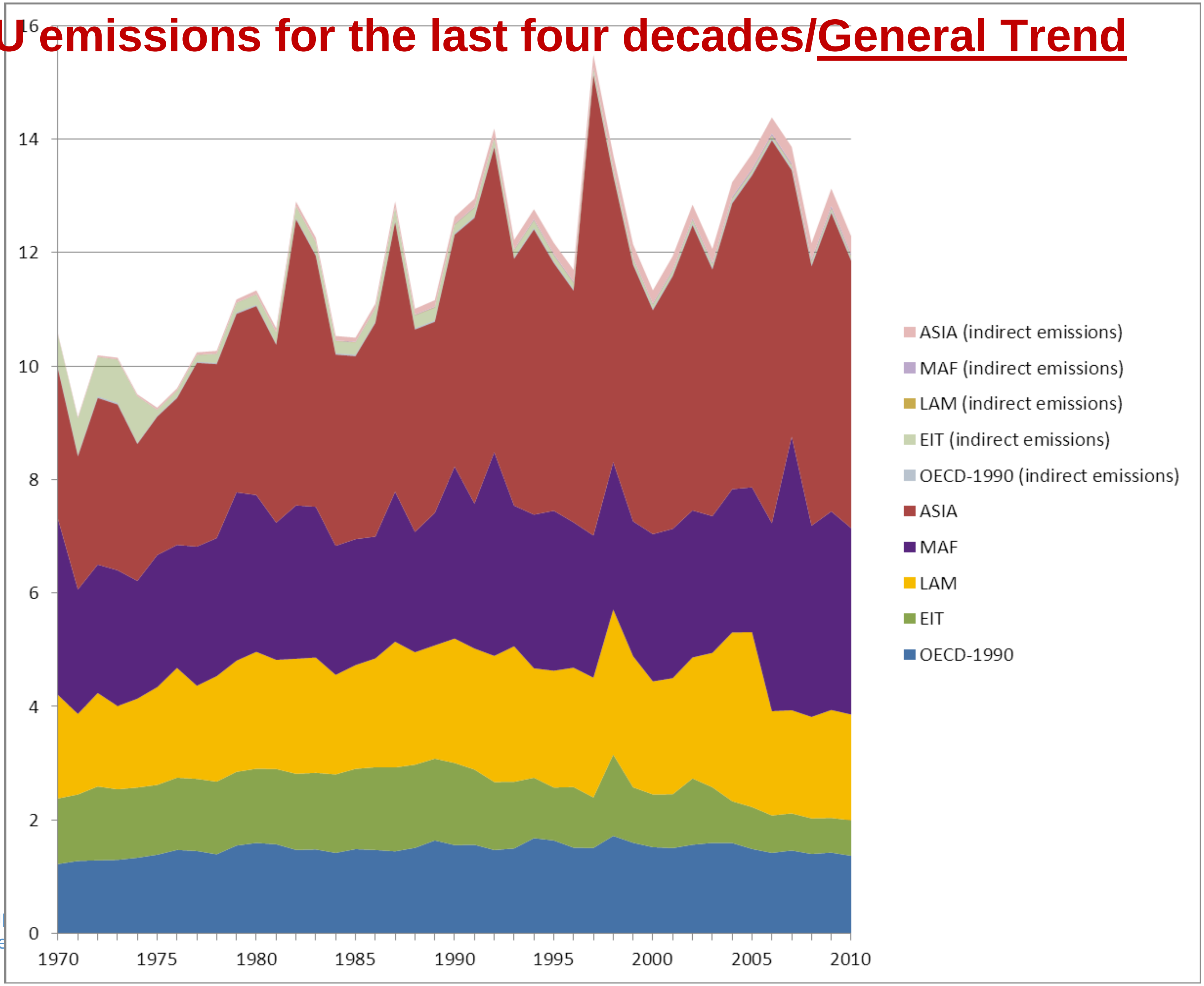
AFOLU

- Agriculture, Forestry and Other Land Use (AFOLU) is unique among the sectors in WGIII.
  - Enhancement of removals of GHGs, as well as reduction of emissions through management of land and livestock
  - Agriculture is central to the livelihoods of many social groups
- AFOLU sector is responsible for < ¼ (~10-12 Gt CO_2eq/yr) of anthropogenic GHG emissions
