Climate-Smart Agriculture in Rwanda

Supplementary Material

This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) - lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) - and the World Bank to identify country-specific baselines on CSA in Africa (Kenya and Rwanda), Asia (Sri Lanka), and Latin America and the Caribbean (Nicaragua and Uruguay). The document was prepared under the co-leadership of Andrew Jarvis, Andreea Nowak, and Caitlin Corner-Dolloff (CIAT), and Marc Sadler, Vikas Choudhary, and Valens Mwumvaneza (World Bank). The main authors of this profile are Désiré Kagabo (RAB) and Andreea Nowak (CIAT) and the team was comprised of Caitlin Corner-Dolloff (CIAT) and Miguel Lizarazo (CCAFS), and Elizabeth Minchew (CIAT-Consultant).

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ANNEX I: Acronyms

CCIOU	Climate Change and International Obligations Unit
CIAT	International Center for Tropical Agriculture
CICA	Agricultural information and Communication Centre
CRS	Catholic Relief Services
CSA	Climate Smart Agriculture
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FONERWA	National Fund for the Environment in Rwanda
GDP	Gross domestic product
GHGs	Greenhouse gases
IBWI	Index-based weather insurance
ICRAF	International Centre for Research in Agro-forestry
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFDC	International Fertilizer Development Center
IISD	International Institute for Sustainable Development
INC	Initial National Communication
ISAR	Institut des Sciences Agronomiques du Rwanda
JICA	Japan international cooperation agency
KFW	German Development Bank
KWAMP	Kirehe Watershed Management project
LWH	Land husbandry, water harvesting and hillside irrigation project
MIDIMAR	Ministry of Disaster Management and Refugees
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government
MINECOAFIN	Ministry of Economic Development and Finance
MININFRA	Ministry of Infrastructures
MINIREN	Ministry of Natural Resources
NAEB	National Agriculture Export Board
NAPA	National Adaptation Program of Action
NDBP	National Domestic Biogas Program
NIRDA	National Industrial Research and Development Agency
NISR	National Institute of Statistics of Rwanda
OECD	Organization for Economic Development
PADAB	Bugesera agricultural development support project

PASP	Post-harvest and agribusiness support project
RAB	Rwanda AgricultureBboard
REMA	Rwanda Environment Management Authority
RNRA	Rwanda Natural Resource Authority
RSSP	Rural Sector Support project
SHR	Synology Hybride
SIDA	Swedish International Development Agency
SNC	Second National Communication
SRI	System for Rice Intensification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate Change
UR-CAVM	University of Rwanda, College of Agriculture and Veterinary Medicine
USAID	United States Agency for International Development
WB	World Bank
WCS	Wildlife Conservation Society
WFP	World Food Programme of the United Nations

Annex III: Evolution of employment in Rwanda's main economic sectors (%)

