JIRCAS-NARO International Symposium on Agricultural Greenhouse Gas Mitigation, August 31st 2017, Tsukuba, Japan

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Climate-Smart Village:

RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CGIAR CCAFS

An integrated scaling up approach to mitigating climate change in African agriculture

ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

Robert Zougmoré, Eva Wollenberg, Samuel Partey, Dawit Solomon

Presentation outline

1. **Food security, agriculture & mitigation targets in Africa**
2. **The Climate-Smart Village approach**
3. **Promising mitigation opportunities in Africa**
   a. Agroforestry
   b. Increased sequestration of soil carbon
   c. Intensification of livestock
   d. Improved emission data
4. **Incentives for upscaling LED options in Africa**

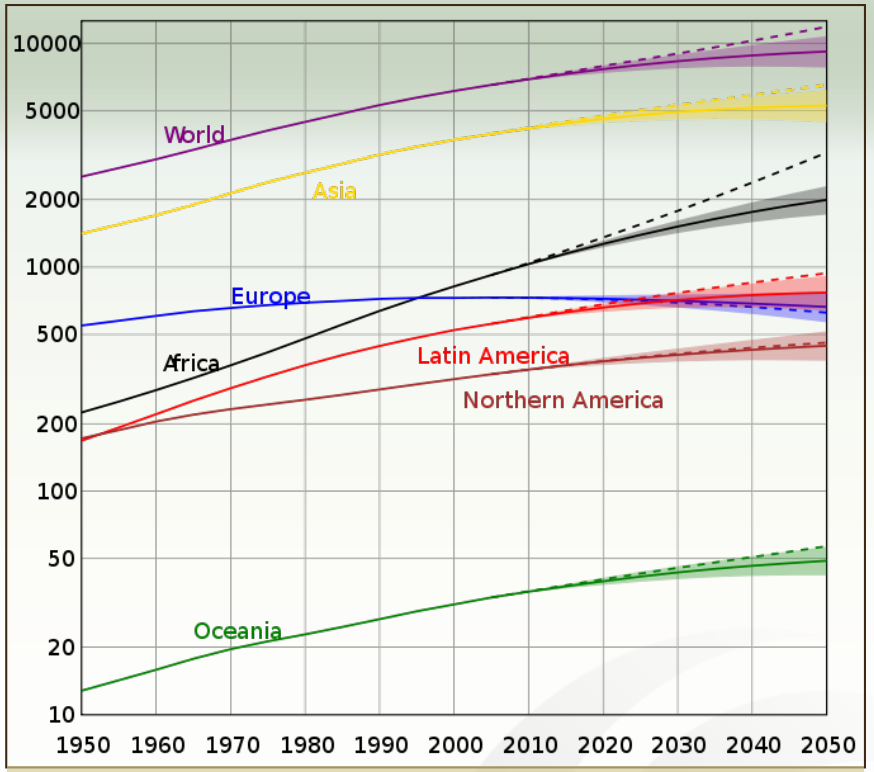
Agricultural GHG Emissions in Sub-Saharan Africa

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

Importance of smallholder farms in SSA:

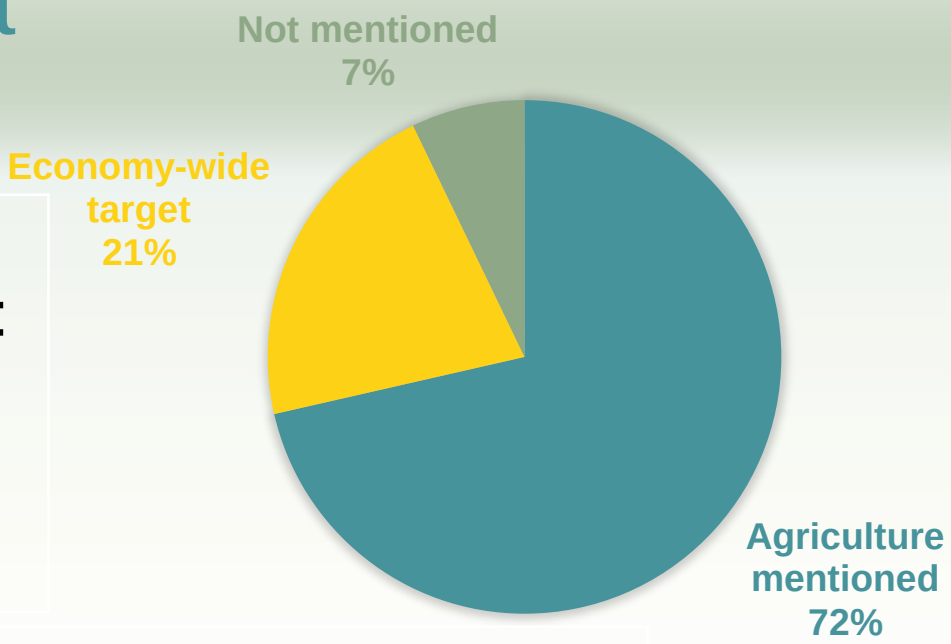
1. 75% of agricultural production and of job production in SSA (AfDB, 2010)
2. 80% of farms < 2 ha (FAO 2010)
3. Yields are very low (~1 Mg ha-1)

Agriculture contributes roughly 14% of total anthropogenic GHG emissions (Herzog 2009)



- **60-70% more food** by 2050 to meet global demand
- Africa 2.4 billion by 2050

