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Asia-Pacific Rural Development and Food Security Forum 2022

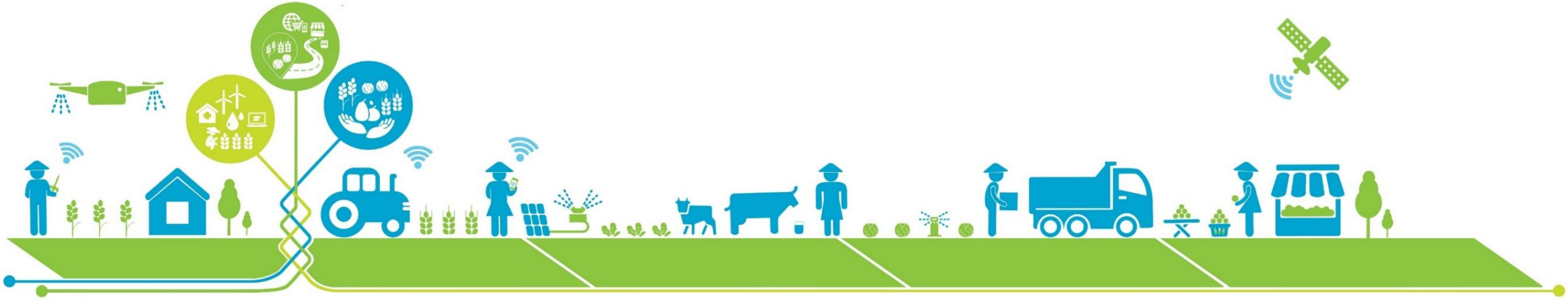
Battling Climate Change and Transforming Agri-food Systems

22-24 March 2022

Technical Session 2:
Pathways to Sustainable and Inclusive Food Systems

Louis Verchot

Alliance Bioversity – CIAT



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		Direct Anthropogenic							
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Panel 1: Contribution of AFOLU									
		FOLU	Agriculture	Total					
		A	B	C = A + B	D	E = C + D	F = (C/E) *100	G	A + G
CO_2[2]	Gt CO_2 y^{-1}	5.2 ± 2.6	No data[11]	5.2 ± 2.6	33.9 ± 1.8	39.1 ± 3.2	13%	-11.2 ± 2.6	-6.0 ± 3.7
CH_4[3,8]	Mt CH_4 y^{-1}	19.2 ± 5.8	141.6 ± 42.5	160.8 ± 43	201.3 ± 100.6	362 ± 109			
	Gt CO_2e y^{-1}	0.5 ± 0.2	4.0 ± 1.2	4.5 ± 1.2	5.6 ± 2.8	10.1 ± 3.1	44%		
N_2O[3,8]	Mt N_2O y^{-1}	0.3 ± 0.1	8.3 ± 2.5	8.7 ± 2.5	2.0 ± 1.0	10.6 ± 2.7			
	Gt CO_2e y^{-1}	0.09 ± 0.03	2.2 ± 0.7	2.3 ± 0.7	0.5 ± 0.3	2.8 ± 0.7	81%		
Total (GHG)	Gt CO_2e y^{-1}	5.8 ± 2.6	6.2 ± 1.4	12.0 ± 2.9	40.0 ± 3.4	52.0 ± 4.5	23%		