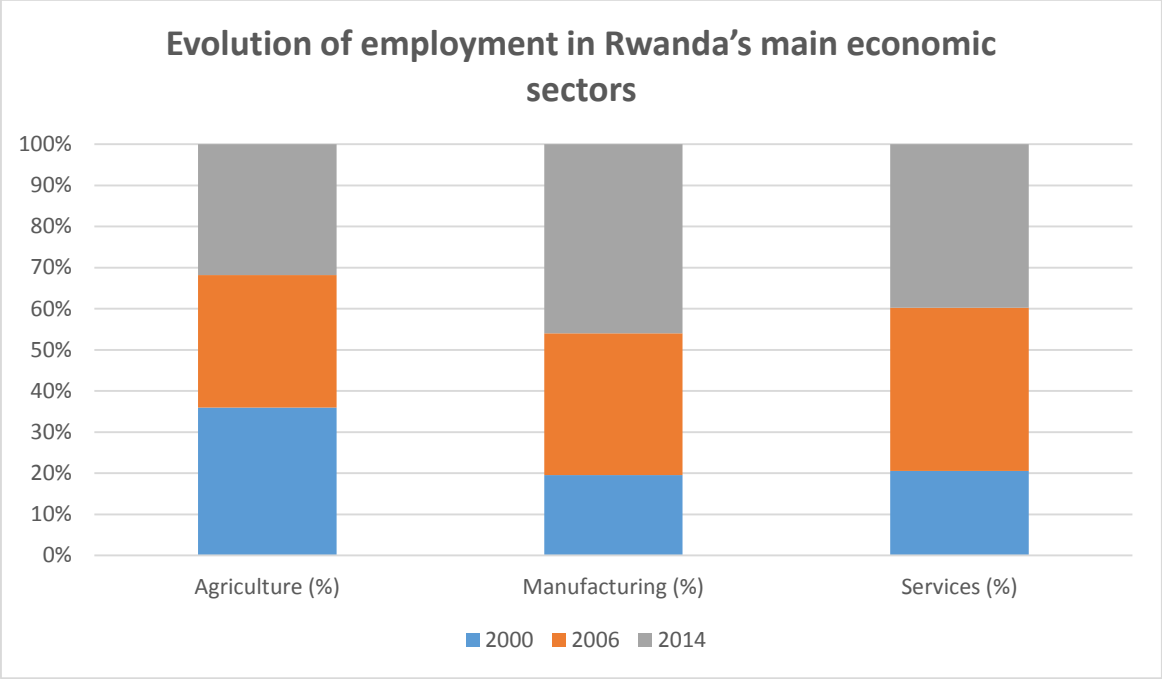

Figure 1: Employment in the main economic sectors (%). Source: *SNIR (2015)*

Annex III: Evolution of main agricultural exports and imports in Rwanda

Table 2: Export value of main agricultural production systems in Rwanda (USD 1000), 2017-2011. Source: *FAOSTAT*

Item	2007	2008	2009	2010	2011	Average
Bananas	96	58	3	14	12	36.6
Beans, dry	72	3658	1370	1118	714	1386.4
Beans, green	759	1404	334	208	1178	776.6
Coffee, green	32479	54632	37181	55894	72538	50544.8
Flour, maize	0	893	82	471	887	466.6
Flour, wheat	351	962	12	43	7052	1684
Maize	834	9	9	193	127	234.4
Potatoes	51	38	723	105	640	311.4
Rice - total (Rice milled equivalent)	10	36	13	87	120	53.2
Soybeans	0	1	0	0	1	0.4
Sweet potatoes	5	0	108	13	54	36
Tea	30369	125454	30830	34527	47426	53721.2

Table 3: Import value of main agricultural production systems in Rwanda (USD 1000), 2017-2011. Source: *FAOSTAT*

Item	2007	2008	2009	2010	2011	Average
Bananas	9	0	337	301	175	164.4
Beans, dry	503	1700	4500	890	3972	2313
Beans, green	818	4	537	794	1139	658.4
Coffee, extracts	118	348	80	515	79	228
Coffee, green	119	1581	2	8	616	465.2
Flour, maize	472	850	7000	4959	7237	4103.6
Flour, wheat	11404	9893	4928	1230	968	5684.6
Maize	3752	3000	11000	14912	6532	7839.2
Malt	7549	12161	9435	7738	9684	9313.4
Milk, whole fresh cow	64	98	92	133	61	89.6
Potatoes	0	199	182	159	162	140.4
Rice - total (Rice milled equivalent)	7486	5018	11816	16384	16608	11462.4
Soybeans	9	8	1150	821	65	410.6
Tea	132	118	126	142	121	127.8

Annex IV: Selection of important production systems in Rwanda

Identifying the main production systems key for food security in the country requires an understanding of the complex interaction between social, economic and environmental factors at national and subnational levels, apart from the spatial and agro-ecological heterogeneity that can be found regionally. This means that the importance of a production system varies both within a country and between countries. In order to account for this variability, the study departed from a methodology developed by CIAT (2014) to identify and prioritize productions systems key for food security in a given country, based on a set of indicators such as: harvested area, variation in production, net production value (NPV), contribution to agricultural gross domestic product (AgGDP), contribution to national gross domestic product (GDP), and calories intake. These indicators help establish the relevance of the production system for the country's economy and food security. Below we discuss more in detail these sub-indicators.

Harvested area (ha): indicates the total cultivated area for the production system. For livestock systems look at pastures. The indicator is calculated as a five-year average and provides information on which production system is the most prevalent per area and can be interpreted as harvested or simple crop area. Knowledge of harvested area also constitutes an indirect source of information regarding land use for agriculture.