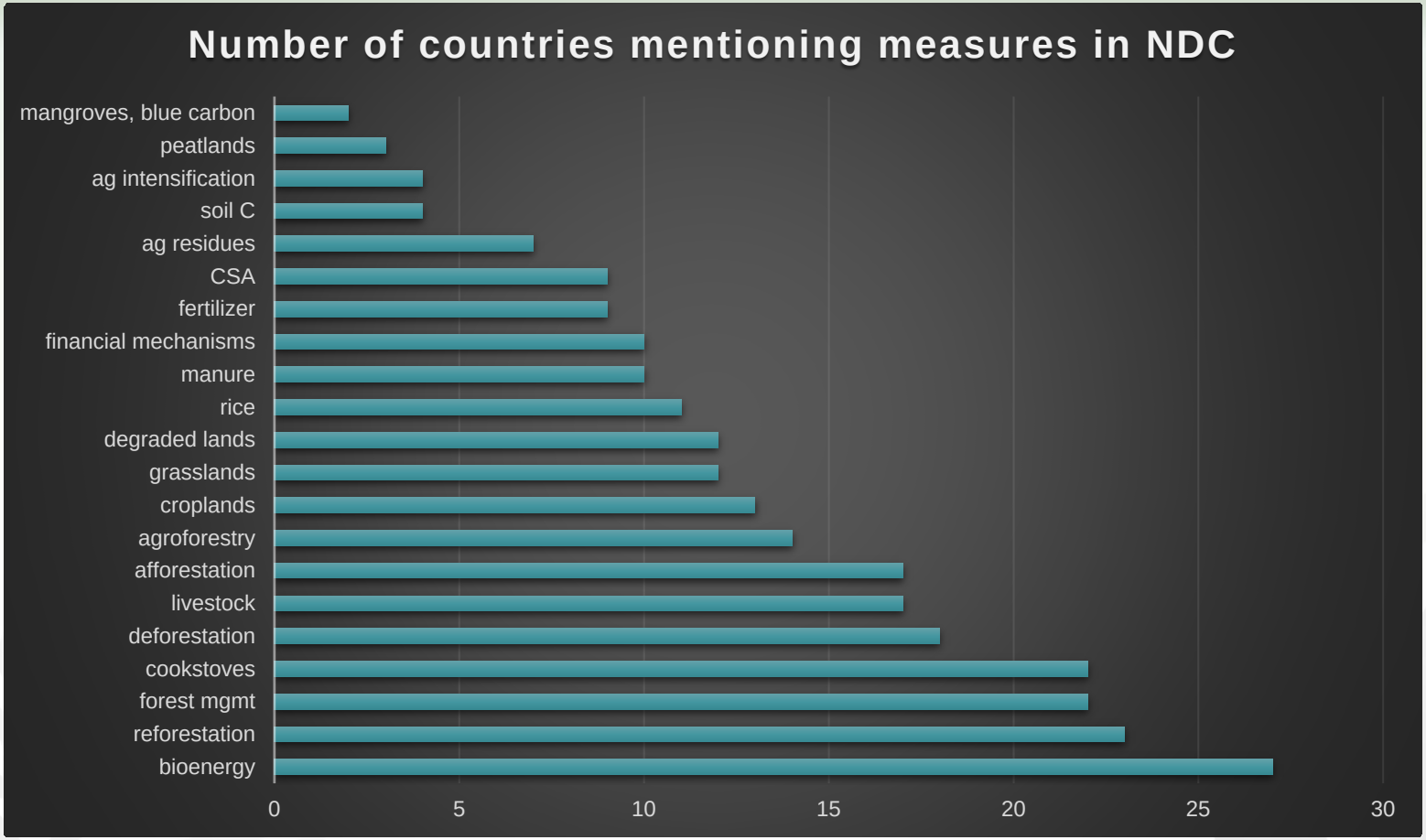
Prominence of agriculture in the NDCs: Africa



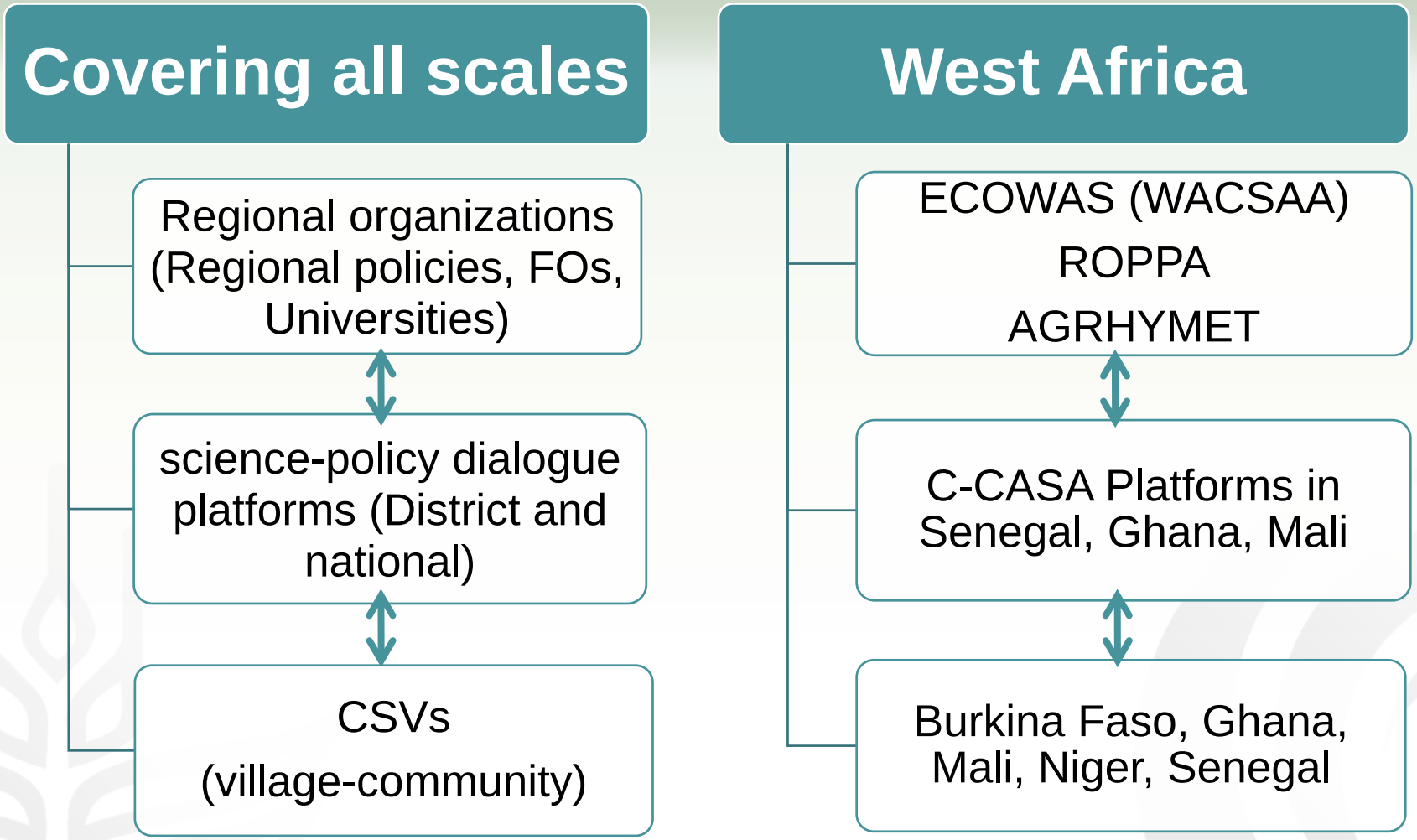
Of the 41 African countries that signed Paris Agreement:

- 72% explicitly included agriculture in their mitigation target
- 8 countries quantified agriculture-specific targets, all against BAU: Benin, Chad, Comoros, Côte d'Ivoire, Chad, Gambia, Mali, Nigeria
- For example: Ethiopia, 90 MtCO2e (48.6%) reduction against BAU in 2030, conditional

Mitigation measures for African countries submitting NDCs (n=41)



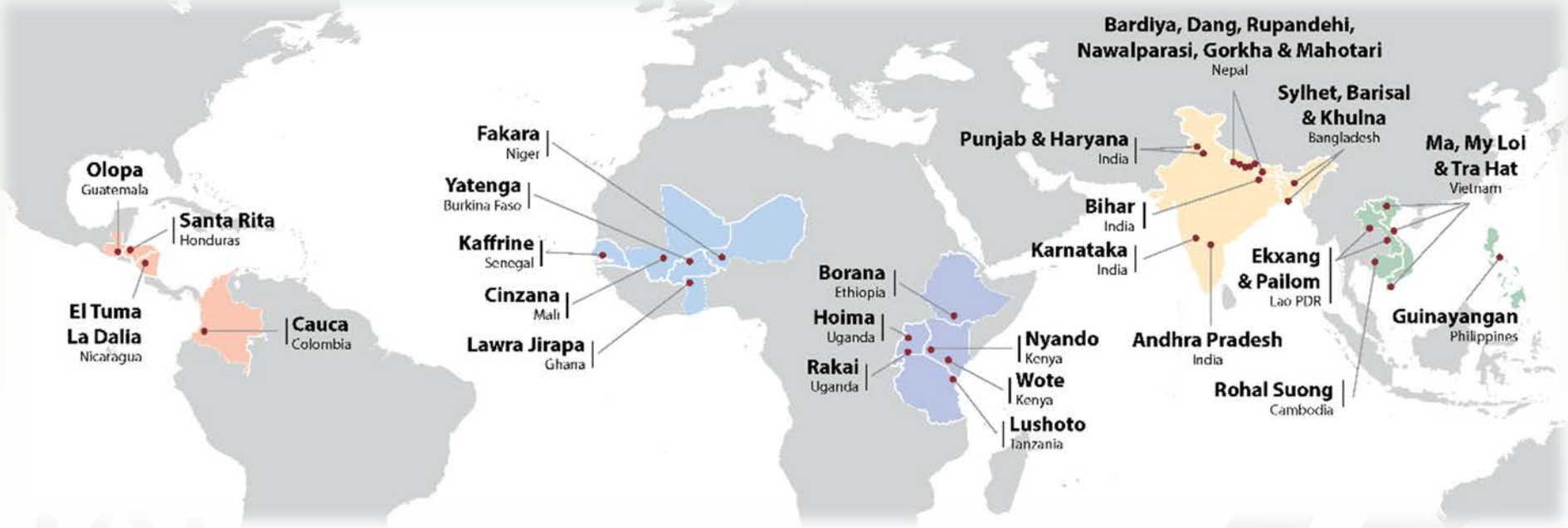
CCAFS working from CSVs up to policy engagement with regional organizations




Integrated solutions:
Climate-Smart
VILLAGES

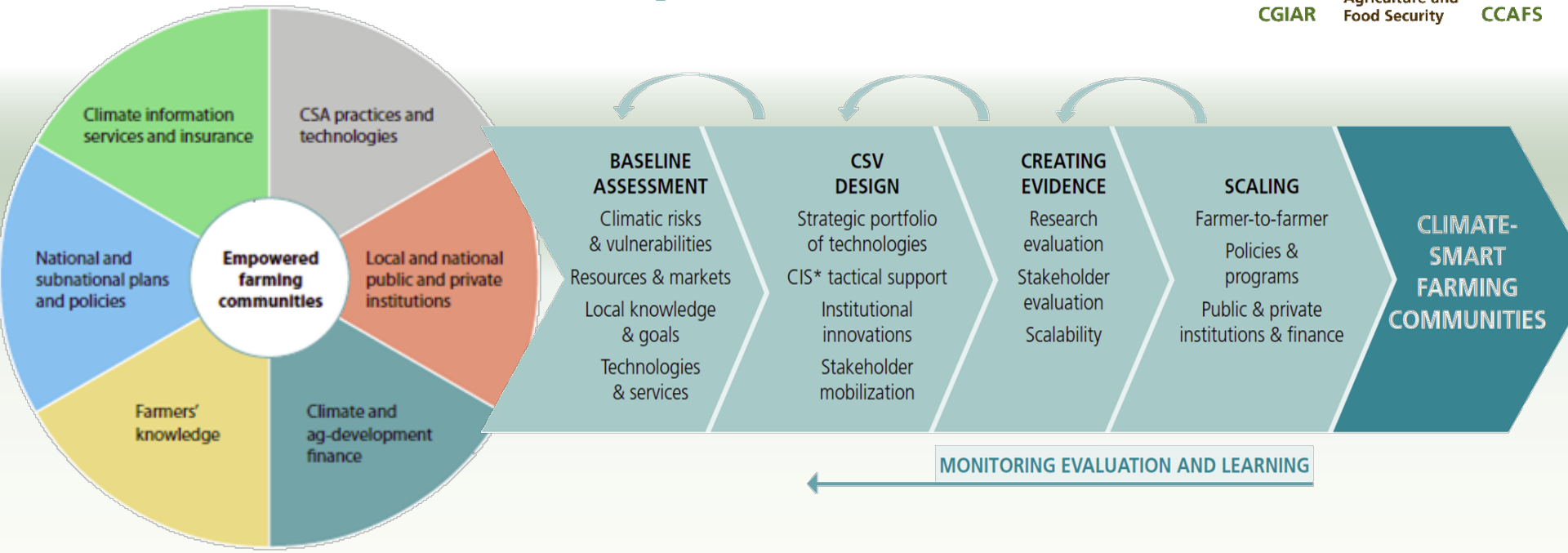
Climate-Smart Village AR4D approach

It addresses the need for proven and effective CSA options in a real-life setting and facilitates co-development of **scaling mechanisms** towards landscapes, subnational and national levels.