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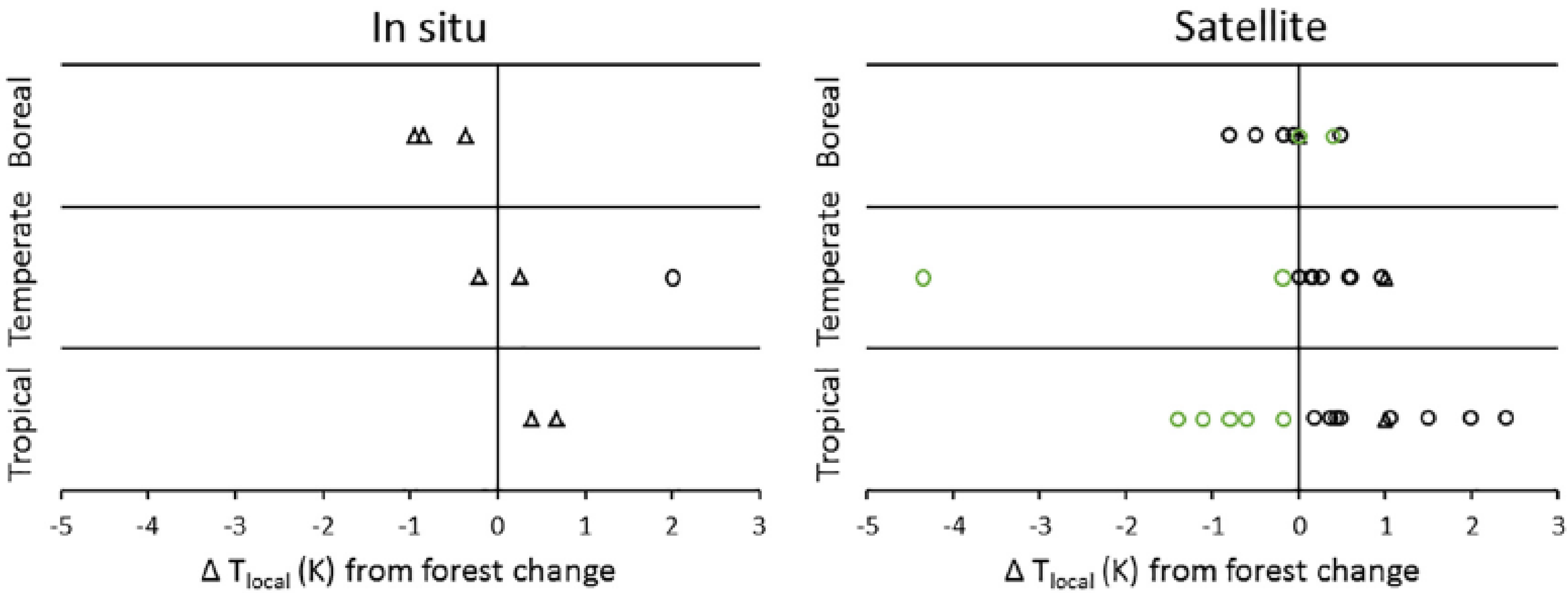
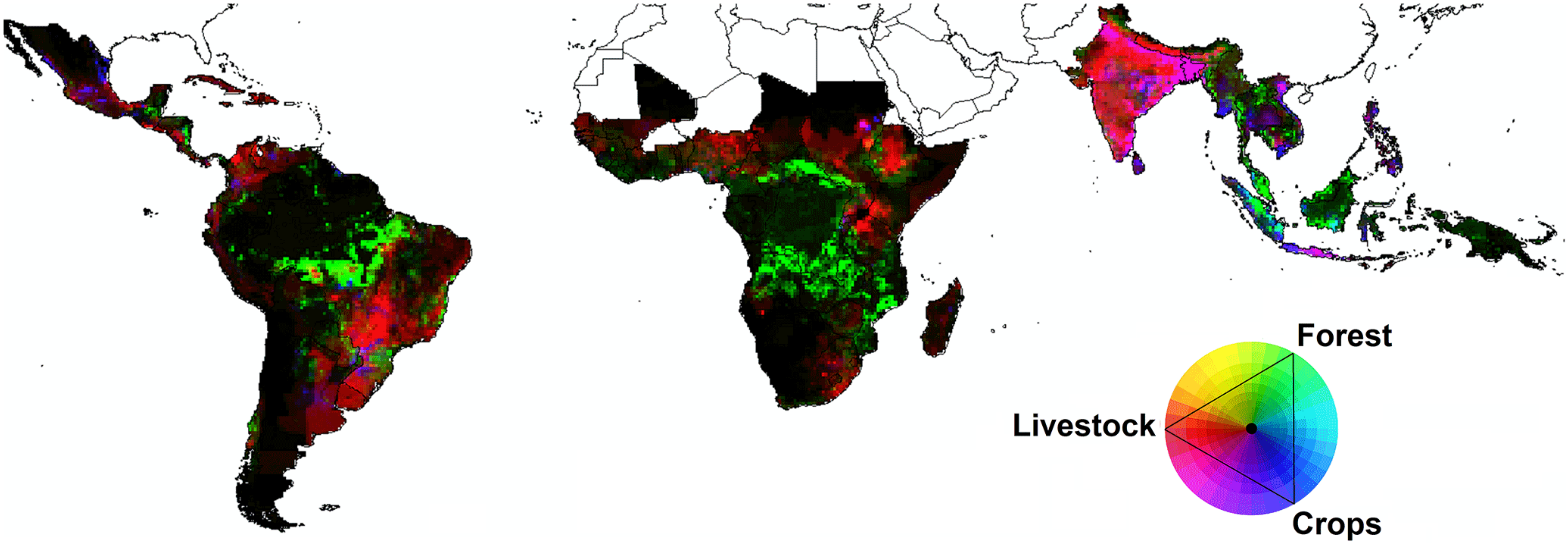
Forests moderate local climate extremes