Variation in production: this indicator was added to the CIAT (2014) methodology, in order to offer more insights on how the production has varied in the past five years, and the implications this may have on the evaluation of the production systems' relevance for national economy and food security. The variation in production for each production system was calculated as follows:

(Variation in production) = (Standard deviation) / Average for 5 years in production)

Contribution to the agricultural GDP (%) illustrates the importance of the production system in the agricultural sector in each country, and becomes a benchmarking parameter that allows it to be compared against other production systems. To calculate the economic contribution of each production system we used the five-year averages (2005-2009; or the most recent years for which data was available for all the indicators) of the *g ross production value (GPV)* (constant 2004-2006 USD), the total gross national agricultural output (agricultural GDP) and gross national GDP (National GDP) data for each country. The contribution of each crop to Agricultural GDP (%) was calculated as follows:

*(Contribution to Ag. GDP) = (gross production value of crop) / (total gross national Ag. GDP) * 100*

Contribution to national GDP (%) allows for a benchmark comparison with the rest of the sectors of the national economy. For this indicator, we took into account the five-year average (most recent years). The contribution of each production system to national GDP was calculated as follows:

*(Contribution to national GDP) = (gross production value of crop) / (total gross national GDP) * 100*

Net production value (USD 2004–2006 USD constant) reflects the importance of each production system in currency value to the economies of the region. For this indicator, we took into account the five-year average (most recent years). Using the following equation, it also becomes an indicator of the volume of production, which can be linked to food security for the case of crops that are considered staple foods or that account for a substantial fraction of the consumption of calories.

(Production in tons) = (Net value of production in US$) / (Unit price of tons in US$/ton)

Calorie intake (food supply) (kcal/capita/day) was chosen as the primary indicator of food security as it reflects which production systems are sustaining the population and reducing hunger (food supply). For this indicator, we took into account the five-year average (most recent years). Calorie intake is measured by the FAO at the country level, and is based on national food balance sheets (Headey and Ecker, 2012).

In order to then identify the production systems most important for national economy and food security, we then calculated the total score of the production system, based on the average value of each indicator mentioned above. These indicators were weighted, assigning for each a percentage (17%). The production system with the highest score indicated highest importance. Formula:

*Total score = (NPV * 0.017) + (Contribution to AgGDP * 0.017) + (Contribution to GDP * 0.017) + (Calorie intake* 0.017) + (Harvested area * 0.017) + (Variation in production * 0.017)*

Since monocultures may present high values in the indicators and skew the results, each indicator was weighted in order to ensure the meaning was not lost. It is important to note that the contribution of a production system to food supply and livelihoods may not be reflected in the specific crop's regional economic contribution to agricultural production. The following table (Table 4) is an illustration of the selection of the production systems in Rwanda.