  - Mainly from deforestation and agricultural emissions from livestock, soil, biomass burning and nutrient management
  - GHG emissions/yr-1 from **agricultural 2000-2010 @ 5.0-5.8 Gt** CO_2eq/yr
  - GHG flux/yr-1 from land use / **land use change activities @ 4.3-5.5** Gt CO_2eq/yr

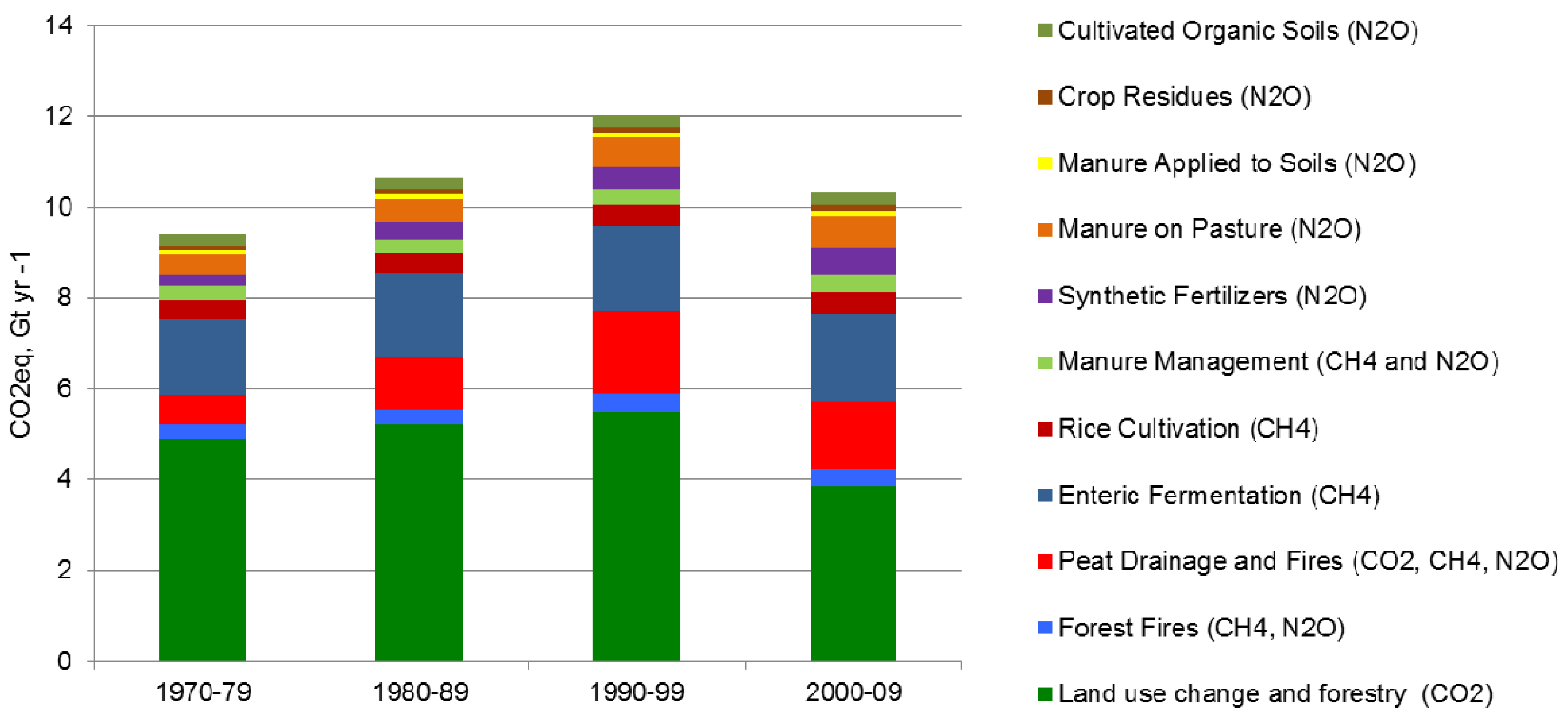
Leveraging the mitigation potential in AFOLU