Black symbols = deforestation; Green symbols = afforestation/reforestation

Contribution of the leading emission sources to emissions 2000–2005



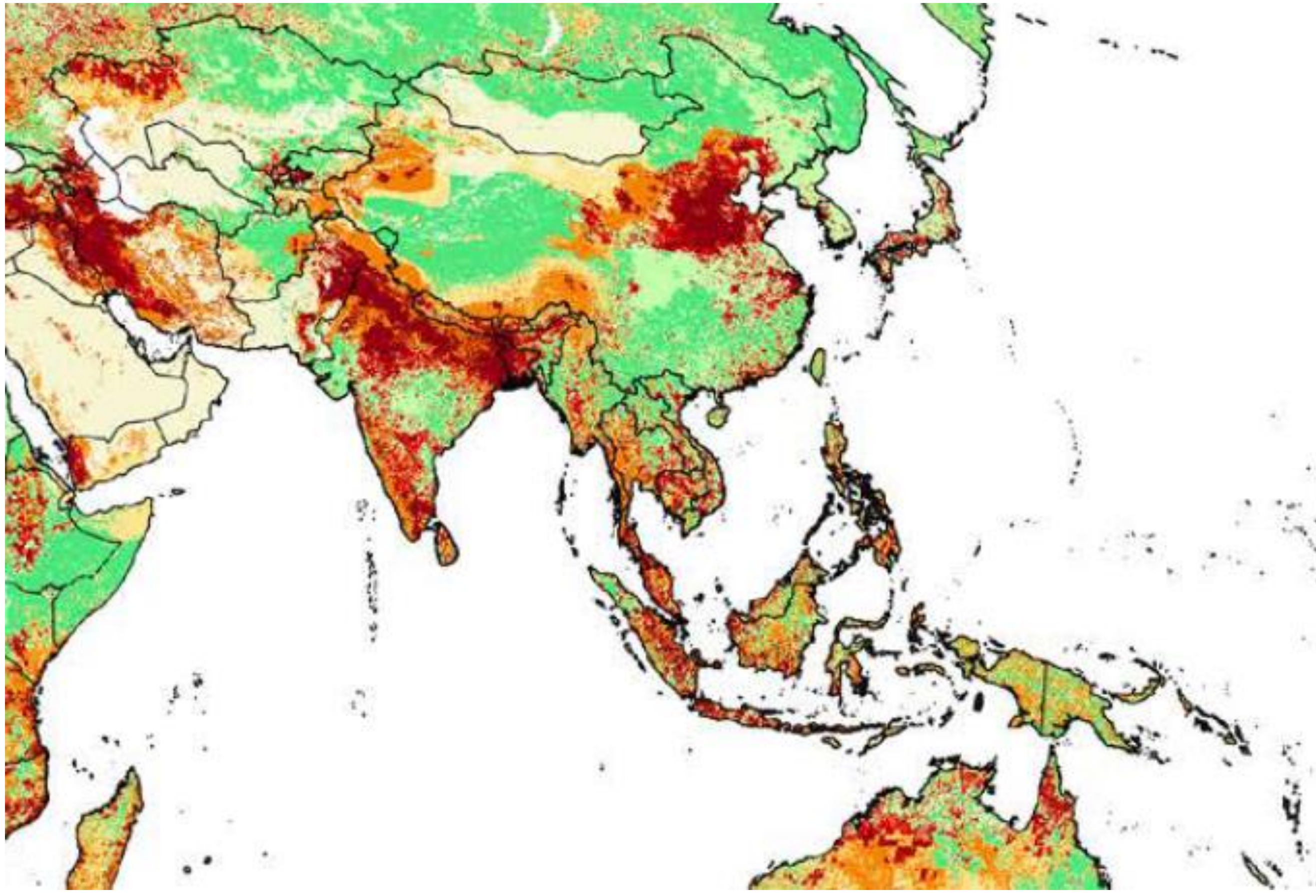
Source: Roman-Cuesta et al. (2016)