Table 4: Indicators for selecting productions key for food security in Rwanda

Beans, dry											
Year	**NPV** (Constant 2004-2006 USD)	**GPV** (Constant 2004-2006 USD)	**Total gross National Ag GDP**	**Contribution to Ag GDP** (%)	**Total Gross National GDP**	**Contribution to national GDP** (%)	**Food supply** (Kcal/ capita/ day)	**Harvested area** (ha)	**Production** (t)	**Coefficient of variation**	**Total score**
2009	178,990	52,778	1,327,010	0.04	3,797,270	0.01	281	336,577	308,000	*0.13*	9,613
2010	190,615	55,954	1,365,556	0.04	3,847,729	0.01	259	345,851	326,532		
2011	190,788	56,119	1,407,790	0.04	4,063,666	0.01	264	319,252	327,497		
2012	190,503	56,748	1,035,629	0.05	3,201,791	0.02	256	341,819	331,166		
2013	251,660	74,174	1,215,336	0.06	3,638,628	0.02	250	479,899	432,857		
Average	*200,511*	*59,155*	*1,270,264*	*0.05*	*3,709,817*	*0.02*	*262*	*364,680*	*345,210*		
Cassava											
2009	102,221	208,915	1,327,010	0.16	3,797,270	0.06	234	163,099	1,681,823	*0.17*	6967
2010	210,988	250,890	1,365,556	0.18	3,847,729	0.07	264	180,210	2,019,741		
2011	248,331	295,295	1,407,790	0.21	4,063,666	0.07	249	197,394	2,377,213		
2012	269,452	320,361	1,035,629	0.31	3,201,791	0.10	257	210,076	2,579,000		
2013	283,765	337,431	1,215,336	0.28	3,638,628	0.09	258	182,278	2,716,421		
Average	*222,951*	*282,578*	*1,270,264*	*0.23*	*3,709,817*	*0.08*	*252*	*186,611*	*2,274,840*		
Coffee											
2009	22,265	10,189	1,327,010	0.01	3,797,270	0.00	0.00	42,900	20,724	*0.05*	998
2010	20,812	9,525	1,365,556	0.01	3,847,729	0.00	0.00	28,828	19,372		
2011	20,756	9,499	1,407,790	0.01	4,063,666	0.00	0.00	33,977	19,319		
2012	23,443	10,728	1,035,629	0.01	3,201,791	0.00	0.00	37,377	21,820		
2013	21,482	9,831	1,215,336	0.01	3,638,628	0.00	0.00	41,762	19,995		
Average	*21,752*	*9,954*	*1,270,264*	*0.01*	*3,709,817*	*0.00*	*0.00*	*36,969*	*20,246*		
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Year	NPV (Constant 2004-2006 USD)	GPV (Constant 2004-2006 USD)	Total gross National Ag GDP	Contribution to Ag GDP (%)	Total Gross Nat. GDP	Contribution to Nat. GDP (%)	Food supply (Kcal/ capita/ day)	Harvested area (ha)	Production (t)	Coefficient of variation	Total score
Maize											
2009	23,033	22,621	1,327,010	0.02	3,797,270	0.01	113	144,896	166,853		
2010	39,865	38,903	1,365,556	0.03	3,847,729	0.01	132	147,129	286,946		
2011	60,307	58,623	1,407,790	0.04	4,063,666	0.01	122	184,658	432,404	*0.38*	4,186
2012	73,392	71,269	1,035,629	0.07	3,201,791	0.02	122	223,414	525,679		
2013	80,101	77,689	1,215,336	0.06	3,638,628	0.02	123	253,698	573,038		
Average	*55,340*	*53,821*	*1,270,264*	*0.04*	*3,709,817*	*0.01*	*122*	*190,759*	*396,984*		
Irish potatoes											
2009	179,088	94,567	1,327,010	0.07	3,797,270	0.02	181	127,226	1,161,943		
2010	197,305	104,959	1,365,556	0.08	3,847,729	0.03	194	126,167	1,289,623		
2011	279,196	145,635	1,407,790	0.10	4,063,666	0.04	198	150,777	1,789,404	*0.27*	7,179
2012	344,262	176,734	1,035,629	0.17	3,201,791	0.06	198	169,493	2,171,517		
2013	372,311	190,260	1,215,336	0.16	3,638,628	0.05	196	164,779	2,337,706		
Average	*274,432*	*142,431*	*1,270,264*	*0.12*	*3,709,817*	*0.04*	*193*	*147,688*	*1,750,039*		
Plantain											
2009	537,617	220,843	1,327,010	0.17	3,797,270	0.06	330	370,000	2,604,000		
2010	618,028	253,875	1,365,556	0.19	3,847,729	0.07	311	345,414	2,993,482		
2011	567,584	233,153	1,407,790	0.17	4,063,666	0.06	323	333,773	2,749,152	*0.07*	16,188
2012	626,863	257,504	1,035,629	0.25	3,201,791	0.08	309	346,411	3,036,273		
2013	664,684	273,040	1,215,336	0.22	3,638,628	0.08	332	349,052	3,219,465		
Average	*602,955*	*247,683*	*1,270,264*	*0.20*	*3,709,817*	*0.07*	*321*	*348,930*	*2,920,474*		
Rice, Paddy											
2009	22,589	31,445	1,327,010	0.02	3,797,270	0.01	53	18,455	82,000		
2010	22,359	31,092	1,365,556	0.02	3,847,729	0.01	57	14,433	81,081		
2011	18,476	25,790	1,407,790	0.02	4,063,666	0.01	73	12,975	67,253	*0.08*	626
2012	22,177	30,885	1,035,629	0.03	3,201,791	0.01	75	14,592	80,541		
2013	23,163	32,242	1,215,336	0.03	3,638,628	0.01	75	14,701	84,079		
Average	*21,753*	*30,291*	*1,270,264*	*0.02*	*3,709,817*	*0.01*	*67*	*15,031*	*78,991*		

