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

Robert Zougmoré, Eva Wollenberg, Samuel Partey, Dawit Solomon
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

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)

Number of countries mentioning measures in NDC

- bioenergy
- reforestation
- forest mgmt
- cookstoves
- deforestation
- livestock
- agriculture
- rice
- degraded lands
- grasslands
- croplands
- agroforestry
- afforestation
- livestock
- deforestation
- cookstoves
- forest mgmt
- reforestation
- bioenergy
- mangroves, blue carbon
- peatlands
- ag intensification
- soil C
- ag residues
- CSA
- fertilizer
- financial mechanisms
- manure
- rice
- degraded lands
- grasslands
- croplands
- agroforestry
- afforestation
- livestock
- deforestation
- cookstoves
- forest mgmt
- reforestation
- bioenergy
CCAFS working from CSVs up to policy engagement with regional organizations

**Covering all scales**
- Regional organizations (Regional policies, FOs, Universities)
- science-policy dialogue platforms (District and national)
- CSVs (village-community)

**West Africa**
- ECOWAS (WACSAAM) ROPPA AGRHYMET
- C-CASA Platforms in Senegal, Ghana, Mali
- Burkina Faso, Ghana, Mali, Niger, Senegal
Integrated solutions:
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
Components considered in a CSV AR4D Site
Example of AR4D CSV of Niger

Variétés de cultures résilientes (mil, sorgho, niébé, légumes feuille)

Kampa Zarma

Techniques de collecte des eaux

Services et informations climatiques

Renforcement des capacités

Séquestration de carbone et restoration fertilité, Agroforesterie
Above and Below Ground
Biomass Carbon on Agricultural Land

- Hot spots 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
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

Implementation of FMNR lead to an increase in SOM levels compared to sites with yearly coppicing but effect is limited to top soil layers (i.e. 0-20 cm).

Duration of FMNR has limited effect on SOM.

Same trend as for total Nitrogen.
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.
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%

\[ EI = \frac{GHG}{	ext{unit product}} \]

Emissions = \[ GHG \]
Why regional GHG emission factors are required for Sub-Saharan Africa

IPCC estimates for CH₄ emission factors were 3 to 8.5 times greater while IPCC estimates for N₂O 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)

<table>
<thead>
<tr>
<th>Country</th>
<th>Crops/livestock</th>
<th>Mitigation options tested</th>
<th>Center</th>
<th>People</th>
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</table>
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.