Table SPM1. Net anthropogenic emissions due to the global food system (Panel 2)

Food system component	Emission ($Gt\ CO_2\ y^{-1}$)	Share of mean total emissions %
Crop and livestock production (N_2O and CH_4)	6.2 ± 0.3	12 – 13%
Deforestation and peatland degradation for food production (primarily CO_2)	4.8 ± 2.4	5 – 14 %
Supply chain (primarily CO_2)	3.8 ± 1.3	5 – 10 %
Food system total	**14.8 ± 3.4**	**23 – 35 %**

Land and natural resource degradation is widespread

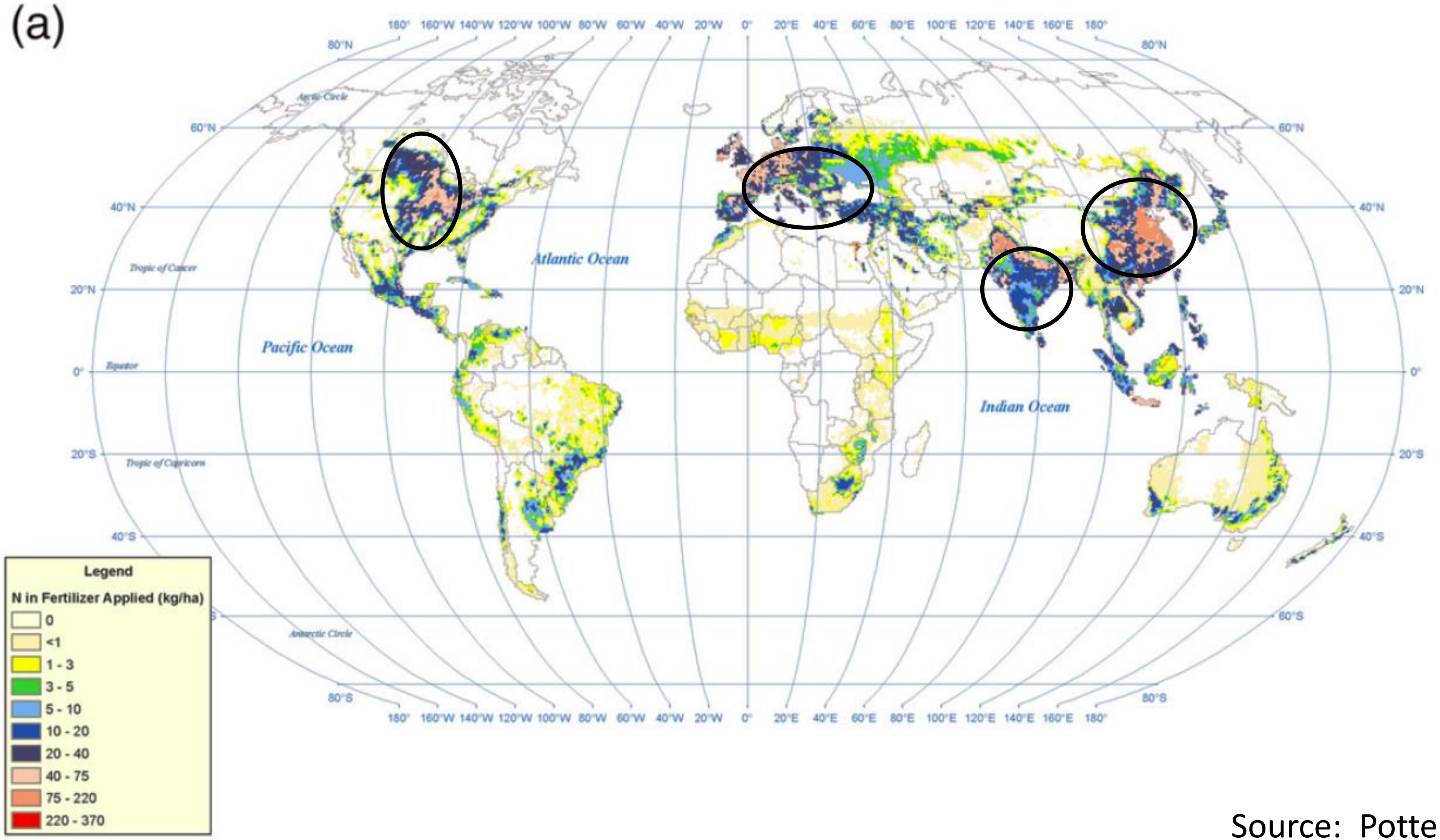
- 34% of agricultural lands are degraded
- 70 – 80% of all forests worldwide have been altered
- Hotspots: South and Southeast Asia