Sweet potatoes											
Year	**NPV** (Constant 2004-2006 USD)	**GPV** (Constant 2004-2006 USD)	**Total gross National Ag GDP**	**Contribution to Ag GDP** (%)	**Total Gross Nat. GDP**	**Contribution to Nat. GDP** (%)	**Food supply** (Kcal/ capita/ day)	**Harvested area** (ha)	**Production (t)**	**Coefficient of variation**	**Total score**
2009	62,386	57,496	1,327,010	0.04	3,797,270	0.02	209	149,724	826,000	*0.08*	3,151
2010	60,666	55,911	1,365,556	0.04	3,847,729	0.01	200	123,386	803,228		
2011	63,449	58,475	1,407,790	0.04	4,063,666	0.01	188	112,194	840,072		
2012	63,829	58,825	1,035,629	0.06	3,201,791	0.02	192	104,928	845,099		
2013	75,929	69,977	1,215,336	0.06	3,638,628	0.02	187	109,388	1,005,305		
Average	*65,252*	*60,137*	*1,270,264*	*0.05*	*3,709,817*	*0.02*	*195*	*119,924*	*863,941*		
Cattle (Meat)											
2009	99,602	99,602	1,327,010	0.08	3,797,270	0.03	4	354,529	36,871	*0.02*	7,496
2010	95,649	95,649	1,365,556	0.07	3,847,729	0.02	4	340,458	35,408		
2011	99,440	99,440	1,407,790	0.07	4,063,666	0.02	4	353,949	36,811		
2012	93,721	93,721	1,035,629	0.09	3,201,791	0.03	4	333,594	34,694		
2013	95,126	95,126	1,215,336	0.08	3,638,628	0.03	4	338,594	35,214		
Average	*96,708*	*96,708*	*1,270,264*	*0.08*	*3,709,817*	*0.03*	*4*	*344,225*	*35,800*		
Cattle (Milk)											
2009	45,249	45,249	1,327,010	0.03	3,797,270	0.01	31	268,678	145,000	*0.11*	5,648
2010	45,249	45,249	1,365,556	0.03	3,847,729	0.01	28	279,716	145,000		
2011	57,326	57,326	1,407,790	0.04	4,063,666	0.01	27	282,300	183,700		
2012	57,419	57,419	1,035,629	0.06	3,201,791	0.02	32	283,000	184,000		
2013	58,043	58,043	1,215,336	0.05	3,638,628	0.02	31	284,000	186,000		
Average	*52,657*	*52,657*	*1,270,264*	*0.04*	*3,709,817*	*0.01*	*30*	*279,539*	*168,740*		

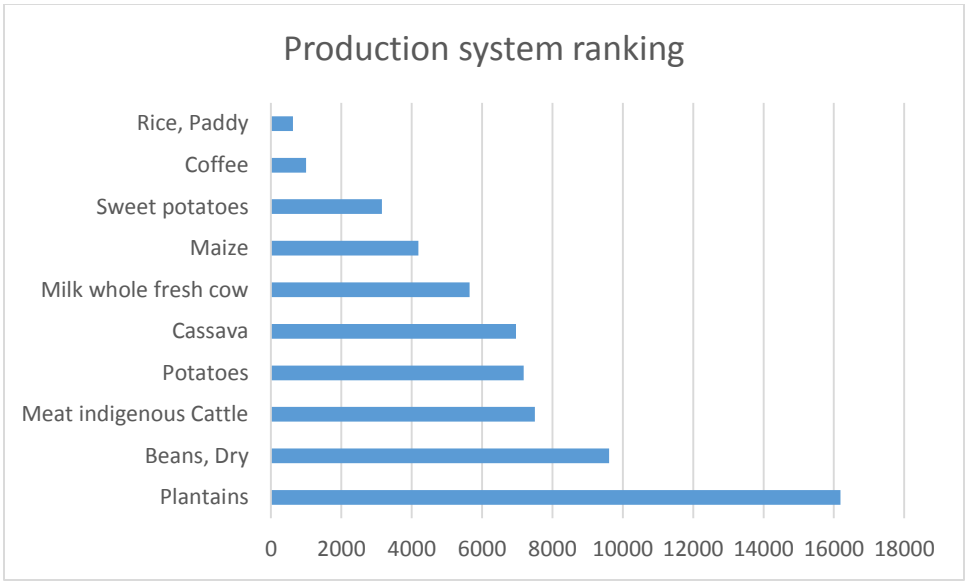

Figure 2: Production system ranking based on total score from Table 4. Source: Compiled from *FAOSTAT*