- 36 CSV sites in 21 countries
- Field and participatory testing of more than 40 practices and technologies
- 13 with mitigation potential
- Learning platform in Phase 2: testing emerging technologies/practices from AFS CRPs

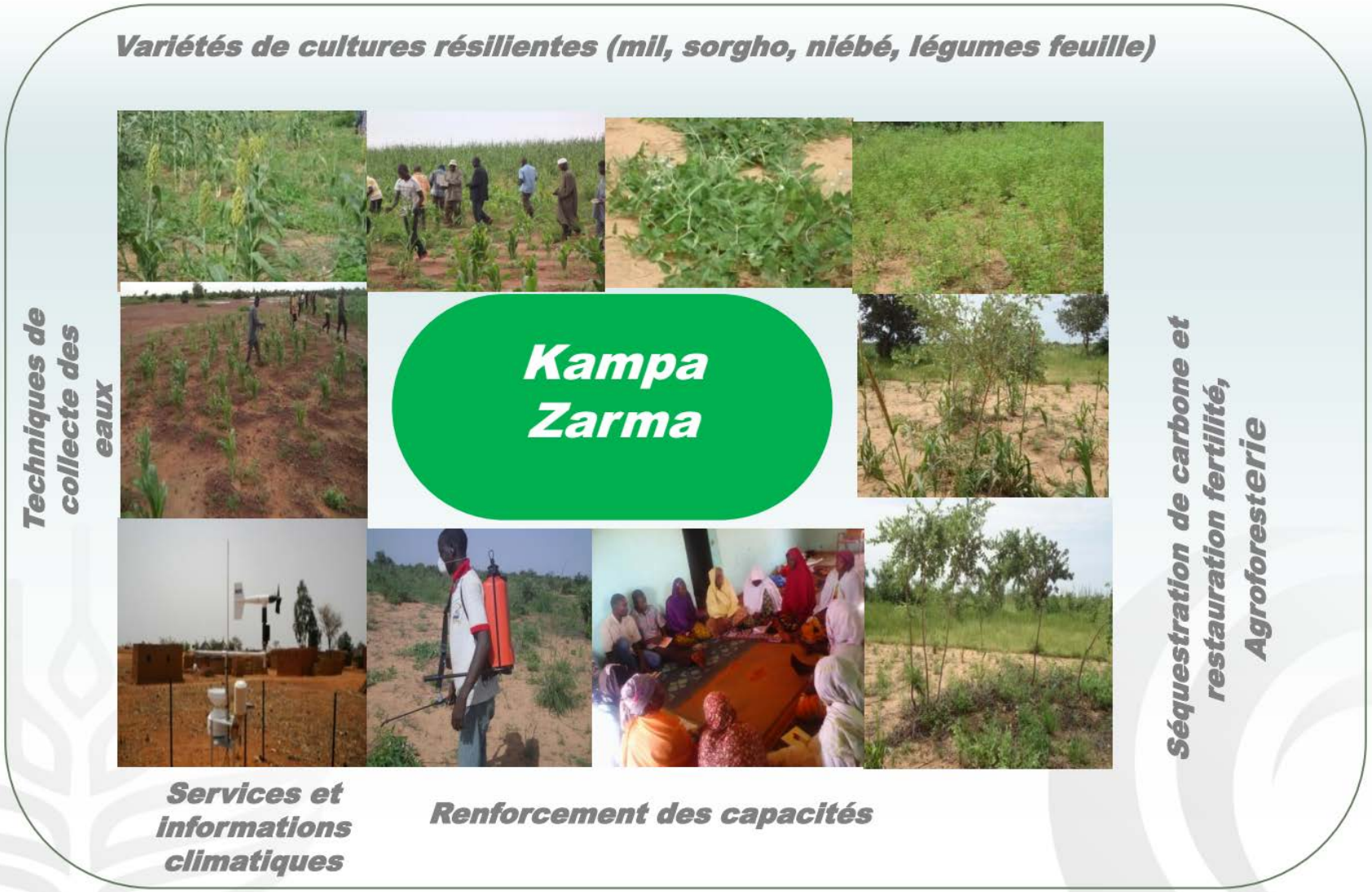
The CSV AR4D implementation:



Components considered in a CSV AR4D Site

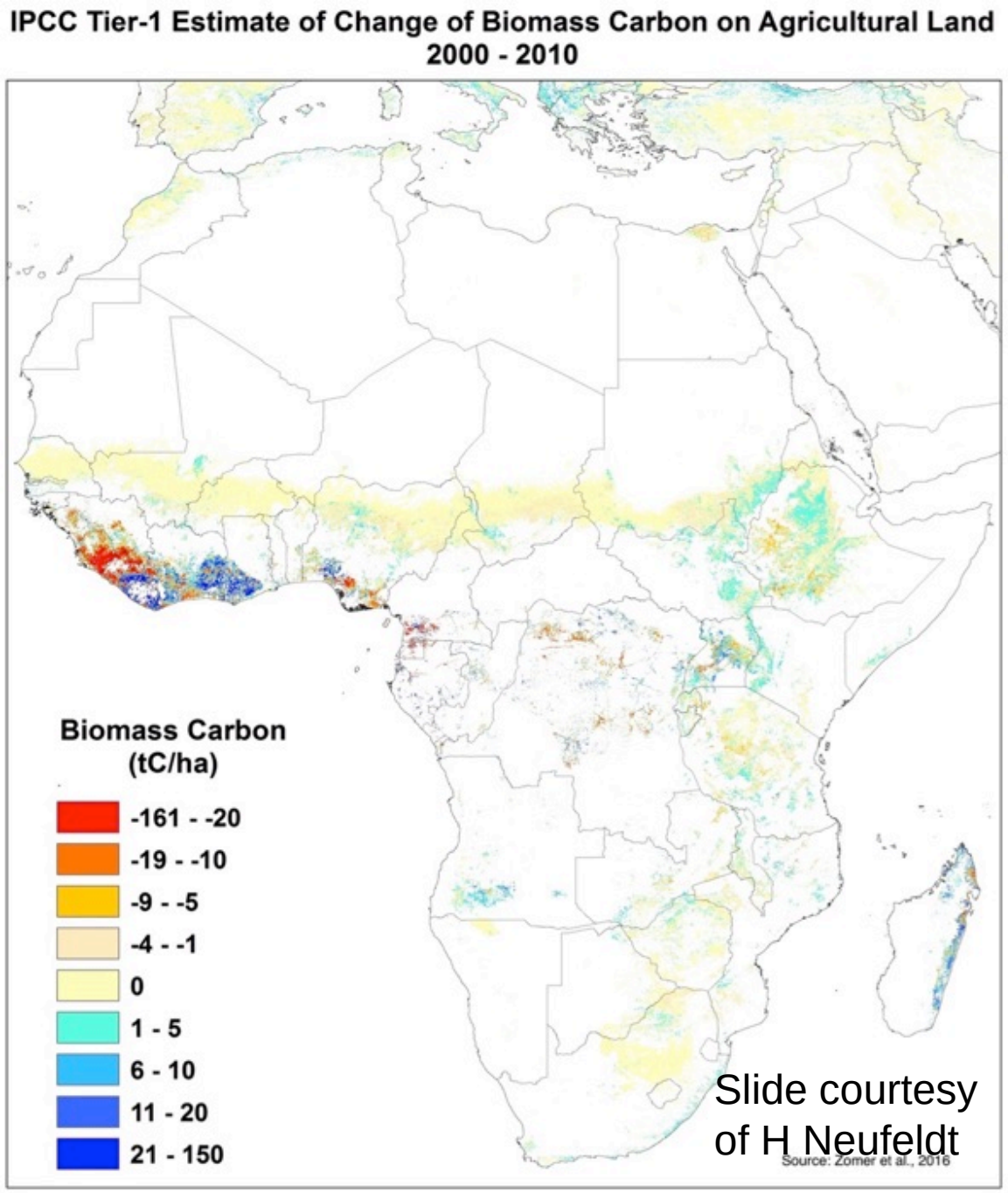
Types of climate-smart options

Example of AR4D CSV of Niger



Above and Below Ground Biomass Carbon on Agricultural Land

- Hot spots of of biomass carbon loss in West Africa
- Sierra Leone - 25% decrease
- Guinea – 14% decrease
- Cameroon – 7% decrease
- Nigeria – 6% decrease
- Tanzania – 16% decrease
- Equatorial Guinea – 18%
- Cote d'Ivoire – 7% increase
- Ghana – 23% increase
- Madagascar – 24% increase



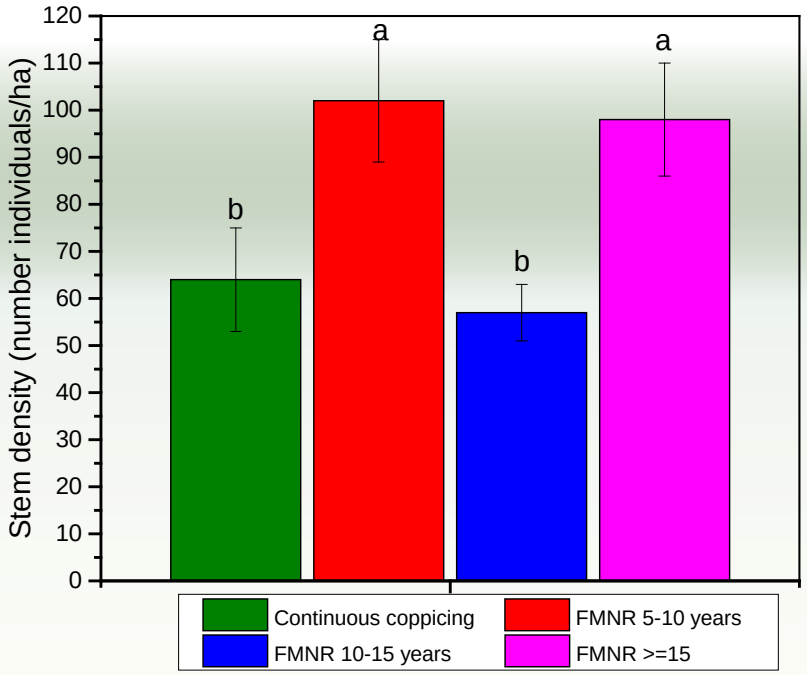
Slide courtesy of H Neufeldt

Mitigation through agroforestry in East Africa CSVs

Trees' contribution to biomass carbon on agricultural lands in Nyando, Lushoto and Hoima CSVs. Planted for fodder, forage, fuelwood, fruits, and timber

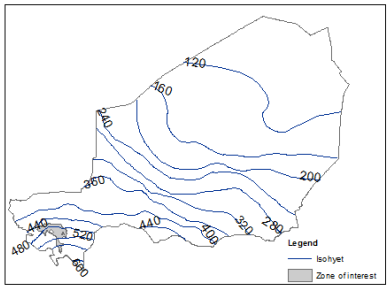
- Lushoto CSVs: In a five year period, ~500,000 trees planted in 7 out of 29 test villages
- Towards achieving 10% tree cover on farm in accordance with local government policy
- Nyando CSVs: In a five year period, over 550,000 trees planted in 7 out of 106 test villages
- Towards achieving 5% tree cover on-farm as rec. by Kericho and Kisumu County governments
- Hoima CSVs: In 3yr, ~4,700 fruit trees (mangoes, and pawpaws) grown in 7 test villages out of 57
- Spearheaded by CCAFS partners (public & private)

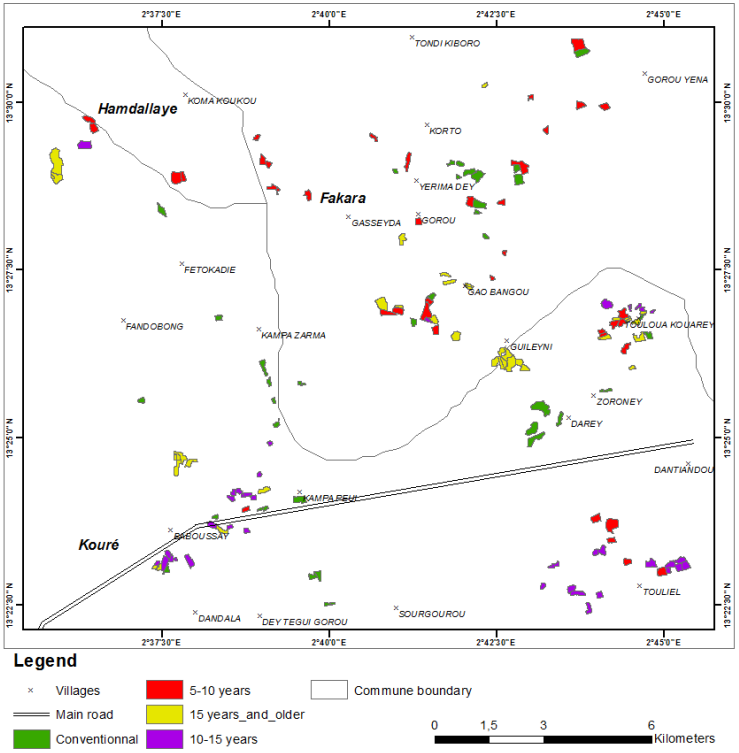
Farmer Managed Natural Regeneration (FMNR): an agroforestry option at CCAFS CSV site of Niger