Strong human-induced land degradation
Light human-induced land degradation
Strong deterioration under low pressure
Light deterioration under low pressure
Stable or improvement under high pressure
Stable or improvement under low pressure
Bare

Source: FAO SOLAW 2021

High rates of Fertilizer N application drive high N_2O emissions in E and S Asia



Source: Potter et al. (2010)

Economic trends

Meat consumption will drive increased GHG emissions

- Global livestock population – 17 billion animals
- Meat consumption has almost tripled in the last four decades and has increased by over 30% in the last ten years.
- Dairy consumption is up by over 70 percent in the last four decades.
- Greatest consumption increases are seen in East and Southeast Asia (>3% y^{-1} through 2020)

Economic trends

Meat consumption will drive increased GHG emissions

- Animal and feed management:
  - CH_4 inhibitors, oils and fats, oilseeds, electron sinks, and tanniferous forages
  - Absolute reductions ~21%; no negative effect on live weight gain
- Diet formulation
  - Decreasing dietary forage-to-concentrate ratio, increasing feeding level, and decreasing grass maturity
  - Intensity reductions ~12%; increased animal production by on average 45%

Rice

Both a victim and a contributor to climate change.

Drought, flood, saltwater, and extreme temperatures devastate crops and risk the livelihoods of 144 million smallholder rice farmers each growing season

Rice cultivation contributes ~10% of anthropogenic CH_4

Breeding new varieties supports resilience to climate shocks

Water, nutrient, and residue management can reduce CH_4 emissions ~80%, but increases N_2O → Net result 50% lower GHG emissions

Monogastrics produce much less GHG than ruminants

Non–carbon dioxide emissions for producing carcasses of beef and pork

	Emissions from cattle		Emissions from pigs	
	kg CO_2 equivalents/ kg carcass	%	kg CO_2 equivalents/ kg carcass	%
Nitrous oxide				
Feed	1.25	12	0.38	13
Manure	1.07	10	0.07	3
Methane				
Manure	1.78	17	2.06	75
Enteric	6.33	61	0.24	9
Total non–carbon dioxide emissions	10.43	—	2.75	—

Source : Carlsson Kanyama and González (2009)