Annex IV: CSA Practices in Rwanda (detailed list)

For collecting data on CSA practices in the country (types of practices, levels of adoption, climate-smartness scores, etc.) we used several processes and methods described below.

Step 1: A first identification and initial listing of practices was carried out through a *literature review* and consultation of the CSA Compendium (CCAFS and ICRAF, forthcoming), and were determined based on the feasibility of implementing them in the important production systems of the country. The list of practices was then confirmed with criteria from in-country experts (mainly agronomists with experience in the selected production systems or agricultural regions of interest in the country).

Step 2: After a first validation of the list of CSA practices identified in the country (and related to the main production systems), experts were then asked to provide, via semi-structured interviews, surveys or focus group discussions, information on where, how, and to what extent the practice is adopted in the country and the production system it is associated with.

Step 3: Moreover, experts were also asked to give qualitative evaluations of different components of the 'climate smartness' concept for each of the identified practices.

For assessing climate-smartness levels of a practice we used categories of indicators (and sub-indicators) related to the management and use of *carbon*, *nitrogen*, *energy*, *weather*, *water* and *knowledge*, using a set of proxies for each to evaluate climate-smartness. We recognize that there are many possible angles to look at when assessing the smartness of a production system, and that this list of categories is not exhaustive. However, we considered them as important entry points for adaptation and mitigation of climate change in the agricultural sector, based on previous work undertaken by Aggarwal et al (2013) as part of CCAFS' initiative on "Climate-Smart Villages", a community approach to sustainable agricultural development. We argue that a combination of efficient use and management of water, energy, carbon and nitrogen, combined with efforts to reduce climate risks and to promote local knowledge and social capital when implementing the practice, increase the practice's likelihood to contribute to goals related to adaptation, mitigation and improved productivity.

In order to operationalize the analysis of the practice's performance in the six categories of interest, we asked experts specific questions that offer insights into the proxies used for carbon-, nitrogen-, energy-, weather-, water-, and knowledge-

smartness. On a scale from 0 to 5, experts indicated the level of change that the implementation of each practice would bring about, based on knowledge and previous 5 experience with implementing the practice. It is important to note that these indicators and associated questions should not be taken as absolute metrics for assessment, but they should just guide the qualitative assessment of the practice and be adapted to the context of the analysis.

Table 5: Valuation of potential positive impact of CSA practices

Value	Potential impact
5	Very high positive change
4	High positive change
3	Moderate positive change
2	Low positive change
1	Very low positive change
0	No change; Not applicable; No data

The smartness level of a category is an average of the scores (0-5) obtained in each sub-indicator of the respective category. The climate-smartness dimensions and respective sub-indicators are outlined in the table below.

Table 6: Smartness dimensions and anticipated change

Smartness category	Anticipated change (sub-indicator)
1. Water smartness	1.1. Allows reduction in the volume of water consumption per unit of product (food) (l/kg/ha, l/ha etc.)
	1.2. Enhances water quality available for agricultural production (by reducing chemicals, sediments, metals in the water bodies)
	1.3. Enhances water and moisture retention in soils (mm/m, %)
	1.4. Promotes protection/ conservation of hydric sources (especially headwaters)
	1.5. Promotes water capture/ use of rainwater for agricultural production
2. Energy smartness	2.1. Allows for reduced consumption of fossil energy (reflected by savings in fossil fuel combustion, or electric energy consumption [J/kg, J/h, etc.])
	2.2. Promotes the use of renewable energy sources (e.g. wind and/or solar energy, biogas, etc.)
3. Carbon smartness	3.1. Increases above- and below-ground biomass (ton/ha; kg/m2 etc.), This is related to the mitigation pillar in terms of carbon dioxide (CO2) capture (plant biomass, wood etc.).
	3.2. Enhances the accumulation of organic matter in soils (soil carbon stock) (Soil Organic Carbon (SOC) or Soil Organic Matter [SOM]: %; kg/ha; g/m3; kg/m3). Refers to the mitigation pillar in terms of CO2 capture (increases in soil Carbon and indirectly improvement of biological and physical soils conditions that impact the greenhouse gas [GHG] emissions.)
	3.3. Reduces soil disturbance (reflected in number of hours of tractor labor, application of alternative soil management techniques, etc.). Refers to the mitigation