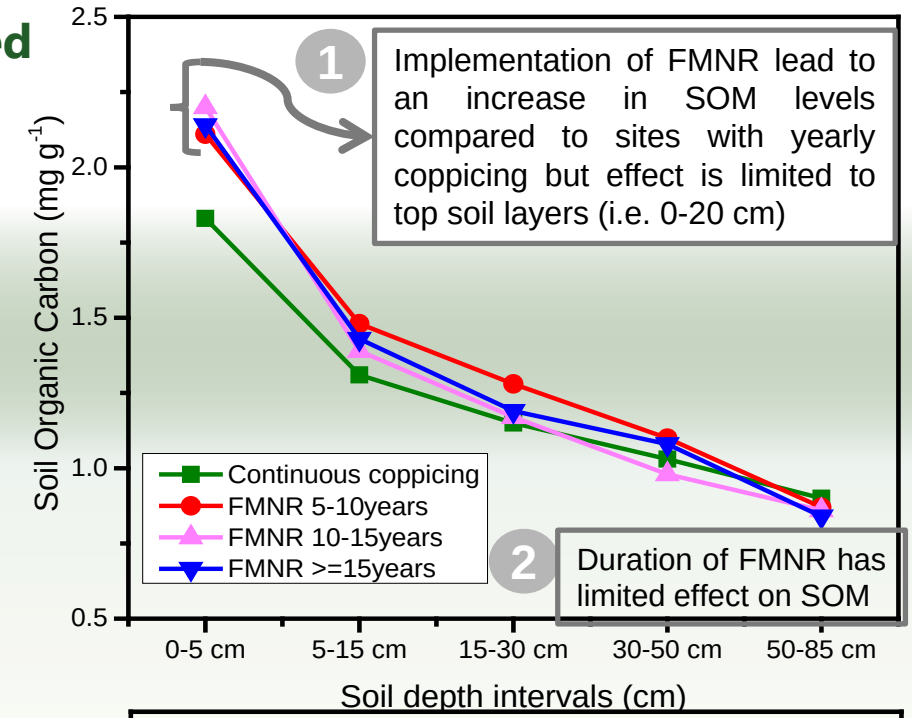


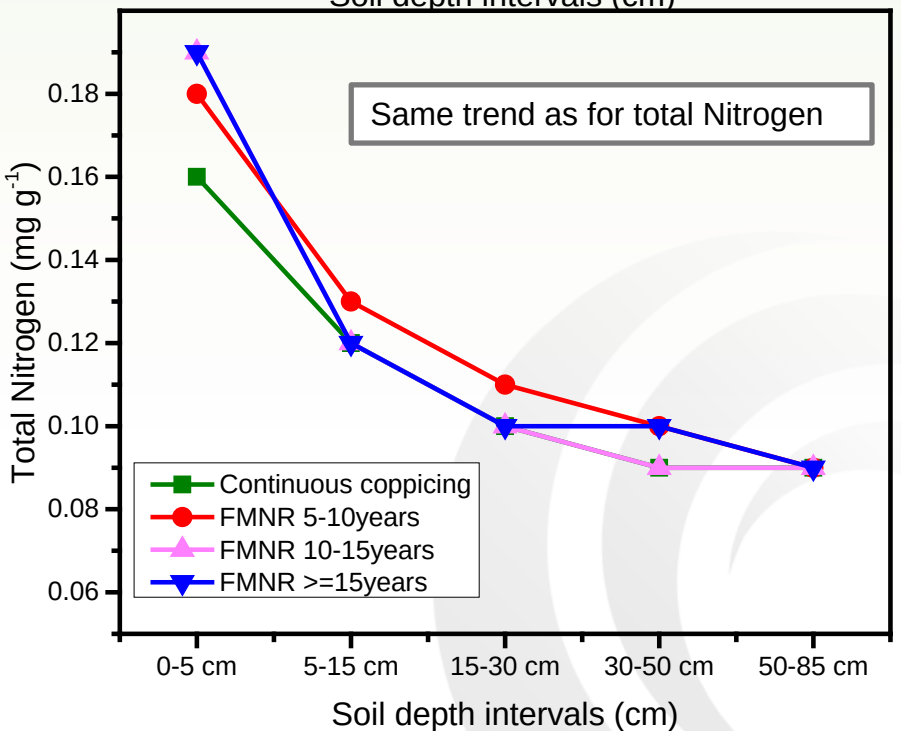
Selection and protection of useful tree species
Crops beneath trees
widespread enthusiasm & application of FMNR in the Sahel

Soil carbon and nitrogen status as influenced by Farmer Managed Natural Regeneration