Organic soils

Some of the highest emissions per ha

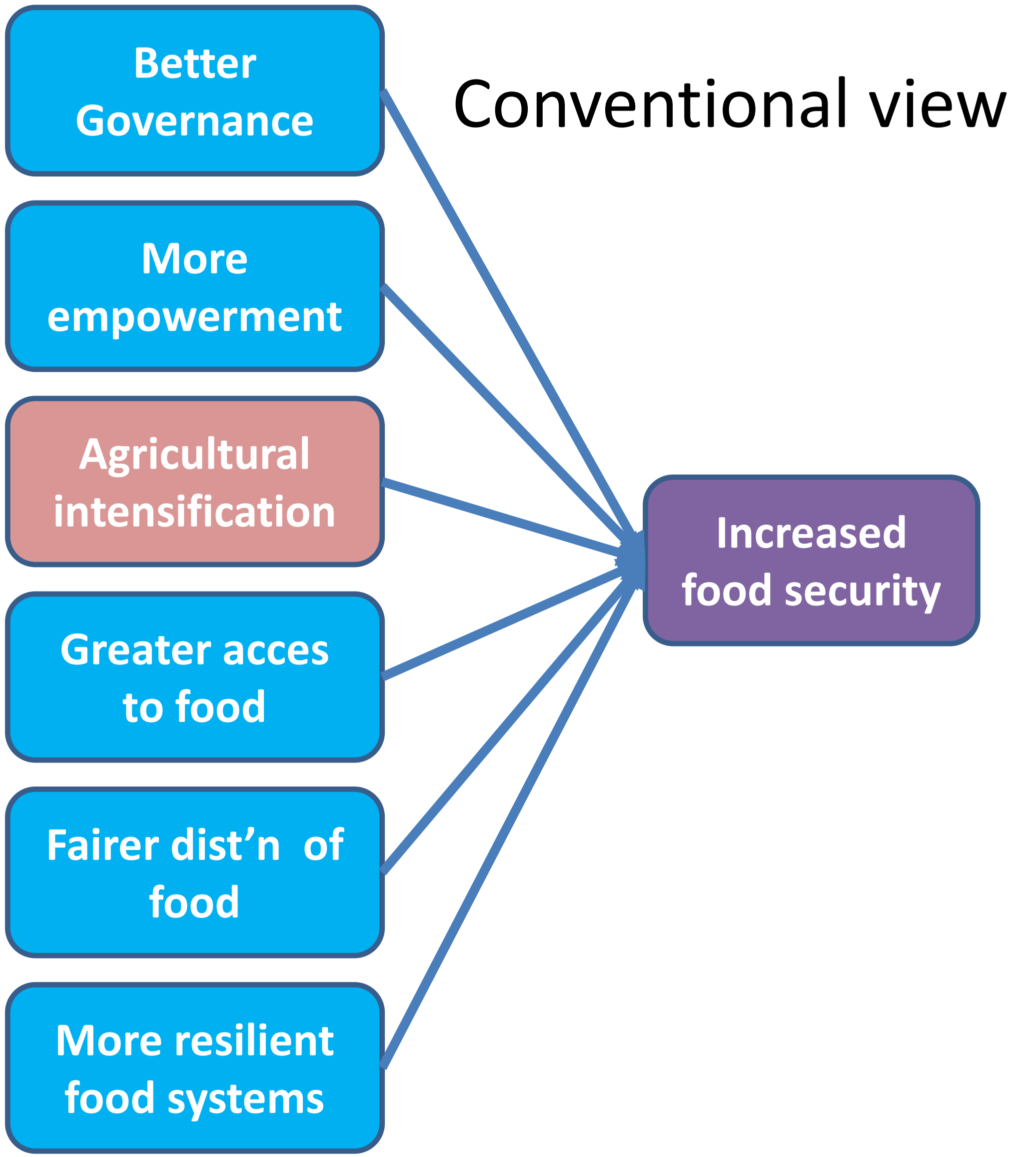
- Over 8.5 million ha have been drained for agriculture in Southeast Asia.
- Emissions from these are around 0.2 billion tonnes CO_2eq annually.
- Fire and fertilization of these soils create more emissions.