- **AFOLU sector have remained similar since AR4** but the share of anthropogenic emissions has decreased to 24% (in 2010), largely due to increases in emissions in the energy sector.
- **Most approaches indicated a decline in <u>FOLU</u> CO_2 emissions** over the most recent years, largely due to decreasing deforestation rates.

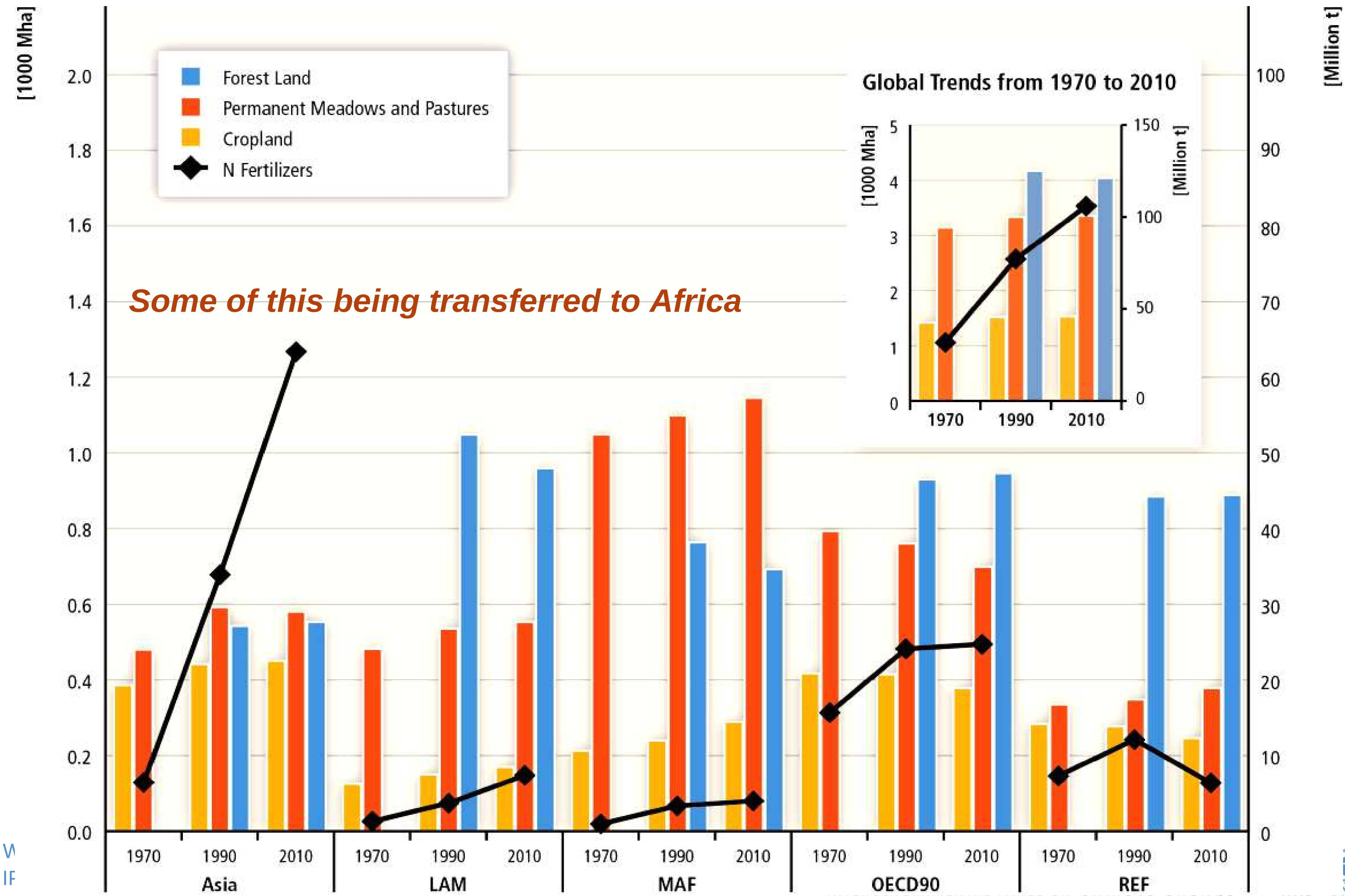
AFOLU emissions for the last four decades/General Trend