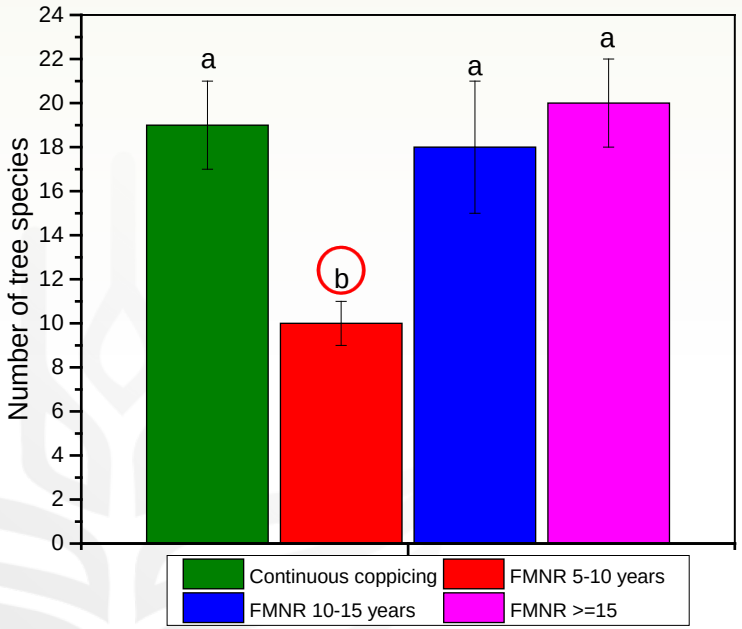


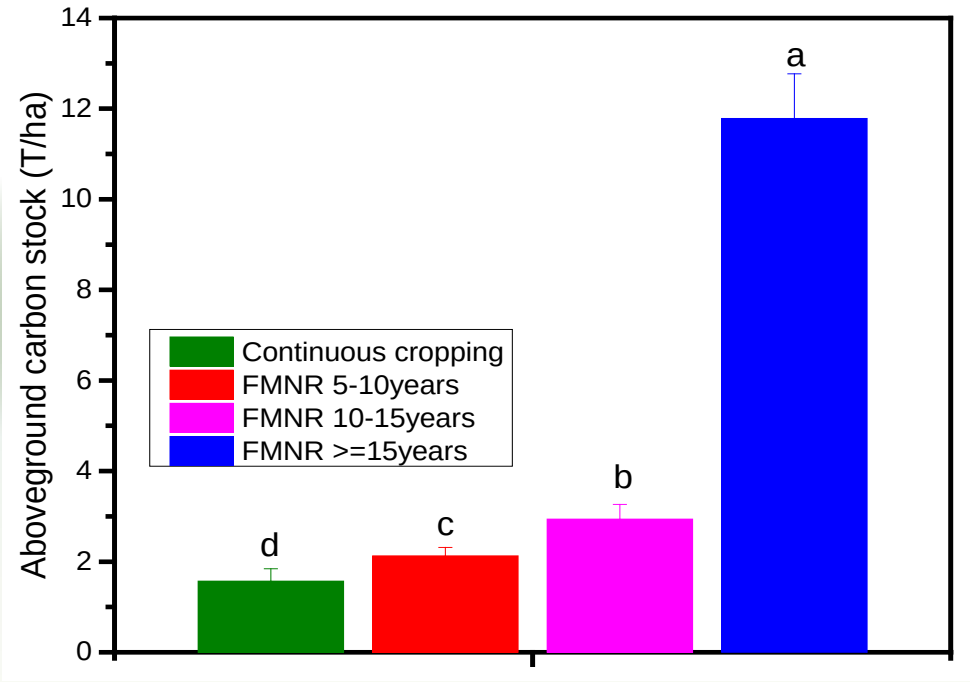


Activities:

- ✓ Farmland tree biodiversity inventory
- ✓ Soil sampling and analysis

Effects of FMNR on soil carbon, nitrogen and fertility status





1. The significant differences between continuous coppicing and land use under implementation of FMNR

2. Aboveground carbon stock (biomass) accumulate with age and vegetation maturity as length of time of FMNR increases

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Does conservation agriculture deliver climate change mitigation through soil carbon sequestration in tropical agro-ecosystems?

David S. Powlson[a], Clare M. Stirling[b], Christian Thierfelder[c], Rodger P. White[d], M.L. Jat[e]

Meta-analysis of SOC changes under CA practices in two tropical regions, the Indo-Gangetic Plains (IGP) and Sub-Saharan Africa (SSA) show ***modest*** increases in SOC stock:

- IGP annual increases in SOC stock compared to conventional practice were between 0.16 - 0.49 Mg C ha^{-1} yr^{-1}.
- SSA increases between 0.28 - 0.96 Mg C ha^{-1} yr^{-1} , but with much greater variation and a significant number of cases with no measurable increase.
- Mitigation potential, and other benefits, from crop diversification are frequently overlooked but warrant greater attention.

Existing agricultural development practices can reduce emissions or emission intensity (1)

USAID PROJECT: ADVANCE II GHANA

Reduced tillage, crop residue burning reduction, nutrient management, AWD

- Yield increases of 51% - 149%
- AWD in rice - reduced emissions 43%
- Reduced burning and residue increased SOM
- Post-harvest losses reduced from 30 to 10%

Emissions intensity decreased

- Maize 117%
- Soybean 267%
- Irrigated rice 66%

Dairy NAMA development in Kenya

Livestock GHG emissions contribute ~90% of Kenya's agricultural emissions, ~20% from dairy; 70% of milk produced on smallholder farms

- **Partners:** State Department of Livestock, Kenya Dairy Board, CCAFS, UN FAO, UNIQUE forestry and land use GmbH, ICRAF, ILRI
- **Outputs:** Concept note submitted to GCF; IFAD to develop full proposal (2018)
- **Dairy NAMA objective:** Over 10 years, transform Kenya's dairy sector to a low-emission and climate resilient development pathway, while improving livelihoods of male and female dairy producers (8.8 MtCO2e reductions, 430,000 beneficiaries)
- **Core strategies:** Incentivizing & building capacities of dairy processors to invest in sustainable intensification in their own supply chains; access to affordable credit & building banks' capacities to serve the sector.
- **Components:**
  - Gender-inclusive dairy advisory services provided by processors
  - Credit for on-farm investment & fodder production
  - Energy efficiency in processing plants and biogas on-farm
  - Public-private policy dialogue and national MRV capacity development
- **Financing:** Focus to leverage investment by processors and banks for sustainable financing: GCF: $56m; IFAD: $14m; GoK: $2m; Banks: $107m; Private sector: $42m

Existing agricultural development practices can reduce emissions or emission intensity (2)

USAID PROJECT REGAL- KENYA

Feed and herd management improvement

- Yield increase 50%

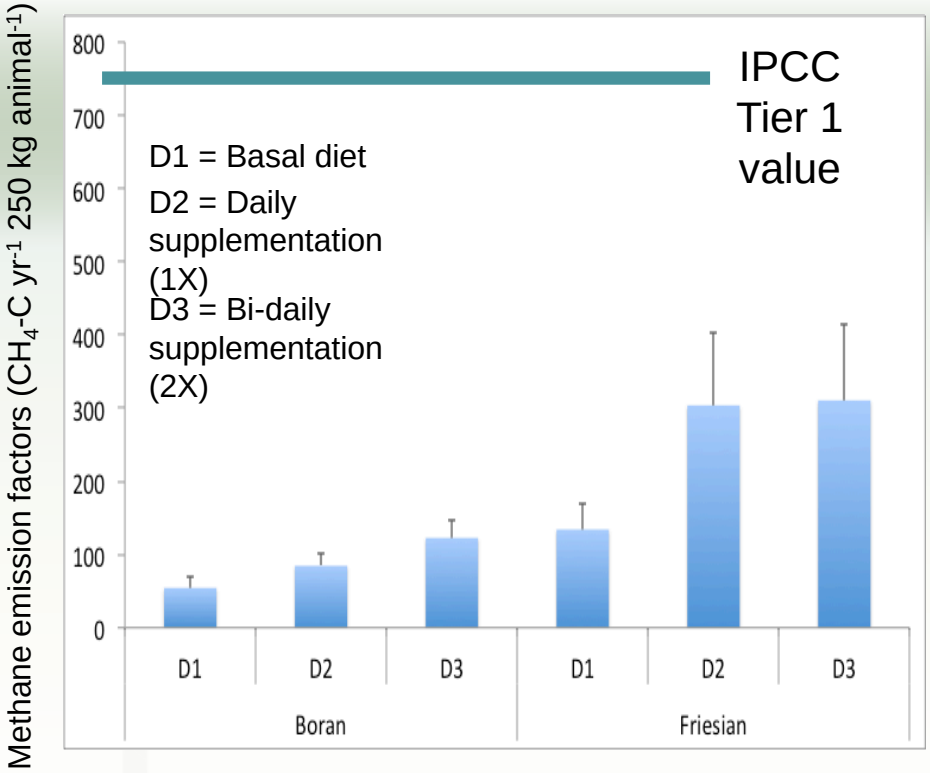
- Emissions reduction mostly from reducing numbers of animals (10% reduction)
- Some from improved feed (minor)