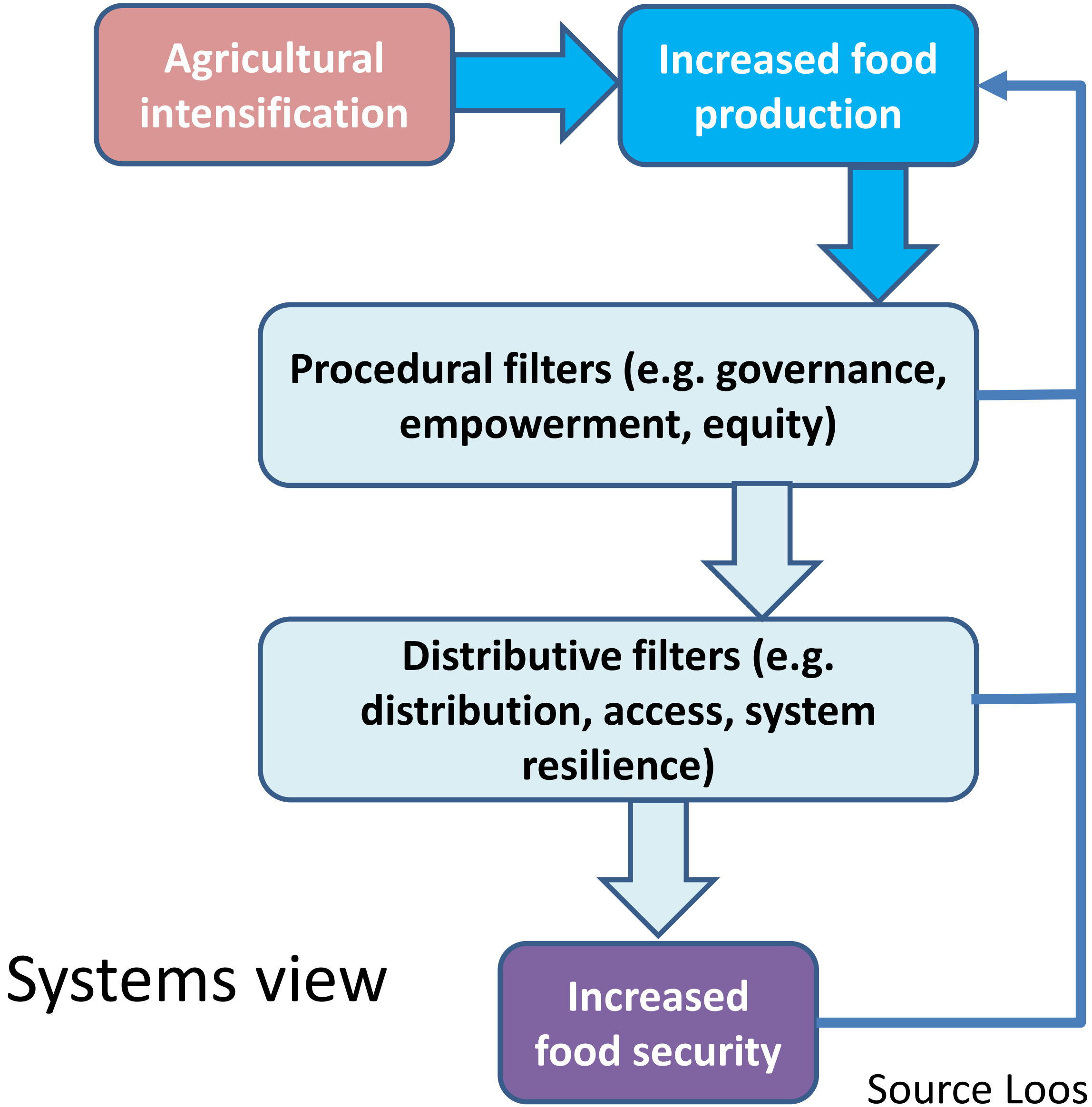
Aquaculture

A growing emissions source

- Production of fish and shellfish in aquaculture > 55 Mt (~half global fish consumption).
- This production has high N_2O emissions, which are predicted to increase to about 6% of anthropogenic N_2O emissions by 2030.

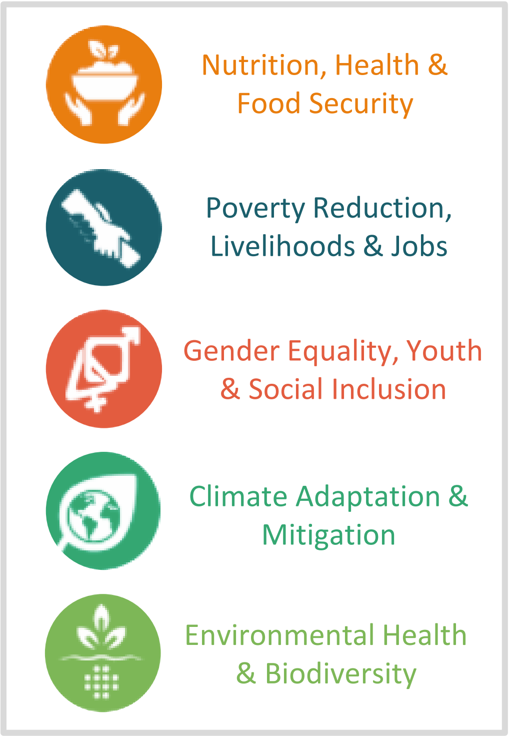
The governance context for investments is important