AFOLU emission-WGII/AR5/ Sector



Global trends from 1971 to 2010 in area of land use/<u>Region</u>



Net global CO_2 flux from AFOLU/Trend in emissions

	1750 to 2011 Cumulative Gt CO_2			1980–1989 Gt CO_2/yr			1990–1999 Gt CO_2/yr			2000–2009 Gt CO_2/yr		
IPCC WGI Carbon Budget, Table 6.1[a]:												
Net AFOLU CO_2 flux [b]	660	±	293	5.22	±	2.93	5.52	±	2.93	3.83	±	2.93
Residual terrestrial sink[c]	-550	±	330	-5.50	±	4.03	-9.53	±	4.40	-9.17	±	4.40
Fossil fuel combustions and cement production[d]	1338	±	110	20.17	±	1.47	23.47	±	1.83	28.23	±	2.20
Meta-analyses of Net AFOLU CO_2 flux:												
IPCC WGI Table 6.2[e]				4.77	±	2.57	4.40	±	2.20	2.93	±	2.20
Houghton et al, 2012[d]				4.18	±	1.83	4.14	±	1.83	4.03	±	1.83

Opportunities for mitigation in AFOLU

- **Supply-side:** reduction of emissions from land use change, land management and livestock management, increasing carbon stocks by sequestration in soils and biomass, or the substitution of fossil fuels by biomass for energy production
- **Demand-side:** by reducing losses and wastes of food, changes in diet and changes in wood consumption.
- **Reduce emission intensity**: Reduce GHG emissions per unit of product>>>Increasing production without an increase in emissions

Barriers and challenges in AFOLU

- Financing, poverty, institutional, ecological, technological development,
- Feedbacks to adaptation and conservation
- Competition between different land - uses
- Promoting synergies: integrated systems or multi-functionality, e.g. ecosystem services