	pillar in terms of CO2, reducing carbon emissions (mainly emissions associated with tillage process)
	3.4. Promotes techniques to better manage the quality of animal diet and/or manure in livestock systems (manure management and animal husbandry mitigation practices, etc.)
4. Nitrogen smartness	4.1. Reduces the need of synthetic nitrogen-based fertilizers (e.g. kg/ha/year)
	4.2. Reduces nitrous oxide (N2O) emissions (by adopting better techniques of fertilizers use and soil management practices). Reflected in, for instance, reductions in number of grams of N2O/m2/year.
5. Weather smartness	5.1. Minimizes negative impacts of climate hazards (such as soil degradation, effects of flood or prolonged drought events among others).
	5.2. Helps prevent climatic risks (refers to practices that allow farmers be more prepared to mitigate climate risks, such as water reservoirs, early warning systems, heat/, water stress- pests- and diseases- tolerant/ resistant varieties, etc.)
6. Knowledge smartness	6.1. Allows rescuing or validates local knowledge or traditional techniques.

Step 4: Experts were then asked to provide qualitative evaluations of the impacts of each practice on the CSA pillars - adaptation, mitigation and productivity. This was complemented with information from a literature review.

Step 5: Then we identified high-interest practices, based on total climate-smartness score and adoption level of the practice, as following:

1. A detailed list of all practices identified in the country was compiled. The practices were ordered by value obtained in the climate-smartness assessment (highest values first);
2. The first quintile of the list, (the 20% highest values of the list) was identified. For instance, if the list includes 50 practices, identify the top 10 with highest smartness score.
3. Practices in the first quintile with low adoption level were then highlighted.
4. The high-interest practices will then be those practices with high smartness values and low adoption rates.

Step 6: From the literature review and expert consultations we also identified challenges and barriers to adoption and/or scaling out of the identified CSA practices, related to policies, institutions, finances, etc.

Step 7: We then studied the implementation of a CSA practice into more detail, by means of a case study.

Table 7: Detailed list of practices identified in Rwanda.

Production system associated with the practice	**CSA Practice** * indicates high-interest practice	**% of harvested area** (crops) **/ % of total land use area** (livestock)	**Adoption rate of the practice** (out of country's agricultural area) Orange: <30% Yellow: 30-60% Green: >60%	**Farm scale**	**Smartness levels** (by climate smartness dimension)						**Climate-smartness average**
					Water	**Energy**	**Carbon**	**Nitrogen**	**Weather**	**Knowledge**	
Plantain	Mulching *	17.3%		Small	4.6	3.5	4.75	4.5	4	3.7	**4.2**
Plantain	Manure pits	17.3%		Medium	4.2	0	0	0	0	4	**1.4**
Plantain	Tied ridges	17.3%		Medium	4.4	3	0	0	4.5	4	**2.7**
Bean	Conservation agriculture (Use of crop residues)	18.1%		Large	3.6	3	4.75	3.5	4	3.7	**3.8**
Bean	Improved crop variety (early maturing)	18.1%		Medium	4.5	0	0	0	5	4	**2.3**
Cassava	Soil conservation techniques (Ridges and furrows)	9.2%		Medium	3.6	3	3.3	3.5	3.5	4.0	**3.5**
Cattle	Zero grazing *	13.2%		Small	3	4.5	4.3	4.5	5	4.0	**4.2**
Cattle	Improved pastures (climate-smart *Brachiaria* grasses)	13.2%		Small	4	4	4.5	4.5	4	3.7	**4.1**
Cattle	Hybrid breeds	13.2%		Small	0	4.5	0	0	0	3	**1.3**
Cattle	Biogas production from cow dung	13.2%		Small	0	5	3	2.5	3	5.0	**3.1**
Cattle	Animal shelter	13.2%		Medium	0	4.5	3.5	4	4.5	5	**3.6**
Cattle	Supplemental feeds	13.2%		Small	0	4	3.5	4	4	5	**3.4**
Coffee	Pest- and disease-resistant varieties	1.8%		Medium	4.5	4	5	3.5	4	3.7	**4.1**