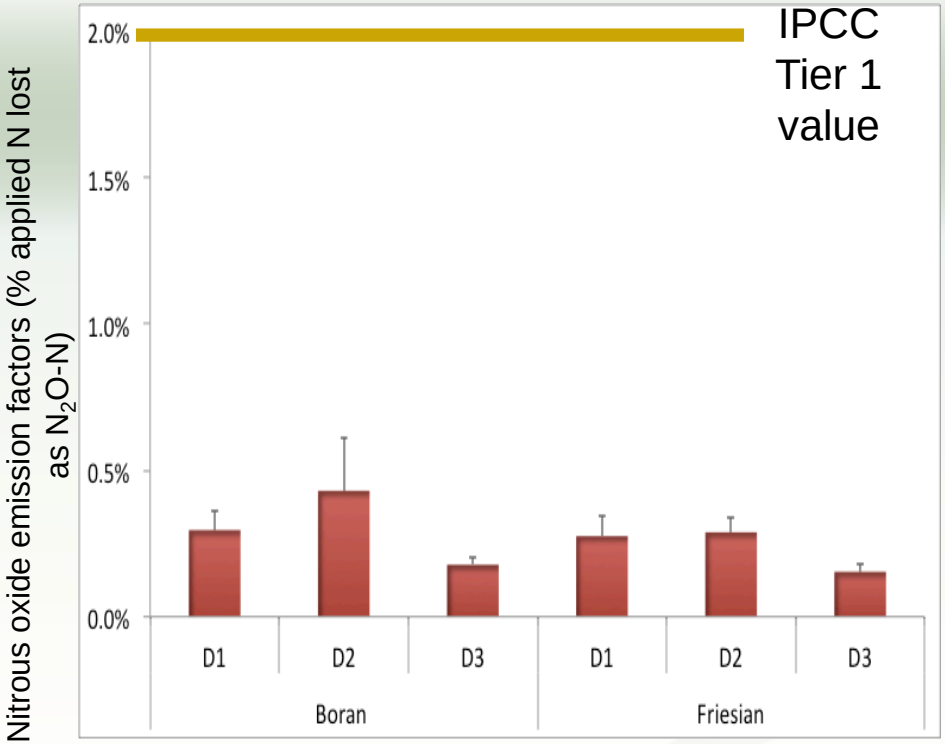
Emissions intensity decreased

- Cattle 34%
- Sheep 40%
- Goats 40%
- Camels 33%

EI = GHG Emissions / unit product

Why regional GHG emission factors are required for Sub-Saharan Africa





- IPCC estimates for CH_4 emission factors were 3 to 8.5 times greater while IPCC estimates for N_2O emission factors were 4 to 13 times greater than measured emission factors
- Reason: likely related to poor quality diets, resulting in low quality manure (high C:N ratio) limiting the production of GHG when compared to other regions (e.g. developed world)

Caution: This is from only one study. More studies from other areas/climates/farming systems within sub-Saharan Africa are required

Slide courtesy of D. Pelster, ILRI

Mazingira Centre activities

(fully operational since summer 2015,strongly supported by KIT, Germany)

Vision:

- to provide crucial environmental baseline data for East Africa
- to serve as center for capacity building for environmental observations and assessments
- hub for scientific exchange in Kenya

CCAFS data sets and emission factors for Africa (see SAMPLES web page)

Country	Crops/livestock	Mitigation options tested	Center	People	Published
Tanzania	Maize	Conservation ag w/ N-fixing trees	ICRAF	Kimaro et al.	✓
Kenya	Forages, tea, veg, maize, cassava	None	ICRAF	Rosenstock et al.	✓
India	Rice-wheat	Tillage, residue, N mgmt	CIMMYT	Sapkota et al.	✓
India	Maize-wheat	Crop establishment, tillage	CIMMYT	Sapkota, Jat	✓
India	Rice-wheat	Tillage, residue mgmt	CIMMYT	Sapkota et al.	✓
India	Maize-wheat	Precision N mgmt	CIMMYT	Sapkota et al.	✓
Kenya	Mixed (landscape gradient)	None	ILRI/CIFOR	Butterbach-Bahl, Rufino	✓
Philippines	Rice	AWD	IRRI	Sander et al.	✓
Philippines	Rice	Straw burning	IRRI	Romasanta et al.	✓
Philippines	Rice	Water & straw mgmt b/w crops	IRRI	Sander et al.	✓
Kenya	Manure on pasture	EF for African cattle breeds	ILRI	Pelster, Butterbach-Bahl	✓
Philippines	Rice	Diversified cropping systems	IRRI, ILRI	Weller et al.	✓
Colombia	Cattle urine on pasture	Biological nitrification inhibition	CIAT	Byrnes et al.	✓
Colombia	Cattle- enteric	Forage composition	CIAT	Chirinda, Arango	
Kenya	Cattle- enteric	Feeding strategies, manure mgmt	ILRI	Goopy	
Mexico	Wheat and maize	Tillage and residue mgmt	CIMMYT	Ortiz-Monasterio	

What incentives for upscaling LED options?

National level

- Meet NDC commitments
- Access climate finance

Farmers

- New technical options
- Increased productivity
- Reduced costs from efficient use of inputs, such as fertilizer

Putting science into action for informed national development plans and policies

National science-policy dialogue platforms, CSA alliances, etc.:

- Expanding agricultural development could reduce much emissions (USAID cases), although expectations of practices like conservation agriculture are not optimistic.
- Agroforestry seen as priority by farmers in CSVs (bottom-up), but livestock is top priority for countries in NDCs (top down). Implementing mitigation at scale will need to bring together the bottom up and top down priorities
- Priority needs now are confluence of finance, information, extension, technology, markets, supporting policies, effective organizational structures among producers and processors.

CSV

National platform

Regional CSA alliance