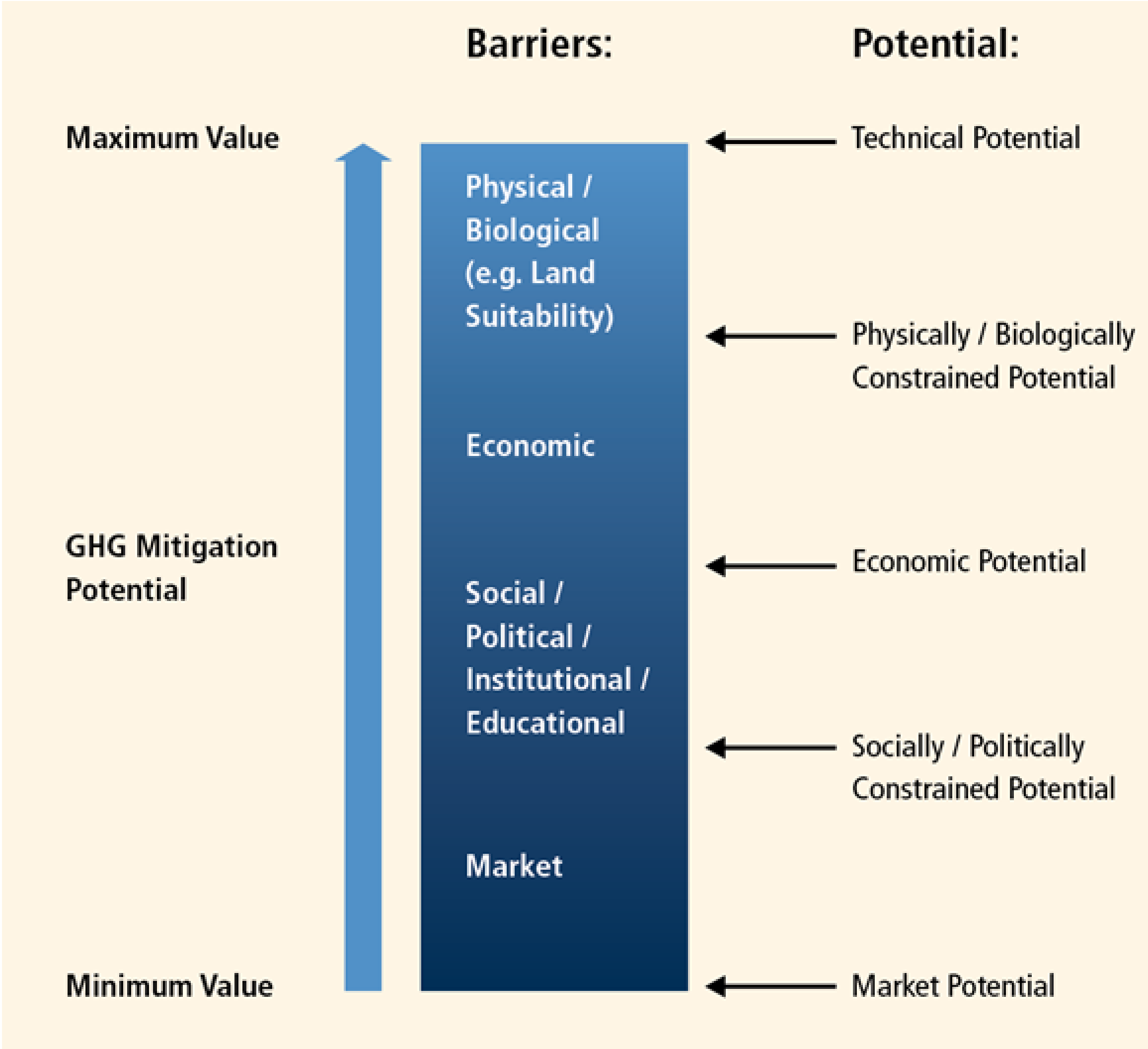
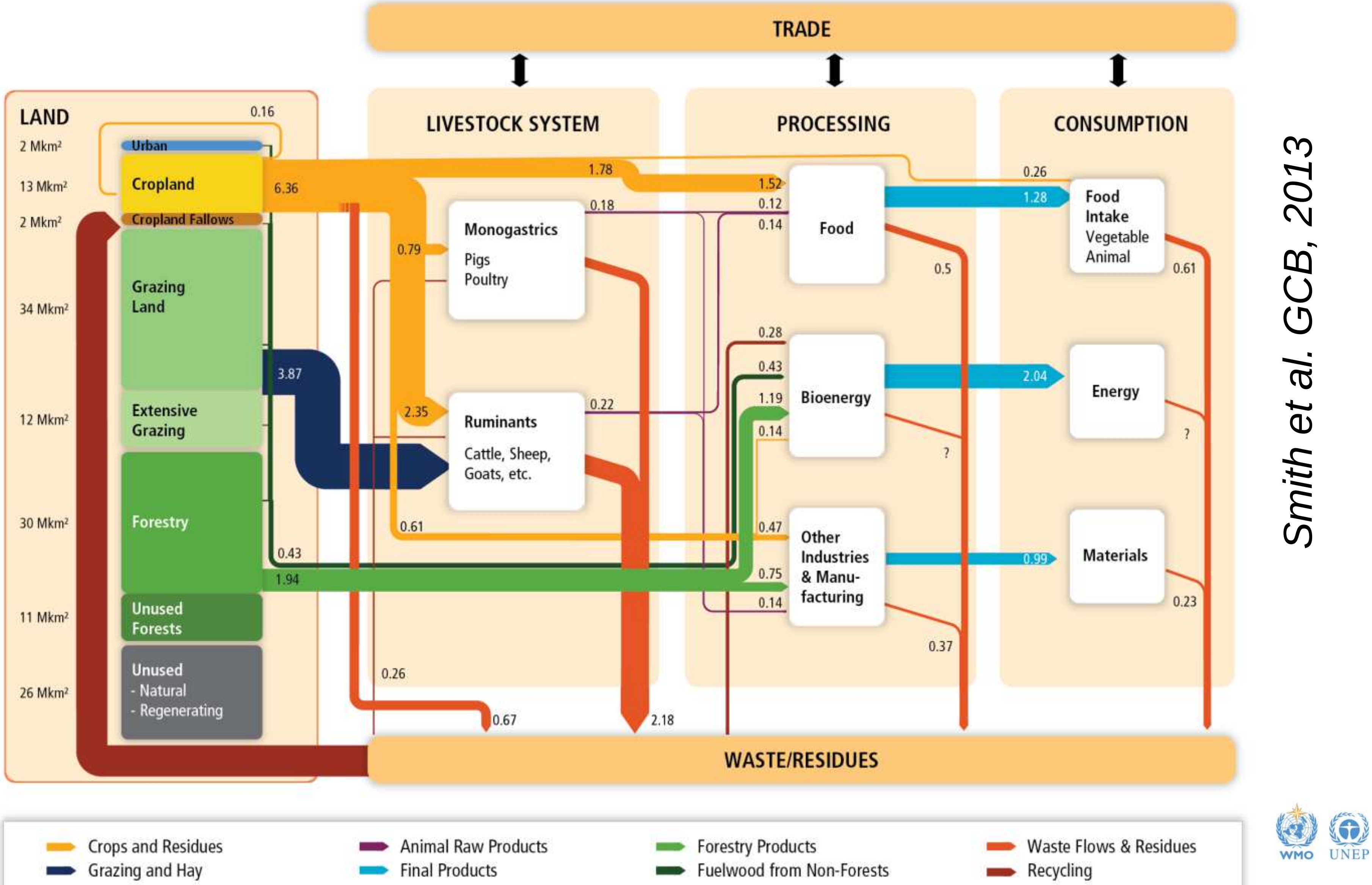


Figure 11.12 Relationship between technical, economic and market potential (after)

AFOLU and Low Emission Development Pathway

- AFOLU= **a variety of mitigation options** and a large, cost-competitive mitigation potential. Provides **flexibility for the development of mitigation technologies** (energy sector)
- Projections: **land - related mitigation strategies (agriculture, forestry, bioenergy) were projected to contribute 20 to 60% of total cumulative abatement to 2030**, and still 15 to 45% to 2100
  - RISKS: potential implications for biodiversity, food security and other services (ensuring co-benefits, avoiding land competition)

Global land use and biomass flows arising from human economic activity in 2000



Smith et al. GCB, 2013

Data Gaps

- Global **high resolution data sets of crop production** systems
- Globally **standardized and homogenized data on soil** as well as **forest degradation**
- Improved understanding of the **mitigation potential, interplay, costs as well as environmental and socio-economic consequences** of land use based mitigation options
- Better understanding of the **effect of changes in climate parameters, rising CO_2 concentrations and N deposition** on productivity and carbon stocks of different types of ecosystems

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