Production system associated with the practice	**CSA Practice** * indicates high-interest practice	**% of harvested area** (crops) **/ % of total land use area** (livestock)	**Adoption rate of the practice** (out of country's agricultural area) Orange: <30% Yellow: 30-60% Green: >60%	**Farm scale**	**Smartness levels** (by climate smartness dimension)						**Climate-smartness average**
					Water	**Energy**	**Carbon**	**Nitrogen**	**Weather**	**Knowledge**	
Coffee	Shade-grown coffee	1.8%		Small	3	3	5	4	4	4	**3.8**
Irish potato	Soil conservation techniques	7.3%		Medium	3.6	2	3.0	3.5	4	4.0	**3.4**
Irish potato	Efficient use of fertilizers	7.3%		Medium	4.2	2.5	3.8	2	3.5	5.0	**3.5**
Irish potato	Improved crop variety (early maturing)	7.3%		Medium	4.5	0	0	0	5	4	**2.3**
Maize	Crop rotation	9.5%		Medium	3.8	2	4	5	5	5.0	**4.1**
Maize	Conservation agriculture	9.5%		Medium	3.6	3	4.3	4	4	3.7	**3.8**
Maize	In-situ soil and water conservation techniques (bench terraces and slow-forming terraces)	9.5%		Medium	4.2	3	2	4	4	4	**3.5**
Maize	Recycling of crop residues*	9.5%		Medium	3.6	4	4.25	4	4	4	**4.0**
Mixed (maize/bean)	Hedgerows on contour bunds	no data		Medium	4.8	3.5	4.5	5	5	4.0	**4.5**
Mixed (maize/bean)	Hedgerows on contouring benches and progressive terraces *	no data		Medium	4.8	3.5	4.5	5	5	4.3	**4.5**
Mixed (maize/bean)	Plant breeding programs (High-yielding and climate-adapted varieties)	no data		Medium	3.8	3.5	4	1.5	4	4	**3.5**

Production system associated with the practice	**CSA Practice** * indicates high-interest practice	**% of harvested area** (crops) **/ % of total land use area** (livestock)	**Adoption rate of the practice** (out of country's agricultural area) Orange: <30% Yellow: 30-60% Green: >60%	**Smartness levels** (by climate smartness dimension)							**Climate-smartness average**
				Water	**Energy**	**Carbon**	**Nitrogen**	**Weather**	**Knowledge**	**Water**	
Mixed (maize/bean)	Efficient use of fertilizers	no data		Medium	3.8	3.5	4	1.5	4	4	**3.5**
Mixed (coffee/banana)	Intercropping *	no data		Small	3.6	4	4.5	4	4	3.3	**3.9**
Mixed (coffee/banana)	Mulching	no data		Medium	4.6	3	4.5	5	4	4.7	**4.3**
Mixed (legumes/cereals)	Crop rotation	no data		Medium	3.8	2	4	5	5	5.0	**4.1**
Mixed (tea/banana)	Soil conservation techniques *	no data		Large	4.6	2.5	4.5	4	4	3.7	**3.9**
Rice	System of Rice Intensification (RIS)	0.70%		Small	3.6	2	4.3	2	4	4	**3.3**
Rice	Efficient use of fertilizers	0.70%		Medium	3.6	2.5	4.3	2	3.5	4.3	**3.4**
Rice	Efficient soil management in marshland	0.70%		Medium	4.2	4	4.3	2	4	4.0	**3.7**
Sweet potato	Soil conservation (ridge and furrow, land cover)	5.90%		Small	4.8	2.5	3.8	3.5	4	3.7	**3.7**
Sweet potato	Green manure	5.90%		Medium	3.8	0	4	4	5	4.7	**3.6**
Tea	Agroforestry	0.7 %		Medium	4.8	3	4.5	5	5	5	**4.6**