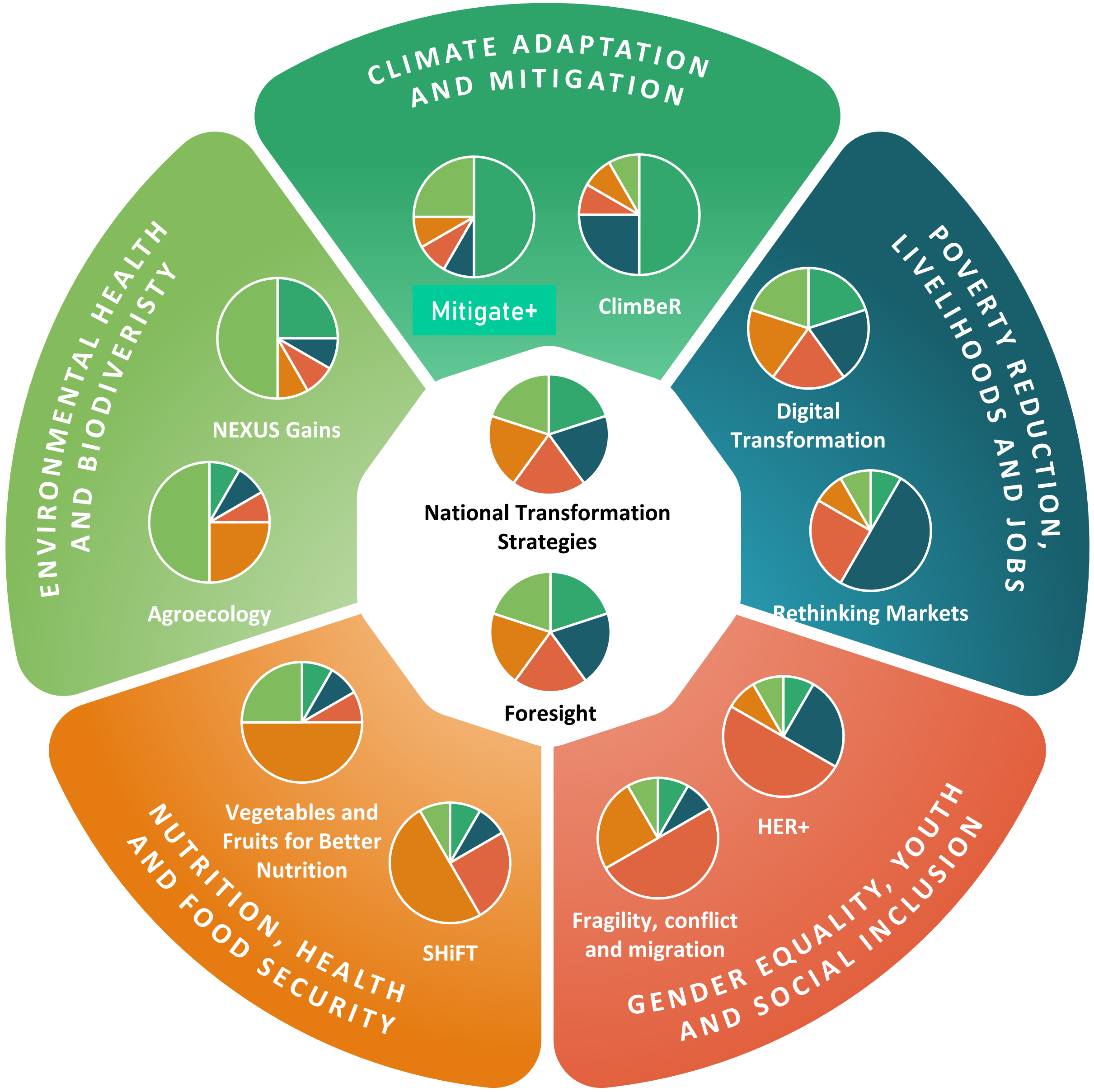




Source Loos et al., 2014

CGIAR reorganization: System Transformation Initiatives





Thank You!

To continue the conversation:
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